SHOP MANUAL

KOMATSU

PC130-6K
PC150LGP-6K

MACHINE MODEL	SERIAL NUMBER
PC130-6K	**K30001 and up**
PC150LGP-6K	**K35001 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.
- PC130-6K, PC150LGP-6K mount the SA4D102E engine; For details of the engine, see the 102 Service Engine Shop Manual.

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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.

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" to "Causes" are also included in this section.

DISASSEMBLY AND ASSEMBLY

This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

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

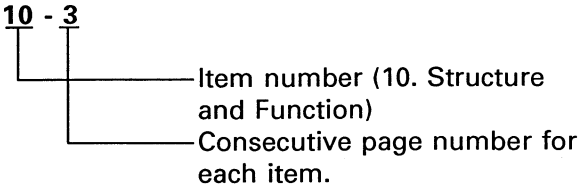
These various volumes are designed to avoid duplicating the same information. Therefore, to deal with all repairs for any model , it is necessary that chassis, engine, electrical and attachment volumes be available.

DISTRIBUTION AND UPDATING

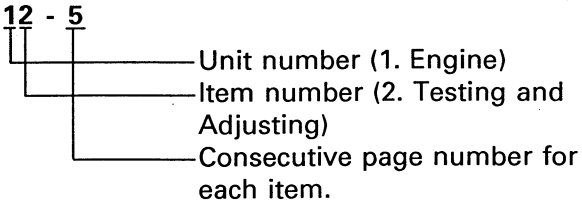
Any additions, amendments or other changes will be sent to KOMATSU distributors. Get the most up-to-date information before you start any work.

FILING METHOD

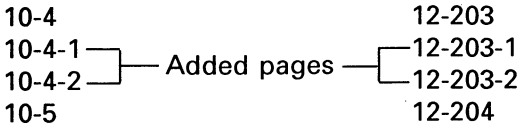
1. See the page number on the bottom of the page. File the pages in correct order.
2. Following examples show how to read the page number.
   Example 1 (Chassis volume):



   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

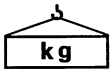
When a manual is revised, an edition mark (①②③....) is recorded on the bottom of the pages.

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 kg

- 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:

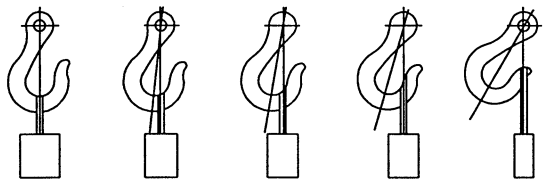
Wire ropes
(Standard "Z" or "S" twist ropes without galvanizing)

Rope diameter	Allowable load	
mm	kN	tons
10	9.8	1.0
11.2	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.



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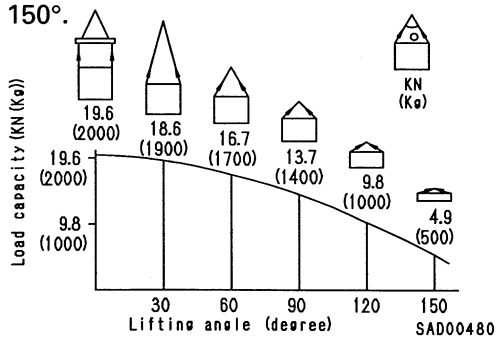
3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound onto the load.
   ⚠ Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result 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°.



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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, features
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 pes.)	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	• Features: 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-3	790-129-9070	1 kg	Can	• Features: Resistance to heat • Used as sealant for flange surfaces and bolts at high temperature locations, used to prevent seizure. • Used as sealant for heat resistance gasket for high temperature locations such as engine precombustion chamber, exhaust pipe, etc.

Category	Komatsu code	Part No.	Q'ty	Container	Main applications, features
Gasket sealant	LG-4	790–129–9020	200 g	Tube	• Features: Resistance to water, oil • Used as sealant for flange surface, thread. • Also possible to use as sealant for flanges with large clearance. • Used as sealant for mating surfaces of final drive case, transmission case.
	LG-5	790–129–9080	1 kg	Polyethylene container	• Used as sealant for various threads, pipe joints, flanges. • Used as sealant for tapered plugs, elbows, nipples of hydraulic piping.
	LG-6	09940–00011	250 g	Tube	• Features: Silicon based, resistance to heat, cold • Used as sealant for flange surface, tread. • Used as sealant for oil pan, final drive case, etc.
	LG-7	09920-00150	150 g	Tube	• Features: 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 TORQUES OF BOLTS AND NUTS

Use these torques for metric bolts and nuts. (Always use torque wrench).

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

TIGHTENING TORQUE OF HOSE NUTS

Use these torques for hose nuts.

Nominal No.	Thread diameter	Width across flat	Tightening torque	
	mm	mm	Nm	kgm
02	14	19	24.5±4.9	2.5±0.5
03	18	24	49±19.6	5±2
04	22	27	78.5±19.6	8±2
05	24	32	137.3±29.4	14±3
06	30	36	176.5±29.4	18±3
10	33	41	196.1±49	20±5
12	36	46	245.2±49	25±5
14	42	55	294.2±49	30±5

TIGHTENING TORQUE OF SPLIT FLANGE BOLTS

Use these torques for split flange bolts.

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

TIGHTENING TORQUE OF O-RING BOSS CONNECTOR

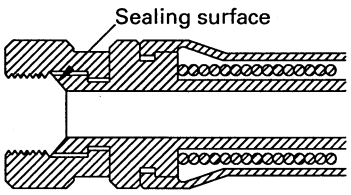
Use these torques for O-ring boss connector

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

TIGHTENING TORQUE OF O-RING BOSS CONNECTOR

Use these torques for O-ring boss connector

Nominal No.	Thread diameter	Width across flat	Tightening torque	
	mm	mm	Nm	kgm
08	8	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	—	127.4±19.6	13±2
36	36	36	151.9±24.5	15.5±2.5
42	42	—	210.7±29.4	21.5±3
52	52	—	323.4±44.1	33±4.5



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TIGHTENING TORQUES OF FLARE NUT

Use these torques for O-ring boss connector

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

TIGHTENING TORQUE FOR 102 ENGINE SERIIES (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

TIGHTENING TORQUE FOR 102 ENGINE SERIIES (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

TIGHTENING TORQUE FOR 102 ENGINE SERIIES (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

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

Nominal number	Copper wire			Cable O.D. (mm)	Current rating (A)	Applicable circuit
	Number of strands	Dia. of strands (mm)	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	—	Black & White	Red & White	Yellow & 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 & Red
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 Ⓐ, then draw a horizontal line from Ⓐ.
   (2) Locate the number 5 in the row across the top, take this as Ⓑ, then draw a perpendicular line down from Ⓑ.
   (3) Take the point where the two lines cross as Ⓒ. This point Ⓒ 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

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
50 Ⓐ	1.969	2.008	2.047	2.087	2.126	2.165 Ⓒ	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

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
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

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

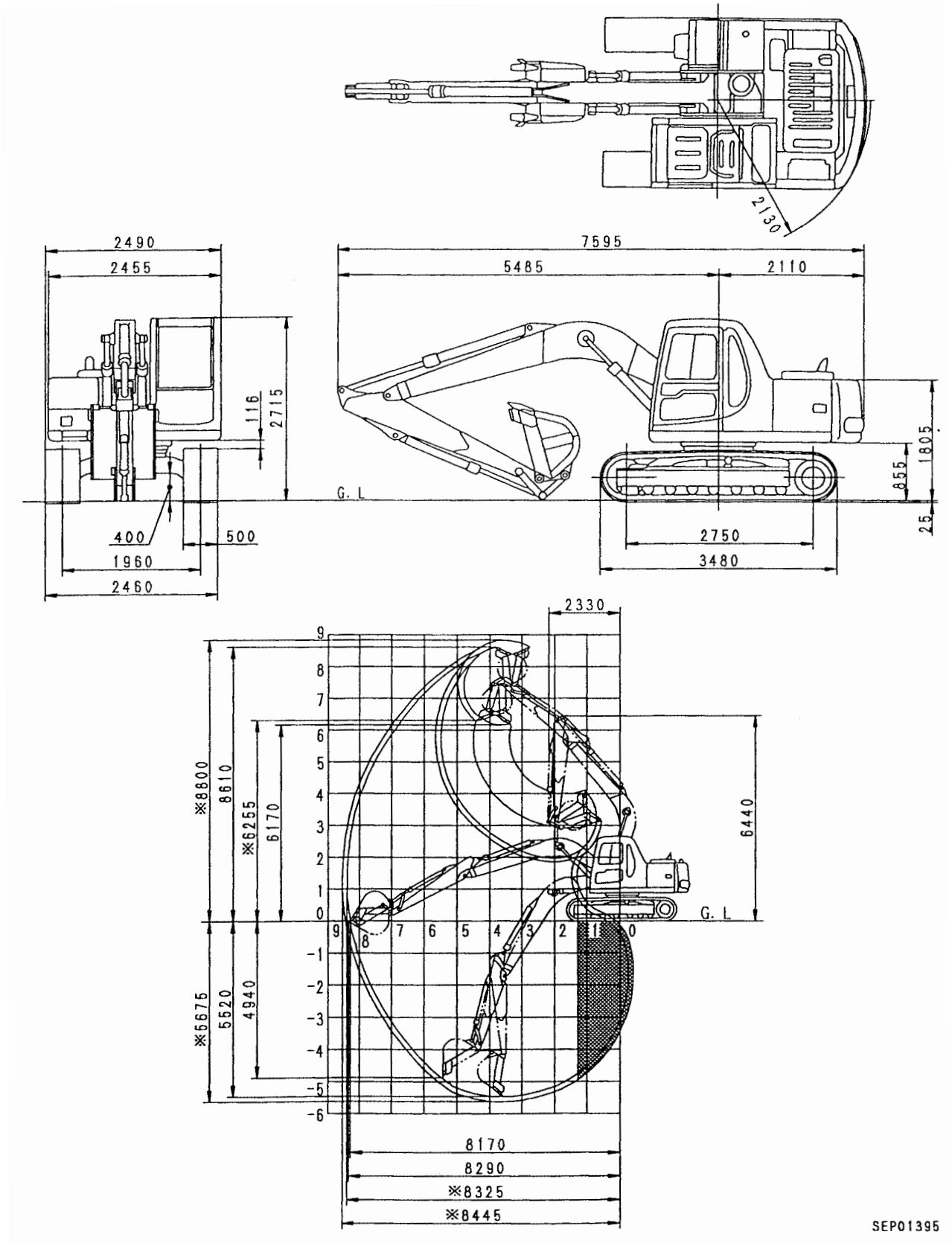
°C		°F	°C		°F	°C		°F	°C		°F
-40.4	**-40**	-40.0	-11.7	**11**	51.8	7.8	**46**	114.8	27.2	**81**	117.8
-37.2	**-35**	-31.0	-11.1	**12**	53.6	8.3	**47**	116.6	27.8	**82**	179.6
-34.4	**-30**	-22.0	-10.6	**13**	55.4	8.9	**48**	118.4	28.3	**83**	181.4
-31.7	**-25**	-13.0	-10.0	**14**	57.2	9.4	**49**	120.2	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	**60**	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

01 GENERAL

GENERAL ASSEMBLY DRAWING

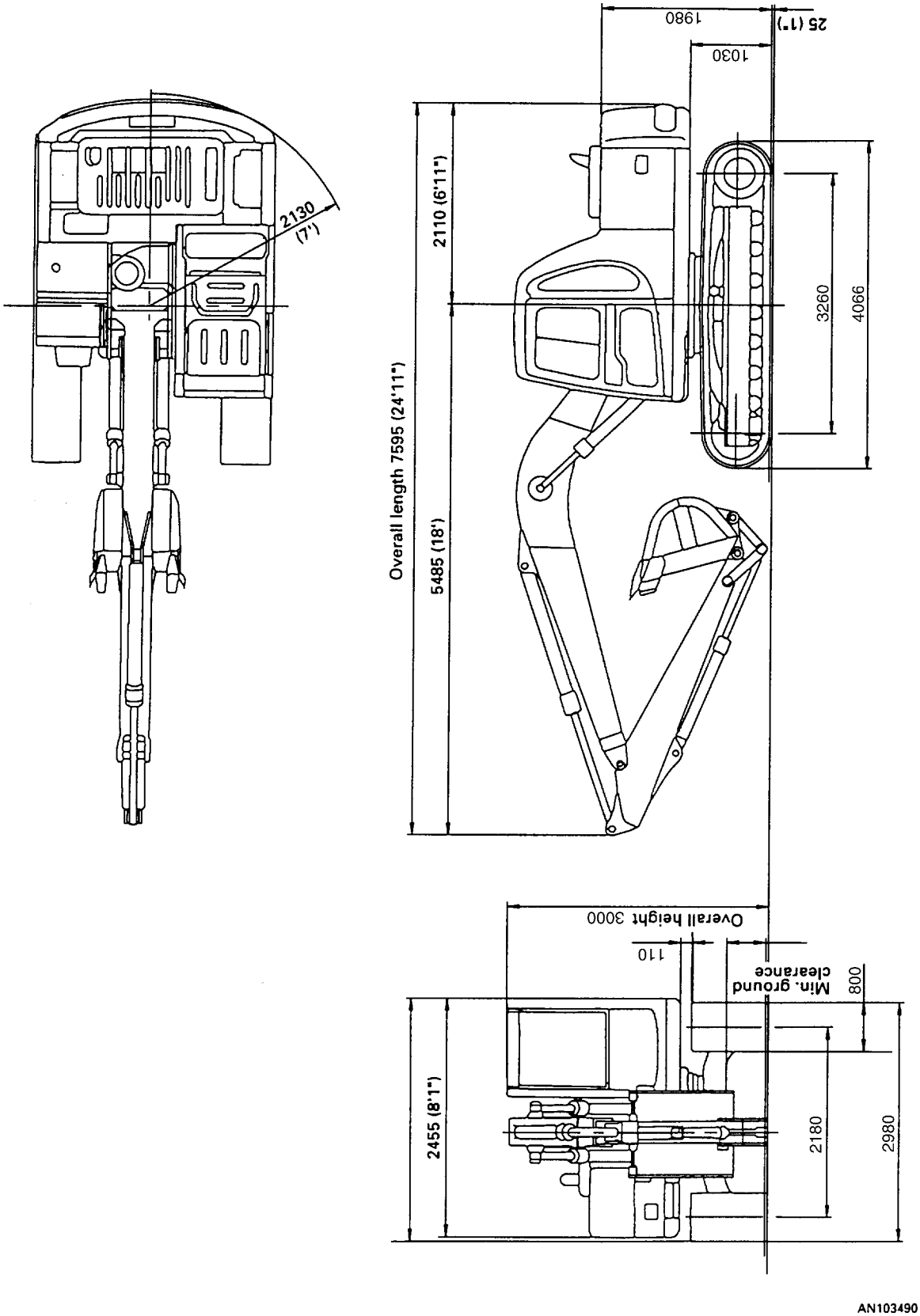
PC130-6K

Unit: mm



★ The values marked ※ are for shovel operations.

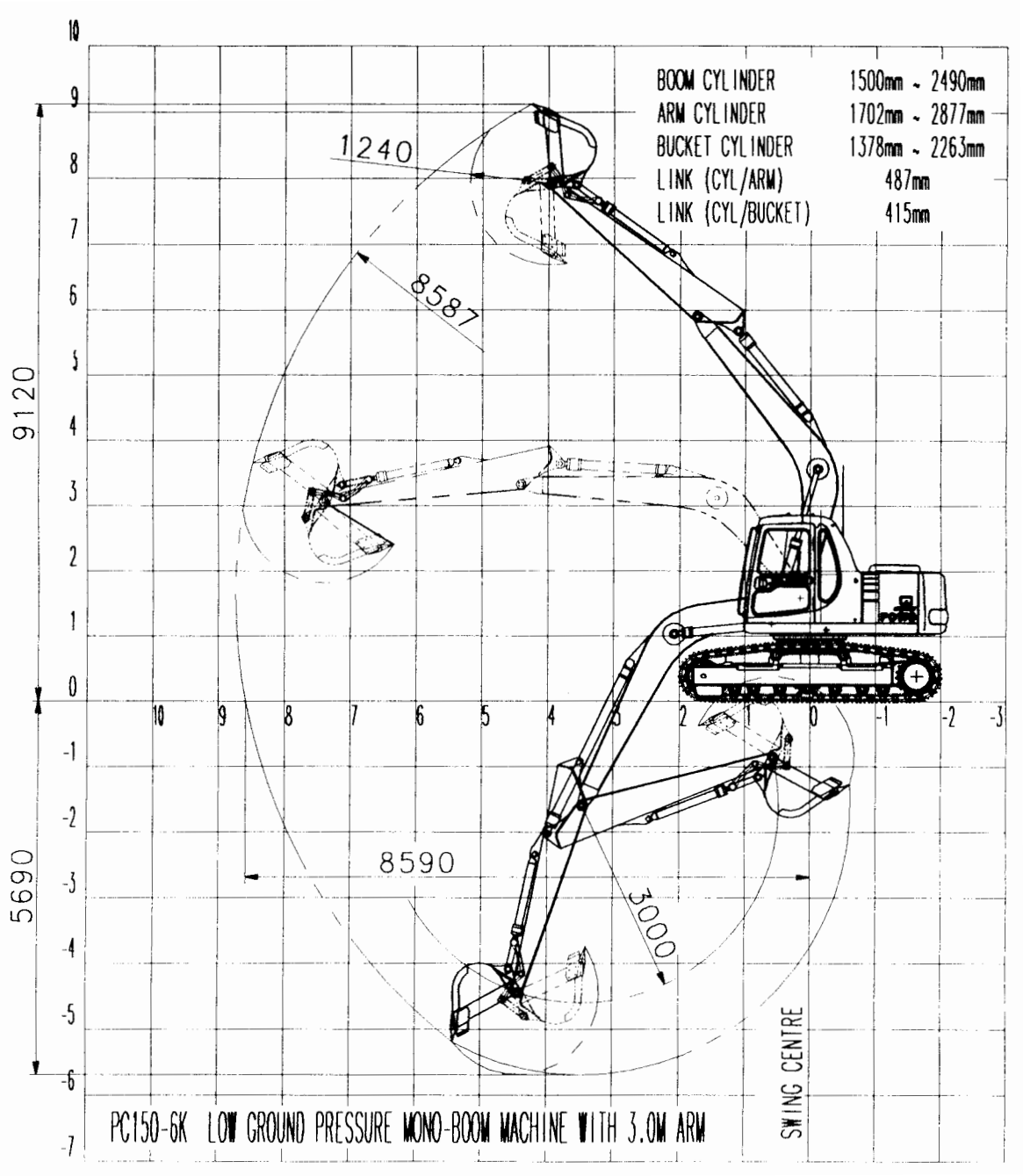
PC150LGP-6K


2130
(7')
1980
25 (1")
1030
2110 (6'11")
Overall length 7595 (24'11")
5485 (18')
3260
4066
Overall height 3000
110
Min. ground clearance
800
2455 (8'1")
2180
2980
AN103490

PC150LGP-6K

1. The mark ❋ indicates the dimensions for shovel operation.
   Never allow other person than the operater to enter the swing range
   (Max. swing range, Max. digging radius).

PC150-6K LOW GROUND PRESSURE MONO-BOOM MACHINE WITH 3.0 M ARM



SPECIFICATIONS

PC130-6K

Machine model				PC130-6K
Serial Number				30001 and up
Bucket capacity (SAE)			m^3	0.50
Operating weight			kg	11,700
Performance	Working ranges	Max. digging depth	mm	5,520
		Max. vertical wall depth	mm	4,940
		Max. digging reach	mm	8,290
		Max. reach at ground level	mm	8,170
		Max. digging height	mm	8,610
		Max. dumping height	mm	6,170
	Max. digging force		kN {kg}	76.5 {7,800}
	Swing speed		rpm	12
	Swing max. slope angle		deg.	20
	Travel speed		km/h	Lo:2.7 Mi:3.6 Hi:5.5
	Gradeability		deg.	35
	Ground pressure (standard shoe width: 500 mm)		kPa {kg/cm^2}	38.25 {0.39}
Dimensions	Overall length (for transport)		mm	7,595
	Overall width		mm	2,490
	Overall width of track		mm	2,460
	Overall height (for transport)		mm	2,715
	Overall height to top of cab		mm	2,715
	Ground clearance of counterweight		mm	855
	Min. ground clearance		mm	400
	Tail swing radius		mm	2,130
	Min. swing radius of work equipment		mm	2,330
	Height of work equipment at min. swing radius		mm	6,440
	Length of track on ground		mm	2,750
	Track gauge		mm	1,960
	Height of machine cab		mm	1,805

Machine model				PC130-6K		
Serial Number				30001 and up		
Engine		Model		S4D102-1		
		Type		4-cycle, water-cooled, in-line, vertical, direct injection, with turbocharger		
		No. of cylinders-bore x stroke	mm	4–102 × 120		
		Piston displacement	ℓ {cc}	3.92 {3,920}		
	Performance	Flywheel horsepower	kW/rpm {HP/rpm}	64/2,200 {87/2,200}		
		Maximum torque	Nm/rpm {kgm/rpm}	328.5/1,300 {33.5/1,300}		
		High idling speed	rpm	2,400		
		Low idling speed	rpm	900		
		Min. fuel consumption ratio	g/kWh {g/HPh}	224 {167}		
	Starting motor			24V, 4.5 kW		
	Alternator			24V, 25A		
	Battery			12V, 80Ah × 2		
	Radiator type			CF19-4		
Under-carriage	Carrier roller			1 on each side		
	Track roller			7 on each side		
	Track shoe			Assembly-type triple grouser, 42 on each side		
Hydraulic system	Hydraulic pump	Type × no.		HPV95 + BAR020 Variable displacement piston type × 1 + gear type × 1		
		Delivery	ℓ/min	197 + 32.9		
		Set pressure	MPa {kg/cm²}	Piston type: 31.9 {325}, gear type: 2.9 {30}		
	Control valve	Type × no.		7-spool type × 1		
		Control method		Hydraulic type		
	Hydraulic motor	Travel motor		GM18VL Variable displacement piston type (with brake valve,parking brake) × 2		
		Swing motor		KMF40ABE-3 Fixed displacement piston type (with safety valve,parking brake) × 1		
	Hydraulic cylinder			Boom cylinder	Arm cylinder	Bucket cylinder
		Type		Double-acting piston	Double-acting piston	Double-acting piston
		Inside diameter of cylinder	mm	105	115	95
		Diameter of piston rod	mm	70	75	65
		Stroke	mm	990	1,175	885
		Max. distance between pins	mm	2,490	2,877	2,263
		Min. distance between pins	mm	1,500	1,702	1,378
	Hydraulic tank			Box-shaped, open		
	Hydraulic oil filter			Tank return side		
	Hydraulic oil cooler			Air cooled (3A-CS)		

WEIGHT TABLE

PC130-6K

⚠ This weight table is a guide for use when transporting or handling component.

Unit : kg

Machine model	PC130-6K
Serial Number	30001 and up
Engine assembly (excl. water, oil)	385
Coupling assembly (PTO)	3.3
Radiator • oil cooler assembly	62.5
Revolving frame assembly	1,000
Operator's cab	287
Operator's seat	29.3
Fuel tank (excl. fuel)	96.8
Hydraulic tank (excl. hydraulic oil)	102.4
Counterweight	2,305
Hydraulic pump assembly	85
Control valve	96
Swing circle assembly	153
Swing machinery assembly	72.2
Swing motor	25.5
Center swivel joint	29.2
Track frame assembly • Track frame • Idler • Idler cushion • Carrier roller • Track roller • Travel motor • final drive assembly • Sprocket	 1,240 79 × 2 72 × 2 11 × 2 21.8 × 14 136.5 × 2 33.7 × 2

Unit : kg

Machine model	PC130-6K
Serial Number	30001 and up
Track shoe assembly • Standard triple grouser shoe (500 mm) • Wide triple grouser shoe (600 mm) • Wide triple grouser shoe (700 mm)	 740 x 2 830 x 2 925 x 2
Boom assembly	1,247
Arm assembly	447.5
Link assembly	92.7
Bucket assembly	399
Boom cylinder assembly	108.5 × 2
Arm cylinder assembly	144.9
Bucket cylinder assembly	87.4

LIST OF LUBRICANT AND WATER

PC130-6K

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE -22 -30 / -4 -20 / 14 -10 / 32 0 / 50 10 / 68 20 / 86 30 / 104°F 40°C	CAPACITY (ℓ) Specified	Refill
Engine oil pan	Engine oil	SAE 30 (32 0 – 104°F 40°C); SAE 10W (-4 -20 – 50 10); SAE 10W-30 (14 -10 – 104°F 40°C); SAE 15W-40 (14 -10 – 104°F 40°C)	17.5	16
PTO case	Engine oil	SAE 30 (14 -10 – 104°F 40°C)	0.75	0.75
Swing machinery case	Engine oil	SAE 30 (14 -10 – 104°F 40°C)	2.5	2.5
Final drive case (each)	Engine oil	SAE 30 (14 -10 – 104°F 40°C)	2.5	2.5
Idler (each)	Engine oil	SAE 30 (14 -10 – 104°F 40°C)	0.100-0.115	0.100-0.115
Track roller (each)	Engine oil	SAE 30 (-22 -30 – 104°F 40°C)	0.072	0.072
Carrier roller (each)	Engine oil	SAE 30 (-22 -30 – 104°F 40°C)	0.09	0.09
Hydraulic system	Engine oil	SAE 10W (14 -10 – 104°F 40°C); SAE 10W-30 (14 -10 – 104°F 40°C); SAE 15W-40 (14 -10 – 104°F 40°C)	140	90
	Hydraulic oil	HO46-HM (★) (14 -10 – 104°F 40°C)		
Fuel tank	Diesel fuel	ASTM D975 No.2 (32 0 – 104°F 40°C); ASTM D975 No. 1 (-22 -30 – 32 0)	240	—
Cooling system	Coolant	**Add antifreeze**	18.2	—

SPECIFICATIONS

PC150LGP-6K

Machine model				PC150LGP-6K
Serial Number				K35001 and up
		Bucket capacity (SAE) (max)	m^3	0.84
		Operating weight (800mm SHOE)	kg	15330
Performance	Working ranges	Max. digging depth	mm	5690
		Max. vertical wall depth	mm	5195
		Max. digging reach	mm	8590
		Max. reach at ground level	mm	8440
		Max. digging height	mm	9120
		Max. dumping height	mm	6700
		Max. digging force	kN {kg}	76.5 (7,800)
		Swing speed	rpm	12
		Swing max. slope angle	deg.	20
		Travel speed	km/h km/h km/h	Low speed: 2.1 Mid. speed: 2.8 High speed: 4.6
		Gradeability	deg.	35
		Ground pressure [standard shoe width: 800 mm]	kPa {kg/cm^2}	26.48 {0.27}
Dimensions		Overall length (for transport)	mm	7595
		Overall width (800 mm SHOE)	mm	2880
		Overall width of track	mm	2880
		Overall height (for transport)	mm	3075
		Overall height to top of cab	mm	3075
		Ground clearance of counterweight	mm	1030
		Min. ground clearance	mm	442
		Tail swing radius	mm	2130
		Min. swing radius of work equipment	mm	2330
		Height of work equipment at min. swing radius	mm	6440
		Length of track on ground	mm	3260
		Track gauge	mm	2180
		Height of machine cab	mm	1980

Machine model				PC150LGP-6K		
Serial Number				K35001 and up		
Engine		Model		SA4D102-1		
		Type		4-cycle, water-cooled, in-line, vertical, direct injection, with turbocharger		
		No. of cylinders – bore x stroke	mm	4 - 102X120		
		Piston displacement	ℓ {cc}	3.92 {3,920}		
	Performance	Flywheel horsepower	kW/rpm {HP/rpm}	64/2,200 {87/2,200}		
		Maximum torque	Nm/rpm {kgm/rpm}	328.5/1,300 {33.5/1,300}		
		High idling speed	rpm	2,400		
		Low idling speed	rpm	900		
		Min. fuel consumption ratio	g/kWh (g/HPh)	212 (156)		
	Starting motor			24V, 4.5 kW		
	Alternator			24V, 25A		
	Battery			12V, 80 Ah x 2		
	Radiator type			CF19-4		
Under-carriage	Carrier roller			1 on each side		
	Track roller			7 on each side		
	Track shoe			Assembly-type triple grouser, 42 on each side		
Hydraulic system	Hydraulic pump	Type / No.		HPV95 + BAR020		
				Variable displacement piston type x 1 + gear x 1		
		Delivery	ℓ/min	197 + 32.9		
		Set pressure	MPa {kg/cm²}	Piston type: 31.9 {325}, gear type: 2.9 {30}		
	Control valve	Type x No.		7-spool type x 1		
		Control method		Hydraulic		
	Hydraulic motor	Travel motor		Variable displacement piston type (with brake valve, parking brake) x 2		
		Swing motor		KMF40ABE-3 Fixed displacement piston type (with brake valve, parking brake) x 1		
	Hydraulic cylinder			Boom cylinder	Arm cylinder	Bucket cylinder
		Type		Double-acting piston	Double-acting piston	Double-acting piston
		Inside diameter of cylinder	mm	105	115	95
		Diameter of piston rod	mm	70	75	65
		Stroke	mm	990	1,175	885
		Max. distance between pins	mm	2,490	2,877	2,263
		Min. distance between pins	mm	1,500	1,702	1,378
	Hydraulic tank			Box-shaped, open		
	Hydraulic filter			Tank return side		
	Hydraulic cooler			Air cooled (3A-CS)		

WEIGHT TABLE

PC150LGP-6K

⚠ This weight table is a guide for use when transporting or handling component

Unit: kg

Machine model	PC150LGP-6K
Serial Number	K35001 and up
Engine assembly (excl. water, oil)	385
Coupling assembly (PTO)	3.3
Radiator • oil cooler assembly	62.5
Revolving frame assembly	1,000
Operator's cab	287
Operator's seat	29.3
Fuel tank (excl. fuel)	96.8
Hydraulic tank (excl. hydraulic oil)	102.4
Counterweight	2,305
Hydraulic pump assembly	85
Control valve	96
Swing circle assembly	153
Swing machinery assembly	72.2
Swing motor	25.5
Center swivel joint	29.2
Track frame assembly	
• Track frame	2460
• Idler	140 x 2
• Idler cushion	135 x 2
• Carrier roller	20 x 4
• Track roller	40 x 14
• Travel motor • final drive assembly	195 x 2
• Sprocket	58 x 2

Unit: kg

Machine model	PC150LGP-6K
Serial Number	K35001 and up
Track shoe assembly	
• Standard triple grouser shoe (800 mm)	1490 x 2
• Wide triple grouser shoe (900 mm)	1560 x 2
Boom assembly	1,247
Arm assembly	447.5
Link assembly	92.7
Bucket assembly	399
Boom cylinder assembly	108.5 x 2
Arm cylinder assembly	144.9
Bucket cylinder assembly	87.4

FUEL, COOLANT AND LUBRICANTS

PC150LGP-6K

PROPER SELECTION OF FUEL, COOLANT AND LUBRICANTS

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE -40 -22 -4 14 32 50 68 86 104 122°F -40 -30 -20 -10 0 10 20 30 40 50°C	CAPACITY Specified	 Refill
Engine oil pan	Engine oil	SAE 15W-40 SAE 10W-30 SAE 30W SAE 10W Synthetic SAE 5W-30	17.5/ 4.62 US gal 3.85 UK gal	17/ 4.49 US gal 3.74 UK gal
Swing machinery case			2.5/ 0.66 US gal 0.55 UK gal	2.5/ 0.66 US gal 0.55 UK gal
Final drive case (each)		SAE 30W	4.0/ 1.05 US gal 0.88 UK gal	4.0/ 1.05 US gal 0.88 UK gal
PTO gear case			0.75/ 0.20 US gal 0.17 UK gal	0.75/ 0.20 US gal 0.17 UK gal
Hydraulic system		SAE 10W SAE 10W-30 SAE 15W-40	140/ 37.0 US gal 30.8 UK gal	90/ 23.8 US gal 19.8 UK gal
Fuel tank	Diesel fuel	ASTM D975 No. 2 ※	240/ 63.4 US gal 52.8 UK gal	- -
Cooling system	Water	Add antifreeze	18.2/ 4.80 US gal 4.00 UK gal	

※ ASTM D975 No. 1

NOTE:
(1) When fuel sulphur content is less than 0.5%, change oil in the oil pan every periodic maintenance hours described in this manual.
Change oil according to the following table if fuel sulphur content is above 0.5%.

Fuel sulphur content	Change interval of oil in engine oil pan
0.5 to 1.0%	1/2 of regular interval
Above 1.0%	1/4 of regular interval

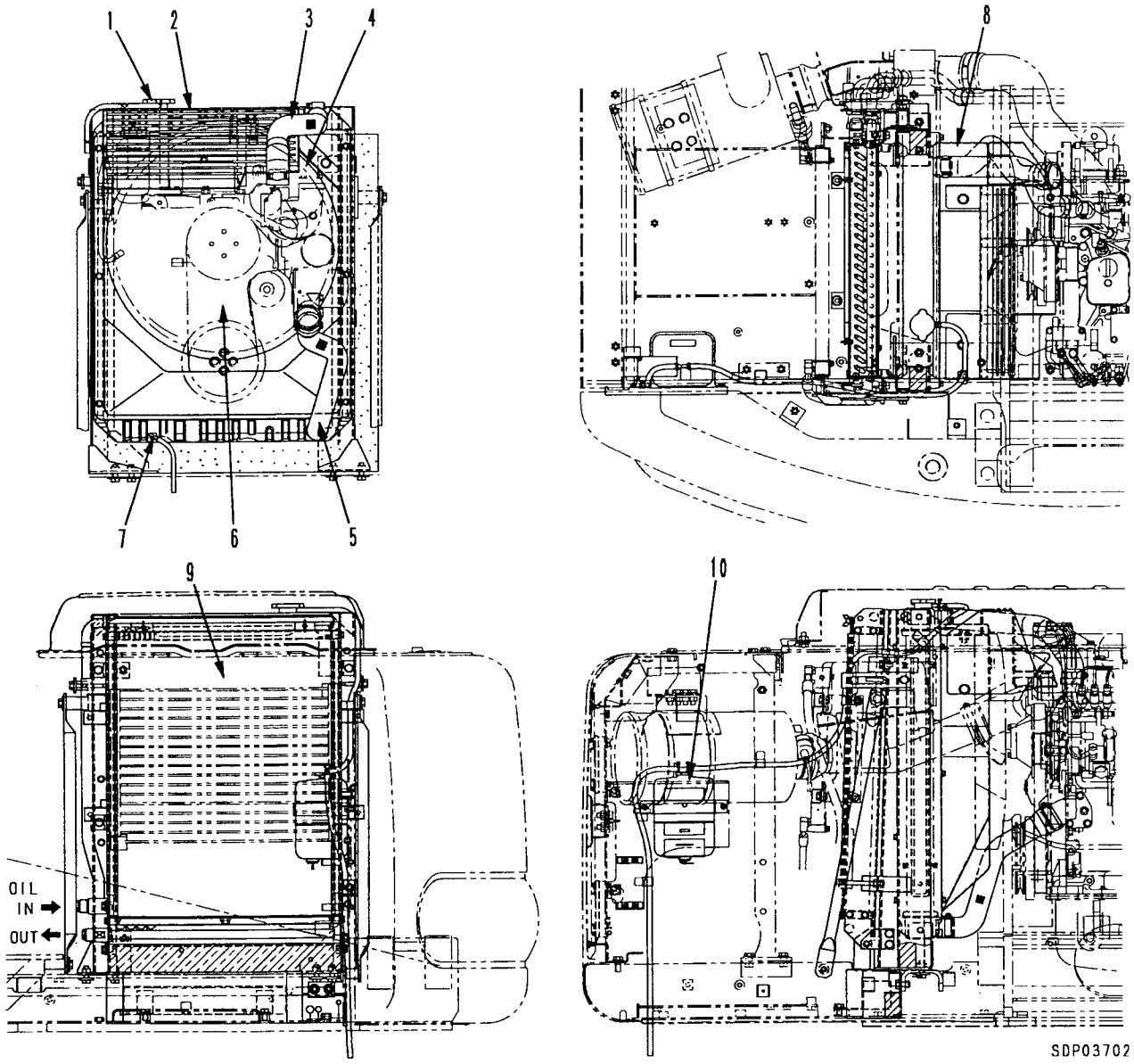
(2) When starting the engine in an atmospheric temperature of lower than 0°C, be sure to use engine oil of SAE10W, SAE10W-30 and SAE15W-40, even though an atmospheric temperature goes up to 10°C more or less in the day time.
(3) Use API classification CD as engine oil and if API classification CC, reduce the engine oil change interval to half.
(4) There is no problem if single grade oil is mixed with multigrade oil (SAE10W-30, 15W-40), but be sure to add single grade oil that matches the temperature in the table on the left.
(5) We recommend Komatsu genuine oil which has been specifically formulated and approved for use in engine and hydraulic work equipment applications.

ASTM: American Society of Testing and Material
SAE: Society of Automotive Engineers
API: American Petroleum Institute

Specified capacity: Total amount of oil including oil for components and oil in piping.
Refill capacity: Amount of oil needed to refill system during normal inspection and maintenance.

10 STRUCTURE AND FUNCTION

RADIATOR AND OIL COOLER



1. Radiator cap
2. Radiator
3. radiator inlet hose
4. Fan guard
5. Radiator outlet hose
6. Fan
7. Drain valve
8. Shroud
9. Oil cooler
10. Reservoir tank

SPECIFICATIONS

Radiator

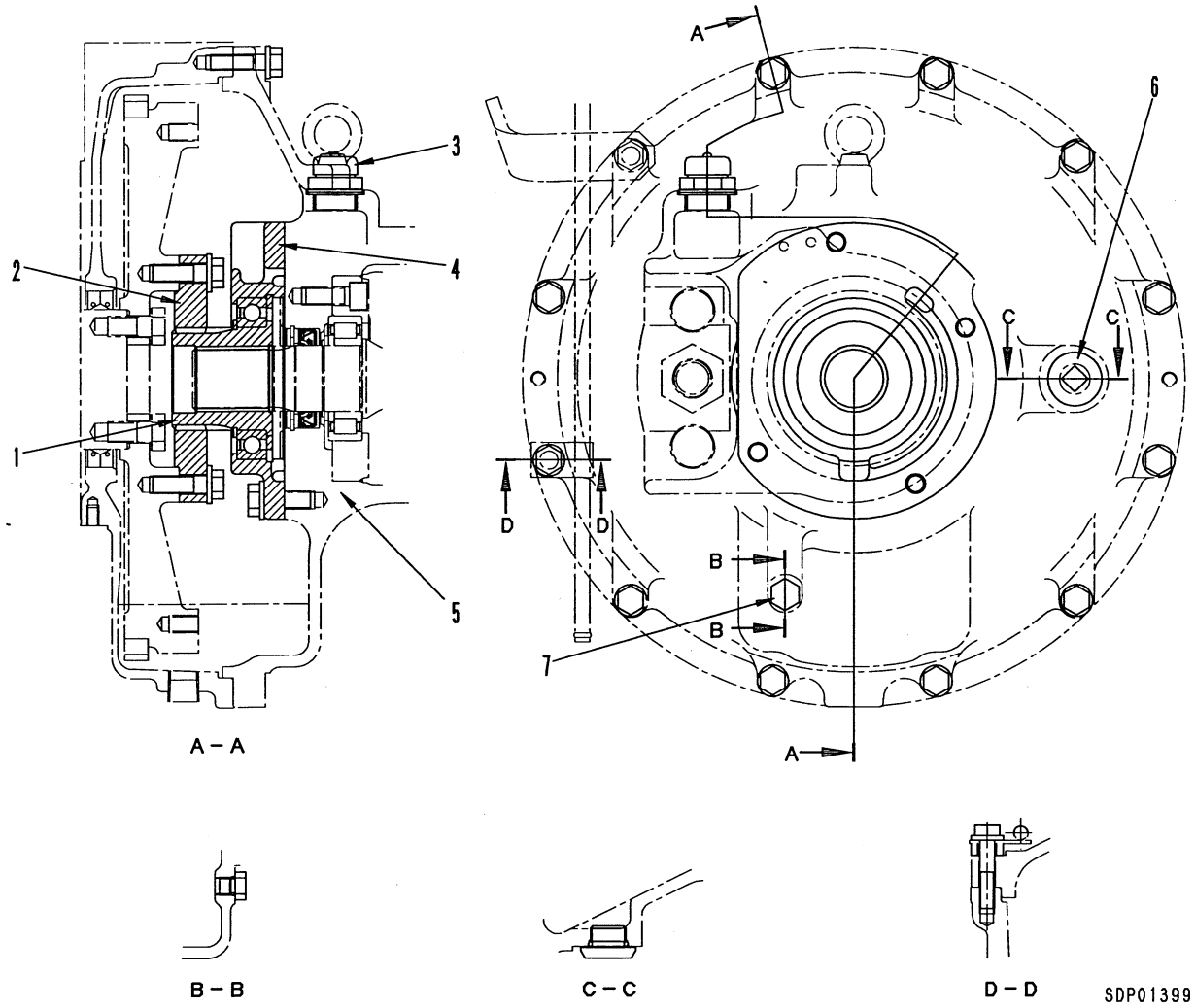
- Core type: CF19-4
- Fine pitch: 3.5/2 mm
- Fan quard
- Total heat dissipation surface: 34.06 m^2
- Pressure valve cracking pressure: 49.03 kPa {0.5 kg/cm^2}
- Vacuum valve cracking pressure: -4.9 kPa {-0.05 kg/cm^2}

Oil cooler

- Core type: 3A-CS
- Fine pitch: 3.5 mm
- Total heat dissipation surface: 12.27 m^2

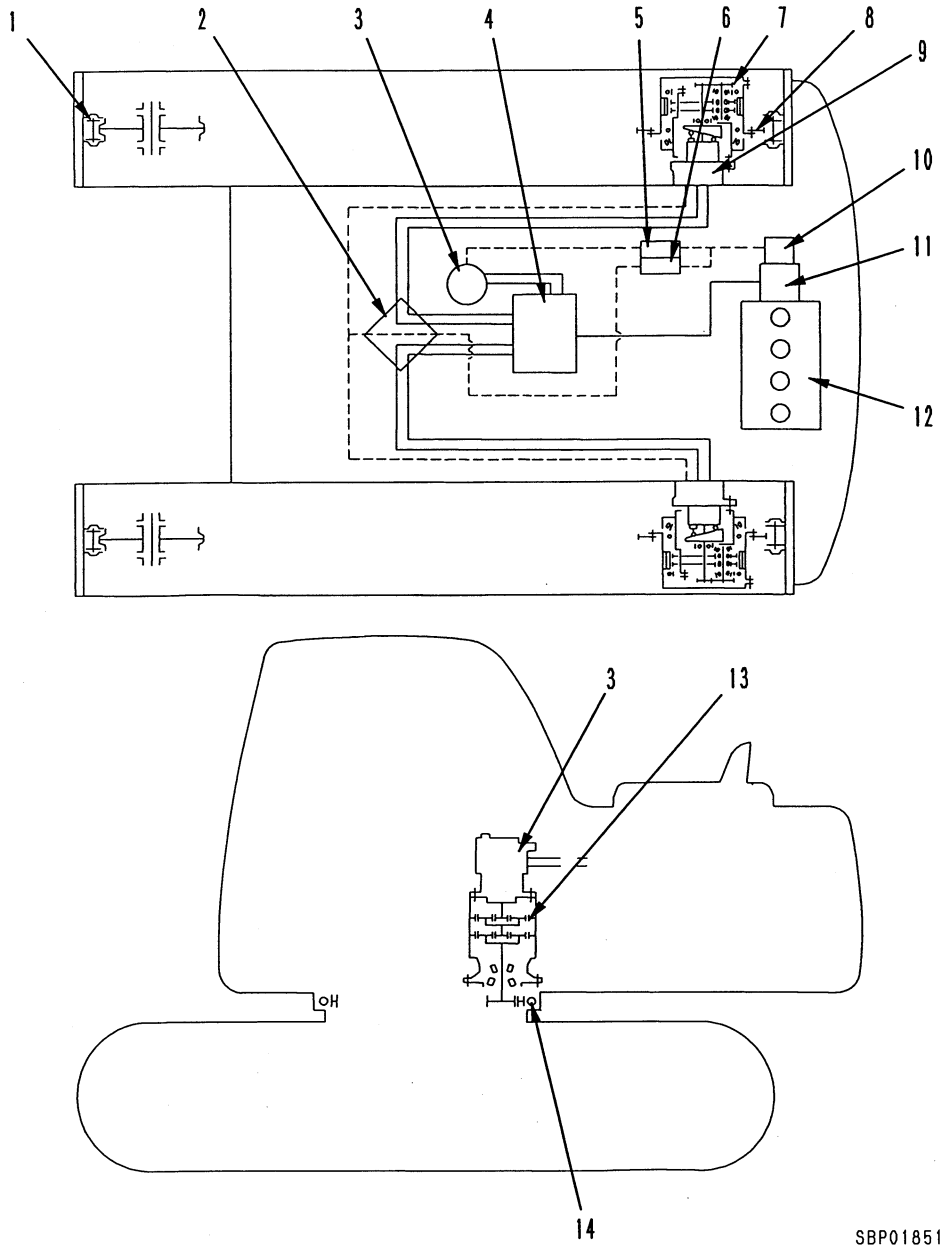
★ The oil cooler is a hinged type, if the 4 mounting bolts are removed, it can opened to make it easier to clean the radiator.

PTO (COUPLING)



1. Shaft
2. Coupling
3. Breather
4. Cage
5. Hydraulic pump
6. Oil filler plug
7. Level plug

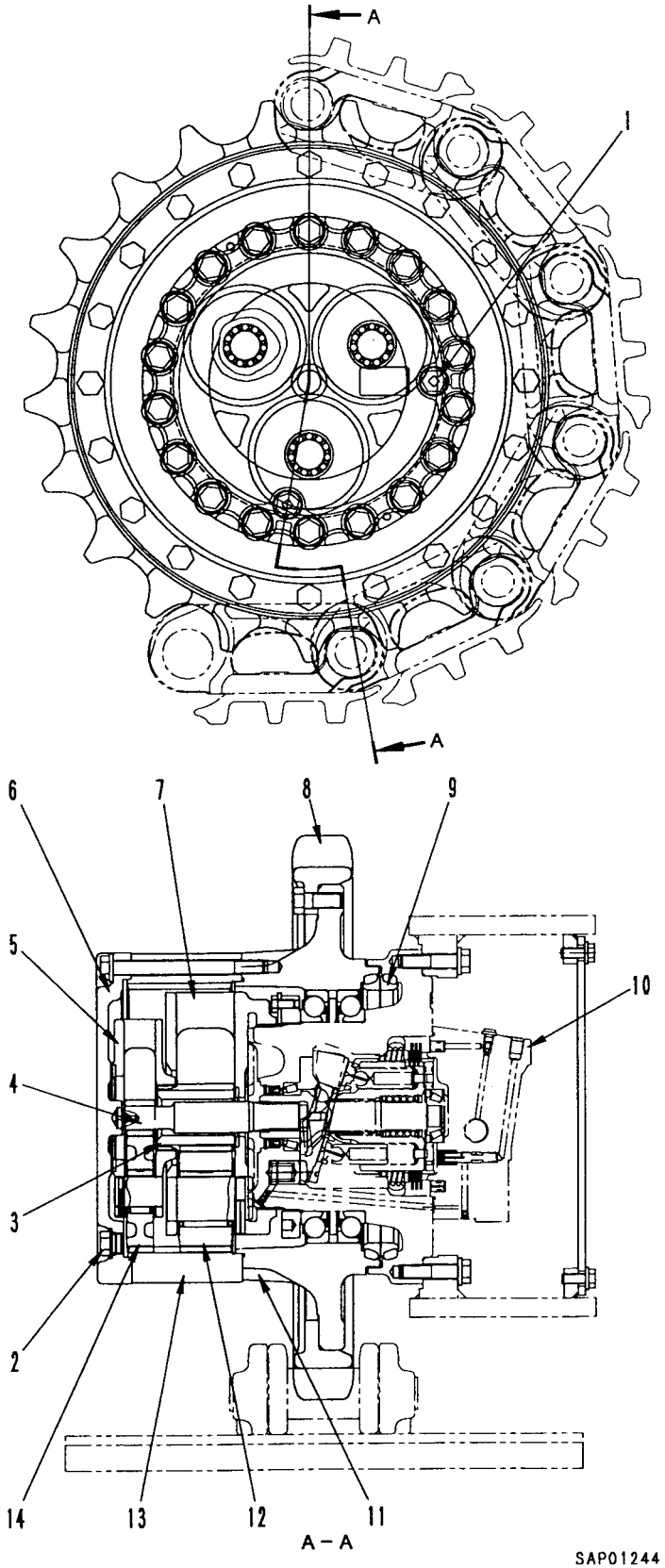
POWER TRAIN



1. Idler
2. Center swivel joint
3. Swing motor (KMF40ABE-3)
4. Control valve
5. Swing brake solenoid valve
6. Travel speed solenoid valve
7. Final drive
8. Sprocket
9. Travel motor (GM18VL)
10. Control pump (BAR020)
11. Hydraulic pump (HPV95)
12. Engine (S4D102-1)
13. Swing machinery
14. Swing circle

FINAL DRIVE

PC130-6K



1. Level plug
2. Drain plug
3. Cover
4. No. 2 sun gear No. of teeth: 21)
5. No. 1 sun gear No. of teeth: 10)
4. No. 1 planetary carrier
6. Cover
7. No. 2 planetary carrier
8. Sprocket
9. Floating seal
10. Travel motor
11. Hub
12. No. 2 planetary gear (No. of teeth: 36)
13. Ring gear (No. of teeth: 95)
14. No. 1 planetary gear (No. of teeth: 42)

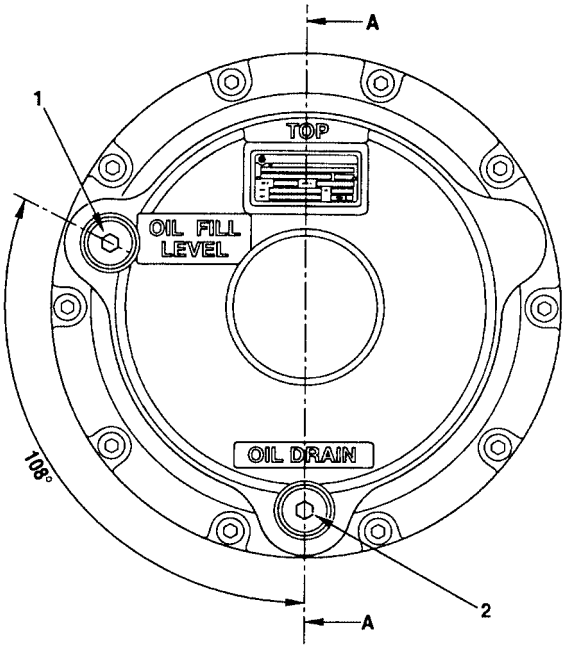
SPECIFICATIONS

Reduction ratio:

$$-\left(\frac{10+95}{10}\right) \times \left(\frac{21+95}{21}\right) +1 = -57.000$$

FINAL DRIVE

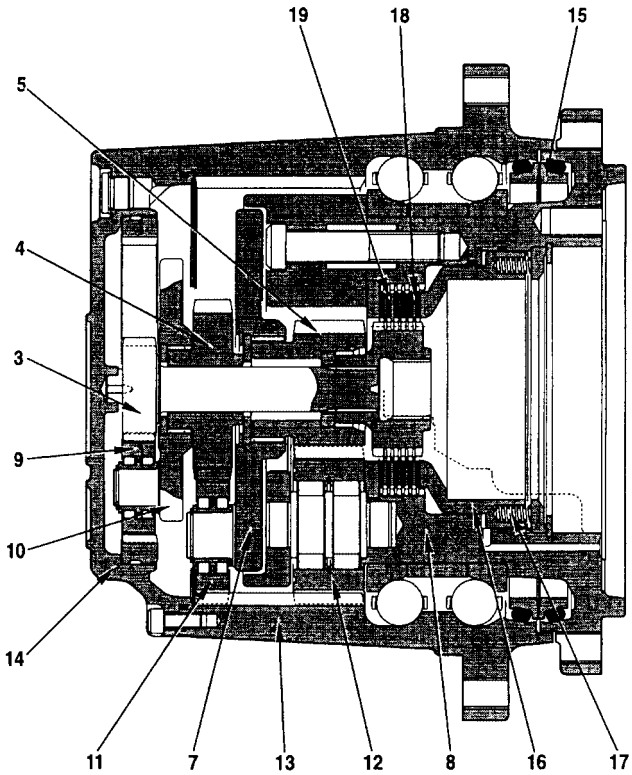
PC150LGP-6K



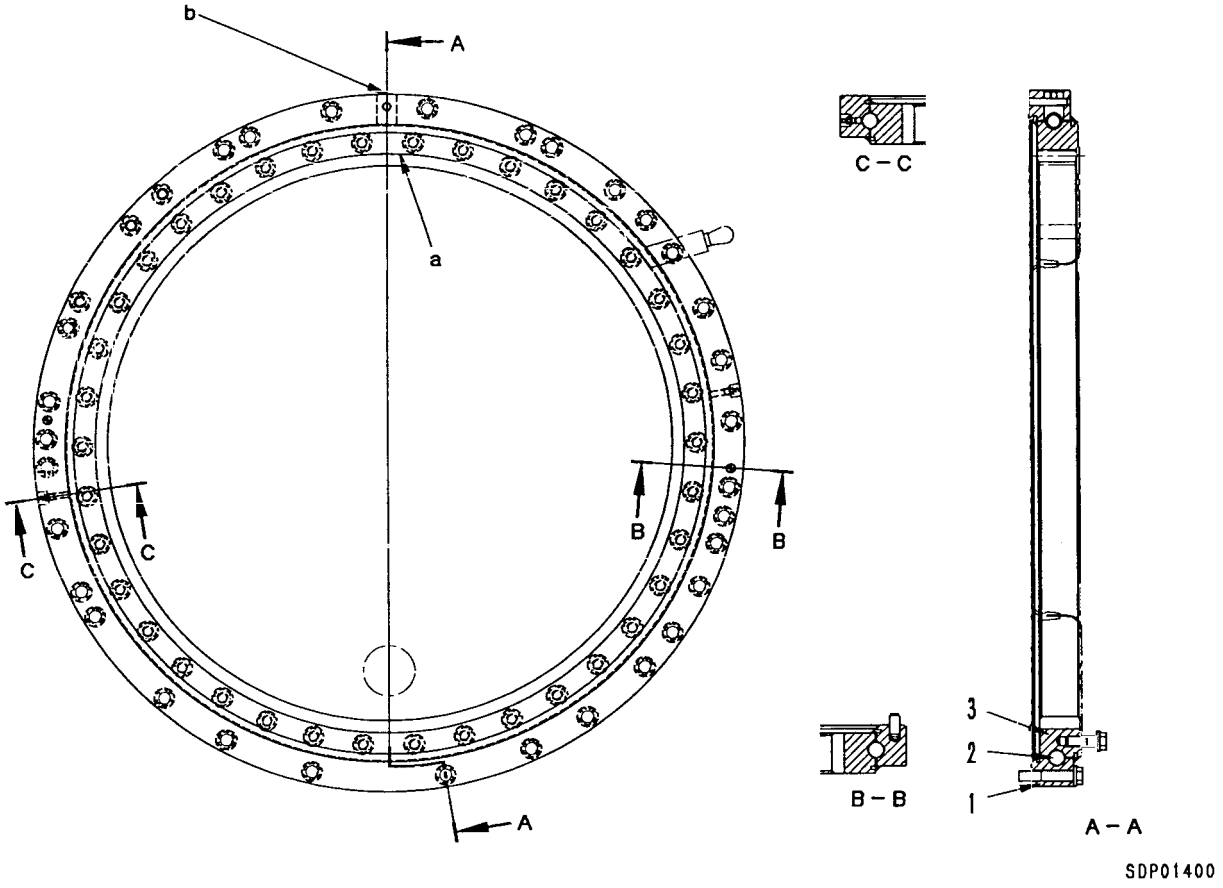
1. Level plug
2. Drain plug
3. No. 1 sun gear (No. Of teeth: 24)
4. No. 2 sun gear No. Of teeth: 28)
5. No. 3 sun gear No. Of teeth: 20)
6. No. 1 planetary carrier
7. No. 2 planetary carrier
8. No. 3 planetary carrier
9. No. 1 planetary gear (No. Of teeth: 26)
10. No. 1 ring gear (No. Of teeth: 78)
11. No. 2 planetary gear (No. Of teeth: 20)
12. No. 3 planetary gear (No. Of teeth: 23)
13. No. 2 ring gear (No. Of teeth: 68)
14. Cover
15. Floating seal
16. Parking brake piston
17. Parking brake spring
18. Parking brake disc
19. Parking brake plate

Reduction ratio:

$$-\left(\frac{24+78}{24}\right) \times \left(\frac{24+78}{24}\right) \times \left(\frac{24+78}{24}\right) +1 = 63.114$$



SWING CIRCLE



1. Outer race
2. Ball
3. Inner race

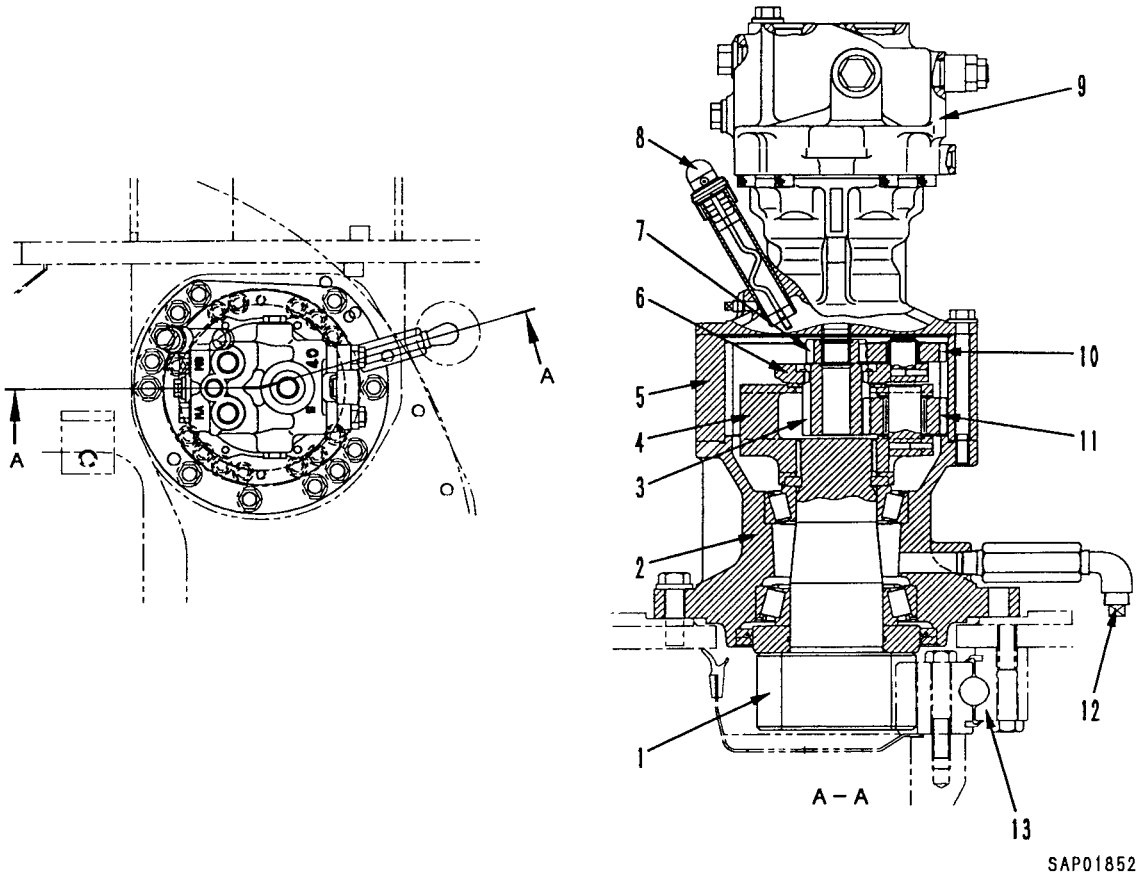
a. Inner race soft zone **"S"** position
b. Outer race soft zone **"S"** position

SPECIFICATIONS

Reduction ratio: $\frac{90}{11}$ = 8.182

Amount of grease: 6.5 l (Grease: G2-LI)

SWING MACHINERY



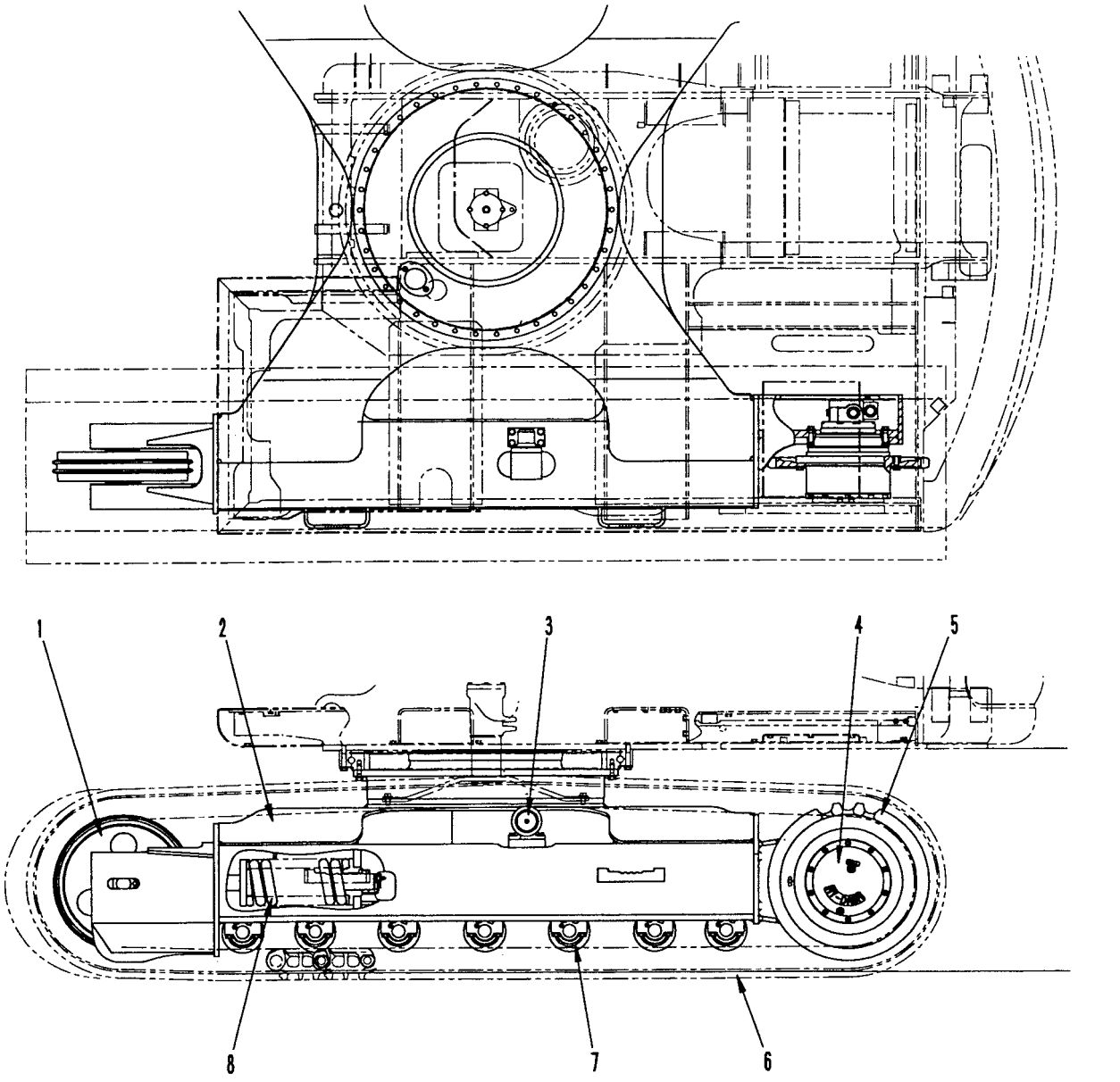
1. Swing pinion (No. of teeth: 11)
2. Case
3. No. 2 sun gear (No. of teeth: 17)
4. No. 2 planetary carrier (No. of teeth: 17)
5. Ring gear (No. of teeth: 61)
6. No. 1 planetary carrier (No. of teeth: 17)
7. No. 1 sun gear (No. of teeth: 14)
8. Oil level gauge/ oil filler port
9. Swing motor
10. No. 1 planetary gear (No. of teeth: 24)
11. No. 2 planetary gear (No. of teeth: 22)
12. Drain plug
13. Swing circle

SPECIFICATIONS

reduction ratio: $\frac{14+61}{14} \times \frac{17+61}{17} = 24.58$

TRACK FRAME

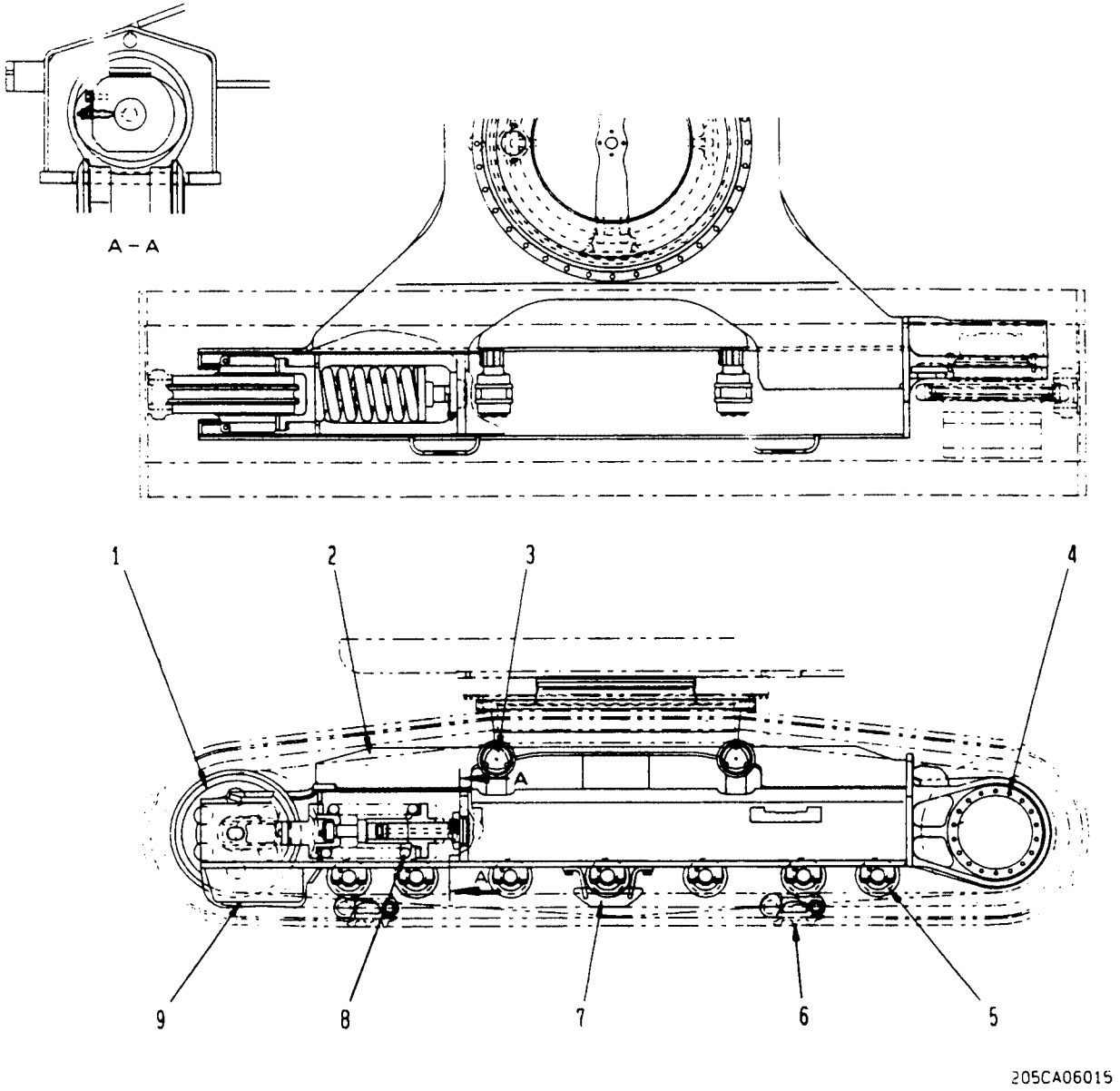
PC130-6K



1. Idler
2. Track frame
3. Carrier roller
4. Travel motor
5. Sprocket
6. Track shoe
7. Track roller
8. Recoil spring

TRACK FRAME, RECOIL SPRING

★ The diagram shows the PC150LGP-6K



1. Idler
2. Track frame
3. Carrier roller
4. Final drive
5. Track roller
6. Track shoe
7. Center guard
8. Recoil spring
9. Front guard

- The dimensions and number of track rollers may differ according to the model, but the basic structure is the same.
- No. of rollers (each side)

Model	No. of track rollers	No. of carrier rollers
PC150LGP-6K	7	2

TRACK SHOE

STANDARD SHOE

Item \ Model	PC130-6K	PC150LGP-6K
Shoe width (triple shoe)	500 mm	800 mm
Link pitch	175.25 mm	190 mm
No. of rollers (each side)	42	45

SELECTION OF TRACK SHOE

- Select the most suitable track shoe from the following table

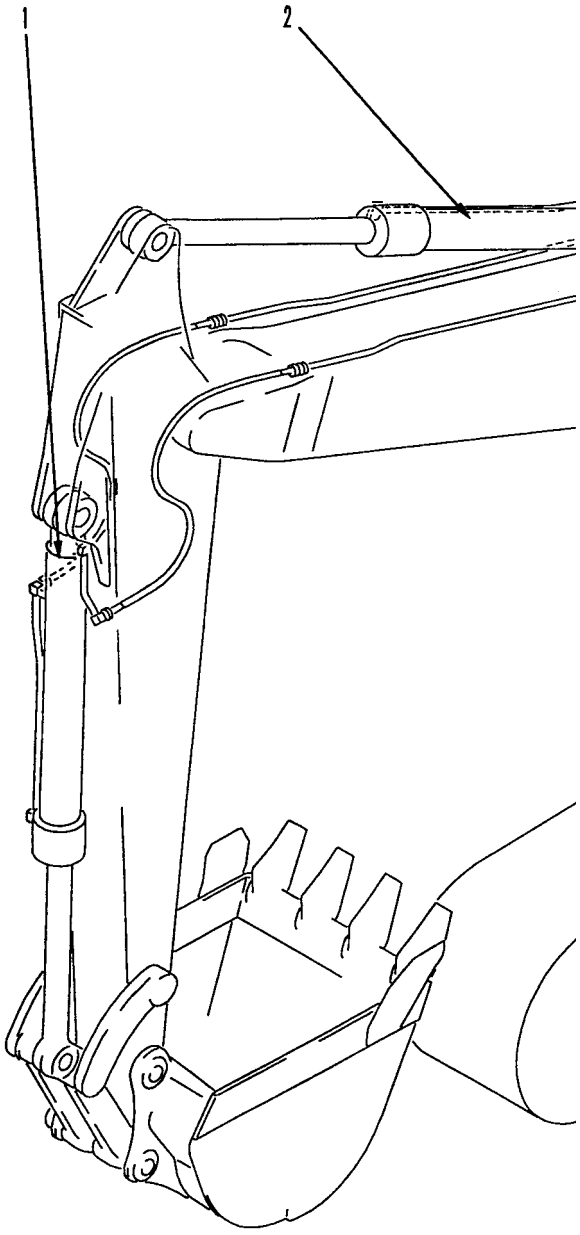
Model	PC130-6K		PC150LGP-6K	
	Specification	Category	Specification	Category
Standard	500 mm triple	A	800 mm triple	C
Option	600 mm triple	B	900 mm triple	C
Option	700 mm triple	C		

Category	Use	Precautions when using
A	Rocky ground, normal river soil	• Travel in Lo speed when traveling on rough ground with obstacles such as large boulders and fallen trees.
B	Normal soil, soft land	• Cannot be used on rough ground where there are large obstacles such as boulders and fallen trees. • Travel in Hi speed only on flat ground; when it is impossible to avoid traveling over obstacles, lower the travel speed to approx. half of Lo speed.
C	Extremely soft ground (swampy ground)	• Use only for ground where "**A**" and "**B**" sink and are impossible to use. • Cannot be used on rough ground where ther are large obstacles such as boulders and fallen trees. • Travel in Hi speed only on flat ground; when it is impossible to avoid traveling over obstacles, lower the travel speed to approx. half of Lo speed.

★ Categories "**B**" and "**C**" are wide shoes, so there are restrictions on their use. Therefore, before using, check the restrictions and consider carefully the conditions of use before recommending a suitable shoe width. If necessary, give the customer guidance in their use.

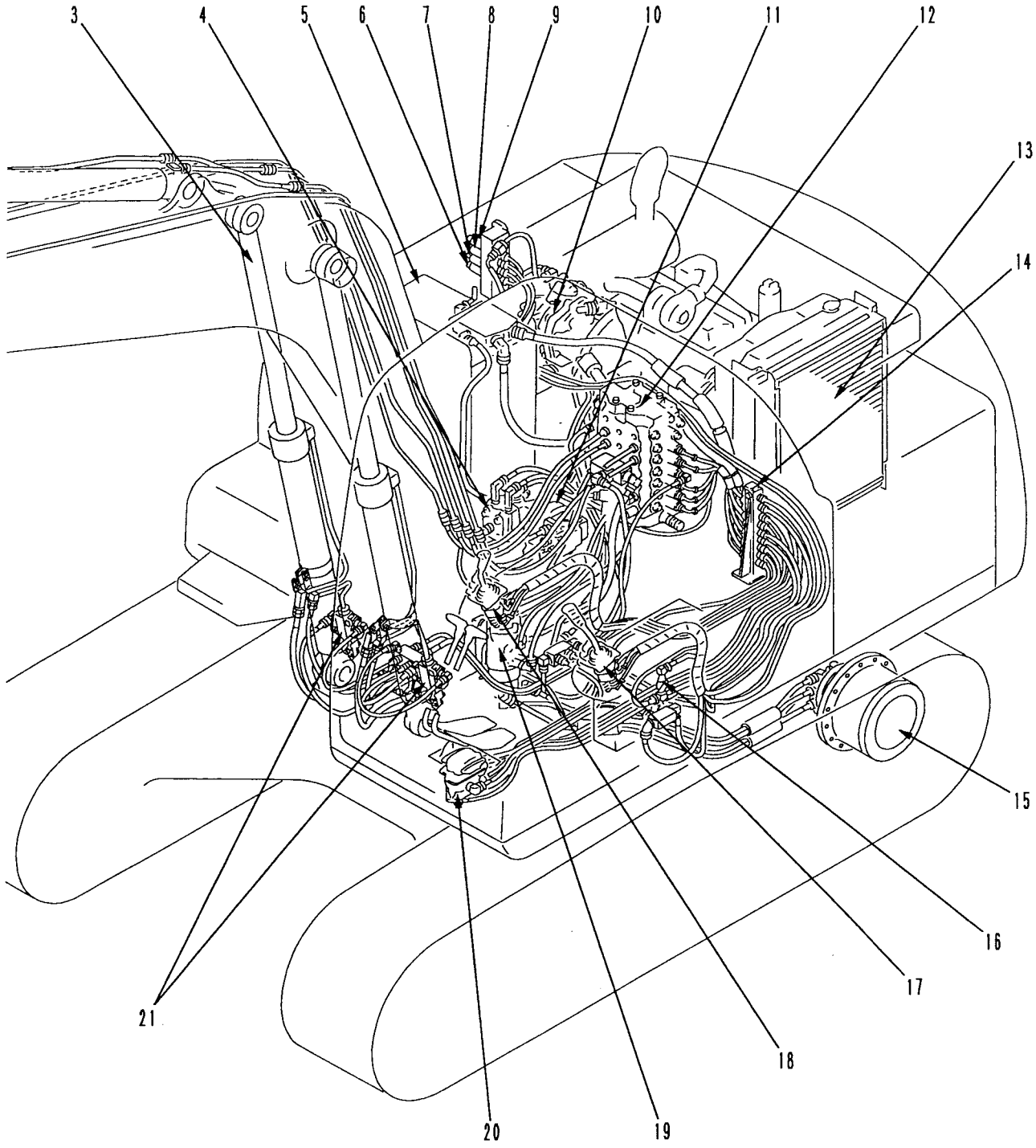
★ When selecting the shoe width, select the narrowest shoe possible within the range that will give no problem with flotation and ground pressure.
If a wider shoe than necessary is used, there will be a large load on the shoe, and this may lead to bending of the shoe, cracking of the links, breakage of the pins, loosening of the shoe bolts, or other problems.

HYDRAULIC PIPING DRAWING



SWP04658

1. Bucket cylinder
2. Arm cylinder
3. Boom cylinder
4. Swing motor
5. Hydraulic tank
6. Travel speed solenoid valve
7. Swing brake solenoid valve
8. 2-stage relief solenoid valve
9. Active mode solenoid valve
10. Hydraulic pump
11. R.H. travel motor
12. Control valve
13. Oil cooler
14. Junction box
15. L.H. travel motor
16. Safety lock valve
17. L.H. work equipment PPC valve
18. R.H. work equipment PPC valve
19. Center swivel joint
20. Travel PPC valve
21. Hose burst protection valves

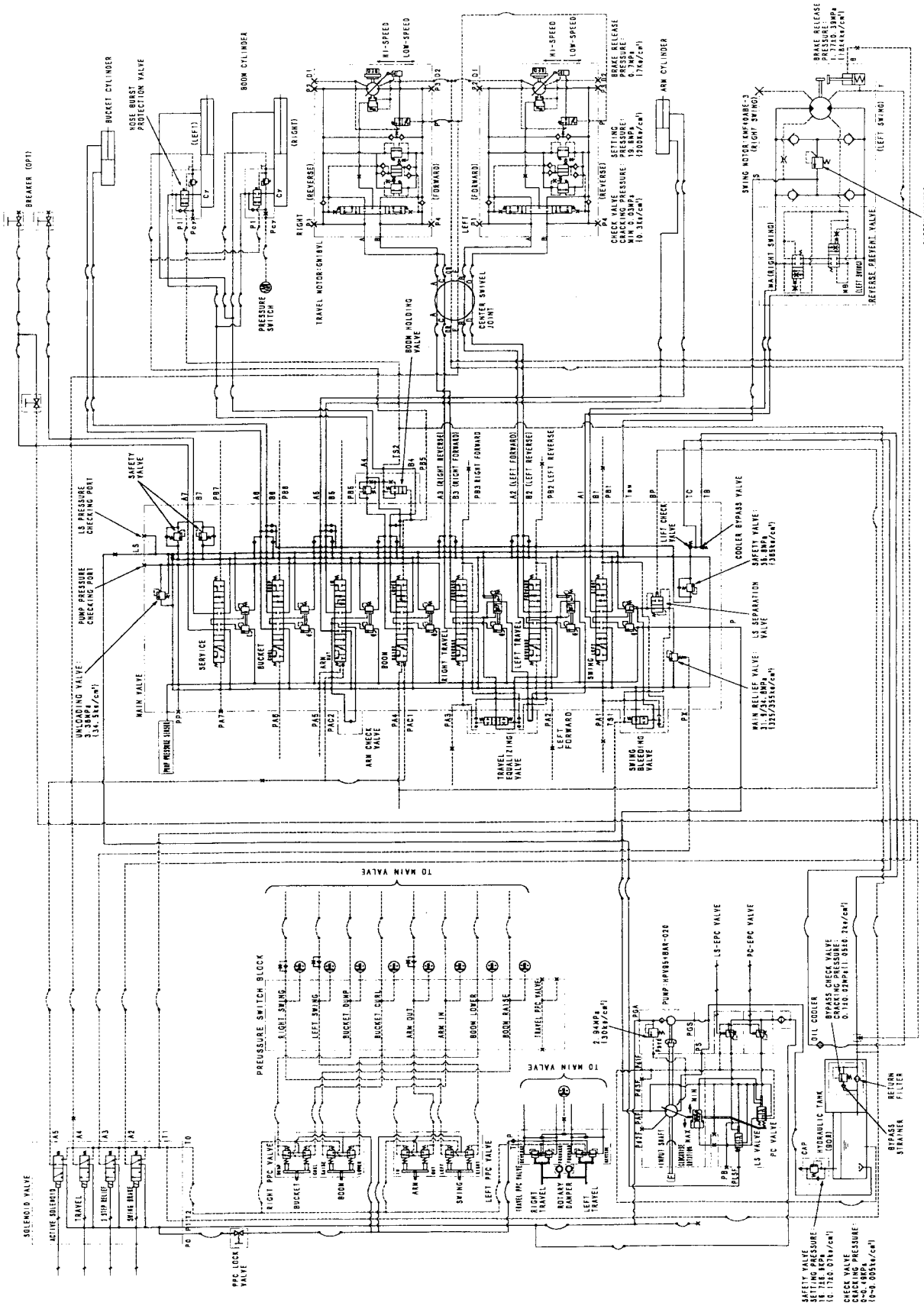


SWP04659

HYDRAULIC CIRCUIT DIAGRAM

PC130-6K

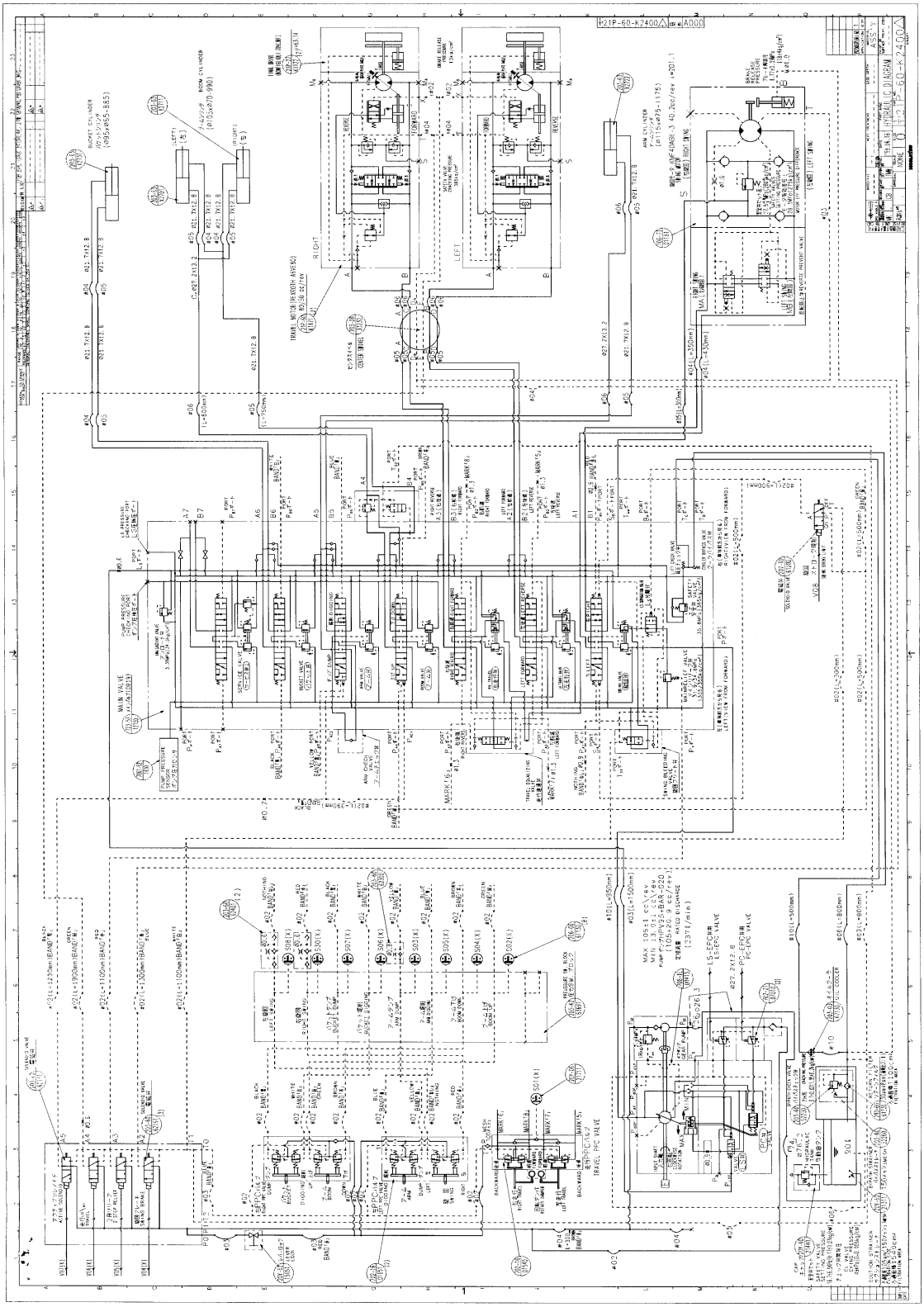
★ For details of this page, see section 90



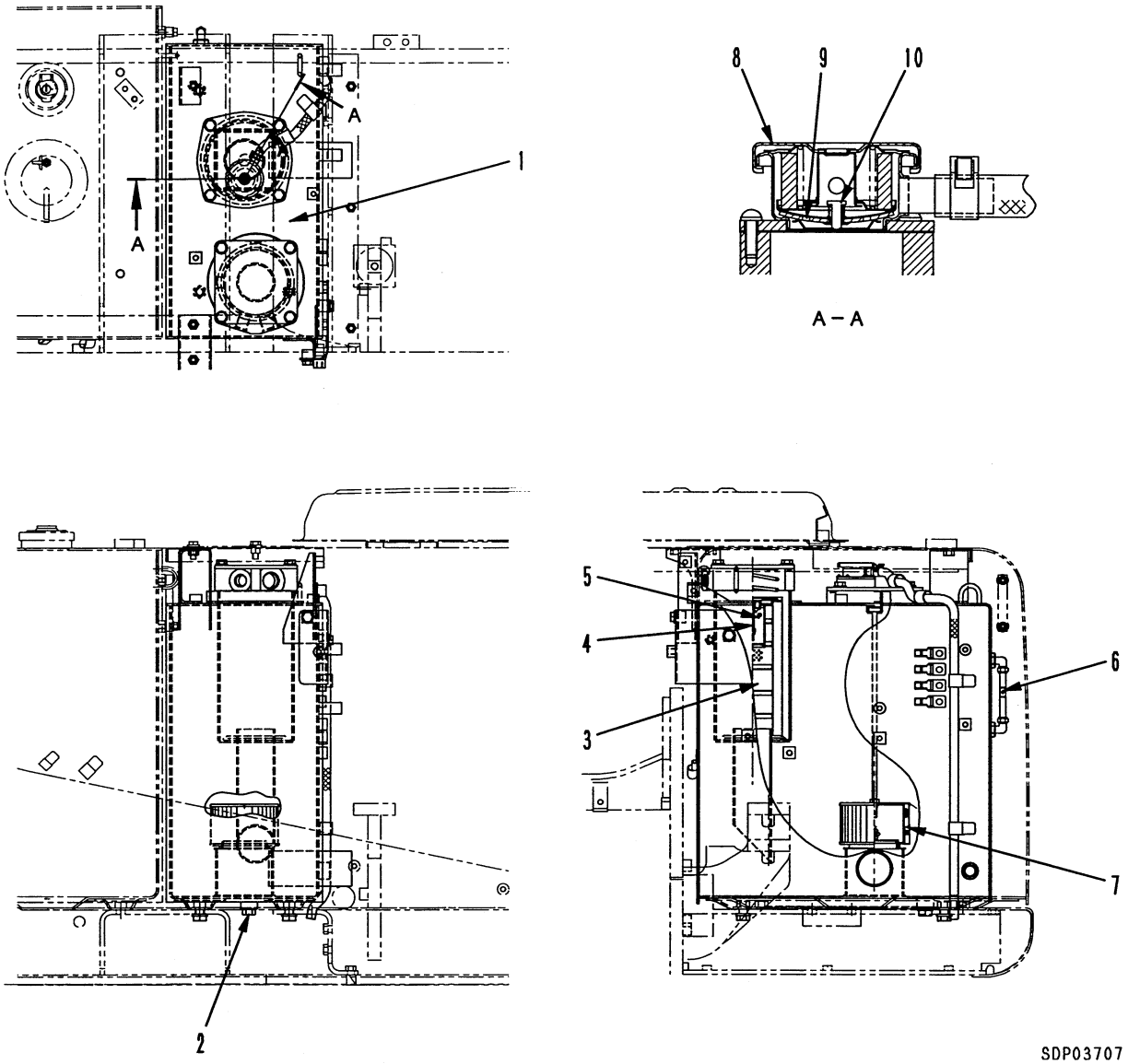
HYDRAULIC CIRCUIT DIAGRAM

PC150LGP-6K

★ For details of this page, see section 90



HYDRAULIC TANK

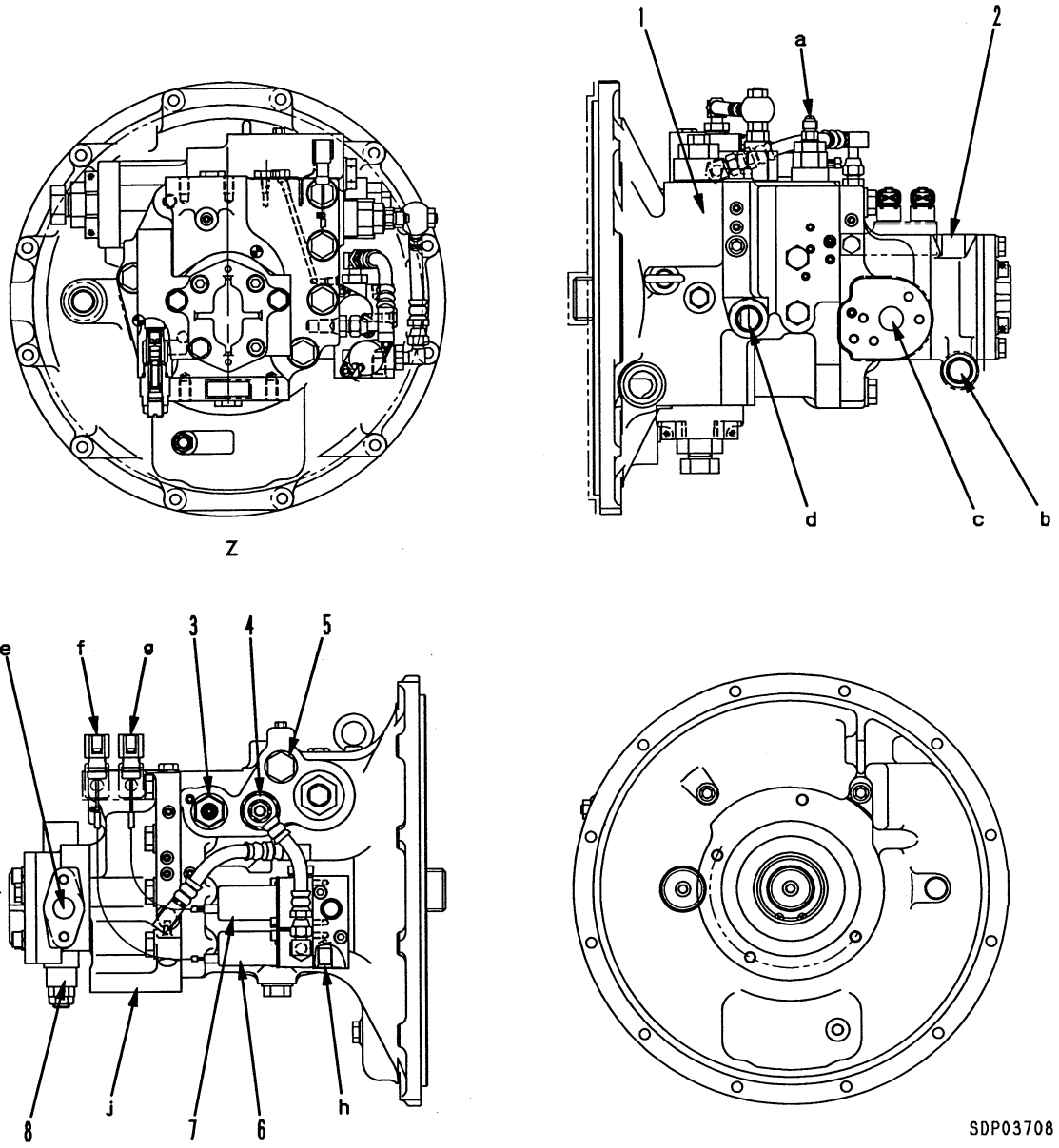


1. Hydraulic tank
2. Drain plug
3. Filter element
4. Bypass valve
5. Bypass strainer
6. Sight gauge
7. Suction strainer
8. Cap
9. Pressure valve
10. Vacuum valve

SPECIFICATIONS

Tank capacity: 140 ℓ
Oil amount: 90 ℓ
Pressure valve cracking pressure :
16.7 ± 6.9 kPa {0.17 ± 0.07 kg/cm²}
Vacuum valve cracking pressure :
0 — –0.49 kPa {0 — –0.005 kg/cm²}
Bypass valve cracking pressure :
103 ± 19.6 kPa {1.05 ± 0.2 kg/cm²}

HYDRAULIC PUMP



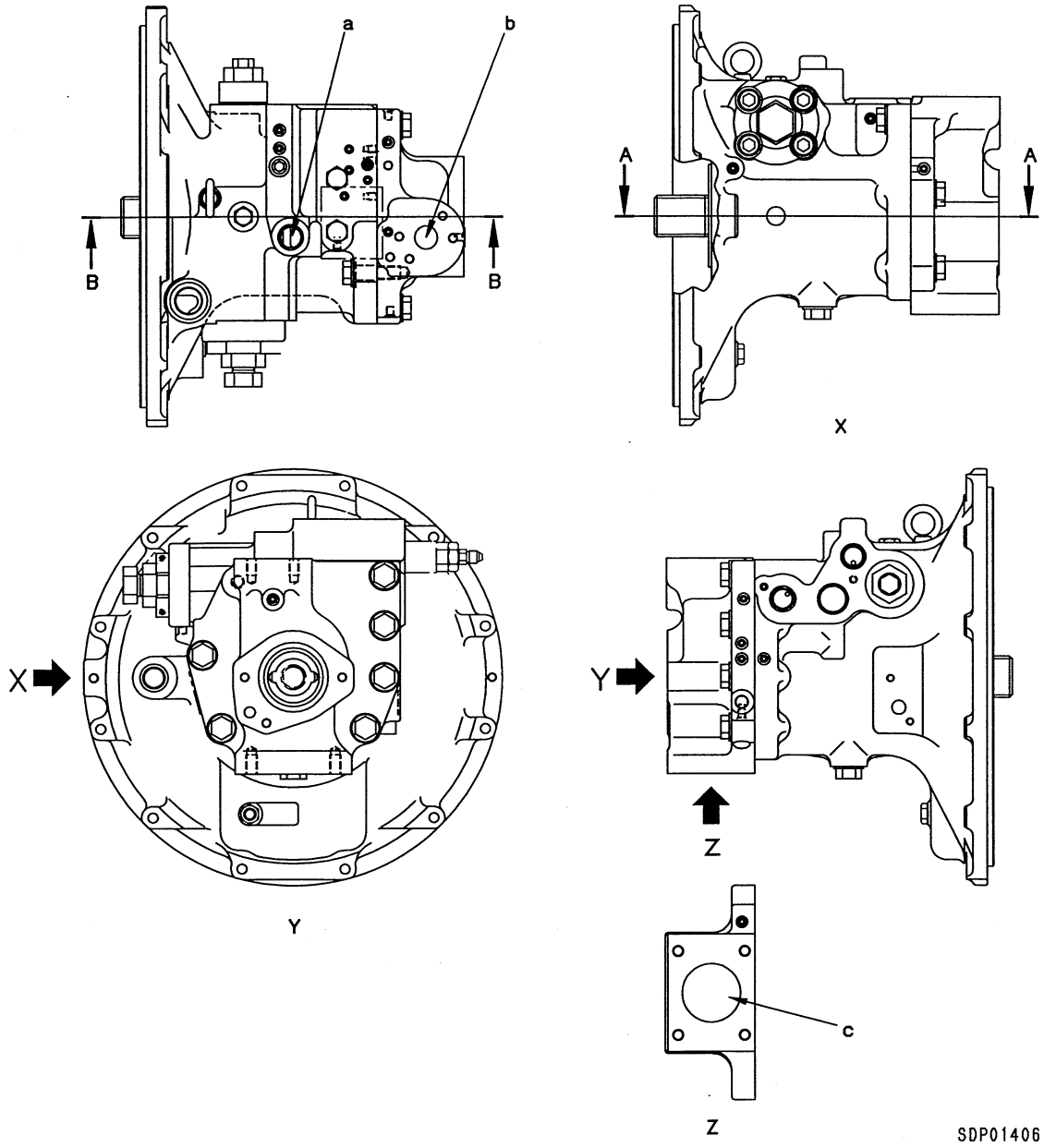
a. Port **PLS** (control valve LS pressure inlet port)
b. Port **PGA** (control pump discharge)
c. Port **PA** (main pump discharge)
d. Port **Pd** (main pump drain)
e. Port **PGS** (control pump suction)
f. Port **im** (PC mode selector current)
g. Port **isig** (LS set selector current)
h. Port **PEPC** (EPC valve basic pressure inlet port)
j. Port **PS** (main pump suction)

1. Main pump
2. Control pump
3. LS valve
4. PC valve
5. Fixed throttle valve
6. PC-EPC valve (for PC mode selector)
7. LS-EPC valve (for LS set selector)
8. Control relief valve

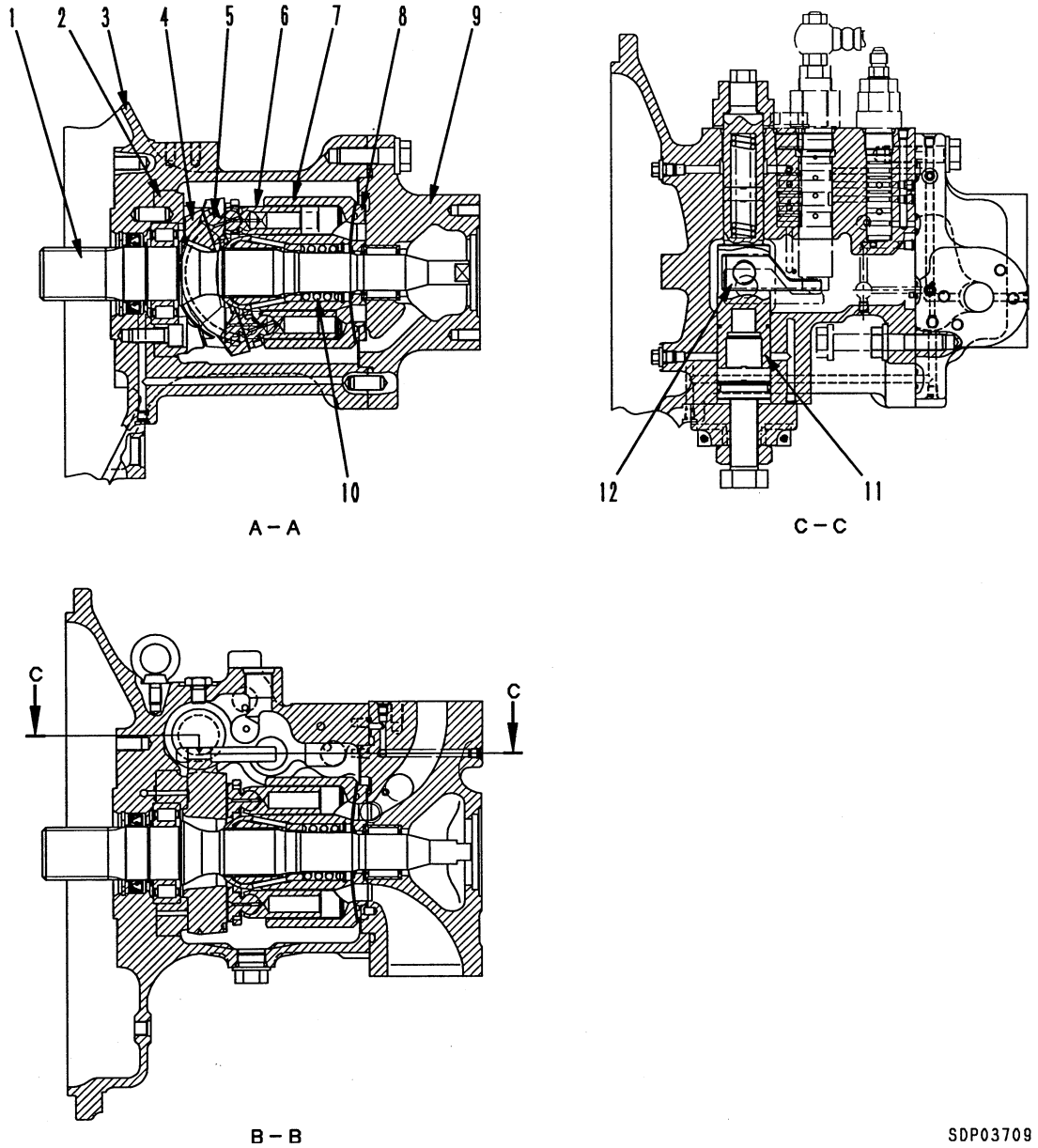
Specifications
Type: HPV95
Theoretical discharge: 105 cc/rev

MAIN PUMP

HPV 95



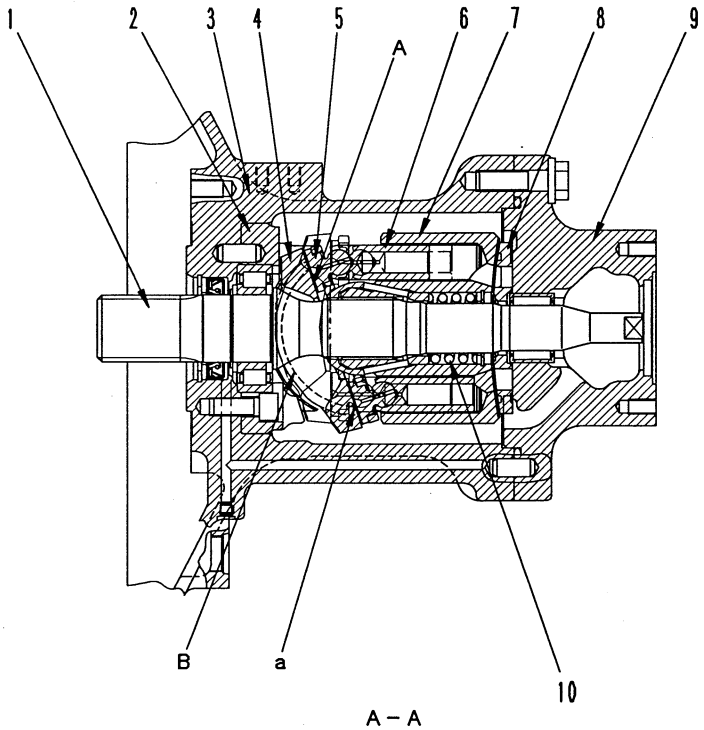
a : Port **Pd** (drain)
b : Port **PA** (discharge)
c : Port **PS** (suction)



1. Shaft
2. Cradle
3. Case
4. Rocker cam
5. Shoe
6. Piston
7. Cylinder block
8. Valve plate
9. End cap
10. Spring
11. Servo piston
12. Slider

Function

- The engine rotation and torque transmitted to the pump shaft is converted into hydraulic energy, and pressurized oil is discharged according to the load.
- It is possible to change the delivery amount by changing the swash plate angle.



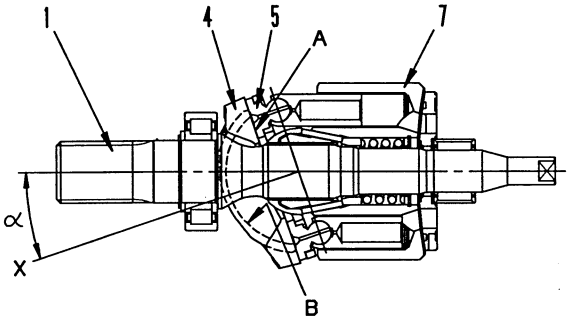
Structure

- Cylinder block (7) is supported to shaft (1) by spline **a**, and shaft (1) is supported by the front and rear bearings.
- The tip of piston (6) is a concave ball, and shoe (5) is caulked to it to form one unit. Piston (6) and shoe (5) form a spherical bearing.
- Locker cam (4) has flat surface **A**, and shoe (5) is always pressed against this surface while sliding in a circular movement. Rocker cam (4) brings high pressure oil at cylindrical surface **B** with cradle (2), which is secured to the case, and forms a static pressure bearing when it slides.
- Piston (6) carries out relative movement in the axial direction inside each cylinder chamber of cylinder block (7).
- Cylinder block (7) seals the pressure oil to valve plate (8) and carries out relative rotation. This surface is designed so that the oil pressure balance is maintained at a suitable level. The oil inside each cylinder chamber of cylinder block (7) is sucked in and discharged through valve plate (8).

OPERATION

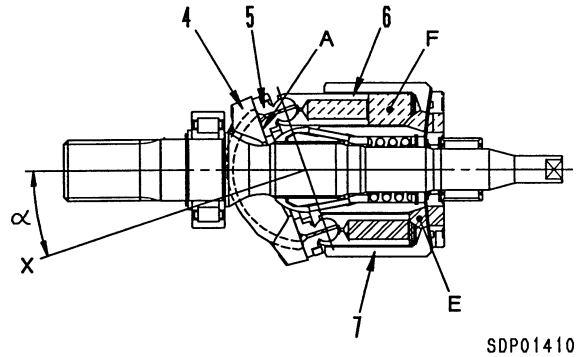
1. Operation of pump

1) Cylinder block (7) rotates together with shaft (1), and shoe (5) slides on flat surface **A**. When this happens, rocker cam (4) moves along cylindrical surface **B**, so angle α between center line **X** of rocker cam(4) and the axial direction of cylinder block (7) changes. (Angle α is called the swash plate angle.)



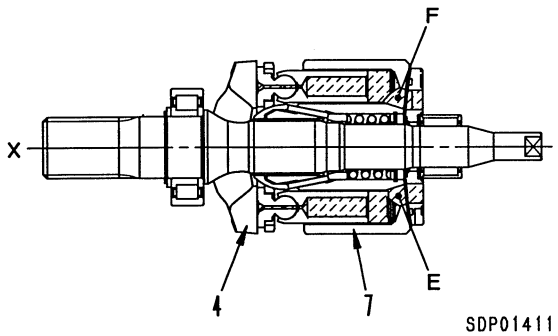
SDP01409

2) Center line **X** of rocker cam (4) maintains swash plate angle α in relation to the axial direction of cylinder block (7), and flat surface **A** moves as a cam in relation to shoe (5). In this way, piston (6) slides on the inside of cylinder block (7), so a difference between volume **E** and **F** is created inside cylinder block (7). The suction and discharge is carried out by this difference **F - E**.
In other words, when cylinder block (7) rotates and the volume of chamber **E** becomes smaller, the oil is discharged during that stroke. On the other hand, the volume of chamber **F** becomes larger, so in that stroke, the oil is sucked in.



SDP01410

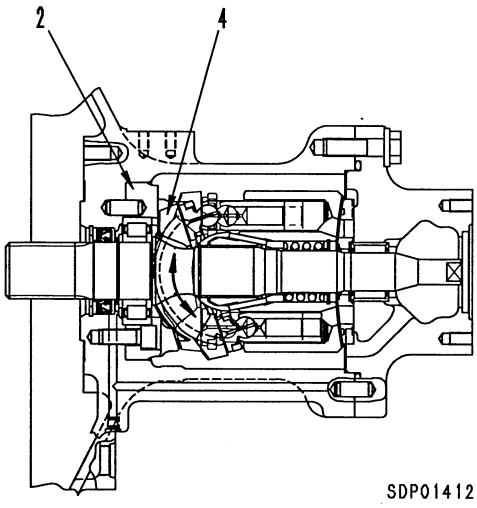
3) If center line **X** of rocker cam (4) is in line with the axial direction of cylinder block (7) (swash plate angle= 0), the difference between volumes **E** and **F** inside cylinder block (7) becomes 0, so the pump does not carry out any suction or discharge of oil. (In actual fact, the swash plate angle never becomes 0.)



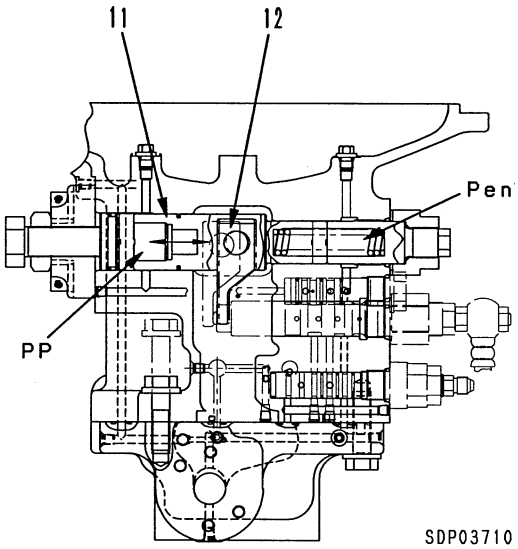
SDP01411

2. Control of discharge amount

- If swash plate angle α becomes larger, the difference in volumes **E** and **F** becomes larger and discharge volume **Q** increases. Swash plate angle α is changed by servo piston (11).
- Servo piston (11) moves in a reciprocal movement (⟷) under the signal pressure of the PC and LS valves. This straight line movement is transmitted through rod (12) to rocker cam (4), and rocker cam (4), which is supported by the cylindrical surface to cradle (2), slides in a rotating movement in direction (↻).
- With servo piston (11), the area receiving the pressure is different on the left and right, so main pump discharge pressure (self pressure) **PP** is always brought to the pressure chamber on the small diameter piston side (front).
  Output pressure **Pen** of the LS valve is brought to the pressure chamber at the large diameter piston end (rear).The relationship in the size of pressure **PP** at the small diameter piston end and pressure **Pen** at the large diameter piston end, and the ratio between the area receiving the pressure of the small diameter piston and the large diameter piston controls the movement of servo piston (11).

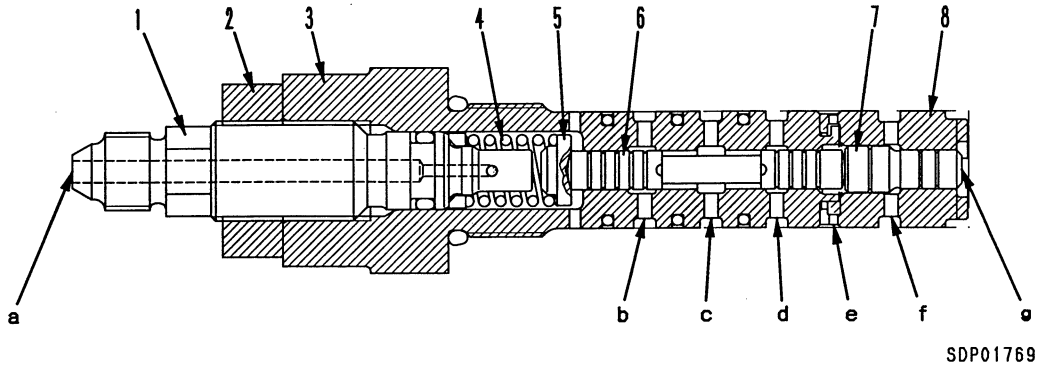


SDP01412



SDP03710

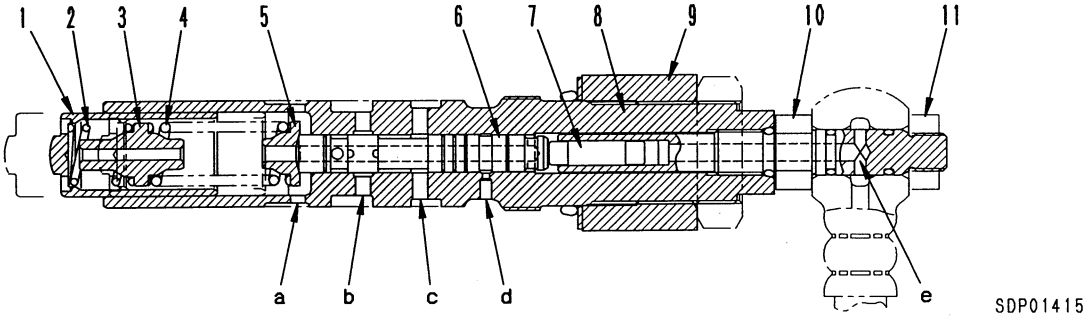
LS VALVE



a : Port **PLS** (Control valve LS pressure inlet port)
b : Port **PA** (Pump delivery pressure inlet port)
c : Port **PLP** (LS valve signal pressure outlet port)
d : Port **PPL** (PC valve signal pressure inlet port)
e : Port **Pa** (Drain pressure outlet port)
f : Port **Psig** (LS control EPC valve pressure inlet port)
g : Port **PA** (Pomp delivery pressure inlet port)

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

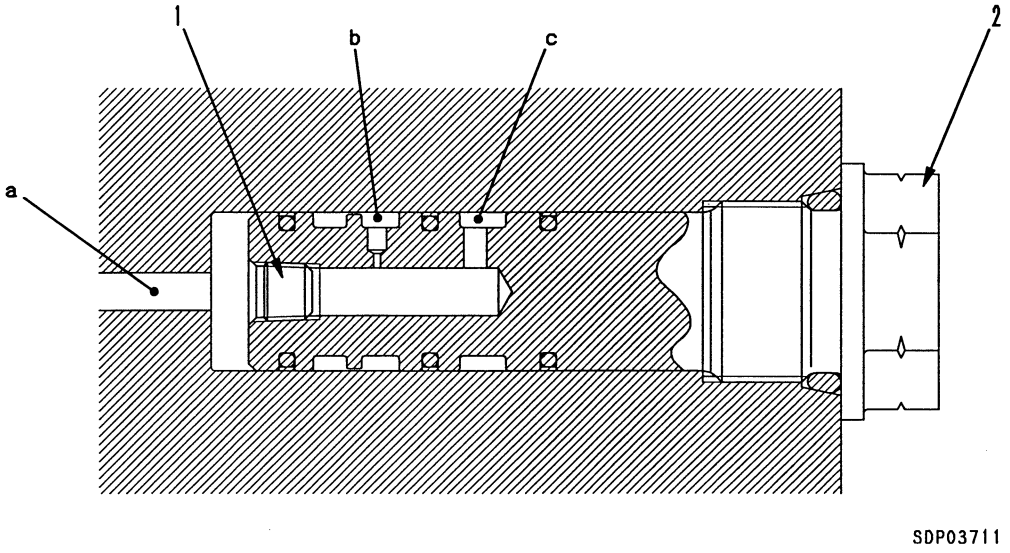
PC VALVE



a : Port **Pa** (Drain pressure outlet port)
b : Port **PPL** (PC valve signal pressure outlet port)
c : Port **PA** (Pump delivery pressure inlet port)
d : Port **PA2** (Pump delivery pressure inlet port)
e : Port **PM** (PC mode select pressure inlet port)

1. Piston
2. Spring
3. Seat
4. Spring
5. Seat
6. Spool
7. Piston
8. Sleeve
9. Locknut
10. Plug
11. Locknut

FIXED THROTTLE VALVE



a : Port **Pa** (drain pressure outlet port)
b : Port **Pout** (control pressure outlet port)
c : Port **Pin** (LS valve signal pressure inlet port)

1. Plug
2. Plug

FUNCTION

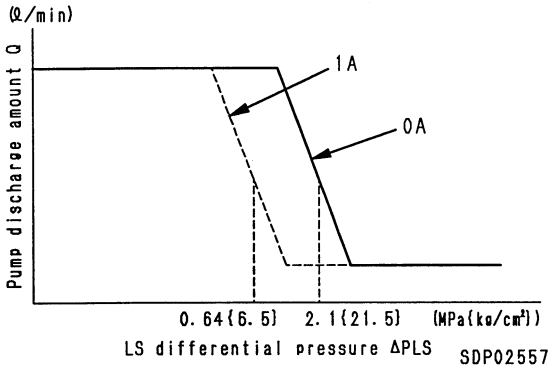
1. LS VALVE

The LS valve detects the load and controls the discharge amount.

This valve controls main pump discharge amount **Q** according to differential pressure **Δ PLS (=PP-PLS)** (the difference between main pump pressure **PP** and control valve outlet port pressure **PLS**) [called the LS differential pressure].

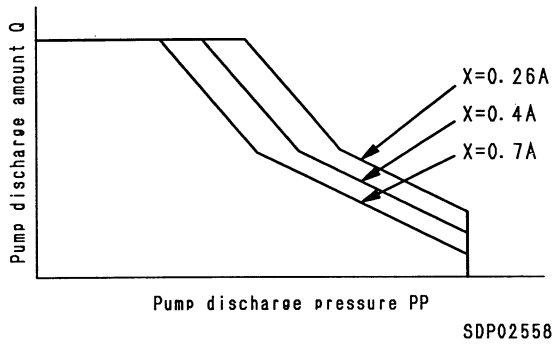
Main pump pressure **PP**, pressure **PLS** [called the LS pressure] coming from the control valve output, and pressure **PSIG** [called the LS selector pressure] from the LS-EPC valve enter this valve. The relationship between discharge amount **Q** and differential pressure **Δ PLS**, (the difference between main pump pressure **PP** and LS pressure **PLS**) (= **PP-PLS**) changes as shown in the diagram on the right according to LS selector current isig of the LS-EPC valve.

When **isig** changes between **0** and **1A**, the set pressure of the spring changes according to this, and the switching point for the pump discharge amount changes at the rated central value between 0.64 ⟷ 2.1 MPa {6.5 ⟷ 21.5 kg/cm²}.

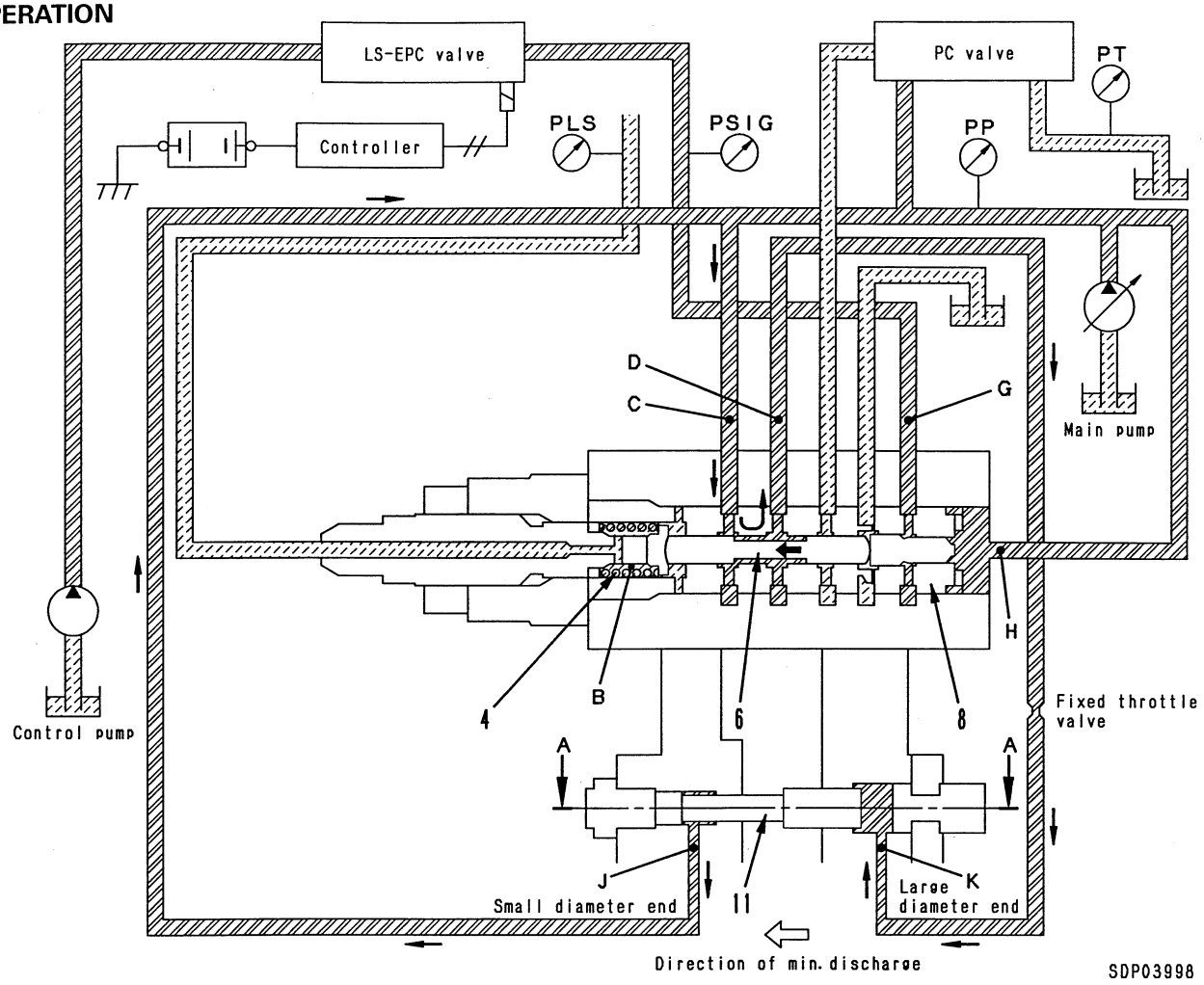


2. PC VALVE

When the pump discharge pressure **PP** is high, the PC valve controls the pump so that no more oil than the constant flow (in accordance with the discharge pressure) flows even if the stroke of the control valve becomes larger. In this way, it carries out equal horsepower control so that the horsepower absorbed by the pump does not exceed the engine horsepower. In other words, if the load during the operation becomes larger and the pump discharge pressure rises, it reduces the discharge amount from the pump; and if the pump discharge pressure drops, it increases the discharge amount from the pump. The relationship between the pump discharge pressure **PP** and pump discharge amount **Q** is shown in the diagram on the right, with the current given to the PC-EPC valve solenoid shown as a parameter. However, in the heavy-duty operation mode, there are cases where it is given the function of sensing the actual speed of the engine, and if the speed drops because of an increase in the load, it reduces the pump discharge amount to allow the speed to recover. In other words, when the load increases and the engine speed drops below the set value, the command current to the PC-EPC valve solenoid from the controller increases according to the drop in the engine speed to reduce the pump swash plate angle.



OPERATION

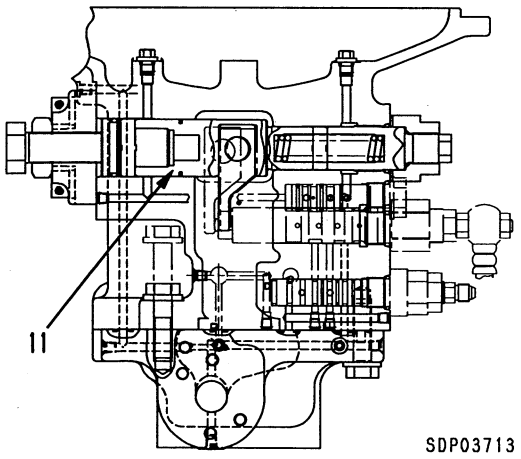


1. LS VALVE

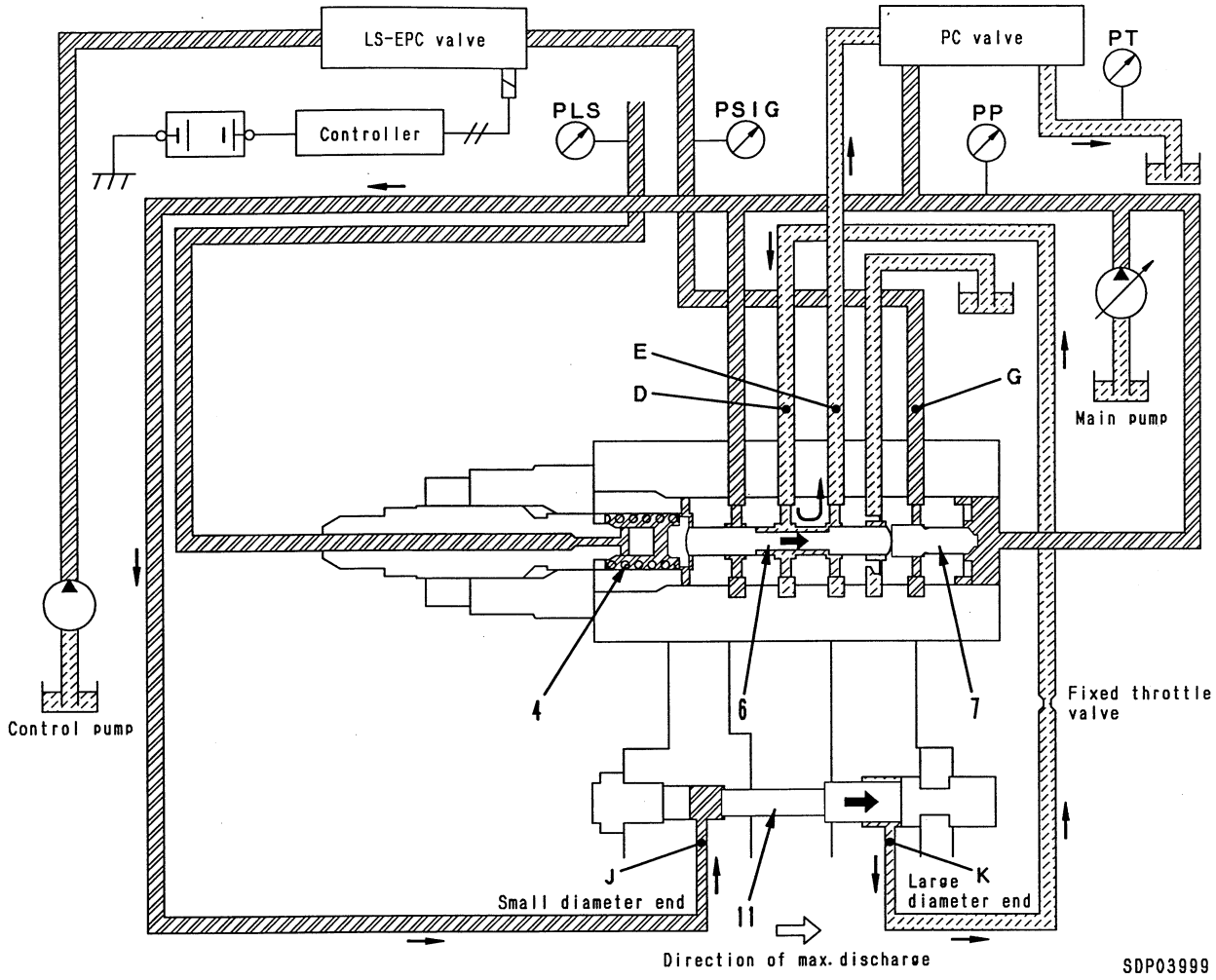
1) When control valve is at neutral position

- The LS valve is a three-way selector valve, with pressure **PLS** (LS pressure) from the inlet port of the control valve brought to spring chamber **B**, and main pump discharge pressure **PP** brought to port **H** of sleeve (8).
  The size of the force produced by this LS pressure **PLS** + force **Z** of spring (4) and the main pump pressure (self-pressure) **PP** determines the position of spool (6). However, the size of the output pressure **PSIG** (the LS selection pressure) of the EPC valve for the LS valve entering port **G** also changes the position of spool (6). (The set pressure of the spring changes.)
- Before the engine is started, servo piston (11) is pushed to the right (large diameter end). (See the diagram on the right)
- When the engine is started and the control lever is at the neutral position, LS pressure **PLS** is 0 MPa {0 kg/cm^2}. (It is interconnected with the drain circuit through the control valve spool.)

At this point, spool (6) is pushed to the left, and port **C** and port **D** are connected. Pump pressure **PP** enters the large diameter end of the piston from port **K**, and the same pump pressure **PP** also enters port **J** at the small diameter end of the piston, so the swash plate is moved to the minimum angle by the difference in area of piston (11).

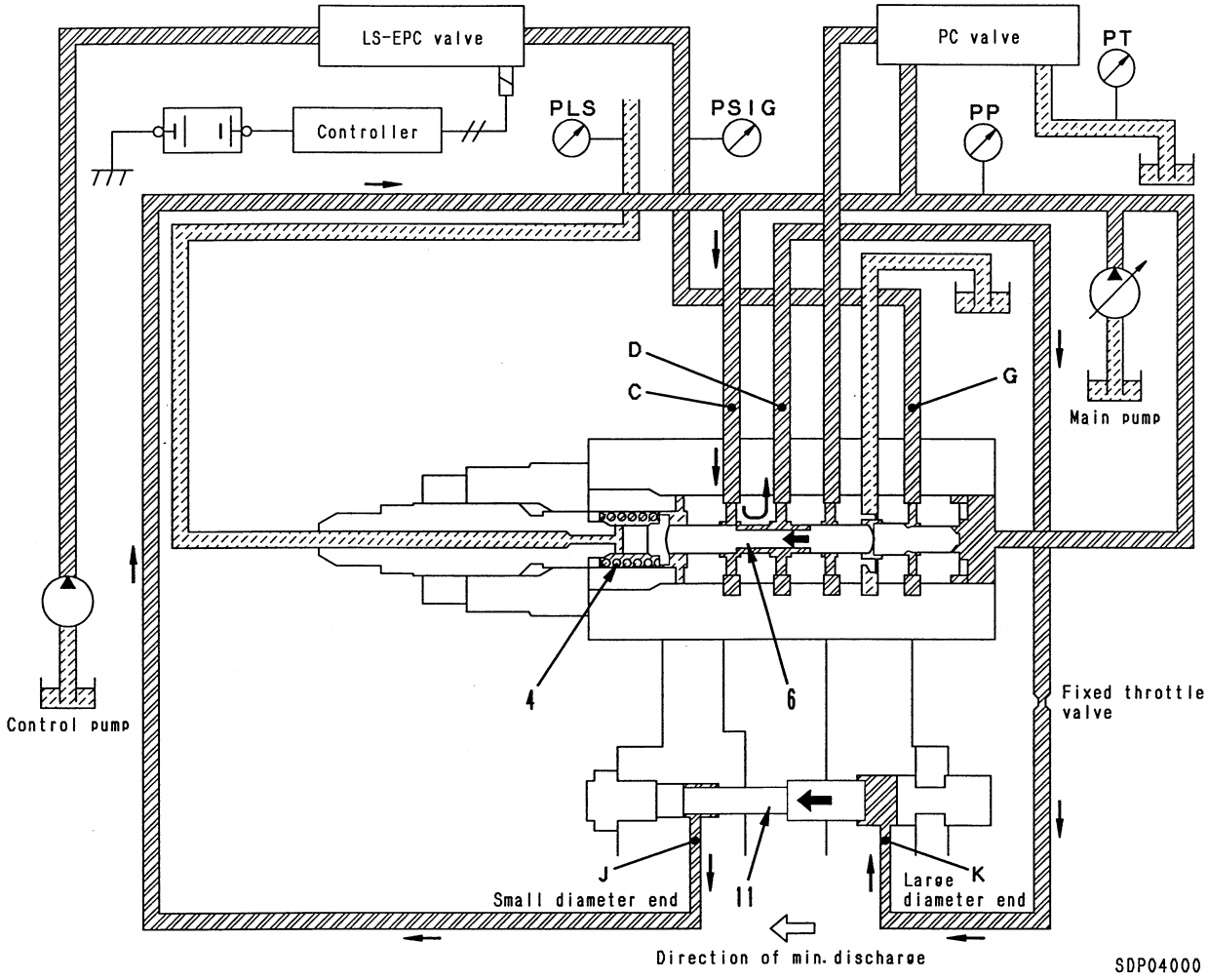


A – A



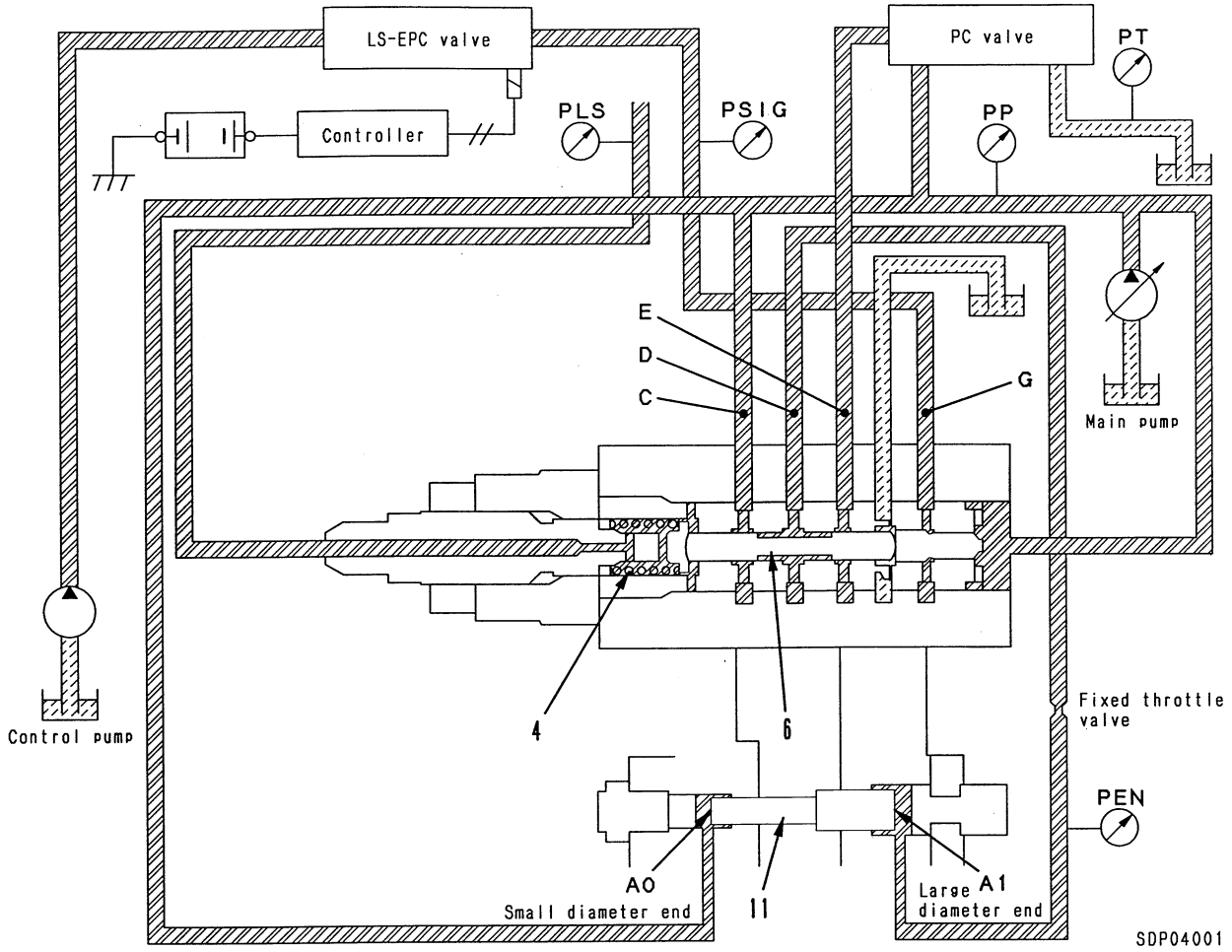
2) Operation in maximum direction for pump discharge amount

- When the difference between main pump pressure **PP** and LS pressure **PLS**, in other words, LS differential pressure Δ **PLS** becomes smaller (for example, when the area of opening of the control valve becomes larger and pump pressure **PP** drops), spool (6) is pushed to the right by the combined force of LS pressure **PLS** and the force of spring (4).
- When spool (6) moves, port **D** and port **E** are joined and connected to the PC valve. When this happens, the PC valve is connected to the drain port, so circuit **D** - **K** becomes drain pressure **PT**. (The operation of the PC valve is explained later.)
- For this reason, the pressure at the large diameter end of servo piston (11) becomes drain pressure **PT**, and pump pressure **PP** enters port **J** at the small diameter end, so servo piston (11) is pushed to the right. Therefore, the swash plate moves in the direction to make the discharge amount larger.
- If the output pressure of the EPC valve for the LS valve enters port **G**, this pressure creates a force to move piston (7) to the left. If piston (7) is pushed to the left, it acts to make the set pressure of spring (4) weaker, and the difference between hydraulic pressure **PLS** and **PP** changes when ports **D** and **E** of spool (6) are connected.



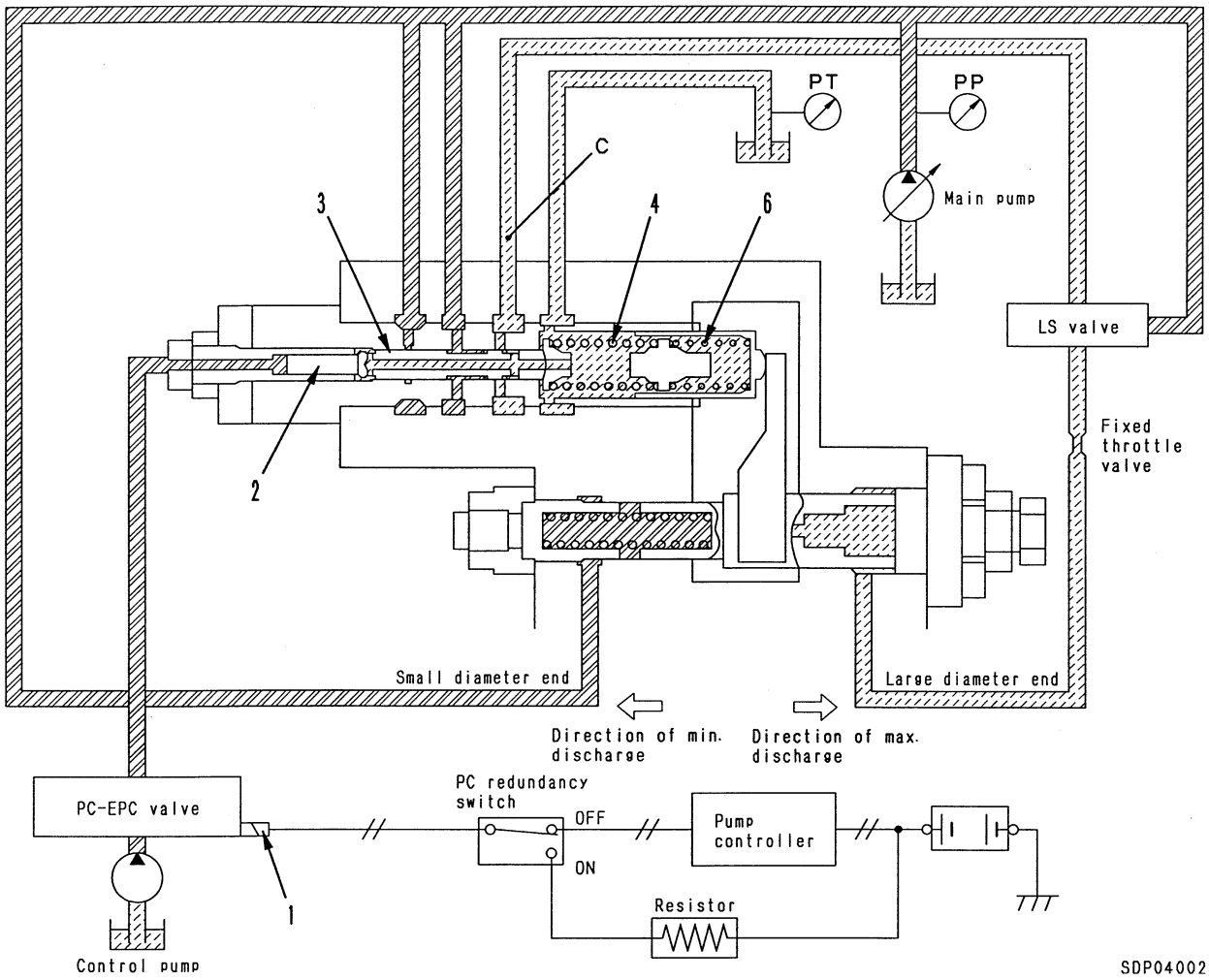
3) Operation in minimum direction for pump discharge amount

- The following explains the situation if servo piston (11) moves to the left (the discharge amount becomes smaller). When LS differential pressure Δ **PLS** becomes larger (for example, when the area of opening of the control valve becomes smaller and pump pressure **PP** rises), the force produced by pump pressure **PP** pushes spool (6) to the left.
- When spool (6) moves, main pump pressure **PP** flows from port **C** to port **D**, and it enters the large diameter end of the piston from port **K**.
- Main pump pressure **PP** also enters port **J** at the small diameter end of the piston, but because of the difference in area between the large diameter end and the small diameter end of servo piston (11), servo piston (11) is pushed to the left. As a result, the swash plate moves in the direction to make angle smaller.
- If LS selection pressure **PSIG** enters port e, it acts to make the set pressure of spring (4) weaker.



4) When servo piston is balanced

- Let us take the area receiving the pressure at the large diameter end of the piston as **A1**, the area receiving the pressure at the small diameter end as **A0**, and the pressure flowing into the large diameter end of the piston as Pen. If main pump pressure **PP** of the LS valve and the combined force of force **Z** of spring (4) and LS pressure **PLS** are balanced, and the relationship is **A0 x PP = A1 x Pen**, servo piston (11) will stop in that position, and the swash plate will be kept at an intermediate position. (It will stop at a position where the openings of the throttle from port **D** to port **E** and from port **C** to port **D** of spool (6) are approximately the same.)
- At this point, the relationship between the area receiving the pressure at both ends of piston (11) is **A0: A1** = 1:2, so the pressure applied to both ends of the piston when it is balanced becomes **PP: Pen** ≒ 1.75: 1.
- The position where spool (6) is balanced and stopped is the standard center, and the force of spring (4) is adjusted so that it is determined when **PP - PLS** = 2.1 MPa {21.5 kg/cm²}. However, if **PSIG** (the output pressure of 0 ⟷ 2.9 MPa {0 ⟷ 30 kg/cm²} of the EPC valve of the LS valve) is applied to port **G**, the balance stop position will change in proportion to pressure **PSIG** between **PP - PLS** = 2.1 ⟷ 0.64 MPa {21.5 ⟷ 6.5 kg/cm²}.



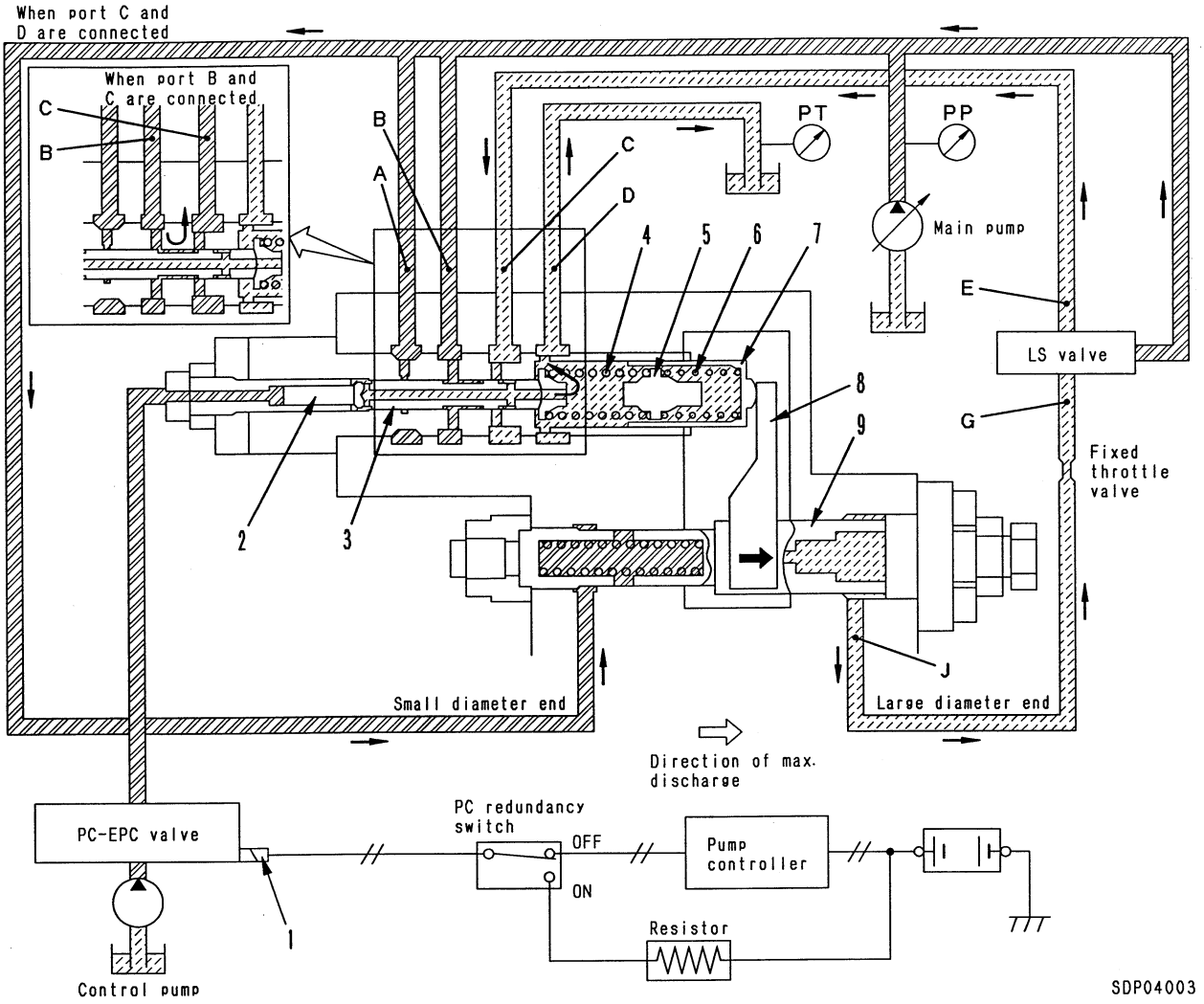
2. PC VALVE

1) When pump controller is normal

a. When the load on the actuator is small and pump pressure PP is low

(1) Action of PC-EPC solenoid (1)

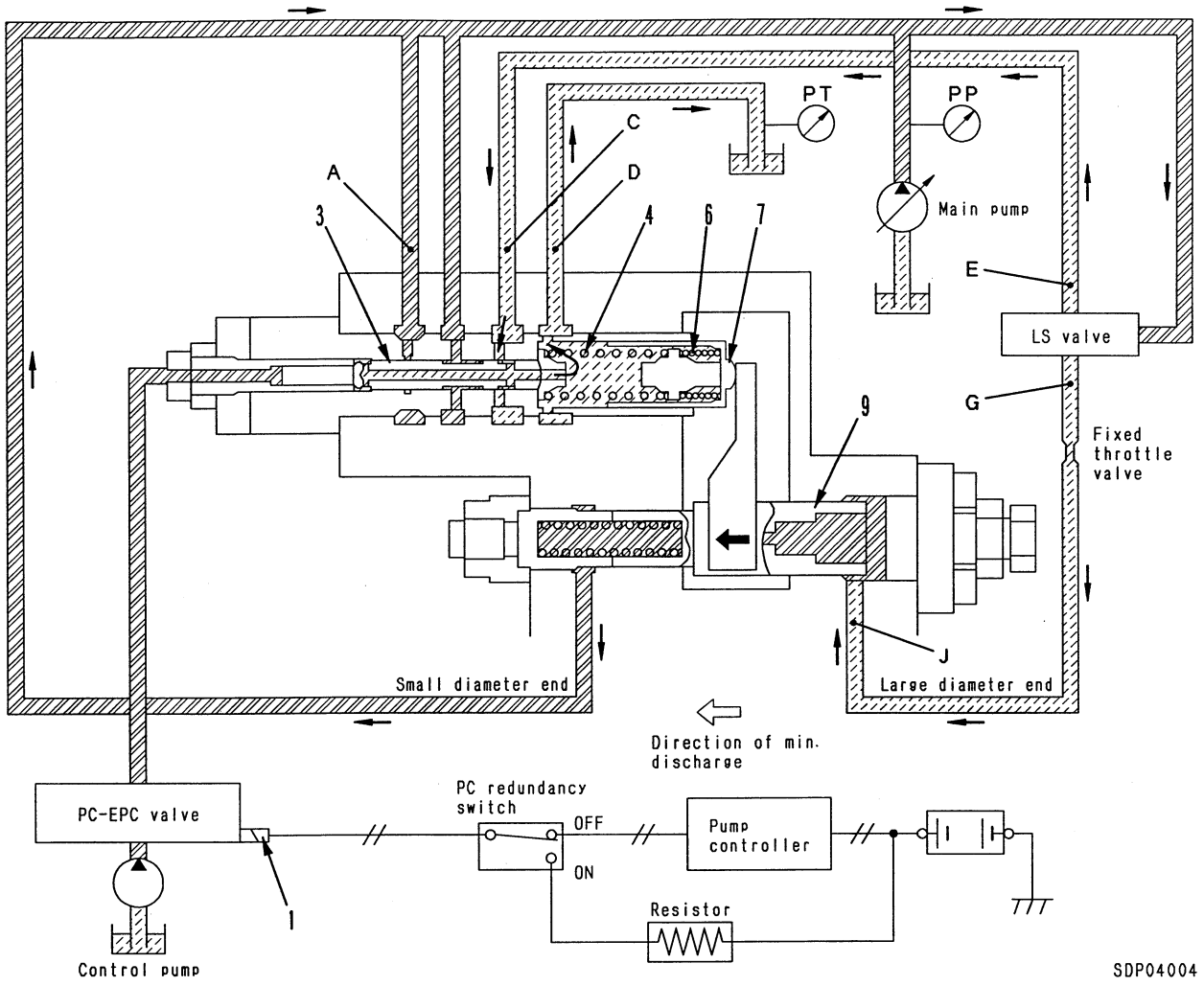
- The command current from the pump controller flows to PC-EPC solenoid (1).
  This command current acts on the PC-EPC valve and outputs the signal pressure. When this signal pressure is received, the force pushing piston (2) is changed.
- On the opposite side to this force pushing piston (2) is the spring set pressures of springs (4) and (6) and pump pressure **PP** pushing spool (3). Spool (3) stops at a position where the combined force pushing spool (3) is balanced, and the pressure (pressure of port **C**) output from the PC valve changes according to this position.
- The size of command current **X** is determined by the nature of the operation (lever operation), the selection of the working mode, and the set value and actual value for the engine speed.



(2) Action of spring

- The spring load of springs (4) and (6) in the PC valve is determined by the swash plate position.
- When servo piston (9) moves, piston (7), which is connected to slider (8), also moves to the right or left.
- If piston (7) moves to the left, spring (6) is compressed, and if it moves further to the left, spring (6) contacts seat (5) and is fixed in position. From this point, only spring (4) is actuated. In other words, the spring load is changed by piston (7) extending or compressing springs (4) and (6).
- If the command current input to PC-EPC valve solenoid (1) changes further, the force pushing piston (2) changes. The spring load of springs (4) and (6) also changes according to the value of the PC-EPC valve solenoid command current.
- Port **C** of the PC valve is connected to port **E** of the LS valve (see (1) LS valve).
  Self-pressure **PP** enters port **B**, the small diameter end of servo piston (9), and port **A**.

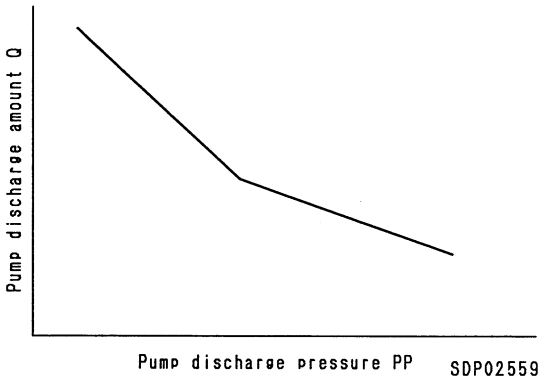
- When pump pressure **PP** is small, spool (3) is on the left. At this point, port **C** and port **D** are connected, and the pressure entering the LS valve becomes drain pressure **PT**. If port **E** and port **G** of the LS valve are connected (see (1) LS valve), the pressure entering the large diameter end of the piston from port **J** becomes drain pressure **PT**, and servo piston (9) moves to the right. In this way, the pump discharge amount moves in the direction of increase.
- As servo piston (9) moves further, piston (7) is moved to the right by slider (8). Springs (4) and (6) expand and the spring force becomes weaker. When the spring force becomes weaker, spool (3) moves to the right, so the connection between port **C** and port **D** is cut, and the pump discharge pressure ports **B** and **C** are connected. As a result, the pressure at port **C** rises, and the pressure at the large diameter end of the piston also rises, so the movement of piston (9) to the right is stopped.
  In other words, the stop position for piston (9) (= pump discharge amount) is decided at the point where the force of springs (4) and (6) and the pushing force from the PC-EPC valve solenoid and the pushing force created by pressure **PP** acting on spool (3) are in balance.



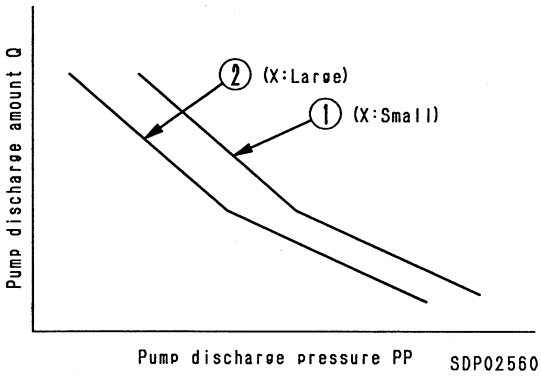
b. When load on actuator is large and pump discharge pressure is high

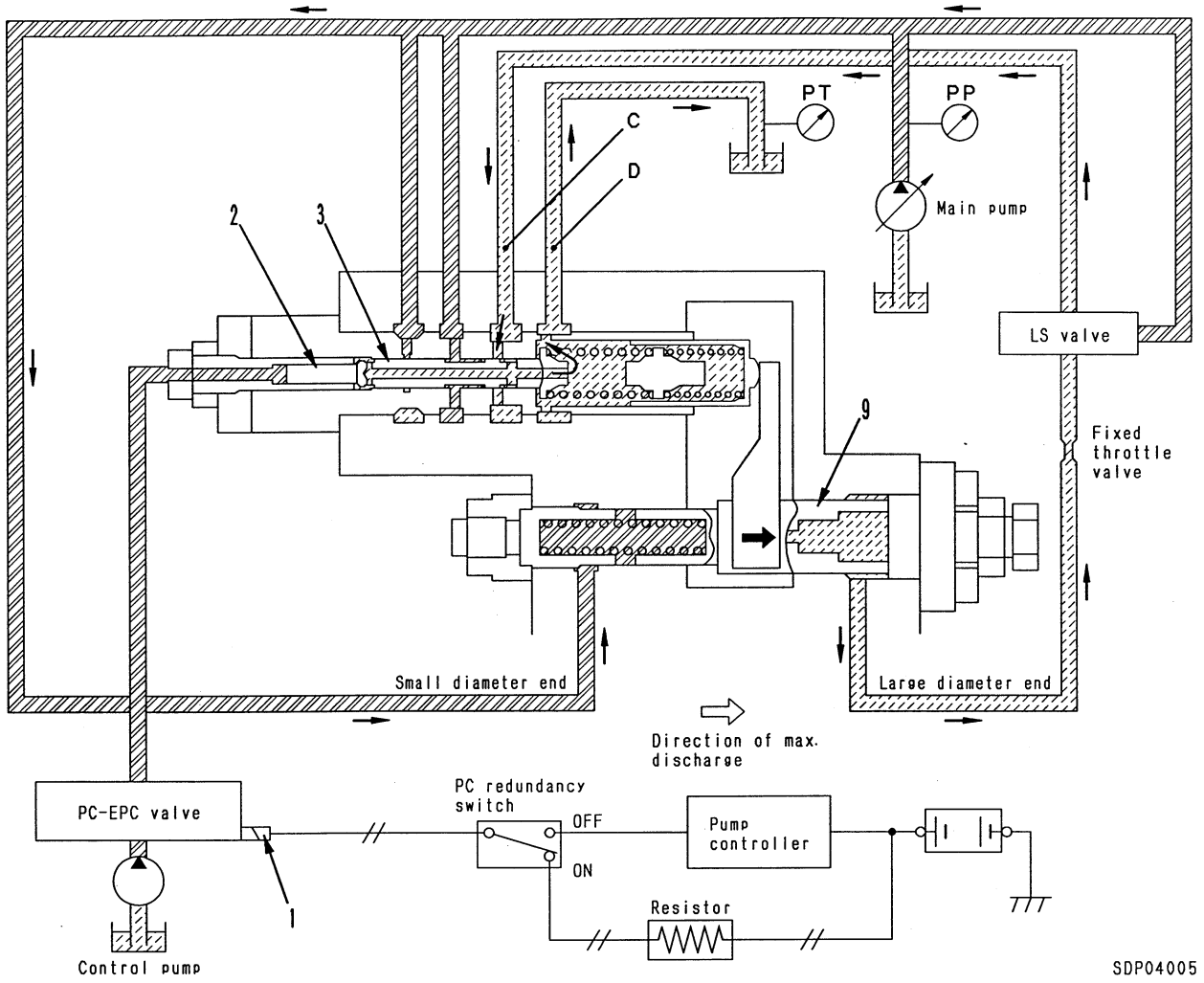
- When the load is large and pump discharge pressure **PP** is high, the force pushing spool (3) to the left becomes larger and spool (3) moves to the position shown in the diagram above.
  When this happens, as shown in the diagram above, part of the pressurized oil from port A passes through the LS valve, flows out from port **C** to port **D**, and the pressurized oil flowing from port **C** to the LS valve becomes approximately 3/5 of main pump pressure **PP**.
- When port **E** and port **G** of the LS valve are connected (see (1) LS valve), the pressure from port **J** enters the large diameter end of servo piston (9), and servo piston (9) stops.
- If main pump pressure **PP** increases further and spool (3) moves further to the left, main pump pressure **PP** flows to port **C** and acts to make the discharge amount the minimum. When piston (9) moves to the left, piston (7) is moved to the left. For this reason, springs (4) and (6) are compressed and push back spool (3).
  When spool (3) moves to the left, the opening of port **C** and port **D** becomes larger. As a result, the pressure at port **C** (= **J**) drops, and piston (9) stops moving to the left. The position in which piston (9) stops when this happens is further to the left than the position when pump pressure **PP** is low.

- The relation of pump pressure **PP** and the position of servo piston (9) forms a bent line because of the double-spring effect of springs (6) and (4). The relationship between pump pressure **PP** and pump discharge amount **Q** is shown in the figure on the right.



- If command current **X** sent to solenoid (1) increases further, the relationship between pump pressure **PP** and pump discharge amount **Q** is proportional to the pushing force of the PC–EPC valve of output pressure. In other words, if the pushing force of output pressure is added to the force pushing to the left because of the pump pressure applied to the piston (2), the relationship between **PP** and **Q** moves from ① to ② in accordance with the increase.

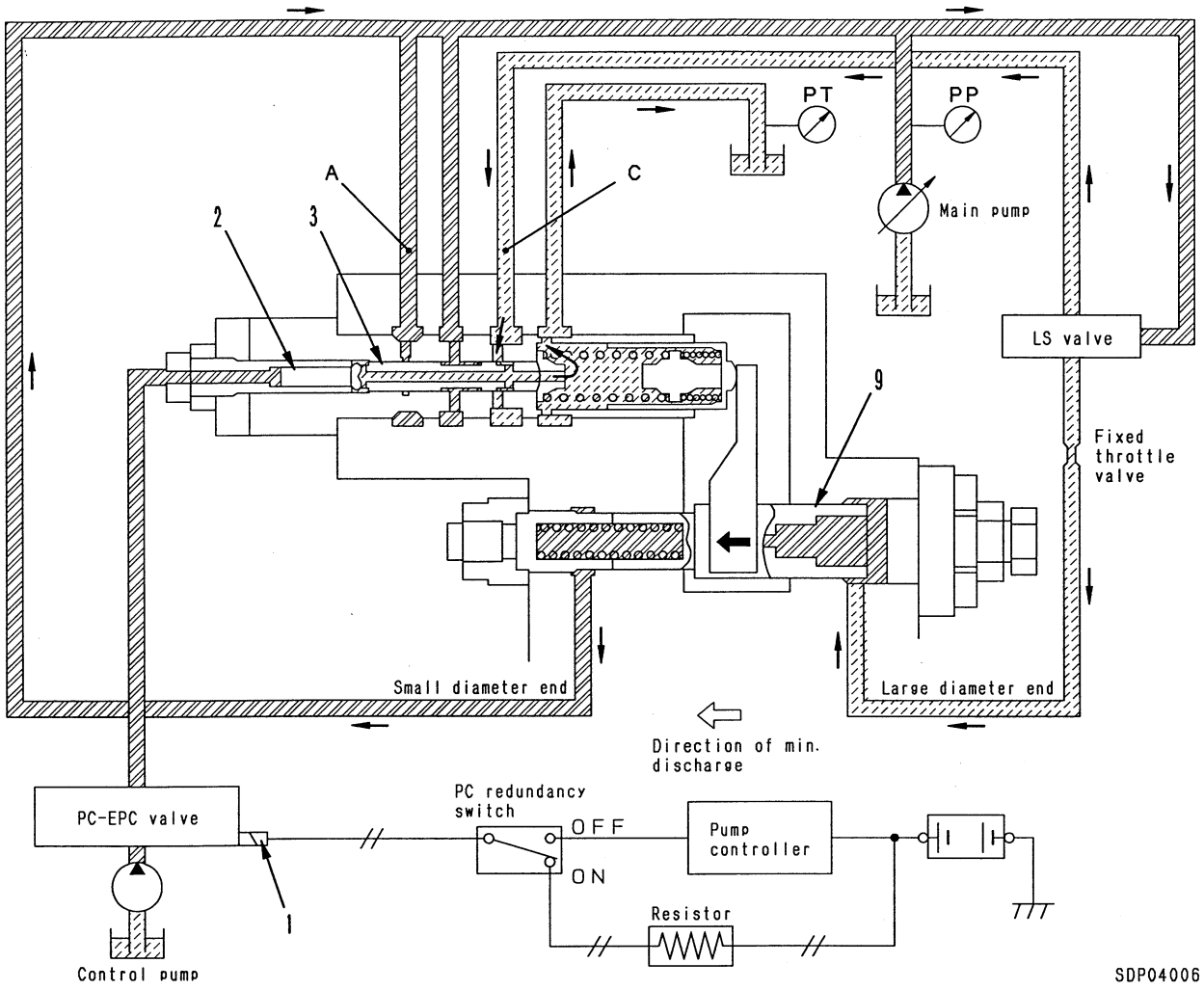




2) When pump controller is abnormal and PC prolix switch is ON

a. When load on main pump is light

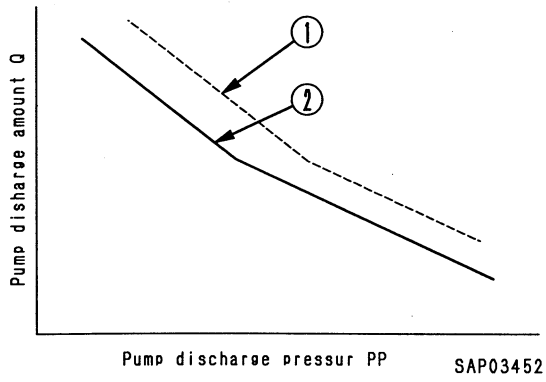
- If there is a failure in the pump controller, turn PC prolix switch ON to switch to the resistor side. In this case, the power source is taken directly from the battery. But if the current is used as it is, it is too large, so the resistor is used to control the current flowing to PC-EPC valve solenoid (1).
- When this is done, the current becomes constant, so the force pushing piston (2) is also constant.
- If main pump pressure **PP** is low, the combined force of the pump pressure and the force of PC-EPC valve solenoid (1) is weaker than the spring set force, so spool (3) is balanced at a position to the left.
- At this point, port **C** is connected to the drain pressure of port **D**, and the large diameter end of the piston of servo piston (9) also becomes the drain pressure **PT** through the LS valve. When this happens, the pressure at the small diameter end of the piston is large, so servo piston (9) moves in the direction to make the discharge amount larger.



b. When main pump load is heavy

- In the same way as in the previous item, when the PC prolix switch is ON, the command current sent to PC-EPC valve solenoid (1) becomes constant. For this reason, the force of piston (2) pushing spool (3) is constant.
- If main pump pressure **PP** increases, spool (3) moves further to the left than when the main pump load is light, and is balanced at the position in the diagram above.
- In this case, the pressure from port **A** flows to port **C**, so servo piston (9) moves to the left (to make the discharge amount smaller) by the same mechanism as explained in Item 2)-b, and stops at a position to the left of the position when the load on the pump is light. In other words, even when the PC prolix switch is ON, the curve for the pump pressure **PP** and discharge amount **Q** is determined as shown in the diagram for the value of the current sent to the PC-EPC valve solenoid through the resistor.

The curve when the PC prolix switch is ON is curve ②, which is to the left of curve ① for when the pump controller is normal.



CONTROL VALVE

OUTLINE

The following four types of control valve are used.
- 7-spool valve (6 + 1 service valve)
- 8-spool valve (6 + 2 service valves)
- 9-spool valve (6 + 3 service valves)

★ Each service valve is an add-on type where one valve each can be added, so it is possible to add valves or remove valves if necessary.

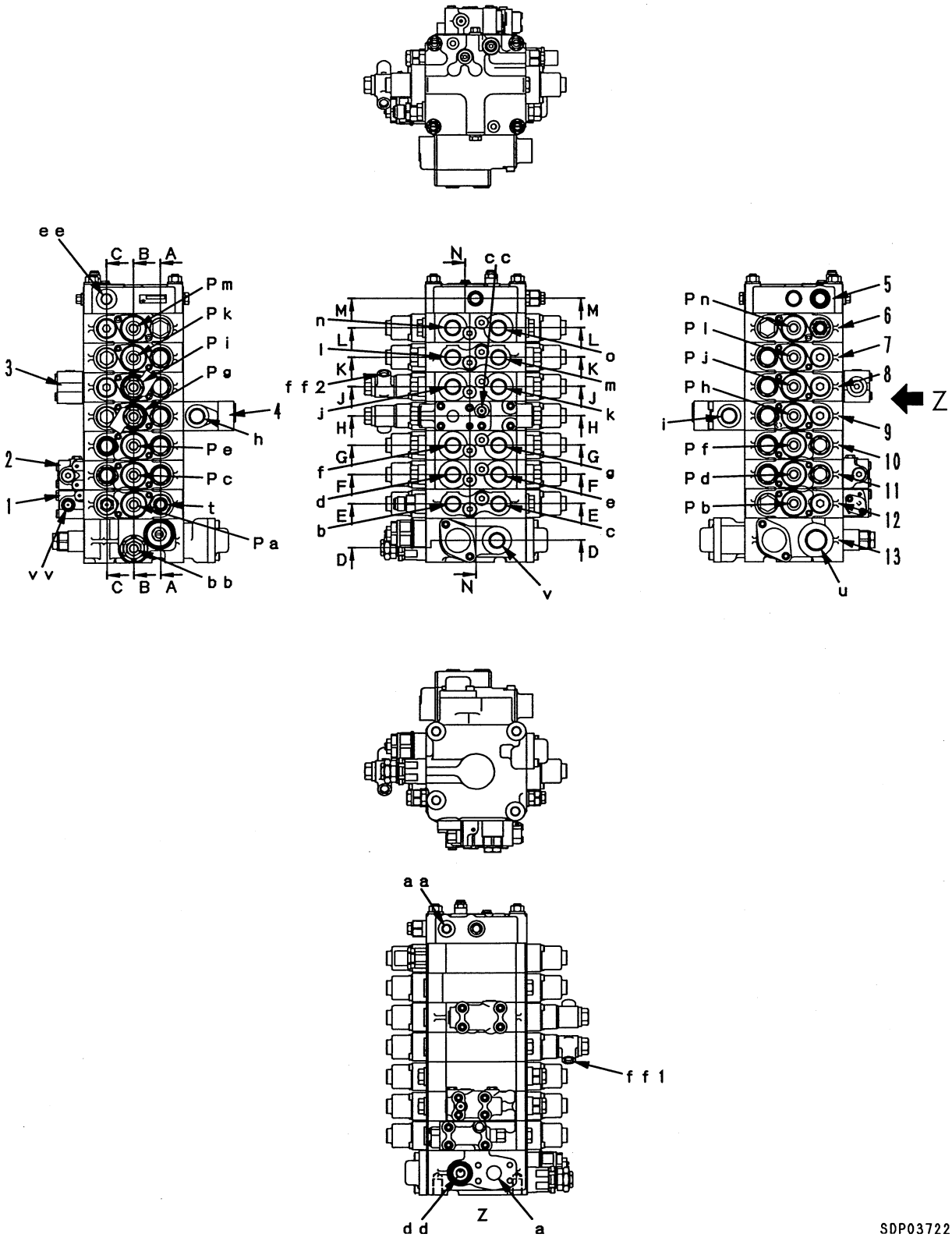
An explanation of the external appearance and the cross section is given only for the 7-spool valve (6 + 1 service valve).

Names, name of ports

1. Swing bleed valve
2. Travel junction valve
3. Arm regeneration valve
4. Boom holding valve
5. Cover
6. Service valve
7. Bucket valve
8. Arm valve
9. Boom valve
10. R.H. travel valve
11. L.H. travel valve
12. Swing valve
13. PT port block

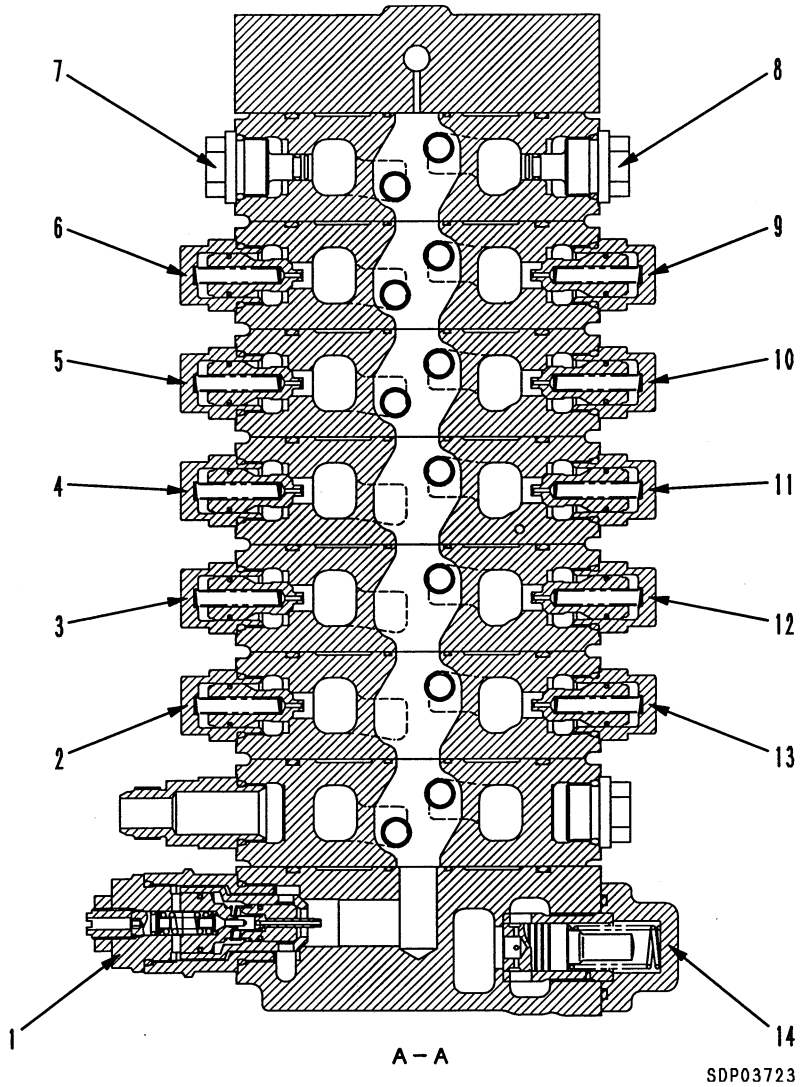
a : Port **PP** (from main pump)
b : Port **A1** (to swing motor MB)
c : Port **B1** (to swing motor MA)
d : Port **A2** (to L.H. travel motor A)
e : Port **B2** (to L.H. travel motor B)
f : Port **A3** (to R.H. travel motor A)
g : Port **B3** (to R.H. travel motor B)
h : Port **A4** (to boom cylinder bottom)
i : Port **B4** (to boom cylinder head)
j : Port **A5** (to arm cylinder head)
k : Port **B5** (to arm cylinder bottom)
l : Port **A6** (to bucket cylinder head)
m : Port **B6** (to bucket cylinder bottom)
n : Port **A7** (to attachment 1)
o : Port **B7** (to attachment 2)
t : Port **TSW** (to swing motor)
u : Port **TC** (to oil cooler)
v : Port **TB** (to tank)
aa : Port **PLS** (to pump LS valve)
bb : Port **PX** (from 2-stage relief solenoid valve)
cc : Port **T** (to tank)
dd : Port **BP** (from boom RAISE PPC/EPC valve)
ee : Pressure sensor port (pressure sensor installed)
ff1 : Port **PA1** (from active mode solenoid valve)
ff2 : Port **PA2** (from active mode solenoid valve)
vv : Port **T** (to tank)
Pa : Port **P1** (from left swing PPC/EPC valve)
Pb : Port **P2** (from right swing PPC/EPC valve)
Pc : Port **P3** (from L.H. travel FORWARD PPC valve)
Pd : Port **P4** (from L.H. travel REVERSE PPC valve)
Pe : Port **P5** (from R.H. travel REVERSE PPC valve)
Pf : Port **P6** (from R.H. travel FORWARD PPC valve)
Pg : Port **P7** (from boom RAISE PPC/EPC valve)
Ph : Port **P8** (from boom LOWER PPC/EPC valve)
Pi : Port **P9** (from arm OUT PPC/EPC valve)
Pj : Port **P10** (from arm IN PPC/EPC valve)
Pk : Port **P11** (from bucket DUMP PPC/EPC valve)
Pl : Port **P12** (from bucket CURL PPC/EPC valve)
Pm: Port **P-1** (from service 1 PPC valve)
Pn : Port **P-2** (from service 1 PPC valve)

7-SPOOL VALVE (6 + 1 SERVICE VALVE)



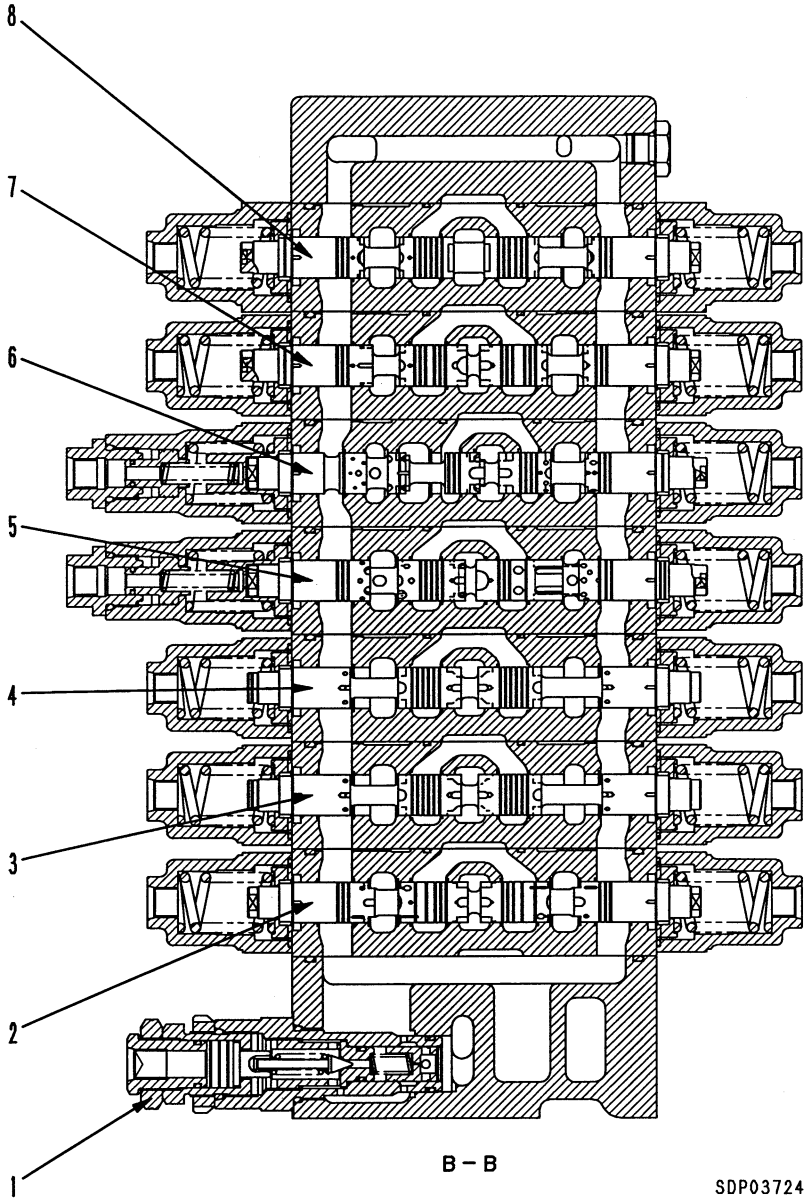
CROSS SECTIONAL DIAGRAM

★ The diagram shows the 7-spool valve (6 + 1 service valve).
(1/8)



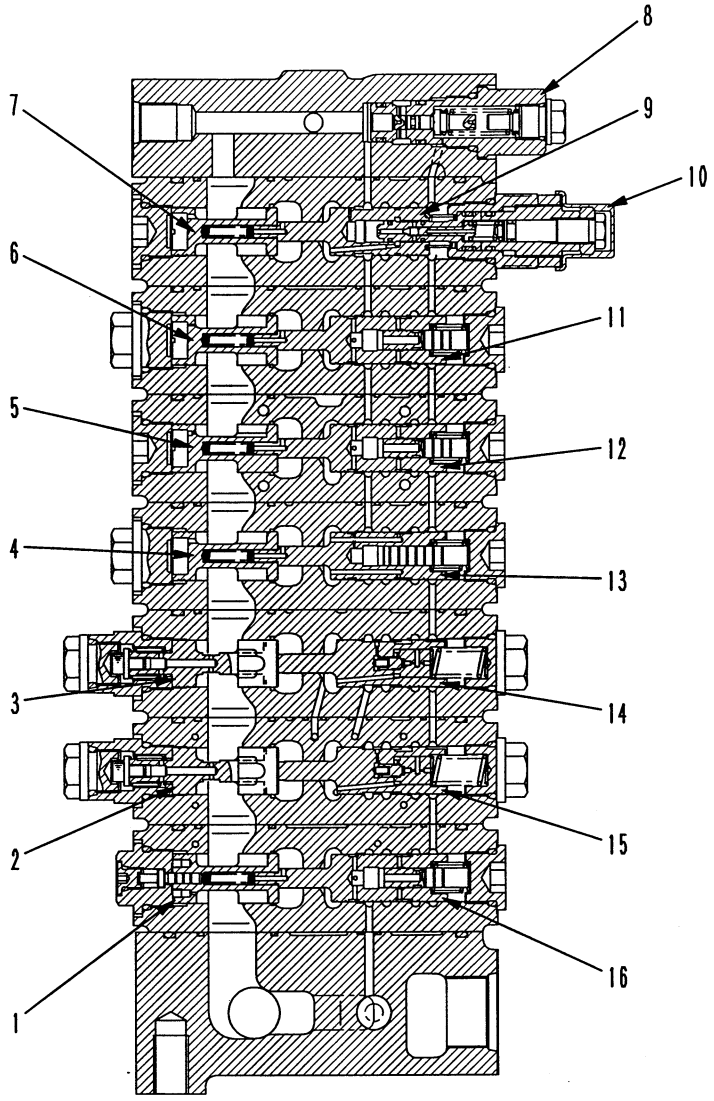
1. Safety-suction valve
2. Suction valve (L.H. travel A)
3. Suction valve (R.H. travel A)
4. Suction valve (boom bottom)
5. Suction valve (arm head)
6. Suction valve (bucket head)
7. Safety-suction valve mount (service A)
8. Safety-suction valve mount (service B)
9. Suction valve (bucket bottom)
10. Suction valve (arm bottom)
11. Suction valve (boom head)
12. Suction valve (R.H. travel B)
13. Suction valve (L.H. travel B)
14. Lift check valve

(2/8)



1. Main relief valve
2. Spool (swing)
3. Spool (L.H. travel)
4. Spool (R.H. travel)
5. Spool (boom)
6. Spool (arm)
7. Spool (bucket)
8. Spool (service)

(3/8)

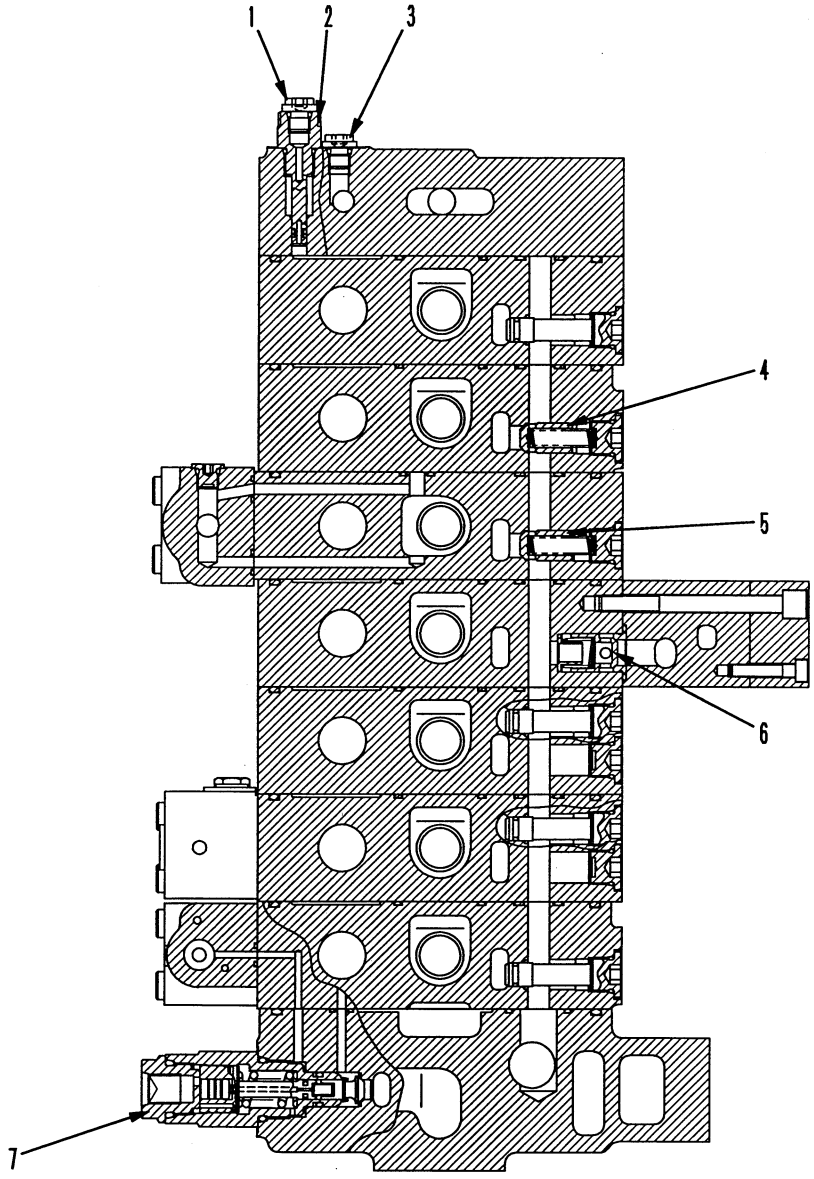


C – C SDP03725

1. Pressure compensation valve F (swing)
2. Pressure compensation valve F (L.H. travel)
3. Pressure compensation valve F (R.H. travel)
4. Pressure compensation valve F (boom)
5. Pressure compensation valve F (arm)
6. Pressure compensation valve F (bucket)
7. Pressure compensation valve F (service)
8. Unload valve
9. Pressure compensation valve R (service)
10. Variable pressure compensation valve
11. Pressure compensation valve R (bucket)
12. Pressure compensation valve R (arm)
13. Pressure compensation valve R (boom)
14. Pressure compensation valve R (R.H. travel)
15. Pressure compensation valve R (L.H. travel)
16. Pressure compensation valve R (swing)

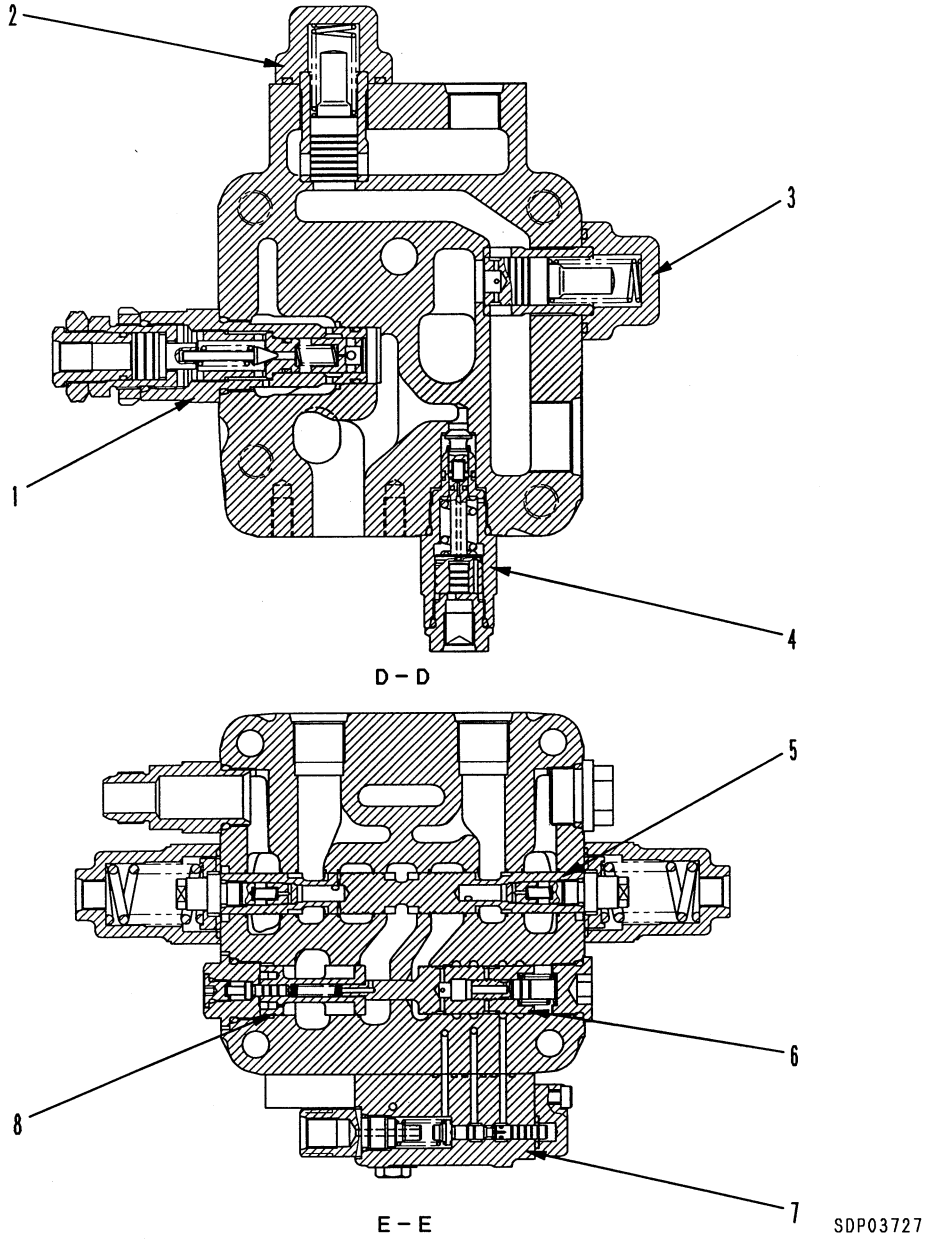
★ The letters F and R refer to the following valves.
F: Flow control valve
R: Reducing valve

(4/8)



1. LS pressure detection valve
2. LS bypass plug
3. Pump pressure detection plug
4. Check valve (bucket head)
5. Check valve (arm head)
6. Check valve (boom bottom)
7. LS select valve

(5/8)

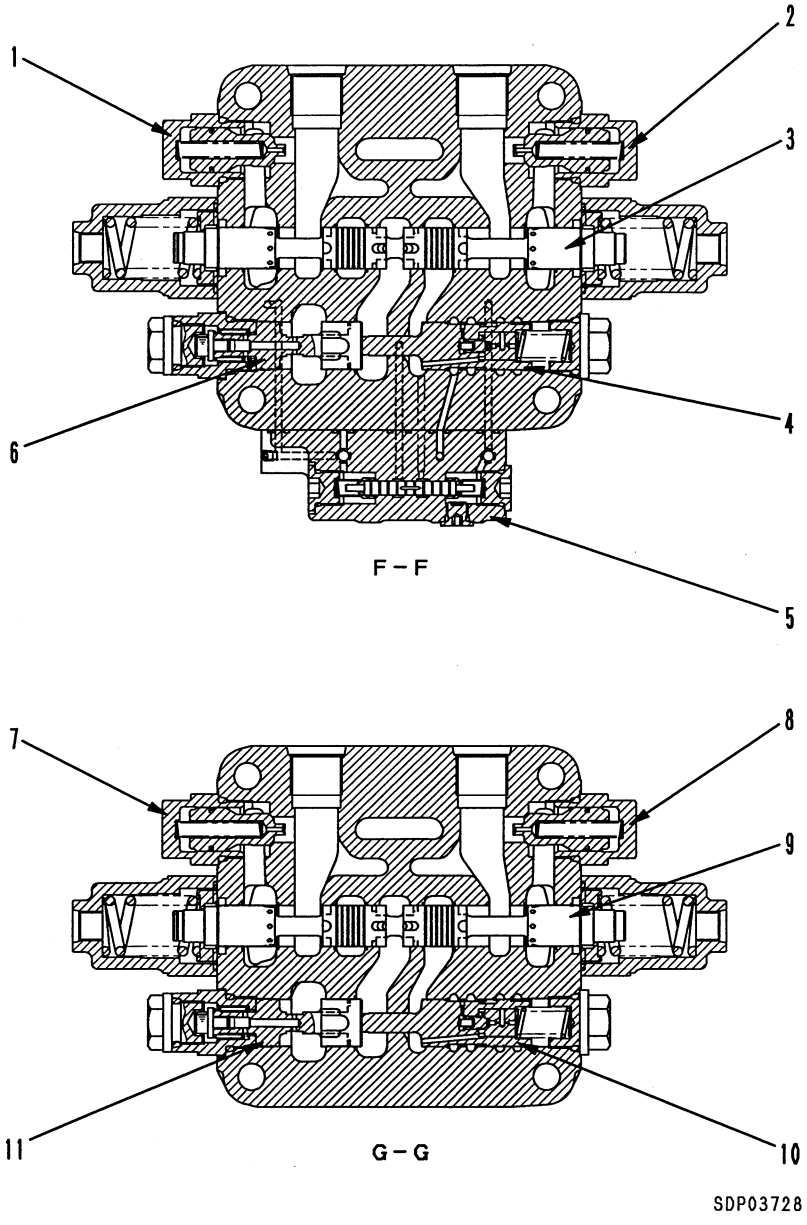


1. Main relief valve
2. Cooler bypass valve
3. Lift check valve
4. LS select valve

SWING VALVE

5. Spool
6. Pressure compensation valve R
7. Swing bleed valve
8. Pressure compensation valve F

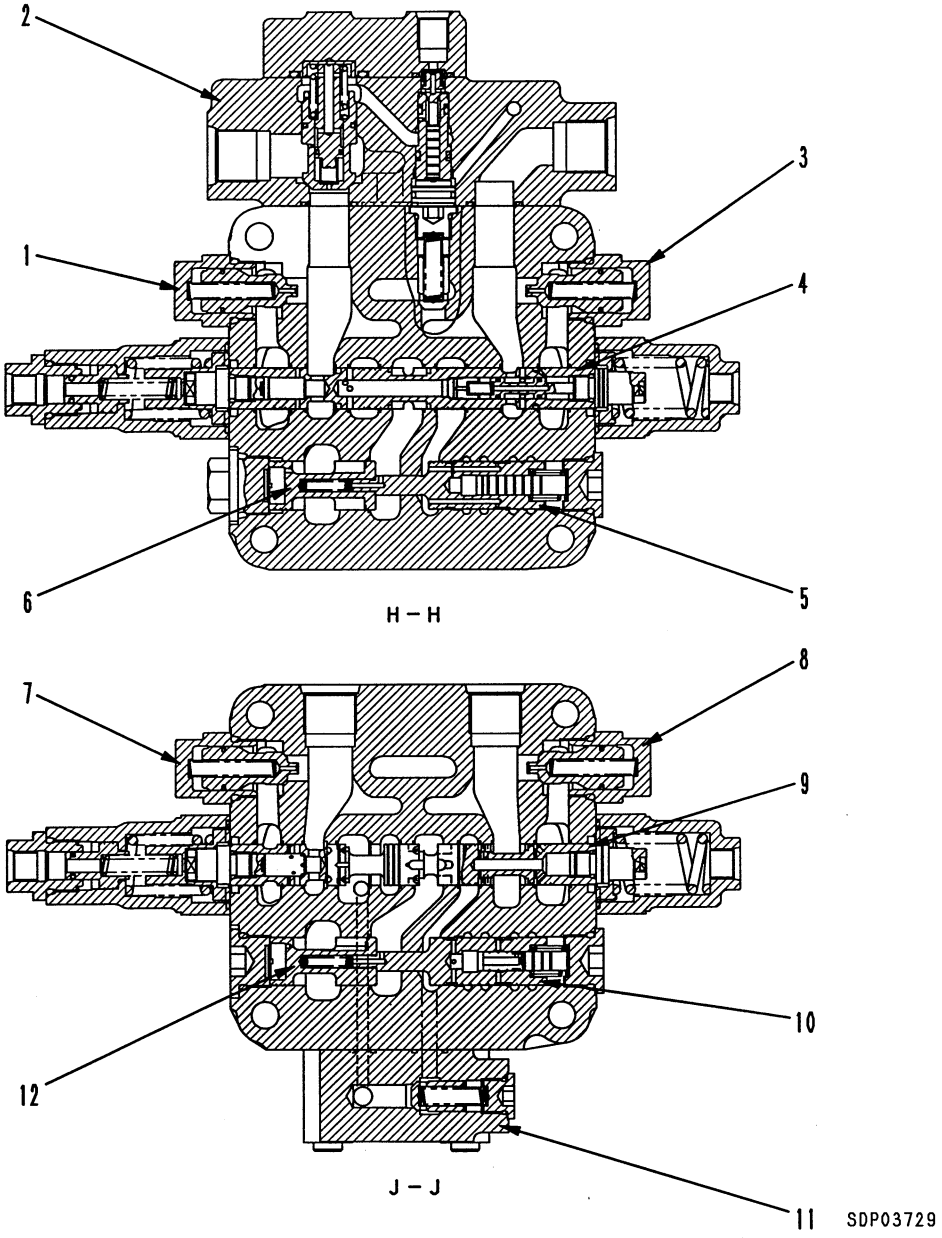
(6/8)



L.H. TRAVEL VALVE
1. Suction valve (A)
2. Suction valve (B)
3. Spool
4. Pressure compensation valve R
5. Travel junction valve
6. Pressure compensation valve F

R.H. TRAVEL VALVE
7. Suction valve (A)
8. Suction valve (B)
9. Spool
10. Pressure compensation valve R
11. Pressure compensation valve F

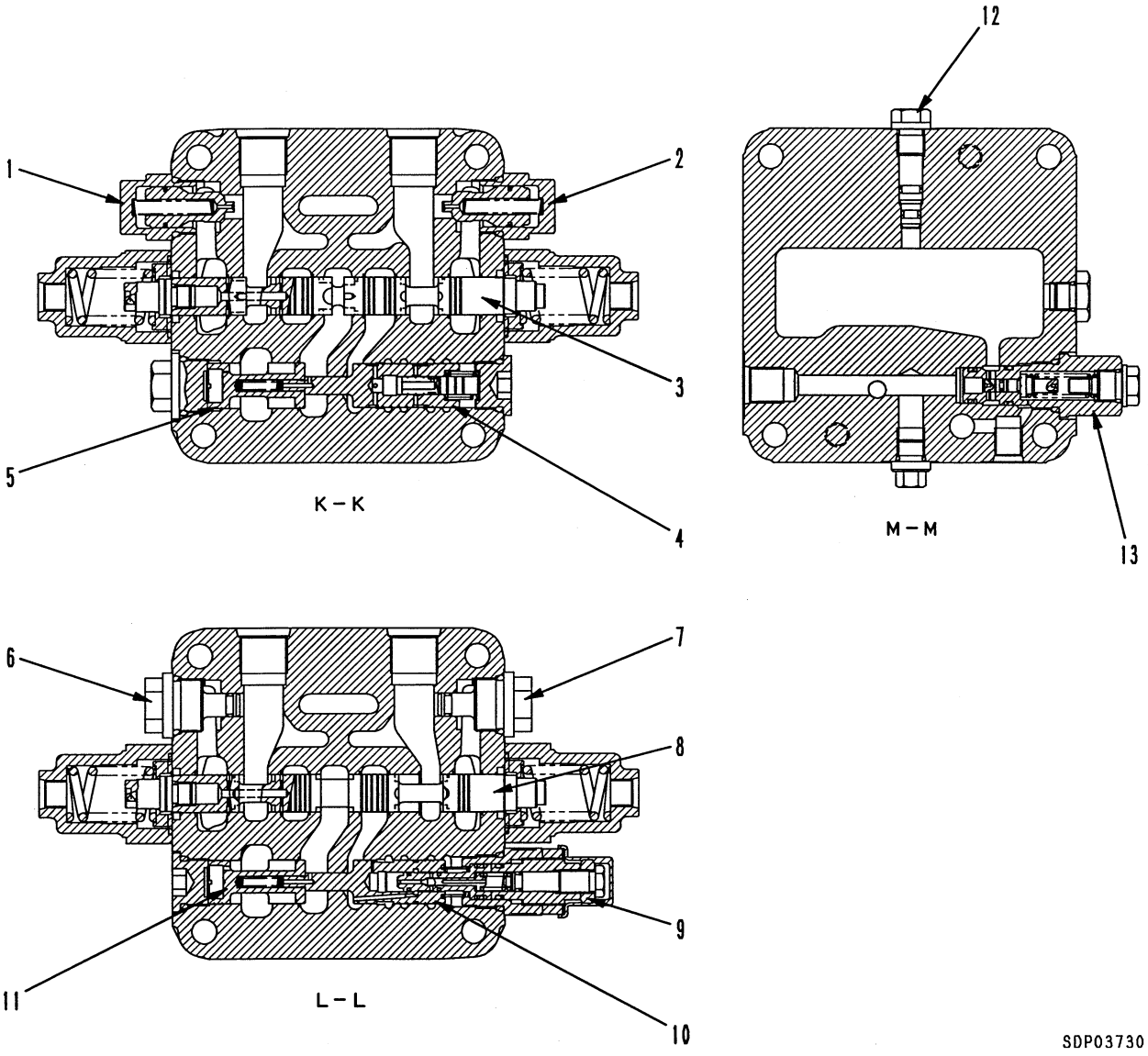
(7/8)



BOOM VALVE
1. Suction valve (A)
2. Boom holding valve
3. Suction valve (B)
4. Spool
5. Pressure compensation valve R
6. Pressure compensation valve F

ARM VALVE
7. Suction valve (A)
8. Suction valve (B)
9. Spool
10. Pressure compensation valve R
11. Arm regeneration valve
12. Pressure compensation valve F

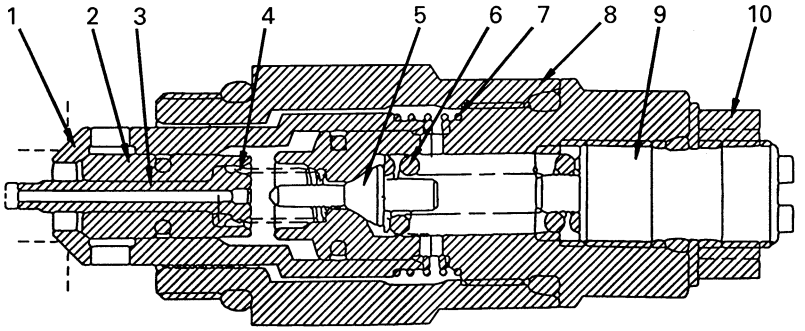
(8/8)



BUCKET VALVE
1. Suction valve (A)
2. Suction valve (B)
3. Spool
4. Pressure compensation valve R
5. Pressure compensation valve F

SERVICE VALVE
6. Safety-suction valve mount (service A)
7. Safety-suction valve mount (service B)
8. Spool
9. Variable pressure compensation valve
10. Pressure compensation valve R
11. Pressure compensation valve F
12. Pressure release plug
13. Unload valve

SAFETY-SUCTION VALVE (FOR SERVICE VALVE)



SBP00198

1. Suction valve
2. Main valve
3. Piston
4. Piston spring
5. Poppet
6. Poppet spring
7. Suction valve
8. Sleeve
9. Adjustment screw
10. Locknut

SPECIFICATIONS

Part No. (reference)	Set pressure	Use
709-70-74600	24.5 MPa {250 kg/cm²} (at 5 ℓ/min)	For crusher (Okada)
709-70-74700	17.15 MPa {175 kg/cm²} (at 5 ℓ/min)	

CLSS

OUTLINE

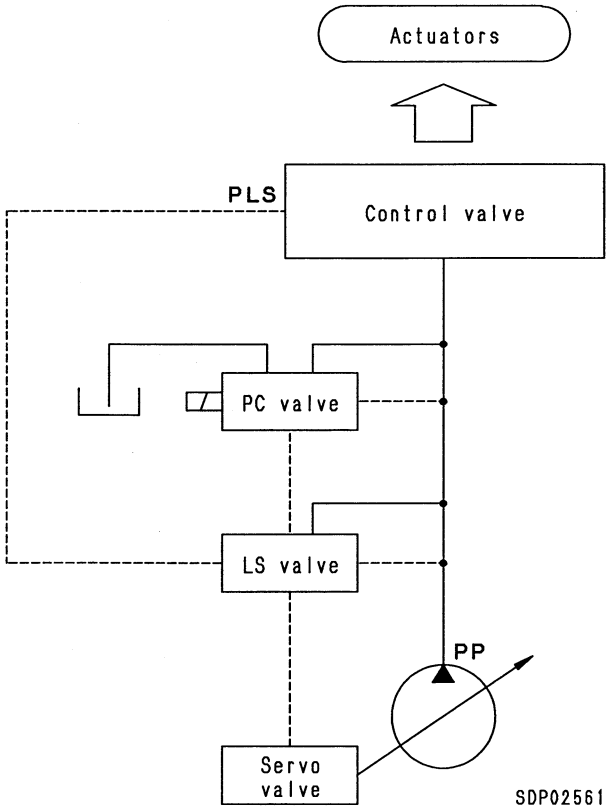
Features

CLSS stands for **C**losed center **L**oad **S**ensing **S**ystem, and has the following features.

1) Fine control not influenced by load
2) Control enabling digging even with fine control
3) Ease of compound operation ensured by flow divider function using area of opening of spool during compound operations
4) Energy saving using variable pump control

Structure

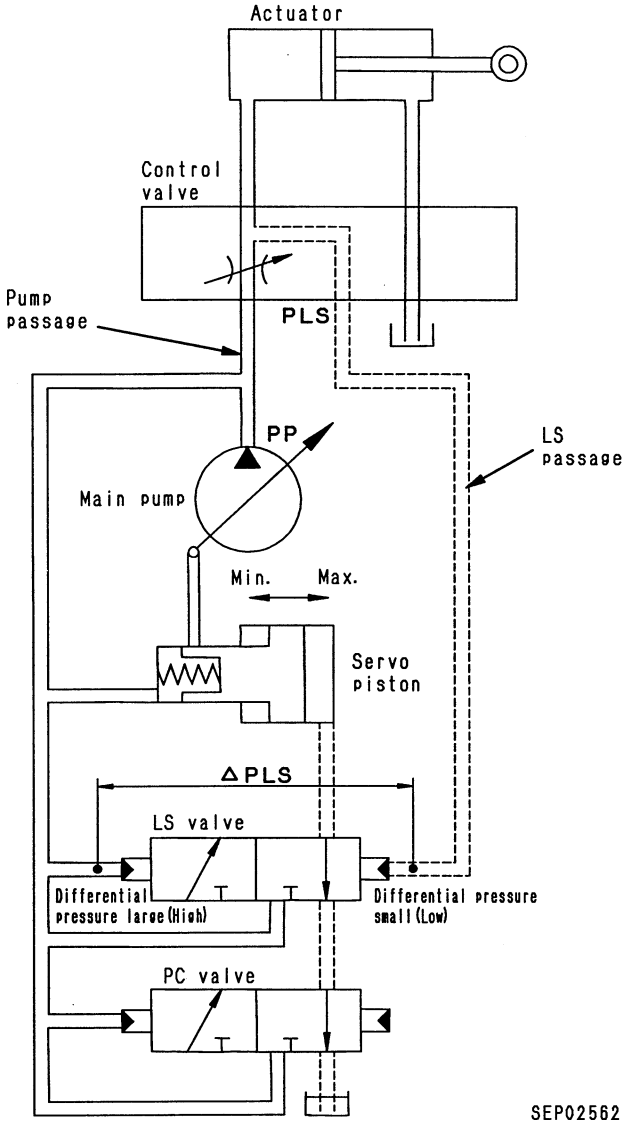
- The CLSS consists of a variable displacement single piston pump, control valve, and actuators.
- The pump body consists of the main pump, PC valve and LS valve.



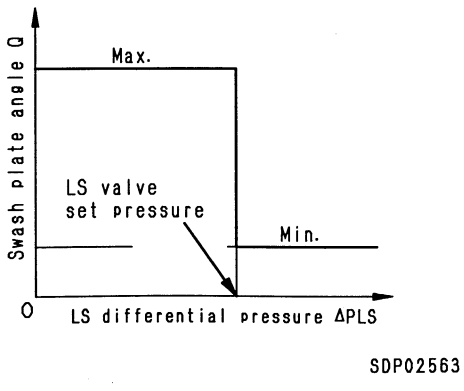
BASIC PRINCIPLE

1. Control of pump swash plate angle

- The pump swash plate angle (pump discharge amount) is controlled so that LS differential pressure ΔPLS (the difference between pump pressure **PP** and control valve outlet port LS pressure **PLS**) (load pressure of actuator) is constant.
  (LS pressure ΔPLS = Pump discharge pressure **PP** – LS pressure **PLS**)

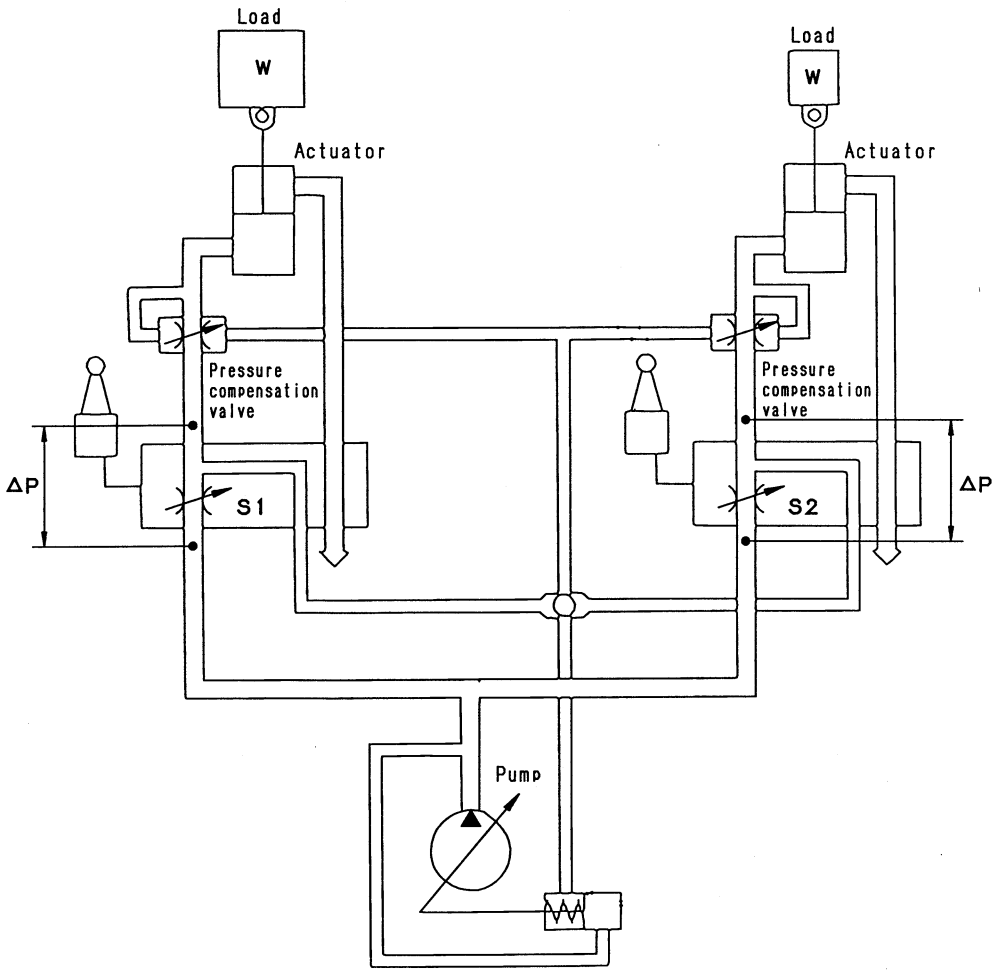


- If LS differential pressure ΔPLS becomes lower than the set pressure of the LS valve (when the actuator load pressure is high), the pump swash plate moves towards the maximum position; if it becomes higher than the set pressure of the LS valve (when the actuator load pressure is low), the pump swash plate moves towards the minimum position.



2. **Pressure compensation**

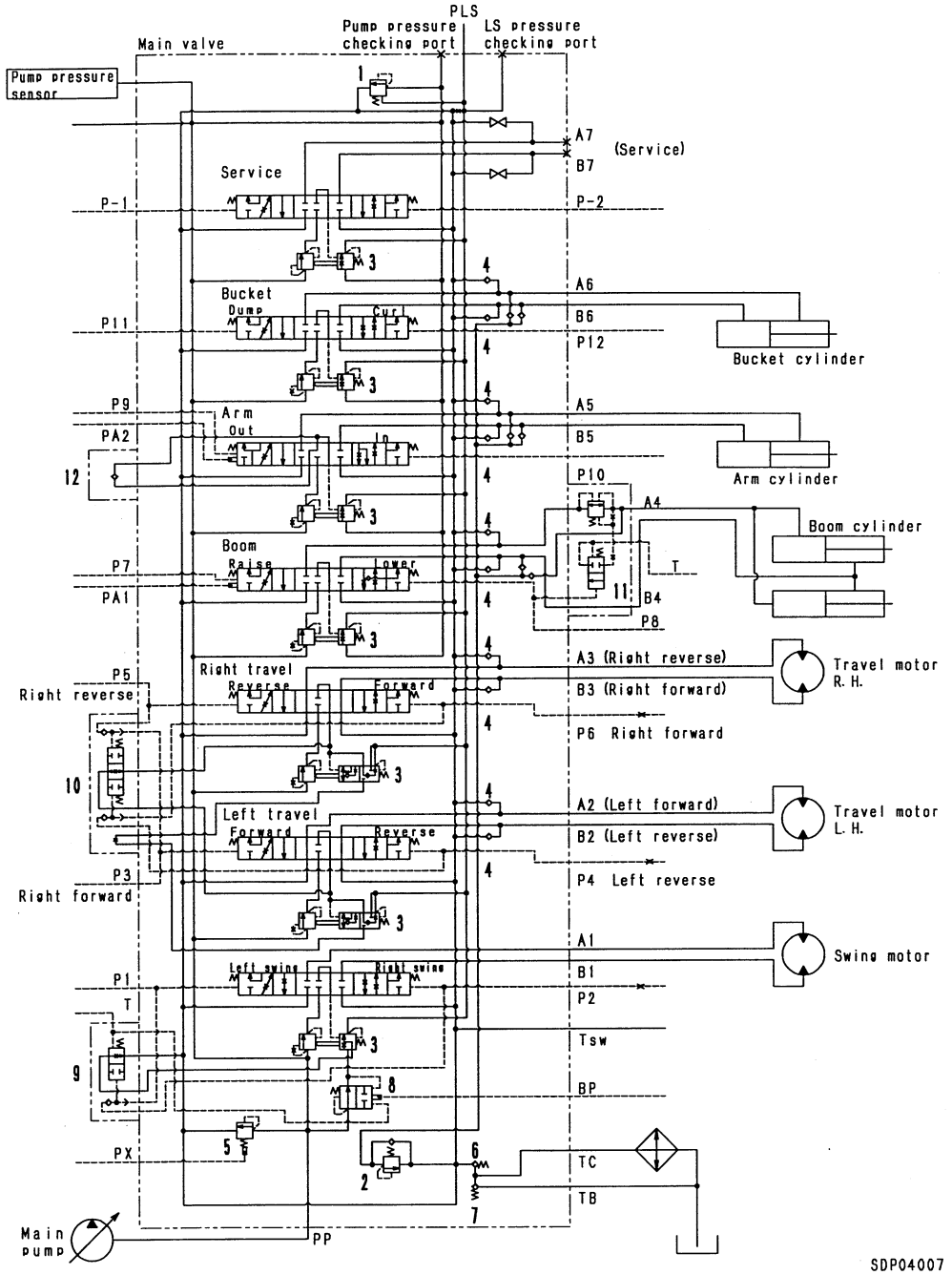
- A pressure compensation valve is installed to the outlet port side of the control valve to balance the load.
  When two actuators are operated together, this valve acts to make pressure difference **ΔP** between the upstream (inlet port) and downstream (outlet port) of the spool of each valve the same regardless of the size of the load (pressure).
  In this way, the flow of oil from the pump is divided (compensated) in proportion to the area of opening **S1** and **S2** of each valve.



SEP02564

OPERATION FOR EACH FUNCTION AND VALVE

Hydraulic circuit diagram and name of valve

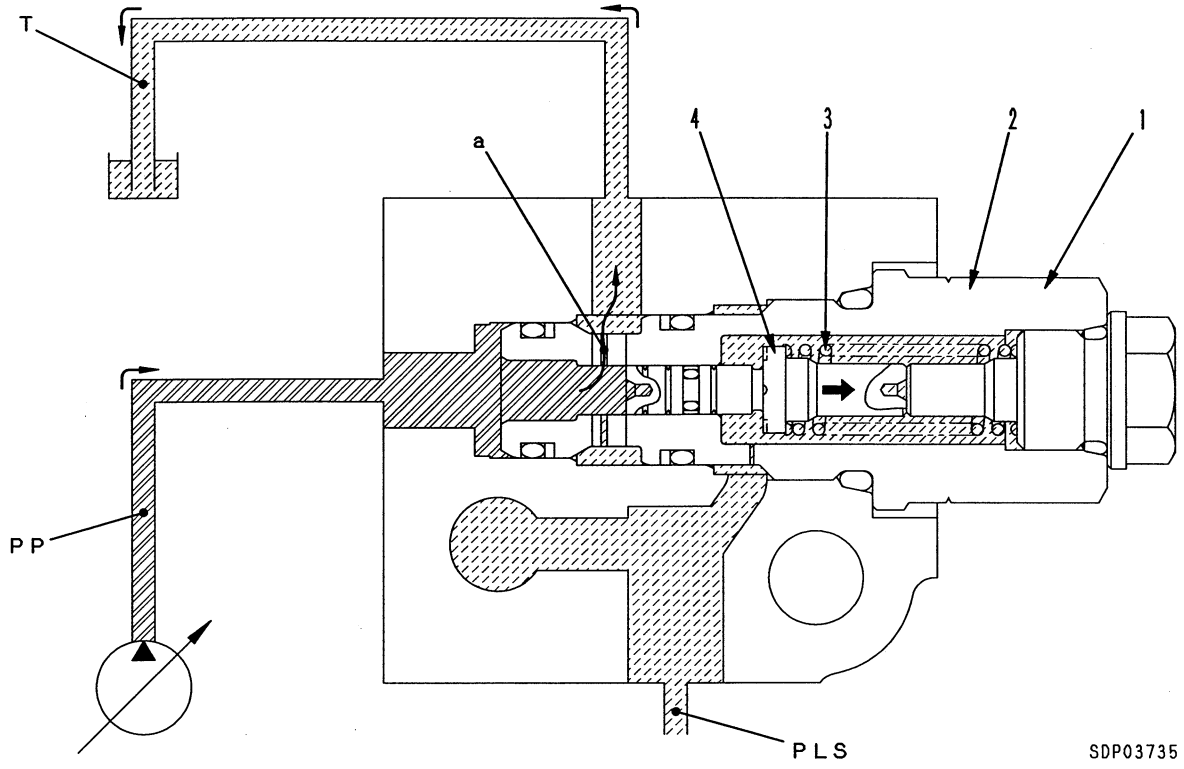


1. Unload valve
   Set pressure: 3.38 MPa {34.5 kg/cm²})
2. Safety-suction valve
   Set pressure: 35.8 MPa {365 kg/cm²})
3. Pressure compensation valve
4. Suction valve
5. Main relief valve
   Set pressure: Normal: 31.9 MPa {325 kg/cm²}
   When rising: 34.8 MPa {355 kg/cm²}
6. Lift check valve
7. Cooler bypass valve
8. LS select valve
9. Swing bleed plug
10. Travel junction valve
11. Boom holding valve
12. Arm regeneration valve

1. UNLOAD VALVE

Function

1) When the control valve is at neutral, pump discharge amount **Q** discharged by the minimum swash plate angle is released to the tank circuit.
When this happens, pump discharge pressure **PP** is set at 2.45MPa {25 kg/cm²} by spring (3) inside the valve. (LS pressure **PLS**: 0MPa {0 kg/cm²})



Operation

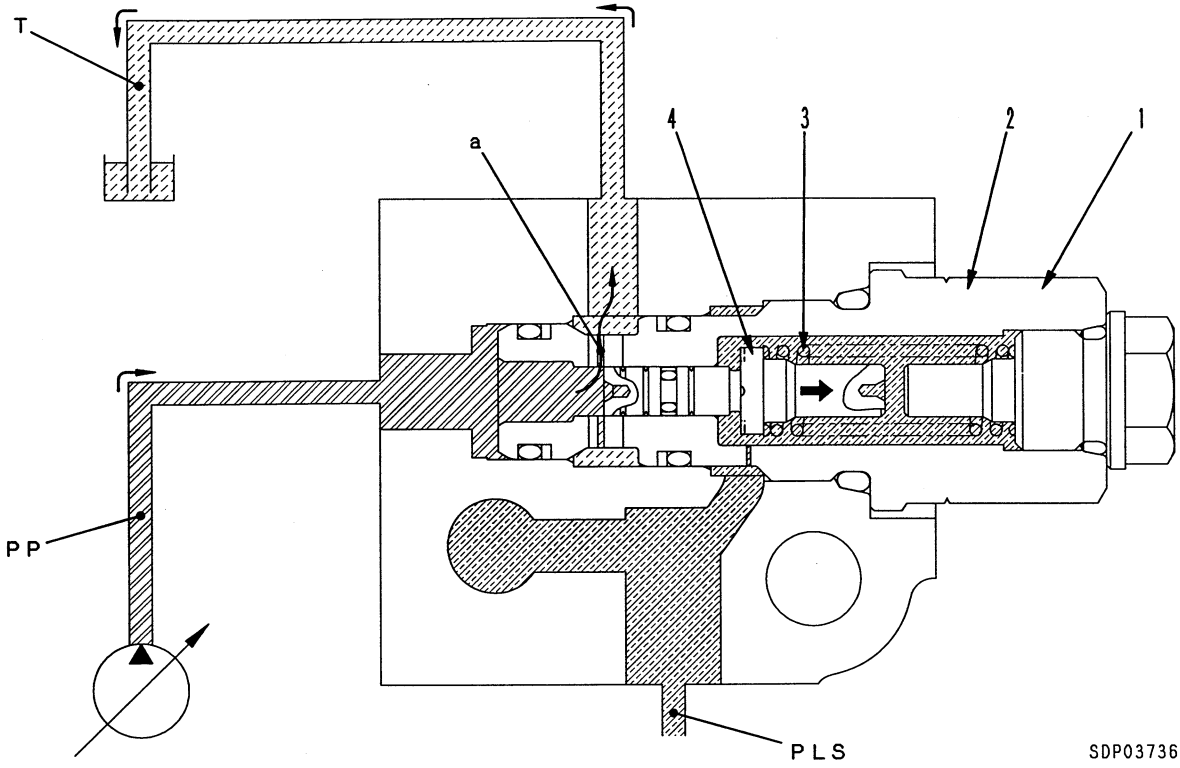
When control valve is at neutral

- Pump discharge pressure **PP** is acting on the left end of spool (4), and LS pressure **PLS** is acting on the right end.
- When the control valve is at neutral, LS pressure **PLS** is 0, so only pump discharge pressure **PP** has any effect, and **PP** is set only by the load of spring (3).
- As pump discharge pressure **PP** rises and reaches the load of spring (3) (2.45MPa {25 kg/cm²}), spool (4) is moved to the right in the direction of the arrow. Pump discharge pressure **PP** then passes through the drill hole in sleeve (2) and is connected to tank circuit **T**.
- In this way, pump discharge pressure **PP** is set to 2.45MPa {25 kg/cm²}.

1. Unload valve
2. Sleeve
3. Spring
4. Spool

PP : Pump circuit (pressure)
PLS : LS circuit (pressure)
T : Tank circuit (pressure)

2) During fine control of the control valve, when the demand flow for the actuator is within the amount discharged by the minimum swash plate angle of the pump, pump discharge pressure **PP** is set to LS pressure **PLS** + 2.45MPa {25 kg/cm²}.
When the differential pressure between pump discharge pressure **PP** and LS pressure **PLS** reaches the load of spring (3) (2.45KPa {25 kg/cm²}), the unload valve opens, so LS differential pressure **ΔPLS** becomes 2.45MPa {25kg/cm²}.



Operation

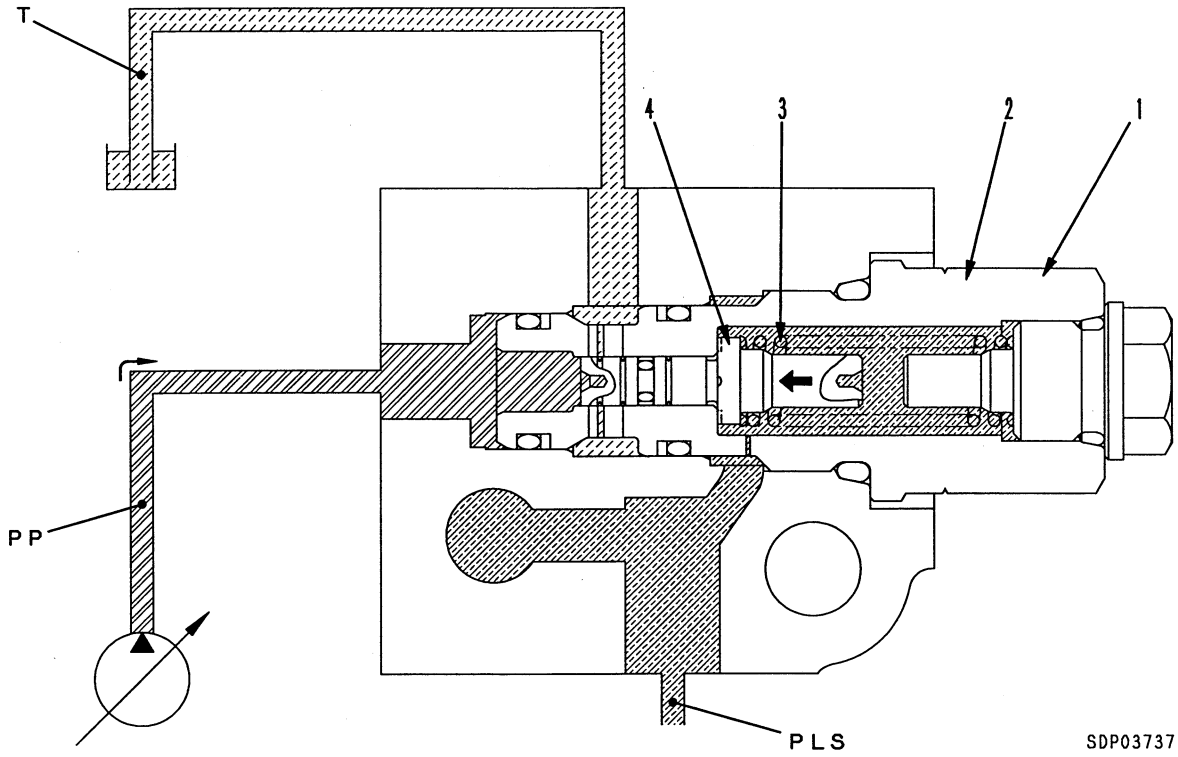
Fine control of control valve

- When fine control is carried out on the control valve, LS pressure **PLS** is generated and acts on the right end of spool (4).
  When this happens, the area of the opening of the control valve spool is small, so there is a big difference between LS pressure **PLS** and pump discharge pressure **PP**.
- When the differential pressure between pump discharge pressure **PP** and LS pressure **PLS** reaches the load of spring (3) (2.45MPa {25 kg/cm²}, spool (4) moves to the right in the direction of the arrow, and pump circuit **PP** and tank circuit **T** are connected.
- In other words, pump discharge pressure **PP** is set to a pressure equal to the spring force (2.45 MPa {25 kg/cm²}) + LS pressure **PLS**, and LS differential pressure **ΔPLS** becomes 2.45 MPa {25 kg/cm²}.

1. Unload valve assembly
2. Sleeve
3. Spring
4. Spool

PP : Pump circuit (pressure)
PLS: LS circuit (pressure)
T : Tank circuit (pressure)

3) When the control valve is being operated and the demand flow for the actuator becomes greater than the pump discharge from the minimum swash plate angle, the flow of the oil out to tank circuit **T** is cut off, and all of pump discharge amount **Q** flows to the actuator circuit.



Operation

Control valve operated

- When the control valve is operated to a bigger stroke, LS pressure **PLS** is generated and acts on the right end of spool (4). When this happens, the area of the opening of the control valve spool is large, so the difference between LS pressure **PLS** and pump discharge pressure **PP** is small.
- For this reason, the differential pressure between pump discharge pressure **PP** and LS pressure **PLS** does not reach the load of spring (3) (2.45MPa {25 kg/cm^2}), so spool (4) is pushed to the left by spring (3).
- As a result, pump circuit **PP** and tank circuit **T** are shut off, and all the pump discharge amount **Q** flows to the actuator circuit.

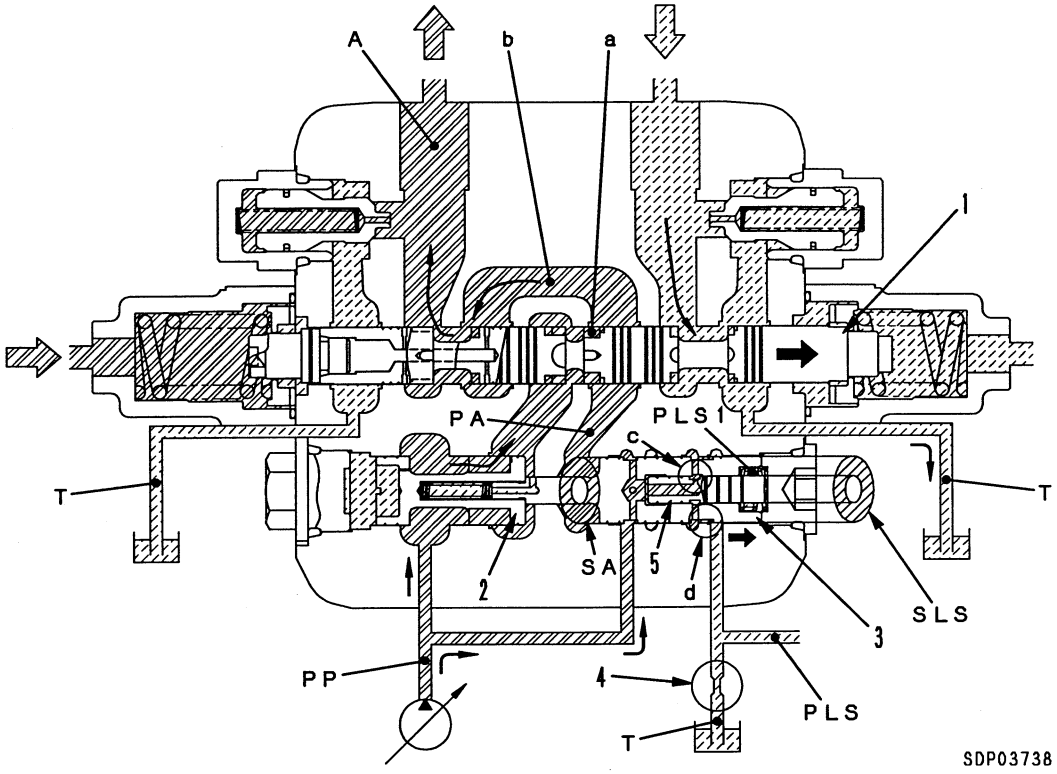
1. Unload valve assembly
2. Sleeve
3. Spring
4. Spool

PP : Pump circuit (pressure)
PLS: LS circuit (pressure)
T : Tank circuit (pressure)

2. INTRODUCTION OF LS PRESSURE

Function

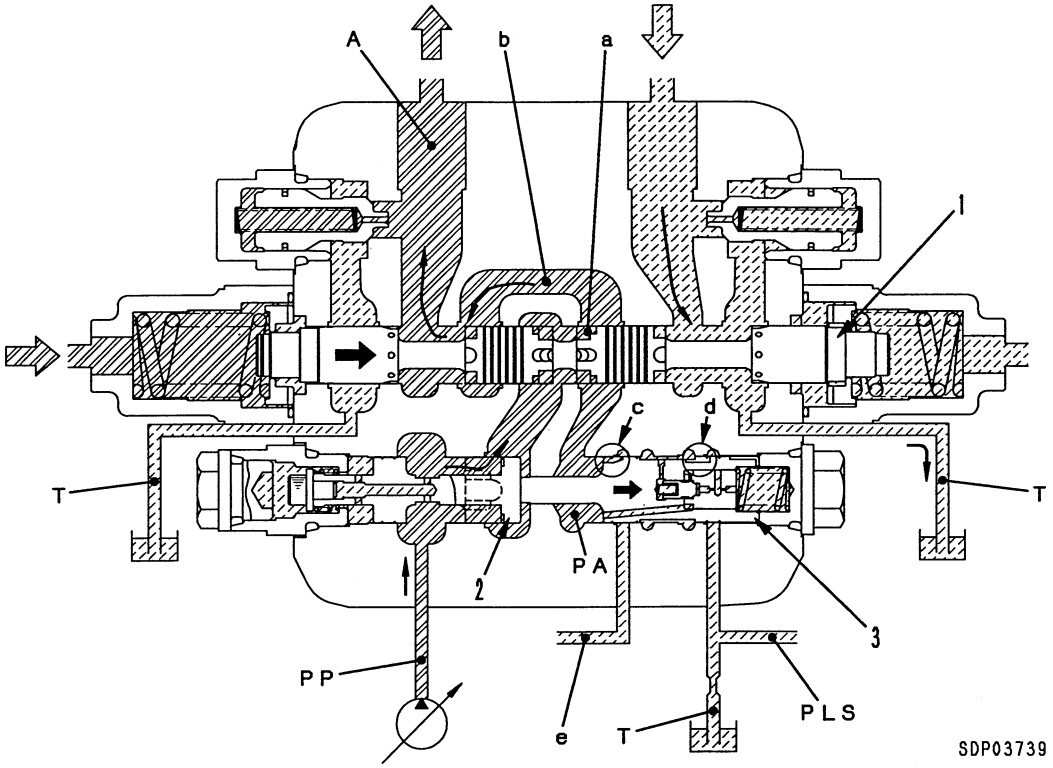
- The LS pressure is the actuator load pressure at the outlet port end of the control valve.
- With the control valve, it actually reduces pump pressure **PP** at reducing valve (3) of the pressure compensation valve to the same pressure as actuation circuit pressure **A**, and sends it to the LS circuit **PLS**.
  In addition, orifice **c** is installed to piston (5) midway between pump circuit **PP** and reducing valve (3), and it acts as a damper.
- With the travel valve, actuator circuit pressure **A** is taken directly to the LS circuit **PLS**.



Operation

1) **Main control valve (boom, arm, bucket, swing)**

- When spool (1) is operated, pump pressure **PP** flows from flow control valve (2) and notch **a** in the spool through bridge passage **b** to actuator circuit **A**.
- At the same time, reducing valve (3) also moves to the right, so pump pressure **PP** brought from orifice c has its pressure reduced by the pressure loss at notch **d**. It goes to LS circuit **PLS**, and then goes to spring chamber **PLS1**.
- When this happens, LS circuit **PLS** is connected to tank circuit **T** from LS bypass plug (4) (see the section on the LS bypass plug).
- The area at both ends of reducing valve (3) is the same (**SA** = **SLS**), and actuator circuit pressure **PA** (=**A**) acts on the **SA** end. The reduced pump pressure **PP** acts on **SLS** at the other end.
- As a result, reducing valve (3) is balanced at **a** position where actuator circuit pressure **PA** and the pressure of spring chamber **PLS1** are the same. Pump pressure **PP** reduced at notch d becomes actuator circuit pressure **A** and is taken to LS circuit PLS.



2) Travel valve

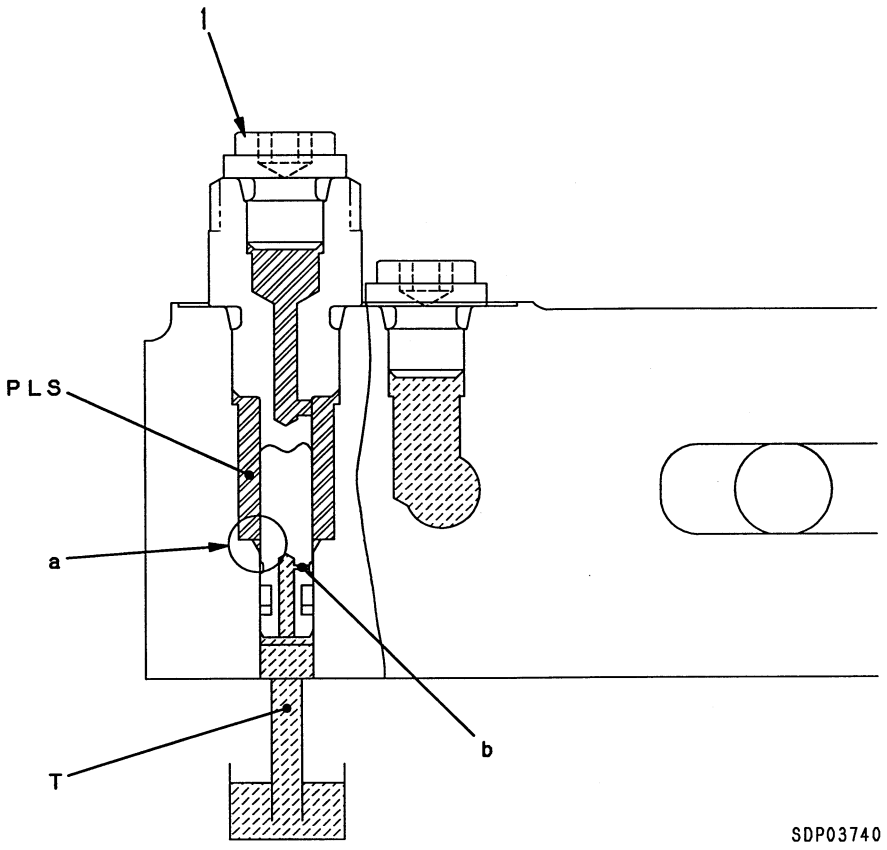
- When spool (1) is operated, pump pressure **PP** flows from flow control valve (2) and notch **a** in the spool through bridge passage b to actuator circuit **A**.
- At the same time, reducing valve (3) is moved to the right by actuator circuit pressure **PA**, and notch **c** and notch **d** are interconnected respectively with travel junction circuit **e** and LS circuit **PLS**.
- As a result, actuator circuit pressure **PA** (= **A**) passes from notch **c** through notch **d** and goes to LS circuit **PLS**.

★ The travel circuit is different from the work equipment circuit: actuator circuit pressure **PA** goes directly to LS circuit **PLS**.

3. LS BYPASS PLUG

Outline

1) This releases the residual pressure of LS pressure **PLS**.
2) It makes the speed of the rise in pressure of LS pressure **PLS** more gentle. In addition, with this discarded throttled flow, it creates a pressure loss in the throttled flow of the spool or shuttle valve, and increases the stability by lowering the effective LS differential pressure.



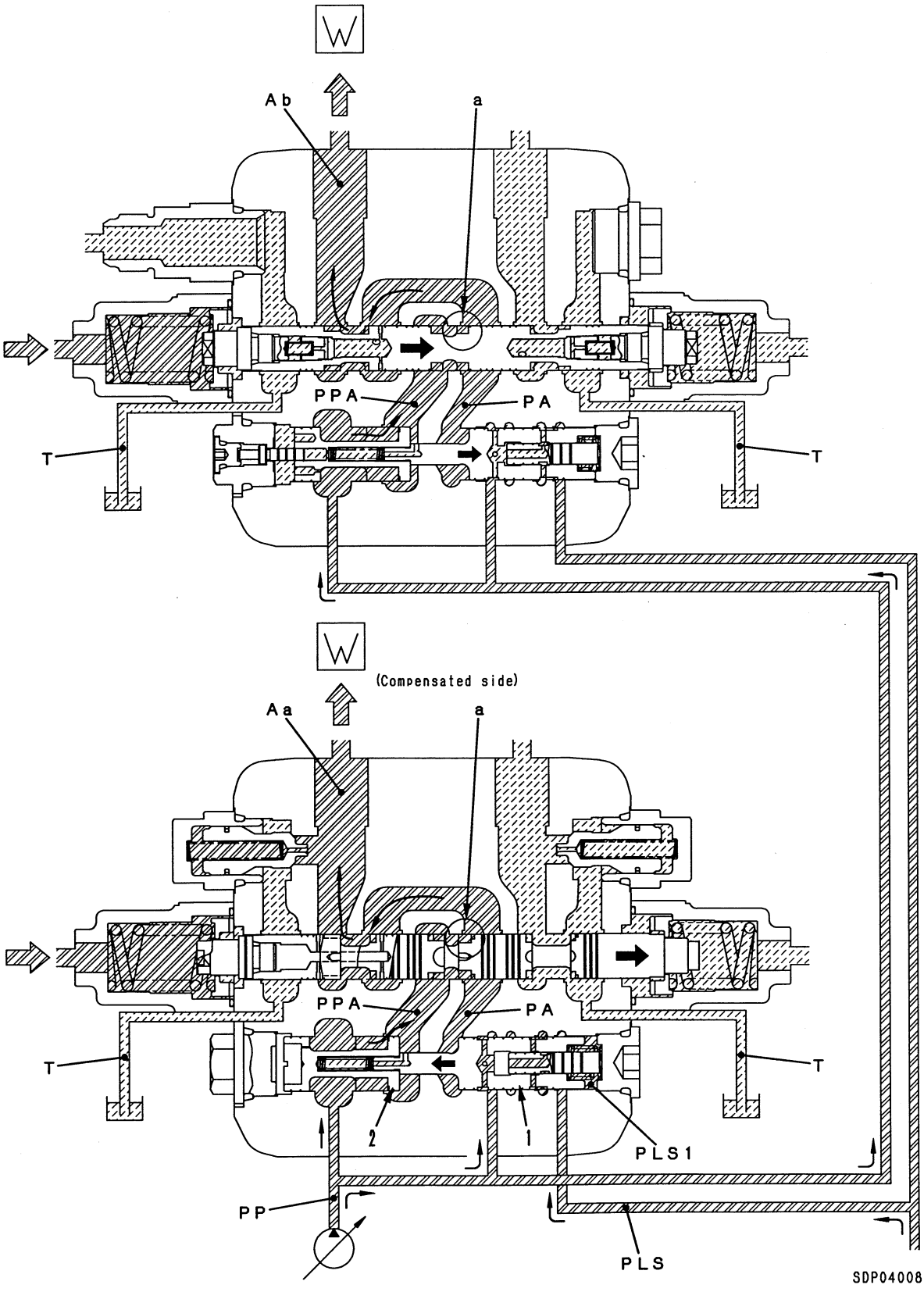
Operation

- The pressurized oil for LS circuit **PLS** passes from clearance filter **a** (formed by the clearance between LS bypass plug (1) and the valve body) through orifice **b** and flows to the tank circuit **T**.

1. LS bypass plug

PLS : LS circuit (pressure)
T : Tank circuit (pressure)

4. PRESSURE COMPENSATION VALVE



Function

- During compound operations, if the load pressure becomes lower than the other actuator and the oil flow tries to increase, compensation is received.
  (When this happens, the other actuator being used for compound operation (right side) is at a higher load than the actuator on this side (left side).)

Operation

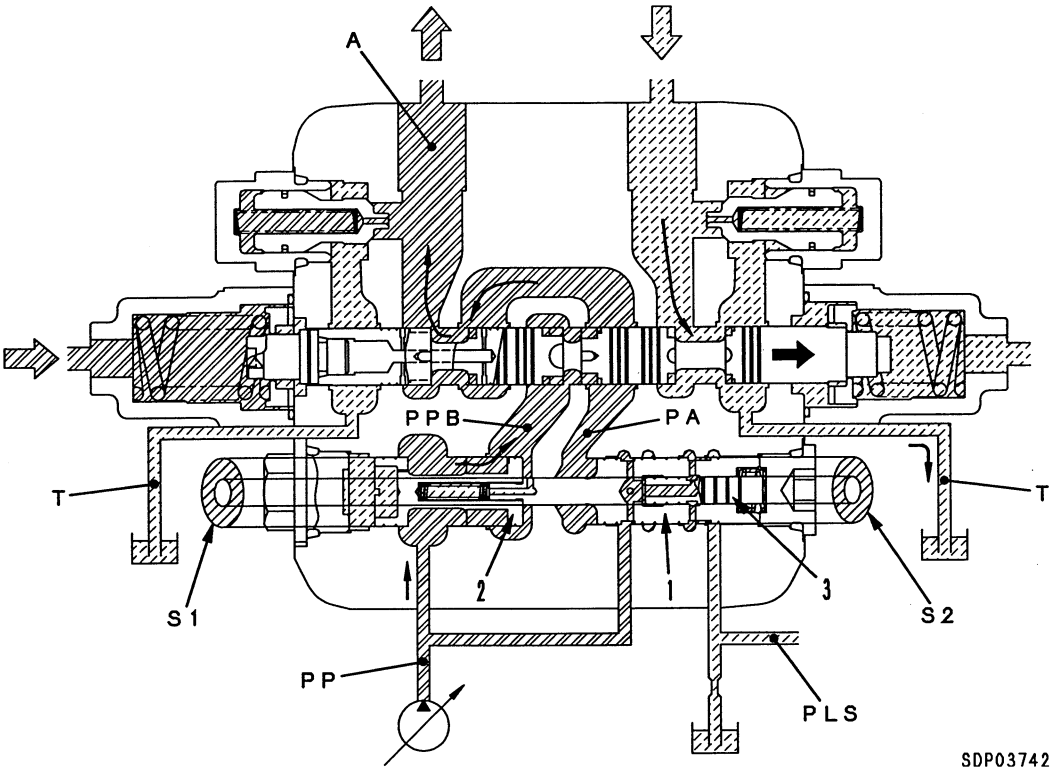
- If the load pressure of the other actuator (top) becomes higher during compound operations, the oil flow in actuator circuit **A** on this side (bottom) tries to increase.
- If this happens, the LS pressure **PLS** of the other actuator acts on spring chamber **PLS1**, and reducing valve (1) and flow control valve (2) are pushed to the left.
- Flow control valve (2) throttles the area of opening between pump circuit **PP** and spool upstream **PPA**, and pressure loss is generated between **PP** and **PPA**.
- Flow control valve (2) and reducing valve (1) are balanced in position where the difference in pressure between **PLS** and **PA** acting on both ends of reducing valve (2) and the pressure loss between **PP** and **PPA** on both sides of flow control valve (2) are the same.
- In this way, the pressure difference between upstream pressure **PPA** and downstream pressure **PA** of both spools used during compound operations is the same, so the pump flow is divided in proportion to the area of opening of notch **a** of each spool.

5. AREA RATIO OF PRESSURE COMPENSATION VALVE

Function

- The pressure compensation valve determines the compensation characteristics by carrying out fine adjustment of the area ratio (**S2/S1**) between area **S2** of reducing valve (1) and area **S1** of flow control valve (2) to match the characteristics of each actuator.

[**S1**: Area of flow control valve (2) - area of piston (3)
S2: Area of reducing valve (1) - area of piston (3)]



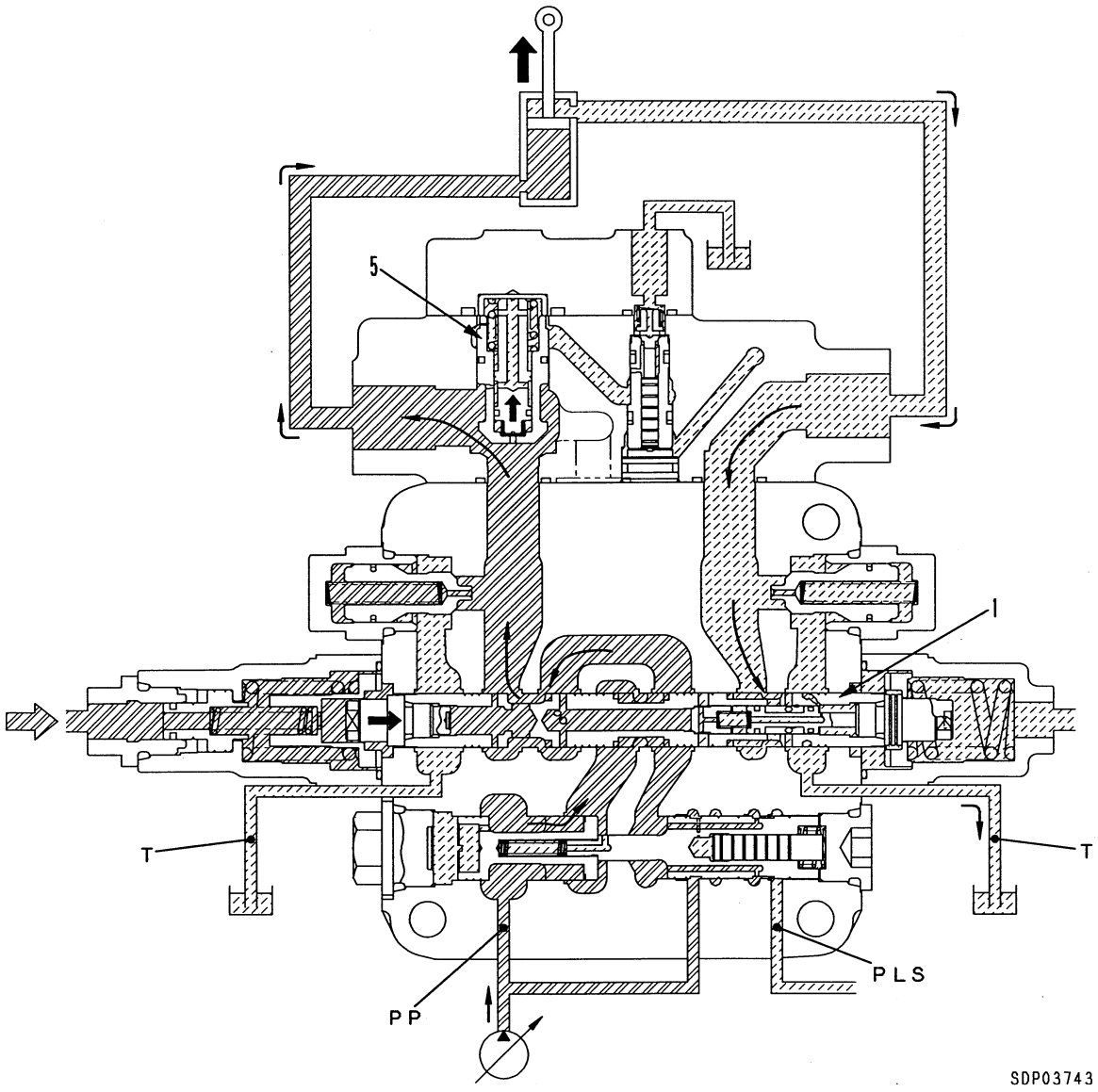
Area ratio (S2:S1) and compensation characteristics

- When ratio is 1.00: [pump pressure **PP** - spool notch upstream pressure **PPB**] = [LS circuit pressure **PLS** - actuator circuit pressure **PA** (=**A**)] and oil flow is divided in proportion to area of opening of spool.
- When ratio is more than 1.00: **PP** - **PPB** > **PLS** - **PA** (=A) and oil flow is divided in a proportion less than area of opening of spool.
- When ratio is less than 1.00: **PP** - **PPB** < **PLS** - **PA** (=A) and oil flow is divided in a proportion more than area of opening of spool.

6. BOOM HOLDING VALVE

Function

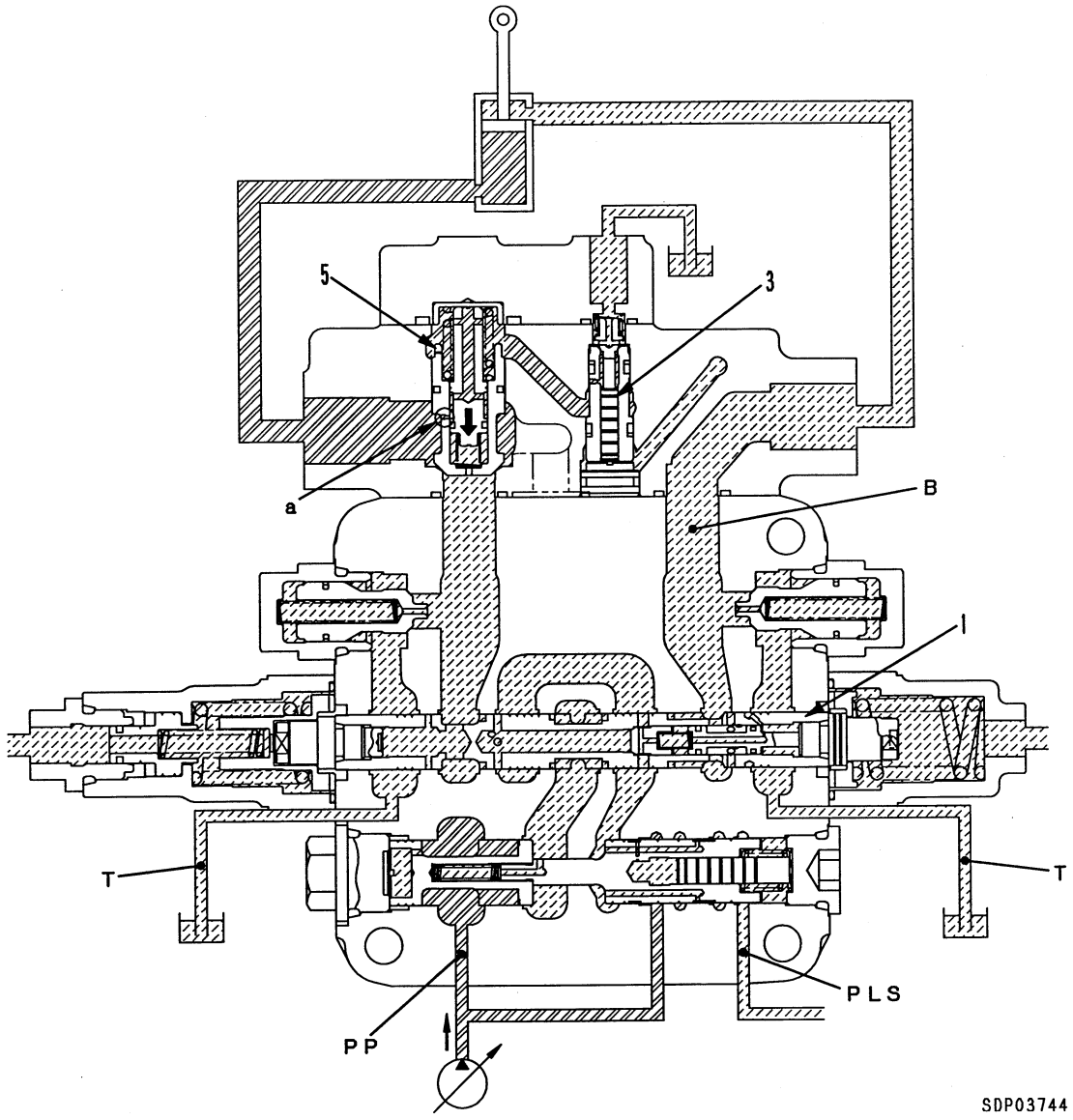
- When the boom lever is not being operated, the oil at the boom bottom leaks from spool (1) and prevents hydraulic drift of the boom.



Operation

1) At boom RAISE

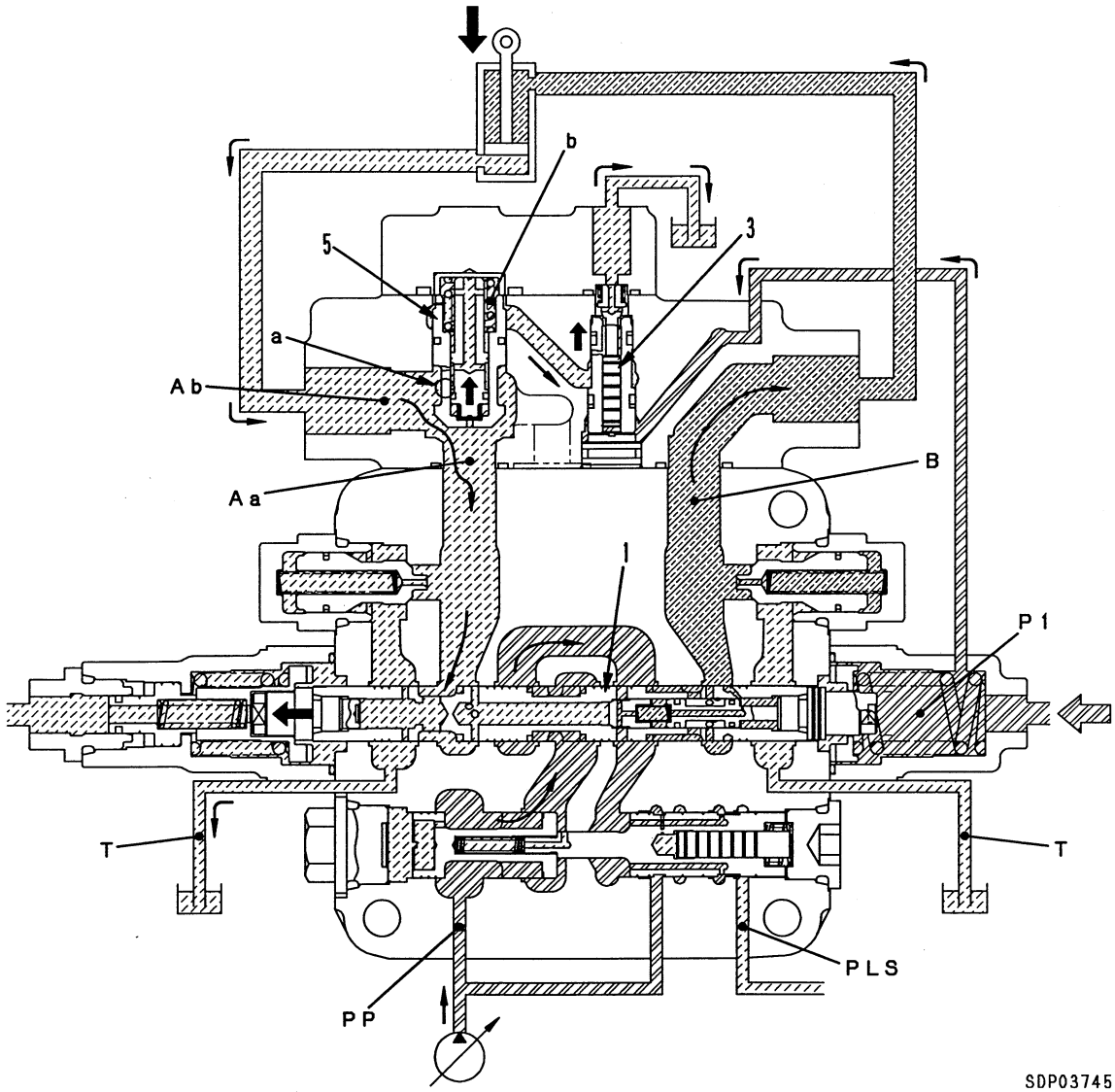
When the control lever is operated to boom RAISE, the main pressure from the control valve pushes poppet (5) up.
As a result, the main pressure oil from the control valve passes through the inside of the valve and flows to the boom cylinder bottom.



2) At boom HOLD

When the control lever has been operated to boom RAISE and is then returned to the HOLD position, the holding pressure at the boom cylinder bottom end is closed by poppet (5). At the same time, the oil flowing inside poppet (5) from orifice **a** in poppet (5) is closed by pilot spool (3).

In this way, the boom is held in position.



3) At boom LOWER

When the control lever is operated to boom LOWER, pilot pressure **P1** from the PPC valve pushes pilot spool (3) and the pressure oil in chamber **b** inside the poppet is drained.

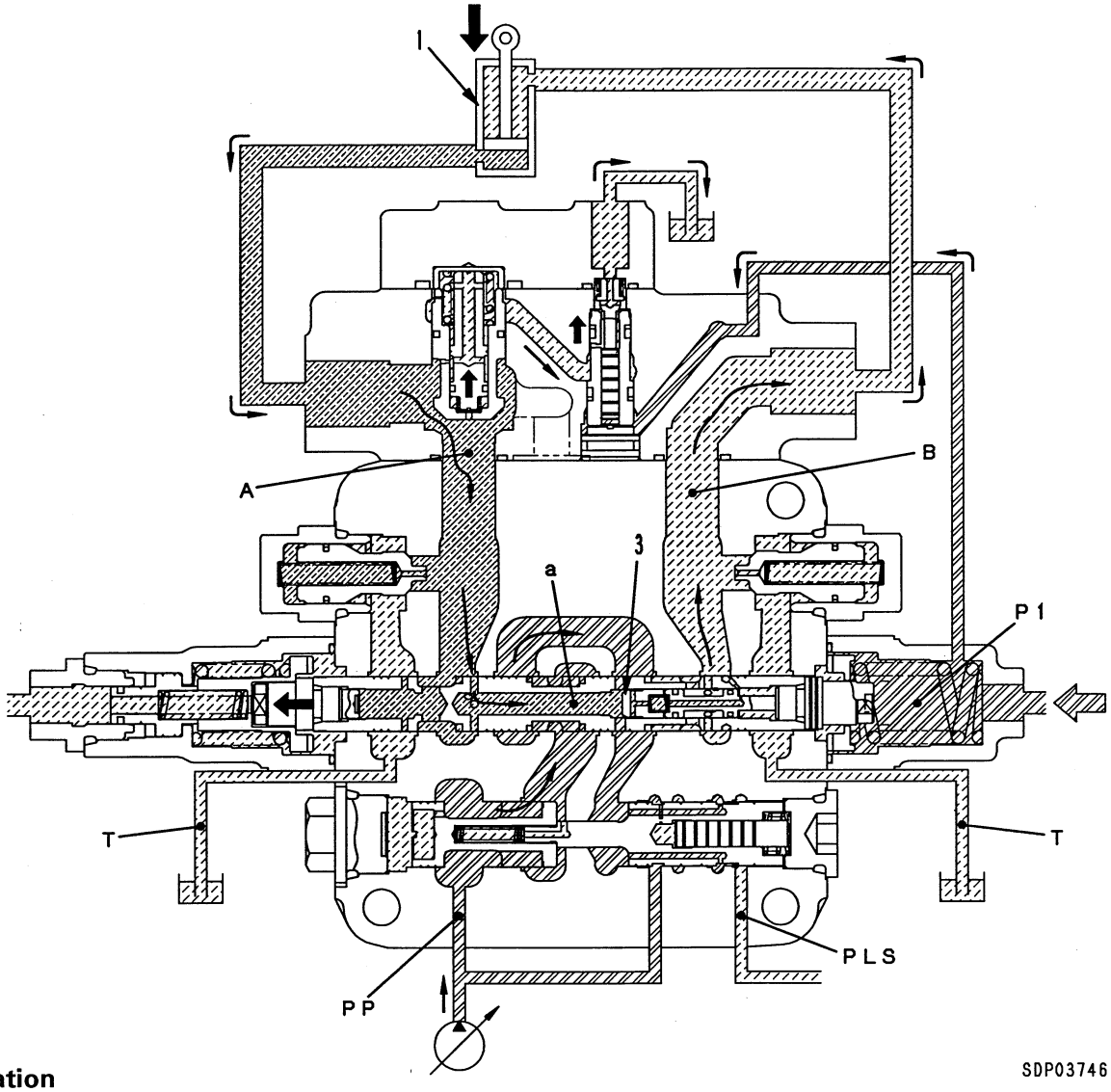
The oil pressure at port **Ab** increases because of the pressure oil from the boom cylinder bottom, but the oil pressure in chamber **b** is lowered by orifice **a**.

If the pressure in chamber **b** becomes lower than the pressure at port **Aa**, poppet (5) opens and the pressure oil from port **Ab** flows to port **Aa** and goes to the control valve.

7. BOOM REGENERATION CIRCUIT

Function

1) When the boom is being lowered, if bottom pressure **A** of cylinder (1) is higher than head pressure **B**, and the boom is lowered under its own weight, this sends the return oil flow at the bottom end to the head end to increase the cylinder speed by that amount.



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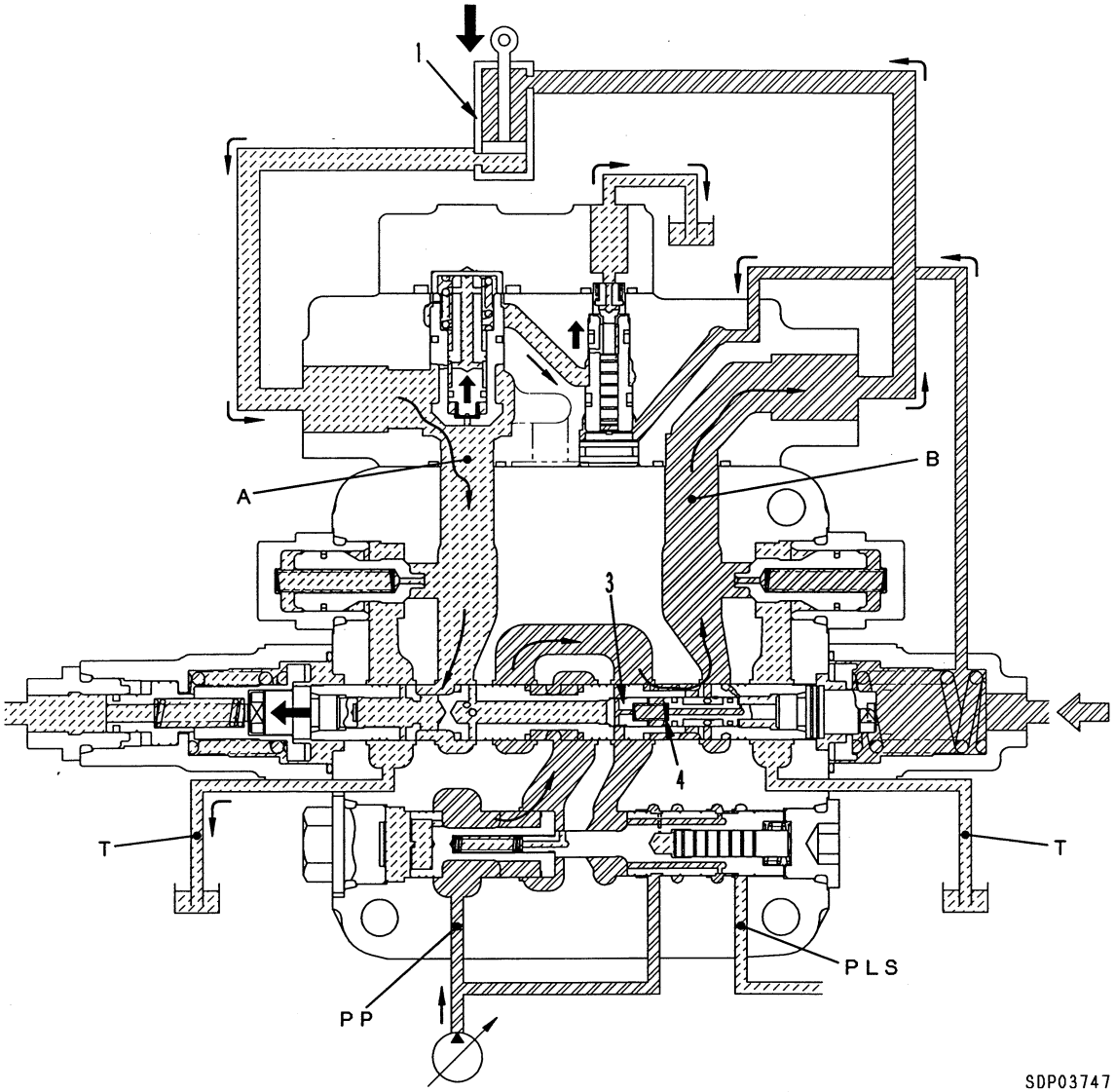
Operation

- If the boom is lowered under its own weight, pressure **A** at the bottom end of boom cylinder (1) becomes higher than pressure **B** at the head end.
- When this happens, part of the return oil at the bottom end passes through regeneration passage **a** of boom spool (1), pushes check valve (3) open, and flows to the head end.
- As a result, the boom lowering speed is increased.

2) When lowering the boom, if head pressure **B** of cylinder (1) is greater than bottom pressure **A**, and the work equipment is in the load process, check valve (3) closes and shuts off the circuit between the head and bottom ends.



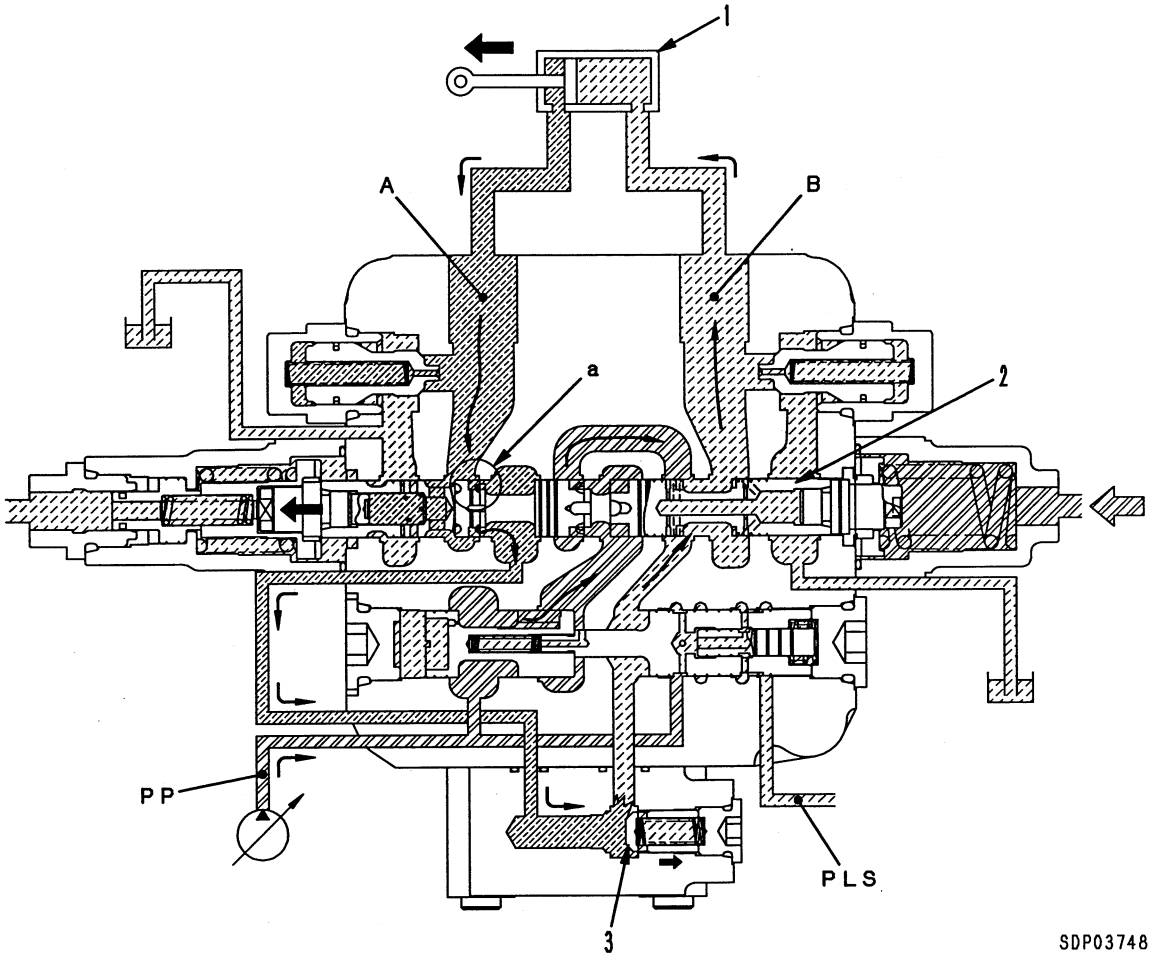
Operation

- When the boom is lowered, if the work equipment is in the load process, pressure **B** at the head end of cylinder (1) becomes higher than pressure **A** at the bottom end.
- When this happens, check valve (3) is closed by spring (4) and pressure **B** at the head end, so the circuit between the head circuit and bottom circuit is shut off.

8. ARM REGENERATION CIRCUIT

Function

1) When the arm is being pulled in, if head pressure **A** of arm cylinder (1) is higher than bottom pressure **B**, and the arm is lowered under its own weight, this sends the return oil flow at the head end to the bottom end to increase the cylinder speed by that amount.



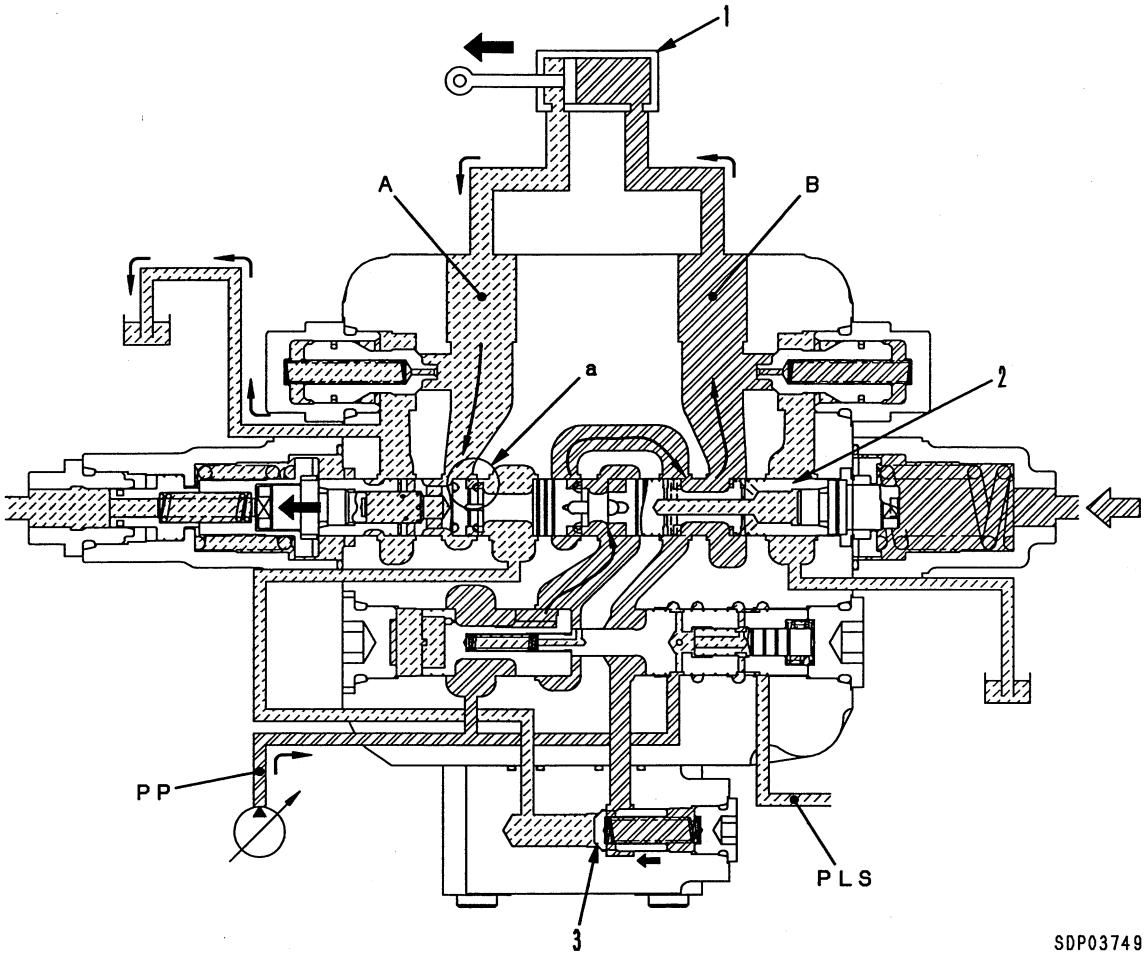
Operation

- If the arm is lowered under its own weight when pulling the arm in, pressure **A** at the head end of arm cylinder (1) becomes higher than pressure **B** at the bottom end.
- When this happens, part of the return oil at the head end passes through regeneration passage **a** of arm spool (1), pushes check valve (3) open, and flows to the bottom end.
- As a result, the arm IN speed is increased.

1. Arm cylinder
2. Arm spool
3. Check valve

PP: Pump circuit (pressure)
A : Head circuit (pressure)
B : Bottom circuit (pressure)

2) When pulling the arm in, if bottom pressure **B** of cylinder (1) is greater than head pressure **A**, and the work equipment is in the digging process, check valve (3) closes and shuts off the circuit between the head and bottom ends.



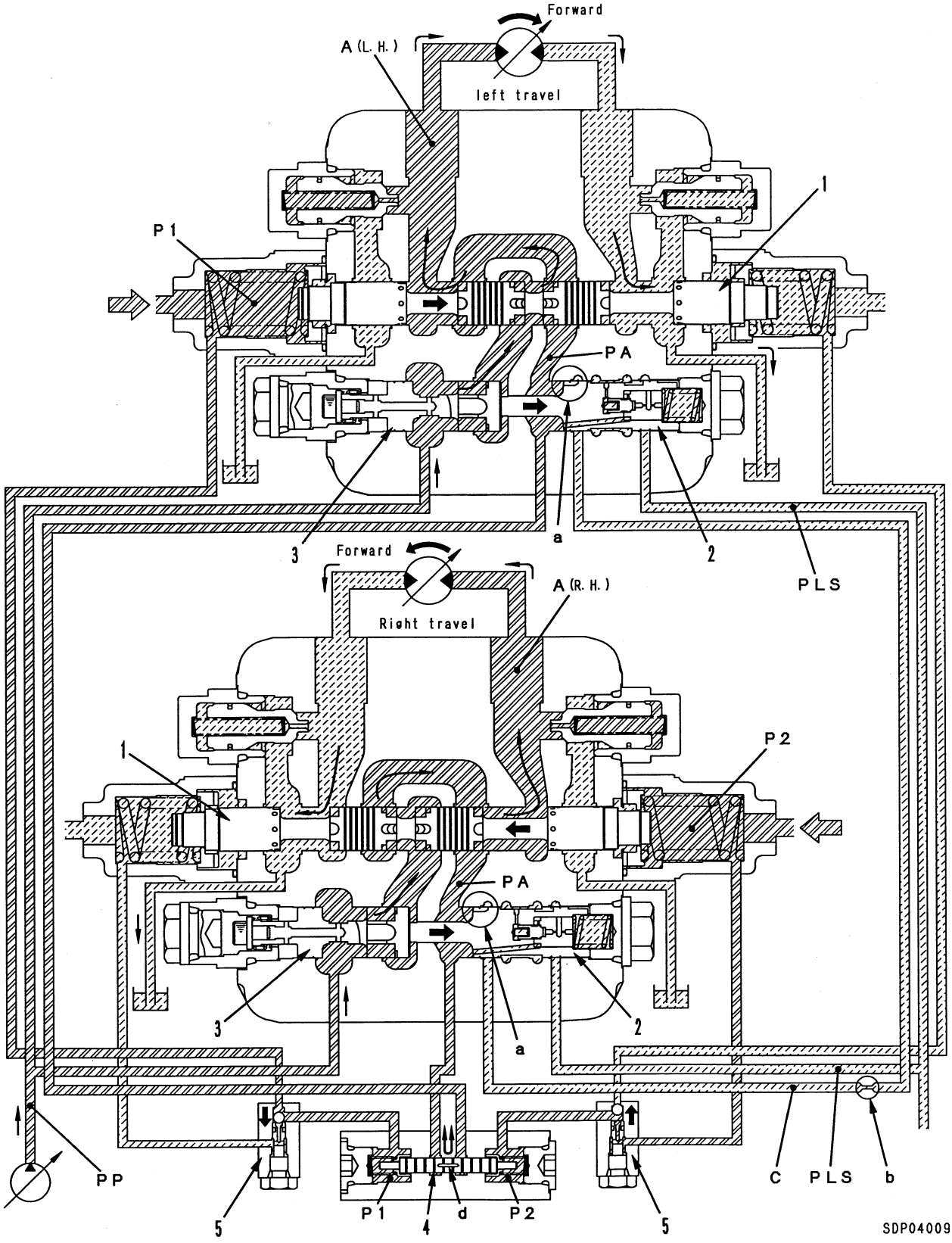
Operation

- When the arm is pulled in, if the work equipment is in the digging process and pressure **B** at the bottom end of arm cylinder (1) rises, check valve (3) closes, so the circuit between the head circuit and bottom circuit is shut off.

1. Arm cylinder
2. Arm spool
3. Check valve

PP: Pump circuit (pressure)
A : Head circuit (pressure)
B : Bottom circuit (pressure)

9. L.H., R.H. TRAVEL JUNCTION CIRCUIT AND VALVE



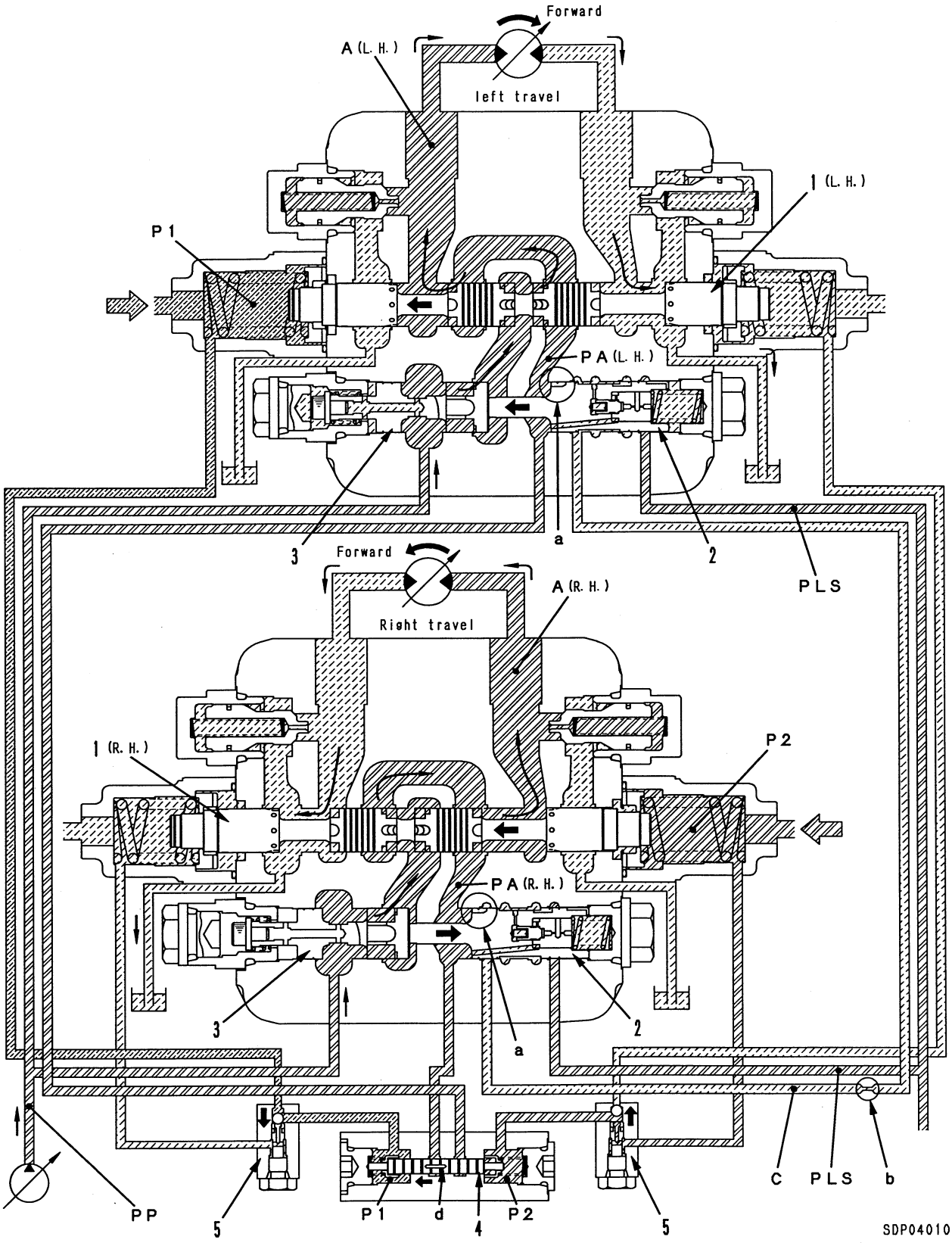
Function

- To compensate for any difference in the oil flow in the left and right travel circuits when traveling in a straight line, the junction circuit opens when the left and right travel spools are operated.
  In this way, the flow of oil to the left and right travel motors is almost the same when traveling in a straight line, so there is no travel deviation.
- When steering the machine, the difference in the load pressure returns the reducing valve of the travel valve on the inside of the turn and the opening of the notch in the travel junction valve spool is closed, so the junction circuit is closed and the machine can be steered.

Operation

When traveling in a straight line

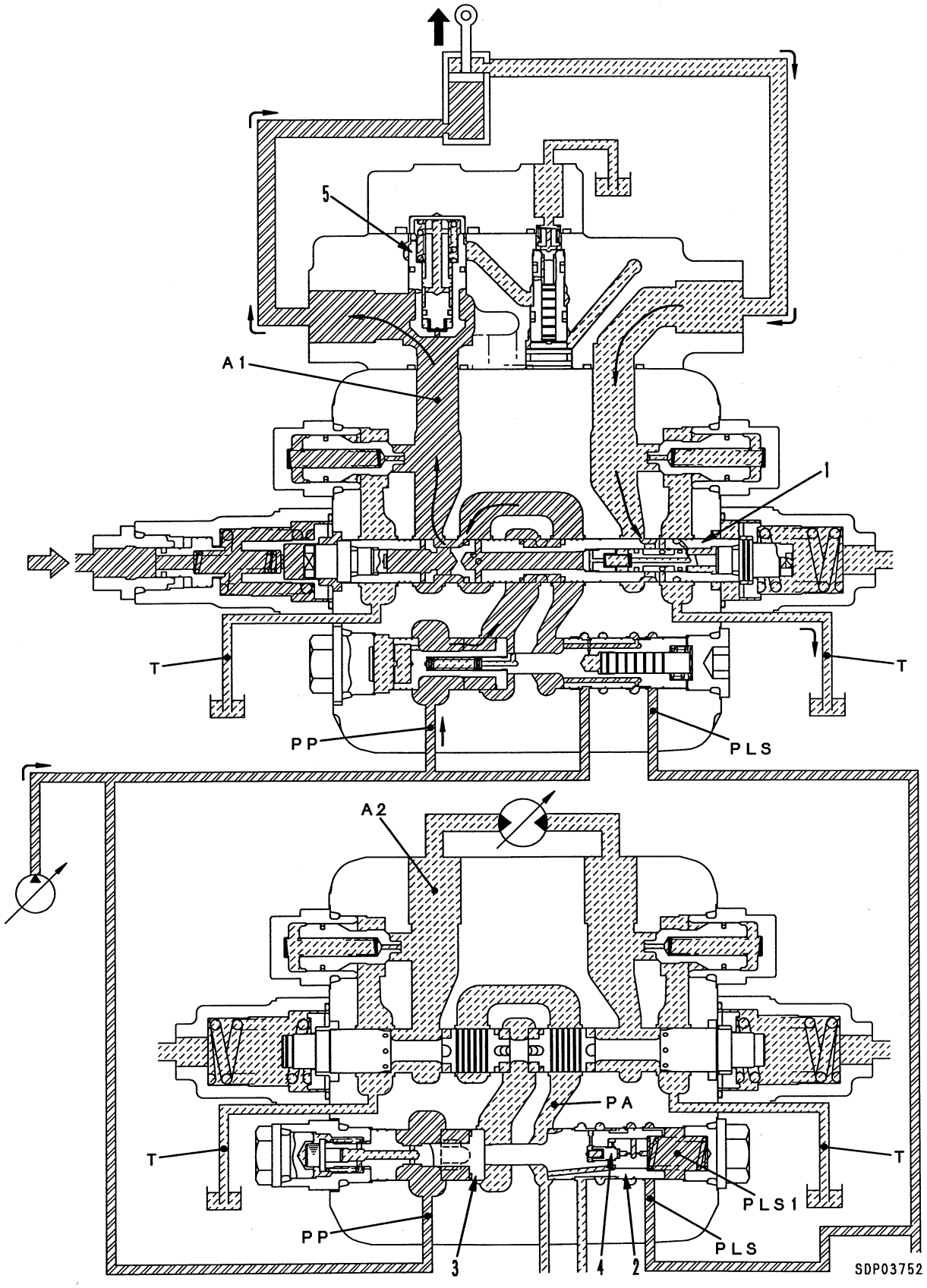
- When left and right travel spools (1) are operated, the pump discharge flows from pump circuit **PP** and circuit **PA** to actuator circuit **A**.
- When traveling in a straight line, to make actuator circuit **PA** equal, left and right reducing valves (2) are pushed to the right by the same amount, and notch **a** and the travel junction circuit are opened.
- L.H. travel FORWARD pressure **P1** and R.H. travel FORWARD pressure **P2** are sent to the spring chambers at both ends of travel junction valve spool (4) through their respective shuttle valve (5). **P1** = **P2**, so spool (4) stops in the center and notch **d** also acts as an interconnecting opening.
- In this way, the left and right travel actuator circuits are interconnected by the travel junction circuit, so if any difference occurs in the flow of oil to the left and right travel motors, the difference is compensated to prevent any deviation in travel.


Forward
A (L. H.)
left travel
1 (L. H.)
P1
PA (L. H.)
3
a
2
PLS
Forward
A (R. H.)
Right travel
1 (R. H.)
P2
PA (R. H.)
3
a
2
C
PLS
b
PP
5
P1
d
4
P2
5
SDP04010

Steering when traveling

- When traveling in a straight line, if left travel spool (left 1) is returned to the neutral position and steering is operated, a difference (right **A** > left **A**) is generated in the load pressure of left and right travel actuator circuits **PA**, and LS pressure **PLS** becomes the same pressure as right **A** (the side with the high load pressure).
- As a result, flow control valve (3) on the left travel side is pushed to the left by LS circuit PLS, that is, right travel load pressure right **A**. Because of this, the opening of the left travel notch **a** is closed, and the left and right travel circuits are shut off. The pressure at the spring chambers at both ends of travel junction valve spool (4) is **P1** < **P2**, so spool (4) is switched to the **P1** side and notch **d** is closed, so it becomes possible to operate the steering when traveling.
- Damper **b** is provided in the circuit to dampen any excessive characteristics in the opening or closing of the travel junction circuit if the spool is operated suddenly.

10. TRAVEL LS BYPASS CIRCUIT



Function

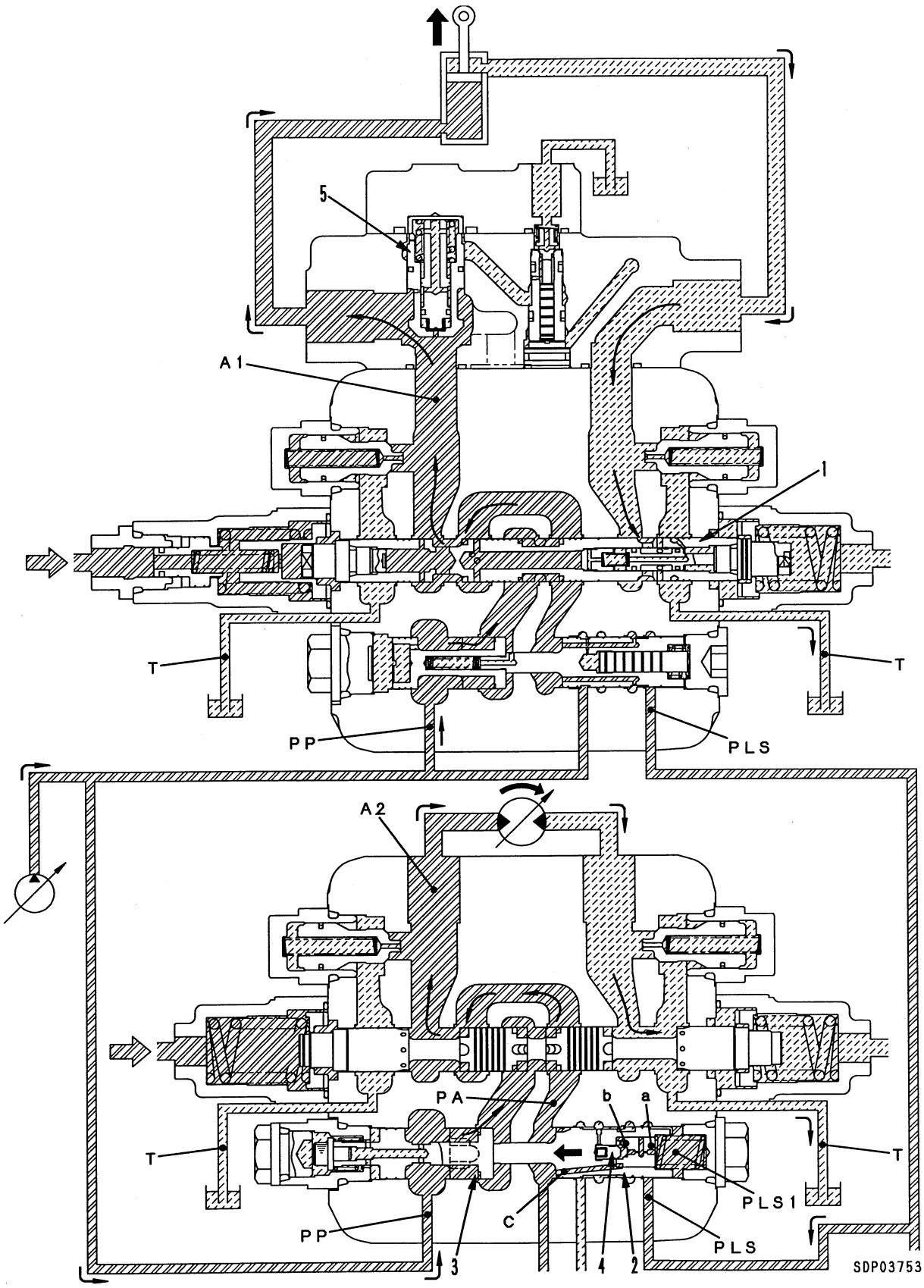
- When the travel and another actuator are operated at the same time, the amount of oil discarded by the throttle in LS circuit **PLS** increases and the pressure compensation precision of the travel circuit is relaxed to keep the drop in the travel speed to the minimum.
- When the travel is operated independently or any other actuator is operated independently, the bypass circuit is closed.

Operation

Normal operation

- When boom spool (1) is operated, LS circuit **PLS** becomes the same pressure as boom circuit pressure **A1**.
- At the same time, LS circuit pressure **PLS** also goes to spring chamber **PLS1** of reducing valve (2) of the travel valve.
- The travel spool is not being operated, so travel actuator circuit **PA** is closed, and check valve (4) inside flow control valve (3) is also closed.
- As a result, when the boom is operated independently, the travel LS bypass circuit is closed.

Travel + other actuator operated

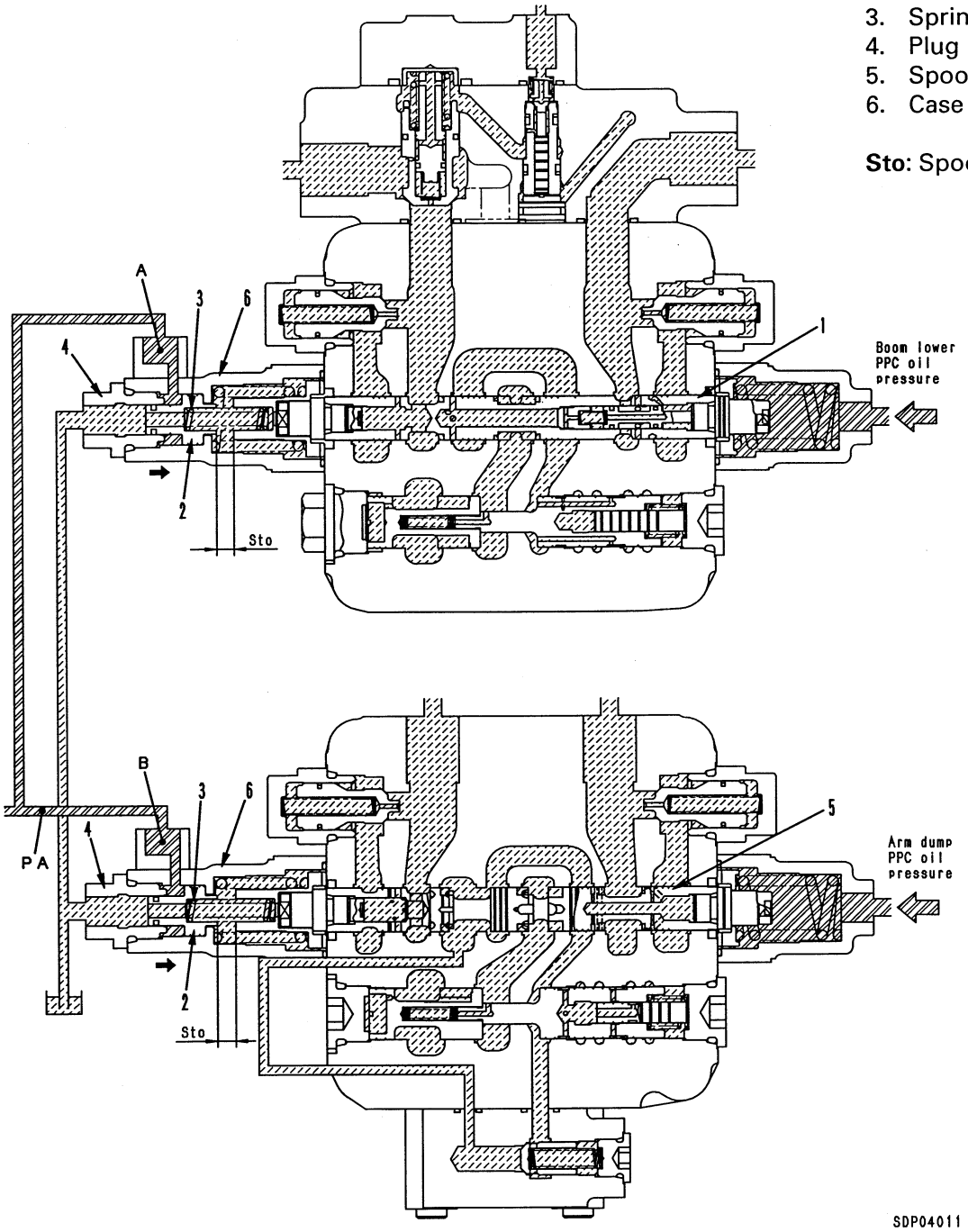


- When boom spool (1) is operated, LS circuit **PLS** becomes the same pressure as boom circuit pressure **A1**.
- With the actuator circuit pressure, the boom RAISE pressure is normally higher than the travel pressure (**A1** > **A2**), so the pressure of spring chamber **PLS1** inside travel flow control valve (3) is higher than travel circuit pressure **PA**.
- As a result, reducing valve (2) moves to the left, LS pressure of spring chamber **PLS1** goes from orifice **a** and pushes check valve (4) open, so oil flows from passage **b** and passage **c** to travel circuit **PA**.
- For this reason, LS circuit pressure **PLS** (which is the same pressure as boom circuit pressure **A1**) flows to travel circuit **A2** to reduce the pressure.

11. ACTIVE MODE FUNCTION

1. Spool (boom)
2. Piston
3. Spring
4. Plug
5. Spool (arm)
6. Case

Sto: Spool stroke

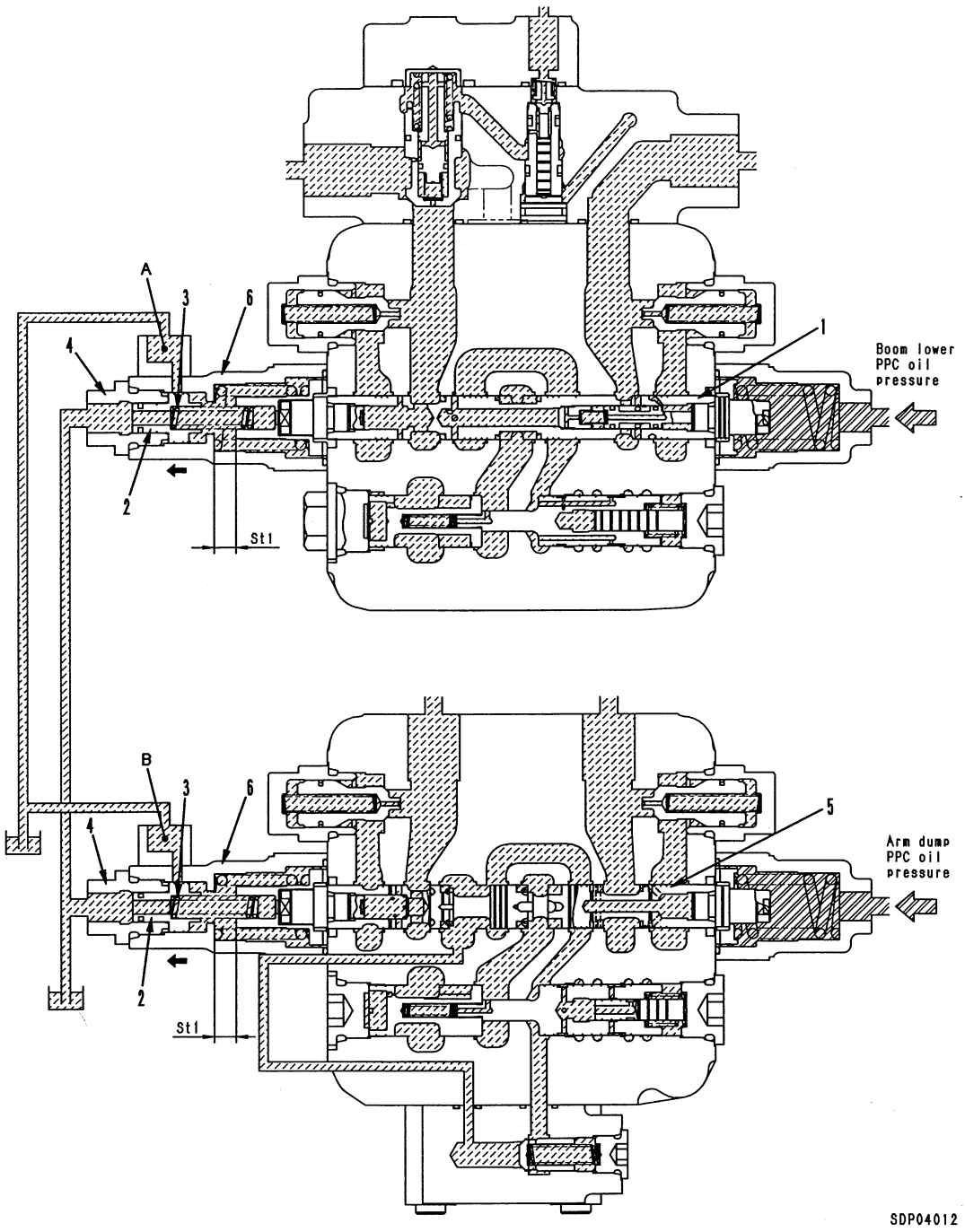


Function

- In the active mode, the maximum stroke of the spool for boom LOWER and arm IN becomes larger, and the flow of oil through the spool increases, so the boom LOWER and arm IN move faster to make it possible to carry out speedy operations.

Operation

1) **When active mode is OFF**
Pilot pressure **PA** passes through port **A** and **B** and acts on the left end face of piston (2), so piston (2) is pushed fully to the right. When this happens, the maximum stroke of spools (1) and (5) becomes **St0** because of the limit on the piston.



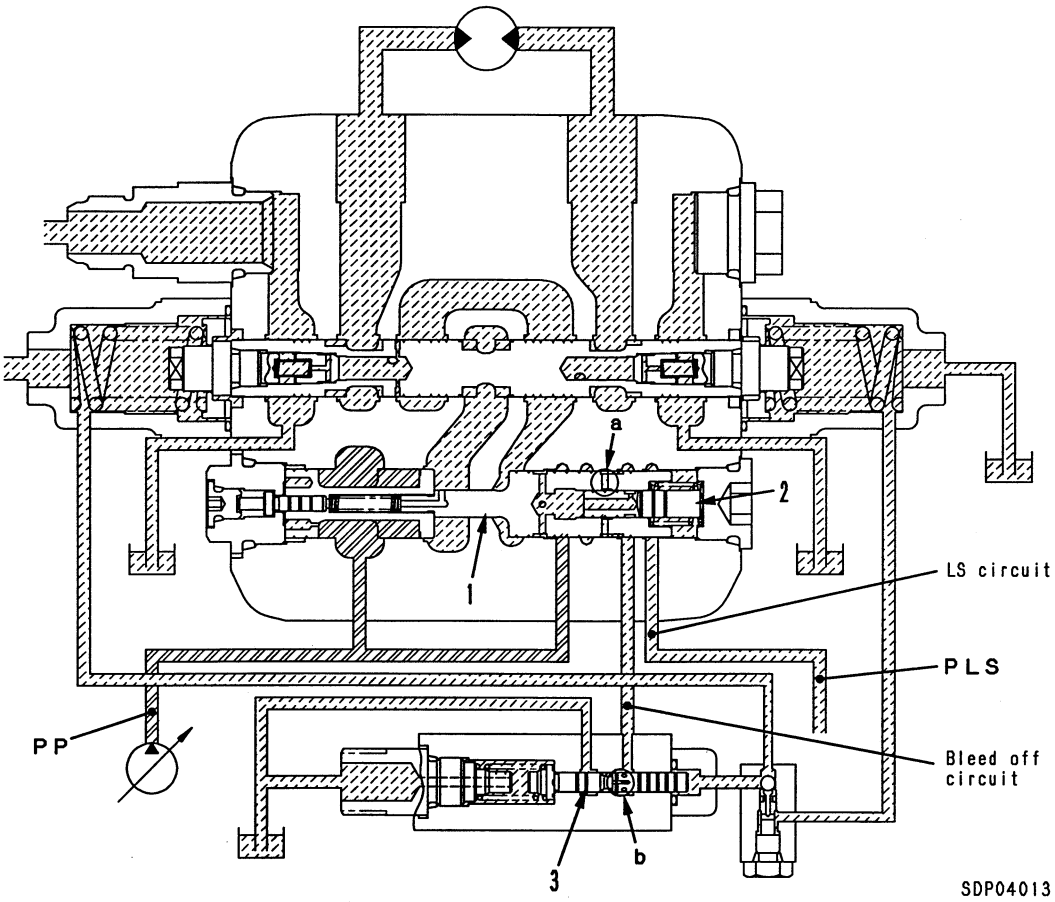
2) When active mode is ON

Ports **A** and **B** are connected to the drain circuit, and the left end of piston (2) becomes the drain pressure, so no force acts on piston (2) and the spool stroke cannot be limited. For this reason, spool (5) contacts case (6) and the stroke becomes larger (**St1**), so the amount of oil flowing through increases.

12. SWING BLEED VALVE

Function

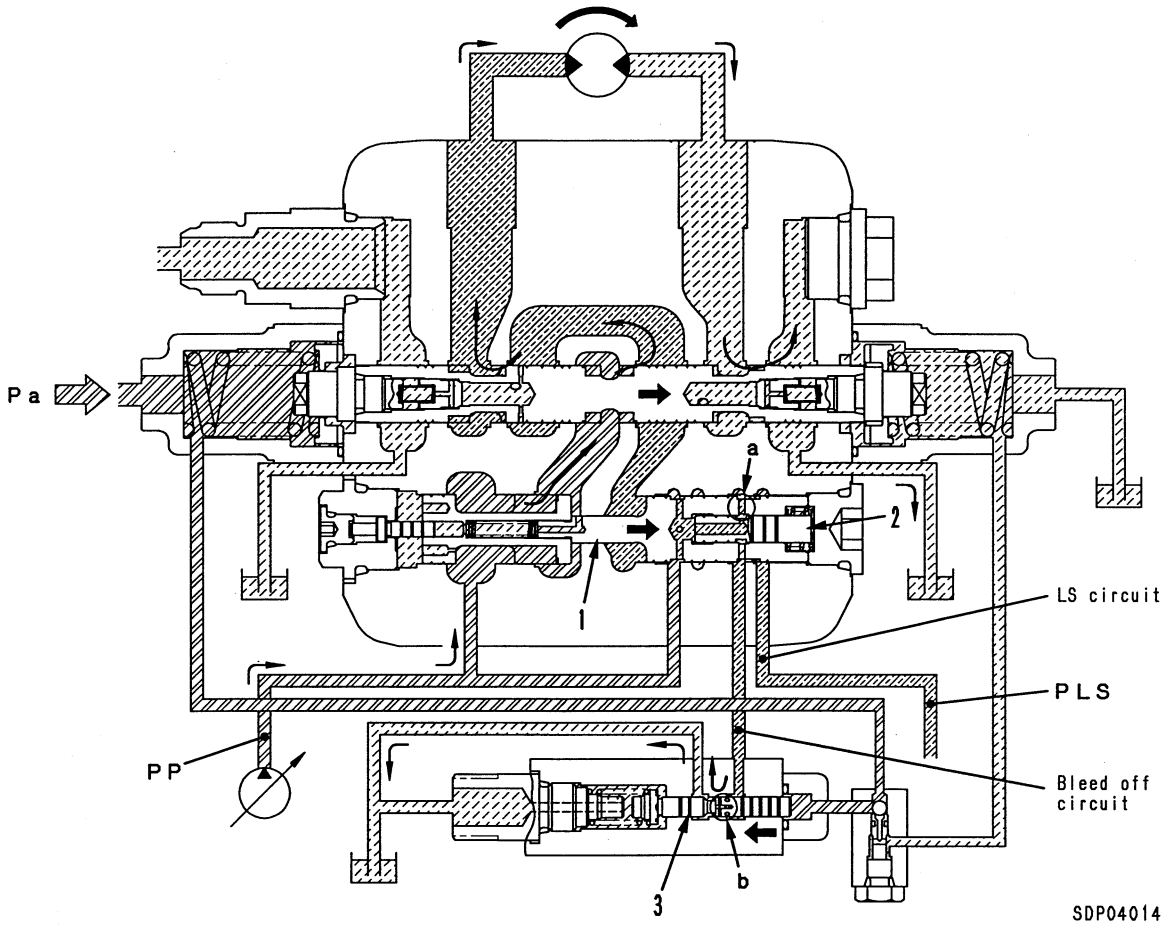
- A bleed valve is installed to the reducing valve to make the rise in the LS pressure smooth during swing operations to ensure smooth movement of the swing.



Operation

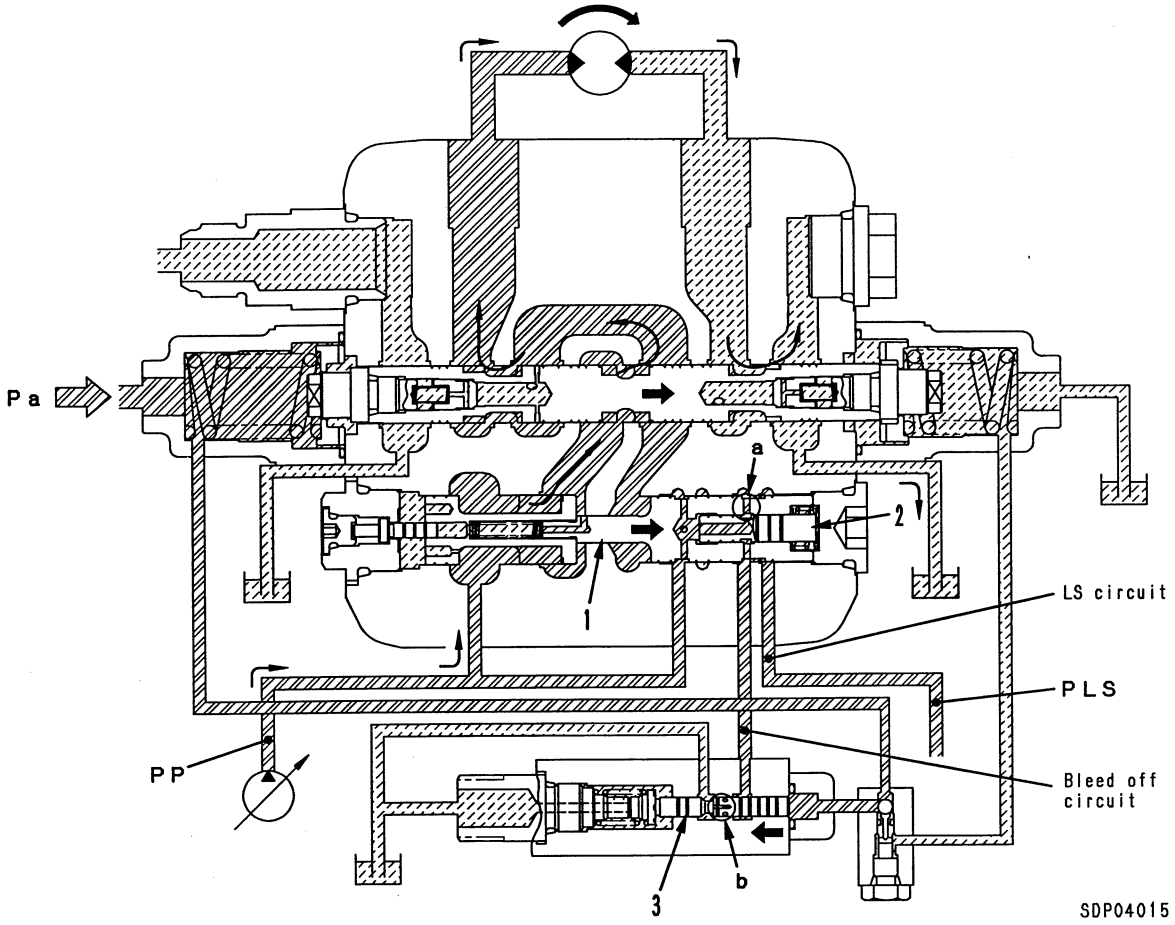
1) When swing is at neutral

- Notch **a** of reducing valve (1) and the LS circuit are closed. The bleed-off circuit and the LS circuit are also closed, so there is no influence on the LS pressure **PLS** when any other work equipment is operated.
- Pump pressure **PP** is also shut off from the bleed-off circuit by piston (2), so there is also no influence on the pressure.
- Notch **b** of bleed spool (3) and the bleed-off circuit are interconnected.



2) During fine operation of swing

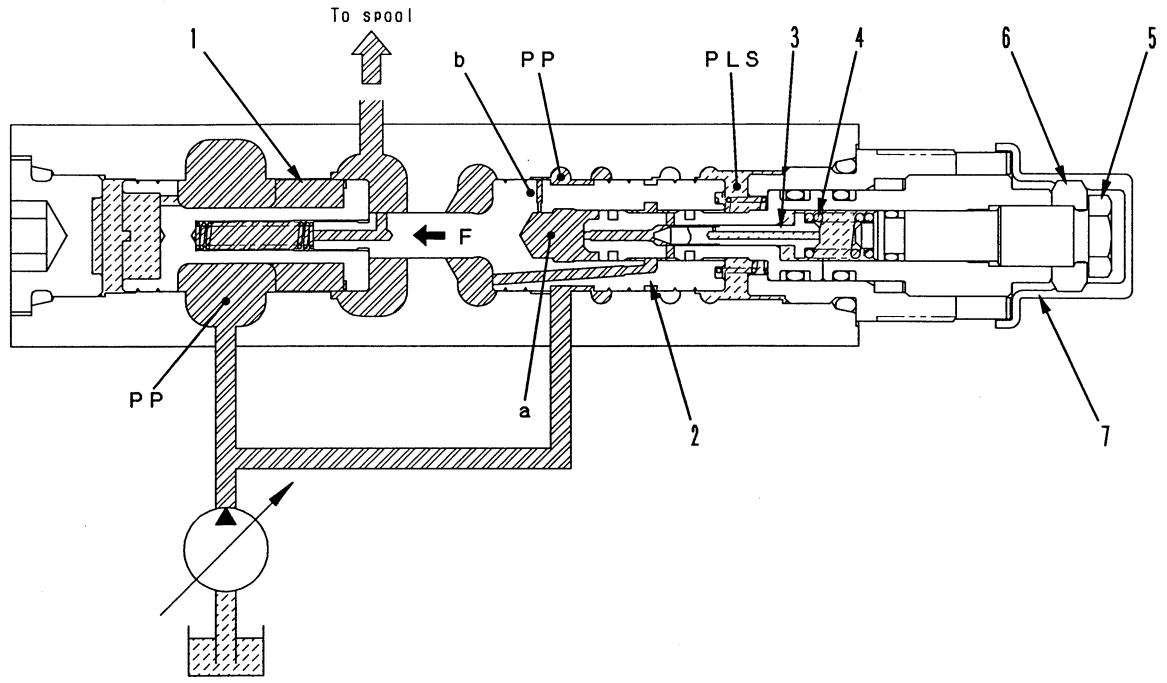
- Reducing valve (1) moves to the right and notch **a** is interconnected with the LS circuit, so pump circuit **PP** and the bleed-off circuit are interconnected through piston (2). The bleed-off circuit and the LS circuit are also interconnected.
- Bleed spool (3) moves to the left in proportion to the rise in swing PPC pressure **Pa**, but in the fine control range, notch **b** throttles the bleed-off circuit and interconnects it, so pump pressure **PP** determines the intermediate pressure before the reducing pressure is supplied to LS pressure **PLS**.
- As a result, the intermediate pressure is set lower than the pump pressure and rises together with the movement of bleed spool (3), so the LS pressure **PLS** rises smoothly.



3) Swing operated fully

- When swing PPC pressure **Pa** becomes the maximum, notch **b** in bleed spool (3) shuts off the bleed-off circuit, and the intermediate pressure becomes equal to the pump pressure. The LS pressure **PLS** becomes equal to the actuator circuit pressure.

13. Variable type pressure compensation valve (for service valve)



SDP04016

1. Flow control valve
2. Reducing valve
3. Poppet
4. Spring
5. Screw
6. Locknut
7. Plastic cap

Function

- It is possible to adjust the division of the oil flow to the service valve when the service valve (for attachment) is operated together with the main control valve (boom RAISE, etc.). (Variable in proportion to surface area)
- The force of spring (4) can be adjusted with screw (5).

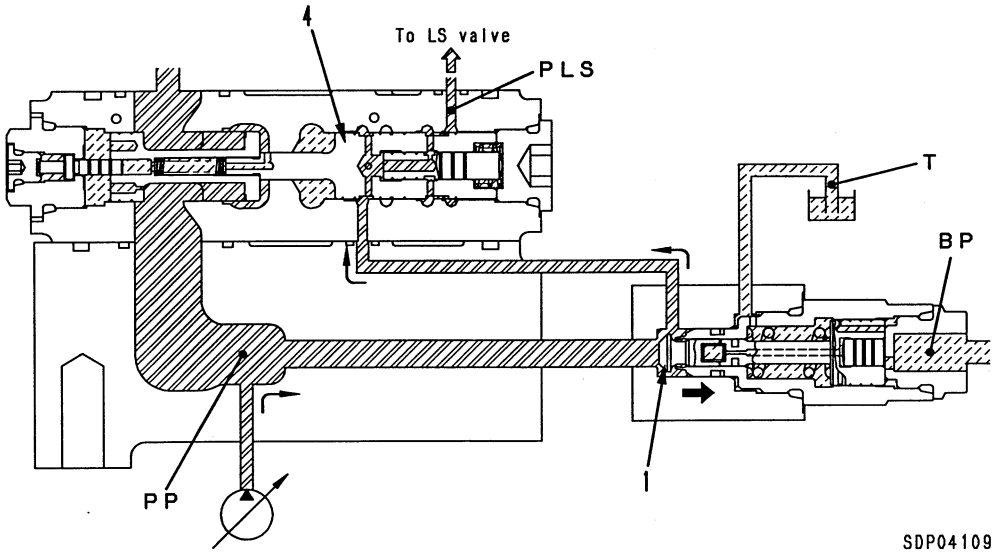
Simultaneous operation with work equipment under heavy load (boom RAISE, etc.)

- Pump pressure **PP** and LS pressure **PLS** are determined by the other work equipment.
- When the pressure in chamber **a** reaches the set pressure of spring (4), poppet (3) opens and the pressure in chamber **a** is maintained at a pressure lower than pump pressure **PP** by throttle **b**.
- As a result, force **F**, which is trying to close flow control valve (1) of the reducing valve (2), becomes small.
  In other words, it is set to a condition where the area ratio becomes smaller, so flow control valve (1) moves to the right and the flow of oil from the pump to the service valve increases.

14. LS SELECT VALVE

Function

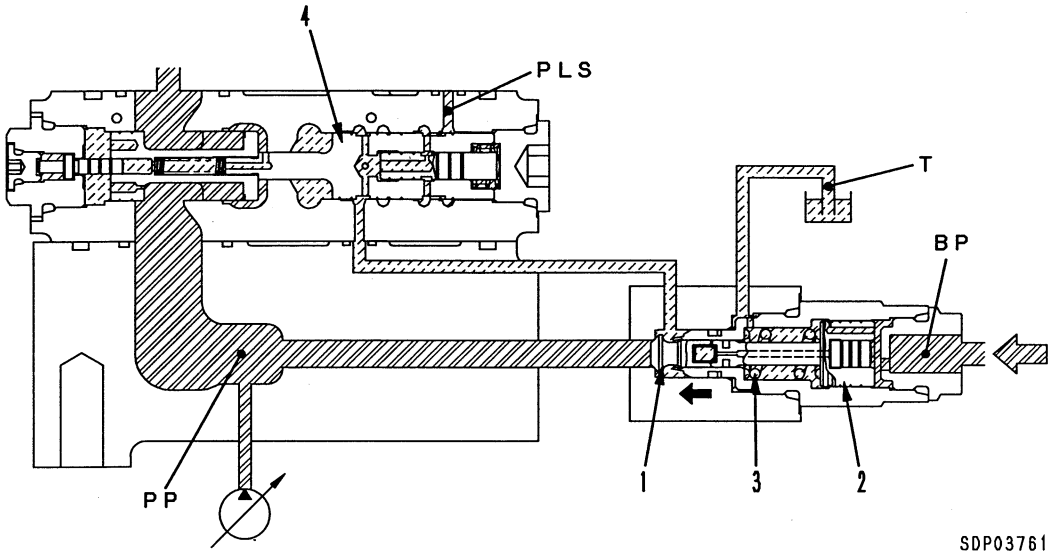
- When the swing + boom RAISE are operated together, this valve ensures the pump flow to drive the swing, and prevents the swing LS pressure from flowing into LS circuit PLS. In this way, it prevents the boom RAISE speed from dropping.



Operation

1) Normal operation

- Normally, except when boom RAISE is operated, the pilot pressure does not act on pilot port **BP**.
- In this condition, pump pressure **PP** pushes valve (1) open and goes to reducing valve (4) of the swing valve. When the swing is operated, LS pressure **PLS** is generated in accordance with the load pressure and flows to the pump LS valve.

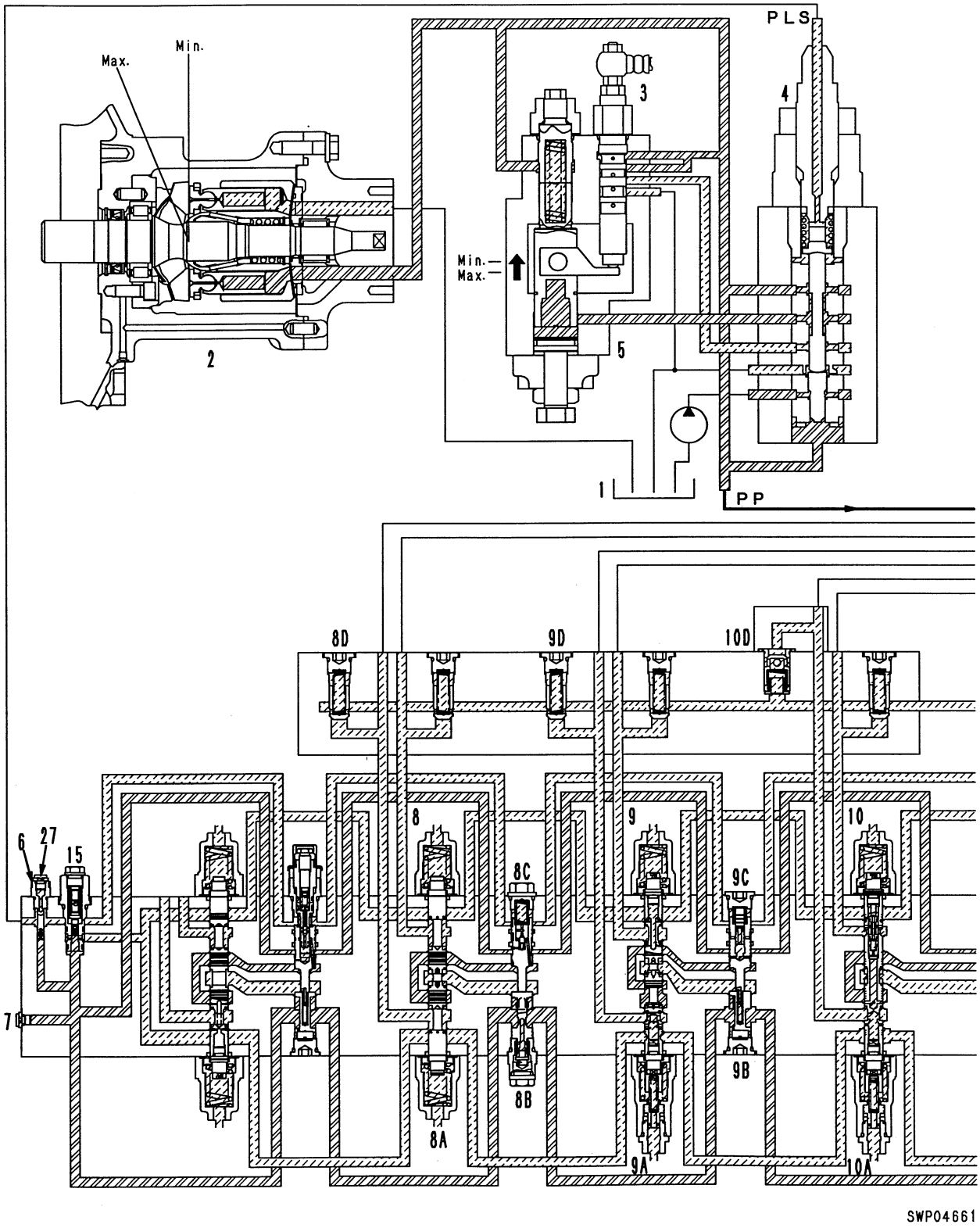


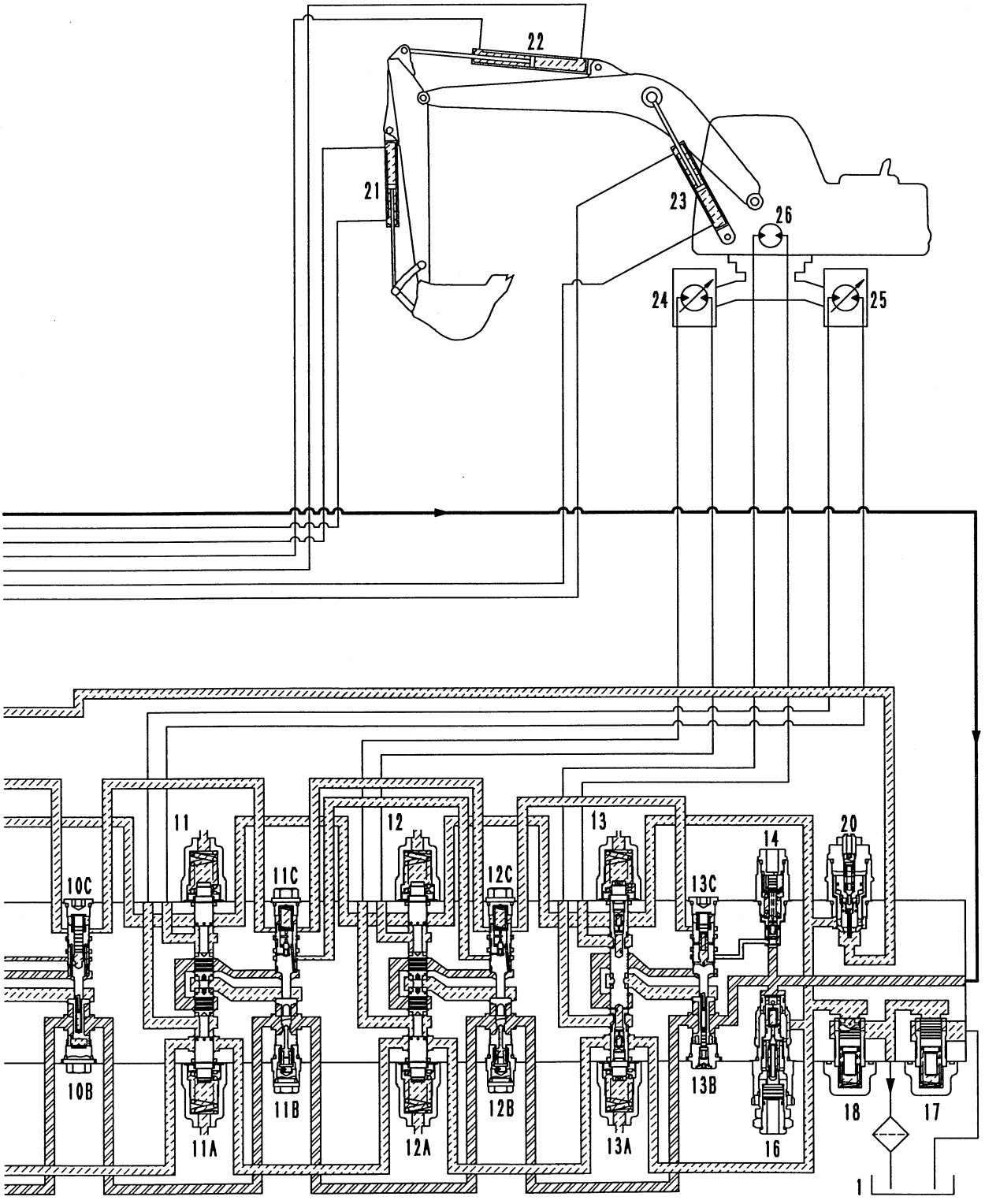
2) Swing + boom RAISE operated at same time

- When the swing + boom RAISE are operated at the same time, the signal pressure from the boom RAISE PPC circuit is sent to pilot port **BP**.
- When this pilot pressure **BP** acts on piston (2) and becomes stronger than spring (3), piston (2) is pushed fully to the left. Valve (1) closes and pump pressure **PP** stops flowing to reducing valve (4) of the swing valve.
- As a result, LS pressure **PLS** is not generated by the swing pressure, so only the LS pressure **PLS** generated by boom RAISE pressure goes to the pump LS valve, and the pump discharge amount is controlled by the boom RAISE LS pressure.
- The size of pilot pressure **BP** is determined by the amount the control lever is operated.

OPERATION OF SYSTEM AS A WHOLE

1) WHEN ALL CONTROL VALVES ARE AT HOLD




22
21
23
26
24
25
11
12
13
14
20
10C
11C
12C
13C
10B
11B
12B
13B
11A
12A
13A
16
18
17
1
SWP04662

Operation (When all control values are at HOLD)

- Pump discharge amount Q all flows from unload valve (15) to tank (1).
- None of the spools (each spool **A**) is being operated, so the LS pressure **PLS** is not generated.
  At the same time, the LS pressure **PLS** is connected to the tank circuit by LS bypass plug (6), so it is the tank pressure.
- In this condition, LS differential pressure Δ**PLS** becomes the unload pressure - tank pressure, and becomes higher than the LS set pressure of LS valve (4), so main pump (2) is set to the minimum swash plate angle.

1. Hydraulic tank

Hydraulic pump

2. Main pump
3. PC valve
4. LS valve
5. Servo piston

Control valve

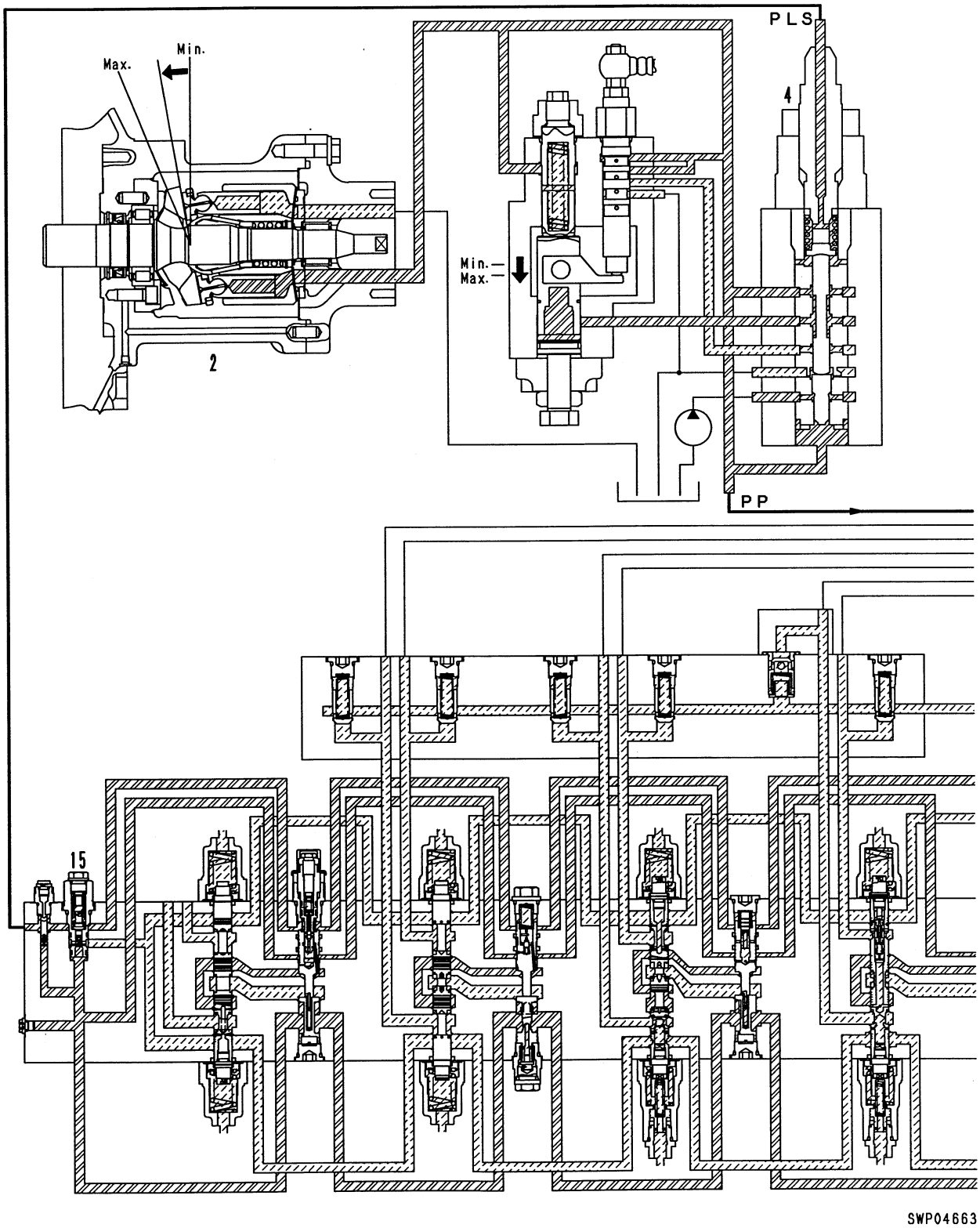
6. LS bypass plug
7. Pump pressure detection plug
8. Bucket valve
   - 8A. Spool
   - 8B. Pressure compensation valve (flow control valve)
   - 8C. Pressure compensation valve (reducing valve)
   - 8D. Check valve
9. Arm valve
   - 9A. Spool
   - 9B. Pressure compensation valve (flow control valve)
   - 9C. Pressure compensation valve (reducing valve)
   - 9D. Check valve
10. Boom valve
    - 10A. Spool
    - 10B. Pressure compensation valve (flow control valve)
    - 10C. Pressure compensation valve (reducing valve)
    - 10D. Check valve
11. R.H. travel valve
    - 11A. Spool
    - 11B. Pressure compensation valve (flow control valve)
    - 11C.Pressure compensation valve (reducing valve)
12. L.H. travel valve
    - 12A. Spool
    - 12B. Pressure compensation valve (flow control valve)
    - 12C. Pressure compensation valve (reducing valve)
13. Swing valve
    - 13A. Spool
    - 13B. Pressure compensation valve (flow control valve)
    - 13C. Pressure compensation valve (reducing valve)
14. LS select valve
15. Unload valve
16. Main relief valve
17. Cooler bypass valve
18. Lift check valve
19. —
20. Central safety valve

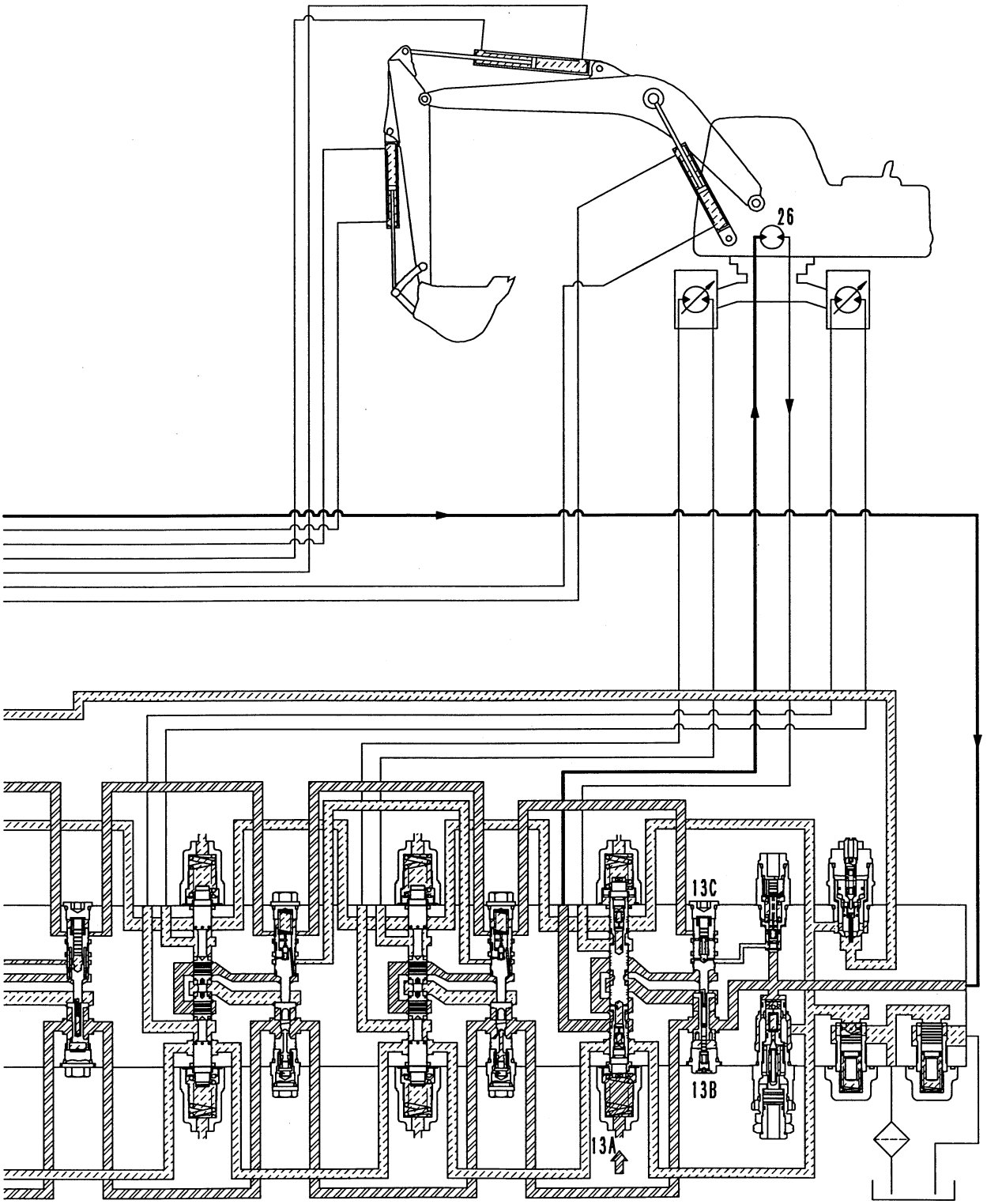
Actuator

21. Bucket cylinder
22. Arm cylinder
23. Boom cylinder
24. L.H. travel motor
25. R.H. travel motor
26. Swing motor
27. LS pressure detection plug

★ The other valves are not shown.

2) When swing is operated independently



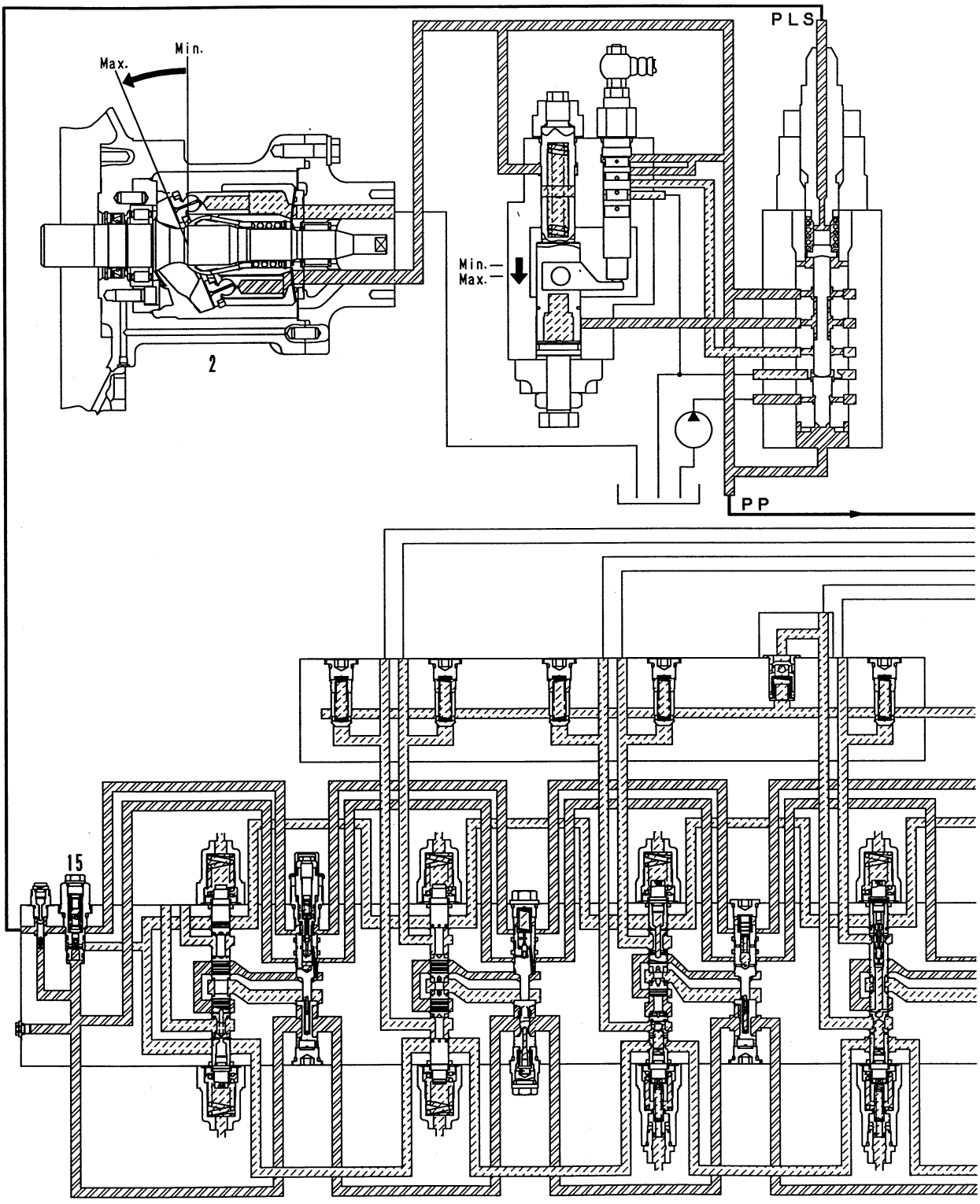


SWP04664

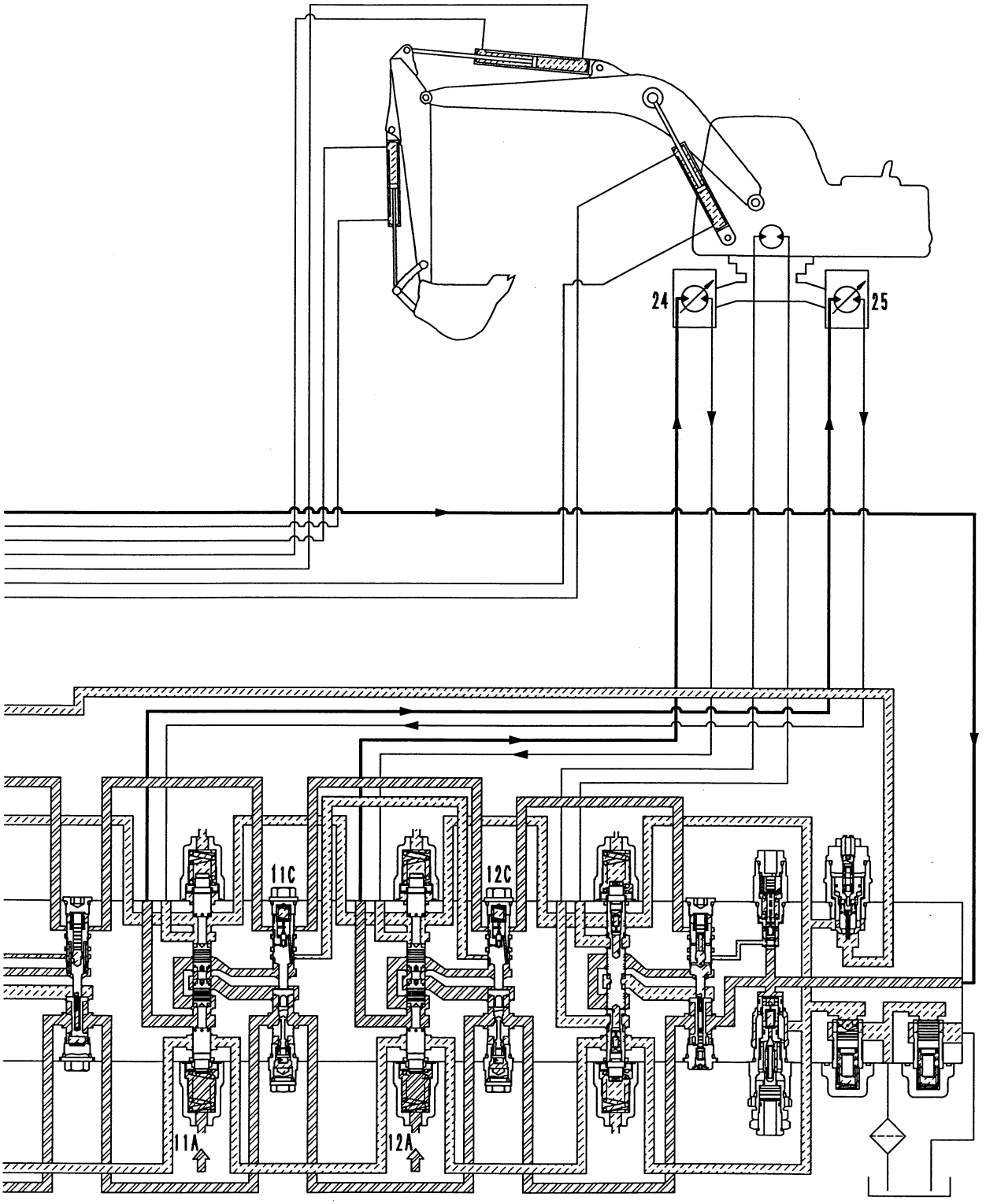
Operation (When swing is operated independently)

- When swing spool (13A) is operated, pump discharge amount **Q** flows to swing motor (26). At the same time, LS pressure **PLS** is generated and unload valve (15) closes.
  LS pressure **PLS** becomes the load pressure of swing motor (26).
- In the swing circuit, the difference between pump discharge pressure **PP** and LS pressure **PLS** (in other words, LS differential pressure **ΔPLS**) becomes the same as the LS set pressure of LS valve (4).
- As a result, the swash plate angle of main pump (2) is kept at a point midway between the minimum and maximum angles, and the main pump discharges the oil flow demanded by the swing circuit (approx. 50%).
  When the swing is operated independently, pump discharge amount **Q** does not become 100%.
- Swing pressure compensation valves (13B) and (13C) move fully to the right.

3) When left and right travel are operated at same time



SWP04665

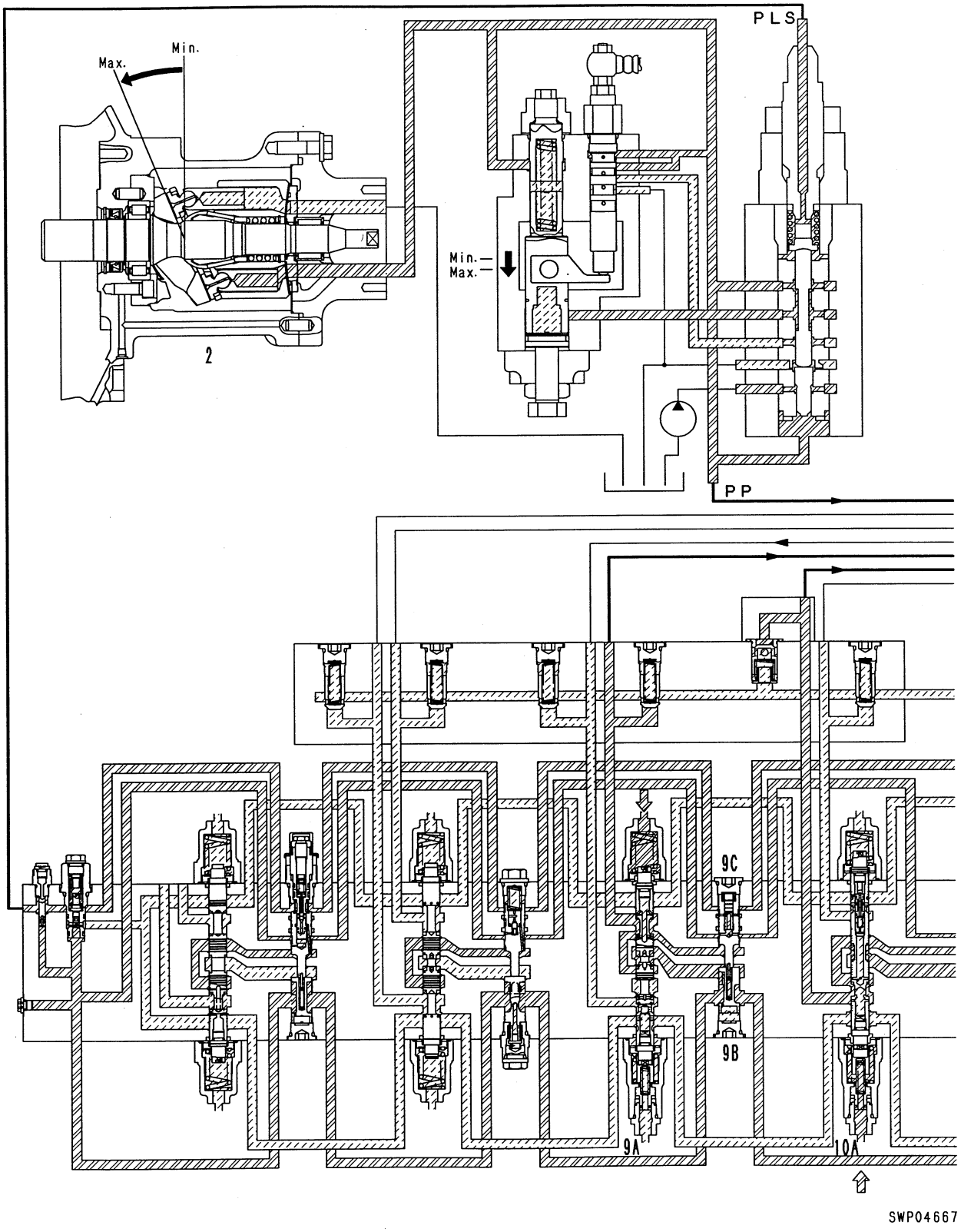


SWP04666

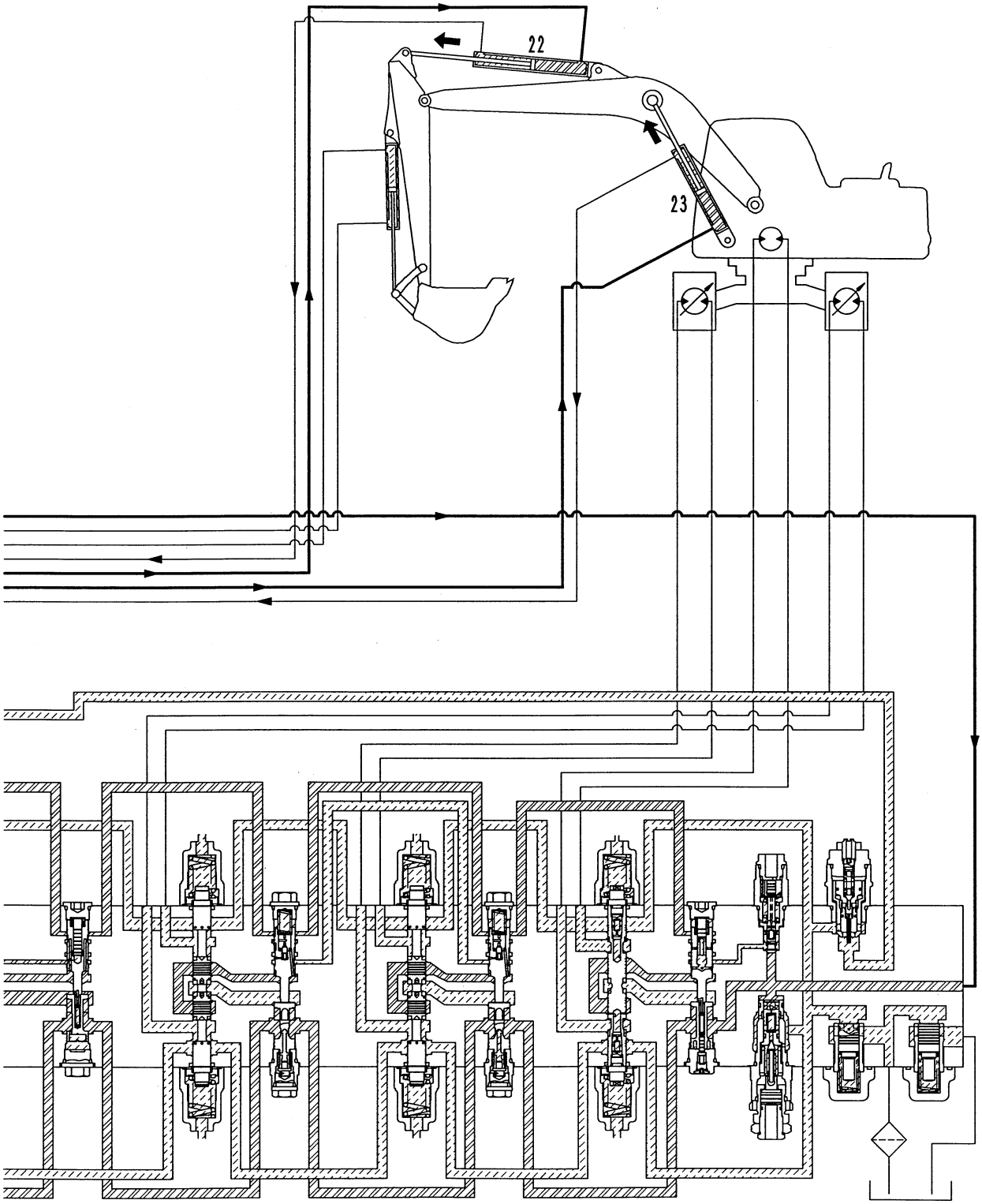
Operation (When left and right travel are operated at same time)

- When left and right travel spools (12A) and (11A) are operated, pump discharge amount **Q** flows to left and right travel motors (24) and (25), and at the same time, LS pressure **PLS** is generated and unload valve (15) closes.
- When this happens, reducing valves (12C) and (11C) of the left and right travel valves move to the right, the travel junction circuit is interconnected, and this prevents any deviation in travel.
- When left and right travel spools (12A) and (11A) are 100% open, if pump discharge amount **Q** is almost 100%, the pressure is set so that it becomes the same as the LS set differential pressure, and main pump (2) is kept at the maximum swash plate angle.
- If left and right travel spools (12A) and (11A) are less than 100% open, pump discharge amount **Q** is controlled in accordance with the area of opening of the spool by LS differential pressure Δ**PLS**.

4) Boom + arm operated at same time



SWP04667



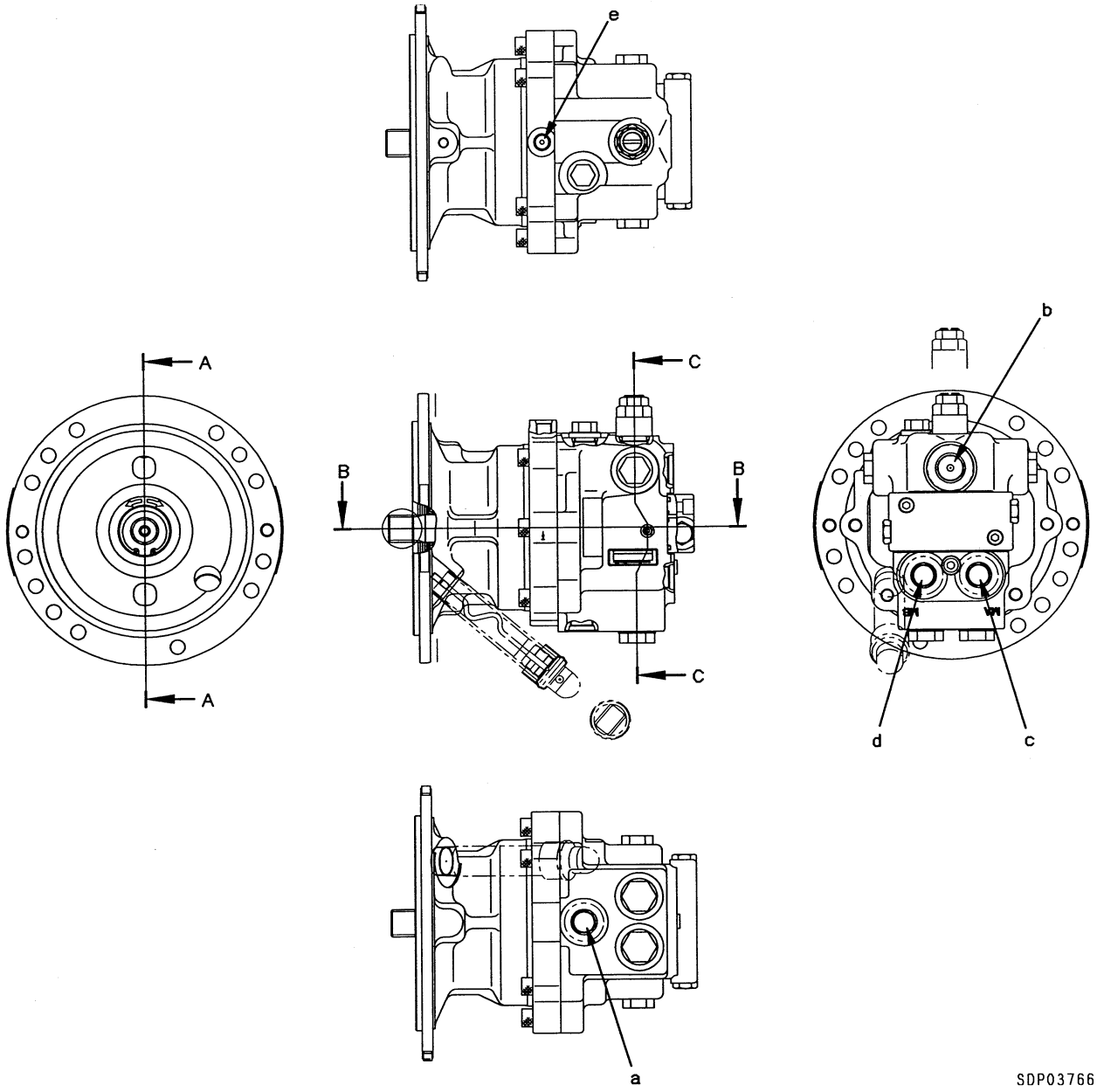
SWP04668

Operation (Boom + arm operated at same time)

- If boom spool (10A) is operated to RAISE and arm spool (9A) is operated at the same time to OUT, pump discharge amount **Q** flows to each cylinder (23) and (22).
- When this happens, the load pressure of boom cylinder (23) is greater than the load pressure of arm cylinder (22), so the oil tries to flow to arm cylinder (22), where the load pressure is low. However, the pressure on the upstream side of arm spool (9A) is compensated by pressure compensation valves (9B) and (9C), which receive the load pressure of the boom (= maximum LS pressure **PLS**).
- In this way, the pressure difference between the upstream pressure and downstream pressure of boom spool (10A) and arm spool (9A) becomes equal, so the flow of oil from main pump (2) is divided in proportion to the area of opening of each spool.
- If the area of opening of boom spool (10A) and arm spool (9A) is 100%, even if pump discharge amount **Q** becomes 100%, LS differential pressure **ΔPLS** is set so that it does not reach the LS valve set differential pressure, so main pump (2) is held at the maximum swash plate angle.
- If the area of opening of boom spool (10A) and arm spool (9A) is less than 100%, pump discharge amount **Q** is controlled in accordance with the area of opening of the spools by LS differential pressure **ΔPLS**.

SWING MOTOR

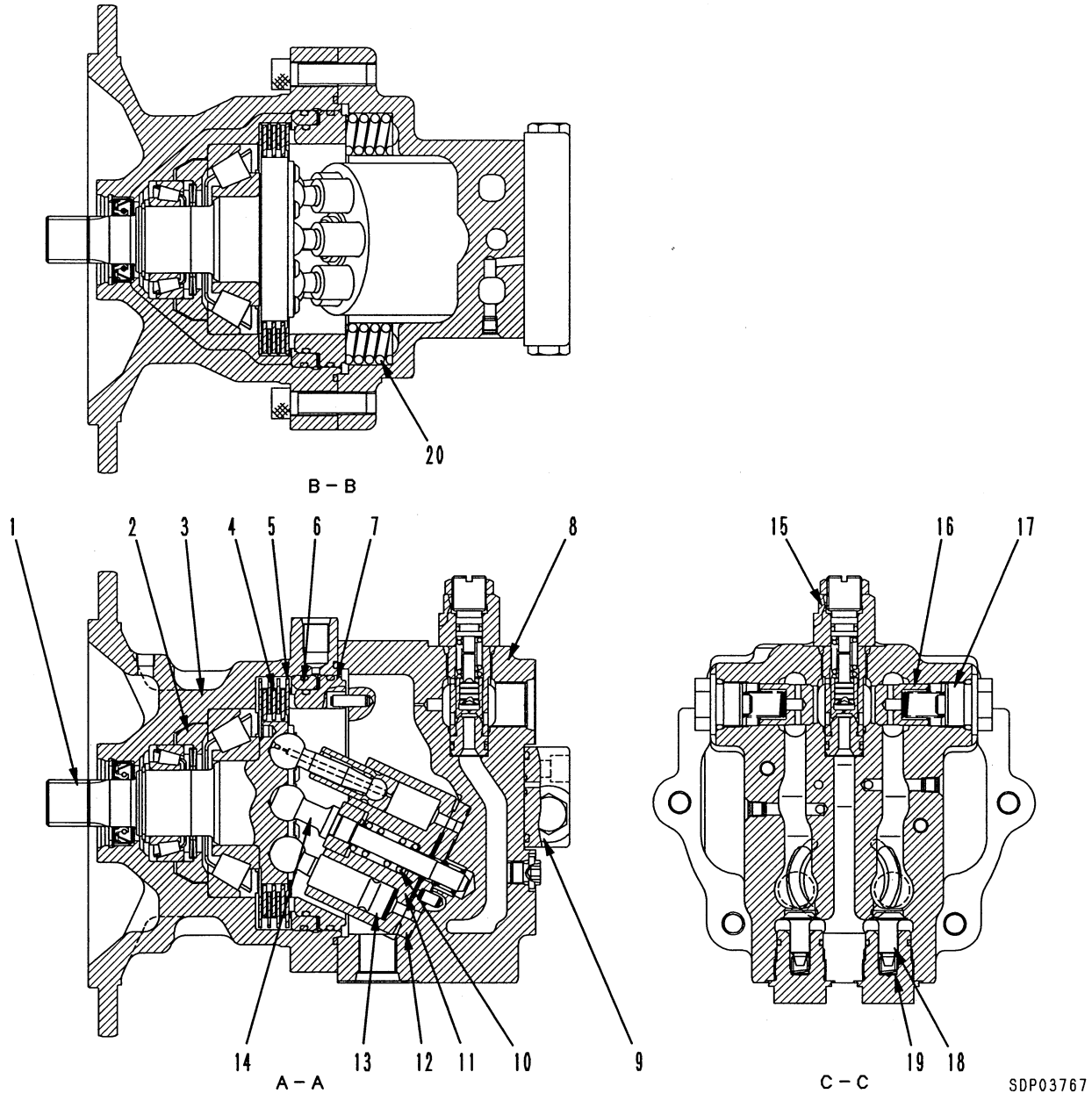
KMF40ABE-3



a : Port **T** (to tank)
b : Port **S** (from control valve)
c : Port **MA** (from control valve)
d : Port **MB** (from control valve)
e : Port **B** (from swing brake solenoid valve)

SPECIFICATIONS

Type	: KMF40ABE-3
Theoretical delivery	: 40.2 cc/rev
Safety valve set pressure	: 27.5 MPa {280 kg/cm^2}
Rated speed	: 2,413 rpm
Brake releasing pressure	: 1.8 MPa {18 kg/cm^2}



1. Drive shaft
2. Spacer
3. Case
4. Disc
5. Plate
6. Brake ring
7. Brake piston
8. Housing
9. Reverse flow check valve
10. Center spring
11. Cylinder
12. Valve plate
13. Piston
14. Center shaft
15. Safety valve
16. Check valve
17. Check valve spring
18. Shuttle valve
19. Shuttle valve spring
20. Brake spring

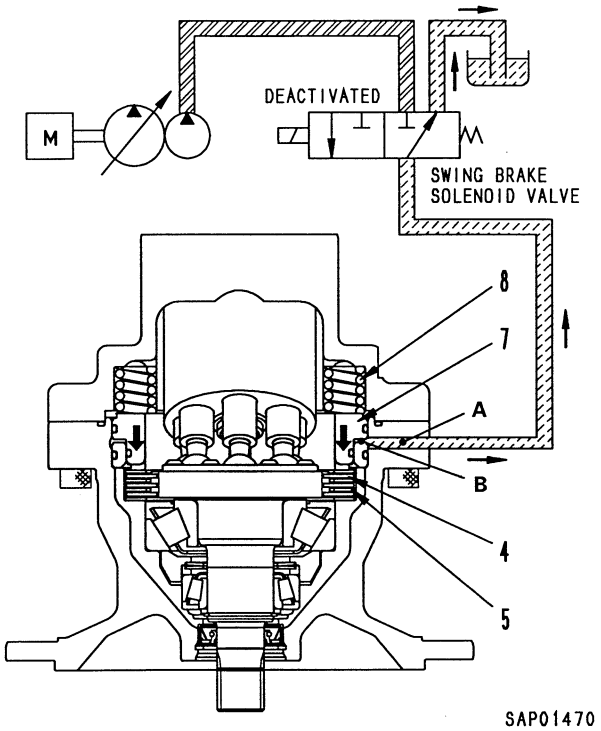
SWING HOLDING BRAKE

OPERATION

1) **When swing brake solenoid valve is DEACTIVATED**

When the swing brake solenoid valve is DEACTIVATED the pressurized oil from the control pump is shut off and port **B** is connected to the tank circuit.

Because of this, brake piston (7) is pushed down in the direction of the arrow by brake spring (8), so disc (4) and plate (5) are pushed together and the brake is applied.

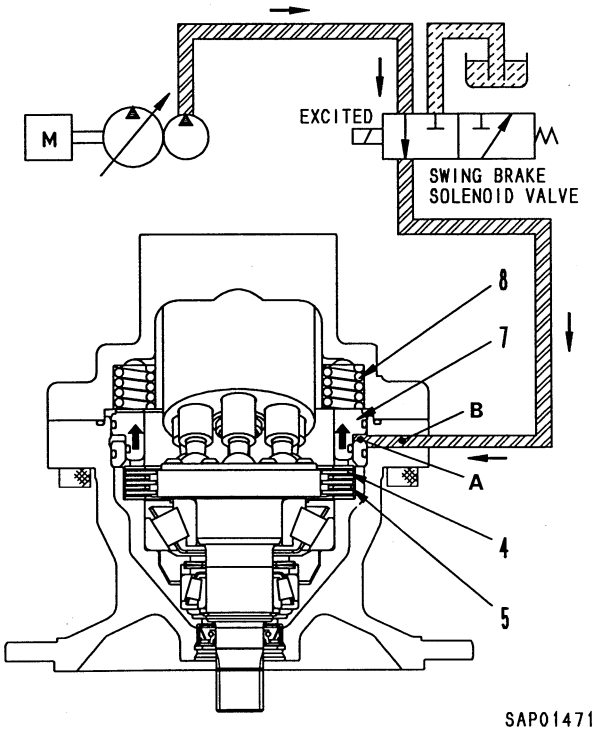


SAP01470

2) **When swing brake solenoid valve is EXCITED**

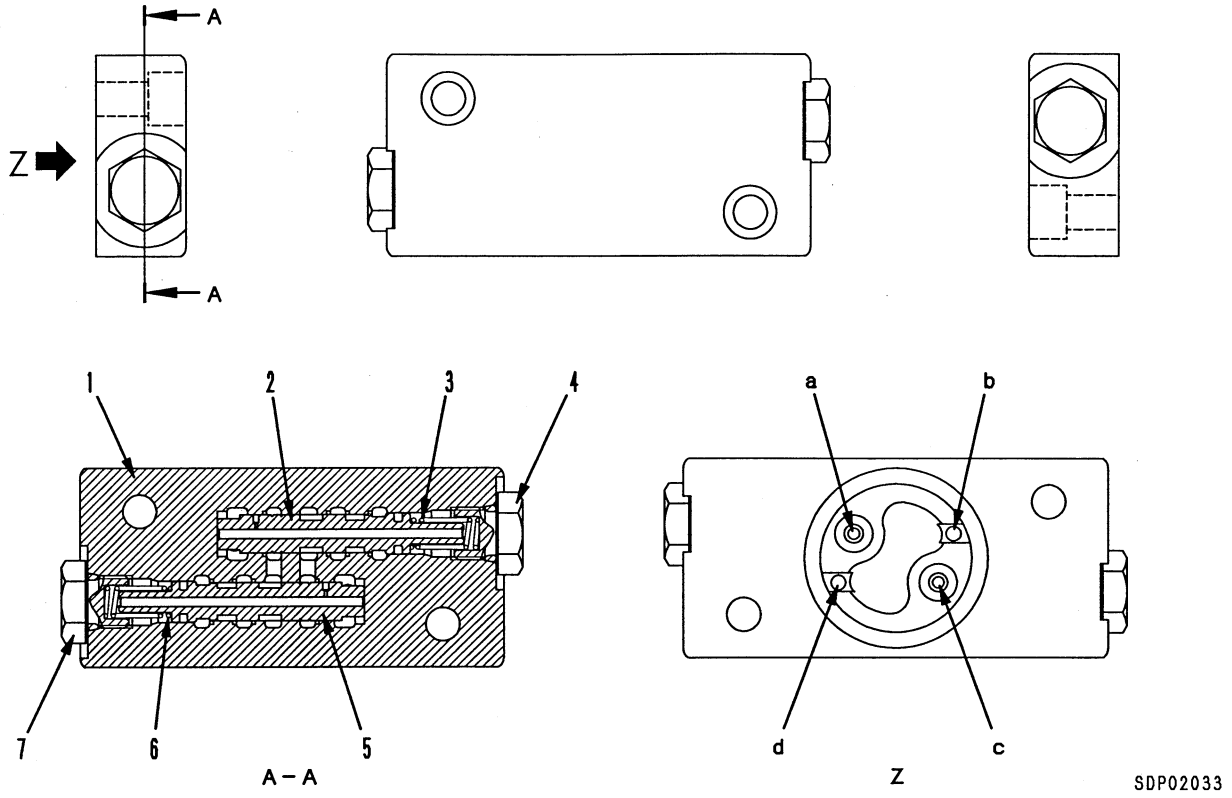
When the swing brake solenoid valve is EXCITED the valve is switched, and the pressurized oil from the control pump enters port **B** and flows to brake chamber **A.**

The pressurized oil entering chamber **A.** Overcomes the force of brake spring (8), and brake piston (7) is pushed up in the direction of the arrow. Because of this, disc (4) and plate (5) separate, and the brake is released.



SAP01471

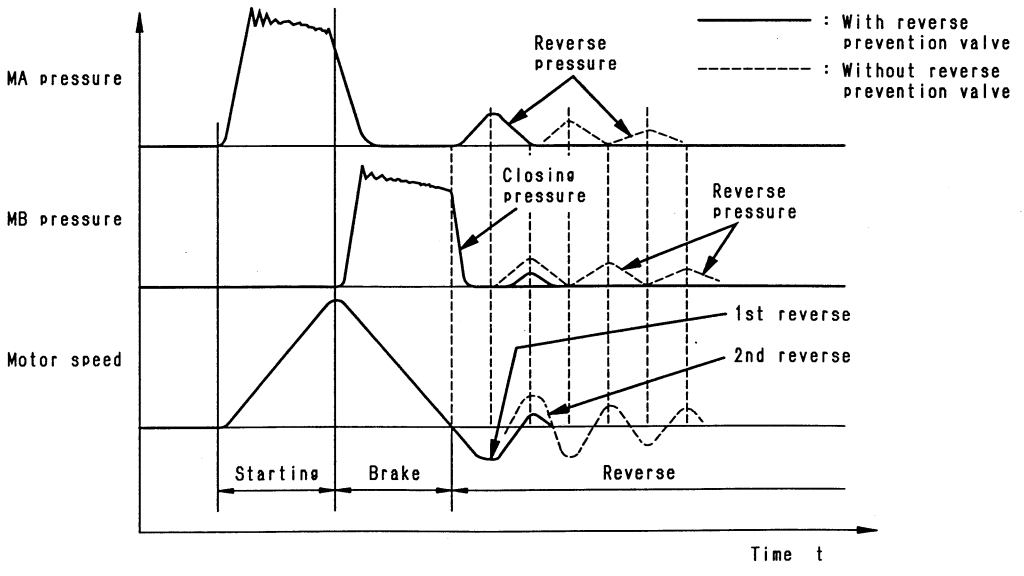
REVERSE FLOW CHECK VALVE



SDP02033

1. Valve body
2. Spool (**MA** side)
3. Spring (**MA** side)
4. Plug (**MA** side)
5. Spool (**MB** side)
6. Spring (**MB** side)
7. Plug (**MB** side)

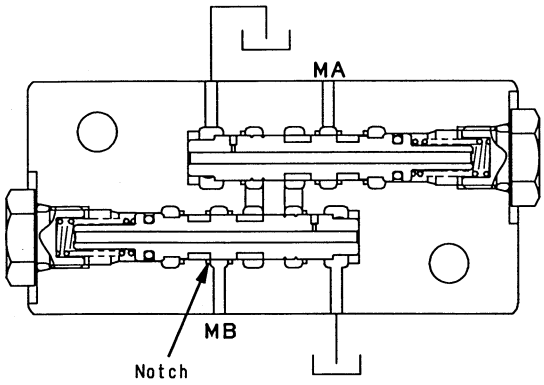
a : **Ma** port
b : **T1** port
c : **MB** port
d : **T2** port



SDP02478

OPERATION OF THE REVERSE FLOW CHECK VALVE

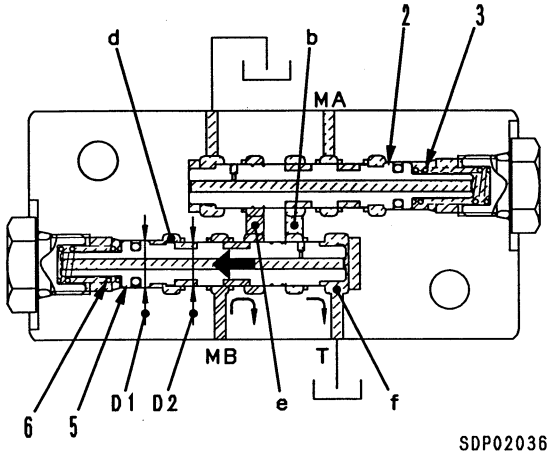
1. **Function**
   When the swing is stopped, this valve reduces the rocking motion of the swing body due to the inertia of the swing body, backlash of the machinery system, the compressibility of the hydraulic oil, etc. This valve is effective to prevent the cargo from being spilled when the swing is stopped as well as to shorten the recycle time (excellent in the positioning accuracy and the next operation can be started quickly).



SDP02479

2. **Operation**
   1) **While the braking pressure is present at the MB port**
   The **MB** pressure is introduced to the **d** chamber via the notch and the spool (5) makes a stroke motion to the left, pressing the spring (6) due to the difference in area (D1>D2) and the interconnection of **MB** to **e** is established.

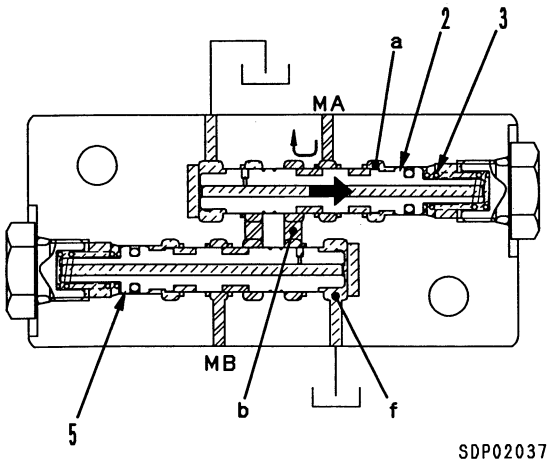
   On this occasion, the **MA** pressure is less than the set pressure of the spring (3), so that the spool (2) does not make a stroke motion and the pressure oil is closed by the spool (2), and the braking force is secured.



SDP02036

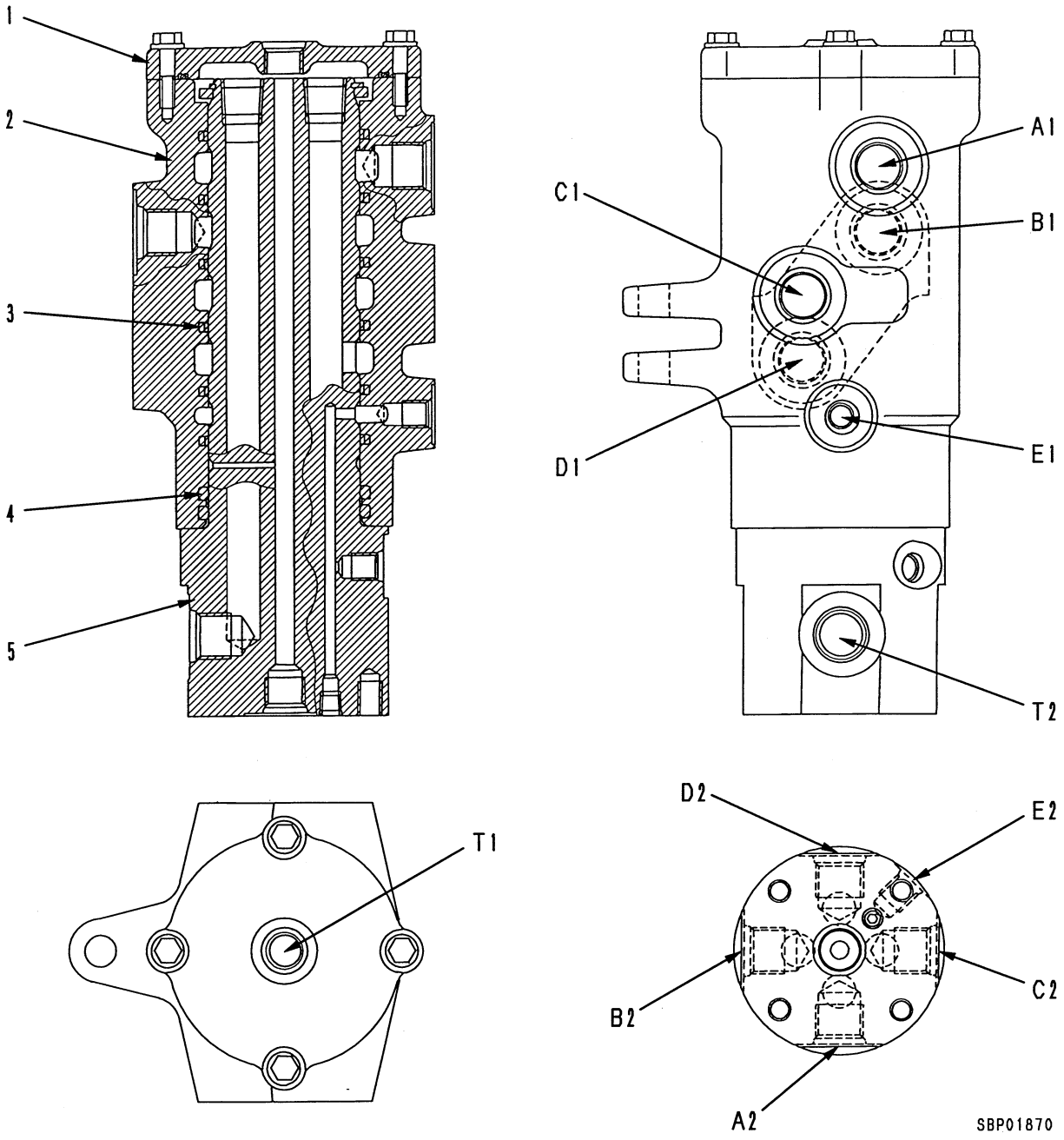
   2) **When the motor is stopped temporarily**
   The motor is reversed by the shutoff pressure that occurred at the **MB** port (First reversal).

   On this occasion, the reverse pressure is generated at the **MA** port side. This pressure at the **MA** port is introduced to the **a** chamber, and the spool (2) makes a stroke motion to the right, pressing the spring (3), and the interconnection of **MA** to **b** is established. Also, the interconnection of **b** to **f** is established through the drill hole and the reverse pressure at the **MA** port is bypassed to the **T** port, thereby preventing the second reversal.



SDP02037

CENTER SWIVEL JOINT



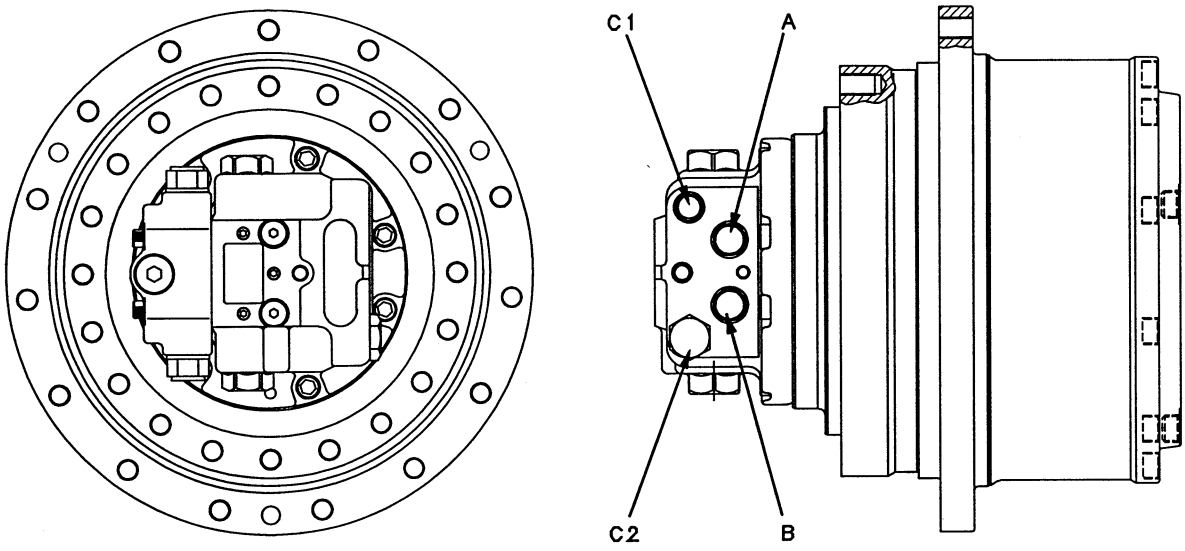
A1 : From control valve **A3**
A2 : To R.H. travel motor **B**
B1 : From control valve **A2**
B2 : To L.H. travel motor **A**
C1 : From control valve **B3**
C2 : To R.H. travel motor **A**

D1 : From control valve **B2**
D2 : To L.H. travel motor **B**
E1 : From travel speed solenoid valve
E2 : To L.H. and R.H. travel motors **D**
T1 : To tank
T2 : From L.H. and R.H. travel motors **C**

1. Cover
2. Body
3. Slipper seal
4. O-ring
5. Shaft

TRAVEL MOTOR

GM18VL

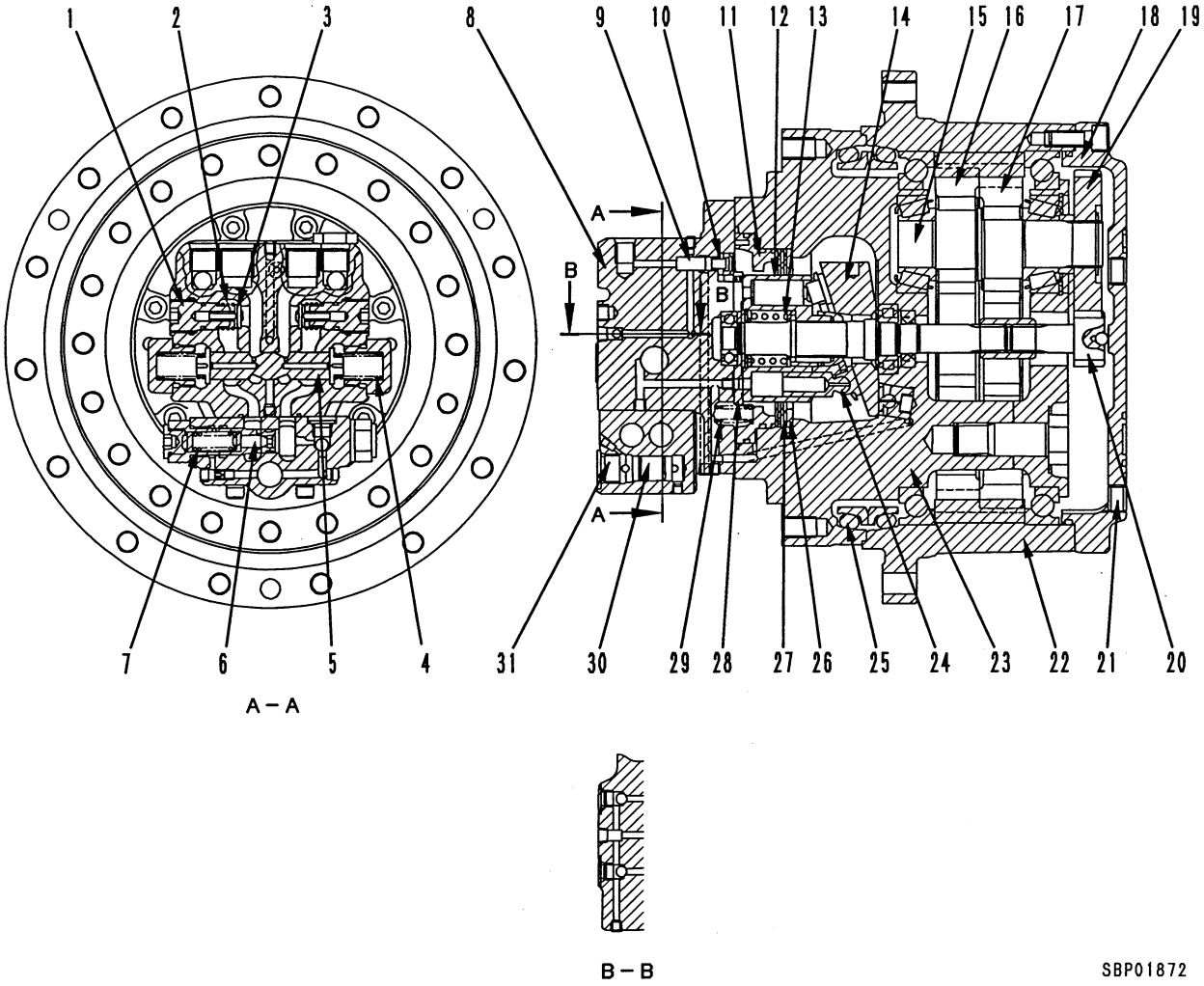


SAP01871

A : From control valve
B : From control valve
C1 : Drain port (to tank) (L.H. travel motor)
C2 : Drain port (to tank) (R.H. travel motor)

SPECIFICATIONS

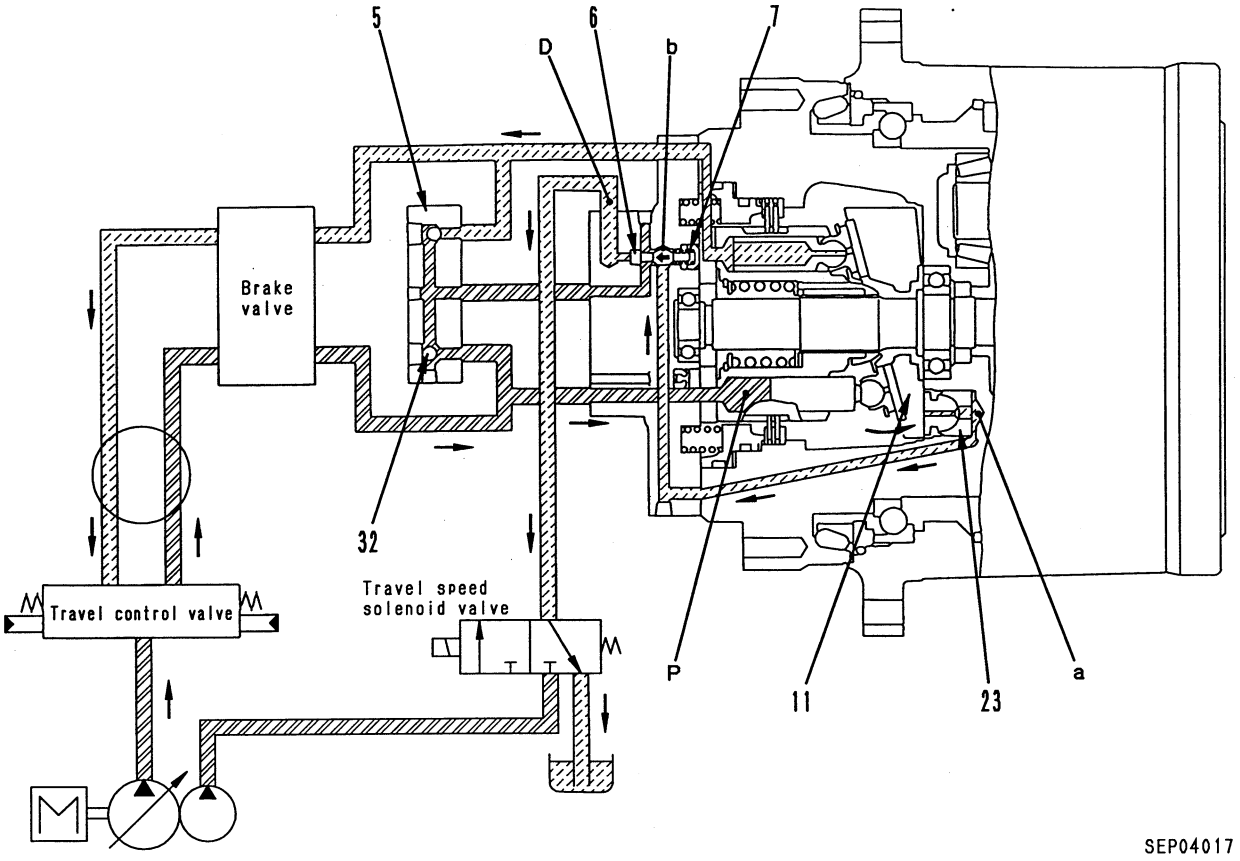
Type	: GM18VL
Theoretical delivery	: Min. 33.2
	: Max. 52.7 cc/rev
Brake releasing pressure	: 0.68 MPa {6.94 kg/cm^2}
Hi-Lo switching pressure	: 2.94 MPa {30 kg/cm^2}
Final drive reduction ratio	: 66



1. Plug
2. Check valve spring
3. Check valve
4. Safety valve spring
5. Safety valve
6. Counterbalance valve
7. Return spring
8. End cap
9. Regulator valve
10. Spring
11. Brake piston
12. Cylinder
13. Spring
14. Swash plate
15. Crankshaft
16. RV gear
17. RV gear
18. Cover
19. Drive gear
20. Drive gear
21. Drain plug
22. Hub
23. Spindle
24. Piston
25. Floating seal
26. Plate
27. Disc
28. Valve plate
29. Spring
30. Piston
31. Plug

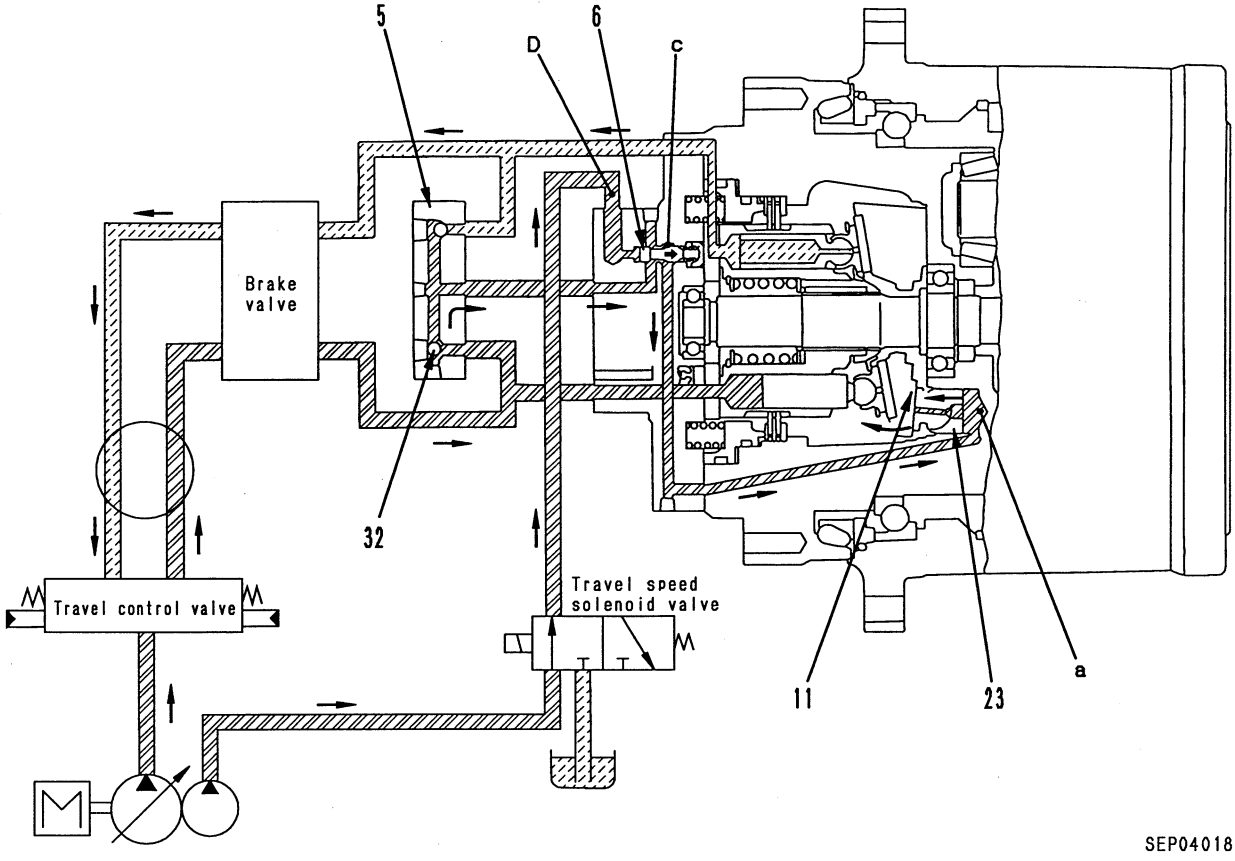
OPERATION OF MOTOR

1) At low speed (motor swash plate angle at maximum)



- The travel speed solenoid valve is deenergized, so the pilot pressure oil from the control pump does not flow to port **D**.
- For this reason, regulator valve (6) is pushed fully to the left by spring (7).
- Because of this, it pushes check valve (32), and the main pressure oil from the control valve going to end cover (5) is shut off by regulator valve (6).
- At the same time, the pressurized oil at chamber **a** of regulator piston (23) passes through passage **b** in regulator valve (6) and is drained to the motor case.
- As a result, swash plate (11) is pushed in the maximum swash plate angle direction by the main pressure inside cylinder chamber **P**, the motor capacity becomes the maximum, and the system is set to low speed travel.

2) **At high speed (motor swash plate angle at minimum)**

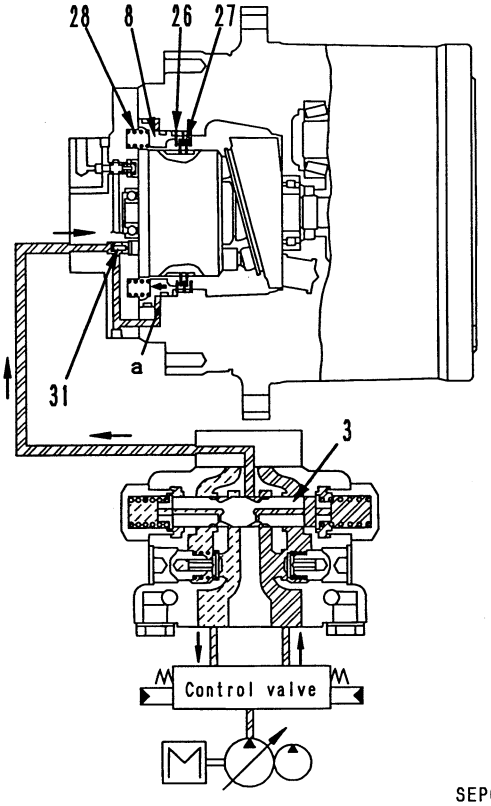


- When the travel speed solenoid valve is energized, the pilot pressure oil from the control pump flows to port **D**, and pushes regulator valve (6) to the right.
- Because of this, the main pressure oil from the control valve passes through passage c in regulator valve (6), enters chamber **a** of regulator piston (23), and pushes regulator piston (23) to the left.
- As a result, swash plate (11) is pushed in the minimum swash plate angle direction, the motor capacity becomes the minimum, and the system is set to high speed travel.

OPERATION OF PARKING BRAKE

1. When starting to travel

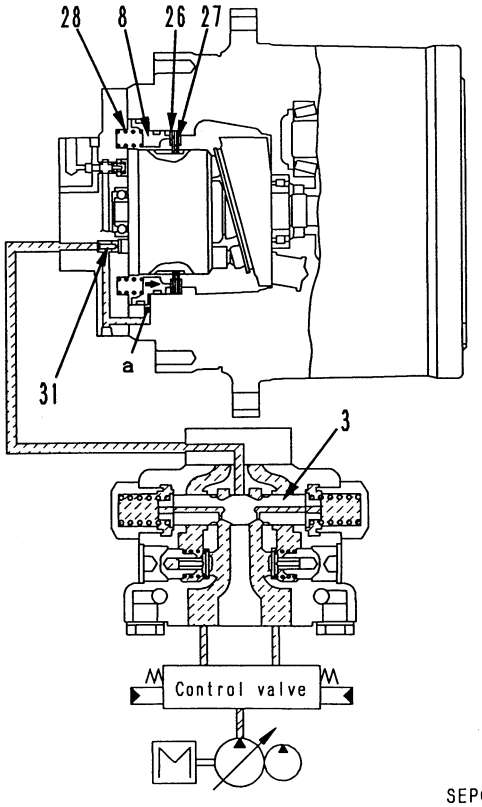
- When the travel lever is operated, the pressurized oil from the pump actuates counterbalance valve spool (3), opens the circuit to the parking brake, pushes open check valve (31), and flows into chamber **a** of brake piston (8).
- The pressure in chamber **a** overcomes the force of spring (28), and pushes brake piston (8) to the left.
- When this happens, the force pushing plate (26) and disc (27) together is lost, so plate (26) and disc (27) separate and the brake is released.



SEP04019

2. When stopping travel

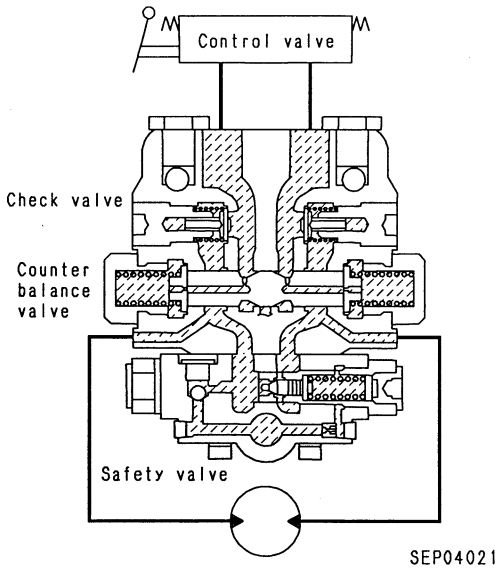
- When the travel lever is placed in neutral, counterbalance valve spool (3) returns to the neutral position and the circuit to the parking brake is closed.
- The pressurized oil in chamber **a** of brake piston (8) is drained to the case from the orifice in check valve (31), and brake piston (8) is pushed fully to the right by spring (28).
- As a result, plate (26) and disc (27) are pushed together, and the brake is applied.



SEP04020

BRAKE VALVE

- The brake valve consists of a check valve, counterbalance valve, and safety valve in a circuit as shown in the diagram on the right.
- The function and operation of each component is as given below.

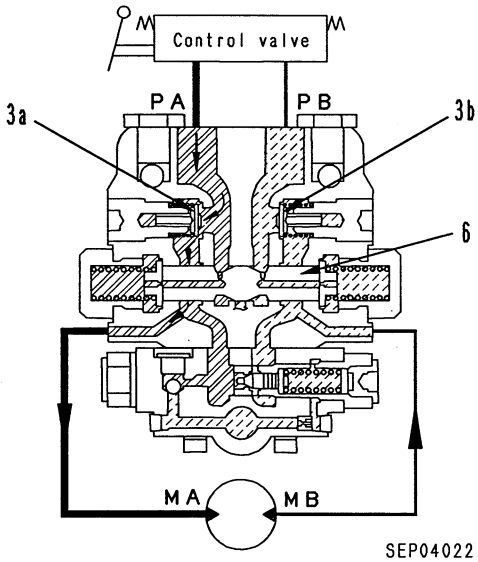


SEP04021

1. Counterbalance valve, check valve

Function

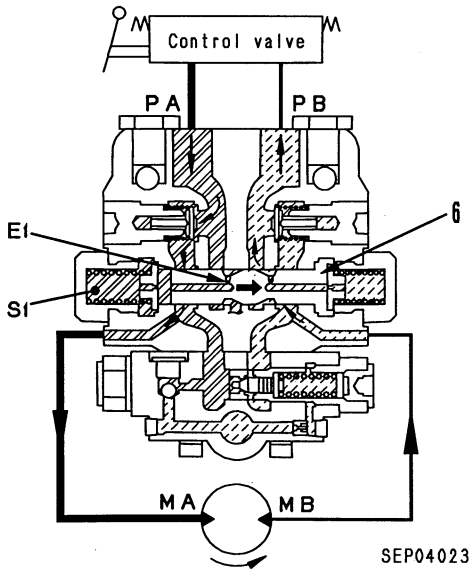
- When traveling down a slope, the weight of the machine makes it try to travel faster than the speed of the motor.
  As a result, if the machine travels with the engine at low speed, the motor will rotate without load and will run away, which is extremely dangerous.
  To prevent this, these valves act to make the machine travel according to the engine speed (pump discharge volume).



SEP04022

Operation when pressure is supplied

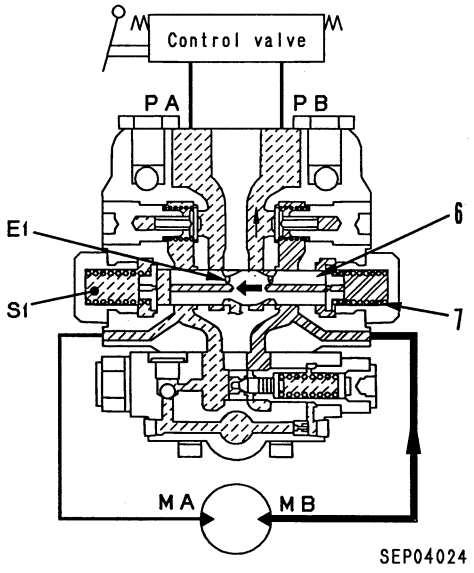
- When the travel lever is operated, the pressurized oil from the control valve is supplied to port **PA**. It pushes open check valve (3a) and flows from motor inlet port **MA** to motor outlet port **MB**.
  However, the motor outlet port is closed by check valve (3b) and spool (6), so the pressure at the supply side rises.
- The pressurized oil at the supply side flows from orifice **E1** in spool (6) to chamber **S1**, and when the pressure in chamber **S1** goes above the spool switching pressure, spool (6) is pushed to the right in the direction of the arrow.
  As a reuslt, port **MB** and port **PB** are connected, the outlet port side of the motor is opened, and the motor starts to rotate.



SEP04023

ACTUATION OF BRAKES ON DOWNHILL SLOPE

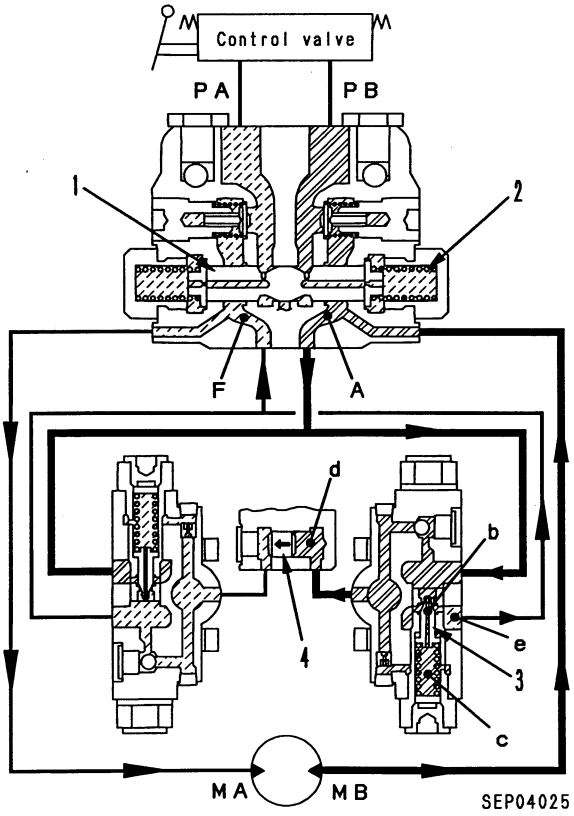
- If the machines runs away on a downhill slope, the motor will overrun, so the oil pressure at the inlet port of the motor will drop, and the pressure in chamber **S1**, which is connected through orifice **E1**, will also drop.
  If the pressure in chamber **S1** goes below the switching pressure of the spool, the spool (6) is returned to the left in the direction of the arrow by spring (7), and port **MB** at the outlet side is throttled.
  For this reason, the pressure at the outlet port rises, resistance to the rotation of the motor is generated, and this prevents the machine from running away.
  In other words, the spool moves to a position where the force generated by the weight of the machine and the pressure at the inlet port are balanced by the pressure at port **MB** at the outlet side. The outlet port circuit is throttled, and the speed is controlled to match the amount of oil discharged from the pump.



1. SAFETY VALVE

Function

- When the machine is stopped (or when it is traveling downhill), the circuits at the inlet and outlet ports of the motor are closed by the counterbalance valve. However, the motor is rotated by the inertia, so the pressure at the outlet port of the motor becomes abnormally high, and the motor or piping will be damaged.
  To prevent this, the abnormally high pressure is released to the inlet port side of the motor to protect the equipment from damage.

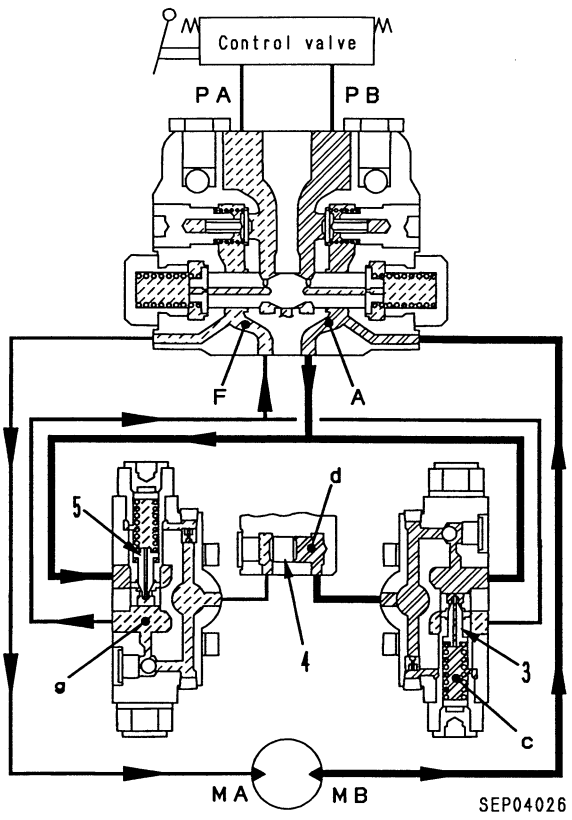


Operation

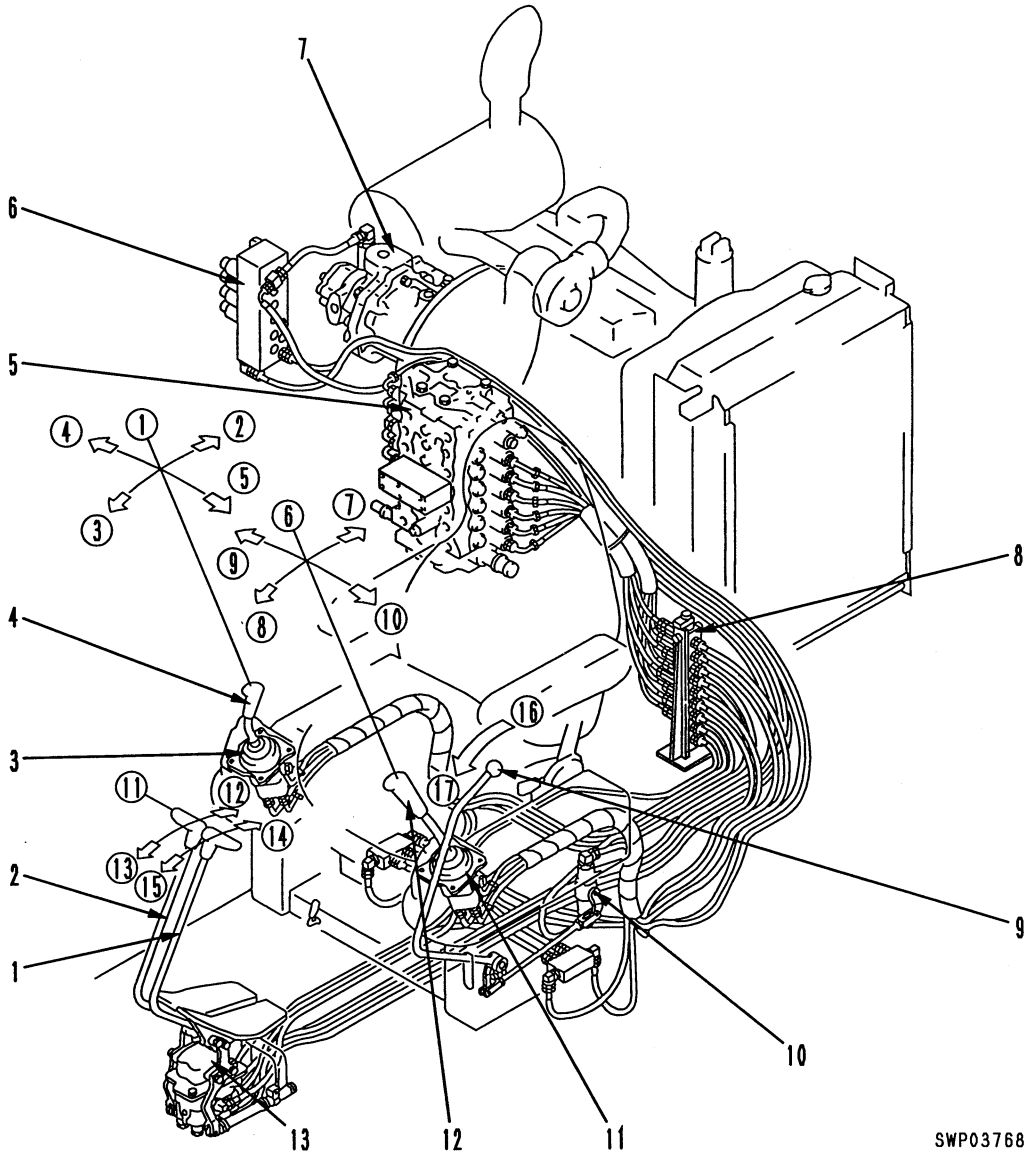
- When the machine is stopped, the supply of pressure oil from port **PA** also stops. When this happens, counterbalance valve (1), which was moved to the right, is returned to the left (neutral position) by the force of spring (2).
- Chamber **A** in the circuit on the outlet port side is closed by counterbalance valve (1), but the motor is rotated by the inertia, so the pressure in chamber **A** rises.

- When the pressure in chamber **A** rises, the pressure oil in chamber **A** passes through throttle **b** of valve (3) and flows from chamber **c** into chamber **d**. The pressure oil entering chamber **d** moves piston (4) to the left. While this is happening, valve (3) is pushed open by the pressure oil in chamber **A**, so the pressure oil in chamber **A** flows from port **e** to chamber **F**. Therefore, the pressure oil in chamber **A** flows at a lower pressure than the oil in chamber **F**. In this way the pressure in chamber **A** is controlled and cavitation in chamber **F** is prevented.

- When piston (4) reaches the end of its stroke, the pressure in chamber **d** and chamber **c** rises, valve (3) is closed again, and the pressure in chamber **A** rises further.
- When this happens, valve (5) opens and the oil inside chamber **A** flows from chamber **g** to chamber **F**. In this way, the pressure inside chamber **A** is controlled in two stages, so braking force is applied smoothly to the hydraulic motor to stop the machine.



VALVE CONTROL

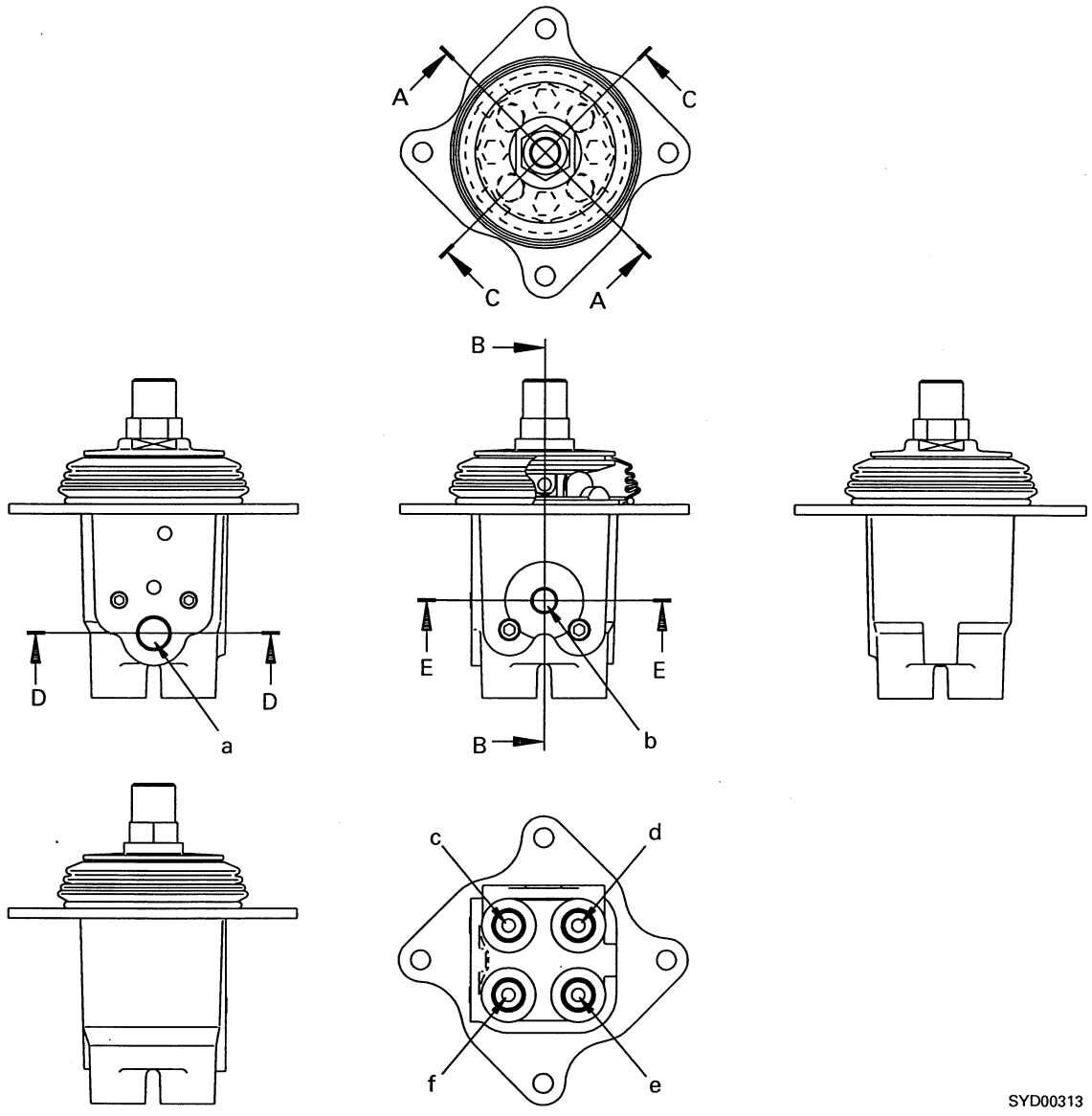


1. L.H. travel control lever
2. R.H. travel control lever
3. R.H. work equipment PPC valve
4. R.H. work equipment control lever
5. Control valve
6. Solenoid block
7. Hydraulic pump
8. Junction box
9. Safety lock lever
10. Safety lock valve
11. L.H. work equipment PPC valve
12. L.H. work equipment control lever
13. Travel PPC valve

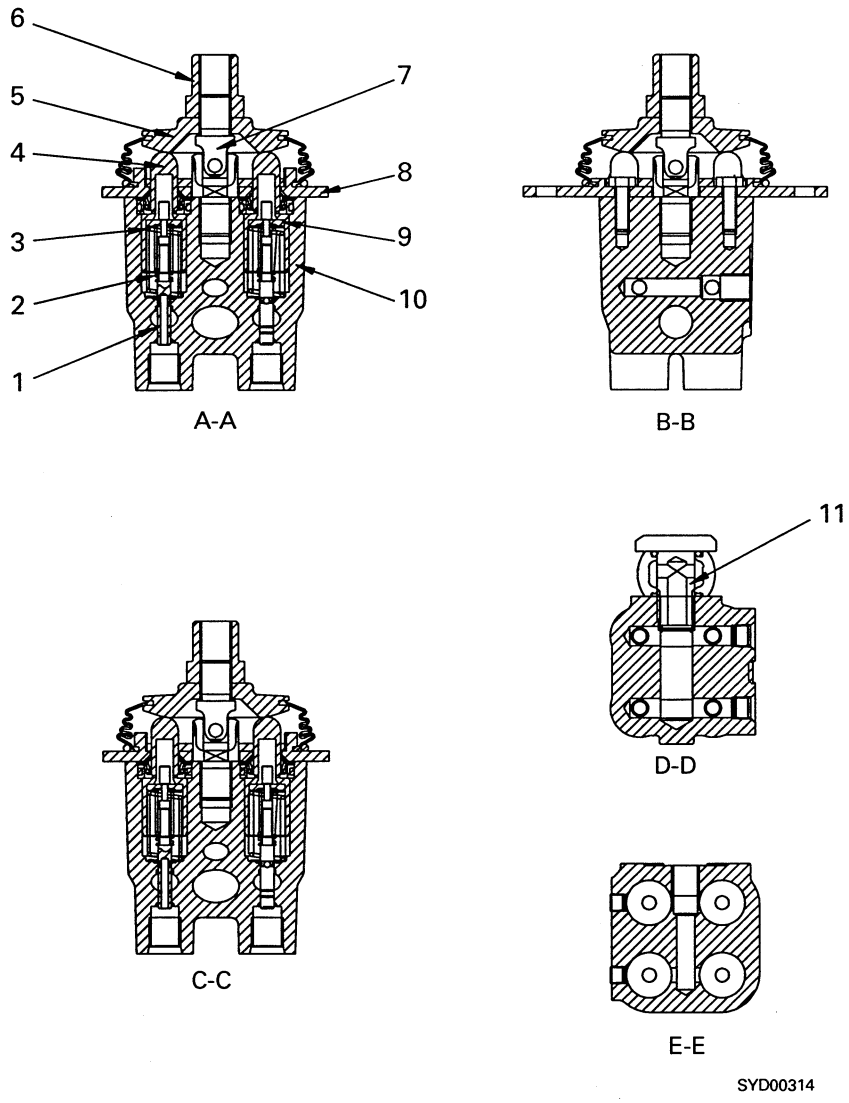
Lever position

① : HOLD
② : Boom RAISE
③ : Boom LOWER
④ : Bucket DUMP
⑤ : Bucket CURL
⑥ : HOLD
⑦ : Arm IN
⑧ : Arm OUT
⑨ : Swing RIGHT
⑩ : Swing LEFT
⑪ : NEUTRAL
⑫ : R.H. travel REVERSE
⑬ : R.H. travel FORWARD
⑭ : L.H. travel REVERSE
⑮ : L.H. travel FORWARD

WORK EQUIPMENT • SWING PPC VALVE



a : Port **P** (from control pump)
b : Port **T** (to tank)
c : Port **P2** (L.H.: Arm IN / R.H.: Boom RAISE)
d : Port **P4** (L.H.: Swing LEFT / R.H.: Bucket DUMP)
e : Port **P1** (L.H.: Arm OUT / R.H.: Boom LOWER)
f : Port **P3** (L.H.: Swing RIGHT / R.H.: Bucket CURL)

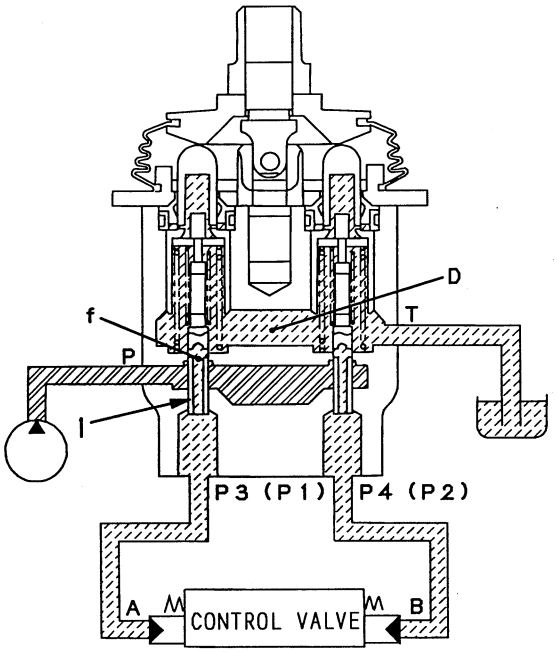


1. Spool
2. Metering spring
3. Centering spring
4. Piston
5. Disc
6. Nut (for connecting lever)
7. Joint
8. Plate
9. Retainer
10. Body
11. Filter

OPERATION

1) At neutral

Ports **A** and **B** of the control valve and ports **P1** and **P2** of the PPC valve are connected to drain chamber **D** through fine controle hole **f** in spool (1). (Fig. 1)



(Fig. 1) SBP01472

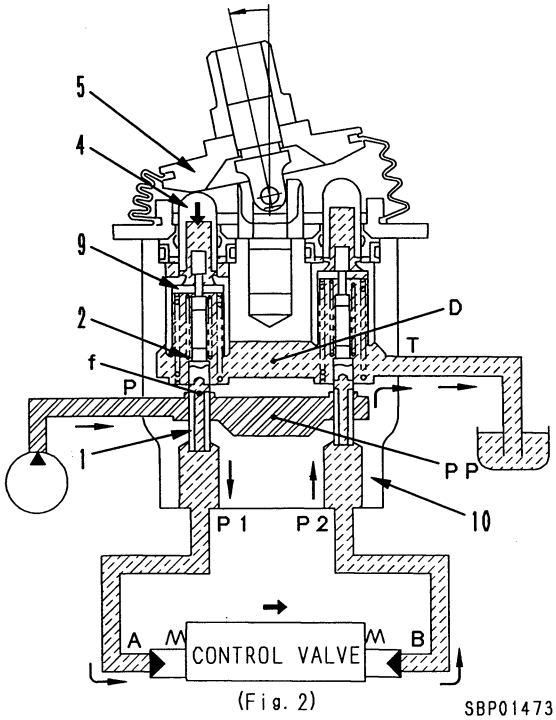
2) During fine control (neutral → fine control)

When piston (4) starts to be pushed by disc (5), retainer (9) is pushed; spool (1) is also pushed by metering spring (2), and moves down.

When this happens, fine control hole **f** is shut off from drain chamber **D**, and at almost the same time, it is connected to pump pressure chamber **PP**, so pilot pressure oil from the control pump passes through fine control hole **f** and goes from port **P1** to port **A**.

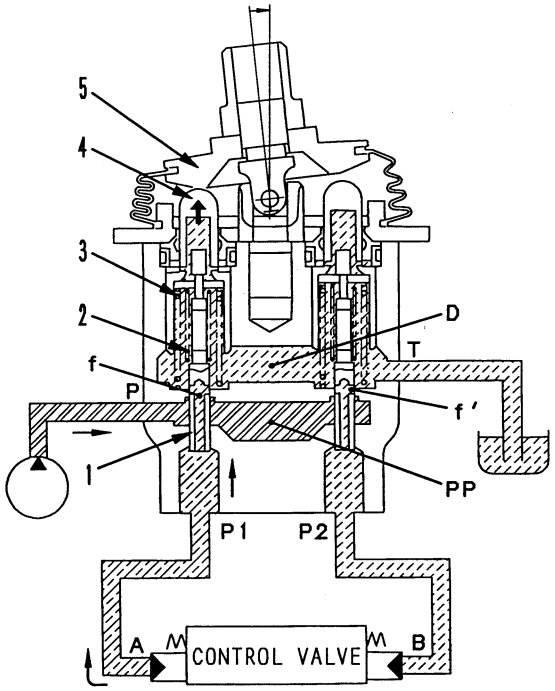
When the pressure at port **P1** becomes higher, spool (1) is pushed back and fine control hole **f** is shut off from pump pressure chamber **PP**. At almost the same time, it is connected to drain chamber **D** to release the pressure at port **P1**. When this happens, spool (1) moves up or down so that the force of metering spring (2) is balanced with the pressure at port **P1**. The relationship in the position of spool (1) and body (10) (fine control hole **f** is at a point midway between drain hole **D** and pump pressure chamber **PP**) does not change until retainer (9) contacts spool (1).

Therefore, metering spring (2) is compressed proportionally to the amount of movement of the control lever, so the pressure at port **P1** also rises in proportion to the travel of the control lever. In this way, the control valve spool moves to a position where the pressure in chamber **A** (the same as the pressure at port **P1**) and the force of the control valve spool return spring are balanced. (Fig. 2)



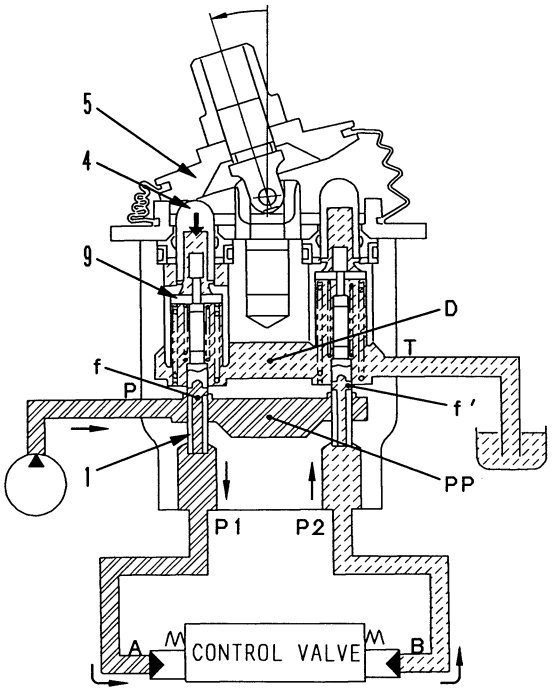
(Fig. 2) SBP01473

3) **During fine control (when control lever is returned)**
When disc (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and the pressure at port **P1**.
When this happens, fine control hole **f** is connected to drain chamber **D** and the pressure oil at port **P1** is released.
If the pressure at port **P1** drops too far, spool (1) is pushed down by metering spring (2), and fine control hole **f** is shut off from drain chamber **P1**. At almost the same time, it is connected to pump pressure chamber **PP**, and the pump pressure is supplied until the pressure at port **P1** recovers to a pressure that corresponds to the lever position.
When the spool of the control valve returns, oil in drain chamber **D** flows in from fine control hole **f '** in the valve on the side that is not working. The oil passes through port **P2** and enters chamber **B** to fill the chamber with oil. (Fig. 3)



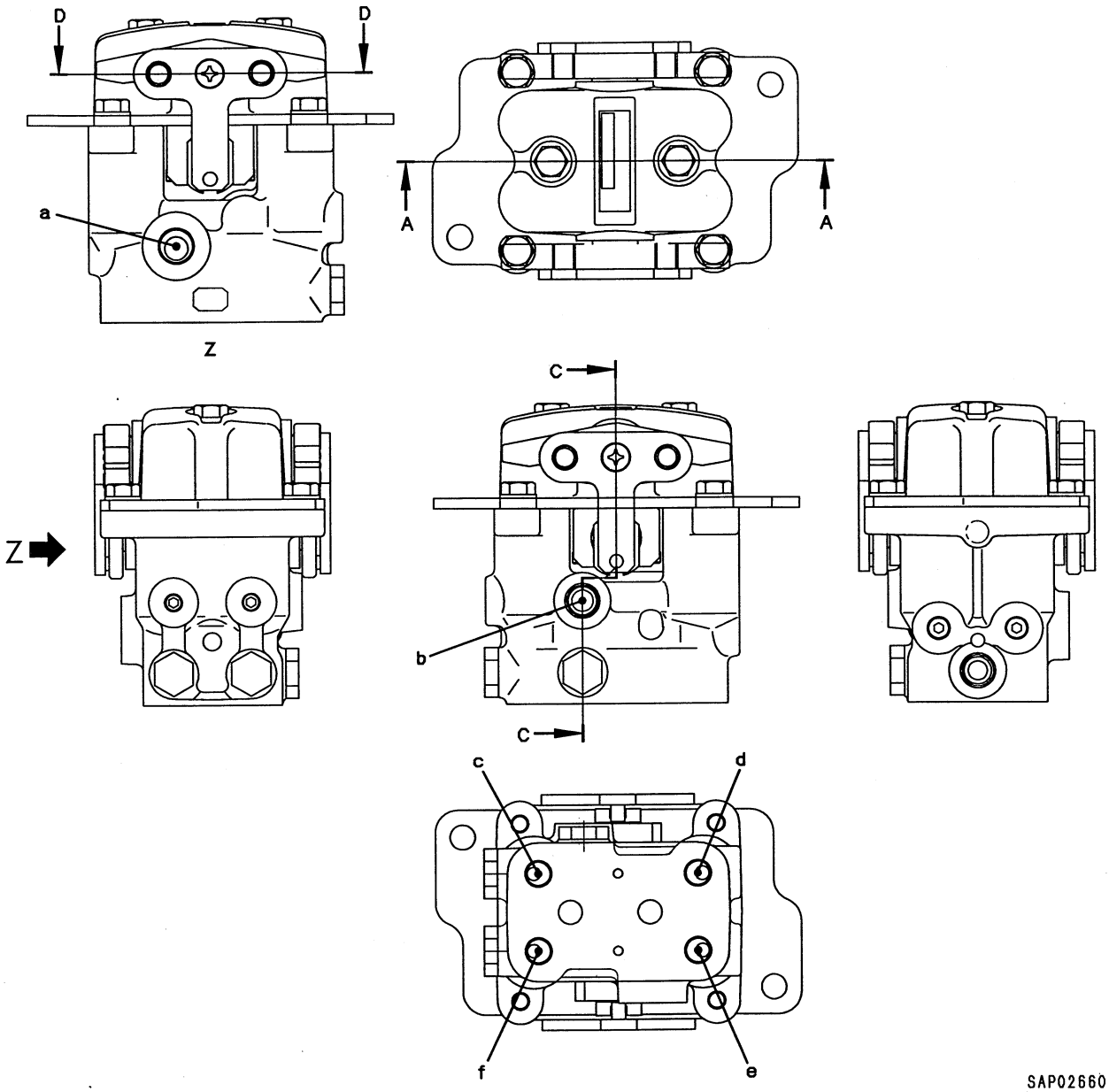
(Fig. 3) SBP01474

4) **At full stroke**
When disc (5) pushes down piston (4), and retainer (9) pushes down spool (1), fine control hole **f** is shut off from drain chamber **D**, and is connected with pump pressure chamber **PP**. Therefore, the pilot pressure from the control pump passes through fine control hole **f** and flows to chamber **A** from port **P1**, and pushes the control valve spool.
The oil returning from chamber **B** passes from port **P2** through fine control hole **f '** and flows to drain chamber **D**. (Fig. 4)

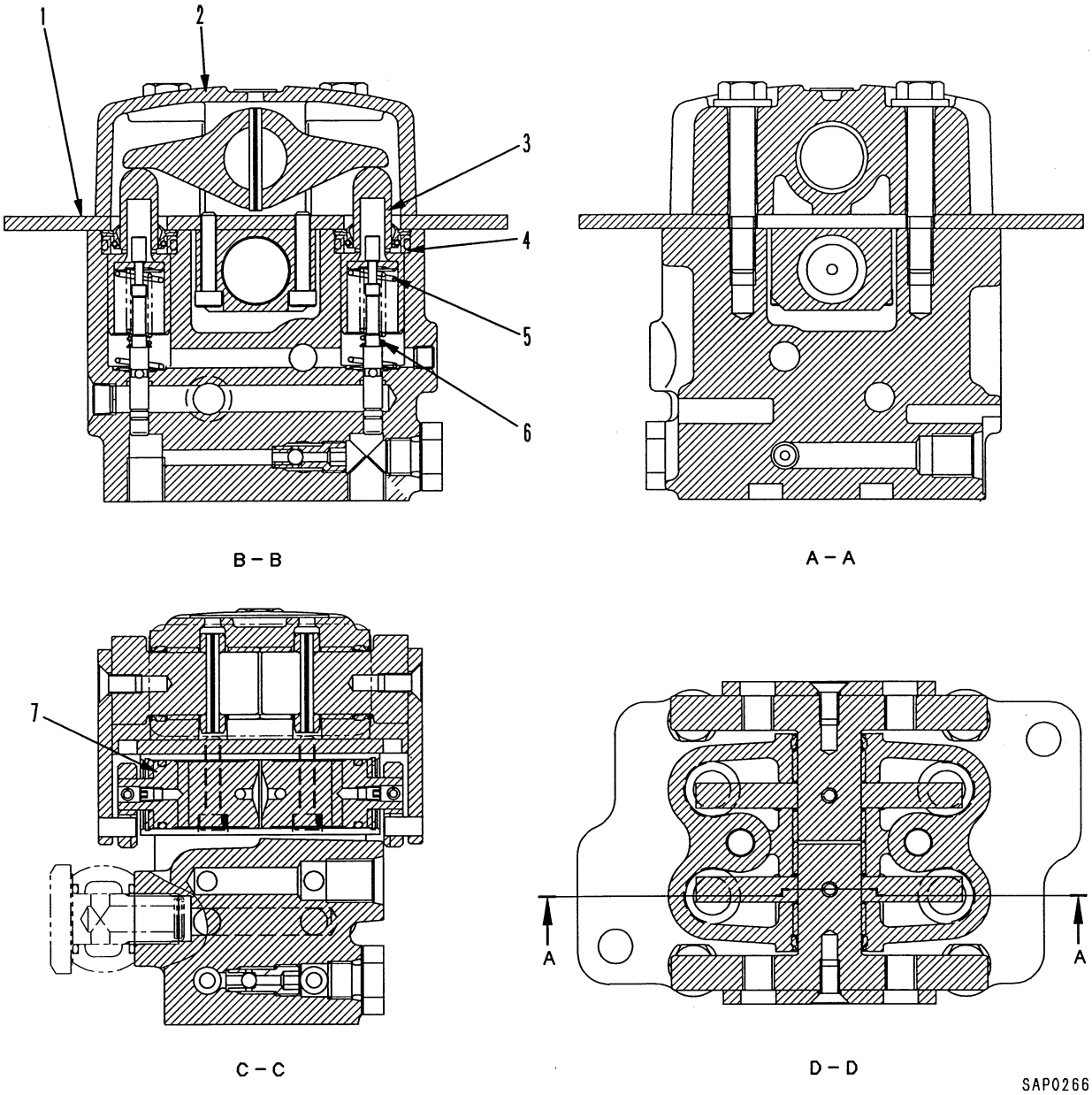


(Fig. 4) SBP01475

TRAVEL PPC VALVE



a : Port **P** (from control pump)
b : Port **T** (to tank)
c : Port **P2** (L.H. travel FORWARD)
d : Port **P1** (L.H. travel REVERSE)
e : Port **P3** (R.H. travel REVERSE)
f : Port **P4** (R.H. travel FORWARD)

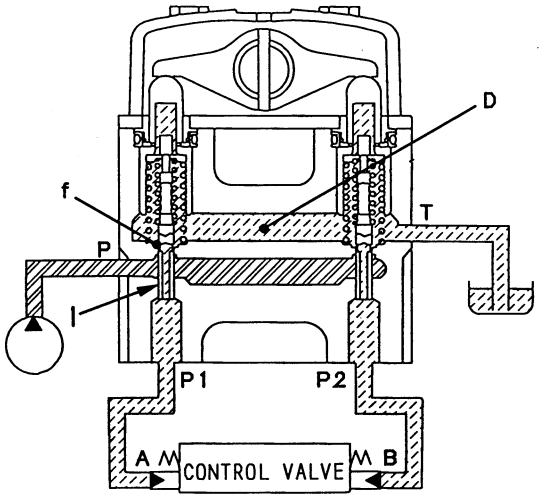


1. Plate
2. Body
3. Piston
4. Collar
5. Metering spring
6. Centering spring
7. Valve
8. Bolt

OPERATION

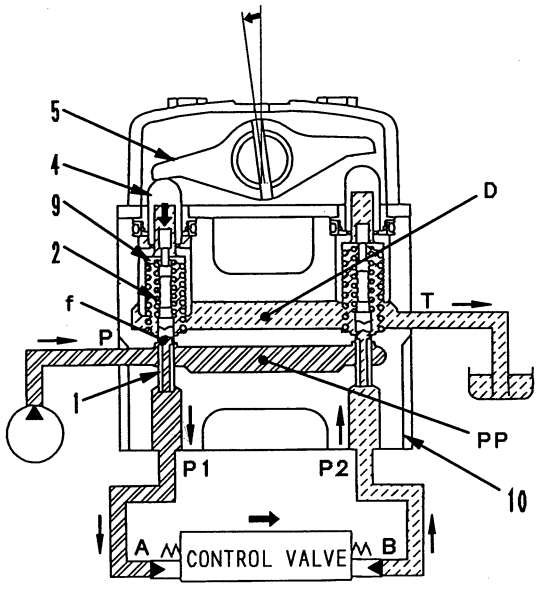
1. **At neutral**
   Ports **A** and **B** of the control valve and ports **P1** and **P2** of the PPC valve are connected to drain chamber **D** through fine control hole **f** in spool (1). (Fig. 1)

2. **Fine control (neutral → fine control)**
   When piston (4) starts to be pushed by disc (5), retainer (9) is pushed. Spool (1) is also pushed by metering spring (2) and moves down.
   When this happens, fine control hole **f** is shut off from drain chamber **D**. At almost the same time, it is connected to pump pressure chamber **PP**, and the pilot pressure of the control pump is sent from port **A** through fine control hole **f** to port **P1**.
   When the pressure at port **P1** rises, spool (1) is pushed back. Fine control hole **f** is shut off from pump pressure chamber **PP**. At almost the same time, it is connected to drain chamber **D**, so the pressure at port **P1** escapes.
   As a result, spool (1) moves up and down until the force of metering spool (2) is balanced with the pressure of port **P1**.
   The relationship of the positions of spool (1) and body (10) (fine control hole **f** is in the middle between drain hole **D** and pump pressure chamber **PP**) does not change until retainer (9) contacts spool (1).
   Therefore, metering spring (2) is compressed in proportion to the travel of the control lever, so the pressure at port **P1** also rises in proportion to the travel of the control lever.
   In this way, the spool of the control valve moves to a position where the pressure of chamber **A** (same as pressure at port **P1**) and the force of the return spring of the control valve spool are balanced. (Fig. 2)



(Fig. 1)

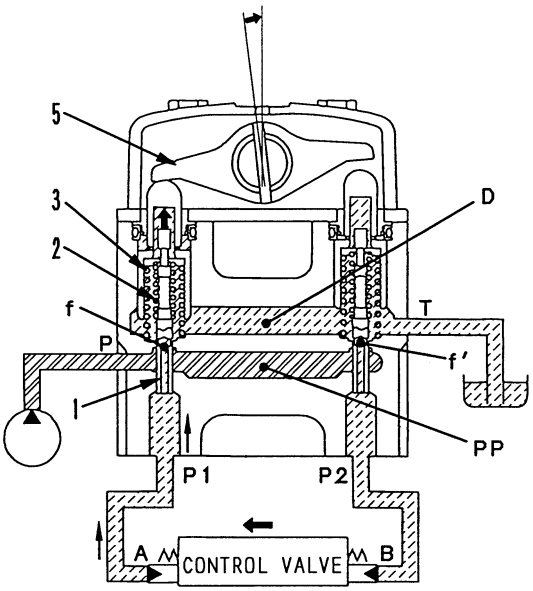
SBP01476



(Fig. 2)

SBP01477

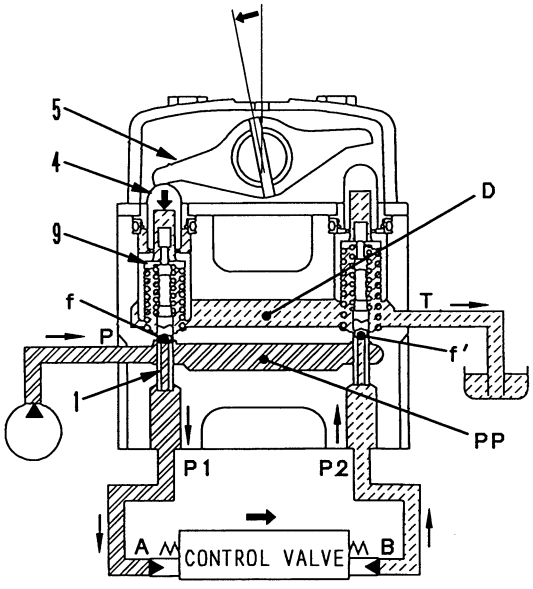
3. **Fine control (control lever returned)**
When disc (5) starts to be returned, spool (1) is pushed up by the force of centering spring (3) and the pressure at port **P1**.
Because of this, fine control hole **f** is connected to drain chamber **D**, and the pressurized oil at port **P1** is released.
If the pressure at port **P1** drops too much, spool (1) is pushed up by metering spring (2), so fine control hole **f** is shut off from drain chamber **D**. At almost the same time, it is connected to pump pressure chamber **PP**, so the pressure at port **P1** supplies the pump pressure until the pressure recovers to a pressure equivalent to the position of the lever.
When the control valve returns, oil in drain chamber **D** flows in from fine control hole **f'** of the valve on the side that is not moving. It passes through port **P2** and goes to chamber **B** to charge the oil. (Fig. 3)



(Fig. 3)

SBP01478

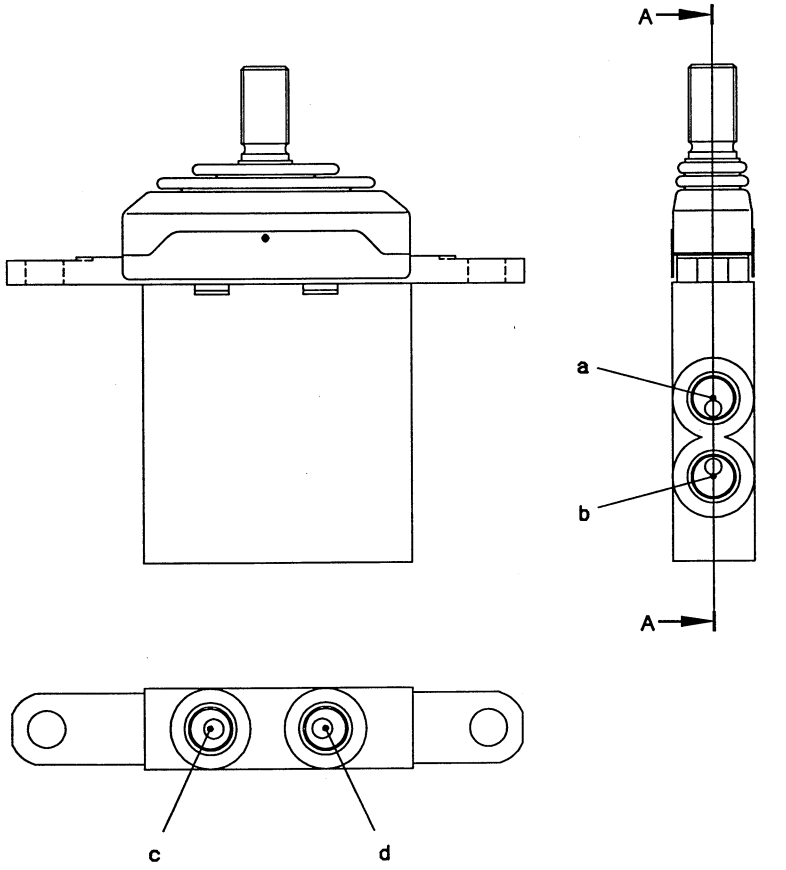
4) **At full stroke**
Disc (5) pushes down piston (4), and retainer (9) pushes down spool (1). Fine control hole **f** is shut off from drain chamber **D**, and is connected to pump pressure chamber **PP**.
Therefore, the pilot pressure oil from the control pump passes through fine control hole **f** and flows to chamber **A** from port **P1** to push the control valve spool.
The return oil from chamber **B** passes from port **P2** through fine control hole **f'** and flows to drain chamber **D**. (Fig. 4)



(Fig. 4)

SBP01479

SERVICE PPC VALVE

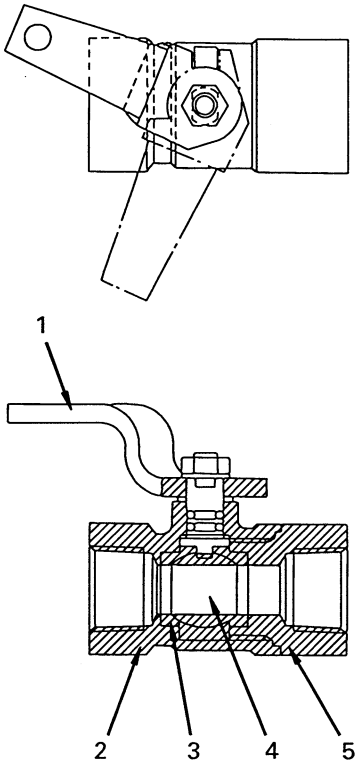


1. Spool
2. Metering spring
3. Centering spring
4. Piston
5. Lever
6. Plate
7. Retainer
8. Body

a : Port **T** (to tank)
b : Port **P** (from control pump)
c : Port **P1**
d : Port **P2**

SAP01389

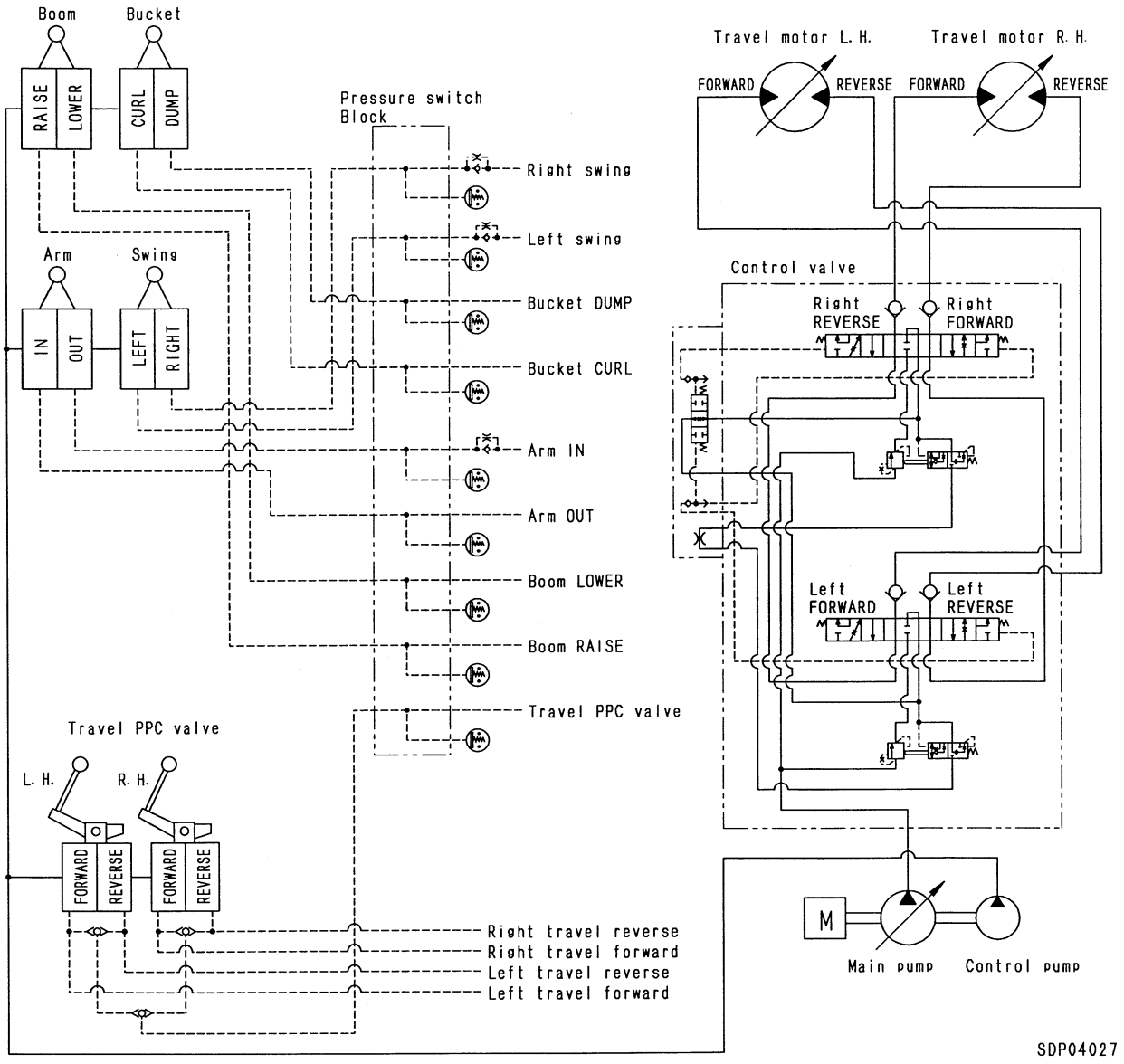
SAFETY LOCK VALVE



SBP00289

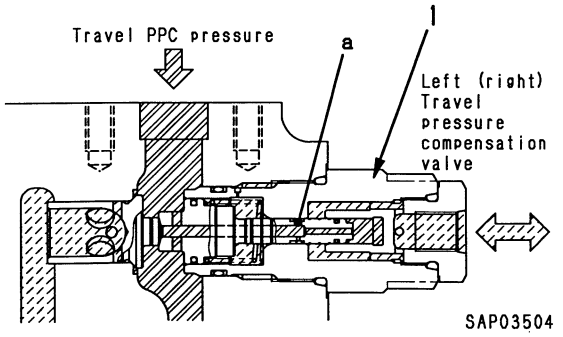
1. Lever
2. Body
3. Seat
4. Ball
5. End cap

STRAIGHT-TRAVEL SYSTEM

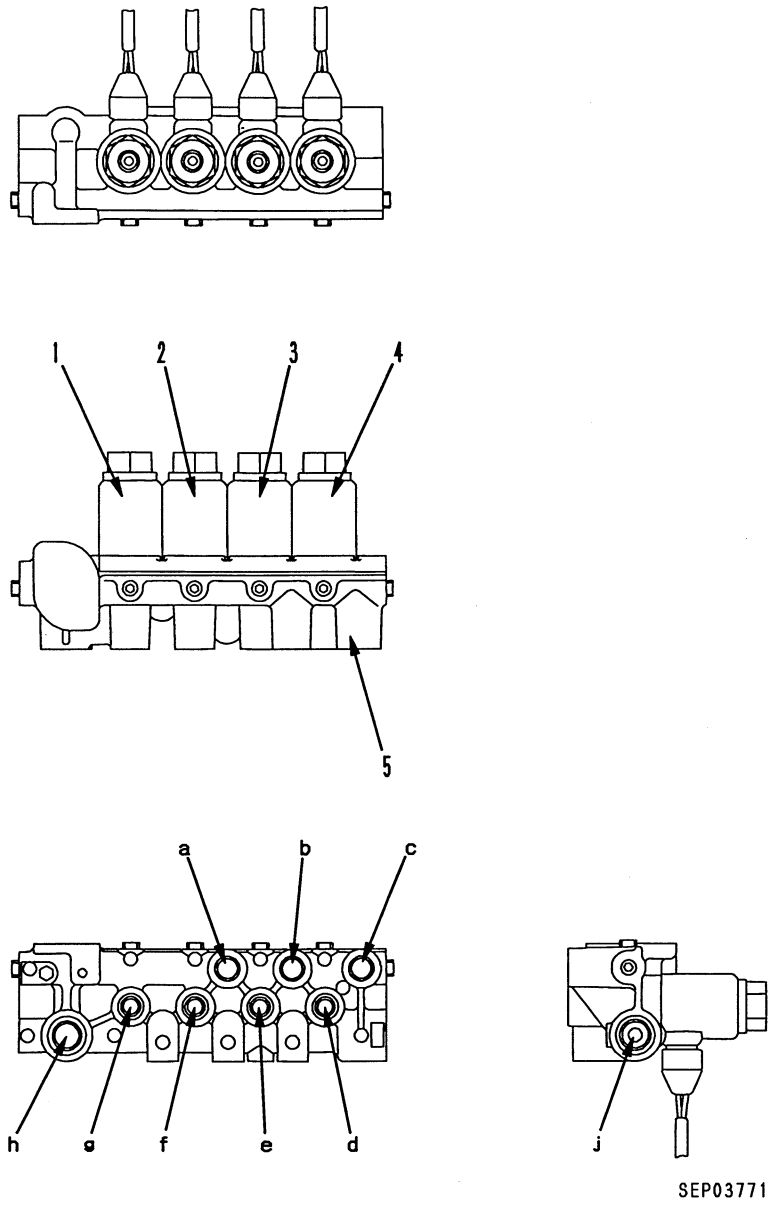


Function

- This system interconnects the pressure compensation valves for L.H. and R.H. travel FORWARD and REVERSE with external piping to ensure the ability to travel in a straight line.
- As shown in the diagram on the right, the left and right ports are interconnected through passage **a** inside travel pressure compensation valve (1).
- By setting the throttle in junction circuit **a** to a suitable value, it is possible to fulfill the requirements for steering ability and the ability to maintain a straight line.



SOLENOID VALVE

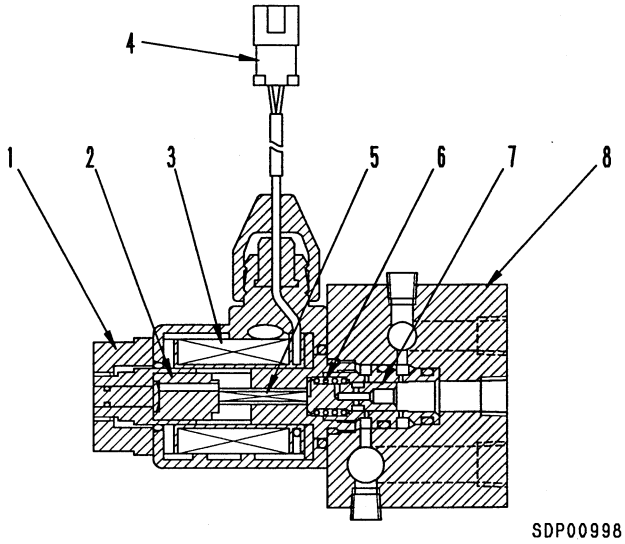


SEP03771

a : Port **T2** (to LS select valve)
b : Port **T1** (from PPC valve)
c : Port **T0** (to tank)
d : Port **A1** (to L.H. and R.H travel motor)
e : Port **A2** (to swing motor)
f : Port **A3** (to main relief valve)
g : Port **A5** (to pump, control valve)
h : Port **P1** (to PPC valve)
i : Port **P0** (from control pump)

1. Active solenoid valve
2. 2-stage relief solenoid valve
3. Swing brake solenoid valve
4. Travel speed solenoid valve
5. Valve block

FOR TRAVEL SPEED, SWING BRAKE, 2-STAGE RELIEF SOLENOID VALVE

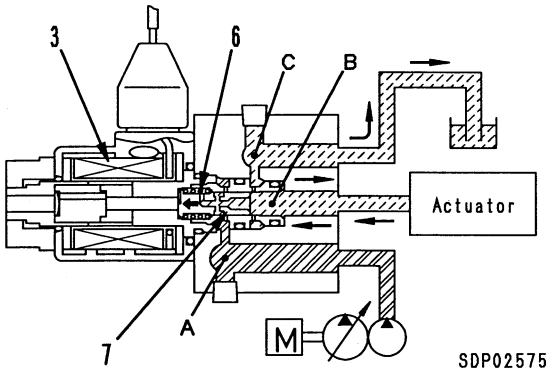


1. Nut
2. Plunger
3. Coil
4. Connector
5. Push pin
6. Spring
7. Spool
8. Block

OPERATION

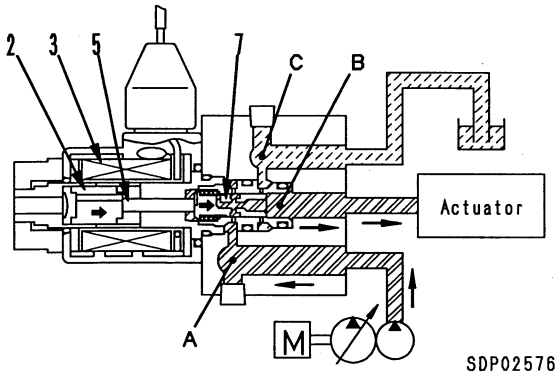
When solenoid is deactivated

- The signal current does not flow from the controller, so coil (3) is deactivated.
  For this reason, spool (7) is pushed to the left in the direction of the arrow by spring (6).
- As a result, port **A** closes and the pressurized oil from the control pump does not flow to the actuator.
- At the same time, the pressurized oil from the actuator flows from port **B** to port **C**, and is then drained to the tank.



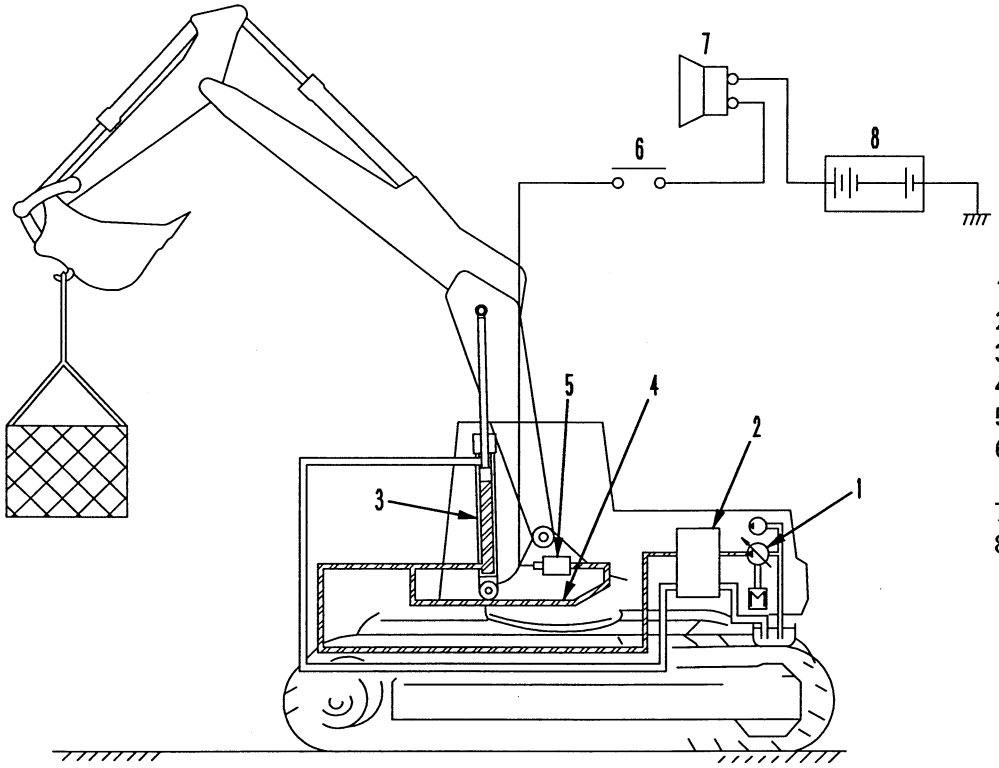
When solenoid is excited

- When the signal current flows from the controller to coil (3), coil (3) is excited, and a propulsion force is generated in plunger (2) to the right in the direction of the arrow.
- For this reason, spool (7) is pushed to the right in the direction of the arrow by push pin (5).
- As a result, the pressurized oil from the control pump flows from port **A** to port **B**, and then flows to the actuator.
  At the same time, port **C** is closed, and this stops the oil from flowing to the tank.



OVERLOAD WARNING DEVICE

OUTLINE



SWP04669

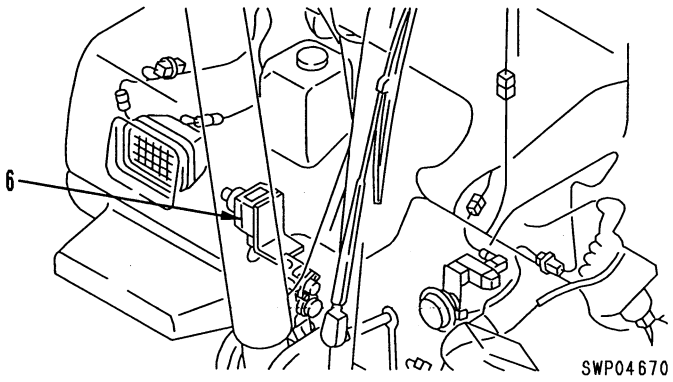
1. Main pump
2. Boom control valve
3. Boom cylinder
4. Hose
5. Oil pressure switch
6. System activates switch
7. Buzzer
8. Battery

Function

- This device is installed to warn the operator when the machine is close to tipping over when it lifts and excessive weight while being used as a crane.

Structure

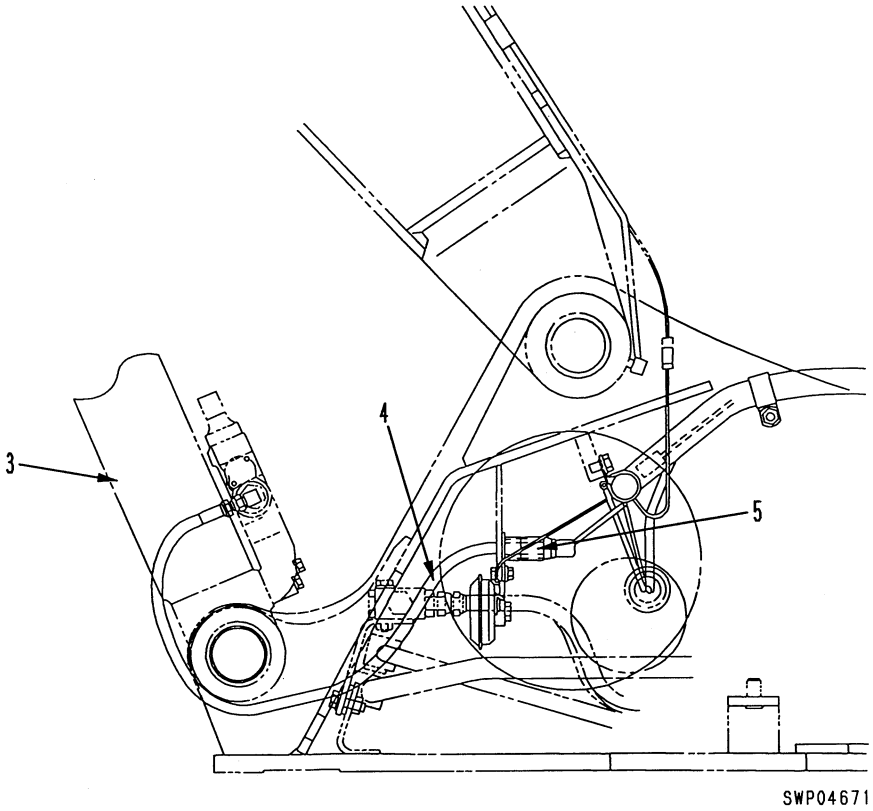
- Under normal operating conditions, this system is inactive. When the machine is to be used for lifting, the operator activates the system by means of a switch (6) located in the tool case (see Fig.).
- When an excessive weight is lifted, the oil pressure goes up at the bottom side of the boom cylinders (3). When this happens, the pressure switch (5) senses the rising pressure, turns the pressure switch ON, and lights the monitor lamp to warn the operator. When the monitor lamp lights, immediately lower the weight to the ground or bring the arm closer in to the operator to prevent the machine from tipping over.
  After use, return the machine to normal operation by setting the warning switch (6) to the OFF position.



SWP04670

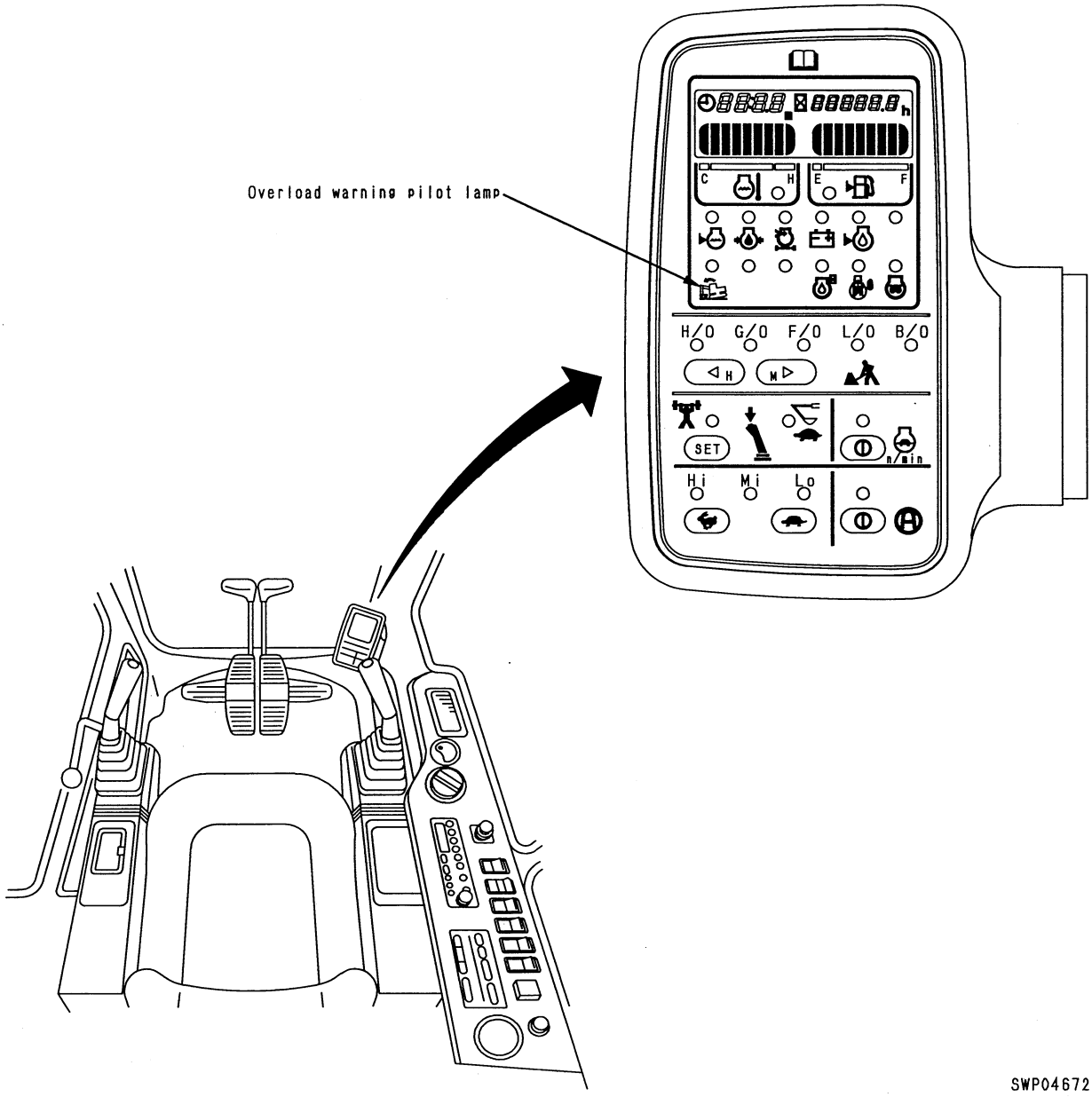
OPERATION

- Hose (4) directs the oil pressure from the bottom side of the boom cylinders (3) to pressure switch (5). When the cylinder pressure reaches the switch set value, the visual warning on monitor panel and an audible buzzer (7) are activated.
- The pressure switch (5) is set at the factory and no attempt should be made to adjust it.



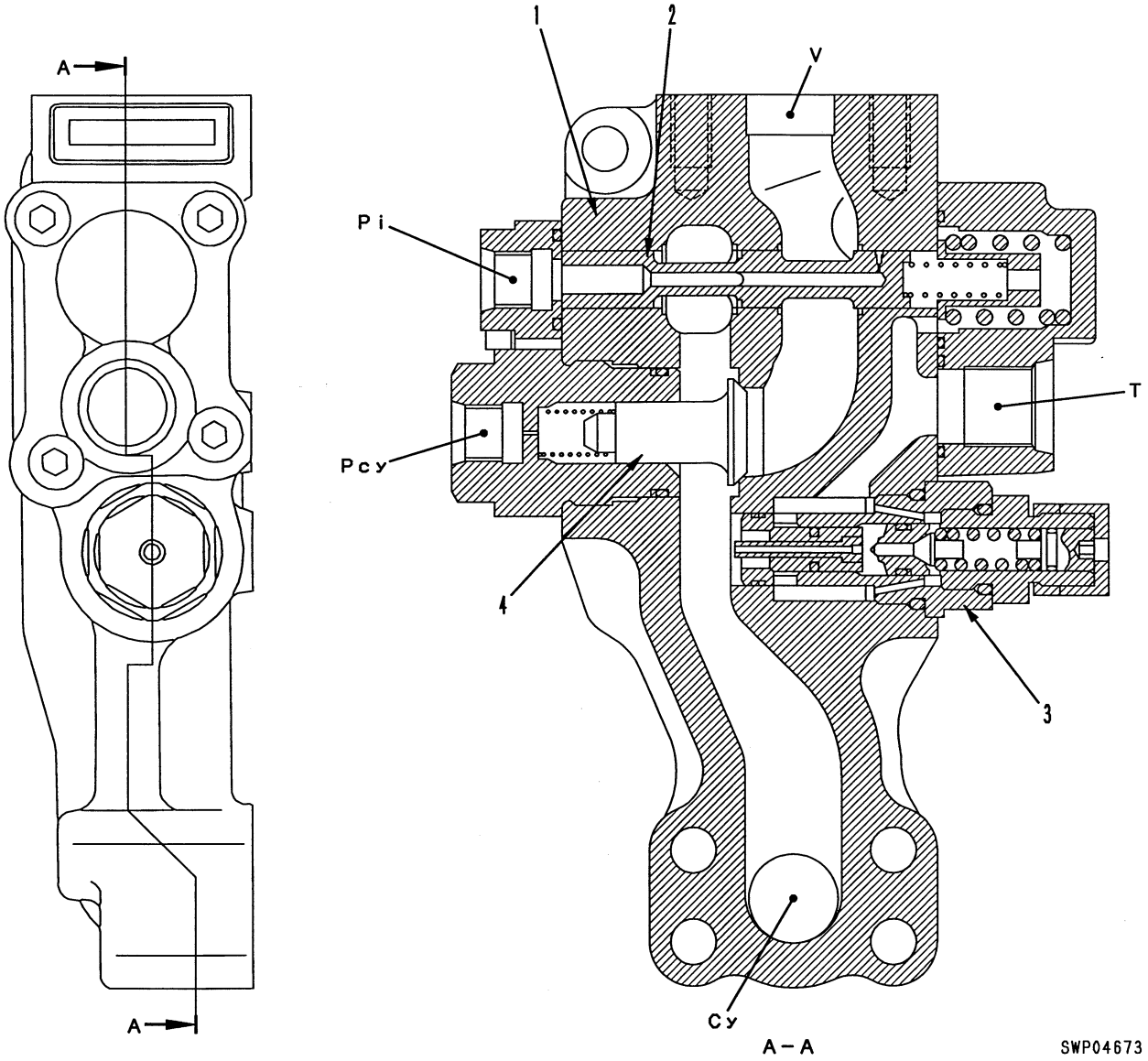
SWP04671

CONTROL PANEL



HOSE BURST PROTECTION VALVE

FOR BOOM



1. Valve body
2. Spool
3. Sefety valve
4. Check valve

T : To tank
V : High pressure from control valve
Cy : To cylinder port
Pi : PPC polot signal
Pcy : To oil pressure switch (overload cution signal)

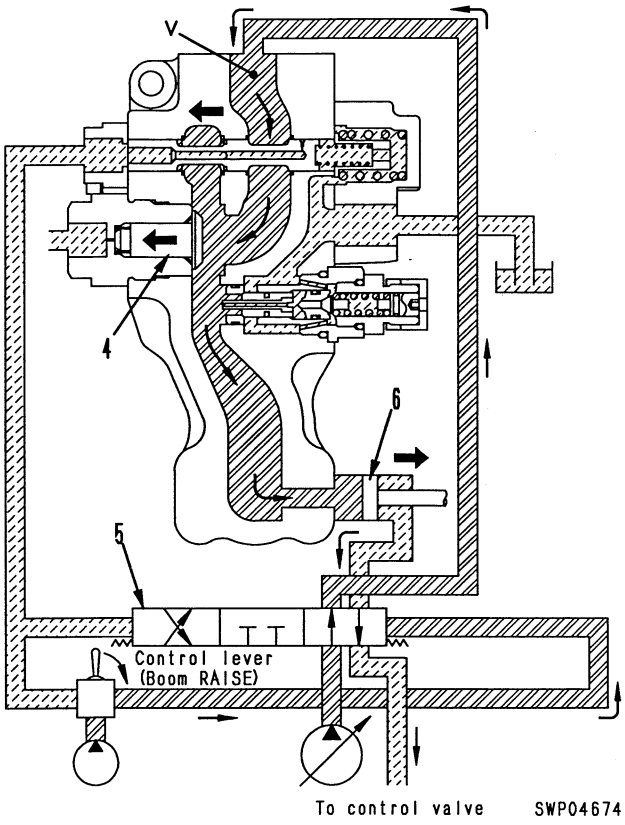
Function

- This valve prevents sudden uncontrolled lowering of the boom, when lifiting, due to the burst of a hose in the boom cylinder line. In such a condition this valve will hold the load until operetor lowers the boom in a controlled way using the normal wrist control.

OPERATION

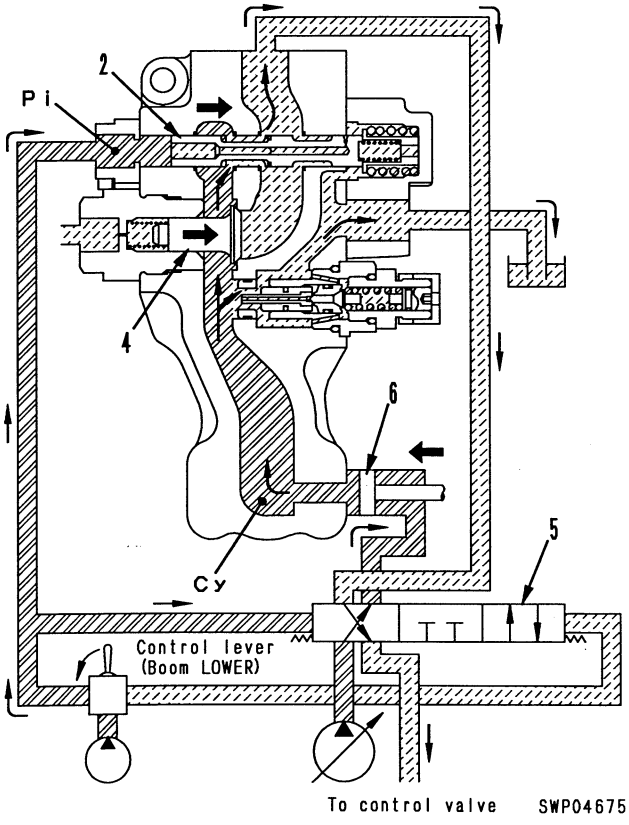
Boom raise

- During boom raising the pilot signal from wrist control operates control valve spool (5) to direct high pressure oil to port **V** of hose burst valve.
- This pressure lifts check valve (4) from seat and high pressure oil flows in the bottom of the cylinder (6) raising the boom.



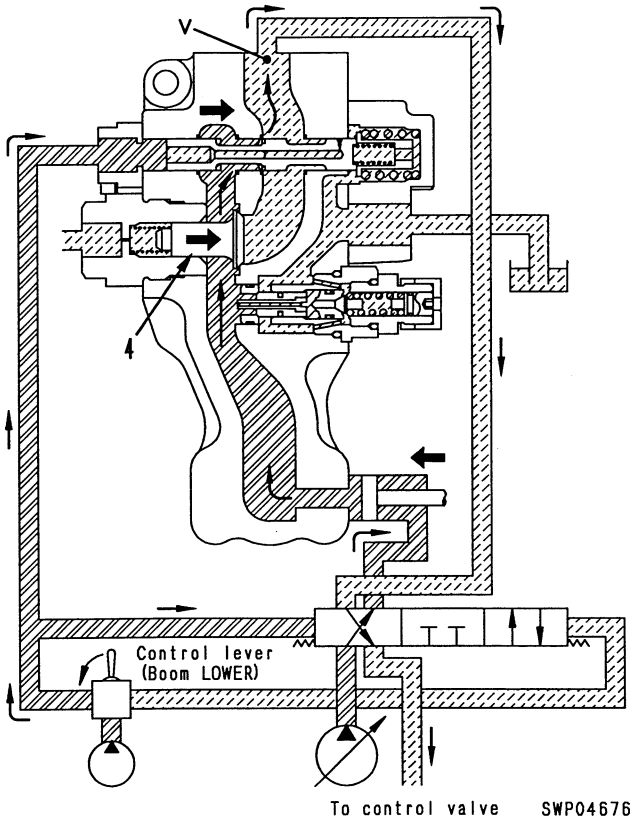
Boom lower

- During boom lowering the pilot signal reverses the front through the control valve spool (5). High pressure oil flows to the head side of the cyliner (6). Oil in the bottom side of the cylinder flows through the port **Cy** of the valve, but cannot flow past the check valve (4). The pilot signal **Pi** also opens the spool (2) of the hose burst valve and allows oil to flow back to tank.

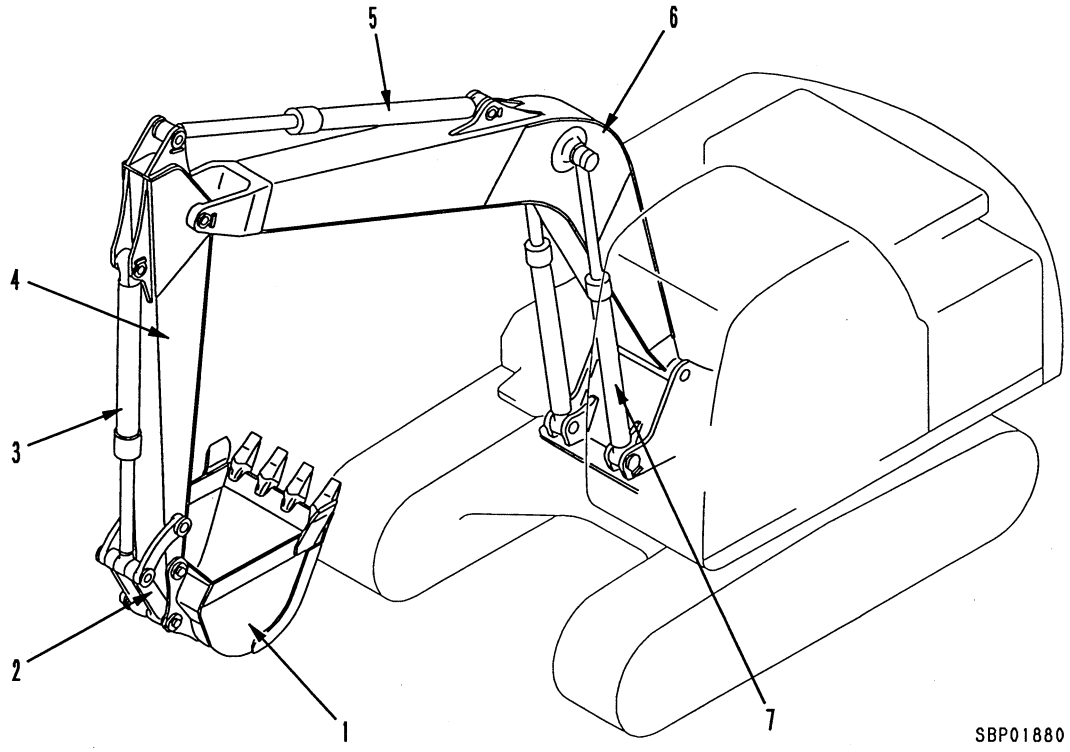


When hose burst occurs
(Operation to lower safety)

- The sudden loss of pressure at port **V** will cause check valve (4) to re-seat and so the valve is locked.
- The boom can be lowered in a controlled way by operating the wrist control in the normal way.



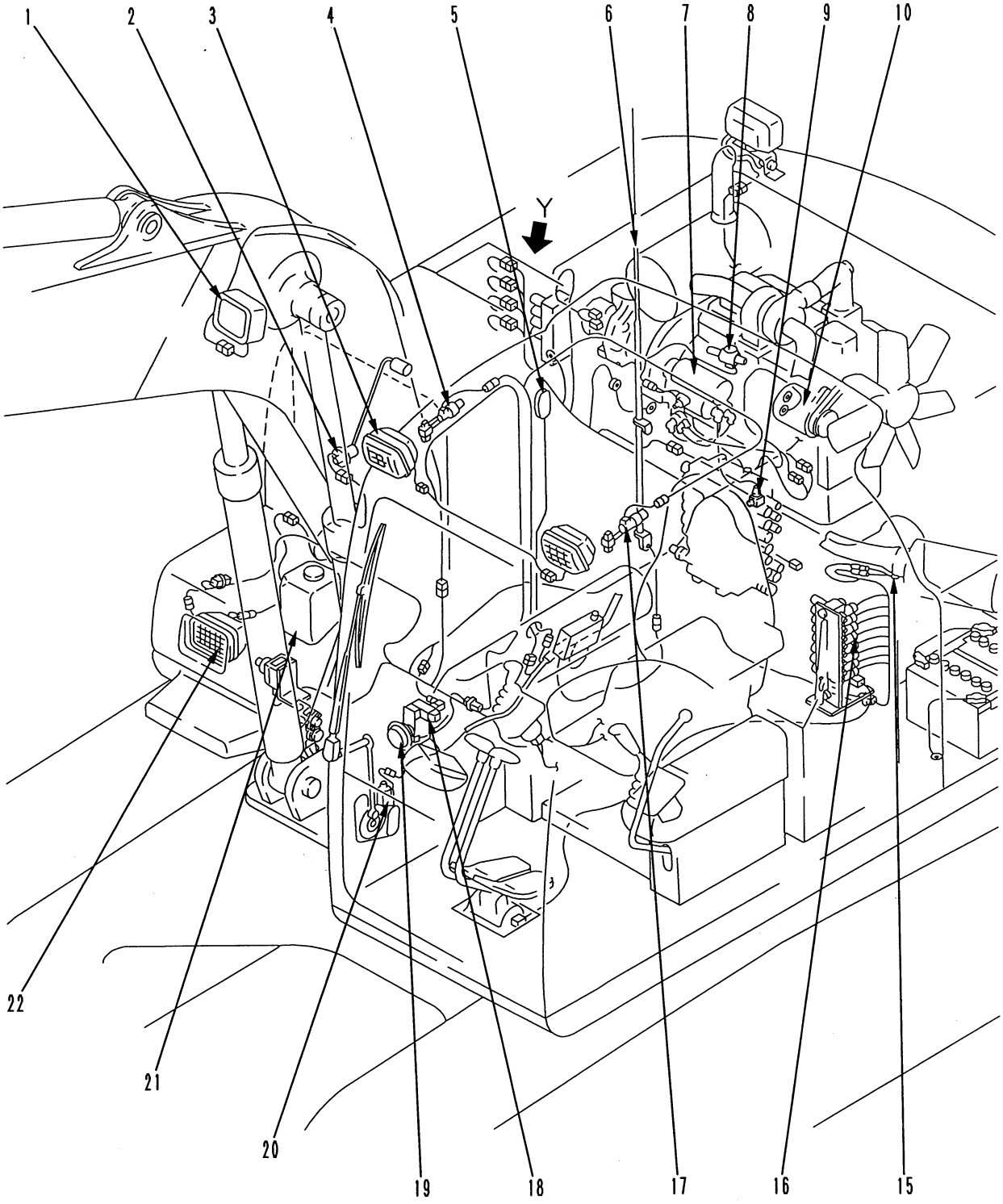
WORK EQUIPMENT

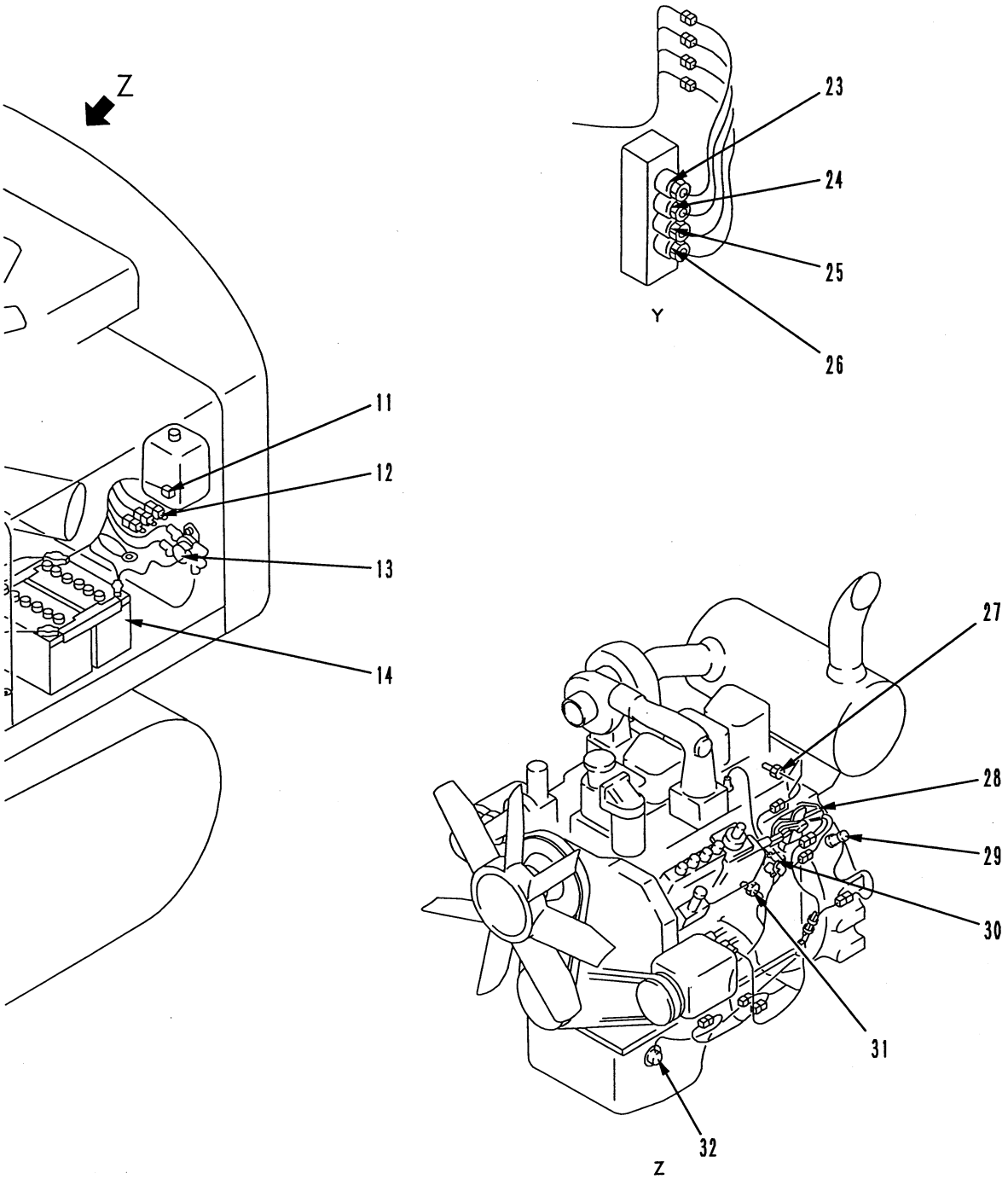


1. Bucket
2. Link
3. Bucket cylinder
4. Arm
5. Arm cylinder
6. Boom
7. Boom cylinder

ACTUAL ELECTRIC WIRING DIAGRAM

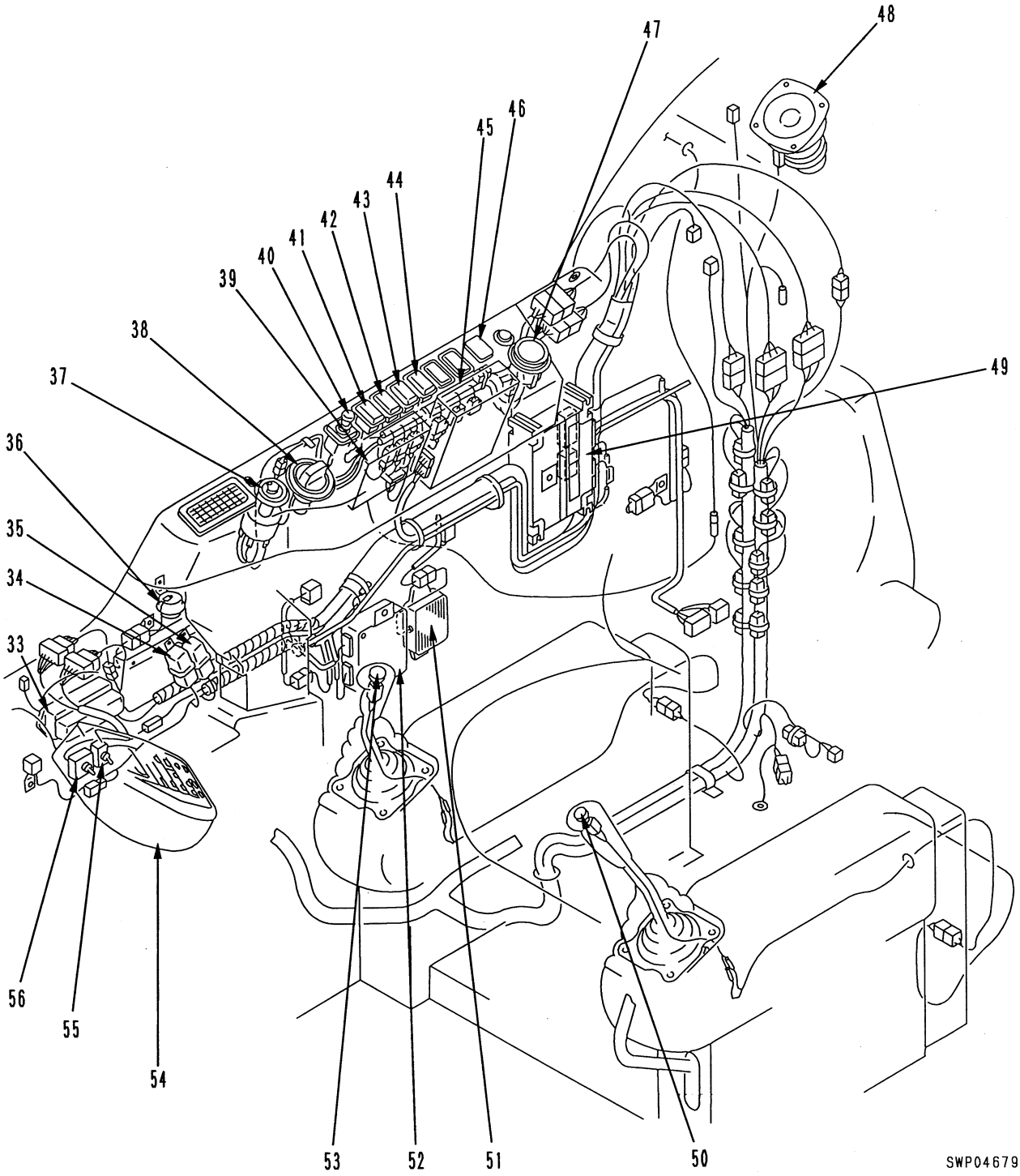
(1/2)





SWP04678

(2/2)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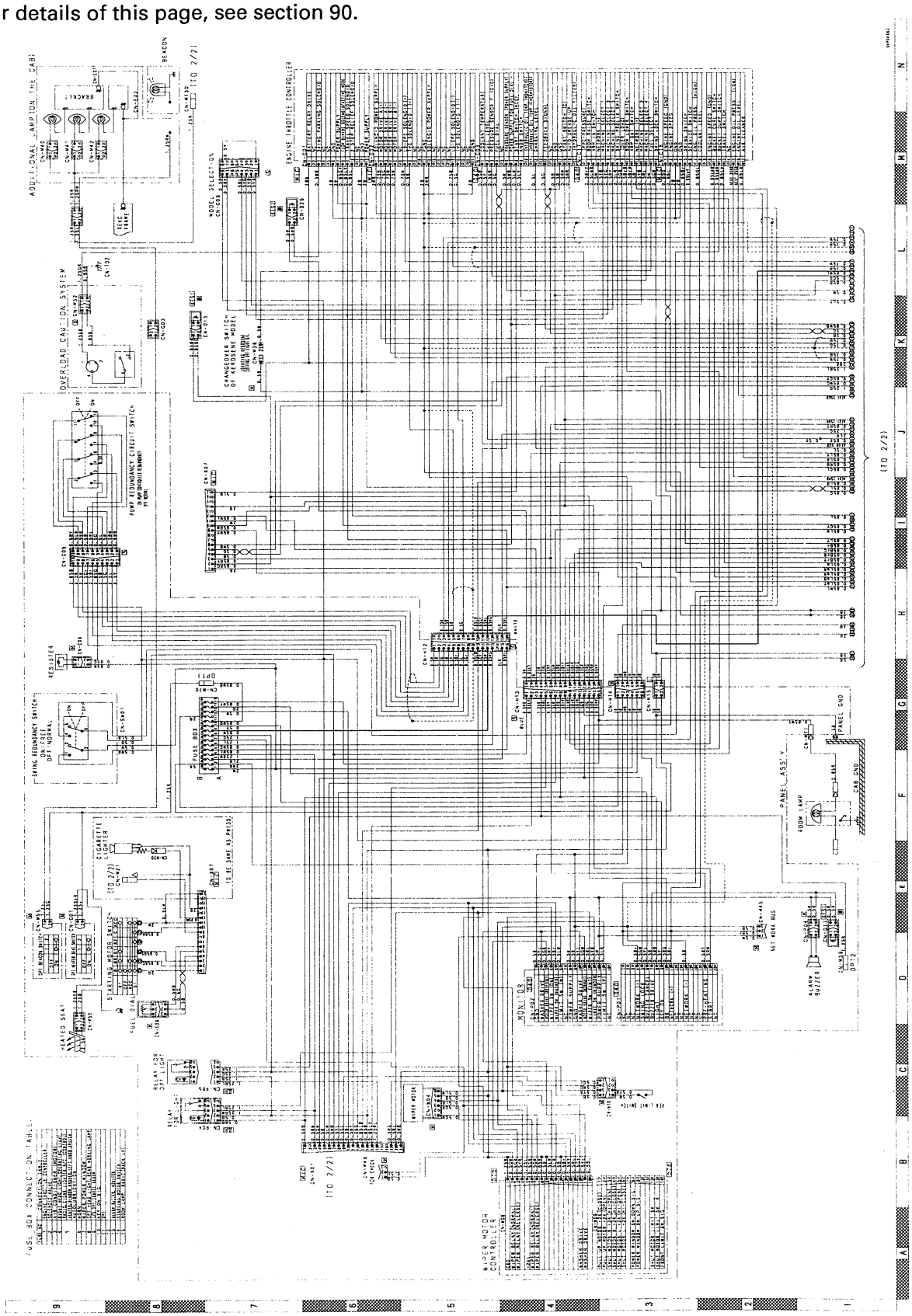
SWP04679

1. Working lamp
2. Fuel level sensor
3. Additional front lamp
4. R.H. auto pull-up lock
5. Room lamp
6. Antenna
7. Starting motor
8. Auto pull-up motor
9. Pump pressure sensor
10. Alternator
11. Coolant level sensor
12. Fusible link
13. Battery relay
14. Battery
15. Air cleaner clogging sensor
16. PPC hydraulic switch
17. L.H. auto pull-up lock
18. Overload warning pressure switch
19. Horn
20. Wiper motor
21. Window washer
22. Front lamp
23. Active mode solenoid valve
24. 2-stage relief solenoid valve
25. Swing brake solenoid valve
26. Travel speed solenoid valve
27. Coolant temperature sensor
28. Governor motor
29. Engine speed sensor
30. Heater relay
31. Engine oil pressure sensor
32. Engine oil level sensor
33. Fuse box
34. Relay for light
35. Relay for additional light
36. Alarm buzzer
37. Starting switch
38. Fuel control dial
39. Radio
40. Cigarette lighter
41. Swing lock switch
42. Wiper switch
43. Light switch
44. Buzzer cancel switch
45. Air conditioner control panel
46. Auto pull-up switch
47. Service meter
48. Speaker
49. Engine throttle controller
50. L.H. knob switch
51. Prolix resistor
52. Wiper, auto pull-up controller
53. Horn switch
54. Monitor panel
55. Swing prolix switch
56. PC prolix switch

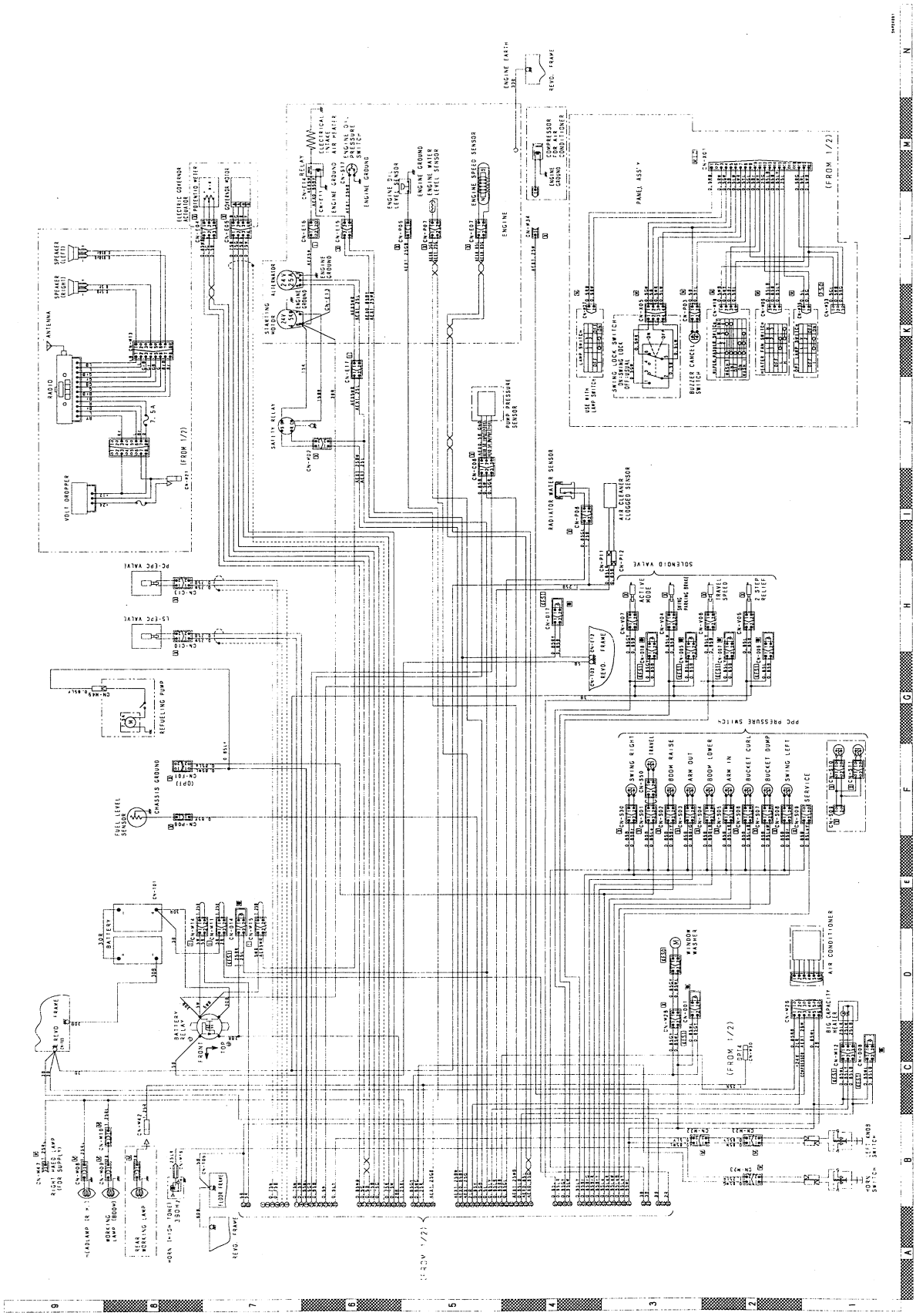
ELECTRICAL CIRCUIT DIAGRAM

(1/2)

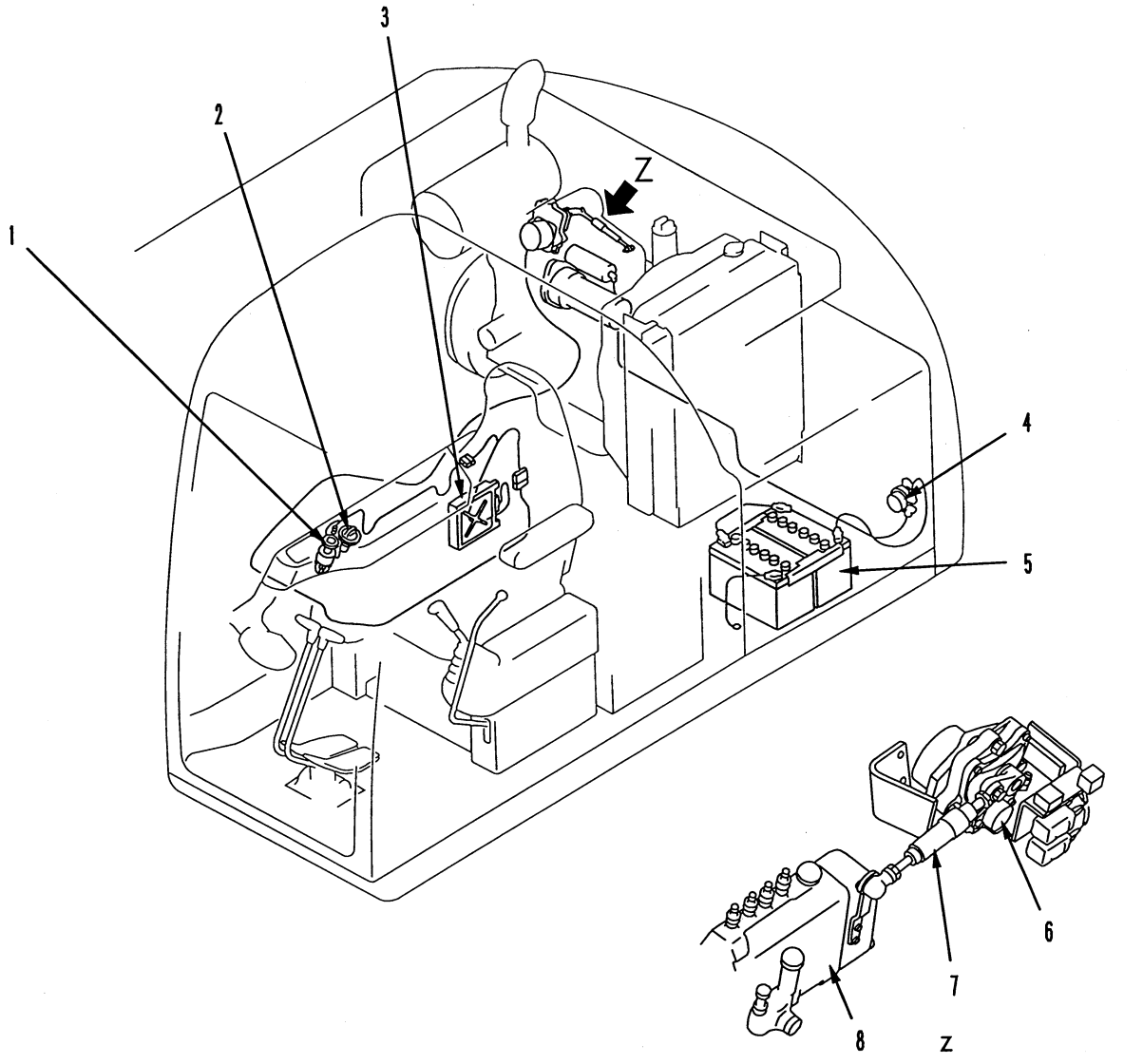
★ For details of this page, see section 90.



(2/2)



ENGINE CONTROL SYSTEM



SBP01890

1. Starting motor
2. Fuel control dial
3. Engine throttle • Pump controller
4. Battery relay
5. Battery
6. Governor motor
7. Loose spring
8. Fuel injection pump

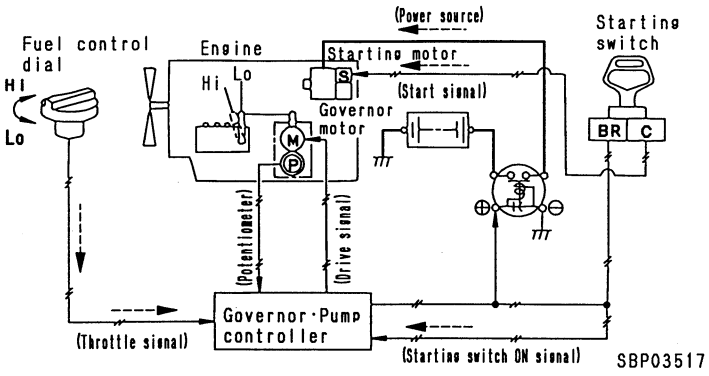
FUNCTION

- The engine can be started and stopped simply by using the starting switch.
- A dial type engine control is used to control the engine speed. The engine throttle pump controller receives the control signal from the fuel control dial, sends a drive signal to the governor motor, and controls the angle of the governor lever in the fuel injection pump.
- At the same time, the engine throttle pump controller also receives signals from other controllers to control the engine speed.

1. OPERATION OF SYSTEM

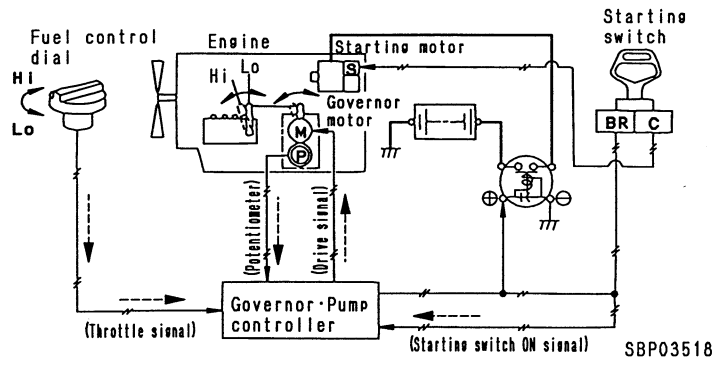
Starting engine

- When the starting switch is turned to the START position, the starting signal flows to the starting motor, and the starting motor turns to start the engine.
  When this happens, the engine throttle • pump controller checks the signal from the fuel control dial and sets the engine speed to the speed set by the fuel control dial.



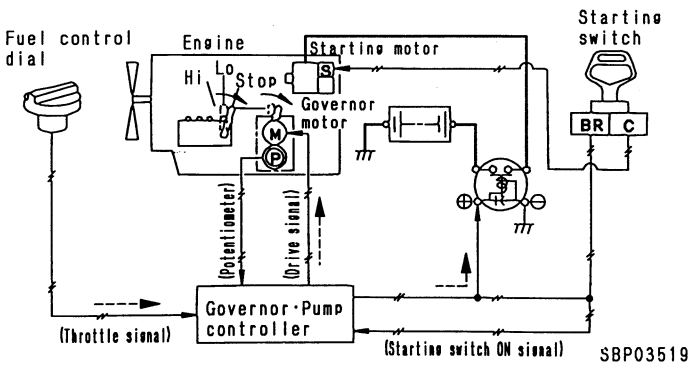
Engine speed control

- The fuel control dial sends a signal to the engine throttle • pump controller according to the position of the dial. The engine throttle • pump controller calculates the angle of the governor motor according to this signal, and sends a signal to drive the governor motor so that it is at that angle.
  When this happens, the operating angle of the governor motor is detected by the potentiometer, and feedback is sent to the engine throttle • pump controller, so that it can observe the operation of the governor motor.



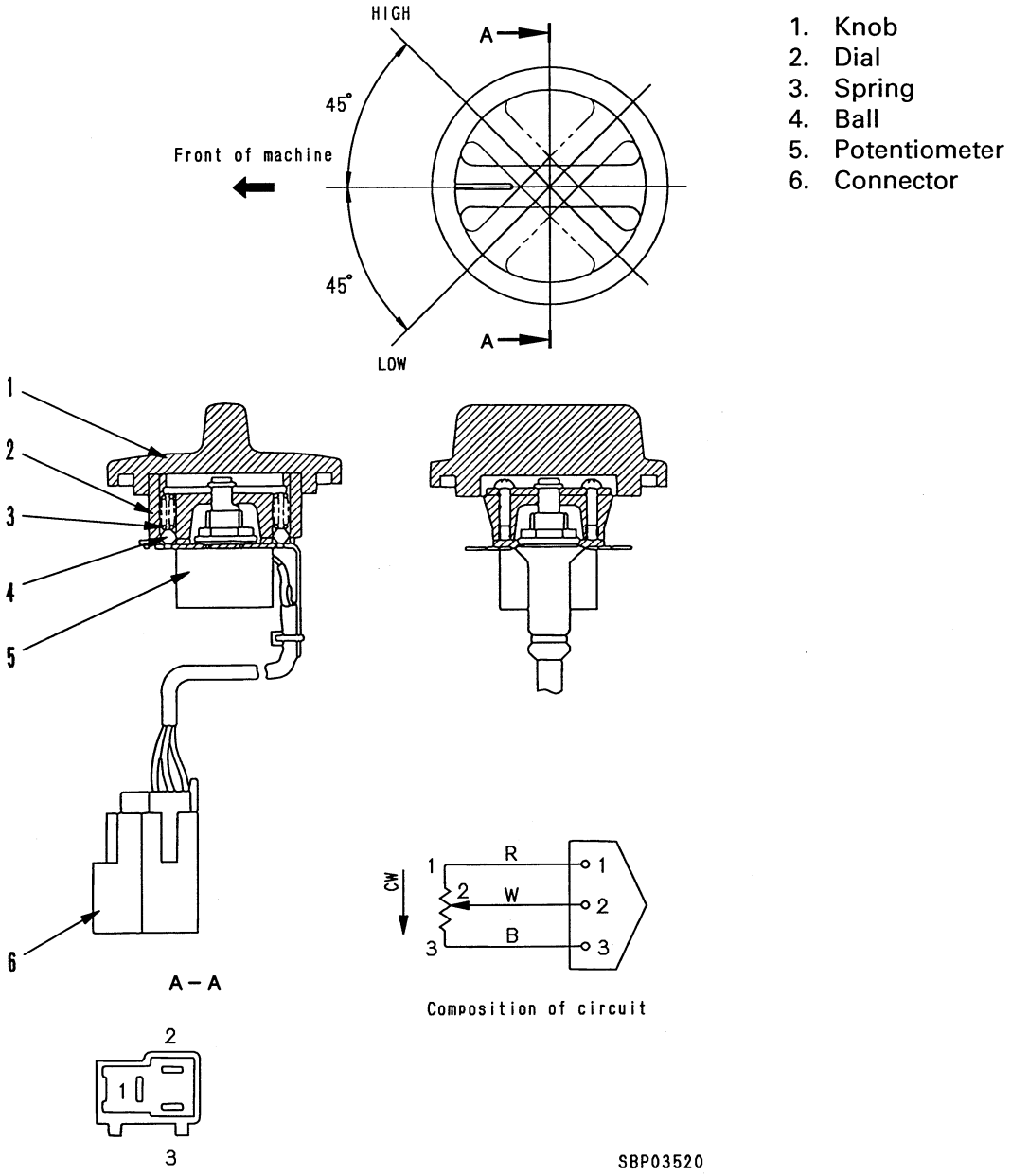
Stopping engine

- When the starting switch is turned to the STOP position, the engine throttle • pump controller drives the governor motor so that the governor lever is set to the NO INJECTION position.
- When this happens, to maintain the electric power in the system until the engine stops completely, the engine throttle • pump controller itself drives the battery relay.



2. COMPONENTS OF SYSTEM

1) FUEL CONTROL DIAL

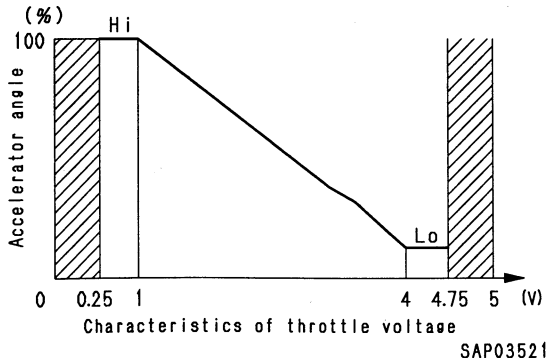


1. Knob
2. Dial
3. Spring
4. Ball
5. Potentiometer
6. Connector

SBP03520

FUNCTION

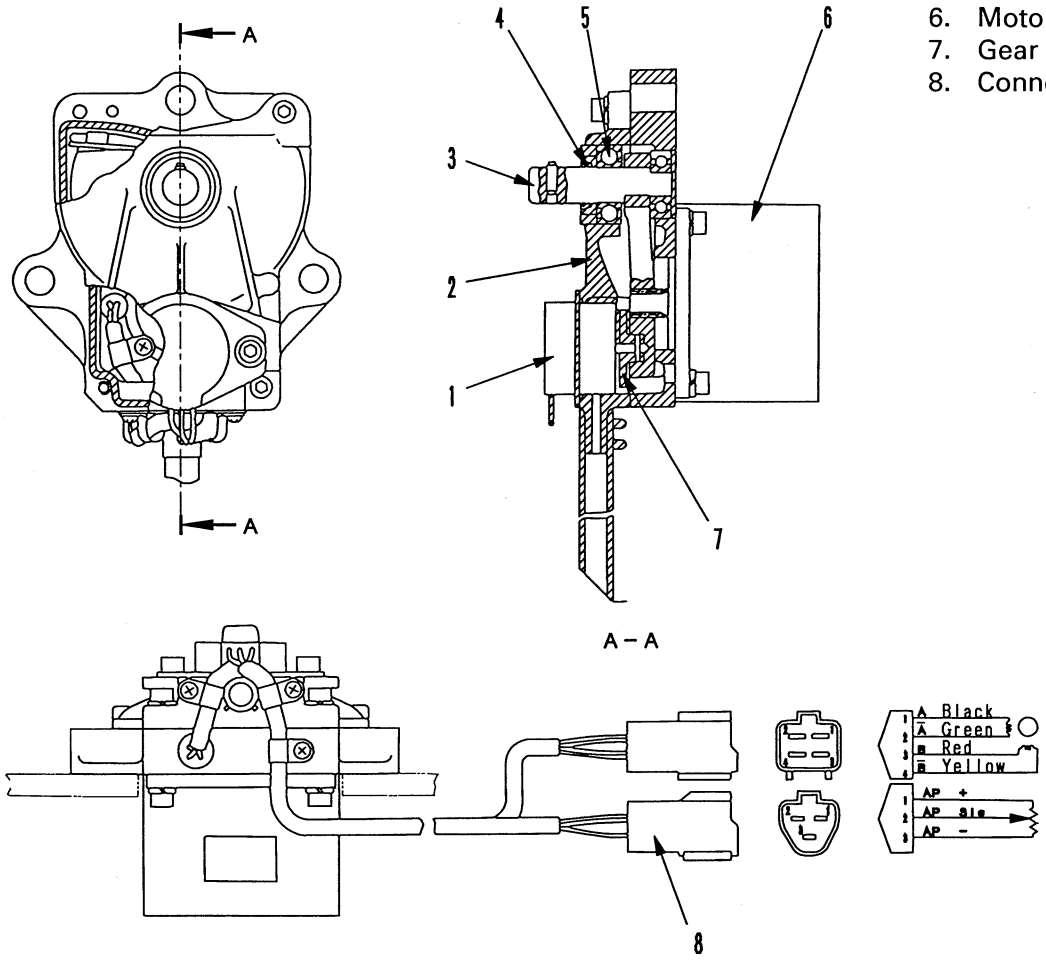
- The fuel control dial is installed at the bottom of the monitor panel. A potentiometer is installed under the knob, and when the knob is turned, it rotates the potentiometer shaft. When the shaft rotates, the resistance of the variable resistor inside the potentiometer changes, and the desired throttle signal is sent to the engine throttle • pump controller. The shaded area in the graph on the right is the abnormality detection area and the engine speed is set at low idling.



SAP03521

2) GOVERNOR MOTOR

1. Potentiometer
2. Cover
3. Shaft
4. Dust seal
5. Bearing
6. Motor
7. Gear
8. Connector



SBP03696

FUNCTION

- The motor is rotated and the governor lever of the fuel injection pump is controlled by the drive signal from the engine throttle • pump controller.
- A stepping motor is used for the motor which provides the motive power.
  In addition, a potentiometer for giving feedback is installed to allow observation of the operation of the motor.
- The rotation of the motor is transmitted to the potentiometer through a gear.

OPERATION

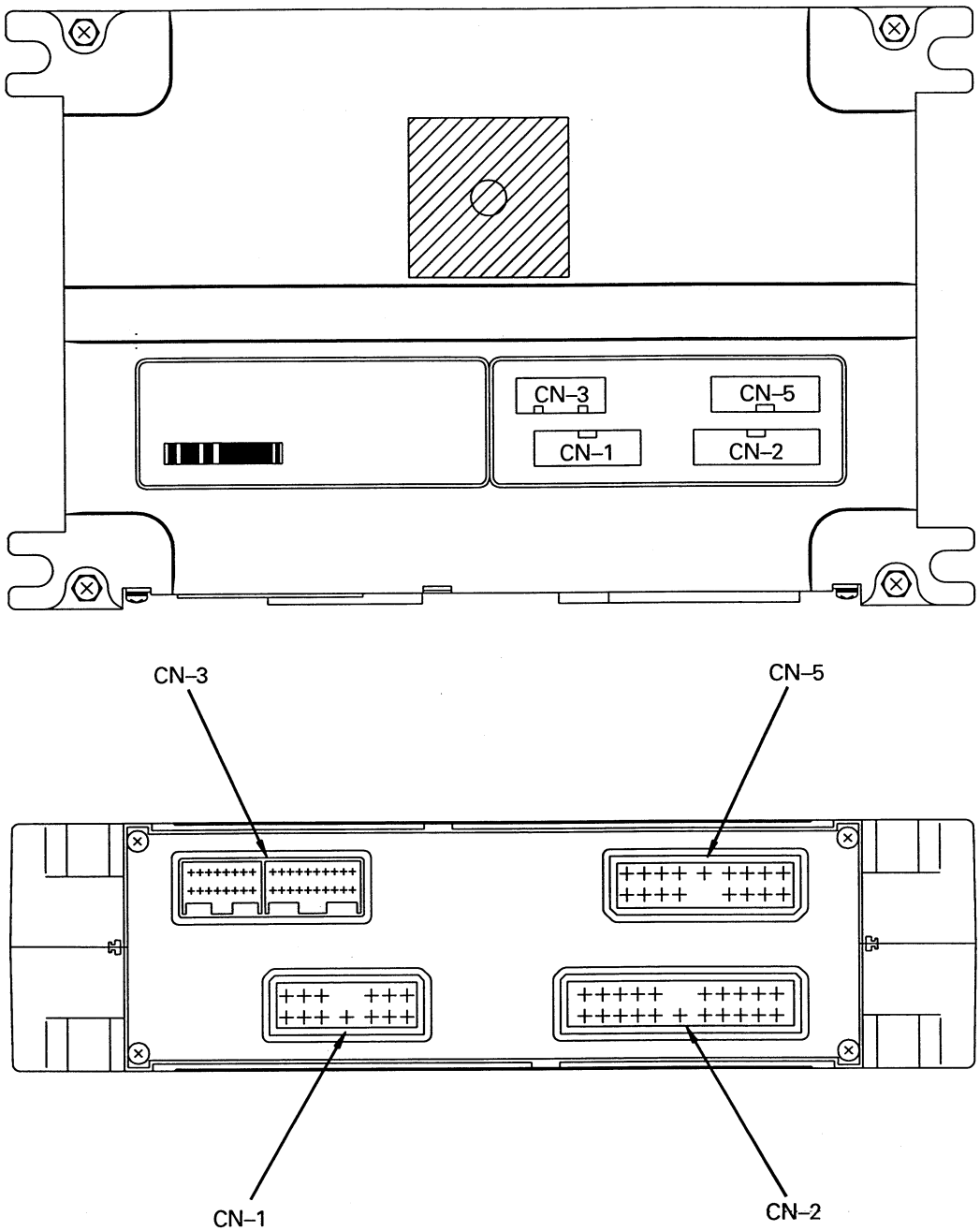
Motor stationary

- Both A phase and B phase of the motor are continuous, and a holding torque is generated in the motor.

Motor rotating

- A pulse current is applied to the A phase and B phase from the engine throttle • pump controller to give synchronous rotation with the pulse.

ENGINE THROTTLE • PUMP CONTROLLER



SAP00327

Input and output signals

CN-1

Pin No.	Name of signal	Input/ output
1	Battery relay drive output	Output
2	Pump merge-divider solenoid/ LS cut-off solenoid	Output
3	Swing holding brake solenoid	Output
4	NC	—
5	NC	—
6	GND	Input
7	Power source (+24V)	Input
8	LS divider solenoid/speed mode solenoid	Output
9	Travel selector solenoid	Output
10	2-stage relief solenoid	Output
11	NC	—
12	GND	Input
13	Power source (+24V)	Input

CN-2

Pin No.	Name of signal	Input/ output
1	Solenoid power source (+24V)	Input
2	Governor motor phase A (+)	Output
3	Governor motor phase A (-)	Output
4	Governor motor phase B (+)	Output
5	Governor motor phase B (-)	Output
6	NC	—
7	LS-EPC solenoid (+)	Output
8	PC solenoid 1 (+)	Output
9	PC solenoid 2 (+)	Output
10	NC	—
11	PGND	Input
12	Solenoid power source (+24V)	Input
13	NC	—
14	NC	—
15	NC	—
16	NC	—
17	LS-EPC solenoid (-)	Ouput
18	PC solenoid 1 (-)	Ouput
19	PC solenoid 2 (-)	Ouput
20	NC	—
21	PGND	Input

CN-3

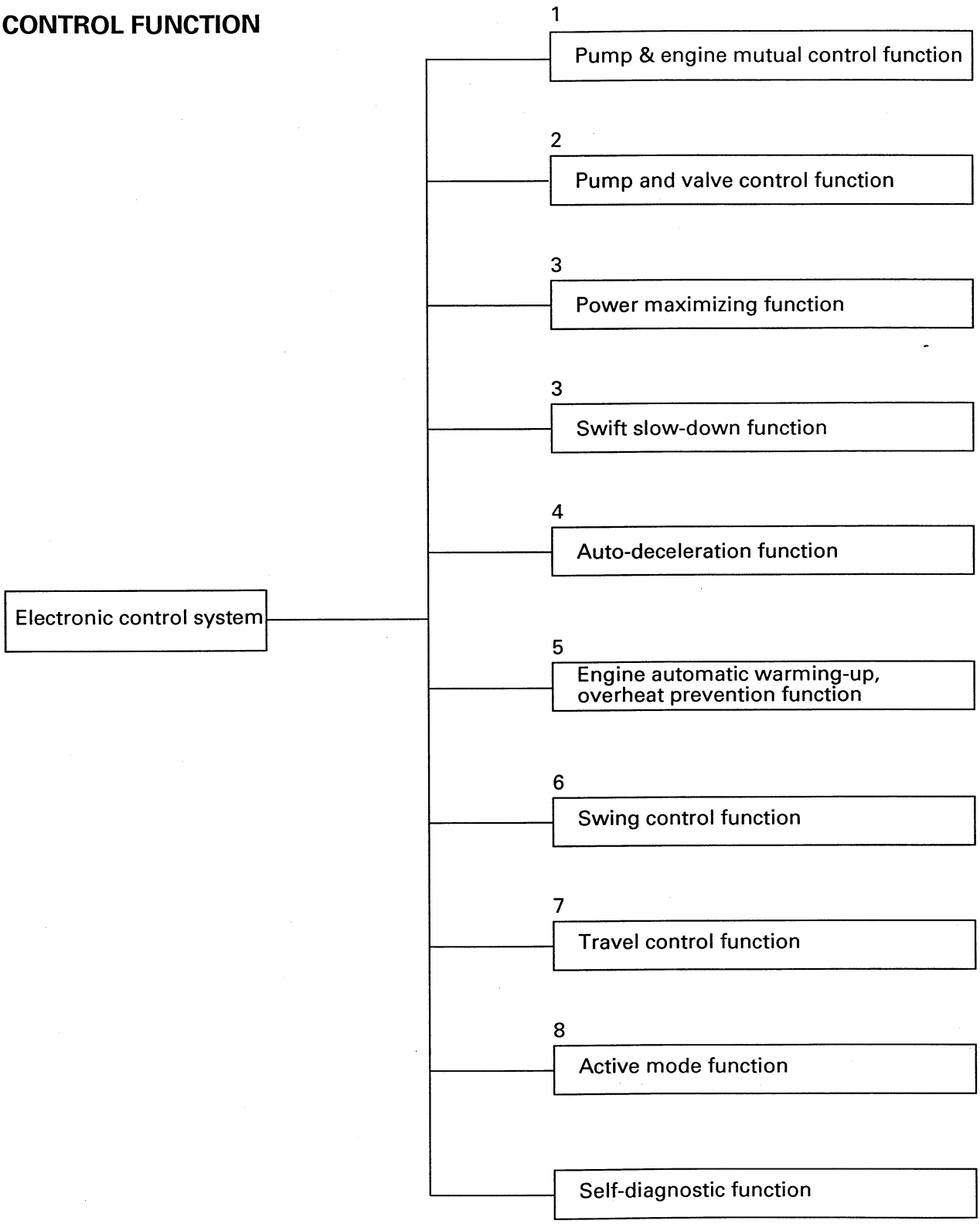
Pin No.	Name of signal	Input/ output
1	Engine water temperature sensor	Input
2	Fuel level sensor	Input
3	Pump F pressure input	Input
4	Throttle potentiometer input	Input
5	NC	—
6	Pressure sensor power source (+24V)	Output
7	Potentiometer power source (+5V)	Output
8	Starting switch (ACC)	Input
9	Knob switch	Input
10	Hydraulic oil temperature sensor (monitor panel)	Input
11	Hydraulic oil temperature sensor (thermistor type)	Input
12	Battery charge (alternator terminal R)	Input
13	Pump R pressure input	Input
14	Feedback potentiometer input	Input
15	NC	—
16	Pressure sensor GND	Input
17	Potentiometer GND	Input
18	Starting switch (terminal C)	Input
19	Automatic greasing controller abnormality	Input
20	Hydraulic filter sensor	Input
21	PPC pressure	Input
22	Boom RAISE pressure switch	Input
23	Arm IN↑pressure switch	Input
24	S-NET (+)	Input, output
25	Model selection 1	Input
26	Model selection 3	Input
27	Model selection 5	Input
28	Swing prolix switch	Input
29	Overload sensor	Input
30	Boom LOWER pressure switch	Input
31	Arm OUT pressure switch	Input
32	S-NET (+)	Input, output
33	Model selection 2	Input
34	Model selection 4	Input
35	Kerosene mode selection	Input
36	Swing lock switch	Input

CN-5

Pin No.	Name of signal	Input/ output
1	Engine speed sensor GND	Input
2	Engine speed sensor	Input
3	GND	Input
4	GND	Input
5	Swing pressure switch	Input
6	Service valve pressure switch	Input
7	Engine oil pressure sensor H	Input
8	Radiator water level sensor	Input
9	Hydraulic oil level sensor	Input
10	Engine speed sensor GND	Input
11	Bucket CURL pressure switch	Input
12	Bucket DUMP pressure switch	Input
13	Travel pressure switch	Input
14	NC	—
15	Engine oil pressure sensor L	Input
16	Engine oil level sensor	Input
17	Air cleaner clogging sensor	Input

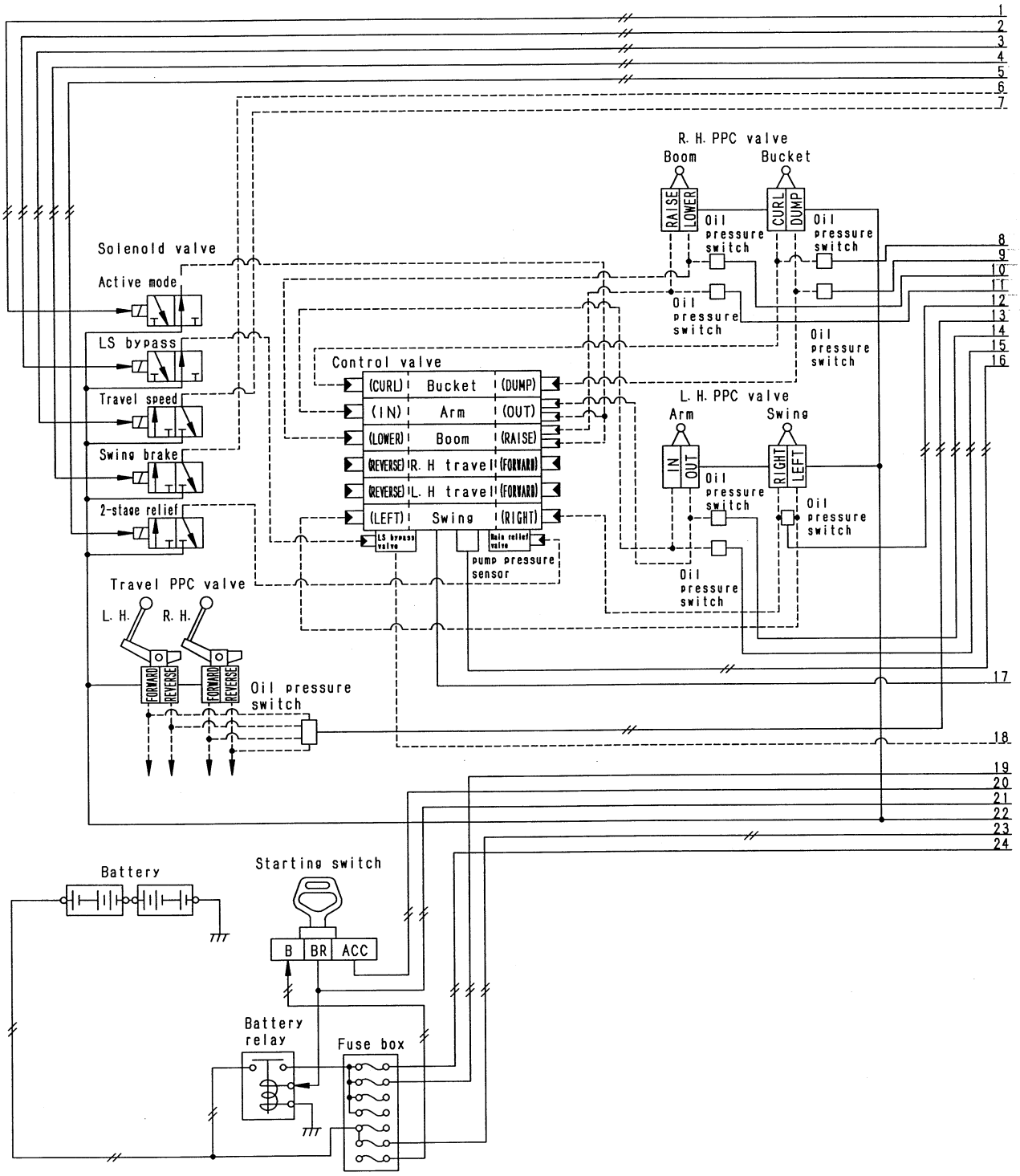
ELECTRONIC CONTROL SYSTEM

CONTROL FUNCTION

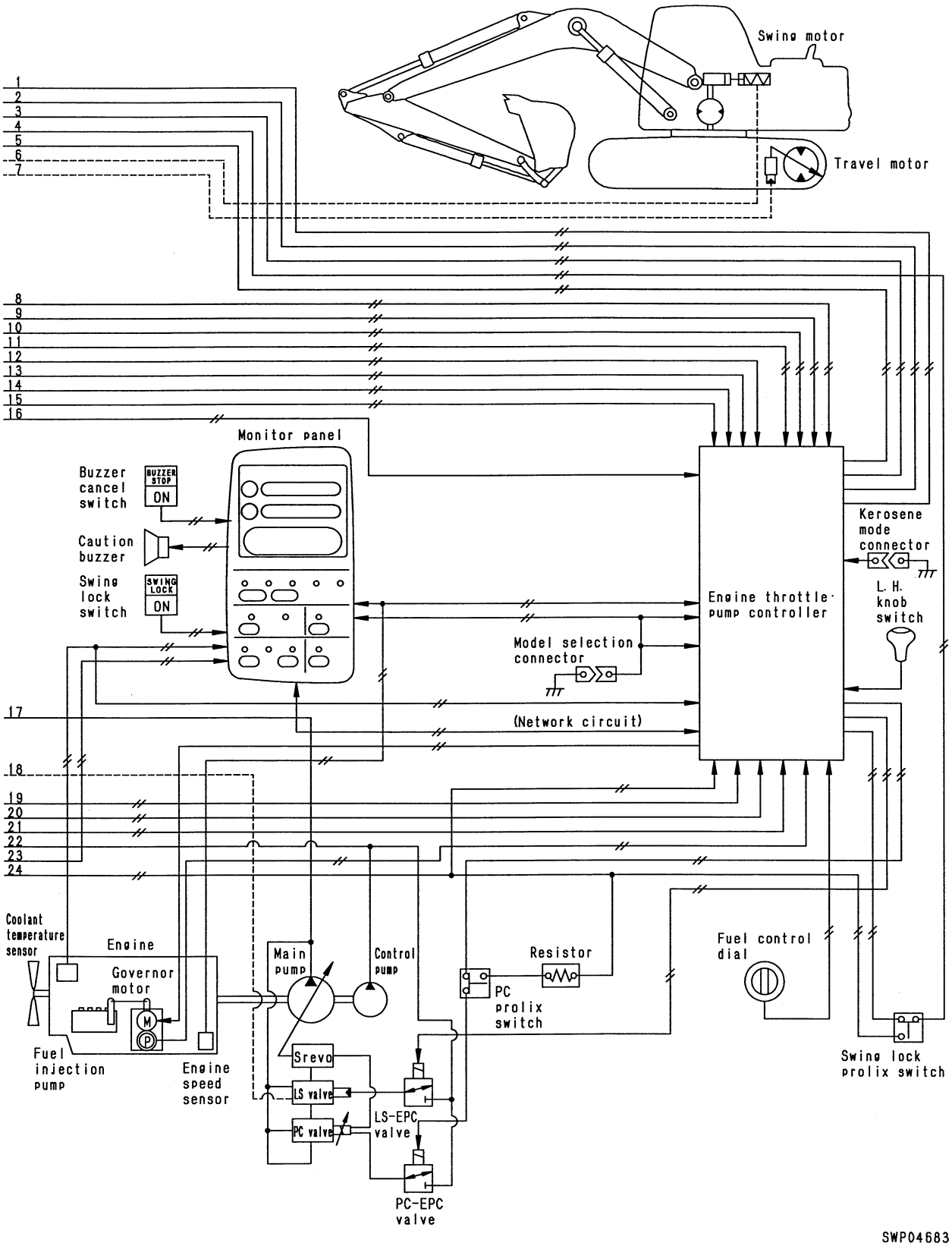


★ For details of the self-diagnostic function, see TROUBLESHOOTING.

TOTAL SYSTEM DIAGRAM

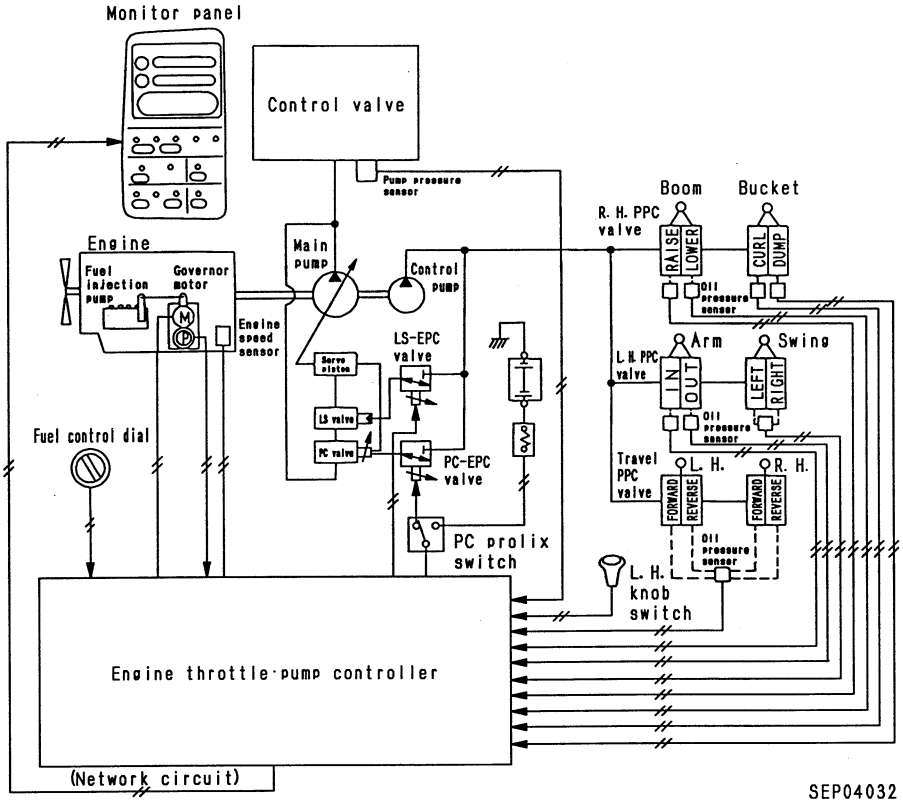


SWP04682


Swing motor
Travel motor
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
Monitor panel
Buzzer cancel switch
BUZZER STOP
ON
Caution buzzer
Swing lock switch
SWING LOCK
ON
Engine throttle· pump controller
Kerosene mode connector
L. H. knob switch
Model selection connector
17
(Network circuit)
18
19
20
21
22
23
24
Coolant temperature sensor
Engine
Governor motor
M
P
Fuel injection pump
Engine speed sensor
Main pump
Control pump
Srevo
LS valve
PC valve
LS-EPC valve
PC-EPC valve
Resistor
PC prolix switch
Fuel control dial
Swing lock prolix switch

SWP04683

1. PUMP & ENGINE MUTUAL CONTROL FUNCTION

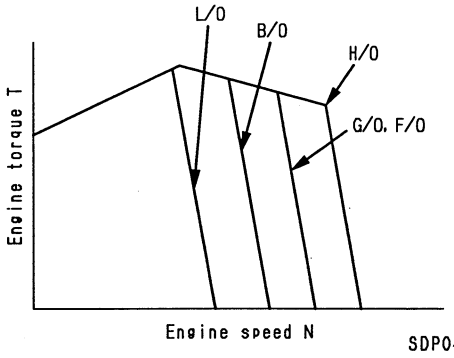


FUNCTION

- There are five modes available for selection with the working mode switch on the monitor panel. These modes are the heavy-duty operation (H/O) mode, general operation (G/O) mode, finishing operation (F/O) mode, lifting operation (L/O mode), and the breaker operation (B/O) mode. It is possible to select the most suitable engine torque and pump absorption torque to match the nature of the work.

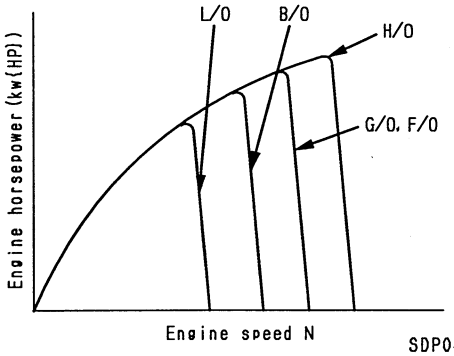
- The pump controller detects the actual engine speed and the speed set by the engine governor through the fuel control dial matches the pump absorption torque set for each mode, and carries out control so that the pump absorbs all of the torque at each output point of the engine.

- Engine torque curve



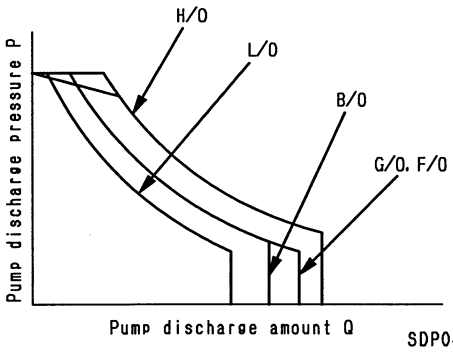
SDP04033

- Engine hosepower curve



SDP04034

- Pump output curve



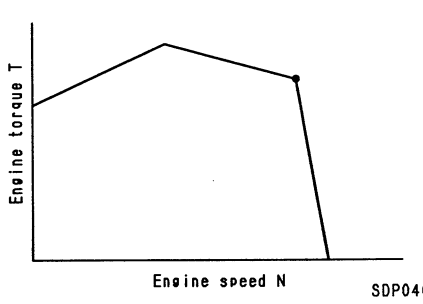
SDP04035

1) Control method in each mode

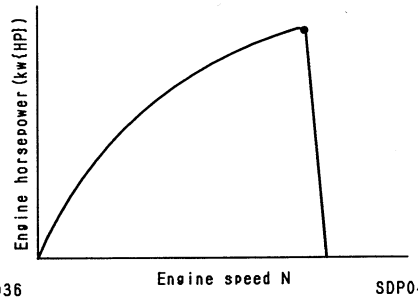
Heavy-duty operation (H/O) mode

- Matching point in heavy-duty operation mode: Rated output point
- When the load on the pump rises and the pressure rises, the engine speed goes down. When this happens, the pump discharge amount is reduced, and the engine speed is controlled so that it becomes the rated speed.
- If the reverse happens and the pressure goes down, the system is controlled so that the pump discharge amount is increased until the engine speed reaches the rated speed. By repeating this control, the engine can always be used at near the rated output point.

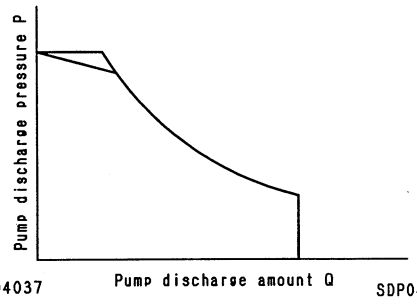
Model	PC130-6K
Heavy-duty operation (H/O)	62 kW/2,200 rpm {84HP/2,200 rpm}



SDP04036



SDP04037

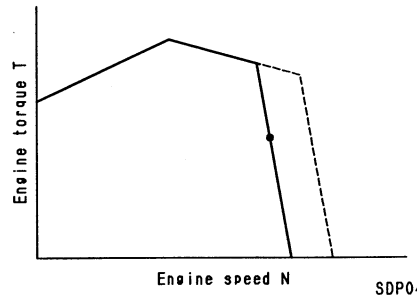


SDP04038

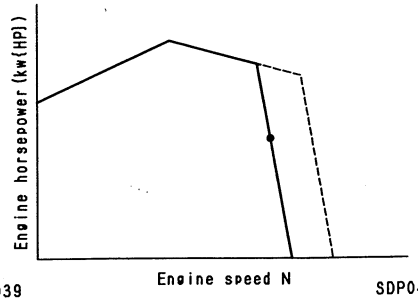
General operation (G/O), finishing operation (F/O) mode

- Matching point in general operation and finishing operation modes: 75% partial output point.
- When the load on the pump rises and the pressure rises, the engine speed goes down. When this happens, mutual control of the engine and pump is used to control the system so that the pump absorption torque follows the equal horsepower curve of the engine, and the engine speed is lowered while keeping the torque constant.
- In this way, the engine is used in a range which provides good fuel efficiency.

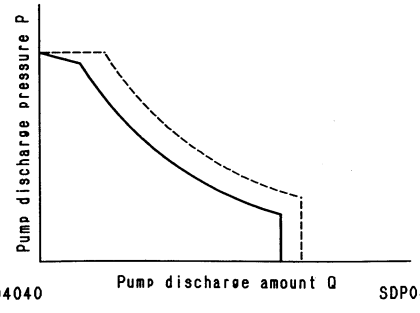
Model	PC130-6K
General operation (G/O), Finishing operation (F/O)	47 kW/1,900 rpm {64 HP/1,900 rpm}



SDP04039



SDP04040

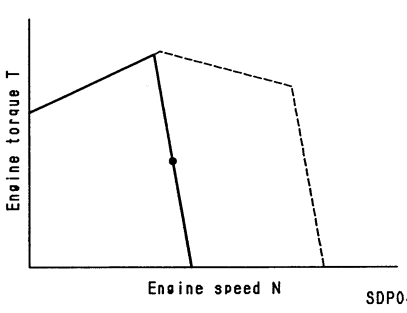


SDP04041

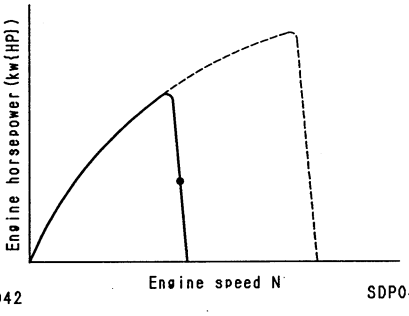
Lifting operation (L/O) mode

- Matching point in lifting operation mode: 50% partial output point
- When the lifting operation mode is selected, the engine speed is automatically lowered to the partial position.
- In this condition, control is carried out in the same way as for the general operation and finishing operation modes to match the load on the pump.
- In this way, the fuel consumption is reduced and the fine control ability is improved.

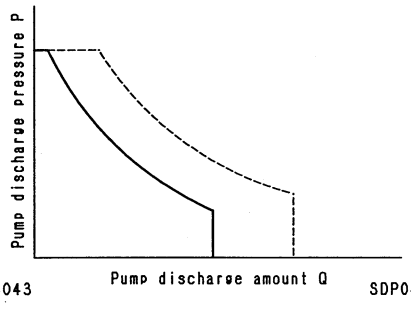
Model	PC130-6K
Lifting operation (L/O)	33 kW/1,600 rpm {44 HP/1,600 rpm}



SDP04042



SDP04043

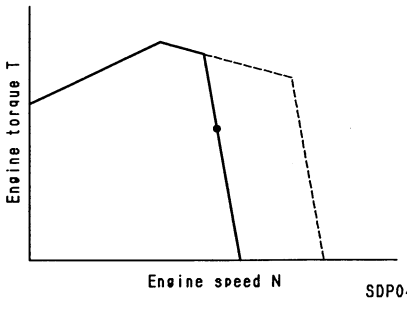


SDP04044

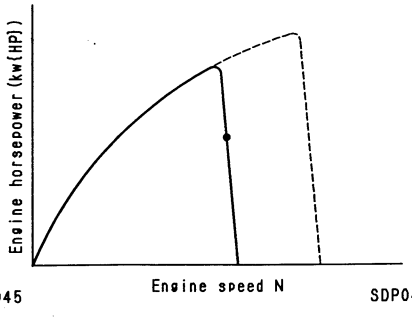
Breaker operation (B/O) mode

- Matching point in breaker operation mode: 75% partial output point
- The pump absorption torque in the breaker operation mode is the same as for the general operation and finishing operation modes, and is controlled to become an even lower speed.
- As a result, the pump absorption torque needed to ensure the breaker drive is ensured, and the engine is used in a range that provides a much better fuel consumption ratio than for the general operation mode or finishing operation mode.

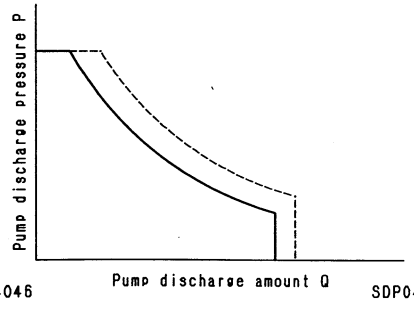
Model	PC130-6K
Breaker operation (B/O)	47 kW/1,750 rpm {64 HP/1,750 rpm}



SDP04045



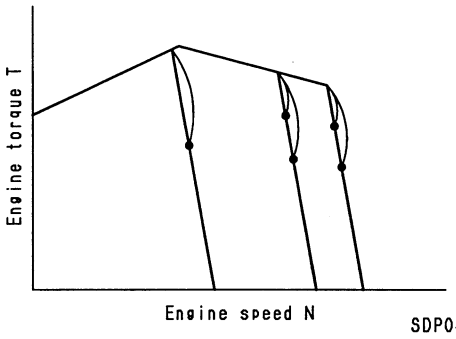
SDP04046



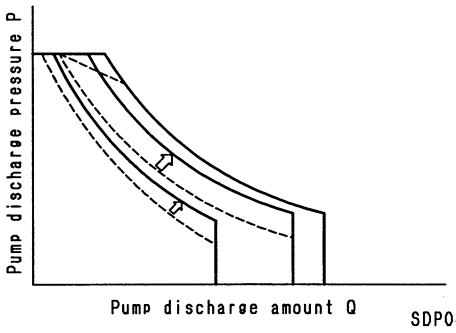
SDP04047

2) Pump control function when traveling

- If the travel is operated in any working mode other than the heavy-duty operation (H/O) mode, the working mode and engine speed are kept as they are, and the pump absorption torque is increased to the maximum horsepower at that speed.



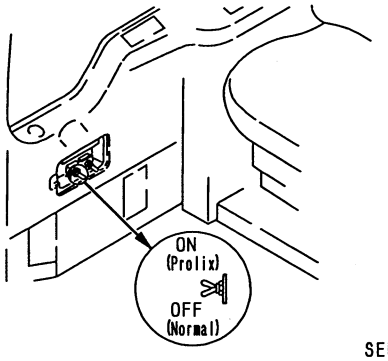
SDP04048



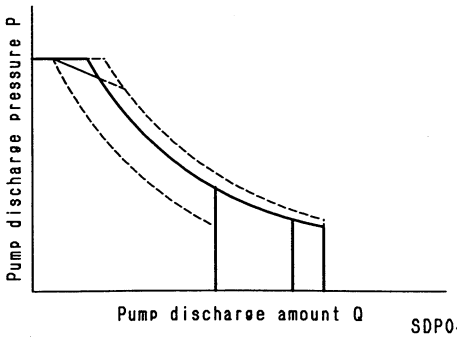
SDP04049

3) Control function when PC prolix switch is ON.

- Even if any abnormality should occur in the controller or sensor, the PC prolix switch can be turned ON to provide an absorption torque more or less equivalent to the general operation (G/O) mode, thereby allowing the machine to maintain its functions.
- In this case, it is designed to allow a constant current to flow from the battery to the PC valve, so oil pressure sensing is carried out only by the PC valve.

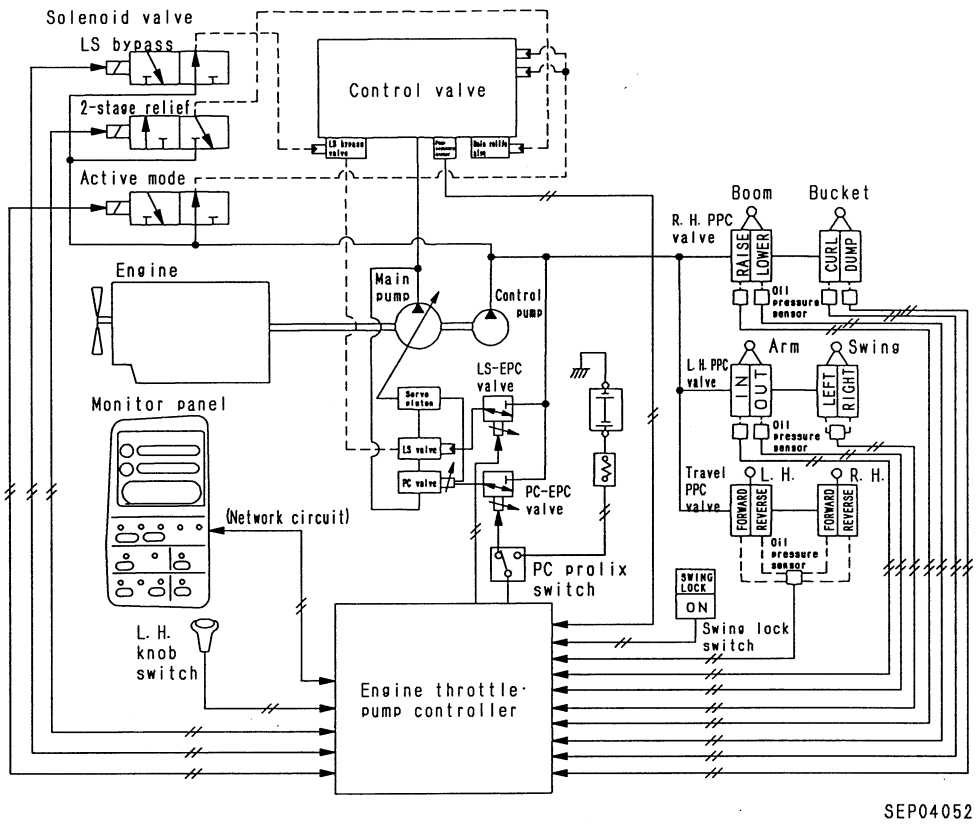


SEP04050



SDP04051

2. PUMP AND VALVE CONTROL FUNCTION



SEP04052

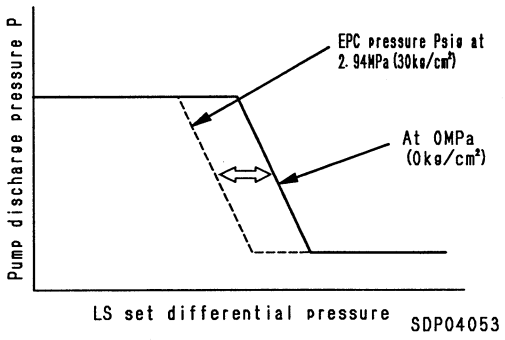
FUNCTION

- The following functions are available to provide the optimum matching under various working conditions: a cut-off function which reduces the relief loss; a function which cancels the cut-off function and prevents the speed from dropping; a 2-stage relief function which increases the digging power; and a fine control mode function which improves the ease of fine control.

1) LS control function

- The switching point (LS set differential pressure) for the pump discharge amount inside the LS valve is changed by changing the output pressure from the LS control EPC valve to the LS valve according to the engine speed and operating condition of the actuator.
- Because of this, the timing for starting the discharge amount from the pump can be optimized, to give excellent ease of compound operation and fine control.

★ For details of the operation, see HYDRAULIC PUMP.

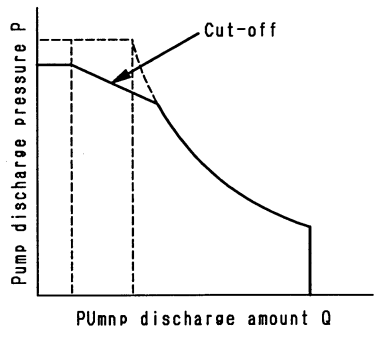


SDP04053

2) Cut-off function

- If the load becomes larger during operation, and the pump discharge pressure rises to close to the relief pressure, the pump pressure sensor detects this, and the controller sends a signal to the PC valve to reduce the discharge amount, thereby reducing the relief loss.

★ For details of the operation, see CLSS.

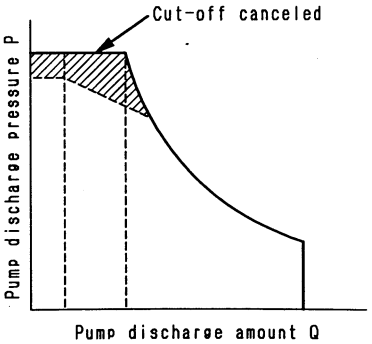


SDP04054

3) Cut-off cancel function

- The cut-off cancel function acts to stop the operation of the cut-off function in order to ensure the pump flow when close to the relief pressure, thereby preventing any drop in speed.
- The relief pressure when the cut-off is operated is 31.85MPa {325 kg/cm²}, and when the cut-off cancel function is operated, the relief pressure becomes approx. 34.79MPa {355 kg/cm²}.
- Actuation conditions for cut-off cancel function

• When traveling • When swing lock switch is ON • In lifting operation (L/O) mode • When power max. function or swift slow-down function are actuated • Heavy-duty operation (H/O) • Active mode



SDP04055

★ Quick warming up for hydraulic oil when swing lock switch is ON:
When the swing lock switch is turned ON, the cut-off function is canceled.
If the work equipment is relieved in this condition, the temperature of the hydraulic oil can be raised more quickly to reduce the warming up time.

4) 2-stage relief function

- The relief pressure for normal operations is 31.85MPa (325 kg/cm²), but when the 2-stage relief function is actuated, the relief pressure rises to approx. 34.79MPa (355 kg/cm²).
  Because of this, the hydraulic pressure is increased by one stage.
- When the 2-stage relief function is actuated, the cut-off cancel function is also actuated automatically.

- Actuating conditions for 2-stage relief function

Conditions	Relief pressure
• When traveling • When swing lock switch is ON • In lifting operation (L/O) mode • When power max. function or swift slow-down function are actuated • Active mode	31.9 MPa {325kg/cm²} ⇩ 34.8 MPa {355kg/cm²}

5) Fine control mode function

- When the finishing operation (F/O) mode is selected from the working mode, the pump LS valve is controlled, and the pump discharge amount is reduced to improve the ease of fine control and the precision when finishing.

- Relationship between working mode and pump discharge amount (for independent operation) (%)

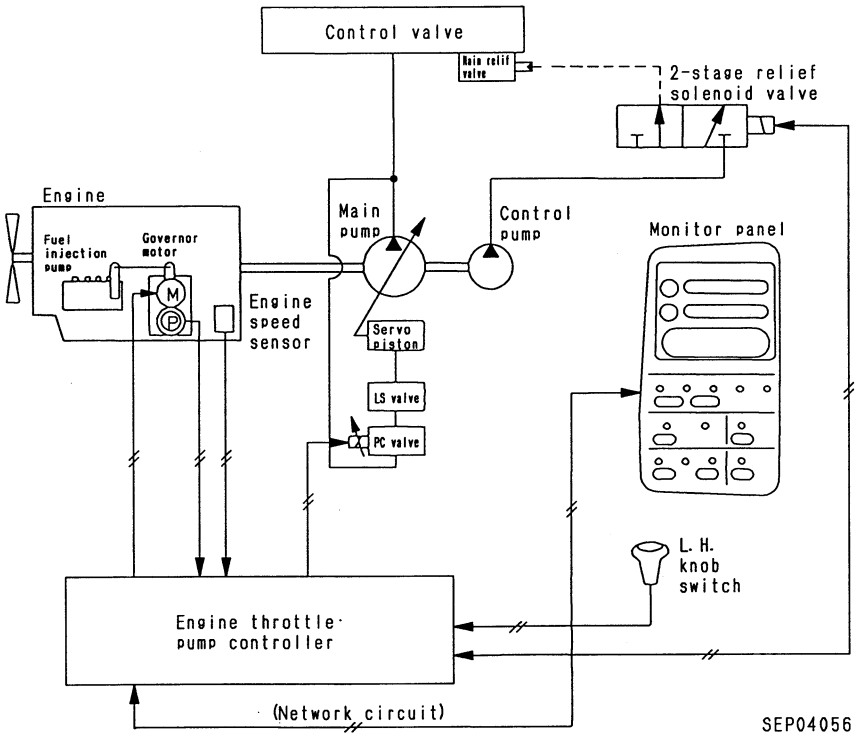
Actuator / Mode	Boom		Arm		Bucket	Swing
	RAISE	LOWER	IN	OUT		
Heavy-duty operation (H/O)	100	50	100	100	50	50
Active operation						
General operation (G/O)						
Finishing operation (F/O)	80	50	60	80	40	40
Lifting operation mode (L/O)	100	50	100	100	50	50
Breaker operation (B/O)						

6) LS bypass function

- When the travel is operated at the same time as the work equipment or swing, the pressure compensation function in the CLSS circuit is weakened to reduce the drop in the travel speed to the minimum.
- With this mechanism, the pressure is controlled so that the LS pressure in the CLSS circuit is made lower than the actual pressure when the travel is operated together with the work equipment or swing. In this way the pressure compensation function is weakened.

★ For details of the operation, see CLSS.

3. POWER MAXIMIZING AND SWIFT SLOW-DOWN FUNCTION



FUNCTION

- This function provides an increase in the digging power for a certain time or switches the working mode to the lifting operation (L/O) and reduced the speed. It is operated using the L.H. knob switch to momentarily match the operating conditions.

★ The power max. function and swift slow-down function are operated with the same switch. Only one of these functions can be selected at any time; they cannot both be operated together.

1) Power max. function

- During digging operations, when that extra bit of digging power is needed (for example, when digging up boulders), the L.H. knob switch can be pressed to raise the hydraulic pressure by approx. 10% and increase the digging force.
- If the L.H. knob switch is pressed ON when the working mode is at H/O or G/O, each function is automatically set as follows.

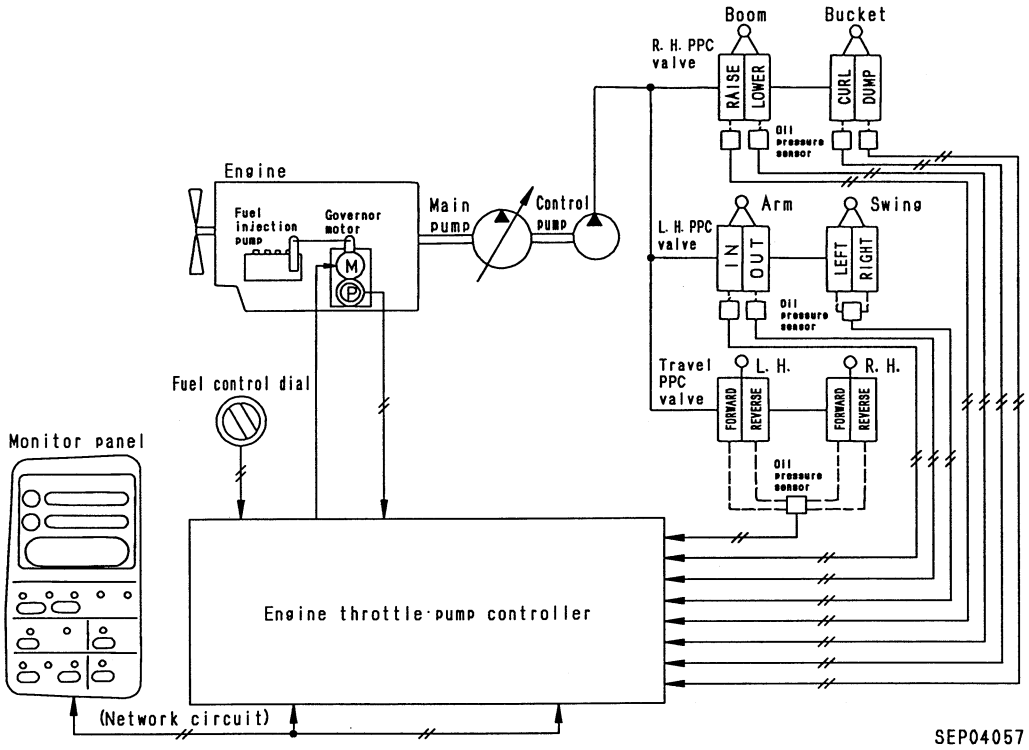
Working mode	Cut-off function	2-stage relief function	Actuating time
Heavy-duty operation (H/O)	Canceled	Actuated 31.85 → 34.79MPa {325 → 355 kg/cm²}	Automatically canceled after 8.5 sec

2) Swift slow-down function

- During normal operations, if it is desired to carry out lifting operations or finishing operations for a moment, the working mode can be switched to lifting operation (L/O) mode by operating the L.H. knob switch.
- If the L.H. knob switch is pressed ON when the working mode is at H/O or G/O, each function is automatically set as follows.

Working mode	Actuating time
Lifting operation (L/O)	While switch is kept pressed

4. AUTO-DECELERATION FUNCTION



FUNCTION

- If all the control levers are at neutral when waiting for work or waiting for a dump truck, the engine speed is automatically reduced to a midrange speed to reduce fuel consumption and noise.
- If any lever is operated, the engine speed returns immediately to the set speed.

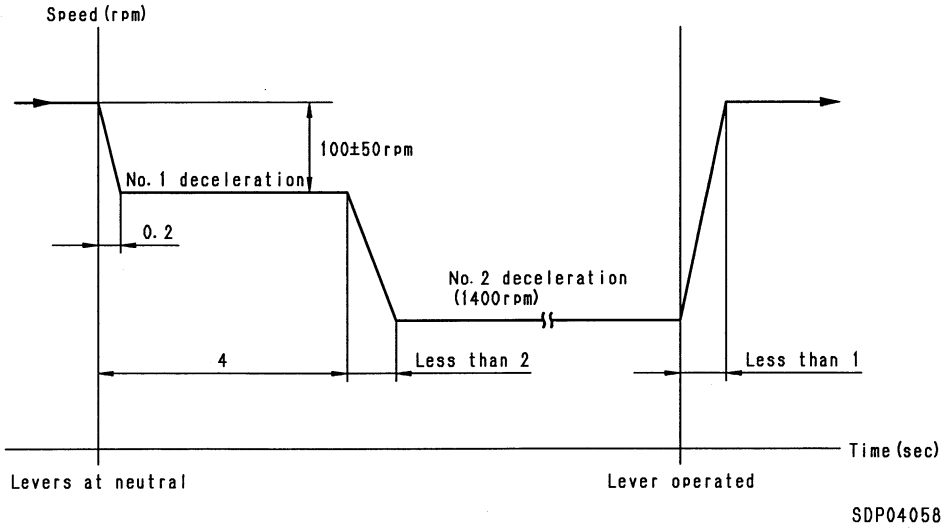
OPERATION

Control levers at neutral

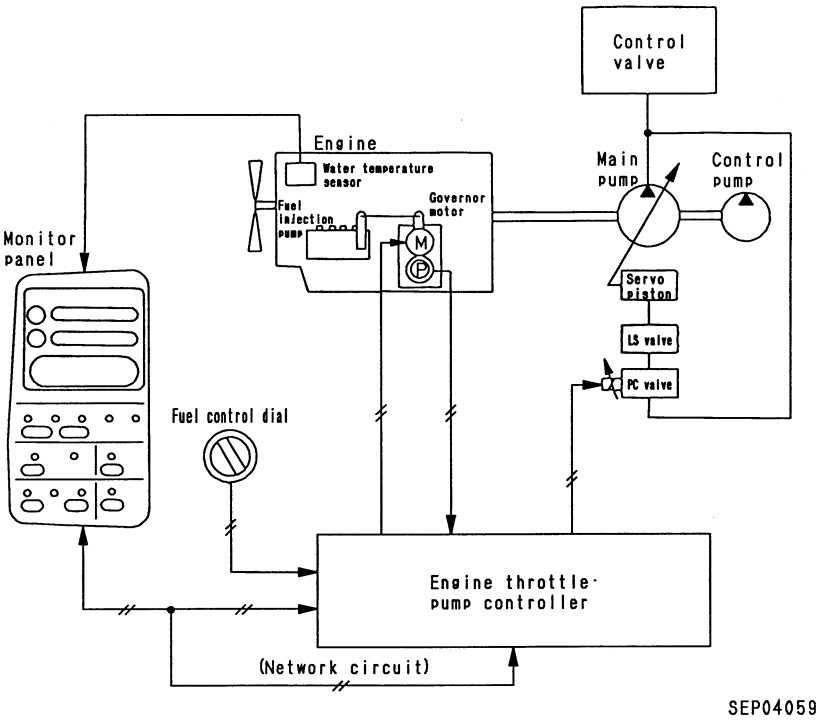
- If the engine is running at above the deceleration actuation speed (approx. 1400 rpm), and all the control levers are returned to neutral, the engine speed drops immediately to approx. 100 rpm below the set speed to the No. 1 deceleration position.
- If another 4 seconds passes, the engine speed is reduced to the No. 2 deceleration position (approx. 1400 rpm), and is kept at that speed until a lever is operated.

When control lever is operated

- If any control lever is operated when the engine speed is at No. 2 deceleration, the engine speed will immediately rise to the speed set by the fuel control dial.



5. AUTOMATIC WARMING-UP AND ENGINE OVERHEAT PREVENTION FUNCTION

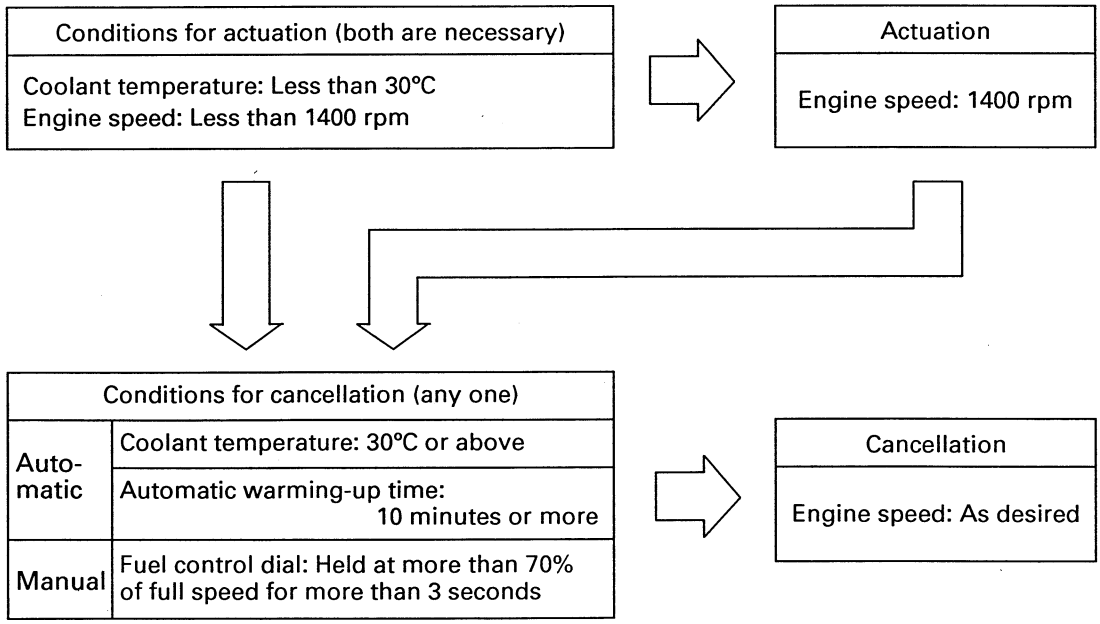


FUNCTION

- If the coolant temperature is low, this automatically raises the engine speed to warm up the engine after it is started. (Automatic warming-up function)
  In addition, if the coolant temperature rises too high during operations, it reduces the load of the pump to prevent overheating. (Engine overheat prevention function)

1) Engine automatic warming-up function

- After the engine is started, if the engine coolant temperature is low, the engine speed is automatically raised to warm up the engine.



2) Engine overheat prevention function

- This function protects the engine by lowering the pump load and engine speed to prevent overheating when the engine coolant temperature has risen too far.
- This system is actuated in two stages. The first stage is when the coolant temperature is between 102°C and 105°C, and the second stage is when the coolant temperature is 105°C and above.

Normal operation
(coolant temperature below 102°C)

Actuation condition	
Normal operation	Coolant temperature: Below 102°C (Coolant temperature gauge: Green range)

1st stage (Coolant temperature between 102°C and 105°C)

Actuation condition	
1st stage	Coolant temperature: Between 102°C and 105°C (Coolant temperature gauge: Red range)

Actuation, remedy	
Heavy-duty General Finishing Breaker	40kW {54 HP}
	Flow 70%
	Mode kept as it is, output reduced
Lifting	Lifting operation kept as it is

Cancel condition	
2nd stage	Coolant temperature: Below 102°C
	When the above condition is met, the system returns to the condition before the overheat prevention function was actuated (automatic reset).

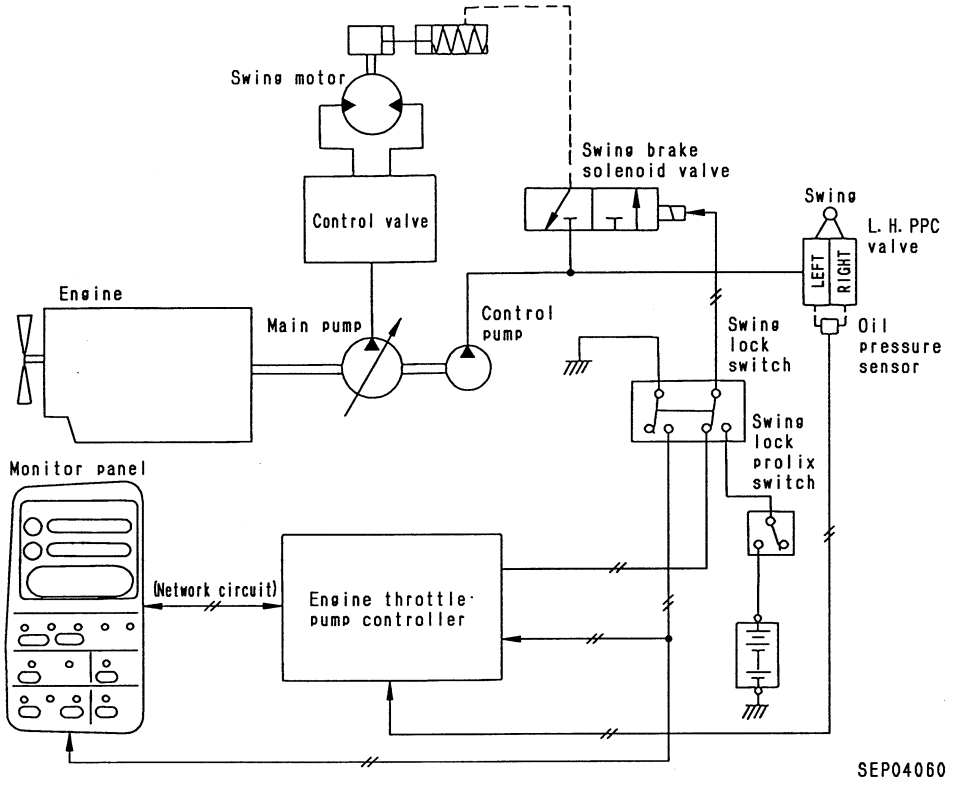
2nd stage (coolant temperature 105°C and above)

Actuation condition	
2nd stage	Coolant temperature: 105°C and above (Coolant temperature gauge: Red range)

Actuation, remedy	
Working mode	In any mode
Engine speed	Low idling
Monitor caution lamp	Lights up
Caution buzzer	Sounds

Cancel condition	
2nd stage	Coolant temperature: Below 102°C Fuel control dial: Return temporarily to low idling position
	When the above conditions are met, the system returns to the condition before the overheat prevention function was actuated (manual reset).

6. SWING CONTROL FUNCTION



FUNCTION

- The system is provided with a swing lock and swing holding brake function.

1) Swing lock, swing holding brake function

- The swing lock (manual) can be locked at any desired position, and the swing holding brake (automatic) is interconnected with the swing, so it prevents any hydraulic drift after the swing is stopped.

※ Operation of swing lock prolix switch

- If any abnormality should occur in the controller, and the swing holding brake is not actuated normally and the swing cannot be operated, the swing lock prolix switch can be operated to cancel the swing lock and allow the swing to be operated.

★ Even when the swing lock prolix switch is turned ON, the swing lock switch stays ON and the swing brake is not canceled.

★ When the swing brake is canceled, the swing has only a hydraulic brake operated by the safety valve, so if the swing is stopped on a slope, there may be hydraulic drift.

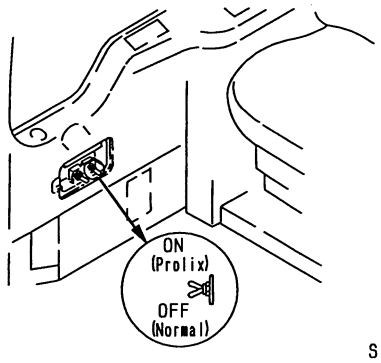
2) Hydraulic oil quick warm-up function when swing lock switch is ON

★ For details, see PUMP AND VALVE CONTROL FUNCTION.

- Swing lock switch and swing lock, holding brake

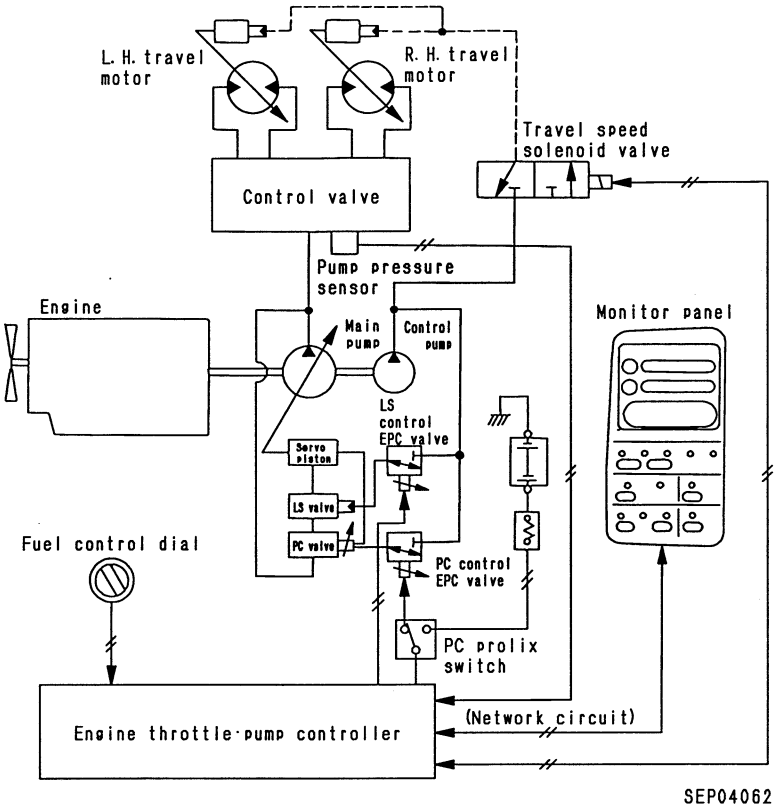
Lock switch	Lock lamp	Function	Operation
OFF	OFF	Swing holding brake	When swing lever is placed at neutral, swing brake is applied after approx. 4 sec; when swing lever is operated, brake is canceled and swing can be operated freely.
ON	ON	Swing lock	Swing lock is actuated and swing is held in position. Even when swing lever is operated, swing lock is not canceld and swing does not move.

Swing lock prolix switch	ON (when controller is abnormal)		OFF (when controller is normal)	
Swing lock switch	ON	OFF	ON	OFF
Swing brake	Swing lock applied	Swing lock canceled	Swing lock applied	Swing holding brake applied



SEP04061

7. TRAVEL CONTROL FUNCTION



FUNCTION

- When traveling, the pump control is carried out, and the travel speed can be selected manually or automatically to give a travel performance that suits the nature of the work or the jobsite.

1) Pump control function when traveling
- If the travel is operated in any working mode other than the heavy-duty operation (H/O) mode, this increases the pump absorption torque while keeping the working mode and engine speed as they are.

★ For details, see PUMP & ENGINE MUTUAL CONTROL FUNCTION.

2) LS bypass function during simultaneous operation of travel + work equipment or swing
- When the travel is operated simultaneously with the work equipment or swing, the pressure compensation function of the CLSS circuit is weakened and the drop in the travel speed is kept to the minimum.

★ For details, see PUMP AND VALVE CONTROL FUNCTION.

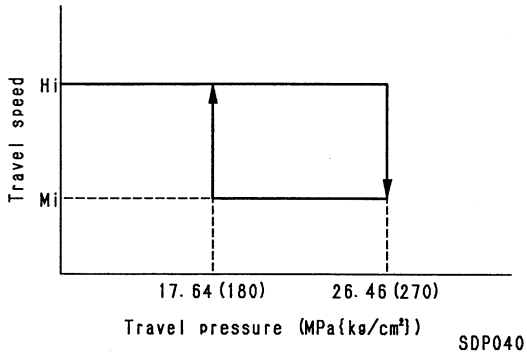
3) Travel speed selection function

i) Manual selection using travel speed switch
If the travel speed switch is set to Lo, Mi, or Hi, the pump controller controls the pump flow and motor volume at each speed range as follows to switch the travel speed.

ii) Automatic selection according to engine speed
If the engine speed is reduced to below 1400 rpm by the fuel control dial:
- If the machine is traveling in Lo, it will not shift even if Mi or Hi are selected.
- If the machine is traveling in Mi, it will not shift even if Hi is selected.
- If the machine is traveling in Hi, it will automatically shift to Mi.

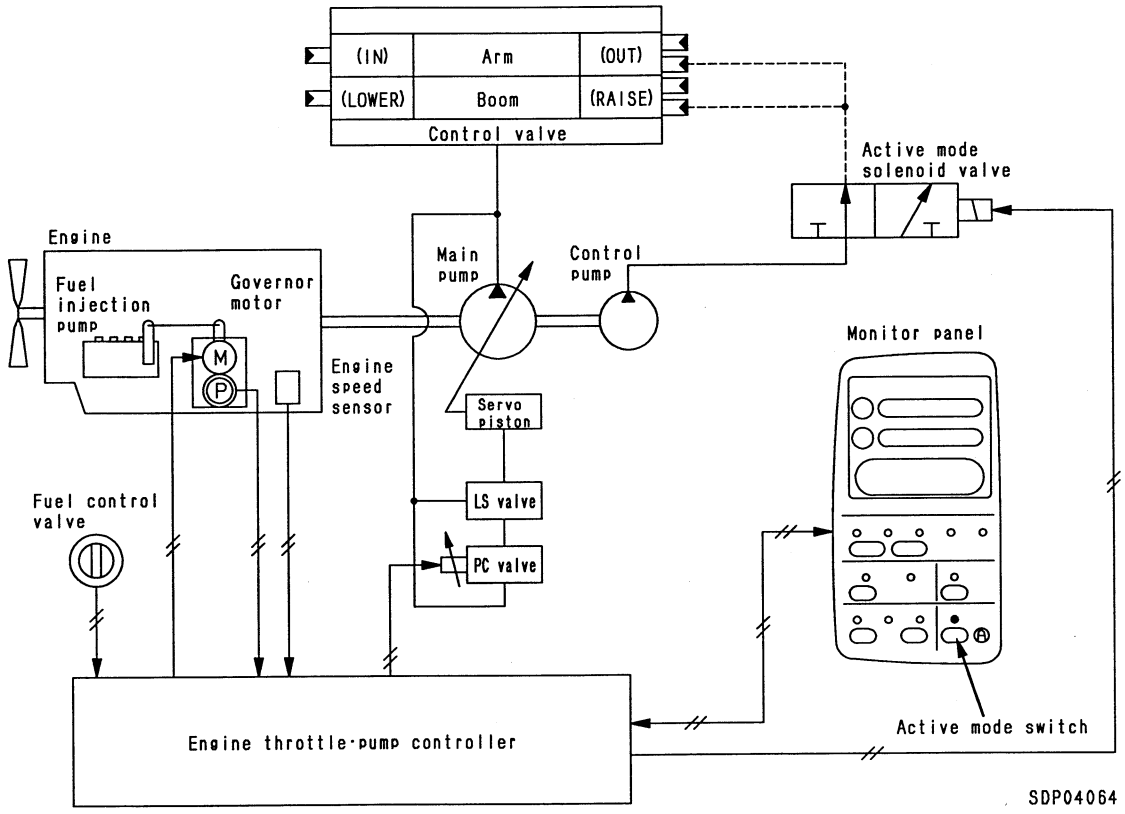
Travel speed switch	Lo (Low speed)	Mi (Mid-range speed)	Hi (High speed)
Pump flow (%)	80	100	100
Motor volume	Max.	Max.	Min.
Travel speed (km/h)	2.7	3.5	5.5

iii) Automatic selection according to pump discharge pressure
If the machine is traveling with the travel speed switch at Hi, and the load increases, such as when traveling up a steep hill, if the travel pressure continues at 26.5MPa {270 kg/cm^2} for more than 0.2 sec, the motor volume is automatically switched and the travel speed changes to Mi.
(The travel speed switch stays at Hi.)
The machine continues to travel in Mi, and when the load is reduced, such as when the machine travels again on flat ground or goes downhill, and the travel pressure stays at 17.6MPa {180 kg/cm^2} or less for more than 0.06 sec, the motor volume is automatically switched and the travel speed returns to Hi.



SDP04063

8. ACTIVE MODE FUNCTION



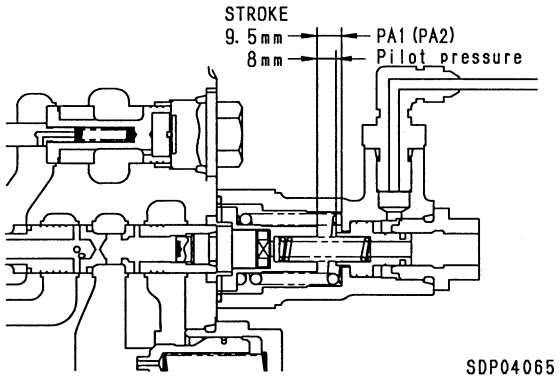
Function

- If the active mode switch on the monitor panel is turned ON (lights up), the speed is increased when there is a light load and the load is detected when there is a heavy load. This makes it possible to speed up the operation.

★ The active mode functions only when the fuel control dial is Max position.

1) Pump absorption horsepower increase, engine speed increase function

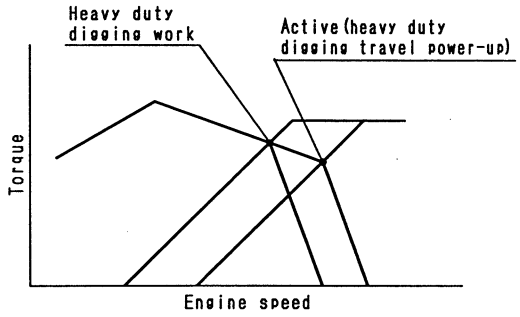
- The cycle time is reduced by increasing the engine speed and pump absorption horsepower. In addition, by increasing the pump absorption horsepower, the bucket raise speed can be increased during hoist and swing operations to provide more effective dump truck loading operations.



SDP04065

2) 2-stage boom LOWER, arm IN speed function

When the active mode switch is turned ON (the active mode solenoid is OFF), the control valve spool stroke when lowering the boom or when moving the arm in is changed from 8 mm to 9.5 mm, and the speed is increased.



SDP04066

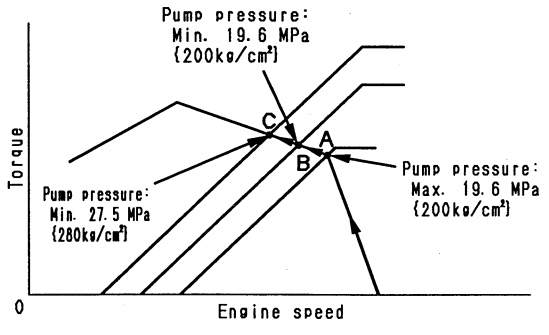
Heavy-duty digging operations	Active
62.5 kW/2,000rpm {83.8 HP)/2,000rpm}	63.9 kW/2,200rpm {85.8 HP)/2,200rpm}

3) Change function for matching point of engine and pump

When the active mode switch is turned ON, if the load is heavy, the matching point of the engine and pump changes, and the engine speed is reduced (100 – 200 rpm) to enable operations to be carried out while detecting the load.

Engine speed

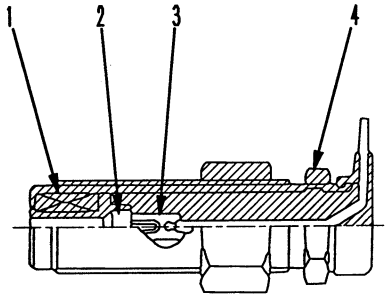
Speed A	Speed B	Speed C
2,200 rpm	2,100 rpm	2,000 rpm

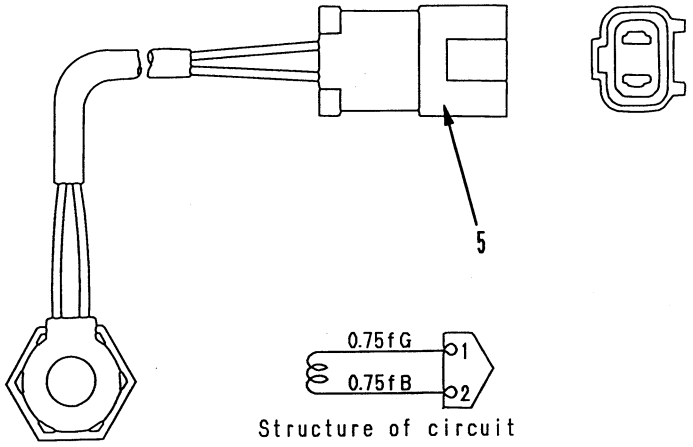


SDP04067

9. COMPOMENTS OF SYSTEM

ENGINE SPEED SENSOR





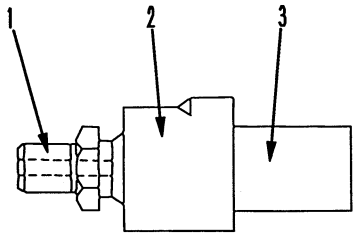
SEP02581

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

Function

- The engine speed sensor is installed to the ring gear portion of the engine flywheel. It counts electrically the number of gear teeth that pass in front of the sensor, and sends the results to the engine throttle • pump controller.
- This detection is carried out by a magnet, and an electric current is generated every time the gear tooth passes in front of the magnet.

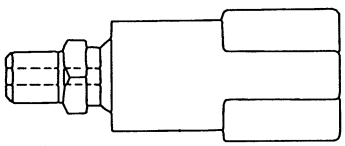
PPC OIL PRESSURE SWITCH

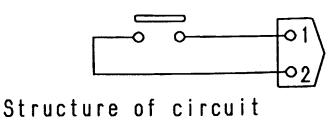


1. Plug
2. Switch
3. Connector

Specifications

Compasition of points: N.O. points
Actuation (ON) pressure:
0.49 ± 0.1 MPa {5.0 ± 1.0 kg/cm²}
Reset (OFF) pressure:
0.29 ± 0.05 MPa {3.0 ± 0.5 kg/cm²}



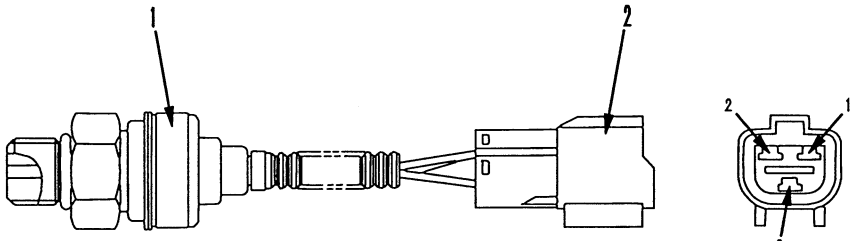


SEP02582

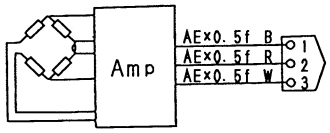
Function

- There are switches installed to the junction box. The operating conditions of each actuator is detected from the PPC pressure, and this is sent to the engine throttle • pump controller.

PUMP PRESSURE SENSOR



1. Sensor
2. Connector



Structure of circuit

SEP02584

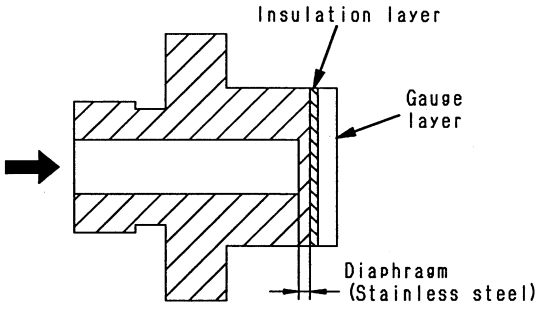
Function

- Two sensors are mounted in each actuator circuit of the boom and arm (four sensors in total). The load pressure on the actuator is converted to the voltage and sent to the engine throttle • pump controller.

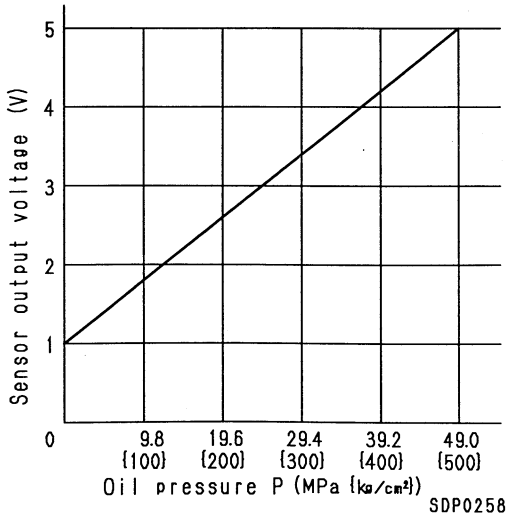
Operation

- When the oil entering from the pressure inlet applies pressure to the diaphragm of the oil pressure detector, the diaphragm is deflected and deformed.
- A gauge layer is mounted at the opposite side of the diaphragm and the resistance value of the gauge converts the deflection of the diaphragm into the output voltage and sends it to the amplifier (voltage amplifier).
- The voltage is further amplified by the amplifier and sent to the engine throttle • pump controller.
- The relational expression of the pressure P (MPa, {kg/cm^2}) and the output voltage (V):

$$V = 0.008 \times P + 1.0$$

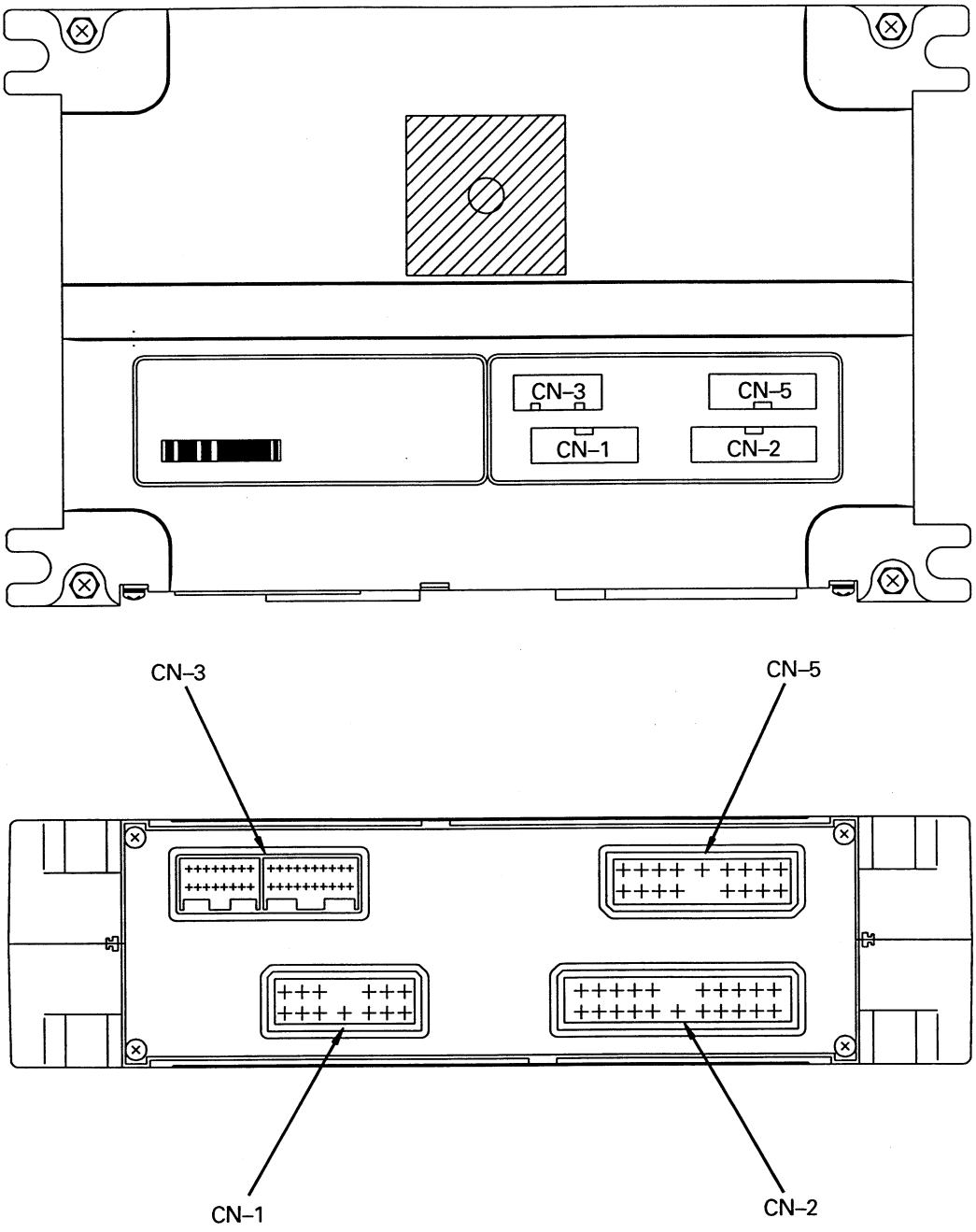


SDP02585



SDP02586

ENGINE THROTTLE•PUMP CONTROLLER



SAP00327

Input and output signals

CN-1

Pin No.	Name of signal	Input/ output
1	Battery relay drive output	Output
2	Pump merge-divider solenoid/ LS cut-off solenoid	Output
3	Swing holding brake solenoid	Output
4	NC	–
5	NC	–
6	GND	Input
7	Power source (+24V)	Input
8	LS divider solenoid/speed mode solenoid	Output
9	Travel selector solenoid	Output
10	2-stage relief solenoid	Output
11	NC	–
12	GND	Input
13	Power source (+24V)	Input

CN-2

Pin No.	Name of signal	Input/ output
1	Solenoid power source (+24V)	Input
2	Governor motor phase A (+)	Output
3	Governor motor phase A (-)	Output
4	Governor motor phase B (+)	Output
5	Governor motor phase B (-)	Output
6	NC	–
7	LS-EPC solenoid (+)	Output
8	PC solenoid 1 (+)	Output
9	PC solenoid 2 (+)	Output
10	NC	–
11	PGND	Input
12	Solenoid power source (+24V)	Input
13	NC	–
14	NC	–
15	NC	–
16	NC	–
17	LS-EPC solenoid (-)	Ouput
18	PC solenoid 1 (-)	Ouput
19	PC solenoid 2 (-)	Ouput
20	NC	–
21	PGND	Input

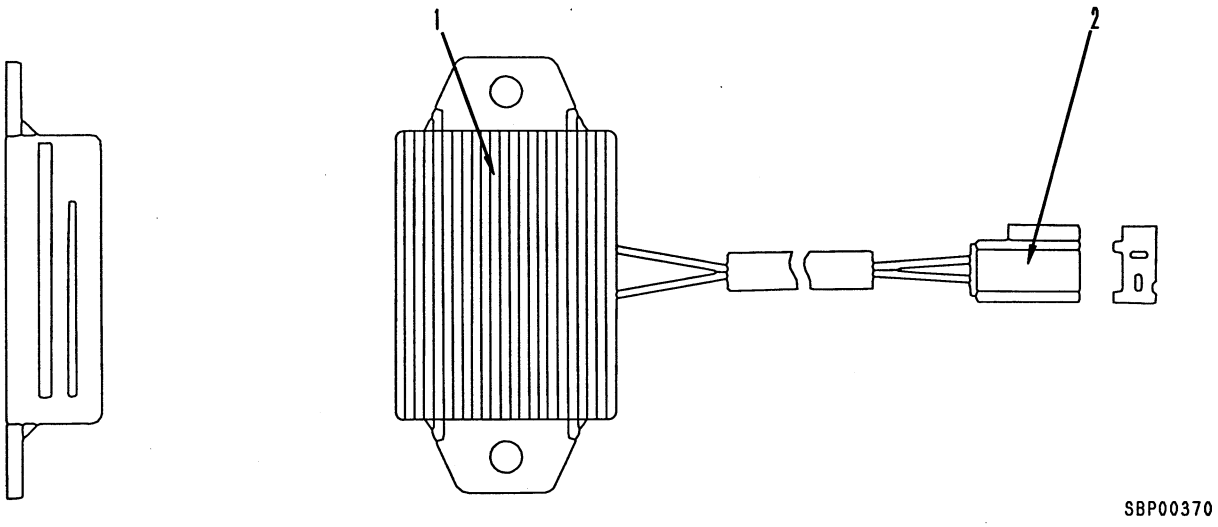
CN-3

Pin No.	Name of signal	Input/ output
1	Engine water temperature sensor	Input
2	Fuel level sensor	Input
3	Pump F pressure input	Input
4	Throttle potentiometer input	Input
5	NC	–
6	Pressure sensor power source (+24V)	Output
7	Potentiometer power source (+5V)	Output
8	Starting switch (ACC)	Input
9	Knob switch	Input
10	Hydraulic oil temperature sensor (monitor panel)	Input
11	Hydraulic oil temperature sensor (thermistor type)	Input
12	Battery charge (alternator terminal R)	Input
13	Pump R pressure input	Input
14	Feedback potentiometer input	Input
15	NC	–
16	Pressure sensor GND	Input
17	Potentiometer GND	Input
18	Starting switch (terminal C)	Input
19	Automatic greasing controller abnormality	Input
20	Hydraulic filter sensor	Input
21	PPC pressure	Input
22	Boom RAISE pressure switch	Input
23	Arm IN†pressure switch	Input
24	S-NET (+)	Input, output
25	Model selection 1	Input
26	Model selection 3	Input
27	Model selection 5	Input
28	Swing prolix switch	Input
29	Overload sensor	Input
30	Boom LOWER pressure switch	Input
31	Arm OUT pressure switch	Input
32	S-NET (+)	Input, output
33	Model selection 2	Input
34	Model selection 4	Input
35	Kerosene mode selection	Input
36	Swing lock switch	Input

CN-5

Pin No.	Name of signal	Input/ output
1	Engine speed sensor GND	Input
2	Engine speed sensor	Input
3	GND	Input
4	GND	Input
5	Swing pressure switch	Input
6	Service valve pressure switch	Input
7	Engine oil pressure sensor H	Input
8	Radiator water level sensor	Input
9	Hydraulic oil level sensor	Input
10	Engine speed sensor GND	Input
11	Bucket CURL pressure switch	Input
12	Bucket DUMP pressure switch	Input
13	Travel pressure switch	Input
14	NC	–
15	Engine oil pressure sensor L	Input
16	Engine oil level sensor	Input
17	Air cleaner clogging sensor	Input

PC PROLIX RESISTOR



1. Resistor
2. Connector

SPECIFICATION
Resistance: 30Ω

FUNCTION
- This resistor acts to allow a suitable current to flow to the PC solenoid when the PC prolix switch is ON.
- No current flows when the PC prolix switch is OFF.

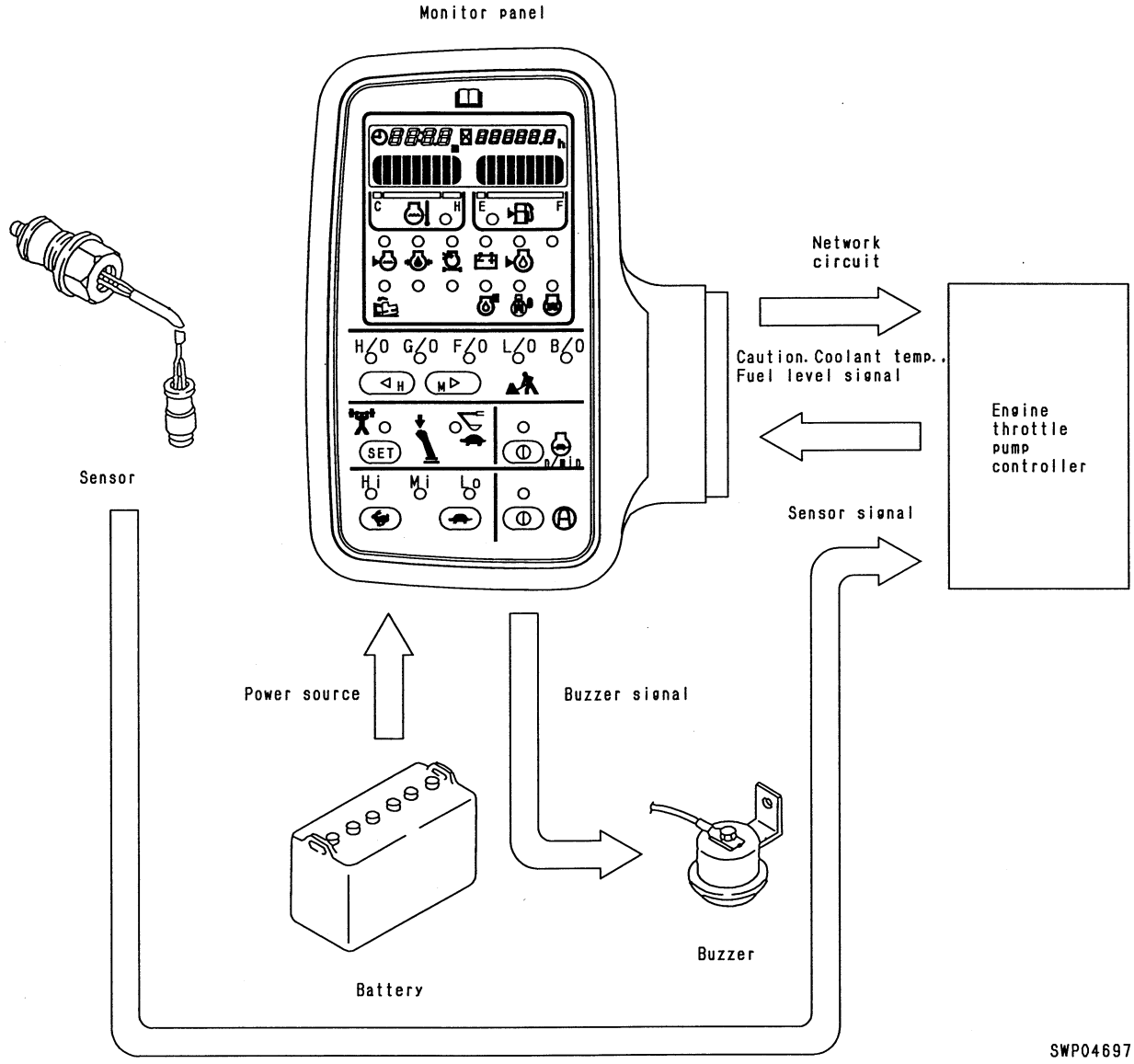
FUEL CONTROL DIAL, GOVERNOR MOTOR, ENGINE THROTTLE•PUMP CONTROLLER)
★ See ENGINE CONTROL SYSTEM.

MONITOR PANEL
★ See MONITORING SYSTEM.

PC VALVE
★ See HYDRAULIC PUMP.

TRAVEL SPEED SOLENOID VALVE
SWING BRAKE SOLENOID VALVE
2-STAGE RELIEF SOLENOID VALVE
ACTIVE MODE SOLENOID VALVE
★ See EPC SOLENOID VALVE.

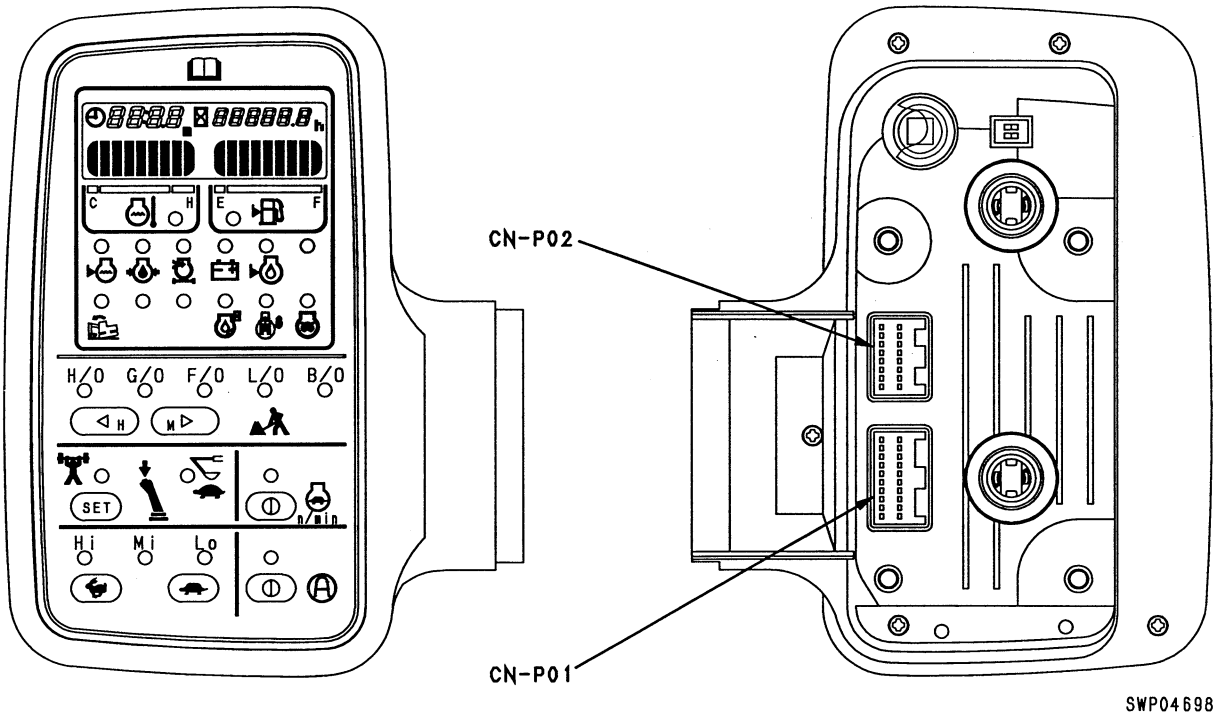
MACHINE MONITOR SYSYTEM



FUNCTION

- The machine monitor system uses the network circuits between the controllers and sensors installed to all parts of the machine to observe the condition of the machine. It processes this information, and displays it on a panel to inform the operator of the condition of the machine.
- The content of the information displayed on the machine can broadly be divided as follows.
  1. Monitor portion
     This gives an alarm if any abnormality occurs in the machine.
  2. Gauge portion
     This always displays the coolant temperature and fuel level.
  - The monitor panel has various mode selector switches, and also functions as the control panel for the electronic control system.

1. MONITOR PANEL



OUTLINE

- The monitor panel consists of the time display, monitor display, and mode selector switches.
- It has a built-in CPU (Central Processing Unit), and processes, displays, and outputs the data from the sensors and controllers.
- The monitor display and monitor display panels use a liquid crystal display (LCD) and LED lamp.
  The mode switches are flat sheet switches.

Input and output signals

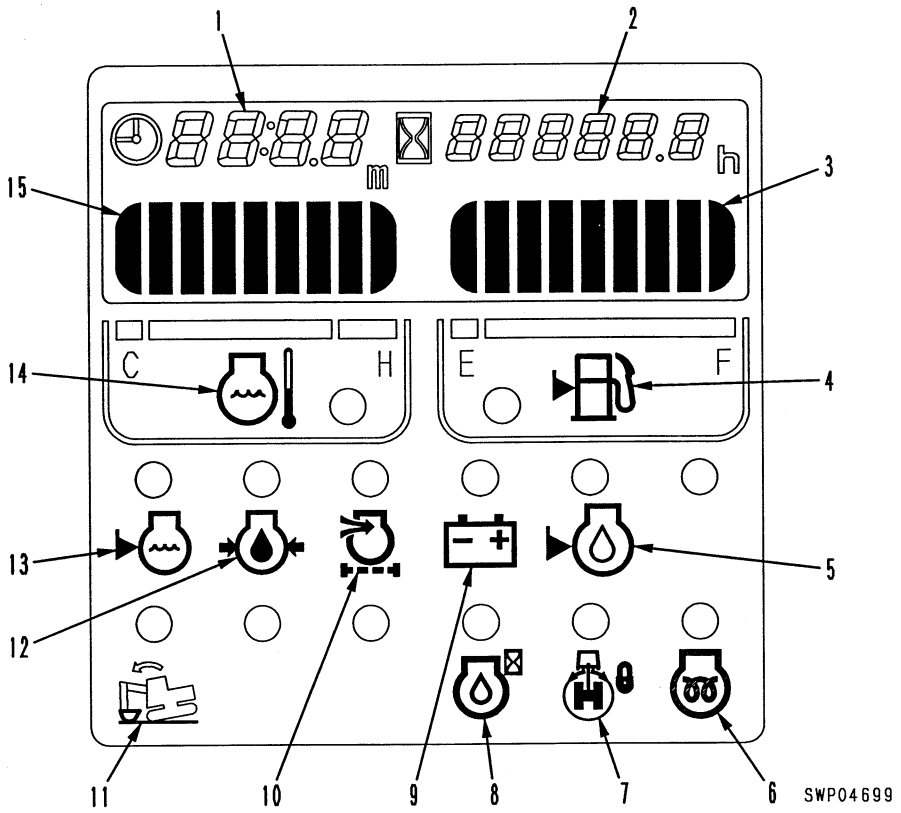
CN-P01

Pin No.	Name of signal
1	NC
2	NC
3	NC
4	Network signal
5	Swing lock
6	Buzzer cancel
7	Buzzer drive
8	Light
9	KEY ON signal
10	BR Terminal
11	Network signal
12	Network GND
13	NC
14	Network GND
15	NC
16	NC
17	NC
18	Preheating
19	Start signal
20	NC

CN-P02

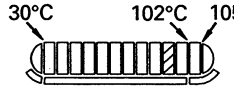
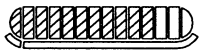
Pin No.	Name of signal
1	GND
2	Washer drive
3	Motor drive (Reverse)
4	Wiper switch (ON)
5	Wiper switch (Washer)
6	Limit switch
7	NC
8	+VB
9	GND
10	Washer drive
11	Motor drive (Normal)
12	Wiper switch (INT)
13	Limit switch (Window)
14	+VB
15	Limit switch (P)
16	NC

MONITOR DISPLAY



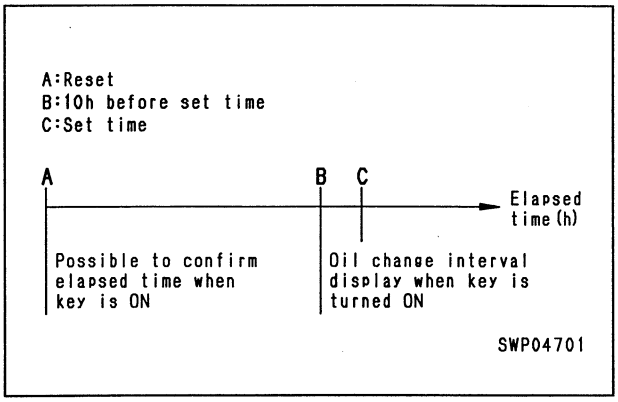
1. Clock (displays error when there is an error)
2. Service meter (Displays telephone number when there is an error)
3. Fuel level gauge
4. Fuel level caution lamp
5. Engine oil level caution lamp
6. Preheating pilot lamp
7. Swing lock pilot lamp
8. Oil maintenance pilot lamp
9. Battery charge caution lamp
10. Air cleaner clogging caution lamp
11. Overload caution lamp
12. Engine oil pressure caution lamp
13. Coolant level caution lamp
14. Coolant temperature caution lamp
15. Coolant temperature gauge

Content of display

Symbol	Display item	Display range	When engine is stopped	When engine is running
 SAP00519	Coolant level	Below low level	Flashes when abnormal	Flashes and buzzer sounds when abnormal
 SAP00520	Engine oil pressure	Below 1500 rpm: below 0.05 MPa {0.5 kg/cm²} Above 1500 rpm: above 0.15 MPa {1.5 kg/cm²}	Lights up when normal (goes out when engine starts)	Flashes and buzzer sounds when abnormal
 SAP00521	Air cleaner clogging	When clogged	Flashes when abnormal	OFF
 SAP00522	Charge level	When charging is defective	Lights up when normal (goes out when engine starts)	Flashes when abnormal
 SAP00523	Engine oil level	Below low level	Flashes when abnormal	OFF
 SAT00098	Parking (Swing lock)	When swing is locked	Lights up when swing lock switch is ON, flashes when swing lock prolix switch is ON	
 SAP02732	Oil maintenance	See section OIL MAINTENANCE FUNCTION of next page.		
 SWP04700	Overload	When overloaded	Lights up when warning switch is ON, and buzzer sounds	
 SAP00526	Preheating	During preheating	Lights up for 30 seconds when starting switch is at HEAT, then flashes for 10 seconds to indicate that preheating is completed	
 SAP00527	Coolant temperature	Flashes when above 102°C, flashes and buzzer sounds when above 105°C	 SAP00529	
 SAP00528	Fuel level	Flashes when below low level	 SAP00530 All light up below appropriate level	

OIL MAINTENANCE FUNCTION

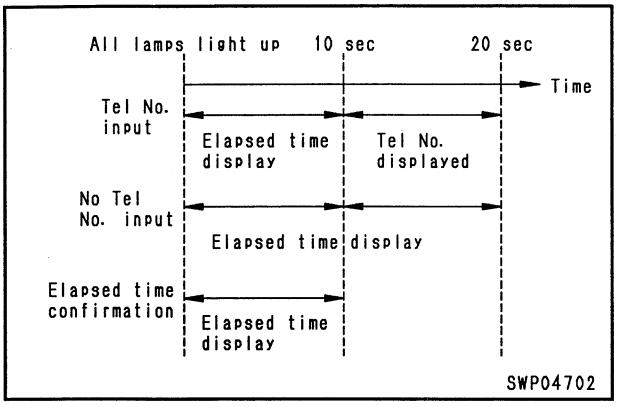
1. **Function, operation**
   The oil maintenance function uses LED lamps on the monitor panel to inform the operator at a fixed interval after the engine oil is changed that the oil change interval has been reached.
   At the same time, it also functions to display the service contact telephone number on the liquid crystal display.
   1) Confirmation of elapsed time
      Normally, no display is given until the elapsed time reaches the point **B** on the right diagram after reset. However, if the buzzer cancel switch is pressed and the key is turned to the ON position (with the buzzer cancel switch hold for 2.5 seconds), the elapsed time is displayed on the service meter display.
   2) Oil change display
      When the elapsed time has reached or passed the point **B** on the right diagram, the service meter display gives the elapsed time and the LED flashes when the key is turned ON.



2. **Setting change interval**
   1) The change interval can be set by using the interval setting mode. The time that can be set are [125 h], [250 h], [500 h], [no setting], and [demo mode]. The default setting is [no setting].
   2) To enter the change interval setting mode, keep the time switch and active mode switch (swing priority switch) pressed simultaneously for 2.5 seconds.
   3) If the buzzer cancel switch is pressed in the change interval setting mode, the time display will change from [...] → [125] → [250] → [500] → [d] ([...] indicates [no setting] and [d] indicates [demo mode]).
   4) To save the change interval time, set the monitor panel display to the desired time (mode), then keep the time switch and active mode switch (swing priority switch) pressed simultaneously for 2.5 seconds.

3. Display timing, content

1) Oil change display
   After all the lamps light up, the elapsed time is displayed for 10 seconds. For the next 10 seconds, the telephone number is displayed.
   However, if no telephone number has been input, the elapsed time is displayed for 20 seconds after all the lamps light up.
2) Elapsed time confirmation
   After all the lamps light up, the elapsed time is displayed for 10 seconds.



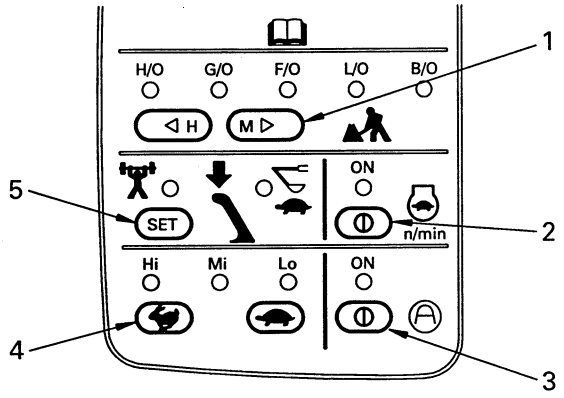
4. Elapsed time reset

1) During the oil change interval display and the elapsed time display, for 10 seconds after all lamps light up (during the elapsed time display), if the buzzer cancel switch is pressed and held for 3 seconds, the elapsed time is reset. When the elapsed time is reset, the elapsed time shows [0h] for 1 second.
2) When the set time is changed, the elapsed time is reset to 0h.

5. Demo mode

1) The set time in the demo mode is 250h and the elapsed time is set to 240h. When the key is turned ON, the oil change display is given. However, the elapsed time does not increase.
   It is also possible to carry out the reset operation during this display.
   In the demo mode, after the key is turned ON three times, the interval setting is automatically set to [no setting] from the 4th time. In addition, the elapsed time is reset to 0h and the elapsed time count starts.

MODE SELECTION SWITCHES



SDP00691

1. Working mode switch
2. Auto-deceleration switch
3. Active mode switch
4. Travel speed switch
5. Power max./Swift slow-down switch

Switch actuation table

- The bold letters indicate the default position of the switch when the starting switch is turned ON.

Switch	Item	Action
◁ H M ▷ SDP00692	WORKING MODE	↱ H/O ⟷ **G/O** ⟷ F/O ⟷ L/O ⟷ B/O ↰
SET SDP00693	LEVER SWITCH	**(POWER UP)** ⟷ (SPEED DOWN) SDP00694
n/min SDP00695	AUTO DECEL	**ON** ⟷ OFF (Note 1)
SDP00696	TRAVEL SPEED	Hi ⟷ Mi ⟷ **Lo**
SDP00697	ACTIVE MODE	**ON** ⟷ OFF (Note 2)

Note 1: If the working mode is operated F/O → G/O or L/O → B/O, the auto-deceleration switch is automatically turned ON if it is OFF. (If it is already ON, it stays ON.)
Conversely, if it is operated G/O → F/O or B/O → L/O, the auto-deceleration switch is automatically turned OFF if it is ON.

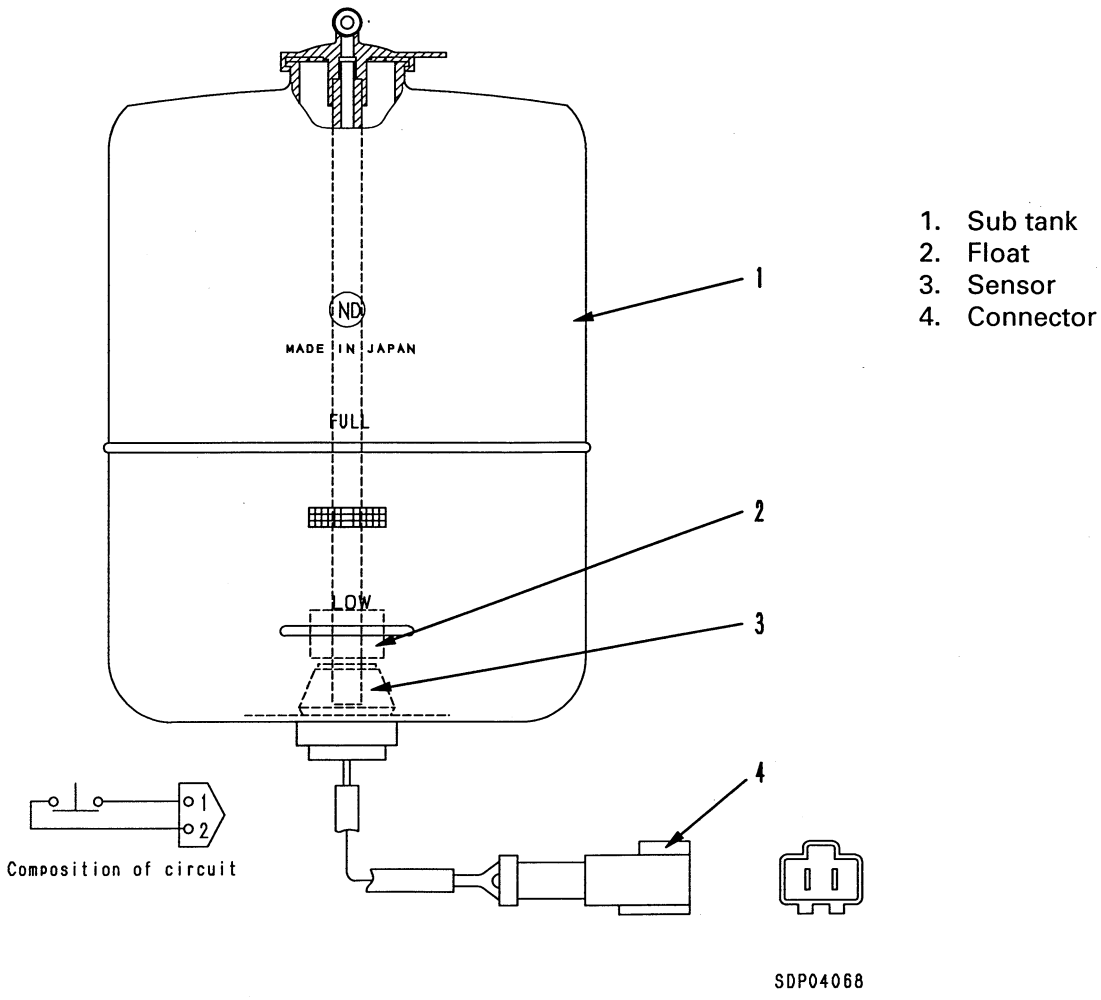
Note 2: Even if it is ON, when the working mode switch is pressed, it is automatically turned OFF.

2. SENSORS

- The signals from the sensors are input directly to the monitor panel.
- There are two types of sensors: contact type and resistance type.
  The contact type sensors are always connected at one end to the chassis GND.

Display	Name of sensor	Type of sensor	When normal	When abnormal
CHECK	Coolant level	Contact type	ON (close)	OFF (open)
	Engine oil level	Contact type	ON (close)	OFF (open)
CAUTION	Engine oil pressure Lo	Contact type	OFF (open)	ON (close)
	Engine oil pressure Hi	Contact type	OFF (open)	ON (close)
	Air cleaner clogging	Contact type	ON (close)	OFF (open)
GAUGE	Coolant temperature	Resistance type	—	—
	Fuel level	Resistance type	—	—

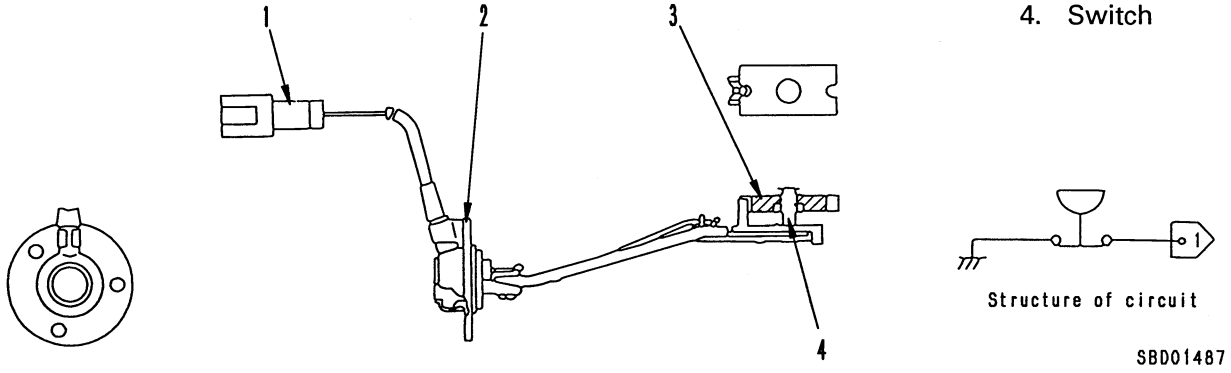
COOLANT LEVEL SENSOR



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

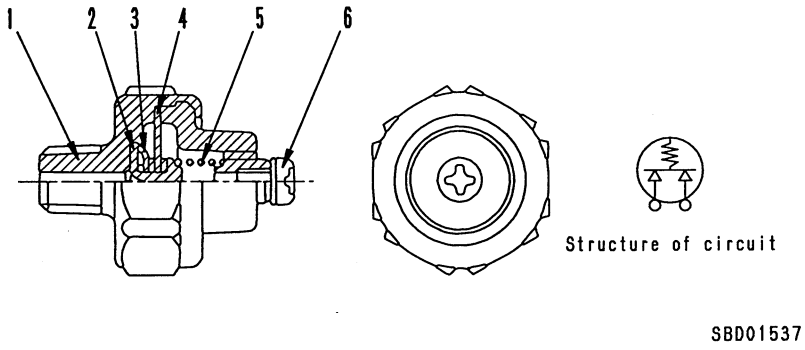
SDP04068

ENGINE OIL LEVEL SENSOR



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

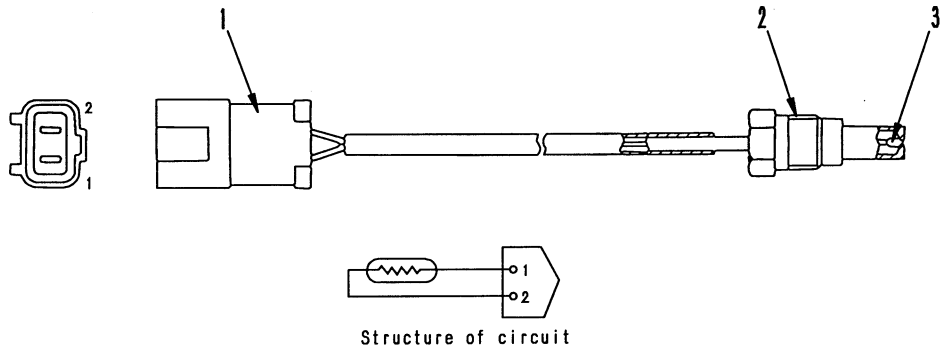
ENGINE OIL PRESSURE SENSOR (Lo, Hi)



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

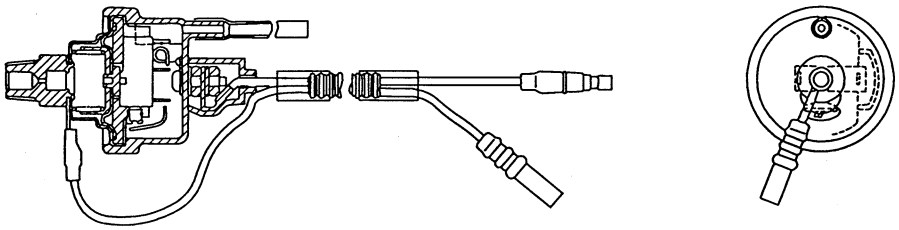
Actuation (ON) pressure
Lo: 0.05 ± 0.02 MPa
{0.5 ± 0.2 kg/cm²} or less
Hi: 0.15 ± 0.02 MPa
{1.5 ± 0.2 kg/cm²} or less

COOLANT TEMPERATURE SENSOR

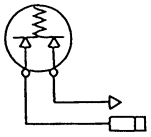


1. Connector
2. Plug
3. Thermistor

AIR CLEANER CLOGGING SENSOR



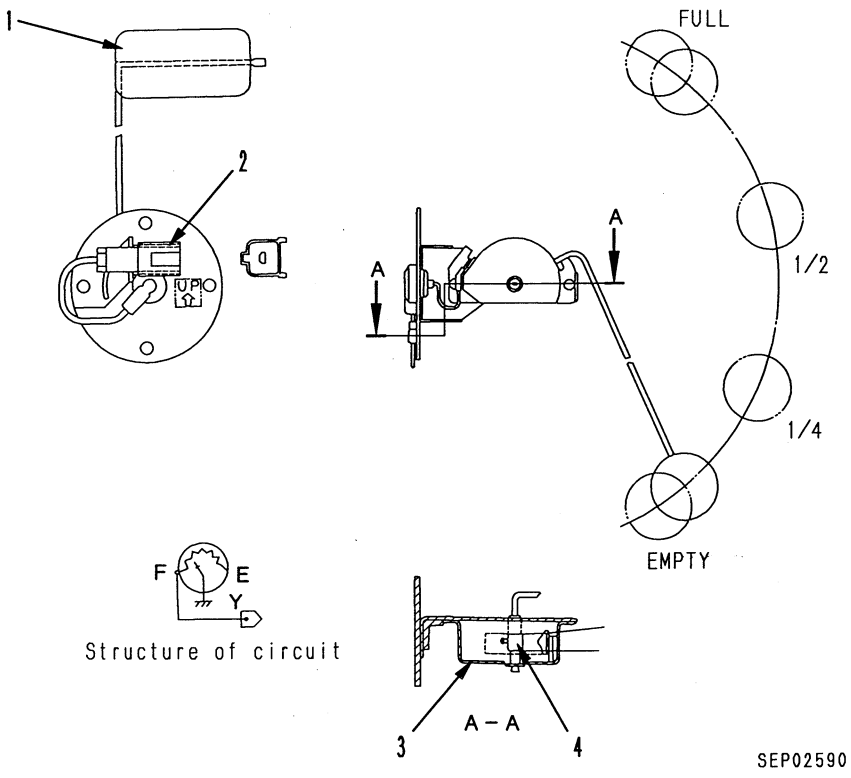
1. Boss
2. Filter
3. Spring
4. Guide
5. Diaphragm
6. Case
7. Hose
8. Connector



Structure of circuit
SEP01700

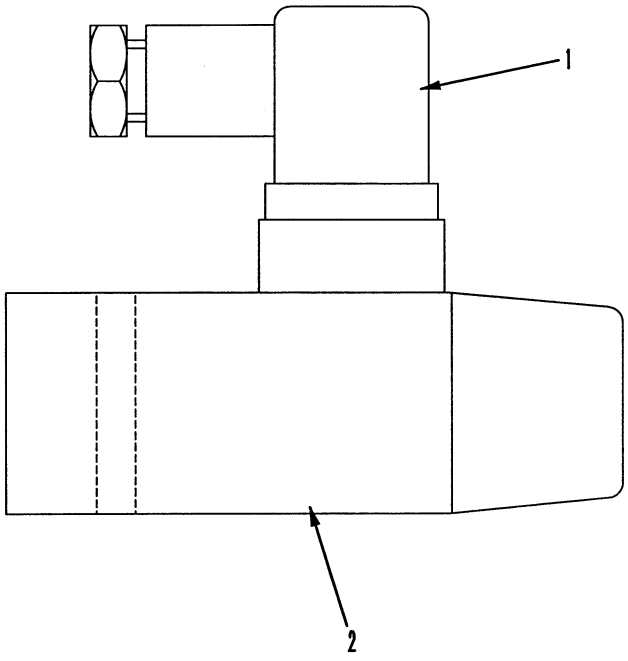
Actuation (OFF) pressure:
-7.47 ± 0.49 KPa
{-762 ± 50 mmH_2O}

FUEL LEVEL SENSOR

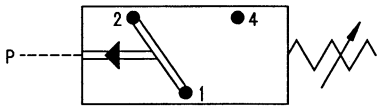


1. Float
2. Connector
3. Cover
4. Variable resistor

OVERLOAD WARNING PRESSURE SWITCH



1. Plug
2. Body



Structure of circuit

SWP04684

20

20 TESTING AND ADJUSTING

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

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.**

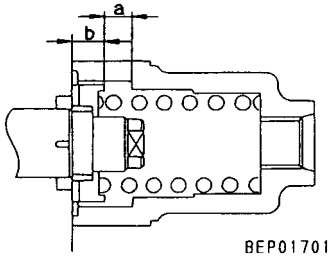
STANDARD VALUE TABLE FOR ENGINE RELATED PARTS

★ The Standard value for new machine and Service limit value in the table below are all values when measured in the heavy-duty operation (H/O) mode.

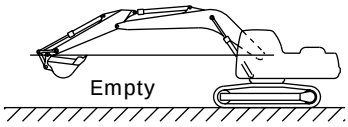
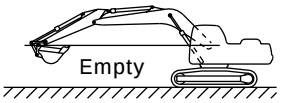
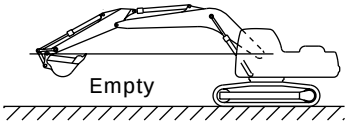
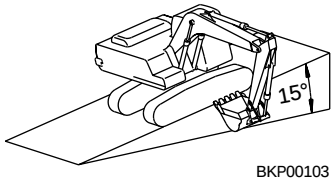
Applicable model				PC130-6K + PC150LGP-6K	
Engine				S4D102-1	
Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Engine speed	High idling		rpm	2,000 ± 100	—
	Low idling			900 ± 50	—
	Rated speed			2,000	—
Exhaust gas color	At sudden acceleration		Bosch index	Max. 5.5	7.5
	At high idling			Max. 1.0	2.0
Valve clearance	(normal temperaure) Intake valve Exhaust valve		mm	 0.25 0.51	 — —
Blow-by pressure	(Water temperature: Operating range) At rated output (SAE30 or SAE15W-40)		kPa {mmH_2O}	Max. 4.90 {50}	980 {100}
Oil pressure	(Water temperature: Operating range)		kPa {kg/cm^2}		
	At high idling (SAE30 or SAE15W-40)			343 – 686 {3.5 – 7.0}	245 {2.5}
	(SAE10W)			294 – 686 {3.0 – 7.0}	206 {2.1}
	At low idling (SAE30 or SAE15W-40)			Min. 98 {1.0}	69 {0.7}
	At low idling (SAE10W)			Min. 78.4 {0.8}	69 {0.7}
Oil temperature	Whole speed range (inside oil pan)		°C	80 – 110	120
Belt tension	Deflection when pressed with finger force of approx. 58.8N {6 kg}	Crankshaft pulley - air conditioner compressor	mm	12 - 15	12 - 15

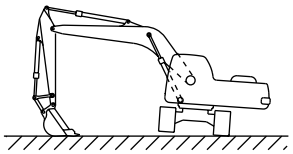
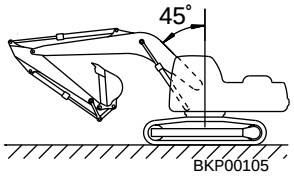
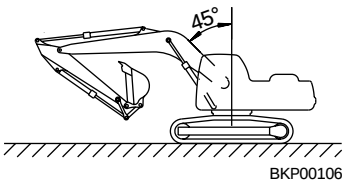
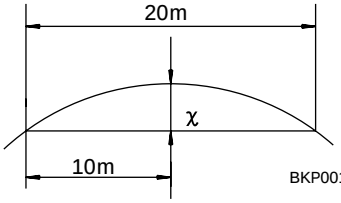
STANDARD VALUE TABLE FOR CHASSIS RELATED PARTS

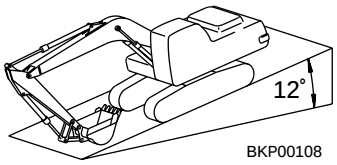
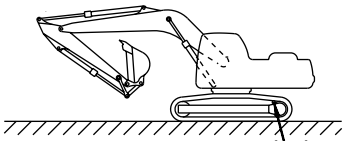
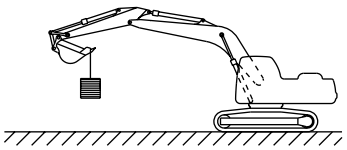
★ The Standard value for new machine and Service limit value in the table below are all values when measured in the heavy-duty mode.

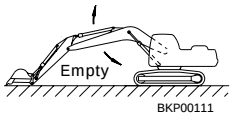
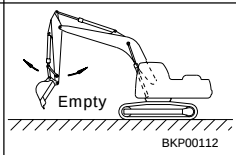
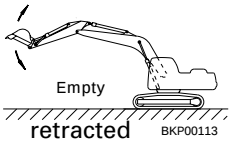
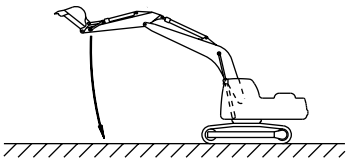
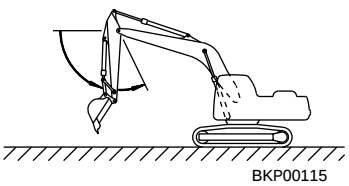
Applicable model				PC130-6K + PC150LGP-6K			
Category	Item	Measurement conditions	Unit	Standard value for new machine		Service limit value	
Engine speed	At 1-pump relief	· Hydraulic oil temperature: 45 – 55°C · Engine water temperature: Within operating range · 1-pump relief: Arm relief	rpm	1,950 ± 100		1,950 ± 100	
	At 1-pump relief (power max.)			Min. 1,800		Min. 1,800	
	Speed when auto deceleration is actuated	· Fuel control dial at MAX. · Control levers at neutral.		1,400 ± 200		1,400 ± 200	
Spool stroke	Boom control valve	 ★ ( ): Value when active mode is actuated	mm	a	b	a	b
	Arm control valve			8 ± 0.5	8 ± 0.5 (9.5 ± 0.5)	8 ± 0.5	8 ± 0.5 (9.5 ± 0.5)
	Bucket control valve						
	Swing control valve						
	Travel control valve			8 ± 0.5	8 ± 0.5	48 ± 0.5	48 ± 0.5
Travel of control levers	Boom control lever	· Center of lever knob · Measure max. value to end of travel · Engine stopped · Excluding neutral play	mm	85 ± 10		85 ± 10	
	Arm control lever			85 ± 10		85 ± 10	
	Bucket control lever			85 ± 10		85 ± 10	
	Swing control lever			85 ± 10		85 ± 10	
	Travel control lever			112 ± 15		112 ± 15	
	Play of control lever			10 ± 5		10 ± 5	

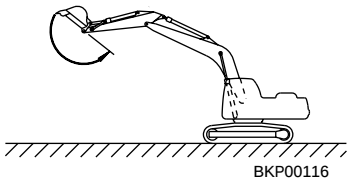
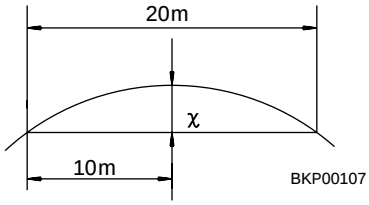
Applicable model					PC130-6K + PC150LGP-6K	
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Operating effort of control levers	Boom control lever	· Engine at full throttle · Hydraulic oil temperature: 45 – 55°C · Fit push-pull scale to center of control lever knob to measure (LEVER) · Measure max. value to end of travel · Tip of pedal (PEDAL)		N {kg}	15.7 ± 2.9 {1.6 ± 0.3}	Max. 24.5 {2.5}
	Arm control lever				15.7 ± 2.9 {1.6 ± 0.3}	Max. 24.5 {2.5}
	Bucket control lever				12.7 ± 2.9 {1.3 ± 0.3}	Max. 21.6 {2.2}
	Swing control lever				12.7 ± 2.9 {1.3 ± 0.3}	Max. 21.6 {2.2}
	Travel control lever		Lever		24.5 ± 5.9 {2.5 ± 0.6}	Max. 39.2 {4.0}
			Pedal		74.5 ± 14.7 {7.6 ± 1.5} (both FORWARD and REVERSE)	Max. 107.9 {11}
Hydraulic pressure	Boom	· Hydraulic oil temperature: 45 - 55°C · Relief pressure with engine at full throttle (Relieve only circuit be measured) · In heavy-duty operation mode	Normal operations	MPa {kg/cm²}	31.9 $^{+2.0}_{0}$ {325 $^{+2.0}_{0}$}	31.9 ± 2.5 {325 ± 25}
			Power max.		34.8 ± 1.0 {355 ± 10}	34.8 ± 2.5 {355 ± 25}
	Arm		Normal operations		31.9 $^{+2.0}_{0}$ {325 $^{+2.0}_{0}$}	31.9 ± 2.5 {325 ± 25}
			Power max.		34.8 ± 1.0 {355 ± 10}	34.8 ± 2.5 {355 ± 25}
	Bucket		Normal operations		31.9 $^{+2.0}_{0}$ {325 $^{+2.0}_{0}$}	31.9 ± 2.5 {325 ± 25}
			Power max.		34.8 ± 1.0 {355 ± 10}	34.8 ± 2.5 {355 ± 25}
	Swing				28.9 ± 1.5 {295 ± 15}	28.9 ± 1.5 {295 ± 30}
	Travel		Relief on one side		34.8 ± 1.0 {355 ± 10}	34.8 ± 2.5 {355 ± 25}
	Control pump				2.9 $^{+0.3}_{-0.4}$ {30 $^{+5}_{-4}$}	Max. 3.2 {37} Max. 2.4 {24}
	PC valve output pressure (servo piston input pressure)	· Engine at full throttle · Hydraulic oil temperature: 45 - 55°C · In heavy-duty operation mode	Control levers at neutral		3.4 ± 0.5 {35 ± 5}	3.4 ± 0.6 {35 ± 6}
			1-pump relief: Normal operations		16.0 ± 1.5 {163 ± 15}	16.0 ± 2.5 {163 ± 25}
			1-pump relief: Power max.		17.5 ± 1.5 {178 ± 15}	17.5 ± 2.5 {178 ± 25}
	LS differential		Control levers at neutral		2.7 $^{+1.0}_{-0.7}$ {28 $^{+10}_{-7}$}	—
			Travel speed Hi, rotating under no load		2.2 ± 0.1 {22.5 ± 1}	—

Applicable model				PC130-6K + PC150LGP-6K	
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Swing	Overrun when stopping swing	Work equipment posture Max. reach  BKP00102 · Engine at full throttle · Hydraulic oil temperature: 45 – 55°C · Stop after swinging one turn and measure distance that swing circle moves	Deg. <mm>	75 ± 10 <730 ± 100>	Max. 90 <730 ± 870>
	Time taken to start swing	Work equipment posture Max. reach  BKP00326 · Engine at full throttle · Hydraulic oil temperature: 45 – 55°C · In heavy-duty operation mode · Time taken to swing 90° and 180° from starting position	90°	2.9 ± 0.3	Max. 3.5
			180°	4.0	8.5
	Time taken to swing	Work equipment posture Max. reach  BKP00102 · Engine at full throttle · Hydraulic oil temperature: 45 – 55°C · In heavy-duty operation mode · Swing one turn, then measure time taken to swing next 5 turns	Sec	26.55 ± 3.45	26.55 ± 4.75
	Hydraulic drift of swing	 BKP00103 · Engine stopped · Hydraulic oil temperature: 45 – 55°C · Set machine on 15° slope, and set upper structure at 90° to the side. · Make match marks on swing circle outer race and track frame. · Measure distance that counter marks move apart after 5 minutes.	mm	0	0
	Leakage from swing motor	· Engine at full throttle · Hydraulic oil temperature: 45 – 55°C · Swing lock switch ON · Relieve swing circuit.	ℓ/min	3	6

Applicable model					PC130-6K + PC150LGP-6K			
Category	Item	Measurement conditions		Unit	Standard value for new machine		Service limit value	
Travel	Travel speed (1)	 BKP00104 · Engine at full throttle · Hydraulic oil temperature: 45 – 55°C · In heavy-duty operation mode · Raise track on one side at a time, rotate one turn, then measure time taken for next 5 turns with no load.	Lo	Sec	45.0 – 9		45.0 – 9	
			Mi		31.1 ± 3.1		31.1 ± 4.3	
			Hi		21.4 ± 2.1		21.4 ± 2.9	
	Travel speed (2)	 BKP00105 · Engine at full throttle · Hydraulic oil temperature: 45 – 55°C · In heavy-duty operation mode · Run up for at least 10 m, then measure time taken to travel next 20 m on flat ground.			PC130-6K		PC150LGP-6K	
			Lo		27.6 ± 5.1	27.6 ± 7.1	40.6	40.6
			Mi		20.3 ± 2.3	20.3 ± 3.2	25.8	25.8
			Hi		13.2 ± 1.2	13.2 ± 1.7	16.0	16.0
	Travel deviation	 BKP00106 · Engine at full throttle · Hydraulic oil temperature: 45 – 55°C · Run up for at least 10 m, then measure deviation when traveling next 20 m on flat ground. ★ Use a hard horizontal surface.  BKP00107 ★ Measure dimension x.		mm	Max. 200		Max. 220	

Applicable model					PC130-6K + PC150LGP-6K	
Category	Item		Measurement conditions	Unit	Standard value for new machine	Service limit value
Travel	Hydraulic drift of travel		 BKP00108 · Engine stopped · Hydraulic oil temperature: 45 – 55°C · Stop machine on 12° slope with sprocket facing straight up the slope. · Measure the distance the machine moves in 5 minutes.	mm	0	0
	Leakage of travel motor		 BKP00109 · Engine at full throttle · Hydraulic oil temperature: 45 – 55°C · Lock shoes and relieve travel circuit.	ℓ/mm	Max. 5	Max. 10
Work equipment	Hydraulic drift of work equipment	Total work equipment (hydraulic drift at tip of bucket teeth)	Posture for measurement  BKP00110 · Place in above posture and measure extension or retraction of each cylinder and downward movement at tip of bucket teeth. · Bucket: Rated load · Horizontal, flat ground · Levers at neutral · Engine stopped · Hydraulic oil temperature: 45 – 55°C · Start measuring immediately after setting. · Measure hydraulic drift every 5 minutes, and judge from results for 15 minutes.	mm	Max. 460	Max. 700
		Boom cylinder (amount of retraction of cylinder)			Max. 8	Max. 12
		Arm cylinder (amount of extension of cylinder)			Max. 90	Max. 90
		Bucket cylinder (amount of retraction of cylinder)			Max. 40	Max. 40

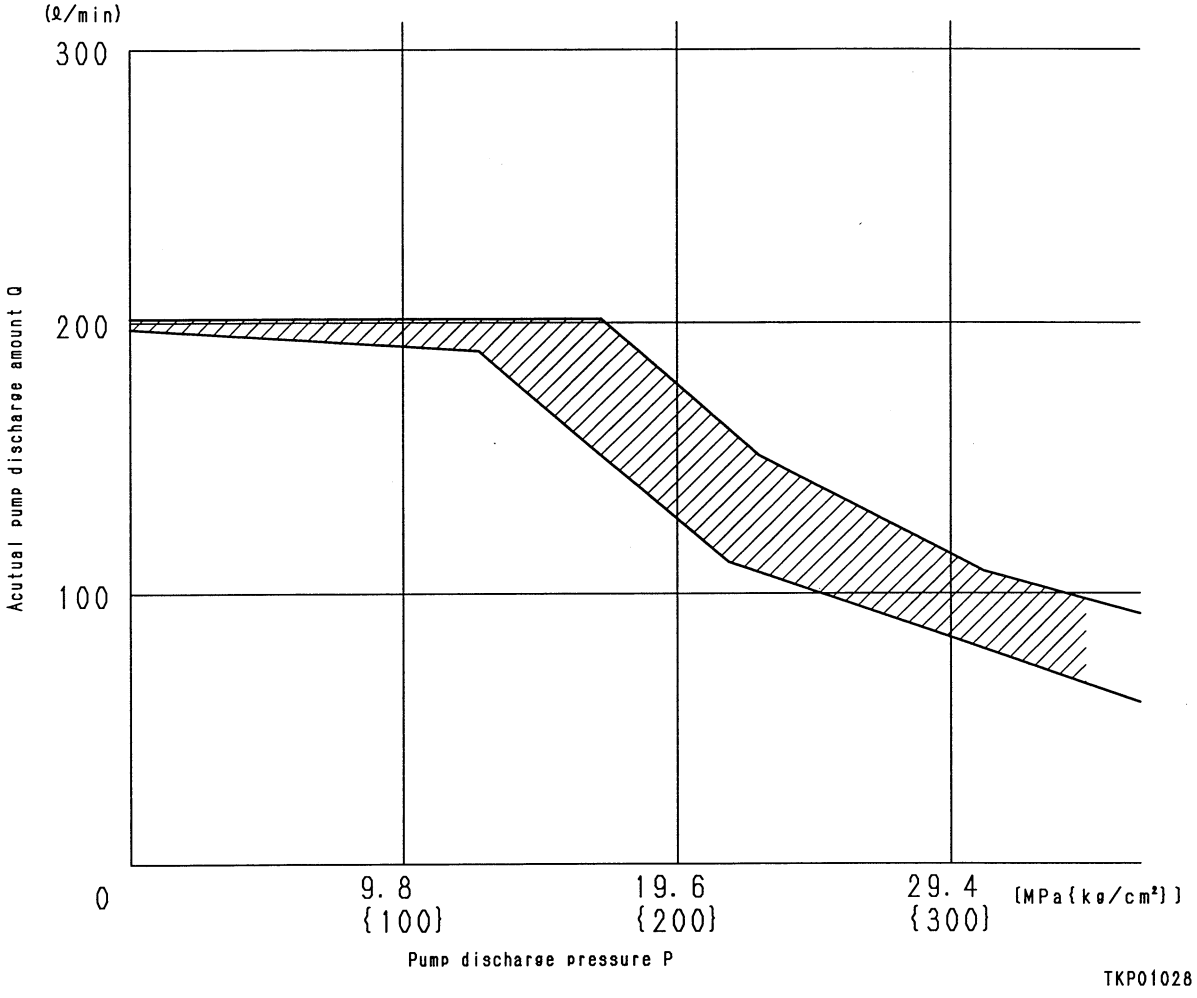
Applicable model						Unit	PC130-6K + PC150LGP-6K	
Category	Item		Measurement conditions				Standard value for new machine	Service limit value
Work equipment	Work equipment speed	Boom Bucket teeth in contact with ground ↕ Cylinder fully extended	 · Engine at full throttle · Hydraulic oil temperature: 45 – 55˚C	RAISE	Heavy-duty operation mode	Sec	3.8 ± 0.4	Max. 4.4
					Active mode		3.8 ± 0.4	Max. 4.4
				LOWER	Heavy-duty operation mode		2.9 ± 0.5	Max. 3.5
					Active mode		2.3 ± 0.5	Max. 2.9
		Arm Cylinder fully retracted ↕ Fully extended	 · Engine at full throttle · Hydraulic oil temperature: 45 – 55˚C	CURL	Heavy-duty operation mode		3.7 ± 0.5	Max. 4.5
					Active mode		3.2 ± 0.4	Max. 4.0
				DUMP	Heavy-duty operation mode		3.1 ± 0.3	Max. 3.7
					Active mode		3.1 ± 0.3	Max. 3.7
		Bucket Cylinder fully ↕ Fully extended	 · Engine at full throttle · Hydraulic oil temperature: 45 – 55˚C	CURL	Heavy-duty operation mode		2.9 ± 0.3	Max. 3.7
					Active mode		2.9 ± 0.3	Max. 3.7
				DUMP	Heavy-duty operation mode		2.3 ± 0.3	Max. 2.9
					Active mode		2.3 ± 0.3	Max. 2.9
	Time lag	Boom	 · Lower boom and measure time taken from point where bucket contacts ground to point where chassis rises from ground · Engine at low idling · Hydraulic oil temperature: 45 – 55˚C				Max. 3	Max. 4
		Arm	 · Stop arm suddenly and measure time taken for arm to stop · Engine at low idling · Hydraulic oil temperature: 45 – 55˚C				Max. 2	Max. 3

Applicable model					PC130-6K + PC150LGP-6K	
Category	Item		Measurement conditions	Unit	Standard value for new machine	Service limit value
Work equipment	Time lag	Bucket	 BKP00116 · Stop bucket suddenly and measure time taken for bucket to stop · Engine at low idling · Hydraulic oil temperature: 45 – 55°C	Sec	Max. 2	Max. 3
	Internal leakage	Cylinders	· Hydraulic oil temperature: 45 – 55°C · Engine at full throttle · Relieve circuit to be measured	cc/min	Max. 3.5	15
		Center swivel joint			10	50
Performance in compound operation	Travel deviation when work equipment + travel are operated		· Engine at full throttle · Hydraulic oil temperature: 45 – 55°C ★ Use a hard horizontal surface.  BKP00107 ★ Measure dimension x.	mm	Max. 500	Max. 550

Applicable model					PC130-6K + PC150LGP-6K	
Category	Item		Measurement conditions	Unit	Standard value for new machine	Service limit value
Performance of hydraulic pump	Hydraulic pump delivery		· Hydraulic oil temperature: 45 – 55°C · Measure with engine at rated speed · At relief valve set pressure: 2.9 Mpa {30 kg/cm²}	ℓ/min	27 ± 6	Max. 20
		Piston pump	See next page		See next page	

Category

Discharge amount of main piston pump (in heavy-duty operation mode)



TKP01028

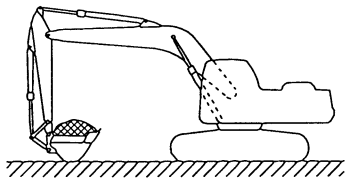
• Pump speed : At 1,900 rpm, PC-EPC current 400 mA

Check point	Test pump discharge pressure {kg/cm²}	Average pressure (kg/cm²)	Standard value for discharge amount Q (ℓ/min)	Judgement standard Q (ℓ/min)
As desired	P1	P1	See graph	See graph

★ The error is large near the point where the graph curves, so avoid measuring at this point.
★ When measuring with the pump mounted on the machine, if it is impossible to set the engine speed to the specified speed with the fuel control dial, take the pump discharge amount and the engine speed (same as pump speed) at the point of measurement, and use them as a base for calculating the pump discharge amount at the specified speed.

Flow control characteristics of PC-EPC valve (STD)

★ The values in this table are used as reference values when carrying out troubleshooting.

Category	Item	Measurement conditions	Unit	PC130-6K
Performance in compound operations	Time taken for swing when starting boom RAISE + swing	 TBP00437 • Engine at full throttle • Hydraulic oil temperature: 45 – 55°C • In heavy-duty operation mode • Load the bucket with the rated load and measure the time taken from the position of starting the swing to the point of passing the 90* position.	Sec.	4.0

STANDARD VALUE TABLE FOR ELECTRICAL PARTS

System	Name of component	Connector No.	Inspection method	Judgement table	Measurement conditions
Control system	Fuel control dial	E06 (male)	Measure resistance	If the condition is as shown in the table below, it is normal Between (1) – (2): 0.25 – 7 kΩ Between (2) – (3): 0.25 – 7 kΩ Between (1) – (3): 4 – 6 kΩ	1) Turn starting switch OFF. 2) Disconnect connector.
	Governor motor: Potentiometer	E04 (male)	Measure resistance	If the condition is as shown in the table below, it is normal Between (1) – (2): 0.25 – 7 kΩ Between (2) – (3): 0.25 – 7 kΩ Between (1) – (3): 4 – 6 kΩ	1) Turn starting switch OFF. 2) Disconnect connector.
	Governor motor: Motor	E05 (male)	Measure resistance	If the condition is as shown in the table below, it is normal Between (1) – (2): 2.5 – 7.5 kΩ Between (3) – (4): 2.5 – 7.5 kΩ Between (1) – (3): No continuity Between (1) – chassis: No continuity Between (3) – chassis: No continuity	1) Turn starting switch OFF. 2) Disconnect connector.
	Engine speed sensor	E07	Measure resistance	If the condition is as shown in the table below, it is normal Between (male) (1) – (2): 500 – 1,000 Ω Between (male) (2) – chassis: Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector.
			Measure voltage	Measure with AC range Between (1) – (2): 0.5 - 3.0 V	1) Start engine. 2) Insert T-adapter.
			Adjust	1) Screw in the speed sensor until it contacts the ring gear, then turn back 1 ± 1/6 turns. 2) It must work normally when adjusted as above.	
	PPC pressure switch	Left swing S08 Right swing S30 Bucket DUMP S07 Bucket CURL S06 Arm OUT S03 Arm IN S05 Boom LOWER S04 Boom RAISE S02	Measure resistance	If the condition is as shown in the table below, it is normal Between (male)(1) – (2): Levers at neutral: Min.1 MΩ; Lever operated: Max. 1 Ω Between (male) (1),(2) – chassis: Min. 1 MΩ	1) Start engine. (or with accumulator charged if engine is stopped) 2) Disconnect connectors S01 – S08.

<table>
<tr><th>System</th><th>Name of component</th><th>Connector No.</th><th>Inpsection method</th><th>Judgement table</th><th>Measurement conditions</th></tr>
<tr><td rowspan="9">Control system</td><td>Pump pressure sensor</td><td>E08</td><td>Measure voltage</td><td>If the condition is as shown in the table below, it is normal
<table><tr><td>Between (2) – (1)</td><td>18– 27 V</td></tr></table><table><tr><td rowspan="2">Between (3) – (1)</td><td>All levers at neutral</td><td>0.5 –1.5 V</td></tr><tr><td>At arm IN relief</td><td>3.1 – 4.5 V</td></tr></table></td><td>1) Start engine.
2) Turn fuel control dial to MAX position.
3) Insert T-adapter.</td></tr>
<tr><td>Swing lock switch</td><td>X05 (female)</td><td>Measure resistance</td><td>If the condition is as shown in the table below, it is normal
<table><tr><td>Between (1) – (2)</td><td>When switch is OFF</td><td>Min. 1MΩ</td></tr><tr><td>Between (1) – (2)</td><td>When switch is ON</td><td>Max. 1Ω</td></tr></table></td><td>1) Turn starting switch OFF.
2) Disconnect connector C02.</td></tr>
<tr><td>PC-EPC solenoid valve</td><td>C13 (male)</td><td>Measure resistance</td><td>If the condition is as shown in the table below, it is normal
<table><tr><td>Between (1) – (2)</td><td>7 – 14 Ω</td></tr><tr><td>Between (1),(2) – chassis</td><td>Min. 1 MΩ</td></tr></table></td><td>1) Turn pump prolix switch OFF.
2) Turn starting switch OFF.
3) Disconnect connector C13.</td></tr>
<tr><td>Swing holding brake solenoid valve</td><td>V04 (male)</td><td>Measure resistance</td><td>If the condition is as shown in the table below, it is normal
<table><tr><td>Between (1) – (2)</td><td>20 – 60 Ω</td></tr><tr><td>Between (1),(2) – chassis</td><td>Min. 1 MΩ</td></tr></table></td><td>1) Turn starting switch OFF.
2) Disconnect connector V04.</td></tr>
<tr><td>Travel speed solenoid valve</td><td>V06 (male)</td><td>Measure resistance</td><td>If the condition is as shown in the table below, it is normal
<table><tr><td>Between (1) – (2)</td><td>20 – 60 Ω</td></tr><tr><td>Between (1),(2) – chassis</td><td>Min. 1 MΩ</td></tr></table></td><td>1) Turn starting switch OFF.
2) Disconnect connector V06.</td></tr>
<tr><td>2-stage relief solenoid valve</td><td>V05 (male)</td><td>Measure resistance</td><td>If the condition is as shown in the table below, it is normal
<table><tr><td>Between (1) – (2)</td><td>20 – 60 Ω</td></tr><tr><td>Between (1),(2) – chassis</td><td>Min. 1 MΩ</td></tr></table></td><td>1) Turn starting switch OFF.
2) Disconnect connector V05.</td></tr>
<tr><td>Active mode solenoid valve</td><td>V07 (male)</td><td>Measure resistance</td><td>If the condition is as shown in the table below, it is normal
<table><tr><td>Between (1) – (2)</td><td>20 – 60 Ω</td></tr><tr><td>Between (1),(2) – chassis</td><td>Min. 1 MΩ</td></tr></table></td><td>1) Turn starting switch OFF.
2) Disconnect connector V07.</td></tr>
<tr><td>LS-EPC solenoid valve</td><td>V10 (male)</td><td>Measure resistance</td><td>If the condition is as shown in the table below, it is normal
<table><tr><td>Between (1) – (2)</td><td>7 – 14 Ω</td></tr><tr><td>Between (1),(2) – chassis</td><td>Min. 1 MΩ</td></tr></table></td><td>1) Turn starting switch OFF.
2) Disconnect connector C10.</td></tr>
</table>

System	Name of component	Connector No.	Inspection method	Judgement table	Measurement conditions
Control system — Engine throttle, pump controller	Power source voltage	C01 C02	Measure voltage	If the condition is as shown in the table below, it is normal Between C01 (7),(13) – C01 (6),(12): 20 – 30 V Between C02 (11),(21) – C01 (6),(12): 20 – 30 V	1) Turn starting switch ON. 2) Insert T-adapter.
	Fuel control dial	C03	Measure voltage	If the condition is as shown in the table below, it is normal Between (7) – (17) (power source): 4.75 – 5.25 V Between (4) – (17) (low idling): 4.0 – 4.75 V Between (4) – (17) (high idling): 0.25 – 1.0 V	1) Turn starting switch ON. 2) Insert T-adapter.
	Governor potentiometer	C03	Measure voltage	If the condition is as shown in the table below, it is normal Between (14) – (17) (power source) Low idling: 2.9 – 3.3 V High idling: 0.5 – 0.9 V Between (7) – (17) (power source): 4.75 – 5.25 V	1) Turn starting switch ON. 2) Insert T-adapter.
	Radiator water temperature signal	P7 (male)	Measure resistance	If the condition is as shown in the table below, it is normal Normal temperature (25°C): Approx.37 – 50 kΩ 100°C: Approx.3.5 – 4.0 kΩ	1) Turn starting switch OFF. 2) Disconnect connector P7. 3) Insert T-adapter into connector at sensor end.
	Governor motor	C02	Measure voltage	If the condition is as shown in the table below, it is normal Between (2) – (3): 1.8 – 4.6 V Between (4) – (5): 1.8 – 4.6 V	1) Turn starting switch ON. 2) Insert T-adapter.
	Battery relay	C01	Measure voltage	If the condition is as shown in the table below, it is normal Between (1) – (6): 20 – 30 V ★ This is only for 2.5 sec after the starting switch is operated ON → OFF; at other times it must be 0 V.	1) Turn starting switch ON. 2) Insert T-adapter.

<table>
<tr><th>System</th><th colspan="2">Name of component</th><th>Connector No.</th><th>Inpsection method</th><th>Judgement table</th><th>Measurement conditions</th></tr>
<tr><td rowspan="3">Control system</td><td rowspan="3">Engine throttle, pump controller</td><td>Swing holding brake solenoid</td><td>C01</td><td>Measure voltage</td><td>If the condition is as shown in the table below, it is normal
<table><tr><td>When swing lever is operated (solenoid ON, swing holding brake canceled)</td><td rowspan="2">Between (3) – (6),(12)</td><td>20 – 30 V</td></tr><tr><td>After approx. 5 seconds have passed since returning swing lever to neutral (solenoid OFF, swing holding brake operated)</td><td>0 – 3 V</td></tr></table></td><td>1) Start engine.
2) Turn swing lock switch OFF.
3) Turn swing lock prolix switch OFF.
4) Insert T-adapter.</td></tr>
<tr><td>Travel speed solenoid</td><td>C01</td><td>Measure voltage</td><td>If the condition is as shown in the table below, it is normal
<table><tr><td>When traveling with travel speed switch at Hi (solenoid ON, travel motor swash plate angle at MIN)</td><td rowspan="2">Between (9) – (6),(12)</td><td>20 – 30 V</td></tr><tr><td>When traveling with travel speed switch at Lo (solenoid OFF, travel motor swash plate angle at MAX)</td><td>0 – 3 V</td></tr></table></td><td>1) Start engine.
2) Insert T-adapter.
3) Turn fuel control dial to MAX position.
4) Travel on level ground.</td></tr>
<tr><td>2-stage relief solenoid</td><td>C01</td><td>Measure voltage</td><td>If the condition is as shown in the table below, it is normal
<table><tr><td>Work equipment control lever operated + power max. switch ON (solenoid ON, 2-stage relief actuated)</td><td rowspan="2">Between (10) – (6),(12)</td><td>20 – 30 V</td></tr><tr><td>All levers at neutral (solenoid OFF, 2-stage relief canceled)</td><td>0 – 3 V</td></tr></table></td><td>1) Start engine.
2) Insert T-adapter.</td></tr>
</table>

System	Name of component	Connector No.	Inpsection method	Judgement table	Measurement conditions
Control system – Engine throttle, pump controller	Active mode solenoid	C01	Measure voltage	If the condition is as shown in the table below, it is normal When active mode switch is ON and engine speed is more than 2100 rpm (solenoid ON, active mode actuated): Between (8) – (6),(12): 20 – 30 V When active mode switch is OFF (solenoid OFF, active mode canceled): Between (8) – (6),(12): 0 – 3 V	1) Start engine. 2) Insert T-adapter.
	PC-EPC solenoid valve (default value)	C02	Measure current	If the condition is as shown in the table below, it is normal • General operation mode Between (8) – (18): 500 ± 40mA	1) Turn starting switch ON. 2) Turn fuel control dial to MAX position. 3) Turn pump prolix switch OFF.
	LS-EPC solenoid valve (default value)	C02	Measure current	If the condition is as shown in the table below, it is normal • General operation mode Between (7) – (17): 800 ± 80mA	1) Turn starting switch ON. 2) Turn fuel control dial to MAX position. 3) All levers at neutral
	L.H. knob switch	C03	Measure voltage	If the condition is as shown in the table below, it is normal When switch is ON: Between (9) – GND: 20 – 28 V When switch is OFF: Between (9) – GND: 0 – 1 V	1) Turn starting switch ON. 2) Insert T-adapter.
	S-NET	C17	Measure voltage	If the condition is as shown in the table below, it is normal (4),(12) – GND: 4 – 8 V	1) Turn starting switch ON. 2) Insert T-adapter.
	Kerosene mode	C17	Measure voltage	If the condition is as shown in the table below, it is normal Standard mode: (15) – GND: 20 – 28 V Kerosene mode: (15) – GND: 0 – 2 V	1) Turn starting switch ON. 2) Insert T-adapter.

<table>
<tr><th>System</th><th colspan="2">Name of component</th><th>Connector No.</th><th>Inpsection method</th><th>Judgement table</th><th>Measurement conditions</th></tr>
<tr><td rowspan="2">Control system</td><td rowspan="2">Engine throttle, pump controller</td><td>No. 2 throttle signal</td><td>Monitoring code 16</td><td></td><td>If the condition is as shown in the table below, it is normal
High idling (rpm)
<table><tr><td>H/O</td><td>Approx. 2,200</td></tr><tr><td>G/O</td><td>Approx. 2,000</td></tr><tr><td>F/O</td><td>Approx. 2,000</td></tr><tr><td>L/O</td><td>Approx. 1,670</td></tr><tr><td>H/O+Power max.</td><td>Approx. 2,400</td></tr><tr><td>Swift slow-down</td><td>Approx. 1,670</td></tr></table></td><td>1) Start engine.
2) Set monitoring code to 16 (command value).
3) Operate working mode switch and L.H. knob switch.</td></tr>
<tr><td>Model selection</td><td>C17 – C02</td><td>Continuity</td><td>If the condition is as shown in the table below, it is normal
<table><tr><td>Model selection 1</td><td>C17 (5) – C02 (11)</td><td>No continuity</td></tr><tr><td>Model selection 2</td><td>C17 (13) – C02 (11)</td><td>No continuity</td></tr><tr><td>Model selection 3</td><td>C17 (6) – C02 (11)</td><td>No continuity</td></tr><tr><td>Model selection 4</td><td>C17 (14) – C02 (11)</td><td>No continuity</td></tr><tr><td>Model selection 5</td><td>C17 (7) – C02 (11)</td><td>No continuity</td></tr></table></td><td>1) Turn starting switch OFF.
2) Disconnect connector.
3) Connect T-adapter to wiring harness end.</td></tr>
</table>

System	Name of component	Connector No.	Inpsection method	Judgement table	Measurement conditions
Monitor system	Air cleaner clogging sensor	P11(male) P12(female)	Continuity	If the condition is as shown in the table below, it is normal Air cleaner normal — Between P11 – P12 — Continuity Air cleaner clogged — Between P11 – P12 — No continuity	1) Start engine. 2) Disconnect P11, P12.
	Engine speed sensor	E7	Measure current	If the condition is as shown in the table below, it is normal Between (1) – (2): 500 – 1,000 Ω Between (2) – chassis: Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector E7.
			Measure voltage	If the condition is as shown in the table below, it is normal Between (1) – (2): 0.5 – 3.0 V	1) Start engine. 2) Insert T-adapter.
			Adjust	1) Screw in the speed sensor until it contacts the ring gear, then turn back 1 ± 1/6 turns. 2) It must work normally when adjusted as above.	
	Coolant level sensor	P08(male)	Measure current	If the condition is as shown in the table below, it is normal Above LOW level in reservoir tank: Max. 1 Ω Below LOW level in reservoir tank: Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector P08. 3) Insert T-adapter into connector at sensor end.
	Engine oil level sensor	P05(male)	Measure current	If the condition is as shown in the table below, it is normal  BLP00002 Raise float: Max. 1 Ω  BLP00003 Lower float: Min. 1 MΩ	1) Turn starting switch OFF. 2) Disconnect connector P05. 3) Drain oil, then remove sensor.
	Coolant temperature sensor	P07(male)	Measure current	If the condition is as shown in the table below, it is normal Normal temperature (25°C): Approx. 37 – 50 kΩ 100°C: Approx. 3.5 – 4.0 kΩ	1) Turn starting switch OFF. 2) Disconnect connector P07. 3) Insert T-adapter into connector at sensor end.

<table>
<tr><th>System</th><th>Name of component</th><th>Connector No.</th><th>Inpsection method</th><th>Judgement table</th><th>Measurement conditions</th></tr>
<tr><td rowspan="2">Monitor system</td><td>Engine oil pressure sensor</td><td>—</td><td>Measure current</td><td>If the condition is as shown in the table below, it is normal
<table><tr><td>Engine oil pressure above 68.6 kPa {0.7 kg/cm²}</td><td>Min. 1 MΩ</td></tr><tr><td>Engine oil pressure below 29.4 kPa {0.3 kg/cm²}</td><td>Max. 1 Ω</td></tr></table></td><td>1) Install oil pressure measurement gauge.
2) Remove wiring harness terminal.
3) Start engine.
4) Put tester in contact between sensor terminal screw and chassis. switch.</td></tr>
<tr><td>Fuel level sensor</td><td>P06(male)</td><td>Measure current</td><td>If the condition is as shown in the table below, it is normal
<table><tr><td> 
BLP00004</td><td>Raise float to stopper</td><td>Approx. 12 Ω or below</td></tr><tr><td> 
BLP00005</td><td>Lower float to stopper</td><td>Approx. 85 – 110 Ω</td></tr></table></td><td>1) Turn starting switch OFF.
2) Disconnect connector P06.
3) Drain fuel, then remove sensor.
4) Insert T-adapter into sensor.
※ Connect the T-adapter to the connector and sensor flange.</td></tr>
</table>

<table>
<tr><th>Name of component</th><th>Connector No.</th><th>Inpsection method</th><th>Judgement table</th><th>Measurement conditions</th></tr>
<tr><td>Alternator</td><td>Between alternator terminal R and chassis</td><td>Measure voltage</td><td>When engine is running
(1/2 throttle or above) → 27.5 – 29.5 V
※ If the battery is old, or after starting in cold areas, the voltage may not rise for some time.</td><td>1) Start engine.</td></tr>
<tr><td>Gauges</td><td colspan="3">
<table>
<tr><th></th><th colspan="2">Position of gauge display</th><th>Display level resistance (kΩ) (Monitor panel input resistance)</th></tr>
<tr><th></th><th colspan="2">Starting switch ON</th><th>Starting switch OFF</th></tr>
<tr><td rowspan="17">Measure resistance between coolant temperature gauge C03 (female) (1) – C03 (female) (16)</td><td rowspan="17">Right side
↑
Display position
↓
Left side</td><td>All OFF(15)</td><td>Min. – Max.
– 0.646</td></tr>
<tr><td>14</td><td>0.575 – 3.420</td></tr>
<tr><td>13</td><td>3.156 – 3.708</td></tr>
<tr><td>12</td><td>3.422 – 3.804</td></tr>
<tr><td>11</td><td>3.512 – 3.900</td></tr>
<tr><td>10</td><td>3.600 – 4.125</td></tr>
<tr><td>9</td><td>3.807 – 4.349</td></tr>
<tr><td>8</td><td>4.015 – 5.122</td></tr>
<tr><td>7</td><td>4.728 – 5.899</td></tr>
<tr><td>6</td><td>5.445 – 6.818</td></tr>
<tr><td>5</td><td>6.294 – 7.910</td></tr>
<tr><td>4</td><td>7.302 – 9.210</td></tr>
<tr><td>3</td><td>8.502 – 10.774</td></tr>
<tr><td>2</td><td>9.946 – 36.535</td></tr>
<tr><td>1</td><td>33.725 –</td></tr>
</table>
★ Level 13, 14 flash
</td><td>1) Insert a dummy resistance with the starting switch OFF, or measure the resistance of the sensor.
2) Check the display with the starting switch ON.</td></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th></th><th colspan="2">Position of gauge display</th><th>Display level resistance (kΩ) (Monitor panel input resistance)</th></tr>
<tr><th></th><th colspan="2">Starting switch ON</th><th>Starting switch OFF</th></tr>
<tr><td rowspan="17">Measure resistance between fuel level gauge C03 (female) (2) – chassis</td><td rowspan="17">Right side
↑
Display position
↓
Left side</td><td>14</td><td>Min. – Max.
– 13.82</td></tr>
<tr><td>13</td><td>11.71 – 17.43</td></tr>
<tr><td>12</td><td>15.18 – 21.25</td></tr>
<tr><td>11</td><td>18.90 – 25.05</td></tr>
<tr><td>10</td><td>22.59 – 28.45</td></tr>
<tr><td>9</td><td>25.82 – 31.85</td></tr>
<tr><td>8</td><td>29.18 – 35.22</td></tr>
<tr><td>7</td><td>32.45 – 39.91</td></tr>
<tr><td>6</td><td>37.00 – 44.60</td></tr>
<tr><td>5</td><td>41.77 – 48.72</td></tr>
<tr><td>4</td><td>45.52 – 55.14</td></tr>
<tr><td>3</td><td>50.42 – 64.35</td></tr>
<tr><td>2</td><td>60.61 – 77.07</td></tr>
<tr><td>1</td><td>72.98 – 691.5</td></tr>
<tr><td>All OFF(0)</td><td>638.00 –</td></tr>
</table>
★ Level 1 flashes
</td><td>1) Insert a dummy resistance with the starting switch OFF, or measure the resistance of the sensor.
2) Check the display with the starting switch ON.</td></tr>
</table>

TOOLS FOR TESTING, ADJUSTING, AND TROUBLESHOOTING

Check or measurement item	Symbol		Part No.	Part Name	Remarks
Engine speed	A	1	799-203-8001	Multi-tachometer	Kit Part No. : 799-203-9000 Digital display L: 60 – 2,000 rpm H: 60 – 19,999 rpm
		2	795-790-2500	Take-off drive	
Coolant and oil temperatures	B		790-101-6000	Digital temperature gauge	–50 – 1,200°C
Oil pressure	C	1	799-101-5002	Hydraulic tester	Pressure gauge 2.5,5.9,39.2,58,8 MPa {25,60,400,600kg/cm²}
			790-261-1203	Digital hydraulic tester	Pressure gauge 68.6MPa{700 kg/cm²}
		2	799-401-2320	Hydraulic gauge	1.0 MPa {10 kg/cm²}
		3	• 790-261-1311	Adapter	Both male and female 14 x 1.5 (female PT 1/8)
			• 790-261-1321		Both male and female 18 x 1.5 (female PT 1/8)
			• 790-261-1331		Both male and female 22 x 1.5 (female PT 1/8)
		4	799-401-2700	Differential pressure gauge	
		5	790-261-1360	Adapter	Both male and female 14 x 1.5 (PT 1/8)
			790-261-1370	Nut	For 14 x 1.5 blind
			07003-31419	Gasket	For blind
		6	—	Hose	
Barring of engine	D		795-799-1130	Gear	
Blow-by pressure	E	1	799-201-1504	Blow-by checker	0 – 4.9 kPa {0 – 500 mm H_2O}
		2	795-790-1950	Tool	
Valve clearance	F		Commercially available	Feeler gauge	
Exhaust color	G	1	799-201-9000	Handy Smoke Checker	Discoloration 0 – 70% (With standard color) (Discoloration % x 1/10 ≒ Bosch index)
		2	Commercially available	Smoke meter	
Operating effort	H		79A-264-0020	Push-pull scale	0 – 294N {0 – 30 kg}
			79A-261-0090		0 – 490N {0 – 30 kg}
Stroke, hydraulic drift	I		Commercially available	Scale	
Work equipment speed	J		Commercially available	Stop watch	
Measuring voltage and resistance values	K		79A-261-0210	Tester	
Troubleshooting of wiring harnesses and sensors	L	1	799-601-2600	T-adapter box	• Kit Part No. T-adapter kit 799-601-8000
		2	799-601-7000	Adapter assembly	
		3	799-601-7190	Adapter	
			799-601-7010		
			799-601-7070		
			799-601-7080		
			799-601-7330		
Measuring wear of sprocket	P		796-427-1110	Wear gauge	

MEASURING ENGINE SPEED

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

★ Measure the engine speed under the following conditions.
1) Coolant temperature: Within operating range
2) Hydraulic oil temperature : 45 – 55°C

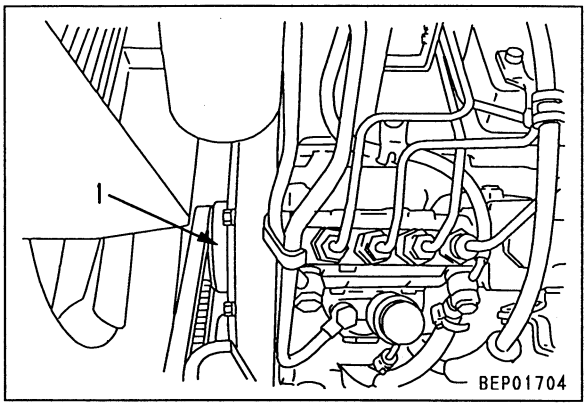
1. Open the engine hood and remove the counterweight top cover.

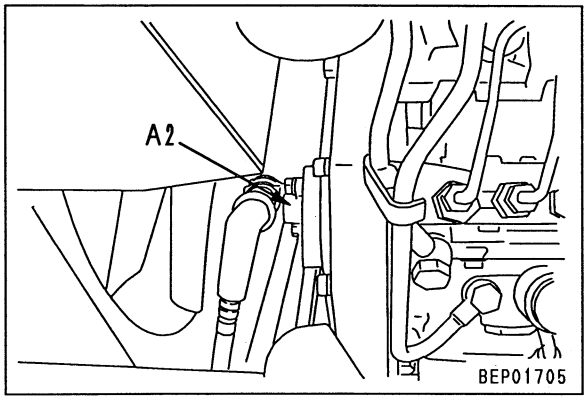
2. Remove cap (1) of the speed pick-up port, then install take-off drive assembly **A2**.

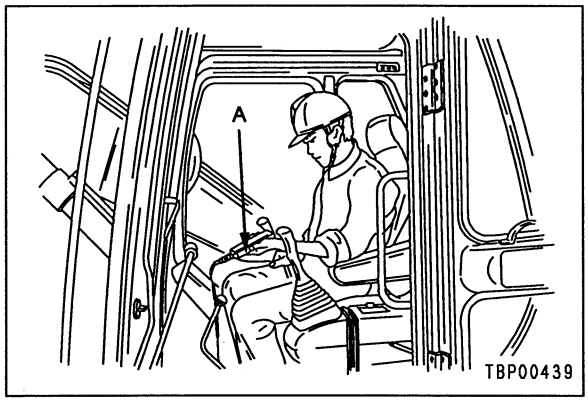
3. Connect tachometer **A1** and take-off drive assembly **A2** with a cable.

4. Start the engine, and measure the engine speed at low idling and high idling.

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







MEASURING EXHAUST COLOR

- When measuring in the field when there is no air or power supply, use smoker checker **G1**; when recording official data, use smoke meter **G2**.

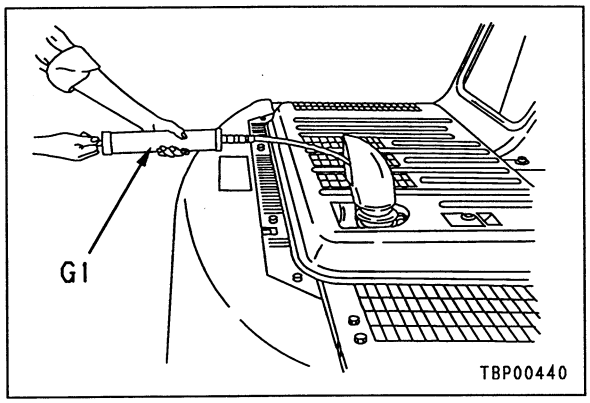
★ Raise the coolant temperature to the operating range before measuring.

⚠ When removing or installing the measuring equipment, be careful not to touch any high temperature part.

1. Measuring with handy smoke checker G1

1) Fit filter paper in tool **G1**.
2) Insert the exhaust gas intake port into the exhaust pipe, accelerate the engine suddenly, and at the same time operate the handle of tool **G1** to catch the exhaust gas on the filter paper.
3) Remove the filter paper and compare it with the scale provided to judge the condition.

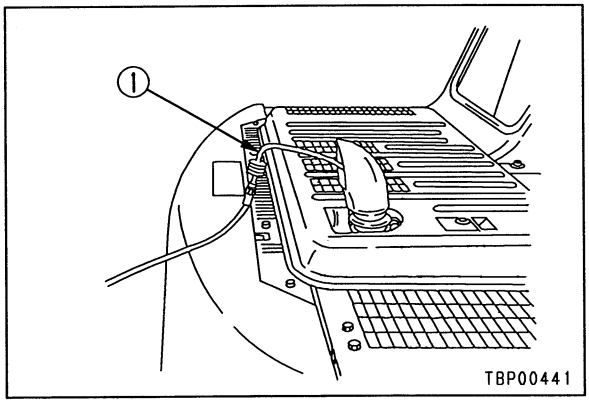
★ Keep the auto-deceleration switch turned OFF.

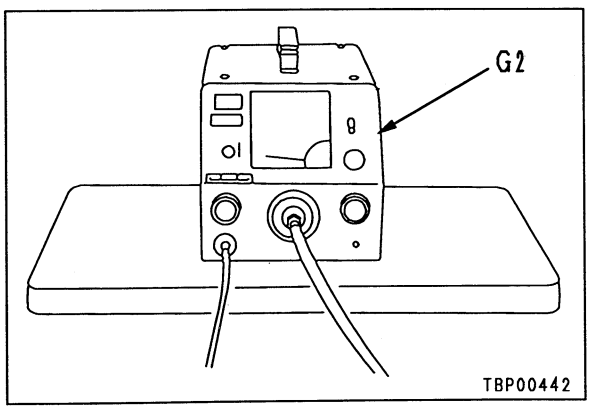


2. Measuring with smoke meter G2

1) Insert probe ① into the outlet port of exhaust pipe, then tighten the clip to secure it to the exhaust pipe.
2) Connect the probe hose, accelerator switch plug, and air hose to tool **G2**.
   ★ The pressure of the air supply should be less than 1.47 MPa {15 kg/cm²}.
3) Connect the power cord to the AC outlet.
   ★ When connecting the port, check first that the power switch of tool **G2** 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 tool **G2** ON.
6) Accelerate the engine suddenly, and at the same time, depress the accelerator pedal of tool **G2** and catch the exhaust gas color on the filter paper.
7) 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.

★ Keep the auto-deceleration switch turned OFF.





ADJUSTING VALVE CLEARANCE

1. Remove the cylinder head cover.

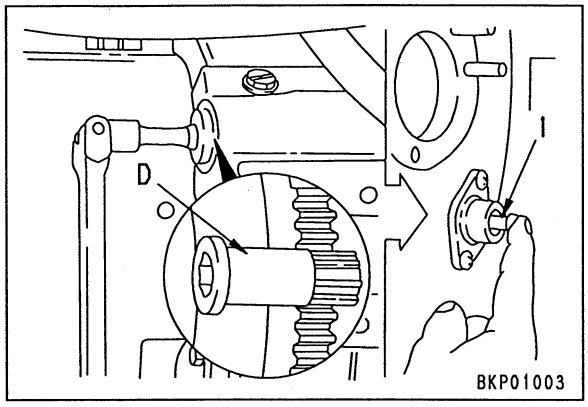
2. Set cranking tool **D** to the flywheel.

3. Rotate the crankshaft in the normal direction to a point where timing pin (1) enters the hole in the gear.
   - ★ Push pin (1) in lightly while cranking.
   - ★ The position where the pin enters the hole is the No. 1 top dead center.

4. When No. 1 cylinder is at top dead center, adjust the 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 pull out timing pin (1).

5. Next, rotate the crankshaft one turn (360°) in the normal direction, align the counter marks made in Step 4 accurately, then adjust the valve clearance of the remaining valves marked ○.
   - ★ To adjust the valve clearance, loosen locknut (4) of adjustment screw (3), then insert feeler gauge **F** between valve stem (5) and rocker arm (6), and turn adjustment screw (3) until the clearance is a sliding fit. Then tighten locknut (4) to hold the adjustment screw in position.

     kgm Locknut : **24.0 Nm {2.45 kgm}**
   - ★ Firing order : 1–2–3–4
   - ★ After tightening the locknut, check the valve clearance again.
   - ★ Valve clearance:
     Intake valve : 0.25 mm
     Exhaust valve : 0.51 mm



Valve arrengement

Cylinder NO.	1	2	3	4
Exhaust valve	●	○	●	○
Intake valve	●	●	○	○

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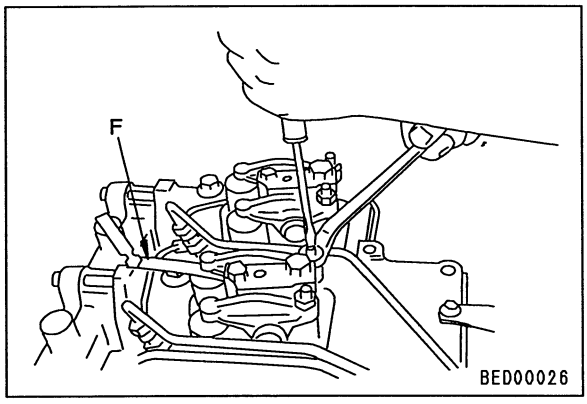
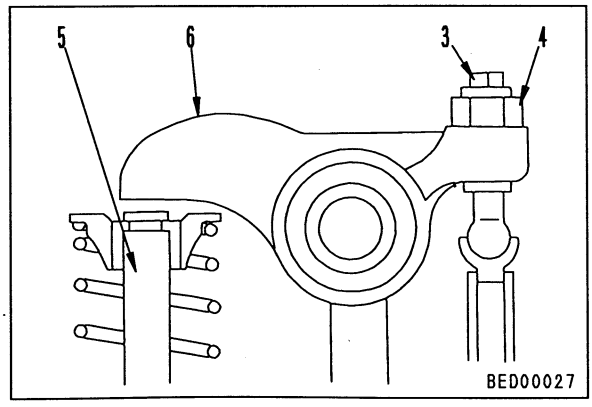




MEASURING BLOW-BY PRESSURE

★ Raise the coolant temperature to the operating range before measuring the blow-by pressure.

1. Install blow-by checker **E1** to the tip of engine breather hose (1).

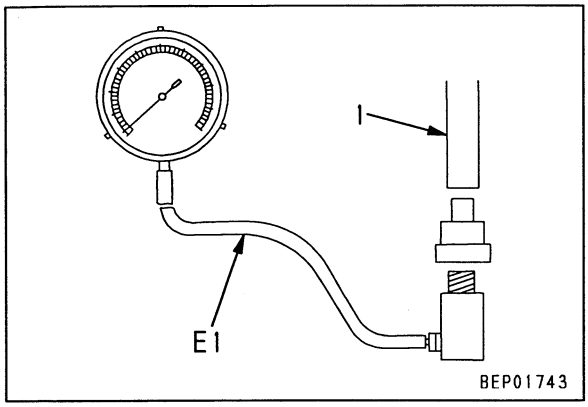
2. Run the engine at the rated output and measure the blow-by pressure.

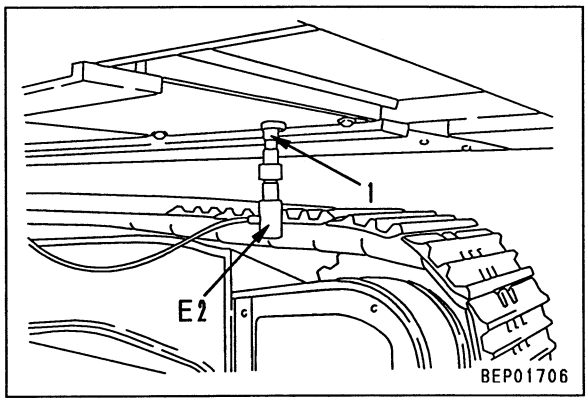
   ⚠ When measuring the blow-by pressure, be careful not to touch any high temperature parts or rotating parts.

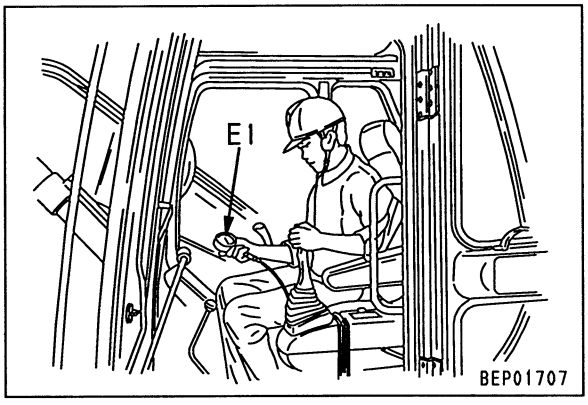
   ★ The blow-by should be measured with the engine running at rated output.

   • 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.



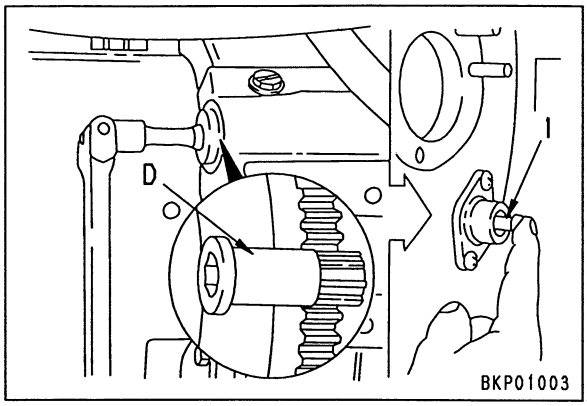




TESTING AND ADJUSTING FUEL INJECTION TIMING

1. Testing

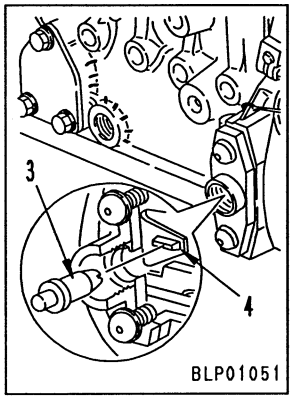
1) Using cranking tool **D**, rotate the crankshaft in the normal direction until timing pin (1) enters the hole in the gear.
2) Remove plug (2), reverse timing pin (3), and check that pin (3) meshes with timing pointer (4) on the injection pump.

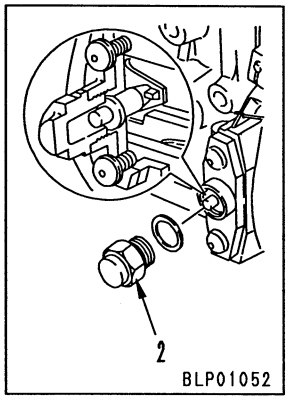


2. Adjusting

- If the timing pin does not mesh

i) Remove the fuel injection pump. For details, see REMOVAL OF FUEL INJECTION PUMP ASSEMBLY.
ii) Rotate the camshaft of the injection pump and mesh timing pin (3) with timing pin pointer (4).
iii) Install the fuel injection pump assembly. For details, see INSTALLATION OF FUEL INJECTION PUMP ASSEMBLY.



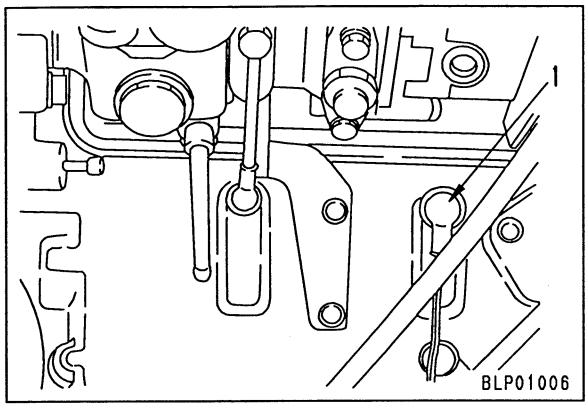


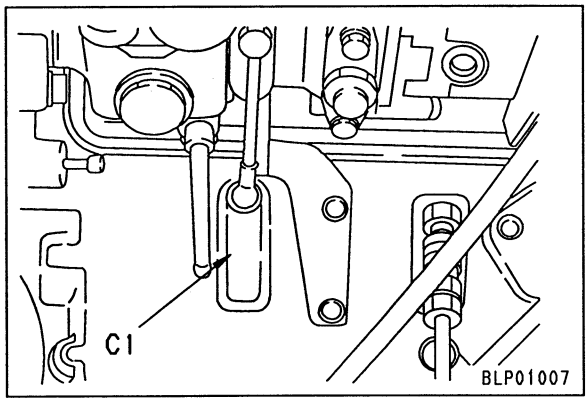
MEASURING ENGINE OIL PRESSURE

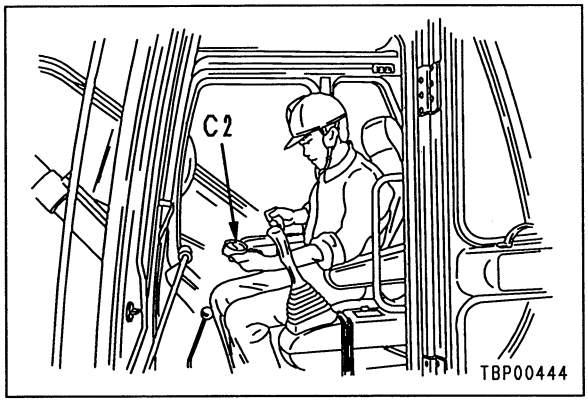
★ Measure the engine oil pressure under the following conditions.
- Coolant temperature: Within operating range

1. Remove engine oil pressure sensor (1), then install the adapter of oil pressure gauge kit **C1** and oil pressure gauge **C2** (1.0 MPa {10 kg/cm²}).

2. Start the engine, and measure the oil pressure at the low pressure end with the engine at low idling and at the high pressure end with the engine at high idling.







ADJUSTING ENGINE SPEED SENSOR

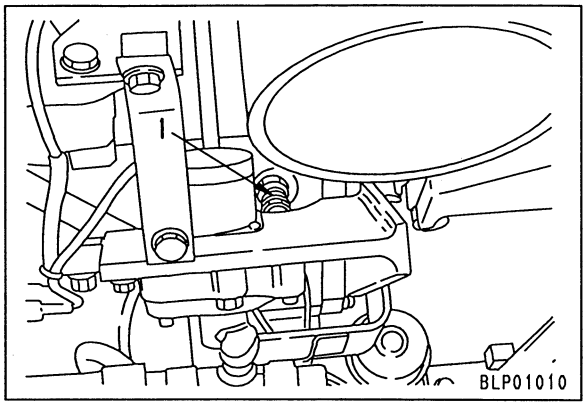
1. Screw in until the tip of sensor (1) contacts gear (2).

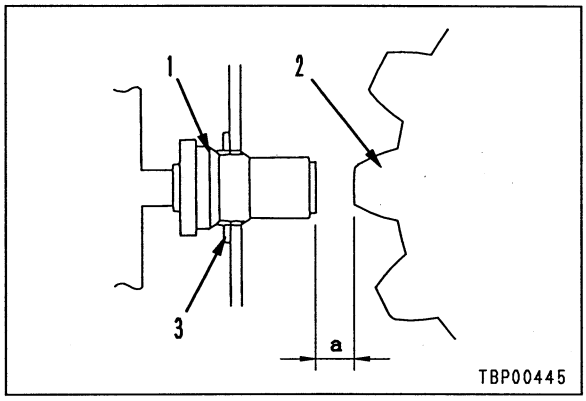
2. When sensor (1)contacts gear (2), turn back $1 \pm \frac{1}{6}$ turns to make clearance **a**.

3. Tighten locknut (3).

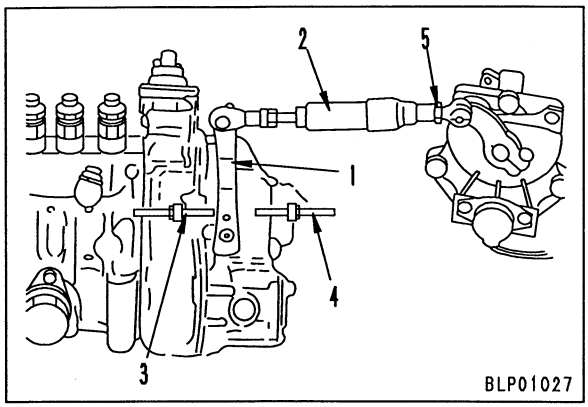
★ Be particularly careful when securing the sensor wiring to ensure that no excessive force is brought to bear on the wiring.

★ Be careful not to let the tip of the sensor be scratched or to let any iron particles stick to the sensor tip.





ADJUSTING GOVERNOR MOTOR LEVER STROKE



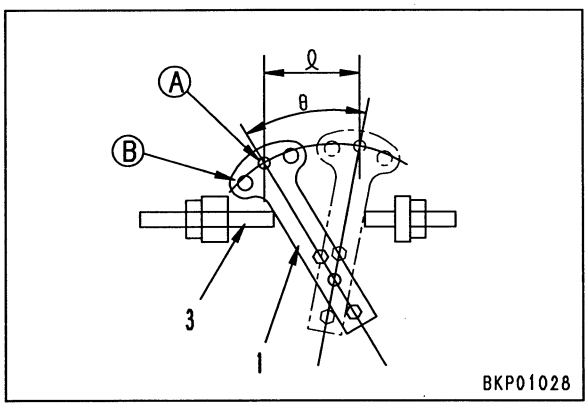
1. **Measuring governor lever stroke of fuel injection pump**
   1) Turn the starting switch OFF, then disconnect rod (2) from governor lever (1).
   2) Measure stroke L of governor lever (1) from FULL stopper (3) to STOP stopper (4).

2. **Selecting mounting hole for governor lever**
   Determine the mounting hole for the governor lever from the stroke measured in Step 1-2) and the table below.

		Standard value	Over standard value	
		①	②	③
Stroke of governor lever (mm)	ℓ	64 – 75	75 – 78	78 or more
Operating angle of governor lever (°)	θ	47 – 56	56 – 59	59 or more
Mounting hole for governor lever		Ⓐ	Ⓑ	

3. **Installing and adjusting rod**
   1) Set the switches to the following conditions:
      - Starting switch : ON
      - Working mode : Heavy-duty operation mode
      - Auto-deceleration : OFF
      - Fuel control dial : MAX
   2) Put governor lever (1) in contact with FULL stopper (2), then connect rod (2).
   3) From the above position, turn rod (2) back 2.5 turns (extend the rod approx. 3.1 mm), and secure in position with locknut (5).
   4) Start the engine, then turn the starting switch OFF and check that the engine stops.

   Note:
   When the spring assembly is removed and the starting switch is at the OFF position, if the governor motor lever is moved suddenly, the governor motor will generate electricity, and this may cause a failure in the governor controller.



TESTING AND ADJUSTING HYDRAULIC PRESSURE IN WORK EQUIPMENT, SWING, TRAVEL CIRCUIT

1. MEASURING

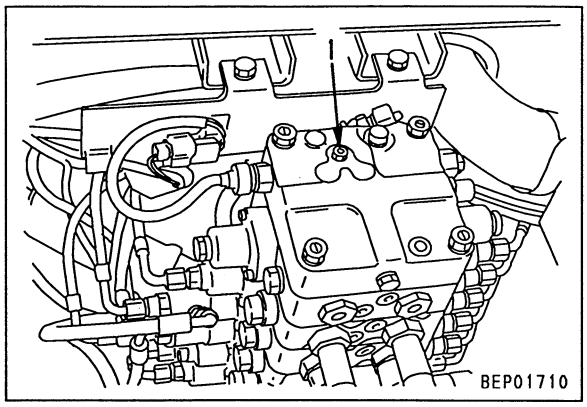
★ Oil temperature when measuring: 45 – 55°C

⚠ Lower the work equipment to the ground and stop the engine. Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank. Then put the safety lock lever in the LOCK position.

- Remove pressure pick-up plug (1) (Thread dia.=10mm, Pitch=1.25mm) from the circuit to be measured, then install oil pressure gauge **C1** (58.8 MPa {600 kg/cm²}).

- **Measuring unload pressure**
  Measure the oil pressure in heavy-duty operation mode with the engine at full throttle and the control levers at neutral.

- **Measuring pump relief pressure**
  1) Oil pressure when main relief pressure is at low pressure (31.9 MPa {325 kg/cm2})
     i) Measure the pressure when each actuator except the travel actuator is relieved in heavy-duty operation mode with the engine at full throttle.
        ★ Note that the set pressure of the safety valve for the swing motor is lower than the main relief pressure, so the value measured will be the relief pressure of the safety valve.
        If the swing lock switch is turned ON, the pressure will rise, so always keep the lock switch OFF when measuring.
        When measuring the relief pressure of the swing circuit, disconnect connector V04 (for the swing holding brake) and lock the swing before starting the engine.
        (After measuring, delete the service code.)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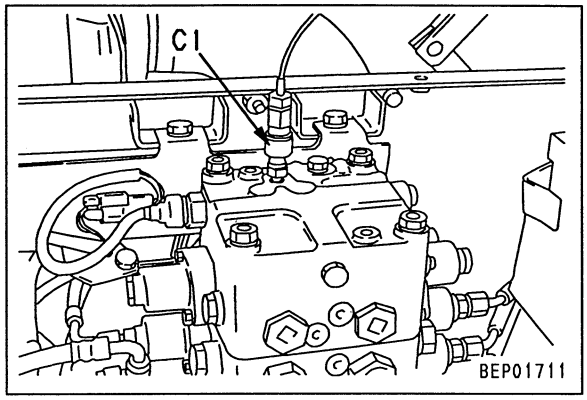

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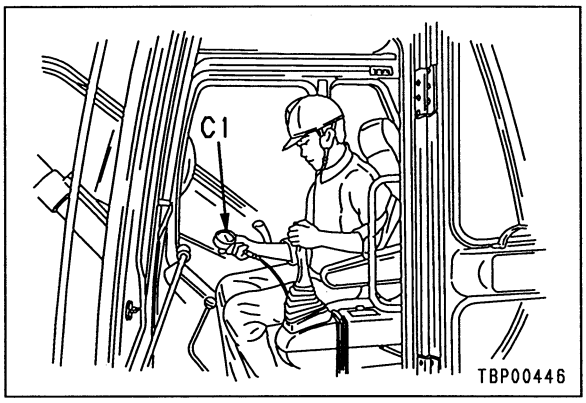

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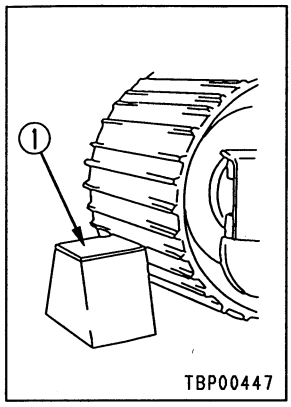
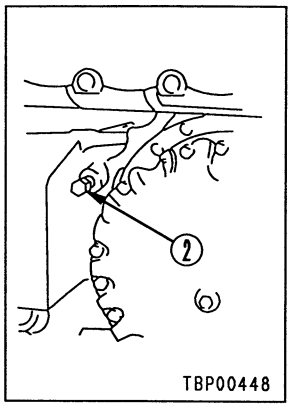
2) When pressure of main relief valve rises to 34.8 MPa {355 kg/cm^2}
   i) When travel is operated
   Measure the oil pressure when the travel is relieved on each side separately in heavy-duty operation mode with the engine at full throttle.
   ★ To relieve the travel circuit, put block ① under the track shoe grouser, or put block ② between the sprocket and frame to lock the track.
   ii) When power max. function is actuated
   When measuring the oil pressure in general operation or heavy-duty operation mode with the engine at full throttle and the power max. function actuated, relieve one of the boom, arm, or bucket circuits, and measure the oil pressure.





2. ADJUSTING

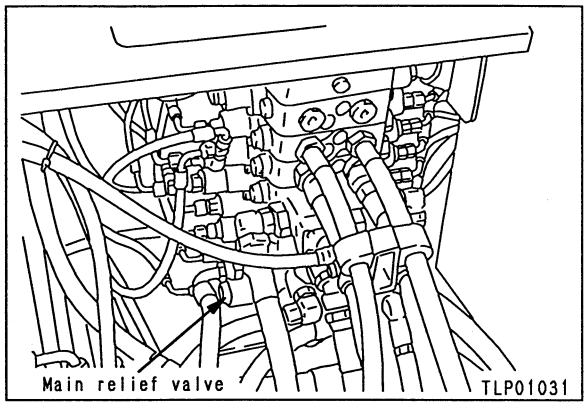
Main relief valve

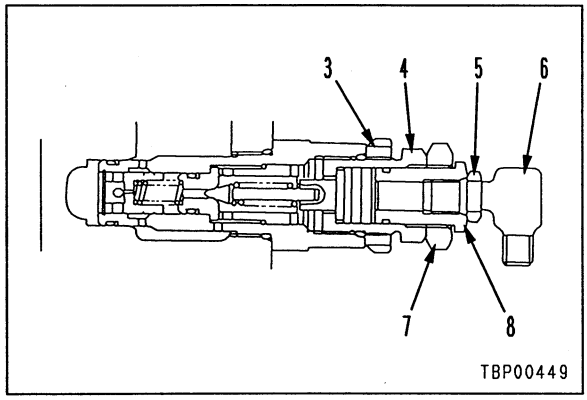
1) Adjusting high set pressure end
   i) Loosen locknut (5).
      ★ Check that elbow (6) can move.
   ii) Loosen locknut (3), then turn holder (4) to adjust.
      ★ Turn the holder to adjust as follows.
         • To INCREASE pressure, turn CLOCKWISE.
         • To DECREASE pressure, turn COUNTERCLOCKWISE.
      ★ Amount of adjustment for one turn of holder: 12.6 MPa {128 kg/cm²}

      kgm Locknut :
      58.8 ± 4.9 Nm {6 ± 0.5 kgm}
      ★ When the high-pressure end is adjusted, the low-pressure end also changes, so adjust the low-pressure end also.

2) Adjusting low set pressure end
   i) Loosen locknut (5).
      ★ Check that elbow (6) can move.
   ii) Loosen locknut (7), then turn holder (8) to adjust.
      ★ Turn the holder to adjust as follows.
         • To INCREASE pressure, turn CLOCKWISE.
         • To DECREASE pressure, turn COUNTERCLOCKWISE.
      ★ Amount of adjustment for one turn of holder: 12.6 MPa {128 kg/cm²}

      kgm Locknut :
      44.1 ± 4.9 Nm {4.5 ± 0.5 kgm}
      ★ Normally, there is a pressure of approx. 1.3 MPa {13 kg/cm²} or less applied to port **PR**, but at the high-pressure setting the pressure is approx. 2.9 MPa {30 kg/cm²}.

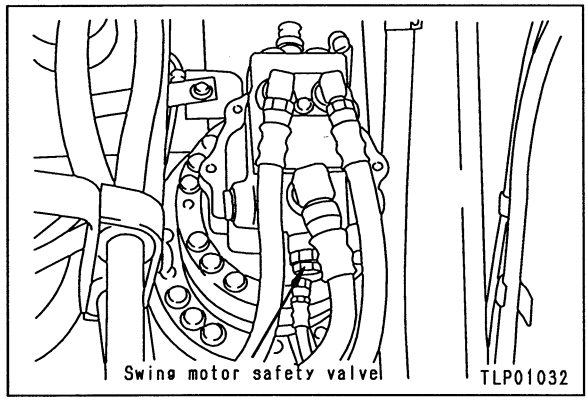


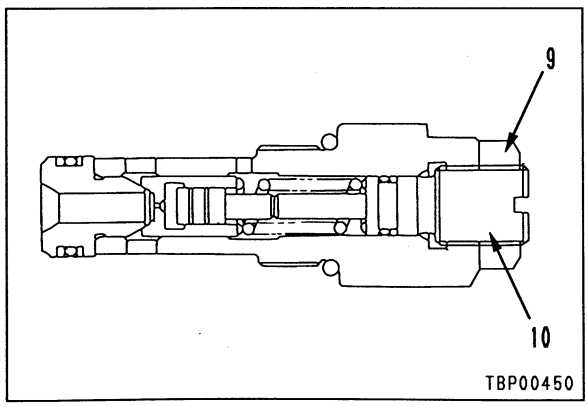


Swing motor safety valve

- Loosen locknut (9), 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.
  ★ After completion of adjustment, repeat the procedure in Item 1 to check again.

★ The safety valve set pressure can be adjusted only for the swing motor. Do not try to adjust the setting for anything except the swing motor.





TESTING AND ADJUSTING PC VALVE OUTPUT PRESSURE (SERVO PISTON INPUT PRESSURE)

Measuring

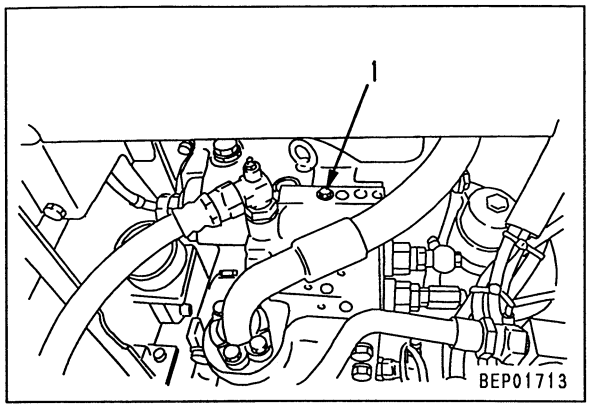
★ Oil temperature when measuring: 45 – 55°C

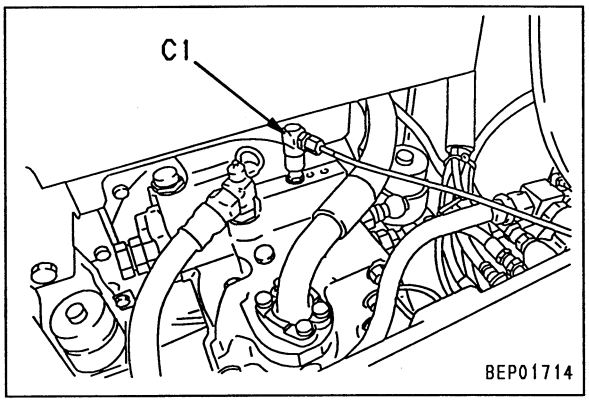
• Measure the oil pressure when the circuit is relieved in the pressure rise mode.

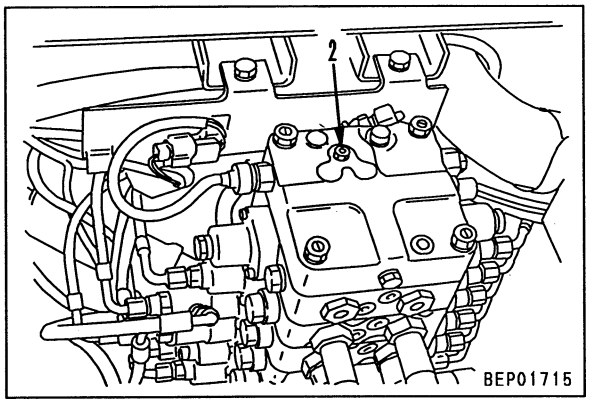
1) Remove pressure measurement plugs (1) and (2) (Thread dia.=10 mm, Pitch=1.5 mm), and install oil pressure gauge **C1**.
   ★ Install a 39.2 MPa {400 kg/cm²} gauge to the servo valve end, and a 58.8 MPa {600 kg/cm²} gauge to the pump outlet port end.
2) Turn the swing lock switch ON.
3) Set the working mode to heavy-duty operation mode.
4) Run the engine at full throttle, turn the knob switch ON, and measure the oil pressure when the arm (IN) circuit is relieved.
   ★ Check that the servo piston input pressure is 1/2 of the pump discharge pressure.

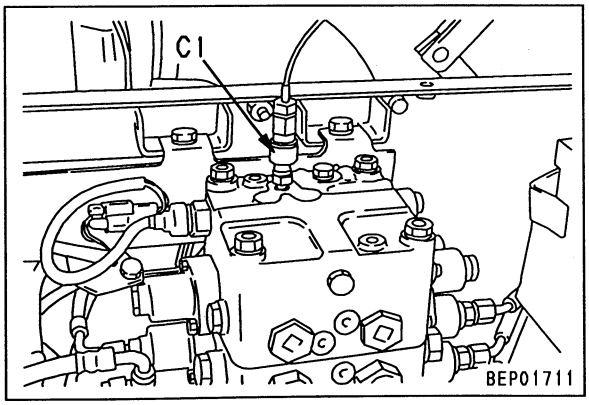
[Reference]

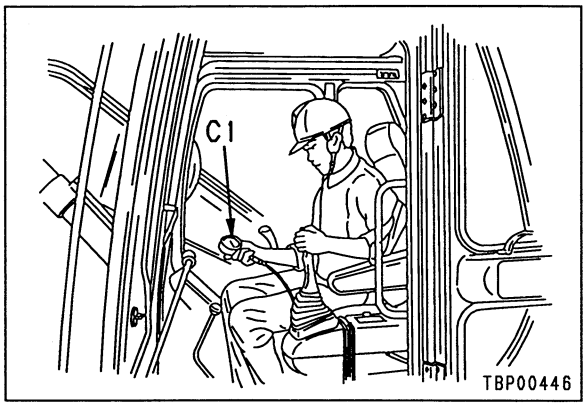
If there is any abnormality in the LS valve or servo piston, the servo piston input pressure will be 0 or almost the same as the pump discharge pressure.







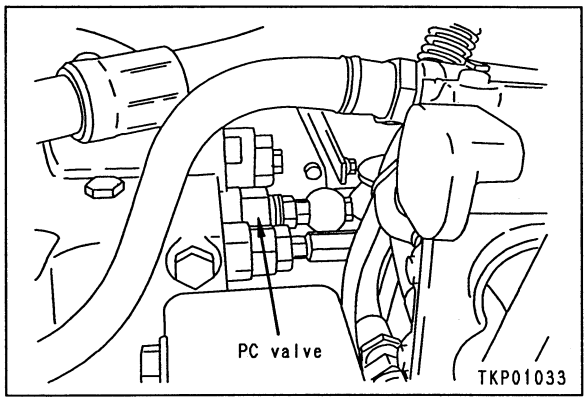




Adjusting

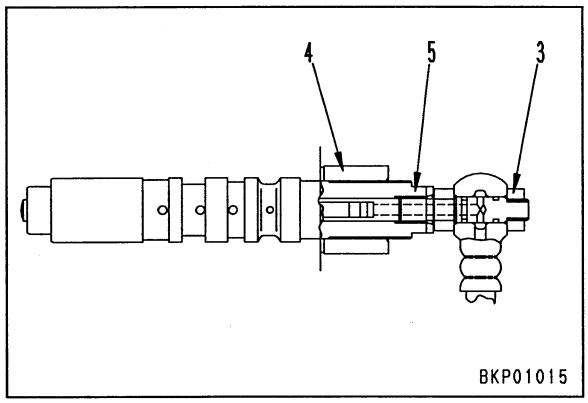
★ If the load becomes larger and the engine speed drops, or if the engine speed remains normal and the work equipment speed drops, and the pump discharge pressure and LS differential pressure are normal, adjust the PC valve as follows.

1) Loosen locknut (4), and if the speed is slow, turn screw (5) to the right; if the engine speed drops, turn the screw to the left.
   - ★ If the screw is turned to the right, the pump absorption torque will be increased, and if it is turned to the left, the pump absorption torque will be reduced.
   - ★ The adjustment range for the screw is a maximum of 1 turn to the left and 180° to the right.
   - ★ Amount of adjustment for one turn of screw: 1.5 mm movement of servo piston stroke



2) After completing the adjustment, tighten the locknuts.

   kgm Locknut (3):
   34.3 ± 4.9 Nm {3.5 ± 0.5 kgm}
   Locknut (4):
   100.5 ± 12.3 Nm {10.25 ± 1.25 kgm}



TESTING AND ADJUSTING LS VALVE OUTPUT PRESSURE (SERVO PISTON INPUT PRESSURE) AND LS DIFFERENTIAL PRESSURE

★ Oil temperature when measuring: 45 – 55°C

1. Measuring LS valve output pressure (servo piston input pressure)

1) Remove pressure measurement plugs (1) and (2) (Thread dia.= 10 mm, Pitch=1.25 mm), and install oil pressure gauge **C1**.
   ★ Install a 39.2 MPa {400 kg/cm²} gauge to the servo valve end, and a 58.8 MPa {600 kg/cm²} gauge to the pump outlet port end.

- Oil pressure when track is rotating under no load on one side

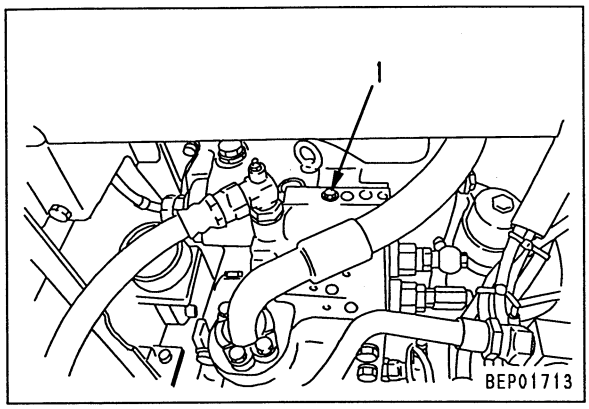
i) Set the working mode to heavy-duty operation mode, and turn the travel speed switch to Hi.

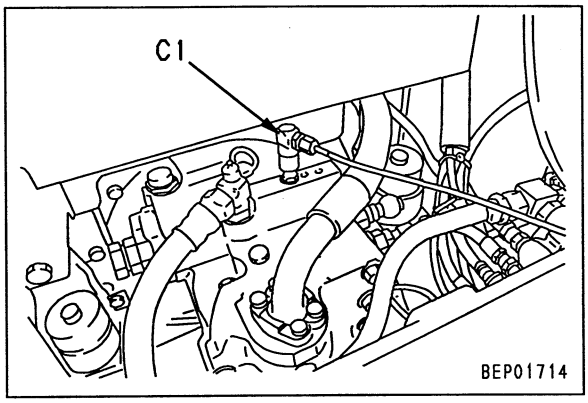
ii) Use the work equipment to raise the track assembly on one side.

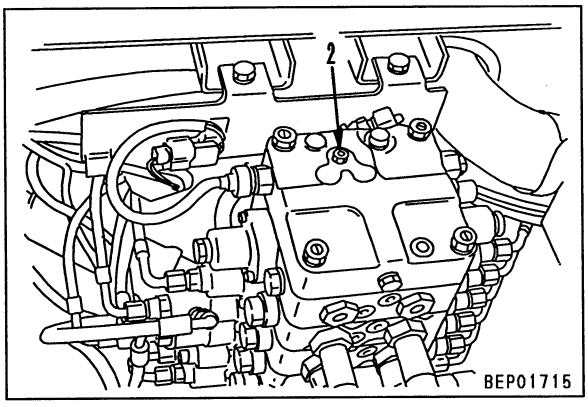
iii) Measure the oil pressure with the engine at full throttle and the travel lever operated to the end of its stroke to rotate the track under no load.
Run the engine at full throttle, operate the travel lever to the end of its stroke, and measure the oil pressure when the working mode and travel speed are switched as shown in Table 1.

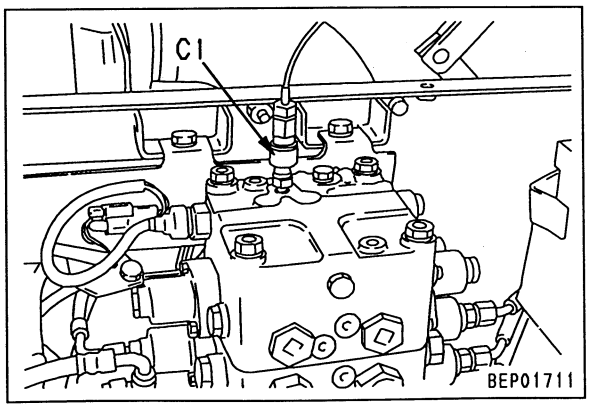
Table 1

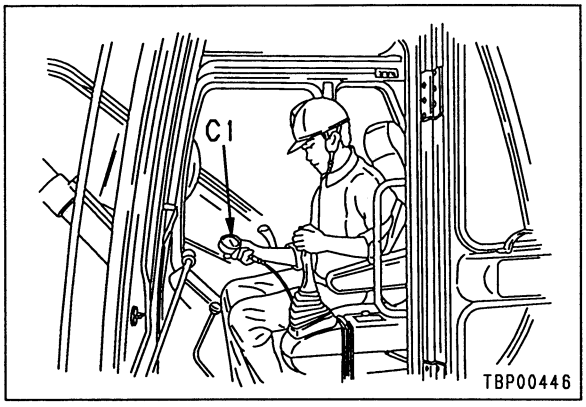
Working mode	Travel lever	Pump pressure MPa{kg/cm²}	Servo inlet port pressure MPa{kg/cm²}	Remarks
H/O mode	Neutral	2.9 ± 0.5 {30 ± 5}	2.9 ± 0.5 {30 ± 5}	About same pressure
H/O mode	Full	7.8 ± 2.0 {80 ± 20}	4.4 ± 1.0 {45 ± 10}	About 3/5 of pressure









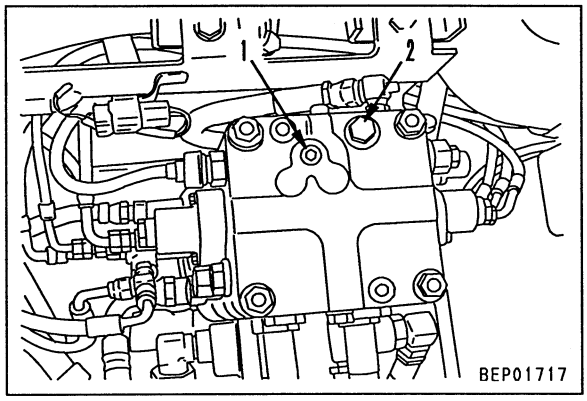


2. Measuring LS differential pressure

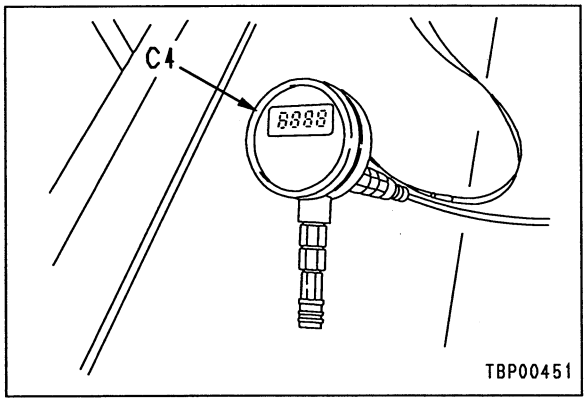
1) Measuring with a differential pressure gauge
   i) Remove oil pressure measurement plugs (1) and (2) (Thread dia.=10mm, Pitch =1.25mm), and install differential pressure gauge **C4**.
   ii) Set to the conditions in Table 2 and measure the LS differential pressure.

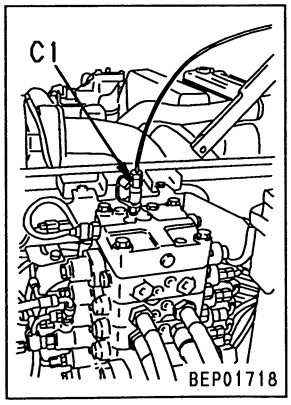
Table 2

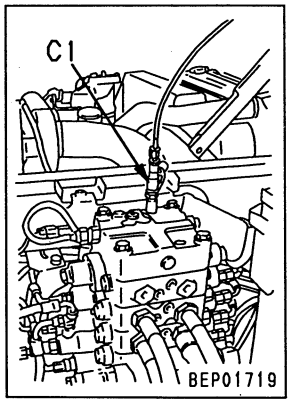
Working mode	Fuel control lever	Operation	Differential pressure MPa{kg/cm²}
H/O mode	Full	Levers at neutral	$2.7^{+1.0}_{-0.7}$ {30^{+10}_{-7}}
H/O mode	Full	Travel speed: Hi Travel circuit under no load (lever fully operated)	2.2 ± 0.1 {22 ± 1}



2) Measuring with oil pressure gauge
   ★ The maximum differential pressure is $2.7^{+1.0}_{-0.7}$ MPa {28^{+10}_{-7} kg/cm²}, so measure with the same gauge.
   i) Install oil pressure gauge **C1** (58.8 MPa {600 kg/cm²}) to plug (1) for measuring the pump discharge pressure.
      ★ Use a gauge with a scale in units of 1.0 MPa {10 kg/cm²}.
      (If no 58.8 MPa {600 kg/cm²} pressure gauge is available, a 39.2 MPa {400 kg/cm²} pressure gauge can be used.)
   ii) Set to the conditions in Table 2 and measure the pump discharge pressure.
      ★ Stand directly in front of the indicator and be sure to read it correctly.
   iii) Remove oil pressure gauge **C1**, then install to LS pressure measurement plug (2).
   iv) Set to the conditions in Table 2 and measure the LS pressure.
      ★ Stand directly in front of the indicator and be sure to read it correctly.
      (Pump discharge pressure) – (LS pressure) = Differential pressure







3. Adjusting LS valve

When the differential pressure is measured under the conditions above, and the results show that the differential pressure is not within the standard value, adjust as follows.

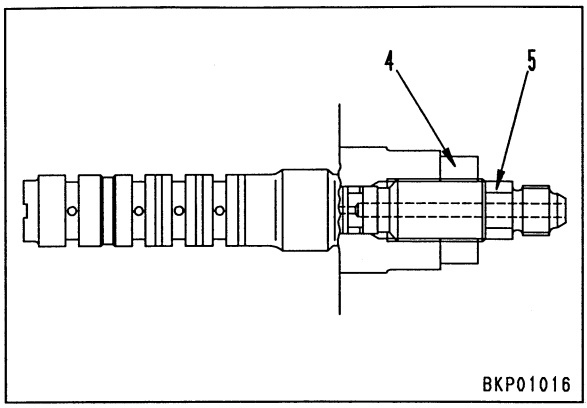
1) Loosen locknut (4) and turn screw (5) to adjust the differential pressure.

- Turn the screw to adjust as follows.
  To INCREASE pressure, turn CLOCKWISE
  To DECREASE pressure, turn COUNTER-CLOCKWISE
  ★ Amount of adjustment for one turn of screw: 1.3 MPa {13.3 kg/cm²}

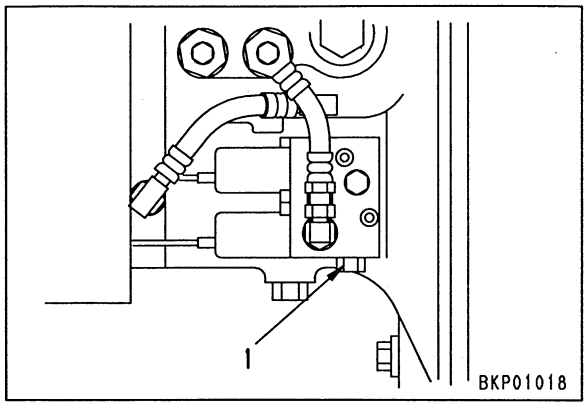
2) After adjusting, tighten locknut (4).

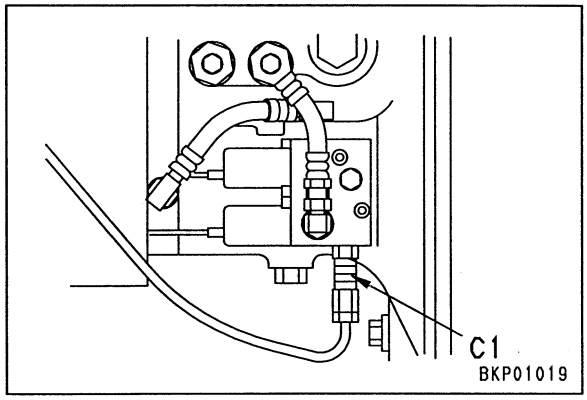
kgm Locknut:
56.4 ± 7.4 Nm {5.75 ± 0.75 kgm}

Note: Always measure the differential pressure while adjusting.



TESTING AND ADJUSTING CONTROL PUMP CIRCUIT OIL PRESSURE





1. Measuring

★ Oil temperature when measuring: 45 – 55°C

1) Remove pressure pick-up plug (1) (Thread dia.=10mm, Pitch=1.25mm), and install oil pressure gauge **C1** (5.9 MPa {60 kg/cm²}).
2) Start the engine and measure with the engine at full throttle.

★ When testing for internal leakage of the equipment in the control circuit, use the parts given below to shut off the circuit for the following sections when measuring the relief pressure.

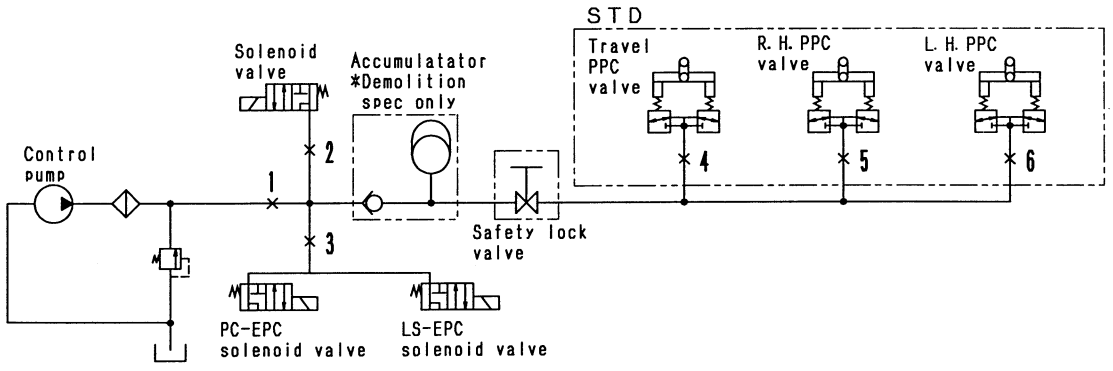
No.	Section of hydraulic circuit shut off	Component that can be checked
1	Control pump outlet port	Control pump
2	Solenoid valve inlet port	Solenoid valve
3	PC, LS-EPC solenoid valve inlet port	PC, LS-EPC solenoid valve
4	Travel PPC valve inlet port	Travel PPC valve
5	R.H. PPC valve inlet port	R.H. PPC valve
6	L.H. PPC valve inlet port	L.H. PPC valve

★ Items No. 2 and below can be checked if the equipment in the previous number is normal.

★ Use the following parts to shut off the circuit.

- For elbow
  Sleeve nut : 07221-20210, 07221-20315
  07221-20422
  Plug : 07222-00210, 07222-00315
  07222-00414

- For hose
  Plug : 07376-50210, 07376-50315
  07376-50422



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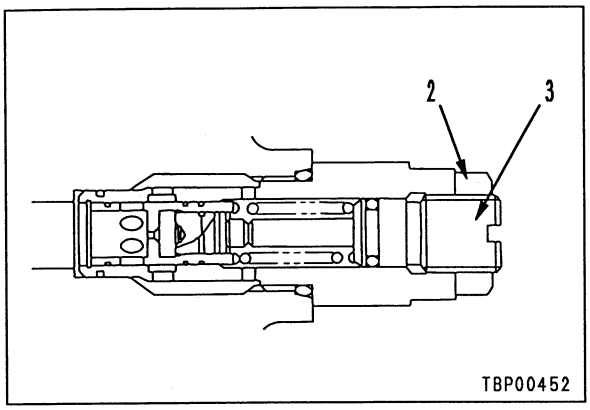
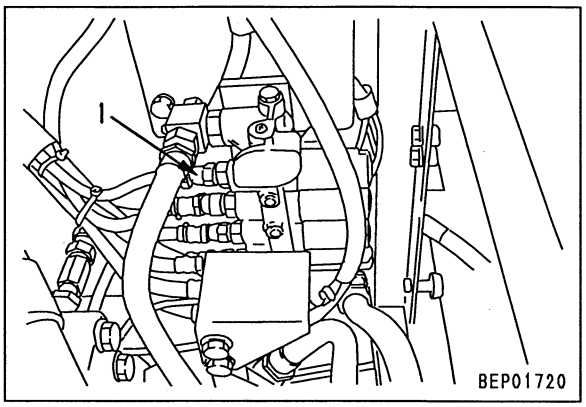
2. Adjusting

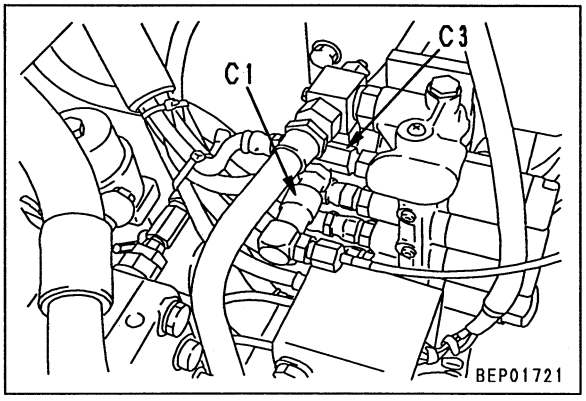
1) Loosen locknut (2) and turn adjustment screw (3) to adjust.
   - ★ Turn the adjustment screw as follows.
     - To INCREASE pressure, turn CLOCKWISE
     - To DECREASE pressure, turn COUNTERCLOCKWISE
   - ★ Amount of adjustment for one turn of adjustment screw: 0.52 MPa {5.4 kg/cm²}

   kgm Locknut :
   63.7 ± 9.8 Nm {6.5 ± 1.0 kgm}
   - ★ After completion of adjustment, repeat the procedure in Item 1 to check the set pressure again.



TESTING SOLENOID VALVE OUTPUT PRESSURE





Measuring

★ Oil temperature when measuring: 45 – 55°C

1. **Measuring output pressure of ON/OFF solenoid valve**
   1) Disconnect outlet hose (1) of the solenoid valve, then use adapter **C3** in the oil pressure gauge kit to install oil pressure gauge **C1** (5.9 MPa {60 kg/cm²}).
   2) Measure the output pressure under the conditions in Table 1.
      Note: The condition of the solenoid valves is as follows.
      When ON : Current flows (hydraulic pressure is generated)
      When OFF : Current does not flow (hydraulic pressure: 0 MPa {0 kg/cm²})
      However, the condition of the LS bypass and active mode solenoids is as follows.
      When ON : Current flows (hydraulic pressure: 0 MPa {0 kg/cm²})
      When OFF : Current does not flow (hydraulic pressure: 2.9 MPa {30 kg/cm²})

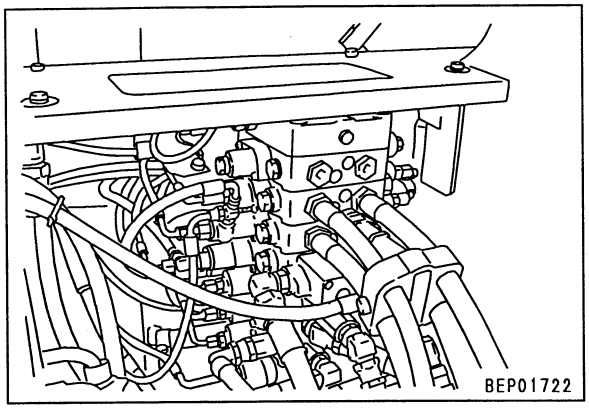
Table 1

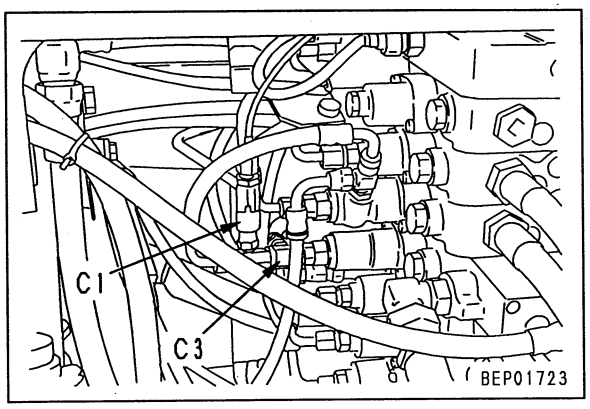
Name of solenoid		Measurement conditions	Operating condition	Condition of solenoid	Oil pressure (MPa {kg/cm²})	Remarks
1	Swing holding brake	Swing or work equipment lever operated	Brake canceled	ON	2.9 ± 0.5 {30 ± 5}	
		All levers except travel at neutral (5 sec after returning to neutral)	Brake actuated	OFF	0	
2	Travel speed selection	Travel speed selection switch at Hi • Engine speed 1,500 rpm or above • Travel lever operated	Travel speed Hi	ON	2.9 ± 0.5 {30 ± 5}	Motor swash plate angle at minimum
		Travel speed selector switch at Lo or engine speed 1,500 rpm or below	Travel speed Lo	OFF	0	Motor swash plate angle at maximum
3	2-stage relief	Swing lock switch ON + work equipment lever operated	Pressure rise	ON	2.9 ± 0.5 {30 ± 5}	
		All levers at neutral		OFF	0	
4	Active solenoid	Active mode switch ON + engine speed 1,800 rpm or above	Active mode actuated	ON	0	
		Any operation except above	Active mode not actuated	OFF	2.9 ± 0.5 {30 ± 5}	

MEASURING PPC VALVE OUTPUT PRESSURE

★ Oil temperature when measuring: 45 – 55°C

1. **Measuring PPC valve output pressure**
   1) Disconnect the hose of the circuit to be measured.
   2) Install adapter **C3** between the hose and elbow.
   3) Install oil pressure gauge **C1** (5.9 MPa {60 kg/cm²}) to adapter **C3**.
   4) Run the engine at full throttle, operate the control lever of the circuit to be measured, and measure the oil pressure.





ADJUSTING WORK EQUIPMENT, SWING PPC VALVE

★ If there is excessive play in the work equipment or swing levers, adjust as follows.

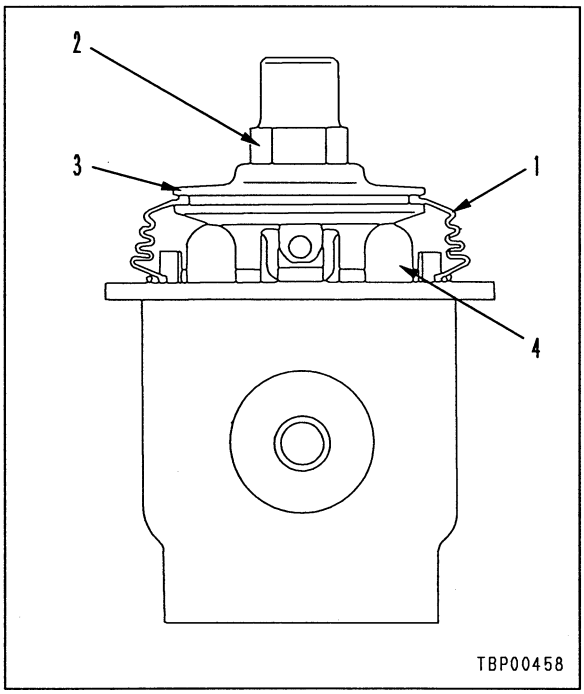
⚠ Lower the work equipment to the ground and stop the engine. Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank. Then set the safety lock lever to the LOCK position.

1. Remove the PPC valve.
2. Remove boot (1).
3. Loosen locknut (2), then screw in disc (3) until it contacts the heads of 4 pistons (4).
   ★ When doing this, do not move the piston.
4. Secure disc (3) in position, then tighten locknut (2) to the specified torque.

   kgm Locknut : **107.9 ± 9.8 Nm {11 ± 1 kgm}**

5. Install boot (1).

★ With the above adjustment, the clearance between disc (3) and piston (4) becomes 0.

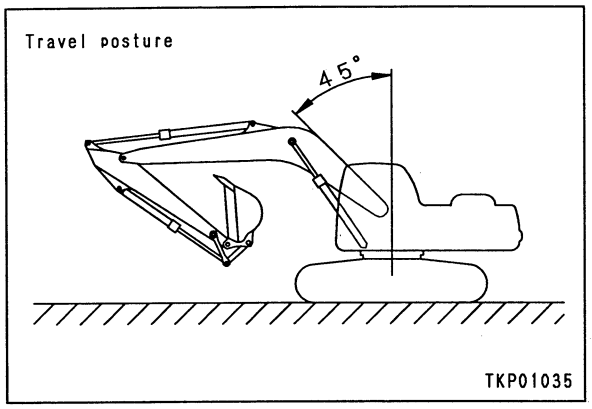


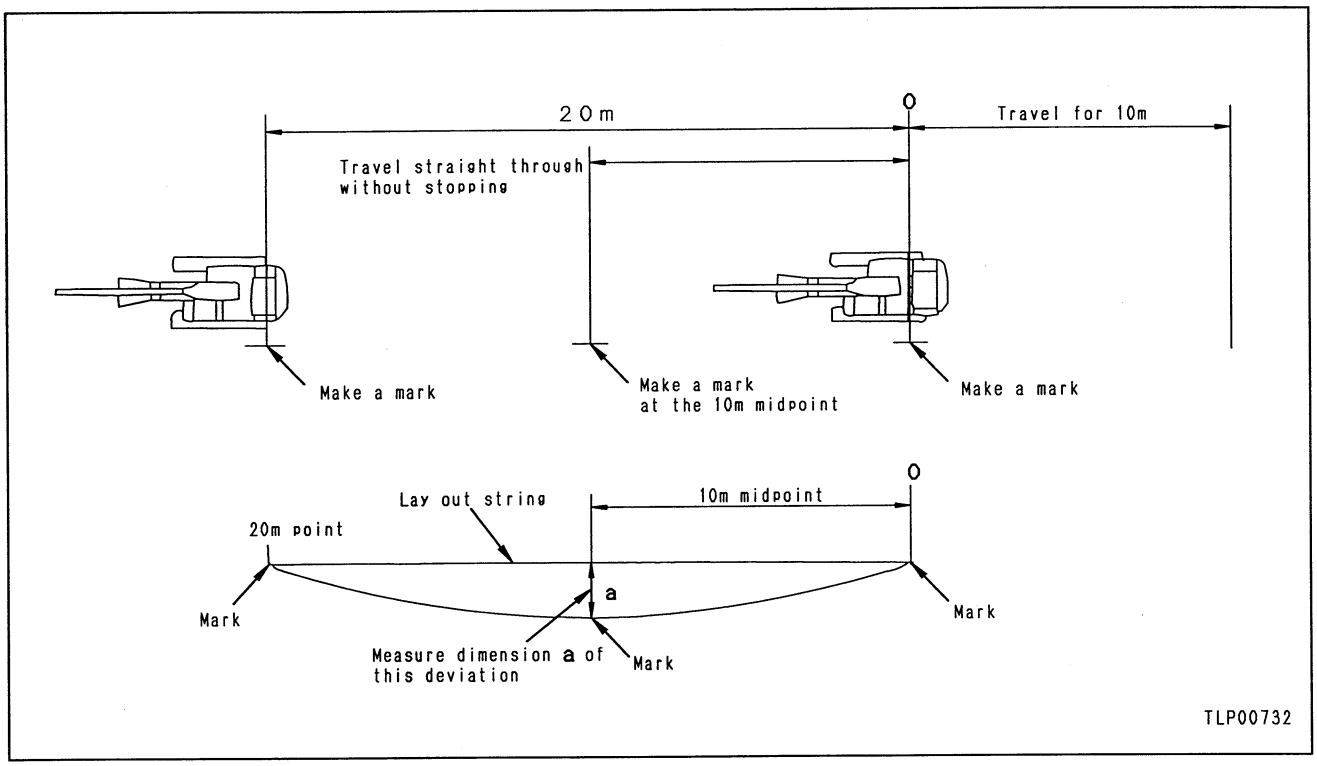
TESTING TRAVEL DEVIATION

1. Measuring when traveling

1) Set the machine in the travel posture.
   ★ For the travel posture, extend the bucket and arm cylinder rods fully, and hold the boom angle at 45°.
2) Travel for 10 m, then measure deviation **a** when traveling for the next 20 m.

★ Measure with the engine at full throttle.
★ Install a hydraulic pressure gauge and measure the pump discharge pressure at the same time.





TESTING LOCATIONS CAUSING HYDRAULIC DRIFT OF WORK EQUIPMENT

★ If there is any hydraulic drift in the work equipment (cylinders), check as follows to determine if the cause is in the cylinder packing or in the control valve.

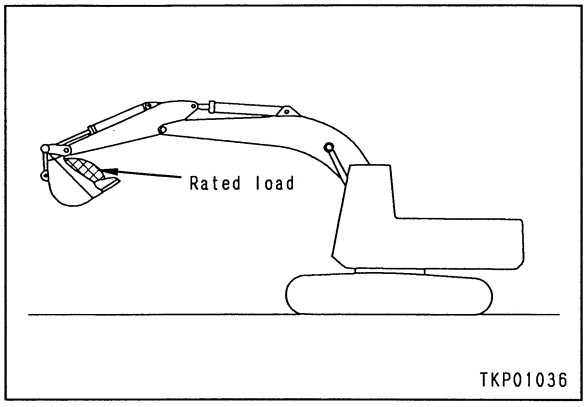
1. Checking for defective cylinder packing (demolition specification machine only)

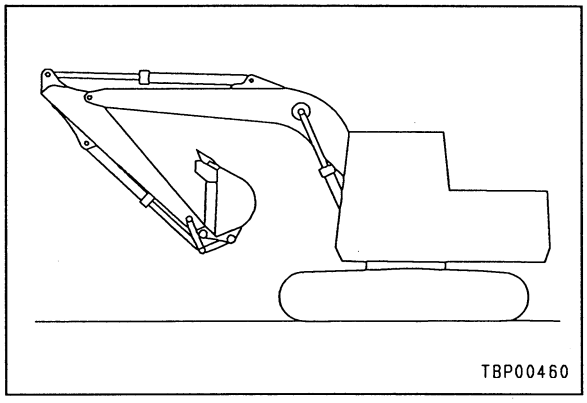
1) Checking boom and bucket cylinders
   i) Set in the same posture as when measuring hydraulic drift, and stop the engine.
   ii) Operate the boom control lever to RAISE or the bucket control lever to CURL.
      • If the lowering speed increases, the packing is defective.
      • If there is no change, "the boom holding valve (boom)" or "the control valve (bucket)" is defective.
2) Checking arm cylinder
   i) Operate the arm cylinder to move the arm in fully, then stop the engine.
   ii) Operate the control lever to arm IN.
      • If the lowering speed increases, the packing is defective.
      • If there is no change, the control valve is defective.
      ★ If the pressure in the accumulator has dropped, run the engine for approx. 10 seconds to charge the accumulator again before operating.

[Reference]

If the cause of the hydraulic drift is in the packing, and the above operation is carried out, the downward movement becomes faster for the following reasons.

1) If the work equipment is set to the above posture (holding pressure applied to the bottom end), the oil at the bottom end leaks to the head end. However, the volume at the head end is smaller than the volume at the bottom end by an amount equal to the volume of the rod, so the internal pressure at the head end increases because of the oil flowing in from the bottom end.
2) When the internal pressure at the head end increases, the pressure at the bottom end also rises in proportion to this. The balance is maintained at a certain pressure (this differs according to the amount of leakage) by repeating this procedure.





3) When the pressure is balanced, the downward movement becomes slower. If the lever is then operated according to the procedure given above, the circuit at the head end is opened to the drain circuit (the bottom end is closed by the check valve), so the oil at the head end flows to the drain circuit and the downward movement becomes faster.

MEASURING OIL LEAKAGE

★ Oil temperature when measuring: 45 – 55°C

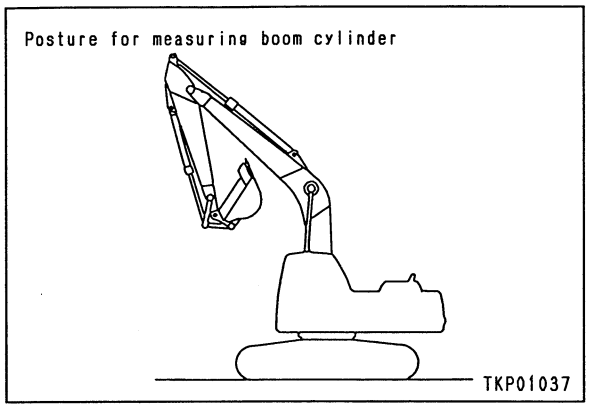
1. Work equipment cylinder

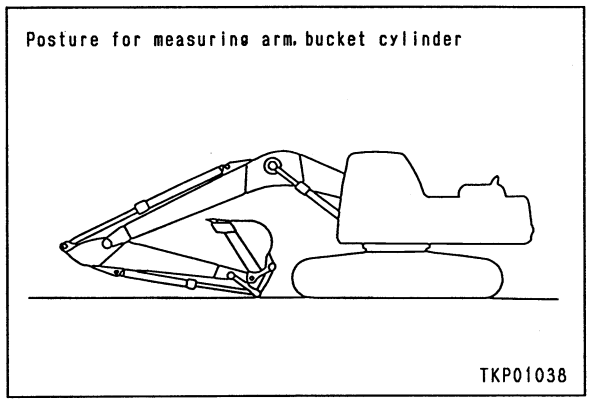
★ If the hydraulic drift of the work equipment is not within the standard value, measure the leakage inside the cylinder as follows, and judge if the cause of the hydraulic drift is in the cylinder or in the control valve.
- If the leakage is within the standard value, the problem is in the control valve.
- If the leakage is greater than the standard value, the problem is in the cylinder.

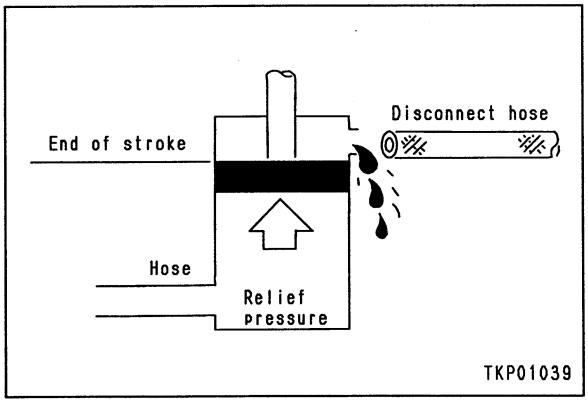
★ Oil temperature when measuring: 45 – 55°C

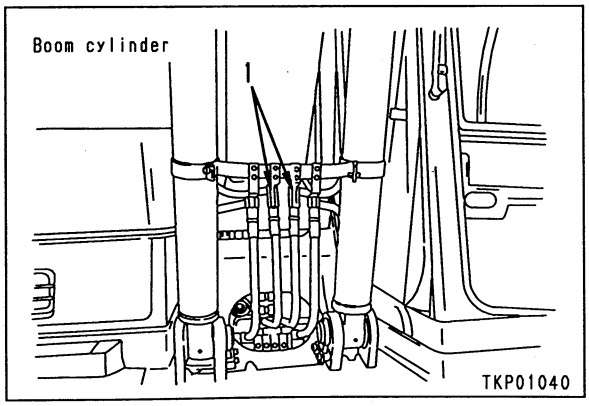
1) Fully extend the rod of the cylinder to be measured, then stop the engine.
2) Disconnect piping (1) at the head end, then block the piping at the chassis end with a blind plug.

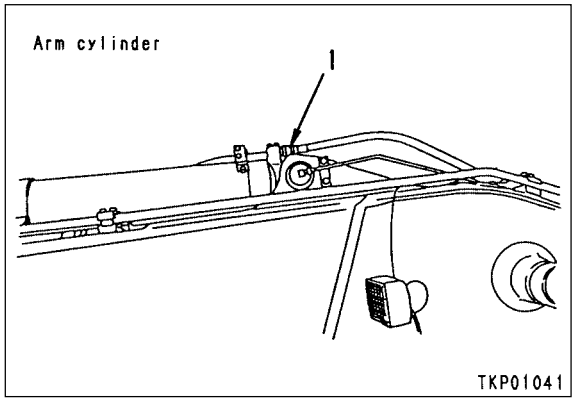
   ⚠ Be careful not to disconnect the piping at the bottom end.
3) Start the engine and apply the relief pressure to the bottom end of the cylinder with the engine at full throttle.
4) Continue this condition for 30 seconds, then measure the oil leakage for the next one minute.

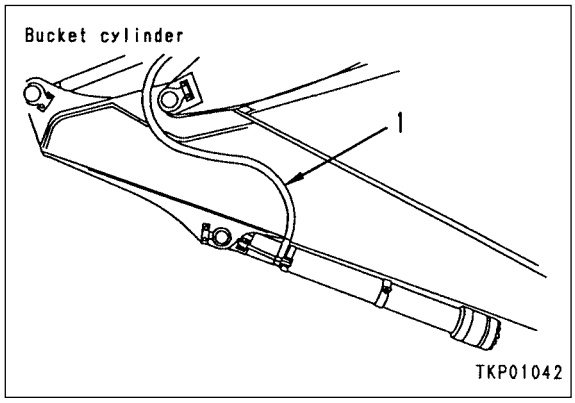






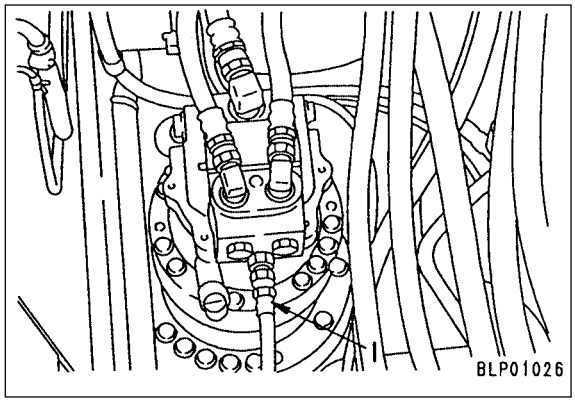






2. Swing motor

1) Disconnect swing motor drain hose (1), then fit a blind plug at the tank end.
2) Turn the swing lock switch ON.
3) Start the engine and operate the swing relief with the engine at full throttle.
4) Continue this condition for 30 seconds, then measure the oil leakage for the next one minute.
   ★ After measuring, swing 180° and measure again.



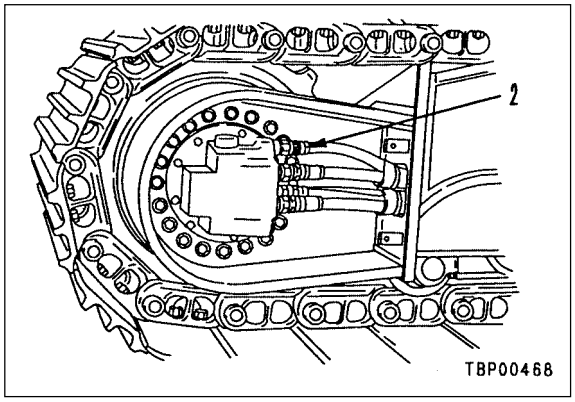
For PC130-6K

3. Travel motor

1) Disconnect travel motor drain hose (2), then fit a blind plug at the hose end.
2) Fit block ① under the track shoe grouser, or fit block ② between the sprocket and frame to lock the track.
3) Start the engine and operate the travel relief with the engine at full throttle.

⚠ When measuring the oil leakage from the travel motor, mistaken operation of the control lever may lead to a serious accident, so always use signals and check when carrying out this operation.

4) Continue this condition for 30 seconds, then measure the oil leakage for the next one minute.
   ★ When measuring move the motor slightly (to change the position between the valve plate and cylinder, and piston and cylinder), and measure several times.



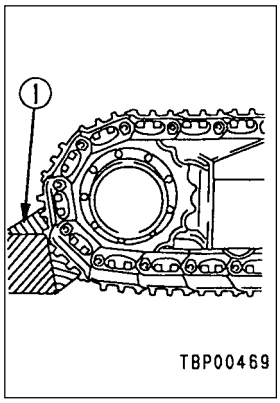
For PC150LGP-6K

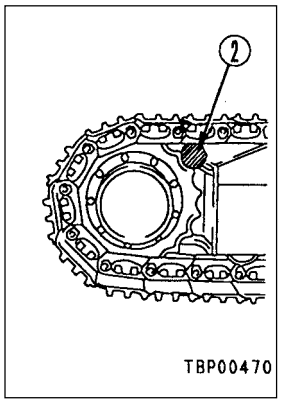
3. Travel motor

1) Disconnect drain hose ① from the travel motor, then fit a blind plug at the hose end.
2) Fit block ① under the track shoe grouser, or fit block ② between the sprocket and frame to lock the track.
3) Start the engine and operate the travel relief with the engine at full throttle.

⚠ When measuring the oil leakage from the travel motor, mistaken operation of the control lever may lead to a serious accident, so always use signals and check when carrying out this operation.

4) Continue this condition for 30 seconds, then measure the oil leakage for the next one minute.
   ★ When measuring move the motor slightly (to change the position between the valve plate and cylinder, and piston and cylinder), and measure several times.

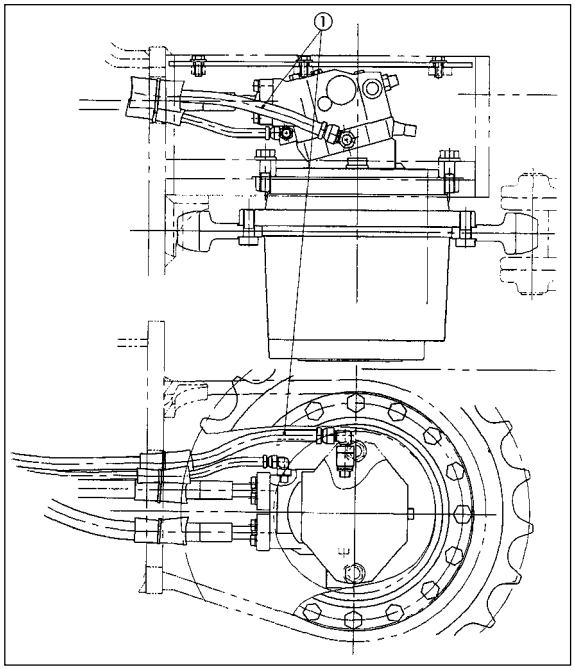


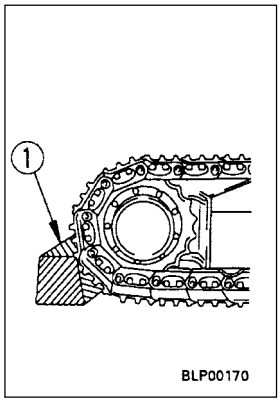


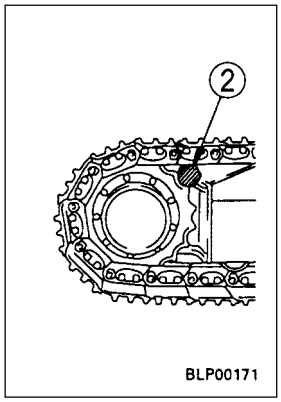
RELEASING REMAINING PRESSURE IN HYDRAULIC CIRCUIT

⚠ No accumulator is installed, so the pressure remaining in the piping between the control valve and the hydraulic cylinder or swing motor cannot be released by operating the control levers.
Therefore, when removing the above piping, be careful of the following points.

1) Run the engine at low idling, operate the hydraulic cylinders so that they are not relieved at the end of the stroke, lower the work equipment to the ground, then stop the engine.
   ★ If the engine is stopped with the cylinder relieved at the end of the stroke, wait for 5 – 10 minutes before starting the operation.
2) When removing the piping, gradually loosen the sleeve nut of the piping to slowly release the pressure remaining in the piping. Remove the piping when the oil stops spurting out.



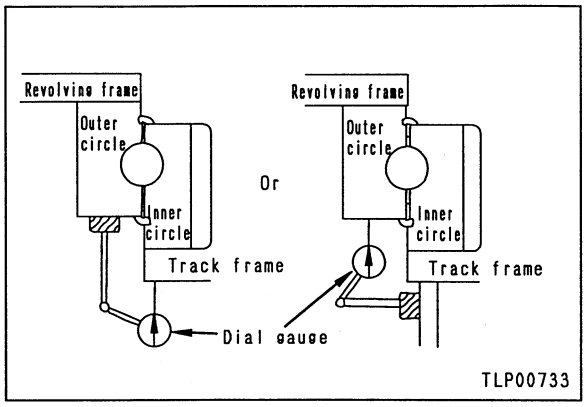




TESTING CLEARANCE OF SWING CIRCLE BEARING

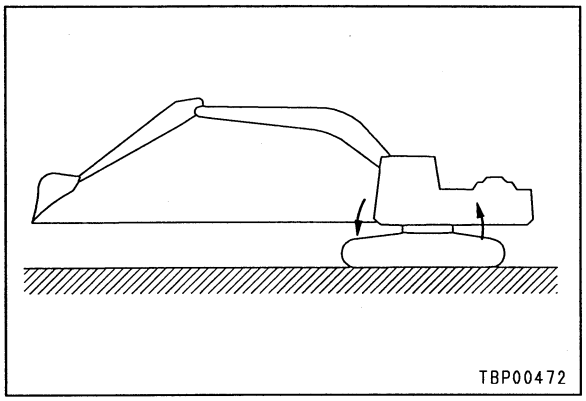
Method of testing clearance of swing circle bearing when mounted on machine

1. Fix a magnet-type dial gauge to the outer circle (or inner circle) of the swing circle, and put the tip of the probe in contact with the inner circle (or outer circle). Set the dial gauge at the front or rear.



2. Extend the work equipment to the maximum reach, and set the tip of the bucket to the same height as the bottom of the revolving frame.
   When this is done, the upper structure will tilt forward, so the front will go down and the rear will rise.

3. Set the dial gauge to the zero point.

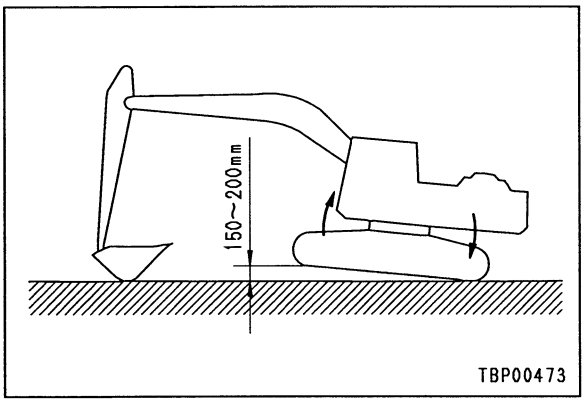


4. Set the arm more or less at right angles to the ground surface, then lower the boom until the front of the machine comes off the ground.
   When this is done, the upper structure will tilt back, so the front will rise and the rear will go down.

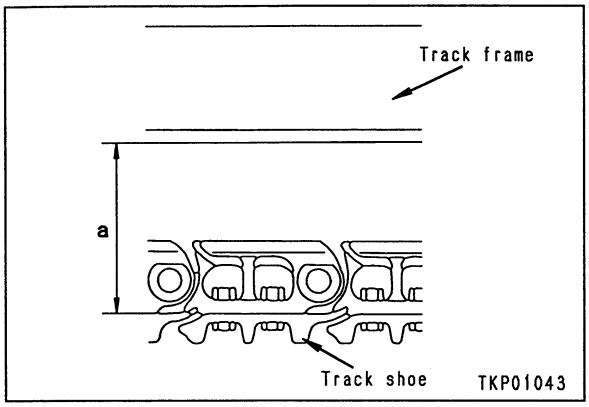
5. Read the value on the dial gauge at this point. The value on the dial gauge is the clearance of the swing circle bearing.

   ⚠ When carrying out the measurement, do not put your hand or feet under the undercarriage.

6. Return to the condition in Step 2 and check that the dial gauge has returned to the zero point. If it has not returned to the zero point, repeat Steps 2 to 5.



TESTING AND ADJUSTING TRACK SHOE TENSION



Testing

1. Raise the track frame using the arm and boom, and measure clearance **a** between the bottom of the track frame and the top of the track shoe.

- Clearance **a** : 230 ± 10 mm

Measurement position

4th track roller from the sprocket.

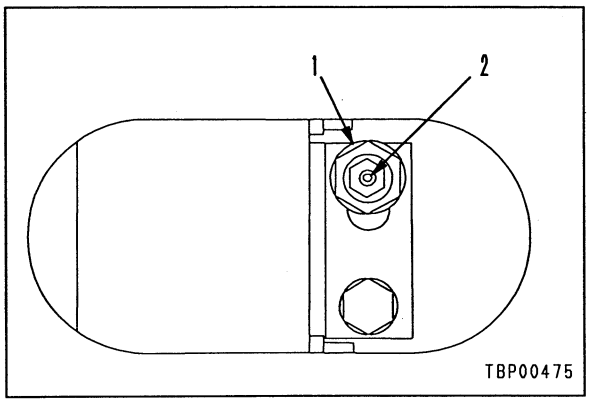
Adjusting

★ If the track shoe tension is not within the standard value, adjust as follows.

1. **When the tension is too high:**
   Loosen plug (1) gradually, and release the grease.

   ⚠ There is danger that the plug may fly out under the high internal pressure of the grease, so never loosen plug (1) more than 1 turn.

   ★ If the grease does not come out easily, move the machine backwards or forwards slowly.



2. **If track is too loose**
   Pump in grease through grease fitting (2).

   ★ If the grease cannot be pumped in easily, move the machine backwards and forwards slowly.

BLEEDING AIR

ORDER FOR OPERATIONS AND PROCEDURE FOR BLEEDING AIR

Air bleeding item / Nature of work	Air bleeding procedure 1 Bleeding air from pump	2 Start engine	3 Bleeding air from cylinder	4 Bleeding air from swing motor	5 Bleeding air from travel motor	6 Start operations
• Replace hydraulic oil • Clean strainer	○	→ ○	→ ○	→ ○	→ ○ (Note)	→ ○ (Note)
• Replace return filter element		○	→	→	→	→ ○
• Replace, repair pump • Remove suction piping	○	→ ○	→ ○	→	→	→ ○
• Replace, repair control valve		○	→ ○	→	→	→ ○
• Replace cylinder • Remove cylinder piping		○	→ ○	→	→	→ ○
• Replace swing motor • Remove swing motor piping		○	→	→ ○	→	→ ○
• Replace travel motor, swivel • Remove travel motor, swivel		○	→	→	→ ○	→ ○

Note : Bleed the air from the swing and travel motors only when the oil inside the motor case has been drained.

1. Bleeding air from pump

1) Loosen air bleed plug (1), and check that oil oozes out from the plug.
2) When oil oozes out, tighten plug (1).

kgm Plug :
17.25 ± 2.5 Nm {1.75 ±0.25 kgm}

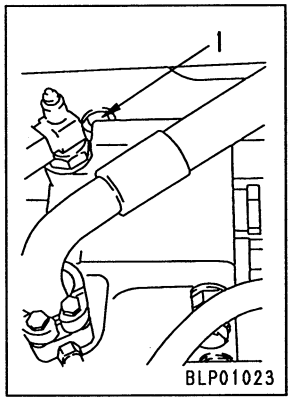
★ If no oil oozes out from the air bleed plug:

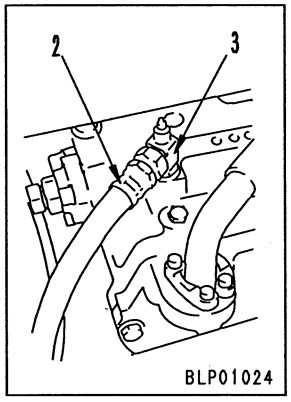
3) Leave plug (1) loosened and remove hose (2) and elbow (3).
4) Pour in oil through the elbow mount hole until oil oozes out from plug (1).
5) Fit elbow (3) and install hose (2).
6) Tighten air bleed plug (1).

kgm Plug :
17.25 ± 2.5 Nm {1.75 ±0.25 kgm}

★ Precautions when starting the engine
After completing the above procedure and starting the engine, run the engine at low idling for 10 minutes.

★ If the coolant temperature is low and automatic warming-up is carried out, cancel it by using the fuel control dial after starting the engine.

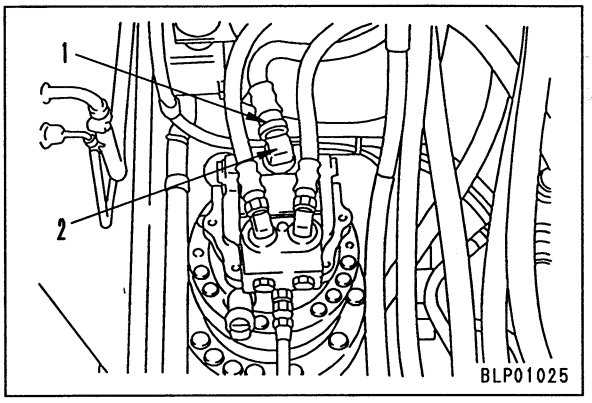




2. Bleeding air from hydraulic cylinders

1) Start the engine and run at idling for approx. 5 minutes.
2) Run the engine at low idling, then raise and lower the boom 4 – 5 times in succession.
   ★ Operate the piston rod to 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 arm and bucket cylinders.

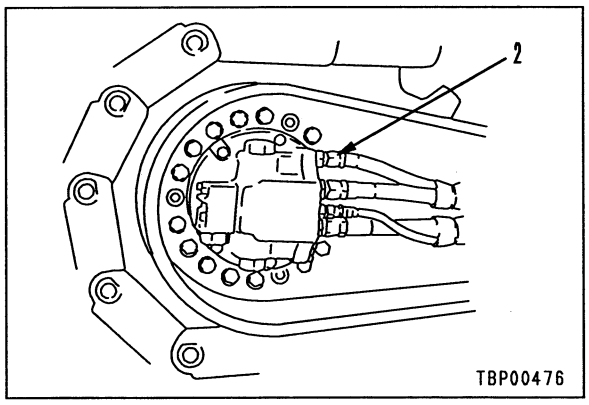
★ When the cylinder has been replaced, bleed the air before connecting the piston rod.
Be particularly careful not to operate the cylinder to the end of its stroke when the piston rod has been connected to the LOWER end of the boom cylinder.



3. Bleeding air from swing motor

1) Lock the swing lever and run at idling for 5 minutes.
   ★ The system is designed so that the pressure at port **S** carries out the air bleeding.
2) Disconnect hose (1) of the swing motor and fit a blind plug in the hose.
3) Run the engine at low idling, and check that oil oozes out from elbow (2).
   ★ If no oil oozes out from the elbow, carry out Step 1) again.
4) Connect hose (1).

kgm Hose : **137.3 ± 29.4 Nm {14 ± 3.0 kgm}**



4. Bleeding air from travel motor

1) Disconnect motor drain hose (2).
2) Run the engine at low idling and check that oil oozes out from the nipple.
3) If oil oozes out, connect hose (2).

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 water 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, and important point is of course to understand the structure and function. 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 any 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 manhours, parts, or oil or grease, and at the same time, 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 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 for symptoms of any abnormality in the machine.
   2) Check the CHECKS BEFORE STARTING items.
   3) Other inspection items.
   4) Other maintenance items can be checked externally, so check any item that is considered to be necessary.
4. Confirming 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 reenact 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 Items 2 – 4 to narrow down the causes of 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.

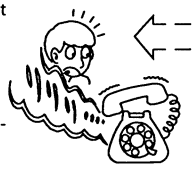
SEQUENCE OF EVENTS IN TROUBLESHOOTING

Office, shop

TEW00180

Step 1
Examination, confirmation of symptoms

1) When a request for repairs is received, first ask the following points.
   - Name of customer
   - Type, serial number of machine
   - Details of jobsite, etc.
2) Ask questions to gain an outline of the problem.
   - Condition of failure
   - Work being carried out at the time of the failure
   - Operating environment
   - Past history, details of maintenance, etc.



TEW00182

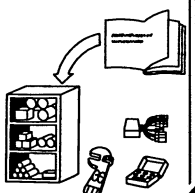
Step 2
Determining probable location of cause

1) Look at the troubleshooting section of the shop manual to find locations of possible causes.

TEP01350

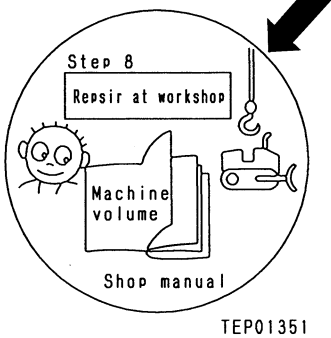
Step 3
Preparation of troubleshooting tools

1) Look at the table of troubleshooting tools in the shop manual and prepare the necessary tools.
   - T-adapter
   - Hydraulic pressure gauge kit, etc.
2) Look in the parts book and prepare the necessary replacement parts.



TEW00186

Step 8
Repair at workshop



TEP01351

Step 4
Go to jobsite

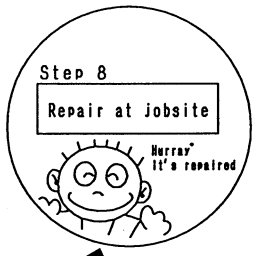
TEW00189

Jobsite

TEW00181

TEP01348

Step 8
Repair at jobsite



TEP01349

Step 7
- Pinpoint locations of failure (carry out troubleshooting)
- Decide action to take

1) Before starting troubleshooting, locate and repair simple failures.
   - Check before starting items
   - Other check items
2) See the Troubleshooting Section of the shop manual, select a troubleshooting flowchart that matches the symptoms, and carry out troubleshooting.

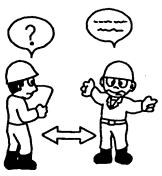
TEW00187

Step 6
Re-enacting failure

- Drive and operate the machine to confirm the condition and judge if there is really a failure.

Step 5
Ask operator questions to confirm details of failure.

- Was there anything strange about the machine before the failure occurred?
- Did the failure occur suddenly?
- Had any repairs been carried out before the failure?



TEW00190

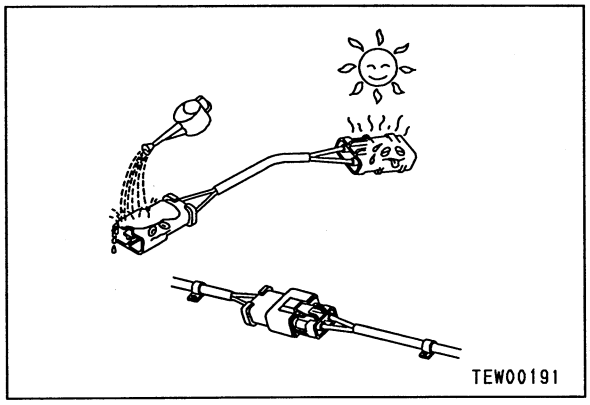
POINTS TO REMEMBER WHEN CARRYING OUT MAINTENANCE

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 gear oil and hydraulic oil).

1. POINTS TO REMEMBER WHEN HANDLING ELECTRIC EQUIPMENT

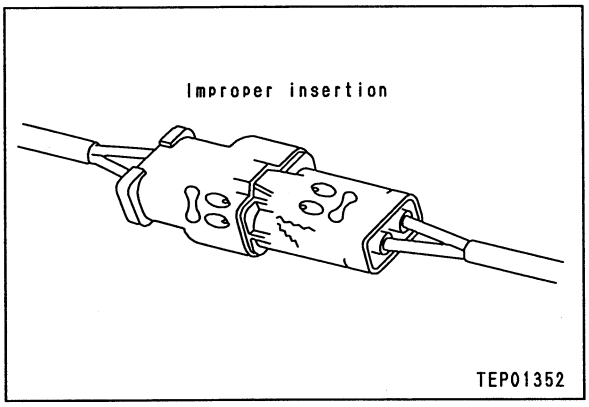
1) Handling wiring harnesses and connectors

Wiring harnesses consist of wiring connecting one component to another component, connectors used for connecting and disconnecting one wire from another wire, and protectors 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

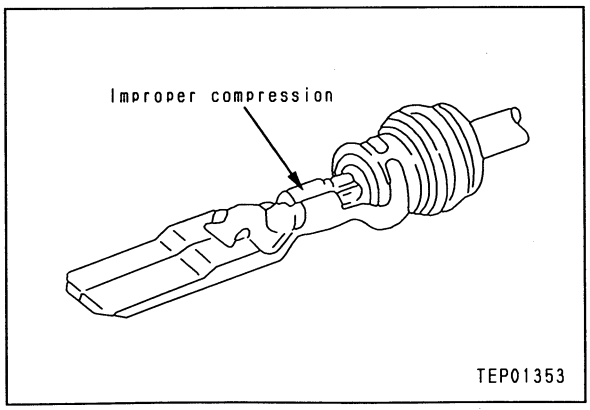
Main failures occurring in wiring harness

① Defective contact of connectors (defective contact between male and female)
Problems with defective 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 oxidization of the contact surfaces.



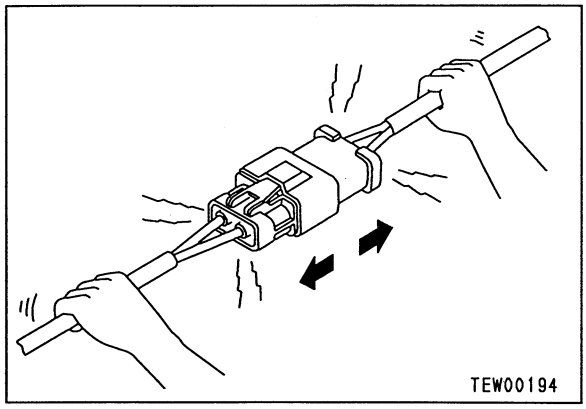
TEP01352

② Defective crimping or soldering of connectors
The pins of the male and female connectors are in contact at the crimped terminal or soldered portion, but if there is excessive force brought to bear on the wiring, the plating at the joint will peel and cause improper connection or breakage.

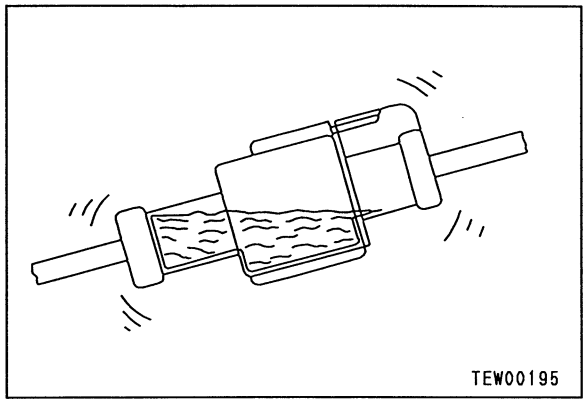


TEP01353

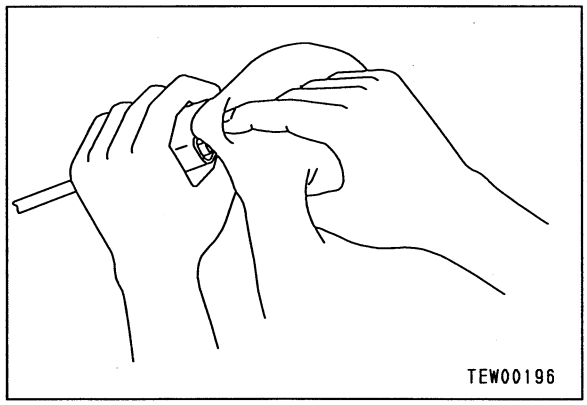
③ Disconnections in wiring
If the wiring is held and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping of the connector may separate, or the soldering may be damaged, or the wiring may be broken.



④ High-pressure water entering 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.
As already said, the connector is designed to prevent water from entering, but at the same time, 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.



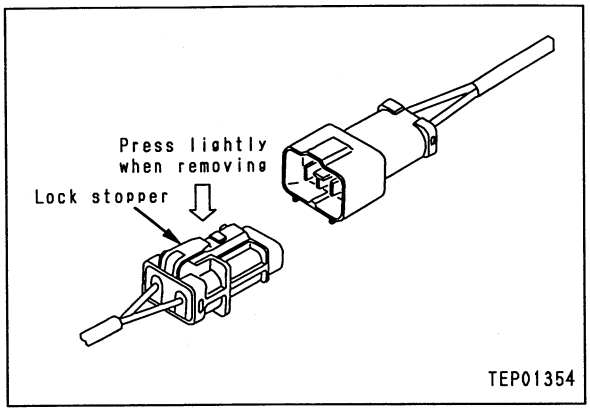
⑤ Oil or dirt stuck to connector
If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, so there will be defective contact.
If there is oil or grease stuck to the connector, wipe it off with a dry cloth or blow it dry with compressed 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 oil or water in the compressed air, the contacts will become even dirtier, so remove the oil and water from the compressed air completely before cleaning with compressed air.



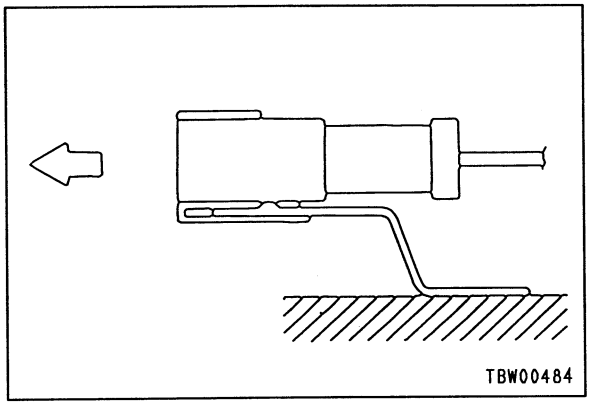
2) Removing, installing, and drying connectors and wiring harnesses

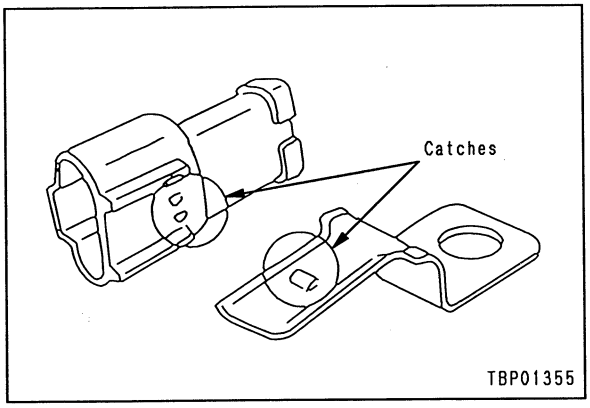
- **Disconnecting connectors**

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 pull with one hand.

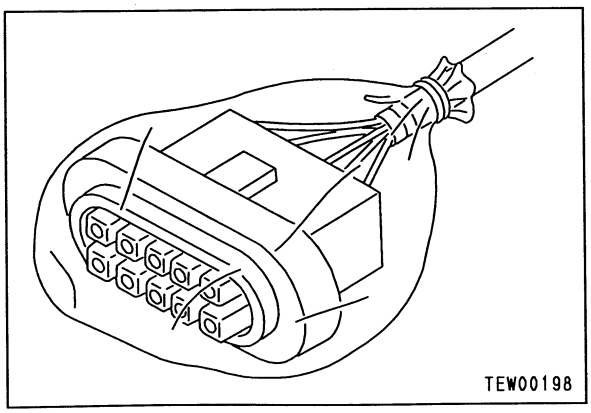


② When removing from clips
When removing a connector from a clip, pull the connector in a parallel direction to the clip.
★ If the connector is twisted up and down or to the left or right, the housing may break.





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 disassembled for a long time, it is particularly easy for improper contact to occur, so always cover the connector.

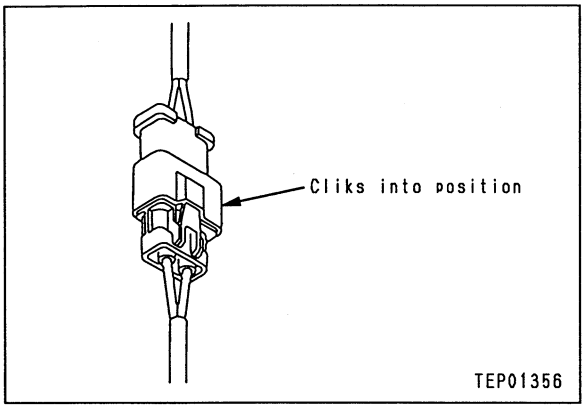


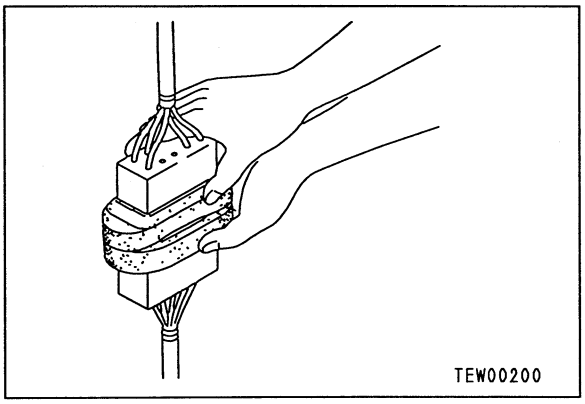
- **Connecting connectors**
  ① Check the connector visually.
  1) Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).
  2) Check that there is no deformation, defective contact, corrosion, or damage to the connector pins.
  3) Check that there is no damage or breakage 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 got 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.

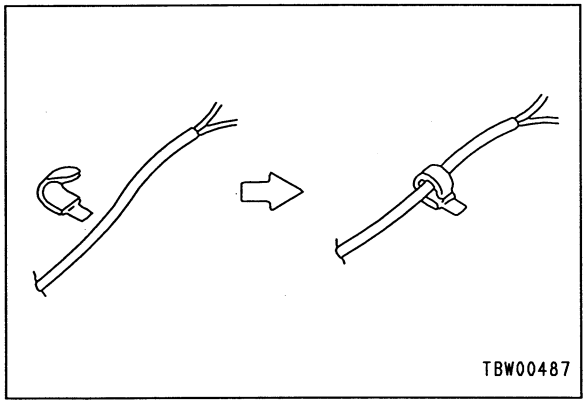
  ② Fix the connector securely.
  Align the position of the connector correctly, then insert it securely.
  For connectors with lock stopper, push in the connector until the stopper clicks into position.

  ③ Correct any protrusion of the boot and any misalignment of the wiring harness
  For connectors fitted with boots, correct any protrusion of the boot. In addition, if the wiring harness is misaligned, or the clamp is out of position, adjust it to its correct position.
  ★ If the connector cannot be corrected easily, remove the clamp and adjust the position.

  ④ If the connector clamp has been removed, be sure to return it to its original position. Check also that there are no loose clamps.

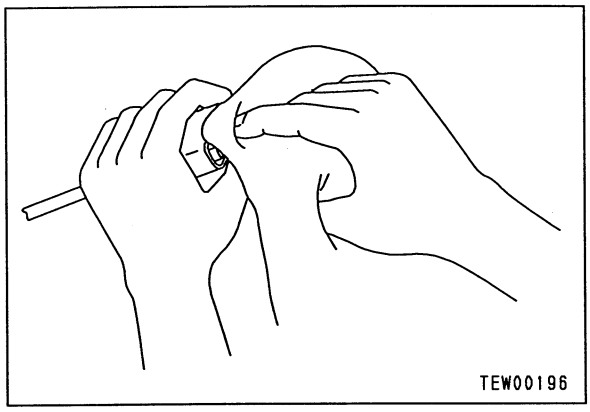




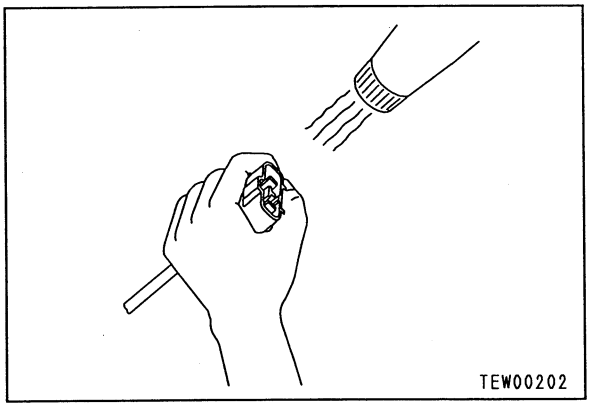


- **Drying wiring harness**
  If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high-pressure water or steam directly on the wiring harness.

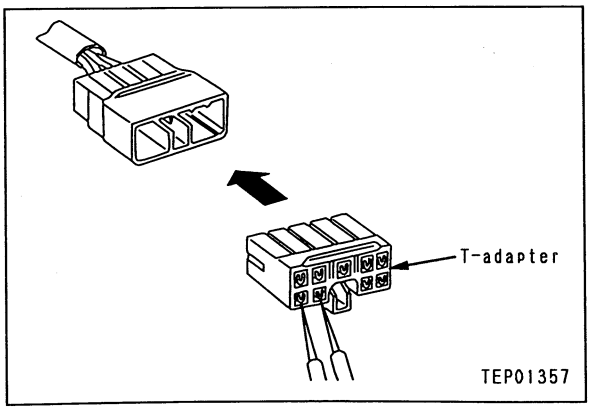
  If water gets directly on the connector, do as follows.
  ① Disconnect the connector and wipe off the water with a dry cloth.
  ★ If the connector is blown dry with compressed air, there is the risk that oil in the air may cause defective contact, so remove all oil and water from the compressed air before 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 regulate the time that the hot air is used in order not to make the connector or related parts too hot, as this will cause deformation or damage to the connector.



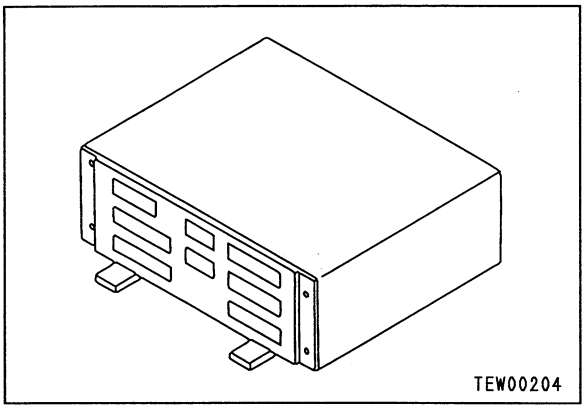
③ Carry out a continuity test on the connector.
After drying, leave the wiring harness disconnected and carry out a continuity test to check for any short circuits between pins caused by water.
★ After completely drying the connector, blow it with contact restorer and reassemble.



3) Handling control box

① The control box contains a microcomputer and electronic control circuits. These control all of the electronic circuits on the machine, so be extremely careful when handling the control box.

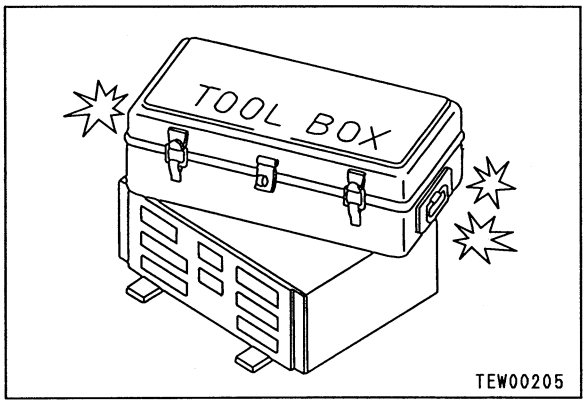
② Do not open the cover of the control box unless necessary.



③ Do not place objects on top of the control box.

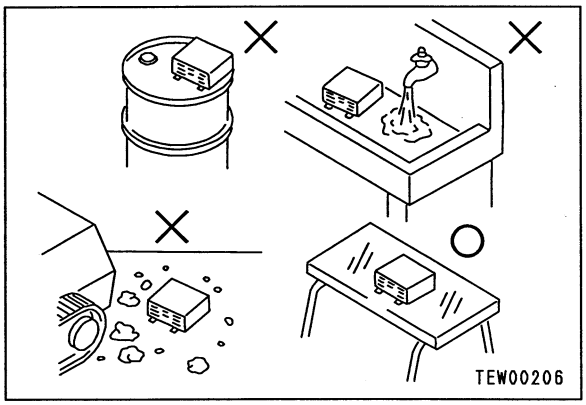
④ Cover the control connectors with tape or a vinyl bag.
Never touch the connector contacts with your hand.

⑤ During rainy weather, 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

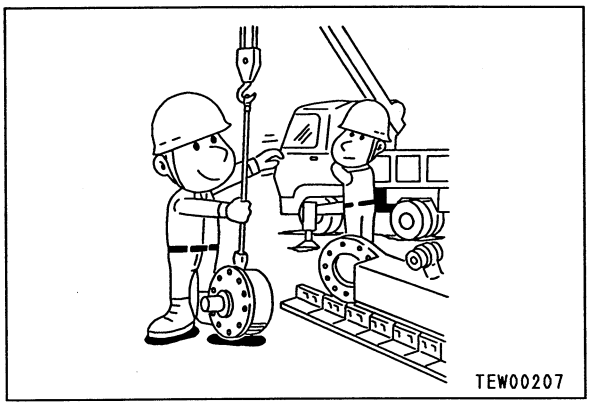
1) Always turn the power OFF before disconnecting or connect connectors.
2) Before carrying out troubleshooting, check that all the related connectors are properly inserted.
   ★ Disconnect and connect the related connectors several times to check.
3) Always connect any disconnected connectors before 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 that circuit.

3. POINTS TO REMEMBER WHEN HANDLING HYDRAULIC EQUIPMENT

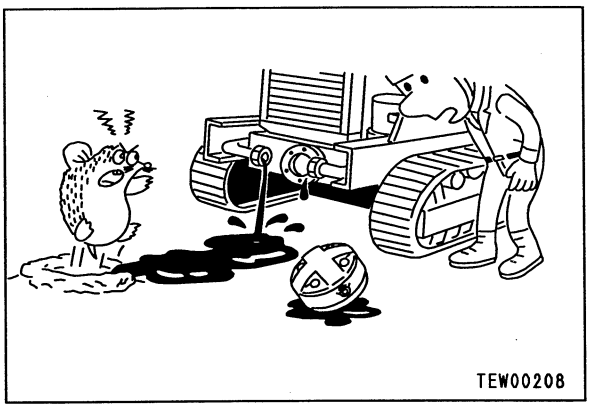
With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

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.

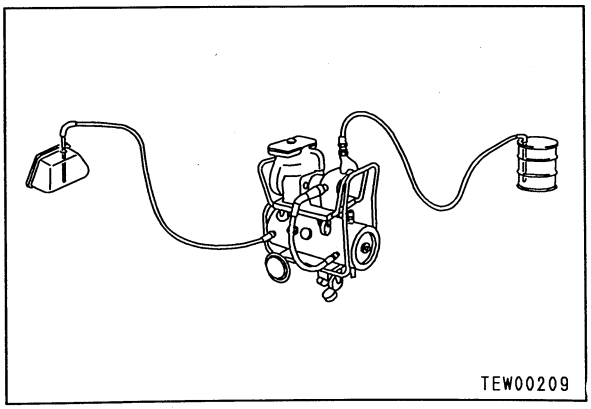
2) **Disassembly and maintenance work in the field**
If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to confirm the performance after repairs, so it is desirable to use unit exchange. Disassembly and main-tenance of hydraulic equipment should be carried out in a specially prepared dustproof workshop, and the performance should be confirmed with special test equipment.


TEW00207

3) **Sealing openings**
After any piping or equipment is removed, the openings should be sealed with caps, tapes, or vinyl bags to prevent any dirt or dust from entering. If the opening is left open or is blocked with a rag, there is danger of dirt entering or of the surrounding area being made dirty by leaking oil so never do this.
Do not simply drain oil out on to the ground, collect it and ask the customer to dispose of it, or take it back with you for disposal.

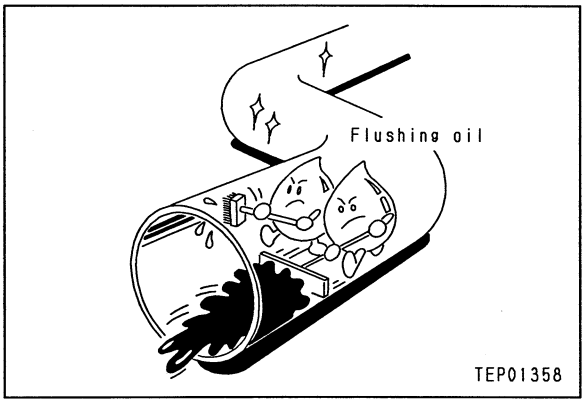

TEW00208

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.

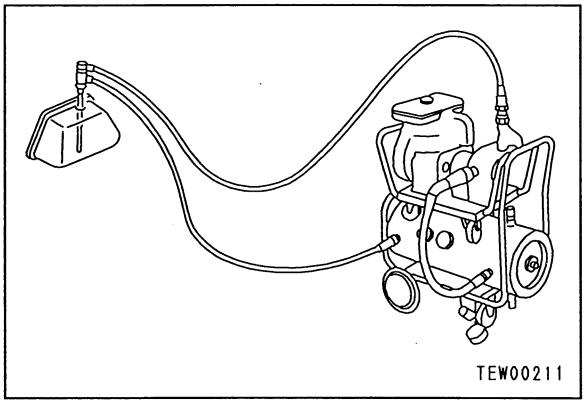

TEW00209

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. (Drain the oil from the hydraulic tank; also 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 ultrafine (about 3μ) particles that the filter built into the hydraulic equipment cannot remove, so it is an extremely effective device.



CHECKS BEFORE TROUBLESHOOTING

	Item	Judgement standard	Remedy
Lubricating oil, coolant	1. Check fuel level, type of fuel	—	Add fuel
	2. Check for impurities in fuel	—	Clean, drain
	3. Check hydraulic oil level	—	Add oil
	4. Check hydraulic strainer	—	Clean, drain
	5. Check swing machinery oil level	—	Add oil
	6. Check engine oil level (oil pan oil level), type of oil	—	Add oil
	7. Check coolant level	—	Add water
	8. Check dust indicator for clogging	—	Clean or replace
	9. Check hydraulic filter	—	Replace
Electrical equipment	1. Check for looseness, corrosion of battery terminal, wiring	—	Tighten or replace
	2. Check for looseness, corrosion of alternator terminal, wiring	—	Tighten or replace
	3. Check for looseness, corrosion of starting motor terminal, wiring	—	Tighten or replace
Hydtaulic, mechanical equipment	1. Check for abnormal noise, smell	—	Repair
	2. Check for oil leakage	—	Repair
	3. Carry out air bleeding	—	Bleed air
Electrics, electrical equipment	1. Check battery voltage (engine stopped)	20 – 30 V	Replace
	2. Check battery electrolyte level	—	Add or replace
	3. Check for discolored, burnt, exposed wiring	—	Replace
	4. Check for missing wiring clamps, hanging wiring	—	Repair
	5 Check for water leaking on wiring (be particularly careful attention to water leaking on connectors or terminals)	—	Disconnect connector and dry
	6. Check for blown, corroded fuses	—	Replace
	7. Check alternator voltage (engine running at 1/2 throttle or above)	(After running for several minutes: 27.5 – 29.5 V)	Replace
	8. Check operating sound of battery (when switch is turned ON/OFF)	—	Replace

CONNECTOR TYPES AND MOUNTING LOCATIONS

Connector No.	Connector type	No. of pins	Place of use	Address
C01	MIC	13	Engine throttle, pump controller	O-2
C02	MIC	21	Engine throttle, pump controller	O-8
C03	040	16	Engine throttle, pump controller	Q-2
C05	S	10	Pump prolix circuit switch	M-4
C06	M	2	Pump prolix resistor	N-2
C08	X	3	Pump pressure sensor	H-8
C09	S	8	Model selectio connector	R-2
C10	X	2	LS-EPC solenoid valve	F-9
C13	X	2	PC-EPC solenoid valve	F-9
C16	MIC	20	Engine throttle, pump controller	P-8
C17	040	16	Engine throttle, pump controller	P-2
D01	KES1	2	For window washer circuit	P-6
D05	KES1	2	For swing brake solenoid circuit	R-7
D06	KES1	2	For 2-stage relief solenoid circuit	R-7
D07	KES1	2	For travel speed solenoid circuit	R-6
D08	KES1	2	For heater circuit	R-5
D11	KES1	2	For alarm buzzer circuit	M-5
D13	KES1	2	For battery relay drive circuit	P-8
D14	KES1	2	For battery relay drive circuit	R-6
D17	KES1	2	For heater relay circuit	R-5
D18	KES1	2	For active mode solenoid valve	R-4
D26	KES1	2	For swing brake prolix circuit	R-4
E04	X	3	Governor potentiometer	L-3
E05	X	4	Governor motor	L-4
E06	M	3	Fuel control dial	M-6
E07	X	2	Engine speed soncor	L-3
E11	—	1	Heater relay	L-4
E14	—	1	Heater relay	L-3
E15	X	2	Intermediate connector	K-2
E16	L	2	Intermediate connector	K-2
E17	L	2	Alternator	I-7
F01	X	2	Travel alarm	I-7
H12	S	16	Intermediate connector	R-8
H13	S	16	Intermediate connector	R-8

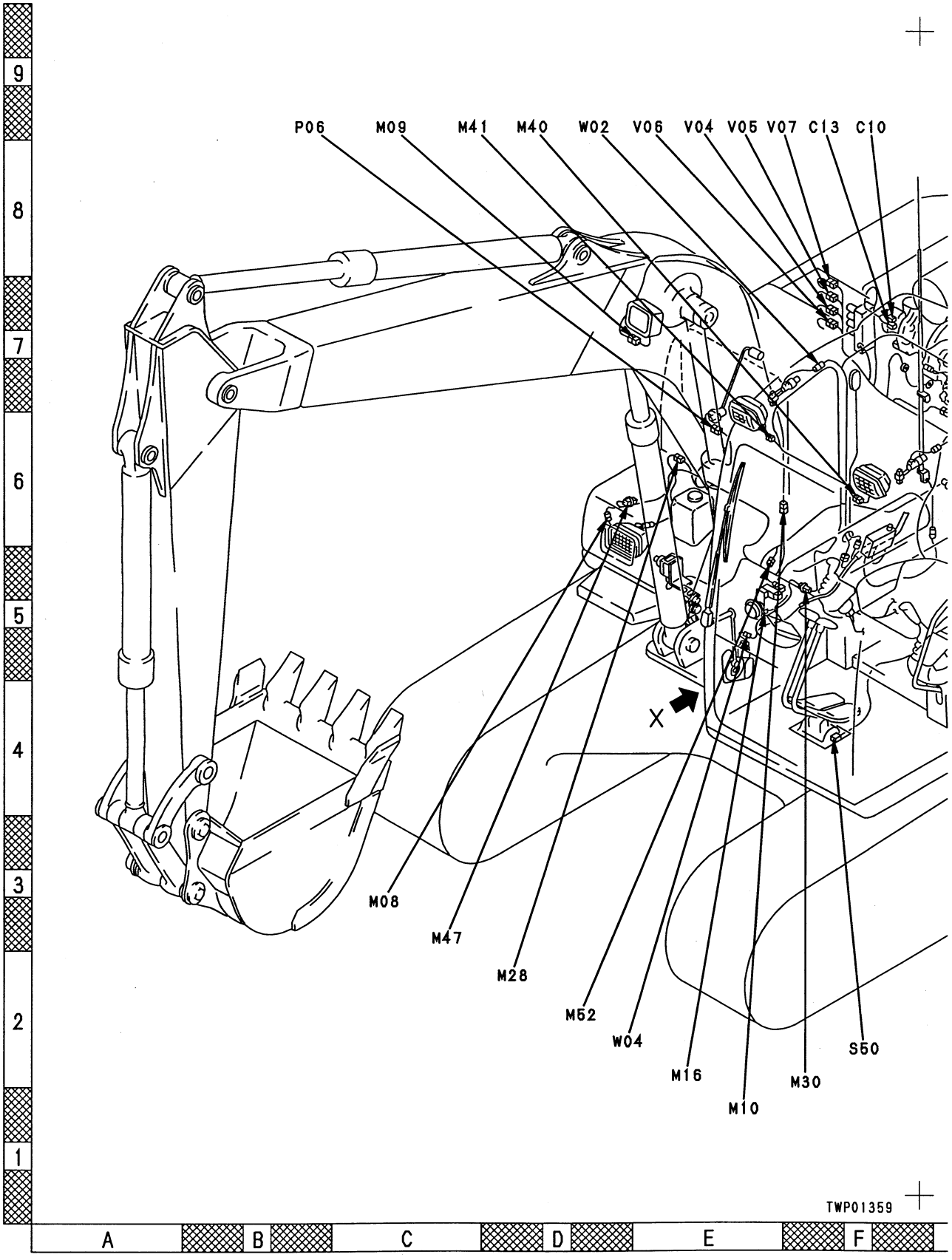
Connector No.	Connector type	No. of pins	Place of use	Address
H-14	M	6	Intermediate connector	Q-8
H-15	L	2	Intermediate connector	R-8
M02	X	2	Safety relay	I-8
M06	M	3	Heater fan switch	N-8
M07	M	2	light switch	M-8
M08	M	1	Right front light	C-3
M09	M	1	Working lamp (boom)	C-9
M10	M	1	Intermediate connector	E-1
M11	L	2	Fusible link	I-6
M12	KES1	3	Heater	R-3
M13	KES0	2	Seaker (R.H.)	Q-8
M14	L	2	Fusible link	I-5
M15	L	2	Fusible link	I-5
M16	—	1	Horm	E-2
M18	M	4	Wiper, washer switch	M-7
M20	—	1	Cigarette lighter	M-6
M21	PA	9	Radio	M-7
M22	M	2	Intermediate connector	R-2
M23	M	2	Horm switch	Q-2
M23	M	2	L.H. knob switch	R-2
M26	M	6	Air conditioner	R-3
M28	X	2	Window washer motor	D-2
M30	—	1	Intermediate connector	F-2
M33	250	3	Auto-pull up switch (with auto-pull up)	N-8
M34	X	1	Electromagnetic clutch for air conditioner compressor	L-2
M36	M	1	Kerosene mode select switch	P-8 Q-8
M38	M	2	Light switch	N-8
M39	—	1	Intermediate connector	Q-8
M40	M	1	Right working light	D-9
M41	M	1	Left working light	C-9
M42	—	1	Intermediate connector	G-8
M43	—	1	Intermediate connector	—
M45	M	3	Network bus	M-3
M46	M	3	For troubleshooting	O-2

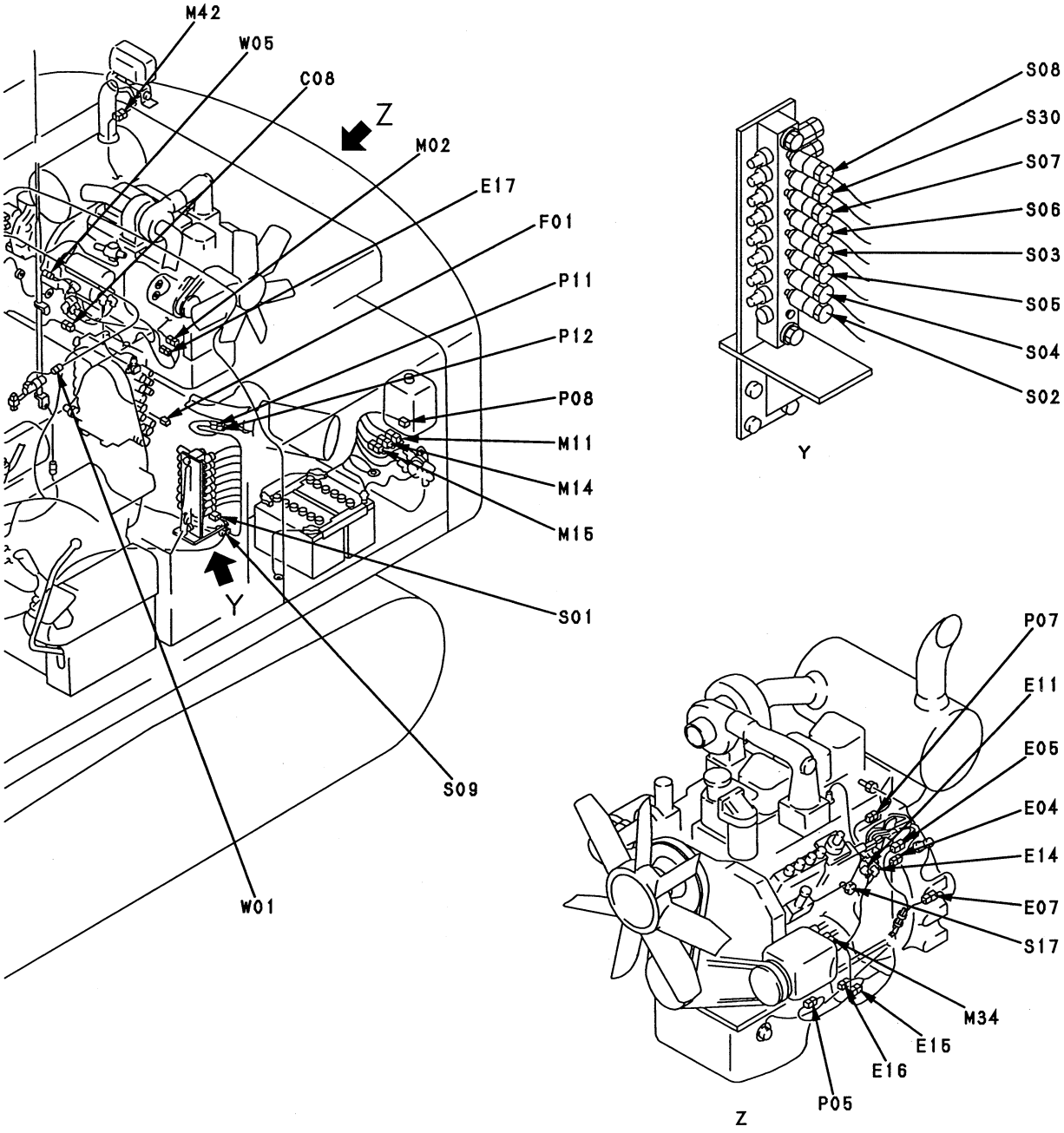
Connector No.	Connector type	No. of pins	Place of use	Address
M47	040	16	For troblechooting (with out pull up)	—
M47	M	1	Right front light	C-3
M52	X	2	Overload warning	D-2
M70	—	1	Intermediate connector	M-4
M71	—	1	Intermediate connector	M-6
M73	KES0	2	Speaker (L.H.)	R-8
P01	040	20	Monitor	M-5
P02	040	16	Monitor	M-5
P03	M	2	Buzzer cancel switch	M-8
P04	M	2	Alarm buzzer	M-5
P05	X	1	Engine oil level sensor	K-2
P06	X	2	Fuel level sensor	B-9
P07	X	2	Coolant temperature sensor	L-5
P08	X	2	Coolenr level sensor	I-6
P11	—	1	Air cleaner clogging sensor	I-7
P12	Shinagawa	1	Air cleaner clogging sensor	I-6
R04	Shinagawa	5	Light relay	M-4
R05		5	Light relay	M-6
S01	X	2	Travel oil pressure switch	I-5
S02	X	2	Boom RAISE oil pressure switch	L-6
S03	X	2	Arm OUT oil pressure switch	L-7
S04	X	2	Boom LOWER oil pressure switch	L-6
S05	X	2	Arm IN oil pressure switch	L-7
S06	X	2	Bucket CURL oil pressure switch	L-7
S07	X	2	Bucket DUMP oil pressure switch	L-8
S08	X	2	Left swing oil pressure switch	L-8
S09	X	2	Service oil pressure switch	I-4
S10	X	2	Service oil pressure switch	—
S11	X	2	Service oil pressure switch	—
S17	—	1	Engine oil pressure switch	L-3
S19	X	2	Service oil pressure switch	—
S20	X	2	Service oil pressure switch	—
S30	X	2	Right swing oil pressure switch	L-8
S50	X	2	Intermediate connector	F-2

Connector No.	Connector type	No. of pins	Place of use	Address
V04	X	2	Swing brake solenioid valve	E-9
V05	X	2	2-stage relief solenioid valve	E-9
V06	X	2	Travel speed select solenioid valve	E-9
V07	X	2	Active mode solenioid valve	F-9
W01	KES1	4	Right front lock (with auto-pull up)	H-3
W02	KES1	4	Left front lock (with auto-pull up)	D-9
W04	M	6	Wiper motor	D-2
W05	KES1	2	Pull up motor (with auto-pull up)	H-8
W06	070	14	Intermediate connector (with auto-pull up)	M-3
W07	KES1	2	Front limmit switch (with auto-pull up)	—
W08	070	18	Wiper motor controller	N-2
W09	070	14	Wiper motor controller (with auto-pull up)	N-2
W10	M	4	M6 switch	—
W10	M	4	Intermediate connector (with auto-pull up)	M-2
X01	MIC	21	Intermediate connector	O-8
X05	M	4	Swing lock switch	M-7
X07	MIC	17	Intermediate connector	O-8

CONNECTOR ARRANGEMENT DIAGRAM

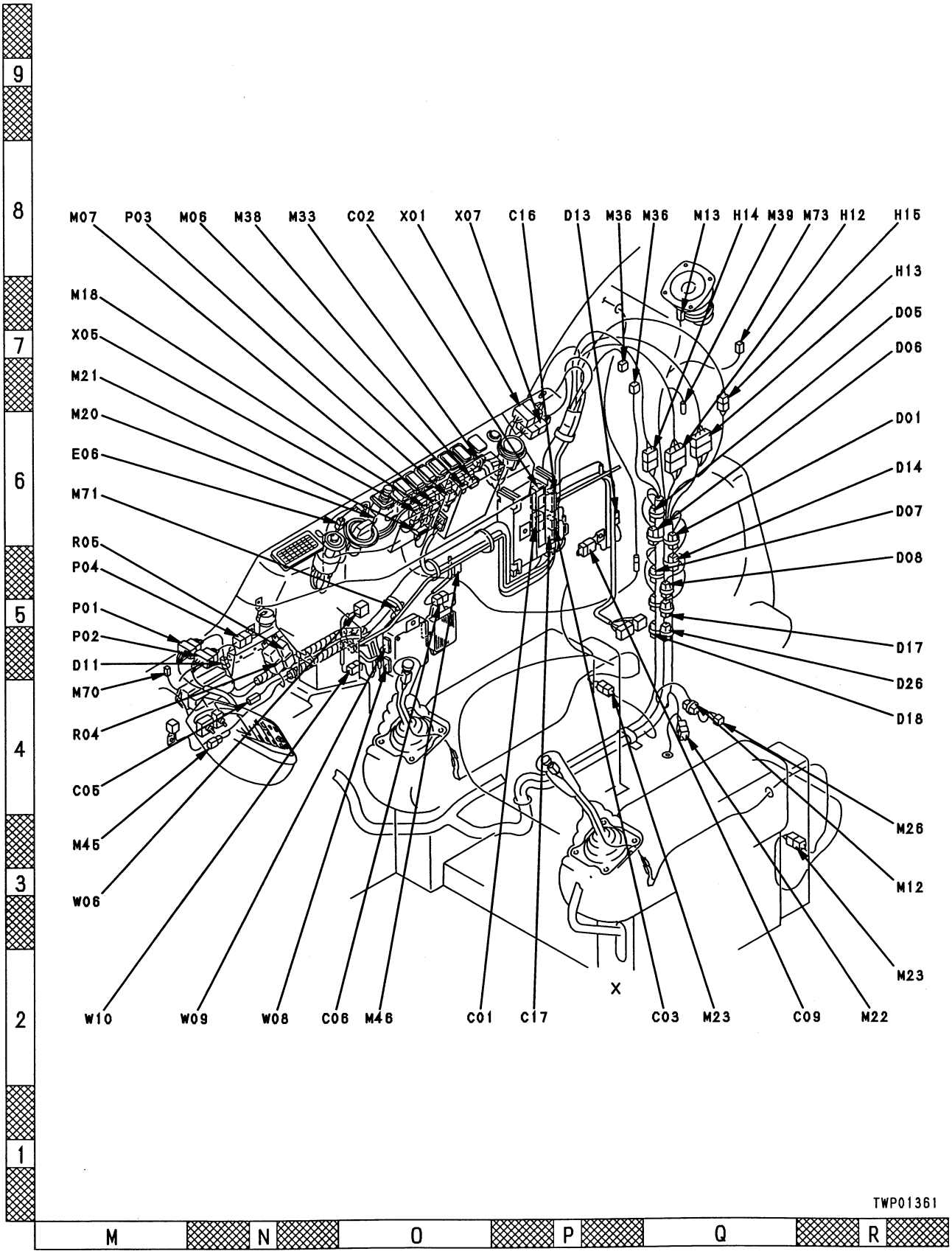
(1/2)




M42
W05
C08
Z
M02
E17
F01
P11
P12
P08
M11
M14
M15
Y
S01
S09
W01
S08
S30
S07
S06
S03
S05
S04
S02
Y
P07
E11
E05
E04
E14
E07
S17
M34
E15
E16
P05
Z

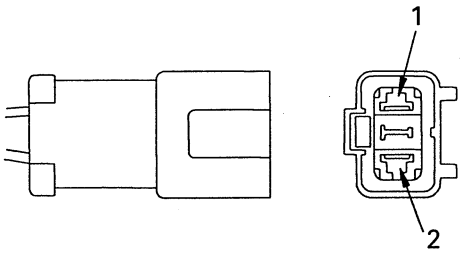
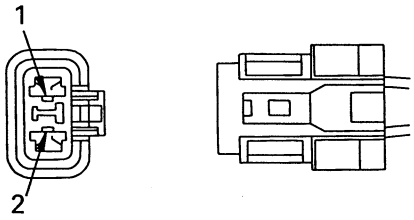
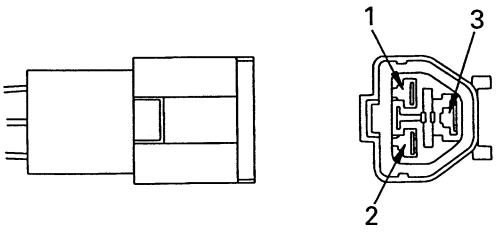
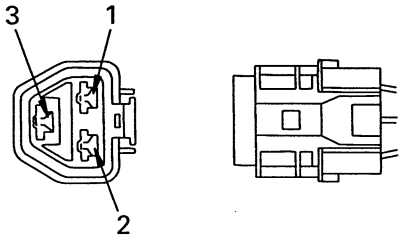
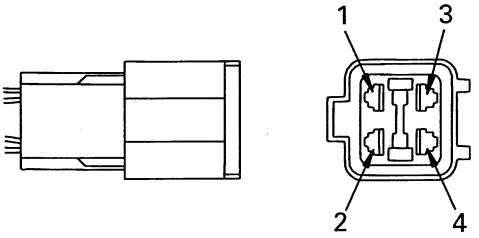
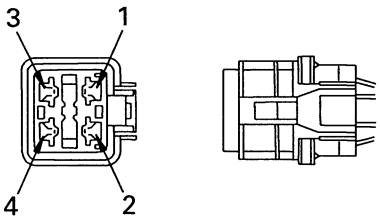
TWP01360

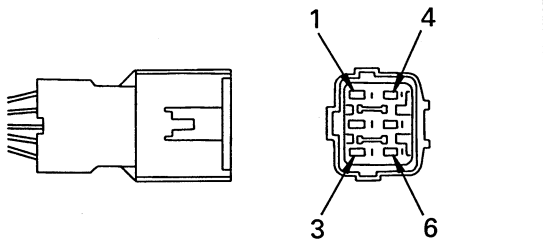
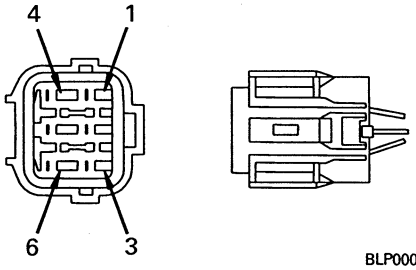
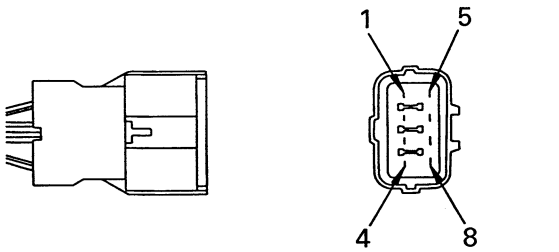
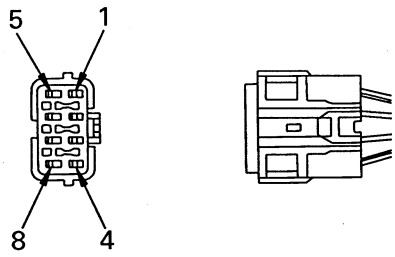
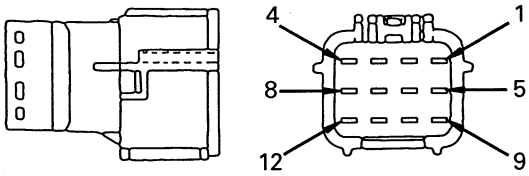
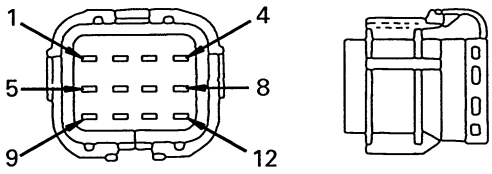
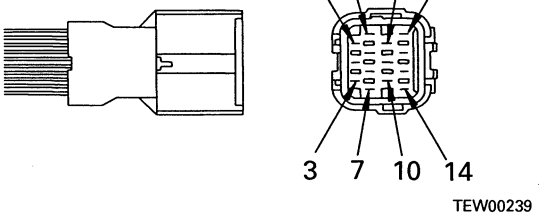
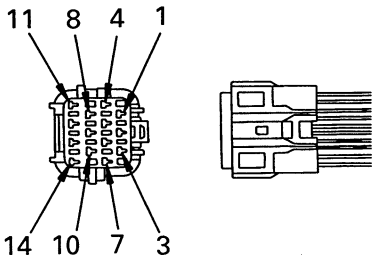
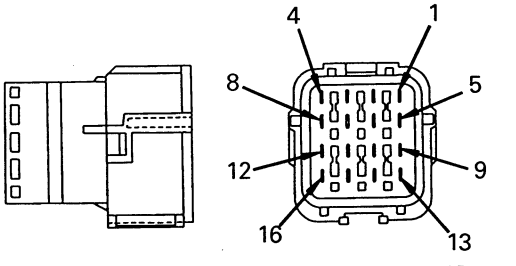
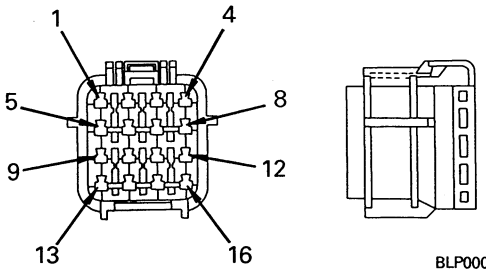
(2/2)

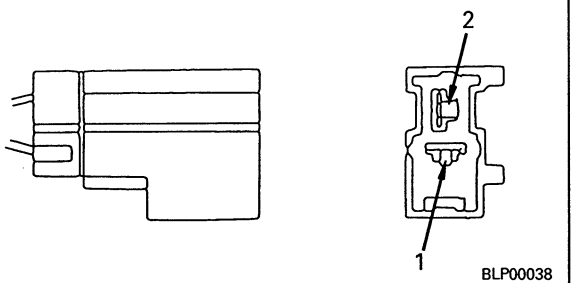
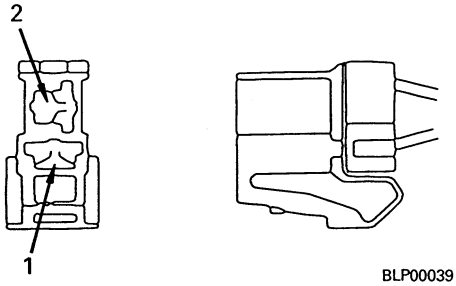
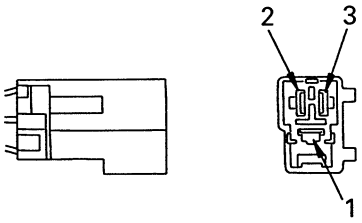
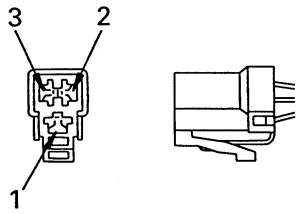
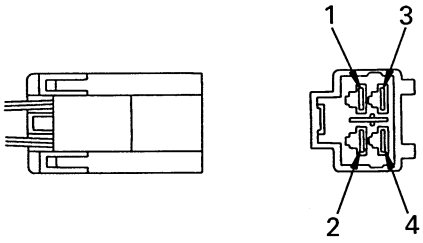
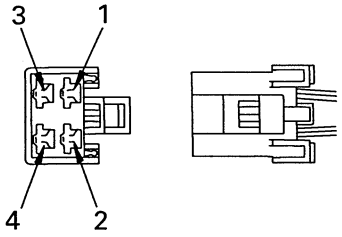
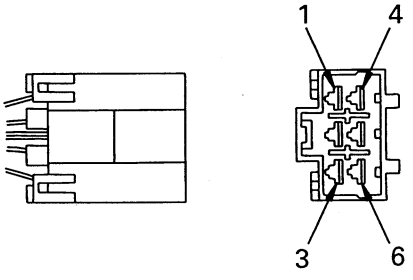
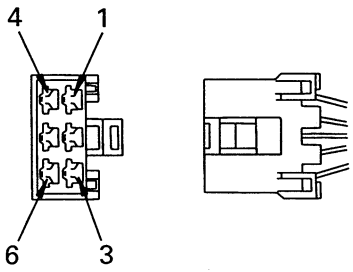
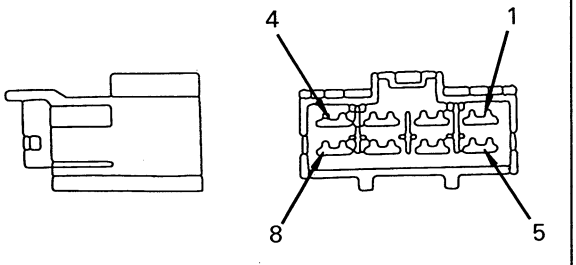
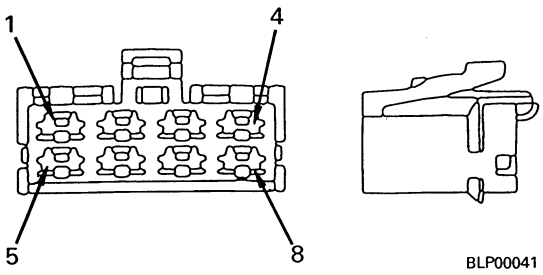

M07
P03
M06
M38
M33
C02
X01
X07
C16
D13
M36
M36
M13
H14
M39
M73
H12
H15
H13
D05
D06
D01
D14
D07
D08
D17
D26
D18
M26
M12
M23
M22
C09
C03
M23
C01
C17
M46
C06
W08
W09
W10
M18
X05
M21
M20
E06
M71
R05
P04
P01
P02
D11
M70
R04
C05
M45
W06
X
9
8
7
6
5
4
3
2
1
M
N
O
P
Q
R
TWP01361

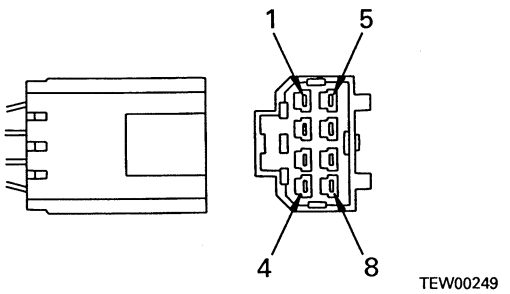
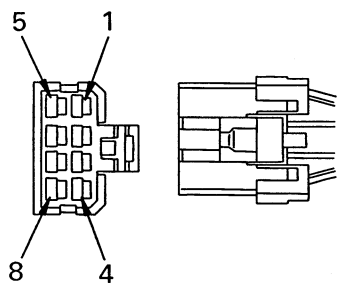
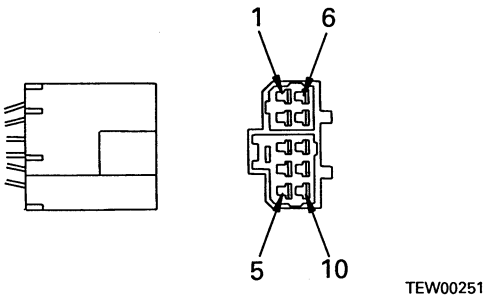
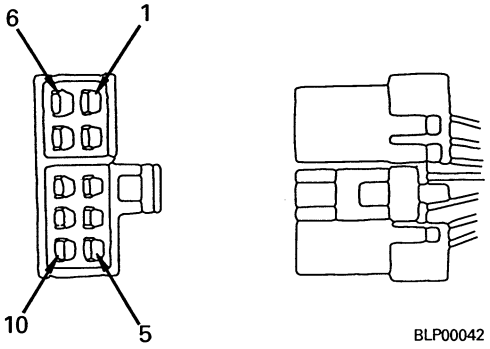
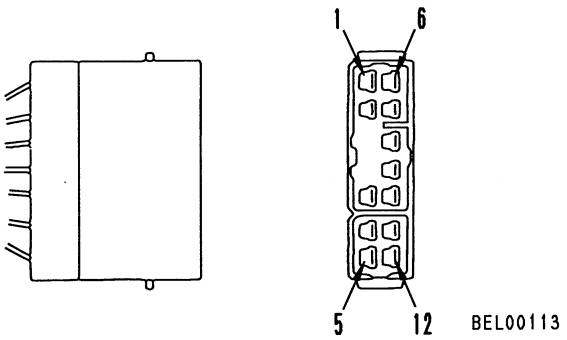
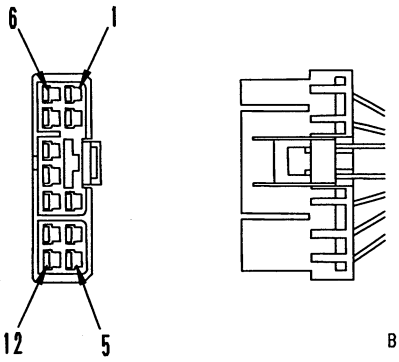
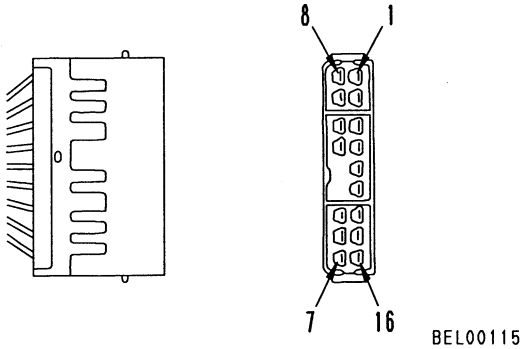
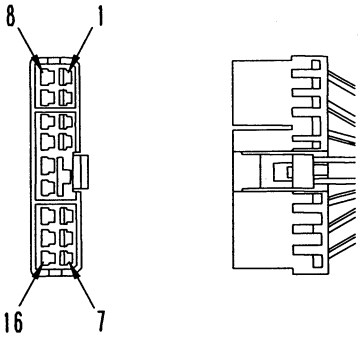
CONNECTION TABLE FOR CONNECTOR PIN NUMBERS

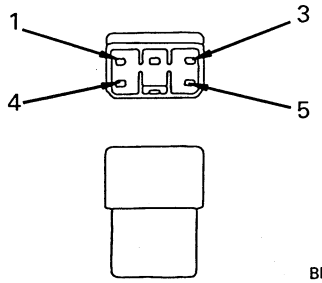
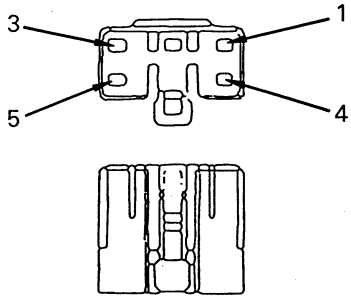
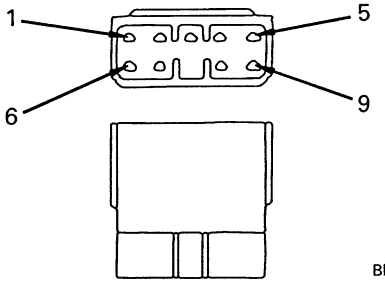
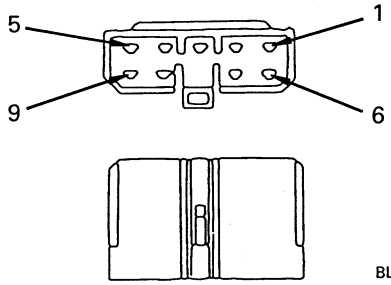
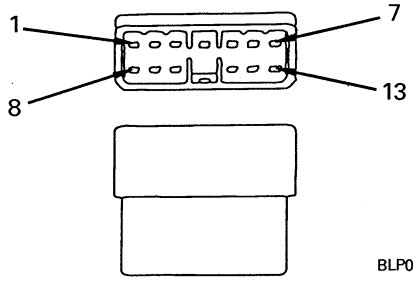
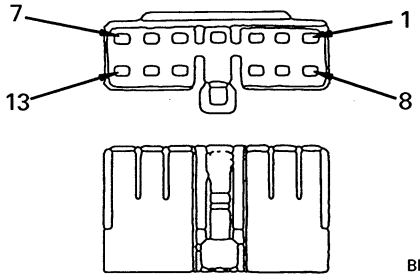
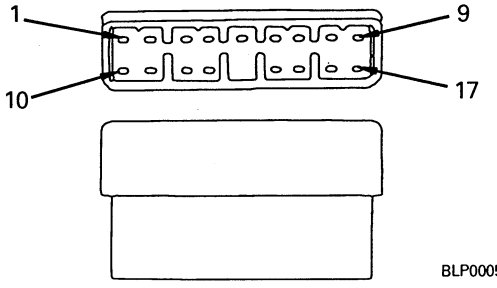
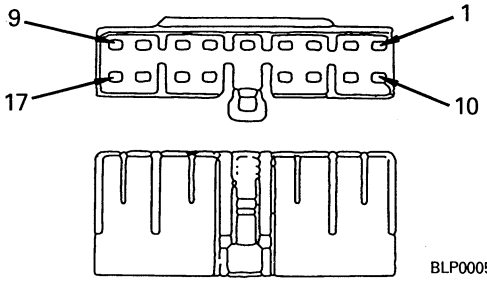
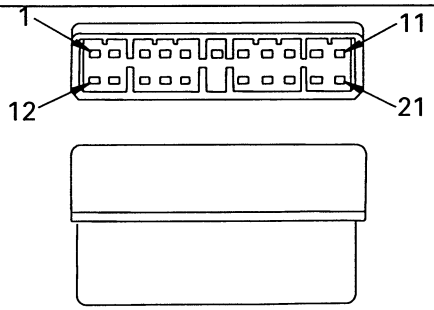
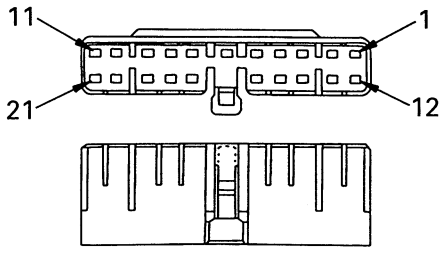
★ The terms male and female refer to the pins, while the terms male housing and female housing refer to the mating portion of the housing.

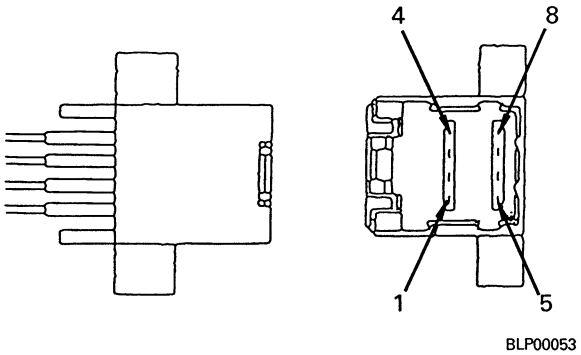
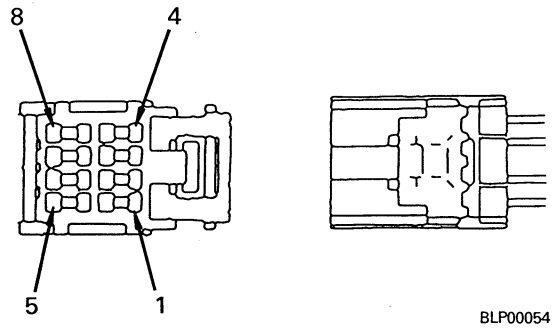
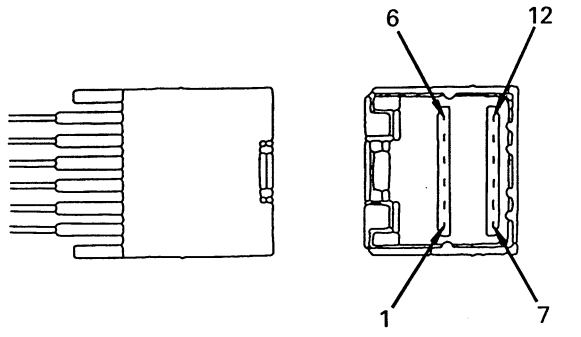
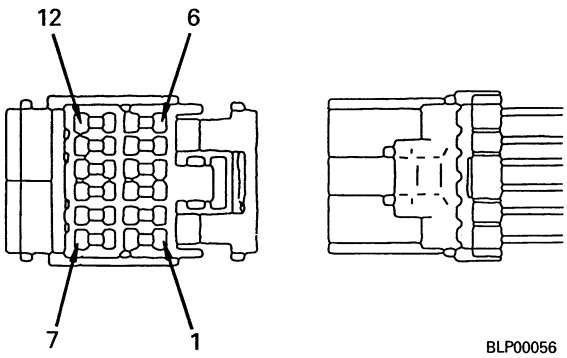
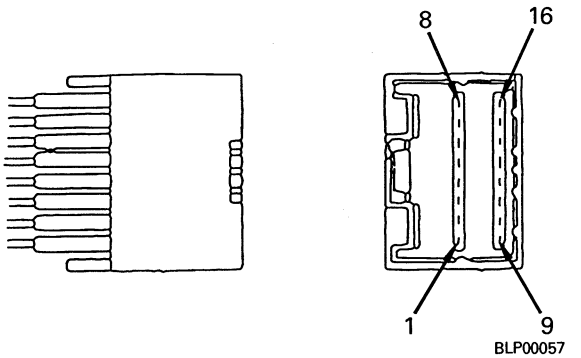
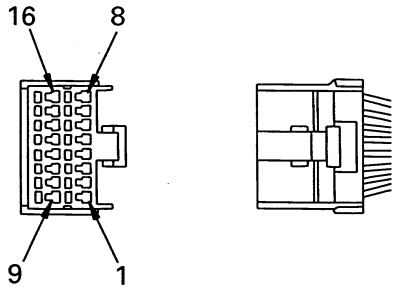
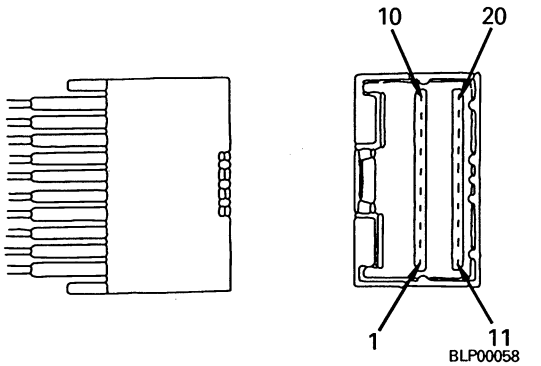
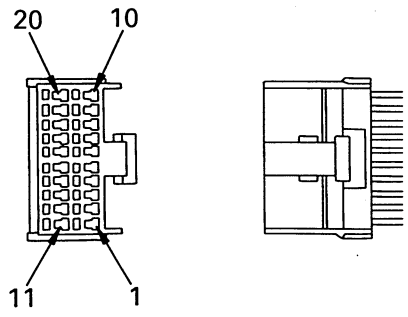
No. of pins	X type connector	
	Male (female housing)	Female (male housing)
2	 TEW00221	 TEW00222
3	 TEW00223	 TEW00224
4	 TEW00225	 TEW00226

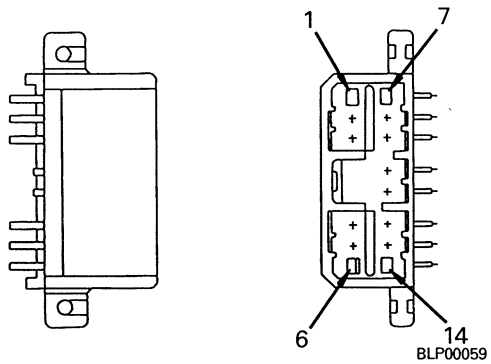
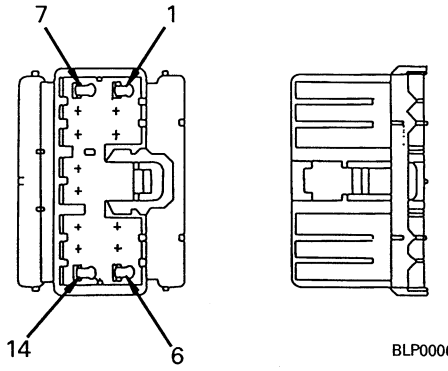
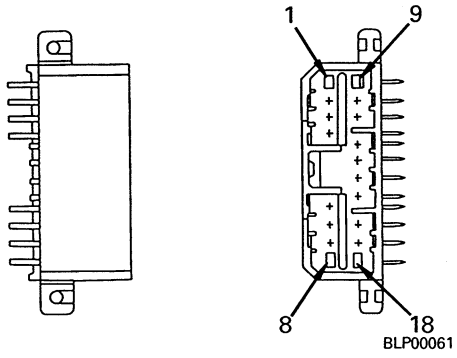
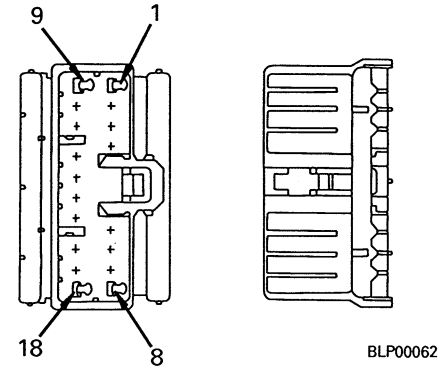
No. of pins	SWP type connector	
	Male (female housing)	Female (male housing)
6	 TEW00235	 BLP00033
8	 TEW00237	 TEW00238
12	 BLP00034	 BLP00035
14	 TEW00239	 TEW00240
16	 BLP00036	 BLP00037

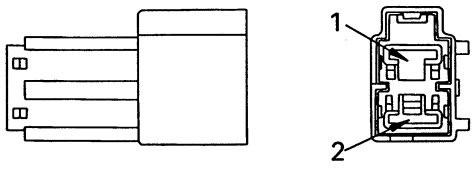
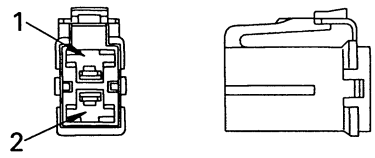
No. of pins	M type connector	
	Male (female housing)	Female (male housing)
2	 BLP00038	 BLP00039
3	 TEW00243	 TEW00244
4	 TEW00245	 TEW00246
6	 TEW00247	 TEW00248
8	 BLP00040	 BLP00041

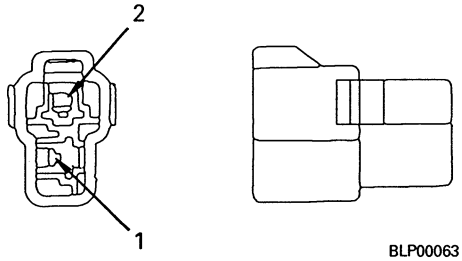
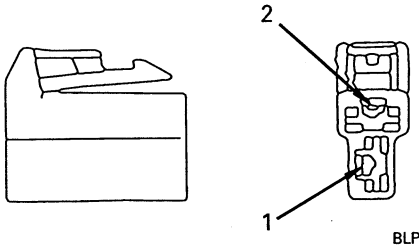
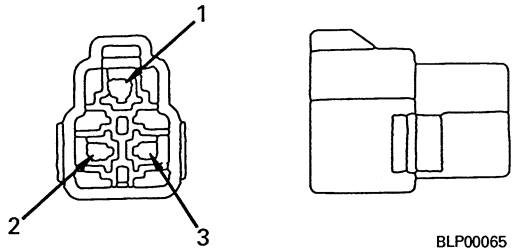
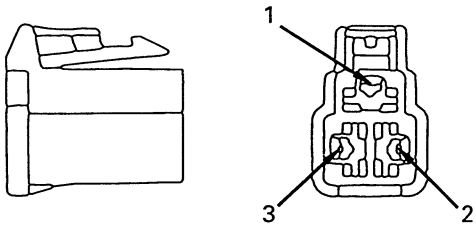
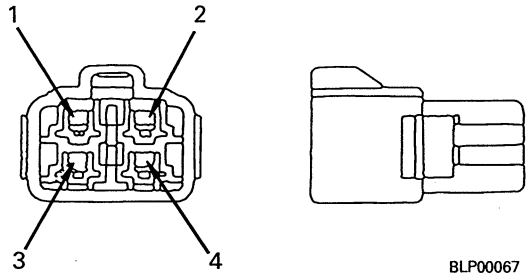
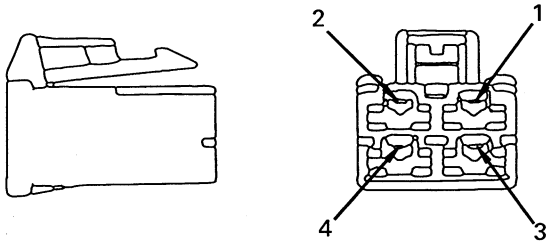
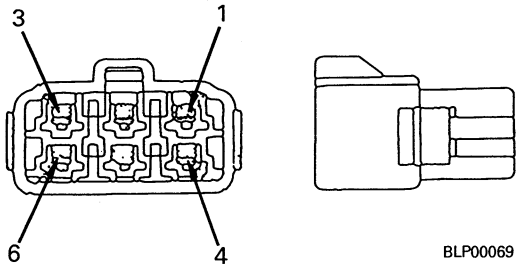
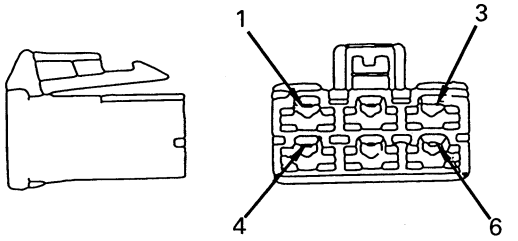
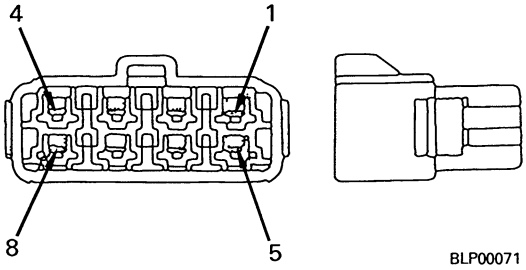
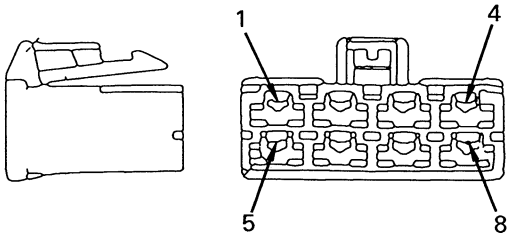
No. of pins	S type connector	
	Male (female housing)	Female (male housing)
8	 TEW00249	 TEW00250
10 (White)	 TEW00251	 BLP00042
12 (White)	 BEL00113	 BEL00114
16 (White)	 BEL00115	 BEL00116

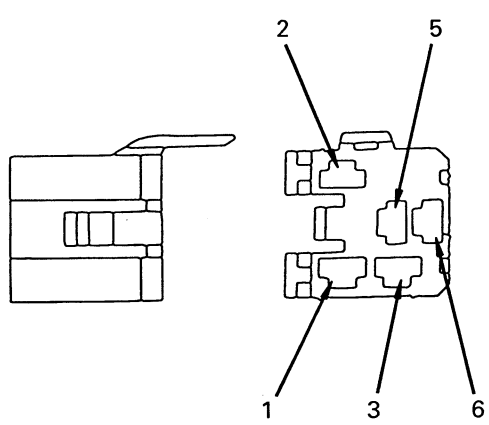
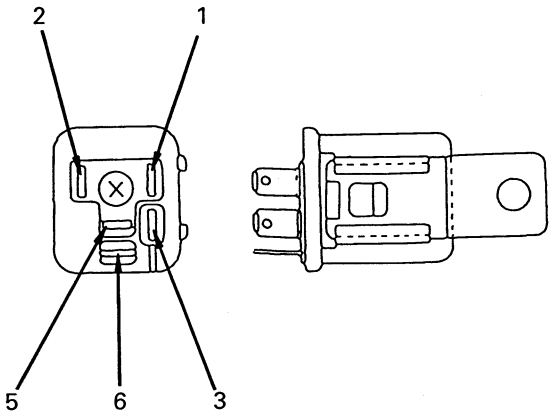
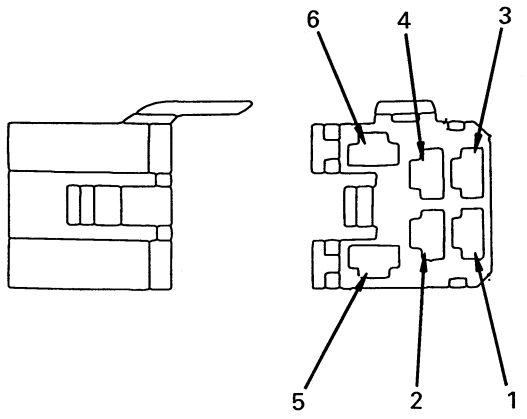
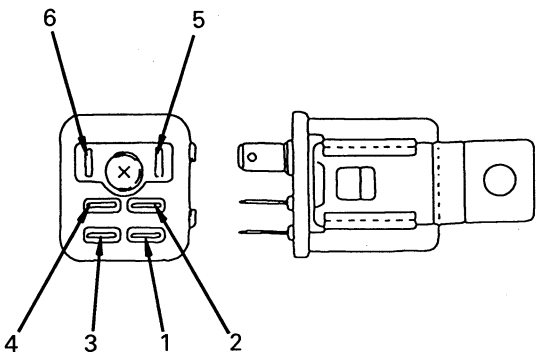
No. of pins	MIC type connector	
	Male (female housing)	Female (male housing)
5	 BLP00045	 BLP00046
9	 BLP00047	 BLP00048
13	 BLP00049	 BLP00050
17	 BLP00051	 BLP00052
21	 TEW00259	 TEW00260

No. of pins	AMP040 type connector	
	Male (female housing)	Female (male housing)
8	 BLP00053	 BLP00054
12	 BLP00055	 BLP00056
16	 BLP00057	 TEW00232
20	 BLP00058	 TEW00234

No. of pins	AMP070 type connector	
	Male (female housing)	Female (male housing)
8		
12		

No. of pins	L type connector	
	Male (female housing)	Female (male housing)
2	 TEW00257	 TEW00258

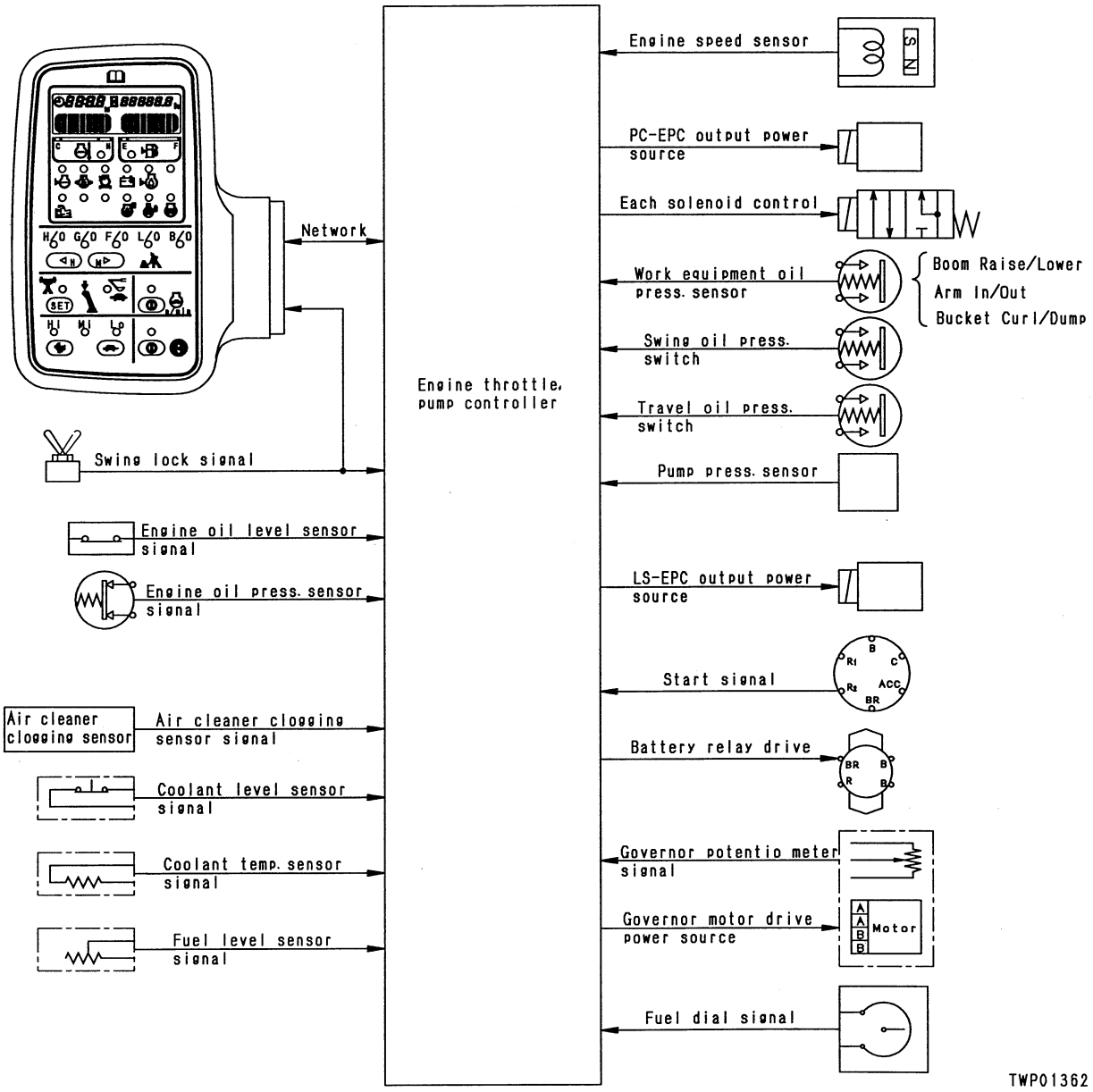
No. of pins	Automobile connector	
	Male (female housing)	Female (male housing)
2	 BLP00063	 BLP00064
3	 BLP00065	 BLP00066
4	 BLP00067	 BLP00068
6	 BLP00069	 BLP00070
8	 BLP00071	 BLP00072

No. of pins	Relay connector (socket)	
	Male (female housing)	Female (male housing)
5	 BLP00073	 BLP00074
6	 BLP00075	 BLP00076

EXPLANATION OF CONTROL MECHANISM FOR ELECTRICAL SYSTEM

1. Explanation of machine control functions

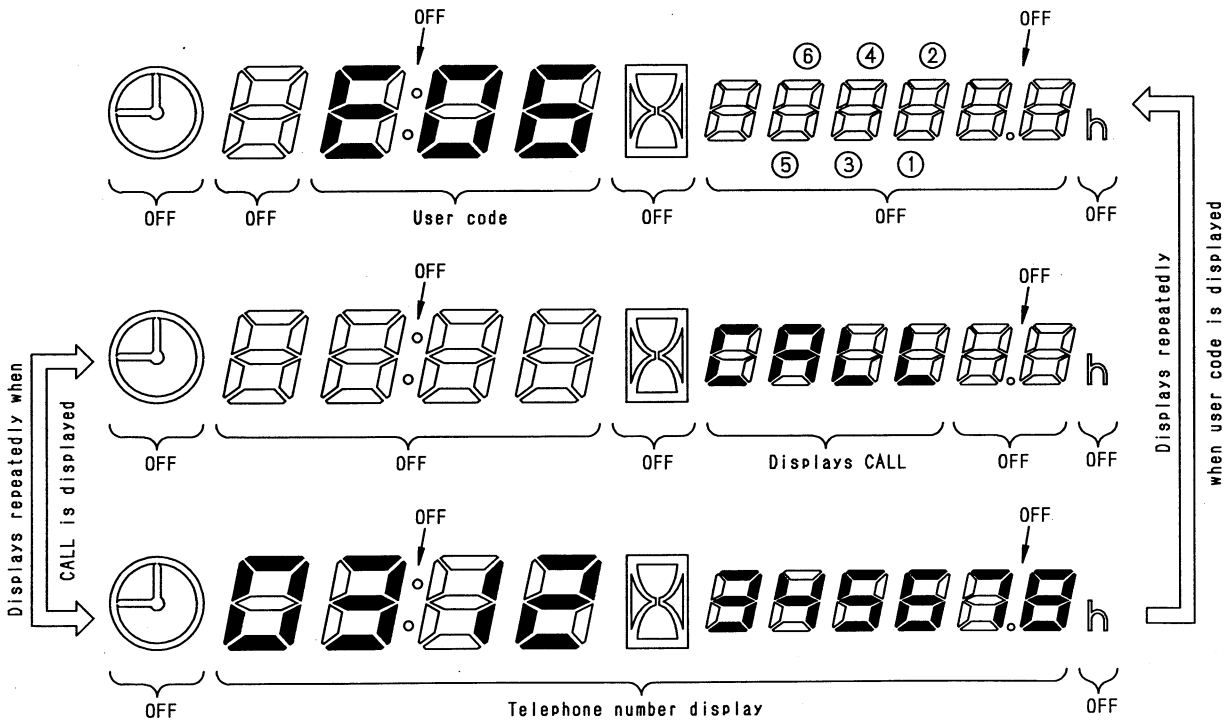
The control mechanism for the electrical system consists of the monitor panel, engine throttle, and pump controller. The monitor panel, engine throttle and pump controller input the signals that are necessary, and together with the signals selected by the monitor panel, engine throttle, and pump controller output or input the necessary signals and control the pump absorption torque and engine output.



DISPLAY METHOD AND SPECIAL FUNCTIONS OF MONITOR PANEL

1. **Display on machine monitor**
   When the starting switch is turned on, all the monitor and gauge lamps light up for approx. 3 seconds, and the buzzer sounds for approx. 1 second. During this time, the monitor itself carries out self diagnosis, and after it has finished, it returns to the normal display.

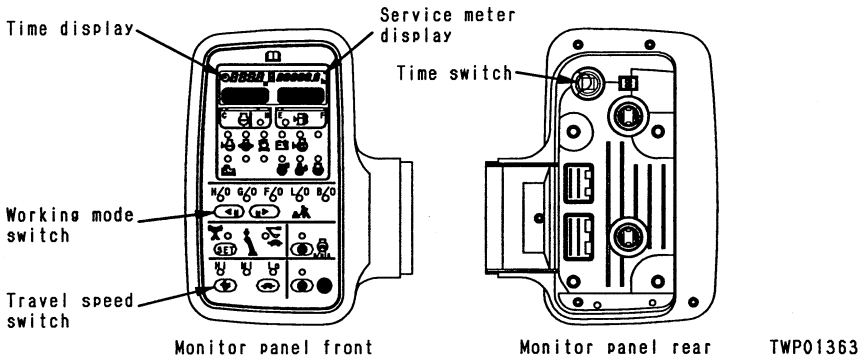
2. **Recording of service codes and user code display function**
   1) All the abnormality data for the engine throttle and pump controller is sent to the monitor panel. When the monitor panel receives this data, it records the abnormality data, and at the same time, depending on the nature of the abnormality, it displays the user code on the time display panel to advise the operator of the action to take.
      However, in cases of abnormalities which are not urgent and do not require the user code to be displayed, the content of the abnormality is simply recorded, and no display is given.
   2) Types of user code and system
      E-02 (PC-EPC system)
      E-03 (Swing holding brake system)
      E-05 (Governor motor system)
      ★ For details of the service codes included in the user code, see the action taken by the controller when an abnormality occurs, the symptoms on the machine or the judgement table.
   3) Displaying user code
      If it becomes necessary to display the user code, the time display panel is automatically switched to advise the operator to take the necessary action.
      - Actual display
        (Example: Disconnection in the cancel solenoid system for the swing holding brake)



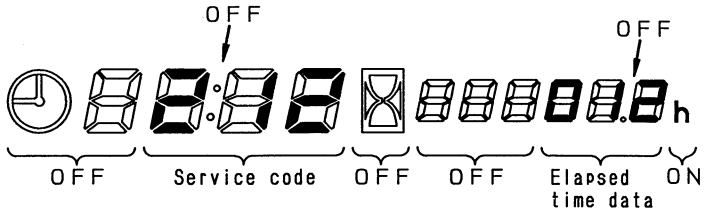
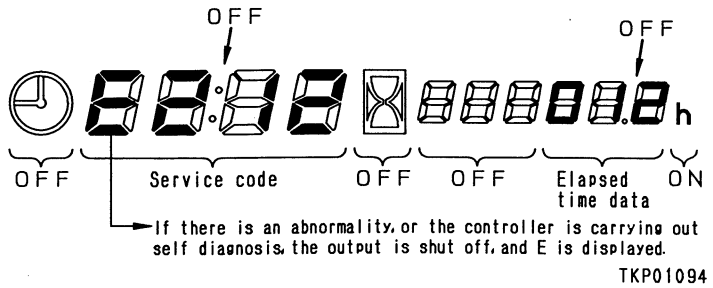
TKP00784

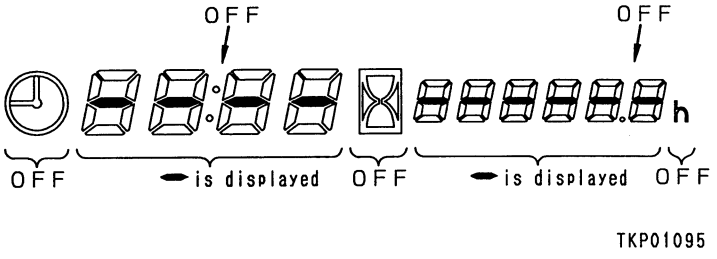
4) Display of trouble data
The monitor panel records both the service codes which are included in the user code and the service codes which are not included. This data can be displayed on the time display as follows.

★ For details of the service codes that are not included in the user code, see ACTION TAKEN BY CONTROLLER WHEN ABNORMALITY OCCURS AND PROBLEMS ON MACHINE or the JUDGEMENT TABLE.



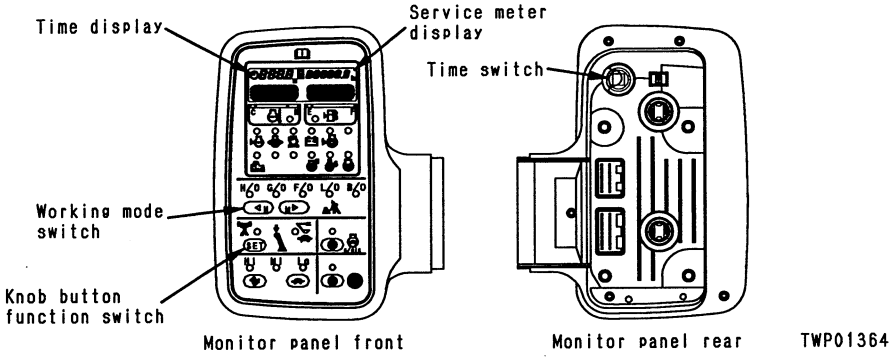
i) Method of displaying trouble data

Operation	Display
1. To set to the trouble data display mode, Keep the TIME switch + L.H. travel speed switch pressed for 2.5 seconds. Note: It is possible to call it up at the following times. 1) In the normal mode 2) In the user code display mode 3) In the machine data monitoring mode 4) In the time adjustment mode 2. To go the next service code display, press the time switch + R.H. working mode switch. 3. To go back the previous service code display, press the time switch + L.H. working mode switch.	1. On the time display and service meter display, the service code and number of hours (service meter hours) that have elapsed since the occurrence of the abnormality are displayed. • Example of displa : When E212 has occurred 12 hours before (on the service meter) 1) Display of service code 2) Display of elapsed time  TKP01093 3) If any abnormality exists at this time, the E mark is displayed.  TKP01094

Operation	Display
4. To finish with the trouble data display mode, keep the time switch + L.H. travel speed switch pressed for 2.5 seconds. 5. To erase the memory, press the time switch, turn the starting switch from OFF to ON, and keep the time switch pressed for 5 seconds.	4) If there is no abnormality code in memory  TKP01095

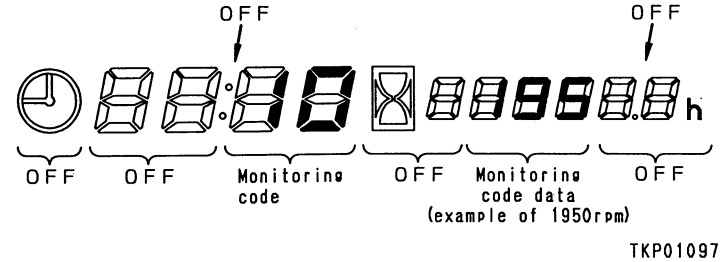
3. Machine data monitoring function

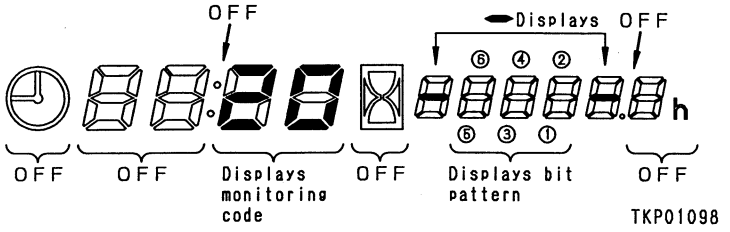
The input signals from the sensors and the output signals to drive the solenoid are displayed on the time display and service meter display.



TWP01364

1) Method of displaying monitoring code

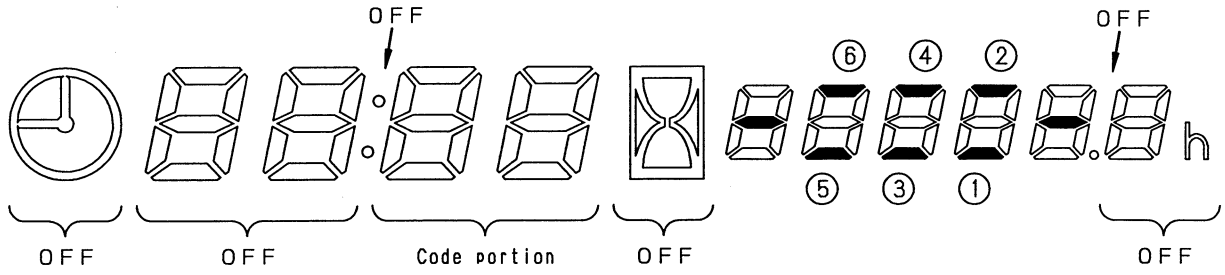
Operation	Display
1. To set to the machine data monitoring mode, keep the time switch + knob button function switch pressed for 2.5 seconds. Note: This is possible at the following times. 1) During the normal mode 2) During the user code display mode 3) During the time adjustment mode 4) During the trouble data display mode	1. On the time display and service meter display, the monitoring code and data are displayed. • Example of display 1) When engine speed is monitored (monitoring code 10)  TKP01097

Operation	Display
2. To go to the next monitoring code display, press the time switch + R.H. working mode switch. 3. To go back to the previous monitoring code display, press the time switch + L.H. working mode switch. 4. To finish with the machine data monitoring code mode, keep the time switch + knob button function switch pressed for 2.5 seconds.	2) When displaying bit pattern • For monitoring codes 08, 20-24, 36, 37, 47-49, 4A, display the bit pattern. • Example of monitoring code 20  • The code No. is displayed in the monitoring code portion, and the display lights up to display bit patterns (1) – (6).

2) Table of machine data monitoring codes
★ For details of the B in the Unit column, see the bit pattern chart in the next section.

No.	Item	Unit	Name of component
01	Monitor model code	—	Monitor panel
02	Engine throttle, pump controller model code	—	Engine throttle, pump controller
03	Engine throttle, pump controller model code	—	Engine throttle, pump controller
08	S-NET component condition display	B	Engine throttle, pump controller, etc.
10	Engine speed	10 rpm	
11	Pump discharge pressure (F) input	MPa {kg/cm²}	Engine throttle, pump controller
12	Pump discharge pressure (R) input	MPa {kg/cm²}	Engine throttle, pump controller
13	PC-EPC electric current output	10 mA	Engine throttle, pump controller
15	LS-EPC electric current output	10 mA	Engine throttle, pump controller
16	No. 2 throttle command Engine throttle, pump controller	rpm	
20	Input signal (1) for engine throttle, pump controller PPC oil pressure switch	B	Engine throttle, pump controller
21	Input signal (2) for engine throttle, pump controller PPC oil pressure switch	B	Engine throttle, pump controller
22	Input signal (3) for engine throttle, pump controller PPC oil pressure switch	B	Engine throttle, pump controller
23	Engine throttle, pump controller solenoid actuation	B	Engine throttle, pump controller
24	Input condition 1 of sensor for engine throttle, pump controller monitor warning	B	Engine throttle, pump controller
25	Input condition 2 of sensor for engine throttle, pump controller monitor warning	B	Engine throttle, pump controller
30	Fuel control dial input value	10 mV	Engine throttle, pump controller
31	Input value for governor motor feedback potentiometer	10 mV	Engine throttle, pump controller
32	VBB voltage (battery voltage)	100 mV	Engine throttle, pump controller
33	Governor motor A phase current	10 mV	Engine throttle, pump controller
34	Governor motor B phase current	100 mV	Engine throttle, pump controller
35	Battery relay output voltage	100 mV	Engine throttle, pump controller
36	Input condition of engine throttle, pump controller	B	Engine throttle, pump controller
37	Output condition of engine throttle, pump controller	B	Engine throttle, pump controller
40	Engine speed	10 rpm	Engine throttle, pump controller
41	Coolant temperature sensor voltage	10 mV	Engine throttle, pump controller
42	Fuel sensor input voltage	10 mV	Engine throttle, pump controller
43	Battery charge input voltage	100 mV	Engine throttle, pump controller
47	Monitor panel output condition 1	B	Monitor panel
48	Monitor panel input condition 1	B	Monitor panel
49	Monitor panel input condition 2	B	Monitor panel
4A	Monitor panel input condition 3	B	Monitor panel
4C	Monitor panel input condition 4	B	Monitor panel

3) Bit pattern chart
As shown in the diagram below, the time display has bit numbers which light up to show that the signal is being transmitted. (For details, see Method of displaying monitoring code.)



TKP01099

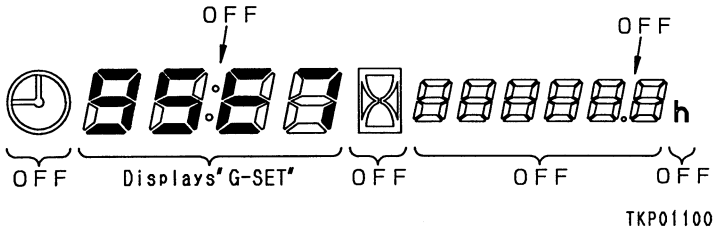
Code	Content	Bit	Details (condition when lighted up)	
08	Connection of S-NET components	①	Engine throttle, pump controller connected (ID=2)	
		②	Engine throttle, pump controller connected (ID=3)	
		③		
		④		
		⑤		
		⑥		
20	Input condition of engine throttle, pump controller PPC switches	①	Swing switch ON	
		②	Travel switch ON	
		③	Boom LOWER switch ON	
		④	Boom RAISE switch ON	
		⑤	Arm IN switch ON	
		⑥	Arm OUT switch ON	
21	Input condition of engine throttle, pump controller PPC switches and other switches	①	Bucket CURL switch ON	
		②	Bucket DUMP switch ON	
		③	Swing lock switch ON	
		④	Service switch ON	
		⑤	Model selection 5	
		⑥	Swing prolix switch ON	
22	Input condition of engine throttle, pump controller model selection and other switches	①	Model selection 1	GND connected
		②	Model selection 2	GND connected
		③	Model selection 3	GND connected
		④	Model selection 4	GND connected
		⑤	Kerosene mode input	GND connected
		⑥	Knob switch ON	

Code	Content	Bit	Details (condition when lighted up)
23	Drive condition of engine throttle, pump controller ON/OFF solenoid valves	①	
		②	(Solenoid ON) active mode OFF (in STD Mode)
		③	Swing holding brake solenoid ON
		④	Pump merge/divider solenoid ON
		⑤	2-stage relief solenoid ON
		⑥	Travel speed selector solenoid ON
24	Input condition 1 of sensor for engine throttle, pump controller monitor warning	①	Engine oil pressure sensor normal (above set pressure)
		②	
		③	Radiator water level sensor abnormal
		④	Engine oil level sensor abnormal
		⑤	Hydraulic oil level sensor abnormal
		⑥	Air cleaner clogging sensor abnormal
25	Input condition 2 of sensor for engine throttle, pump controller monitor warning	①	
		②	
		③	
		④	
		⑤	Automatic greasing controller abnormal (option)
		⑥	
36	Output condition of engine throttle, pump controller	①	
		②	
		③	
		④	
		⑤	Starting switch ON
		⑥	
37	Output condition of engine throttle, pump controller	①	Battery relay Actuated
		②	
		③	
		④	
		⑤	
		⑥	
47	Monitor panel output condition 1	①	
		②	Alarm buzzer Actuated
		③	Wiper motor drive (R) Actuated
		④	Wiper motor drive (L) Actuated
		⑤	Window washer drive Actuated
		⑥	

Code	Content	Bit	Details (condition when lighted up)	
48	Monitor panel input condition 1	①	Wiper (ON)	OFF
		②	Wiper (INT)	OFF
		③	Wiper (WASHER)	OFF
		④	Window limit switch	Open
		⑤	Limit switch (P)	Open
		⑥	Limit switch (W)	Open
49	Monitor panel input condition 2	①	KEY ON SWITCH	OFF
		②	Terminal BR	Voltage Hi
		③	LIGHT SWITCH	OFF
		④	Preheating switch	OFF
		⑤	START C	Sometimes turns ON
		⑥	Monitor panel LED lighting output	OFF
4A	Monitor panel input condition 3	①	Time switch	OFF
		②	PPC oil pressure selector switch	OFF
		③	Overload selector switch	OFF
		④	STD/DLX selection	When STD
		⑤	Swing lock switch	OFF
		⑥	Buzzer cancel switch	OFF
4C	Monitor panel input condition 4	①		
		②	Wiper motor normal rotation relay output	When there is abnormality in specified voltage
		③	Wiper motor reverse rotation relay output	When there is abnormality in specified voltage
		④	Window washer motor drive output	When there is abnormality in specified voltage
		⑤		
		⑥		

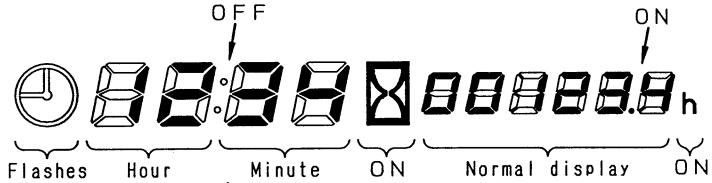
4. Governor motor adjustment mode

This is used when adjusting the linkage between the governor motor and the injection pump. (For details of the procedure, see TESTING AND ADJUSTING.)

Operation	Display
1. To set to the governor motor adjustment mode, keep the time switch + R.H. travel speed switch + R.H. working mode switch pressed for 2.5 seconds. 2. To return to the time display mode use the same procedure as in Step 1.	1.  TKP01100 2. Buzzer sounds once a second

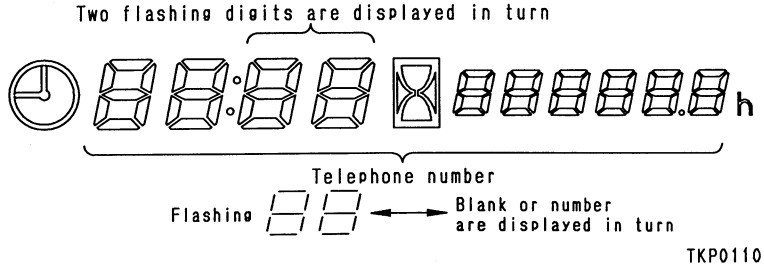
5. Time adjustment mode

To adjust the time, do as follows.

Operation	Display
1. To set to the time adjustment mode, keep the time switch pressed for 2.5 seconds. 2. Use the L.H. working mode switch to advance the hour. 3. Use the R.H. working mode switch to advance the minute. 4. To return to the time display mode use the same procedure as in Step 1.	1. The time mark portion flashes  TKP01101 ※ The example shows the situation when setting to 12:34.

6. Telephone number input

To input telephone numbers, do as follows.

Operation	Display
1. To set to the telephone number input mode, keep the time switch + auto-deceleration switch pressed for 2.5 seconds. 2. When the time switch + L.H. working mode switch are pressed, the display moves 2 digits at a time to the left, and when the R.H. working mode switch is pressed, the display moves 2 digits at a time to the right. The 2 digits at the new location flash.	 TKP01102

Operation	Display
3. When the time switch + R.H. travel speed switch are pressed, the flashing number on the right changes [0] – [9] – [blank] - [0], and when the time switch + L.H. travel speed switch are pressed, the flashing number on the left changes in the same way. 4. After inputting the telephone number, keep the time switch + auto-deceleration switch pressed for 2.5 seconds. This returns to the time mode (normal mode) and saves the telephone number.	

METHOD OF USING JUDGEMENT TABLE

This judgement table is a tool to determine if the problem with the machine is caused by an abnormality in the electrical system or by an abnormality in the hydraulic or mechanical system. The symptoms are then used to decide which troubleshooting table (E–○○, S–○○, C–○○, F–○○, H–○○, M–○○) matches the symptoms.
The judgement table is designed so that it is easy to determine from the user code and service code which troubleshooting table to go to.

★ The abnormality display (warning) given by the monitor panel leads directly to troubleshooting of the machine monitor (M–○○). (See troubleshooting of the machine monitor system)

1. When using judgement table for engine throttle · pump controller (governor control system) and engine related parts

- If a service code is displayed on the monitor panel, go to the troubleshooting code at the bottom of the judgement table (E–○○).
  (A ● mark is put at the places where the failure mode and service code match.)
- If a problem has appeared but no service code is displayed on the monitor panel, go to the point where the failure mode matches the troubleshooting code on the right of the judgement table (E–○○ or S–○○).

<Example> Failure mode "Engine does not start".

Procedure: Check if the service code is being displayed on the monitor panel.

JUDGEMENT TABLE FOR ENGINE THROTTLE, PUMP CONTROLLER (GOVERNOR CONTROL SYSTEM), AND ENGINE RELATED PARTS

Failure mode		Abnormality in engine throttle, pump controller power source system	Engine throttle, pump controller, engine related parts (E3:system) Self-diagnostic display: Abnormality in fuel control dial input value	Abnormality (disconnection) in motor drive system	Abnormality (short circuit) in motor drive system	Abnormality in feedback potentiometer system	Abnormality (short circuit) in battery relay output	Abnormality (step-out) in motor	hecking monitoring, check items: Battery relay drive signal	No. 2 throttle command value	Fuel control dial command value	Governor motor potentiometer	Governor motor A phase current	Governor motor B phase current	Coolant temperature voltage	Machine monitor check item: Is red range displayed? 102°C or above	105°C or above	Does starting motor turn?	Troubleshooting code if no service code display is given
User code			E05						Monitoring code										
Service code			308	317	318	306	315	316	35	16	30	31	33	34	41		108		
1	Engine does not start easily																		S-1
2	Engine does not start																	○	S-2
3	Engine speed stays at low idling, and does not follow accelerator; or engine pickup is poor	●	●	●	●	●					≪	≪	≪	≪			○		S-3
4	Engine stops during operation																		S-4
5	Engine rotation is irregular — When idling speed is irregular																		E-9a), S-5
	Engine rotation is irregular — When there is hunting		●	●	●	●		●				≪							E-9a), S-5
6	Lack of output (engine high idling speed is too low)		●			●				≪	≪				○				E-10, S-6
7	Auto-deceleration does not work																		E-3 • E-3
8	Engine does not stop	●		●	●	●	●		○				≪	≪					E-11
9	Warming-up operation is defective														○		○		E-3 • E-4
10	Exhaust gas is black																		S-7
11	Oil consumption is excessive, or exhaust gas is blue																		S-8
12	Oil becomes dirty prematurely																		S-9
13	Fuel consumption is excessive, or exhaust gas is blue																		S-10
14	Oil is mixed in coolant																		S-11
15	Oil pressure lamp lights up																		S-12
16	Oil level rises																		S-13
17	Coolant temperature rises too high														○	○			S-14
18	Abnormal noise is generated																		S-15
19	There is excessive vibration																		S-16
20	Engine speed does not change even when working mode is switched									≪									E-3 • E-4
21	Troubleshooting code when service code is displayed	E-1	E-2	E-3	E-4	E-5	E-6	E-7	—	—	—	—	—	—	—	—	—	—	
22	Troubleshooting code when there is abnormality in monitoring or machine monitor check	—	—	—	—	—	—	—	E-12	—	—	—	—	—	M-14	M-13	M-13	E-8	

○: This shows applicable item for service code
≪: This shows item that needs only checking with monitoring
○: This shows item to check with monitoring or machine monitor

[Judgement]

1) If a service code is being displayed on the monitor panel..... go to troubleshooting [E3:○○] for the engine throttle · pump controller (governor control system).
2) If no service code is displayed on the monitor panel, and the engine does not start:

- Check that starting motor rotates
  - Starting motor rotates ..... Go to troubleshooting S-2 of mechanical system
  - Starting motor does not rotate.... Go to troubleshooting E-8 of electrical system

2. When using judgement table for engine throttle · pump controller (governor control system) and hydraulic related parts

- If a service code is displayed on the monitor panel, go to the troubleshooting code at the bottom of the judgement table (C-○○).
  (A ● mark is put at the places where the failure mode and service code match.)
- If a problem has appeared but no service code is displayed on the monitor panel, go to the point where the failure mode matches the input signal, and check the display for the input signal (the display at the place with a ○ mark).
  - If it is displayed normally, go to the troubleshooting code on the right of the judgement table (H-○○).
  - If the input signal is not displayed on the monitor panel, go to the troubleshooting code at the bottom of the judgement table (F-○○).

<Example> Failure mode "Upper structure does not swing".
Procedure: Check if the service code is being displayed on the monitor panel.

JUDGMENT TABLE FOR PUMP CONTROLLER AND HYDRAULIC RELATED PARTS

★ If service code E218 (abnormality in network system) is displayed, go to troubleshooting for N Mode.

	Failure mode	Abnormality in controller power source	Short circuit in PC-EPC solenoid system	Disconnection in PC-EPC solenoid system	Short circuit in swing holding brake solenoid system	Disconnection in swing holding brake solenoid system	Short circuit in 2-stage relief solenoid system	Disconnection in 2-stage relief solenoid system	Short circuit in travel speed solenoid system	Disconnection in travel speed solenoid system	Short circuit in active mode solenoid	Disconnection in active mode solenoid	Model selection input error	Short circuit in LS-EPC solenoid system	Disconnection in LS-EPC solenoid system	Abnormality in pump pressure sensor system	Abnormality in pressure sensor power source system	Abnormality in engine speed sensor system	Swing (1)	Travel (2)	Boom LOWER (3)	Boom RAISE (4)	Arm IN (5)	Arm OUT (6)	Bucket CURL (1)	Bucket DUMP (2)	Swing lock switch (3)	Kerosene mode (5)	Knob switch (6)	Active mode (2)	Swing holding brake (3)	2-stage relief (5)	Travel speed (6)	Mode selection code	Engine speed input	Pump discharge pressure input	PC-EPC current output	LS-EPC current output	Is the voltage for engine water temperature	Troubleshooting code if no service code is displayed
			Engine throttle, pump controller (E2:XX system) / Self-diagnostic display																Check items with monitoring mode / Oil pressure switch											Solenoid drive condition				Check items with monitoring mode						
	User code		E02		—		E03		—					—					Bit pattern															Monitoring code						
	Service code		232	233	203	213	205	215	206	216	207	208	217	222	223	224	226	227	20						21			22		23				02	10	11	13	15	41	
All work equipment, travel, swing	Speeds of all work equipment, swing, travel are slow or lack power		●	●									●		●			●										○						☆	☆	☆	☆	☆	☆	H- 1
All work equipment, travel, swing	There is excessive drop in engine speed, or engine stalls	●	●	●									●																					☆	☆		☆			H- 2
All work equipment, travel, swing	No work equipment, travel, swing move																																							H- 3
All work equipment, travel, swing	Abnormal noise generated (around pump)																																							H- 4
All work equipment, travel, swing	Auto-deceleration does not work	●																	○	○	○	○	○	○	○	○									☆					H- 5
All work equipment, travel, swing	Fine control ability is poor or response is poor																																							H- 6
Work equipment	Boom is slow or lacks power																				○	○														☆				H- 7
Work equipment	Arm is slow or lacks power																						○	○												☆				H- 8
Work equipment	Bucket is slow or lacks power																								○	○										☆				H- 9
Work equipment	Boom does not move																																							H-10
Work equipment	Arm does not move																																							
Work equipment	Bucket does not move																																							
Work equipment	Excessive hydraulic drift																																							H-11
Work equipment	Excessive time lag (engine at low idling)														●						○		○		○													☆		H-12
Work equipment	Lack of power when pressure rises						●	●												○		○	○		○				○			☆				☆				H-13
Work equipment	Other equipment moves when single circuit is relieved																																							H-14
Work equipment	Work equipment speed is slow when active mode is ON, or is fast when active mode is OFF										●	●																			☆									H-15
Compound operations	In F/O mode, arm IN speed is faster than specified speed													●	●																								☆	H-16
Compound operations	In compound operations, work equipment with larger load is slow																																							H-17
Compound operations	In swing + boom RAISE, boom is slow																																							H-18
Compound operations	In swing + travel, travel speed drops excessively																		○	○																				H-19
Compound operations	In work equipment + travel, travel speed drops excessively																			○	○	○	○	○	○	○														H-20
Travel system	Travel deviation: Deviation is excessive in normal travel operations																																							H-21
Travel system	Travel deviation: Deviation is excessive when starting																																							
Travel system	Travel speed is slow																			○																				H-22
Travel system	Steering is difficult to turn or lacks power						●	●	●	●					●					○												☆	☆			☆		☆		H-23
Travel system	Travel speed does not switch or is faster than specified speed	●							●	●				●	●	●	●			○													☆					☆		H-24
Travel system	Does not move (one side only)																																							H-25
Swing system	Does not swing: Both left and right				●	●													○								○				☆					☆				H-26
Swing system	Does not swing: One direction only																																							
Swing system	Swing acceleration is poor or swing speed is slow: Both left and right																																			☆				H-27
Swing system	Swing acceleration is poor or swing speed is slow: One direction only																																							
Swing system	Excessive overrun when stopping swing: Both left and right																																							H-28
Swing system	Excessive overrun when stopping swing: One direction only																																							
Swing system	Excessive shock when stopping swing (one direction only)																																							H-29
Swing system	Excessive abnormal noise when stopping swing																																							H-30
Swing system	Excessive hydraulic drift of swing: When swing holding brake is canceled																																							H-31
Swing system	Excessive hydraulic drift of swing: When swing holding brake is applied																		☆																					
Swing system	Swing speed is faster than specified swing speed													●	●																							☆		H-32
	Troubleshooting code when service code is displayed	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10	C-11	C-12	C-13	C-14	C-15	C-16	C-17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Troubleshooting code when there is abnormality in monitoring code check	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	F-1	F-2	F-3	F-4	F-5	F-6	F-7	F-8	F-9	F-10	F-11	—	—	—	—	—	—	—	—	—	—	

☆ : This shows item that needs only checking with monitoring
○ : This shows item to check with monitoring or machine monitor
● : This shows applicable item for service code

[Judgement]

1) If a service code is being displayed on the monitor panel......go to troubleshooting [E2:○○] for the engine throttle · pump controller (pump control system).
2) If no service code is displayed on the monitor panel, and the upper structure does not swing: .

- Check engine throttle · pump controller input signal (Check in monitoring mode)
  - There is a signal.... Go to troubleshooting H-25 of mechanical system
  - There is no signal . Go to troubleshooting F-○○ of engine throttle · pump controller input signal system (F mode for applicable system)

METHOD OF USING TROUBLESHOOTING CHARTS

1. Category of troubleshooting code number

Troubleshooting Code No.	Component	Service code
C –OO	Troubleshooting of engine throttle, pump controller [Pump control system]	E2 –OO system
E –OO	Troubleshooting of engine throttle, pump controller [Governor control system]	E3 –OO system
F –OO	Troubleshooting of engine throttle, [Input single system]	—
H –OO	Troubleshooting of hydraulic, mechanical system	—
M–OO	Troubleshooting of machine monitor panel system	E1 –OO system
N –OO	Troubleshooting of communications system	E218 system
S –OO	Troubleshooting of engine system	—

2. Method of using troubleshooting table for each troubleshooting mode

(1) Troubleshooting code number and problem (for (1) – (4), see the examples on the next page.)
The title at the top of the troubleshooting chart gives the troubleshooting code and failure mode (problem with the machine).

(2) Distinguishing conditions
Even with the same failure mode (problem), the method of troubleshooting may differ according to the model, component, or problem. In such cases, the failure mode (problem) is further divided into sections marked with small letters (for example, a)), so go to the appropriate section to carry out troubleshooting.
If the troubleshooting table is not divided into sections, start troubleshooting from the first check item in the failure mode.

(3) Method of following troubleshooting chart
- Check or measure the item inside ▭ (YES / NO), and according to the answer follow either the YES line or the NO line to go to the next ▭. (Note: The number written at the top right corner of the ▭ is an index number; it does not indicate the order to follow.)
- Following the YES or NO lines according to the results of the check or measurement will lead finally to the Cause column. Check the cause and take the action given in the Remedy column on the right.
- Below the ▭ there are the methods for inspection or measurement, and the judgement values. If the judgement values below the ▭ are correct or the answer to the question inside the ▭ is YES, follow the YES line; if the judgement value is not correct, or the answer to the question is NO, follow the NO line.
- Below the ▭ is given the preparatory work needed for inspection and measurement, and the judgement values. If this preparatory work is neglected, or the method of operation or handling is mistaken, there is danger that it may cause mistaken judgement, or the equipment may be damaged. Therefore, before starting inspection or measurement, always read the instructions carefully, and start the work in order from Item 1).

(4) General precautions
When carrying out troubleshooting for the failure mode (problem), precautions that apply to all items are given at the top of the page and marked with ★.
The precautions marked ★ are not given in the ▭, but must always be followed when carrying out the check inside the ▭.

(5) Troubleshooting tools
When carrying out the troubleshooting, prepare the necessary troubleshooting tools. For details, see TOOLS FOR TESTING, ADJUSTING, AND TROUBLESHOOTING.

(6) Installation position, pin number
A diagram or chart is given for the connector type, installation position, and connector pin number. When carrying out troubleshooting, see this chart for details of the location for inspection and measurement of the wiring connector CNOO appearing in the troubleshooting flow chart for each failure mode (problem).

<Example>

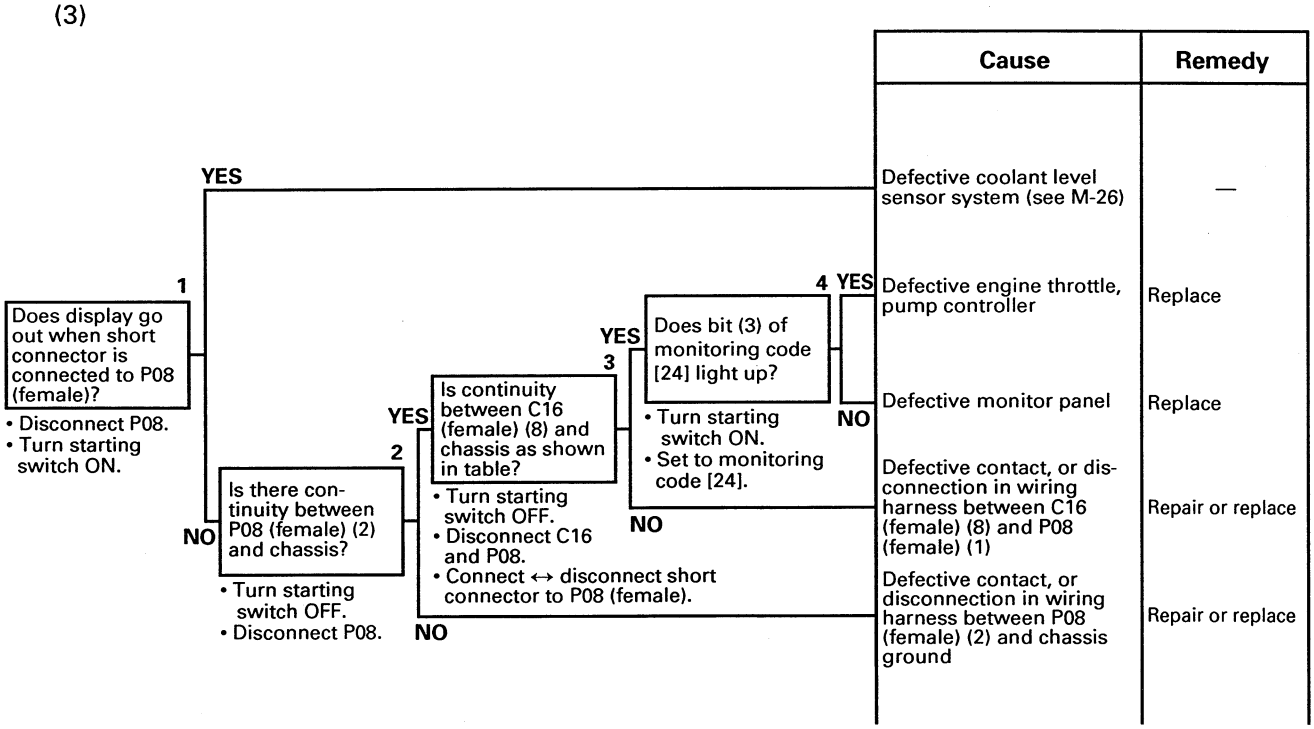
(1) M-9 When starting switch is turned ON (engine stopped), basic check items flash

(4) ★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

(2) a)  SAP00519 **(coolant level) flashes**
★ Check that the coolant level is correct before carrying out troubleshooting.

b)  SAP00523 **(engine oil level) flashes**
★ Check that the engine oil level is correct before carrying out troubleshooting.

(3)



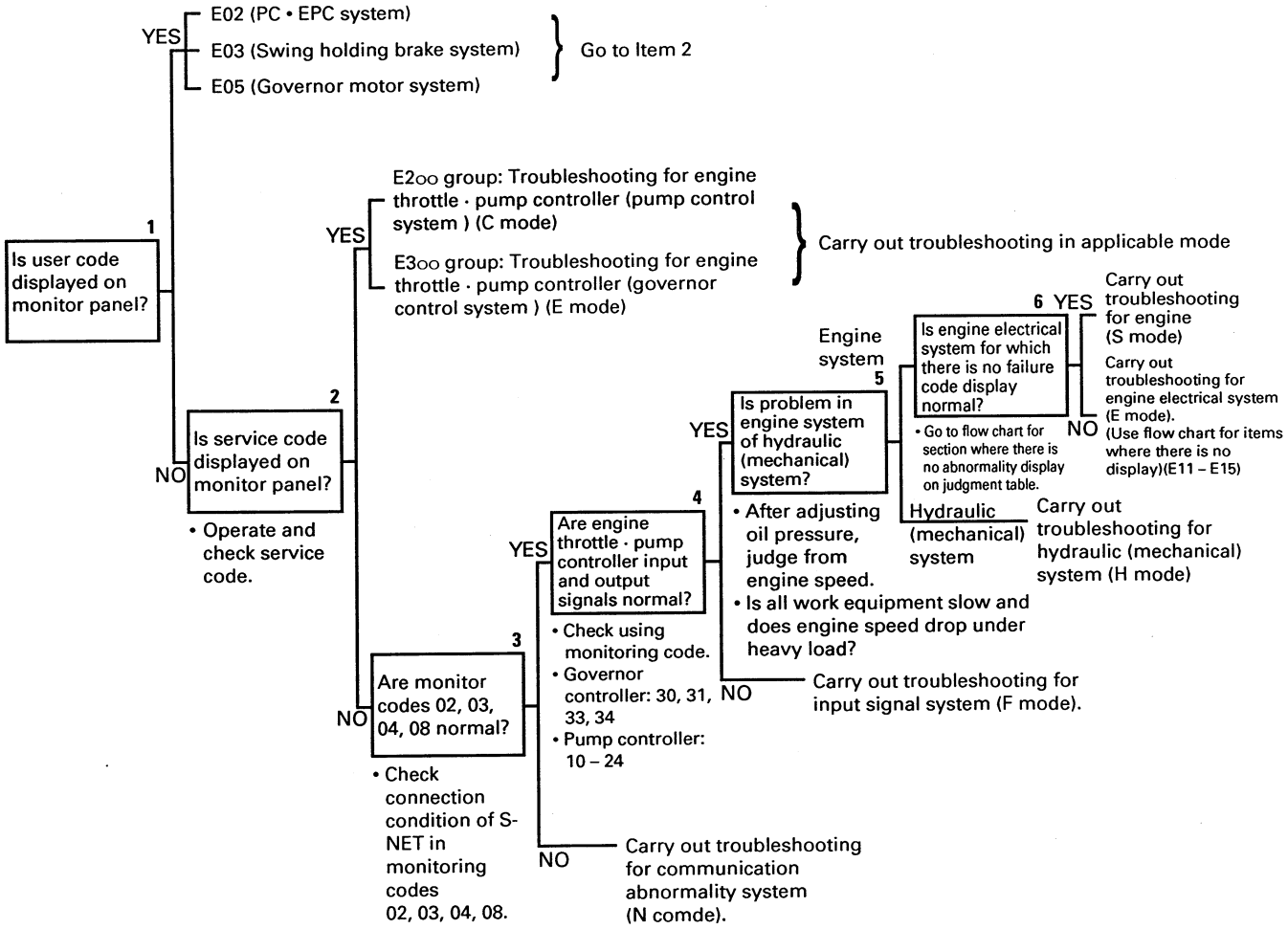
Table

Short connector	Continuity
Connected	Yes
Disconnected	No

DETAILS OF TROUBLESHOOTING AND TROUBLESHOOTING PROCEDURE

If any abnormality should occur, it is necessary to go to the correct troubleshooting chart in accordance with the judgement table for that type of failure (engine throttle · pump controller (governor control system) and engine throttle · pump controller (pump control system). For details of the troubleshooting and troubleshooting procedure, refer to this flow chart.
When carrying out troubleshooting, ask the operator as much as possible about the condition of the machine, and check the following items before starting.
(1) Condition of controller connection (check with monitoring codes 02 – 03)
(2) Blown fuses
(3) Battery voltage (monitoring mode 32)
(4) Electricity generation (charge input) voltage (monitoring code 43)

The procedure for carrying out check items No. 3 and 4 in the flow chart below is given on the following pages.



★ For details, see engine throttle · pump controller (governor control system) (pump control system) in the JUDGEMENT TABLE.

If there is no abnormality display in the communications system transmitted in S-NET, it can be taken that the output signal from the monitor panel has been transmitted. However, even if there is no abnormality display, if the operation is defective, use the following procedure when checking directly.
If any abnormality occurs in the S-NET system, the system is automatically switched to the following default mode, so be careful when carrying out troubleshooting.

Default Mode when communications cannot be carried out for the monitor and engine throttle • pump controller

	Set mode	Pump control	Governor control
1	Working mode	G/O mode	H/O mode
2	Throttle signal	FULL	FULL
3	Auto-deceleration	ON (deceleration mode	ON (deceleration mode)
4	Coolant temperature signal	OFF	—
5	—	—	—
6	Power max. mode	ON (power max. possible)	—
7	Travel speed	Lo	—
8	Automatic warming up	—	ON (automatic warming-up mode)

1. Procedure for checking monitor panel output signal

★ For details of operating the monitoring mode, see MONITOR PANEL DISPLAY AND SPECIAL FUNCTIONS.

1. Connection condition of components
   1) Set to the monitoring mode and display monitoring code 08.
   2) The time display (bits) will light up to display the components that are connected.
      ★ Engine throttle · pump controller (pump control system) (1) and engine throttle · pump controller (governor control system) (2) will light up.

2. Checking working mode signal {check No. 2 throttle signal (monitoring code 16) at the same time}
   1) Set to the monitoring mode and display monitoring code 10.
   2) Switch the working mode as shown in Table 1 and check that the engine speed changes.

Table 1

Working mode	Operation	Engine speed (high idling) [The figures in ( ) are the rated speed] (rpm)
ACTIVE MODE	Work equipment	Approx. 2,400 (2,200)
	Travel	Approx. 2,400 (2,200)
H/O	Work equipment	Approx. 2,200 (2,000)
	Travel	Approx. 2,200 (2,000)
G/O, F/O	Work equipment	Approx. 2,000 (1,800)
	Travel	Approx. 2,000 (–)
L/O	Work equipment	Approx. 1,670 (1,500)
	Travel	Approx. 1,670 (–)
B/O	Work equipment	Approx. 1,850 (1,650)
	Travel	Approx. 1,850 (–)

3. Checking travel speed selection signal
   1) Set to the monitoring mode and display monitoring code 23.
   2) Change the speed selector switch to Hi or Mi and run the engine at 1500 rpm or above. Check that bit (6) lights up when traveling at Hi or Mi (front or rear pump oil pressure: 17.7 – 23.5 MPa {180 – 240 kg/cm^2}

2. Checking input signal of engine throttle · pump controller

★ Check the input signals for each controller as follows.

• Pump control system

1. Checking input signal
   1) Check hydraulic switch
      i) Set to the monitoring mode, and display monitoring codes 20 and 21.
      ii) Operate each work equipment lever, and check how the bit pattern lights up.
         ★ For details of the bit pattern chart, see MONITOR PANEL DISPLAY AND SPECIAL FUNCTIONS.
   2) Check speed sensor (check engine speed)
      i) Set to the monitoring mode, and display monitoring code 10.
      ii) Use the fuel control dial to change the speed, and measure the speed when this is done.
   3) Check pump discharge pressure sensor
      i) Set to the monitoring mode, and display monitoring codes 11.
      ii) Operate work equipment, travel, swing lever and measure the hydraulic pressure at the pump outlet.
   4) Check kerosene mode input signal
      i) Set to the monitoring mode, and display monitoring code 22.
      ii) Connect the CN-M36 connector and check that bit (5) lights up.
   5) Check knob switch input signal .
      i) Set to the monitoring mode, and display monitoring code 22.
      ii) Turn the knob switch ON and check that bit (6) lights up.

2. Check output signals
   1) Check LS-EPC solenoid output current
      i) Set to the monitoring mode, and display monitoring code 15.
      ii) Run the engine at high idling with all the levers at neutral and in the G/O or H/O mode, and measure the current.
         ★ All levers at neutral: 900 ± 80 mA
         Engine at high idling, any lever operated (other than travel): 0 A
   2) No. 2 throttle signal
      i) Set to the monitoring mode, and display monitoring code 16.
      ii) Use the procedure in Item 2 for checking the monitor panel output signal, and measure the engine speed.

3) Checking ON ↔ OFF solenoid condition
   i) Set to the monitoring mode, and display monitoring code 23.
   ii) Refer to Table 3 and check that the applicable bit lights up.

Table 3 Types of solenoid and conditions for actuation

Name of solenoid	Actuation condition	Bit that lights up
Active mode	Active mode switch OFF	(2)
Swing holding brake	Swing or work equipment lever operated	(3)
2-stage relief	Travel lever operated	(5)
Travel speed selector	Travel speed selector switch Hi or Mi	(6)

★ Operate the lever slightly not enough to move the machine.

4) Check PC-EPC solenoid output current
   i) Set to the monitoring mode, and display monitoring codes 13 and 14.
   ii) With the starting switch kept at the ON position (G/O mode), measure the current when the fuel control dial is turned to the MAX position and auto-decel is OFF.
   • Current with starting switch ON (G/O mode) and fuel control dial at MAX
   PC130-6K : 550 ± 80 (mA)

• **Governor control system**
1. Check input signal
   1) Check fuel control dial input voltage
      i) Set to the monitoring mode, and display monitoring code 30.
      ii) Measure the voltage when the fuel control dial is turned from low idling to high idling.
      ★ Voltage: 0.25 – 4.75 V
   2) Check governor potentiometer voltage
      i) Set to the monitoring mode, and display monitoring code 31.
      ii) Measure the potentiometer voltage when the fuel control dial is turned from low idling to high idling.
      ★ Voltage: 0.5 – 4.2 V (auto-decle at OFF)

2. Check output signal
   1) Check governor motor drive current
      i) Set to the monitoring mode, and display monitoring codes 33 and 34.
      ★ Code 33 is the A phase and code 34 is the B phase
      ii) Measure the governor motor drive current when the fuel control dial is turned in the acceleration direction and deceleration direction.
      ★ Current: 700 ± 70 (mA)

   2) Measure battery relay drive output voltage
      i) Set to the monitoring mode, and display monitoring code 35.
      ii) Measure the battery relay drive output voltage when the starting switch is turned from ON to OFF.
      or
      iii) Set to the monitoring mode, and display monitoring code 37.
      iv) Check that bit (1) lights up when the starting switch is turned from ON to OFF.

SERVICE CODE TABLE

Service code	Abnormal system	User code
E101	Abnormality in error history data	—
E102	Abnormality in time data	—
E103	Short circuit in buzzer output, contact with 24V wiring harness for buzzer drive	—
E104	Air cleaner clogging detected	—
E106	Abnormality in engine oil pressure sensor (Hi) detected	—
E108	Water temperature over 105*C detected	—
E112	Short circuit in wiper motor drive normal rotation system	—
E113	Short circuit in wiper motor drive reverse rotation system	—
E114	Short circuit in window washer drive system	—
E201	Short circuit in LS bypass solenoid system	—
E203	Short circuit in swing holding brake solenoid system	E03
E205	Short circuit in 2-stage relief solenoid system	—
E206	Short circuit in travel speed solenoid system	—
E207	Short circuit in active mode solenoid system	—
E208	Disconnection in active mode solenoid system	—
E213	Disconnection in swing holding brake solenoid system	E03
E215	Disconnection in 2-stage relief solenoid system	—
E216	Disconnection in travel speed solenoid system	—
E217	Error in model selection input	—
E218	Network response overtime error	—
E222	Short circuit in LS-EPC solenoid system	—
E223	Disconnection in LS-EPC solenoid system	—
E224	Abnormality in pump pressure sensor system	—
E226	Abnormality in pressure sensor system power source	—
E227	Abnormality in engine speed sensor	—
E232	Short circuit in pump PC-EPC solenoid system	E02
E233	Disconnection in pump PC-EPC solenoid system	
E306	Abnormality in feedback potentiometer system	—
E308	Abnormality in fuel control dial input value	E05
E313	Automatic greasing controller error (option)	—
E315	Short circuit in battery relay output system	—

Service code	Abnormal system	User code
E316	Step-out in governor motor	—
E317	Disconnection in governor motor system	E05

TROUBLESHOOTING OF COMMUNICATIONS SYSTEM (N MODE)

N-1 Communications abnormality

★ This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.
★ If the starting switch was turned off after the abnormality occurred, turn the starting switch on and check that the service code displays E. (If it is not displayed, the problem has been removed.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

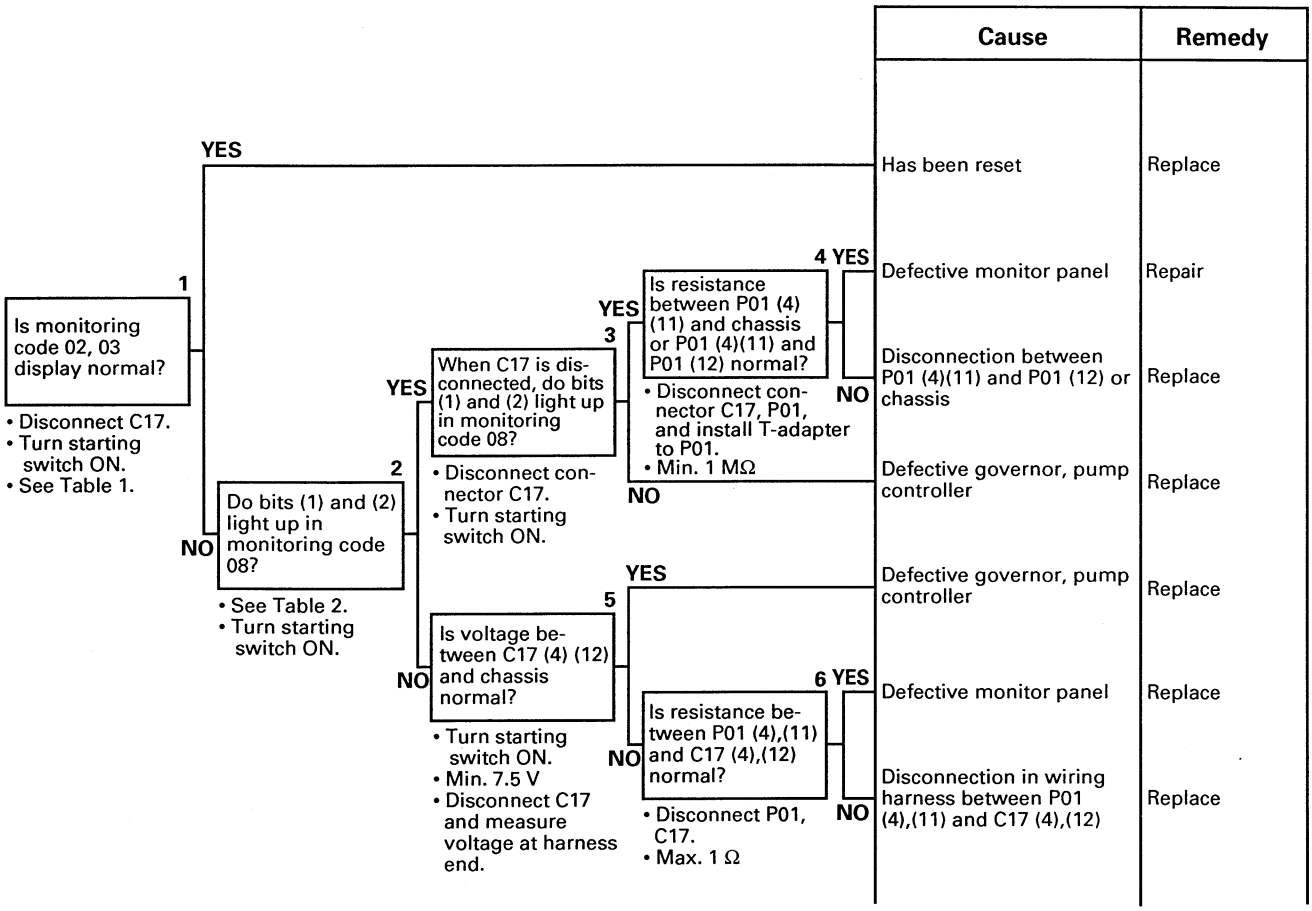


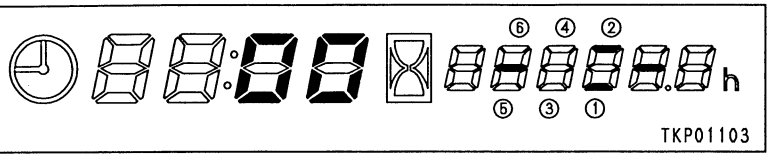
Table 1

Monitoring code		Display
01	Monitor panel model code	120
02	Engine throttle, pump controller model code	120
03	Engine throttle, pump controller model code	120

- When the controllers are not connected to the network, "—" is displayed. If the correct alphanumerics are not displayed (or another model is displayed), the controllers show abnormal model selection.

Table 2

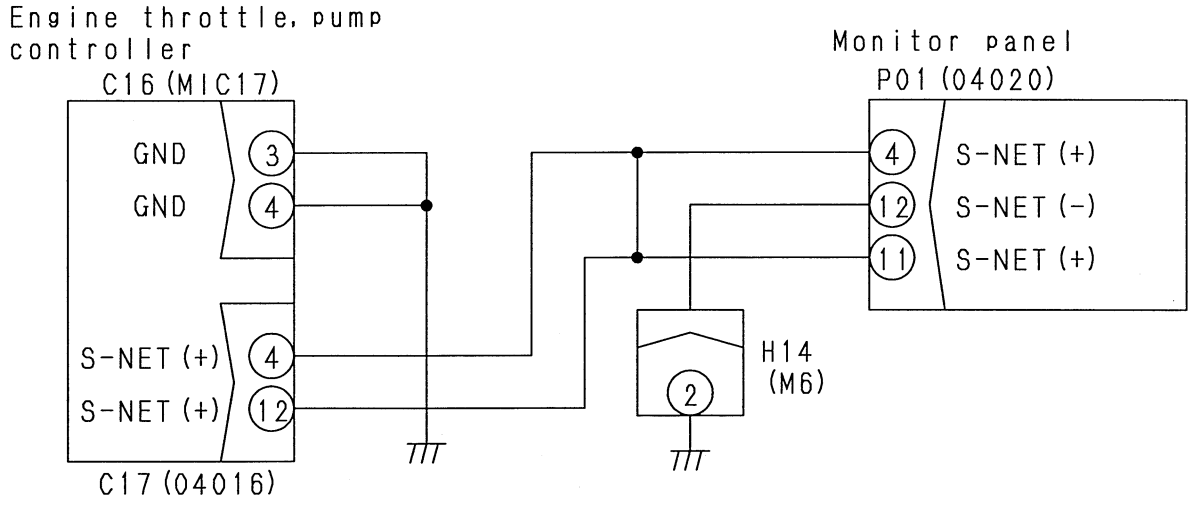
Monitor code \ Display	
08	Network when connected



- Light up when connected
  (1) Engine throttle, pump controller
  (2) Engine throttle, pump controller

- Note: Checks can be carried out with code 08 only when there is a disconnection in the network. The display does not change when there is a short circuit.
  Therefore, checks when there is a short circuit should be carried out basically using Table 1.

N-1 Related electrical circuit diagram



TROUBLESHOOTING OF ENGINE THROTTLE, PUMP CONTROLLER [GOVERNOR CONTROL SYSTEM] (E MODE)

POINTS TO REMEMBER WHEN CARRYING OUT TROUBLESHOOTING OF ENGINE THROTTLE, PUMP CONTROLLER (GOVERNOR CONTROL SYSTEM)

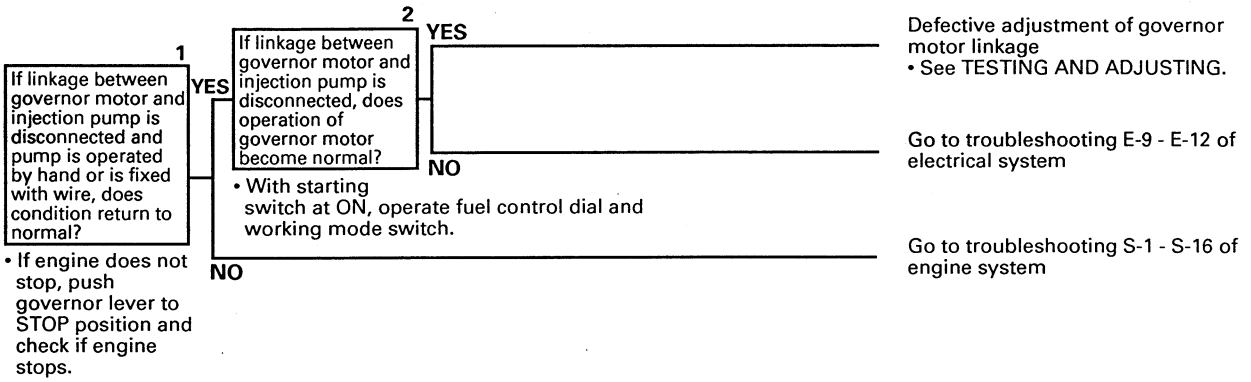
1. Points to remember when there is abnormality which is not displayed by user code

The engine is controlled by an engine throttle, pump controller.

The problems that may occur with this system include the following.

1. Idling speed is too high (too low)
2. High idling speed is too low
3. Auto-deceleration speed is too high (too low)
4. Engine speed for automatic warming-up operation is too high (too low)
5. There is hunting
6. Engine does not stop

If any abnormality occurs, and the abnormality is displayed on the time display portion of the monitor panel, use the troubleshooting table to determine the appropriate troubleshooting flow chart from E1 to E10. However, if there is any abnormality in the machine and no abnormality display is given, it is necessary to determine whether the problem is in the mechanical system or in the electrical system. If the linkage between the governor motor and the injection pump is not properly adjusted, problems 1 to 6 listed above may occur. Therefore, if there is no abnormality display, but one of problems 1 to 6 above has occurred, carry out troubleshooting as follows.



Disconnect the linkage as explained above, or check the adjustment and go to the troubleshooting flow chart for the mechanical system or electrical system. For details of the procedure for adjusting the linkage, see TESTING AND ADJUSTING.

2. Points to remember if abnormality returns to normal by itself

In the following cases, there is a high probability that the same problem will occur again, so it is desirable to follow up this problem carefully.

1) If any abnormality returns to normal by itself, or
2) If the connector is disconnected and the T-adapter is inserted, or if the T-adapter is removed and the connector is returned to its original position when carrying out troubleshooting of the failure, and the service code is no longer displayed, or if the monitor display returns to normal.
3) After completing troubleshooting, always erase the service code from memory.

3. User code memory retention function

When displaying the abnormality code in memory and carrying out troubleshooting, note down the content of the display, then erase the display. After trying to re-enact the problem, carry out troubleshooting according to the failure code that is displayed.

(There are cases where mistaken operation or abnormalities that occur when the connector is disconnected are recorded by the memory retention function. Erasing the data in this way saves any wasted work.)

ACTION TAKEN BY CONTROLLER WHEN ABNORMALITY OCCURS AND PROBLEMS ON MACHINE

User code	Service code	Abnormal system	Nature of abnormality
E05	E308	E308 Abnormality in fuel control dial input value	1. Short circuit in wiring harness between C03 (7) – (14), (7) – (17), (14) – (17) 2. Short circuit in wiring harness between E04 (1) – (2), (1) – (3), (2) – (3) 3. Short circuit in wiring harness between E06 (1) – (2), (1) – (3), (2) – (3) 4. Short circuit in wiring harness between C03 (7) – (4), (4) – (17) 5. Disconnection in wiring harness between C03 (7) – X07 (6) – E06 (1) 6. Disconnection in wiring harness between C03 (4) – X07 (5) – E06 (2) 7. Disconnection in wiring harness between C03 (17) – X07 (4) – E06 (3) 8. Defective fuel control dial 9. Defective contact of C03, X07, E06 connectors
	E317	Abnormality (disconnection) in motor drive system	1. Disconnection inside governor motor 2. Disconnection in wiring harness between C02 (2) – E05 (1) 3. Disconnection in wiring harness between C02 (4) – E05 (3) 4. Disconnection in wiring harness between C02 (3) – E05 (2) 5. Disconnection in wiring harness between C02 (5) – E05 (4) 6. Defective contact of E05 connector
	E318	Abnormality (short circuit) in motor drive system	1. Short circuit inside governor motor 2. Wiring harnesses between C02 (2) – E05 (1), and between C02 (4) – E05 (3) short circuiting with wiring harness between C02 (3) – E05 (2) 3. Wiring harnesses between C02 (4) – E05 (3), and between C02 (2) – E05 (1) short circuiting with wiring harness between C02 (5) – E05 (4) 4. Wiring harness in Items 2 and 3 short circuiting with ground

<table>
<tr><th>Condition when norma (voltage, current, resistance)</th><th>Action by controller when abnormality is detected</th><th>Problem that appears on machine when there is abnormality</th></tr>
<tr><td>
<table>
<tr><th>E03 (male)</th><th>E06 (female)</th><th>Resistance value</th></tr>
<tr><td>(7) – (4)</td><td>(1) – (2)</td><td>0.25 – 7kΩ</td></tr>
<tr><td>(4) – (17)</td><td>(2) – (3)</td><td>0.25 – 7kΩ</td></tr>
<tr><td>(7) – (17)</td><td>—</td><td>2 – 3 kΩ</td></tr>
<tr><td>—</td><td>(1) – (3)</td><td>2 – 3 kΩ</td></tr>
<tr><td>Between each pin and chassis</td><td>—</td><td>Min.1 MΩ</td></tr>
</table>
</td><td>Maintains engine speed at position of fuel control dial immediately before abnormality occurred</td><td>1. Does not become partial speed when set at MAX position
2. Does not reach high idling when set at partial speed
3. There are cases of hunting
4. Lacks output (max. speed of engine is too low)</td></tr>
<tr><td>
<table>
<tr><th>E05 (male)</th><th>E01 (female)</th><th>Resistance value</th></tr>
<tr><td>(1) – (2)</td><td>(2) – (3)</td><td>2.5 – 7kΩ</td></tr>
<tr><td>(3) – (4)</td><td>(4) – (5)</td><td>2.5 – 7kΩ</td></tr>
<tr><td>(1) – (3)</td><td>(2) – (4)</td><td>Min.1 MΩ</td></tr>
<tr><td>(1) – (4)</td><td>(2) – (5)</td><td>Min.1 MΩ</td></tr>
<tr><td>Between pins (1), (2), (3), (4) and chassis</td><td>Between pins (2), (3), (4) and (5) and chassis</td><td>Min.1 MΩ</td></tr>
</table>
Motor drive current : Hold : 0.7 A
Start : 0.84 A
</td><td>Takes no particular action</td><td>1. When there is a disconnection in both the A phase and B phase at the same time, the problem is the same as for a short circuit in the governor motor system
2. When there is a disconnection in only one of A phase or B phase
1) Engine does not stop
2) Stops moving at position immediately before failure, so engine speed cannot be controlled
3) There are cases of hunting</td></tr>
<tr><td>
<table>
<tr><th>E05 (male)</th><th>E01 (female)</th><th>Resistance value</th></tr>
<tr><td>(1) – (2)</td><td>(2) – (3)</td><td>2.5 – 7kΩ</td></tr>
<tr><td>(3) – (4)</td><td>(4) – (5)</td><td>2.5 – 7kΩ</td></tr>
<tr><td>(1) – (3)</td><td>(2) – (4)</td><td>Min.1 MΩ</td></tr>
<tr><td>(1) – (4)</td><td>(2) – (5)</td><td>Min.1 MΩ</td></tr>
<tr><td>Between pins (1), (2), (3), (4) and chassis</td><td>Between pins (2), (3), (4) and (5) and chassis</td><td>Min.1 MΩ</td></tr>
</table>
Motor drive current : Hold : 0.7 A
Start : 0.84 A
</td><td>Sets motor drive current to 0</td><td>1. If during operation
1) Sets to low idling
2) Engine does not stop
3) There are cases of hunting
2. When stopped
1) Engine starts, but stays at low idling
2) Engine does not stop after starting
3) There are cases of hunting</td></tr>
</table>

User code	Service code	Abnormal system	Nature of abnormality
—	E306	Abnormality in feedback potentiometer system	1. Short circuit in wiring harness between C03 (7) – (14), (7) – (17), (14) – (17) 2. Short circuit in wiring harness between E04 (1) – (2), (1) – (3), (2) – (3) 3. Short circuit in wiring harness between E06 (1) – (2), (1) – (3), (2) – (3) 4. Short circuit in wiring harness between C03 (7) – (4), (4) – (17) 5. Disconnection in wiring harness between C03 (7) – E04 (1) 6. Disconnection in wiring harness between C03 (14) – E04 (2) 7. Disconnection in wiring harness between C03 (17) – E04 (3) 8. Defective governor motor potentiometer 9. Defective contact of C03, E04 connectors
—	E315	Abnormality (short circuit) in battery relay output system	If excess current flows between C03 (1) and battery relay ★ This occurs only when turning starting switch to OFF in order to stop engine.
—	E316	Abnormality (step-out) in motor	1. Defective adjustment of rod or twisting of loose spring
			2. Abnormality in governor motor
			3. Abnormality in engine throttle, pump controller

<table>
<tr><th>Condition when norma (voltage, current, resistance)</th><th>Action by controller when abnormality is detected</th><th>Problem that appears on machine when there is abnormality</th></tr>
<tr><td>
<table>
<tr><th>E05 (male)</th><th>E01 (female)</th><th>Resistance value</th></tr>
<tr><td>(7) – (4)</td><td>(1) – (2)</td><td>0.25 – 7kΩ</td></tr>
<tr><td>(7) – (17)</td><td>(2) – (3)</td><td>0.25 – 7kΩ</td></tr>
<tr><td>(14) – (17)</td><td>—</td><td>2 – 3 kΩ</td></tr>
<tr><td>—</td><td>(1) – (3)</td><td>4 – 6 kΩ</td></tr>
<tr><td>Between each pin and chassis</td><td>—</td><td>Min.1 MΩ</td></tr>
</table>
</td><td>Calculates position of motor and carries out control from value of voltage immediately before abnormality occurred</td><td>1. Precision of engine speed control may be reduced.
For example:
1) Engine does not change to high idling speed (a little too low)
2) Engine does not change to low idling speed (a little too high)
3) Defective engine speed for auto-deceleration or automatic warming-up
4) Engine may not stop
★ The governor motor moves in the direction to stop the engine, but motor may not move completely to the position to stop the engine.
5) There are cases of hunting</td></tr>
<tr><td>Between C03 (1) and chassis: 20 – 30 V
★ Hold with the motor in the stop position for 2 – 2.5 sec, return to the low idling position, then turn the battery relay OFF.</td><td>Sets battery relay drive current to 0</td><td>Engine does not stop</td></tr>
<tr><td>1. Linkage adjustment correct
2. Must move lightly when connector is removed
3. Normal</td><td>1. Displays when returning from high idling to low idling
★ Start again (repeat step-out)
2. In some cases it may not display when returning from partial speed to low idling</td><td>Engine speed cannot be controlled (particularly at high idling), so there is hunting</td></tr>
</table>

JUDGEMENT TABLE FOR ENGINE THROTTLE, PUMP CONTROLLER (GOVERNOR CONTROL SYSTEM), AND ENGINE RELATED PARTS

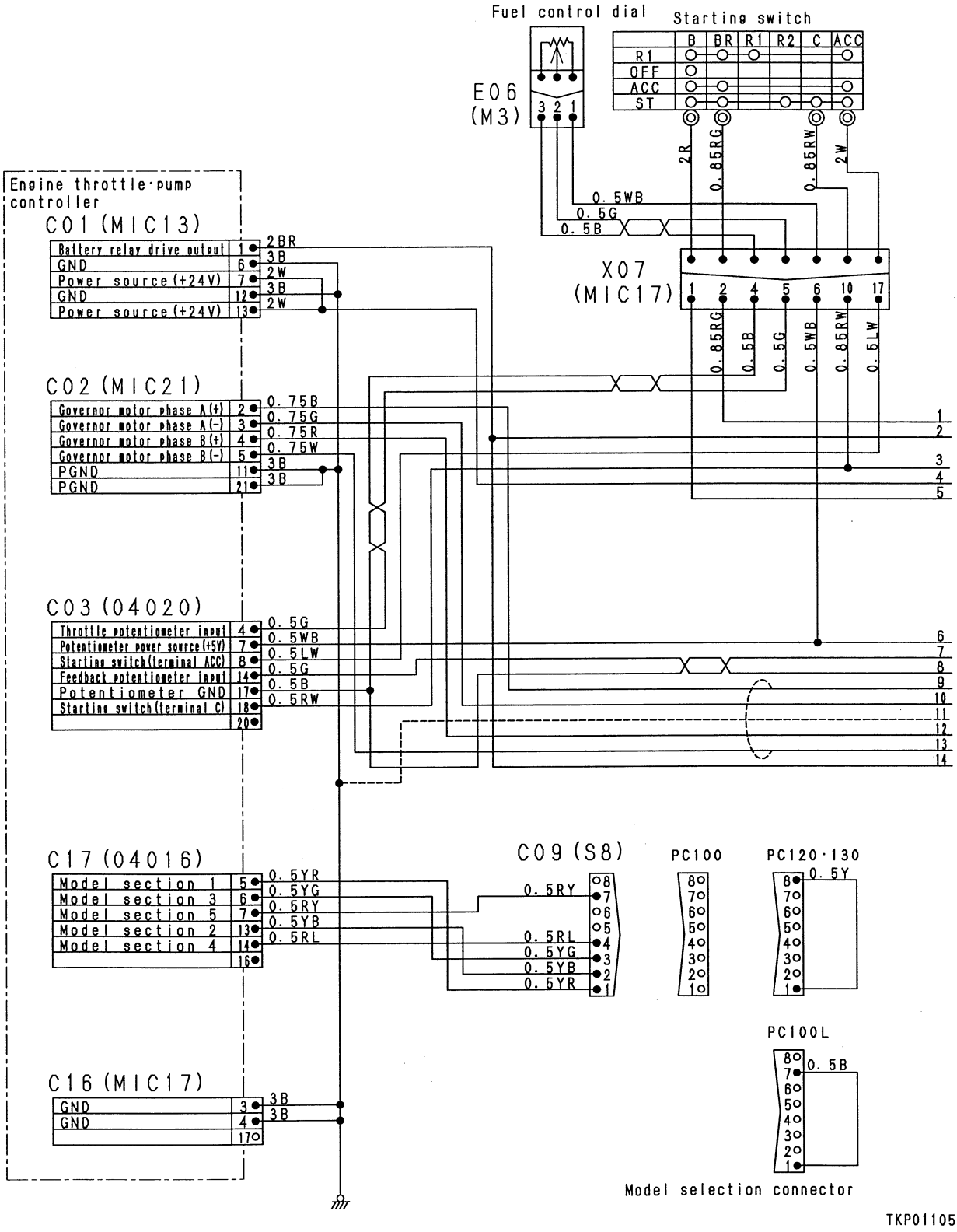
Failure mode			Abnormality in engine throttle, pump controller power source system	Engine throttle, pump controller, engine related parts (E3:system) Self-diagnostic display: Abnormality in fuel control dial input value	Abnormality (disconnection) in motor drive system	Abnormality (short circuit) in motor drive system	Abnormality in feedback potentiometer system	Abnormality (short circuit) in battery relay output	Abnormality (step-out) in motor
		User code		E05					
		Service code		308	317	318	306	315	316
1	Engine does not start easily								
2	Engine does not start								
3	Engine speed stays at low idling, and does not follow accelerator; or engine pickup is poor		●	●	●	●	●		
4	Engine stops during operation								
5	Engine rotation is irregular	When idling speed is irregular							
		When there is hunting		●	●	●	●		●
6	Lack of output (engine high idling speed is too low)			●			●		
7	Auto-deceleration does not work								
8	Engine does not stop		●		●	●	●	●	
9	Warming-up operation is defective								
10	Exhaust gas is black								
11	Oil consumption is excessive, or exhaust gas is blue								
12	Oil becomes dirty prematurely								
13	Fuel consumption is excessive, or exhaust gas is blue								
14	Oil is mixed in coolant								
15	Oil pressure lamp lights up								
16	Oil level rises								
17	Coolant temperature rises too high								
18	Abnormal noise is generated								
19	There is excessive vibration								
20	Engine speed does not change even when working mode is switched								
21	Troubleshooting code when service code is displayed		E-1	E-2	E-3	E-4	E-5	E-6	E-7
22	Troubleshooting code when there is abnormality in monitoring or machine monitor check		—	—	—	—	—	—	—

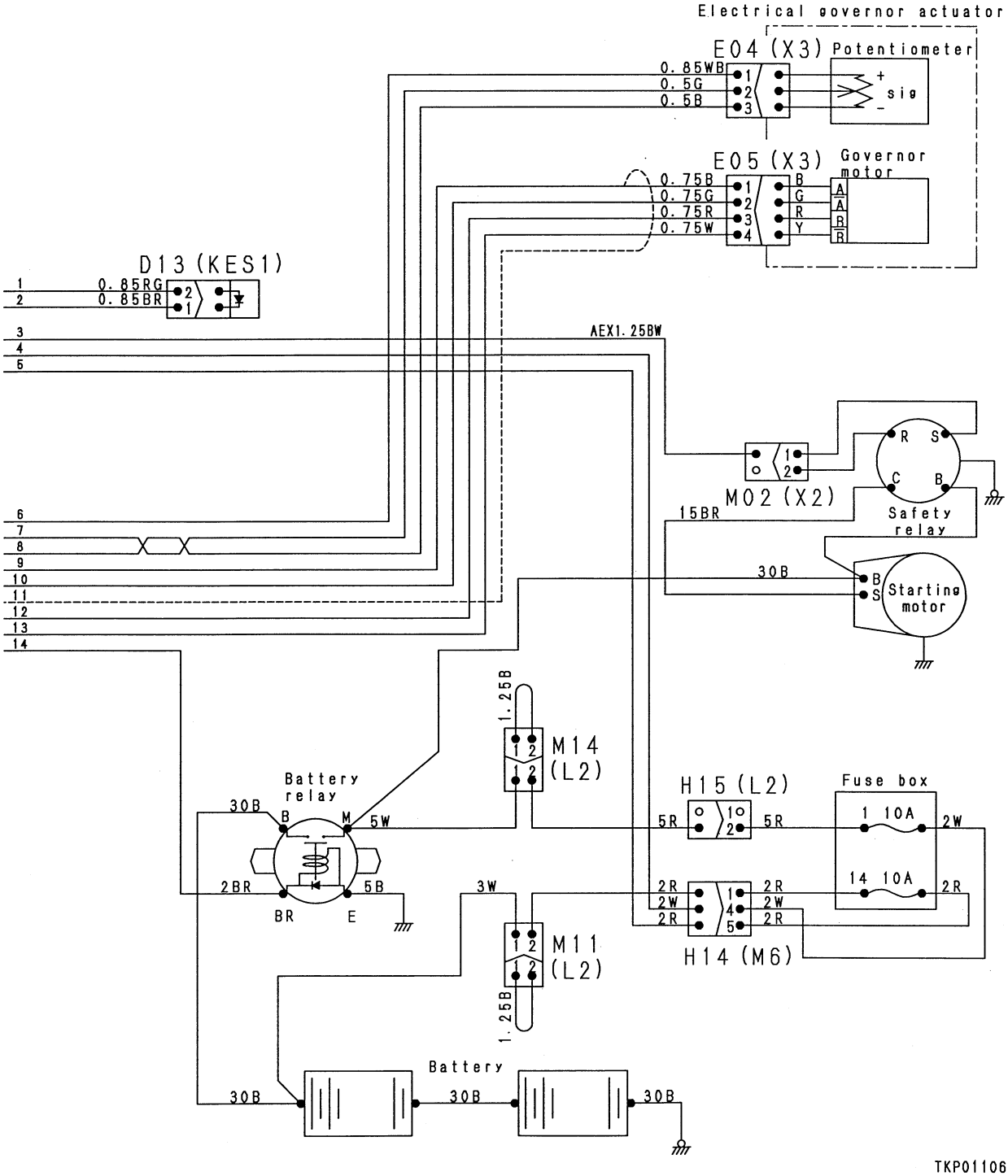
○ : This shows applicable item for service code
※ : This shows item that needs only checking with monitoring

hecking monitoring, check items							Machine monitor check item			
							Is red range displayed?			
Battery relay drive signal	No. 2 throttle command value	Fuel control dial command value	Governor motor potentiometer	Governor motor A phase current	Governor motor B phase current	Coolant temperature voltage	102°C or above	105°C or above	Does starting motor turn?	Troubleshooting code if no service code display is given
Monitoring code										
35	16	30	31	33	34	41		108		
										S-1
									○	S-2
		※	※	※	※			○		S-3
										S-4
										E-9a) , S-5
			※							E-9a) , S-5
	※	※				○				E-10 , S-6
										E-3 • E-3
○				※	※					E-11
						○		○		E-3 • E-4
										S-7
										S-8
										S-9
										S-10
										S-11
										S-12
										S-13
						○	○			S-14
										S-15
										S-16
	※									E-3 • E-4
—	—	—	—	—	—	—	—	—	—	—
E-12	—	—	—	—	—	M-14	M-13	M-13	E-8	—

○ : This shows item to check with monitoring or machine monitor

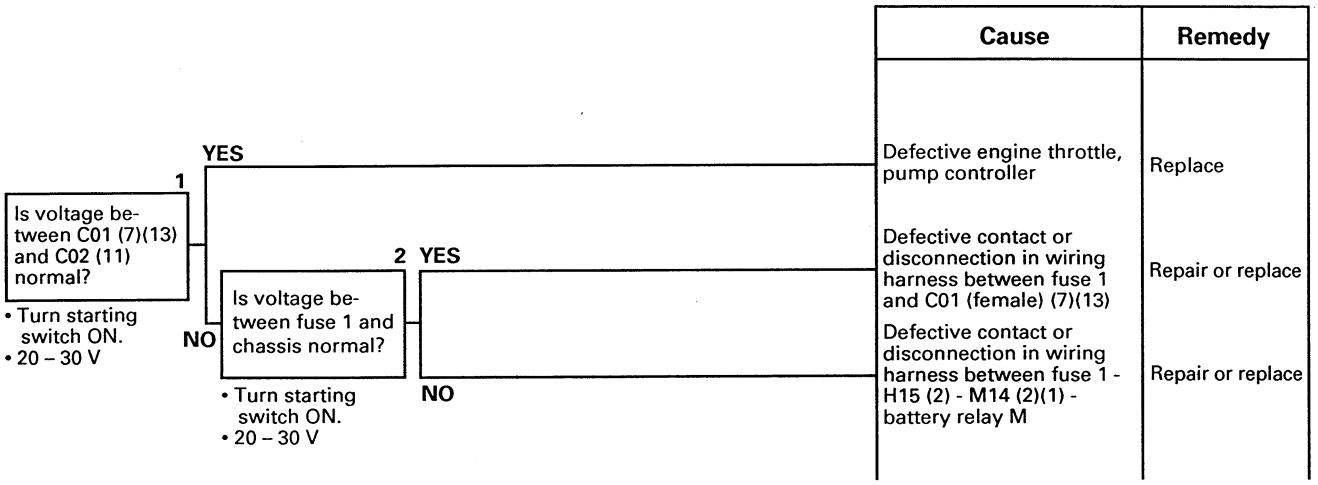
ELECTRICAL CIRCUIT DIAGRAM OF ENGINE THROTTLE, PUMP CONTROLLER SYSTEM



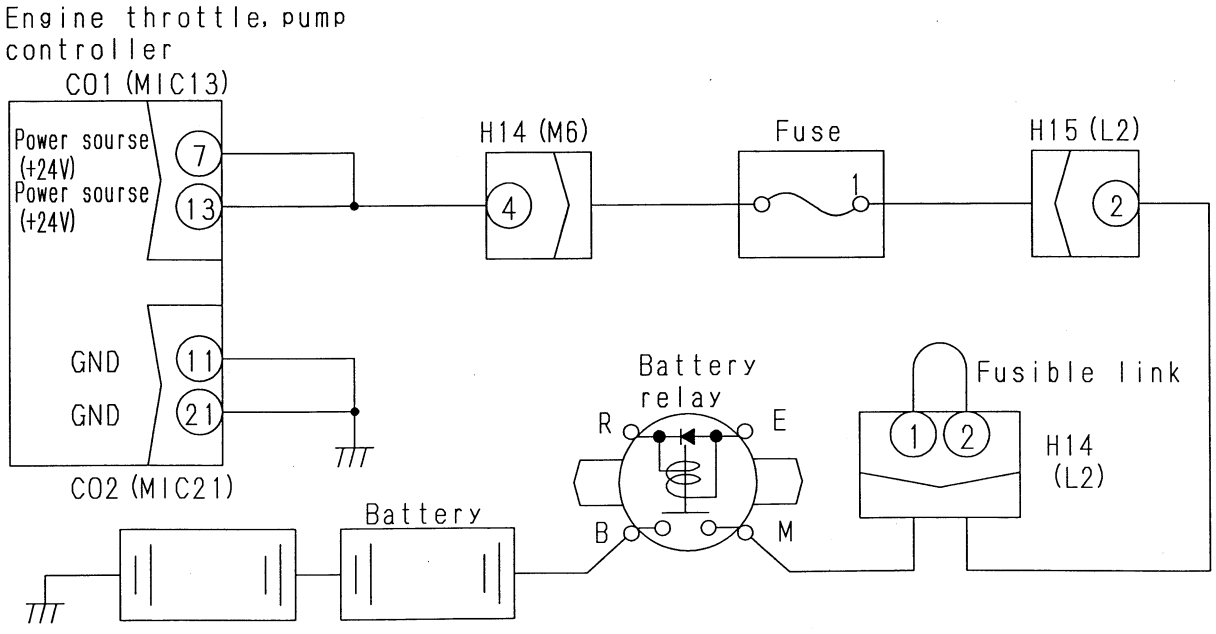

Electrical governor actuator
E04 (X3) Potentiometer
0.85WB
0.5G
0.5B
+
sig
-
E05 (X3) Governor motor
0.75B
0.75G
0.75R
0.75W
B
G
R
Y
A
A
B
B
D13 (KES1)
0.85RG
0.85BR
AEX1.25BW
M02 (X2)
R
S
C
B
Safety relay
15BR
30B
Starting motor
1.25B
M14 (L2)
Battery relay
30B
B
M
5W
2BR
5B
BR
E
H15 (L2)
5R
Fuse box
1 10A
2W
14 10A
2R
3W
2R
2W
H14 (M6)
M11 (L2)
Battery
TKP01106

E-1 Abnormality in engine throttle, pump controller power source (controller LED is OFF)

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ Check that fuse 1 is normal.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.
★ When the starting motor rotates correctly. (If the starting motor also does not rotate, go to E-8.)



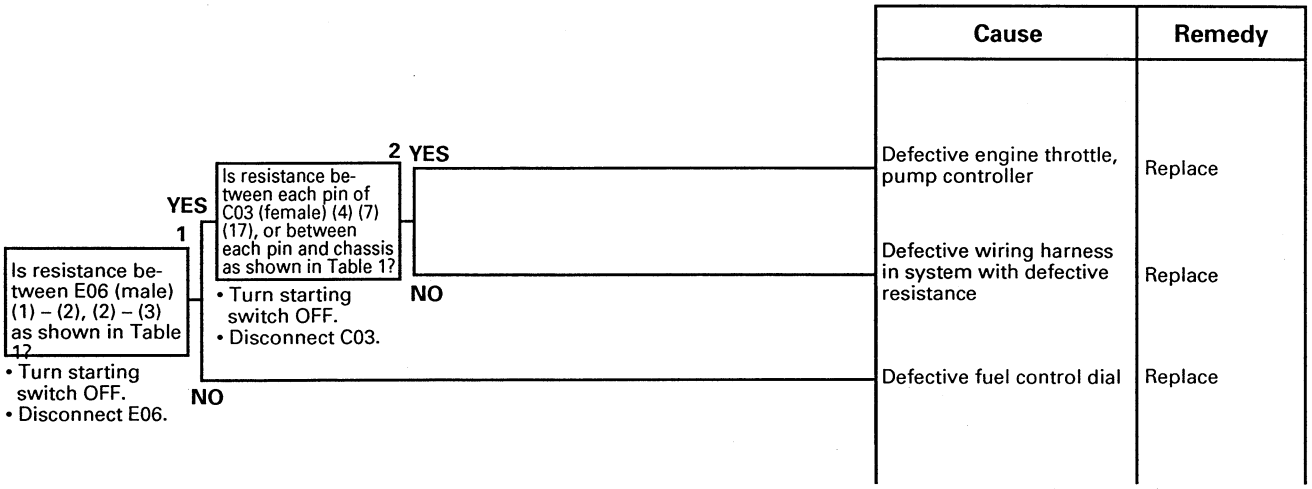
E-1 Related electrical circuit diagram



TKP01107

E-2 [E308] Abnormality in fuel control dial input value is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

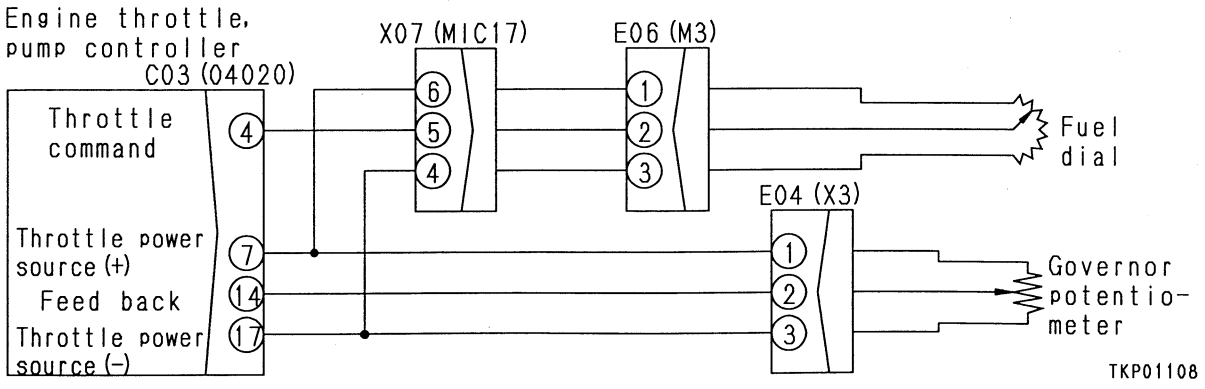


Note: If E306 also occurs at the same time, check the wiring harness below.
• Wiring harness between C03 (female) (7) – E04 (female) (1) short circuiting with ground, or contact with other wiring harness

Table 1

C03 (female)	E06 (male)	Resistance value
(7) – (4)	(1) – (2)	0.25 – 7 kΩ
(4) – (17)	(2) – (3)	0.25 – 7 kΩ
(7) – (17)	—	2 – 3 kΩ
—	(1) – (3)	4 – 6 kΩ
Between each pin and chassis	—	Min. 1 MΩ

E-2 Related electrical circuit diagram



E-3 [E317] Abnormality (disconnection) in governor motor drive system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ During operation,
1) if there is a simultaneous disconnection in A phase and B phase :
1) the engine will run at low idling 2) the engine will not stop
2) if there is a disconnection in either A phase or B phase : the engine speed will remain the same as before the abnormality occurred
★ If the problem occurs when the engine is stopped, 1) the engine can be started, but it stays in low idling, or 2) it will not stop after it is started.

⚠ Check with the engine stopped (push the fuel control lever of the fuel injection pump to the NO INJECTION position).
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

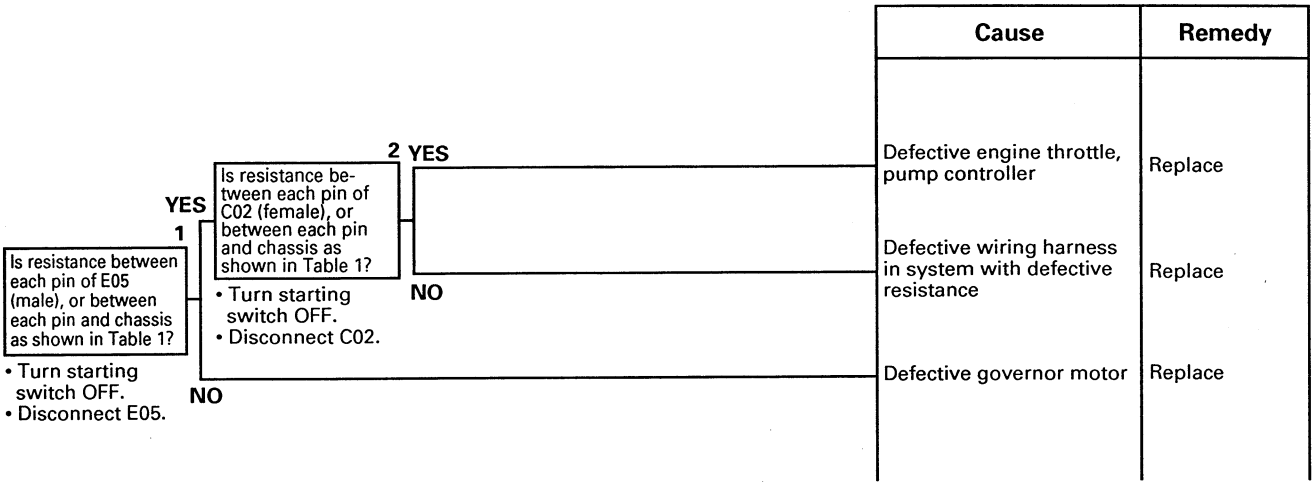
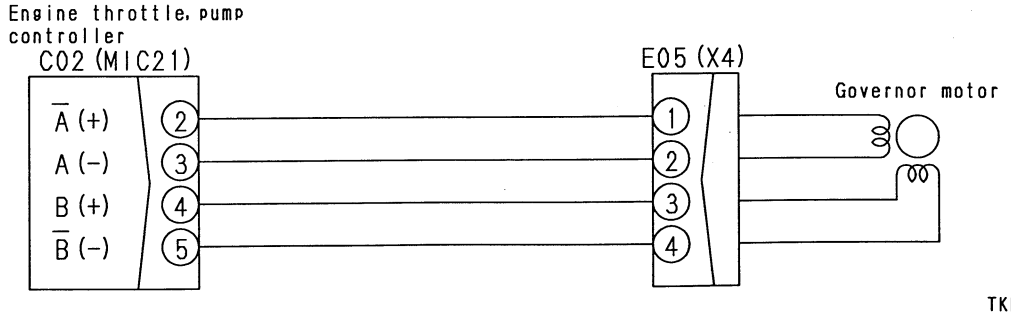


Table 1

E05 (male)	C02 (female)	Resistance value
(1) – (2)	(2) – (3)	2.5 – 7.5 Ω
(3) – (4)	(4) – (5)	2.5 – 7.5 Ω

E-3 Related electrical circuit diagram



E-4 [E318] Abnormality (short circuit) in governor motor drive system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the abnormality occurs during operation, because of the force of the spring,
1) the engine will run at low idling 2) the engine will not stop
★ If the problem occurs when the engine is stopped,
1) the engine can be started, but it stays in low idling, or 2) it will not stop after it is started.

⚠ Stop the engine (push the fuel control lever of the fuel injection pump to the NO INJECTION position) before checking.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

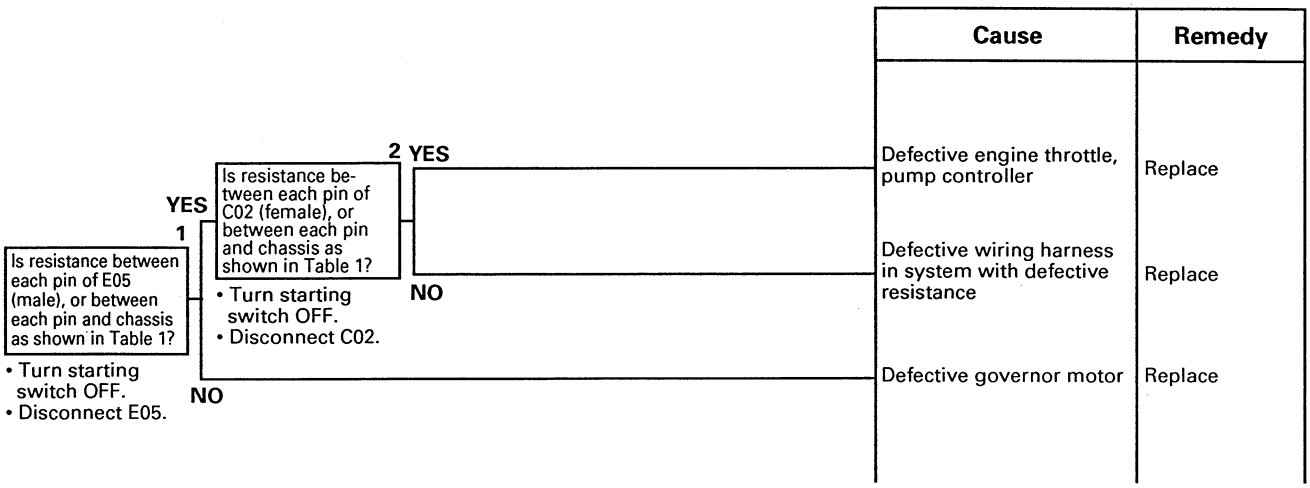
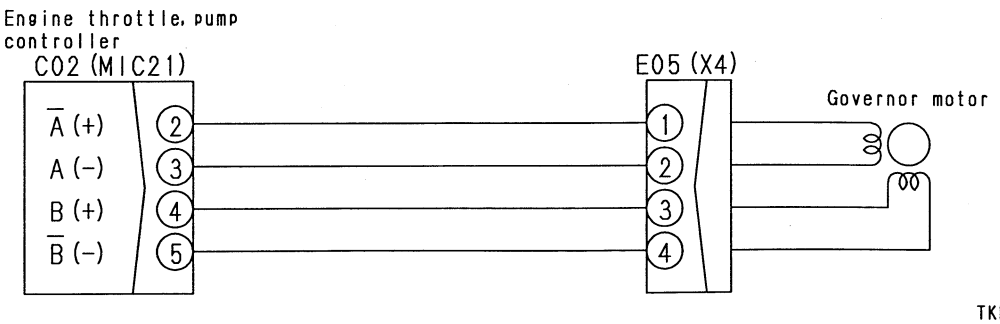


Table 1

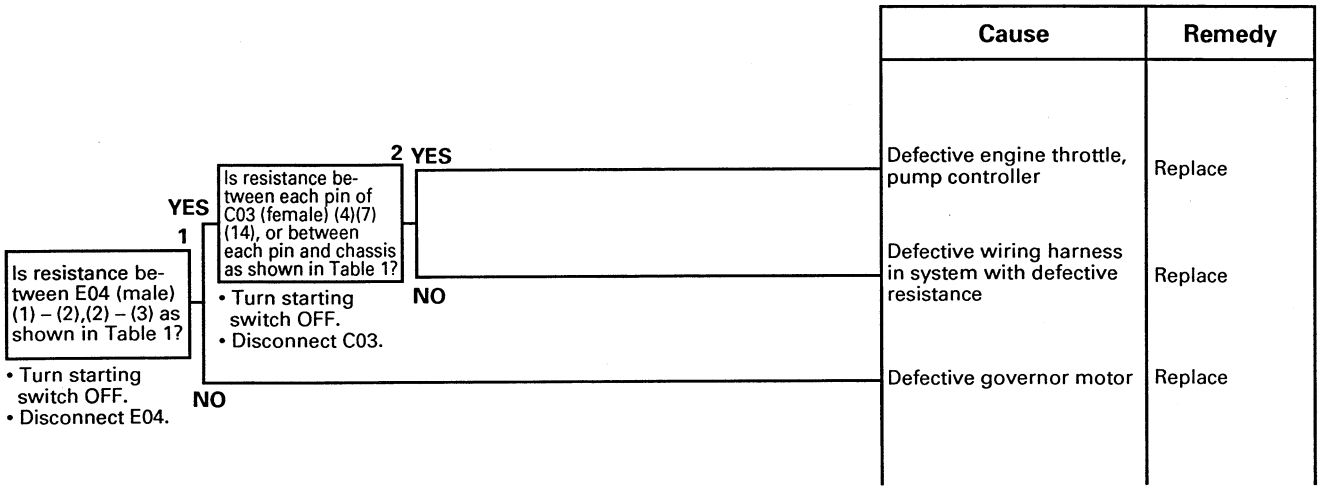
E05 (male)	C02 (female)	Resistance value
(1) – (2)	(2) – (3)	2.5 – 7.5 Ω
(3) – (4)	(4) – (5)	2.5 – 7.5 Ω
(1) – (3)	(2) – (4)	Min. 1 MΩ
(1) – (4)	(2) – (5)	Min. 1 MΩ
Between chassis and pins (1)(2)(3)(4)	Between chassis and pins (2)(3)(4)(5)	Min. 1 MΩ

E-4 Related electrical circuit diagram



E-5 [E306] Abnormality in feedback potentiometer system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

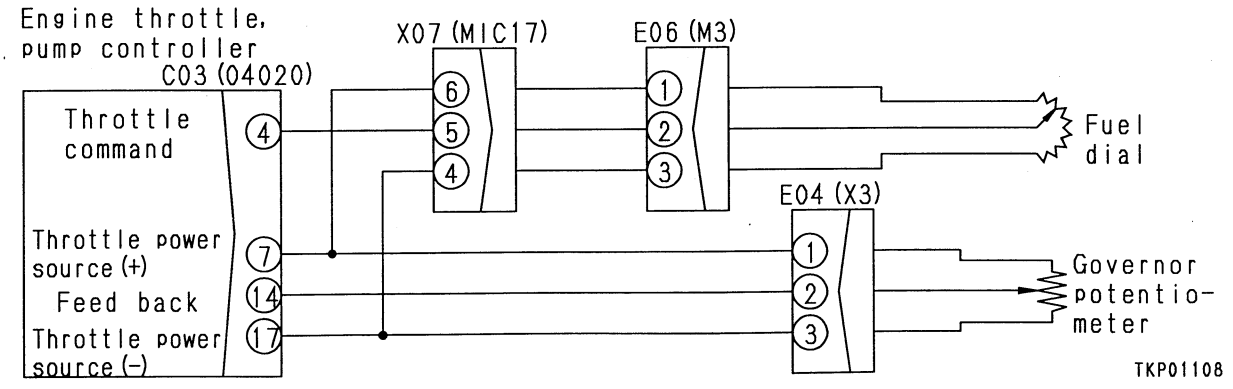


Note: If E308 also occurs at the same time, check the wiring harness below.
• Wiring harness between C03 (female) (7) – X07 (6) – E06 (female) (1) short circuiting with ground, or contact with other wiring harness

Table 1

C03 (female)	E04 (male)	Resistance value
(7) – (14)	(1) – (2)	0.25 – 7 kΩ
(14) – (17)	(2) – (3)	0.25 – 7 kΩ
(7) – (17)	—	2 – 3 kΩ
—	(1) – (3)	4 – 6 kΩ
Between each pin and chassis	—	Min. 1 MΩ

E-5 Related electrical circuit diagram



E-6 [E315] Abnormality (short circuit) in battery relay output system is displayed

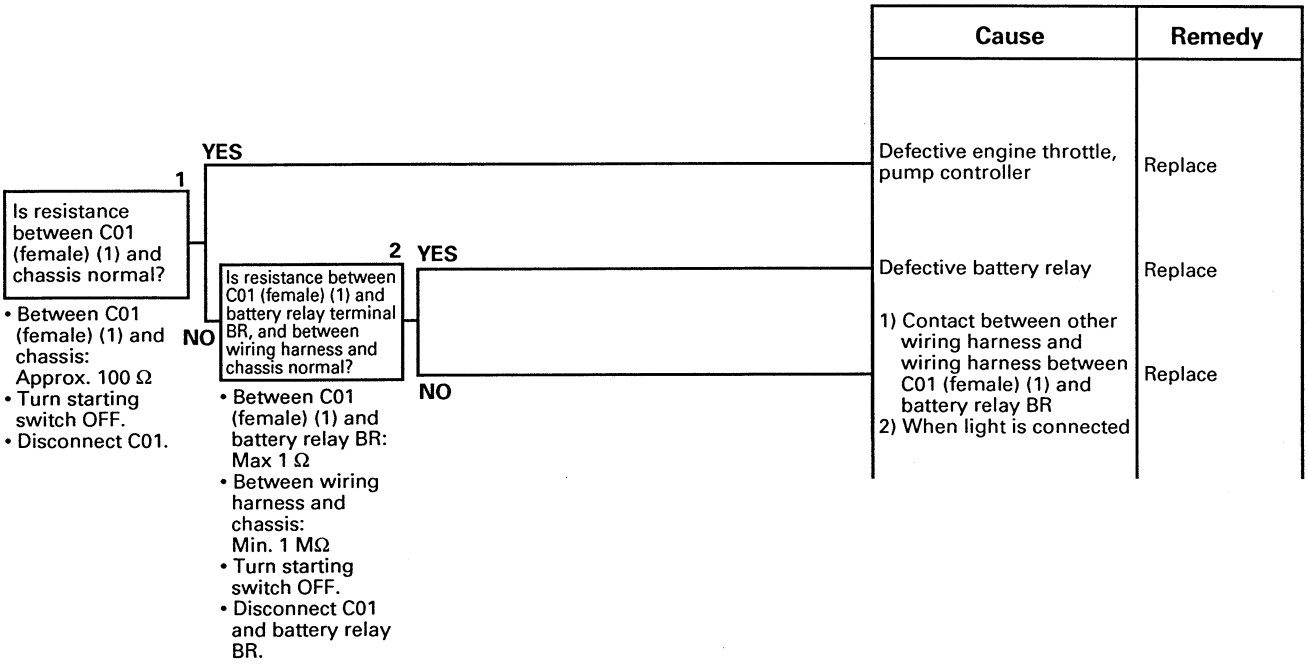
★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**

⚠ Check with the engine stopped (push the fuel control lever of the fuel injection pump to the NO INJECTION position).

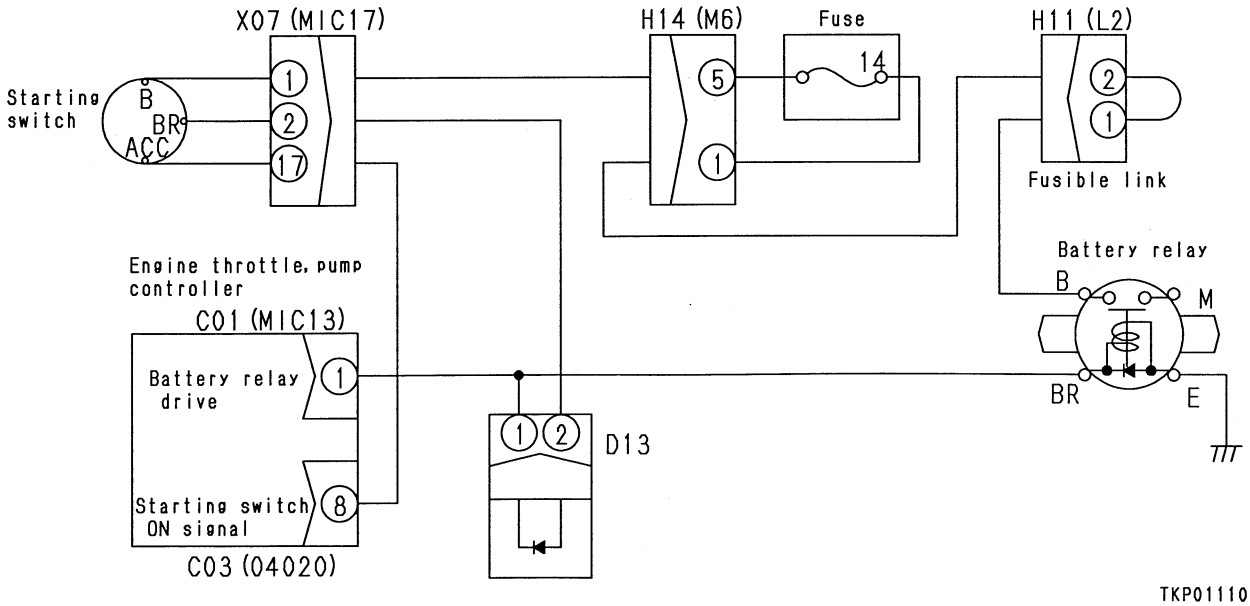
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on the next step.

★ This only occurs when the engine is stopped and the starting switch is turned OFF.

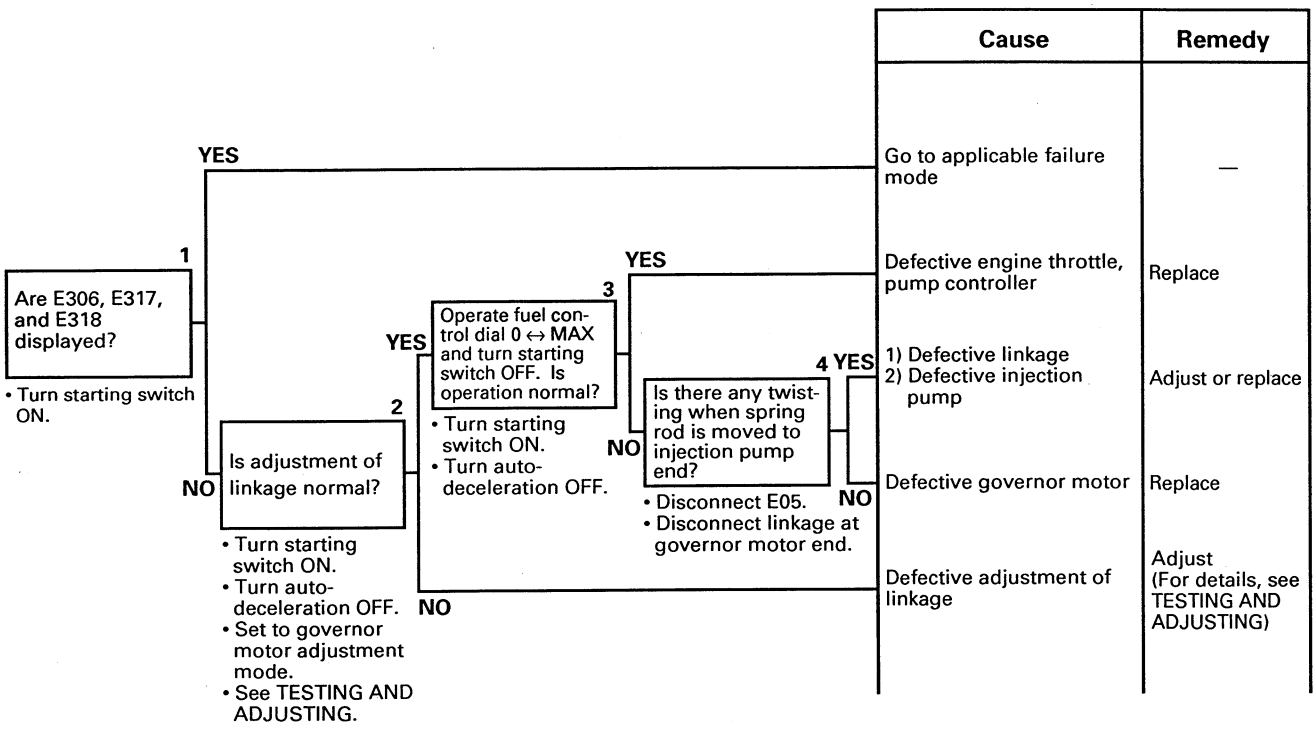


E-6 Related electrical circuit diagram



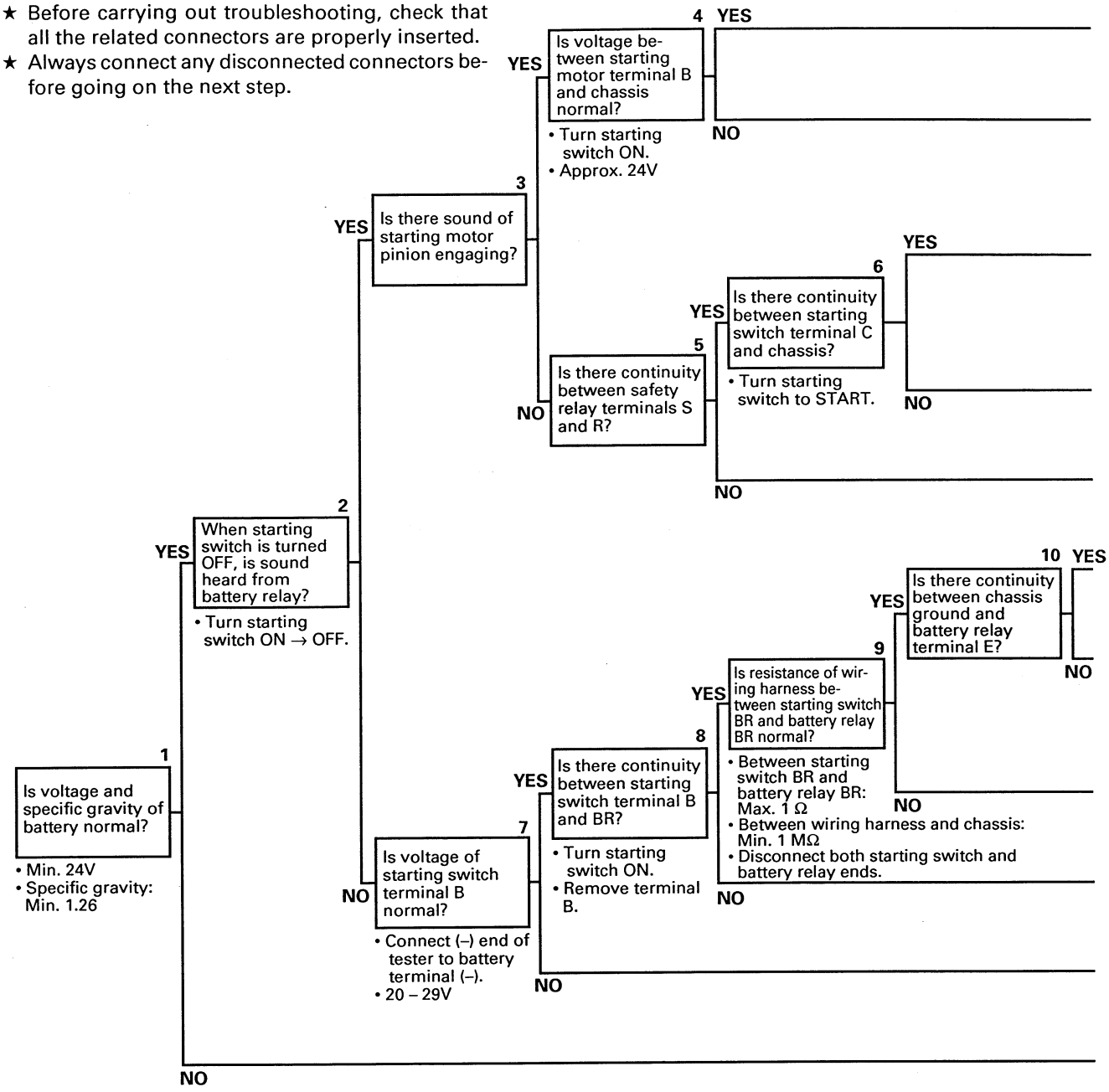
E-7 [E316] Abnormality (step-out) in motor is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If any other service code [E306] – [E318] has occurred at the same time, start troubleshooting from codes except [E316].
★ Check that the fuse is normal.
★ Read the precautions given in TESTING AND ADJUSTING, "Adjusting stroke of governor motor lever" in the shop manual before carrying out the troubleshooting.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

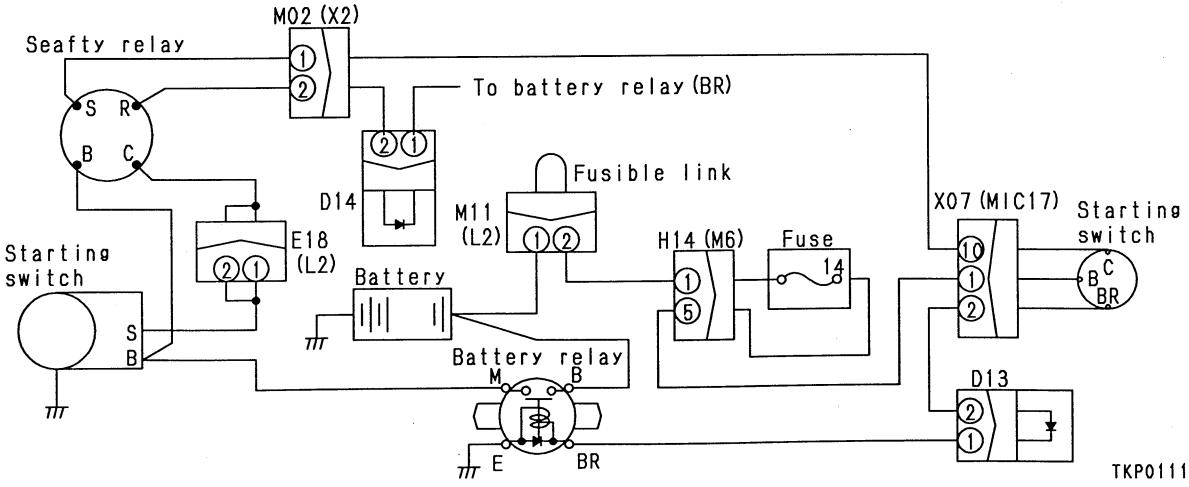


E-8 Engine does not start

★ When starting motor does not rotate.
★ Check that fuse 14 is normal before starting troubleshooting.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



E-8 Related electrical circuit diagram



Cause	Remedy
Defective starting motor	Replace
Defective contact of wiring harness between battery (+) - battery relay B - battery relay M - starting motor terminal B (including battery relay)	Replace
Defective contact or disconnection in wiring harness between starting switch terminal C - X07 (10) - M02 (1) - safety relay - M02 (2) - D14 - battery relay BR, and starting motor terminal B - safety relay - starting motor terminal S	Replace
Defective starting switch (between terminals B and BR)	Replace
Defective safety relay	Replace
Defective battery relay	Replace
Defective contact of wiring harness between battery relay terminal E and revolving frame ground connection terminal	Replace
Defective contact or disconnection in wiring harness between starting switch terminal BR - D13 - battery relay terminal BR	Replace
Defective starting switch (between B and BR)	Replace
Defective contact or disconnection in wiring harness between battery terminal (+) - M11 - H14 (1) - fuse 14 - H14 (5) - X07 (1) - starting switch terminal B (including fusible link)	Replace
Lack of battery capacity	Charge or replace

E-9 Engine speed is irregular

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

a) Idling speed is irregular

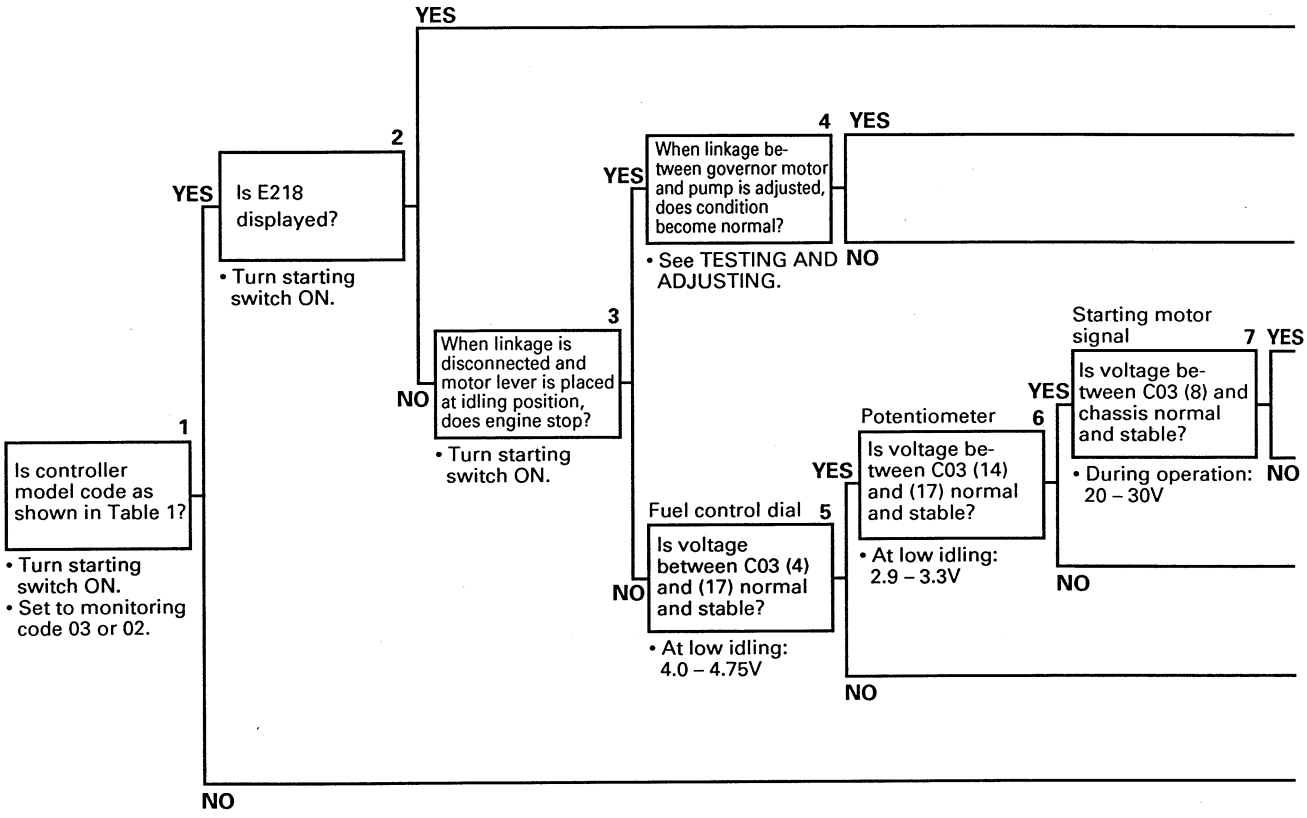


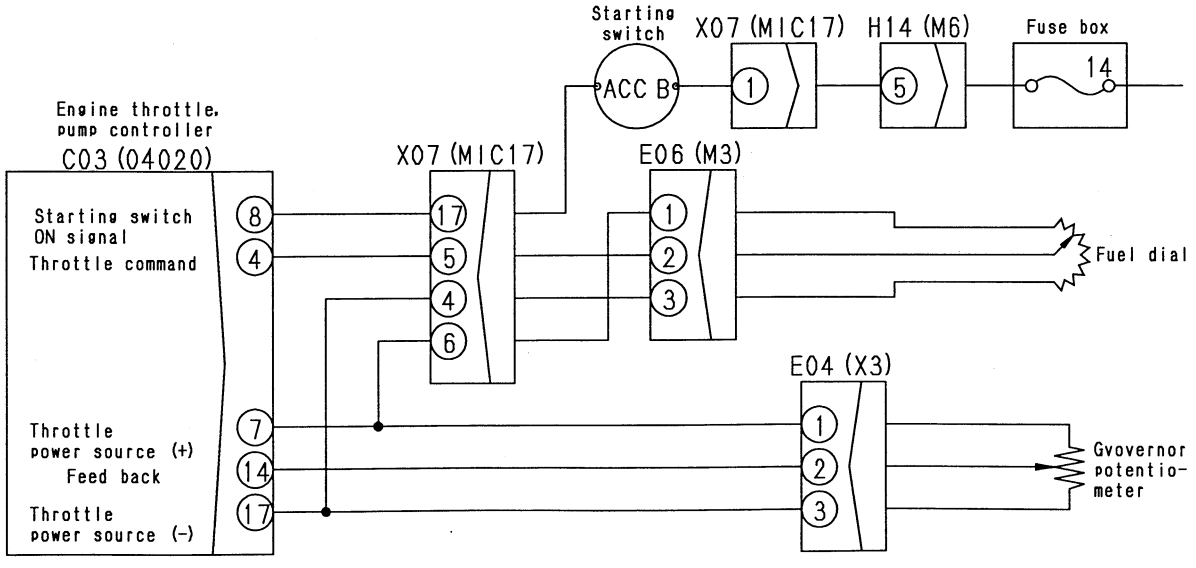
Table 1

Controller model code


★ The above diagram shows monitoring code 03.

Cause	Remedy
See N Mode	—
Defective adjustment of linkage	Adjust
Defective injection pump	See S mode
Defective governor motor	Replace
Defective contact of wiring harness between starting switch ACC - X07 (17) - C03 (female) (8), or defective starting switch	Repair or replace
See E-5	—
See E-2	—
See C-14	—

E-9 Related electrical circuit diagram



TKP01112

b) There is hunting

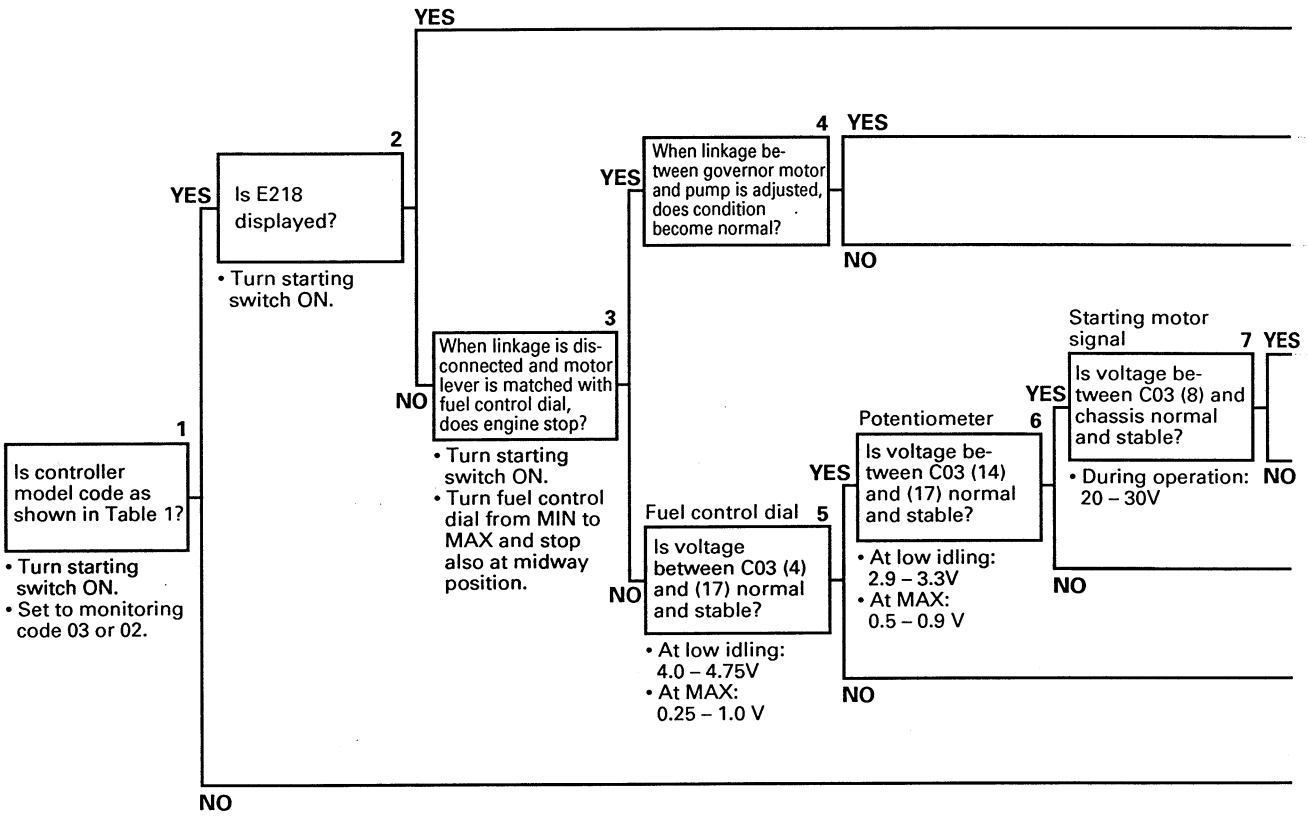


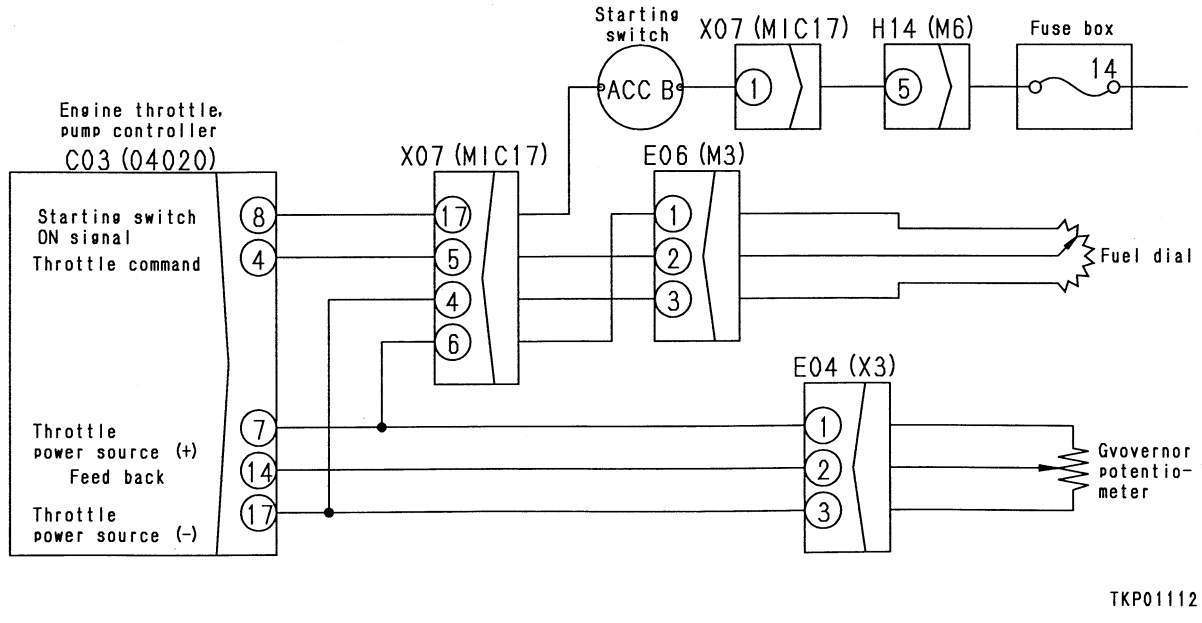
Table 1

Controller model code


★ The above diagram shows monitoring code 03.

Cause	Remedy
See N Mode	—
Defective adjustment of linkage	Adjust
Defective injection pump	See S mode
Defective governor motor	Replace
Defective contact of wiring harness between starting switch ACC - X07 (17) - C03 (female) (8), or defective starting switch	Repair or replace
See E-5	—
See E-2	—
See C-14	—

E-9 Related electrical circuit diagram



E-10 Lack of output (engine high idling speed is too low)

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

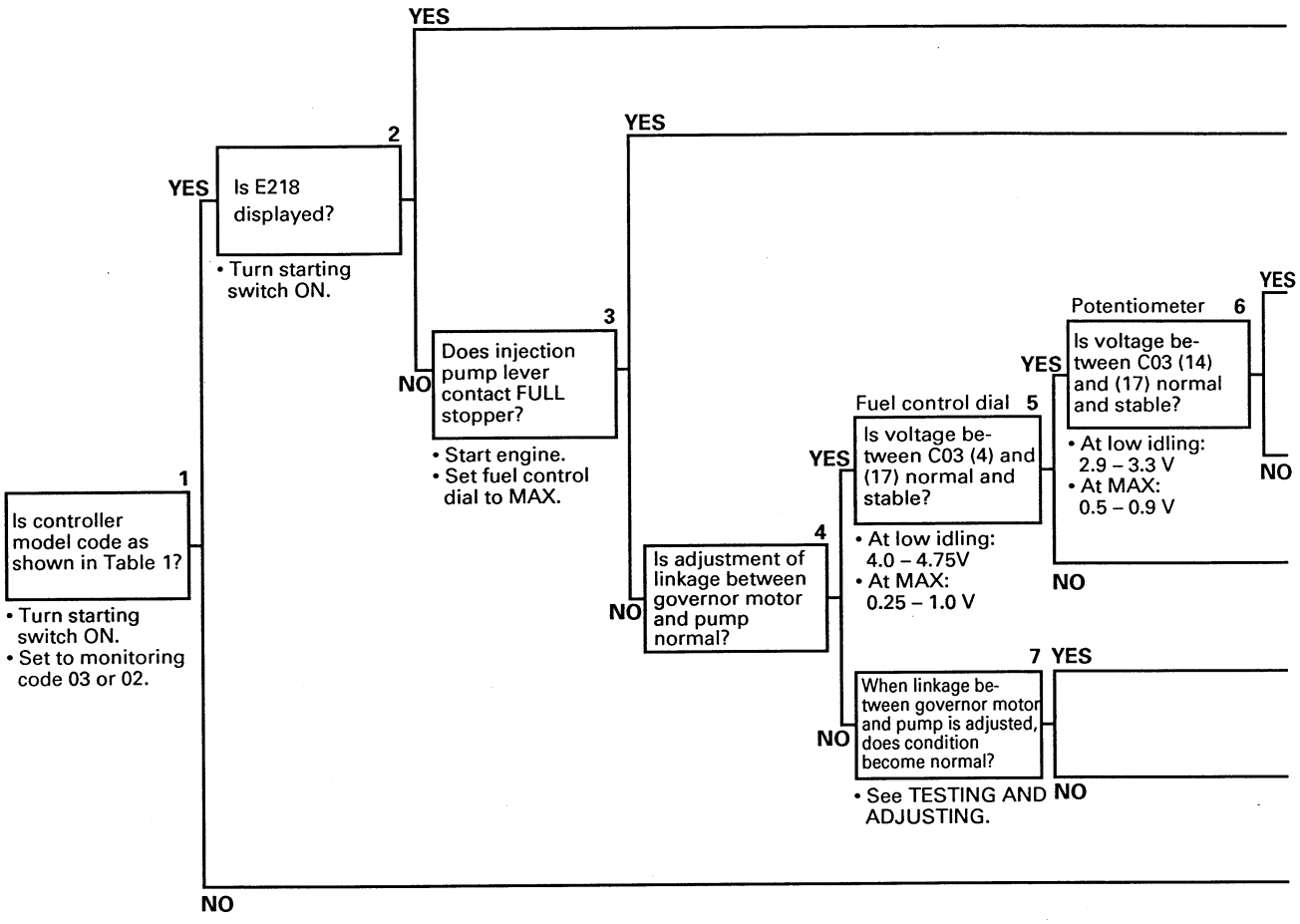
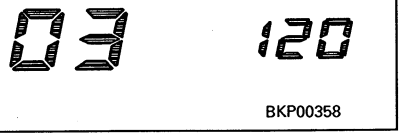


Table 1

Controller model code


★ The above diagram shows monitoring code 03.

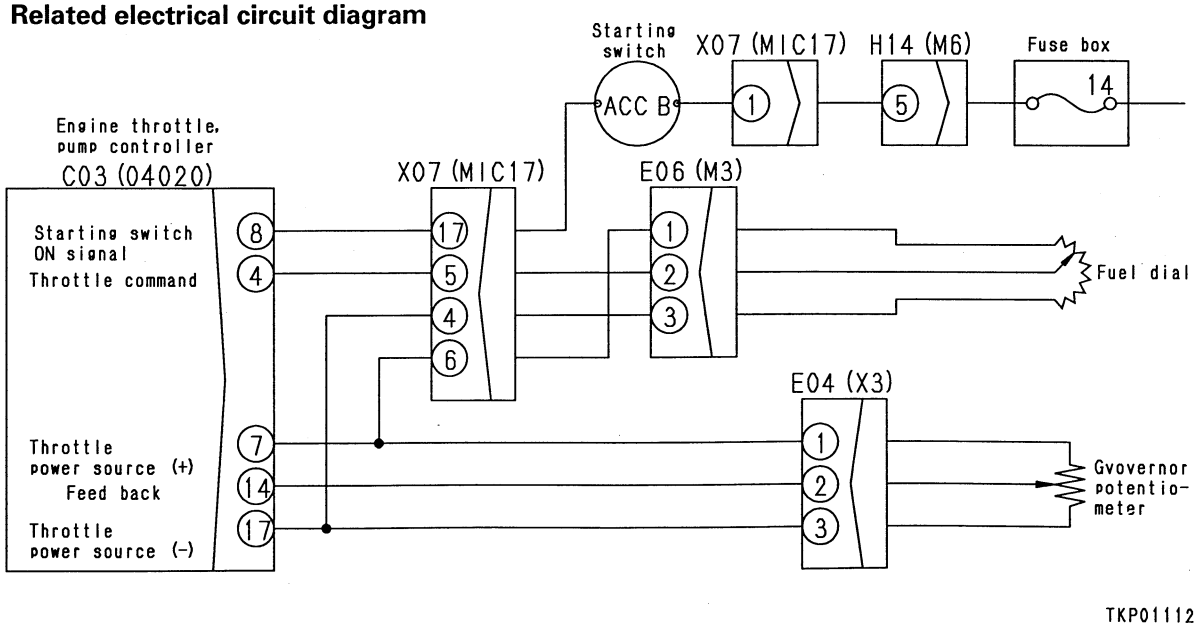
Starting motor signal 8

Is voltage between C03 (8) and chassis normal and stable?

- During operation: 20 – 30 V

	Cause	Remedy
YES	See N Mode	—
	Defective injection pump	See S mode
	Defective governor motor	Replace
NO	Defective contact of wiring harness between starting switch ACC - X07 (17) - C03 (female) (8), or defective starting switch	Repair or replace
	See E-5	—
	See E-2	—
	Defective adjustment of governor motor linkage	Adust
	See S mode	—
	See C-14	—

E-10 Related electrical circuit diagram



E-11 Engine does not stop

⚠ Check with the engine stopped (push the fuel control lever of the fuel injection pump to the NO INJECTION position).

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on the next step.

★ Read the precautions given in TESTING AND ADJUSTING, "Adjusting stroke of governor motor lever" in the shop manual before carrying out the troubleshooting.

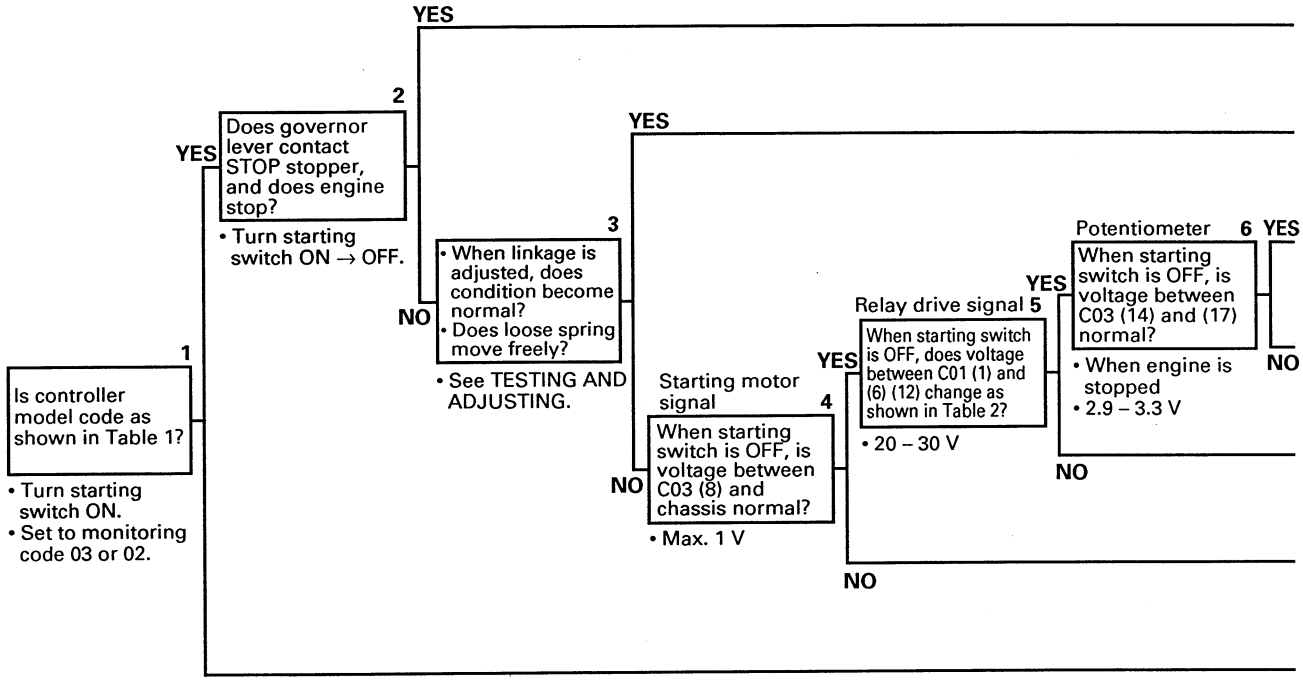
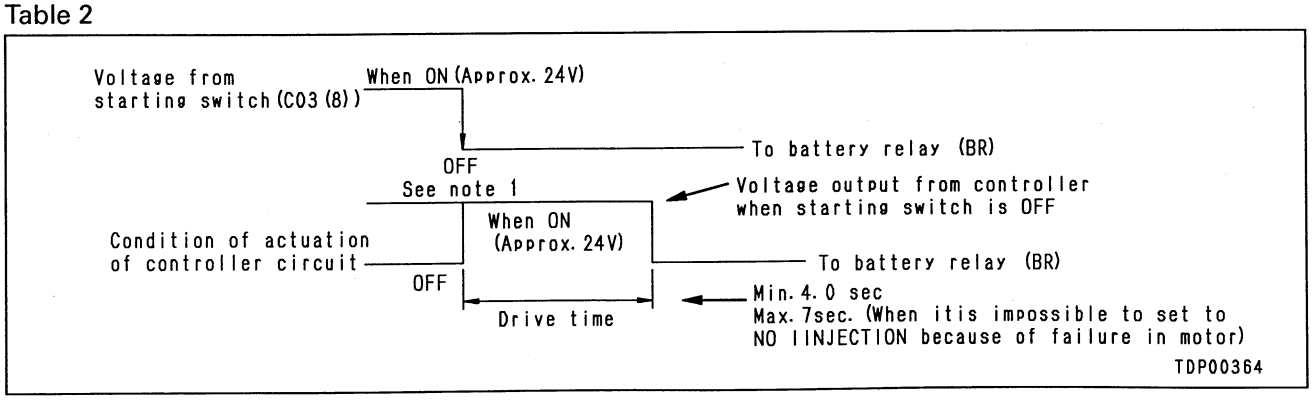


Table 1

Controller model code
03 120
BKP00358

★ The above diagram shows monitoring code 03.

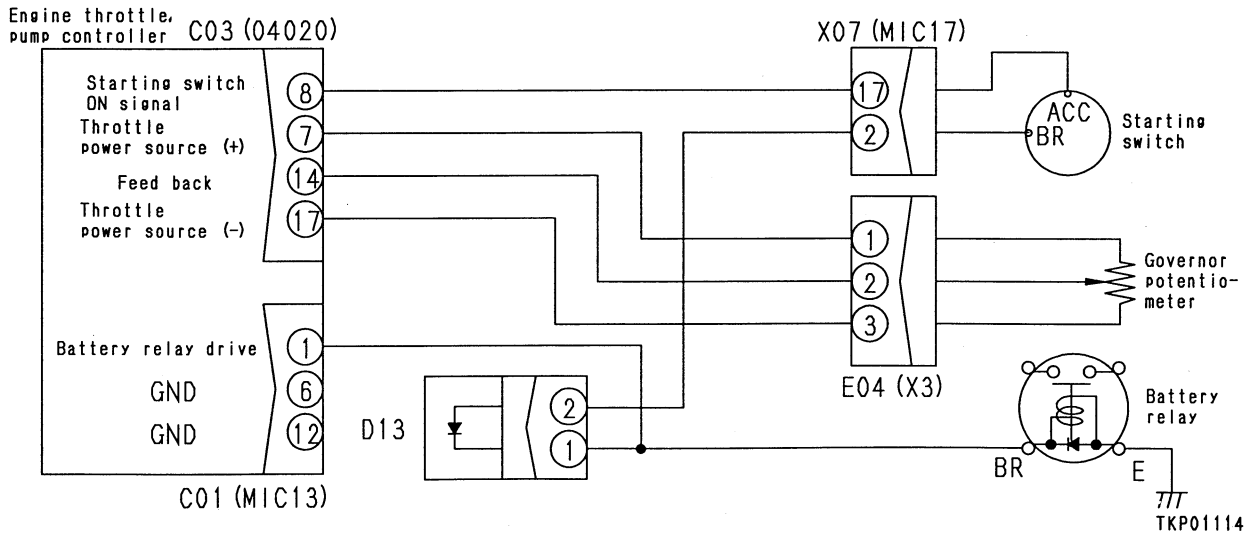
Table 2



Note: When the starting switch is ON, the controller end is OFF, but a voltage of approx. 20 – 30V is always flowing from starting switch BR, so if the voltage is measured at C01 (1), there is a voltage of 20 – 30V.

Cause	Remedy
Defective injection pump	See S mode
Defective adjustment of linkage	Adust
Defective governor motor	Replace
See E-5	—
Defective engine throttle, pump controller	Replace
Contact with 24V wiring harness between starting switch ACC - X07 (17) - C03 (female) (8), or defective starting switch	Replace
See C-14	—

E-11 Related electrical circuit diagram



E-12 Defective operation of battery relay system (engine does not stop)

★ This only occurs when the engine is stopped and the starting switch is turned OFF.

⚠ Check with the engine stopped (push the fuel control lever of the fuel injection pump to the NO INJECTION position).

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on the next step.

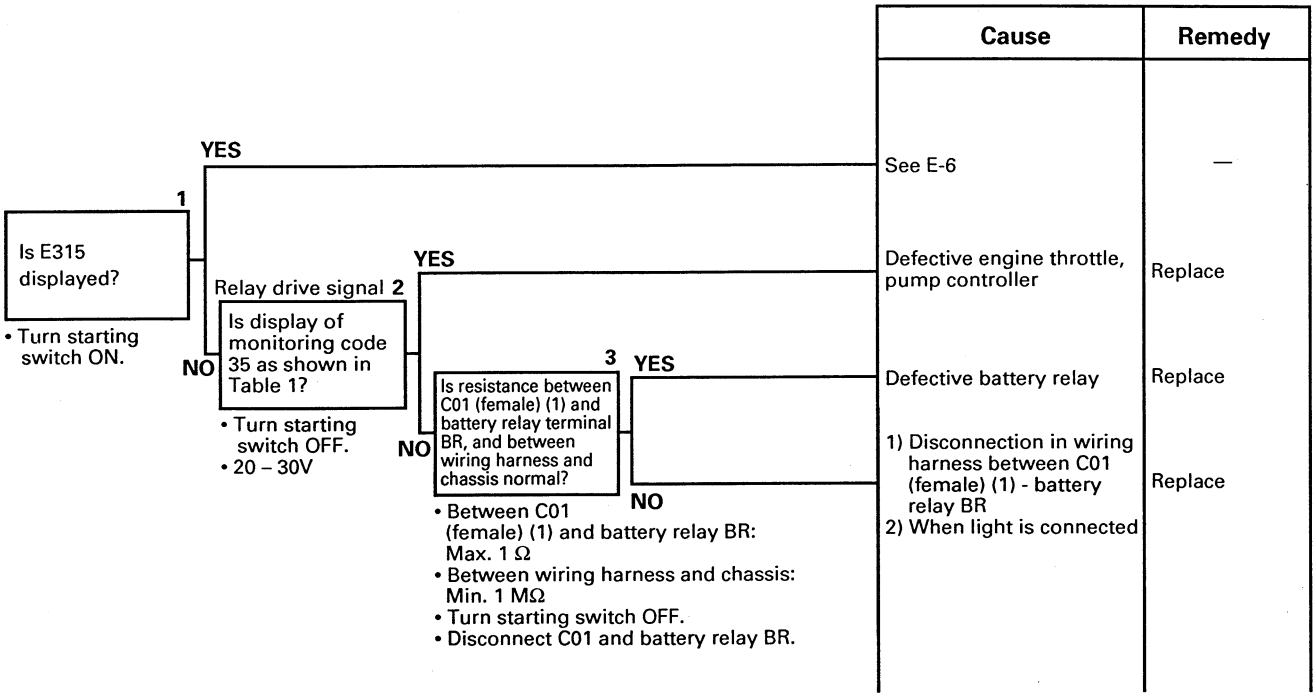
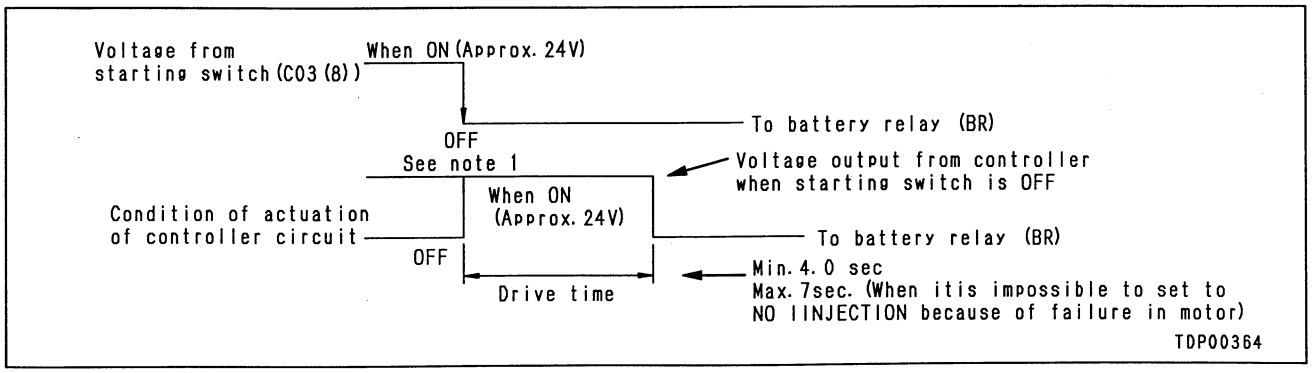
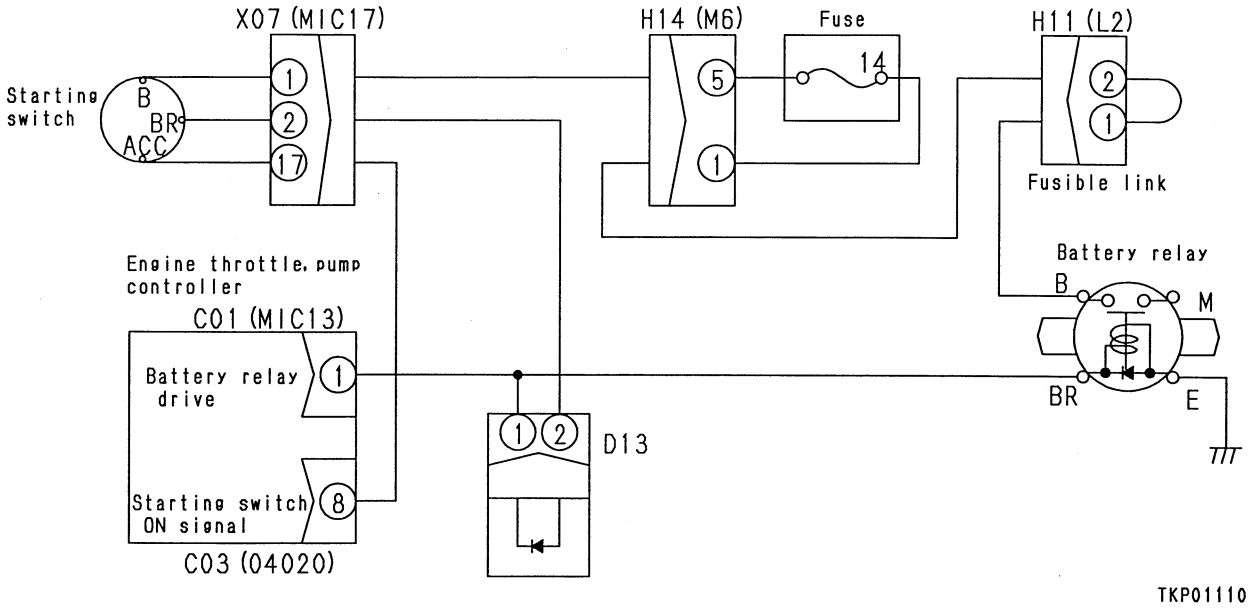


Table 2



Note: When the starting switch is ON, the controller end is OFF, but a voltage of approx. 20 – 30V is always flowing from starting switch BR, so if the voltage is measured at C01 (1), there is a voltage of 20 – 30V.

E-12 Related electrical circuit diagram



TROUBLESHOOTING OF ENGINE (S MODE)

METHOD OF USING TROUBLESHOOTING CHART

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 inspeciton without using troubleshooting tools.

Next, troubleshooting tools or direct inspection are used to check the high probability causes to make final confirmation.

[Questions]

Sections Ⓐ + Ⓑ in the chart on the right corresponds to the items where answers can be obtained from the user. The items in Ⓑ are items that can be obtained from the user, depending on the user's level.

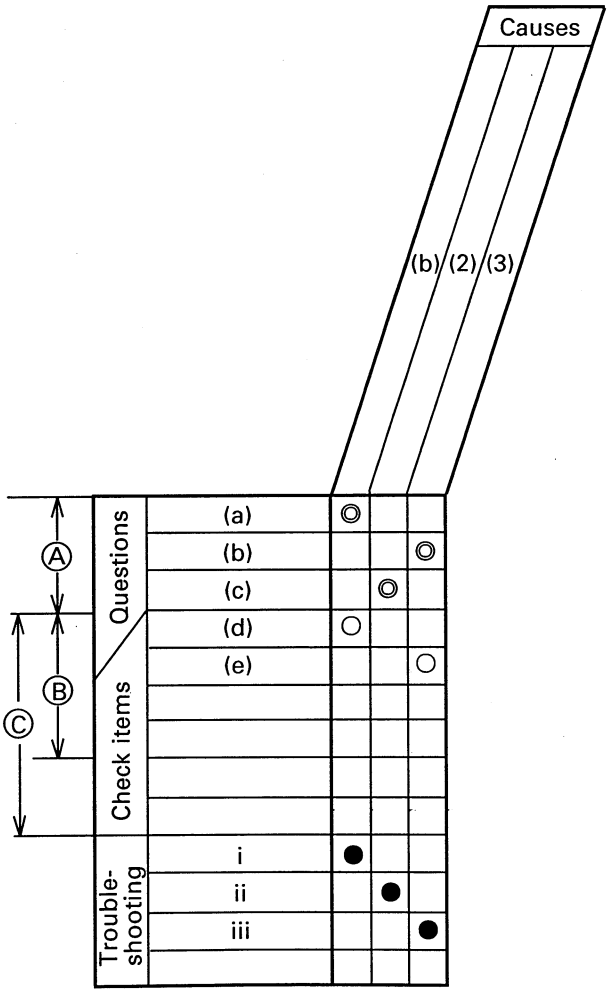
[Check items]

The serviceman carries out simple inspection to narrow down the causes. The items under Ⓒ in the chart on the right correspond to this.

The serviceman narrows down the causes from information Ⓐ that he has obtained from the user and the results of Ⓒ that he has obtained from his own inspection.

[Troubleshooting]

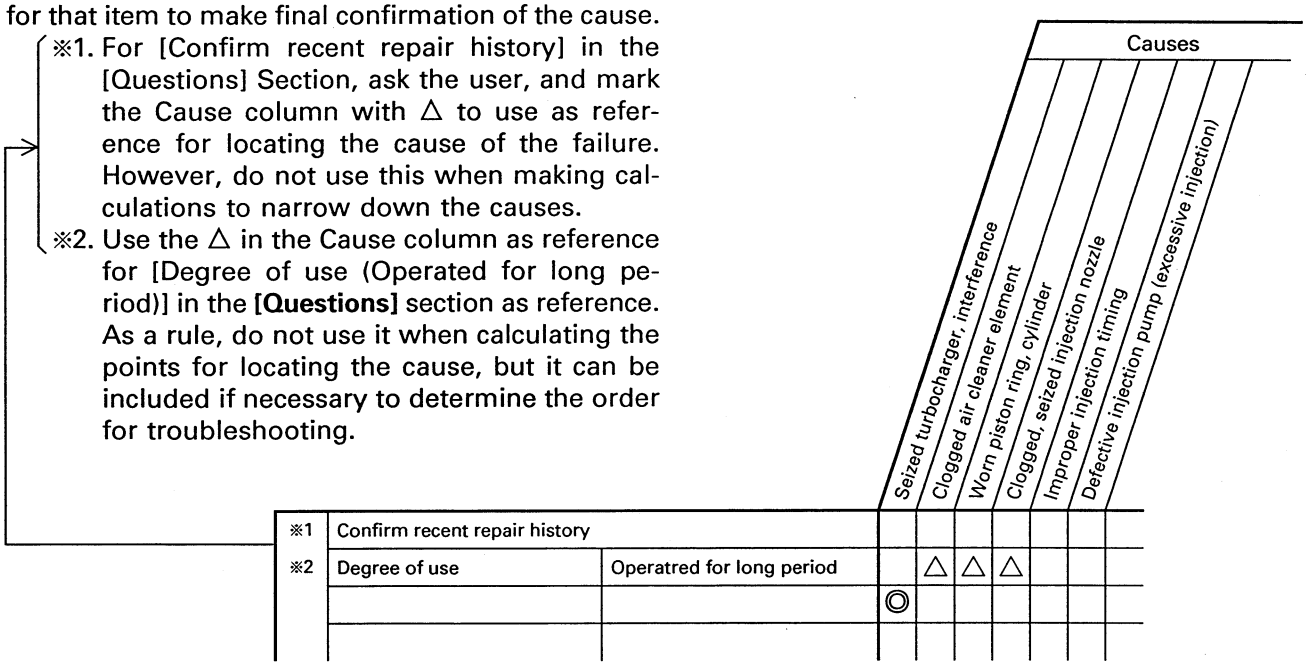
Troubleshooting is carried out in the order of probability, starting with the causes that have been marked as having the highest probability from information gained from **[Questions]** and **[Check items]**.



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 of these, causes that have a high probability are marked with ◎.
Check each of the **[Questions]** and **[Check items]** in turn, and marked the ○ or ◎ 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 cause.

※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.

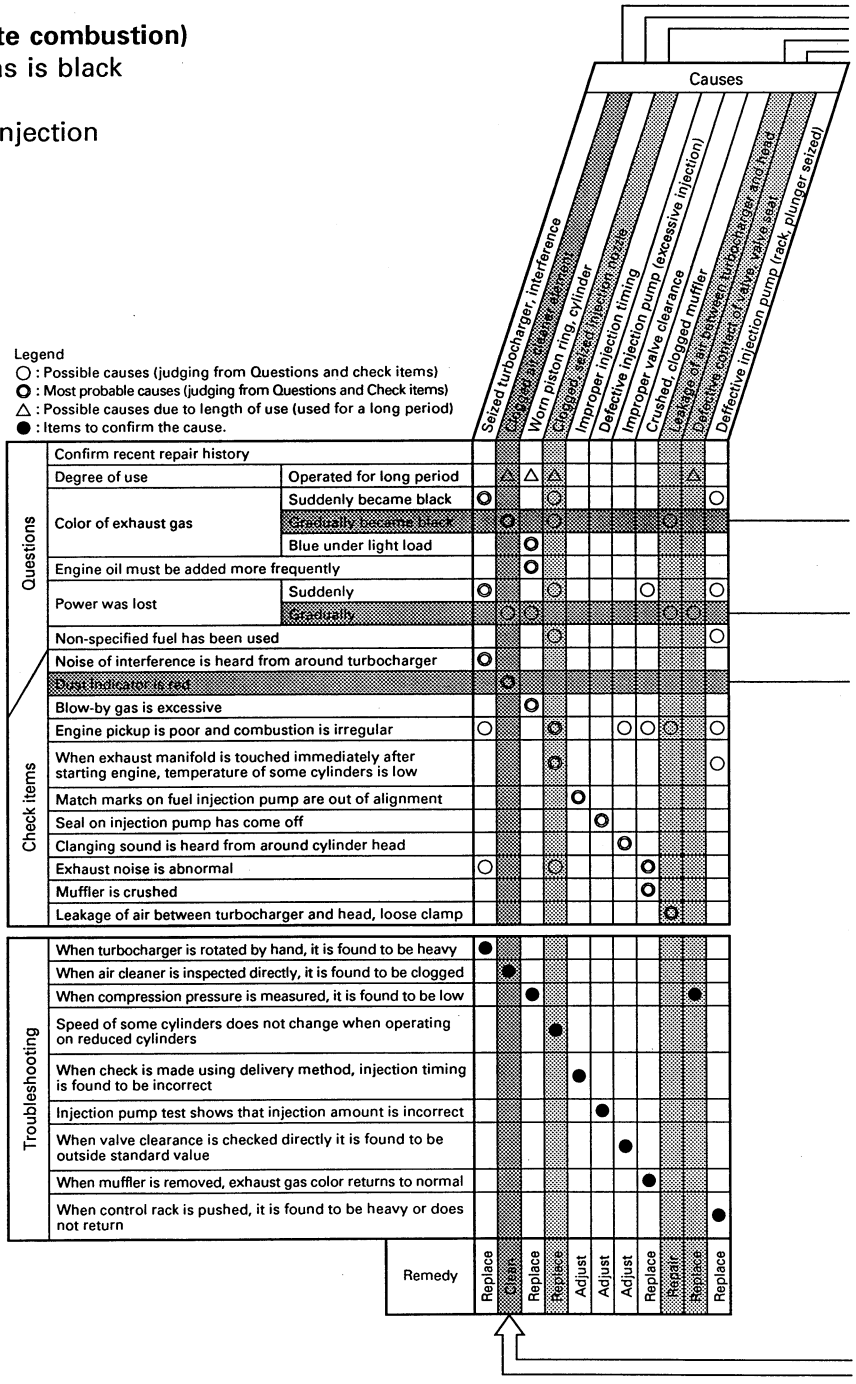
※2. Use the △ in the Cause column as reference for [Degree of use (Operated for long period)] in the **[Questions]** section as reference. As a rule, do not use it when calculating the points for locating the cause, but it can be included if necessary to determine the order for troubleshooting.

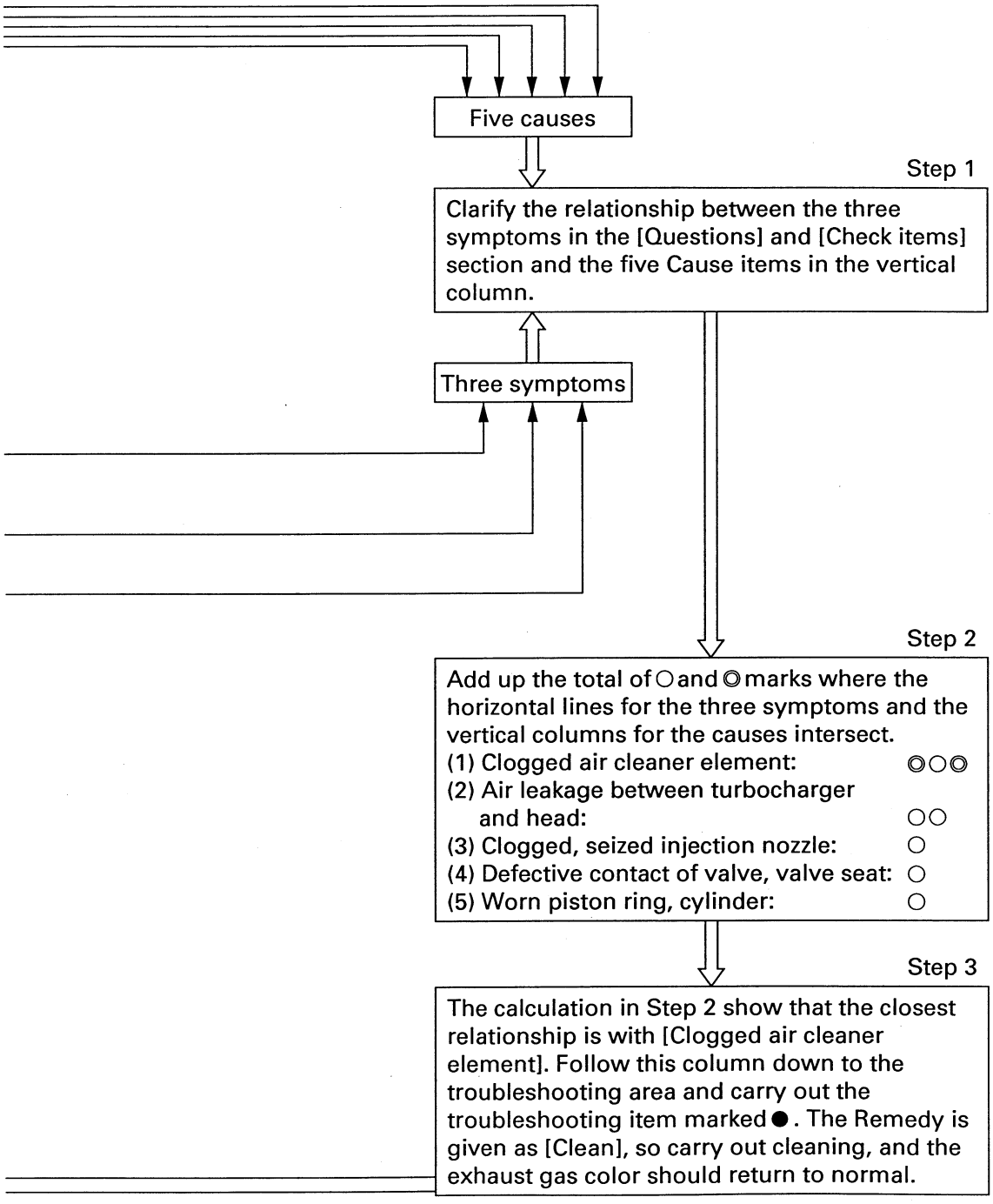


- **Example of troubleshooting when exhaust gas is black**
  Let us assume that [Clogged air cleaner] is taken to be the cause of black exhaust gas. Three symptoms have causal relationship with this problem: [Exhaust gas slowly became black], [Power slowly became weaker], and [Dust indicator is red].
  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 of fuel




Five causes
Step 1
Clarify the relationship between the three symptoms in the [Questions] and [Check items] section and the five Cause 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 piston 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, use ASTM D975 No. 1)

★ Battery charging rate

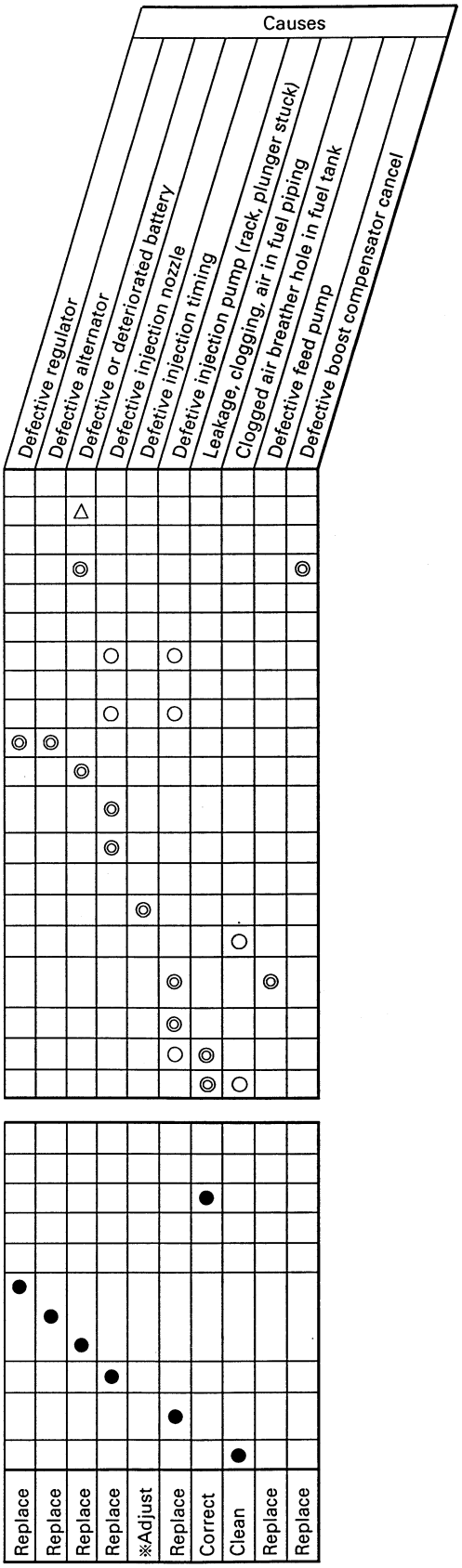
Ambient temperature \ Charging rate	100 %	90 %	80 %	75 %	70 %
20°C	1.28	1.26	1.24	1.23	1.22
0°C	1.29	1.27	1.25	1.24	1.23
–10°C	1.30	1.28	1.26	1.25	1.24

- The specific gravity should exceed the value 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				◎	◎	◎	
	Dust indicator lamp is red				◎			
	Non-specified fuel has being used					○	○	
Check items	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 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 pump)							
	When fuel cap is inspected directly, it is found to be clogged							
	Remedy		Replace	Correct	Clean	Clean	Clean	Replace

※ Use a test stand

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.



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.

- Failure in power train
- Defective electrical system

Legend
○: Possible causes (judging from Questions and check items)
◎: Most probable causes (judging from Questions and check items)
△: Possible causes due to length of use (used for a long period)
●: Items to confirm the cause.

			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 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			○				◎			
	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 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								●		
		Troubleshooting of DEFECTIVE WIRING IN STARTING CIRCUIT	—	Replace	Replace	Replace	Replace	Replace	Replace	Replace	Replace
		Remedy									

(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 TEMPRATURE 14 -10	32 0	50 10	68 20	86°F 30°C
Diesel fuel	ASTM D975 No.1	ASTM D975 No.1	ASTM D975 No.2	ASTM D975 No.2	ASTM D975 No.2

★ In winter, if ASTM D975 No. 1 diesel oil is not available, a 50-50 mixture of ASTM D975 No. 2 diesel oil and kerosene can be used.

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

		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	Defective engine stop motor	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								◎			
Check items	When starting switch is turned ON, linkage is not actuated									◎	◎	
	When fuel filter is drained, fuel does not come out											◎
	When engine is cranked with starting motor, 1) Injection pump coupling does not turn	◎										
	2) No fuel comes out even when fuel filter air bleed plug is loosened	◎			○	○						○
	3) No fuel spurts out even when injection pump sleeve nut is	◎	◎	◎								
	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								●			
	Motor does not move even when engine stop motor linkage 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

Legend
○: Possible causes (judging from Questions and check items)
◎: Most probable causes (judging from Questions and check items)
△: Possible causes due to length of use (used for a long period)
●: Items to confirm the cause.

		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	Defective or deteriorated battery	Leakage, clogging, air in fuel system	Clogged injection nozzle, defective spray	Clogged air breather hole in fuel tank cap	Improper fuel used
Questions	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 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							◎					
Check items	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 injection pump sleeve nut 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 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 injction
- Improper fuel used

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

			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, interference	Improper valve clearance	Clogged air breather hole in fuel tank cap	Clogged, leaking fuel piping	Defective contact of valve and valve seat
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			◎	◎	◎	◎						
	Engine oil must be added more frequently							◎					
	Rust and water are found when fuel tank is drained			◎	◎								
	Dust indicator lamp is red		◎										
	Noise of interference is heard from around turbocharger								◎				
Check items	Engine pick-up suddenly became poor					○			◎		○	○	
	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 is excessive							◎					

			Clean	Clean	Clean	Correct	Replace	Replace	Replace	Adjust	Clean	Correct	Replace
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 stops 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.

Legend
○: Possible causes (judging from Questions and check items)
◎: Most probable causes (judging from Questions and check items)
△: Possible causes due to length of use (used for a long period)
●: Items to confirm the cause.

			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	◎	◎	◎	◎	◎	◎				○			○	◎
		Engine overheated and stopped	◎	○			○									
		Engine stopped slowly						◎	○	○						
		There was hunting and engine stopped						◎	○	○			○			
	Fuel level lamp lights up							◎								
	Fuel tank is found to be empty							◎								
Check items	Replacement of filters has not been carried out according to Operation Manual								◎	◎						
	Non-specified fuel is being used								○	○	○				○	
	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	◎	◎												
		Turns in opposite direction			◎											
		Moves amount of backlash				◎	◎									
		Shaft does not turn						◎								
	Rust and water are found when fuel 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	—

Troubleshooting of CHASSIS

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 ELECTRICAL SYSTEM.

Legend
○: Possible causes (judging from Questions and check items)
◎: Most probable causes (judging from Questions and check items)
△: Possible causes due to length of use (used for a long period)
●: Items to confirm the cause.

			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					◎					
	Fuel tank is found to be empty						◎					
	Replacement of filters has not been carried out according to Operation Manual							◎	◎			
	Rust, water are found when fuel tank is drained							○	○			
Check items	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 lever 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 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.

Legend
○: Possible causes (judging from Questions and check items)
◎: Most probable causes (judging from Questions and check items)
△: Possible causes due to length of use (used for a long period)
●: Items to confirm the cause.

			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
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					◎	◎	◎	◎						
	Dust indicator lamp is red		◎												
Check items	Color of exhaust gas	Black	◎	◎											
		Blue under light load			◎										
	Noise of interference is heard from around turbocharger			◎											
	Blow-by gas is 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 engine (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 lever is placed at FULL position, it does not contact stopper										●				
	When feed pump is operated, operation is too light or too heavy											●			
	When fuel cap is inspected directly, it is found to be clogged												●		
		Remedy	Clean	Replace	Replace	Clean	Clean	Correct	Replace	Adjust	Replace	Adjust	Correct	Clean	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

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

			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		◎		○					○		
		Blue 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 is 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 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

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

			Causes: Broken piston ring	Worn piston ring, cylinder liner	Clogged breather or breather hose	Leakage from oil filter or oil cooler	Leakage from oil piping	Leakage from oil drain plug	Broken oil cooler	Worn seal at turbine end	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	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			◎									
Check items	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 TORQFLOW 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

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

			Causes: Worn piston ring, cylinder liner	Clogged breather, breather hose	Clogged oil filter	Worn valve, valve guide	Clogged oil cooler	Clogged turbocharger drain pipe	Defective seal at turbocharger turbine end	Exhaust smoke is black
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period	△			△			△	
	Engine oil must be added more frequently		◎							
	Non-specified oil is being used				○					
Check items	Color of exhaust gas	Blue 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 drain tube is clogged							●		
	Excessive play of turbocharger shaft								●	
	When safety valve is directly inspected, spring is found to be catching or broken									Carry out troubleshooting for EXHAUST SMOKE IS BLACK
	Remedy		Replace	Clean	Replace	Replace	Clean	Clean	Replace	—

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

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

			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 pump and inspect directly							●		
	When engine speed is measured, low idling 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

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

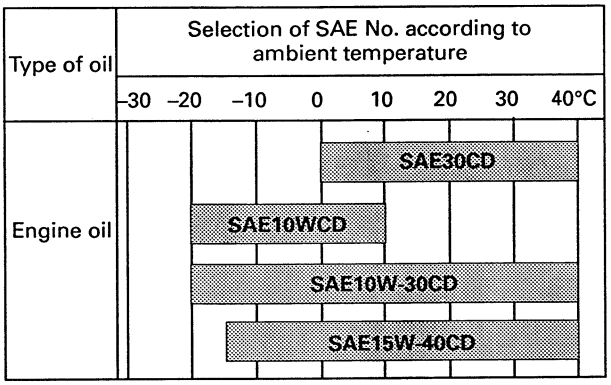
			Causes: Broken oil cooler core, O-ring	Broken cylinder head, head gasket	Broken power train oil cooler	Holes caused by pitting	Internal cracks in cylinder block
Questions	Confirm recent repair history						
	Degree of use of machine	Operated for long period	△			△	
	Oil level	Suddenly increased	○	○	○		
		Gradually increased				○	○
Check items	Hard water is being used as cooling water		○			○	
	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



Legend
○: Possible causes (judging from Questions and check items)
◎: Most probable causes (judging from Questions and check items)
△: Possible causes due to length of use (used for a long period)
●: Items to confirm the cause.

			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		◎												
	Caution lamp lights up		◎							○					
	Non-specified oil is being used		○	○											
	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								◎	◎		○	○	
Check items	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		●	●											Carry out troubleshooting for OIL LEVEL RISES
	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 value												●		
		Remedy	Clean	Clean	Clean	Clean	Correct	Replace	Add	Adjust	Adjust	Correct	Replace	Replace	—

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

Legend
○: Possible causes (judging from Questions and check items)
◎: Most probable causes (judging from Questions and check items)
△: Possible causes due to length of use (used for a long period)
●: Items to confirm the cause.

		Causes: Broken oil cooler core, O-ring	Defective nozzle holder sleeve	Broken cylinder head, head gasket (precombustion chamber)	Worn, damaged rear seal surface	Defective pump auxiliary equipment seal	Leakage of fuel from piping inside head cover	Defective part inside injection pump (flange type)	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	◎	○	○						○	○
	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			◎						○	
Check items	Water pump breather hole is clogged with mud										
	When water pump breather hole is cleaned, water comes out										
	Oil level goes down in clutch, TORQFLOW transmission, or damper chamber				◎						
	Oil level goes down in hydraulic tank					◎					
	Engine oil smells of diesel fuel						◎	◎			
	Fuel must be added more frequently						◎	◎			
	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.

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

			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	Rises 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 even at cracking temperature					●								
	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										●			
	Remove oil pan and inspect directly											●		
		Remedy	Replace	Correct	Correct	Replace	Replace	Add	Correct	Replace	Replace	Replace	Replace	Carry out troubleshooting for CHASSIS —

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

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

			Causes: Excessive wear of piston ring, cylinder liner	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 head	Defect inside muffler (dividing board out of position)
Questions	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		◎											
Check items	Color of exhaust gas	Blue under light load	◎											
		Black		◎						○			○	
	Metal particles are found in oil filter		◎		◎									
	Blow-by gas is 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 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 is 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 alignment
- Abnormal combustion

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

			Causes: Worn connecting rod, main bearing	Worn balancer, 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 injection)
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period	△	△	△					
	Condition of vibration	Suddenly increased				○			○	
		Gradually increased	○	○	○					
	Non-specified oil is being used		○	○						
Check items	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

TROUBLESHOOTING OF ENGINE THROTTLE, PUMP CONTROLLER [PUMP CONTROL SYSTEM] (C MODE)

POINTS TO REMEMBER WHEN TROUBLESHOOTING PUMP CONTROLLER SYSTEM

1. **Points to remember if abnormality returns to normal by itself**
   In the following cases, there is a high probability that the same problem will occur again, so it is desirable to follow up the problem carefully.
   1) If any abnormality returns to normal by itself, or
   2) If the connector is disconnected and the T-adapter is inserted, or if the T-adapter is removed and the connector is returned to its original position when carrying out troubleshooting of the failure, and the service code is no longer displayed, or if the monitor display returns to normal.
   3) After completing troubleshooting, always erase the service code from memory.

2. **Service code memory retention function**
   When displaying the abnormality code in memory and carrying out troubleshooting, note down all the contents of the display, then erase the display. After trying to re-enact the problem, carry out troubleshooting according to the service code that is displayed.
   (There are cases where mistaken operation or abnormalities that occur when the connector is disconnected are recorded by the memory retention function. Erasing the data in this way saves any wasted work.)

ACTION TAKEN BY CONTROLLER WHEN ABNORMALITY OCCURS AND PROBLEMS ON MACHINE

User code	Service code	Abnormal system	Nature of abnormality
E02	E232	Short circuit in pump PC-EPC solenoid system	1. Internal short circuit, short circuit with chassis ground in pump PC-EPC solenoid 2. Short circuit with power source, short circuit with chassis ground in wiring harness between controller C02 (8) and PC-EPC solenoid C13 (1) ((+) end) 3. Wiring harness between controller C02 (18) and PC-EPC solenoid C13 (2) ((–) end) short circuiting with power source 4. Defective engine throttle, pump controller
	E233	Disconnection in pump PC-EPC solenoid system	1. Internal disconnection, defective contact in pump PC-EPC solenoid 2. Defective contact or disconnection in wiring harness between controller C02 (8) and PC-EPC solenoid C13 (1) ((+) end) 3. Short circuit with chassis ground, defective contact or disconnection in wiring harness between controller C02 (18) and PC-EPC solenoid C13 (2) ((-) end) 4. Defective engine throttle, pump controller
E02	E203	Short circuit in swing holding brake solenoid system	1. Internal short circuit, short circuit with chassis ground in swing holding brake solenoid 2. Wiring harness between controller C01 (3) and solenoid V04 (1) ((+) end) short circuiting with chassis ground 3. Defective engine throttle, pump controller
	E213	Disconnection in swing holding brake solenoid system	1. Internal disconnection, defective contact in swing holding brake solenoid 2. Short circuit with power source, defective contact or disconnection in wiring harness between controller C01 (3) and solenoid V04 (1) ((+) end) 3. Defective contact or disconnection in wiring harness between solenoid V04 (2) and chassis ground ((–) end) 4. Defective engine throttle, pump controller

Condition when norma (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality
• Resistance of solenoid: 7 – 14 Ω	1. Makes output to PC-EPC solenoid 0 2. Displays user code E02 on monitor panel ★ If the abnormality is restored by the vibration of the machine, the condition will return to normal when the power source is reset. (However, the service code does not go out.)	1. No current flows to the pump PC-EPC solenoid Therefore, when the load is large, there is a big drop in the engine speed, which may result in the engine stalling. 2. Swing acceleration is poor
• Resistance of solenoid: 7 – 14 Ω • Current: 1,000 mA (H/O mode, auto-deceleration ON, levers at neutral, fuel control dial at MAX.)	1. The current stops flowing to the PC-EPC solenoid, so no particular action is taken. 2. If there is short circuit with chassis ground at (–) terminal, current (1A or more) continues to flow to PC-EPC solenoid 3. Displays user code E02 on monitor panel ★ If the abnormality is restored by the vibration of the machine, the condition will automatically return to normal. (However, the service code does not go out.)	1. In the case of 1, it is the same as E232. 2. In the case of 2, the current (1A or more) continues to flow to the pump PC-EPC solenoid, so the output pressure of the pump PC-EPC valve increases and the overall speed becomes slower.
• Resistance of solenoid: 20 – 60 Ω	1. Makes output to solenoid 0 2. Displays user code E03 on monitor panel ★ If the abnormality is restored by the vibration of the machine, the condition will return to normal when the power source is reset. (However, the service code does not go out.)	When the swing is operated, the motor brake is not released, so the upper structure does not swing.
• Resistance of solenoid: 20 – 60 Ω	1. The current stops flowing to the solenoid, so no particular action is taken. 2. Displays user code E03 on monitor panel ★ If the abnormality is restored by the vibration of the machine, the condition will automatically return to normal. (However, the service code does not go out.)	Same as E203 display

User code	Service code	Abnormal system	Nature of abnormality
—	E205	Short circuit in 2-stage relief solenoid system	1. Internal short circuit, short circuit with chassis ground in 2-stage relief solenoid 2. Wiring harness between controller C01 (10) and solenoid V05 (1) ((+) end short circuiting with chassis ground 3. Defective engine throttle, pump controller
—	E206	Short circuit in travel speed solenoid system	1. Internal short circuit, short circuit with chassis ground in travel speed solenoid 2. Wiring harness between controller C01 (9) and solenoid V06 (1) ((+) end) short circuiting with chassis ground 3. Defective engine throttle, pump controller
—	E207	Short circuit in active mode solenoid system	1. Internal short circuit, short circuit with chassis ground in active mode solenoid 2. Wiring harness between controller C01 (8) and solenoid V07 (1) ((+) end) short circuiting with chassis ground 3. Defective engine throttle, pump controller
—	E208	Disconnection in active mode solenoid system	1. Internal disconnection, defective contact in active mode solenoid 2. Short circuit with power source, defective contact or disconnection in wiring harness between controller C01 (8) and solenoid V07 (1) ((+) end) 3. Defective contact or disconnection in wiring harness between solenoid V07 (2) and chassis ground ((–) end) 4. Defective engine throttle, pump controller
—	E215	Disconnection in 2-stage relief solenoid system	1. Internal disconnection, defective contact in 2-stage relief solenoid 2. Short circuit with power source, defective contact or disconnection in wiring harness between controller C01 (10) and solenoid V05 (1) ((+) end) 3. Defective contact or disconnection in wiring harness between solenoid V05 (1) and chassis ground ((-) end) 4. Defective engine throttle, pump controller
—	E216	Disconnection in travel speed solenoid system	1. Internal disconnection, defective contact in travel speed solenoid 2. Short circuit with power source, defective contact or disconnection in wiring harness between controller C01 (9) and solenoid V06 (1) ((+) end) 3. Defective contact or disconnection in wiring harness between solenoid V06 (2) and chassis ground ((–) end) 4. Defective engine throttle, pump controller

Condition when norma (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality
• Resistance of solenoid: 20 – 60 Ω	1. Makes output to solenoid 0 ★ If the abnormality is restored by the vibration of the machine, the condition will return to normal when the power source is reset. (However, the service code does not go out.)	1. When traveling or using the power max. function, the relief pressure is not raised, so there is lack of power. ★ When traveling, 2-stage relief solenoid works only on PC120 and 130
• Resistance of solenoid: 20 – 60 Ω	1. Makes output to solenoid 0 ★ If the abnormality is restored by the vibration of the machine, the condition will return to normal when the power source is reset. (However, the service code does not go out.)	Even when travel speed selection is operated, travel speed does not change (remains at Lo)
• Resistance of solenoid: 20 – 60 Ω	1. Makes output to solenoid 0 ★ If the abnormality is restored by the vibration of the machine, the condition will return to normal when the power source is reset. (However, the service code does not go out.)	1. In active mode, work equipment speed does not increase
• Resistance of solenoid: 20 – 60 Ω	1. The current stops flowing to the solenoid, so no particular action is taken. ★ If the abnormality is restored by the vibration of the machine, the condition will automatically return to normal. (However, the service code does not go out.)	Same as E207 display
• Resistance of solenoid: 20 – 60 Ω	1. The current stops flowing to the solenoid, so no particular action is taken. ★ If the abnormality is restored by the vibration of the machine, the condition will automatically return to normal. (However, the service code does not go out.)	Same as E205 display
• Resistance of solenoid: 20 – 60 Ω	1. The current stops flowing to the solenoid, so no particular action is taken. ★ If the abnormality is restored by the vibration of the machine, the condition will automatically return to normal. (However, the service code does not go out.)	Same as E206 display

User code	Service code	Abnormal system	Nature of abnormality
—	E217	Model selection input error	1. Short circuit with chassis ground, defective contact or disconnection in model selection wiring harness C17 (5)(6)(7)(13)(14) 2. Defective engine throttle, pump controller
—	E218	Network response overtime error	1. Disconnection, short circuit, short circuit with chassis ground in network wiring harness 2. Abnormality in engine throttle, pump controller 3. Abnormality in monitor panel
—	E222	Short circuit in LS-EPC solenoid system	1. Internal short circuit, short circuit with chassis ground in LS-EPC solenoid 2. Short circuit with power source, short circuit with chassis ground in wiring harness between controller C02 (7) and solenoid C10 (1) ((+) end) 3. Wiring harness between controller C02 (17) and solenoid C10 (2) ((–) end) short circuiting with power source 4. Defective engine throttle, pump controller
—	E224	Disconnection in LS-EPC solenoid system	1. Internal disconnection, defective contact in LS-EPC solenoid 2. Defective contact or disconnection in wiring harness between controller C02 (7) and solenoid C10 (1) ((+) end) 3. Short circuit with chassis ground, defective contact or disconnection in wiring harness between controller C02 (17) and solenoid C10 (2) ((–) end) 4. Defective engine throttle, pump controller
—	E223	Abnormality in pump pressure sensor system	1. Internal disconnection, defective contact, short circuit, short circuit with chassis ground in pump pressure sensor 2. Short circuit, defective contact or disconnection in wiring harness between controller C03 (6) and pressure sensor C08 (2) ((+) end), and between C03 (16) and C08 (1) ((–) end) 3. Short circuit with chassis ground, short circuit with power source, defective contact or disconnection in wiring harness between controller C03 (3) and pressure sensor C08 (3) (SIG end) 4. Defective engine throttle, pump controller

Condition when norma (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality
• Between C17 (6)(13) and chassis: Max. 1 Ω • Between C17 (5)(7)(14) and chassis: Min. 1 Ω	Detects abnormality in input 1. Retains data when starting switch is ON 2. Functions as PC100 when non-set conditions are input	1. Engine stalls, or 2. All work equipment, swing, travel speeds are slow or lack power
	1. When communications are impossible with the monitor, controls as follows. (1) Working mode : G/O (2) Priority mode : OFF (3) Travel speed : Lo (4) Auto-deceleration: ON (5) Power max. : ON (others are as usual)	1. (1) Even when travel is operated, the power does not increase (2) The swift slow-down function does not work (3) The auto-deceleration cannot be canceled (4) The travel speed does not increase (5) The priority mode has no effect (6) The automatic mode has no effect
• Resistance of solenoid: 7 –14 Ω	1. Makes output to LS-EPC solenoid 0 ★ If the abnormality is restored by the vibration of the machine, the condition will return to normal when the power source is reset. (However, the service code does not go out.)	1. The Lo travel speed is too fast. 2. In L/O mode and F/O mode, the work equipment speed is too fast. 3. When the engine is running at low idling, the swing speed is too fast.
• Current: 705 mA (Levers at neutral, low idling)	1. The current stops flowing to the LS-EPC solenoid, so no particular action is taken. 2. If there is short circuit with chassis ground at (–) terminal, current (1A or more) continues to flow to LS-EPC solenoid ★ If the abnormality is restored by the vibration of the machine, the condition will automatically return to normal. (However, the service code does not go out.)	1. In the case of 1, it is the same as E222 2. In the case of 2, the current (1A or more) continues to flow to the LS-EPC solenoid, so the work equipment, travel, and swing speeds are slow
• Between C03 (3) and (16): 0.5 – 4.5 V • Between C03 (6) and (16) : 18 – 28 V • Between C03 (female) (3) and (16), (3) and chassis: Min. 1 MΩ (Disconnect connectors C03 and C08.)	1. Takes pump pressure as 0 MPa {0 kg/cm²} when actuating. ★ If the abnormality is restored by the vibration of the machine, the condition will automatically return to normal. (However, the service code does not go out.)	1. The travel speed does not automatically shift (it does not change from Hi to Lo). ★ If the button is operated manually, the panel display is switched.

User code	Service code	Abnormal system	Nature of abnormality
—	E226	Abnormality in pressure sensor power source system	1. Internal short circuit, short circuit with chassis ground in pump pressure sensor 2. Short circuit with chassis ground, short circuit in wiring harness between controller C03 (6) and pressure sensor C08 (2) ((+) end) 3. Defective engine throttle, pump controller
—	E227	Abnormality in engine speed sensor system	1. Short circuit with chassis ground, internal disconnection, defective contact in engine speed sensor 2. Short circuit with chassis ground, defective contact or disconnection in wiring harness between controller C16 (1) and speed sensor E07 (2) ((–) end), and between C16 (2) and E07 (1) (SIG end) 3. Defective engine throttle, pump controller

Condition when norma (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality
• Between C03 (6) and (16): 18 – 28 V	1. Takes pump pressure as 0 MPa {0 kg/cm²} when actuating. 2. When abnormality is detected, it switches the output OFF, and when all levers are returned to neutral, it outputs again. ★ This automatic resetting is repeated up to 3 times.	1. The travel speed does not automatically shift (it does not change from Hi to Lo). ★ If the button is operated manually, the panel display is switched.
• Resistance: 500 – 1000 Ω • Voltage (AC range) : 0.5 – 3.0 V (engine started)	1. It functions as the equivalent of the G/O mode (the speed rises)	1. It operates about the same as G/O mode (prolix) (the power is slightly lower)

JUDGMENT TABLE FOR PUMP CONTROLLER AND HYDRAULIC RELATED PARTS

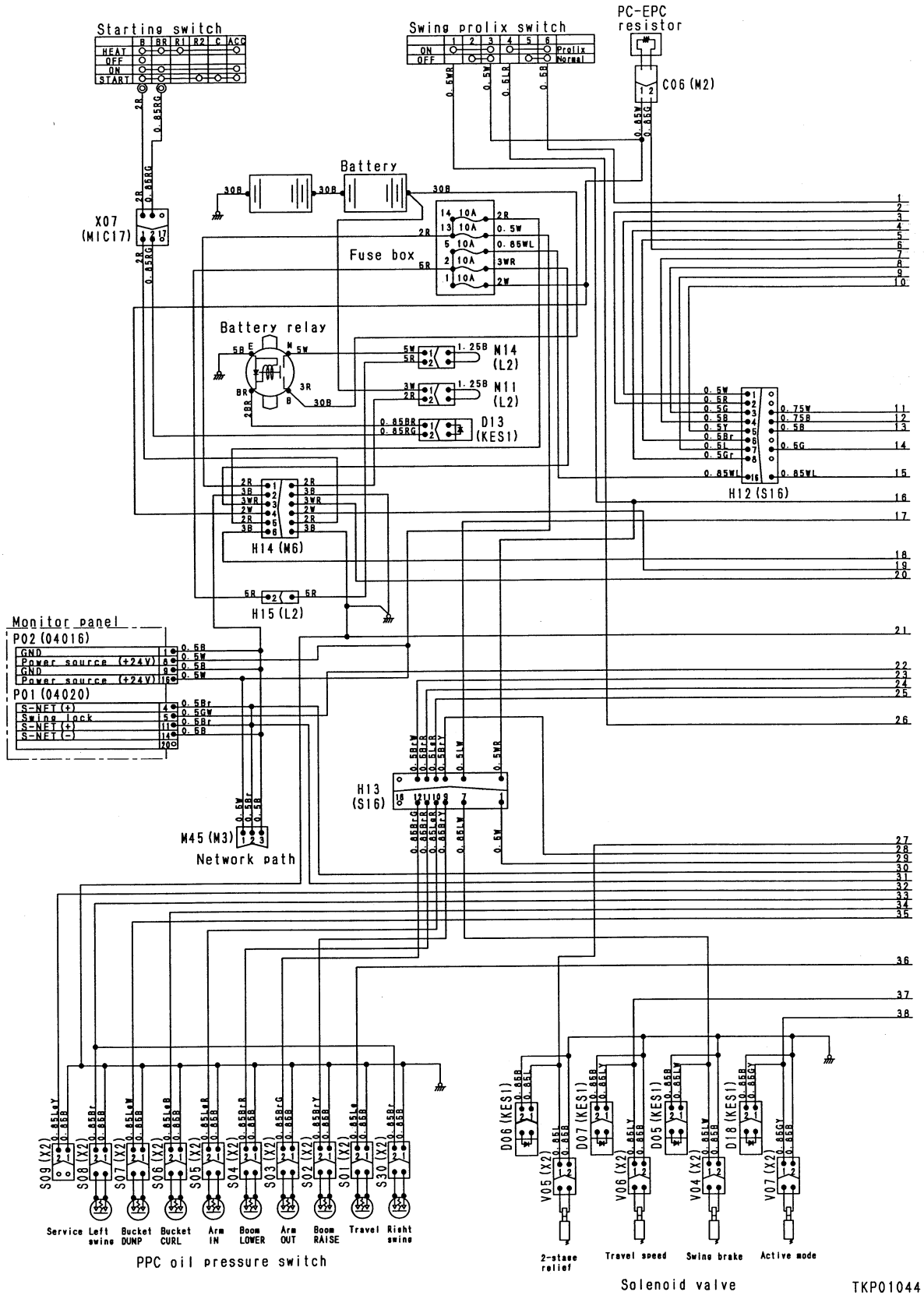
Failure mode			Abnormality in controller power source	Engine throttle, pump controller (E2:XX system) Self-diagnostic display: Short circuit in PC-EPC solenoid system	Disconnection in PC-EPC solenoid system	Short circuit in swing holding brake solenoid system	Disconnection in swing holding brake solenoid system	Short circuit in 2-stage relief solenoid system	Disconnection in 2-stage relief solenoid system	Short circuit in travel speed solenoid system	Disconnection in travel speed solenoid system	Short circuit in active mode solenoid	Disconnection in active mode solenoid	Model selection input error
	User code			E02		—		E03				—		
	Service code			232	233	203	213	205	215	206	216	207	208	217
All work equipment, travel, swing	Speeds of all work equipment, swing, travel are slow or lack power			●	●									●
	There is excessive drop in engine speed, or engine stalls		●	●	●									●
	No work equipment, travel, swing move													
	Abnormal noise generated (around pump)													
	Auto-deceleration does not work		●											
	Fine control ability is poor or response is poor													
Work equipment	Boom is slow or lacks power													
	Arm is slow or lacks power													
	Bucket is slow or lacks power													
	Boom does not move													
	Arm does not move													
	Bucket does not move													
	Excessive hydraulic drift													
	Excessive time lag (engine at low idling)													
	Lack of power when pressure rises							●	●					
	Other equipment moves when single circuit is relieved													
	Work equipment speed is slow when active mode is ON, or is fast when active mode is OFF											●	●	
Compound operations	In F/O mode, arm IN speed is faster than specified speed													
	In compound operations, work equipment with larger load is slow													
	In swing + boom RAISE, boom is slow													
	In swing + travel, travel speed drops excessively													
	In work equipment + travel, travel speed drops excessively													
Travel system	Travel deviation	Deviation is excessive in normal travel operations												
		Deviation is excessive when starting												
	Travel speed is slow													
	Steering is difficult to turn or lacks power							●	●	●	●			
	Travel speed does not switch or is faster than specified speed		●							●	●			
	Does not move (one side only)													
Swing system	Does not swing	Both left and right				●	●							
		One direction only												
	Swing acceleration is poor or swing speed is slow	Both left and right												
		One direction only												
	Excessive overrun when stopping swing	Both left and right												
		One direction only												
	Excessive shock when stopping swing (one direction only)													
	Excessive abnormal noise when stopping swing													
	Excessive hydraulic drift of swing	When swing holding brake is canceled												
		When swing holding brake is applied												
	Swing speed is faster than specified swing speed													
	Troubleshooting code when service code is displayed		C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10	C-11	C-12
	Troubleshooting code when there is abnormality in monitoring code check		—	—	—	—	—	—	—	—	—	—	—	—

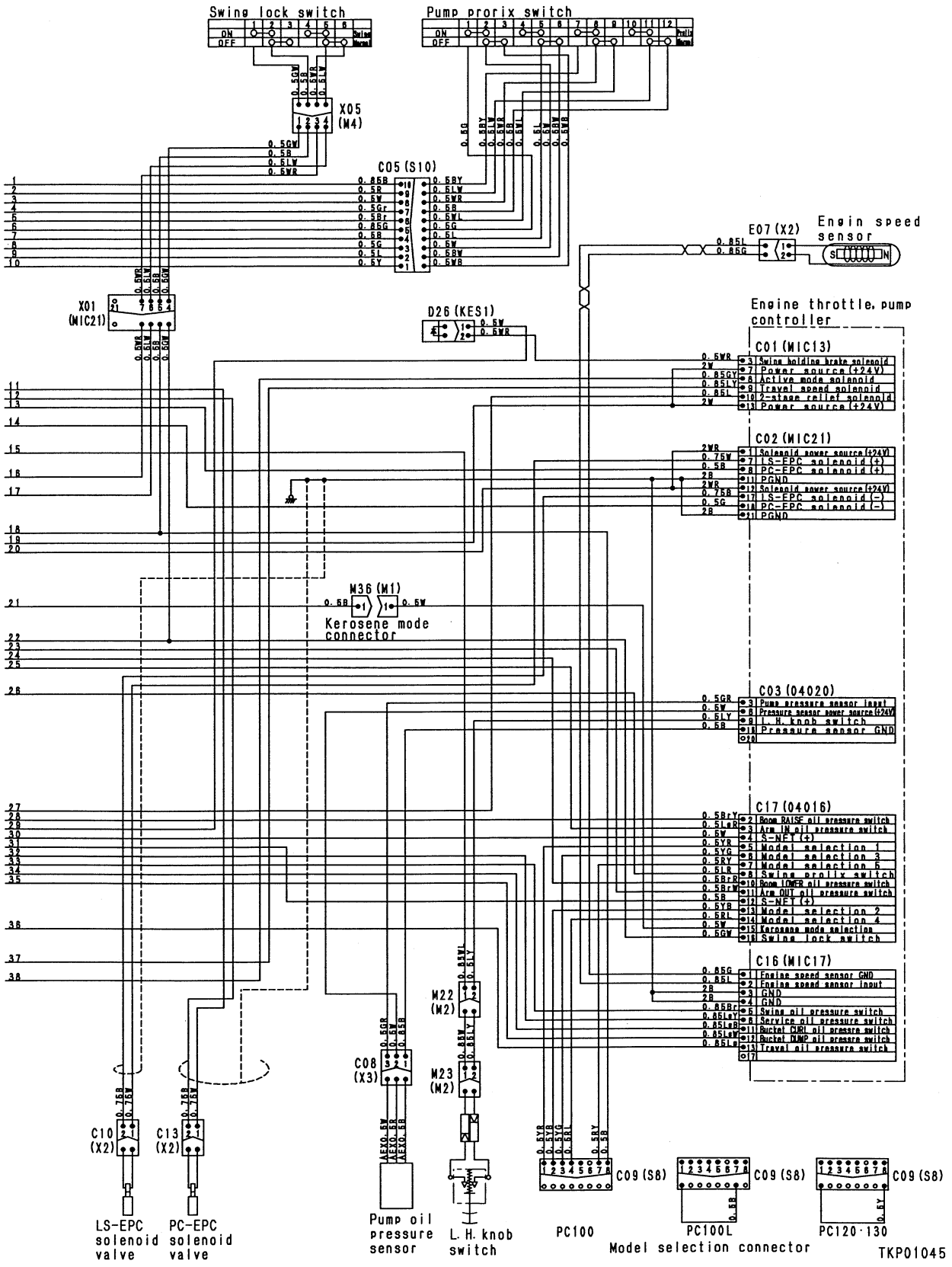
※ : This shows item that needs only checking with monitoring
○ : This shows item to check with monitoring or machine monitor
● : This shows applicable item for service code

★ If service code E218 (abnormality in network system) is displayed, go to troubleshooting for N Mode.

Check items with monitoring mode																									Troubleshooting code if no service code is displayed
					Oil pressure switch											Solenoid drive condition									
Short circuit in LS-EPC solenoid system	Disconnection in LS-EPC solenoid system	Abnormality in pump pressure sensor system	Abnormality in pressure sensor power source system	Abnormality in engine speed sensor system	Swing (1)	Travel (2)	Boom LOWER (3)	Boom RAISE (4)	Arm IN (5)	Arm OUT (6)	Bucket CURL (1)	Bucket DUMP (2)	Swing lock switch (3)	Kerosene mode (5)	Knob switch (6)	Active mode (2)	Swing holding brake (3)	2-stage relief (5)	Travel speed (6)	Mode selection code	Engine speed input	Pump discharge pressure input	PC-EPC current output	LS-EPC current output	Is the voltage for engine water temperature	
—					Bit pattern															Monitoring code						
222	223	224	226	227	20						21			22		23				02	10	11	13	15	41	
	●			●										○						※	※	※	※	※	※	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-27
																										H-28
																										H-29
																										H-30
					※																					H-31
●	●																							※		H-32
C-13	C-14	C-15	C-16	C-17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	—	—	—	F-1	F-2	F-3	F-4	F-5	F-6	F-7	F-8	F-9	F-10	F-11	—	—	—	—	—	—	—	—	—	—	

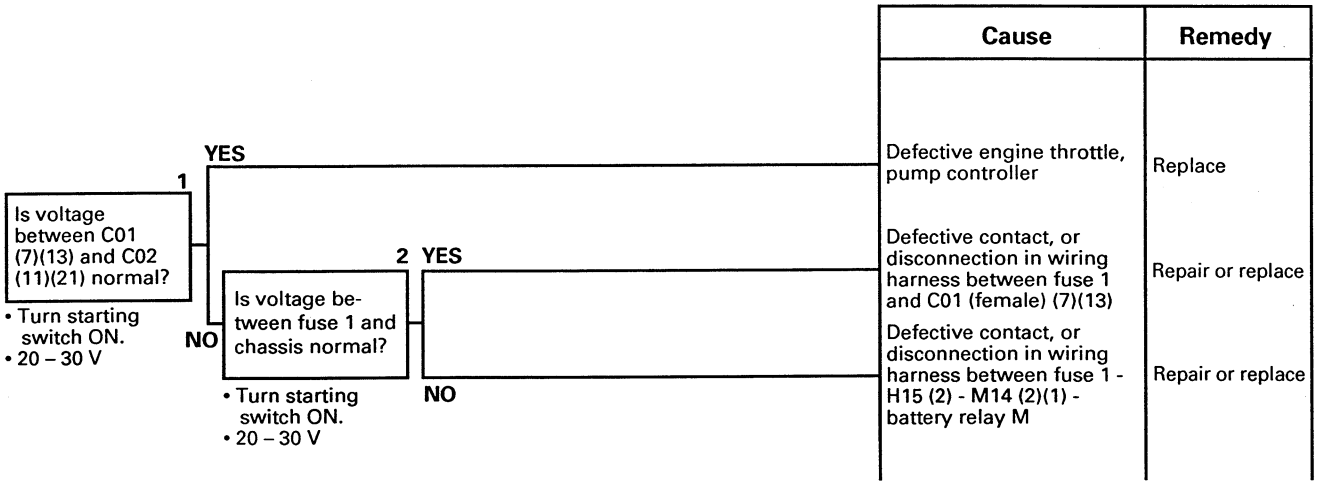
ELECTRICAL CIRCUIT DIAGRAM OF C MODE SYSTEM



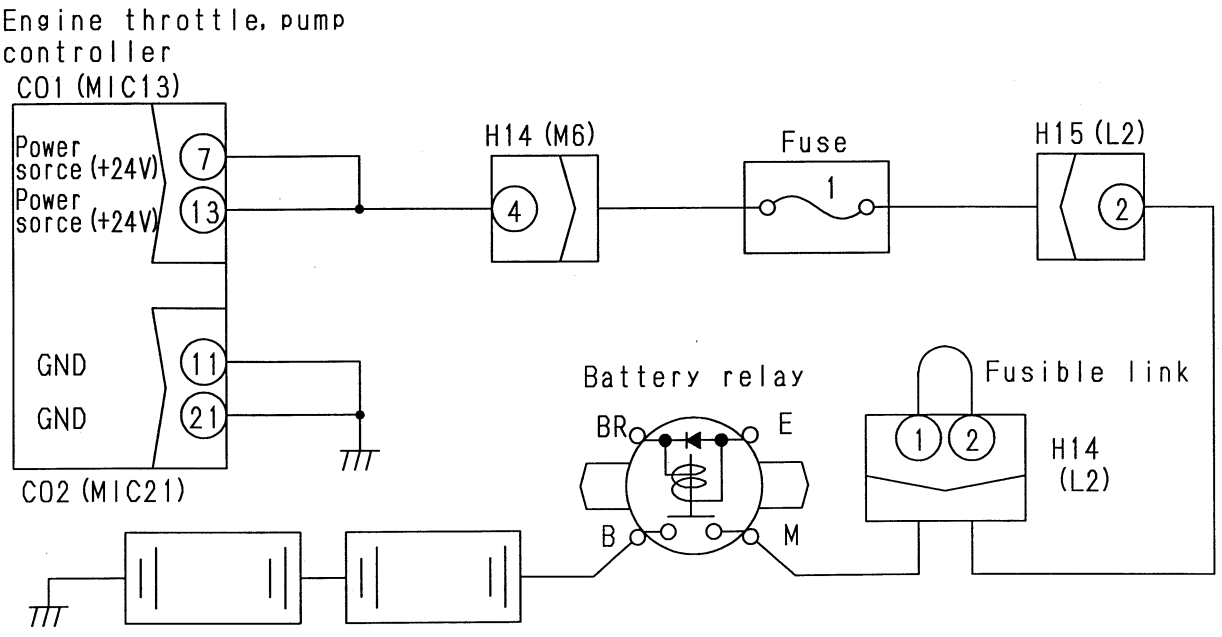

Swing lock switch
Pump prorix switch
X05 (M4)
C05 (S10)
E07 (X2)
Engine speed sensor
X01 (MIC21)
D26 (KES1)
Engine throttle, pump controller
C01 (MIC13)
C02 (MIC21)
M36 (M1)
Kerosene mode connector
C03 (04020)
C17 (04016)
C16 (MIC17)
M22 (M2)
C08 (X3)
M23 (M2)
C10 (X2)
C13 (X2)
C09 (S8)
C09 (S8)
C09 (S8)
LS-EPC solenoid valve
PC-EPC solenoid valve
Pump oil pressure sensor
L.H. knob switch
PC100
PC100L
PC120·130
Model selection connector
TKP01045

C-1 Abnormality in controller power source system (controller LED is OFF)

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ Check that fuses 1 and 14 are normal.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.
★ When the starting motor rotates correctly. (If the starting motor also does not rotate, go to E-8.)



C-1 Related electrical circuit diagram



TKP01046

C-2 [E232] Short circuit in pump PC-EPC solenoid system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Always turn the pump prolix switch OFF.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

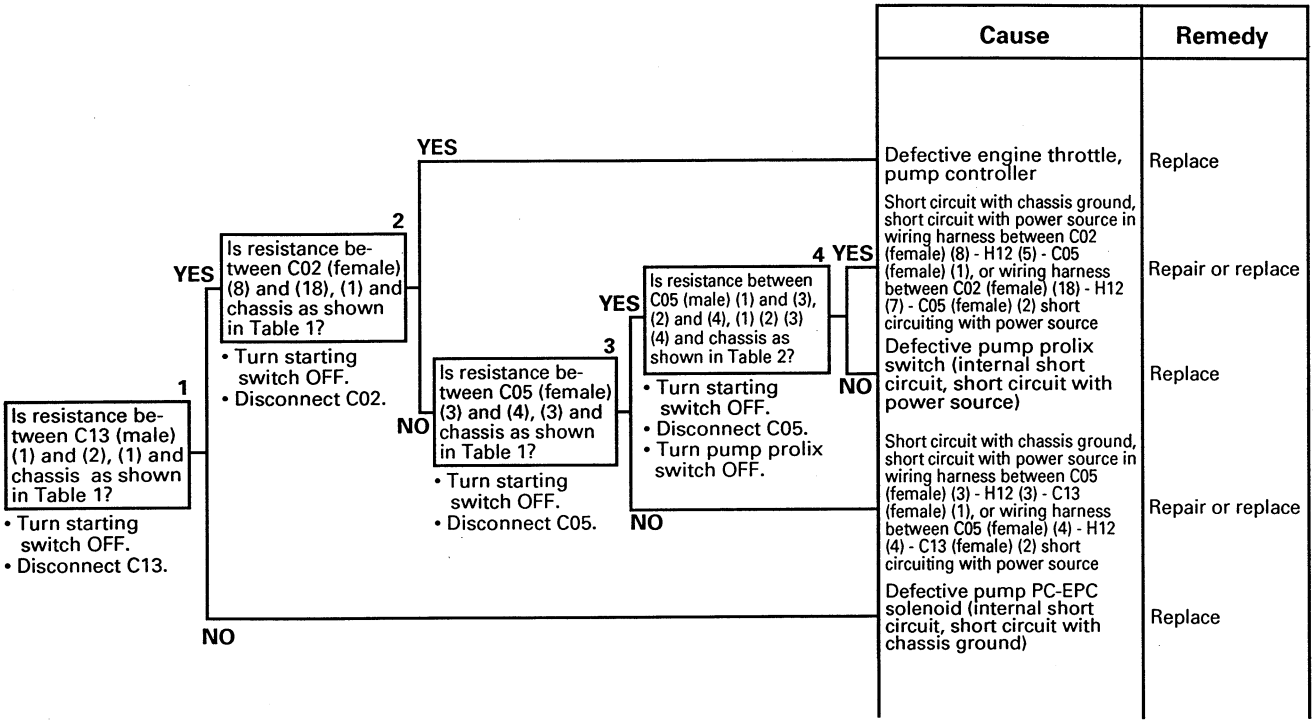


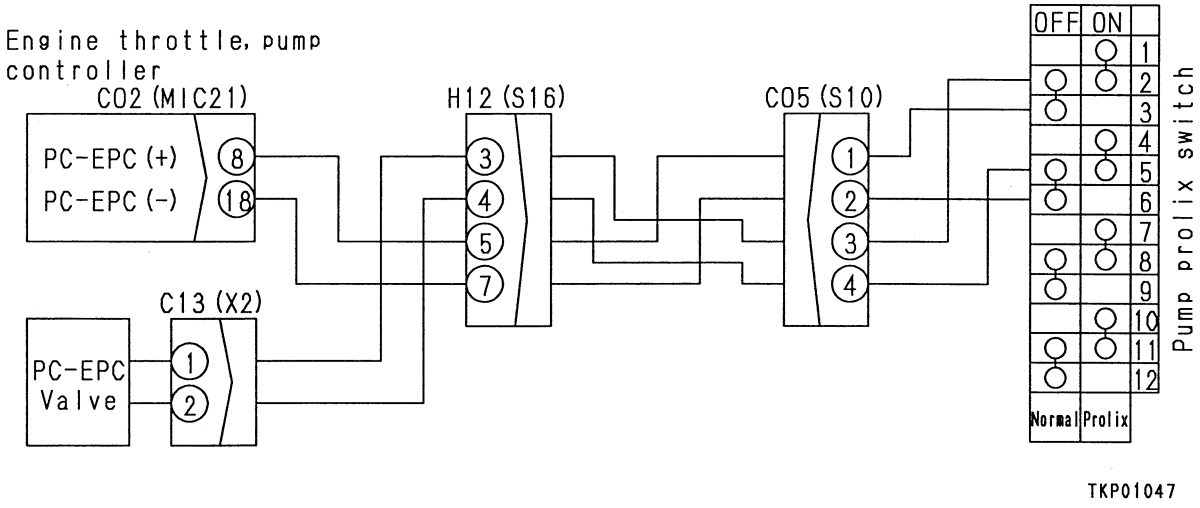
Table 1

Troubleshooting 1	Troubleshooting 2	Troubleshooting 3	Resistance value
Between C13 (male) (1) and (2)	Between C02 (female) (8) and (18)	Between C05 (female) (3) and (4)	10 – 22 Ω
Between C13 (male) (1) and chassis	Between C02 (female) (8) and chassis	Between C05 (female) (3) and chassis	Min. 1 MΩ

Table 2

Troubleshooting 4	Resistance value
Between C05 (male) (1) – (3), (2) – (4)	Max. 1 Ω
Between C05 (male) (1)(2)(3)(4) and chassis	Min. 1 MΩ

C-2 Related electrical circuit diagram



C-3 [E233] Disconnection in PC-EPC solenoid system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ If there is a disconnection in the solenoid or wiring harness, no current flows to the solenoid. If the No. 2 pin of the solenoid is short circuiting with the chassis ground, the current (approx. 1 A) continues to flow to the solenoid.
★ Always turn the pump prolix switch OFF.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

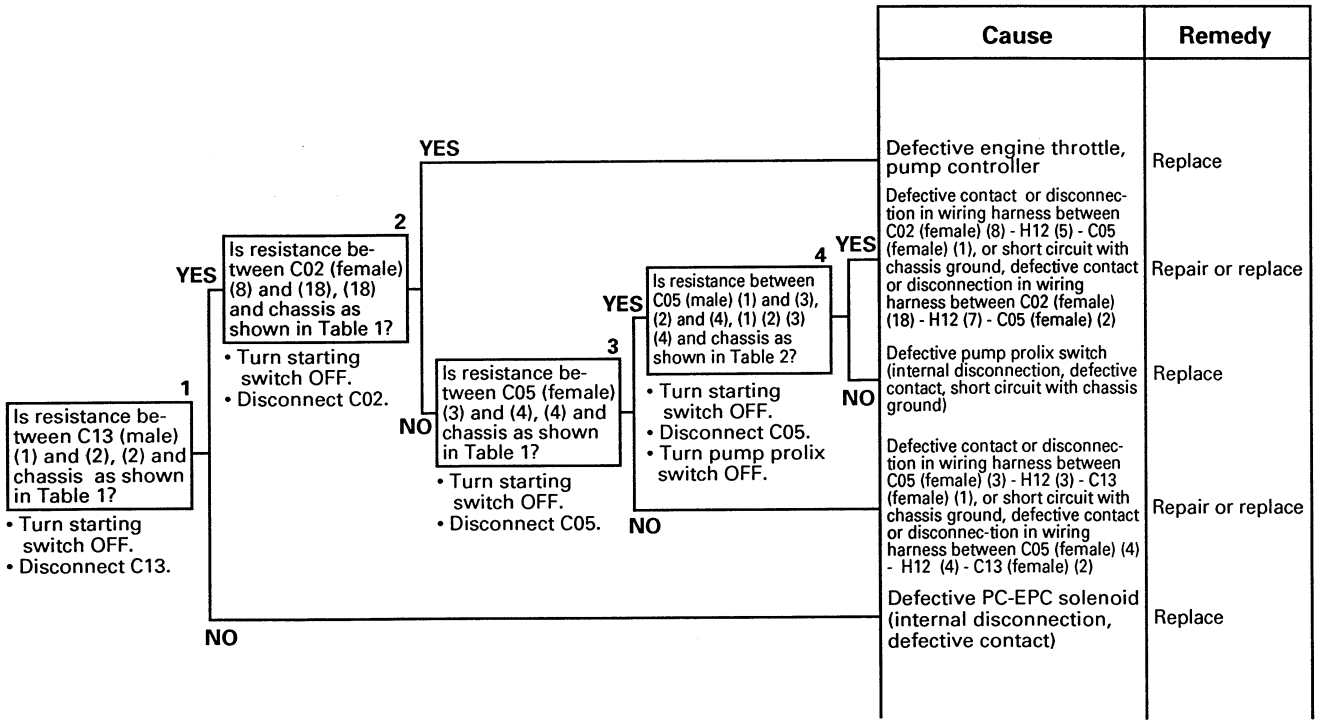


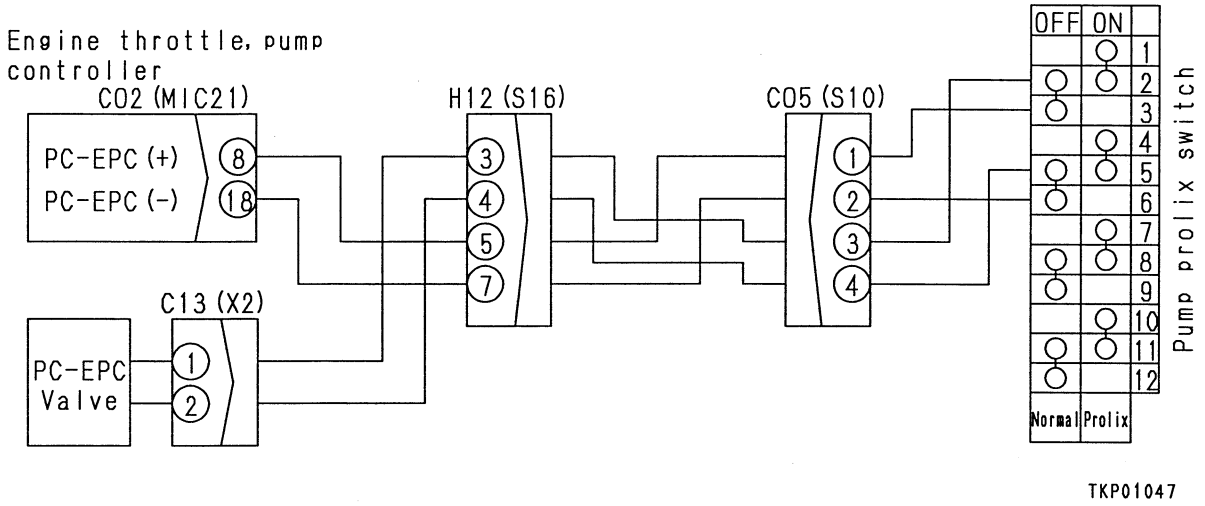
Table 1

Troubleshooting 1	Troubleshooting 2	Troubleshooting 3	Resistance value
Between C13 (male) (1) and (2)	Between C02 (female) (8) and (18)	Between C05 (female) (3) and (4)	10 – 22 Ω
Between C13 (male) (2) and chassis	Between C02 (female) (18) and chassis	Between C05 (female) (4) and chassis	Min. 1 MΩ

Table 2

Troubleshooting 4	Resistance value
Between C05 (male) (1) – (3), (2) – (4)	Max. 1 Ω
Between C05 (male) (1)(2)(3)(4) and chassis	Min. 1 MΩ

C-3 Related electrical circuit diagram



C-4 [E203] Short circuit in swing holding brake solenoid system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Always turn the swing lock prolix switch OFF, then turn the swing lock switch OFF before checking.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

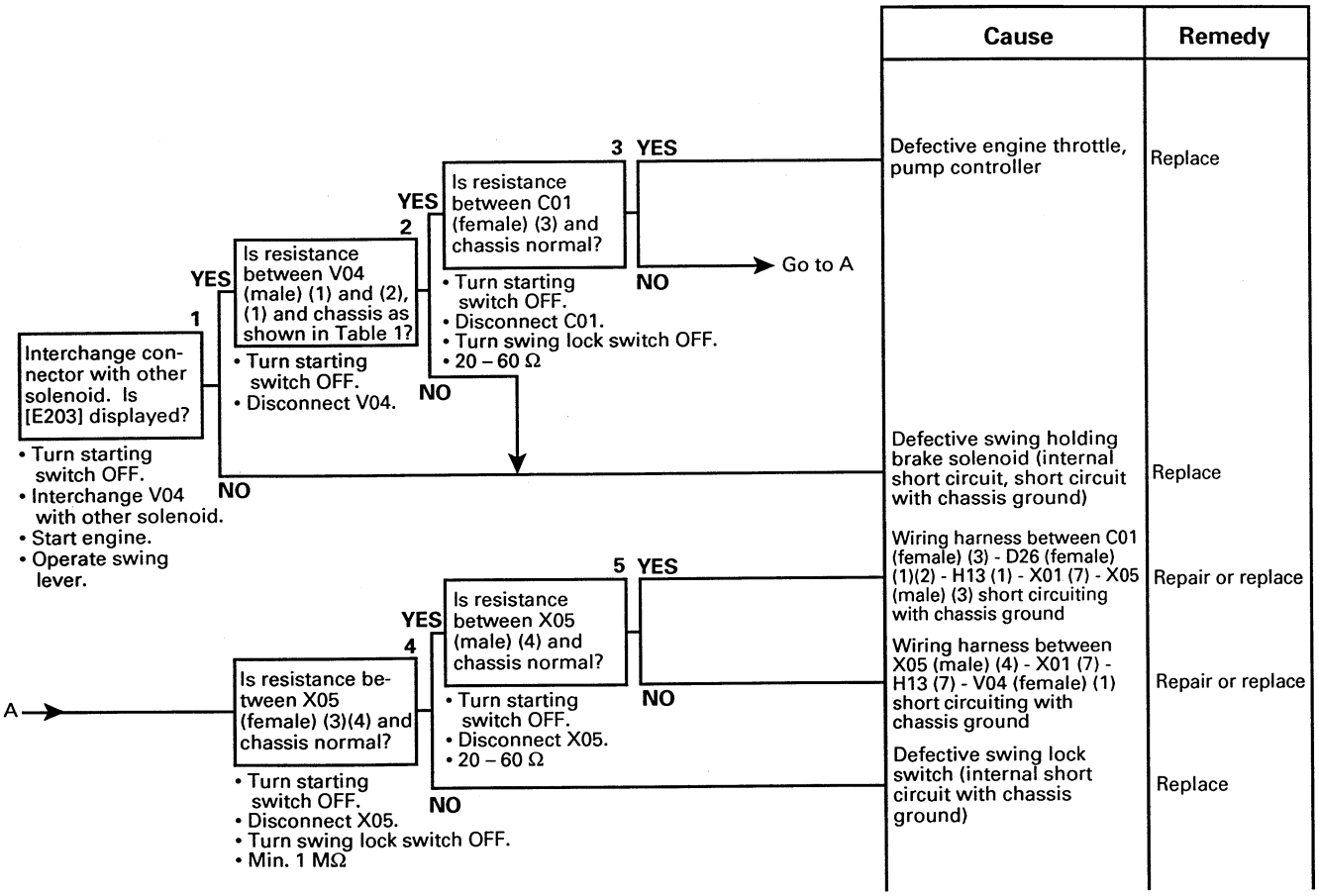
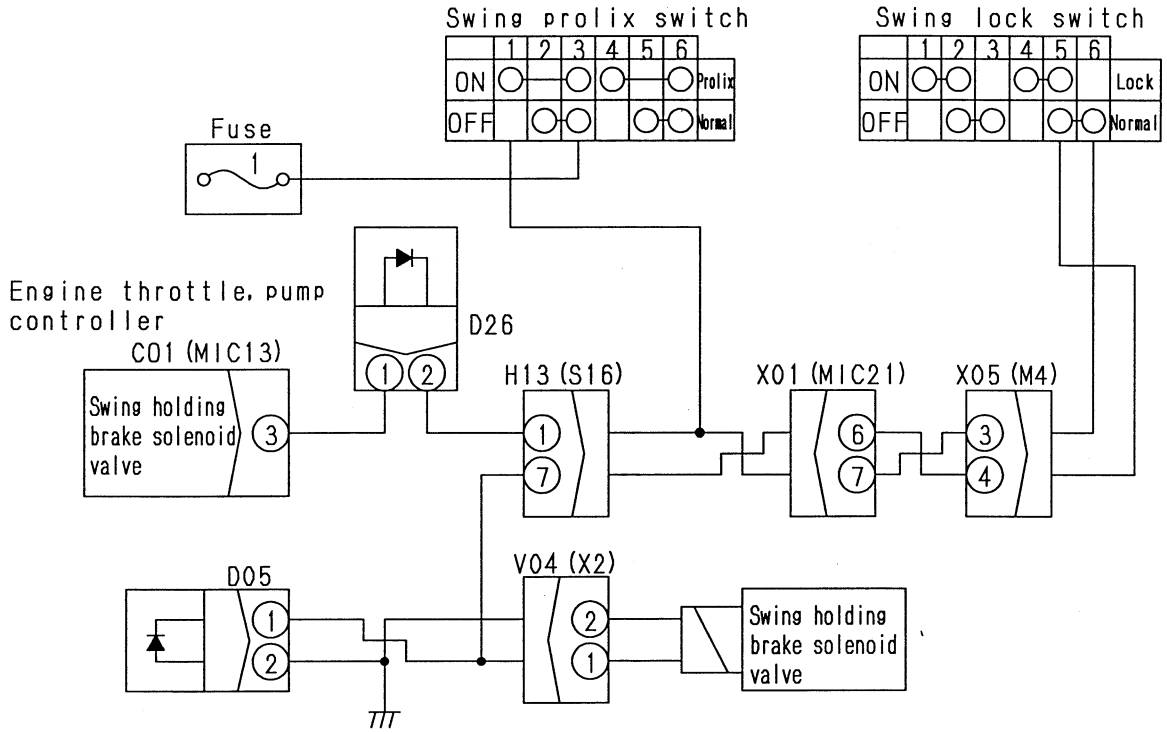


Table 1

Between V04 (male) (1) and (2)	20 – 60 Ω
Between V04 (male) (1) and chassis	Min. 1 M Ω

C-4 Related electrical circuit diagram



C-5 [E213] Disconnection in swing holding brake solenoid system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Always turn the swing lock prolix switch OFF, then turn the swing lock switch OFF before checking.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

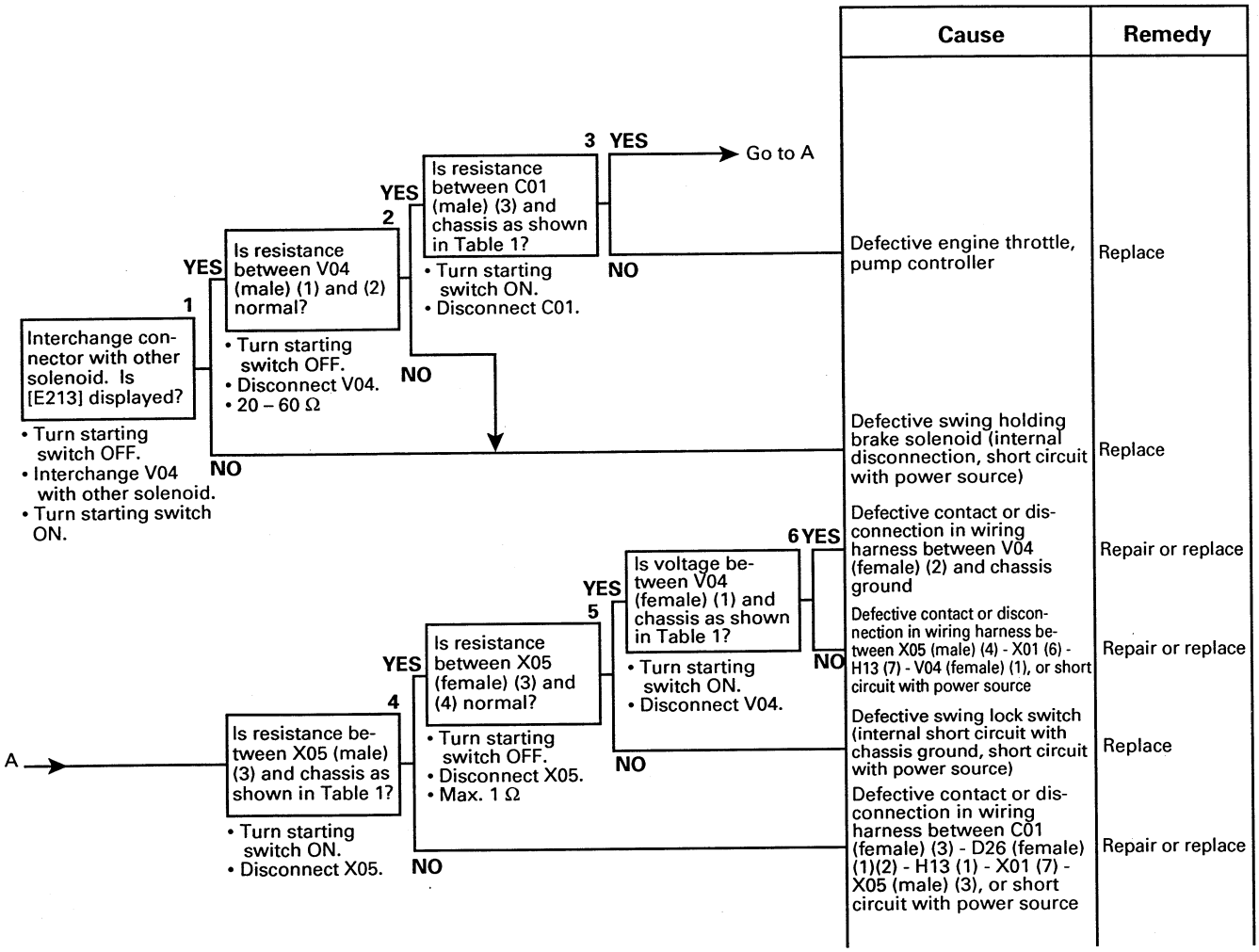
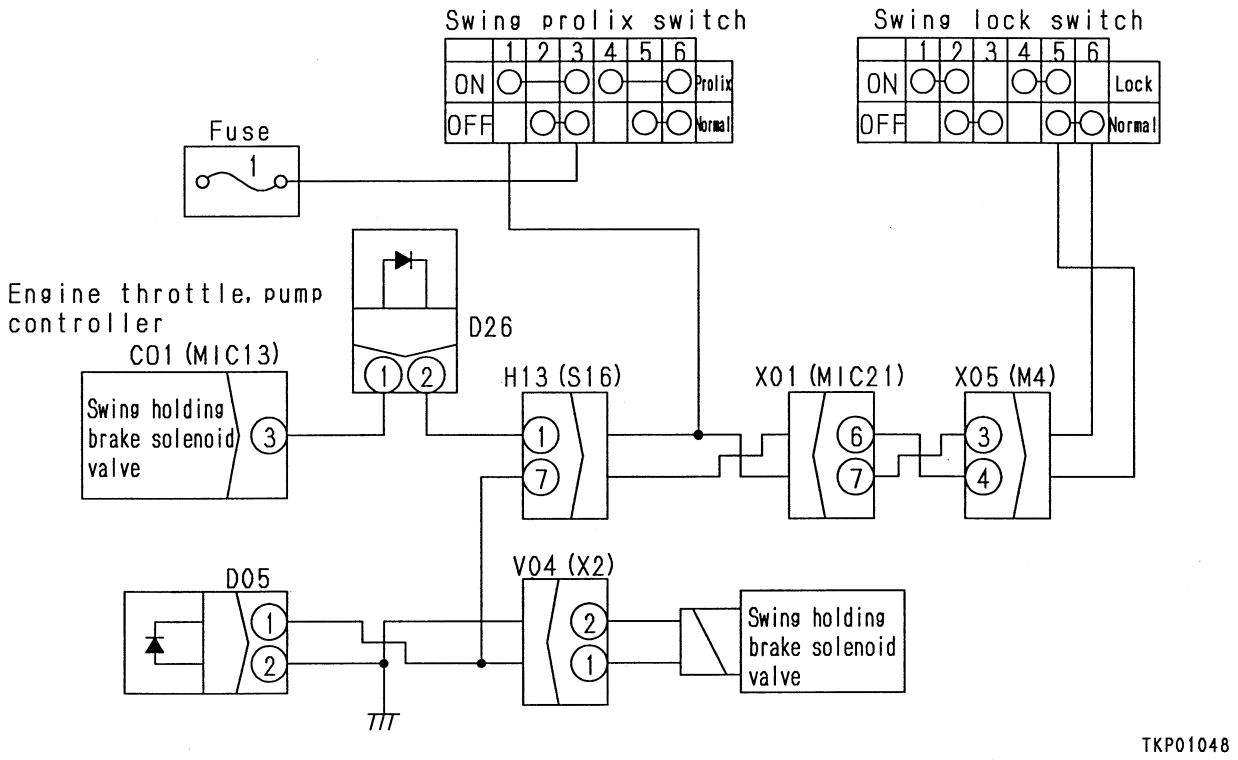


Table 1

Troubleshooting 3	Troubleshooting 4	Troubleshooting 6	Voltage	Measurement condition
Between C01 (male) (3) and chassis	Between X05 (male) (3) and chassis	Between V04 (female) (1) and chassis	0 – 3 V	5 sec. after all levers are returned to neutral
			20 – 30 V	When swing lever is operated

C-5 Related electrical circuit diagram



C-6 [E205] Short circuit in 2-stage relief solenoid system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

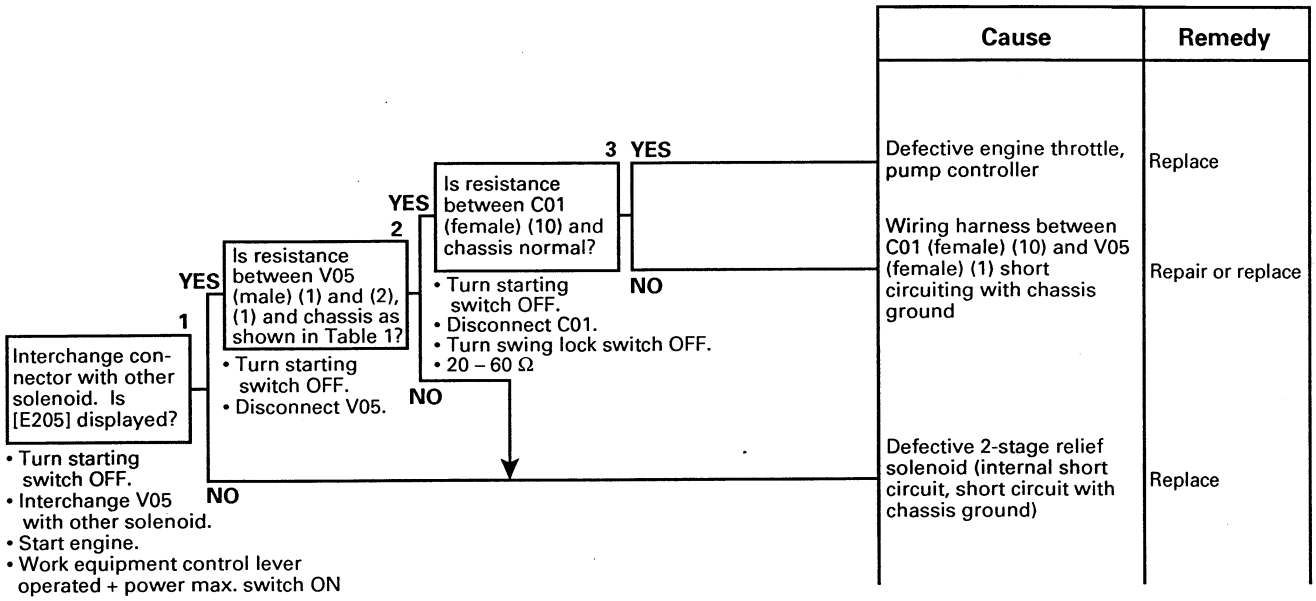
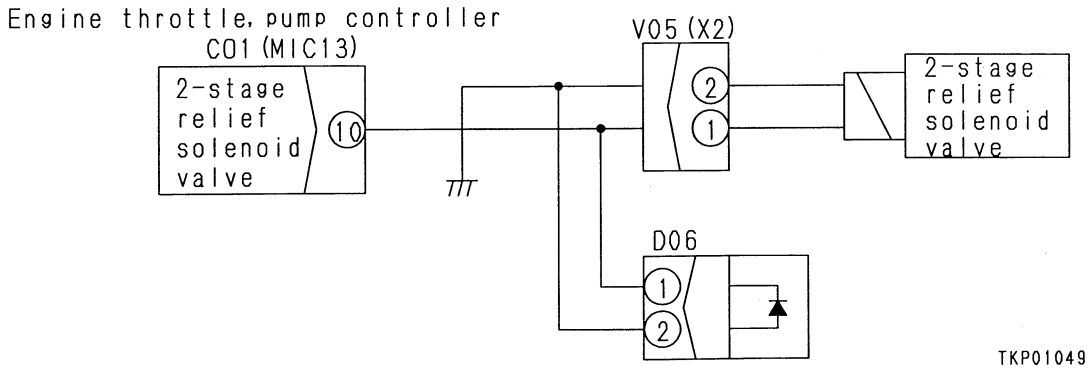


Table 1

Between V05 (male) (1) and (2)	20 – 60 Ω
Between V05 (male) (1) and chassis	Min. 1 MΩ

C-6 Related electrical circuit diagram



C-7 [E215] Disconnection in 2-stage relief solenoid system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

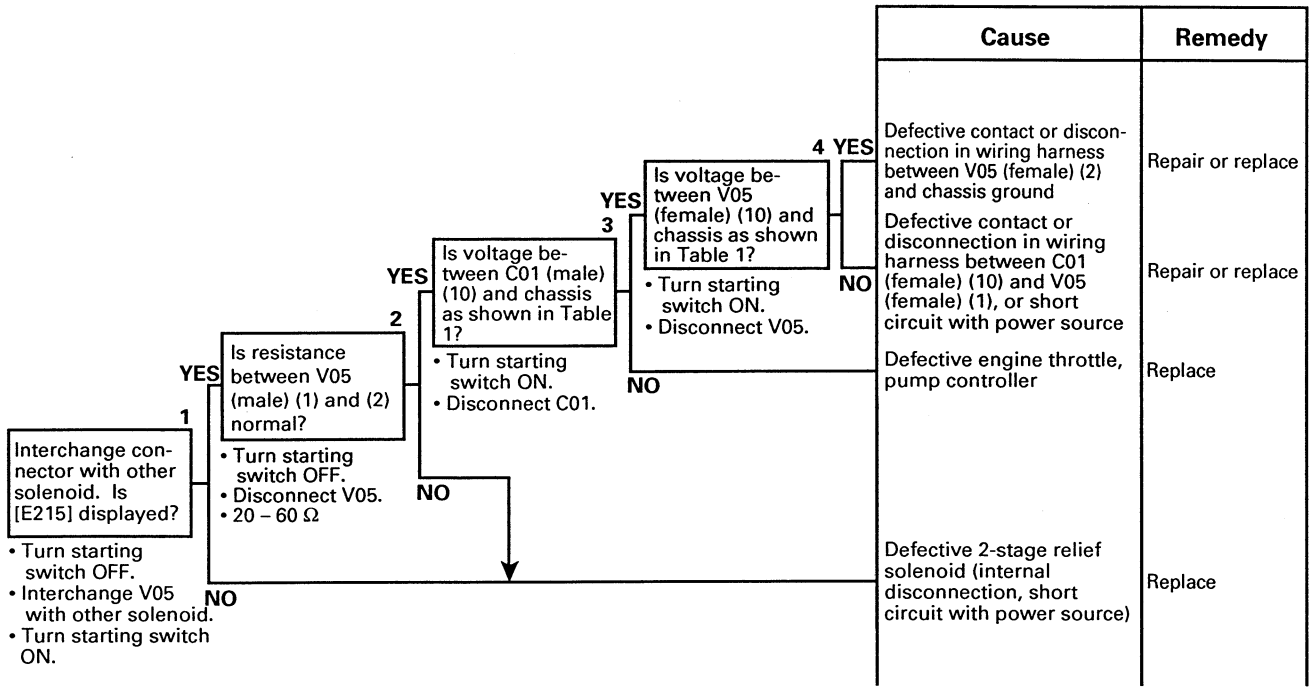
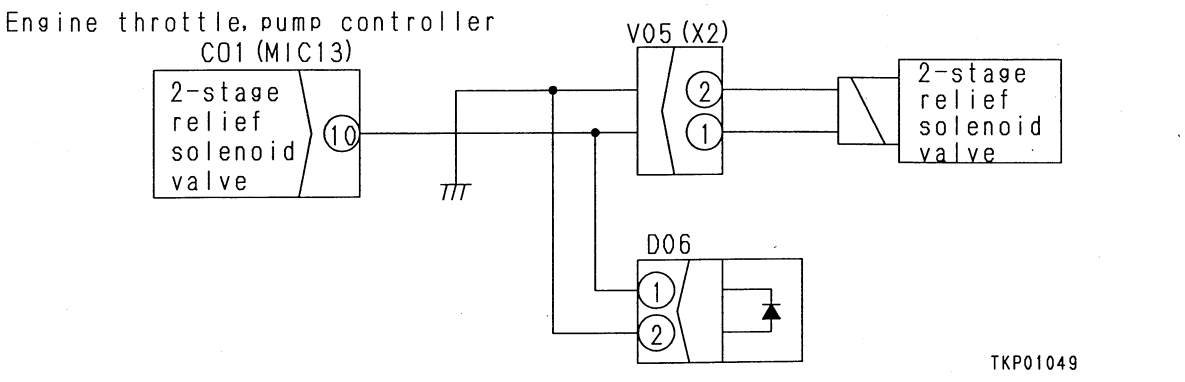


Table 1

Troubleshooting 3	Troubleshooting 4	Voltage	Measurement condition
Between C01 (male) (10) and chassis	Between V05 (female) (1) and chassis	0 – 3 V	All control levers at neutral
		20 – 30 V	When control lever is operated + power max. switch ON

C-7 Related electrical circuit diagram



C-8 [E206] Short circuit in travel speed solenoid system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

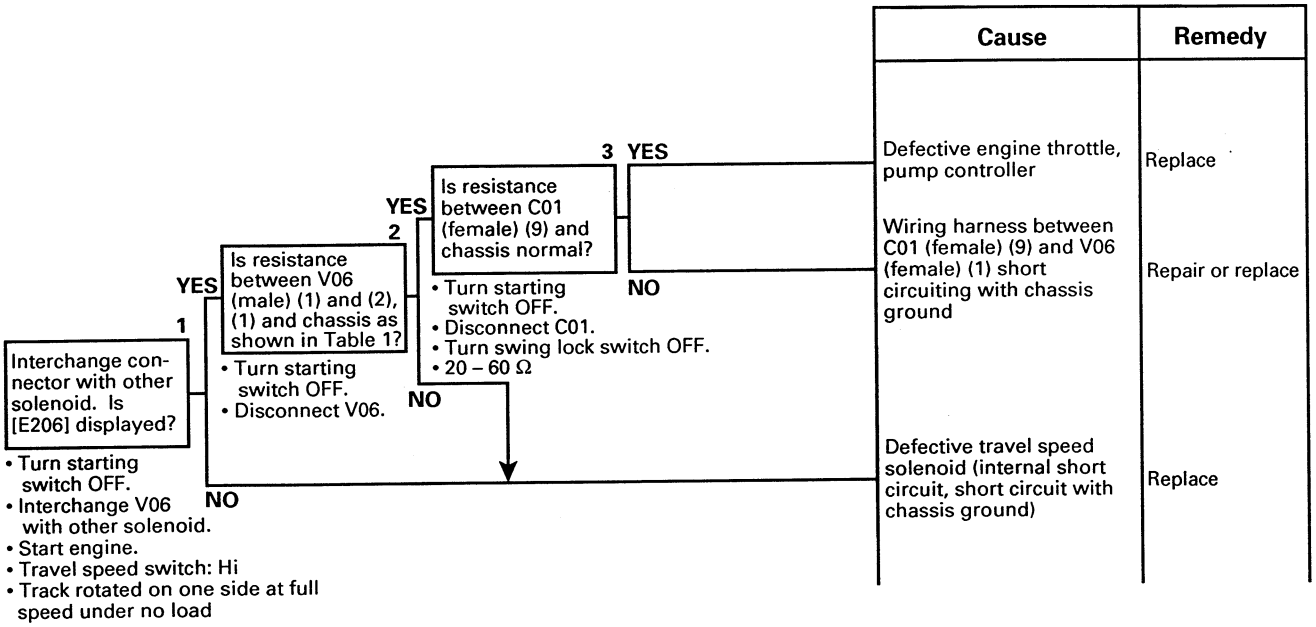
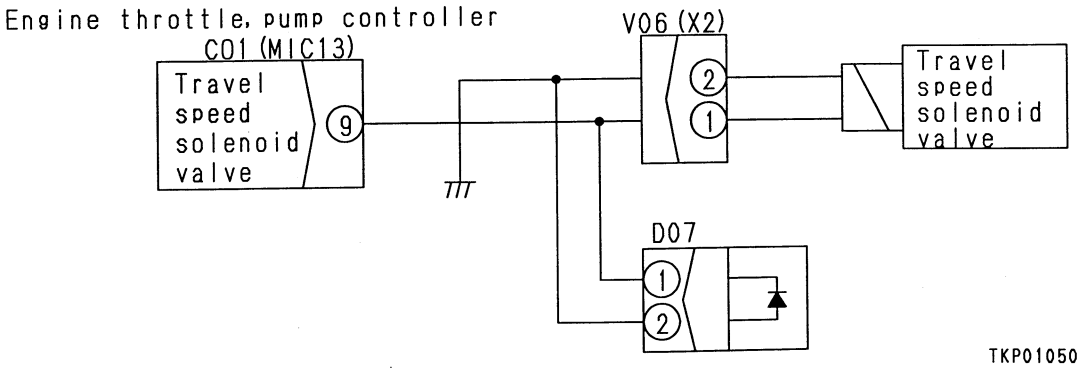


Table 1

Between V06 (male) (1) and (2)	20 – 60 Ω
Between V06 (male) (1) and chassis	Min. 1 M Ω

C-8 Related electrical circuit diagram



C-9 [E216] Disconnection in travel speed solenoid system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

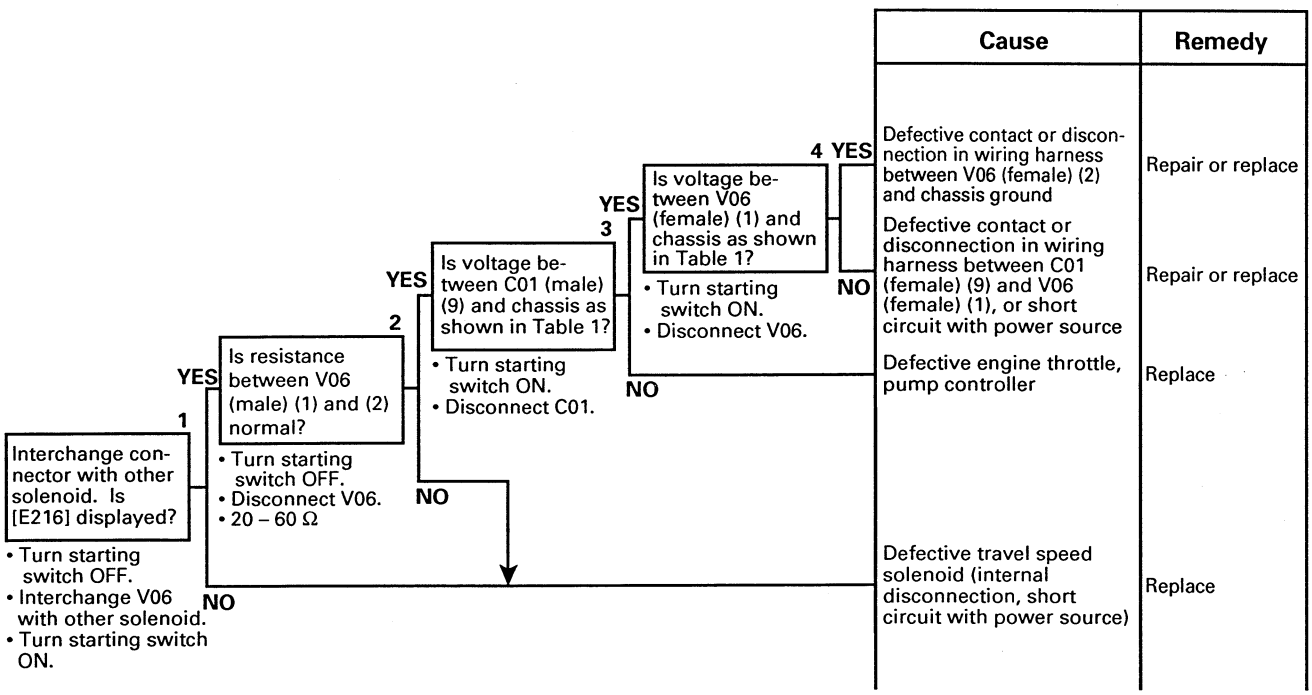
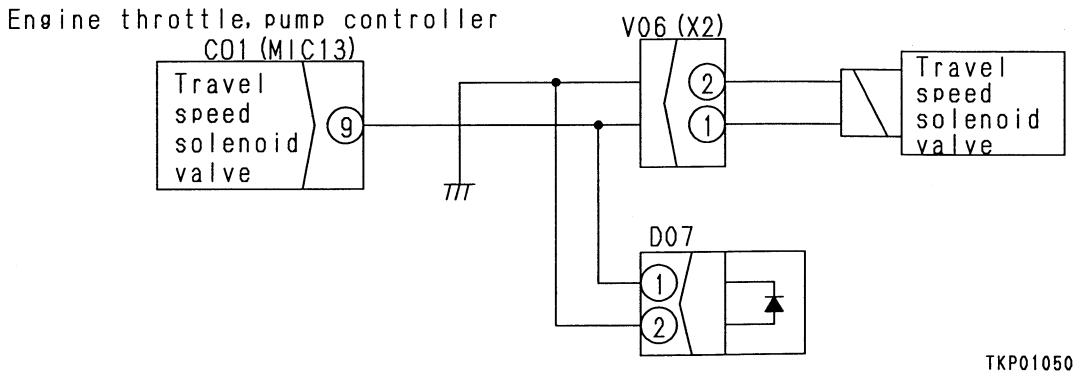


Table 1

Troubleshooting 3	Troubleshooting 4	Voltage	Measurement condition
Between C01 (male) (9) and chassis	Between V06 (female) (1) and chassis	0 – 3 V	When travel speed switch is at Lo
		20 – 30 V	Travel speed switch Hi + track rotated on one side at full speed under no load

C-9 Related electrical circuit diagram



C-10 [E207] Short circuit in active mode solenoid system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

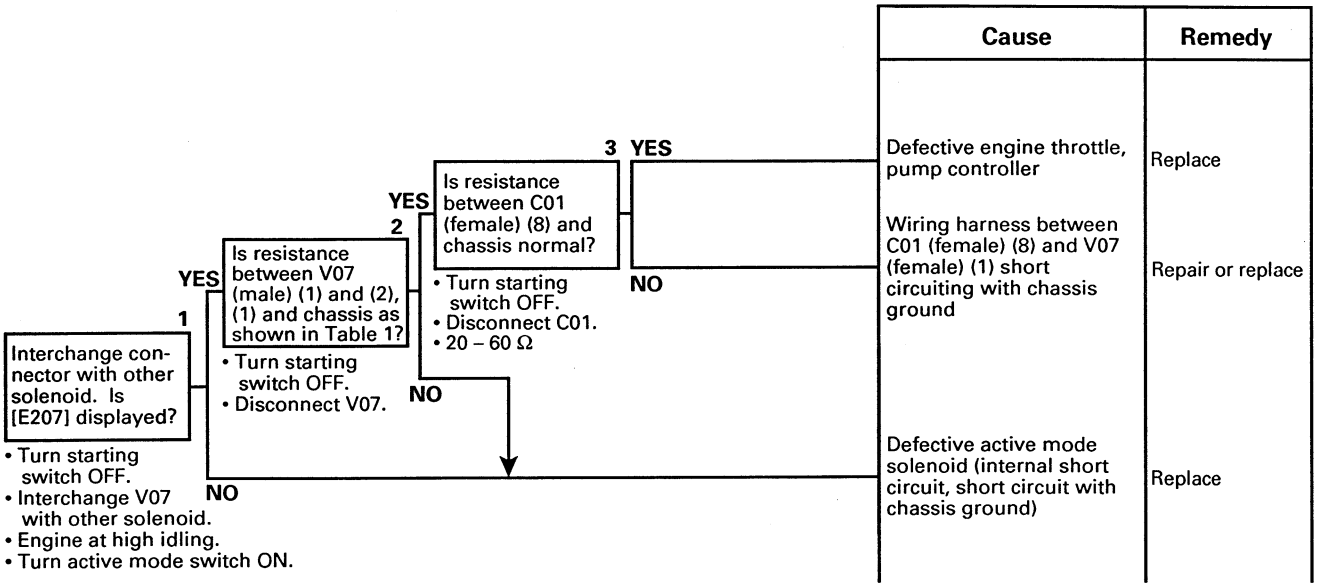
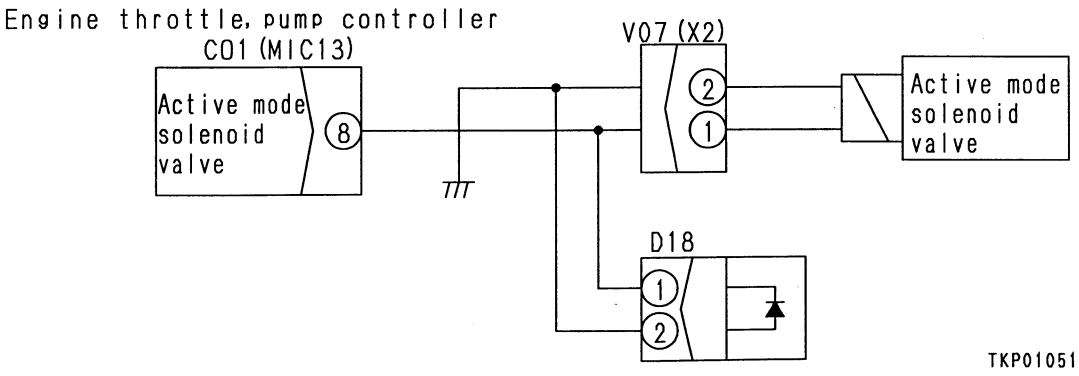


Table 1

Between V07 (male) (1) and (2)	20 – 60 Ω
Between V07 (male) (1) and chassis	Min. 1 M Ω

C-10 Related electrical circuit diagram



C-11 [E208] Disconnection in active mode solenoid system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

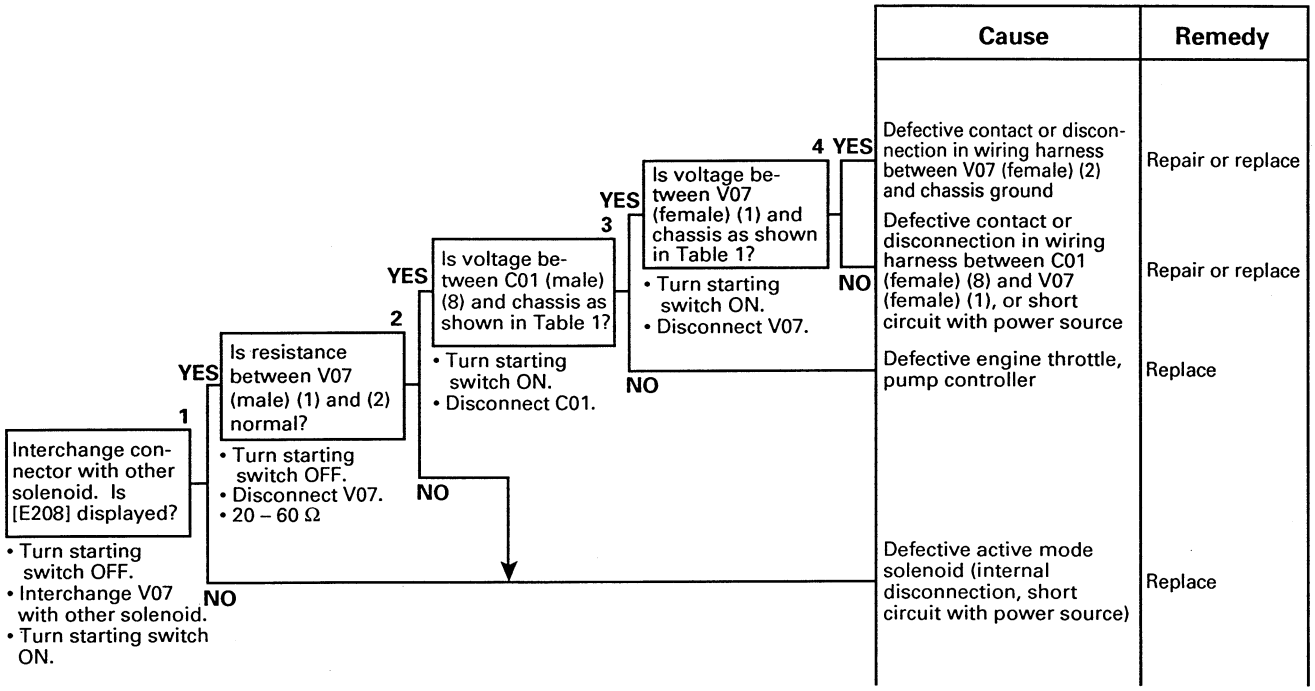
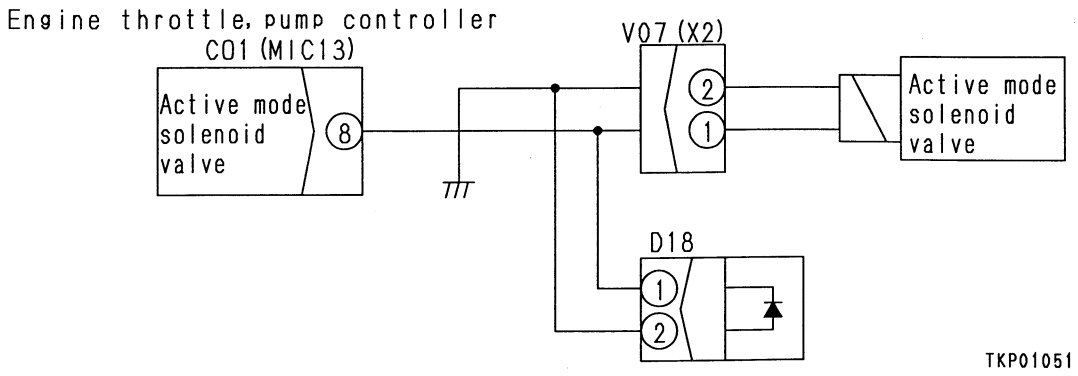


Table 1

Troubleshooting 3	Troubleshooting 4	Voltage	Measurement condition
Between C01 (male) (8) and chassis	Between V07 (female) (2) and chassis	0 – 3 V	Active mode switch OFF
		20 – 30 V	Engine at full throttle + active mode switch ON

C-11 Related electrical circuit diagram



C-12 [E217] Model selection input error is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

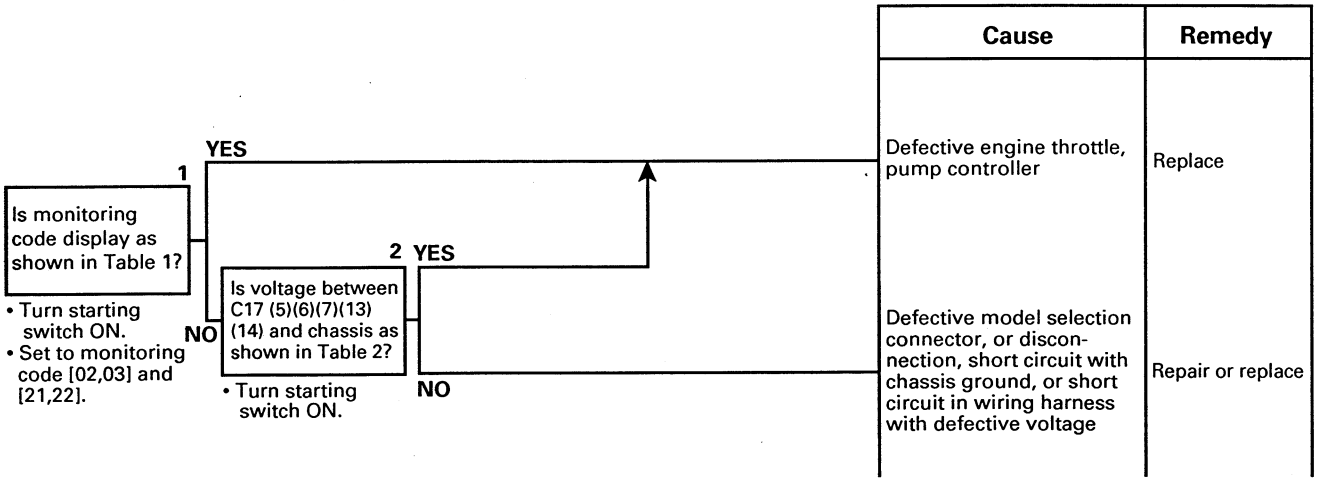
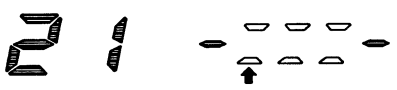
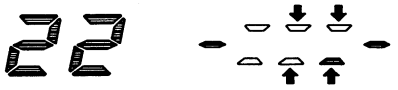


Table 1 Monitoring code display

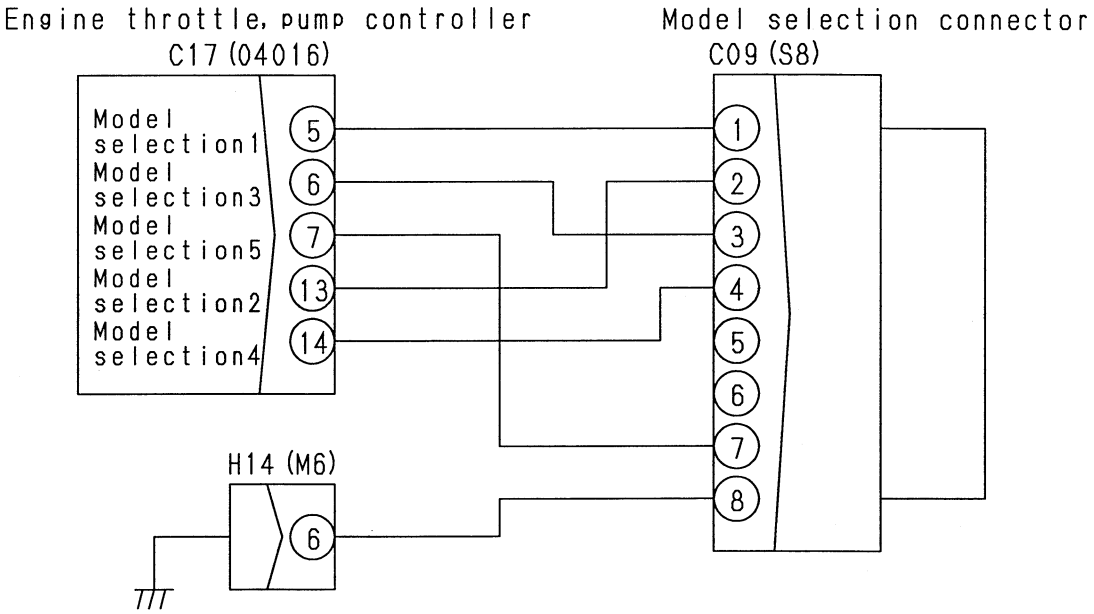
Model code display	Display of model selection signal input	
Monitoring code 02, 03	Monitoring code 21	Monitoring code 22
 BKP00368	 BKP00194	 BKP00370

★ The diagram shows monitoring code 02.
★ Check the display of the bit pattern marked by the arrow.

Table 2 Voltage wirning harness

Between (5) and chassis	Between (6) and chassis	Between (7) and chassis	Between (13) and chassis	Between (14) and chassis
Max. 1V	20 – 30 V	20 – 30 V	20 – 30 V	20 – 30 V

C-12 Related electrical circuit diagram



TKP01053

C-13 [E222] Short circuit in LS-EPC solenoid system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

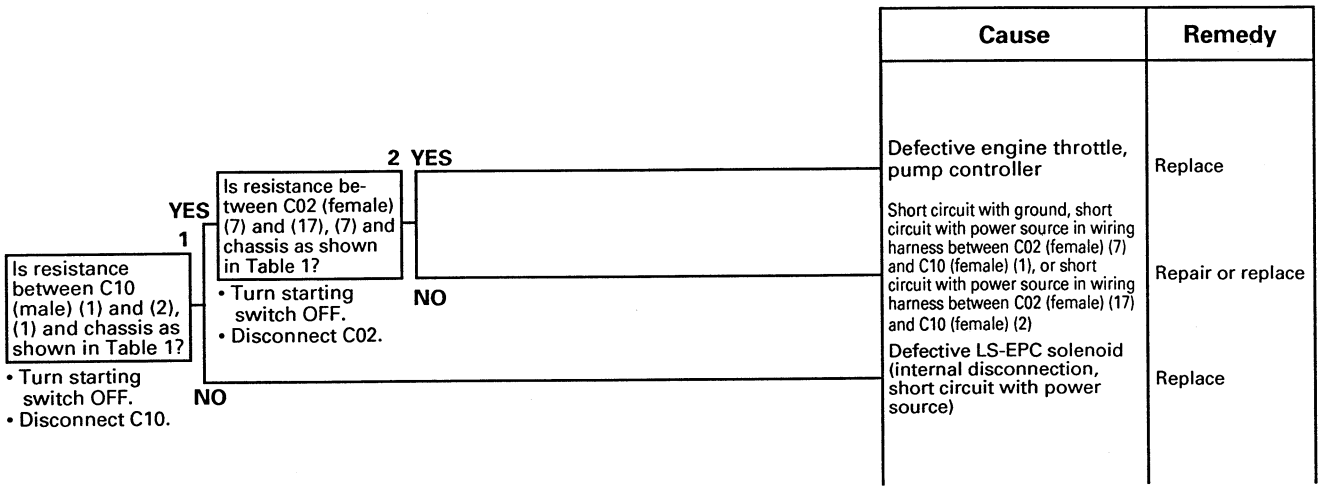
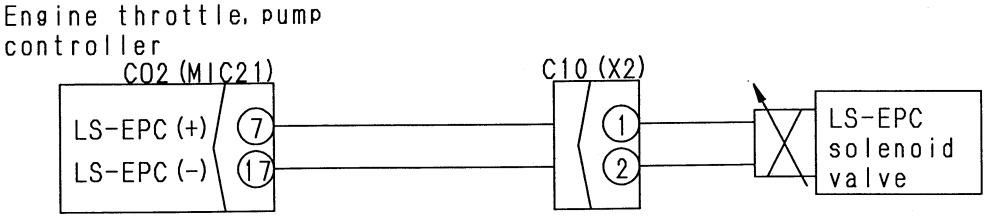


Table 1

Troubleshooting 1	Troubleshooting 2	Resistance value
Between C10 (male) (1) and (2)	Between C02 (female) (7) and (17)	7 – 14 Ω
Between C10 (male) (1) and chassis	Between C02 (female) (7) and chassis	Min. 1 MΩ

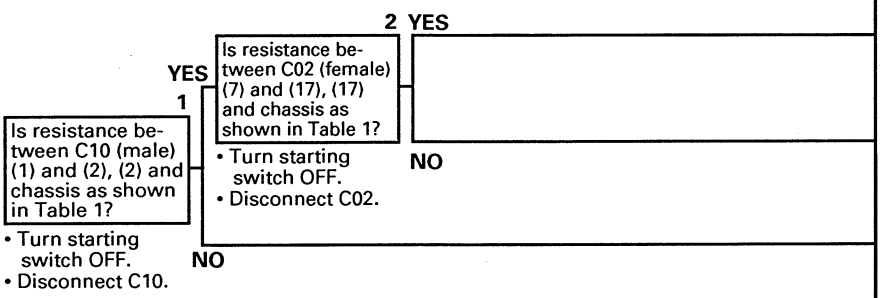
C-13 Related electrical circuit diagram



TKP01054

C-14 [E223] Disconnection in LS-EPC solenoid system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

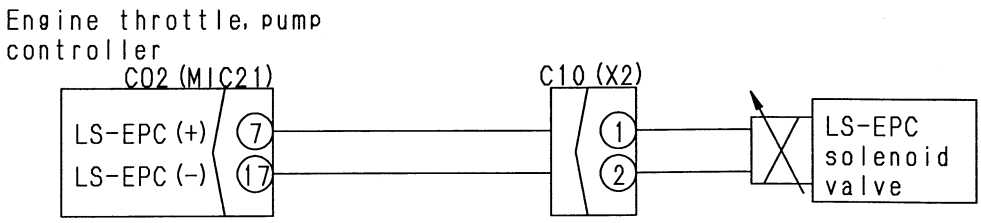


Cause	Remedy
Defective engine throttle, pump controller	Replace
Defective contact short circuit with chassis ground in wiring harness between C02 (female) (7) and C10 (female) (1), or defective contact or discon-nection in wiring harness be-tween C02 (female) (17) and C10 (female) (2) or short circuit with chassis ground	Repair or replace
Defective LS-EPC solenoid (internal disconnection, defective contact, short circuit with chassis ground)	Replace

Table 1

Troubleshooting 1	Troubleshooting 2	Resistance value
Between C10 (male) (1) and (2)	Between C02 (female) (7) and (17)	7 – 14 Ω
Between C10 (male) (2) and chassis	Between C02 (female) (17) and chassis	Min. 1 MΩ

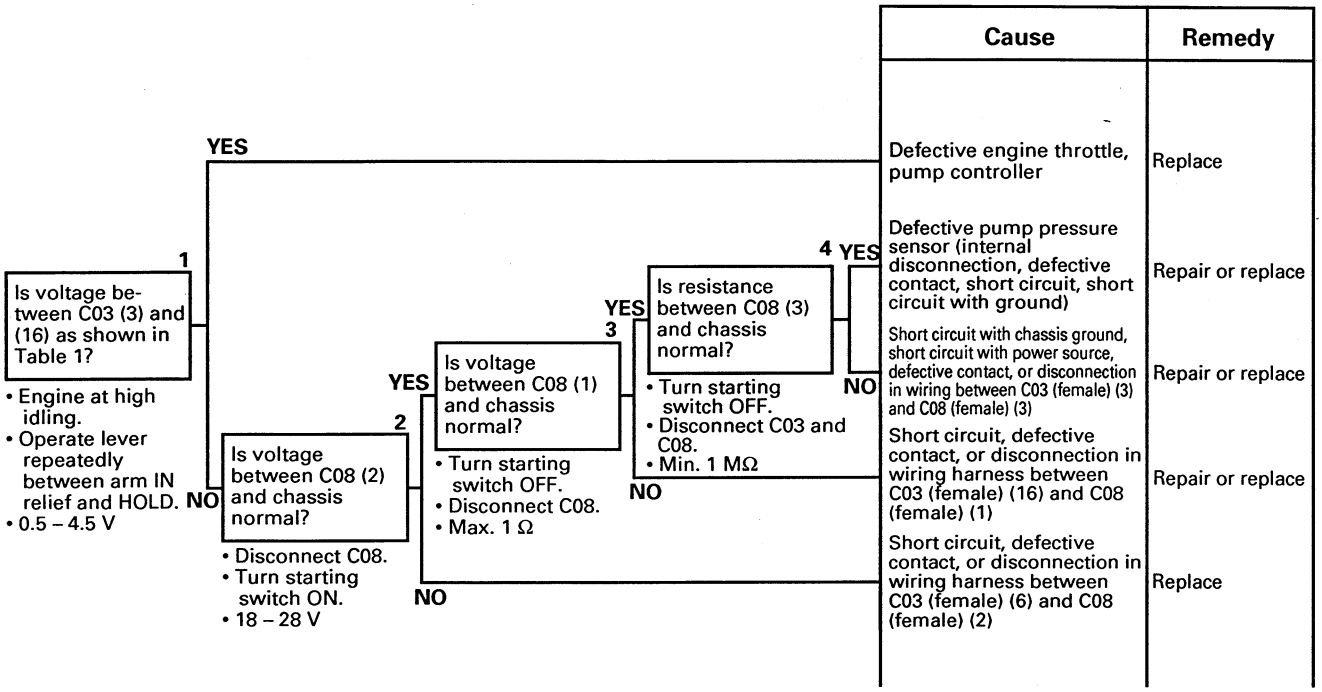
C-14 Related electrical circuit diagram



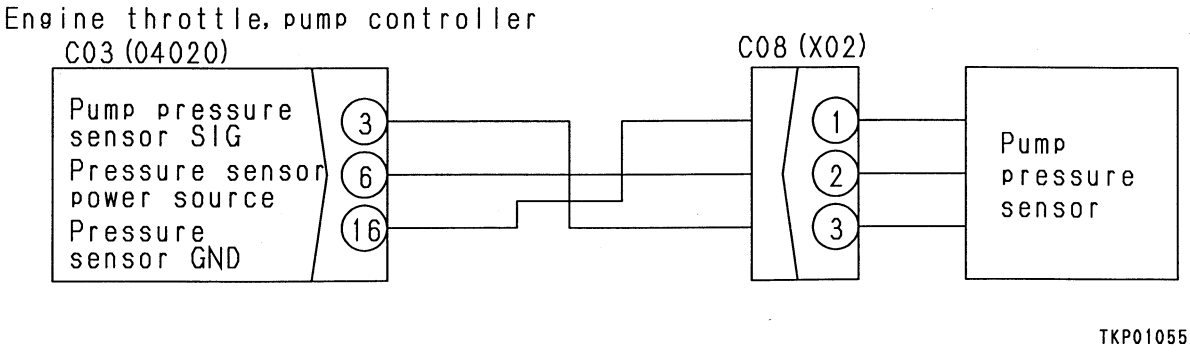
TKP01054

C-15 [E224] Abnormality in pump pressure sensor system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



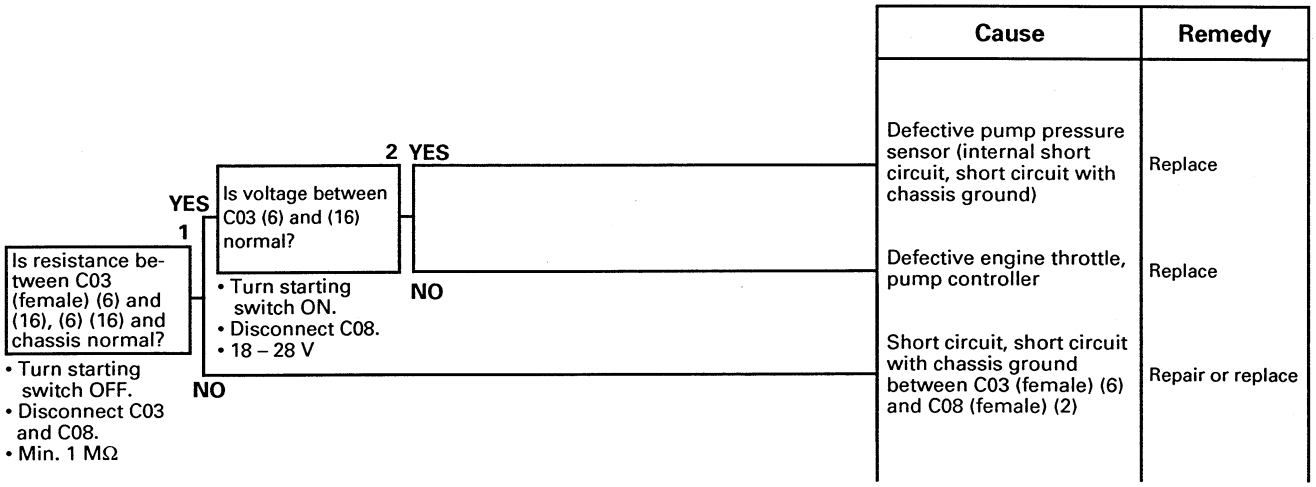
C-15 Related electrical circuit diagram



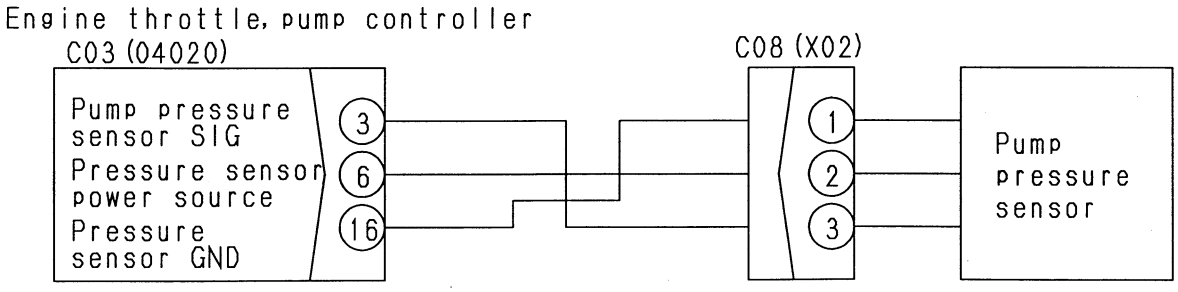
TKP01055

C-16 [E226] Abnormality in pressure sensor power source system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



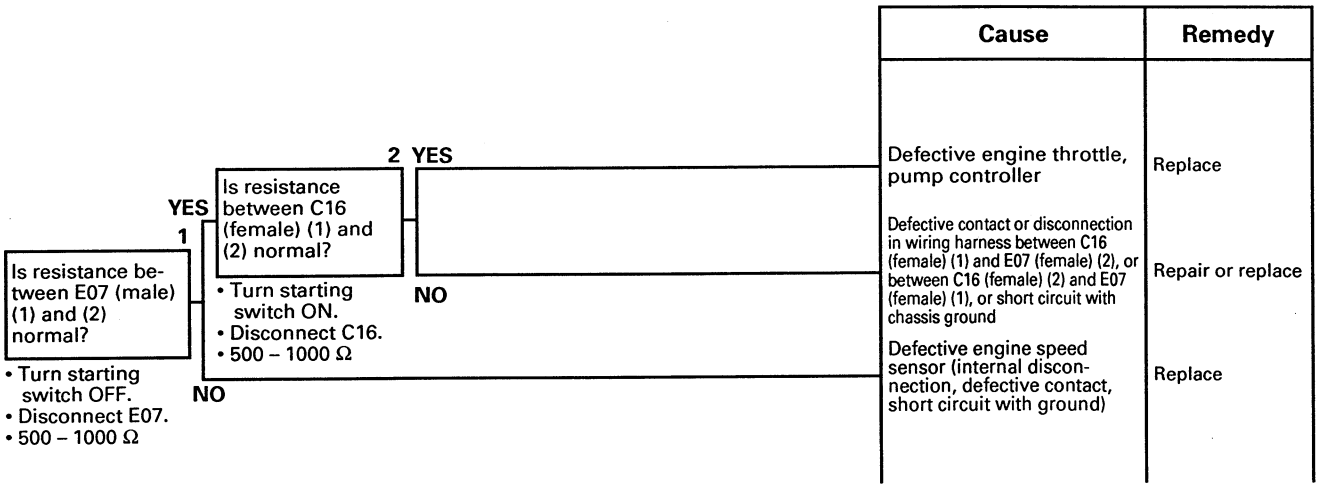
C-16 Related electrical circuit diagram



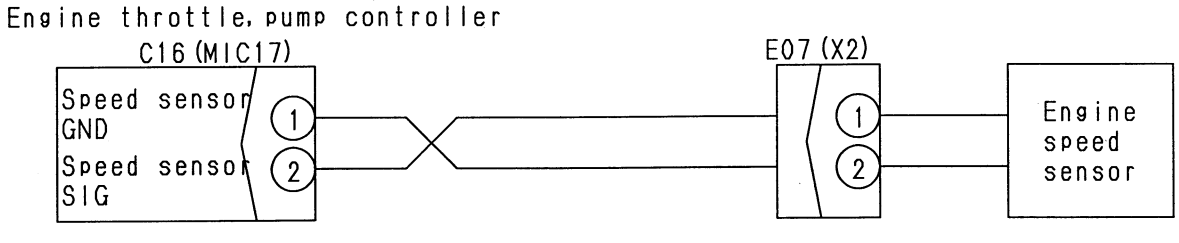
TKP01055

C-17 [E227] Abnormality in engine speed sensor system is displayed

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the service code "E" is not displayed, the problem has been removed.**
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check that the service code "E" is displayed. (If it is not displayed, the problem has been removed.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



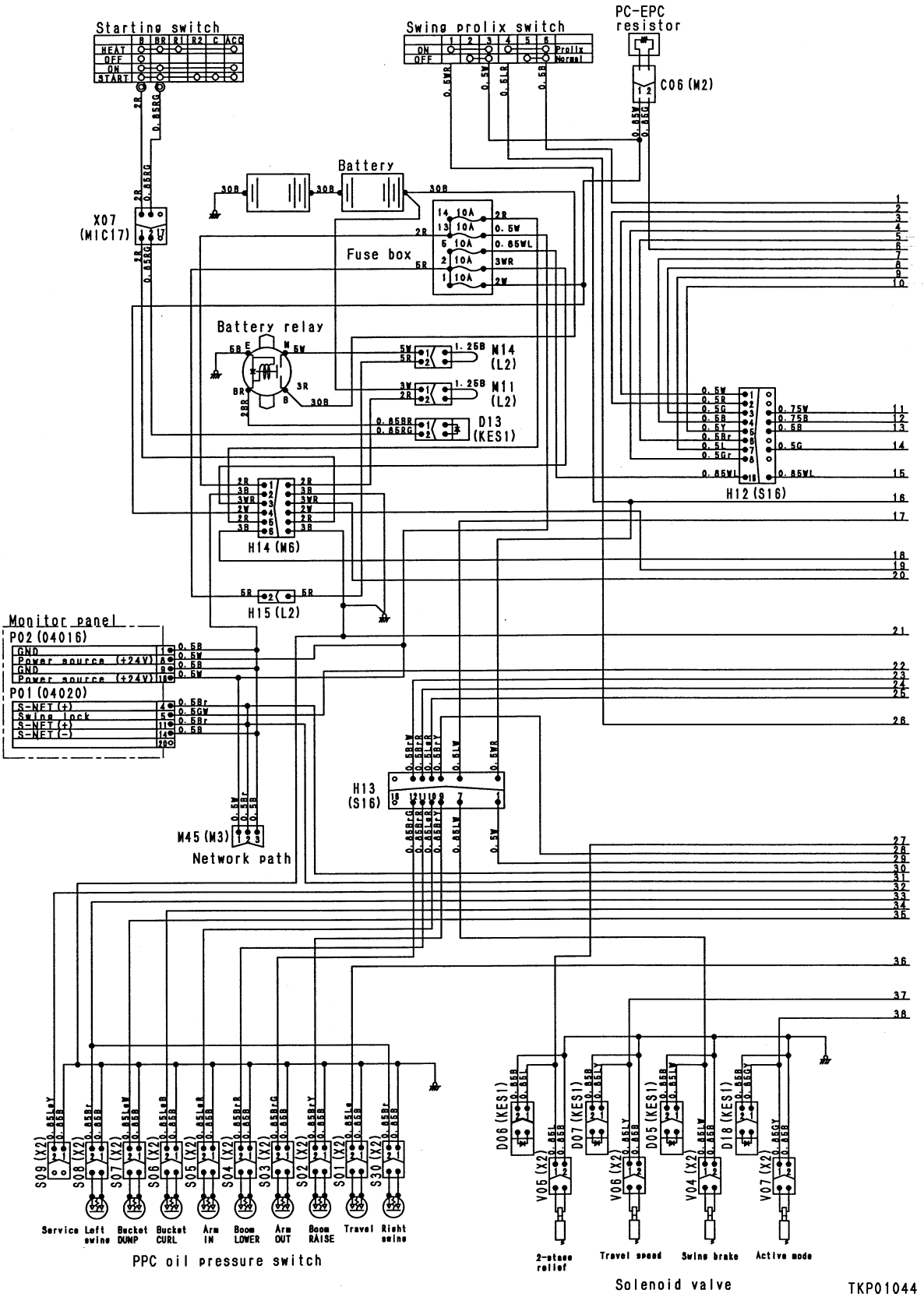
C-17 Related electrical circuit diagram

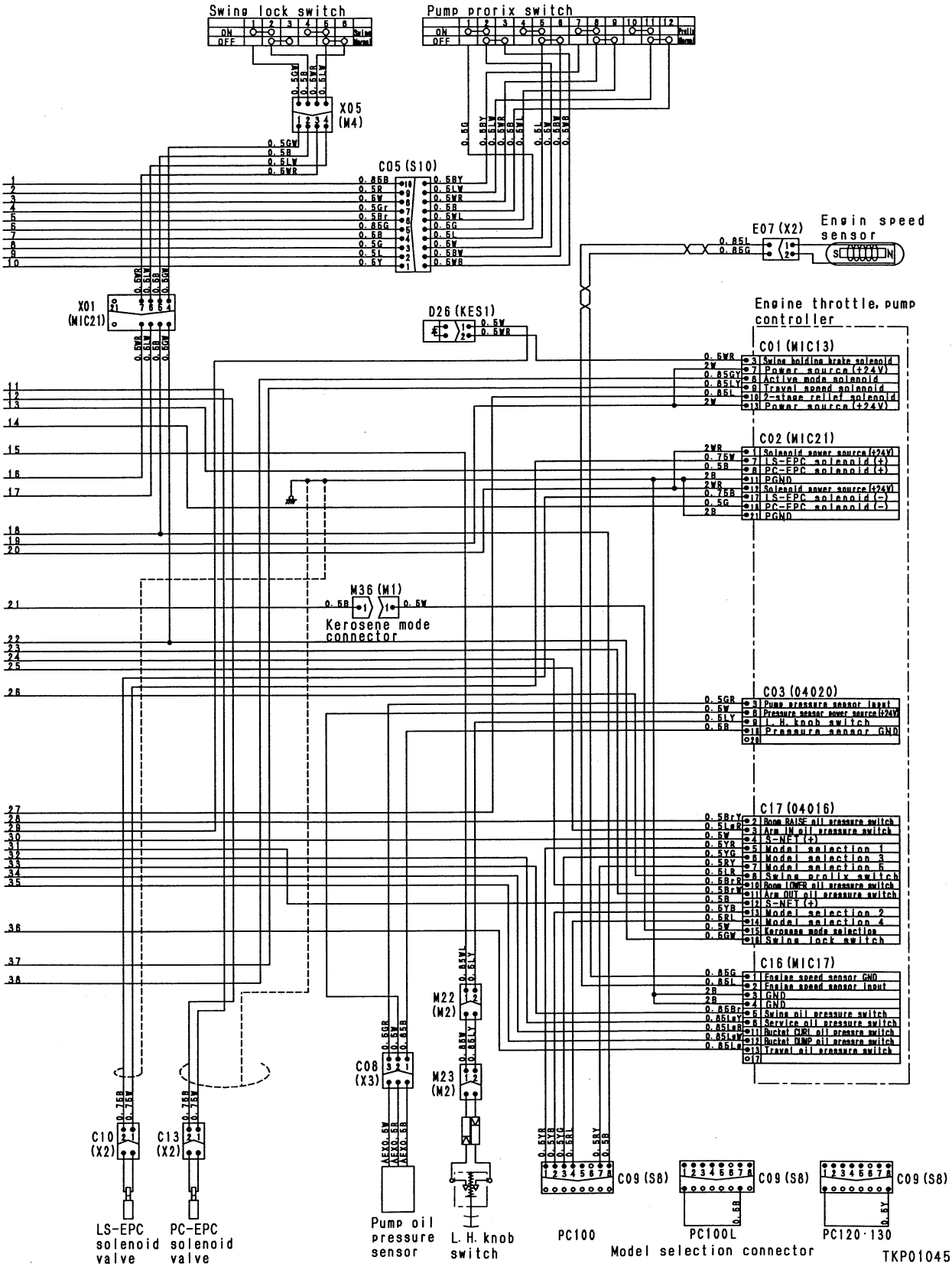


TKP01056

TROUBLESHOOTING OF ENGINE THROTTLE, PUMP CONTROLLER [INPUT SIGNAL SYSTEM] (F MODE)

ELECTRICAL CIRCUIT DIAGRAM OF F MODE SYSTEM



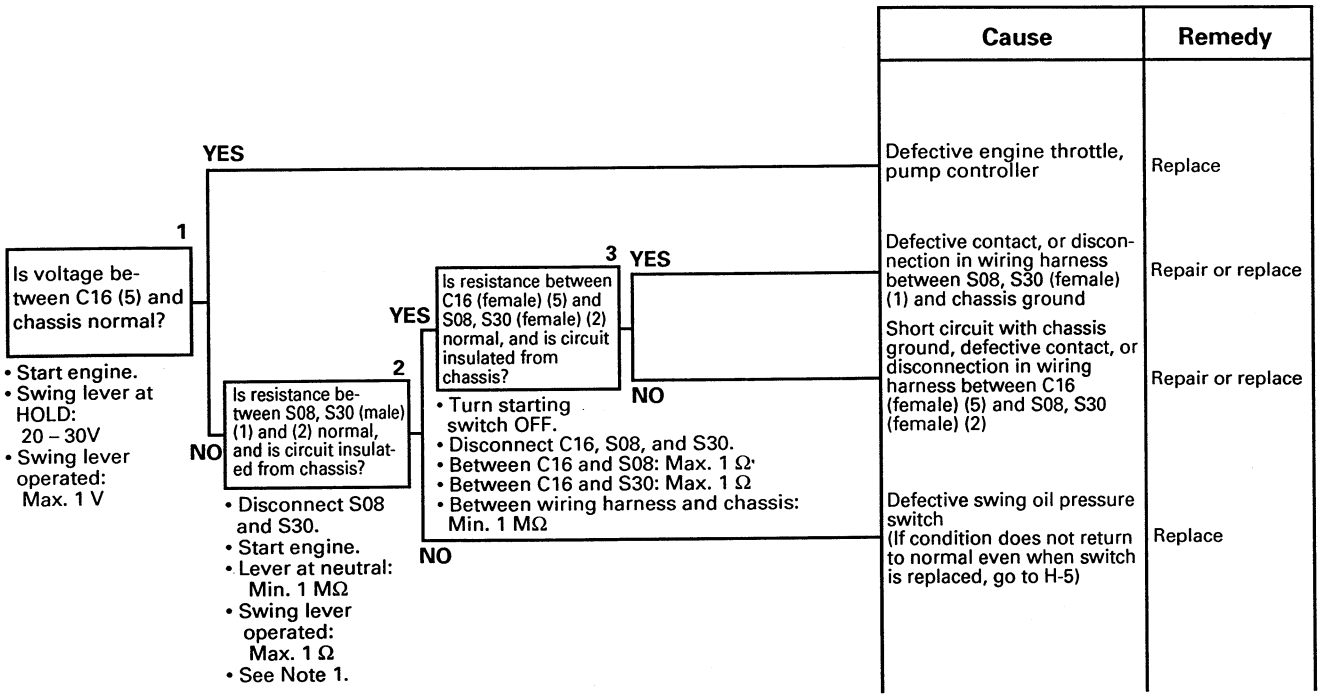

Swing lock switch
Pump prorix switch
X05 (M4)
C05 (S10)
E07 (X2)
Engin speed sensor
X01 (MIC21)
D26 (KES1)
Engine throttle, pump controller
C01 (MIC13)
C02 (MIC21)
M36 (M1)
Kerosene mode connector
C03 (04020)
C17 (04016)
C16 (MIC17)
M22 (M2)
M23 (M2)
C08 (X3)
C10 (X2)
C13 (X2)
C09 (S8)
LS-EPC solenoid valve
PC-EPC solenoid valve
Pump oil pressure sensor
L. H. knob switch
PC100
PC100L
PC120·130
Model selection connector
TKP01045

F-1 Bit pattern 20-(1) Swing oil pressure switch does not light up

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the monitoring mode display returns to normal, the problem has been removed.**

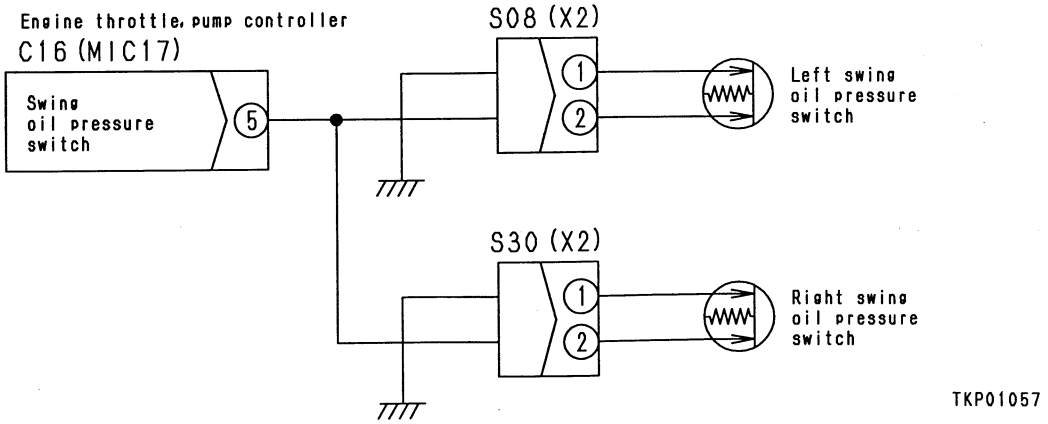
⚠ Turn the swing lock switch ON before operating the swing lever.

★ If there is no display when the lever is operated in one direction, the PPC shuttle valve is defective. (See H-5)
(When measuring with the engine stopped, charge the accumulator before starting.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



Note 1: It is also possible to fit a short connector and judge the condition. In this case, check the voltage between C16 (5) and the chassis.
- If it is 20 – 30V : Go to YES
- If it is less than 1V : Go to NO

F-1 Related electrical circuit diagram

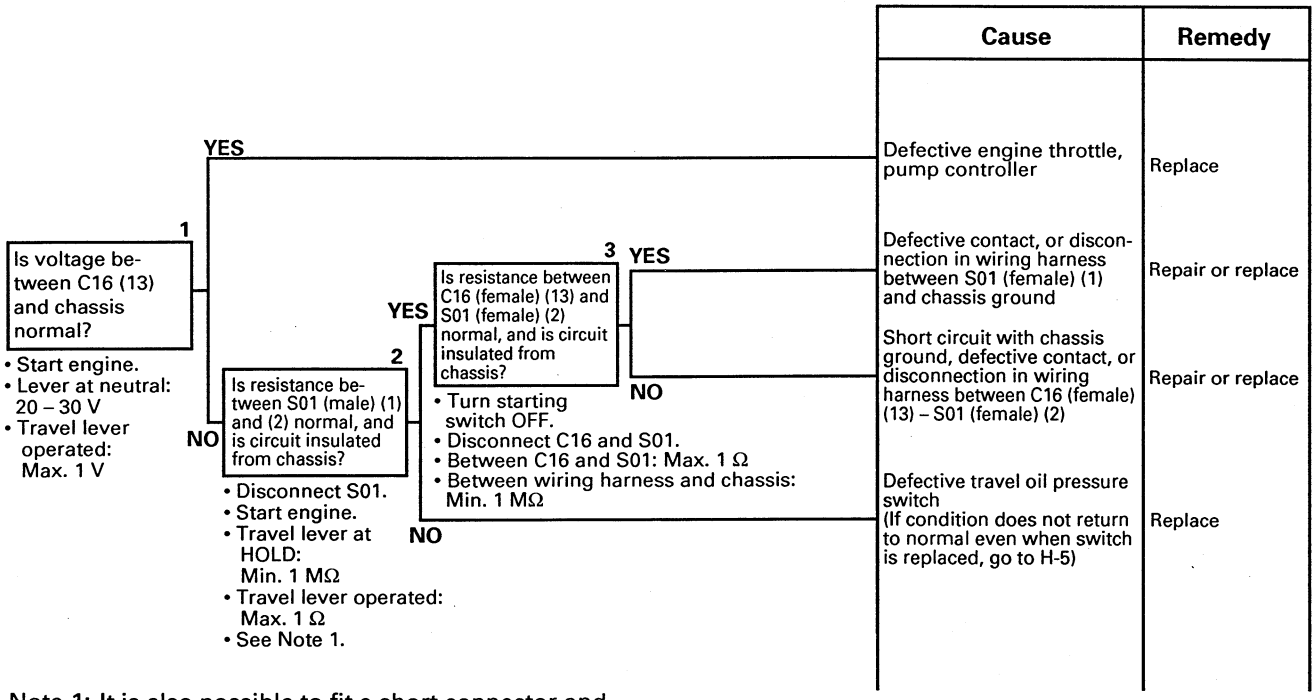


F-2 Bit pattern 20-(2) Travel oil pressure switch does not light up

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the monitoring mode display returns to normal, the problem has been removed.**

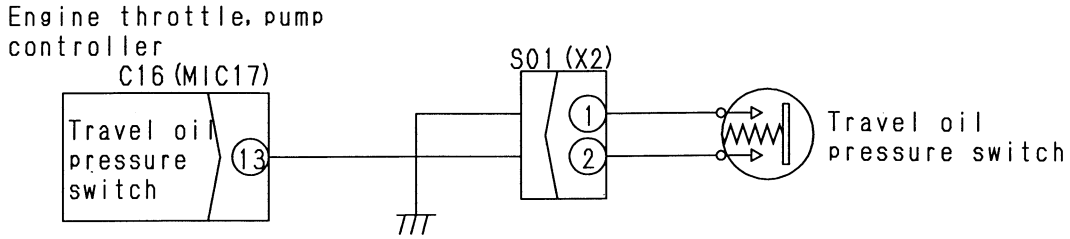
⚠ Before operating the travel lever, check that the surrounding area is safe.

★ If there are displays which light up and not light up when the travel lever is operated on every operations, the PPC shuttle valve is defective. (See H-5)
(When measuring with the engine stopped, charge the accumulator before starting.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



Note 1: It is also possible to fit a short connector and judge the condition. In this case, check the voltage between C16 (13) and the chassis.
- If it is 20 – 30V : Go to YES
- If it is less than 1V : Go to NO

F-2 Related electrical circuit diagram



TKP01058

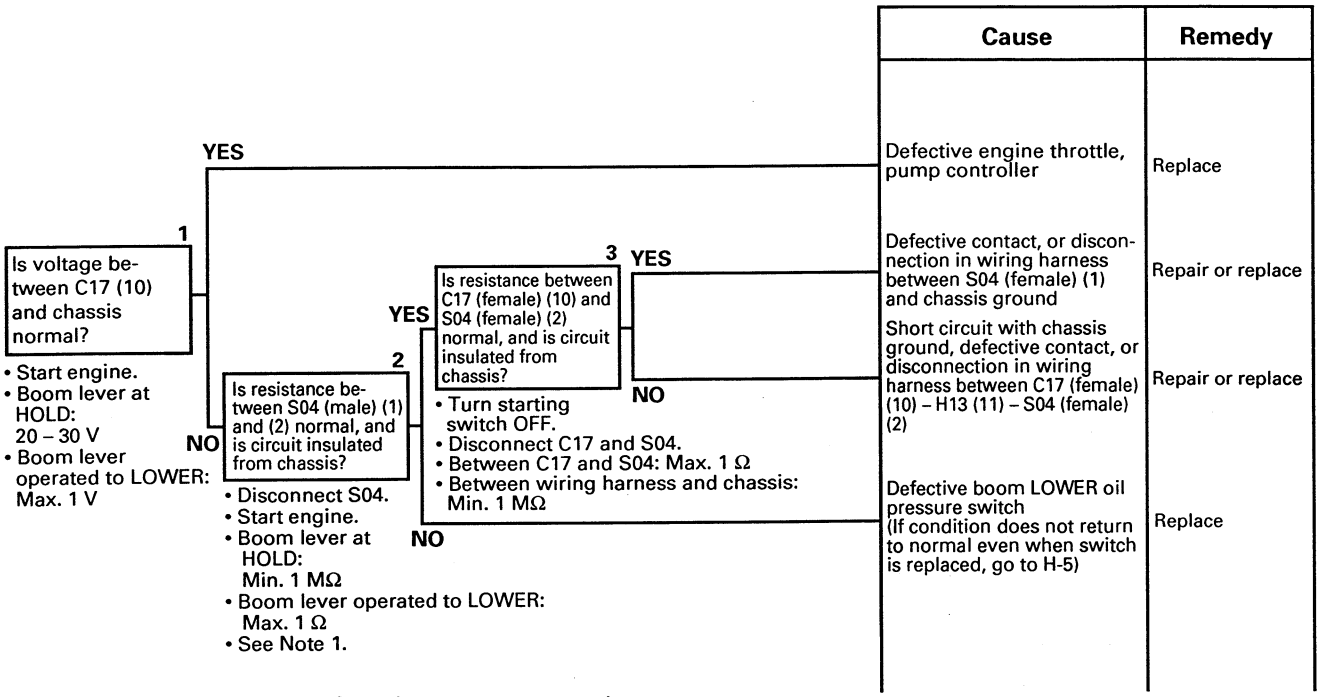
F-3 Bit pattern 20-(3) Boom LOWER oil pressure switch does not light up

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the monitoring mode display returns to normal, the problem has been removed.**

⚠ When measuring with the engine running, make sure that the work equipment does not move when the lever is operated.
(When measuring with the engine stopped, charge the accumulator before starting.)

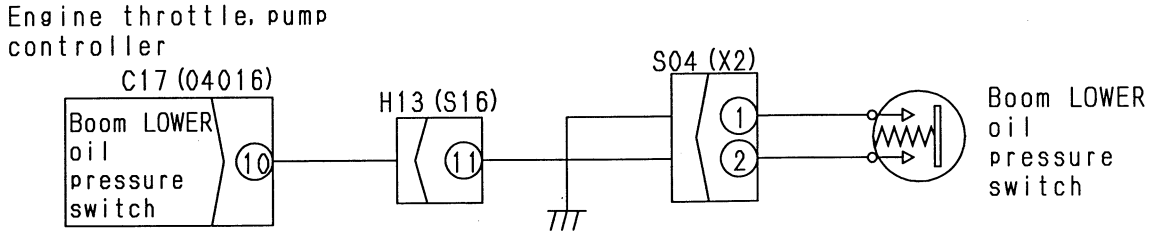
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on the next step.



Note 1: It is also possible to fit a short connector and judge the condition. In this case, check the voltage between C17 (10) and the chassis.
- If it is 20 – 30V : Go to YES
- If it is less than 1V : Go to NO

F-3 Related electrical circuit diagram



TKP01059

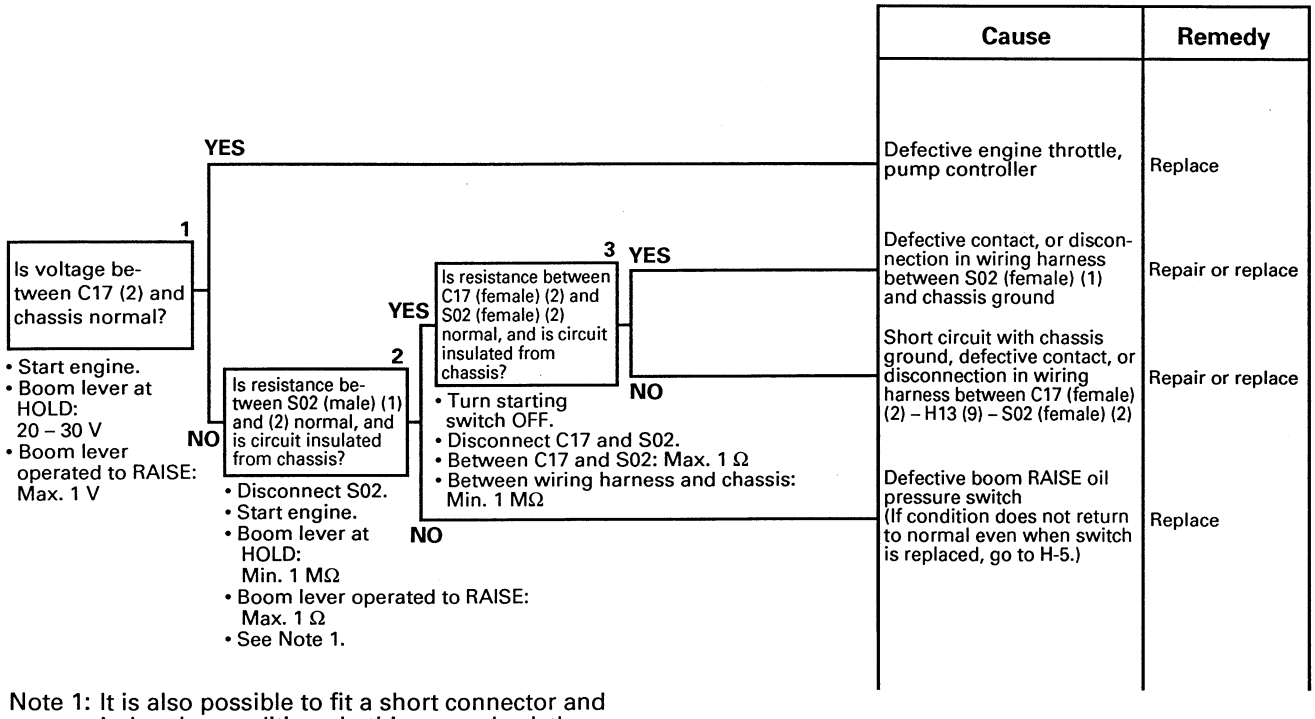
F-4 Bit pattern 20-(4) Boom RAISE oil pressure switch does not light up

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the monitoring mode display returns to normal, the problem has been removed.**

⚠ When measuring with the engine running, make sure that the work equipment does not move when the lever is operated.
(When measuring with the engine stopped, charge the accumulator before starting.)

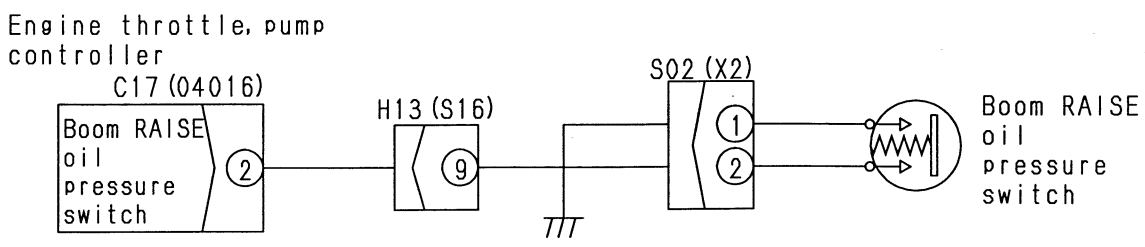
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on the next step.



Note 1: It is also possible to fit a short connector and judge the condition. In this case, check the voltage between C17 (2) and the chassis.
- If it is 20 – 30V : Go to YES
- If it is less than 1V : Go to NO

F-4 Related electrical circuit diagram



TKP01060

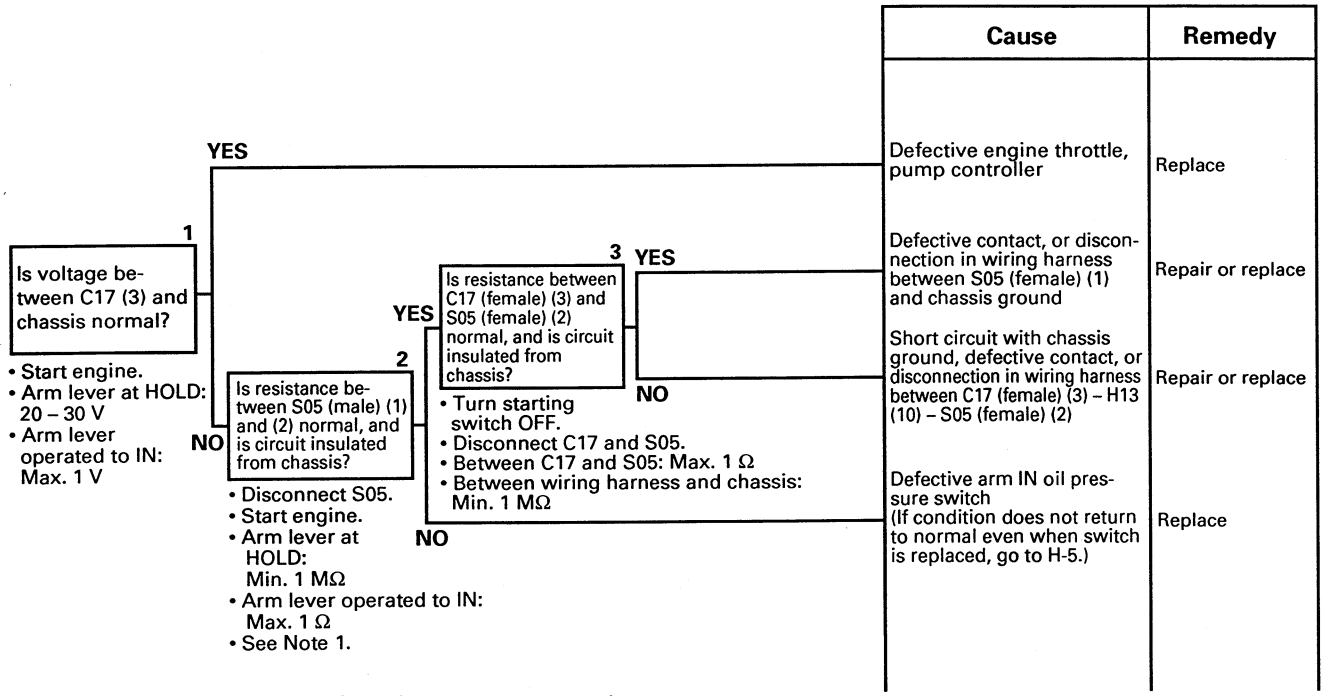
F-5 Bit pattern 20-(5) Arm IN oil pressure switch does not light up

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the monitoring mode display returns to normal, the problem has been removed.**

⚠ When measuring with the engine running, make sure that the work equipment does not move when the lever is operated.
(When measuring with the engine stopped, charge the accumulator before starting.)

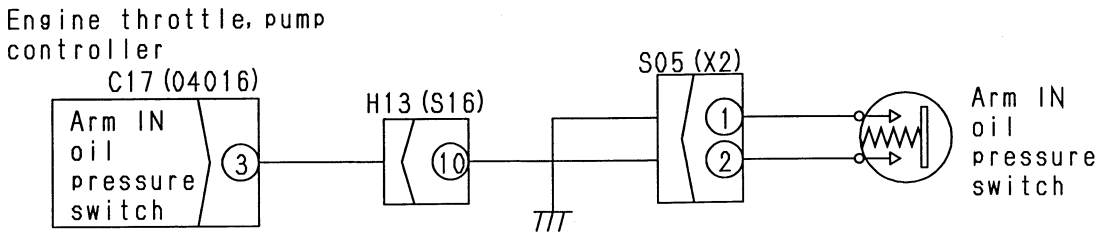
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on the next step.



Note 1: It is also possible to fit a short connector and judge the condition. In this case, check the voltage between C17 (3) and the chassis.
- If it is 20 – 30V : Go to YES
- If it is less than 1V : Go to NO

F-5 Related electrical circuit diagram



TKP01061

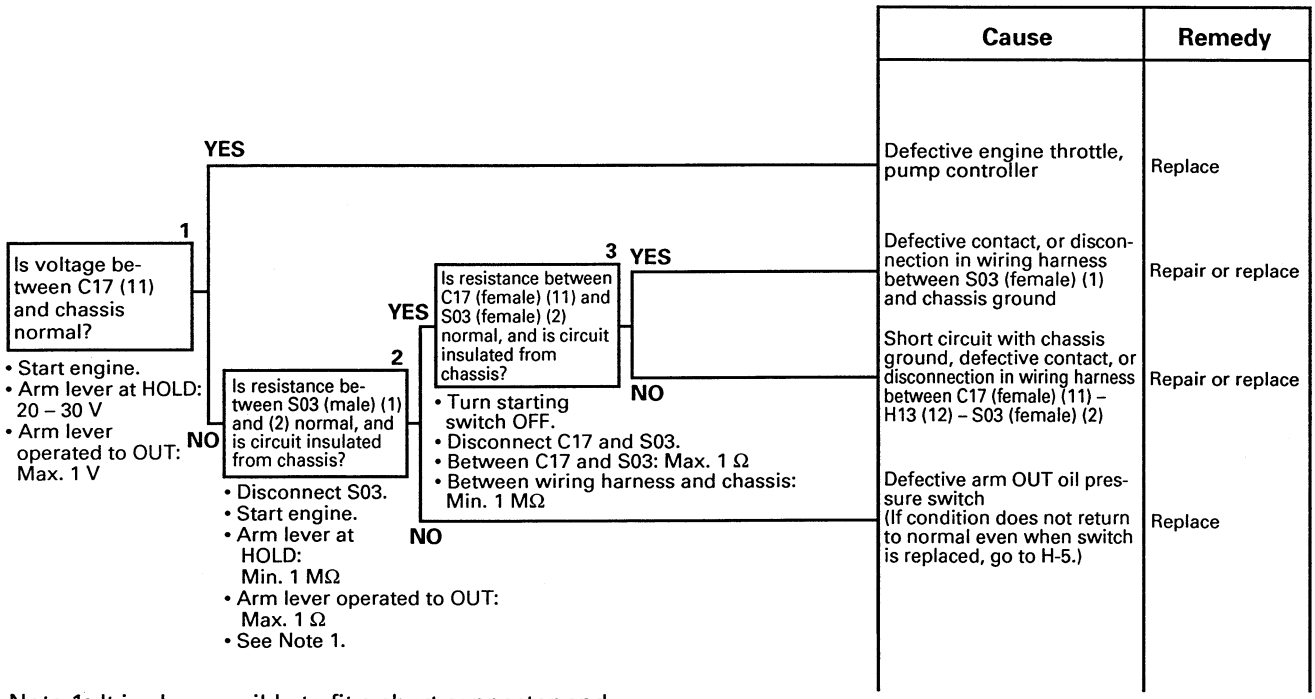
F-6 Bit pattern 20-(6) Arm OUT oil pressure switch does not light up

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the monitoring mode display returns to normal, the problem has been removed.**

⚠ When measuring with the engine running, make sure that the work equipment does not move when the lever is operated.
(When measuring with the engine stopped, charge the accumulator before starting.)

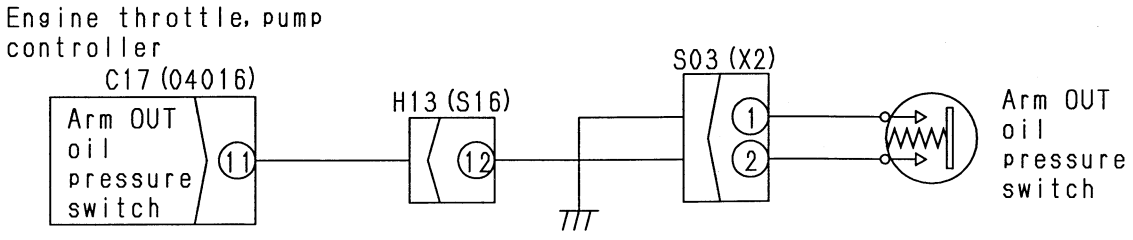
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on the next step.



Note 1: It is also possible to fit a short connector and judge the condition. In this case, check the voltage between C17 (11) and the chassis.
- If it is 20 – 30V : Go to YES
- If it is less than 1V : Go to NO

F-6 Related electrical circuit diagram



TKP01062

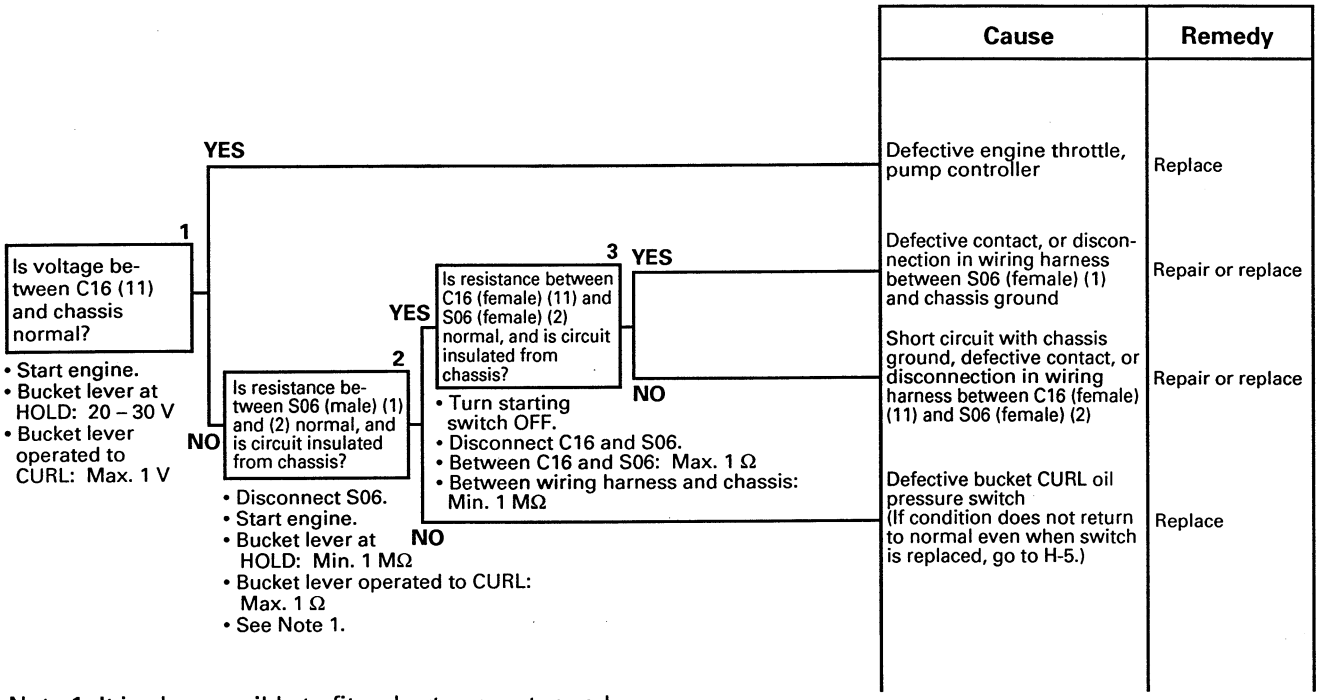
F-7 Bit pattern 21-(1) Bucket CURL oil pressure switch does not light up

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the monitoring mode display returns to normal, the problem has been removed.**

⚠ When measuring with the engine running, make sure that the work equipment does not move when the lever is operated.
(When measuring with the engine stopped, charge the accumulator before starting.)

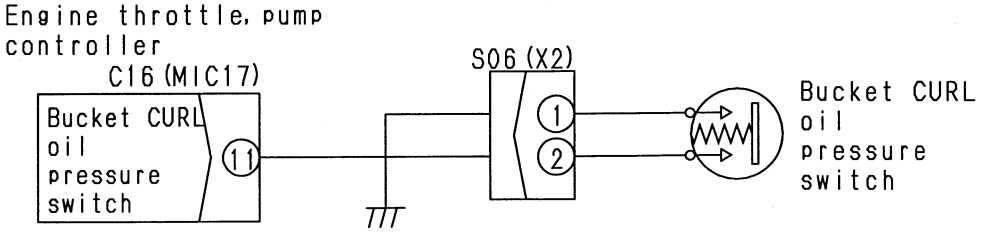
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on the next step.



Note 1: It is also possible to fit a short connector and judge the condition. In this case, check the voltage between C16 (11) and the chassis.
- If it is 20 – 30V : Go to YES
- If it is less than 1V : Go to NO

F-7 Related electrical circuit diagram



TKP01063

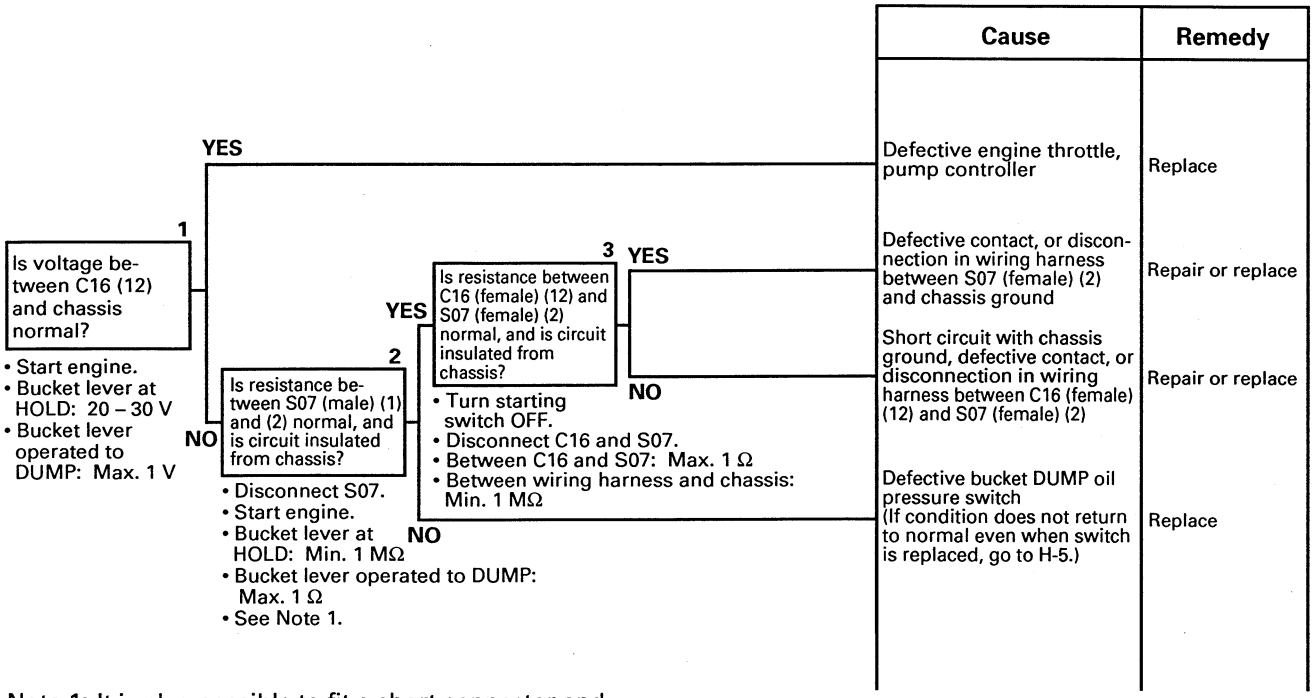
F-8 Bit pattern 21-(2) Bucket DUMP oil pressure switch does not light up

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the monitoring mode display returns to normal, the problem has been removed.**

⚠ When measuring with the engine running, make sure that the work equipment does not move when the lever is operated.
(When measuring with the engine stopped, charge the accumulator before starting.)

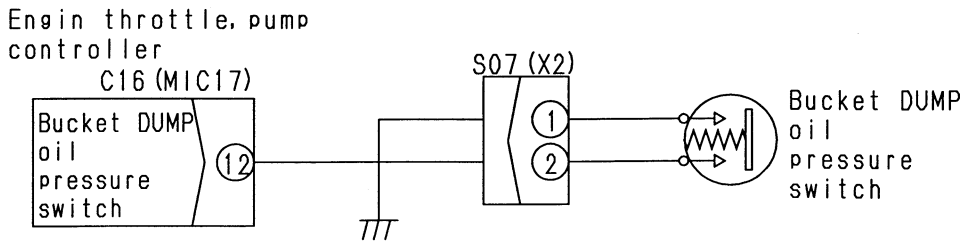
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.

★ Always connect any disconnected connectors before going on the next step.



Note 1: It is also possible to fit a short connector and judge the condition. In this case, check the voltage between C16 (12) and the chassis.
- If it is 20 – 30V : Go to YES
- If it is less than 1V : Go to NO

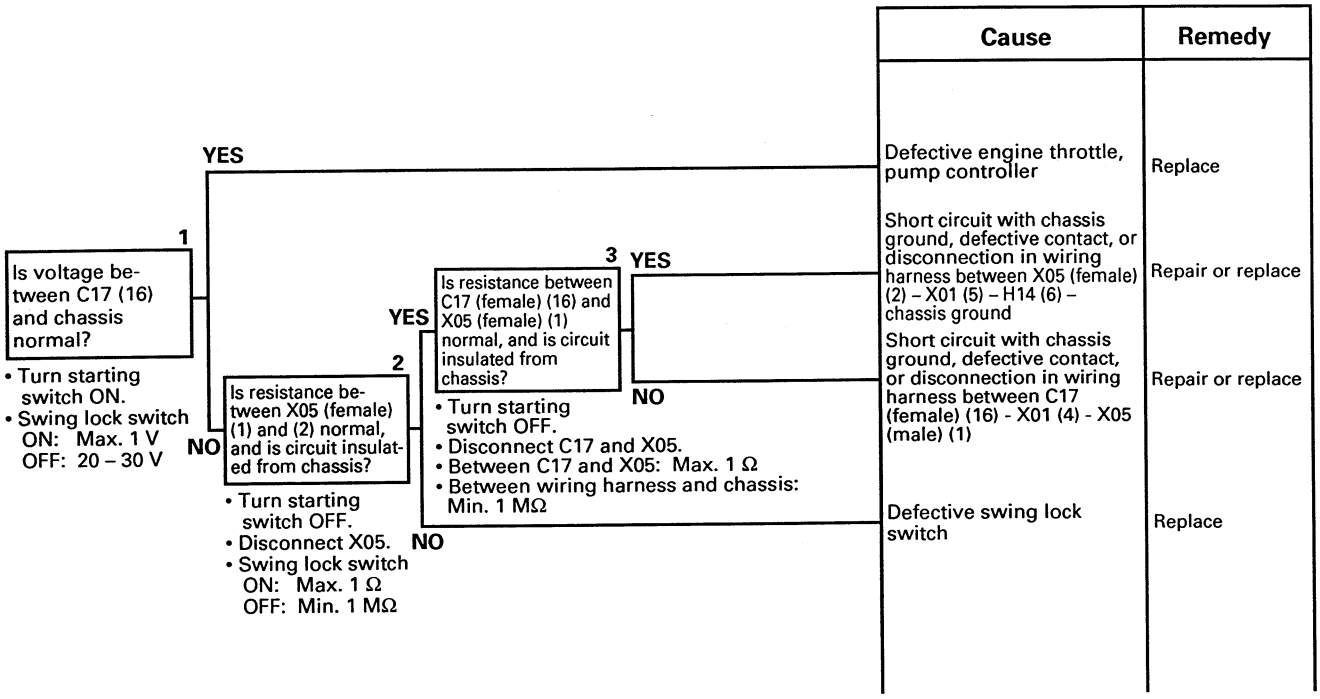
F-8 Related electrical circuit diagram



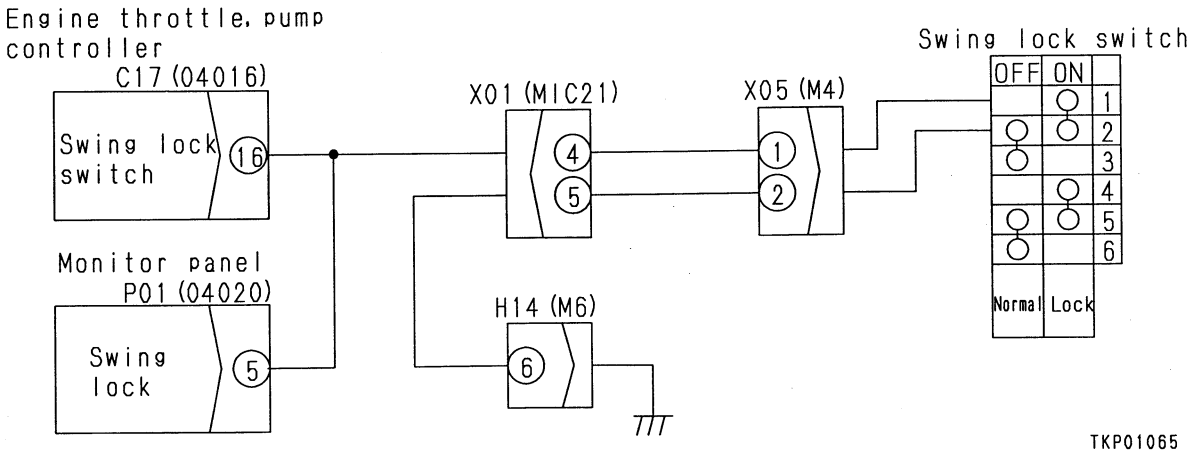
TKP01064

F-9 Bit pattern 21-(3) Swing lock switch does not light up

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the monitoring mode display returns to normal, the problem has been removed.**
★ If the panel display is normal (if the panel swing lock lamp does not light up, go to M-21).
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

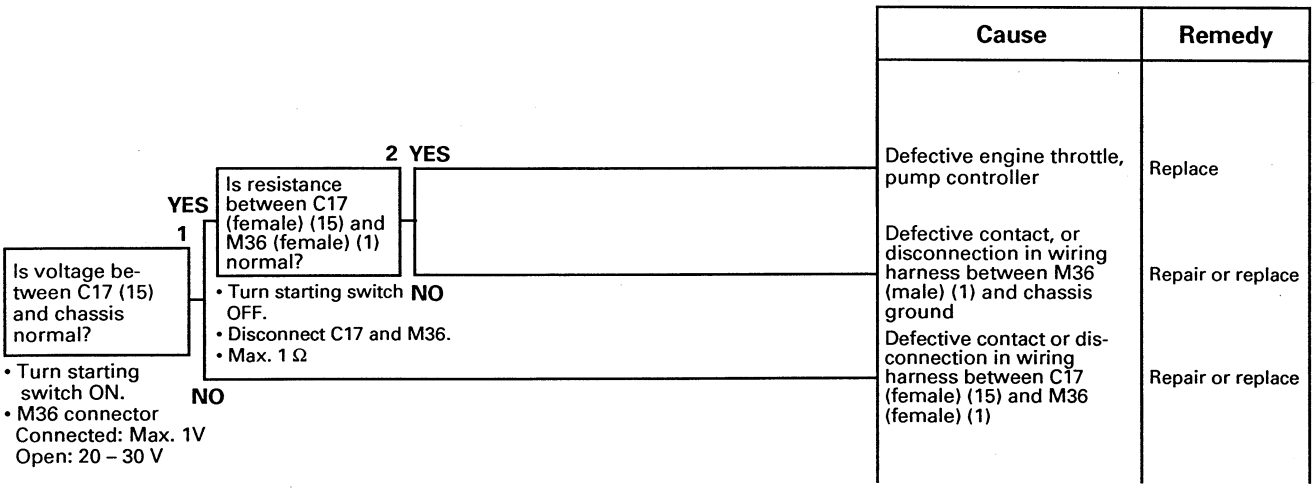


F-9 Related electrical circuit diagram

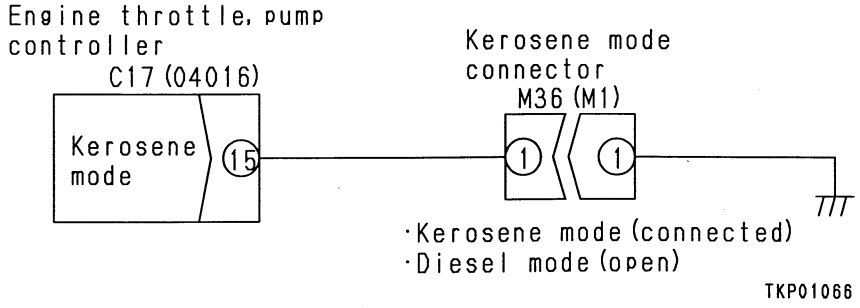


F-10 Bit pattern 22-(5) Kerosene mode connection does not light up

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the monitoring mode display returns to normal, the problem has been removed.**
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

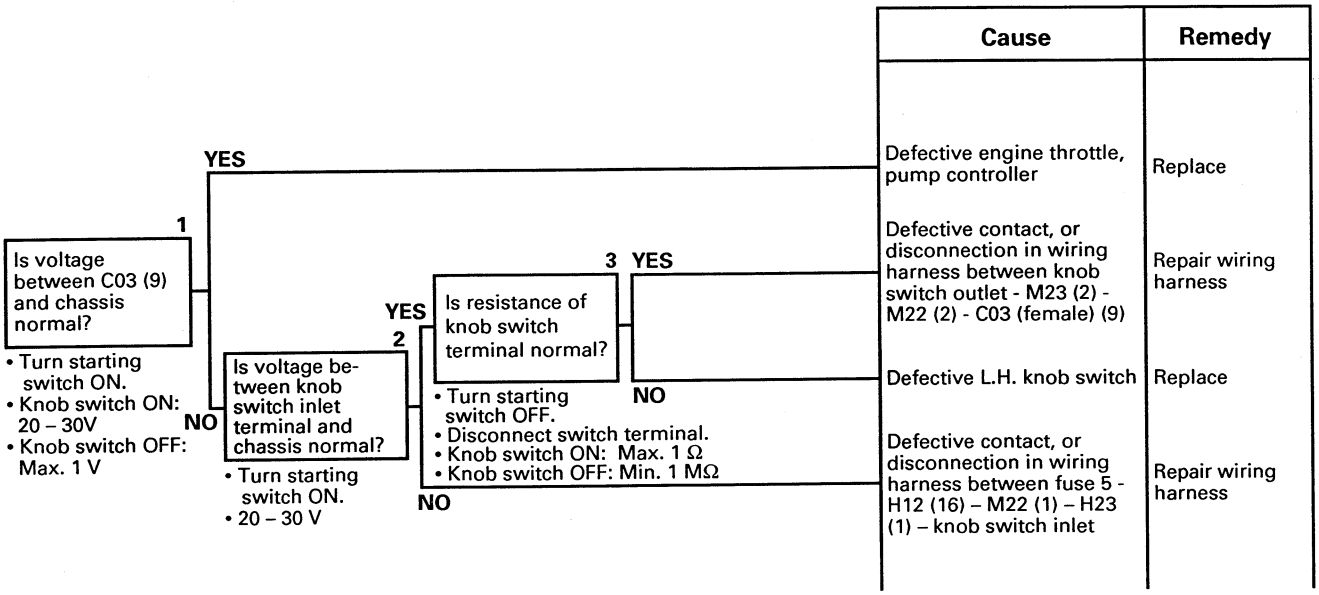


F-10 Related electrical circuit diagram

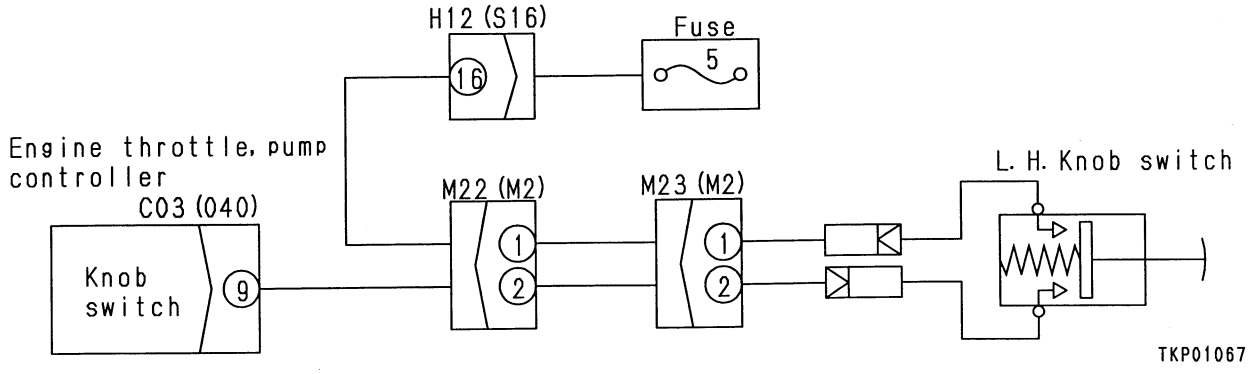


F-11 Bit pattern 22-(6) L.H. knob switch does not light up

★ **This troubleshooting is carried out when there is still an abnormality, so when disconnecting the connector and inserting the T-adapter, or when removing the T-adapter and returning the connector to its original position, if the monitoring mode display returns to normal, the problem has been removed.**
★ Check that fuse 5 is normal.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



F-11 Related electrical circuit diagram



TROUBLESHOOTING OF HYDRAULIC, MECHANICAL SYSTEM (H MODE)

TABLE OF FAILURE MODES AND CAUSES FOR HYDRAULIC AND MECHANICAL SYSTEM

Failure mode \ Parts causing failure			Pump							Control valve										
			PC-EPC valve	LS valve	Servo piston	Pump proper	Control pump	Strainer	PTO spline	Spool	Unload valve	Main relief valve	Pressure compensation valve	LS select valve	LS circuit throttle	Travel junction valve	Boom lock valve	Regeneration valve: Boom	Regeneration valve: Arm
All work equipment, travel, swing	Speeds of all work equipment, swing, travel are slow or lack power		○	○		○	○				○	○				○				
	There is excessive drop in engine speed, or engine stalls		○		○															
	No work equipment, travel, swing move					○	○		○											
	Abnormal noise generated (around pump)					○		○												
	Auto-deceleration does not work																			
	Fine control ability is poor or response is poor			○											○					
Work equipment	Boom is slow or lacks power									○			○				○	○		
	Arm is slow or lacks power									○			○							○
	Bucket is slow or lacks power									○			○							
	Boom does not move									○							○			
	Arm does not move									○										
	Bucket does not move									○										
	Excessive hydraulic drift									○			○				○			
	Excessive time lag (engine at low idling)												○							
	Lack of power when pressure rises											○								
	Other equipment moves when single circuit is relieved												○							
	Work equipment speed is slow when active mode is ON, or is fast when active mode is OFF																			
	In F/O mode, arm IN speed is faster than set speed			○																
Compound operations	In compound operations, work equipment with larger load is slow												○							
	In swing + boom (RAISE), boom is slow																○			
	In swing + travel, travel speed drops excessively																			
	In work equipment (boom RAISE) + travel, travel speed drops excessively																			
Travel system	Travel deviation	Deviation is excessive								○			○			○				
		Deviation is excessive when starting														○				
	Travel speed is slow									○			○							
	Steering is difficult to turn or lacks power											○	○			○				
	Travel speed does not switch or is faster than set speed																			
	Does not move (one side only)																			
Swing system	Does not swing	Both left and right																		
		One direction only								○										
	Swing acceleration is poor or swing speed is slow	Both left and right																		
		One direction only								○			○							
	Excessive overrun when stopping swing	Both left and right																		
		One direction only								○										
	Excessive shock when stopping swing (one direction only)									○										
	Excessive abnormal noise when stopping swing																			
	Excessive hydraulic drift of swing	When brake is ON																		
		When brake is OFF								○			○							
	Swing speed is faster than specified swing speed			○																

★ In the failure modes, modes for compound operations are used when independent operations are normal
○ : Main cause △ : Secondary cause

Safety-suction valve	Suction valve	PPC valve	PPC shuttle	Safety lock valve	Swivel joint	Solenoid valve: LS-EPC valve	Solenoid valve: 2-stage relief	Solenoid valve: Travel speed selector	Solenoid valve: Swing holding brake	Solenoid valve: Active mode	Swing motor: Holding brake	Swing motor: Safety valve	Swing motor: Suction valve	Swing motor: Leakage, breakage inside body	Travel motor: Safety valve	Travel motor: Counterbalance valve	Travel motor: Check valve	Travel motor: Travel speed selector servo	Travel motor: Leakage, breakage inside body	Swing machinery	Final drive	Hydraulic cylinder	Back pressure valve	Travel junction valve	Pressure switch: Boom RAISE	Pressure switch: Boom LOWER	Pressure switch: Arm IN	Pressure switch: Arm OUT	Pressure switch: Bucket CURL	Pressure switch: Bucket DUMP	Pressure switch: Swing Left swing	Pressure switch: Swing Right swing	Pressure switch: Travel	Pressure sensor	Engine system	Trouble-shooting code
						○																												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
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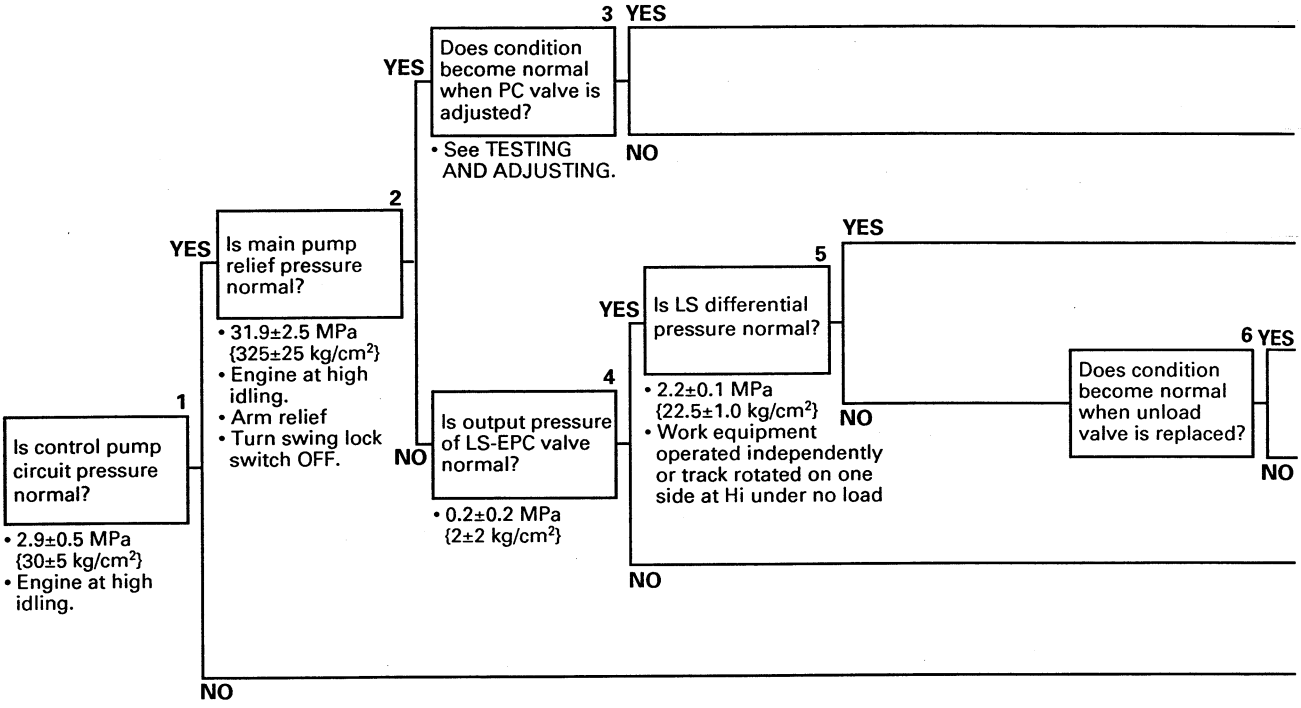
		○	○																○					○										H-21
															○																			
		○	○			○													○					○									○	H-22
	○				○		○	○							○		○	○						○									○	H-23
						○		○										○															○	H-24
	○														○				○		○													H-25
									○		○			○						○										○	○				H-26
		○										○																						
														○																					H-27
		○	○									○	○																					
														○																					H-28
		○										○																						
		○																																H-29
												○	○							○			○											H-30
									○		○																							H-31
																																		H-32

H-1 Speeds of all work equipment, swing, travel are slow or lack power

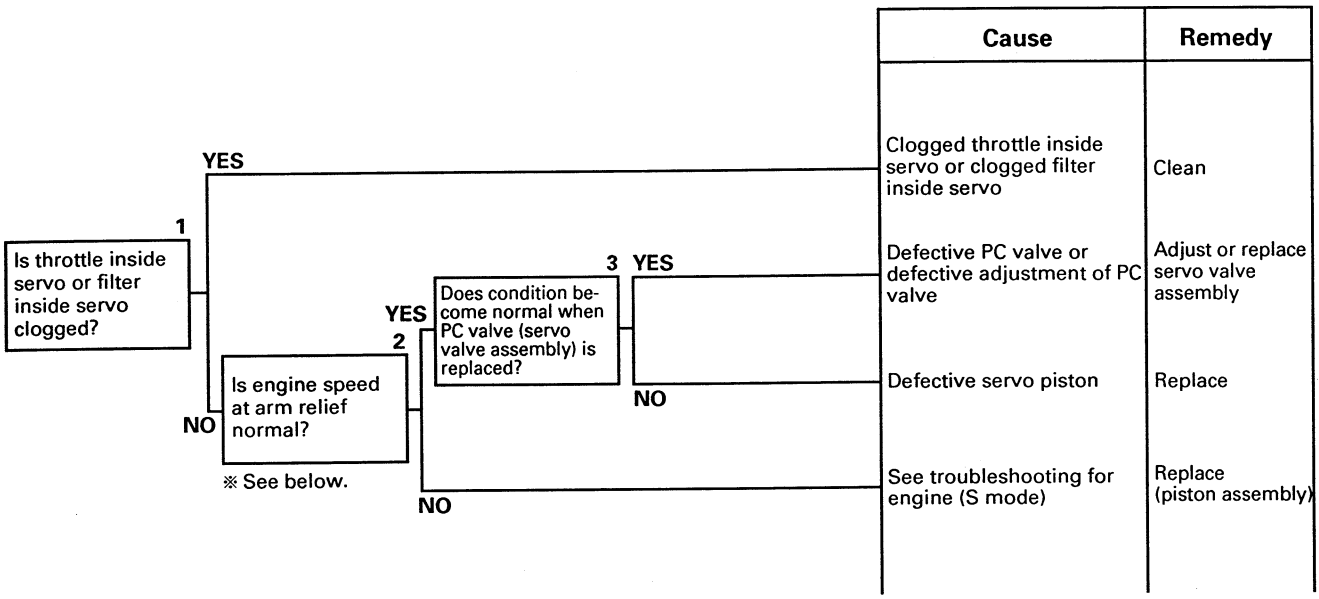
★ Carry out troubleshooting in the heavy-duty operation mode.
★ Check that no abnormal noise is being generated from the main pump before carrying out troubleshooting. (If there is any abnormal noise, carry out troubleshooting for H-4.)



Cause	Remedy
Defective adjustment of PC valve	Adjust
Defective piston pump	Repair or replace
Defective operation of main valve (Defective reducing valve Defective main valve LS circuit)	Repair or replace
Defective operation of unload valve	Correct or replace
Defective operation of main relief valve	Replace
Defective operation of LS-EPC valve	Replace
Defective hydraulic equipment in control pump circuit (See TESTING AND ADJUSTING)	Adjust or replace

H-2 There is excessive drop in engine speed, or engine stalls

★ Carry out troubleshooting in the heavy-duty operation mode.
★ Check that the main relief pressure is normal.

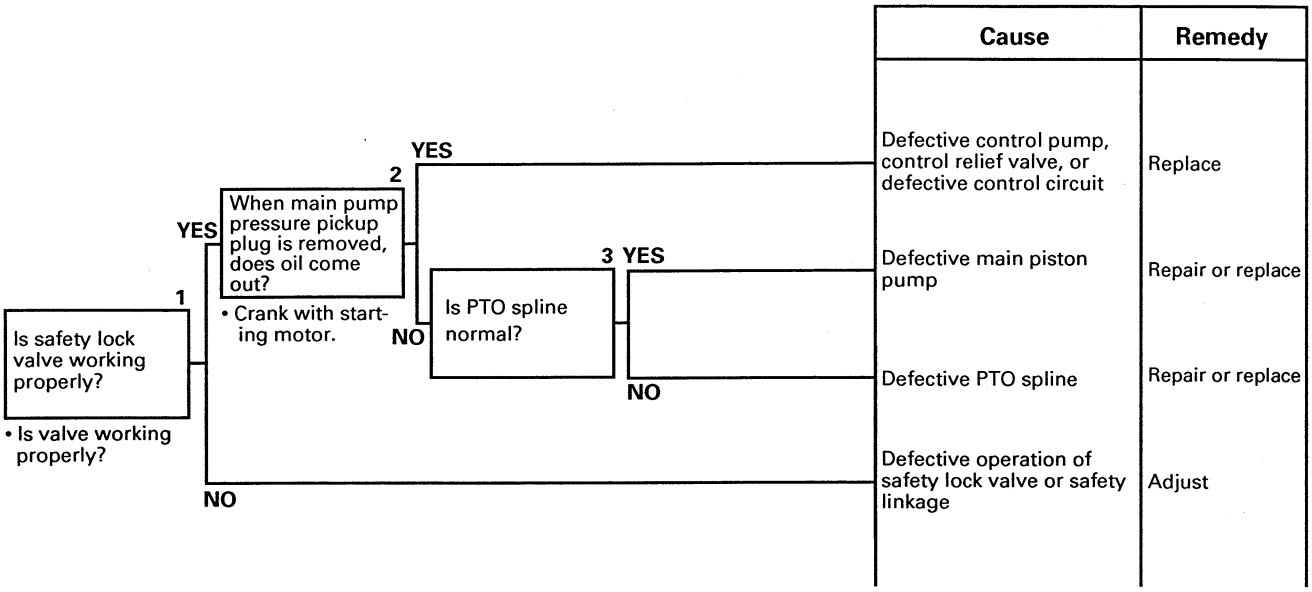


※ Replace the servo valve assembly with a new part, and if the engine speed is lower than the value in Table 1, carry out troubleshooting for S mode.
If it is higher, it can be judged that the PC valve (servo valve) is defective, so replace it.

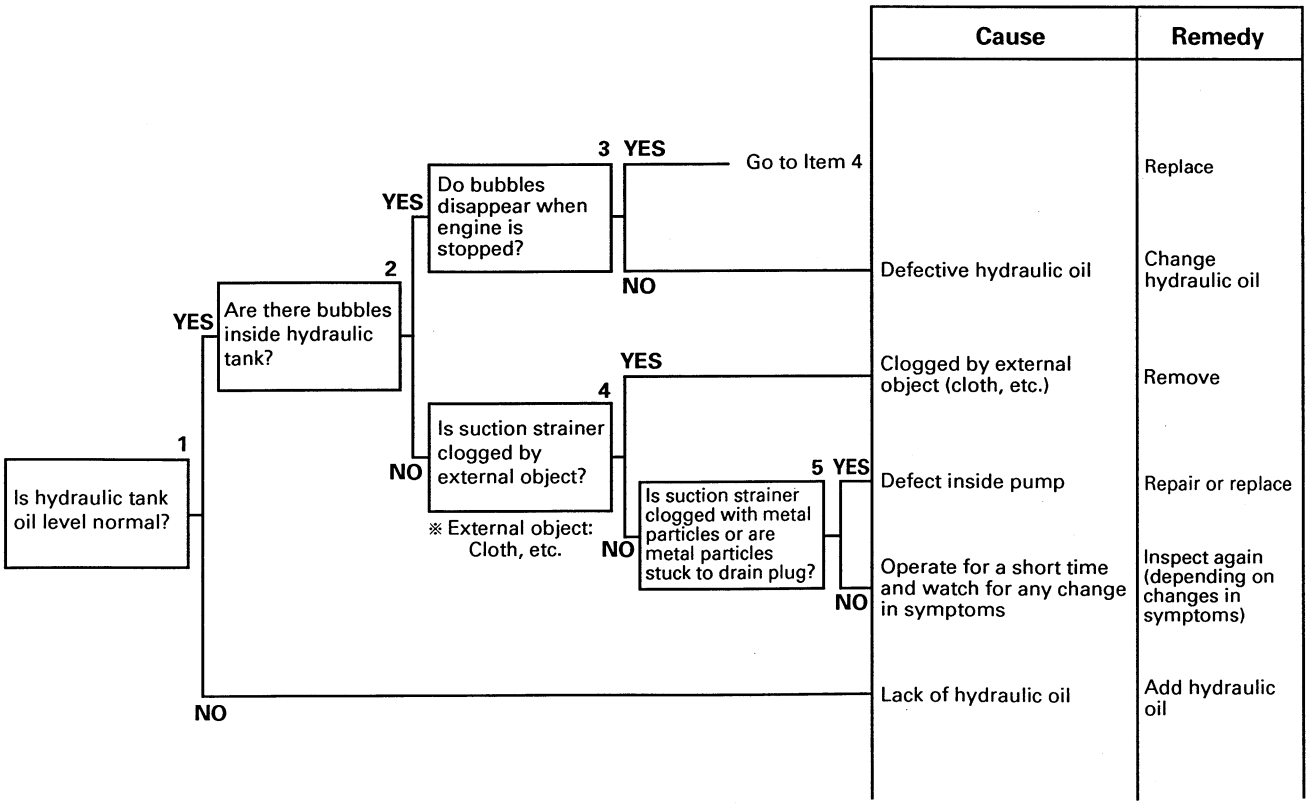
Table 1

Engine speed at arm relief	Conditions
Min. 2000 rpm	• Engine at high idling • Swing lock switch ON • Measure the speed at the point where the drop in engine speed is greatest when the arm cylinder is at end of stroke and the lever is operated slowly to the full position.

H-3 No work equipment, travel, swing move

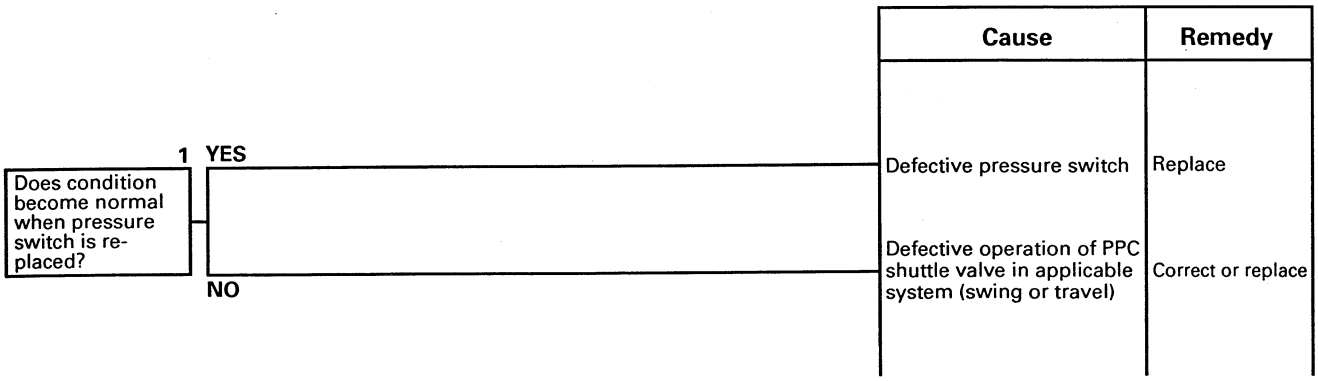


H-4 Abnormal noise generated (around pump)



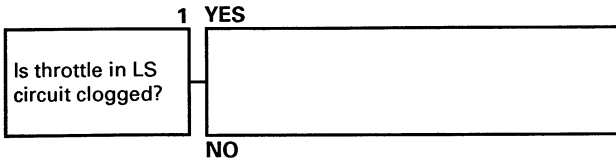
H-5 Auto-deceleration does not work (when PPC shuttle valve is cause)

★ The control pressure for the travel and swing passes through the PPC shuttle valve and is supplied to the pressure switch.



Cause	Remedy
Defective pressure switch	Replace
Defective operation of PPC shuttle valve in applicable system (swing or travel)	Correct or replace

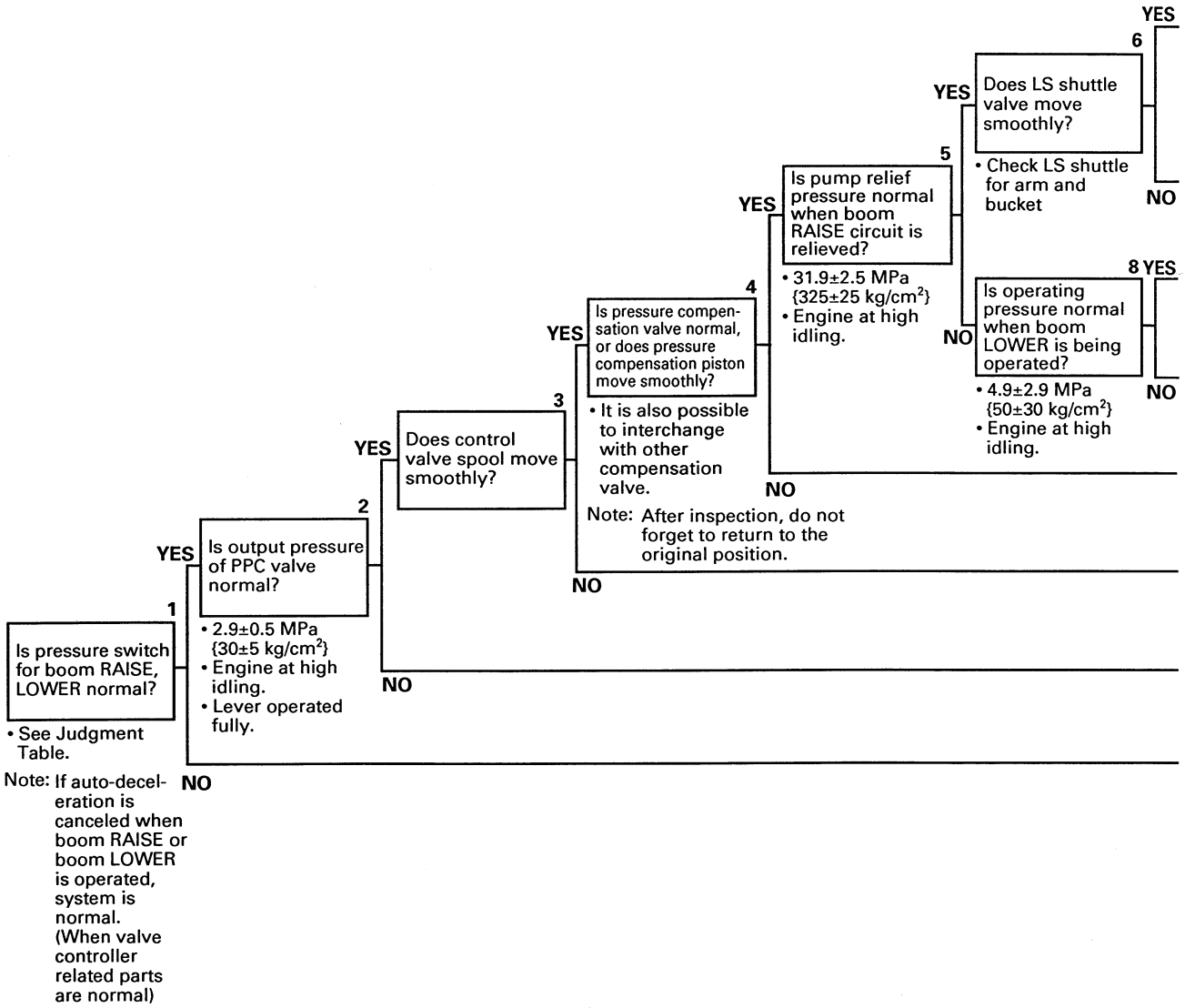
H-6 Fine control ability is poor or response is poor

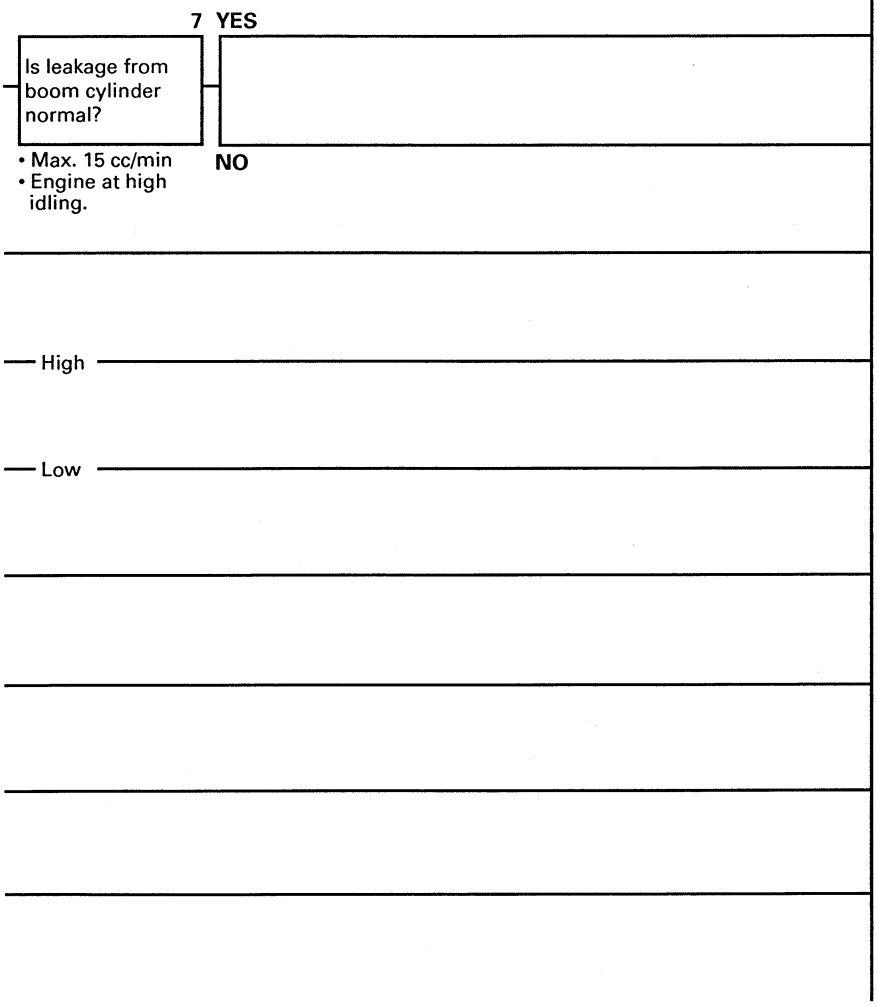


Cause	Remedy
Clogged throttle in LS circuit	Clean
Defective servo valve assembly (LS valve), or defective servo piston	Replace

H-7 Boom is slow or lacks power

★ When travel and swing speeds are normal.
★ Carry out troubleshooting in the heavy-duty operation mode.

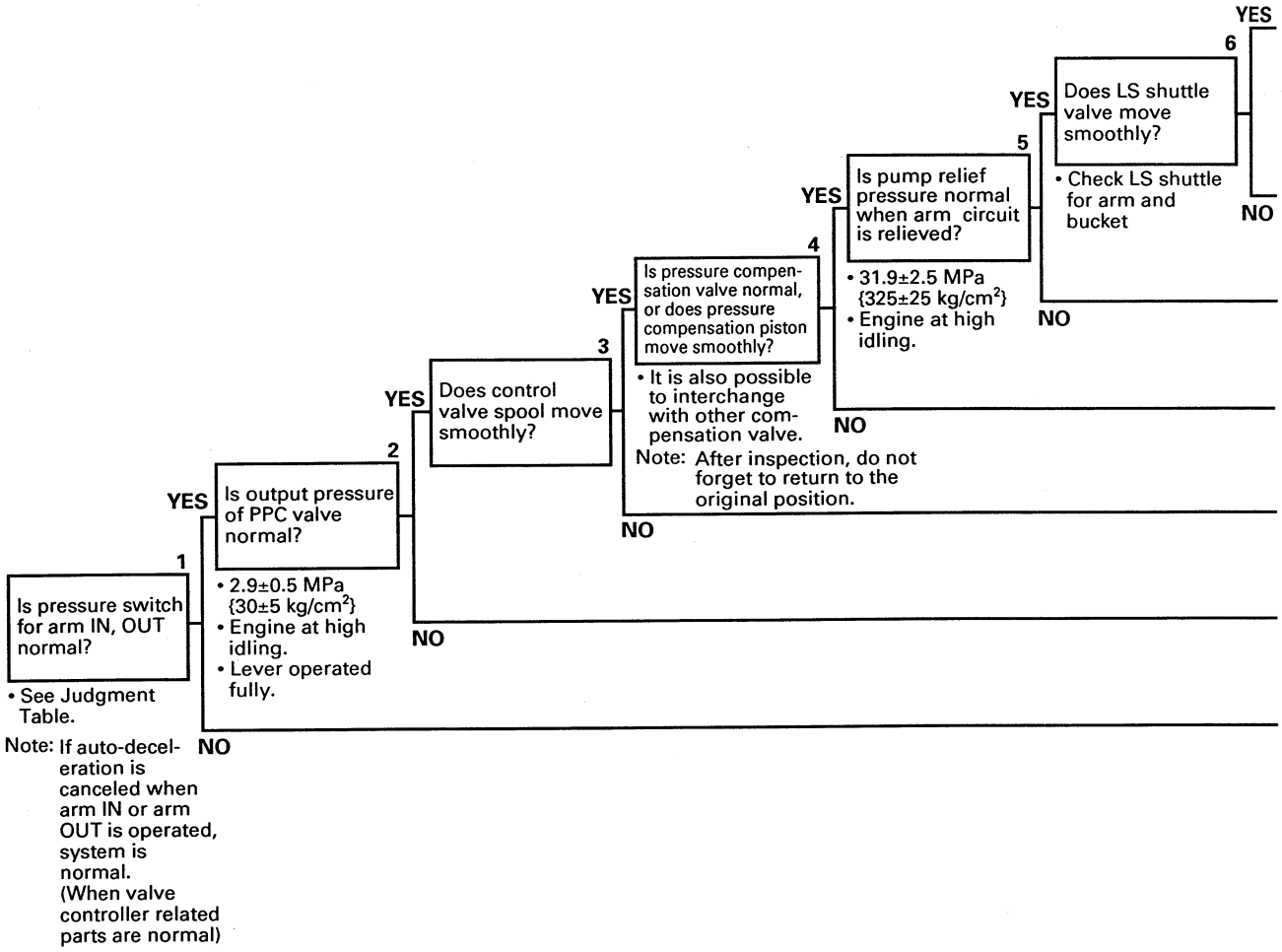


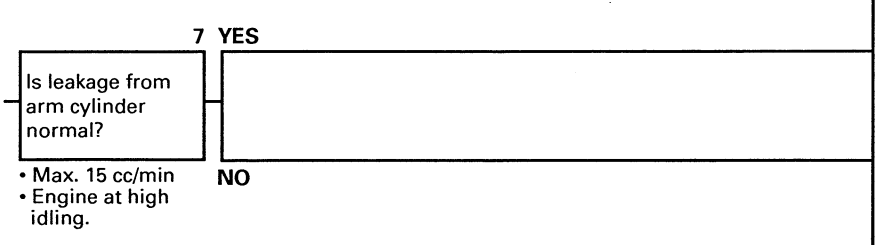


Cause	Remedy
Defective boom cylinder piston packing	Repair or replace
Defective operation of boom lock valve	Correct or replace
Defective operation of LS shuttle valve (LS shuttle for arm or bucket)	Correct or replace
Defective operation of boom lock valve or suction valve of control valve	Correct or replace
Defective operation of boom regeneration valve	Correct or replace
Defective operation of pressure compensation valve or pressure compensation piston	Correct or replace
Defective operation of control valve spool	Correct or replace
Defective PPC valve	Replace
Defective boom RAISE or boom LOWER pressure switch	Replace

H-8 Arm is slow or lacks power

★ When travel and swing speeds are normal.
★ Carry out troubleshooting in the heavy-duty operation mode.

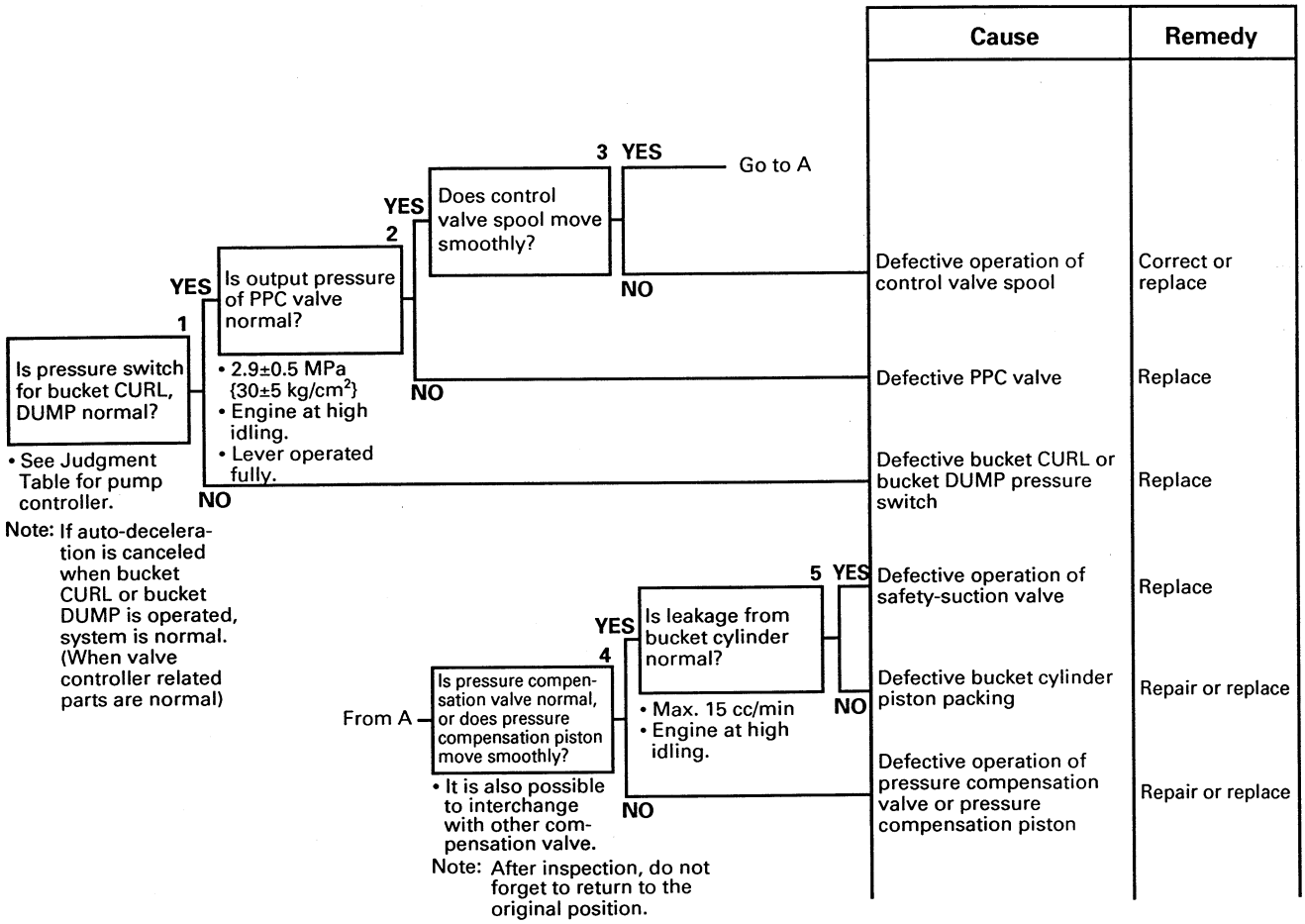




Cause	Remedy
Defective operation of arm regeneration valve or arm counterbalance valve	Correct or replace
Defective arm cylinder piston packing	Repair or replace
Defective operation of LS shuttle valve (LS shuttle for bucket)	Correct or replace
Defective operation of safety-suction valve	Replace
Defective operation of pressure compensation valve or pressure compensation piston	Correct or replace
Defective operation of control valve spool	Correct or replace
Defective PPC valve	Replace
Defective arm IN or arm OUT pressure switch	Replace

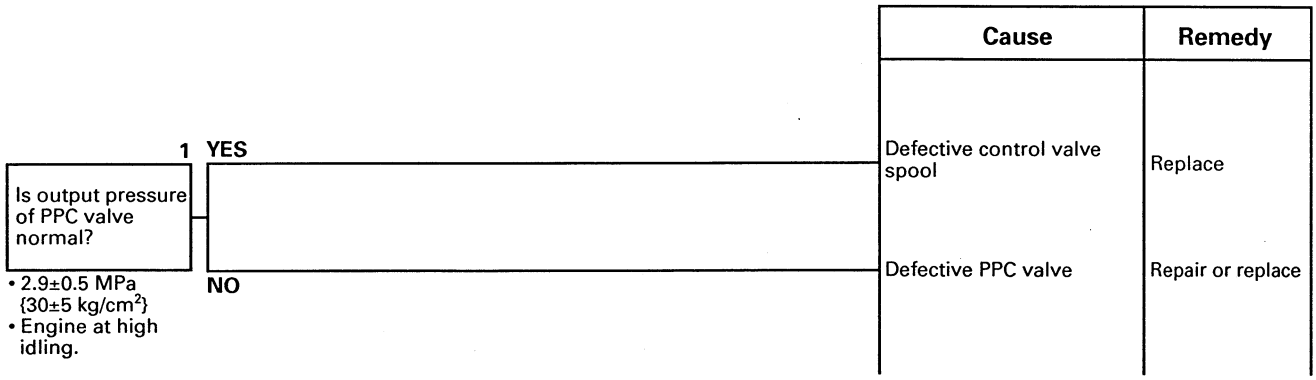
H-9 Bucket is slow or lacks power

★ When travel and swing speeds are normal.

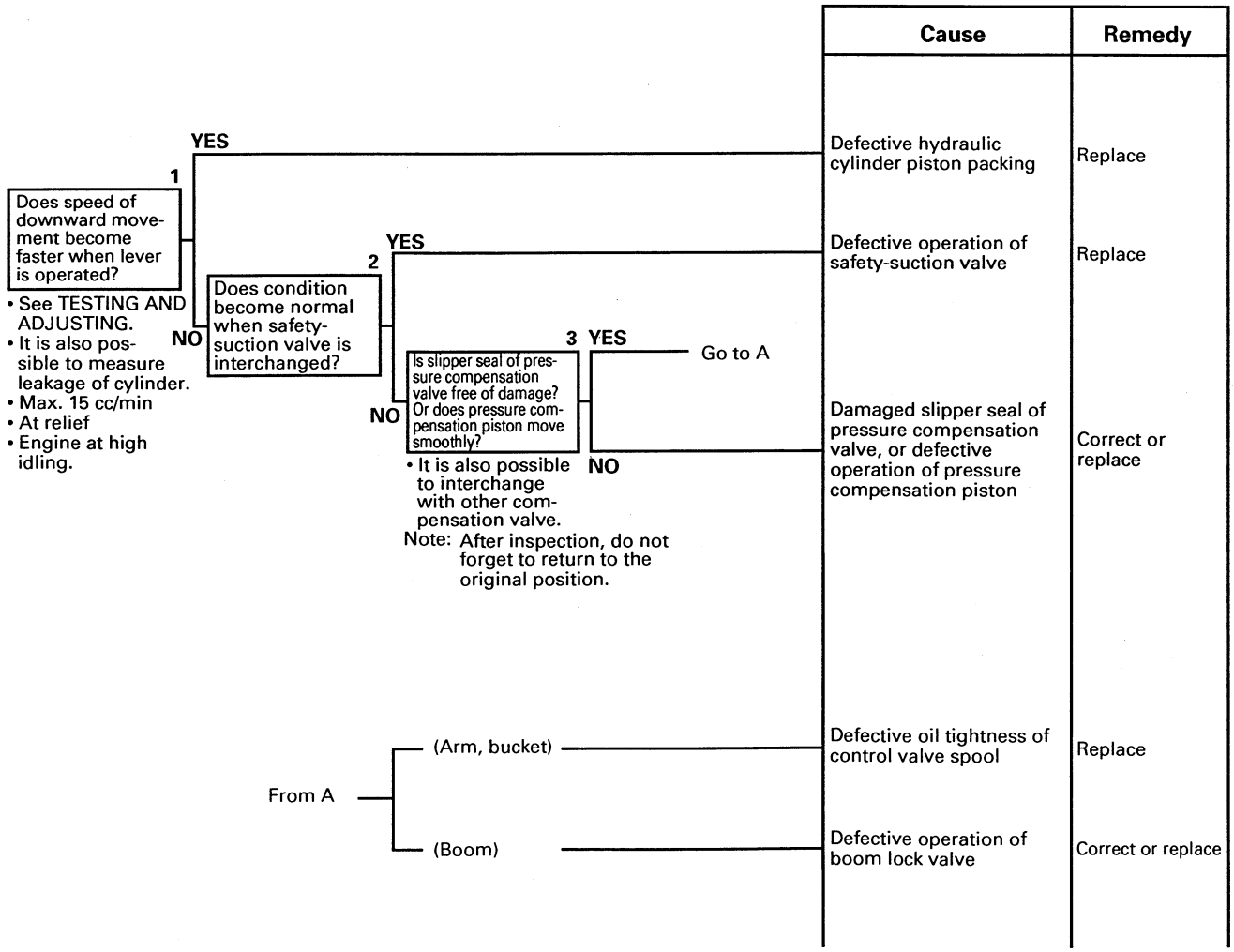


H-10 Work equipment (boom, arm, bucket) does not move (but travel and swing are normal)

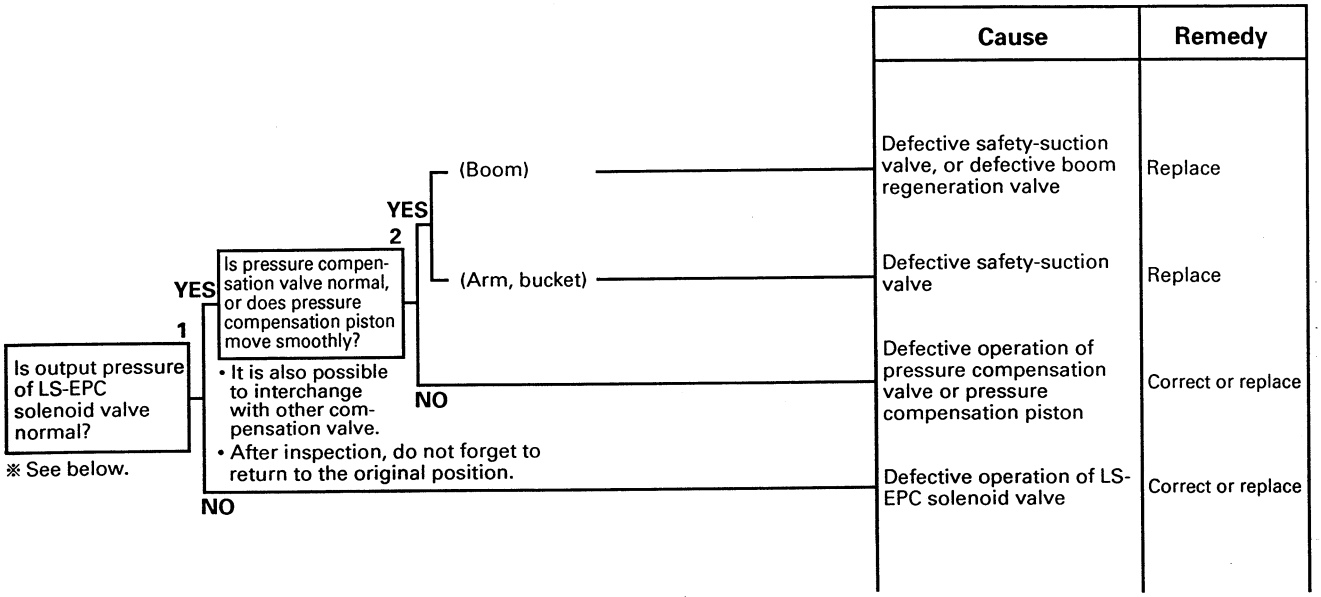
★ When boom, arm, and bucket are each operated independently.



H-11 Excessive hydraulic drift (boom, arm, bucket)

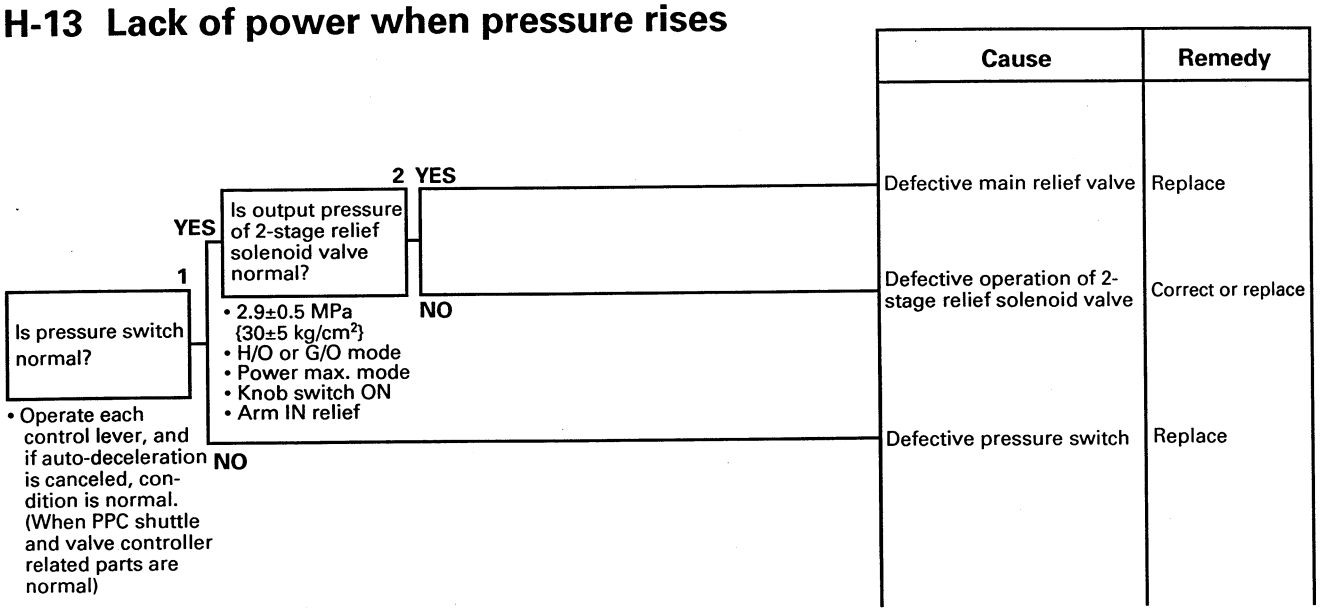


H-12 Excessive time lag (engine at low idling)

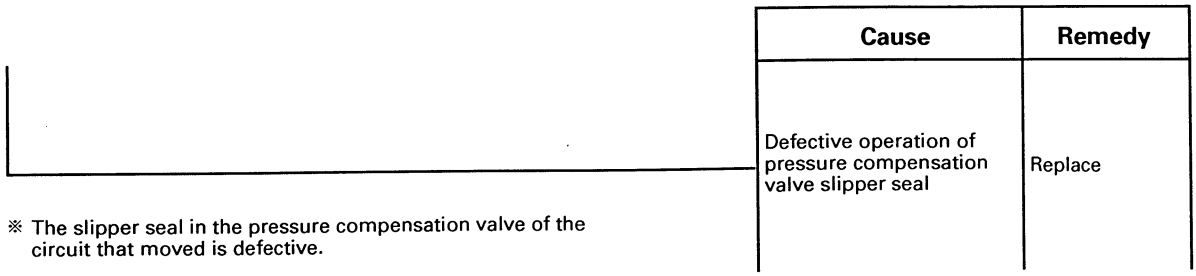


※ Output pressure of LS-EPC solenoid
- Approx. 2.5 MPa {26 kg/cm²} is output from the LS-EPC solenoid when the engine is at low idling (approx. 1000 rpm or below), regardless of the working mode.

H-13 Lack of power when pressure rises



H-14 Other equipment moves when single circuit is relieved

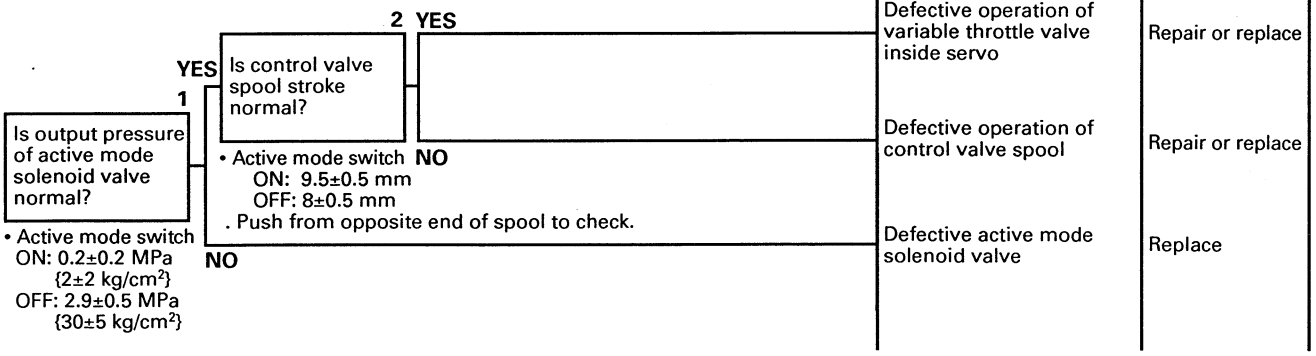


※ The slipper seal in the pressure compensation valve of the circuit that moved is defective.

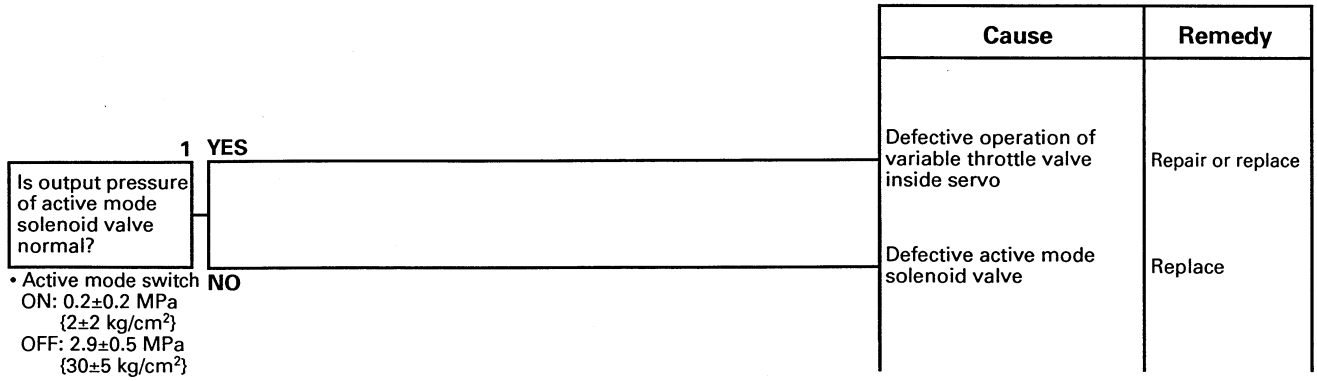
H-15 Work equipment speed is slow when active mode is ON, or is fast when active mode is OFF

★ Carry out troubleshooting with engine at high idling + heavy-duty operation mode.

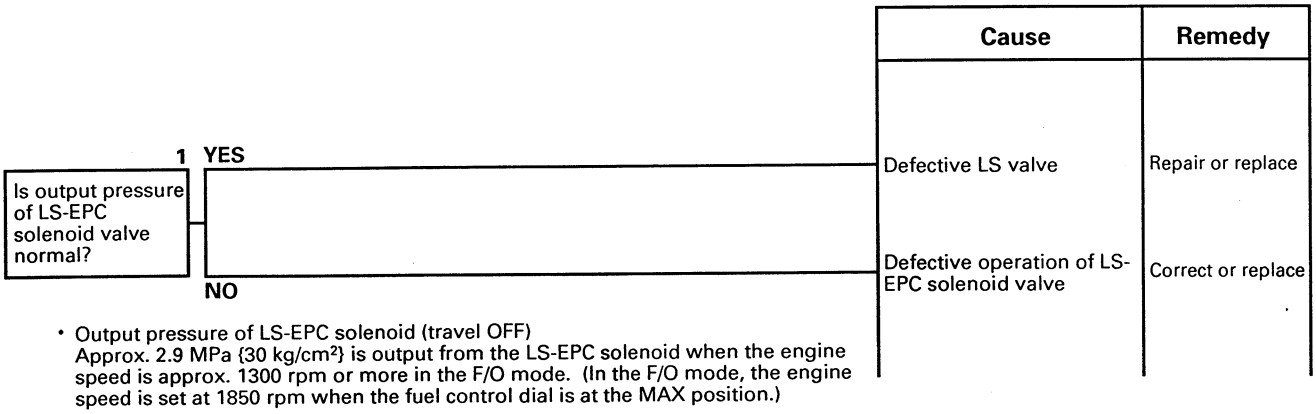
a) Boom LOWER, arm IN speeds are too slow or too fast



b) Boom RAISE, arm OUT, bucket CURL, DUMP speeds are too slow or too fast



H-16 In F/O mode, arm IN speed is faster than specified speed



- Output pressure of LS-EPC solenoid (travel OFF)
  Approx. 2.9 MPa {30 kg/cm²} is output from the LS-EPC solenoid when the engine speed is approx. 1300 rpm or more in the F/O mode. (In the F/O mode, the engine speed is set at 1850 rpm when the fuel control dial is at the MAX position.)

H-17 In compound operations, work equipment with larger load is slow

Table 1

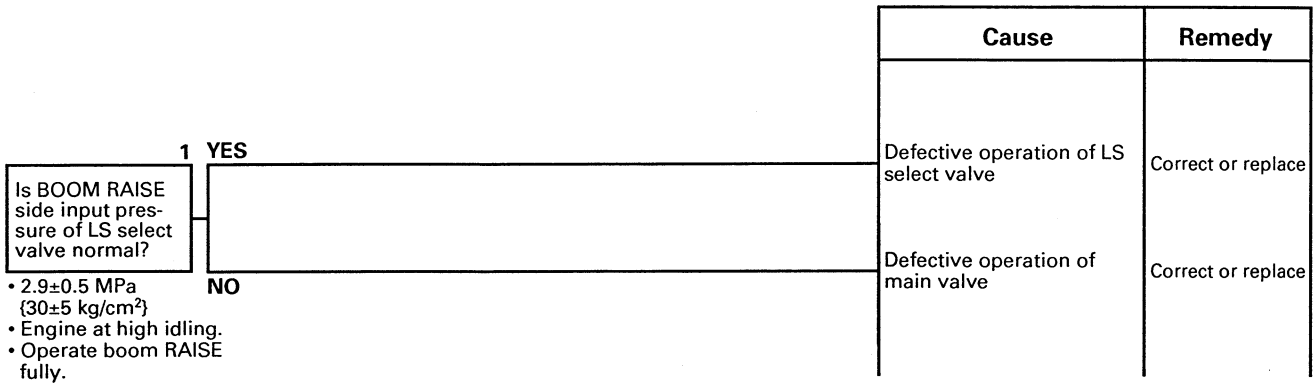
Cause	Remedy
Defective operation of pressure compensation valve	Replace (replace pressure compensation valve on side where load is lower)

Table 2

	Combination for compound operation	Side where load is larger
1	Boom RAISE + arm IN	Boom RAISE
2	Boom RAISE + arm OUT	Arm OUT
3	Boom RAISE + bucket CURL	Boom RAISE
4	Arm OUT + bucket CURL	Arm OUT
5	Boom LOWER + arm OUT	Arm OUT

H-18 In swing + boom RAISE, boom RAISE is slow

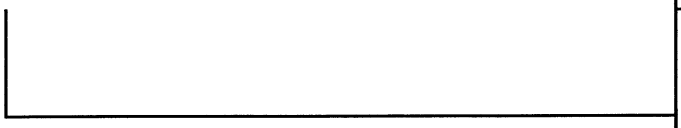
★ If swing and boom RAISE work normally when operated independently.



Cause	Remedy
Defective operation of LS select valve	Correct or replace
Defective operation of main valve	Correct or replace

H-19 In swing + travel, travel speed drops excessively

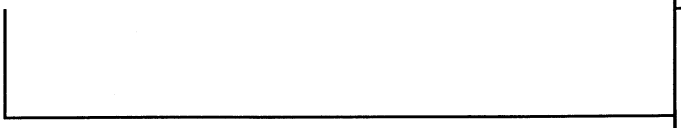
★ If swing and travel work normally when operated independently.



Cause	Remedy
Defective operation of travel reducing valve (clogged LS bypass)	Correct or replace

H-20 In work equipment + travel, travel speed drops excessively

★ If work equipment (boom RAISE) and travel work normally when operated independently.

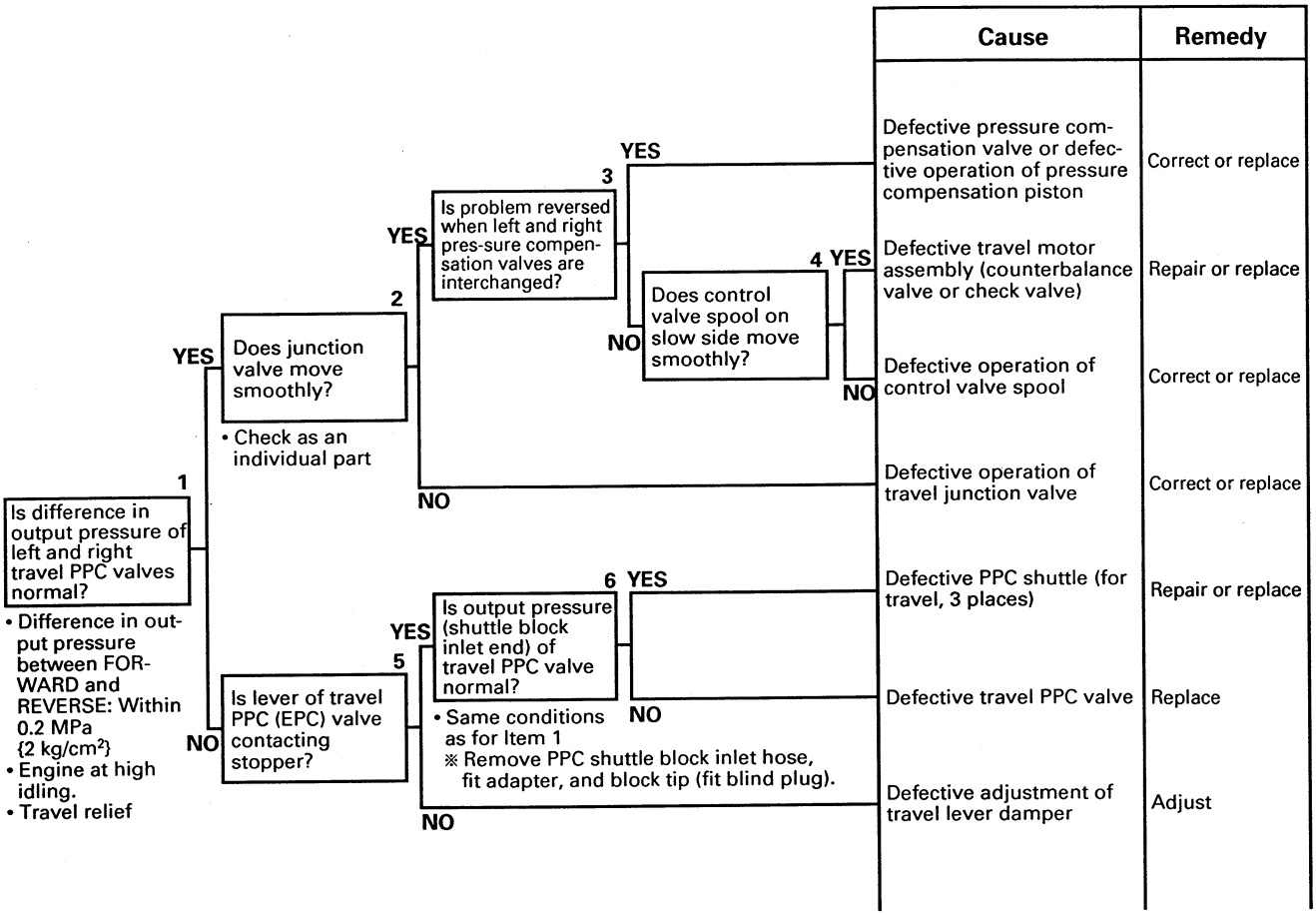


Cause	Remedy
Defective operation of travel reducing valve (clogged LS bypass)	Correct or replace

H-21 Travel deviation

★ Carry out troubleshooting in the heavy-duty operation mode.

a) When there is deviation in normal travel



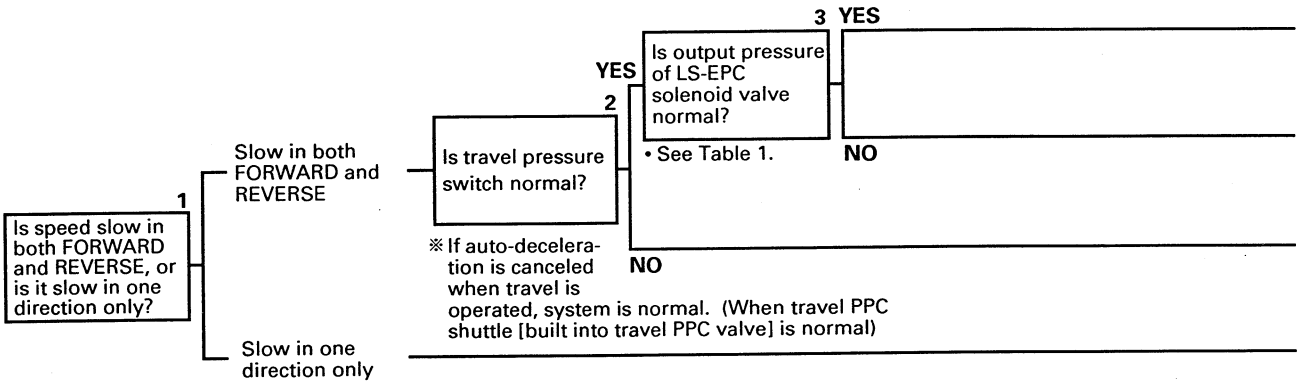
b) Excessive travel deviation when starting

Table 1

Cause	Remedy
Defective operation of travel counterbalance valve	Correct or replace

H-22 Travel speed is slow

★ When travel speed is normal.
★ Check operating condition of pressure switch with monitoring code before carrying out troubleshooting.
★ Carry out troubleshooting in the heavy-duty operation mode.

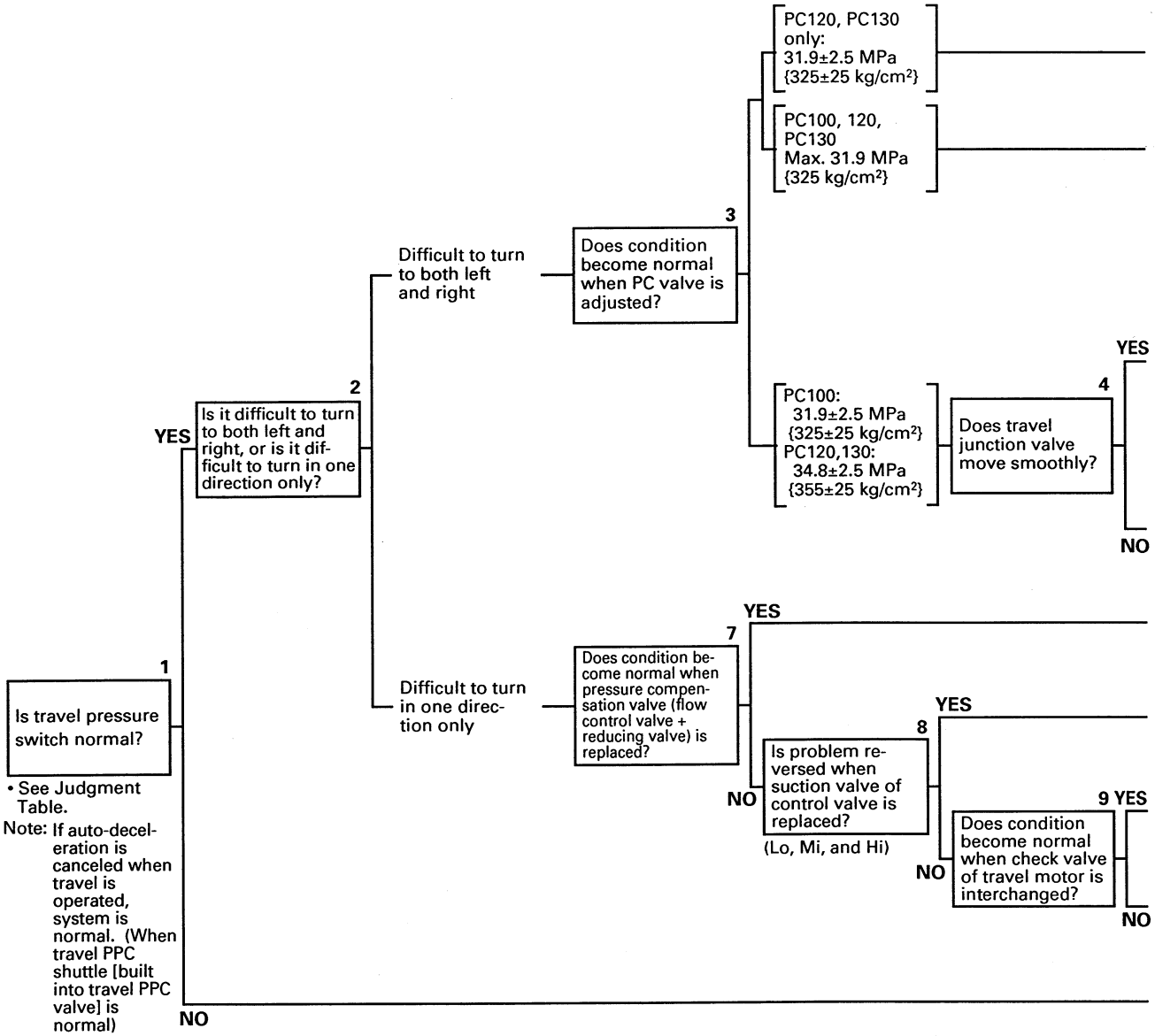


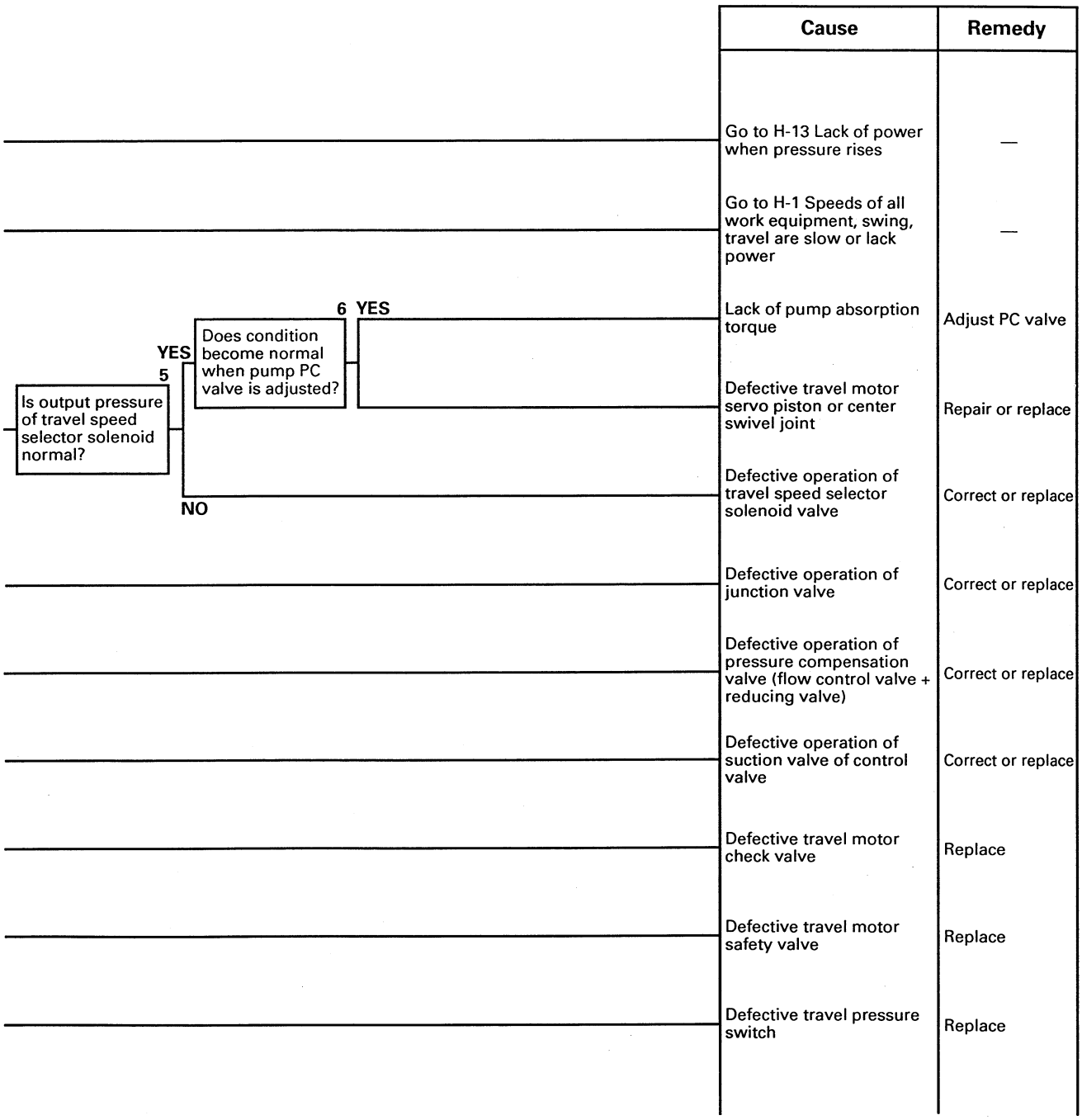
Lo	Mid	Hi
1.8±0.2 MPa {18±2 kg/cm²}	0.2±0.2 MPa {2±2 kg/cm²}	0.2±0.2 MPa {2±2 kg/cm²}
• Engine at high idling. • Travel lever at fine control position (autodeceleration canceled)		

Cause	Remedy
Defective operation of main valve travel valve	Correct or replace
Defective operation of LS-EPC solenoid valve	Replace
Defective pressure switch	Replace
Go to H-21 Travel deviation	—

H-23 Steering is difficult to turn or lacks power

★ Carry out troubleshooting in the heavy-duty operation mode.





Cause	Remedy
Go to H-13 Lack of power when pressure rises	—
Go to H-1 Speeds of all work equipment, swing, travel are slow or lack power	—
Lack of pump absorption torque	Adjust PC valve
Defective travel motor servo piston or center swivel joint	Repair or replace
Defective operation of travel speed selector solenoid valve	Correct or replace
Defective operation of junction valve	Correct or replace
Defective operation of pressure compensation valve (flow control valve + reducing valve)	Correct or replace
Defective operation of suction valve of control valve	Correct or replace
Defective travel motor check valve	Replace
Defective travel motor safety valve	Replace
Defective travel pressure switch	Replace

H-24 Travel speed does not switch or is faster than specified speed

★ Carry out troubleshooting in the heavy-duty operation mode.

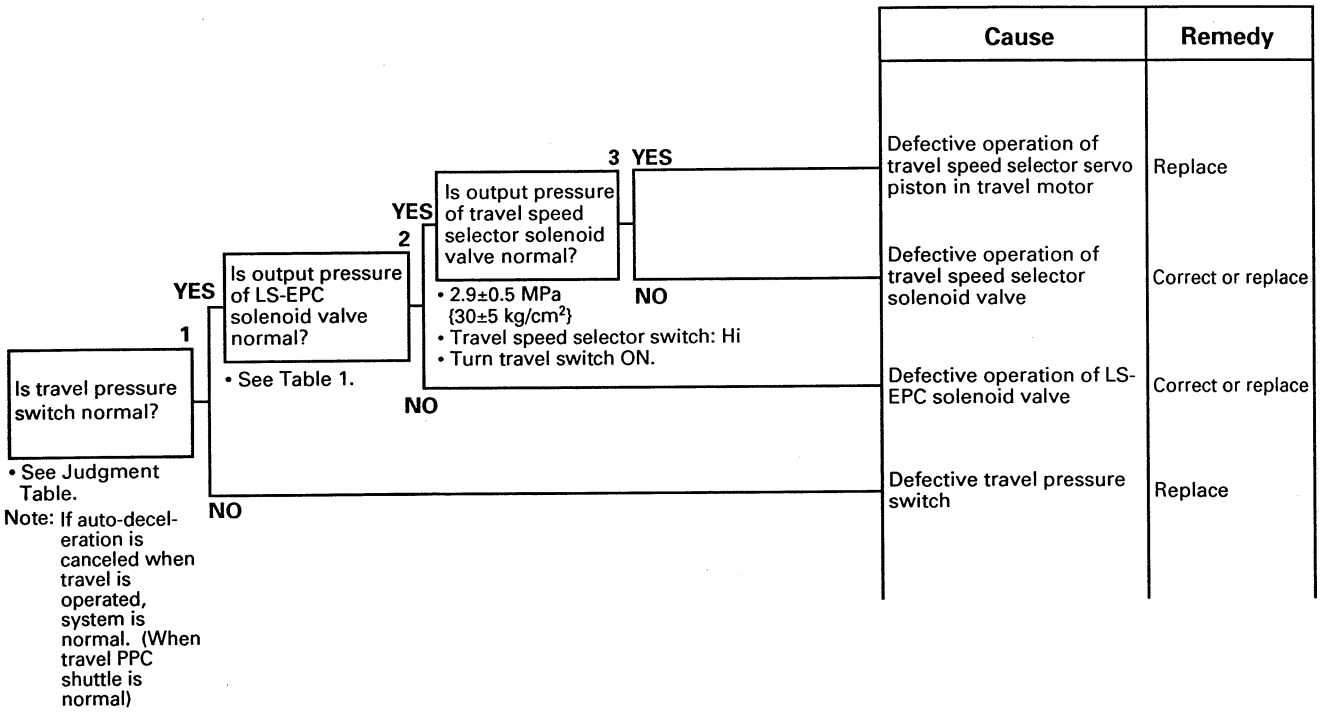
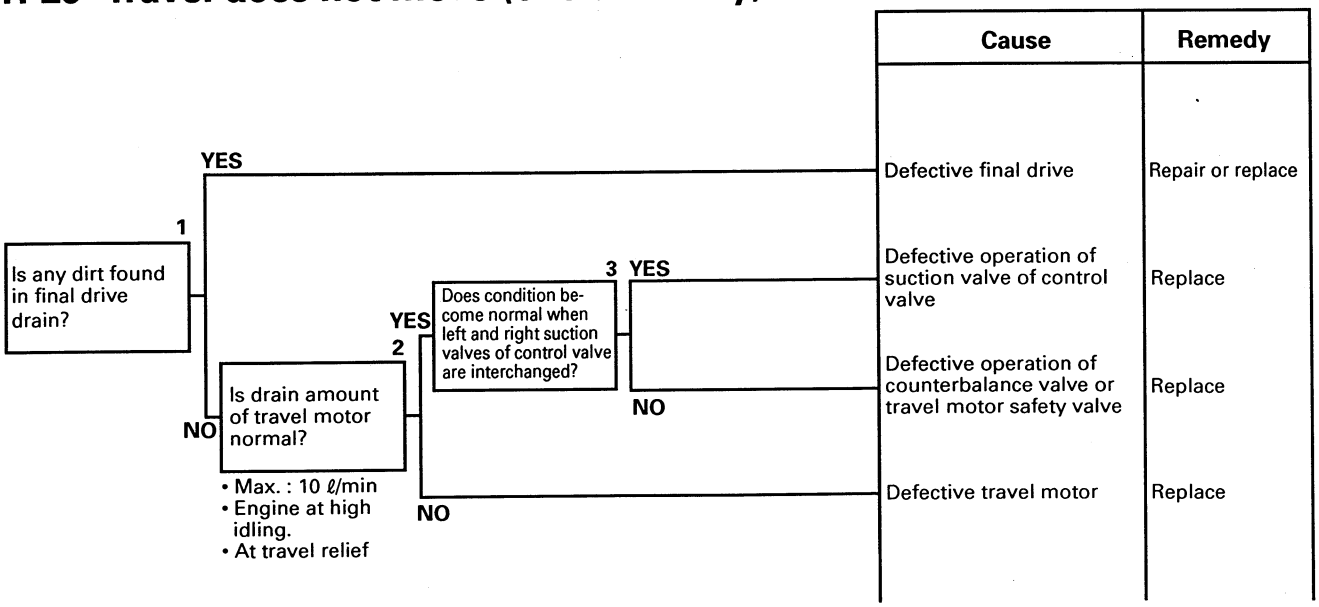


Table 1 Output pressure of LS-EPC solenoid

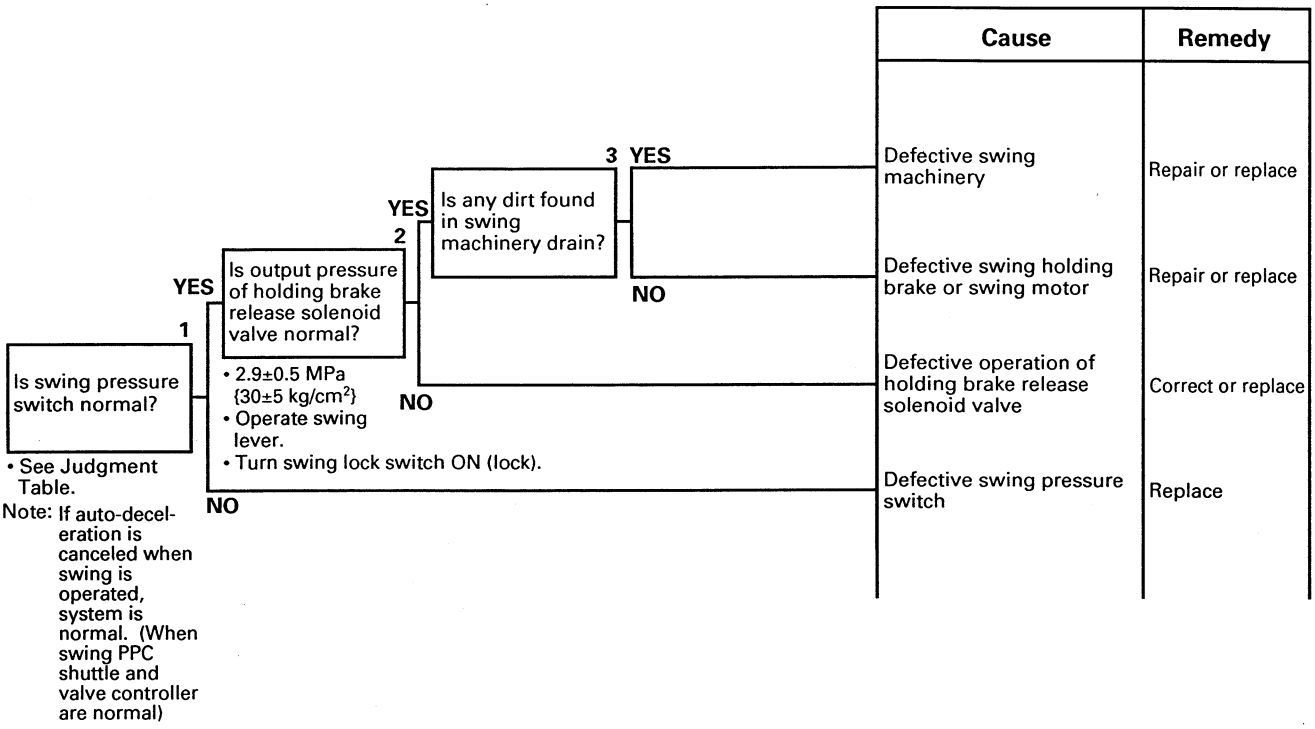
Lo	Mid	Hi
2.0±0.2 MPa {20±2 kg/cm²}	0.59±0.2 MPa {6±2 kg/cm²}	0.2±0.2 MPa {2±2 kg/cm²}
• Engine at high idling. • Travel lever at fine control position (autodeceleration canceled)		

H-25 Travel does not move (one side only)

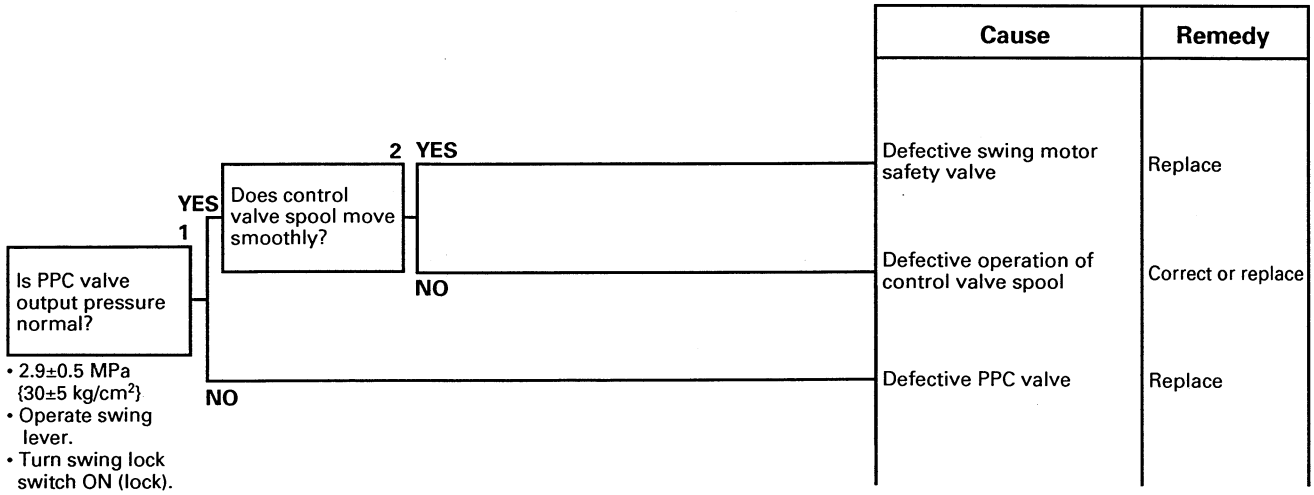


H-26 Does not swing

a) Does not swing to either left or right

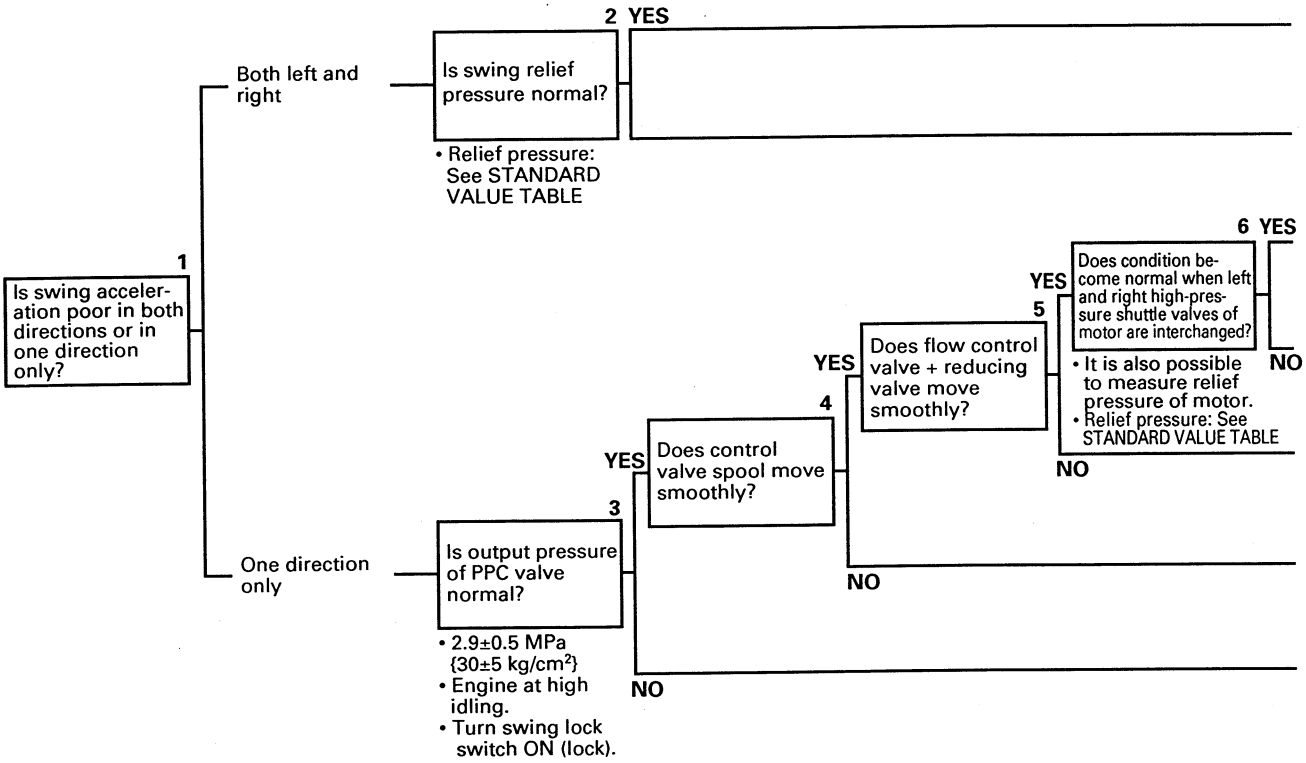


b) Does not swing in one direction



H-27 Swing acceleration is poor

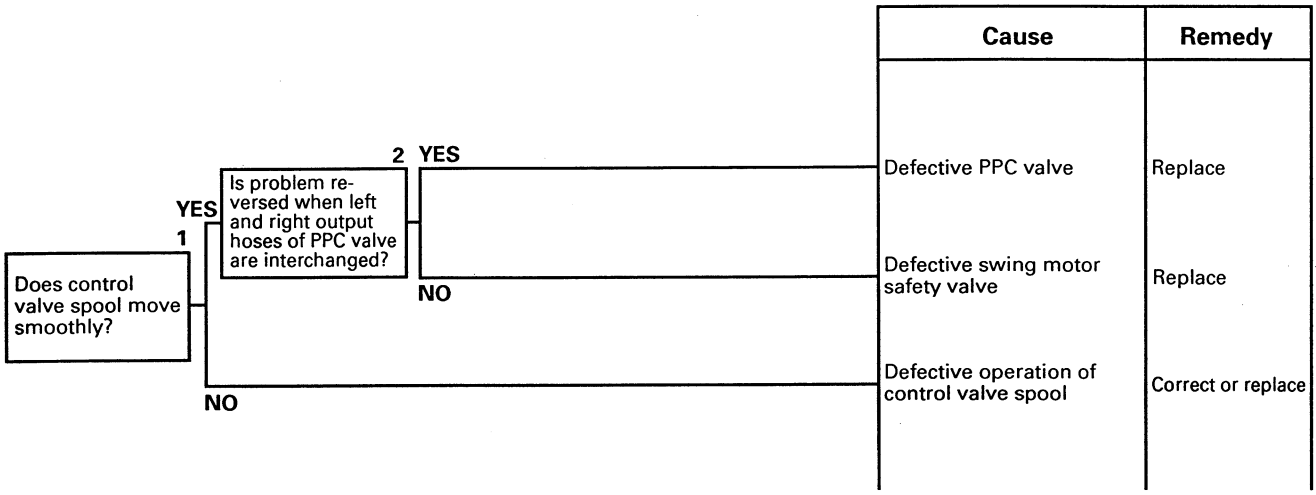
★ Carry out troubleshooting in the heavy-duty operation mode.



Cause	Remedy
Go to ONE DIRECTION ONLY	
Defective swing motor safety valve	Replace
Defective swing motor high-pressure shuttle valve (one side)	Replace
Defective swing motor suction valve	Replace
Defective operation of flow control valve + reducing valve	Correct or replace
Defective operation of control valve spool	Correct or replace
Defective PPC valve	Replace

H-28 Excessive overrun when stopping swing

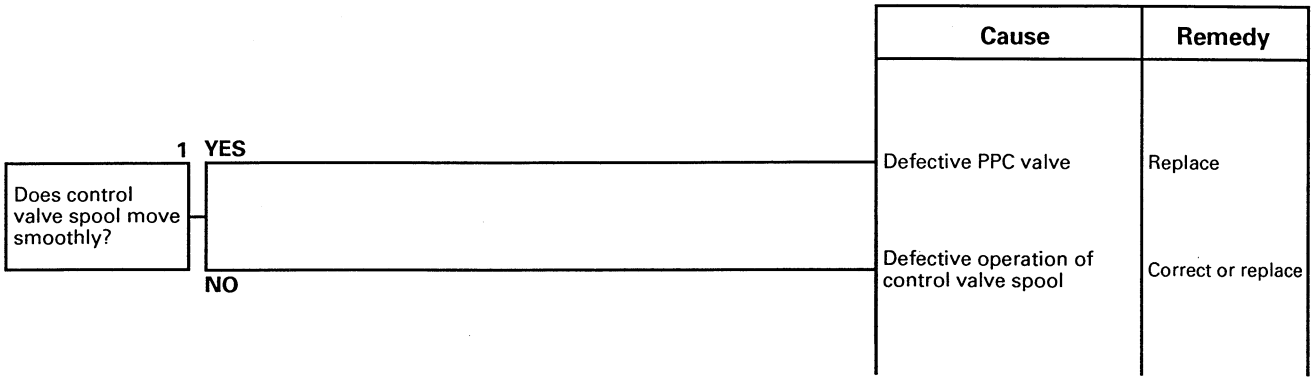
a) One direction only



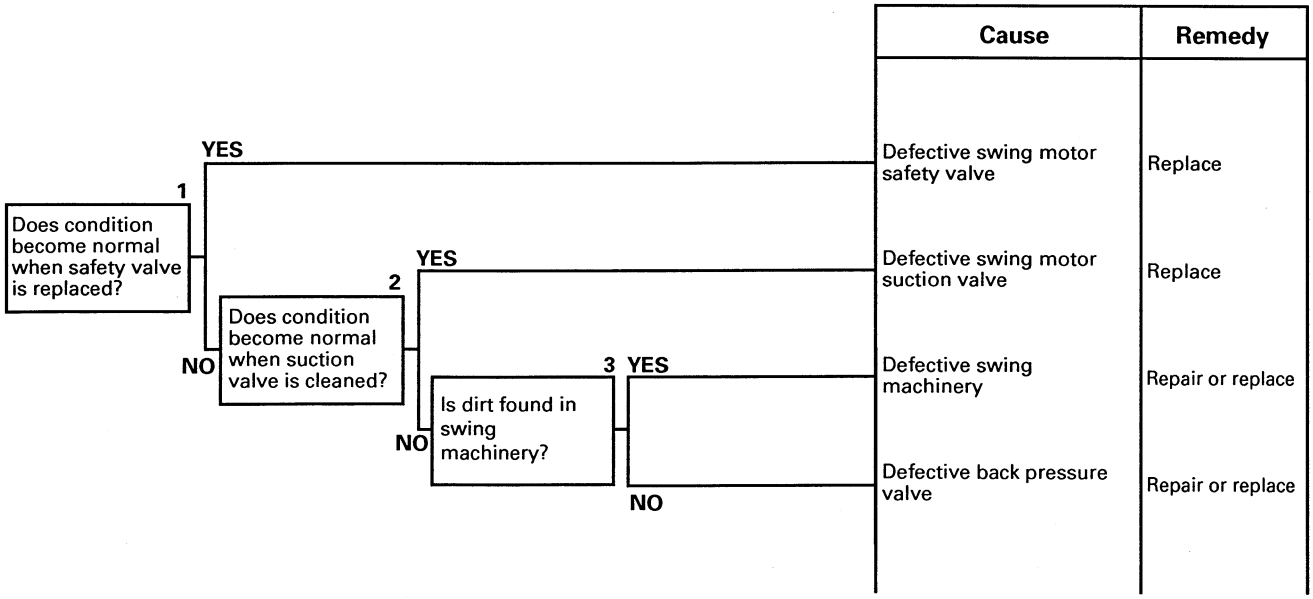
b) Both directions

Cause	Remedy
Defective swing motor	Correct or replace

H-29 Excessive shock when stopping swing (one direction only)

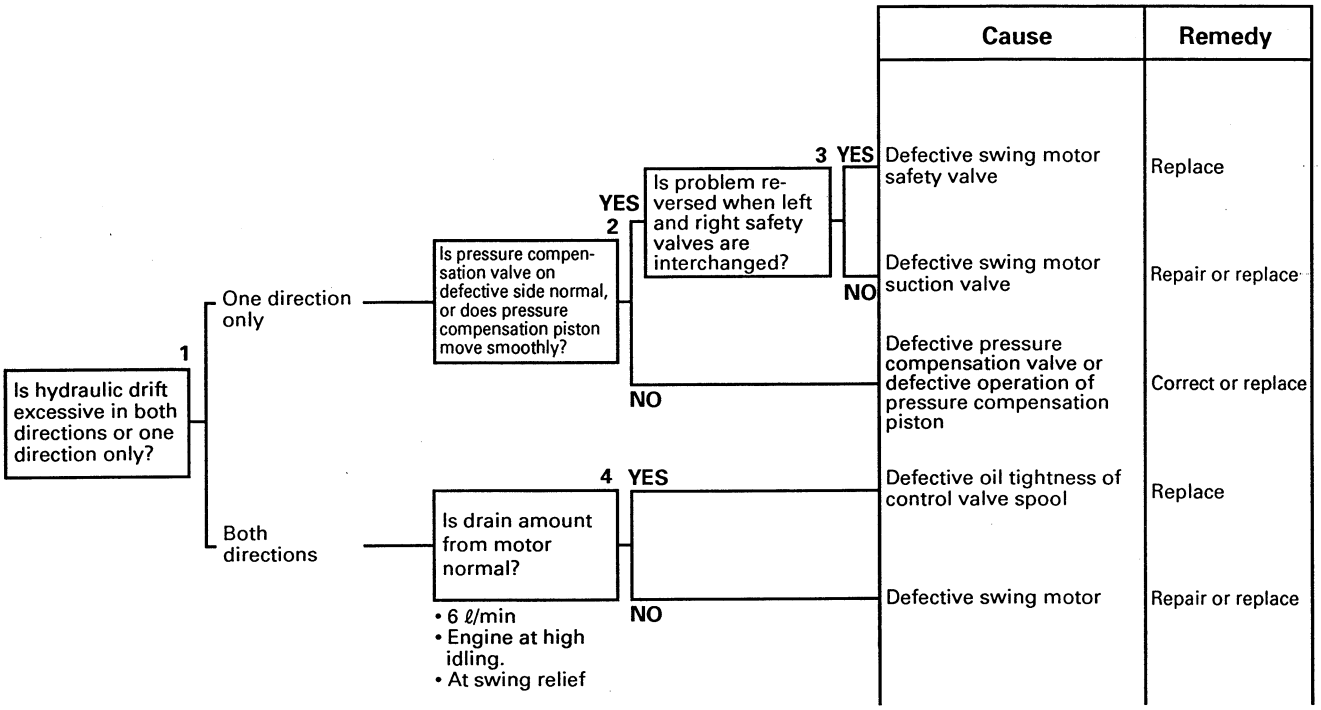


H-30 Excessive abnormal noise when stopping swing

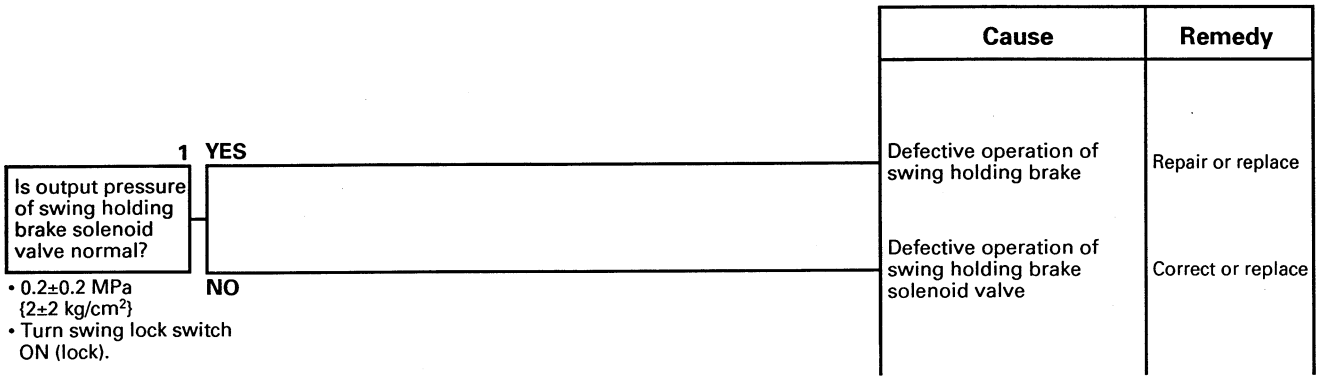


H-31 Excessive hydraulic drift of swing

a) When holding brake is released



b) When holding brake is applied



H-32 Swing speed is faster than specified swing speed

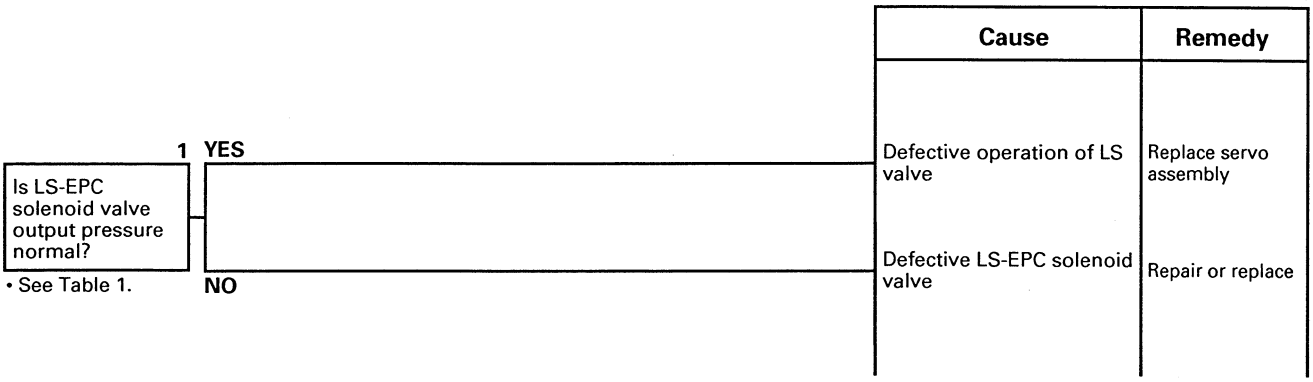


Table 1 Output pressure of LS-EPC solenoid valve

H/O mode	G/O mode	F/O mode	L/O mode
0.2±0.2 MPa {2.0±2.0 kg/cm²}	0.2±0.2 MPa {2.0±2.0 kg/cm²}	1.18±0.2 MPa {12±2.0 kg/cm²}	0.88±0.2 MPa {9.0±2.0 kg/cm²}
• Engine at high idling.			

TROUBLESHOOTING OF MACHINE MONITOR PANEL SYSTEM (M MODE)

ACTION TAKEN BY MONITOR PANEL WHEN ABNORMALITY OCCURS AND PROBLEMS ON MACHINE

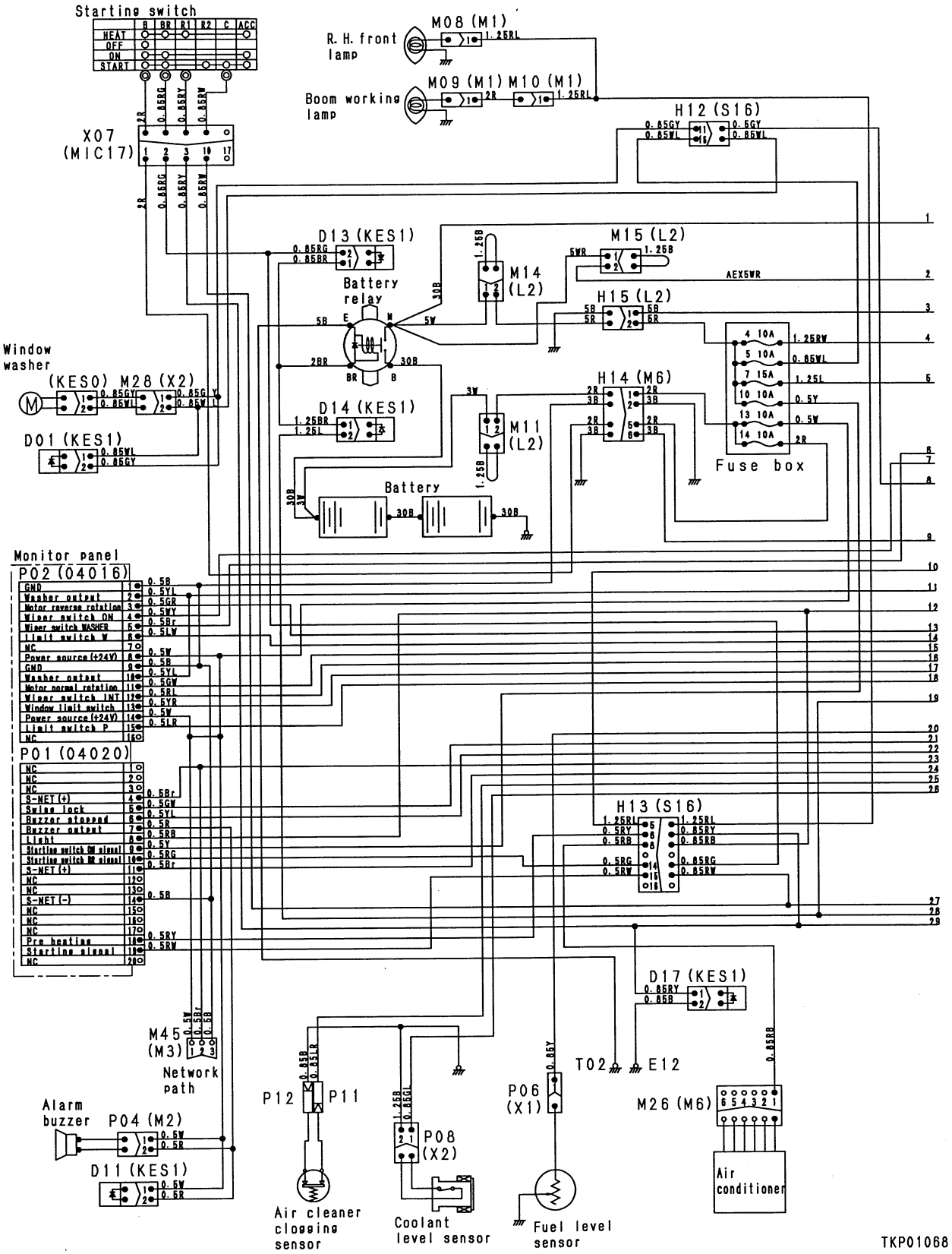
User code	Service code	Abnormal system	Nature of abnormality
—	E101	Abnormality in trouble data memory	1. Abnormality in internal memory 2. Excess voltage (more than 36V) has occurred 3. Low voltage (less than 12V) has occurred 4. Connector has separated
—	E102	Abnormality in time data	1. Abnormality in internal clock function 2. Excess voltage (more than 36V) has occurred 3. Low voltage (less than 12V) has occurred 4. Connector has separated
—	E103	Short circuit in buzzer output system	1. Short circuit inside buzzer 2. Power line in contact with wiring harness between monitor (P01 (7)) and buzzer 3. Abnormality in monitor panel
—	E104	Air cleaner clogging detection	Air cleaner clogging sensor detects clogging
—	E106	Drop in engine oil pressure detection	Engine oil pressure sensor detect drop in oil pressure
—	E108	Engine water temperature 105°C detection	Coolant temperature sensor detects water temperature 105°C

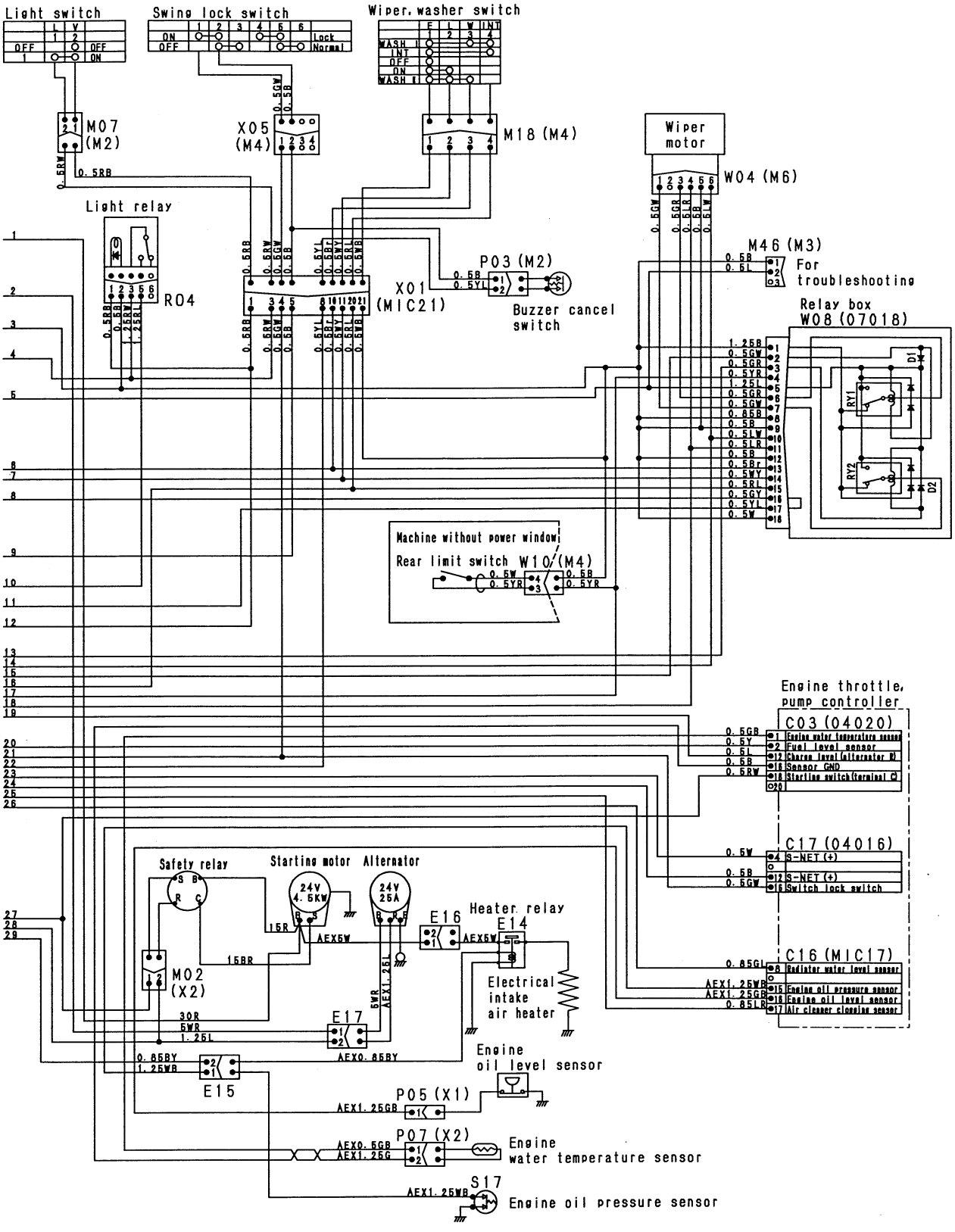
Condition when norma (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality
• When starting switch is turned ON, keep time switch pressed for 5 seconds to actuate clear function	—	1. Service code cannot be cleared 2. Time becomes 00 : 00.
	—	1. Service code cannot be cleared 2. Time becomes 00:00. 3. Clock does not advance.
• Voltage between P01 (7) – chassis Buzzer ON : Max. 1V Buzzer OFF : 20 – 30V ★When there is disconnection, E103 is not displayed and buzzer does not sound	—	Buzzer does not sound
• Resistance between P11 (male) and P12 (female): Max. 1 Ω (start engine)	—	If detection of abnormality continues, air cleaner clogging caution lamp flashes and buzzer sounds
• Resistance between sensor terminal and chassis: Max. 1 MΩ (engine running at mid-range speed)	—	If detection of abnormality continues, engine oil pressure caution lamp flashes and buzzer sounds
• Resistance between P07 (1) and (2): Min. 3.156 kΩ (start engine)	—	1. If detection of abnormality continues, coolant temperature caution lamp flashes and buzzer sounds 2. If detection of abnormality continues, engine speed is set to low idling

User code	Service code	Abnormal system	Nature of abnormality
—	E112	AE112 Short circuit in wiper motor drive normal rotation system	1. Internal short circuit, short circuit with chassis ground in wiper motor 2. Internal short circuit, short circuit with chassis ground in relay box 3. Short circuit with chassis ground, short circuit in wiring harness between monitor P02 (11) and relay box W08 (2), or between W08 (6) and wiper motor W04 (3)
—	E113	AE113 Short circuit in wiper motor drive reverse rotation system	1. Internal short circuit, short circuit with chassis ground in wiper motor 2. Internal short circuit, short circuit with chassis ground in relay box 3. Short circuit with chassis ground, short circuit in wiring harness between monitor P02 (3) and relay box W08 (3), or between W08 (7) and wiper motor W04 (1)
—	E114	SE114 Short circuit in window washer drive system	1. Internal short circuit, short circuit with chassis ground in washer motor 2. Internal short circuit, short circuit with chassis ground in relay box 3. Short circuit with power source in wiring harness between monitor P02 (2)(10) and relay box W08 (17), or between W08 (16) and M28 (1)

Condition when norma (voltage, current, resistance)	Action by controller when abnormality is detected	Problem that appears on machine when there is abnormality
• Voltage between W04 (3) and (5): Max. 3 V ↕ 20 – 30 V ★Repeats in fixed cycle.	Makes output to relay box 0	Operation of wiper stops.
• Voltage between W04 (1) and (5): Max. 3 V ↕ 20 – 30 V ★Repeats in fixed cycle.	Same as E112	Same as E112
• Motor resistance : 5 – 20 Ω	Makes output to washer motor 0	Operation of window washer stops.

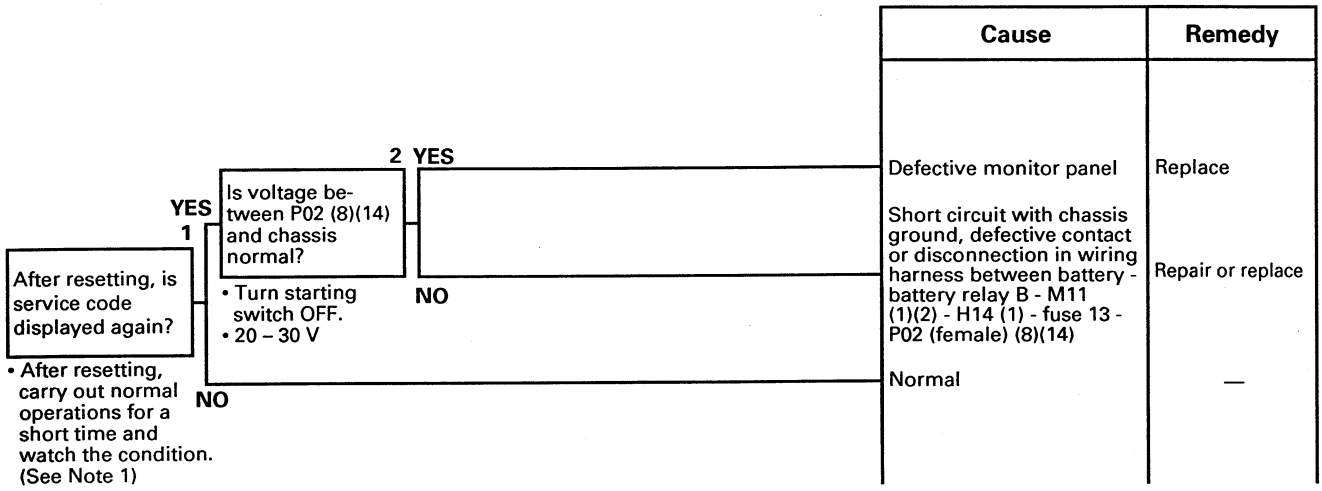
ELECTRICAL CIRCUIT DIAGRAM FOR M MODE SYSTEM




Light switch
Swing lock switch
Wiper, washer switch
M07 (M2)
X05 (M4)
M18 (M4)
Wiper motor
W04 (M6)
Light relay
R04
X01 (MIC21)
P03 (M2)
Buzzer cancel switch
M46 (M3)
For troubleshooting
Relay box W08 (07018)
Machine without power window
Rear limit switch W10 (M4)
Engine throttle, pump controller
C03 (04020)
C17 (04016)
C16 (MIC17)
Safety relay
Starting motor
Alternator
24V 4.5KW
24V 25A
E16
E14
Heater relay
M02 (X2)
E17
Electrical intake air heater
Engine oil level sensor
E15
P05 (X1)
P07 (X2)
Engine water temperature sensor
S17
Engine oil pressure sensor
TKP01069

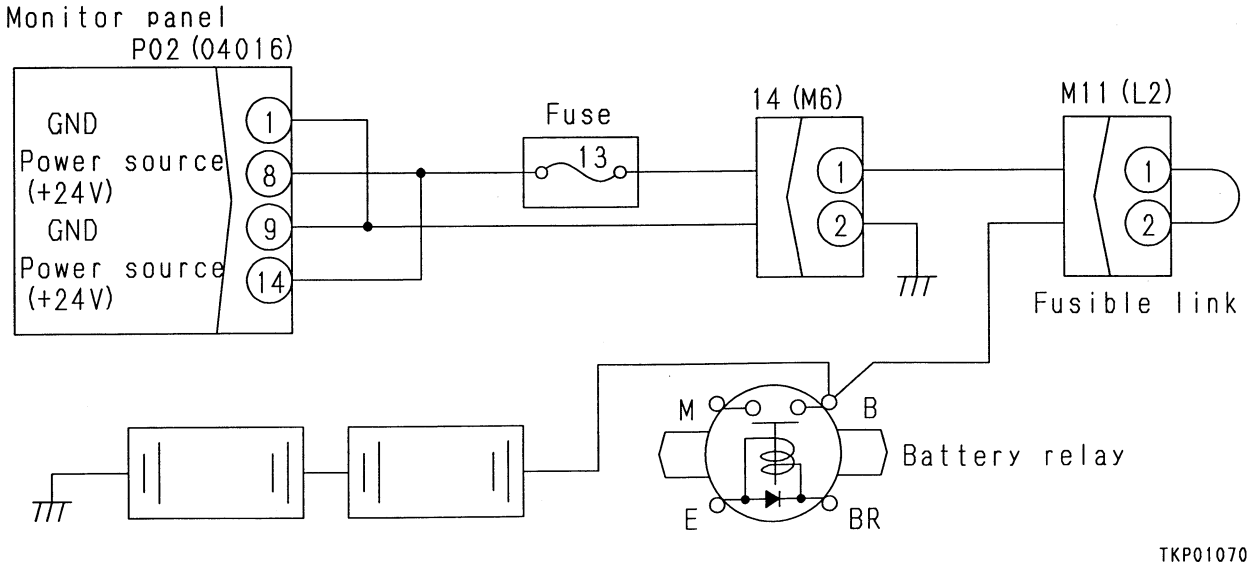
M-1 [E101] Abnormality in trouble data memory is displayed [E102] Error in time data is displayed

★ This problem occurs when connector P02, fuse 13, connector M14, connector M11, battery relay terminal B of the monitor panel power source system are disconnected, or the battery terminal is disconnected, or these parts are connected again during troubleshooting, but this is not an abnormality. (If the monitor panel circuit is shut off when the starting switch is turned OFF.)
★ After resetting, if the service code is displayed again, carry out troubleshooting as follows.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



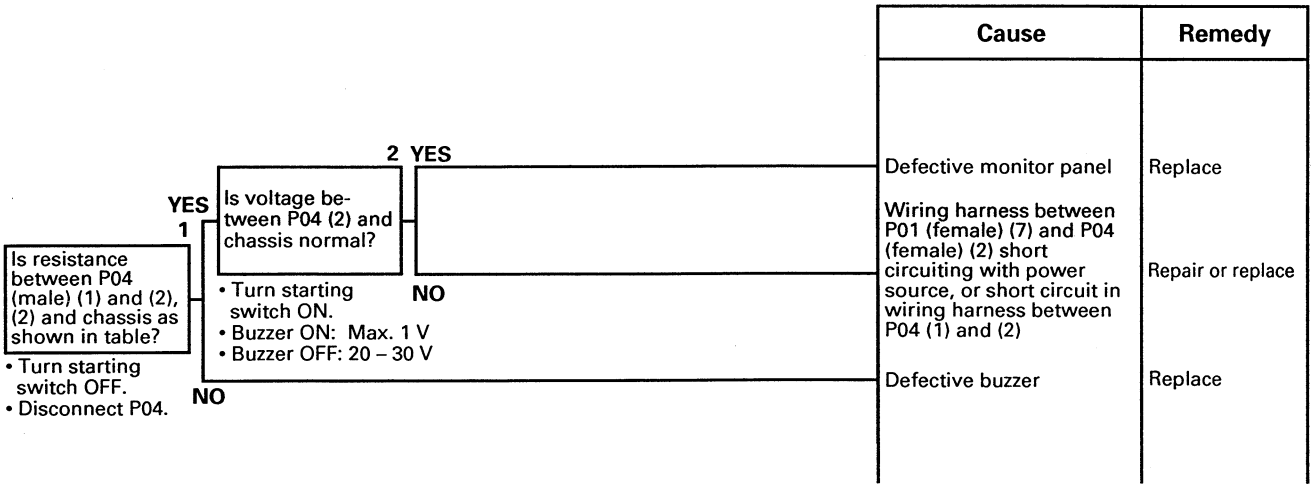
Note 1 Resetting operation: Turn the starting switch OFF, then keep the clock switch at the rear of the monitor panel pressed and turn the starting switch ON again. Keep the clock switch pressed for a further 5 seconds.
(This operation deletes all the service codes stored in the memory.)

M-1 Related electrical circuit diagram



M-2 [E103] Short circuit in buzzer output or contact of 24V wiring harness with buzzer drive harness is displayed

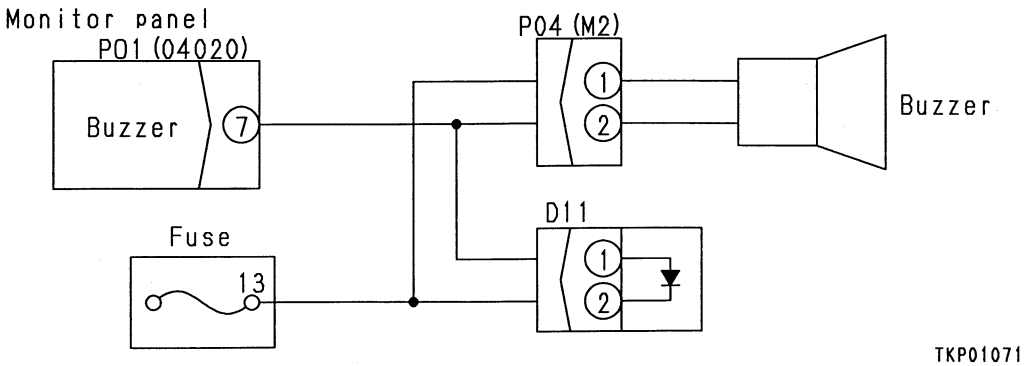
★ If the starting switch is turned OFF after an abnormality occurs, turn the starting switch ON and check if the service code "E" is displayed. (If it is not displayed, the system has been reset.)
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



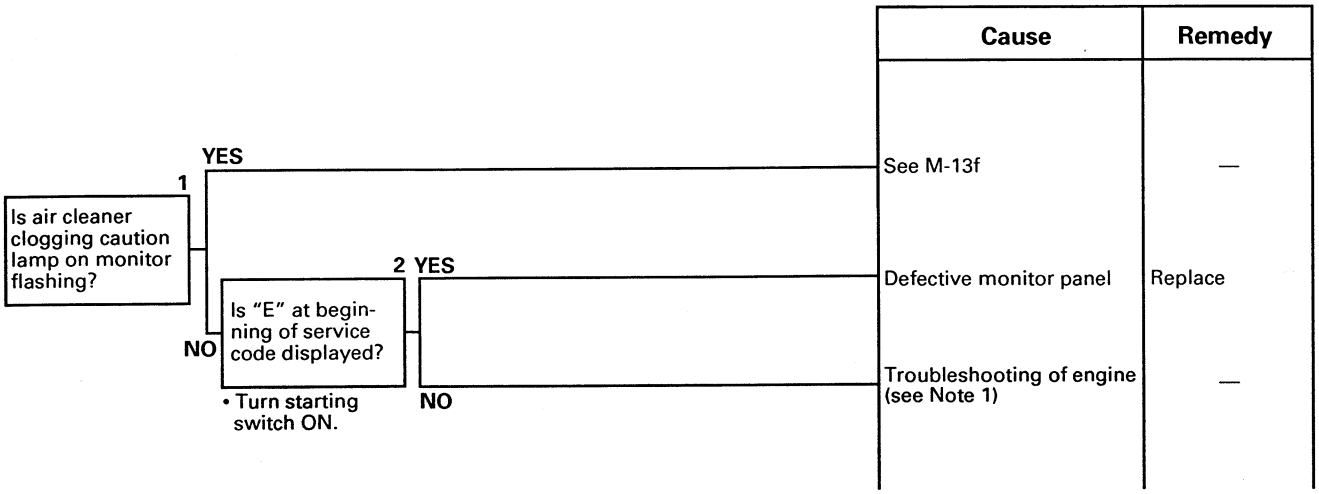
Table

P04 (male)	Resistance value
Between (1) and (2)	200 – 300 Ω
Between (2) and chassis	Min. 1 MΩ

M-2 Related electrical circuit diagram

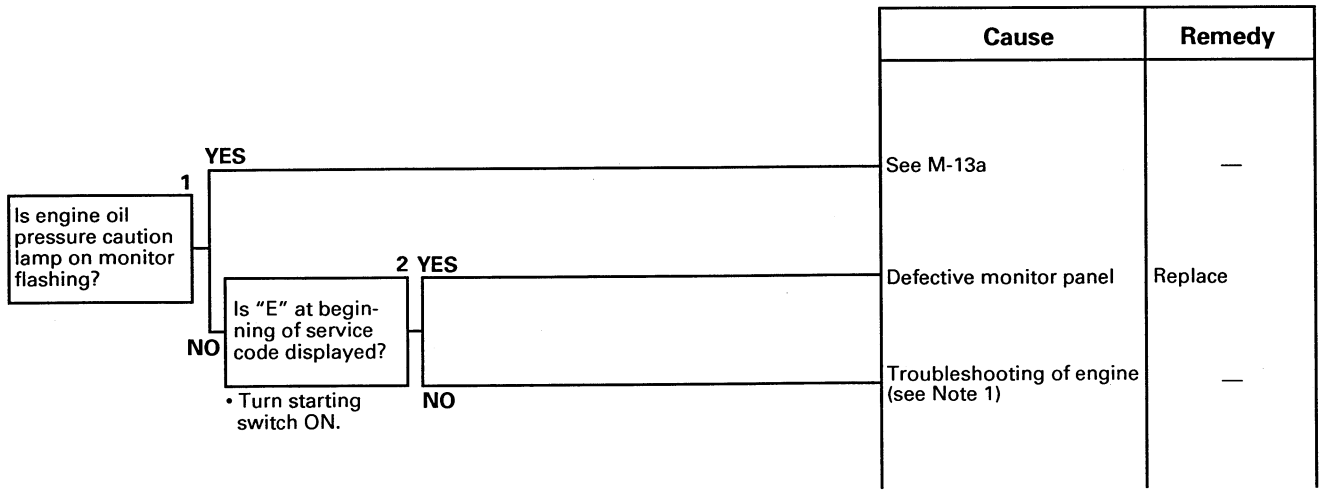


M-3 [E104] Air cleaner clogging detected is displayed



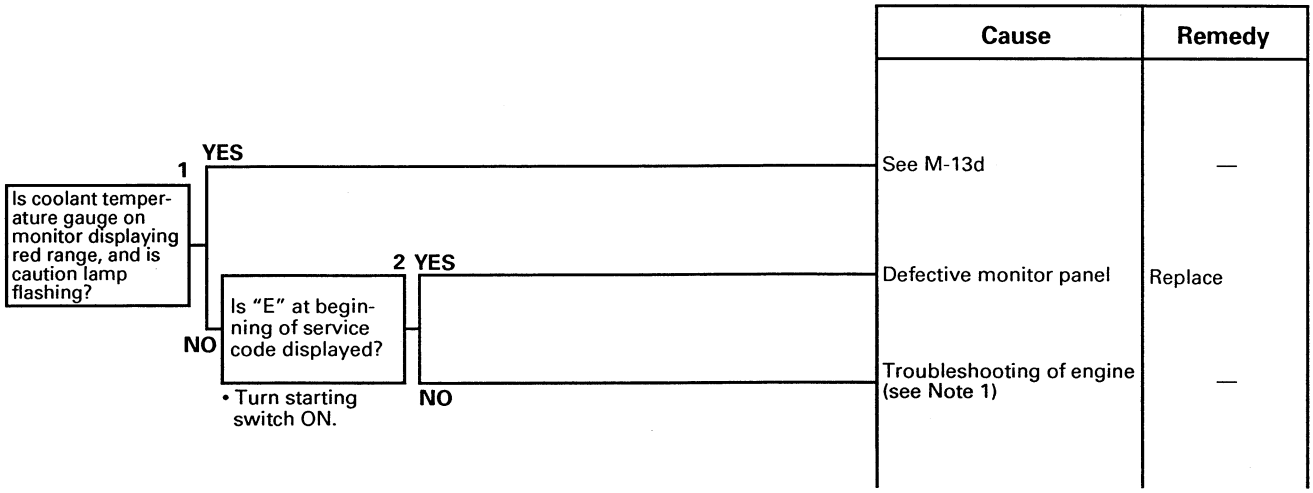
Note 1: The display on the monitor panel returns to normal, but the air cleaner clogging sensor has detected clogging in the past, so carry out troubleshooting of the engine system to remove the cause.

M-4 [E106] Drop in engine oil pressure detected is displayed



Note 1: The display on the monitor panel returns to normal, but the engine oil pressure sensor has detected a drop in pressure in the past, so carry out troubleshooting of the engine system to remove the cause.

M-5 [E108] Engine water temperature 105°C detected is displayed

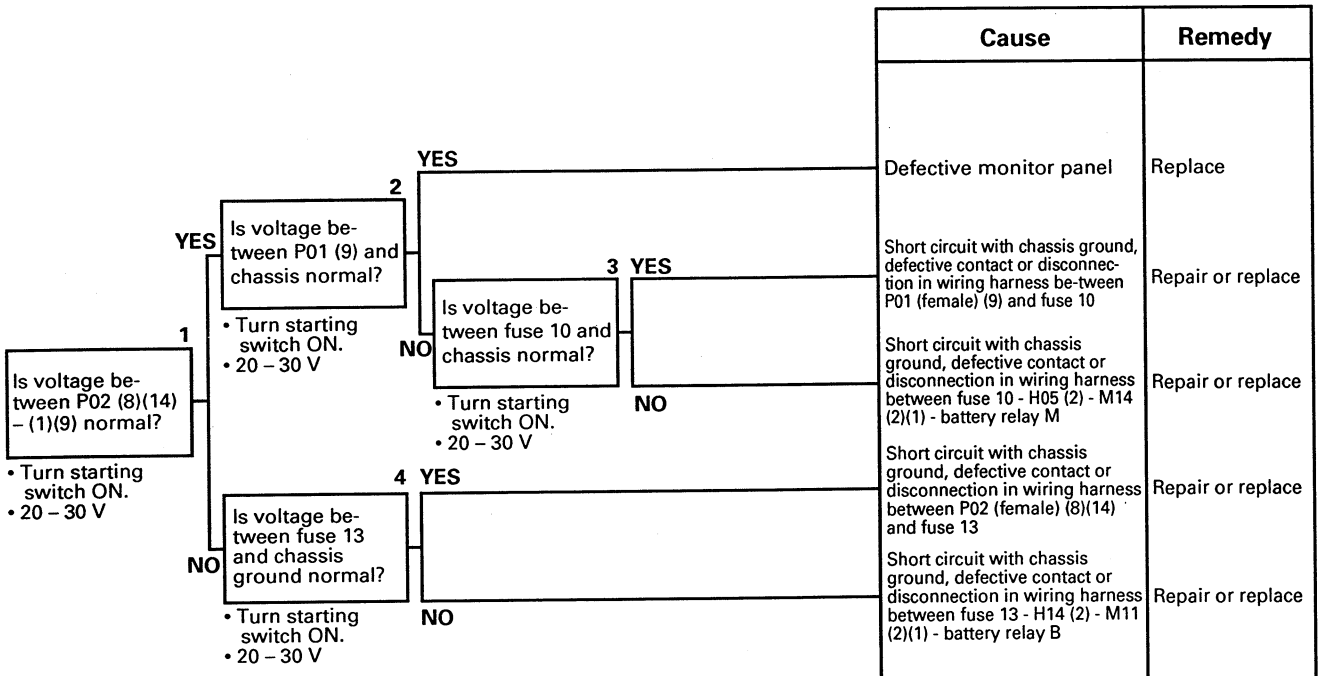


Note 1: The display on the monitor panel returns to normal, but the coolant temperature sensor has detected a water temperature of 105°C in the past, so carry out troubleshooting of the engine system to remove the cause.

M-6 When starting switch is turned ON, none of lamps on monitor panel light up

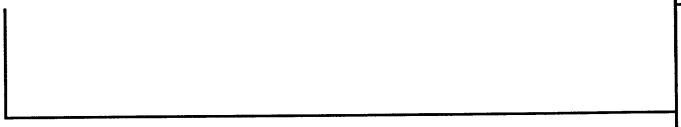
★ Check that fuses 10 and 13 are normal.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

a) None of lamps on monitor panel light up



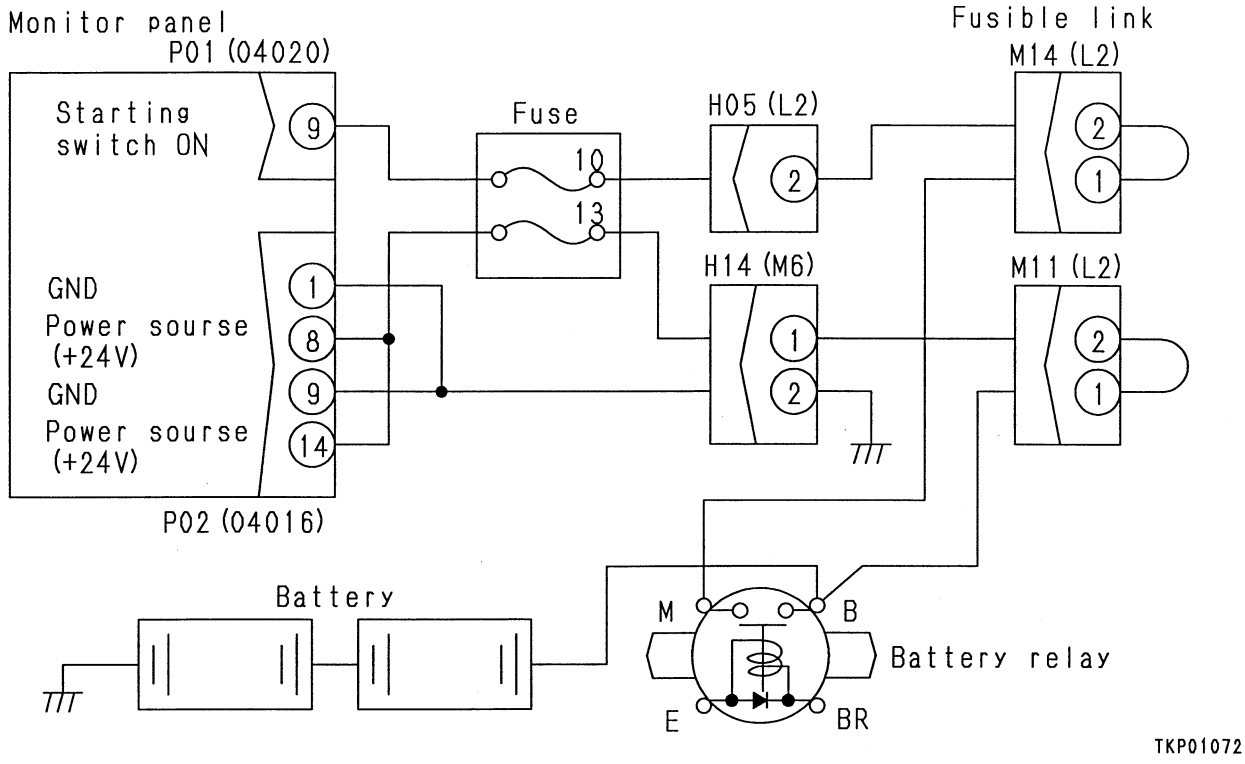
Cause	Remedy
Defective monitor panel	Replace
Short circuit with chassis ground, defective contact or disconnection in wiring harness between P01 (female) (9) and fuse 10	Repair or replace
Short circuit with chassis ground, defective contact or disconnection in wiring harness between fuse 10 - H05 (2) - M14 (2)(1) - battery relay M	Repair or replace
Short circuit with chassis ground, defective contact or disconnection in wiring harness between P02 (female) (8)(14) and fuse 13	Repair or replace
Short circuit with chassis ground, defective contact or disconnection in wiring harness between fuse 13 - H14 (2) - M11 (2)(1) - battery relay B	Repair or replace

b) Some of lamps on monitor panel do not light up



Cause	Remedy
Defective omonitor panel	Replace

M-6 a) Related electrical circuit diagram



M-7 When starting switch is turned ON, monitor panel lamps all stay lighted up and do not go out

Cause	Remedy
Defective omonitor panel	Replace

M-8 When starting switch is turned ON, items lighted up on monitor panel are different from actual machine (model)

★ Immediately after replacing the monitor panel, turn the starting switch OFF, then turn it ON again to check.

Cause	Remedy
Defective monitor panel	Replace
Carry out troubleshooting for C Mode (see C-14)	—

1 Is display of monitoring code [01] as shown in table?
- Turn starting switch ON.
- Set to monitoring code [01].

YES → Defective monitor panel — Replace

NO → Carry out troubleshooting for C Mode (see C-14)

Table 1

Controller model code


BKP00381

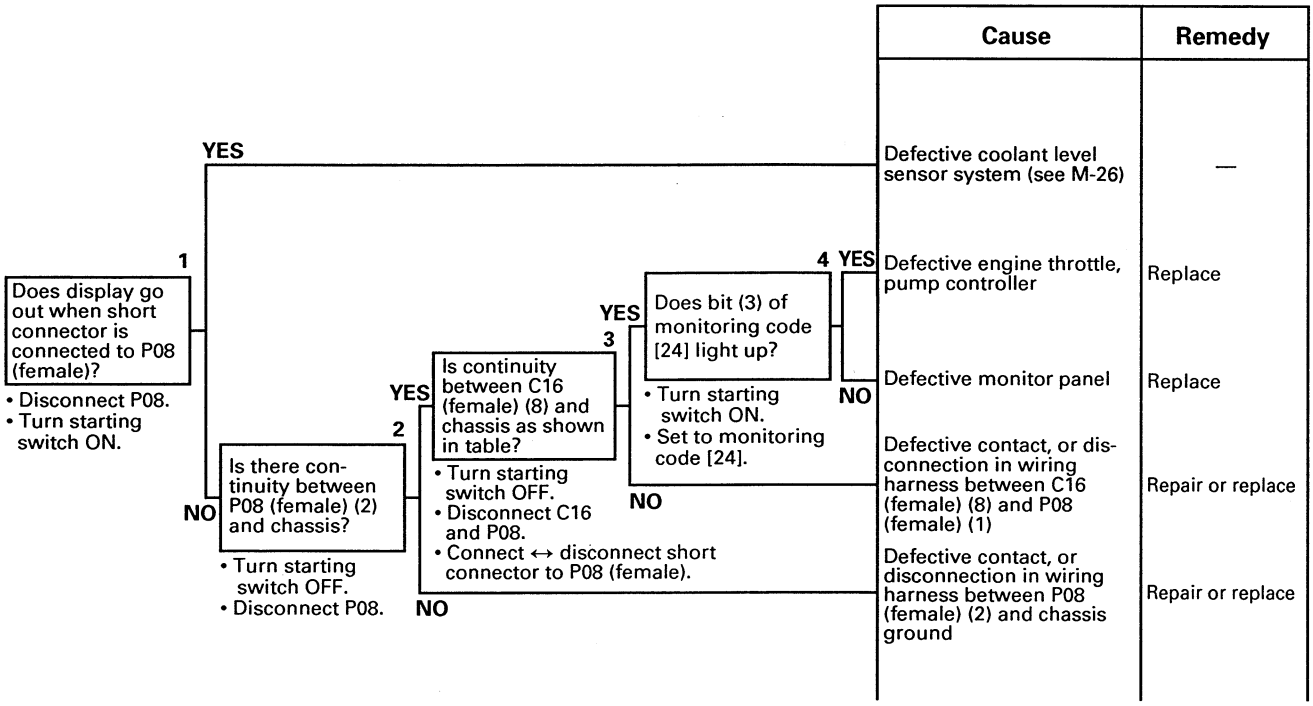
M-9 When starting switch is turned ON (engine stopped), basic check items flash

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

a)  (coolant level) flashes

SAP00519

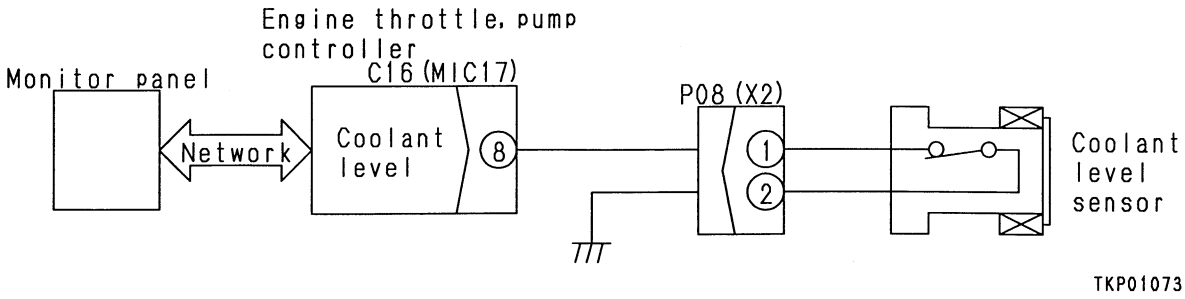
★ Check that the coolant level is correct before carrying out troubleshooting.



Table

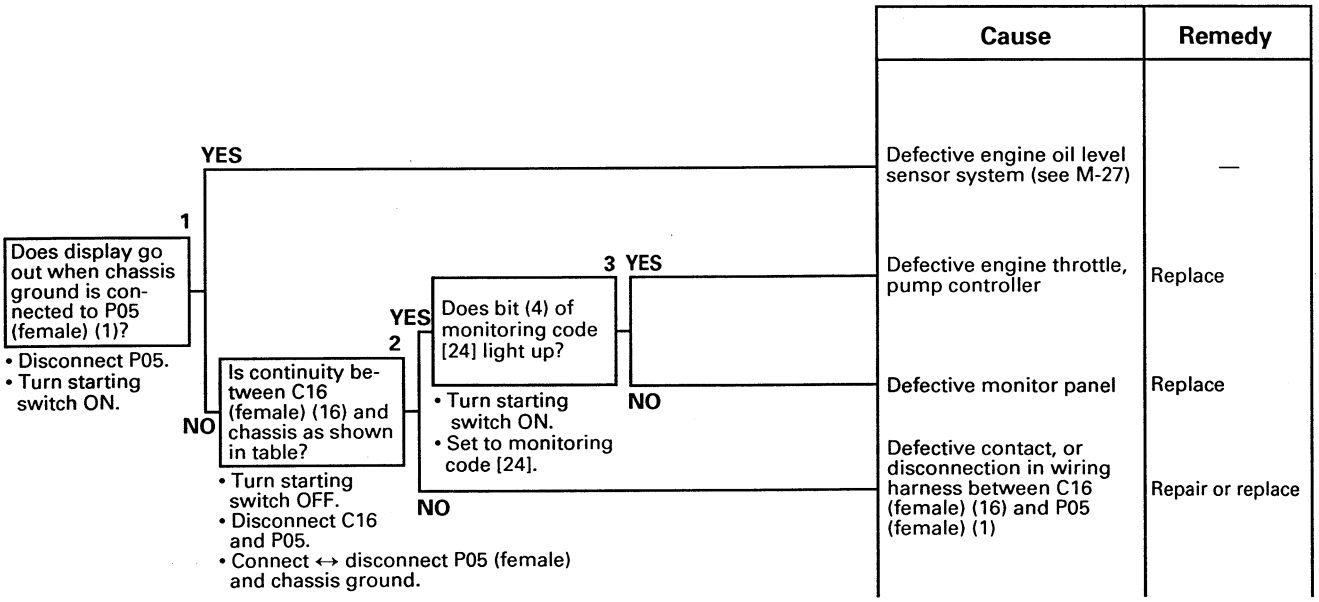
Short connector	Continuity
Connected	Yes
Disconnected	No

M-9 a) Related electrical circuit diagram



b) SAP00523 **(engine oil level) flashes**

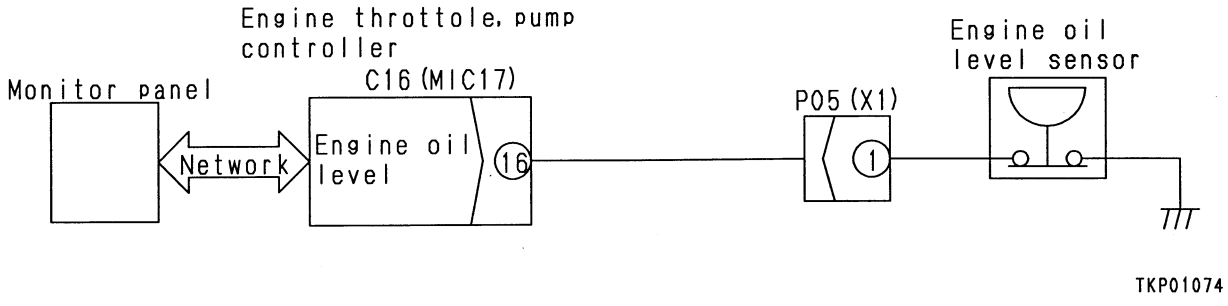
★ Check that the engine oil level is correct before carrying out troubleshooting.



Table

Connection with ground	Continuity
Connected	Yes
Disconnected	No

M-9 b) Related electrical circuit diagram

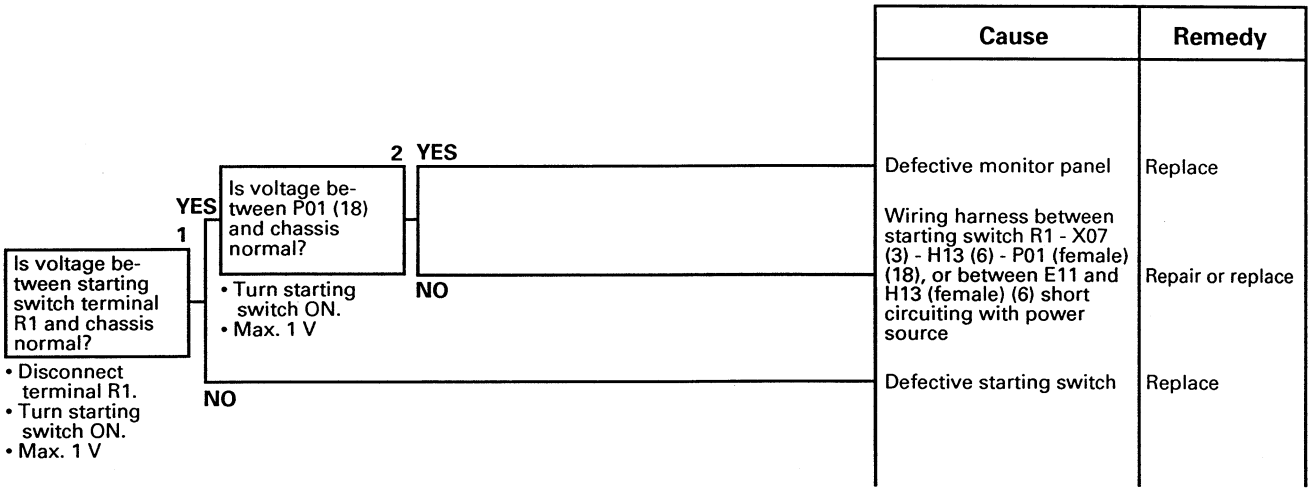


TKP01074

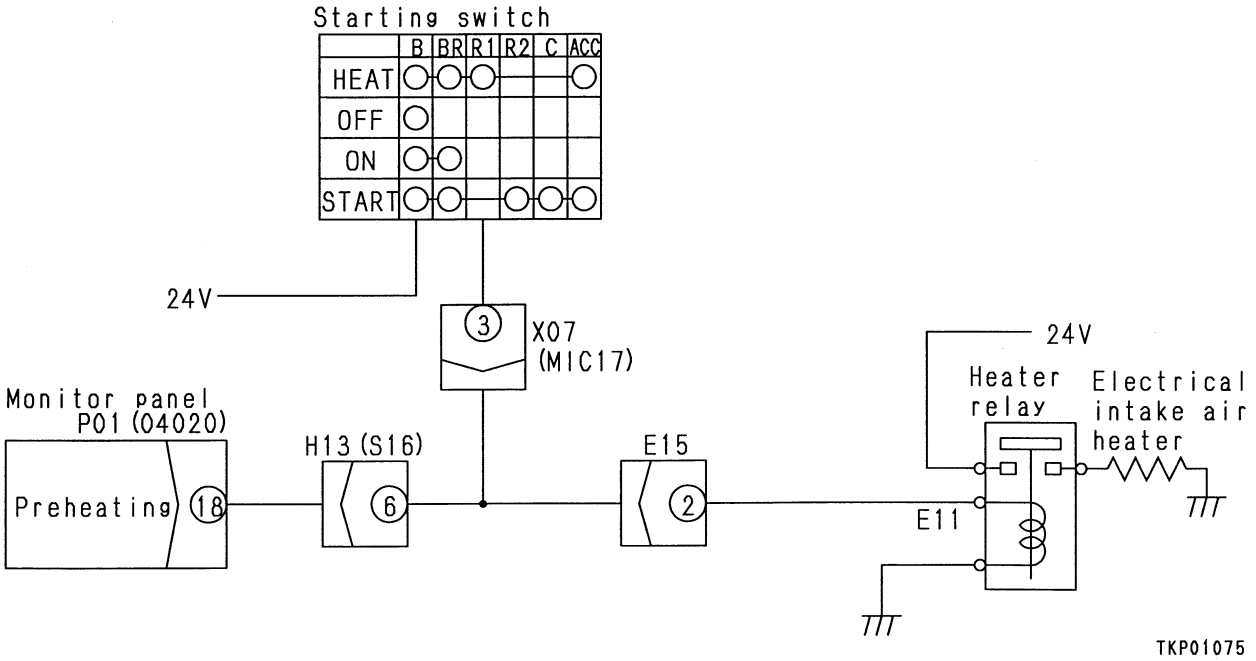
M-10 Preheating is not being used but (preheating monitor) lights up

SAP00526

★Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★Always connect any disconnected connectors before going on the next step.



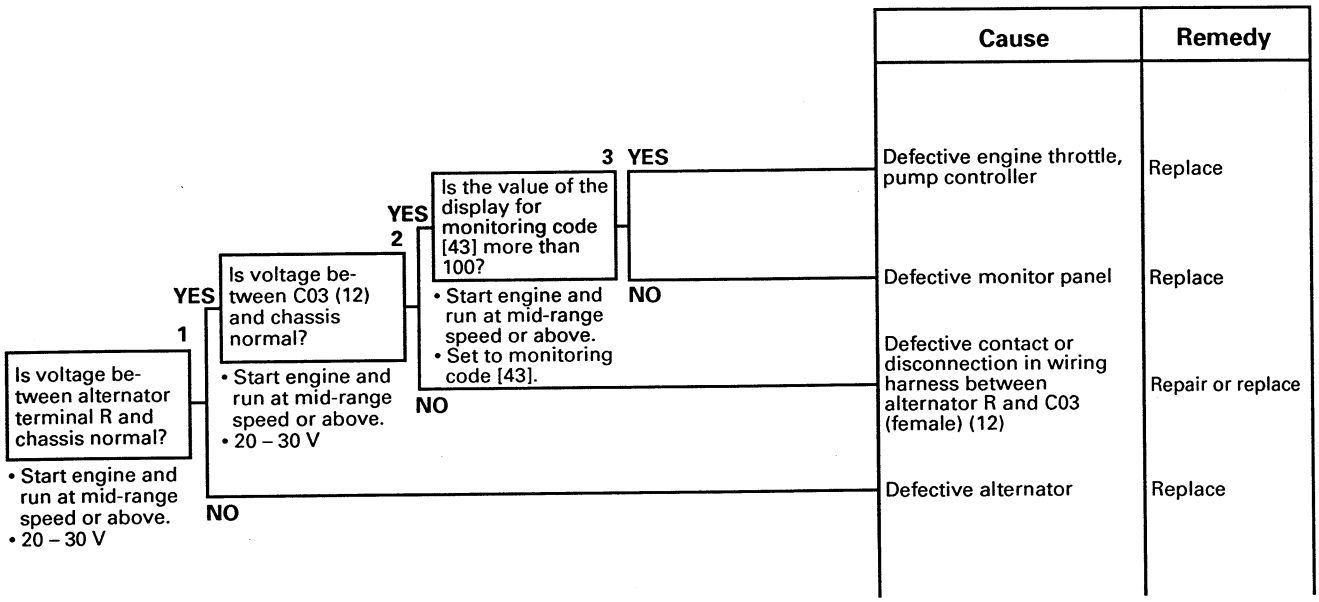
M-10 Related electrical circuit diagram



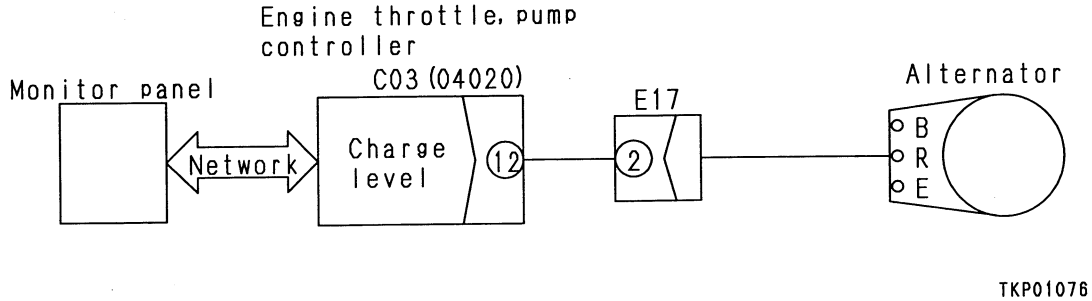
M-11 When starting switch is turned on and engine is started, basic check items flash

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.
★ Check both the alternator system and the engine oil pressure system.

a) Alternator system

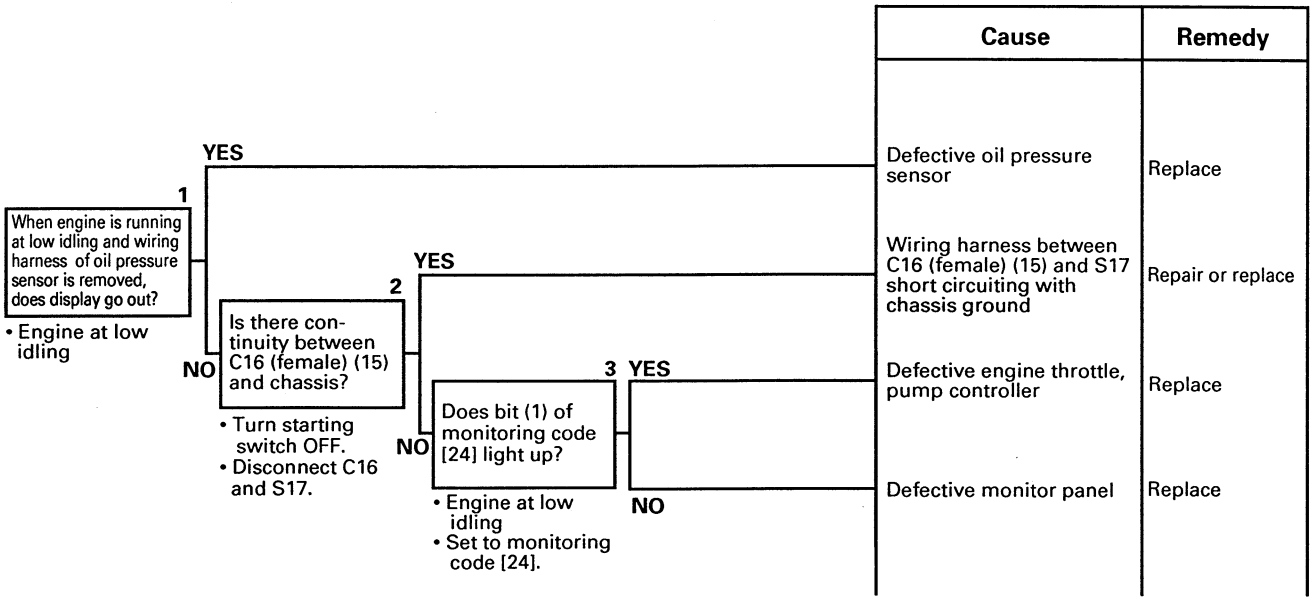


M-11 a) Related electrical circuit diagram

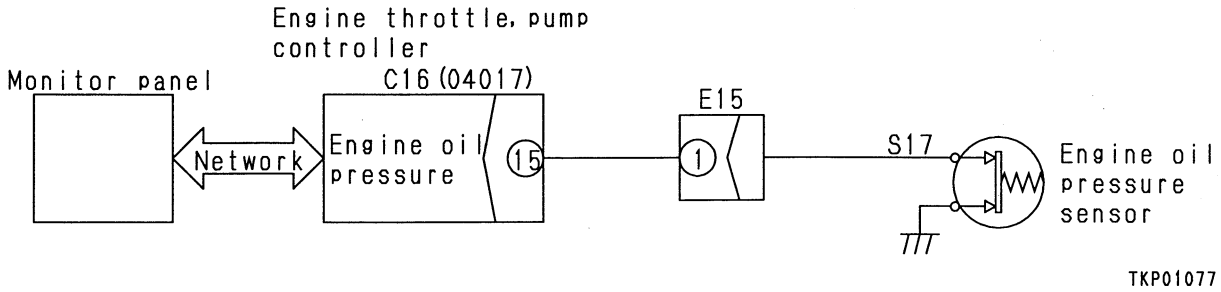


b) Engine oil pressure system

★ When engine oil pressure is normal



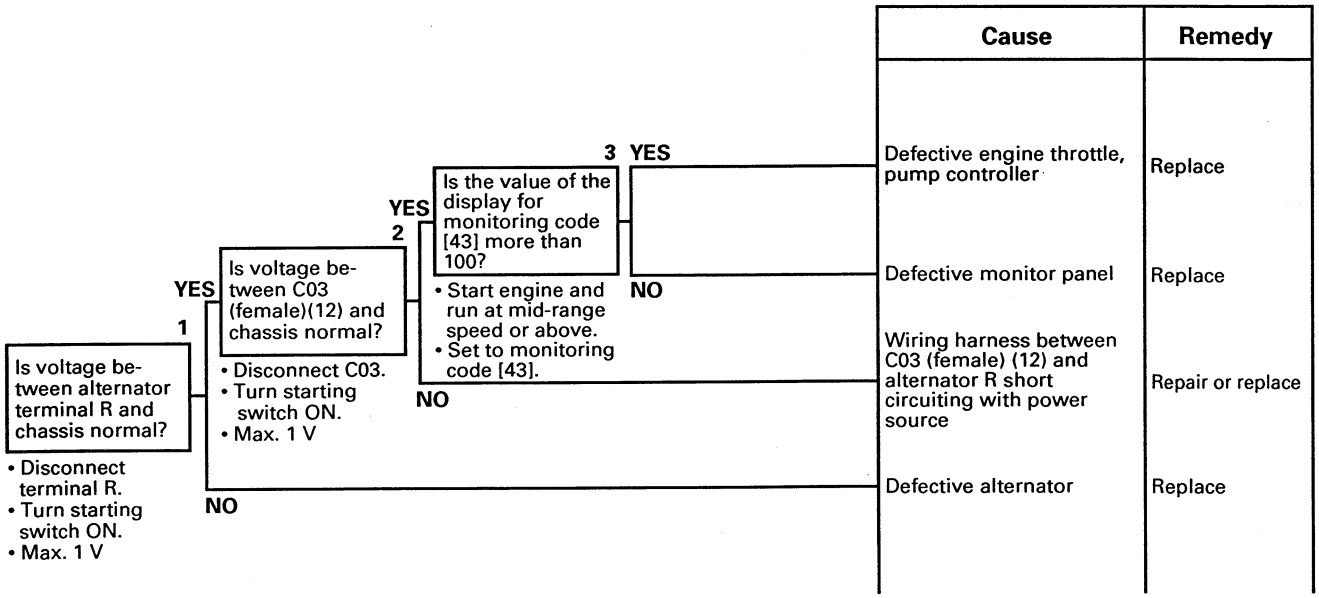
M-11 b) Related electrical circuit diagram



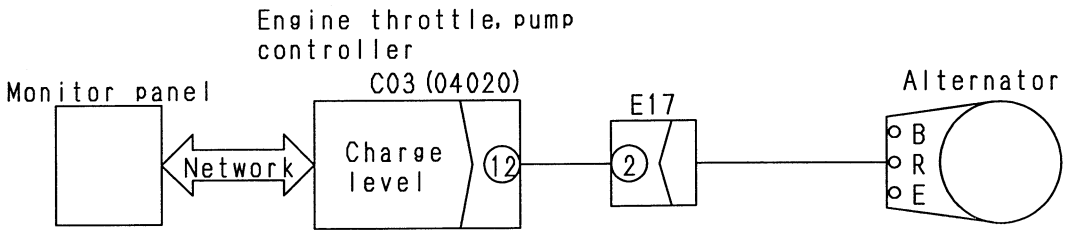
M-12 When starting switch is turned on (engine stopped), caution items, emergency stop items flash (but when battery, engine oil pressure do not light up)

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.
★ Check both the alternator system and the engine oil pressure system.

a) Alternator system



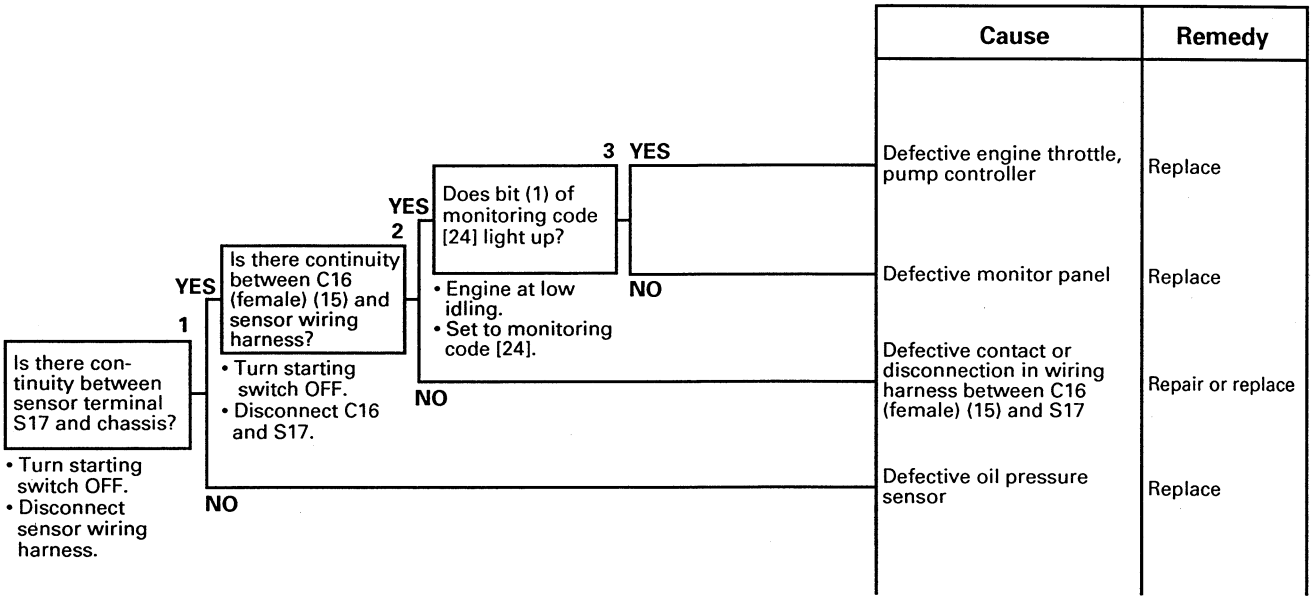
M-12 a) Related electrical circuit diagram



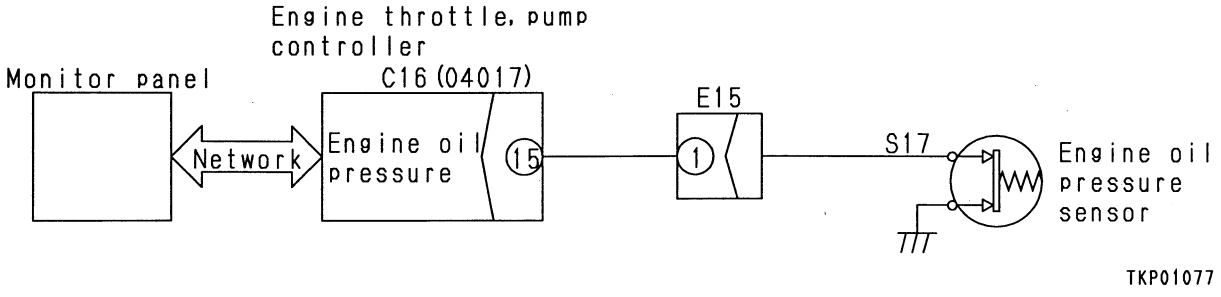
TKP01076

b) Engine oil pressure sensor system

★ When engine oil pressure is normal



M-12 b) Related electrical circuit diagram



M-13 When starting switch is turned on and engine is started, caution items, emergency stop items flash (but when there is no abnormality in engine or items to check before troubleshooting)

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

a)  SAP00520 **(engine oil pressure) flashes**

★ Check that the engine oil pressure is normal before carrying out troubleshooting.

Cause	Remedy
See M11 b)	—

b)  SAP00519 **(coolant level) flashes**

★ Check that the coolant level is normal before carrying out troubleshooting.

Cause	Remedy
See M-9 a).	—

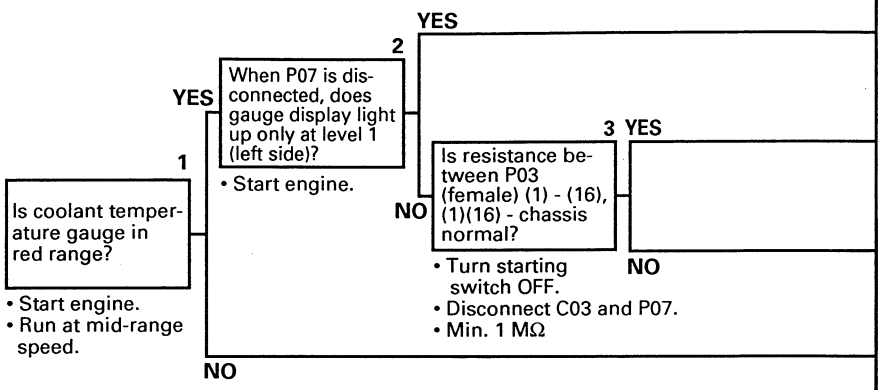
c)  SAP00522 **(charge level) flashes**

Cause	Remedy
See M-11 a)	—

d)  (coolant temperature) flashes

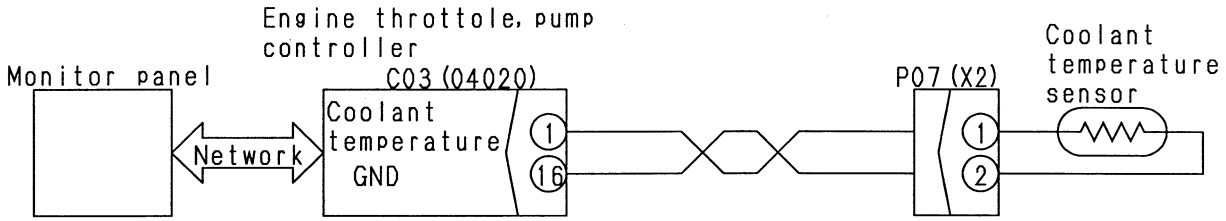
SAP00527

★ Check that the coolant temperature is normal before carrying out troubleshooting.



Cause	Remedy
Defective coolant temperature sensor system (see M-26)	—
Defective engine throttle, pump controller	Replace
Short circuit in wiring harness between C03 (female) (1) and P07 (female) (1), and between C03 (female) (16) and P07 (female) (2)	Repair or replace
Defective monitor panel	Replace

M-13 d) Related electrical circuit diagram

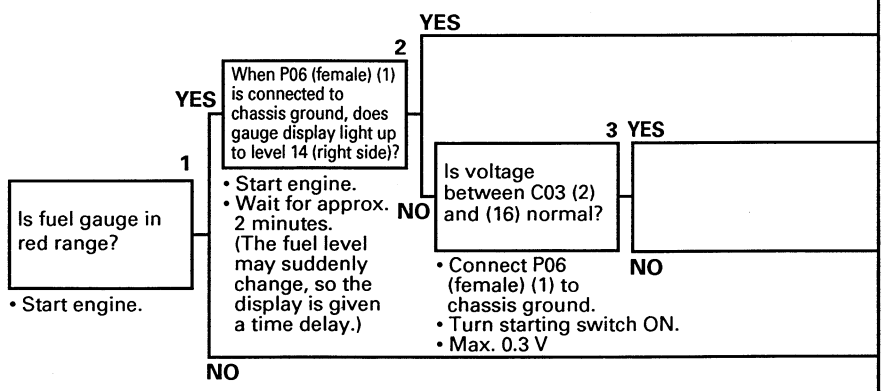


TKP01082

e)  (fuel level) flashes

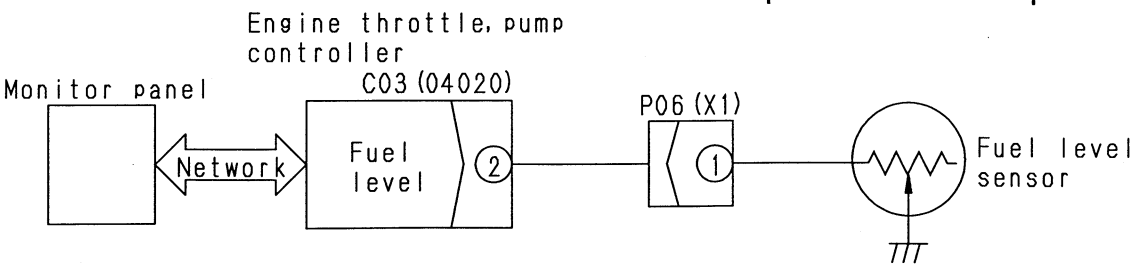
SAP00528

★ Check that there is fuel before carrying out troubleshooting.



Cause	Remedy
Defective fuel level sensor system (see M-25)	—
Defective engine throttle, pump controller	Replace
Defective contact or disconnection in wiring harness between C03 (female) (2) and P06 (female) (1)	Repair or replace
Defective monitor panel	Replace

M-13 e) Related electrical circuit diagram

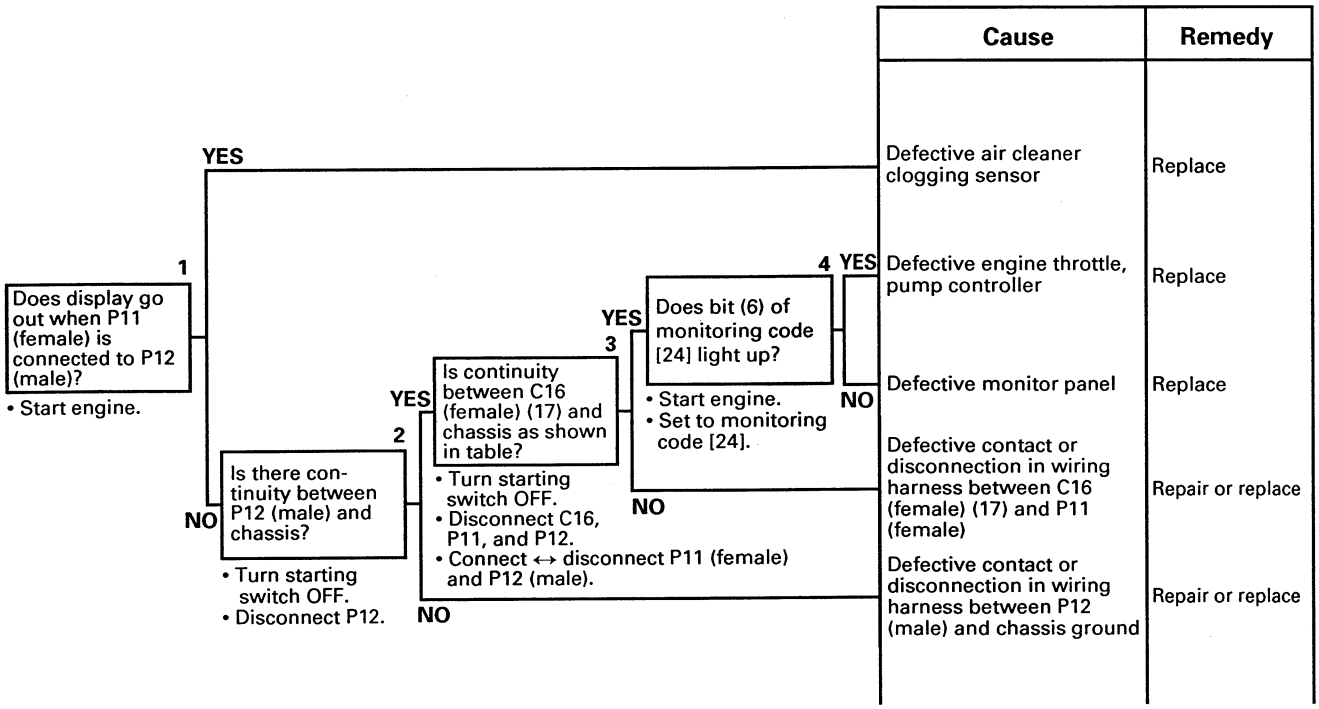


TKP01078

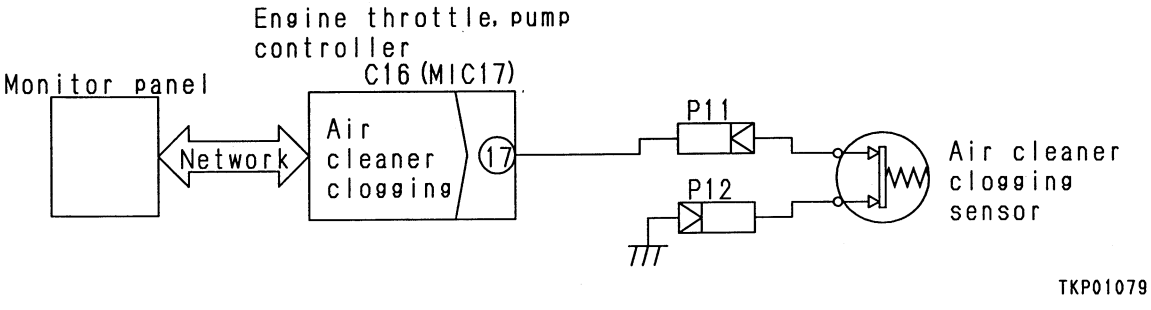
f)  (air cleaner clogging) flashes

SAP00521

★ Check that the air cleaner is not clogged before starting troubleshooting.

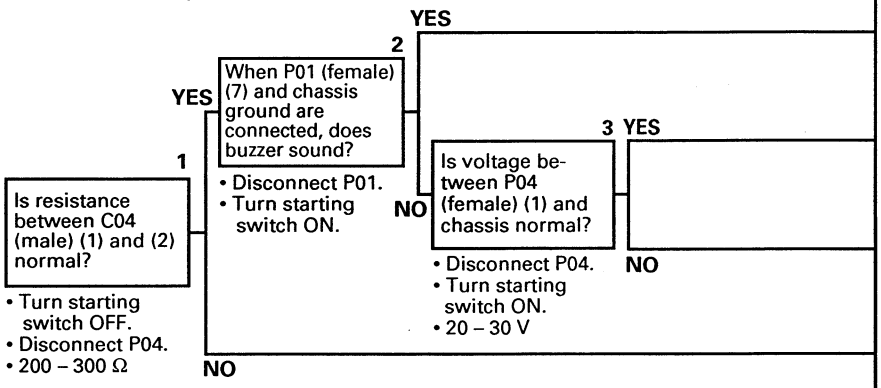


M-13 f) Related electrical circuit diagram



M-14 When starting switch is turned ON (engine stopped), buzzer does not sound for 1 second
Caution items are flashing but buzzer does not sound

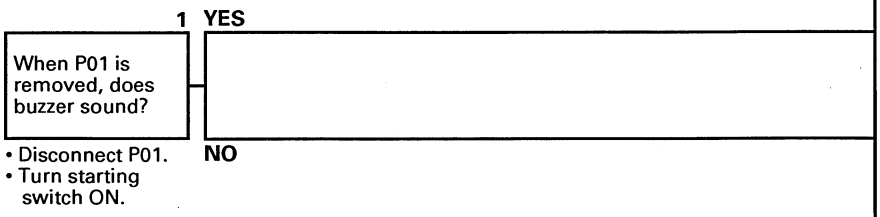
★ Of the caution items, the buzzer will not sound even if there is an abnormality in the battery charge or fuel level.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



Cause	Remedy
Defective monitor panel	Replace
Defective contact or disconnection in wiring harness between P01 (female) (7) and P04 (female) (2)	Repair or replace
Short circuit with chassis ground, defective contact or disconnection in wiring harness between P04 (female) (1) and fuse 13	Repair or replace
Defective buzzer	Replace

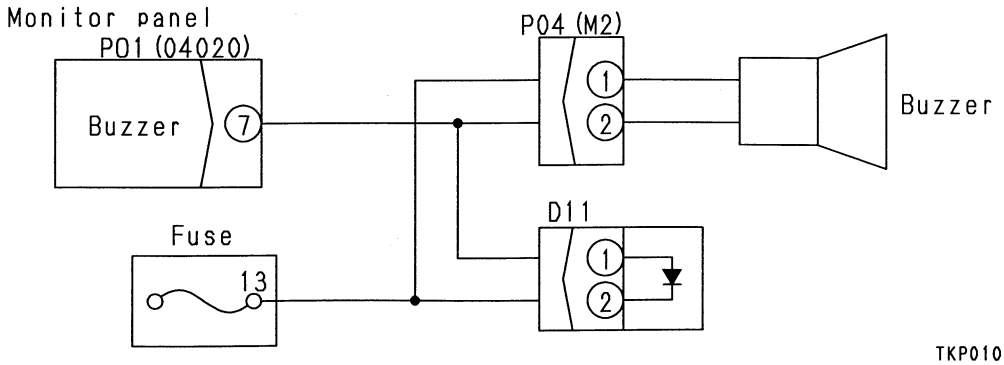
M-15 No abnormality is displayed on monitor but buzzer sounds

★ When the buzzer sounds continuously.
If it sounds intermittently, carry out troubleshooting for M-14.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



Cause	Remedy
Wiring harness between P01 (female) (7) and P04 (female) (2) short circuiting with chassis ground, or defective buzzer	Repair or replace
Defective monitor panel	Replace

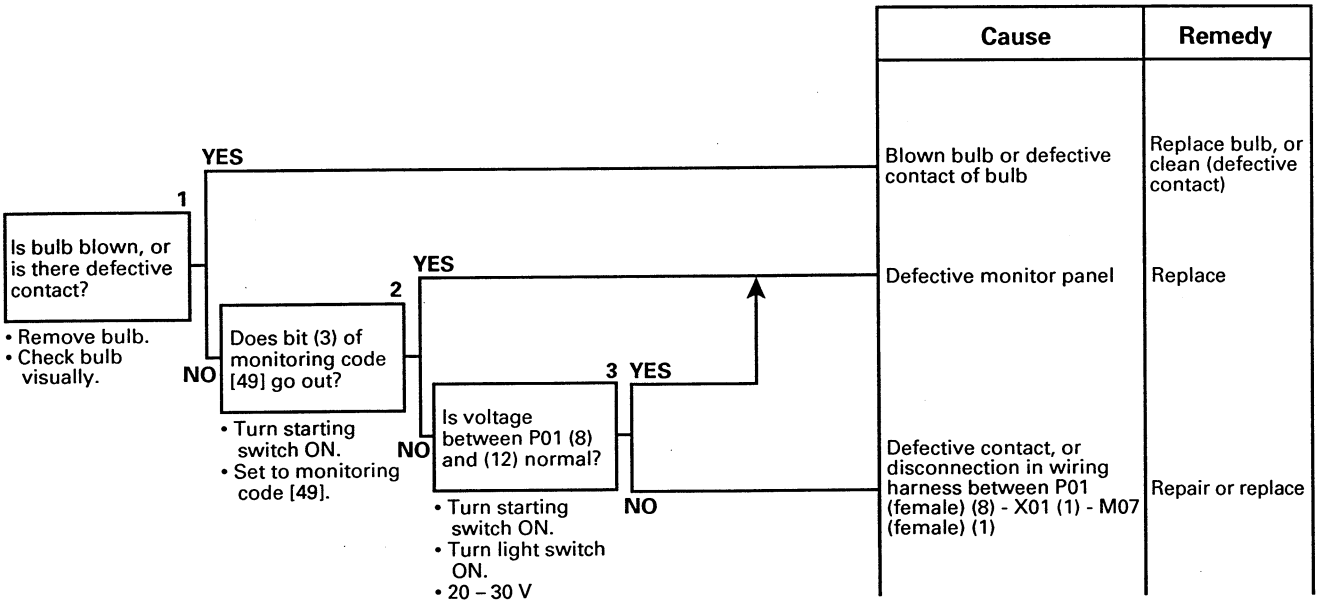
M-14, 15 Related electrical circuit diagram



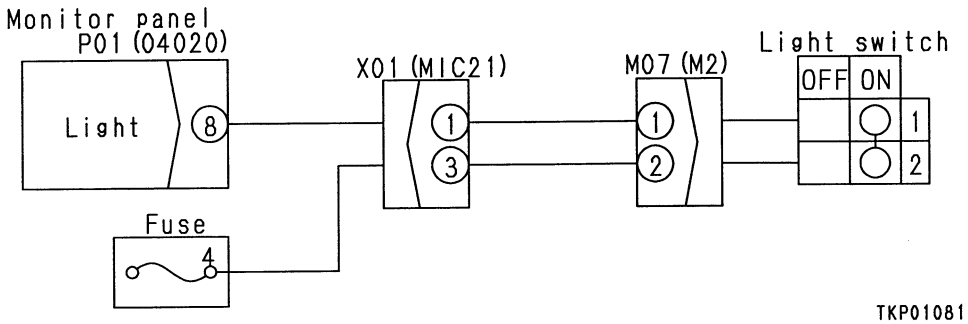
TKP01071

M-16 Liquid crystal night lighting on monitor panel does not light up (liquid crystal display is normal)

★ When the front lamp and working lamp light up normally.

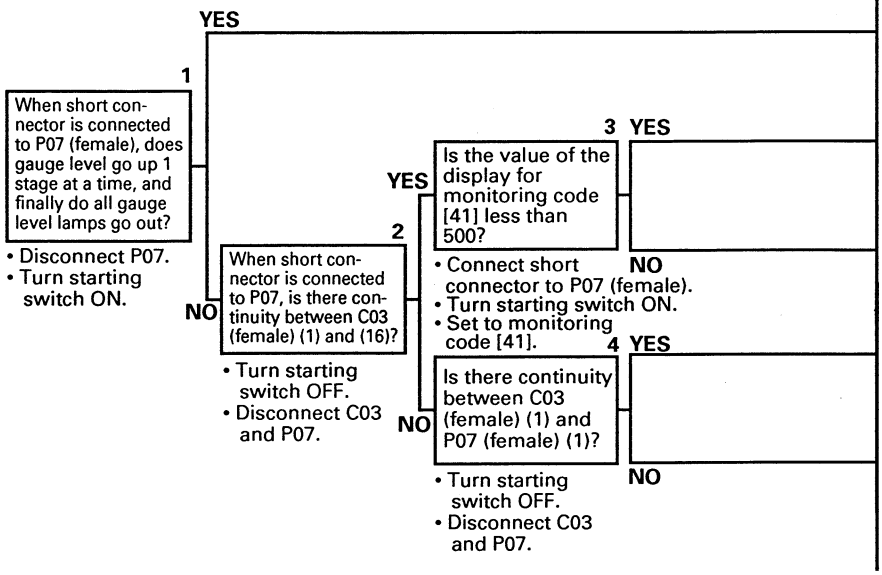


M-16 Related electrical circuit diagram



M-17 Coolant temperature gauge does not rise

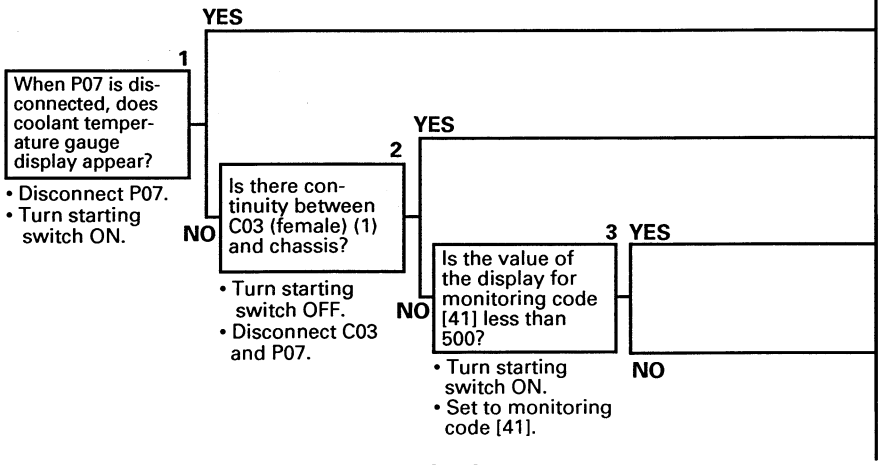
★ If the coolant temperature actually does not rise, check the engine system.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



Cause	Remedy
Defective coolant temperature sensor system (see M-26)	—
Defective monitor panel	Replace
Defective engine throttle, pump controller	Replace
Defective contact or disconnection in wiring harness between C03 (female) (16) and P07 (female) (2)	Repair or replace
Defective contact or disconnection in wiring harness between C03 (female) (1) and P07 (female) (1)	Repair or replace

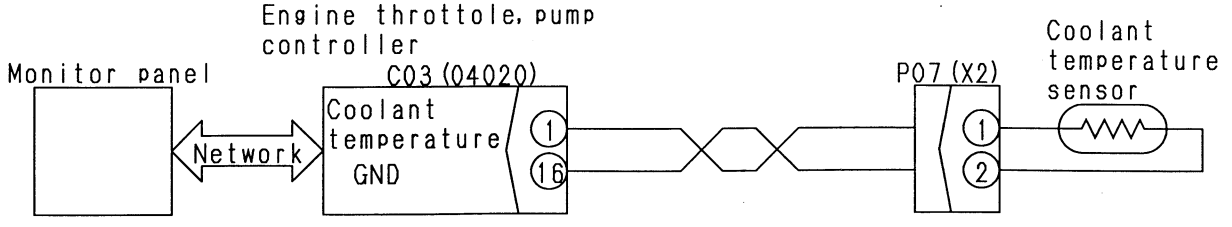
M-18 Coolant temperature gauge does not give any display (none of gauge lamps light up during operation)

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



Cause	Remedy
Defective coolant temperature sensor system (see M-26)	—
Wiring harness between P03 (female) (1) and P07 (female) (1) short circuiting with chassis ground	Repair or replace
Defective engine throttle, pump controller	Replace
Defective monitor panel	Replace

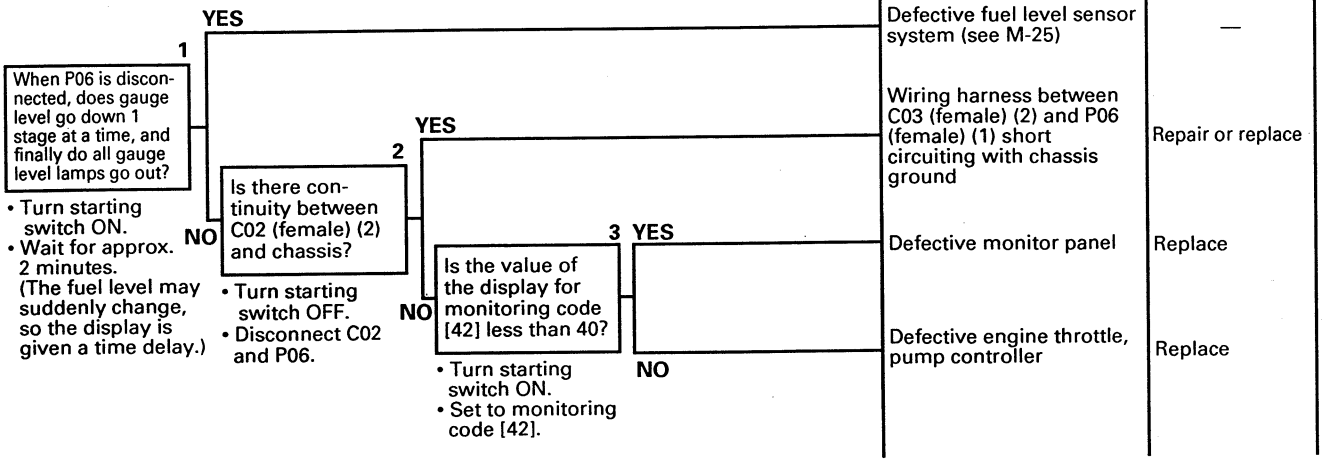
M-17, 18 Related electrical circuit diagram



TKP01082

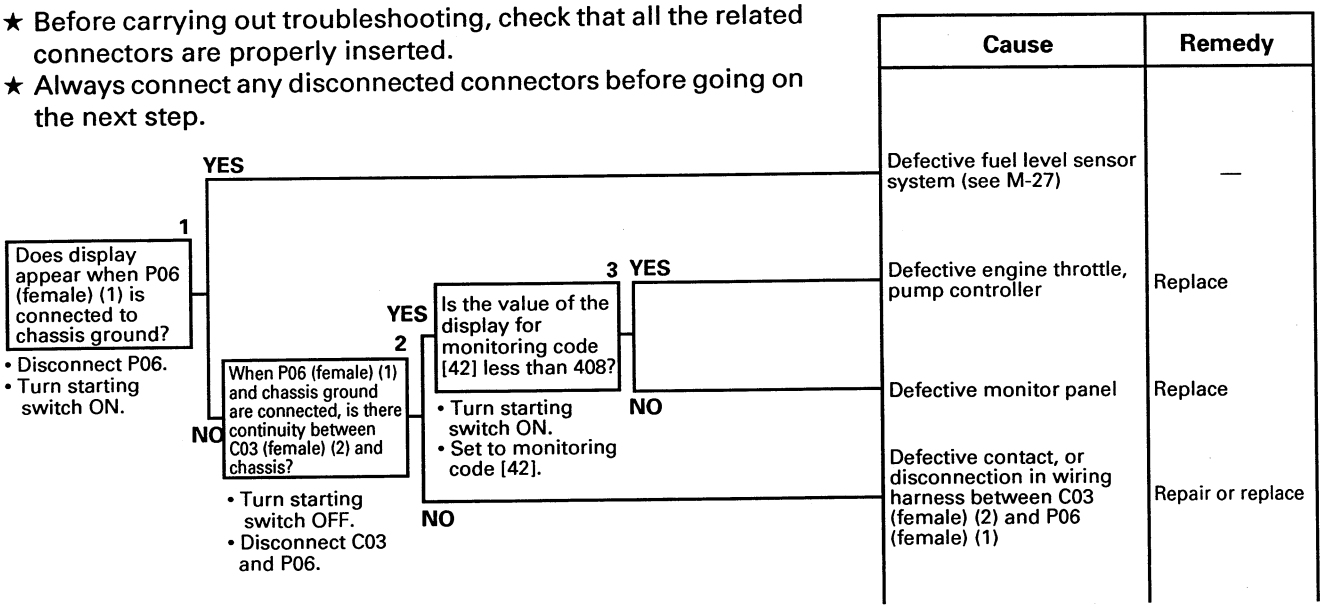
M-19 Fuel level gauge always displays FULL

★ Check if the tank is actually full before carrying out troubleshooting.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

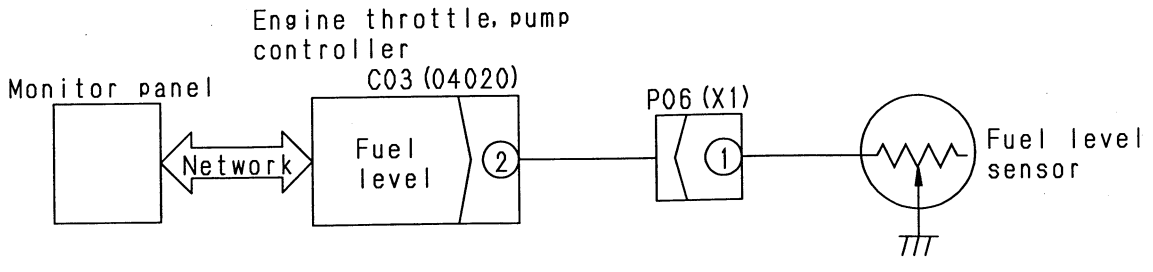


M-20 Fuel level gauge does not give display

★ Check that there is actually no fuel before carrying out troubleshooting.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



M-19, 20 Related electrical circuit diagram



M-21 Swing lock switch is turned ON (LOCK) but (swing lock monitor) does not light up

SAT00098

★ Carry out this troubleshooting only if the swing lock is actually being actuated.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

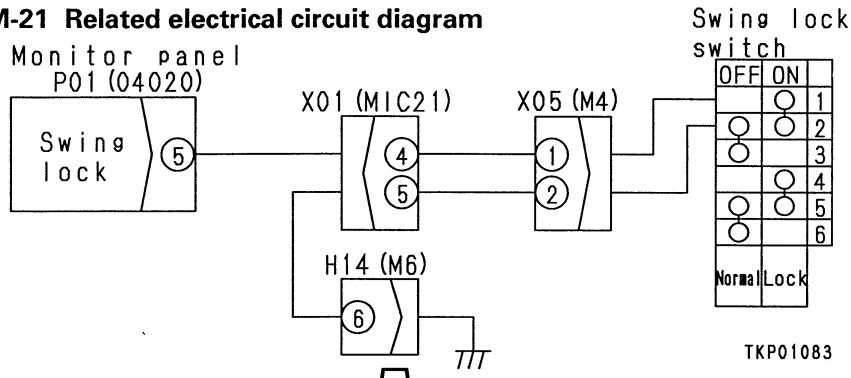
1 Is voltage between P01 (5) and chassis as shown in table?
• Turn starting switch ON.
YES
NO

Cause	Remedy
Defective monitor panel	Replace
Defective contact or disconnection in wiring harness between C01 (female) (5) - X01 (4) - X051 (male) (1)	Repair or replace

Table

Swing lock switch ON	Max. 1 V
Swing lock switch OFF	20 – 30 V

M-21 Related electrical circuit diagram



M-22 Swing prolix switch is ON (prolix), but (swing lock monitor) does not flash

SAT00098

★ Carry out this troubleshooting only if the swing prolix is actually being actuated.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

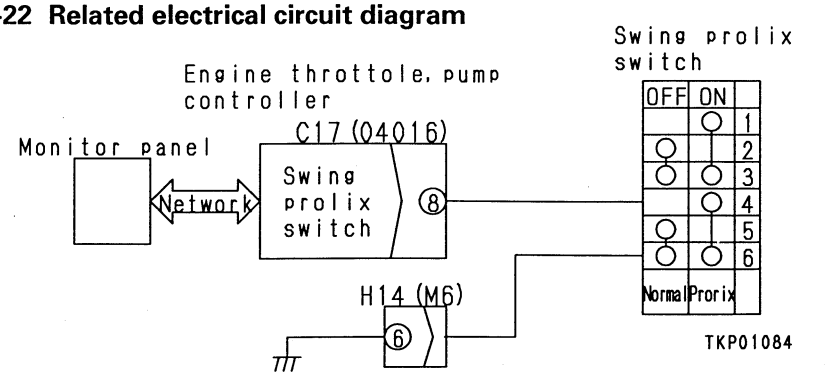
1 Is voltage between P17 (8) and chassis as shown in table?
• Turn starting switch ON.
YES
2 Does bit (6) of monitoring code [21] light up?
• Turn starting switch ON.
• Set to monitoring code [21].
YES
NO
NO

Cause	Remedy
Defective monitor panel	Replace
Defective engine throttle, pump controller	Replace
Defective contact or disconnection in wiring harness between C17 (female) (8) and prolix switch (4)	Repair or replace

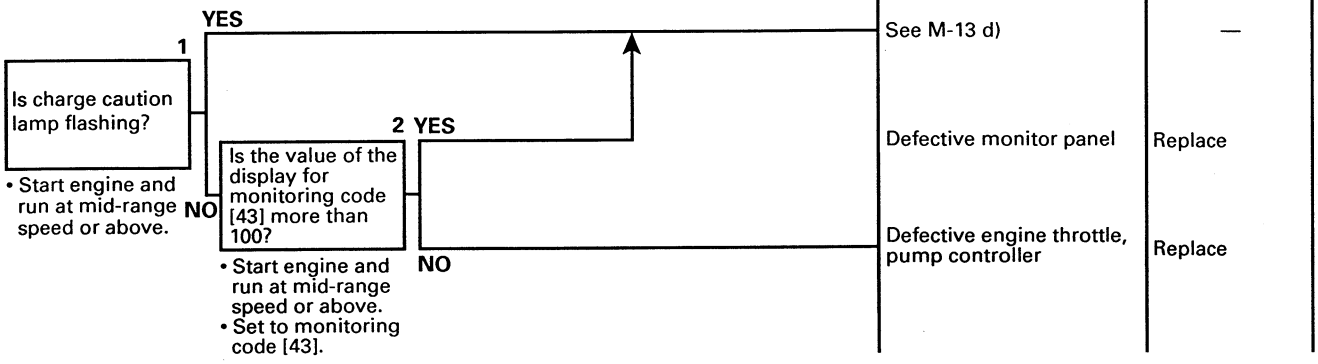
Table

Swing lock switch ON	Max. 1 V
Swing lock switch OFF	20 – 30 V

M-22 Related electrical circuit diagram

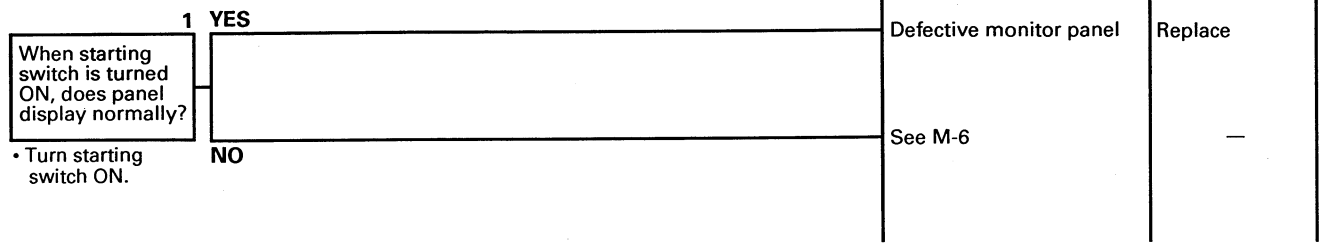


M-23 Service meter does not advance when engine is running



Cause	Remedy
See M-13 d)	—
Defective monitor panel	Replace
Defective engine throttle, pump controller	Replace

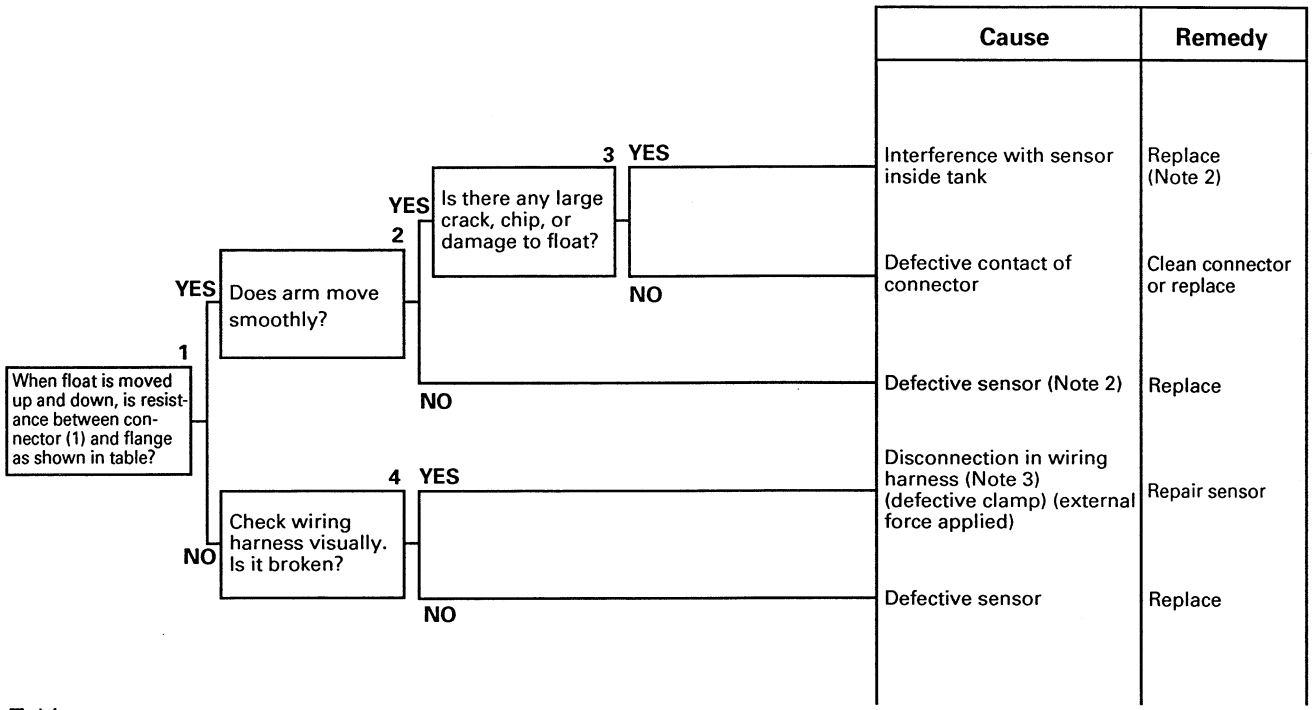
M-24 When starting switch is OFF and time switch is pressed, time, service meter are not displayed



Cause	Remedy
Defective monitor panel	Replace
See M-6	—

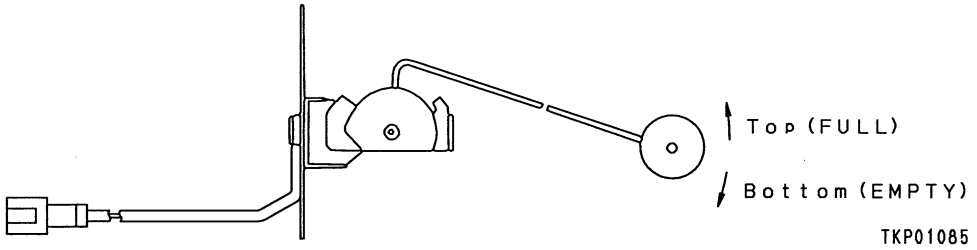
M-25 Defective fuel level sensor system

★ Remove the fuel level sensor when carrying out the troubleshooting.



Table

Top (FULL) stopper position	Approx. 12 Ω or below
Bottom (EMPTY) stopper position	Approx. 85 – 110 Ω

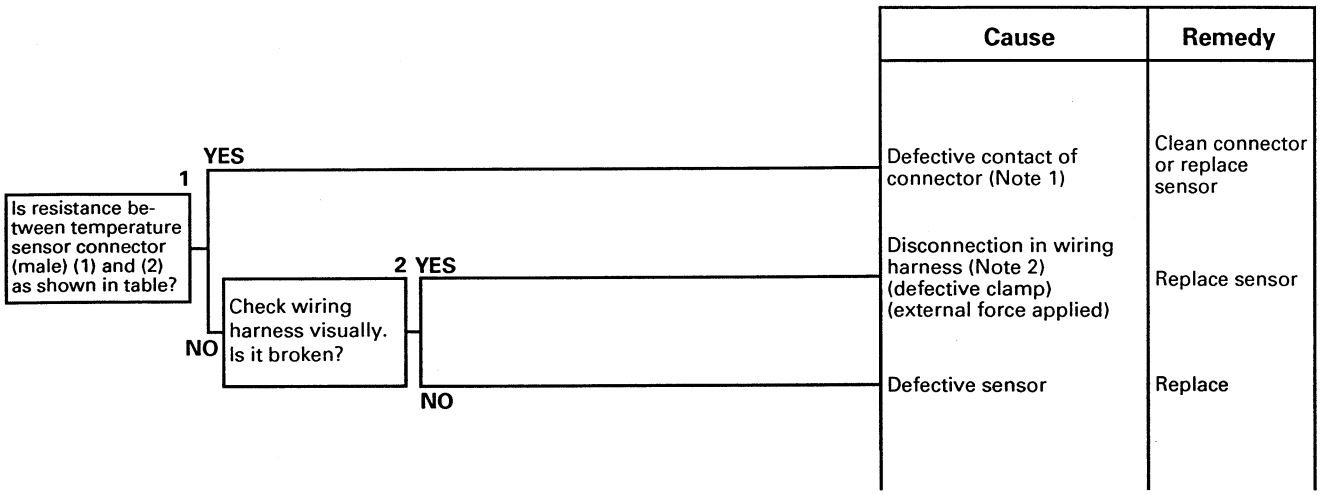


Note 1 : Difference between fuel level and gauge display
For gauge display position 14 (F), the amount of fuel is 78 – 100%; and for display position 1 (E) it is below 14.5%. If the chassis is at an angle, the displayed amount of fuel will be different from the actual amount. Therefore, when checking, stop the machine at a horizontal place and wait for at least 2 minutes before checking the gauge. (The display is given a time delay so that the gauge can deal with sudden changes in the fuel level.)

Note 2 : There is the possibility of defective installation or interference with the sensor inside the tank, so be careful when installing.

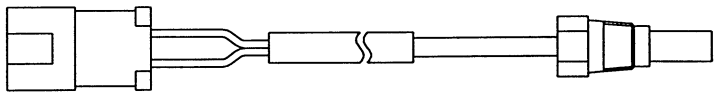
Note 3 : Check for vibration at the connector mount. If there is excessive vibration, take the appropriate action.

M-26 Defective coolant temperature sensor system



Table

Normal temperature (25°C)	Approx. 37 – 50 kΩ
100°C	Approx. 3.5 – 4.0 kΩ



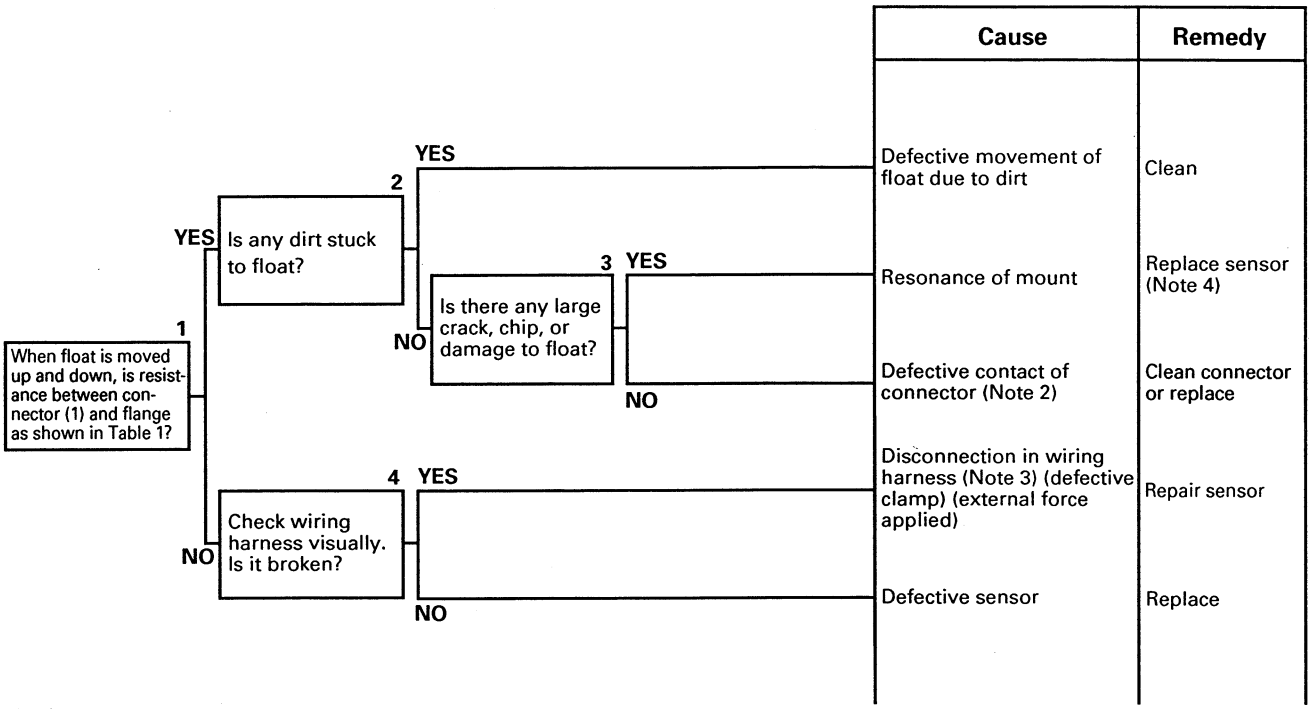
BKP00291

Note 1 : If the problem occurs again, the connector (female) at the chassis end is probably defective, so check the connector and wiring harness at the chassis end.

Note 2 : Check for vibration at the connector mount. If there is excessive vibration, take the appropriate action.

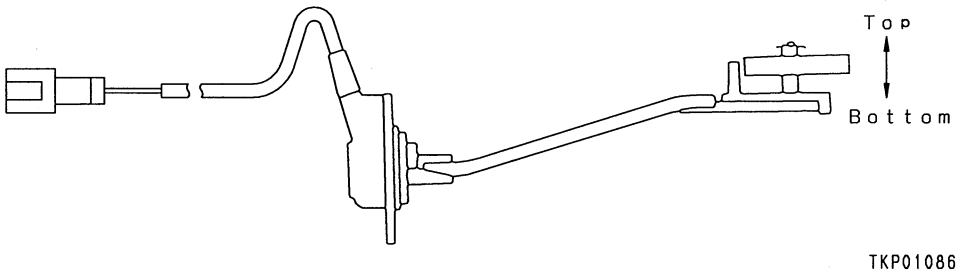
M-27 Defective engine oil level sensor system

★ Remove the engine oil level sensor when carrying out troubleshooting.



Table

Float UP	Max. 1 Ω
Float DOWN	Min. 1 MΩ



Note 1 : Variations in oil level
The oil level may change according to the angle of the machine, the engine speed, or the temperature of the oil, so if there is any display, check the oil level again with the machine at a horizontal place.

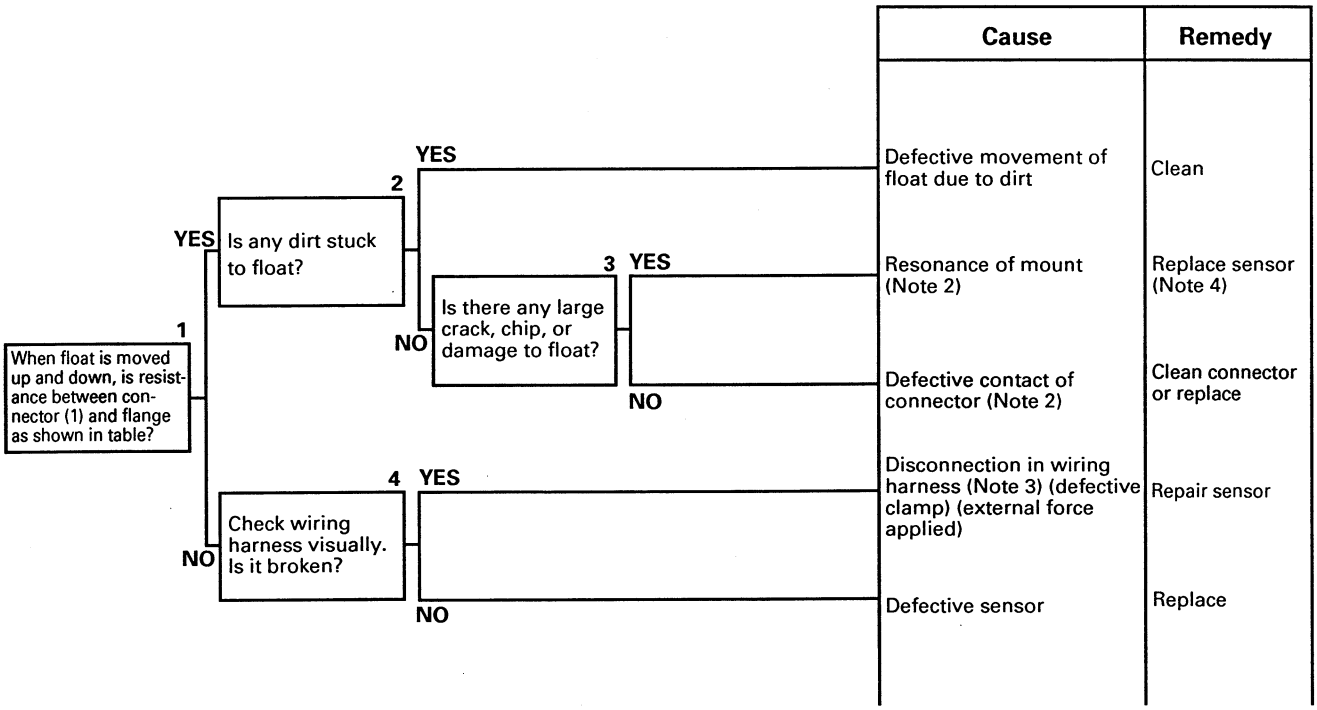
Note 2 : If the problem occurs again, the connector (female) at the chassis end is probably defective, so check the connector and wiring harness at the chassis end.

Note 3 : Check for vibration at the connector mount. If there is excessive vibration, take the appropriate action.

Note 4 : Defective installation is a possible cause, so be careful when installing. If the problem occurs again, check for any vibration of the mount, and if there is excessive vibration, take the appropriate action.

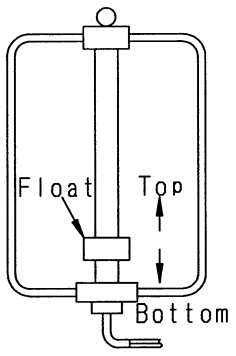
M-28 Defective coolant level sensor system

★ Remove the coolant level sensor when carrying out troubleshooting.



Table

Float UP	Max. 1 Ω
Float DOWN	Min. 1 MΩ



TKP01087

Note 1 : Variations in coolant level
The coolant level may change according to the angle of the machine, or the swaying of the machine, so if there is any display, check the coolant level again with the machine at a horizontal place.

Note 2 : If the problem occurs again, the connector (female) at the chassis end is probably defective, so check the connector and wiring harness at the chassis end.

Note 3 : Check for vibration at the connector mount. If there is excessive vibration, take the appropriate action.

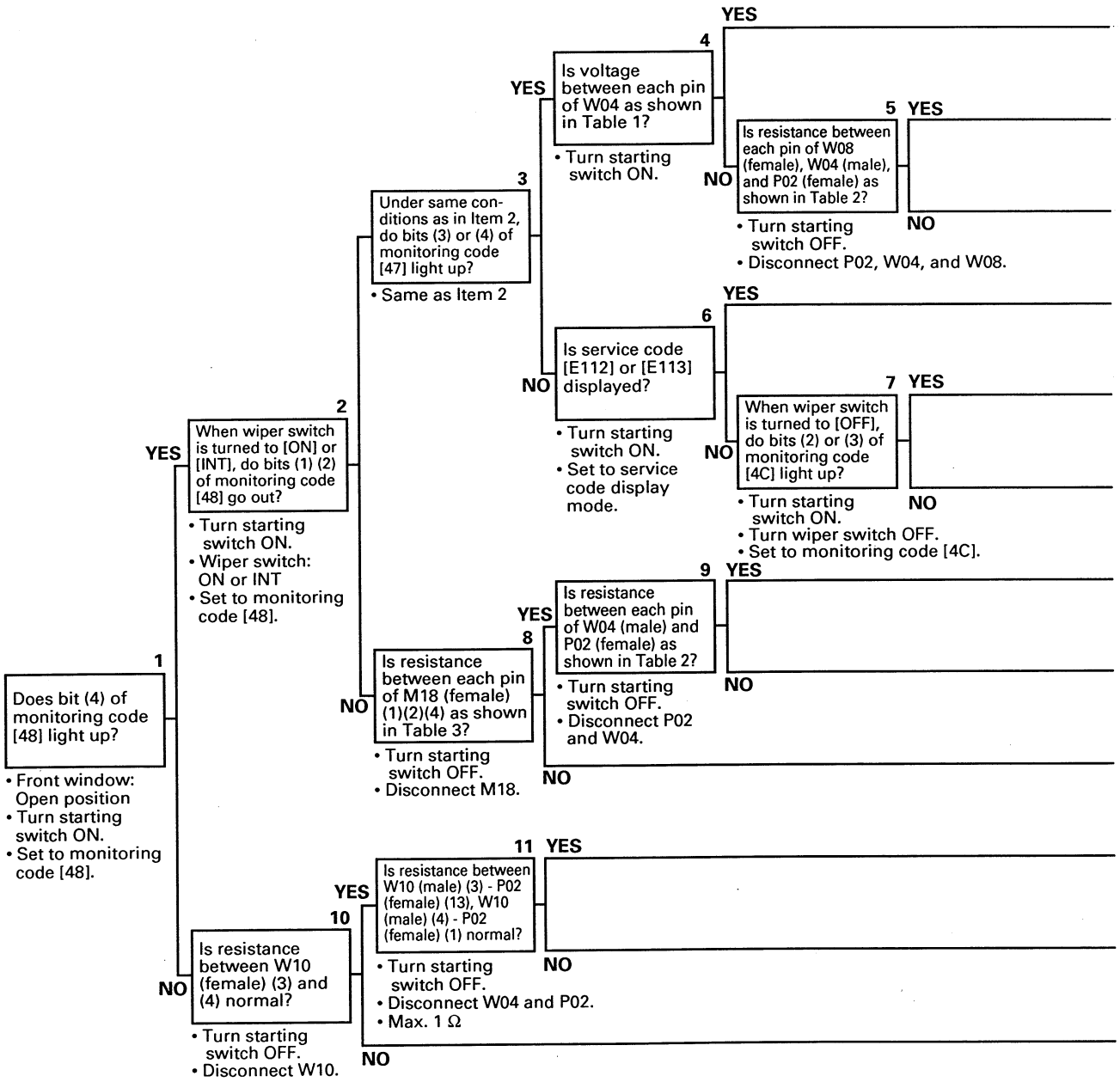
Note 4 : Defective installation is a possible cause, so be careful when installing. If the problem occurs again, check for any vibration of the mount, and if there is excessive vibration, take the appropriate action.

M-29 Wiper does not work or switch is not being used but wiper is actuated

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

a) Wiper does not work

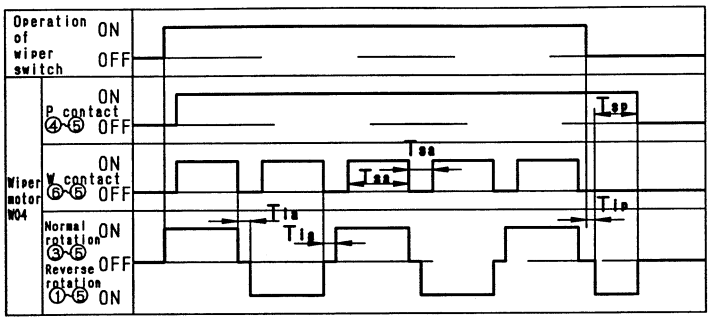
★ Check that fuse 7 is normal.
★ Carry out this troubleshooting if service codes [E112] or [E113] are displayed.



Cause	Remedy
Defective wiper motor	Replace
Defective relay box	Replace
Defective contact or disconnection in wiring harness with defective resistance	Replace
Wiring harness between P02 (female) (3) and W08 (female) (3), or between P02 (female) (11) and W08 (female) (2) short circuiting with power source	Repair or replace
Defective contact or disconnection in above wiring harness	Repair or replace
Defective monitor panel	Replace
Defective monitor panel	Replace
Defective contact or disconnection in wiring harness with defective resistance	Repair or replace
Defective wiper, washer switch	Replace
Defective monitor panel	Replace
Defective contact or disconnection in wiring harness between P02 (female) (13) and W10 (male) (3), between P02 (female) (1) - H14 (2) - chassis ground, or between W10 (male) (4) - H15 (1) - chassis ground	Repair or replace
Defective rear limit switch, or front window is open	Repair or replace

Table 1

Timing chart (when wiper switch is ON)

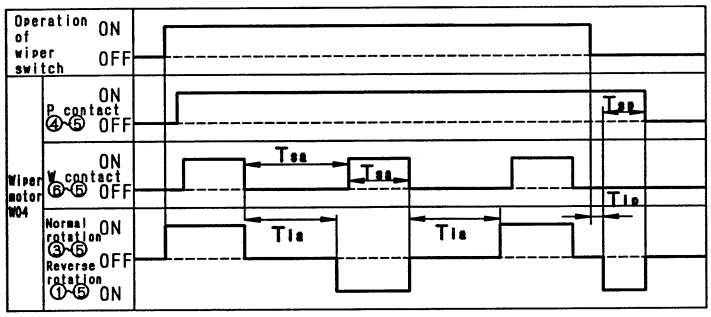


Voltage when OFF: Max. 3V; when ON: 20-30V

TKP01088

Item	Symbol	Set time
Length of pause until next actuation	Tia	0.13 sec
Safety circuit during operation of wiper [safety function (1)]	Tsa	10 sec
Length of pause when stowing wiper blade	Tip	1.5 sec
Safety circuit when stowing wiper [safety function (2)]	Tsp	10 sec

Timing chart (when wiper switch is at INT)



Voltage when OFF: Max. 3V; when ON: 20-30V

TKP01089

Item	Symbol	Set time
Length of pause until next actuation	Tia	4 sec
Safety circuit during operation of wiper [safety function (1)]	Tsa	10 sec
Length of pause when stowing wiper blade	Tip	1.5 sec
Safety circuit when stowing wiper [safety function (2)]	Tsp	10 sec

Table 2

	Resistance value
Between W04 (female) (1) and W08 (female) (7)	Max. 1 Ω
Between W04 (female) (3) and W08 (female) (6)	
Between W04 (female) (4) and P02 (female) (5)	
Between W04 (female) (5) and P02 (female) (1)	
Between W04 (female) (6) and P02 (female) (6)	
Between W04 (female) (1) (3) (4) (5) (6) – GND	Min. 1 MΩ
Between W08 (female) (2) and P02 (female) (11)	Max. 1 Ω
Between W08 (female) (3) and P02 (female) (3)	

Table 3

Wiper switch	(female)	(male)	Resistance value
INT	Between (1) and (2)	Between (1) and (4)	Min. 1 MΩ
	Between (1) and (4)	Between (1) and (12)	Max. 1 Ω
	Between (2) and (4)	Between (4) and (12)	Min. 1 MΩ
OFF	Between (1) and (2)	Between (1) and (4)	Min. 1 MΩ
	Between (1) and (4)	Between (1) and (12)	
	Between (2) and (4)	Between (4) and (12)	
ON	Between (1) and (2)	Between (1) and (4)	Max. 1 Ω
	Between (1) and (4)	Between (1) and (12)	Min. 1 MΩ
	Between (2) and (4)	Between (4) and (12)	

b) Wiper switch is not being used but wiper is actuated

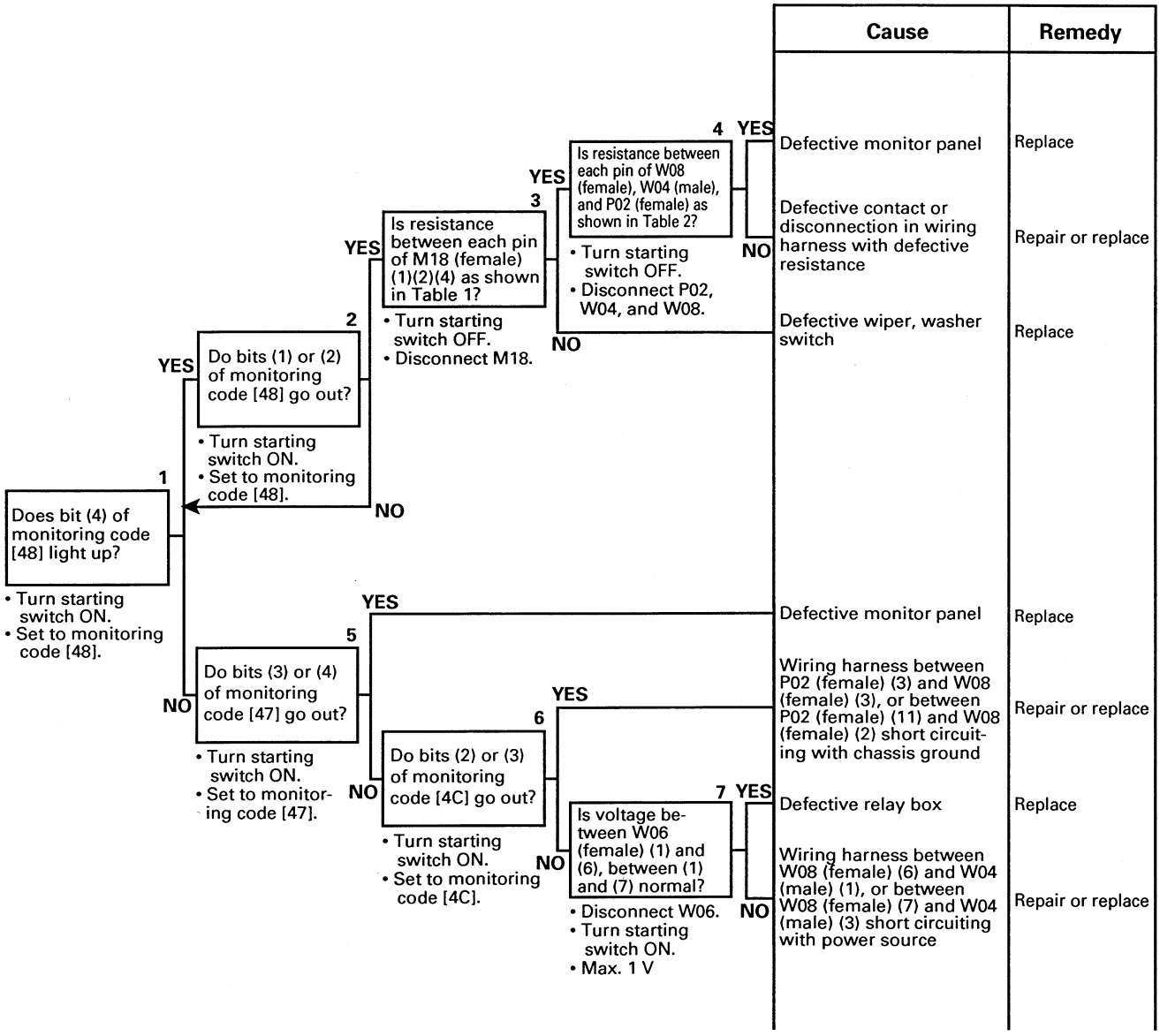


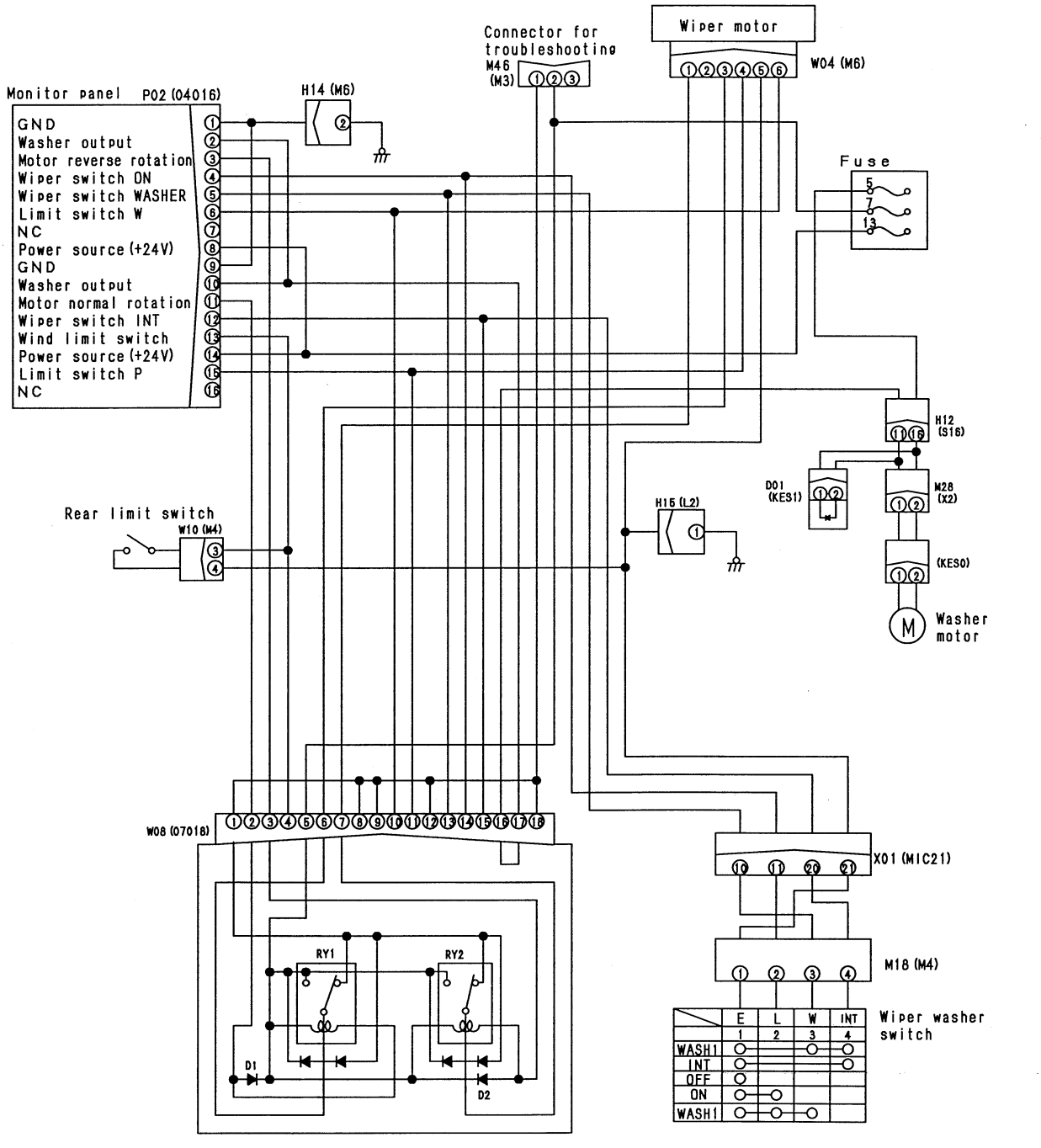
Table 1

	Resistance value
Between W04 (female) (1) and W08 (female) (7)	Max. 1 Ω
Between W04 (female) (3) and W08 (female) (6)	
Between W04 (female) (4) and P02 (female) (5)	
Between W04 (female) (5) and P02 (female) (1)	
Between W04 (female) (6) and P02 (female) (6)	
Between W04 (female) (1) (3) (4) (5) (6) – GND	Min. 1 MΩ
Between W08 (female) (2) and P02 (female) (11)	Max. 1 Ω
Between W08 (female) (3) and P02 (female) (3)	

Table 2

Wiper switch	(female)	(male)	Resistance value
INT	Between (1) and (2)	Between (1) and (4)	Min. 1 MΩ
	Between (1) and (4)	Between (1) and (12)	Max. 1 Ω
	Between (2) and (4)	Between (4) and (12)	Min. 1 MΩ
OFF	Between (1) and (2)	Between (1) and (4)	Min. 1 MΩ
	Between (1) and (4)	Between (1) and (12)	
	Between (2) and (4)	Between (4) and (12)	
ON	Between (1) and (2)	Between (1) and (4)	Max. 1 Ω
	Between (1) and (4)	Between (1) and (12)	Min. 1 MΩ
	Between (2) and (4)	Between (4) and (12)	

M-29 Related electrical circuit diagram



TKP01090

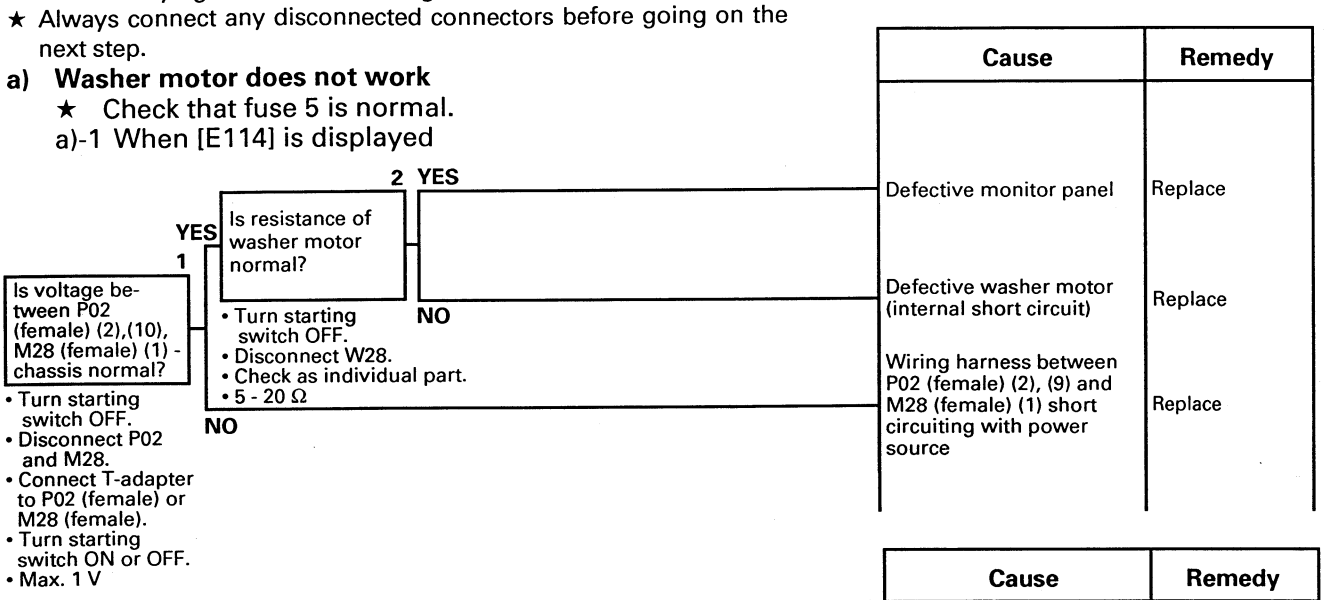
M-30 Washer motor does not work, or switch is not being used but washer motor is actuated

★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

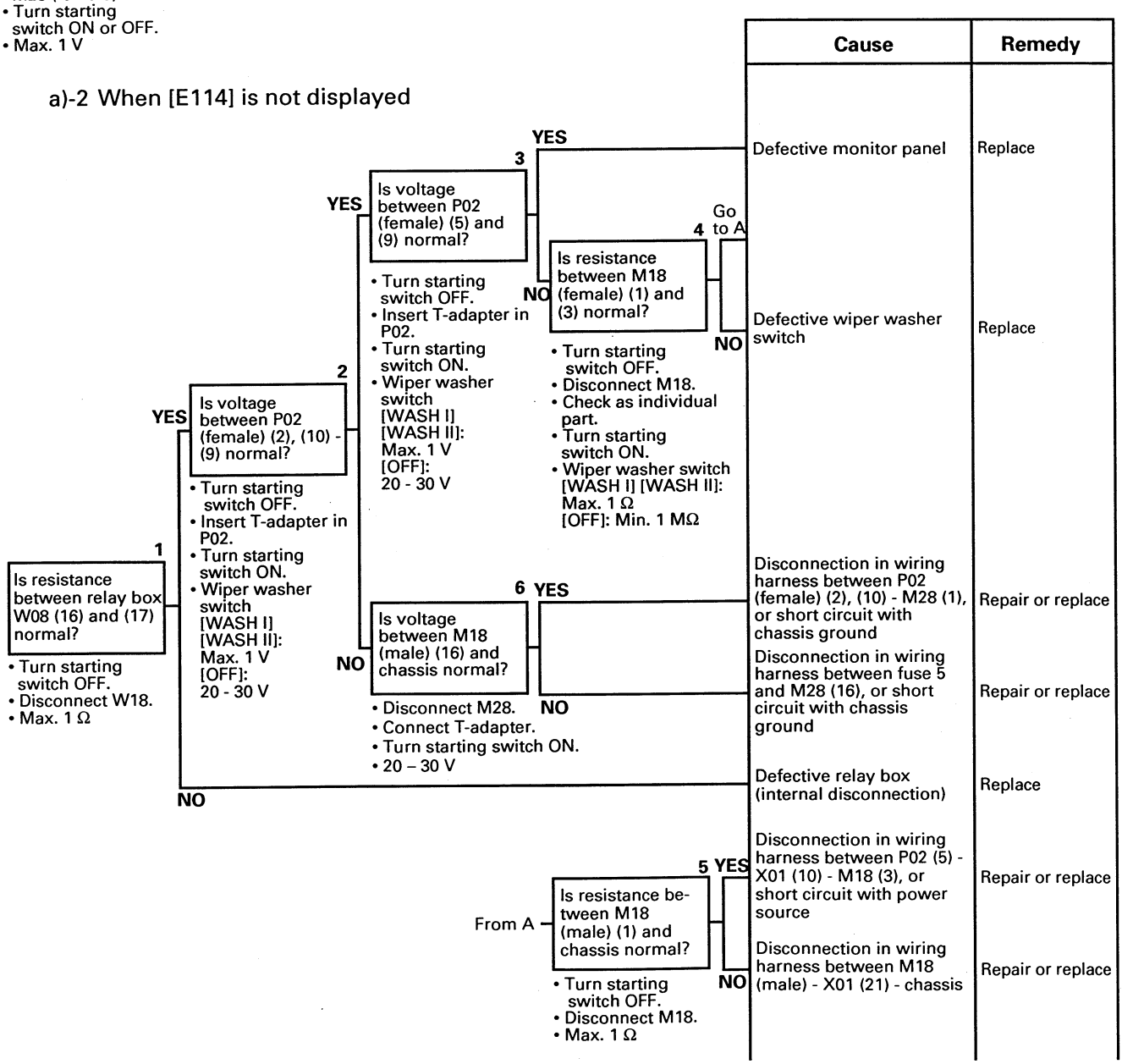
a) Washer motor does not work

★ Check that fuse 5 is normal.

a)-1 When [E114] is displayed



a)-2 When [E114] is not displayed



b) Switch is not being used but washer motor is actuated
★ In this troubleshooting mode, [E114] is not displayed.

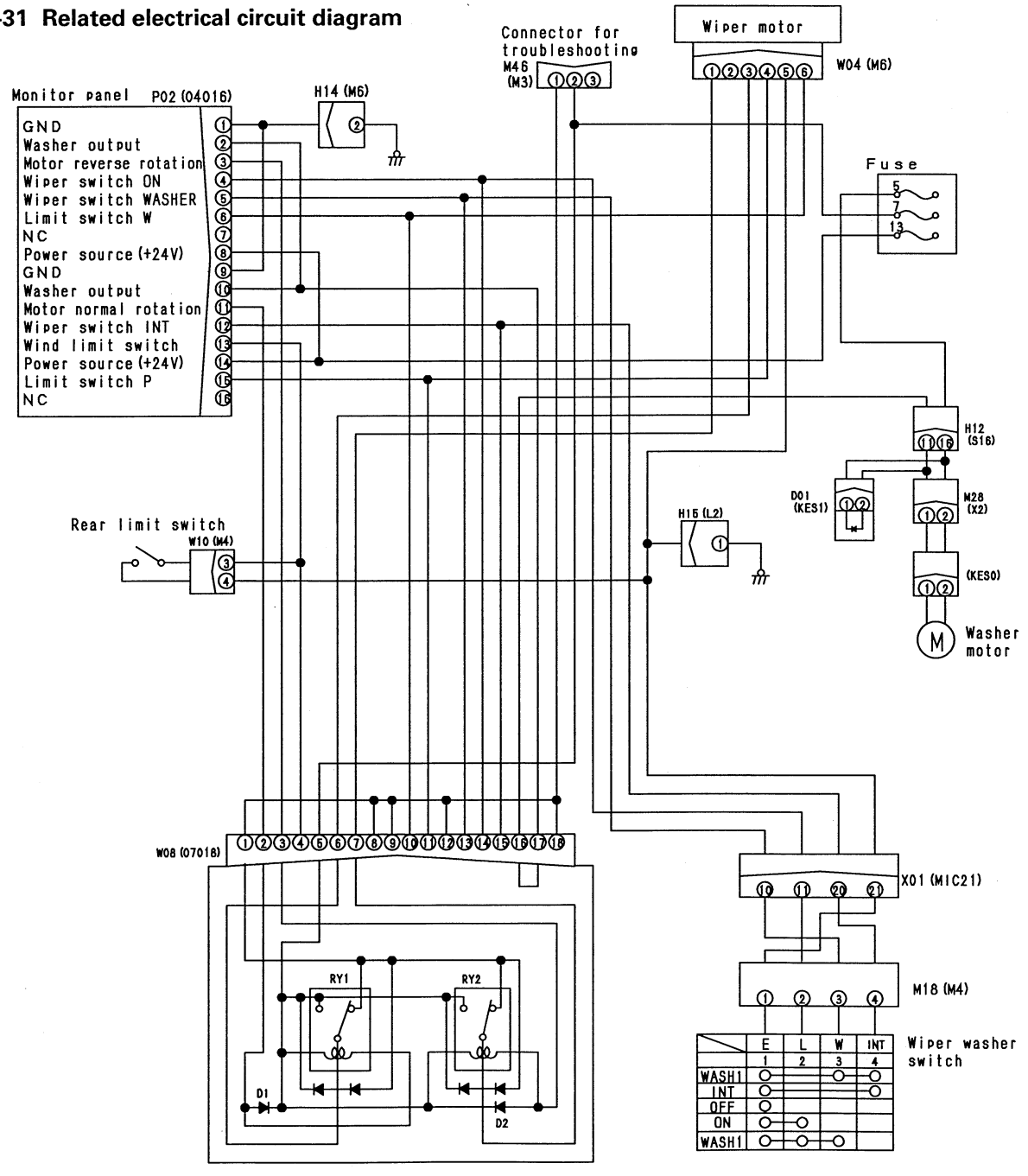
1 Is resistance between P02 (female) (3), M18 (male) (3), W08 (13) – chassis normal?

- YES
- NO

- Turn starting switch OFF.
- Disconnect P02, M18, and W08.
- Min. 1 Ω

Cause	Remedy
Defective monitor panel	Replace
Wiring harness between P02 (female) (5), M18 (male) – W08 (female) (13) short circuiting with chassis ground	Repair or replace

M-31 Related electrical circuit diagram



TKP01090

30 DISASSEMBLY AND ASSEMBLY

METHOD OF USING MANUAL

1. **When removing or installing unit assemblies**
   ① When removing or installing a unit assembly, the order of work and techniques used are given for the removal operation; the order of work for the installation operation is not given.
   ② Any special techniques applying only to the installation procedure are marked [※ 1], and the same mark is placed after the relevant step in the removal procedure to indicate which step in the installation procedure it applies to.

   (Example)
   REMOVAL OF ○○○○ ASSEMBLY ..... Title of operation
   ..... Precautions related to safety when carrying out the operation
   1. XXXX(1) ..... Step in operation
      ★ ..... Technique or important point to remember when removing XXXX (1).
   2. △ △ △ △ (2): ..... [※ 1] Indicates that a technique is listed for use during installation
   3. □□□□ assembly (3)
      ..... Quantity of oil or water drained

   INSTALLATION OF ○○○○ ASSEMBLY ..... Title of operation
   • Carry out installation in the reverse order to removal.
   [※ 1] ..... Technique used during installation
   ★ ..... Technique or important point to remember when installing △ △ △ △ (2).
   • Adding water, oil ..... Step in operation
      ★ ..... Point to remember when adding water or oil
      ..... Quantity when filling with oil and water

2. General precautions when carrying out installation or removal (disassembly or assembly) of units are given together as PRECAUTIONS WHEN CARRYING OUT OPERATION, so be sure to follow these precautions when carrying out the operation.

3. **Listing of special tools**
   ① For details of the description, part number, and quantity of any tools (**A1**, etc.) that appear in the operation procedure, see the SPECIAL TOOLS LIST given in this manual.

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 and 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.

Nominal number	Plug (nut end)	Sleeve nut (elbow end) Use the two items below as a set
02	07376-50210	07221-20210 (Nut), 07222-00210 (Plug)
03	07376-50315	07221-20315 (Nut), 07222-00312 (Plug)
04	07376-50422	07221-20422 (Nut), 07222-00414 (Plug)
05	07376-50522	07221-20522 (Nut), 07222-00515 (Plug)
06	07376-50628	07221-20628 (Nut), 07222-00616 (Plug)
10	07376-51034	07221-21034 (Nut), 07222-01018 (Plug)
12	07376-51234	07221-21234 (Nut), 07222-01219 (Plug

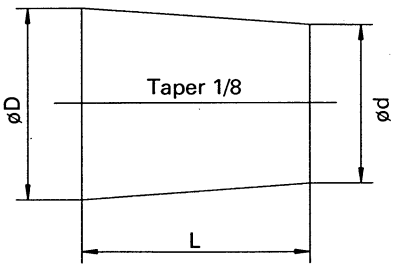
1) Hoses and tubes using sleeve nuts

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

2) Split flange type hoses and tubes

3) If the part is not under hydraulic pressure, the following corks can be used.

Nominal number	Part Number	Dimensions		
		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



DEW00401

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.
4. After doing this, run the engine at normal speed.

★ When using the machine for the first time after repair or long storage, follow the same procedure.

3. Precautions when completing the operation

- If the coolant has been drained, tighten the drain valve, and add water to the specified level. Run the engine to circulate the water through the system. Then check the water level again.
- If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
- If the piping or hydraulic equipment have been removed, always bleed the air from the system after reassembling the parts.
  ★ For details, see TESTING AND ADJUSTING, Bleeding air.
- Add the specified amount of grease (molybdenum disulphide grease) to the work equipment parts.

SPECIAL TOOL LIST

★ Tools with part number 79OT-OOO-OOOO 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 O in the Sketch column are tools introduced in special sketches (See SKETCHES OF SPECIAL TOOLS).

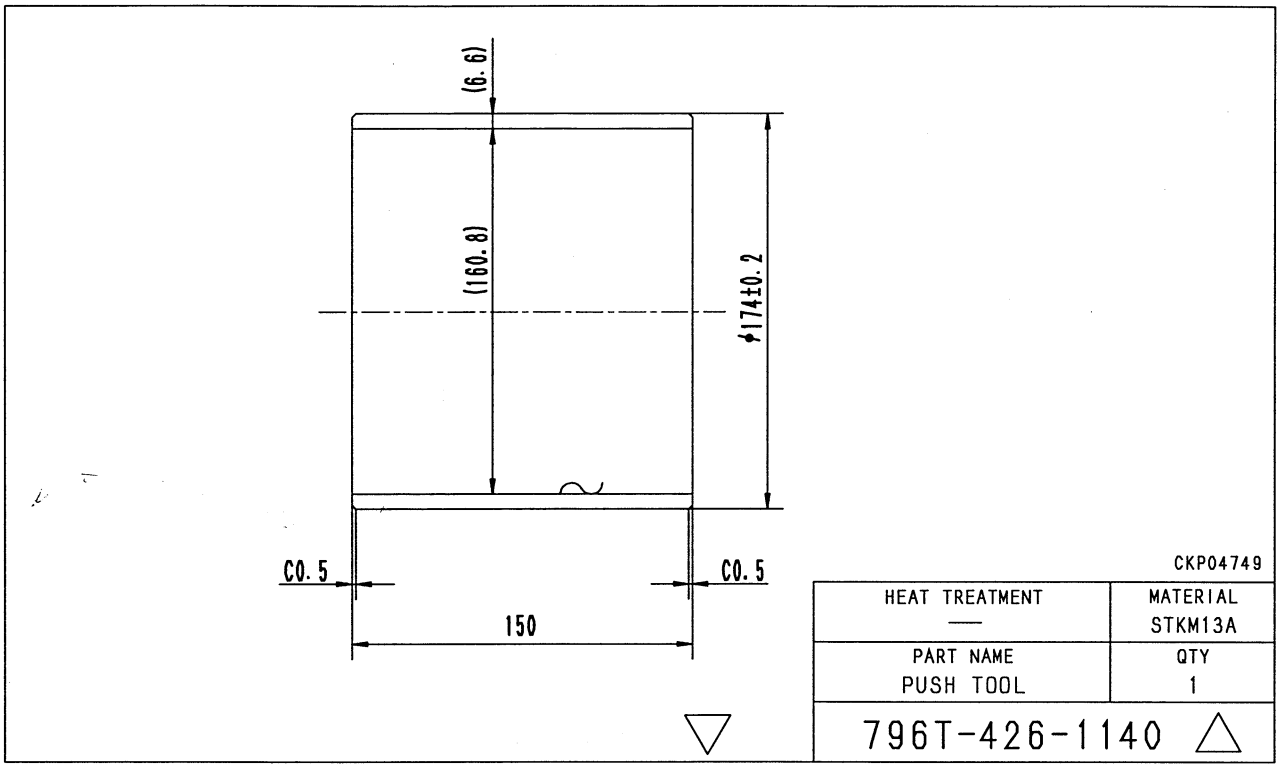
Component	Symbol	Part No.	Part Name	Necessity	Q'ty	New/remodel	Sketch	Nature of work, remarks
Installation of cylinder head assembly	A	790-331-1110	Wrench	■	1			Tightening of cylinder head bolt
Installation of fuel injection pump assembly	A-1	795-799-1390 or 795-799-1210	Remover Puller	■ ■	1 1			Removal of drive gear
	A-2	795-799-1130	Gear	■	1			Barring of engine
Removal of nozzle holder assembly	A-3	795-799-1170	Puller	■	1			Removal of nozzle holder
• Removal, installation of engine, main pump assembly • Radiator, hydraulic cooler assembly • Control pump assembly • Main pump assembly • Servo valve assembly	B	796-460-1210	Oil stopper	●	1			
Disassembly of center swivel joint assembly	C	790-101-2501	Push puller	●	1			
Removal, installation of recoil spring assembly	D-1	791-600-2001 or 791-685-8005	Compressor (A) Compressor (B)	■ ■	1 1			
		791-635-3160	Extension	■	1			
		790-201-2800 • 790-21-2780	Push tool kit • Spacer	 ■	 1			
		790-101-1300 790-101-1102	Cylinder (980kN{100ton}) Pump	■ ■	1 1			
	D-2	790-201-1500	Push tool kit	●	1			Installation of recoil spring piston dust seal
		• 790-201-1590	• Plate		1			
		• 790-101-5021	• Grip		1			
		• 01010-50816	• Bolt		1			
Removal, installation of track shoe	E	791-616-1040	Remover & installer	■	1			Removal, press fitting of master pin
		790-105-1100	Cylinder (294kN{30ton})	■	1			
		790-101-1102	Pump	■	1			

Component	Symbol		Part No.	Part Name	Necessity	Q'ty	New/ remodel	Sketch	Nature of work, remarks	
Removal, installation of road liner (rubber pad type)	E-1	1	09007-01455	Hexagonal wrench	●	1			Width across flats: 14 mm	
		2	Commercially available	Hexagonal socket	●	1			14 mm	
Assembly of idler assembly Assembly of track roller assembly	F	1	791-675-1510	Installer	■	1			Installation of floating seal	
		2	791-601-1000	Oil pump	●	1			Charging with oil, checking for air leakage	
Replacement of pump shaft oil seal	G		791-463-1141	Push tool	■	1				
			790-201-2740	Spacer	■	1				
Disassembly, assembly of hydraulic cylinder	H	1	790-502-1003	Cylinder repair stand	■	1				
			790-101-1102	Pump	■	1				
		2	790-102-1320	Socket (width across flats: 70 mm)	■	1			Bucket	Removal, installation of piston nut
			790-302-1340	Socket (width across flats: 80 mm)	■	1			Boom	
			790-302-1430	Socket (width across flats: 85 mm) long	■	1			Arm	
		3	790-720-1000	Expander	■	1			Expansion of piston ring	
		4	796-720-1650	Ring	■	1			Bucket	Installation of piston ring
			07281-01029	Clamp	■	1				
			796-720-1660	Ring	■	1			Boom	
			07281-01159	Clamp	■	1				
		5	790-201-1702	Push tool kit	■	1			Bucket	Press fitting of bushing
			• 790-201-1791	• Push tool		1				
			• 790-101-5021	• Grip		1				
			• 01010-50816	• Bolt		1				
			790-201-1702	Push tool kit	■	1			Boom	
			• 790-201-1811	• Push tool		1				
			• 790-101-5021	• Grip		1				
			• 01010-50816	• Bolt		1				
			790-201-1702	Push tool kit	■	1			Arm	
			• 790-201-1821	• Push tool		1				
			• 790-101-5021	• Grip		1				
			• 01010-50816	• Bolt		1				
		6	790-201-1500	Push tool kit	■	1			Bucket	Insertion of dust seal
			• 790-201-1610	• Plate		1				
			• 790-101-5021	• Grip		1				
			• 01010-50816	• Bolt		1				
			790-201-1500	Push tool kit	■	1			Boom	
			• 790-201-1620	• Plate		1				
			• 790-101-5021	• Grip		1				
			• 01010-50816	• Bolt		1				

Component	Symbol		Part No.	Part Name	Necessity	Q'ty	New/remodel	Sketch	Nature of work, remarks
Disassembly, assembly of hydraulic cylinder	H	6	790-201-1500	Push tool kit	■	1			Arm
			• 790-201-1630	• Plate		1			
			• 790-101-5021	• Grip		1			
			• 01010-50816	• Bolt		1			
Disassembly, assembly of swing machinery assembly	N	1	790-101-2501	Push puller	●	1			Removal of bearing
			• 790-101-2510	• Block		1			
			• 790-101-2550	• Leg		2			
			• 790-101-2560	• Nut		2			
			• 790-101-2570	• Plate		2			
		2	• 790-101-3100	Bearing puller	●	1			
		3	790-101-4200	Puller (294kN{30ton})	●	1			
		4	796T-426-1140	Push tool	■	1		○	Press fitting of oil seal
			790-201-2680	Plate	■	1			
Disassembly, assembly of main pump assembly	W		790-501-5000	Unit repair stand (for 100V)	●	1			Disassembly, assembly of pump
			790-501-5200	Unit repair stand (for 220, 240V)	●	1			
			790-901-2110	Bracket	●	1			
			790-901-2150	Plate	●	1			
	X		796-467-1140	Nut	■	1	N		Securing PC valve
	Y		790-201-3610	Bolt	■	1			Disassembly, assembly of cylinder block assembly
			792-422-1120	Washer	■	1			
			01643-32460	Washer	■	1			
			01643-32060	Washer	■	1			
			01582-02016	Nut	■	1			
	Z		790-201-2700	Push tool KIT	■	1			Press fitting of roller bearing
			• 790-201-2730	• Spacer		1			
	AA	1	796-467-1100	Push tool KIT	■	1			Installation of servo piston seal
		2	• 796-467-1110	• Guide		1			
		3	• 796-467-1120	• Push tool		1			
	BB		790-101-5001	Push tool KIT	■	1			Press fitting of needle bearing
			• 790-101-5061	• Plate		1			
			• 790-101-5021	• Grip		1			
			• 01010-50816	• Bolt		1			
	CC		796-751-1500	Wrench assembly	■	1			Measuring shaft rotating torque
	DD		791-463-1141	Push tool	■	1			Press fitting of oil seal
			790-201-2740	Spacer	■	1			

SKETCHES OF SPECIAL TOOLS

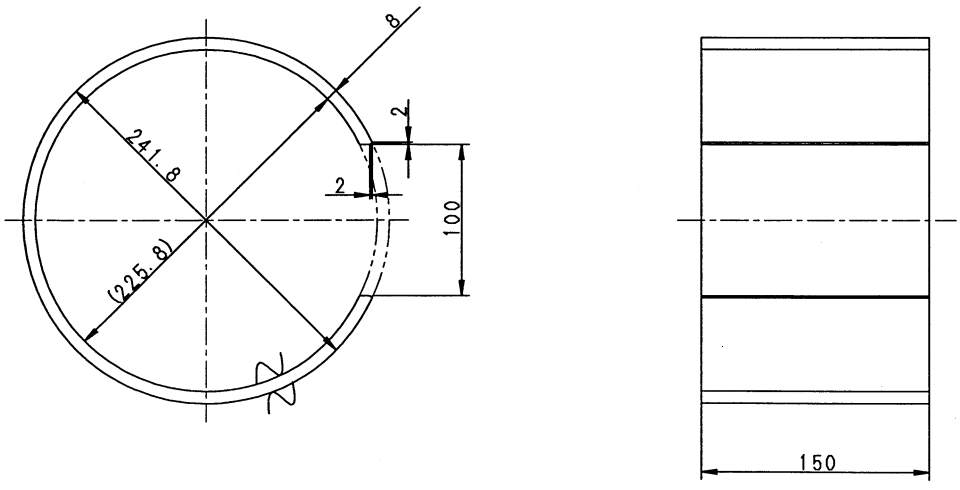
Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches.



CKP04749

HEAT TREATMENT	MATERIAL
—	STKM13A
PART NAME	QTY
PUSH TOOL	1
796T-426-1140 △	

★ For corners where there is no specification, check that there are no burrs or flashes.



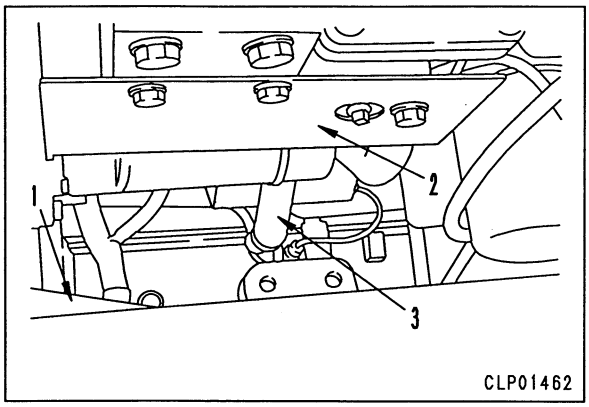
CKP04076

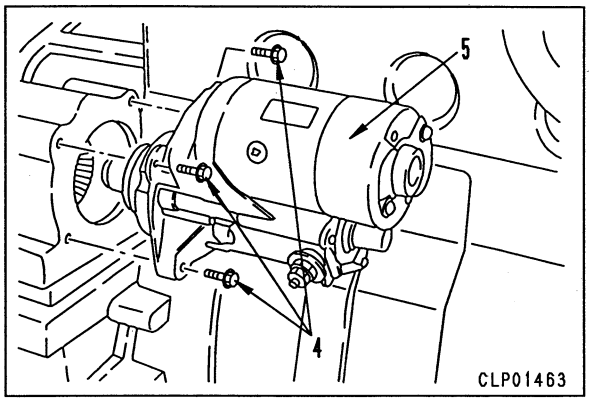
HEAT TREATMENT	MATERIAL
0000000000	STKM13A
PART NAME	QTY
PUSH TOOL	1
796T-427-1220 △	

REMOVAL OF STARTING MOTOR ASSEMBLY

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

1. Open engine hood and remove side cover (1) and exhaust manifold cover (2).
2. Disconnect wires (3).
3. Remove 3 bolts (4). ※ 1
4. Remove starting motor assembly (5).





INSTALLATION OF STARTING MOTOR ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm Starting motor assembly mounting bolt: **43.1 Nm {4.4 kgm}**

REMOVAL OF ALTERNATOR ASSEMBLY

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

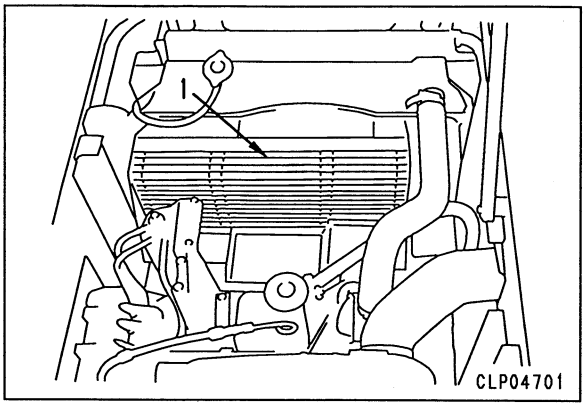
1. Open engine hood and remove fan guard (1).

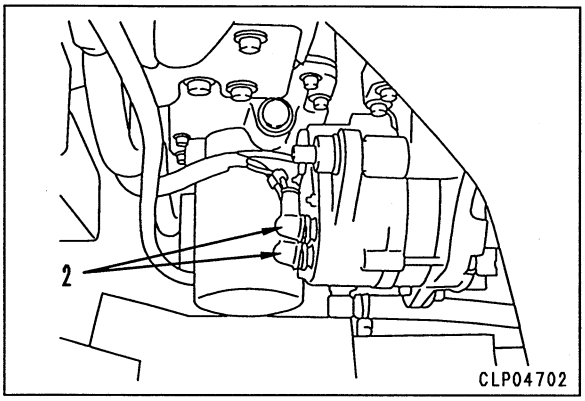
2. Disconnect wires (2).
★ Before disconnecting the wiring, fit tags to distinguish the mounting position.

3. Using wrench ①, raise tensioner (3) and remove fan belt (4).

   ⚠ Be extremely careful not to get your fingers caught when removing the fan belt.

4. Remove alternator mounting bolts (5) and (6), then remove alternator assembly (7) ※ 1





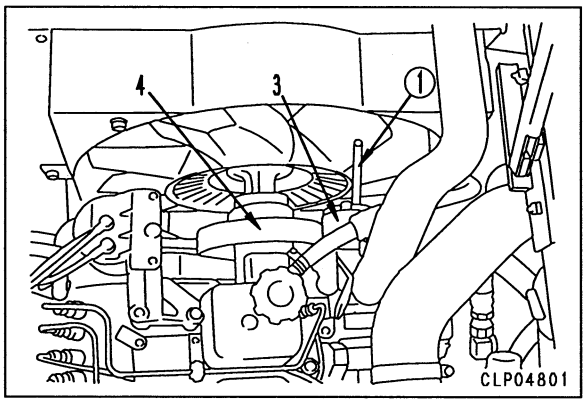
INSTALLATION OF ALTERNATOR ASSEMBLY

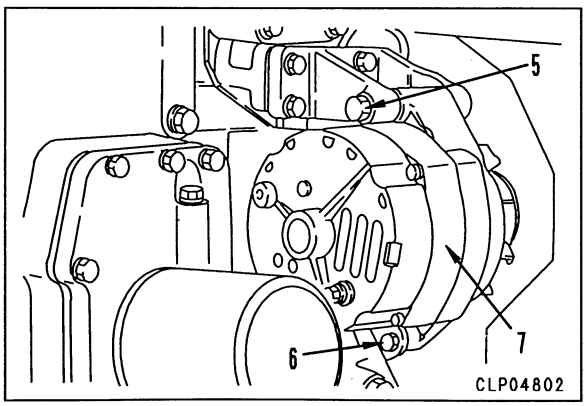
- Carry out installation in the reverse order to removal.

※ 1

kgm Alternator assembly mounting bolt: :
(5): 80.4 Nm {8.2 kgm}
(6): 43.1 Nm {4.4 kgm}

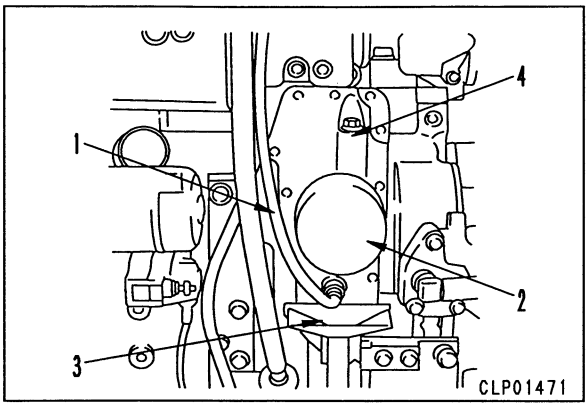
★ Use a straight edge and check that the alternator pulley is centered with the other pulleys.

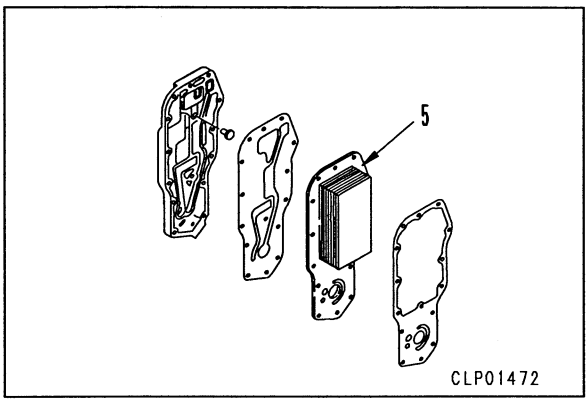




REMOVAL OF ENGINE OIL COOLER CORE ASSEMBLY

1. Remove alternator assembly. For details, see REMOVAL OF ALTERNATOR ASSEMBLY.
2. Disconnect turbocharger lubrication hose (1), oil filter (2), and oil pan (3).
3. Remove cooler cover assembly (4). [※ 1]
4. Remove cooler core (5) from oil cooler cover assembly.





INSTALLATION OF ENGINE OIL COOLER CORE ASSEMBLY

- Carry out installation in the reverse order to removal.

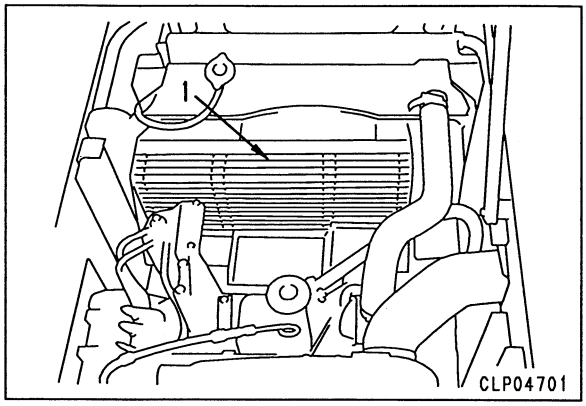
[※ 1]

kgm Oil cooler assembly mounting bolt :
24.5 Nm {2.5 kgm}

REMOVAL OF FUEL INJECTION PUMP ASSEMBLY

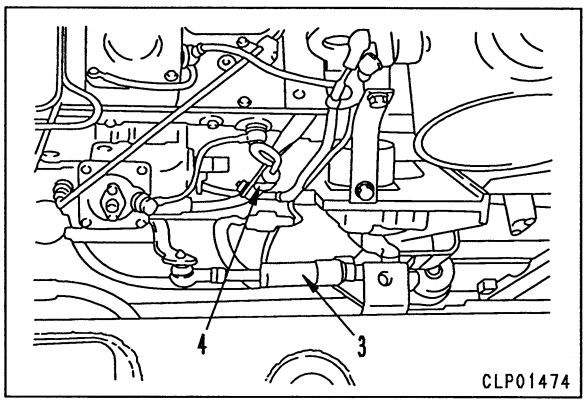
1. Open engine hood and remove counterweight top cover.

2. Remove fan guard (1).



3. Disconnect governor motor rod (1). [※ 1]
   - ★ Rotate the shaft of the governor motor and do not stop it suddenly.
   - ★ Always disconnect the governor motor connector before disconnecting the rod.

4. Remove lock clip (4) of engine oil dipstick guide.



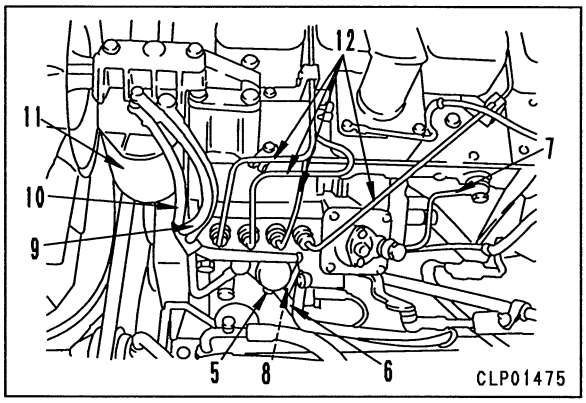
5. Disconnect fuel supply hoses (5) and (6).
   - ★ Fuel will flow out when the hoses are disconnected, so insert wooden plugs in the hoses to prevent the fuel from leaking.

6. Remove boost compensator tube (7).

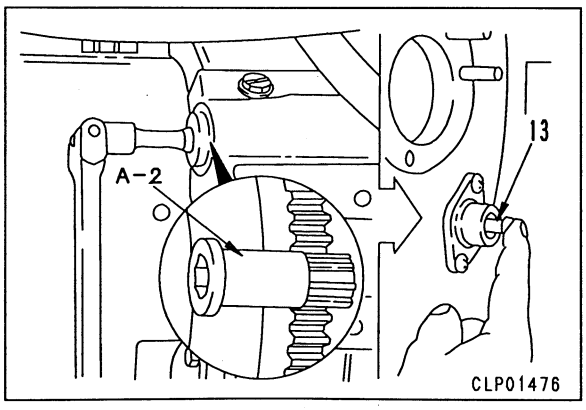
7. Remove lubrication tube (8).

8. Disconnect hose (9) and 2 tubes (10) between fuel filter and fuel injection pump at pump end, then remove fuel filter (11) together with bracket.

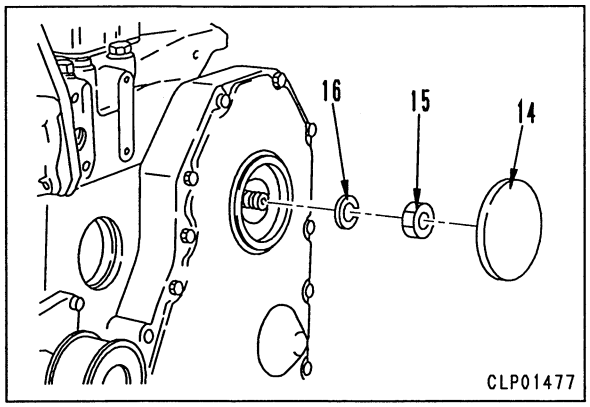
9. Disconnect delivery tubes (12). [※ 2]



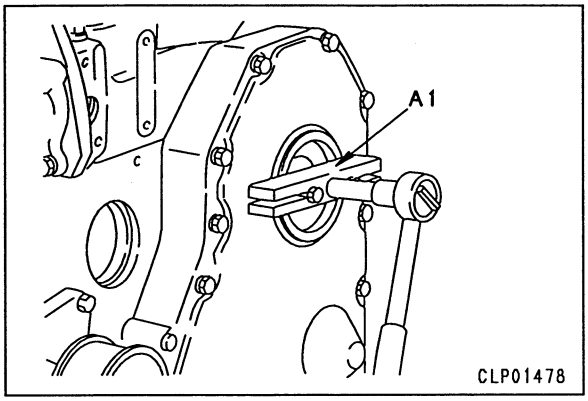
10. Using tool **A2**, rotate engine in normal direction, and push No. 1 cylinder compression top dead center positioning pin (13) into gear.
    - ★ Push the pin lightly against the gear and rotate the engine slowly.
    - ★ After determining the TDC position, check if the meshing of the timing pin has come out.



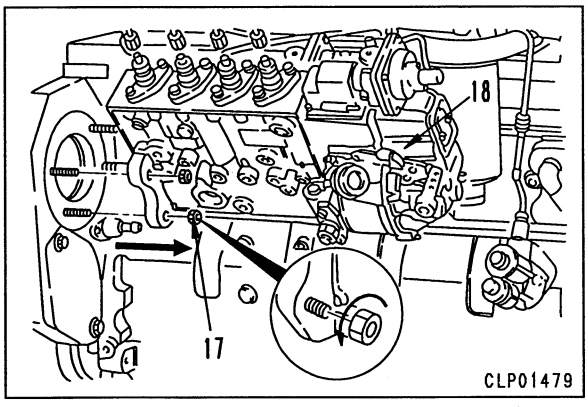
11. Turn cap (14) to remove, then remove nut (15) and washer (16). ※ 3
    ★ Be careful not to drop the nut or washer inside the case.



12. Using tool **A1**, pull drive gear of fuel injection pump and loosen from shaft.



13. Remove 4 mounting nuts (17), then remove fuel injection pump assembly (18). ※ 4



INSTALLATION OF FUEL INJECTION PUMP ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

★ Adjust the governor lever. For details, see TESTING AND ADJUSTING, Adjusting travel of governor motor lever.

※ 2

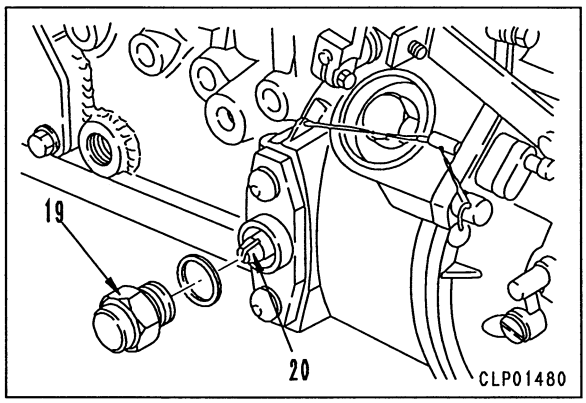
kgm Delivery tube sleeve nut :
29.4 Nm {3.0 kgm}

※ 3

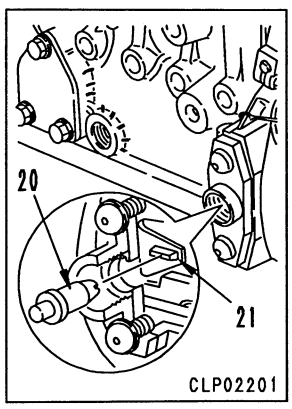
- Install the fuel injection pump assembly as follows.

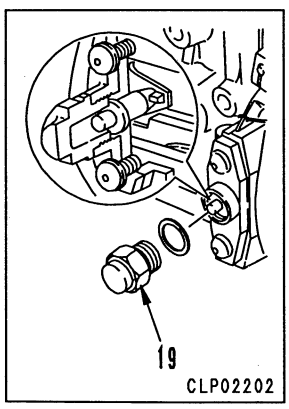
1) Check that the No. 1 cylinder is at compression top dead center.
   ★ For details, see Removal Step 10.

2) Remove plug (19), then remove timing pin (20).



3) Reverse the position of timing pin (19), align the timing pin groove with pointer (21) inside the pump, then temporarily tighten plug (19).
   ★ If the tooth of pointer (21) cannot be aligned with the timing pin hole, rotate the shaft of the fuel injection pump to align the pointer tooth.

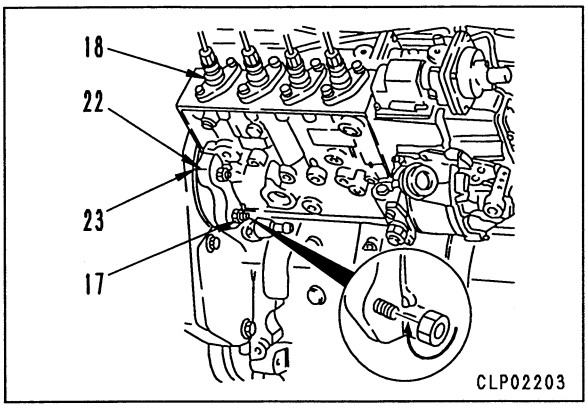




4) Align pump camshaft with pump drive gear and install fuel injection pump assembly (18).
   ★ Tighten mounting nut (17) temporarily.

5) Align line (22) on fuel injection pump body with line (23) on timing gear case, then tighten nut (17).

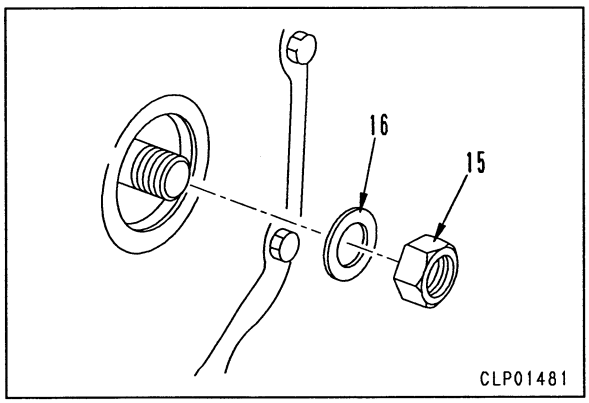
   kgm Nut : **42.2 Nm {4.3 kgm}**



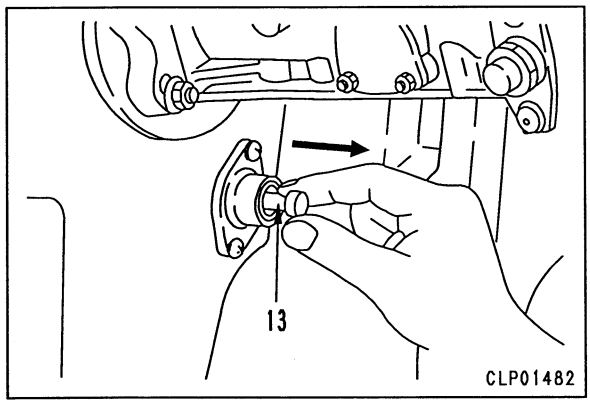
6) Assemble washer (16), and tighten nut (26) temporarily.
   ★ Be extremely careful not to drop the nut or washer inside the case when installing.

   kgm Nut : **12.5 ± 2.5 Nm {1.27 ± 0.25 kgm}**

   ★ This is not the final torque value.
   ★ To prevent damage to the timing pin, be careful not to tighten the nut to more than the above tightening torque.



7) Remove meshing of engine timing pin (13).



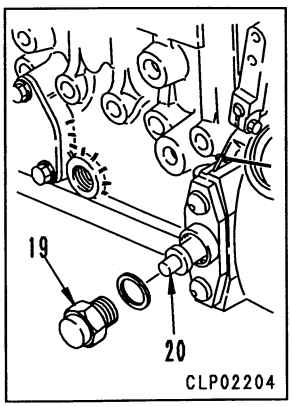
8) Remove plug (19), reverse position of timing pin (20), then assemble and install plug to fuel injection pump.

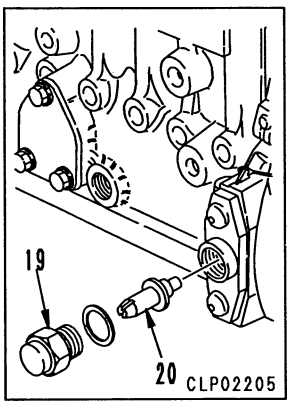
   kgm Plug : **14.7 Nm {1.5 kgm}**

9) Tighten drive nut (15) of fuel injection pump fully.

   kgm Nut : **164.8 Nm {16.8 kgm}**

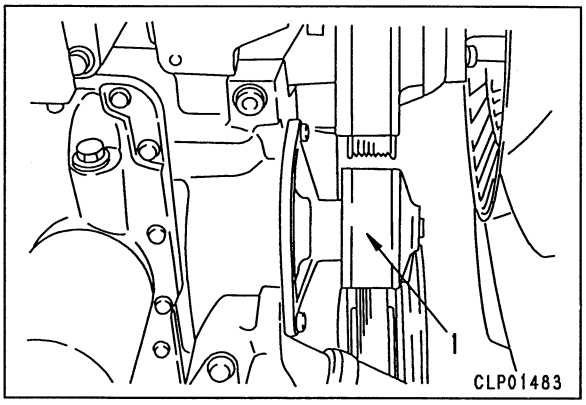
10) Carry out the rest of the installation in the reverse order to removal.





REMOVAL OF WATER PUMP ASSEMBLY

1. Drain coolant.
2. Remove alternator assembly. For details, see REMOVAL OF ALTERNATOR ASSEMBLY.
3. Remove water pump assembly (1). [※ 1]



INSTALLATION OF WATER PUMP ASSEMBLY

- Carry out installation in the reverse order to removal.

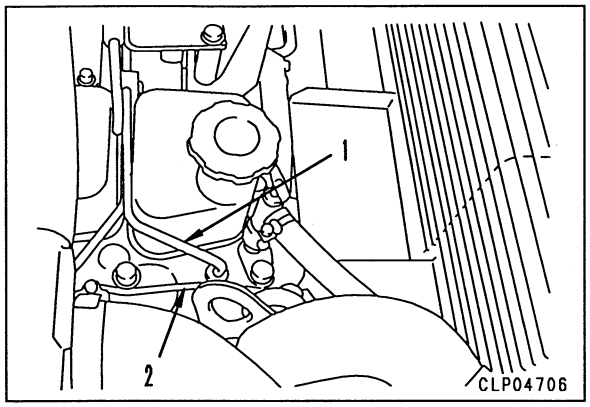
[※ 1]

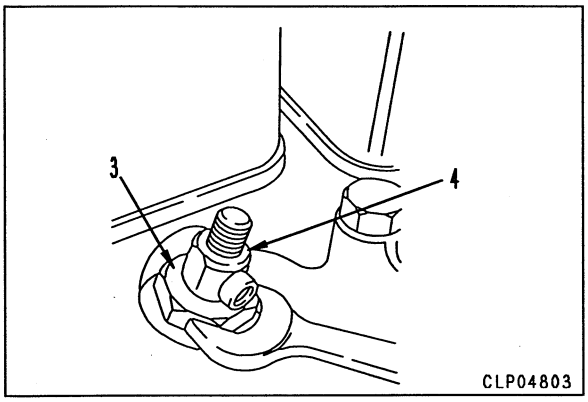
kgm Water pump assembly mounting bolt:
24.5 Nm {2.5 kgm}

- **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.

REMOVAL OF NOZZLE HOLDER ASSEMBLY

1. Open engine hood.
2. Disconnect delivery tube (1) at nozzle holder assembly end. ※ 1
3. Remove spill tube (2). ※ 2
4. Loosen nut (3) and remove nozzle holder assembly (4). ※ 3
   - ★ If it is difficult to remove the nozzle holder assembly, use tool **A3** to remove it.
   - ★ Be careful not to let dirt or dust get into the nozzle holder assembly mount.





INSTALLATION OF NOZZLE HOLDER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm Delivery tube sleeve nut : **29.4 Nm {3.0 kgm}**

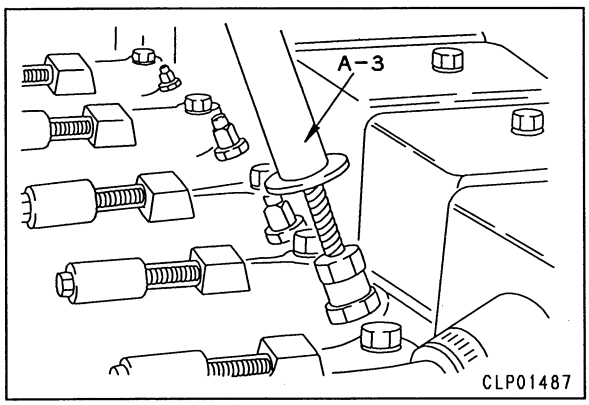
※ 2

kgm Joint bolt : **8.0 Nm {0.82 kgm}**

※ 3

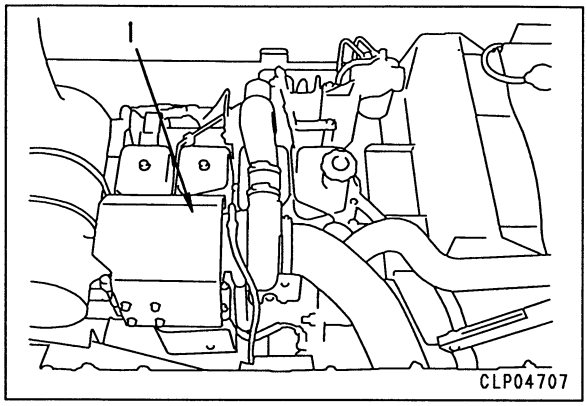
kgm Locknut : **59.8 Nm {6.1 kgm}**

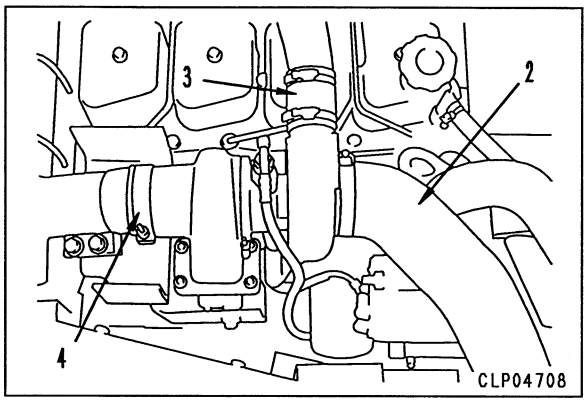
★ When assembling the nozzle holder, clean the nozzle holder mount, and check that there is no dirt or dust inside the sleeve before assembling.
Tighten the mounting bolts gradually in turn and be careful not to tighten unevenly.



REMOVAL OF TURBOCHARGER ASSEMBLY

1. Open engine hood and remove insulator (1).
2. Disconnect intake hose (2).
3. Loosen clamp of air supply connector intermediate hose (3), then move hose towards pipe.
4. Remove clamp (4) connecting turbocharger and exhaust muffler.
5. Disconnect turbocharger lubrication inlet hose (5) and drain tube (6).
6. Remove divider plate between muffler and main pump assembly, then remove 4 mounting bolts (8) of bracket of muffler assembly (7), and move towards pump.
7. Remove 4 turbocharger mounting nuts (9), then remove turbocharger assembly (10). ※ 1



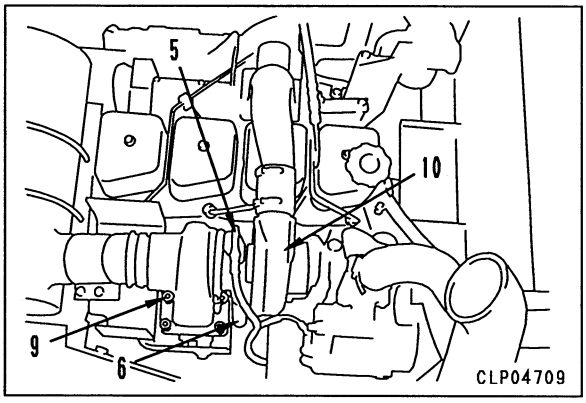


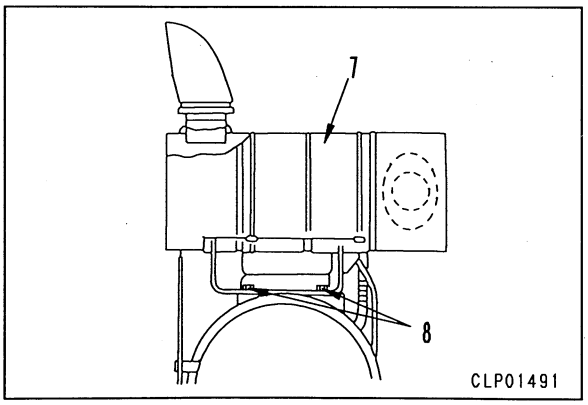
INSTALLATION OF TURBOCHARGER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

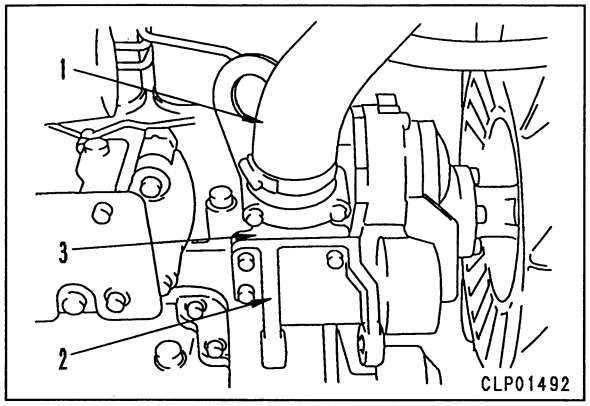
kgm Turbocharger assembly mounting bolt:
43.1 Nm {4.4 kgm}

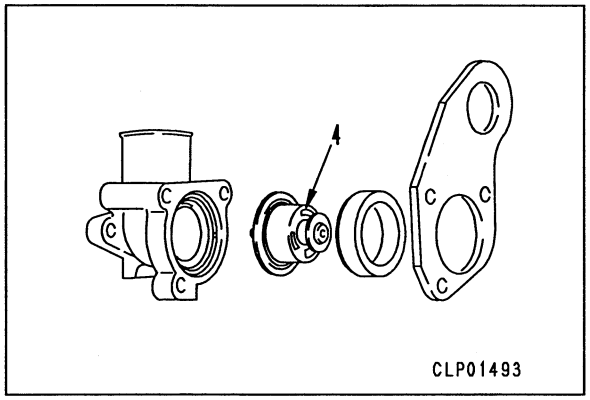




REMOVAL OF THERMOSTAT ASSEMBLY

1. Drain coolant.
2. Remove alternator assembly. For details, see REMOVAL OF ALTERNATOR ASSEMBLY.
3. Disconnect radiator inlet port hose (1).
4. Remove bracket (2).
5. Remove thermostat housing (3).
6. Remove thermostat (4).





INSTALLATION OF THERMOSTAT ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

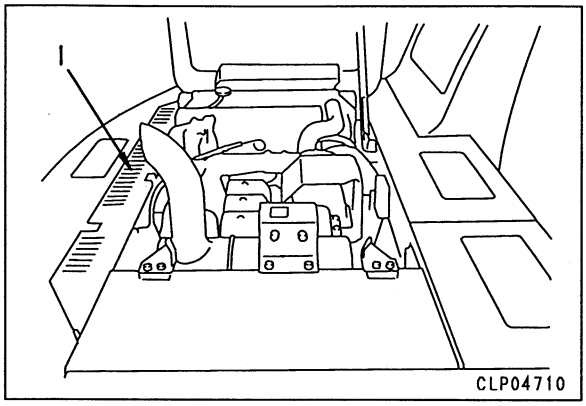
kgm Thermostat housing mounting bolt:
24.5 Nm {2.5 kgm}

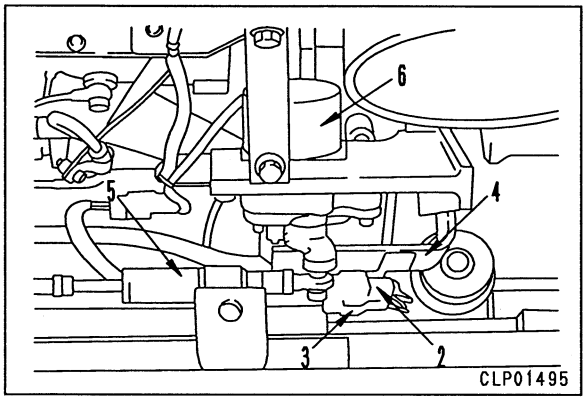
- **Refilling with water**
  ★ Add water through the water filler to the specified level. Run the engine to circulate the water through the system. Then check the water level again.

REMOVAL OF GOVERNOR MOTOR ASSEMBLY

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

1. Open engine hood and remove counterweight top cover (1).
2. Disconnect wiring connectors (2) and (3), and remove bracket (4).
3. Disconnect rod (5), then remove 3 bolts, and remove governor motor assembly (6). ※ 1
   ★ Rotate the shaft of the governor motor and do not stop it suddenly.





INSTALLATION OF GOVERNOR MOTOR ASSEMBLY

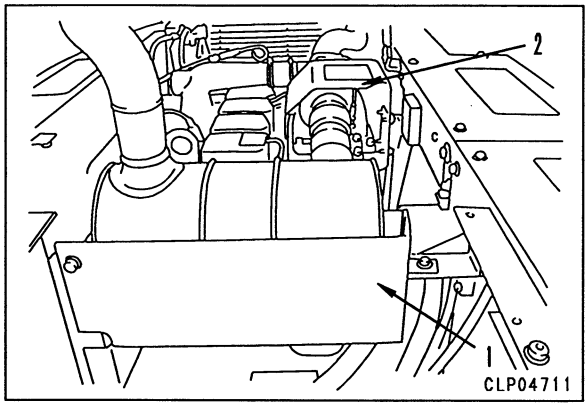
- Carry out installation in the reverse order to removal.

※ 1
★ Adjust the rod. For details, see TESTING AND ADJUSTING, Testing and adjusting travel of governor motor lever.

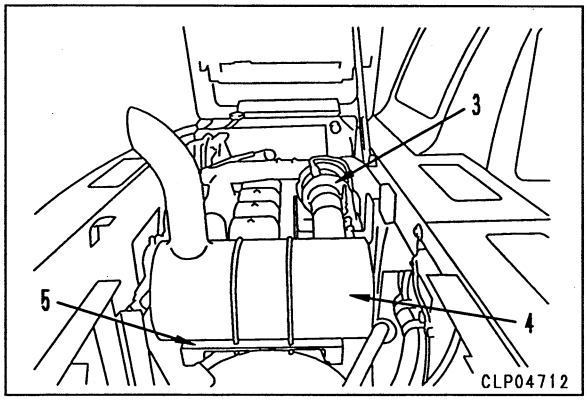
REMOVAL OF CYLINDER HEAD ASSEMBLY

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

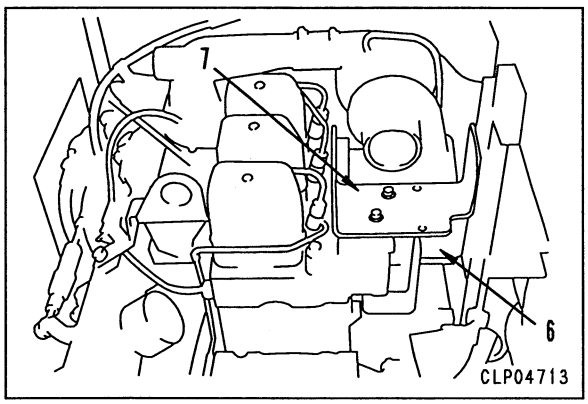
1. Drain coolant.
2. Open engine hood and remove pump top cover, counterweight top cover, exhaust muffler cover (1), and insulator (2).



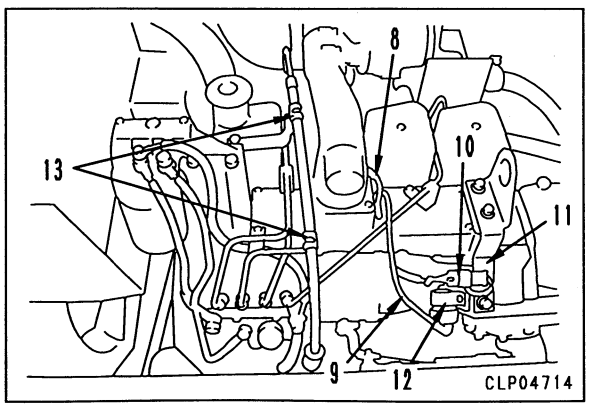
3. Remove clamp (3) between turbocharger and muffler, then remove exhaust muffler (4) together with bracket (5). ※ 1



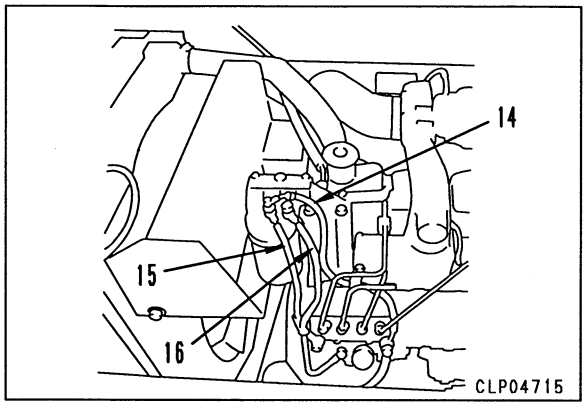
4. Remove exhaust manifold cover (6).
5. Remove bracket (7).



6. Disconnect ground connection (8) and electrical intake air heater wiring (9).
7. Disconnect water temperature sensor wiring connector (10).
8. Remove bracket (11), then remove electrical intake air heater (12) together with bracket.
9. Disconnect clamps (13) of engine oil dipstick guide.

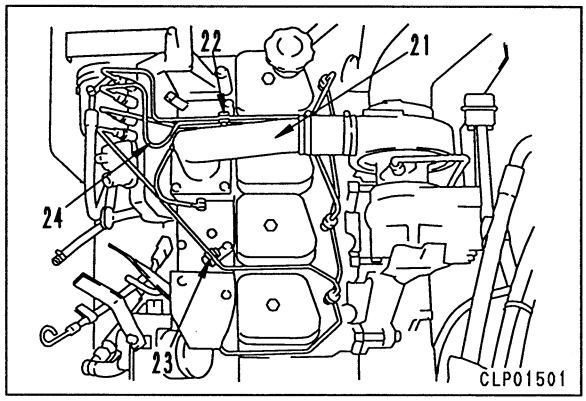


10. Disconnect hose (14) and tubes (15) and (16) between fuel filter and fuel injection pump at fuel injection pump end, and remove fuel filter assembly.



11. Remove air supply connector (21). ※ 2

12. Remove clamps (22) and (23), then remove 4 delivery tubes (24). ※ 3

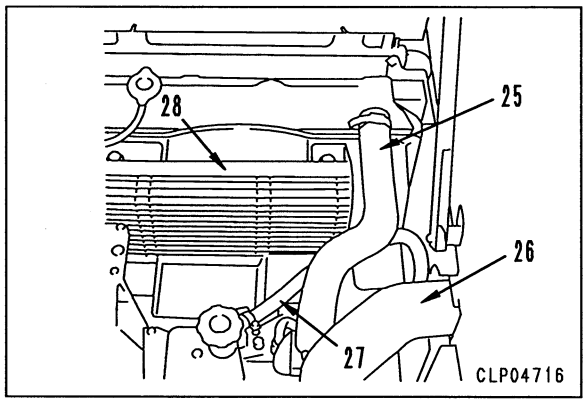


13. Remove radiator inlet hose (25).

14. Disconnect intake hose (26), move towards cab, then tie with rope.

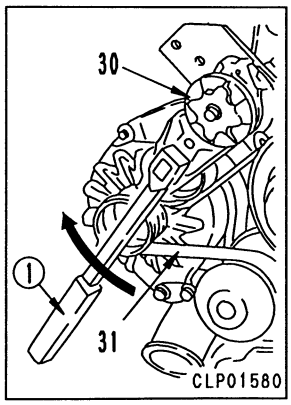
15. Disconnect heater hose (27).

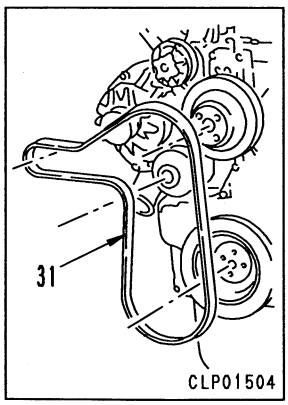
16. Remove fan guard (28).



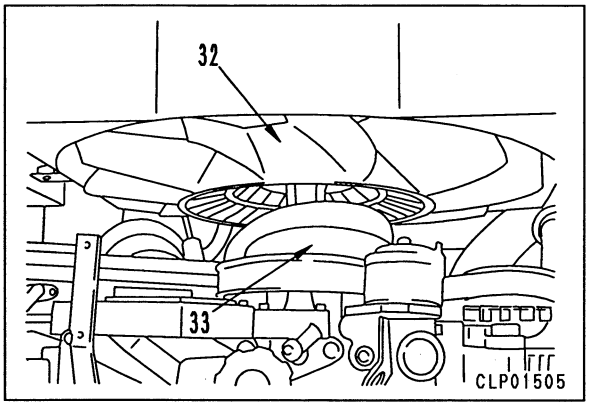
17. Using wrench ①, raise tensioner (30), and remove fan belt (31).

⚠ Be extremely careful not to get your fingers caught when removing the fan belt.

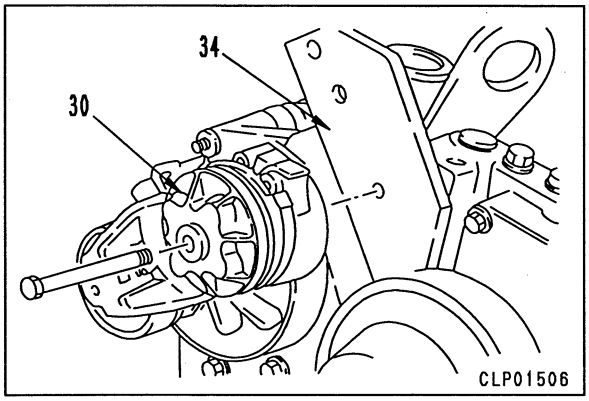




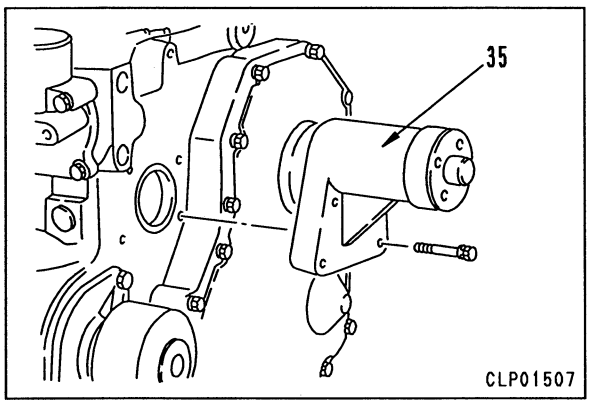
18. Remove fan pulley mounting bolts and move fan (32) towards radiator, then remove fan pulley (33).



19. Remove tensioner (30), then remove bracket (34).

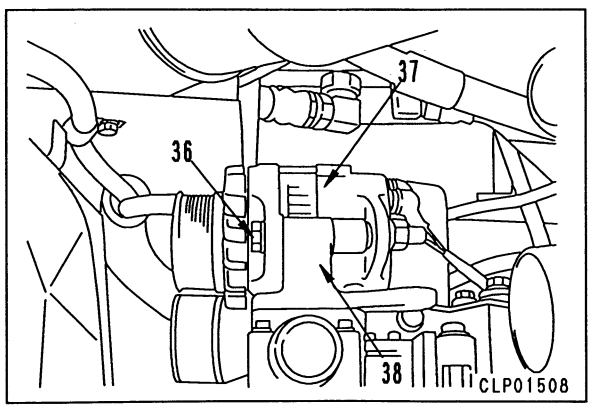


20. Remove fan hub (35).



21. Remove mounting bolt (36) and move alternator assembly (37) to outside.

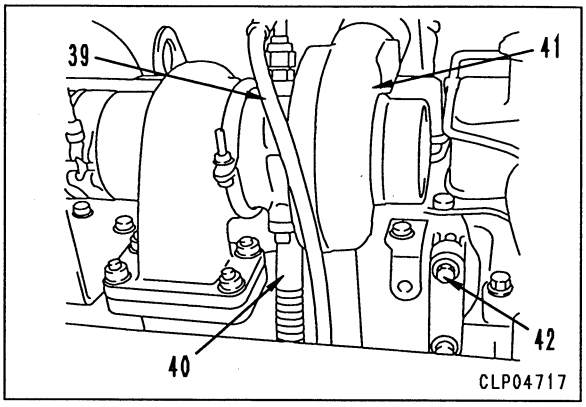
22. Remove bracket (38).



23. Disconnect turbocharger inlet hose (39). ※ 8

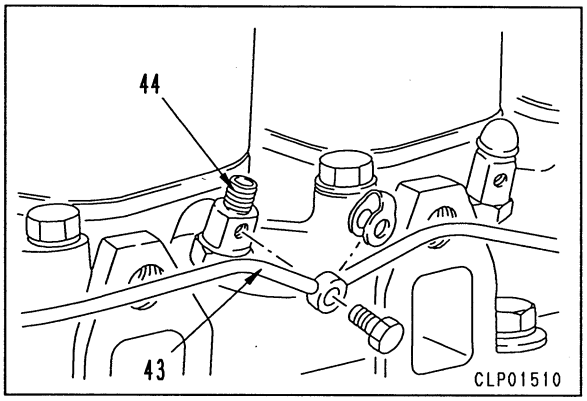
24. Remove turbocharger drain tube (40). ※ 8

25. Sling turbocharger and exhaust manifold assembly (41), then remove mounting bolts (42) and lift off assembly. ※ 9

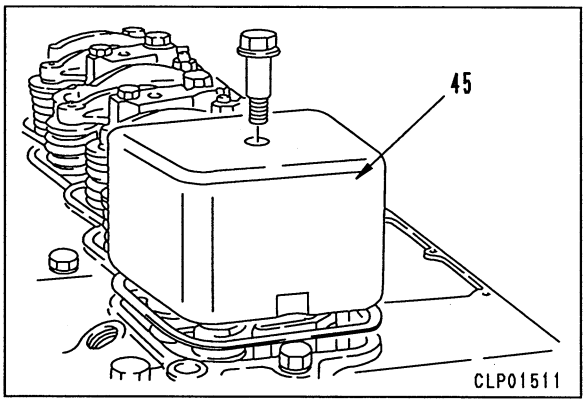


26. Remove spill tube (43). ※ 10

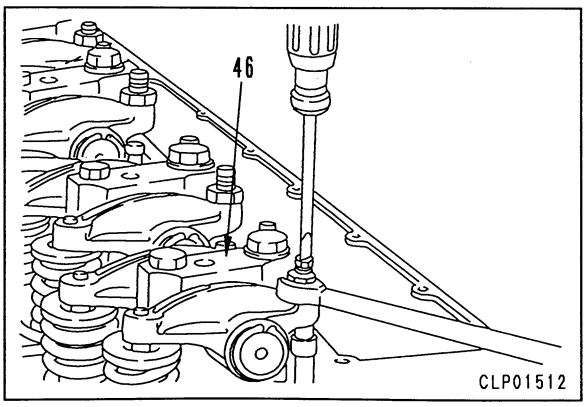
27. Remove nozzle holder assembly (44). ※ 11



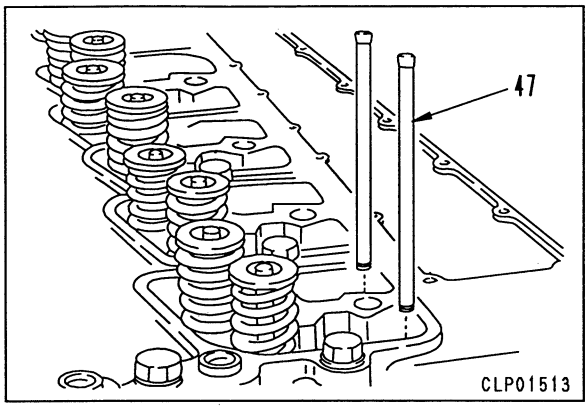
28. Remove head cover (45). ※ 12



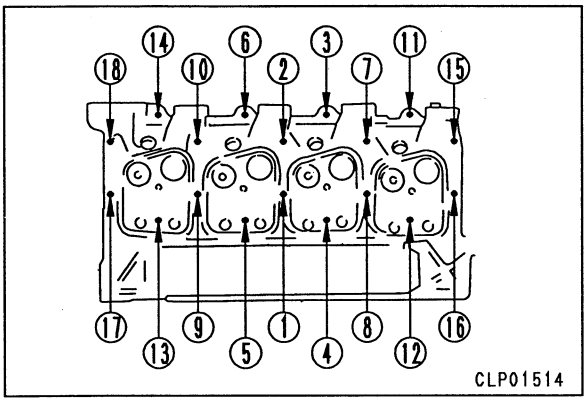
29. Remove rocker arm assembly (46). ※ 13
    ★ Loosen the locknut, then loosen the adjustment screw 2 – 3 turns.



30. Remove push rod (47).



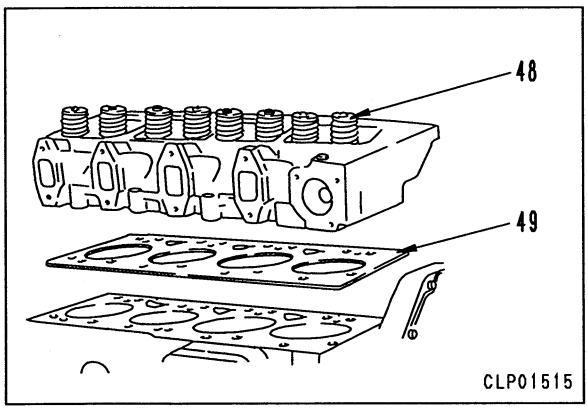
31. Remove mounting bolts of cylinder head in order shown in diagram. ※14



32. Lift off cylinder head assembly (48).

kg Cylinder head assembly : **40 kg**

33. Remove cylinder head gasket (49). ※15



INSTALLATION OF CYLINDER HEAD ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm Exhaust outlet pipe clamp :
7.8 Nm {0.8 kgm}

※ 2

kgm Air supply hose clamp : **7.8 Nm {0.8 kgm}**

※ 3

kgm Delivery tube sleeve nut :
32.4 Nm {3.3 kgm}

※ 4

kgm Fan pulley mounting bolt :
43.1 Nm {4.4 kgm}

※ 5

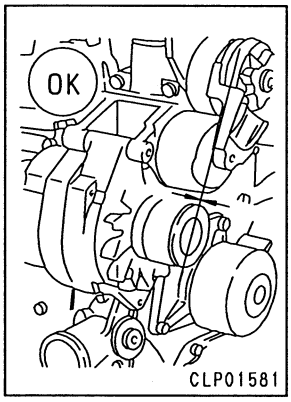
kgm Bracket mounting bolt : **23.5 Nm {2.4 kgm}**

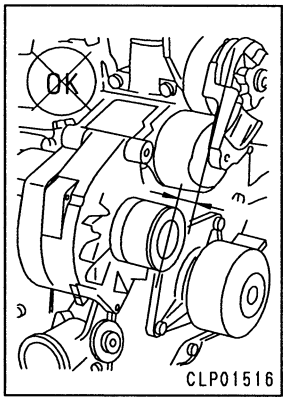
kgm Tensioner mounting bolt :
43.1 Nm {4.4 kgm}

※ 6

kgm Alternator assembly mounting bolt :
80.4 Nm {8.2 kgm}

★ Use a straight edge and check that the alternator pulley is centered with the other pulleys.





※ 7

kgm Bracket mounting bolt : **23.5 Nm {2.4 kgm}**

※ 8

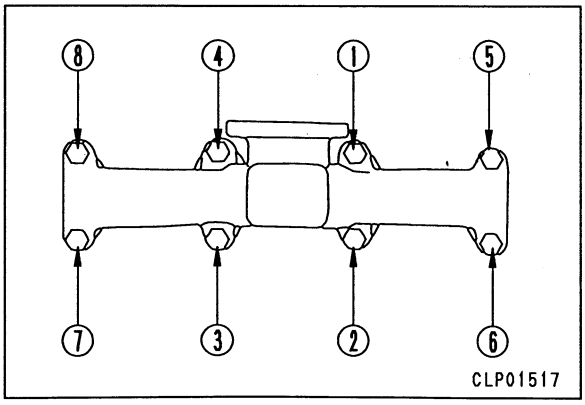
kgm Turbocharger inlet hose sleeve nut :
35.3 Nm {3.6 kgm}

kgm Turbocharger outlet tube mounting bolt :
23.5 Nm {2.4 kgm}

※ 9

★ Install in the order ① – ⑧ shown in the diagram on the right.

kgm Exhaust manifold mounting bolt :
43.1 Nm {4.4 kgm}



※10

kgm Spill tube joint bolt : **8.8 Nm {0.9 kgm}**

※11

kgm Nozzle holder assembly locknut : **59.8 Nm {6.1 kgm}**

※12

kgm Head cover mounting bolt : **23.5 Nm {2.4 kgm}**

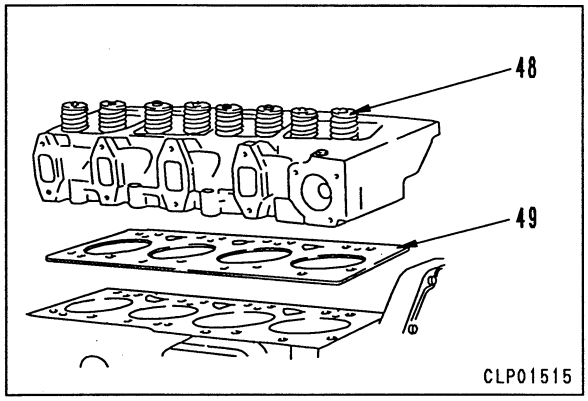
※13, ※14, ※15

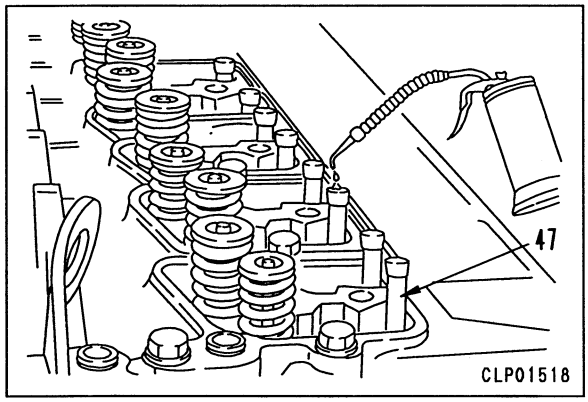
- Install the rocker arm assembly and cylinder head assembly as follows.

★ Check that there is no dirt or dust inside the cylinder or on the cylinder head mounting surface.

1) Set cylinder head gasket (49) to cylinder block.
   ★ Check that the gasket is correctly aligned with the holes in the block.
2) Raise cylinder head assembly (48) and set to cylinder block.
3) Assemble push rod (47).

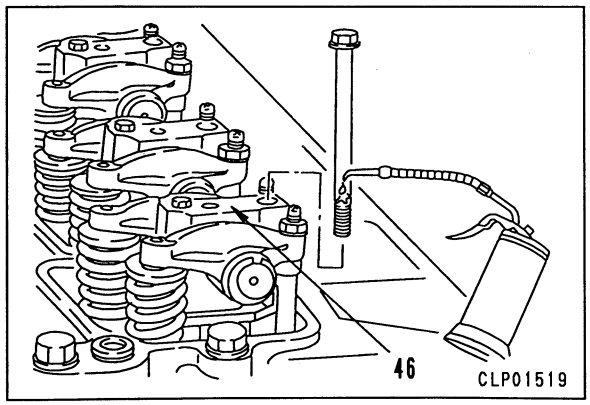
Add engine oil to the push rod socket.





4) Fit rocker arm assembly (46) and tighten mounting bolts by hand.
   ★ Check that the ball of the adjustment screw is fitted securely in the socket of the push rod.

Add engine oil to the thread and seat of the 8 mm and 12 mm diameter mounting bolts.



5) Tighten cylinder head mounting bolts in order shown in diagram.

Add engine oil to the thread and seat of the mounting bolts.

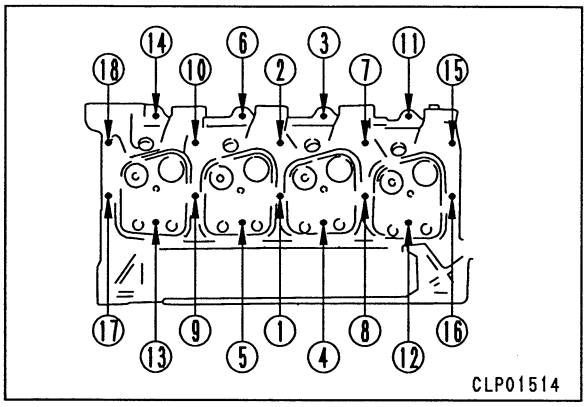
kgm Cylinder head mounting bolt :

1st pass: Tighten to 90.2 Nm {9.2 kgm} in the order ① – ⑱

2nd pass: Tighten to 117.7 Nm {12 kgm} in the order ④, ⑤, ⑫, ⑬

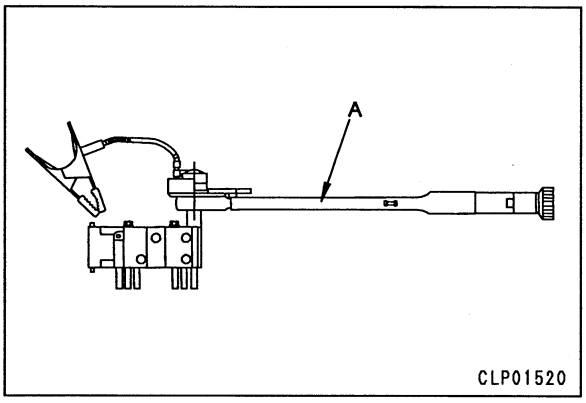
3rd pass: 1) When using tool **A**
- Using angle tightening wrench (tool **A**), tighten bolts 90° in order ① – ⑱.

2) When not using tool **A**
- Make mark with felt pen on bolt and head, then tighten bolt 90°.



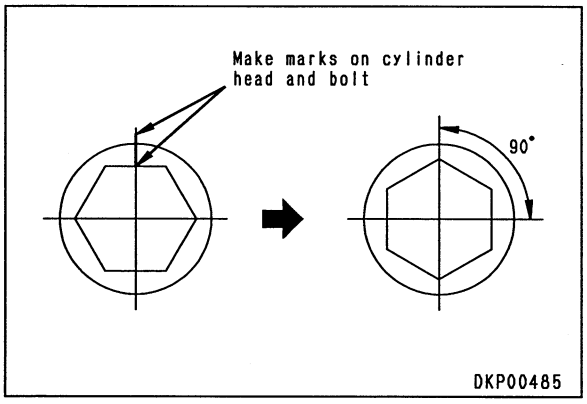
6) Tighten rocker arm assembly mounting bolts (diameter: 8 mm).

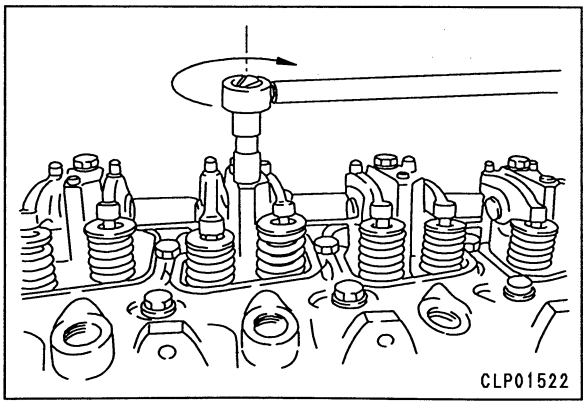
kgm Rocker arm mounting bolt (diameter: 8 mm) : **23.5 Nm {2.4 kgm}**



7) Adjust 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 circulate the water through the system. Then check the water level again.





REMOVAL OF ENGINE, MAIN PUMP ASSEMBLY

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

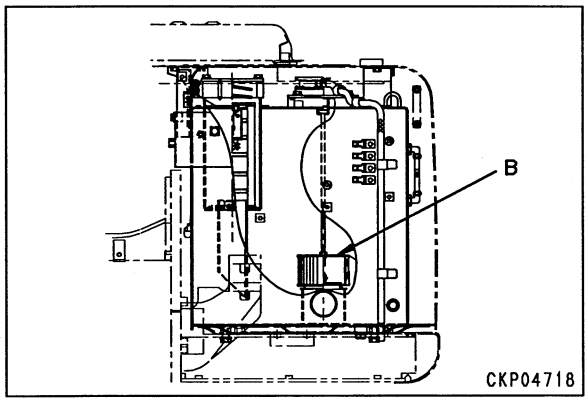
⚠ Lower the work equipment completely to the ground and stop the engine. Then loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

- Remove the hydraulic tank strainer, and using tool **B**, stop the oil.
- When not using tool **B**, remove the drain plug, and drain the oil from the hydraulic tank and inside the system.

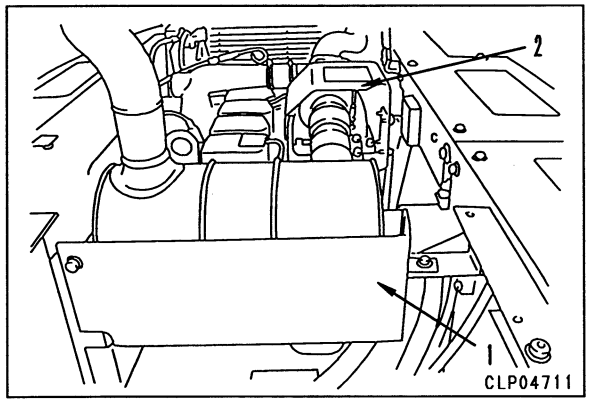
  Hydraulic tank : **Approx. 100 ℓ**

- Drain coolant.

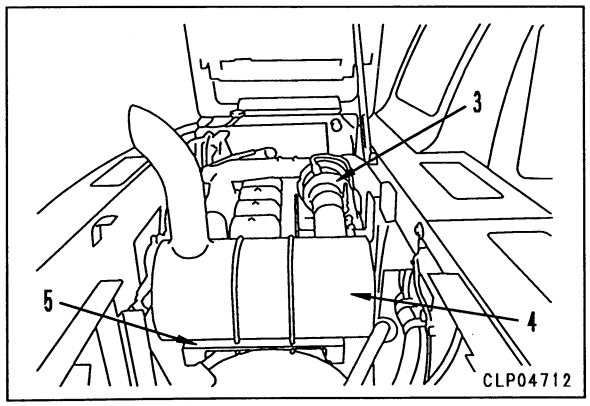
1. Remove pump bottom cover and engine bottom cover.
2. Open engine hood and remove pump top cover.



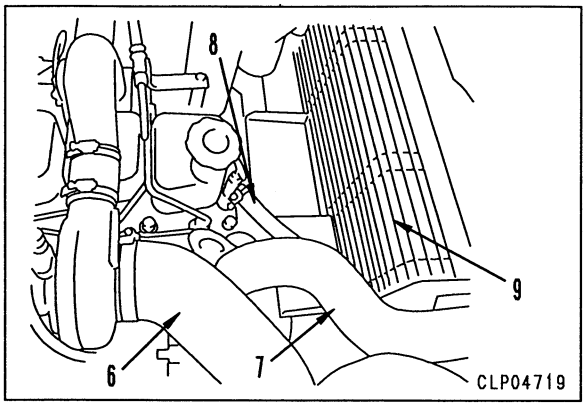
3. Remove counterweight top cover, exhaust muffler cover (1), and insulator (2).



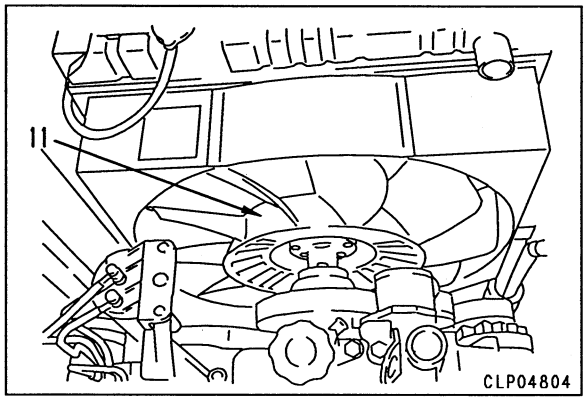
4. Remove clamp (3), then remove exhaust muffler (4) together with bracket (5).



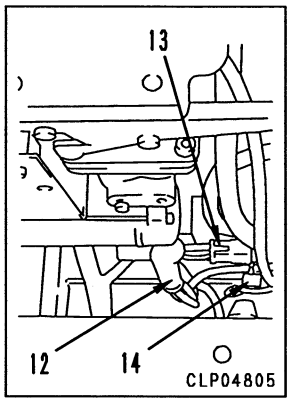
5. Disconnect intake hose (6).
6. Remove radiator inlet hose (7).
7. Disconnect heater hose (8).
8. Remove fan guard (9).

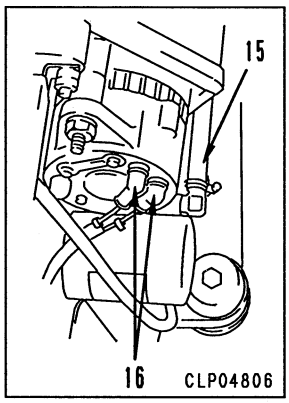


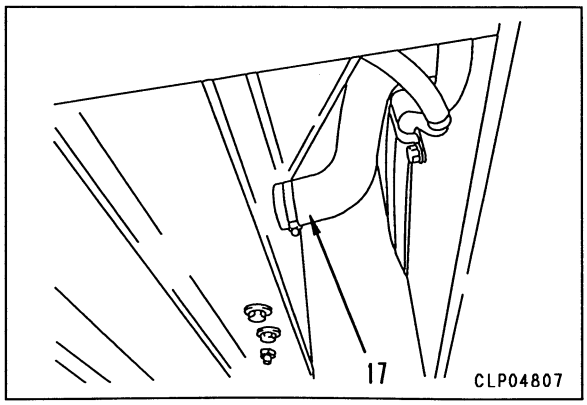
9. Remove fan (11).



10. Disconnect starting motor wiring (12).
11. Disconnect starting motor magnet switch connector (13).
12. Disconnect engine oil level sensor connector (14).
13. Disconnect heater hose (15).
14. Disconnect alternator wiring (16).
    ★ Mark the wiring with tags to show the connection position.
15. Disconnect radiator outlet hose (17).

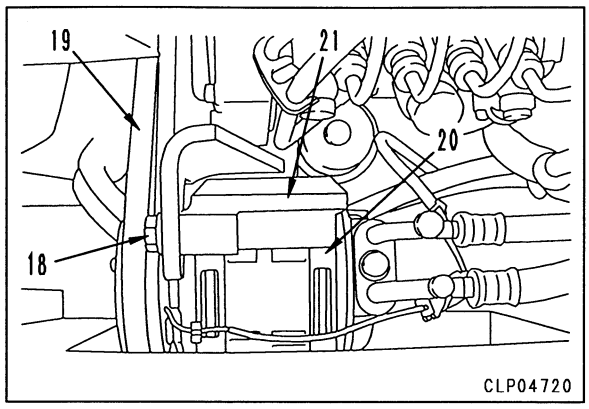




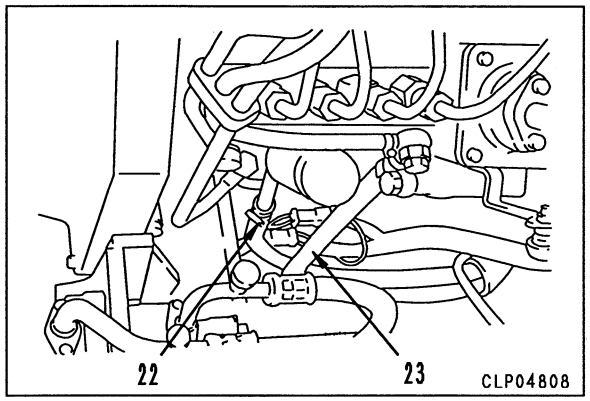


16. Loosen tension adjustment bolt (18) for air conditioner compressor belt , then move compressor towards engine and remove belt (19). ※ 1

17. Remove 4 mounting bolts and disconnect compressor (20) together with bracket (21), then move towards counterweight.



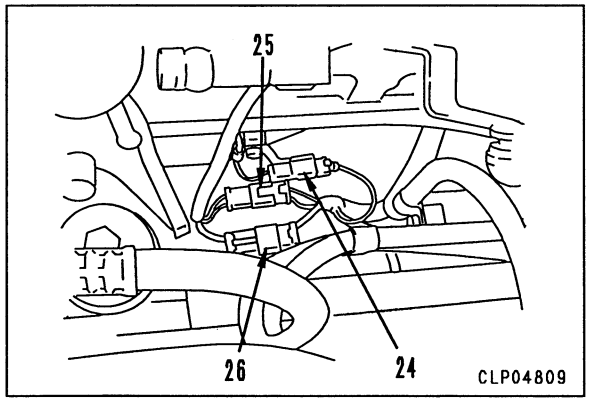
18. Disconnect fuel hoses (22) and (23).
★ When the hose is disconnected, fuel will flow out, so insert a wooden plug into the hose to prevent the fuel from leaking out.



19. Disconnect engine oil pressure sensor wiring connector (24).

20. Disconnect engine oil level sensor wiring connector (25).

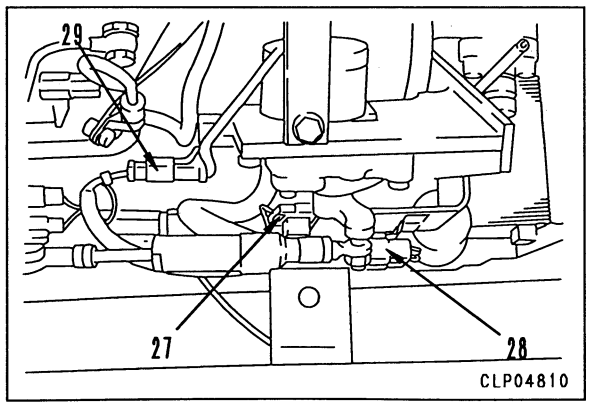
21. Disconnect electrical intake air heater wiring connector (26).



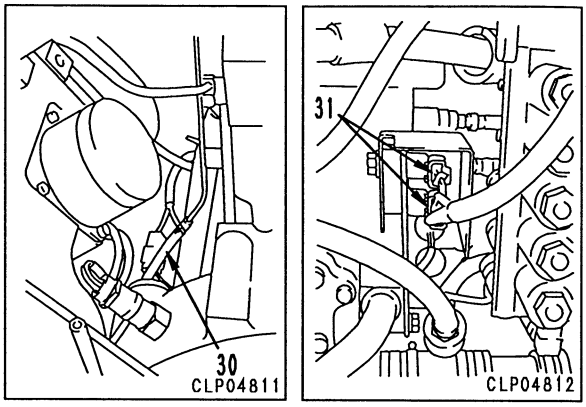
22. Disconnect engine speed sensor wiring connector (27).

23. Disconnect 2 governor motor wiring connectors (28).

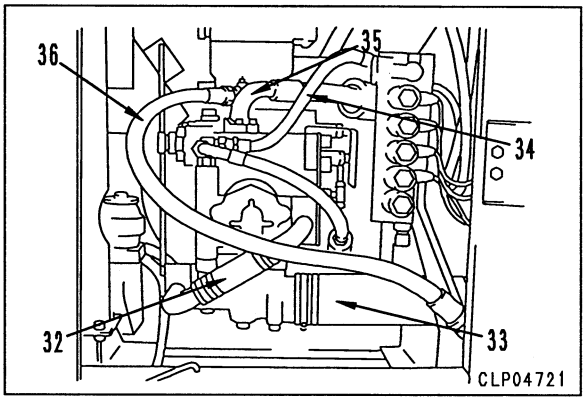
24. Disconnect water temperature sensor wiring connector (29).



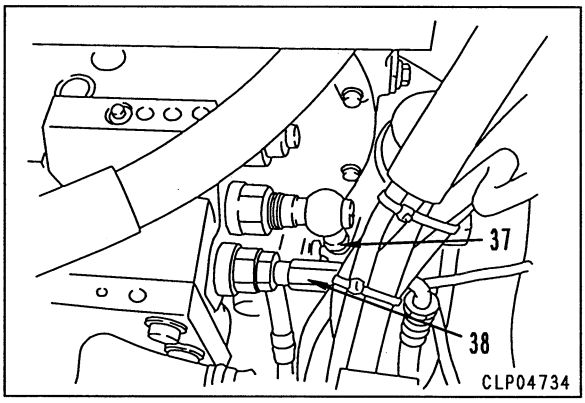
25. Disconnect spill hose (30).
26. Disconnect EPC valve wiring connectors (31).



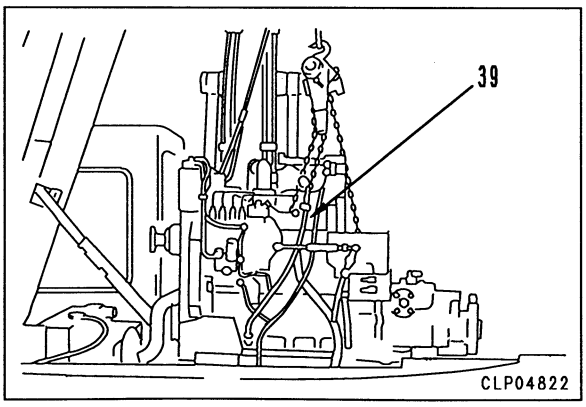
27. Remove control pump suction tube (32).
28. Disconnect main pump suction tube (33).
29. Disconnect control pump outlet hose (34).
30. Disconnect main pump outlet hose (35).
31. Disconnect main pump drain hose (36).



32. Disconnect hoses (37) and (38).
33. Disconnect EPC valve basic pressure hose.



34. Remove mount bolt, then lift off engine and hydraulic pump assembly (39) slowly. ※ 2
    ★ When removing the engine and hydraulic pump assembly, check that all wiring and piping has been disconnected, and be careful not to hit any part when removing.
    kg Engine, hydraulic pump assembly : **420 kg**



INSTALLATION OF ENGINE, MAIN PUMP ASSEMBLY

- Carry out installation in the reverse order to removal.

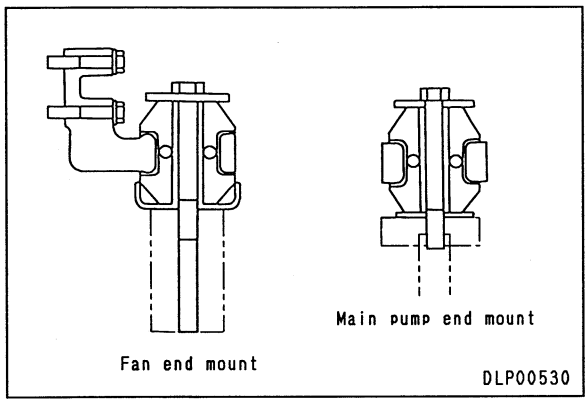
※ 1

★ Adjust the fan belt tension. For details, see TESTING AND ADJUSTING, Testing and adjusting air conditioner compressor belt tension.

※ 2

★ Set the engine mount rubber as shown in the diagram, then install the engine and main pump assembly.

kgm Engine mounting bolt :
277.0 ± 31.9 Nm {28.25 ± 3.25 kgm}



- **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.

- **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.

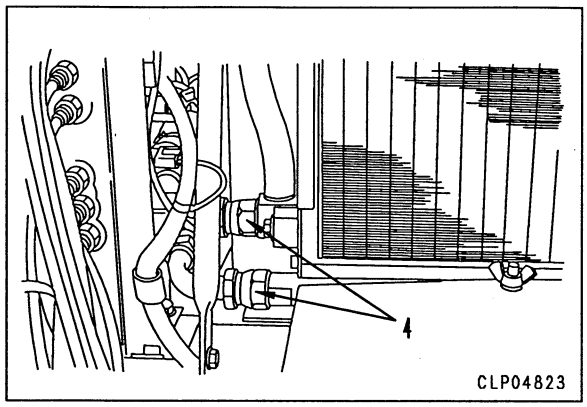
- **Bleeding air**
  ★ Bleed the air from the main pump. For details, see TESTING AND ADJUSTING, Bleeding air.

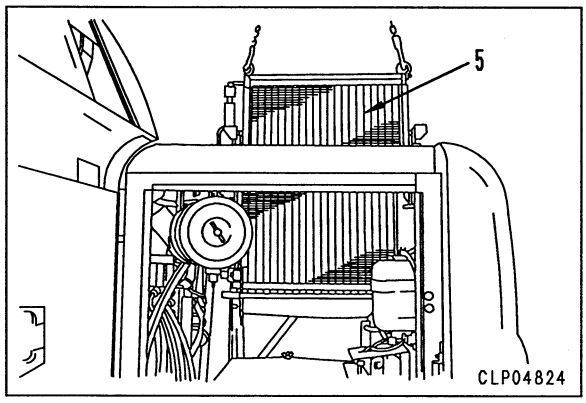
REMOVAL OF HYDRAULIC COOLER ASSEMBLY

1. Remove engine hood, then remove counterweight top cover and control valve top cover.

2. Disconnect cooler hoses (4).

3. Sling hydraulic cooler assembly (5), then remove 6 mounting bolts, and lift off slowly.
   ★ When removing the hydraulic cooler assembly, be extremely careful not to damage the core.
   kg Hydraulic cooler assembly : **30 kg**





INSTALLATION OF HYDRAULIC COOLER ASSEMBLY

- Carry out installation in the reverse order to removal.

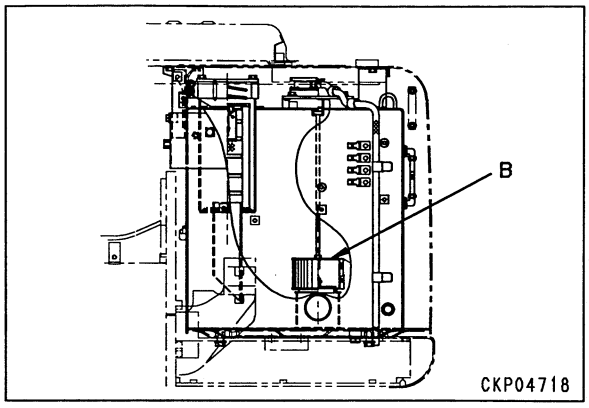
- **Refilling with oil (hydraulic tank)**
  ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

REMOVAL OF RADIATOR, HYDRAULIC COOLER ASSEMBLY

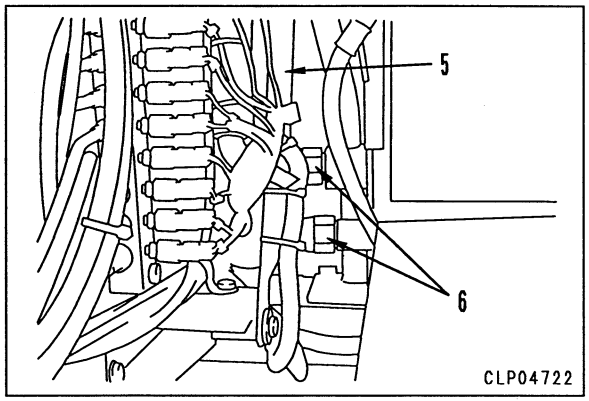
⚠ Lower the work equipment completely to the ground and stop the engine. Then loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

- Remove the hydraulic tank strainer, and using tool **B**, stop the oil.
  - When not using tool **B**, remove the drain plug, and drain the oil from the hydraulic tank and inside the system.

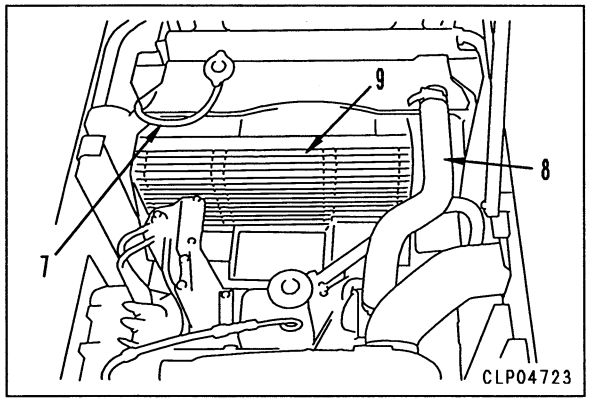
  Hydraulic tank : **Approx. 100 ℓ**
- Drain coolant



1. Remove engine hood, then remove counterweight top cover and control valve top cover.
2. Remove left and right stays (5).
3. Disconnect hydraulic cooler hoses (6).

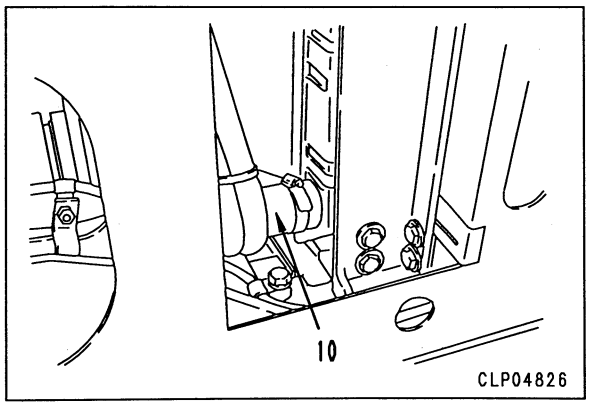


4. Disconnect aeration hose (7).
5. Disconnect radiator inlet hose (8).
6. Remove fan guard (9).

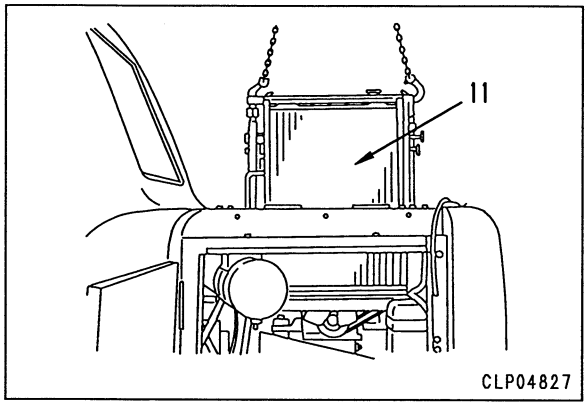


7. Disconnect radiator outlet hose (10).
8. Sling radiator and hydraulic cooler assembly (11), then remove 4 bottom mounting bolts, and lift off slowly. ※1
   ★ When removing the radiator and hydraulic cooler assembly, be extremely careful not to damage the core.

   kg Radiator, hydraulic cooler assembly : **75 kg.**



INSTALLATION OF RADIATOR, HYDRAULIC COOLER ASSEMBLY



- Carry out installation in the reverse order to removal.

※ 1

★ Install the radiator and hydraulic cooler assembly so that there is a clearance of 13 mm or more to the left and right, and top and bottom between the fan and shroud.

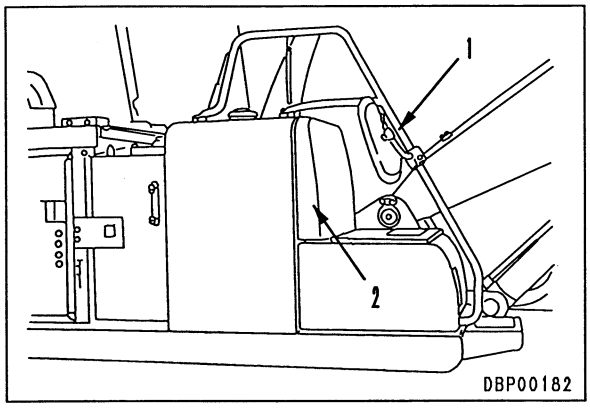
- **Refilling with water**
  ★ Add water through the water filler to the specified level. Run the engine to circulate the water through the system. Then check the water level again.

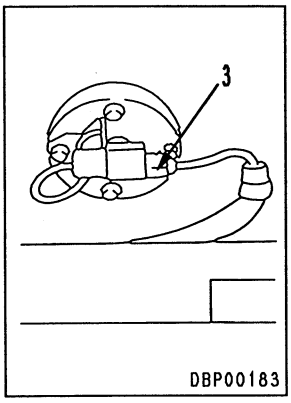
- **Refilling with oil (hydraulic tank)**
  ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

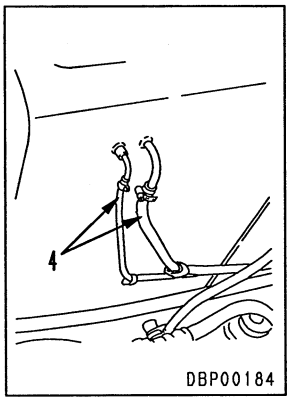
REMOVAL OF FUEL TANK ASSEMBLY

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

1. Drain fuel.
   Fuel tank :
   Approx. 240 ℓ (when tank is full)
2. Remove hydraulic tank top cover.
3. Remove handrails (1) and (2).
4. Disconnect fuel level sensor wiring connector (3).
5. Disconnect fuel return hoses (4).
6. Disconnect fuel supply hose (5).
7. Remove mounting bolts and lift off fuel tank assembly (6). ※ 1
   kg Fuel tank assembly : **100 kg**





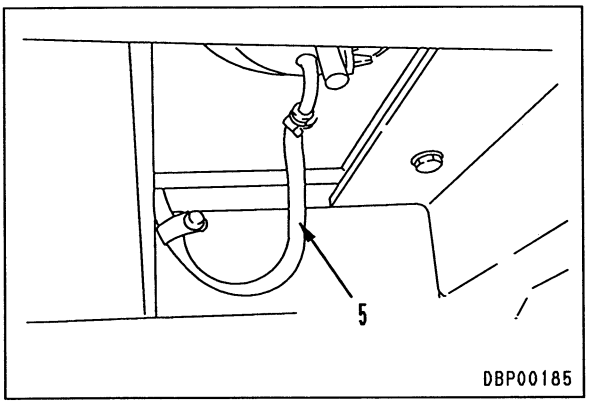


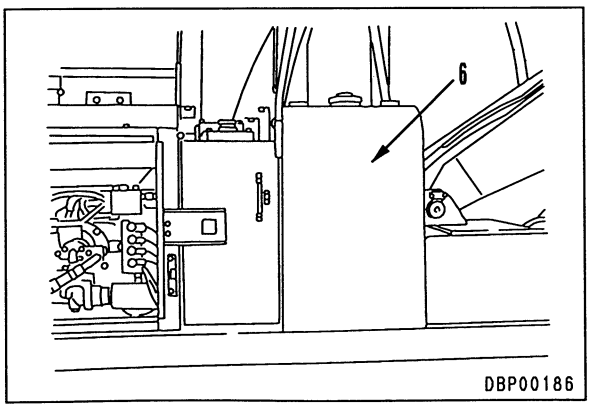
INSTALLATION OF FUEL TANK ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1
Thread of fuel tank mounting bolt :
Thread tightener (LT-2)
kgm Fuel tank mounting bolt :
277.0 ± 31.9 Nm {28.25 ± 3.25 kgm}

- **Refilling with oil (fuel tank)**
  Add fuel oil.



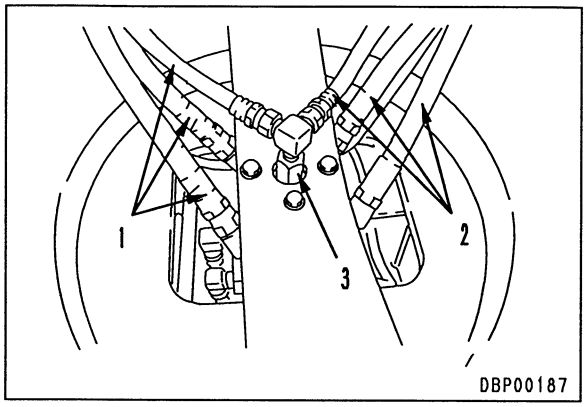


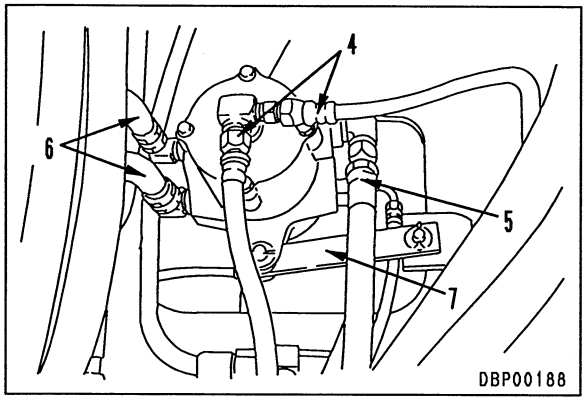
REMOVAL OF CENTER SWIVEL JOINT ASSEMBLY

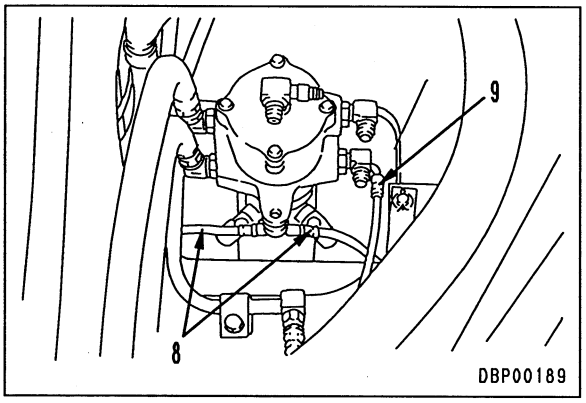
⚠ Lower the work equipment completely to the ground and stop the engine. Then loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

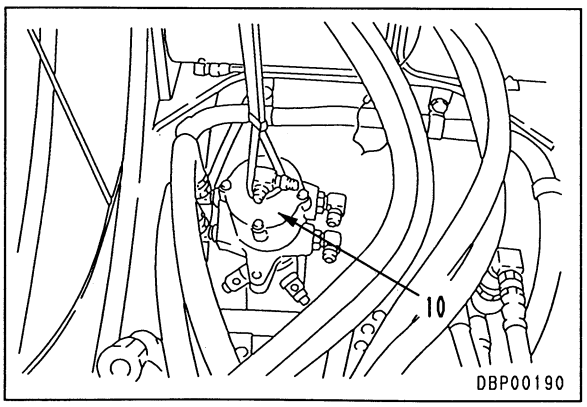
★ Mark all the piping with tags to prevent mistakes in the mounting position when installing.

1. Disconnect hoses (1) and (2) between travel motor and swivel joint.
2. Remove elbow (3).
3. Disconnect drain hoses (4).
4. Disconnect hoses (5) and (6) between control valve and swivel joint.
   ★ Disconnect hose (6) at the control valve end.
5. Disconnect plate (7).
6. Disconnect travel speed selector hoses (8) and (9).
7. Remove center swivel joint assembly (10). [※ 1]
   kg Center swivel joint : **35 kg**









INSTALLATION OF CENTER SWIVEL JOINT ASSEMBLY

- Carry out installation in the reverse order to removal.

[※ 1]

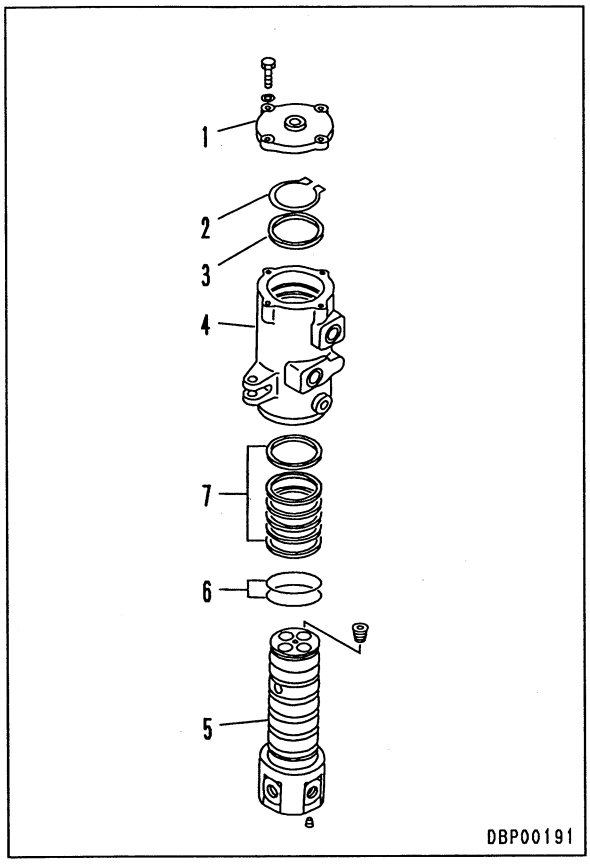
Thread of swivel joint mounting bolt : **Thread tightener (LT-2)**

kgm Swivel joint mounting bolt : **110.3 ±12.2 Nm {11.25 ± 1.25 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.
- **Bleeding air**
  ★ Bleed the air from the travel motor. For details, see TESTING AND ADJUSTING, Bleeding air.

DISASSEMBLY OF CENTER SWIVEL JOINT ASSEMBLY

1. Remove cover (1).
2. Remove snap ring (2).
3. Using tool **C**, pull out swivel rotor (4) and ring (3) from swivel shaft (5).
4. Remove O-ring (6) and slipper seal (7) from swivel rotor.



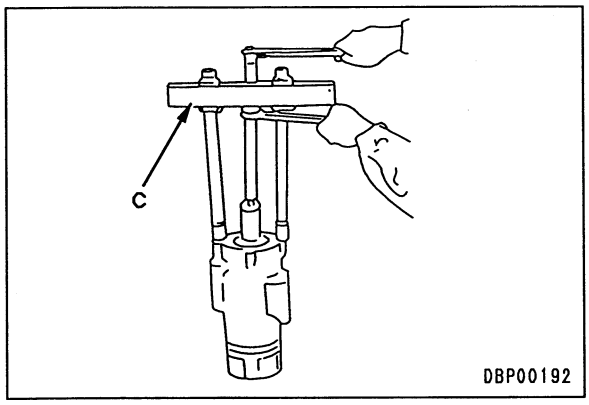
ASSEMBLY OF CENTER SWIVEL JOINT ASSEMBLY

1. Assemble slipper seal (7) and O-ring (6) to swivel rotor.
2. Set swivel shaft (5) to block, then using push tool, tap swivel rotor (4) with a plastic hammer and install.

   Contact surface of rotor, shaft:
   Grease (G2-LI)

   ★ When installing the rotor, be extremely careful not to damage the slipper seal and the O-ring.
3. Install ring (3) and secure with snap ring (2).
4. Fit O-ring and install cover (1).

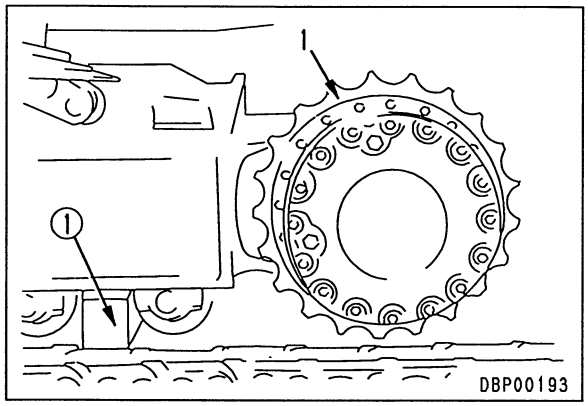
   kgm Mounting bolt :
   31.3 ± 2.9 Nm {3.2 ± 0.3 kgm}



REMOVAL OF SPROCKET

1. Remove track shoe assembly. For details, see REMOVAL OF TRACK SHOE ASSEMBLY.
2. Swing work equipment 90°, then push up chassis with work equipment and set block ① between track frame and track shoe.
3. Lift off sprocket (1). ※ 1

   kg Sprocket : **40 kg**



INSTALLATION OF SPROCKET

- Carry out installation in the reverse order to removal.

※ 1

Thread of sprocket mounting bolt :
Thread tightener (LT-2)

kgm Sprocket mounting bolt :
343.2 ± 19.6 Nm {35 ± 2 kgm}

REMOVAL OF TRAVEL MOTOR ASSEMBLY

1. Remove sprocket. For details, see REMOVAL OF SPROCKET.

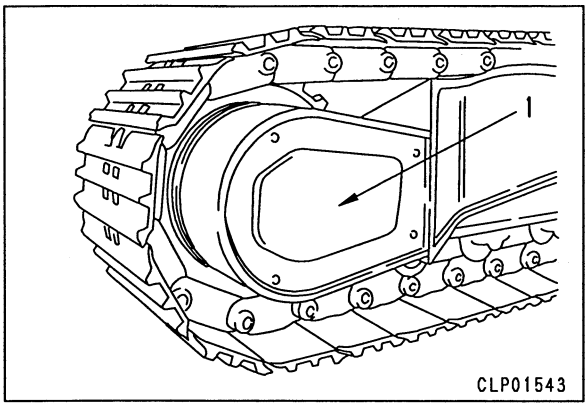
   ⚠ Lower the work equipment completely to the ground and stop the engine. Then loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

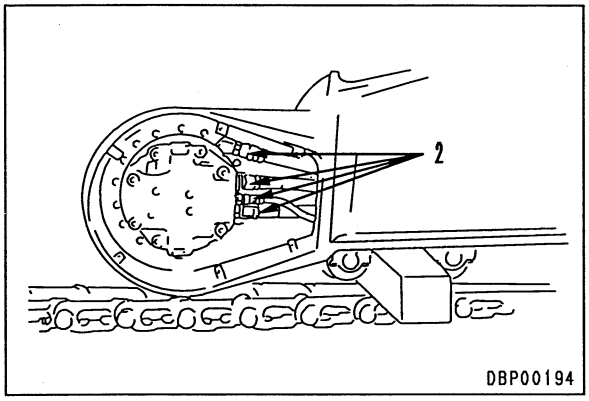
2. Remove cover (1).

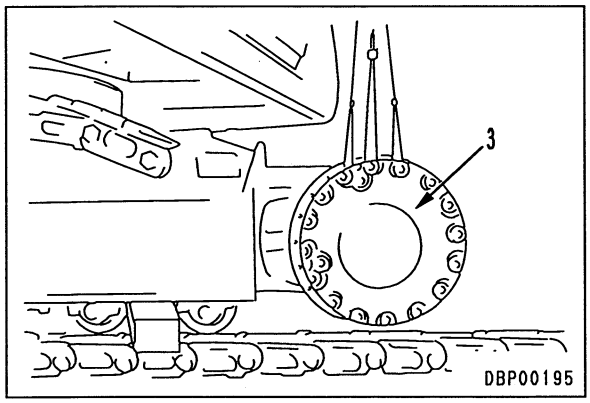
3. Disconnect 4 travel motor hoses (2), and lift off travel motor assembly (3). ※ 1

★ Be extremely careful not to damage the nipple tool surface of the hose mount.

kg Travel motor assembly : **140 kg**







INSTALLATION OF TRAVEL MOTOR ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

Thread of travel motor mounting bolt : **Thread tightener (LT-2)**

kgm Travel motor mounting bolt : **277.0 ± 31.9 Nm {28.25 ± 3.25 kgm}**

★ Bleed the air from the travel motor (hydraulic tank). For details, see TESTING AND ADJUSTING, Bleeding air, Bleeding air from travel motor.

- **Refilling with oil**

★ 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.

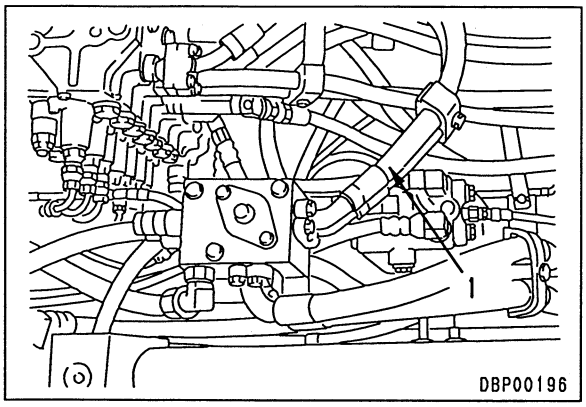
REMOVAL OF SWING MACHINERY, SWING MOTOR ASSEMBLY

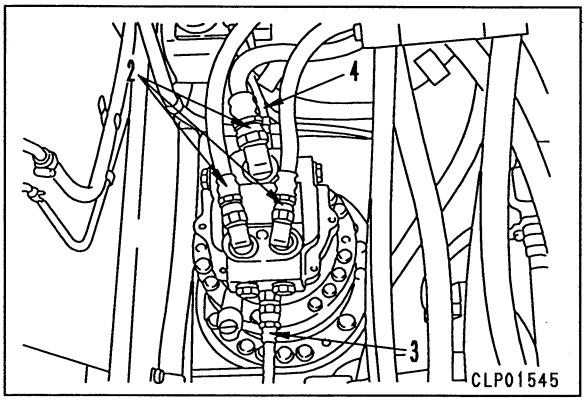
⚠ Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.

1. Disconnect hose (1). (PC130-6 demolition specification machine only)

2. Disconnect swing motor inlet and outlet hoses (2), (3), and (4).

3. Remove mounting bolts, sling swing machinery and swing motor assembly (5), then use forcing screw ① to remove. [※ 1]
   ★ When removing the swing machinery and swing motor assembly, lift off slowly and be careful not to damage the wiring or piping.
   kg Swing machinery, swing motor assembly : **100 kg**





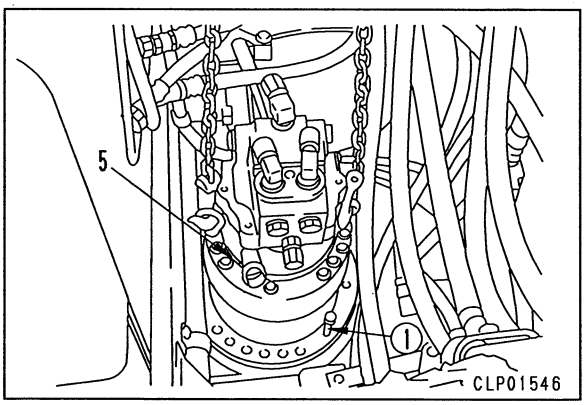
INSTALLATION OF SWING MACHINERY, SWING MOTOR ASSEMBLY

- Carry out installation in the reverse order to removal.

[※ 1]

Mating surface of swing machinery case : **Gasket sealant (LG-4 or LG-6)**

kgm Swing machinery, swing motor assembly mounting bolt : **277.0 ± 31.9 Nm {28.28 ± 3.25 kgm}**



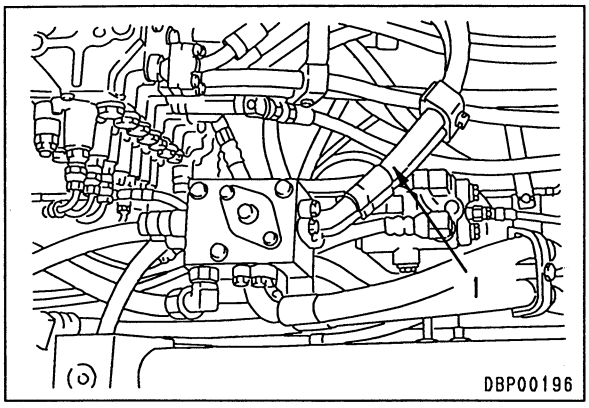
- **Refilling with oil (hydraulic tank)**
  ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

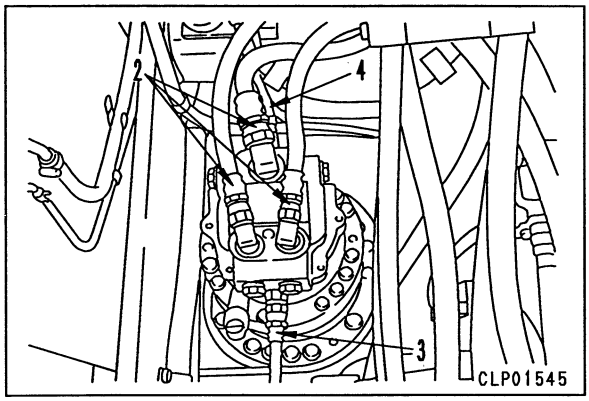
- **Bleeding air**
  ★ Bleed the air from the swing motor. For details, see TESTING AND ADJUSTING, Bleeding air.

REMOVAL OF SWING MOTOR ASSEMBLY

⚠ Lower the work equipment completely to the ground and stop the engine. Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank. Then set the safety lock lever to the LOCK position.

1. Drain oil from swing machinery case.
   Swing machinery case : **Approx. 2.5 ℓ**
2. Disconnect hose (1). (PC130-6 demolition specification machine only)
3. Disconnect swing motor inlet and outlet hoses (2), (3), and (4).
4. Sling swing motor assembly (5), then use forcing screws ① to remove. ※ 1
   kg Swing motor assembly : **30 kg**





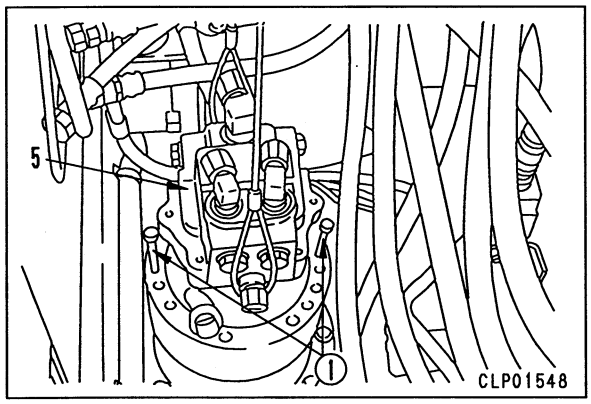
INSTALLATION OF SWING MOTOR ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm Swing motor assembly mounting bolt : **110.3 ± 12.3 Nm {11.25 ± 1.25 kgm}**

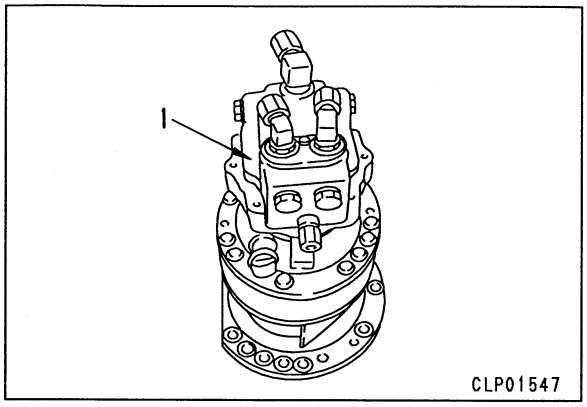
- **Refilling with oil (swing machinery case)**
  Add oil through the oil filler to the specified level.
- **Refilling with oil (hydraulic tank)**
  ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
- **Bleeding air**
  ★ Bleed the air from the swing motor. For details, see TESTING AND ADJUSTING, Bleeding air.



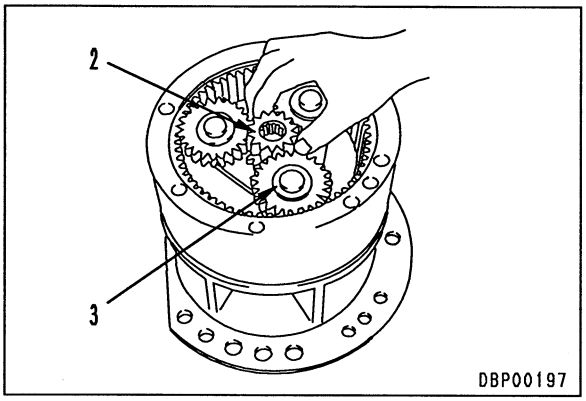
DISASSEMBLY OF SWING MACHINERY ASSEMBLY

1. **Draining oil**
   Remove drain plug and drain oil from swing machinery.
   Swing machinery case : **2.5 ℓ**

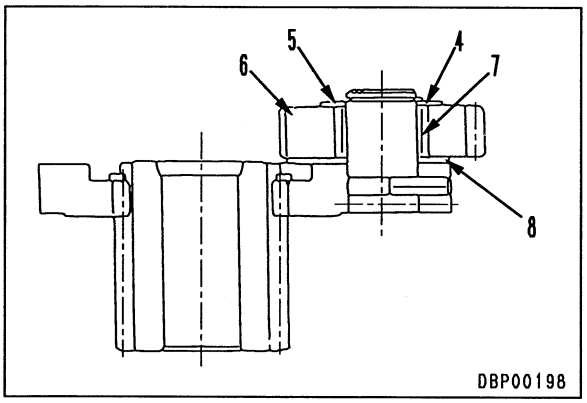
2. **Swing motor assembly**
   Remove swing motor assembly (1).



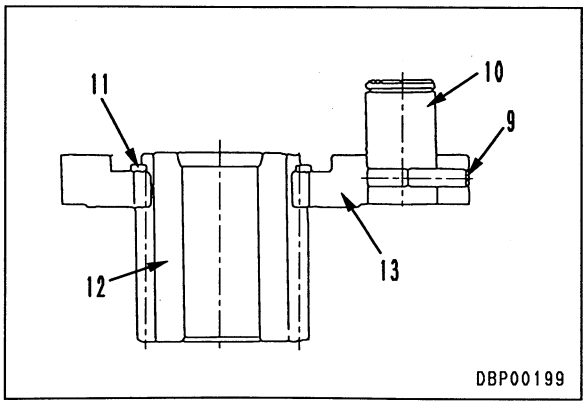
3. **No. 1 carrier, No. 2 sun gear assembly**
   1) Remove No. 1 sun gear (2).
   2) Remove No. 1 carrier and No. 2 sun gear assembly (3).



   3) Disassemble No. 1 carrier and No. 2 sun gear assembly as follows.
      i) Remove snap ring (4), then remove thrust washer (5), gear (6), bearing (7), and thrust washer (8).

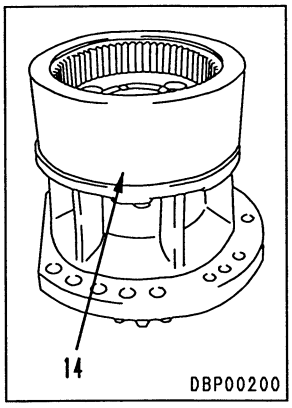


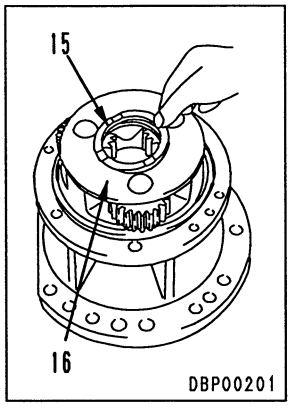
      ii) Knock in pin (9), and knock out shaft (10).
      ★ After removing the shaft, remove pin (9).
      iii) Remove snap ring (11), then remove No. 2 sun gear (12) from carrier (13).



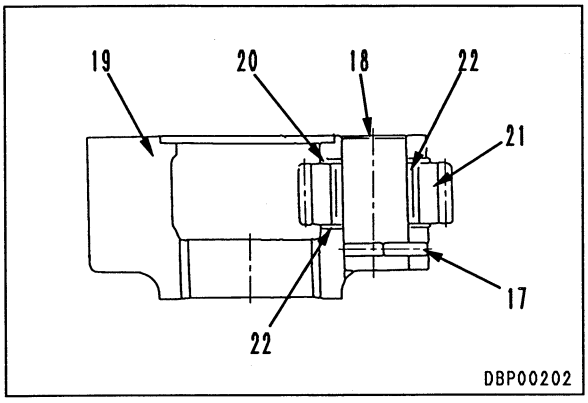
4. **Ring gear**
   Remove ring gear (14).

5. **No. 2 carrier assembly**
   1) Remove spacer (15).
   2) Remove No. 2 carrier assembly (16).

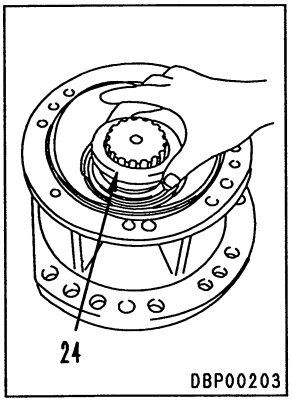


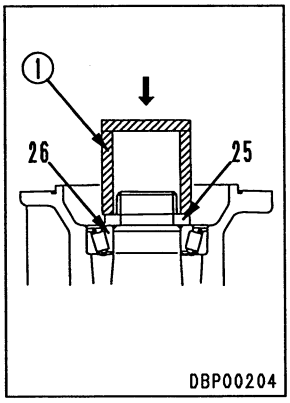


   3) Disassemble No. 2 carrier assembly as follows.
      i) Push in pin (17), and knock out shaft (18) from carrier (19).
         ★ After removing the shaft, remove pin (17).
      ii) Remove thrust washer (20), gear (21), bearing (22), and thrust washer (23).

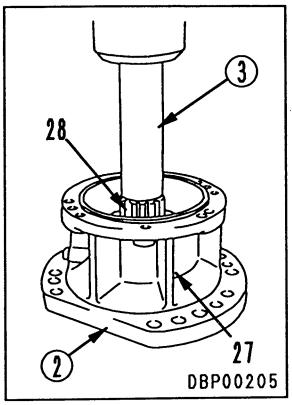


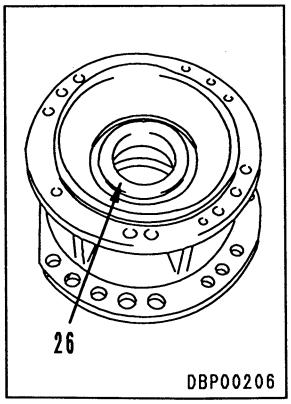
6. **Retainer, collar**
   1) Remove retainer (24).
   2) Set shaft and case assembly in press, push split collar (25) with push tool ①, and press fit bearing (26).
      ★ Operate the press slowly, and press fit the bearing to a position where it is possible to remove the split collar.
   3) Remove split collar (25).



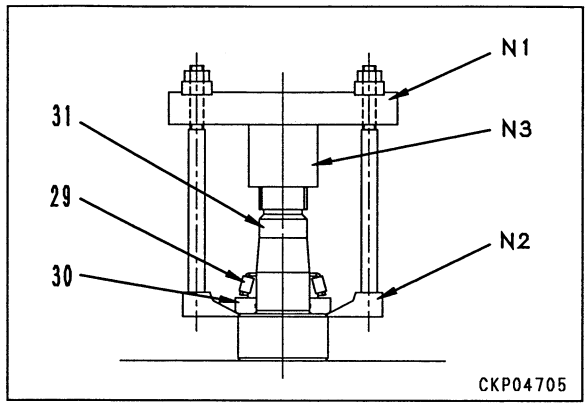


7. **Shaft assembly**
   1) Set block ② to shaft and case assembly (27), then using push tool ③, remove shaft assembly (28) with press.
   2) Remove bearing (26).



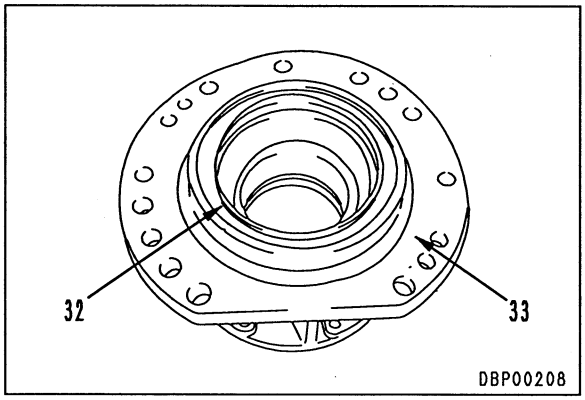


3) Set shaft assembly to press, then using tools **N1**, **N2**, and **N3**, remove bearing (29) and collar (30) from shaft (31).

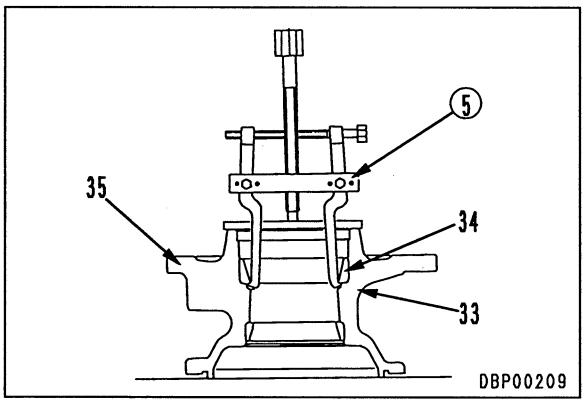


8. Oil seal, bearing outer races

1) Remove oil seal (32) from case (33).



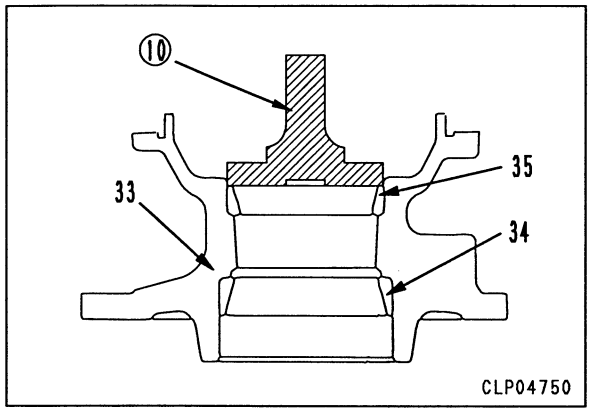
2) Using puller ⑤, remove bearing outer races (34) and (35) from case (33).



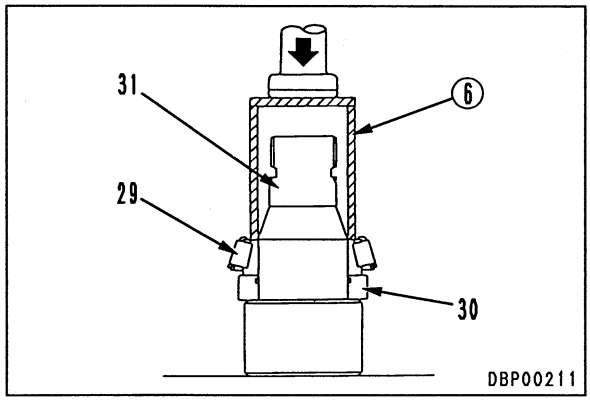
ASSEMBLY OF SWING MACHINERY ASSEMBLY

★ Clean all parts, and check for dirt or damage. Coat the sliding surfaces of all parts with engine oil before installing.

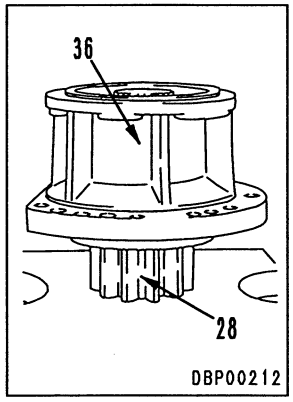
1. **Bearing outer races**
   Using push tool ⑩, press fit outer races (34) and (35) to case (33).

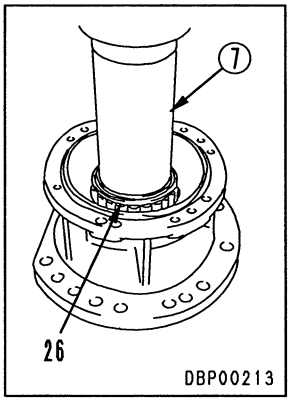


2. **Shaft assembly**
   1) Fit O-ring to inside of collar (30), and install to shaft (31).
   2) Using push tool ⑥, press fit bearing (29) with press.

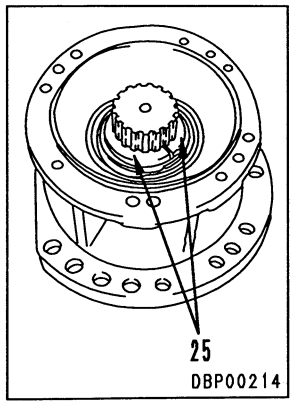


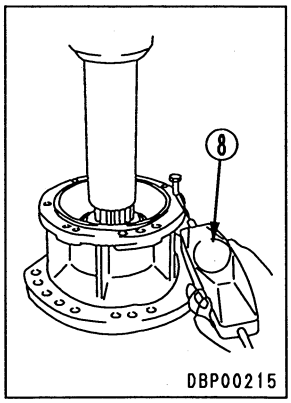
   3) Set case assembly (36) to shaft assembly (28).
   4) Using push tool ⑦, press fit bearing (26) to a position where it is possible to insert split collar.
      ★ Press-fitting force : 11.8 kN {1,200 kg}
      ★ Rotate the case and gradually press fit the bearing.





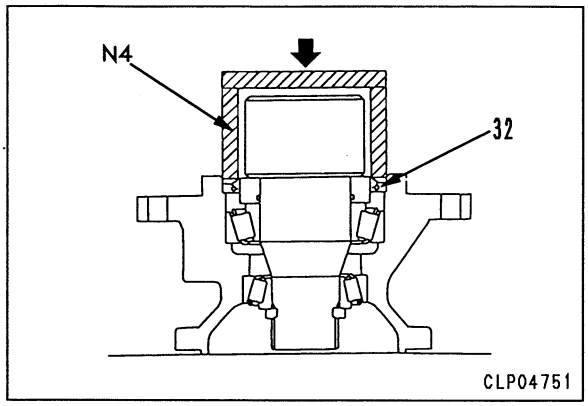
   5) Install split collar (25).
   6) Screw bolt (Thread dia.=12mm, Pitch=1.75mm) into case, then using push-pull scale ⑧, measure tangential force in direction of rotation.
      ★ Tangential force : Max. 176 N {18 kg}
      ★ The tangential force is the maximum force when starting rotation.



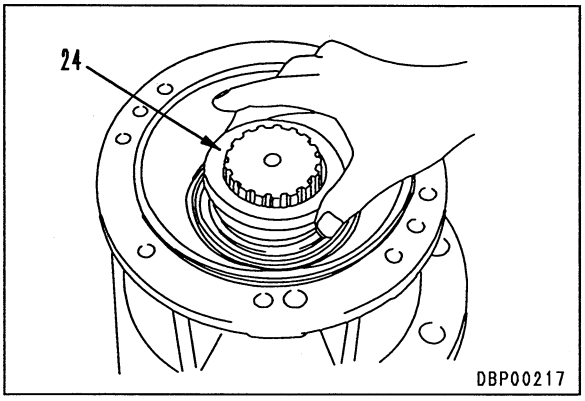


3. **Oil seal**
   Using push tool **N4**, press fit oil seal (32).
   ★ Replace the oil seal with a new part.

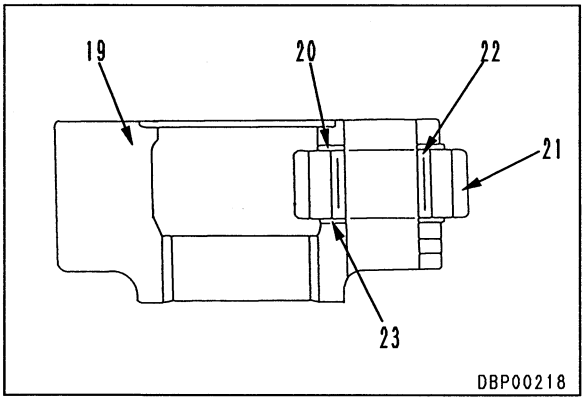
   Lip of oil seal : **Grease (G2-LI)**



4. **Retainer**
   Install retainer (24).

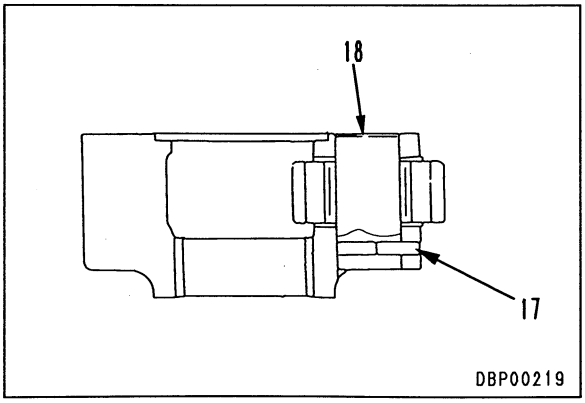


5. **No. 2 carrier assembly**
   1) Assemble No. 2 carrier assembly as follows.
      i) Assemble bearing (22) to gear (21).
      ii) Fit top and bottom thrust washers (20) and (23), then set gear assembly to carrier (19).



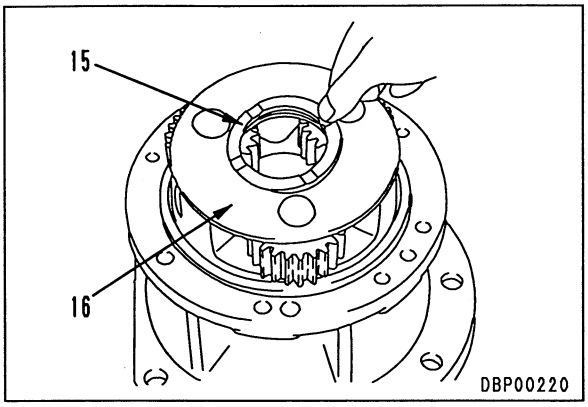
      iii) Align position of pin holes of shaft and carrier, then tap with a plastic hammer to install shaft (18).
         ★ When installing the shaft, rotate the planetary gear and be careful not to damage the thrust washer.

      iv) Insert pin (17).
         ★ After inserting the pin, caulk the pin portion of the carrier.



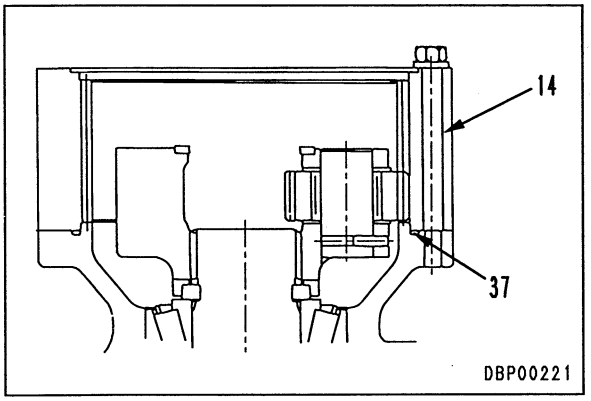
2) Install No. 2 carrier assembly (16) to shaft and case assembly.

3) Install spacer (15).



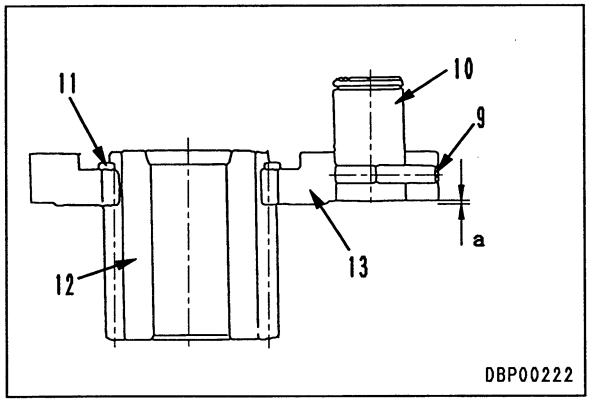
6. Ring gear

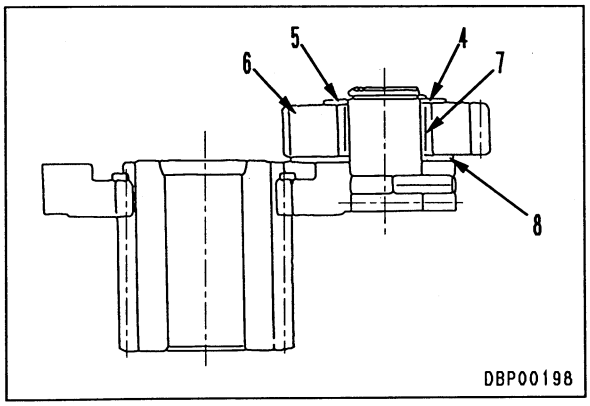
Assemble O-ring (37) to shaft and case assembly, and install ring gear (14).



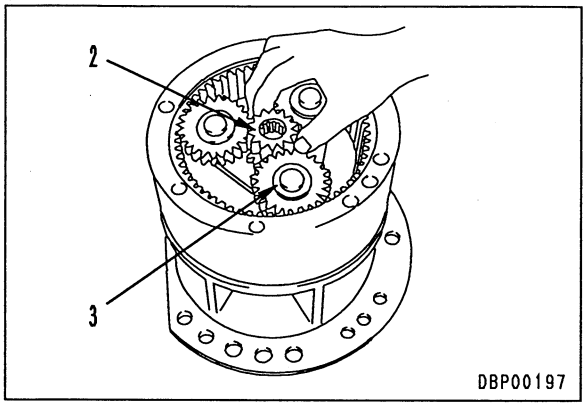
7. No. 1 carrier, No. 2 sun gear assembly

1) Assemble No. 1 carrier and No. 2 sun gear assembly as follows.
   i) Assemble No. 1 carrier (13) to No. 2 sun gear (12), and install snap ring (11).
   ii) Align with position of pin holes of shaft and carrier, then tap with a plastic hammer to install shaft (10).
   iii) Insert pin (9).
      ★ After inserting the pin, caulk the pin portion of the carrier.
      ★ Check that stepped difference **a** between the shaft and carrier is less than 0.2 mm.
   iv) Assemble thrust washer (8), bearing (7), gear (6), and thrust washer (5), and install snap ring (4).



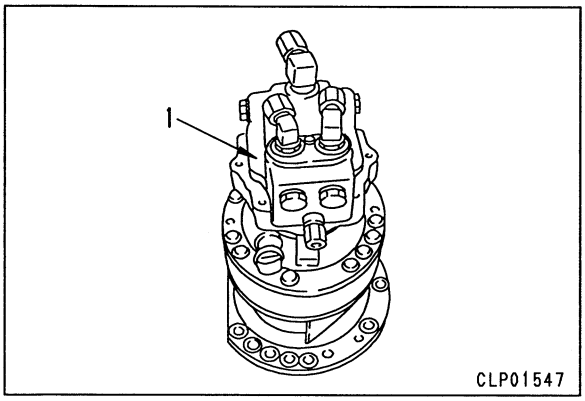


2) Install No. 1 carrier and No. 2 sun gear assembly (3).
3) Install No. 1 sun gear (2).



8. Swing motor assembly
Install swing motor assembly (1).

kgm Mounting bolt :
110.3 ± 12.3 Nm {11.25 ± 1.25 kgm}



9. Refilling with oil
Tighten drain plug and add engine oil through oil filler.

Swing machinery case : **Approx. 2.5 ℓ**

REMOVAL OF REVOLVING FRAME ASSEMBLY

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

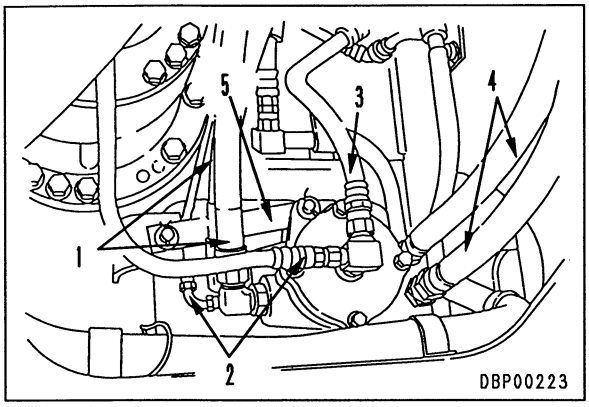
1. Remove 2 boom cylinder assemblies. For details, see REMOVAL OF BOOM CYLINDER ASSEMBLY.

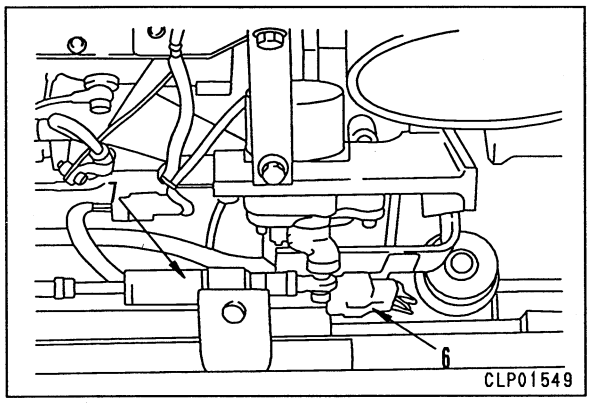
2. Remove work equipment assembly. For details, see REMOVAL OF WORK EQUIPMENT ASSEMBLY.

3. Remove counterweight assembly. For details, see REMOVAL OF COUNTERWEIGHT ASSEMBLY.

4. Disconnect hoses (1), (2), (3), and (4) mounted at top of swivel joint assembly, and remove stopper link (5).

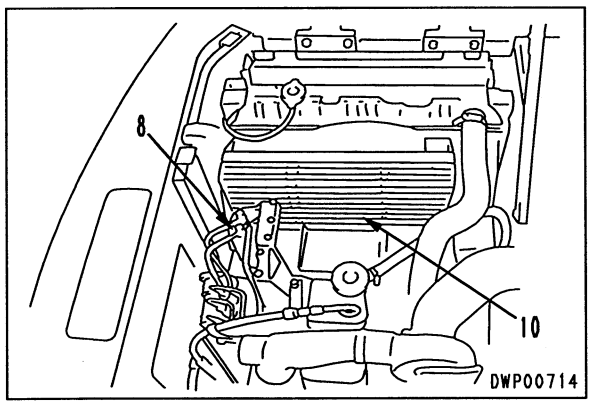
5. Remove connector (6) for engine throttle controller from holder, disconnect it, then disconnect rod (7). ※ 1
   ★ Disconnect wiring clamps also.



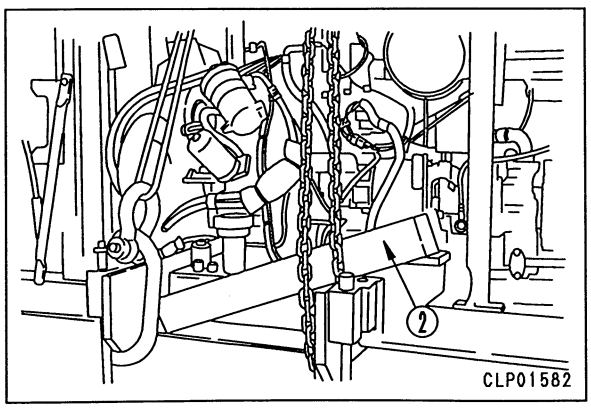


6. With fuel hose connected, remove fuel filter assembly (8) together with mounting bracket, then secure it with wire in a position where it will not hit lifting wire.

7. Remove fan guard (10).



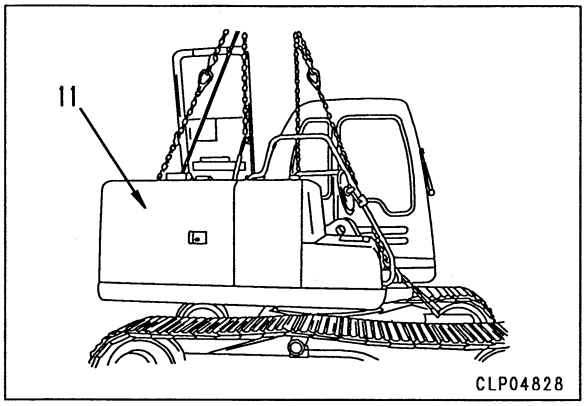
8. Raise block ②, set between wire and frame, then sling, taking care that wire does not hit engine or other parts.



9. Remove mounting bolts, then lift off revolving frame assembly (11). ※ 2
   ★ Leave 2 bolts each at the front and rear, use a lever block to adjust the balance of the revolving frame assembly to the front and rear, and left and right, then remove the remaining bolts, and lift off.

   ⚠ When removing the revolving frame assembly, be careful not to hit the center swivel joint assembly.

   kg Revolving frame assembly : **3,300 kg**



INSTALLATION OF REVOLVING FRAME ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

★ Adjust the governor motor rod. For details, see TESTING AND ADJUSTING, Adjusting governor motor rod.

※ 2

Mating surface of swing circle :
Gasket sealant (LG-1)

Thread of revolving frame mounting bolt :
Thread tightener (LT-2)

kgm Revolving frame mounting bolt :
277.5 ± 32.4 Nm {28.3 ± 3.3 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.

- **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.

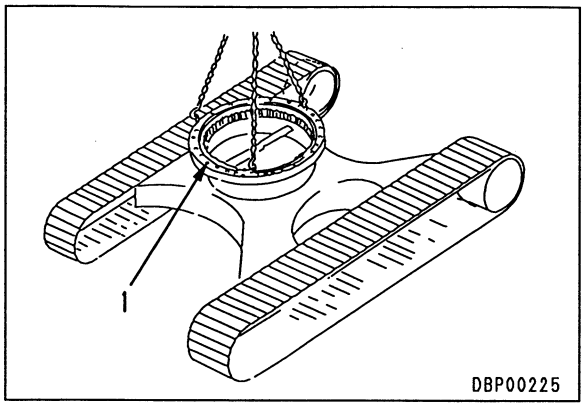
- **Bleeding air**
  ★ Bleed the air. For details, see TESTING AND ADJUSTING, Bleeding air.

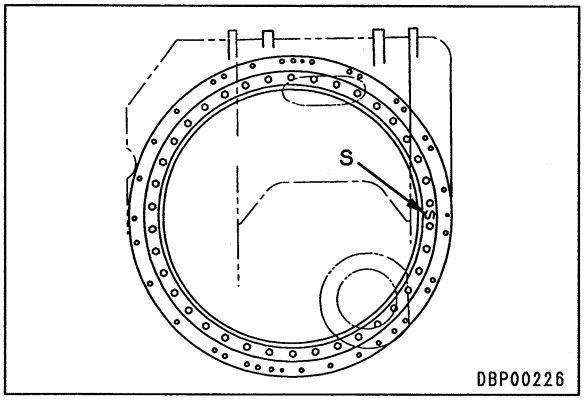
REMOVAL OF SWING CIRCLE ASSEMBLY

⚠ Lower the work equipment completely to the ground and stop the engine. Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank. Then set the safety lock lever to the LOCK position.

1. Remove revolving frame assembly. For details, see REMOVAL OF REVOLVING FRAME ASSEMBLY.
2. Sling swing circle assembly (1) and remove 38 mounting bolts. ※ 1
3. Remove swing circle assembly (1). ※ 2

   kg Swing circle assembly : **168 kg**





INSTALLATION OF SWING CIRCLE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

Thread of swing circle mounting bolt :
Thread tightener (LT-2)

kgm Swing circle mounting bolt :
277.5 ± 32.4 Nm {28.3 ± 3.3 kgm}

※ 2

★ Raise swing circle assembly (1), set the soft zone **S** mark on the inside ring of the inner race facing 90° to the left side, then install to the track frame.

Amount of circle grease : **6.5 ℓ**
Grease (G2-LI)

REMOVAL OF IDLER, RECOIL SPRING ASSEMBLY

1. Remove track shoe assembly. For details, see REMOVAL OF TRACK SHOE ASSEMBLY.

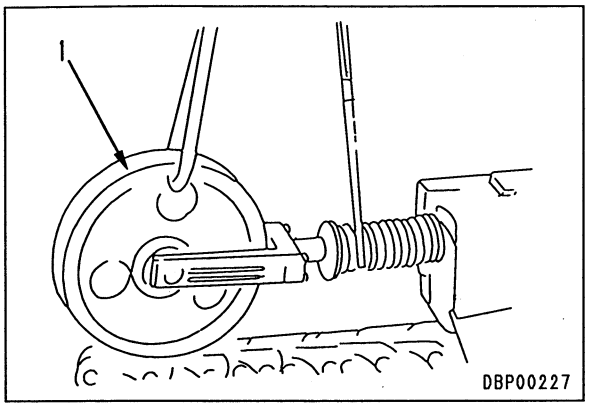
2. Sling idler and recoil spring assembly (1), and pull out to the front to remove.

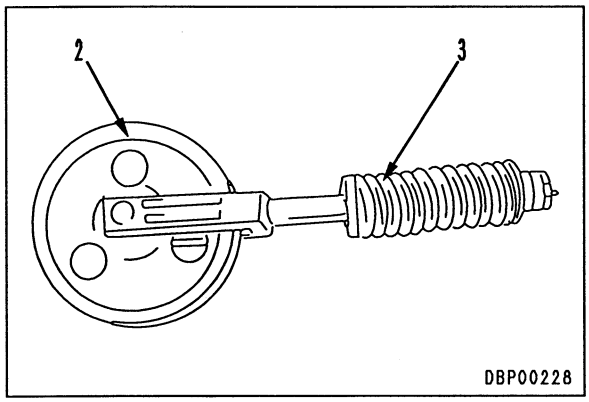
   kg Idler, recoil spring assembly : **155 kg**

3. Disconnect recoil spring assembly (3) from idler assembly (2). ※ 1

   kg Idler assembly : **80 kg**

   kg Recoil spring assembly : **75 kg**





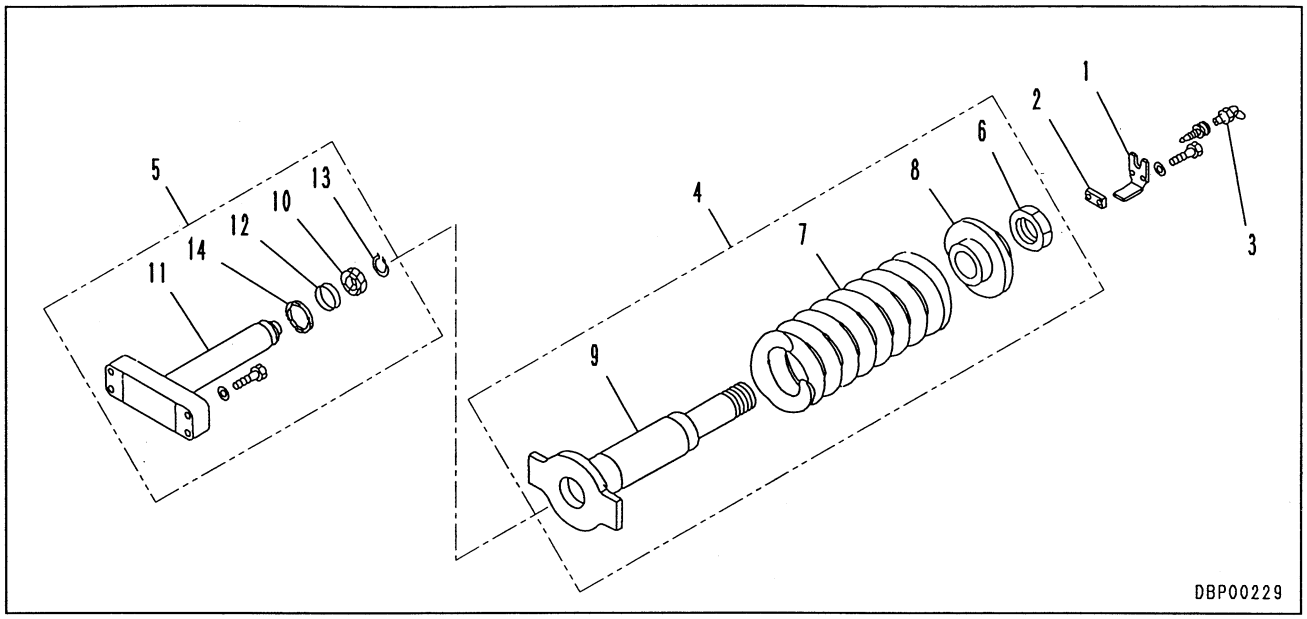
INSTALLATION OF IDLER, RECOIL SPRING ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

Thread of recoil spring assembly mounting bolt : **Thread tightener (LT-2)**

DISASSEMBLY OF RECOIL SPRING ASSEMBLY



1. Remove lock plate (1), then remove seat (2) and valve (3).

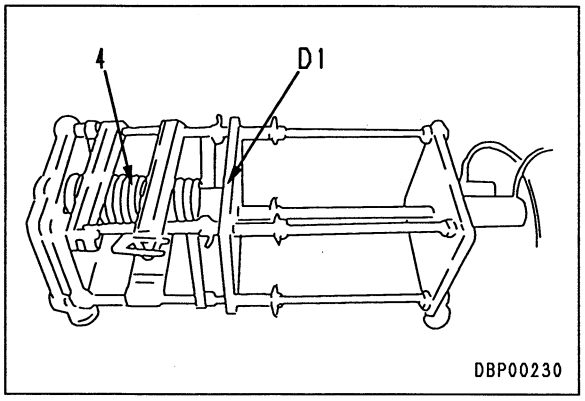
2. Remove yoke piston assembly (5) from recoil spring assembly (4).

3. **Disassembly of recoil spring assembly**
   1) Set recoil spring assembly (4) to tool **D1**.

   ⚠ The recoil spring is under large installed load, so be sure to set the tool properly. Failure to do this is dangerous.
   ★ Installed load of spring : 78 kN {8,000 kg}

   2) Apply hydraulic pressure slowly to compress spring, then remove nut (6).
      ★ Compress the spring to a point where the nut becomes loose.
      ★ Release the hydraulic pressure slowly to release the tension of the spring.
      ★ Remove pilot (8), cylinder (9), and dust seal (10) from spring (7).

4. **Disassembly of yoke piston assembly**
   1) Remove wear ring (12) from yoke piston (11).
   2) Remove snap ring (13), then remove U-packing (14).



ASSEMBLY OF RECOIL SPRING ASSEMBLY

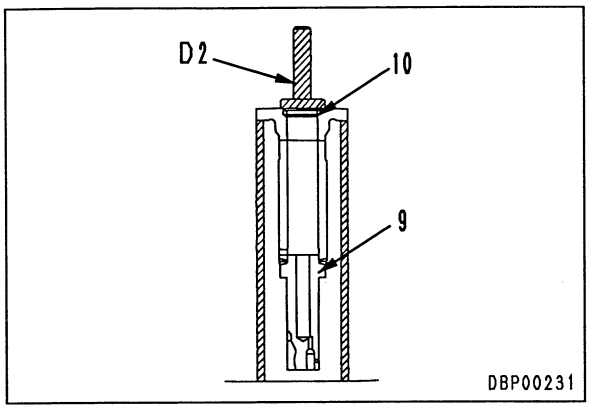
1. **Assembly of yoke piston assembly**
   1) Assemble U-packing (14) to piston (11), and secure with snap ring (13).
   2) Assemble wear ring (12).

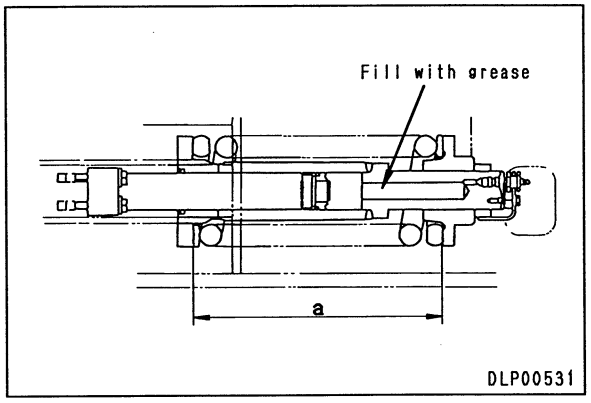
2. **Assembly of recoil spring assembly**
   1) Using tool **D2**, install dust seal (10) to cylinder (9).
   2) Assemble cylinder (9) and pilot (8) to spring (7), and set in tool **D1**.
   3) Apply hydraulic pressure slowly to compress spring, and tighten nut (6) so that installed length of spring is dimension "**a**".
      ★ Installed length "**a**" of spring : **390 mm**
   4) Remove recoil spring assembly (4) from tool **D1**.

3. Fill inside of cylinder with at least 120 cc of grease.
   Inside of cylinder : **Grease (G2-LI)**

4. Assemble yoke piston assembly (5) to recoil spring assembly (4).
   Sliding portion of yoke piston, wear ring : **Grease (G2-LI)**

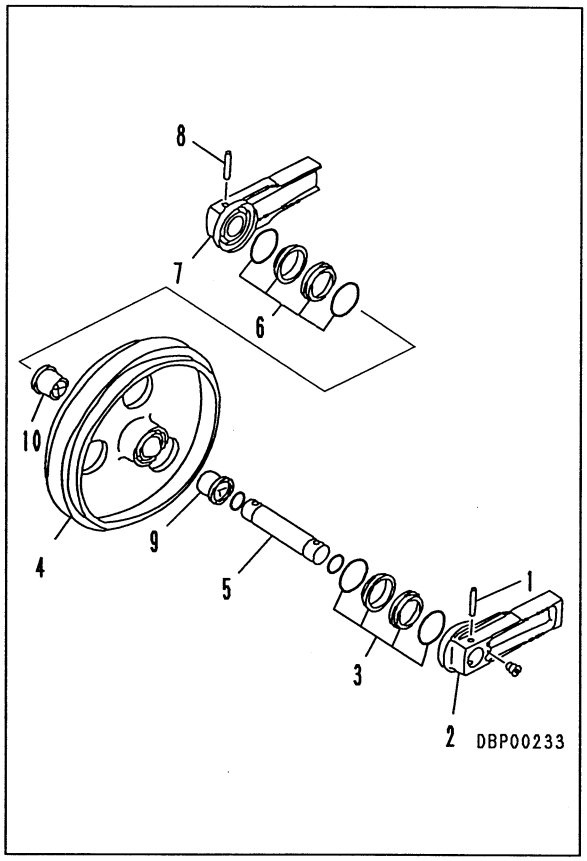
5. Fit valve (3) and seat (2), and secure with lock plate (1).
   ★ Install the valve so that the grease fitting faces the outside.



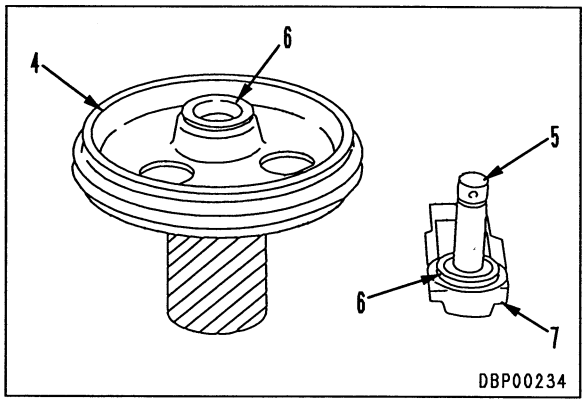


DISASSEMBLY OF IDLER ASSEMBLY

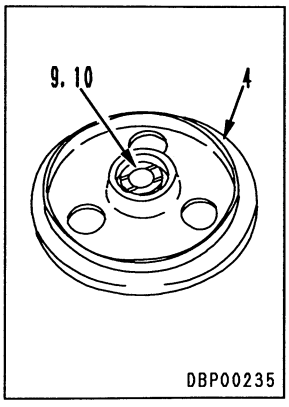
1. Remove dowel pin (1), then remove support (2).
2. Remove floating seal (3) from support (2) and idler (4).
3. Pull out idler (4) from shaft (5) and support (7) assembly.
   ★ It is filled with 90 cc. of oil, so drain the oil at this point or lay a cloth to prevent the area from becoming dirty.

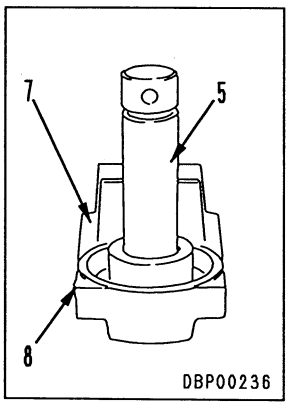


4. Remove floating seal (6) on opposite side from idler (4) and shaft (5) and support (7) assembly.



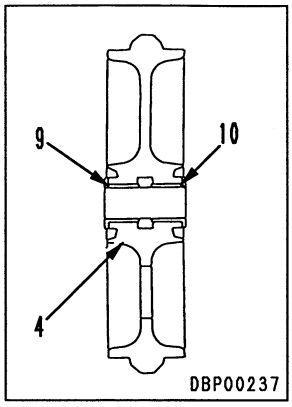
5. Remove dowel pin (8), then remove support (7) from shaft (5).
6. Remove bushings (9) and (10) from idler (4).

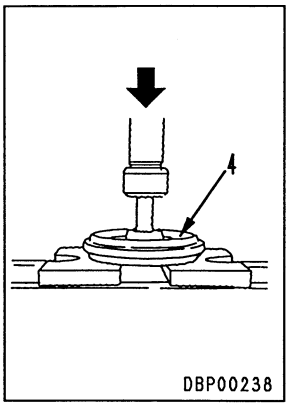




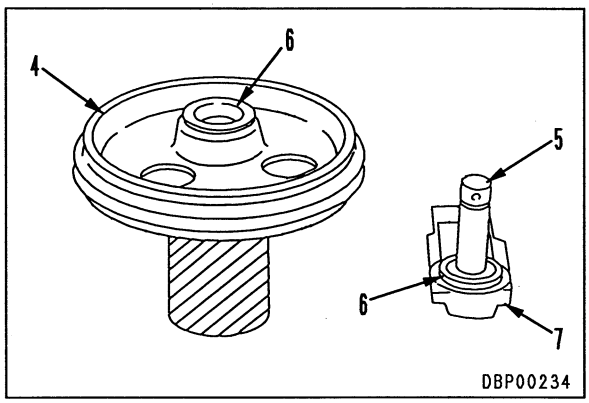
ASSEMBLY OF IDLER ASSEMBLY

1. Press fit bushings (9) and (10) to idler (4).

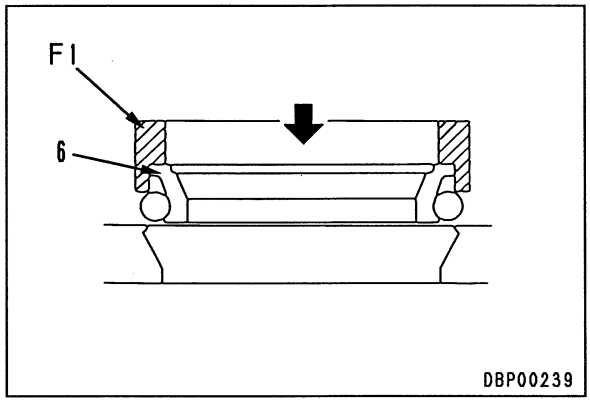




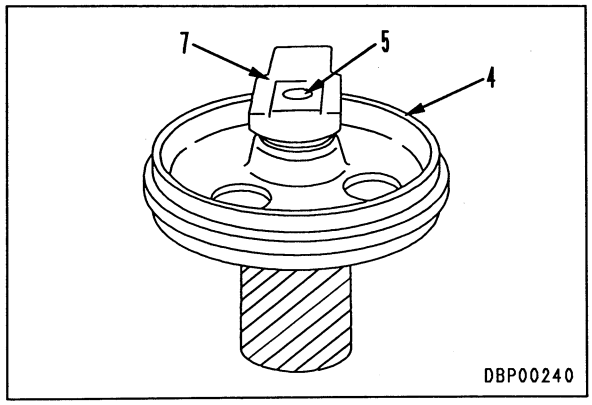
2. Fit O-ring and install support (7) to shaft (5) with dowel pin (8).



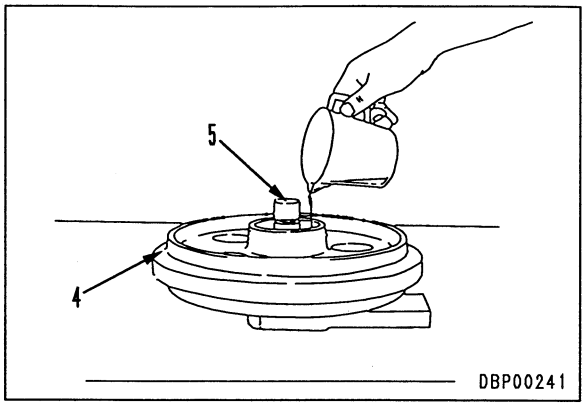
3. Using tool **F1**, install floating seal (6) to idler (4) and shaft (5) and support (7) assembly.
   - ★ Coat the sliding surface of the floating seal with oil, and be careful not to let any dirt or dust get stuck to it.
   - ★ Remove all grease and oil from the contact surface of the O-ring and the floating seal.



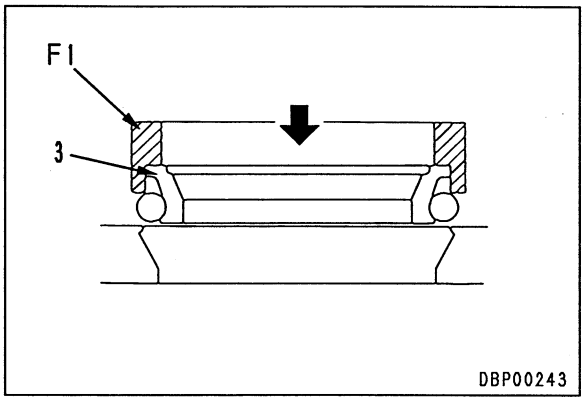
4. Assemble shaft (5) and support (7) assembly to idler (4).

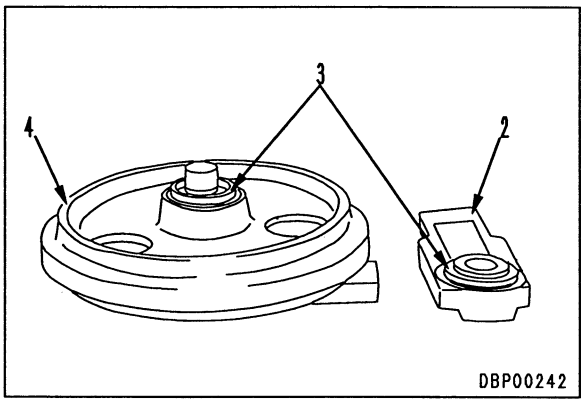


5. Add oil between shaft (5) and idler (4).
   Oil : **90 cc (EO30-R)**

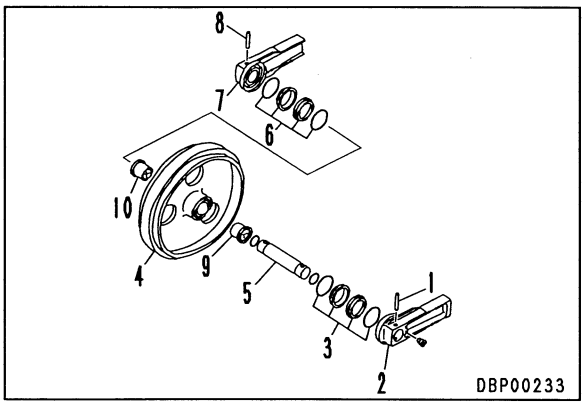


6. Using tool **F1**, install floating seal (3) to idler (4) and support (2).
   ★ Coat the sliding surface of the floating seal with oil, and be careful not to let any dirt or dust get stuck to it.
   ★ Remove all grease and oil from the contact surface of the O-ring and the floating seal.





7. Install O-ring, then install support (2) with dowel pin (1).

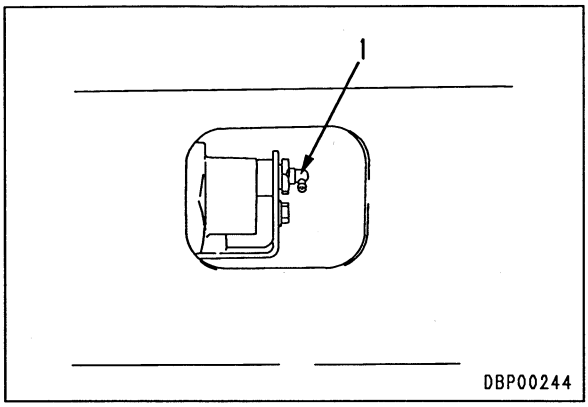


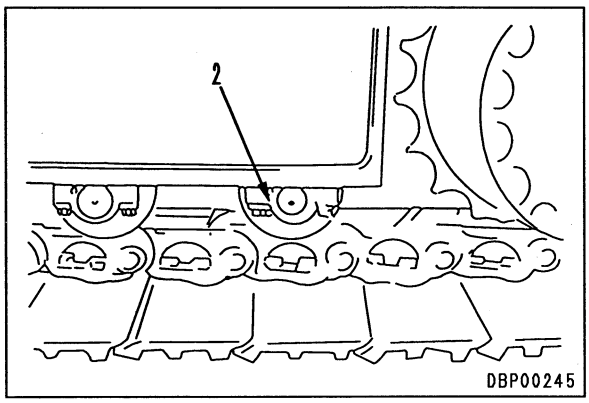
REMOVAL OF TRACK ROLLER ASSEMBLY

1. Lower work equipment, then loosen lubricator (1), and relieve track tension. [※ 1]

   ⚠ The adjustment cylinder is under extremely high pressure. Never loosen the lubricator more than one turn. If the grease does not come out easily, move the machine backwards and forwards.

2. Remove mounting bolts of track roller, then swing work equipment 90°, jack up machine, and remove track roller assembly (2) towards outside of machine. [※ 2]





INSTALLATION OF TRACK ROLLER ASSEMBLY

- Carry out installation in the reverse order to removal.

[※ 1]

★ Adjust the track tension. For details, see TESTING AND ADJUSTING, Testing and adjusting track tension.

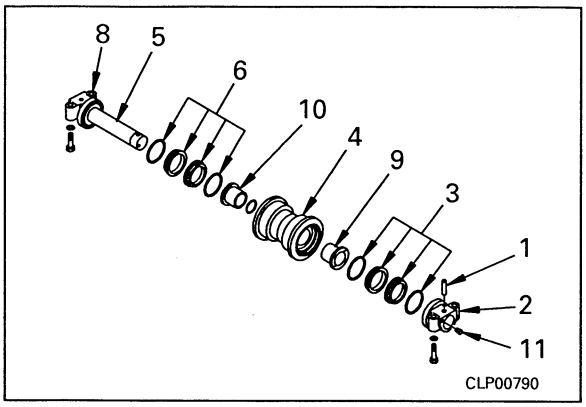
[※ 2]

Thread of track roller assembly mounting bolt : **Thread tightener (LT-2)**

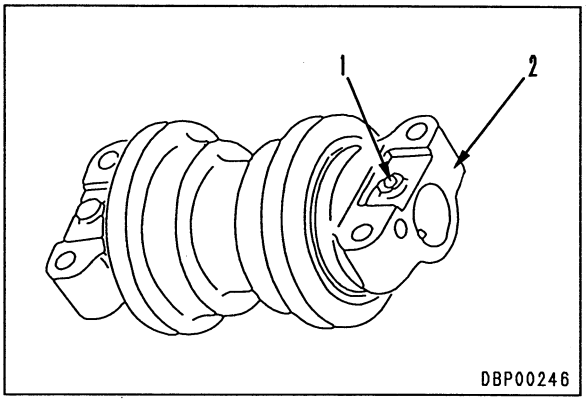
★ Place the plug on the outside of the chassis, and set the track roller assembly in the mounting position.
★ Operate the work equipment levers to lower the machine slowly and tighten the mounting bolts temporarily.
★ Operate the work equipment levers to lower the machine completely to the ground, then tighten the mounting bolts fully.

DISASSEMBLY OF TRACK ROLLER ASSEMBLY

1. Remove pin (1), then remove collar (2).

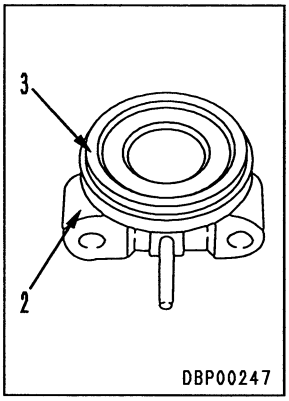


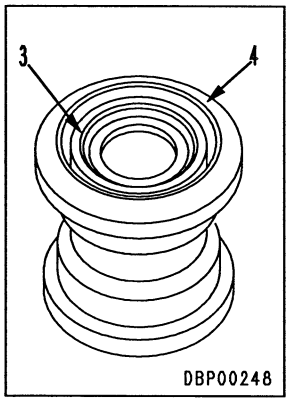
2. Remove floating seal (3) from collar (2) and roller (4).

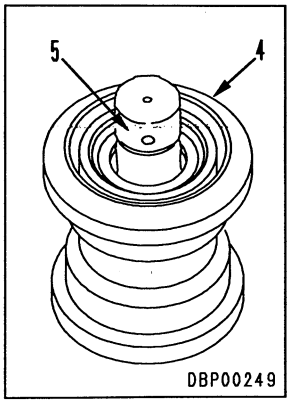


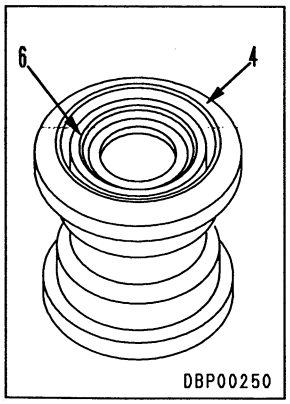
3. Pull out roller (4) from shaft (5).
   ★ It is filled with 100 – 115 cc. of oil, so drain the oil at this point or lay a cloth to prevent the area from becoming dirty.

4. Remove floating seal (6) on opposite side from roller (4) and shaft (5).

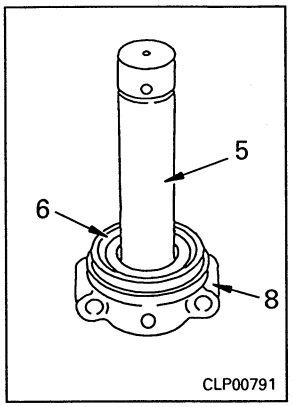


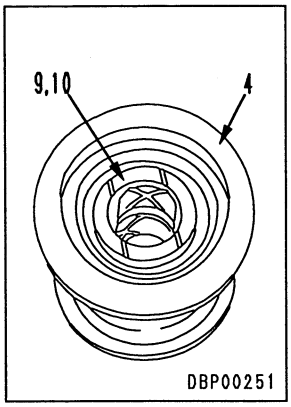






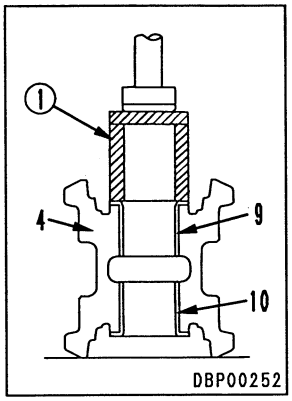
5. Remove collar (8) from shaft (5).
6. Remove bushings (9) and (10) from roller (4).

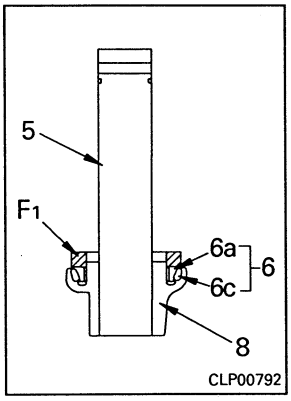


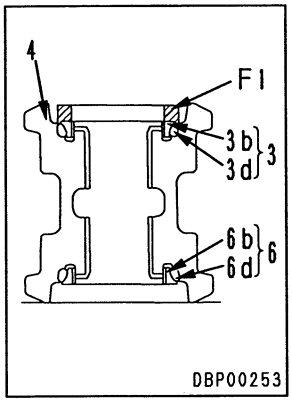


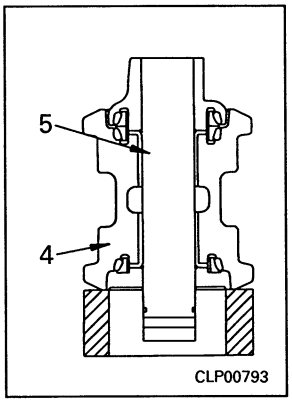
ASSEMBLY OF TRACK ROLLER ASSEMBLY

1. Using push tool ①, press fit bushings (9) and (10) to roller (4).
2. Assemble collar (8) to shaft (5).
3. Using tool **F1**, install floating seal (6) to shaft (5).
   ★ When assembling the floating seal, clean the contact surface of O-ring (6c) and floating seal (6a), remove all grease and oil, and dry it. Make sure that no dirt or dust sticks to the contact surface of the floating seal.
4. Using tool **F1**, install floating seals (6) and (3) to roller (4).
   ★ For details of the precautions when installing floating seals (6b) and (6d), and (3b) and (3d), see the precautions marked ★ for Step 3.
5. Assemble shaft (5) to roller (4).

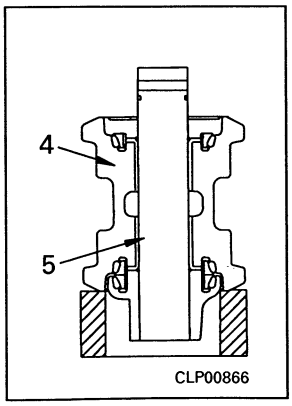


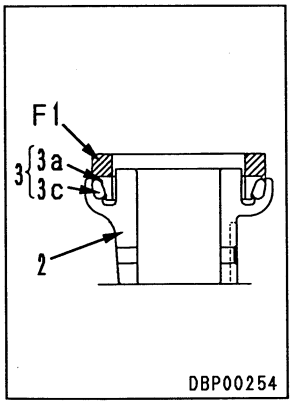




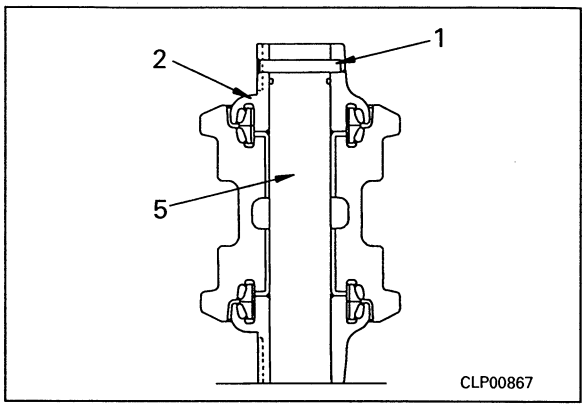


6. Turn over roller (4) and shaft (5) assembly.
7. Using tool **F1**, install floating seal (3) to collar (2).
   ★ For details of the precautions when installing floating seals (3a) and (3c), see the precautions marked ★ for Step 3.



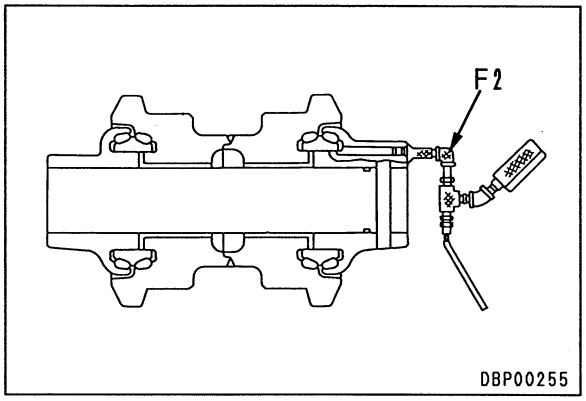


8. Assemble collar (2) to shaft (5), and install pin (1).



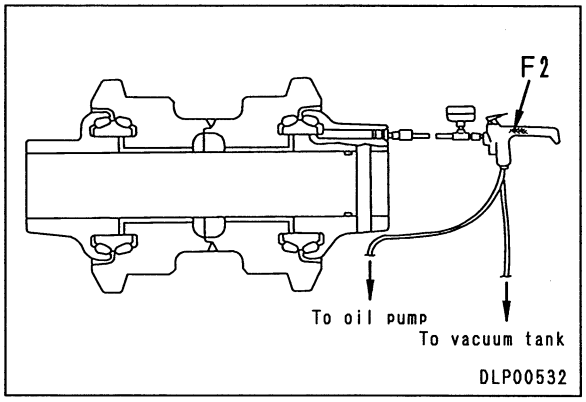
9. Using tool **F2**, apply basic pressure to roller oil filler port, and check for leakage of air from seal.
   ★ Basic pressure : 0.1 MPa {1 kg/cm²}

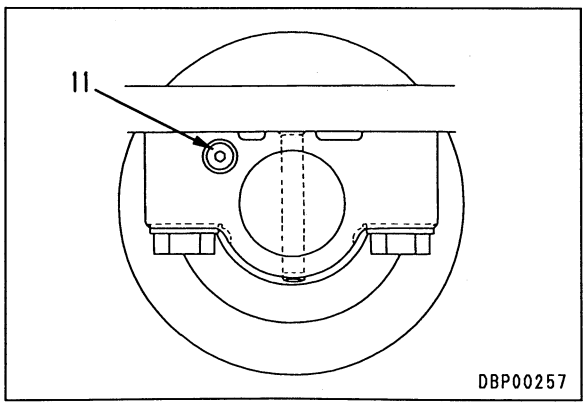
   ★ Method of checking
   The basic pressure shall be maintained for 10 seconds and the indicator of the gauge shall not go down.



10. Using tool **F2**, fill track roller assembly with oil, then tighten plug (11).

    Track roller oil : **100 – 115 cc (EO30-CD)**



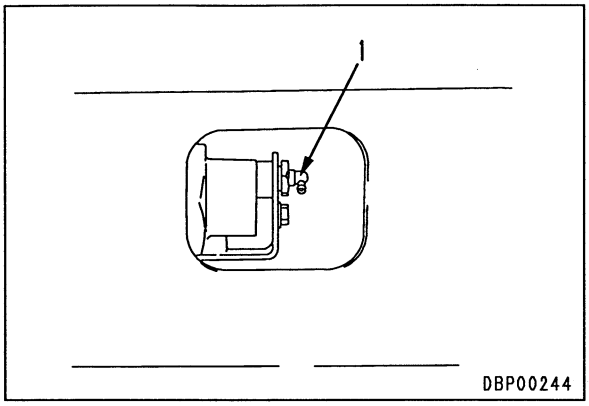


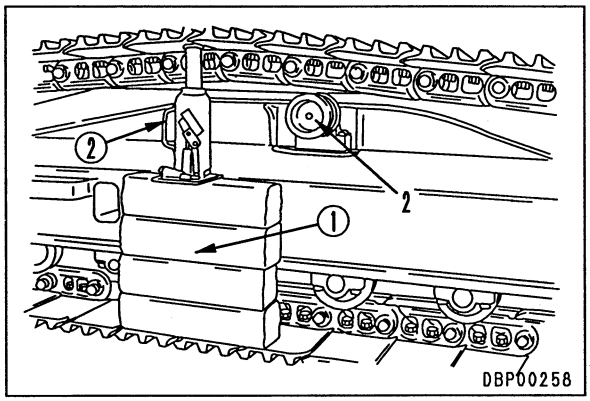
REMOVAL OF CARRIER ROLLER ASSEMBLY

1. Lower work equipment, then loosen lubricator (1), and relieve track tension. [※ 1]

   ⚠ The adjustment cylinder is under extremely high pressure. Never loosen the lubricator more than one turn. If the grease does not come out, move the machine backwards and forwards.

2. Using block ① and hydraulic jack ②, push up track to a position where carrier roller assembly can be removed, then remove carrier roller assembly (2). [※ 2]





INSTALLATION OF CARRIER ROLLER ASSEMBLY

- Carry out installation in the reverse order to removal.

[※ 1]

★ Adjust the track tension. For details, see TESTING AND ADJUSTING, Testing and adjusting track tension.

[※ 2]

Thread of carrier roller assembly mounting bolt : **Thread tightener (LT-2)**

REMOVAL OF TRACK SHOE ASSEMBLY

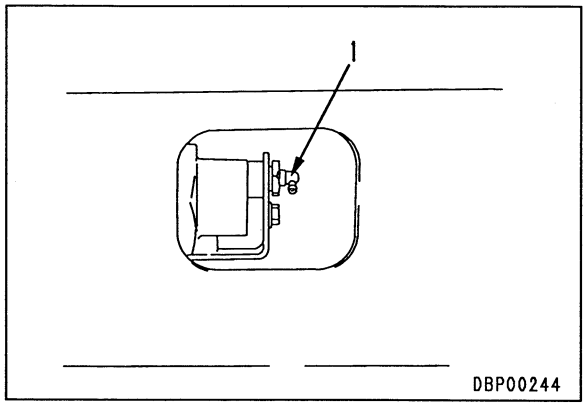
1. Lower work equipment, then loosen lubricator (1), and relieve track tension. [※ 1]

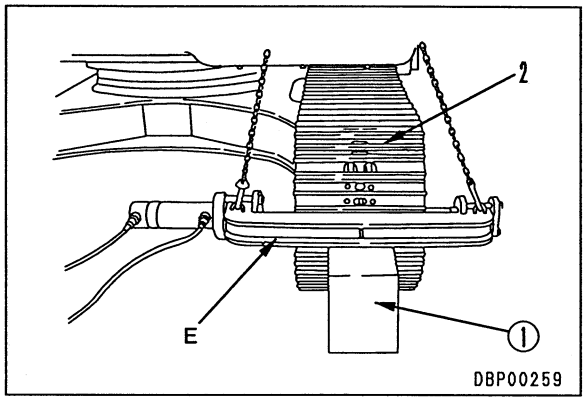
   ⚠ The adjustment cylinder is under extremely high pressure. Never loosen the lubricator more than one turn. If the grease does not come out, move the machine backwards and forwards.

2. Move machine forward so that position of master pin is at front of idler, and set block ① in position.

3. Using tool **E**, pull out master pin. [※ 2]

4. Remove tool **E**, pull out temporary pin, and remove dust seal, then drive machine in reverse to lay out track (2). [※ 3]





INSTALLATION OF TRACK SHOE ASSEMBLY

[※ 1]

★ Adjust the track tension. For details, see TESTING AND ADJUSTING, Testing and adjusting track tension.

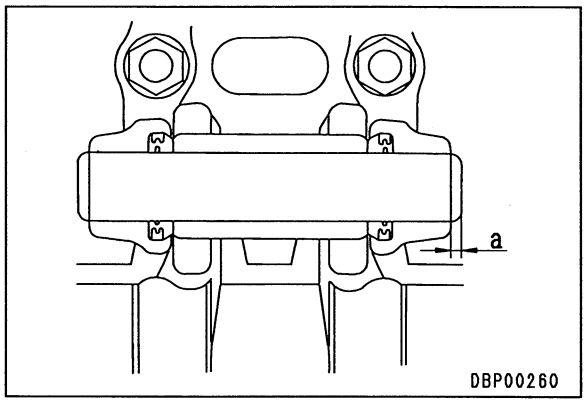
[※ 2]

★ Use tool **E** and press fit the master pin so that the protrusion of the master pin is dimension **"a"**.
Protrusion **"a"** of master pin : **5.5 ± 2 mm**

[※ 3]

★ When assembling the dust seal, coat the bushing contact surface with grease (G2-LI).

★ If the rubber of the road liner (rubber pad type) becomes worn or broken and the head of the mounting bolt becomes damaged, replace the shoe with a new part immediately. If the head of the mounting bolt becomes flattened, it will be impossible to remove it.

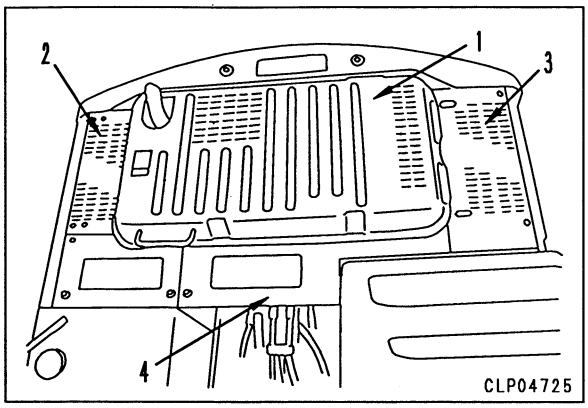


REMOVAL OF HYDRAULIC TANK ASSEMBLY

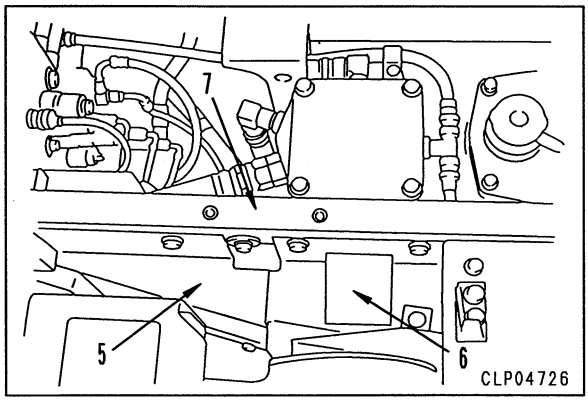
1. Drain oil from hydraulic tank.

   Hydraulic tank : **Approx. 100 ℓ**

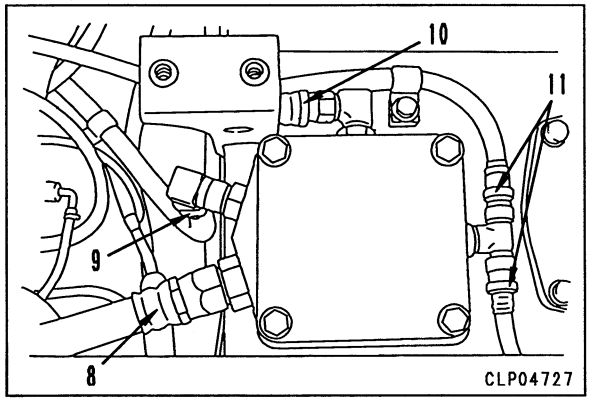
2. Open engine hood (1), and remove covers (2), (3), and (4).



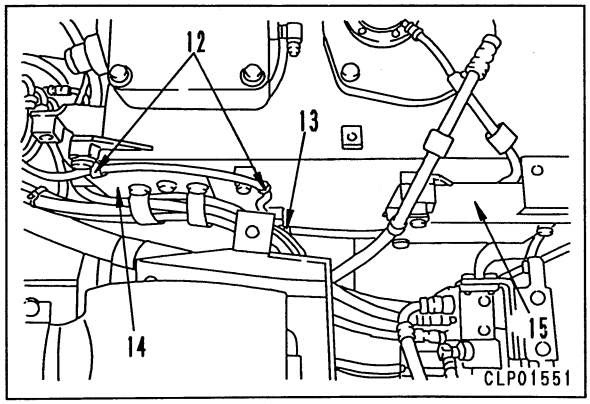
3. Remove engine room divider cover (5), then remove fire prevention cover (6).
4. Remove frame (7).



5. Disconnect hydraulic filter inlet hoses (8), (9), (10), and (11).



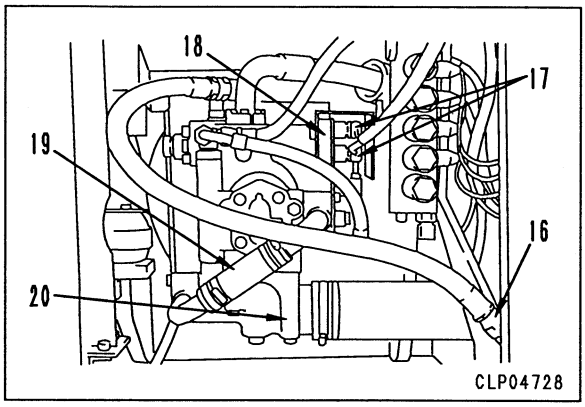
6. Remove pressure sensor wiring clamps (12).
7. Remove solenoid valve wiring clamp (13).
8. Remove PPC hose bracket (14).
9. Remove wiring connector bracket (15).



10. Disconnect hydraulic tank inlet hose (16).

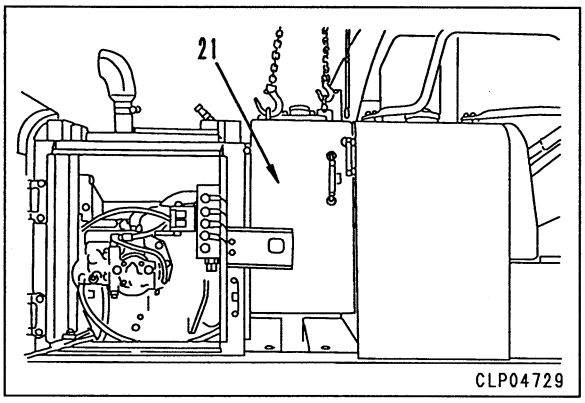
11. Disconnect wiring connectors (17), remove bracket (18) tightened together with tube, then remove control pump inlet tube (19).

12. Remove main pump suction tube (20).



13. Remove mounting bolts, and lift off hydraulic tank assembly (21). ※ 1

kg Hydraulic tank assembly : **120 kg**



INSTALLATION OF HYDRAULIC TANK ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

Thread of hydraulic tank mounting bolt : **Thread tightener (LT-2)**

kgm Hydraulic tank mounting bolt : **277.0 ± 31.9 Nm {28.25 ± 3.25 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.

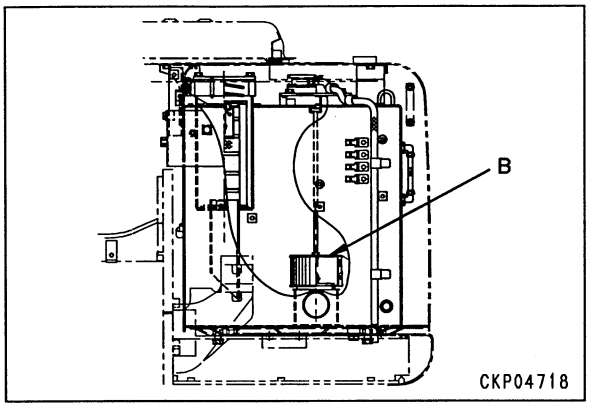
- **Bleeding air**
  ★ Bleed the air. For details, see TESTING AND ADJUSTING, Bleeding air.

REMOVAL OF CONTROL PUMP ASSEMBLY

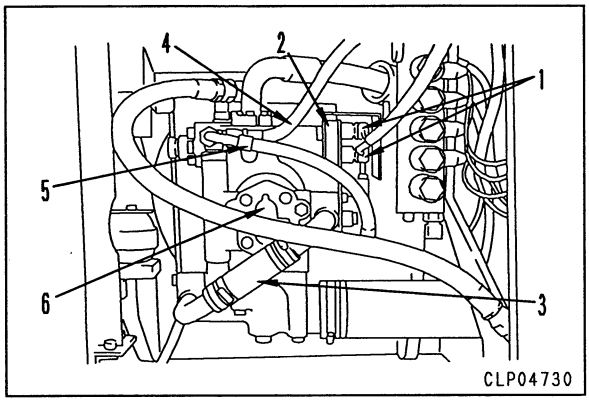
⚠ Lower the work equipment completely to the ground and stop the engine. Then loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

- Remove the hydraulic tank strainer, and using tool **B**, stop the oil.
- When not using tool **B**, remove the drain plug, and drain the oil from the hydraulic tank and inside the system.

Hydraulic tank : **Approx. 100 ℓ**



1. Disconnect wiring connectors (1), remove bracket (2) tightened together with tube, then remove control pump inlet tube (3).
2. Disconnect control pump outlet hose (4).
3. Remove branch hose (5).
4. Remove control pump assembly (6), then remove coupling (7). ※ 1



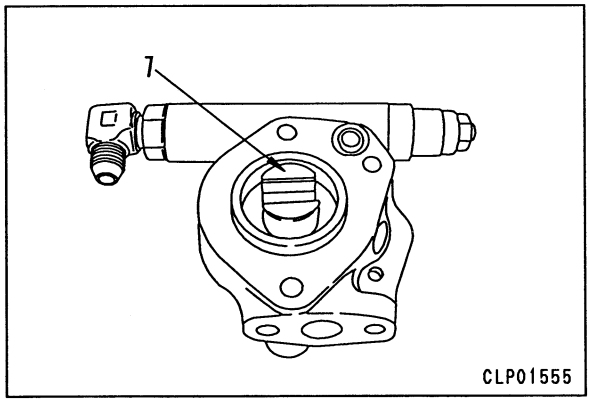
INSTALLATION OF CONTROL PUMP ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm Control pump mounting bolt :
66.2 ± 7.4 Nm {6.75 ± 0.75 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 OF MAIN PUMP ASSEMBLY

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

⚠ Lower the work equipment completely to the ground and stop the engine. Then loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

- Remove the hydraulic tank strainer, and using tool **B**, stop the oil.
- When not using tool **B**, remove the drain plug, and drain the oil from the hydraulic tank and inside the system.

Hydraulic tank : **Approx. 100 ℓ**

1. Drain oil from PTO gear case.

PTO gear case : **Approx. 0.75 ℓ**

2. Open engine hood, and remove main pump top cover, then remove exhaust muffler cover (1) and insulator (2).

3. Disconnect connecting pipe portion at turbocharger end, and remove exhaust muffler (3) together with bracket.

4. Disconnect wiring connectors (4), remove bracket (5) tightened together with tube, then remove control pump suction tube (6).

5. Disconnect main pump suction tube (7).

6. Remove branch hose (8).

7. Disconnect control pump outlet hose (9).

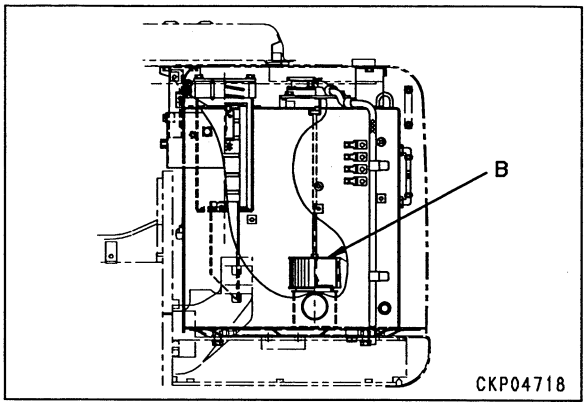
8. Disconnect main pump outlet hose (10).

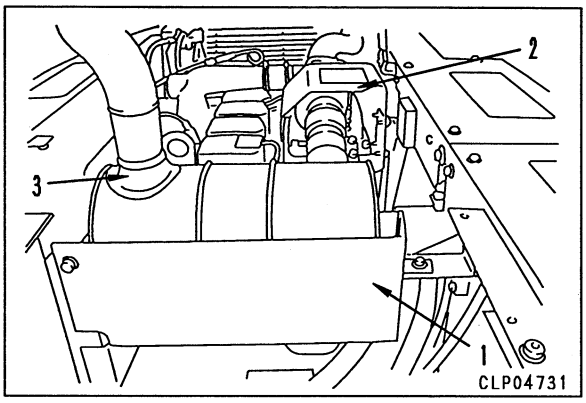
9. Disconnect main pump drain hose (11).

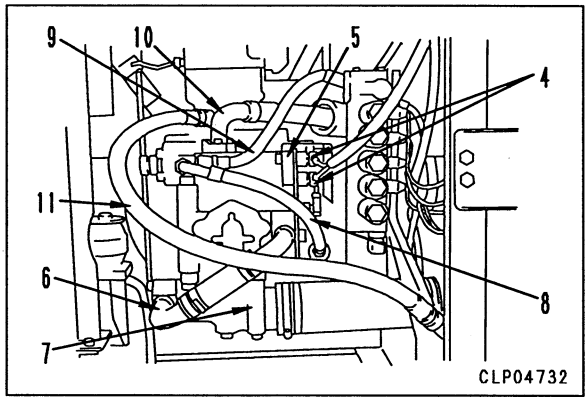
10. Disconnect LS pressure input hose (12).

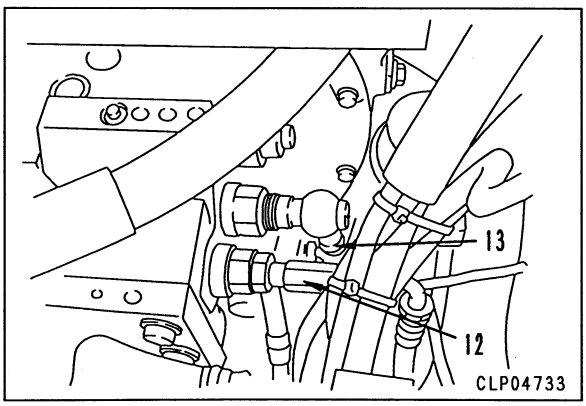
11. Disconnect hose (13).

12. Disconnect EPC valve basic pressure hose.





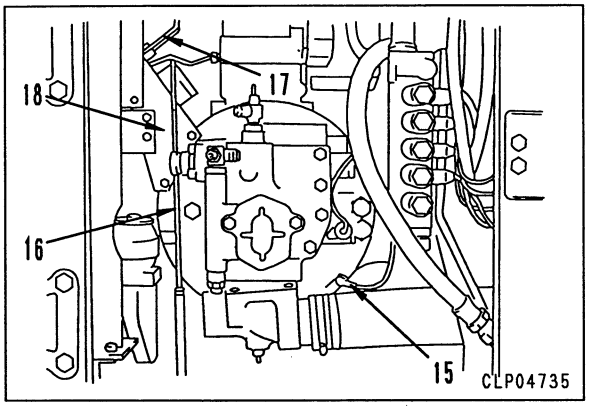




13. Disconnect ground connection (15).

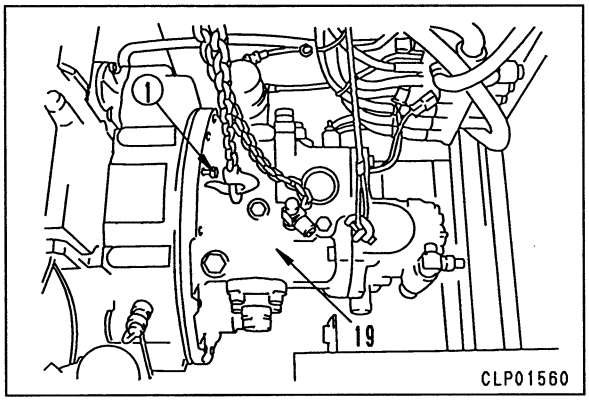
14. Remove exhaust drain pipe (16).

15. Remove bracket (17), then remove 2 mounting bolts, and move governor motor bracket assembly (18) towards counterweight end.



16. Sling main pump assembly (19), remove mounting bolts, then use forcing screws ① to remove.
※ 1

Main pump assembly : **85 kg**



INSTALLATION OF MAIN PUMP ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

Mating surface of pump case :
Gasket sealant (LG-6)

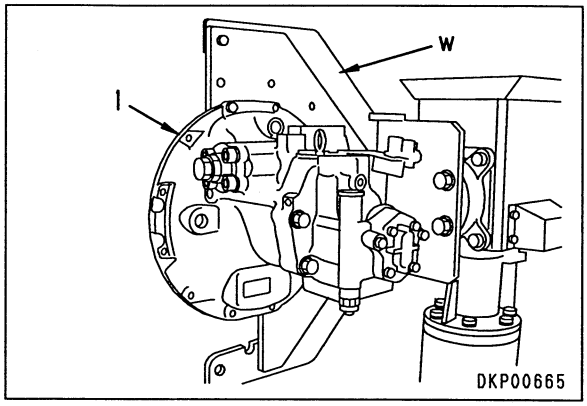
- **Refilling with oil (PTO gear case)**
  ★ Add engine oil through the oil filler to the specified level.

- **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.

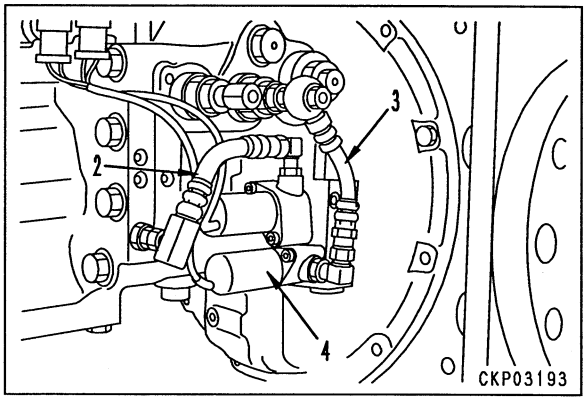
- **Bleeding air**
  ★ Bleed the air from main pump. For details, see TESTING AND ADJUSTING, Bleeding air.

DISASSEMBLY OF MAIN PUMP ASSEMBLY

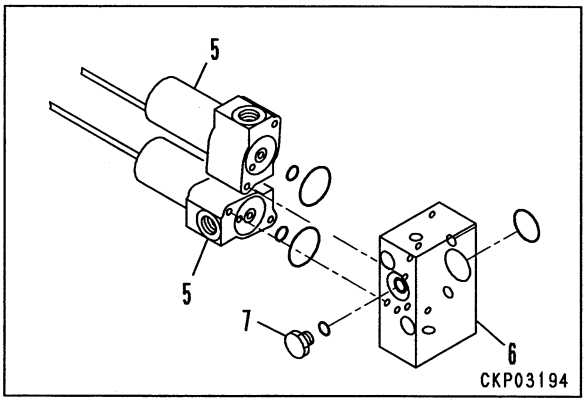
1. **Hydraulic pump assembly**
   Set hydraulic pump assembly (1) to tool **W**.



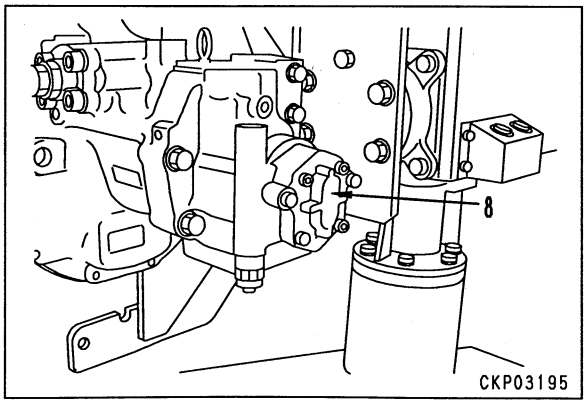
2. **EPC valve assembly**
   1) Remove hoses (2) and (3).
   2) Remove EPC valve assembly (4).



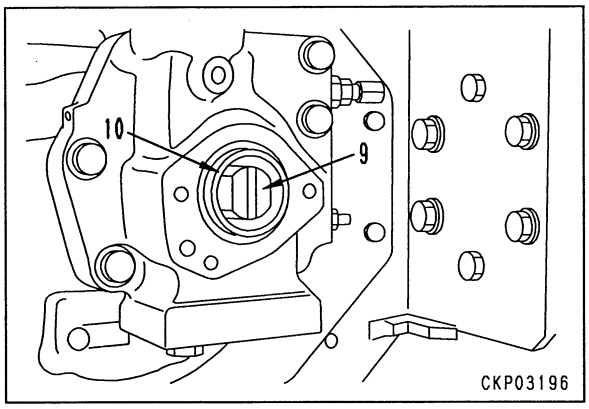
   3) Disassemble EPC valve assembly as follows.
      i) Remove 2 EPC valves (5) from block (6).
      ii) Remove plug (7).



3. **Control pump assembly**
   1) Remove control pump assembly (8).

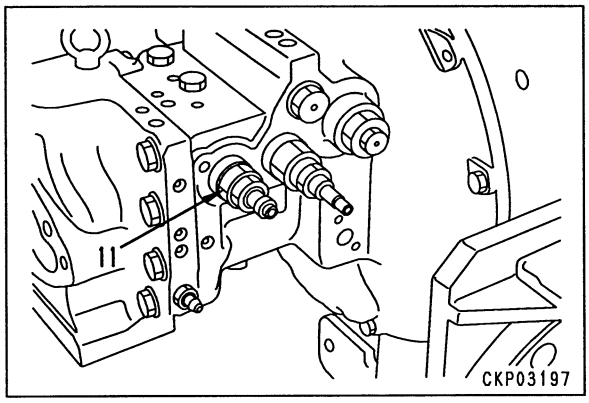


2) Remove coupling (9).
3) Remove collar (10).

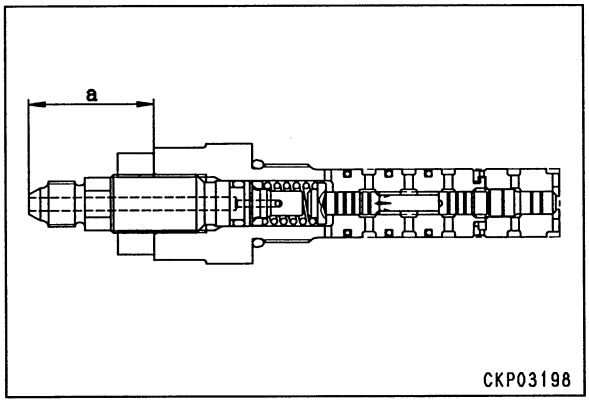


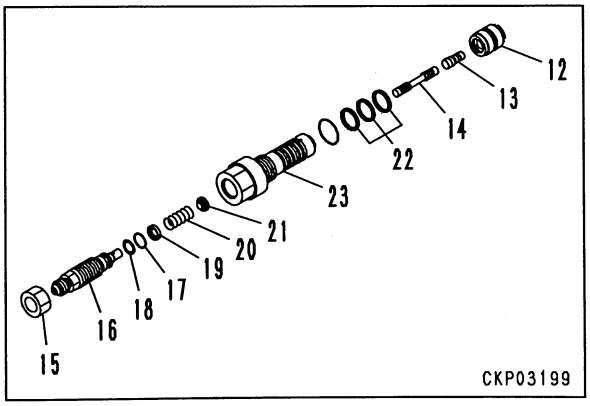
4. LS valve assembly

1) Remove LS valve assembly (11).



2) Disassemble LS valve assembly as follows.
   ★ Measure screwed-in depth **a** of the plug before disassembling.
   i) Remove sleeve (12).
      ★ The connecting portion is eccentric, so rotate to remove.
   ii) Remove piston (13) from sleeve (12).
   iii) Remove piston (14).
   iv) Remove locknut (15), then remove plug (16).
   v) Remove O-ring (17) and backup ring (18) from plug (16).
   vi) Remove seat (19), spring (20), and seat (21).
   vii) Remove 3 seals (22) from sleeve (23).



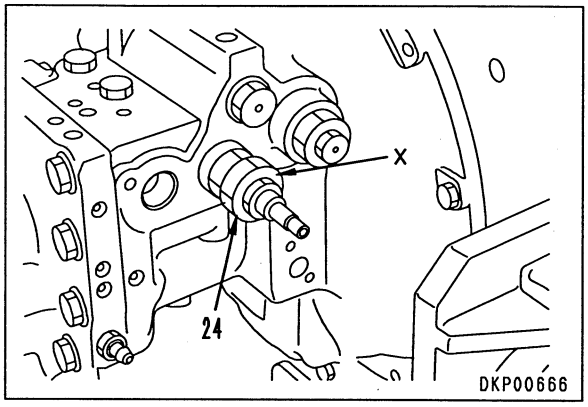


5. PC valve assembly

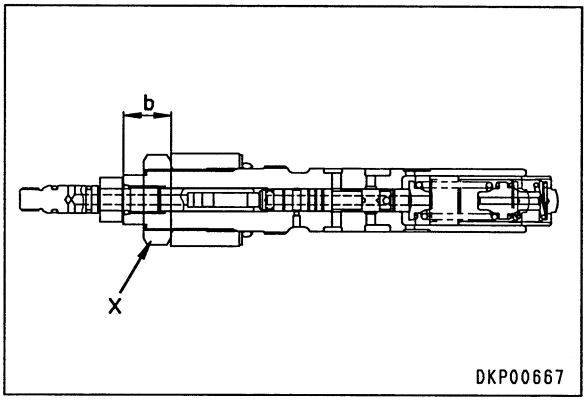
1) Install tool **X** to PC valve.

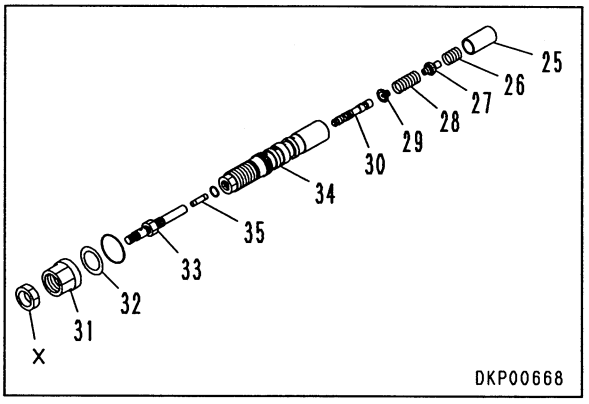
kgm Tool **X** :
100 ± 12.3 Nm {10.3 ± 1.25 kgm}

2) Remove PC valve assembly (24).



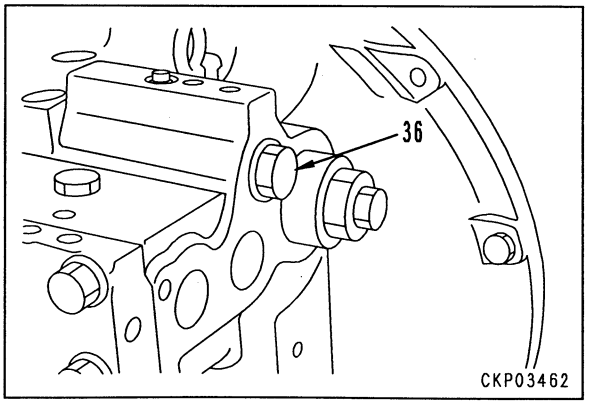
3) Disassemble PC valve assembly as follows.
★ Measure screwed-in depth **b** of the sleeve before disassembling.
i) Remove piston (25), spring (26), seat (27), spring (28), and seat (29).
ii) Remove spool (30).
iii) Remove tool **X**.
iv) Remove nut (31) and washer (32).
v) Remove plug (33) from sleeve (34).
vi) Remove pin (35) from plug (33).



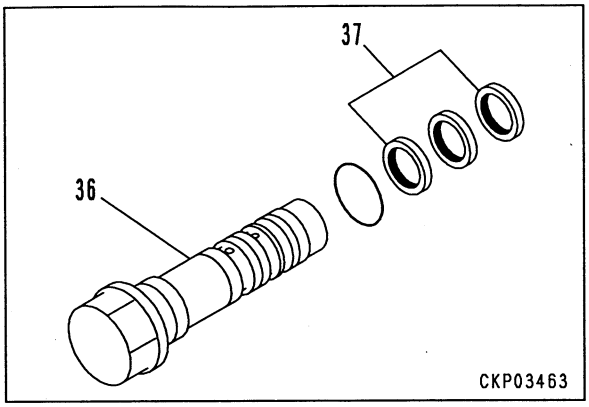


6. Orifice plug

1) Remove orifice plug (36).

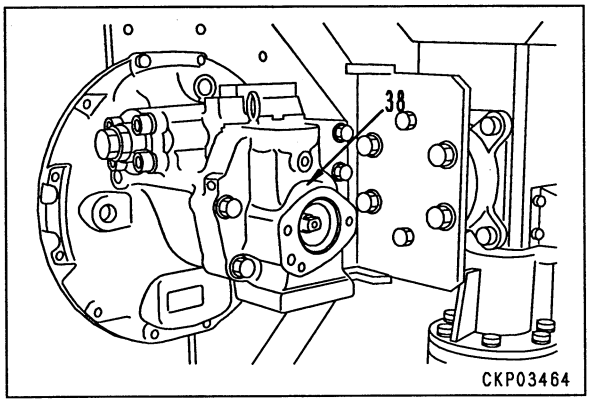


2) Remove 3 seals (37) from orifice plug (36).

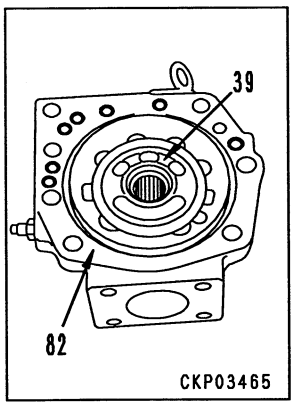


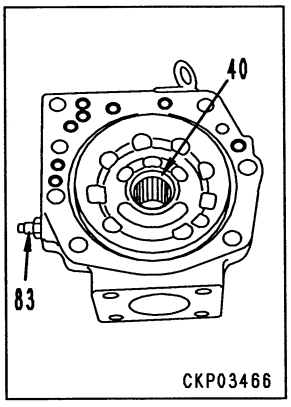
7. End cap assembly

1) Remove end cap assembly (38).



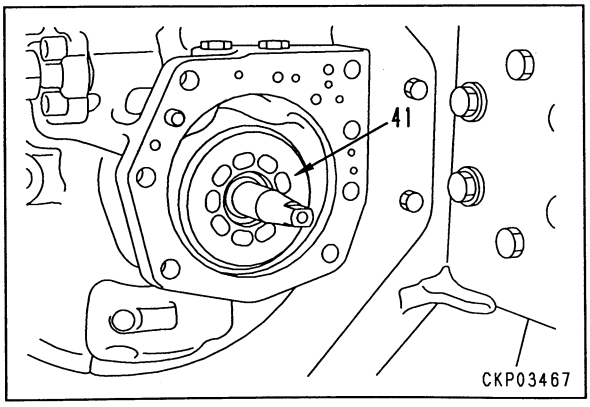
2) Disassemble end cap assembly as follows.
   i) Remove valve plate (39) from end cap (82).
      ★ The valve plate may be stuck to the cylinder block, so be careful when removing.
   ii) Remove needle bearing (40).
   iii) Remove nipple (83).



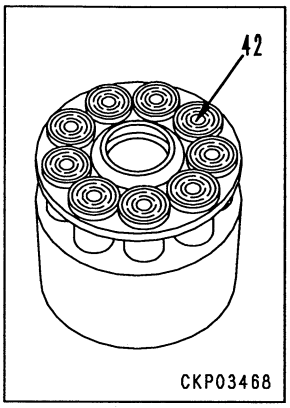


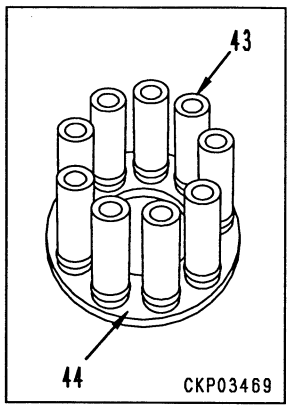
8. Cylinder block, piston assembly

1) Remove cylinder block and piston assembly (41).
   ★ To ensure that the cylinder block and piston assembly come off together as one unit, set the case slightly at an angle when removing.

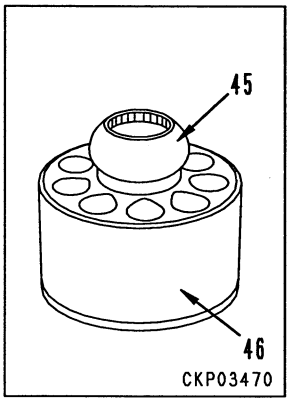


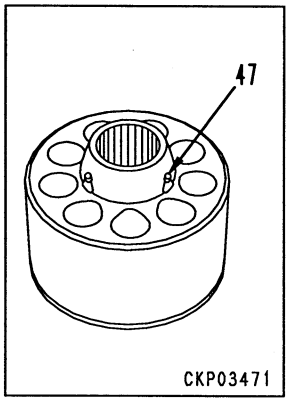
2) Disassemble cylinder block and piston assembly as follows.
   i) Remove piston assembly (42).
   ii) Remove 9 pistons (43) from shoe retainer (44).



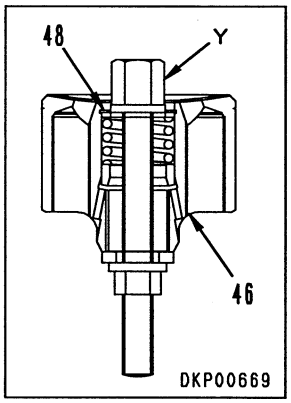


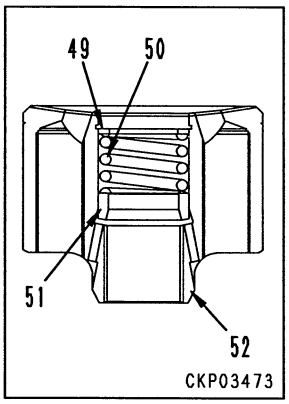
   iii) Remove retainer guide (45) from cylinder block assembly (46).
   iv) Remove 3 pins (47).





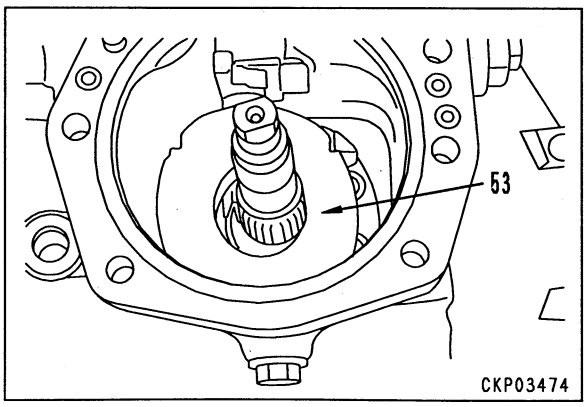
   v) Set tool **Y** to cylinder block assembly (46) and compress spring.
   vi) Remove snap ring (48), then remove tool **Y**.
   vii) Remove seat (49), spring (50), and seat (51) from cylinder block (52).



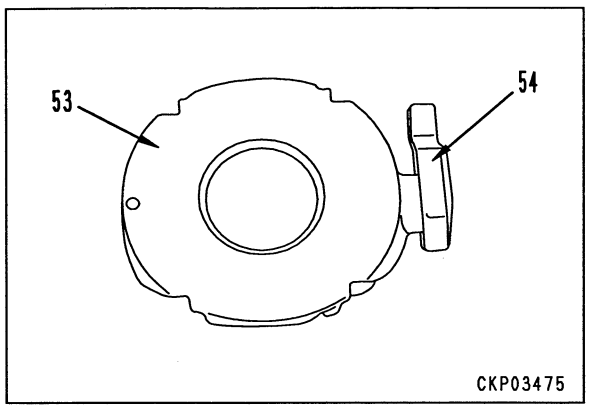


9. Rocker cam

1) Remove rocker cam (53) together with slider.

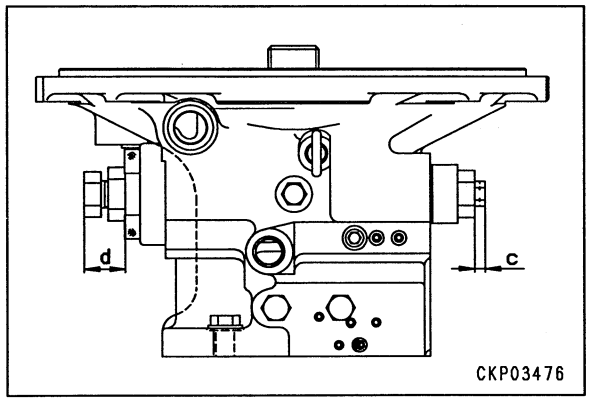


2) Remove slider (54) from rocker cam (53).

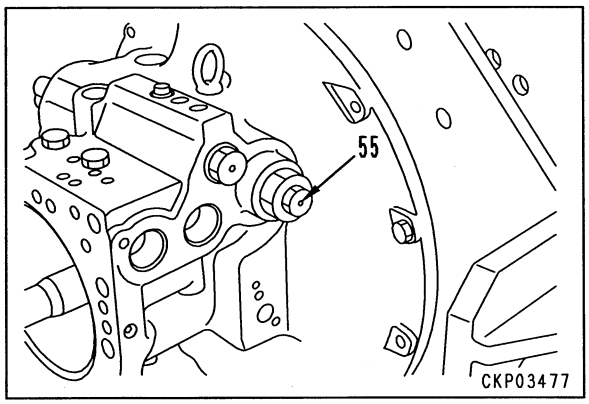


10. Servo piston

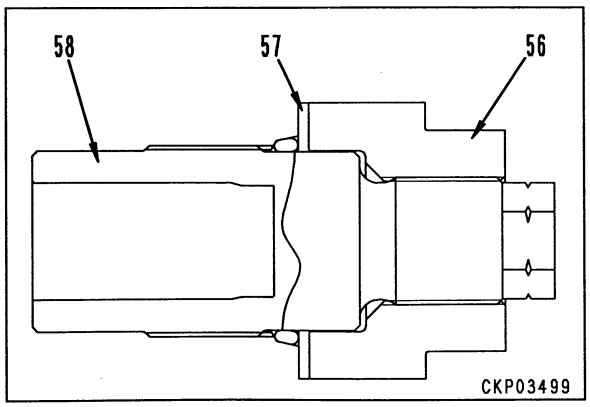
★ Measure adjustment dimension **c** of the minimum swash plate angle (MIN) and adjustment dimension **d** of the maximum swash plate angle (MAX) before disassembling.



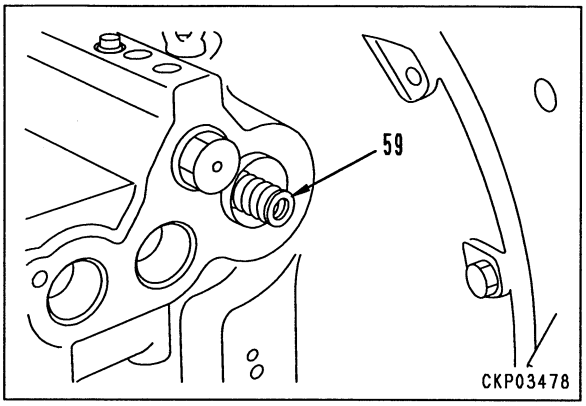
1) Loosen locknut, and rotate MIN stopper assembly (55) to remove.



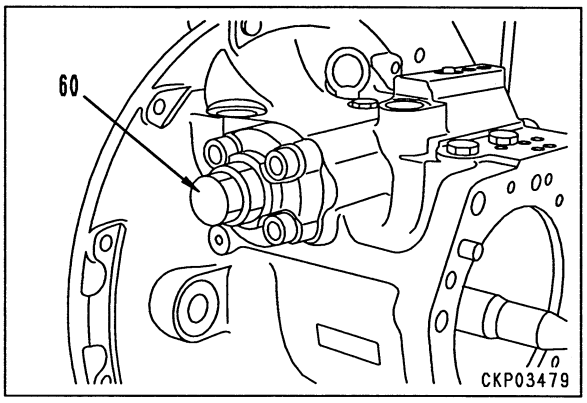
2) Disassemble MIN stopper assembly as follows.
Remove locknut (56) and washer (57) from screw (58).



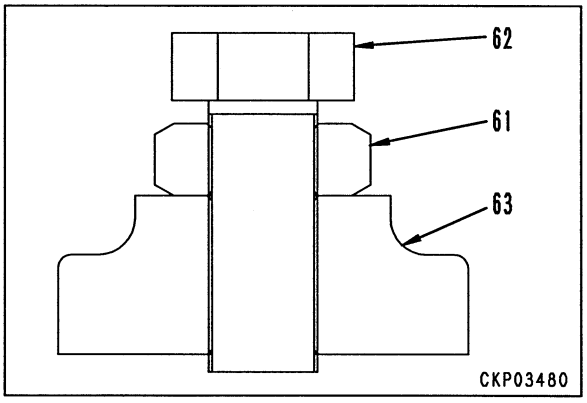
3) Remove spring (59).



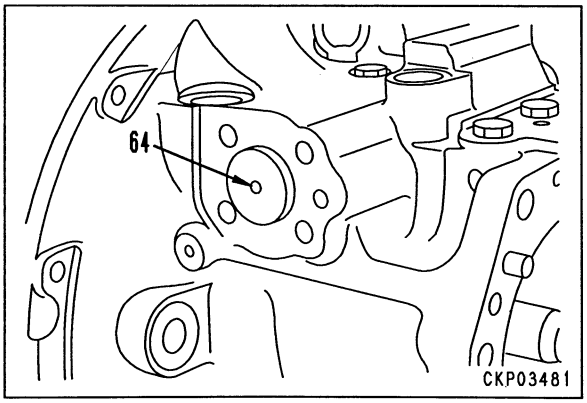
4) Remove 4 mounting bolts, then remove MAX stopper assembly (60).



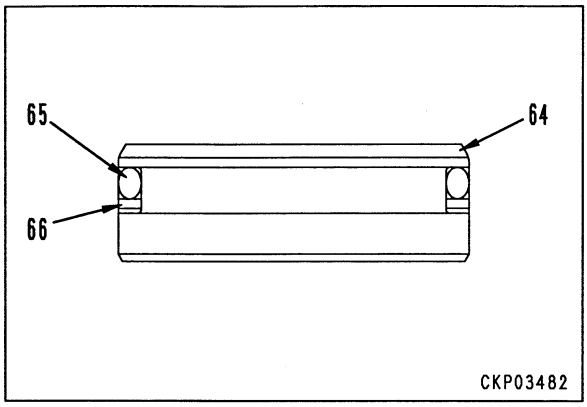
5) Disassemble MAX stopper assembly as follows.
Loosen nut (61), and remove bolt (62) from cover (63).



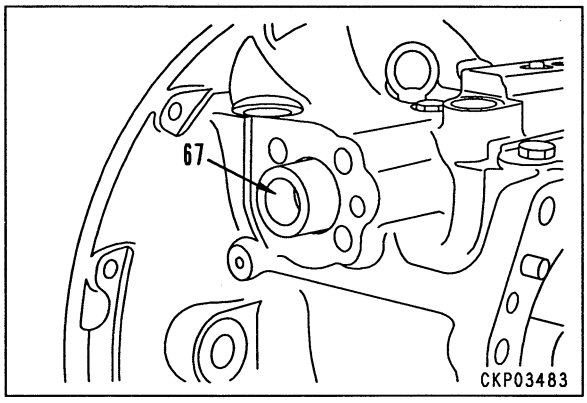
6) Using forcing screw, remove stopper (64).



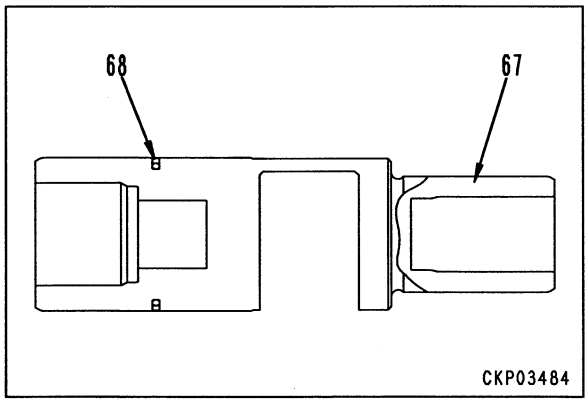
7) Disassemble stopper as follows.
Remove O-ring (65) and backup ring (66) from stopper (64).



8) Remove servo piston (67).

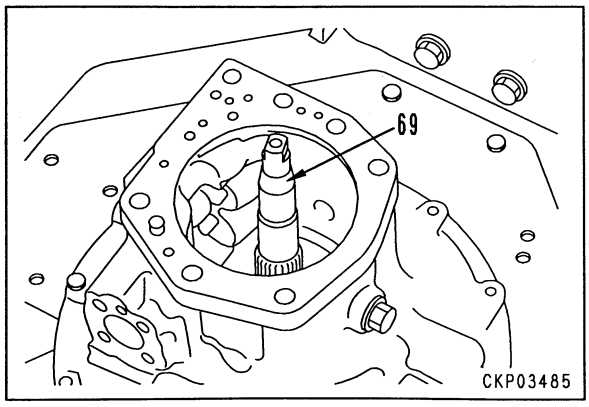


9) Disassemble servo piston as follows.
Remove seal (68) from servo piston (67).

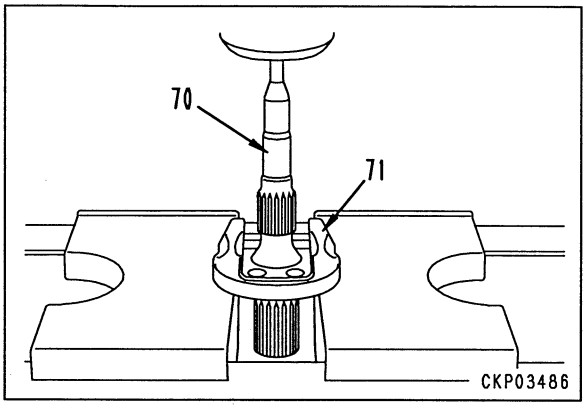


11. Shaft, cradle assembly

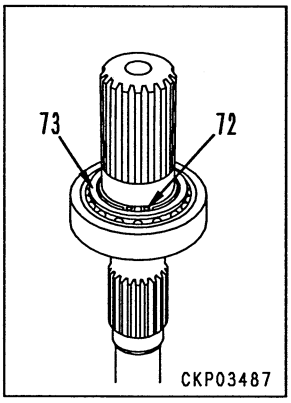
1) Remove 4 mounting bolts, then remove shaft and cradle assembly (69).

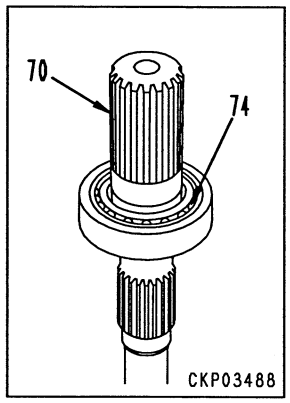


2) Disassemble shaft and cradle assembly as follows.
   i) Using press, remove shaft (70) from cradle (71).
      ★ Be careful not to drop the shaft.

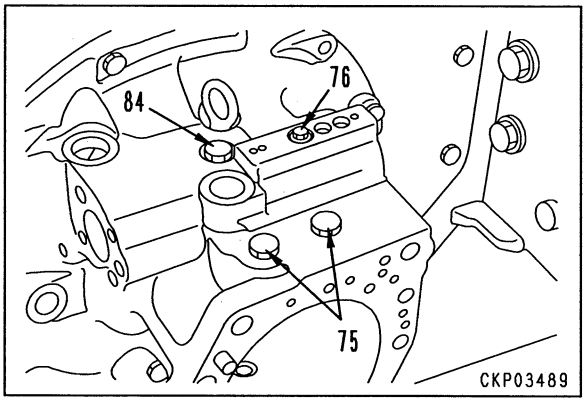


   ii) Remove snap ring (72), then remove washer (73).
      ★ Check the thickness of the washer.
   iii) Remove roller bearing (74) from shaft (70).

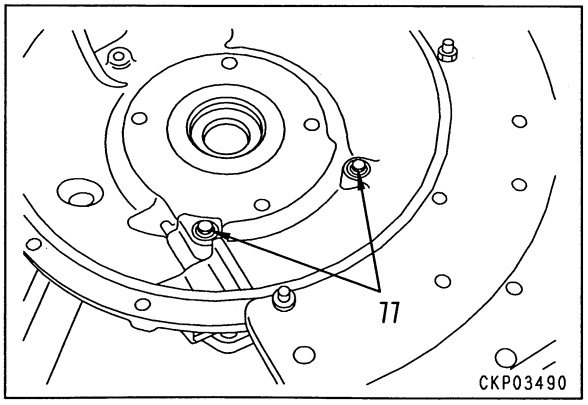




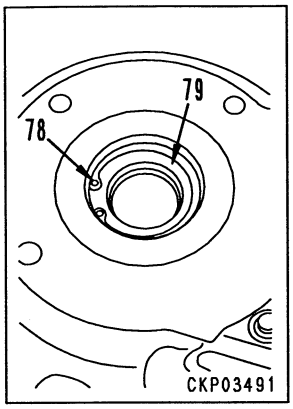
12. Pump case
1) Remove 2 plugs (75).
2) Remove plug (84).
3) Remove plug (76).
4) Remove drain plug.

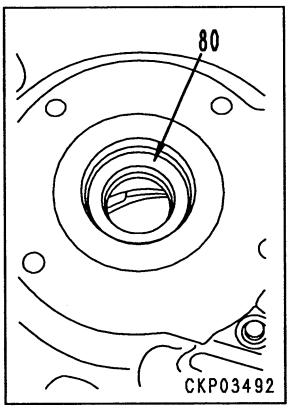


5) Remove 2 plugs (77).



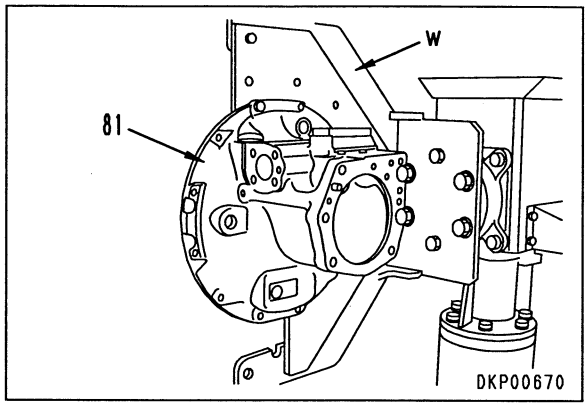
6) Remove snap ring (78), then remove spacer (79).
7) Remove oil seal (80).





ASSEMBLY OF MAIN PUMP ASSEMBLY

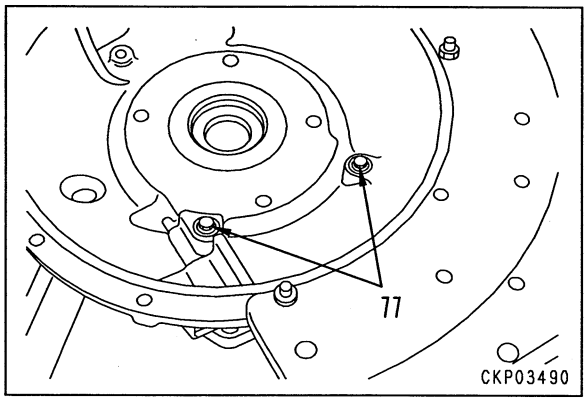
★ Clean all parts, remove all burrs, check for dirt or damage, and be particularly sure to clean the drill hole oil passage.
★ Coat the rotating and sliding surfaces of all parts with engine oil (EO10-CD) before assembling.
★ Always check the contact of the following parts before assembling. For details, see CHECKING CONTACT BETWEEN PARTS.
1) Cradle and rocker cam
2) Cylinder block and valve plate
3) Valve plate and end cap



1. Pump case

1) Set pump case (81) to tool **W**.
2) Fit O-rings and install 2 plugs (77).

kgm Plug : **23.5 ± 3.5 Nm {2.4 ± 0.4 kgm}**



3) Fit O-ring and install plug (76).

kgm Plug : **23.5 ± 3.5 Nm {2.4 ± 0.4 kgm}**

4) Fit O-ring and install plug (84).

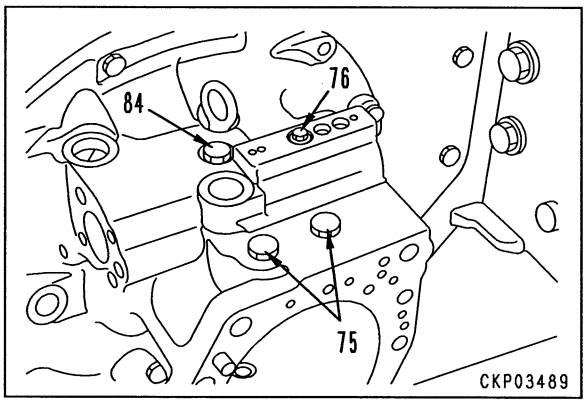
kgm Plug : **17.2 ± 2.45 Nm {2.4 ± 0.25 kgm}**

5) Fit O-rings and install 2 plugs (75).

kgm Plug : **39.2 ± 4.9 Nm {4.0 ± 0.5 kgm}**

6) Fit O-ring and install drain plug.

kgm Drain plug : **68.6 ± 9.8 Nm {7 ± 1 kgm}**

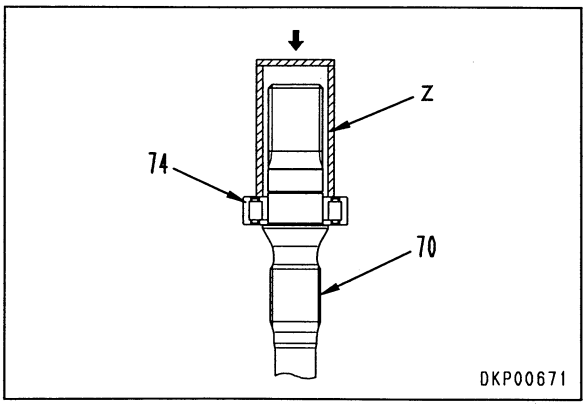


2. Shaft, cradle assembly

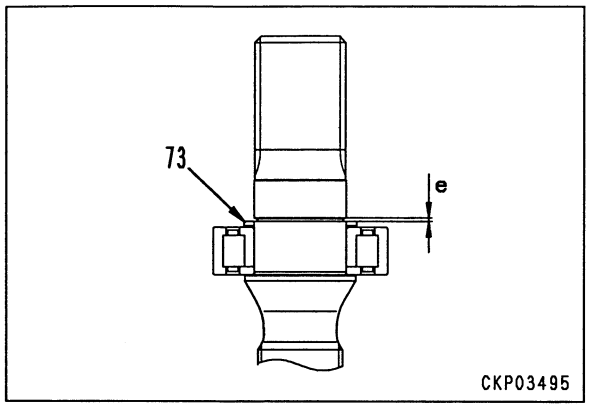
1) Using tool **Z**, press fit roller bearing (74) to shaft (70).

Press-fitting surface of bearing : **Grease (G2-LI)**

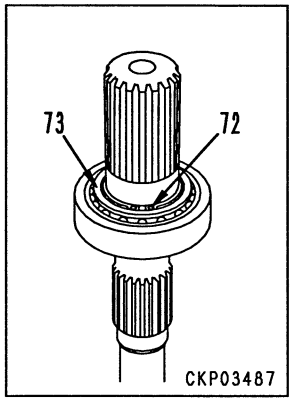
★ When assembling the bearing, insert the flange ring on the shaft first, then assemble the inner race and outer race, and press fit.

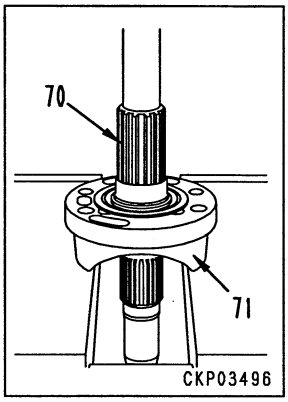


2) Select washer thickness as follows.
   i) Select washer (73) of any thickness and assemble temporarily.
   ii) Measure dimension e from top surface of washer to top end of snap ring groove.
   iii) Calculate from dimension **e** and thickness of temporarily assembled washer (73) and select washer so that dimension e is 1.45 – 1.60 mm.
   • Washer thickness :
   2.8, 2.9, 3.0, 3.1 mm

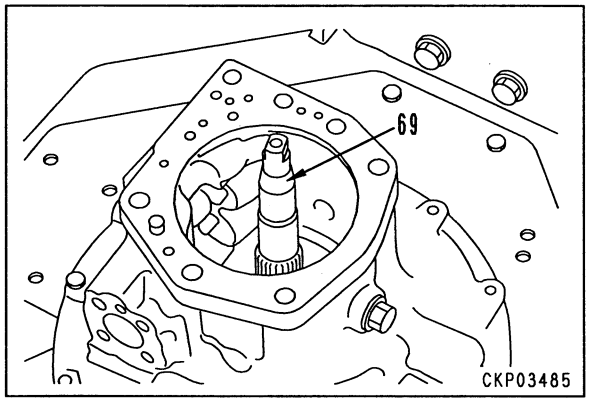


3) Fit selected washer (73), and secure with snap ring (72).
4) Using press, press fit shaft (70) to cradle (71).



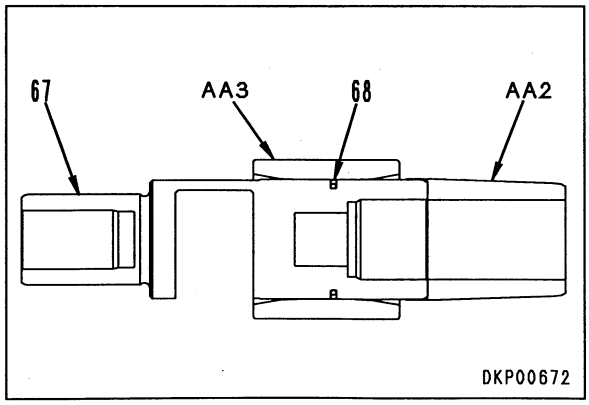


5) Fit O-ring to bottom of cradle, and install shaft and cradle assembly (69).
   ★ Align the dowel pin at the case end with the pin hole at the cradle end, and set in the mounting position.
   kgm Mounting bolt :
   110 ± 12.3 Nm {11.3 ± 1.25 kgm}

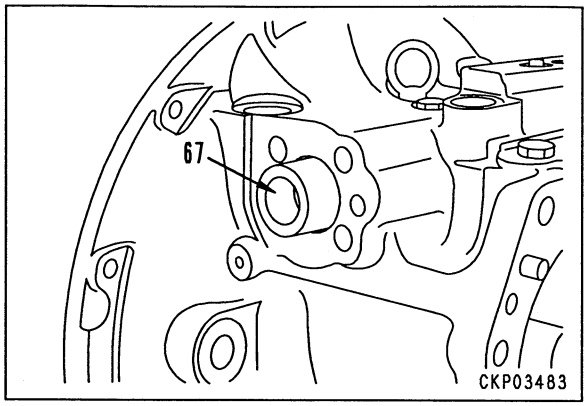


3. Servo piston

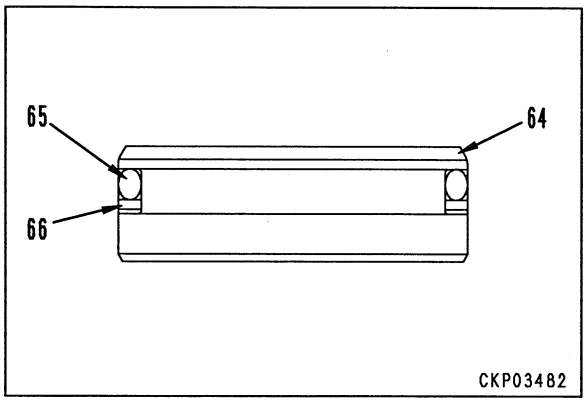
1) Assemble servo piston as follows.
   Using tool **AA**, install seal (68) to servo piston (67).
   ★ Using tool **AA2**, expand the seal and assemble it in the ring groove. Correct any twisting of the seal, then compress it with tool **AA3**.



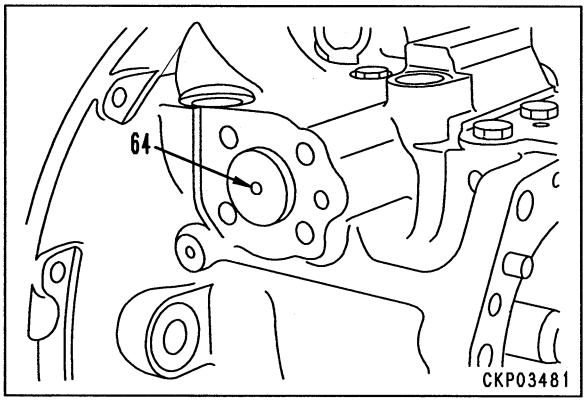
2) Assemble servo piston (67).



3) Assemble stopper as follows.
Install O-ring (65) and backup ring (66) to stopper (64).
★ Install in the direction shown in the diagram on the right.

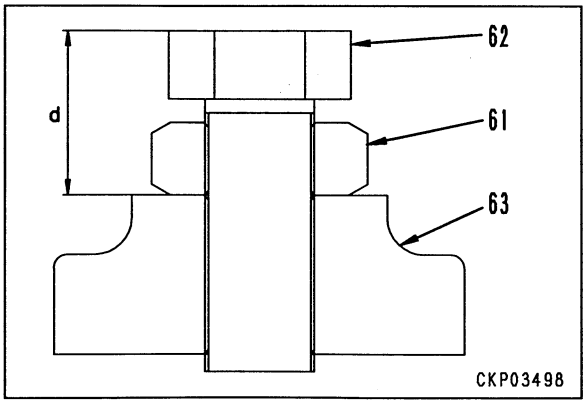


4) Install stopper (64).
★ Install with the end with the tap hole facing the outside.



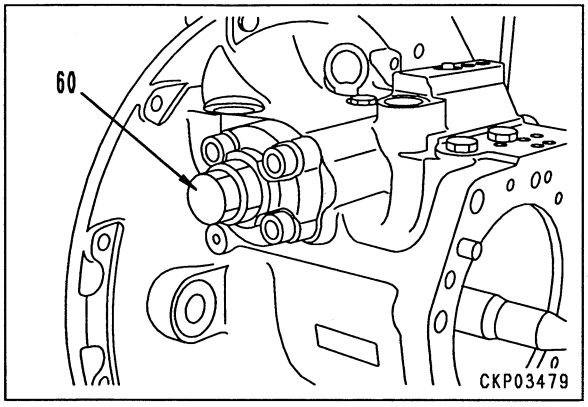
5) Assemble MAX stopper assembly as follows.
Fit bolt (62) to cover (63), and secure with nut (61).
★ Align with adjustment dimension **d** of the maximum swash plate angle (MAX) measured during disassembly.
• Standard adjustment dimension **d** :
36.1 ± 0.1 mm

kgm Nut : **421 ± 19.6 Nm {43 ± 2 kgm}**

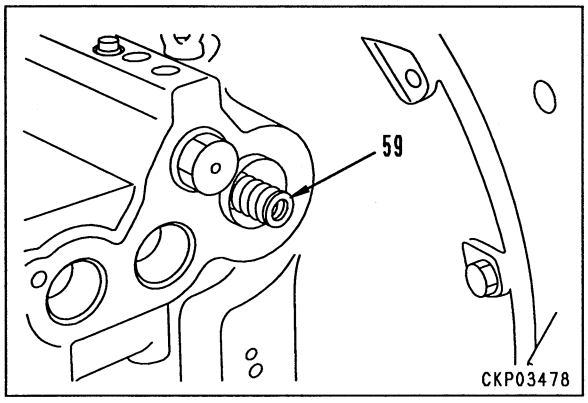


6) Install MAX stopper assembly (60).

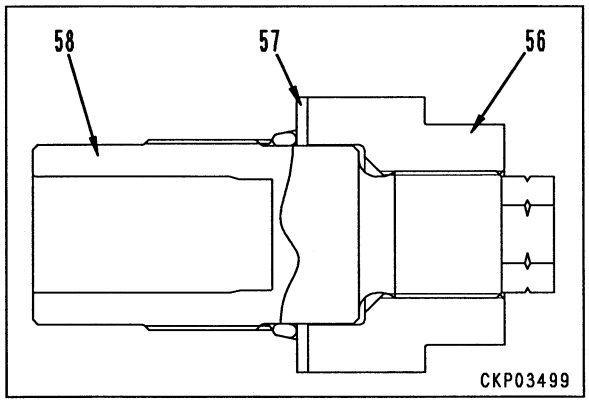
kgm Mounting bolt :
177 ± 20.5 Nm {18 ± 2 kgm}



7) Install spring (59).

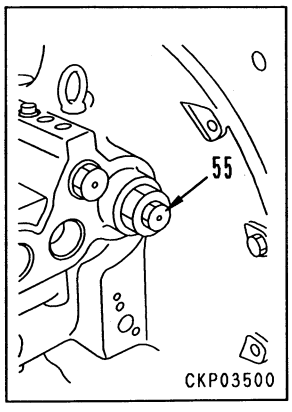


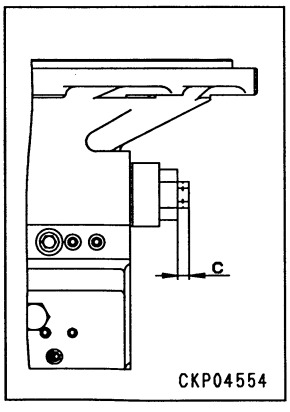
8) Assemble MIN stopper assembly as follows. Fit O-ring and install washer (57) and locknut (56) to screw (58).
★ Install the washer with the surface with the V-notch facing the locknut end.



9) Install MIN stopper assembly (55).
★ Align with adjustment dimension **c** of the minimum swash plate angle (MIN) measured during disassembly.
• Standard adjustment dimension **c** :
9.5 ± 0.1 mm

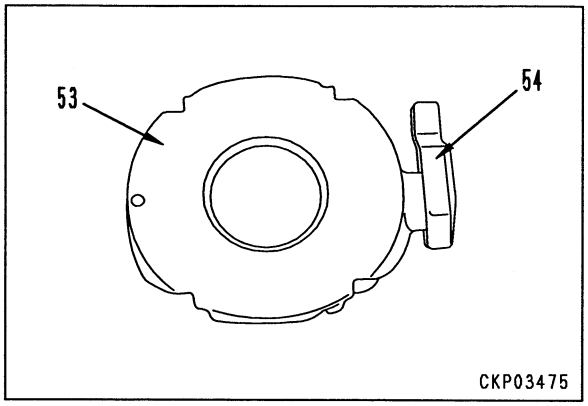
kgm Locknut : **529 ± 19.6 Nm {54 ± 2 kgm}**



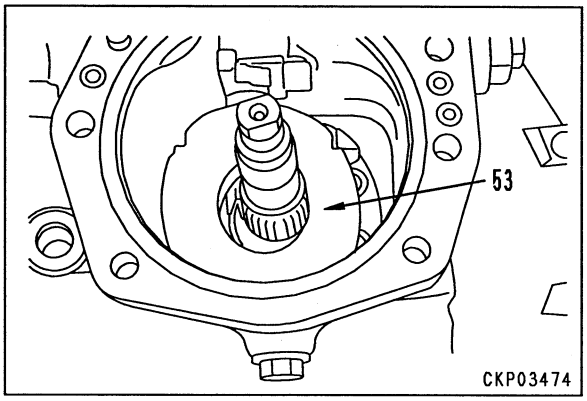


4. Rocker cam

1) Install slider (54) to rocker cam (53).
   ★ Install so that the stepped end of the rocker cam faces the right side when seen from the front.

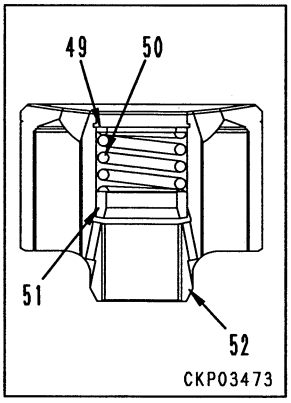


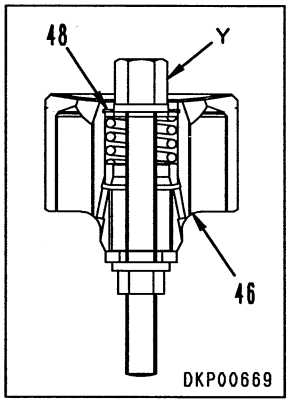
2) Install rocker cam (53).
   ★ Check that the sliding surface of the cradle and rocker cam are fitted together securely.

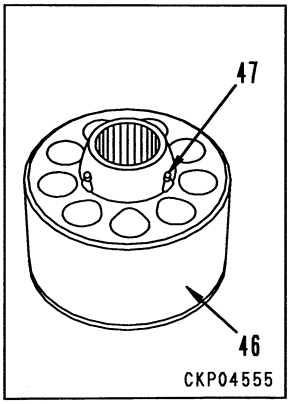


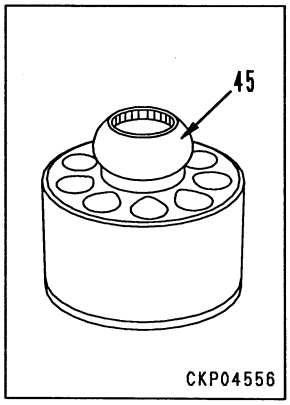
5. Cylinder block, piston assembly

1) Assemble cylinder block and piston assembly as follows.
   i) Set seat (51), spring (50), and seat (49) to cylinder block (52).
      ★ Assemble with the chamfered portion on the inside diameter of seat (51) facing down.
   ii) Set tool **Y** to cylinder block assembly (46) and compress spring.
   iii) Install snap ring (48).
   iv) Install 3 pins (47) to cylinder block assembly (46).
   v) Install retainer guide (45).

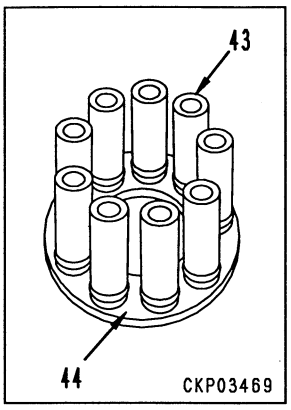


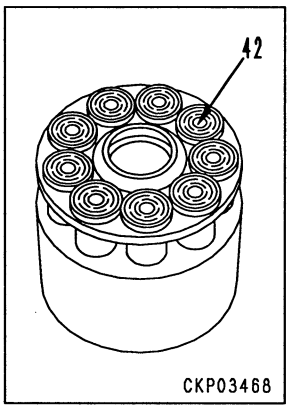




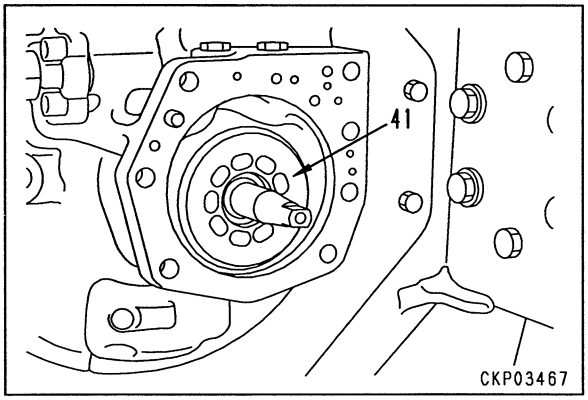


vi) Set 9 pistons (43) to shoe retainer (44).
vii) Assemble piston assembly (42) to cylinder block assembly.





2) Assemble cylinder block and piston assembly (41).
★ Check that the spline of the shaft and cylinder block is meshed and that the sliding portion of the rocker cam and piston shoe are in tight contact.



6. End cap assembly

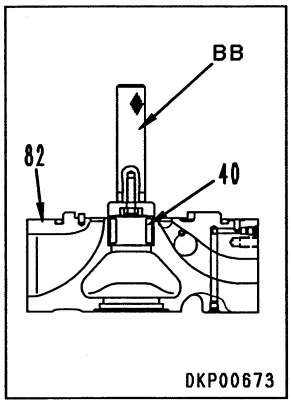
1) Assemble end cap assembly as follows.
i) Using tool **BB**, press fit needle bearing (40) to end cap (82).

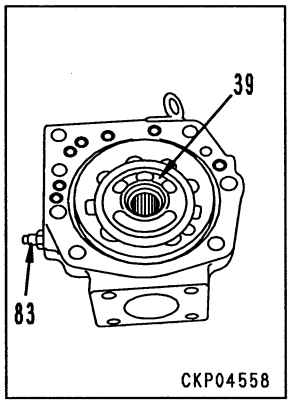
Press-fitting surface of bearing : **Grease (G2-LI)**

ii) Install nipple (83).

kgm Locknut: **34.3 ± 4.9 Nm {3.5 ± 0.5 kgm}**

iii) Install valve plate (39).
★ Align the pin groove of the valve plate end and the pin of the end cap end, and check that the valve plate and end cap are in tight contact.

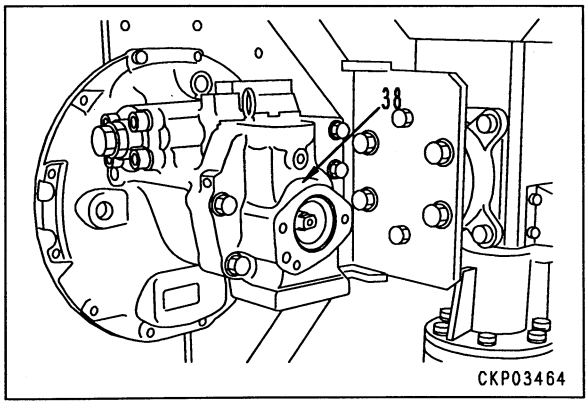




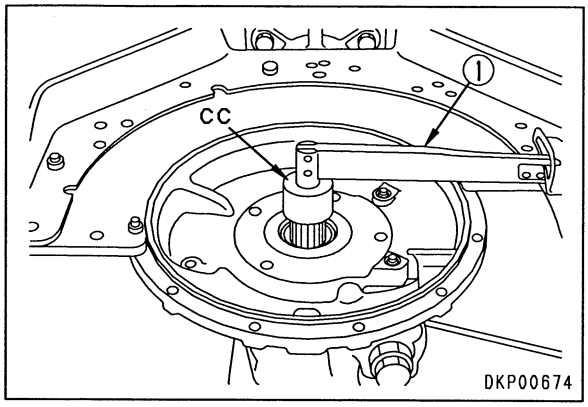
2) Fit O-ring and install end cap assembly (38).

Mating surface of pump case : **Gasket sealant (LG-5 or LG-7)**

kgm Mounting bolt : **177 ± 19.5 Nm {18 ± 2 kgm}**

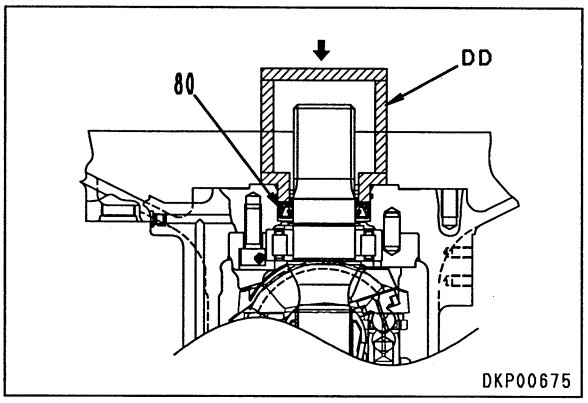


3) Using tool **CC** and torque wrench ①, measure shaft rotating torque.
   ★ Rotate shaft at a constant speed (3 – 5 sec/ 1 turn) and measure rotating torque.
   • Rotating torque :
     Max. 24.5 Nm (Max. 2.5 kgm)
     (Torque variation range:
     Max. 2.94 Nm (Max. 0.3 kgm)
   ★ If the rotating torque is not normal, disassemble again and look for the cause.

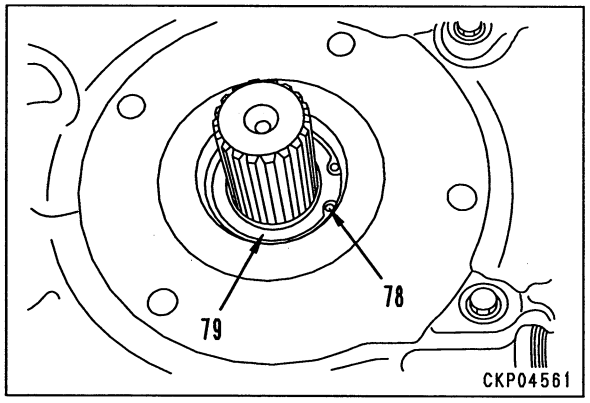


7. Oil seal

1) Using tool **DD**, press fit oil seal (80).

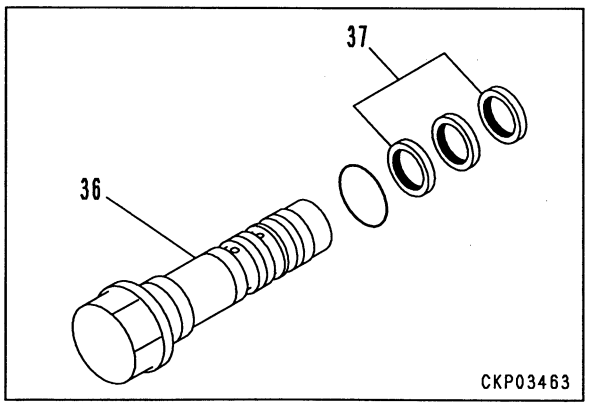


2) Fit spacer (79) and secure with snap ring (78).



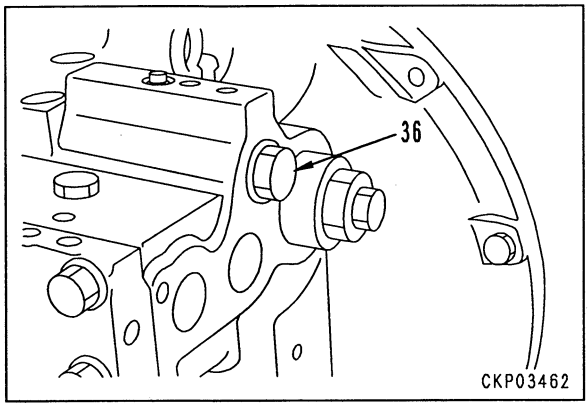
8. Orifice plug

1) Install 3 seals (37) to orifice plug (36).
   ★ Leave for a short time until the seals become fitted on the orifice plug.



2) Fit O-ring and install rear orifice plug (36).

kgm Orifice plug :
66.2 ± 7.35 Nm {6.75 ± 0.75 kgm}

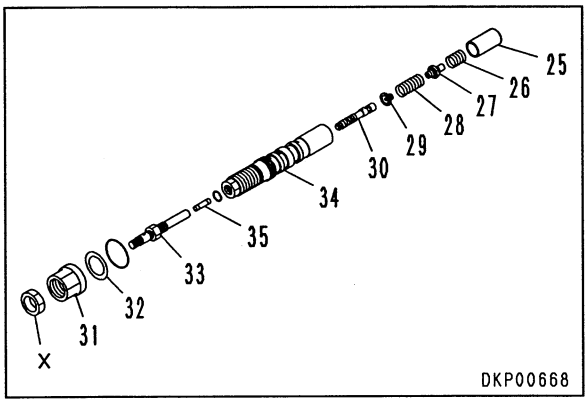


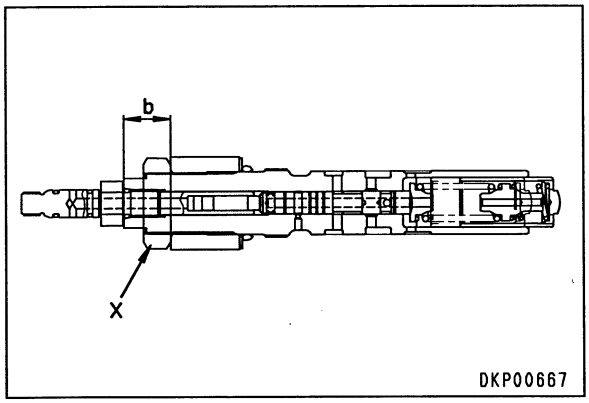
9. PC valve assembly

1) Assemble PC valve assembly as follows.
   i) Assemble pin (35) to plug (33).
   ii) Fit O-ring and install plug (33) to sleeve (34).

   kgm Sleeve :
   34.3 ± 4.9 Nm {3.5 ± 0.5 kgm}
   iii) Fit O-ring and install washer (32) and nut (31).
   ★ Install the washer with the surface with the V-notch facing the locknut end.
   iv) Tighten with tool **X** temporarily.
   v) Assemble spool (30).
   vi) Assemble seat (29), spring (28), seat (27), spring (26), and piston (25).
   ★ Assemble seat (27) so that the shorter protrusion is facing sleeve (34).
   ★ Align with screwed-in dimension **b** of the sleeve measured before disassembly, then secure with tool **X**.

   kgm Tool **X** :
   100 ± 12.3 Nm {10.3 ± 1.25 kgm}

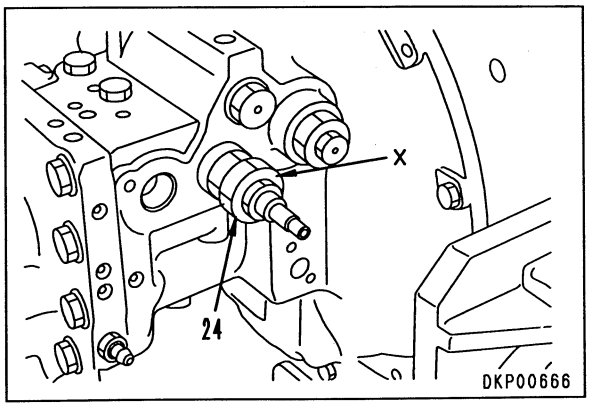




2) Fit O-ring and install PC valve assembly (24).

kgm PC valve assembly :
100 ± 12.3 Nm {10.3 ± 12.5 kgm}

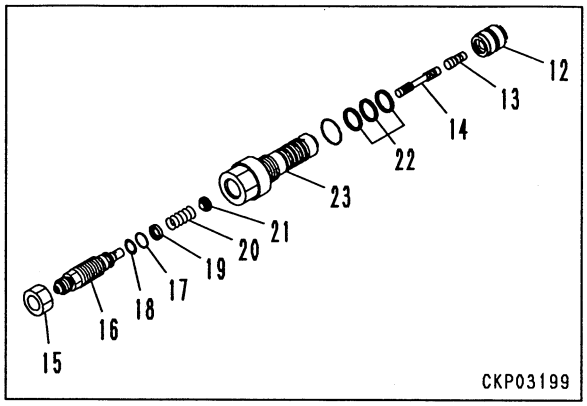
3) Remove tool **X**.

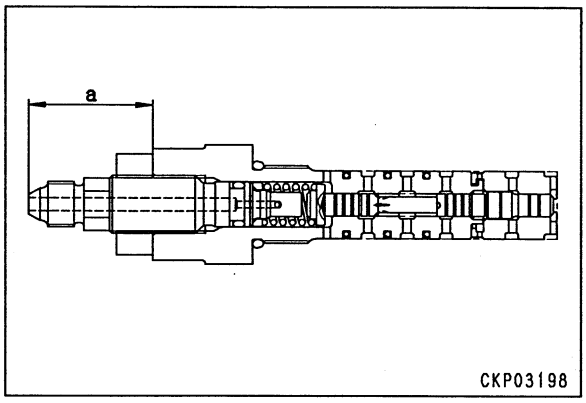


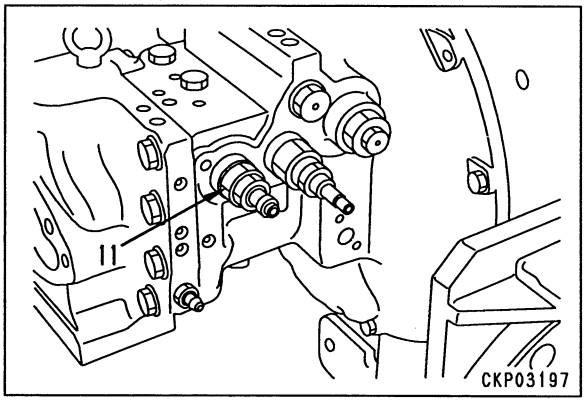
10. LS valve assembly

1) Assemble LS valve assembly as follows.
   i) Install 3 seals (22) to sleeve (23).
      ★ Leave for a short time until the seals become fitted on the sleeve.
   ii) Install O-ring (17) and backup ring (18) to plug (16).
      ★ Install in the direction shown in the diagram on the right.
   iii) Assemble seat (21), spring (20), and seat (19) to sleeve (23).
      ★ Assemble with the chamfered portion on the inside diameter of seat (19) facing plug (16).
   iv) Install plug (16) to sleeve (23), and tighten locknut (15) temporarily.
   v) Assemble piston (14).
   vi) Assemble piston (13) to sleeve (12).
   vii) Install sleeve (12) to sleeve (23).
      ★ The connecting portion is eccentric, so align the connecting portion and turn 90°.
   ★ Align with screwed-in dimension **a** of the sleeve measured before disassembly, then secure with a locknut.
   • Standard screwed-in dimension **a** :
     38.1 mm
   kgm Locknut :
     56.4 ± 7.35 Nm {5.75 ± 0.75 kgm}

2) Fit O-ring and install LS valve assembly (87).
   kgm LS valve assembly :
     145 ± 12.5 Nm {14.7 ± 1.25 kgm}

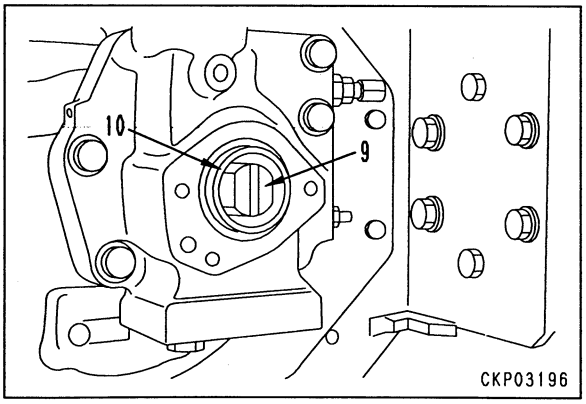






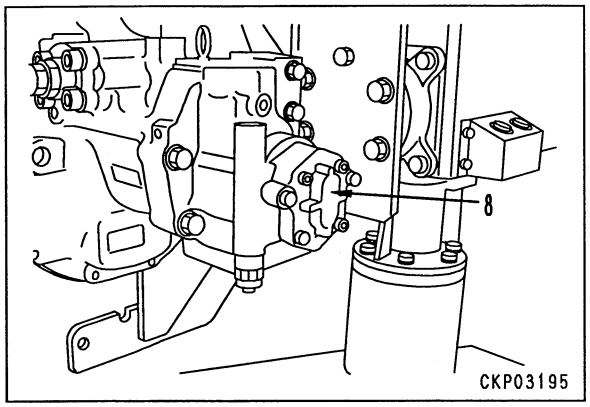
11. Control pump assembly

1) Install collar (10).
2) Install coupling (9).



3) Fit O-ring, then install control pump assembly (8).

kgm Mounting bolt:
66.2 ± 7.35 Nm {6.75 ± 0.75 kgm}



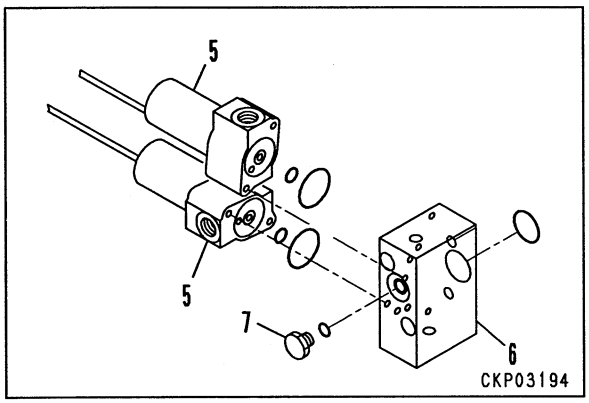
12. EPC valve assembly

1) Assemble EPC valve assembly as follows.
   i) Fit O-ring and install plug (7) to block (6).

kgm Plug :
11.3 ± 1.45 Nm {1.15 ± 0.15 kgm}

   ii) Fit O-ring and install 2 EPC valves (5).

kgm Mounting bolt :
13.3 ± 1.45 Nm {1.35 ± 0.15 kgm}



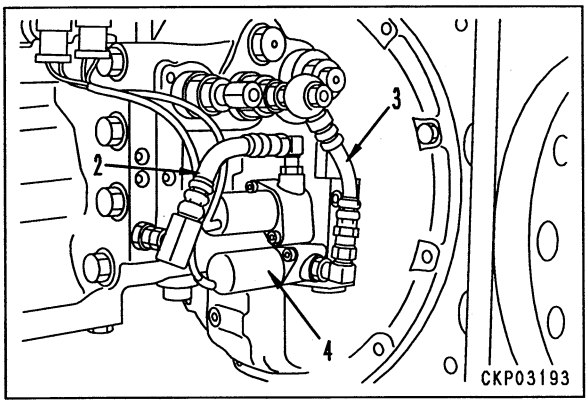
2) Fit O-ring and install EPC valve assembly (4).

kgm Mounting bolt :
30.5 ± 3.5 Nm {3.15 ± 0.35 kgm}

3) Install hoses (3) and (2).

kgm Elbow nut :
34.3 ± 4.9 Nm {3.5 ± 0.5 kgm}

kgm Sleeve nut :
24.5 ± 4.9 Nm {2.5 ± 0.5 kgm}

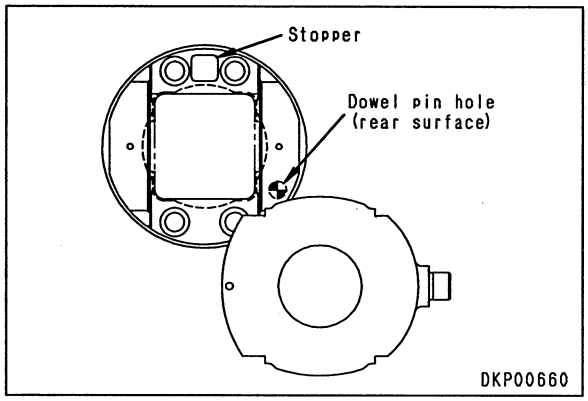


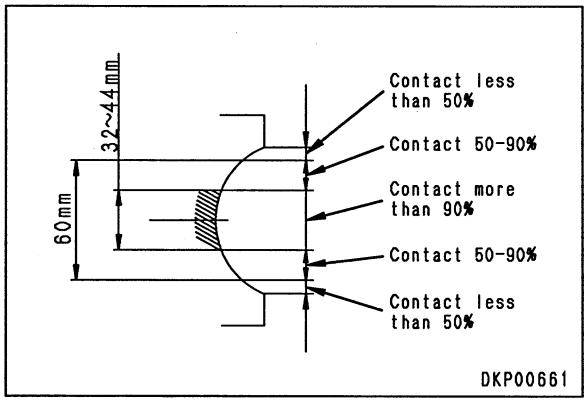
CHECKING CONTACT BETWEEN PARTS

★ If either part of the following pairs of sliding parts has been repaired or replaced with a repair part (new part), check the contact as follows.
There is no need for this check if both parts of the pair have been repaired or replaced with a repair part (new part).
1) Cradle and rocker cam
2) Cylinder block and valve plate
3) Valve plate and end cap

1. Cradle and rocker cam

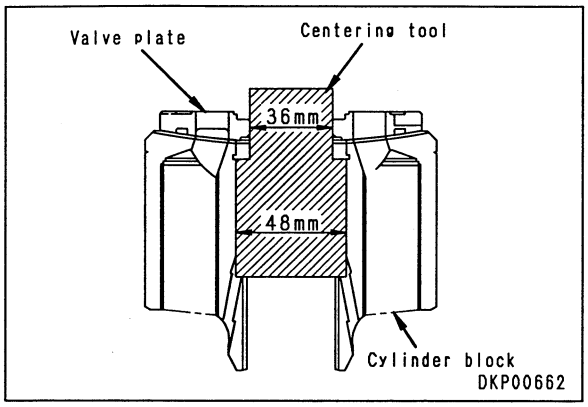
1) Remove all oil and grease from the parts to be checked.
   ★ Do not wipe with a cloth.
2) Paint the cradle with inspection paint, then put the rocker cam on top.
   ★ Coat thinly with paint.
   ★ Install in the direction shown in the diagram on the right.
3) Push the rocker cam with a force of 39.2 – 49.0 N {4 – 5 kg}, and move it between the maximum swash plate angle and the position on the opposite side where it contacts the stopper. Repeat this process 2 or 3 times.
4) Remove the rocker cam, transfer the contact surface to a tape, and check the contact surface.
   ★ The standard for the contact is as given below.
   (i) Within 32 – 44 mm of center (center portion): Contact of more than 90%
   (ii) Range from center portion (32 – 44 mm) to 60 mm: Contact of 50% – 90%
   (iii) Not within width of 60 mm (outside): Contact of less than 50%
   (It is not permitted to have contact only at the outside and no contact at the center.)
   ★ If the contact is defective and lapping is carried out, it must always be carried out for both parts together.

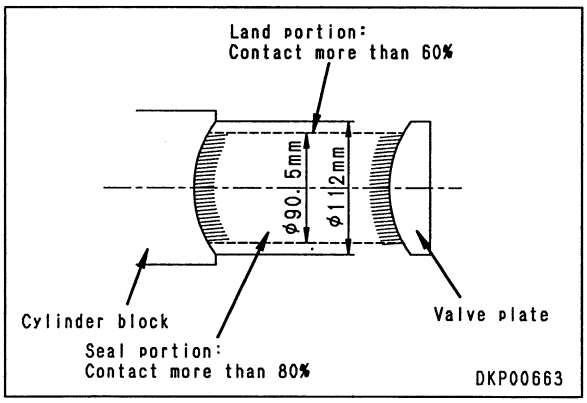




2. Cylinder block and valve plate

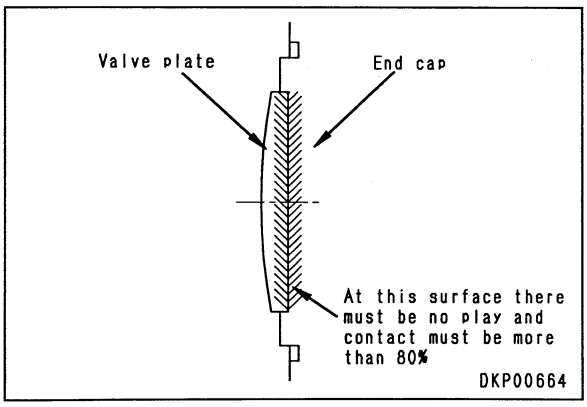
1) Make a centering tool for the cylinder block and valve plate.
   ★ The tool can be made from plastic, bakelite or any other soft material.
2) Remove all oil and grease from the parts to be checked.
   ★ Do not wipe with a cloth.
3) Paint the cylinder block with inspection paint, then put the tool and valve plate on top.
   ★ Coat thinly with paint.
4) Push the valve plate with a force of 39.2 – 49.0 N {4 – 5 kg} against the cylinder block, turn the valve plate 90°, then turn it back to the original position. Repeat this process 2 or 3 times.
5) Remove the valve plate, transfer the contact surface to a tape, and check the contact surface.
   ★ The standard for the contact is as given below.
   (i) Seal portion (range of ø 90.5 mm from bottom): Contact of more than 80% and no break around whole circumference
   (ii) Land portion (range of ø 90.5 mm – ø 112 mm): Contact of more than 60% and no break around whole circumference





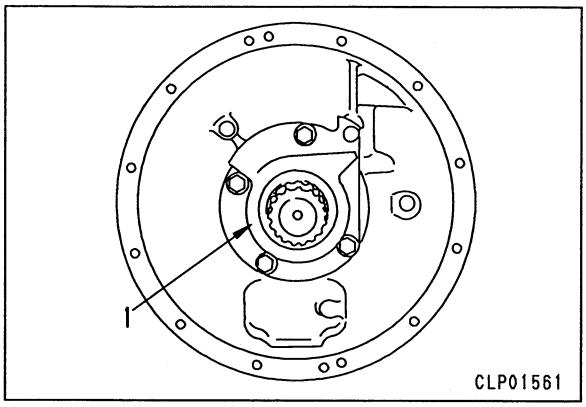
3. Valve plate and end cap

1) Remove all oil and grease from the parts to be checked.
   ★ Do not wipe with a cloth.
2) Paint the end cap with inspection paint, then put the valve plate on top.
   ★ Coat thinly with paint.
3) Push the valve plate with a force of 39.2 – 49.0 N {4 – 5 kg} against the end cap, turn the valve plate 90°, then turn it back to the original position. Repeat this process 2 or 3 times.
4) Remove the valve plate, transfer the contact surface to a tape, and check the contact surface.
   ★ The contact of the mating surface of the valve plate and end cap must cover at least 80% without any variation.
   ★ If the contact is defective, use a surface plate and correct by lapping.



REMOVAL OF MAIN PUMP INPUT SHAFT OIL SEAL

1. Remove main pump assembly. For details, see REMOVAL OF MAIN PUMP ASSEMBLY.
2. Remove bearing case assembly (1). ※ 1
3. Remove snap ring (2), then remove spacer (3).
4. Lever up oil seal (4) with a screwdriver and remove it. ※ 2
   ★ When removing the oil seal, be extremely careful not to damage the shaft.



INSTALLATION OF MAIN PUMP INPUT SHAFT OIL SEAL

- Carry out installation in the reverse order to removal.

※ 1

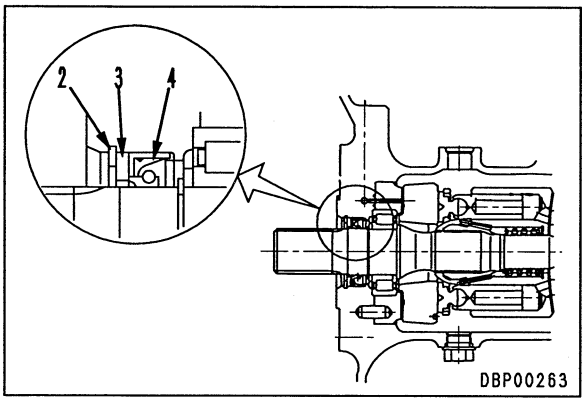
kgm Bearing cage mounting bolt :
110.3 ± 12.3 Nm {11.25 ± 1.25 kgm}

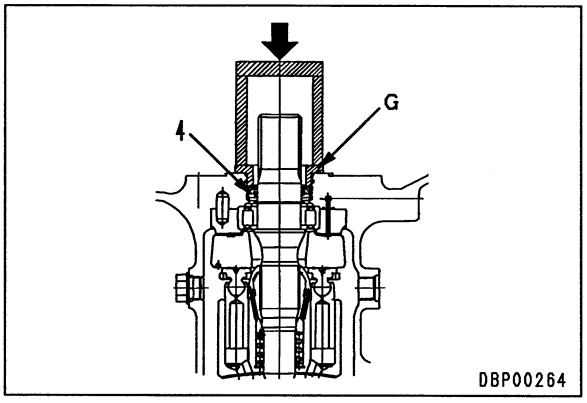
※ 2

Lip of oil seal : **Grease (G2-LI)**

Coat the outside circumference of the oil seal with grease (G2-LI) thinly, then press fit.

★ Using tool **G**, press fit oil seal (4).

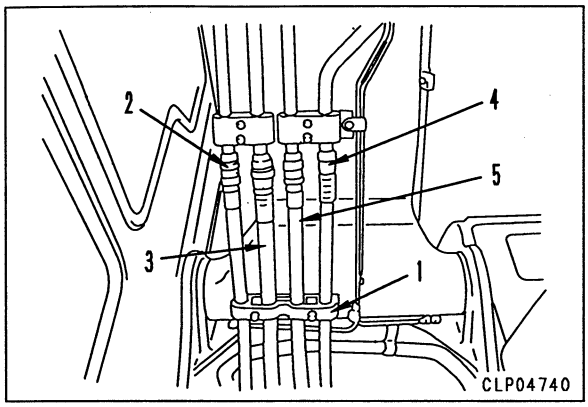




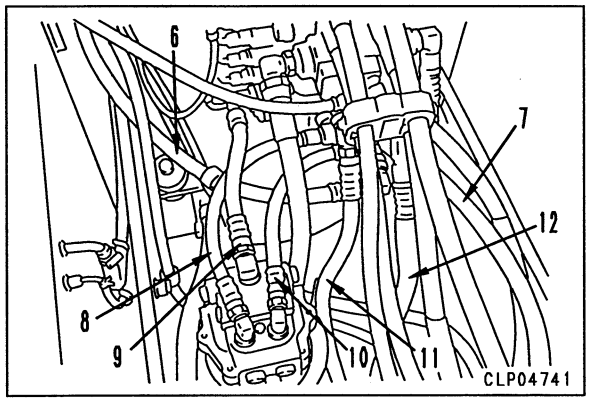
REMOVAL OF CONTROL VALVE ASSEMBLY

⚠ Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing pressure in hydraulic circuit.

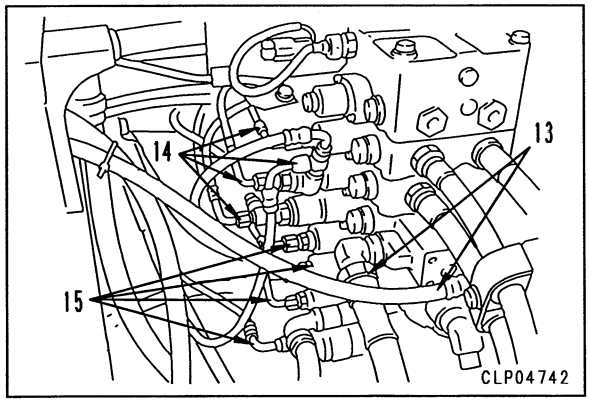
1. Remove engine room divider plate and chassis bodywork cover above control valve assembly.
2. Remove clamp (1), then disconnect hoses (2), (3), (4), and (5).



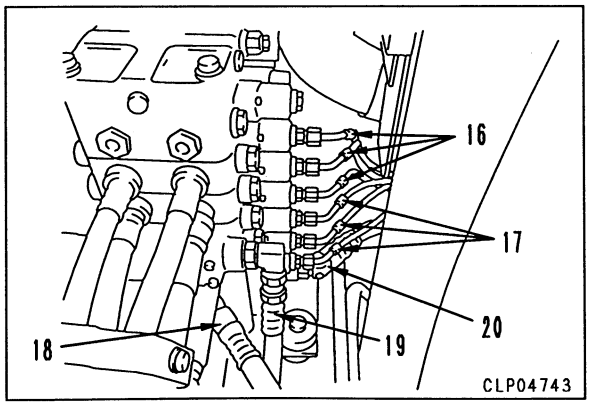
3. Disconnect hoses (6), (7), (8), (9), (10), (11), and (12).



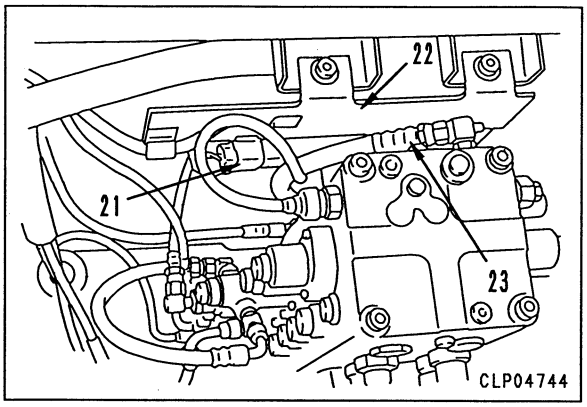
4. Disconnect hoses (13), (14), and (15).



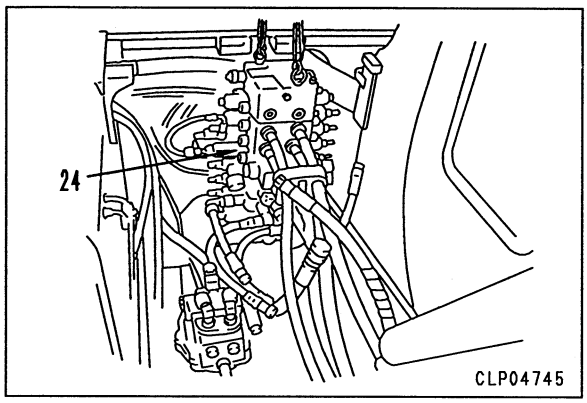
5. Disconnect hoses (16), (17), (18), (19), and (20).



6. Remove connector (21) from clip, then disconnect it.
7. Remove wiring harness bracket (22).
8. Disconnect hose (23).



9. Remove mounting bolts, and lift off control valve assembly (24).
   kg Control valve assembly : **100 kg**



INSTALLATION OF CONTROL VALVE ASSEMBLY

- 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.
- **Bleeding air**
  ★ Bleed the air from the circuit between the valve and the hydraulic cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.

DISASSEMBLY OF CONTROL VALVE ASSEMBLY

★ After the machine is stopped, the circuit of the safety-suction valve remains under pressure for some time, so loosen pressure release plug (108) to release the pressure.

★ The set pressure of the safety valve cannot be adjusted when it is installed on the machine, so do not disassemble.

★ The spools, flow control valves, and reducing valves are not interchangeable. They must also be installed facing in the correct direction, so mark them before removing them.

1. **Main relief valve, safety-suction valve, LS select valve, suction valve, unload valve**
   Remove main relief valve assembly (1), safety-suction valve assembly (2), LS select valve assembly (3), suction valve assemblies (4) - (13), and unload valve assembly (14).

2. **Lift check valve, cooler bypass valve**
   1) Remove case (15), then remove spring (16), piston (17), and sleeve (18).

   2) Remove case (18), then remove spring (20), piston (21), and sleeve (22).

3. **Swing control valve**
   1) Remove cases (23) and (24), then remove spring (25) and retainer (26).

   2) Remove spool assembly (27).
      ★ Do not disassemble spool assembly (27).

4. **Swing bleed valve**
   1) Remove flange (28).

   2) Remove plug (29), then remove spring (30) and spool (31).

   3) Remove plug (32), then remove ball (33).

5. **L.H. travel control valve, R.H. travel control valve**
   1) Remove cases (34) and (35), then remove spring (36) and retainer (37).

   2) Remove spool (38).

6. **Travel junction valve**
   1) Remove plug (39), then remove spring (40), retainer (41), and spool (42).

   2) Remove plug (43), then remove ball (44).

7. **Boom control valve**
   1) Remove cases (45) and (46), then remove springs (47) and (48), and retainers (49) and (50).

   2) Remove spool assembly (51).
      ★ Do not disassemble spool assembly (51).

8. **Boom holding valve**
   ★ When removing the boom holding valve assembly from the valve body, remove mounting bolts (52) – (57).
   Bolt (58) is for temporarily holding plate (59).

   ★ When removing valve (60) and piston (61) without removing the boom holding valve assembly from the body, remove mounting bolts (52) – (55) and (58), then remove plate (59).

   1) Remove plate (59), then remove spring (62), piston (63), spring (64), valve (60) and spring (65), and piston (66).

   2) Remove plug (67), then remove sleeve (68).

9. **Arm control valve**
   1) Remove cases (69) and (70), then remove springs (71) and (72), and retainers (73) and (74).

   2) Remove spool assembly (75).

10. **Arm regeneration valve**
    1) Remove plug (76), then remove spring (77) and valve (78).

11. **Bucket control valve**
    1) Remove case (79), then remove spring (80) and retainer (81).

    2) Remove spool assembly (82).
       ★ Do not disassemble spool assembly (82).

12. Service control valve

1) Remove case (83), then remove spring (84) and retainer (85).

2) Remove spool assembly (86).
   ★ Do not disassemble spool assembly (86).

13. Pressure compensation valves

★ Before removing any pressure compensation valve, check and mark its mounting position.

1) Remove variable pressure compensation valve (87), bucket CURL pressure compensation valve (88), arm IN pressure compensation valve (89), boom LOWER pressure compensation valve (90), R.H. travel REVERSE pressure compensation valve (91), L.H. travel REVERSE pressure compensation valve (92), and right swing pressure compensation valve (93).

2) Remove service pressure compensation valve (94), bucket DUMP pressure compensation valve (95), arm OUT pressure compensation valve (96), boom RAISE pressure compensation valve (97), R.H. travel FORWARD pressure compensation valve (98), L.H. travel FORWARD pressure compensation valve (99), and left swing pressure compensation valve (100).

★ After removing the pressure compensation valves, remove the check valve from each pressure compensation valve mount.

14. Combination studs (service valve added)

★ When adding a service valve, there is no need to disassemble any other place.

1) Remove nuts (101) – (104), then remove 4 combination studs (105).

2) Remove cover (106).

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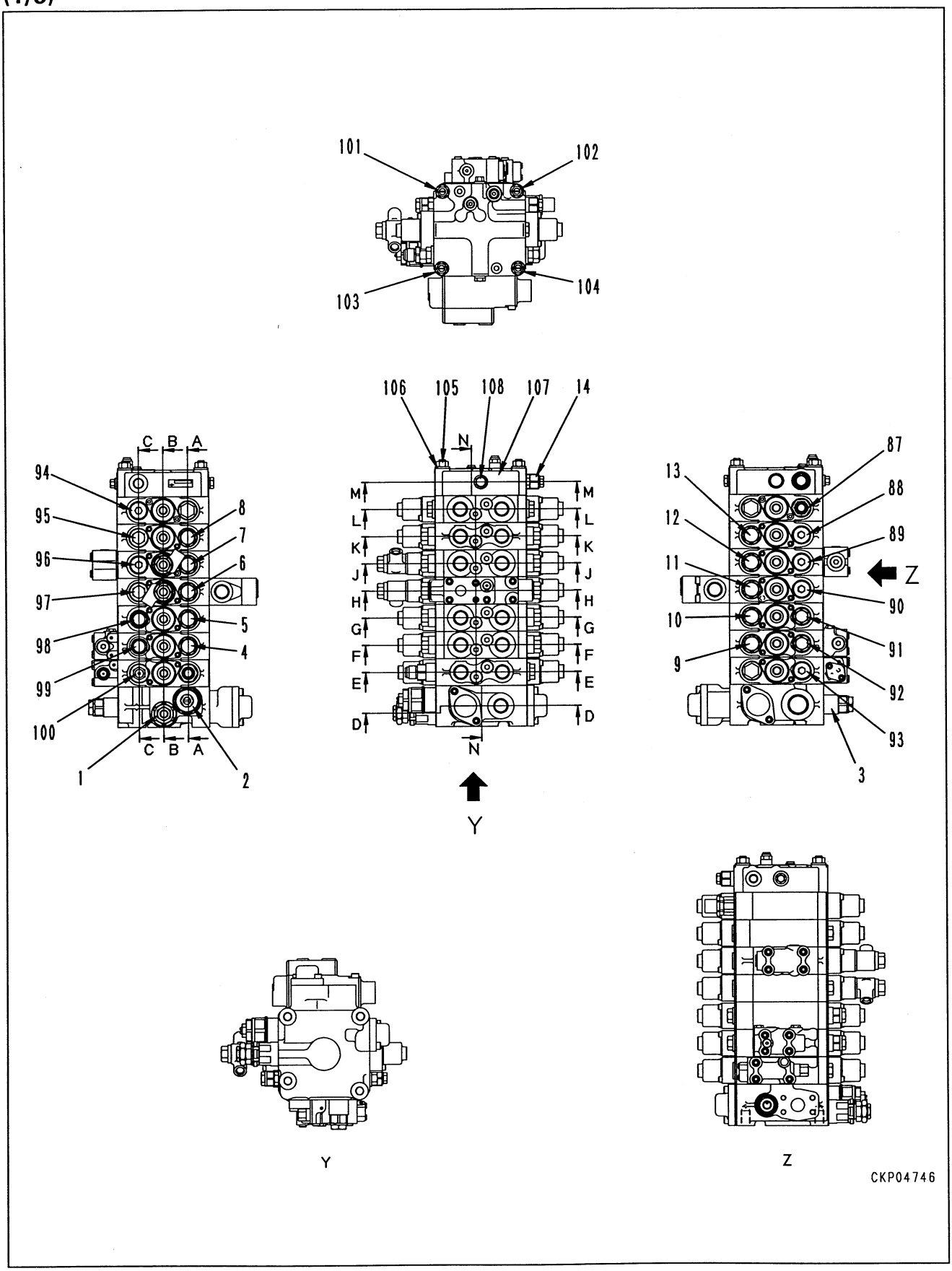
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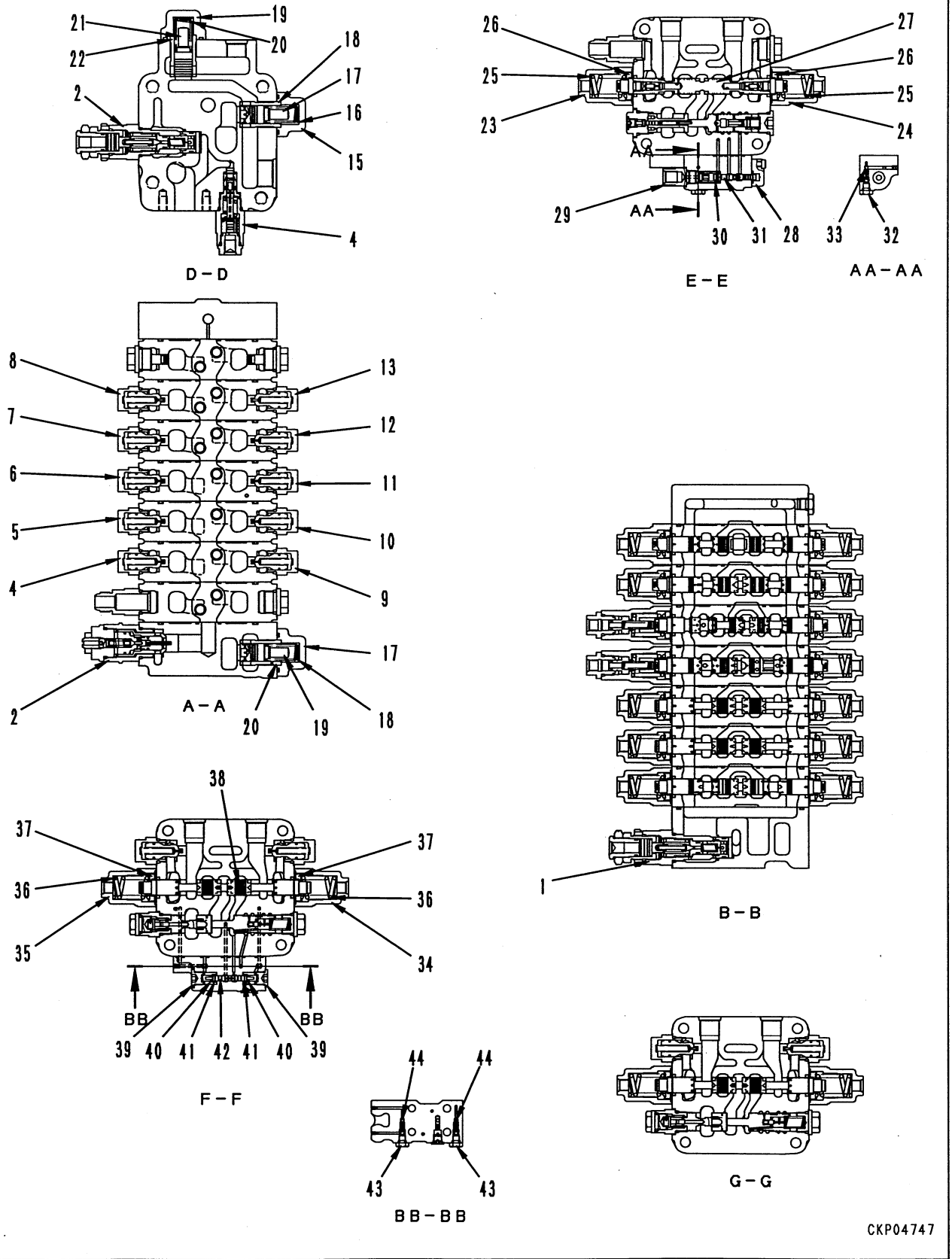
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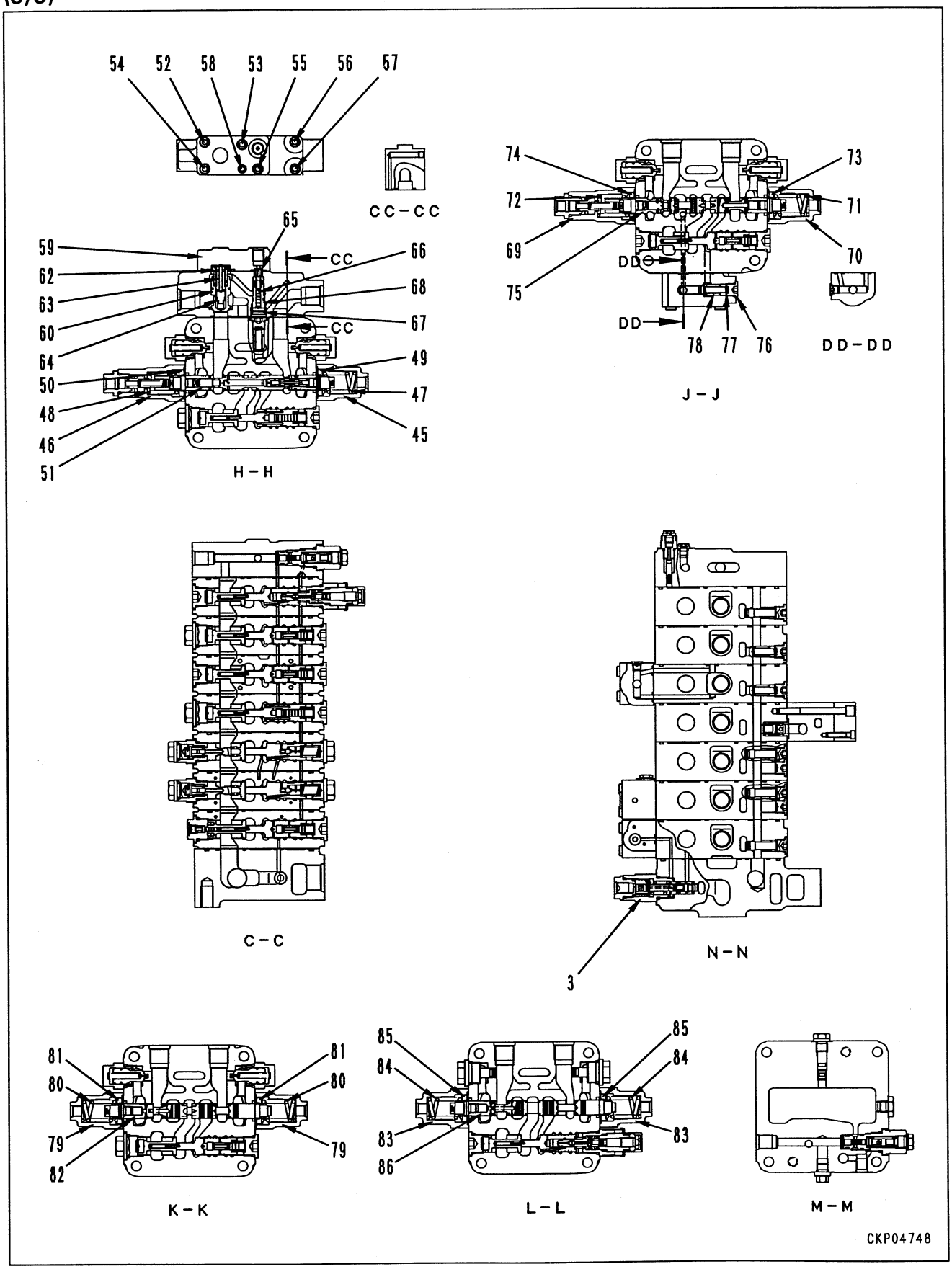
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ASSEMBLY OF CONTROL VALVE ASSEMBLY

- Coat the sliding surface with engine oil before assembling.

1. Combination studs (service valve added)

1) Temporarily tighten combination studs for adding service valve.

2) Install service valve stack.

3) Install cover (107).

4) Install washer (106), and tighten nuts (101) – (104).
   ★ Divide into 3 passes and tighten in the order (101) → (104) → (103) → (102).
   1st pass: **64 ± 4.9 Nm {6.5 ± 0.5 kgm}**
   When doing this, check that the height from the top end face of the nut to the top end face of the stud is 0.5 - 3 mm. If the height is not within this range, loosen the nut and use the slot in the top end face of the stud to adjust.
   2nd pass: **83.36 ±4.9 Nm {8.5 ± 0.5 kgm}**
   3rd pass: **105.42 ± 7.4 Nm {10.75 ± 0.75 kgm}**
   Check again that the height from the top end face of the nut to the top end face of the stud is 0.5 – 3 mm.

2. Pressure compensation valve

★ Check marks made on each pressure compensation valve when disassembling, and install pressure compensation valves in correct position.

1) Before installing pressure compensation valves below, install check valves.

2) Fit O-rings, then install left swing pressure compensation valve (100), L.H. travel FORWARD pressure compensation valve (99), R.H. FORWARD pressure compensation valve (98), boom RAISE pressure compensation valve (97), arm OUT pressure compensation valve (96), bucket DUMP pressure compensation valve (95), and service pressure compensation valve (94).

3) Fit O-rings, then install right swing pressure compensation valve (93), L.H. travel REVERSE pressure compensation valve (92), R.H. REVERSE pressure compensation valve (91), boom LOWER pressure compensation valve (90), arm IN pressure compensation valve (89), bucket CURL pressure compensation valve (88), and variable pressure compensation valve (87).

kgm Pressure compensation valves (88) – (94), (96) :
166.6 ± 19.6 Nm {17 ± 2 kgm}

kgm Pressure compensation valves (87), (95), (97), (100) :
218.20 ± 22.06 Nm {22.25 ± 2.25 kgm}

kgm Pressure compensation valves (98), (99) :
110.32 ± 12.26 Nm {11.25 ± 1.25 kgm}

3. Service control valve

1) Assemble spool assembly (86) to valve body.

2) Assemble retainer (85) and spring (84), then fit O-ring to case (83) and install.

kgm Case mounting bolt :
13.24 ± 1.47 Nm {1.35 ± 0.15 kgm}

4. Bucket control valve

1) Assemble spool assembly (82) to valve body.

2) Assemble retainer (81) and spring (80), then fit O-ring to case (79) and install.

kgm Case mounting bolt :
13.24 ± 1.47 Nm {1.35 ± 0.15 kgm}

5. Arm regeneration valve

1) Assemble arm regeneration valve (78) and spring (77).

2) Fit O-ring to plug (76) and install.

kgm Plug :
56.39 ± 7.35 Nm {5.75 ± 0.75 kgm}

6. Arm control valve

1) Assemble spool assembly (75) to valve body.

2) Assemble retainers (73) and (74), and springs (71) and (72), then fit O-rings to cases (69) and (70) and install.

kgm Case mounting bolt :
13.24 ± 1.47 Nm {1.35 ± 0.15 kgm}

7. Boom holding valve

1) Install sleeve (68) and plug (67).

2) Assemble piston (66), spring (65) and valve (60), spring (64), piston (63), and spring (62), and install plate (59).

kgm Plate mounting bolt :
30.89 ± 3.43 Nm {3.15 ± 0.35 kgm}

8. Boom control valve

1) Assemble spool assembly (51) to valve body.

2) Assemble retainers (49) and (50), and springs (47) and (48), then fit O-rings to cases (45) and (46) and install.

kgm Case mounting bolt :
13.24 ± 1.47 Nm {1.35 ± 0.15 kgm}

9. Travel junction valve

1) Assemble ball (44) to valve body, then fit O-ring to plug (43) and tighten.

kgm Plug :
7.35 ± 1.47 Nm {0.75 ± 0.15 kgm}

2) Assemble spool (42), retainer (41), and spring (40), then fit O-ring to plug (39) and tighten.

kgm Plug :
55.90 ± 6.86 Nm {5.7 ± 0.7 kgm}

10. L.H. travel control valve, R.H. travel control valve

1) Assemble spool assembly (38) to valve body.

2) Assemble retainer (37) and spring (36), then fit O-rings to cases (34) and (35) and install.

kgm Case mounting bolt :
13.24 ± 1.47 Nm {1.35 ± 0.15 kgm}

11. Swing bleed valve

1) Assemble ball (33) to valve body, then fit O-ring to plug (32) and tighten.

kgm Plug :
7.35 ± 1.47 Nm {1.35 ± 0.15 kgm}

2) Assemble spool (31) and spring (30), then fit O-ring to plug (29) and tighten.

kgm Plug :
29.4 ± 4.90 Nm {3 ± 0.5 kgm}

3) Install flange (28).

kgm Flange mounting bolt :
13.24 ± 1.47 Nm {1.35 ± 0.15 kgm}

12. Swing control valve

1) Assemble spool assembly (27) to valve body.

2) Assemble retainer (26) and spring (25), then fit O-rings to cases (23) and (24) and install.

kgm Case mounting bolt :
13.24 ± 1.47 Nm {1.35 ± 0.15 kgm}

13. Lift check valve, cooler bypass valve

1) Assemble sleeve (22), piston (21), and spring (20) to valve body.

2) Fit O-ring to case (19) and install.

kgm Case mounting bolt :
13.24 ± 1.47 Nm {1.35 ± 0.15 kgm}

3) Assemble sleeve (18), piston (17), and spring (16) to valve body.

4) Fit O-ring to case (15) and install.

kgm Case mounting bolt :
13.24 ± 1.47 Nm {1.35 ± 0.15 kgm}

14. Main relief valve, safety-suction valve, LS select valve, suction valve, unload valve

1) Fit O-ring and install main relief valve assembly (1).

kgm Main relief valve assembly :
98.1 ± 9.8 Nm {10 ± 1 kgm}

2) Fit O-ring and install safety-suction valve assembly (2).

kgm Safety-suction valve assembly :
186.3 ± 9.8 Nm {19 ± 1 kgm}

3) Fit O-ring and install LS select valve assembly (3).

kgm LS select valve assembly :
127.5 ± 19.6 Nm {13 ± 2 kgm}

4) Fit O-ring and install suction valve assemblies (4) – (13).

kgm Suction valve assembly :
147.1 ± 9.8 Nm {15 ± 1 kgm}

5) Fit O-ring and install unload valve assembly (14).

kgm Unload valve assembly :
166.7 ± 19.6 Nm {17 ± 2 kgm}

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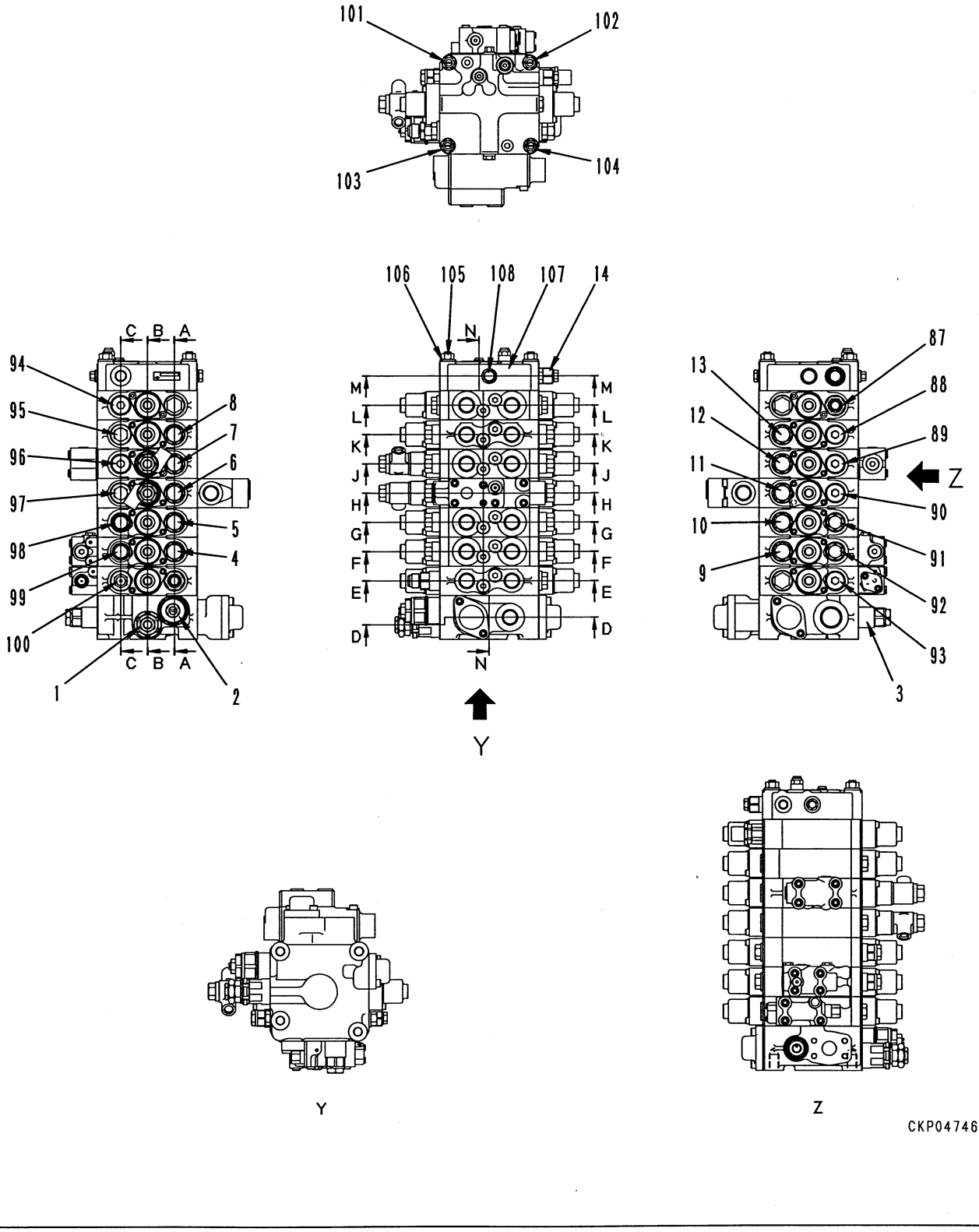
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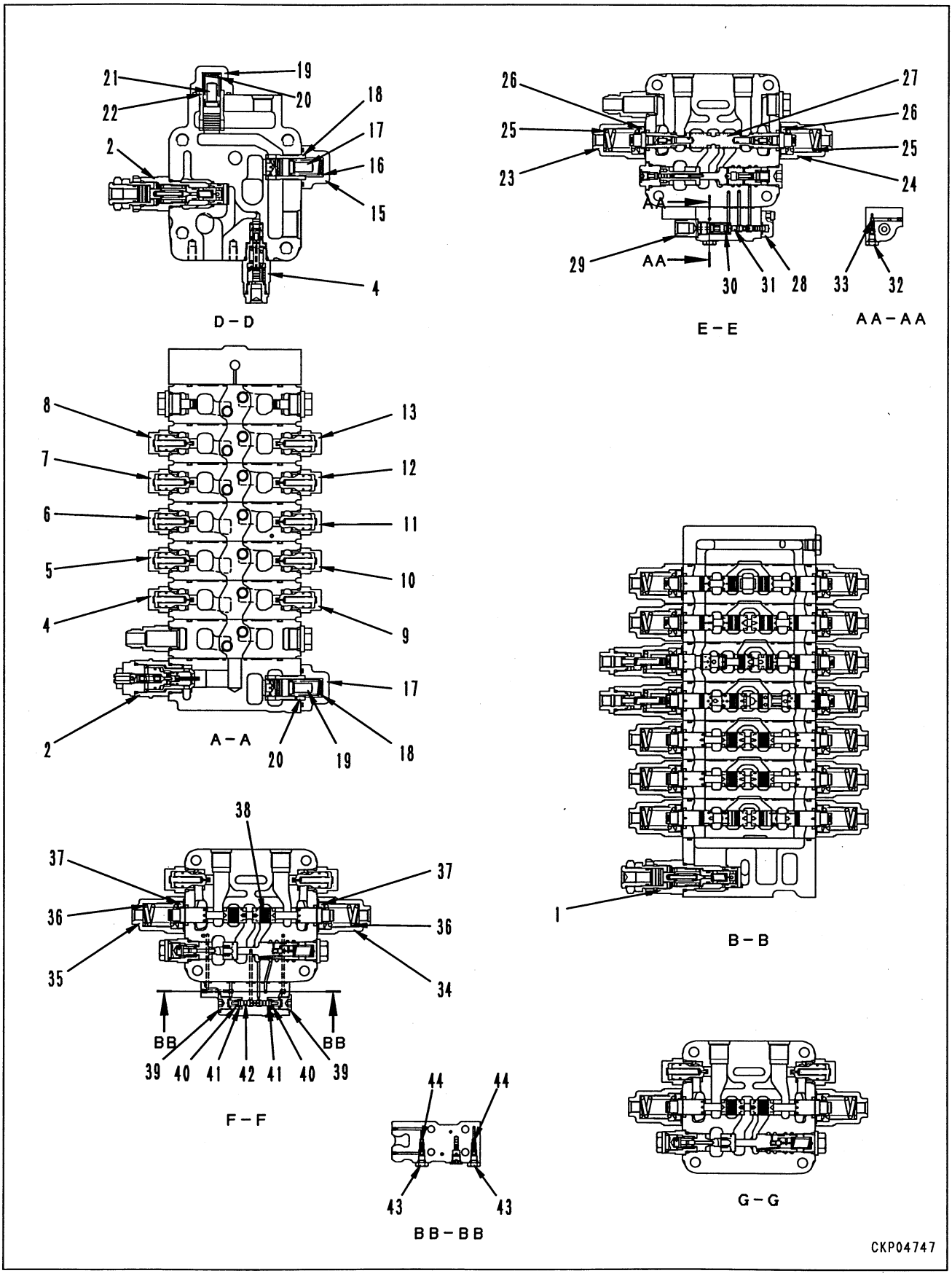
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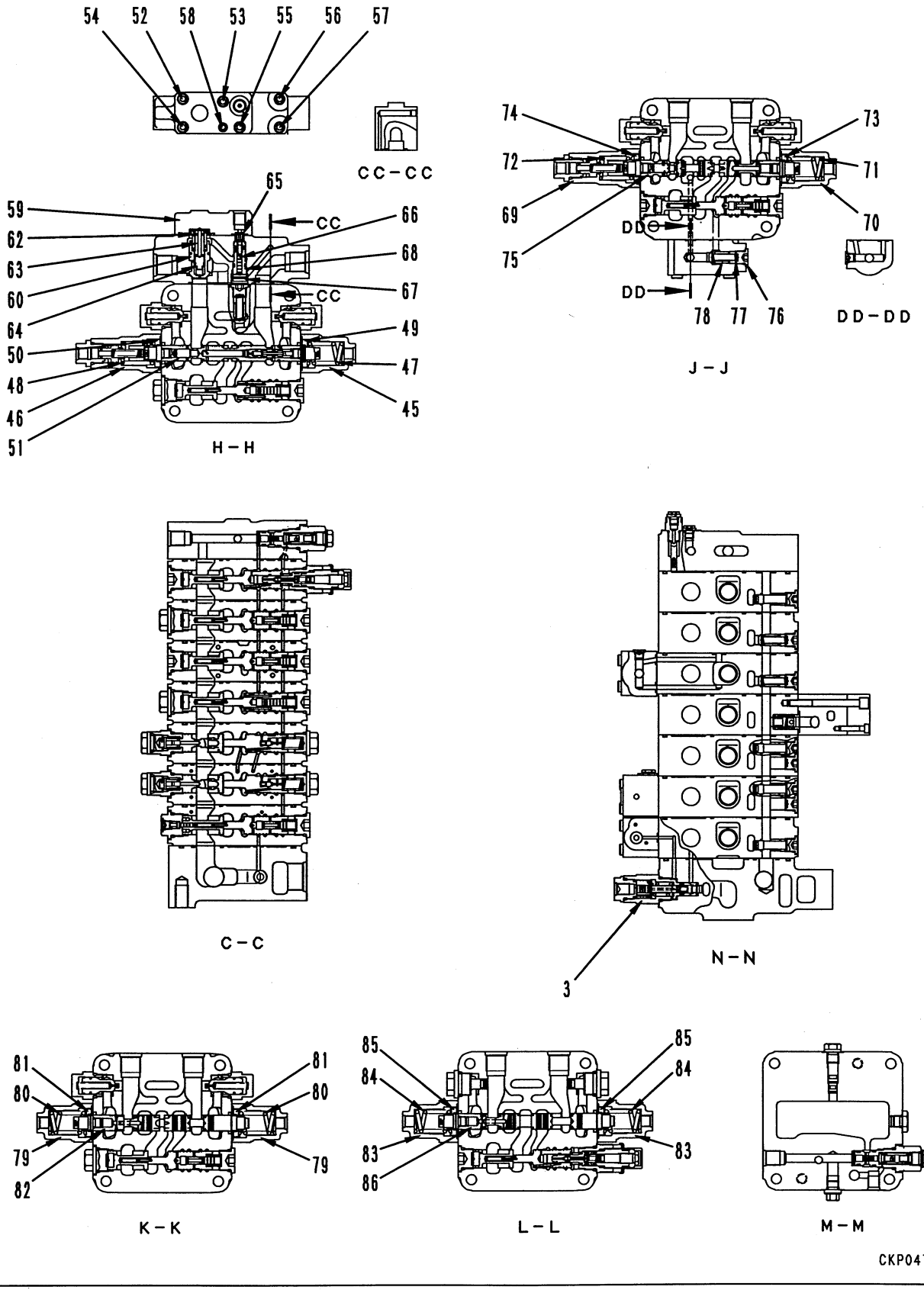
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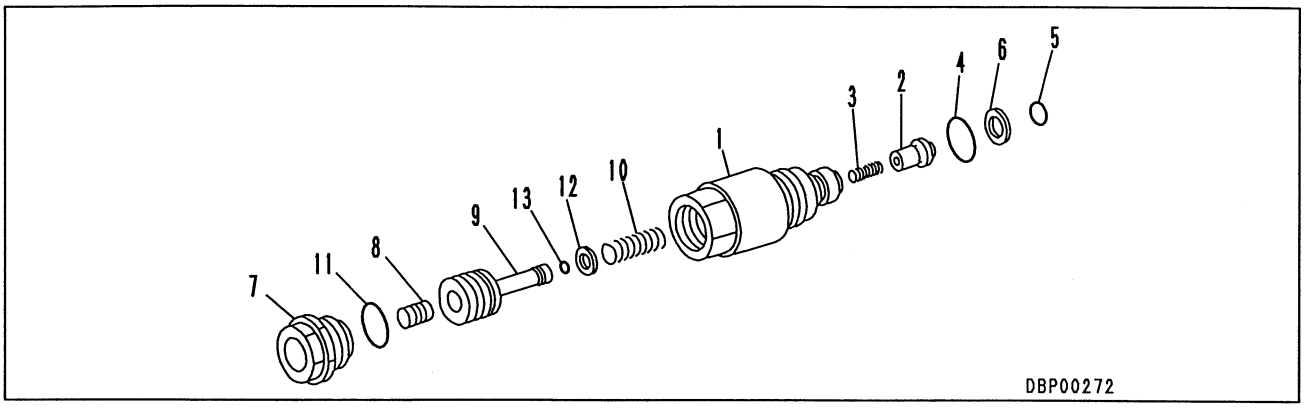
DISASSEMBLY OF LS SELECT VALVE



1. Remove sleeve (2) and spring (3) from sleeve (1).
2. Remove O-rings (4) and (5), and seal (6) from sleeve (1).
3. Remove plug (7), then remove pistons (8) and (9), and spring (10).
4. Remove O-ring (11) from plug (7), then remove seal (12) and O-ring (13) from piston (9).
   ★ After disassembling, if there is any abnormality in any part except O-rings (4), (5), (11), or seal (6), replace the whole LS select valve assembly.

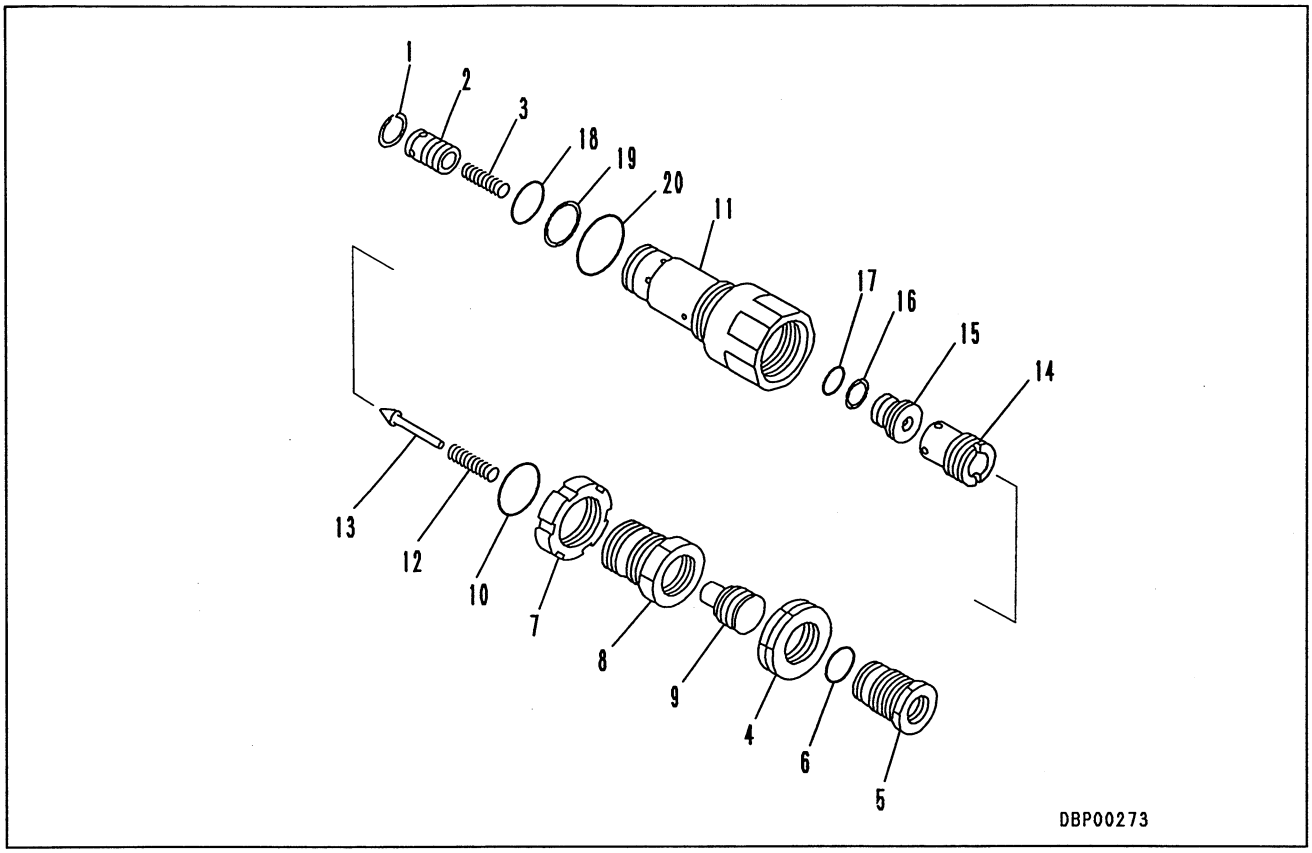
ASSEMBLY OF LS SELECT VALVE

- Before assembling, coat the sliding surface with engine oil.

1. Install O-ring (13) and seal (12) to piston (9), then assemble piston (8) and spring (10), and install to sleeve (1).
2. Assemble O-ring (11) to plug (7) and install to sleeve (1).

   kgm Plug : **68.7 ± 9.8 Nm {7 ± 1 kgm}**
3. Assemble spring (3) to sleeve (2), and install to sleeve (1).
4. Install O-rings (4) and (5), and seal (6) to sleeve (1).

DISASSEMBLY OF MAIN RELIEF VALVE ASSEMBLY



1. Remove ring (1), then remove valve (2) and spring (3).

2. Loosen nut (4) and remove plug (5), then remove O-ring (6) and nut (4) from plug (5).

3. Loosen nut (7) and remove holder (8), then remove retainer (9), O-ring (10), and nut (7) from holder (8).

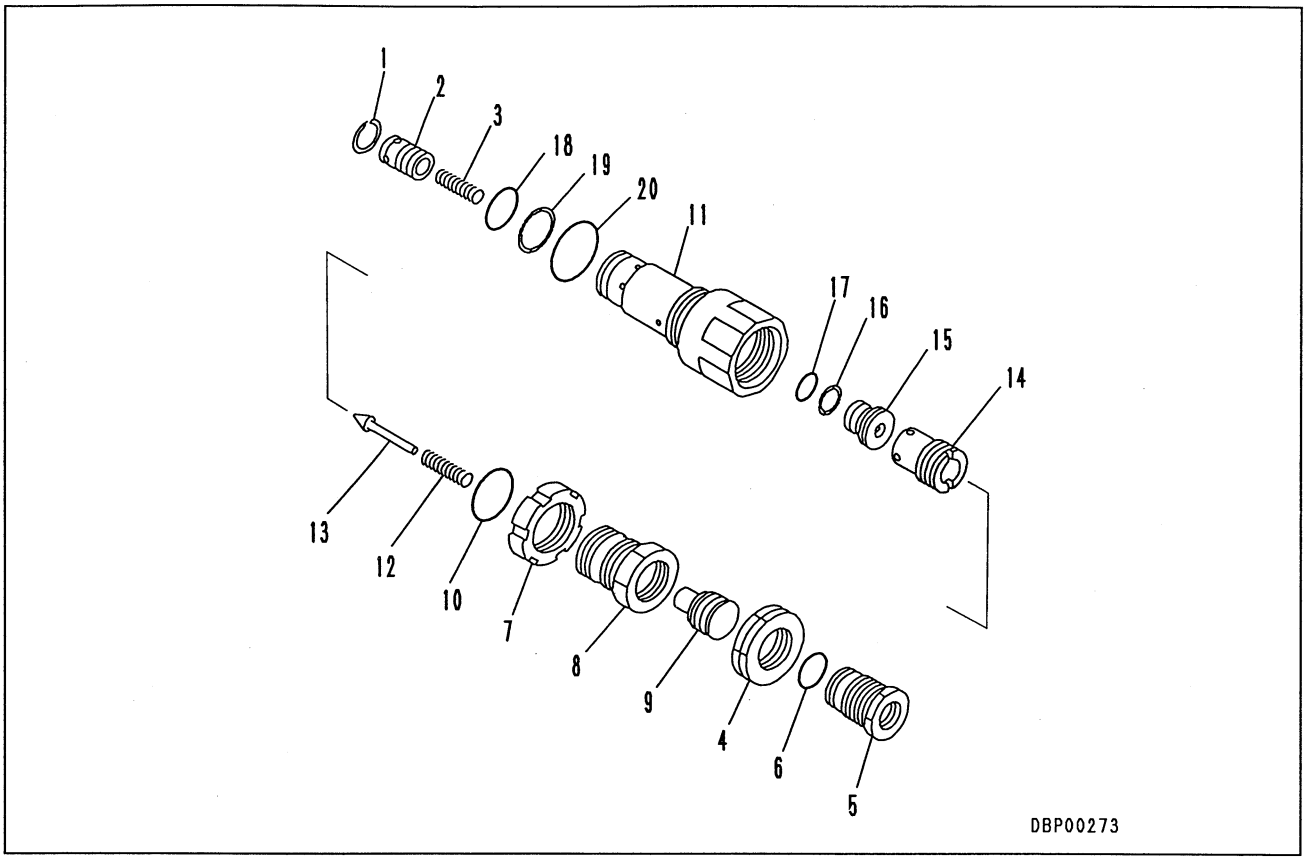
4. Remove spring (12) and poppet (13) from sleeve (11), then remove sleeve (14) and seat (15).

5. Remove ring (16) and O-ring (17) from seat (15).

6. Remove O-ring (18), seal (19), and O-ring (20) from sleeve (11).

★ After disassembling, if there is any abnormality in valve (2), holder (8), retainer (9), sleeve (14), seat (15), ring (16), O-ring (17), or sleeve (11), replace the whole main relief valve assembly.

ASSEMBLY OF MAIN RELIEF VALVE ASSEMBLY



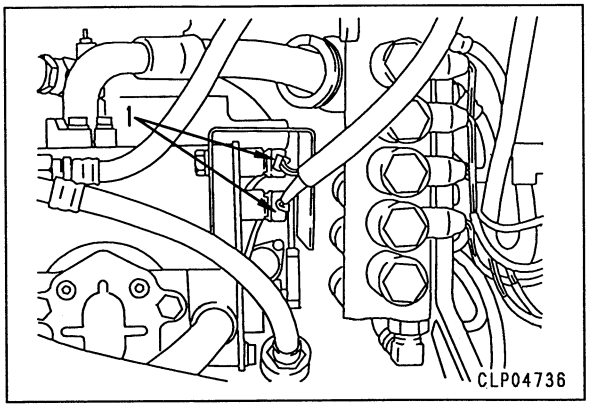
- Before assembling coat the sliding surface with engine oil.

1. Install O-ring (17) and ring (16) to seat (15), and assemble sleeve (11).
2. Assemble sleeve (14) to sleeve (11).
3. Install nut (7) and O-ring (10) to holder (8), then assemble retainer (9), poppet (13), and spring (12), and install to sleeve (11).
   ★ Set contact surface of seat (15) and poppet (13) in position securely.
4. Assemble nut (4) and O-ring (6) to plug (5), and install to holder (8).
5. Assemble spring (3) and valve (2) to sleeve (11), and install ring (1).
6. Install O-rings (20) and (18) and seal (19) to sleeve (11).
7. Tighten nut (7) to specified torque.
   kgm Nut : **68.8 ± 4.9 Nm {6 ± 0.5 kgm}**
8. Tighten nut (4) to specified torque.
   kgm Nut : **44.1 ± 4.9 Nm {4.5 ± 0.5 kgm}**

★ After installing to the control valve assembly, adjust the pressure. For details, see TESTING AND ADJUSTING, Testing and adjusting oil pressure of work equipment, swing, and travel circuits.

REMOVAL OF PC, LS-EPC VALVE ASSEMBLY

1. Remove bottom cover of main pump assembly.
2. Disconnect wiring connector (1).
3. Disconnect hoses (2) and (3).
4. Remove PC-EPC valve assembly (4) and LS-EPC valve assembly (3). ※ 1



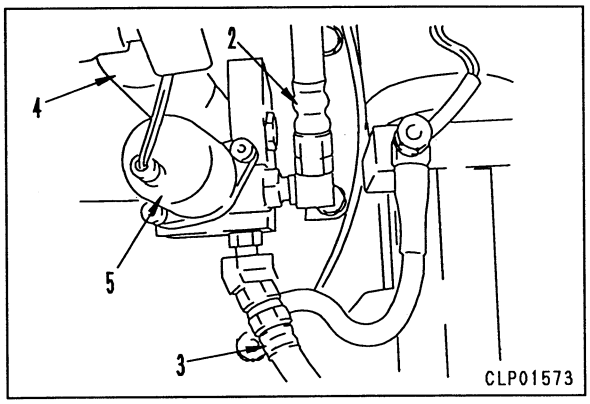
INSTALLATION OF PC, LS-EPC VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm PC, LS-EPC valve mounting bolt:
11.3 ± 1.5 Nm {1.15 ± 0.15 kgm}

kgm Hose nut:
66.2 ± 7.4 Nm {6.75 ± 0.75 kgm}



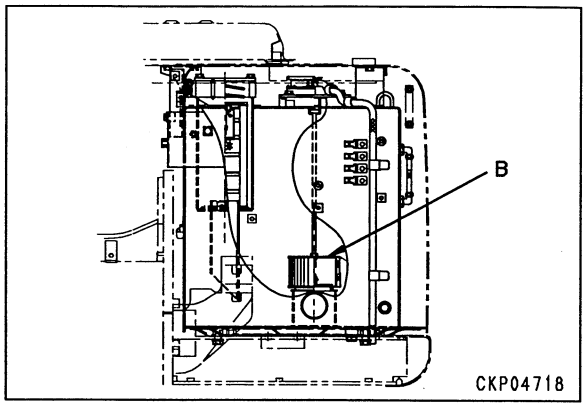
REMOVAL OF PC VALVE ASSEMBLY

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

⚠ Lower the work equipment completely to the ground and stop the engine. Then loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

- Remove the hydraulic tank strainer, and using tool **B**, stop the oil.
  - When not using tool **B**, remove the drain plug, and drain the oil from the hydraulic tank and inside the system.

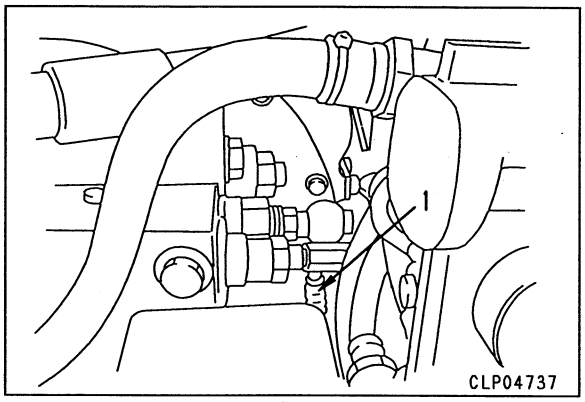
  Hydraulic tank : **Approx. 100 ℓ**



1. Disconnect hose (1). ※ 1

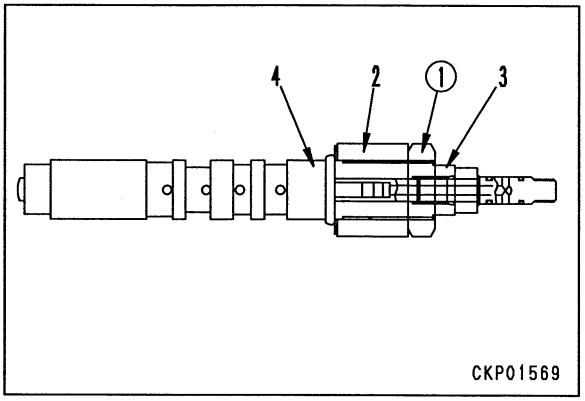
2. Install locknut ① (796-467-1140). ※ 2

   kgm Locknut :
   100.5 ± 12.3 Nm {10.25 ± 1.25 kgm}



3. Turn locknut (2) in direction of loosening, and tighten to locknut ① end. ※ 3
   ★ Turning angle for locknut (2): Approx. 30°

4. Fit wrench to hexagonal width across flats of sleeve (3), then loosen and remove PC valve assembly (4).



INSTALLATION OF PC VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm Hose locknut :
34.3 ± 4.9 Nm {3.5 ± 0.5 kgm}

※ 2

★ After installing the PC valve assembly, remove locknut ①.

※ 3

kgm Locknut (2) :
100.5 ±12.3 Nm {10.25 ± 1.25 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 OF LS VALVE ASSEMBLY

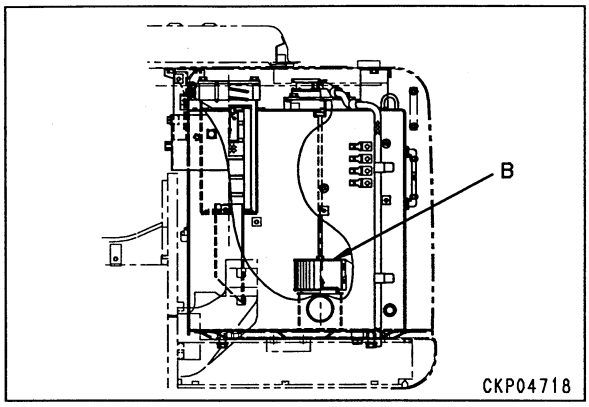
⚠ Disconnect the cable from the negative (–) terminal of the battery.

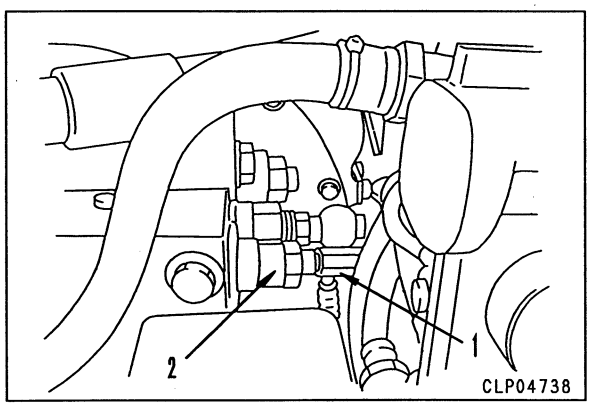
⚠ Lower the work equipment completely to the ground and stop the engine. Then loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

- Remove the hydraulic tank strainer, and using tool **B**, stop the oil.
  - When not using tool **B**, remove the drain plug, and drain the oil from the hydraulic tank and inside the system.

  Hydraulic tank : **Approx. 100 ℓ**

1. Disconnect hose (1).
2. Fit wrench to hexagonal width across flats of sleeve, then loosen and remove LS valve assembly (2). ※ 1





INSTALLATION OF LS VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm LS valve assembly :
139.7 ± 12.3 Nm {14.75 ± 1.25 kgm}

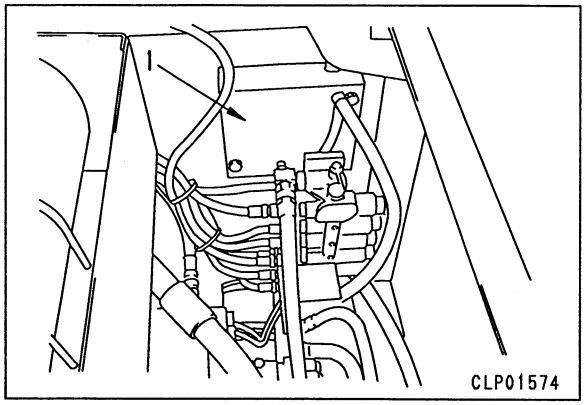
- **Refilling with oil (hydraulic tank)**
  - ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

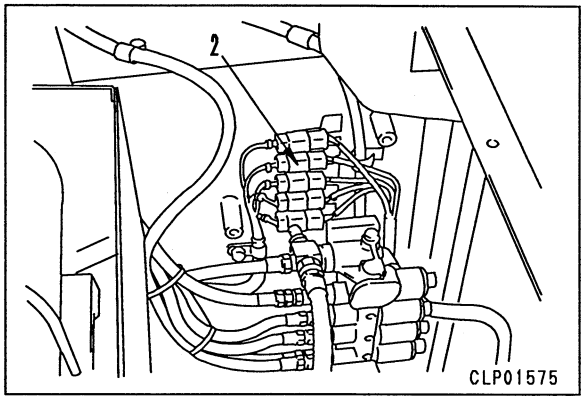
REMOVAL OF SOLENOID VALVE ASSEMBLY

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

1. Open R.H. side cover.
2. Remove wiring connector cover (1).
3. Remove 5 solenoid wiring connectors (2) from clip, then disconnect.
   ★ Mark the male and female ends of each connector with tags to prevent mistakes when connecting.
4. Disconnect 10 hoses (3).
   ★ Fit tags to the hoses.
5. Remove mounting bolts, then remove solenoid valve assembly (4).

- When removing solenoid valve as an individual part
  Remove mounting nut (5), then remove solenoid valve (6). ※ 1





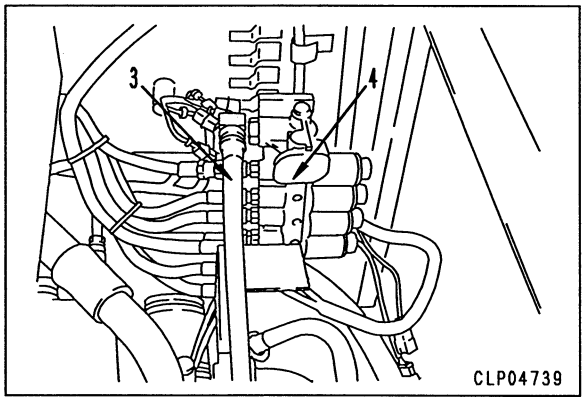
INSTALLATION OF SOLENOID VALVE ASSEMBLY

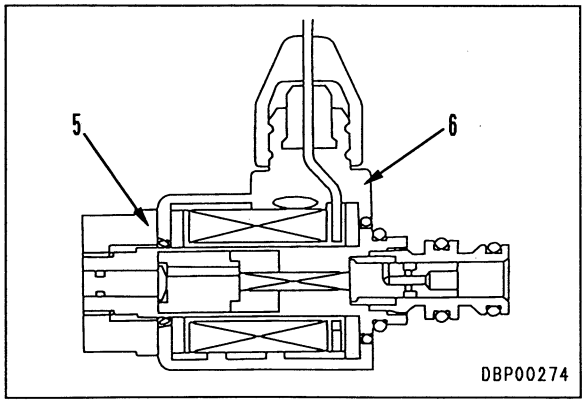
- Carry out installation in the reverse order to removal.

※ 1

kgm Mounting nut (5) :
4.9 ± 1.0 Nm {0.5 ± 0.1 kgm}

kgm Solenoid valve (6) (individual part) :
39.2 ± 9.8 Nm {4 ± 1 kgm}





REMOVAL OF WORK EQUIPMENT PPC VALVE ASSEMBLY

⚠ Lower the work equipment completely to the ground and stop the engine. Then loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

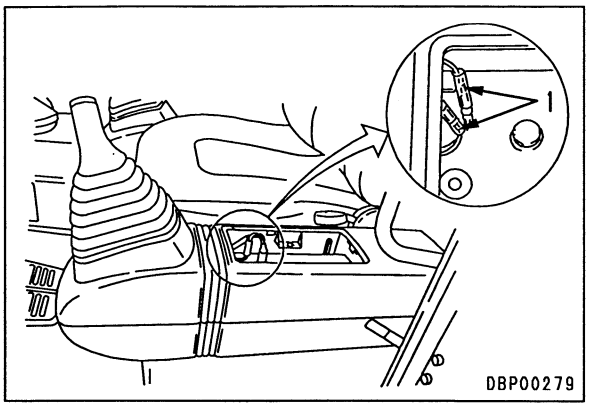
1. Remove cover, and disconnect wiring connector (1).

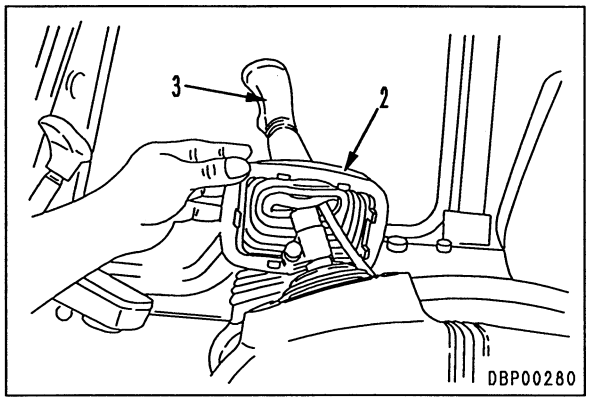
2. Remove boot (2) from cover, raise boot, then remove lever (3).
   ★ Mark the mounting position of the lever before removing.

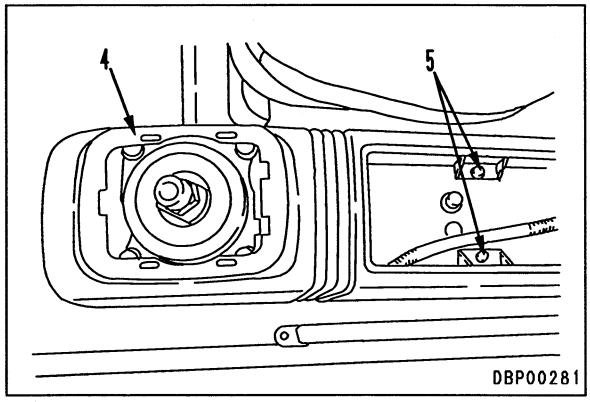
3. Remove 4 mounting bolts (5) of cover (4), then remove.
   ★ Remove the lock with a screwdriver and gradually lift the cover up to remove.

4. Remove joint bolt (6) and disconnect hose (7). ※ 1

5. Remove mounting bolts, raise PPC valve assembly (8), then disconnect hoses (9) and (10), and remove. ※ 2
   ★ Mark the connecting position of the hoses before disconnecting.







INSTALLATION OF WORK EQUIPMENT PPC VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

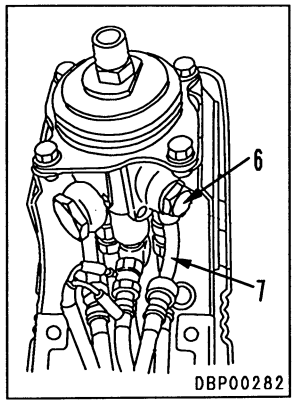
※ 1

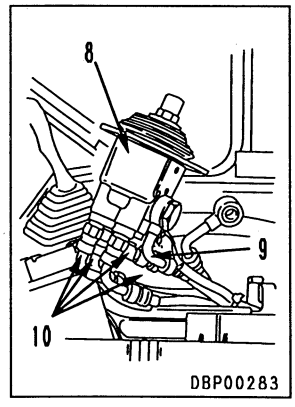
kgm Hose mounting joint bolt :
29.4 ± 4.9 Nm {3.0 ± 0.5 kgm}

※ 2

kgm Hose mounting joint bolt :
39.2 ± 4.9 Nm {4.0 ± 0.5 kgm}

★ If there is excessive play in the control levers, adjust the PPC valve. For details, see TESTING AND ADJUSTING, Adjusting PPC valve.





DISASSEMBLY OF WORK EQUIPMENT PPC VALVE ASSEMBLY

(PPC VALVE FOR BOOM, ARM, BUCKET, SWING CONTROL)

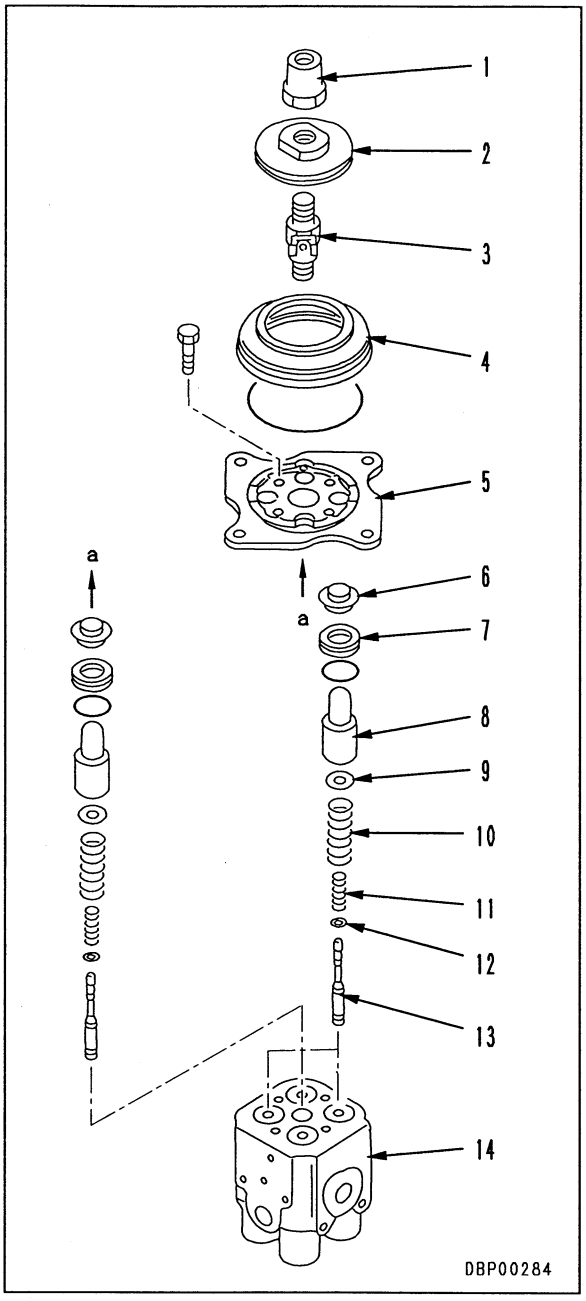
1. Remove nut (1), then remove disc (2) and boot (3).

2. Remove bolts, then remove plate (5).
   ★ Do not remove joint (4) unless it is to be replaced.

3. Remove seal (6) and collar (7).

4. Pull out piston (8), and remove retainer (9), springs (10) and (11), and shim (12).
   ★ Spring (10) consists of two sets of two types of springs with different installed loads, so check the mounting position (oil pressure port) and mark with tags to prevent mistakes when installing.

5. Pull out valve (13) from body (14).



ASSEMBLY OF WORK EQUIPMENT PPC VALVE ASSEMBLY

(PPC VALVE FOR BOOM, ARM, BUCKET, SWING CONTROL)

1. Assemble valve (13) to body (14).

2. Assemble shim (12) and spring (11) to valve (13).
   ★ When assembling spring (11), set the end with the small coil diameter (inside diameter) at shim (12) end.

3. Assemble spring (10), retainer (9), and piston (8).
   ★ The number of loops in the coil for spring (10) is different for each of the hydraulic ports below, so be careful when installing.

Position of port	Free length of spring
P1,P2	44.4 mm
P3,P4	42.4 MM

   ★ The position of each port is marked on the bottom of the valve body.

   Piston : **Grease (G2-LI)**

   ★ When assembling piston (8), coat the outside of the piston and the inside of the hole in the body with grease.

4. Fit O-ring to collar (7) and assemble in body (14), then install seal (6).

5. Install plate (5).

   kgm Mounting bolt :
   13.24 ± 1.47 Nm {1.35 ± 0.15 kgm}

6. Install joint (4).

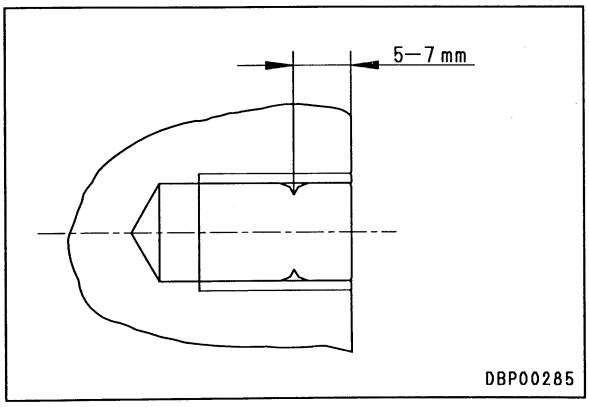
   Sliding portion of joint : **Grease (G2-LI)**

   Female thread of body :
   Thread tightener (LT-2)

   ★ Coat two places on the female thread with one drop each of Loctite as shown in the diagram on the right.

   kgm Joint : **44.1 ± 4.9 Nm {4.5 ± 0.5 kgm}**

   ★ Keep strictly to the tightening torque.



7. Assemble boot (3) and disc (2), and tighten with nut (1).

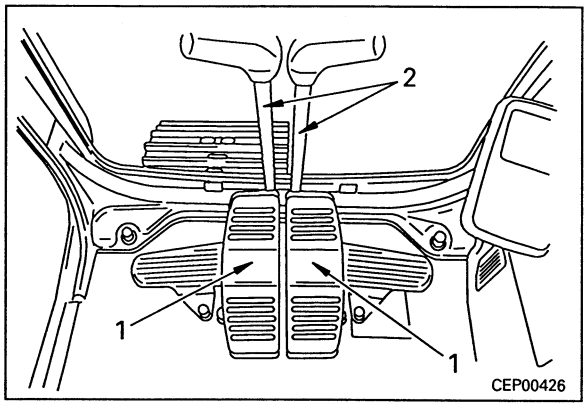
   kgm Nut : **112.8 ± 14.7 Nm {11.5 ± 1.5 kgm}**

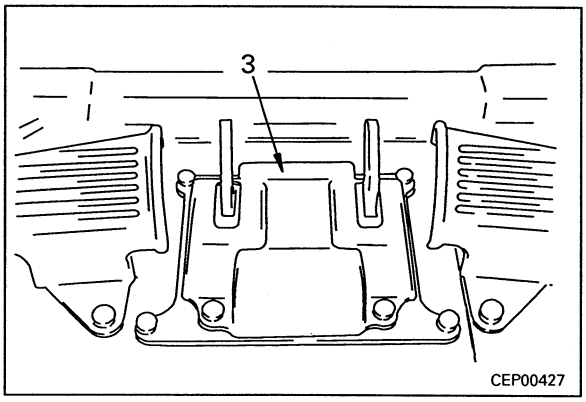
   ★ After assembling the disc, adjust the height of the disc. For details, see TESTING AND ADJUSTING, Adjusting PPC valve.

REMOVAL OF TRAVEL PPC VALVE ASSEMBLY

⚠ Lower the work equipment completely to the ground and stop the engine. Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank. Then set the safety lock lever to the LOCK position.

1. Remove travel PPC valve bottom cover.
2. Remove floor mat.
3. Remove pedals (1) and levers (2).
4. Remove cover (3). ※ 1
5. Remove covers (4), then remove springs (5).
6. Disconnect 6 PPC hoses (7), and remove travel PPC valve assembly (8). ※ 2





INSTALLATION OF TRAVEL PPC VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

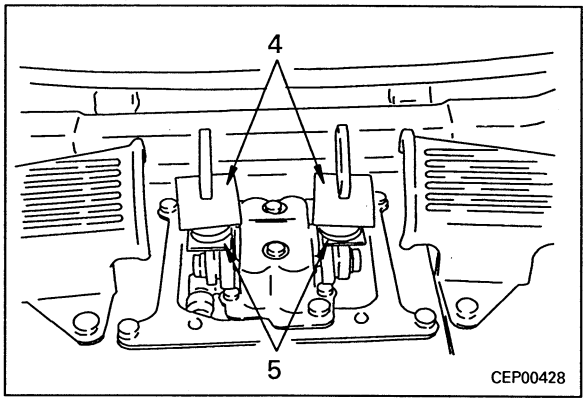
※ 1

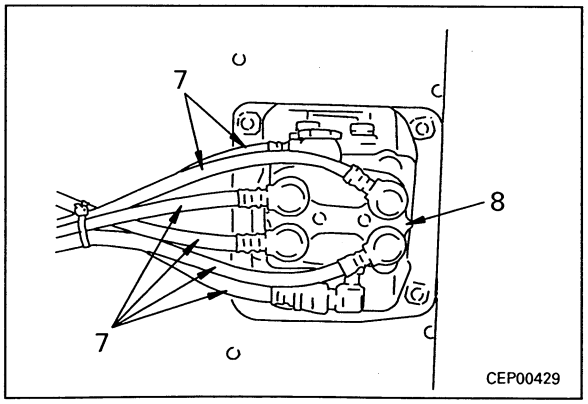
kgm Cover mounting bolt :
19.6 ± 2 Nm {2.0 ± 0.2 kgm}

※ 2

kgm Hose mounting joint bolt
(width across flats: 30mm) :
39.2 ± 4.9 Nm {4.0 ± 0.5 kgm}

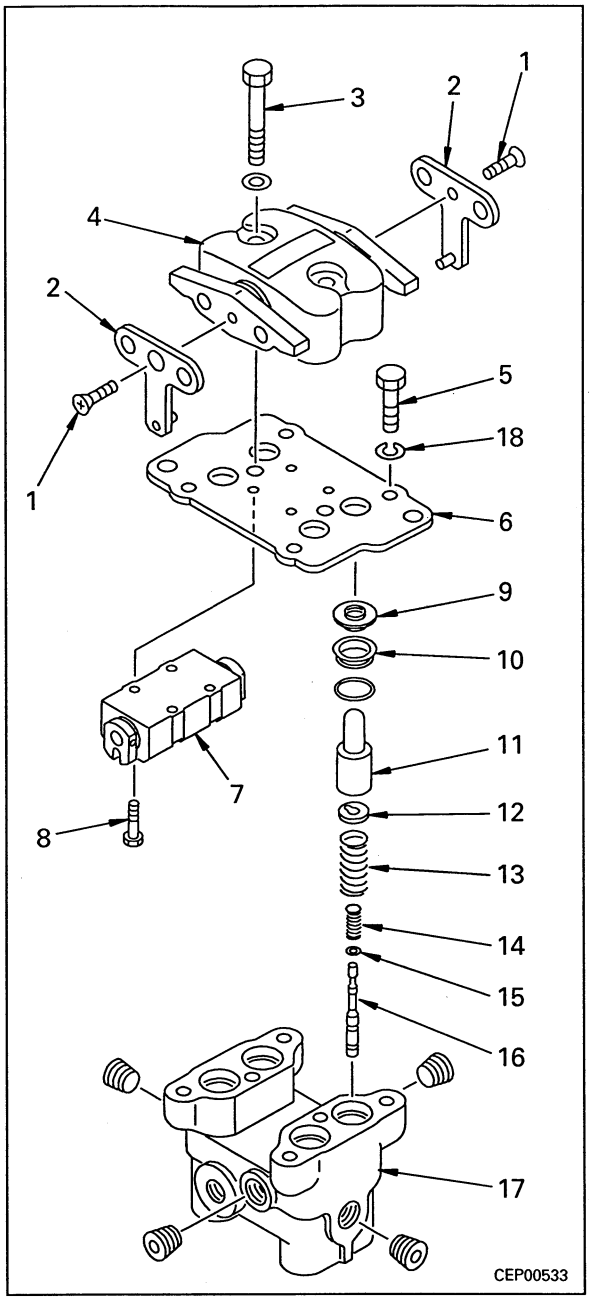
kgm Hose mounting joint bolt
(width across flats: 22mm) :
29.4 ± 4.9 Nm {3.0 ± 0.5 kgm}



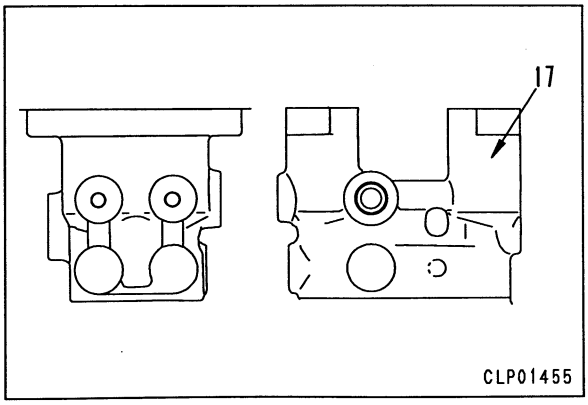


DISASSEMBLY OF TRAVEL PPC VALVE ASSEMBLY

1. Remove screw (1), then remove lever (2).
2. Remove mounting bolts (3), then remove case and shaft assembly (4).
3. Remove mounting bolts (5), then remove plate (6) and damper assembly (7) as one unit.
   ★ Check the thickness and mounting position of washer (18).
4. Remove mounting bolts (8), then remove damper assembly (7) from plate (6).
5. Remove seal (9) and collar (10).
6. Pull out piston (11), and remove retainer (12), springs (13) and (14), and shims (15).
   ★ Check the number and thickness of shims (15) for each mounting position, and keep in a safe place.
7. Pull out valve (16) from body (17).

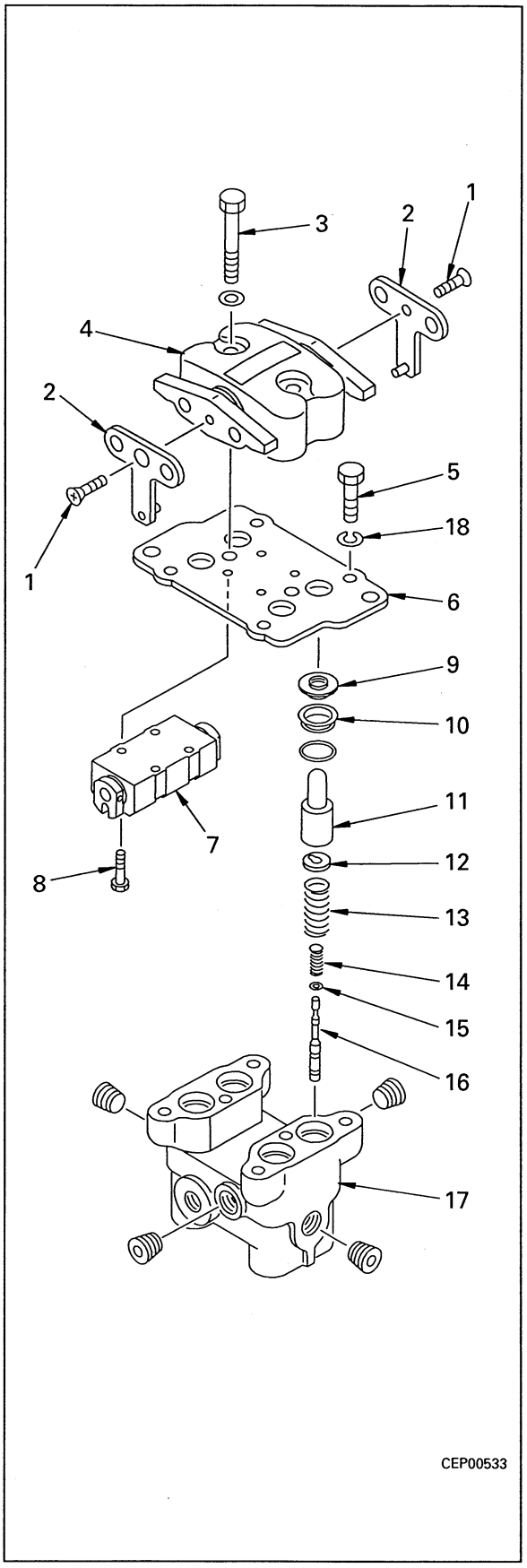


- Detail of shape of body (17)



ASSEMBLY OF TRAVEL PPC VALVE ASSEMBLY

1. Assemble valve (16) in body (17).
2. Assemble shims (15) and spring (14) to valve (16).
   ★ Assemble the same number and thickness of shims (15) as was removed during disassembly.
   Standard shim thickness : 0.3 mm
   ★ Spring (14) is not symmetrical at the top and bottom, so assemble with the small coil diameter (inside diameter) at the shim end.
3. Assemble spring (13), retainer (12), and piston (11).
   Outside circumference of piston, body hole : **Grease (G2-LI)**
4. Fit O-ring to collar (10) and assemble in body (17), then install seal (9).
5. Assemble plate (6) to damper assembly (7), then tighten mounting bolts (8).
   Mounting bolt : **Thread tightener (LT-2)**
   kgm Mounting bolt :
   4.4 ± 0.5 Nm {0.45 ± 0.05 kgm}
6. Assemble plate (6) and damper assembly (7) as one unit, then tighten mounting bolts (5).
   ★ Assemble a standard washer (1.6 mm) for washer (18).
   After completion of assembly, measure the difference between the angles when the left and right levers are operated fully. If the difference in the angle is more than 0.7°, change the thickness of washer (18) and make the difference in the angle less than 0.7°.
   • Washer thickness : **1.0, 1.3, 1.6 mm**
   ★ If the thickness of the washer is reduced by 0.3 mm, the angle when the levers are operated fully increases by 0.39°.
   kgm Mounting bolt :
   31.0 ± 3.4 Nm {3.15 ± 0.35 kgm}
7. Assemble case and shaft assembly (4), then tighten mounting bolts (3).
   Sliding portion of shaft, connecting portion of lever and piston : **Grease (G2-LI)**
   kgm Mounting bolt:
   28.0 ± 3.4 Nm {2.85 ± 0.35 kgm}
8. Install lever (2) and tighten screw (1).
   Sliding portion of lever pin and plate:
   Grease (G2-LI)
   kgm Screw : **8.8 ± 1.0 Nm {0.9 ± 0.1 kgm}**



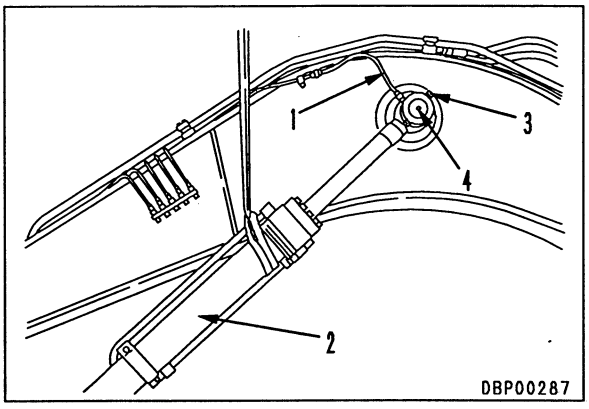
REMOVAL OF BOOM CYLINDER ASSEMBLY

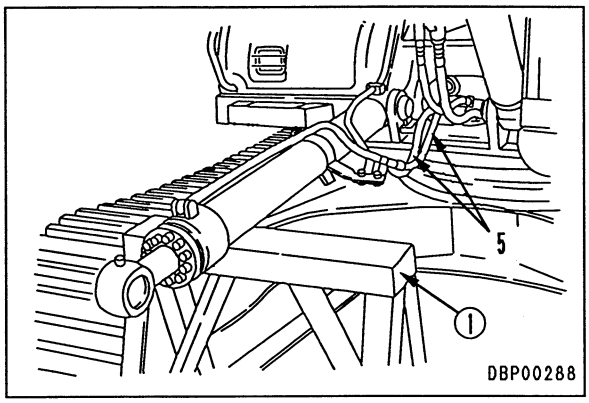
⚠ Extend the arm and bucket fully, lower the work equipment completely to the ground, and put the safety lock lever to the LOCK position.

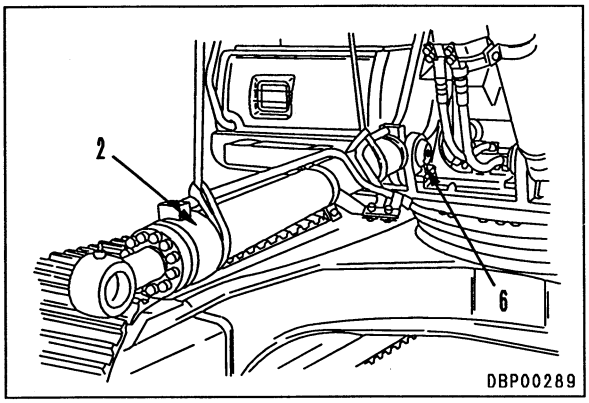
1. Disconnect grease hose (1).
2. Sling boom cylinder assembly (2), and remove lock bolt (3). ※ 1
3. Remove plate, then remove head pin (4). ※ 2
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.
4. Start engine, and retract piston rod, then tie piston rod with wire to prevent it from coming out.
   ★ Set stand ① under the cylinder assembly, and adjust the position for slinging.

   ⚠ Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.
5. Disconnect hoses (5).
6. Remove plate, then remove bottom pin (6), and remove boom cylinder assembly (2). ※ 3
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.

   kg Boom cylinder assembly : **130 kg**





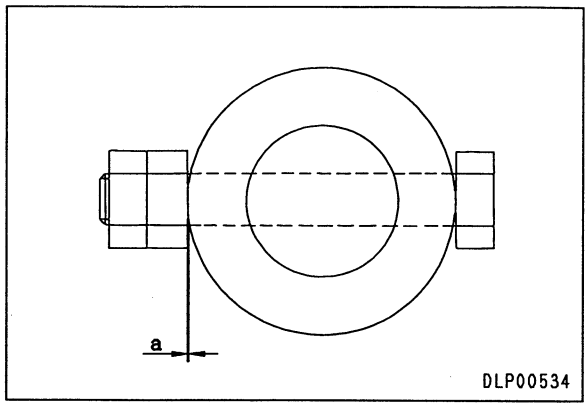


INSTALLATION OF BOOM CYLINDER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

★ When tightening the locknut, tighten so that clearance **a** between the plate and nut is 0.5 – 1.5 mm.



※ 2

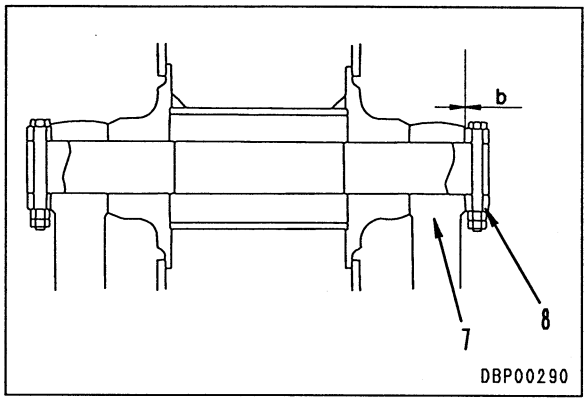
Inside surface of bushing when assembling pin : **Anti-friction compound (LM-P)**

Greasing after assembling pin : **Grease (LM-G)**

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that clearance **b** between cylinder rod (7) and plate (8) is less than 1 mm.

★ Standard shim thickness : 1.0 mm



※ 3

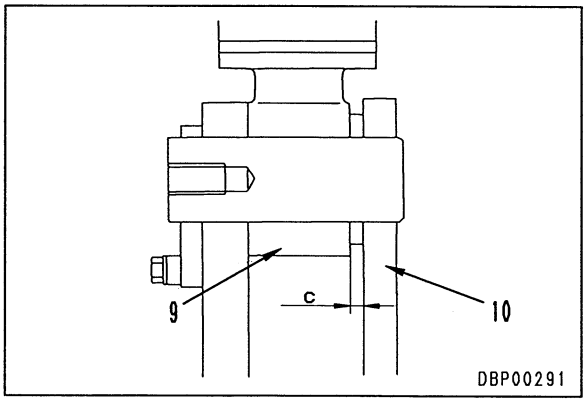
Inside surface of bushing when assembling pin : **Anti-friction compound (LM-P)**

Greasing after assembling pin : **Grease (LM-G)**

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that clearance **c** between cylinder bottom (9) and bracket (10) is less than 1 mm.

★ Standard shim thickness : 1.0 mm, 2.0 mm



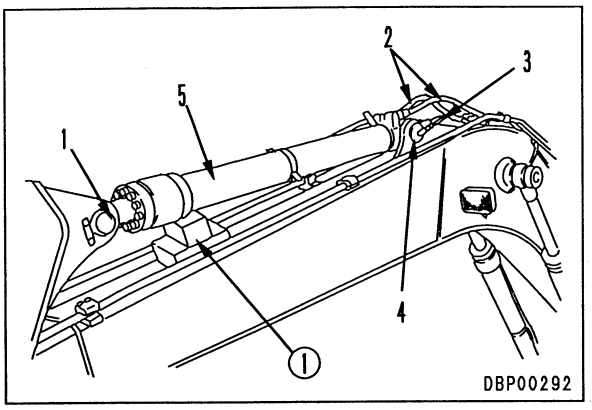
- **Bleeding air**

★ Bleed the air. For details, see TESTING AND ADJUSTING, Bleeding air from hydraulic cylinder.

- **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 OF ARM CYLINDER ASSEMBLY



⚠ Extend the arm cylinder piston rod approx. 200 mm, lower the work equipment completely to the ground, then set the safety lock lever to the LOCK position.

1. Set block ① between arm cylinder and boom.
2. Remove plate, then remove head pin (1). ※ 1
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.
3. Start engine, and retract piston rod, then tie piston rod with wire to prevent it from coming out.

   ⚠ Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.
4. Disconnect hoses (2).
5. Disconnect grease tube (3).
6. Raise arm cylinder assembly, remove plate, remove bottom pin (4), then remove arm cylinder assembly (5). ※ 2
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.

   kg Arm cylinder assembly : **170 kg**

INSTALLATION OF ARM CYLINDER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

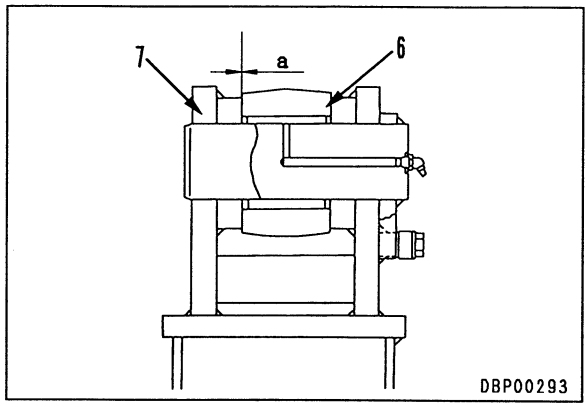
Inside surface of bushing when assembling pin : **Anti-friction compound (LM-P)**

Greasing after assembling pin : **Grease (LM-G)**

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that clearance **a** between cylinder rod (6) and bracket (7) is less than 1 mm.

★ Standard shim thickness : 1.0 mm



※ 2

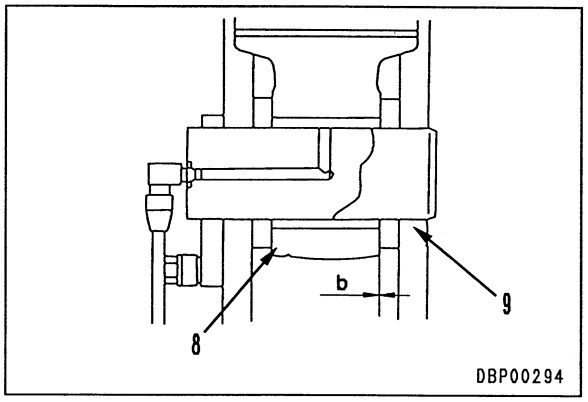
Inside surface of bushing when assembling pin : **Anti-friction compound (LM-P)**

Greasing after assembling pin : **Grease (LM-G)**

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that clearance **b** between cylinder bottom (8) and bracket (9) is less than 1 mm.

★ Standard shim thickness : 1.0 mm



- **Bleeding air**
  - ★ Bleed the air. For details, see TESTING AND ADJUSTING, Bleeding air from hydraulic cylinder.

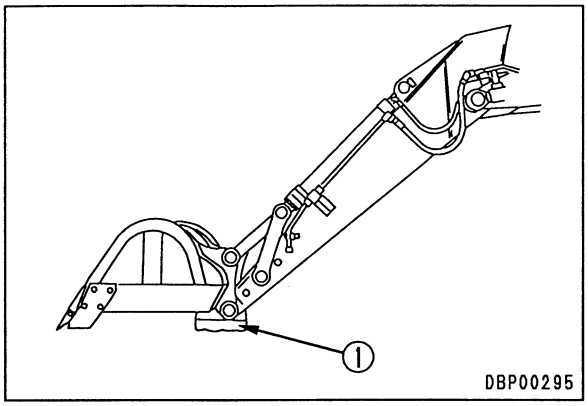
- **Refilling with oil (hydraulic tank)**
  - ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

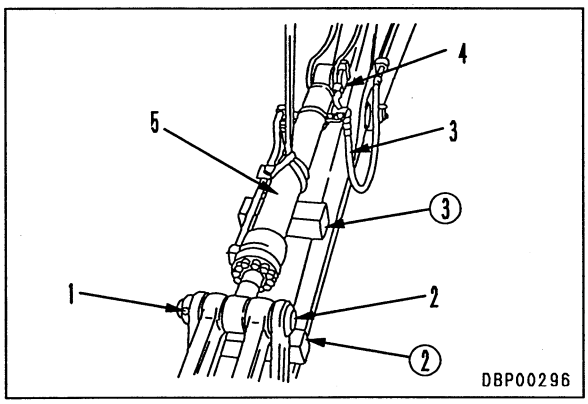
REMOVAL OF BUCKET CYLINDER ASSEMBLY

⚠ Extend the bucket cylinder piston rod approx. 200 mm, lower the work equipment completely to the ground, then set the safety lock lever to the LOCK position.

1. Set block ① under arm top.
2. Set block ② between link and arm, and block ③ between bucket cylinder and arm.
3. Remove lock bolt (1). ※ 1
4. Remove plate, then remove head pin (2). ※ 2
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.
5. Start engine, and retract piston rod, then tie piston rod with wire to prevent it from coming out.
   ⚠ Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.
6. Disconnect 2 hoses (3).
7. Raise bucket cylinder assembly, remove plate, remove bottom pin (4), then remove bucket cylinder assembly (5). ※ 3
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.

   kg Bucket cylinder assembly : **100 kg**





INSTALLATION OF BUCKET CYLINDER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

★ When tightening the locknut, tighten so that clearance **a** between the plate and nut is 0.5 - 1.5 mm.

※ 2

Inside surface of bushing when assembling pin : **Anti-friction compound (LM-P)**

Grease after assembling pin : **Grease (LM-G)**

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that clearance **b** between link (6) and link (7) is less than 1 mm.
★ Standard shim thickness : 1.0 mm, 2.0 mm

※ 3

Inside surface of bushing when assembling pin : **Anti-friction compound (LM-P)**

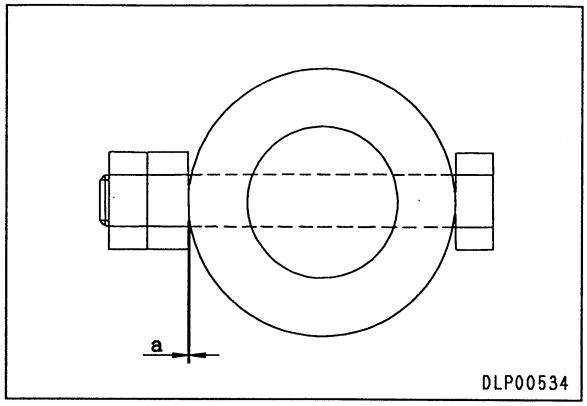
Grease after assembling pin : **Grease (LM-G)**

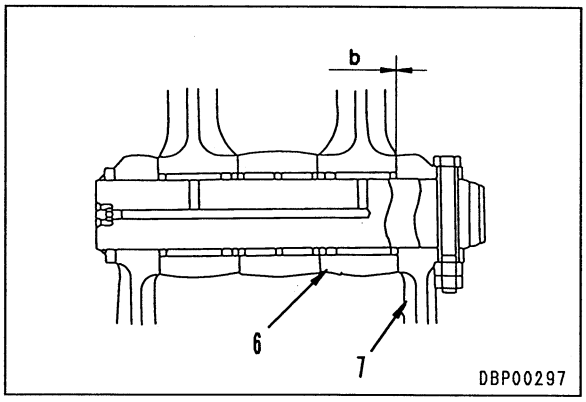
⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

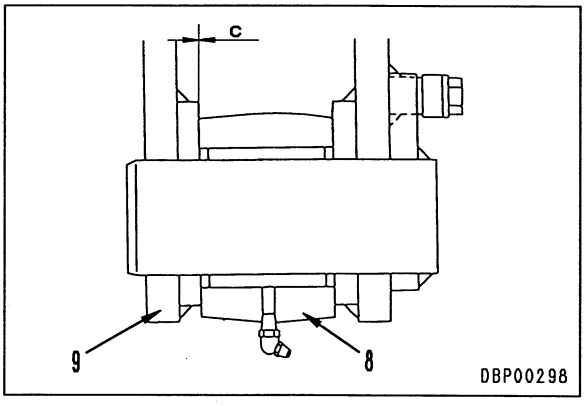
★ Adjust the shim thickness so that clearance **c** between cylinder bottom (8) and bracket (9) is less than 1 mm.
★ Standard shim thickness : 1.0 mm

- **Bleeding air**
  ★ Bleed the air. For details, see TESTING AND ADJUSTING, Bleeding air from hydraulic cylinder.

- **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.



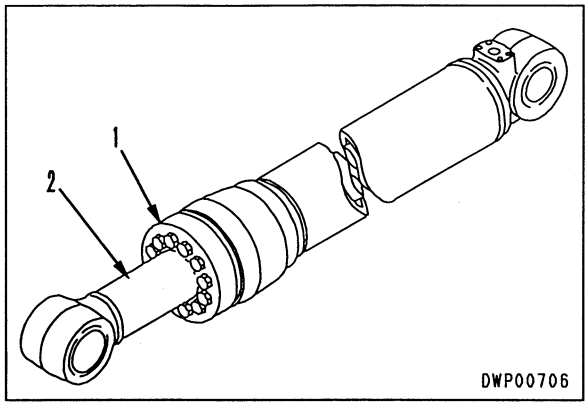




DISASSEMBLY OF HYDRAULIC CYLINDER ASSEMBLY

1. Piston rod assembly

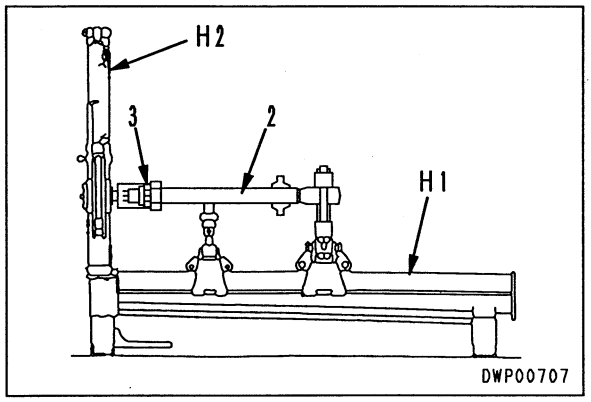
1) Remove piping from cylinder assembly.
2) Remove mounting bolts and disconnect head assembly (1).
3) Pull out piston rod assembly (2).
   ★ Place a container under the cylinder to catch the oil.



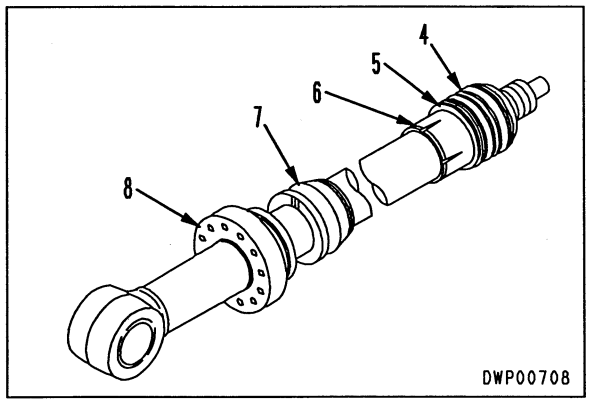
4) Disassemble piston rod assembly as follows.
   i) Set piston rod assembly (2) in tool **H1**.
   ii) Using tool **H2**, remove nut (43).
   ★ Width across flats of nut

Unit : mm

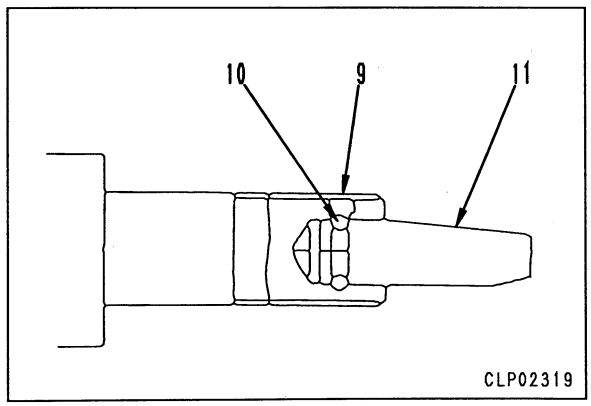
Cylinder	Boom	Arm	Bucket
Width across flats of nut	80	85	70



   iii) Remove piston assembly (4).
   iv) Remove retainer (5) and plunger (6).
   • Arm cylinder only
   v) Remove collar (7).
   • Arm cylinder only
   vi) Remove head assembly (8).

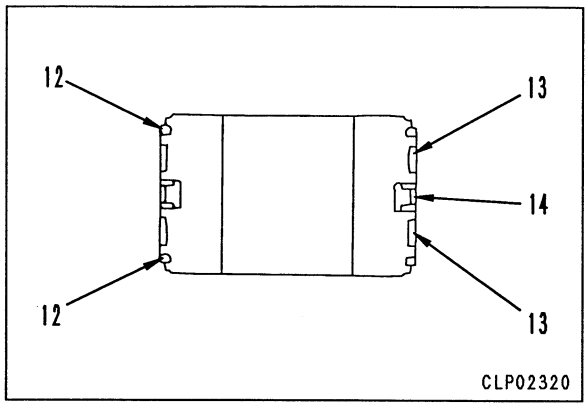


   vii) Remove cap (9), and pull out 11 ball bearings (10), then remove plunger (11).
   • Arm cylinder only



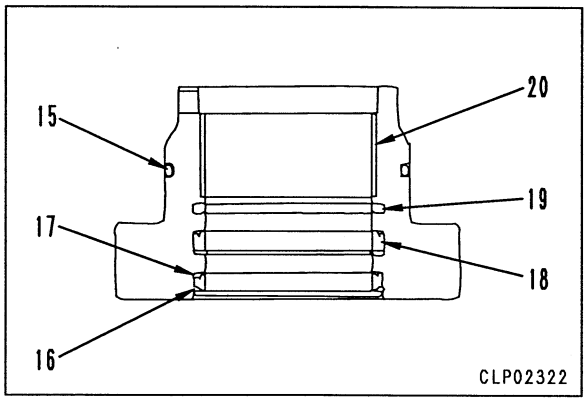
2. Disassembly of piston assembly

1) Remove rings (12).
2) Remove wear rings (13).
3) Remove piston ring (14).



3. Disassembly of cylinder head assembly

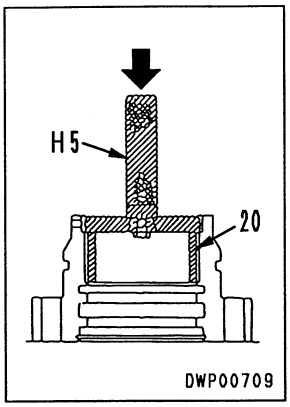
1) Remove O-ring and backup ring (15).
2) Remove snap ring (16), then remove dust seal (17).
3) Remove rod packing (18).
4) Remove buffer ring (19).
5) Remove bushing (20).

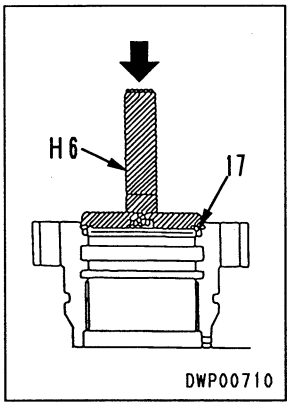


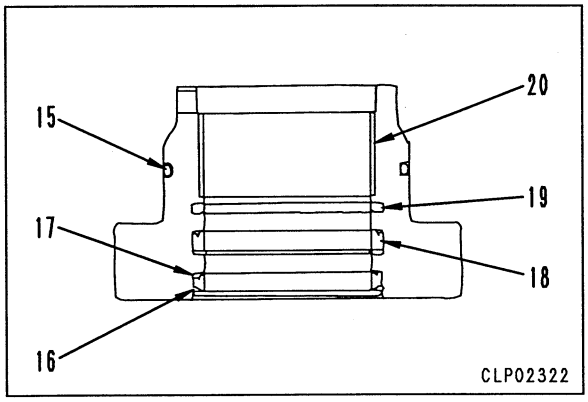
ASSEMBLY OF HYDRAULIC CYLINDER ASSEMBLY

★ Be careful not to damage the packings, dust seals, and O-rings.
★ Do not try to force the backup ring into position. Warm it in warm water (50 – 60°C) before fitting it.

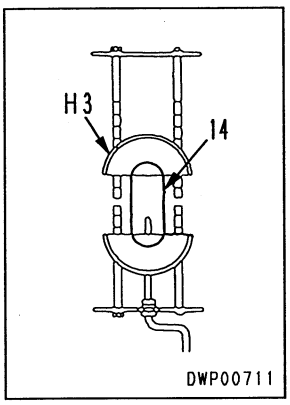
1. Assembly of cylinder head assembly
1) Using tool **H5**, press fit bushing (20).
2) Assemble buffer ring (19).
3) Assemble rod packing (18).
4) Using tool **H6**, install dust seal (17), and secure with snap ring (16).
5) Install backup ring and O-ring (15).

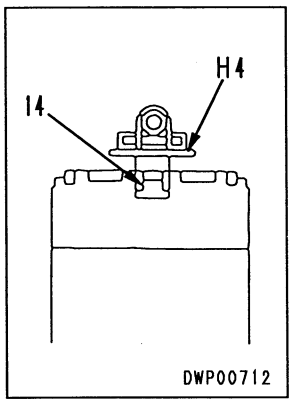






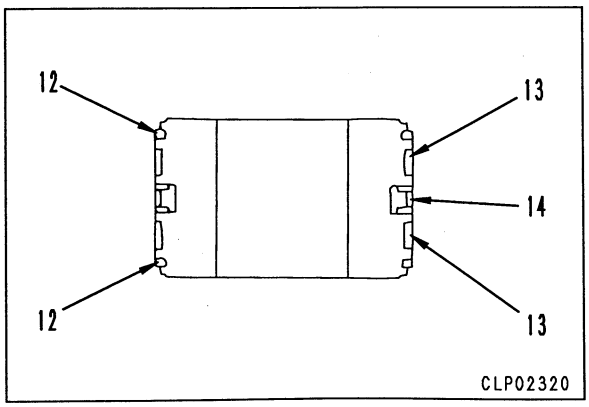
2. Assembly of piston assembly
1) Using tool **H3**, expand piston ring (14).
★ Set the piston ring on the tool **H3**, and turn the handle 8 – 10 times to expand the ring.
2) Set tool **H4** in position, and compress piston ring (14).





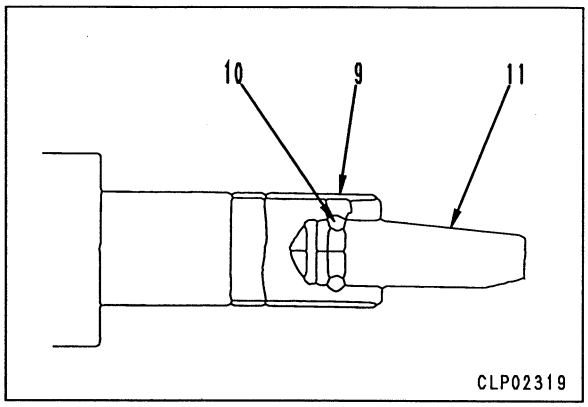
3) Assemble wear rings (13).
4) Assemble rings (12).
★ Be careful not to open the end gap of the ring too wide.

Ring groove : **Grease (G2-LI)**

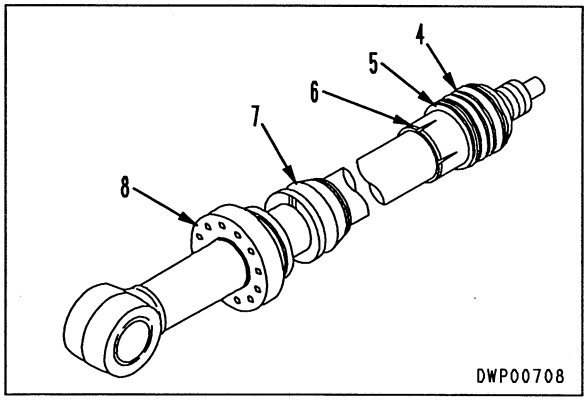


3. Piston rod assembly

1) Set plunger (11) to piston rod and assemble 12 balls (10), then secure with cap (9).
   ★ Check that there is a slight play at the tip of the plunger.
   • Arm cylinder only



2) Assemble head assembly (8).
3) Fit O-ring and backup ring and assemble collar (7).
   • Arm cylinder only
4) Assemble plunger (6).
   • Arm cylinder only
5) Assemble retainer (5).
   • Arm cylinder only
6) Assemble piston assembly (4).



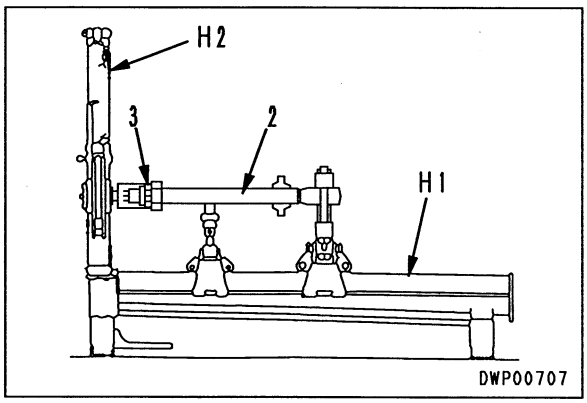
7) Set piston rod assembly (2) to tool **H1**.
8) Using tool **H2**, tighten nut (3).

Nut : **Thread tightener (LT-2)**

Nut :

Unit : Nm {kgm}

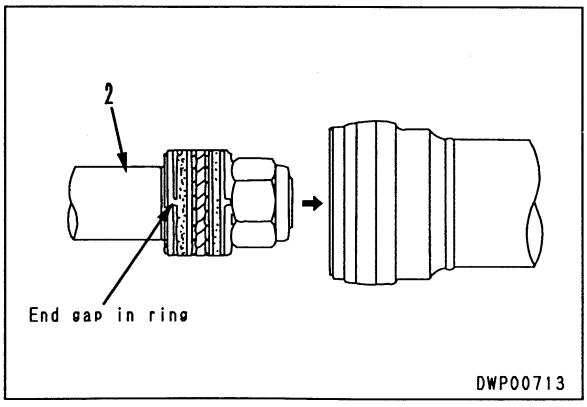
Cylinder	Tightening torque
Boom	5.1 ± 0.5 {520 ± 52}
Arm	7.1 ± 0.7 {720 ± 72}
Bucket	3.3 ± 0.3 {340 ± 34}



9) Assemble piston rod assembly (2).

Seal : **Grease (G2-LI)**

★ Set the end gap of the ring at the horizontal (side) position, align the center of shaft and cylinder tube, then insert.
★ After inserting, check that the ring is not broken and has not come out, then push in fully.



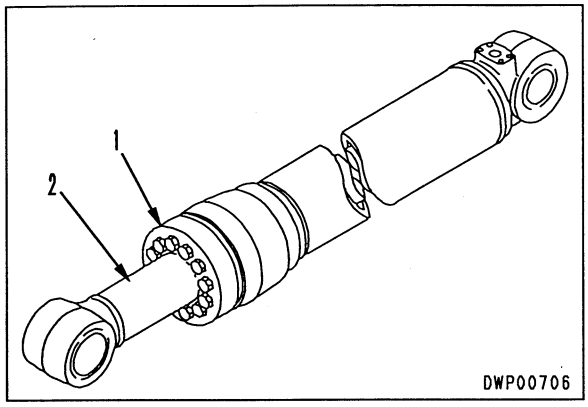
10) Tighten head assembly (1) with mounting bolts.

kgm Mounting bolt :

Unit : Nm {kgm}

Cylinder	Tightening torque
Boom	172 ± 24.5 {17.5 ± 2.5}
Arm	270 ± 39 {27.5 ± 4.0}
Bucket	172 ±24.5 {17.5 ± 2.5}

11) Install piping.

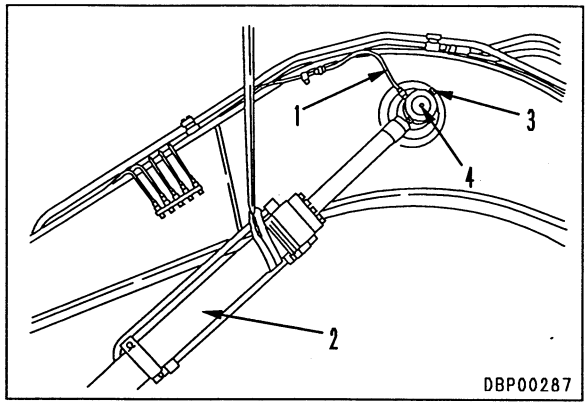


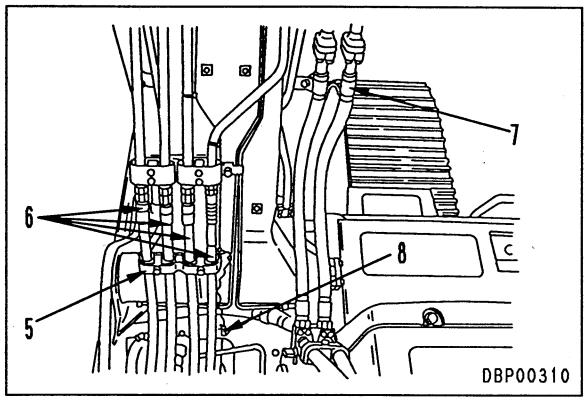
REMOVAL OF WORK EQUIPMENT ASSEMBLY

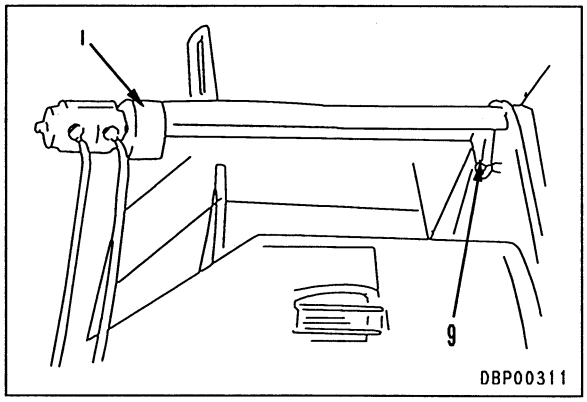
⚠ Extend the arm and bucket fully, lower the work equipment to the ground, and set the safety lock lever to the LOCK position.

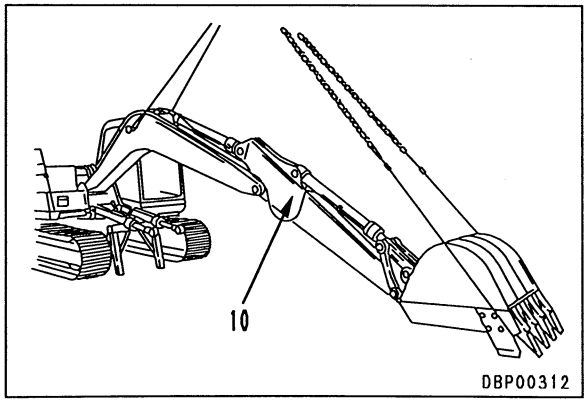
1. Disconnect grease hose (1).
2. Sling boom cylinder assembly (2), and remove lock bolt (3). ※ 1
3. Remove plate, then remove head pin (4). ※ 2
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.
4. Start engine, and retract piston rod, then tie piston rod with wire to prevent it from coming out, and lower it onto block.
   ★ Disconnect the boom cylinder on the opposite side in the same way.
   ⚠ Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.
5. Remove clamp (5), and disconnect hoses (6) and (7), then secure to valve with rope.
   ★ Hose (7) is for the PC130-6 demolition specification machine only.
6. Disconnect wiring connector (8) for working lamp.
7. Raise work equipment assembly, remove plate, then remove foot pin (9) using tool **I**, and remove work equipment assembly (10). ※ 3
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.

   kg Work equipment assembly : **1,900 kg**







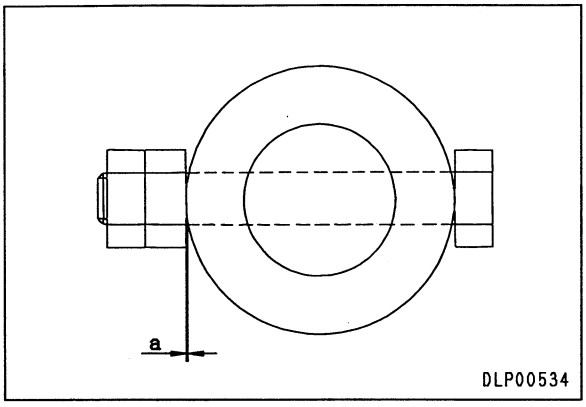


INSTALLATION OF WORK EQUIPMENT ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

★ When tightening the locknut, tighten so that clearance **a** between the plate and nut is 0.5 - 1.5 mm.



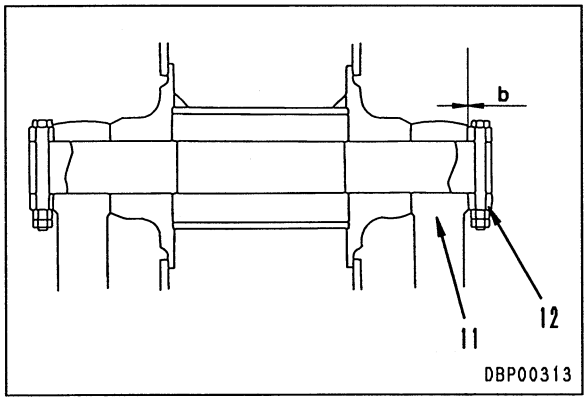
※ 2

Inside surface of bushing when assembling pin : **Anti-friction compound (LM-P)**

Grease after assembling pin : **Grease (LM-G)**

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that clearance **b** between cylinder rod (11) and plate (12) is less than 1 mm.
★ Standard shim thickness : 1.0 mm



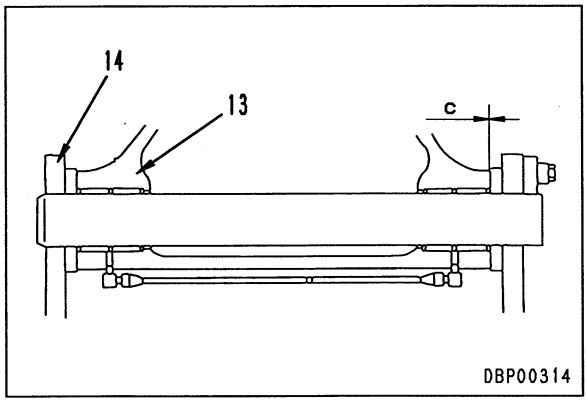
※ 3

Inside surface of bushing when assembling pin : **Anti-friction compound (LM-P)**

Grease after assembling pin : **Grease (LM-G)**

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that clearance **c** between boom (13) and bracket (14) is less than 0.5 mm.
★ Standard shim thickness : 0.5 mm, 1.0 mm, 2.0 mm



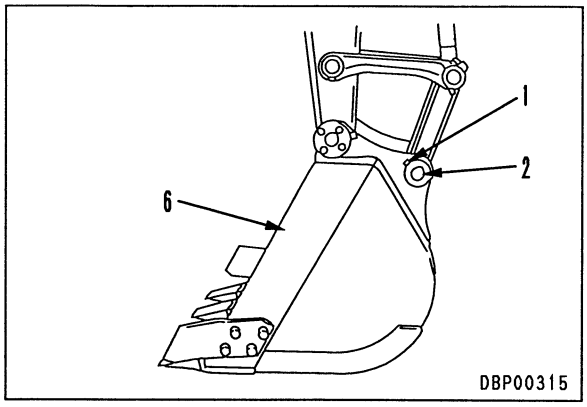
- **Bleeding air**
  ★ Bleed the air. For details, see TESTING AND ADJUSTING, Bleeding air from hydraulic cylinder.

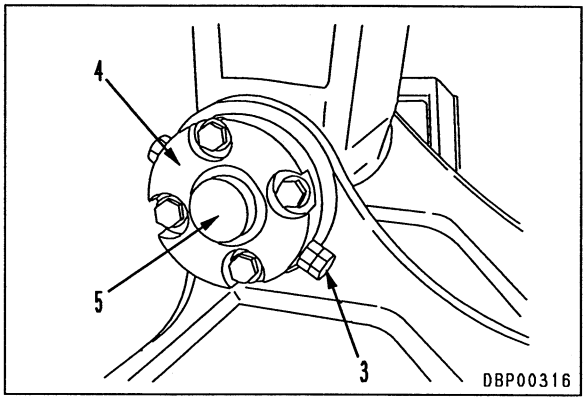
- **Refilling with oil (hydraulic tank)**
  ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

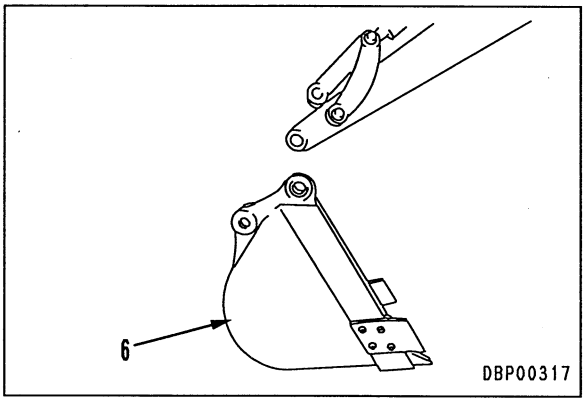
REMOVAL OF BUCKET ASSEMBLY

⚠ Set the back of the bucket facing down, lower the work equipment completely to the ground, and set the safety lock lever to the LOCK position.

1. Remove lock bolt (1). ※ 1
2. Remove connecting pin (2) between link and bucket. ※ 2
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.
3. Start engine, and retract piston rod, then tie piston rod with wire to prevent it from coming out.
4. Remove lock bolt (3). ※ 3
5. Remove plate (4), then remove connecting pin (5) between arm and bucket. ※ 4
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.
6. After raising work equipment, swing to disconnect bucket assembly (6).
   kg Bucket assembly : **400 kg**







INSTALLATION OF BUCKET ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1 ※ 3

★ When tightening the locknut, tighten so that clearance **a** between the plate and nut is 0.5 - 1.5 mm.

※ 2

Inside surface of bushing when assembling pin : **Anti-friction compound (LM-P)**

Grease after assembling pin : **Grease (LM-G)**

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that clearance **b** between bucket boss (7) and link (8) is less than 1 mm.

★ Standard shim thickness : 1.0 mm, 2.0 mm

※ 4

Inside surface of bushing, inside surface, end face of collar (10) when assembling pin : **Anti-friction compound (LM-P)**

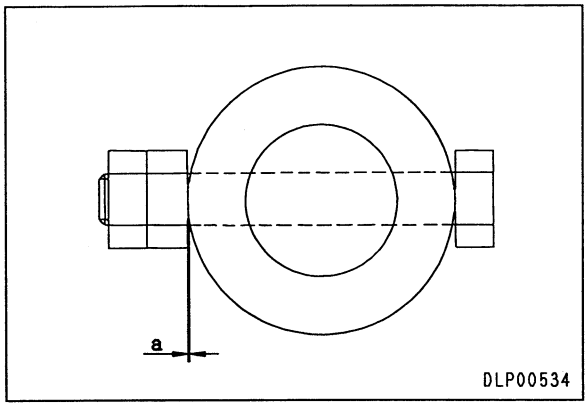
Grease after assembling pin : **Grease (LM-G)**

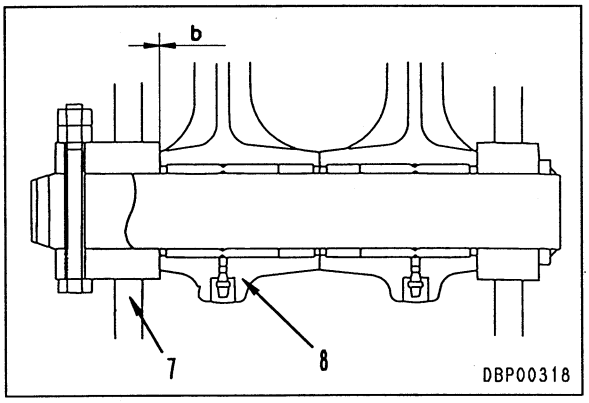
⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

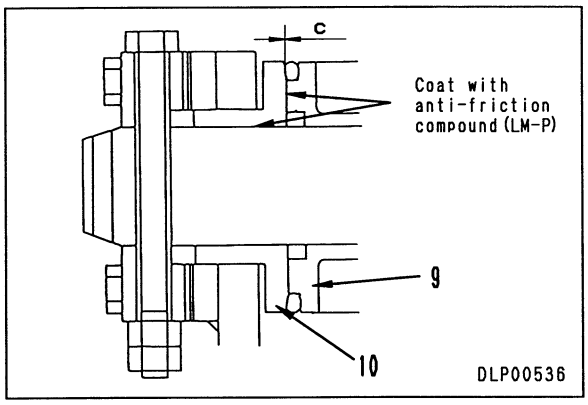
★ Set the O-ring at the end face of the bucket boss securely.

★ Adjust the shim thickness so that clearance **c** between arm top (9) and spacer (10) is less than 0.5 mm.

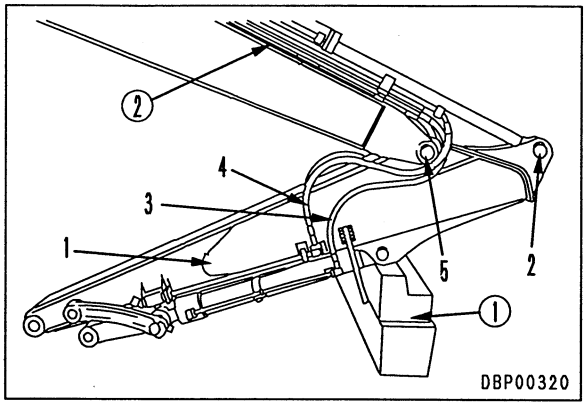
★ Standard shim thickness : 0.5 mm, 1.0 mm







REMOVAL OF ARM ASSEMBLY



1. Remove bucket assembly. For details, see REMOVAL OF BUCKET ASSEMBLY.

2. Secure front link to arm with wire.

3. Pull in arm so that it is easy to remove pin at arm cylinder head, then lower arm and bucket cylinder assembly (1) on to block ①.

   ⚠ Set the safety lock lever to the LOCK position.

4. Set block ② between arm cylinder and boom.

5. Remove plate, then remove arm cylinder head pin (2). ※ 1
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.

6. Start engine, and retract piston rod, then tie piston rod with wire to prevent it from coming out.

   ⚠ Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.

7. Disconnect 2 hoses (3) and 2 hoses (4).
   ★ Install blind plugs at the male end and in the disconnected hoses.
   ★ Hoses (4) are for PC130-6 demolition specification machine only.

8. Remove plate, then remove connecting pin (5) between arm and boom. ※ 2
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.

9. After raising boom, swing to remove arm and bucket cylinder assembly (1).

   kg Arm, bucket cylinder assembly : **550 kg**

INSTALLATION OF ARM ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

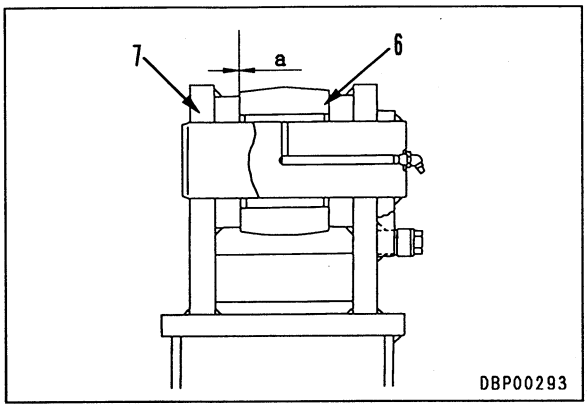
Inside surface of bushing when assembling pin : **Anti-friction compound (LM-P)**

Grease after assembling pin : **Grease (LM-G)**

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that clearance **a** between cylinder rod (6) and bracket (7) is less than 1 mm.

★ Standard shim thickness : 1.0 mm



※ 2

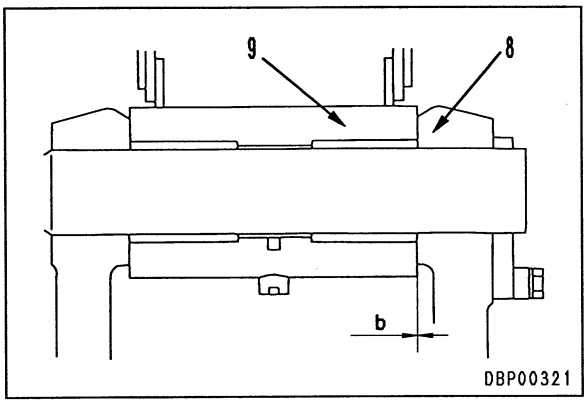
Inside surface of bushing when assembling pin : **Anti-friction compound (LM-P)**

Grease after assembling pin : **Grease (LM-G)**

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that clearance **b** between boom top (8) and arm bottom (9) is less than 0.5 mm.

★ Standard shim thickness : 0.5 mm, 1.0 mm



- **Bleeding air**
  ★ Bleed the air. For details, see TESTING AND ADJUSTING, Bleeding air from hydraulic cylinder.

- **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 OF BUCKET, ARM ASSEMBLY

⚠ Extend the arm cylinder piston rod approx. 200 mm, lower the work equipment completely to the ground, then set the safety lock lever to the LOCK position.

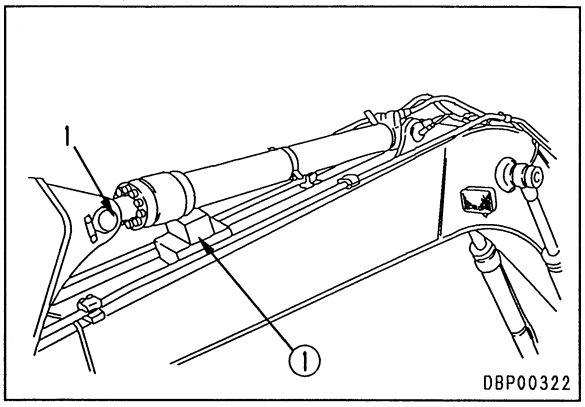
1. Set block ① between arm cylinder and boom.

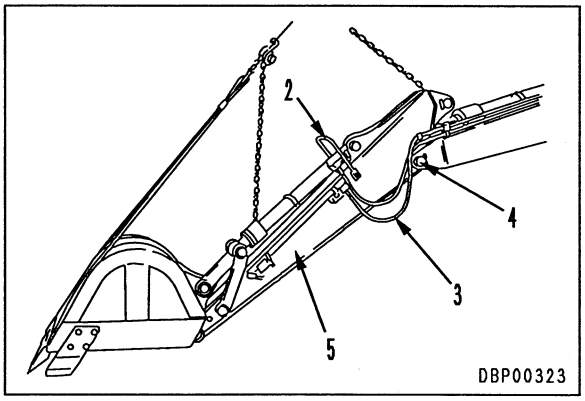
2. Remove plate, then remove arm cylinder head pin (1). ※ 1
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.

3. Start engine, and retract piston rod, then tie piston rod with wire to prevent it from coming out.
   ⚠ Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.

4. Disconnect 2 hoses (2) and 2 hoses (3).
   ★ Install blind plugs at the male end and in the disconnected hoses.
   ★ Hose (3) is for the PC130-6 demolition specification machine only.

5. Raise bucket and arm assembly, remove plate, then remove connecting pin (4) between arm and boom, and remove bucket and arm assembly (5). ※ 2
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.
   kg Bucket, arm assembly : **950 kg**





INSTALLATION OF BUCKET, ARM ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

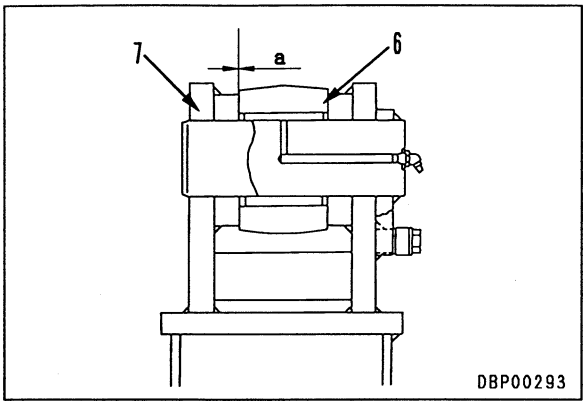
Inside surface of bushing when assembling pin : **Anti-friction compound (LM-P)**

Grease after assembling pin : **Grease (LM-G)**

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that clearance **a** between cylinder rod (6) and bracket (7) is less than 1 mm.

★ Standard shim thickness : 1.0 mm



※ 2

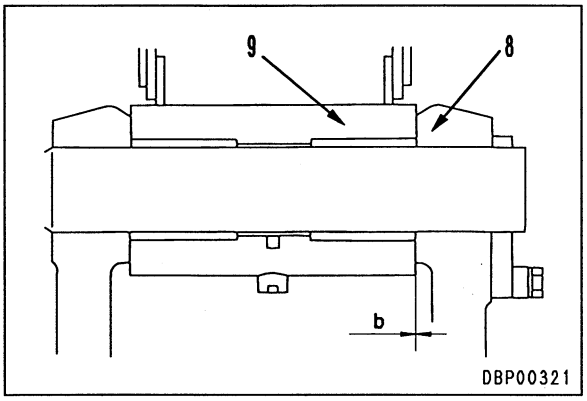
Inside surface of bushing when assembling pin : Anti-friction compound (LM-P)

Grease after assembling pin : **Grease (LM-G)**

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that clearance **b** between boom top (8) and arm bottom (9) is less than 0.5 mm.

★ Standard shim thickness : 0.5 mm, 1.0 mm



- **Bleeding air**

★ Bleed the air. For details, see TESTING AND ADJUSTING, Bleeding air from hydraulic cylinder.

- **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 OF BOOM ASSEMBLY

1. Remove bucket and arm assembly. For details, see REMOVAL OF BUCKET, ARM ASSEMBLY.

2. Lower boom assembly completely to ground, and set safety lock lever to LOCK position.

3. Disconnect grease hose (1).

4. Sling boom cylinder assembly (2) and remove lock bolt (3). ※ 1

5. Remove plate, then remove head pin (4). ※ 2
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.

6. Start engine, and retract piston rod, then tie piston rod with wire to prevent it from coming out, and lower it onto block.
   ★ Disconnect the boom cylinder on the opposite side in the same way.

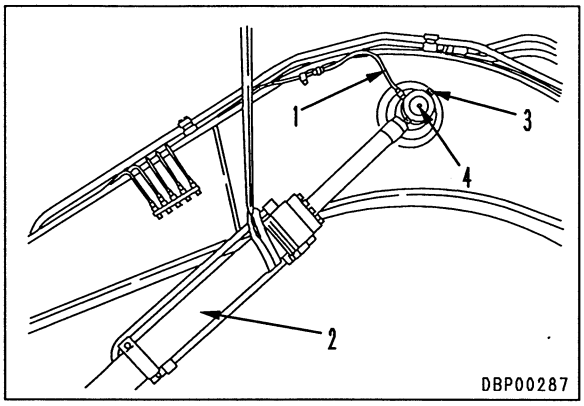
   ⚠ Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.

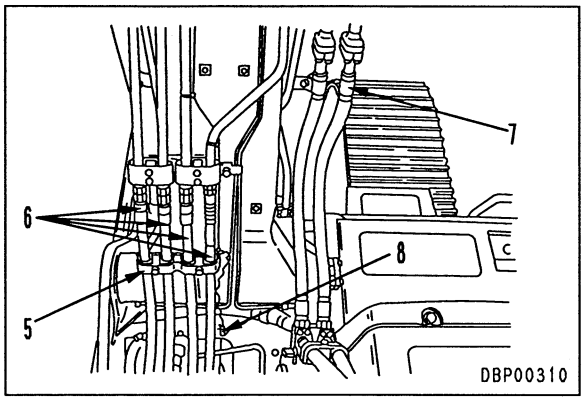
7. Remove clamp (5), and disconnect hoses (6) and (7), then secure to valve with rope.
   ★ Hose (7) is for the PC130-6 demolition specification machine only.

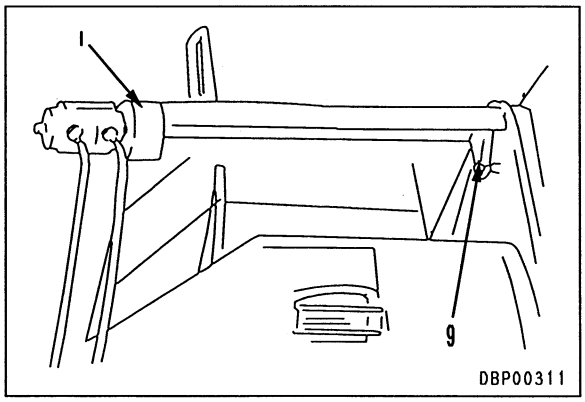
8. Disconnect wiring connector (8) for working lamp.

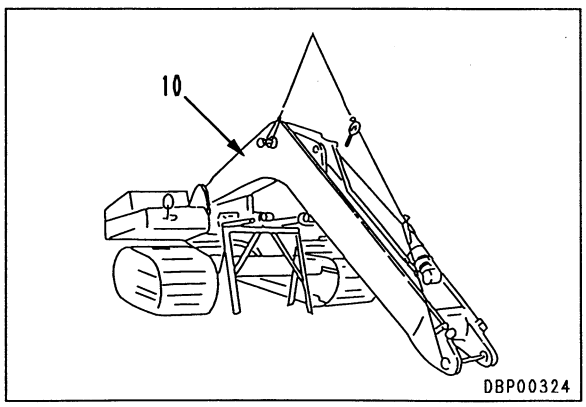
9. Raise boom assembly and remove plate, remove foot pin (9) using tool I, then remove boom assembly (10). ※ 3
   ★ There are shims installed, so check the number and thickness, and keep in a safe place.

   kg Boom assembly : **1,250 kg**







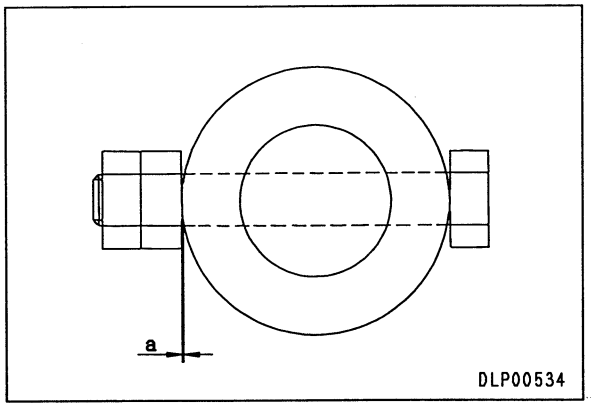


INSTALLATION OF BOOM ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

★ When tightening the locknut, tighten so that clearance **a** between the plate and nut is 0.5 – 1.5 mm.



※ 2

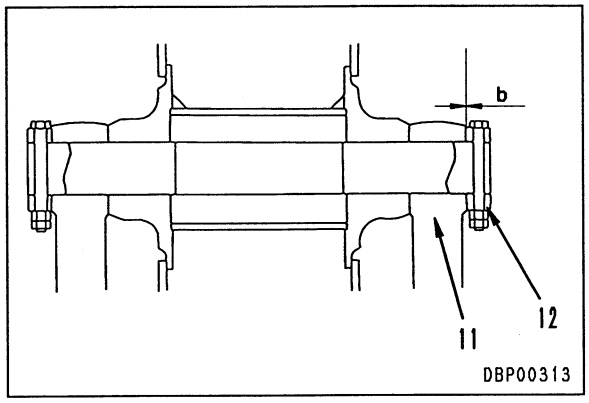
Inside surface of bushing when assembling pin : **Anti-friction compound (LM-P)**

Grease after assembling pin : **Grease (LM-G)**

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that clearance **b** between cylinder rod (11) and plate (12) is less than 1 mm.

★ Standard shim thickness : 1.0 mm



※ 3

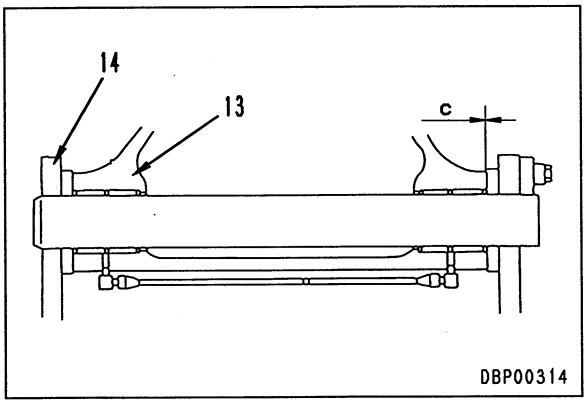
Inside surface of bushing when assembling pin : **Anti-friction compound (LM-P)**

Grease after assembling pin : **Grease (LM-G)**

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

★ Adjust the shim thickness so that clearance **c** between boom (13) and bracket (14) is less than 0.5 mm.

★ Standard shim thickness : 0.5 mm, 1.0 mm, 2.0 mm



- **Bleeding air**

★ Bleed the air. For details, see TESTING AND ADJUSTING, Bleeding air from hydraulic cylinder.

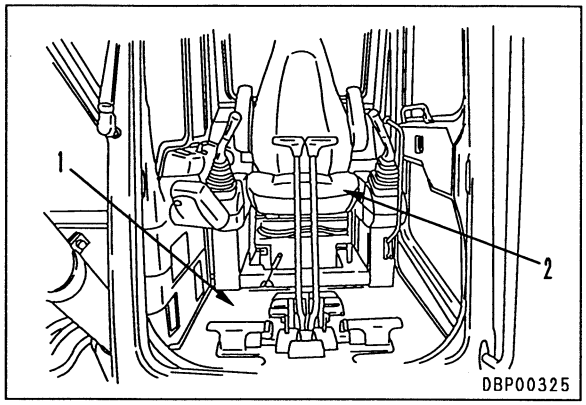
- **Refilling with oil (hydraulic tank)**

★ 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.

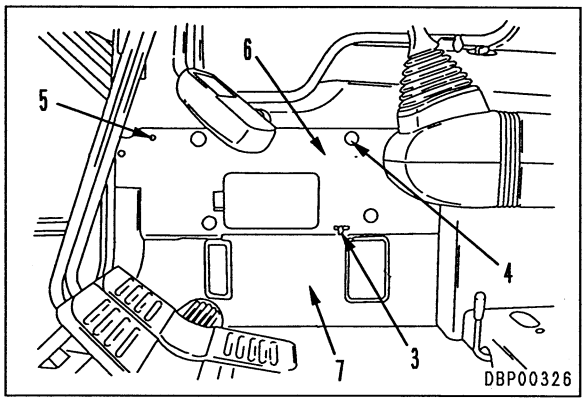
REMOVAL OF OPERATOR'S CAB ASSEMBLY

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

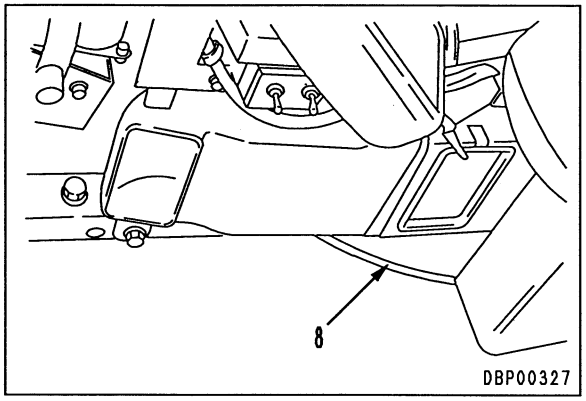
1. Remove floor mat (1).
2. Remove operator's seat assembly (2).
   kg Operator's seat assembly : **40 kg**
3. Remove knob (3).



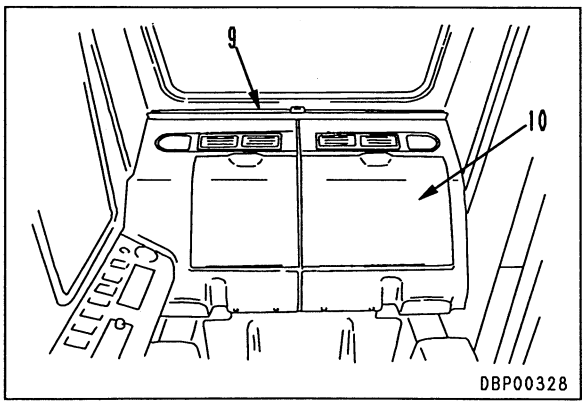
4. Remove 4 caps (4) and clip (5), then remove middle panel (6).
5. Remove bottom panel (7).
   ★ The panel is held by a clip, so remove the clip when removing the panel and be careful not to break it.



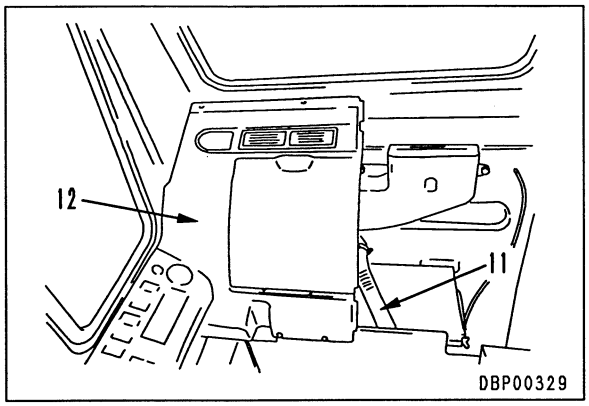
6. Disconnect washer hose (8).



7. Remove plate (9), then remove cover (10).

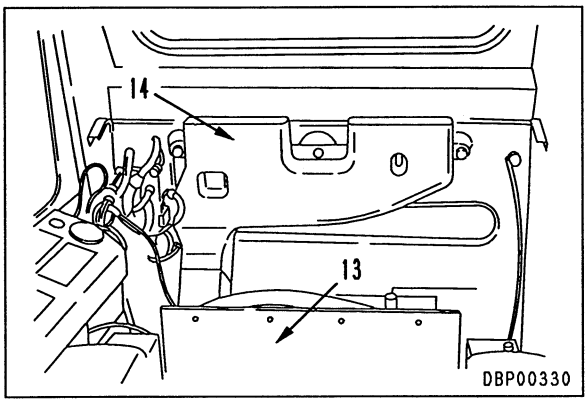


8. Disconnect air conditioner hose (11) and speaker wiring connector, then remove cover (12).
   ★ When removing the cover, the speaker wiring connector cannot be seen, so lift up the cover to disconnect the wiring connector.



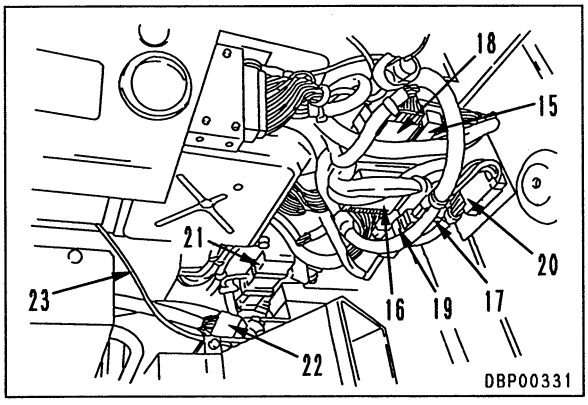
9. Remove divider board (13).

10. Remove air conditioner duct (14).

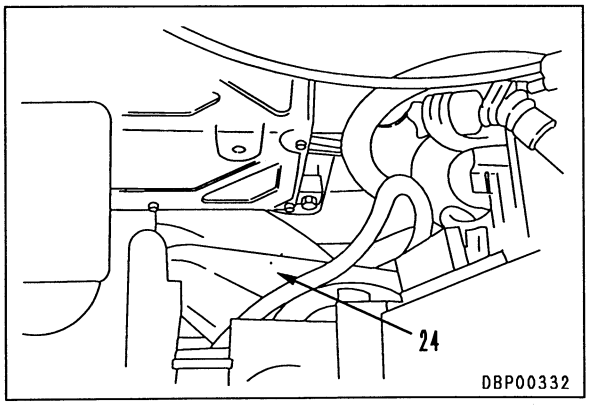


11. Disconnect wiring connectors CN-H01 (15), CN-H02 (16), CN-H03 (17), CN-H04 (18), CN-H05 (19), CN-H06 (20), and CN-K01 (21), and air conditioner wiring connector (22).
   • Wiring connector CN-K01 (21) is for the PC130-6 demolition specification machine only.

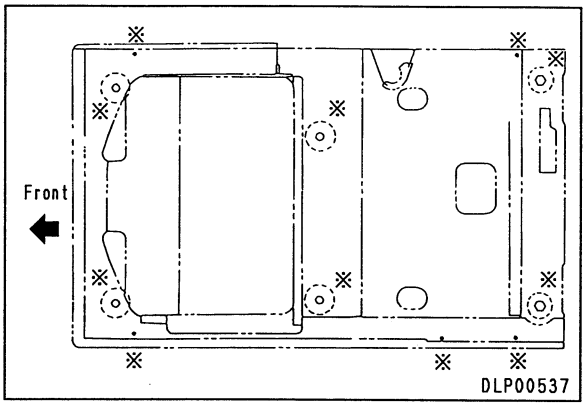
12. Disconnect air conditioner cable (23).



13. Remove air conditioner hose (24).



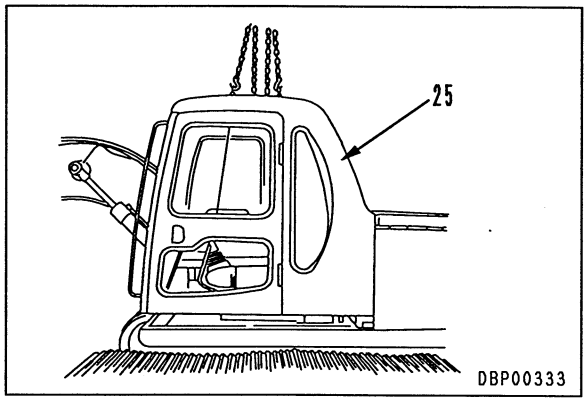
14. Remove 11 cab mounting bolts (marked ※).



15. Using eyebolts (1), remove operator's cab assembly (25).

kg Operator's cab assembly : **300 kg**

★ When raising the cab assembly, check that all the wiring has been disconnected, then lift off slowly and be careful not to hit any part.



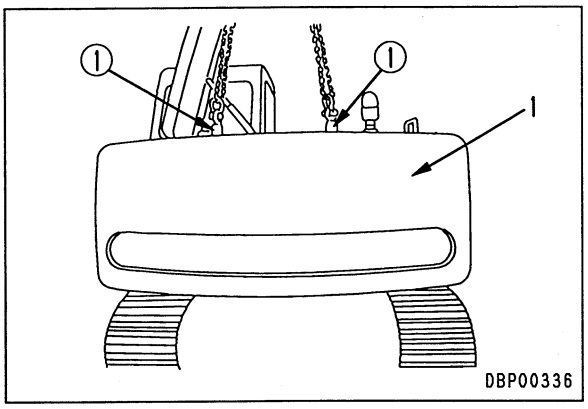
INSTALLATION OF OPERATOR'S CAB ASSEMBLY

- Carry out installation in the reverse order to removal.

REMOVAL OF COUNTERWEIGHT ASSEMBLY

1. Remove counterweight top cover.
2. Set eyebolts (1) to counterweight assembly ①, and sling.
3. Remove 4 mounting bolts (2) and lift off counterweight assembly (1). ※ 1

   kg Counterweight assembly : **2,420 kg**



INSTALLATION OF COUNTERWEIGHT ASSEMBLY

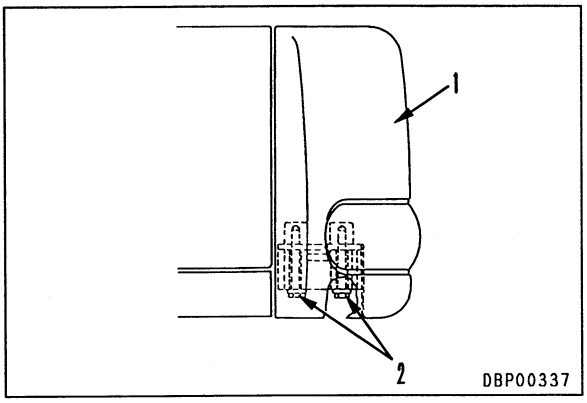
- Carry out installation in the reverse order to removal.

※ 1

Thread of counterweight mounting bolt : **Thread tightener (LT-2)**

kgm Counterweight mounting bolt : **1,323.9 ± 147.1 Nm {135 ±15 kgm}**

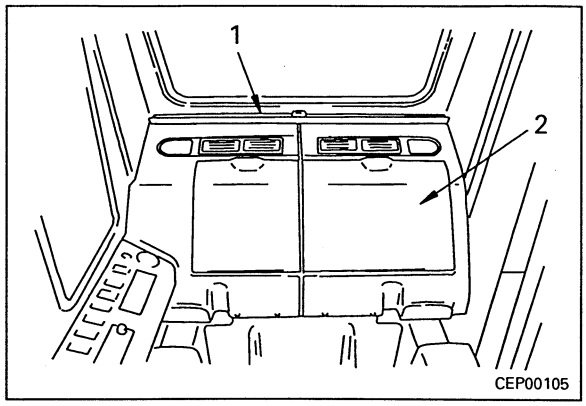
★ When installing the counterweight, adjust so that the stepped difference and the clearance from the bodywork are uniform on the left and right.

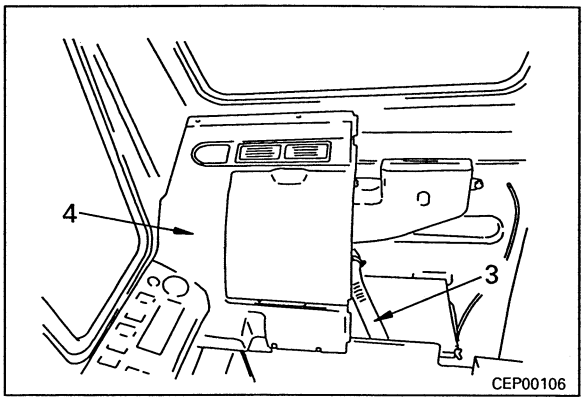


REMOVAL OF ENGINE THROTTLE, PUMP CONTROLLER ASSEMBLY

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

1. Slide operator's seat to front.
2. Remove plate (1), then remove left cover (2).
3. Disconnect air conditioner hose (3) and speaker wiring connector, then remove cover (4).
   ★ Raise the cover slightly when disconnecting the speaker wiring connector.
4. Remove 5 connectors (5).
5. Remove engine throttle and pump controller assembly (6). ※ 1



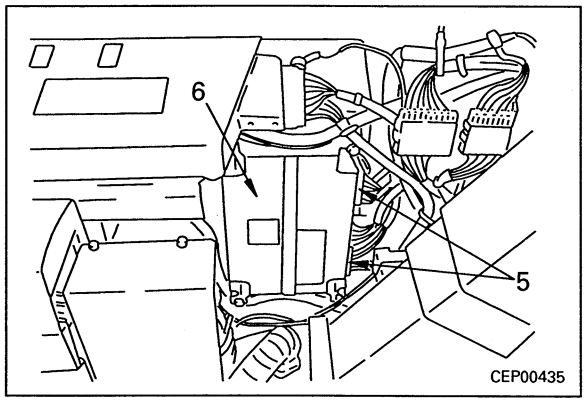


INSTALLATION OF ENGINE THROTTLE, PUMP CONTROLLER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

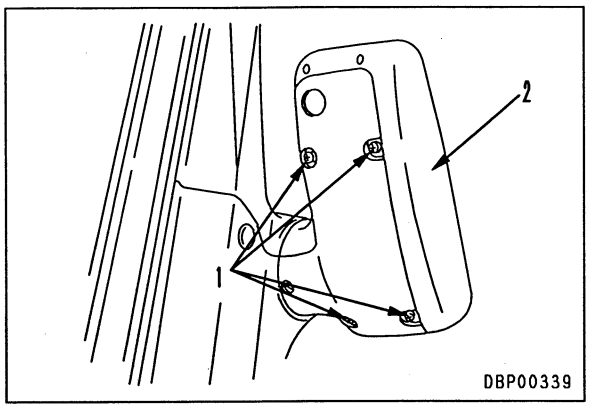
- Check the performance of the work equipment, travel, and swing. For details, see TESTING AND ADJUSTING.

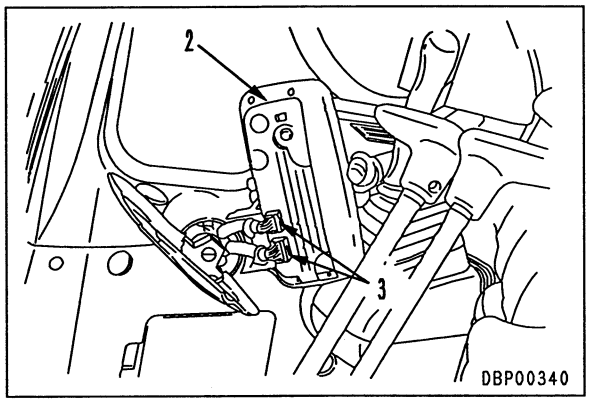


REMOVAL OF MONITOR ASSEMBLY

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

1. Remove screws (1), then lift up monitor assembly (2).
2. Disconnect wiring connectors (3), then remove monitor assembly (2).





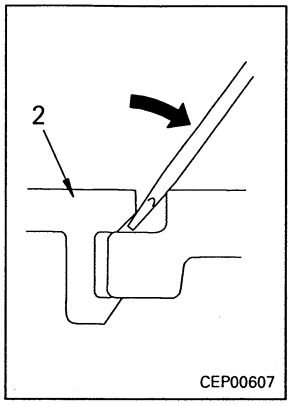
INSTALLATION OF MONITOR ASSEMBLY

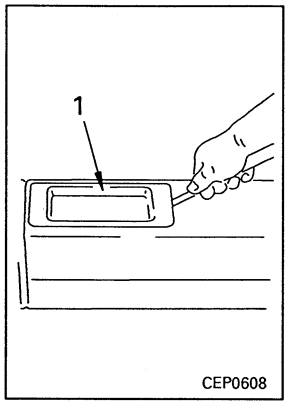
- Carry out installation in the reverse order to removal.

REMOVAL OF CONTROL STAND CASE

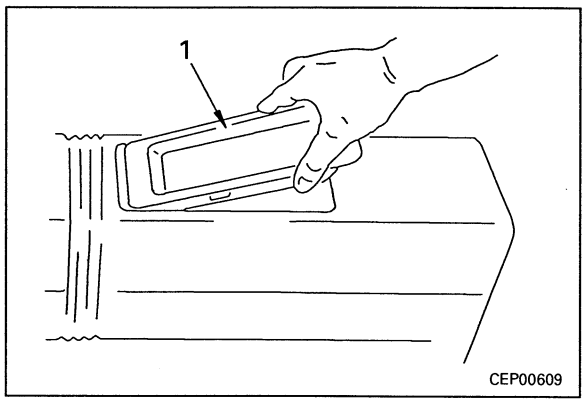
1. Tray

1) Insert a thin flat (–) headed screwdriver into notch at rear of tray (1) and lever up lightly to release rear claw (2).
   ★ The claw can only be released from the rear.





2) Pull tray (1) to rear to remove.



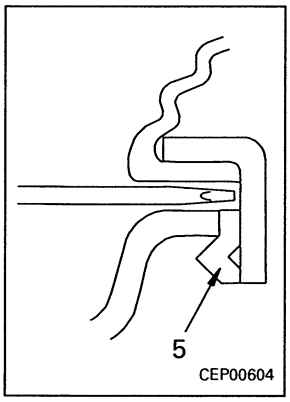
2. Boot

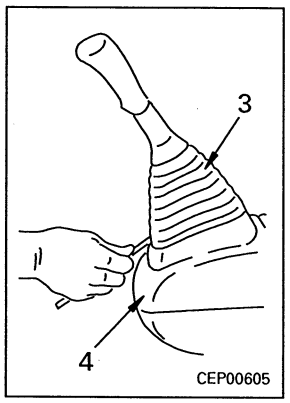
1) Insert a thin flat (–) headed screwdriver between boot (3) and upper case (4), remove claw (5) at front of boot from upper case, then raise front.

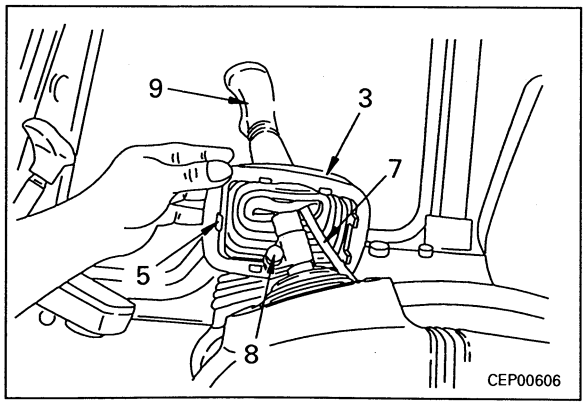
2) Pull boot (3) to front to remove claw at rear of boot. ※ 1

3) Disconnect wiring connector (7) from hole for removed tray.

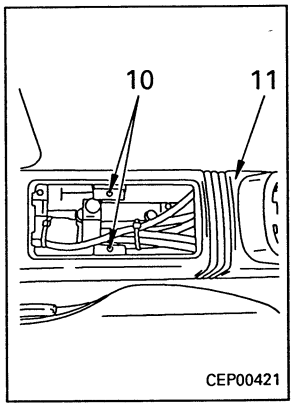
4) Push boot up, remove bolt (8), then remove lever (9) and boot (3).
   ★ Check the direction of the lever.

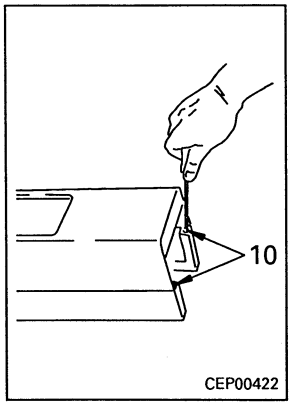




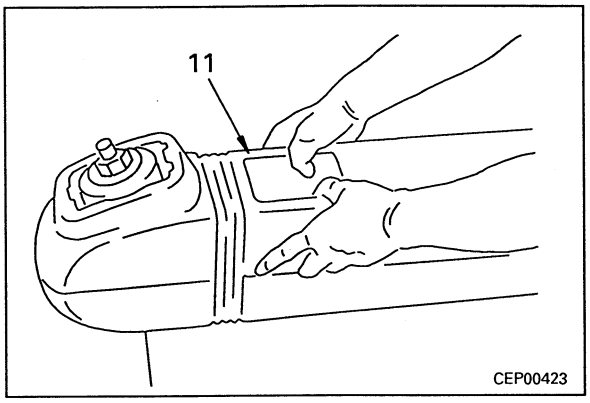


3. **Upper case**
   1) Remove 4 upper case mounting screws (10).



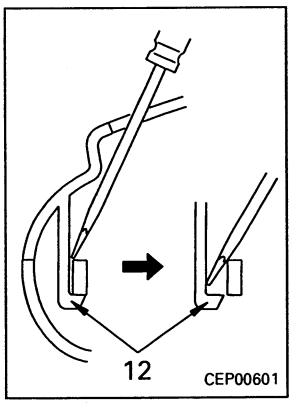


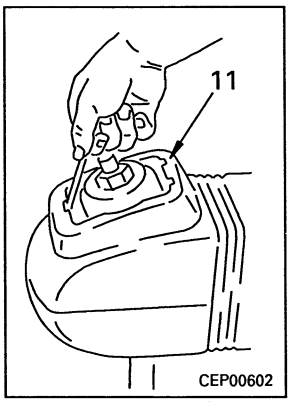
   2) Push bottom center of upper case (11) from both sides, and lift up to release claws at both sides.



   3) Use a flat (–) headed screwdriver from front of upper case (11) to release claws (12) at front of case.

   4) Remove upper case (11).





INSTALLATION OF CONTROL STAND CASE

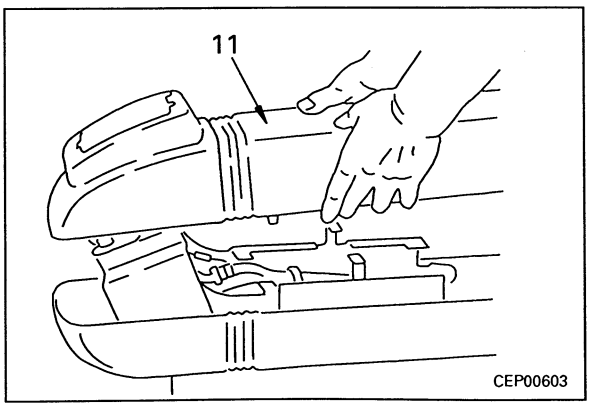
- Carry out installation in the reverse order to removal.

※ 1

★ When installing the boot, insert the claw at the rear first.

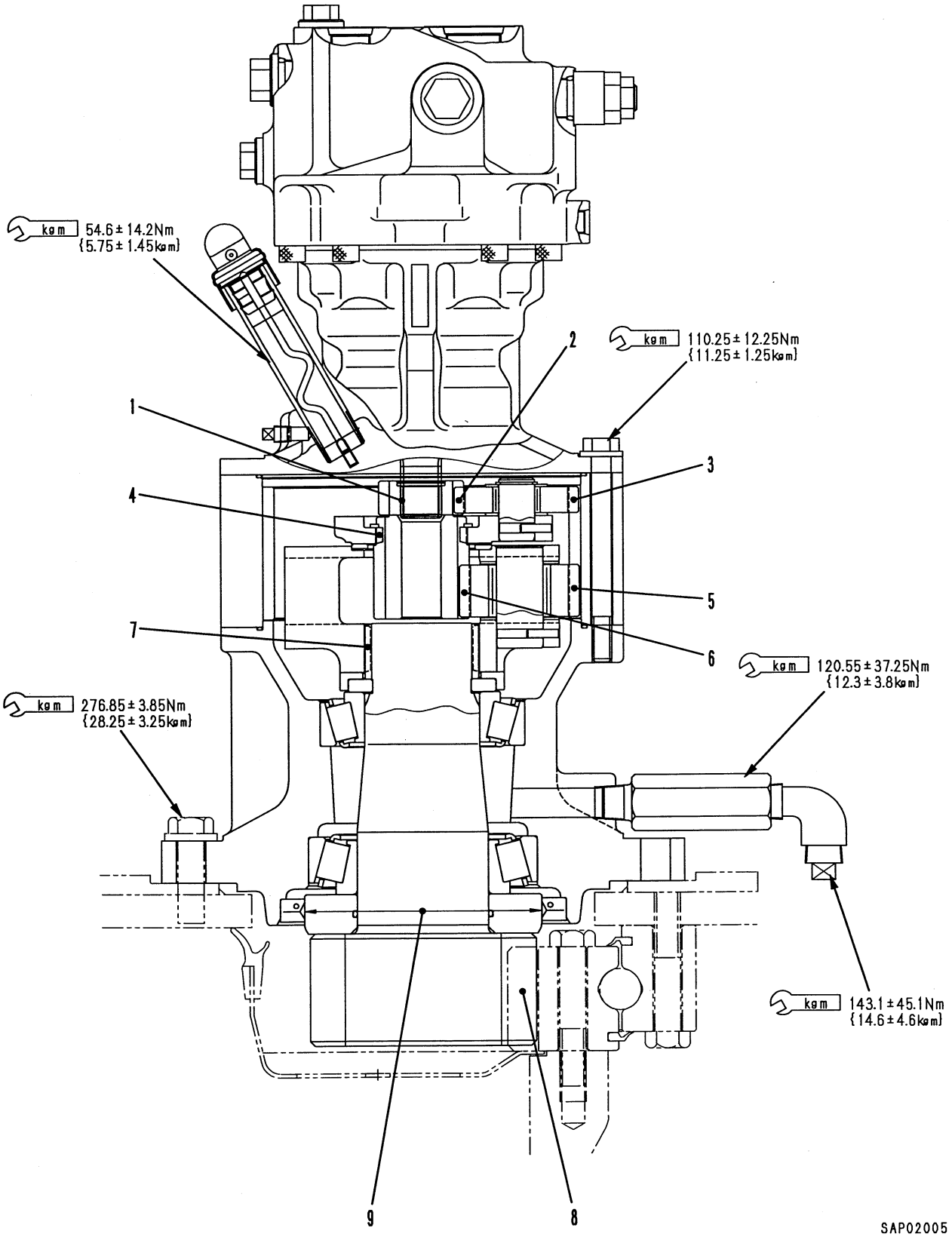
※ 2

★ When installing the tray and upper case, insert the claws at the front first.



40 MAINTENANCE STANDARD

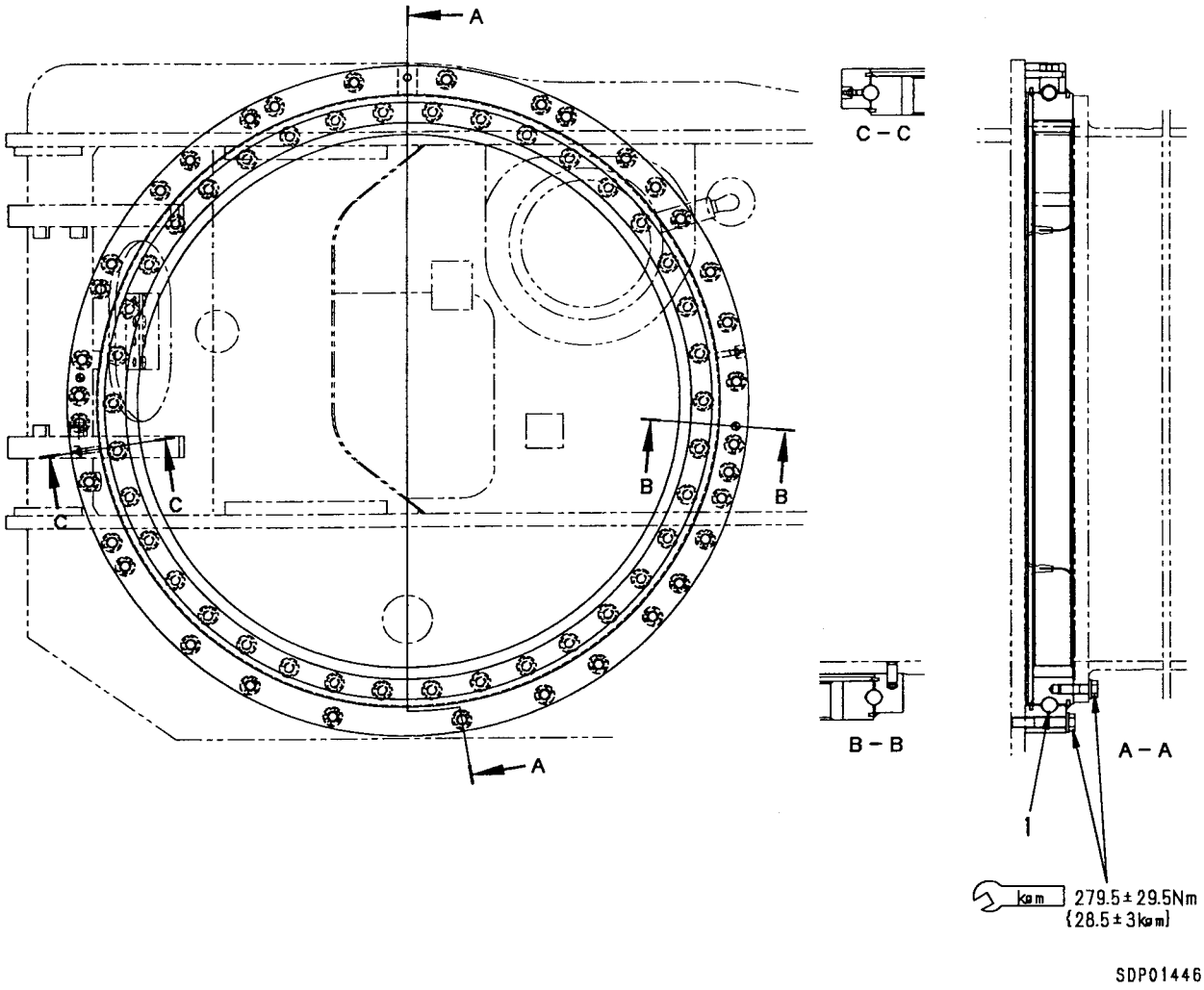
SWING MACHINERY



Unit: mm

No.	Check item	Criteria		Remedy
1	Backlash between swing motor shaft and No. 1 sun gear.	Standard size	Repair limit	Replace
		0.07 - 0.18	0.4	
2	Backlash between No. 1 sun gear and No. 1 planetary gear.	0.13 - 0.31	0.6	
3	Backlash between No. 1 planetary gear and ring gear.	0.15 - 0.34	0.7	
4	Backlash between No. 2 sun gear and No. 2 planetary gear.	0.14 - 0.34	0.7	
5	Backlash between No. 2 sun gear and No. 2 planetary gear.	0.13 - 0.31	0.6	
6	Backlash between No. 2 planetary gear and ring gear.	0.15 - 0.34	0.7	
7	Backlash between No. 2 planetary carrier and swing pinion.	0.08 - 0.19	0.4	
8	Backlash between swing pinion and swing circle.	0.13 - 1.16	2.3	Apply hard-chrome plating recondition, or replace
9	Wear of swing pinion surface contacting with oil seal.	Standard size	Repair limit	
		$145\ ^{0}_{-0.100}$	144.8	

SWING CIRCLE

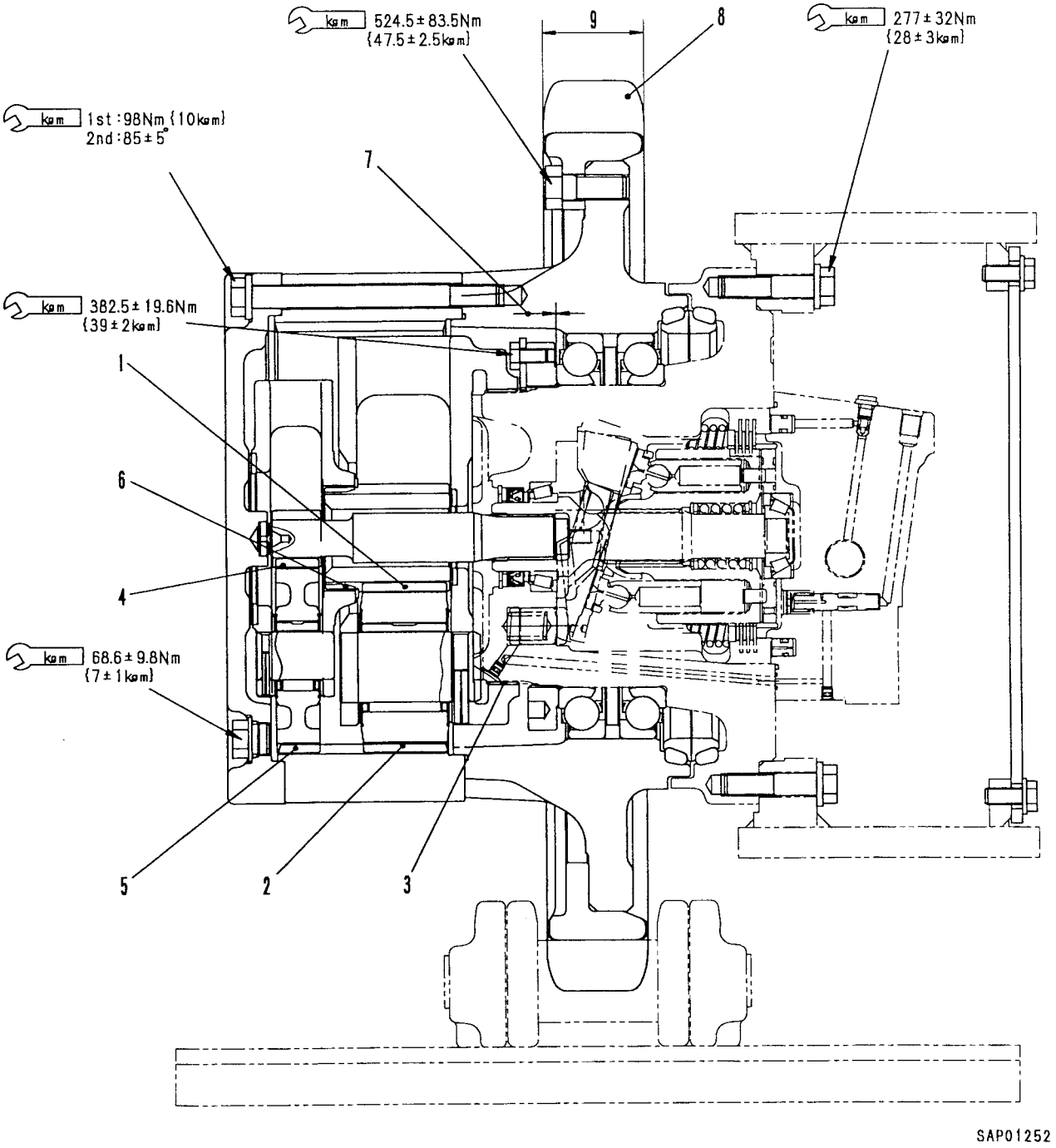


Unit: mm

No.	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Axial clearance of bearing	0.10 - 0.25	0.3	Replace

SM rev. PC130/150LGP-6K

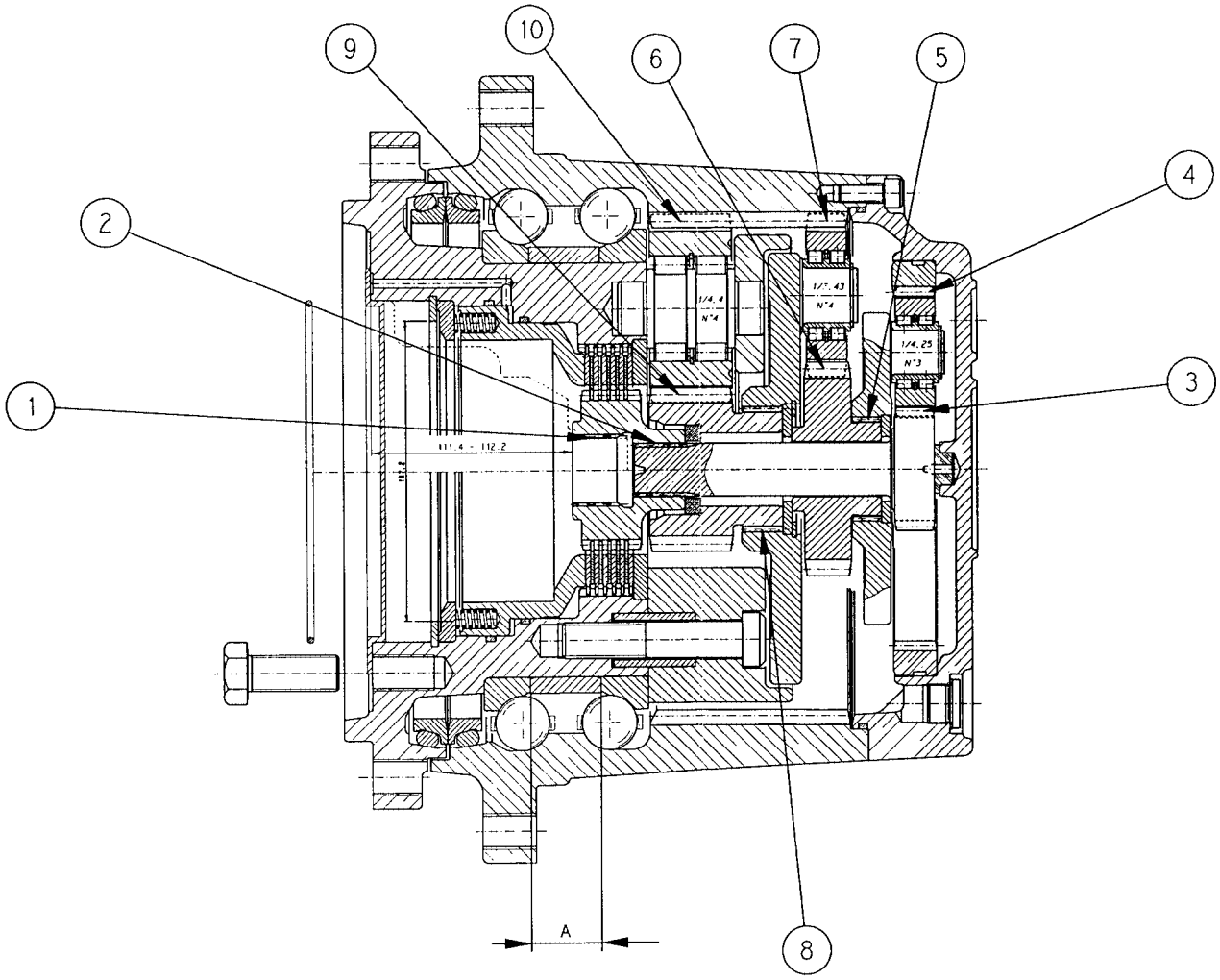
FINAL DRIVE
PC130-6K



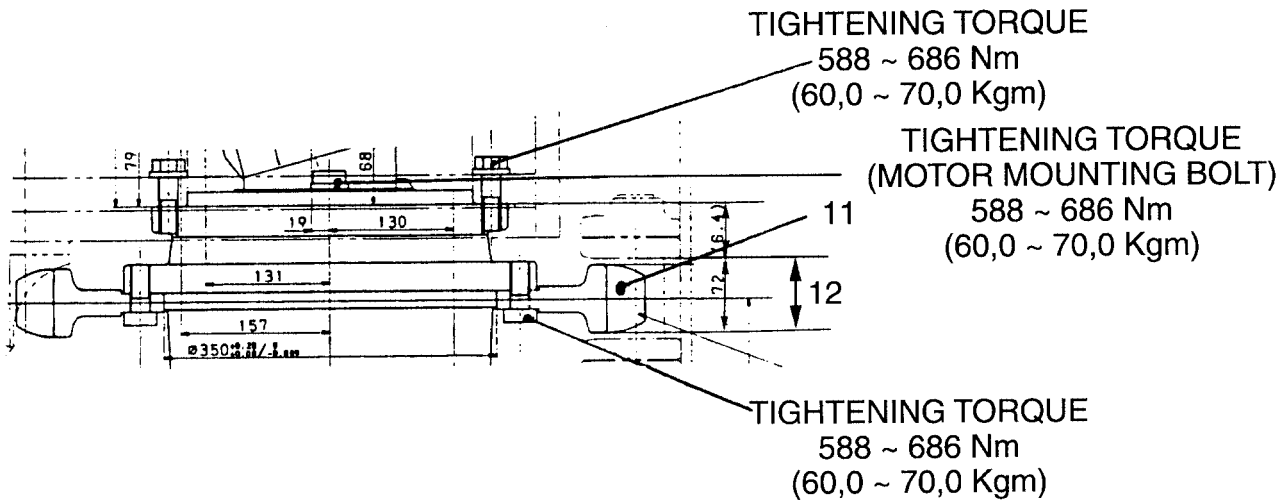
Unit: mm

No.	Check item	Criteria		Remedy
1	Backlash between No. 1 sun gear and No. 1 planetary gear	Standard size: 0.15 - 0.49	Repair limit: 1.00	Replace
2	Backlash between No. 1 planetary gear and ring gear	0.17 - 0.57	1.10	
3	Backlash between No. 1 planetary carrier and motor	0.06 - 0.25	—	
4	Backlash between No. 2 sun gear and No. 2 planetary gear	0.14 - 0.46	1.00	
5	Backlash between No. 2 planetary gear and ring gear	0.17 - 0.57	1.10	
6	Backlash between No. 2 planetary carrier and No. 1 sun gear	0.38 - 0.66	1.00	
7	End play of sprocket shaft	0 - 0.10	—	
8	Amount of wear on sprocket tooth	Repair limit: 6		Rebuild or replace
9	Width of sprocket tooth	Standard size: 71	Clearance limit: 68	

FINAL DRIVE
PC150LGP-6K



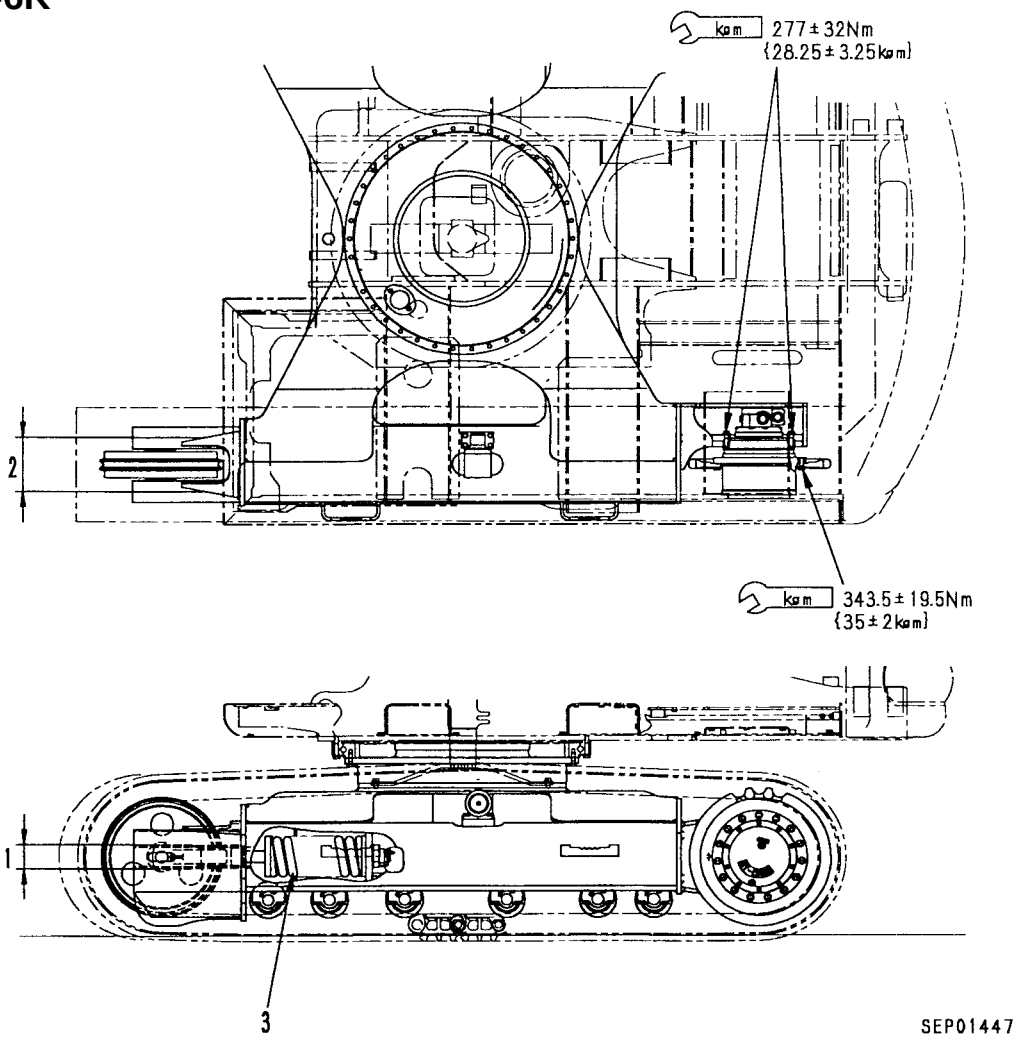
PC150LGP-6K



Unit: mm

Pos.	Check item	Standard clearance (mm)	Clearance limit (mm)	Component	Check measurement standard (mm)	Check measurement limit (mm)
1	Backlash between motor shaft and brake shaft	0,064- 0,154	0,33	Motor Shaft:	Measurement over pin ø4,5mm 45,137 -0,050 -0,111	Measurement over pin ø4,5mm 44,91
				Brake shaft:	Measurement over pin ø3,5mm 32,739 +0,121 +0,044	Measurement over pin ø3,5mm 33,01
2	Backlash between brake shaft and 1st stage sun gear	0,064- 0,155	0,33	Brake shaft:	Measurement over pin ø3,5mm 22,484 +0,171 +0,063	Measurement over pin ø3,5mm 22,85
				Sun gear:	Measurement over pin ø4mm 34,144 -0,054 -0,120	Measurement over pin ø4mm 33,90
3	Backlash between 1st stage sun gear and 1st stage planet gear	0,096 - 0,165	0,43	Sun gear:	Span measurement over 4 teeth 27,93 -0,040 -0,080	Span measurement over 4 teeth 27,73
				Planet gear:	Span measurement over 4 teeth 27,425 -0,050 -0,075	Span measurement over 4 teeth 27,23
4	Backlash between 1st stage planet gear and toothed ring	0,133 - 0,213	0,48	Planet gear:	Span measurement over 4 teeth 27,531 -0,050 -0,075	Span measurement over 4 teeth 27,23
				Toothed ring:	Measurement over pin ø4mm 192,072 +0,350 +0,210	Measurement over pin ø4mm 192,77
5	Backlash between 1st stage planet carrier and 2nd stage sun gear	0,020 - 0,098	0,27	Planet carrier:	Measurement over pin ø3,5mm 49,879 +0,088 +0,002	Measurement over pin ø3,5mm 50,12
				Sun gear:	Measurement over pin ø3,5mm 59,847 -0,029 -0,075	Measurement over pin ø3,5mm 59,64
6	Backlash between 2nd stage sun gear and 2nd stage planet gear	0,149 - 0,255	0,68	Sun gear:	Span measurement over 4 teeth 43,996 -0,060 -0,120	Span measurement over 4 teeth 43,68
				Planet gear:	Span measurement over 4 teeth 43,996 -0,060 -0,120	Span measurement over 4 teeth 43,52
7	Backlash between 2nd stage planet gear and toothed ring	0,213 - 0,399	0,83	Planet gear:	Span measurement over 4 teeth 43,996 -0,060 -0,120	Span measurement over 4 teeth 43,52
				Toothed ring:	Measurement over pin ø6,5mm 266,50 +0,720 +0,340	Measurement over pin ø6,5mm 267,78
8	Backlash between 2nd stage planet carrier and 3rd stage sun gear	0,020 - 0,098	0,27	Planet carrier:	Measurement over pin ø4mm 60,579 +0,094 -0,002	Measurement over pin ø4mm 60,84
				Sun gear:	Measurement over pin ø4mm 73,232 -0,034 -0,082	Measurement over pin ø4mm 73,01
9	Backlash between 3rd stage sun gear and 3rd stage planet gear	0,149 - 0,255	0,68	Sun gear:	Span measurement over 3 teeth 32,08 -0,060 -0,120	Span measurement over 3 teeth 31,76
				Planet gear:	Span measurement over 4 teeth 43,90 -0,080 -0,120	Span measurement over 4 teeth 43,58
10	Backlash between 3rd stage planet gear and toothed ring	0,213 - 0,399	0,83	Planet gear:	Span measurement over 4 teeth 43,90 -0,080 -0,120	Span measurement over 4 teeth 43,52
				Toothed ring:	Measurement over pin ø4mm 266,50 +0,720 +0,340	Measurement over pin ø6,5mm 267,78
11	Wear of sprocket teeth	Repair limit: 6				
12	Sprocket tooth width	Standard size	Repair limit	Rebuild or replace		
		72	68			

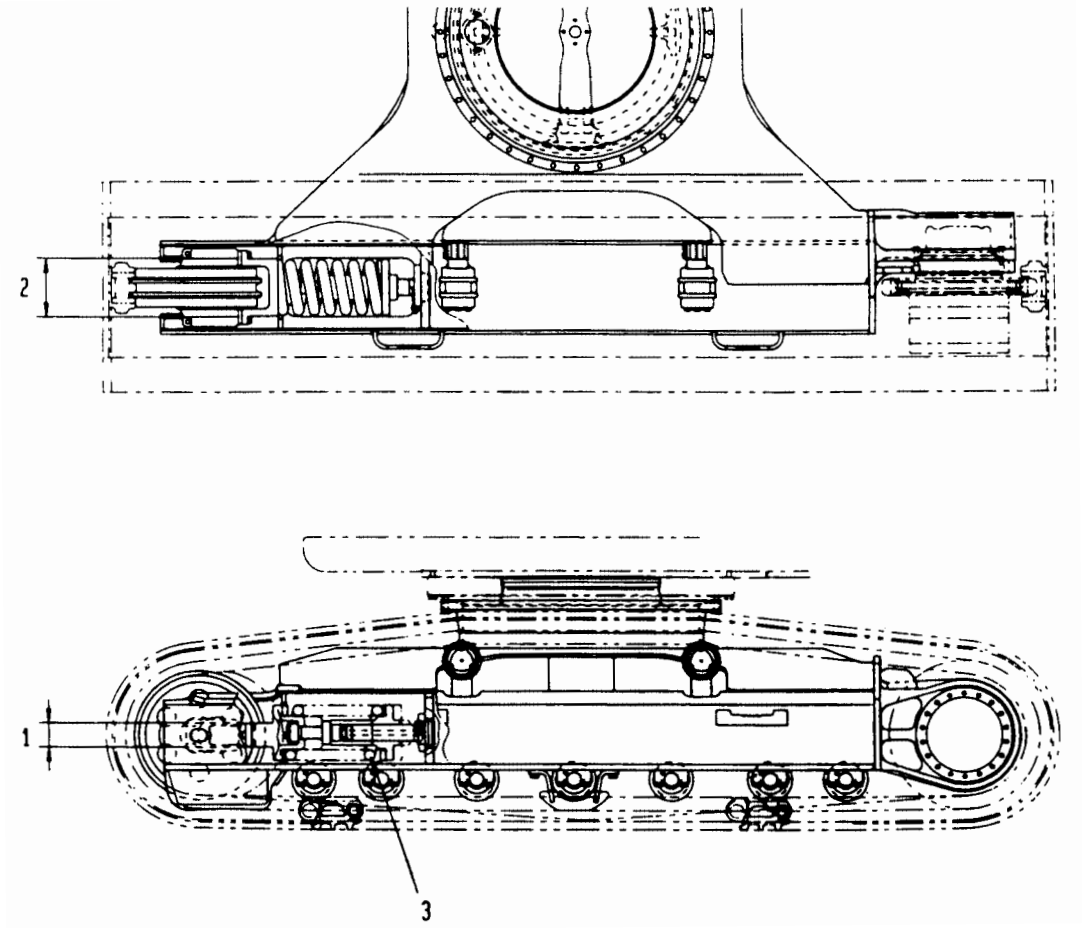
TRACK FRAME
PC130-6K



Unit: mm

No.	Check item	Criteria					Remedy
				Standard clearance	Clearance limit		
1	Vertical width of idler guide	Track frame		84	89		Rebuild
		Idler		82	77		Rebuild or replace
2	Horizontal width of idler guide	Track frame		185	193		Rebuild
		Idler		183	175		Rebuild or replace
3	Recoil spring	Standard size			Repair limit		Replace
		Free length	Installed length	Installed load	Free length	Installed load	
		505	390	78.5 kN {8,000 kg}	494	69.8 kN {7,120 kg}	

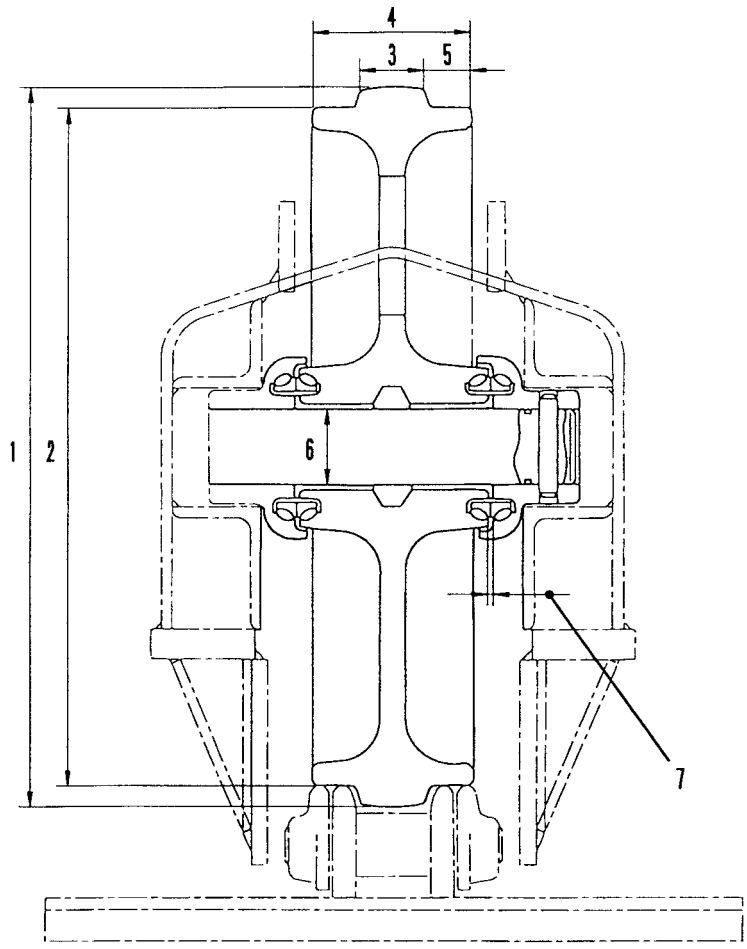
TRACK FRAME, RECOIL SPRING
PC150LGP-6K



Unit: mm

No.	Check item		Criteria					Remedy
					Standard size	Tolerance	Repair limit	
1	Vertical width of idler guide		Track frame		107			Rebuild or replace
			Idler support		105			
2	Horizontal width of idler guide		Track frame		250			
			Idler support		247.4			
			Standard size			Repair limit		
3	Recoil spring		Free length x OD	Installed length	Installed load	Free length	Installed load	Replace
		PC180/160	587.5 x 243	466	133.5 kN {13,610 kg}	576	106.8 kN {10,885 kg}	

IDLER
PC130-6K



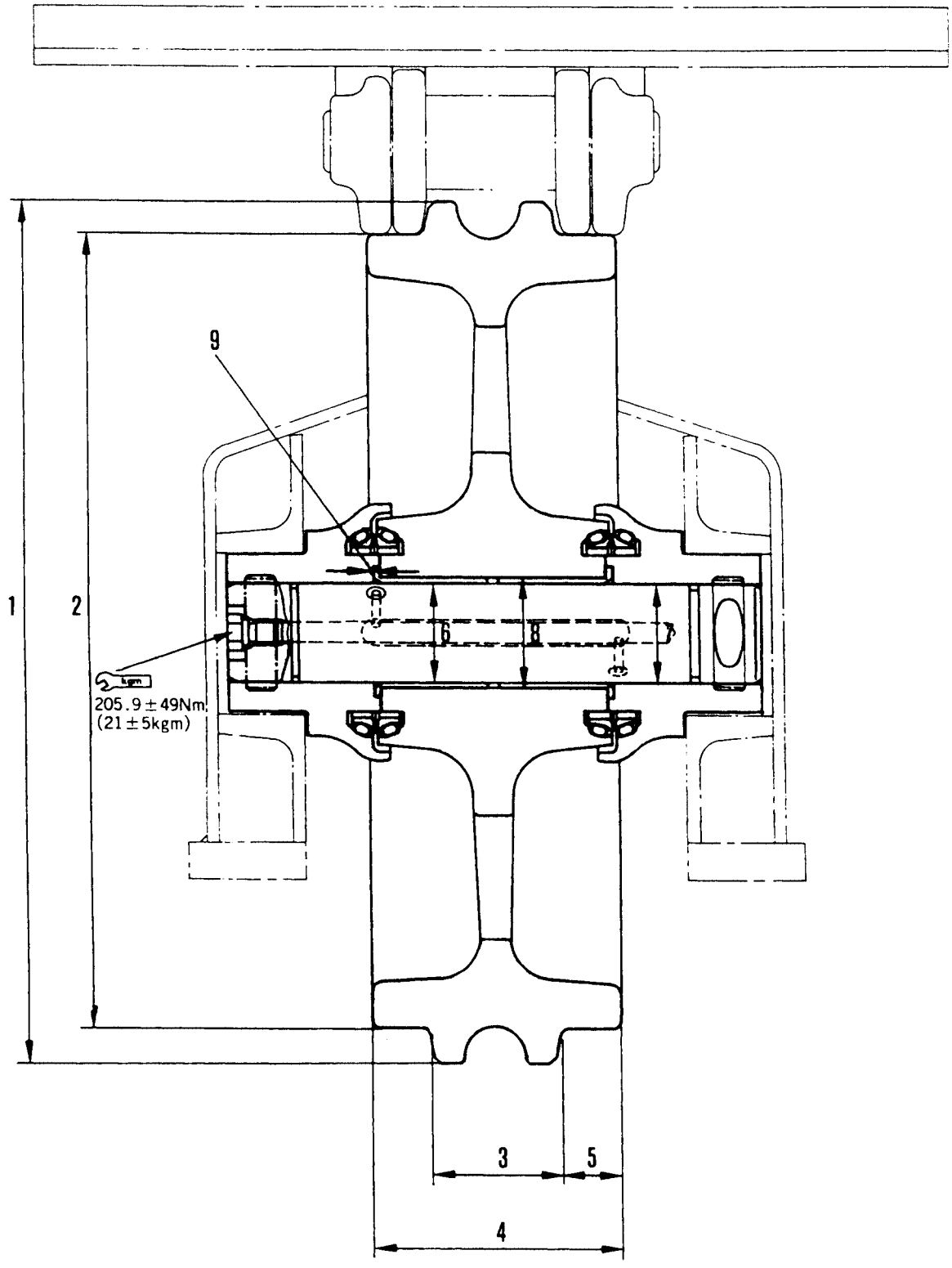
SBP02006

Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of proruding portion	Standard size			Repair limit		Rebuild or replace
		527			517		
2	Outside diameter of tread	489			477		
3	Width of protrusion	52			42		
4	Overall width	115			107		
5	Width of tread	31.5			36.5		Replace
6	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
		54	–0.250 –0.280	+0.074 0	0.250 – 0.354	1.5	
7	End play of idler shaft	Standard clearance			Clearance limit		
		1.049 – 3.25			1.5		

SM rev. PC130/150LGP-6K

IDLER
PC150LGP-6K



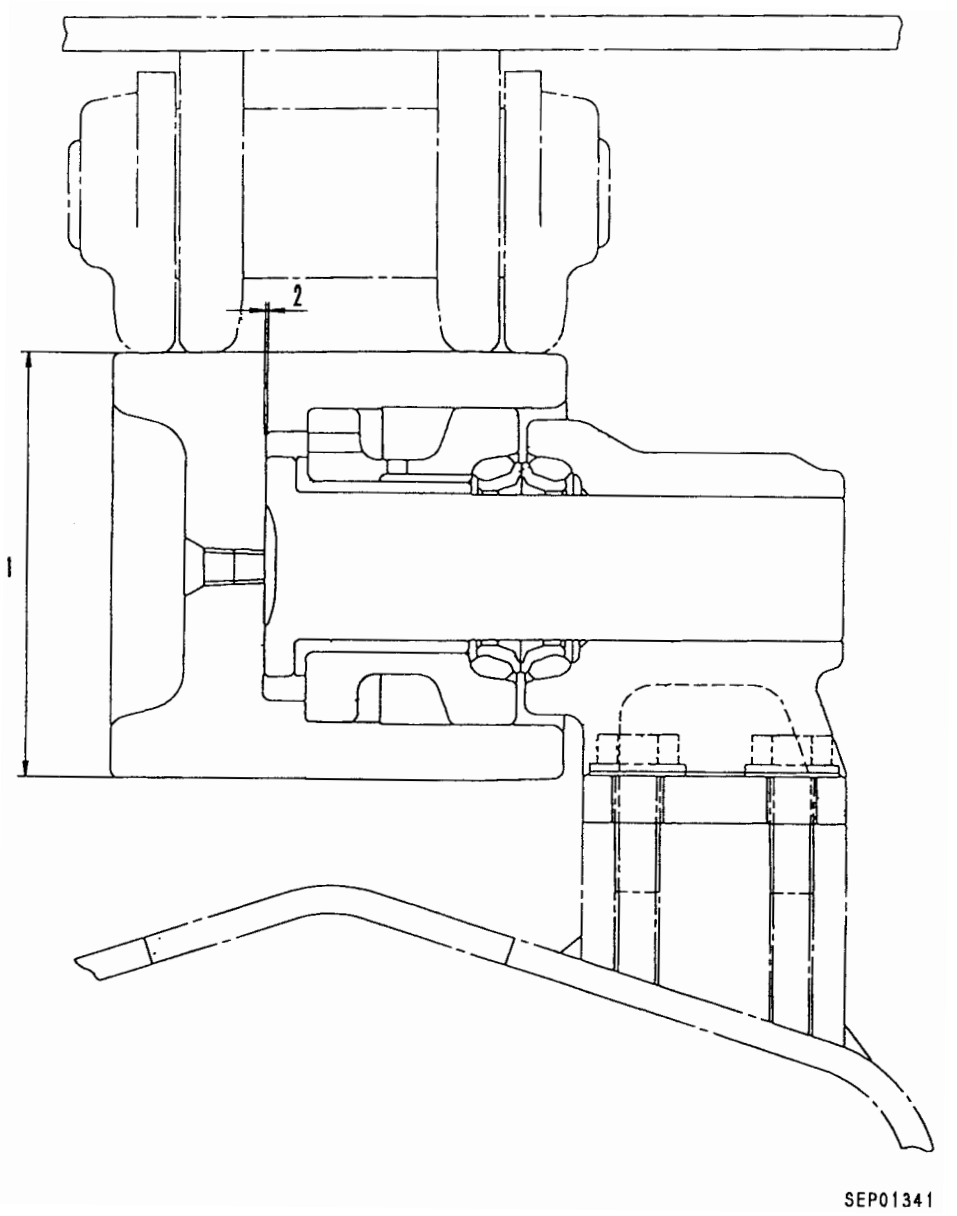
205F05186

PC150LGP-6K

Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="5">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of proruding portion</td><td colspan="3">Standard size</td><td colspan="2">Repair limit</td><td rowspan="4">Rebuild or replace</td></tr>
<tr><td colspan="3">560</td><td colspan="2">—</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="3">520</td><td colspan="2">508</td></tr>
<tr><td>3</td><td>Width of protrusion</td><td colspan="3">85</td><td colspan="2">—</td></tr>
<tr><td>4</td><td>Overall width</td><td colspan="3">164</td><td colspan="2">—</td><td></td></tr>
<tr><td>5</td><td>Width of tread</td><td colspan="3">39.5</td><td colspan="2">45.5</td><td rowspan="2">Replace bushing</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Clearance between shaft and bushing</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></td><td>80</td><td>–0.250
–0.350</td><td>+0.074
–0.036</td><td>0.214 – 0.424</td><td>1.5</td><td></td></tr>
<tr><td>7</td><td>Clearance between shaft and support</td><td>80</td><td>–0.250
–0.290</td><td>–0.110
–0.220</td><td>0.03 – 0.180</td><td>—</td><td>Replace</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Interference between idler and bushing</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard interference</td><td rowspan="2">Interference limit</td><td rowspan="4">Replace bushing</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td></td><td>87.6</td><td>+0.089
+0.059</td><td>–0.006
–0.072</td><td>0.065 – 0.161</td><td>—</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">Side clearance of idler (each)</td><td colspan="3">Standard clearance</td><td colspan="2">Clearance limit</td></tr>
<tr><td colspan="3">0.39 – 1.00</td><td colspan="2">1.5</td></tr>
</table>

CARRIER ROLLER
PC130-6K

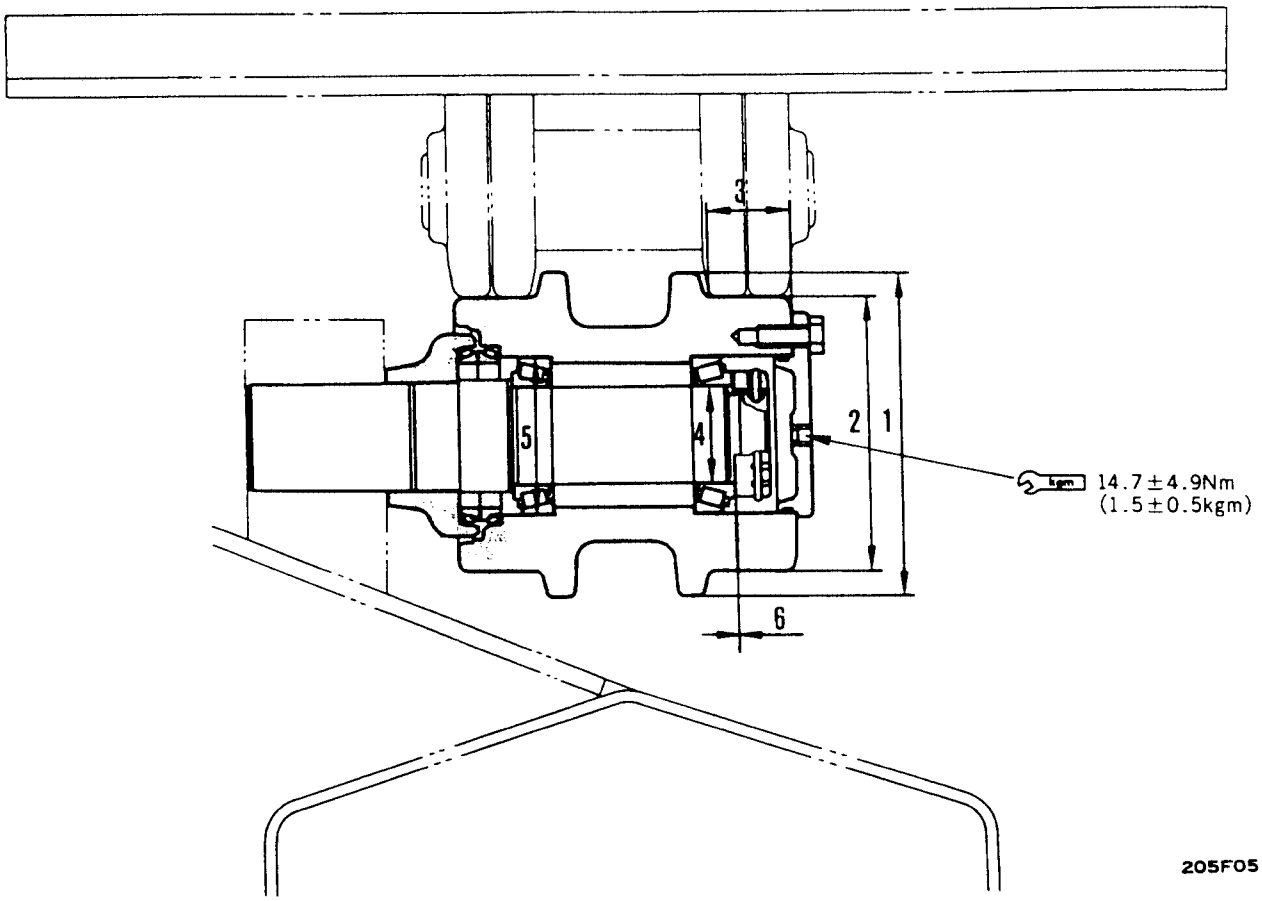


Unit: mm

No.	Check item	Criteria		Remedy
1	Outside diameter of tread	Standard size	Repair limit	Rebuild or replace
		116	106	
2	End play of roller	Standard clearance	Clearance limit	Replace
		0.363 - 0.537	1.5	

SM rev. PC130/150LGP-6K

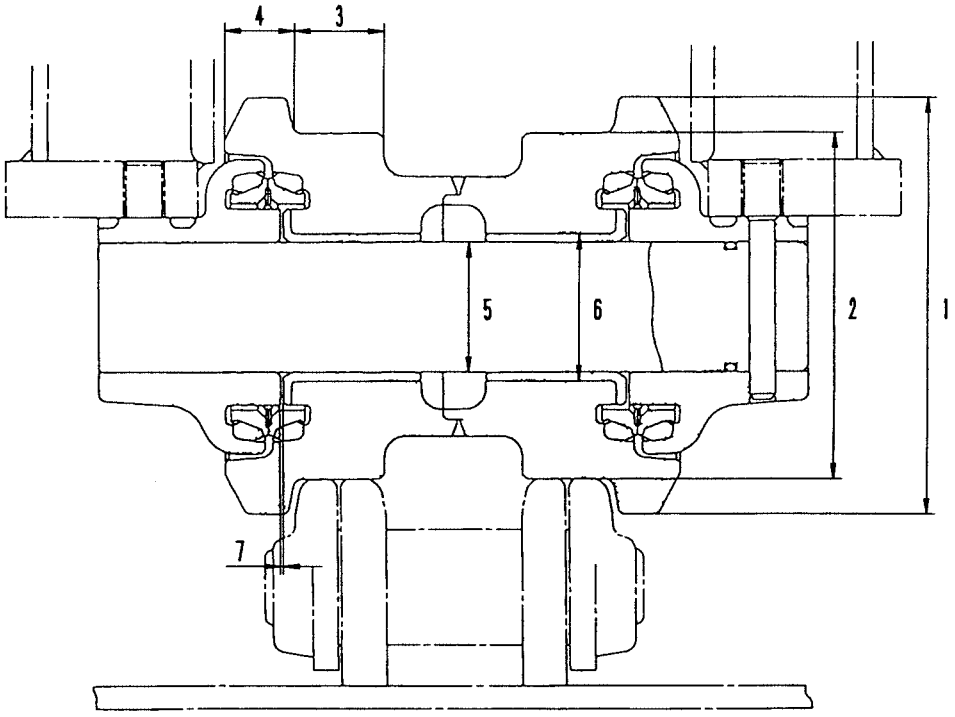
CARRIER ROLLER
PC150LGP-6K



Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of flange (outside)	Standard size			Repair limit		Rebuild or replace
		165			—		
2	Outside diameter of tread	140			130		
3	Width of tread	43			50		
4	Interference between shaft and bearing	Standard size	Tolerance		Standard interference	Interference limit	Replace
			Shaft	Hole			
		50	0 -0.016	0 –0.012	-0.016 – 0.012	—	
5	Interference between roller and bearing	80	0 –0.013	–0.021 –0.051	0.008 – 0.051	—	
6	Side clearance of roller	Standard size			Repair limit		
		0.01 – 0.18			—		

TRACK ROLLER
PC130-6K



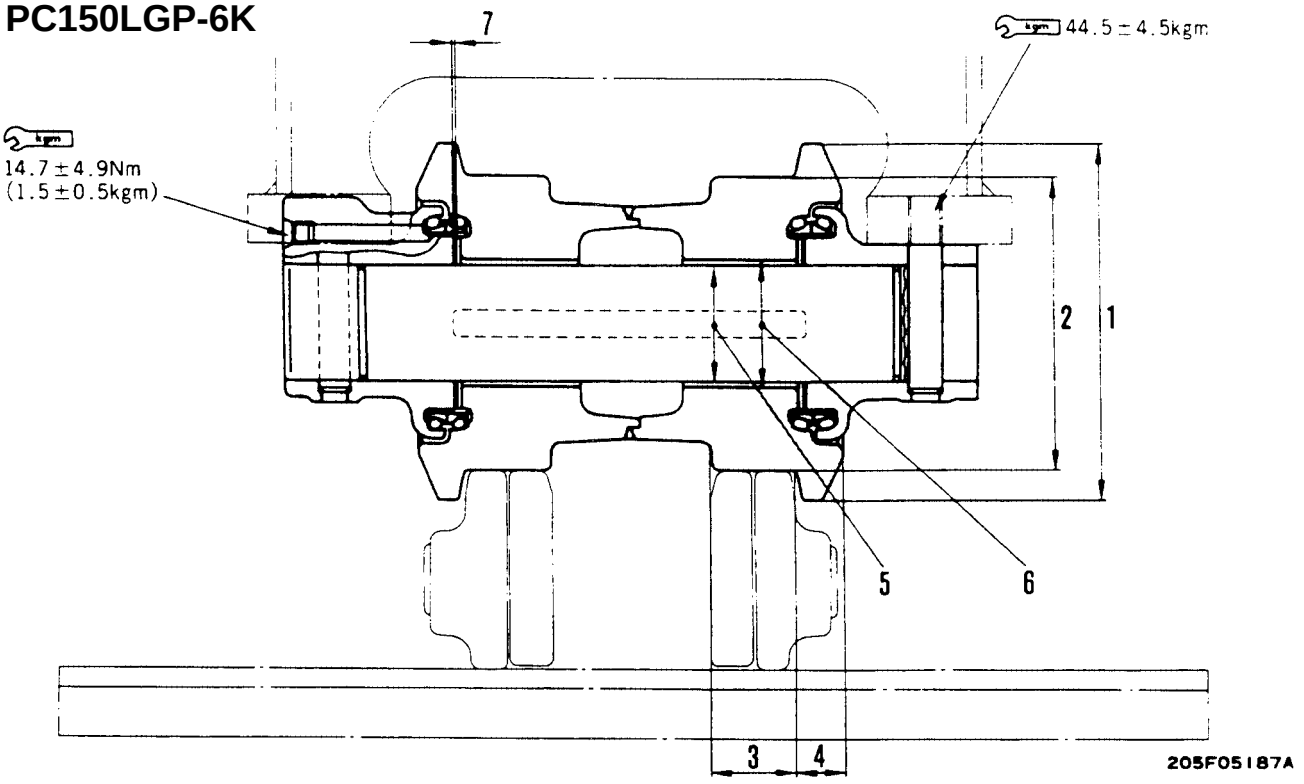
SEP01342

Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of flange	Standard size: 158		Repair limit: 148			Rebuild or replace
2	Outside diameter of tread	130		125			
3	Width of tread	35		30.5			
4	Width of flange	26.5		—			
5	Clearance between shaft and bushing	Standard size: 50	Tolerance – Shaft: –0.250 –0.270	Tolerance – Hole: +0.187 -0.025	Standard clearance: 0.225 – 0.457	Clearance limit: 1.5	Replace bushing
6	Interference between roller and bearing	Standard size: 57	Tolerance – Shaft: +0.190 +0.110	Tolerance – Hole: +0.009 +0.060	Standard interference: 0.020 – 0.130	Interference limit: —	
7	Side clearance of idler (both sides)	Standard clearance: 0.31 – 0.69		Clearance limit: 1.5			Replace

TRACK ROLLER

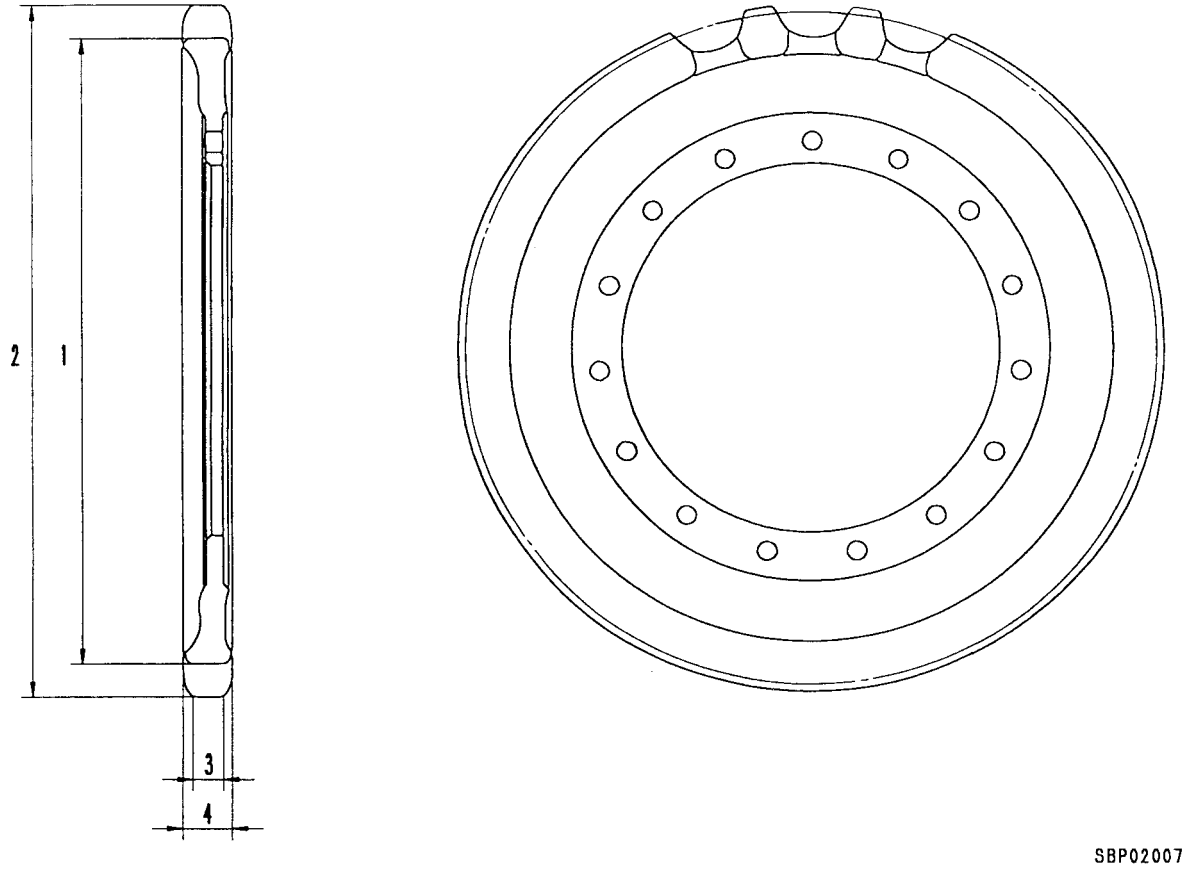
PC150LGP-6K



Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of flange (outside)	Standard size: 186		Repair limit: —			Rebuild or replace
2	Outside diameter of tread	154		142			
3	Width of tread	44.5		52			
4	Width of flange	24.4		—			
5	Clearance between shaft and bushing	Standard size: 60	Tolerance: Shaft –0.215 –0.315	Hole +0.195 0.	Standard clearance: 0.215 – 0.510	Clearance limit: 1.5	Replace bushing
6	Interference between roller and bearing	Standard size: 67	Tolerance: Shaft +0.153 +0.053	Hole +0.030 0	Standard interference: 0.023 – 0.153	Interference limit: —	
7	Side clearance of idler (both sides)	Standard clearance: 0.41 – 0.95		Clearance limit: 1.5			Replace

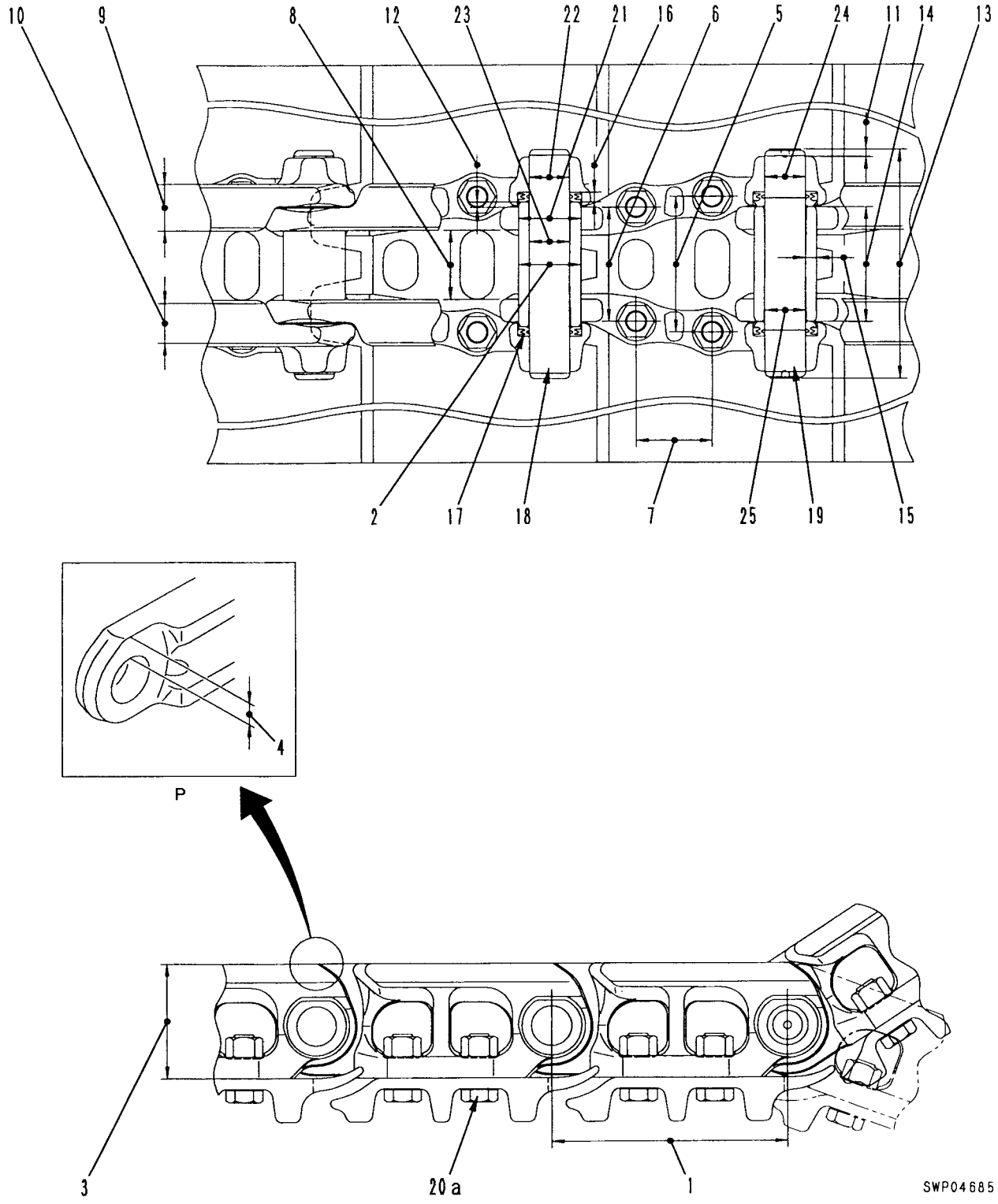
SPROCKET
PC130-6K



Unit: mm

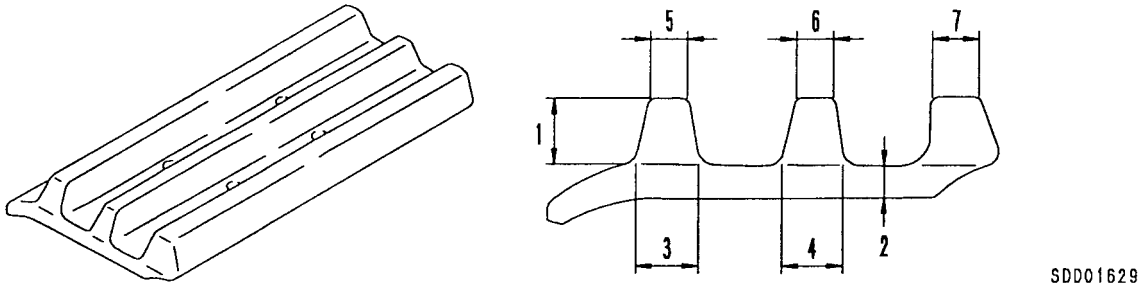
No.	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
1	Wear in diameter of sprocket tooth root	186	+1.0 -2.0	535	Rebuild or replace
2	Wear in diameter of sprocket tooth top	607	—	595	
3	Wear in width of sprocket tooth top	27	—	22	
4	Wear in width of sprocket tooth root	42	+1.5	39	

TRACK SHOE
PC130-6K
TRIPLE-GROUSER SHOE



★ P Portion shows the link of bushing press fitting end.

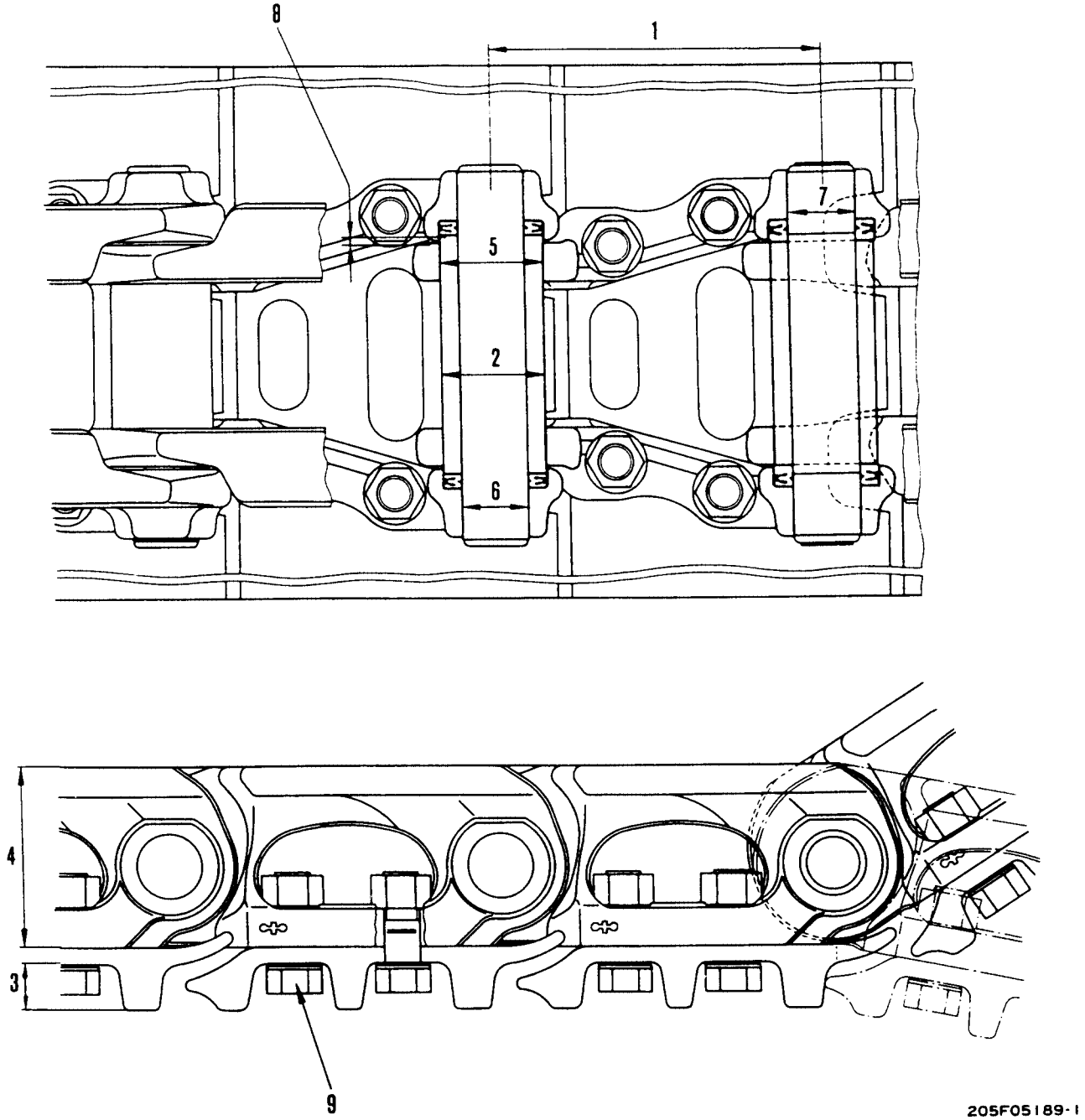
TRIPLE SHOE



Unit: mm

No.	Check item	Criteria		Remedy
1	Height	Standard size	Repair limit	Rebuild or replace
		25	15	
2	Thickness	8		
3	Length of base	24		
4		19		
5	Length of tip	18		
6		11		
7		18		

TRACK SHOE
PC150LGP-6K

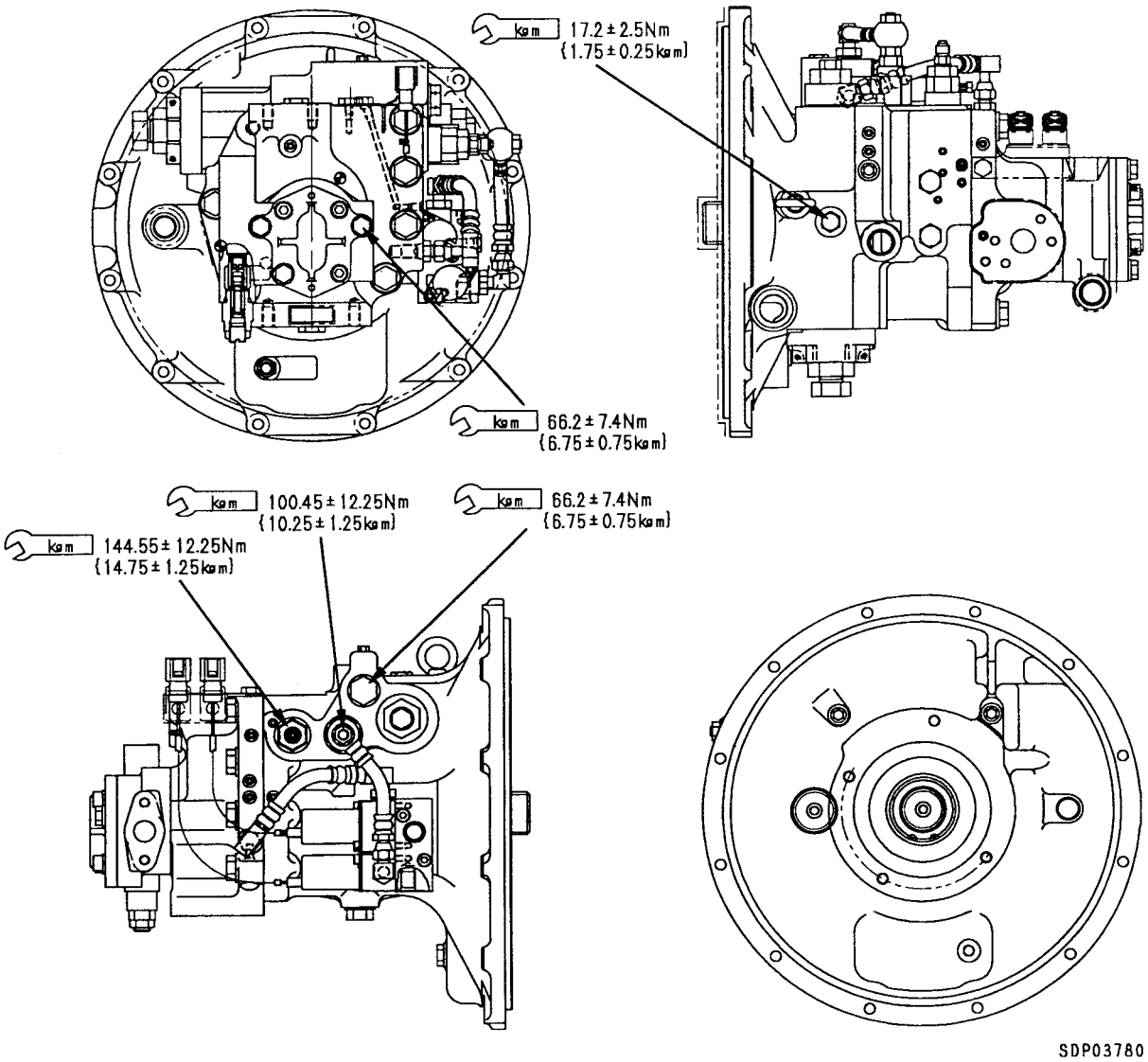


PC150LGP-6K

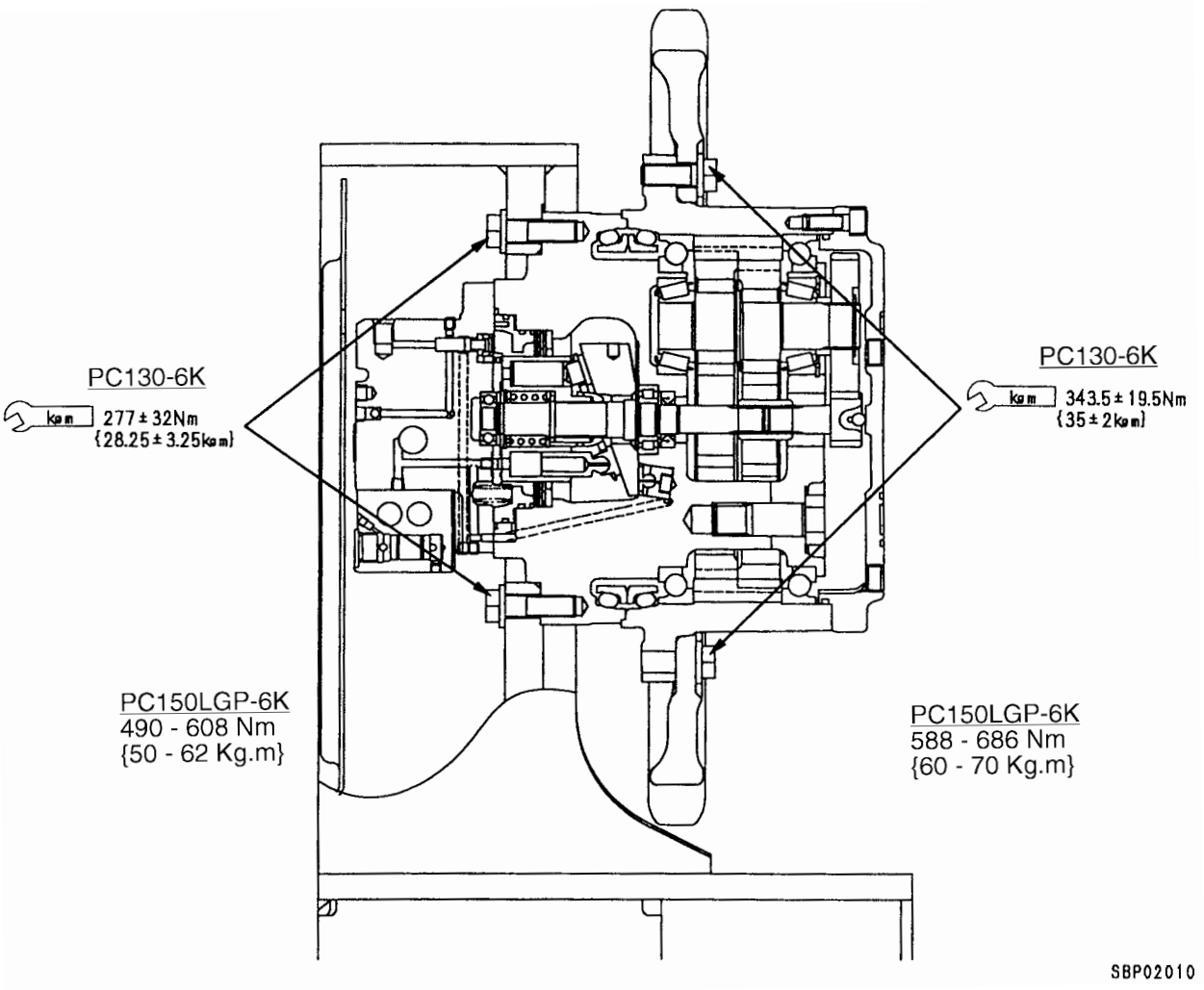
Unit: mm

No.	Check item		Criteria					Remedy
1	Link pitch		Standard size		Repair limit			Turn or replace
			190.25		194.25			
2	Outside diameter of bushing		59.3		54.3			
3	Height of grouser	Triple	26		16			Lug welding rebuild or replace
		Swamp	102.5		90.5			
4	Height of link		105		97			
5	Interference between bushing and link		Standard size	Tolerance		Standard interference	Interference limit	Replace with over size
				Shaft	Hole			
			59	+0.304 +0.264	+0.074 0	0.190 - 0.304	0.100	
6	Interference between regular pin and link		38	+0.222 +0.072	-0.138 -0.200	0.210 - 0.422	0.140	
7	Interference between master pin and link		37.8	+0.230 +0.200	+0.062 0	0.138 - 0.230	0.130	
8	Protrusion of bushing		4.85					Adjust
9	Tightening torque of shoe bolt		Initial tightening torque: 392 ± 39.2 Nm (40 ± 4 kgm) Additional tightening angle: 120° ± 10°					Tighten

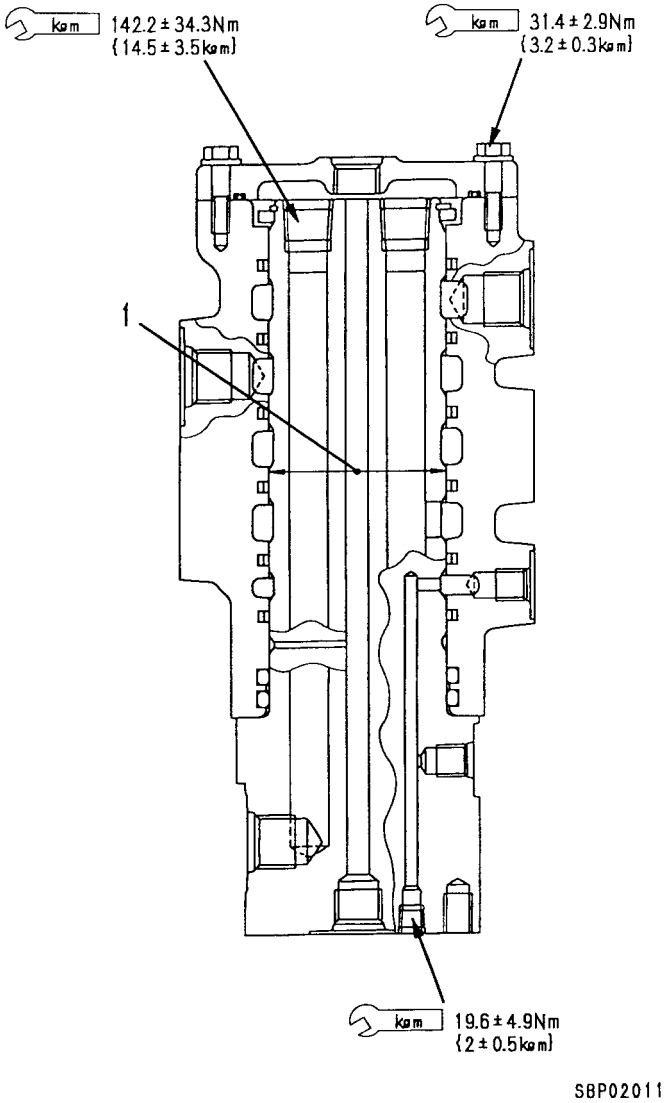
HYDRAULIC PUMP
MAIN PUMP
HPV95



TRAVEL MOTOR
GM18VL



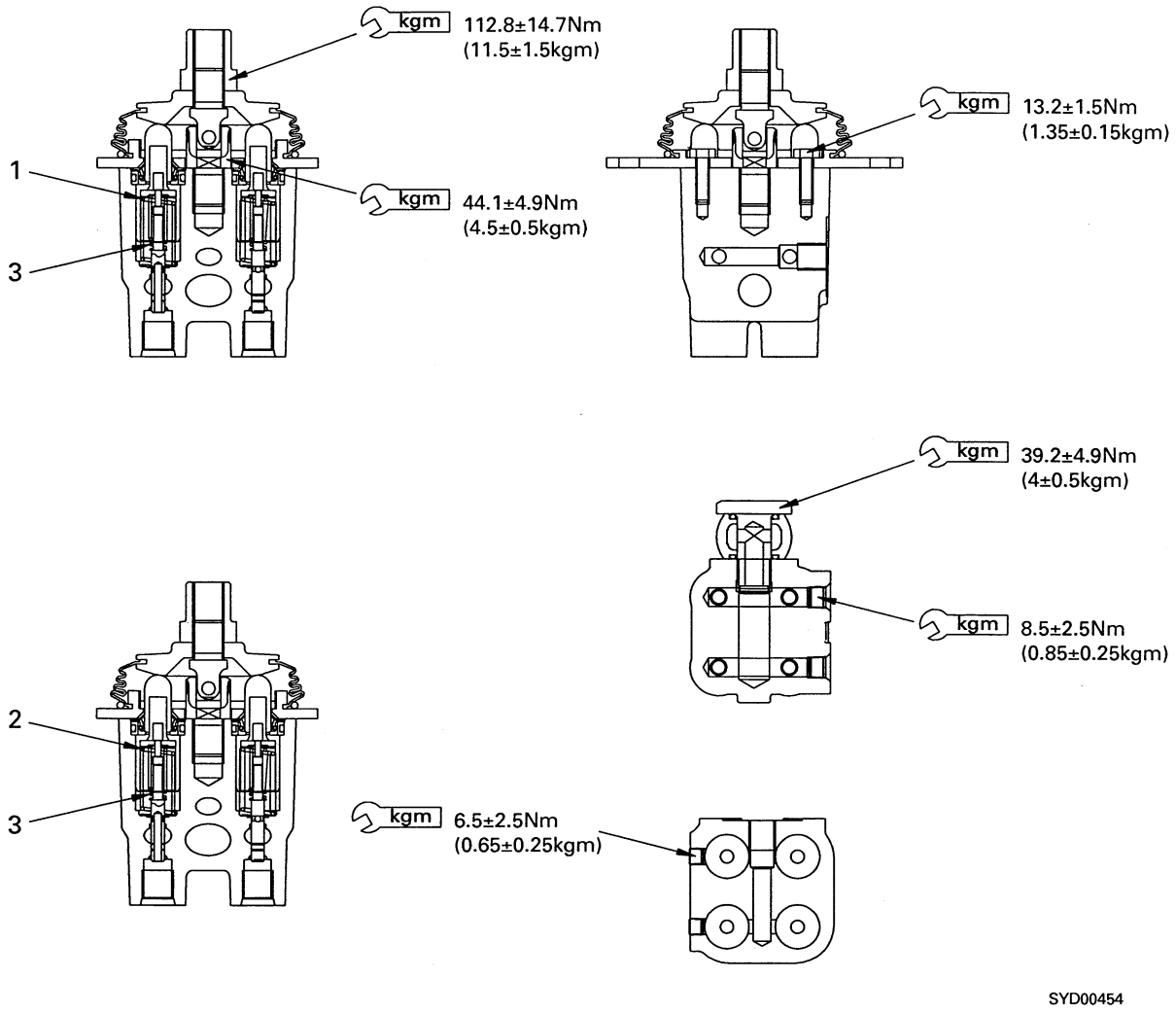
CENTER SWIVEL JOINT



Unit: mm

No.	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
1	Clearance between rotor and shaft	80	0.056 - 0.105	0.111	Replace

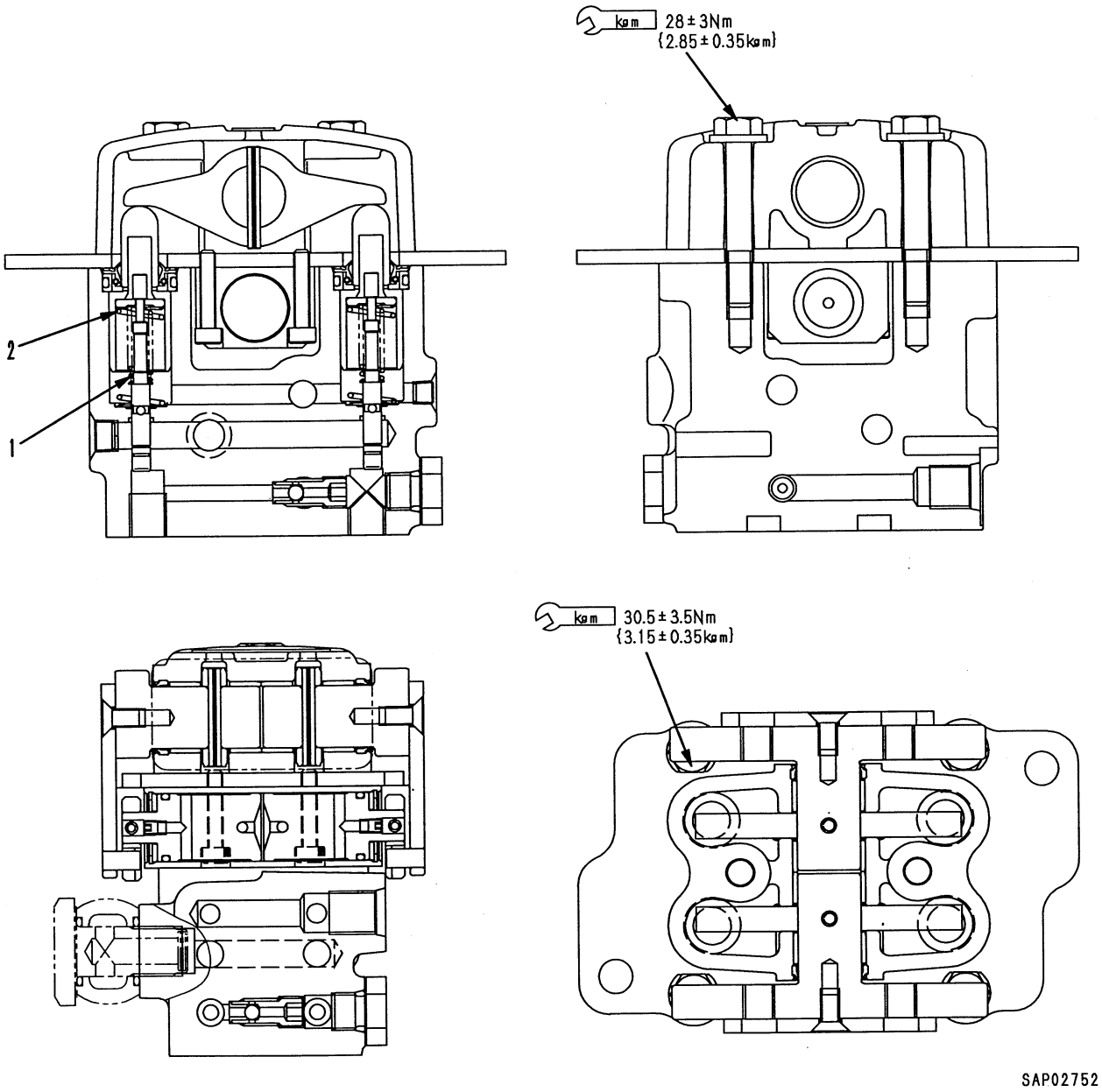
WORK EQUIPMENT • SWING PPC VALVE



Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Centering spring (for P3, P4)	Free length ×O.D.	Installed length	Installed load	Free length	Installed load	Replace spring if any damages or deformations are found.
		42.4 × 15.5	34	17.6 N {1.8 kg}	—	13.7 N {1.4 kg}	
2	Centering spring (for P1, P2).	44.4 × 15.5	34	29.4 N {3.0 kg}	—	23.5 N {2.4 kg}	
3	Metering spring	26.5×8.2	24.9	16.7 N {1.7 kg}	—	13.7 N {1.4 kg}	

TRAVEL PPC VALVE

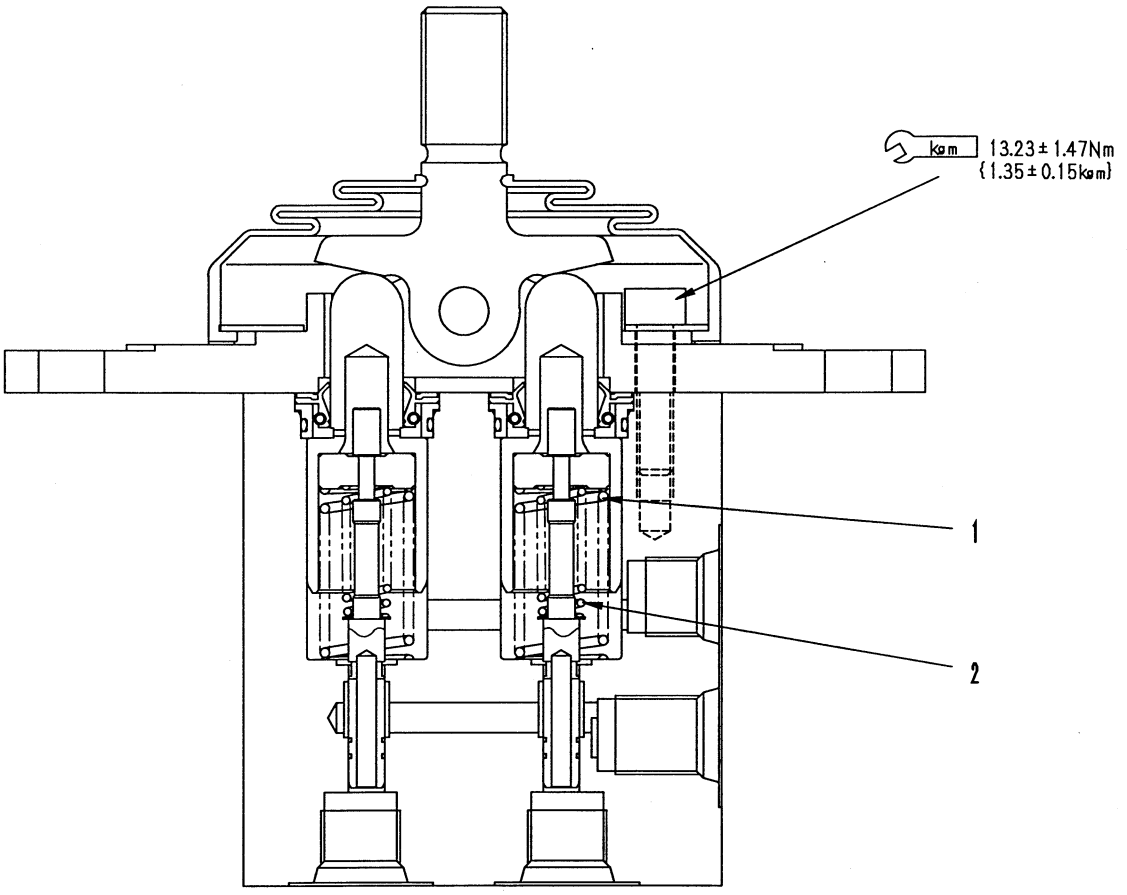


SAP02752

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Metering spring	Free length × O.D.	Installed length	Installed load	Free length	Installed load	Replace spring if any damages or deformations are found.
		26.5 × 8.15	24.7	16.7 N {1.7 kg}	—	13.7 N {1.4 kg}	
2	Centering spring	48.1 × 15.5	32.5	108 N {11 kg}	—	86.3 N {8.8 kg}	

SERVICE PPC VALVE

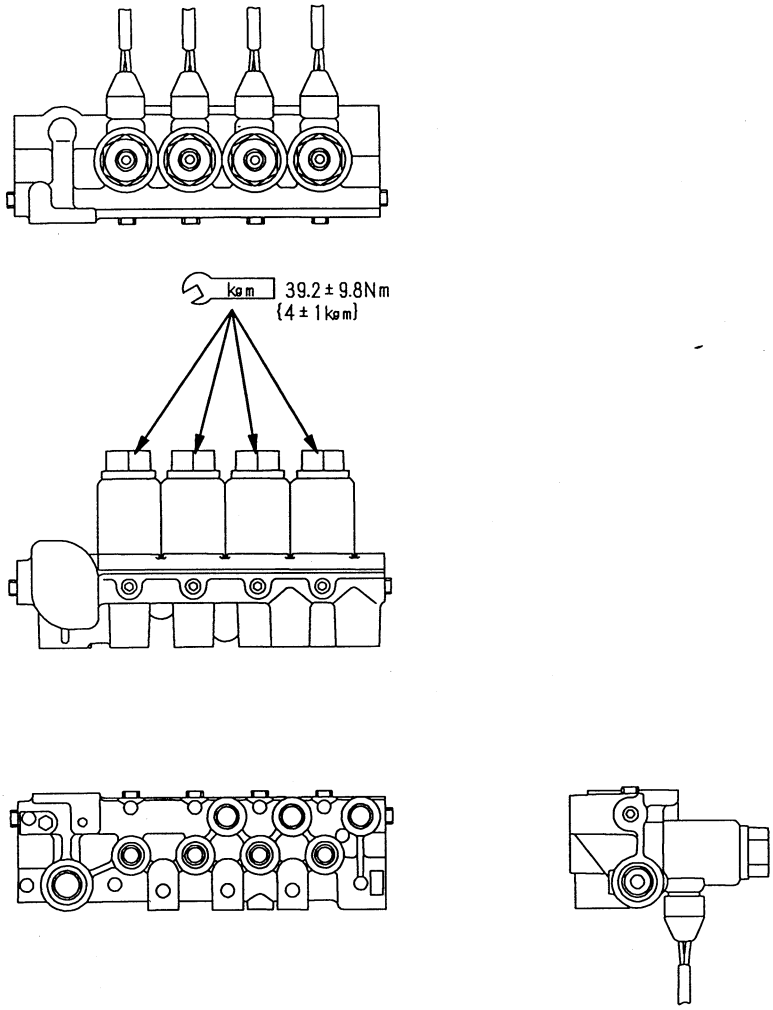


SAP01393

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length × O.D.	Installed length	Installed load	Free length	Installed load	
1	Centering spring	54.4 × 21.2	40.5	308.7 N {31.5 kg}	53.1	277.5 N {28.3 kg}	Replace spring if any damages or deformations are found.
2	Metering spring	25.9 × 11.0	25.0	24.5 N {2.5 kg}	25.8	21.6 N {2.2 kg}	

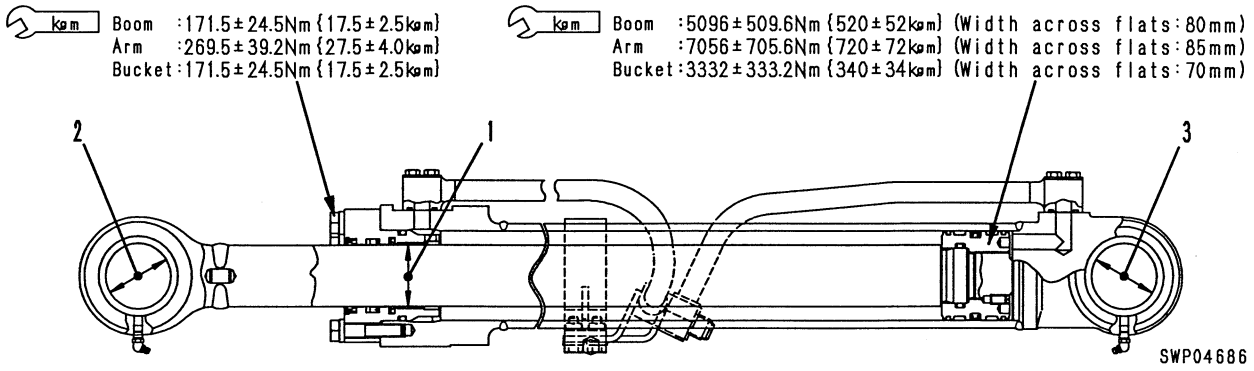
SOLENOID VALVE



SEP03791

HYDRAULIC CYLINDER

★ Figure shows boom lift cylinder.



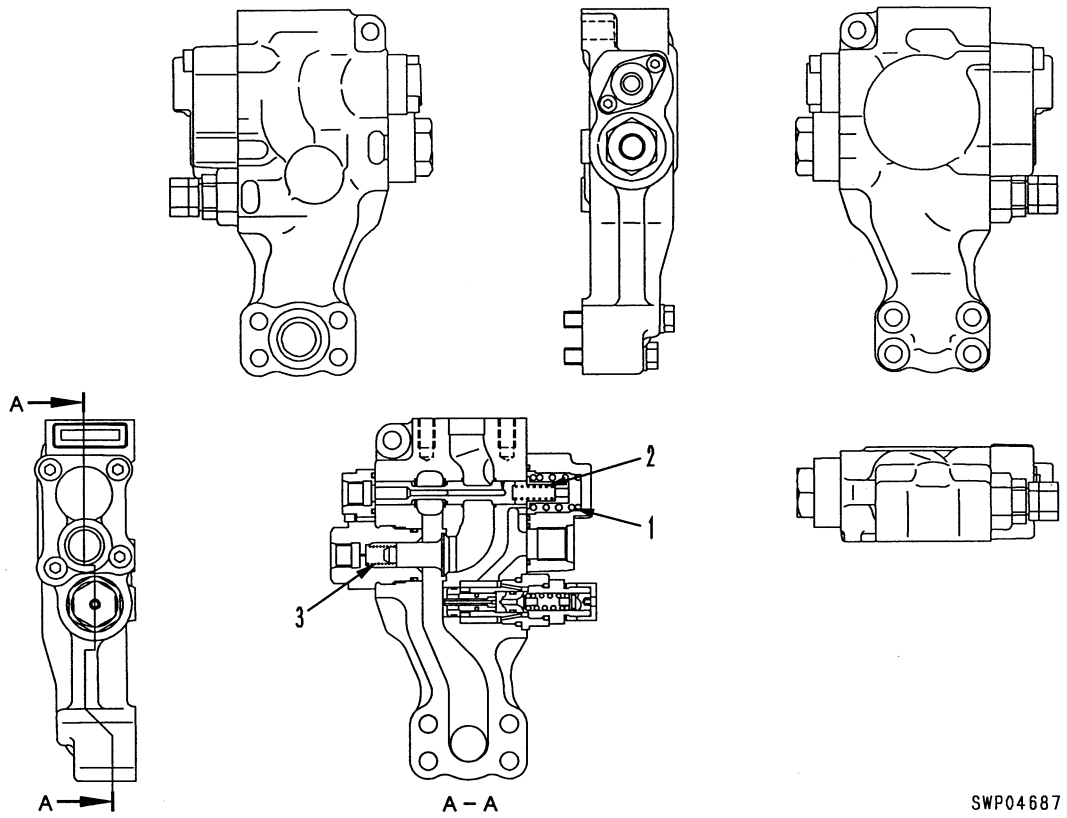
Unit: mm

No.	Check item	Cylinder name	Criteria: Standard size	Tolerance: Shaft	Tolerance: Hole	Standard clearance	Clearance limit	Remedy
1	Clearance between piston rod and bushing	Boom	70	−0.030 −0.076	+0.259 +0.063	0.093 – 0.336	0.435	Replace bushing
		Arm	75	−0.030 −0.076	+0.279 +0.065	0.0935 – 0.355	0.455	
		Bucket	65	−0.030 −0.076	+0.250 +0.055	0.085 – 0.326	0.426	
2	Clearance between piston rod support and bushing	Boom	70	−0.030 −0.100	+0.198 +0.124	0.154 – 0.298	1.0	Replace pin and bushing
		Arm	70	−0.030 −0.100	+0.198 +0.124	0.154 – 0.298	1.0	
		Bucket	65	−0.030 −0.100	+0.174 +0.100	0.130 – 0.274	1.0	
3	Clearance between cylinder bottom support and bushing	Boom	70	−0.030 −0.100	+0.198 +0.124	0.154 – 0.298	1.0	
		Arm	70	−0.030 −0.100	+0.198 +0.124	0.154 – 0.298	1.0	
		Bucket	65	−0.030 −0.100	+0.174 +0.100	0.130 – 0.274	1.0	

HOSE BURST PROTECTION VALVE

FOR BOOM

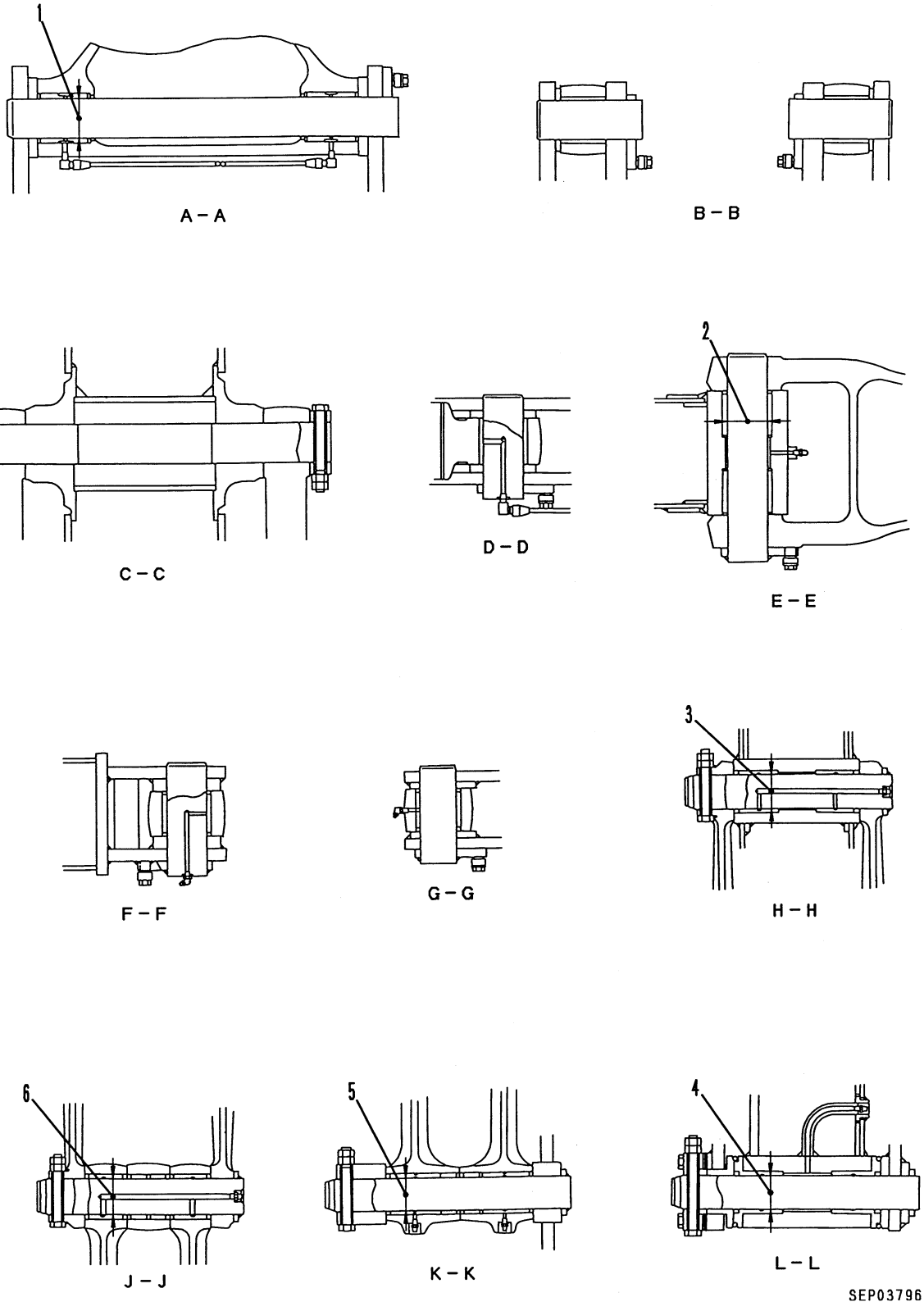
★ For machine equipped with arm safety valve (Hose burst protection valve), the Maintenance Standard of arm safety-valve is the same as this valve.

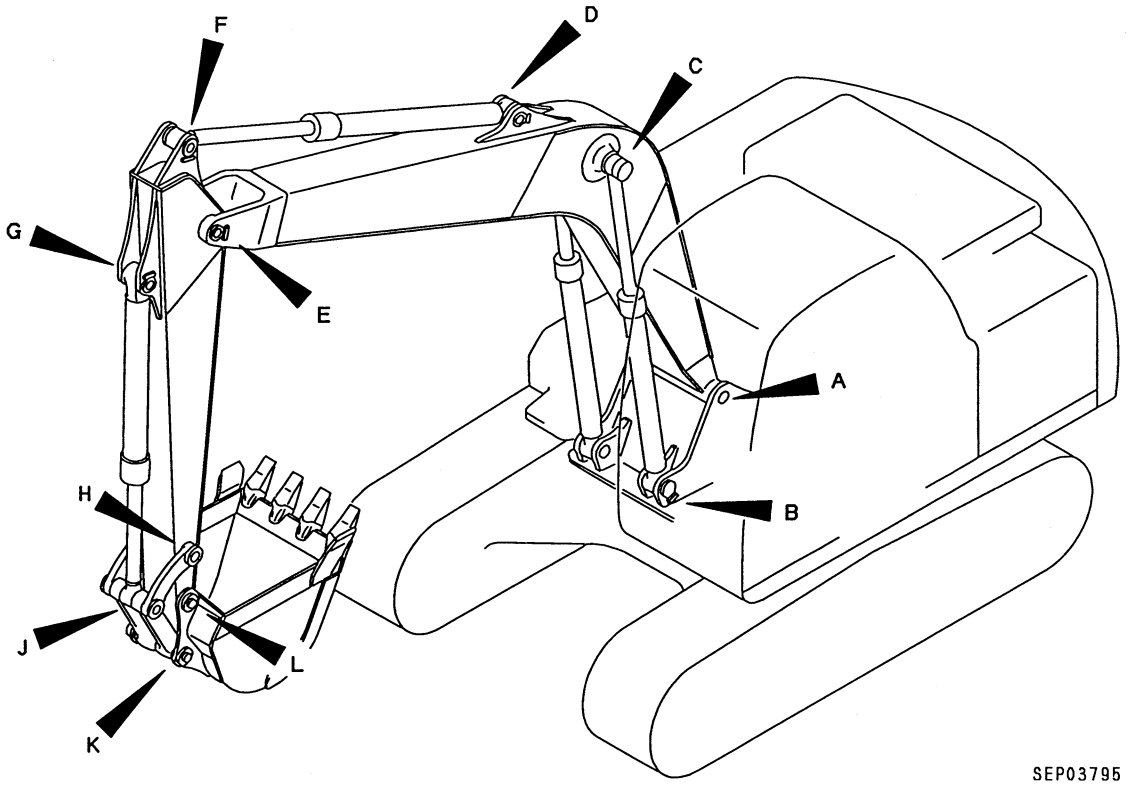


Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length	Installed length	Installed load	Free length	Installed load	
1	Pilot valve spring (For boom)	30.9	29.0	69.6 N {7.1 kg}	—	55.9 N {5.7 kg}	Replace spring if any damages or deformations are found
	Pilot valve spring (For arm)	32.5	29	85.3 N {8.7 kg}	—	68.6 N {7.0 kg}	
2	Pilot valve spring (For boom and arm)	31.8	25	29.4 N {3.0 kg}	—	23.5 N {2.4 kg}	
3	Check valve spring (For boom and arm)	24.5	18	4.9 N {0.5 kg}	—	3.9 N {0.4 kg}	

WORK EQUIPMENT



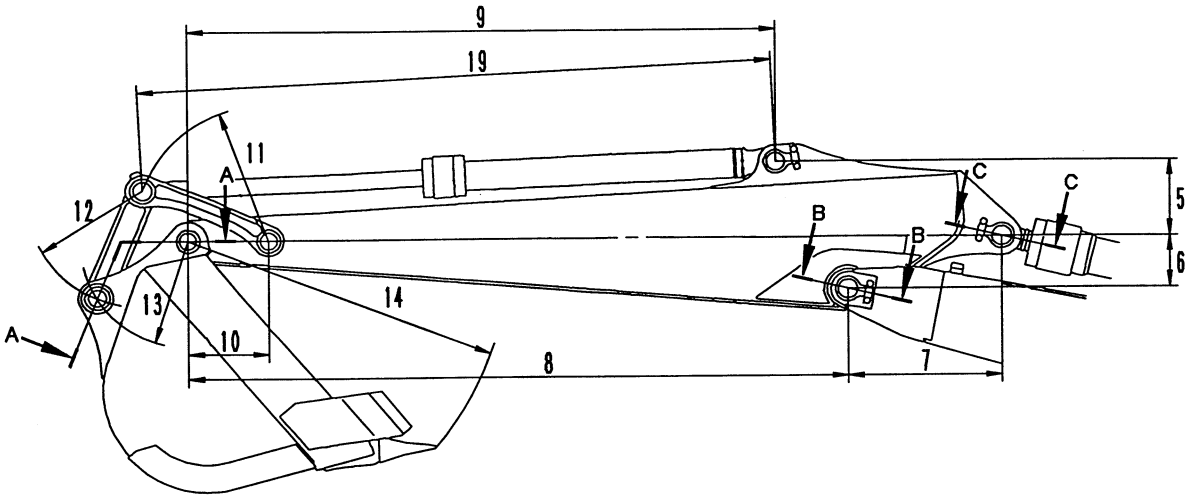


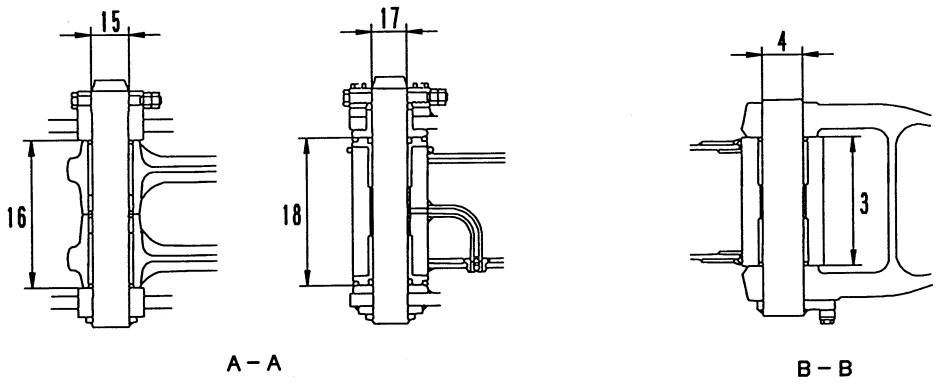
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between connecting pin and bushing of revolving frame and boom.	70	–0.030 –0.100	+0.140 +0.074	0.104 – 0.240	0.8	Replace
2	Clearance between connecting pin and bushing of boom and arm.	70	–0.030 –0.100	+0.141 +0.074	0.104 – 0.241	0.8	
3	Clearance between connecting pin and bushing of arm and link.	60	–0.030 –0.080	+0.130 –0.074	0.104 – 0.210	0.8	
4	Clearance between connecting pin and bushing of arm and bucket.	60	–0.030 –0.080	+0.129 +0.074	0.104 – 0.209	0.8	
5	Clearance between connecting pin and bushing of link and bucket.	60	–0.030 –0.080	+0.135 +0.074	0.104 – 0.215	0.8	
6	Clearance between connecting pin and bushing of link and link.	60	–0.030 –0.080	+0.133 +0.074	0.104 – 0.213	0.8	

DIMENSION OF WORK EQUIPMENT

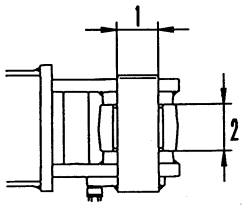
1. ARM





A – A

B – B



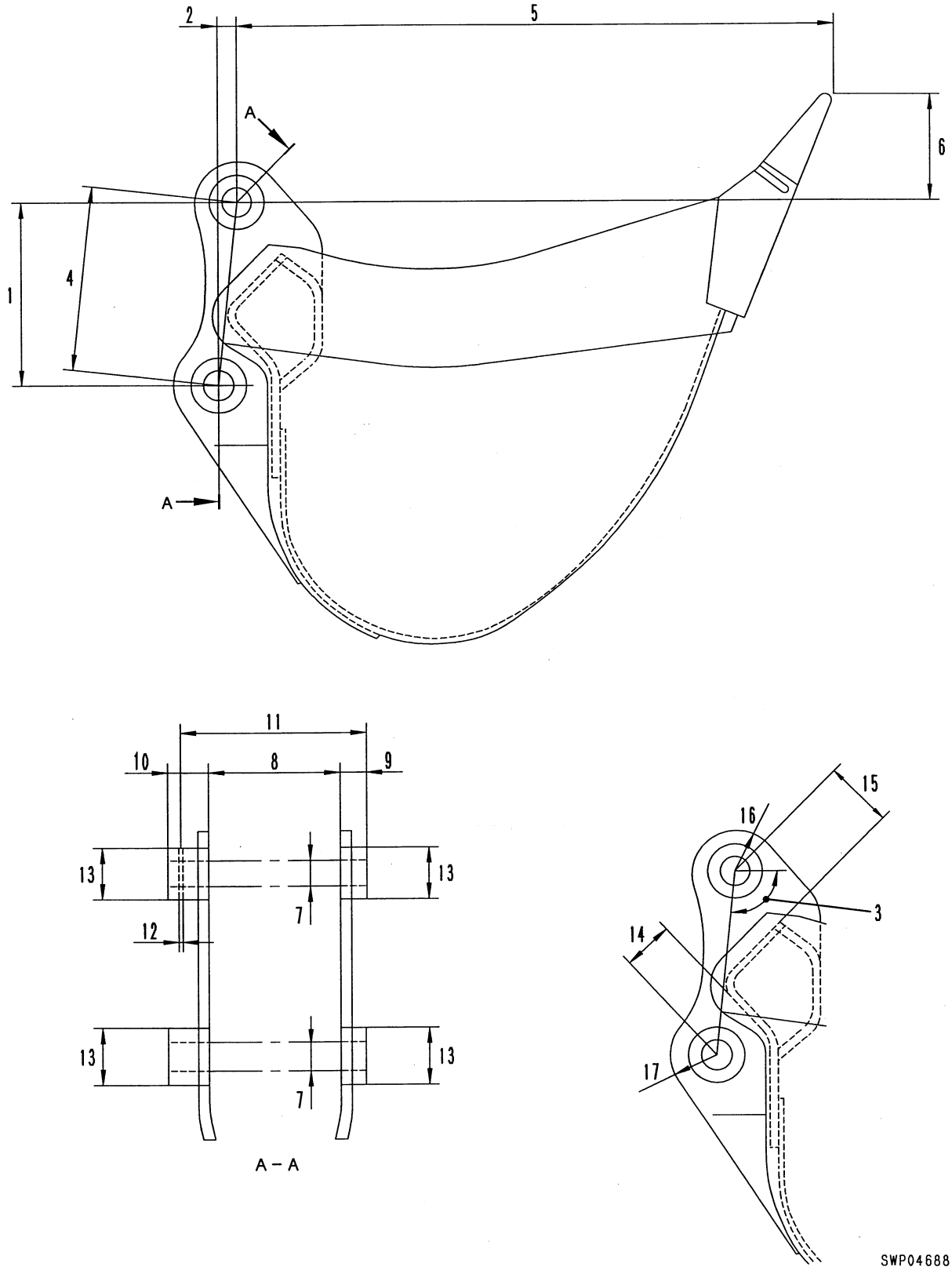
C – C

SEP01359

Unit: mm

No.		PC130-6K
1		ø70
2		80
3		226
4		ø70
5		275.7
6		199.7
7		635
8		2,492.2
9		2,100
10		290
11		487
12		415
13		374.9
14		1,241.3
15		ø60
16		261
17		ø60
18		275
19	Min.	1,378
	Max.	—

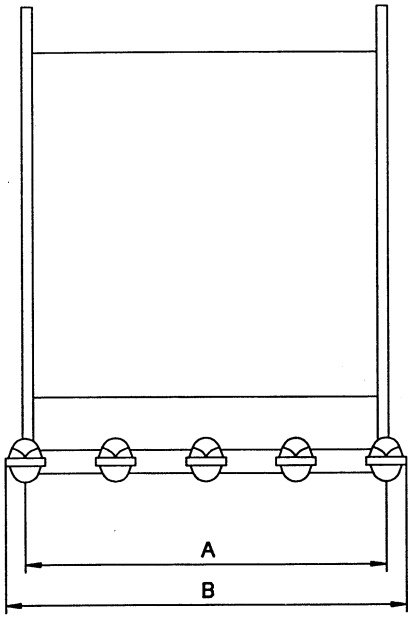
2. BUCKET PORTION



Unit: mm

No.	PC130-6K
1	ø70
2	38
3	95.8°
4	374.9
5	1,197
6	222
7	ø60
8	260
9	50
10	85
11	380
12	ø18
13	ø110
14	101.5
15	138
16	85
17	85

BUCKET CAPACITIES



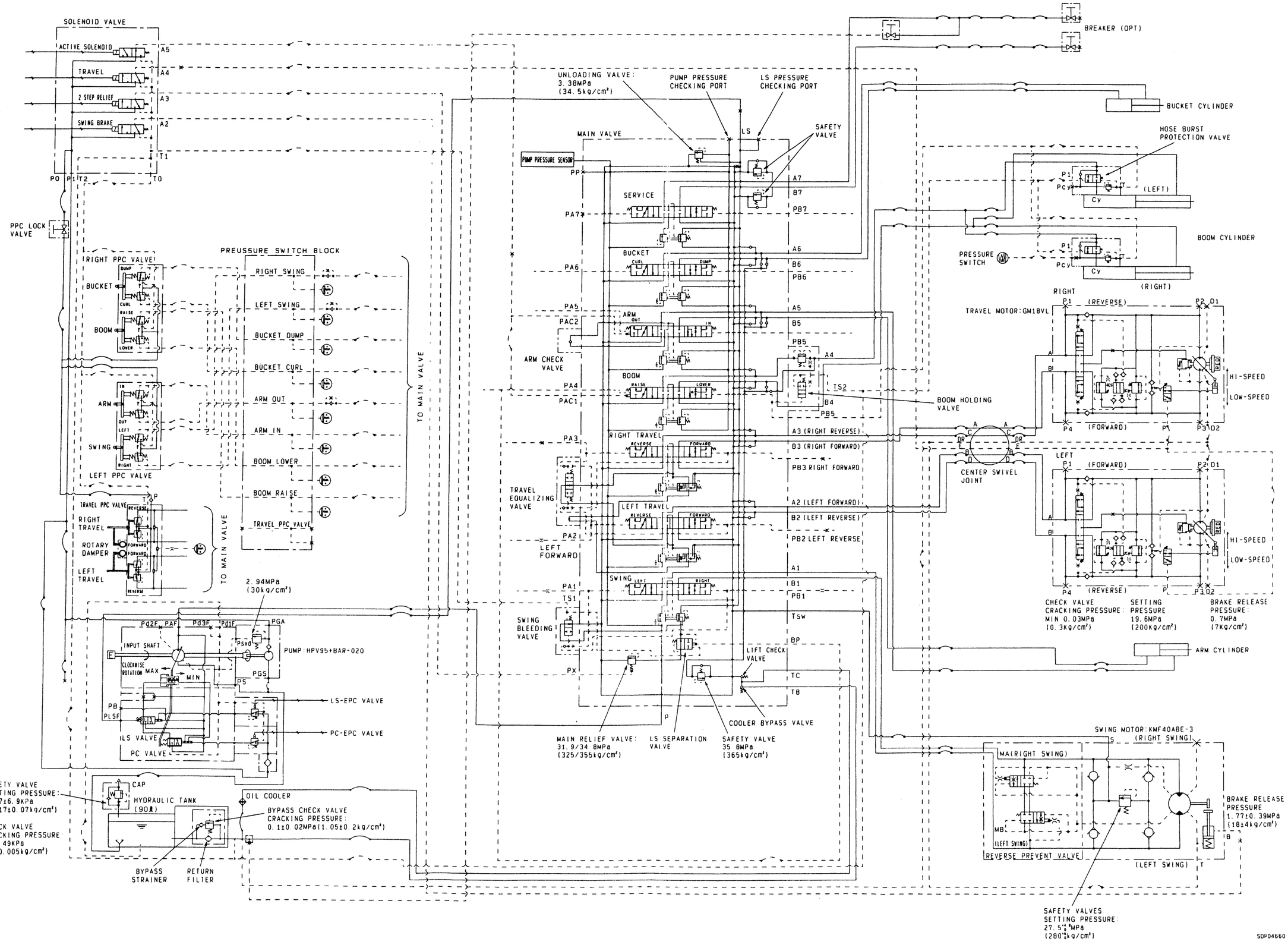
SWP04689

Unit : ℓ

WIDTH A (mm)	WIDTH B (mm)	CAPACITIES (SAE/CECE)
450	500	235/220
500	550	275/255
550	600	315/290
600	650	350/325
650	700	390/360
700	750	430/395
750	800	470/425
800	850	510/460
850	900	550/495
900	950	590/530
950	1,000	630/570
1,000	1,050	675/605
1,050	1,100	715/640
1,100	1,150	755/675
1,150	1,200	795/710
1,200	1,250	840/745

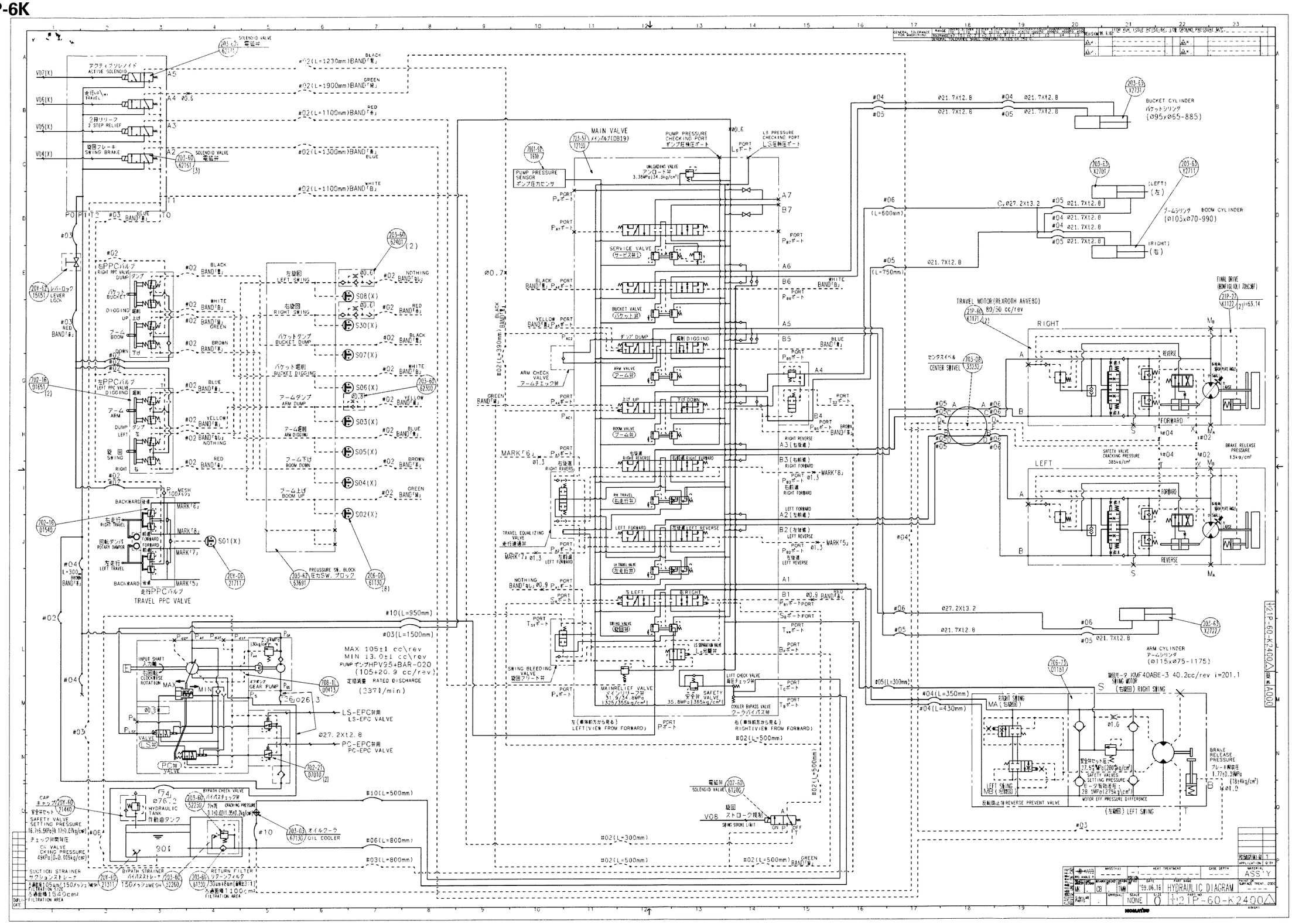
90 OTHER

HYDRAULIC CIRCUIT DIAGRAM



HYDRAULIC CIRCUIT DIAGRAM

PC150LGP-6K



ELECTRICAL CIRCUIT DIAGRAM (1/2)

FUSE BOX CONNECTION TABLE.

FUSE NO.	CONNECTION TABLE
1	ENGINE THROTTLE CONTROLLER
2	SOLENOID VALVE
3	AIR CONDITIONER (MOTOR)
4	RIGHT HEAD LIGHT, OPERATING LIGHT
5	RADIO, CIGAR LIGHTER, A/C (CONTROL) HEATER, WINDOW WASHER, LEFT KNOB SWITCH AUTOLUBRICATION
6	HORN
7	WIPER, POWER WINDOW
8	OPT HEAD LIGHT, REAR WORKING LAMP
9	LCS, OPT, TRAVEL ALARM
10	KEY ON SIG.
11	OPT
12	
13	ALARM BUZZER, MONITOR
14	STARTING MOTOR SWITCH
15	ROOM LAMP, RADIO(BACK UP)

ELECTRICAL CIRCUIT DIAGRAM (2/2)