SHOP MANUAL

KOMATSU

PC30R-8
PC35R-8
PC40R-8
PC45R-8

MACHINE MODEL	SERIAL NUMBER
PC30R-8	**10001 and up**
PC35R-8	**35001 and up**
PC40R-8	**30001 and up**
PC45R-8	**5001 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.

- PC30R, 35R-8 mount the 3D84E-3F engine.
  PC40R, 45R-8 mount the 4D84E-3D engine.
  For details of the engine, see the 68E-88E Series Engine Shop Manual.

© 2000 KOMATSU
All Rights Reserved
Printed in Japan 09-00(02)

CONTENTS

No. of page

01 GENERAL 01-1

10 STRUCTURE AND FUNCTION 10-1

20 TESTING AND ADJUSTING 20-1

30 DISASSEMBLY AND ASSEMBLY 30-1

40 MAINTENANCE STANDARD 40-1

90 OTHERS 90-1

The affected pages are indicated by the use of the following marks. It is requested that necessary actions be taken to these pages according to the table below.

Mark	Indication	Action required
○	Page to be newly added	Add
●	Page to be replaced	Replace
( )	Page to be deleted	Discard

Pages having no marks are those previously revised or made aditions.

LIST OF REVISED PAGES

Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number
●	00-1	④		01-16	①		10-33	①		10-74	①		20-104	
	00-2	②		01-17	①		10-34	①		10-75	①		20-105	
●	00-2-1	④		01-18	①		10-35	①		10-77	①		20-106	
●	00-2-2	④		01-19	①		10-36	①		10-78	①		20-107	
○	00-2-3	④		01-20	①		10-37	①		10-79	①		20-108	
●	00-3			01-21	①		10-38	①		10-80	①		20-109	③
●	00-4			01-22	①		10-39	①		10-81	①		20-110	
●	00-5			01-23	①		10-40	①		10-82	①		20-111	
●	00-6						10-41	①		10-83	①		20-112	
●	00-7			10-1	①		10-42	①		10-84	①		20-113	
●	00-8			10-2	①		10-43	①		10-85	①		20-114	
●	00-9			10-3	①		10-44	①		10-86	①		20-115	
●	00-10			10-4	①		10-45	①		10-87	①		20-116	
●	00-11			10-5	①		10-46	①		10-88	①		20-117	
●	00-12			10-6	①		10-47	①		10-89	①		20-118	
●	00-13			10-7	①		10-48	①		10-90	①		20-119	
●	00-14			10-8	①		10-49	①					20-120	
●	00-15			10-9	①		10-50	①		20-1			20-121	③
●	00-16			10-10	①		10-51	①		20-2	③		20-121-1	③
●	00-17			10-11	①		10-52	①		20-3	③		20-122	
●	00-18			10-12	①		10-53	①		20-4			20-123	
●	00-19			10-13	①		10-54	①		20-5			20-124	
○	00-20			10-14	①		10-55	①		20-6			20-125	
○	00-21			10-15	①		10-56	①		20-7			20-126	
○	00-22			10-16	①		10-57	①		20-8			20-127	
				10-17	①		10-58	①		20-9			20-128	
	01-1	①		10-18	①		10-59	①		20-10			20-129	
	01-2	①		10-19	①		10-60	①		20-11			20-130	
	01-3	①		10-20	①		10-61	①		20-12	③		20-201	
	01-4	①		10-21	①		10-62	①		20-13	③		20-202	
	01-5	①		10-22	①		10-63	①		20-14			20-203	
	01-6	①		10-23	①		10-64	①		20-15			20-204	
	01-7	①		10-24	①		10-65	①		20-16			20-205	
	01-8	①		10-25	①		10-66	①		20-17			20-206	
	01-9	①		10-26	①		10-67	①		20-18			20-207	
	01-10	①		10-27	①		10-68	①		20-19			20-208	
	01-11	①		10-28	①		10-69	①		20-20			20-209	
	01-12	①		10-29	①		10-70	①		20-21			20-210	
	01-13	①		10-30	①		10-71	①		20-101			20-211	
	01-14	①		10-31	①		10-72	①		20-102			20-212	
	01-15	①		10-32	①		10-73	①		20-103			20-213	

Mark	Page	Revision number
	20-214	
	20-215	
	20-216	
	20-217	
	20-218	
	20-219	
	20-220	
	20-221	
	20-222	
	20-223	
	20-224	
	20-225	
	20-226	
	20-227	
	20-301	
	20-302	
	20-303	
	20-304	
	20-305	
	20-306	
	20-307	
	20-308	
	20-309	
	20-310	
	20-311	
	20-312	
	20-313	
	20-401	
	20-402	
	20-403	
	20-404	
	20-405	
	20-406	
	20-407	
	20-408	
	20-409	
	20-410	
	20-411	
	20-412	
	20-413	
	20-414	
	20-415	
	20-416	
	20-417	
	20-418	
	20-419	
	20-420	
	20-501	
	20-502	
	20-503	
	20-504	
	20-505	
	20-506	
	20-507	
	20-508	
	20-509	
	20-510	
	20-511	
	20-512	
	20-513	
	20-514	
●	30-1	④
●	30-2	④
	30-3	②
	30-4	②
	30-5	②
	30-6	②
●	30-7	④
○	30-7-1	④
○	30-7-2	④
○	30-7-3	④
●	30-8	④
○	30-8-1	④
○	30-8-2	④
○	30-8-3	④
○	30-8-4	④
○	30-8-5	④
	30-9	②
	30-10	②
	30-11	②
	30-12	②
	30-13	②
	30-14	②
	30-15	②
	30-16	②
	30-17	②
	30-18	②
	30-19	②
	30-20	②
	30-21	②
	30-22	②
	30-23	②
	30-24	②
	30-25	②
	30-26	②
	30-27	②
	30-28	②
	30-29	②
	30-30	②
	30-31	②
	30-32	②
	30-33	②
	30-34	②
	30-35	②
	30-36	②
	30-37	②
	30-38	②
	30-39	②
○	30-39-1	④
○	30-39-2	④
○	30-39-3	④
○	30-39-4	④
○	30-39-5	④
○	30-39-6	④
○	30-39-7	④
○	30-39-8	④
○	30-39-9	④
○	30-39-10	④
○	30-39-11	④
○	30-39-12	④
○	30-39-13	④
○	30-39-14	④
○	30-39-15	④
○	30-39-16	④
○	30-39-17	④
○	30-39-18	④
○	30-39-19	④
○	30-39-20	④
○	30-39-21	④
○	30-39-22	④
○	30-39-23	④
○	30-39-24	④
○	30-39-25	④
○	30-39-26	④
○	30-39-27	④
○	30-39-28	④
○	30-39-29	④
○	30-39-30	④
○	30-39-31	④
○	30-39-32	④
○	30-39-33	④
○	30-39-34	④
○	30-39-35	④
○	30-39-36	④
○	30-39-37	④
○	30-39-38	④
○	30-39-39	④
○	30-39-40	④
○	30-39-41	④
○	30-39-42	④
○	30-39-43	④
○	30-39-44	④
○	30-39-45	④
○	30-39-47	④
○	30-39-48	④
○	30-39-49	④
○	30-39-50	④
○	30-39-51	④
○	30-39-52	④
○	30-39-53	④
○	30-39-54	④
○	30-39-55	④
○	30-39-56	④
○	30-39-57	④
○	30-39-58	④
○	30-39-59	④
○	30-39-60	④
○	30-39-61	④
○	30-39-62	④
○	30-39-63	④
○	30-39-64	④
○	30-39-65	④
○	30-39-66	④
○	30-39-67	④
○	30-39-68	④
○	30-39-69	④
○	30-39-70	④
○	30-39-71	④
○	30-39-72	④
○	30-39-73	④
○	30-39-74	④
○	30-39-75	④
○	30-39-76	④
○	30-39-77	④
○	30-39-78	④
○	30-39-79	④
○	30-39-80	④
○	30-39-81	④
○	30-39-82	④
○	30-39-83	④
○	30-39-84	④
○	30-39-85	④
○	30-39-86	④
○	30-39-87	④
○	30-39-88	④
○	30-39-89	④
○	30-39-90	④
○	30-39-91	④
○	30-39-92	④
○	30-39-93	④
○	30-39-94	④
○	30-39-95	④
○	30-39-96	④
○	30-39-97	④
○	30-39-98	④
○	30-39-99	④
○	30-39-100	④
○	30-39-101	④
○	30-39-102	④
○	30-39-103	④
○	30-39-104	④
○	30-39-105	④
○	30-39-106	④
○	30-39-107	④
○	30-39-108	④
○	30-39-109	④
○	30-39-110	④
○	30-39-111	④
●	30-40	②
	30-41	②
	30-42	②
	30-43	②
	30-44	②
	30-45	②
	30-46	②
	30-47	②
	30-48	②
○	30-48-1	④
○	30-48-2	④
○	30-48-3	④
○	30-48-4	④
○	30-48-5	④
○	30-48-6	④
○	30-48-7	④
○	30-48-8	④
○	30-48-9	④
○	30-48-10	④
○	30-48-11	④
○	30-48-12	④
○	30-48-13	④
	30-49	②
	30-50	②
	30-51	②
	30-52	②
	30-53	②
	30-54	②
	30-55	②
	30-56	②
	30-57	②
	30-58	②
	30-59	②
	30-60	②
	30-61	②
	30-62	②
	30-63	②
	30-64	②
	30-65	②
	30-66	②
	30-67	②
	30-68	②
	30-69	②
	30-70	②
	30-71	②
○	30-71-1	④
○	30-71-2	④
○	30-71-3	④
○	30-71-4	④
○	30-71-5	④
○	30-71-6	④

Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number	Mark	Page	Revision number
○	30-71-7	④		30-114	②		90-11	①						
○	30-71-8	④		30-115	②		90-13	①						
○	30-71-9	④		30-116	②		90-15	①						
○	30-71-10	④		30-117	②									
○	30-71-11	④		30-118	②									
○	30-71-12	④		30-119	②									
○	30-71-13	④		30-120	②									
○	30-71-14	④		30-121	②									
○	30-71-15	④		30-122	②									
○	30-71-16	④		30-123	②									
○	30-71-17	④		30-124	②									
○	30-71-18	④		30-125	②									
○	30-71-19	④		30-126	②									
●	30-72	②												
	30-73	②		40-1	①									
	30-74	②		40-2	①									
	30-75	②		40-4	①									
	30-76	②		40-5	①									
	30-78	②		40-6	①									
	30-79	②		40-7	①									
	30-80	②		40-8	①									
	30-81	②		40-9	①									
	30-82	②		40-10	①									
	30-83	②		40-11	①									
	30-84	②		40-12	①									
	30-85	②		40-13	①									
	30-86	②		40-14	①									
	30-87	②		40-15	①									
	30-88	②		40-16	①									
	30-89	②		40-17	①									
	30-90	②		40-18	①									
	30-91	②		40-19	①									
	30-92	②		40-20	①									
	30-93	②		40-21	①									
	30-94	②		40-22	①									
	30-95	②		40-23	①									
	30-96	②		40-24	①									
	30-97	②		40-25	①									
	30-98	②		40-26	①									
	30-99	②		40-27	①									
	30-100	②		40-28	①									
	30-101	②		40-29	①									
	30-102	②		40-30	③									
	30-103	②		40-31	①									
	30-104	②		40-32	①									
	30-105	②		40-33	①									
	30-106	②		40-34	①									
	30-107	②		40-35	①									
	30-108	②												
	30-109	②		90-1	①									
	30-110	②		90-3	①									
	30-111	②		90-5	①									
	30-112	②		90-7	①									
	30-113	②		90-9	①									

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

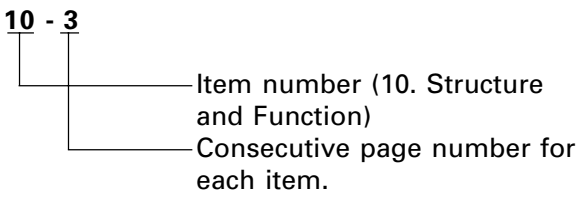
These various volumes are designed to avoid duplicating the same information. Therefore, to deal with all repairs for any model , it is necessary that chassis, engine, electrical and attachment volumes be available.

DISTRIBUTION AND UPDATING

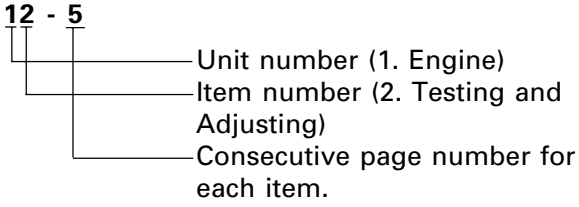
Any additions, amendments or other changes will be sent to KOMATSU distributors. Get the most up-to-date information before you start any work.

FILING METHOD

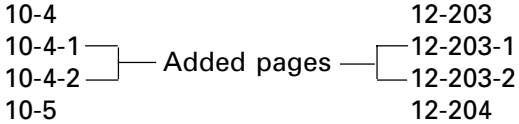
1. See the page number on the bottom of the page. File the pages in correct order.
2. Following examples show how to read the page number.
   Example 1 (Chassis volume):



   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

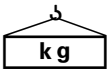
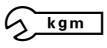
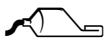
When a manual is revised, an edition mark (①②③....) is recorded on the bottom of the pages.

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:

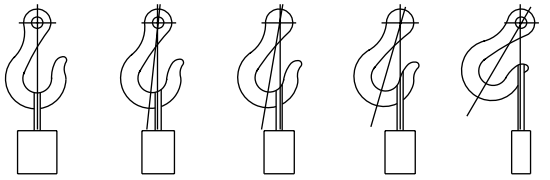
Wire ropes
(Standard "Z" or "S" twist ropes without galvanizing)

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.

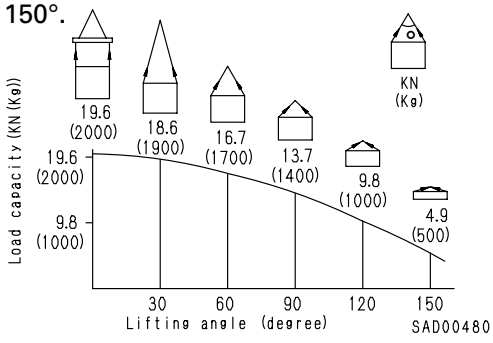


SAD00479

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.

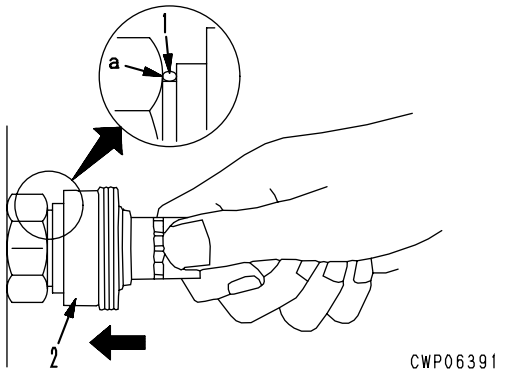
4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook. When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles. The table below shows the variation of allowable load kN {kg} when hoisting is made with two ropes, 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°.

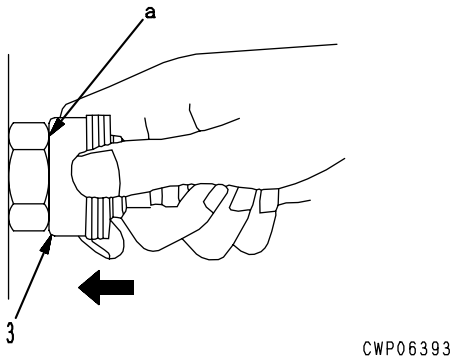


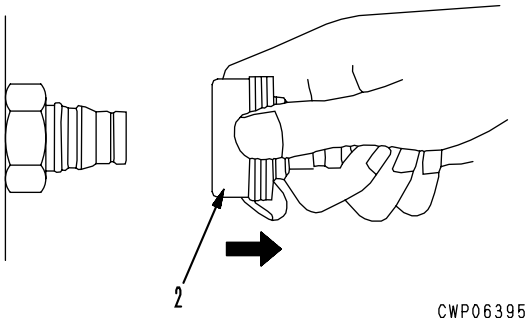
SAD00480

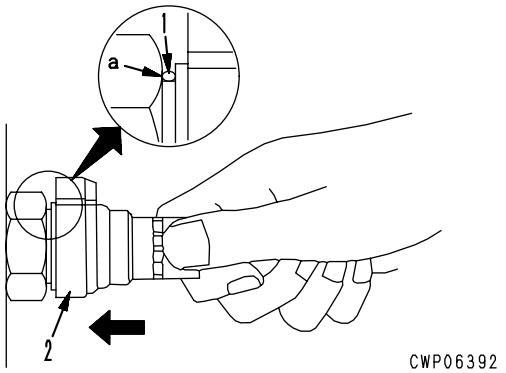
METHOD OF DISASSEMBLING, CONNECTING PUSH-PULL TYPE COUPLER

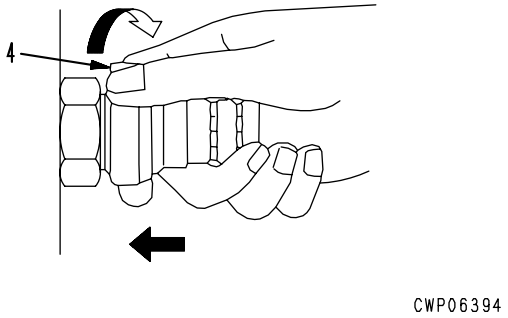
★ There are 2 types of push-pull type coupler. The method of disassembling and connecting is different, so see the table below when disassembling and connecting the coupler.

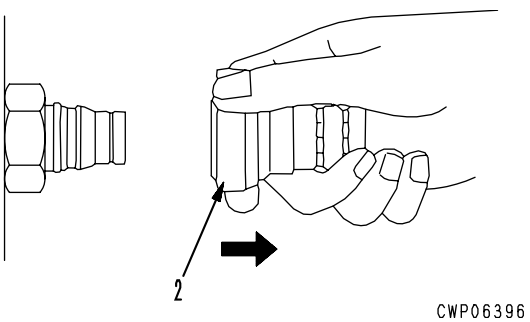
<table>
<tr><th></th><th>Type 1</th><th>Type 2</th></tr>
<tr><td>Disassembly</td>
<td>
1) Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface a of the hexagonal portion at the male end.


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


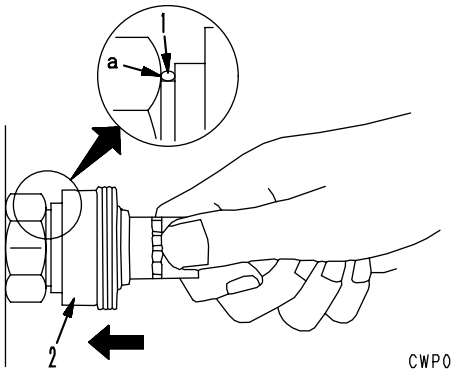
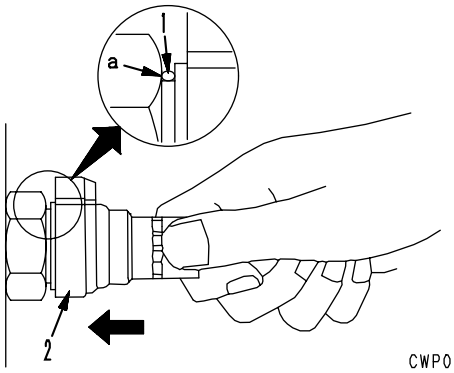
3) Hold in the condition in Steps 1) and 2), and pull out whole body (2) to disconnect it.


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


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


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


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

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

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 TORQUE TABLE (WHEN USING TORQUE WRENCH)

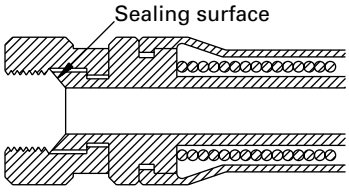
★ In the case of metric nuts and bolts for which there is no special instruction, tighten to the torque given in the table below.

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

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

TABLE OF TIGHTENING TORQUES FOR FLARED NUTS

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



SAD00483

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

TABLE OF TIGHTENING TORQUES FOR SPLIT FLANGE BOLTS

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

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

TABLE OF TIGHTENING TORQUES FOR O-RING BOSS PIPING JOINTS

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

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

TABLE OF TIGHTENING TORQUES FOR O-RING BOSS PLUGS

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

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

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

UNITS

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

Example:

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

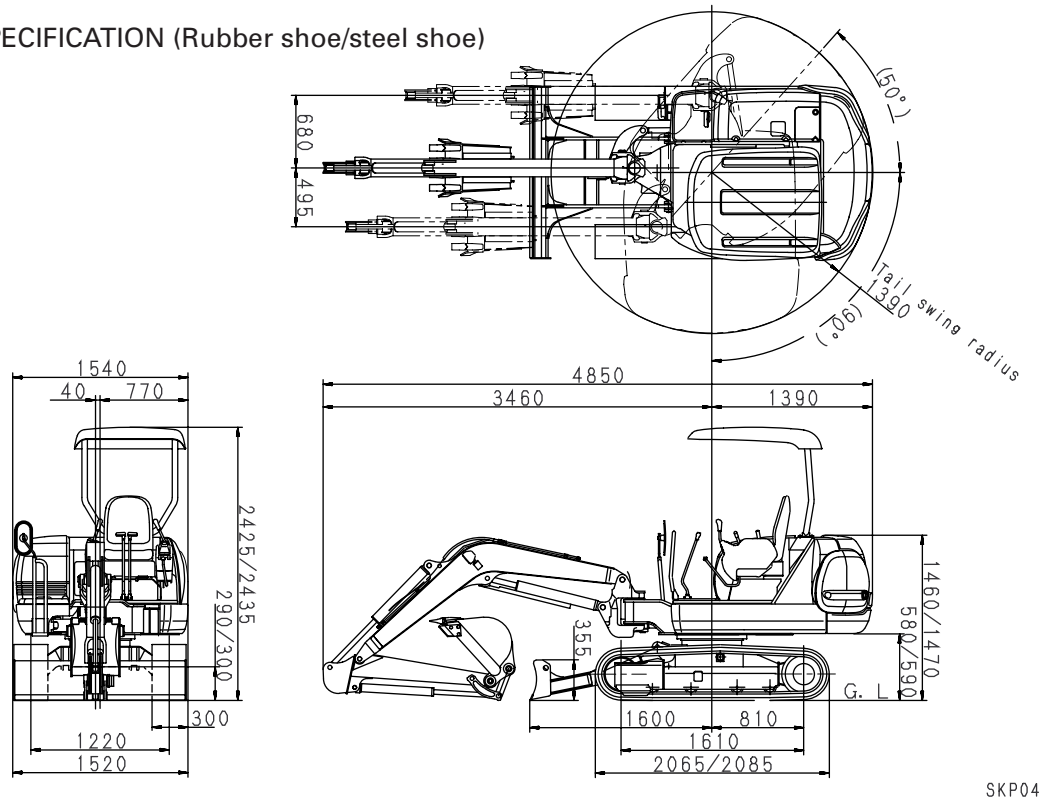
01 GENERAL

General assembly drawing 01- 2
Specifications 01-10
Weight table 01-18
List of lubricant and water 01-22

GENERAL ASSEMBLY DRAWING

PC30R-8

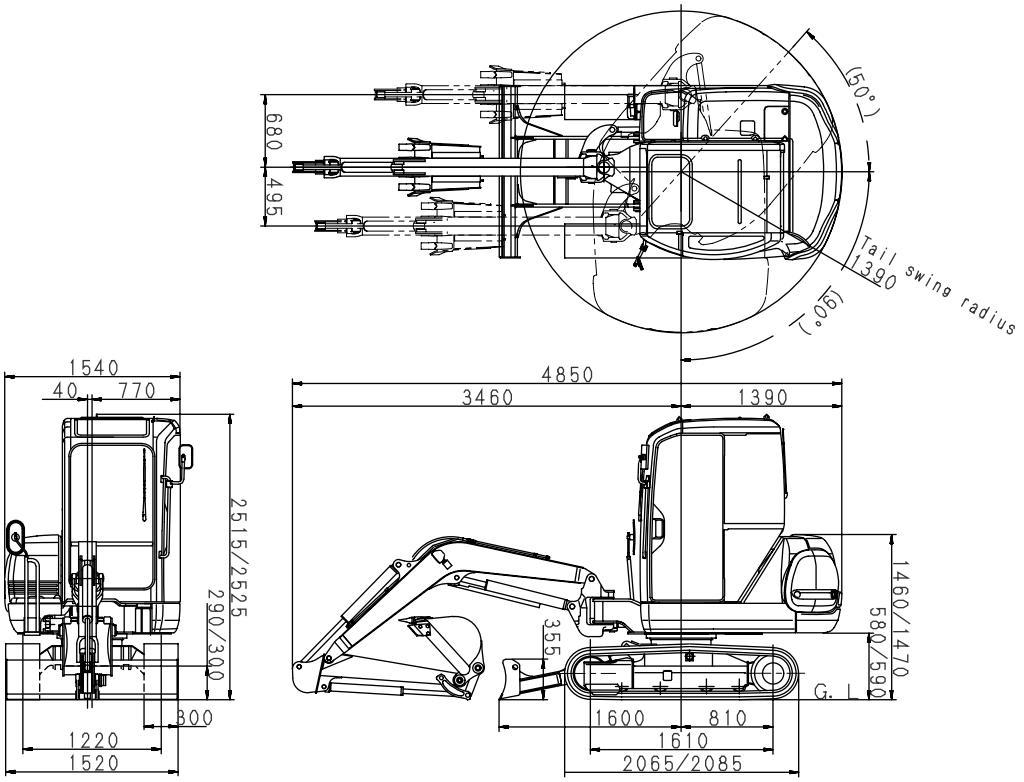
- CANOPY SPECIFICATION (Rubber shoe/steel shoe)



SKP04537

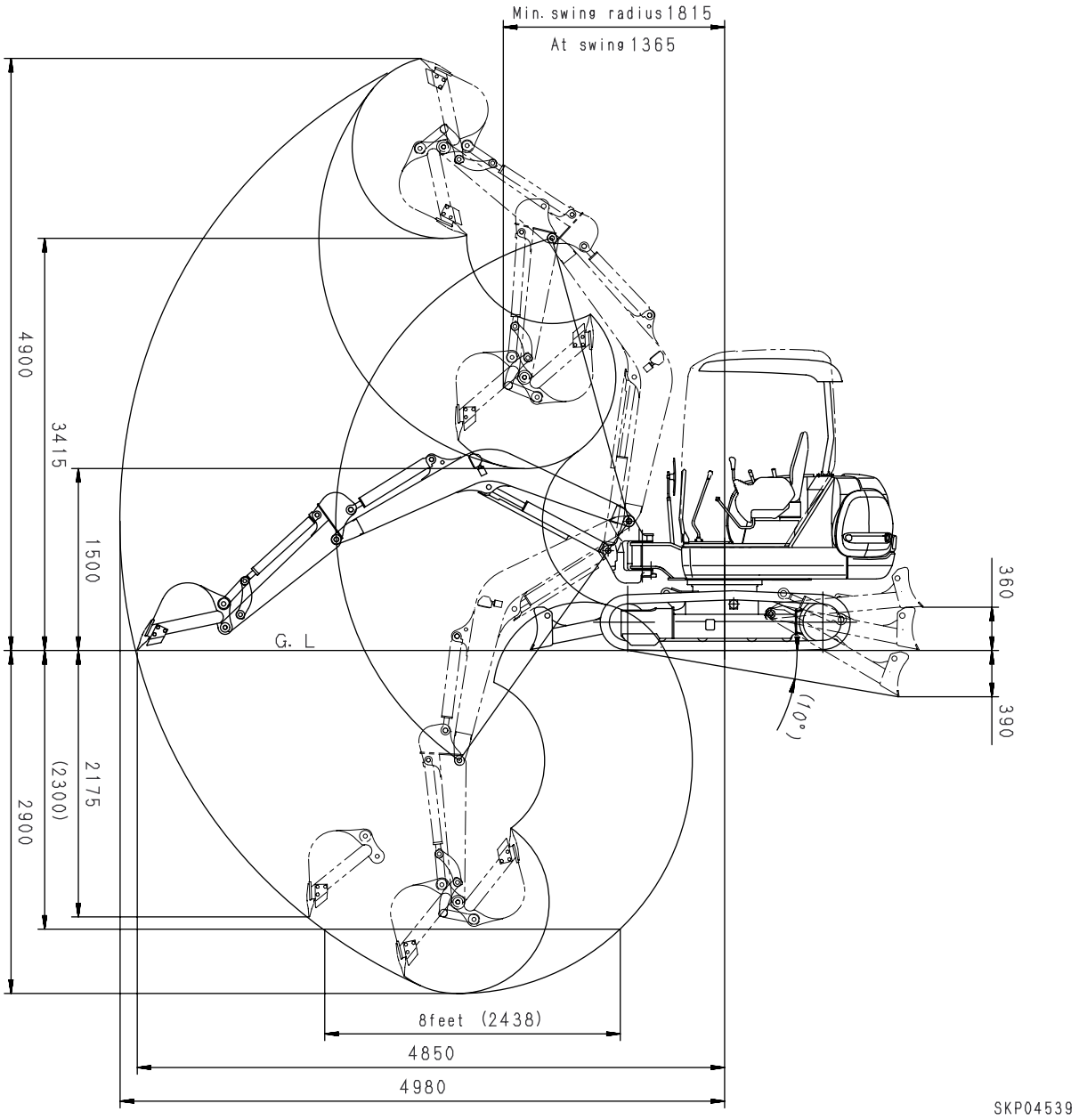
PC30R-8

- CAB SPECIFICATION (Rubber shoe/steel shoe)



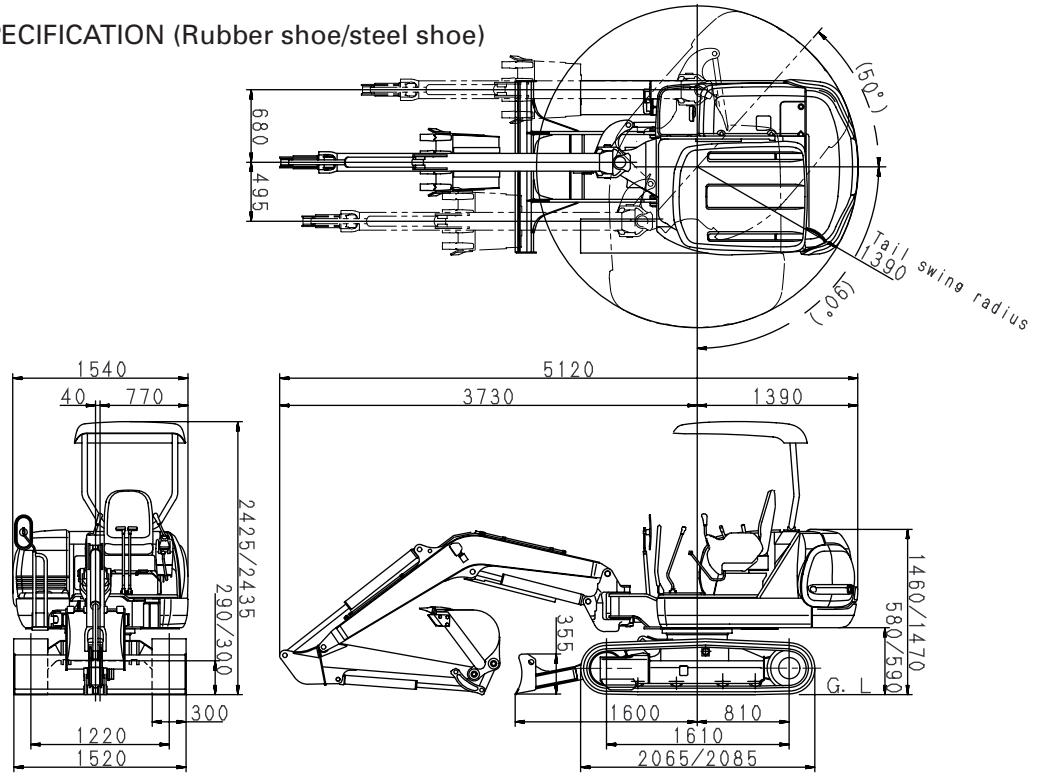
SKP04538

PC30R-8
WORKING RANGES



PC35R-8

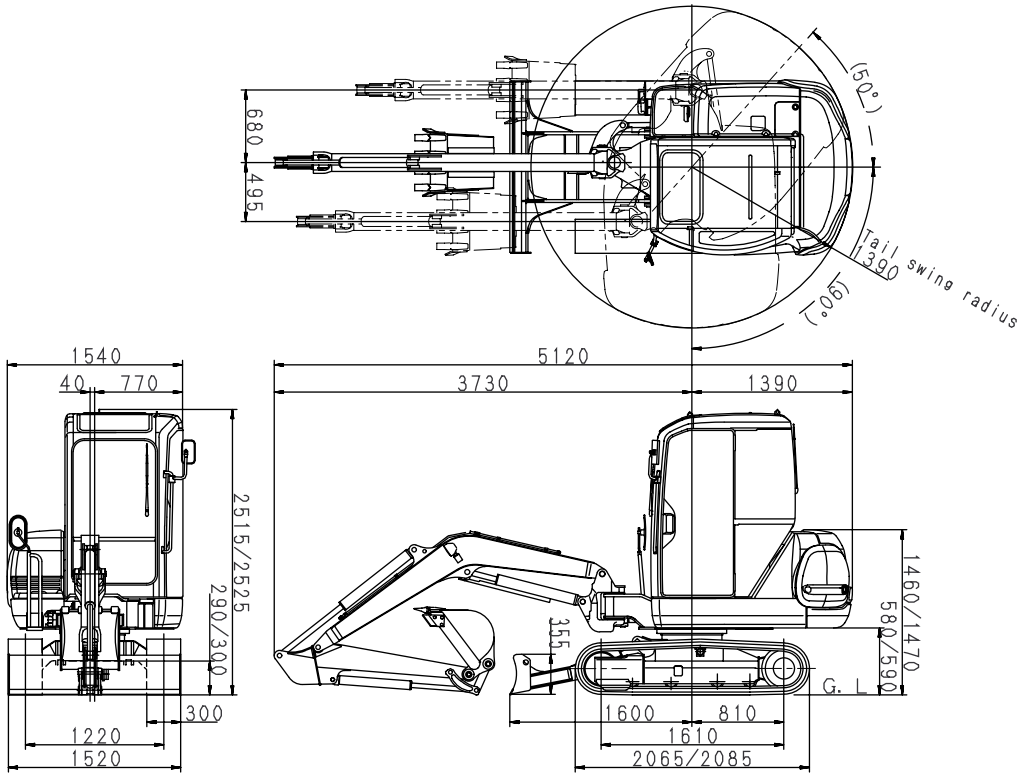
- CANOPY SPECIFICATION (Rubber shoe/steel shoe)



SKP04540

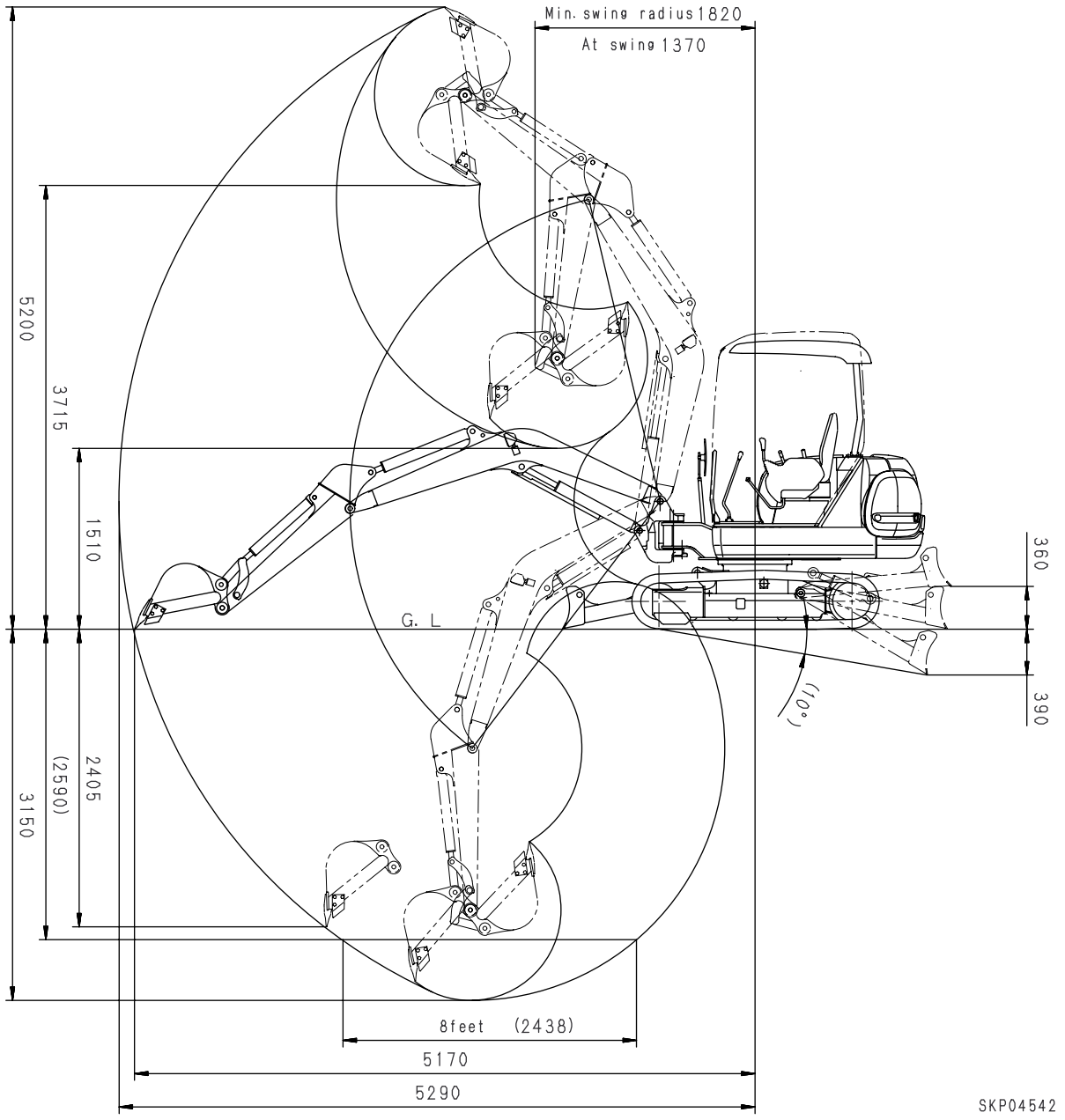
PC35R-8

- CAB SPECIFICATION (Rubber shoe/steel shoe)



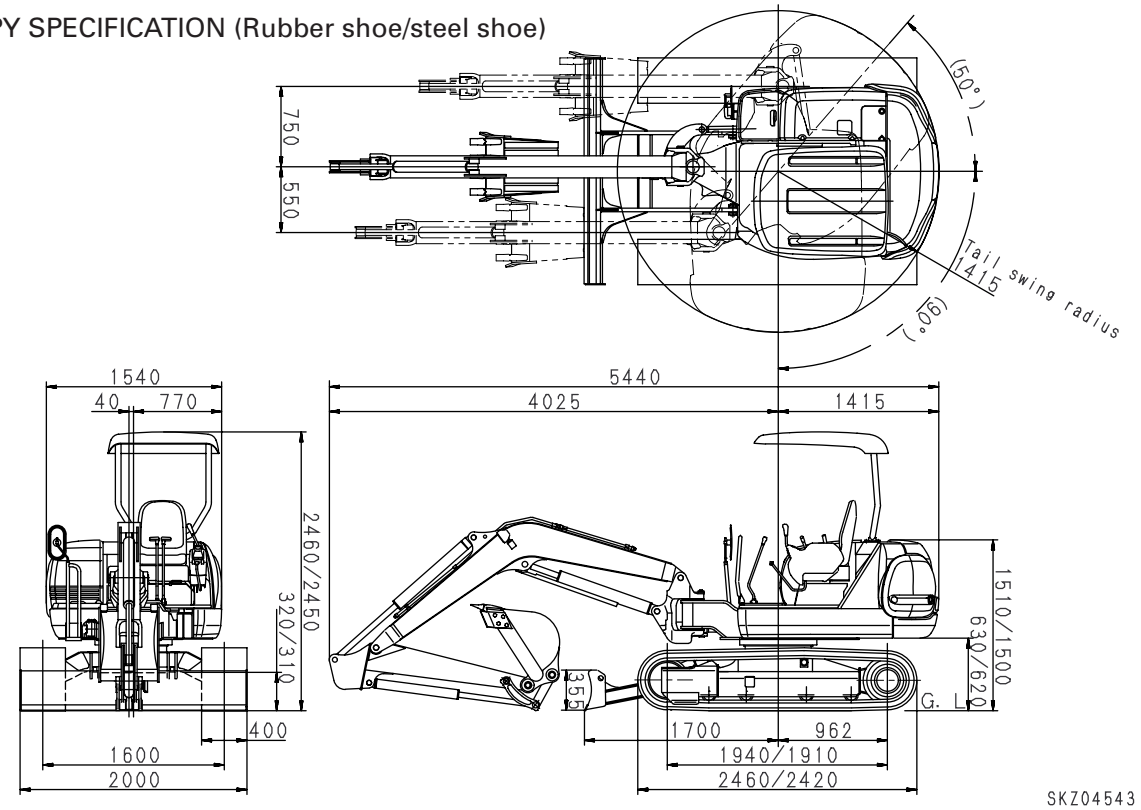
SKP04541

PC35R-8
WORKING RANGES



PC40R-8

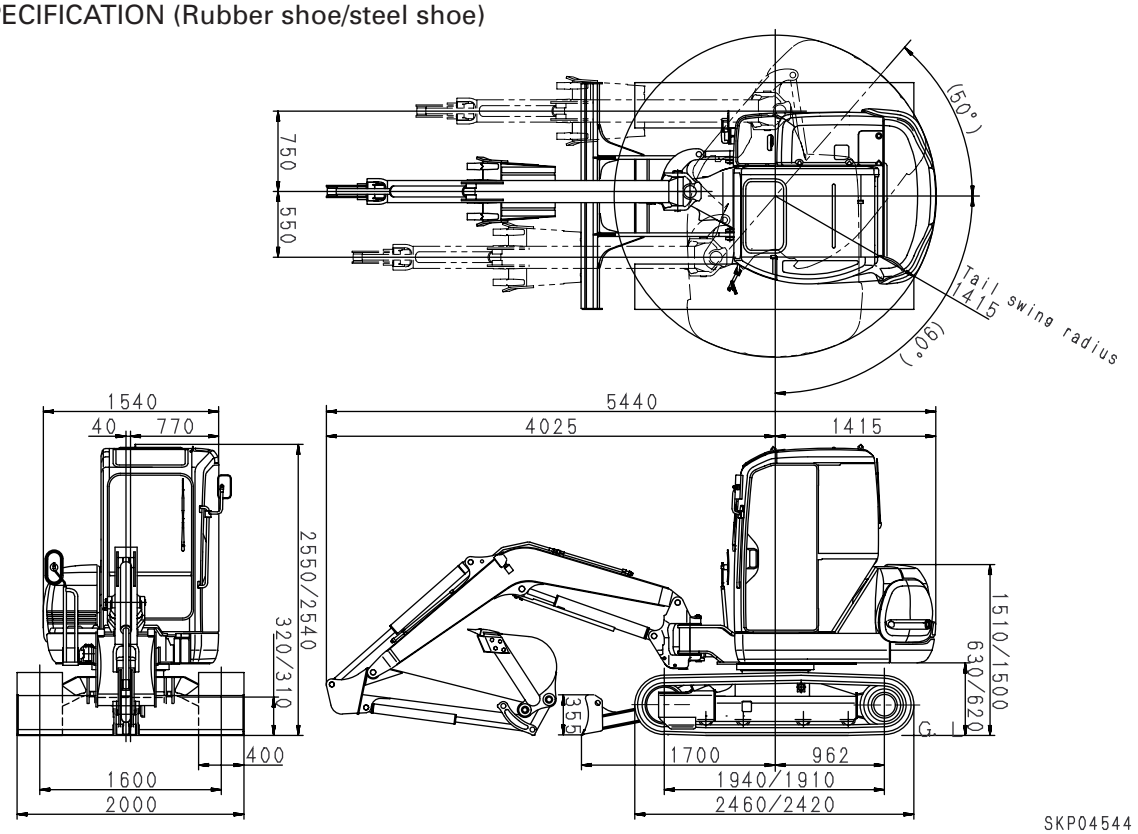
- CANOPY SPECIFICATION (Rubber shoe/steel shoe)



SKZ04543

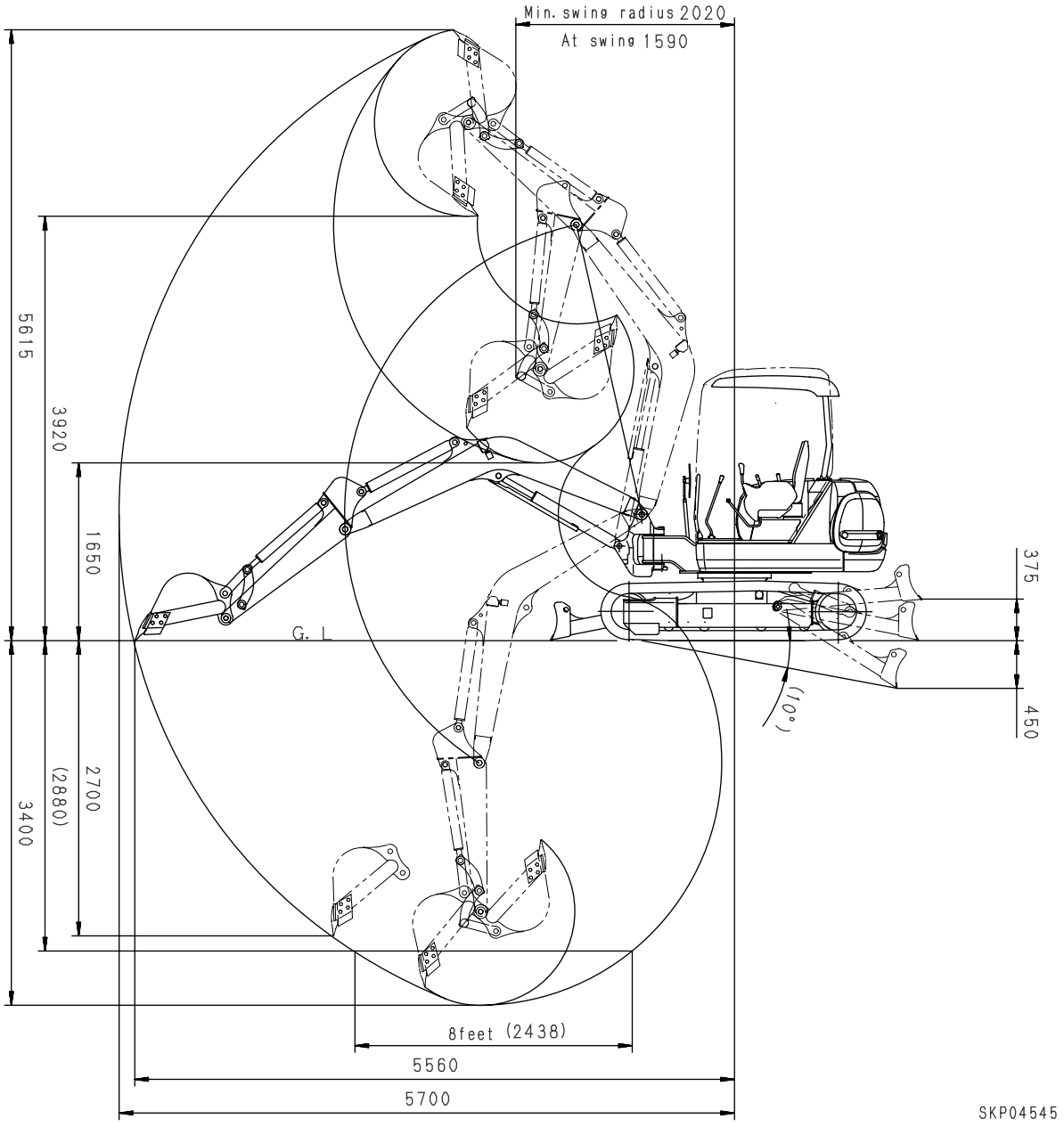
PC40R-8

- CAB SPECIFICATION (Rubber shoe/steel shoe)



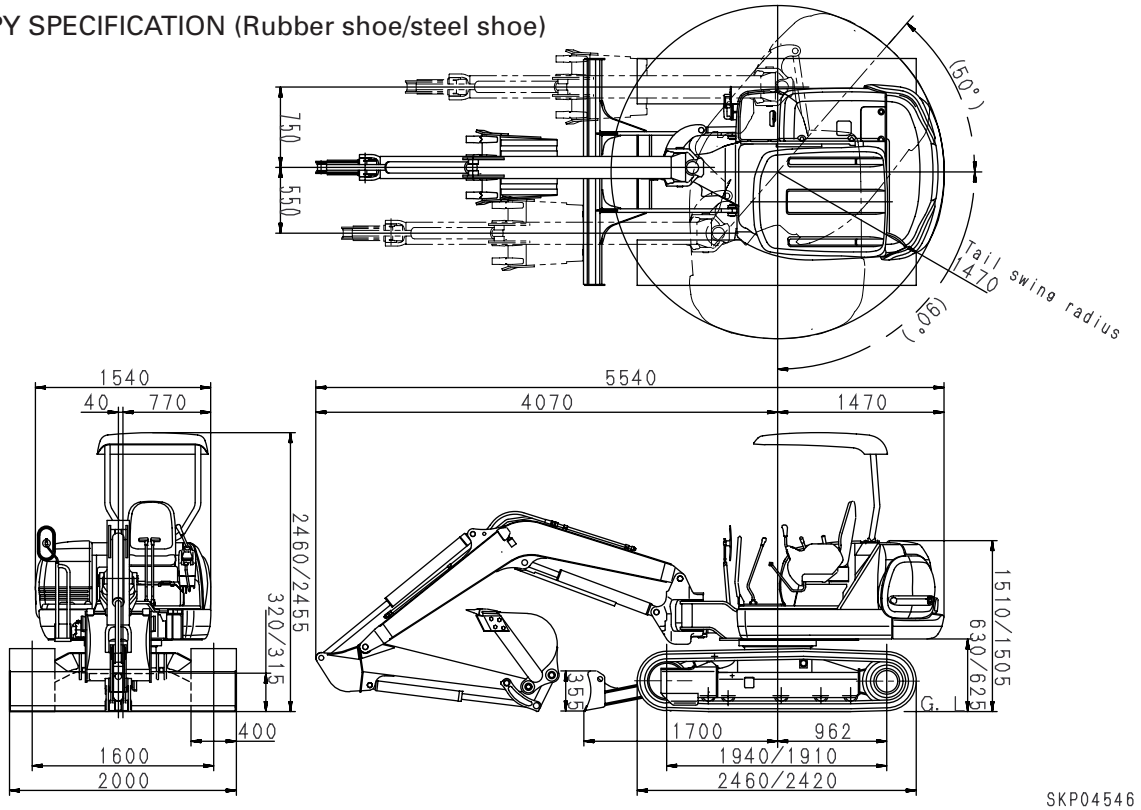
SKP04544

PC40R-8
WORKING RANGES



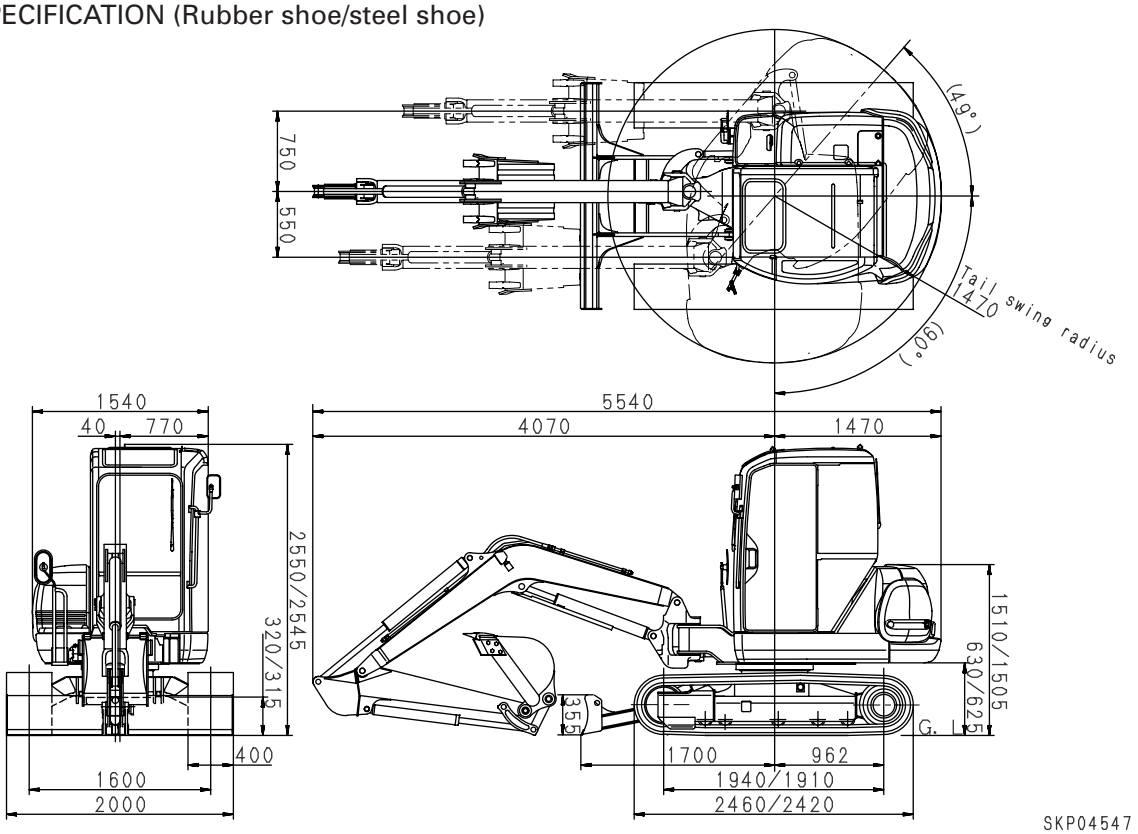
PC45R-8

- CANOPY SPECIFICATION (Rubber shoe/steel shoe)

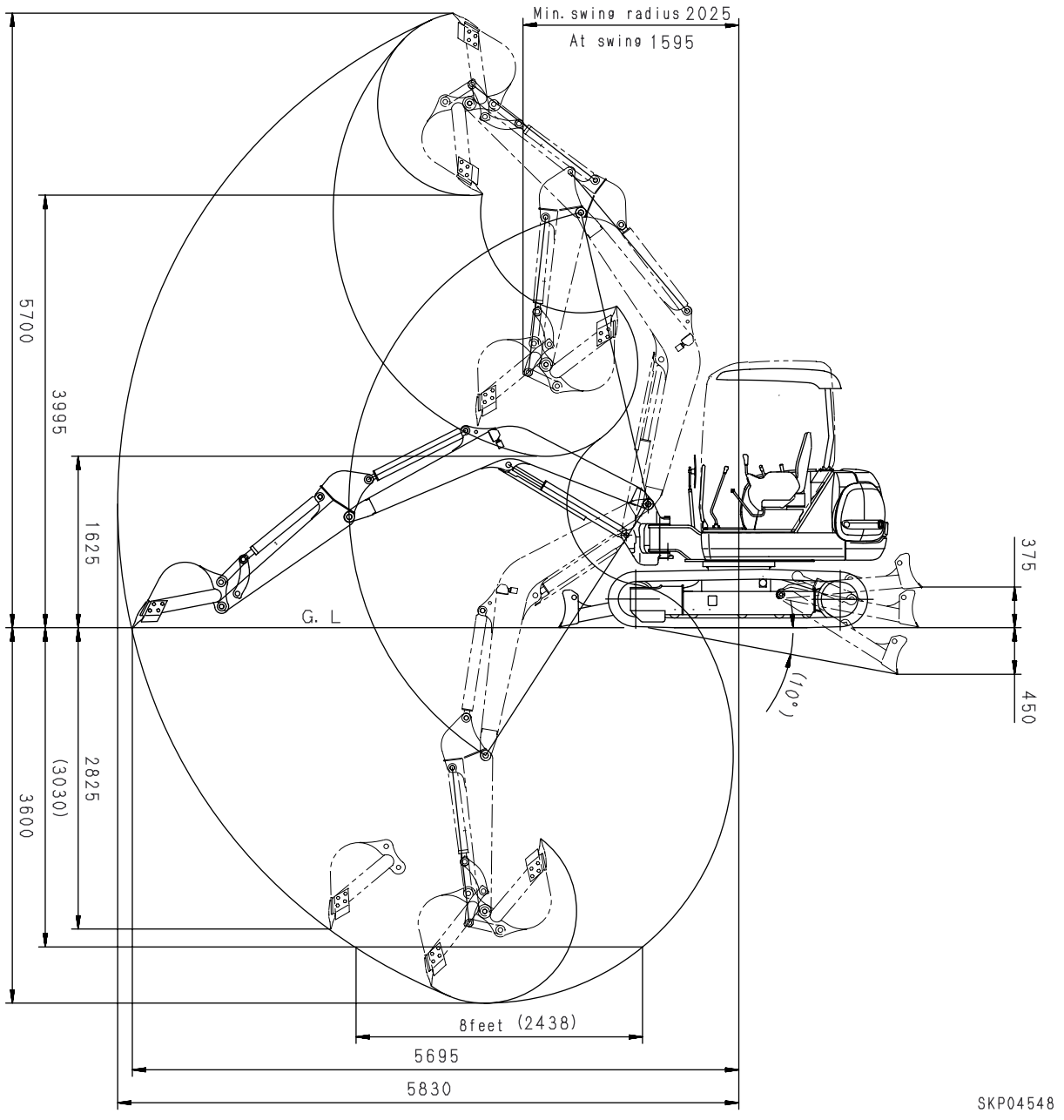


PC45R-8

- CAB SPECIFICATION (Rubber shoe/steel shoe)



PC45R-8
WORKING RANGES



SPECIFICATIONS

Machine model				PC30R-8	
				Canopy specification	Cab specification
Serial number				10001 and up	10001 and up
		Bucket capacity	m^3	0.09	0.09
		Operating weight	kg	2,955	3,110
Performance	Working ranges	Max. digging depth	mm	2,900	2,900
		Max. vertical wall depth	mm	2,175	2,175
		Max. digging reach	mm	4,980	4,980
		Max. reach at groung level	mm	4,850	4,850
		Max. digging height	mm	4,900	4,900
		Max. dumping height	mm	3,415	3,415
		Bucket offset	mm	495 (L.H.), 680 (R.H.)	495 (L.H.), 680 (R.H.)
		Max. digging force	kN {kg}	230 {2,350}	230 {2,350}
		Swing speed	rpm	9.0	9.0
		Swing max. slope angle	°	20	20
		Travel speed (Hi/Lo)	km/h	4.5/2.7 (4.6/2.8)	4.5/2.7 (4.6/2.8)
		Gradeability	°	30	30
		Ground pressure (at standard shoe)	kPa {kg/cm^2}	27.5 {0.28}	29.3 {0.30}
Dimensions		Ovarall length (for transport)	mm	4,850	4,850
		Overall width	mm	1,540	1,540
		Overall width (crawler)	mm	1,520	1,520
		Overall height (for transport)	mm	2,435 (2,425)	5,525 (2,515)
		Ground clearance of conterweight	mm	580	580
		Min. ground clearance	mm	290	290
		Tail swing radius	mm	1,390	1,390
		Min. swing radius of work equipment	mm	1,815	1,815
		Min. swing radius of work equipment (at boom swing)	mm	1,365	1,365
		Height of work equipment at min. swing radius	mm	3,725	3,725
		Length of track on ground	mm	1,610	1,610
		Track gauge	mm	1,220	1,220
		Machine cab height	mm	1,460	1,460
		Blade width	mm	1,520	1,520
		Blade height	mm	355	355

★ ( ): Rubber shoe specification.

Machine model				PC30R-8	
				Canopy specification	Cab specification
Serial number				10001 and up	10001 and up
Engine		Model		3D84E-3F	
		Type		4-cycle, water cooled, in-line direct injection type	
		No. of cylinders – bore × stroke	mm	3 – 84 × 90	
		Piston displacement	ℓ {cc}	1.496 {1,496}	
	Performance	Fly wheel horsepower	kW/rpm {PS/rpm}	20.6/2,500 {28/2,500}	
		Maxium torque	Nm/rpm {kgm/rpm}	85.3/1,800 {8.7/1,800}	
		High idling speed	rpm	2,675	
		Low idling speed	rpm	1,100	
		Min. fuel consumption ratio	g/kWh {g/PSh}	231 {170}	
		Starting motor		12V, 1.2 kW	
		Alternator		12V, 40A	
		Battery		12V, 70Ah (75D31R)	
		Radiator type		CF24-1	
Under-carriage		Carrier roller (each side)		1 on each side	
		Track roller (each side)		4 on cach side	
		Track shoe (Rubber shoe)		Rubber pad shoe	
		Track shoe (Steel shoe) (each side)		Double grouser: 43 each side	
Hydraulic system	Hydraulic pump	Type × no.		LPV45 + FBR8.5 × 1	
		Delivery	ℓ/min	85 + 20	
		Set pressure	MPa {kg/cm²}	24.5 {250} swing 15.2 {155}	
	Control valve	Type × no.		9-spool type × 1	
		Control method		Hydraulic assist type (boom, arm bucket, swing) Direct control type (travel, brade, boom swing)	
	Hydraulic motor	Travel motor		Piston type with countervalance valve (PHV300)	
		Swing motor		Piston type, brake valve, with swing shaft brake (LMF16)	
		Hydraulic cylinder		Reciprocating piston	
		Hydraulic tank		Box-shaped, close	
		Hydraulic oil filter		Tank return side	
		Hydraulic oil cooler		Air cooled	

Machine model				PC35R-8	
				Canopy specification	Cab specification
Serial number				35001 and up	35001 and up
		Bucket capacity	m^3	0.11	0.11
		Operating weight	kg	3,200	3,350
Performance	Working ranges	Max. digging depth	mm	3,150	3,150
		Max. vertical wall depth	mm	2,405	2,405
		Max. digging reach	mm	5,290	5,290
		Max. reach at groung level	mm	5,170	5,170
		Max. digging height	mm	5,200	5,200
		Max. dumping height	mm	3,715	3,715
		Bucket offset	mm	495 (L.H.), 680 (R.H.)	495 (L.H.), 680 (R.H.)
		Max. digging force	kN {kg}	26.4 {2,690}	26.4 {2,690}
		Swing speed	rpm	9.0	9.0
		Swing max. slope angle	°	20	20
		Travel speed (Hi/Lo)	km/h	4.5/2.7 (4.6/2.8)	4.5/2.7 (4.6/2.8)
		Gradeability	°	30	30
		Ground pressure (at standard shoe)	kPa {kg/cm^2}	30.4 {0.31}	31.4 {0.32}
Dimensions		Ovarall length (for transport)	mm	5,120	5,120
		Overall width	mm	1,540	1,540
		Overall width (crawler)	mm	1,520	1,520
		Overall height (for transport)	mm	2,435 (2,425)	2,525 (2,515)
		Ground clearance of conterweight	mm	580	580
		Min. ground clearance	mm	290	290
		Tail swing radius	mm	1,415	1,415
		Min. swing radius of work equipment	mm	1,820	1,820
		Min. swing radius of work equipment (at boom swing)	mm	1,370	1,370
		Height of work equipment at min. swing radius	mm	2,970	2,970
		Length of track on ground	mm	1,610	1,610
		Track gauge	mm	1,220	1,220
		Machine cab height	mm	1,460	1,460
		Blade width	mm	1,520	1,520
		Blade height	mm	355	355

★ ( ): Rubber shoe specification.

Machine model				PC35R-8	
				Canopy specification	Cab specification
Serial number				35001 and up	35001 and up
Engine			Model		3D84E-3F
			Type		4-cycle, water cooled, in-line direct injection type
			No. of cylinders – bore × stroke	mm	3 – 84 × 90
			Piston displacement	ℓ {cc}	1.496 {1,496}
	Performance		Fly wheel horsepower	kW/rpm {PS/rpm}	20.6/2,500 {28/2,500}
			Maxium torque	Nm/rpm {kgm/rpm}	85.3/1,800 {8.7/1,800}
			High idling speed	rpm	2,675
			Low idling speed	rpm	1,100
			Min. fuel consumption ratio	g/kWh {g/PSh}	231 {170}
			Starting motor		12V, 1.2 kW
			Alternator		12V, 40A
			Battery		12V, 70Ah (75D31R)
			Radiator type		CF24-1
Under-carriage			Carrier roller (each side)		1 on each side
			Track roller (each side)		4 on cach side
			Track shoe (Rubber shoe)		Rubber pad shoe
			Track shoe (Steel shoe) (each side)		Double grouser: 43 each side
Hydraulic system	Hydraulic pump		Type × no.		LPV45 + FBR8.5 × 1
			Delivery	ℓ/min	85 + 20
			Set pressure	MPa {kg/cm²}	24.5 {250} swing 16.2 {165}
	Control valve		Type × no.		9-spool type × 1
			Control method		Hydraulic assist type (boom, arm bucket, swing) Direct control type (travel, brade, boom swing)
	Hydraulic motor		Travel motor		Piston type with countervalance valve (PHV350)
			Swing motor		Piston type, brake valve, with swing shaft brake (LMF16)
			Hydraulic cylinder		Reciprocating piston
			Hydraulic tank		Box-shaped, close
			Hydraulic oil filter		Tank return side
			Hydraulic oil cooler		Air cooled

Machine model				PC40R-8	
				Canopy specification	Cab specification
Serial number				30001 and up	30001 and up
		Bucket capacity	m^3	0.14	0.14
		Operating weight	kg	4,055	4,210
Performance	Working ranges	Max. digging depth	mm	2,400	2,400
		Max. vertical wall depth	mm	2,700	2,700
		Max. digging reach	mm	5,700	5,700
		Max. reach at groung level	mm	5,560	5,560
		Max. digging height	mm	5,615	5,615
		Max. dumping height	mm	3,920	3,920
		Bucket offset	mm	550 (L.H.), 750 (R.H.)	550 (L.H.), 750 (R.H.)
		Max. digging force	kN {kg}	30.2 {3,080}	30.2 {3,080}
		Swing speed	rpm	9.0	9.0
		Swing max. slope angle	°	17	17
		Travel speed (Hi/Lo)	km/h	4.3/2.6 (4.6/2.8)	4.3/2.6 (4.6/2.8)
		Gradeability	°	30	30
		Ground pressure (at standard shoe)	kPa {kg/cm^2}	24.5 {0.25}	24.5 {0.25}
Dimensions		Ovarall length (for transport)	mm	5,440	5,440
		Overall width	mm	2,000	2,000
		Overall width (crawler)	mm	2,000	2,000
		Overall height (for transport)	mm	2,450 (2,460)	2,540 (2,550)
		Ground clearance of conterweight	mm	630	630
		Min. ground clearance	mm	320	320
		Tail swing radius	mm	1,415	1,415
		Min. swing radius of work equipment	mm	2,020	2,020
		Min. swing radius of work equipment (at boom swing)	mm	1,590	1,590
		Height of work equipment at min. swing radius	mm	4,270	4,270
		Length of track on ground	mm	1,910 (1,940)	1,910 (1,940)
		Track gauge	mm	1,600	1,600
		Machine cab height	mm	1,510	1,510
		Blade width	mm	2,000	2,000
		Blade height	mm	355	355

★ ( ): Rubber shoe specification.

Machine model				PC40R-8	
				Canopy specification	Cab specification
Serial number				30001 and up	30001 and up
Engine			Model		4D84E-3D
			Type		4-cycle, water cooled, in-line direct injection type
			No. of cylinders – bore × stroke	mm	4 – 84 × 90
			Piston displacement	ℓ {cc}	1.995 {1,995}
	Performance		Fly wheel horsepower	kW/rpm {PS/rpm}	28.3/2,500 {38.5/2,500}
			Maxium torque	Nm/rpm {kgm/rpm}	117.6/1,800 {12.0/1,800}
			High idling speed	rpm	2,675
			Low idling speed	rpm	1,100
			Min. fuel consumption ratio	g/kWh {g/PSh}	238 {175}
			Starting motor		12V, 1.4 kW
			Alternator		12V, 40A
			Battery		12V, 70Ah (75D31R)
			Radiator type		CF24-1
Under-carriage			Carrier roller (each side)		1 on each side
			Track roller (each side)		4 on cach side
			Track shoe (Rubber shoe)		Rubber pad shoe
			Track shoe (Steel shoe) (each side)		Triple grouser: 38 each side
Hydraulic system	Hydraulic pump		Type × no.		LPV45 + SBR10 × 1
			Delivery	ℓ/min	110 + 25
			Set pressure	MPa {kg/cm²}	24.5 {250} swing 17.7 {180}
	Control valve		Type × no.		9-spool type × 1
			Control method		Hydraulic assist type (boom, arm bucket, swing) Direct control type (travel, brade, boom swing)
	Hydraulic motor		Travel motor		Piston type with countervalance valve (PHV500)
			Swing motor		Piston type, brake valve, with swing shaft brake (LMF16)
			Hydraulic cylinder		Reciprocating piston
			Hydraulic tank		Box-shaped, close
			Hydraulic oil filter		Tank return side
			Hydraulic oil cooler		Air cooled

Machine model				PC45R-8	
				Canopy specification	Cab specification
Serial number				5001 and up	5001 and up
		Bucket capacity	m^3	0.16	0.16
		Operating weight	kg	4,300	4,455
Performance	Working ranges	Max. digging depth	mm	3,600	3,600
		Max. vertical wall depth	mm	2,825	2,825
		Max. digging reach	mm	5,830	5,830
		Max. reach at groung level	mm	5,695	5,695
		Max. digging height	mm	5,700	5,700
		Max. dumping height	mm	3,995	3,995
		Bucket offset	mm	550 (L.H.), 750 (R.H.)	550 (L.H.), 750 (R.H.)
		Max. digging force	kN {kg}	34.7 {3,540}	34.7 {3,540}
		Swing speed	rpm	9.0	9.0
		Swing max. slope angle	°	17	17
		Travel speed (Hi/Lo)	km/h	4.3/2.6 (4.6/2.8)	4.3/2.6 (4.6/2.8)
		Gradeability	°	30	30
		Ground pressure (at standard shoe)	kPa {kg/cm^2}	25.5 {0.26}	26.5 {0.27}
Dimensions		Ovarall length (for transport)	mm	5,540	5,540
		Overall width	mm	2,000	2,000
		Overall width (crawler)	mm	2,000	2,000
		Overall height (for transport)	mm	2,455 (2,460)	2,545 (2,550)
		Ground clearance of conterweight	mm	630	630
		Min. ground clearance	mm	320	320
		Tail swing radius	mm	1,470	1,470
		Min. swing radius of work equipment	mm	2,025	2,025
		Min. swing radius of work equipment (at boom swing)	mm	1,595	1,595
		Height of work equipment at min. swing radius	mm	4,375	4,375
		Length of track on ground	mm	1,910 (1,940)	1,910 (1,940)
		Track gauge	mm	1,600	1,600
		Machine cab height	mm	1,510	1,510
		Blade width	mm	2,000	2,000
		Blade height	mm	355	355

★ ( ): Rubber shoe specification.

Machine model				PC45R-8	
				Canopy specification	Cab specification
Serial number				5001 and up	5001 and up
Engine			Model		4D84E-3D
			Type		4-cycle, water cooled, in-line direct injection type
			No. of cylinders – bore × stroke	mm	4 – 84 × 90
			Piston displacement	ℓ {cc}	1.995 {1,995}
	Performance		Fly wheel horsepower	kW/rpm {PS/rpm}	28.3/2,500 {38.5/2,500}
			Maxium torque	Nm/rpm {kgm/rpm}	117.6/1,800 {12.0/1,800}
			High idling speed	rpm	2,675
			Low idling speed	rpm	1,100
			Min. fuel consumption ratio	g/kWh {g/PSh}	238 {175}
			Starting motor		12V, 1.4 kW
			Alternator		12V, 40A
			Battery		12V, 70Ah (75D31R)
			Radiator type		CF24-1
Under-carriage			Carrier roller (each side)		1 on each side
			Track roller (each side)		5 on cach side
			Track shoe (Rubber shoe)		Rubber pad shoe
			Track shoe (Steel shoe) (each side)		Triple grouser: 38 each side
Hydraulic system	Hydraulic pump		Type × no.		LPV45 + SBR10 × 1
			Delivery	ℓ/min	110 + 25
			Set pressure	MPa {kg/cm²}	24.5 {250} swing 19.7 {200}
	Control valve		Type × no.		9-spool type × 1
			Control method		Hydraulic assist type (boom, arm bucket, swing) Direct control type (travel, brade, boom swing)
	Hydraulic motor		Travel motor		Piston type with countervalance valve (GM06VL)
			Swing motor		Piston type, brake valve, with swing shaft brake (LMF16)
			Hydraulic cylinder		Reciprocating piston
			Hydraulic tank		Box-shaped, close
			Hydraulic oil filter		Tank return side
			Hydraulic oil cooler		Air cooled

WEIGHT TABLE

⚠ This weight table is a guide for use when transportiong or handing components.

Unit: kg

Machine model	PC30R-8	PC35R-8
Serial number	10001 and up	35001 and up
Engine assembly	207	207
• Engine (with engine mount)	176	176
• P.T.O	731	731
• Hydraulic pump	24.3	24.3
Radiator assembly	20.2	20.2
Hydraulic tank (without hydraulic oil)	35.7	35.7
Fuel tank (without fuel)	6.6	6.6
Operator's cab	177	177
Revolving frame	539	790
Swing machinery	22.6	22.6
Swing motor (with brake valve)	13.7	13.7
Travel motor (with reduction gear)	47 × 2	47 × 2
9-spool control valve	30	30
Center swivel joint	16	16
Counterweight (with side protector)	85	336
Track frame assembly	666	666
• Track frame	330	330
• Carrier roller	2.4 × 2	2.4 × 2
• Track roller	5.3 × 8	5.3 × 8
• Recoil spring assembly	14.3 × 2	14.3 × 2
• Idler	37 × 2	37 × 2
• Sprocket	8.6 × 2	8.6 × 2
• Swing circle assembly	40.4	40.4

★ ( ): Rubber shoe specification.

Unit: kg

Machine model	PC30R-8	PC35R-8
Serial number	10001 and up	35001 and up
Track shoe assembly • With standard track shoe	168 × 2 (124.2 × 2)	168 × 2 (124.2 × 2)
Boom assembly	118.1	122.2
Arm assembly	54.8	63.8
Bucket assembly	76	84.5
Boom cylinder assembly	33.1	33.1
Arm cylinder assembly	22.1	25.9
Bucket cylinder assembly	17.3	18
Boom swing cylinder assembly	31.7	31.7
Blade cylinder assembly	22.6	22.6
Boom swing bracket assembly	67.5	67.5
Blade assembly	152.1	152.1
Canopy assembly	32	32

Unit: kg

Machine model	PC40R-8	PC45R-8
Serial number	30001 and up	5001 and up
Engine assembly	253.4	253.4
• Engine (with engine mount)	221.9	221.9
• P.T.O	7.1	7.1
• Hydraulic pump	24.4	24.4
Radiator assembly	24.6	24.6
Hydraulic tank (without hydraulic oil)	35.7	35.7
Fuel tank (without fuel)	6.6	6.6
Operator's cab	177	177
Revolving frame	884	1004
Swing machinery	30.2	30.2
Swing motor (with brake valve)	14.3	14.3
Travel motor (with reduction gear)	56.2 × 2	63.2 × 2
9-spool control valve	30	30
Center swivel joint	16	16
Counterweight (with side protector)	336	456
Track frame assembly	946	981.5
• Track frame	502	502
• Carrier roller	2.4 × 2	2.4 × 2
• Track roller	10.3 × 8	10.3 × 10
• Recoil spring assembly	16.4 × 2	16.4 × 2
• Idler	45.6 × 2	45.6 × 2
• Sprocket	13.5 × 2	13.5 × 2
• Swing circle assembly	58.6	60.5

★ ( ): Rubber shoe specification.

Unit: kg

Machine model	PC40R-8	PC45R-8
Serial number	30001 and up	5001 and up
Track shoe assembly • With standard track shoe	264.5 × 2 (221.5 × 2)	297.5 × 2 (221.5 × 2)
Boom assembly	167	172
Arm assembly	86	94
Bucket assembly	108	111
Boom cylinder assembly	45	45
Arm cylinder assembly	34	35
Bucket cylinder assembly	26	29
Boom swing cylinder assembly	39	43
Blade cylinder assembly	33.2	33.2
Boom swing bracket assembly	93.7	93.7
Blade assembly	195	195
Canopy assembly	32	32

LIST OF LUBRICANT AND WATER

PROPER SELECTION OF FUEL, COOLANT AND LUBRICANTS

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE -22 -4 14 32 50 68 86 104°F -30 -20 -10 0 10 20 30 40°C	CAPACITY (ℓ) Specified	CAPACITY (ℓ) Refill
Engine oil pan	Engine oil	SAE 30 SAE 10W SAE 10W-30 SAE 15W-40	PC30R,35R 7.4 ℓ PC40R,45R 8.6 ℓ	PC30R,35R 6.9 ℓ PC40R,45R 8.0 ℓ
Final drive case (each)	Engine oil	SAE 30	PC30R,35R 0.7 ℓ PC40R 0.8 ℓ PC45R 1.1 ℓ	PC30R,35R 0.7 ℓ PC40R 0.8 ℓ PC45R 1.1 ℓ
Track roller (each)	Engine oil	SAE 30	40cc	—
Idler (each)	Engine oil	SAE 30	20cc	—
Carrier roller (each)	Grease	Alvania EP-2 (Shell) or equivalent	30cc	—
Hydraulic system	Engine oil	SAE 10W SAE 10W-30 SAE 15W-40	63 ℓ	33 ℓ
Fuel tank	Diesel fuel	ASTM D975 No.2 ※ 1	50 ℓ	—
Cooling system (Including sub tank)	Water	Add antifreeze	PC30R,35R 6.8 ℓ PC40R,45R 7.5 ℓ	—

※ 1: ASTM D975 No.1

NOTE:

- 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

- 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.
- Use API classification CD as engine oil and if API classification CC, reduce the engine oil change interval to half.
- 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.
- We recommend Komatsu genuine oil which has been specifically formulated and approved for use in engine and hydraulic work equipment applications.

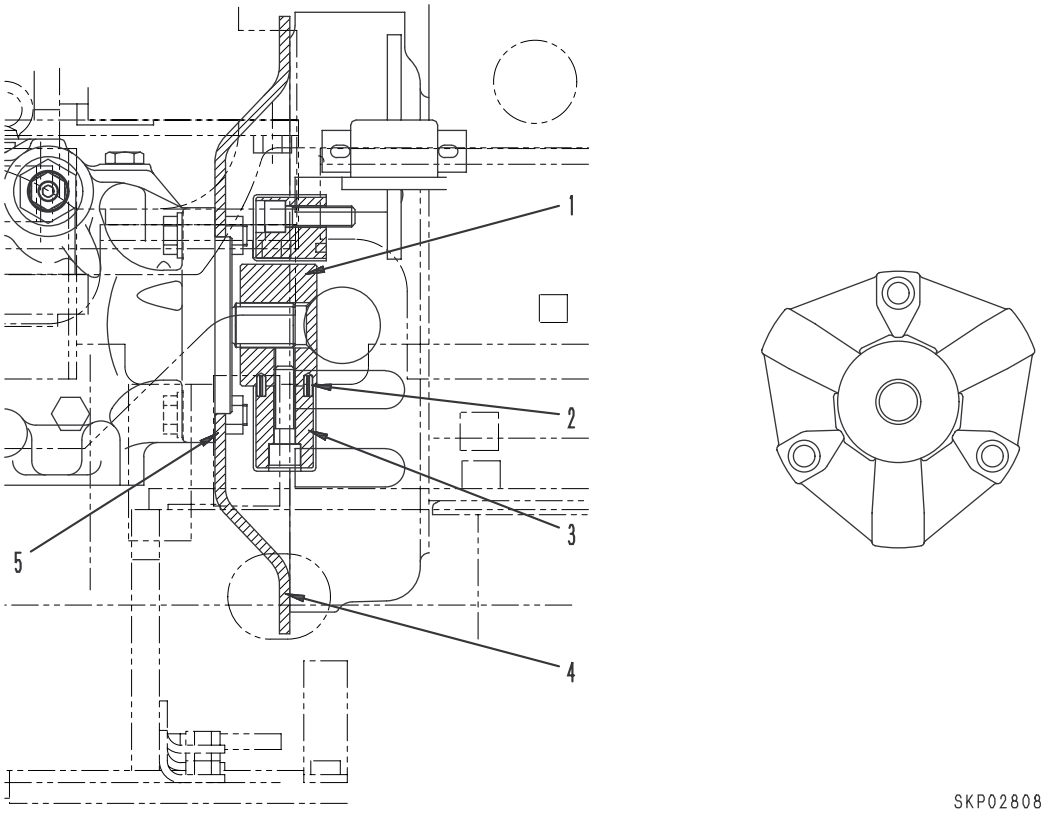
Specified capacity: Total amount of oil including oil for components and oil in piping.
Refill capacity: Amount of oil needed to refill system during normal inspection and maintenance.

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

10 STRUCTURE AND FUNCTION

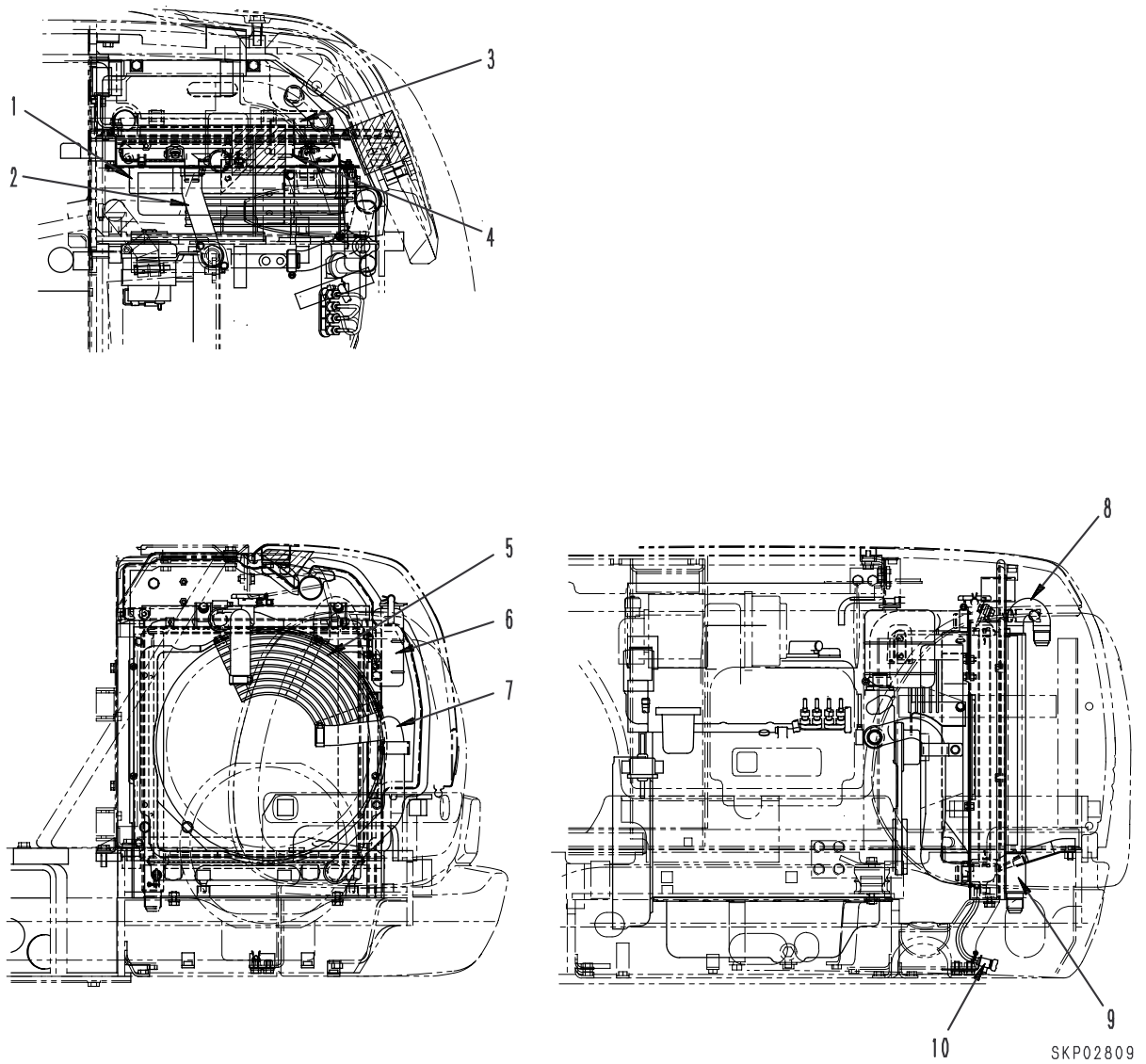
PTO (Coupling) 10- 2
Radiator, oil cooler 10- 3
Engine control 10- 4
Power train 10- 5
Swing circle 10- 6
Swing machinery 10- 7
Track frame, recoil spring 10- 8
Hydraulic piping drawing 10- 9
Hydraulic circuit diagram 10-10
Hydraulic pump 10-18
Center swivel joint 10-25
Swing motor 10-26
Travel motor 10-31
9-spool control valve 10-42
CLSS 10-50
Multi-control valve 10-74
Electrical wiring diagram 10-75
Valve control 10-77
Work equipment, swing PPC valve 10-78
Solenoid valve 10-82
Work equipment 10-84
Machine monitor system 10-85
Electrical circuit diagram 10-89
Hydraulic cylinder 10-90

PTO (COUPLING)



1. Boss
2. Spring pin
3. Rubber
4. Cover
5. Pump case

RADIATOR, OIL COOLER



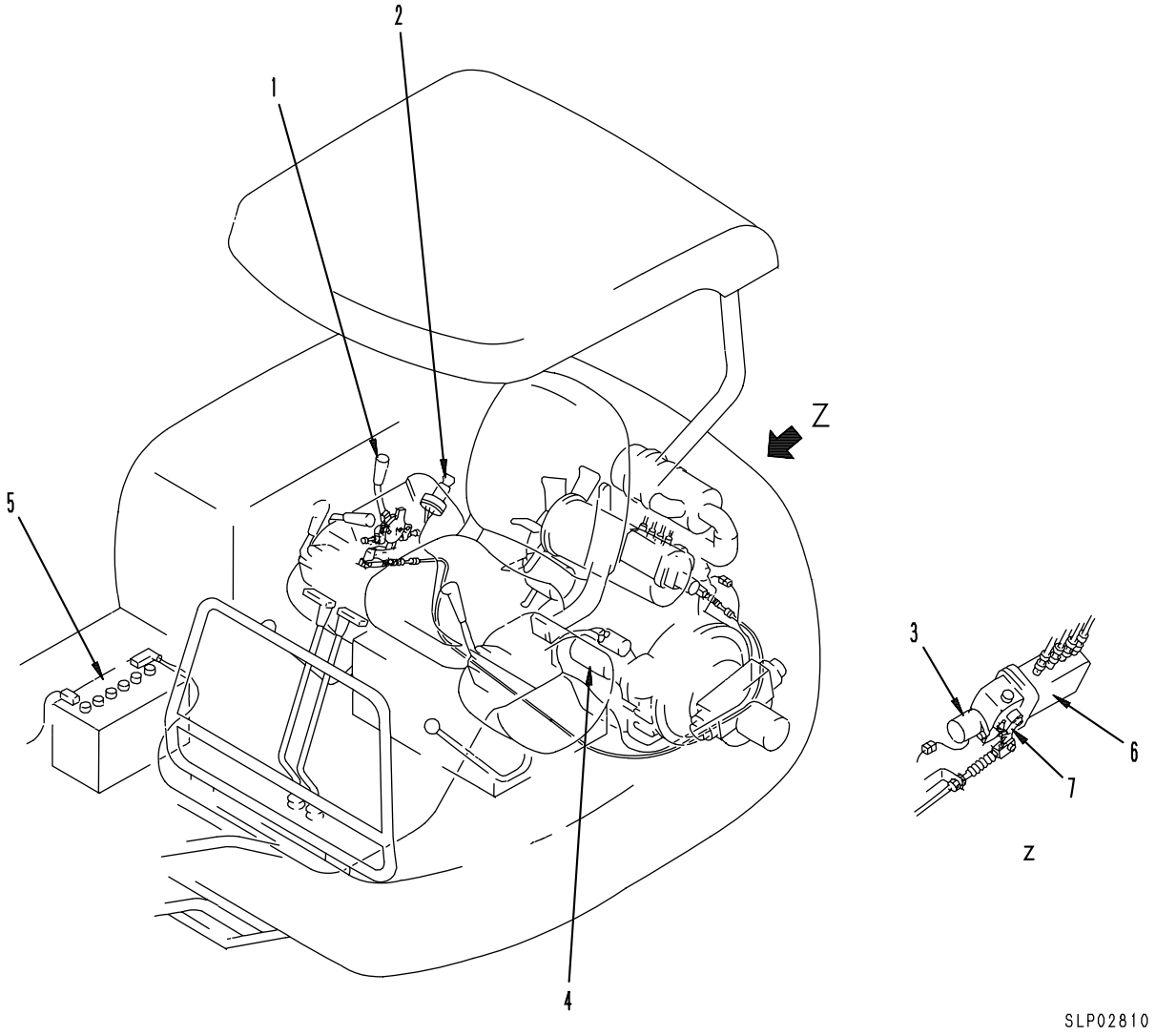
1. Shroud
2. Radiator inlet hose
3. Oil cooler
4. Radiator
5. Fan guard
6. Reserve tank
7. Radiator outlet hose
8. Oil cooler inlet port
9. Oil cooler outlet port
10. Drain valve

SPECIFICATIONS

Radiator
- Core type: CF24-1
- Heat dissipat-ion area: 6.04 m^2
- Fin pitch: 3.0/2 mm
- Water capacity: 4.4 ℓ

Oil cooler
- Core type: CFT-1
- Heat dissipation area: 3.92 m^2
- Fin pitch: 4.0/2mm
- Oil capacity: —

ENGINE CONTROL



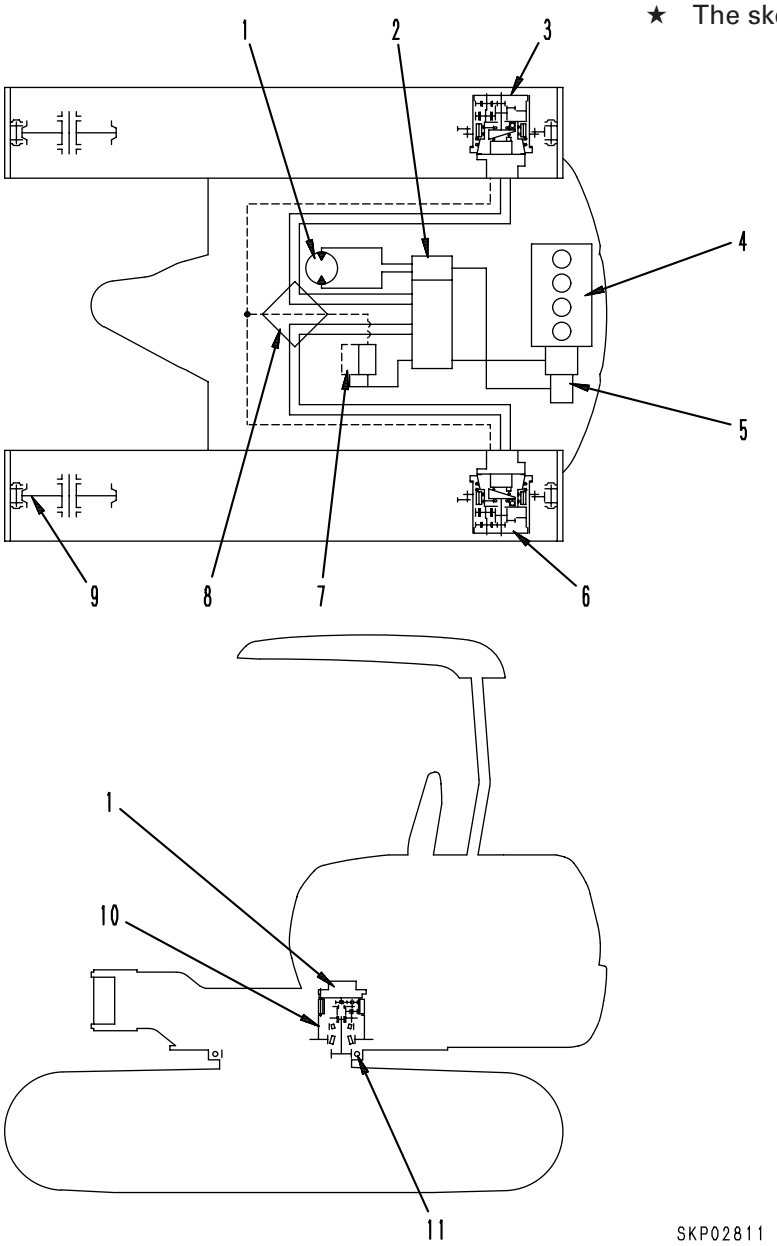
1. Battery
2. Fuel control lever
3. Starting switch
4. Starting motor
5. Engine stop solenoid
6. Fuel injection pump
7. Governor lever

OUTLINE

- The engine can be started and stopped simply by using the starting switch.
- The fuel control lever is used to control the engine speed.

POWER TRAIN

★ The sketch shows the PC40R.



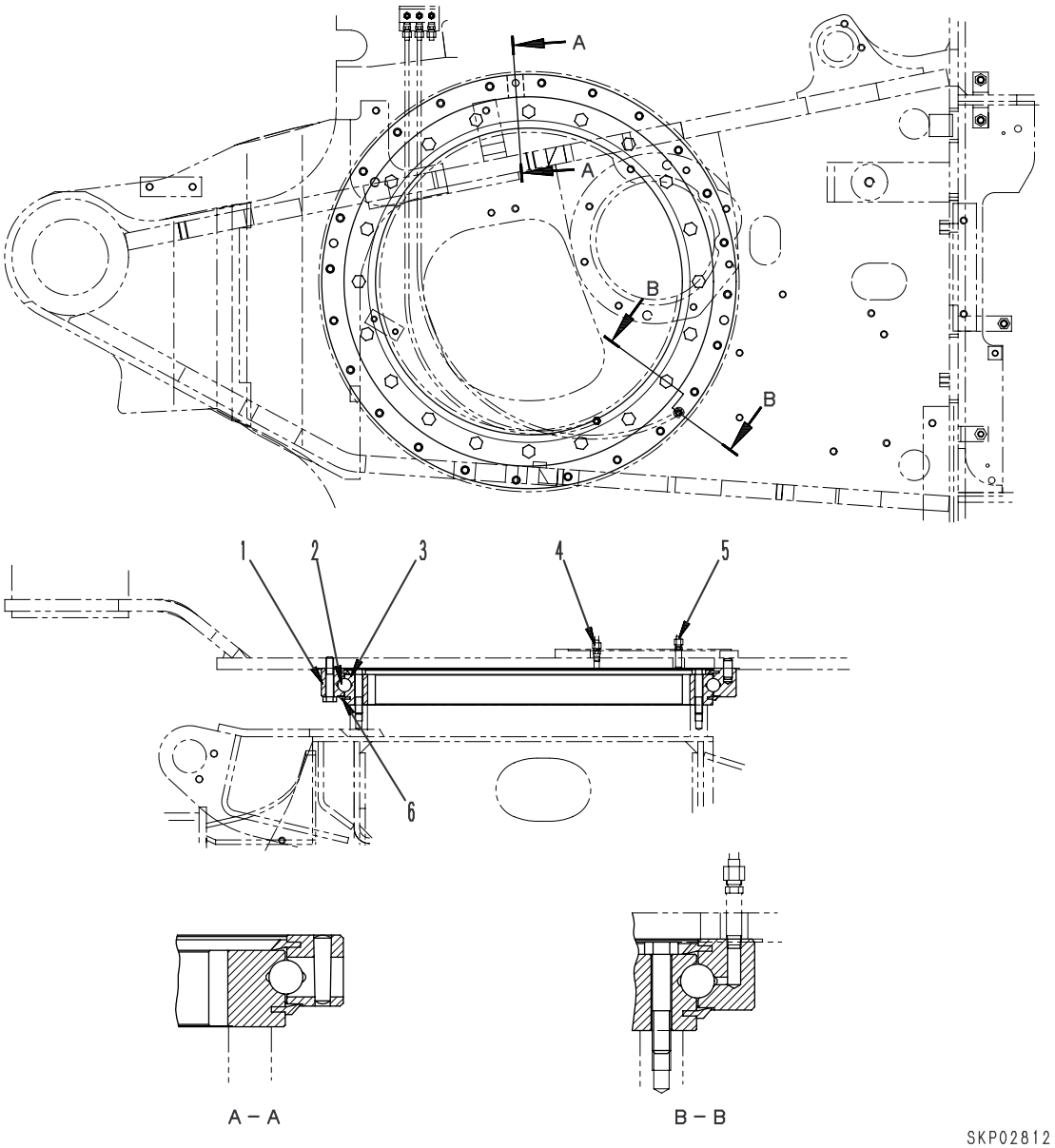
1. Swing motor
2. 9-spool control valve
3. R.H. travel motor
4. Engine
5. Hydraulic pump
6. L.H. travel motor
7. Travel 2-speed selector solenoid valve
8. Center swivel joint
9. Idler
10. Swing machinery
11. Swing circle

OUTLINE

The mechanical power from engine (4) is converted to hydraulic power by hydraulic pump (5). This hydraulic power is divided by control valve (2) according to the purpose. It is converted back to mechanical power by hydraulic motors (3) or (5), travel motor (1), or the hydraulic cylinders of each piece of work equipment, and is used to operate the travel, swing, and work equipment.

SWING CIRCLE

★ The sketch shows the PC40R.



1. Swing circle outer race
2. Ball bearing
3. Swing circle inner race
4. Swing circle pinion lubrication
5. Swing circle bearing lubrication
6. Seal

SWING MACHINERY

★ The sketch shows the PC40R, 45R.

1. Motor
2. Ring gear
3. No. 1 planetary gear
4. No. 2 planetary gear
5. Swing pinion
6. Taper roller bearing
7. Swing machinery case
8. No. 2 sun gear
9. No. 1 sun gear

SPECIFICATION

	PC30R	PC35R	PC40R	PC45R
Reduction ratio	17.422		24.099	
Swing reduction ratio	145.63		190.39	187.97
Swing speed	10.2 rpm		9.79 rpm	9.91 rpm
Lubricating oil	0.90 ℓ (EO10-CD)		1.3 ℓ (EO10-CD)	

TRACK FRAME, RECOIL SPRING

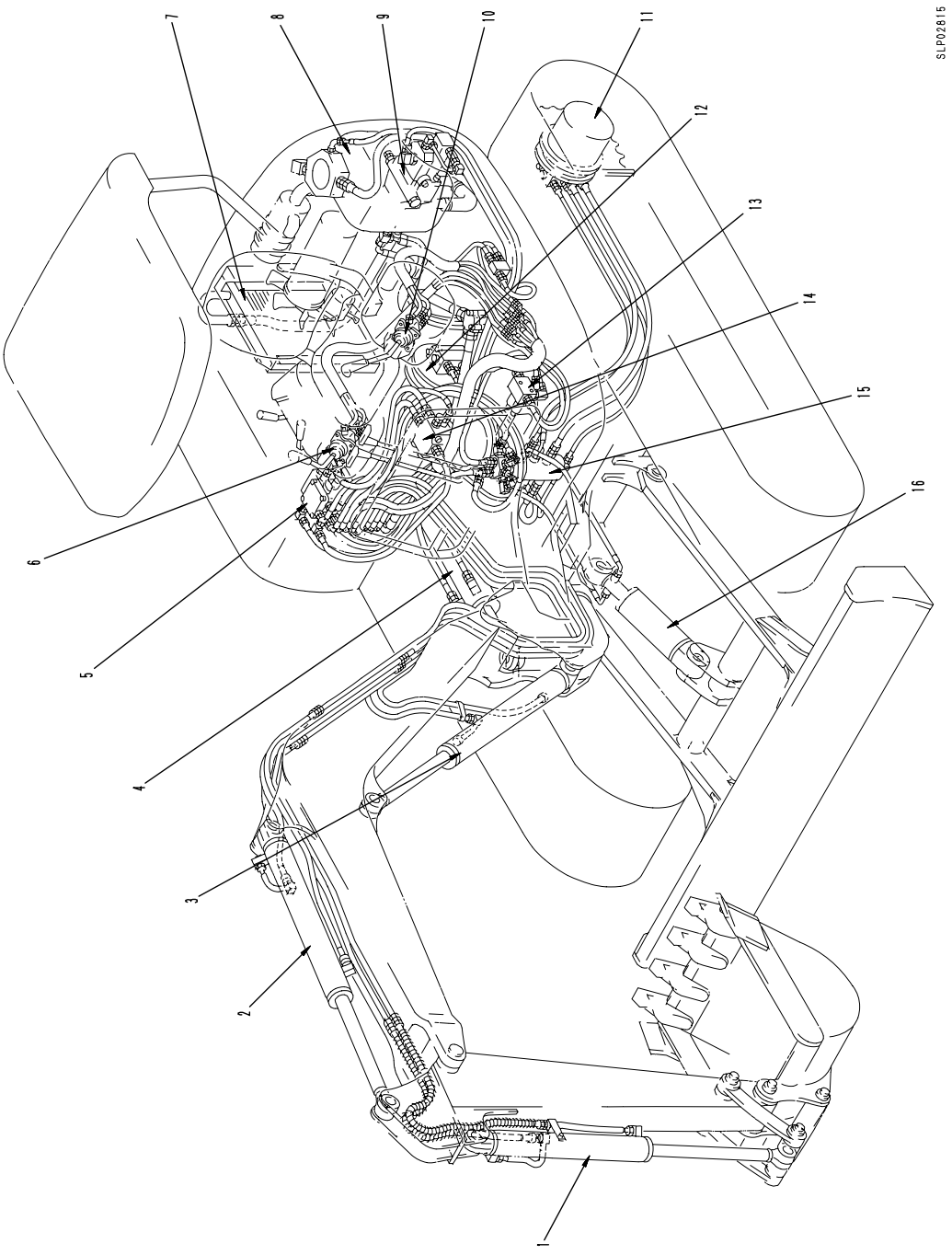
★ The sketch shows the PC40R.

1. Idler
2. Rod
3. Cylinder
4. Carrier roller
5. Track frame
6. Sprocket
7. Travel motor
8. Track roller
9. Track shoe
10. Lubricator
11. Recoil spring
12. Guard (steel shoe only)

HYDRAULIC PIPING DRAWING

★ For details of this page, see page 90-13.

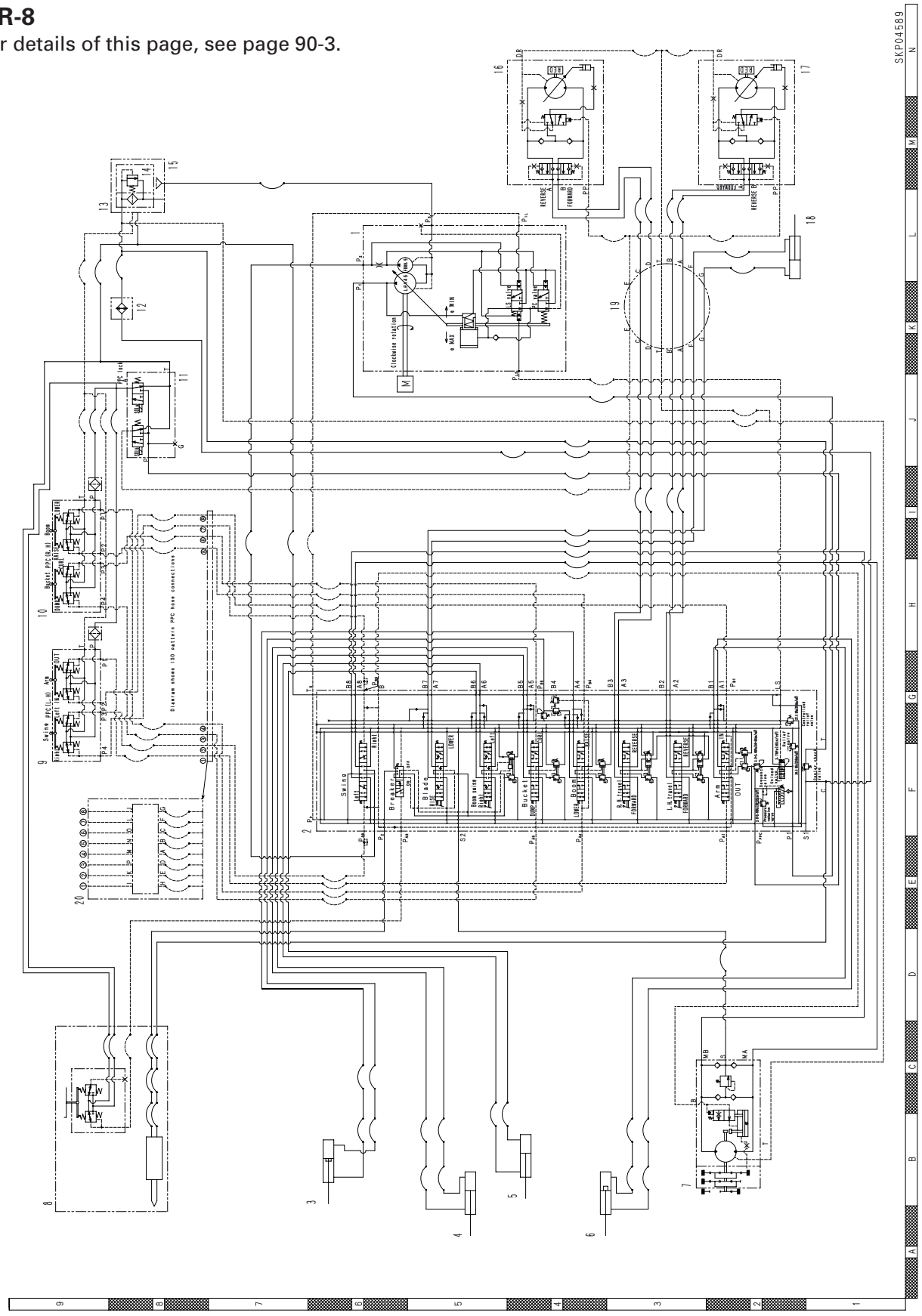
1. Bucket cylinder
2. Arm cylinder
3. Boom cylinder
4. Boom swing cylinder
5. 9-spool control valve
6. R.H. PPC valve
7. Oil cooler
8. Hydraulic tank
9. Hydraulic pump
10. L.H. PPC valve
11. L.H. travel motor
12. R.H. travel motor
13. Solenoid valve
14. Swing motor
15. Swivel joint
16. Blade cylinder



HYDRAULIC CIRCUIT DIAGRAM

PC30R-8

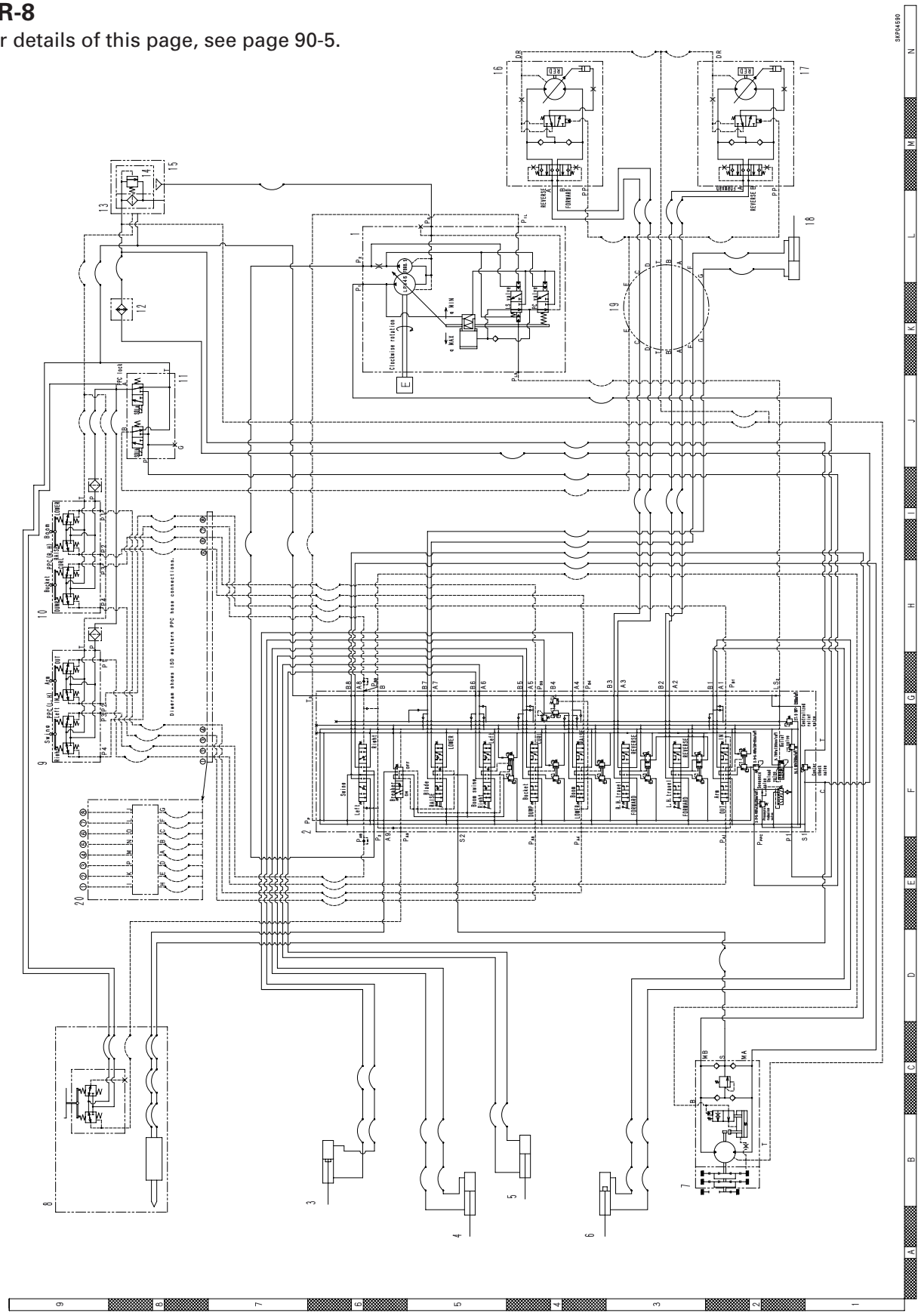
★ For details of this page, see page 90-3.



1. Hydraulic pump (LPV45+FBR8.5)
2. Main control valve
3. Boom cylinder
4. Bucket cylinder
5. Boom swing cylinder
6. Arm cylinder
7. Swing motor
8. Breaker
9. PPC valve (swing, arm)
10. PPC valve (bucket, boom)
11. Travel 2-speed selector solenoid valve
12. Oil cooler
13. Hydraulic tank
14. Bypass valve
15. Strainer
16. R.H. travel motor
17. L.H. travel motor
18. Blade cylinder
19. Swivel joint
20. 4 WAY

PC35R-8

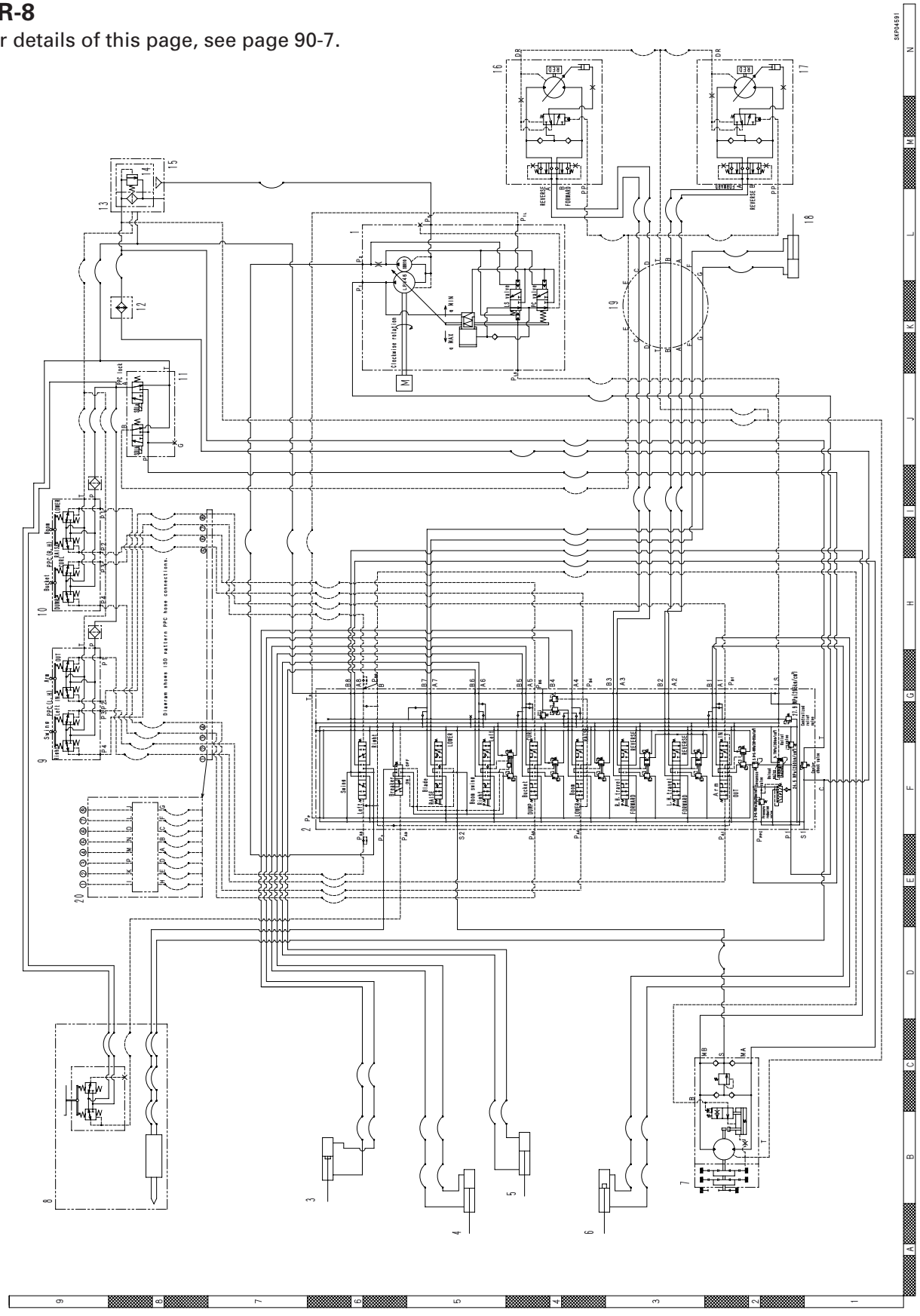
★ For details of this page, see page 90-5.



1. Hydraulic pump (LPV45+FBR8.5)
2. Main control valve
3. Boom cylinder
4. Bucket cylinder
5. Boom swing cylinder
6. Arm cylinder
7. Swing motor
8. Breaker
9. PPC valve (swing, arm)
10. PPC valve (bucket, boom)
11. Travel 2-speed selector solenoid valve
12. Oil cooler
13. Hydraulic tank
14. Bypass valve
15. Strainer
16. R.H. travel motor
17. L.H. travel motor
18. Blade cylinder
19. Swivel joint
20. 4 WAY

PC40R-8

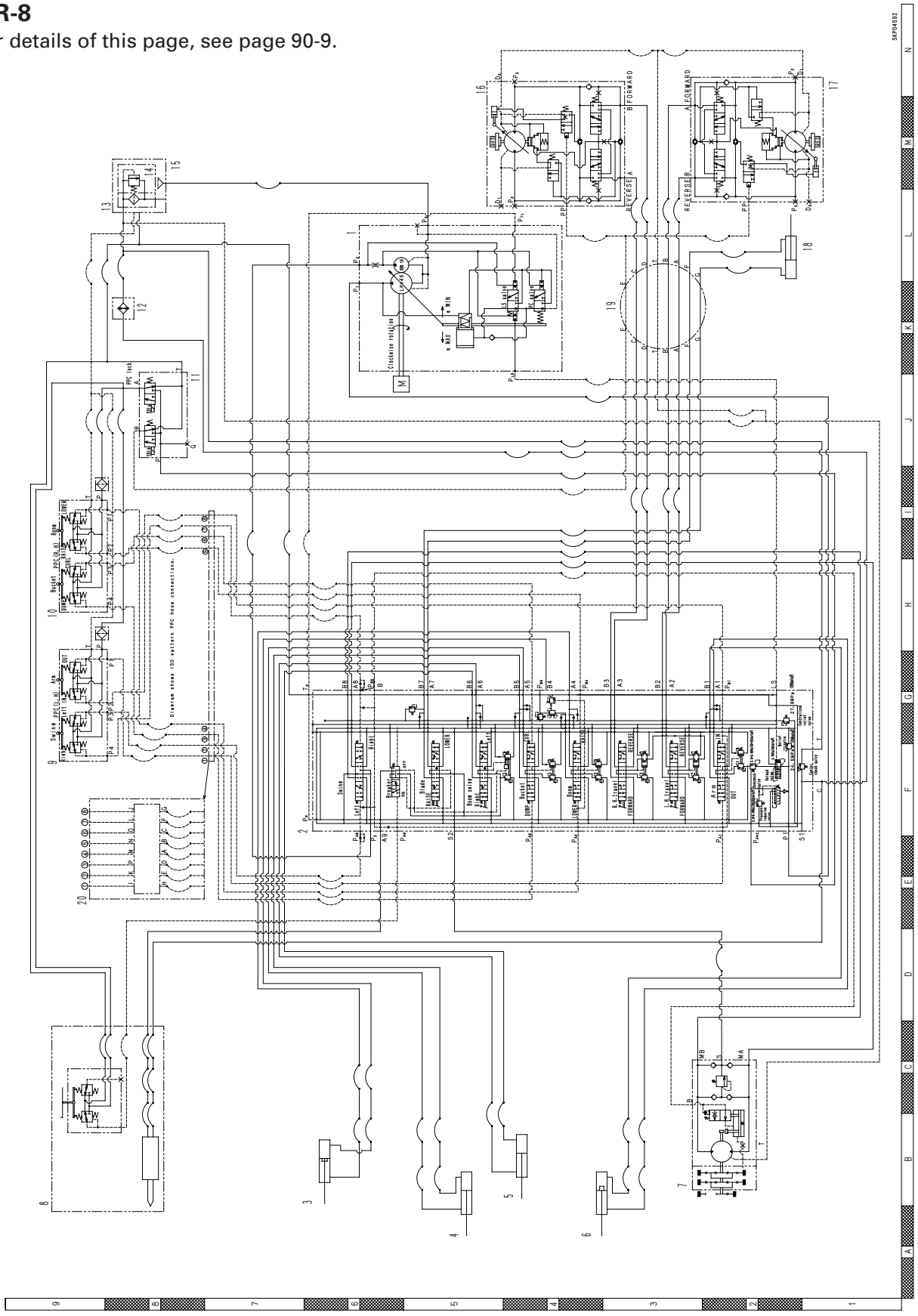
★ For details of this page, see page 90-7.



1. Hydraulic pump (LPV45+FBR10)
2. Main control valve
3. Boom cylinder
4. Bucket cylinder
5. Boom swing cylinder
6. Arm cylinder
7. Swing motor
8. Breaker
9. PPC valve (swing, arm)
10. PPC valve (bucket, boom)
11. Travel 2-speed selector solenoid valve
12. Oil cooler
13. Hydraulic tank
14. Bypass valve
15. Strainer
16. R.H. travel motor
17. L.H. travel motor
18. Blade cylinder
19. Swivel joint
20. 4 WAY

PC45R-8

★ For details of this page, see page 90-9.

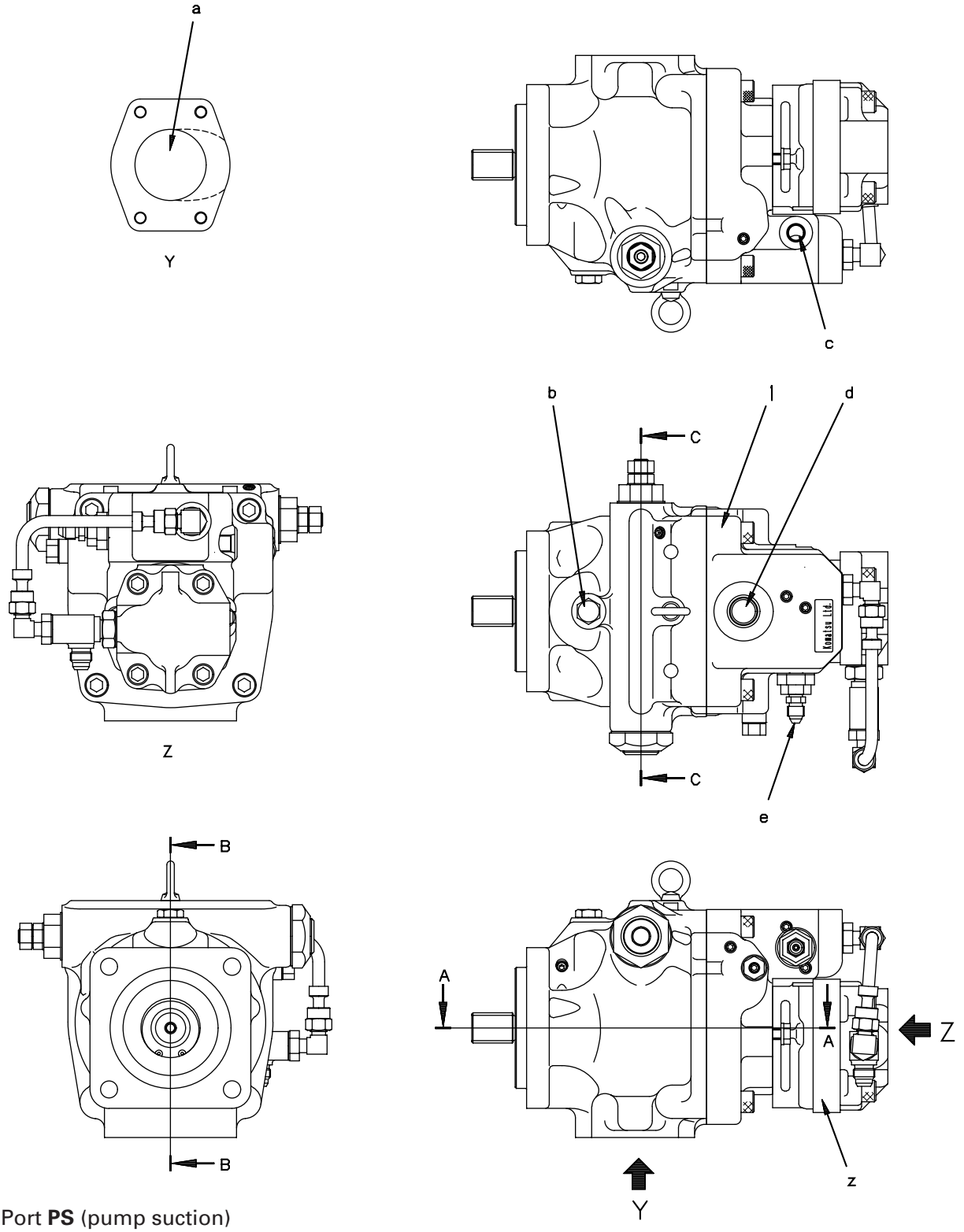


1. Hydraulic pump (LPV45+FBR10)
2. Main control valve
3. Boom cylinder
4. Bucket cylinder
5. Boom swing cylinder
6. Arm cylinder
7. Swing motor
8. Breaker
9. PPC valve (swing, arm)
10. PPC valve (bucket, boom)
11. Travel 2-speed selector solenoid valve
12. Oil cooler
13. Hydraulic tank
14. Bypass valve
15. Strainer
16. R.H. travel motor
17. L.H. travel motor
18. Blade cylinder
19. Swivel joint
20. 4 WAY

HYDRAULIC PUMP

LPV45+SBR8.5 (PC30, 35R)
LPV45+SBR10 (PC40, 45R)

★ The sketch shows the PC40R, 45R.

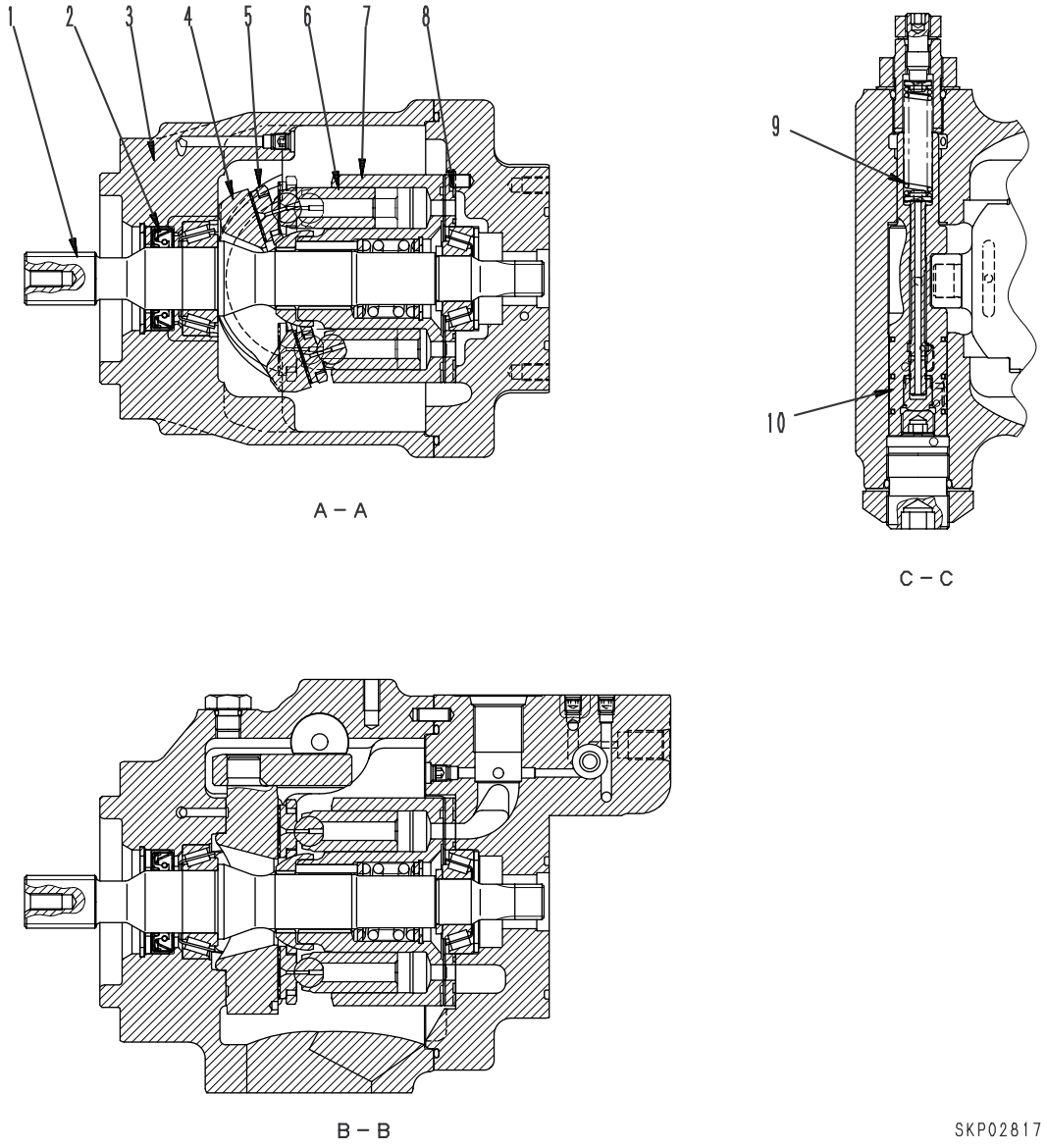


a. Port **PS** (pump suction)
b. Port **PDA** (air bleed port)
c. Port **P1L** (pump pressure input port)
d. Port **P1** (main pump discharge)
e. Port **PLS** (control valve LS pressure inlet)
f. Port **P2** (gear pump discharge)

SKP02816

1. Main pump
2. Gear pump

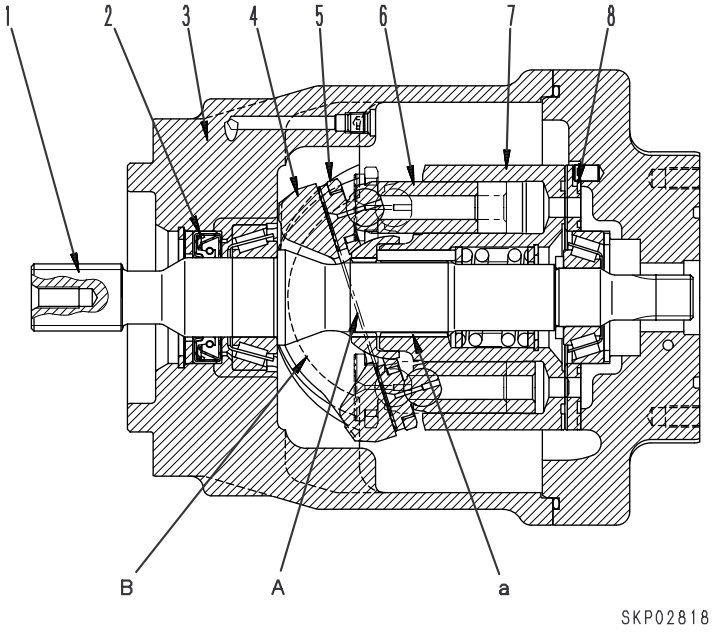
1. MAIN PUMP



1. Shaft
2. Oil seal
3. Case (acts also as cradle)
4. Rocker cam
5. Shoe
6. Piston
7. Cylinder block
8. Valve plate
9. Spring
10. Servo piston (acts also as PC valve)

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 discharge amount by changing the swash plate angle.

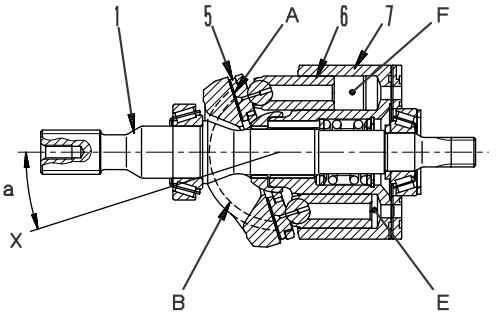


STRUCTURE

- Cylinder block (7) is supported to shaft (1) by spline a, and shaft (1) is supported by the front and rear bearings.
- The end of piston (6) has a concave ball shape and shoe (5) is caulked to it to form one unit. Piston (6) and shoe (5) form a spherical bearing.
- Rocker cam (4) has plane **A**, and shoe (5) is always pressed against this surface as it slides in a circle. Rocker cam (4) forms a static bearing bringing high pressure oil at cylindrical surface **B** of the case, and carries out a sliding movement.
- Piston (6) carries out motion relative to the axial direction inside each cylinder chamber of cylinder block (7).
- Cylinder block (7) carries out rotation relative to valve plate (8) while sealing the pressurized oil, and this surface ensures that the hydraulic balance is maintained correctly.
  The oil inside each cylinder chamber of cylinder block (7) is sucked in and discharged through valve plate (8).

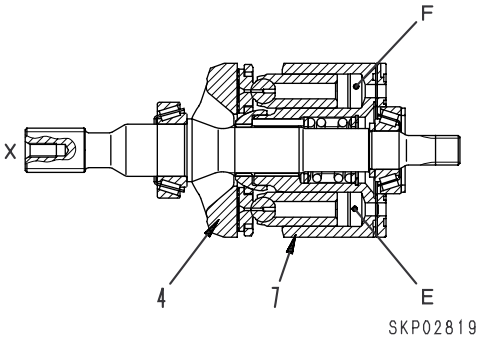
OPERATION

1) Operation of pump



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

ii) Center line **X** of rocker cam (4) maintains swash plate angle a in relation to the axial direction of cylinder block (7), and plane **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 into chamber **F**.
(The diagram shows the condition when chamber **F** is at the end of the suction stroke and chamber **E** is at the end of the discharge stroke.)

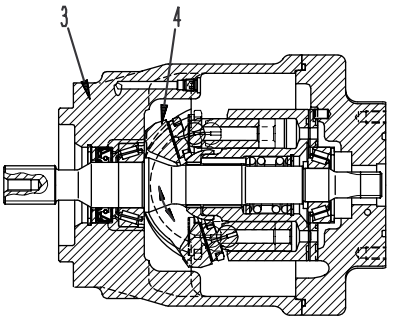


iii) If center line **X** of rocker cam (4) is in line with the axial direction of cylinder block (7) (swash plate angle = 0), the difference between volumes **E** and **F** inside cylinder block (7) becomes 0, so the pump does not carry out any suction or discharge of oil. (In actual fact, the swash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

iv) In other words, the relationship between the swash plate angle **a** and the pump discharge is proportional.

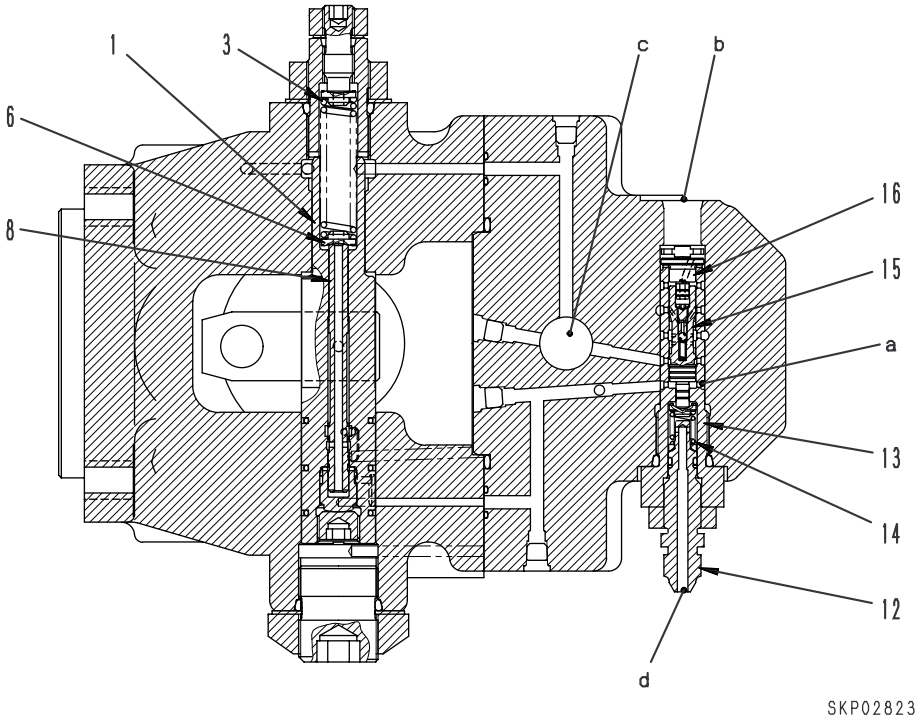
2) Control of discharge amount

- If swash plate angle a becomes larger, the difference in volumes **E** and **F** becomes larger and discharge volume **Q** increases.
  Swash plate angle a is changed by servo piston (11).
- Servo piston (10) moves in a reciprocal movement (↕) under the signal pressure of the TCC and LS valves.
  This straight line movement is transmitted to rocker cam (4), and rocker cam (4), which is supported by the cylindrical surface to case (3), slides in a rotating movement in direction (↻).
- With servo piston (10), the area receiving the pressure is different at the top and bottom, so main pump discharge pressure (self-pressure) **PP** is always brought to the pressure chamber at the small diameter piston end (top).
  Output pressure **Pen** of the LS valve is brought to the pressure chamber at the large diameter piston end (bottom).
  The relationship between 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 area receiving the pressure of the large diameter piston controls the movement of servo piston (10).



SKP02820

2. TCC VALVE, LS VALVE, SERVO PISTON



a. Port **GH** (swing pump pressure inlet)
b. Port **PIL** (pump input port)
c. Port **P1** (main pump pressure port)
d. Port **PLS** (control valve LS pressure inlet)

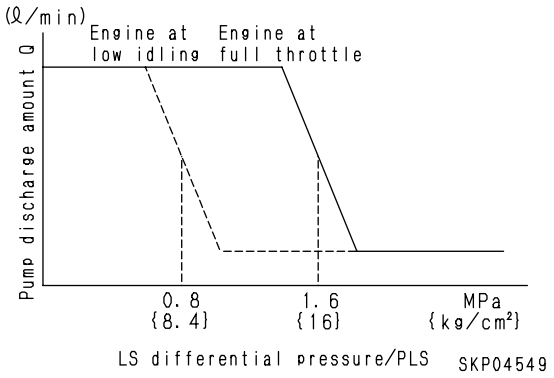
Servo piston
1. Servo piston (acts also as TCC valve)
2. Spring
3. Piston
4. Seat

LS valve
5. Piston
6. Piston
7. Sleeve
8. Spring
9. Plug

LS VALVE

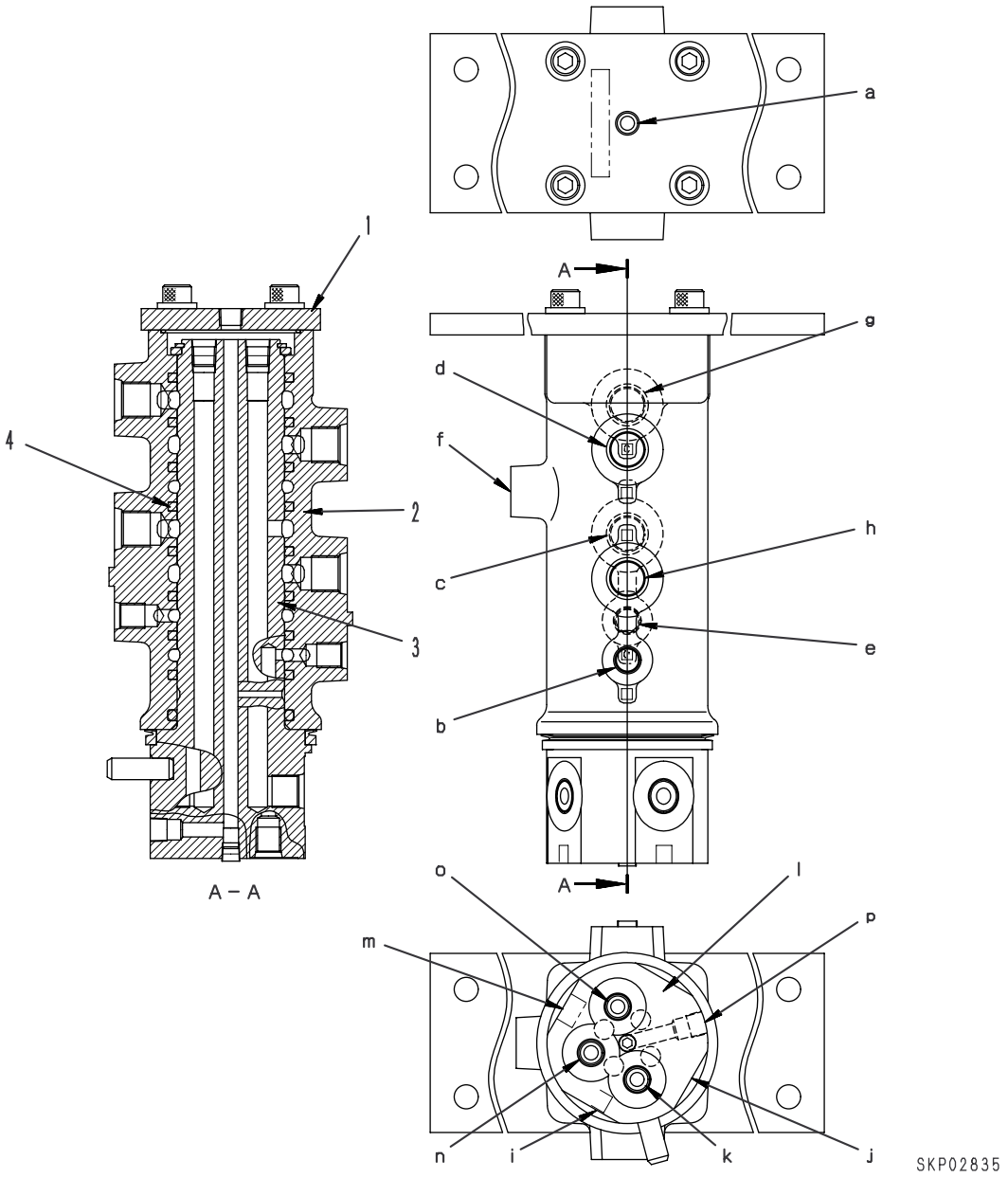
FUNCTION

- The LS valve controls the pump discharge amount according to the amount of movement of the control lever (that is the oil flow demanded by the actuator).
- The LS valve detects the oil flow demanded by the actuator from the differential pressure ∆**PLS** between main pump discharge pressure PP and control valve outlet pressure **PLS**, and controls main pump discharge amount **Q**.
  (PP is called the pump pressure, **PLS** is called the LS pressure, and ∆**PLS** is called the LS differential pressure.)
- In other words, the pressure loss (= LS differential pressure ∆**PLS**) generated by the flow of oil from the pump passing through opening area of the control valve spool is detected. By controlling pump discharge amount **Q** so that this pressure loss remains constant, a pump discharge amount is supplied in accordance with the demands of the control valve.
- However, when carrying out fine control or in other cases where the range does not exceed the maximum flow of the pump (the flow demanded by the control valve is always supplied), the discharge amount is the same as when the engine is at high idling, even if the engine is at low idling. To overcome this, a function has been added to automatically lower the LS differential pressure and reduce the discharge amount when the engine is running at low idling.
- The engine speed is detected by pressures **GH** and **GL** on both sides of the fixed throttle (metering throttle) in the swing gear pump discharge passage. This acts on LS valve No. 3 and No. 4 pressure-receiving chambers **a2** and **b2**, and changes the LS setting.
  When the engine is running at low idling, the gear pump discharge amount is reduced, so pressures **GH** and **GL** on both sides of the metering throttle become almost the same (the metering differential pressure between **GH** and **GL** becomes lower).
  On the other hand, when the engine is run at full throttle, the swing pump discharge amount is increased and the metering differential pressure becomes higher.
  - ★ When the metering pressure is high (engine speed is high), the LS setting is made higher.
  - ★ When the metering differential pressure is low (engine speed is low), the LS setting is made lower.



- Pump pressure **PP**, LS pressure **PLS**, and the pressures on both sides of the swing gear pump metering throttle (**GH**, **GL**) are brought to the LS valve.
  The relationship between pump discharge amount **Q** and LS differential pressure ∆**PLS** changes as shown in the diagram on the top.

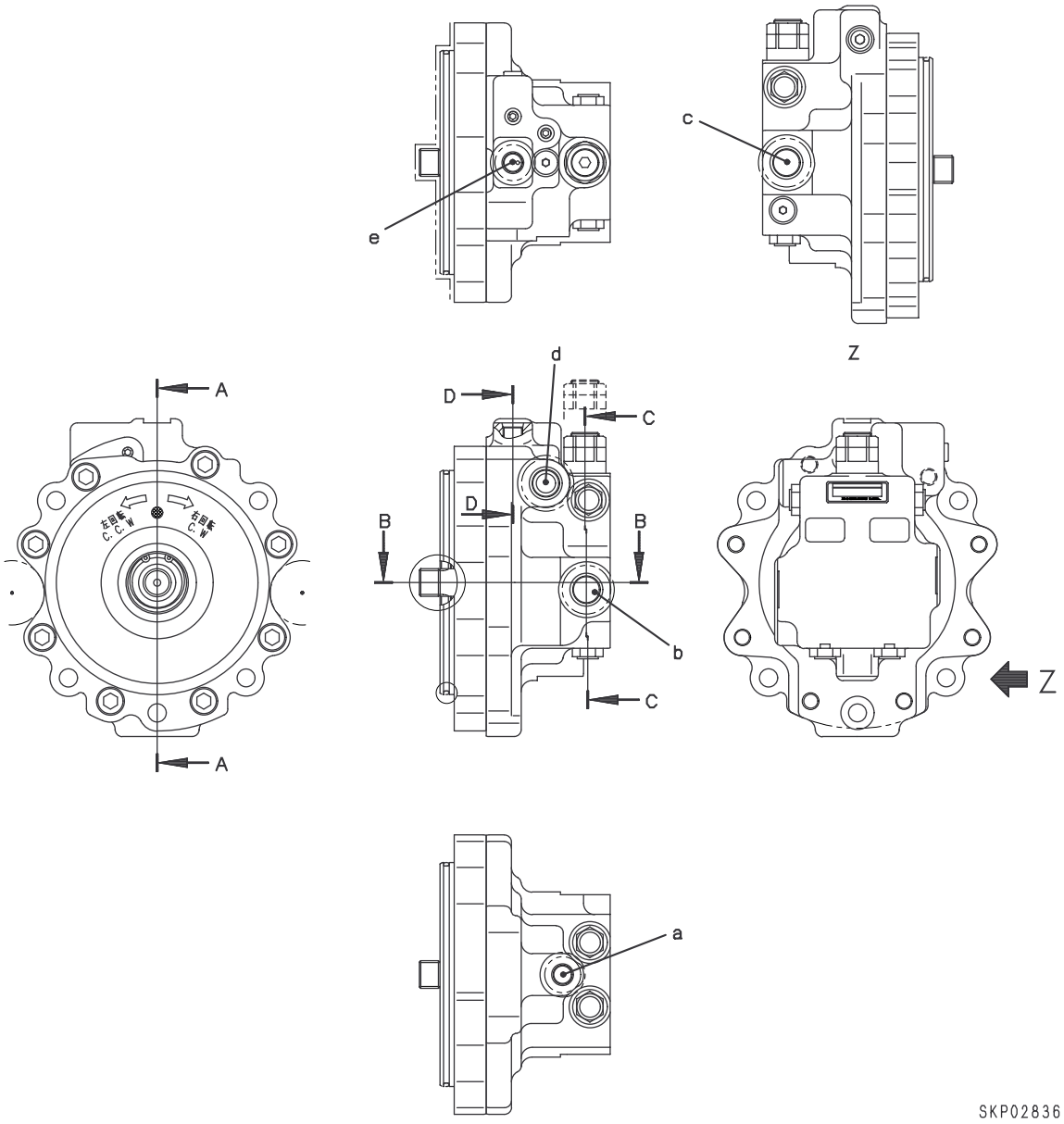
CENTER SWIVEL JOINT



1. Top cover
2. Shaft
3. Rotor
4. Slipper seal

a. To tank
b. From blade control valve (port **F**)
c. From R.H. travel control valve (port **D**)
d. From L.H. travel control valve (port **A**)
e. From blade control valve (port **G**)
f. From travel 2-speed selector solenoid valve (port **E**)
g. From R.H. travel control valve (port **C**)
h. From L.H. travel control valve (port **B**)
i. To L.H. travel motor (port **B**)
j. To L.H. travel motor (port **A**)
k. To blade cylinder head end (port **F**)
l. To R.H. travel motor (port **D**)
m. To R.H. travel motor (port **C**)
n. To blade cylinder bottom (port **G**)
o. To travel 2-speed selector valve (port **E**)
p. From travel motor drain port

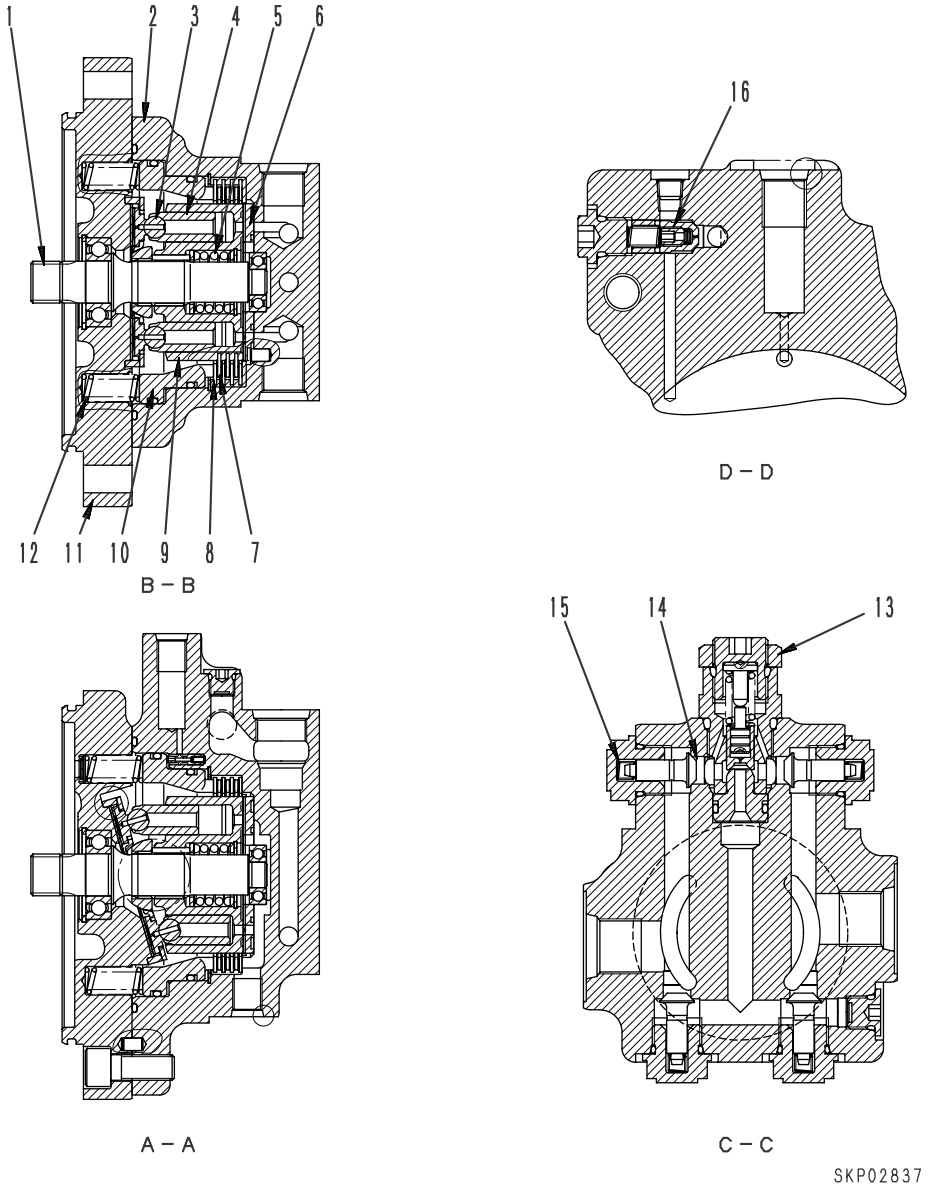
SWING MOTOR



a. To tank (port **T**)
b. From control valve (port **MA**)
c. From control valve (port **MB**)
d. From tank (port **S**)
e. From control valve (port **B**)

SPECIFICATIONS

Item \ Model	PC30R	PC35R	PC40R	PC45R
Type	LMF16			
Theoretical delivery (cc/rev)	16.1			
Rated speed (rpm)	1,340		1,615	
Rated flow (ℓ/min)	21		26	
Suction valve cracking pressure (MPa {kg/cm²})	Max. 0.03 {0.3}			
Safety valve set pressure (MPa {kg/cm²})	15.2 {155}	16.2 {165}	17.7 {180}	19.6 {200}



1. Output shaft
2. Housing
3. Shoe
4. Piston
5. Center spring
6. Valve plate
7. Disc
8. Plate
9. Cylinder
10. Brake piston
11. Swash plate
12. Brake spring
13. Safety valve
14. Check valve
15. Check valve spring
16. Hydraulic timer valve

HYDRAULIC MOTOR PORTION

1. Function

This hydraulic motor is a swash plate type axial piston motor, which converts the hydraulic force sent from the hydraulic pump to a rotating movement.

2. Principle of operation

The oil sent from the hydraulic pump goes from valve plate (7) and enters cylinder block (5).

The structure of the motor takes in the oil at one side only of the **Y** – **Y** line joining the top and bottom dead centers of the stroke of piston (4).

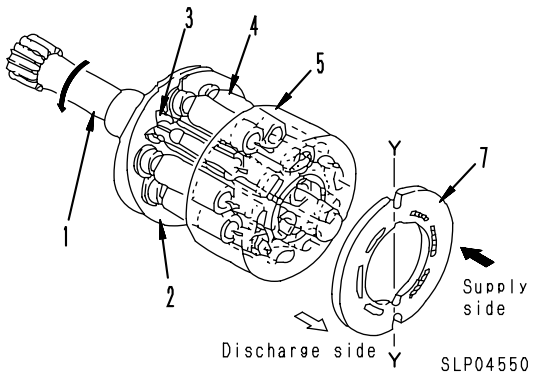
The pressure oil entering one side of cylinder block (5) generates force **F1** (**F1** = **P** kg/cm^2 × $\frac{\pi}{4}$ D^2 cm^2) pushing each piston (4) (3 or 4 pistons).

This force acts on thrust plate (2), but thrust plate (2) is secured at a certain angle α° to output shaft (1), so the force is divided into force **F2** and **F3**.

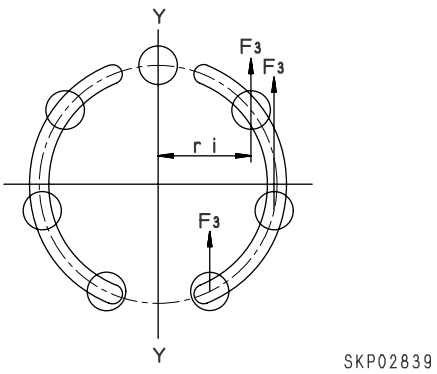
Of the divided forces, the radial force F3 generates the torque (**T** = **F3** × ri) for line **Y** – **Y** joining the top and bottom dead centers.

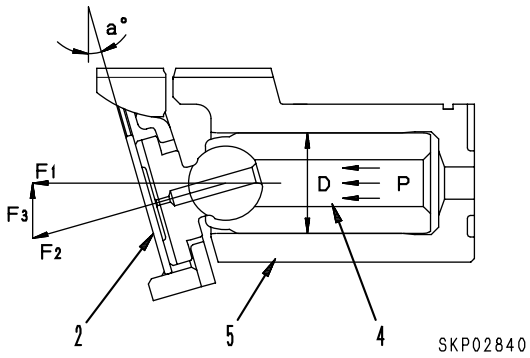
The combined force of this torque {**T** = Σ (**F3** × ri)} goes as a rotating force through the piston to rotate cylinder block (5).

Cylinder block (5) is joined to the output shaft by a spline, so the output shaft rotates and transmits the torque.



1. Output shaft
2. Thrust plate (swash plate)
3. Shoe
4. Piston
5. Cylinder block
6. Valve plate





SAFETY VALVE PORTION

1. Outline

The safety valve portion consists of a check valve and safety valve.

2. Function

When the swing is stopped, the output circuit of the motor is closed by control valve (1), but the motor continues to rotate because of inertia. For this reason, the pressure at the output side of the motor becomes abnormally high, and this will damage the motor. To prevent this, the oil causing the abnormal hydraulic pressure is allowed to escape from the outlet port (high-pressure side) of the motor to port **S**, thereby preventing damage to the motor.

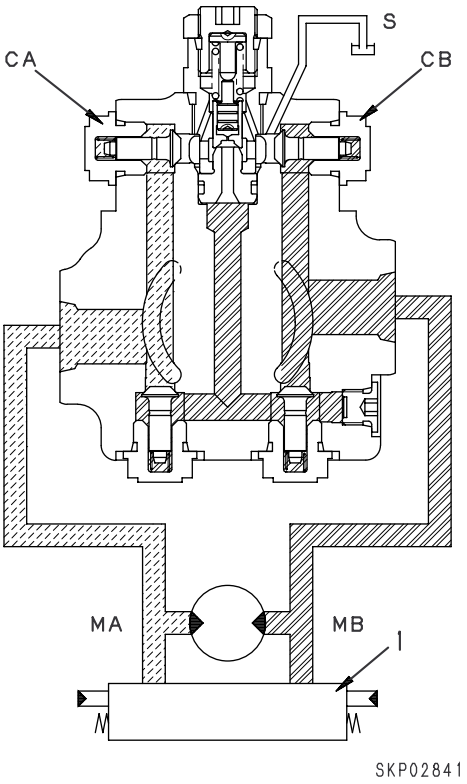
3. Operation

1) When starting swing

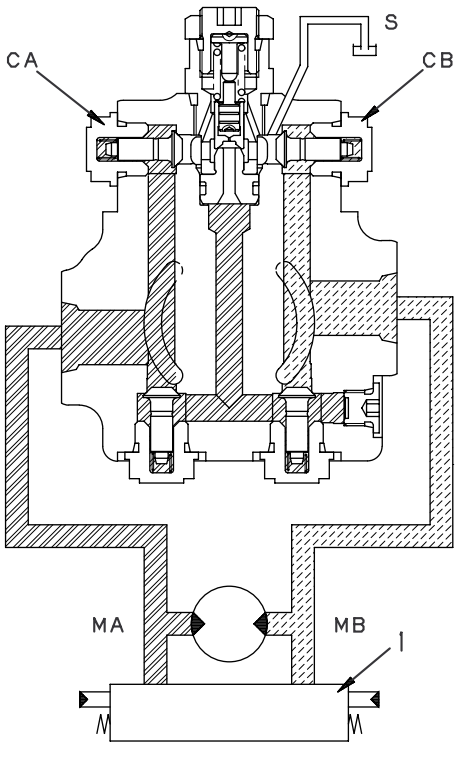
- When the swing control lever is operated to left swing, the pressurized oil from the pump passes through control valve (1) and is supplied to port **MB**. Because of this, the pressure at port **MB** rises, starting torque is generated in the motor, and the motor starts to rotate. The oil from the outlet port of the motor passes from port **MA** through control valve (1) and returns to the tank.

2) When stopping swing

- When the swing control lever is returned to hold, no pressurized oil is supplied from the pump to port **MB**.
  The return circuit to the tank is closed by control valve (1), so the pressure of the oil from the outlet port of the motor increases at port MA. Resistance to the rotation of the motor is created, and the brake starts to act.
- The pressure at port **MA** rises to the set pressure of the safety valve, and in this way, a high braking torque acts on the motor, and the motor stops.
- When the safety valve is being actuated, the relief oil from the safety valve and the oil from port **S** pass through check valve **CB** and are supplied to port **MB**. This prevents cavitation from occurring at port **MB**.



SKP02841



SKP02842

OPERATION OF SWING BRAKE

1) PPC lever (swing, arm IN) at HOLD

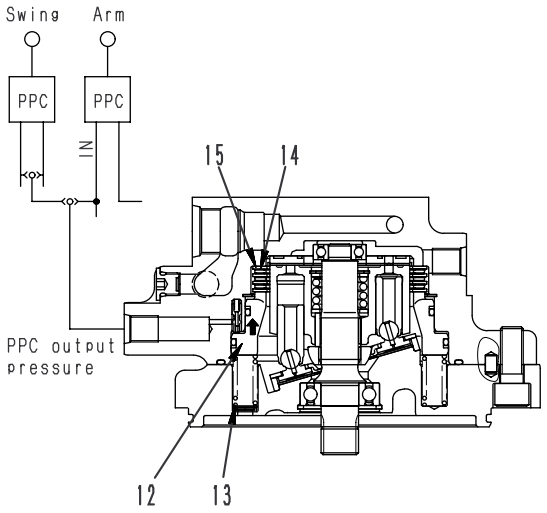
- When the **PPC** lever (swing, arm IN) is at HOLD, the **PPC** output pressure is 0 MPa {0 kg/cm^2}.
- For this reason, brake piston (12) is pushed up by brake spring (13), and disc (14) and plate (15) are pushed together to apply the brake.

2) PPC lever (swing, arm IN) operated

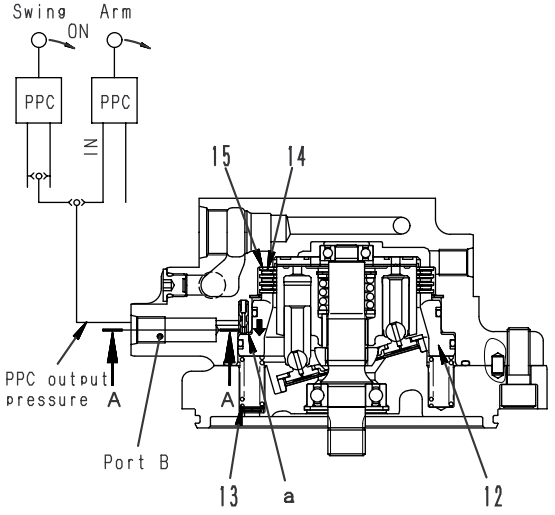
- When the **PPC** lever is operated, the **PPC** output pressure enters port **B** and flows to brake chamber **a**.
  The pressurized oil entering chamber a overcomes brake spring (13) and pushes brake piston (12) down. As a result, disc (14) and plate (15) separate and the brake is released.

3) Operation of hydraulic timer valve

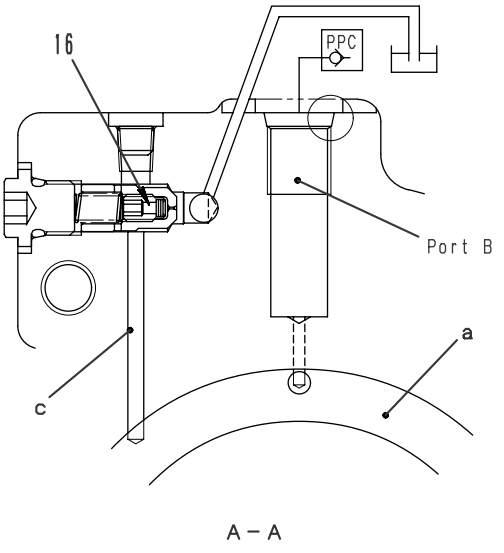
- Hydraulic timer valve (16) acts to delay the start of the swing brake effect in order to ensure smooth deceleration and to prevent damage to the parts of the motor if the swing brake is applied suddenly when stopping the swing motor.
- When the **PPC** lever is operated, the **PPC** output pressure goes to chamber a and the swing brake is released. In this condition, if the **PPC** lever is returned to neutral, the supply of pressure oil to port **B** stops and the pressure in chamber a drops.
  As a result, the oil in chamber a is pushed out by brake spring (13).
- There is a check valve in the **PPC** valve circuit at the port **B** side, so the oil flow is stopped and it flows out to passage **c**. However, the passage of the flow is throttled by the orifice (ϕ0.4) in the hydraulic timer valve, so the oil inside chamber **a** flows out only slowly, and this delays the actuation of the swing brake by the determined amount of time.



SKP04551



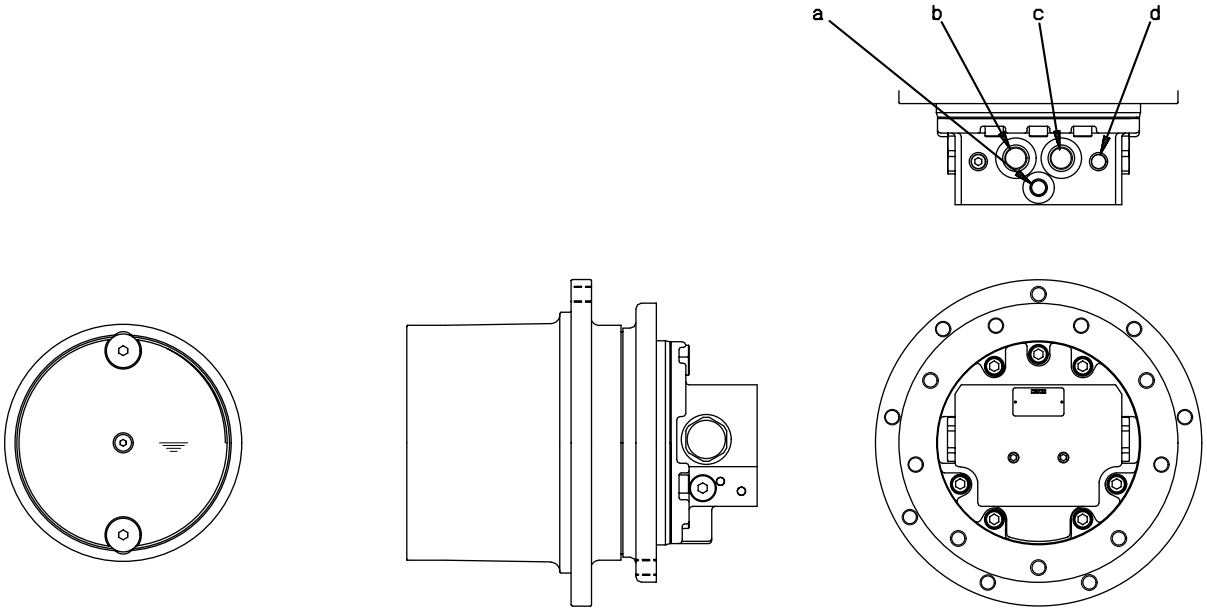
SKP04552



SKP04553

TRAVEL MOTOR

- **PC30R-8, PC35R-8, PC40R-8**

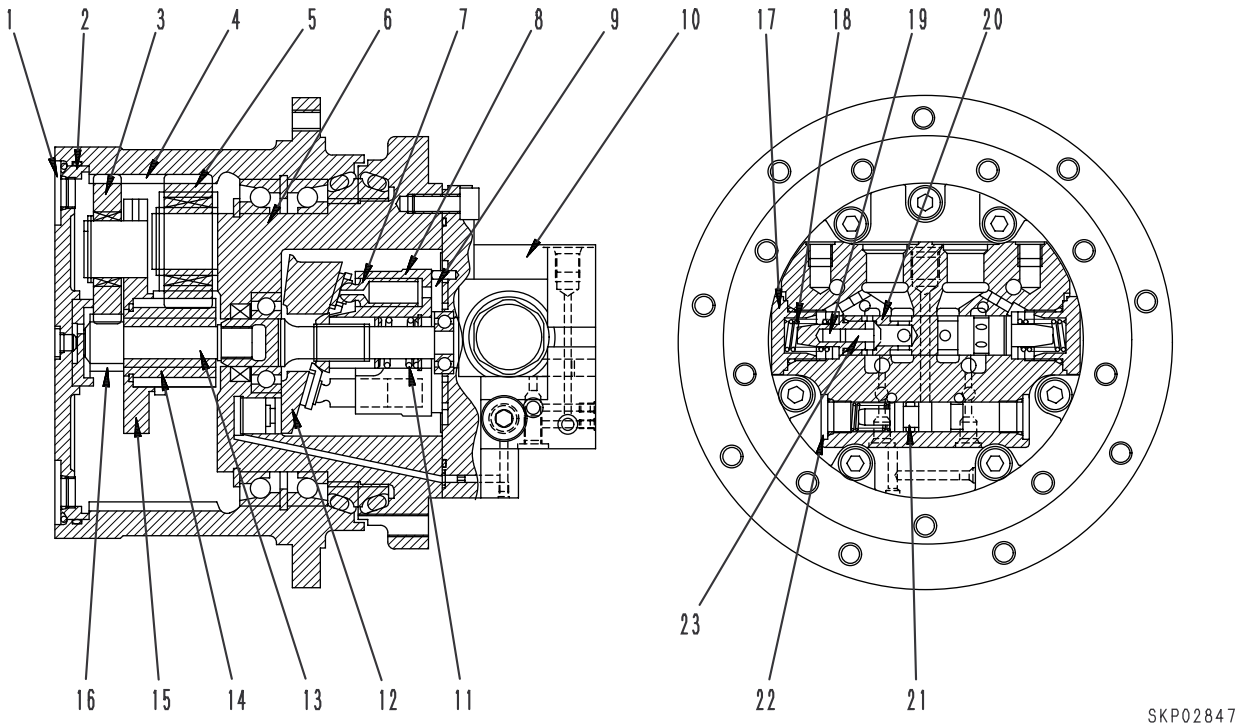


SKP02846

a. Port PP (from travel boost solenoid valve)
b. Port A (travel control valve)
c. Port B (travel control valve)
d. Port DR (to tank)

SPECIFICATIONS

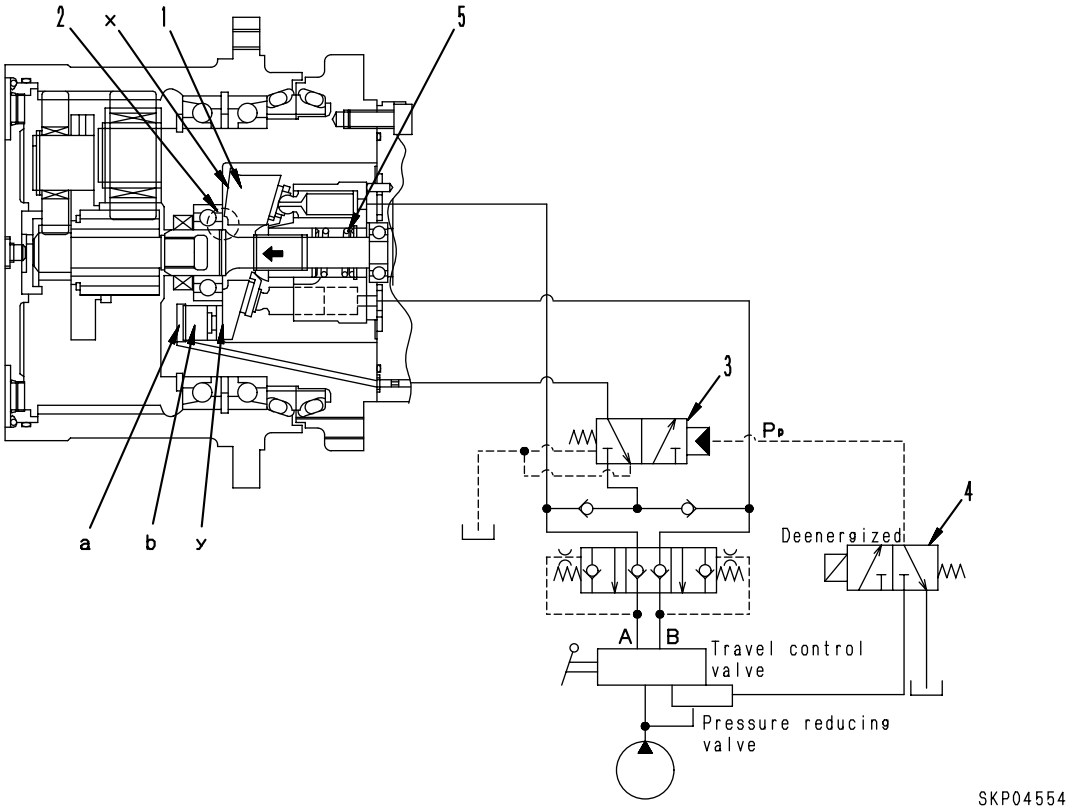
Item \ Model	PC30R	PC35R	PC40R
Type	PHV-300	PHV-350	PHV-500
Capacity (high speed)/ (low speed) cc/rev	13.1/21.5	11.4/18.6	21.2/35.3
Speed switching pressure MPa {kg/cm^2}	1.5 {15}		
Reduction ratio	40.6	52.7	36.8



1. Drain plug
2. Cover
3. No. 2 planetary gear
4. Ring gear
5. No. 1 planetary gear
6. Housing
7. Piston
8. Cylinder
9. Valve plate
10. Brake valve
11. Center spring
12. Swash plate
13. Output shaft
14. No. 1 sun gear
15. No. 2 planetary carrier
16. No. 2 sun gear
17. Plug
18. Spool return spring
19. Check valve spring
20. Counterbalance valve spool
21. 2-speed spool
22. Plug
23. Check valve

SELECTION OF TRAVEL SPEED

PC30, 35, 40



OUTLINE

- Swash plate (1) has two faces at the rear (**x** and **y**), and is supported by ball (2).
- The travel speed is switched by pressurized oil acting on control chamber a and control piston b.

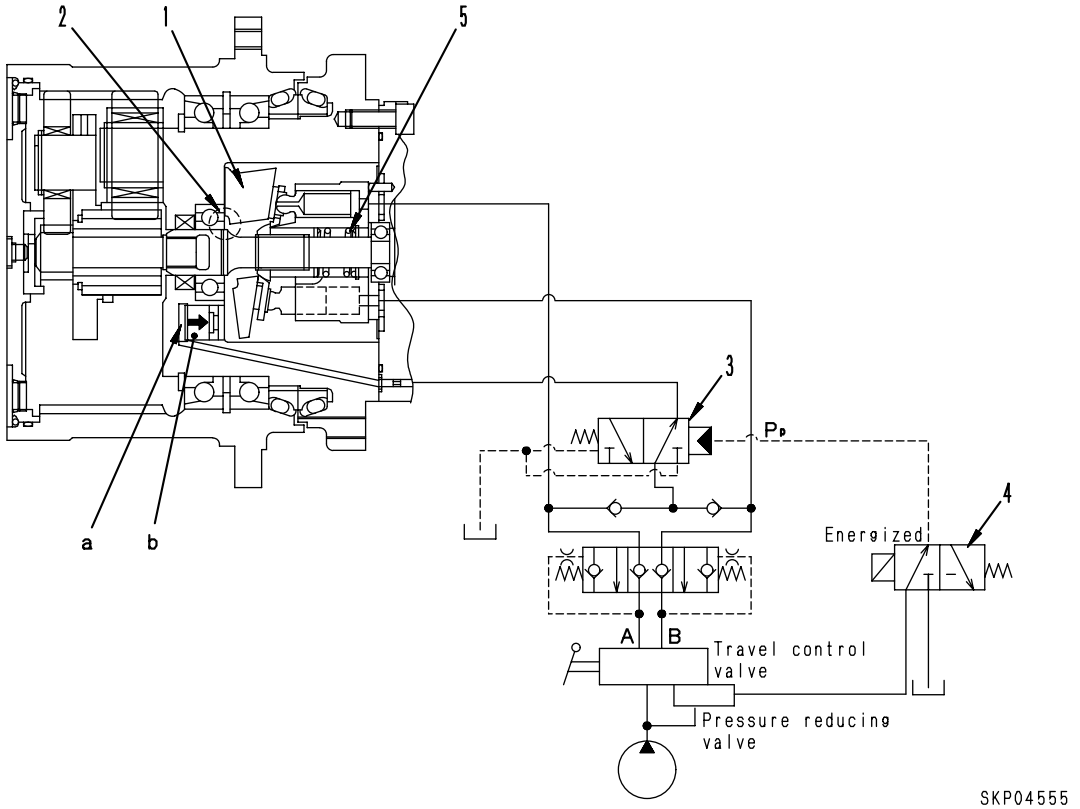
OPERATION

1) Low speed

When the travel boost pedal is released, travel speed boost solenoid valve (4) is deenergized and no pressurized oil is supplied to port **PP**.

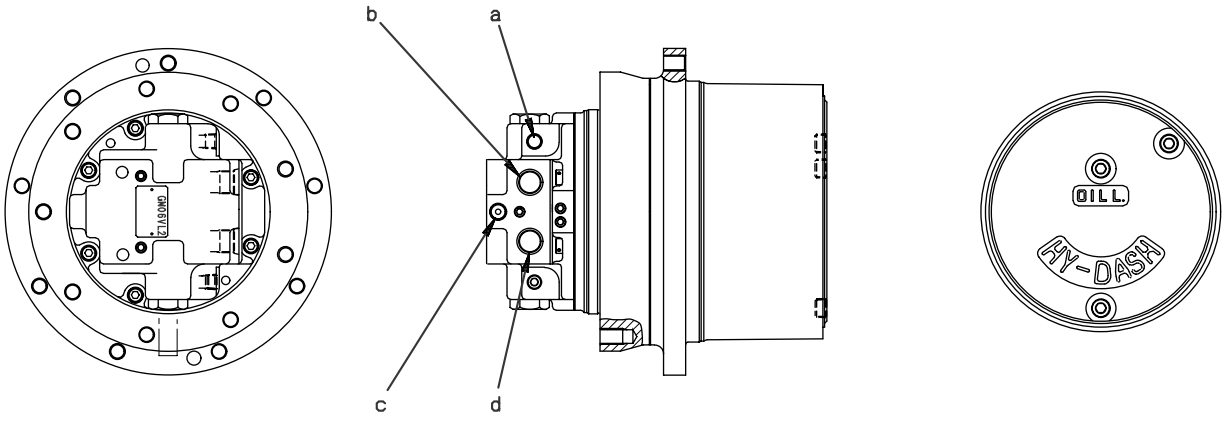
- In this condition, control chamber a is connected to the drain port, and swash plate (1) is pushed fully to the left in the direction of the arrow by center spring (5).
- As a result, the swash plate angle is set to the maximum and the motor capacity becomes large, so the travel speed is set to low speed.

2) High speed



- When the travel boost pedal is depressed, travel speed solenoid valve (4) is energized, pressurized oil is supplied to port **PP**, and regulator valve (3) is switched.
- When this happens, the pressurized oil from the travel control valve passes through regulator valve (2), flows into control chamber a, and moves control piston b to the right in the direction of the arrow.
  As a result, swash plate (1) pushes against center spring (5), uses ball (2) as an axis, and changes the swash plate angle to the minimum. The motor capacity becomes the minimum and the travel speed is set to high speed.

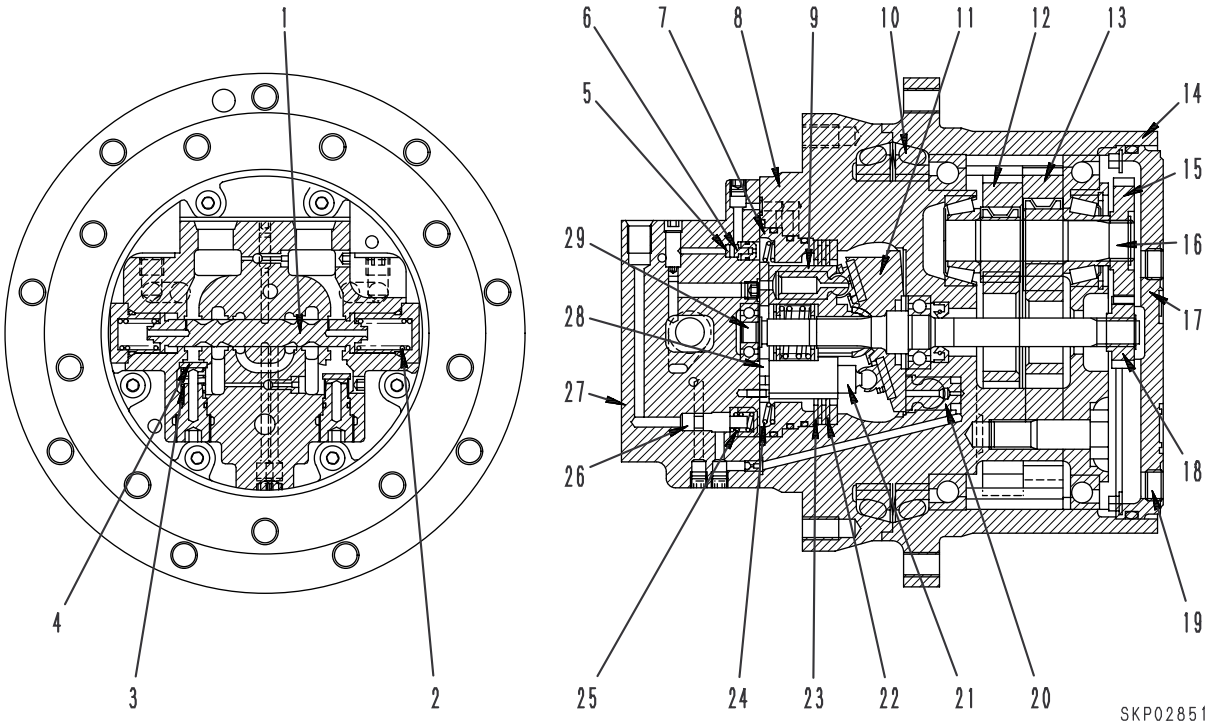
PC45R-8



a. Port **D** (to tank)
b. Port **A** (from travel control valve)
c. Port **P** (from travel boost solenoid valve)
d. Port **B** (from travel control valve)

SPECIFICATIONS

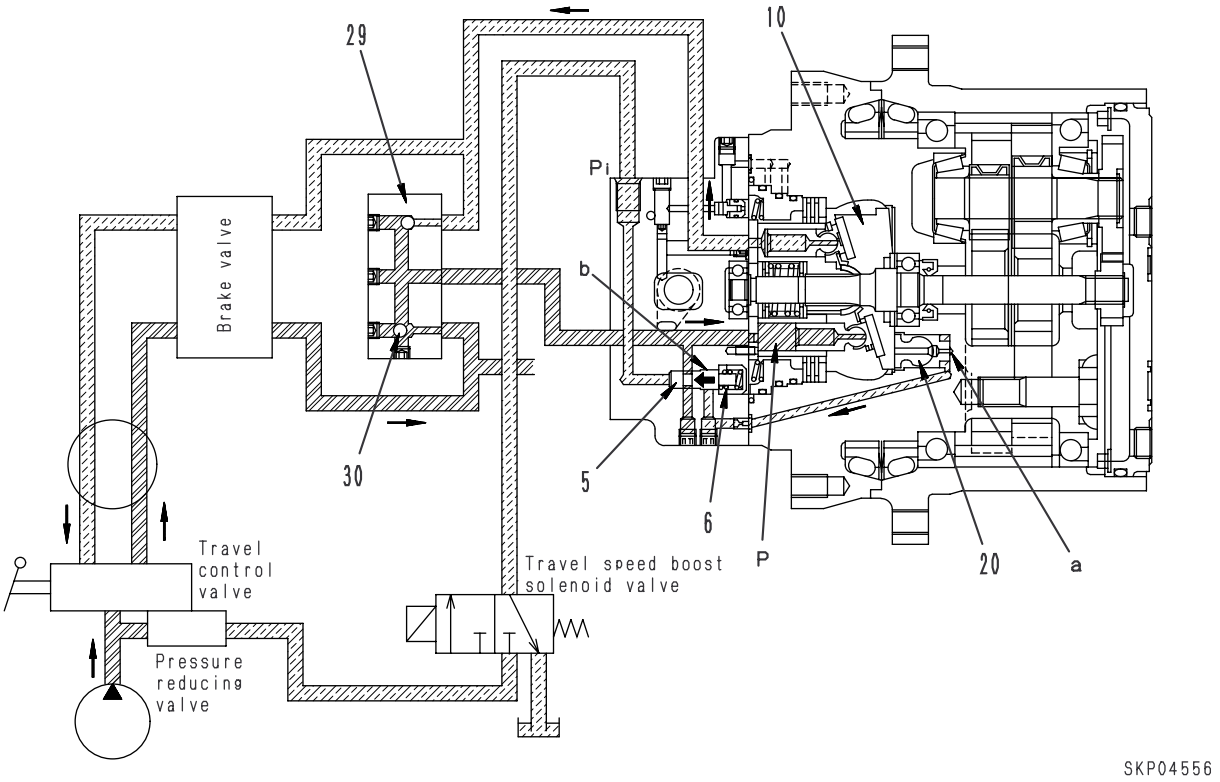
Type : GM06VL
Capacity: 16cc/rev (low speed)
27cc/rev (high speed)
Travel speed switching pressure :
2.9 – 3.4 MPa {30 – 35 kg/cm^2}
Reduction ratio : 52.5



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

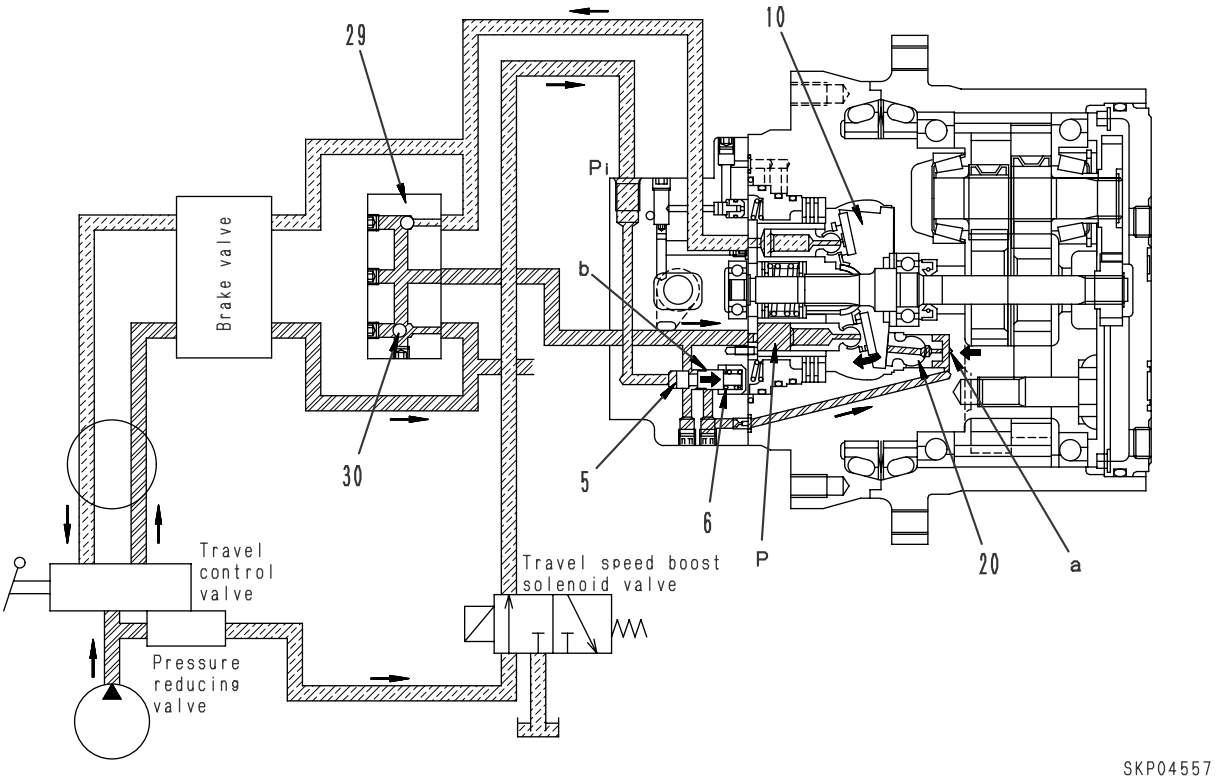
OPERATION OF MOTOR

1) Low speed (motor swash plate angle at maximum)



- The solenoid valve is deenergized, so the pilot pressure oil from the control pump does not flow to port **Pi**.
  For this reason, regulator valve (5) is pushed fully to the left in the direction of the arrow by spring (6).
  Because of this, it pushes check valve (30), and the main pressure oil from the control valve going to end cover (29) is shut off by regulator valve (5).
- At the same time, the pressurized oil in chamber **a** of at regulator piston (20) passes through passage **b** in regulator valve (5) and is drained to the motor case.
- As a result, swash plate (10) is pushed in the direction of the maximum swash plate angle by the main oil pressure inside cylinder chamber **P**, the motor capacity becomes maximum, and the system is set to low speed.

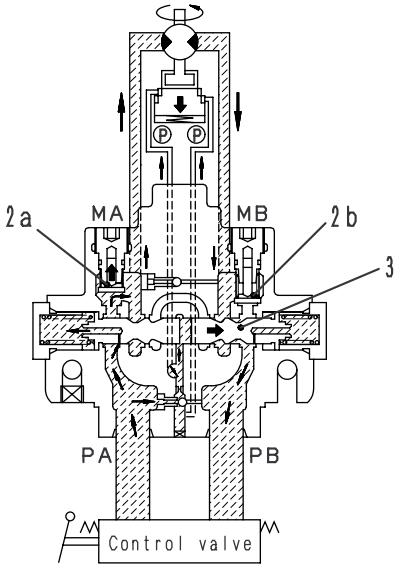
2) At high speed (motor swash plate angle at minimum)



- When the solenoid valve is energized, the pilot pressure oil from the control pump flows to port **Pi**, and pushes regulator valve (5) to the right in the direction of the arrow.
- Because of this, the main pressure oil from the control valve passes through passage **c** in the regulator valve, enters chamber **a** of regulator piston (20), and pushes regulator piston (20) to the left in the direction of the arrow.
- As a result, swash plate (10) is pushed in the direction of the maximum minimum swash plate angle, the motor capacity becomes minimum, and the system is set to high travel speed.

OPERATION OF BRAKE VALVE

- The brake valve consists of check valves (2a) and (2b) and counterbalance spool (31) in a circuit as shown in the diagram on the right.



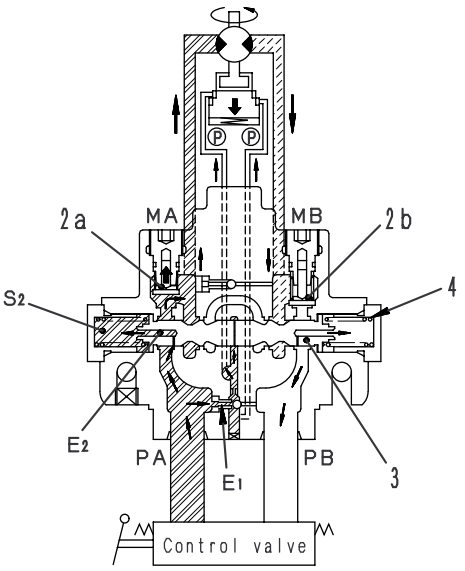
SKP04558

FUNCTION

- When traveling downhill, 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 the machine 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 amount).

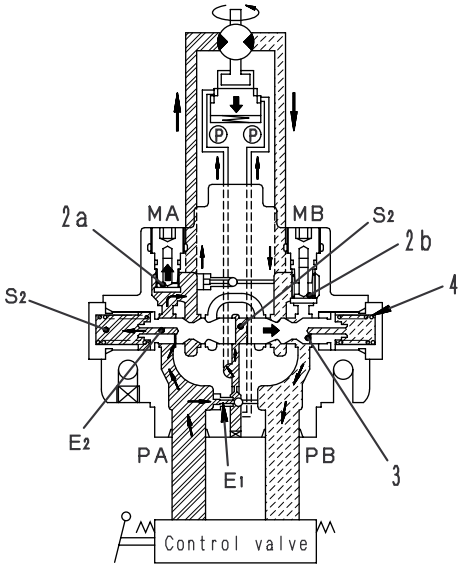
OPERATION WHEN PRESSURIZED OIL IS SUPPLIED

- When the travel lever is operated, the pressurized oil from the control valve is supplied to port **PA**. It pushes open check valve (2a) and flows from motor inlet port **MA** to motor outlet port **MB**.
  However, the motor outlet port is closed by check valve (2b) and spool (3), so the pressure at the supply side rises.



SKP04559

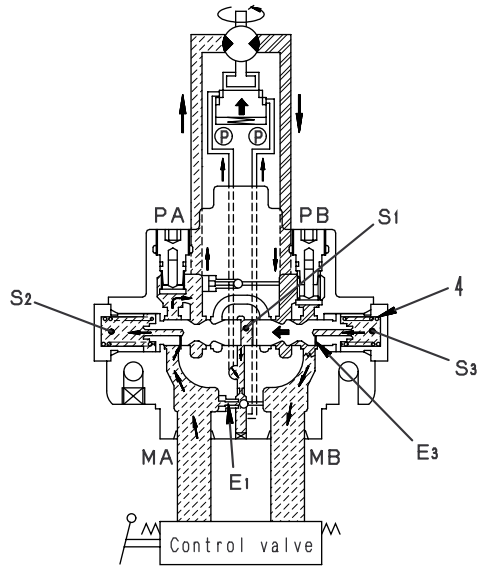
- The pressurized oil at the supply side flows from orifices **E1** and **E2** to chambers **S1** and **S 2**. When the pressure in chamber **S1** goes above the pressure of return spring (4), spool (3) is pushed to the right in the direction of the arrow.
  As a result, port **MB** and port **PB** are connected, the outlet port side of the motor is opened, and the motor starts to rotate.



SKP04560

OPERATION OF BRAKE WHEN TRAVELING DOWNHILL

- If the machine tries to run away when traveling downhill, the motor will turn under no load, so the pressure at the motor inlet port will drop, and the pressure in chambers **S1** and **S2** through orifice **E1** will also drop.
  When the pressure in chamber **S1** drops below the pressure of return spring (4), spool (3) is returned to the left in the direction of the arrow.
  At the same time, the oil in chamber **S3** passes through orifice **E3** and tries to flow into port **MB**. However, back pressure is created by the throttling effect of port **E3**, so the return speed of the spool is controlled by returning the spool to the left in the direction of the arrow. Port **MB** at the outlet side is throttled.
  As a result, the pressure at the outlet port side rises, resistance is generated to the rotation of the motor, and this prevents the machine from running away.
  In other words, the spool moves to a position where the pressure at outlet port **MB** balances the pressure at the inlet port and the force generated by the weight of the machine. It throttles the outlet port circuit and controls the travel speed according to the amount of oil discharged from the pump.



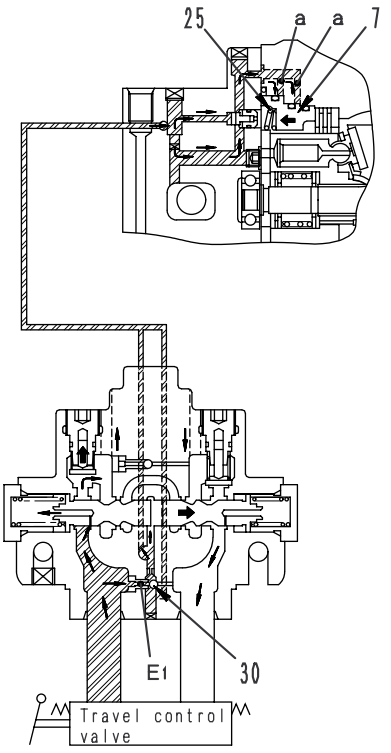
SKP04561

OPERATION OF PARKING BRAKE

1) When starting to travel

When the travel lever is operated, the pressurized oil from the pump passes through orifice **E1**, pushes open check valve (30), flows into chamber a of brake piston (7), and pushes piston (7) to the left in the direction of the arrow.

When this happens, the force of spring (25) pushing plate (23) and disc (24) together is lost, so plate (23) and disc (24) separate and the brake is released.



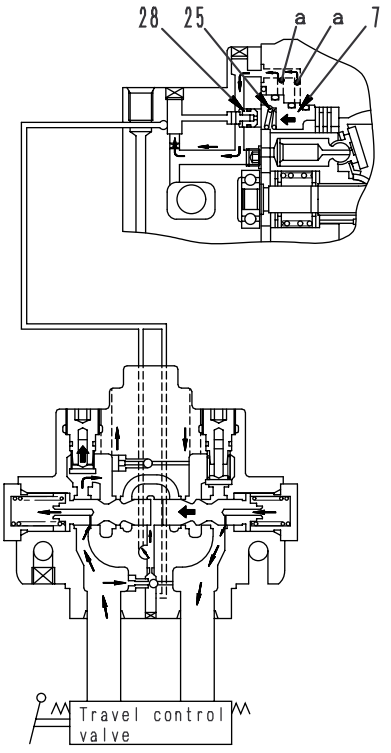
SKP04562

2) When stopping travel

When the travel lever is placed at neutral, the pressure oil from the pump is shut off.

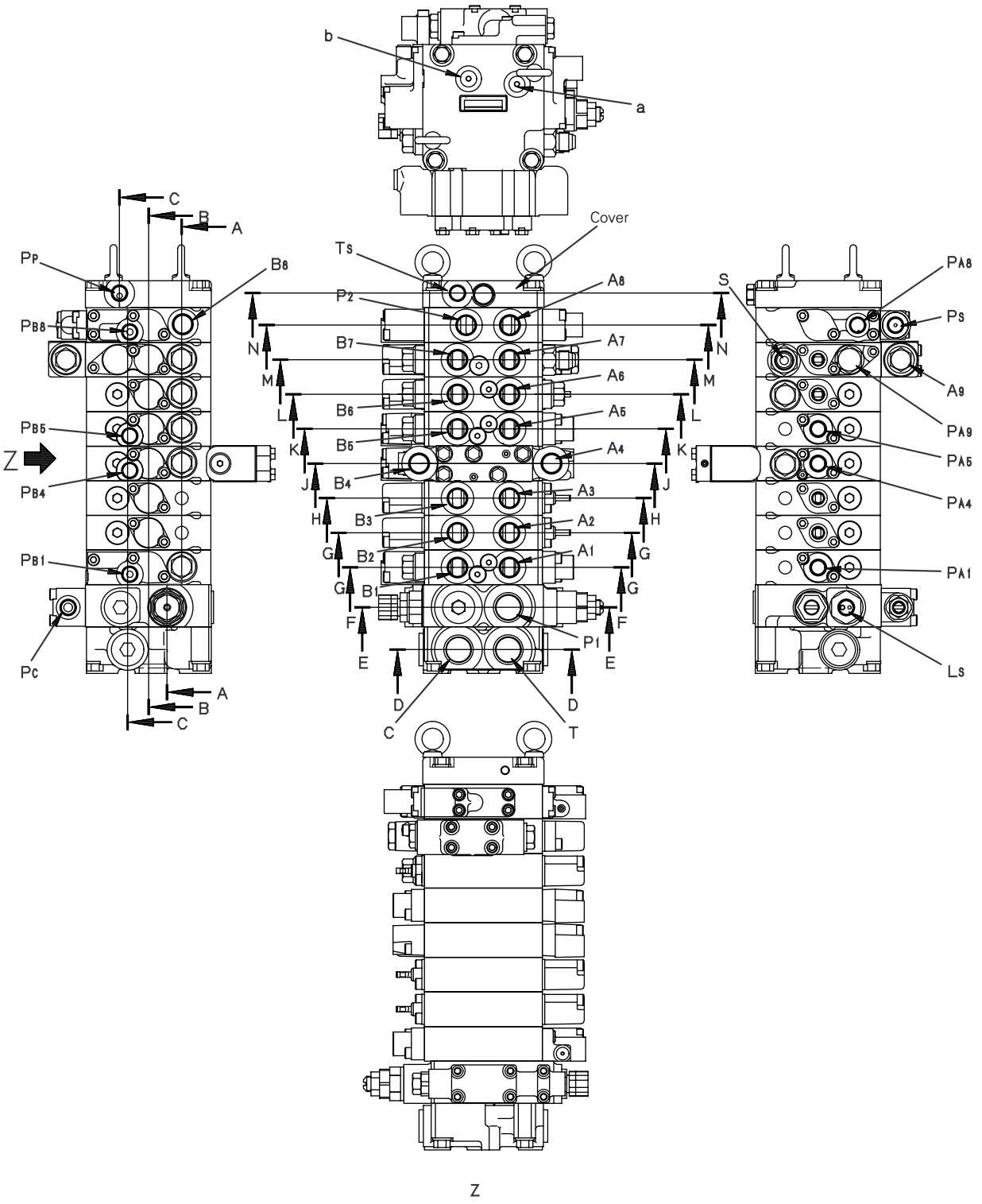
The pressurized oil in chamber **a** of brake piston (7) is drained to the case from the orifice in check valve (28), and brake piston (7) is pushed fully to the right in the direction of the arrow by spring (25).

As a result, plate (23) and disc (24) are pushed together, and the brake is applied.



SKP04563

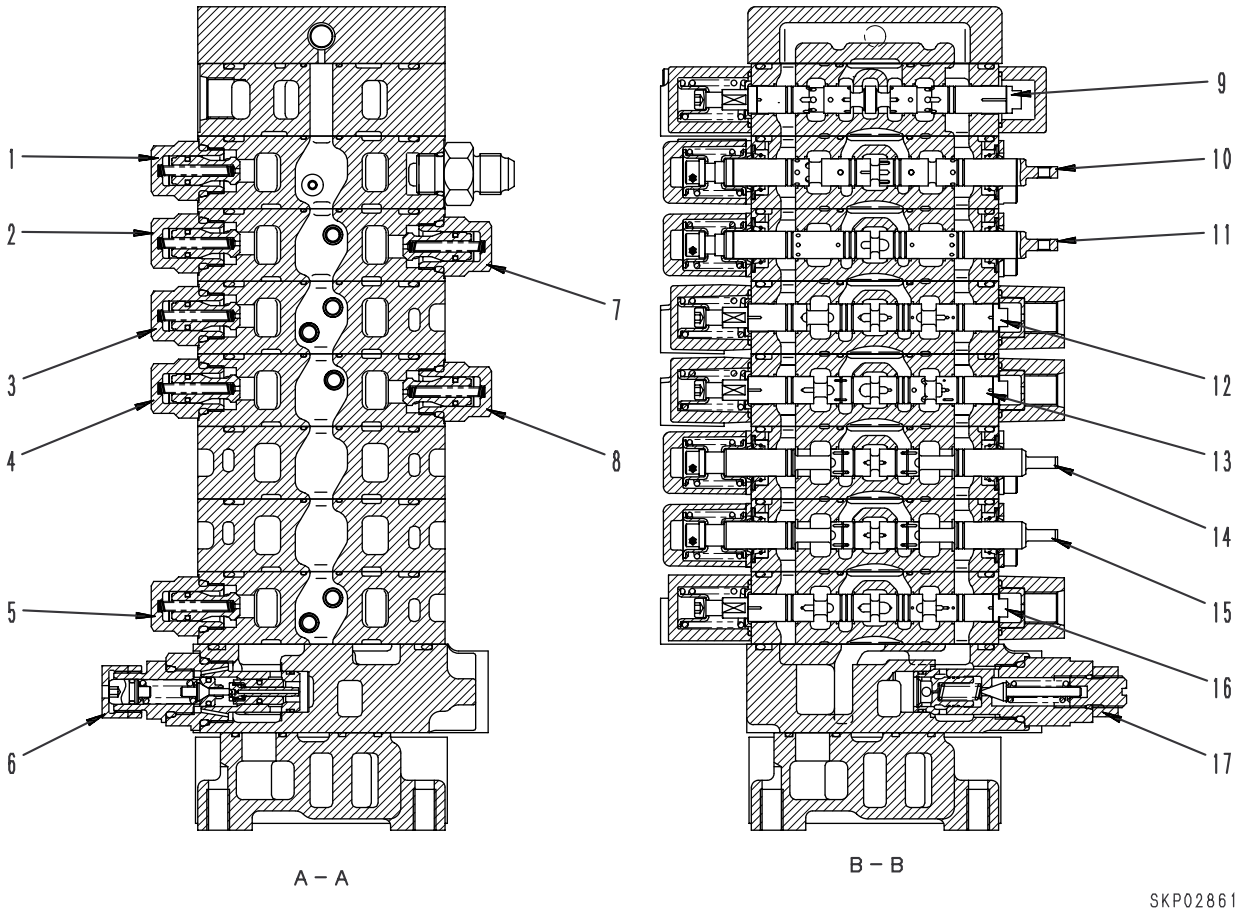
9-SPOOL CONTROL VALVE



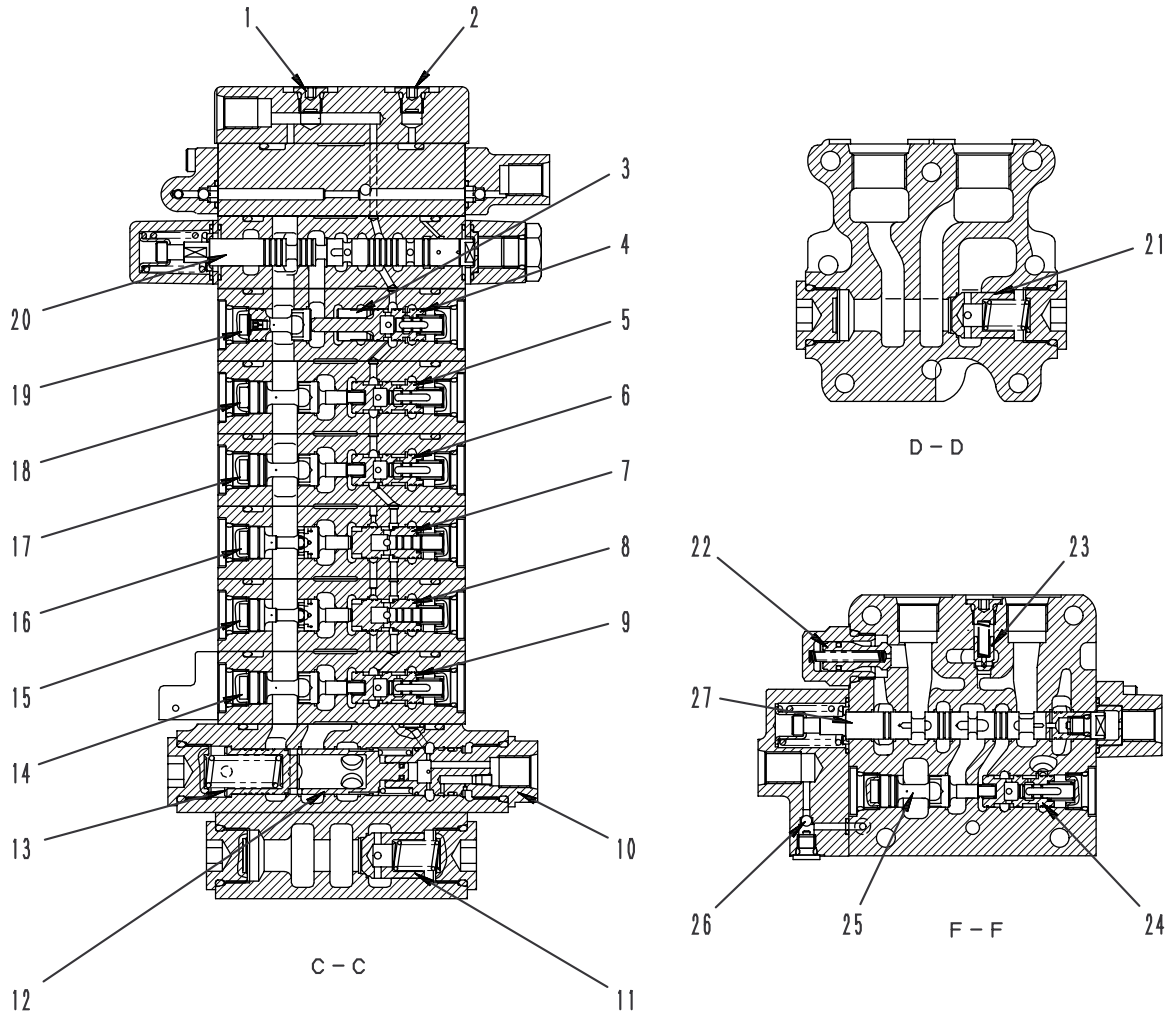
SKP02860

★ The above diagram shows the standard valve.
★ Each service valve is a single add-on type, so it is possible to add or remove the extra valves at any time.
★ The service valve is added on between the 8th valve and the cover.
★ The cross-sectional structure of the service valve is the same as the structure for the bucket valve of the standard valve, so refer to the bucket valve for details.

a. Pressure detection (LS pressure)
b. Pressure detection (pump pressure)
P1. Pump port (from main pump to variable pump)
P2. Pump port (from main pump to gear pump)
T. Tank port (to tank)
C. Cooler port (to oil cooler)
S. Swing motor suction port (to swing motor port **S**)
A1. (to arm cylinder head)
B1. (to arm cylinder bottom)
A2. (to travel motor)
B2. (to travel motor)
A2. (to travel motor)
B2. (to travel motor)
A3. (to travel motor)
B3. (to travel motor)
A4. (to boom cylinder head)
B4. (to boom cylinder bottom)
A5. (to bucket cylinder head)
B5. (to bucket cylinder bottom)
A6. (to boom swing cylinder head)
B6. (to boom swing cylinder bottom)
A7. (to blade cylinder head)
B7. (to blade cylinder bottom)
A8. (to swing motor **MB**)
B8. (to swing motor **MA**)
A9. (to breaker)
TS. Seal drain port (to tank)
LS. Port LS (to pump LS valve)
PP. (to pump LS valve)
PS. (to swing motor port **B**)
PC. (to PPC valve port **P**)
PA1. (from arm OUT PPC valve)
PB1. (from arm IN PPC valve)
PA4. (from boom LOWER PPC valve)
PB4. (from boom RAISE PPC valve)
PA5. (from bucket DUMP PPC valve)
PB5. (from bucket CURL PPC valve)
PA8. (from left swing PPC valve)
PB8. (from right swing PPC valve)
PA9. (from breaker PPC valve)



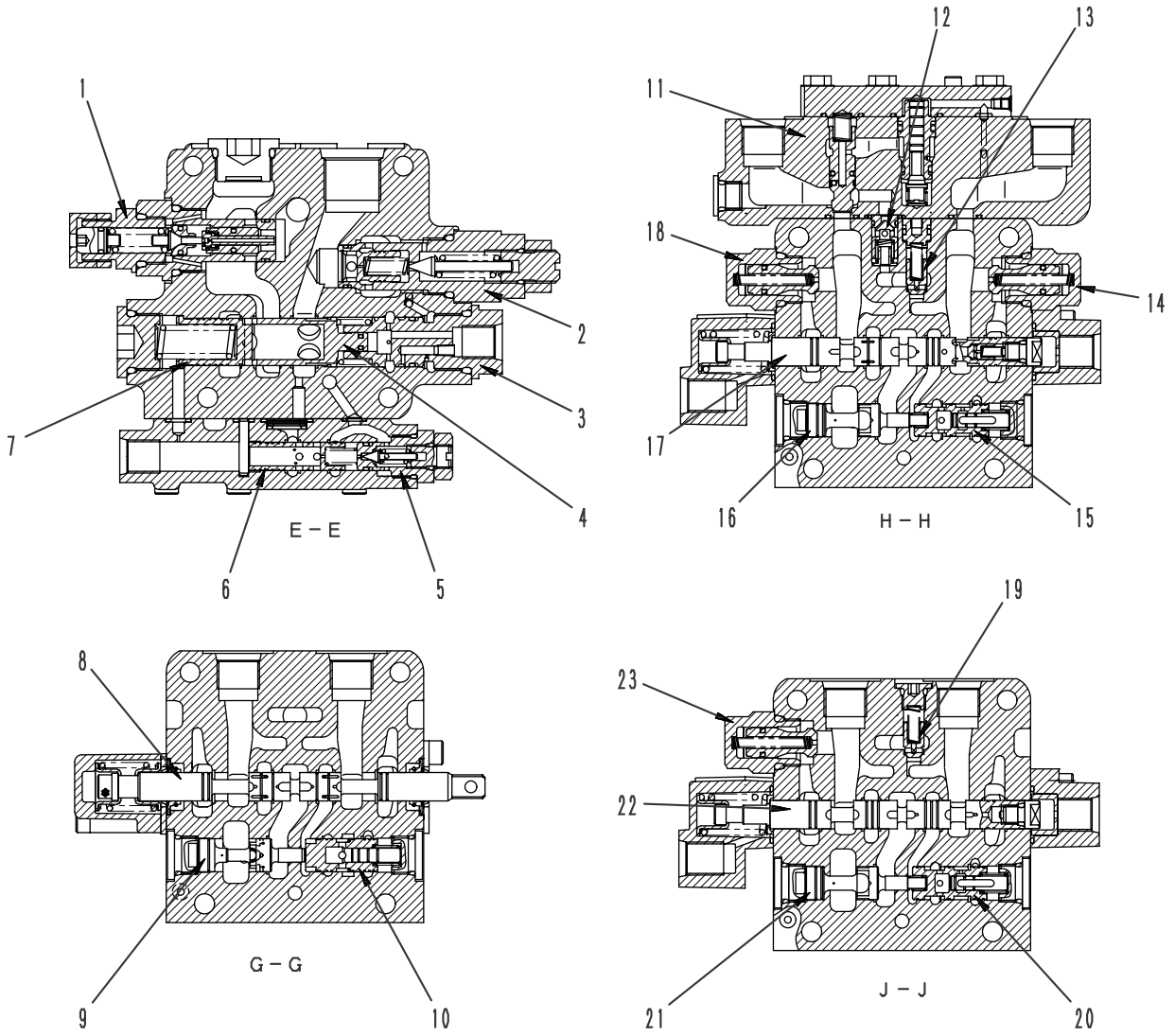
1. Suction valve (blade bottom)
2. Suction valve (boom swing bottom)
3. Suction valve (bucket bottom)
4. Suction valve (boom bottom)
5. Suction valve (arm bottom)
6. Safety valve
7. Suction valve (boom swing head)
8. Suction valve (boom head)
9. Spool (swing)
10. Spool (blade)
11. Spool (boom swing)
12. Spool (bucket)
13. Spool (boom)
14. Spool (R.H. travel)
15. Spool (L.H. travel)
16. Spool (arm)
17. Main relief valve



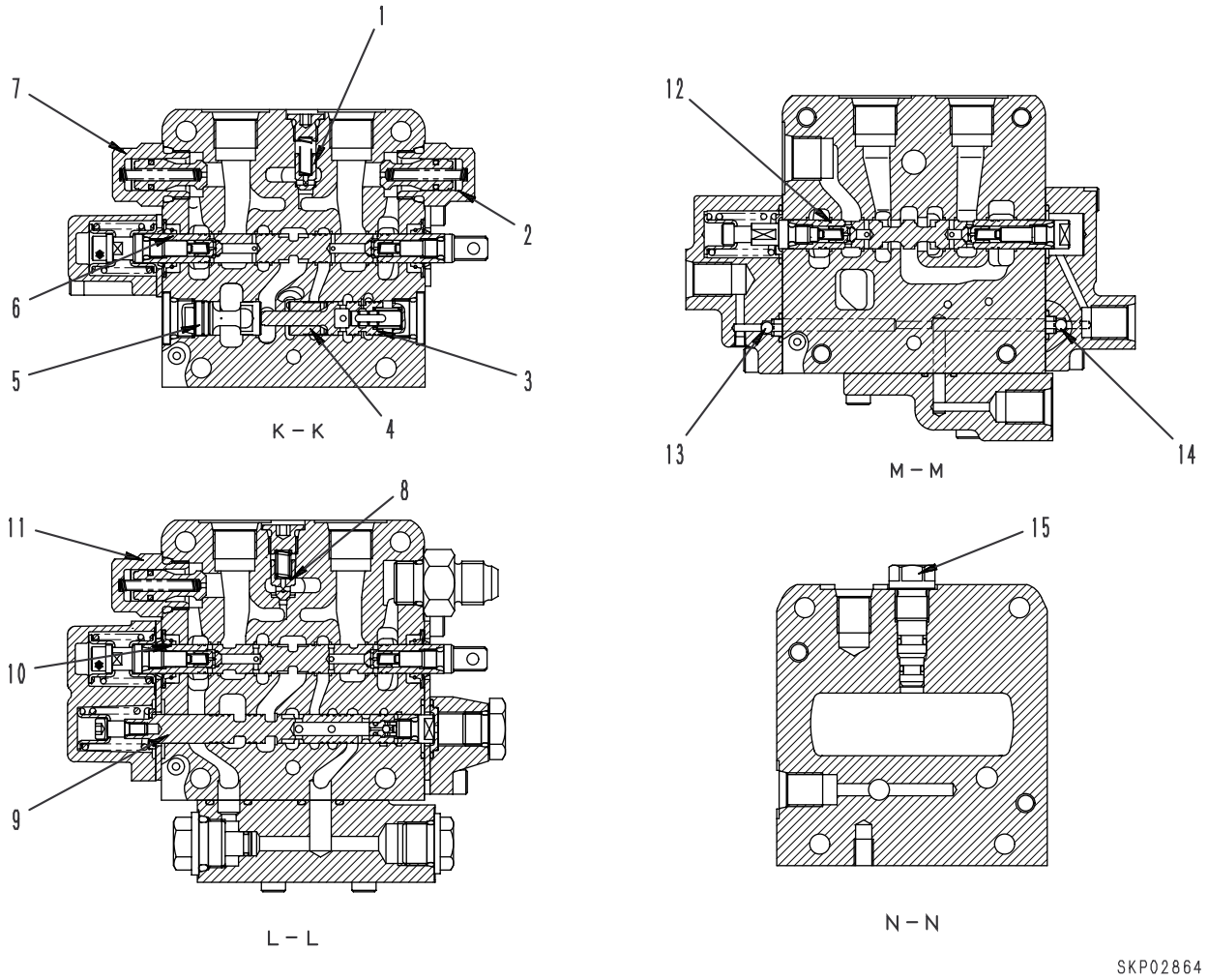
SKP02862

1. Pump pressure detection plug
2. LS pressure detection plug
3. Pressure compensation valve **R** (boom swing • blade)
4. Pressure compensation valve **R** (boom swing • blade)
5. Pressure compensation valve **R** (bucket)
6. Pressure compensation valve **R** (boom)
7. Pressure compensation valve **R** (R.H. travel)
8. Pressure compensation valve **R** (L.H. travel)
9. Pressure compensation valve **R** (arm)
10. LS bypass plug
11. Cooler bypass valve
12. Unload valve
13. Self-pressure reducing sequence valve
14. Pressure compensation valve **F** (arm)
15. Pressure compensation valve **F** (L.H. travel)
16. Pressure compensation valve **F** (R.H. travel)
17. Pressure compensation valve **F** (boom)
18. Pressure compensation valve **F** (bucket)
19. Pressure compensation valve **F** (boom swing • blade)
20. Spool (breaker)
21. Cooler bypass
22. Suction valve
23. Check valve
24. Pressure compensation valve **R**
25. Pressure compensation valve **F**
26. Pilot pressure check valve
27. Spool

★ **F**: Flow control valve
★ **R**: Pressure reducing valve



1. Safety valve
2. Main relief valve
3. LS bypass plug
4. Unload valve
5. Self-pressure reducing pilot relief valve
6. Self-pressure reducing spool
7. Self-pressure reducing sequence valve
8. Spool
9. Pressure compensation valve **F**
10. Pressure compensation valve **R**
11. Boom holding valve
12. Check valve
13. Check valve
14. Suction valve
15. Pressure compensation valve **R**
16. Pressure compensation valve **F**
17. Spool
18. Suction valve
19. Check valve
20. Pressure compensation valve **R**
21. Pressure compensation valve **F**
22. Spool
23. Suction valve



1. Check valve
2. Suction valve
3. Pressure compensation valve **F**
4. Piston
5. Pressure compensation valve **F**
6. Spool
7. Suction valve
8. Check valve
9. Spool (breaker)
10. Spool (blade)
11. Suction valve
12. Spool
13. Pilot pressure check valve
14. Pilot pressure check valve
15. Pressure bleed plug

OPERATION OF SYSTEM AS A WHOLE

1) When all control valves are at HOLD Operation

- Main pump discharge amount **Q1** all flows from unload valve (16) to tank (1).
- None of the spools (each spool **A** of the valves) is being operated, so the LS pressure **PLS** is not generated.
- At the same time, the LS pressure PLS1 is connected to the tank circuit by LS bypass plug (7), so it is the tank pressure.
- In this condition, LS differential pressure ∆**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.

2) When swing is operated independently

- When the swing spool is operated, gear pump discharge amount **Q2** flows from the swing spool to the swing motor.
- Main pump discharge amount **Q1** all flows from unload spool (16) to tank (1).

3) When actuator is operated independently (example: boom)

- When boom spool (11A) is operated, pump discharge amount **Q** flows to boom cylinder (25). At the same time, LS pressure **PLS** is generated and unload valve (16) closes.
- LS pressure **PLS** becomes the load pressure of boom cylinder (25).
  In the boom circuit, the difference between pump discharge pressure PP and LS pressure **PLS** (in other words, LS differential pressure ∆**PLS**) becomes the same as the LS set pressure of LS valve (4).
- As a result, the swash plate angle of main pump (2A) is kept at a point midway between the minimum and maximum angles.
- Pump pressure **PP** passes through the drill hole in flow control valve (11B) and goes to the left end, so boom pressure compensation valves (11B) and (11C) move fully to the right.
- When the other actuators are operated independently, pump discharge amount **Q** does not become 100%, so the operation is the same as for the boom.

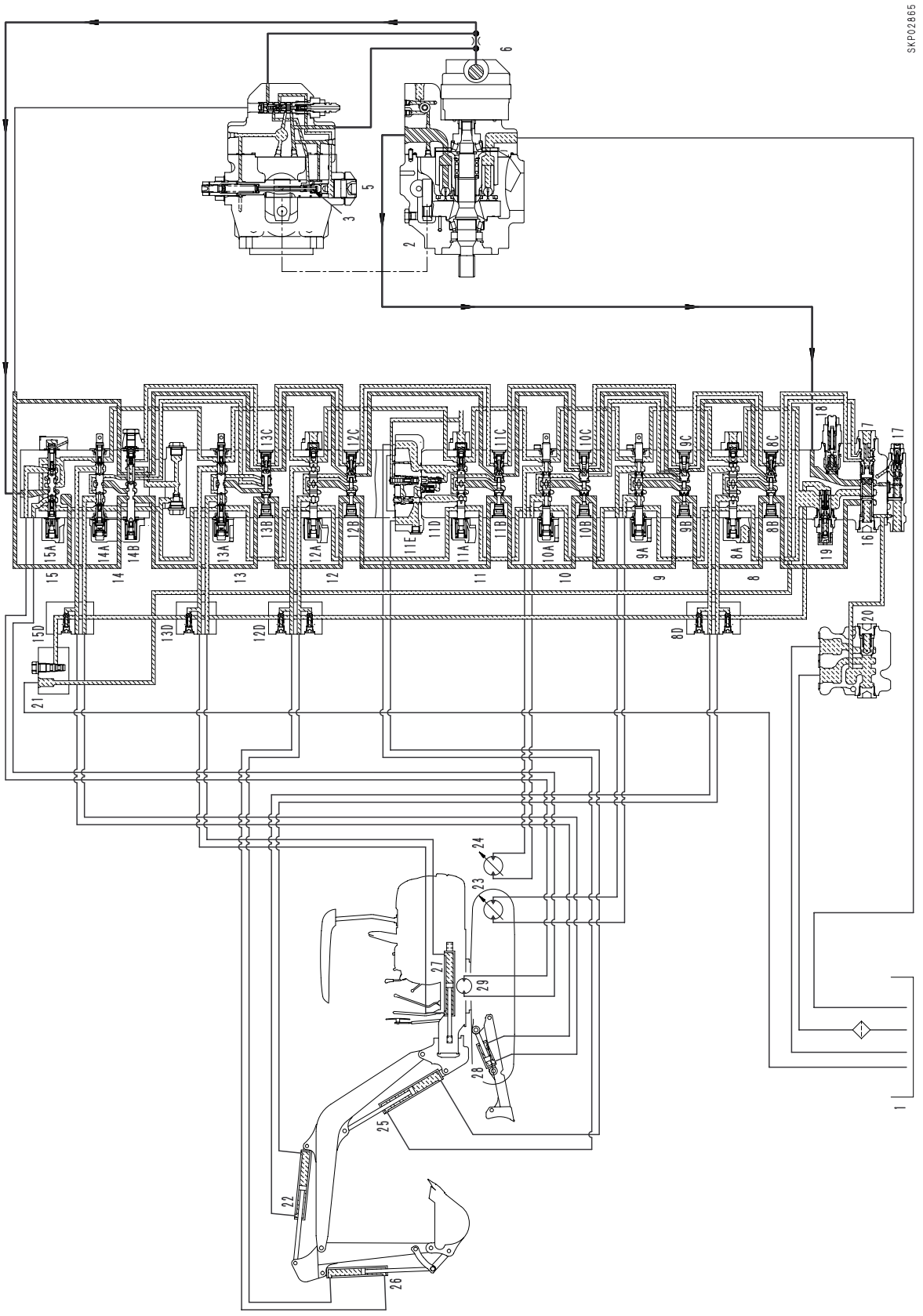
4) When left and right travel are operated at same time

- When left and right travel spools (9A) and (10A) are operated, pump discharge amount **Q** flows to left and right travel motors (23) and (24), and at the same time, LS pressure **PLS** is generated and unload valve (16) closes.
- When this happens, reducing valves (9C) and (10C) of the left and right travel valves move to the right, the travel junction circuit is interconnected, and this prevents any deviation in travel.
- Even when left and right travel spools (9A) and (10A) are 100% open, the pump discharge amount does not become 100%, so LS differential pressure ∆**PLS** becomes the same pressure as the LS set pressure of LS valve (4), and the swash plate angle of main pump (2) is kept at **a** point midway between the minimum and maximum angles.

5) Compound operation of actuators (example: boom + arm operated at same time)

- If boom spool (11A) is operated to RAISE and arm spool (8A) is operated at the same time to OUT, pump discharge amount **Q** flows to each cylinder (22) and (25).
- When this happens, the load pressure of boom cylinder (25) 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 (8A) is compensated by pressure compensation valves (11B) and (11C), 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 (11A) and arm spool (8A) 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 (11A) and arm spool (8A) is 100%, even if pump discharge amount **Q** becomes 100%, LS differential pressure **PLS** is set so that it does not reach the set pressure of LS valve (4), so main pump (2) is held at the maximum swash plate angle.
- If the total demand flow of boom spool (11A) and arm spool (8A) is less than 100% of pump discharge amount **Q**, pump discharge amount Q is controlled in accordance with the area of opening of the spools by LS differential pressure ∆**PLS**.

★ For details of this page, see page 90-15.



CLSS

1. OUTLINE

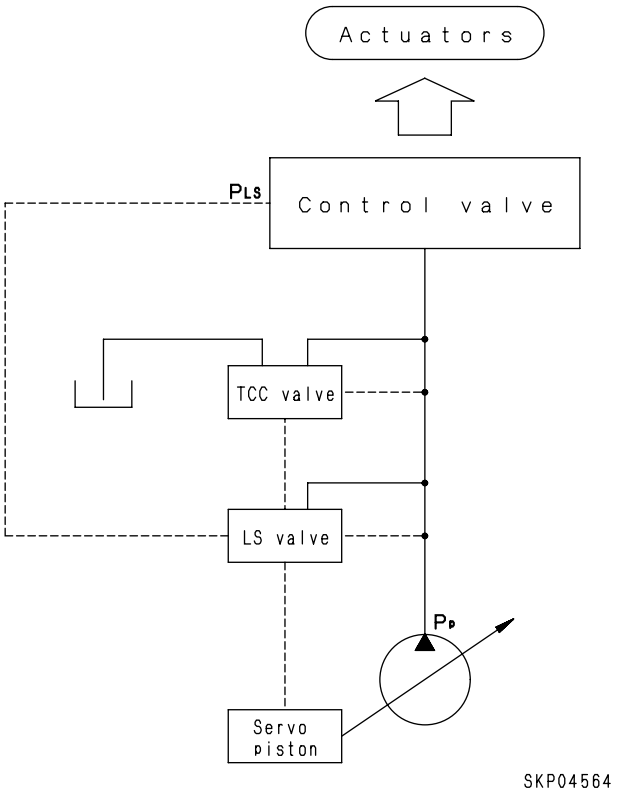
Features

CLSS stands for Closed Center Load Sensing System, 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, TCC valve and LS valve.

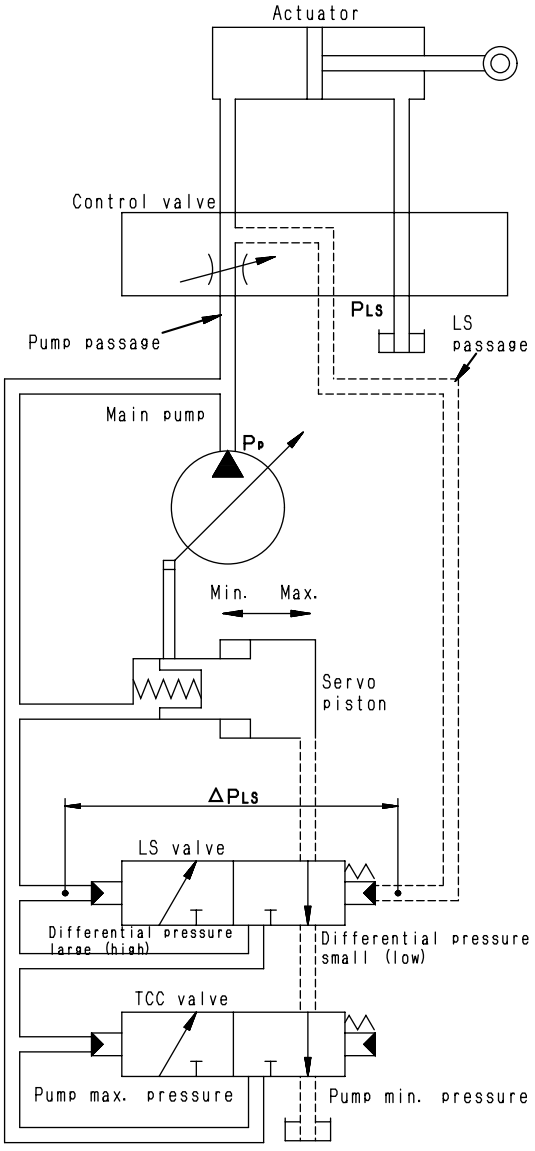


2. BASIC PRINCIPLE

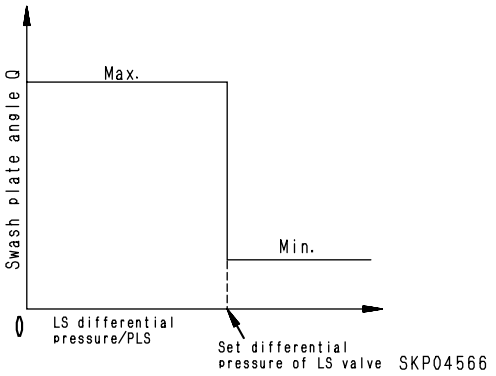
1) Control of pump swash plate angle

- The pump swash plate angle (pump discharge amount) is controlled so that LS differential pressure ∆**PLS** is constant. LS differential pressure ∆**PLS** is the difference in pressure between pump discharge pressure **PP** and LS pressure **PLS** (actuator load pressure) at the outlet port of the control valve
  (LS differential pressure ∆**PLS** = Pump discharge pressure **PP** – **LS** pressure **PLS**)
- If LS differential pressure ∆**PLS** becomes lower than the set pressure of the LS valve, the pump swash plate angle becomes greater, and if it becomes higher, the pump swash plate angle becomes smaller.

★ For details of the operation, see HYDRAULIC PUMP.



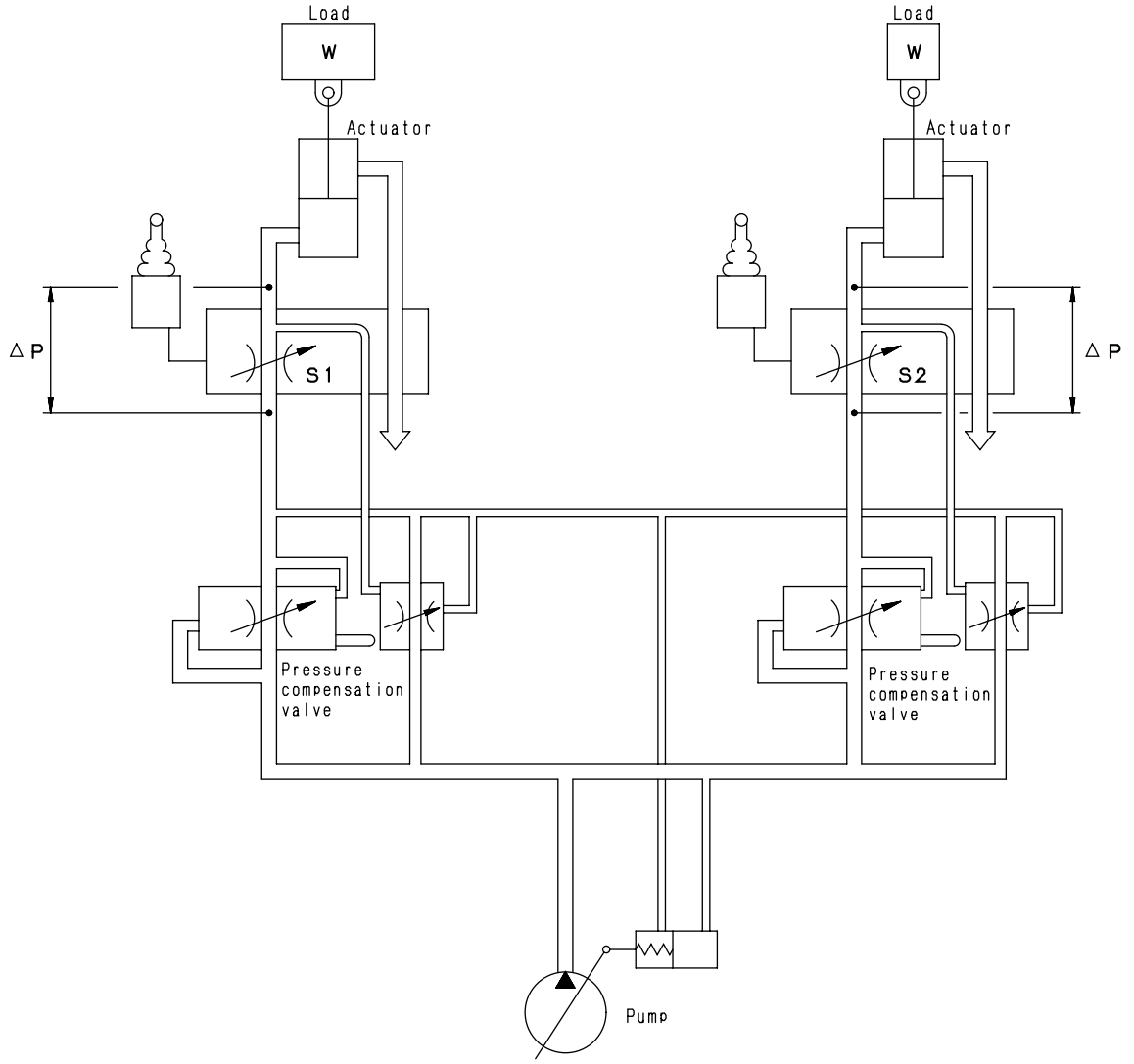
SKP04565



SKP04566

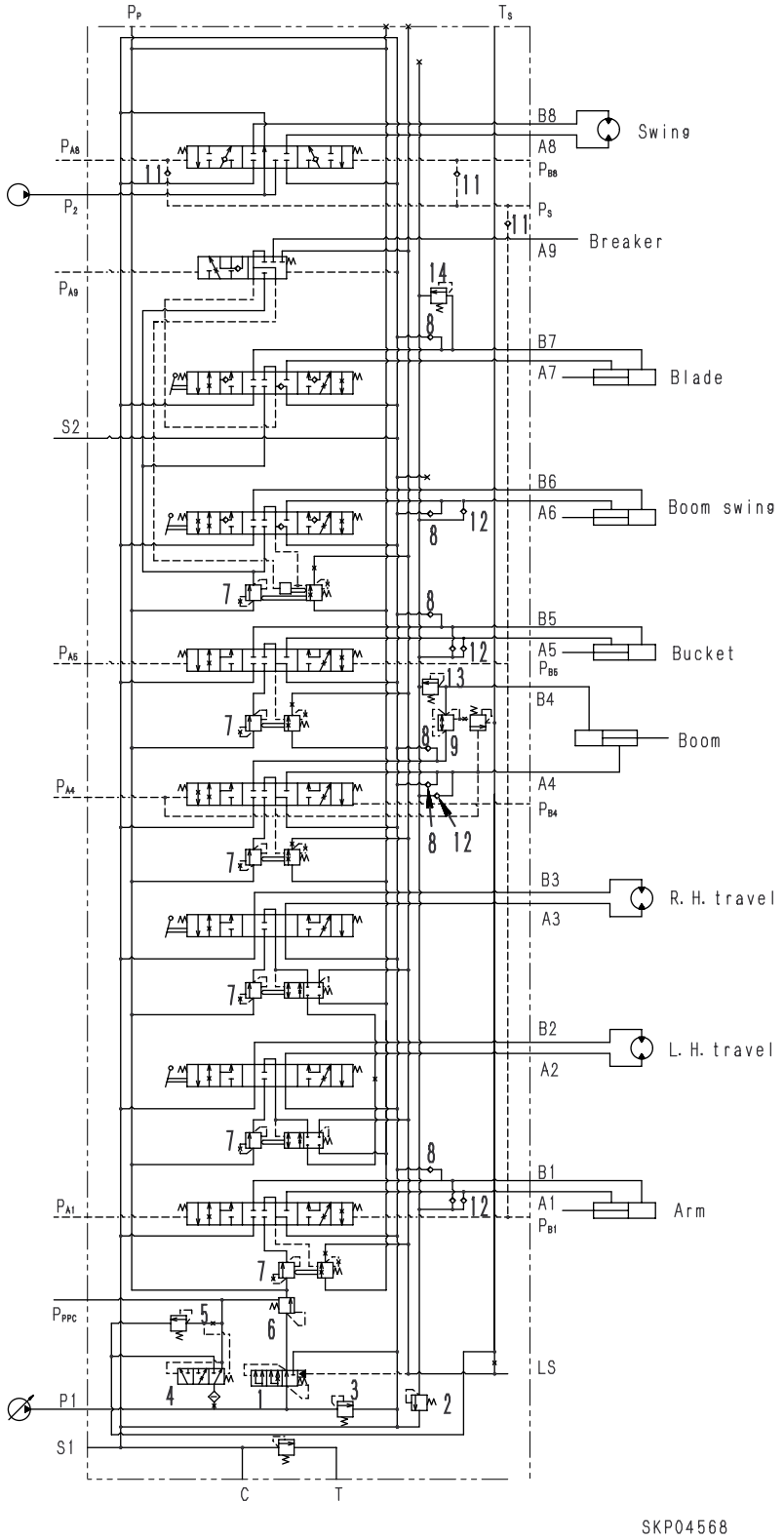
2) Pressure compensation control

- A valve (pressure compensation valve) is installed to the inlet port side of the control valve to balance the load.
  When there is compound operation of the actuators, this valve acts to make pressure difference **ΔP** constant for the upstream flow (inlet port) and downstream flow (outlet port) of the notch of each spool.
  In this way, the flow of oil from the pump is divided in proportion to area of opening **S1** and **S2** of each valve.



SKP04567

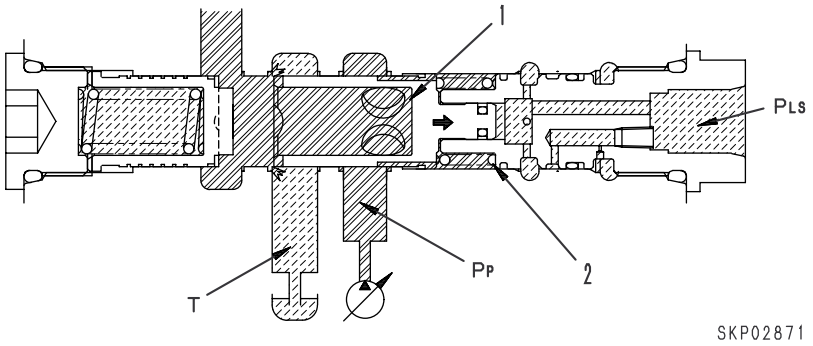
3. OPERATION FOR EACH FUNCTION AND VALVE
Hydraulic circuit diagram and names of valves



SKP04568

1. Unload valve
   (LS pressure + 3.43 MPa {35 kg/cm²})
2. Safety valve (27.9 MPa {285 kg/cm²})
3. Main relief valve
   (24.5 MPa {250 kg/cm²})
4. Self-pressure reducing valve
5. Pilot relief valve
   (2.9 MPa {30 kg/cm²})
6. Self-pressure sequence valve
   (0.3 MPa {2.9 kg/cm²})
7. Pressure compensation valve
8. Suction valve
9. Lock valve
10. Cooler check valve
    (0.4 MPa {4 kg/cm²})
11. Pilot pressure check valve
12. Check valve
13. Check valve (boom RAISE)
    (2 MPa {20 kg/cm²})
14. Check valve (blade RAISE)
    (2.5 MPa {25 kg/cm²})

1) Unload valve



FUNCTION

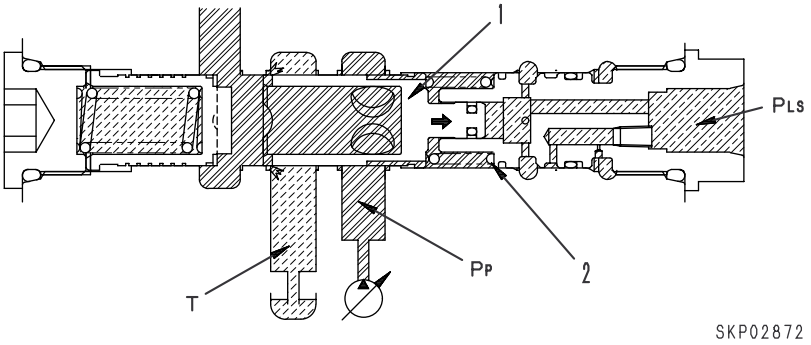
1. When the control valve is at neutral, pump discharge amount **Q** discharged by the minimum swash plate angle is released to the tank circuit.
When this happens, pump discharge pressure **PP** is set at 3.43 MPa {35 kg/cm²} by spring (2) inside the valve. (LS pressure **PLS**: 0 MPa {0 kg/cm²})

OPERATION

When control valve is at neutral

- Pump discharge pressure **PP** is acting on the left end of pool (1), and LS pressure **PLS** is acting on the right end.
- When the control valve is at neutral, LS pressure **PLS** is not generated, so only pump discharge pressure **PP** has any effect, and **PP** is set only by the load of spring (2).
- As pump discharge pressure Pp rises and reaches the load of spring (2) (3.43 MPa {35 kg/cm²}), spool (1) is moved to the right in the direction of the arrow. Pump circuit pressure PP then passes through the notch in spool (1) and is connected to tank circuit **T**.
- In this way, pump discharge pressure **PP** is set to 3.43 MPa {35 kg/cm²}.

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** + 3.43 MPa {35 kg/cm²}.
When the difference pressure between pump discharge pressure PP and LS pressure PLS reaches the load of spring (2) (3.43 MPa {35 kg/cm²}), the unload valve opens, so LS differential pressure Δ**PLS** becomes 3.43 MPa {35 kg/cm²}.

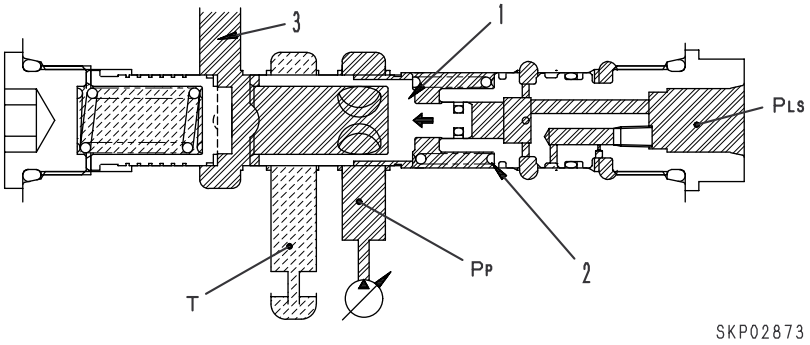


OPERATION

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 (1).
  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 (2) (3.43 MPa {35 kg/cm^2}), spool (1) 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 (3.43 MPa {35 kg/cm^2}) + LS pressure **PLS**, and LS differential pressure ∆**PLS** becomes 3.43 MPa {35 kg/cm^2}.

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.

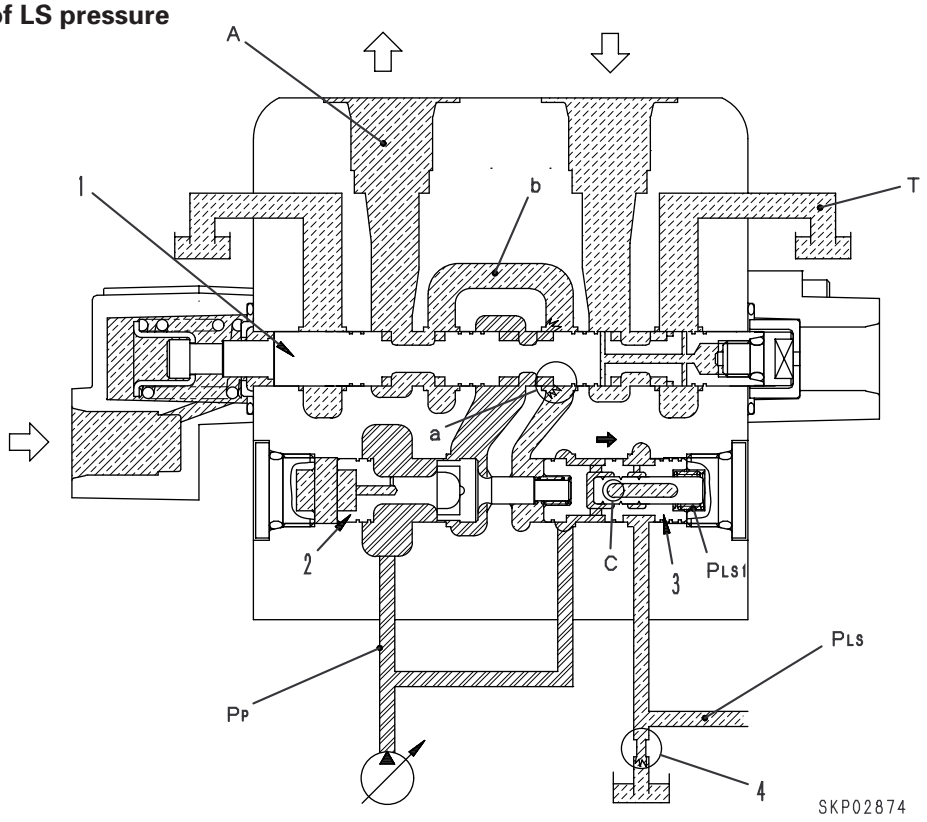


OPERATION

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 (1).
  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 (2) (3.43 MPa {35 kg/cm^2}), so spool (1) is pushed to the left in the direction of the arrow by spring (2).
- As a result, pump circuit **PP** and tank circuit **T** are shut off, and all the pump discharge

2) Introduction of LS pressure



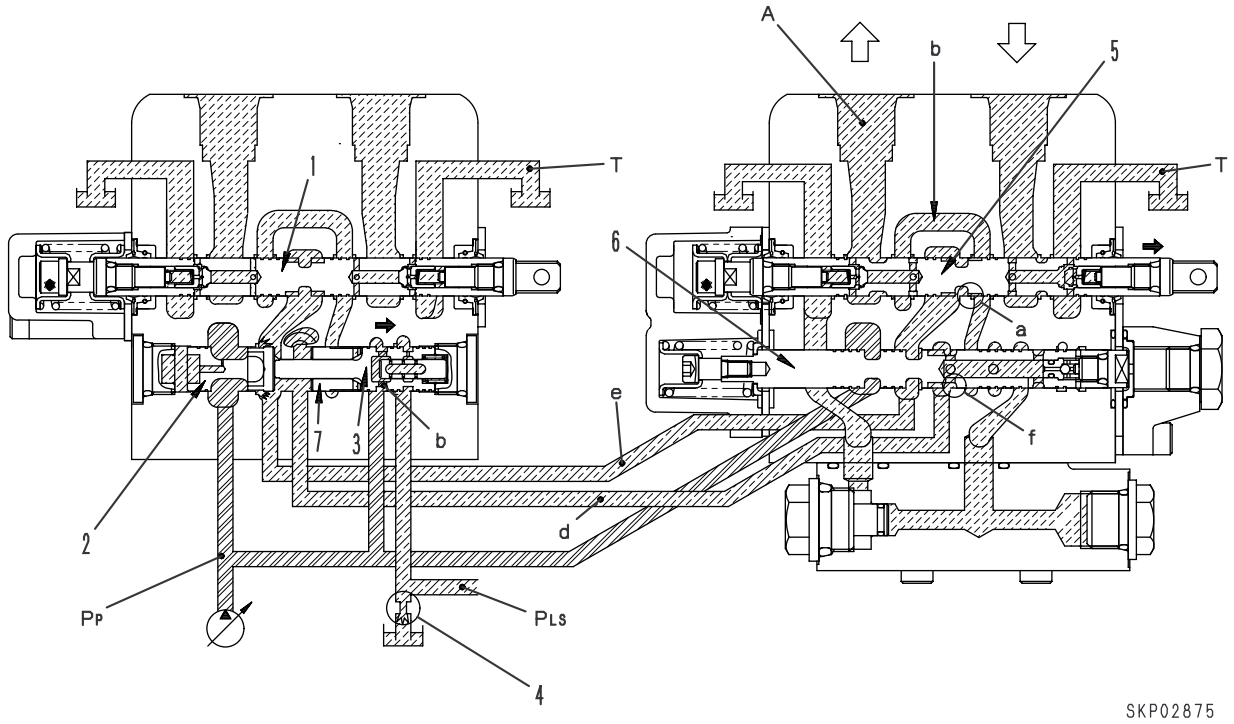
FUNCTION

- The LS pressure is the actuator load pressure at the outlet port end of 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**.
- With the boom swing and blade valves, pump pressure PP is reduced to the same pressure as actuator circuit pressure **A** by one reducing valve (3) used for both systems, and the pressure is sent to the LS circuit **PLS**.
- With the breaker valve, actuator circuit pressure **A** is taken directly to the LS circuit **PLS**.

OPERATION

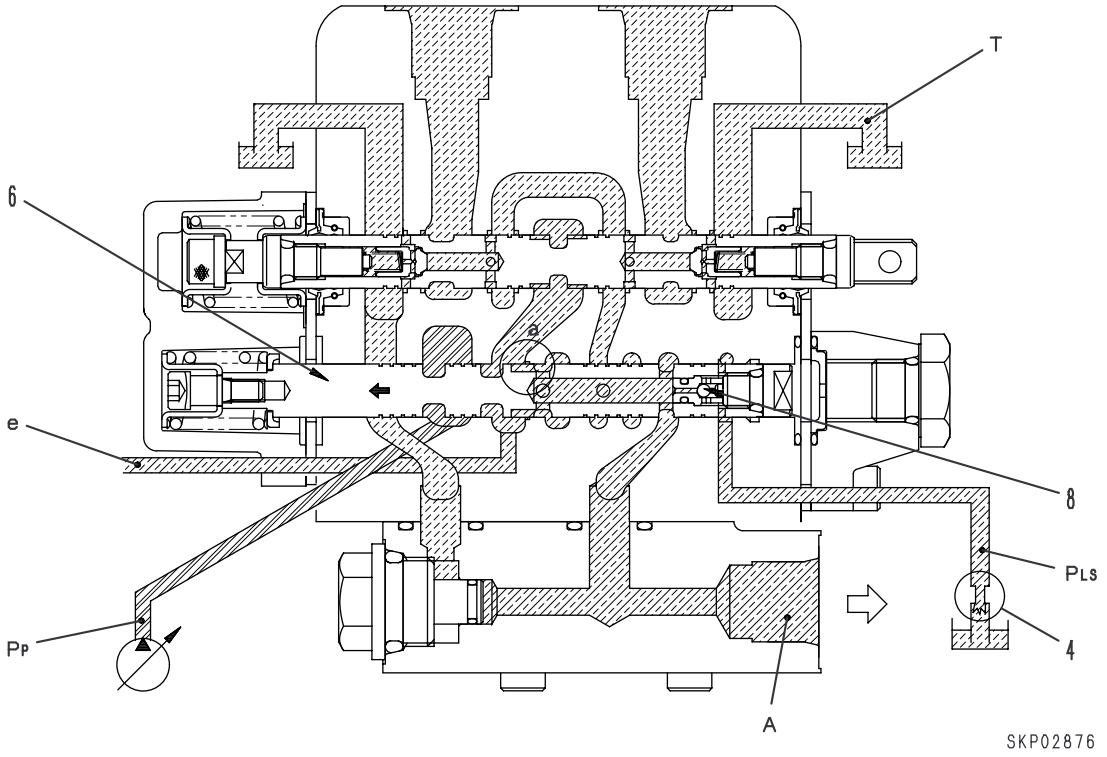
1. Work equipment valves (boom, arm, bucket, swing)

- 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 in the direction of the arrow, so pump pressure **PP** has its pressure reduced by the pressure loss at notch **C**. It is introduced 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).
- Actuator circuit pressure **PA** (=**A**) acts on the left end of reducing valve (3); the reduced pump pressure **PP** acts on 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. Boom swing, blade valve

- In the same way as with the work equipment valves, when boom swing spool (1) is operated, pump pressure **PP** is reduced by reducing valve (3) and is sent to the LS circuit **PLS**.
- When blade spool (5) is operated, pump pressure **PP** flows from flow control valve (2), passage **e**, and notch **a** in the spool through bridge passage **b** to actuator circuit **A**.
- At the same time, the actuator circuit pressure passes through notch f in breaker spool (6), then goes through passage **d**, and acts on the left end of piston (7). Piston (7) and reducing valve (3) then move to the right in the direction of the arrow.
- As a result, pump pressure **PP** is reduced at notch **d**, becomes the actuator circuit pressure, and is sent to LS circuit **PLS**.
  - ★ The boom swing and blade valves are different from the work equipment valves: they share one pressure compensation

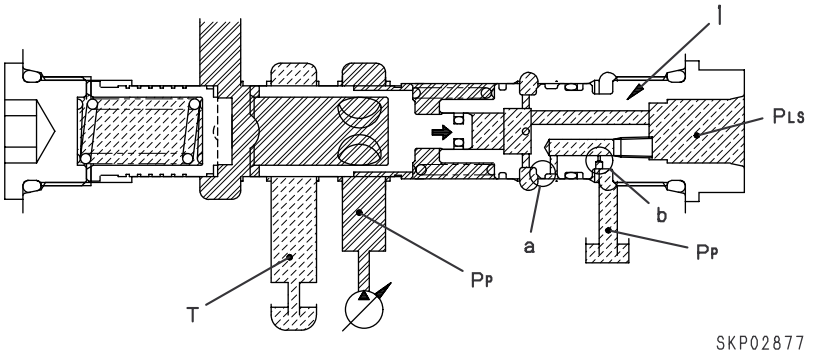


3. Breaker valve

- When breaker spool (6) is operated, pump pressure **PP** flows through flow control valve (2), passage e, and notch **a** in breaker spool (6) to actuator circuit **A**.
- At the same time, actuator circuit pressure passes through check valve (8) and is interconnected with the LS circuit **PLS**.

★ The breaker circuit is different from the other circuits: actuator circuit pressure goes directly to LS circuit **PLS**.

3) LS bypass plug



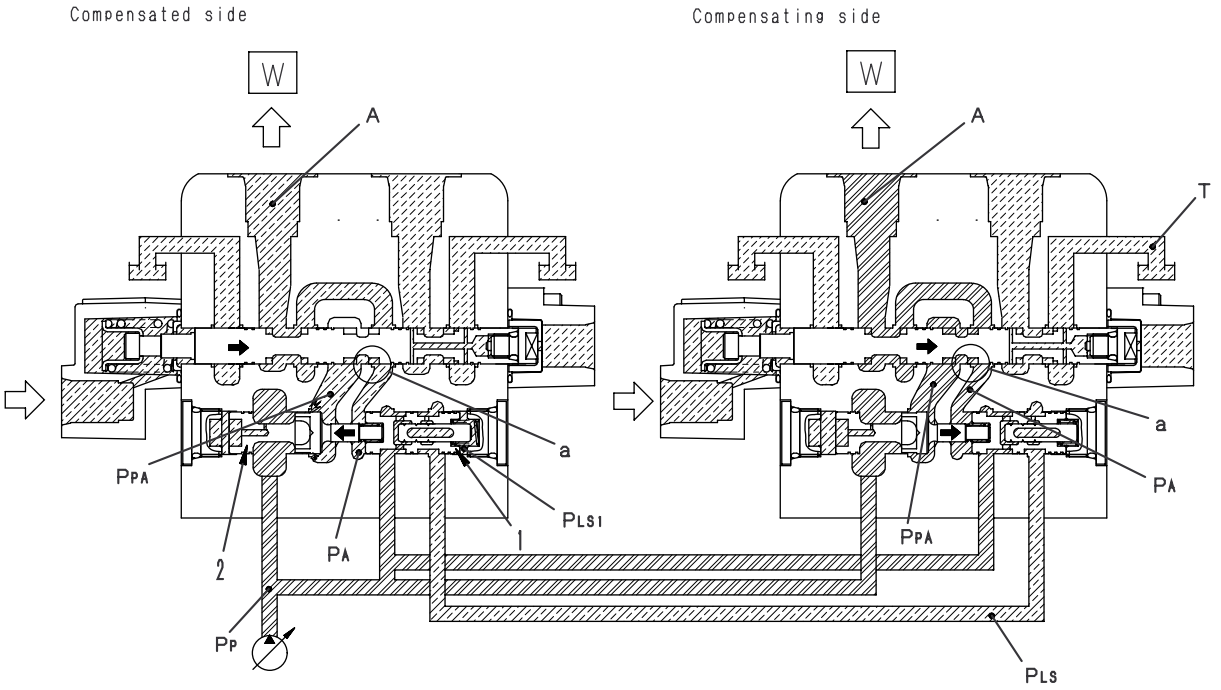
FUNCTION

- It releases the residual pressure of LS pressure **PLS**.
- 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 tank circuit **T**.

4) Pressure compensation valve



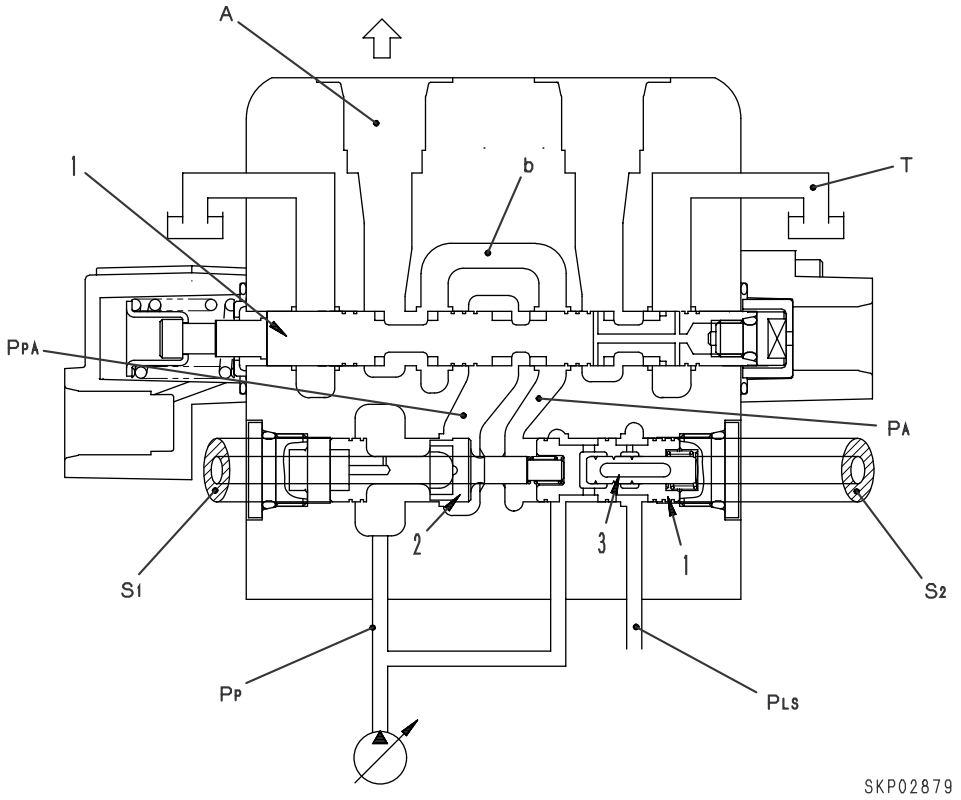
FUNCTION

- 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 (right side) becomes higher during compound operations, the oil flow in actuator circuit **A** on this side (left side) 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 in the direction of the arrow.
- 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

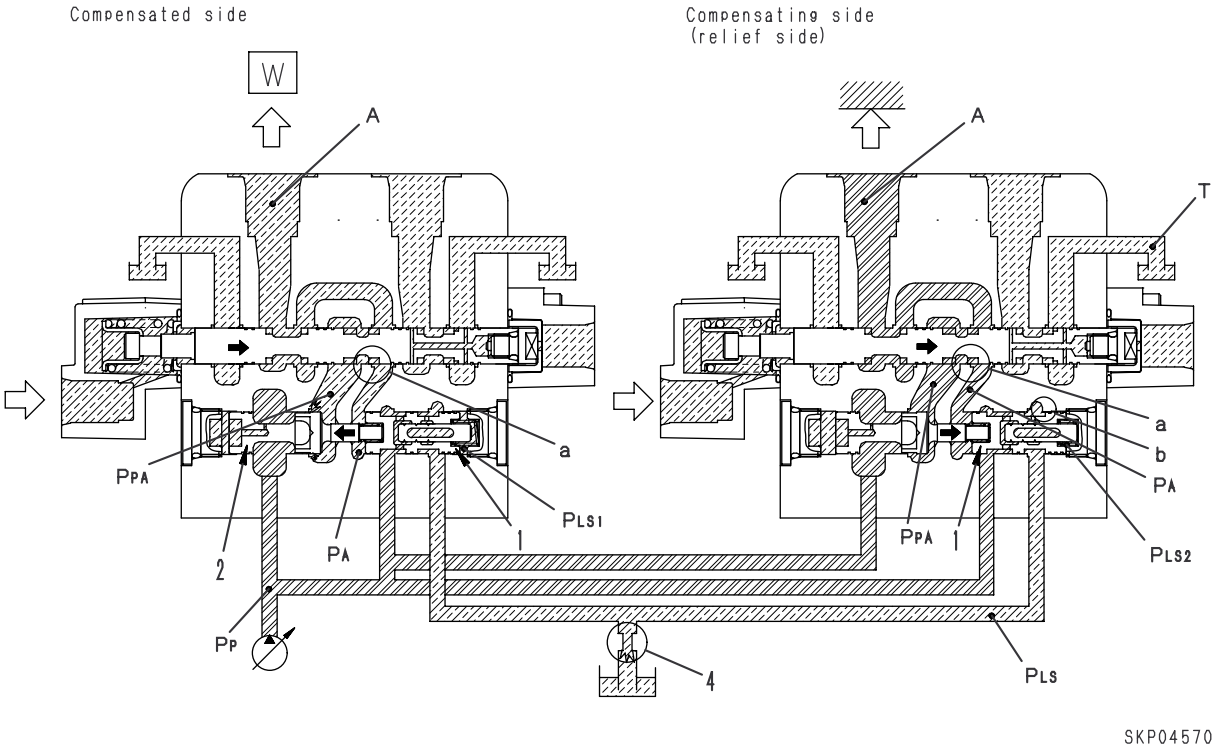
- The pressure compensation valve determines the compensation characteristics by carrying out fine adjustment of the area ratio (**S2**/**S1**) between area **S2** of reducing valve (1) and area **S1** of flow control valve (2) to match the characteristics of each actuator.
  - **S1**: Area of flow control valve (2) – area of piston (3)
  - **S2**: Area of reducing valve (1) – area of piston (3)

AREA RATIO (S1:S2) AND COMPENSATION CHARACTERISTICS

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

Valve	Ratio of area
Arm	0.98
Travel	1.00
Boom	0.95
Bucket	1.00
Boom swing	0.98
Blade	0.98
Service	1.00

6) Throttling LS introduction of pressure compensation valve



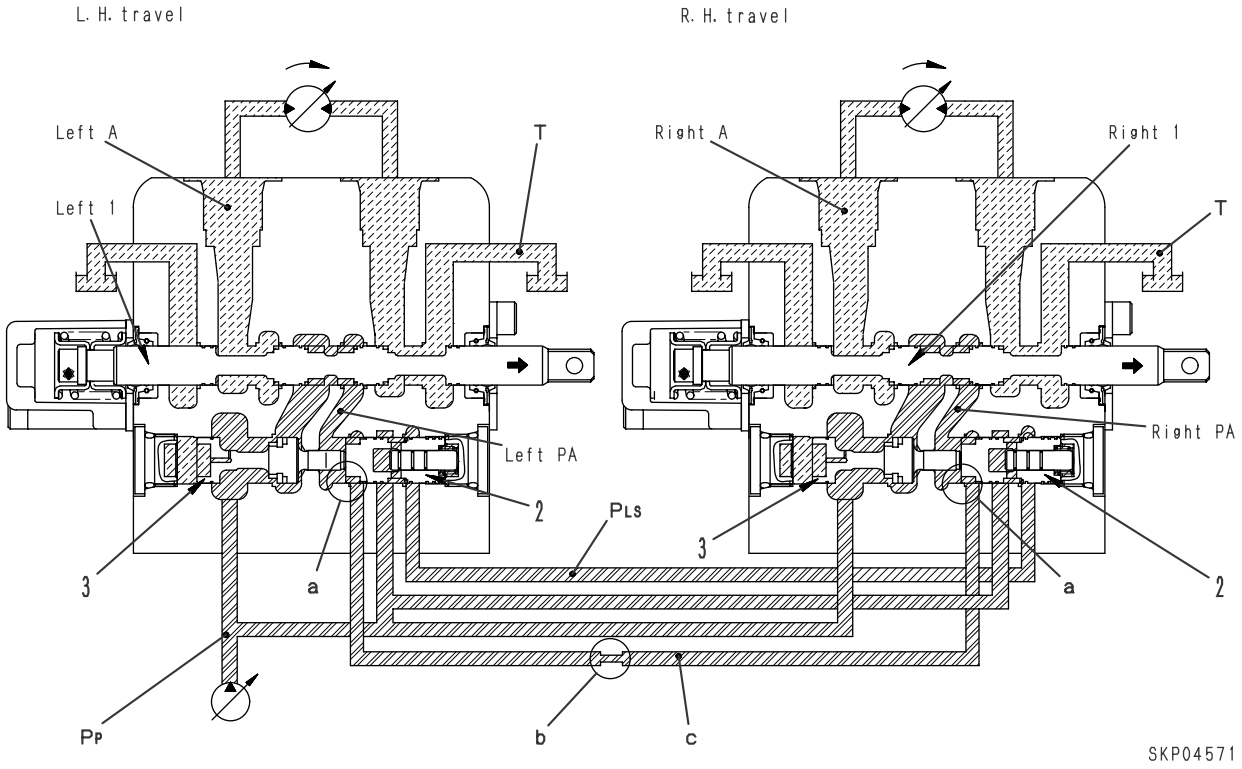
FUNCTION

- If the other actuator is relieved during compound operations, LS introduction throttle **b** of reducing valve (1) divides the flow and sends more oil to the side receiving compensation.

OPERATION

- If the other actuator (right side) is relieved during compound operations, each circuit pressure (**PPA**, **PA**) of the other actuator becomes the same as the pump circuit pressure (**PP** = relief pressure).
- In this case, spring chamber **PLS2** of the other actuator becomes the same as pump circuit pressure **PP** because of the balance of reducing valve (1).
- **PLS2** passes through LS introduction throttle b of reducing valve (1) and becomes **PLS**. **PLS** is connected to the tank circuit from LS bypass plug (4), so pressure loss is generated at LS introduction throttle b (the condition becomes **PLS** < **PLS2**).
- As a result, even if the other actuator is relieved, a pressure differential is created between **PP** and **PLS**, so more oil flows to actuator circuit **A** on this side (left side).

7) L.H., R.H. travel junction circuit



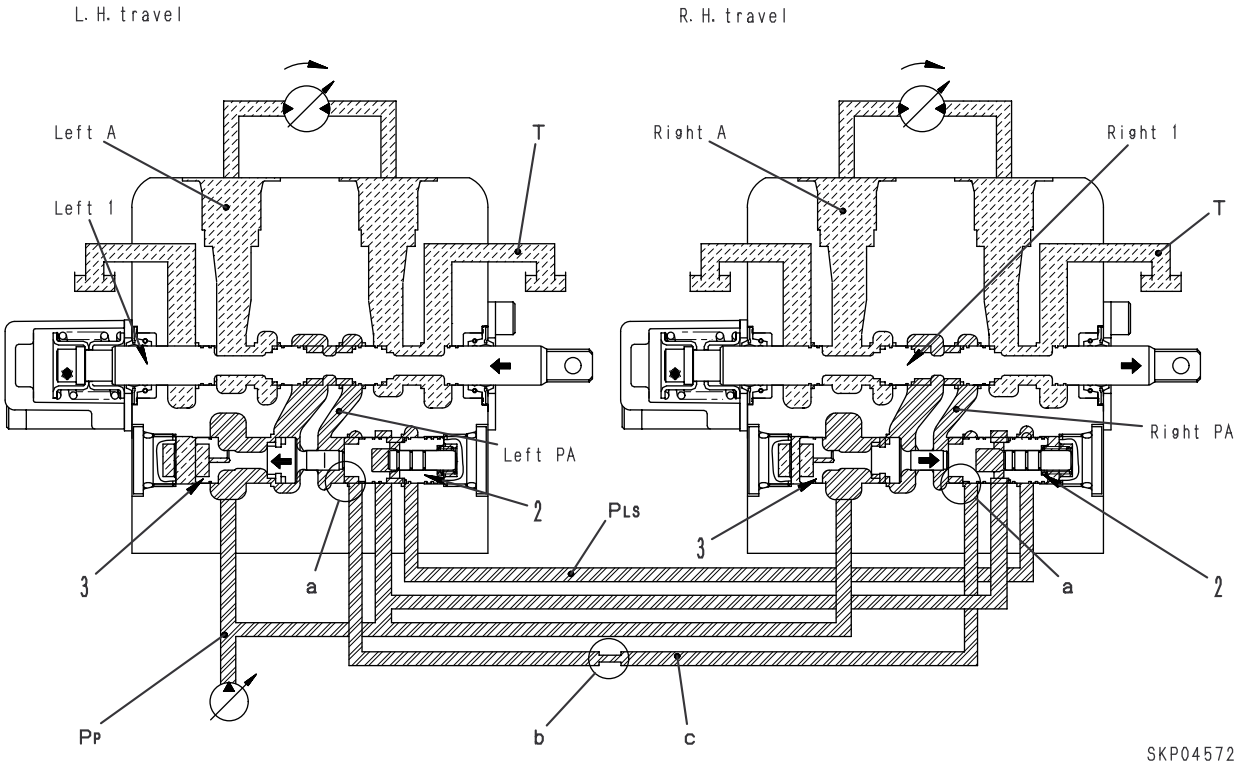
FUNCTION

- 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 becomes smaller, so the machine can be steered.

OPERATION

When traveling in a straight line

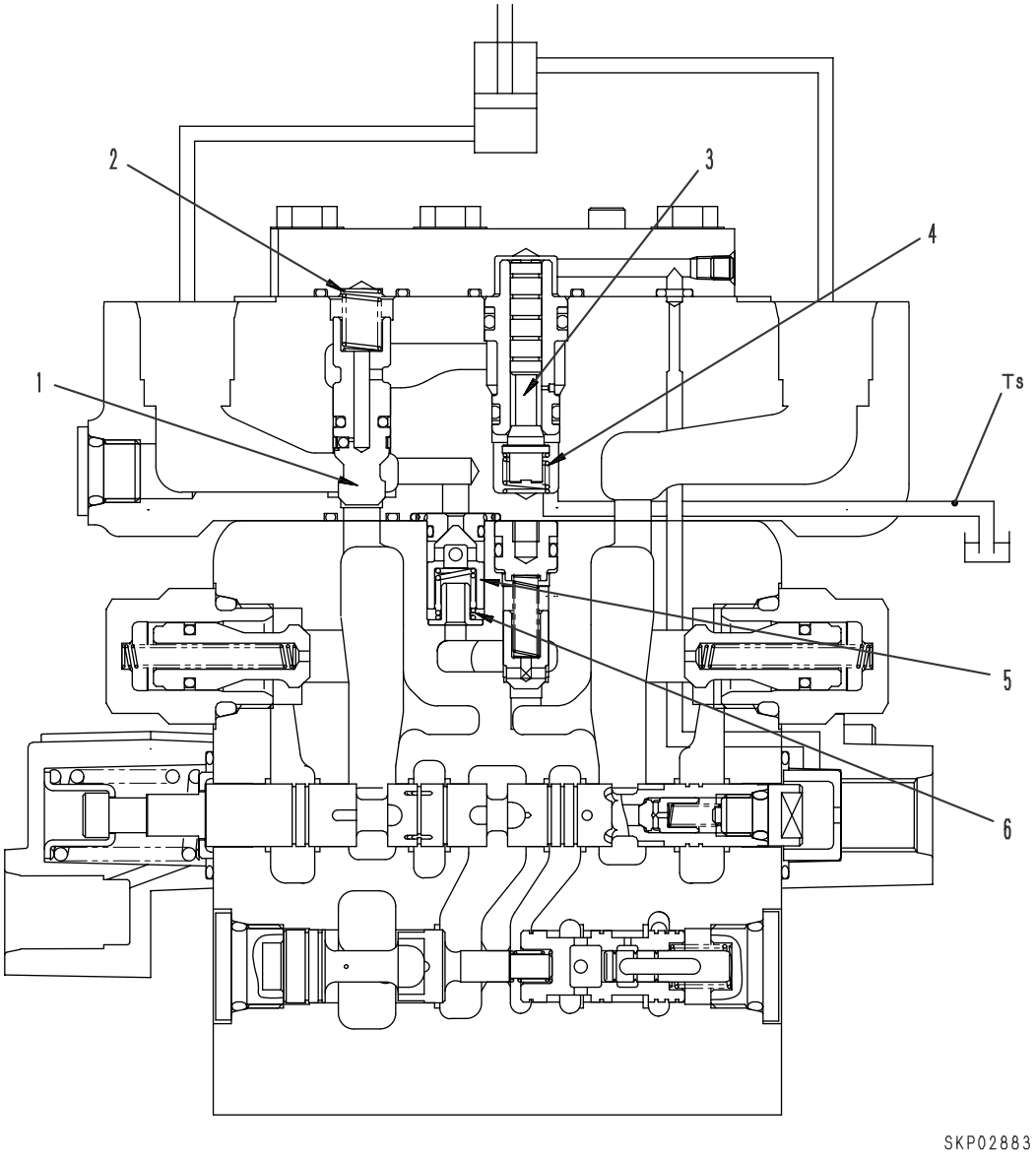
- When left and right travel spools (1) are operated, the pump discharge flows from pump circuit **PP** and circuits **PA** to actuator circuits **A**.
- When traveling in a straight line, to make actuator circuits **PA** equal, left and right reducing valves (2) are pushed to the right in the direction of the arrow by the same amount, and notch a and the travel junction circuit are opened.
- 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, compensation is carried out to prevent any deviation in travel.



Steering when traveling

- When traveling in a straight line, if the left travel spool (left 1) is returned to the neutral position and the 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 in the direction of the arrow by LS circuit **PLS**. Because of this, the opening of the left notch a is made smaller, 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.

8) Boom holding valve



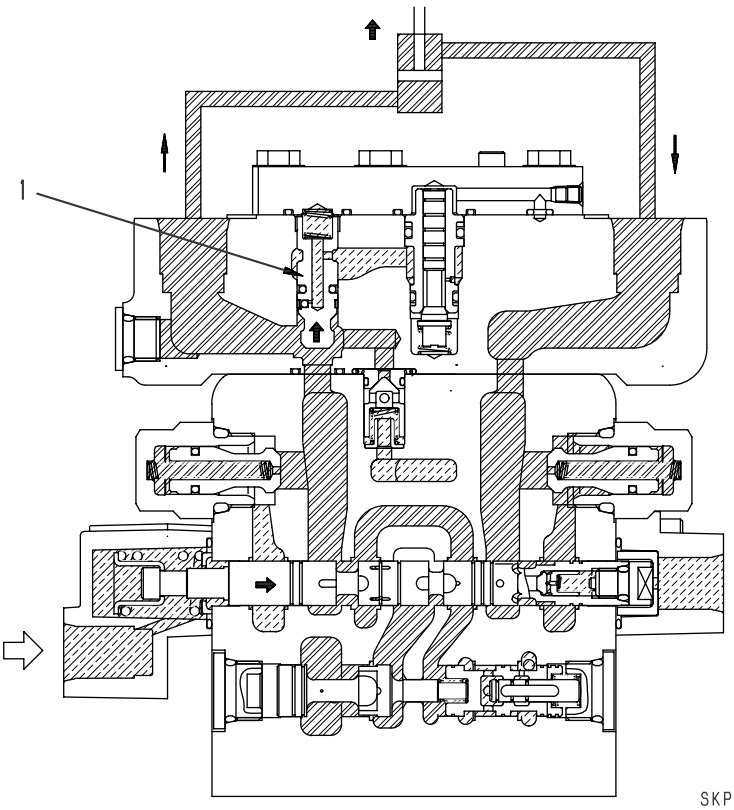
1. Poppet
2. Poppet spring
3. Pilot spool
4. Pilot spring
5. Check valve
6. Check valve spring

BOOM HOLDING VALVE

1) At boom RAISE

When the control lever is operated to boom RAISE, the main pressure from the control valve pushes up poppet (1) in the direction of the arrow.

Because of this, the main pressure oil from the control valve passes through the valve and flows to the bottom end of the boom cylinder.

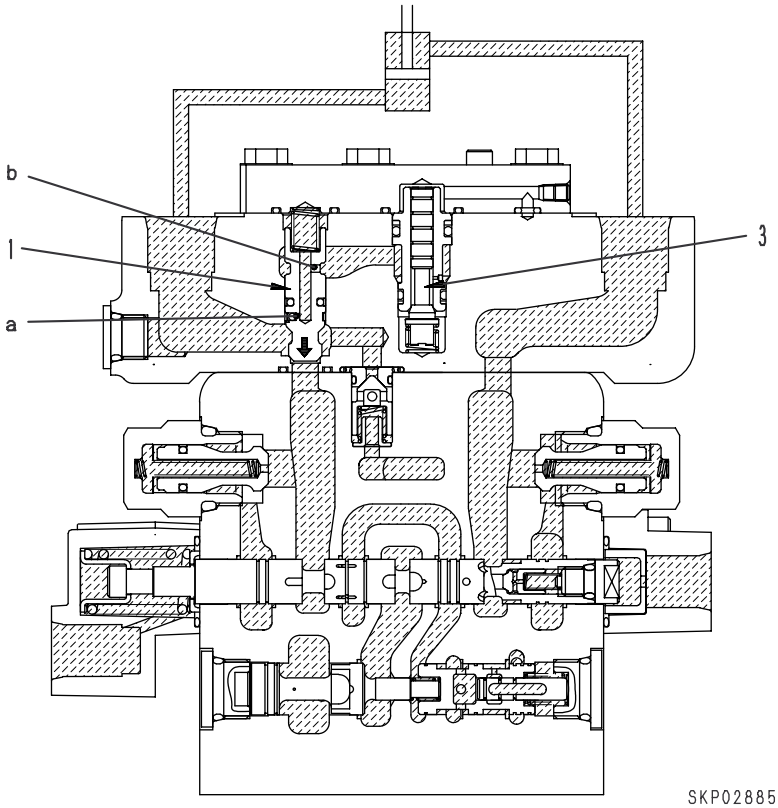


SKP02884

2) Boom lever at HOLD

When the boom is raised and the control lever is returned to HOLD, the circuit for the holding pressure at the bottom end of the boom cylinder is closed by poppet (1). At the same time, the circuit for the oil flowing into poppet (1) through orifices **a** and **b** of poppet (1) is closed by pilot spool (3).

As a result, the boom is held in position.



SKP02885

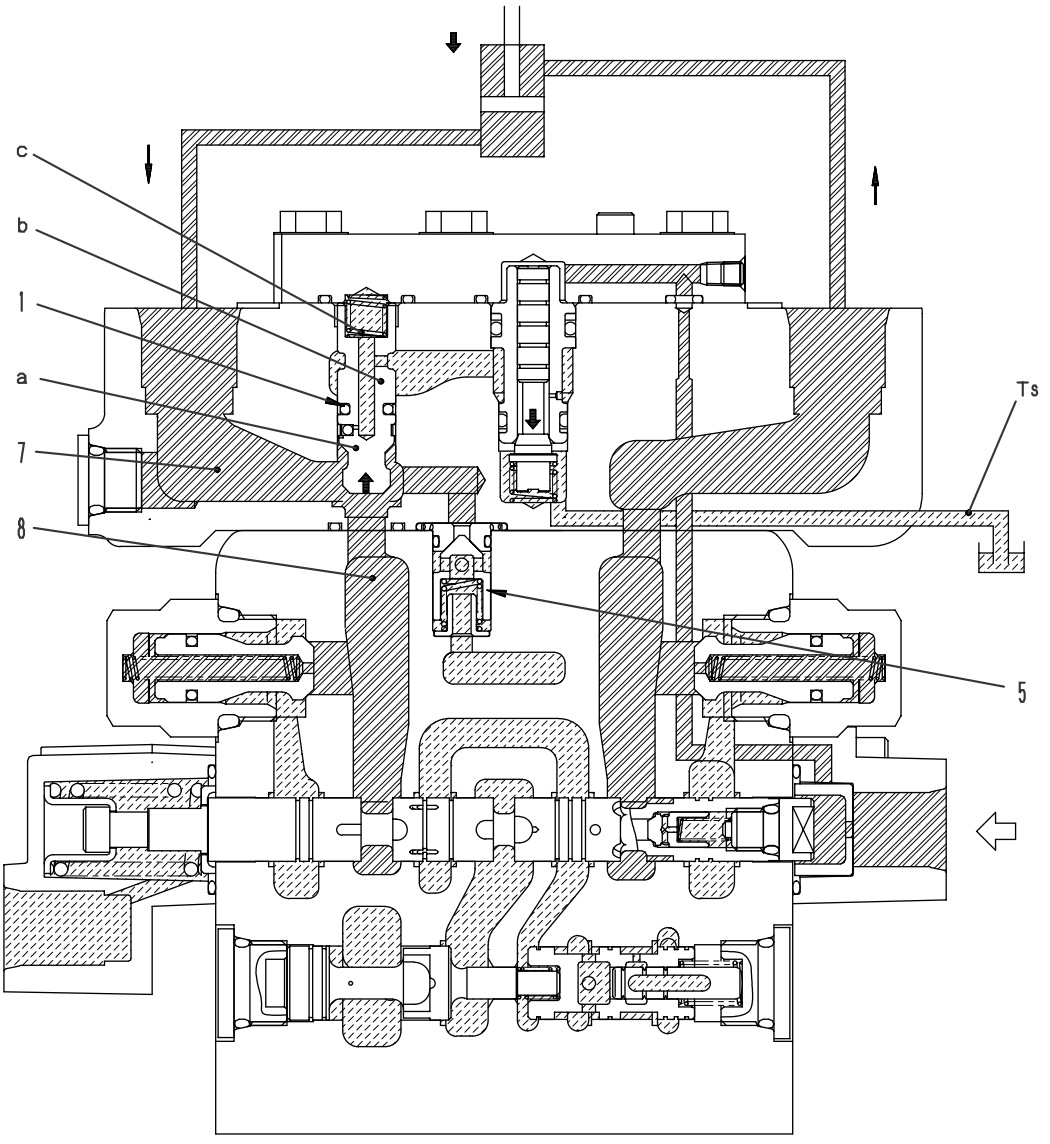
3) Boom LOWER

When the control lever is operated to boom LOWER, the pilot pressure pushes pilot spool and the pressurized oil in chamber **C** inside the poppet is drained.

When the pressure at cylinder bottom rises because of the pressurized oil from the bottom end of the boom cylinder, the pressure of the pressurized oil in chamber **C** is lowered because of orifices **a** and **b**.

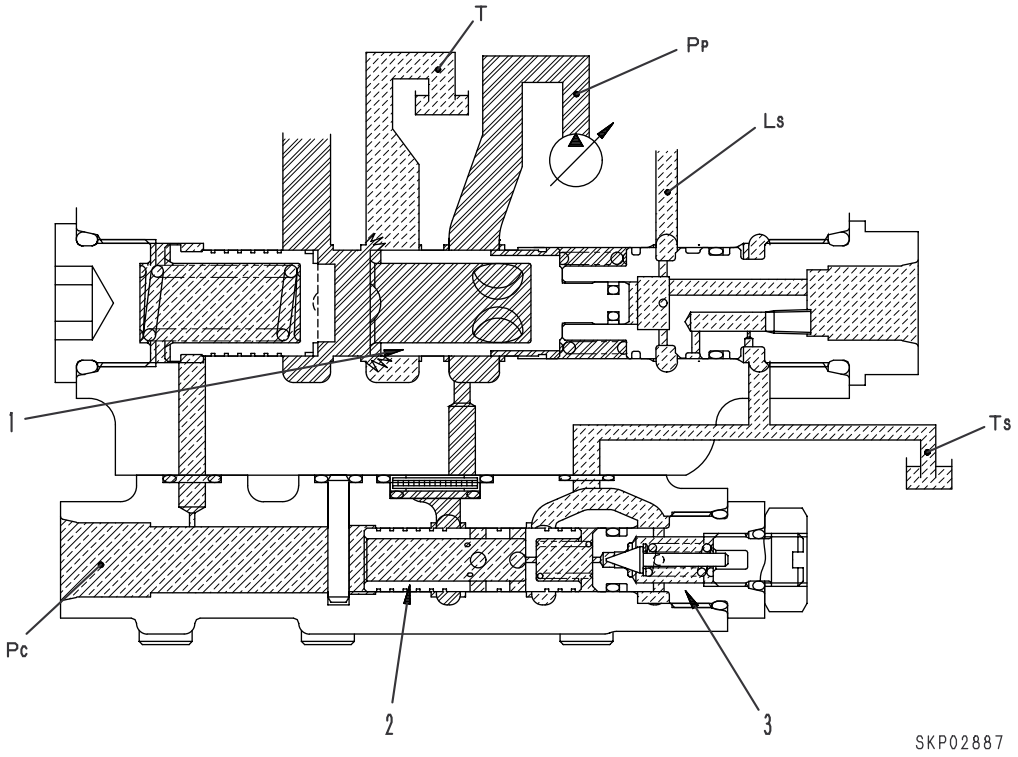
If the pressure in chamber **C** drops below the pressure at port (8), poppet (1) opens, the pressurized oil flows from port (7) to port (8), and then flows to the control valve.

If any abnormal pressure is generated in the circuit at the bottom end of the boom cylinder, the safety valve is actuated through check valve (5).



SKP02886

9) Self-pressure reducing valve



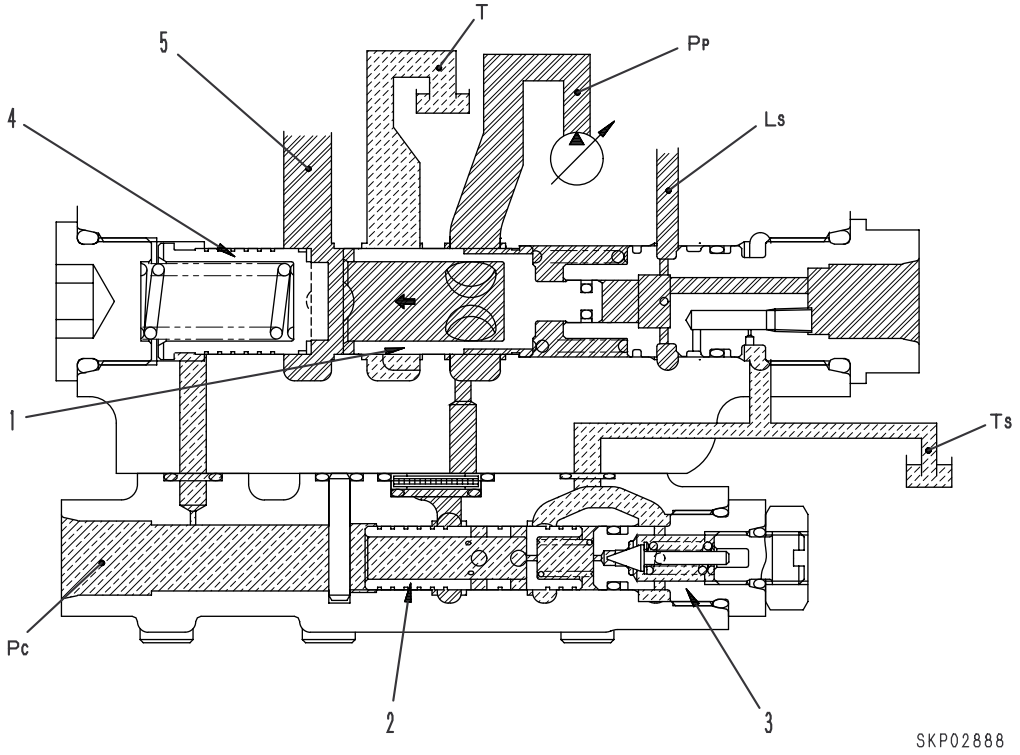
FUNCTION

- This reduces pump discharge pressure **PP** and supplies the pilot basic pressure (2.9 MPa {30 kg/cm²}) to the **PPC** valve.
- When the actuator circuit pressure is low, the self-pressure sequence valve closes and raises the pump discharge pressure **PP** to ensure the pilot basic pressure.

OPERATION

Control valve at HOLD

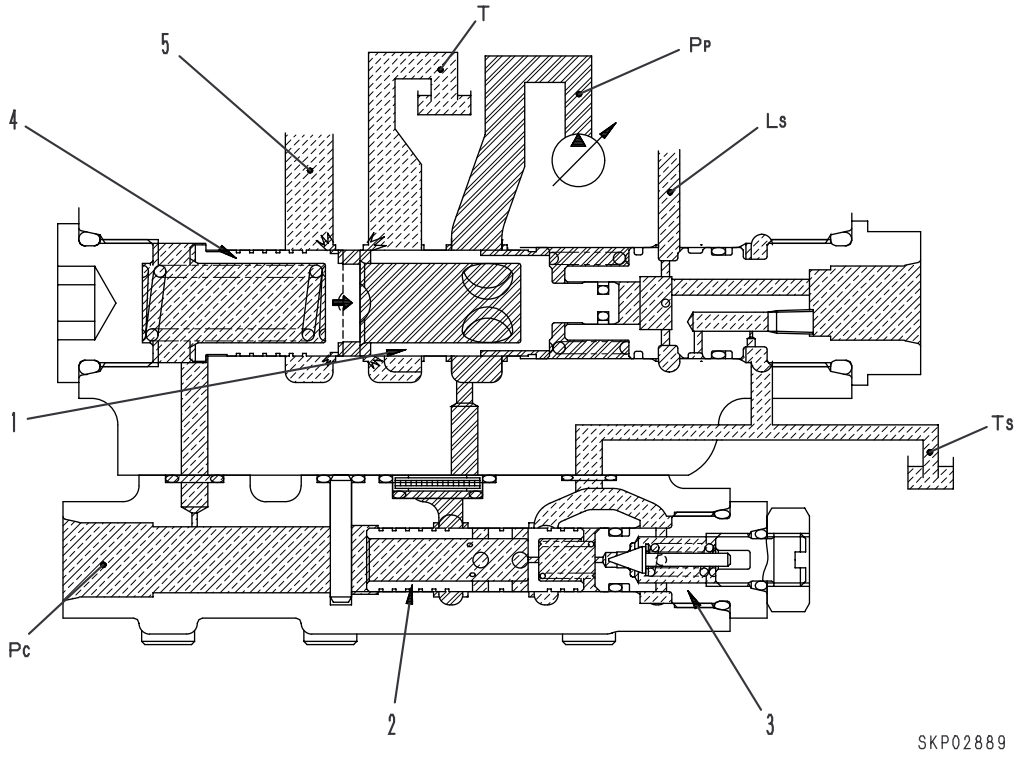
- Unload spool (1) moves and the pump discharge pressure **PP** is set to 2.9 MPa {30 kg/cm²}.
  (For details, see the section on the unload valve.)
- Pump discharge pressure **PP** is reduced to 2.9 MPa {30 kg/cm²} by self-pressure reducing spool (2) and self-pressure reducing pilot relief valve (3). The basic pressure is supplied from port **PC** to the **PPC** valve.



OPERATION

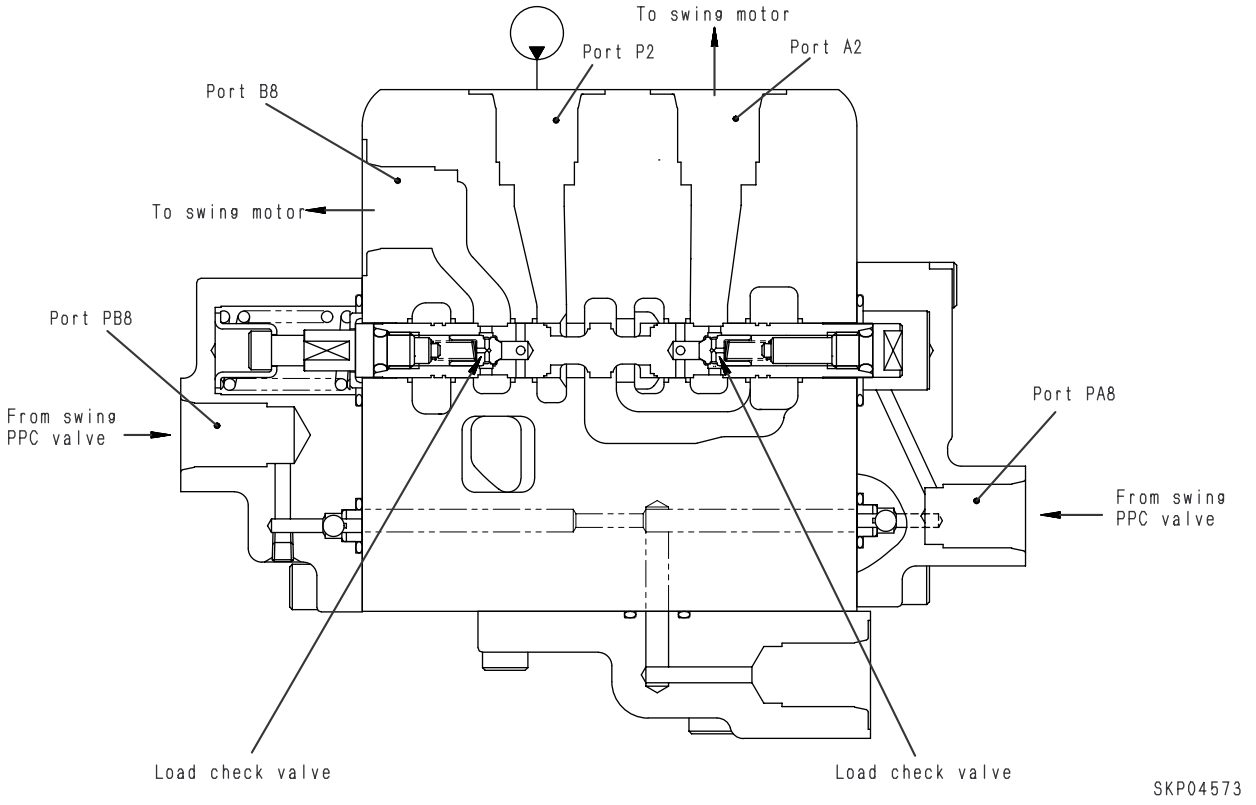
When control valve is operated

- Unload spool (1) moves to the left in the direction of the arrow, and pump discharge pressure **PP** becomes higher than the pressure of actuator circuit (5) by the amount of the LS differential pressure.
  (For details, see the section on the unload valve.)
- If pump discharge pressure **PP** goes above 2.9 MPa {30 kg/cm^2}, pump discharge pressure **PP** is reduced to 2.9 MPa {30 kg/cm^2} by self-pressure reducing spool (2) and self-pressure reducing pilot relief valve (3). The basic pressure is supplied from port **PC** to the **PPC** valve.
- When this happens, self-pressure reducing sequence valve (4) remains open.



- When pump discharge pressure **PP** is less than 2.9 MPa {30 kg/cm²}, self-pressure reducing sequence valve (4) moves to the right in the direction of the arrow, so the size of the opening between **PP** and actuator circuit (5) becomes smaller.
  As a result, a difference in pressure is generated by **PP** and actuator circuit (5), **PP** is raised to above 2.9 MPa {30 kg/cm²}, and pump discharge pressure **PP** is reduced to 2.9 MPa {30 kg/cm²} by self-pressure reducing spool (2) and self-pressure reducing pilot relief valve (3). The basic pressure is supplied from port **PC** to the PPC valve.

10) Swing valve



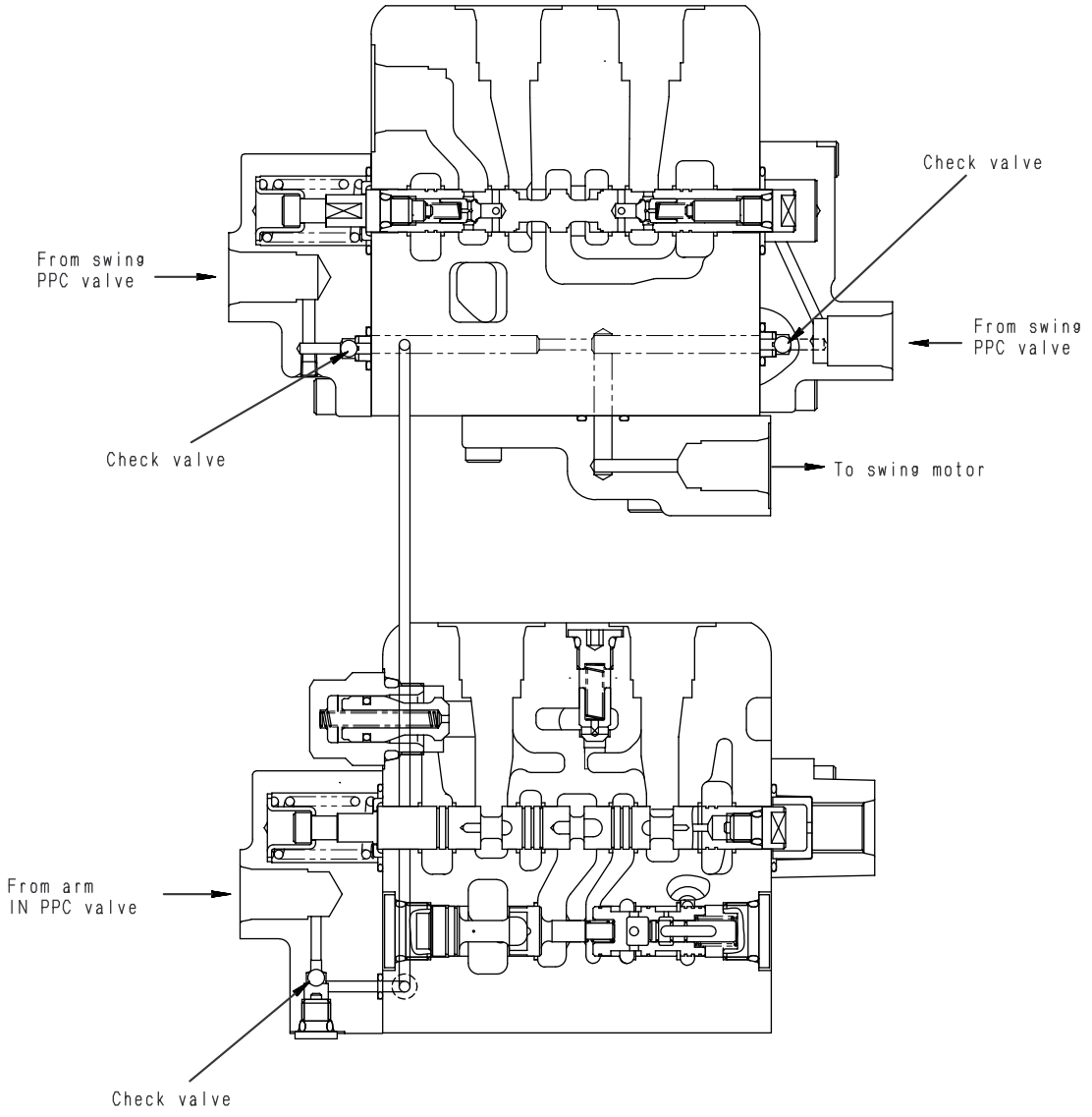
FUNCTION
The swing section is the open center valve of the fixed pump.

OPERATION
- When the pressure at port **PB8** is increased from the PPC valve, the spool moves to the right and oil flows to port **B8**.
- When the pressure at port **PA8** is increased from the PPC valve, the spool moves to the left and oil flows to port **A8**.
- There is one port **A** and **B** each inside the spools of the load check valves.

11) Swing holding brake cancel system

FUNCTION

This takes the swing PPC pressure and arm IN PPC pressure as a signal and releases the swing motor shaft brake.

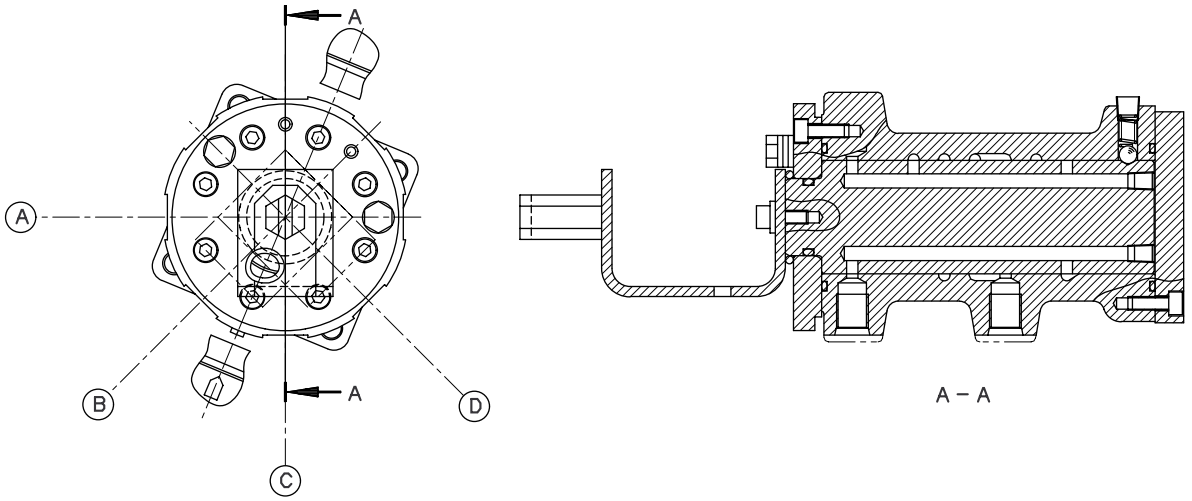


SKP04574

OPERATION

- The left and right swing PPC pressure and arm IN PPC pressure are each output to port **Br** through the check valve inside the spring case. (The highest pressure is output to port **Br**.)
- The arm and swing are connected by a pilot passage inside the control valve.

MULTI-CONTROL VALVE



A. Kobelco pattern
B. Mitsubishi pattern
C. Komatsu pattern
D. JIS pattern

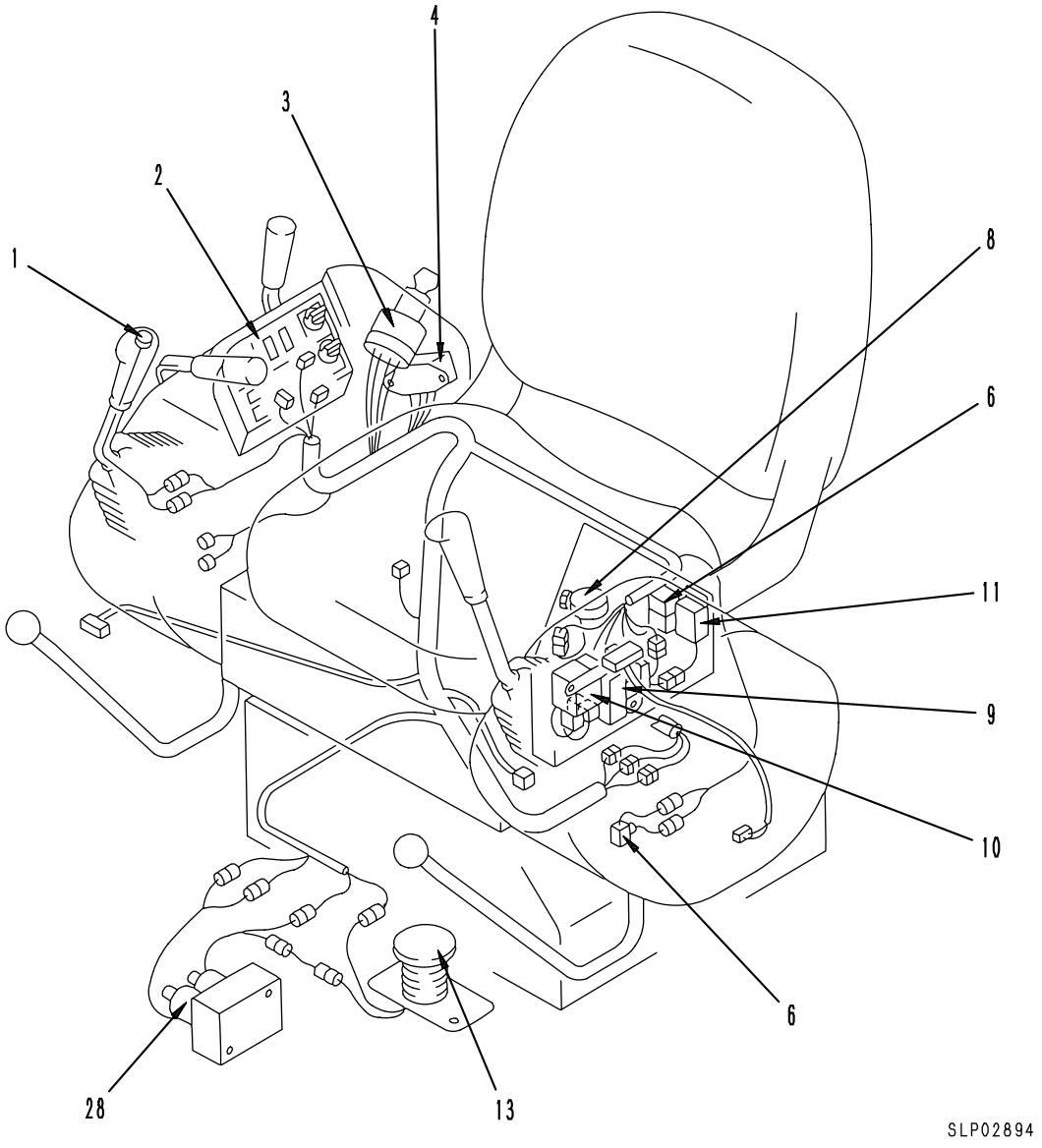
SKP02892

Pattern selection table (port names correspond to symbols in diagram)

JIS pattern	Right swing	H	I	PPC left valve, front
	Left swing	G	J	PPC left valve, rear
	Arm IN	F	L	PPC left valve, right
	Arm OUT	E	K	PPC left valve, left
	Bucket DUMP	D	P	PPC right valve, right
	Bucket CURL	C	O	PPC right valve, left
	Boom RAISE	B	N	PPC right valve, rear
	Boom LOWER	A	M	PPC right valve, front
Mitsubishi pattern	Right swing	H	I	PPC left valve, front
	Left swing	G	J	PPC left valve, rear
	Arm IN	F	L	PPC left valve, right
	Arm OUT	E	K	PPC left valve, left
	Bucket DUMP	D	P	PPC right valve, right
	Bucket CURL	C	O	PPC right valve, left
	Boom RAISE	B	N	PPC right valve, rear
	Boom LOWER	A	M	PPC right valve, front
Komatsu pattern	Right swing	H	I	PPC left valve, front
	Left swing	G	J	PPC left valve, rear
	Arm IN	F	L	PPC left valve, right
	Arm OUT	E	K	PPC left valve, left
	Bucket DUMP	D	P	PPC right valve, right
	Bucket CURL	C	O	PPC right valve, left
	Boom RAISE	B	N	PPC right valve, rear
	Boom LOWER	A	M	PPC right valve, front
Kobelco pattern	Right swing	H	I	PPC left valve, front
	Left swing	G	J	PPC left valve, rear
	Arm IN	F	L	PPC left valve, right
	Arm OUT	E	K	PPC left valve, left
	Bucket DUMP	D	P	PPC right valve, right
	Bucket CURL	C	O	PPC right valve, left
	Boom RAISE	B	N	PPC right valve, rear
	Boom LOWER	A	M	PPC right valve, front

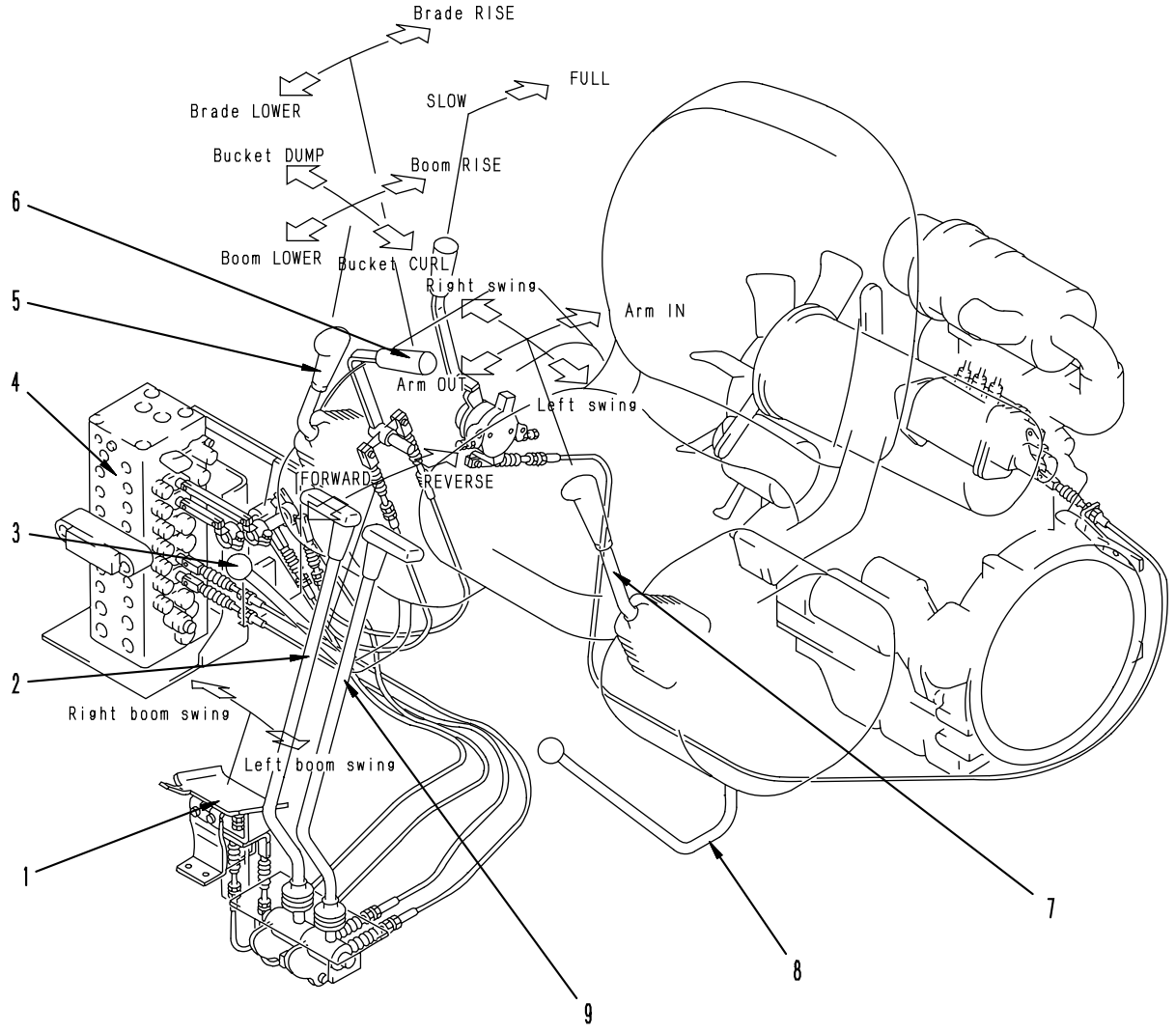
SKP04594

ELECTRICAL WIRING DIAGRAM



1. Horn switch
2. Monitor panel
3. Starting switch
4. Fuse box
5. Alarm buzzer
6. PPC lock relay
7. Engine stop timer
8. Safety relay
9. Engine stop motor relay
10. PPC lock switch
11. Travel boost pedal
12. PPC lock solenoid valve

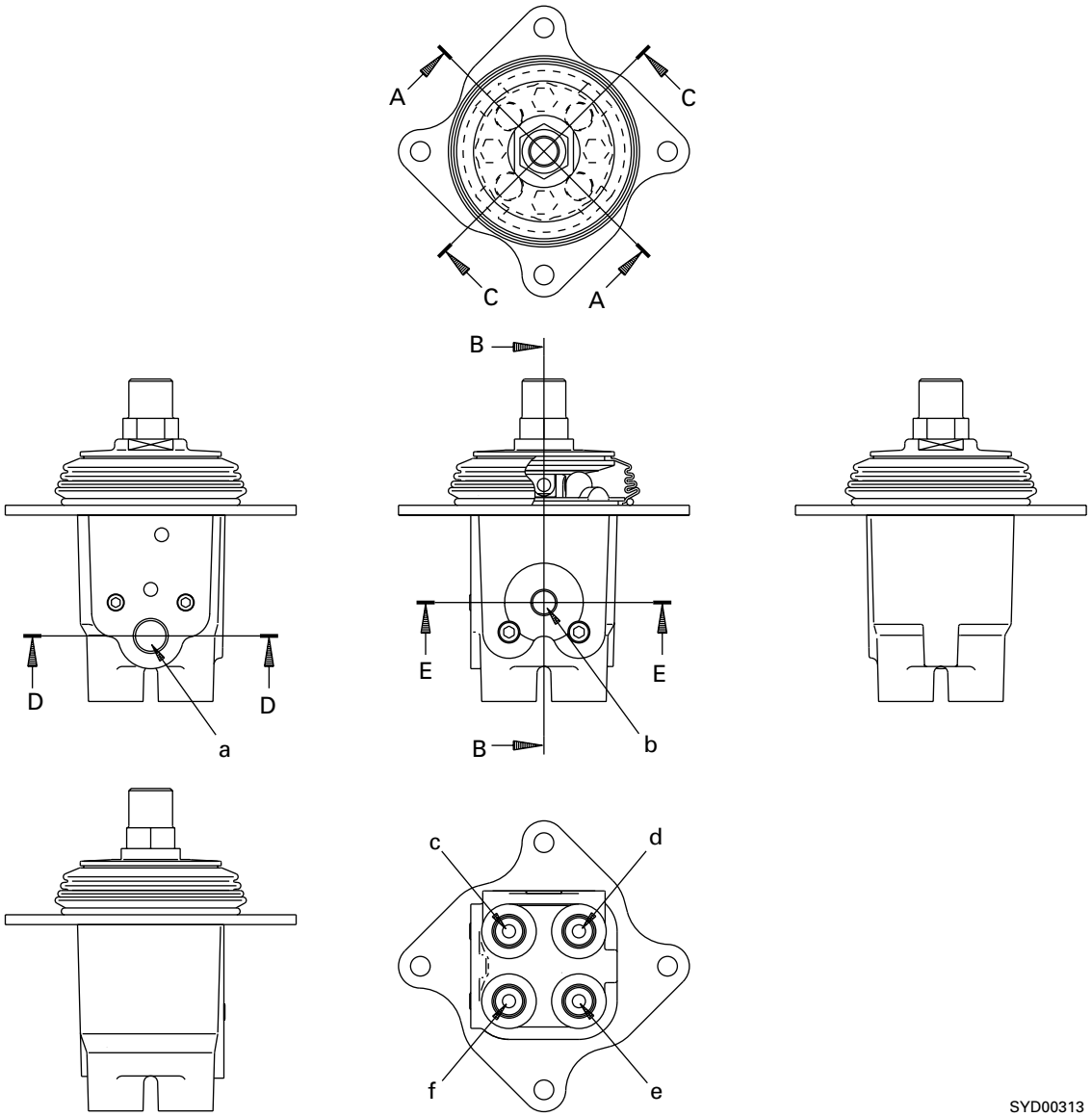
VALVE CONTROL



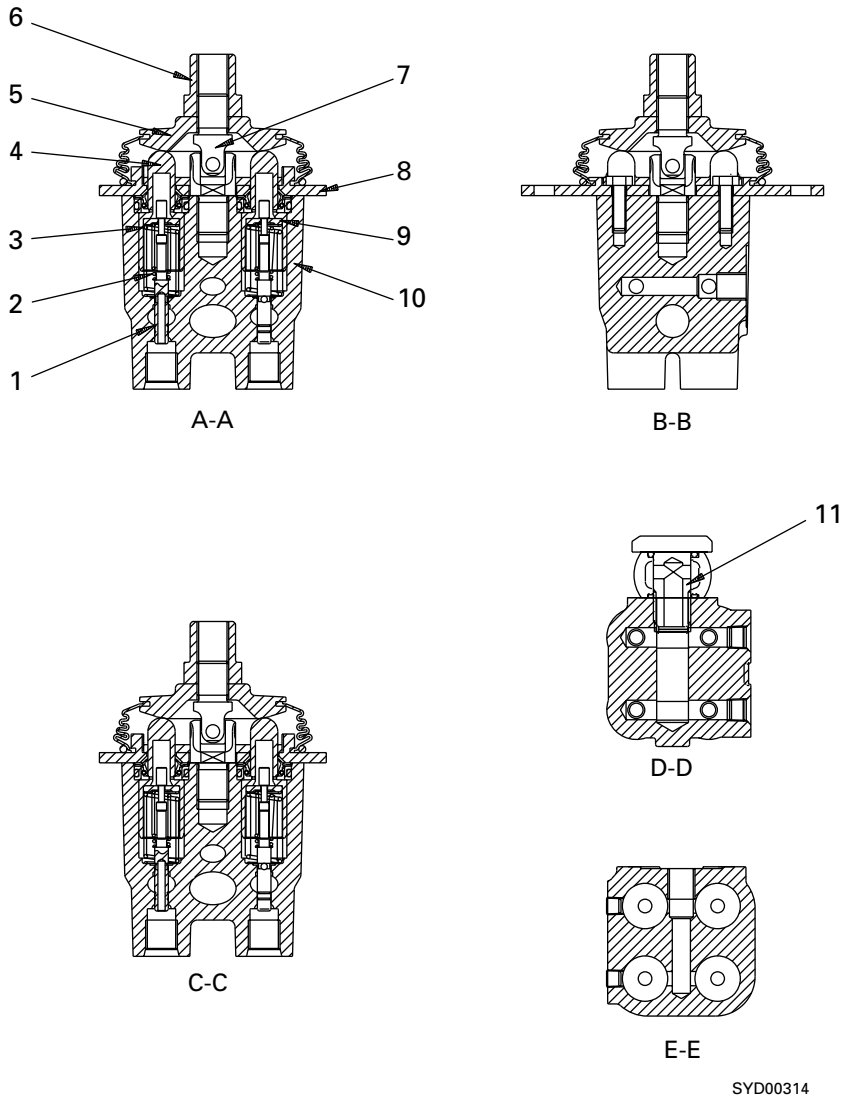
SLP04575

1. Boom swing pedal
2. R.H. travel lever
3. R.H. work equipment lock lever
4. 9-spool control valve
5. R.H. PPC valve
6. Blade control lever
7. L.H. work equipment lever (for arm, swing)
8. L.H. work equipment lock lever
9. L.H. travel lever

WORK EQUIPMENT, SWING PPC VALVE



a. Port **P** (from main valve PPPC port)
b. Port **T** (to tank)
c. Port **P2** (L.H.: Arm IN / R.H.: Boom RAISE)
d. Port **P4** (L.H.: Left swing / R.H.: Bucket DUMP)
e. Port **P1** (L.H.: Arm OUT / R.H.: Boom LOWER)
f. Port **P3** (L.H.: Right swing / R.H.: Bucket CURL)

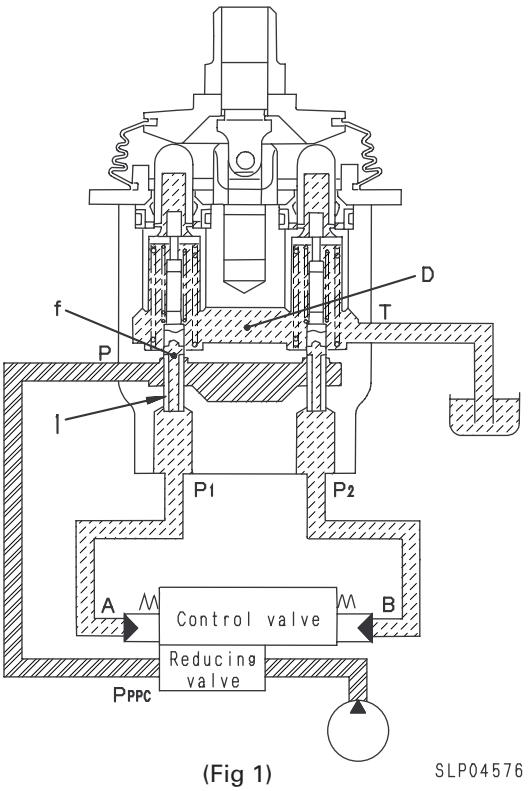


1. Spool
2. Metering spring
3. Centering spring
4. Piston
5. Disc
6. Nut (for connecting lever)
7. Joint
8. Plate
9. Retainer
10. Body
11. Filter

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 control hole **f** in spool (1). (Fig. 1)



(Fig 1) SLP04576

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 from the main valve port **PPPC** is sent from port **1** through fine control hole **f** to port **PA**.

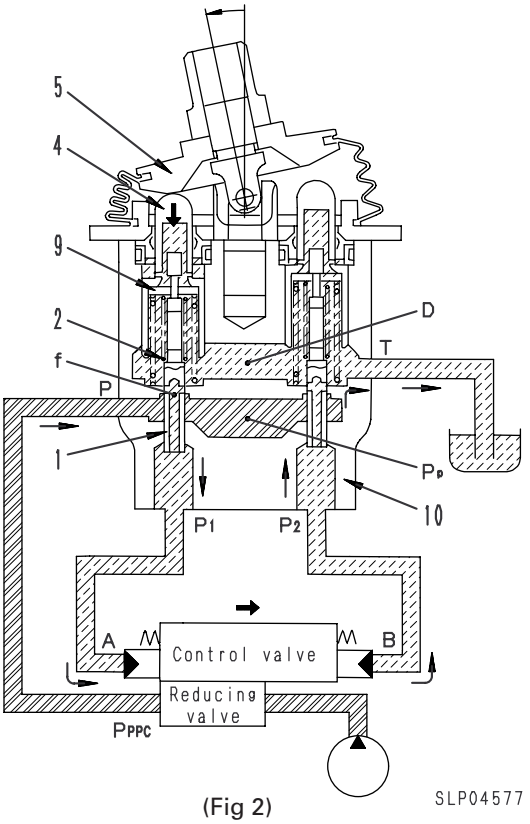
When the pressure at port **P1** rises, spool (1) is pushed back. Fine control hole f is shut off from pump pressure chamber **PP**. At almost the same time, it is connected to drain chamber **D**, so the pressure at port **P1** escapes.

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** (the same as the pressure at port **P1**) and the force of the return spring of the control valve spool are balanced. (Fig. 2)



(Fig 2) SLP04577

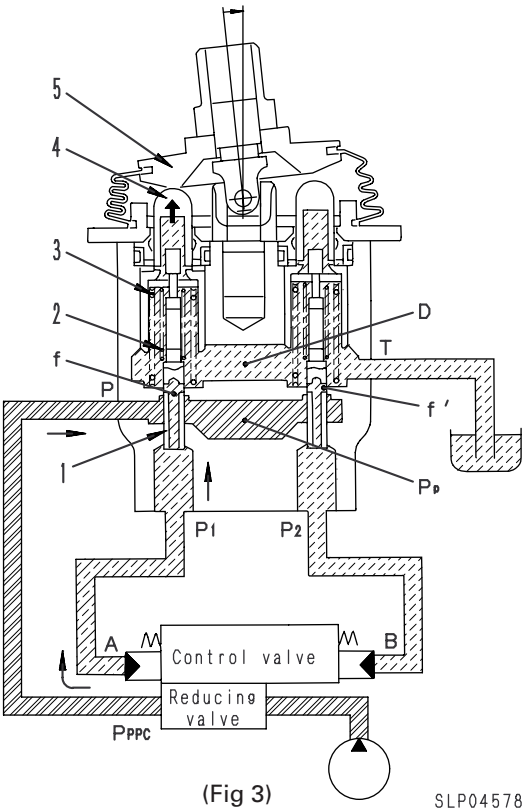
3) Fine control (control lever returned)

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 down 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 it with oil. (Fig. 3)

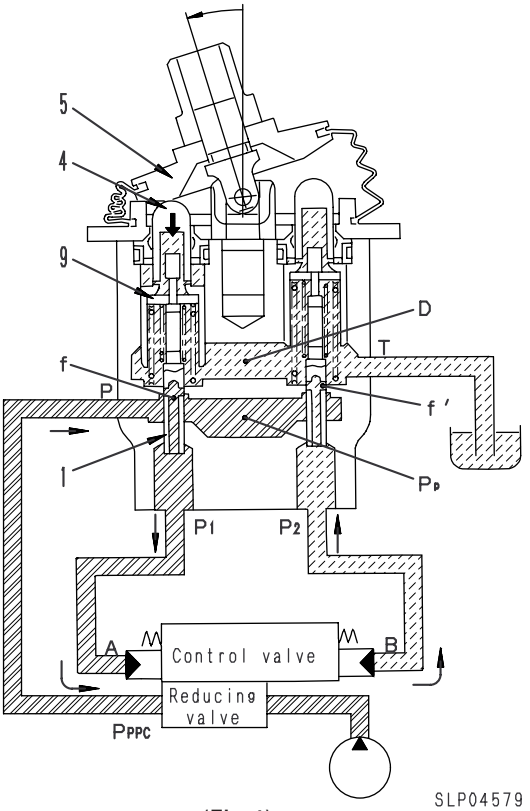


(Fig 3) SLP04578

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 main valve port **PPPC** passes through fine control hole **f** and flows from port **P1** to chamber **A** 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)

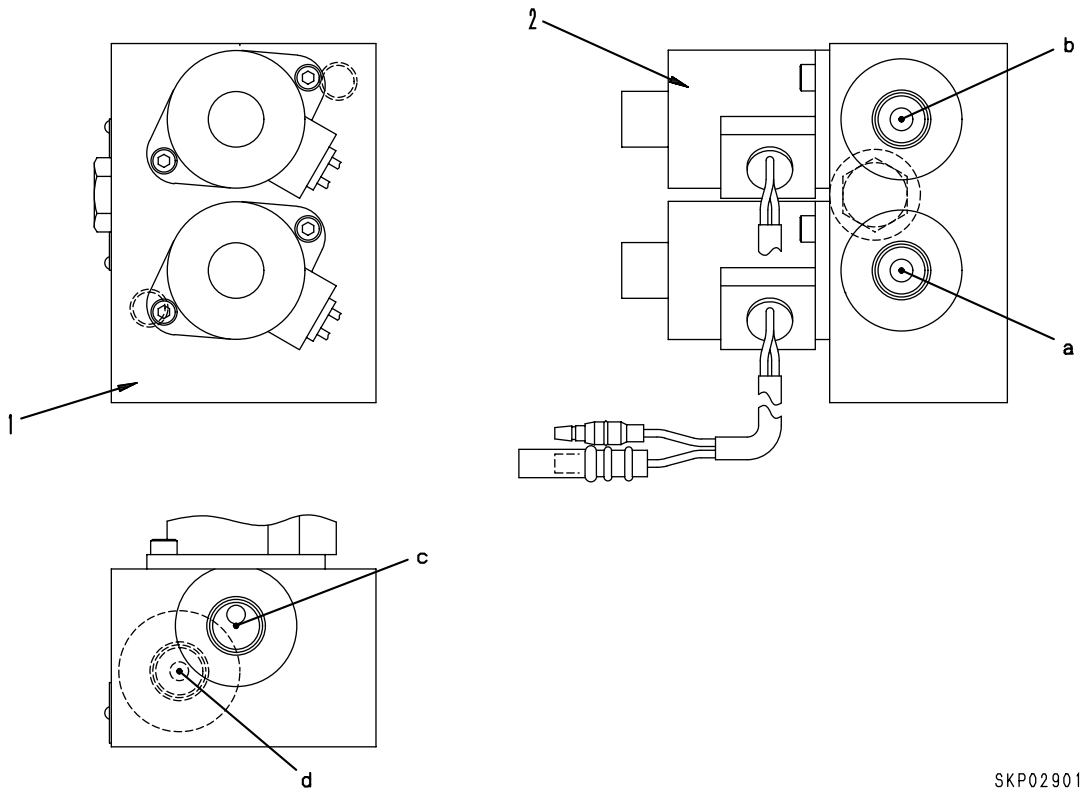


SLP04579

(Fig 4)

SOLENOID VALVE

FOR TRAVEL 2-SPEED SELECTOR, PPC LOCK



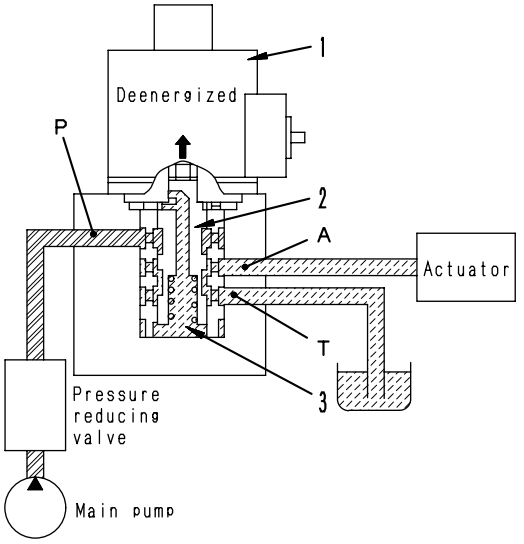
1. Valve body
2. Solenoid

a. Port **A** (to PPC valve)
b. Port **B** (to travel 2-speed selector valve)
c. Port **P** (from pump)
d. Port **T** (to hydraulic tank)

OPERATION

When solenoid is deenergized

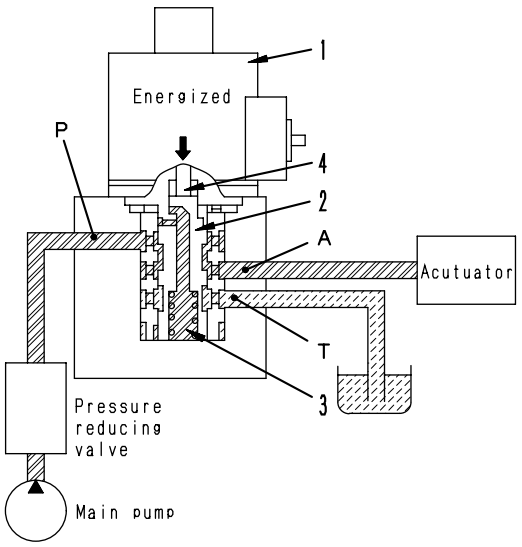
- The signal current from the PPC pressure lock switch or the travel 2-speed selector valve does not flow from the controller, so solenoid (1) is deenergized.
- For this reason, spool (2) is pushed to the right in the direction of the arrow by spring (3).
- As a result, port **P** closes and the pilot pressure oil does not flow to the actuator.
  At the same time, the oil from the actuator flows from port **A** to port **T**, and is then drained to the tank.



SKP04580

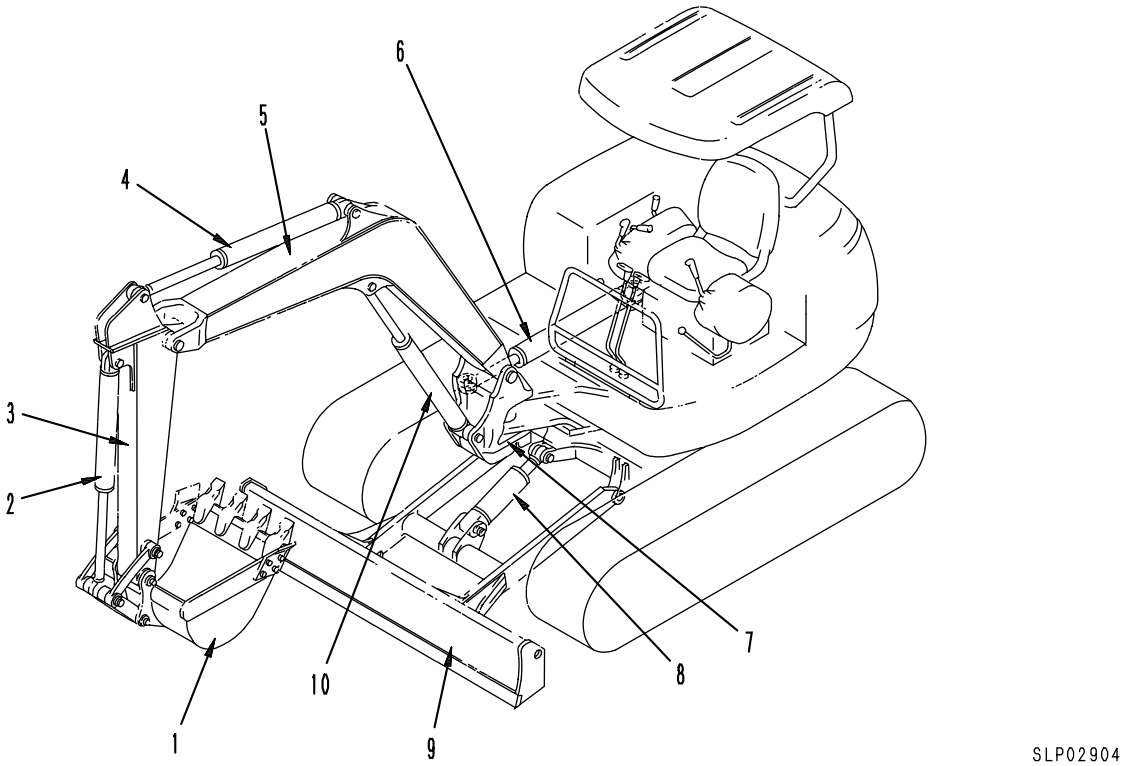
When solenoid is energized

- When the signal current flows from the PPC pressure lock switch or the travel 2-speed selector valve to solenoid (1), solenoid (1) is energized.
- For this reason, spool (2) is pushed down in the direction of the arrow by push pin (4).
- As a result, the pilot pressure oil flows from port **P** through the inside of spool (2) to port **A**, and then flows to the actuator.
  At the same time, port **T** is closed, and this stops the oil from flowing to the tank.



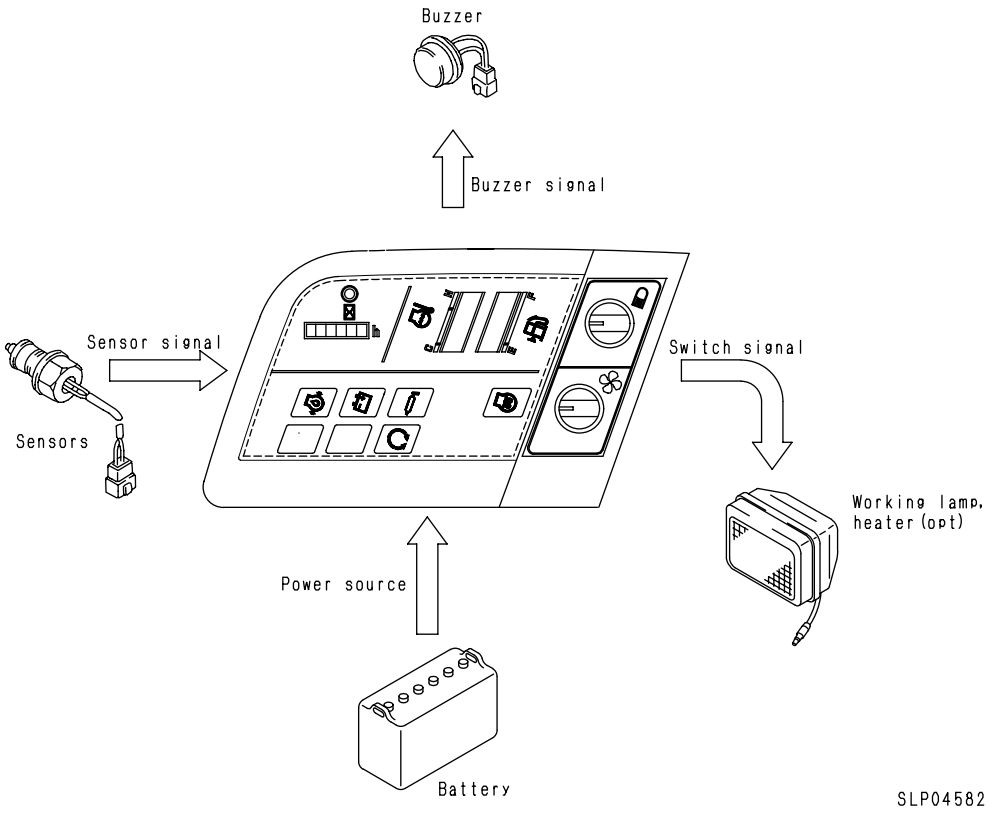
SKP04581

WORK EQUIPMENT



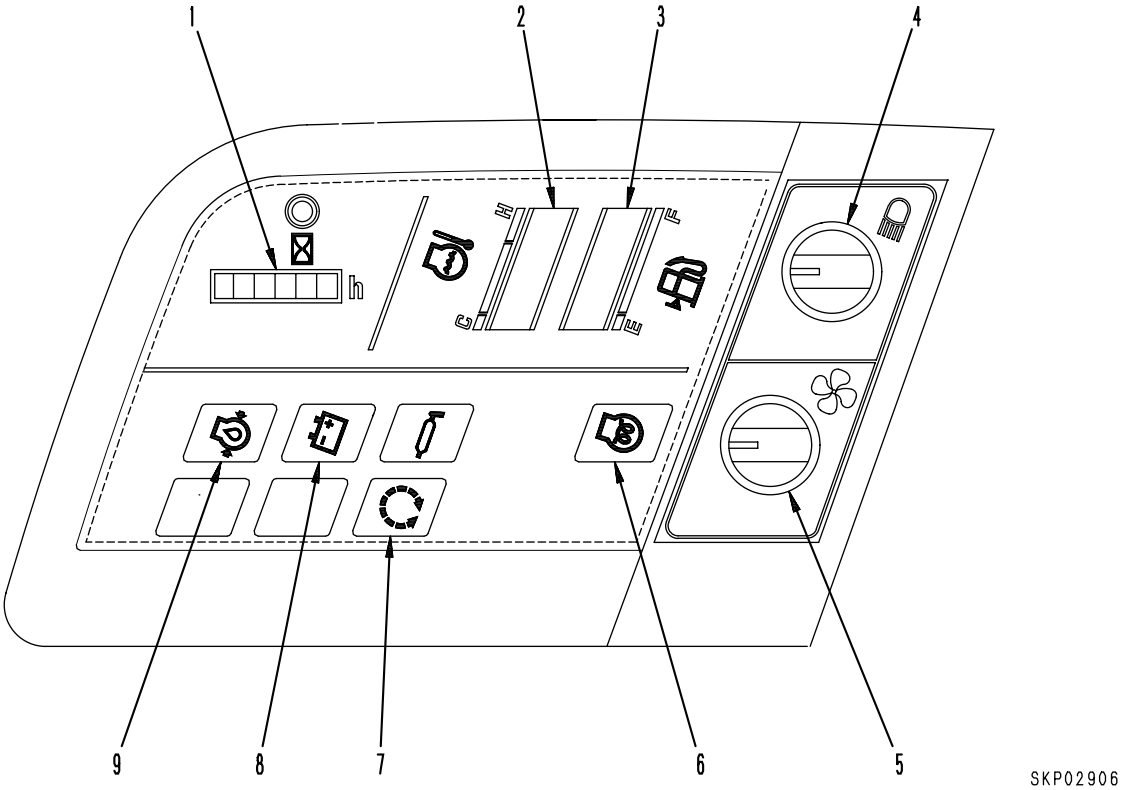
1. Bucket
2. Bucket cylinder
3. Arm
4. Arm cylinder
5. Boom
6. Boom swing cylinder
7. Boom swing bracket
8. Blade cylinder
9. Blade
10. Boom cylinder

MACHINE MONITOR SYSTEM



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 swiftly, 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.
- In addition, the monitor panel has switches for various electrical components.



1. Service meter
2. Coolant temperature
3. Fuel gauge
4. Light switch
5. Heater switch (for cab specification machine)
6. Preheating
7. Deceleration (opt)
8. Charge level
9. Engine oil pressure

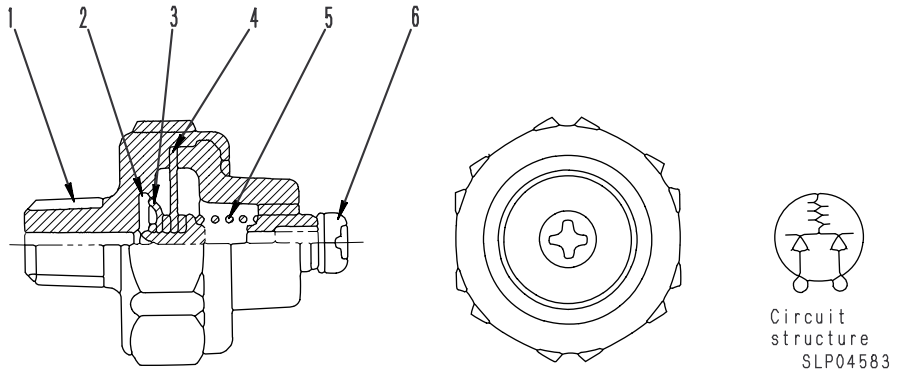
Display category	Symbol	Display item	Display range	Display method
Caution	SAP00523	Deceleration (opt)		
	SAP00520	Engine oil pressure	Below 0.05 MPa {0.5 kg/cm²}	Displays when starting switch is turned ON Display is OFF when normal, and ON when abnormal [If an abnormality occurs when the engine is running, the buzzer sounds.
	SAP00523	Charge level	When charging is defective	
Gauges	SAP00527	Coolant temperature	C H 55 67 80 97 102 105 ℃ SKP02907	One segment lights up to show temperature [When temperature reaches top level (above 105°C), segment flashes and buzzer sounds.
	SAP00528	Fuel level	E F SKP02908	All segments light up below fuel level [When fuel reaches bottom level (empty), segment flashes
Pilot	SAP00526	Preheating	During preheating	Lights up (18 seconds) when starting switch is at HEAT, and then goes out to show that the preheating is completed.
Service meter	SKP02909	Service meter	Counts time when engine is running	0 – 99999.9 h

2. SENSOR

- The signals from the sensor are input directly to the panel.
  One end of the contact type sensors is always connected to the chassis ground.

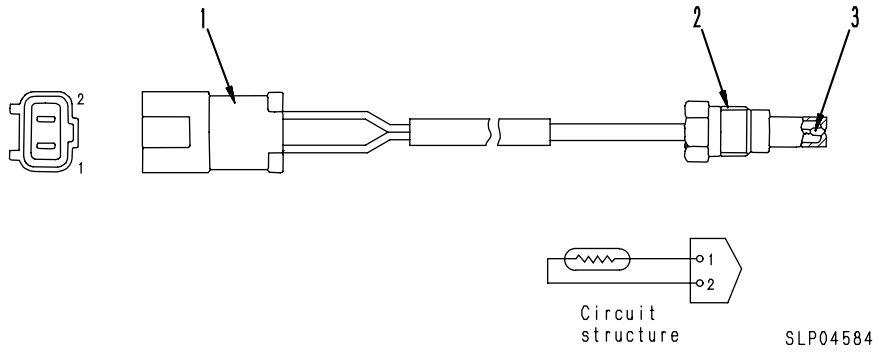
Display category	Function of sensor	Type of sensor	When normal	When abnormal
Caution	Engine oil pressure	Contact	OFF (open)	ON (closed)
Gauge	Coolant temperature	Resistance	—	—
Fuel level	Fuel level	Resistance	—	—

1) Engine oil pressure sensor



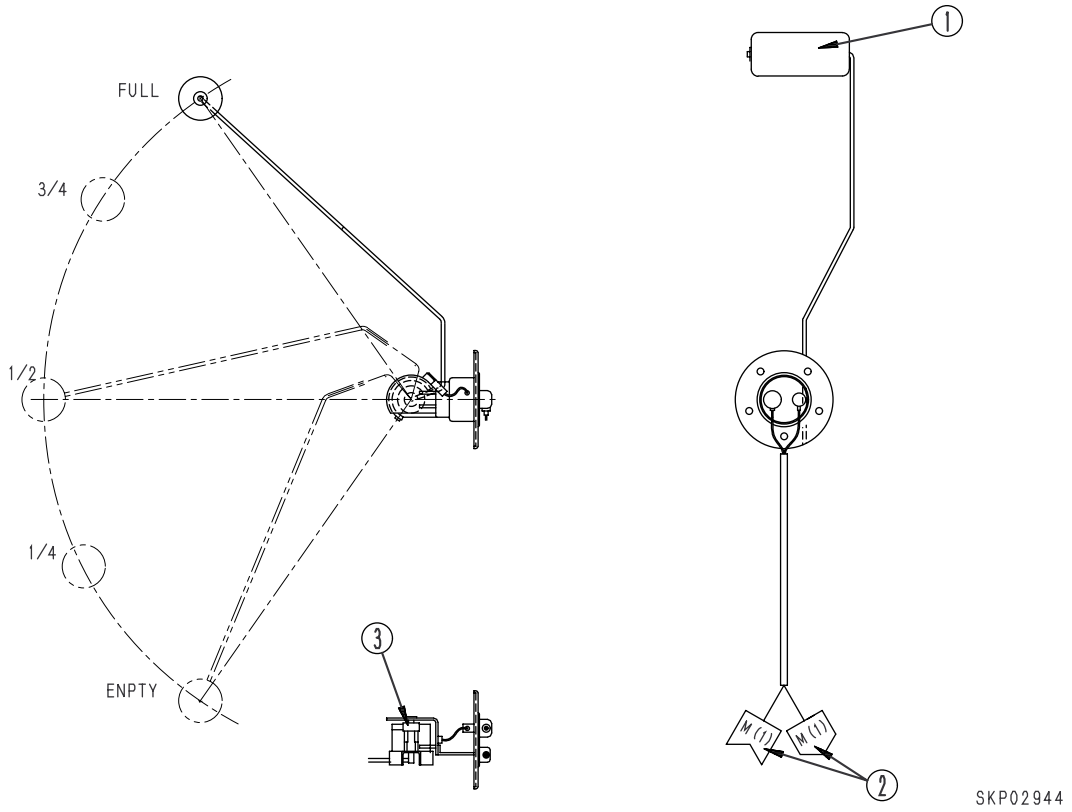
1. Plug
2. Contact ring
3. Contact
4. Diaphragm
5. Spring
6. Terminal

2) Coolant temperature sensor



1. Connector
2. Plug
3. Thermistor

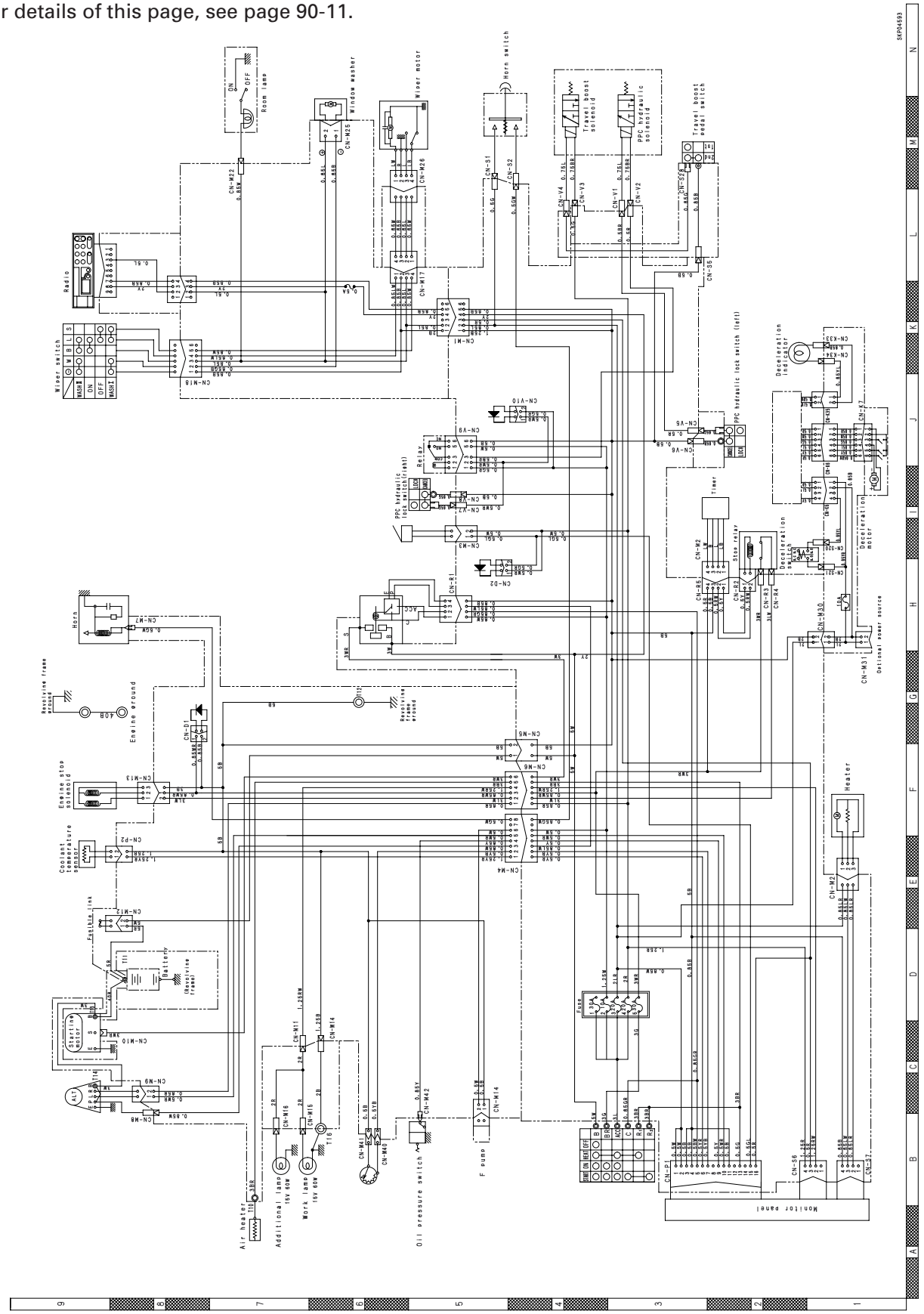
3) Fuel level sensor



1. Float
2. Connector
3. Variable resistance

ELECTRICAL CIRCUIT DIAGRAM

★ For details of this page, see page 90-11.

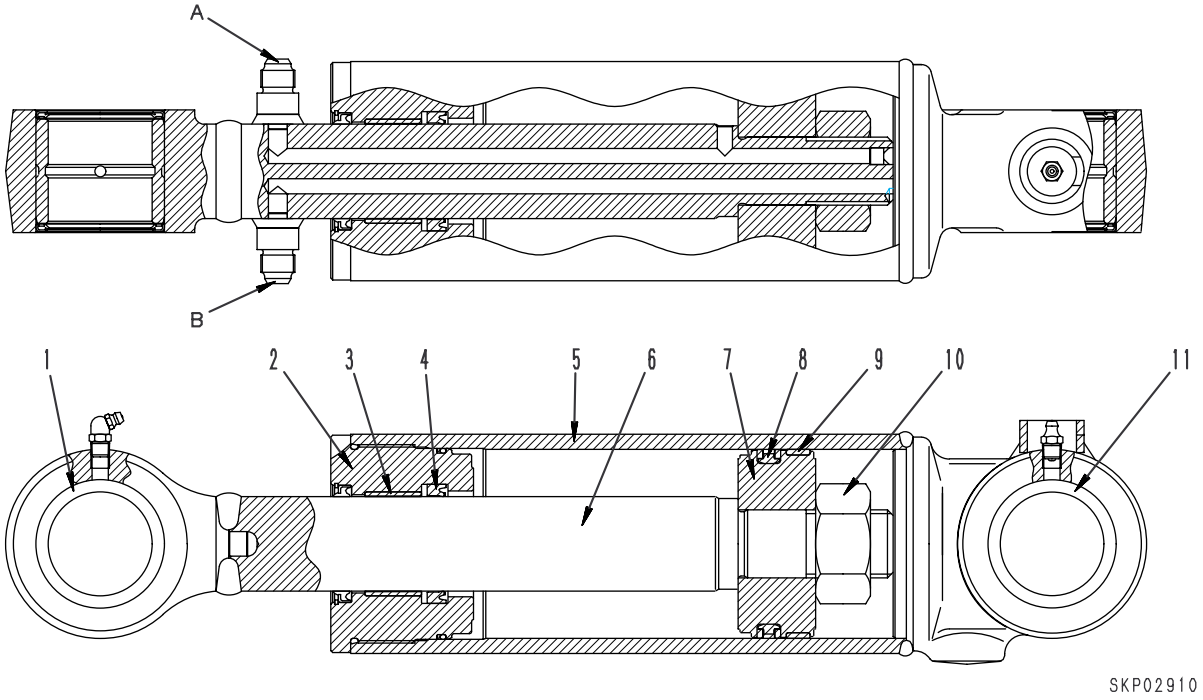


HYDRAULIC CYLINDER

BLADE CYLINDER

- Piston rod type (built into oil passage)

★ The diagram shows the cylinder on the PC40, 45R.



1. Head bushing
2. Cylinder head
3. Wear ring
4. Rod packing
5. Cylinder
6. Piston rod
7. Piston
8. Piston ring
9. Wear ring
10. Piston nut
11. Bottom bushing

A. Bottom port
B. Head port

SPECIFICATIONS

Cylinder inside diameter		Cylinder inside diamete	Piston rod diameter	Stroke	Distance between pins Max. – Min.	Width across flats of piston nut
Boom	PC30R	75	45	540	910 – 1450	46
	PC35R	80	45	540	910 – 1450	46
	PC40, 45R	90	50	665	1035 – 1700	55
Arm	PC30R	75	40	470	785 – 1255	46
	PC35R	75	45	595	915 – 1510	50
	PC40R	80	50	650	981.5 – 1631.5	55
	PC45R	85	50	695	1030 – 1725	55
Bucket	PC30R	60	40	490	780 – 1270	41
	PC35R	65	40	490	780 – 1270	46
	PC40R	70	45	580	900 – 1480	46
	PC45R	75	50	580	900 – 1480	50
Boom swing	PC30, 35R	85	45	635	940 – 1575	46
	PC40R	90	50	635	975 – 1610	55
	PC45R	95	50	635	975 – 1610	55
Blade	PC30, 35R	90	45	120	470 – 590	50
	PC40, 45R	100	50	140	503 – 643	55

20 TESTING AND ADJUSTING

STANDARD VALUE TABLE

Standard value table for engine related parts 20- 2
Standard value table for chassis related parts 20- 4
Standard value table for electrical parts .. 20- 20

TESTING AND ADJUSTING 20- 101

TROUBLESHOOTING 20- 201

★ 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, inset the safety pins, and use blocks to prevent the machine from moving.

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

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

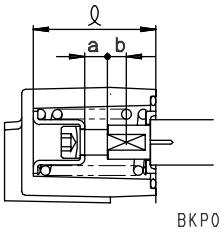
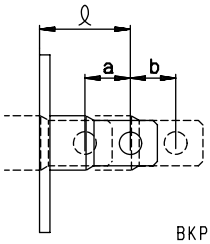
⚠ Be careful not to get caught in the fan, fan belt or other rotating parts.

STANDARD VALUE TABLE FOR ENGINE RELATED PARTS

Applicable model			PC30R, 35R-8	
Engine			3D84E-3F	
Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Engine speed	High idling	rpm	2,650 ± 50	—
	Low idling	rpm	1,100 ± 50	—
	Rated speed	rpm	2,500	—
Exhaust gas color	At sudden acceleration	Bosch index	Max. 3.5	5.5
	At high idling	Bosch index	Max. 1.0	2.0
Valve clearance (Cold)	Intake valve	mm	0.20	—
	Exhaust valve	mm	0.20	—
Compression pressure	Oil temperature: 40 – 60°C	MPa {kg/cm^2}	2.94 {30}	2.55 {26}
(SAE30 oil)	(engine speed)	rpm	(250)	(250)
Blow-by pressure (SAE30 oil)	(Water temperature: Operating range) At high idling	Pa {mmH$_2$O}	— {—}	— {—}
Oil pressure (SAE30 oil)	(Water temperature: Operating range)			
	At high idling	MPa {kg/cm^2}	0.3 – 3.4 {3.0 – 3.5}	Min. 0.2 {Min. 2.0}
	At low idling (SAE30)	MPa {kg/cm^2}	Min. 0.15 {Min. 1.5}	Min. 0.1 {Min. 1.0}
	At low idling (SAE10W)	MPa {kg/cm^2}	Min. 0.15 {Min. 1.5}	Min. 0.1 {Min. 1.0}
Oil temperature	Whole speed range (inside oil pan)	°C	Max. 120	Max. 120
Fuel injection timing	Before compression top dead center	deg.	14 ± 1	—
Fan belt tension	Deflection when pressed with finger force of approx. 58.8 N {6 kg}	mm	5 – 6	—

PC40R, 45R-8					
4D84E-3D					
Standard value for new machine	Service limit value				
2,650 ± 50 1,100 ± 50 2,500	— — —				
Max. 3.5 Max. 1.5	5.5 2.5				
0.20 0.20	— —				
2.94 {30} (250)	2.55 {26} (250)				
— {—}	— {—}				
0.3 – 3.4 {3.0 – 3.5} Min. 0.15 {Min. 1.5} Min. 0.15 {Min. 1.5}	Min. 0.2 {Min. 2.0} Min. 0.1 {Min. 1.0} Min. 0.1 {Min. 1.0}				
Max. 120	Max. 120				
14 ± 1	—				
5 – 6	—				

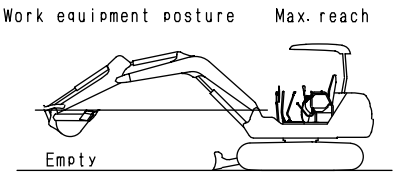
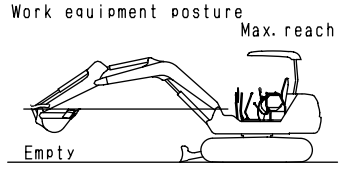
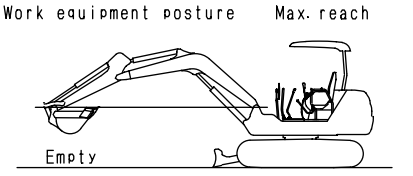
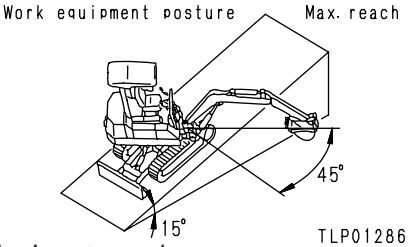
STANDARD VALUE TABLE FOR CHASSIS RELATED PARTS

Applicable model					PC30R-8					
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 oil pressure: Within operating range • Engine water temperature: Within operating range • 1-pump relief: Bucket relief • 2-pump relief: Bucket + swing relief		rpm	Min. 2,060			Min. 2,060		
	At 2-pump relief				Min. 2,060			Min. 2,060		
Spool stroke					ℓ	a	b	ℓ	a	b
	Boom control valve			mm	30	6	6	30	6	6
	Arm control valve									
	Bucket control valve									
	Swing control valve									
	Breaker control valve									
	Boom swing control valve				20	6	6	20	6	6
	Blade control valve									
	L.H. travel control valve									
	R.H. travel control valve									
Travel of control levers stroke	Boom control lever	• Center of lever knob • Tip of pedal • Read max. value to end of travel • Engine stopped	N → RAISE, LOWER	mm	100 ± 10			100 ± 10		
	Arm control lever		N → IN, OUT		100 ± 10			100 ± 10		
	Bucket control lever		N → CURL, DUMP		100 ± 10			100 ± 10		
	Swing control lever		N → Left, right swing		100 ± 10			100 ± 10		
	Boom swing control lever		N → Left, right boom swing		25 ± 5			25 ± 5		
	Blade control lever		N → RAISE, LOWER		50 ± 5			50 ± 5		
	Travel control lever		N → FORWARD, REVERSE (left, right)		85 ± 10			85 ± 10		
	Fuel control lever		Min. ⟷ Max.		180 ± 20			180 ± 20		
	Play of control lever		Work equipment, swing		Max. 5			Max. 5		
			Travel		Max. 35			Max. 35		

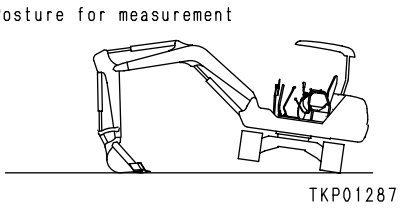
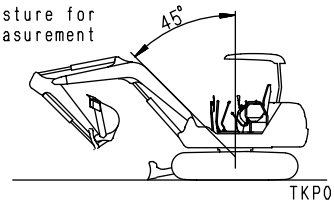
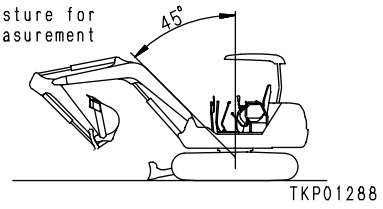
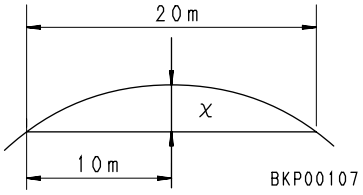
PC35R-8						PC40R-8						PC45R-8					
Standard value for new machine			Service limit value			Standard value for new machine			Service limit value			Standard value for new machine			Service limit value		
Min. 2,060			Min. 2,060			Min. 2,060			Min. 2,060			Min. 2,060			Min. 2,060		
Min. 2,060			Min. 2,060			Min. 2,060			Min. 2,060			Min. 2,060			Min. 2,060		
ℓ	a	b	ℓ	a	b	ℓ	a	b	ℓ	a	b	ℓ	a	b	ℓ	a	b
36	6	6	30	6	6	30	6	6	30	6	6	30	6	6	30	6	6
20	6	6	20	6	6	20	6	6	20	6	6	20	6	6	20	6	6
100 ± 10			100 ± 10			100 ± 10			100 ± 10			100 ± 10			100 ± 10		
100 ± 10			100 ± 10			100 ± 10			100 ± 10			100 ± 10			100 ± 10		
100 ± 10			100 ± 10			100 ± 10			100 ± 10			100 ± 10			100 ± 10		
100 ± 10			100 ± 10			100 ± 10			100 ± 10			100 ± 10			100 ± 10		
25 ± 5			25 ± 5			25 ± 5			25 ± 5			25 ± 5			25 ± 5		
50 ± 5			50 ± 5			50 ± 5			50 ± 5			50 ± 5			50 ± 5		
85 ± 10			85 ± 10			85 ± 10			85 ± 10			85 ± 10			85 ± 10		
180 ± 20			180 ± 20			180 ± 20			180 ± 20			180 ± 20			180 ± 20		
Max. 5			Max. 5			Max. 5			Max. 5			Max. 5			Max. 5		
Max. 35			Max. 35			Max. 35			Max. 35			Max. 35			Max. 35		

Applicable model					PC30R-8	
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 • Oil temperature: 45 – 55°C • Fit push-pull scale to center of control lever knob to measure • Fit push-pull scale to tip of pedal to measure • Measure max. value to end of travel	N {kg}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}
	Arm control lever				15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}
	Bucket control lever				15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}
	Swing control lever				15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}
	Boom swing control lever				78.4 ± 9.8 {8.0 ±1.0}	78.4 ± 9.8 {8.0 ±1.0}
	Blade control lever				29.4 ± 3.92 {3.0 ± 0.4}	29.4 ± 3.92 {3.0 ± 0.4}
	Travel control lever				17.64 ± 3.92 {1.8 ± 0.4}	17.64 ± 3.92 {1.8 ± 0.4}
	Fuel control lever	Min. → Max.			29.4 ±14.7 {3.0 ± 1.5}	29.4 ±14.7 {3.0 ± 1.5}
		Max. → Min.			24.5 ±14.7 {2.5 ± 1.5}	24.5 ±14.7 {2.5 ± 1.5}
Hydraulic pressure	Unload pressure		• Oil temperature: 45 – 55°C • Engine at full throttle • All levers at neutral • Pump outlet port pressure	MPa {kg/cm²}	4.41 ± 0.49 {45 ± 5}	4.41 ± 0.49 {45 ± 5}
	Boom		• Oil temperature: 45 – 55°C • Engine at full throttle • Pump outlet port pressure • Relieve only circuit to be measured		2.45 $^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$}	2.45 $^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$}
	Arm				2.45 $^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$}	2.45 $^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$}
	Bucket				2.45 $^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$}	2.45 $^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$}
	Swing				15.19 $^{+1.47}_{-0.49}$ {155 $^{+15}_{-5}$}	15.19 $^{+1.47}_{-0.49}$ {155 $^{+15}_{-5}$}
	Boom swing				2.45 $^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$}	2.45 $^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$}
	Blade				2.45 $^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$}	2.45 $^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$}
	Travel				2.45 $^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$}	2.45 $^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$}
	Control pump				2.94 $^{+0.49}_{-0.1}$ {30 $^{+5}_{-1}$}	2.94 $^{+0.49}_{-0.1}$ {30 $^{+5}_{-1}$}
	LS differential pressure		• Oil temperature: 45 – 55°C • Engine at full throttle ★ LS differential pressure = Pump outlet port pressure – LS pressure	All levers at hold	4.41 ± 0.49 {45 ± 5}	4.41 ± 0.49 {45 ± 5}
				Travel under no load, travel lever at half-way position	1.57 ± 0.1 {16 ± 1}	1.57 ± 0.1 {16 ± 1}

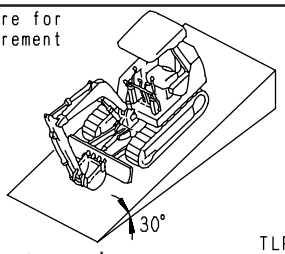
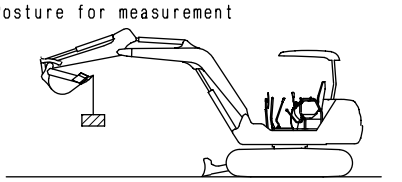
PC35R-8		PC40R-8		PC45R-8	
Standard value for new machine	Service limit value	Standard value for new machine	Service limit value	Standard value for new machine	Service limit value
15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}
15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}
15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}
15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}	15.68 ± 4.9 {1.6 ± 0.5}
78.4 ± 9.8 {8.0 ±1.0}	78.4 ± 9.8 {8.0 ±1.0}	78.4 ± 9.8 {8.0 ±1.0}	78.4 ± 9.8 {8.0 ±1.0}	78.4 ± 9.8 {8.0 ±1.0}	78.4 ± 9.8 {8.0 ±1.0}
29.4 ± 3.92 {3.0 ± 0.4}	29.4 ± 3.92 {3.0 ± 0.4}	29.4 ± 3.92 {3.0 ± 0.4}	29.4 ± 3.92 {3.0 ± 0.4}	29.4 ± 3.92 {3.0 ± 0.4}	29.4 ± 3.92 {3.0 ± 0.4}
17.64 ± 3.92 {1.8 ± 0.4}	17.64 ± 3.92 {1.8 ± 0.4}	17.64 ± 3.92 {1.8 ± 0.4}	17.64 ± 3.92 {1.8 ± 0.4}	17.64 ± 3.92 {1.8 ± 0.4}	17.64 ± 3.92 {1.8 ± 0.4}
29.4 ±14.7 {3.0 ± 1.5}	29.4 ±14.7 {3.0 ± 1.5}	29.4 ±14.7 {3.0 ± 1.5}	29.4 ±14.7 {3.0 ± 1.5}	29.4 ±14.7 {3.0 ± 1.5}	29.4 ±14.7 {3.0 ± 1.5}
24.5 ±14.7 {2.5 ± 1.5}	24.5 ±14.7 {2.5 ± 1.5}	24.5 ±14.7 {2.5 ± 1.5}	24.5 ±14.7 {2.5 ± 1.5}	24.5 ±14.7 {2.5 ± 1.5}	24.5 ±14.7 {2.5 ± 1.5}
4.41 ± 0.49 {45 ± 5}	4.41 ± 0.49 {45 ± 5}	4.41 ± 0.49 {45 ± 5}	4.41 ± 0.49 {45 ± 5}	4.41 ± 0.49 {45 ± 5}	4.41 ± 0.49 {45 ± 5}
$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }
$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }
$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }
$16.17^{+1.47}_{-0.49}$ {165 $^{+15}_{-5}$ }	$16.17^{+1.47}_{-0.49}$ {165 $^{+15}_{-5}$ }	$17.64^{+1.47}_{-0.49}$ {180 $^{+15}_{-5}$ }	$17.64^{+1.47}_{-0.49}$ {180 $^{+15}_{-5}$ }	$19.6^{+1.47}_{-0.49}$ {200 $^{+15}_{-5}$ }	$19.6^{+1.47}_{-0.49}$ {200 $^{+15}_{-5}$ }
$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }
$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }
$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }	$2.45^{+0.78}_{-0.2}$ {250 $^{+8}_{-2}$ }
$2.94^{+0.49}_{-0.1}$ {30 $^{+5}_{-1}$ }	$2.94^{+0.49}_{-0.1}$ {30 $^{+5}_{-1}$ }	$2.94^{+0.49}_{-0.1}$ {30 $^{+5}_{-1}$ }	$2.94^{+0.49}_{-0.1}$ {30 $^{+5}_{-1}$ }	$2.94^{+0.49}_{-0.1}$ {30 $^{+5}_{-1}$ }	$2.94^{+0.49}_{-0.1}$ {30 $^{+5}_{-1}$ }
4.41 ± 0.49 {45 ± 5}	4.41 ± 0.49 {45 ± 5}	4.41 ± 0.49 {45 ± 5}	4.41 ± 0.49 {45 ± 5}	4.41 ± 0.49 {45 ± 5}	4.41 ± 0.49 {45 ± 5}
1.57 ± 0.1 {16 ± 1}	1.57 ± 0.1 {16 ± 1}	1.57 ± 0.1 {16 ± 1}	1.57 ± 0.1 {16 ± 1}	1.57 ± 0.1 {16 ± 1}	1.57 ± 0.1 {16 ± 1}

Applicable model					PC30R-8	
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Swing	Overrun when stopping swing	 • Engine at full throttle • Hydraulic oil temperature: 45 – 55°C • Stop after swinging one turn and measure distance that swing circle moves ( ): Distance of movement on outside circumference of swing circle		deg. (mm)	Max. 40 (—)	50 (—)
	Time taken to start swing	 • Engine at full throttle • Hydraulic oil temperature: 45 – 55°C • Time taken to swing 90° and 180° from starting position	90°	Sec.	2.3 ± 0.3	2.9
			180°		—	—
	Time taken to swing	 • Engine at full throttle • Hydraulic oil temperature: 45 – 55°C • Swing one turn, then measure time taken to swing next 5 turns		Sec.	33 ± 3	38
	Hydraulic drift of swing	 • Engine stopped • Hydraulic oil temperature: 45 – 55°C • Bucket at rated load or fully loaded with soil • Set machine on 15° slope with upper structure at 45° to front. • Make counter marks on swing circle outer race and track frame. • Measure distance that counter marks move apart after 5 minutes.		mm (deg.)	Rated load: 145 kg 0 (0)	0 (0)
	Leakage from swing motor	• Engine at full throttle • Hydraulic oil temperature: 45 – 55°C • Relieve swing circuit.		cc/ mim	—	—

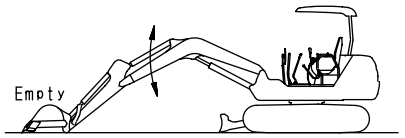
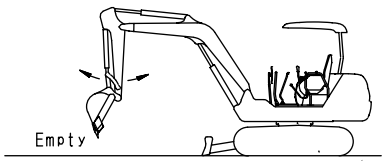
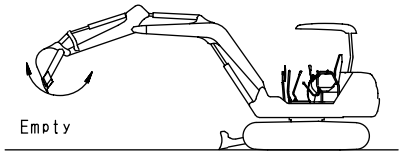
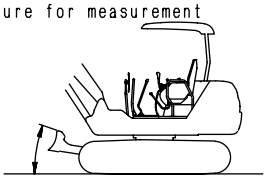
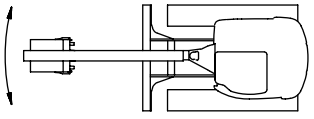
PC35R-8		PC40R-8		PC45R-8	
Standard value for new machine	Service limit value	Standard value for new machine	Service limit value	Standard value for new machine	Service limit value
Max. 40 (—)	50 (—)	Max. 40 (—)	50 (—)	Max. 40 (—)	50 (—)
2.3 ± 0.3	2.9	2.4 ± 0.3	3.0	2.4 ± 0.3	3.0
—	—	—	—	—	—
33 ± 3	38	33 ± 3	38	33 ± 3	38
Rated load: 180 kg 0 (0)	0 (0)	Rated load: 230 kg 0 (0)	0 (0)	Rated load: 250 kg 0 (0)	0 (0)
—	—	—	—	—	—

Applicable model					PC30R-8	
Category	Item	Measurement conditions		Unit	Standard value for new machine	Service limit value
Travel	Travel speed (1)	Posture for measurement  TKP01287 • Engine at full throttle • Hydraulic oil temperature: 45 – 55°C • Raise track on one side at a time, rotate one turn, then measure time taken for next 5 turns under no load.	Low speed	Sec.	29 ± 2	29 ± 4
			High speed		18 ± 2	18 ± 4
	Travel speed (2)	Posture for measurement 45°  TKP01288 • Engine at full throttle • Hydraulic oil temperature: 45 – 55°C • Run up for at least 10 m, and measure time taken to travel next 20 m on flat ground. • ( ): Steel shoe specification machine	Low speed	Sec.	25.7 ± 2 (26.5 ± 2)	25.7 ± 4 (26.5 ± 4)
			High speed		15.7 ± 2 (16.2 ± 2)	15.7 ± 4 (16.2 ± 4)
	Travel deviation	Posture for measurement 45°  TKP01288 • Engine at full throttle • Hydraulic oil temperature: 45 – 55°C • Run up for at least 10 m, and measure deviation when traveling next 20 m on flat ground. • Use a hard horizontal surface.  20 m, χ, 10 m, BKP00107 ★Measure dimension χ		mm	Low speed: Max. 500 High speed: Max. 300	Low speed: 550 High speed: 330

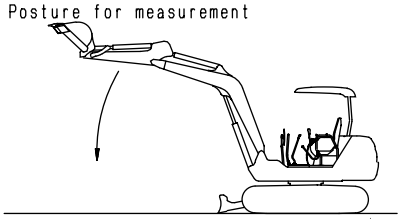
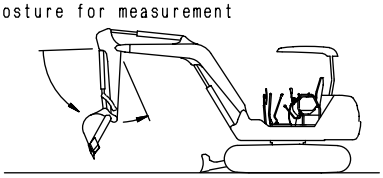
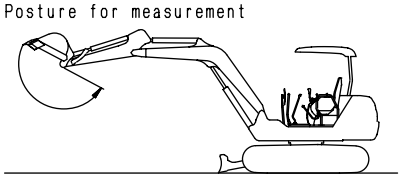
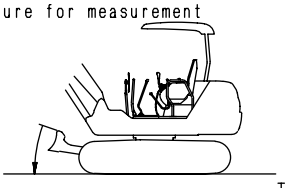
PC35R-8		PC40R-8		PC45R-8	
Standard value for new machine	Service limit value	Standard value for new machine	Service limit value	Standard value for new machine	Service limit value
29 ± 2	29 ± 4	34 ± 2	34 ± 4	34 ± 2	34 ± 4
18 ± 2	18 ± 4	21 ± 2	21 ± 4	21 ± 2	21 ± 4
25.7 ± 2 (26.5 ± 2)	25.7 ± 4 (26.5 ± 4)	25.7 ± 2 (27.8 ± 2)	25.7 ± 4 (27.8 ± 4)	25.7 ± 2 (27.8 ± 2)	25.7 ± 4 (27.8 ± 4)
15.7 ± 2 (16.2 ± 2)	15.7 ± 4 (16.2 ± 4)	15.7 ± 2 (17 ± 2)	15.7 ± 4 (17 ± 4)	15.7 ± 2 (17 ± 2)	15.7 ± 4 (17 ± 4)
Low speed: Max. 500 High speed: Max. 300	Low speed: 550 High speed: 330	Low speed: Max. 500 High speed: Max. 300	Low speed: 550 High speed: 330	Low speed: Max. 500 High speed: Max. 300	Low speed: 550 High speed: 330

Applicable model					PC30R-8	
Category	Item		Measurement conditions	Unit	Standard value for new machine	Service limit value
Travel	Hydraulic drift of travel		Posture for measurement  TLP01289 • Engine stopped • Hydraulic oil temperature: 45 – 55°C • Stop machine on 30° slope with sprocket facing straight up the slope. • Measure the distance the machine moves in 5 minutes.	mm	Max. 300	330
	Leakage of travel motor		• Engine at full throttle • Hydraulic oil temperature: 45 – 55°C • Lock shoes and relieve travel circuit.	ℓ / mm	—	—
Work equipment	Hydraulic drift of work equipment	Total work equipment [hydraulic drift at tip of bucket teeth]	Posture for measurement  TKP01290 • Place in above posture and measure extension or retraction of each cylinder and downward movement at tip of bucket teeth. • Horizontal, flat ground • Bucket: Rated load • 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	Rated load: 145 kg Max. 300	450
		Boom cylinder [amount of retraction of cylinder]			6	9
		Arm cylinder [amount of extension of cylinder]			24	36
		Bucket cylinder [amount of retraction of cylinder]			18	27
		Boom swing cylinder [amount of retraction, extension of cylinder]	• Engine stopped • Hydraulic oil temperature: 45 – 55°C • Bucket: Rated load • Place in same posture as above on 15° slope with upper structure facing 90° to side, and measure extension or retraction of cylinder for 15 minutes		Max.20	30
		Blade [downward movement at tip of blade]	• Engine stopped • Hydraulic oil temperature: 45 – 55°C • Raise blade fully, and measure downward movement at cutting edge of blade for 15 minutes		Max.30	45

PC35R-8		PC40R-8		PC45R-8	
Standard value for new machine	Service limit value	Standard value for new machine	Service limit value	Standard value for new machine	Service limit value
Max. 300	330	Max. 300	330	0	0
—	—	—	—	—	—
Rated load: 180 kg Max. 300	450	Rated load: 230 kg Max. 300	450	Rated load: 250 kg Max. 300	450
6	9	6	9	7	11
27	41	36	54	30	45
17	26	18	27	16	24
Max.20	30	Max.20	30	Max.20	30
Max.30	45	Max.30	45	Max.30	45

Applicable model						PC30R-8	
Cat-egory	Item		Measurement conditions		Unit	Standard value for new machine	Service limit value
Work equipment	Work equipment speed	Boom Bucket teeth in contact with ground ↕ Cylinder fully extended	Posture for measurement  TKP01291 • Engine at full throttle • Hydraulic oil temperature: 45 – 55°C	RAISE	sec.	3.0 ± 0.3	3.6
				LOWER		3.0 ± 0.3	3.6
		Arm Cylinder fully retracted ↕ Fully extended	Posture for measurement  TKP01292 • Engine at full throttle • Hydraulic oil temperature: 45 – 55°C	IN		3.0 ± 0.3	3.6
				OUT		3.1 ± 0.3	3.7
		Bucket Cylinder fully retracted ↕ Fully extended	Posture for measurement  TKP01293 • Engine at full throttle • Hydraulic oil temperature: 45 – 55°C	CURL		3.0 ± 0.3	3.6
				DUMP		2.2 ± 0.2	2.6
		Blade Blade in contact with ground ↕ Blade fully raised	Posture for measurement  TKP01294 • Engine at full throttle • Hydraulic oil temperature: 45 – 55°C	RAISE		1.2 ± 0.3	1.8
				LOWER		1.2 ± 0.3	1.8
		Boom swing Cylinder fully retracted ↕ Fully extended	Posture for measurement  TKP01295 • Engine at full throttle • Hydraulic oil temperature: 45 – 55°C	Left swing		7.5 ± 1.5	10
				Right swing		7.5 ± 1.5	10

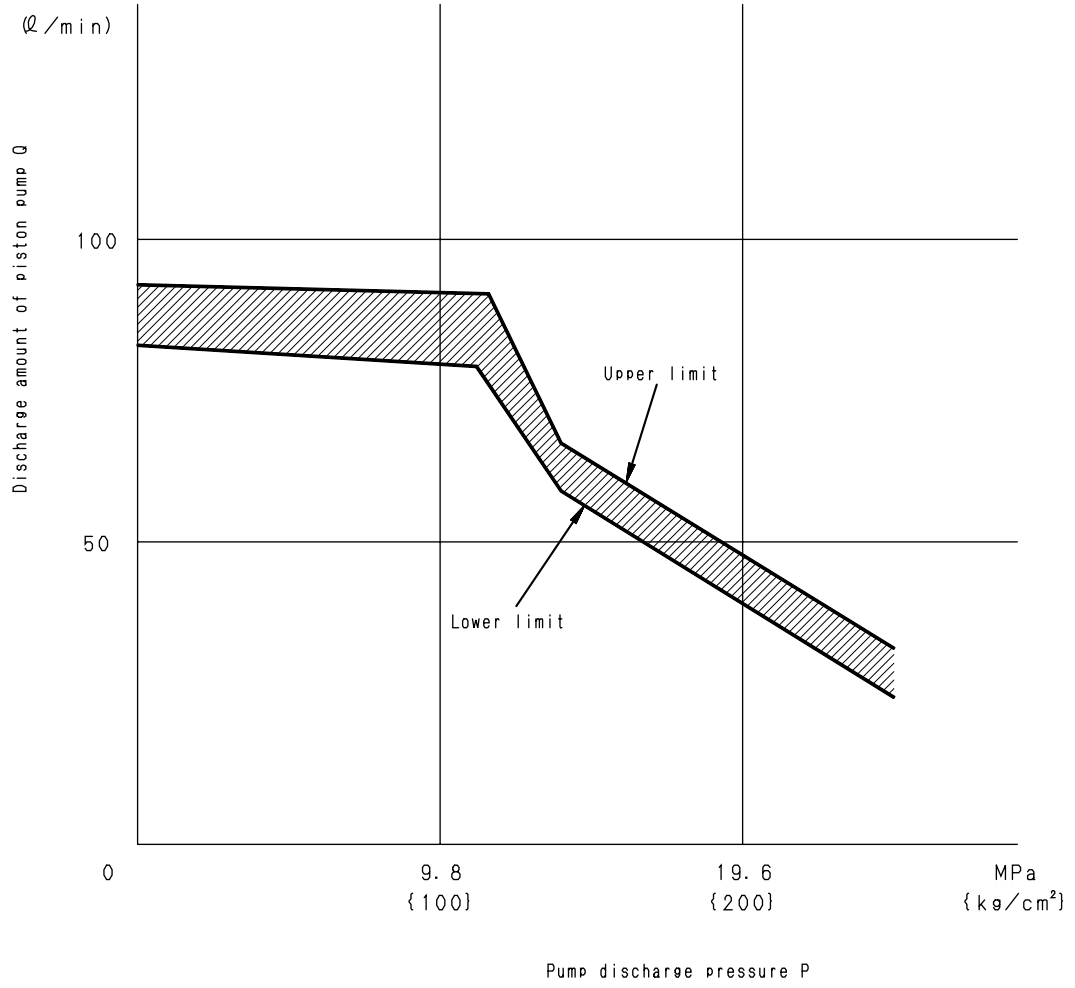
PC35R-8		PC40R-8		PC45R-8	
Standard value for new machine	Service limit value	Standard value for new machine	Service limit value	Standard value for new machine	Service limit value
3.0 ± 0.3	3.6	3.0 ± 0.3	3.6	3.0 ± 0.3	3.6
3.0 ± 0.3	3.6	3.0 ± 0.3	3.6	3.0 ± 0.3	3.6
3.0 ± 0.3	3.6	3.0 ± 0.3	3.6	3.0 ± 0.3	3.6
3.1 ± 0.3	3.7	2.7 ± 0.3	3.3	2.7 ± 0.3	3.3
3.0 ± 0.3	3.6	3.0 ± 0.3	3.6	3.0 ± 0.3	3.6
2.2 ± 0.2	2.6	2.2 ± 0.2	2.6	2.2 ± 0.2	2.6
1.2 ± 0.3	1.8	1.2 ± 0.3	1.8	1.2 ± 0.3	1.8
1.2 ± 0.3	1.8	1.2 ± 0.3	1.8	1.2 ± 0.3	1.8
7.5 ± 1.5	10	7.5 ± 1.5	10	7.5 ± 1.5	10
7.5 ± 1.5	10	7.5 ± 1.5	10	7.5 ± 1.5	10

Applicable model					PC30R-8	
Category	Item		Measurement conditions	Unit	Standard value for new machine	Service limit value
Work equipment	Time lag	Boom	Posture for measurement  TKP01296 • Engine at low idling • Hydraulic oil temperature: 45 – 55°C • Retract arm, boom cylinders fully and set boom at max. height. Lower boom and measure time taken from point where bucket contacts ground to point where chassis rises from ground	Sec.	Max. 2	Max. 2
		Arm	Posture for measurement  TKP01297 • Engine at low idling • Hydraulic oil temperature: 45 – 55°C • Set top of boom horizontal and retract bucket cylinder fully. Then extend cylinder and measure time taken for arm to stop at bottom and then start again		0	0
		Bucket	Posture for measurement  TKP01298 • Engine at low idling • Hydraulic oil temperature: 45 – 55°C • Set top of boom horizontal and retract arm cylinder fully. Then extend cylinder and measure time taken for bucket to stop at bottom and then start again		0	0
		Blade	Posture for measurement  TKP01299 • Engine at low idling • Hydraulic oil temperature: 45 – 55°C • Raise blade to max. height. Then lower boom and measure time taken from point where blade contacts ground to point where chassis rises from ground		Max. 1	Max. 1
	Internal leakage	Cylinders	• Hydraulic oil temperature: 45 – 55°C • Engine at full throttle • Relieve circuit to be measured	cc/ mm	Max. 2	10
		Center swivel joint			—	—

PC35R-8		PC40R-8		PC45R-8	
Standard value for new machine	Service limit value	Standard value for new machine	Service limit value	Standard value for new machine	Service limit value
Max. 2	Max. 2	Max. 2	Max. 2	Max. 2	Max. 2
0	0	0	0	0	0
0	0	0	0	0	0
Max. 1	Max. 1	Max. 1	Max. 1	Max. 1	Max. 1
Max. 2	10	Max. 2	10	Max. 2	10
—	—	—	—	—	—

Applicable model				PC30R, 35R-8	
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Performance of hydraulic pump / Discharge amount of hydraulic pump	Gear pump	• Hydraulic oil temperature: 45 – 55°C • Measure with engine running at rated speed • Measure at relief valve set pressure	ℓ / mm	20	18

Discharge amount of piston pump (gear pump under no load)



TKP01300

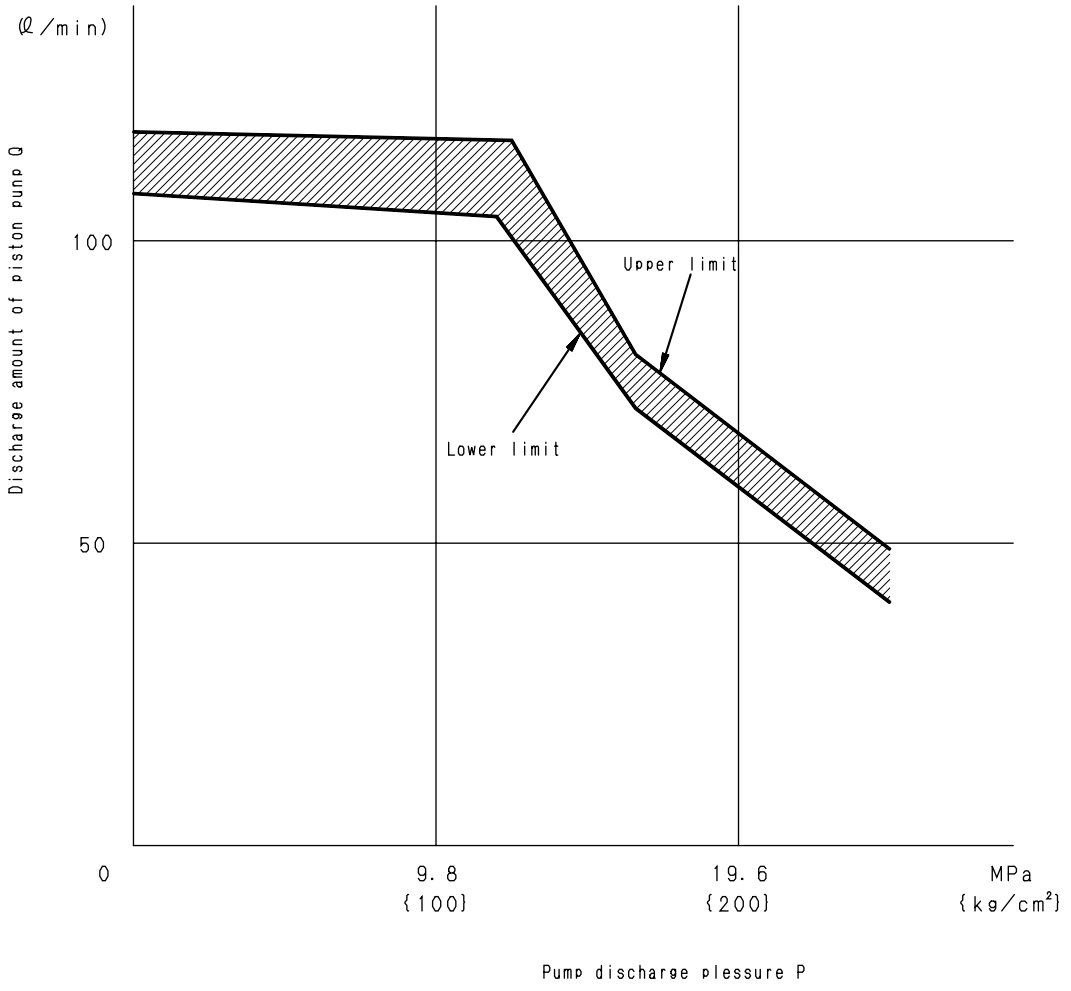
• Rated speed of pump: 2500 rpm

Check point	Test pump discharge pressure {kg/cm²}	Average pressure {kg/cm²}	Standard value for discharge amount Q {ℓ/min}	Judgement standard limit 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.

Applicable model				PC40R, 45R-8	
Category	Item	Measurement conditions	Unit	Standard value for new machine	Service limit value
Performance of hydraulic pump	Discharge amount of hydraulic pump	Gear pump	• Hydraulic oil temperature: 45 – 55°C • Measure with engine running at rated speed • Measure at relief valve set pressure	ℓ / mm	25	22

Discharge amount of piston pump (gear pump under no load)



TKP01301

Check point	Test pump discharge pressure {kg/cm²}	Average pressure {kg/cm²}	Standard value for discharge amount Q {ℓ/min}	Judgement standard limit 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.

STANDARD VALUE TABLE FOR ELECTRICAL PARTS

<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">Machine monitor system</td><td rowspan="2">Monitor panel</td><td>CHECK, CAUTION section</td><td></td><td></td><td>If the condition is as shown in TABLE 1 AND TABLE 2, THE MONITOR PANEL IS NORMAL.
Table 1 (CHECK, CAUTION section)
<table><tr><th>Monitor item (input connector)</th><th>Measurement conditions</th><th>Display</th><th>Engine oil pressure</th></tr><tr><td rowspan="2">Engine oil pressure P1 (9)</td><td rowspan="2">Engine started</td><td>ON</td><td>Max. 1 V</td></tr><tr><td>OFF</td><td>10 – 15V</td></tr><tr><td rowspan="2">Charge P1 (10)</td><td rowspan="2">Engine started</td><td>ON</td><td>Max. 5 V</td></tr><tr><td>OFF</td><td>10 – 15V</td></tr><tr><td rowspan="2">Preheat P1 (10)</td><td rowspan="2">Engine stopped</td><td>ON</td><td>5 – 7V</td></tr><tr><td>OFF</td><td>Max. 1 V</td></tr></table></td><td>1) Connect T-adapter</td></tr>
<tr><td>Gauges</td><td></td><td></td><td>Table 2 (Gauges)
<table><tr><th></th><th colspan="2">Position of gauge display
Starting switch ON</th><th>Display level resistance (Monitor panel input resistance)
Starting switch OFF</th></tr><tr><td rowspan="8">Measure resistance between coolant temperature gauge P1 (female) (6) – (3)</td><td rowspan="8">Right side
↑
Display position
↓
Left side</td><td>All OFF</td><td>Min. – Max. (k)
0 – 0.34</td></tr><tr><td>7</td><td>0.05 – 3.40</td></tr><tr><td>6</td><td>3.19 – 3.67</td></tr><tr><td>5</td><td>3.46 – 4.19</td></tr><tr><td>4</td><td>3.95 – 6.75</td></tr><tr><td>3</td><td>6.36 – 10.05</td></tr><tr><td>2</td><td>9.47 – 15.1</td></tr><tr><td>1</td><td>13.75 – Disconnection</td></tr><tr><td rowspan="8">Measure resistance between fuel level gauge P1 (female) (7) – (3)</td><td rowspan="8">Right side
↑
Display position
↓
Left side</td><td>7</td><td>Min. – Max. (k)
0 – 15.7</td></tr><tr><td>6</td><td>12.6 – 24.0</td></tr><tr><td>5</td><td>20.5 – 30.6</td></tr><tr><td>4</td><td>26.7 – 39.6</td></tr><tr><td>3</td><td>35.2 – 51.6</td></tr><tr><td>2</td><td>46.5 – 78.0</td></tr><tr><td>1</td><td>71.2 – 800</td></tr><tr><td>All OFF</td><td>500 – Disconnection</td></tr></table></td><td>1) Turn starting switch OFF, insert dummy resistance, or measure resistance of sensor.
2) Turn starting switch ON, and check display.</td></tr>
</table>

System	Name of component	Connector No.	Inpsection method	Judgement table	Measurement conditions
Machine monitor system	Engine oil pressure sensor	T9 (male)	Measure resistance	If the condition is as shown in the table below, it is normal Between T9 – chassis: Above 68.6 kPa {0.7 kg/cm²} → Min. 1 M Between T9 – chassis: Below 49.0 kPa {0.5 kg/cm²} → Max. 1	1) Disconnect connector T9. 2) Start engine.
	Coolant temperature sensor	P2 (male)	Measure resistance	If the condition is as shown in the table below, it is normal Between P2 – chassis: Normal temperature (25°C) → Approx. 37 – 50 k Between P2 – chassis: 100°C → Approx. 3.5 – 4.0 k	1) Turn starting switch OFF. 2) Disconnect connector P2.
	Fuel level sensor	P4 (female) P5 (male)	Measure resistance	If the condition is as shown in the table below, it is normal Between P4 – P5: Full → Max. 10 Between P4 – P5: Empty → Min. 85	1) Turn starting switch OFF. 2) Disconnect connectors P4 and P5.
	Alternator	Between alternator terminal R – chassis	Measure voltage	When engine is running (1/2 throttle or above) → 13.5 – 14.5 V ※ If the battery is old, or after starting in cold areas, the voltage may not rise for some time.	1) Start engine.
PPC lock solenoid valve, travel boost system	PPC lock solenoid valve	V1 (female) V2 (male)	Measure resistance	If the condition is as shown in the table below, it is normal Between V1 – V2 → 5 – 25 k Between V1, V2 and chassis → Min. 1 M	1) Turn starting switch OFF. 2) Disconnect connectors V1 and V2.
	Travel speed boost solenoid valve	V3 (male) V4 (female)	Measure resistance	If the condition is as shown in the table below, it is normal Between V3 – V4 → 5 – 25 k Between V3, V4 and chassis → Min. 1 M	1) Turn starting switch OFF. 2) Disconnect connectors V3 and V4.

TESTING AND ADJUSTING

Tools for testing, adjusting, and troubleshooting 20-102
Measuring engine speed 20-103
Measuring exhaust color 20-104
Adjusting valve clearance 20-105
Measuring compression pressure 20-106
Testing and adjusting fuel injection timing 20-107
Measuring engine oil pressure 20-108
Testing and adjusting fan belt tension 20-109
Adjusting control levers and pedals 20-110
Measuring sprocket wear 20-113
Testing and adjusting track shoe tension 20-114
Testing and adjusting hydraulic pressure in work equipment, swing, travel circuit 20-115
Testing and adjusting LS differential pressure 20-118
Adjusting PC valve 20-120
Testing and adjusting control circuit pressure 20-121
Testing output pressure of solenoid valve 20-122
Testing PPC valve output pressure and swing holding brake inlet port pressure (PC20R) 20-123
Adjusting work equipment, swing PPC valve 20-125
Testing and adjusting travel deviation 20-126
Testing oil leakage 20-127
Releasing remaining pressure from hydraulic circuit 20-128
Releasing remaining pressure from hydraulic tank 20-128
Pressurizing hydraulic tank 20-128
Bleeding air 20-129

TOOLS FOR TESTING, ADJUSTING, AND TROUBLESHOOTING

Check or measurement item	Symbol		Part No.	Part Name	Remarks
Engine speed	A	1	799-203-9000	Multi-tachometer	Digital display L : 60 – 2,000 rpm H: 60 – 19,999 rpm
		2	• 799-203-8901	• Clamp set	
Coolant and oil temperatures	B		799-101-1502	Digital temperature gauge	–99.9 — +1,299°C
Oil pressure	C	1	799-101-5002	Hydraulic tester	Pressure gauge: 2.5,5.9,39.2,58.8 MPa {25,60,400,600 kg/cm²}
			790-261-1203	Digital hydraulic tester	Pressure gauge: 68.6MPa{700 kg/cm²}
		2	• 799-101-5160	• Nipple	PT1/8
			799-101-5220	Nipple	10 × 1.25
			07002-11023	O-ring	
		3	• 790-261-1311	• Adapter	14 x 1.5 (female PT 1/8) for both male and female
			• 790-261-1321		18 x 1.5 (female PT 1/8) for both male and female
			• 790-261-1331		22 x 1.5 (female PT 1/8) for both male and female
		4	790-401-2320	Hydraulic gauge	1.0 MPa {10 kg/cm²}
		5	799-401-2701	Differential pressure gauge	
Compression pressure	D	1	795-502-1205	Compression gauge	0 – 6.9 MPa {0 – 70 kg/cm²}
		2	795-111-1110	Adapter	
		3	• 795-101-1571	• Joint	
Valve clearance	E		Commercially available	Feeler gauge	
Exhaust color	F	1	799-201-9000	Handy Smoke Checker	Discoloration 0 – 70% (with standard color) (Discoloration % × 1/10 ≒ Bosch index)
		2	Commercially available	Smoke meter	
Operating effort	G		Commercially available	Push-pull scale	
Stroke, hydraulic drift	H		Commercially available	Scale	
Work equipment speed	J		Commercially available	Stop watch	
Measuring voltage and resistance values	K		Commercially available	Tester	
Troubleshooting of wiring harnesses and sensors	L		799-601-8000	T-adapter kit	
Measuring wear of sprocket	M		796-127-1111	Wear gauge	PC30R • PC35R
			796-127-1121		PC40R • PC45R

MEASURING ENGINE SPEED

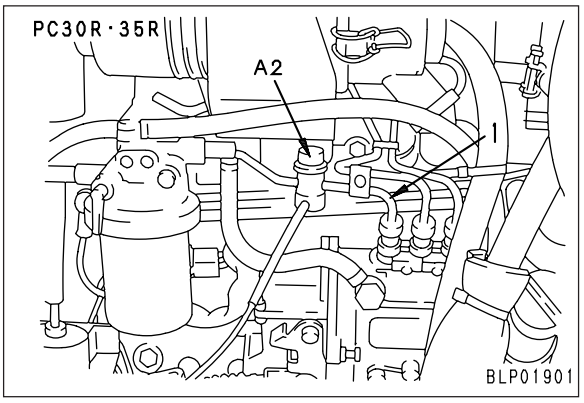
⚠ Be careful not to touch any hot parts when removing or installing the measuring tools.

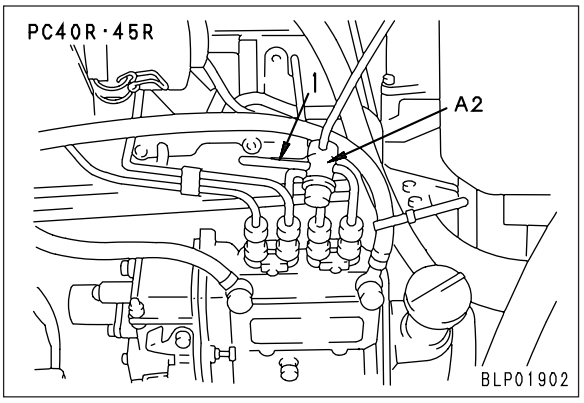
★ Measure the engine speed under the following conditions.
- Cooling water temperature: Within operating range
- Hydraulic oil temperature : 45 – 55°C

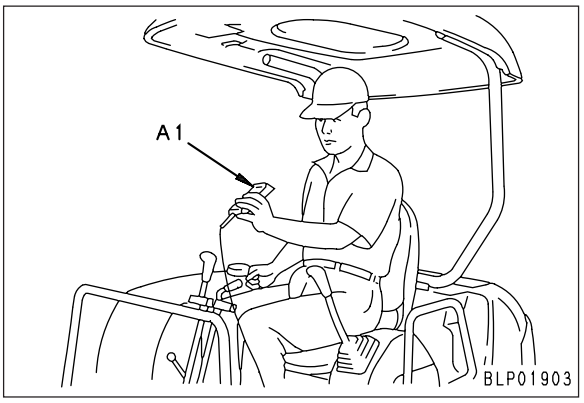
1. Install clamp set **A2** of multi-tachometer to fuel injection tube (1), then connect to multi-tachometer **A1**.

2. Start the engine, and measure the engine speed when it is set to the conditions for measuring.
   1) Measuring low idling and high idling speed: Measure the engine speed with the fuel control lever set to low idling and high idling.
   2) Measuring speed at 1-pump relief: Run the engine at full throttle, operate the bucket control lever, and measure the engine speed when the bucket CURL is relieved.
   3) Measuring speed at 2-pump relief: Run the engine at full throttle, operate the bucket and swing control levers, and measure the engine speed when the bucket CURL and swing are relieved.

      ⚠ For the swing, use the work equipment and lock securely.







MEASURING EXHAUST COLOR

- When measuring in the field where there is no air or electric power supply, use Handy Smoke Checker **F1**; when recording formal data, use Smoke Meter **F2**.

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

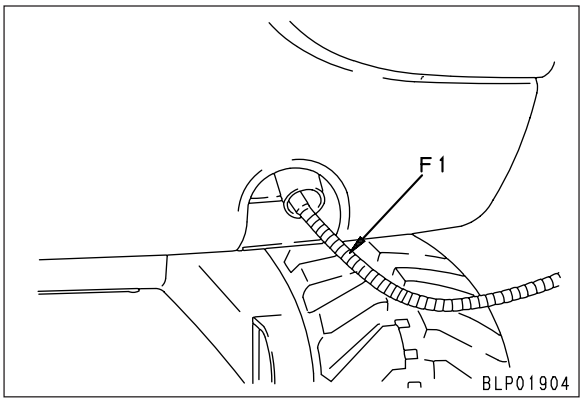
⚠ Be careful not to touch any hot parts when removing or installing the measuring tools.

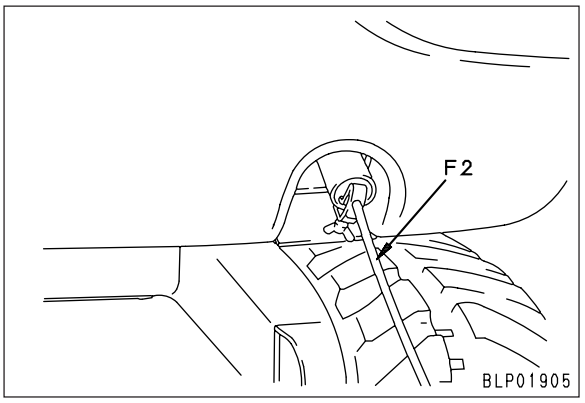
1. Measuring with Handy Smoke Checker F1.

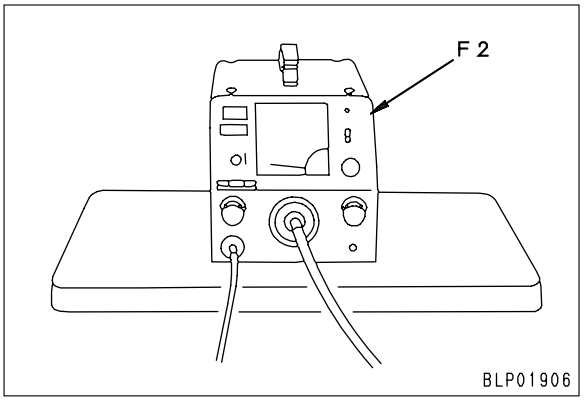
1) Install filter paper to Handy Smoke Checker **F1**.
2) Insert the exhaust gas suction port into the exhaust pipe.
3) Accelerate the engine suddenly, and operate the handle of Handy Smoke Checker **F1** at the same time to collect the exhaust gas on the filter paper.
4) Remove the filter paper and compare it with the scale supplied to judge the condition.

2. Measuring with Smoke Meter F2

1) Insert the probe of Smoke Meter **F2** into the outlet port of the exhaust pipe, and tighten the clip to secure it to the exhaust pipe.
2) Connect the air hose and the socket of the probe hose and accelerator switch to Smoke Meter **F2**.
   ★ Keep the pressure of the air supply below 15 kg/cm^2.
3) Connect the power cord to the AC100V socket.
   ★ When connecting the cord, check that the power switch of the smoke meter is OFF.
4) Loosen the cap nut of the suction pump, and fit the filter paper.
   ★ Fit the filter paper securely so that the exhaust gas cannot leak.
5) Turn the power switch of Smoke Meter **F2** ON.
6) Accelerate the engine suddenly, and depress the accelerator pedal of Smoke Meter **F2** at the same time to collect the exhaust gas color on the filter.
7) Place the filter paper used to catch the exhaust gas color on top of at least 10 sheets of unused filter paper inside the filter paper holder, and read the value shown.







ADJUSTING VALVE CLEARANCE

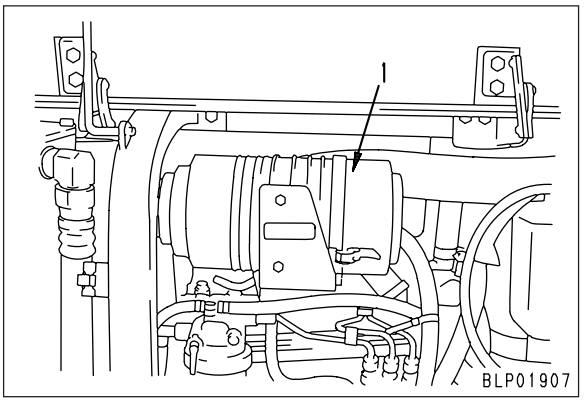
1. Remove air cleaner (1), then remove the cylinder head cover.

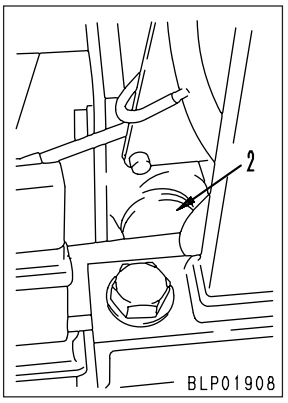
2. Remove cap (2) of the flywheel housing.

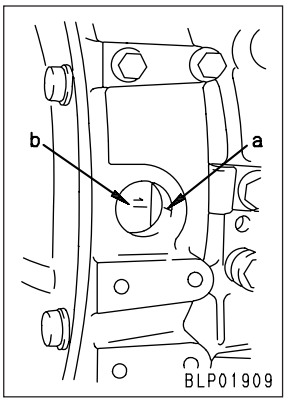
3. Rotate the crankshaft in the normal direction to align the No. 1 line **b** on the flywheel with line **a** on the housing. When rotating, check the movement of the valves of the No. 1 cylinder (flywheel end).
   - ★ Cylinder No. 1 is the cylinder at the flywheel end of the engine.
   - ★ When the crankshaft is rotated, the valves of the cylinder at top dead center do not move. If the valves are moving, rotate the crankshaft one more turn and align the lines.
   - ★ PC30R, 35R: Rotate the crankshaft 240° each time and adjust the valve clearance of each cylinder according to the firing order.
     - Firing order : 1—3—2
   - ★ PC40R, 45R: Rotate the crankshaft 180* each time and adjust the valve clearance of each cylinder according to the firing order.
     - Firing order : 1—3—4—2
   - ★ There is a line on the flywheel for the top dead center of each cylinder.

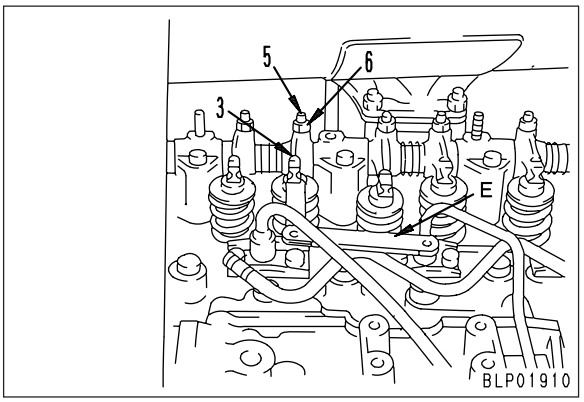
4. To adjust the valve clearance, loosen locknut (6), then insert feeler gauge **E** between rocker lever (3) and valve stem (4), and turn adjustment screw (5) until the clearance is a sliding fit. Then tighten locknut (6) to hold the adjustment screw in position.

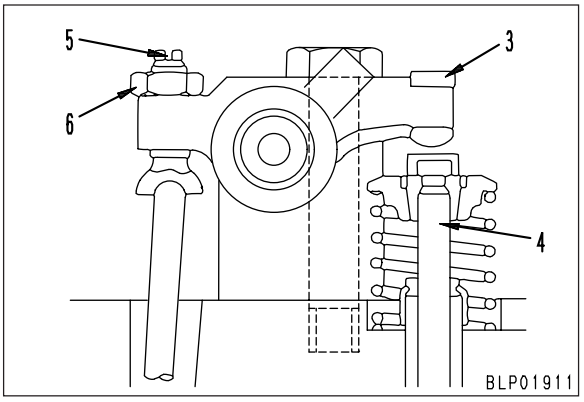
   kgm Locknut : **25.48 ± 2.94 Nm {2.6 ± 0.3 kgm}**
   - ★ After tightening the locknut, check the clearance again.











MEASURING COMPRESSION PRESSURE

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

1. Adjust the valve clearance.
   For details, see ADJUSTING VALVE CLEARANCE.

2. Warm up the engine to make the oil temperature 40 – 60°C.

3. Remove nozzle holder assembly (1) from the cylinder to be measured.

4. Install adapter **D2** and joint **D3** to the mount of the nozzle holder, then connect compression gauge **D1**.

   kgm Adapter mounting nut:
   4.41 ± 0.49 Nm {0.45 ± 0.05 kgm}

5. Set multi-tachometer **A** in position.

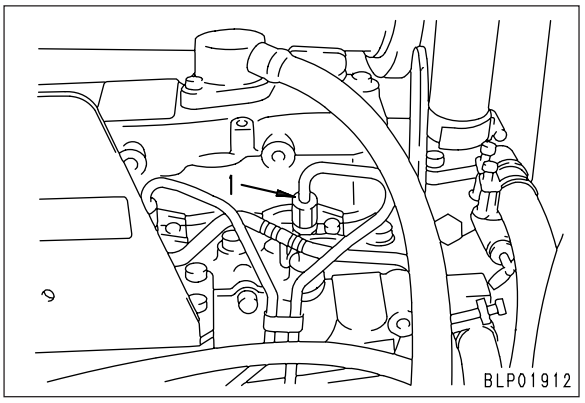
6. Disconnect engine stop solenoid connector (1).

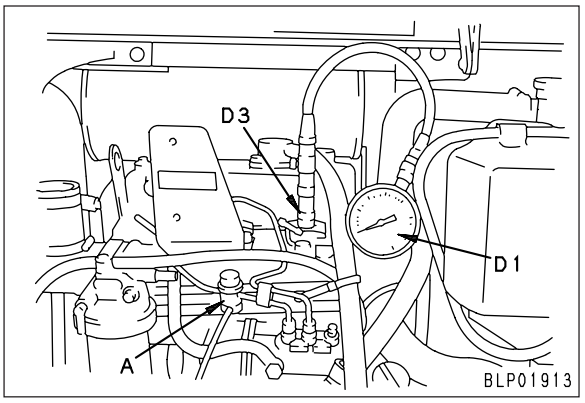
7. Close the fuel filter stop valve.

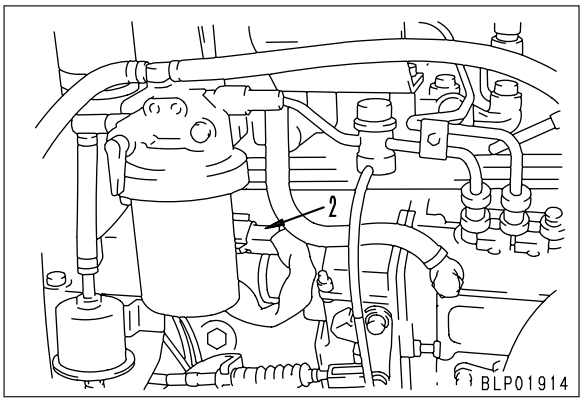
8. Crank the engine with the starting motor and measure the compression pressure.
   - ★ Measure the compression pressure at the point where the compression gauge indicator remains steady.
   - ★ When measuring the compression pressure, measure the engine speed to confirm that it is within the specified range.

★ After measuring the compression pressure, install the nozzle holder assembly.

kgm Nozzle holder mounting nut:
4.41 ± 0.49 Nm {0.45 ± 0.05 kgm}





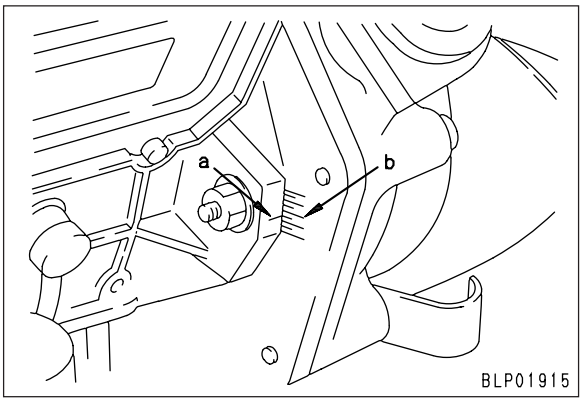


TESTING AND ADJUSTING FUEL INJECTION TIMING

Testing

★ If the fuel injection pump has been removed and installed, check as follows.

1. Check that line **a** on the fuel injection pump is aligned with line **b** on the flange.
   ★ The line on the flange is the 6th line from the top.



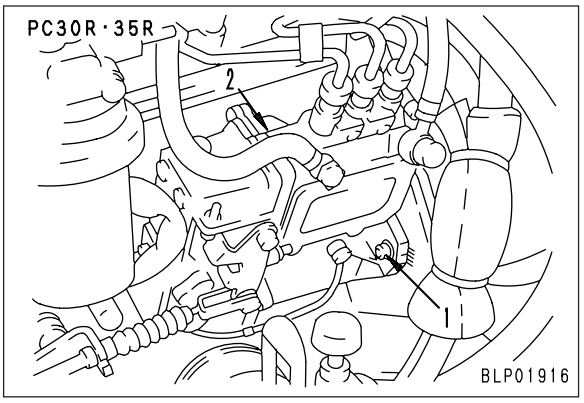
Adjusting

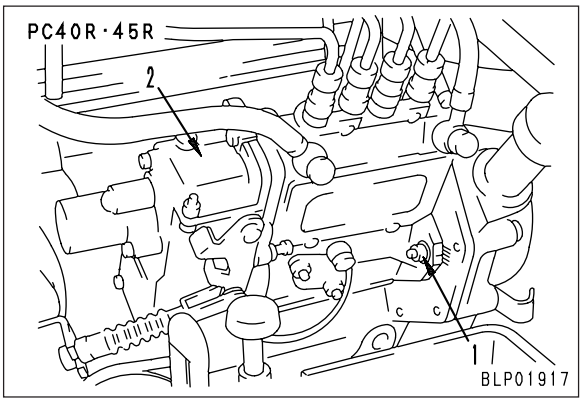
★ If the lines are not aligned, adjust as follows.

1. Loosen mounting nut (1), then move fuel injection pump (2) to align the line.

2. Tighten nut (1).

   kgm Fuel injection pump mounting nut:
   25.48 Nm {2.6 kgm}

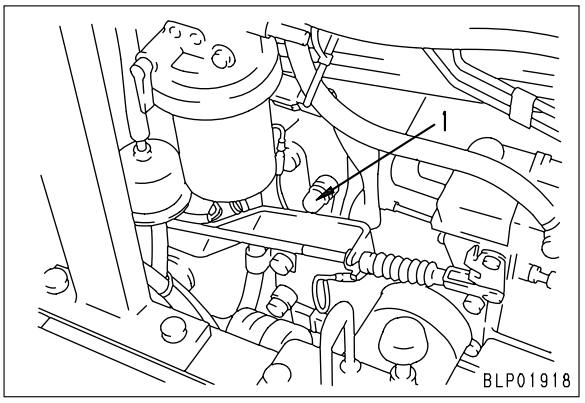




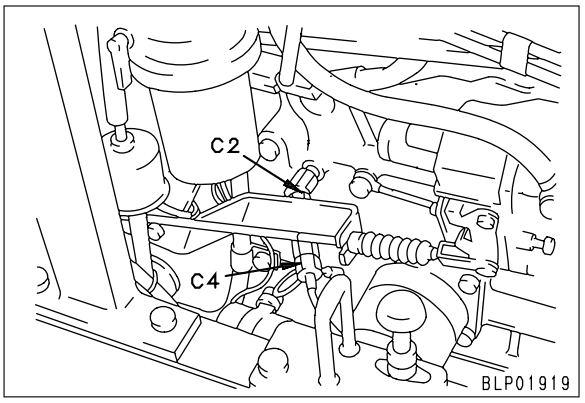
MEASURING ENGINE OIL PRESSURE

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

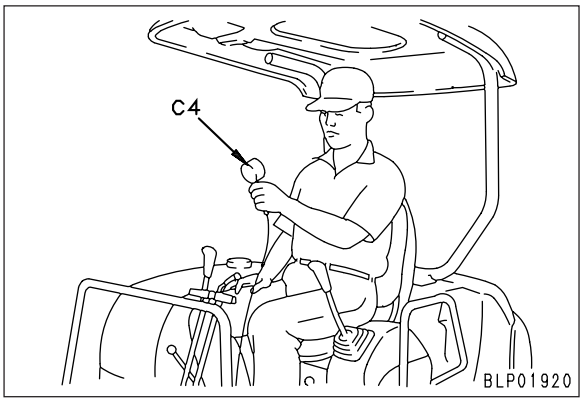
1. Remove engine oil pressure switch (1).



2. Install nipple **C2**, then connect oil pressure gauge **C4** (1.0 MPa {10 kg/cm^2}).



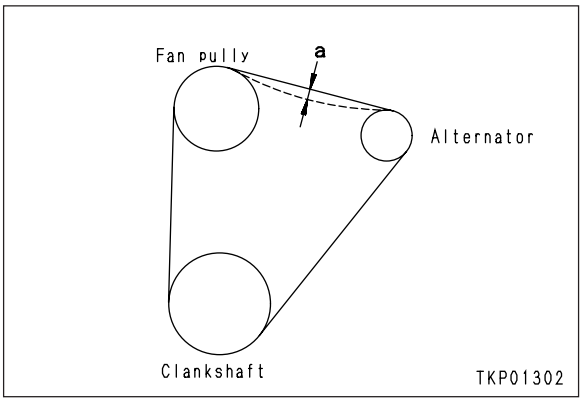
3. Start the engine, and measure the oil pressure with the engine at low idling and high idling.



TESTING AND ADJUSTING FAN BELT TENSION

Testing

1. Measure deflection a of the belt when pressed with a force of approx. 58.8 Nm {approx. 6 kg} at a point midway between the fan pulley and the alternator pulley.
   - Belt deflection **a**: 5 – 6 mm



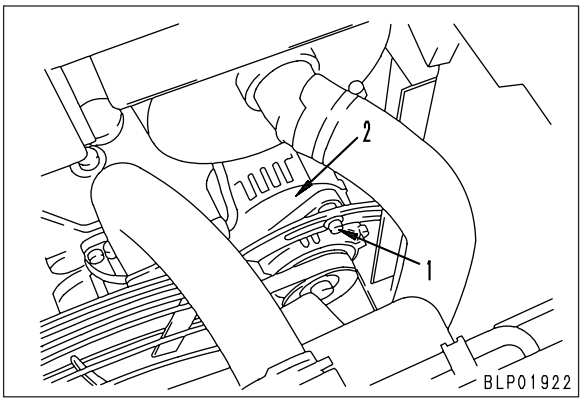
Adjusting

★ If the deflection is not normal, adjust as follows.

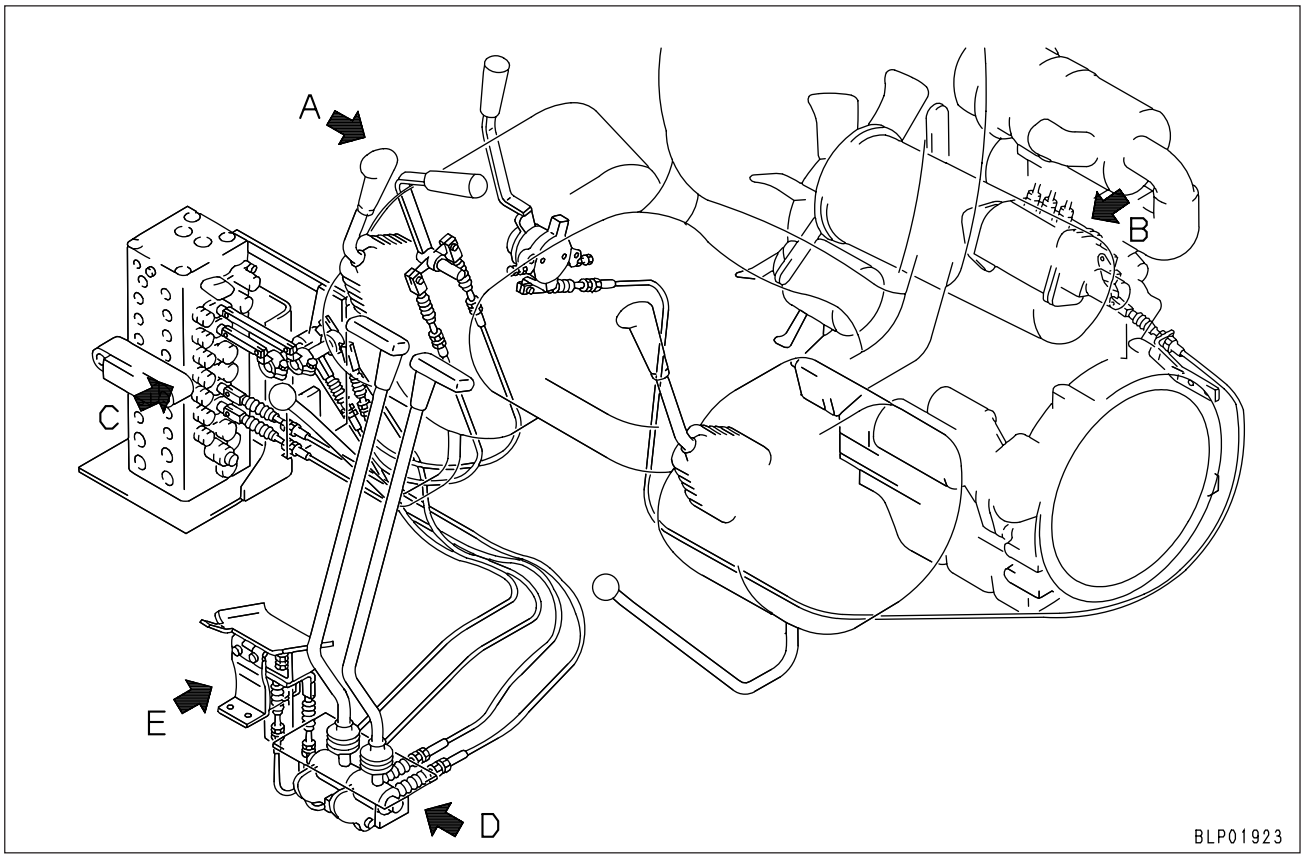
1. Loosen the alternator mounting bolts and adjustment bolt (1).

2. Using a bar, move alternator (2) towards the outside to adjust the belt tension.

3. Tighten adjustment bolt (1), then tighten the alternator mounting bolts.

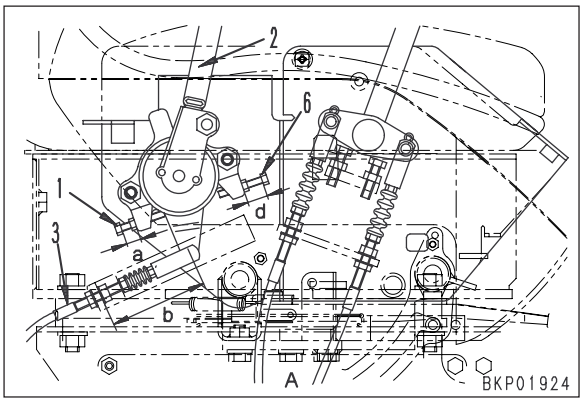


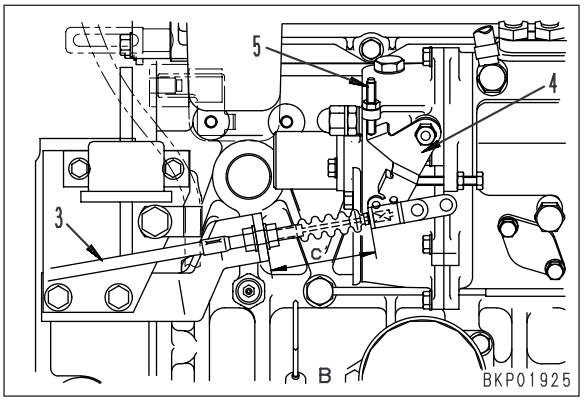
ADJUSTING CONTROL LEVERS AND PEDALS



1. Adjusting fuel control lever

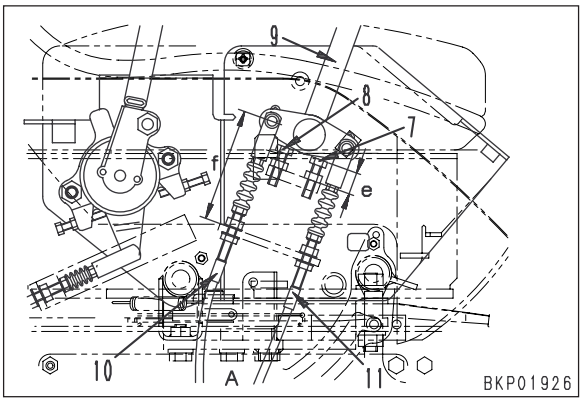
1) Adjust low idling stopper bolt (1) to dimension **a**, then tighten the locknut.
   - Mounting dimension **a**: 13 mm
   - ★ Leave the high idling stopper bolt loose.
2) Set fuel control lever (2) to the low idling position.
3) Adjust the yoke at the fuel control lever end of cable (3) to dimension **b**, then tighten the locknut.
   - Mounting dimension **b**: 86.7 mm
4) Set fuel control lever (2) to the high idling position.
5) Adjust the yoke at the fuel injection pump end of cable (3) so that lever (4) of the fuel injection pump contacts stopper bolt (5), then tighten the locknut.
   - Mounting dimension **c** (reference): 102 mm
6) Adjust so that high idling stopper bolt (6) contacts fuel control lever (2), then tighten the locknut.
   - Mounting dimension **d** (reference): 18.1 mm

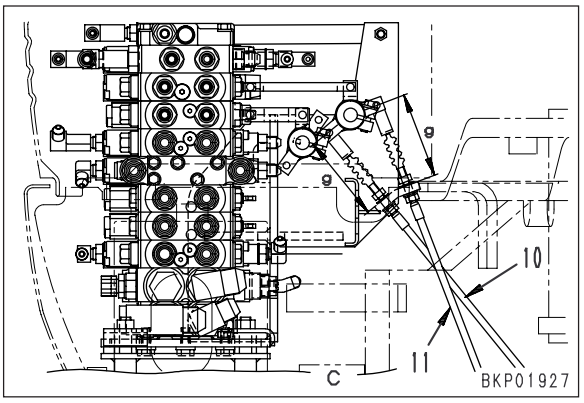




2. Adjusting blade control lever

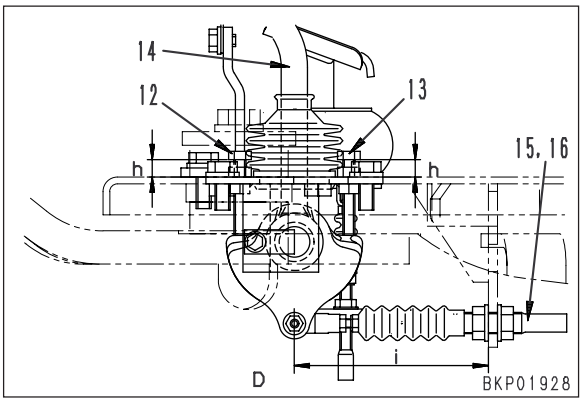
1) Adjust front and rear stopper bolts (7) and (8) to dimension **e**, then place blade control lever (9) at the neutral position and tighten the locknut temporarily.
   - Temporary mounting dimension **e**: 19.6 mm
2) Adjust the yoke portion at the lever end of cables (10) and (11) to dimension **f**.
   - Mounting dimension **f**: 100.5 mm
3) Adjust the yoke portion at the valve end of cables (10) and (11) to dimension **g**.
   - Mounting dimension **g**: 91 mm
4) Loosen stopper bolts (7) and (8) and retract fully.
5) Operate blade control lever (9) fully to the front and rear, adjust so that it contacts stopper bolts (7) and (8) at each position, then tighten the locknut.

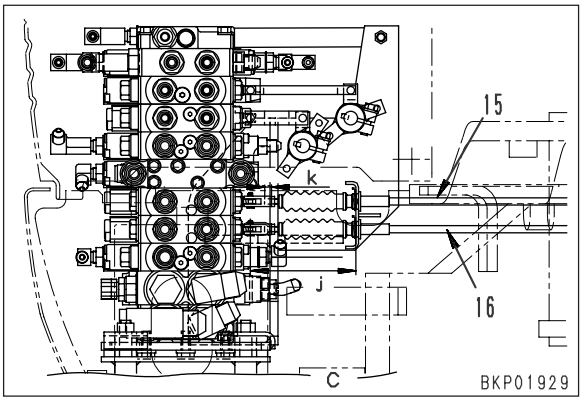




3. Adjusting travel control lever

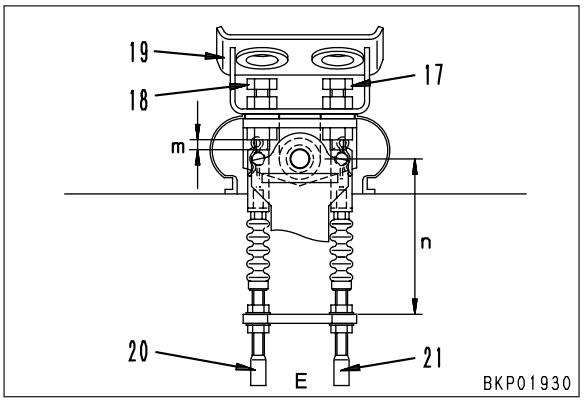
1) Adjust front and rear stopper bolts (12) and (13) to dimension **h**, then place travel control lever (14) at the neutral position and tighten the locknut temporarily.
   - Temporary mounting dimension **h**: 12.1 mm
2) Adjust the yoke portion at the lever end of cables (15) and (16) to dimension **i**.
   - Mounting dimension **i**: 128.2 mm
3) Adjust the yoke portion at the valve end of cables (15) and (16) to dimension **j**.
   - Mounting dimension **j**: 91 mm
   - ★ When installing the yoke to the cable, screw dimension **k** of the thread into the yoke.
   - Dimension **k** for screwing in yoke: 8 mm
4) Loosen stopper bolts (12) and (13) and retract fully.
5) Operate travel control lever (14) fully to the front and rear, adjust so that it contacts stopper bolts (12) and (13) at each position, then tighten the locknut.

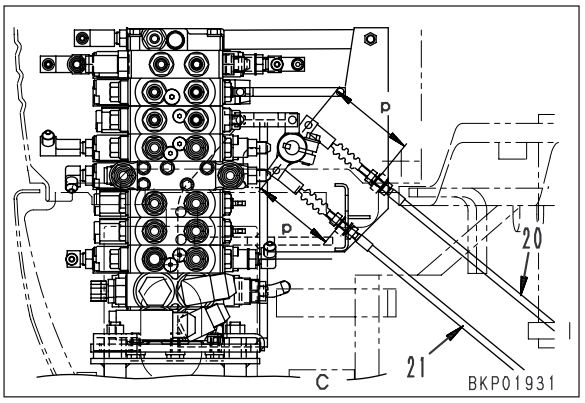




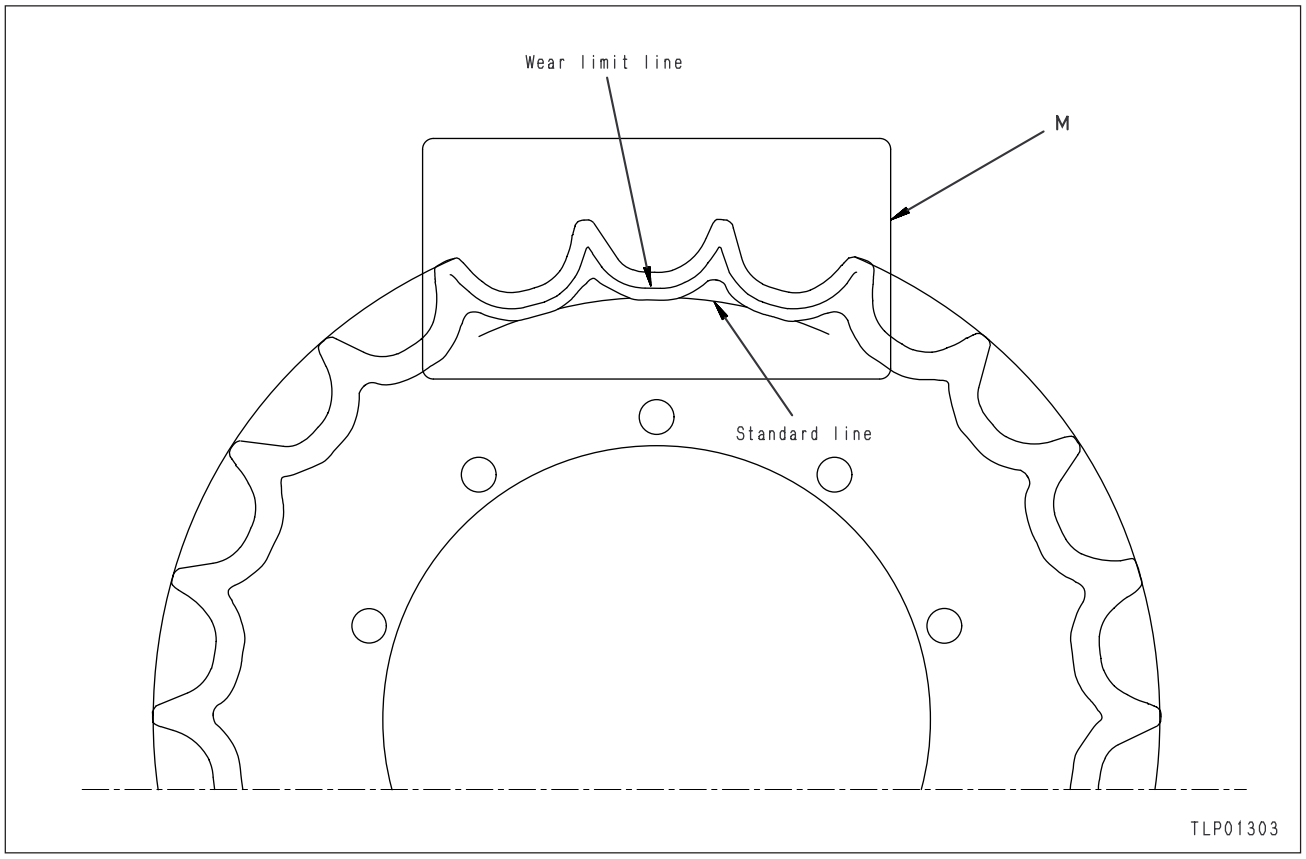
4. Adjusting boom swing control pedal

1) Adjust front and rear stopper bolts (17) and (18) to dimension **m**, then place boom swing control pedal (19) at the neutral position and tighten the locknut temporarily.
   - Temporary mounting dimension **m**: 00 mm
2) Adjust the yoke portion at the lever end of cables (20) and (21) to dimension **n**.
   - Mounting dimension **n**: 91 mm
3) Adjust the yoke portion at the lever end of cables (20) and (21) to dimension **p**.
   - Mounting dimension **p**: 91 mm
4) Loosen stopper bolts (17) and (18) and retract fully.
5) Operate boom swing control pedal (19) fully to the front and rear, adjust so that it contacts stopper bolts (17) and (18) at each position, then tighten the locknut.





MEASURING SPROCKET WEAR



1. Remove the track shoe assembly.
   ★ For details, see DISASSEMBLY AND ASSEMBLY, REMOVAL OF RUBBER SHOE ASSEMBLY or REMOVAL OF STEEL SHOE ASSEMBLY.

2. Align wear gauge **M** with the sprocket.
   ★ Align the standard line, then align the wave shape of the sprocket with the wave shape of the wear gauge.

3. Judge the sprocket wear.
   ★ If the wave shape of the sprocket is above the wear limit line: It is possible to continue to use the sprocket.
   ★ If the wave shape of the sprocket has reached the wear limit line: Replace the sprocket with a new part.

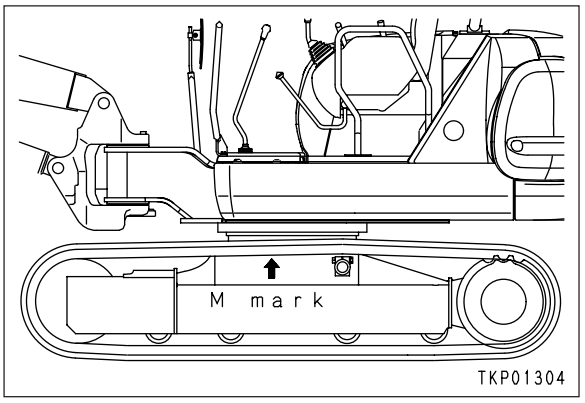
TESTING AND ADJUSTING TRACK SHOE TENSION

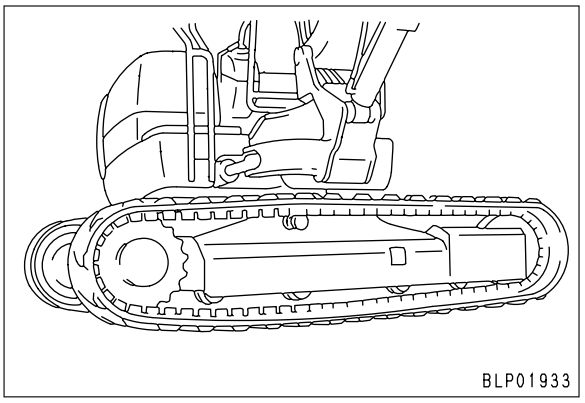
Testing

1. Move the machine forward or backward to set the connection of the rubber shoe (**M** mark) at the top at the center of the track between the idler and sprocket.
   ★ Rubber shoe specification machine only.

2. Using the boom and arm, push up the track on the side being inspected.

3. Measure clearance **a** between the tread of the track roller and the top surface of the track link.
   ★ Measure at the 3rd track roller from the sprocket.
   • Standard clearance (tension)
   Rubber shoe : 14 – 19 mm (PC30R, 35R)
   : 20 – 25 mm (PC40R, 45R)
   Steel shoe : 30 – 50 mm

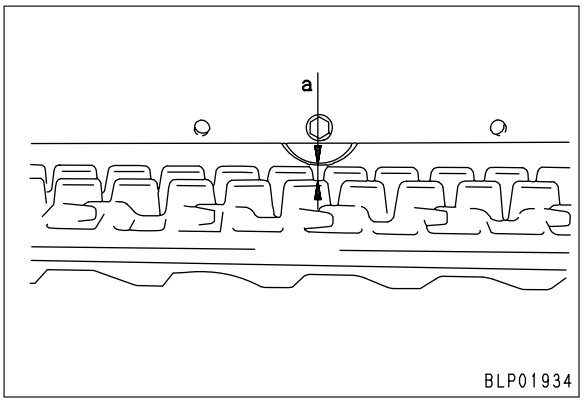




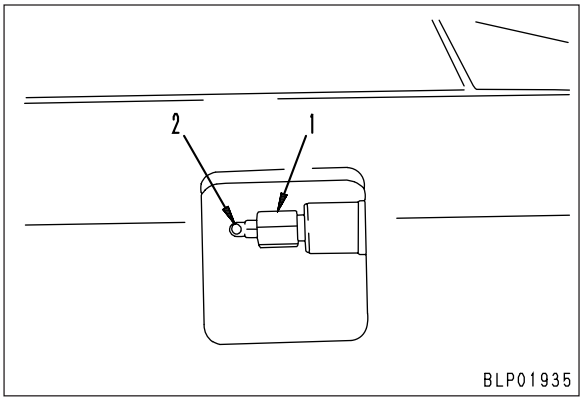
Adjusting

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

1. **If tension is too tight**
   Slowly loosen valve (1) and release grease.
   ⚠ There is danger that the valve may fly out under the high internal pressure of the grease, so never loosen the valve more than 1 turn.
   ★ If the grease does not come out easily, move the machine backwards or forwards slowly.



2. **If tension is too loose**
   Pump in grease through grease fitting (2).
   ★ If the track tension does not increase easily, move the machine backwards or forwards slowly.



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

Measuring

★ Oil temperature when measuring: 45 – 55°C

⚠ Before removing the oil pressure measurement plug, release the pressure inside the hydraulic tank. For details, see RELEASING REMAINING PRESSURE FROM HYDRAULIC TANK.

⚠ After installing the oil pressure gauge, pressurize the hydraulic tank. For details, see PRESSURIZING HYDRAULIC TANK.

1. Measuring unload oil pressure

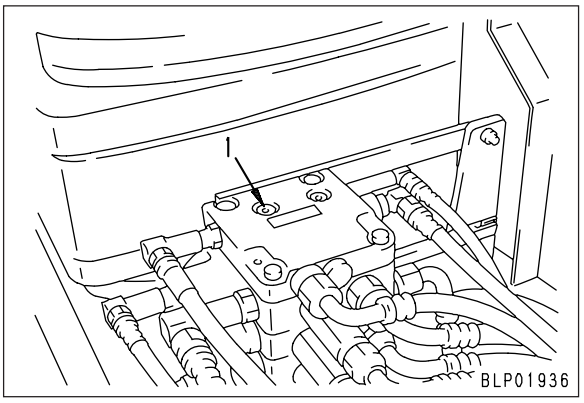
1) Remove oil pressure measurement plug (1) (Thread dia.=10mm, Pitch=1.25mm).
2) Fit nipple **C2**, then install oil pressure gauge **C1** (39.2 MPa {400 kg/cm²}).
3) Run the engine at full throttle and measure the oil pressure with all levers at HOLD.

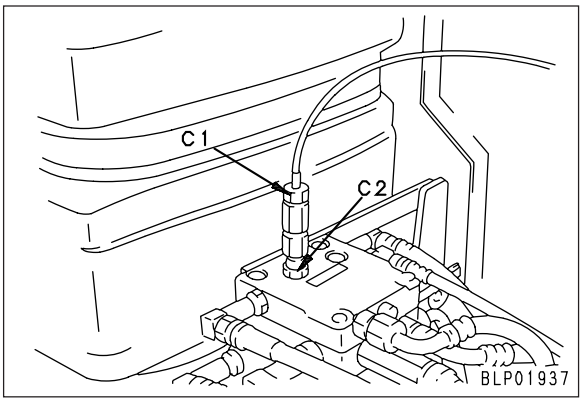
2. Measuring work equipment and travel relief pressure

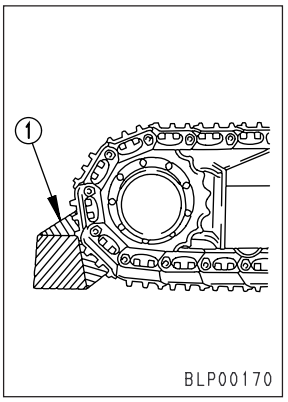
1) Remove oil pressure measurement plug (1) (Thread dia.=10mm, Pitch=1.25mm).
2) Fit nipple **C2**, then install oil pressure gauge **C1** (39.2 MPa {400 kg/cm²}).
3) Run the engine at full throttle and measure the oil pressure with each actuator operated to relief.

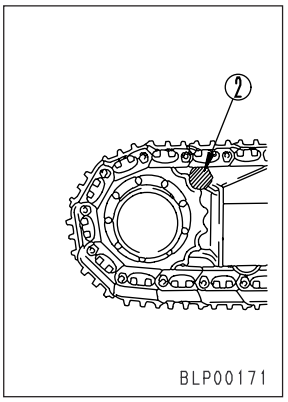
⚠ For the work equipment, operate each cylinder to the end of its stroke.

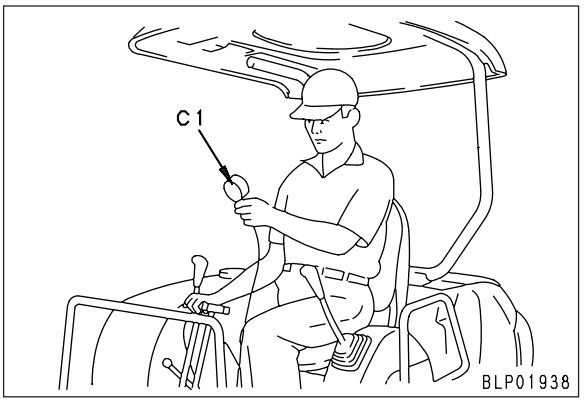
⚠ For the travel, lock the track by fitting block ① under the track shoe grouser or by fitting block ② between the sprocket and frame.





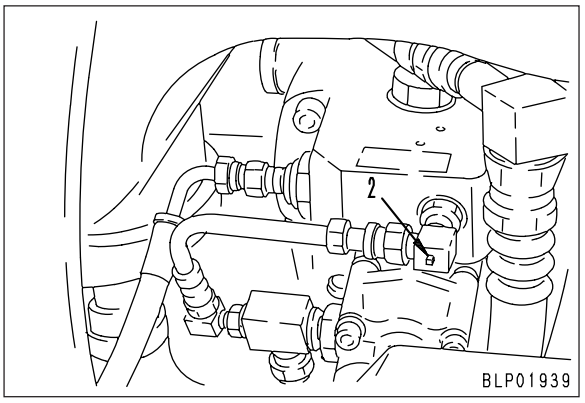






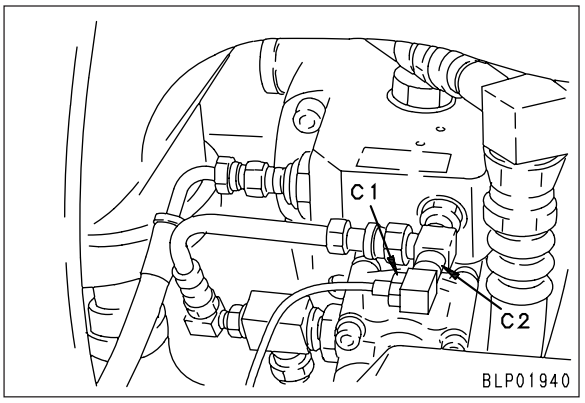
3. Measuring swing relief pressure

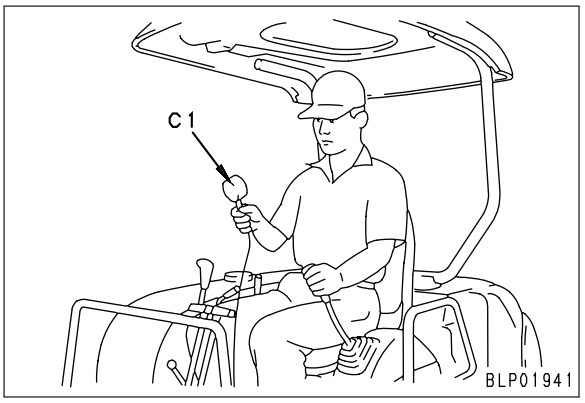
1) Remove oil pressure measurement plug (2) (PT1/8).



2) Fit nipple **C2**, then install oil pressure gauge **C1** (39.2 MPa {400 kg/cm^2}).
3) Run the engine at full throttle and measure the oil pressure with the swing relieved.

⚠ For the swing, use the work equipment, and lock securely.





Adjusting

★ The unload valve cannot be adjusted.

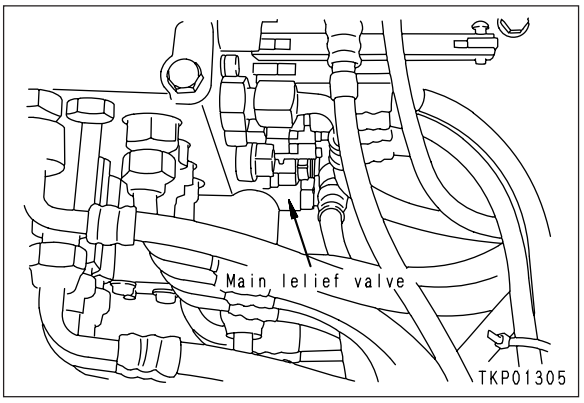
1. Adjusting main relief valve

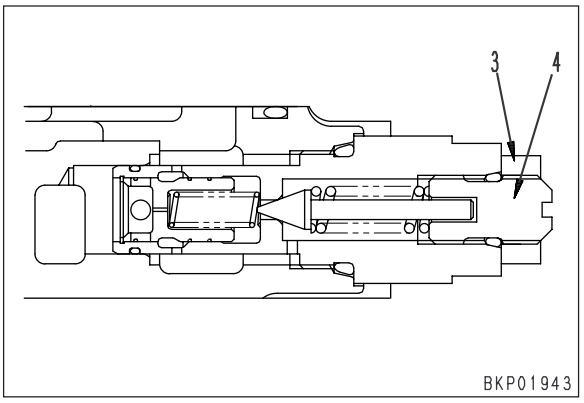
★ If the work equipment and travel relief pressure is not normal, adjust the main relief valve as follows.

1) Loosen locknut (3) and turn adjustment screw (4) to adjust.
   ★ Turn the adjustment screw to adjust as follows.
      • To INCREASE pressure, turn CLOCKWISE
      • To DECREASE pressure, turn COUNTERCLOCKWISE
   ★ Amount of adjustment for one turn of adjustment screw: 12.6 MPa {128 kg/cm²}
2) After adjusting, tighten locknut (3).

   kgm Locknut: **69 ± 10 Nm {6 ± 1 kgm}**

★ After completion of adjustment, repeat the measurement procedure above to check the oil pressure again.





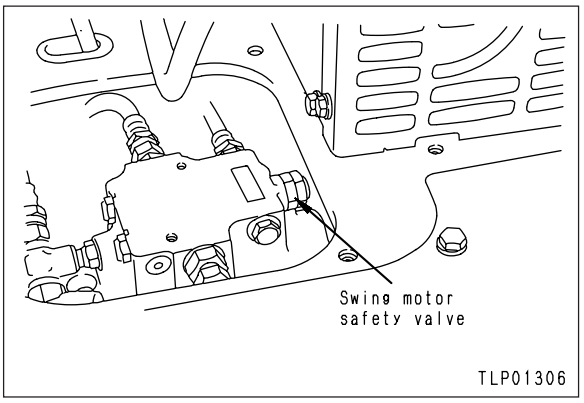
2. Swing motor safety valve

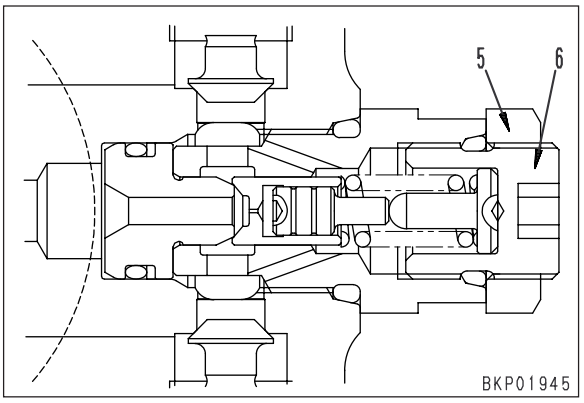
★ If the swing relief pressure is not normal, adjust the swing motor safety valve as follows.

1) Loosen locknut (5) and turn adjustment screw (6) 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: 17.54 MPa {179 kg/cm²}
2) After adjusting, tighten locknut (5).

   kgm Locknut:
   90.65 ± 12.25 Nm {9.25 ± 1.25 kgm}

★ After completion of adjustment, repeat the measurement procedure above to check the oil pressure again.





TESTING AND ADJUSTING LS DIFFERENTIAL PRESSURE

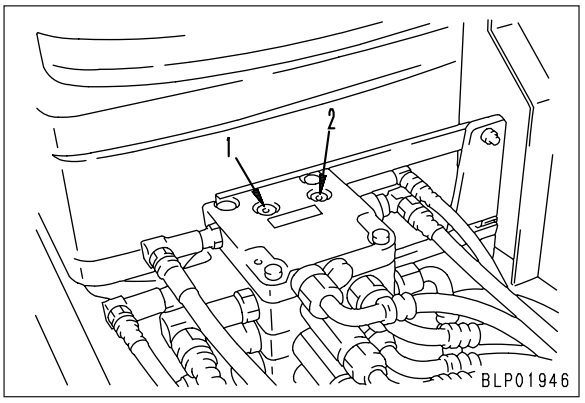
Measuring

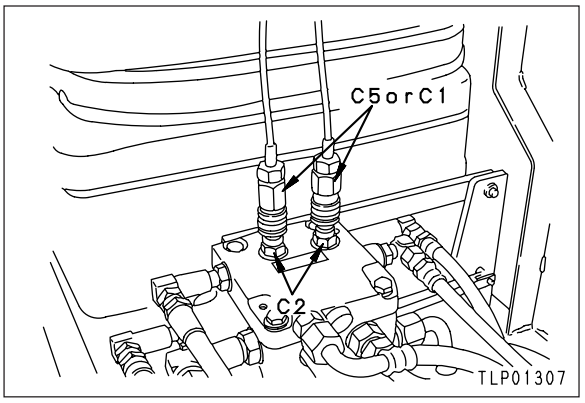
1. Measuring with differential pressure gauge

1) Remove oil pressure measurement plugs (1) and (2) (Thread dia.=10mm, Pitch=1.25mm).
2) Fit nipple **C2**, then install differential pressure gauge **C5**.
   ★ Connect pump discharge pressure (1) to the high-pressure side of the differential pressure gauge and LS pressure (2) to the low-pressure side.
3) Using the work equipment, push up the track on one side.
4) Run the engine at full throttle, set to the conditions in the table, and measure the LS differential pressure.

Table

Travel lever	LS differential pressure MPa{kg/cm²}	Remarks
Neutral	4.41 ± 0.49 {45 ± 5}	LS differential pressure becomes same as unload pressure
Half (travel rotates freely)	1.57 ± 0.1 {16 ± 1}	

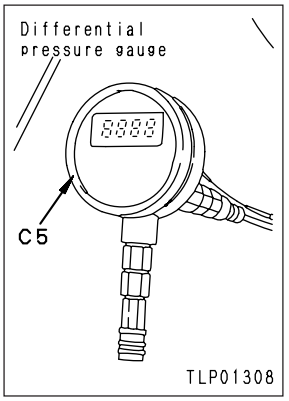


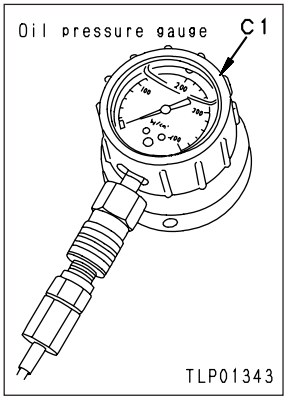


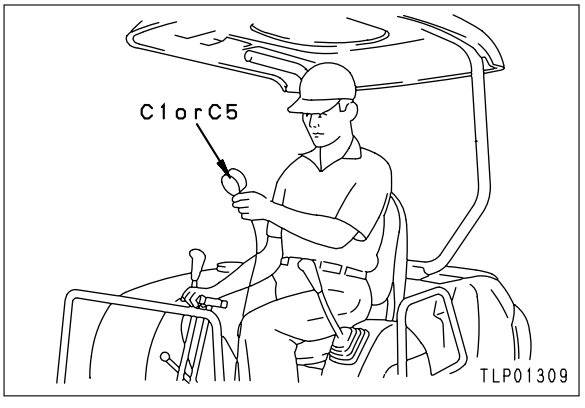
2. Measuring with oil pressure gauge

★ The differential pressure at its maximum is less than 1.96 MPa {20 kg/cm²}, so measure with the same pressure gauge.

1) Remove oil pressure measurement plugs (1) and (2) (Thread dia.=10mm, Pitch=1.25mm).
2) Fit nipple **C2**, then install oil pressure gauge **C1** (39.2 MPa {400 kg/cm²}).
   ★ Use a gauge with a scale in units of 1.0 MPa {10 kg/cm²}.
3) Using the work equipment, push up the track on one side.
4) Run the engine at full throttle, set to the conditions in the table, and measure the pump discharge pressure.
   ★ Read the gauge indicator accurately from directly in front of it.
5) Run the engine at full throttle, set to the conditions in the table, and measure the LS pressure.
   ★ Read the gauge indicator accurately from directly in front of it.
6) Calculate the LS differential pressure from the pump discharge pressure and the LS pressure.







Adjusting

1. Adjusting LS valve

★ If the LS differential pressure is not normal, adjust the LS valve as follows.

1) Disconnect hose (3).
2) Loosen locknut (4) and turn adjustment screw (5) to adjust.

★ Turn the adjustment screw as follows.

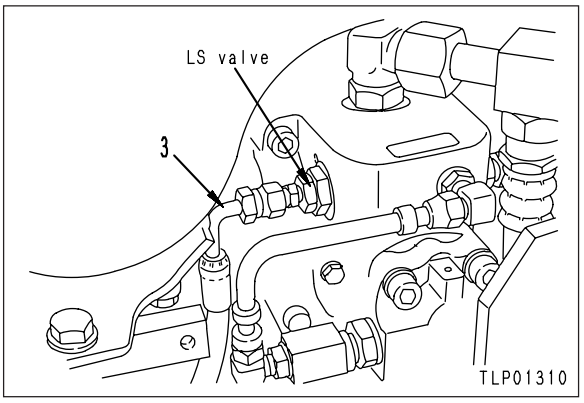
- To INCREASE pressure, turn CLOCKWISE
- To DECREASE pressure, turn COUNTER-CLOCKWISE

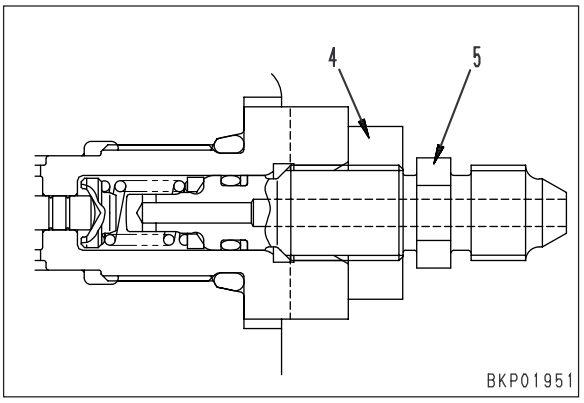
★ Amount of adjustment for one turn of adjustment screw: 127 MPa {13 kg/cm^2} (LS differential pressure)

3) After adjusting, tighten locknut (4).

kgm Locknut : **59 ± 10 Nm {6 ± 1 kgm}**

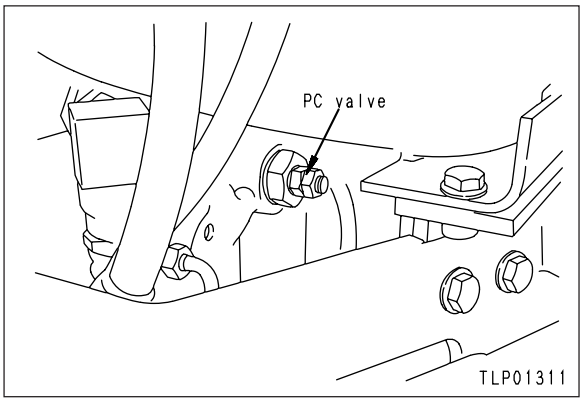
★ After completion of adjustment, repeat the measurement procedure above to check the set pressure again.



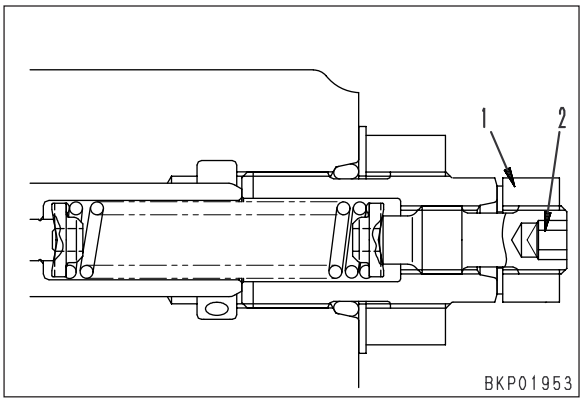


ADJUSTING PC VALVE

★ If the load becomes high and the engine speed drops, or the engine speed remains normal and the work equipment becomes slower, but the pump discharge pressure and the LS differential pressure are normal, adjust the pump PC valve as follows.
★ The PC valve is assembled inside the servo piston.



1. Loosen locknut (1) and turn adjustment screw (2) to adjust.
   ★ Turn the adjustment screw as follows.
      • If the work equipment speed is slow: Turn CLOCKWISE (INCREASE pump absorption torque)
      • If the engine speed drops: Turn COUNTERCLOCKWISE (DECREASE pump absorption torque)
   ★ Turn the adjustment screw within a range of 180° to the left and right.



2. After adjusting, tighten locknut (1).

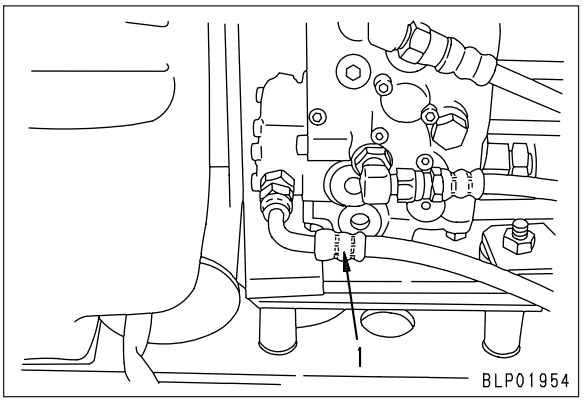
   kgm Locknut : **29.4 ± 4.9 Nm {3 ± 0.5 kgm}**

TESTING AND ADJUSTING CONTROL CIRCUIT PRESSURE

Measuring

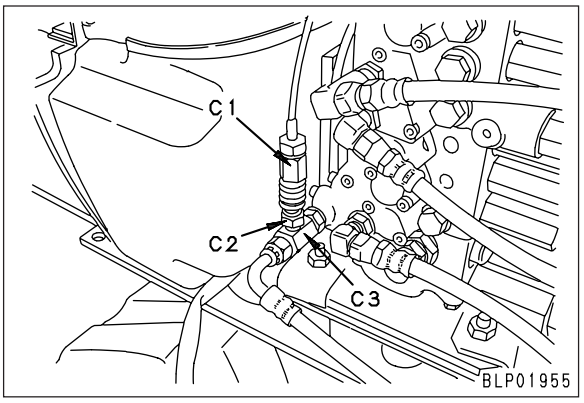
★ Oil temperature when measuring: 45 – 55°C

1. Disconnect hose (1).



2. Fit adapter **C3** and nipple **C2**, then install oil pressure gauge **C1** (5.9 MPa {60 kg/cm²}).

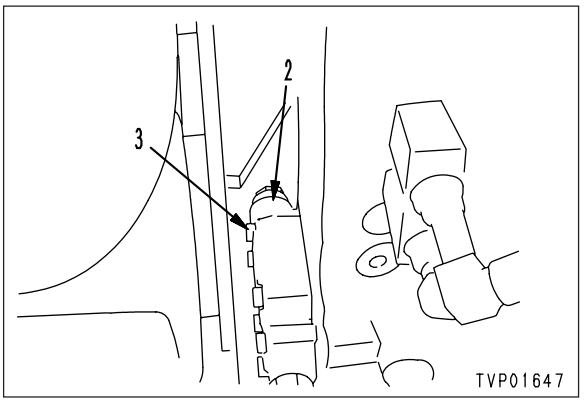
3. Measure the oil pressure with the engine at full throttle and the control levers at HOLD.

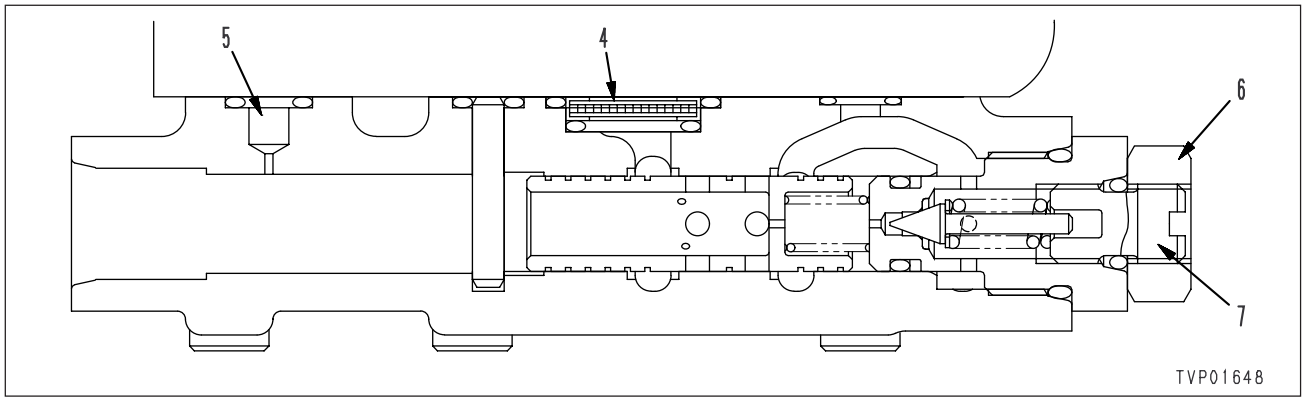


Adjusting

1. In order to turning the adjustment screw, remove with self reducing pressure valve (2) still installed to the valve body.

2. Loosen 6 mounting bolts (3) of self reducing pressure valve, then remove sub assembly.
   When doing this, be extremely careful not to drop coin filter (4) and poppet (5).
   (They are small and easy to lose.)





3. With the parts as a sub assembly, turn relief valve locknut (6) and adjustment screw (7) to adjust. (There is no need to remove the relief valve.)
   ★ Amount of adjustment for one turn of adjustment screw: 0.98 MPa {10 kg/cm^2}
      • Turn to RIGHT to INCREASE pressure
      • Turn to LEFT to DECREASE pressure
   ★ Amount of adjustment for one turn of adjustment screw: Amount of change in pressure

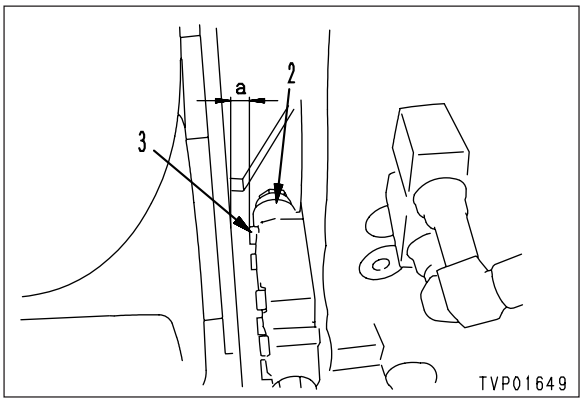
4. After adjusting, tighten locknut (6).

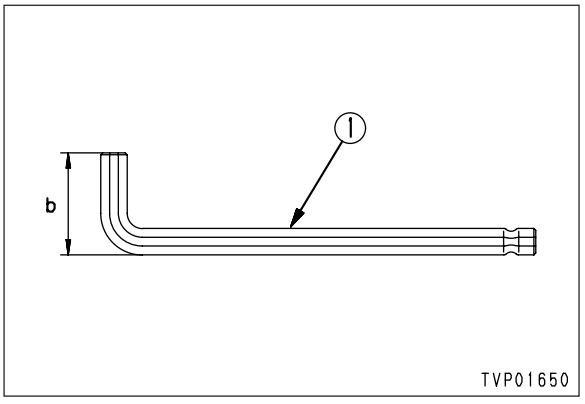
5. Installation
   1) Taking care not to drop coin filter (4) and poppet (5), install the self pressure reducing valve sub assembly.
   2) Tighten 6 mounting bolts (3).

      kgm Mounting bolt:
      11.25 ± 14.5 Nm {1.15 ± 0.15 kgm}

      Note: Clearance **a** between the self reducing pressure valve (2) and the chassis parts is small, so special tool (1) (hexagon wrench, width across flats: 5 mm) is needed when removing or installing 6 mounting bolts (3) of self pressure reducing valve.

      ★ Dimension **b** of special tool ① is approx. 30 mm, but the dimension may change slightly because of the variation in the mounting position of the valve, so in such cases, adjust dimension **b**.





TESTING OUTPUT PRESSURE OF SOLENOID VALVE

★ Oil temperature when measuring: 45 – 55°C

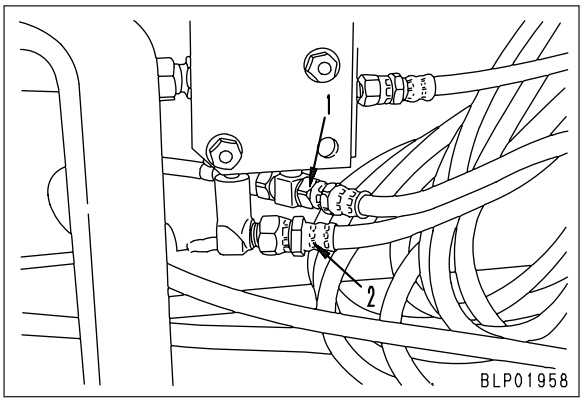
1. Disconnect outlet hose (1) or (2) from the valve to be measured.
   - (1): PPC lock solenoid valve
   - (2): Travel boost solenoid valve

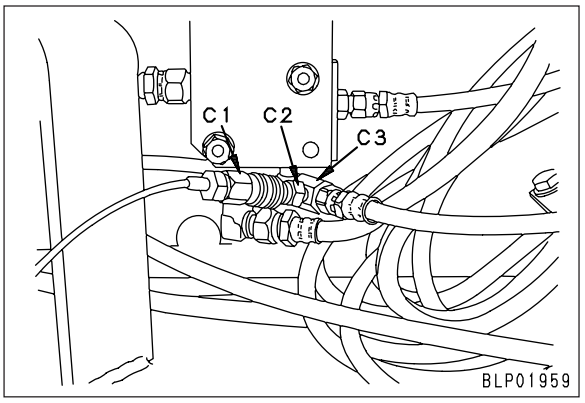
2. Fit adapter **C3** and nipple **C2**, then install oil pressure gauge **C1** (5.9 MPa {60 kg/cm²}).

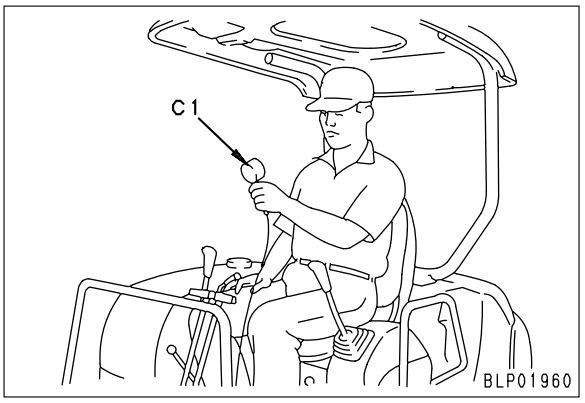
3. Run the engine at full throttle, set to the conditions in Table 1, and measure the output pressure.

Table 1

No.	Valve	Measurement conditions	Actuation of solenoid	Oil pressure
1	PPC lock	Lock lever at LOCK	OFF	0 {0}
		Lock lever at FREE	ON	$2.94^{+0.49}_{-0.1}$ $\{30^{+5}_{-1}\}$
2	Travel boost	Boost pedal OFF	OFF	0 {0}
		Boost pedal ON	ON	$2.94^{+0.49}_{-0.1}$ $\{30^{+5}_{-1}\}$





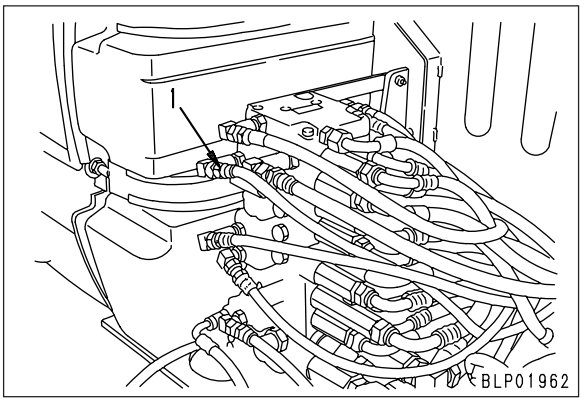


TESTING PPC VALVE OUTPUT PRESSURE AND SWING HOLDING BRAKE INLET PORT PRESSURE (PC20R)

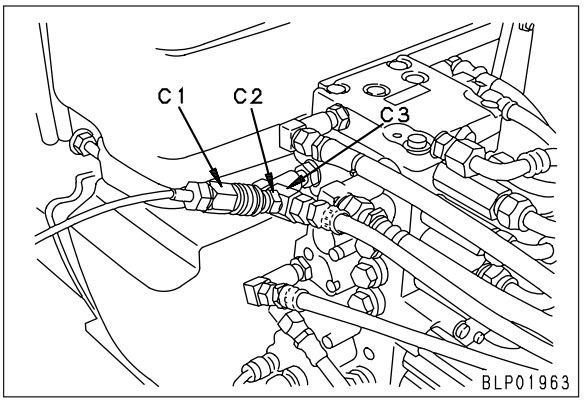
★ Oil temperature when measuring: 45 – 55°C

1. Measuring PPC valve output pressure

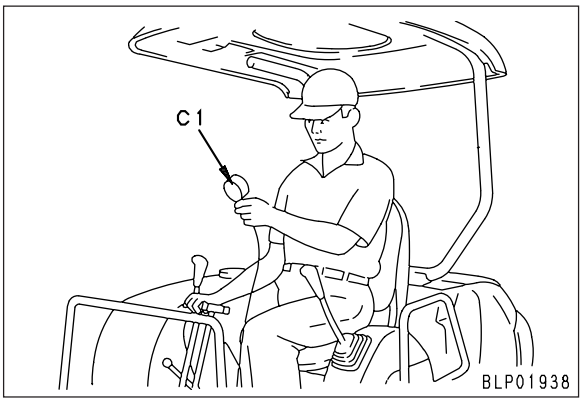
1) Disconnect PPC hose (1) of the circuit to be measured.
   ★ For details of the hose to disconnect, see the circuit diagram on the next page.



2) Fit adapter **C3** and nipple **C2**, then install oil pressure gauge **C1** (5.9 MPa {60 kg/cm²}).

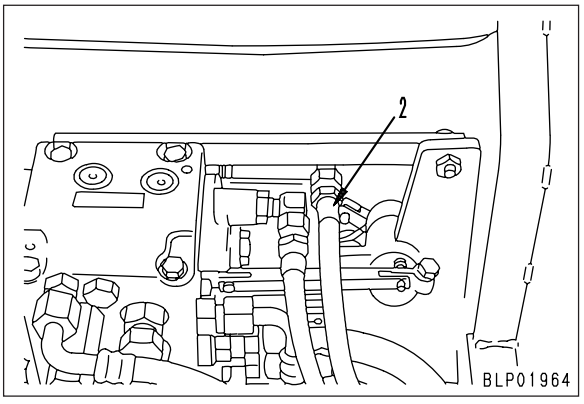


3) Measure the output pressure with the engine at full throttle and the control lever operated.
   ★ The standard value is the same as the control circuit pressure (when the control lever is operated fully).



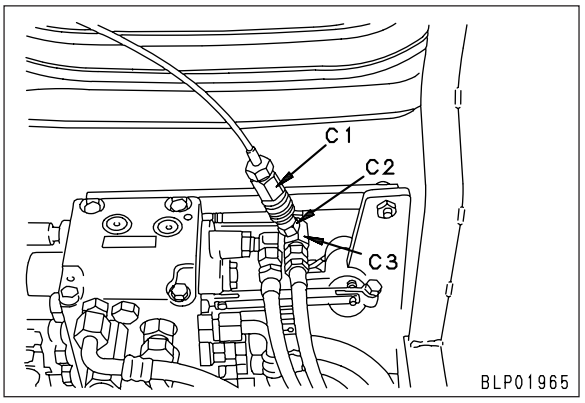
2. Measuring swing holding brake inlet port pressure

1) Disconnect hose (2).
2) Fit adapter **C3** and nipple **C2**, then install oil pressure gauge **C1** (5.9 MPa {60 kg/cm²}).
3) Measure the inlet port pressure with the engine at full throttle and the control lever operated to left swing, right swing, or arm IN.
   ★ The standard value is the same as the control circuit pressure (when the control lever is operated fully).

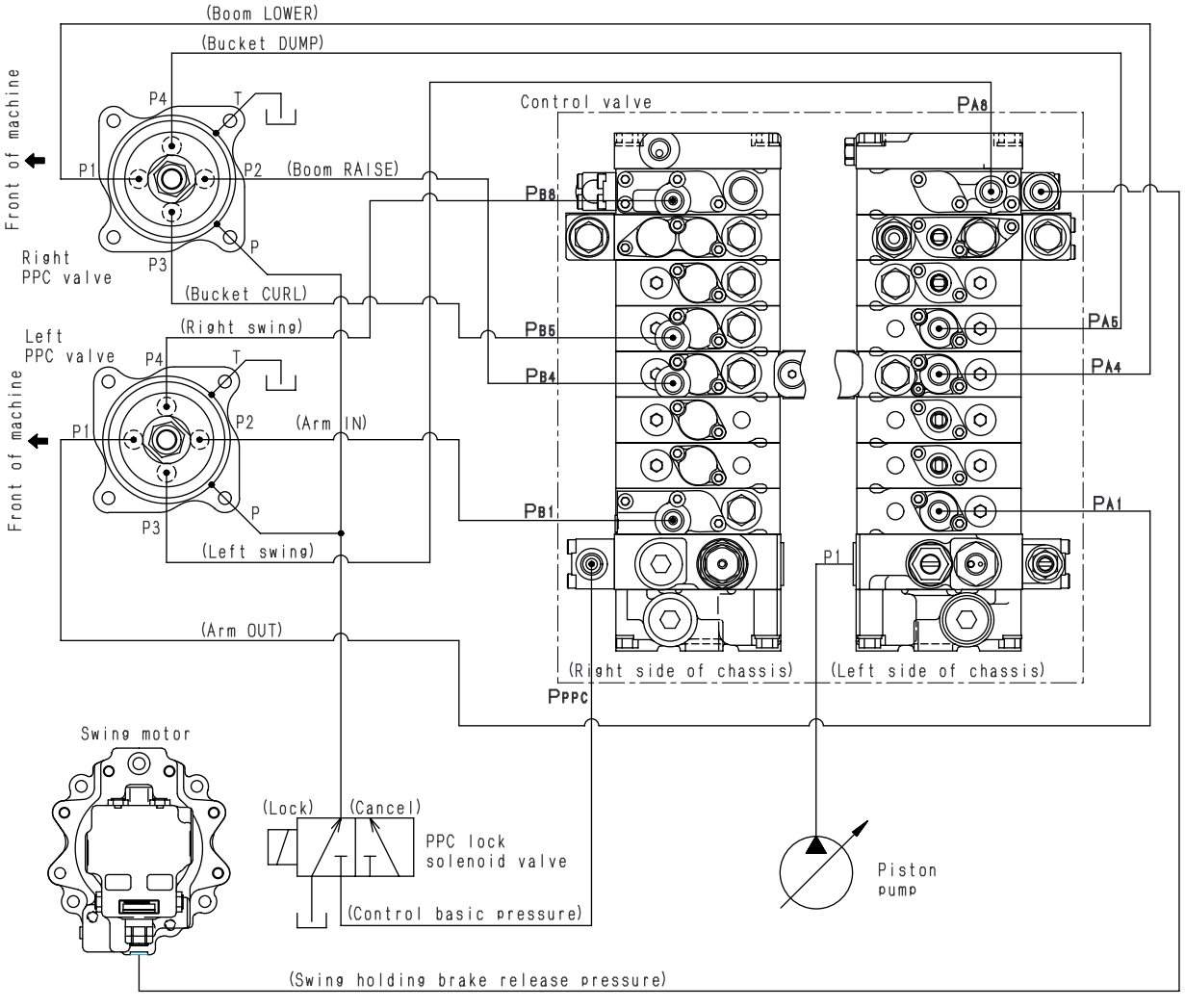


<Reference>

- If the PPC valve output pressure is normal for all of left swing, right swing, and arm IN, and the swing holding brake inlet port pressure is not normal for any of these operations, it can be judged that the PPC shuttle valve for the abnormal system is defective.
- The PPC shuttle valve is assembled inside the control valve spring case.



PPC valve and swing holding brake circuit diagram



★This diagram shows the connections for the JIS pattern.

TKP01313

ADJUSTING WORK EQUIPMENT, SWING PPC VALVE

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

1. Remove the PPC valve.
   ★ For details, see DISASSEMBLY AND ASSEMBLY, REMOVAL OF PPC VALVE ASSEMBLY.

2. Remove boot (1).

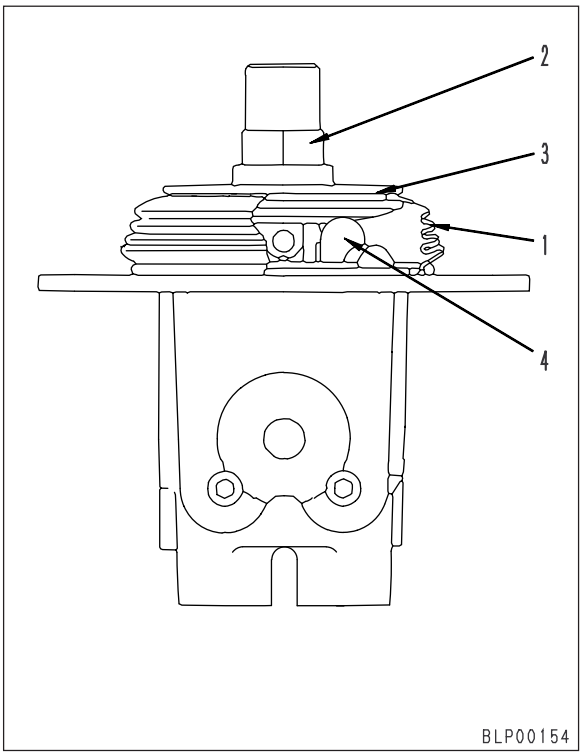
3. Loosen locknut (2), then screw in disc (3) to a position where it contacts the heads of 4 pistons (4).
   ★ When doing this, do not make the piston move.

4. Fix the position of disc (3), then tighten locknut (2) to the specified torque.

   kgm Locknut : **113± 15Nm {11.5 ± 1.5 kgm}**

5. Install boot (1).

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

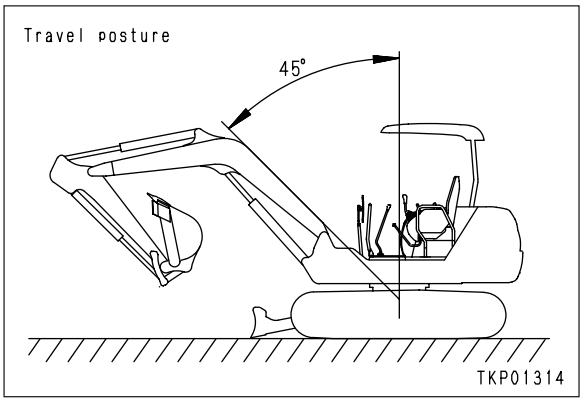


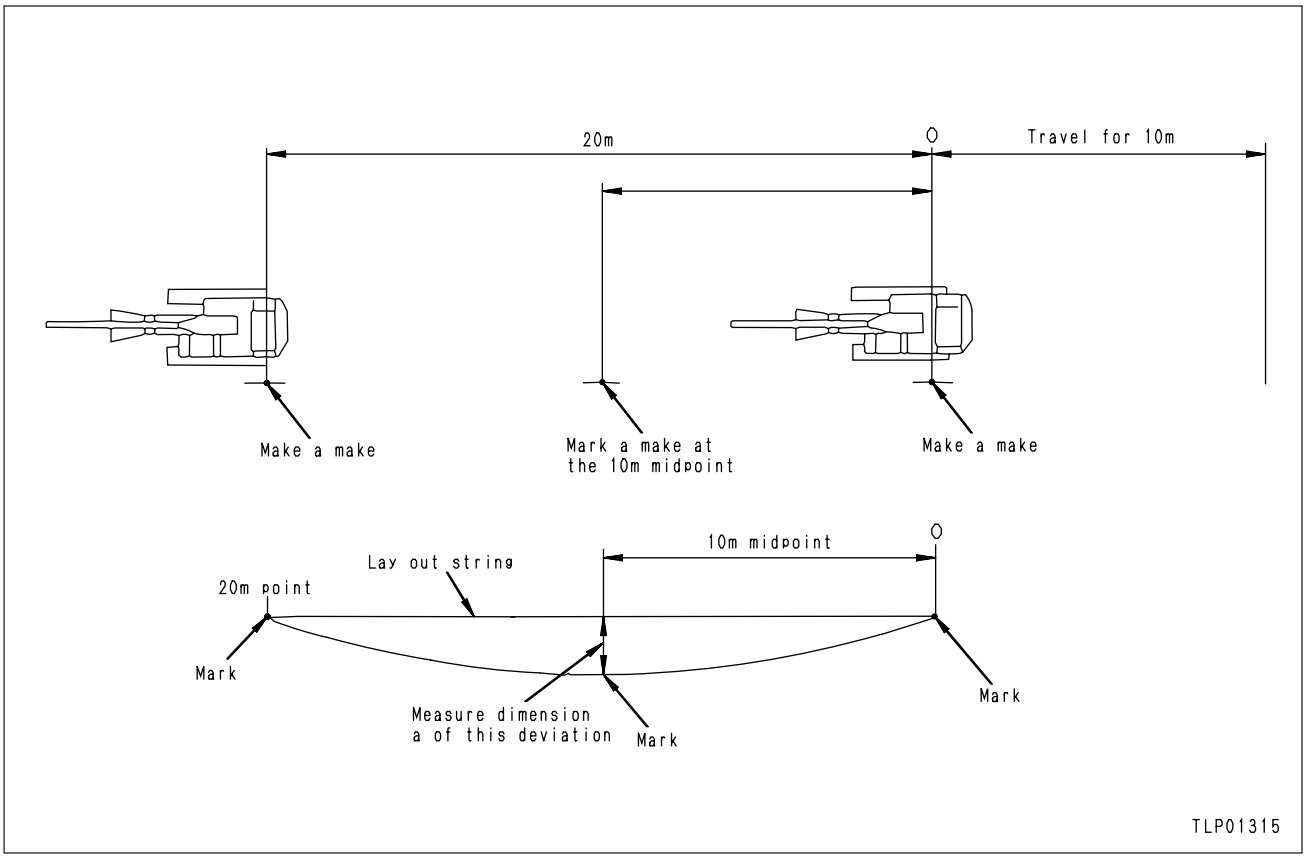
TESTING AND ADJUSTING TRAVEL DEVIATION

★ When traveling on flat ground

1. Set the machine in the travel posture.
   ★ When setting the machine in the travel posture, extend the bucket and arm cylinder rod fully, and hold the boom at an angle of 45°.

2. Travel for 10m, then measure the deviation when traveling for the next 20m.
   ★ Measure with the engine at full throttle.
   ★ Install the oil pressure gauge and measure the pump discharge pressure at the same time.





TESTING OIL LEAKAGE

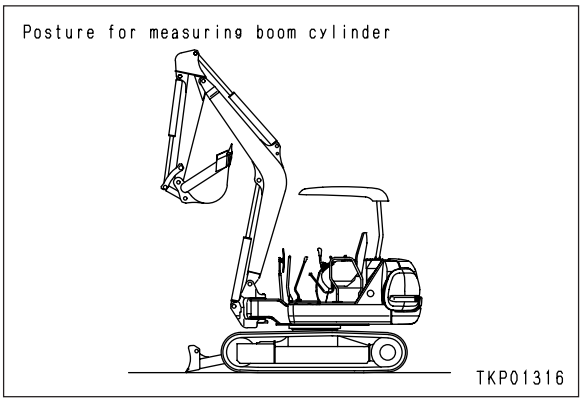
★ Oil temperature when measuring: 45 – 55°C
  ★ If the hydraulic drift of the work equipment exceeds the standard value, carry out this operation to measure the leakage inside the cylinder to check if the cause of the hydraulic drift is in the cylinder or in the control valve.
    • If the leakage is within the standard value, the control valve is the cause.
    • If the leakage is not within the standard value, the cylinder is the cause.

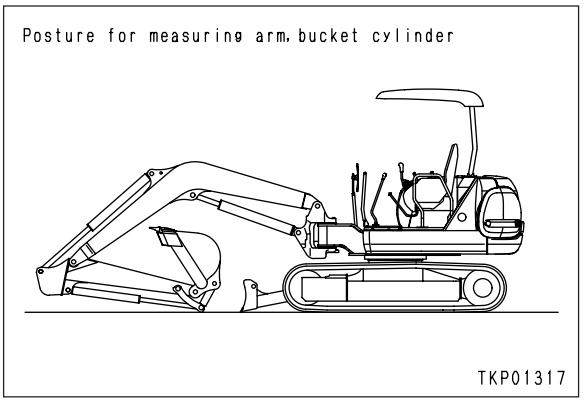
1. Fully extend the rod of the work equipment cylinder to be measured, then stop the engine.

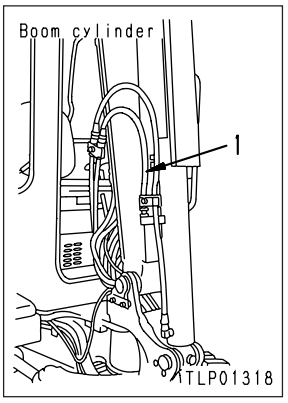
2. Disconnect hose (1) at the head end and block the hose at the chassis end with a blind plug.
   ⚠ Be careful not to disconnect the piping at the bottom end.

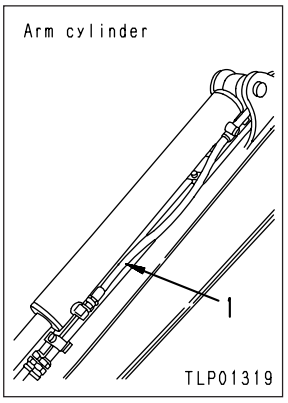
3. Start the engine, run at full throttle, and apply relief pressure to the cylinder bottom end as follows.
   ★ Boom cylinder: Boom RAISE
   Arm cylinder: Arm IN
   Bucket cylinder: Bucket CURL

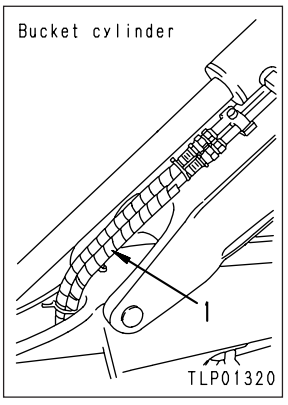
4. Wait for 30 seconds, then measure the leakage for the next one minute.

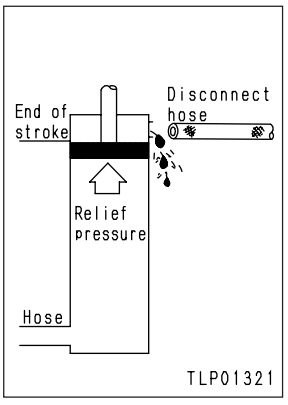












RELEASING REMAINING PRESSURE FROM HYDRAULIC CIRCUIT

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

1. Run the engine at low idling, operate the hydraulic cylinders so that as far as possible the pressure is 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 hydraulic circuit relieved and the hydraulic cylinder at the end of its stroke, do not carry out any work for 5 to 10 minutes.

2. When removing the piping, loosen the piping sleeve nut gradually to release the pressure remaining in the piping slowly, then remove the piping after the oil stops spurting out.

RELEASING REMAINING PRESSURE FROM HYDRAULIC TANK

⚠ The hydraulic tank is a sealed type, so it is pressurized.
When removing the hoses or plugs installed to the hydraulic tank, release the remaining pressure in the hydraulic tank as follows.

1. Lower the work equipment to the ground and stop the engine.

2. Loosen the hydraulic tank oil filler plug slowly to release the pressure inside the hydraulic tank.

PRESSURIZING HYDRAULIC TANK

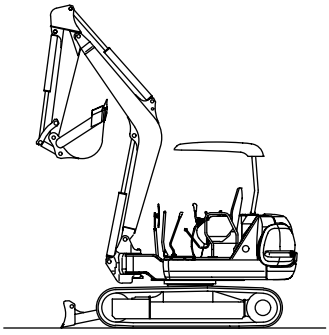
★ If the oil filler plug of the hydraulic tank has been removed, pressurize the hydraulic tank as follows.

1. Run the engine at low idling and set the work equipment to the pressurizing posture.

2. Stop the engine, open the hydraulic tank oil filler plug, then tighten it again.
   ★ This operation pressurizes the hydraulic tank.

3. Start the engine and lower the work equipment to the ground.

Hydraulic tank pressurijing posture



TKP01322

BLEEDING AIR

Order for operations and procedure for bleeding air

Air bleeding item / Nature of work	Air bleeding procedure						
	1	2	3	4	5	6	7
	Bleeding air from pump	Start engine	Bleeding air from cylinder	Bleeding air from swing motor	Bleeding air from travel motor	Pressurize hydraulic tank	Start operations
• Change hydraulic oil • Clean strainer	○ →	○ →	○ →	○ (Note) →	○ (Note) →	○ →	○
• Replace return filter element		○ →	→	→	→	○ →	○
• Replace, repair pump • Remove suction piping	○ →	○ →	○ →	→	→	○ →	○
• Replace, repair control valve		○ →	○ →	→	→	○ →	○
• Replace, repair cylinder • Remove cylinder piping		○ →	○ →	→	→	○ →	○
• Replace, repair swing motor • Remove swing motor piping		○ →	→	○ →	→	○ →	○
• Replace, repair travel motor, swivel • Remove travel motor, swivel piping		○ →	→	→	○ →	○ →	○

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

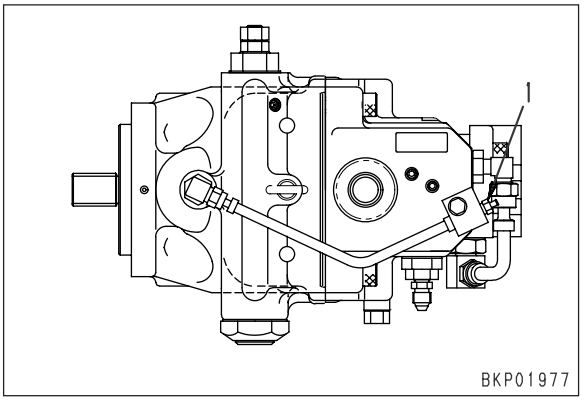
1. Bleeding air from pump

1) Loosen air bleed plug (1), and bleed the air from the plug hole.
   ★ When no more air comes out with the oil, the bleeding operation is completed.
2) Tighten air bleed plug (1).

   kgm Air bleed plug :

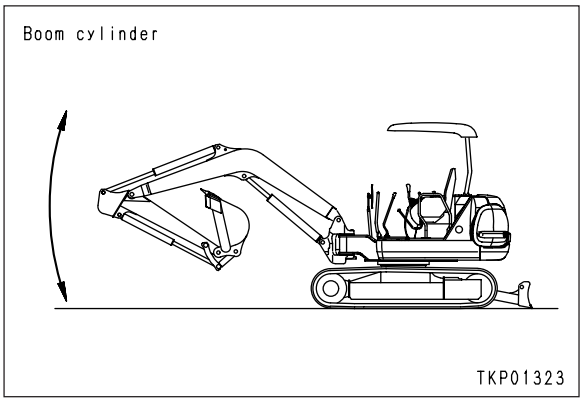
   8.8 ± 1 Nm {0.9 ± 1 kgm}

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



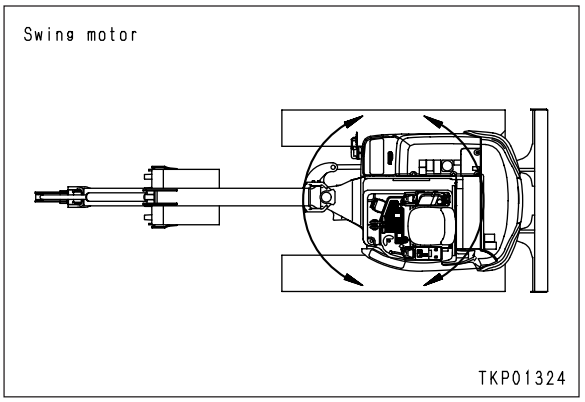
2. Bleeding air from hydraulic cylinders

1) Start the engine and run at idling for approx. 5 minutes.
2) Run the engine at low idling, and 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, bucket, boom swing, and blade cylinders.



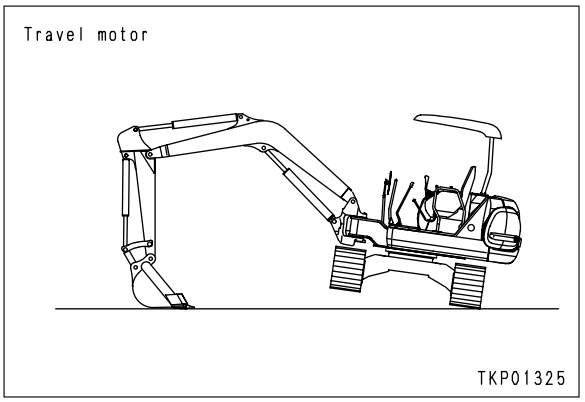
3. Bleeding air from swing motor

1) Run the engine at low idling and swing 3 turns to the left.
2) Next, swing 3 turns to the right.



4. Bleeding air from travel motor

1) Run the engine at low idling and use the work equipment to raise the track on the left side.
2) Run the engine at low idling, and rotate the track on the left side under no load for approx. 30 seconds.
3) Repeat Steps 1) and 2) for the track on the right side.



5. Pressurizing hydraulic tank

1) Before pressurizing the hydraulic tank, check the hydraulic oil level.
2) Pressurize the hydraulic tank. For details, see PRESSURIZING HYDRAULIC TANK.

TROUBLESHOOTING

Points to remember when troubleshooting 20-202
Sequence of events in troubleshooting 20-203
Points to remember when carrying out maintenance 20-204
Checks before troubleshooting 20-212
Connector types and mounting locations 20-213
Connection table for connector pin numbers 20-216
Method of using troubleshooting charts 20-226
Troubleshooting of electrical system (E mode) 20-301
Troubleshooting of hydraulic and mechanical system (H mode) 20-401
Troubleshooting of machine monitor system (M mode) 20-501

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.

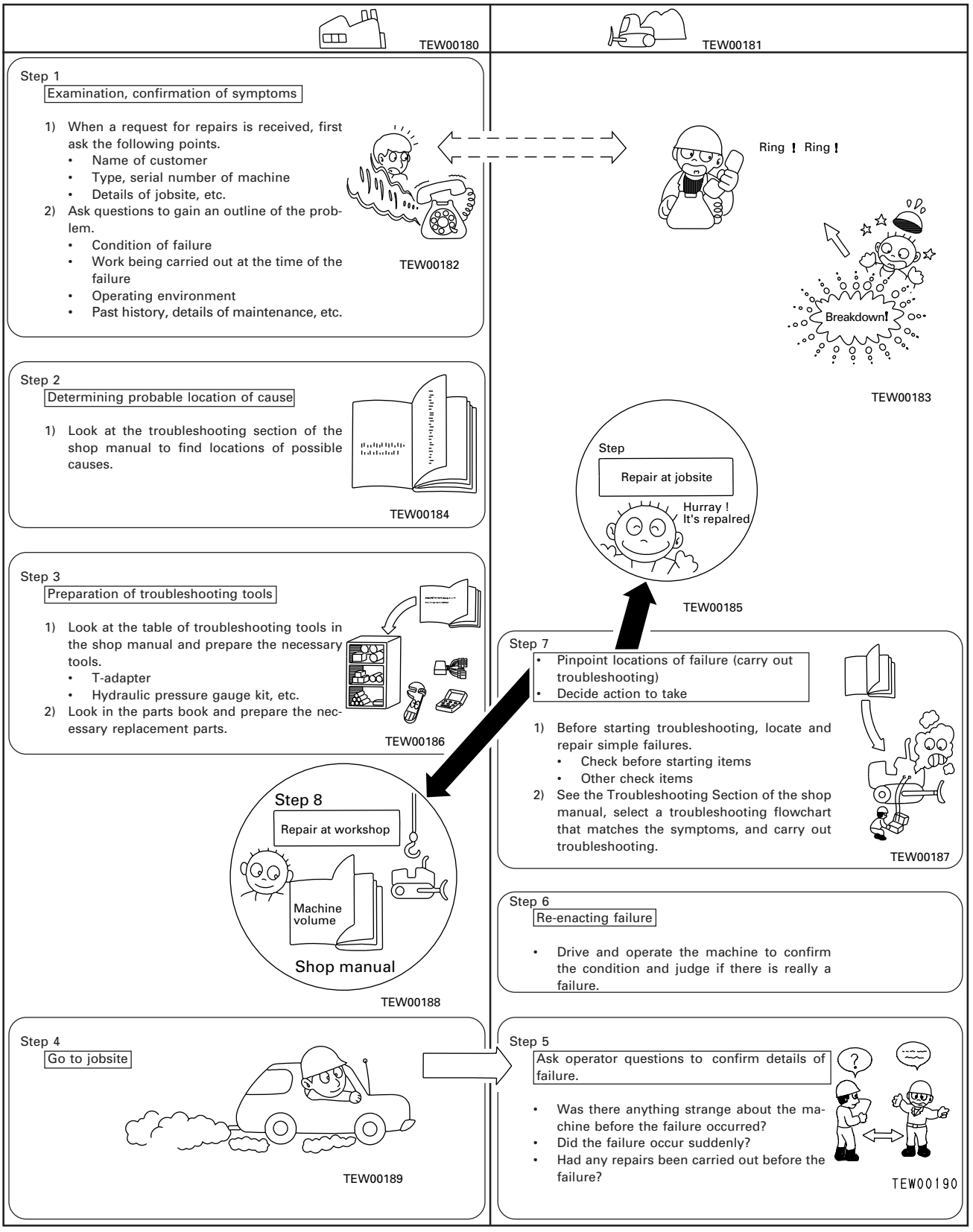
⚠ When removing the plug or cap from a location which is under pressure from oil, water, or air, always release the internal pressure first. When installing measuring equipment, be sure to connect it properly.

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 through 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 occured apart from the problem that had been reported?
   2) Was there anything strange about the machine before tha 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) Were there abnormal symptoms about the machine?
   2) Check checking items before starting.
   3) Check other checking 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 occureed. Then, remove the root cause.

SEQUENCE OF EVENTS IN TROUBLESHOOTING



POINTS TO REMEMBER WHEN CARRYING OUT MAINTENANCE

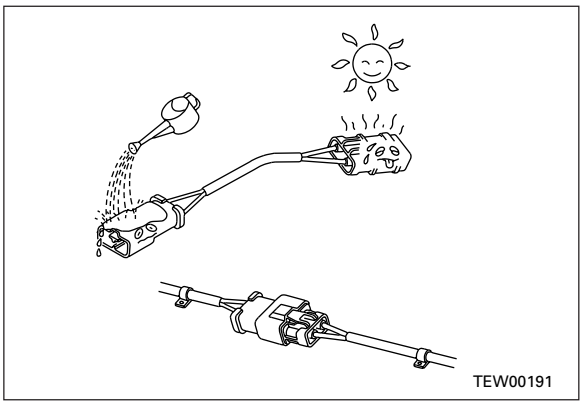
To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct operation, maintenance and inspection, troubleshooting, and repairs must be carried out. This section deals particularly with correct repair procedures for mechatronics 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.

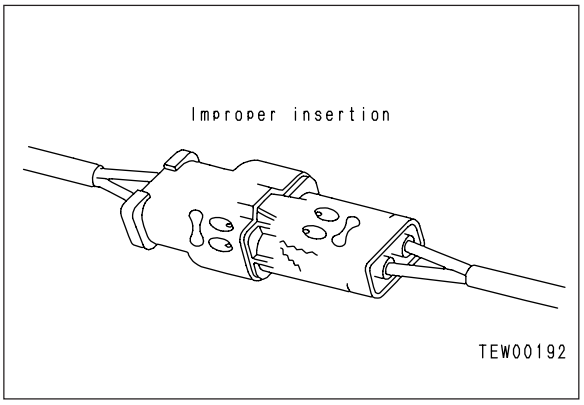
Compared with other electrical components fitted in boxes or cases, wiring harnesses are more likely to be affected by the direct effects of rain, water, heat, or vibration. Furthermore, during inspection and repair operations, they are frequently removed and installed again, so they are likely to suffer deformation or damage. For this reason, it is necessary to be extremely careful when handling wiring harnesses.



Main failures occurring in wiring harness

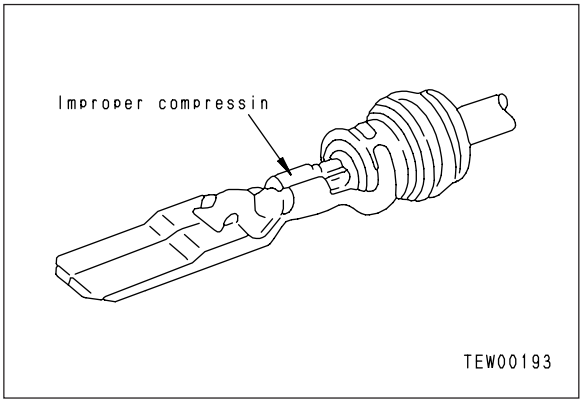
① Defective contact of connectors (defective contact between male and female)

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.

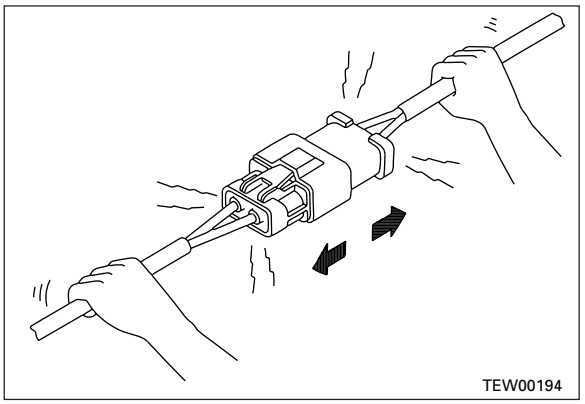


② Defective crimping or soldering of connectors

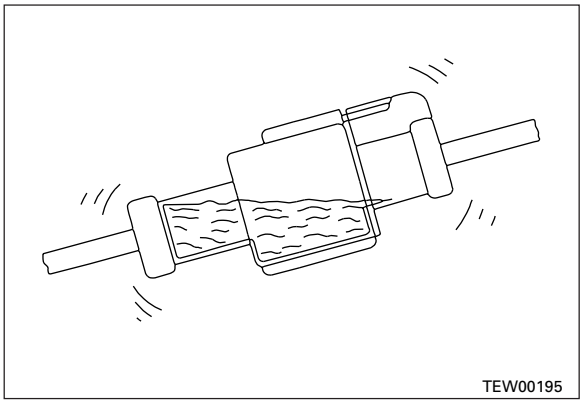
The pins of the male and female connectors are in contact at the crimped terminal or soldered portion, but if there is excessive force brought to bear on the wiring, the plating at the joint will peel and cause improper connection or breakage.



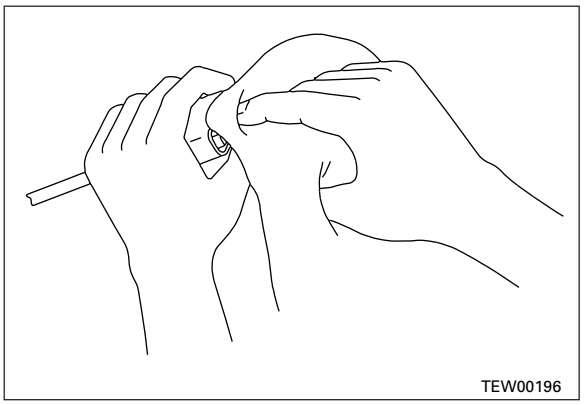
③ Disconnections in wiring
If the wiring is held and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping of the connector may separate, or the soldering may be damaged, or the wiring may be broken.


TEW00194

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.


TEW00195

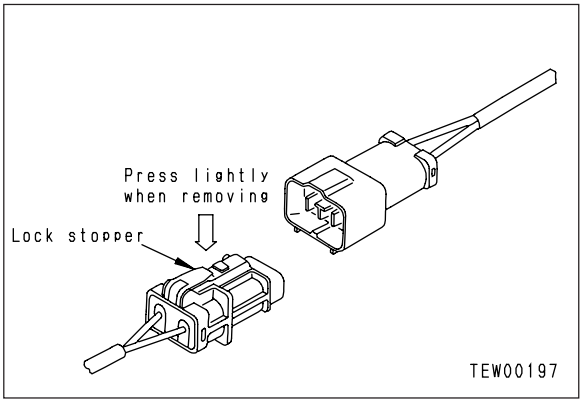
⑤ Oil or dirt stuck to connector
If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, so there will be defective contact.
If there is oil or grease stuck to the connector, wipe it off with 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.


TEW00196

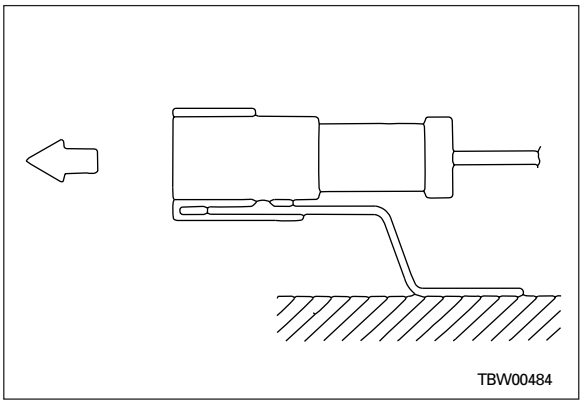
2) Removing, installing, and drying connectors and wiring harnesses

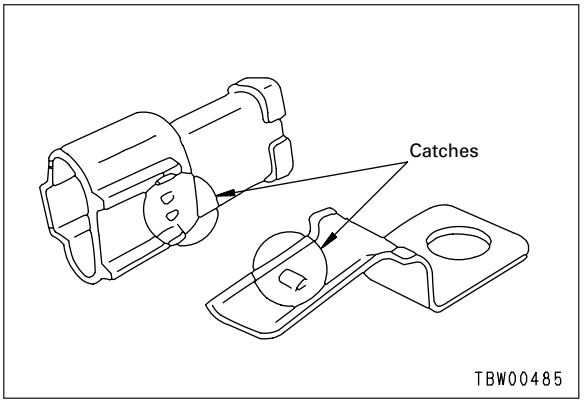
- **Disconnecting connectors**

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.

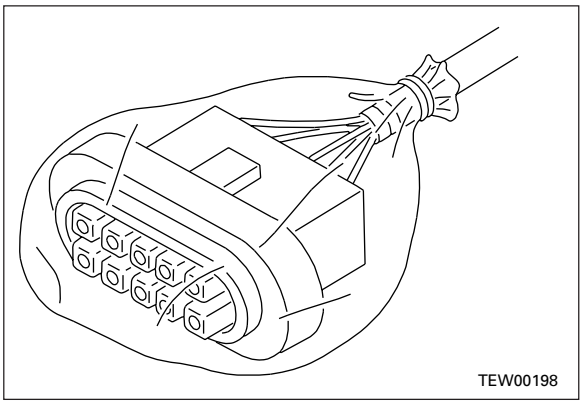


② When removing from clips
When removing a connector from a clip, pull the connector in a parallel direction to the clip.
★ If the connector is twisted up and down or to the left or right, the housing may break.





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.

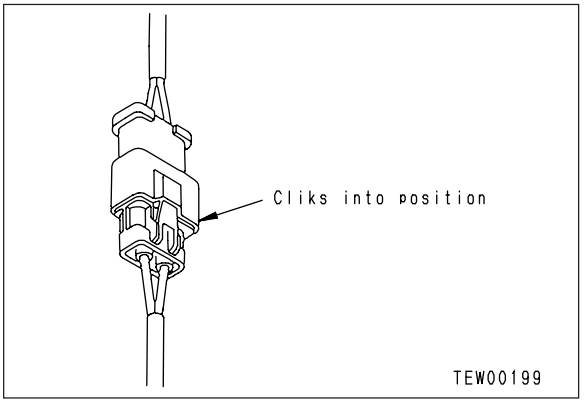


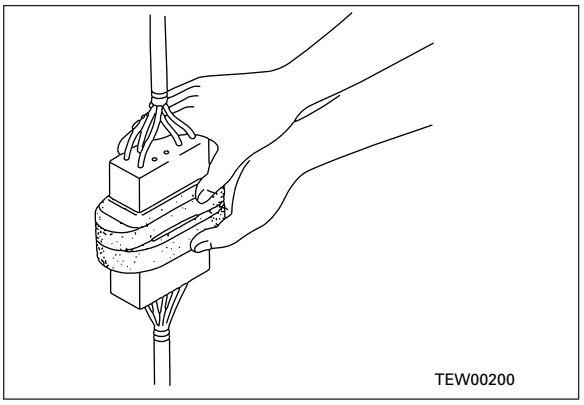
- **Connecting connectors**
  ① Check the connector visually.
  1) Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).
  2) Check that there is no deformation, defective contact, corrosion, or damage to the connector pins.
  3) Check that there is no damage or breakage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

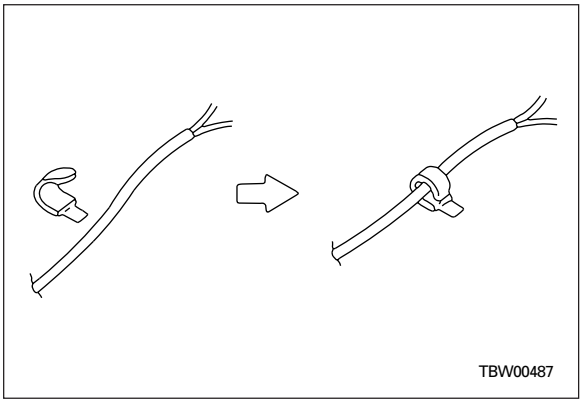
  ② Fix the connector securely.
  Align the position of the connector correctly, then insert it securely.
  For connectors with lock stopper, push in the connector until the stopper clicks into position.

  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.

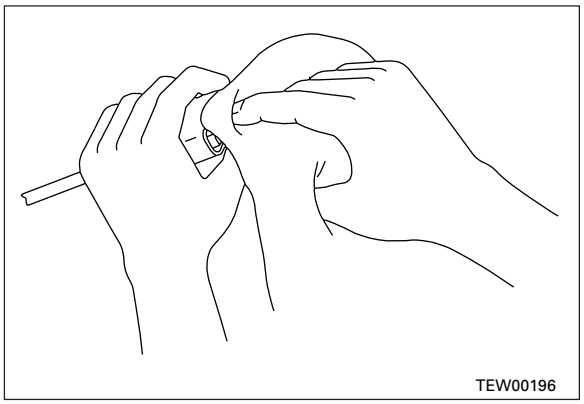




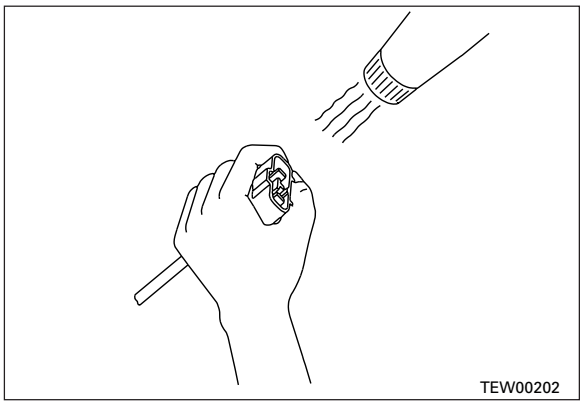


- **Drying wiring harness**
  If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high-pressure water or steam directly on the wiring harness.

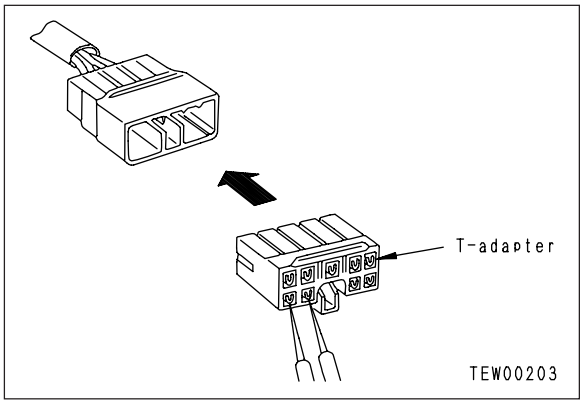
  If water gets directly on the connector, do as follows.
  ① Disconnect the connector and wipe off the water with a dry cloth.
  ★ If the connector is blown dry with compressed air, there is the risk that oil in the air may cause defective contact, so remove all oil and water from the compressed air before blowing with air.


TEW00196

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.


TEW00202

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.

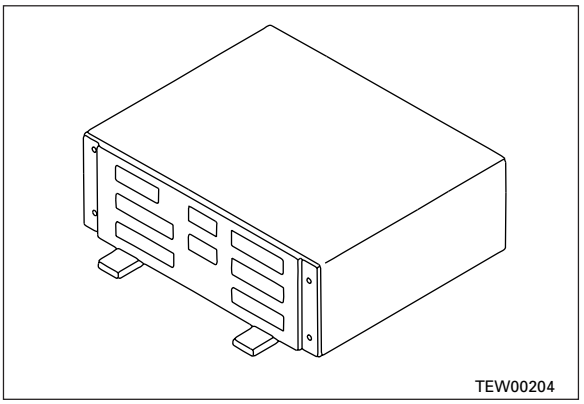


TEW00203

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.

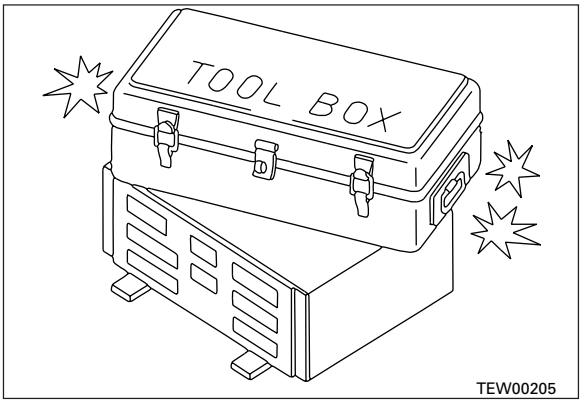
② Do not open the cover of the control box unless necessary.


TEW00204

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.

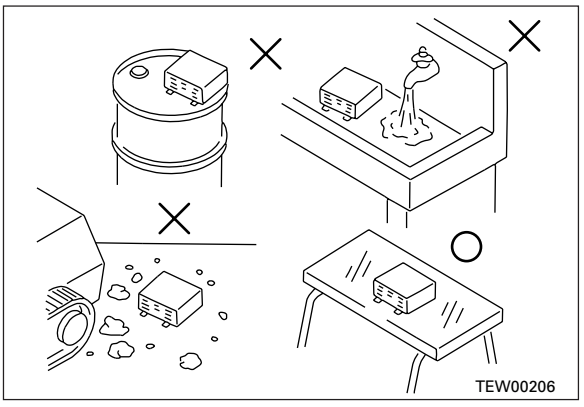
⑤ During rainy weather, do not leave the control box in a place where it is exposed to rain.



TEW00205

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.


TEW00206

2. Points to remember when troubleshooting electric circuits

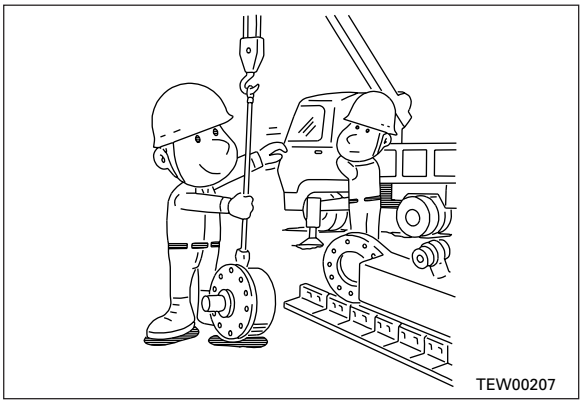
1) Always turn the power OFF before disconnecting or connect connectors.
2) Before carrying out troubleshooting, check that all the related connectors are properly inserted.
   ★ Disconnect and connect the related connectors several times to check.
3) Always connect any disconnected connectors before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

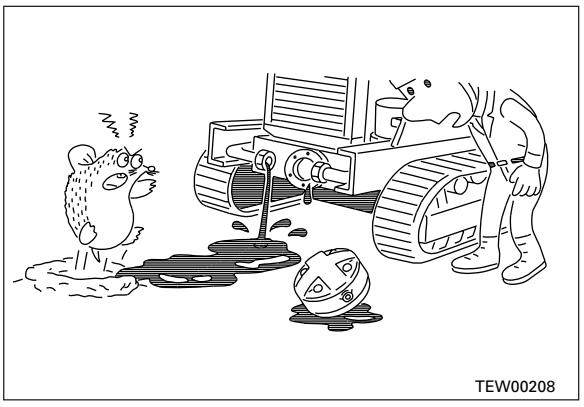
With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

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.

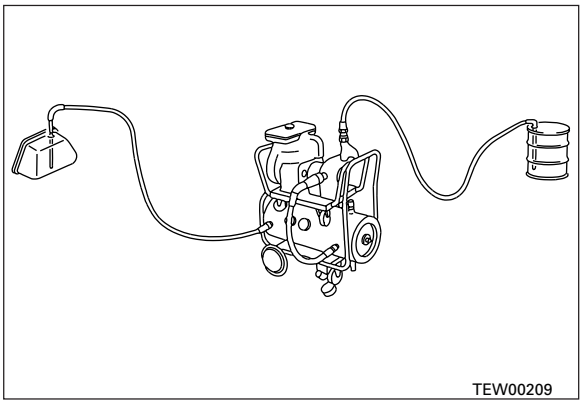
2) **Disassembly and maintenance work in the field**
If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to confirm the performance after repairs, so it is desirable to use unit exchange. Disassembly 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

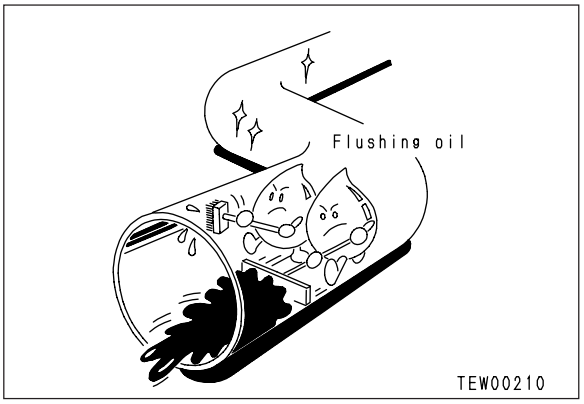
5) Change hydraulic oil when the temperature is high.

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.

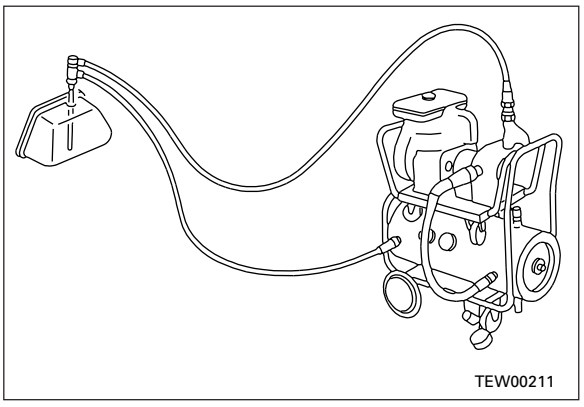
Normally, flushing is carried out twice: primary flushing is carried out with flushing oil, and secondary flushing is carried out with the specified hydraulic oil.



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.



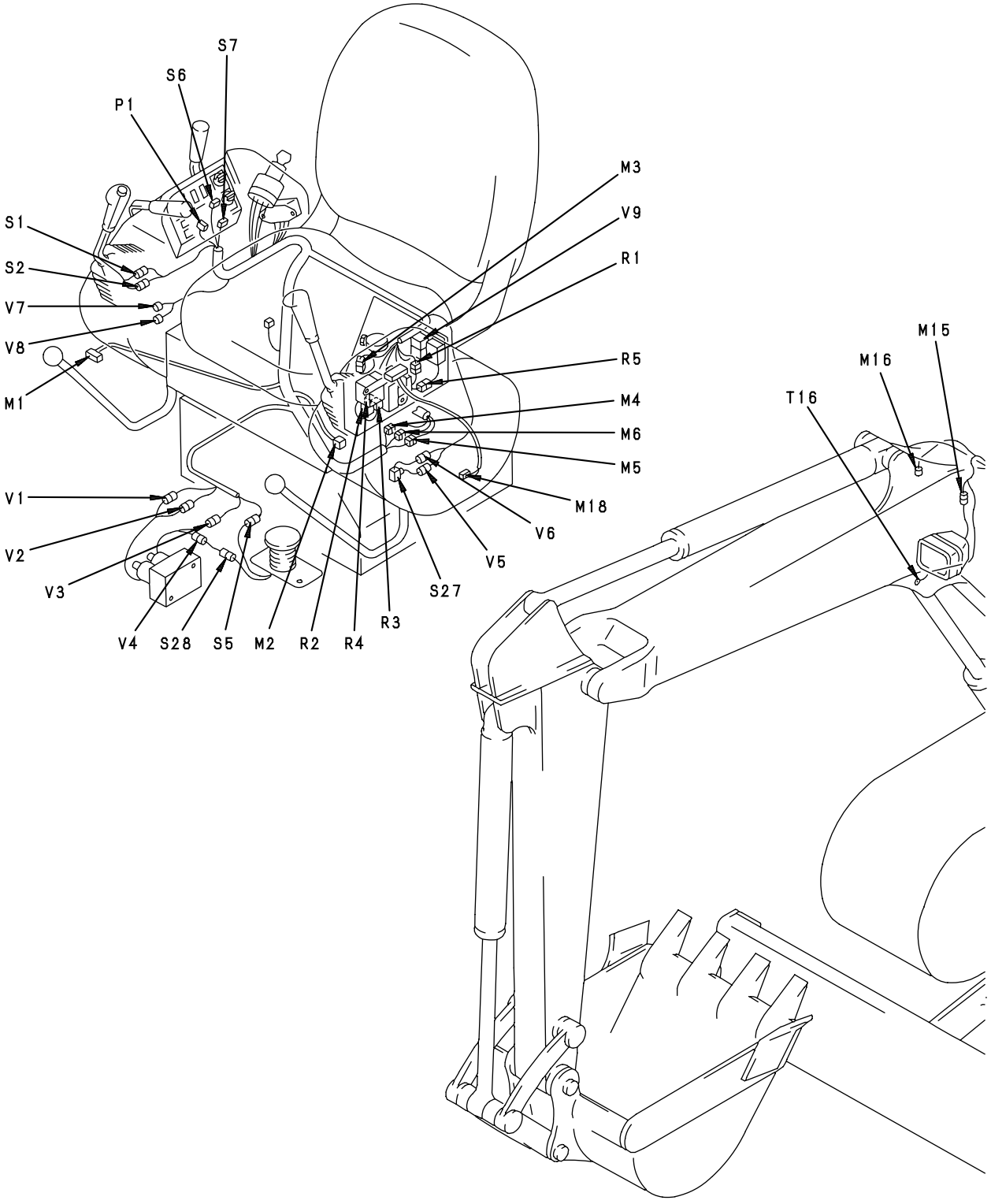
CHECKS BEFORE TROUBLESHOOTING

	Item	Judgement standard	Remedy
Lubricating oil, cooling water	1. Check fuel level	—	Add fuel
	2. Check for dirt or water in fuel	—	Clean, drain
	3. Check hydraulic oil level	—	Add oil
	4. Check hydraulic oil strainer	—	Clean, drain
	5. Check engine oil level (level of oil in oil pan)	—	Add oil
	6. Check cooling water level	—	Add water
	7. Check condition of dust indicator	—	Clean or replace
	8. Check hydraulic oil filter		Replace
Electrical equipments	1. Check for loose or corroded battery terminals	—	Tighten or replace
	2. Check for loose or corroded alternator terminals	—	Tighten or replace
	3. Check for loose or corroded starting motor terminals	—	Tighten or replace
Hydraulic, mechanical equipments	1. Check for abnormal noise or smell	—	Repair
	2. Check for oil leakage	—	Repair
	3. Bleed air from system	—	Bleed air
Electrical components	1. Check battery voltage (engine stopped)	10 – 15 V	Replace
	2. Check level of battery electrolyte	—	Add or replace
	3. Check for discolored, burnt, or bare wiring	—	Replace
	4. Check for missing wiring clamps, hanging wires	—	Repair
	5. Checks for getting wet onto wiring (check carefully getting wet at connectors and terminals)	—	Disconnect connector and dry connection
	6. Check for broken or corroded fuses	—	Replace
	7. Check alternator voltage (engine running at over half throttle)	[After running for few min. 13.5 – 14.5 V]	Replace

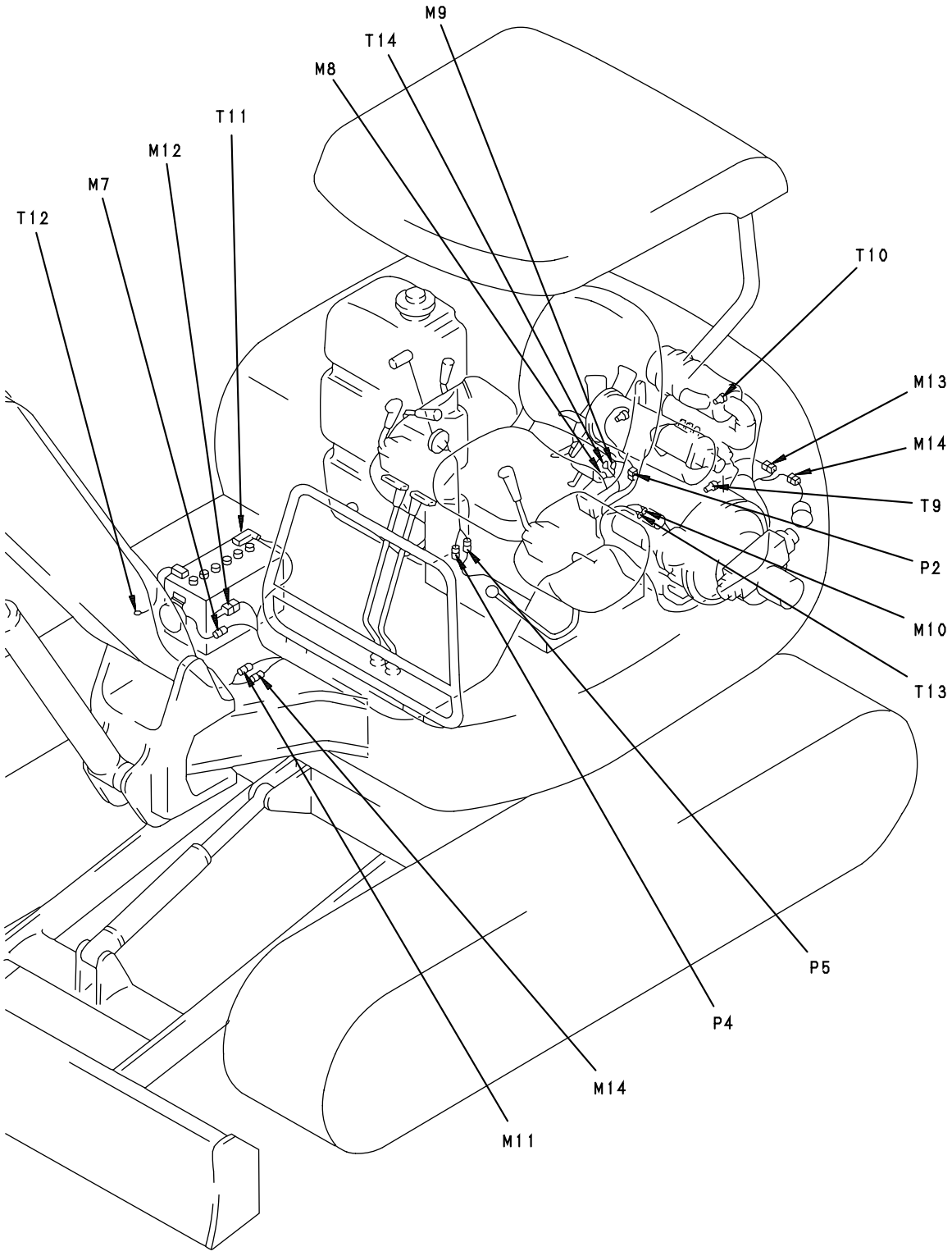
CONNECTOR TYPES AND MOUNTING LOCATIONS

Connector No.	Connector type	No. of pins	Mounting location	Address
D1	—	2	Diode (engine stop solenoid circuit)	—
D2	—	2	Diode (alarm buzzer circuit)	—
K5		4	Deceleration controller	—
K6		6	Deceleration controller	—
K7		6	Deceleration motor	—
K33	—	1	Deceleration indicator	—
K34	—	1	Deceleration indicator	—
K35		2	Deceleration indicator resistance	—
M1		6	Intermediate connector	A6
M2		3	Heater (operator's cab specifications)	B5
M3		2	Alarm buzzer	D8
M4		8	Intermediate connector	D7
M5		2	Intermediate connector	D6
M6		6	Intermediate connector	D6
M7	—	1	Horn	G8
M8	—	1	Alternator	H9
M9		2	Alternator	I9
M10	—	1	Starting motor	L5
M11	—	1	Intermediate connector	I2
M12		2	Fusible link	G8
M13		3	Engine stop solenoid	L7
M14		2	Fuel feed pump	L6
M14	—	1	Intermediate connector	J2
M15	—	1	Working lamp	F7
M16	—	1	Working lamp (additional)	F7
M17		4	Intermediate connector	—
M18		6	Wiper switch (operator's cab specifications)	D6
M22	—	1	Room lamp (operator's cab specifications)	—
M25		2	Window washer (operator's cab specifications)	—
M26		4	Wiper motor (operator's cab specifications)	—
M30		2	Intermediate connector	—
M31		2	Service power source	
P1		16	Monitor panel	A8
P2		2	Coolant temperature sensor	L5

Connector No.	Connector type	No. of pins	Mounting location	Address
P4	—	1	Fuel level sensor	K2
P5	—	1	Fuel level sensor	K3
R1		4	Safety relay	D7
R2		2	Engine stop relay	B5
R3	—	1	Engine stop relay	C5
R4	—	1	Engine stop relay	C5
R5		4	Engine stop timer	D7
S1	—	1	Horn switch	A8
S2	—	1	Horn switch	A7
S5	—	1	Travel boost switch	B5
S6		4	Lamp switch	B9
S7		4	Heater switch (operator's cab specifications)	B9
S20	—	1	Deceleration switch	—
S21	—	1	Deceleration switch	—
S27	—	1	PPC lock switch	C5
S28	—	1	Travel boost switch	B5
T9	—	1	Engine oil pressure switch	L6
T10	—	1	Intake heater	K7
T11	—	1	Battery	H8
T12	—	1	Revolving frame ground	G8
T13	—	1	Starting motor	L5
T14	—	1	Alternator	I9
T16	—	1	Work equipment ground	E7
V1	—	1	PPC lock solenoid valve	A6
V2	—	1	PPC lock solenoid valve	A5
V3	—	1	Travel boost solenoid valve	A5
V4	—	1	Travel boost solenoid valve	A5
V5	—	1	PPC lock switch	C5
V6	—	1	PPC lock switch	D6
V7	—	1	For service	A7
V8	—	1	For service	A7
V9	—	5	Relay for service	A8
V10	—	2	Diode (relay circuit for service)	—

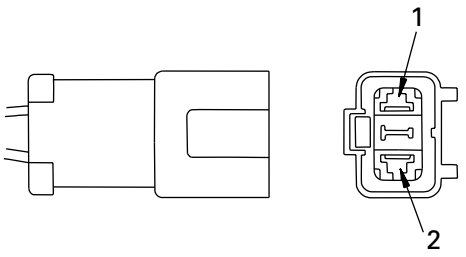
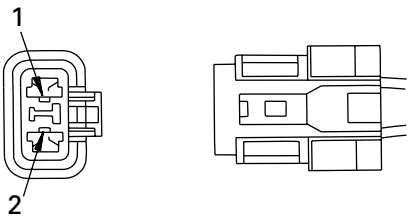
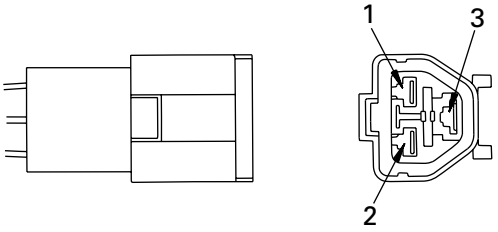
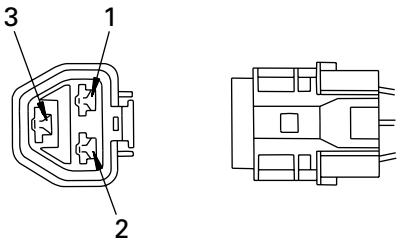
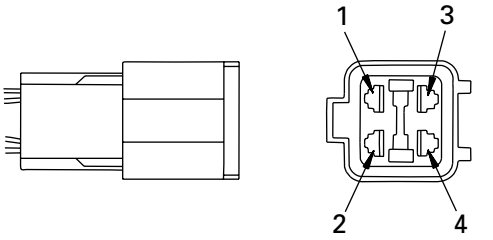
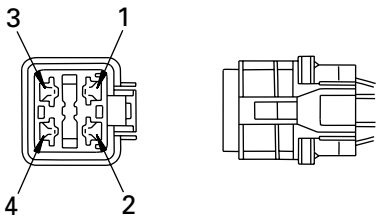

S7
S6
P1
M3
V9
R1
S1
S2
V7
V8
M1
R5
M4
M6
M5
M18
V6
V5
V1
V2
V3
S27
R3
V4
S28
S5
M2
R2
R4
M15
M16
T16

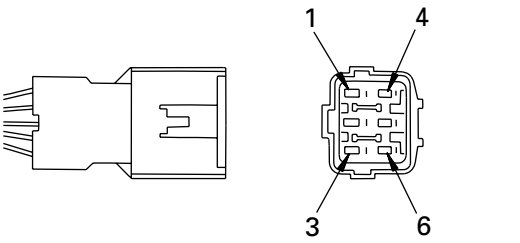
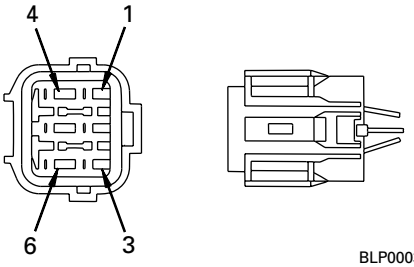
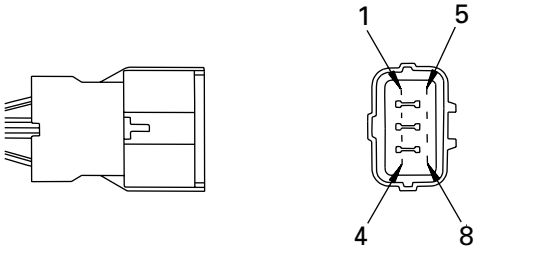
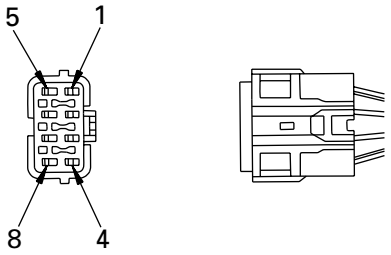
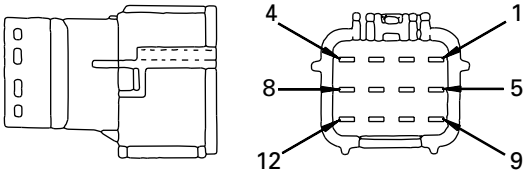
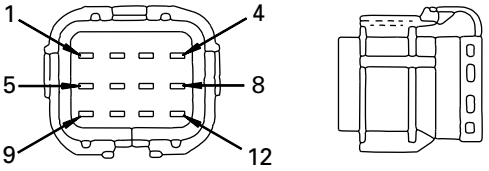
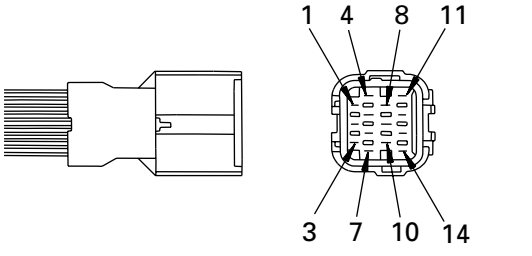
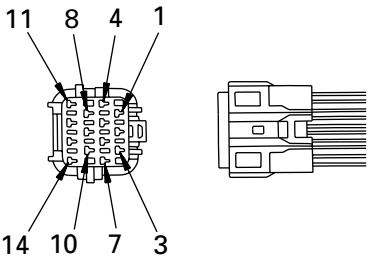
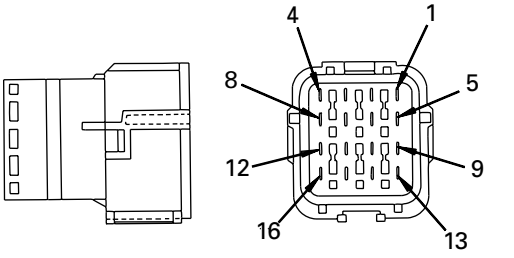
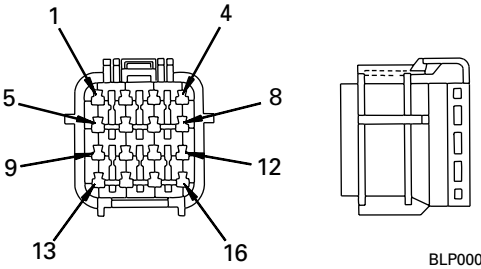
BLP02080

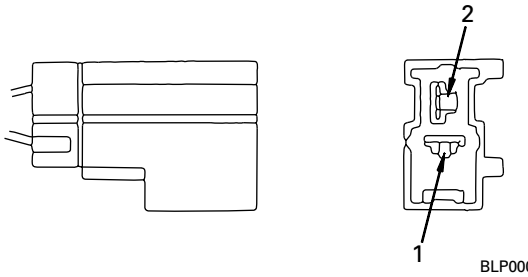
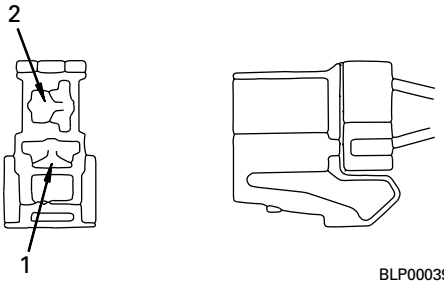
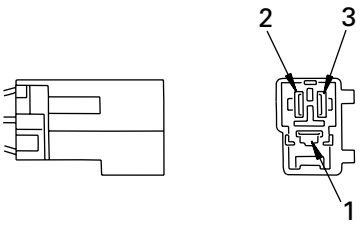
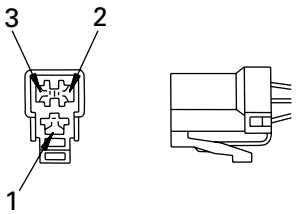
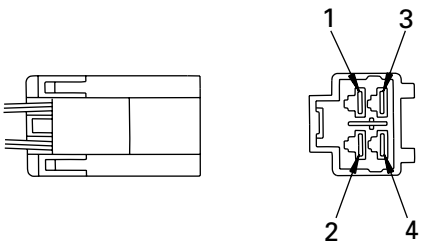
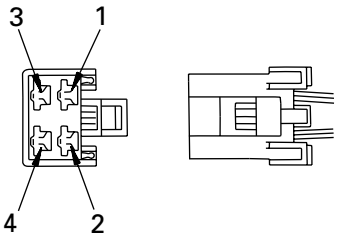
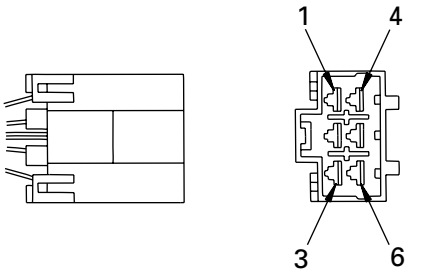
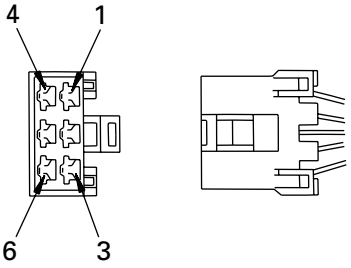
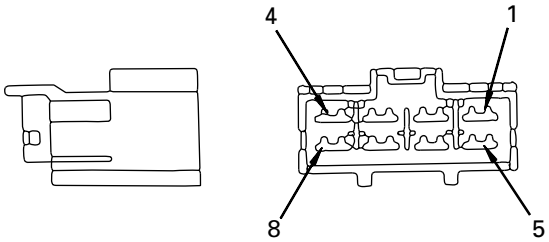
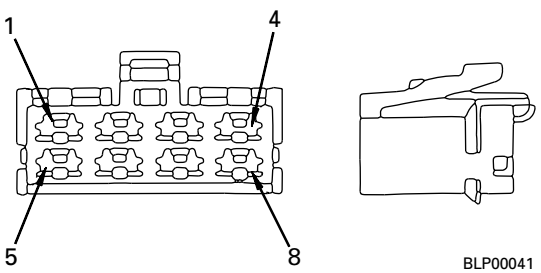

M9
T14
M8
T11
M12
M7
T12
T10
M13
M14
T9
P2
M10
T13
P5
P4
M14
M11
BLP02081

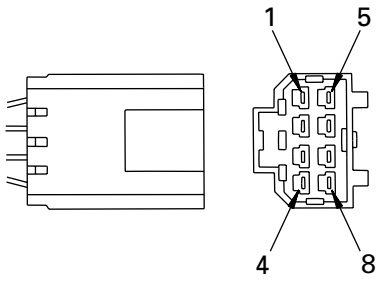
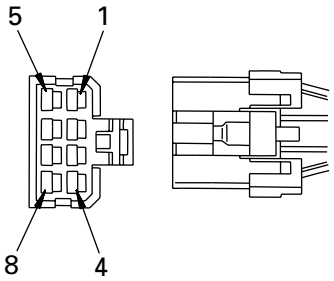
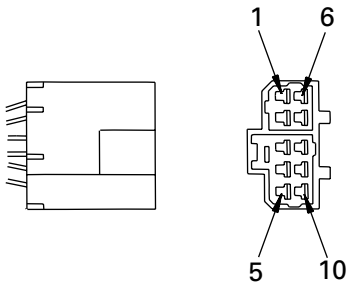
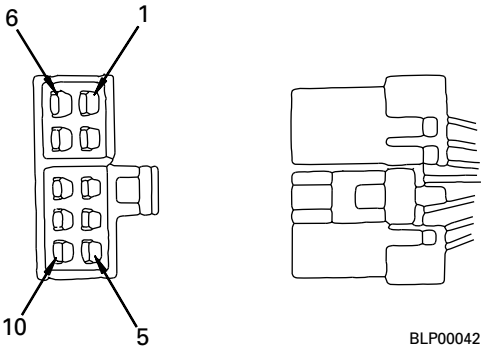
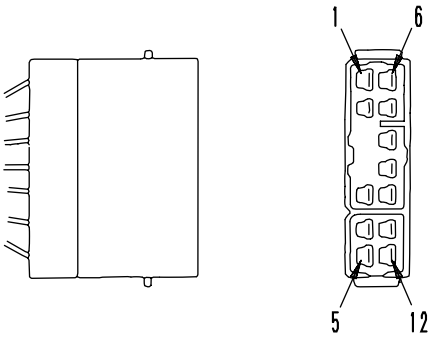
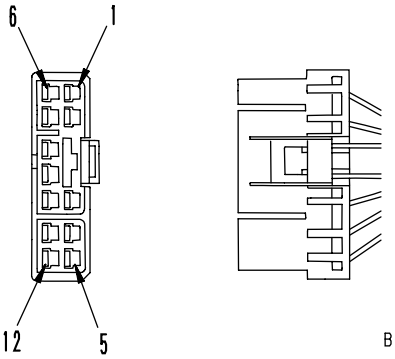
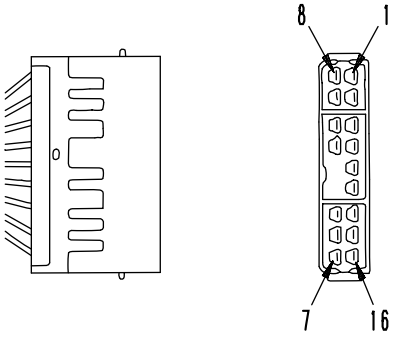
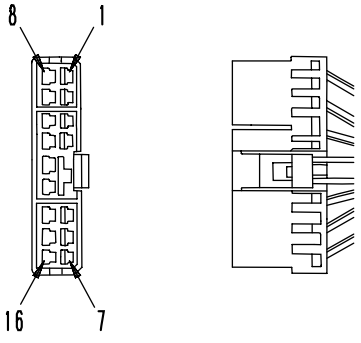
CONNECTION TABLE FOR CONNECTOR PIN NUMBERS

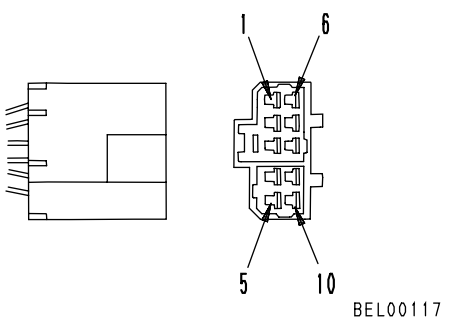
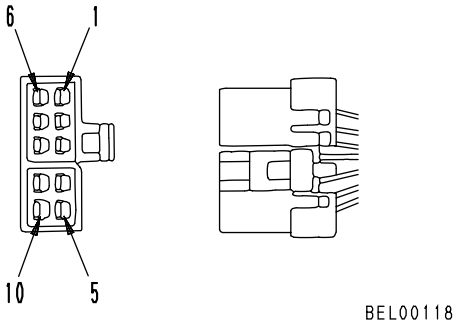
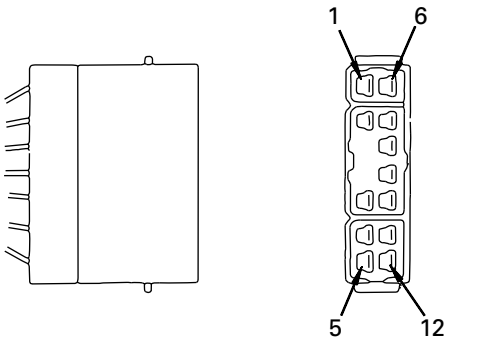
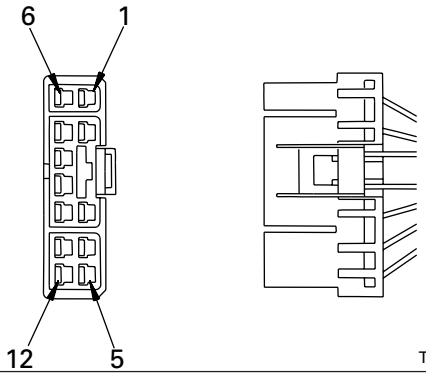
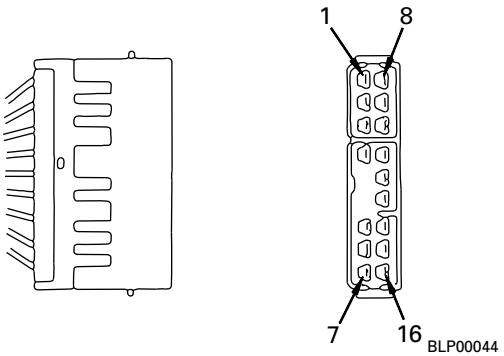
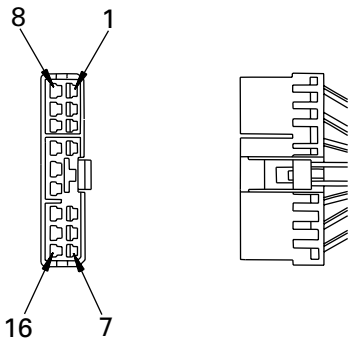
★ The terms male and female refer to the pins, while the terms male housing and female housing refer to the mating portion of the housing.

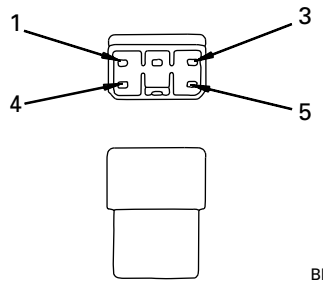
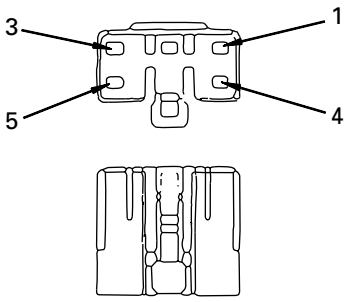
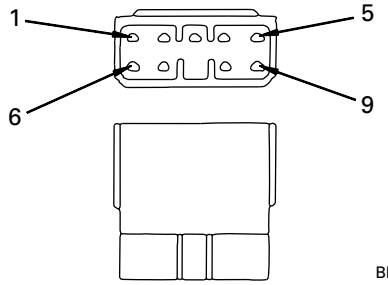
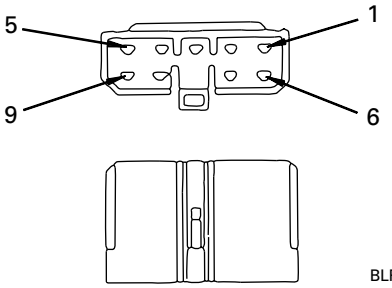
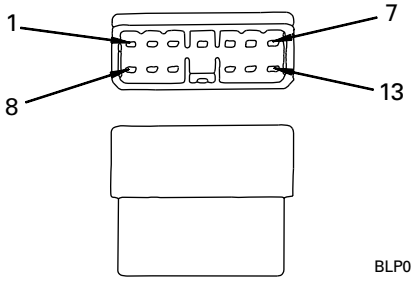
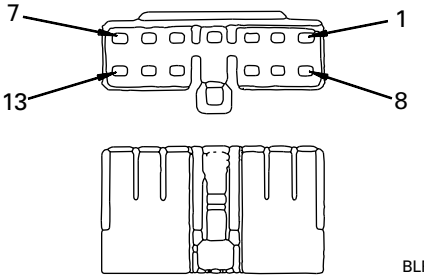
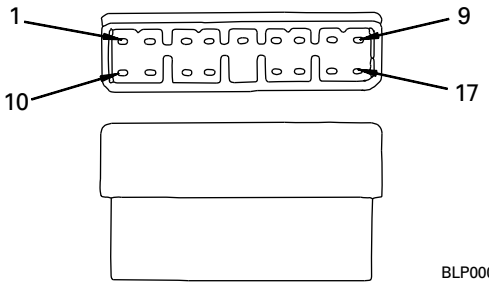
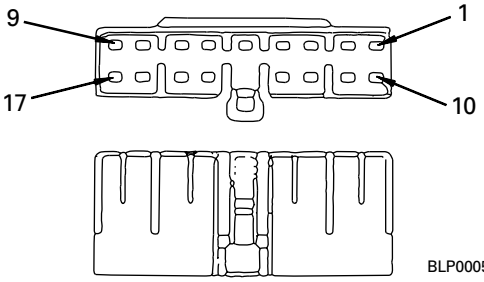
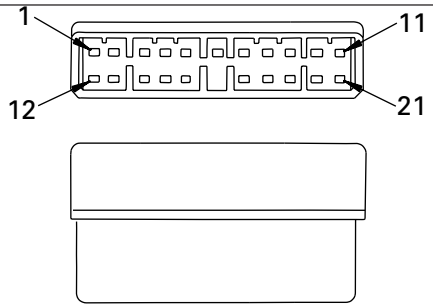
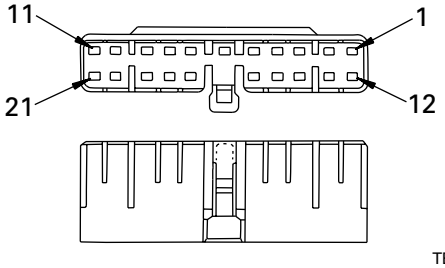
No. of pins	X type connector	
	Male (female housing)	Female (male housing)
2	 TEW00221	 TEW00222
3	 TEW00223	 TEW00224
4	 TEW00225	 TEW00226

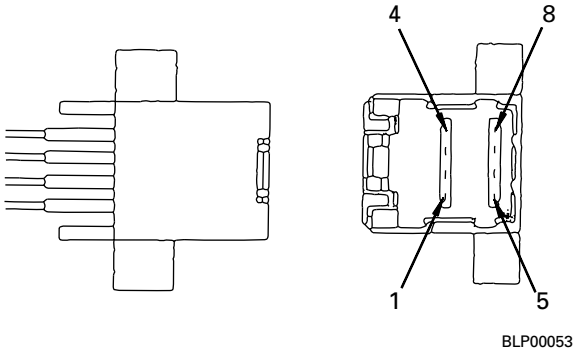
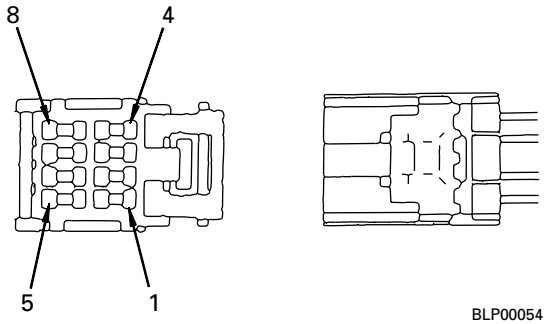
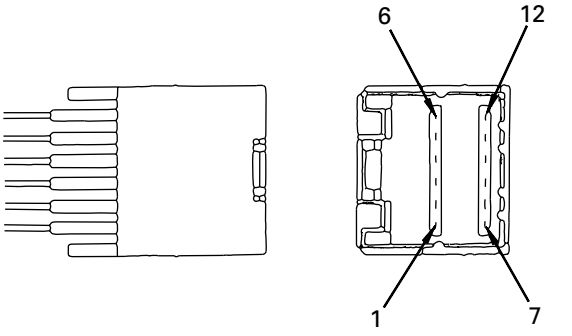
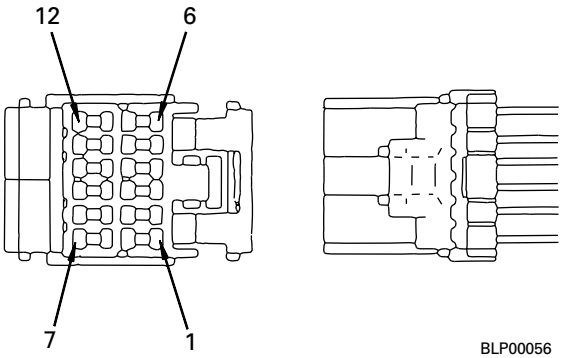
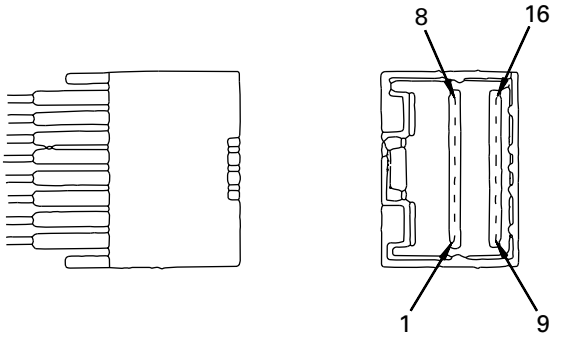
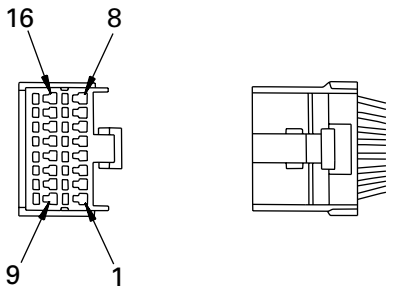
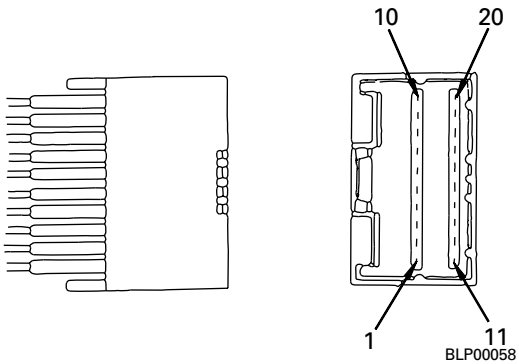
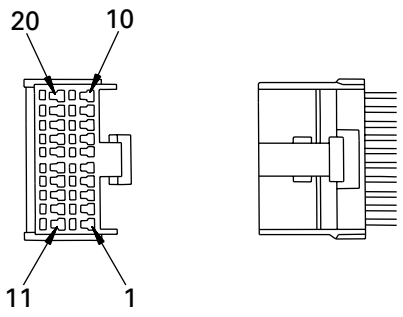
No. of pins	SWP type connector	
	Male (female housing)	Female (male housing)
6	 TEW00235	 BLP00033
8	 TEW00237	 TEW00238
12	 BLP00034	 BLP00035
14	 TEW00239	 TEW00240
16	 BLP00036	 BLP00037

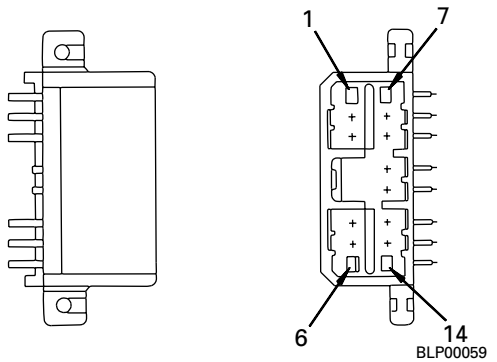
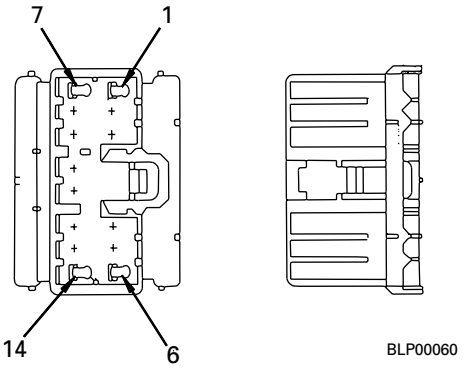
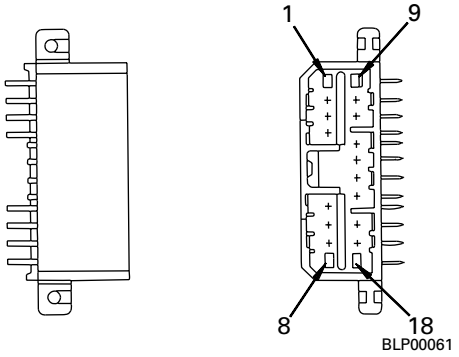
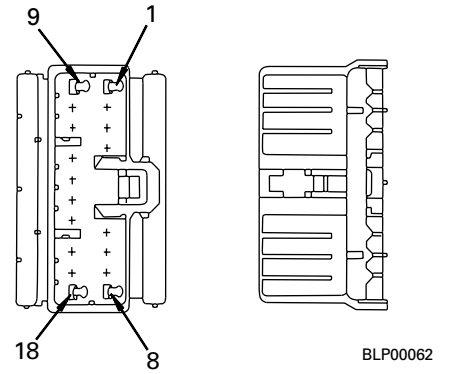
No. of pins	M type connector	
	Male (female housing)	Female (male housing)
2	 BLP00038	 BLP00039
3	 TEW00243	 TEW00244
4	 TEW00245	 TEW00246
6	 TEW00247	 TEW00248
8	 BLP00040	 BLP00041

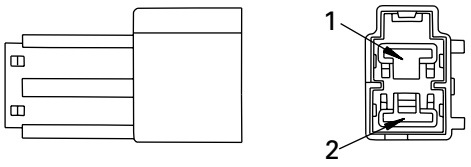
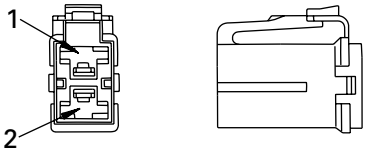
No. of pins	S type connector	
	Male (female housing)	Female (male housing)
8	 TEW00249	 TEW00250
10 (White)	 TEW00251	 BLP00042
12 (White)	 BEL00113	 BEL00114
16 (White)	 BEL00115	 BEL00116

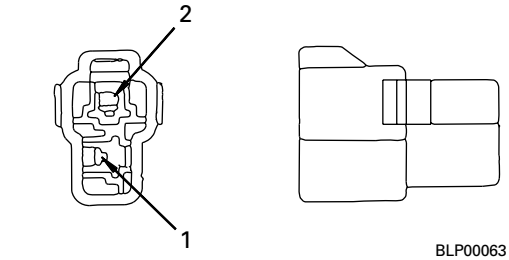
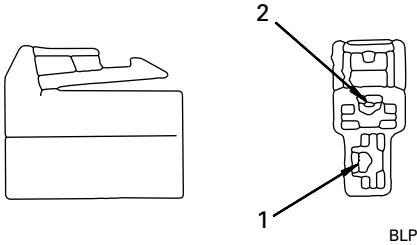
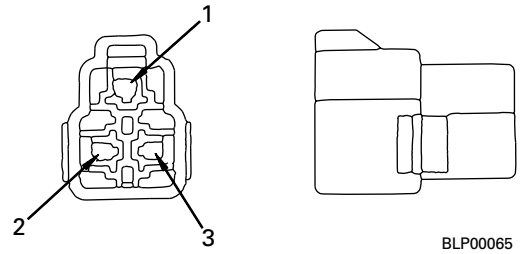
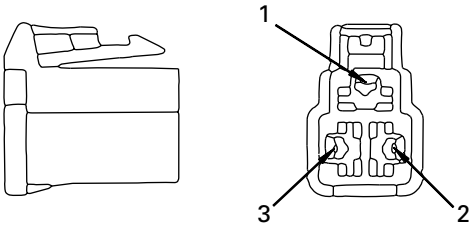
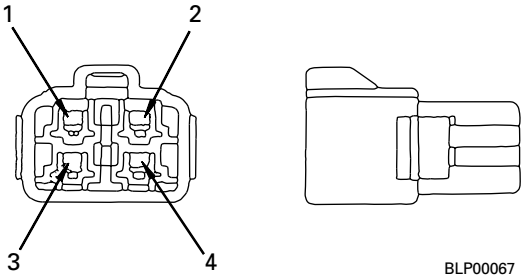
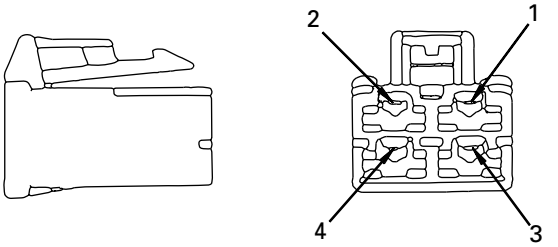
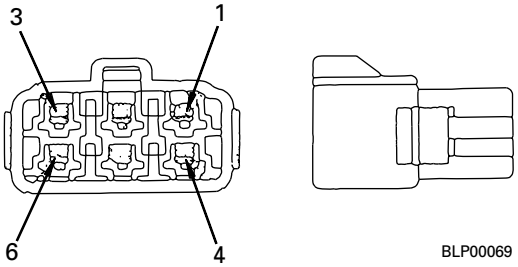
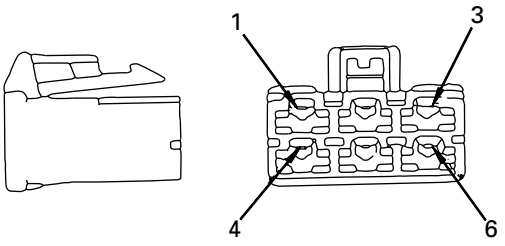
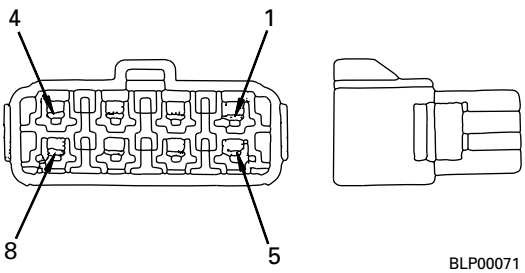
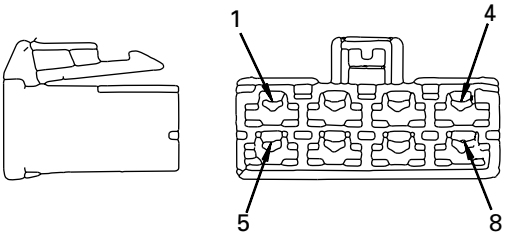
No. of pins	S type connector	
	Male (female housing)	Female (male housing)
10 (Blue)		
12 (Blue)		
16 (Blue)		

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

METHOD OF USING TROUBLESHOOTING CHARTS

1. Category of troubleshooting code number

Troubleshooting Code No.	Component
E-○○	Troubleshooting of electrical system
H-○○	Troubleshooting of hydraulic, mechanical system
M-○○	Troubleshooting of machine monitor system

2. Method of using troubleshooting table for each troubleshooting mode

1) Troubleshooting code number and problem
The title of the troubleshooting chart gives the troubleshooting code, service code, and failure mode (problem with the machine). (See Example (1))

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. (See Example (2))
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. (See Example (3))
- 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 ★. (See Example (4))
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 connection. When carrying out troubleshooting, see this chart for details of the connector pin number and location for inspection and measurement of the
wiring connector number appearing in the troubleshooting flow chart for each failure mode (problem).

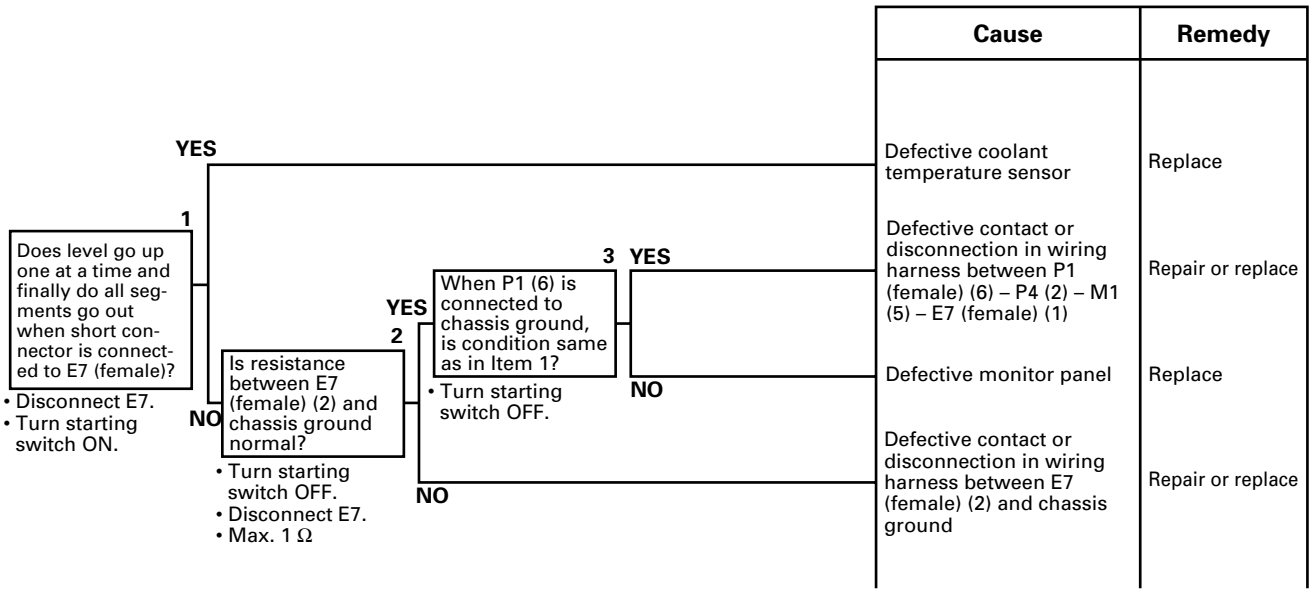
<Example>

(1) M-10 Abnormality in coolant temperature gauge

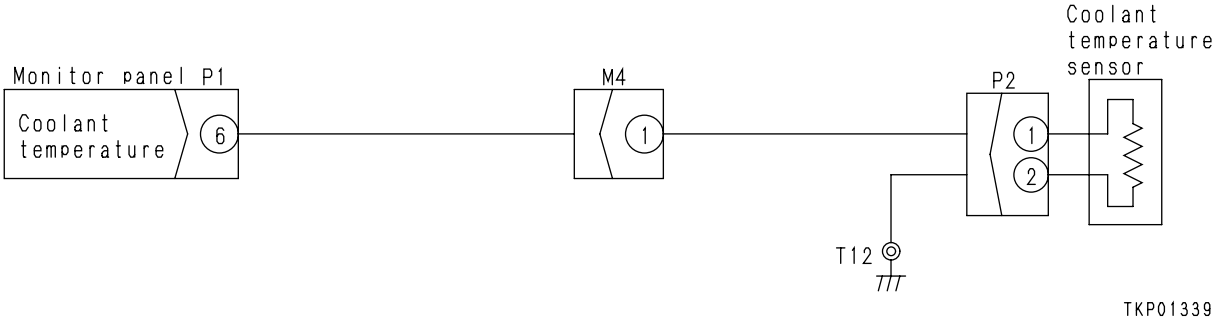
(4) ★ When the coolant temperature is normal.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

(2) **a) Level does not rise from segment C**

(3)



M-10 Related electrical circuit diagram

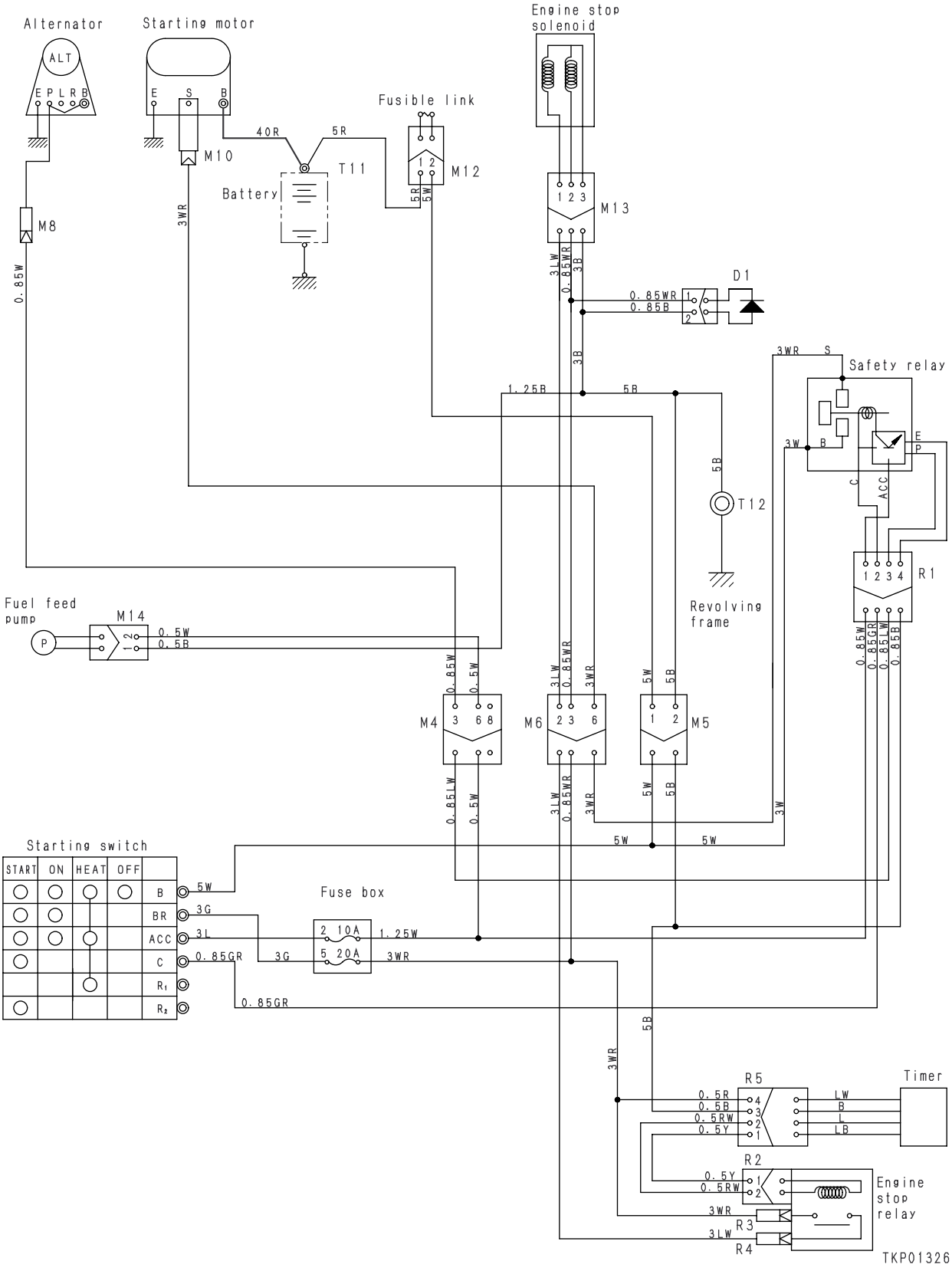


TROUBLESHOOTING OF ELECTRICAL SYSTEM (E MODE)

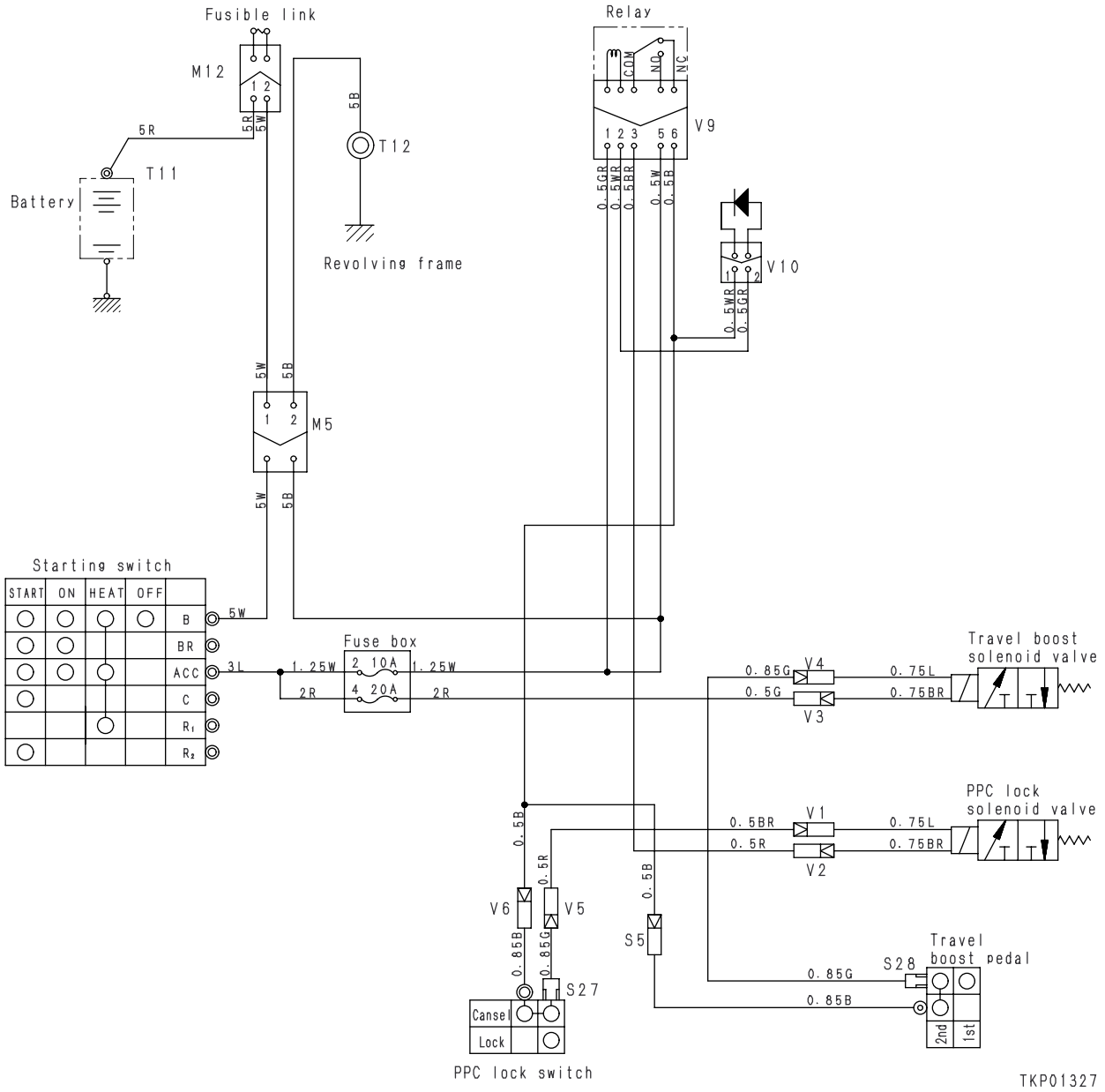
E-mode related electrical circuit diagram 20-302
E-1 Engine does not start 20-304
a) When starting motor does not turn (starting system) 20-304
b) When starting motor turns (engine stop solenoid system) 20-307
E-2 Engine does not stop 20-309
E-3 Work equipment does not move even when work equipment lock lever is canceled 20-310
E-4 Work equipment moves even when work equipment lock lever is locked 20-311
E-5 Travel speed does not increase even when travel boost pedal is depressed 20-312
E-6 Travel speed does not decrease even when travel boost pedal is released 20-313

E-MODE RELATED ELECTRICAL CIRCUIT DIAGRAM

ENGINE START/STOP SYSTEM



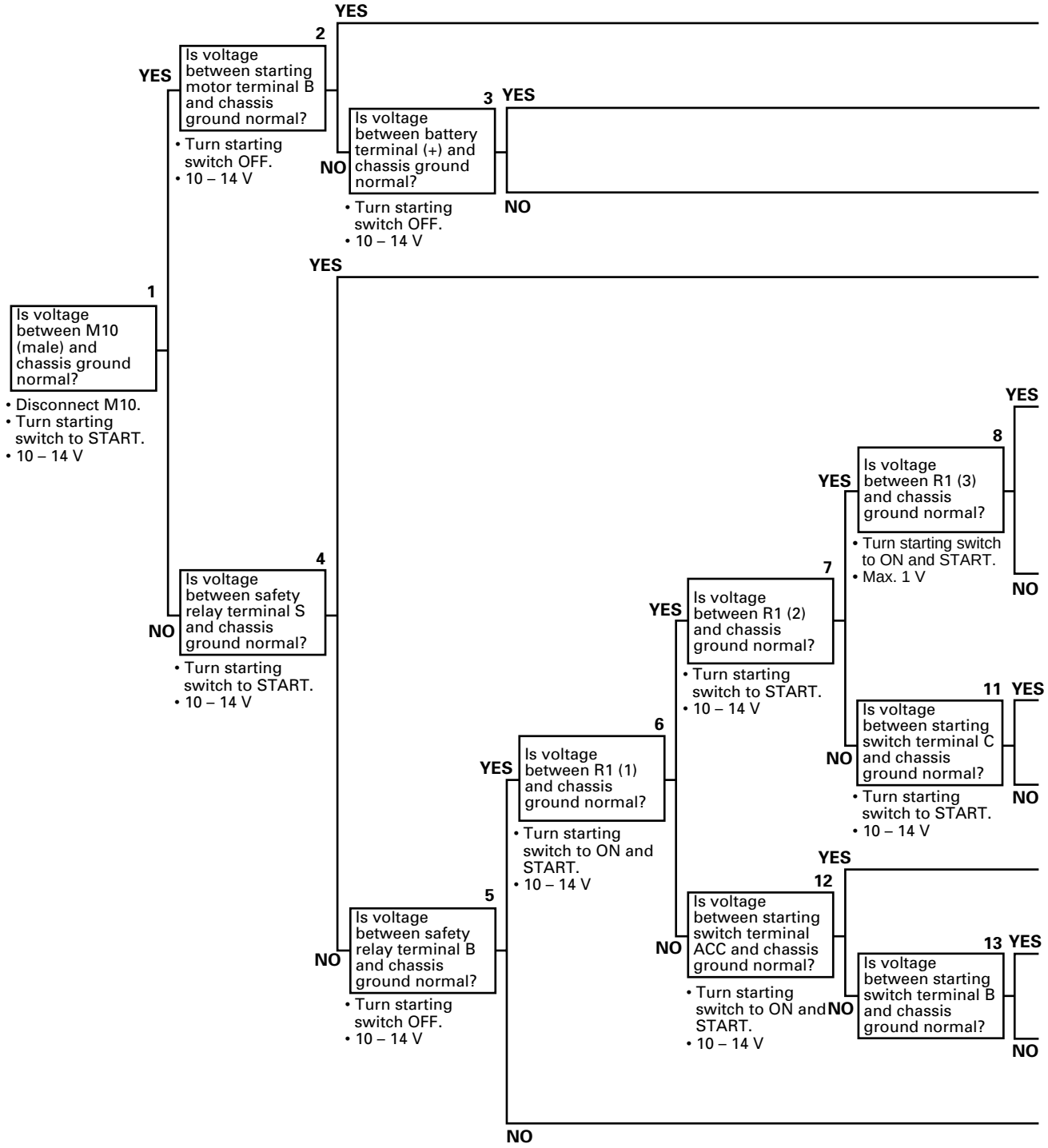
LOCK, TRAVEL BOOST SOLENOID VALVE SYSTEM

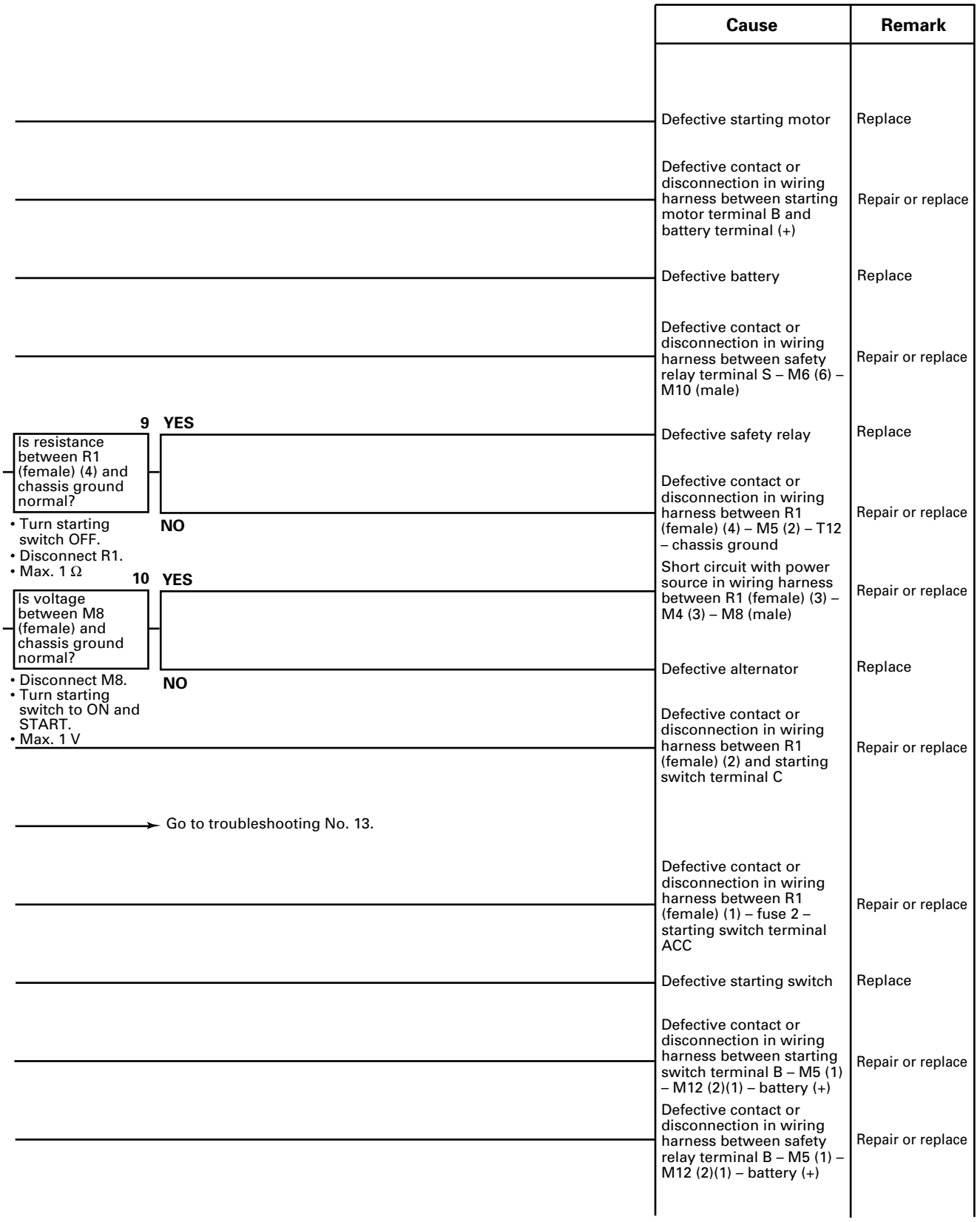


E-1 Engine does not start

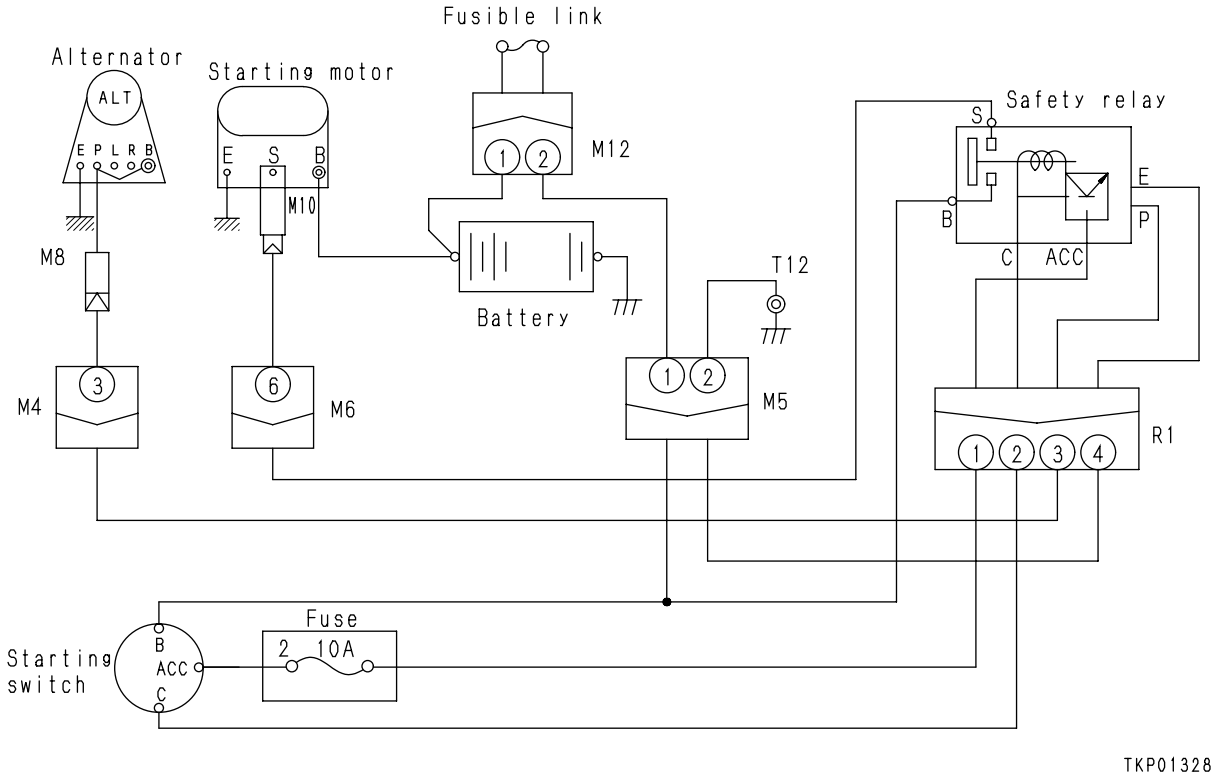
a) When starting motor does not turn (starting system)

★ Check that fuse 2 is normal (if it is blown, check for a short circuit with the ground in the circuits related to fuse 2).
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



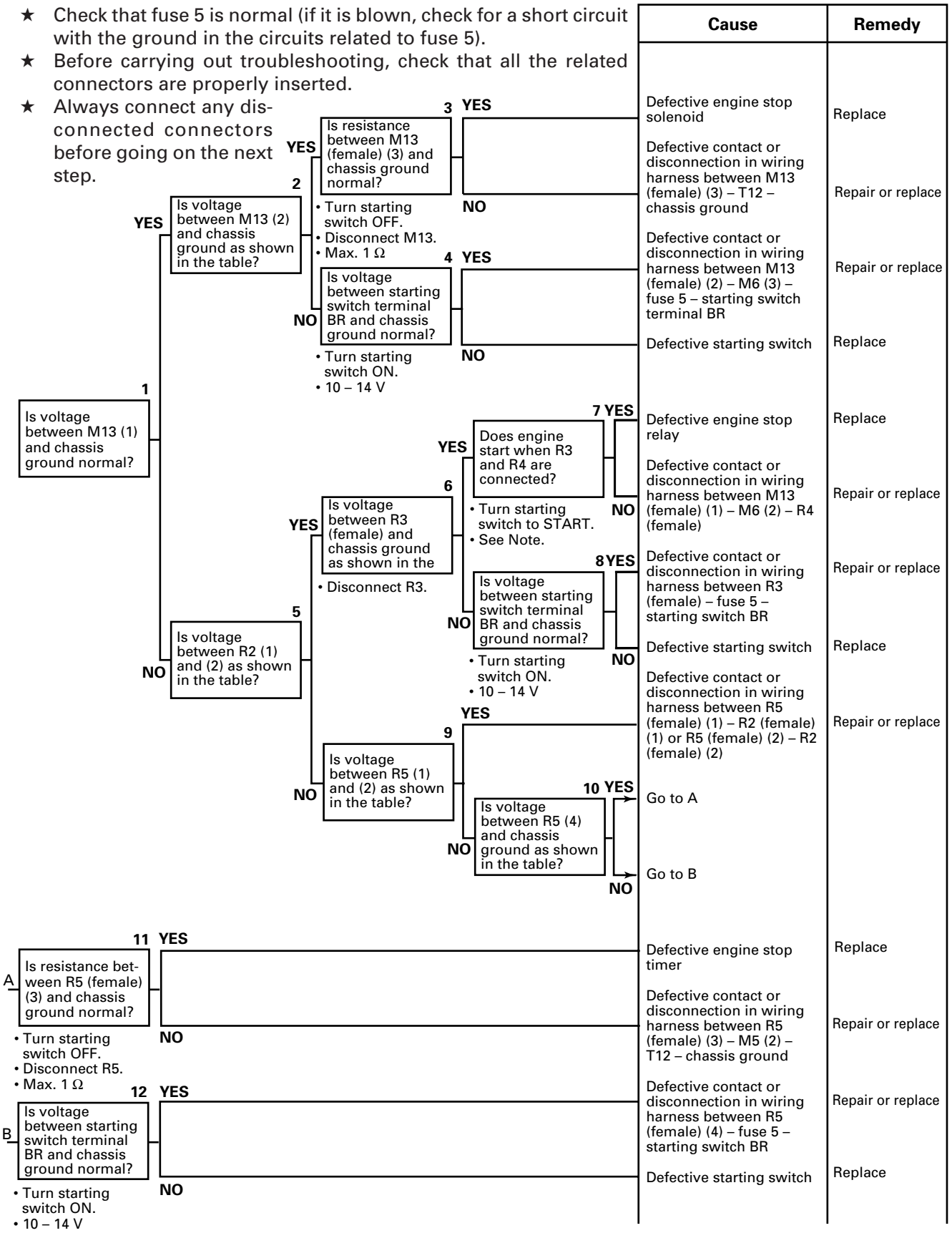

Cause
Remark
Defective starting motor
Replace
Defective contact or disconnection in wiring harness between starting motor terminal B and battery terminal (+)
Repair or replace
Defective battery
Replace
Defective contact or disconnection in wiring harness between safety relay terminal S – M6 (6) – M10 (male)
Repair or replace
9
YES
Is resistance between R1 (female) (4) and chassis ground normal?
• Turn starting switch OFF.
• Disconnect R1.
• Max. 1 Ω
NO
Defective safety relay
Replace
Defective contact or disconnection in wiring harness between R1 (female) (4) – M5 (2) – T12 – chassis ground
Repair or replace
10
YES
Is voltage between M8 (female) and chassis ground normal?
• Disconnect M8.
• Turn starting switch to ON and START.
• Max. 1 V
NO
Short circuit with power source in wiring harness between R1 (female) (3) – M4 (3) – M8 (male)
Repair or replace
Defective alternator
Replace
Defective contact or disconnection in wiring harness between R1 (female) (2) and starting switch terminal C
Repair or replace
Go to troubleshooting No. 13.
Defective contact or disconnection in wiring harness between R1 (female) (1) – fuse 2 – starting switch terminal ACC
Repair or replace
Defective starting switch
Replace
Defective contact or disconnection in wiring harness between starting switch terminal B – M5 (1) – M12 (2)(1) – battery (+)
Repair or replace
Defective contact or disconnection in wiring harness between safety relay terminal B – M5 (1) – M12 (2)(1) – battery (+)
Repair or replace

E-1 a) Related electrical circuit diagram



b) When starting motor turns (engine stop solenoid system)

★ Check that fuse 5 is normal (if it is blown, check for a short circuit with the ground in the circuits related to fuse 5).
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



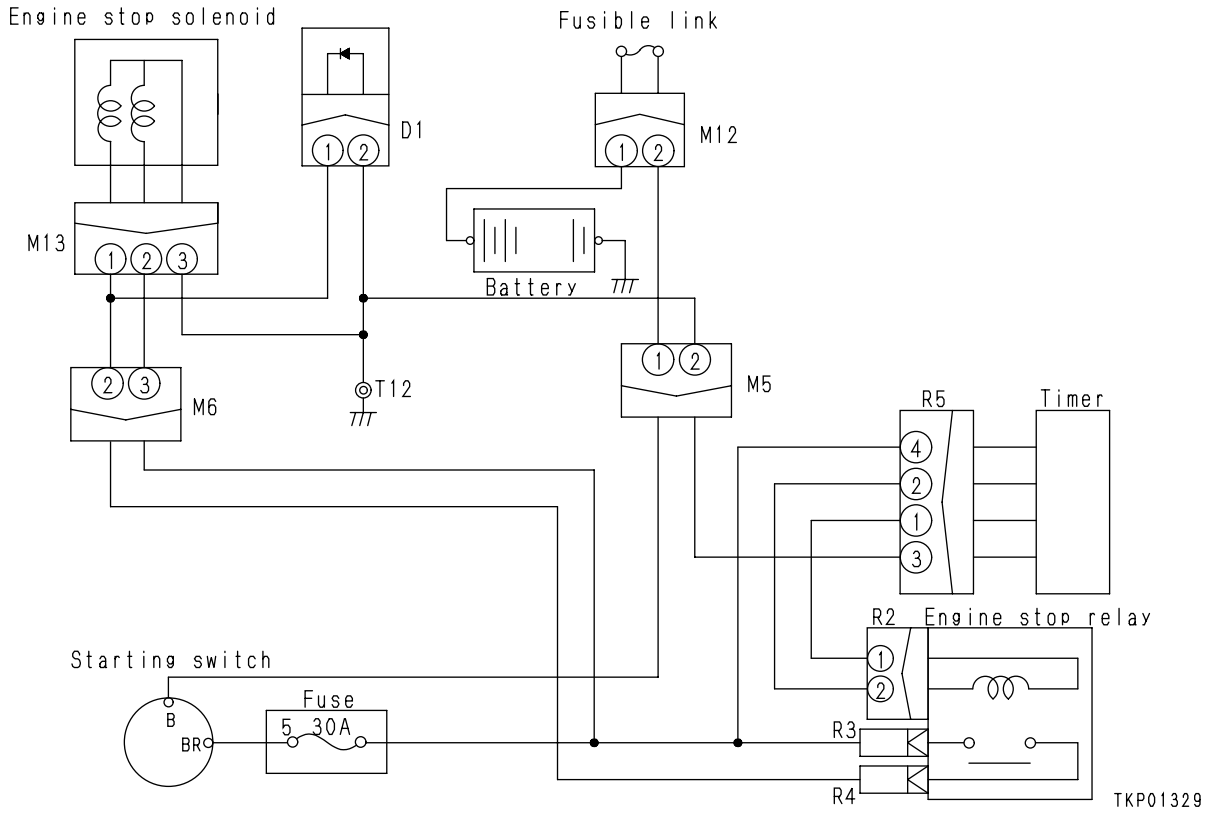
Cause	Remedy
Defective engine stop solenoid	Replace
Defective contact or disconnection in wiring harness between M13 (female) (3) – T12 – chassis ground	Repair or replace
Defective contact or disconnection in wiring harness between M13 (female) (2) – M6 (3) – fuse 5 – starting switch terminal BR	Repair or replace
Defective starting switch	Replace
Defective engine stop relay	Replace
Defective contact or disconnection in wiring harness between M13 (female) (1) – M6 (2) – R4 (female)	Repair or replace
Defective contact or disconnection in wiring harness between R3 (female) – fuse 5 – starting switch BR	Repair or replace
Defective starting switch	Replace
Defective contact or disconnection in wiring harness between R5 (female) (1) – R2 (female) (1) or R5 (female) (2) – R2 (female) (2)	Repair or replace
Go to A	
Go to B	
Defective engine stop timer	Replace
Defective contact or disconnection in wiring harness between R5 (female) (3) – M5 (2) – T12 – chassis ground	Repair or replace
Defective contact or disconnection in wiring harness between R5 (female) (4) – fuse 5 – starting switch BR	Repair or replace
Defective starting switch	Replace

Table

M13	R2, R3	R5	Starting switch ON
Between (1) – chassis	Between R2 (1) – (2)	Between (1) – (2)	10 – 14 V for 1 second, then less than 1 V 1 second later
Between (2) – chassis	Between R3 (female) – chassis	Between (4) – chassis	10 – 14 V (continuous)

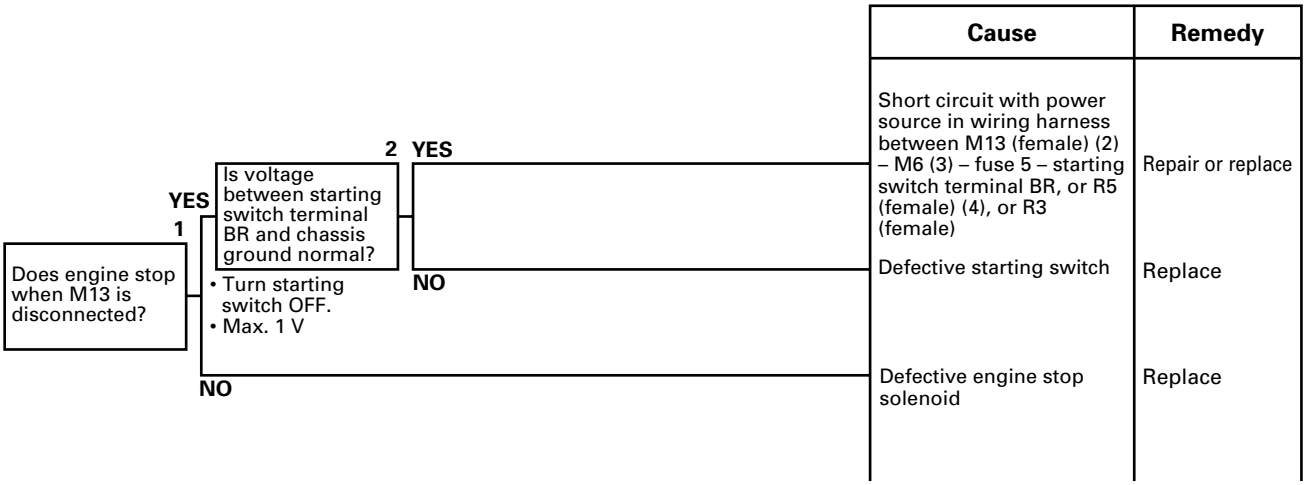
Note: Connect R3 and R4 for approx. 1 second (if they are kept connected for a long time, it will cause the engine stop solenoid to burn out).

E-1 b) Related electrical circuit diagram



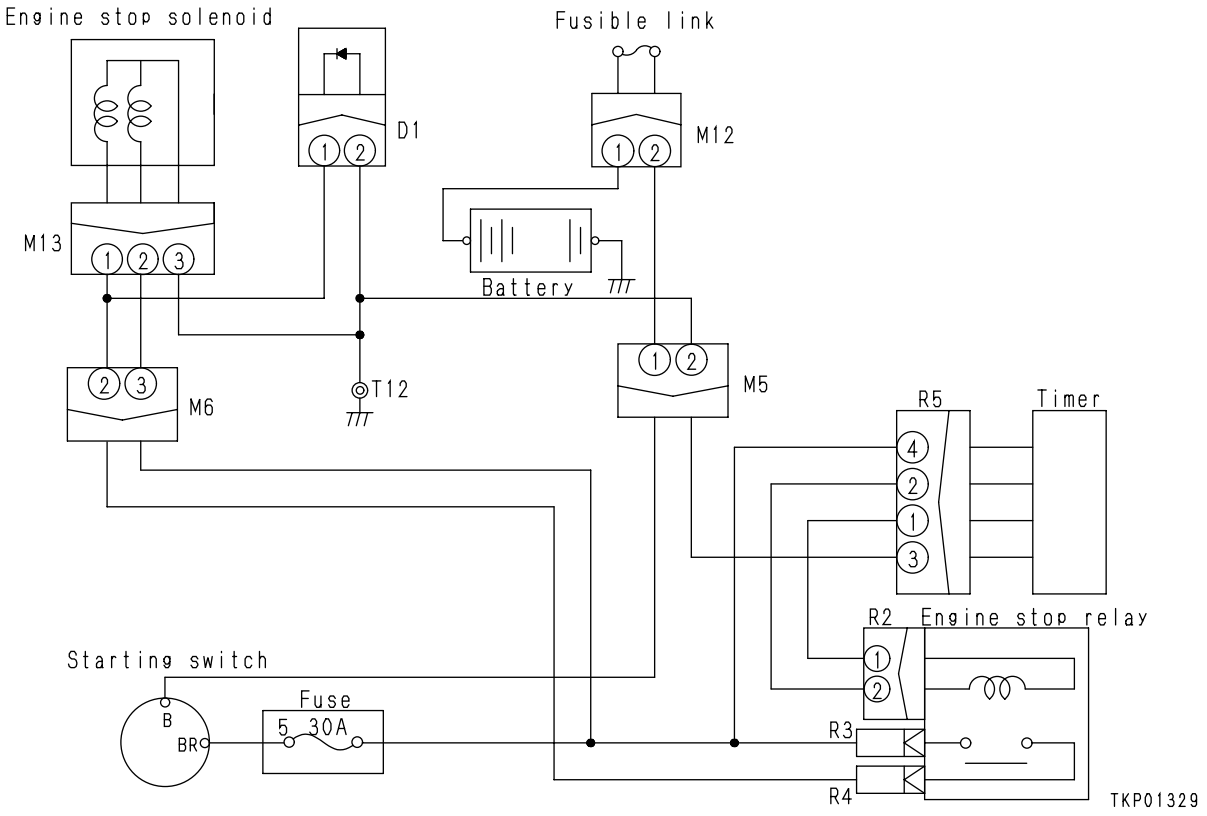
E-2 Engine does not stop

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



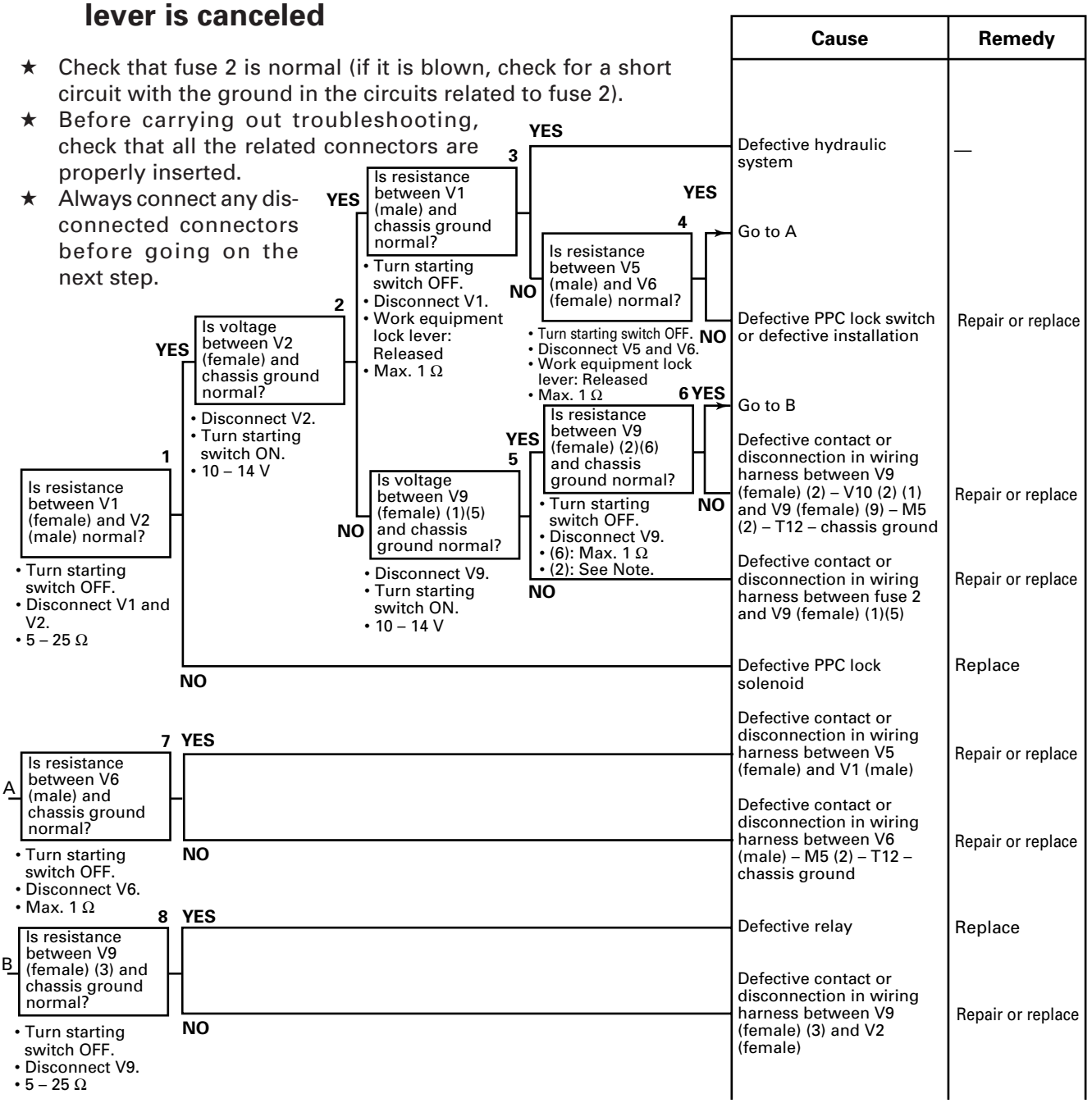
Cause	Remedy
Short circuit with power source in wiring harness between M13 (female) (2) – M6 (3) – fuse 5 – starting switch terminal BR, or R5 (female) (4), or R3 (female)	Repair or replace
Defective starting switch	Replace
Defective engine stop solenoid	Replace

E-2 Related electrical circuit diagram



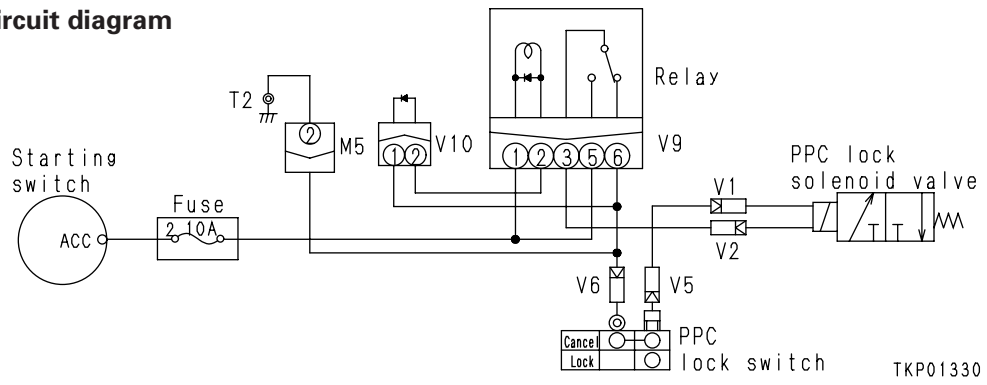
E-3 Work equipment does not move even when work equipment lock lever is canceled

★ Check that fuse 2 is normal (if it is blown, check for a short circuit with the ground in the circuits related to fuse 2).
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



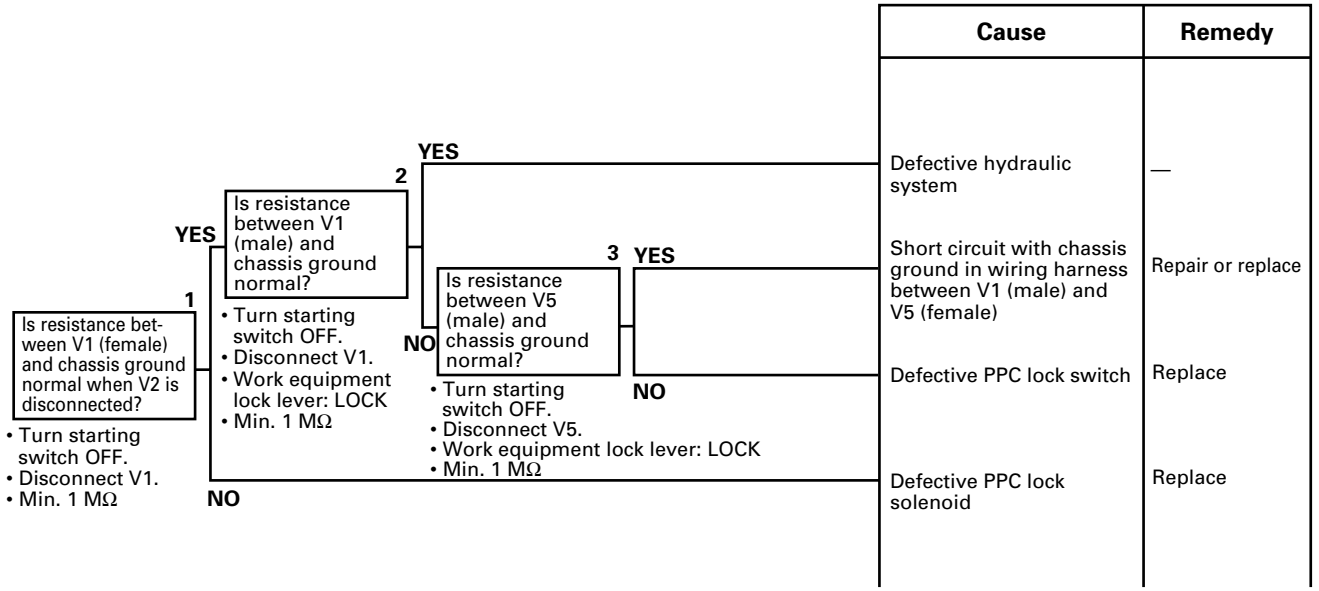
Note: Check the resistance value with the tester diode mode. If there is continuity, go to YES.

E-3 Related electric circuit diagram



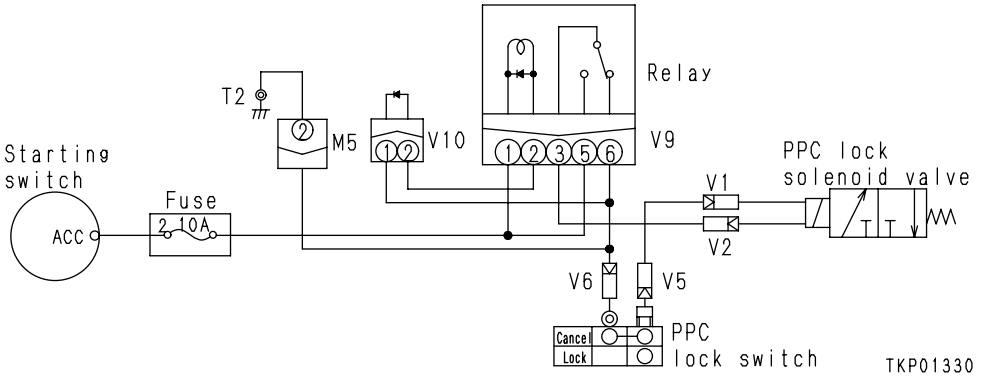
E-4 Work equipment moves even when work equipment lock lever is locked

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



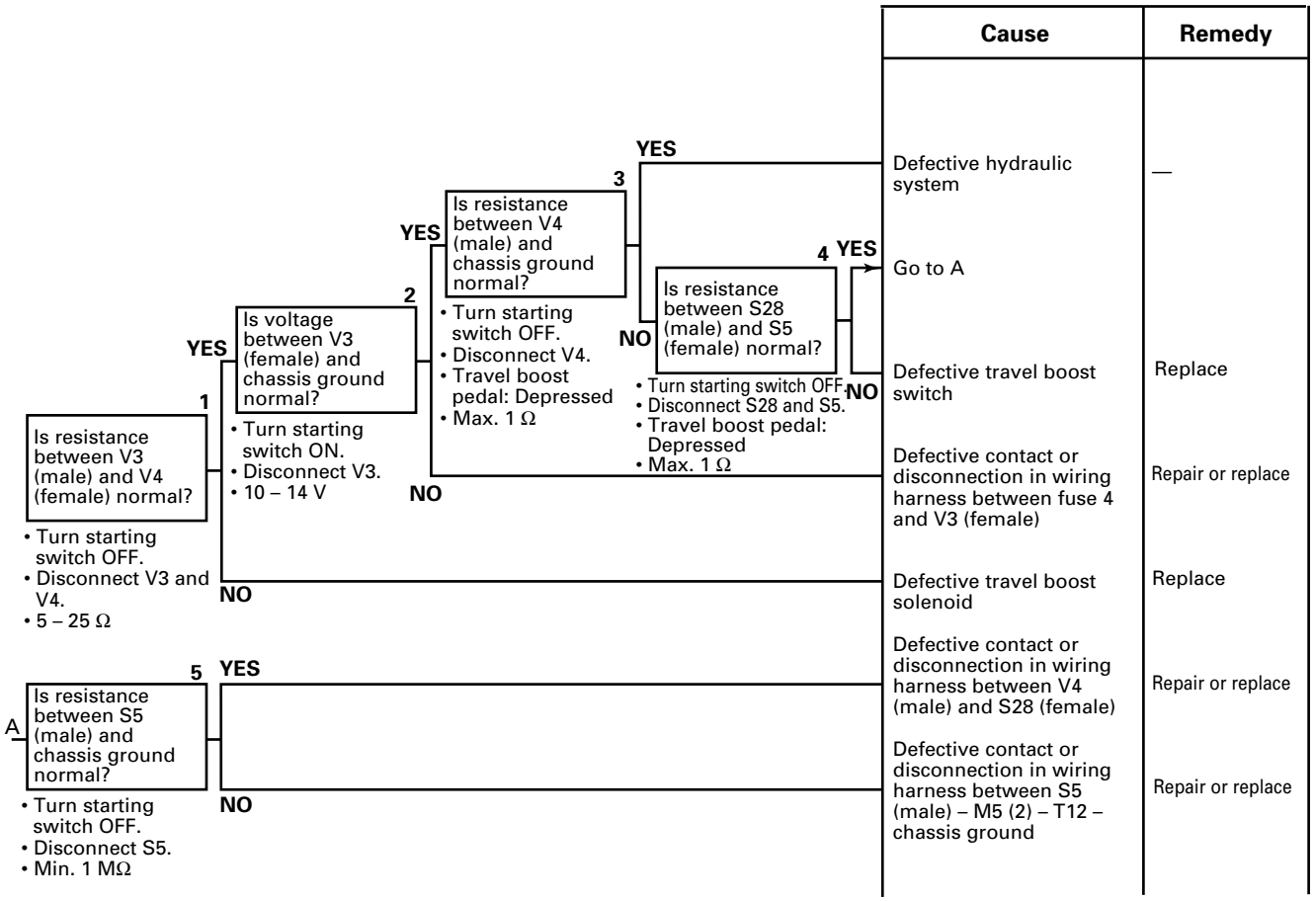
Cause	Remedy
Defective hydraulic system	—
Short circuit with chassis ground in wiring harness between V1 (male) and V5 (female)	Repair or replace
Defective PPC lock switch	Replace
Defective PPC lock solenoid	Replace

E-4 Related electric circuit diagram

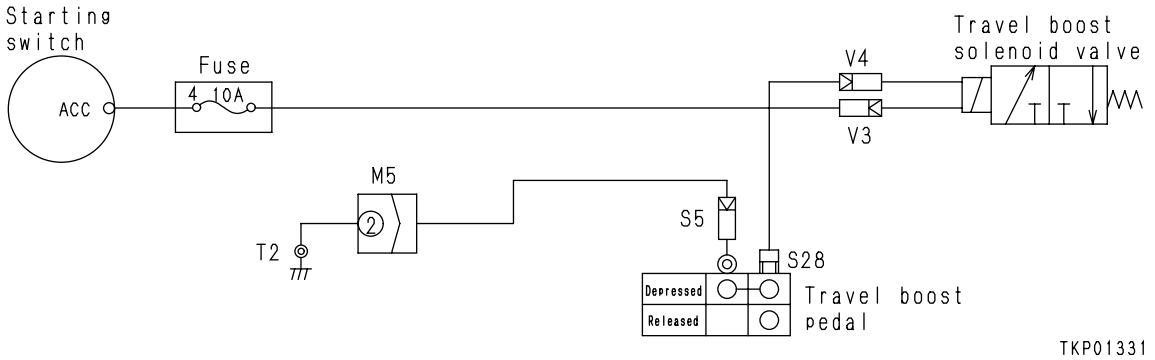


E-5 Travel speed does not increase even when travel boost pedal is depressed

★ Check that fuse 4 is normal (if it is blown, check for a short circuit with the ground in the circuits related to fuse 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.

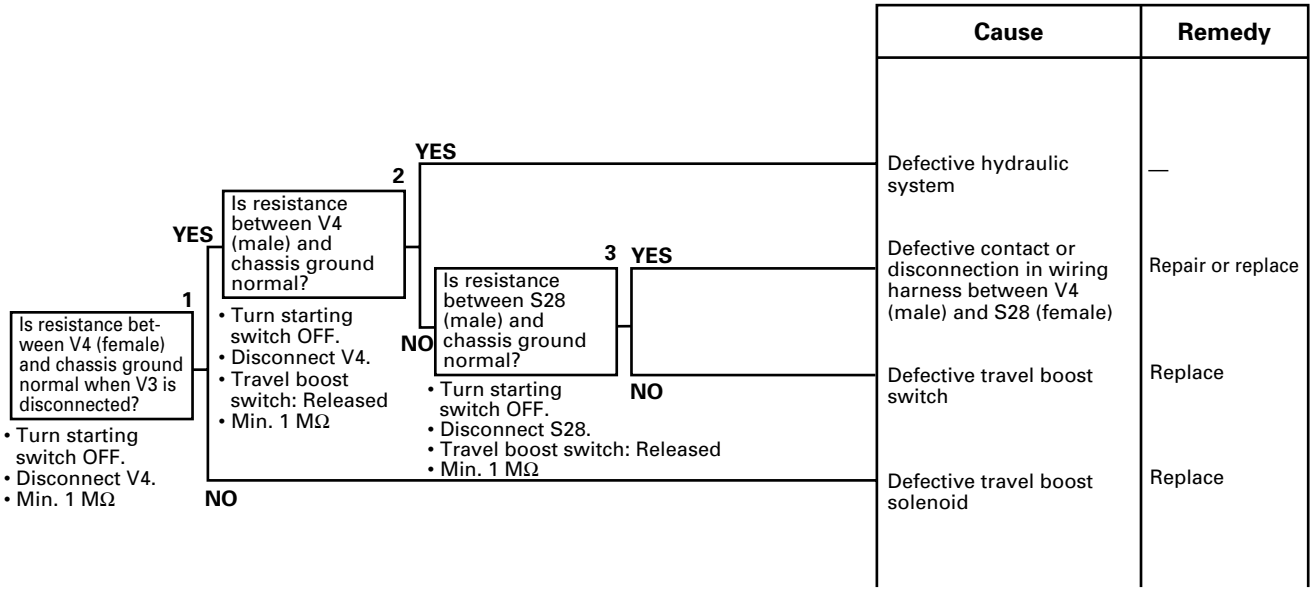


E-5 Related electric circuit diagram

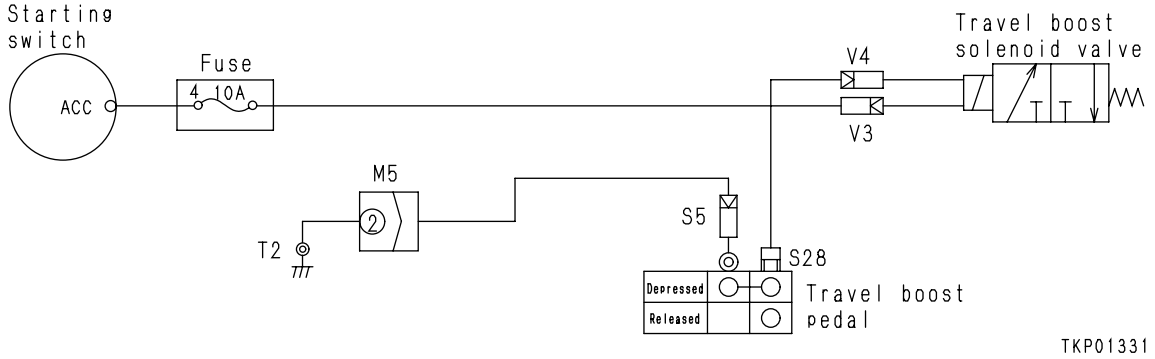


E-6 Travel speed does not decrease even when travel boost pedal is released

★ 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-6 Related electric circuit diagram



TROUBLESHOOTING OF HYDRAULIC, MECHANICAL SYSTEM (H MODE)

Table of failure modes and causes 20-402
H- 1 Speeds of all work equipment, swing, travel are slow or lack power 20-404
H- 2 There is excessive drop in engine speed, or engine stalls 20-405
H- 3 No work equipment, travel, swing move 20-406
H- 4 Abnormal noise generated (from around pump) 20-406
H- 5 Fine control ability is poor or response is poor 20-407
H- 6 Boom is slow or lacks power 20-408
H- 7 Arm is slow or lacks power 20-408
H- 8 Bucket is slow or lacks power 20-409
H- 9 Boom swing is slow or lacks power 20-409
H-10 Blade is slow or lacks power 20-410
H-11 Boom, arm, bucket do not move (boom swing, blade, travel and swing are normal) 20-410
H-12 Excessive hydraulic drift (boom, arm, bucket, boom swing, blade) 20-411
a) Boom 20-411
b) Arm, bucket, boom swing 20-411
c) Blade 20-411
H-13 Excessive time lag (engine at low idling) 20-412
H-14 In compound operations, work equipment with larger load is slow 20-412
H-15 Travel deviation 20-413
a) Deviation in normal travel 20-413
b) Deviation when starting 20-413
H-16 Travel speed is slow or lacks power 20-414
H-17 Steering does not turn easily 20-414
H-18 Travel speed does not switch 20-415
H-19 Travel does not move (one side only) 20-415
H-20 Swing speed is slow or lacks power 20-416
a) Speed is slow or lacks power in both directions 20-416
b) Speed is slow or lacks power in one direction only (left or right) 20-416
H-21 Does not swing 20-417
a) Does not swing in either direction 20-417
b) Does not swing in one direction (left or right) 20-417
H-22 Swing acceleration is poor 20-418
a) Acceleration is poor in both directions 20-418
b) Acceleration is poor in one direction only (left or right) 20-418
H-23 Excessive overrun when stopping swing 20-419
a) Overrun when stopping is excessive in both directions 20-419
b) Overrun when stopping is excessive in one direction only (left or right) 20-419
H-24 Excessive shock when stopping swing (in one direction only) 20-420
H-25 Excessive abnormal noise when stopping swing 20-420
H-26 Excessive hydraulic drift of swing 20-420

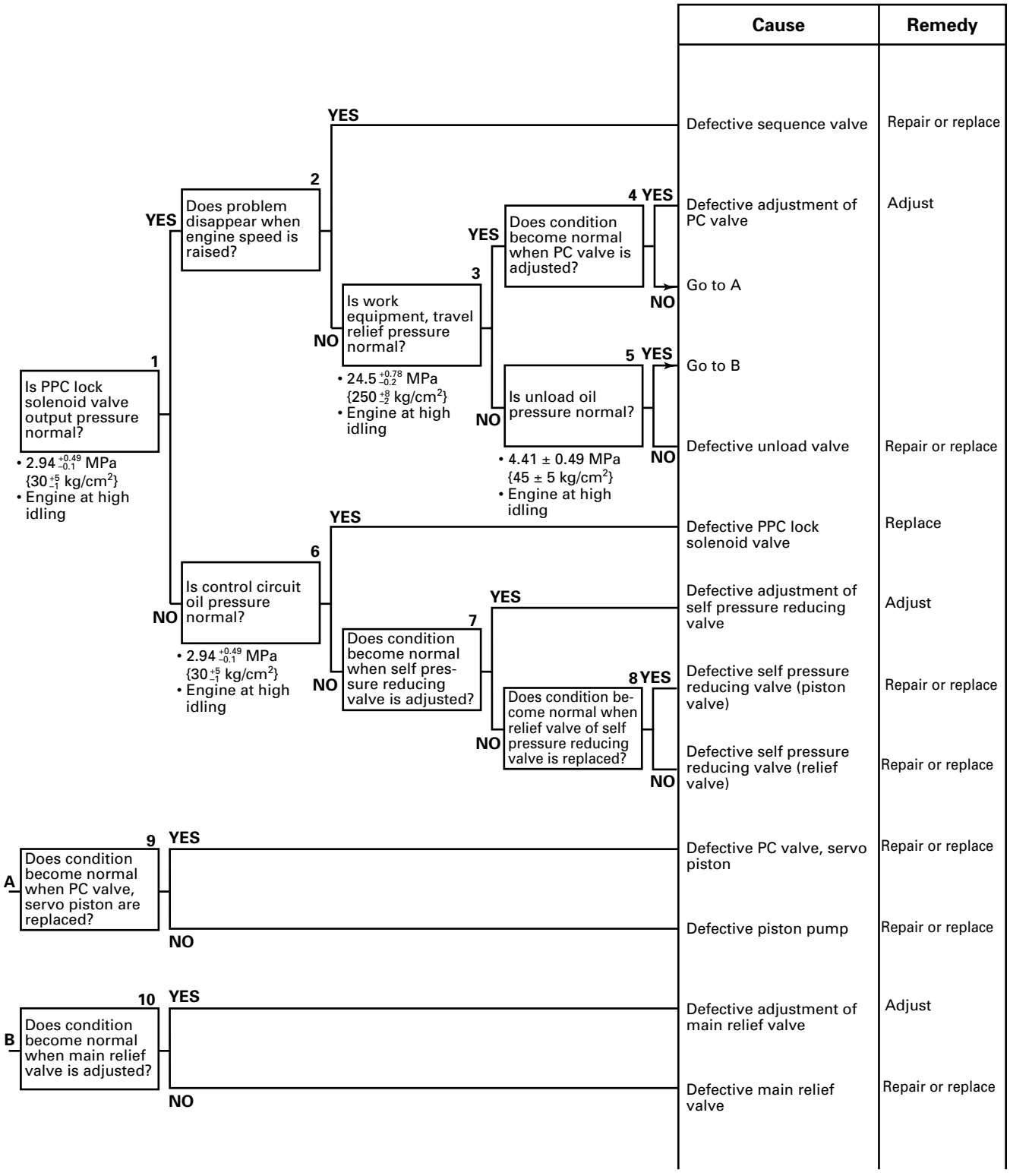
TABLE OF FAILURE MODES AND CAUSES

Failure mode \ Parts causing failure			Damper	Strainer	Hydraulic pump: PC valve	Hydraulic pump: LS valve	Hydraulic pump: Servo piston	Hydraulic pump: Piston pump	Hydraulic pump: Gear pump	Control valve: Spool	Control valve: Unload valve	Control valve: Main relief valve	Control valve: Self pressure reducing valve	Control valve: Sequence valve
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)			●				●						
	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 swing is slow or lacks power									●				
	Blade is slow or lacks power									●				
	Boom does not move									●				
	Arm does not move									●				
	Bucket does not move									●				
	Excessive hydraulic drift	Boom												
		Arm								●				
		Bucket								●				
		Boom swing								●				
		Blade								●				
	Excessive time lag													
	In compound operations, work equipment with larger load is slow									●				
Travel system	Travel deviation	Deviation during normal travel								●				
		Deviation when starting												
	Travel speed is slow or lacks power				●		●					●		
	Steering does not turn easily									●				
	Travel speed does not switch													
	Travel does not move (one side only)													
Swing system	Swing speed is slow or lacks power	Both left and right							●					
		One direction only								●				
	Does not swing	Both left and right							●					
		One direction only								●				
	Swing acceleration is poor	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													

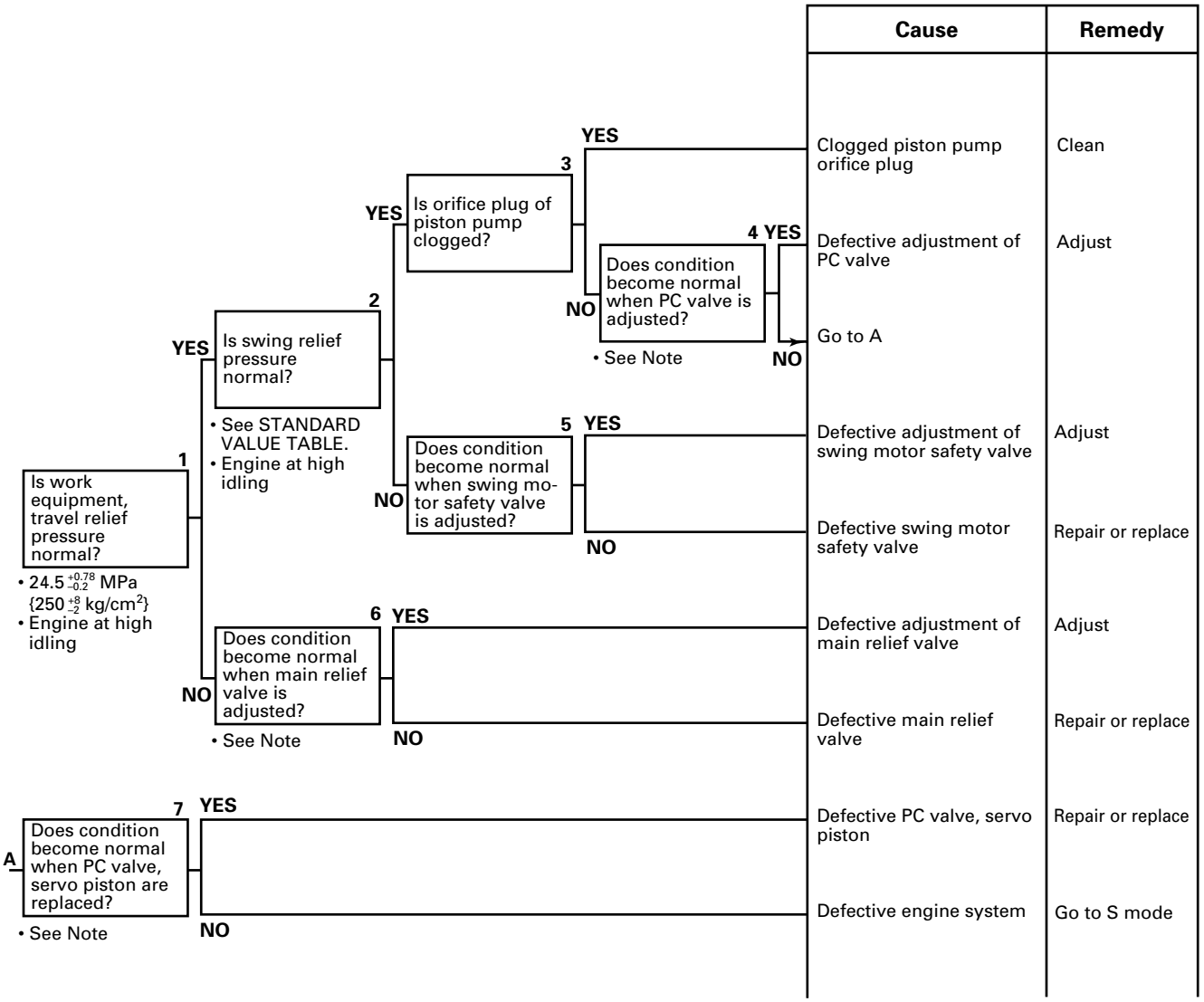
Control valve									Solenoid valve		PPC valve	Swing motor						Swing machinery	Center swivel joint	Travel motor						Hydraulic cylinder	Control valve	Engine system	Trouble-shooting mode
Pressure compensation valve	Central safety valve	Check valve	Blade safety valve	Suction valve	PPC shuttle valve	Boom lock valve	Cooler check valve		PPC lock solenoid	Travel boost solenoid	PPC valve	Swing holding brake	Safety valve	Check valve	Suction valve	Motor proper			Counterbalance valve	Check valve	Speed selector servo	Motor proper	Final drive					
									●																			H-1
													●														●	H-2
●									●																			H-3
																												H-4
																												H-5
●	●			●							●														●			H-6
●	●			●							●														●			H-7
●	●			●							●														●			H-8
●	●			●																					●	●		H-9
●	●		●	●																					●	●		H-10
											●																	H-11
											●																	
											●																	
						●																			●			H-12
					●																				●			
					●																				●			
					●																				●			
					●																				●			
					●																							H-13
●																												H-14
●																			●			●	●			●		H-15
																			●									
																												H-16
●																		●										H-17
										●											●							H-18
																			●			●	●					H-19
													●			●												H-20
											●			●	●													
												●				●	●											H-21
						●					●																	
												●	●			●												H-22
						●					●				●													
													●			●												H-23
											●			●	●													
											●																	H-24
								●					●		●		●											H-25
												●																H-26

H-1 Speeds of all work equipment, swing, travel are slow or lack power

★ Carry out this troubleshooting if the actuators in 2 or more systems are slow or lack power at the same time.



H-2 There is excessive drop in engine speed, or engine stalls



Table

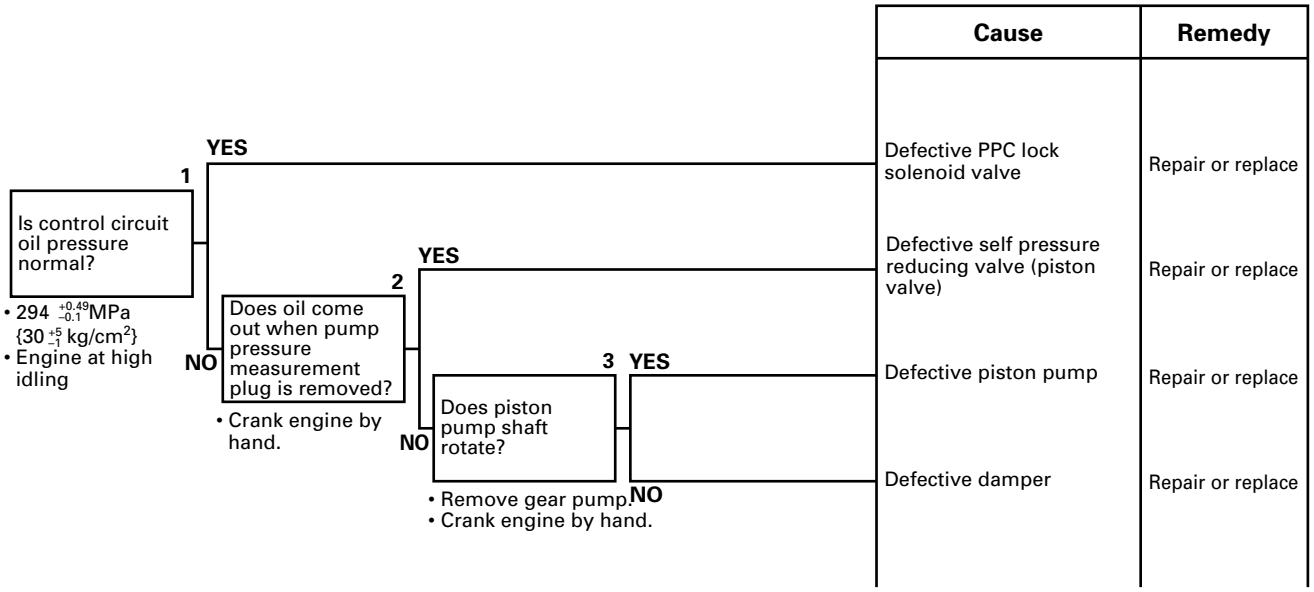
Model	Swing relief pressure
PC30R	15.19 +1.47 −0.49 MPa {155 +15 −5 kg/cm²}
PC35R	16.17 +1.47 −0.49 MPa {165 +15 −5 kg/cm²}
PC40R	17.64 +1.47 −0.49 MPa {180 +15 −5 kg/cm²}
PC45R	19.6 +1.47 −0.49 MPa {200 +15 −5 kg/cm²}

Note: To judge, measure the engine speed during 1-pump relief or 2-pump relief.

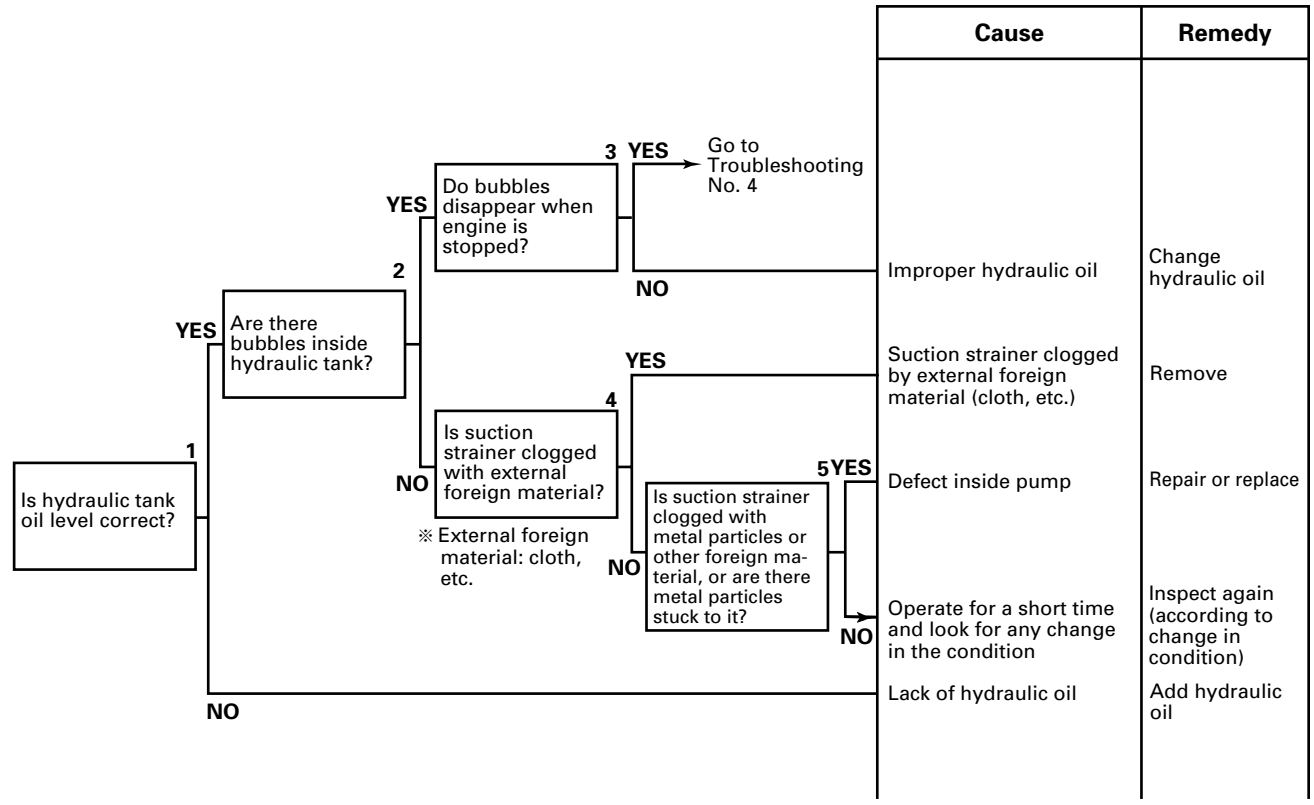
Model	1-pump relief	2-pump relief
PC30R	Min. 2060 rpm	Min. 2060 rpm
PC35R	Min. 2060 rpm	Min. 2060 rpm
PC40R	Min. 2060 rpm	Min. 2060 rpm
PC45R	Min. 2060 rpm	Min. 2060 rpm

H-3 No work equipment, travel, swing move

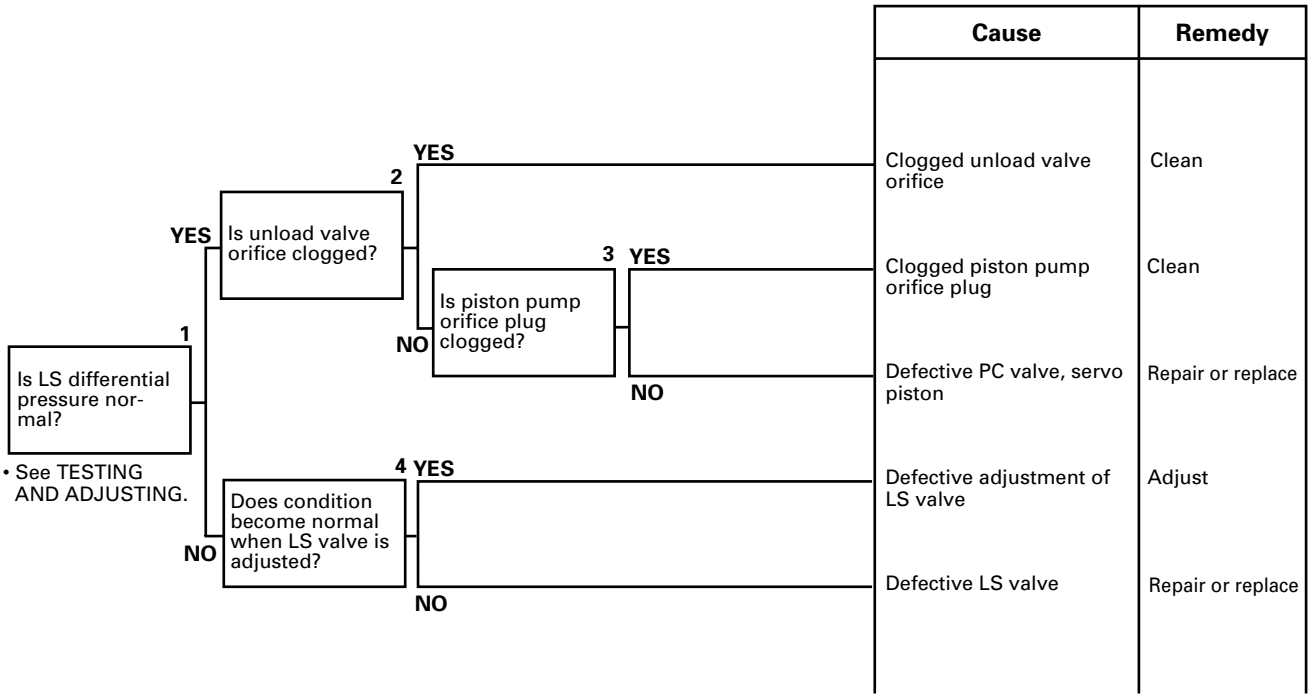
★ Carry out this troubleshooting if the actuators in 2 or more systems are slow or lack power at the same time.



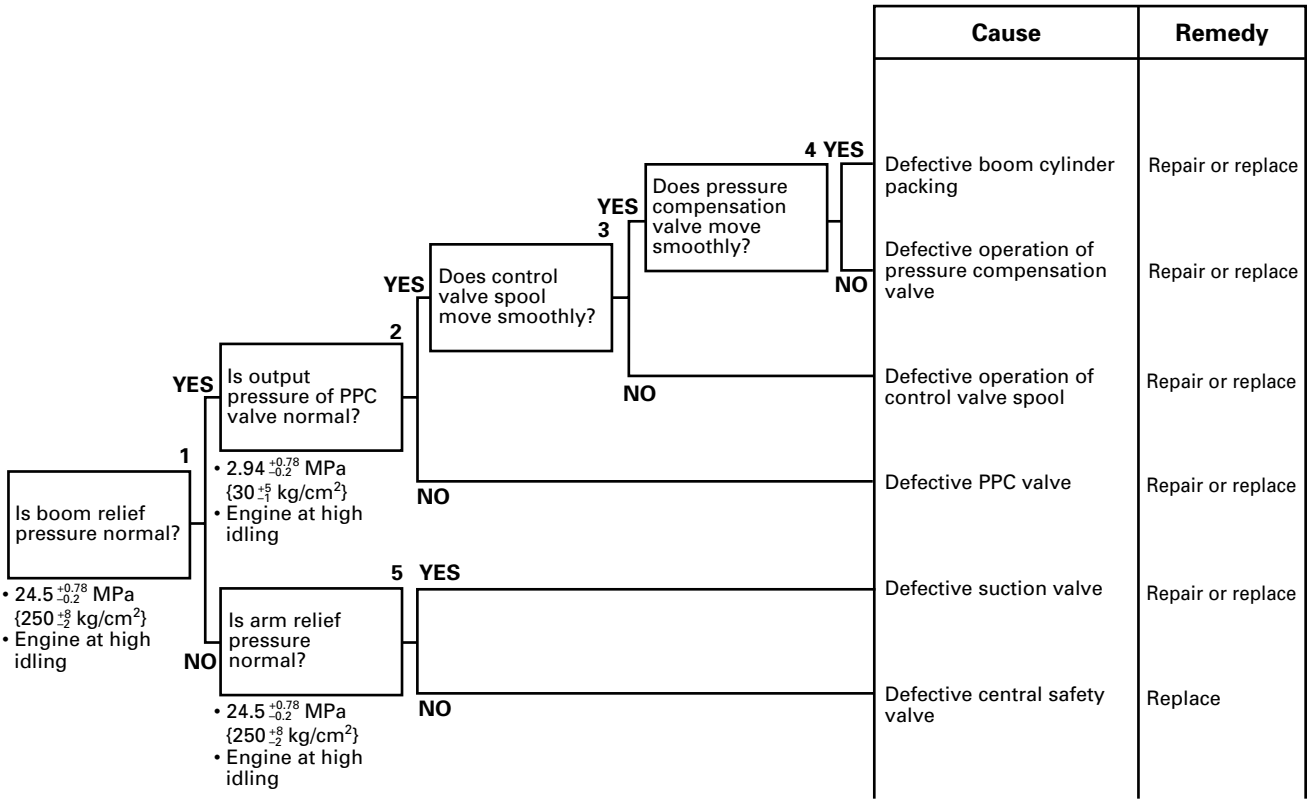
H-4 Abnormal noise generated (from around pump)



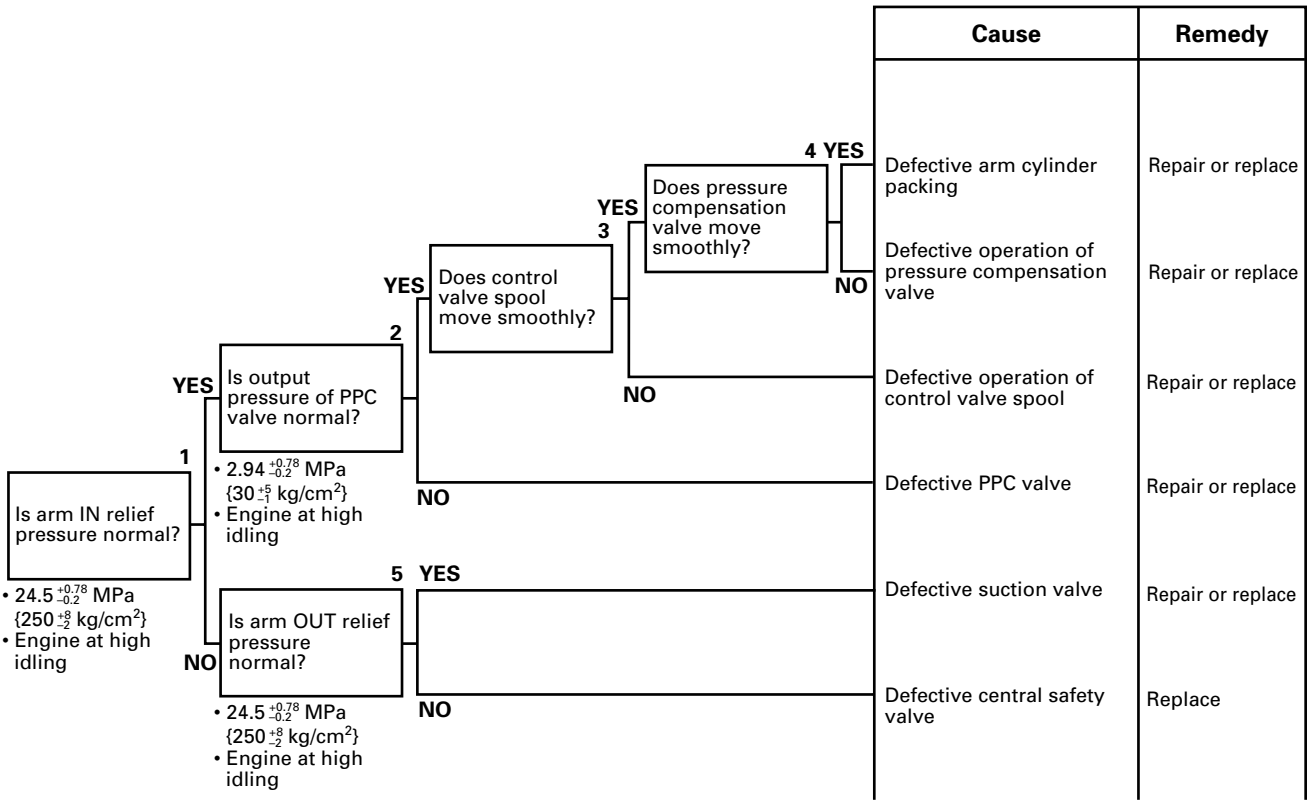
H-5 Fine control ability is poor or response is poor



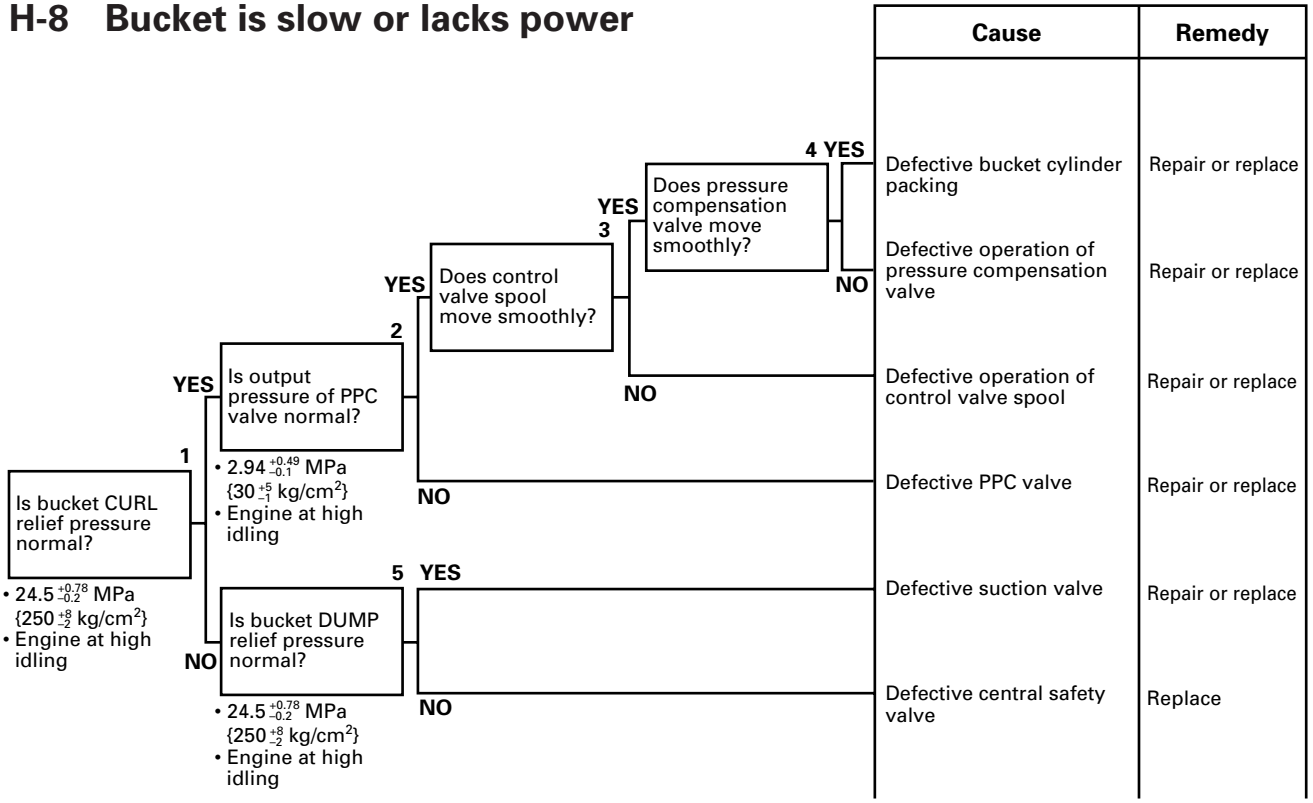
H-6 Boom is slow or lacks power



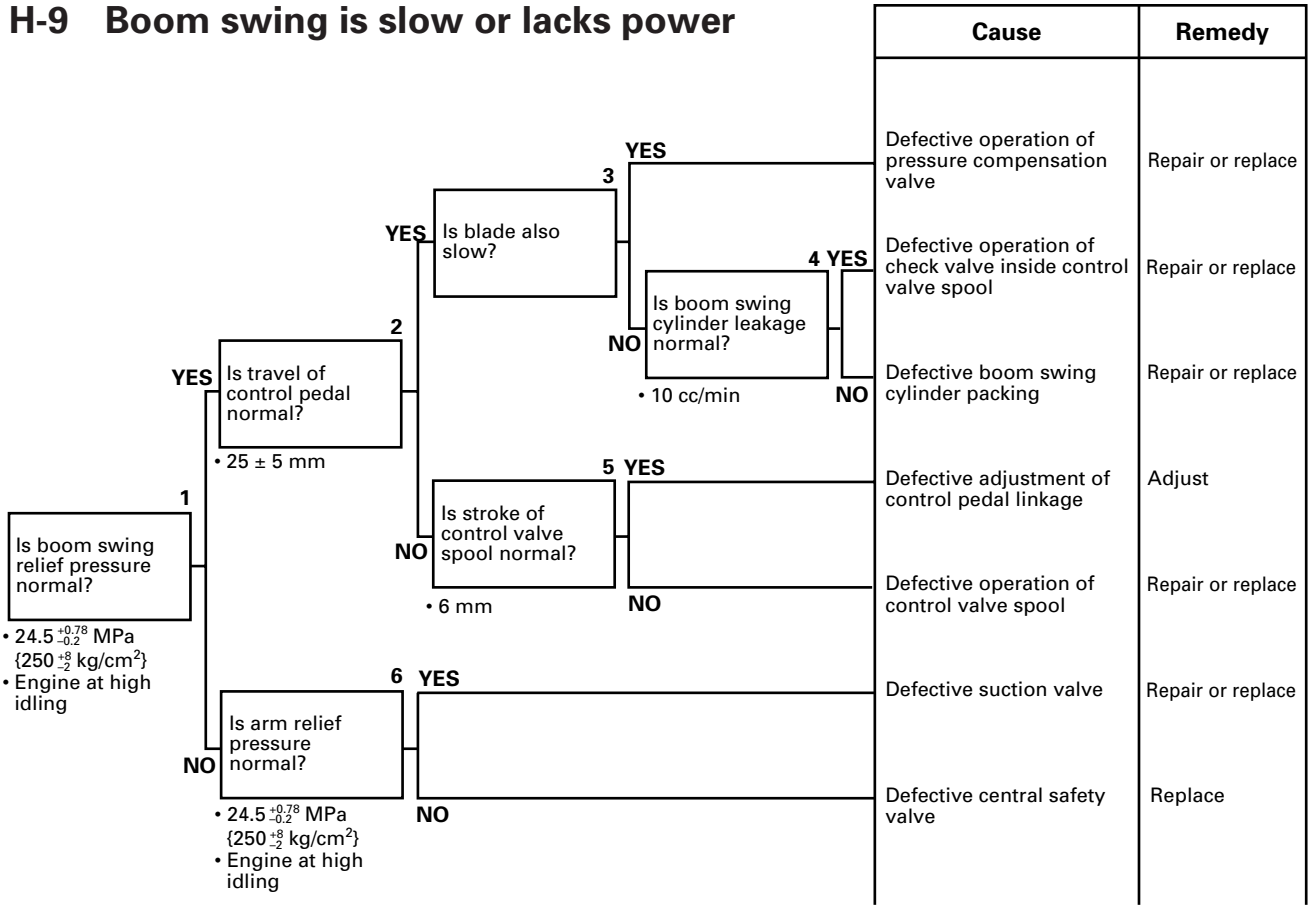
H-7 Arm is slow or lacks power



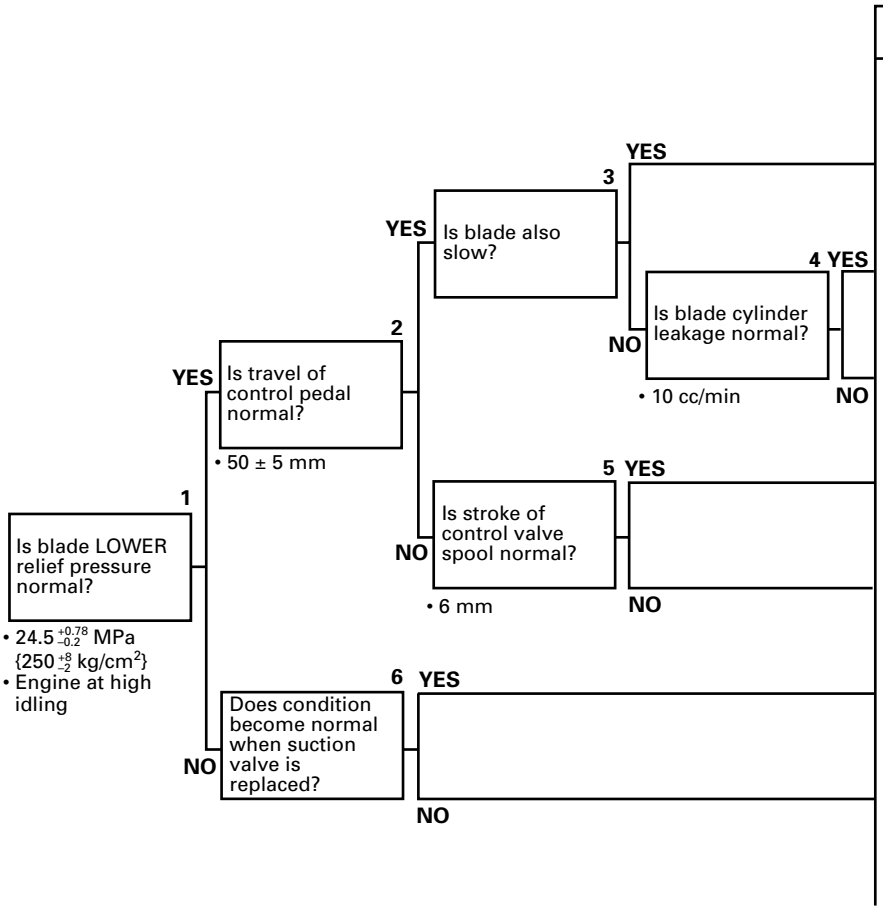
H-8 Bucket is slow or lacks power



H-9 Boom swing is slow or lacks power



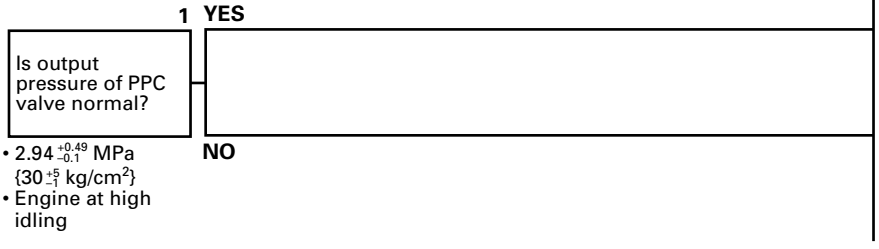
H-10 Blade is slow or lacks power



Cause	Remedy
Defective operation of pressure compensation valve (inside boom swing control valve)	Repair or replace
Defective operation of check valve inside control valve spool	Repair or replace
Defective blade cylinder packing	Repair or replace
Defective adjustment of control lever linkage	Adjust
Defective operation of control valve spool	Repair or replace
Defective suction valve	Repair or replace
Defective central safety valve (PC30 – 40R) Defective safety valve (PC45R)	Replace

H-11 Boom, arm, bucket do not move (boom swing, blade, travel and swing are normal)

★ If the boom, arm, or bucket do not move when they are operated independently.

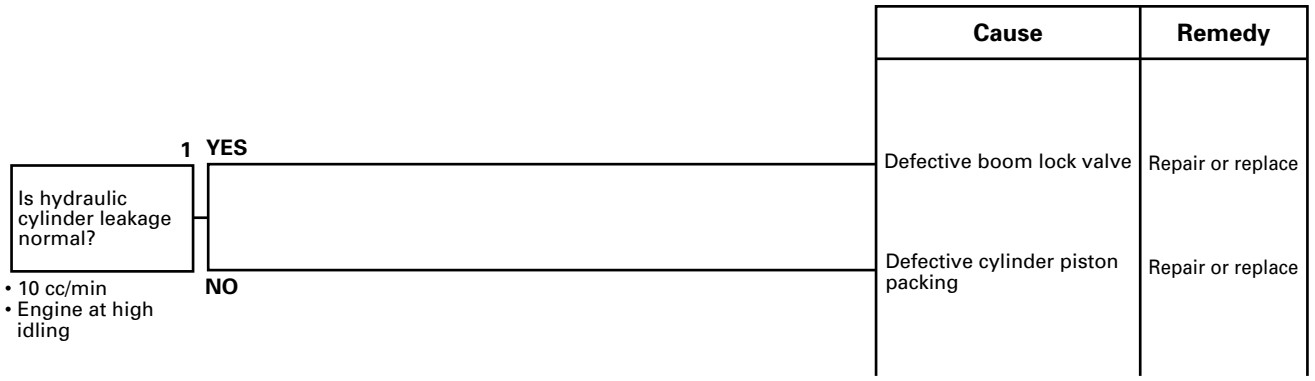


Cause	Remedy
Defective operation of control valve spool	Repair or replace
Defective PPC valve	Repair or replace

H-12 Excessive hydraulic drift (boom, arm, bucket, boom swing, blade)

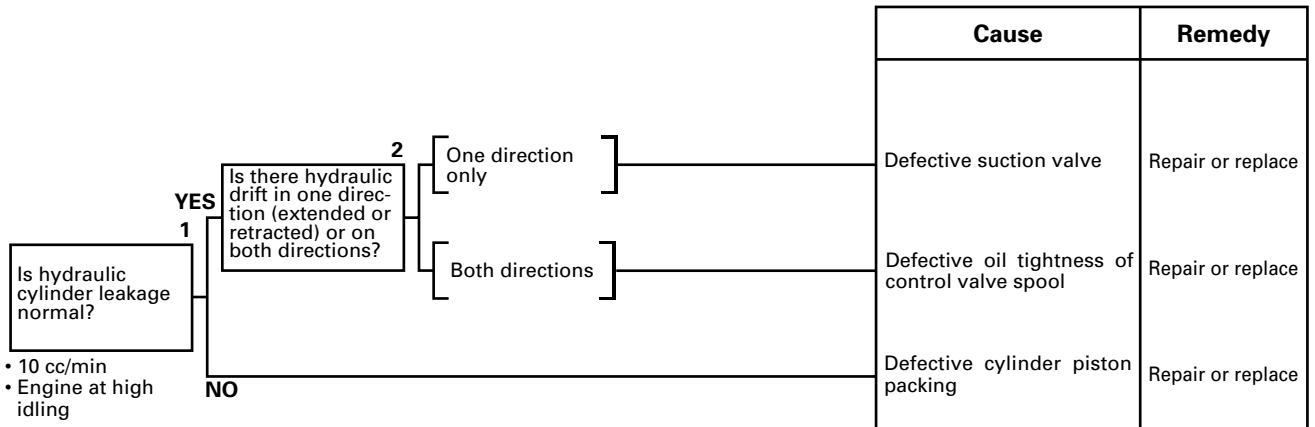
★ When there is simultaneous hydraulic drift in the boom, arm, bucket, and boom swing, judge that the cause is a defective central safety valve.

a) Boom



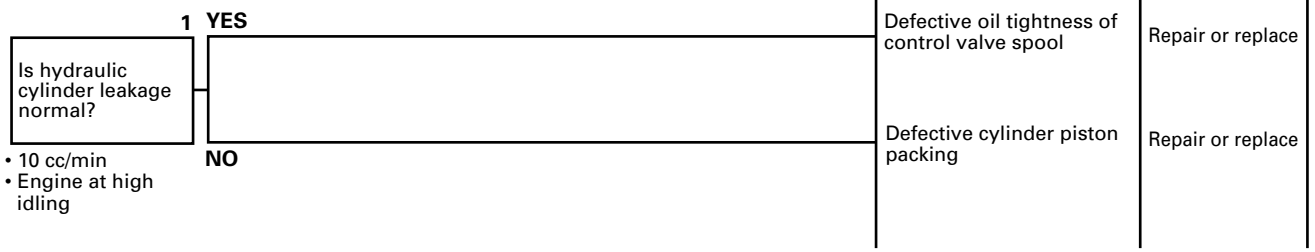
Cause	Remedy
Defective boom lock valve	Repair or replace
Defective cylinder piston packing	Repair or replace

b) Arm, bucket, boom swing



Cause	Remedy
Defective suction valve	Repair or replace
Defective oil tightness of control valve spool	Repair or replace
Defective cylinder piston packing	Repair or replace

c) Blade



Cause	Remedy
Defective oil tightness of control valve spool	Repair or replace
Defective cylinder piston packing	Repair or replace

H-13 Excessive time lag (engine at low idling)

★ When the work equipment speed is normal.

Cause	Remedy
Defective suction valve	Repair or replace

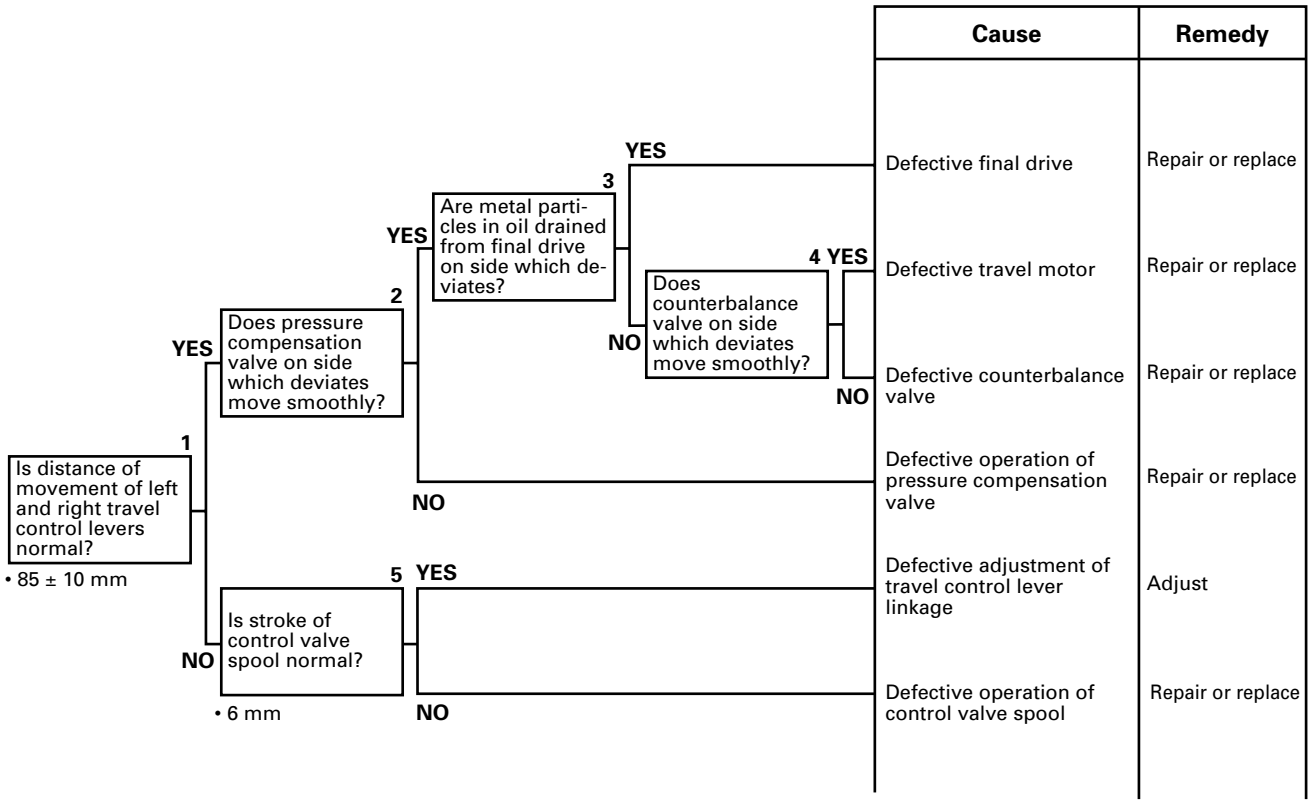
H-14 In compound operations, work equipment with larger load is slow

Cause	Remedy
Defective operation of pressure compensation valve on side where load is light	Replace

	Combination for compound operation	Side with larger load	Side with lighter load
1	Boom RAISE + arm IN	Boom RAISE	Arm IN
2	Boom RAISE + arm OUT	Arm OUT	Boom RAISE
3	Boom RAISE + bucket CURL	Boom RAISE	Bucket CURL
4	Arm OUT + bucket CURL	Arm OUT	Bucket CURL
5	Boom LOWER + arm OUT	Arm OUT	Boom LOWER

H-15 Travel deviation

a) Deviation in normal travel

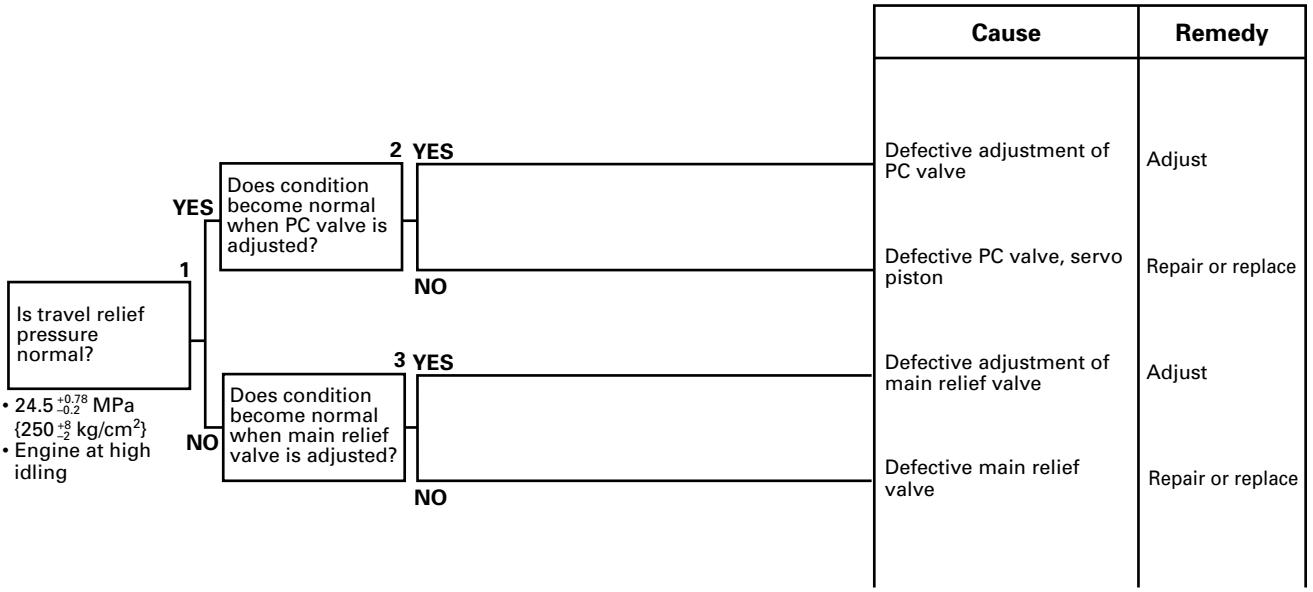


b) Deviation when starting



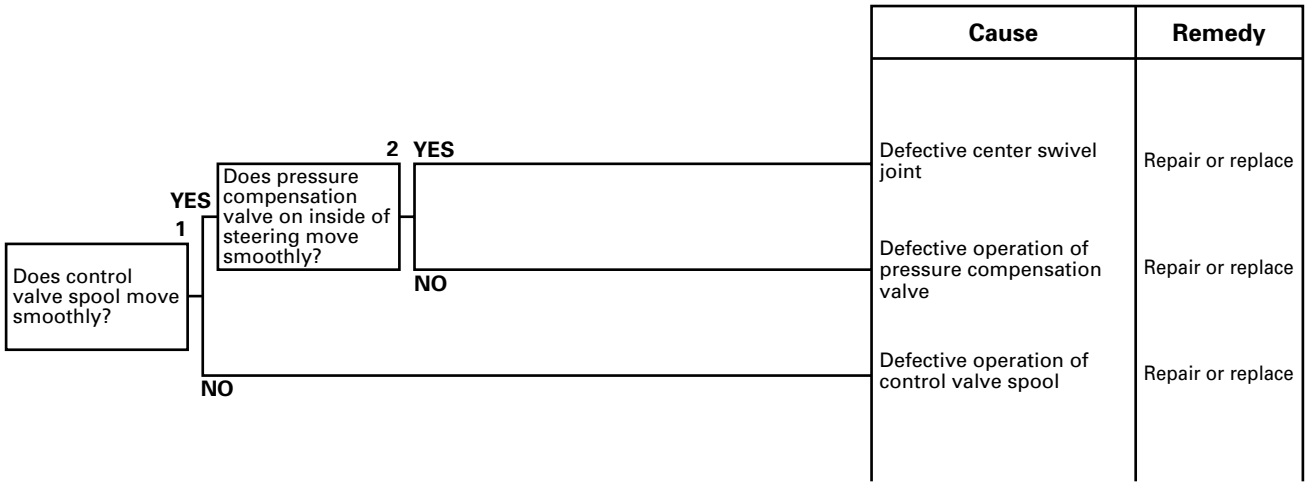
H-16 Travel speed is slow or lacks power

★ When there is no travel deviation (if there is travel deviation, go to H-15 Travel deviation).
★ When the work equipment speed is normal.

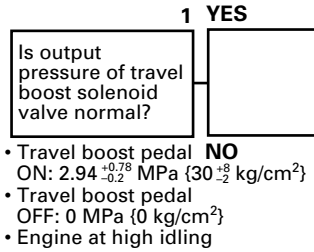


H-17 Steering does not turn easily

★ When there is no travel deviation (if there is travel deviation, go to H-15 Travel deviation).

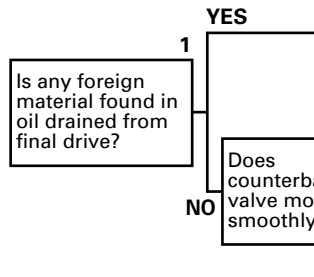


H-18 Travel speed does not switch



Cause	Remedy
Defective travel motor speed selector servo	Repair or replace
Defective travel boost solenoid valve	Repair or replace

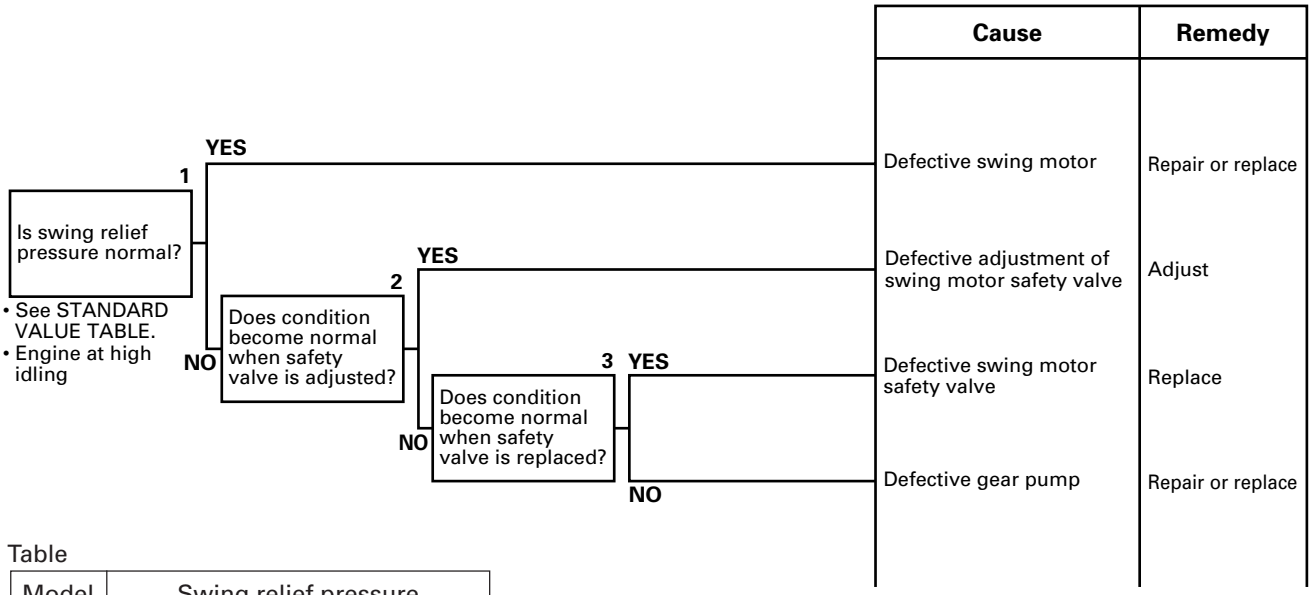
H-19 Travel does not move (one side only)



Cause	Remedy
Defective final drive	Repair or replace
Defective travel motor	Repair or replace
Defective counterbalance valve	Repair or replace

H-20 Swing speed is slow or lacks power

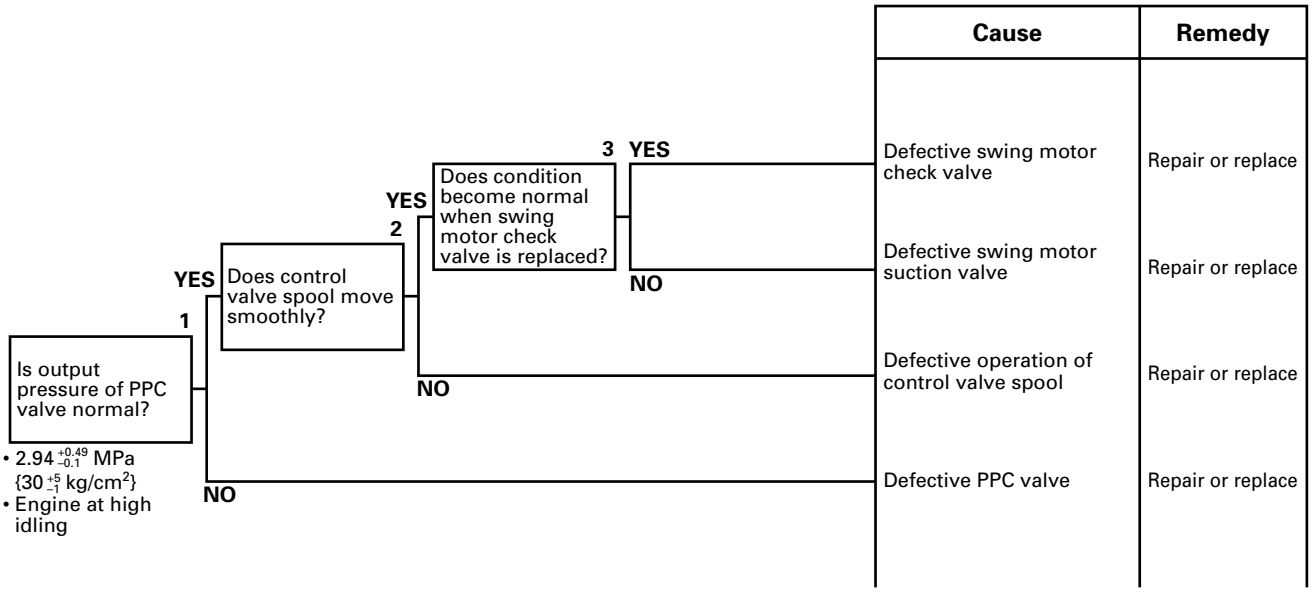
a) Speed is slow or lacks power in both directions



Table

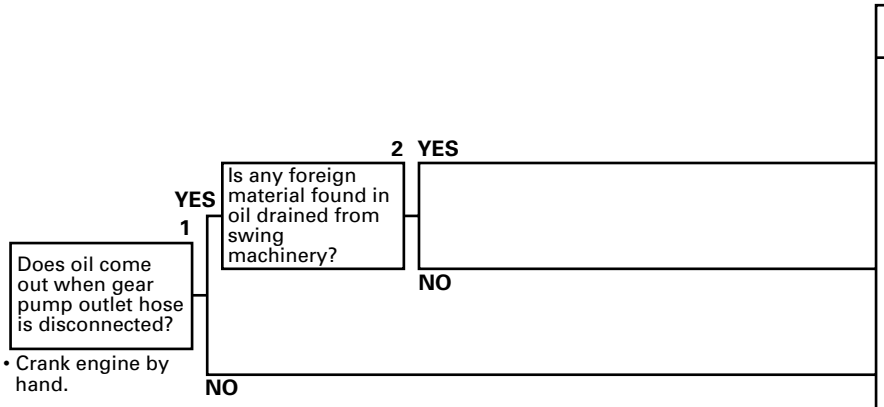
Model	Swing relief pressure
PC30R	15.19 $^{+1.47}_{-0.49}$ MPa {155 $^{+15}_{-5}$ kg/cm^2}
PC35R	16.17 $^{+1.47}_{-0.49}$ MPa {165 $^{+15}_{-5}$ kg/cm^2}
PC40R	17.64 $^{+1.47}_{-0.49}$ MPa {180 $^{+15}_{-5}$ kg/cm^2}
PC45R	19.6 $^{+1.47}_{-0.49}$ MPa {200 $^{+15}_{-5}$ kg/cm^2}

b) Speed is slow or lacks power in one direction only (left or right)



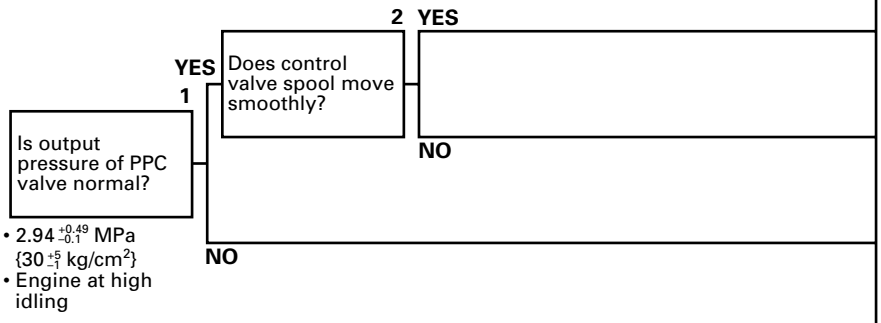
H-21 Does not swing

a) Does not swing in either direction



Cause	Remedy
Defective swing machinery	Repair or replace
Defective swing motor or defective swing holding brake	Repair or replace
Defective gear pump	Repair or replace

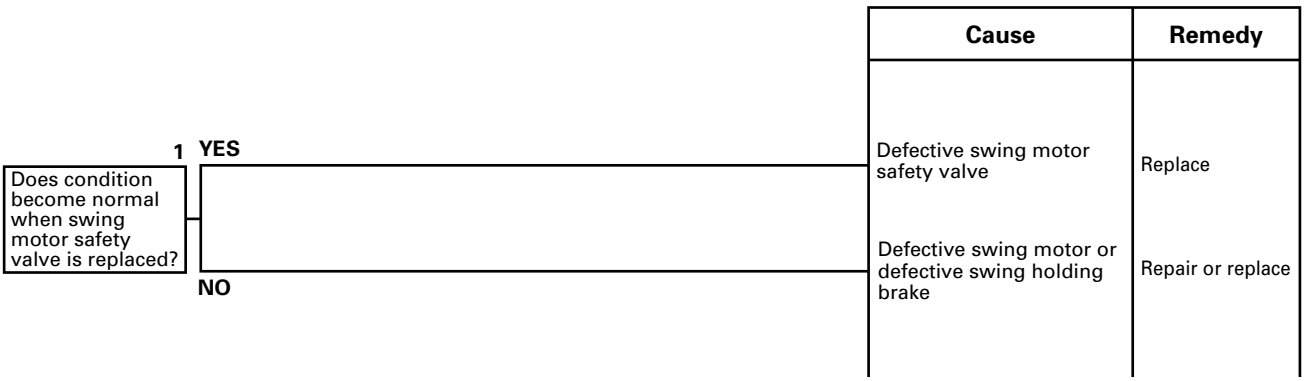
b) Does not swing in one direction (left or right)



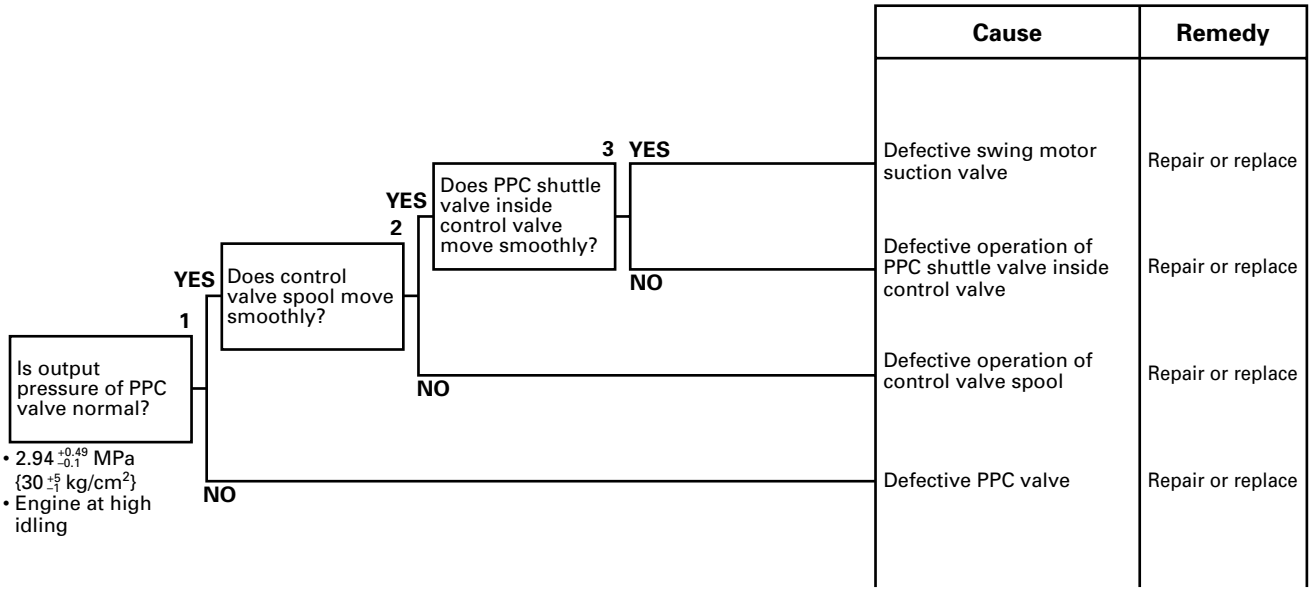
Cause	Remedy
Defective operation of PPC shuttle valve inside control valve	Repair or replace
Defective operation of control valve spool	Repair or replace
Defective PPC valve	Repair or replace

H-22 Swing acceleration is poor

a) Acceleration is poor in both directions

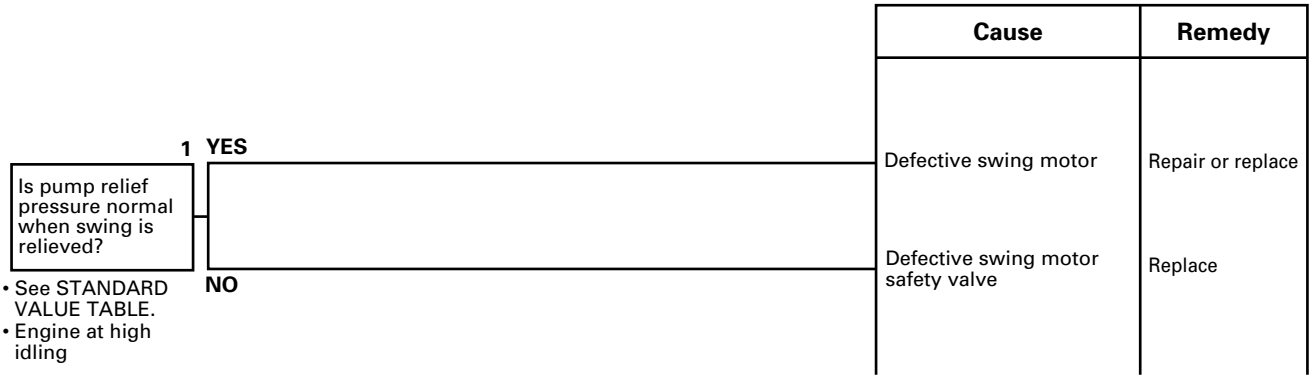


b) Acceleration is poor in one direction only (left or right)



H-23 Excessive overrun when stopping swing

a) Overrun when stopping is excessive in both directions

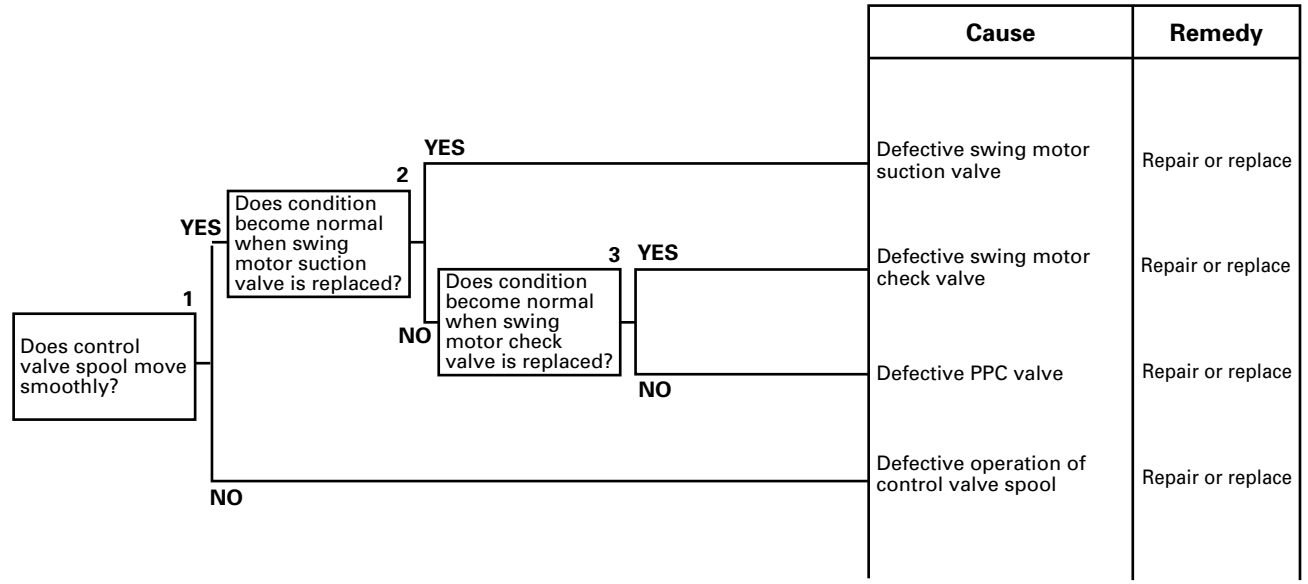


• See STANDARD VALUE TABLE.
• Engine at high idling

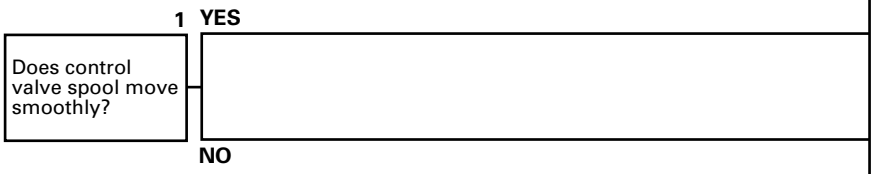
Table

Model	Swing relief pressure
PC30R	15.19 $^{+1.47}_{-0.49}$ MPa {155 $^{+15}_{-5}$ kg/cm^2}
PC35R	16.17 $^{+1.47}_{-0.49}$ MPa {165 $^{+15}_{-5}$ kg/cm^2}
PC40R	17.64 $^{+1.47}_{-0.49}$ MPa {180 $^{+15}_{-5}$ kg/cm^2}
PC45R	19.6 $^{+1.47}_{-0.49}$ MPa {200 $^{+15}_{-5}$ kg/cm^2}

b) Overrun when stopping is excessive in one direction only (left or right)

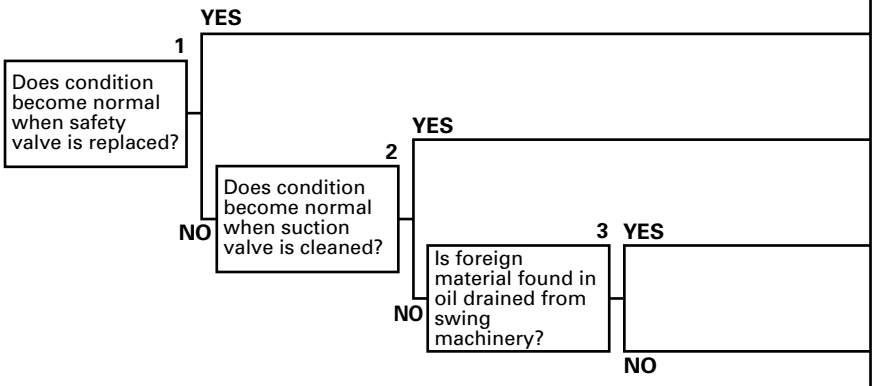


H-24 Excessive shock when stopping swing (in one direction only)



Cause	Remedy
Defective PPC valve	Repair or replace
Defective operation of control valve spool	Repair or replace

H-25 Excessive abnormal noise when stopping swing



Cause	Remedy
Defective swing motor safety valve	Replace
Defective swing motor suction valve	Clean
Defective swing machinery	Repair or replace
Defective control valve cooler check valve	Repair or replace

H-26 Excessive hydraulic drift of swing

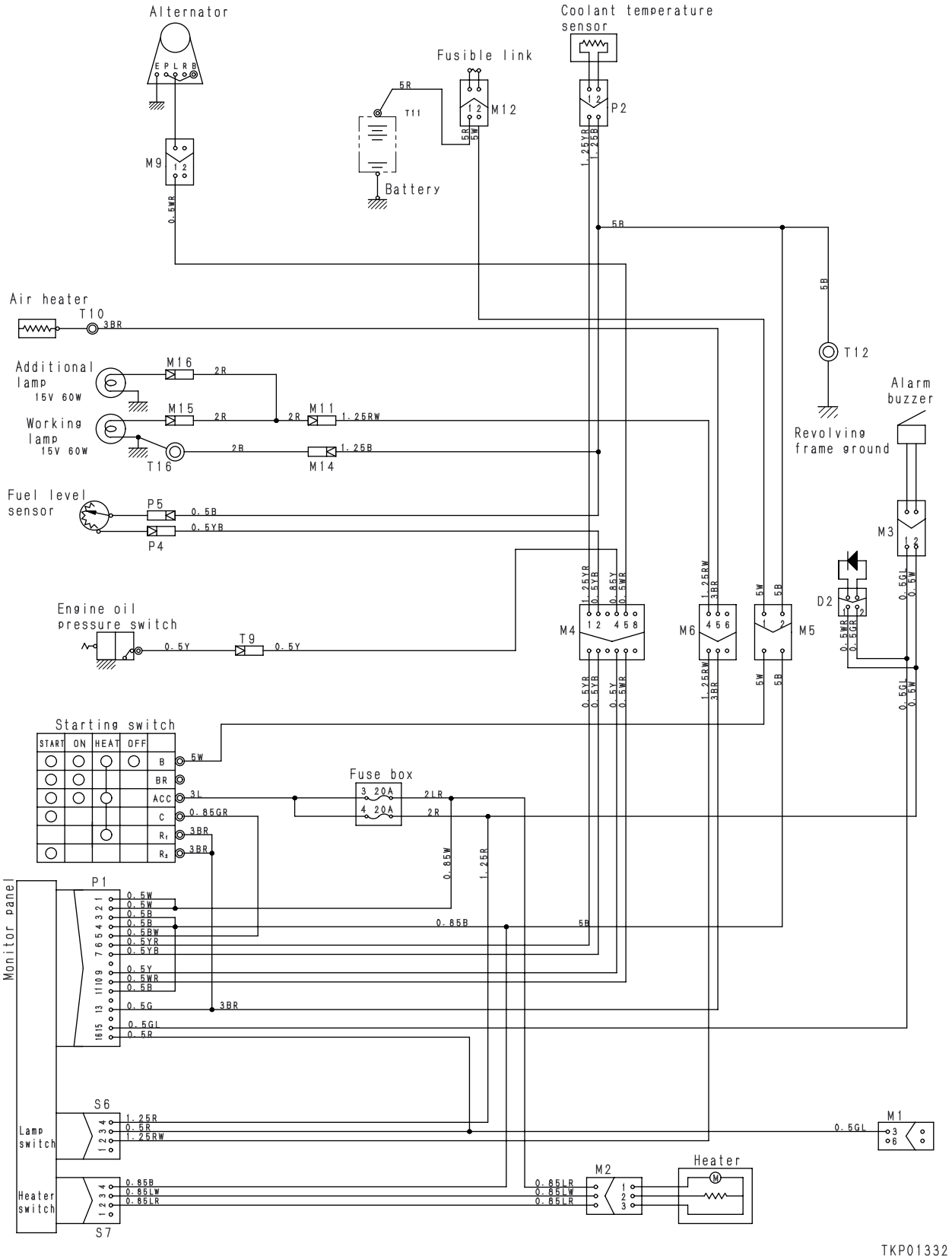


Cause	Remedy
Defective swing holding brake	Repair or replace

TROUBLESHOOTING OF MACHINE MONITOR SYSTEM (M MODE)

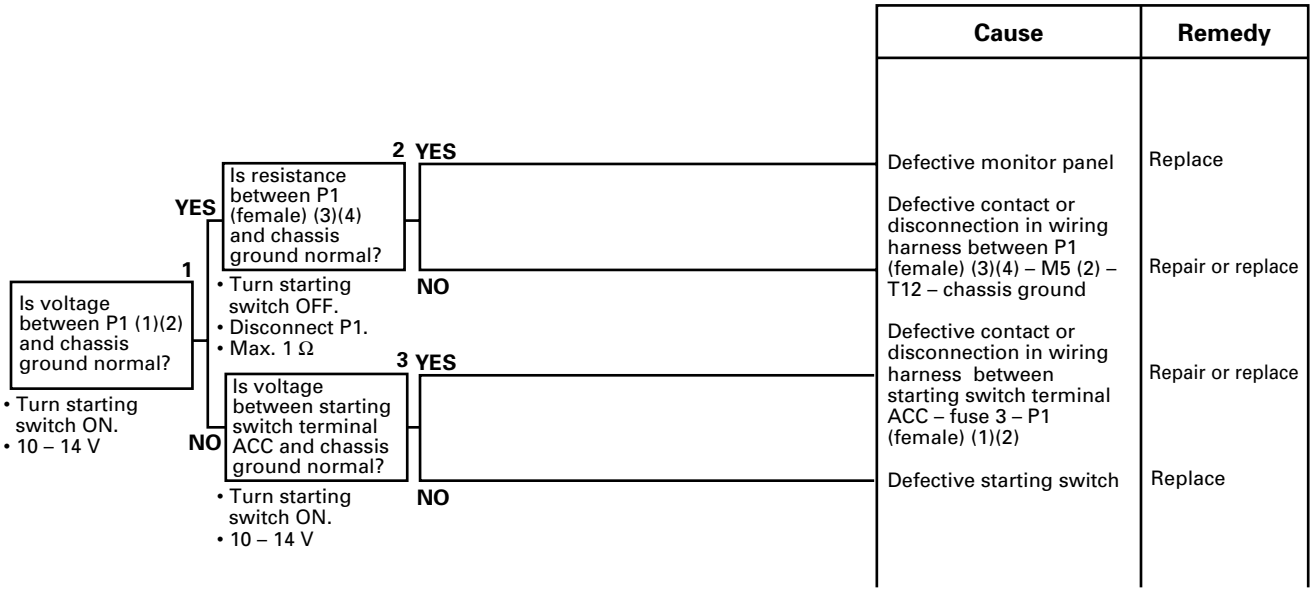
Electrical circuit diagram for M mode related parts 20-502
M- 1 When starting switch is turned ON, no display is given 20-503
M- 2 When starting switch is turned ON, even when self check is completed (all lamps light up for 3 seconds), lamps do not go out 20-503
M- 3 When starting switch is turned ON, some self check lamps do not light up for 3 seconds ... 20-504
a) No gauge lamps light up (fuel, coolant temperature) 20-504
b) Caution lamps (engine oil pressure, battery charge), pilot lamp (preheating) do not light up 20-504
M- 4 During self check (all lamps light up for 3 seconds), even if starting switch is turned to START, self check is not completed for 3 seconds 20-504
M- 5 When starting switch is ON (engine stopped), engine oil pressure caution lamp does not light up 20-505
M- 6 When starting switch is ON (engine stopped), charge caution lamp does not light up 20-505
M- 7 When starting switch is turned to HEAT, preheating pilot lamp does not light up 20-506
M- 8 When engine is running, engine oil pressure caution lamp lights up 20-506
M- 9 When engine is running, charge caution lamp lights up 20-507
M-10 Abnormality in coolant temperature gauge 20-508
a) Level does not rise from segment C 20-508
b) Level does not go down from segment H, or all segments go out 20-508
c) Coolant temperature does not match gauge display 20-509
M-11 Abnormality in fuel gauge 20-510
a) Level does not rise from segment E or all segments go out 20-510
b) Level does not go down from segment F 20-510
c) Fuel level does not match gauge display 20-511
M-12 Defective operation of alarm buzzer 20-512
a) Buzzer does not sound 20-512
b) Buzzer continues to sound and does not stop 20-512
M-13 When engine is running, service meter does not advance 20-513
a) When charge caution lamp does not light up 20-513
b) When charge caution lamp lights up 20-513
c) Pilot lamp does not flash (service meter is actuated) 20-513
M-14 Night lighting does not light up 20-514
a) Gauge lighting does not light up 20-514
b) Service meter lighting does not light up 20-514

ELECTRICAL CIRCUIT DIAGRAM FOR M MODE RELATED PARTS



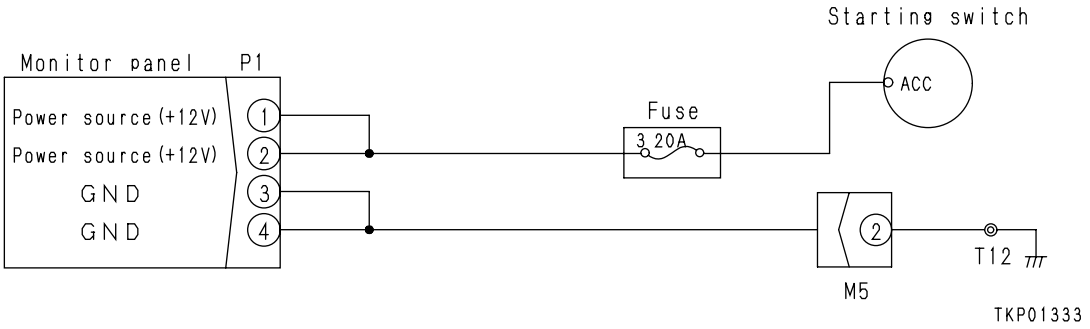
M-1 When starting switch is turned ON, no display is given

★ Check that fuse 3 is normal (if it is blown, check for a short circuit with the ground in the circuits related to fuse 3).
★ 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 P1 (female) (3)(4) – M5 (2) – T12 – chassis ground	Repair or replace
Defective contact or disconnection in wiring harness between starting switch terminal ACC – fuse 3 – P1 (female) (1)(2)	Repair or replace
Defective starting switch	Replace

M-1 Related electrical circuit diagram



M-2 When starting switch is turned ON, even when self check is completed (all lamps light up for 3 seconds), lamps do not go out

Cause	Remedy
Defective monitor panel	Replace

M-3 When starting switch is turned ON, some self check lamps do not light up for 3 seconds

a) No gauge lamps light up (fuel, coolant temperature)

Cause	Remedy
Defective monitor panel	Replace

b) Caution lamps (engine oil pressure, battery charge), pilot lamp (preheating) do not light up

1 Is there disconnection in lamp which does not light up?
- Check visually for blown bulb.

YES
NO

Cause	Remedy
Blown bulb	Replace
Defective monitor panel	Replace

M-4 During self check (all lamps light up for 3 seconds), even if starting switch is turned to START, self check is not completed for 3 seconds

★ 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 P1 (5) and chassis ground normal?
- Turn starting switch to START.
- 10 – 14 V

YES
NO

Cause	Remedy
Defective monitor panel	Replace
Defective contact or disconnection in wiring harness between starting switch terminal C and P1 (female) (5)	Repair or replace

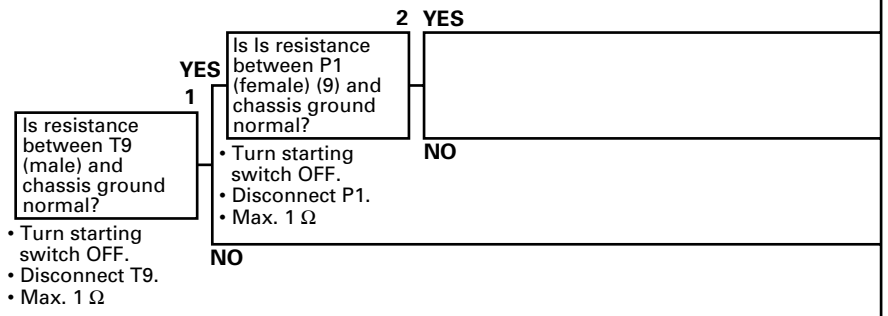
M-4 Related electrical circuit diagram



TKP01334

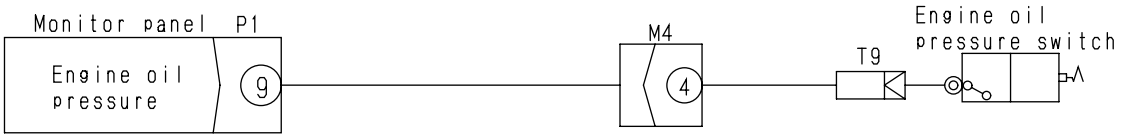
M-5 When starting switch is ON (engine stopped), engine oil pressure caution lamp does not light up

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



Cause	Remedy
Defective monitor panel	Replace
Defective contact or disconnection in wiring harness between P1 (female) (9) – M4 (4) – T9 (female)	Repair or replace
Defective engine oil pressure switch	Replace

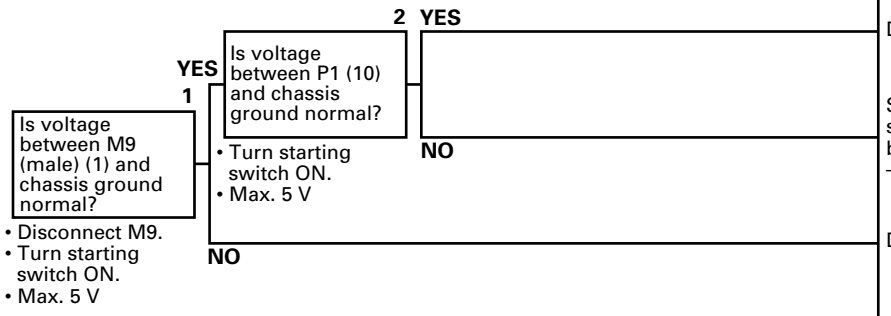
M-5 Related electrical circuit diagram



TKP01335

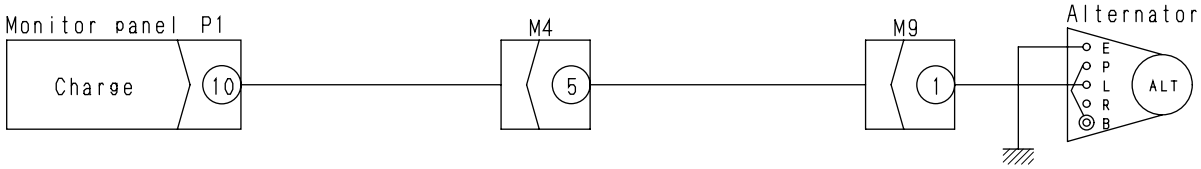
M-6 When starting switch is ON (engine stopped), charge caution lamp does not light up

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



Cause	Remedy
Defective monitor panel	Replace
Short circuit with power source in wiring harness between P1 (female) (10) – M4 (5) – M9 (female) (1)	Repair or replace
Defective alternator	Replace

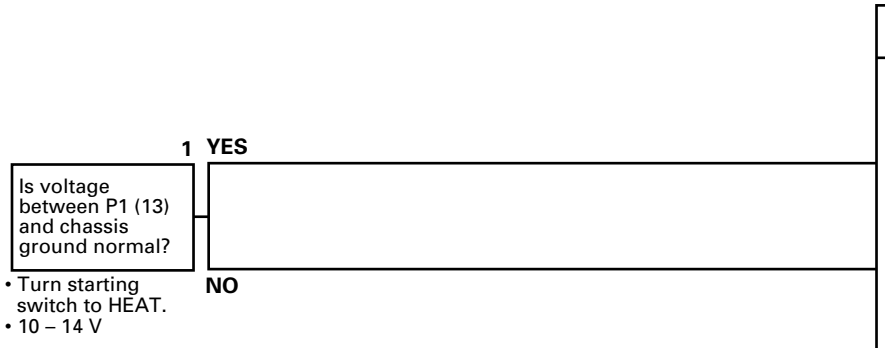
M-6 Related electrical circuit diagram



TKP01336

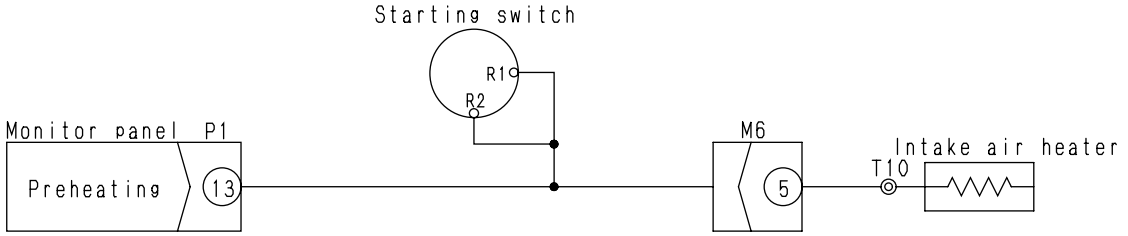
M-7 When starting switch is turned to HEAT, preheating pilot lamp does not light up

★ When the engine preheating 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.



Cause	Remedy
Defective monitor panel	Replace
Defective contact or disconnection in wiring harness between P1 (female) (13) – starting switch terminal R2 and R1	Repair or replace

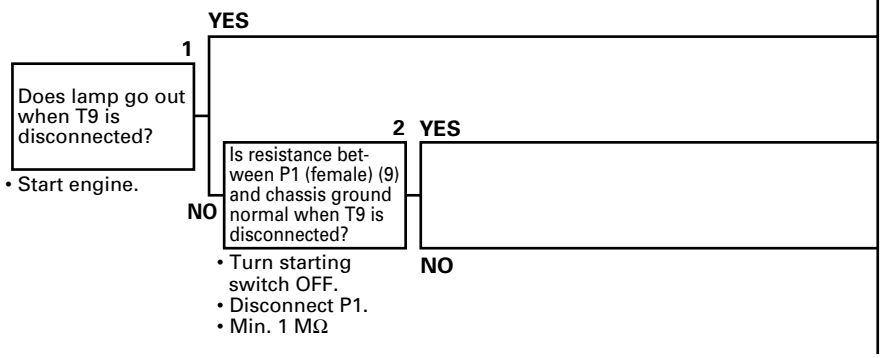
M-7 Related electrical circuit diagram



TKP01337

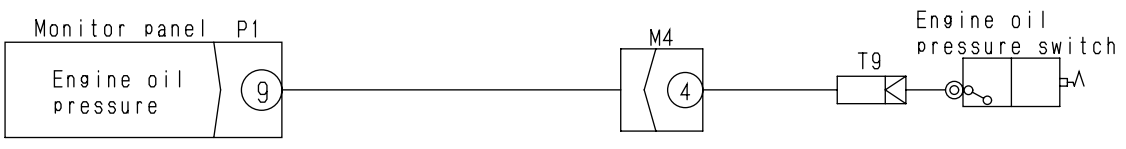
M-8 When engine is running, engine oil pressure caution lamp lights up

★ When the engine oil pressure 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.



Cause	Remedy
Defective engine oil pressure switch	Replace
Defective monitor panel	Replace
Short circuit with chassis ground in wiring harness between P1 (female) (9) – M4 (4) – T9 (female)	Repair or replace

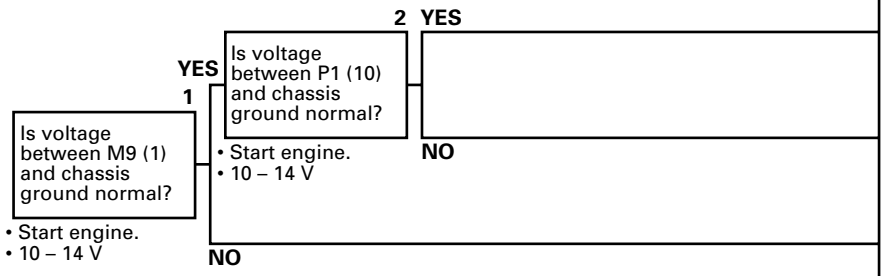
M-8 Related electrical circuit diagram



TKP01338

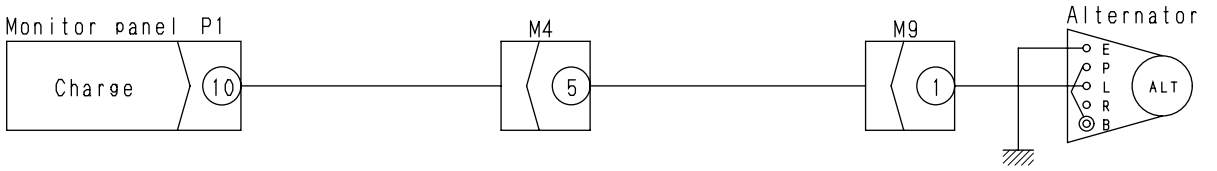
M-9 When engine is running, charge caution lamp lights up

★ When the charging 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.



Cause	Remedy
Defective monitor panel	Replace
Defective contact, disconnection, or short circuit with chassis ground in wiring harness between P1 (female) (10) – M4 (5) – M9 (female) (1)	Repair or replace
Defective alternator	Replace

M-9 Related electrical circuit diagram

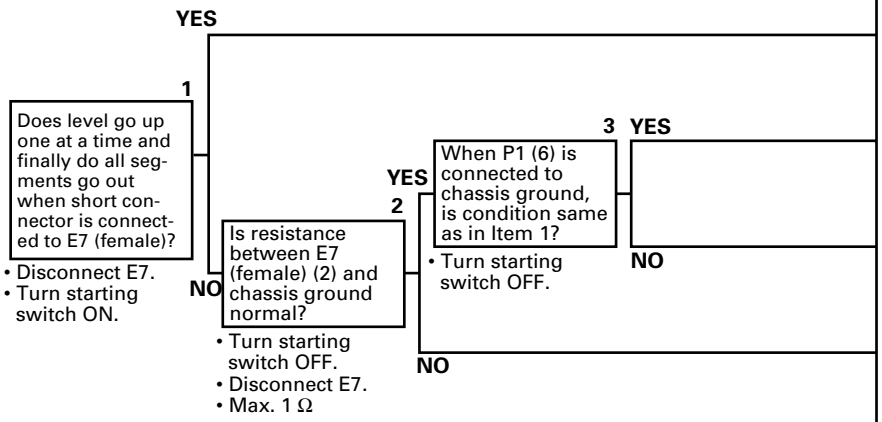


TKP01336

M-10 Abnormality in coolant temperature gauge

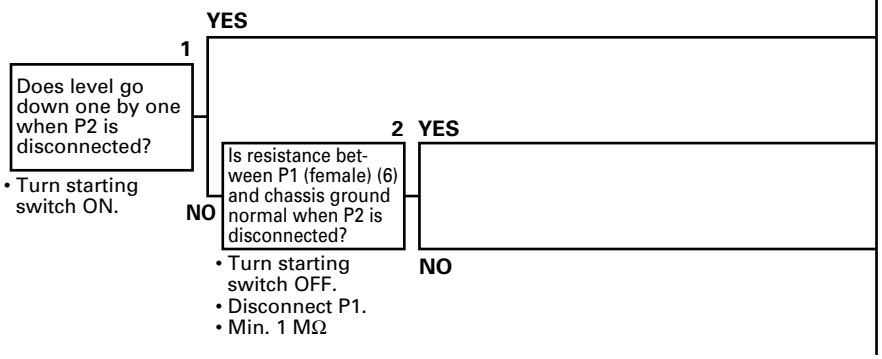
★ When the coolant temperature is normal.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

a) Level does not rise from segment C



Cause	Remedy
Defective coolant temperature sensor	Replace
Defective contact or disconnection in wiring harness between P1 (female) (6) – P4 (2) – M1 (5) – E7 (female) (1)	Repair or replace
Defective monitor panel	Replace
Defective contact or disconnection in wiring harness between E7 (female) (2) and chassis ground	Repair or replace

b) Level does not go down from segment H, or all segments go out



Cause	Remedy
Defective coolant temperature sensor	Replace
Defective monitor panel	Replace
Short circuit with chassis ground in wiring harness between P1 (female) (6) – M4 (1) – P2 (female) (1)	Repair or replace

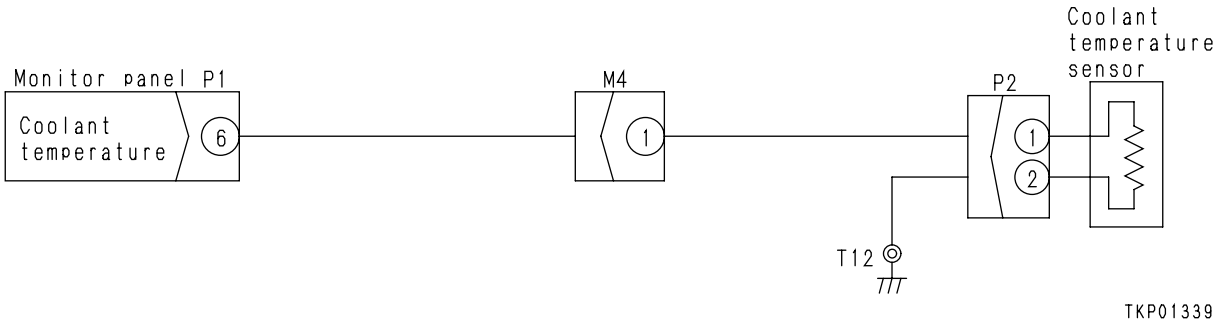
c) Coolant temperature does not match gauge display

	Cause	Remedy
1 Is resistance between P2 (male) (1) and (2) as shown in the table? • Check sensor as individual part.		
YES	Defective monitor panel	Replace
NO	Defective coolant temperature sensor	Replace

Table

Temperature	Resistance value	Temperature	Resistance value
25°C	38.18 – 47.77	90°C	4.469 – 5.166
30°C	31.59 – 39.07	95°C	4.107 – 4.448
80°C	6.199 – 6.935	100°C	3.604 – 3.903
85°C	5.386 – 5.976	105°C	3.157 – 3.426

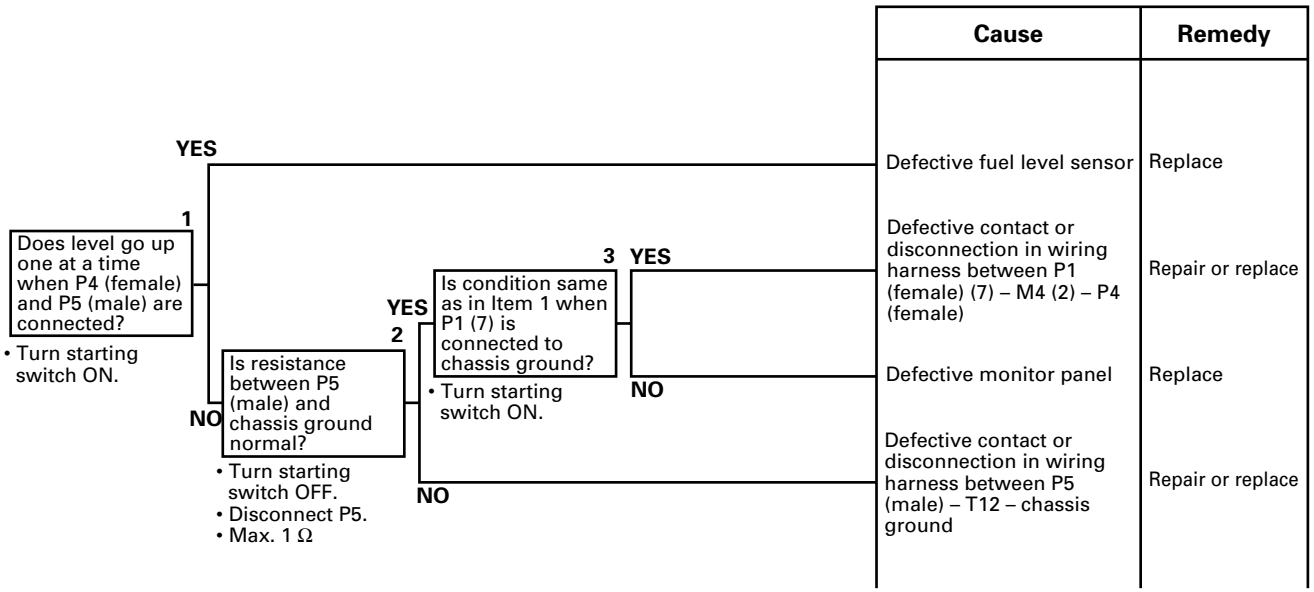
M-10 Related electrical circuit diagram



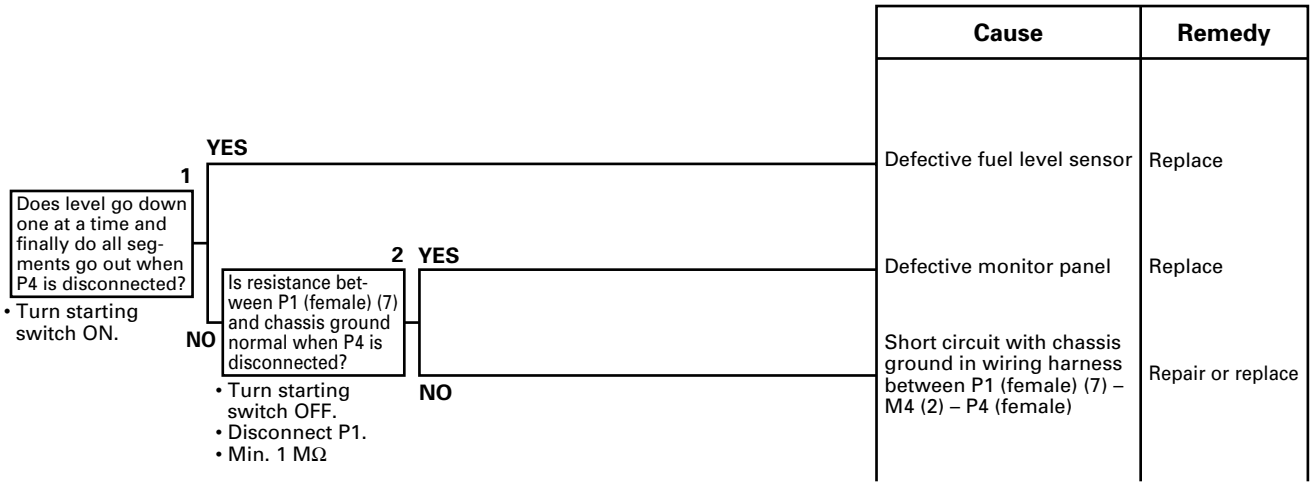
M-11 Abnormality in fuel gauge

★ When the fuel level 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.

a) Level does not rise from segment E or all segments go out



b) Level does not go down from segment F



c) Fuel level does not match gauge display

1 Is resistance between P4 (male) and P5 (female) as shown in the table?
- Check sensor as individual part.

YES → Defective monitor panel → Replace

NO → Defective fuel level sensor → Replace

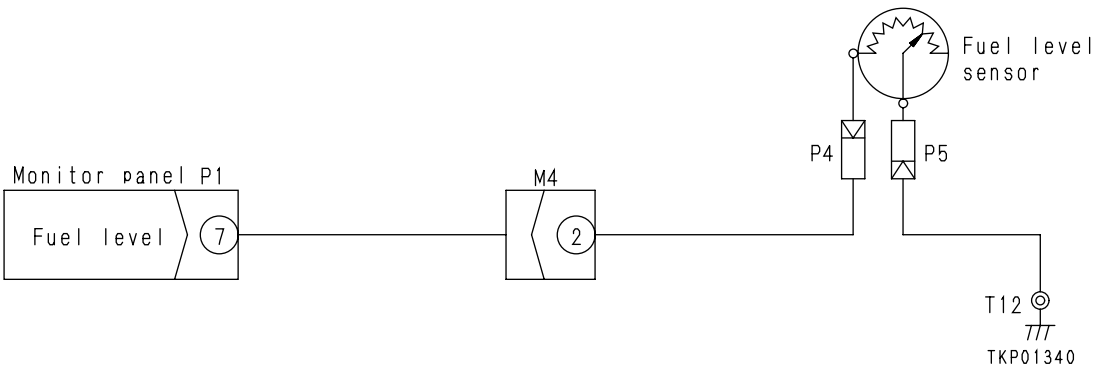
Cause	Remedy
Defective monitor panel	Replace
Defective fuel level sensor	Replace

( )

Float position	Resistance value
Top	$10^{+1.0}_{-0.5}$
Top 1/4	(19)
1/2 (center)	32 ±3
Bottom 1/2	(49.5)
Bottom	80^{+12}_{-2}

★ Figures in ( ) are reference values.

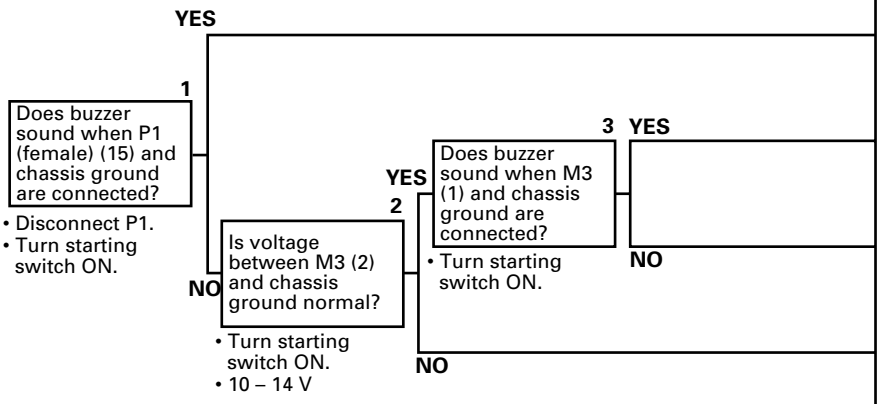
M-11 Related electrical circuit diagram



M-12 Defective operation of alarm buzzer

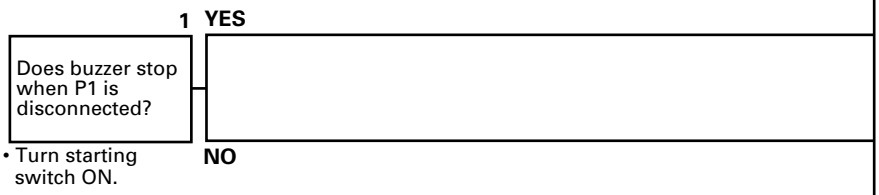
★ Check that fuse 4 is normal (if it is blown, check for a short circuit with the ground in the circuits related to fuse 4).
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

a) Buzzer does not sound



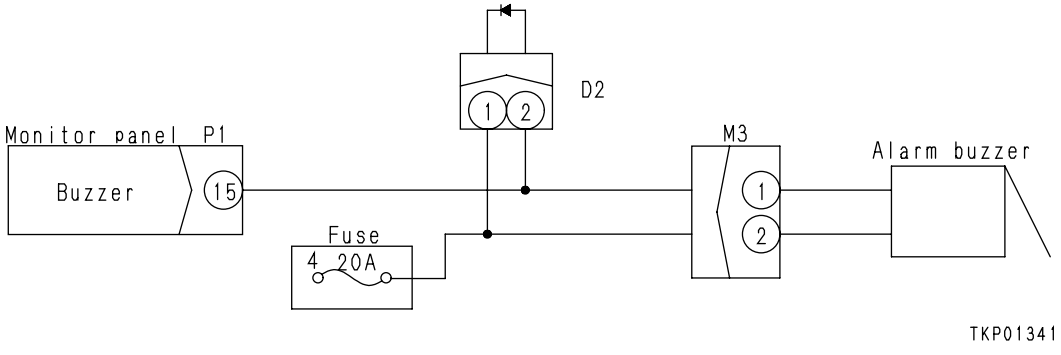
Cause	Remedy
Defective monitor panel	Replace
Defective contact or disconnection in wiring harness between P1 (female) (15) and M3 (female) (1)	Repair or replace
Defective buzzer	Replace
Defective contact or disconnection in wiring harness between fuse 4 and M3 (female) (2)	Repair or replace

b) Buzzer continues to sound and does not stop



Cause	Remedy
Defective monitor panel	Replace
Short circuit with chassis ground in wiring harness between P1 (female) (15) and M3 (female) (1)	Repair or replace

M-12 Related electrical circuit diagram



M-13 When engine is running, service meter does not advance

★ 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) When charge caution lamp does not light up

Cause	Remedy
Defective monitor panel	Replace

b) When charge caution lamp lights up
★ Go to Troubleshooting No. M-9.

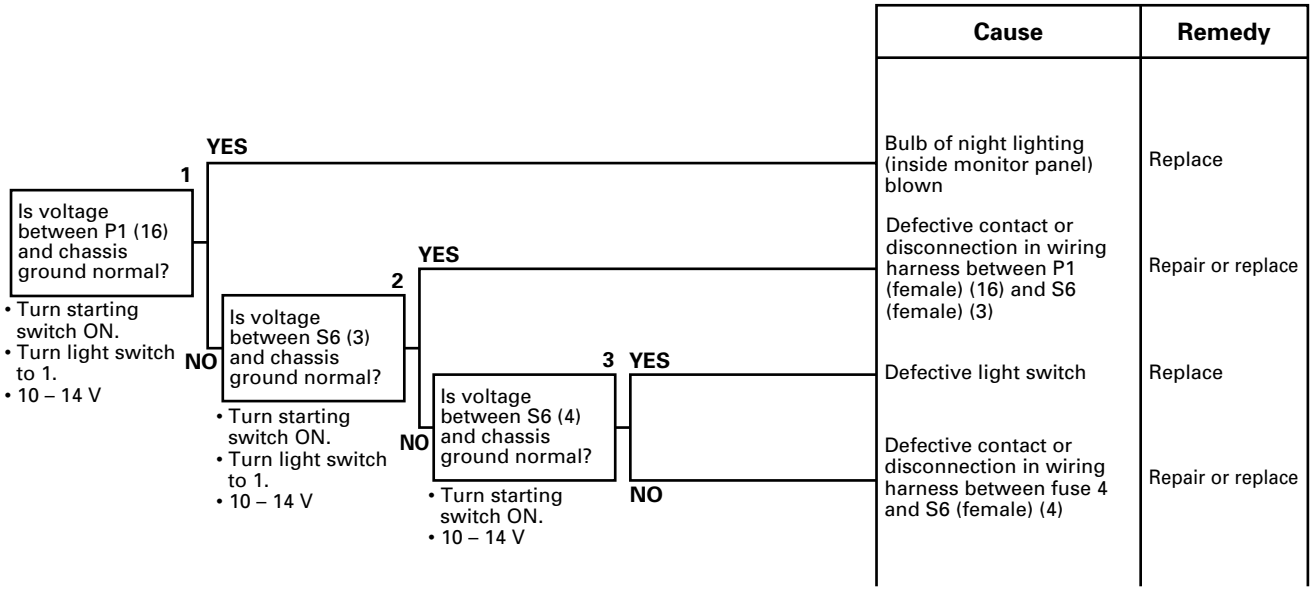
c) Pilot lamp does not flash (service meter is actuated)

Cause	Remedy
Defective monitor panel	Replace

M-14 Night lighting does not light up

★ Check that fuse 4 is normal (if it is blown, check for a short circuit with the ground in the circuits related to fuse 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.

a) Gauge lighting does not light up

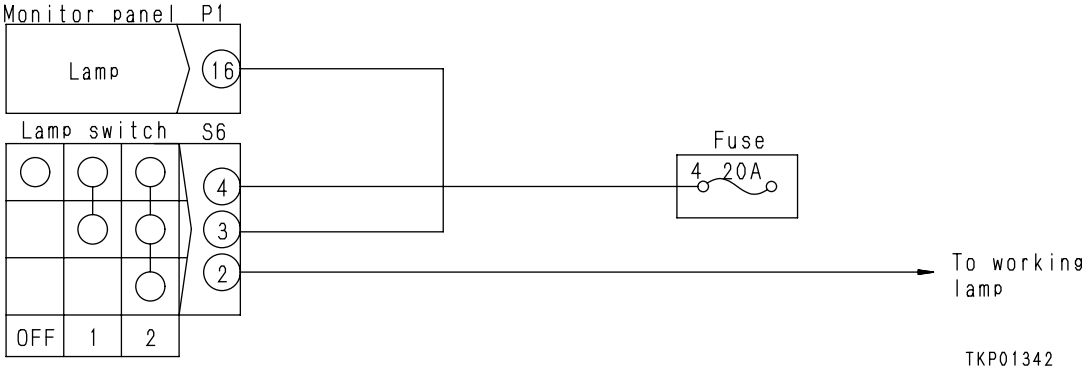


Cause	Remedy
Bulb of night lighting (inside monitor panel) blown	Replace
Defective contact or disconnection in wiring harness between P1 (female) (16) and S6 (female) (3)	Repair or replace
Defective light switch	Replace
Defective contact or disconnection in wiring harness between fuse 4 and S6 (female) (4)	Repair or replace

b) Service meter lighting does not light up

Cause	Remedy
Defective monitor panel	Replace

M-14 Related electrical circuit diagram



30 DISASSEMBLY AND ASSEMBLY

METHOD OF USING MANUAL 30- 3
PRECAUTIONS WHEN CARRYING OUT OPERATION 30- 4
SPECIAL TOOL LIST 30- 6
SKETCHES OF SPECIAL TOOLS 30- 8
STARTING MOTOR
Removal and Installation 30- 9
ALTERNATOR
Removal and Installation 30-10
FUEL INJECTION PUMP
Removal 30-11
Installation 30-12
NOZZLE HOLDER
Removal and Installation 30-15
WATER PUMP
Removal 30-16
Installation 30-17
THERMOSTAT
Removal and Installation 30-18
ENGINE FRONT SEAL
Removal and Installation 30-19
ENGINE REAR SEAL
Removal 30-20
Installation 30-21
CYLINDER HEAD
Removal 30-22
Installation 30-24
RADIATOR, HYDRAULIC COOLER
Removal 30-28
Installation 30-29
ENGINE, HYDRAULIC PUMP
Removal 30-30
Installation 30-34
FUEL TANK
Removal and Installation 30-35
DAMPER
Removal and Installation 30-36
CENTER SWIVEL JOINT
Removal and Installation 30-37
Disassembly and Assembly 30-38
TRAVEL MOTOR
Removal and Installation 30-39
PHV-300 (FOR PC30R-8)
Disassembly and Assembly 30-39-1
PHV-350 (FOR PC35R-8)
Disassembly and Assembly 30-39-16
PHV-500 (FOR PC40R-8)
Disassembly and Assembly 30-39-31
GM06VL (FOR PC45R-8)
Disassembly and Assembly 30-39-47
SPROCKET
Removal and Installation 30-40
SWING MOTOR, SWING MACHINERY
Removal 30-41
Installation 30-42
Disassembly 30-43
Assembly 30-46
SWING MOTOR
LMF16AB
Disassembly 30-48-1
Assembly 30-48-6
REVOLVING FRAME
Removal 30-49
Installation 30-51
SWING CIRCLE
Removal and Installation 30-52
IDLER
Removal and Installation 30-53
Disassembly 30-54
Assembly 30-55
RECOIL SPRING
Removal and Installation 30-56
Disassembly 30-57
Assembly 30-59
TRACK ROLLER
Removal and Installation 30-61
Disassembly 30-62
Assembly 30-63
CARRIER ROLLER
Removal and Installation 30-64
Disassembly and Assembly 30-65

RUBBER SHOE
Removal and Installation 30-66
STEEL SHOE
Removal and Installation 30-67
HYDRAULIC TANK
Removal and Installation 30-69
HYDRAULIC COOLER
Removal and Installation 30- 70
HYDRAULIC PUMP
Removal and Installation 30- 71
MAIN PUMP
Disassembly 30-71-1
Assembly 30-71-9
CONTROL VALVE
Removal 30- 72
Installation 30- 73
Disassembly 30- 74
Assembly 30- 82
2-SPOOL SOLENOID VALVE
Removal and Installation 30- 89
LEFT PPC VALVE
Removal and Installation 30- 90
RIGHT PPC VALVE
Removal and Installation 30- 91
PPC VALVE
Disassembly 30- 92
Assembly 30- 93
BOOM CYLINDER
Removal 30- 94
Installation 30- 95
ARM CYLINDER
Removal 30- 96
Installation 30- 97
BUCKET CYLINDER
Removal 30- 98
Installation 30- 99
BOOM SWING CYLINDER
Removal 30-100
Installation 30-101
BLADE CYLINDE
Removal 30-102
Installation 30-103
HYDRAULIC CYLINDER
Disassembly 30-104
Assembly 30-107
WORK EQUIPMENT
Removal 30-110
Installation 30-111
BUCKET
Removal and Installation 30-112
ARM
Removal 30-113
Installation 30-114
BUCKET, ARM
Removal 30-115
Installation 30-116
BOOM
Removal 30-117
Installation 30-118
BOOM SWING BRACKET
Removal 30-119
Installation 30-120
BLADE
Removal 30-121
Installation 30-122
OPERATOR'S CAB
Removal and Installation 30-123
CANOPY
Removal and Installation 30-123
FLOOR FRAME
Removal and Installation 30-123

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.

1) Hoses and tubes using sleeve nuts

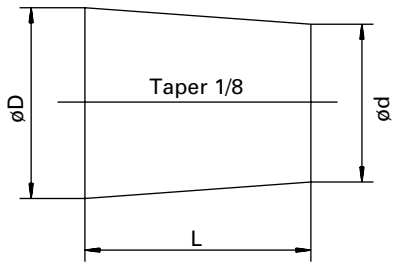
Nominal number	Plug (nut end)	Sleeve nut (elbow end) Use the two items below as a set
02	07376-50210	07221-20210 (Nut), 07222-00210 (Plug)
03	07376-50315	07221-20315 (Nut), 07222-00312 (Plug)
04	07376-50422	07221-20422 (Nut), 07222-00414 (Plug)
05	07376-50522	07221-20522 (Nut), 07222-00515 (Plug)
06	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)

2) Split flange type hoses and tubes

Nominal number	Flange (hose end)	Sleeve head (tube end)	Split flange
04	07379-00400	07378-10400	07371-30400
05	07379-00500	07378-10500	07371-30500

3) If the part is not under hydraulic pressure, the following corks can be used.

Nominal number	Part Number	Dimensions		
		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 pin or lock plate 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 in succession, stopping 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 has been removed for repair, 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 related parts.

SPECIAL TOOL LIST

★ Tools with part number 79○T-○○○-○○○○ cannot be supplied (they are items to be locally manufactured).
★ Necessity: ■ : ..... Cannot be substituted, should always be installed (used)
● : ..... Extremely useful if available, can be substituted with commercially available part
New/remodel: N : ..... Tools with new part numbers, newly developed for this model
R : ..... Tools with upgraded part numbers, remodeled from items already available for other models
Blank: .... Tools already available for other models, used without any modification
★ Tools marked ○ in the Sketch column are tools introduced in special sketches (See SKETCHES OF SPECIAL TOOLS).

Component	Symbol		Part No.	Part Name	Necessity	Q'ty	New/remodel	Sketch	Nature of work, remarks	
Disassembly, assembly of swing motor, swing machinery assembly	F	1	790-101-5001	Push tool KIT A	●	1				Press fitting of oil seal
			• 790-101-5141	• Plate		1			PC30R • 35R	
			• 790-101-5021	• Grip		1				
			• 01010-50816	• Bolt		1				
			790-101-5201	Push tool KIT B	●	1				
			• 790-101-5241	• Plate		1			PC40R • 45R	
			• 790-101-5221	• Grip		1				
			• 01010-51225	• Bolt		1				
		2	790-101-5201	Push tool KIT B	●	1				Press fitting of main bearing outer race
			• 790-101-5271	• Plate		1			PC30R • 35R	
			• 790-101-5311	• Plate		1			PC40R • 45R	
			• 790-101-5221	• Grip		1				
			• 01010-51225	• Bolt		1				
		3	790-101-5201	Push tool KIT B	●	1				Press fitting of sub bearing outer race
			• 790-101-5261	• Plate		1			PC30R • 35R	
			• 790-101-5281	• Plate		1			PC40R • 45R	
			• 790-101-5221	• Grip		1				
			• 01010-51225	• Bolt		1				
		4	796-760-9110	Push tool	■	1			PC30R • 35R	Press fitting of main bearing inner race
			796-460-1120	Push tool	■	1			PC40R • 45R	
		5	791-463-1320	Push tool	■	1			PC30R • 35R	Press fitting of sub bearing inner race
			791-463-1120	Push tool	■	1			PC40R • 45R	
		6	796-720-3800	Wrench assembly	■	1			PC30R • 35R	Measuring shaft starting torque
			796-730-2300	Wrench assembly	■	1			PC40R • 45R	
			795-630-1803	Torque wrench	●	1				
Disassembly, assembly of idler assembly	L	1	790-101-5001	Push tool KIT A	●	1			Press fitting of bushing	
			• 790-101-5081	• Plate		1				
			• 790-101-5021	• Grip		1				
			• 01010-50816	• Bolt		1				
		2	791-430-3230	Installer	■	1			Installation of floating seal	

Component	Symbol		Part No.	Part Name	Necessity	Q'ty	New/ remodel	Sketch	Nature of work, remarks
Disassembly, assembly of track roller assembly	L	3	790-101-5001	Push tool KIT A	●	1			
			• 790-101-5051	• Plate		1			PC30R • 35R — Press fitting of bushing
			• 790-101-5081	• Plate		1			PC40R • 45R — Press fitting of bushing
			• 790-101-5021	• Grip		1			
			• 01010-50816	• Bolt		1			
		4	790-434-1660	Installer	■	1			PC30R • 35R — Installation of floating seal
			791-430-3230	Installer	■	1			PC40R • 45R — Installation of floating seal
Disassembly, assembly of carrier roller assembly		5	790-101-5001	Push tool KIT A	●	1			Press fitting of bearing and cap
			• 790-101-5081	• Plate		1			
			• 790-101-5021	• Grip		1			
			• 01010-50816	• Bolt		1			
		6	790-101-5001	Push tool KIT A	●	1			Press fitting of dust seal
			• 790-101-5111	• Plate		1			
			• 790-101-5021	• Grip		1			
			• 01010-50816	• Bolt		1			
Disassembly, assembly of recoil spring assembly	M		792-371-1400	Sleeve	■	1			Removal, installation of spring
Disassembly, assembly of swing motor assembly	P	1	790-501-5000	Unit repair stand (For 100 V)	■	1			Disassembly, assembly of motor assembly
			790-501-5200	Unit repair stand (For 220, 240 V)					
		2	790-901-2110	Bracket	■	1			
		3	790-901-2220	Plate	■	1			
		4	796T-126-1180	Plate	■	2	N	○	
		2	799-301-1600	Oil leak tester KIT(A)	■	1			Removal of brake piston
		3	01010-61260	Bolt	■	1			Disassembly, assembly of cylinder block assembly
			796T-126-1160	Washer	■	1	N	○	
			01643-31445	Washer	■	1			
			01580-01210	Nut	■	1			
		4	790-201-2610	Plate	■	1			Press fitting of sub-bearing
			790-201-2710	Spacer	■	1			
		5	796T-126-1170	Guide	■	1	N	○	Assembly of motor assembly
		6	790-101-5201	Push tool KIT (B)	■	1			Fitting of spacer
			790-101-5261	• Plate	■	1			
			790-101-5221	• Grip	■	1			
			01010-51225	• Bolt	■	1			
		7	790-201-2110	Plate	■	1			Press fitting of main bearing
			790-201-2710	Spacer	■	1			
		8	790-101-1430	Coupler assembly	■	1			Release of brake (For measurement of turning torque)
			796-660-1490	Nipple	■	1			
			799-101-5130	Gauge	■	1			

Component	Symbol			Part No.	Part Name	Necessity	Q'ty	New/ remodel	Sketch	Nature of work, remarks
Disassembly, assembly of swing motor assembly	P	8	4	799-101-5160	Nipple	■	1			Release of brake (For measurement of turning torque)
			5	799-301-1190	Nipple	■	1			
			6	799-301-1660	T-piece	■	1			
			7	205-70-51390	Nipple	■	1			
			8	790-301-1210	Joint	■	1			
			9	07002-11423	O-ring	■	1			
		9	1	796-720-3510	Wrench	■	1			Measurement of turning torque of shaft
			2	01306-10606	Set screw	■	2			
			3	795-630-1803	Torque wrench	■	1			
Disassembly, assembly of main pump assembly	Q	1	1	790-501-5000	Unit repair stand (for 100V)	■	1			Disassembly, assembly of pump
				790-501-5200	Unit repair stand (for 220, 240V)					
			2	790-901-2110	Bracket	■	1			
			3	796T-267-1130	Plate	■	1	N	○	
		2	1	796T-267-1170	Stopper	■	1	N	○	Securing shaft
			2	01010-60835	Bolt	■	1			
			3	01643-30823	Washer	■	1			
		3	1	796T-267-1250	Plate	■	1	N	○	Removal of sub bearing inner race
			2	01010-61230	Bolt	■	4			
		4	1	01017-61400	Bolt	■	1			Disassembly, assembly of cylinder block assembly
			2	796T-266-1120	Washer	■	1	N	○	
			3	01643-32060	Washer	■	1			
			4	01643-31445	Washer	■	1			
			5	01580-01411	Nut	■	1			
		5		790-101-5001	Push tool KIT	●	1			Press fitting of main bearing outer race
				• 790-101-5091	Plate		1			
				• 790-101-5021	Grip		1			
				• 01010-50816	Bolt		1			
		6		796T-267-1150	Push tool	■	1	N	○	Press fitting of main bearing inner race
		7		796T-267-1140	Push tool	■	1	N	○	Press fitting of sub bearing inner race
		8		790-101-5001	Push tool KIT	●	1			Press fitting of sub bearing outer race
				• 790-101-5071	Plate		1			
				• 790-101-5021	Grip		1			
				• 01010-50816	Bolt		1			
		9		01435-00814	Bolt	■	1			Measuring drive shaft rotating torque
				795-630-1803	Torque wrench	■	1			
		10		796T-267-1180	Push tool	■	1	N	○	Press fitting of oil seal

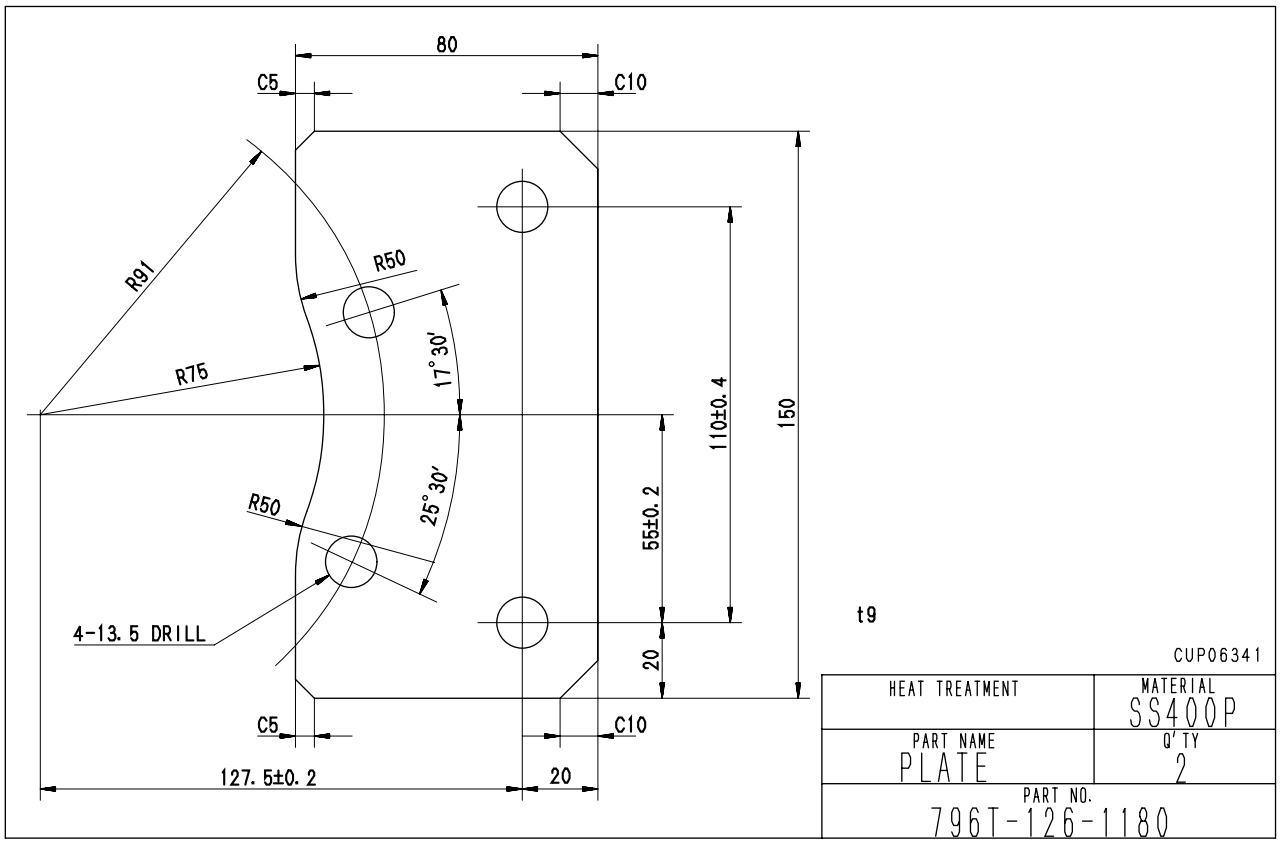
Component	Symbol		Part No.	Part Name	Necessity	Q'ty	New/remodel	Sketch	Nature of work, remarks
Removal, installation of steel shoe assembly (PC40R,45R)	R		791-615-7001 or 791-616-1020	Remover & installer	■	1			Removal, installation of master pin
			796-126-1120	Guide	■	1			
			790-101-1102	Hydraulic pump	■	1			
			790-105-1100	Cylinder (30t {294kN})	■	1			
Disassembly, assembly of center swivel joint	T		790-101-2501	Push puller KIT	●	1			Disconnection of shaft and rotor
			• 790-101-2510	• Plate		1			
			• 790-101-2520	• Screw		1			
			• 791-112-1180	• Nut		1			
			• 790-101-2540	• Washer		1			
			• 790-101-2630	• Leg		2			
			• 790-101-2570	• Plate		4			
			• 790-101-2560	• Nut		2			
			• 790-101-2660	• Adapter		2			
Disassembly, assembly of hydraulic cylinder assembly	U	1	790-502-1003	Unit repair stand	■	1			Disassembly, assembly of hydraulic cylinder
			790-101-1102	Hydraulic pump	■	1			
		2	790-330-1100	Wrench assembly	■	1			Removal, installation of cylinder head
		3	790-302-1480	Socket	■	1			For nut width across flats 41 mm — Removal, installation of piston nut
			790-102-1520	Adapter	■	1			
			790-302-1390	Socket	■	1	N		For nut width across flats 46 mm
			790-102-1520	Adapter	■	1			
			790-302-1270	Socket	■	1			For nut width across flats 50 mm (short)
			790-302-1490	Socket	■	1	N		For nut width across flats 50 mm (long)
			790-102-1520	Adapter	■	1			
			790-302-1280	Socket	■	1			For nut width across flats 55 mm (short)
			790-302-1470	Socket	■	1			For nut width across flats 55 mm (long)
			790-102-1520	Adapter	■	1			
		4	790-210-1702	Push tool KIT	■	1			Press fitting of bushing
			• 790-201-1741	• Push tool		1			For bushing inside diameter 40 mm
			• 790-201-1751	• Push tool		1			For bushing inside diameter 45 mm
			• 790-201-1761	• Push tool		1			For bushing inside diameter 50 mm
			• 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 assembly	U	5	790-201-1500	Push tool KIT		■	1		Installation of dust seal
			• 790-201-1550	• Plate		1			For seal outside diameter 45 mm
			• 790-201-1560	• Plate		1			For seal outside diameter 50 mm
			• 790-201-1570	• Plate		1			For seal outside diameter 55 mm
			• 790-101-5021	• Grip		1			
			• 01010-50816	• Bolt		1			
		6	790-720-1000	Expander	●	1			Installation of piston ring
		7	796-720-1630	Ring	●	1			For piston outside diameter 60 mm
			07281-00709	Clamp	●	1			
			796-720-1740	Ring	●	1			For piston outside diameter 65 mm
			07281-00809	Clamp	●	1			
			796-720-1640	Ring	●	1			For piston outside diameter 70, 75, 80 mm
			07281-00909	Clamp	●	1			
			796-720-1650	Ring	●	1			For piston outside diameter 85, 90, 95 mm
			07281-01029	Clamp	●	1			
			796-720-1660	Ring	●	1			For piston outside diameter 100, 110 mm
			07281-01159	Clamp	●	1			

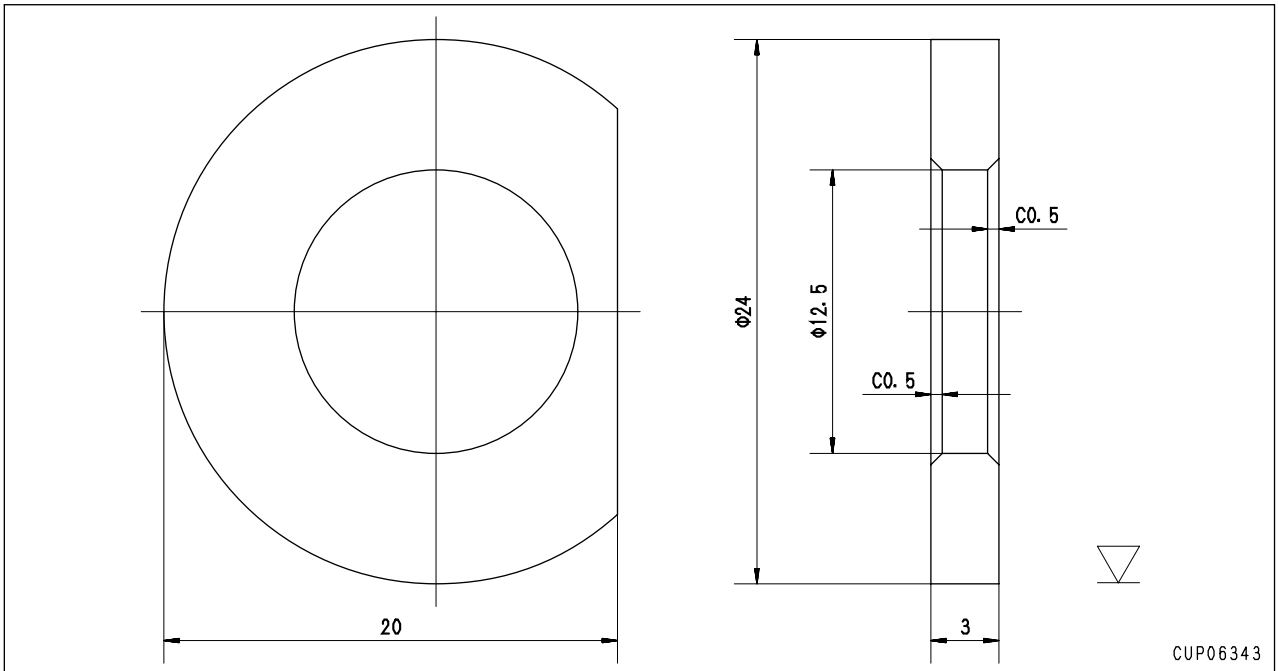
SKETCHES OF SPECIAL TOOLS

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

P1-4 Plate

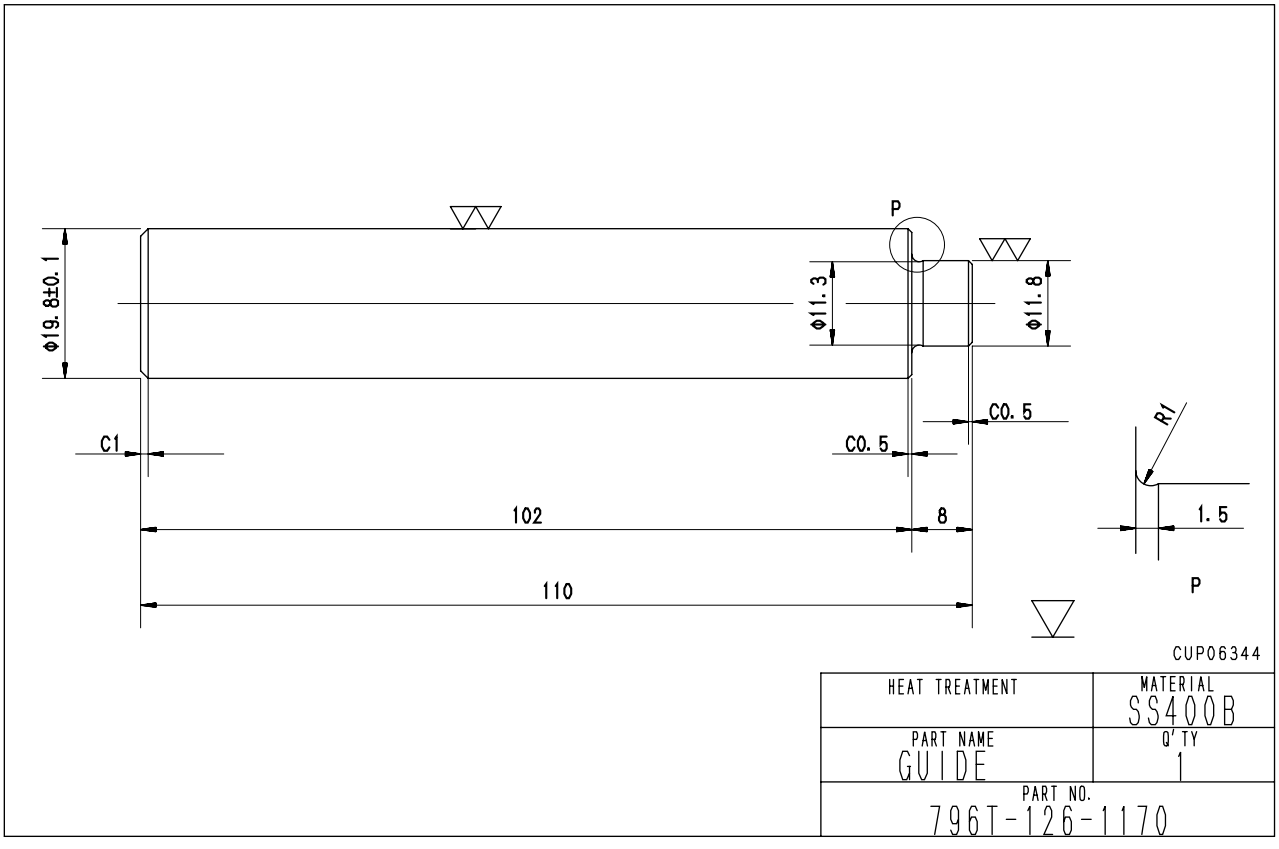


P3-2 Washer



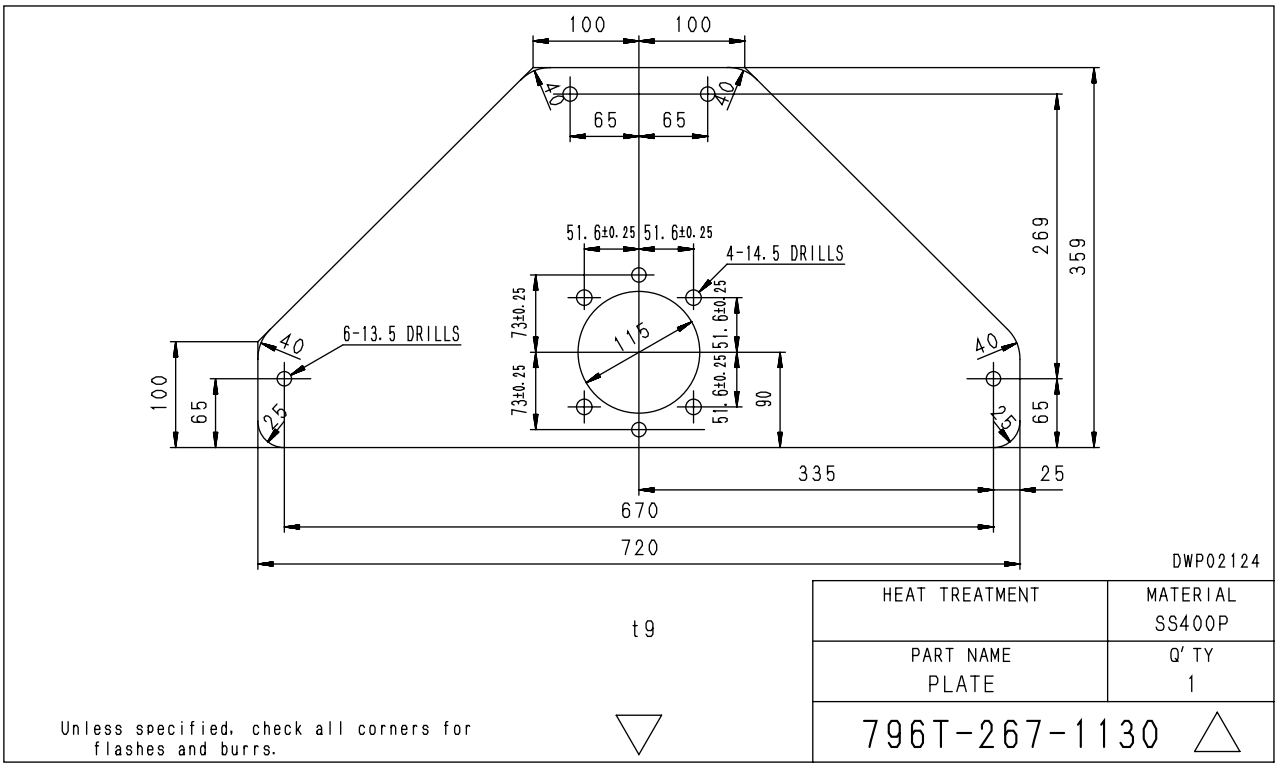
HEAT TREATMENT	MATERIAL
	SS400B
PART NAME	Q'TY
WASHER	1
PART NO.	
796T-126-1160	

P5 Guide



HEAT TREATMENT	MATERIAL
	SS400B
PART NAME	Q'TY
GUIDE	1
PART NO.	
796T-126-1170	

Q1-3 Plate

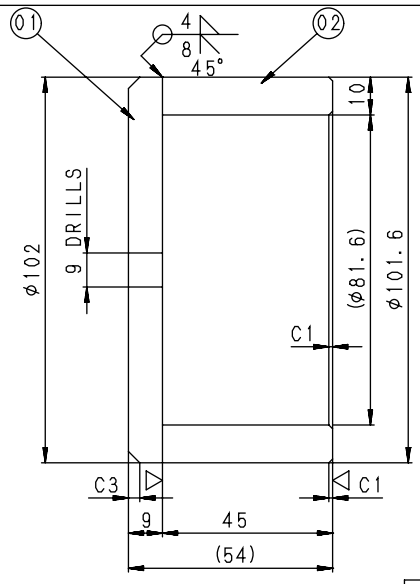


t9

Unless specified, check all corners for flashes and burrs.

HEAT TREATMENT	MATERIAL
	SS400P
PART NAME	Q'TY
PLATE	1
796T-267-1130 △	

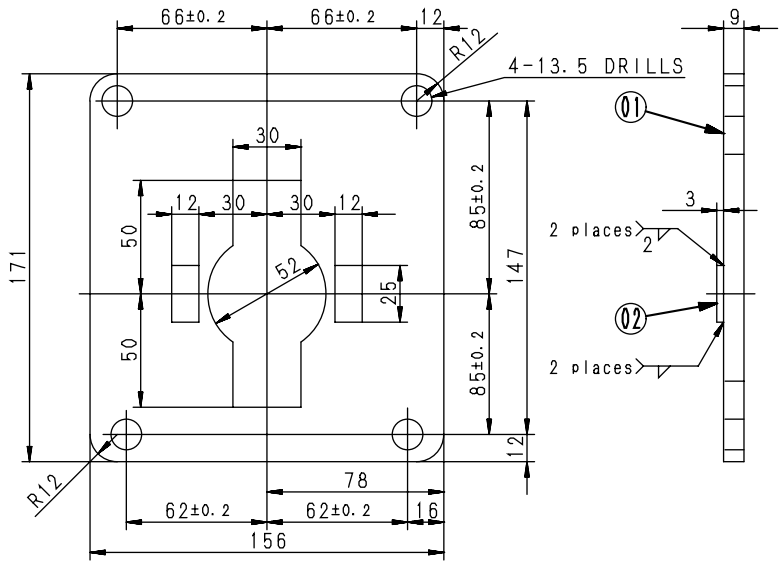
Q2-1 Stopper



HEAT TREATMENT	MATERIAL
	SEE DWG
PART NAME	Q'TY
STOPPER	1
796T-267-1170 △	

SYM.	PART NAME	MATERIAL	QTY/SET	MASS (kg)	REMARKES
02	TUBE	STKM13A	1	1.01	φ101.6xt10
01	PLATE	SS400P	1	0.57	t9

Q3-1 Plate



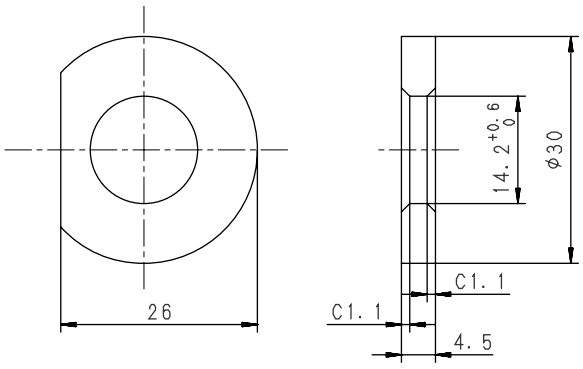
DWP02125

Unless specified, check all corners for flashes and burrs.

HEAT TREATMENT	MATERIAL
----	SEE DWG
PART NAME	Q'TY
PLATE	1
796T-267-1250 △	

SYM.	PART NAME	MATERIAL	QTY/SET	MASS (kg)	REMARKS
02	PLATE	SS400P	2	0.01	t3
01	PLATE	SS400P	1	1.59	t9

Q4-2 Washer

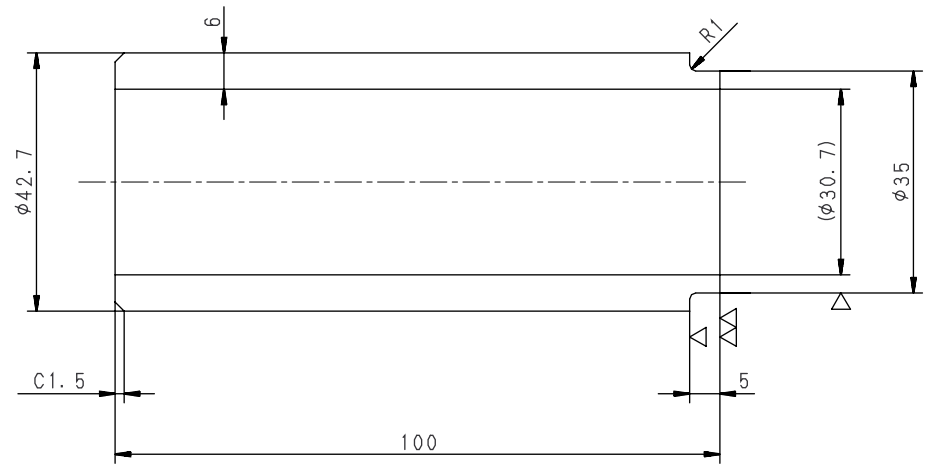


DWP02259

Unless specified, check all corners for flashes and burrs.

HEAT TREATMENT	MATERIAL
----	SS400B
PART NAME	Q'TY
WASHER	1
796T-266-1120 △	

Q6 Push tool

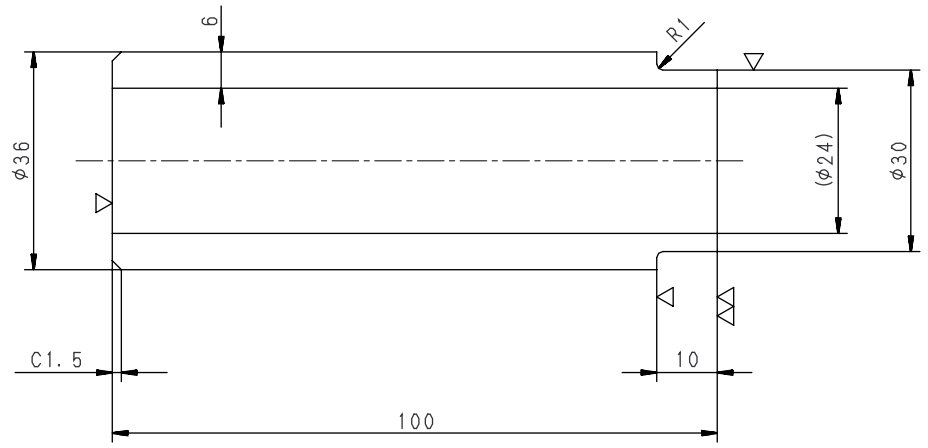


DWP02260

Unless specified, check all corners for flashes and burrs.

HEAT TREATMENT	MATERIAL
----	STKM13A
PART NAME	Q'TY
PUSH TOOL	1
796T-267-1150 △	

Q7 Push tool

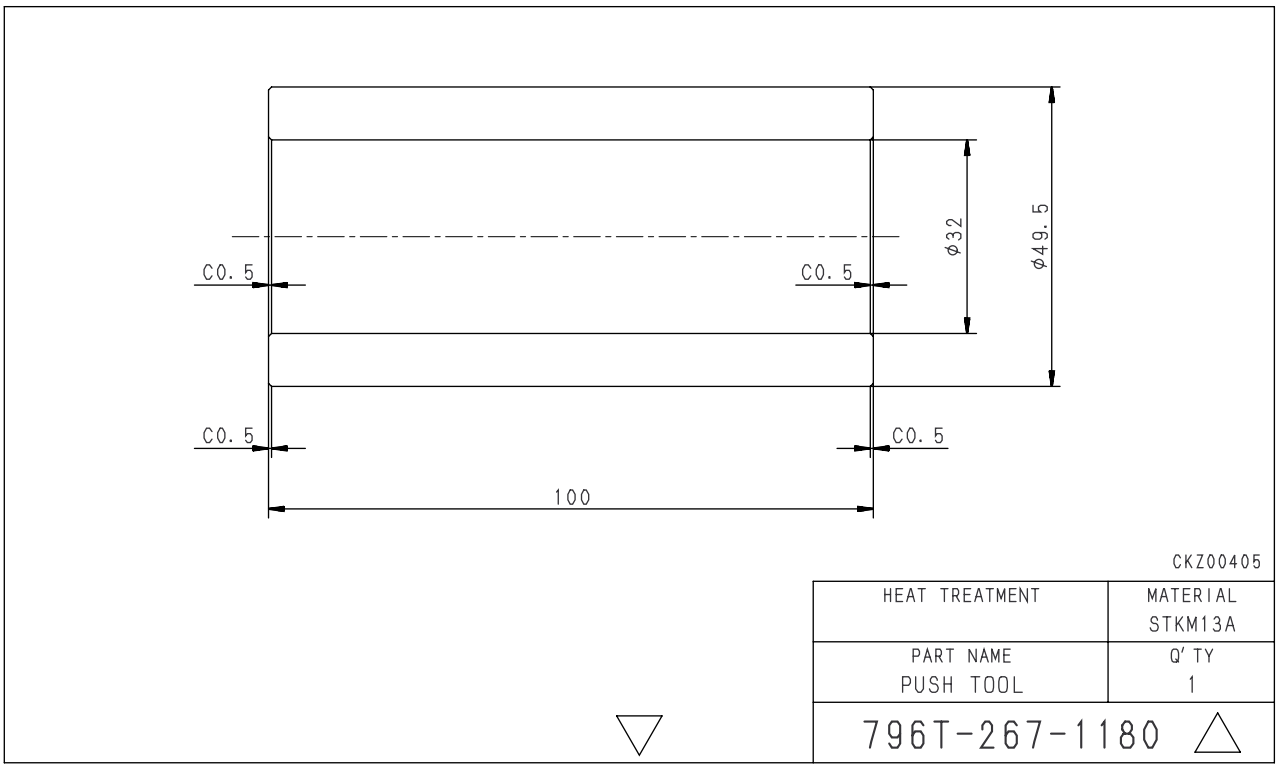


DWP02261

Unless specified, check all corners for flashes and burrs.

HEAT TREATMENT	MATERIAL
----	STKM13A
PART NAME	Q'TY
PUSH TOOL	1
796T-267-1140 △	

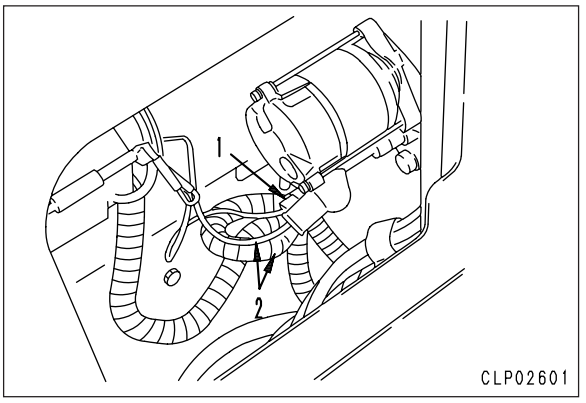
Q10 Push tool

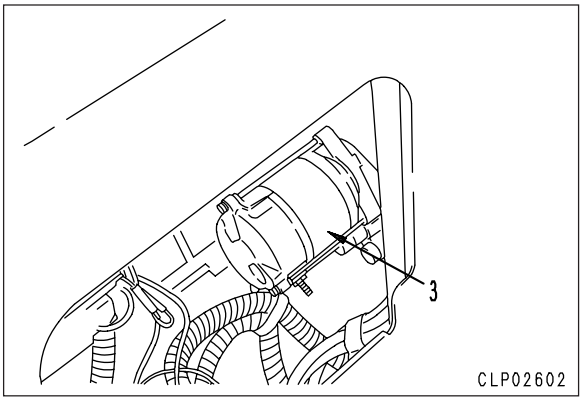


REMOVAL OF STARTING MOTOR ASSEMBLY

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

1. Remove operator's cab assembly. For details, see REMOVAL OF OPERATOR'S CAB ASSEMBLY.
   ★ Operator's cab specification machine only.
2. Remove inspection cover at rear of operator's seat.
3. Disconnect connector (1).
4. Disconnect 2 wires (2).
5. Remove starting motor assembly (3).





INSTALLATION OF STARTING MOTOR ASSEMBLY

- Carry out installation in the reverse order to removal.

REMOVAL OF ALTERNATOR ASSEMBLY

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

1. Remove operator's cab assembly.
   For details, see REMOVAL OF OPERATOR'S CAB ASSEMBLY.
   ★ For the operator's cab specification machine only.

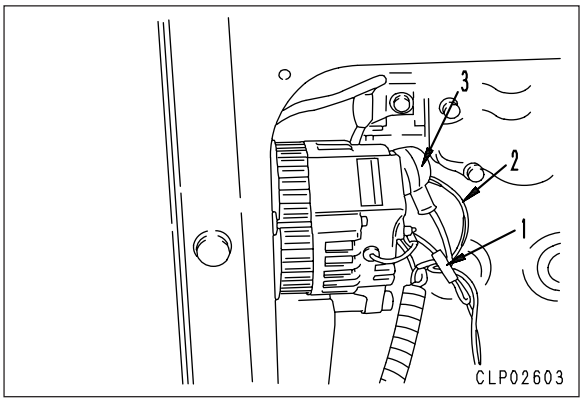
2. Remove inspection cover at rear of operator's seat and inspection cover at top of radiator.

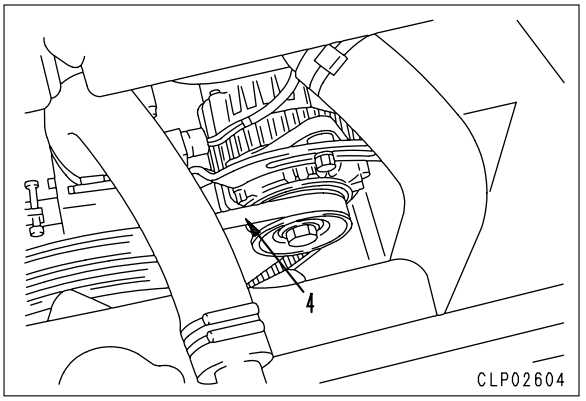
3. Disconnect connectors (1) and (2).

4. Disconnect wiring (3).

5. Loosen mounting bolt and adjustment bolt, and remove fan belt (4) from pulley. ※ 1

6. Remove alternator assembly (5).
   ★ There are spacers fitted to the mounting bolts so be careful not to lose them.



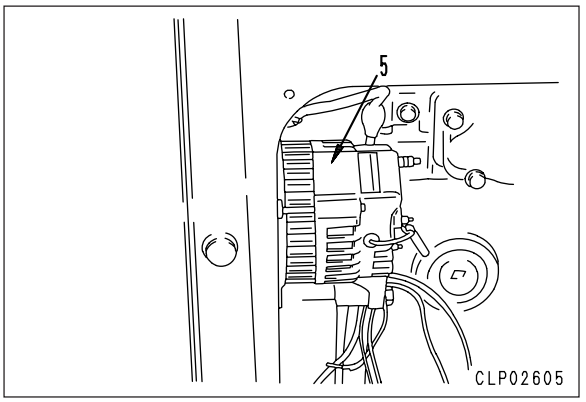


INSTALLATION OF ALTERNATOR ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

★ Adjust the fan belt tension. For details, see TESTING AND ADJUSTING, Testing and adjusting fan belt tension.



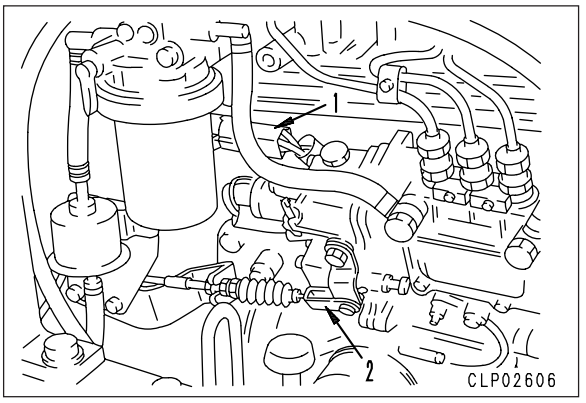
REMOVAL OF FUEL INJECTION PUMP ASSEMBLY (PC30R,35R)

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

1. Remove radiator and hydraulic cooler assembly. For details, see REMOVAL OF RADIATOR, HYDRAULIC COOLER ASSEMBLY.

2. Disconnect engine stop solenoid connector (1).

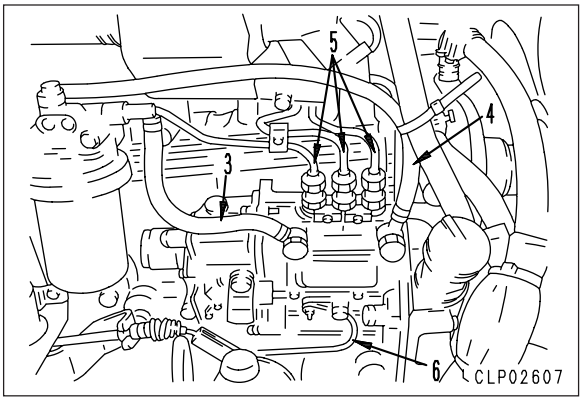
3. Disconnect fuel control cable (2). ※ 1



4. Disconnect fuel supply hose (3) and return hose (4).

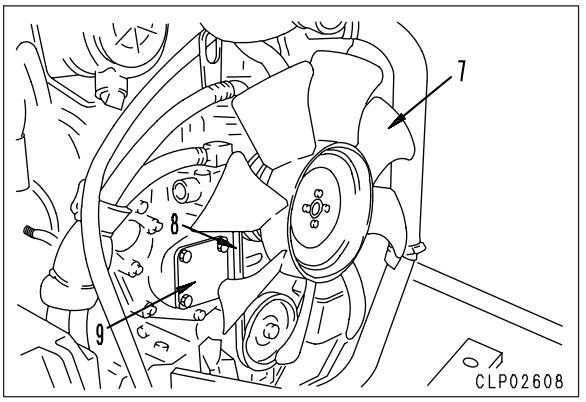
5. Disconnect 3 fuel injection tubes (5).

6. Disconnect lubrication tube (6).
   ★ Disconnect from both the fuel injection pump and the cylinder block.



7. Remove fan (7), then remove fan belt (8). ※ 2
   ★ Before removing, loosen the adjustment bolt and mounting bolt of the alternator, and loosen the fan belt tension.

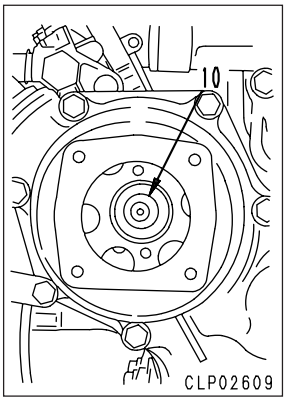
8. Remove cover (9).

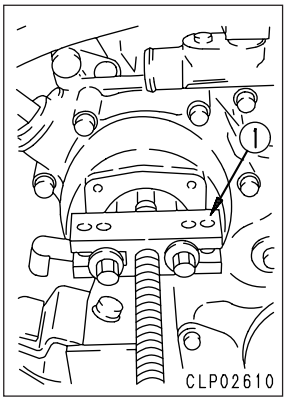


9. Remove gear mounting nut (10). ※ 3
   ★Be careful not to drop the nut and washer inside the case.

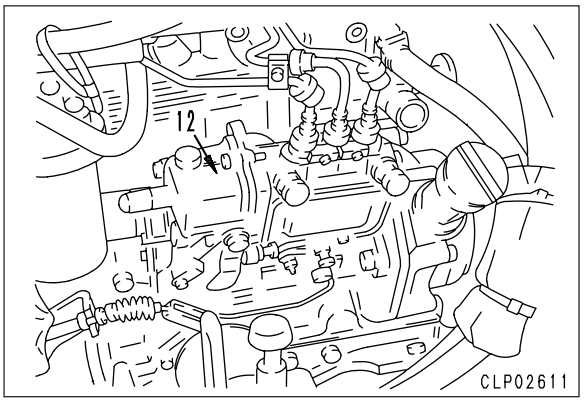
10. Remove 3 fuel injection pump mounting nuts. ※ 4

11. Using puller ①, disconnect fuel injection pump drive gear and pump shaft.
    ★ Before disconnecting, make counter marks on the drive gear and the idler gear.





12. Remove fuel injection pump assembly (12).



INSTALLATION OF FUEL INJECTION PUMP ASSEMBLY (PC30R,35R)

- Carry out installation in the reverse order to removal.

※ 1

★ Adjust the fuel control linkage. For details, see TESTING AND ADJUSTING, Adjusting control lever and pedal.

※ 2

★ Adjust the fan belt tension. For details, see TESTING AND ADJUSTING, Testing and adjusting fan belt tension.

※ 3

kgm Gear mounting nut :
63.7 ± 4.9 Nm {6.5 ± 0.5 kgm}

※ 4

★ Adjust the fuel injection timing. For details, see TESTING AND ADJUSTING, Testing and adjusting fuel injection timing.

kgm Fuel injection pump mounting nut :
20.58 ± 0.98 Nm {2.1 ± 0.1 kgm}

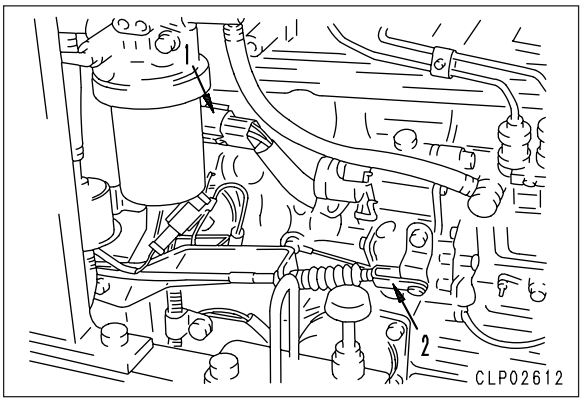
REMOVAL OF FUEL INJECTION PUMP ASSEMBLY (PC40R,45R)

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

1. Remove radiator and hydraulic cooler assembly. For details, see REMOVAL OF RADIATOR, HYDRAULIC COOLER ASSEMBLY.

2. Disconnect engine stop solenoid connector (1).

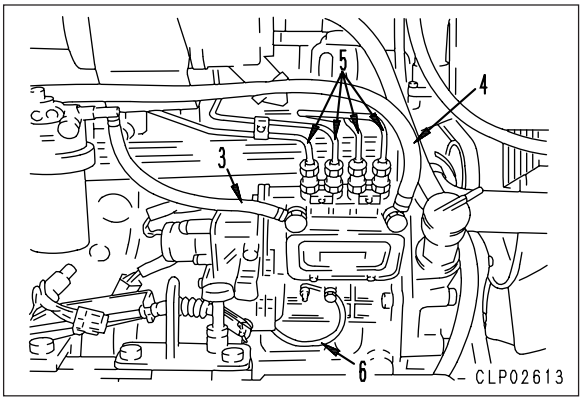
3. Disconnect fuel control cable (2). ※ 1



4. Disconnect fuel supply hose (3) and return hose (4).

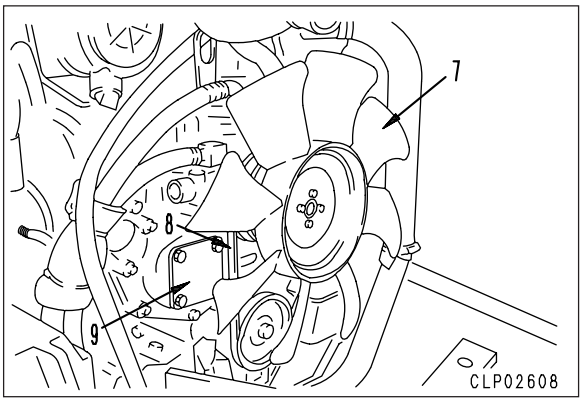
5. Disconnect 4 fuel injection tubes (5).

6. Disconnect lubrication tube (6).
   ★ Disconnect from both the fuel injection pump and the cylinder block.



7. Remove fan (7), then remove fan belt (8). ※ 2
   ★ Before removing, loosen the adjustment bolt and mounting bolt of the alternator, and loosen the fan belt tension.

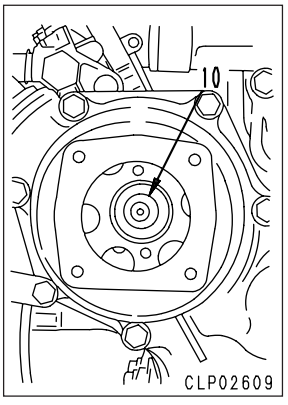
8. Remove cover (9).

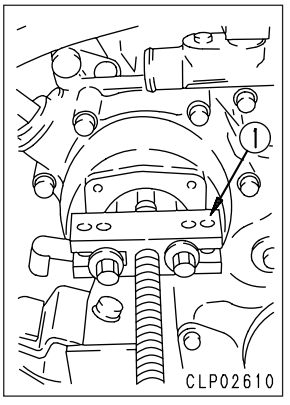


9. Remove gear mounting nut (10). ※ 3
   ★ Be careful not to drop the nut and washer inside the case.

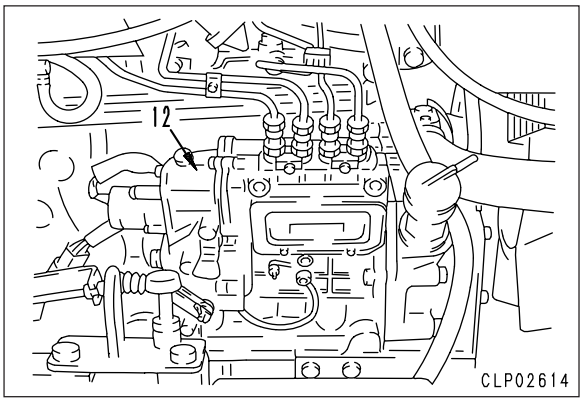
10. Remove 3 fuel injection pump mounting nuts. ※ 4

11. Using puller ①, disconnect fuel injection pump drive gear and pump shaft.
    ★ Before disconnecting, make counter marks on the drive gear and the idler gear.





12. Remove fuel injection pump assembly (12).



INSTALLATION OF FUEL INJECTION PUMP ASSEMBLY (PC40R, 45R)

- Carry out installation in the reverse order to removal.

※ 1

★ Adjust the fuel control linkage. For details, see TESTING AND ADJUSTING, Adjusting control lever and pedal.

※ 2

★ Adjust the fan belt tension. For details, see TESTING AND ADJUSTING, Testing and adjusting fan belt tension.

※ 3

kgm Gear mounting nut :
63.7 ± 4.9 Nm {6.5 ± 0.5 kgm}

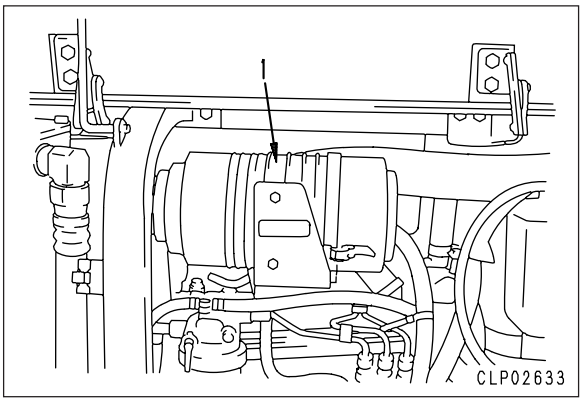
※ 4

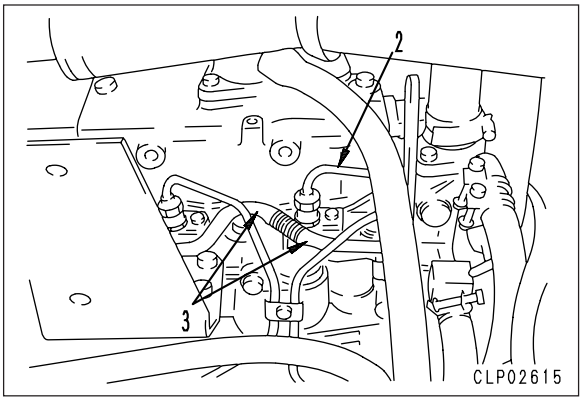
★ Adjust the fuel injection timing. For details, see TESTING AND ADJUSTING, Testing and adjusting fuel injection timing.

kgm Fuel injection pump mounting nut :
20.58 ± 0.98 Nm {2.1 ± 0.1 kgm}

REMOVAL OF NOZZLE HOLDER ASSEMBLY

1. Remove air cleaner assembly (1). ※ 1
   ★ For the PC40R and 45R, remove the air cleaner assembly mounting bracket also.
2. Remove fuel injection tube (2).
3. Disconnect 2 spill hoses (3).
4. Remove retainer (4), then remove nozzle holder assembly (5). ※ 2





INSTALLATION OF NOZZLE HOLDER ASSEMBLY

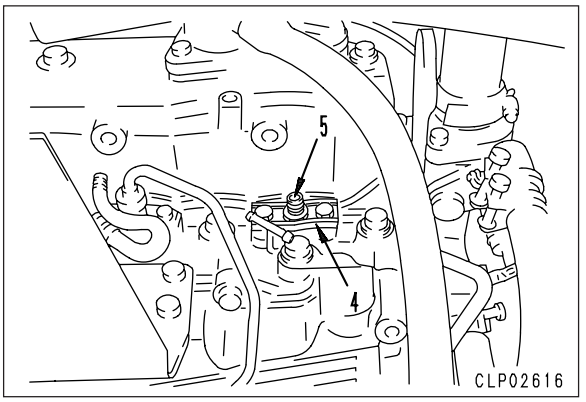
- Carry out installation in the reverse order to removal.

※ 1

kgm Intake hose clamp :
5.9 ± 0.49 Nm {60 ±5 kgcm}

※ 2

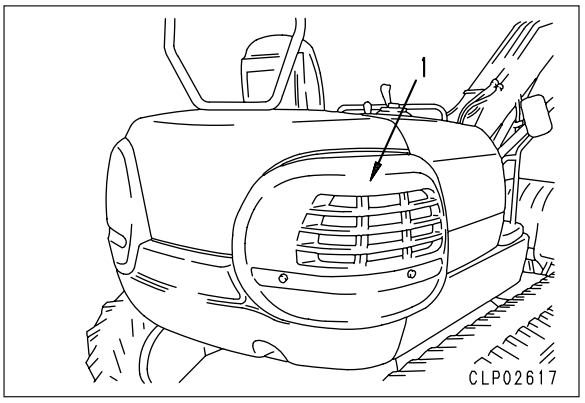
kgm Retainer mounting nut :
4.41 ± 0.49 Nm {0.45 ± 0.05 kgm}



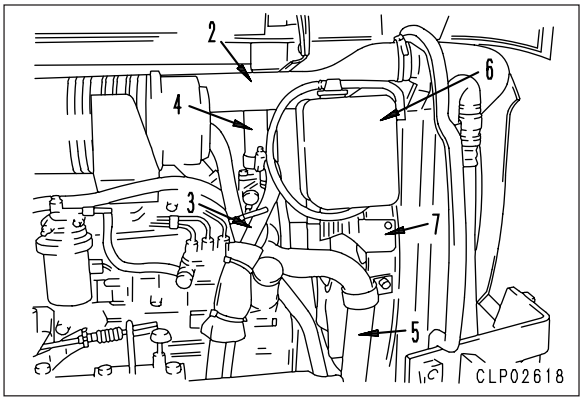
REMOVAL OF WATER PUMP ASSEMBLY

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

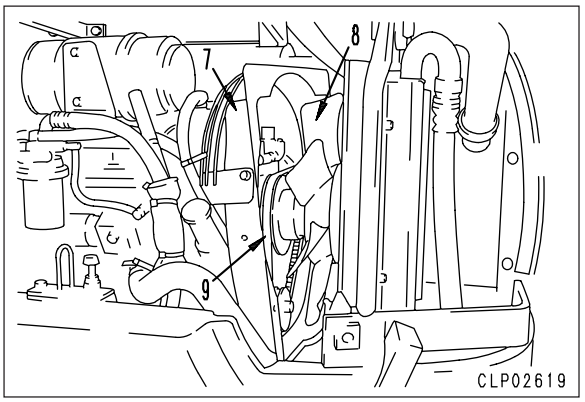
1. Drain coolant.
2. Lift off right protector (1).
   kg Right protector : **40 kg**
3. Remove inspection cover at rear of operator's seat.



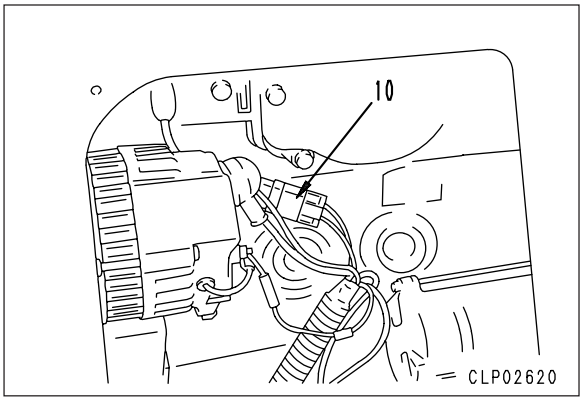
4. Remove itake hose (2). ※ 1
5. Disconnect 2 heater hoses (3).
   ★ Operator's cab specification machine only.
6. Disconnect radiator inlet hose (4) and outlet hose (5). ※ 2
7. Disconnect hose and remove sub tank (6).



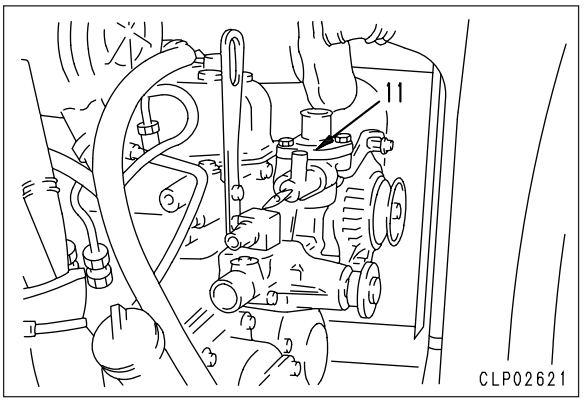
8. Disconnect shroud and fan net assembly (7), and move towards engine.
9. Remove fan (8), then remove fan belt (9). ※ 3
   ★ Before removing, loosen the alternator mounting bolt and adjustment bolt, and loosen the tension of the fan belt.
10. Remove shroud and fan net assembly (7).



11. Disconnect water temperature sensor connector (10).
    ★ Disconnect the wiring clamp also.



12. Remove water pump assembly (11).



INSTALLATION OF WATER PUMP ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm Intake hose clamp :
5.9 ± 0.49 Nm {60 ± 5 kgcm}

※ 2

kgm Radiator hose clamp :
8.3 ± 0.49 Nm {85 ± 5 kgcm}

※ 3

★ Adjust the fan belt tension. For details, see TESTING AND ADJUSTING, Testing and adjusting fan belt tension.

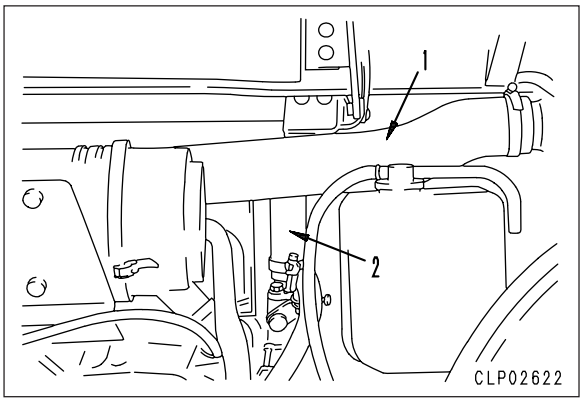
※ 4

kgm Water pump assembly mounting bolt :
10.78 ± 1.96 Nm {1.1 ± 0.2 kgm}

- **Refilling with water**
  Add water through water filler to the specified level. Run the engine to circulate the water through the system. Then check the water level again.

REMOVAL OF THERMOSTAT ASSEMBLY

1. Drain coolant.
2. Remove intake hose (1). ※ 1
3. Disconnect radiator inlet hose (2). ※ 2
4. Remove cover (3).
5. Remove thermostat assembly (4).



INSTALLATION OF THERMOSTAT ASSEMBLY

- Carry out installation in the reverse order to removal.

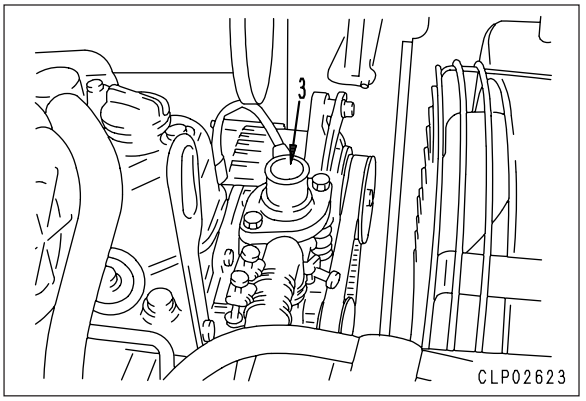
※ 1

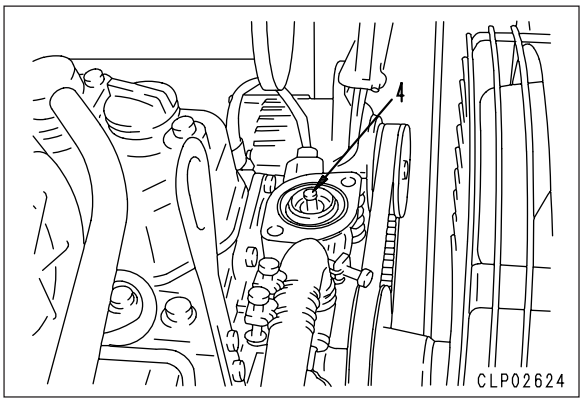
kgm Intake hose clamp :
5.9 ± 0.49 Nm {60 ± 5 kgcm}

※ 2

kgm Radiator inlet hose clamp :
8.3 ± 0.49 Nm {85 ± 4 kgcm}

- **Refilling with water**
  Add water through 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 FRONT SEAL

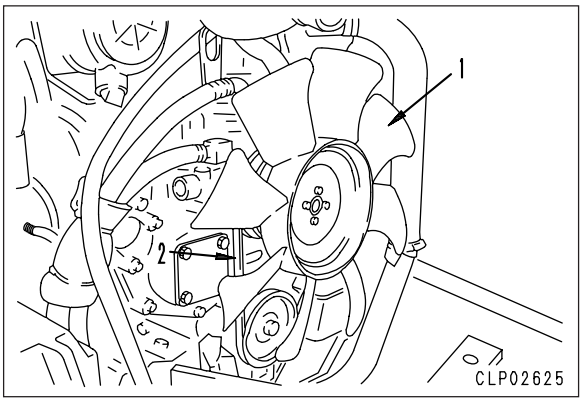
1. Remove radiator and hydraulic cooler assembly. For details, see REMOVAL OF RADIATOR, HYDRAULIC COOLER ASSEMBLY.

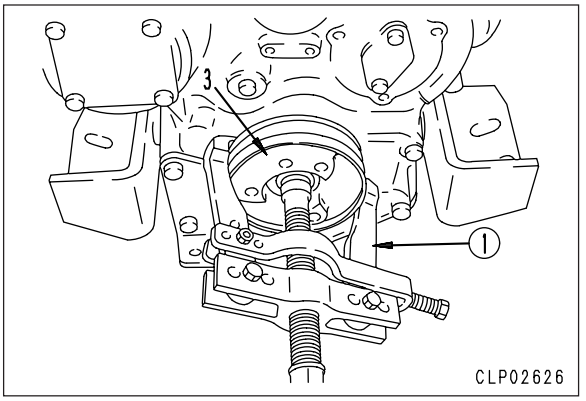
2. Remove fan (1), then remove fan belt (2). ※ 1
   ★ Before removing, loosen the alternator mounting bolt and adjustment bolt, and loosen the tension of the fan belt.

3. Remove crankshaft pulley mounting bolt. ※ 2

4. Using puller ①, remove crankshaft pulley (3). ※ 3

5. Remove engine front seal (4). ※ 4





INSTALLATION OF ENGINE FRONT SEAL

- Carry out installation in the reverse order to removal.

※ 1

★ Adjust the fan belt tension. For details, see TESTING AND ADJUSTING, Testing and adjusting fan belt tension.

※ 2

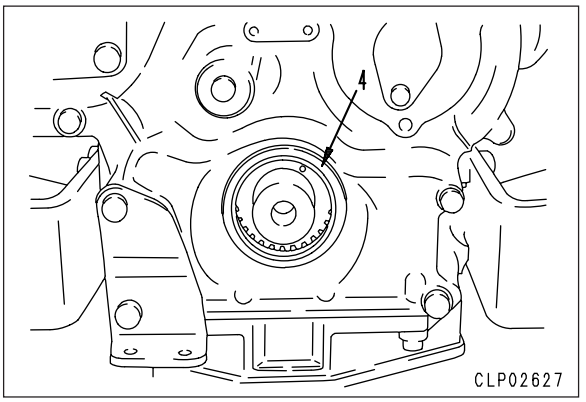
kgm Crankshaft pulley mounting bolt :
$112.7^{+9.8}_{0}$ Nm {$11.5^{+1.0}_{0}$ kgm}

※ 3

★ Align the crankshaft pulley with the crankshaft dowel pin when installing.

※ 4

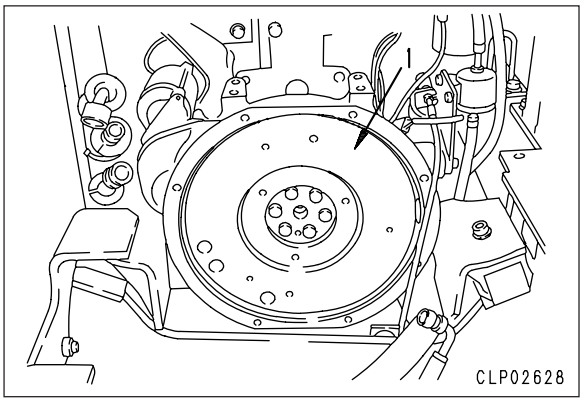
Lip of oil seal : **Engine oil (EO30-CD)**



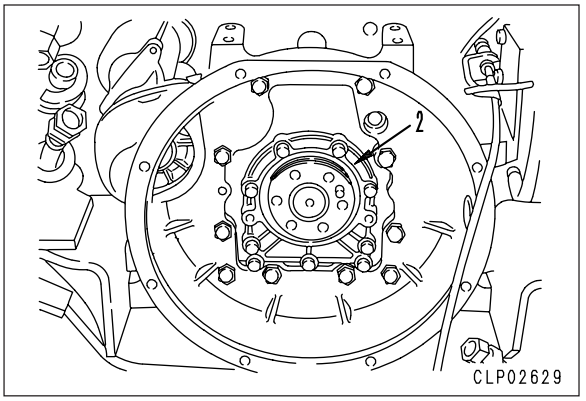
REMOVAL OF ENGINE REAR SEAL

1. Remove damper assembly. For details, see REMOVAL OF DAMPER ASSEMBLY.

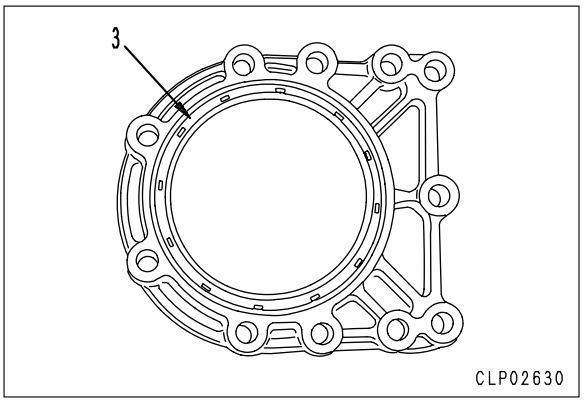
2. Remove flywheel (1). ※ 1



3. Remove seal case (2). ※ 2
   ★ There are notches at both ends, so lever with a screwdriver to remove.



4. Remove engine rear seal (3) from seal case. ※ 3



INSTALLATION OF ENGINE REAR SEAL

- Carry out installation in the reverse order to removal.

※ 1

Mounting surface of seal case and lip of oil seal : **Engine oil (EO30-CD)**

★ Press fit the oil seal until it is level with the surface of the seal case.

※ 2

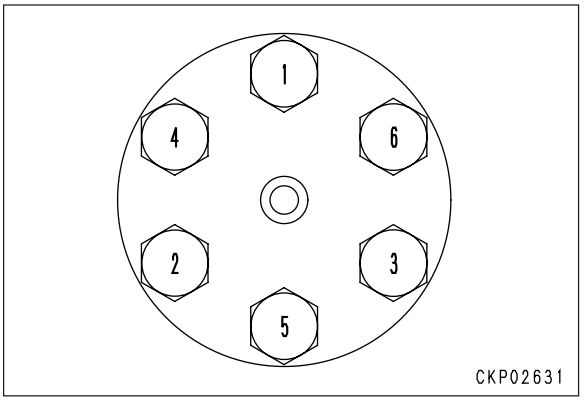
Seal case mounting surface : **Gasket sealant (LG-7)**

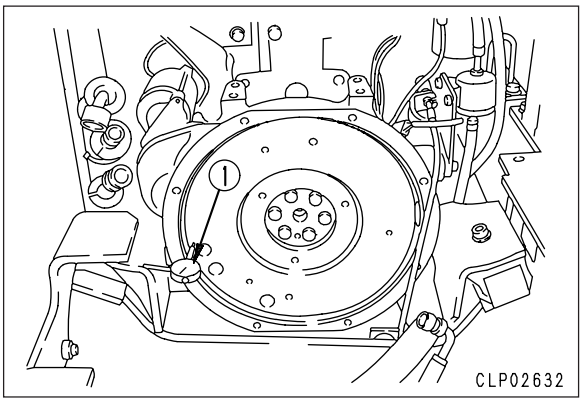
※ 3

★ When tightening the flywheel mounting bolts, follow the order in the diagram on the right.

kgm Flywheel mounting bolt : **85.75 ± 2.45 Nm {8.75 ± 0.25 kgm}**

★ After installing the flywheel, use dial gauge ① and measure the face runout and radial runout of the flywheel.
- Face runout : Max. 0.20 mm
- Radial runout : Max. 0.20 mm

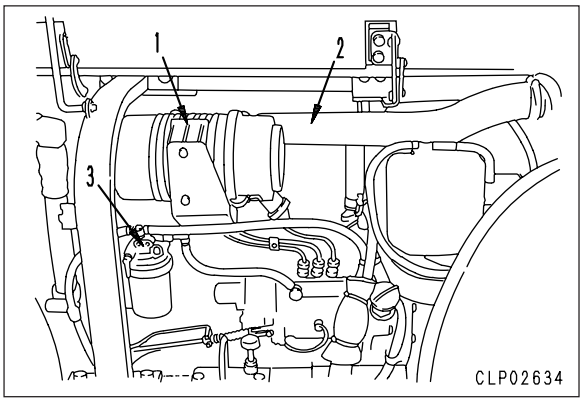




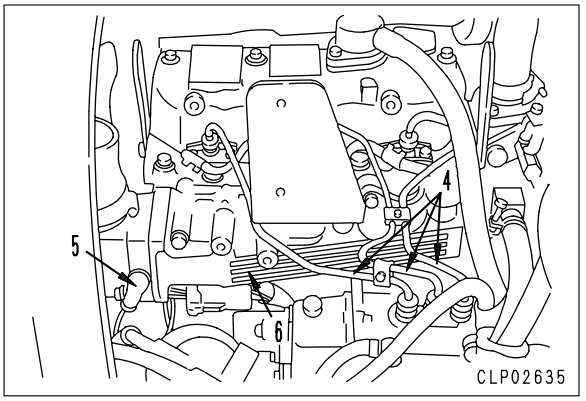
REMOVAL OF CYLINDER HEAD ASSEMBLY (PC30R,35R)

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

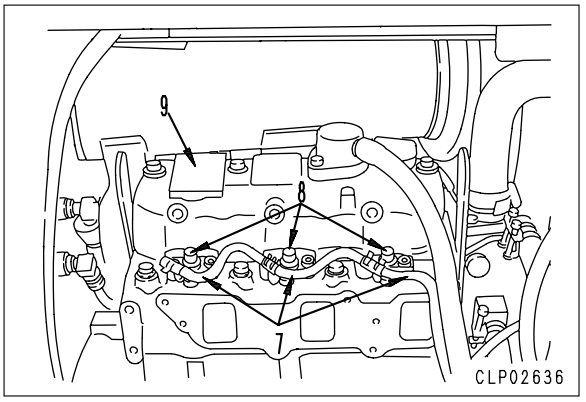
1. Drain coolant.
2. Remove air cleaner assembly (1), then remove intake hose (2). ※ 1
3. Disconnect fuel filter (3) and move towards counterweight.



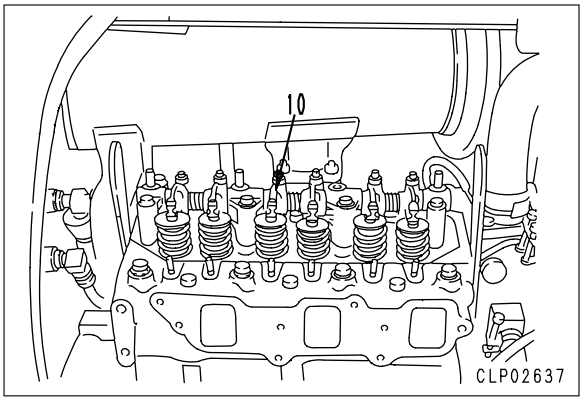
4. Remove 3 fuel injection tubes (4).
5. Disconnect heater wiring (5).
6. Remove intake manifold (6).



7. Disconnect 3 spill hoses (7).
8. Remove retainer, them remove 3 nozzle holder assemblies (8). ※ 2
9. Remove cylinder head cover (9).

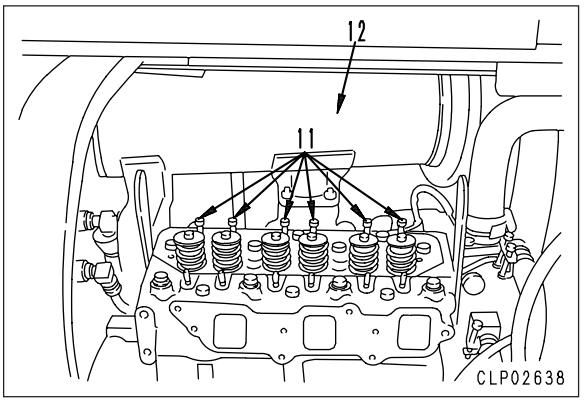


10. Remove rocker arm assembly (10). ※ 3
    ★ Loosen the locknut, then loosen the adjustment screw 2 – 3 turns.

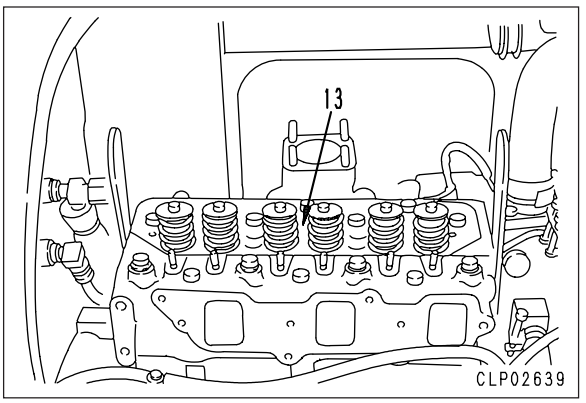


11. Remove 6 push rods (11).

12. Remove muffler (12). ※ 4
    ★ Disconnect the clamp of the exhaust pipe at the front of the engine, then move the exhaust pipe towards the radiator.



13. Remove cylinder head assembly (13) together with exhaust manifold. ※ 5
    ★ Before removing, disconnect the clamp of the water temperature sensor wiring harness.



INSTALLATION OF CYLINDER HEAD ASSEMBLY (PC30R,35R)

- Carry out installation in the reverse order to removal.

※ 1

kgm Intake hose clamp :
5.9 ± 0.49 Nm {60 ± 5 kgcm}

※ 2

kgm Retainer mounting nut :
4.41 ± 0.49 Nm {0.45 ± 0.05 kgm}

※ 3

★ When tightening the mounting bolts, start from the center and work to the outside in turn.

kgm Rocker arm assembly mounting bolt :
25.48 ± 2.94 Nm {2.6 ± 0.3 kgm}

★ Check that the ball of the adjustment screw is securely fitted in the socket of the push rod.

★ Adjust the valve clearance. For details, see TESTING AND ADJUSTING, Adjusting valve clearance.

※ 4

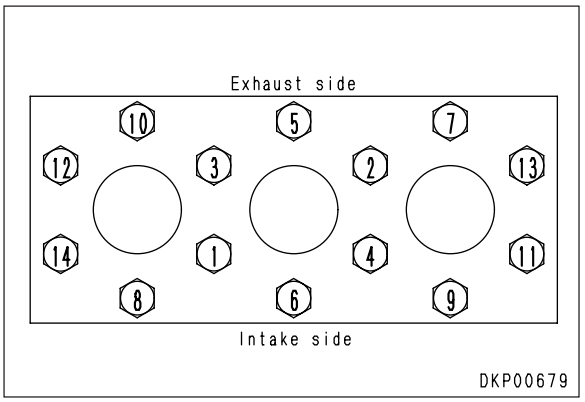
kgm Exhaust pipe clamp nut :
Inside nut : **7.84 ± 1.96 Nm {0.8 ± 0.2 kgm}**
Both nuts :
66.15 ± 7.35 Nm {6.75 ± 0.75 kgm}

※ 5

★ Tighten the cylinder head assembly mounting bolts in the order shown in the diagram on the right.

kgm Cylinder head assembly mounting bolt :

Step	(Nm {kgm})
1st	29.4 ± 4.9 {3 ± 0.5}
2nd	58.8 ± 4.9 {6 ± 0.5}
3rd	78.4 ± 4.9 {8 ± 0.5}

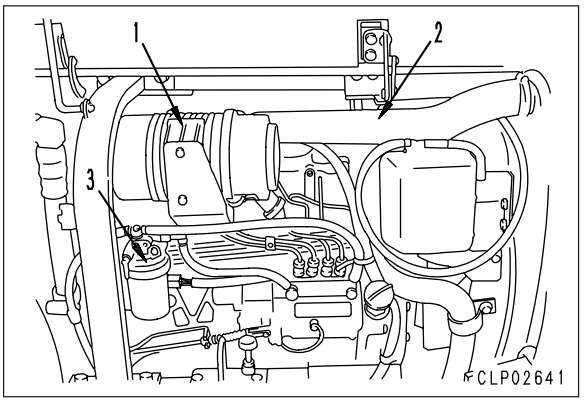


- **Refilling with water**
  Add water through water filler to the specified level. Run the engine to circulate the water through the system. Then check the water level again.

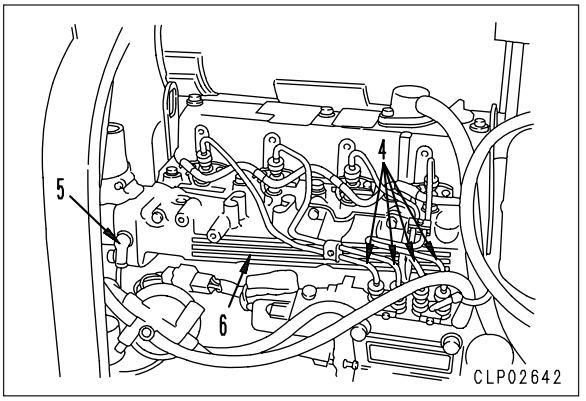
REMOVAL OF CYLINDER HEAD ASSEMBLY (PC40R,45R)

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

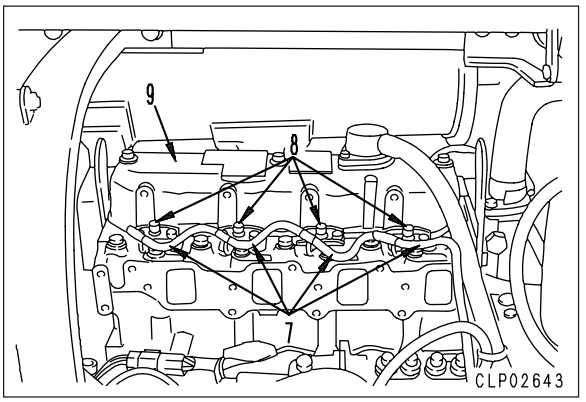
1. Drain coolant.
2. Remove air cleaner assembly (1), then remove intake hose (2). ※ 1
   ★ Remove the air cleaner mounting bracket also.
3. Disconnect fuel filter (3) and move towards counterweight.



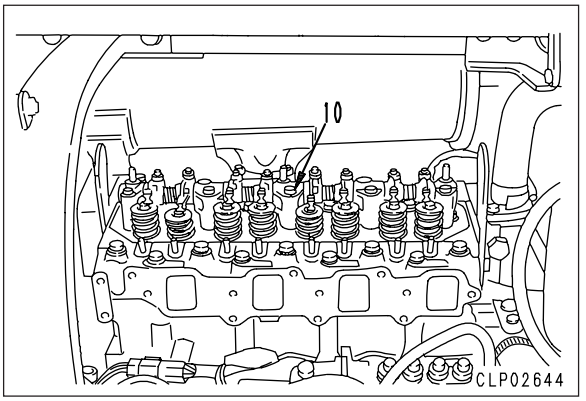
4. Remove 4 fuel injection tubes (4).
5. Disconnect heater wiring (5).
6. Remove intake manifold (6).



7. Disconnect 4 spill hoses (7).
8. Remove retainer, them remove 4 nozzle holder assemblies (8). ※ 2
9. Remove cylinder head cover (9).

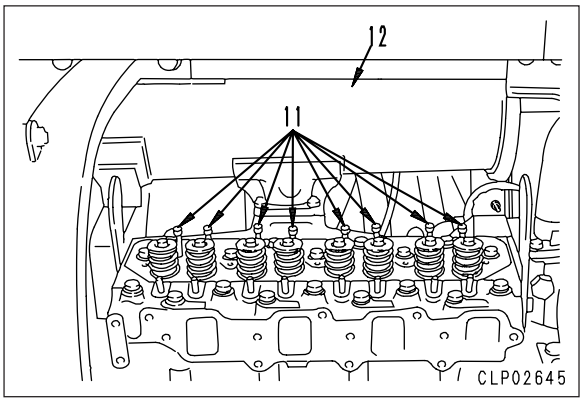


10. Remove rocker arm assembly (10). ※ 3
    ★ Loosen the locknut, then loosen the adjustment screw 2 – 3 turns.

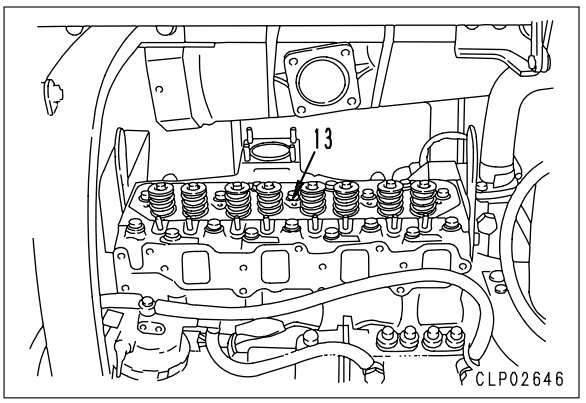


11. Remove 8 push rods (11).

12. Remove muffler (12). ※ 4
    - ★ Disconnect the clamp of the exhaust pipe at the front of the engine, then move the exhaust pipe towards the radiator.
    - ★ Tie the muffler to the engine room cover and lift it up.



13. Remove cylinder head assembly (13) together with exhaust manifold. ※ 5
    - ★ Before removing, disconnect the clamp of the water temperature sensor wiring harness.



INSTALLATION OF CYLINDER HEAD ASSEMBLY (PC40R,45R)

- Carry out installation in the reverse order to removal.

※ 1

kgm Intake hose clamp :
5.9 ± 0.49 Nm {60 ± 5 kgcm}

※ 2

kgm Retainer mounting nut :
4.41 ± 0.49 Nm {0.45 ± 0.05 kgm}

※ 3

★ When tightening the mounting bolts, start from the center and work to the outside in turn.

kgm Rocker arm assembly mounting bolt :
25.48 ± 2.94 Nm {2.6 ± 0.3 kgm}

★ Check that the ball of the adjustment screw is securely fitted in the socket of the push rod.
★ Adjust the valve clearance. For details, see TESTING AND ADJUSTING, Adjusting valve clearance.

※ 4

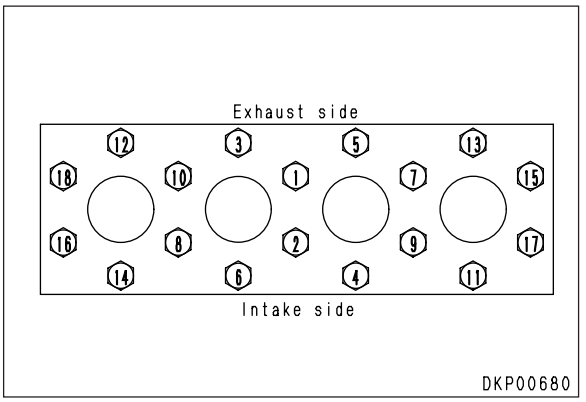
kgm Exhaust pipe clamp nut :
Inside nut : **7.84 ± 1.96 Nm {0.8 ± 0.2 kgm}**
Both nuts :
66.15 ± 7.35 Nm {6.75 ± 0.75 kgm}

※ 5

★ Tighten the cylinder head assembly mounting bolts in the order shown in the diagram on the right.

kgm Cylinder head assembly mounting bolt :

Step	(Nm {kgm})
1st	29.4 ± 4.9 {3 ± 0.5}
2nd	58.8 ± 4.9 {6 ± 0.5}
3rd	78.4 ± 4.9 {8 ± 0.5}

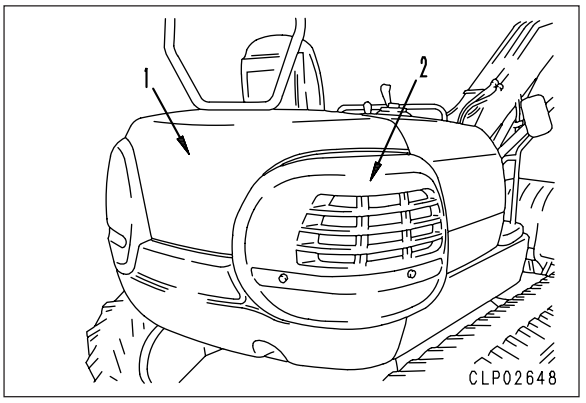


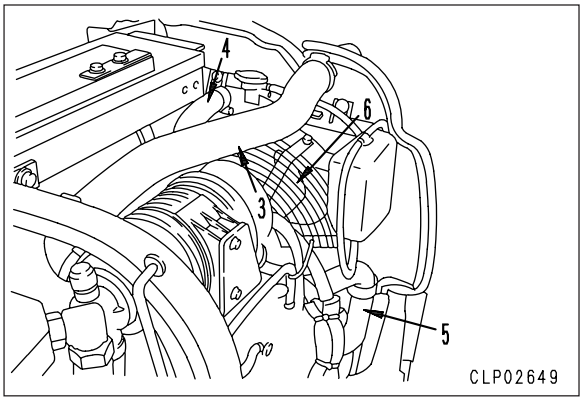
- **Refilling with water**
  Add water through water filler to the specified level. Run the engine to circulate the water through the system. Then check the water level again.

REMOVAL OF RADIATOR, HYDRAULIC COOLER ASSEMBLY

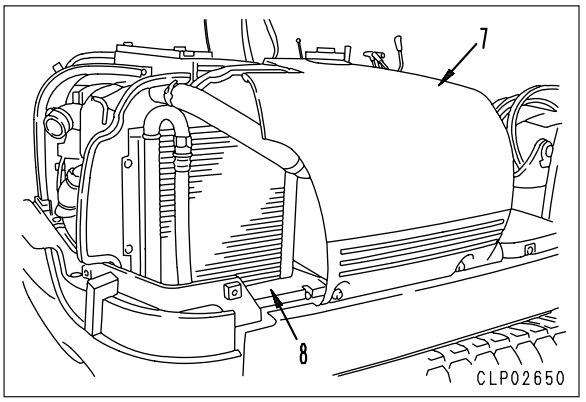
⚠ Release the remaining pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic tank.

1. Drain coolant.
2. Drain hydraulic oil.
   Hydraulic tank : **Approx. 33 ℓ**
3. Remove engine hood (1).
4. Lift off right protector (2).
   Right protector : **40 kg**
5. Remove intake hose (3). ※ 1
6. Disconnect radiator inlet hose (4) and outlet hose (5). ※ 2
7. Remove fan net (6).

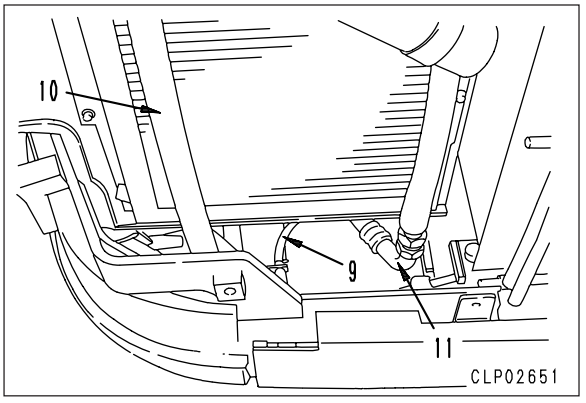




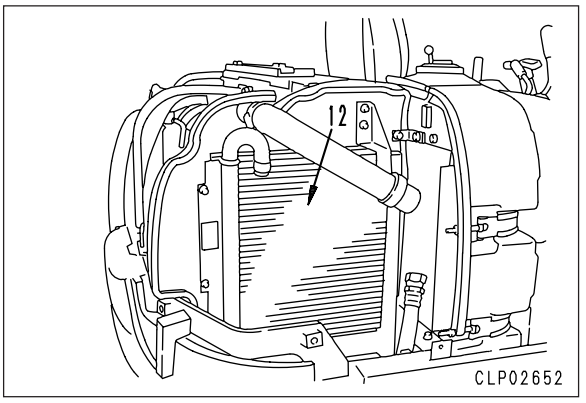
8. Remove right cover (7).
   ★ Remove the inspection cover at the top of the radiator, then remove the cover bracket.
9. Remove adiabatic cover (8).



10. Disconnect radiator drain hose (9).
11. Disconnect hydraulic cooler inlet hose (10) and outlet hose (11).



12. Remove radiator and hydraulic cooler assembly (12).



INSTALLATION OF RADIATOR, HYDRAULIC COOLER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm Intake hose clamp :
5.9 ± 0.49 Nm {60 ± 5 kgcm}

※ 2

kgm Radiator hose clamp :
8.3 ± 0.49 Nm {85 ± 5 kgcm}

- **Refilling with water**
  Add water through 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 oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
  Hydraulic tank : **Approx. 33 ℓ (EO10W-CD)**

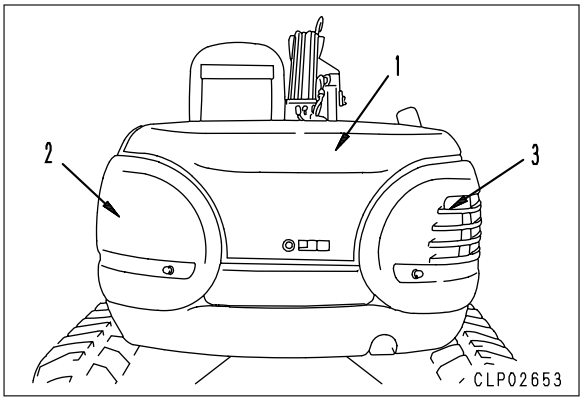
- **Bleeding air**
  Bleed the air from the hydraulic circuit. For details, see TESTING AND ADJUSTING, Bleeding air.

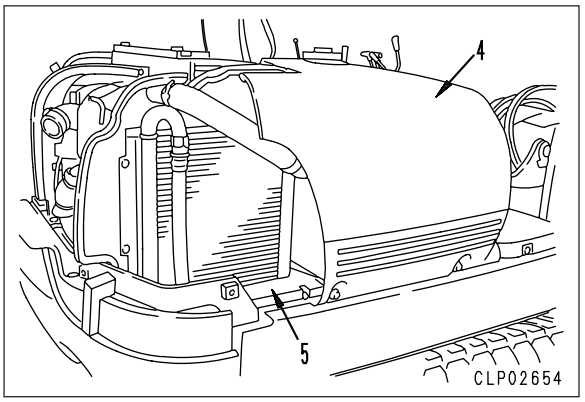
REMOVAL OF ENGINE, HYDRAULIC PUMP ASSEMBLY

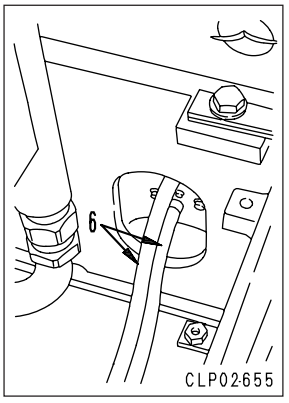
⚠ Release the remaining pressure in the hydraulic circuit and hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit and Releasing remaining pressure in hydraulic tank.

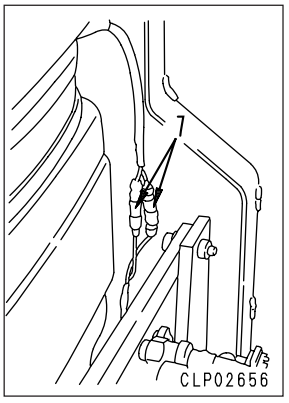
⚠ Disconnect the cable from the negative (–) terminal of the battery.

1. Remove operator's cab assembly. For details, see REMOVAL OF OPERATOR'S CAB ASSEMBLY.
   ★ Operator's cab specification machine only. Remove canopy assembly. For details, see REMOVAL OF CANOPY ASSEMBLY.
   ★ Canopy specification machines only.
2. Drain coolant.
3. Drain hydraulic oil.
   Hydraulic tank : **Approx. 33 ℓ**
4. Drain fuel.
   Fuel tank : **Approx. 50 ℓ (when full)**
5. Remove inspection cover at rear of operator's seat.
6. Remove engine hood (1).
7. Remove left protector (2) and right protector (3).
   kg Left and right protectors : **40 kg**
8. Remove right cover (4).
   ★ Remove the inspection cover at the top of the radiator also.
9. Remove adiabatic cover (5).
10. Disconnect 2 fuel hoses (6).
    ★ After disconnecting the hoses, fit tags to distinguish them.
11. Disconnect 2 fuel level sensor connectors (7).



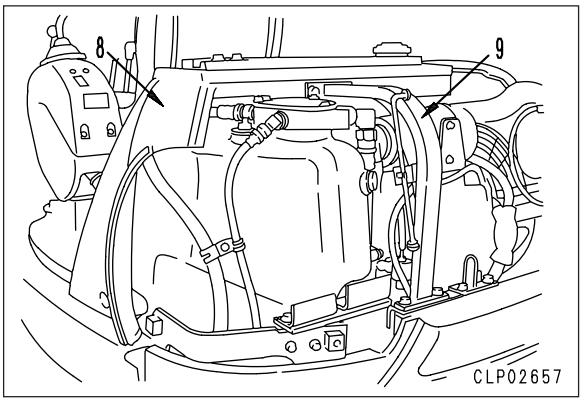






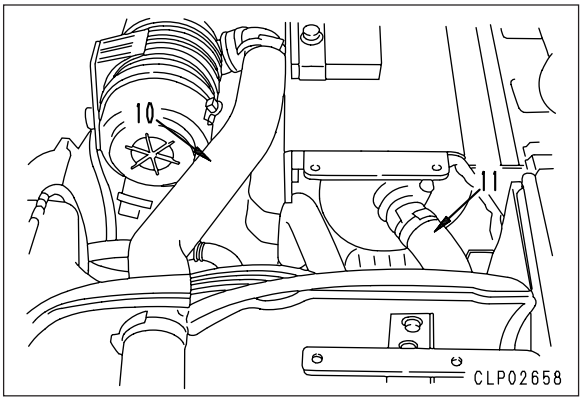
12. Remove left cover (8).

13. Remove engine room stay (9).

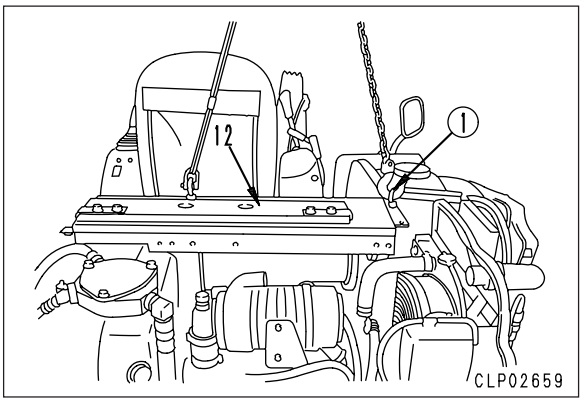


14. Remove intake hose (10). ※ 1

15. Disconnect exhaust pipe (11). ※ 2
    ★ Disconnect the clamp of the exhaust pipe at the front of the engine, then move the exhaust pipe towards the radiator.



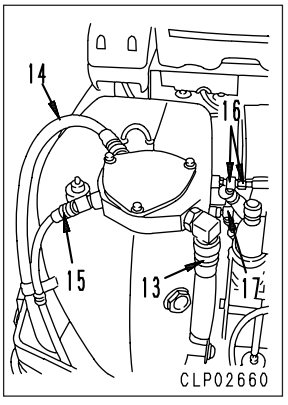
16. Using 2 eyebolts ①, lift off engine room cover and fuel tank assembly (12).
    ★ Remove the mounting bolts of the radiator bracket portion also.
    kg Engine room cover, fuel tank assembly : **60 kg**

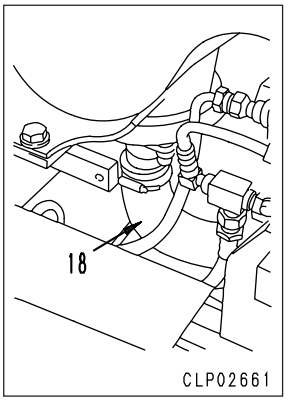


17. Disconnect hoses (13), (14), and (15) at top of hydraulic tank.

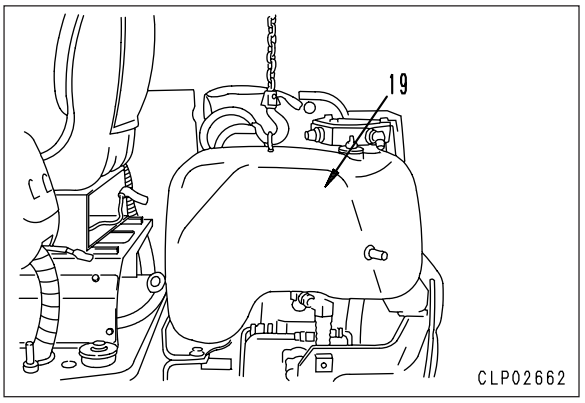
18. Disconnect 2 hoses (16) and hose (17) at right side of hydraulic tank.

19. Remove hose (18) at bottom of hydraulic tank. ※ 3

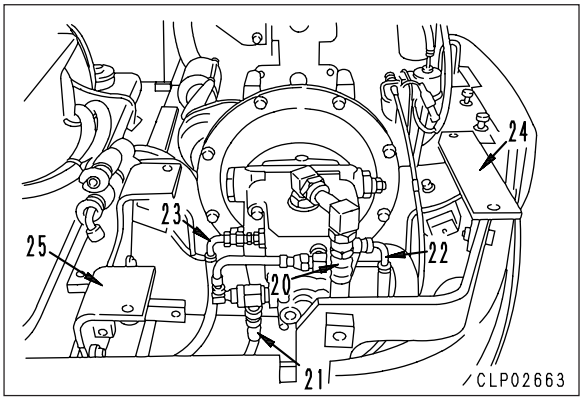




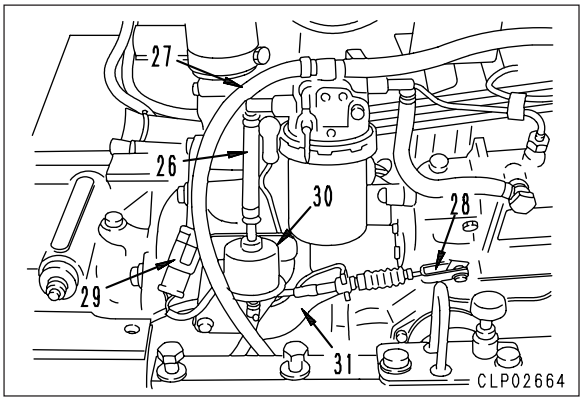
20. Lift off hydraulic tank assembly (19).
    kg Hydraulic tank assembly : **45 kg**



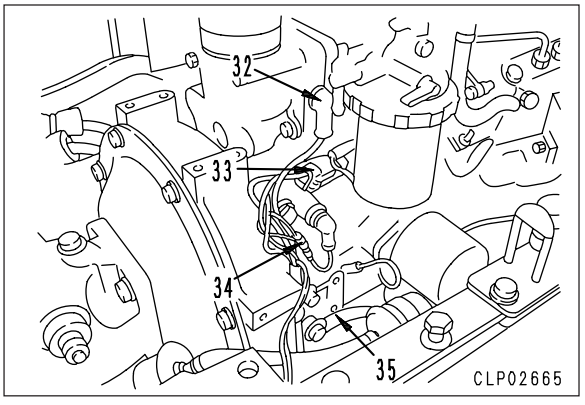
21. Disconnect hydraulic pump outlet hoses (20) and (21).
22. Disconnect hydraulic pump pilot hoses (22) and (23).
23. Remove hydraulic tank brackets (24) and (25).



24. Disconnect fuel supply hose (26) and return hose (27).
25. Disconnect fuel control cable (28). ※ 4
26. Disconnect fuel feed pump connector (29).
27. Disconnect fuel feed pump bracket (30) and fuel control bracket (31), and move towards counterweight end.



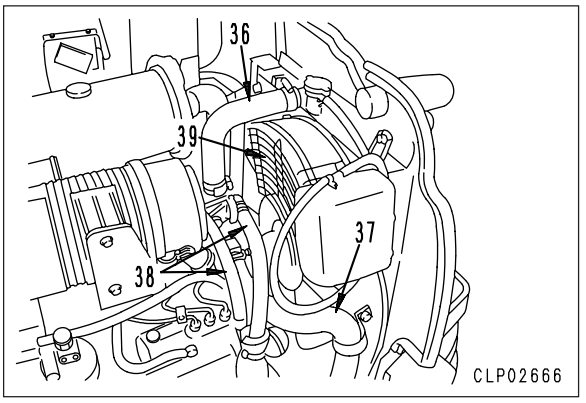
28. Disconnect intake air heater wiring (32).
29. Disconnect engine stop solenoid connector (33).
30. Disconnect engine oil pressure switch connector (34).
31. Disconnect engine ground connection wiring (35).
    ★ Disconnect the clamp of the cylinder block wiring also.



32. Disconnect radiator inlet hose (36) and outlet hose (37). ※ 5

33. Disconnect 2 heater hoses (38).
    ★ Operator's cab specification machine only.

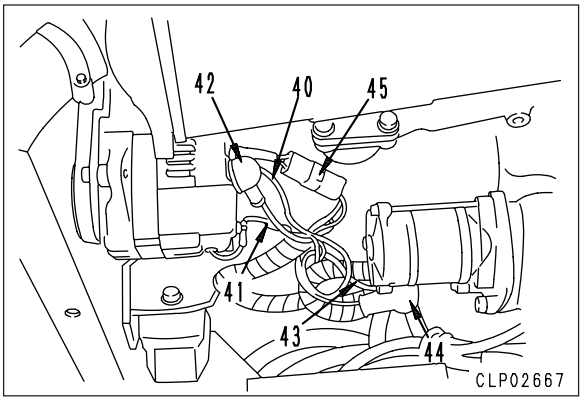
34. Remove fan net (39).



35. Disconnect alternator connectors (40) and (41), and wiring (42).

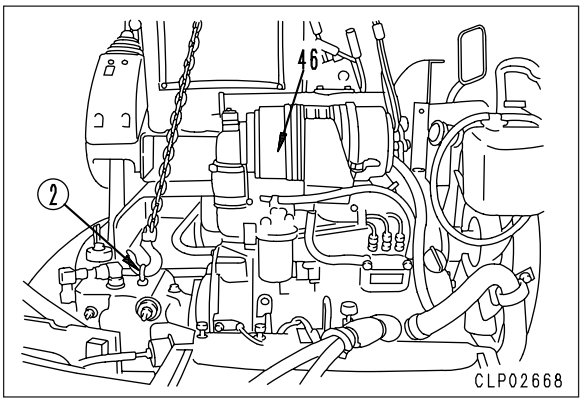
36. Disconnect starting motor connector (43) and 2 sets of wiring (44).

37. Disconnect water temperature sensor connector (45).
    ★ Disconnect the clamp of the cylinder block wiring also.



38. Using eyebolt ②, lift off engine and hydraulic pump assembly (46). ※ 6
    ★ Check that all piping and wiring has been disconnected, and be careful not to hit any other parts when removing.

    kg Engine, hydraulic pump assembly :
    210 kg (PC30R, 35R)
    260 kg (PC40R, 45R)



INSTALLATION OF ENGINE, HYDRAULIC PUMP ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm Intake hose clamp :
5.9 ± 0.49 Nm {60 ± 5 kgcm}

※ 2

kgm Exhaust pipe clamp nut :
Inside nut :
7.84 ± 1.96 Nm {0.8 ± 0.2 kgm}
Both nuts :
66.15 ± 7.35 Nm {6.75 ± 0.75 kgm}

※ 3

kgm Hose clamp at bottom of hydraulic tank : **5.9 ± 0.49 Nm {60 ± 5 kgcm}**

※ 4

★ Adjust the fuel control linkage. For details, see TESTING AND ADJUSTING, Adjusting control lever and pedal.

※ 5

kgm Radiator hose clamp :
8.3 ± 0.49 Nm {85 ± 5 kgcm}

※ 6

Engine mounting bolt :
Thread tightener (LT-2)
★ When coating, be careful not to get any thread tightener on the rubber cushion.

kgm Engine mounting bolt :
66.15 ± 7.35 Nm {6.75 ± 0.75 kgm}

- **Refilling with water**
  Add water through 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.
  Hydraulic tank :
  Approx. 33 ℓ (EO10W-CD)

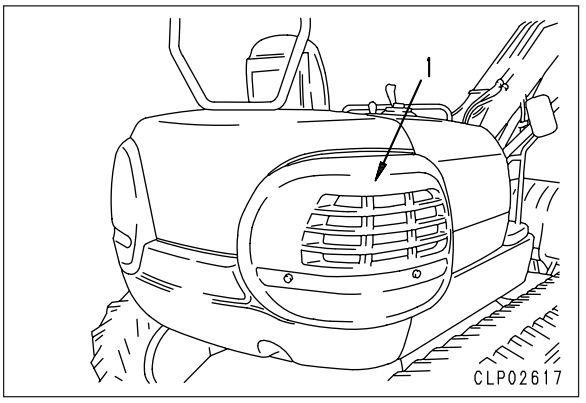
- **Refilling with fuel (fuel tank)**
  Add fuel to the fuel tank.

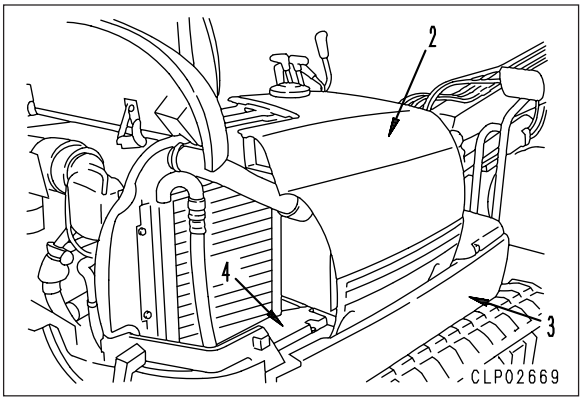
- **Bleeding air**
  Bleed the air from the hydraulic circuit.
  For details, see TESTING AND ADJUSTING, Bleeding air.

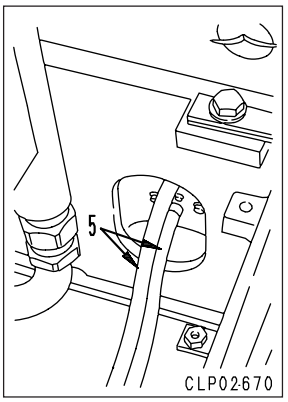
REMOVAL OF FUEL TANK ASSEMBLY

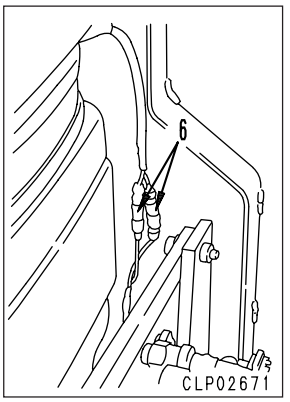
⚠ Disconnect the cable from the negative (–) terminal of the battery.

1. Drain fuel.
   Fuel tank : **Approx. 50 ℓ (when full)**
2. Lift off right protector (1).
   kg Right protector : **40 kg**
3. Remove right cover (2).
4. Remove right side cover (3).
5. Remove adiabatic cover (4).
6. Disconnect 2 fuel hoses (5).
   ★ After disconnecting the hoses, fit tags to distinguish them.
7. Disconnect 2 fuel level sensor connectors (6).
8. Disconnect 2 bands (7). ※ 1
9. Remove fuel tank assembly (8).









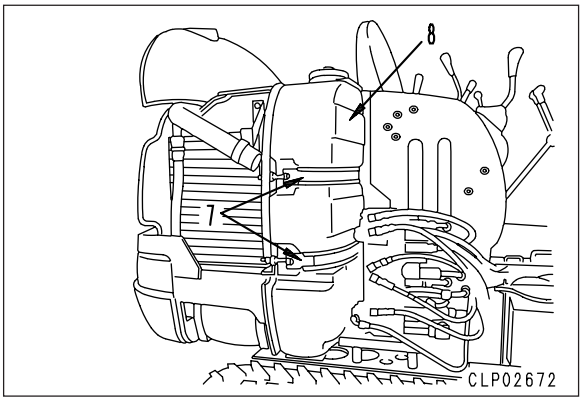
INSTALLATION OF FUEL TANK ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm Band mounting nut:
5.9 ± 0.49 Nm {0.6 ± 0.05 kgm}

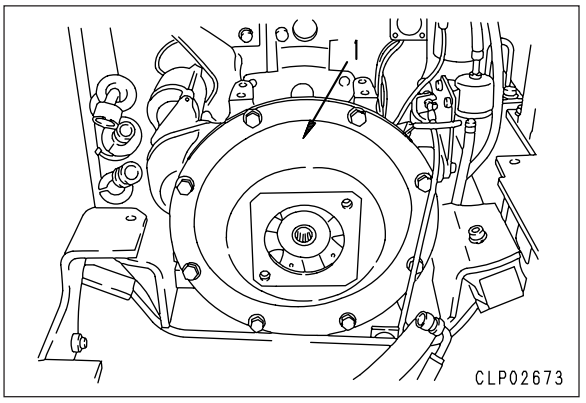
- **Refilling with fuel (fuel tank)**
  Add fuel to the fuel tank.



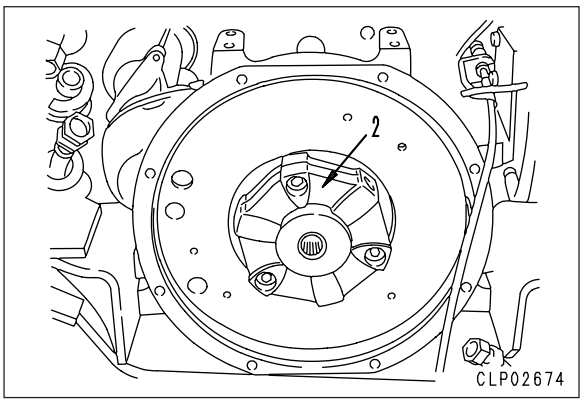
REMOVAL OF DAMPER ASSEMBLY

1. Remove hydraulic pump assembly. For details, see REMOVAL OF HYDRAULIC PUMP ASSEMBLY.

2. Remove cover (1).



3. Remove damper assembly (2). ※ 1



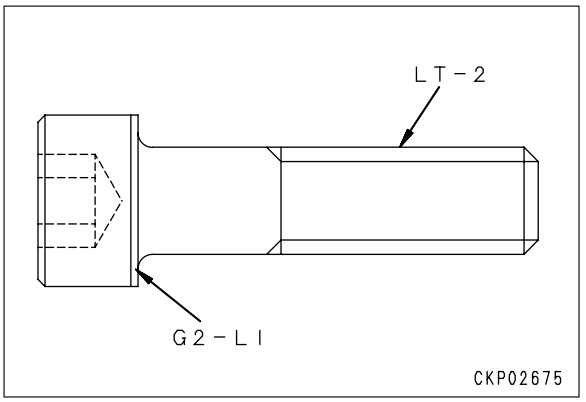
INSTALLATION OF DAMPER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

Damper assembly mounting bolt :
Thread portion : **Thread tightener (LT-2)**
★ When coating the thread, be careful not to get any thread tightener on the rubber portion of the coupling.
Seat portion : **Grease (G2-LI)**
★ When coating with grease, be careful not to get it on the threaded portion.

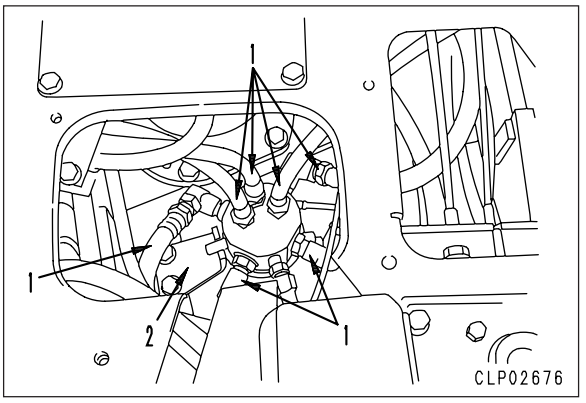
kgm Damper assembly mounting bolt :
87.75 ± 4.45 Nm {8.95 ± 0.45 kgm}

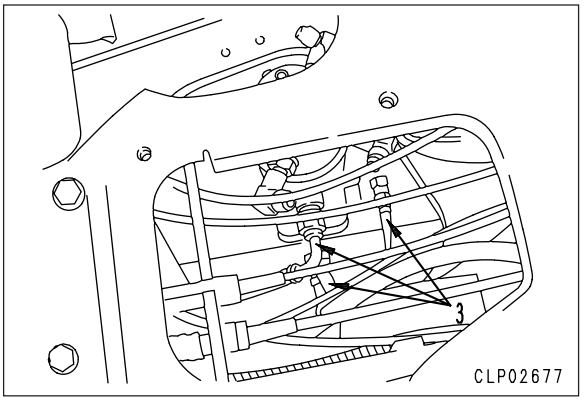


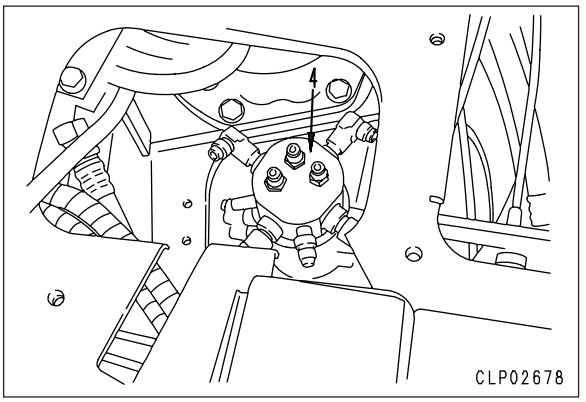
REMOVAL OF CENTER SWIVEL JOINT ASSEMBLY

⚠ Release the remaining pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic tank.

1. Remove floor frame cover.
2. Remove track frame undercover.
3. Disconnect 8 top hoses (1).
   ★ Fit blind plugs in the drain hoses (front of machine).
   ★ After disconnecting the hoses, fit tags to distinguish them.
4. Remove stopper (2).
5. Disconnect 10 bottom hoses (3).
   ★ After disconnecting the hoses, fit tags to distinguish them.
6. Remove center swivel joint assembly (4).
   ★ Remove the mounting bolts, then pull out from under the chassis and remove.





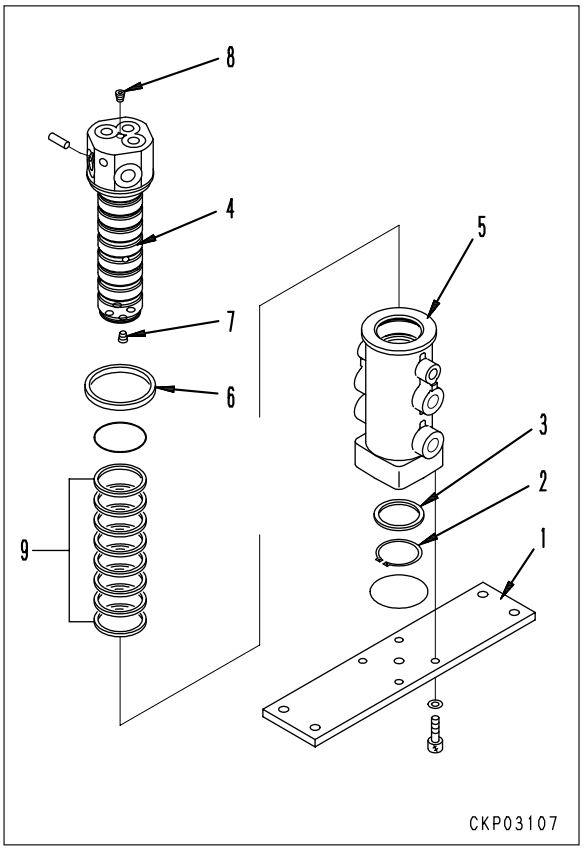


INSTALLATION OF CENTER SWIVEL JOINT ASSEMBLY

- 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 travel motor. For details, see TESTING AND ADJUSTING, Bleeding air.

DISASSEMBLY OF CENTER SWIVEL JOINT ASSEMBLY

1. Remove plate (1).
2. Using snap ring pliers, remove snap ring (2).
3. Remove spacer (3).
4. Using tool **T**, pull out shaft (4) from rotor (5).
5. Remove dust seal (6) from shaft (4).
6. Remove 4 plugs (7) and 1 plug (8) from shaft (4).
7. Remove 8 slipper seals (9) from rotor (5).



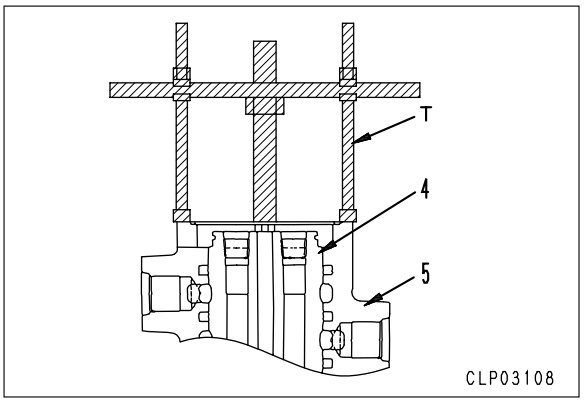
ASSEMBLY OF CENTER SWIVEL JOINT ASSEMBLY

1. Install 8 slipper seals (9) and O-rings to rotor (5).
2. Install plug (8) and 4 plugs (7) to shaft (4).
   ★ Remove all oil and grease from the plug thread, then dry the thread.

   Whole circumference of thread : **Thread tightener (LG-5)**

   kgm Plug (8) : **11.8 ± 24.5 Nm {1.2 ± 2.5 kgm}**
   Plug (7) : **32 ± 13 Nm {3.3 ± 1.3 kgm}**
3. Install dust seal (6) to shaft (4).
4. Install shaft (4) to rotor (5).
   ★ Before installing, coat the dust seal lip and contact surface and rotor and shaft with grease (G2-LI).
   ★ Tap the rotor with a plastic hammer and be careful not to damage the O-ring when installing.
5. Install spacer (3).
6. Using snap ring pliers, install snap ring (2).
7. Fit O-ring and install plate (1).

   kgm Mounting bolt : **66 ± 7 Nm {6.7 ± 0.7 kgm}**



REMOVAL OF TRAVEL MOTOR ASSEMBLY

⚠ Release the remaining pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic tank.

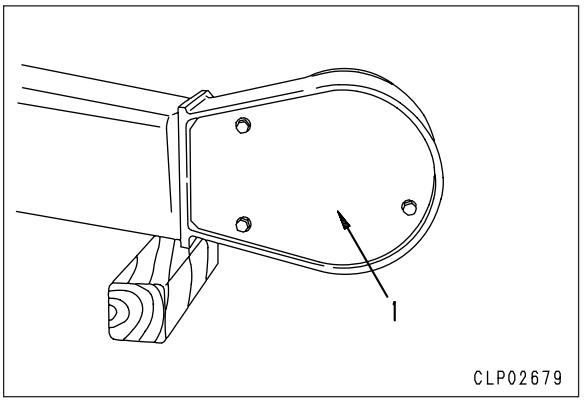
1. Remove sprocket. For details, see REMOVAL OF SPROCKET.

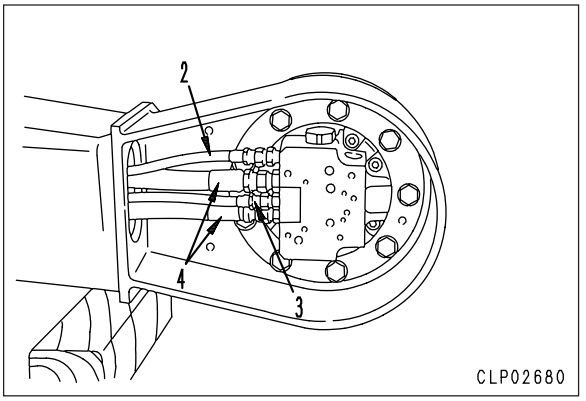
2. Remove cover (1).

3. Disconnect drain hose (2), pilot hose (3), and 2 main hoses (4).
   ★ Fit a blind plug in the drain hose.
   ★ After disconnecting the hoses, fit tags to distinguish them.

4. Lift off travel motor assembly (5). ※ 1

   kg Travel motor assembly :
   50 kg (PC30R, 35R)
   60 kg (PC40R)
   65 kg (PC45R)





INSTALLATION OF TRAVEL MOTOR ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

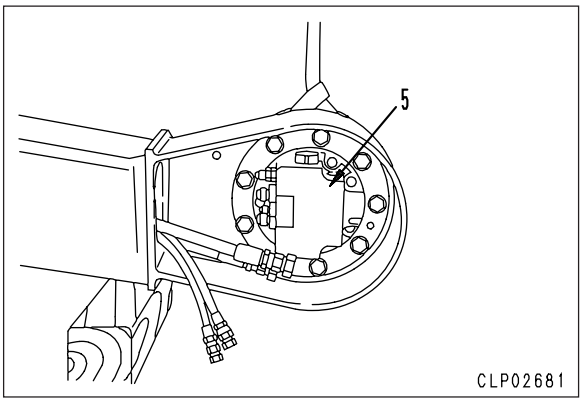
Travel motor mounting bolt :
Thread tightener (LT-2)

※ 2

kgm Travel motor mounting bolt :
PC30R, 35R :
110.25 ± 12.25 Nm {11.25 ± 1.25 kgm}
PC40R, 45R : **176.4 ± 19.6 Nm {18 ± 2 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 AND ASSEMBLY OF TRAVEL MOTOR

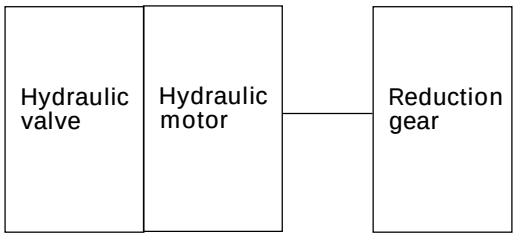
PHV-300 (FOR PC30R-8)

PROCEDURE FOR DISASSEMBLY AND ASSEMBLY

When carrying out disassembly and assembly, wash all parts thoroughly in flushing oil and be careful not to let any dirt get in. If dirt gets between assembly parts, it will cause seizure. Handle the parts with care and be careful not to scratch or damage them.

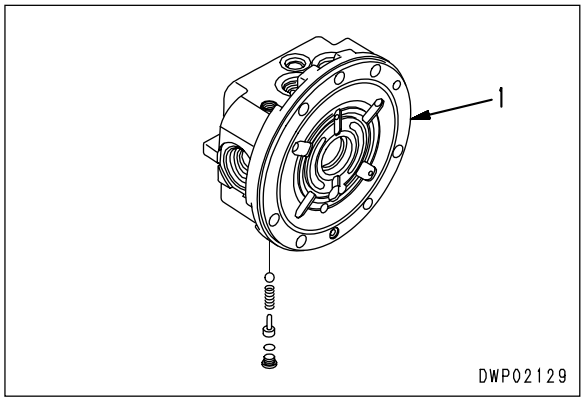
The following is an explanation of the procedure for assembling the travel motor. The disassembly procedure is in the opposite order. Note that the parts (bearings, pins) which are press fitted can basically not be disassembled.

The travel motor consists of 3 blocks as shown in the diagram below; each block is explained in turn.



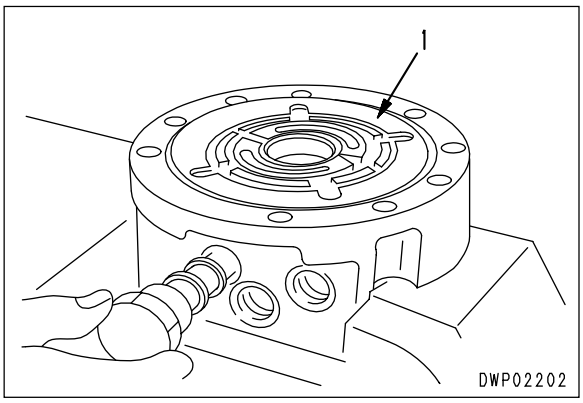
1. Fit ball, spring, spring holder, and O-ring to plug, then assemble plug to body (1).

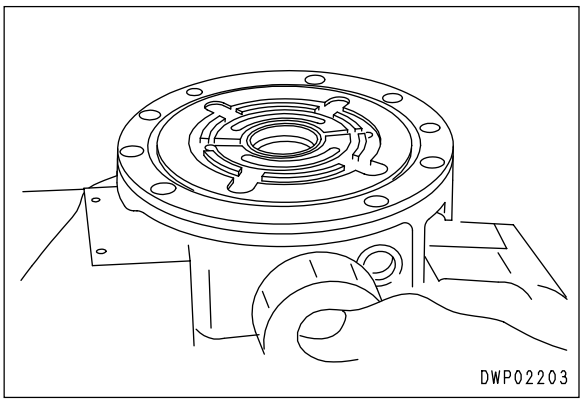
   kgm Plug: **12 – 13 Nm {1.2 – 1.3 kgm}**
   (Width across flats: 5 mm)



2. Fit spool assembly, ring, spring, and O-ring to plug, then assemble plug to body (1).
   ★ The spool assembly cannot be disassembled.
   ★ When fixing body (1) in a vice, use an aluminum sheet to protect it.

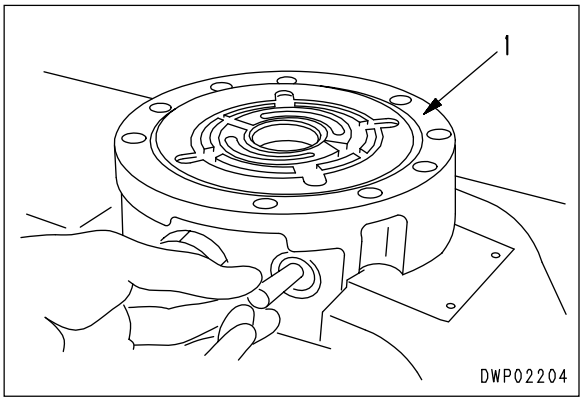
   kgm Plug: **196 – 245 Nm {20 – 25 kgm}**
   (Width across flats: 36 mm)

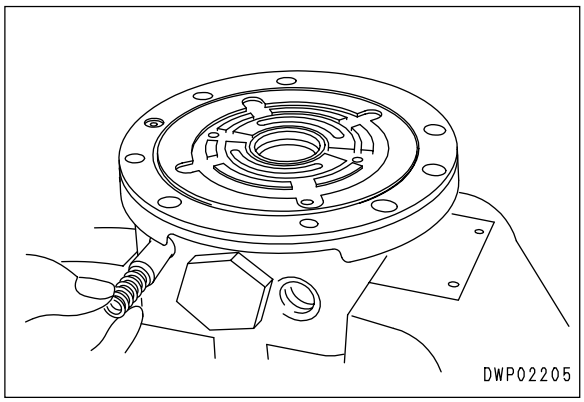


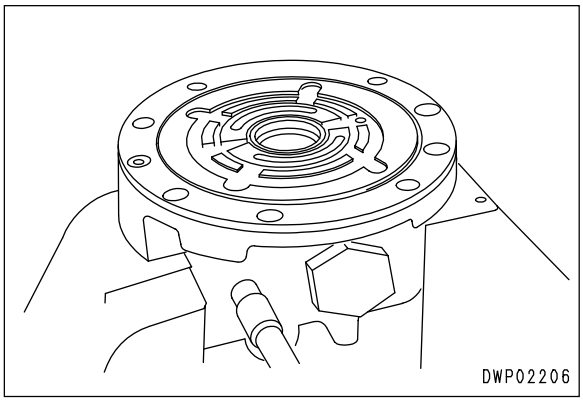


3. Fit spacer, spool, spring, and O-ring to plug, then assemble plug to body (1).

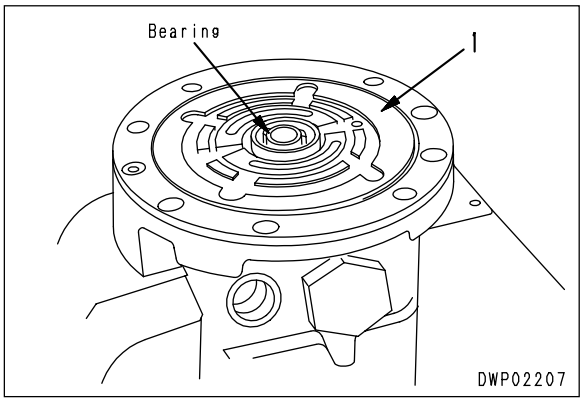
   kgm Plug: **46 – 51 Nm {4.7 – 5.3 kgm}**
   (Width across flats: 8 mm)



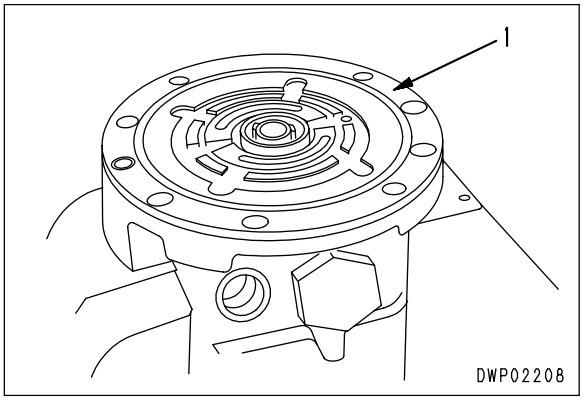




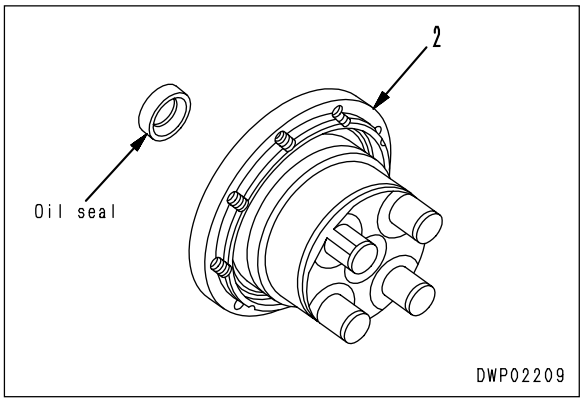
4. Press fit bearing and spring pin to body (1).

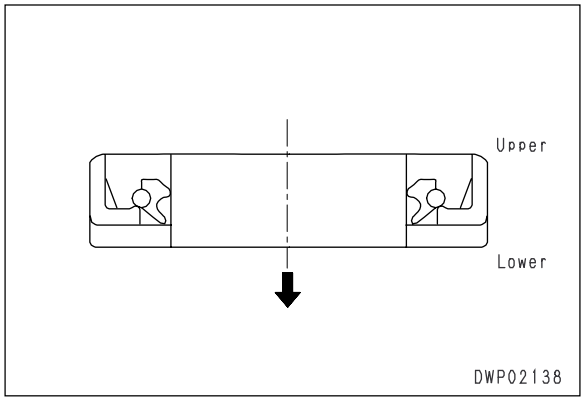


5. Install 2 O-rings to body (1).

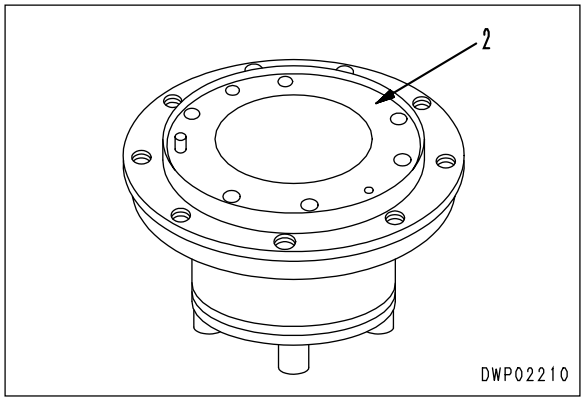


6. Press fit oil seal to body (2).
   ★ Fill the lip of the oil seal with grease.
   ★ Press fit in the direction shown in the diagram.

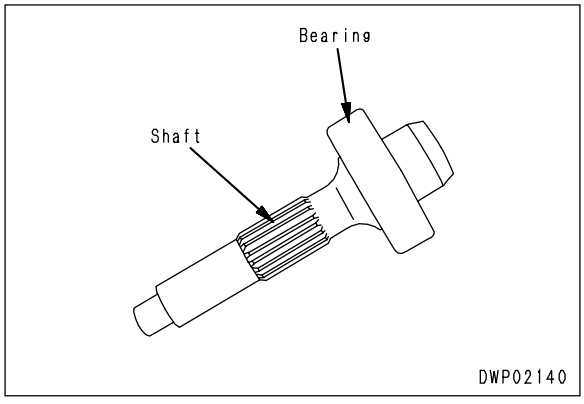




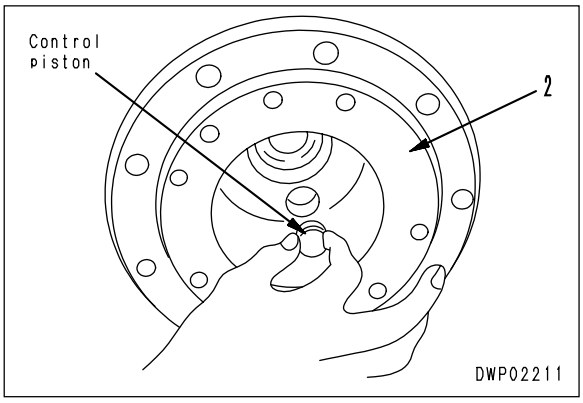
7. Assemble parallel pin to body (2).



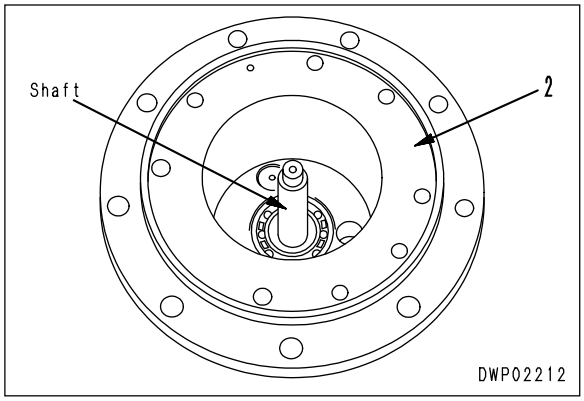
8. Press fit bearing to shaft.



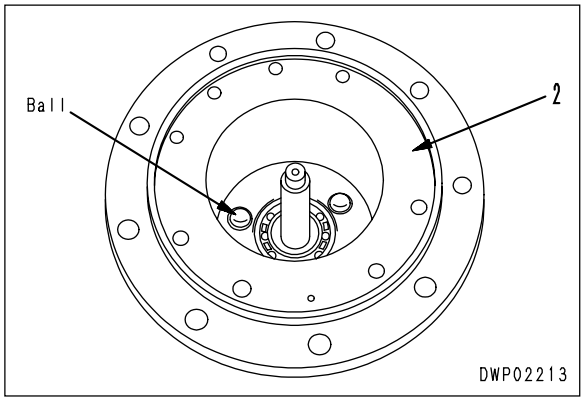
9. Assemble control piston to to body (2).

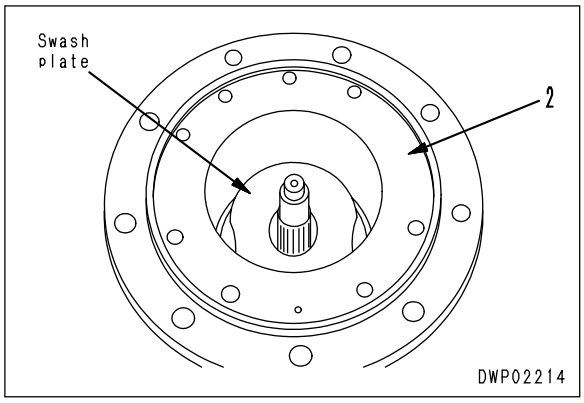


10. Assemble shaft to body (2).
    ★ Be careful not to let the shaft damage the oil seal.

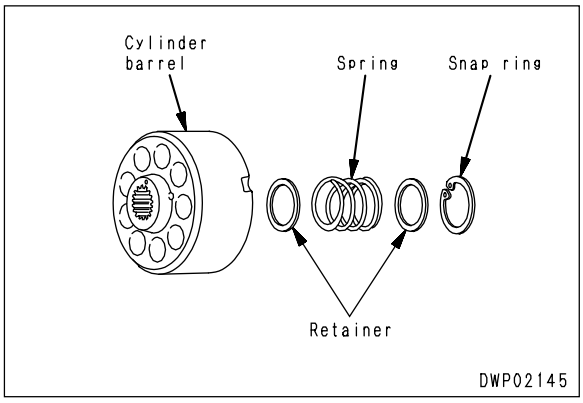


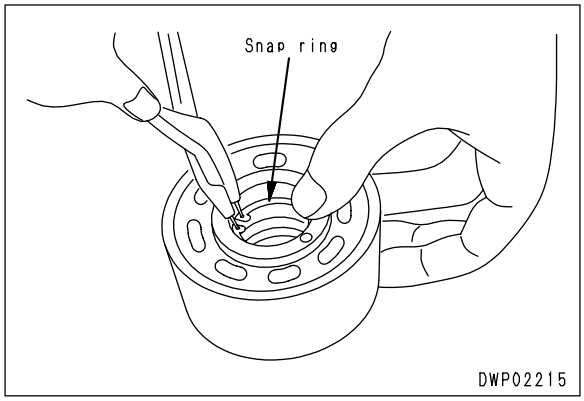
11. Assemble ball and swash plate to body (2).



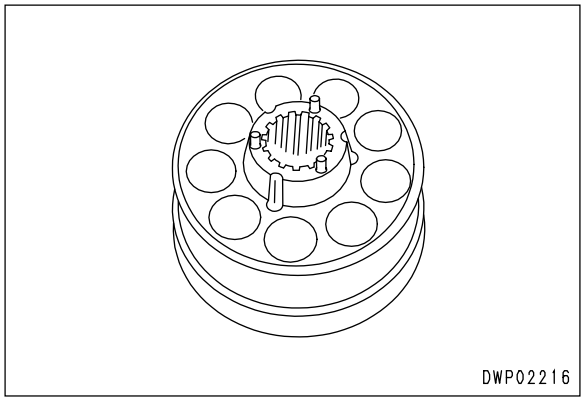


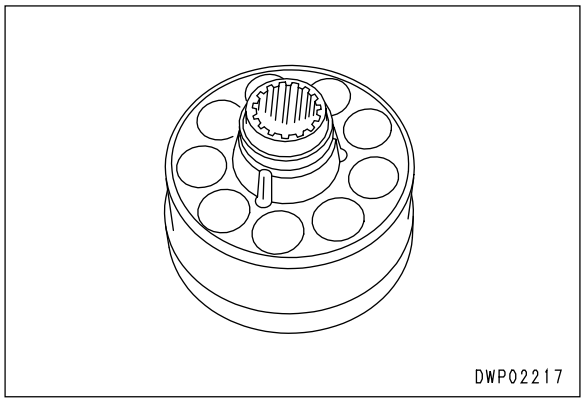
12. Assemble retainer, spring, and retainer in turn to cylinder barrel, then secure with snap ring.

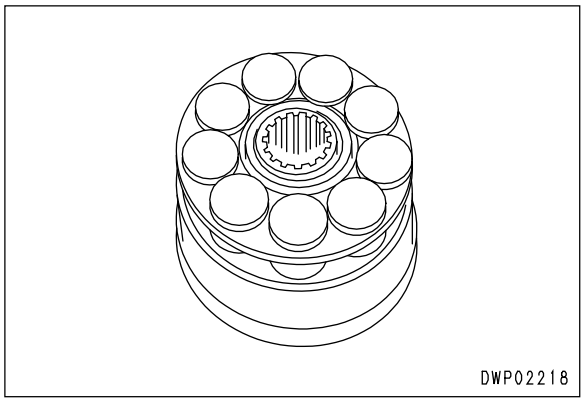




13. Assemble pin, barrel holder, piston/shoe in turn to shoe holder, then assemble shoe holder to cylinder barrel to make cylinder barrel assembly.

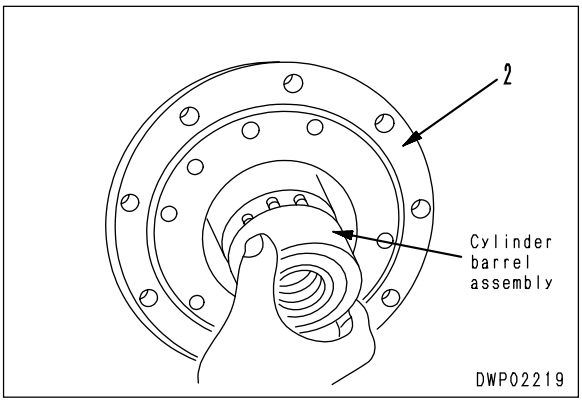




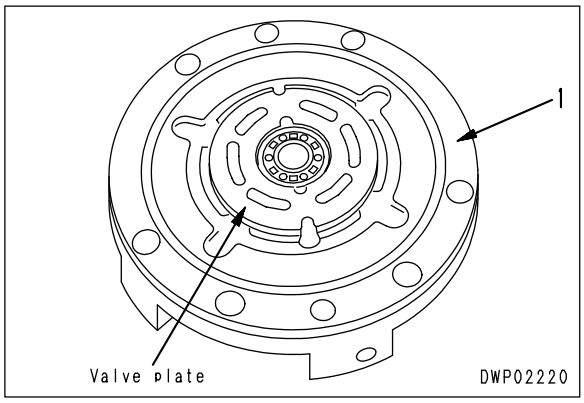


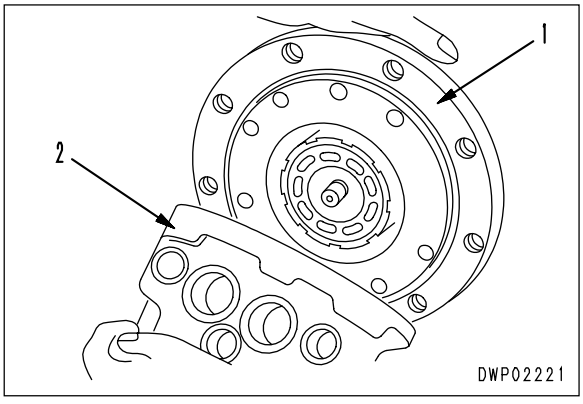
14. Assemble cylinder barrel assembly to body (2).

15. Fill inside of body (2) with oil (approx. 200 cc).



16. Assemble valve plate to body (1), then fit to body (2).
    ★ Coat both faces of the valve plate with grease to prevent it from falling.

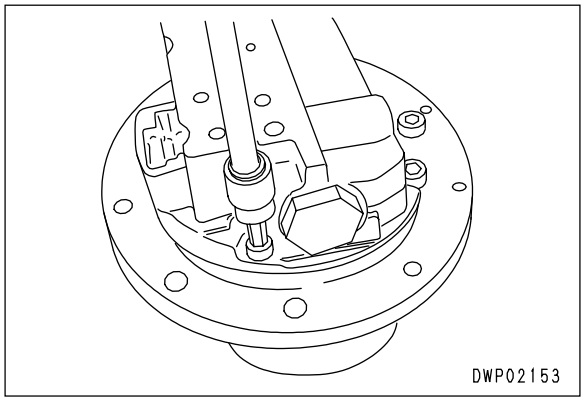




17. Tighten with hexagon socket head bolt.

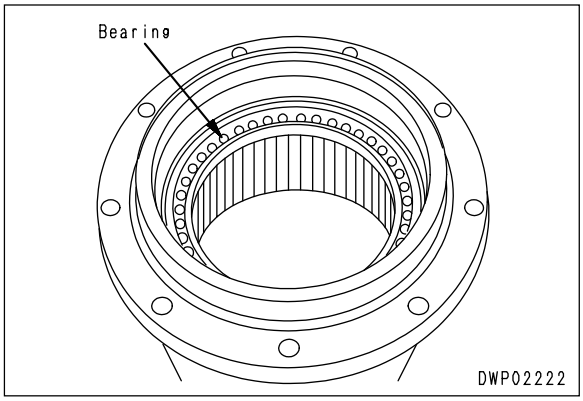
    kgm Bolt (M10): **51 – 65 Nm {5.2 – 6.6 kgm}**
    (Width across flats: 8 mm)

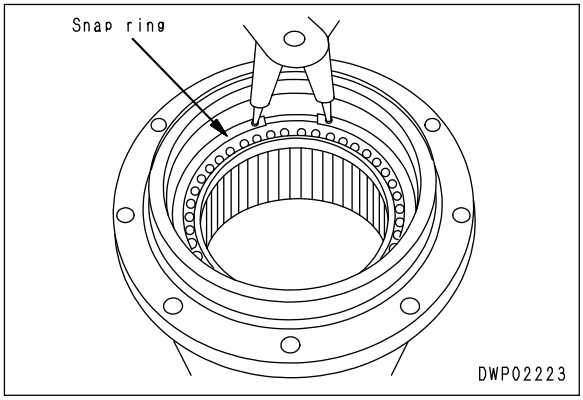
    ★ When fixing the motor in a vice, use an aluminum sheet to protect the body.

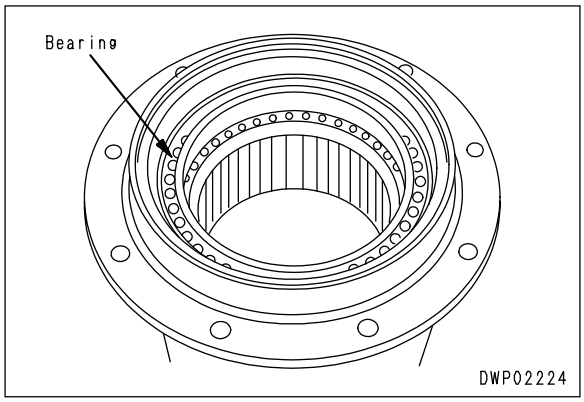


18. Assemble bearing, snap ring for hole, and bearing in turn to body.

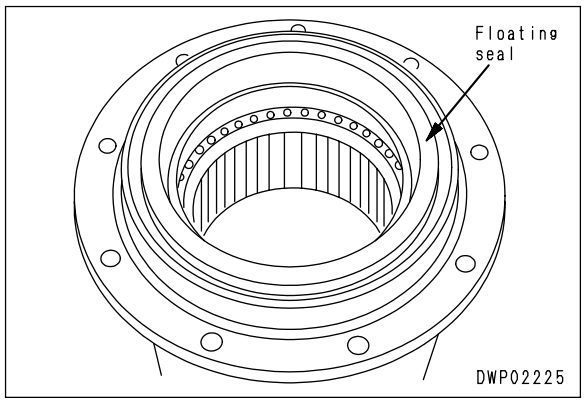
    ★ Press fit the bearing so that the thick inner race is on the outside compared with the snap ring.



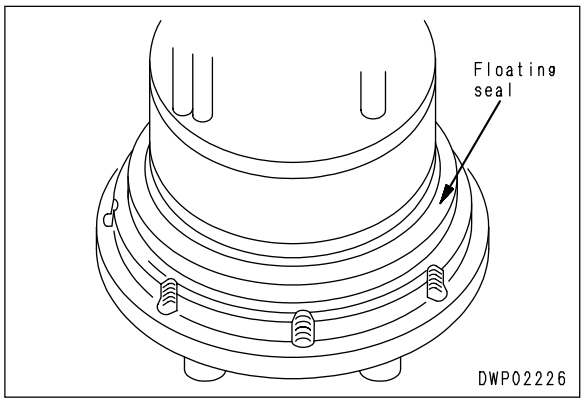




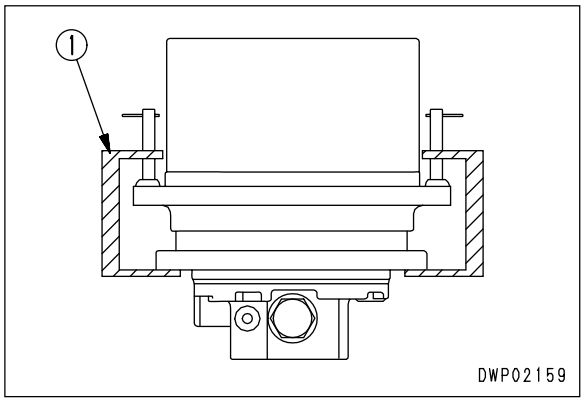
19. Assemble floating seal and O-ring assembly to body.
    ★ If it is difficult to assemble, coat the O-ring with grease.

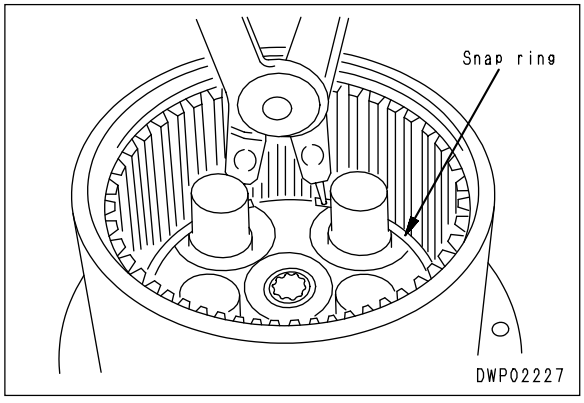


20. Assemble floating seal and O-ring assembly to hydraulic motor.
    ★ If it is difficult to assemble, coat the O-ring with grease.

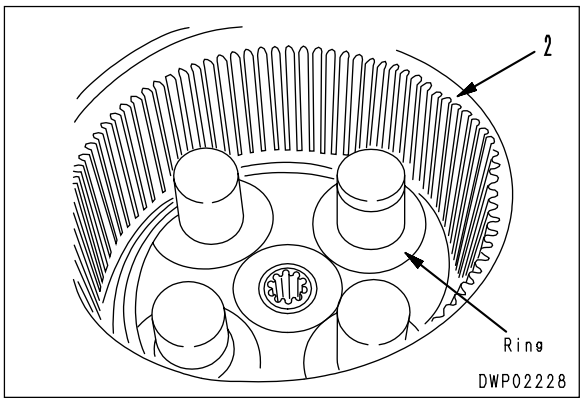


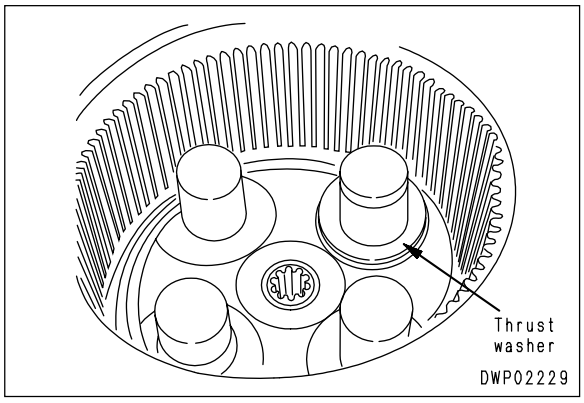
21. Assemble hydraulic motor to body, then secure with snap ring.
    1) Remove all oil and grease from seat surface of floating seal.
    2) If it is difficult to insert in the body, use a plastic hammer to tap uniformly around the circumference of the body to insert.
    3) Use tool ① or a hydraulic press to tighten the reduction gear flange and hydraulic motor flange, then install the snap ring.
    4) Adjust the thickness of the snap ring to adjust the preload of the bearing.

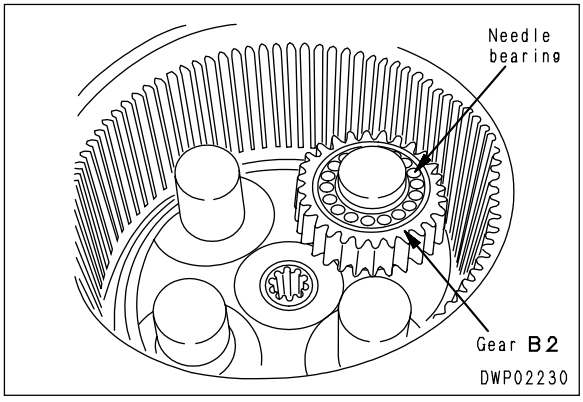


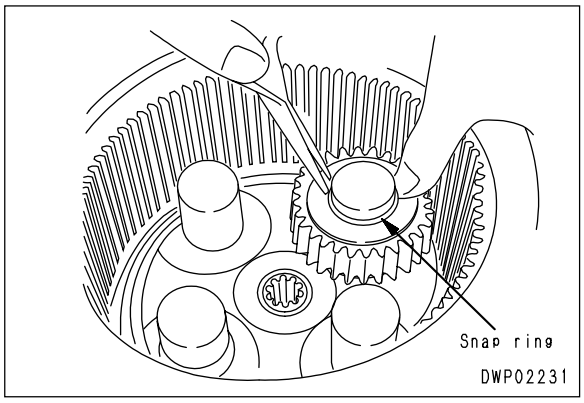


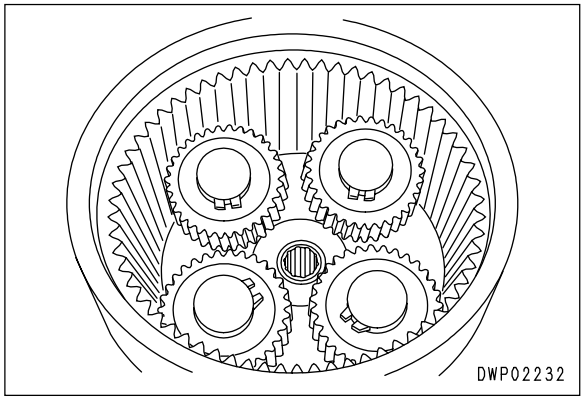
22. Assemble ring, thrust washer, gear **B2**, needle, and thrust washer in order, then secure with snap ring.
    ★ Assemble the thrust washer with the large inside diameter first.



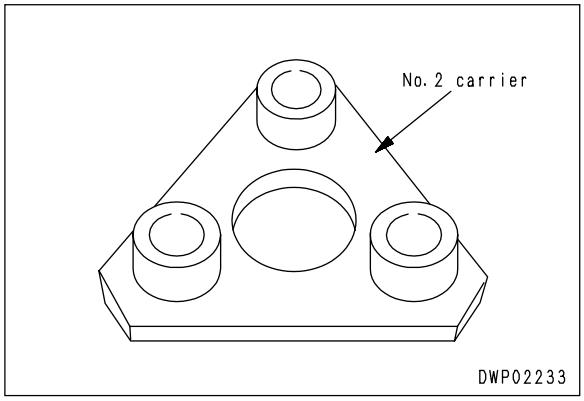




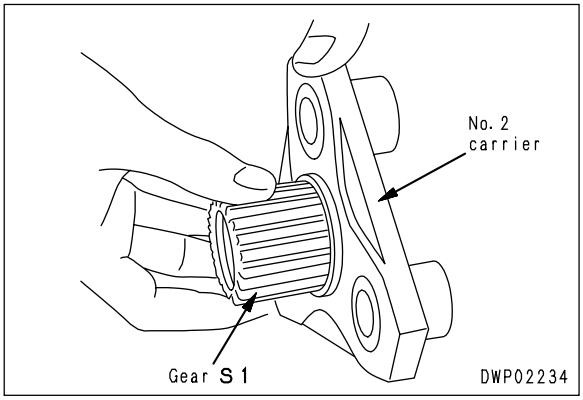


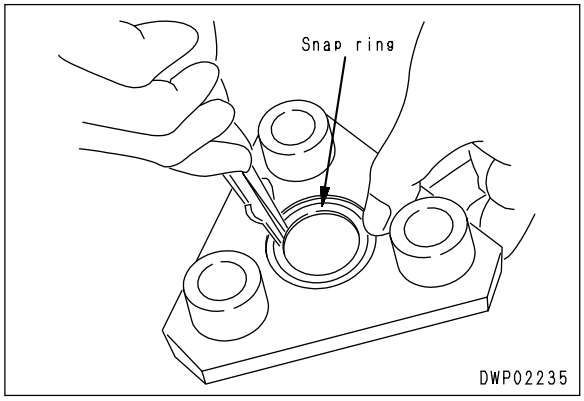


23. Press fit pin **B2** and spring pin to No.2 carrier.

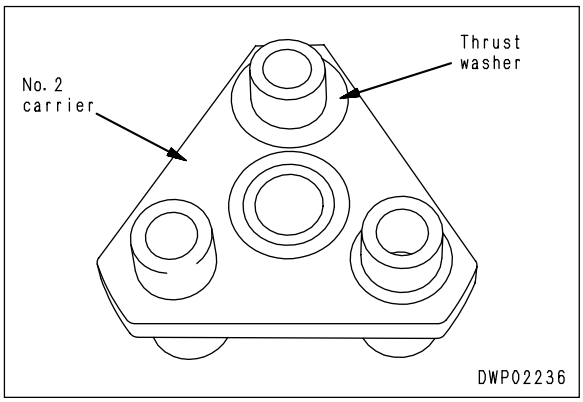


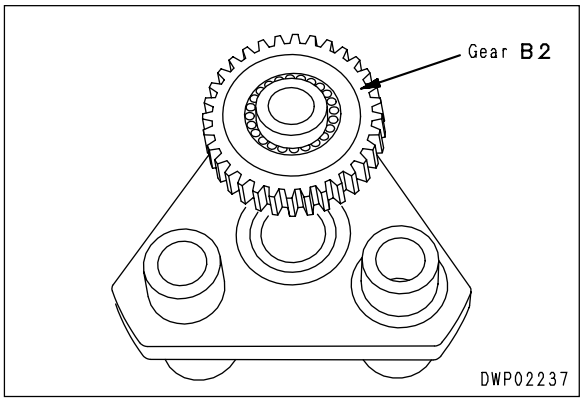
24. Assemble gear **S1** to No.2 carrier, then secure with snap ring.

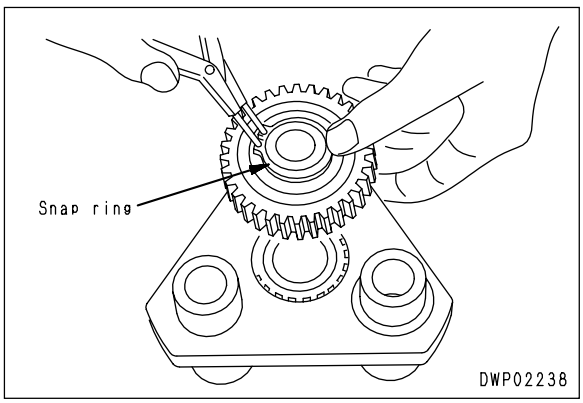


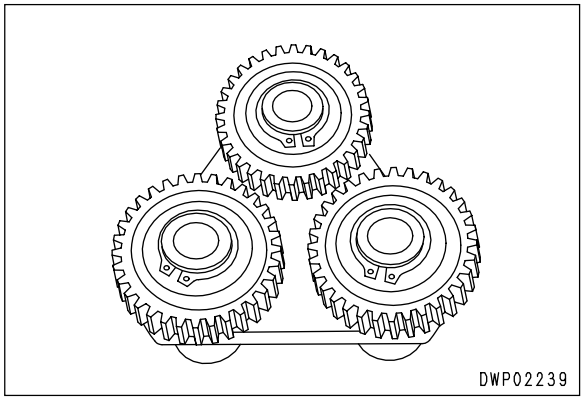


25. Assemble thrust washer, gear **B2**, needle, and thrust washer in turn to No.2 carrier, then secure with snap ring to make No.2 carrier assembly.

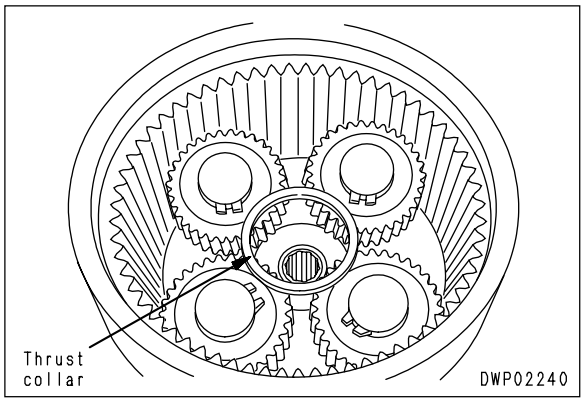


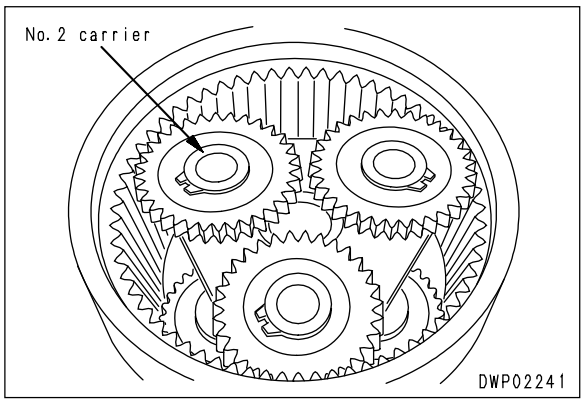




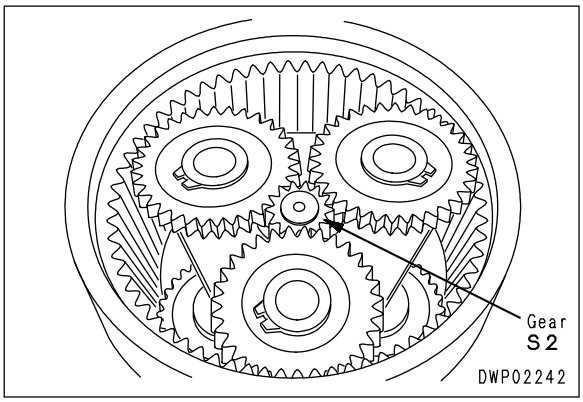


26. Assemble thrust collar and No.2 carrier assembly to body.

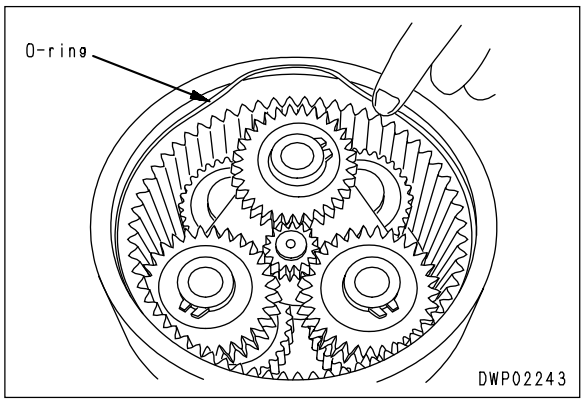




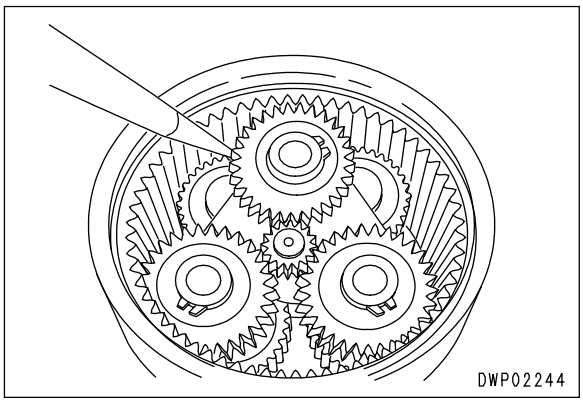
27. Assemble gear **S2.**



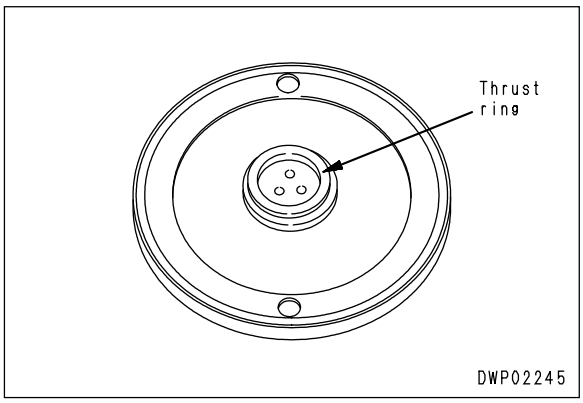
28. Fit O-ring to body.



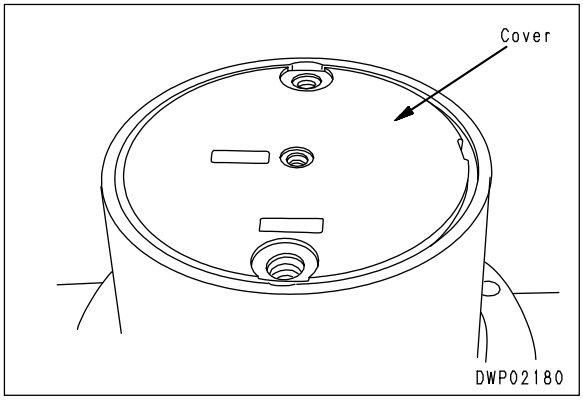
29. Fill with 700 cc of lubricating oil.



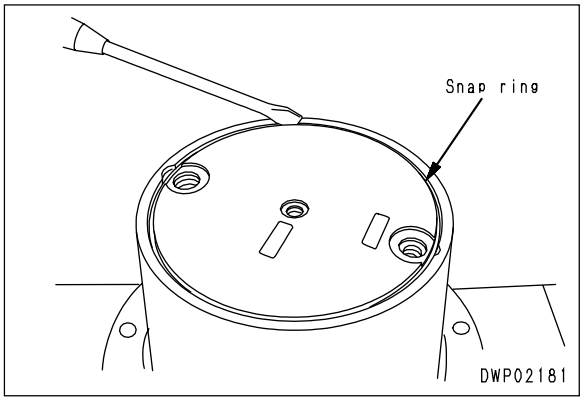
30. Assemble thrust ring to cover.
    ★ Coat with grease to hold in position.



31. Assemble cover to body.
    1) Coat the O-ring with grease, assemble horizontally, and be careful not to damage it.
    2) Align the tap holes (G3/8) at the top and bottom with the notches in the body when assembling.

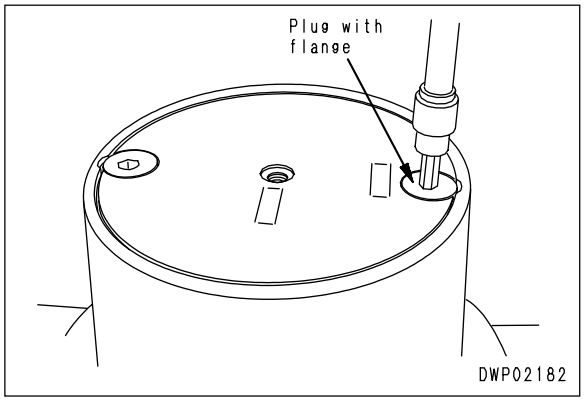


32. Assemble snap ring and secure cover.
    ★ Put a flat-headed screwdriver in contact with the end face of the snap ring and tap in the direction of the circumference to install.



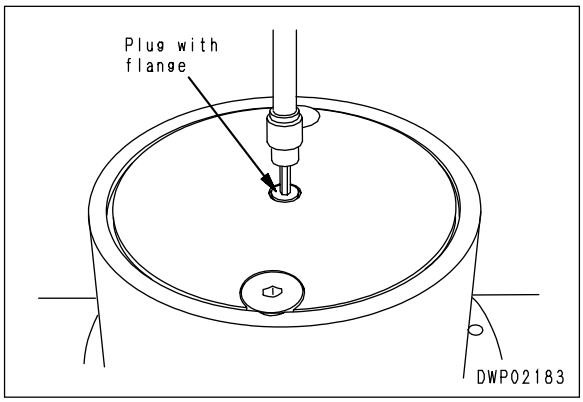
33. Fit O-ring to plug (G3/8) with flange, then tighten.

kgm Plug: **46 – 51 Nm {4.7 – 5.2 kgm}**
(Width across flats: 8 mm)



34. Fit O-ring to plug (G1/8) with flange, then tighten.

kgm Plug: **12 – 13 Nm {1.2 – 1.3 kgm}**
(Width across flats: 5 mm)



DISASSEMBLY AND ASSEMBLY OF TRAVEL MOTOR

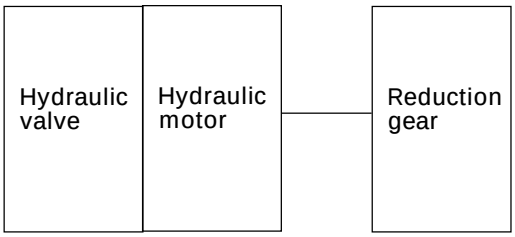
PHV-350 (FOR PC35R-8)

PROCEDURE FOR DISASSEMBLY AND ASSEMBLY

When carrying out disassembly and assembly, wash all parts thoroughly in flushing oil and be careful not to let any dirt get in. If dirt gets between assembly parts, it will cause seizure. Handle the parts with care and be careful not to scratch or damage them.

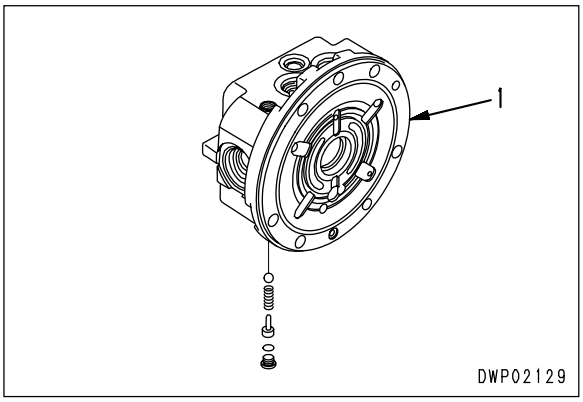
The following is an explanation of the procedure for assembling the travel motor. The disassembly procedure is in the opposite order. Note that the parts (bearings, pins) which are press fitted can basically not be disassembled.

The travel motor consists of 3 blocks as shown in the diagram below; each block is explained in turn.



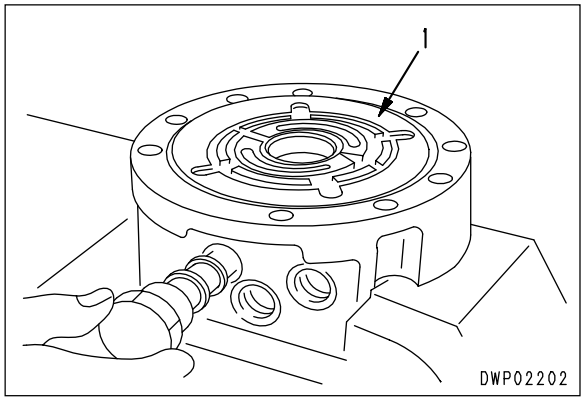
1. Fit ball, spring, spring holder, and O-ring to plug, then assemble plug to body (1).

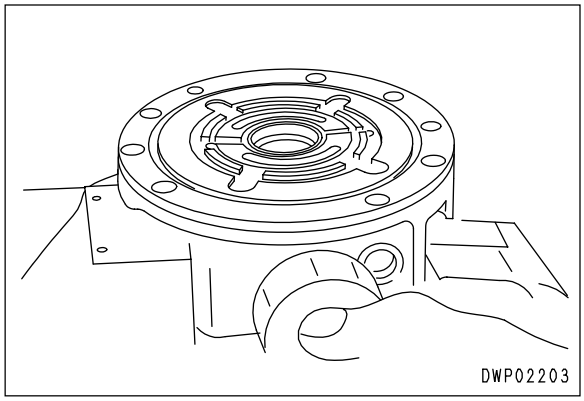
   kgm Plug: **12 – 13 Nm {1.2 – 1.3 kgm}**
   (Width across flats: 5 mm)



2. Fit spool assembly, ring, spring, and O-ring to plug, then assemble plug to body (1).
   ★ The spool assembly cannot be disassembled.
   ★ When fixing body (1) in a vice, use an aluminum sheet to protect it.

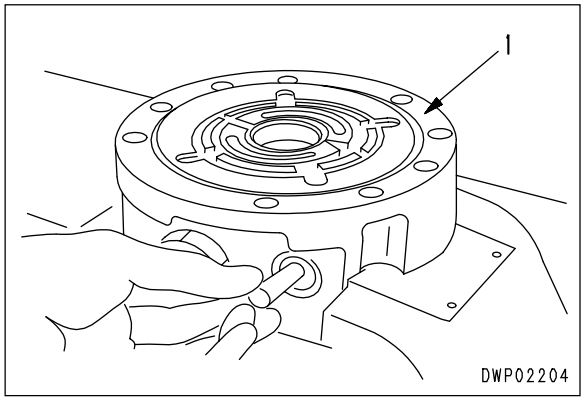
   kgm Plug: **196 – 245 Nm {20 – 25 kgm}**
   (Width across flats: 36 mm)

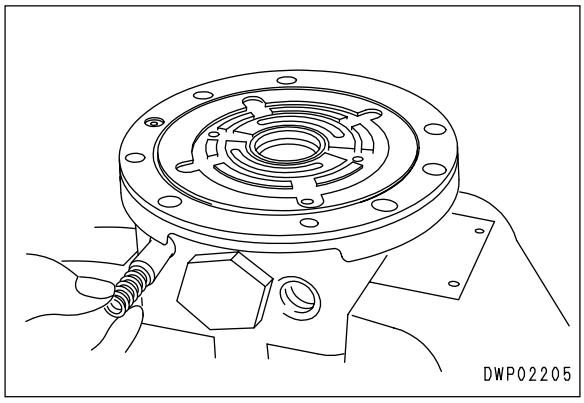


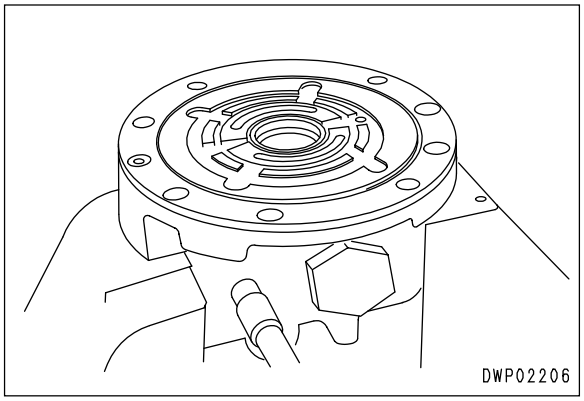


3. Fit spacer, spool, spring, and O-ring to plug, then assemble plug to body (1).

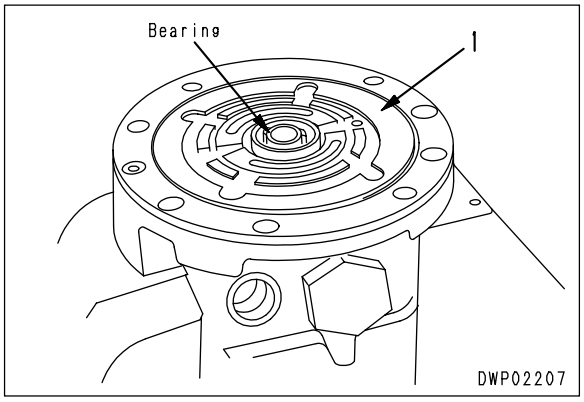
   kgm Plug: **46 – 51 Nm {4.7 – 5.3 kgm}**
   (Width across flats: 8 mm)



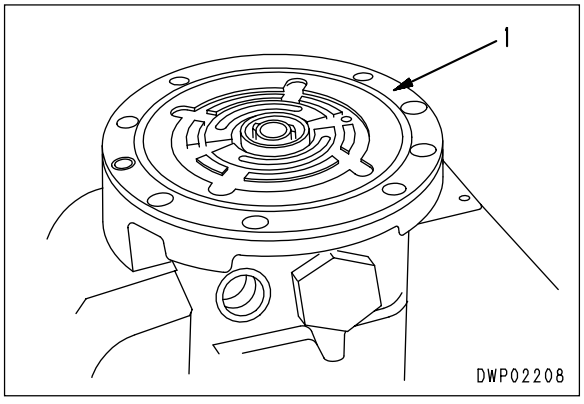




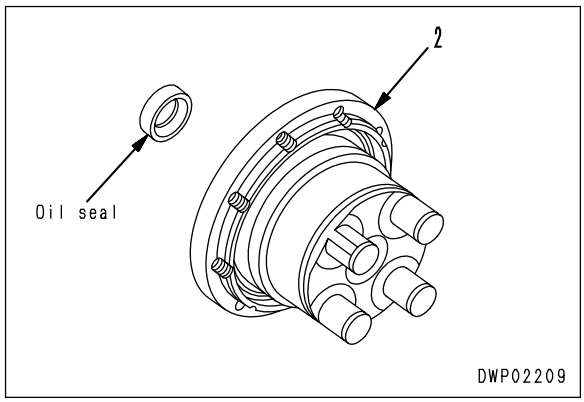
4. Press fit bearing and spring pin to body (1).

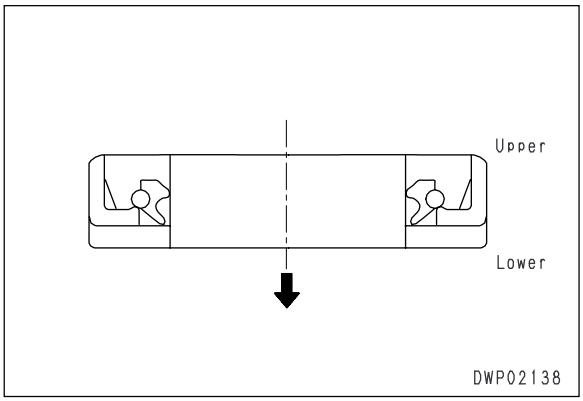


5. Install 2 O-rings to body (1).

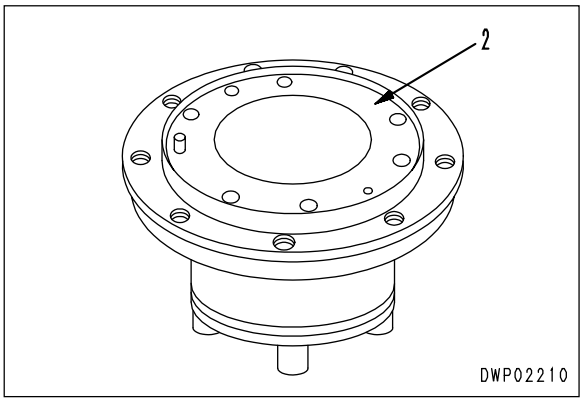


6. Press fit oil seal to body (2).
   ★ Fill the lip of the oil seal with grease.
   ★ Press fit in the direction shown in the diagram.

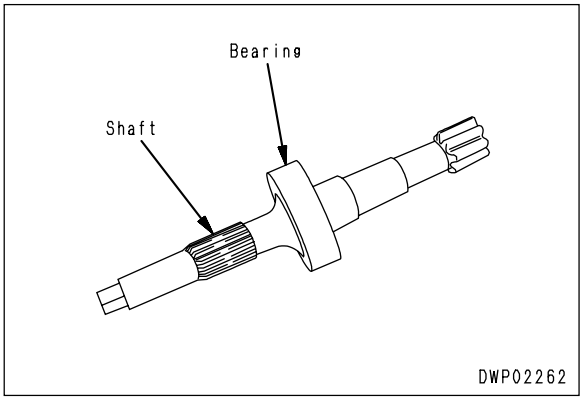




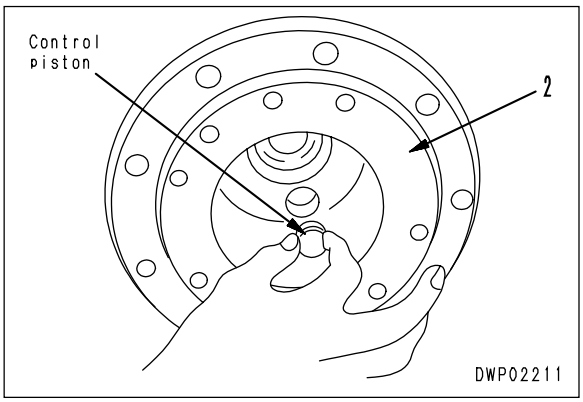
7. Assemble parallel pin to body (2).



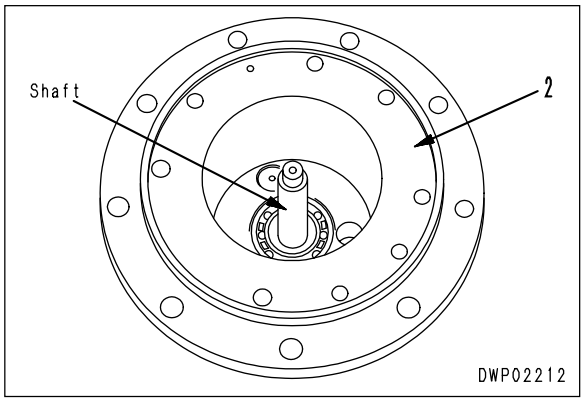
8. Press fit bearing to shaft.



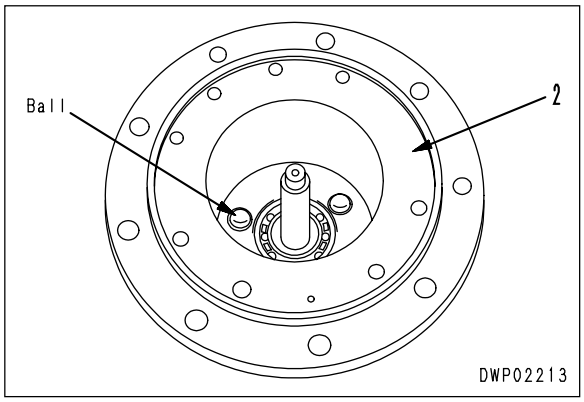
9. Assemble control piston to to body (2).

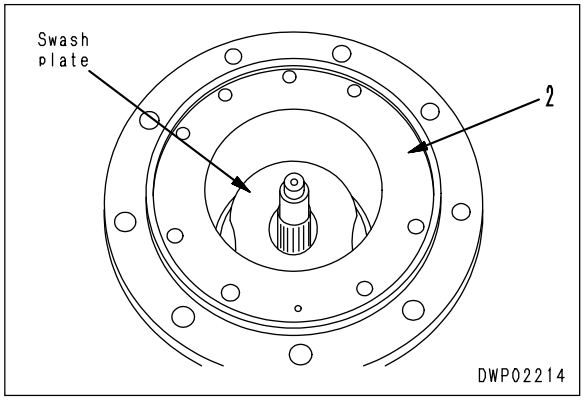


10. Assemble shaft to body (2).
    ★ Be careful not to let the shaft damage the oil seal.

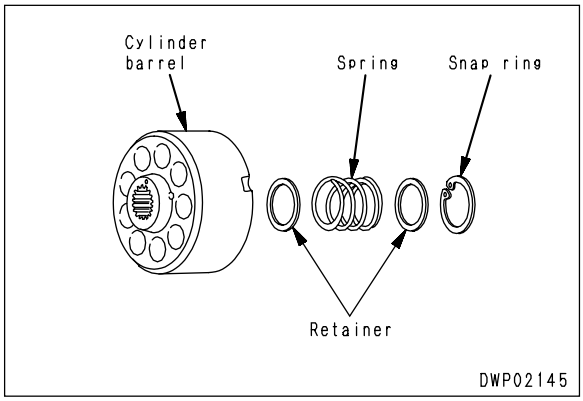


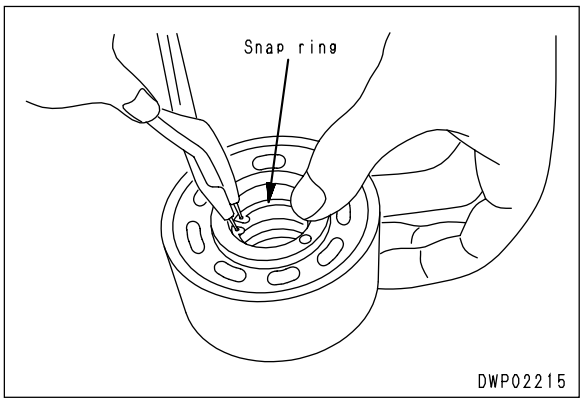
11. Assemble ball and swash plate to body (2).



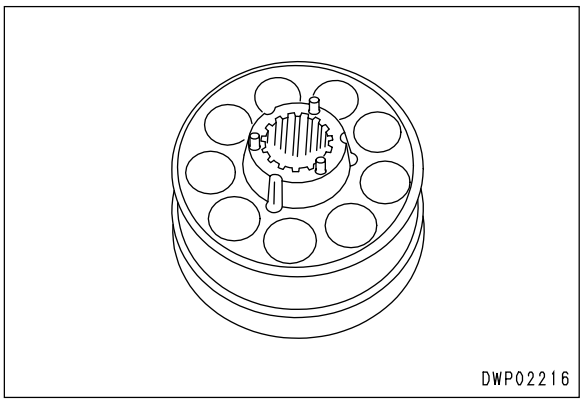


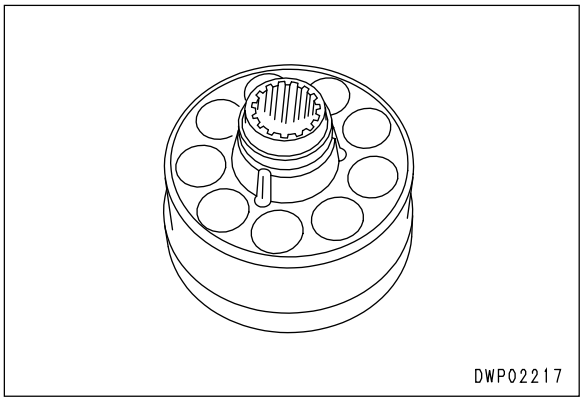
12. Assemble retainer, spring, and retainer in turn to cylinder barrel, then secure with snap ring.

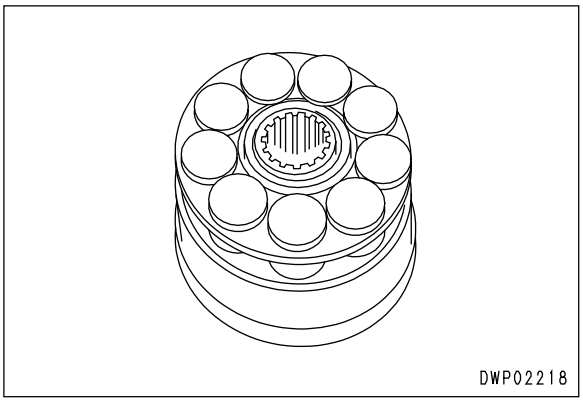




13. Assemble pin, barrel holder, piston/shoe in turn to shoe holder, then assemble shoe holder to cylinder barrel to make cylinder barrel assembly.

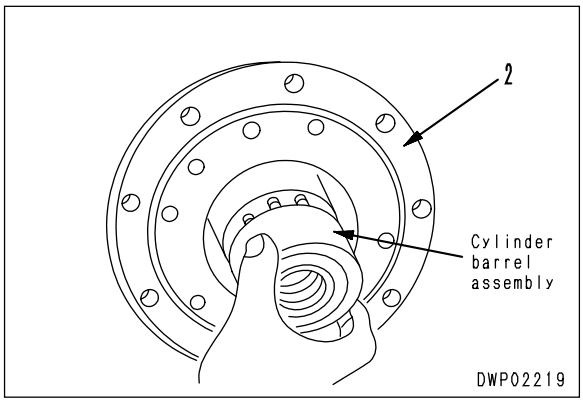




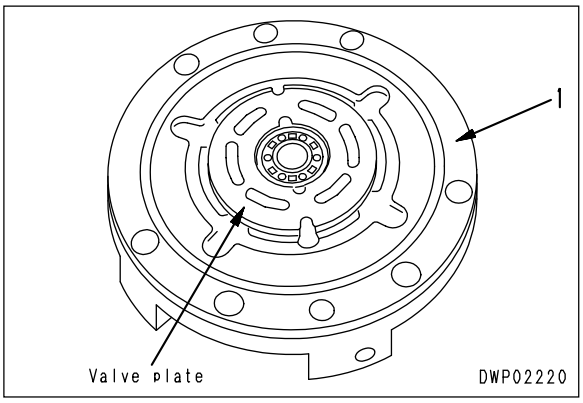


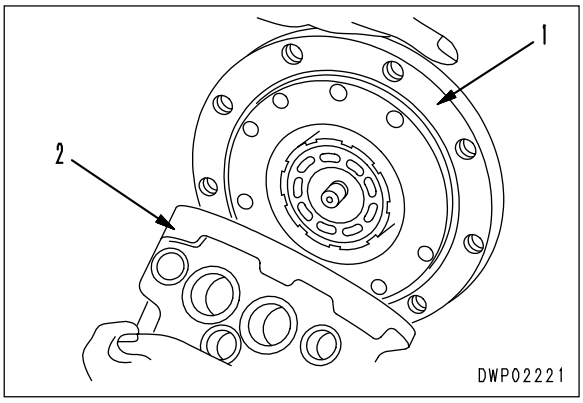
14. Assemble cylinder barrel assembly to body (2).

15. Fill inside of body (2) with oil (approx. 200 cc).



16. Assemble valve plate to body (1), then fit to body (2).
    ★ Coat both faces of the valve plate with grease to prevent it from falling.

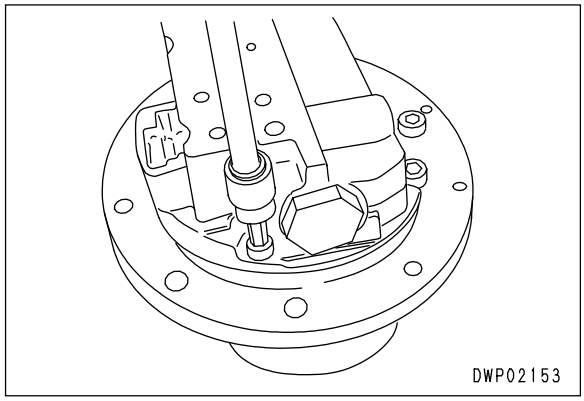




17. Tighten with hexagon socket head bolt.

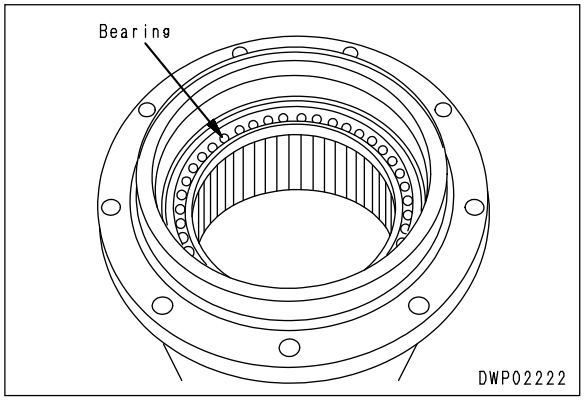
    kgm Bolt (M10): **51 – 65 Nm {5.2 – 6.6 kgm}**
    (Width across flats: 8 mm)

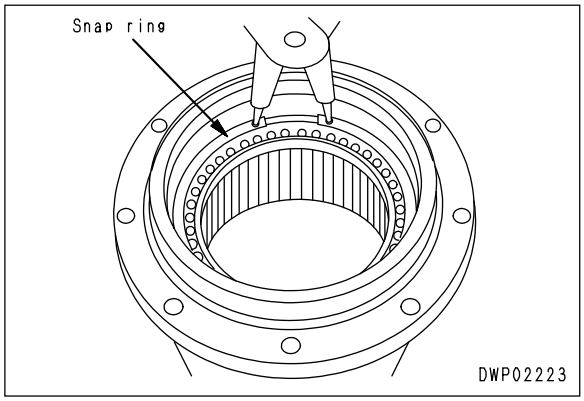
    ★ When fixing the motor in a vice, use an aluminum sheet to protect the body.

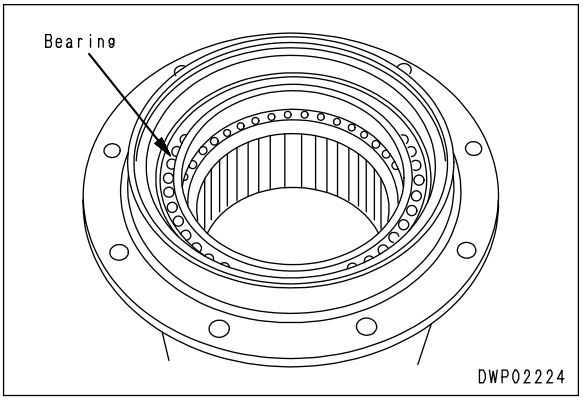


18. Assemble bearing, snap ring for hole, and bearing in turn to body.

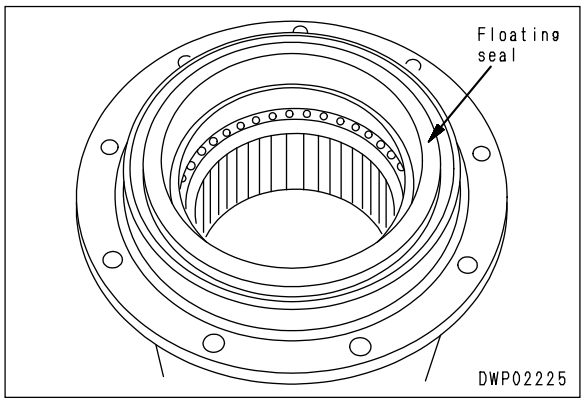
    ★ Press fit the bearing so that the thick inner race is on the outside compared with the snap ring.



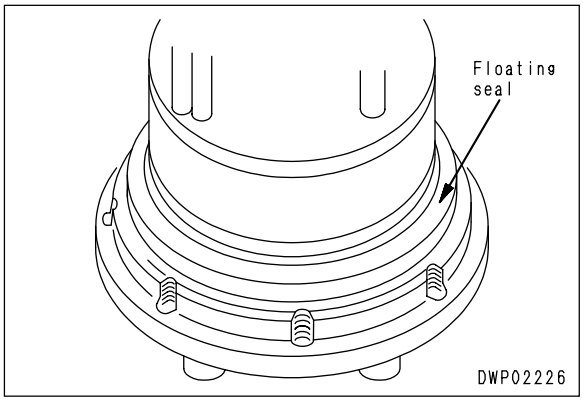




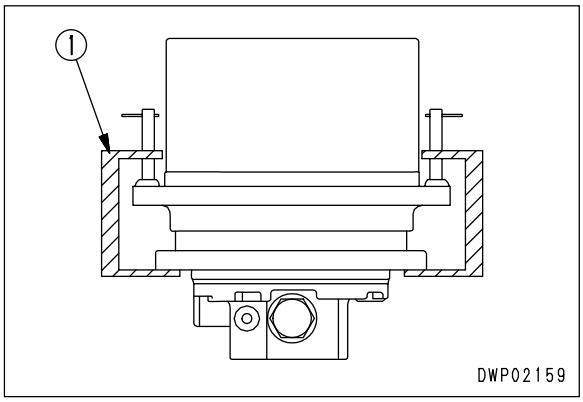
19. Assemble floating seal and O-ring assembly to body.
    ★ If it is difficult to assemble, coat the O-ring with grease.

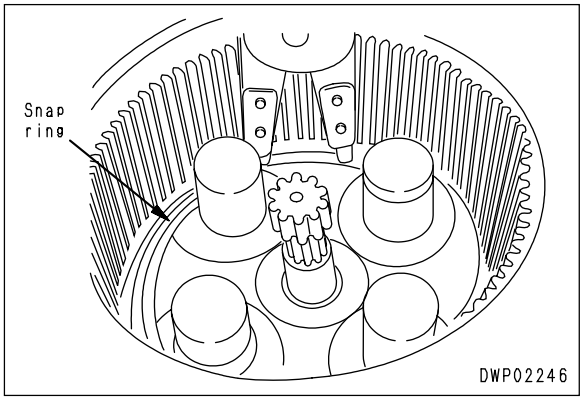


20. Assemble floating seal and O-ring assembly to hydraulic motor.
    ★ If it is difficult to assemble, coat the O-ring with grease.

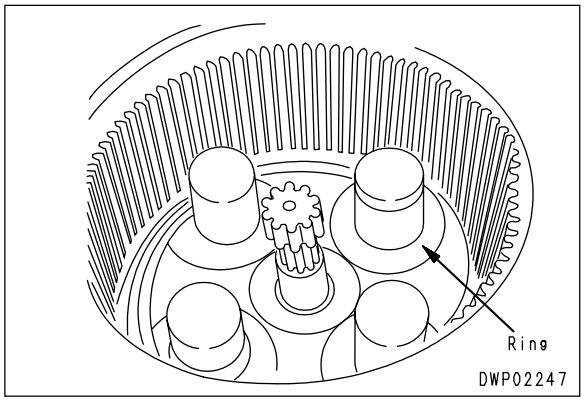


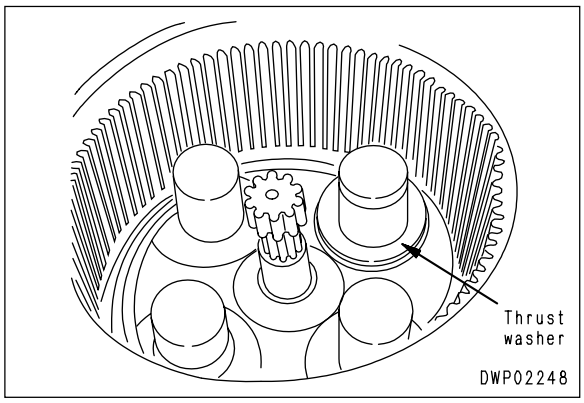
21. Assemble hydraulic motor to body, then secure with snap ring.
    1) Remove all oil and grease from seat surface of floating seal.
    2) If it is difficult to insert in the body, use a plastic hammer to tap uniformly around the circumference of the body to insert.
    3) Use tool ① or a hydraulic press to tighten the reduction gear flange and hydraulic motor flange, then install the snap ring.
    4) Adjust the thickness of the snap ring to adjust the preload of the bearing.

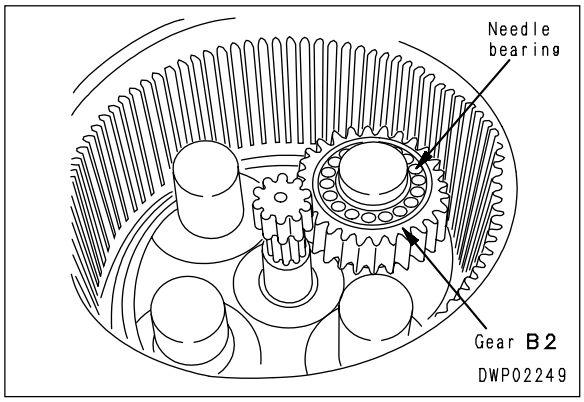


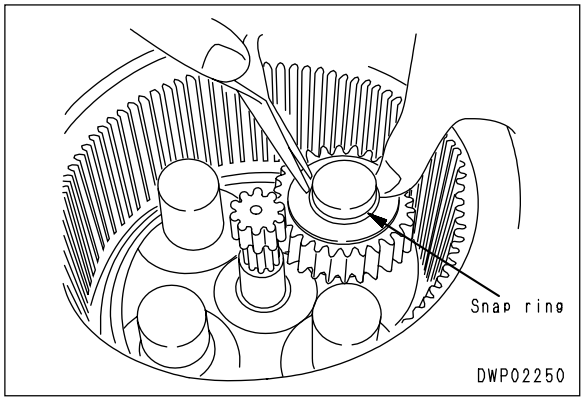


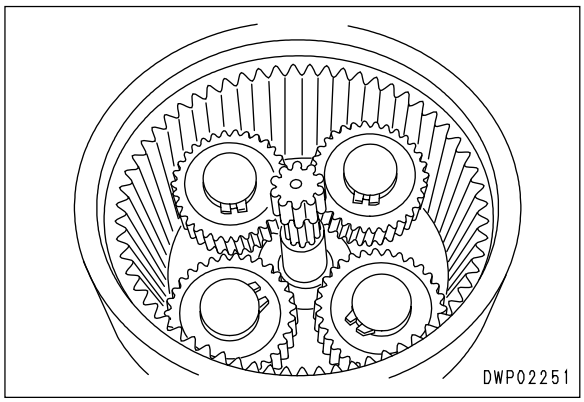
22. Assemble ring, thrust washer, gear **B2**, needle, and thrust washer in order, then secure with snap ring.
    ★ Assemble the thrust washer with the large inside diameter first.



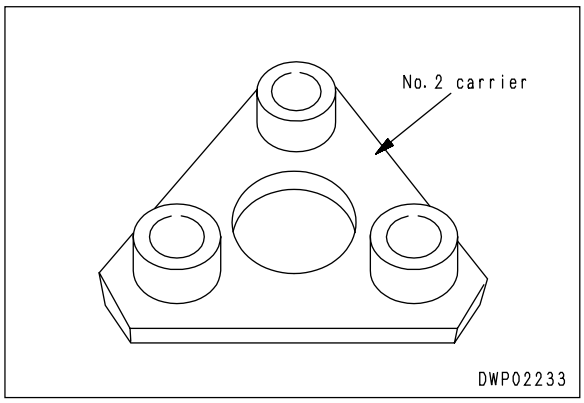




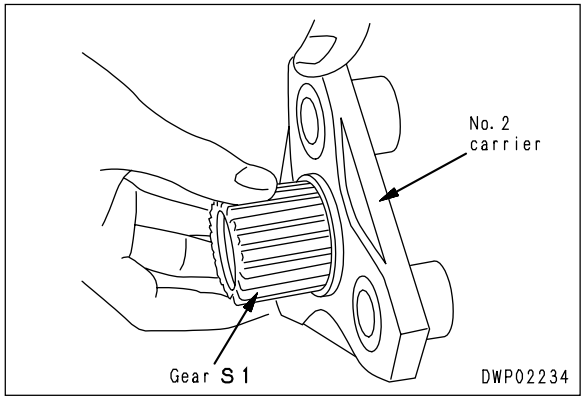


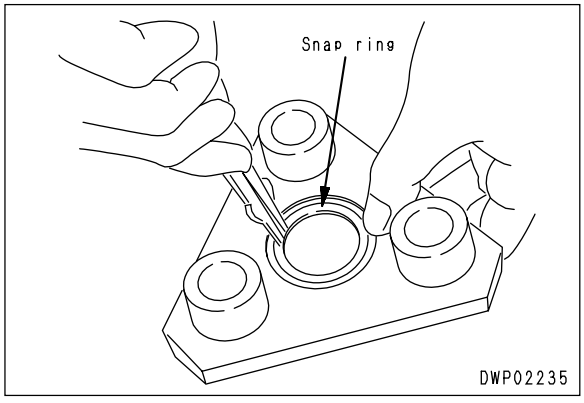


23. Press fit pin **B2** and spring pin to No.2 carrier.

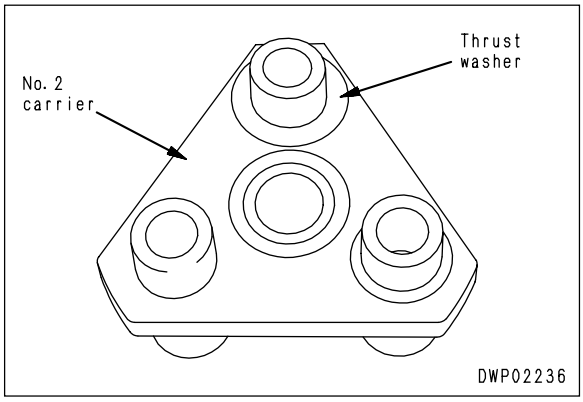


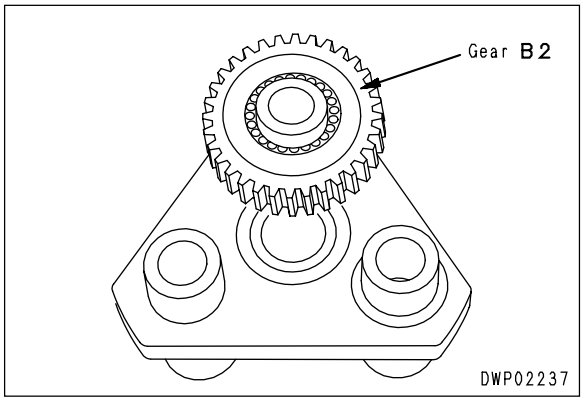
24. Assemble gear **S1** to No.2 carrier, then secure with snap ring.

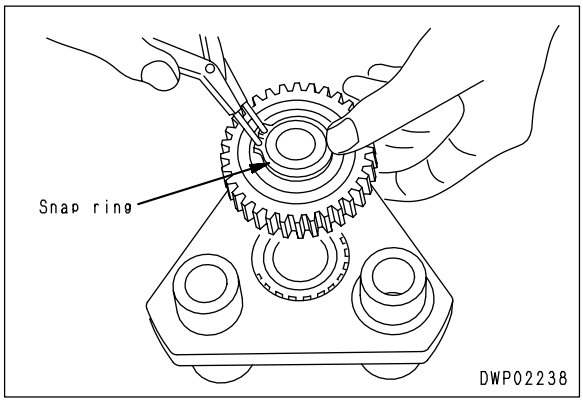


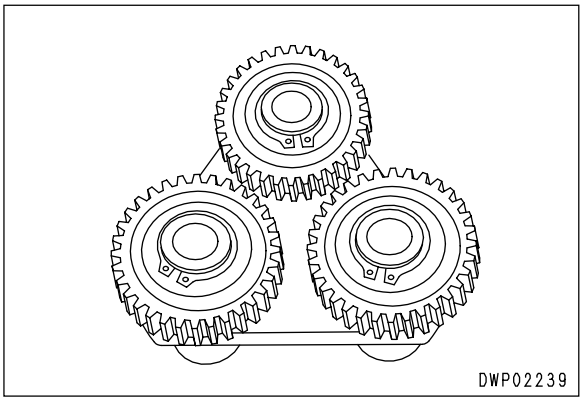


25. Assemble thrust washer, gear **B2**, needle, and thrust washer in turn to No.2 carrier, then secure with snap ring to make No.2 carrier assembly.

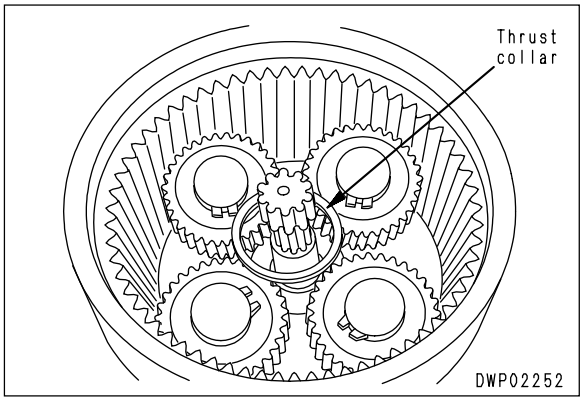


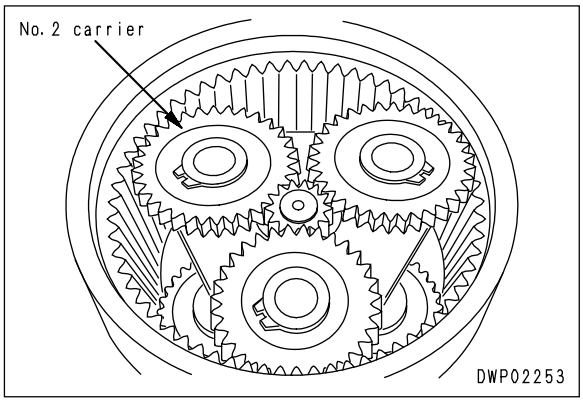




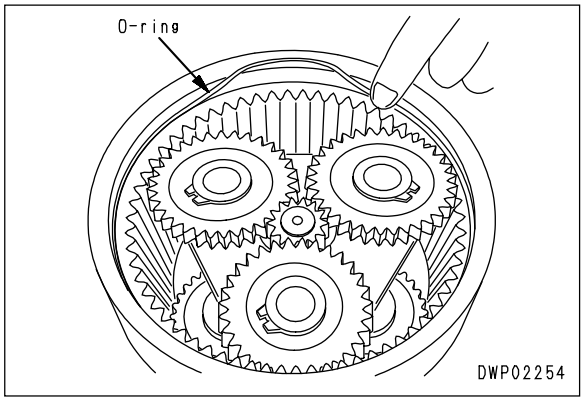


26. Assemble thrust collar and No.2 carrier assembly to body.

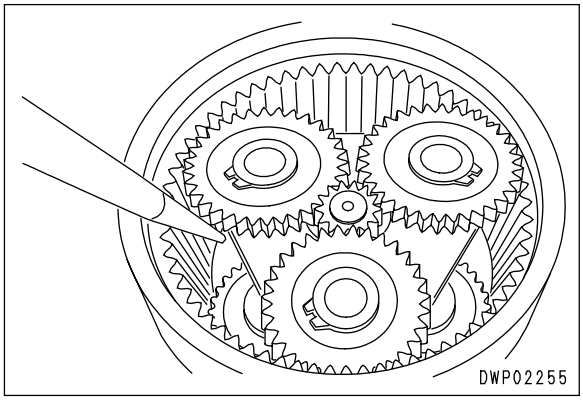




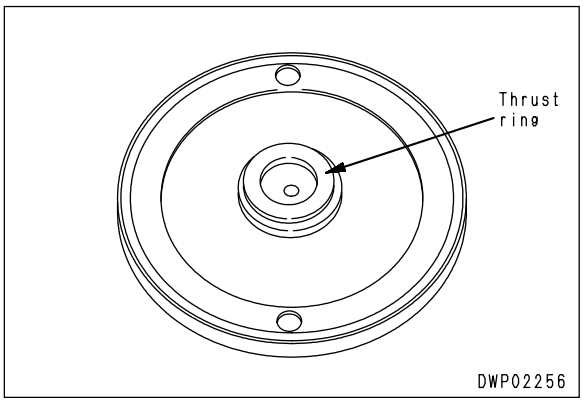
27. Fit O-ring to body.



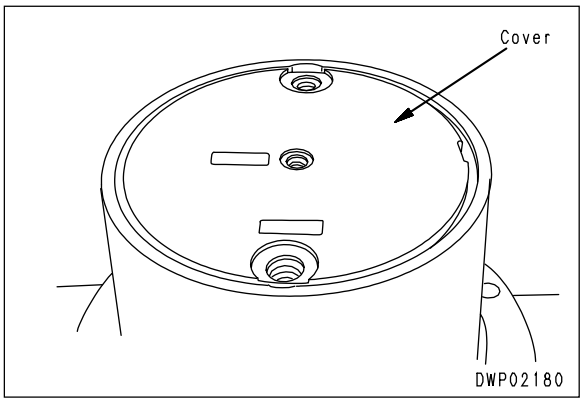
28. Fill with 700 cc of lubricating oil.



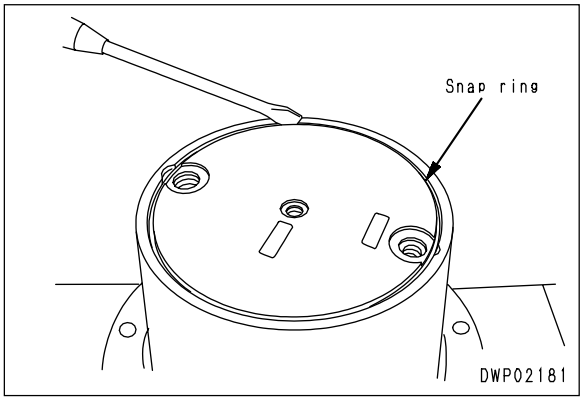
29. Assemble thrust ring to cover.
    1) Coat with grease to hold in position.
    2) Set with the larger chamfered side at the bottom.



30. Assemble cover to body.
    1) Coat the O-ring with grease, assemble horizontally, and be careful not to damage it.
    2) Align the tap holes (G3/8) at the top and bottom with the notches in the body when assembling.

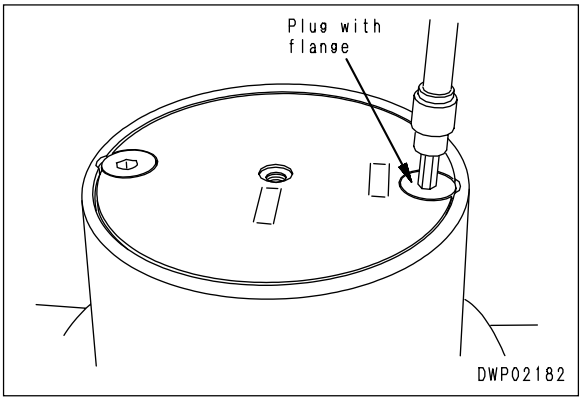


31. Assemble snap ring and secure cover.
    ★ Put a flat-headed screwdriver in contact with the end face of the snap ring and tap in the direction of the circumference to install.



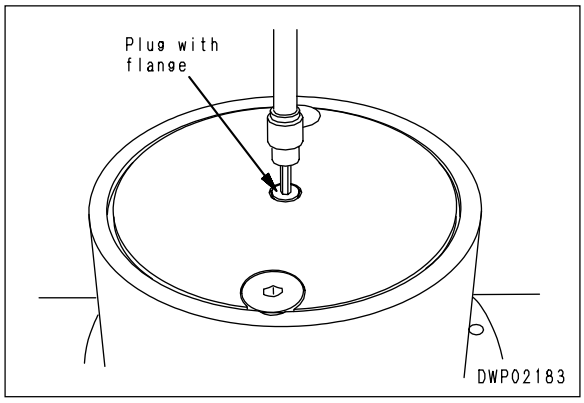
32. Fit O-ring to plug (G3/8) with flange, then tighten.

    kgm Plug: **46 – 51 Nm {4.7 – 5.2 kgm}**
    (Width across flats: 8 mm)



33. Fit O-ring to plug (G1/8) with flange, then tighten.

kgm Plug: **12 – 13 Nm {1.2 – 1.3 kgm}**
(Width across flats: 5 mm)



DISASSEMBLY AND ASSEMBLY OF TRAVEL MOTOR

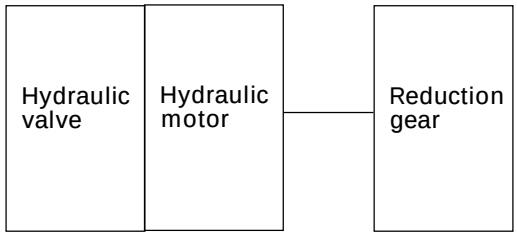
PHV-500 (FOR PC40R-8)

PROCEDURE FOR DISASSEMBLY AND ASSEMBLY

When carrying out disassembly and assembly, wash all parts thoroughly in flushing oil and be careful not to let any dirt get in. If dirt gets between assembly parts, it will cause seizure. Handle the parts with care and be careful not to scratch or damage them.

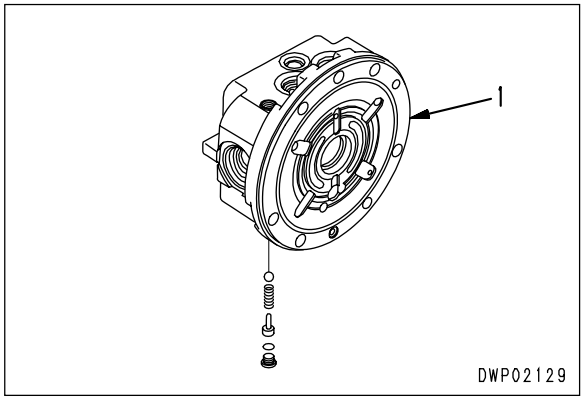
The following is an explanation of the procedure for assembling the travel motor. The disassembly procedure is in the opposite order. Note that the parts (bearings, pins) which are press fitted can basically not be disassembled.

The travel motor consists of 3 blocks as shown in the diagram below; each block is explained in turn.



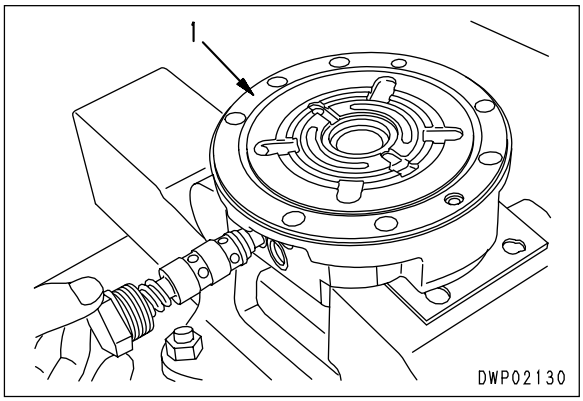
1. Fit ball, spring, spring holder, and O-ring to plug, then assemble plug to body (1).

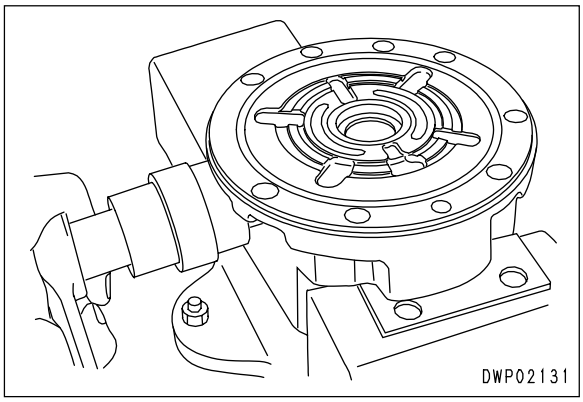
   kgm Plug: **12 – 13 Nm {1.2 – 1.3 kgm}**
   (Width across flats: 5 mm)



2. Fit spool assembly, ring, spring, and O-ring to plug, then assemble plug to body (1).
   ★ The spool assembly cannot be disassembled.
   ★ When fixing body (1) in a vice, use an aluminum sheet to protect it.

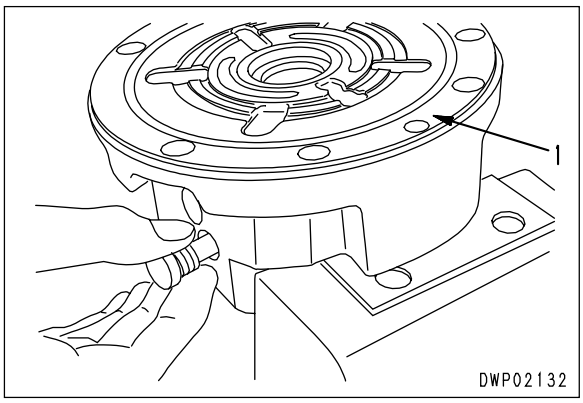
   kgm Plug: **196 – 245 Nm {20 – 25 kgm}**
   (Width across flats: 36 mm)

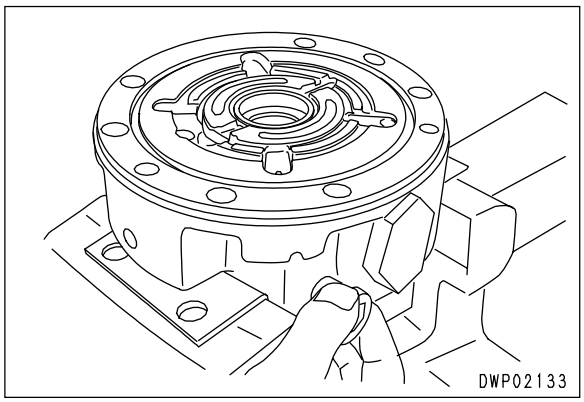


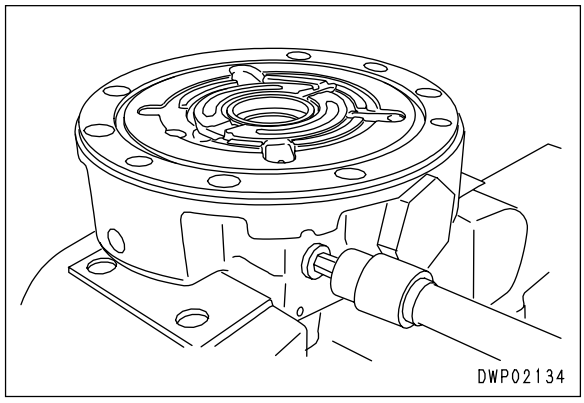


3. Fit spacer, spool, spring, and O-ring to plug, then assemble plug to body (1).

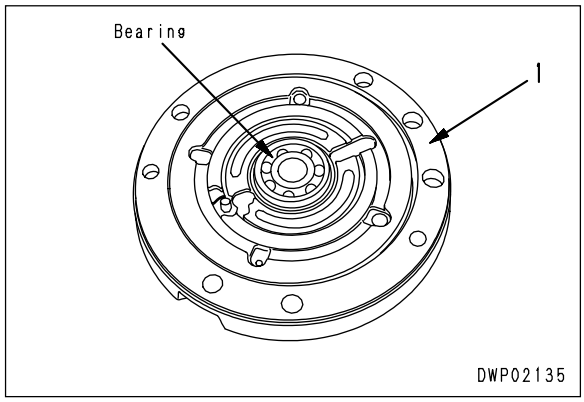
   kgm Plug: **46 – 51 Nm {4.7 – 5.3 kgm}**
   (Width across flats: 8 mm)



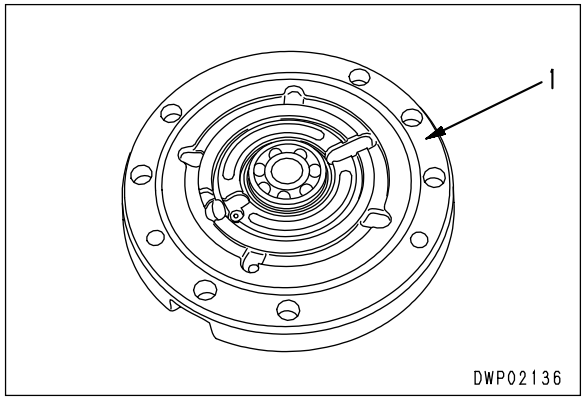




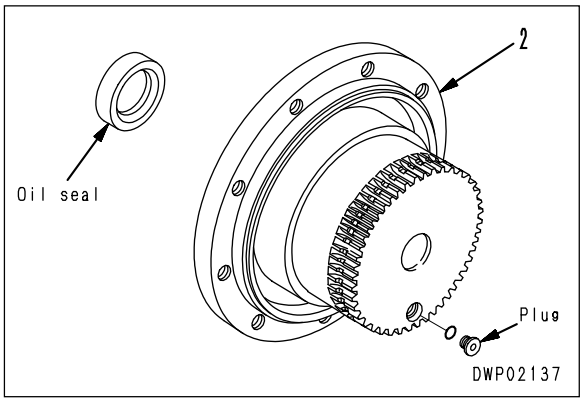
4. Press fit bearing and spring pin to body (1).



5. Install 2 O-rings to body (1).

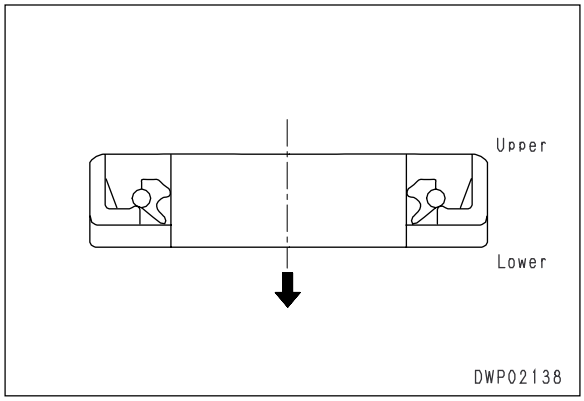


6. Press fit oil seal to body (2).
   ★ Fill the lip of the oil seal with grease.
   ★ Press fit in the direction shown in the diagram.

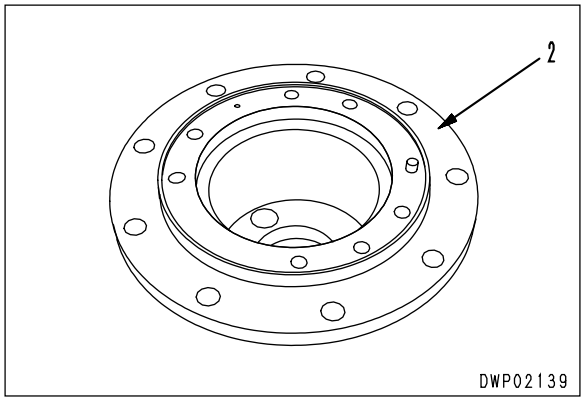


7. Fit O-ring to body (2), then tighten plug.

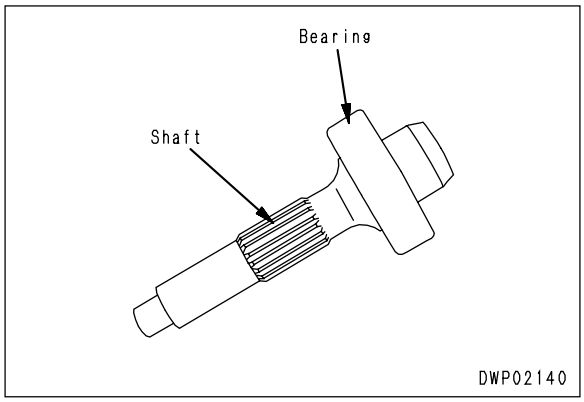
   kgm Plug: **12 – 13 Nm {1.2 – 1.3 kgm}**
   (Width across flats: 5 mm)



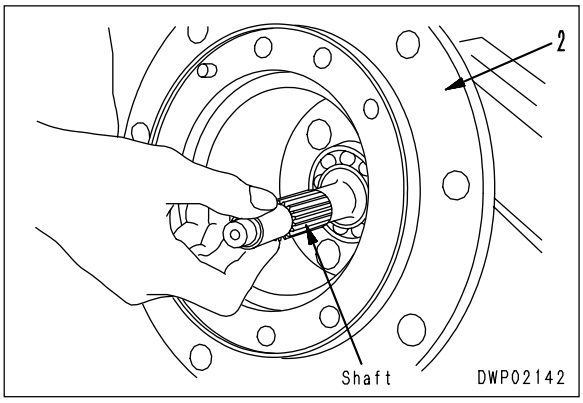
8. Assemble parallel pin to body (2).



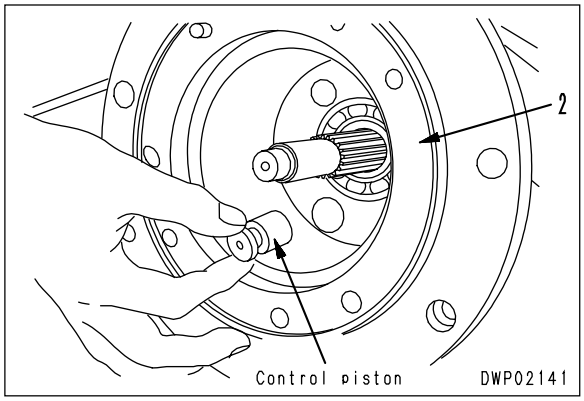
9. Press fit bearing to shaft.



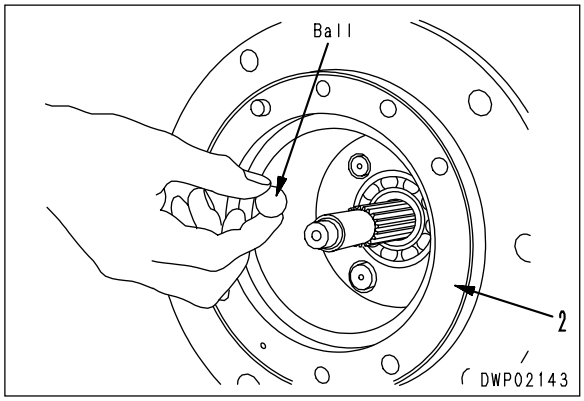
10. Assemble shaft to body (2).
    ★ Be careful not to let the shaft damage the oil seal.

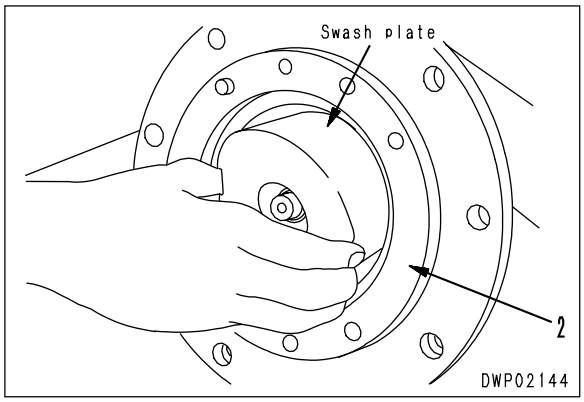


11. Assemble control piston to to body (2).

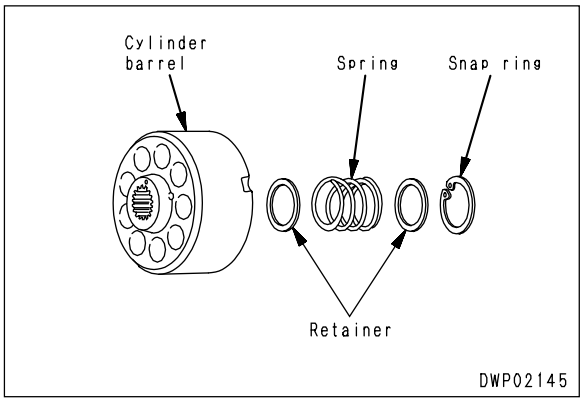


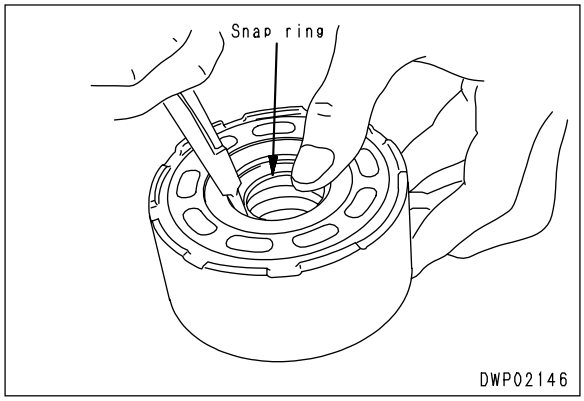
12. Assemble ball and swash plate to body (2).



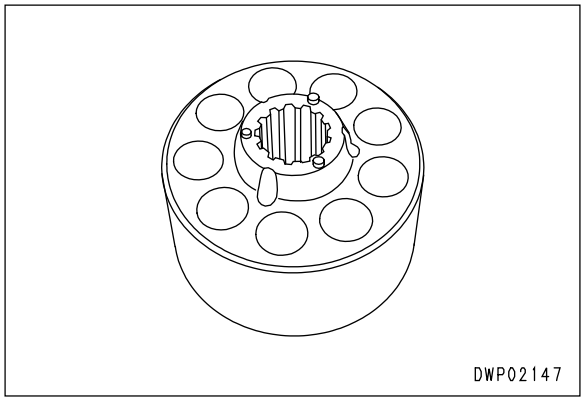


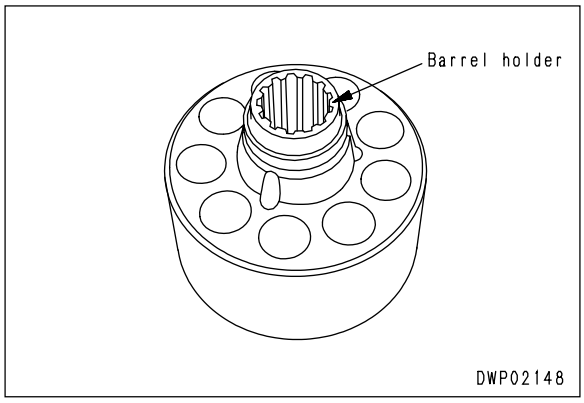
13. Assemble retainer, spring, and retainer in turn to cylinder barrel, then secure with snap ring.

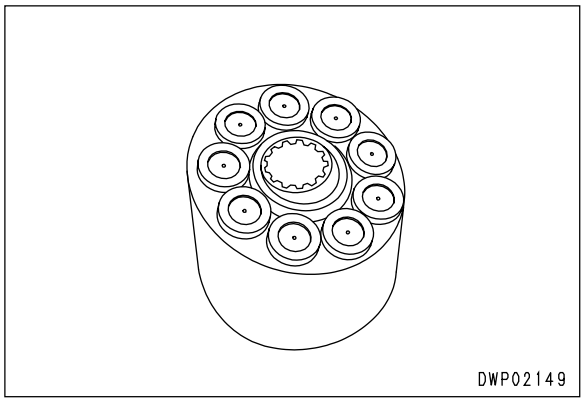




14. Assemble pin, barrel holder, piston/shoe in turn to shoe holder, then assemble shoe holder to cylinder barrel to make cylinder barrel assembly.

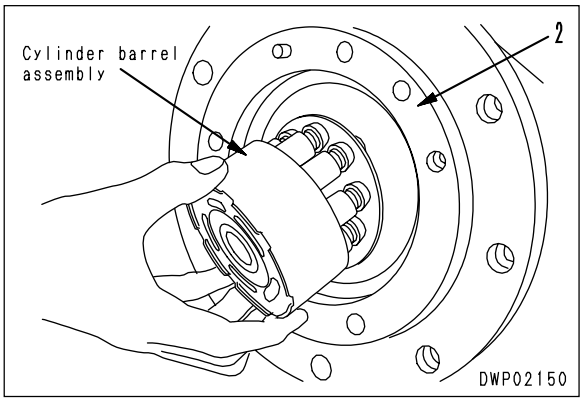




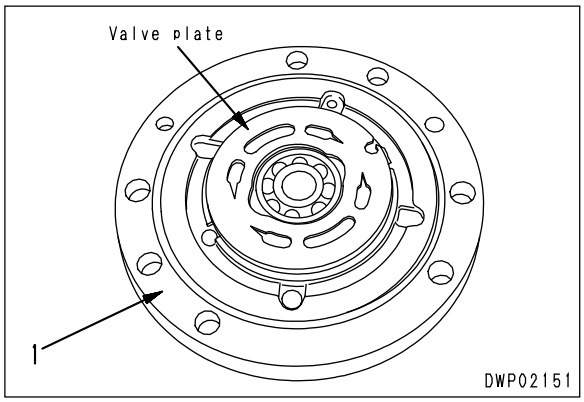


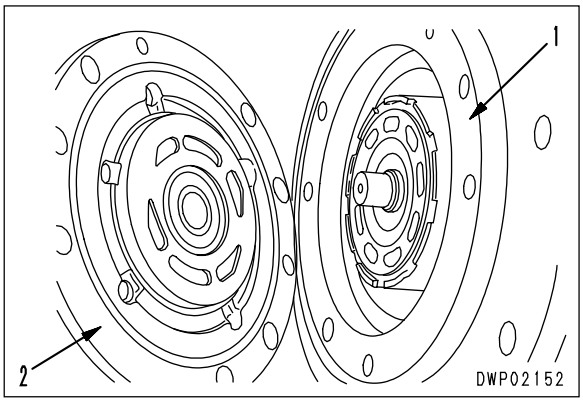
15. Assemble cylinder barrel assembly to body (2).

16. Fill inside of body (2) with oil (approx. 200 cc).



17. Assemble valve plate to body (1), then fit to body (2).
    ★ Coat both faces of the valve plate with grease to prevent it from falling.

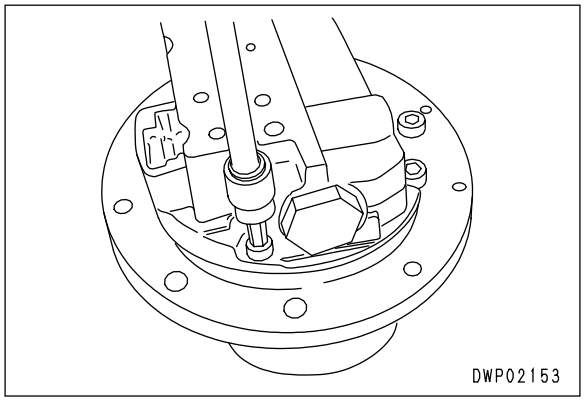




18. Tighten with hexagon socket head bolt.

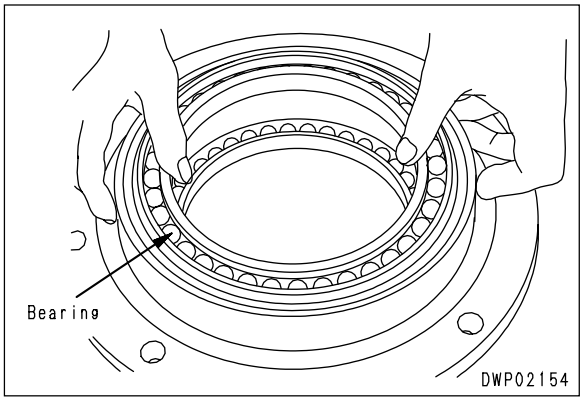
    kgm Bolt (M10): **51 – 65 Nm {5.2 – 6.6 kgm}**
    (Width across flats: 8 mm)

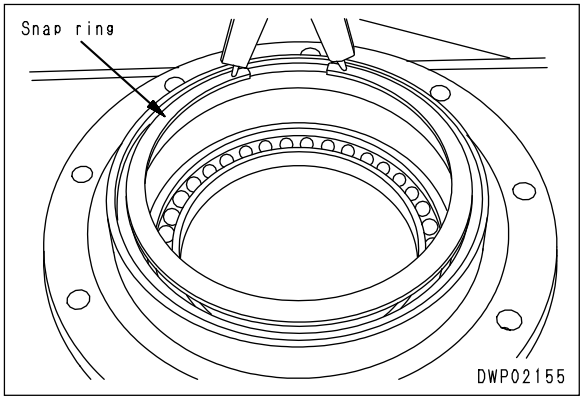
    ★ When fixing the motor in a vice, use an aluminum sheet to protect the body.

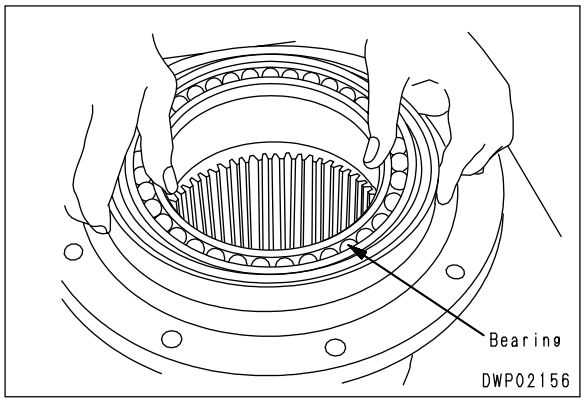


19. Assemble bearing, snap ring for hole, and bearing in turn to body.

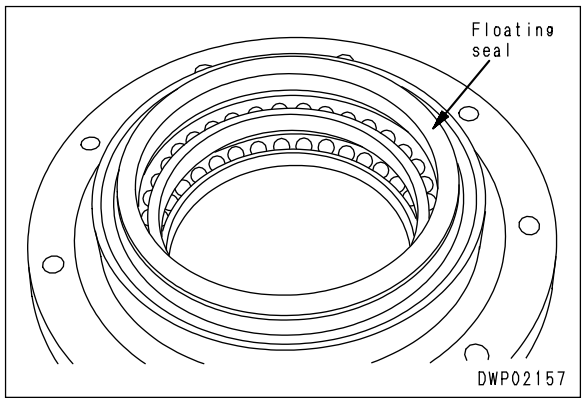
    ★ Press fit the bearing so that the thick inner race is on the outside compared with the snap ring.



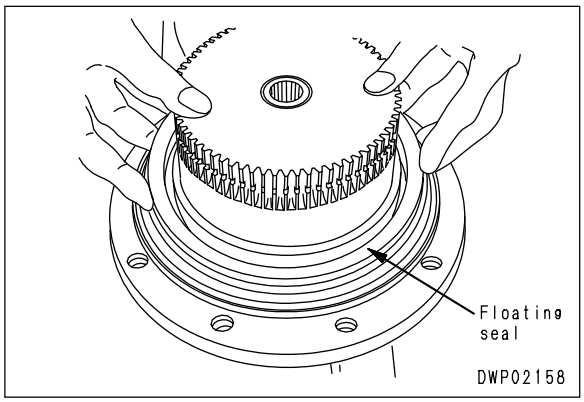




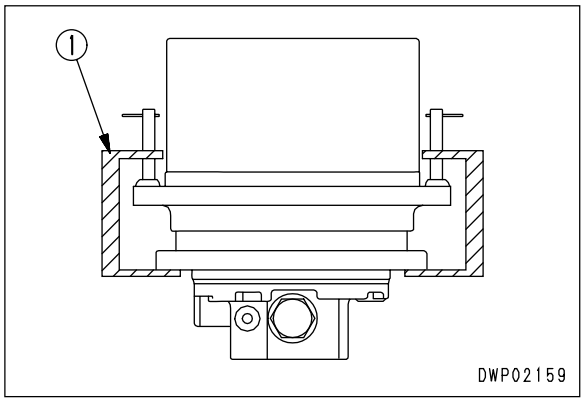
20. Assemble floating seal and O-ring assembly to body.
    ★ If it is difficult to assemble, coat the O-ring with grease.

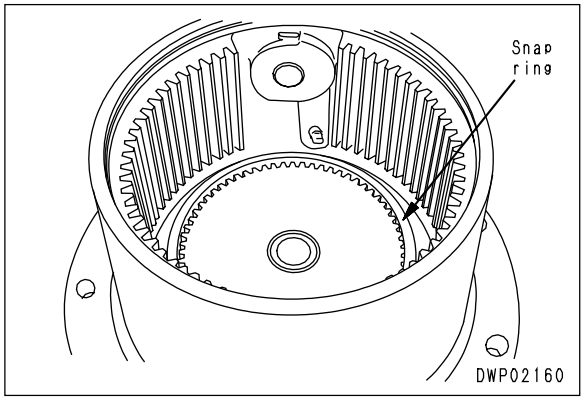


21. Assemble floating seal and O-ring assembly to hydraulic motor.
    ★ If it is difficult to assemble, coat the O-ring with grease.

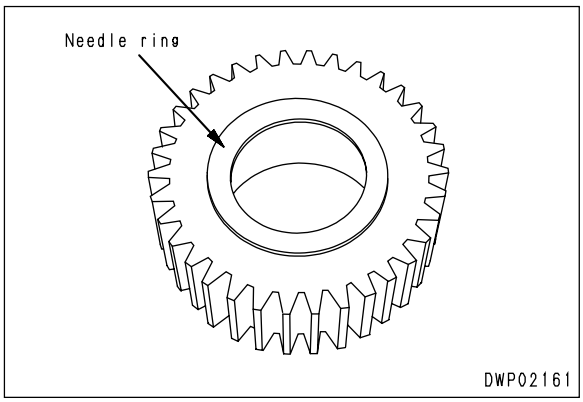


22. Assemble hydraulic motor to body, then secure with snap ring.
    1) Remove all oil and grease from seat surface of floating seal.
    2) If it is difficult to insert in the body, use a plastic hammer to tap uniformly around the circumference of the body to insert.
    3) Use tool ① or a hydraulic press to tighten the reduction gear flange and hydraulic motor flange, then install the snap ring.
    4) Adjust the thickness of the snap ring to adjust the preload of the bearing.

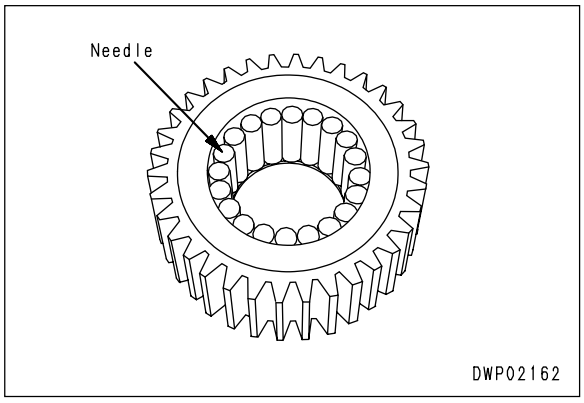




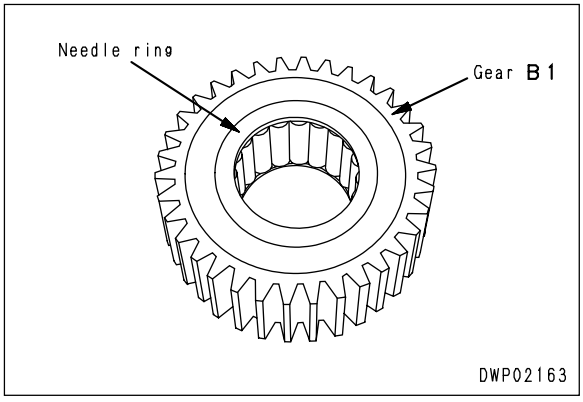
23. Press fit needle ring to gear **B1**.



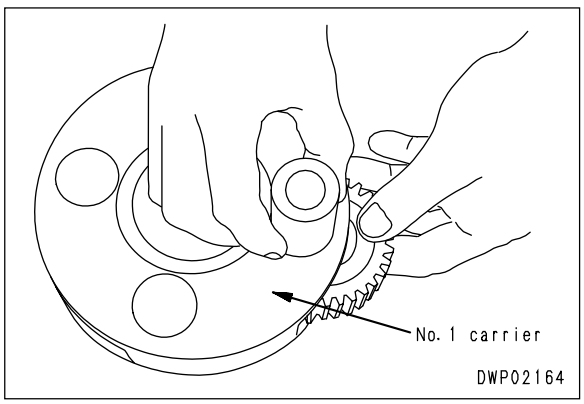
24. Assemble needle.
    ★ After assembling, coat with grease to prevent it from coming out.

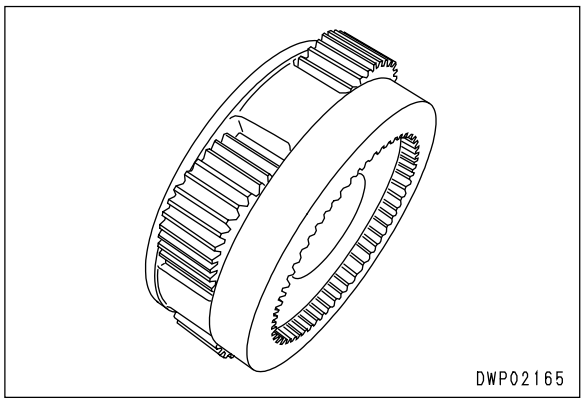


25. Press fit needle ring and make gear **B1** assembly.

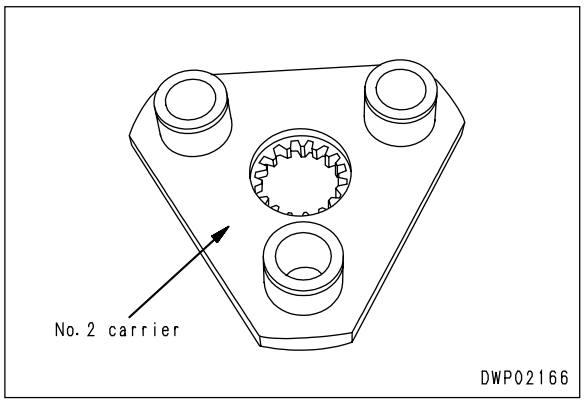


26. Assemble thrust washer, gear **B1** assembly, thrust washer, and pin **B1** in turn to No.1 carrier, then press fit spring pin to make No.1 carrier assembly.

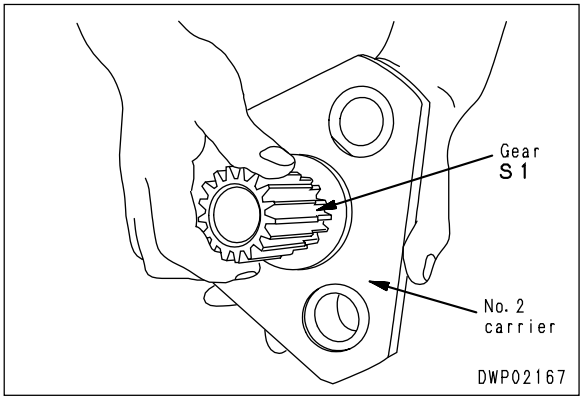


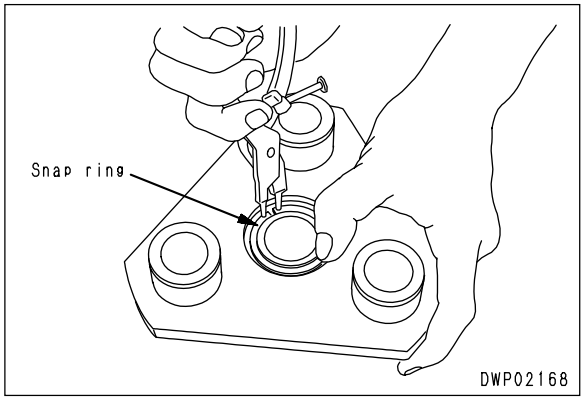


27. Press fit pin **b2** and spring pin to No.2 carrier.

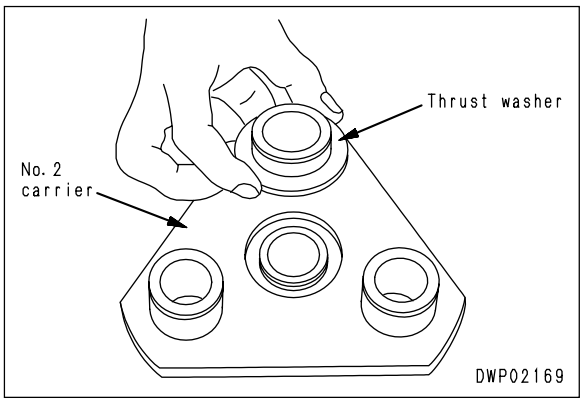


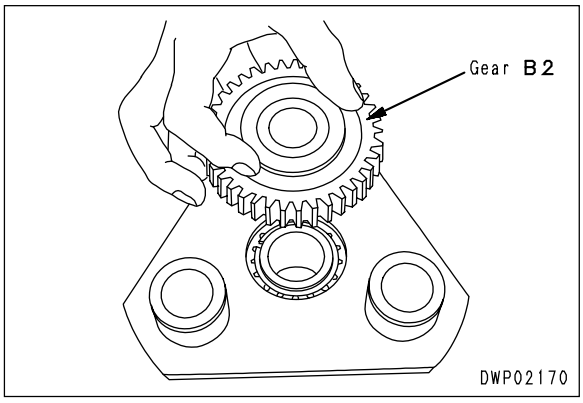
28. Assemble gear **S1** to No.2 carrier, then secure with snap ring.

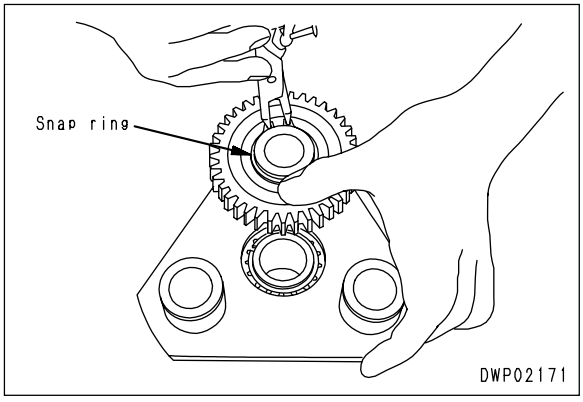


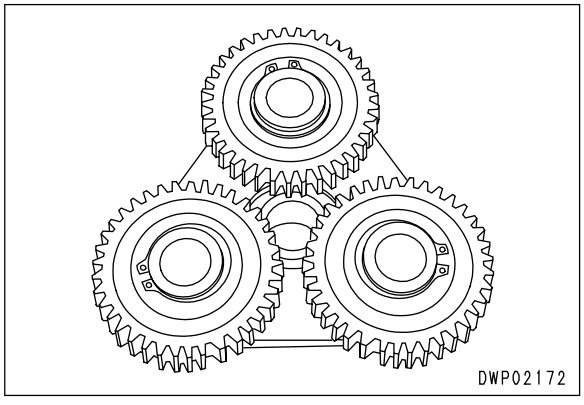


29. Assemble thrust washer, gear **B2**, needle, and thrust washer in turn to No.2 carrier, then secure with snap ring to make No.2 carrier assembly.

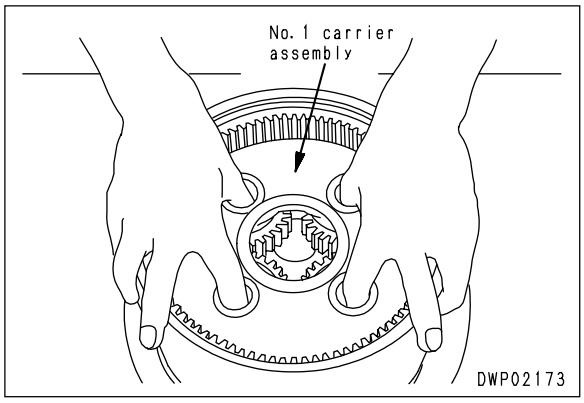




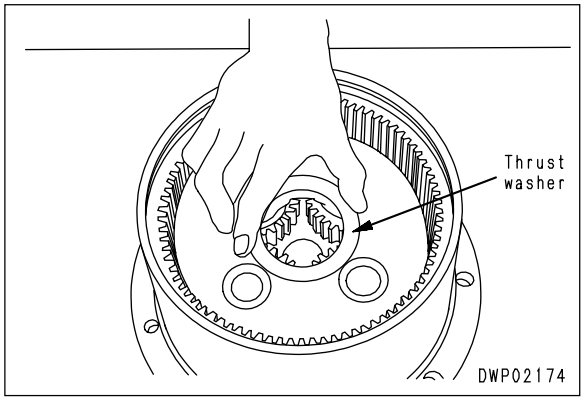


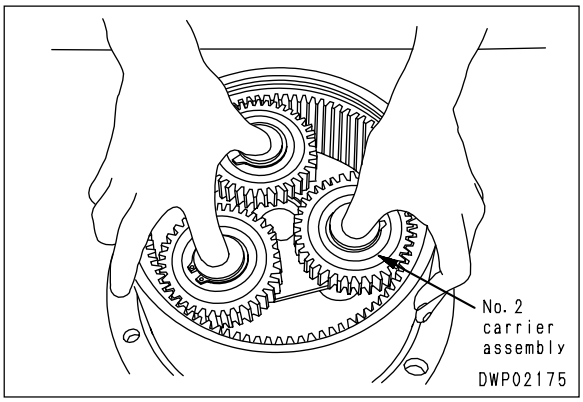


30. Assemble No.1 carrier assembly to body.
    ★ Assemble so that the spline of No.1 carrier meshes with the spline of the body.

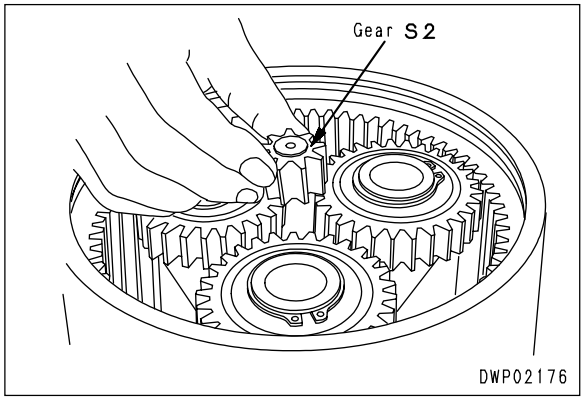


31. Assemble thrust washer and No.2 carrier in turn to body.

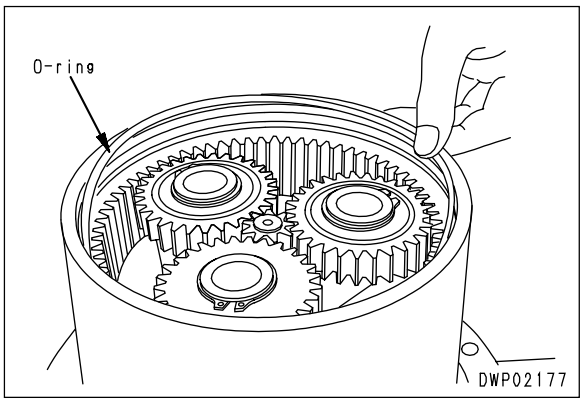




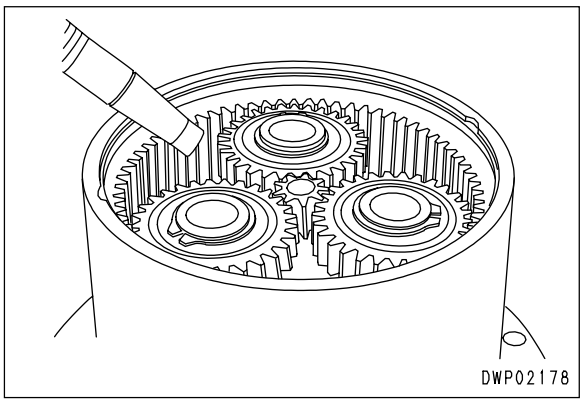
32. Assemble gear **S2.**



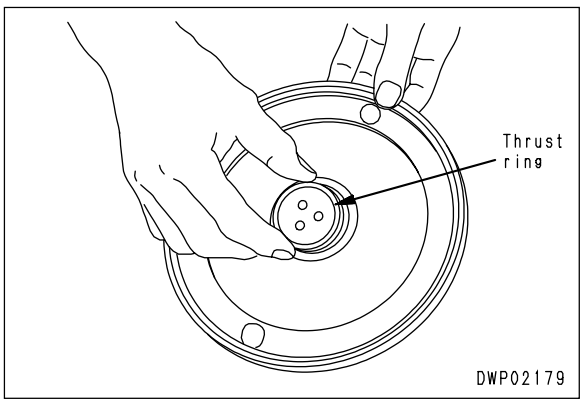
33. Fit O-ring to body.



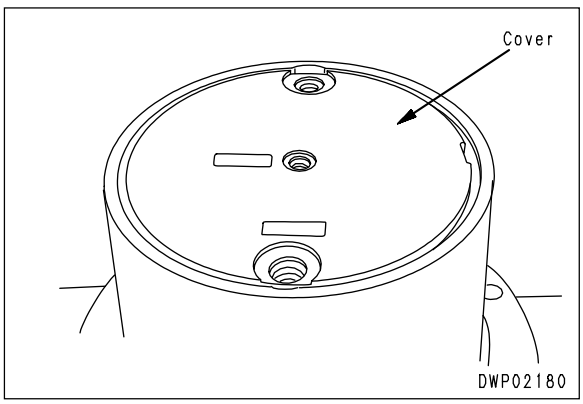
34. Fill with 800 cc of lubricating oil.



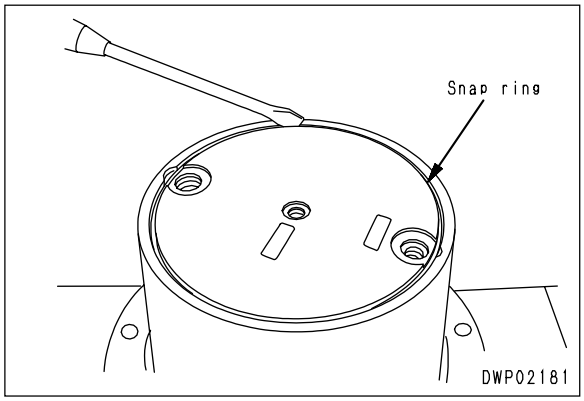
35. Assemble thrust ring to cover.
    ★ Coat with grease to hold in position.



36. Assemble cover to body.
    1) Coat the O-ring with grease, assemble horizontally, and be careful not to damage it.
    2) Align the tap holes (G3/8) at the top and bottom with the notches in the body when assembling.

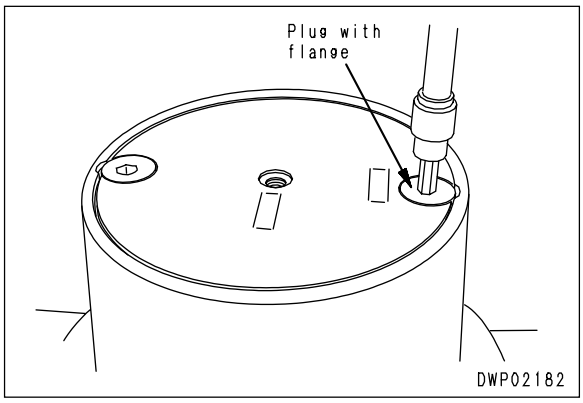


37. Assemble snap ring and secure cover.
    ★ Put a flat-headed screwdriver in contact with the end face of the snap ring and tap in the direction of the circumference to install.



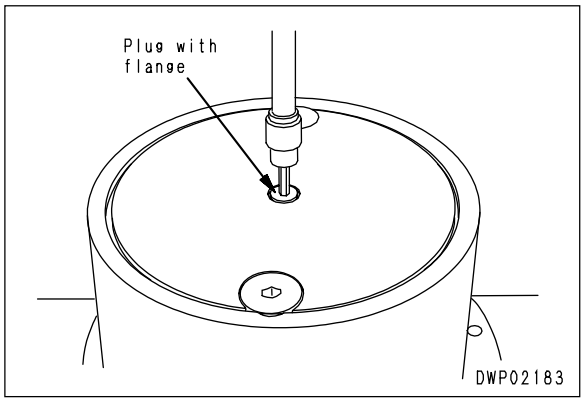
38. Fit O-ring to plug (G3/8) with flange, then tighten.

    kgm Plug: **46 – 51 Nm {4.7 – 5.2 kgm}**
    (Width across flats: 8 mm)



39. Fit O-ring to plug (G1/8) with flange, then tighten.

    kgm Plug: **12 – 13 Nm {1.2 – 1.3 kgm}**
    (Width across flats: 5 mm)



DISASSEMBLY, ASSEMBLY OF TRAVEL MOTOR

GM06VL
FOR PC45R-8

CONTENTS

Safety 30-97- 68
Sectional drawing of assembly 30-97- 69
Parts list 30-97- 71
Tools 30-97- 72
Tightening torque 30-97- 79
Disassembly 30-97- 80
Maintenance standards table 30-97-102
Assembly 30-97-104
Dimensions table of clearance adjustment parts 30-97-130
Performance confirmation test 30-97-131

SAFETY

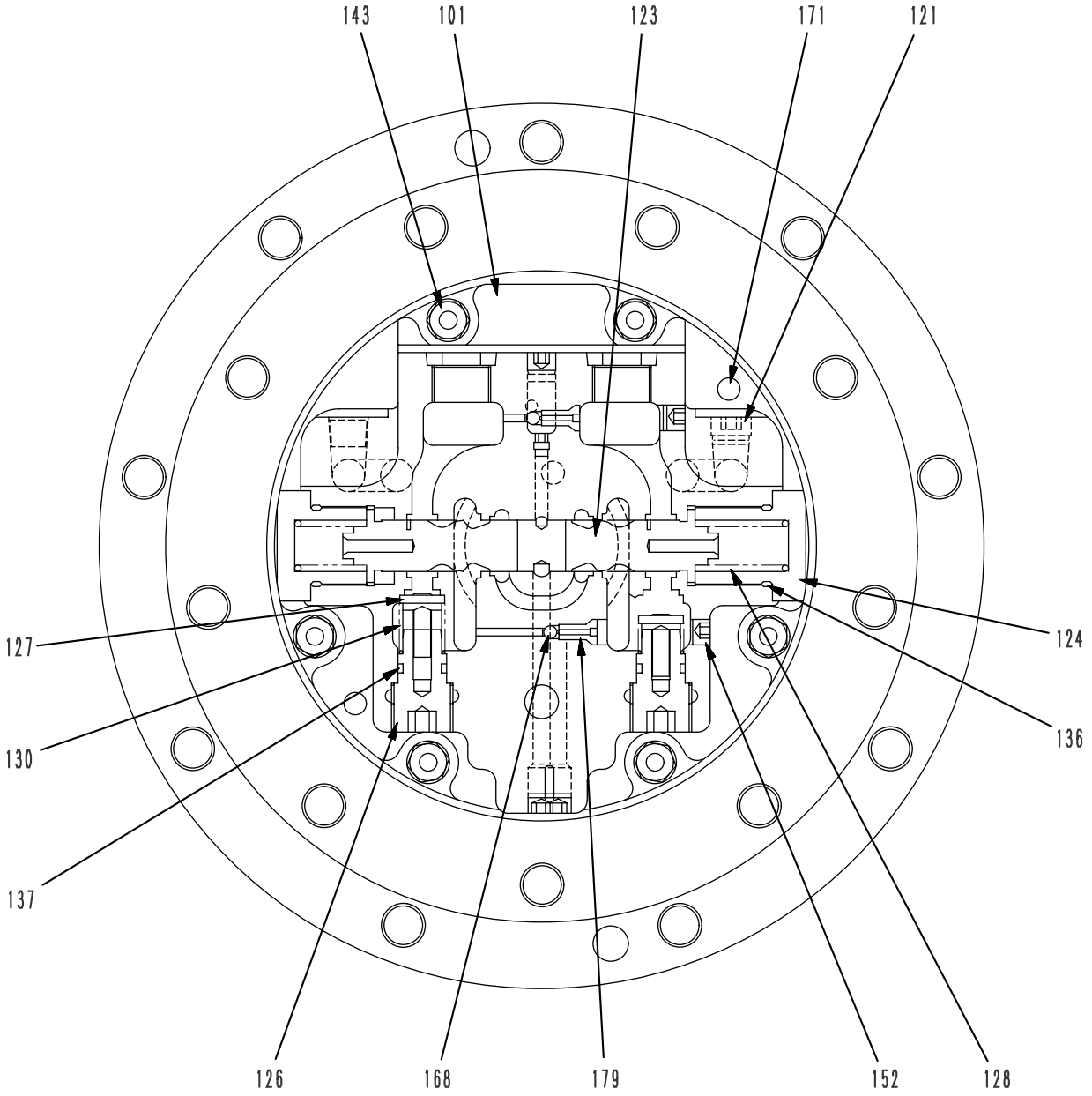
TYPES AND MEANING OF WARNING TERMS

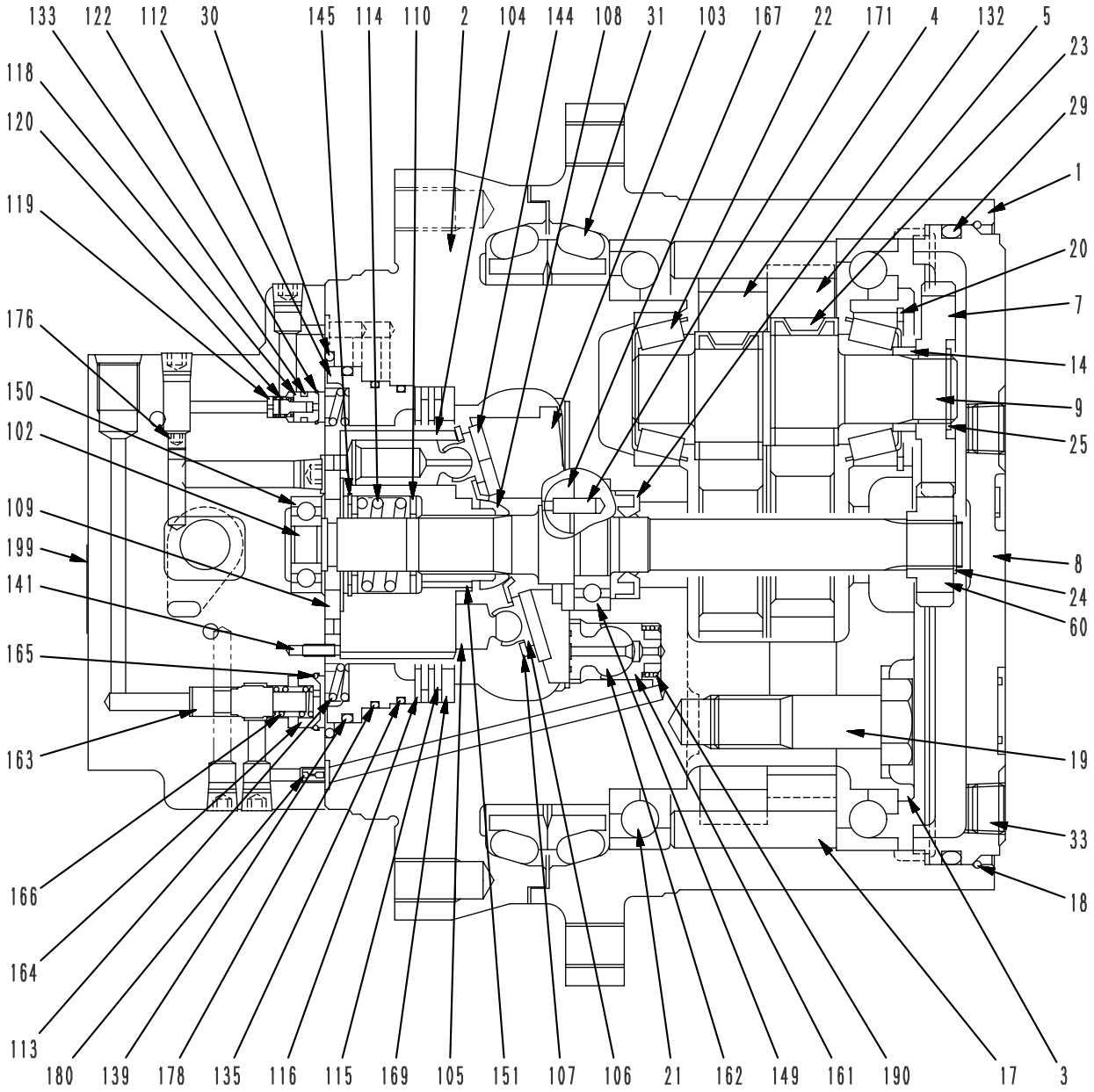
- The four warning terms shown in the following table are used in the maintenance manual according to the degree of expected danger (or the scale of an expected accident).
- Understand the meaning of these warning terms and observe the instructions given together with these terms.

WARNING TERM	MEANING
DANGER	This term means that there is an imminent danger and is used when neglecting the given procedure or instruction can cause death or serious injury.
WARNING	This term means that there is a latent danger and is used when neglecting the given procedure or instruction can cause death or serious injury.
CAUTION	This term means that there is a latent danger and is used when neglecting the given procedure or instruction can cause injury of medium or light degree or damage of equipment or devices.
	This symbol is used to draw the reader's attention or emphasize some information.

The terms of Danger and Warning do not appear in this maintenance manual, however.

SECTIONAL DRAWING OF ASSEMBLY




133
122
112
30
145
114
110
2
104
144
108
31
103
167
22
171
4
132
5
23
29
1
20
7
14
9
25
8
24
60
19
33
18
3
17
190
161
149
162
21
106
107
151
105
169
115
116
135
178
139
180
113
164
166
163
165
141
199
109
102
150
176
120
118
119

DVP01921

PARTS LIST

No.	Part name	Q'ty
	REDUCTION GEAR ASSEMBLY	
1	Hub	1
	Spindle kit	1
	• Spindle assembly	1
2	• • Spindle	1
3	• • Hold flange	1
19	• Reamer bolt	3
	RV gear assembly	1
	• RV gear kit	1
4	• • RV gear A	1
5	• • RV gear B	1
9	• Crankshaft	3
22	• Tapered roller bearing	6
23	• Needle roller bearing	6
6	Input gear	1
	Spur gear kit	1
7	• Spur gear	3
8	Cover	1
14	Distance piece	3
17	Pin	30
18	Ring	1
20	Snap ring	3
	[t: Above 1.90 up to 1.95 ↓ <At interval of 0.05> t: Above 2.45 up to 2.50]	
21	Ball bearing	2
24	C-type snap for shaft	1
25	C-type snap for shaft	3
27	O-ring	3
29	O-ring	1
30	O-ring	1
31	Floating seal	2
33	Hexagon socket head plug	3
	Rear flange assembly	1
	HYDRAULIC MOTOR	
	• Rear flange kit	1
101	• • Rear flange	1
123	• • Spool	2
152	• • Hexagon socket head plug	10
176	• • Orifice	1
179	• • Plug with flange	2
180	• • Filter	1
199	• • Nameplate	1
118	• Valve seat	1
119	• Valve	1
120	• Spring	1
121	• Hexagon socket head plug	1
122	• Ring	1
124	• Plug	2
126	• Plug	2

No.	Part name	Q'ty
127	• Valve	2
128	• Spring	2
130	• Spring	2
133	• O-ring	1
136	• O-ring	2
137	• O-ring	2
163	• Valve	1
164	• Stopper	1
165	• Ring	1
166	• Spring	1
168	• Steel ball	2
102	Shaft	1
103	Swash plate	1
104	Cylinder block	1
	Piston kit	1
	• Piston assembly	9
105	• • Piston	1
106	• • Shoe	1
107	Retainer plate	1
108	Thrust ball	1
109	Timing plate	1
110	Washer	2
112	Piston	1
113	Spring	8
114	Spring	1
115	Friction plate	2
116	Mating plate	2
132	Oil seal	1
135	O-ring	1
139	O-ring	1
141	Parallel pin	2
143	Hexagon socket head bolt	6
144	Thrust plate	1
145	Round R-type snap ring	1
149	Bearing	1
150	Bearing	1
151	Roller	3
	Piston assembly	1
161	• Piston	1
162	• Shoe	1
167	Pivot	2
169	Mating plate	1
171	Parallel pin	4
178	O-ring	1
190	Spring	1

TOOLS

1. Standard tools

Name	Type/Standard	Q'ty
Torque wrench	Nominal size: 1800, dial type	1
Torque wrench	Nominal size: 5600, dial type	1
Hexagon wrench	Nominal size: 5	1
Hexagon socket	Nominal size: 5, insertion angle: 12.7	1
Hexagon socket	Nominal size: 6, insertion angle: 12.7	1
Hexagon socket	Nominal size: 8, insertion angle: 12.7	1
Hexagon wrench	Nominal size: 8	1
Hexagon socket	Nominal size: 6, insertion angle: 12.7	1
Socket	Nominal size: 30, insertion angle: 12.7	1
Socket	Nominal size: 24, insertion angle: 12.7	1
Extension bar	Insertion angle: 12.7	1
Spanner	Round strong spanner 30 x 32	1
Hand hammer	Nominal size: 12	1
Plastic hammer	L = Approx. 300	1
Snap ring pliers	For shaft	1
Snap ring pliers	For hole	1
Center punch	ø9.5 x 100	1
Pin punch	ø3 x 150	1
Sling	Hook, wire rope	1 set
Washing brush		1
Wire brush		1
Container	Vat for general use W450 x D300 x H120	3
Paint marker	White oil paint	1
Leather gloves		1 pair
Wire netting basket		1 pc.
Rubber mat		1
Sealing tape		1 pc.
Jug	For hydraulic oil and lubricating oil	2

2. Devices

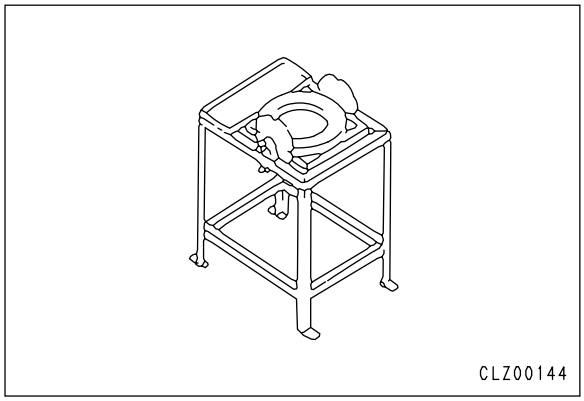
Applicable parts (Index No. in structural/ disassembly drawing)	Name	Type/Standard	Q'ty
Disassembly, assembly of products	Work table for general use		1 set
Cleaning of products and parts	Cleaning tank	For rough cleaning and finish cleaning	1 set
104, 149	Press work table	Capacity of press: Min. 1.96 kN {200 kg}	1 set
149	Heating tank	Heating ability: Min. 100°C Capacity: 500 x 500 x 500	1 set
1	Electric drill	Portable electric drill (Max. drill diameter: ϕ10)	1
1	Drill	ϕ2	1
161, 162, 163 for drying cleaned products and parts	Compressed air	Pressure: 294 – 490 kPa {3 – 5 kg/cm^2}	
3	Lathe		1 set

3. Measuring tools

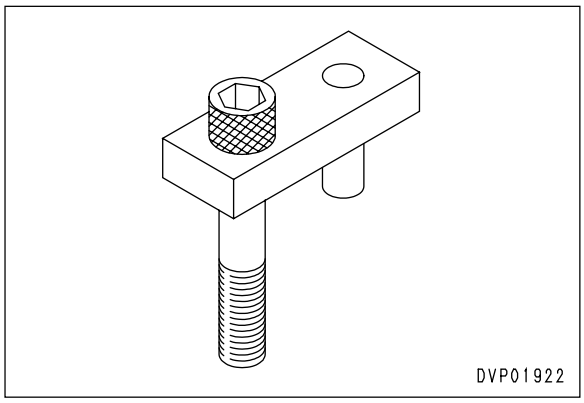
Applicable parts (Index No. in structural/ disassembly drawing)	Name	Type/Standard	Q'ty
For adjustment of thickness of snap ring (20)	Thickness gauge	Measurement range: 0.04 – 0.3 mm	2
For adjustment of thickness of snap ring (20)	Outside micrometer	Measurement range: 0 – 25 mm Min. division: 0.01	1
For adjustment of preload on ball bearing (21)	Unit-type depth micrometer	Measurement range: 0 – 25 mm Min. division: 0.01	1

4. Manufactured tools

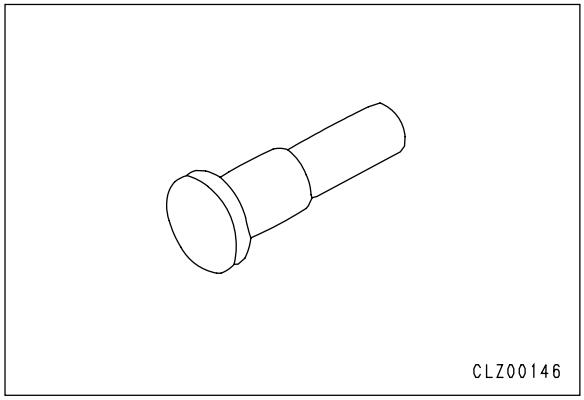
1) Work table for travel motor
   - A work table used to carry out disassembly and assembly work of the travel motor easily and safely.



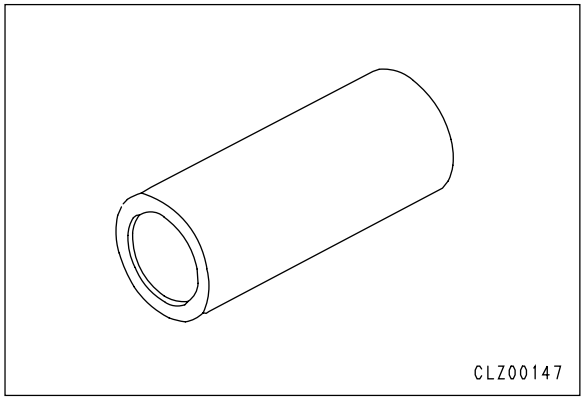
2) Clamp
   - A clamp used to fix spindle (2) and hub (1).



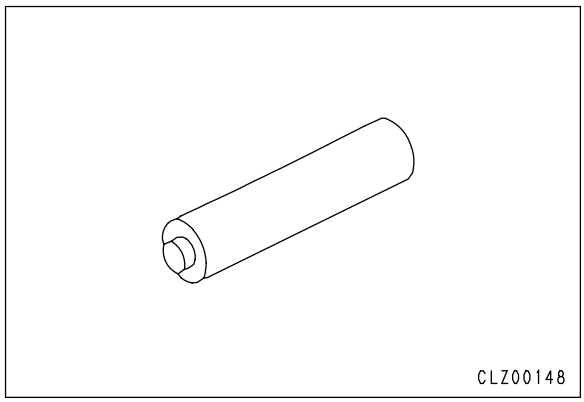
3) Holder (I)
   - A holder used to insert spring (114), washer (110), and snap ring (145) in cylinder block (104).
   - A holder used to remove spring (114) from cylinder block (104).



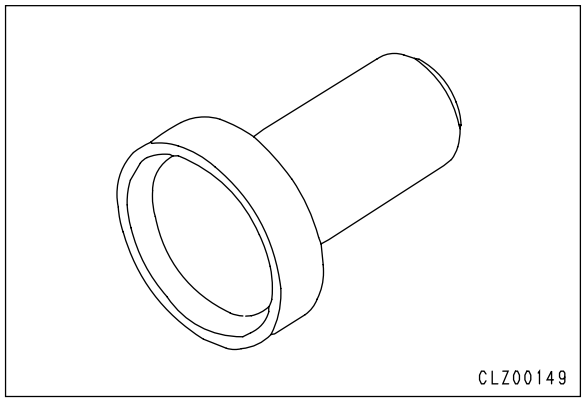
4) Holder (II)
   - A holder used to remove deep groove ball bearing (149) from shaft (102).



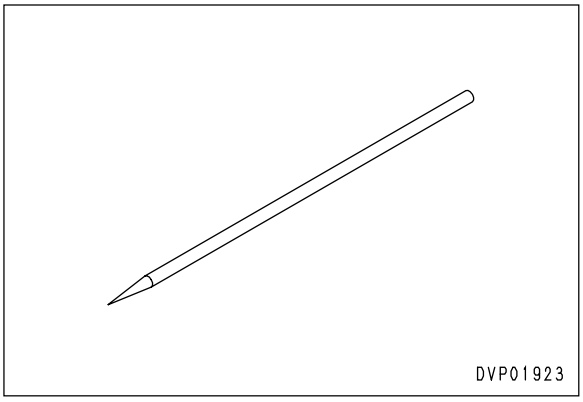
5) Holder (III)
   - A holder used to press fit oil seal (132) to the oil seal hole of spindle (2).



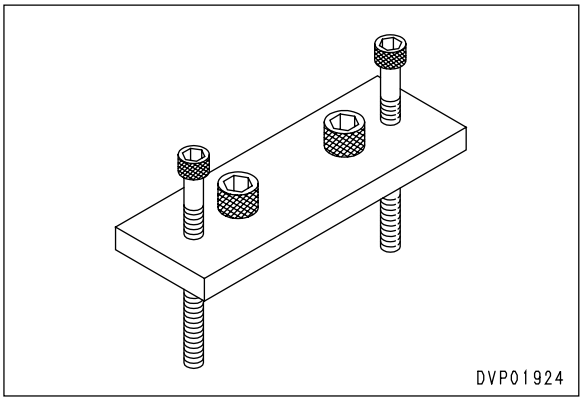
6) Holder (IV)
   - A holder used to set the RV gear assembly securely. Apply this holder to the outer race of tapered roller bearing (22) of crankshaft (9) of the RV gear assembly and hit it lightly with a hammer to set the RV gear assembly.



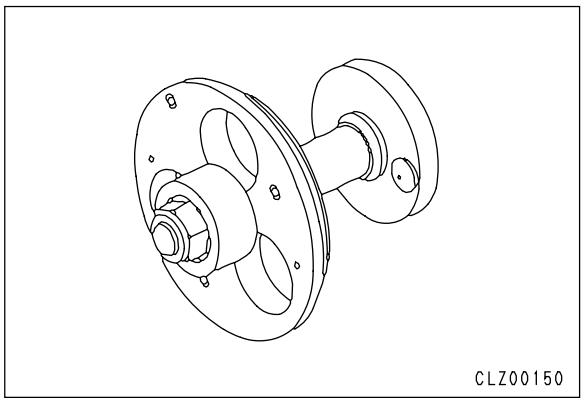
7) Pointed steel rod
   - A steel rod used to take ring (18) out of hub (1).



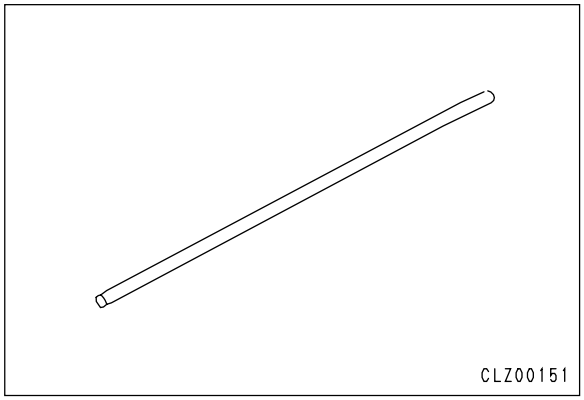
8) Cover removing jig
   - A jig used to remove cover (8) from hub (1).



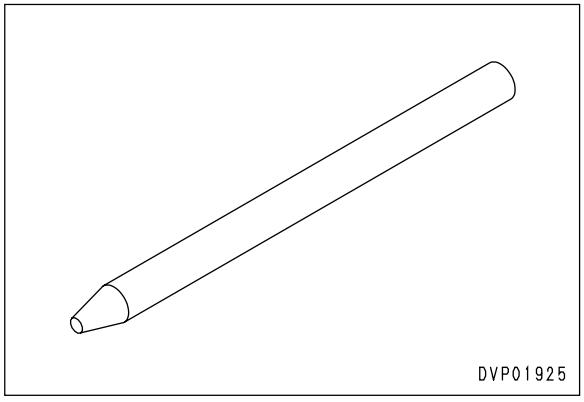
9) Jig to adjust preload on main bearing
   - A jig used to press fit bearing (21) to hub (1).
   - A jig used to measure the axial clearance of bearing (21).



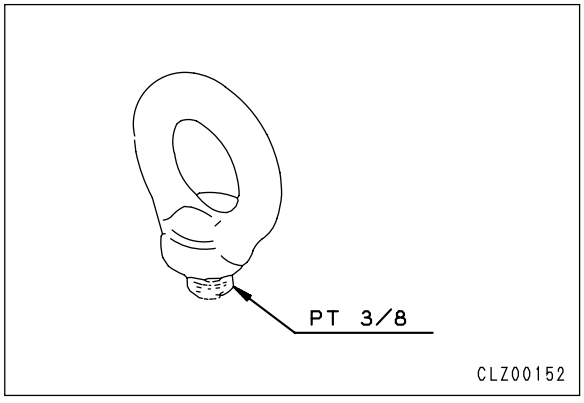
10) Steel rod (I)
   - A steel rod used to take ring (18) out of hub (1).



11) Aluminum rod
   - An aluminum rod used to remove oil seal (132) from the spindle.
   - An aluminum rod used to remove main bearing (21) and pin (17) from hub (1).

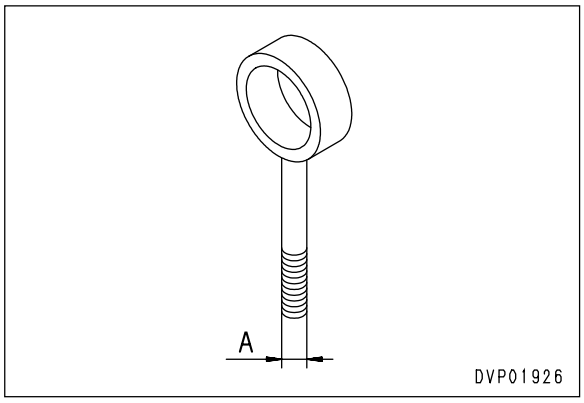


12) Eyebolt for PT
   - An eyebolt used together with wires and a crane to take cover (8) out of hub (1).

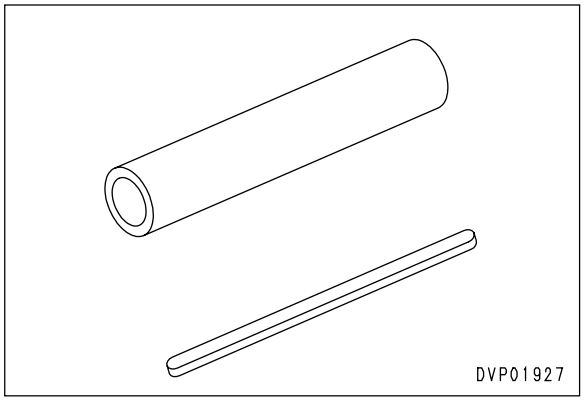


13) Long eyebolt
- An eyebolt used to sling the travel motor, spindle (2), and hub (1).

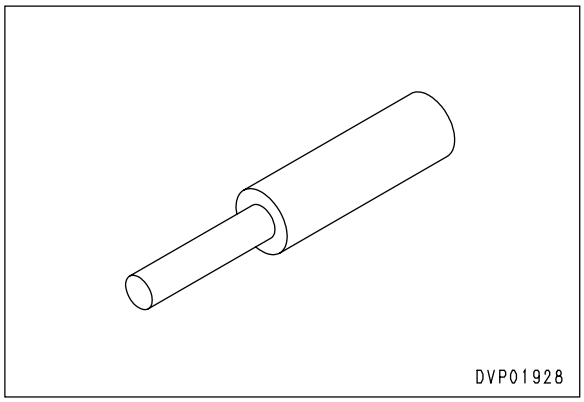
Use	A
Hub	M14
Spindle	M14
Travel motor	M14



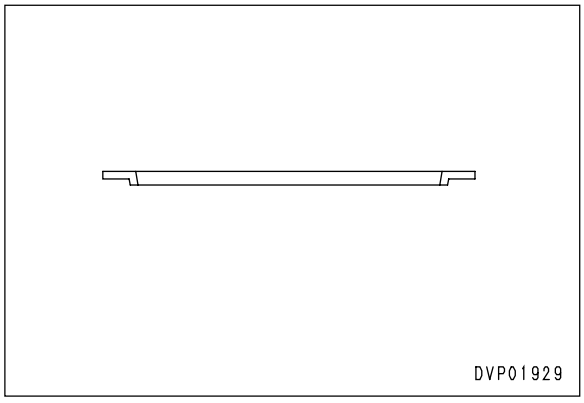
14) Spatula
- A spatula used to remove the inner race of bearing (21) from spindle (2).
- A spatula used to remove timing plate (109) from rear flange (101).



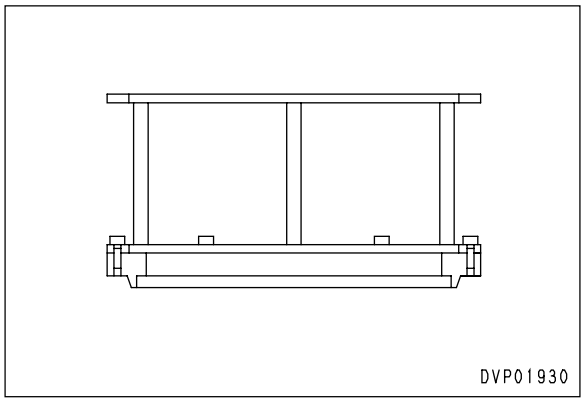
15) Steel rod (II)
- A steel rod used to remove the outer race of bearing (21).



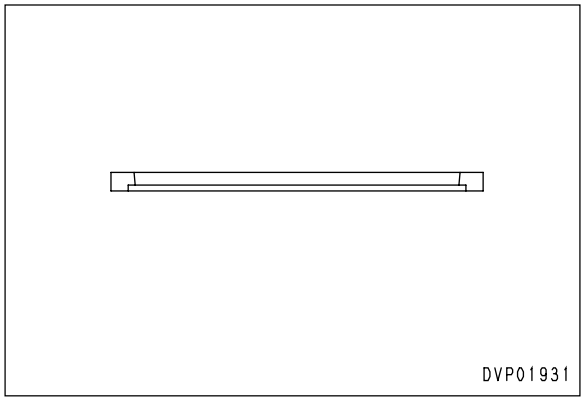
16) Jig to fit floating seal (I)
- A jig used to fit floating seal (31) to hub (1).



17) Jig to fit floating seal (II)
- A jig used to fit floating seal (31) to hub (1) and spindle (2).



18) Jig to fit floating seal (III)
- A jig used to fit floating seal (31) to spindle (2).



TIGHTENING TORQUE

Part No.	Bolt/Nut to be used		Width across flats (mm)	Tightening torque (Nm {kgm})
	Name	Nominal size		
19	Reamer bolt	M16 P2.0	24	188.29 {1,920}
33	Hexagon socket head plug	PT3/8	8	39.23 {400}
124	Plug	M25 P1.5	30	107.87 {1,100}
126	Plug	M20 P1.5	8	78.45 {800}
143	Hexagon socket head bolt	M8 P1.25	6	29.42 {300}
121	Plug	PF1/4	6	29.42 {300}
154	Hexagon socket head plug	PT1/8	5	12.26 {125}

DISASSEMBLY

1. Preparation

- Before disassembling the travel motor, prepare the following items.

1) Preparation of work table
   - Prepare a work table for disassembling the travel motor.
   - The work table must be so strong that the internal parts of the travel motor can be disassembled and assembled on it and its top must be so wide that those parts can be arranged on it and will not move or fall during the work.
   - Spread a rubber or vinyl sheet over the work table.
2) Preparation of tools and materials
   Prepare the tools and materials shown in the tool section.

2. General precautions for work

★ Since the disassembled internal parts are coated with hydraulic oil, the are slippery. Take care not to let them slip down to hurt you or themselves.

★ Combustible liquid such as kerosene is used to clean the parts. Handle it very carefully since it can cause a fire and a burn on you.

1) Before disassembling the travel motor, consider the inspection items, characteristics of the detected trouble, etc. and then work according to the given disassembly procedure.
2) Since the parts are made very precisely, handle them carefully. Take care not to hit them against each other or drop them.
3) If a firmly fitted part is removed by hitting or prying it, it may have burrs or may be broken. As a result, it cannot be installed any more and the performance may be lowered by it. Work on such a part patiently.
4) If the travel motor is left disassembled partly or perfectly, its parts may be rusted by moisture and dust. Accordingly, if it is obliged to interrupt the work, take rust-preventive measures and protect the parts from dust.
5) When disassembling, make match marks on the mating faces of the parts.
6) Arrange the removed parts well so that they will not be damaged or lost.
7) Replace each seal once the travel motor is disassembled, as a rule. Accordingly, prepare the all replacement seals before disassembling.

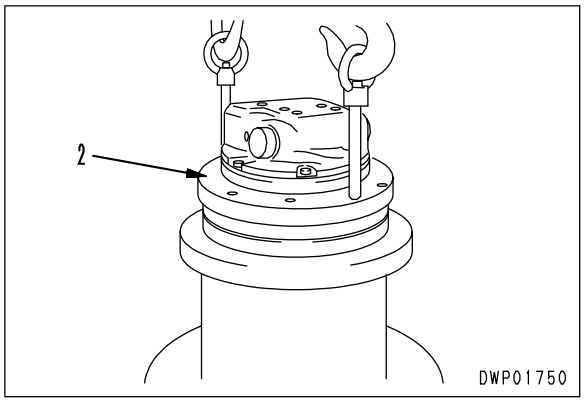
3. Cleaning of travel motor

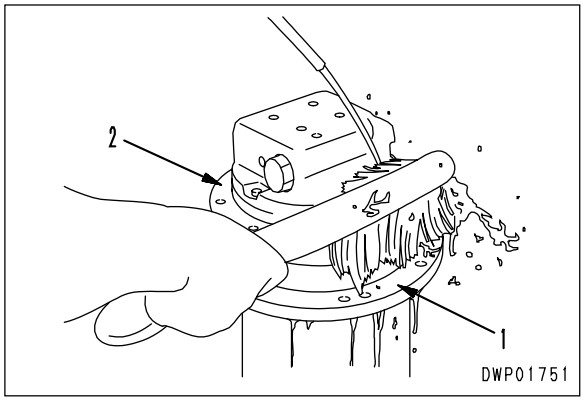
1) Tighten eyebolts into the mounting screw holes of spindle (2).

⚠ Install the 2 eyebolts symmetrically into the mounting screw holes of the spindle.

2) Install wires to the eyebolts and sling the travel motor and carry into the cleaning tank.
3) Clean each part of the travel motor with a washing brush.

⚠ Since the space between hub (1) and spindle (2) (in which the floating seal is installed) is filled with soil and sand, clean it very carefully.

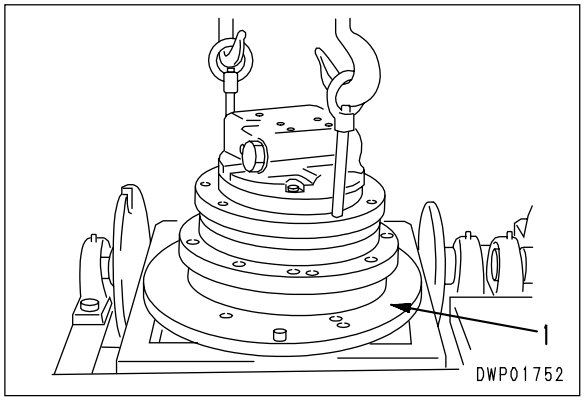




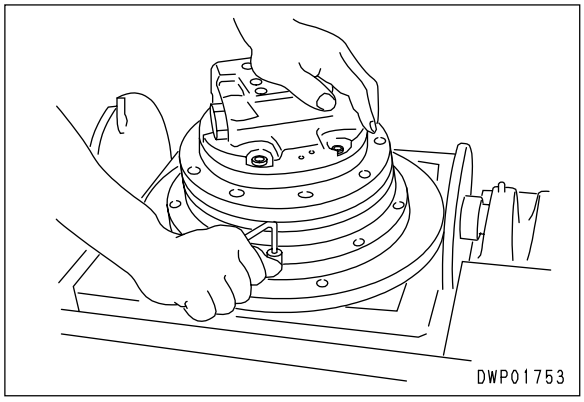
4. Installation of travel motor

1) Install the travel motor to the worktable.

⚠ Matching the screw holes of hub (1) to those of the worktable, insert the travel motor in the mounting hole of the worktable carefully.



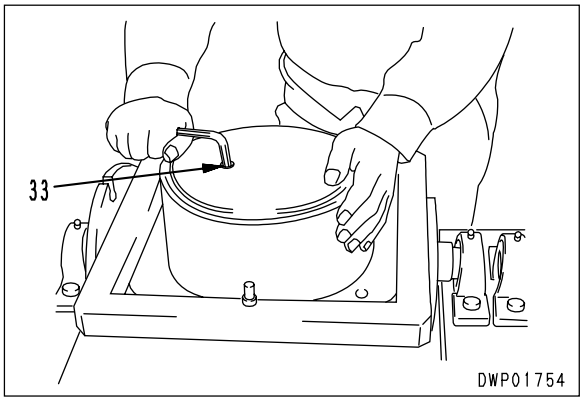
2) Fix the travel motor to the worktable with two hexagon socket head bolts.



5. Draining gear oil

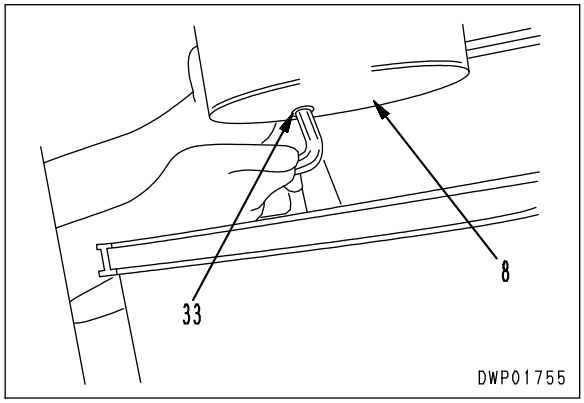
1) Turn over the travel motor.
2) Loosen hexagon socket head plugs (33) (3 pieces).

⚠ If the hexagon socket head plugs (33) are removed, oil flows out when the travel motor is turned over. Accordingly, loosen them to the degree that they can be loosened with the fingers.



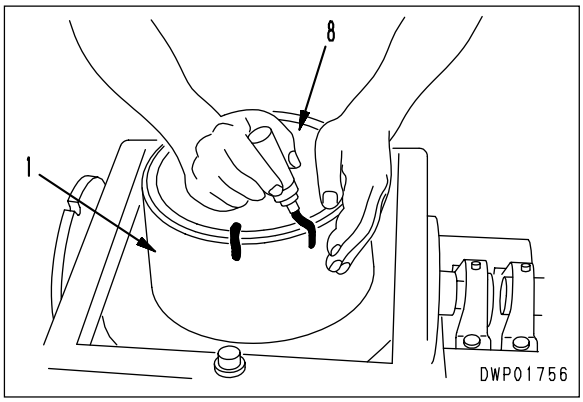
3) Turn over the travel motor.
4) Remove hexagon socket head plugs (33) (3 pieces) from cover (8) and drain the lubricating oil.

⚠ When draining the lubricating oil, place a container under the worktable.

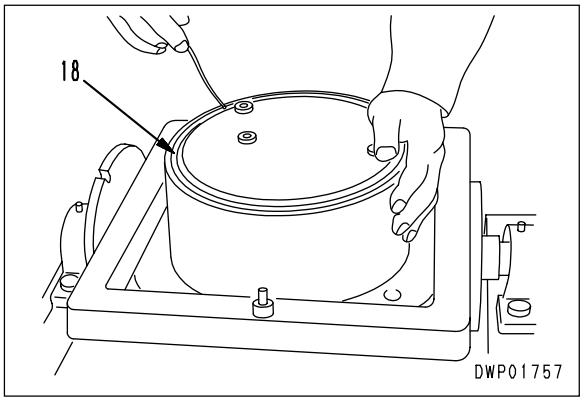


6. Removal of cover

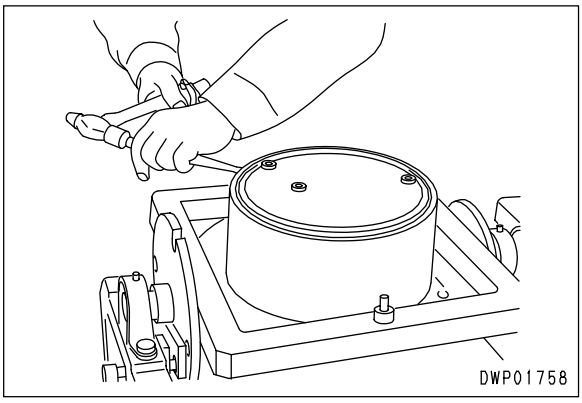
1) Turn over the travel motor.
2) Make match marks on the mating faces of hub (1) and cover (8) with an oil paint marker.

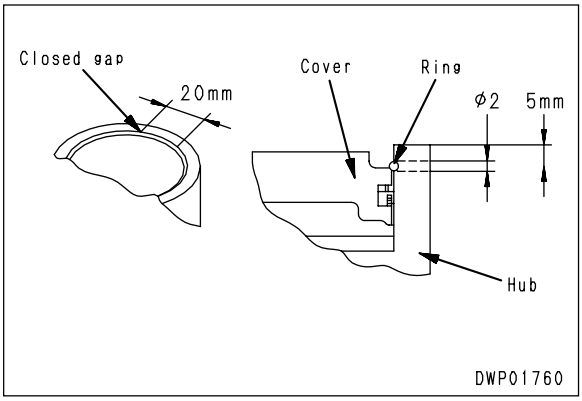


3) Find out the closed gap of ring (18) and pry out ring (18) with the pointed steel rod. If ring (18) cannot be taken out easily, however, take it out by the following method.



i) Find out the closed gap of ring (18) and make a punch hole for drilling at a point on outside of the hub about 20 mm inside from the end of ring (18).

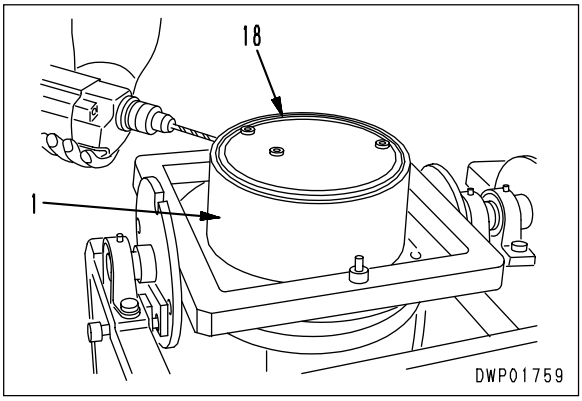




ii) Make a hole 2 mm in diameter with an electric drill from outside of hub (1) toward ring (18).

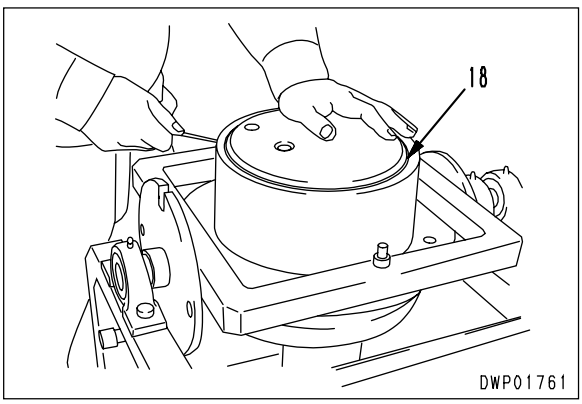
⚠ Apply the drill to the punch hole and make the hole straight until the ring is pushed by the ring and raised from the cover.

⚠ Wipe off the metal chips made by drilling so that they will not stick to the parts to be disassembled.

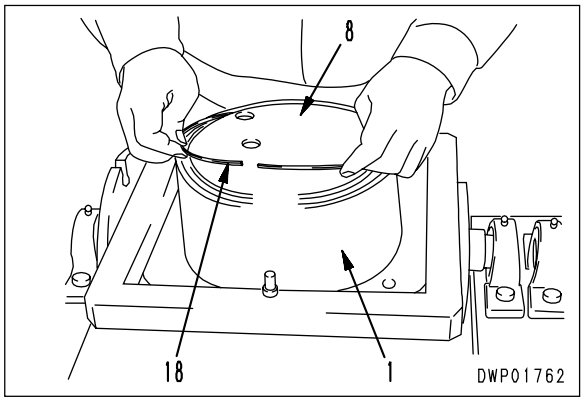


iii) Insert the steel bar in the hole to push out ring (18).

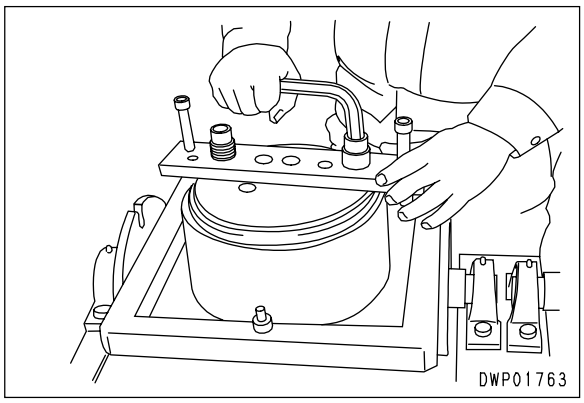
⚠ At this time, the tip of ring (18) is pushed out above cover (8).



4) Hold the tip of ring (18) pushed up above cover (8) with the hands and remove ring (18) from the ring groove of hub (1).

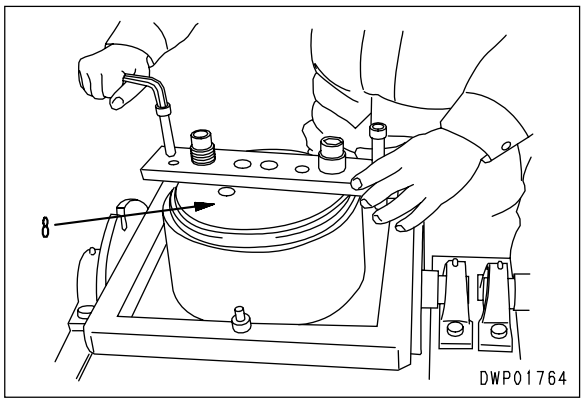


5) Tighten the 2 bolts at the center of the cover removing jig into the screw holes for hexagon socket head plugs (33).



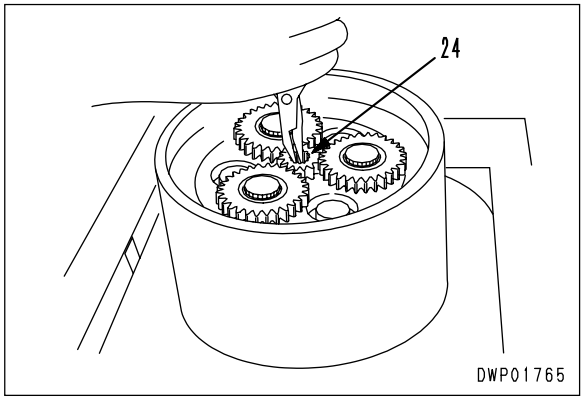
6) Place blocks under 2 outer bolts of the cover removing jig and tighten those bolts, and cover (8) rises gradually.
7) Remove O-ring (29) from removed cover (8).

⚠ Do not reuse removed O-ring (29).

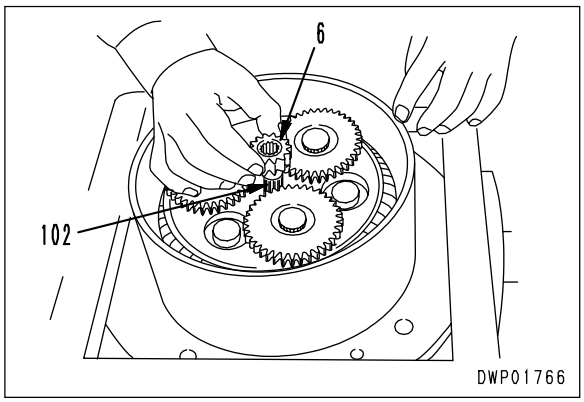


7. Removal of input gear

1) Remove C-type shaft snap rings (24) from shaft (102).



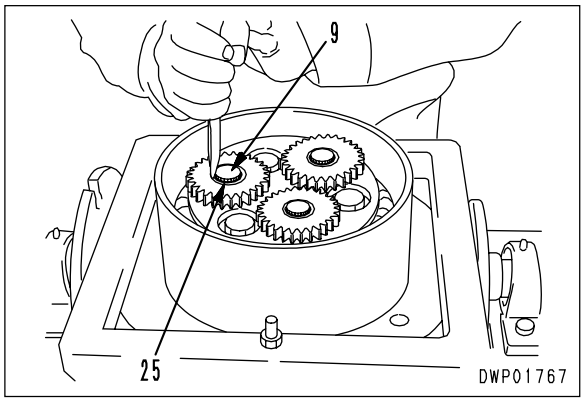
2) Remove input gear (6) from shaft (102).



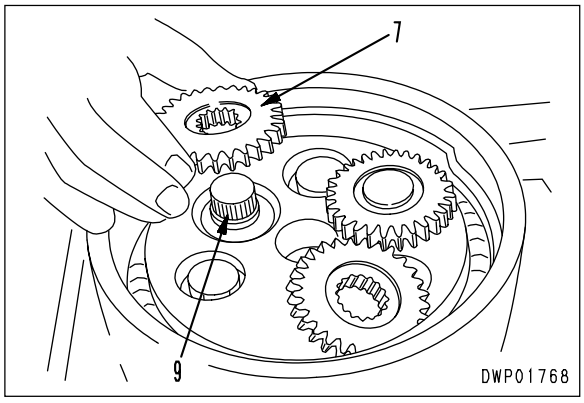
8. Removal of spur gears

⚠ When a snap ring is removed with pliers, it may fly off the pliers nose. Take care.

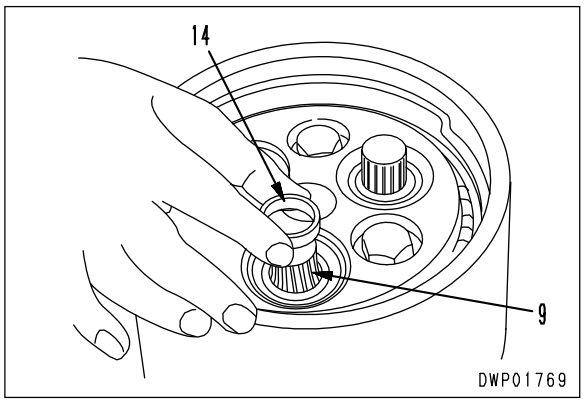
1) Remove C-type shaft snap rings (25) (3 pieces) from crankshafts (9).



2) Remove spur gears (7) (3 pieces) from crankshafts (9).



3) Remove distance pieces (14) (3 pieces) from crankshafts (9).



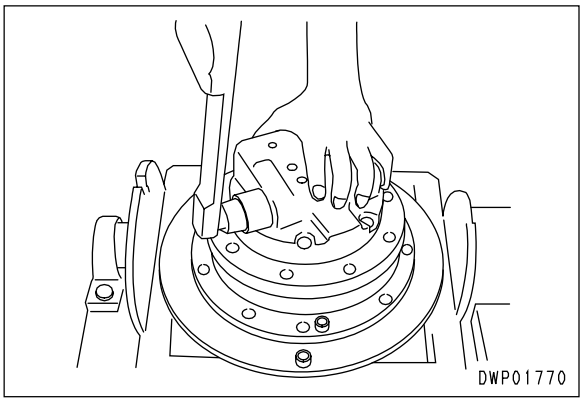
9. Removal of rear flange

1) Turn over the travel motor.

⚠ The following work is executed to remove the plugs easily when the inside of the rear flange needs to be disassembled. At this time, loosen the plugs to the degree that they can be removed with the fingers.

⚠ If the inside of the rear flange does not need to be disassembled, do not loosen the plugs.

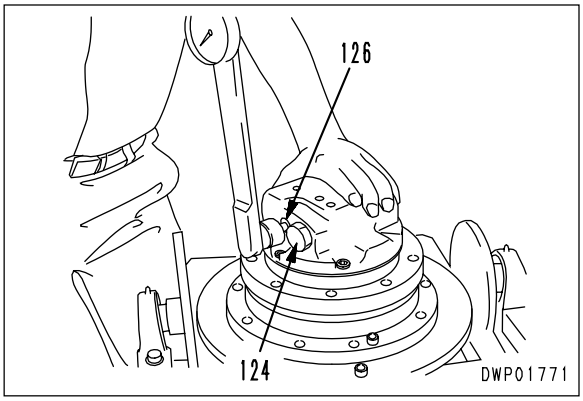
2) Loosen plugs (124) (Both of them).



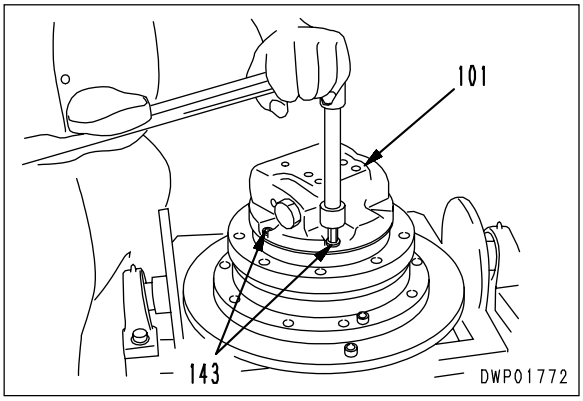
3) Loosen plugs (126) (both of them).

⚠ This work is executed to remove the plugs easily when the inside of the rear flange needs to be disassembled.

⚠ If the inside of the rear flange does not need to be disassembled, do not loosen the plugs.

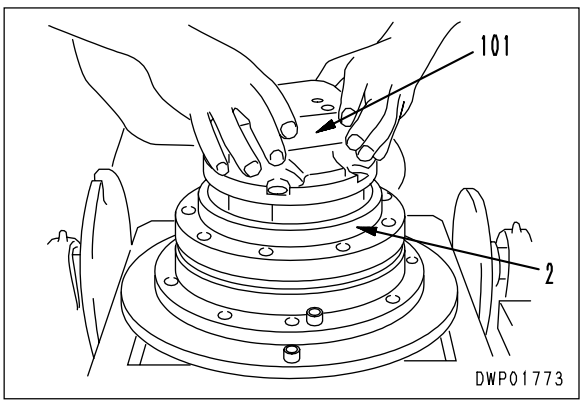


4) Remove hexagon socket head bolts (143) (6 pieces) from rear flange (101).

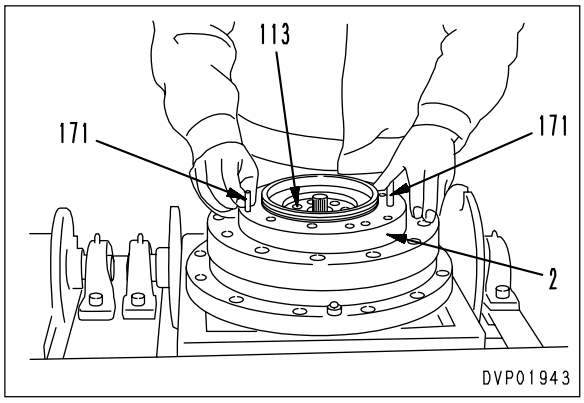


5) Remove rear flange (101) from spindle (2).

⚠ Hold the rear flange with both hands and lift up straight carefully to remove. If it is pried forcibly or hit to remove, timing plate (109) may fall and may be broken.

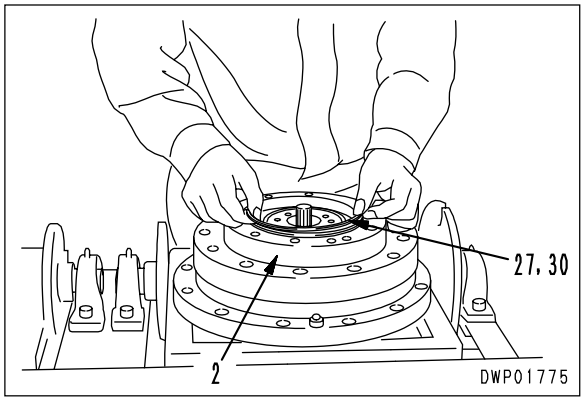


6) Remove parallel pin (171) from spindle (2).



7) Remove O-ring (30) from spindle (2).
8) Remove O-ring (27) from spindle (2).

⚠ Do not reuse removed O-rings (27) and (30).

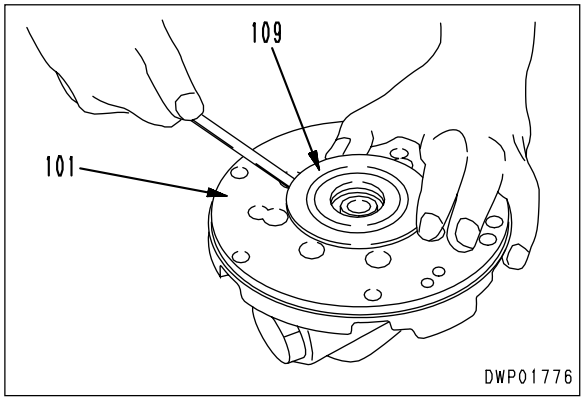


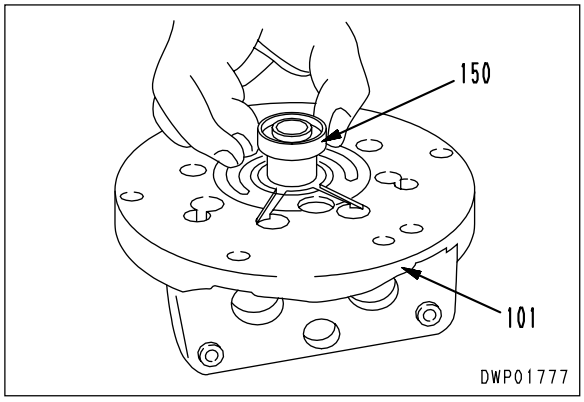
10. Disassembly of rear flange

1) Place rear flange (101) with the mating face for spindle (2) up.
2) Remove timing plate (109) from rear flange (101).

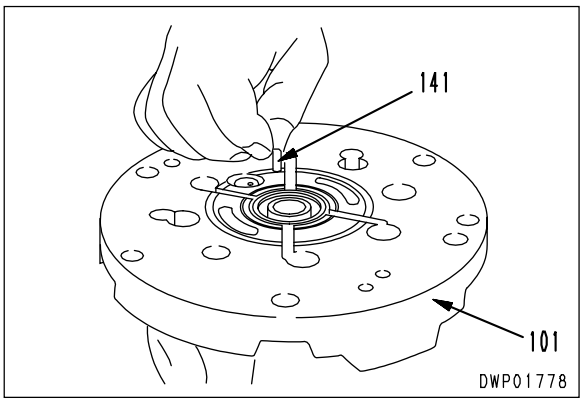
⚠ The timing plate may be fitted to the mating face of the rear flange because of oil and may not be removed easily. In this case, insert a spatula in the cast groove on the mating face of the rear flange and raise off the timing plate lightly. If a sharp tool such as a screw-driver is inserted between the mating faces, the mating faces will be damaged and oil will leak. Accordingly, do not use such a sharp tool.

3) Remove bearing (150) from rear flange (101).



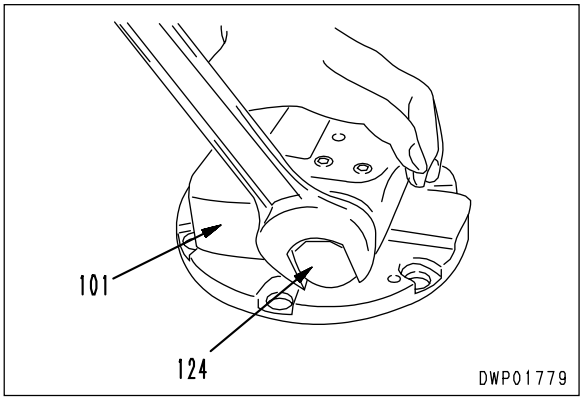


4) Remove parallel pin (141) from rear flange (101).



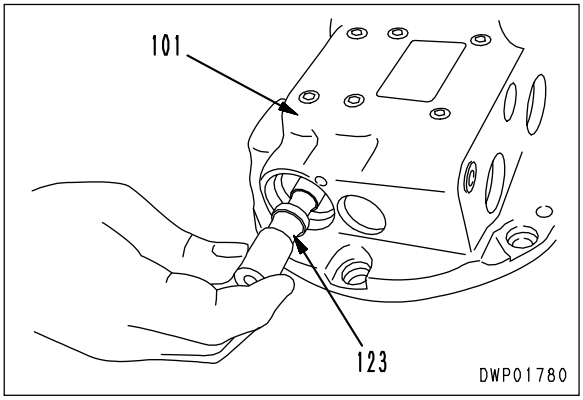
11. Disassembly of brake valve in rear flange

1) Remove plugs (124) (2 pieces) from rear flange (101).

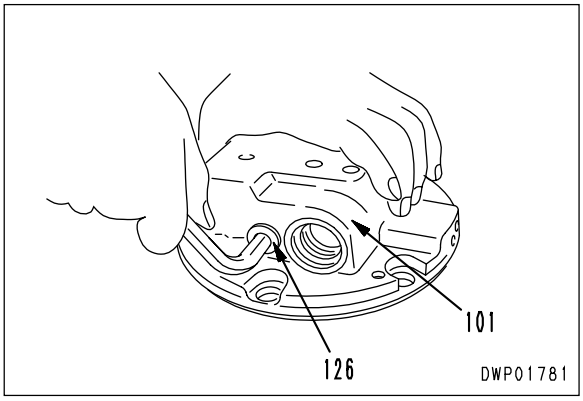


2) Take 2 stoppers (125) and 2 springs (128) out of rear flange (101).
3) Take spool (123) out of rear flange (101).

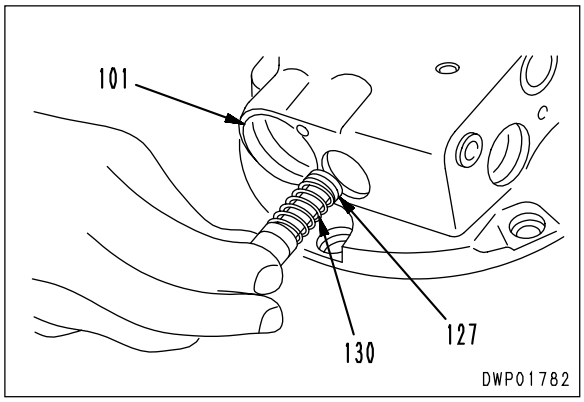
⚠ Slant rear flange (101) with either plug port down, and spool (123) slips down. Hold the tip of the spool and take it out.



4) Take plugs (126) (2 pieces) out of rear flange (101).

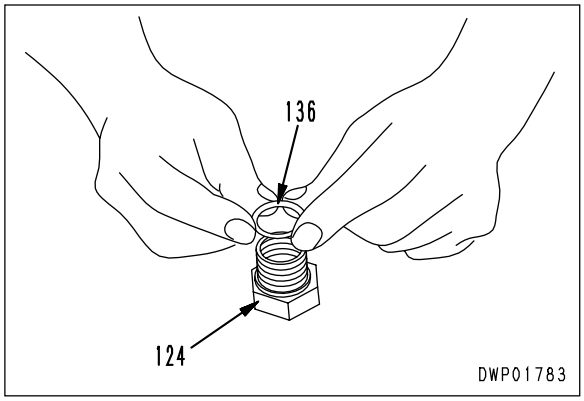


5) Take 2 springs (130) and 2 valves (127) out of rear flange (101).



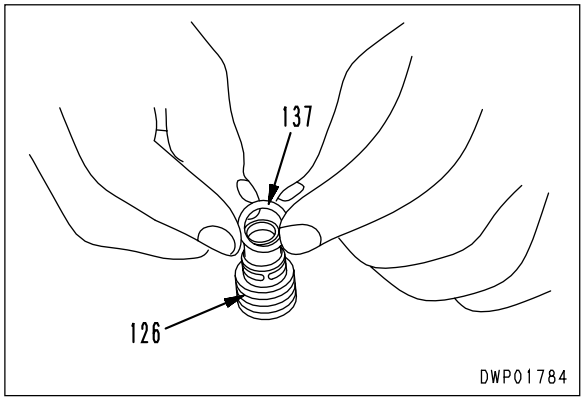
6) Remove O-rings (136) from plugs (124).

⚠ Do not reuse removed O-ring (136).



7) Remove O-ring (137) from plug (126).

⚠ Do not reuse removed O-ring (137).

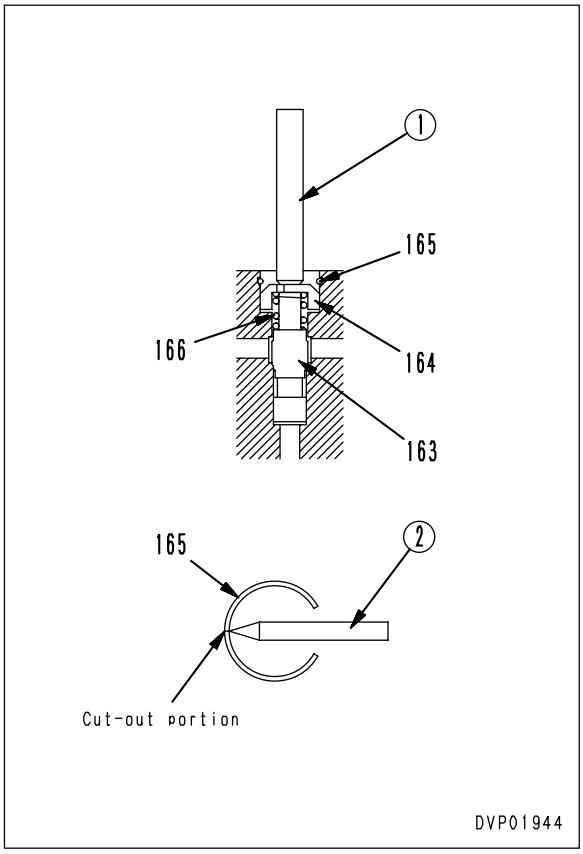


12. Removal of pilot valve in rear flange

1) Press stopper (164) with steel rod ① and press the cut part of ring (165) with pointed steel rod ②.
Ring (165) is deformed and projected from the ring groove of the rear flange (101) by this action, and it can be removed

⚠ Do not reuse ring (165).

⚠ Remove ring (165) only when valve (163) needs to be replaced.

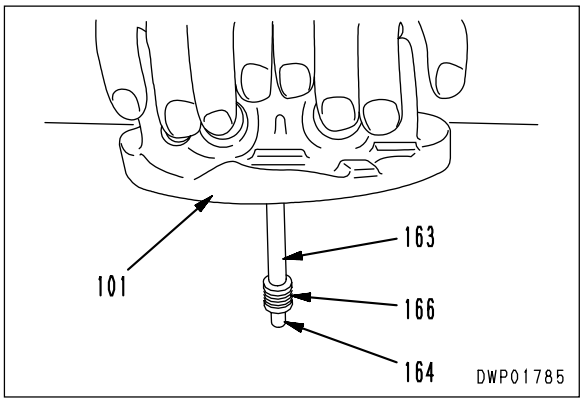


2) Lift up rear flange (101) with the hole of the removed ring down, and stopper (164), spring (166), and valve (163) can be removed from the rear flange.

⚠ If ring (165) is removed, the hole is scratched. Accordingly, repair the hole carefully after removing the ring.

[Caution]

- **If the above parts cannot be removed by lifting the rear flange with the hole down, supply compressed air gradually to the 2nd-speed selector port.**
- **If the compressed air is supplied suddenly, the parts may jump out to hurt you. Accordingly, supply the compressed air gradually.**



13. Removal of hexagon socket head plug

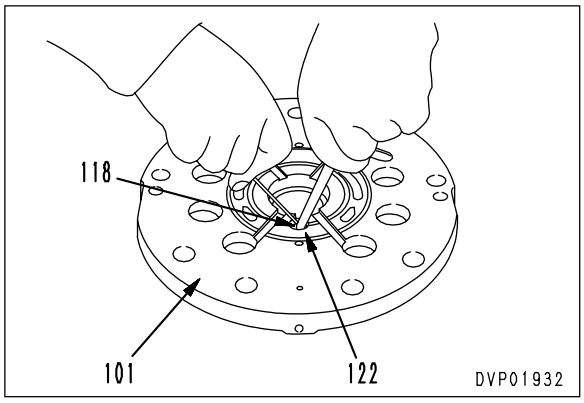
1) Remove hexagon socket head plug (152) only when it is required to do so. If malfunction is caused by dirt, etc., remove this hexagon socket head plug and clean the oil port thoroughly. At this time, take care not to let steel ball (168) fall.

14. Removal of valve (119) for parking brake

⚠ Remove ring (122) only when valve (119) needs to be replaced.

1) Place rear flange (101) on the worktable with the inside up.
2) Pressing valve seat (118) with the steel rod, apply a pointed steel rod to the cut part of ring (122) and remove ring (122) from rear flange (101).

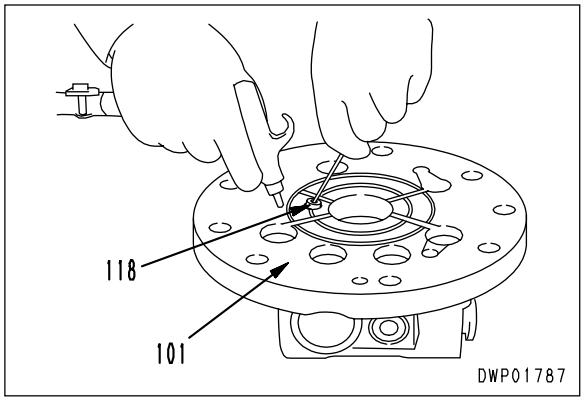
⚠ If ring (122) is removed, the hole is scratched. Accordingly, repair the hole carefully after removing the ring.



[Caution]

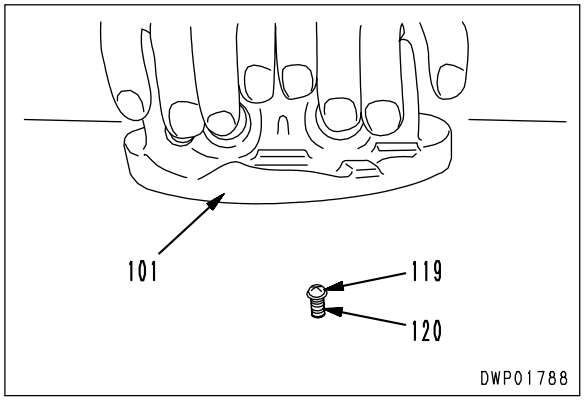
- **If the compressed air is supplied suddenly, the parts may jump out to hurt you. Accordingly, supply the compressed air gradually.**

3) Block the hole of valve seat (118) and supply compressed air from the oil passage to remove valve seat (118) from rear flange (101).

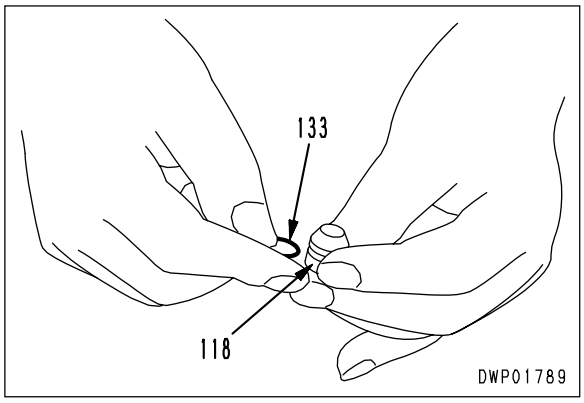


4) Shake rear flange (101) lightly with the hole down, and valve (119) and spring (120) are removed.

⚠ Do not reuse ring (122), valve seat (118) and O-ring (133).

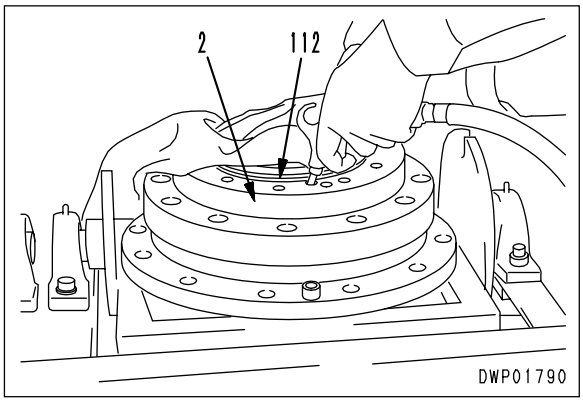


5) Remove O-ring (133) from valve seat (118).

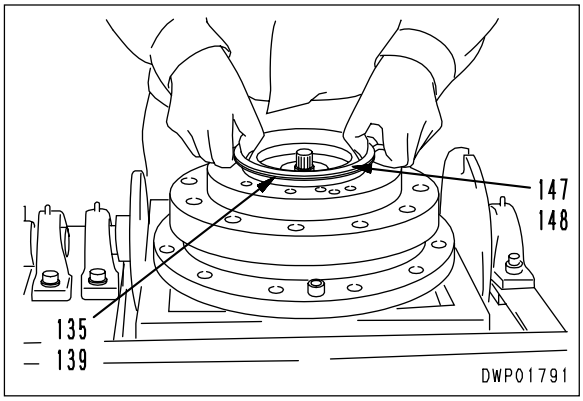


15. Disassembly of parking brake unit
[Caution]
- **If compressed air is applied suddenly, piston (112) may jump out of spindle (2) and it is very dangerous. Accordingly, place a protective cover, etc. over piston (112).**

1) Apply compressed air to the tube hole for the parking brake on spindle (2) to take piston (112) out of spindle (2).



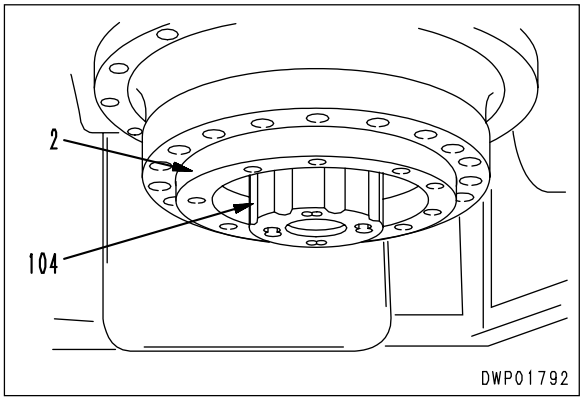
2) Take O-rings (135) and (139) and backup ring (147) out of piston (112).



16. Disassembly of hydraulic motor

⚠ If the travel motor is laid on its side, the oil flows out. Accordingly, place a container under the travel motor.

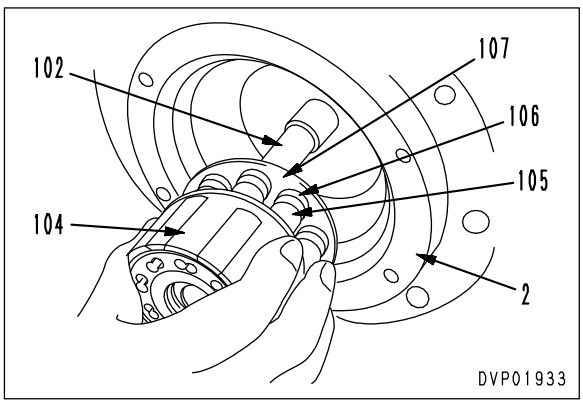
1) Turn the travel motor by 90 degrees.
2) Drain the oil from the travel motor.
3) Remove mating plate (116), friction plates (115), and mating plate (169) alternately.



4) Hold cylinder block (104) with the hands and turn it to both directions by 2 – 3 turns to separate shoe (106) from thrust plate (144).

⚠ If cylinder block (104) is pulled out without performing the above action, shoe (106) is left on thrust plate (144) and the parts sticking to cylinder block (104) (piston, shoe, etc.) come off cylinder block (104) and fall in spindle (2).

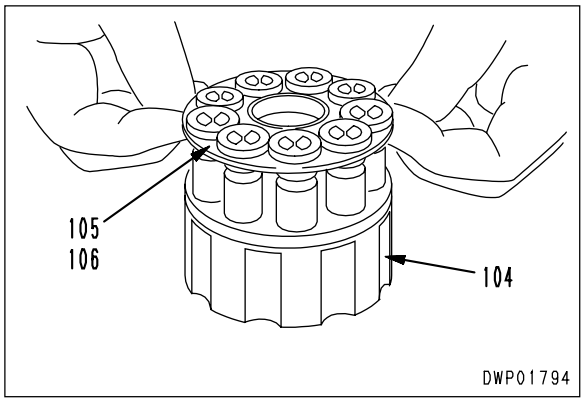
5) Pull cylinder block (104) out of shaft (102).



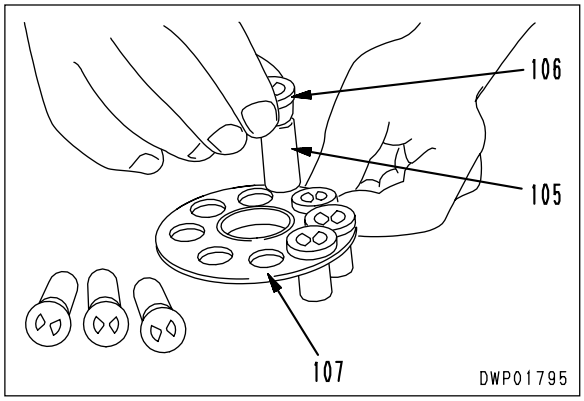
6) Remove the piston assembly [piston (105) and shoe (106)] and retainer plate (107) from cylinder block (104).

⚠ At this time, hold retainer plate (107) with both hands and remove it together with the above parts.

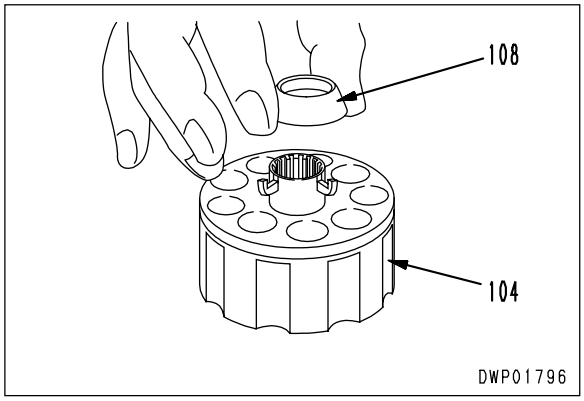
⚠ Piston (105) and shoe (106) are made in one unit by drawing them at the spherical part of the piston. It is impossible to separate piston (105) and shoe (106) from each other without damaging shoe (106). If either or both of them need to be replaced, replace them as a set (hereinafter, referred to as the piston assembly).



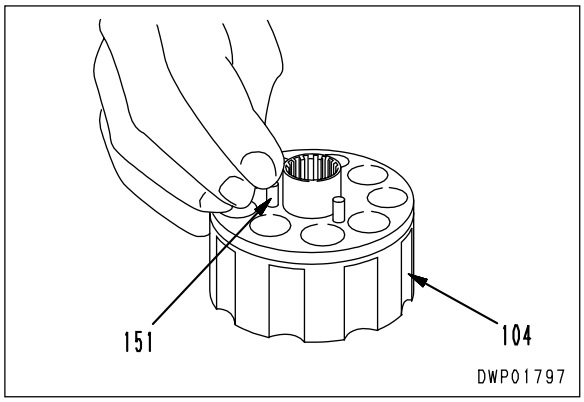
7) Pull piston assemblies (105) and (106) (9 assemblies) out of retainer plate (107).



8) Take thrust ball (108) out of cylinder block (104).



9) Take rollers (151) (3 pieces) out of cylinder block (104).



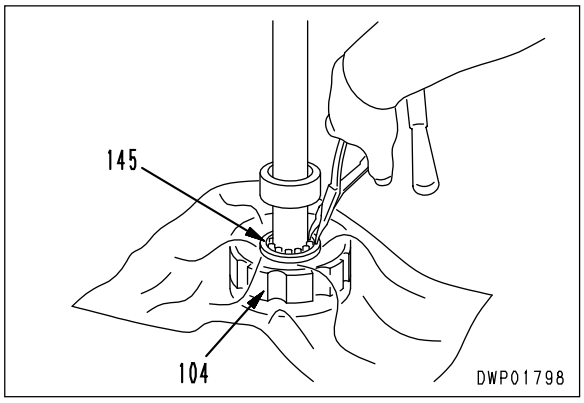
17. Removal of springs in cylinder block

1) Place cylinder block (104) on the press work-table.

⚠ When removing the springs align holder (I) with the washer to prevent damage of the cylinder block caused by contact.

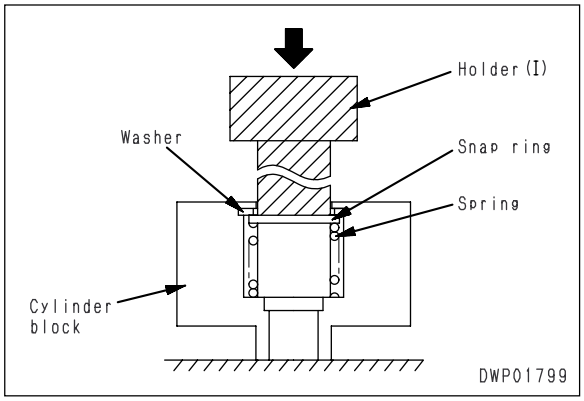
⚠ Cover the cylinder block with a vinyl sheet for protection.

⚠ Remove the springs only when they need to be replaced.

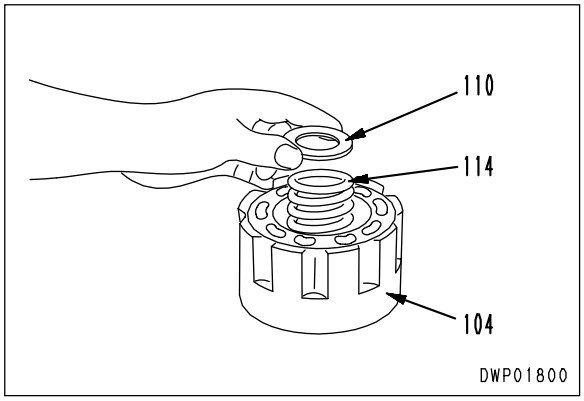


2) Place holder (I) on washer (110). Securing holder (I) with the press, remove round R-type snap ring (145) from the snap ring groove of cylinder block (104) with snap ring pliers.

3) Loosen the press slowly until the spring force is released.
[Caution]
- **If the press is released suddenly, the spring may jump out to hurt you. Loosen the press slowly.**



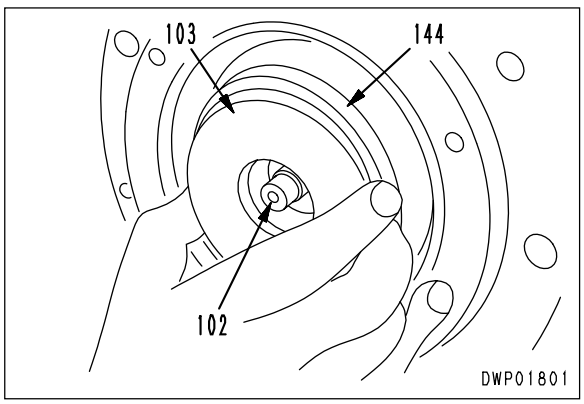
4) Take round R-type snap ring (145), washer (110), spring (114), and washer (110) out of cylinder block (104).



18. Pulling out shaft

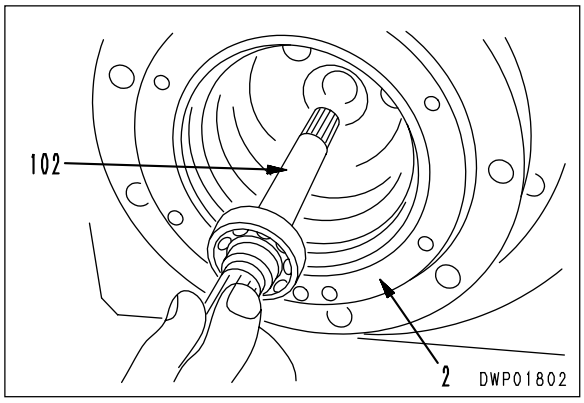
1) Remove swash plate (103) from shaft (102).
2) Remove thrust plate (144) from swash plate (103).

⚠ Swash plate (103) may not be removed easily because of the oil on its mating face. In this case, supply compressed air between the swash plate and thrust plate, and the swash plate is removed easily.



3) Pull shaft (102) out of spindle (2).

⚠ The shaft can be pulled out easily by hitting its end on the reduction gear side lightly with a plastic hammer.
If the shaft is hit strongly, it may jump out. Take care.



4) Take 2 pivots (167) and 2 parallel pins (171) out of spindle (2).

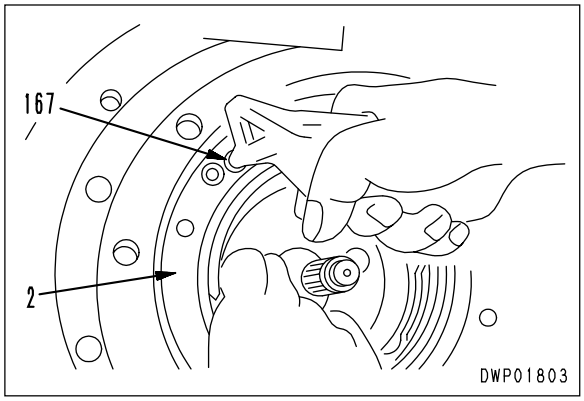
[Caution]

- **The 2nd-speed piston assembly may jump out because of compressed air and may hurt you in the following case. Accordingly, install a protective cover to the part which may jump out.**

5) Supply compressed air to the passage of spindle (2) to take the 2nd-speed selector piston assembly (piston and shoe) and spring (190) out of spindle (2).

Piston assembly
- Piston (161)
- Shoe (162)

⚠ Compressed air:
0.29 – 0.49 MPa {3 – 5 kg/cm²}

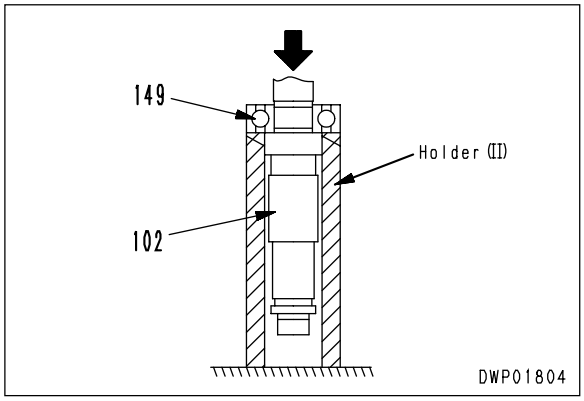


19. Removal of bearing

⚠ Remove the bearing only when it needs to be removed.

1) Place holder (II) on the press work stand and put shaft (102) in it.
2) Push the shaft end with the press to remove bearing (149) from the shaft.

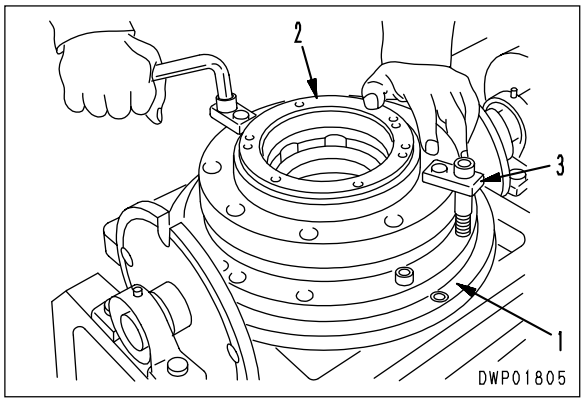
⚠ Do not reuse the bearing.



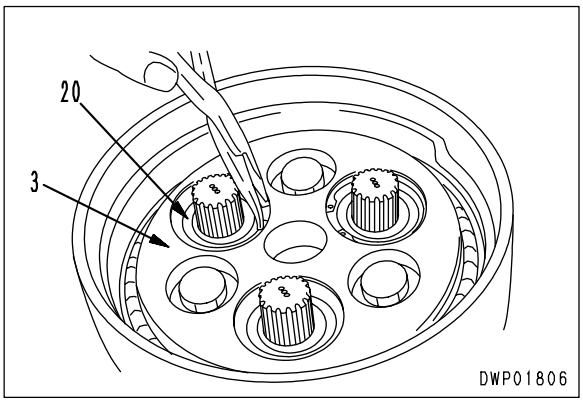
20. Removal of hold flange and bearing

1) Turn the travel motor by 90 degrees.
2) Set the clamps to hub (1) and spindle (2) simultaneously to secure them.

⚠ If hold flange (3) is removed without setting the clamps, hub (1) and spindle (2) will separate from each other and spindle (2) will fall from the worktable. Be sure to use the clamps.

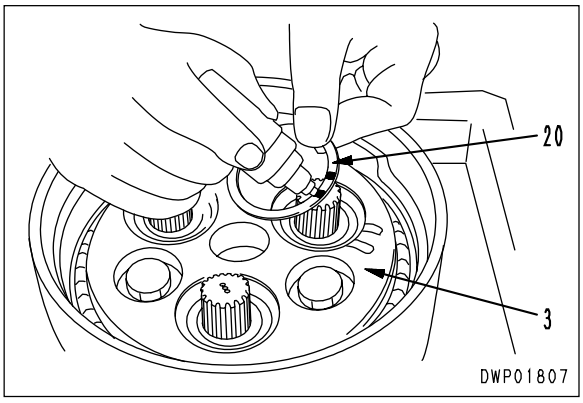


3) Turn over the travel motor.
4) Remove snap rings (20) (3 pieces) from hold flange (3).



5) Make match marks on snap ring (20) and hold flange (3) with an oil paint marker.

⚠ Make these marks so that the snap ring and hold flange will be installed to the original positions.



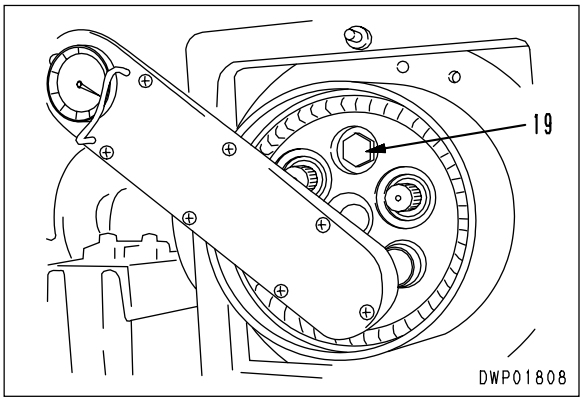
6) Turn the travel motor by 90 degrees.
7) Loosen reamer bolts (19) (3 pieces).

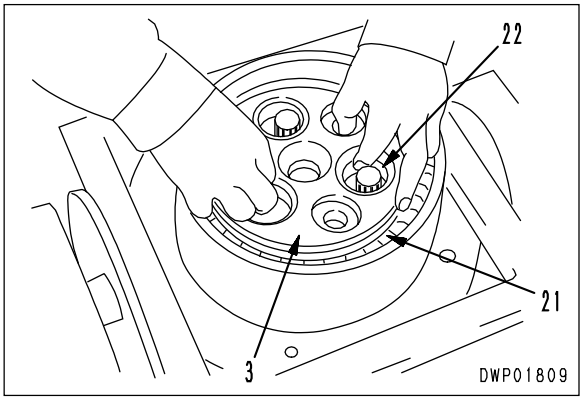
⚠ The threaded parts of the reamer bolts (19) are coated with adhesive. When the reamer bolts are loosened, if the adhesive sticks to their reaming parts, they may be seized and may not be removed easily. Accordingly, loosen the reamer bolts as slowly as possible.

⚠ The tightening torque of these reamer bolts is 188.3 ± 29.4 Nm {19.2 ± 3 kgm}. Since the threaded parts are coated with adhesive, larger torque than 188.3 ± 29.4 Nm {19.2 ± 3 kgm} is required to loosen them, however.

8) Turn the travel motor by 90 degrees again to return it to the original position.
9) Remove hold flange (3) from spindle (2).

⚠ When hold flange (3) is removed, the inner race of bearing (21) and outer races (3 pieces) of tapered roller bearings (22) are removed, too.

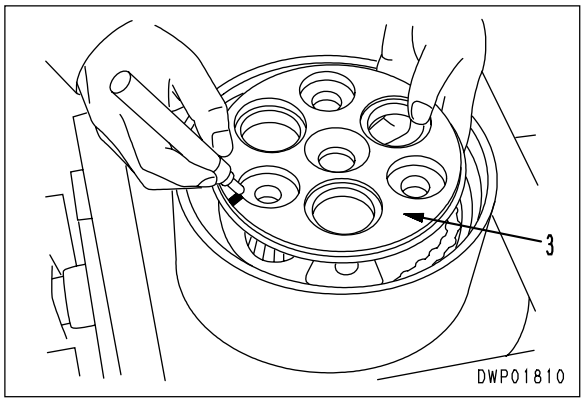




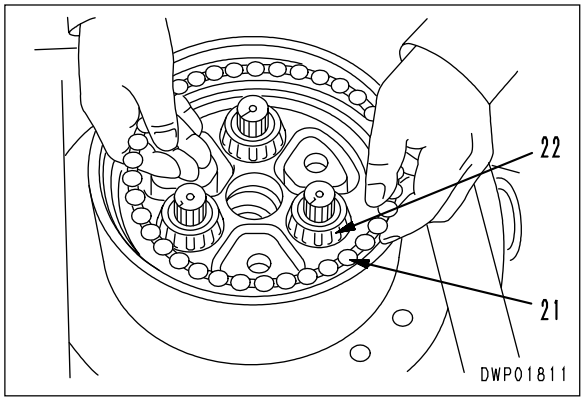
10) Make match marks on hold flange (3) and spindle (2) with an oil paint marker.

⚠ Make these marks so that hold flange (3) will be installed to the position of spindle (2) before disassembly.

⚠ The 3 holes on spindle (2) for installing reamer bolts (19) have been made simultaneously. When spindle (2) or hold flange (3) needs to be replaced, replace both of them as an assembly. (Hereinafter, this assemble will be referred to as the spindle assembly.)



11) Remove the steel balls and retainer assembly from bearing (21).



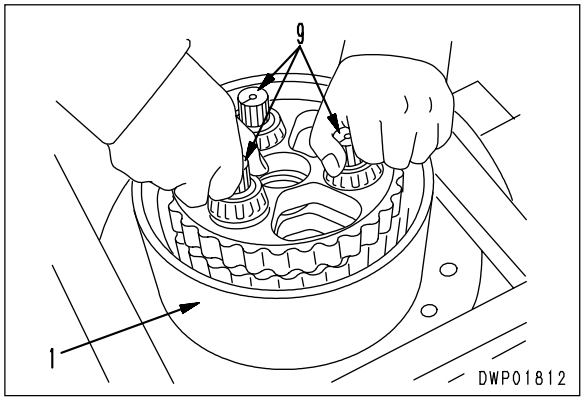
21. Removal of RV gear assembly

1) Take the RV gear assembly out of hub (1).

⚠ Hold the end of crankshaft (9) and lift it up straight to take out the RV gear assembly.

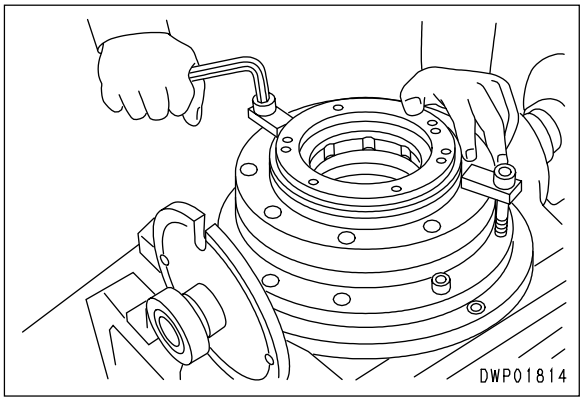
⚠ Do not disassemble the RV gear assembly as a rule. If it is disassembled and reassembled, its performance will be lowered.

※ Parts of RV gear assembly
- RV gear A (4)
- RV gear B (5)
- Crankshaft (9)
- Tapered roller bearing (22)
- Needle roller bearing with retainer (23)



22. Removal of clamps

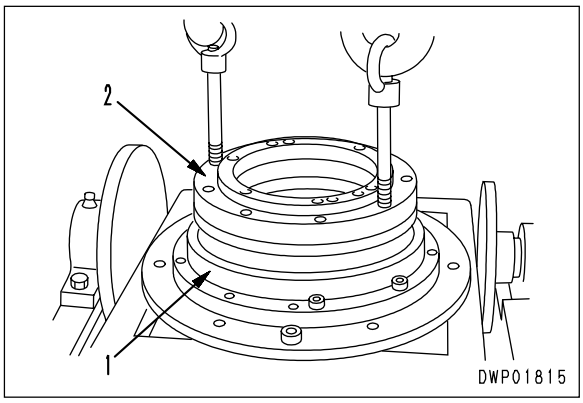
1) Turn over the travel motor.
2) Remove the clamps (2 pieces).



23. Removal of spindle

1) Place a clean container under the travel motor.
2) Tighten 2 eyebolts symmetrically into the mounting screw holes of spindle (2).
3) Install hooks to the eyebolts and sling them with a crane to remove spindle (2) from hub (1).

⚠ When removing spindle (2) from hub (1), hold it with the hands so that it will not touch the hub.

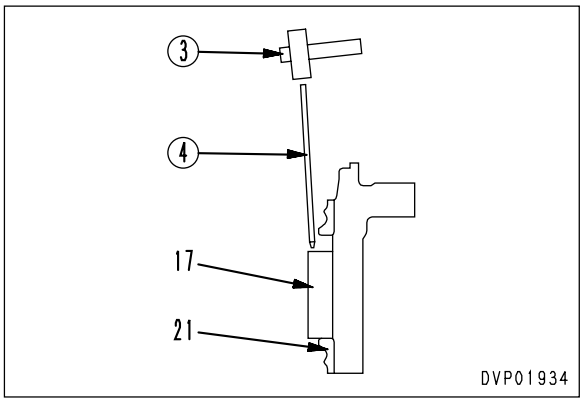


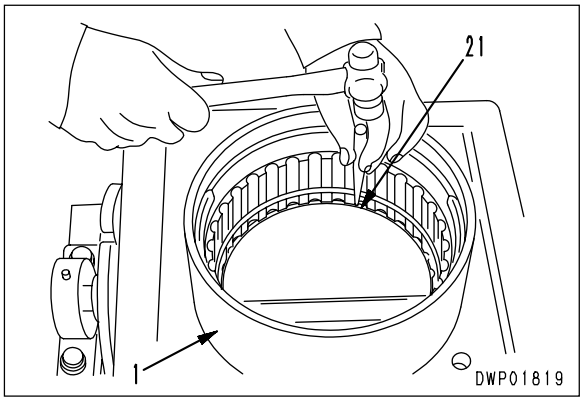
24. Removal of bearing

1) Remove floating seal (31) from hub (1).
2) Take out the steel balls and retainer assembly of bearing (21).

⚠ When the outer race of bearing (21) is removed, it falls from hub (1). Accordingly, place a rubber mat on under the worktable to protect the falling outer race.

3) Hit the end of pin (17) lightly with a steel rod ④ and a hammer ③ to remove the outer race of bearing (21) from hub (1). At this time, pin (17) may fall, too.
4) Take out pin (17).
5) Turn over the travel motor.
6) Remove the outer race of bearing (21) from hub (1) by hitting it with the steel rod and hammer lightly from cover (8) side of hub (1).

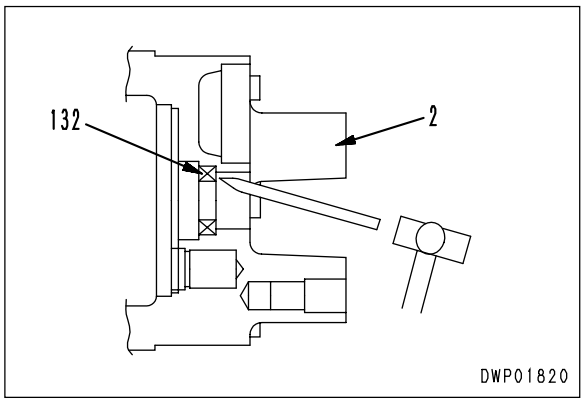




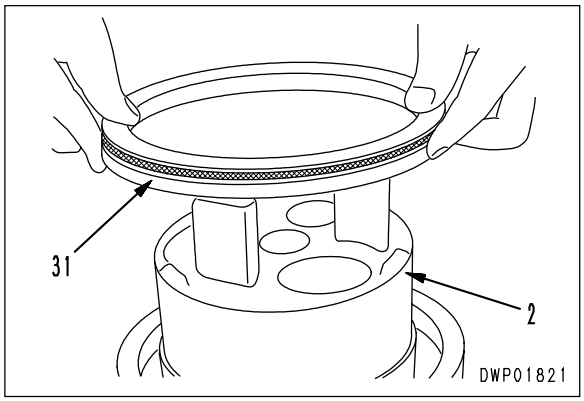
25. Removal of spindle parts

1) Remove oil seal (132) from spindle (2).

⚠ Never reuse removed oil seal (132).

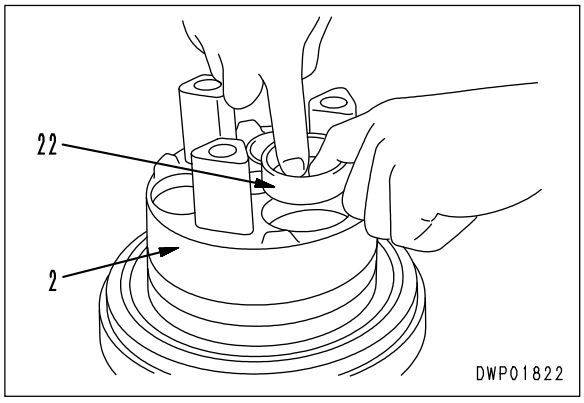


2) Take floating seal (31) out of spindle (2).



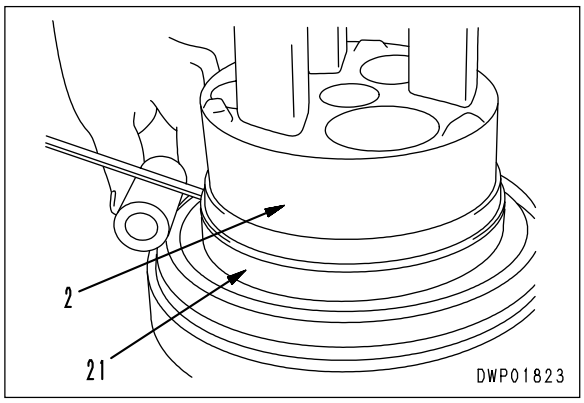
3) Take outer races (3 pieces) of tapered roller bearings (22).

⚠ The outer races of tapered roller bearings (22) may stick to the spindle and may not be taken out easily because of the gear oil films. In this case, hit the center of the mounting hole of the spindle (2) lightly with an aluminum bar, and the oil films are broken and the outer races can be taken out easily.



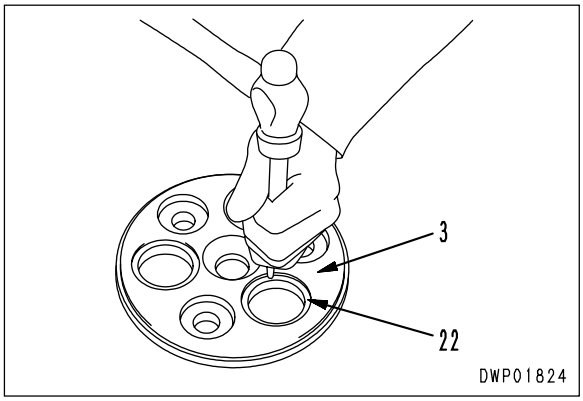
4) Remove the inner race of bearing (21) from spindle (2) with a spatula and a steel pipe.

⚠ Remove the inner race of bearing (21) from the spindle only when it needs to be replaced.



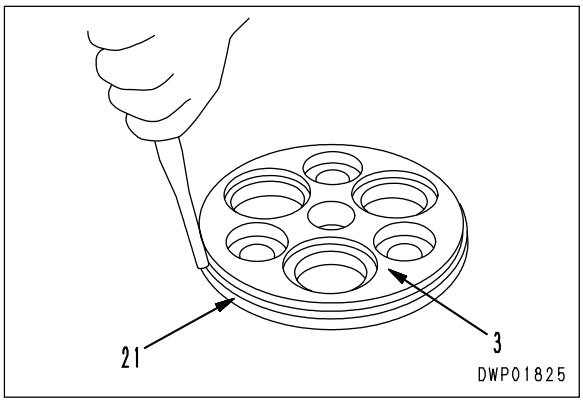
26. Removal of hold flange parts

1) Take the outer races of tapered roller bearings (22) out of hold flange (3) by hitting it with a hammer.



⚠ Remove the inner race of bearing (21) only when it needs to be replaced.

2) Remove the inner race of bearing (21) from hold flange (3) with a steel rod and a hammer.



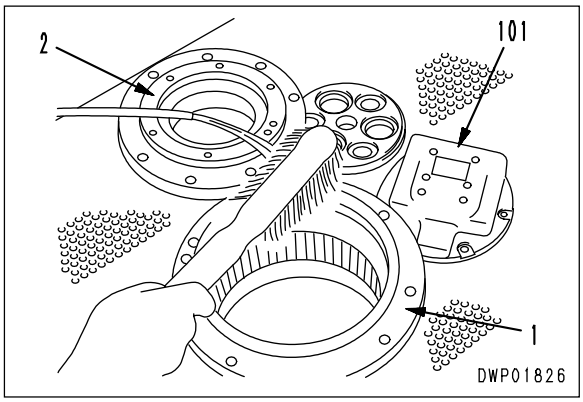
27. Rough cleaning of parts

1) Classify the parts into hub (1), spindle (2), cover (8), rear flange (101), and the other parts (hereinafter, referred to as the internal parts).
2) Put the hub, spindle, cover, and rear flange in the cleaning tank and clean them.

⚠ Clean these parts and remove soil and sand from them carefully.

[Caution]

- **Kerosene is combustible liquid. Take care of a fire extremely.**



3) Put the internal parts and kerosene in the rough cleaning container and clean them.

⚠ If dirty parts are washed in water soon after they are put in kerosene, they may be scratched. Accordingly, leave them in kerosene until the dirt and grease become loose and float.

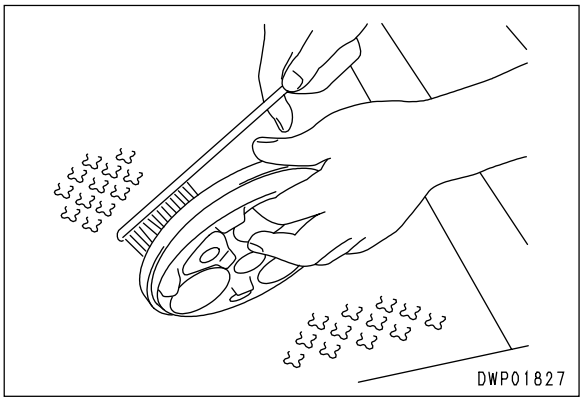
28. Finish cleaning

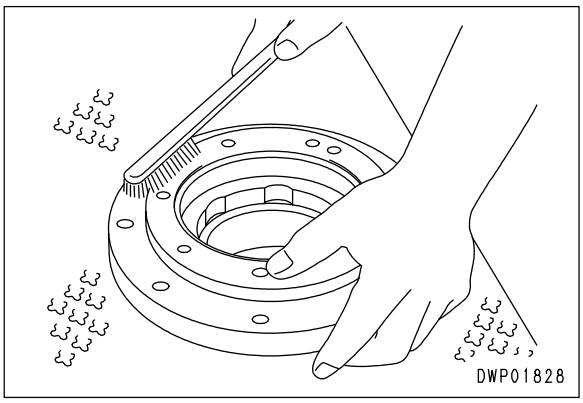
1) Put the parts and kerosene in the finish cleaning container and clean them carefully to their inside, turning them slowly.
2) Wipe kerosene off the parts with clean cloths.

⚠ Dry the inside of hub (1), spindle (2), and hold flange (3) by blowing compressed air against them in a clean and dry place. After drying them, apply hydraulic oil to them.

⚠ Dry the inside of rear flange (101), hydraulic motor parts, and RV gear assembly naturally in a clean and dry place. After drying them, apply hydraulic oil to them.

⚠ If steel balls of bearing (21) and pins (17) (30 pieces) are handled roughly, they may scratch each other and may be lost. Accordingly, handle them very carefully.





MAINTENANCE STANDARDS TABLE

Part name Index No. in structural/disassembly drawing	Inspection and measurement item	Standard value	Correctable value	Allowable limit value	Measuring instrument	Repair method
1. Hub (1)	• Bore of pin	(Surface roughness: 12S)		Must be free from scratch, uneven wear, and seizure.	Visual inspection	
2. Spindle (2)	• Diameter of reamed hole	ø17 mm		Max. ø17.056 mm	Cylinder gauge	
3. RV gear A (4) RV gear B (5)	• Flaking of cycloid tooth surface	0		Must be free from flaking large than 6.5 mm^2.	Visual inspection	
	• Pitting of cycloid tooth surface	0		Must be free from pitting large than 1 mm^2.	Visual inspection	
	• Flaking of hole of needle roller bearing with retainer (23)	0		Must be free from flaking large than 6.5 mm^2.	Visual inspection	
4. Crankshaft (9)	• Flaking of eccentric part	0		Must be free from flaking large than 6.5 mm^2.	Visual inspection	
	• Pitting of eccentric part	0		Must be free from pitting large than 1 mm^2.	Visual inspection	
5. Distance piece (10)	• Wear of sealing surface	0		Max. wear: 0.2 mm	Shape and roughness tester	
6. Floating seal (31)	• Sealing surface	(Surface roughness: 0.8S)		Must be free from flaw and rust.	Visual inspection	
7. Thrust plate (144)	• Wear of sliding surface against shoe (106)	Wear: 0 (Surface roughness: 0.4S)	Wear: 20μ	Max. wear: 10μ	Shape and roughness tester	• Lap sliding surface to eliminate scratches.
8. Cylinder block (104)	• Uneven wear of sliding surface against timing plate (109)	Wear: 0 (Surface roughness: 0.4S)	Wear: 20μ	Max. wear: 5μ	Shape and roughness tester	• Lap sliding surface to eliminate scratches.
	• Diameter of bore	ø15.005		Max. diameter: ø15.015 mm	Cylinder gauge	
9. Piston assembly (105, 106)	• Outside diameter of piston (105)	ø14.996		Min. diameter: ø14.986 mm	Indicating micrometer	
	• Uneven wear of sliding surface of shoe (106) against thrust plate (144)	Wear: 0	Wear: 20μ	Max. wear: 5μ	Shape and roughness tester	• Lap sliding surface to eliminate scratches.
	• Play of spherical joint of piston (105) and shoe (106).	Play: 0.05 mm		Max. play: 0.2 mm	Lever-type dial gauge	

Part name Index No. in structural/disassembly drawing	Inspection and measurement item	Standard value	Correctable value	Allowable limit value	Measuring instrument	Repair method
10. Timing plate (109)	• Wear of sliding surface against cylinder block (104)	Wear: 0 (Surface roughness: 0.4S)	Wear: 20μ	Max. wear: 5μ	Shape and roughness tester	• Lap sliding surface to eliminate scratches.
11. Spool (123) and rear flange (101)	• Clearance between outside of spool (123) and hole for spool of rear flange (101)	Clearance: 7 – 12μ		Max. clearance: 33μ	Indicating micrometer, cylinder gauge	
12. Piston assembly (161, 162)	• Play of spherical joint of piston (161) and shoe (162).	Play: 0.2 mm		Max. play: 0.3 mm	Lever-type micrometer	
13. Friction plate (15)	• Outside surface	20 (Surface roughness: 12S)		Must be free from scratch, uneven wear, and seizure.	Visual inspection	
	• Plate thickness	2.8 mm		Thickness must be 2.5 mm or checker grooves must be left.	Slide calipers, visual inspection	

ASSEMBLY

- Carry out assembly in the reverse order to disassembly, as a rule.

1. Preparation

Prepare a worktable, tools, and materials for disassembling, similarly to preparation for disassembly.

2. General precautions for work

1) Observe the same general precautions with disassembly.
2) Remove all metal chips and foreign matter from the all parts and check that any part does not have a burr, bruise, etc. before assembling. If there is any burr or bruise, remove it with an oilstone.
3) Replace the O-rings, oil seals, and floating seal with new ones.
4) Replace the reamer bolts with new ones, as a rule. If it is obliged to reuse one, remove all adhesive from it with a brush. If bolt seat has any flaw, remove it with an oilstone and then degrease the reamer bolt.
5) Since the reamer bolt holes of spindle (2) and threaded parts of reamer bolts (19) are to be coated with adhesive when they are assembled, degrease them.
6) When fitting the O-rings, oil seals, and floating seals, take care not to damage them. (Apply a little amount of grease to their surface so that they will fit smoothly.)
7) When installing the hydraulic motor parts and moving or sliding parts of the valves, be sure to apply clean hydraulic oil (NAS Standard Grade 9 or higher) to them.
8) When assembling, do not put on cloth gloves. (If they are used, a fiber can cause malfunction.)
9) Tighten each bolt or plug to the torque shown in the torque table.
10) After finishing the assembly work, plug the all ports to prevent dirt from entering them.

3. Assembly procedure



If any part is replaced before assembling, the preload on the ball bearing and thickness of the snap ring may need to be adjusted. Accordingly, see if any of the following part has been replaced before assembling.

1) Replacement parts which require adjustment of preload on ball bearing
   Hub (1), spindle (2), collar (11), hold flange (3), ball bearing (21)
2) Replacement parts which require adjustment of thickness of snap ring



Spindle (2), hold flange (3), crankshaft (9), spacer (12), tapered roller bearing (22), snap ring (20)
If any of the above part is replaced before assembling, be sure to use only the adjusted parts. If a part which has not been adjusted is used, the travel motor will malfunction and cause breakage soon. Accordingly, observe this precaution.

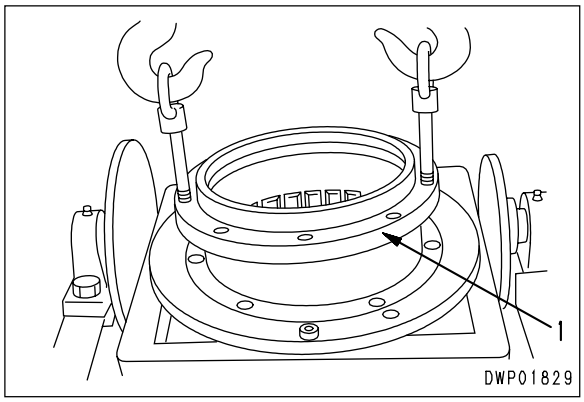
4. Reassembly of hub assembly

1) Check that any of hub (1), spindle (2), hold flange (3), and bearings (21) (2 pieces) has not been replaced with new one.

⚠ If any of the above parts has not been replaced, go to the next step.

⚠ If any of the above parts has been replaced, adjust the preload on the bearing before going to the next step.

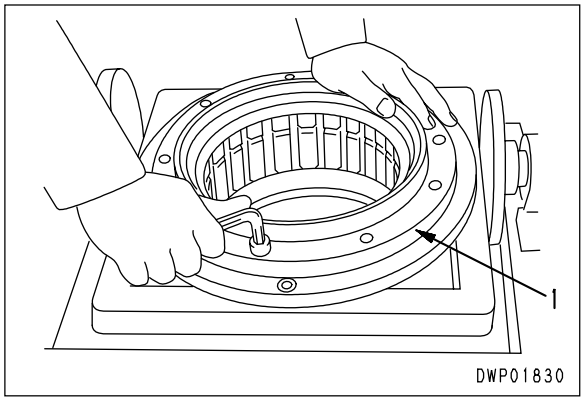
2) Tighten 2 eyebolts symmetrically into the screw holes of hub (1).



3) Install hooks and wires to the eyebolts and sling and install hub (1) to the worktable with a crane.

⚠ Matching the screw holes of hub (1) to those of the worktable, insert the hub in the mounting hole of the worktable carefully.

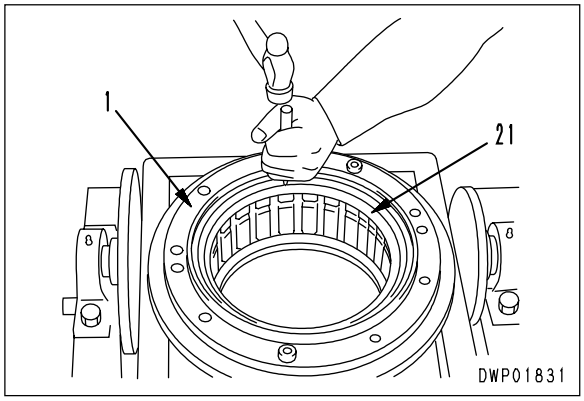
4) Fix hub (1) to the worktable with hexagon socket head bolts.



5) Insert the outer race (1 piece) of bearing (21) in hub (1) with a pin punch and a hammer.

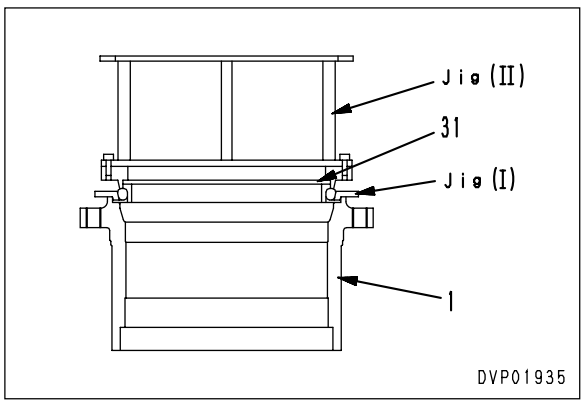
⚠ Apply the pin punch to the rim of the outer race of bearing (21) and hit it lightly with a hammer all round to fit the bearing little by little.

6) Place the steel balls and retainer assembly of bearing (21) on the outer race of bearing (21).



7) Apply lithium grease thinly to the O-ring of floating seal (31) and fit floating seal (31) to the floating seal groove of hub (1).

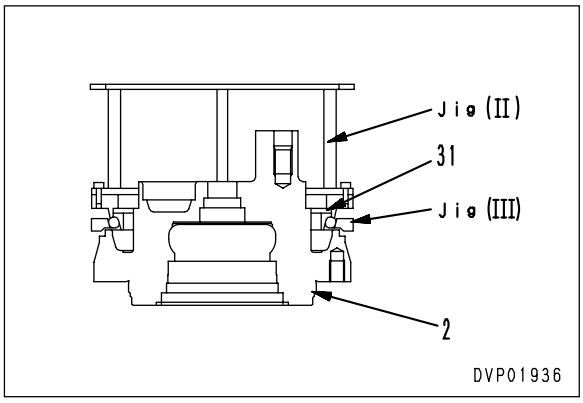
⚠ Place floating seal fitting jig (I), floating seal, and floating seal fitting jig (II) in order and press them until both floating seal fitting jigs touch each other. Remove the fitting jigs and check that the floating seal is parallel with the hub end and is not projected more than 1 mm.



5. Reassembly of spindle assembly

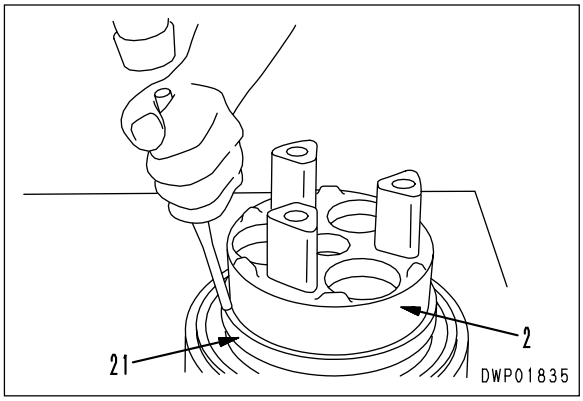
1) Apply lithium grease to the O-ring of floating seal (31) and then fit it to the floating seal groove of spindle (2).

⚠ Place floating seal fitting jig (III), floating seal, and floating seal fitting jig (II) in order and press them until both floating seal fitting jigs touch each other. Remove the fitting jigs and check that the floating seal is parallel with the hub end and is not projected more than 1 mm.

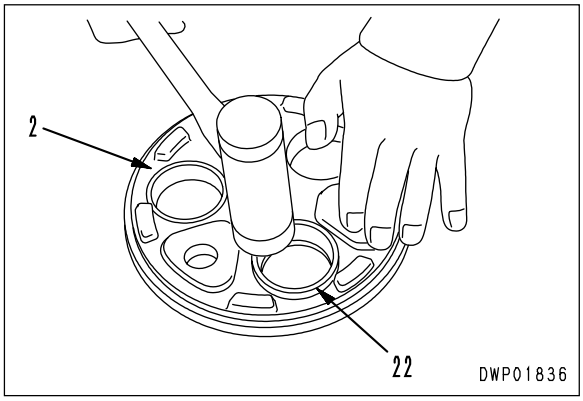


2) Press fit the inner race (1 piece) of bearing (21) to spindle (2) with a pin punch and a hammer.

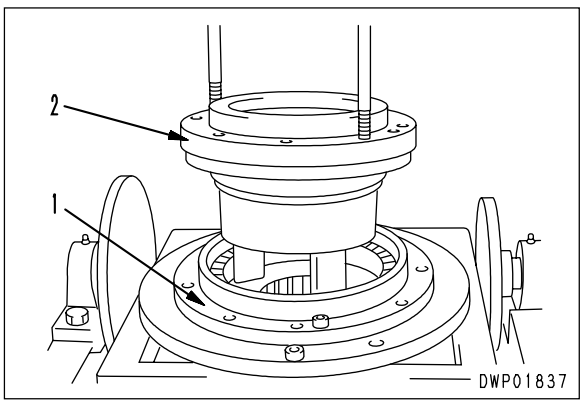
⚠ Apply the pin punch to the rim of bearing (21) and hit it lightly with a hammer all round to fit the bearing little by little.



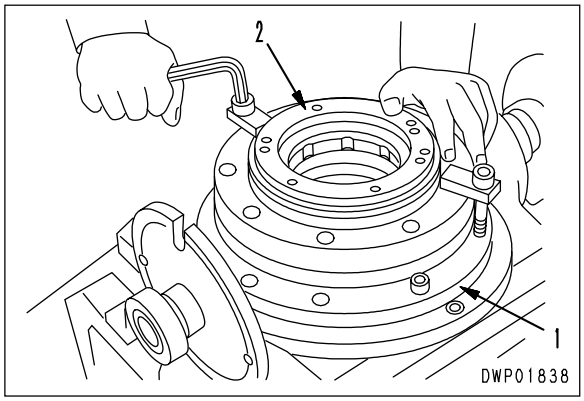
3) Fit outer races (3 pieces) of tapered roller bearings (22) to the respective outer race holes in spindle (2) by hitting them lightly with a plastic hammer.



4) Turn over the spindle.
5) Install 2 eyebolts symmetrically to spindle (2).
6) Install hooks and wires to the eyebolts and sling spindle (2) with the crane and insert it in hub (1) slowly.



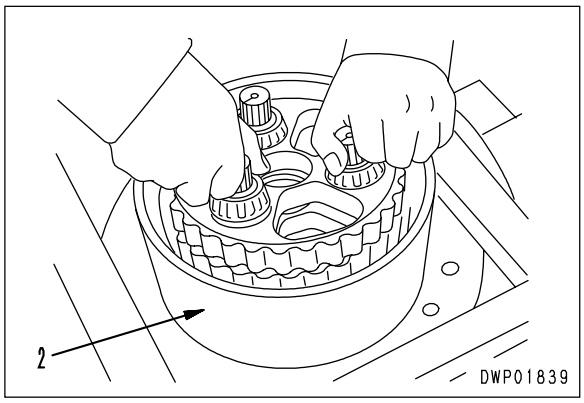
7) Tighten the clamps symmetrically to hub (1) and spindle (2).



8) Turnover the travel motor.
9) Install the RV gear assembly to spindle (2).

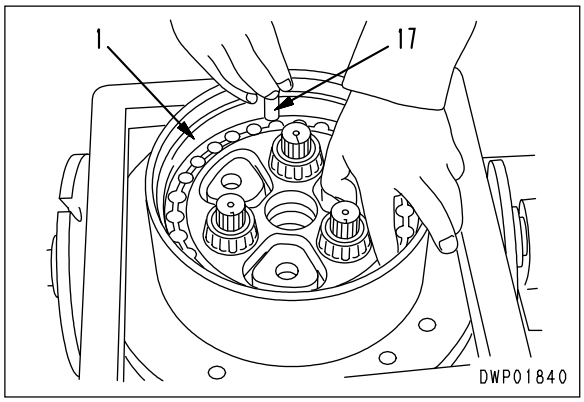
⚠ If the RV gear assembly has been disassembled, reassemble it perfectly.

⚠ Hold the crankshaft end with both hands and raise and install the RV gear assembly to the spindle carefully, matching the inner race of the tapered roller bearing of the crankshaft to the outer race hole of the tapered roller bearing fitted to the spindle. If the RV gear assembly is dropped to install it, the tapered roller bearing will be damaged and the travel motor will malfunction.



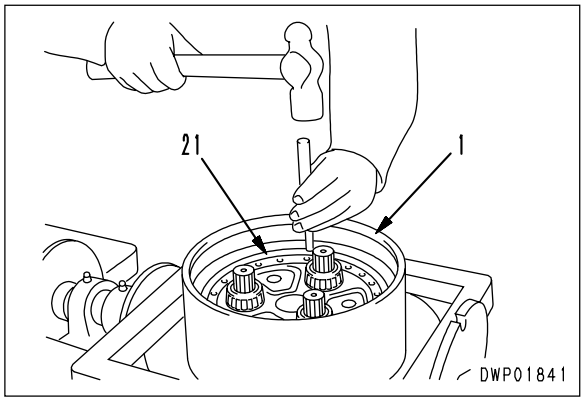
10) Insert pins (17) (30 pieces) between the pin spaces of hub (1) and tooth spaces of the gear.

⚠ Apply gear oil to pins (17) before inserting them.

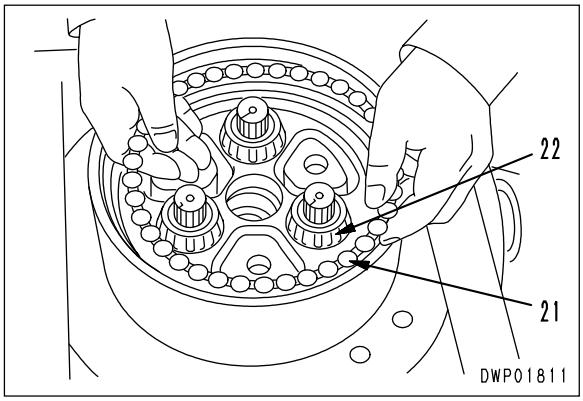


6. Installation of bearing

1) Install the outer race of bearing (21) into hub (1) with a steel rod and a hammer.



2) Place the steel balls and retainer assembly of bearing (21) on the outer race of bearing (21).

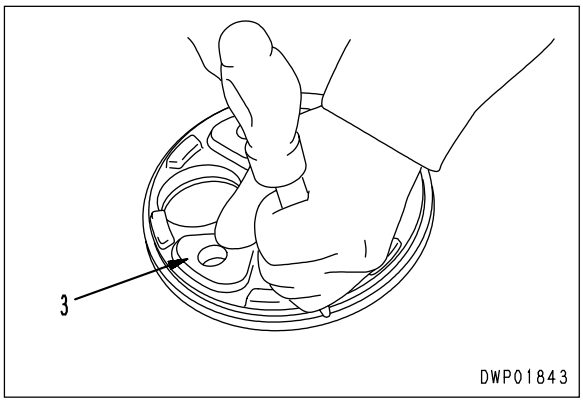


7. Installation of hold flange

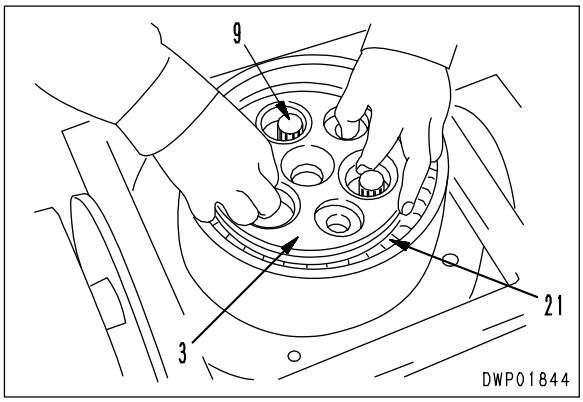
1) Fit the inner race of bearing (21) to hold flange (3) with a steel rod and a hammer.

⚠ Apply bearing mount compound to the fitting parts of the hold flange (3) and bearing.

⚠ Since hold flange (3) is press fitted to bearing (21), if it is fitted offset, it may be scuffed and can cause malfunction. Take care extremely.



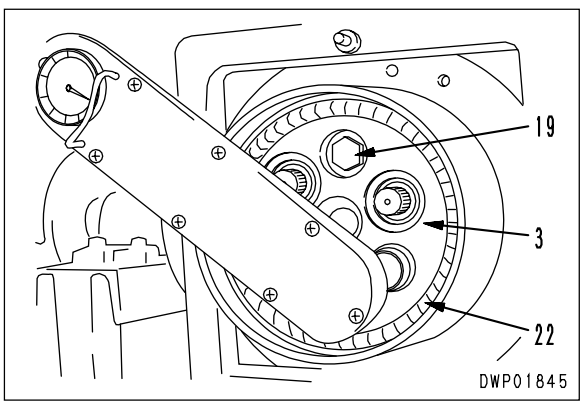
2) Fit hold flange (3) to bearing (21), setting the match marks on spindle (2) and crankshaft (9) to the positions before disassembly.



8. Tightening of reamer bolts

1) Turn the travel motor by 90 degrees.
2) Apply anti-seizure lubricating oil to the reaming parts of reamer bolts (19) and apply adhesive to the threaded parts of the reamer bolts.

⚠ If reamer bolts (19) are stained with oil or grease, degrease, clean, and dry in air for 10 minutes and then apply adhesive to their threaded parts.



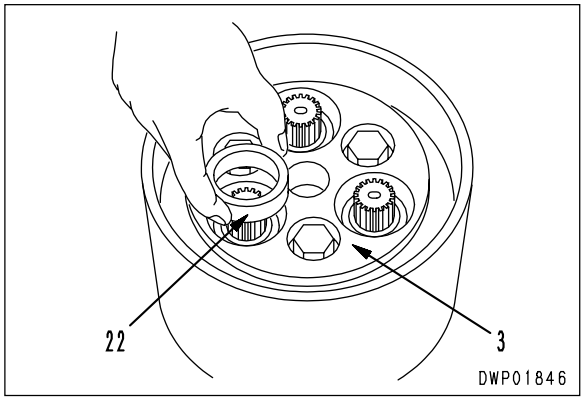
3) Tighten reamer bolts (19) (3 pieces) until hold flange (3) is press fitted to bearing (22) perfectly.
4) Tighten reamer bolts (19) (3 pieces) to the specified torque.

   kgm Reamer bolts (19):
   188.2 ± 29.4 Nm {19.2 ± 3 kgm}

   ⚠ Tighten 3 reamer bolts (19) evenly little by little. If only 1 or 2 of them are tightened first, hold flange (3) will slant and bearing (21) will not be fitted accurately in hold flange (3) and can cause seizure of reamer bolts (19).

   ⚠ If the seats of 3 reamer bolts (19) are not fitted accurately to the surface of the hold flange, inspect and remove the cause.

5) Fit the outer race of tapered roller bearing (22) to hold flange (3).



9. Fitting of snap rings

1) Check that any of hub (1), spindle (2), hold flange (3), RV gear assembly, and snap rings (20) has not been replaced with new one.

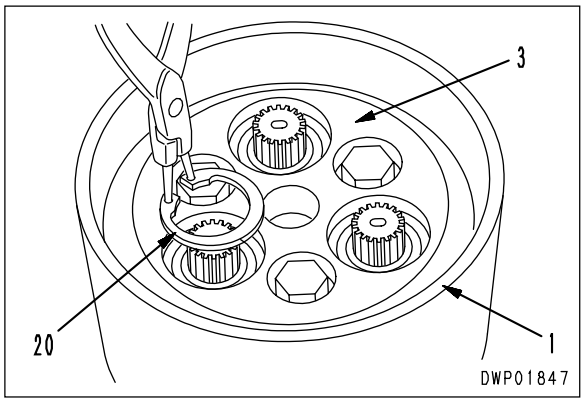
   ⚠ If any of the above parts has not been replaced, go to the next step.

   ⚠ If any of the above parts has been replaced, adjust the axial clearance of tapered roller bearing (22) before going to the next step.

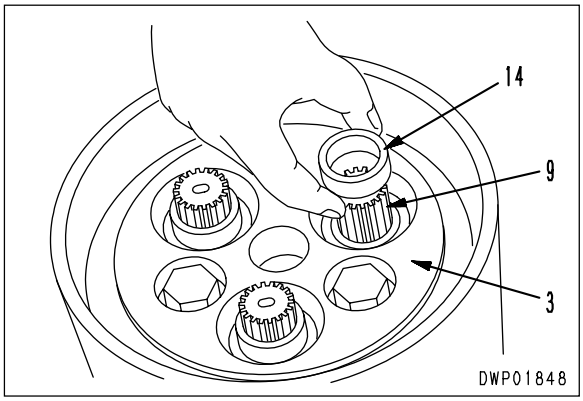
   ⚠ When replacing only snap rings (20), select the same ones as the used ones or similar ones from 12 types.

2) Fit snap rings (20) to the snap ring holes in hold flange (3).

   ⚠ Fit 3 snap rings (20) to the positions before disassembly, matching them to the match marks on hold flange (3). When using new snap rings (20), select ones having the thickness selected in the previous process.

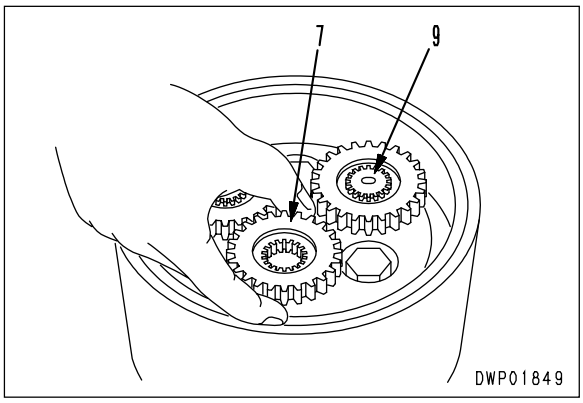


3) Install distance pieces (14) (3 pieces) to crankshaft (9).

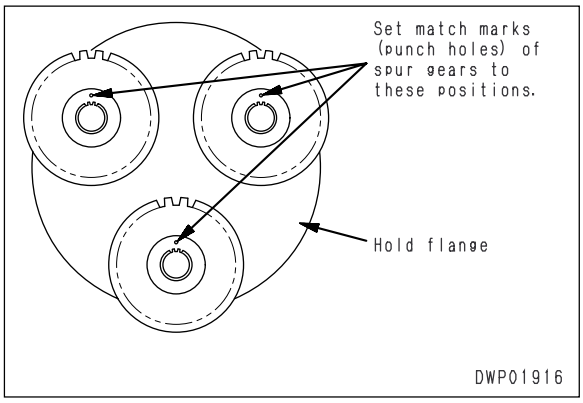


10. Installation of spur gears

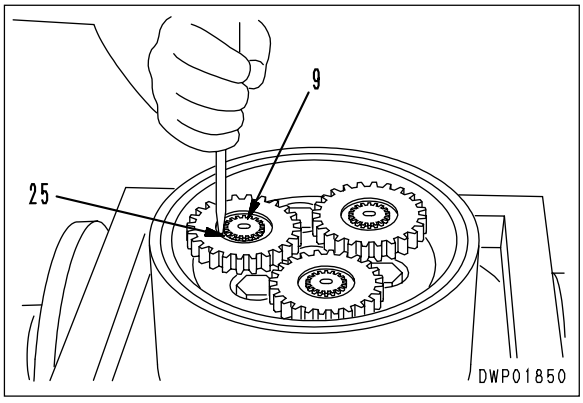
1) Install spur gears (7) (3 pieces) to crankshaft (9).



⚠ Install spur gears (7) (3 pieces) to crankshaft (9), matching their match marks (punch holes) as shown in the figure below.

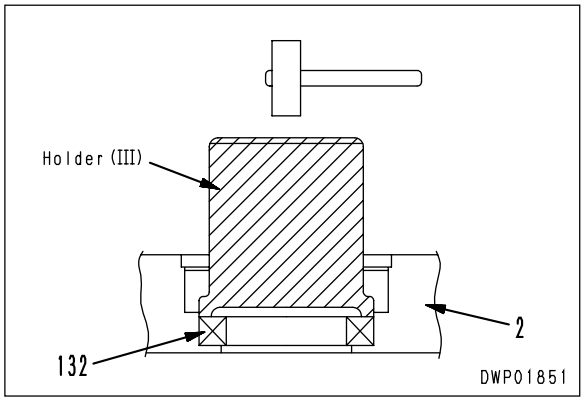


2) Install C-type shaft snap rings (25) (3 pieces) to the snap ring grooves of crankshaft (9).



11. Press fitting of oil seal

1) Turn over the worktable for the travel motor.
2) Remove the clamps.
3) Apply lithium grease to the lip of the oil seal and press fit oil seal (132) to the oil seal hole of spindle (2) with holder (III) and a hammer.



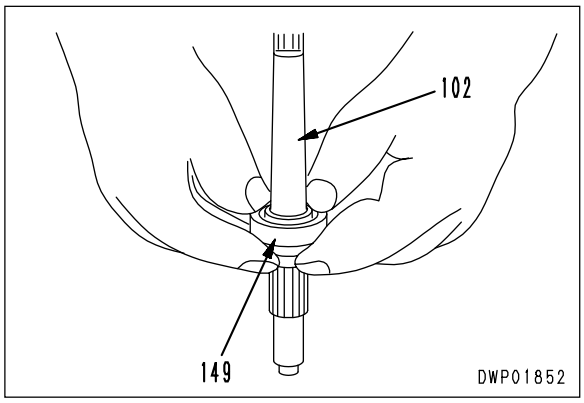
12. Installation of shaft

1) Put bearing (149) in a heating tank and heat it at 100 ± 10°C for 10 minutes and then insert it in shaft (102).

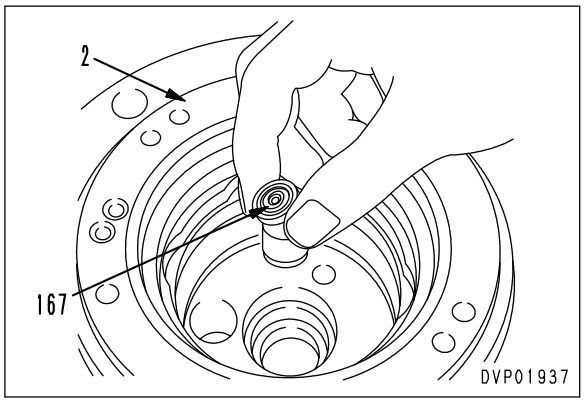
⚠ Put on leather gloves to insert the bearing and take care not to get burnt.

⚠ Insert bearing (149) until it is fitted to the flange of shaft (102).

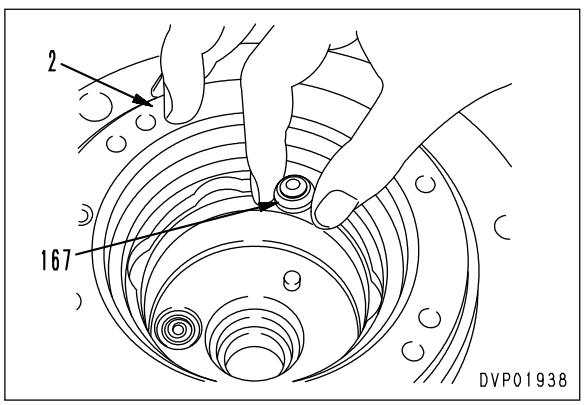
2) Apply lithium grease to the all periphery of bearing (149).



3) Soak the piston assembly (piston and shoe) in hydraulic oil and install it and spring (190) to spindle (2).
4) Turn the worktable for the travel motor by 90 degrees.

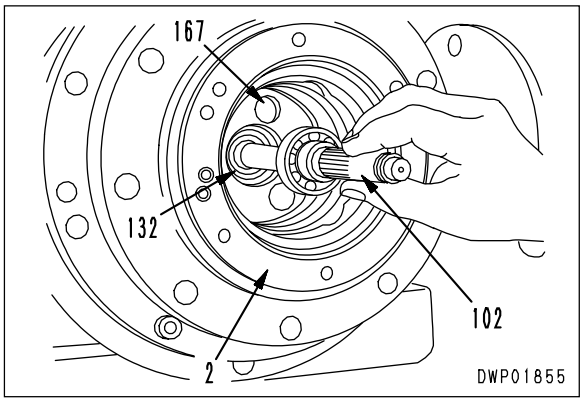


5) Install parallel pins (171) (2 pieces) in the pin holes of spindle (2).
6) Apply lithium grease as paste to pivots (167) (2 pieces) and fit them to parallel pins (171) of spindle (2).



7) Fit shaft (102) to spindle (2).

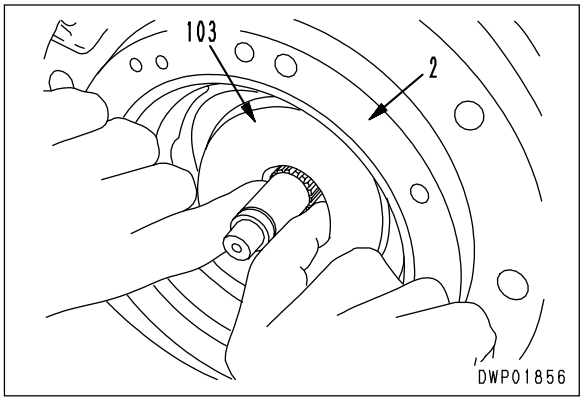
⚠ Fit shaft (102) to spindle (2) slowly, taking care that it will not damage the lip of oil seal (132) fitted in spindle (2). If the lip is damaged, oil will leak and the travel motor will be broken soon.



8) Apply molybdenum disulfide grease to the spline of shaft (102).
9) Install swash plate (103) to spindle (2).

⚠ Install thrust plate (144) to swash plate (103) in advance.

⚠ When installing swash plate (103) to spindle (2), match its pivot holes to pivots (167) fitted to spindle (2).

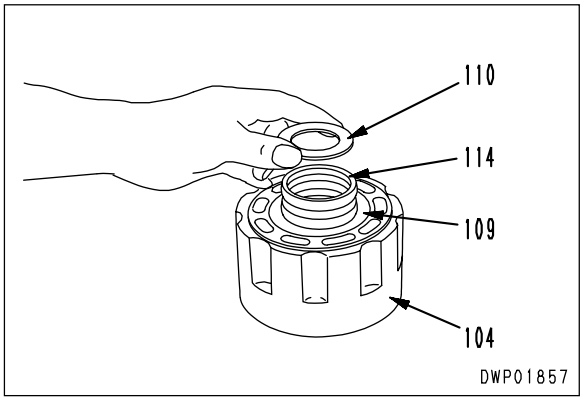


13. Reassembly of cylinder block

1) Insert washer (110), spring (114), washer (110), and round R-type snap ring (145) in cylinder block (104) in order.

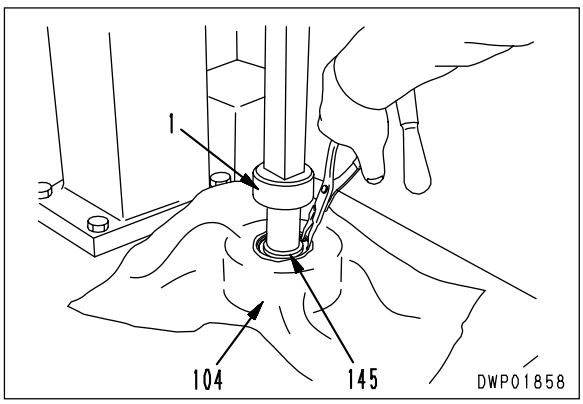
[Caution]
- **The round R-type snap ring (145) may fly out of the pliers. Accordingly, fix it to the pliers securely.**

2) Place cylinder block (104) on the press worktable.



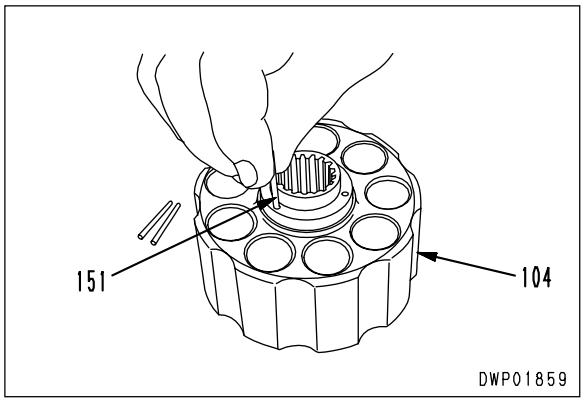
3) Place holder (I) on washer (110). Securing it with the press, install round R-type snap ring (145) to the snap ring groove of cylinder block (104) with snap ring pliers.

⚠ Cover cylinder block (104) with a vinyl sheet to protect its contact face against timing plate (109).



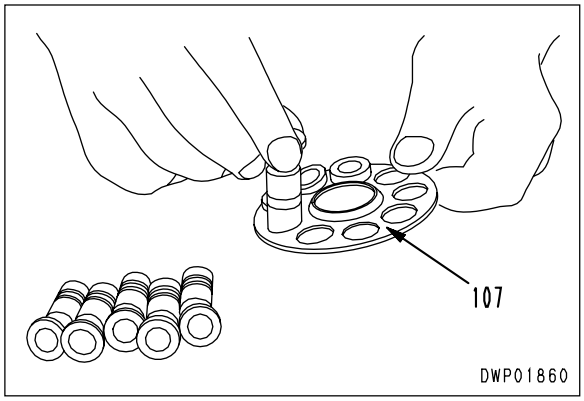
14. Reassembly of hydraulic motor parts

1) Fit rollers (151) (3 pieces) to the hole of cylinder block (104).
2) Place thrust ball (108) on roller (151).



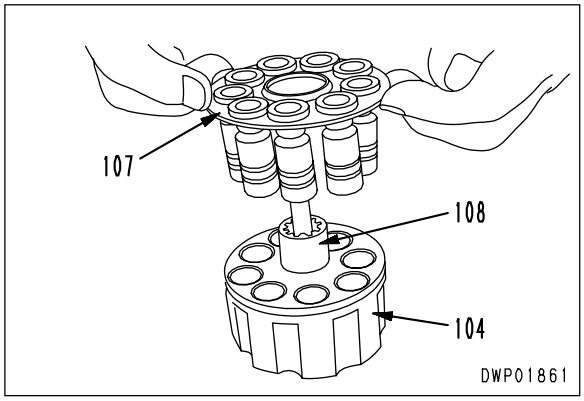
3) Fit 9 piston assemblies to retainer plate (107).

⚠ After fitting the piston assemblies, soak all of them in hydraulic oil.



4) Install 7 piston assemblies to cylinder block (104).

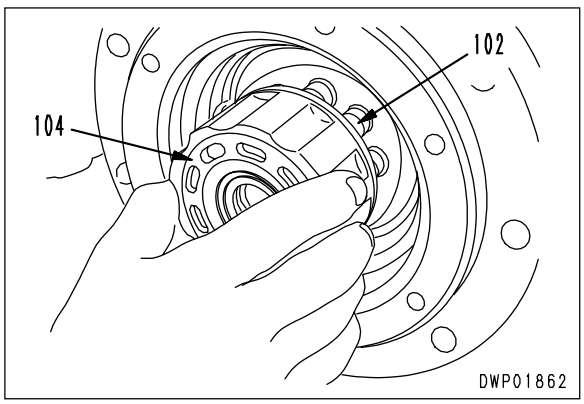
⚠ Match retainer plate (107) to the spherical part of thrust ball (108).



5) Install cylinder block (104) to shaft (102).

⚠ When installing cylinder block (104), match its spline hole to the spline part of shaft (102).

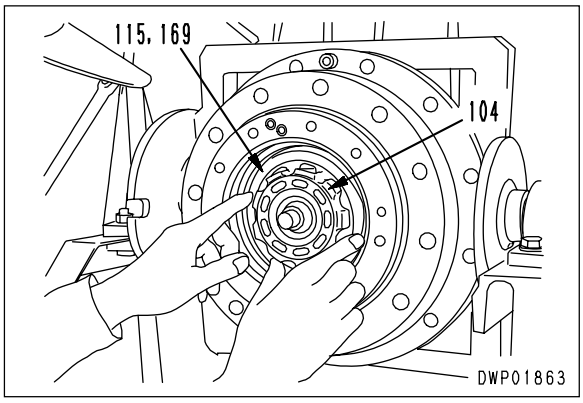
⚠ After installing the cylinder block, revolve it by hand to check that it has no play. If it has any play, inspect it.



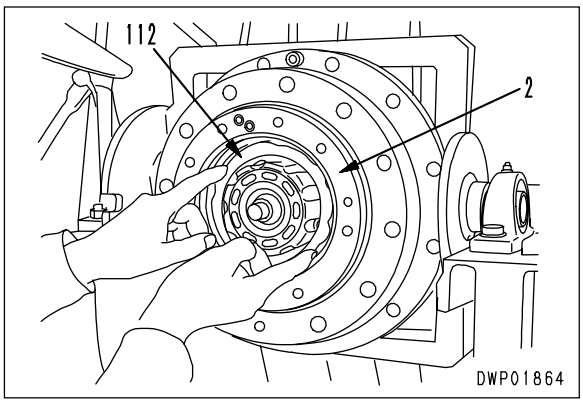
15. Assembly of parking brake assembly

1) Turn the worktable by 90 degrees.
2) Install mating plate (169), friction plate (115), and mating plate (116) to the peripheral groove of cylinder block (104) in order.

⚠ Before installing friction plate (115), soak it in hydraulic oil.



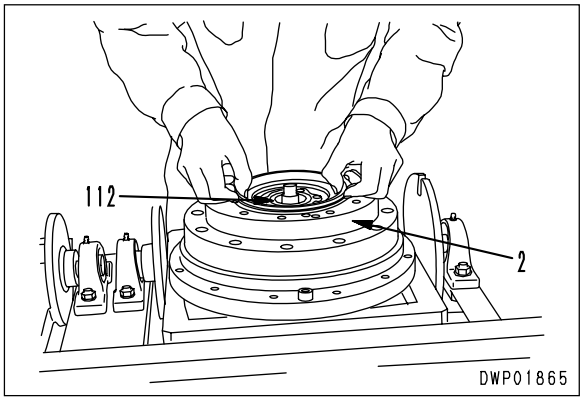
3) Fit O-rings (135) and (139) to the O-ring grooves of piston (112). At this time, apply lithium grease thinly to O-rings (135) and (139) and backup rings (147) and (148).



4) Install piston (112) in spindle (2).

⚠ If piston (112) does not enter spindle (2) smoothly because of the resistance of O-rings (135) and (139), hit its end lightly with a plastic hammer.

⚠ When installing piston (112), take care not to damage the O-rings.



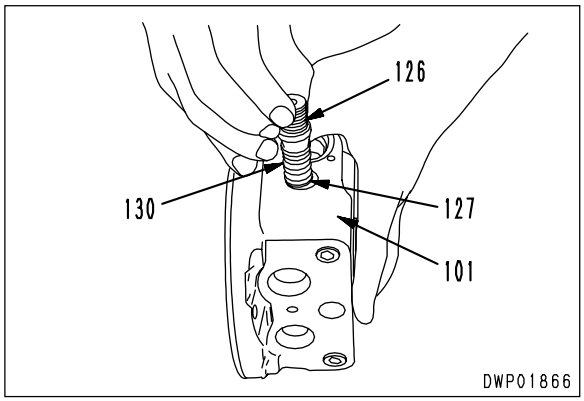
16. Reassembly of brake valve parts in rear flange

1) Install O-rings (137) (2 pieces) to plugs (126) (2 pieces).

⚠ Apply grease to O-rings (137).

2) Install valve (127) and spring (130) to each plug (126). At this time, apply lithium grease to the spring to lower the spring force and connect the valve, spring, and plug by utilizing the adhesion of the grease.

⚠ Apply HELMESEAL No. SS60F to the threaded parts of plugs (126).

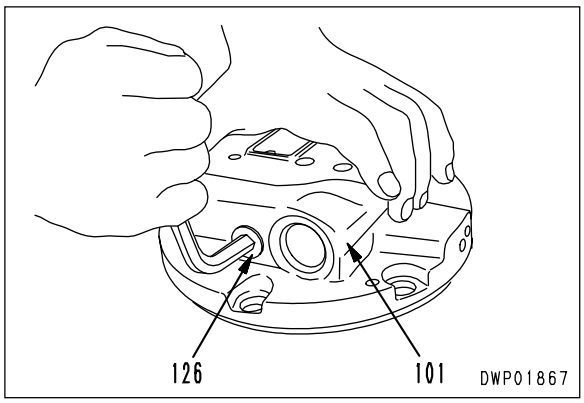


3) Insert each plug (126) in rear flange (101).

⚠ When inserting each plug (126), place rear flange (101) on the work table with the plug mounting screw hole up and align the plug with the screw hole.
Protect the O-ring and prevent removal of spring (130) from valve (127) caused by contact of the inside wall of the rear flange and valve.

⚠ If spring (130) comes off valve (127), the valve will not fit to the seat of rear flange (101) and oil leak.

4) After inserting plugs (126), tighten them into rear flange (101) temporarily with a hexagon wrench.

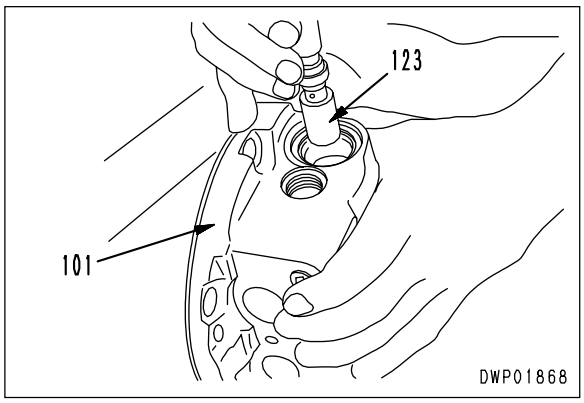


5) Insert spool (123) in rear flange (101).

⚠ When inserting the spool, apply hydraulic oil to it.

[Caution]

- **When installing the spool, align it with the hole of the rear flange so that its outside surface and the inside surface of the rear flange will not be damaged.**
- **If the hole of the rear flange and outside surface of the spool are damaged by contact, internal leakage will occur after assembly and the performance of the travel motor will lower.**

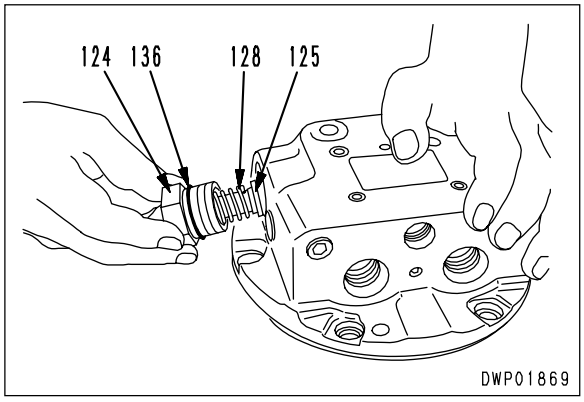


6) Fit O-rings (136) to plugs (124).

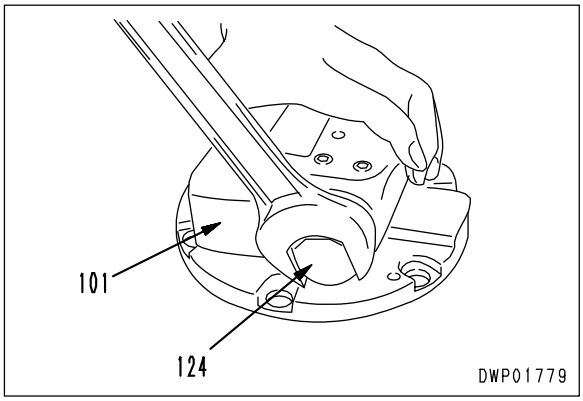
⚠ Apply lithium grease to O-rings (136).

7) Install stoppers (125) and springs (128) to plugs (124).
8) Install plugs (124) (2 pieces) to rear flange (101).

⚠ When installing each plug to the rear flange, take care not to deform the spring.

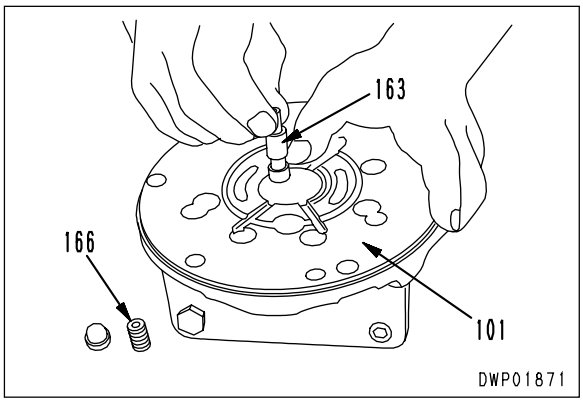


9) Tighten plugs (124) (2 pieces) into rear flange (101) temporarily with a spanner.

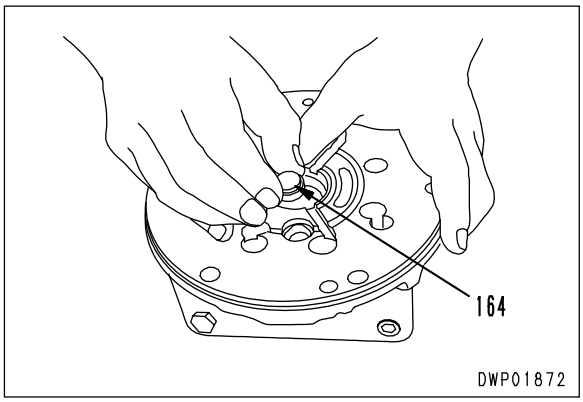


17. Reassembly of rear flange parts

1) Installation of pilot valve in rear flange
   i) Place the rear flange with the mating face against spindle (2) up.
   ii) Insert valve (163) in rear flange (101).



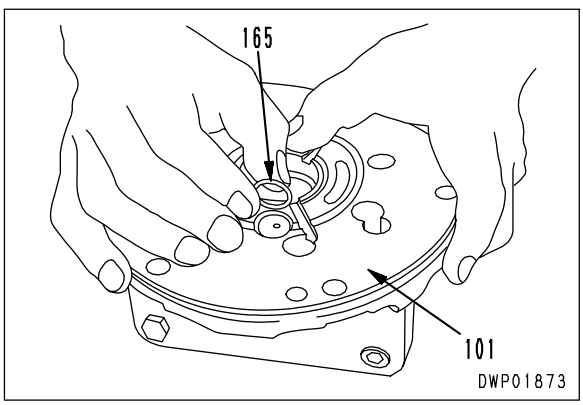
   iii) Fit spring (166) to valve (163) and place stopper (164) over them.



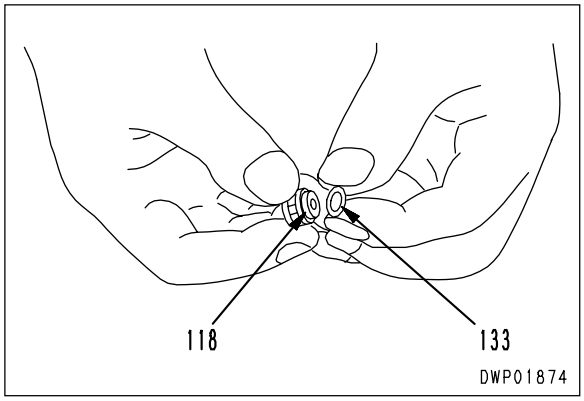
   iv) Bend new ring (165) a little and put it in rear flange (101) from above stopper (164) and insert it in the ring groove.

   ⚠ Be sure to fit ring (165) to the ring groove of rear flange (101).
   If ring (165) is not fitted to the ring groove, valve (163) does not operate stably and high speed and low speed cannot be selected normally.

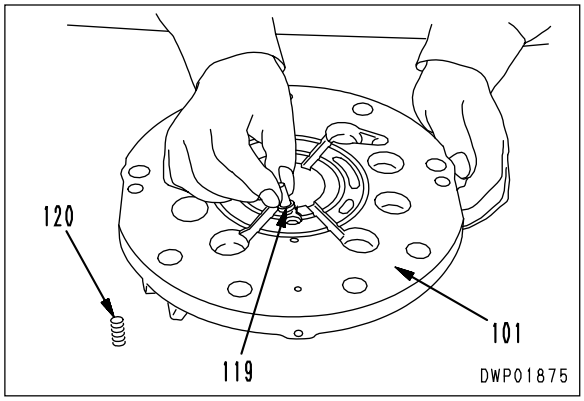
   ⚠ Be sure to use new ring (165).



2) Assembly of valve for parking brake
   i) Fit O-ring (133) to valve seat (118).
   ⚠ Apply grease to O-ring (133).

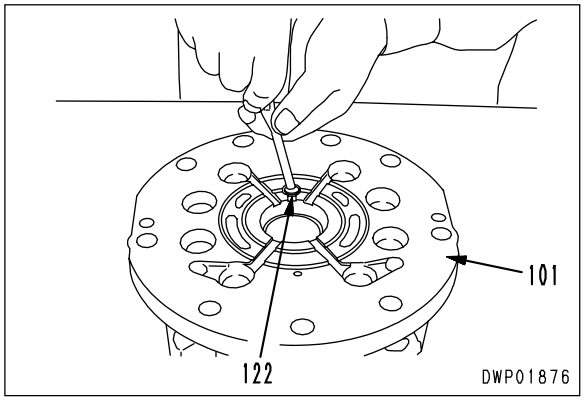


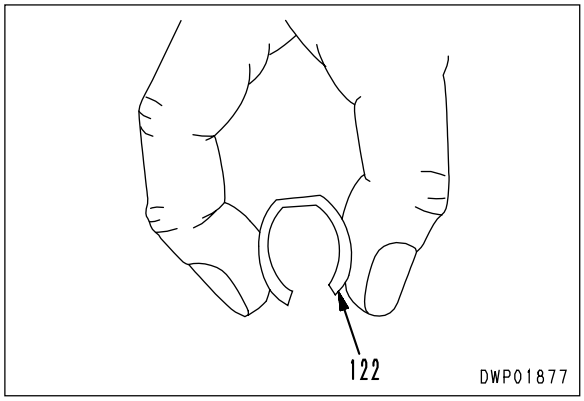
   ii) Insert valve (119), spring (120), and valve seat (118) to rear flange (101) in order.



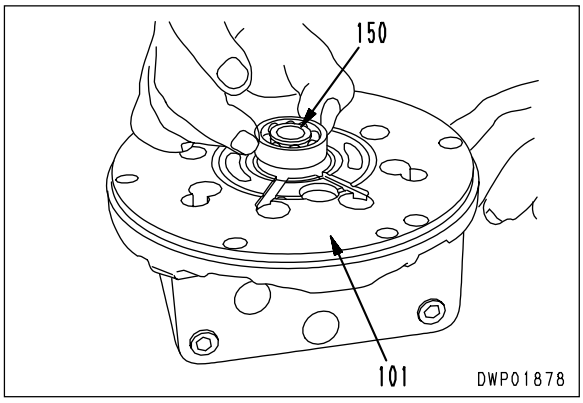
   iii) Bend ring (122) a little.

   iv) Insert ring (122) in rear flange (101) and fit it to the ring groove.
   ⚠ Use new ring (122).

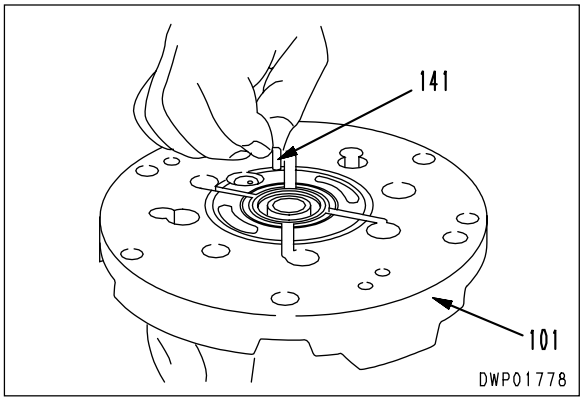




3) Apply hydraulic oil to bearing (150) and fit it to rear flange (101).

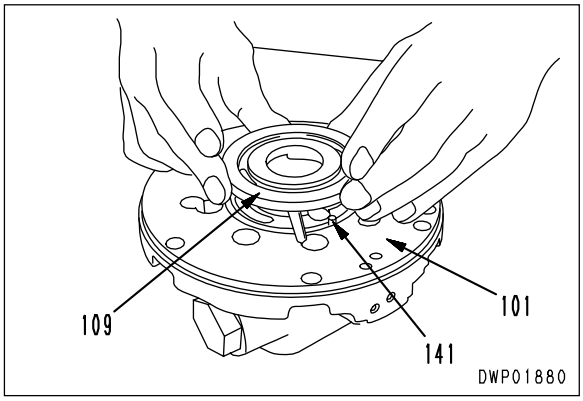


4) Fit parallel pins (141) (2 pieces) to the pin holes of rear flange (101).



5) Apply grease to the mating face of timing plate (109) against rear flange (101).
6) Install timing plate (109) to rear flange (101), using parallel pins (141) as guides.

⚠ Install timing plate (109) until it fits to rear flange (101).
The timing plate must be fitted so that it will not fall from the rear flange when it is installed to spindle (2).



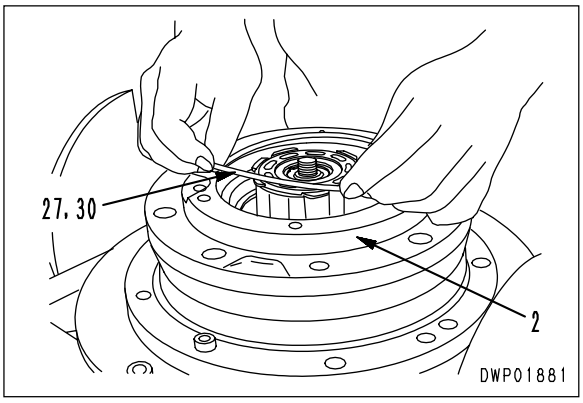
18. Installation of hexagon socket head plug

1) Check that there is steel ball (168) in the rear flange.
2) Wind a sealing tape onto plug (152) and tighten plug (152) into rear flange 101 to the specified torque.

kgm Plug (152):
12.3 ± 2.5 Nm {1.25 ± 0.25 kgm}

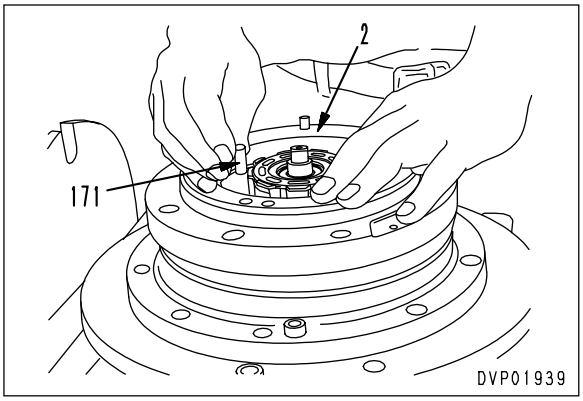
19. Connection of rear flange and spindle

1) Turn the worktable for the travel motor by 90 degrees to bring spindle (2) side up.
2) Fit O-rings (27) and (30) to the O-ring grooves of spindle (2).

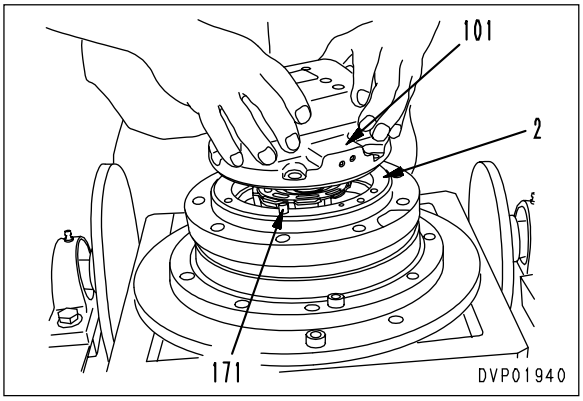


⚠ When fitting O-rings, do not apply grease to them. If grease is applied at this time, it may ooze out through the joint of the rear flange and spindle while travel motor is operating. Since the grease oozing out can be mistaken for oil leakage, do not apply grease to O-ring (30).

3) Fit parallel pins (171) (2 pieces) to the pin holes of spindle (2).
4) Supply hydraulic oil of 0.3 liters into spindle (2).

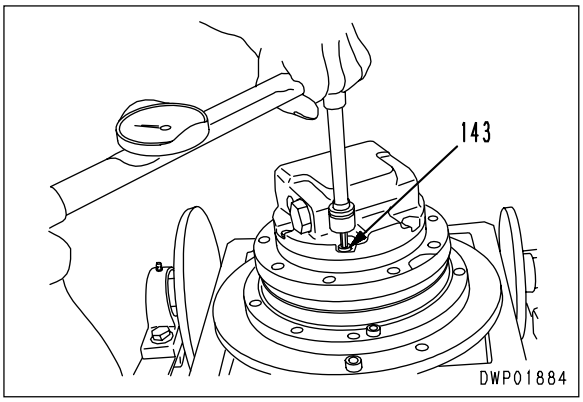


5) Install rear flange (101) to spindle (2), matching its pin holes to parallel pins (171) (2 pieces) fitted to spindle (2).



⚠ When installing rear flange (101) to spindle (2), install springs (113) (8 pieces) to the rear flange. At this time, apply lithium grease to springs (113) to prevent them from coming off the rear flange.

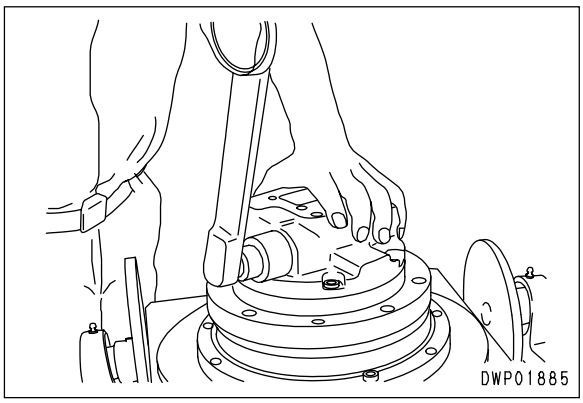
6) Tighten hexagon socket head bolts (143) (6 pieces) into spindle (2) to the specified torque.



kgm Hexagon socket head bolts (143):
29.4 ± 4.9 Nm {3.0 ± 0.5 kgm}

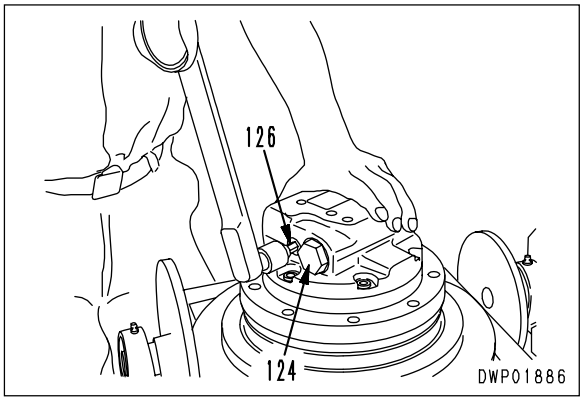
7) Tighten plugs (124) to the specified torque.

kgm Plugs (124):
107.9 ± 24.5 Nm {11 ± 1.5 kgm}



8) Tighten plugs (126) to the specified torque.

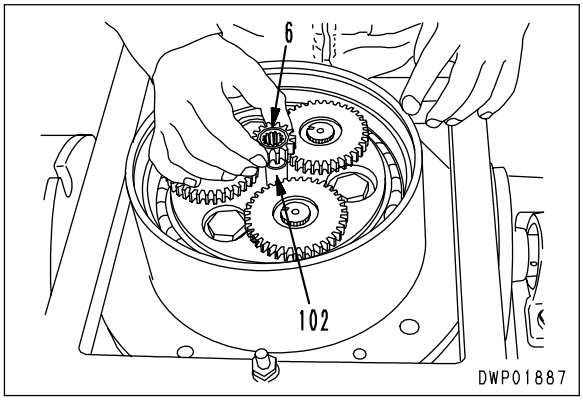
kgm Plugs (126):
49.0 ± 9.8 Nm {8 ± 1.0 kgm}



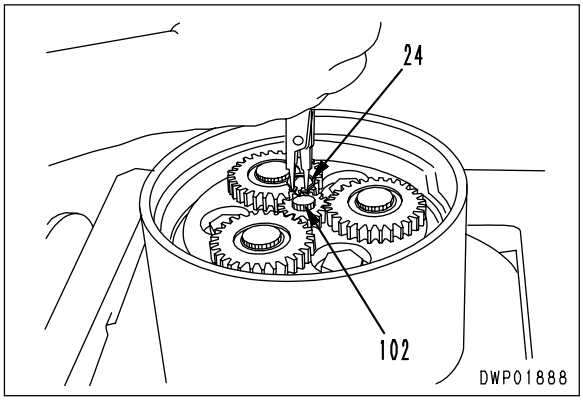
20. Reassembly of input gear

1) Turn over the travel motor.
2) Install input gear (6) to shaft (102).

⚠ Fit input gear (6) to shaft (102), meshing it with 3 spur gears (7). If it does not mesh, inspect.



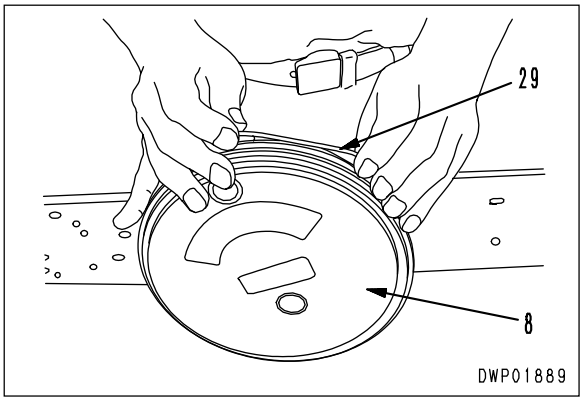
3) Install C-type shaft snap rings (24) to the snap ring grooves of shaft (102).



21. Reassembly of cover

1) Supply gear oil of 1.1 liters into hub (1).
2) Fit O-ring (29) to the O-ring groove of cover (8).

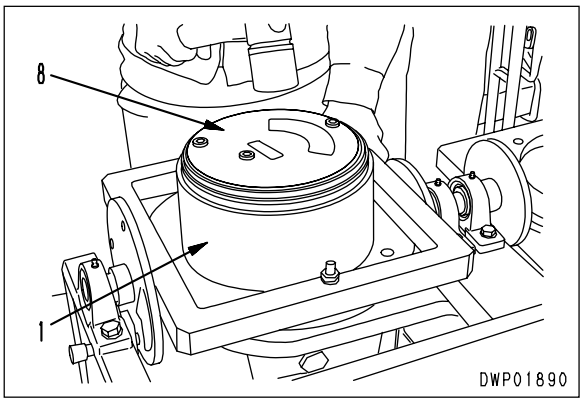
⚠ Apply grease to O-ring (29).



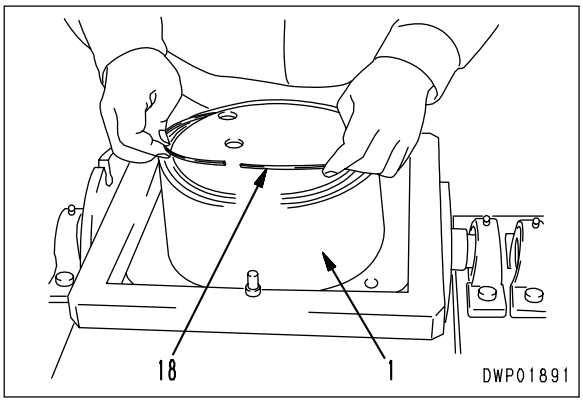
3) Install cover (8) to hub (1).

⚠ Match them match marks of cover (8) and hub (1) to install them to the positions before disassembly.

⚠ Install cover (8) by hitting its periphery lightly with a plastic hammer. If it is installed suddenly by hitting it strongly, the O-ring will be broken and lubricating oil will leak.



4) Fit ring (18) to the ring groove of hub (1).

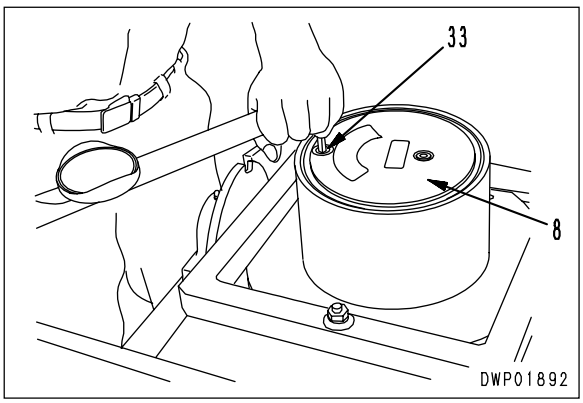


5) Wind sealing tape onto hexagon socket head plugs (33) (3 pieces) and tighten them into cover (8) to specified torque.

kgm Hexagon socket head plugs (33):
39.2 ± 14.7 Nm {4 ± 1.5 kgm}

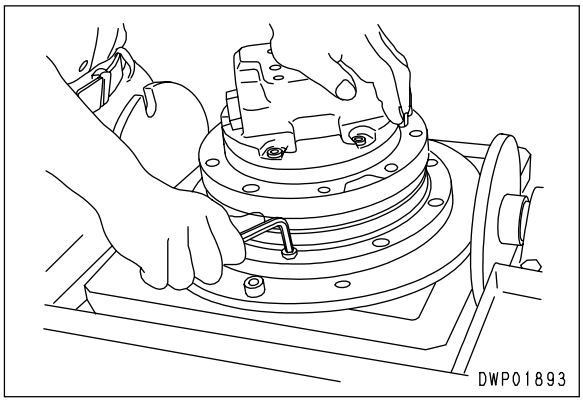
⚠ Wind the sealing tape onto each hexagon socket head plug (33) at least 2 turns.

⚠ Tighten each hexagon socket head plug (33) until the number of threads projected from the end of cover (8) becomes ±1.



20. Removal of travel motor

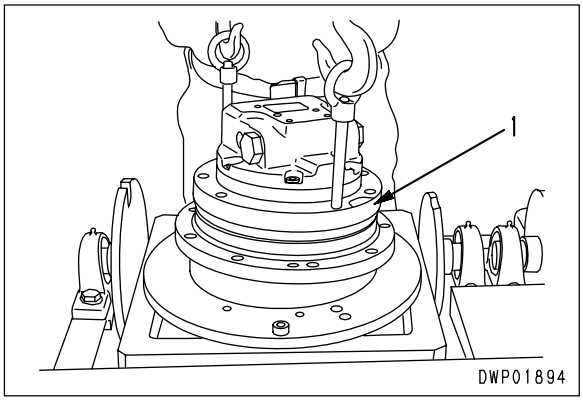
1) Turn over travel motor.
2) Remove the travel motor mounting bolts from the worktable.



3) Tighten eyebolts (2 pieces) into the screw holes of hub (1).

   Install 2 eyebolts symmetrically to the screw holes of hub (1)

4) Install hooks and wires to the eyebolts and remove the travel motor from the worktable with the crane.



23. Adjustment of preload on bearing

⚠ A proper preload must be applied to bearing (21) to secure a proper life span. If any part which affects the preload is replaced, assemble the parts temporarily and check the preload according to the following procedure.

⚠ Parts which affect preload on bearing
Hub (1), spindle (2), hold flange (3), bearing (21)

⚠ If any of the above parts is not replaced, skip this process and go to (1) Reassembly of hub assembly.

⚠ The following are the procedures for assembling temporarily to adjust the preload and checking and adjusting the preload.

Temporary assembling procedure for adjusting preload on bearing

1) Check that any of hub (1), spindle (2), hold flange (3), and bearings (21) (2 pieces) has not been replaced with new one.

   ⚠ If any of the above parts has not been replaced, go to the next step.

   ⚠ If any of the above parts has been replaced, adjust the preload on the bearing before going to the next step.

2) Tighten 2 eyebolts symmetrically into the screw holes of hub (1).
3) Install hooks and wires to the eyebolts and sling and install hub (1) to the worktable with a crane.

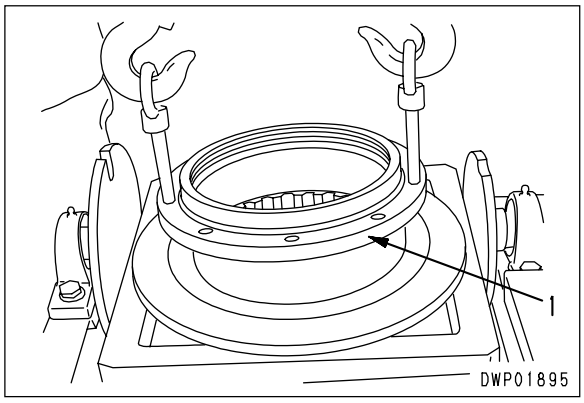
   ⚠ Matching the screw holes of hub (1) to the mounting screw holes of the worktable, insert hub (1) in the mounting hole of the worktable carefully.

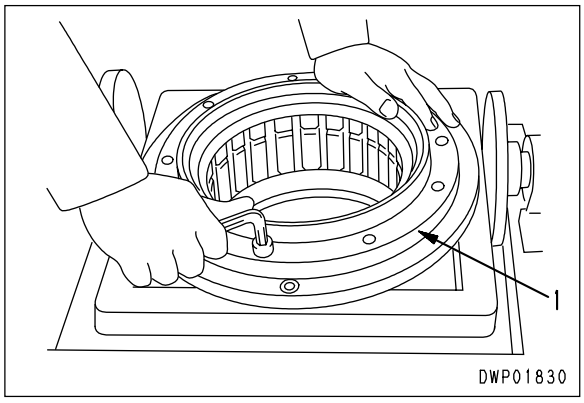
4) Secure hub (1) to the worktable with hexagon socket head bolts.

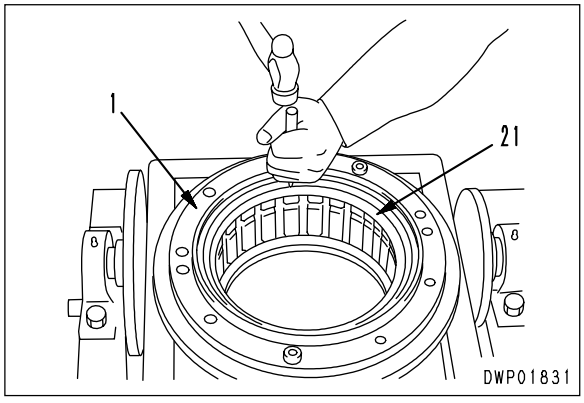
5) Press fit the outer race (1 piece) of bearing (21) to hub (1) with a pin punch and a hammer.

   ⚠ Apply the pin punch to the rim of bearing (21) and hit it lightly with a hammer all round to fit the bearing little by little.

6) Place the steel balls and retainer assembly of bearing (21) on the outer race of bearing (21).

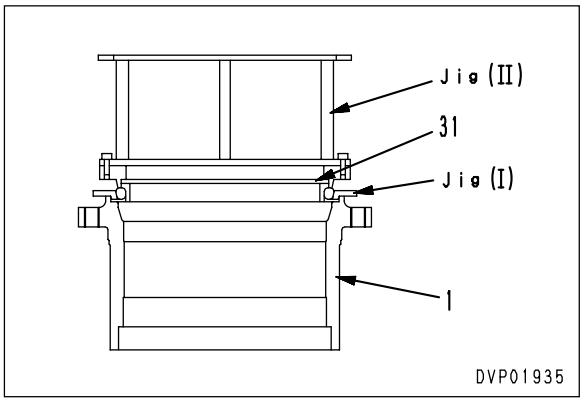






7) Apply lithium grease thinly to the O-ring of floating seal (31) and then fit floating seal (31) to the floating seal groove of hub (1).

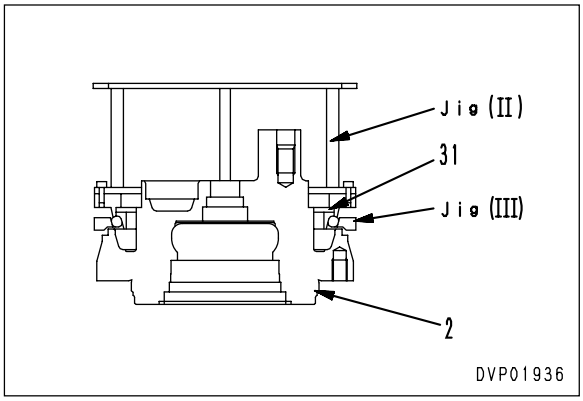
⚠ Place floating seal fitting jig (I), floating seal, and floating seal fitting jig (II) in order and press them until both floating seal fitting jigs touch each other. Remove the fitting jigs and check that the floating seal is parallel with the hub end and is not projected more than 1 mm.



Reassembly of spindle assembly

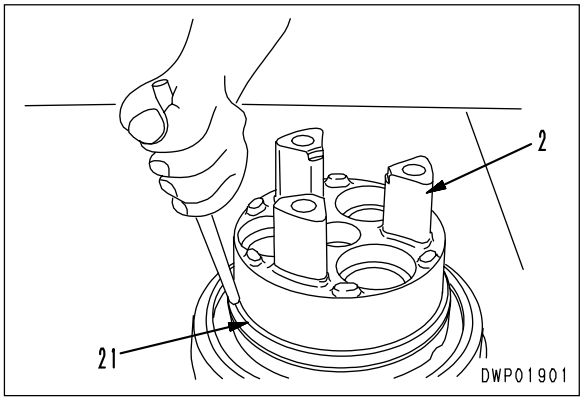
1) Apply lithium grease to the O-ring of floating seal (31) and then fit it to the floating seal groove of spindle (2).

⚠ Place floating seal fitting jig (III), floating seal, and floating seal fitting jig (II) in order and press them until both floating seal fitting jigs touch each other. Remove the fitting jigs and check that the floating seal is parallel with the hub end and is not projected more than 1 mm.

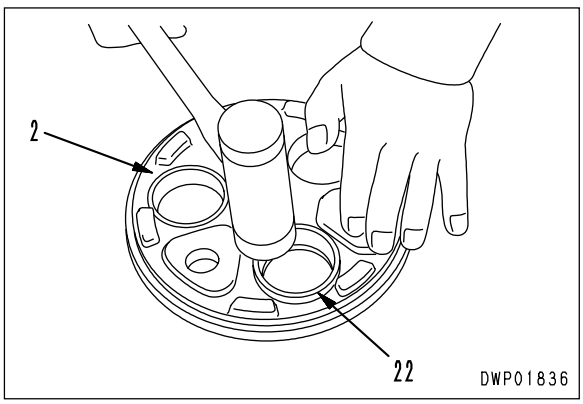


2) Press fit the inner race (1 piece) of bearing (21) to spindle (2) with a pin punch and a hammer.

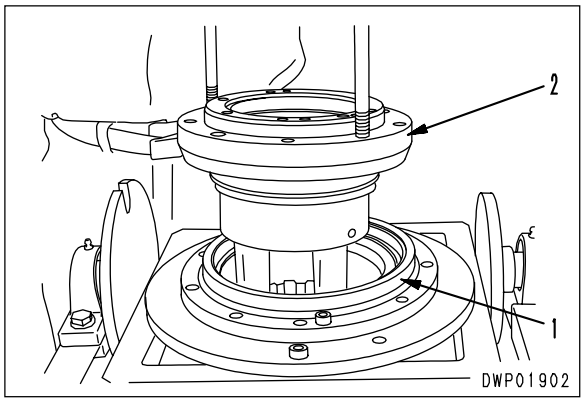
⚠ Apply the pin punch to the rim of bearing (21) and hit it lightly with a hammer all round to fit the bearing little by little.



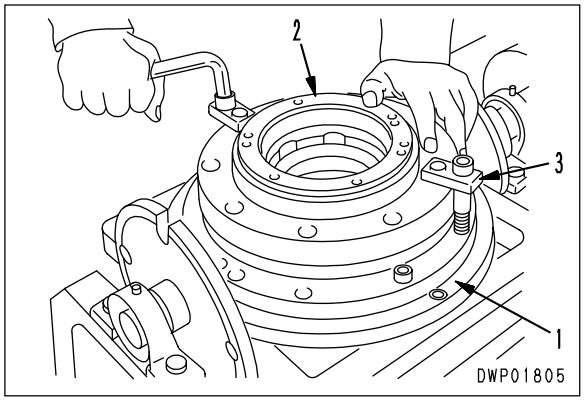
3) Fit outer races (3 pieces) of tapered roller bearings (22) to the respective outer race holes in spindle (2) by hitting them lightly with a plastic hammer.



4) Turn over the spindle.
5) Install 2 eyebolts symmetrically to spindle (2).
6) Install hooks and wires to the eyebolts and sling spindle (2) with the crane and insert it in hub (1) slowly.



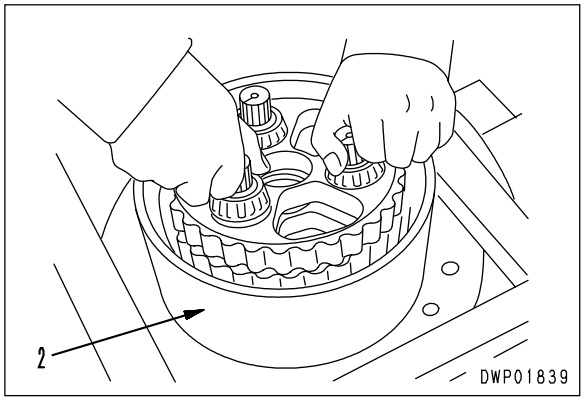
7) Tighten the clamps symmetrically to hub (1) and spindle (2).



8) Turnover the travel motor.
9) Install the RV gear assembly to spindle (2).

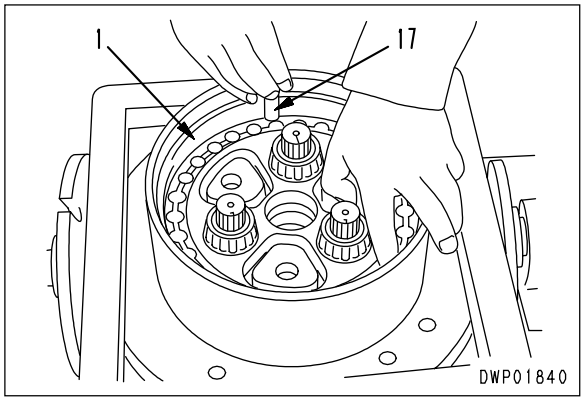
⚠ If the RV gear assembly has been disassembled, reassemble it perfectly.

⚠ Hold the crankshaft end with both hands and raise and install the RV gear assembly to the spindle carefully, matching the inner race of the tapered roller bearing of the crankshaft to the outer race hole of the tapered roller bearing fitted to the spindle. If the RV gear assembly is dropped to install it, the tapered roller bearing will be damaged and the travel motor will malfunction.



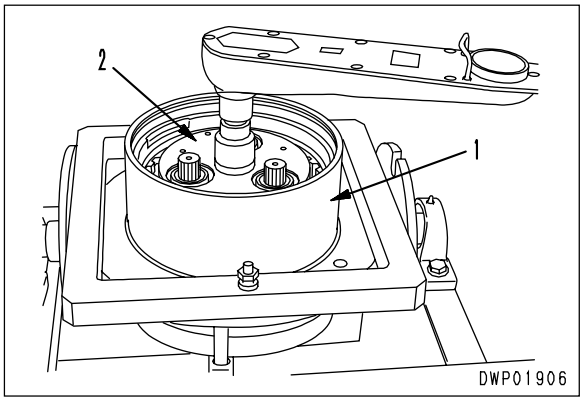
10) Insert pins (17) (30 pieces) between the pin spaces of hub (1) and tooth spaces of the gear.

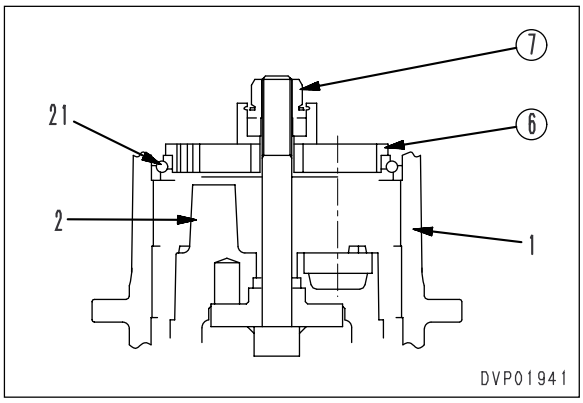
⚠ Apply gear oil to pins (17) before inserting them.



11) Install main bearing preload adjustment jig ⑥ to spindle (2) and tighten special nut ⑦ to press fit bearing (21) to hub (1) as shown in the figure at left.

kgm Special nut ⑦: **29.4 Nm {3 kgm}**



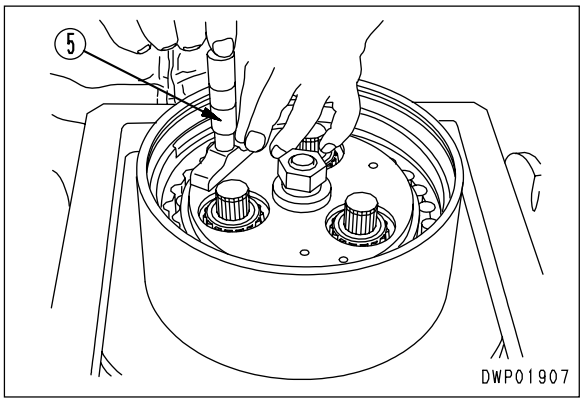


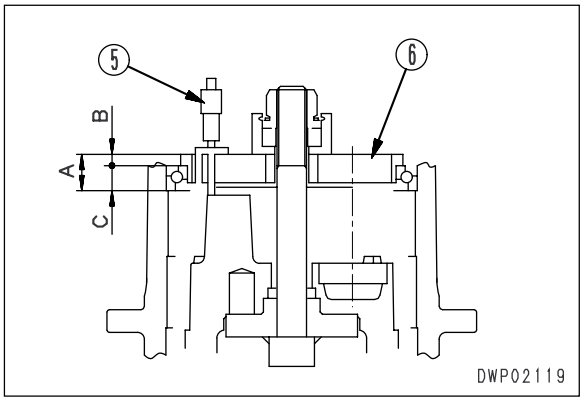
12) Measure depth "A" with depth micrometer ⑤ through the measurement hole of main bearing preload adjustment jig ⑥.

13) Since dimension "B" of main bearing preload adjustment jig ⑥ is known, obtain clearance "C" by the following formula.

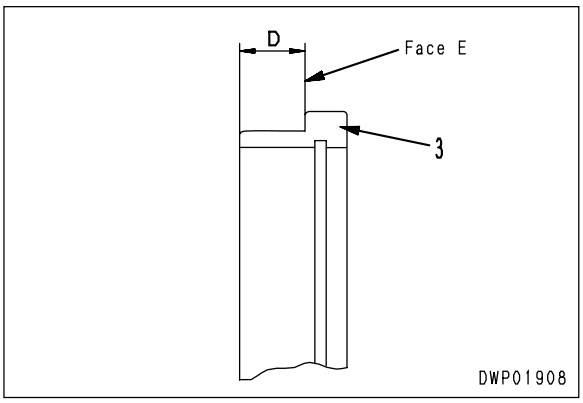
"C" = "A" – "B"

A: Measured value
B: Dimension of jig
C: Standard dimension





14) Obtain dimension “D” of hold flange (3).

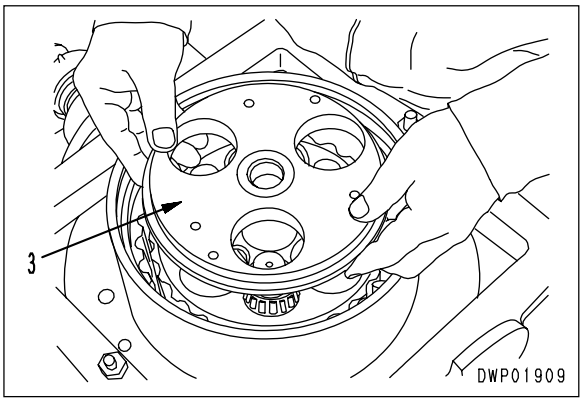


15) Adjust hold flange (3) by the following methods, depending on the measurement in 12) - 14) above.
Dimension “C” is the standard dimension of the hold flange.

I) When the measured dimension of the hold flange (3) is larger than the standard dimension (C < D).
Cut face E of the hold flange (3) with a lathe, etc. to the standard dimension.

II) When the measured dimension of hold flange (3) is within the tolerance of the standard dimension (C = D).
Use the hold flange as it is.

III) When measured dimension of the hold flange (3) is less than the standard dimension (C > D).
Cut face F of the hold flange (3) with a lathe, etc. to the standard dimension.



16) Remove the main bearing preload adjustment jig ⑥ from spindle (2).
After adjusting the hold flange according to above steps I), II), and III), disassemble it, referring to the section of disassembly of the temporary assembly, and then assemble permanently.

⚠ When the temporary assembly is disassembled, the outer race of the tapered roller bearing press fitted into the hole of the spindle and the inner race fitted to the hold flange do not need to be removed.

24. Adjustment of axial clearance of tapered roller bearing

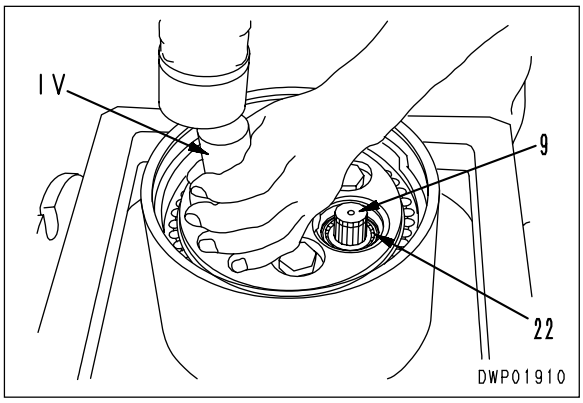
⚠ If any of the following parts is replaced, the axial clearance of tapered roller bearing (22) must be adjusted to a proper level by adjusting the thickness of snap ring (20).
Hub (1), spindle (2), hold flange (3), RV gear assembly, snap ring (20)

⚠ If any of the above parts is not replaced, go to 6 without adjusting the snap ring thickness.

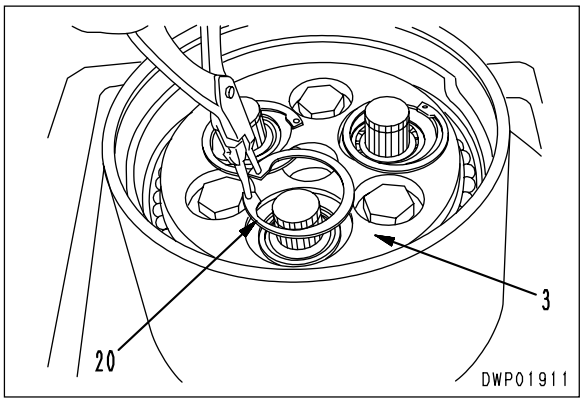
⚠ The following is the method of adjusting axial clearance of the tapered roller bearing.

1) Lightly hit the outer race of tapered roller bearing (22) installed to crankshaft (9) with a hammer and holder (IV).

⚠ This action is required to insert the RV gear assembly in spindle (2) securely.

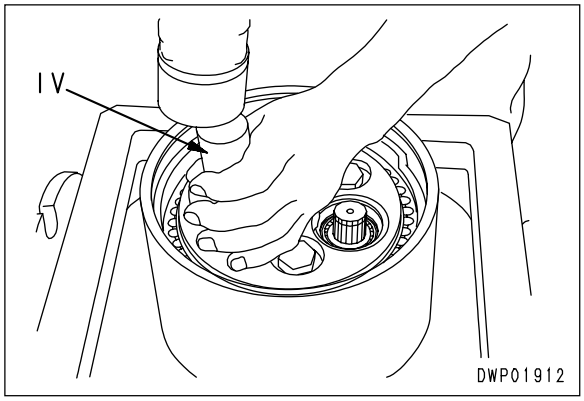


2) Fit thinnest snap ring (20) to the snap ring groove in hold flange (3).



3) Lightly hit the periphery of the snap ring with the hammer and holder (IV).

⚠ Check that the RV gear assembly is inserted securely in spindle (2).

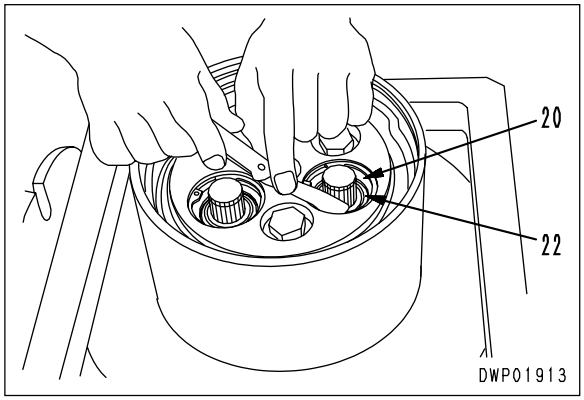


4) Insert a thickness gauge between snap ring (20) and tapered roller bearing (22) to measure the clearance.
5) Measurement of snap ring thickness
   - Set thickness of snap ring (Max.)

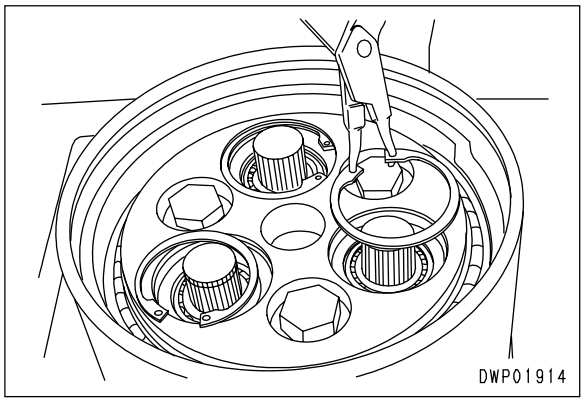
$$\text{Max.} = \boxed{\begin{matrix}\text{Thickness}\\ \text{of thickness}\\ \text{gauge}\end{matrix}} + \boxed{\begin{matrix}\text{Thickness}\\ \text{of snap}\\ \text{ring fitted}\\ \text{at present}\end{matrix}}$$

   - Set thickness of snap ring (Min.)

$$\text{Min.} = \boxed{\begin{matrix}\text{Thickness}\\ \text{of thickness}\\ \text{gauge}\end{matrix}} + \boxed{\begin{matrix}\text{Thickness}\\ \text{of snap}\\ \text{ring fitted}\\ \text{at present}\end{matrix}} - \boxed{0.05}$$

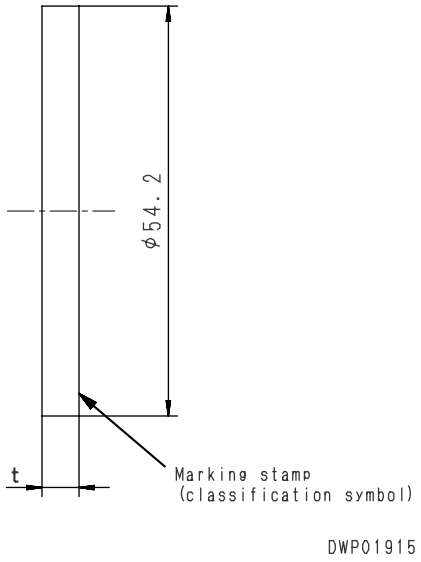


6) After the snap ring thickness is decided, select one from the 12 types and install it to the hold flange.
7) After installing the snap ring having the decided thickness, start the permanent assembly from 6.



DIMENSIONS TABLE OF CLEARANCE ADJUSTMENT PARTS

No.	Part name \ GM Model	GM06VL
1	Snap ring (20)	



Type symbol	Dimension t
A	Above 1.90 up to 1.95
B	Above 1.95 up to 2.00
C	Above 2.00 up to 2.05
D	Above 2.05 up to 2.10
E	Above 2.10 up to 2.15
F	Above 2.15 up to 2.20
G	Above 2.20 up to 2.25
H	Above 2.25 up to 2.30
I	Above 2.30 up to 2.35
J	Above 2.35 up to 2.40
K	Above 2.40 up to 2.45
L	Above 2.45 up to 2.50

PERFORMANCE CONFIRMATION TEST

After maintaining the GM motor, test its performance according to the following procedure.

1. Necessary measuring instruments

1	Pressure gauge (For 3.43 MPa {35 kg/cm^2})	2 pcs.
2	Measuring cylinder (For 5 liters)	1 pc.
3	Stopwatch	1 pc.

2. Test procedure

1 Installation and piping of GM motor

Install the GM motor to the machine body (sprocket) and pipe it.
Do not install the track, however [since the performance test of the GM motor (no-load operation) is executed].

Notes) 1. Pipe the GM motor so that a pressure gauge (main circuit) can be installed and the draining rate of the hydraulic motor can be measured.
2. Do not install the GM motor by hitting it with a hammer, etc. but install it carefully by utilizing the bolt holes.

2 Running-in of GM motor

	Speed of GM motor	Pressure	Revolving direction	Operating time
1	10 rpm	No load	Right/Left	1 minute or more for each test
2	20 rpm			

3 Performance confirmation test on GM motor

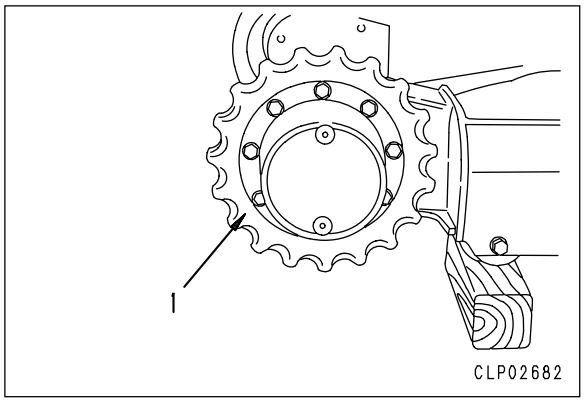
1	Preparatory operation before testn.	Operate until temperature rises to the following points. • Hydraulic oil temperature: 45 - 55°C • Outside temperature of hub of reduction gear assembly: 40 - 80°C
2	Confirmation test ..... Criteria	Measure the following items to check the performance. Drive pressure of GM motor — Max. 1.57 MPa {16 kg/cm^2} at 10 rpm Draining rate of hydraulic motor — Max. 0.5 liters/min. at 10 rpm

- Acceptable → Install track.
- Rejected → Disassemble and adjust again.

REMOVAL OF SPROCKET

1. Remove track shoe assembly. For details, see REMOVAL OF RUBBER SHOE ASSEMBLY or REMOVAL OF STEEL SHOE ASSEMBLY.

2. Remove sprocket (1). ※1



INSTALLATION OF SPROCKET

- Carry out installation in the reverse order to removal.

※1

Sprocket mounting bolt :
Thread tightener (LT-2)

kgm Sprocket mounting bolt :
PC30R, 35R :
110.25 ± 12.25 Nm {11.25 ± 1.25 kgm}
PC40R, 45R : **176.4 ± 19.6 Nm {18 ± 2 kgm}**

REMOVAL OF SWING MOTOR, SWING MACHINERY ASSEMBLY

⚠ Release the remaining pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic tank.

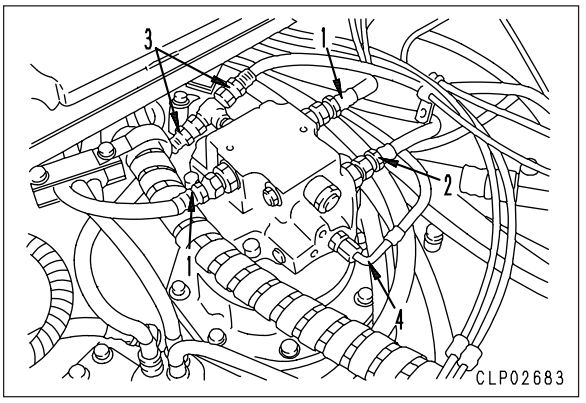
1. Remove floor frame assembly. For details, see REMOVAL OF FLOOR FRAME ASSEMBLY.

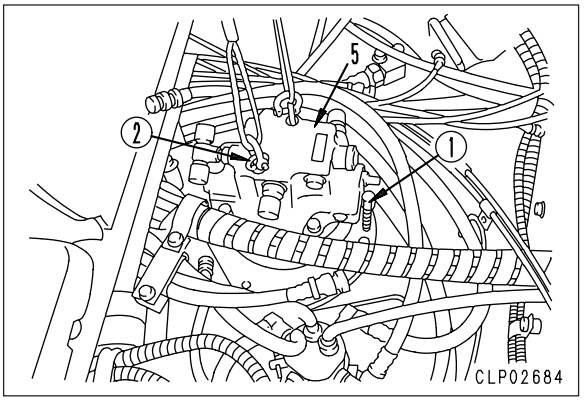
2. Disconnect 2 main hoses (1) and suction hose (2).
   ★ After disconnecting the hoses, fit tags to distinguish them.

3. Disconnect 2 drain hoses (3) and pilot hose (4).
   ★ Fit blind plugs in the drain hoses (hydraulic tank end).

4. Remove mounting bolts, then using forcing screw ①, disconnect swing motor and swing machinery assembly from revolving frame. ※ 1

5. Using 2 eyebolts ②, lift off swing motor and swing machinery assembly (5).
   kg Swing motor, swing machinery assembly :
   40 kg (PC30R, 35R)
   45 kg (PC40R, 45R)





INSTALLATION OF SWING MOTOR, SWING MACHINERY ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm Swing motor, swing machinery assembly mounting bolt :
110.25 ± 12.25 Nm {11.25 ± 1.25 kgm}

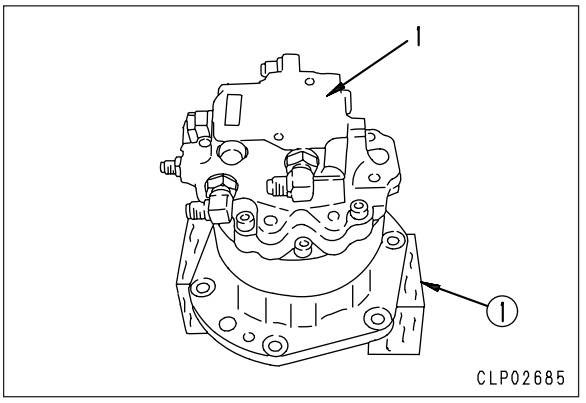
- **Refilling with oil (hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

- **Bleeding air**
  Bleed the air from the swing motor. For details, see TESTING AND ADJUSTING, Bleeding air.

DISASSEMBLY OF SWING MOTOR, SWING MACHINERY ASSEMBLY

★ There is no oil drain plug installed, so prepare an oil container to catch the oil inside the case, and drain the oil during the disassembly process.

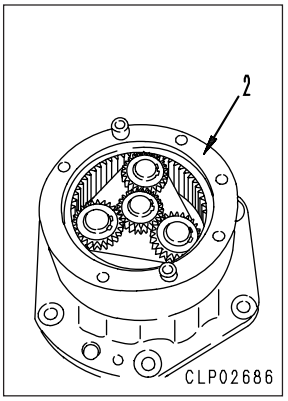
Case : **PC30R, 35R : 0.9 ℓ**
PC40R, 45R : 1.3 ℓ



1. **Preparatory work**
   Set swing motor and swing machinery assembly on block ①.

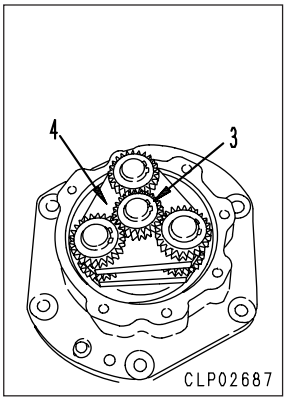
2. **Swing motor assembly**
   Remove swing motor assembly (1).

3. **Ring gear**
   Remove ring gear (2).

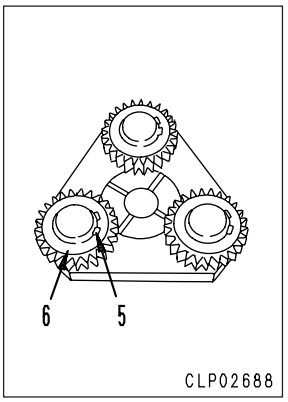


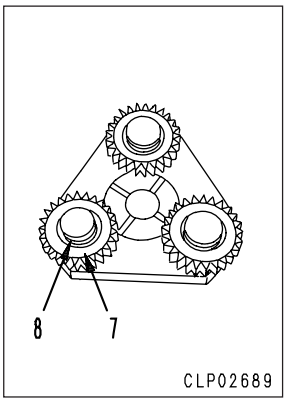
4. **No. 1 sun gear**
   Remove No. 1 sun gear (3).

5. **No. 1 planetary carrier assembly**
   1) Remove No. 1 planetary carrier assembly (4).

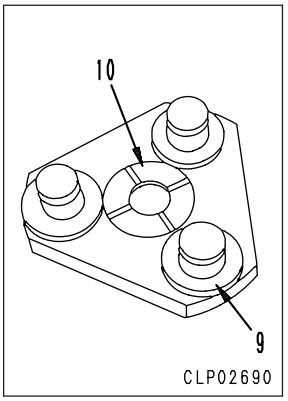


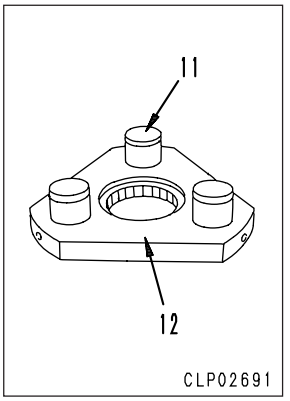
   2) Disassemble No. 1 planetary carrier assembly as follows.
      i) Using snap ring pliers, remove 3 snap rings (5).
      ii) Remove 3 thrust washers (6).
      iii) Remove 3 planet gears (7).
      iv) Remove 3 needle bearings (8).





      v) Remove 3 thrust washers (9).
      vi) Remove thrust plate (10).
      vii) Knock pins into shafts, then remove 3 shafts (11) from carrier (12).
         ★ After removing the shafts, remove the pins from the shafts.



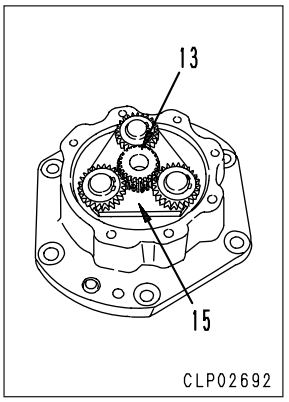


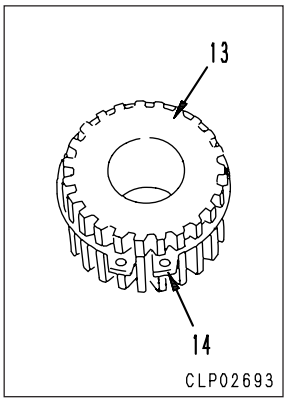
6. No. 2 sun gear

1) Remove No. 2 sun gear (13).
2) Using snap ring pliers, remove snap ring (14) from sun gear (13).

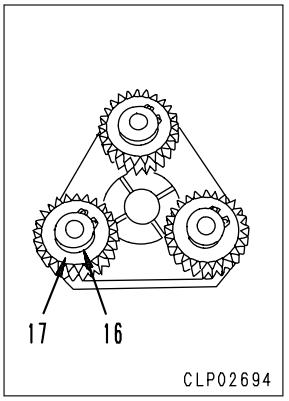
7. No. 2 planetary carrier assembly

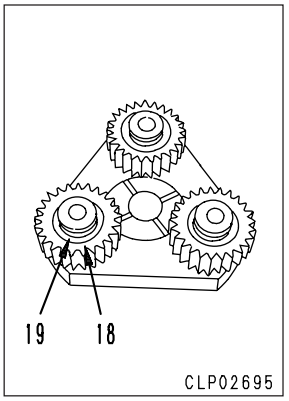
1) Remove No. 2 planetary carrier assembly (15).



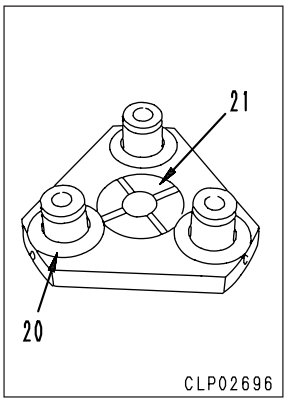


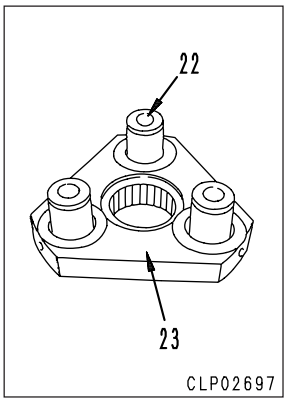
2) Disassemble No. 2 planetary carrier assembly as follows.
   i) Using snap ring pliers, remove 3 snap rings (16).
   ii) Remove 3 thrust washers (17).
   iii) Remove 3 planet gears (18).
   iv) Remove 3 needle bearings (19).





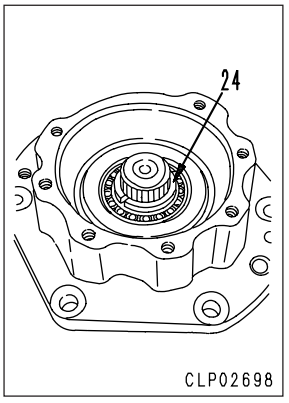
   v) Remove 3 thrust washers (20).
   vi) Remove thrust plate (21).
   vii) Knock pins into shafts, then remove 3 shafts (22) from carrier (23).
      ★ After removing the shafts, remove the pins from the shafts.

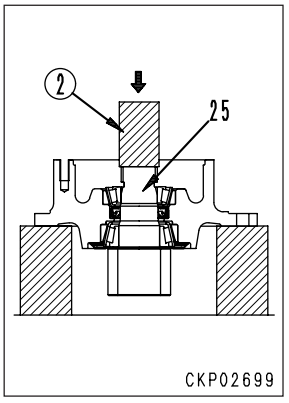




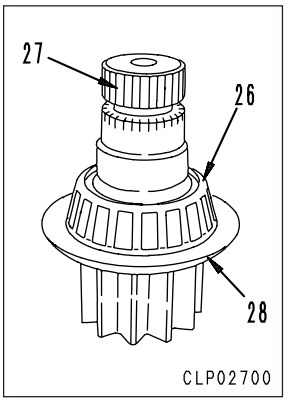
8. Output shaft assembly

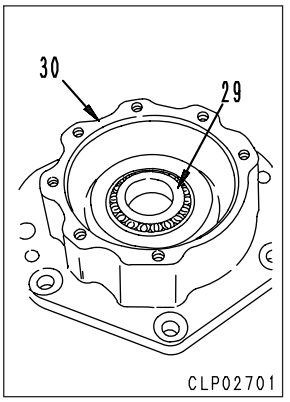
1) Remove 2 spacers (24).
2) Using push tool ②, remove output shaft assembly (25).





3) Disassemble output shaft assembly as follows.
   i) Remove bearing inner race (26) from shaft (27).
   ii) Remove seal (28).

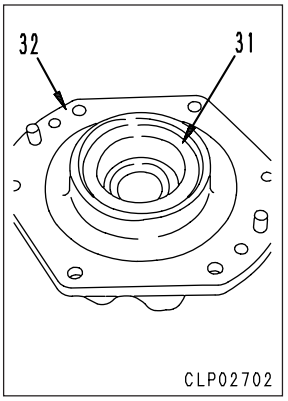


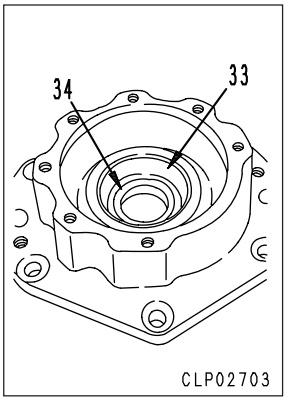


9. Case assembly

1) Remove bearing inner race (29) from case assembly (30).

2) Disassemble case assembly as follows.
   i) Remove bearing outer race (31) from case (32).
   ii) Remove bearing outer race (33).
   iii) Remove oil seal (34).





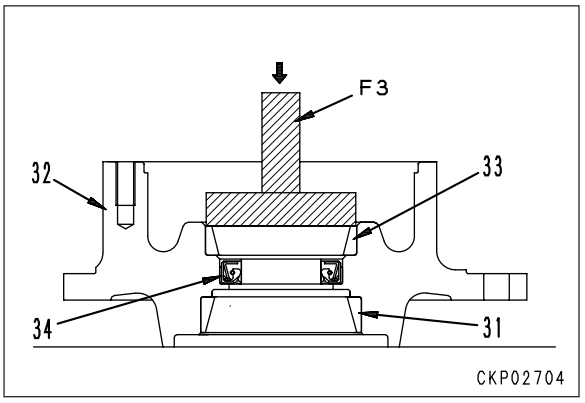
ASSEMBLY OF SWING MOTOR, SWING MACHINERY ASSEMBLY

1. Case assembly

Assemble case assembly as follows.

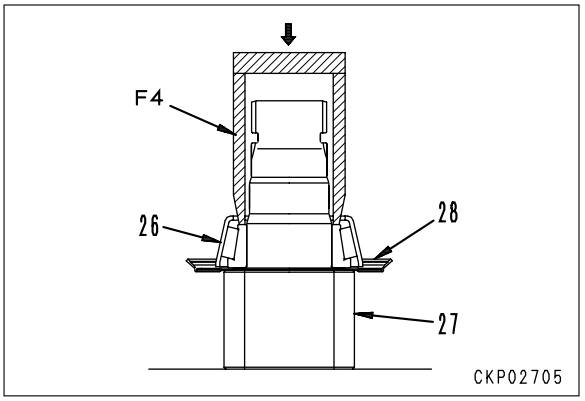
1) Using tool **F1**, press fit oil seal (34) to case (32).
   ★ When press fitting the oil seal, set with the rubber surface at the bottom and the metal surface at the top.

   Fill 40 – 60% of the space at the oil seal lip with grease (G2-LI).
2) Using tools **F2** and **F3**, press fit bearing outer races (33) and (31) to case (32).



2. Output shaft assembly

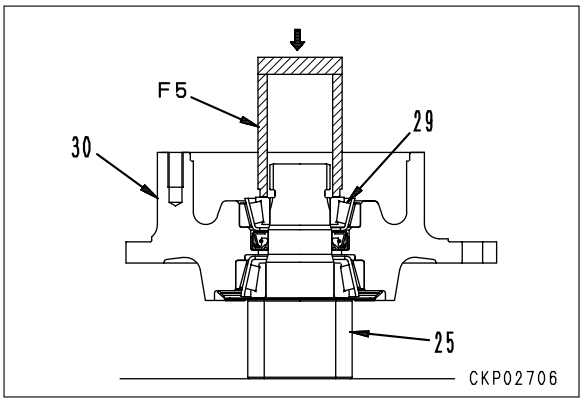
1) Assemble output shaft assembly as follows.
   i) Install seal (28) to shaft (27).
      ★ Install the seal with the lip at the top.
   ii) Using tool **F4**, press fit bearing inner race (26) to shaft (27).



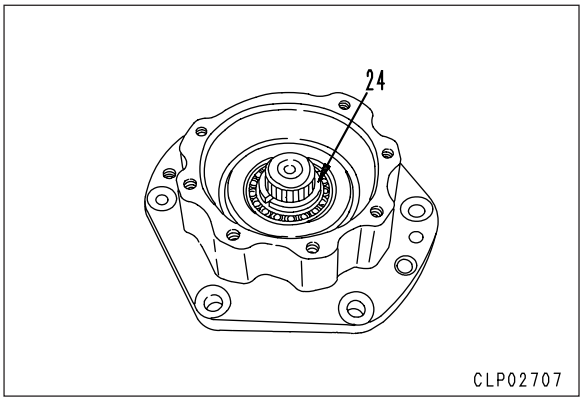
2) Set case assembly (30) to shaft assembly (25).

   Coat the rolling surface of the bearing inner race, the track surface, and the seal lip with grease (G2-LI).
   - PC30R, 35R : Approx. 40 g
   - PC40R, 45R : Approx. 60 g

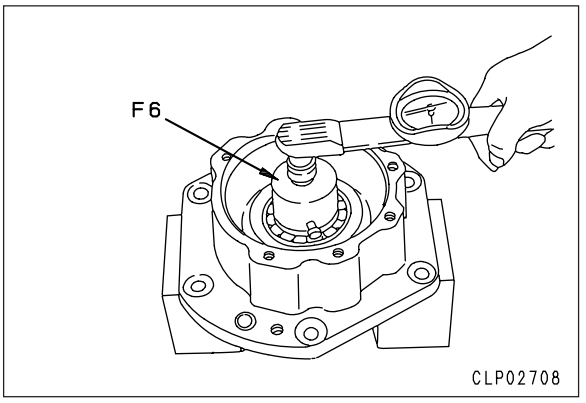
3) Using tool **F5**, press fit bearing inner race (29).
   ★ Press-fitting force:
   PC30R, 35R : Max. 11,170 N {Max. 1,140 kg}
   PC40R, 45R : Max. 13,300 N {Max. 1,360 kg}
   ★ Press fit the bearing inner race gradually while rotating the case.



4) Install spacer (24).
   ★ After installing, set the case and output shaft assembly on top of the block.

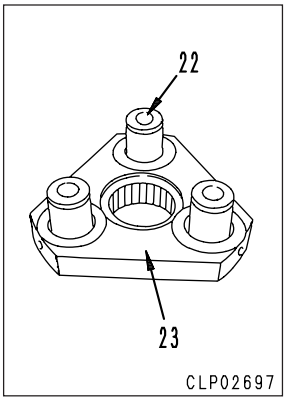


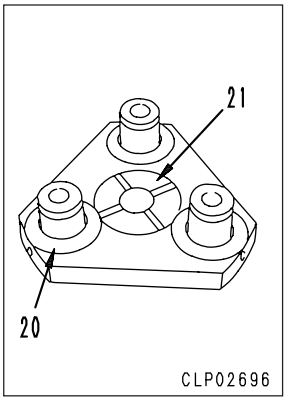
5) Using tool **F6**, measure starting torque of output shaft.
   ★ Starting torque :
   Max. 13.2 Nm {Max. 1.35 kgm}



3. No. 2 planetary carrier assembly

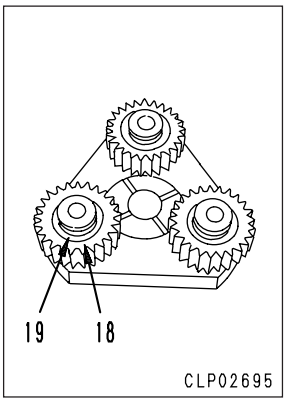
1) Assemble No. 2 planetary carrier as follows.
   i) Set 3 shafts (22) to carrier (23), and knock in pins.
      ★ After press fitting the pins, caulk the carrier portion at 2 places around the pin holes.
   ii) Install thrust plate (21).
   iii) Install 3 thrust washers (20).

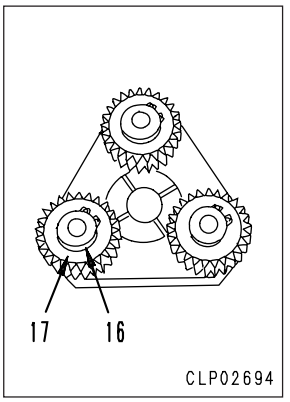




   iv) Install 3 needle bearings (19).
   v) Install 3 planet gears (18).
   vi) Install 3 thrust washers (17).
   vii) Using snap ring pliers, install 3 snap rings (16).
      ★ Use new snap rings.
      ★ When installing the snap ring, do not open the end gap more than 7 mm.

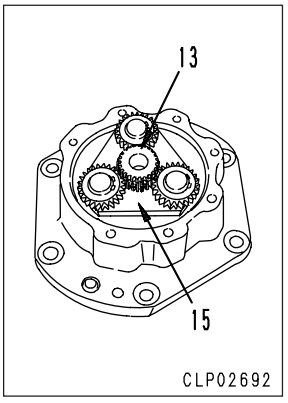
2) Install No. 2 planetary carrier assembly (15).

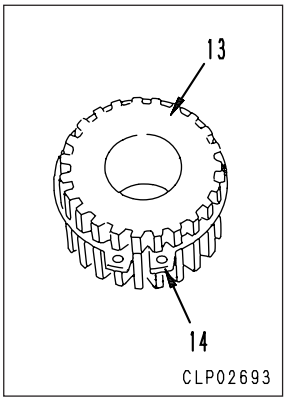




4. No. 2 sun gear

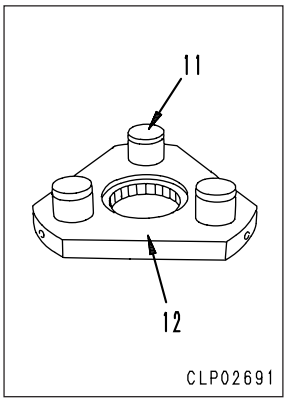
1) Using snap ring pliers, install snap ring (14) to sun gear (13).
2) Install No. 2 sun gear (13).
   ★ Install with the longer dimension from the snap ring at the bottom.

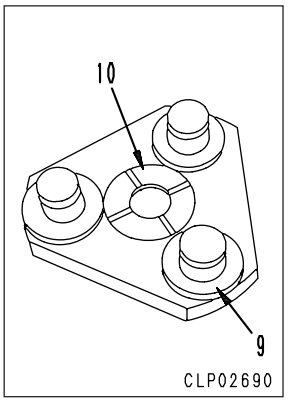




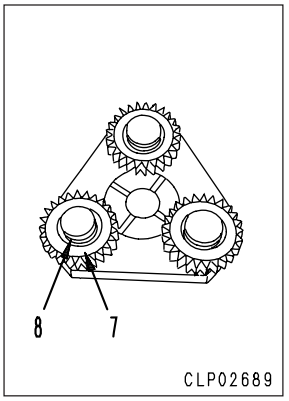
5. No. 1 planetary carrier assembly

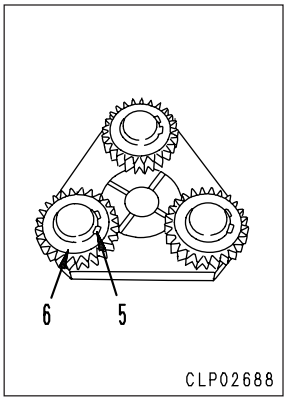
1) Assemble No. 1 planetary carrier as follows.
   i) Set 3 shafts (11) to carrier (12), and knock in pins.
      ★ After press fitting the pins, caulk the carrier portion at 2 places around the pin holes.
   ii) Install thrust plate (10).
   iii) Install 3 thrust washers (9).





   iv) Install 3 needle bearings (8).
   v) Install 3 planet gears (7).
   vi) Install 3 thrust washers (6).
   vii) Using snap ring pliers, install 3 snap rings (5).
      ★ Use new snap rings.
      ★ When installing the snap ring, do not open the end gap more than 7 mm.





2) Install No. 1 planetary carrier assembly (4).

6. No. 1 sun gear

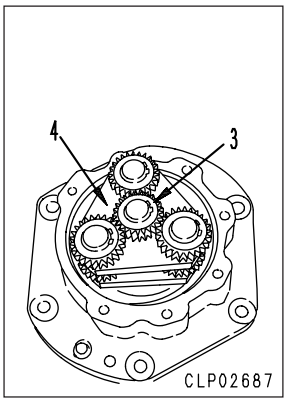
Install No. 1 sun gear (3).

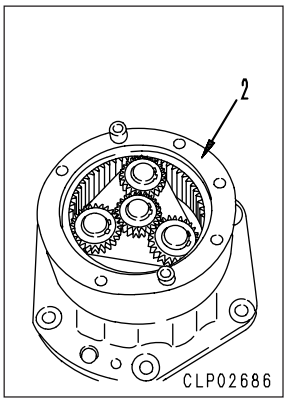
7. Ring gear

Install ring gear (2).

Case mating surface :
Gasket sealant (LG-4)

kgm Mounting bolt :
65 ± 6 Nm {6.75 ± 0.75 kgm}





8. Refilling with oil

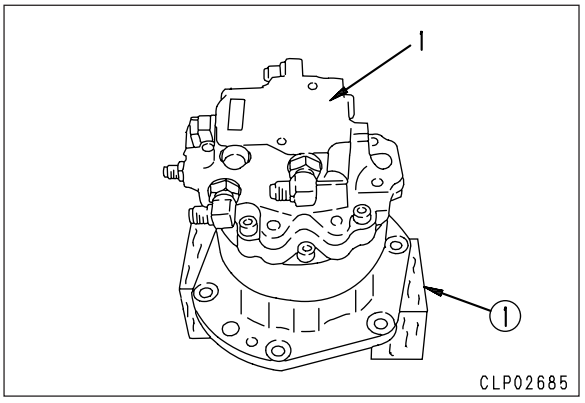
Fill case with engine oil.

Case : PC30R, 35R : **0.9 ℓ (EO10-CD)**
PC40R, 45R : **1.3 ℓ (EO10-CD)**

9. Swing motor assembly

Fit O-ring and install swing motor assembly ①.

kgm Mounting bolt :
65 ± 6 Nm {6.75 ± 0.75 kgm}

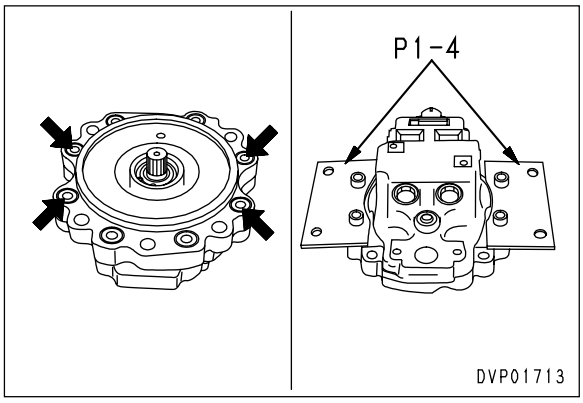


DISASSEMBLY OF SWING MOTOR ASSEMBLY

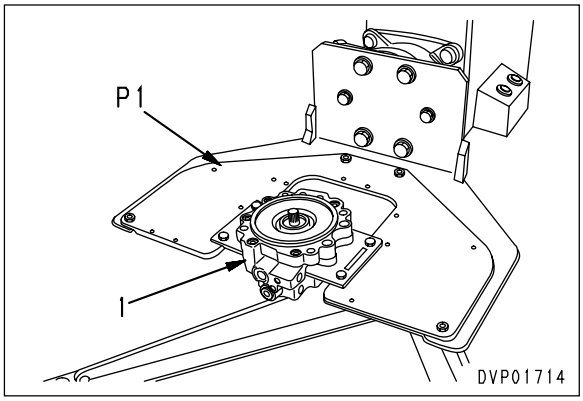
LMF16AB

1. Installation of repair stand

1) Remove the 4 swash plate mounting bolts and install tool **P1-4** to the swing motor assembly.

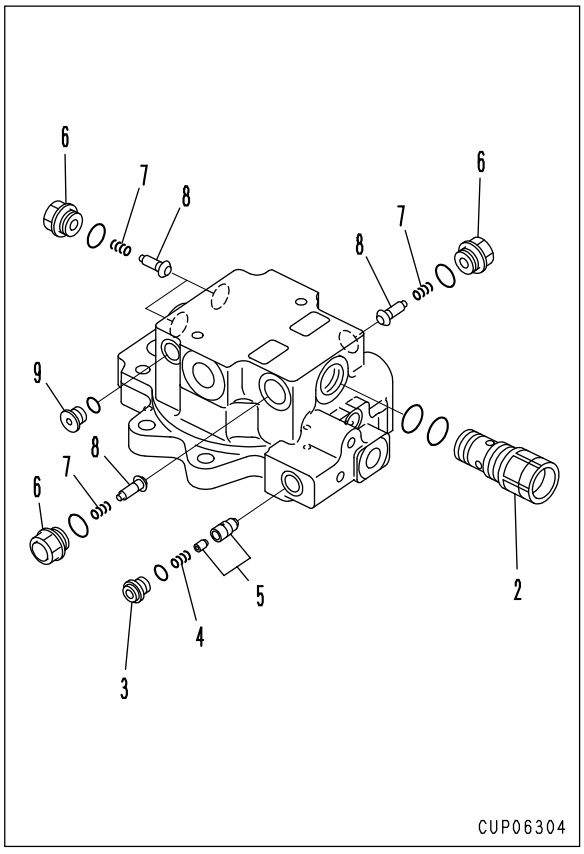


2) Set swing motor assembly (1) to tool **P1**.



2. Safety valve, hydraulic timer valve, check valves, and plugs

1) Remove safety valve (2).
2) Remove plug (3), spring (4), and hydraulic timer valve (5).
3) Remove plugs (6), springs (7), and check valves (8).
4) Remove plug (9).
   ★ The following works can be done even if this work is not performed.

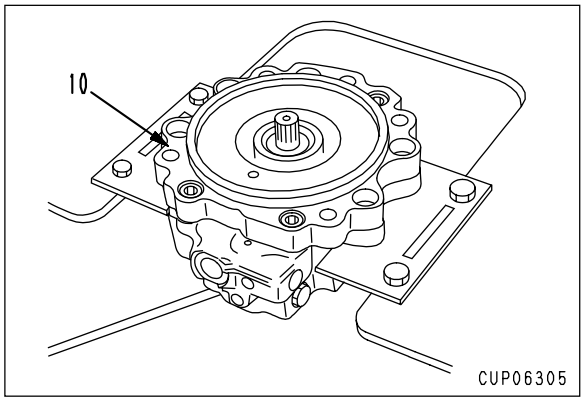


3. Swash plate and shaft assembly

Loosen the mounting bolts diagonally and evenly and remove swash plate and shaft assembly (10).

★ The spacer and thrust plate are sticking to the rear side of the swash plate and they are removed together with the swash plate. Take care not to drop them.

★ The washers and filters may be sticking to the brake spring holes of the swash plate. Take care not to drop them.

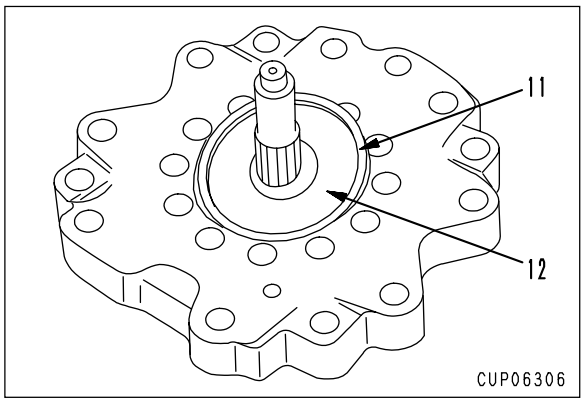


4. Spacer and thrust plate

Remove spacer (11) and thrust plate (12) from the swash plate and shaft assembly.

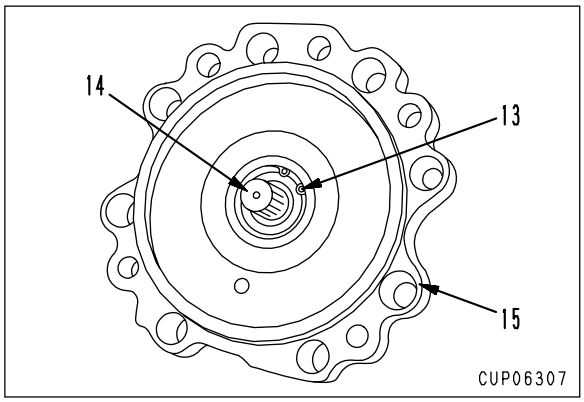
★ The thrust plate has a front side and rear side. Check its direction when removing.

★ The installation method of the spacer depends on its material.
Steel spacer: Press fit
Copper alloy spacer: Clearance fit



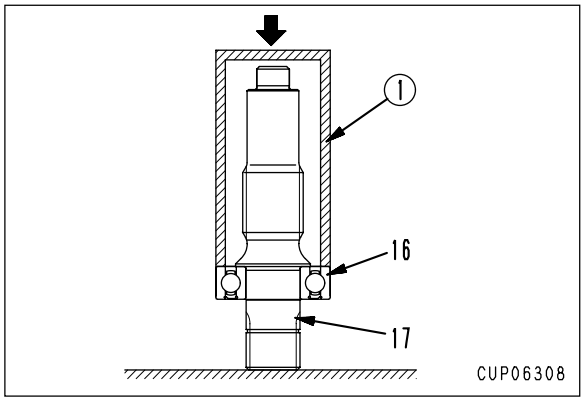
5. Shaft assembly

Remove snap ring (13) and then remove shaft assembly (14) from swash plate (15).



• **Disassembly of shaft assembly**

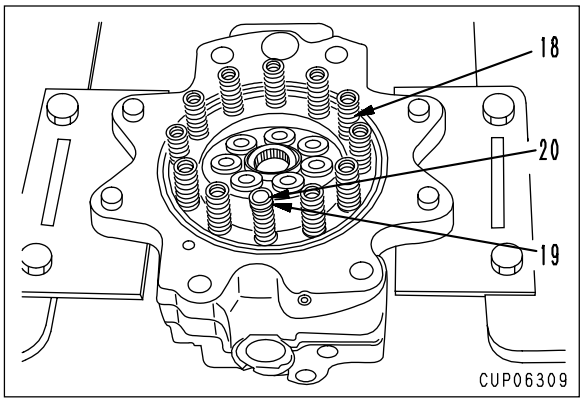
Remove main bearing (16) from shaft (17) with push tool ①.



6. Brake springs

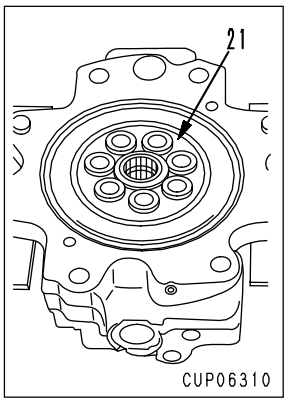
Remove brake springs (18) (12 pieces).

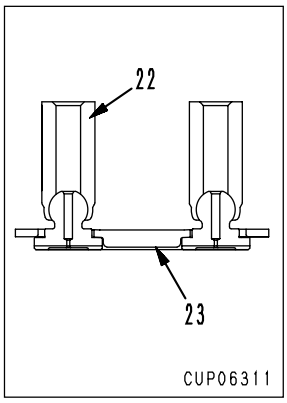
★ Washer (19) and filter (20) installed to the swash plate are on only one spring. Check the position of that spring.



7. Shoe retainer and piston assembly

1) Pull shoe retainer and piston assembly (21) out of the cylinder block.
2) Pull pistons (22) out of shoe retainer (23).



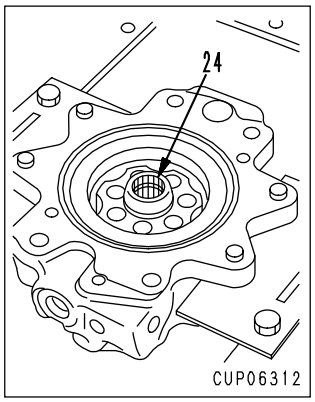


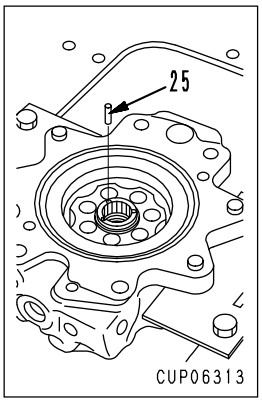
8. Retainer guide

Remove retainer guide (24).

9. Preload pins

Remove preload pins (25) (3 pieces).

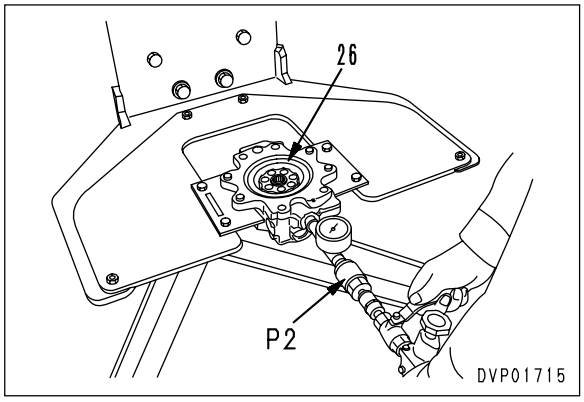




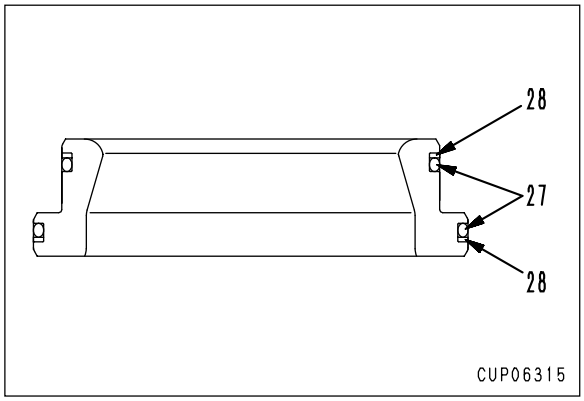
10. Brake piston

Apply air pressure to port **B** through tool **P2** gradually to remove brake piston (26).

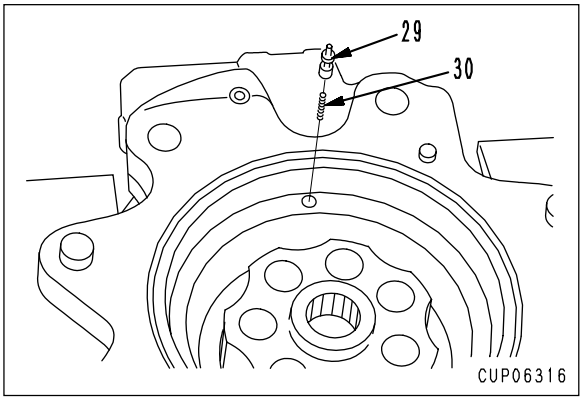
★ When applying air pressure, hold the brake piston with a cloth, etc. so that it will not jump out.



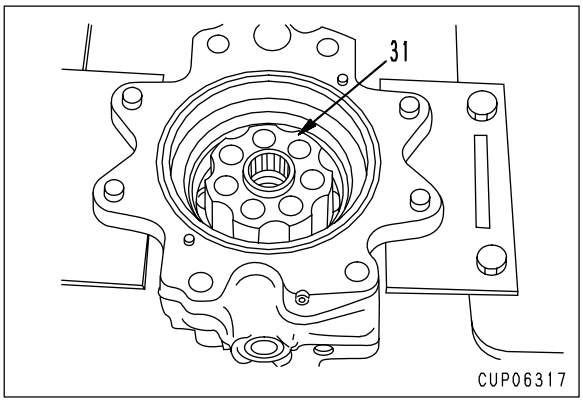
- **Disassembly of brake piston**
  Remove O-rings (27) and backup rings (28) from the brake piston.



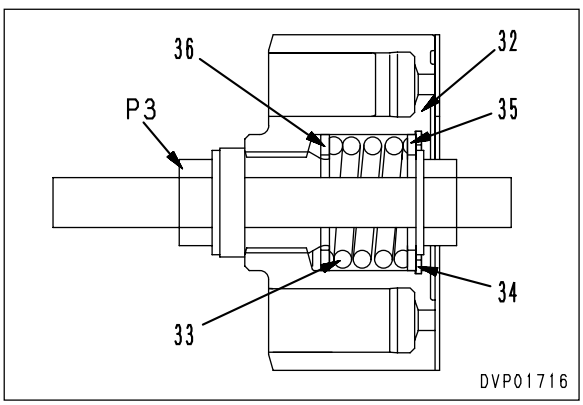
11. Piston
Remove piston (29) and spring (30) from the motor housing.



12. Cylinder block assembly
Remove cylinder block assembly (31) from the motor housing.

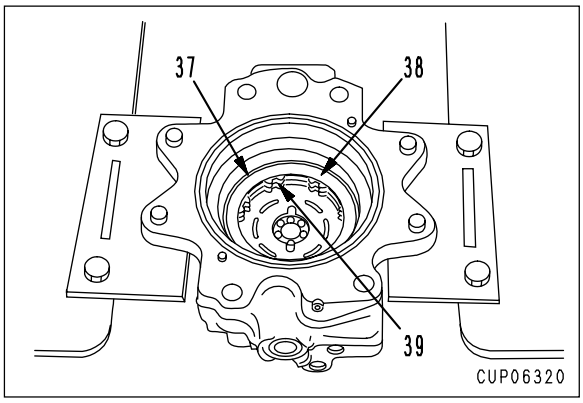


- **Disassembly of cylinder block assembly**
  1) Set tool **P3** to the cylinder block.
  2) Securing the bolt of **P3** with a wrench, etc., tighten the nut to compress spring (33) and remove snap ring (34).
  3) Loosen the nut of tool **P3** gradually to release the spring tension and remove tool **P3**.
  4) Remove washer (35), spring (33), and washer (36) from cylinder block (32).



13. Plates and discs

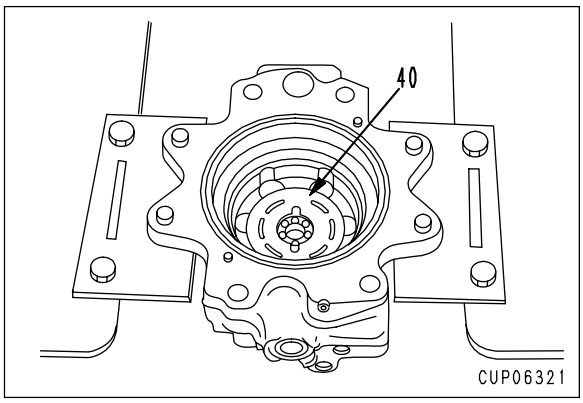
1) Remove snap ring (37).
2) Remove plates (38) and discs (39).
   - ★ The numbers of the plates and discs are 4 and 3 respectively.
   - ★ Do not clean the discs with solvent or blow air against them strongly.



14. Valve plate

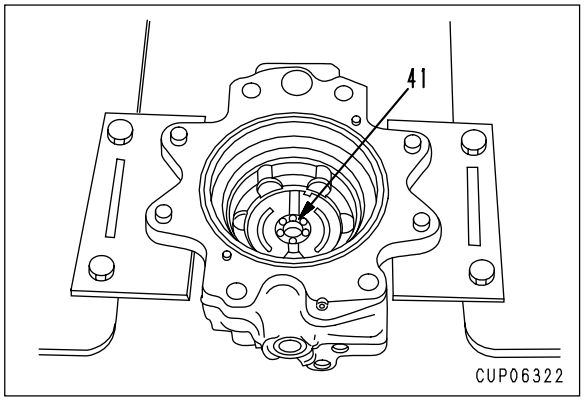
Remove valve plate (40).

- ★ When reusing the valve plate, keep it, taking care not to damage its contact face against the cylinder block.



15. Sub-bearing

Remove sub-bearing (41) from the motor housing.



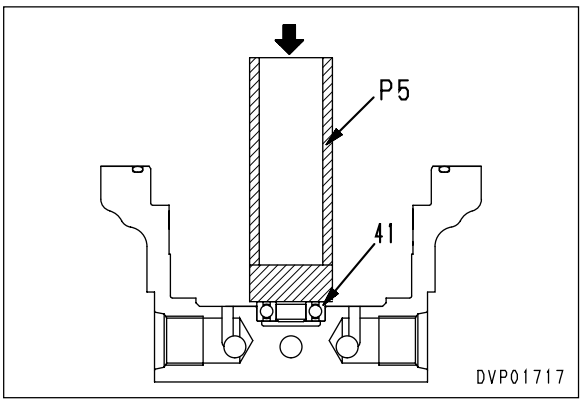
ASSEMBLY OF SWING MOTOR ASSEMBLY

LMF16AB

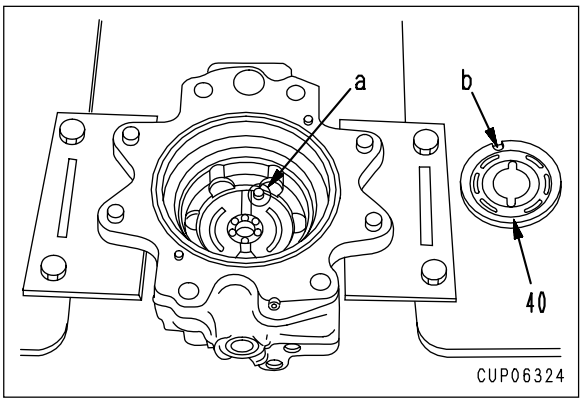
★ Clean the parts carefully. In particular, remove all foreign matter from holes and oil passages.
★ Check that the parts are free from burrs.
★ Apply engine oil (New oil of EO10-CD) to the rotary parts and sliding parts before assembling.
★ Check the following parts for contact before assembling, referring to "Check of contact of each part".
  • Motor housing and valve plate

1. Sub-bearing
Press fit sub-bearing (41) with tool **P4** until it is fitted to the bottom of the motor housing.
★ Press fitting load: Max. 833 N {85 kg}

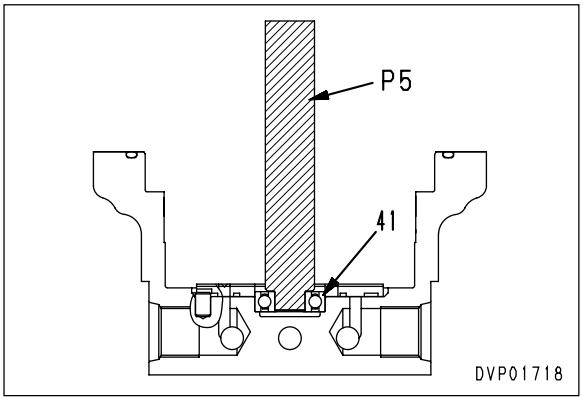
Press fitting surface of bearing:
Engine oil (EO10-CD)



2. Valve plate
Install valve plate (40).
★ Match pin hole **b** of the valve plate to pin **a** on the motor housing side.
★ When installing the valve plate, take care that it will not interfere with the pin and sub-bearing on the motor housing side.

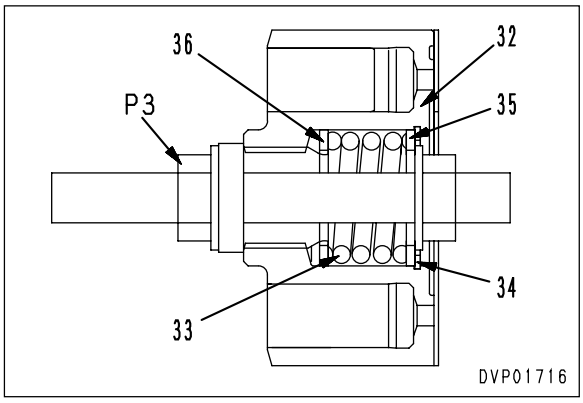


3. Guide (Tool P5)
Set tool **P5** to the inner race hole of sub-bearing (41).
★ Do not pull out tool **P5** until the shaft assembly is installed.

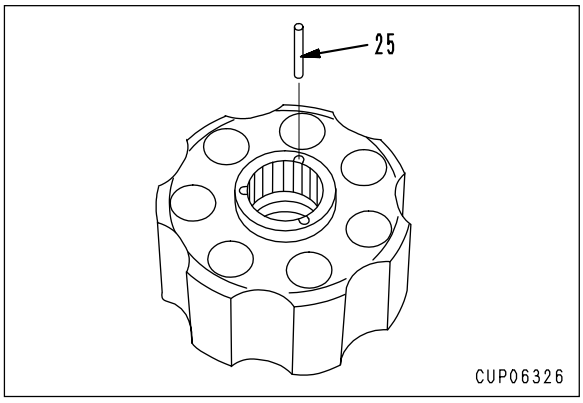


4. Cylinder block assembly

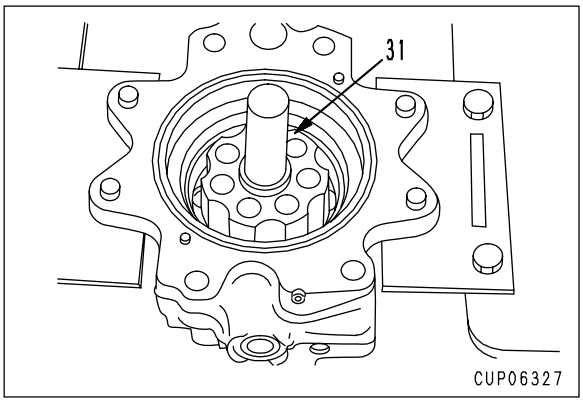
- **Assembly of cylinder block assembly**
  1) Install washer (36), spring (33), and washer (35) to cylinder block assembly (32).
  2) Set tool **P3** to the cylinder block assembly.
  3) Securing the bolt of tool **P3**, tighten the nut to compress spring (33) and install snap ring (34).
     ★ Check that the snap ring is fitted to the mounting groove securely.
  4) Remove tool **P3**.



  5) Install 3 preload pins (25) to the shaft hole of the cylinder block.
     ★ Apply grease (G2-LI) to the preload pins before installing them so that they will not come off the mounting grooves.



- **Installation of cylinder block assembly**
  Install cylinder block assembly (31) to the motor housing.
  ★ Check that 3 preload pins (25) have not come off.

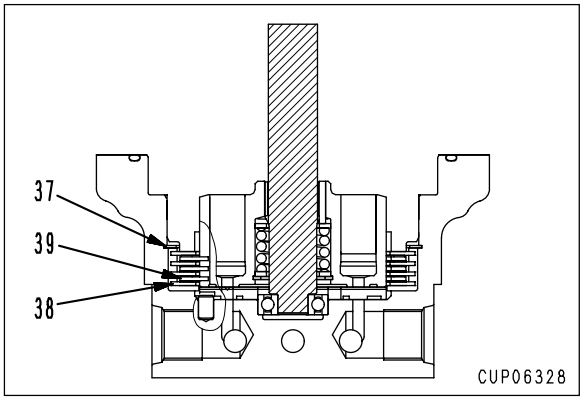


5. Plates and discs

  1) Install plates (38) and discs (39).
     ★ Install the plates and discs alternately. (Plates: 4 pieces, discs: 3 pieces)

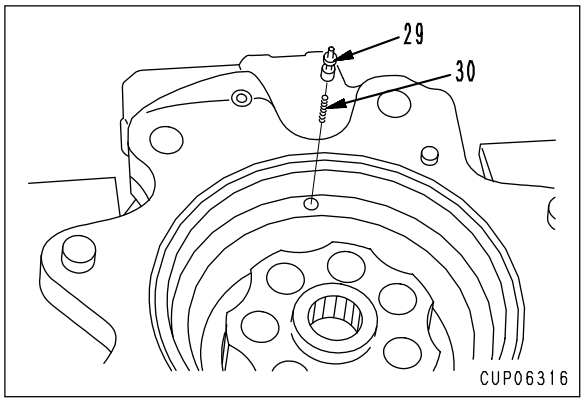
     Disc surface: **Engine oil (EO10-CD)**

     ★ When installing each plate, match its outside projection to the inside groove of the motor housing.
     ★ When installing each disc, match its inside projection to the outside groove of the cylinder block.
  2) Install snap ring (37).
     ★ Check that the snap ring is fitted to the mounting groove securely.



6. Piston

Install spring (30) and piston (29) to the motor housing.

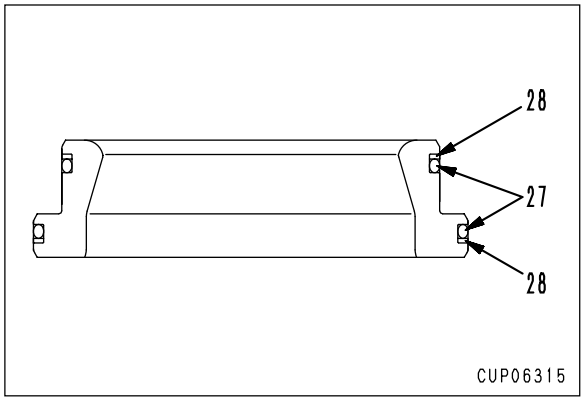


7. Brake piston

- **Assembly of brake piston**

  Install O-rings (27) and backup rings (28) to the brake piston.

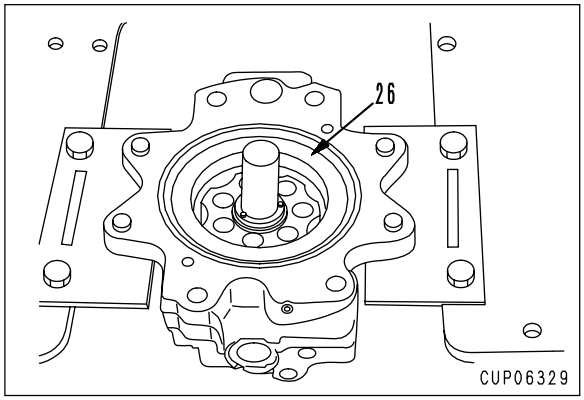
  ★ Install the backup rings as shown in the figure.



- **Installation of brake piston**

  Install brake piston (26) to the motor housing.

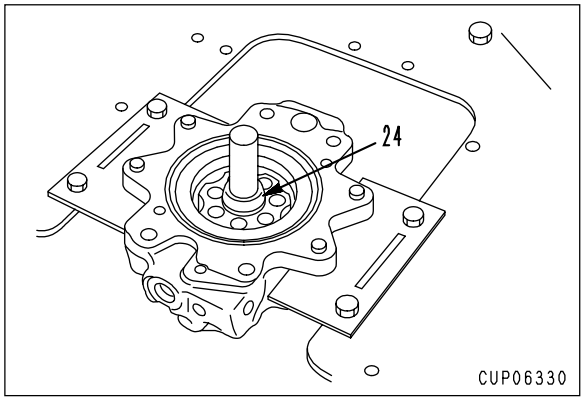
  ★ Install the brake piston straight so that the O-rings and backup rings will not be damaged.



8. Retainer guide

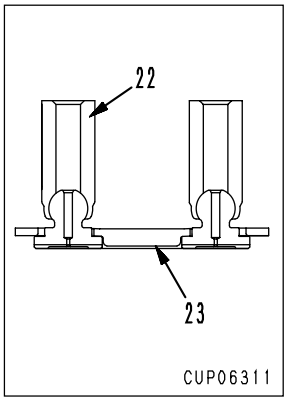
Install retainer guide (24).

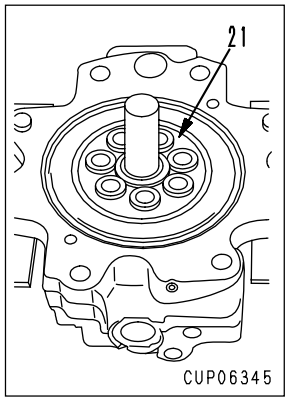
★ After installing the retainer guide, match the spline to the cylinder block.



9. Shoe retainer and piston assembly

1) Install piston (22) to shoe retainer (23).
2) Install shoe retainer and piston assembly (21) to the cylinder block.





10. Spacer and thrust plate

Install spacer (11) and thrust plate (12) to the swash plate.

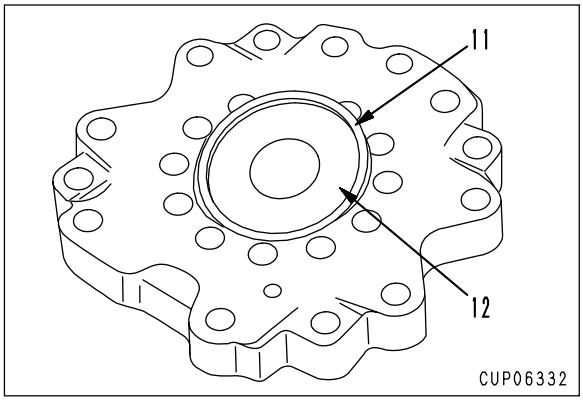
★ The installation method of the spacer depends on its material.
Steel spacer: Press fit
Copper alloy spacer: Clearance fit

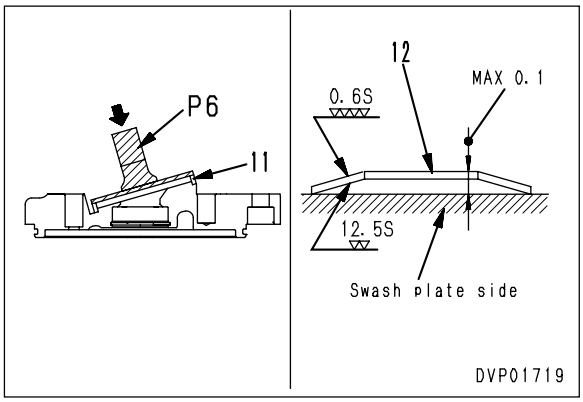
★ Press fit steel spacer with tool **P6** until it is fitted to the swash plate.

★ Press fitting load: Max. 980 N {100 kg}

Press fitting surface:
Engine oil (EO10-CD)

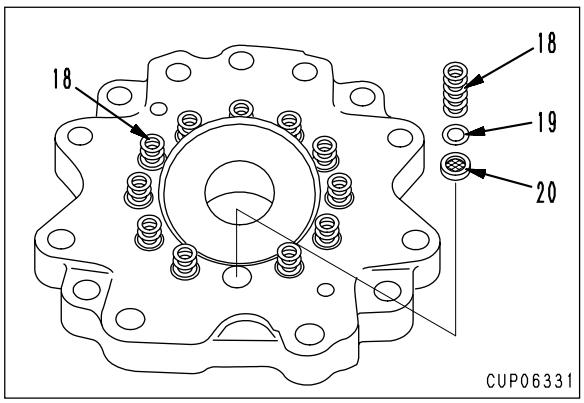
★ Judge the direction of the thrust plate by the difference of the surface machining accuracy and the sectional shape and install it as shown in the figure.





11. Filter and brake spring

1) Install filter (20) and washer (19) to the swash plate.
★ Turn over the swash plate and find out the through spring hole and install the filter to that hole.
2) Install 12 brake springs (18) to the swash plate.

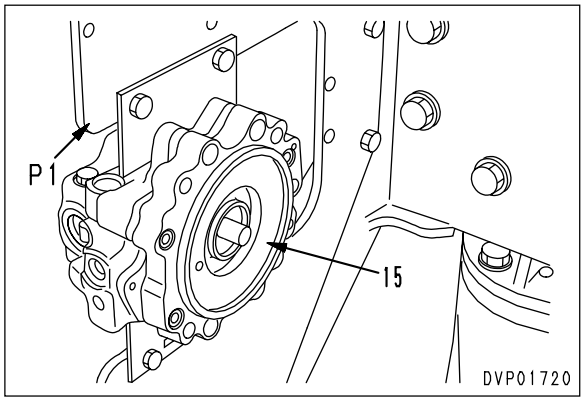


12. Swash plate

1) Turn tool **P1** to bring the opening of the motor housing to the side.
2) Install swash plate (15) to the motor housing and tighten the mounting bolt temporarily.

Mating face of motor housing:
Gasket sealant (LG-5/LG-7)

★ Take care that the O-ring will not be caught.
★ Tighten the mounting bolt to the specified torque after the shaft assembly is installed.



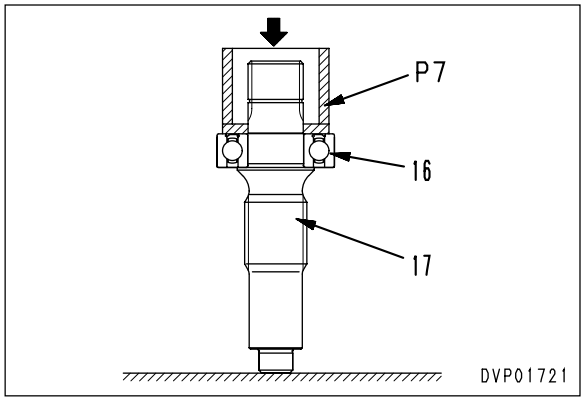
13. Shaft assembly

• **Assembly of shaft assembly**

Press fit bearing (16) to shaft (17) with tool **P7**.

★ Set the bearing so that the shield side will be on the outside of the shaft.
★ Apply tool **P7** to the inner race of the bearing securely and press fit the bearing until it is fitted to the shaft end.
★ When press fitting the bearing, take care not to damage the shield.
★ Press fitting load: 0.34 - 1.67 kN {35 - 170 kg}

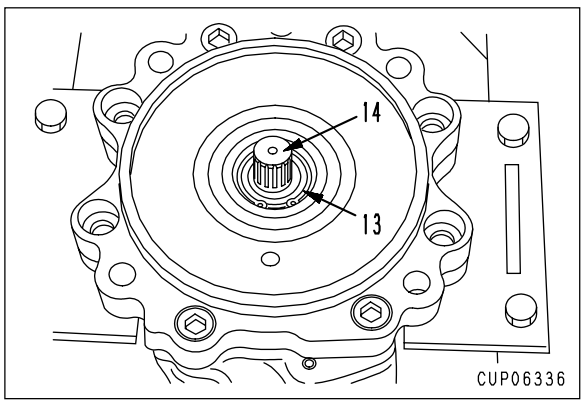
Press fitting surface of bearing:
Engine oil (EO10-CD)



• **Installation of shaft assembly**

1) Turn tool **P1** to direct the swash plate up.
2) Pull tool **P5** out of the swing motor assembly.
3) Install shaft assembly (14) and secure it with snap ring (13).
   ★ Check that the snap ring is fitted to the mounting groove securely.
4) Tighten the swash plate mounting bolts to the specified torque.

kgm Mounting bolt:
98.1 – 122.7 Nm {10 – 12.5 kgm}



14. Safety valve, hydraulic timer valve, check valves, and plugs

1) Fit the O-ring and install plug (9).

Plug: **Adhesive (LOCTITE 638/648)**

Plug: **14.7 – 24.5 Nm {1.5 – 2.5 kgm}**

2) Install check valves (8) and springs (7). Fit the O-rings and install plugs (6).

Plug: **Adhesive (LOCTITE 638/648)**

Plug: **44.1 – 63.7 Nm {4.5 – 6.5 kgm}**

3) Install hydraulic timer valve (5) and spring (4). Fit the O-ring and install plug (3).

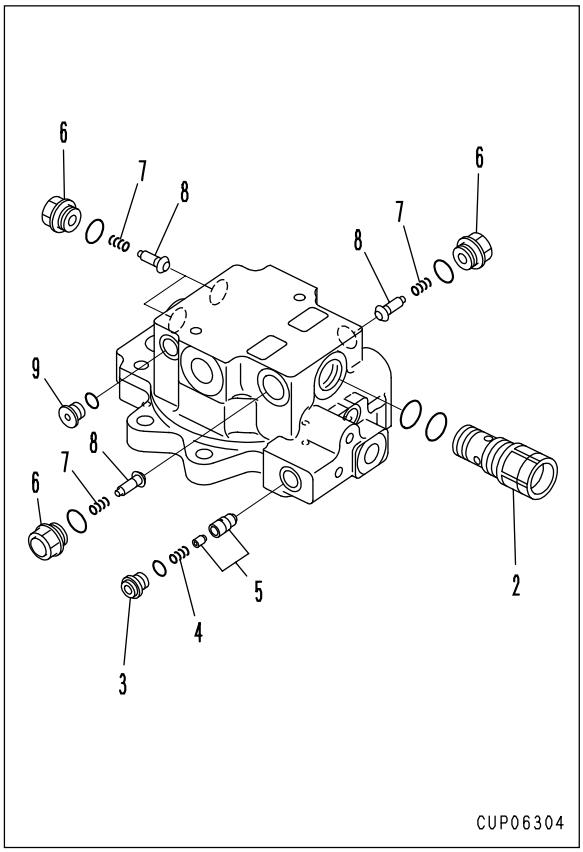
Plug: **Adhesive (LOCTITE 638/648)**

Plug: **14.7 – 24.5 Nm {1.5 – 2.5 kgm}**

4) Fit the O-ring and backup ring and install safety valve (2).

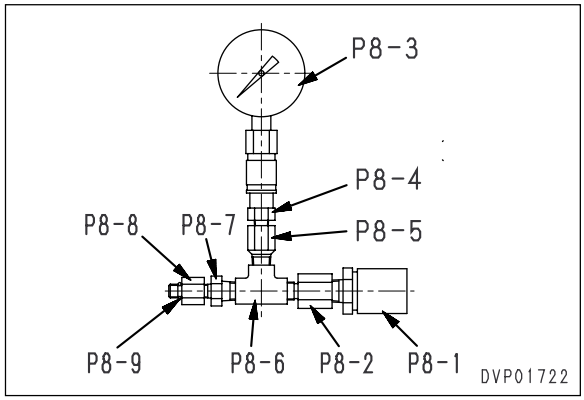
Safety valve: **49.1 – 58.9 Nm {5 – 6 kgm}**
108 – 142 Nm {11 – 14.5 kgm}
(Only PC50UU-2)

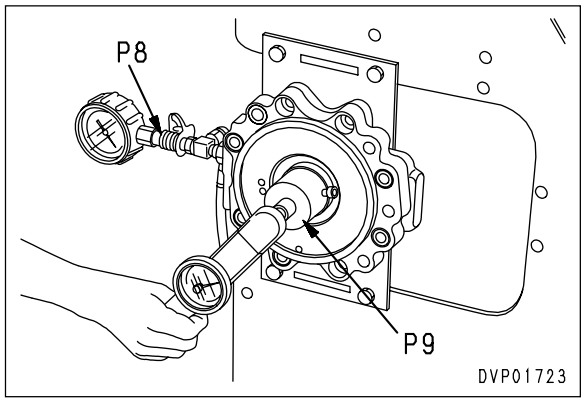
★ Apply 2 drops (about 0.04 g) of adhesive to a part 2 – 3 mm from each screw end of plugs (3), (6), and (9).
★ Clean the threads of the above plugs and the mating female screw holes and then degrease and dry them.
★ After tightening the above plugs, do not apply pressure for 30 minutes.



15. Check of turning torque

1) Referring to the figure, assemble tool **P8**.
2) Set tool **P9** to the shaft end.
3) Install tool **P8** to port B and apply hydraulic pressure to release the brake.
★ Brake releasing pressure:
2.9 ± 0.3 MPa {30 ± 3 kg/cm^2}
4) Turn the shaft at a constant speed of 3 – 5 sec/turn and measure the turning torque.
★ Standard turning torque:
4.9 – 9.8 Nm {0.5 – 1.0 kgm}
★ Fluctuation of turning torque:
Max. 1.96 Nm {Max. 0.2 kgm}
★ Prepare a pan to receive oil which flows out through the shaft and filter when the turning torque is measured.

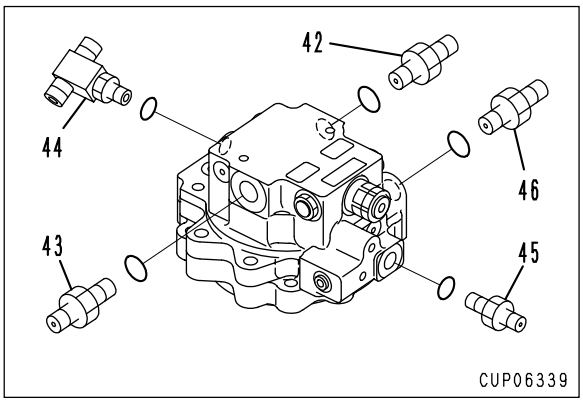




16. Port nipples

Fit the O-ring and install each nipple.

kgm Nipple for port **MA** (42):
78 – 103 Nm {8 – 10.5 kgm}
Nipple for port **MB** (43):
78 – 103 Nm {8 – 10.5 kgm}
Nipple for port **T** (44):
29 – 39 Nm {3 – 4 kgm}
Nipple for port **B** (45):
29 – 39 Nm {3 – 4 kgm}
Nipple for port **S** (46):
78 – 103 Nm {8 – 10.5 kgm}



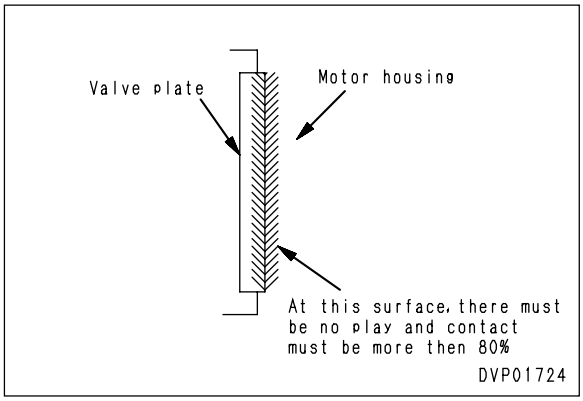
CHECK OF CONTACT OF EACH PART

★ If either motor housing or valve plate is replaced with a spare (new one) or repaired, check their contact according to the following procedure.

★ If both of the motor housing and valve plate are replaced with spares (new ones), this check is not necessary.

Check of contact of motor housing and valve plate

1) Degrease and dry the all parts.
   ★ Do not wipe the parts with cloths, etc.
2) Apply check paint to the motor housing and place the valve plate on it.
   ★ Apply the paint thinly and evenly.
3) Pressing valve plate against the motor housing with force of 32.9 – 49.0 N {4 – 5 kgm}, turn the valve plate by 90 degrees and return it 2 – 3 times.
4) Remove the valve plate and transfer the contact surface onto a tape and check it.
   ★ Standard contact: Mating faces must not have any play and contact area must be more than 80%.



REMOVAL OF REVOLVING FRAME ASSEMBLY

⚠ Release the remaining pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic tank.

1. Remove operator's cab assembly. For details, see REMOVAL OF OPERATOR'S CAB ASSEMBLY.
   ★ Operator's cab specification machine only.
   Remove canopy assembly. For details, see REMOVAL OF CANOPY ASSEMBLY.
   ★ Canopy specification machine only.

2. Remove work equipment assembly. For details, see REMOVAL OF WORK EQUIPMENT ASSEMBLY.

3. Disconnect 2 hoses (1).

4. Sling boom cylinder assembly, then remove bottom pin (2), and lift off boom cylinder assembly (3). ※ 1
   kg Boom cylinder assembly :
   35 kg (PC30R, 35R)
   45 kg (PC40R, 45R)

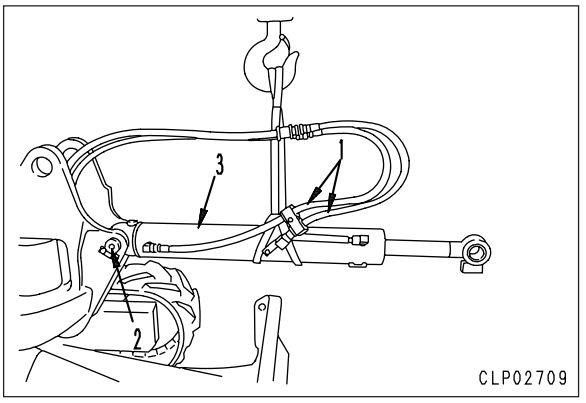
5. Lift off left protector (4) and right protector (5).
   kg Left and right protectors : **40 kg**

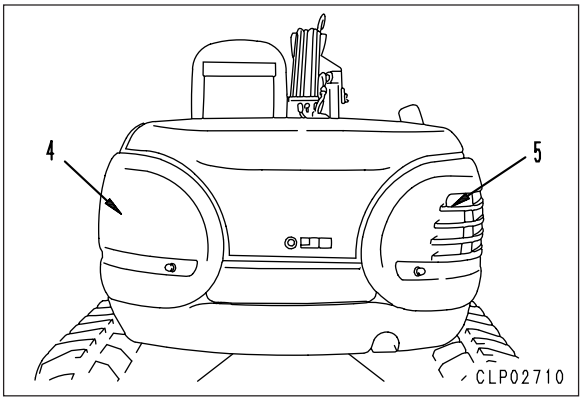
6. Remove handrail (6).
   ★ Canopy specification machine only.

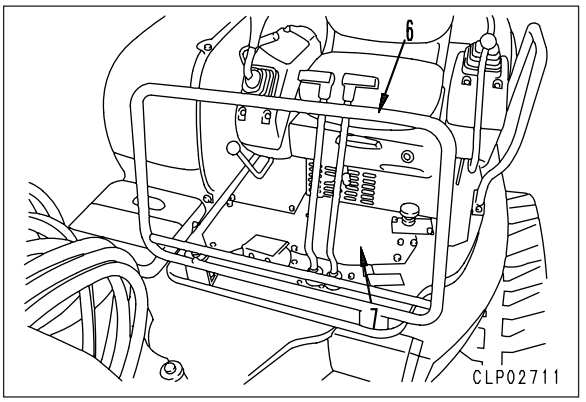
7. Remove floor frame cover (7).

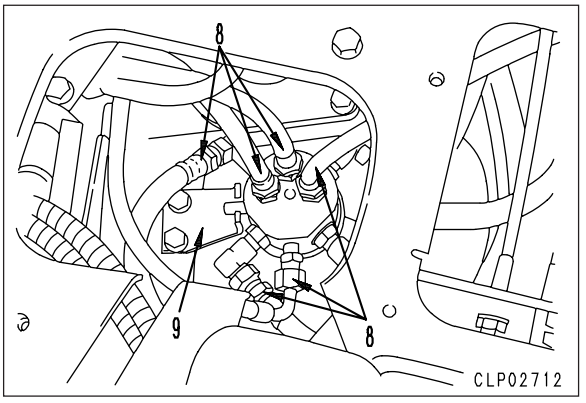
8. Disconnect 8 hoses (8) at top of swivel joint.
   ★ Fit a blind plug in the drain hose (front of machine).
   ★ After disconnecting the hoses, fit tags to distinguish them.

9. Remove stopper (9).

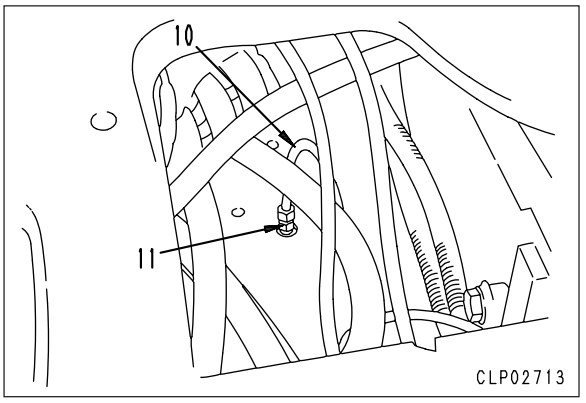








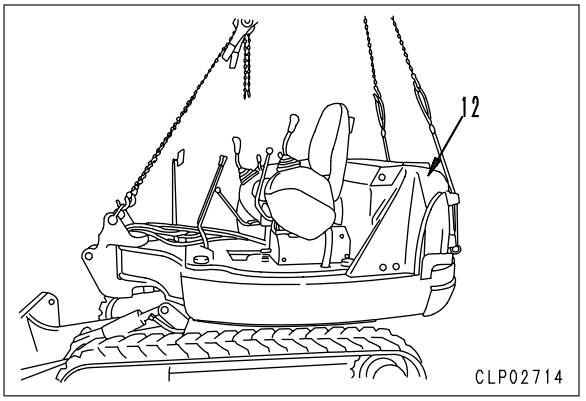
10. Disconnect grease tube (10) and remove grease connector (11).



11. Using eyebolts, sling revolving frame assembly (12).
    - ★ Fit the lifting equipment to the boom mount at 2 places at the front and to the protector mounting bolt portion at 2 places at the rear, then install the mounting bolts.
    - ★ Sling the assembly, then leave 2 or 3 mounting bolts each at the front and rear, and remove all the other mounting bolts. ※ 2

12. Remove mounting bolts, then remove revolving frame assembly (12). ※ 3
    - ★ Using a lever block, adjust the balance of the revolving frame to the front, rear, left and right, then remove the remaining mounting bolts, and lift off.
    - ★ Be careful not to hit the swivel joint when removing.

    kg Revolving frame assembly :
    1,500 kg (PC30R, 35R)
    1,550 kg (PC40R, 45R)



NSTALLATION OF REVOLVING FRAME ASSEMBLY

. Carry out installation in the reverse order to removal.

※ 1

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)

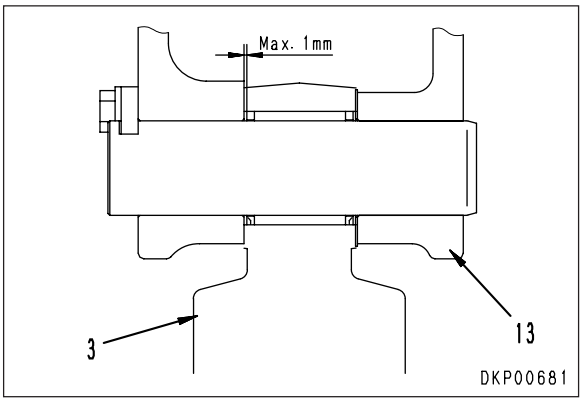
Greasing after assembling :
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the bottom of boom cylinder (3) and boom swing bracket (13) is less than 1 mm.
- Shim thickness : 1 mm

※ 2 ※ 3

Revolving frame assembly mounting bolt :
Thread tightener (LT-2)

kgm Revolving frame assembly mounting bolt :
112.7 ± 9.8 Nm {11.5 ± 1 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.

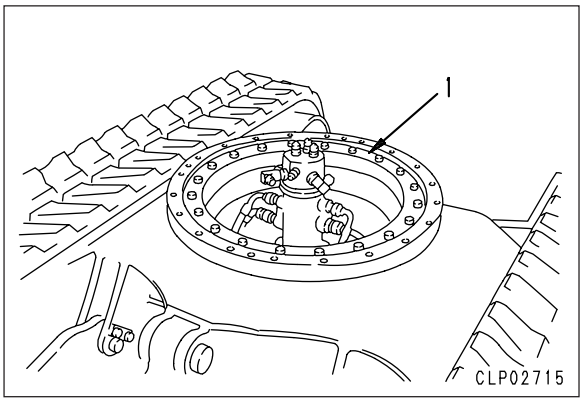
- **Bleeding air**
  Bleed the air from the boom cylinder, blade cylinder, and travel motor. For details, see TESTING AND ADJUSTING, Bleeding air.

REMOVAL OF SWING CIRCLE ASSEMBLY

1. Remove revolving frame assembly. For details, see REMOVAL OF REVOLVING FRAME ASSEMBLY.

2. Using eyebolts, lift off swing circle assembly (1).
※ 1

kg Swing circle assembly :
45 kg (PC30R, 35R)
60 kg (PC40R)
65 kg (PC45R)



INSTALLATION OF SWING CIRCLE ASSEMBLY

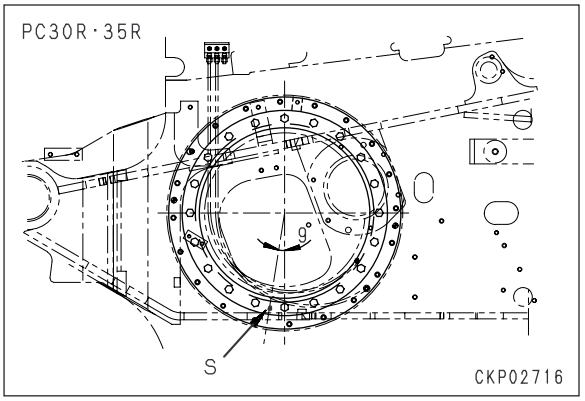
- Carry out installation in the reverse order to removal.

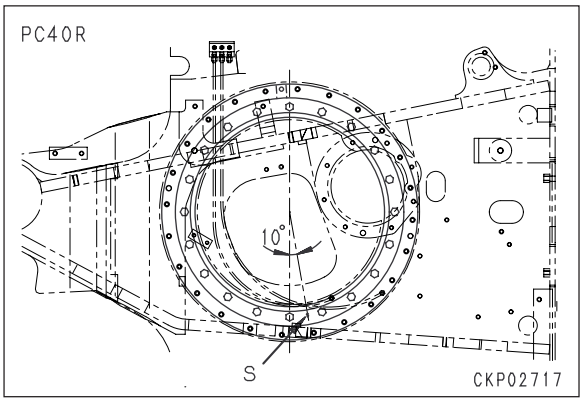
※ 1
★ Install so that the soft zone **S** mark on the inner race is on the left side of the track frame.

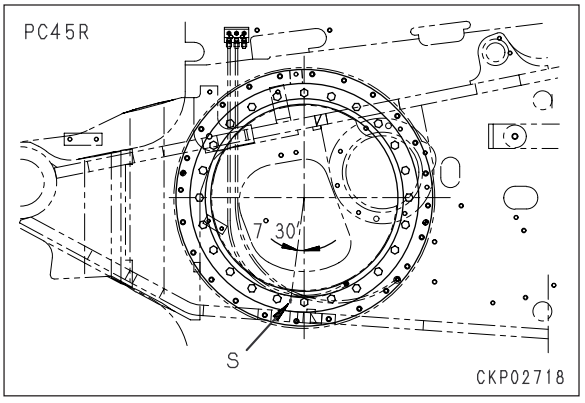
Swing circle assembly mounting bolt :
Thread tightener (LT-2)

kgm Swing circle assembly mounting bolt :
112.7 ± 9.8 Nm {11.5 ± 1 kgm}

Face of inner race teeth : **Grease (G2-LI)**





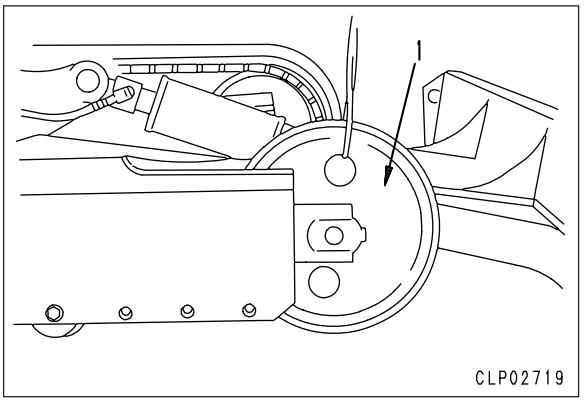


REMOVAL OF IDLER ASSEMBLY

1. Remove track shoe assembly. For details, see REMOVAL OF RUBBER SHOE ASSEMBLY or REMOVAL OF STEEL SHOE ASSEMBLY.

2. Lift off idler assembly (1).

   kg Idler assembly : **40 kg (PC30R, 35R)**
   50 kg (PC40R, 45R)

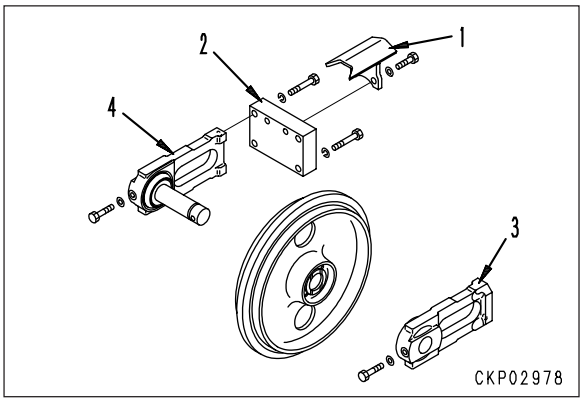


INSTALLATION OF IDLER ASSEMBLY

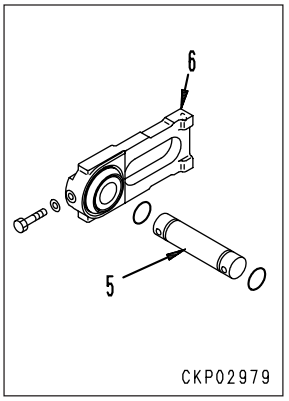
- Carry out installation in the reverse order to removal.

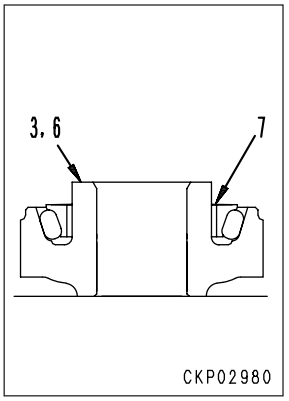
DISASSEMBLY OF IDLER ASSEMBLY

1. Remove cover (1) and bracket (2).
2. Remove support (3).
3. Remove support and shaft assembly (4).

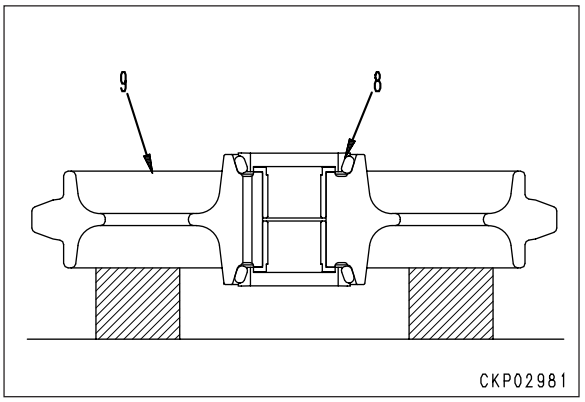


4. Remove shaft (5) from support (6).
5. Remove floating seal (7) from supports (3) and (6).

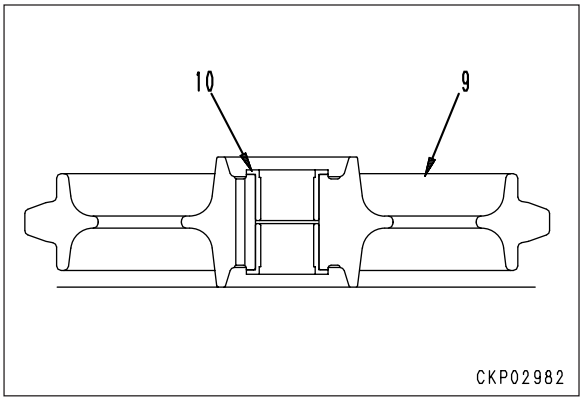




6. Remove 2 floating seals (8) from idler (9).

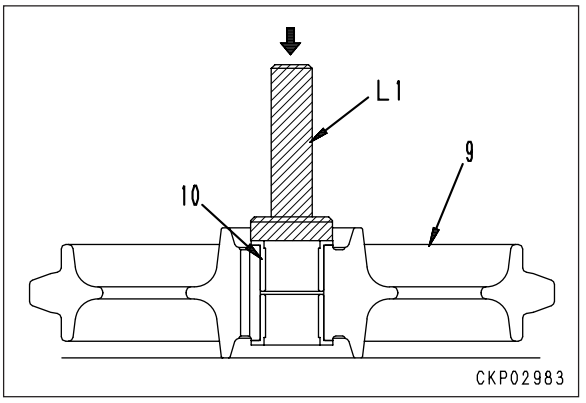


7. Remove 2 bushings (10) from idler (9).

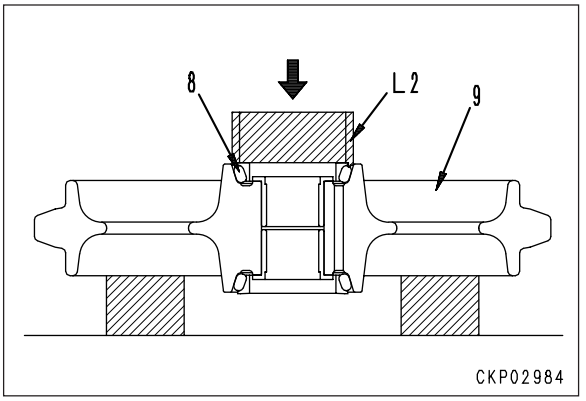


ASSEMBLY OF IDLER ASSEMBLY

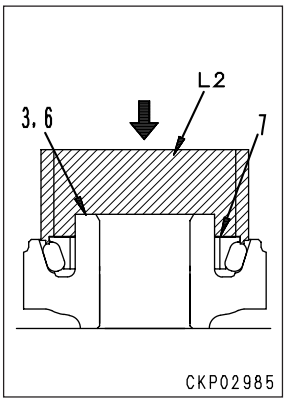
1. Using tool **L1**, press fit 2 bushings (10) to idler (9).

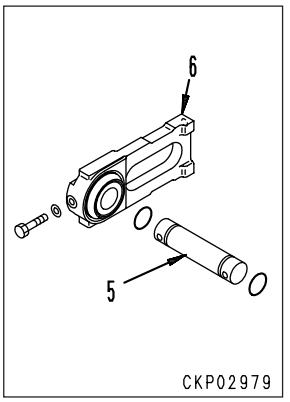


2. Using tool **L2**, install 2 floating seals (8) to idler (9).
   - ★ Wash and remove all grease and oil from the O-ring and O-ring contact surface, then dry the parts.
   - ★ Coat the sliding surface of the oil seal with engine oil (EO30-CD) before installing, and be careful not to let any dirt or dust stick to it.



3. Using tool **L2**, install floating seal (7) to supports (3) and (6).
   - ★ Wash and remove all grease and oil from the O-ring and O-ring contact surface, then dry the parts.
   - ★ Coat the sliding surface of the oil seal with engine oil (EO30-CD) before installing, and be careful not to let any dirt or dust stick to it.





4. Fit O-ring and install shaft (5) to support (6).

   Mounting bolt : **Thread tightener (LT-2)**

5. Install support and shaft assembly (4) to idler.

6. Fill inside of idler with engine oil.

   Inside portion of idler :
   Approx. 20 cc (EO30-CD)

7. Install support (3).

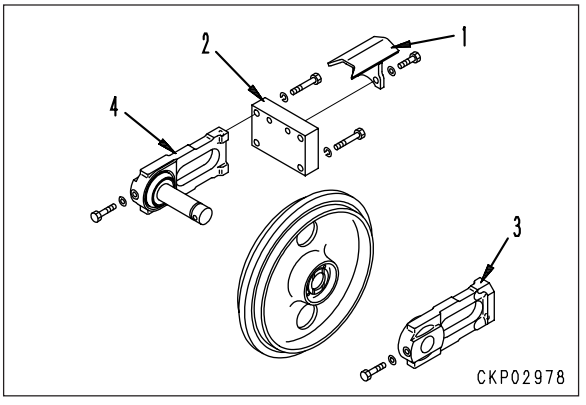
   Mounting bolt : **Thread tightener (LT-2)**

8. Install bracket (2).

   Mounting bolt : **Thread tightener (LT-2)**

   kgm Mounting bolt :
   110.5 ± 12.5 Nm {11.25 ± 1.25 kgm}

9. Install cover (1).



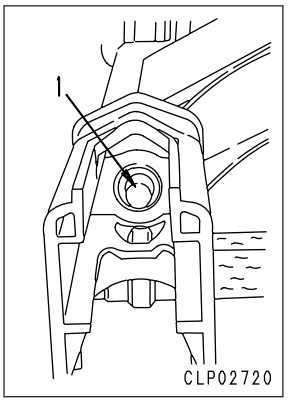
REMOVAL OF RECOIL SPRING ASSEMBLY

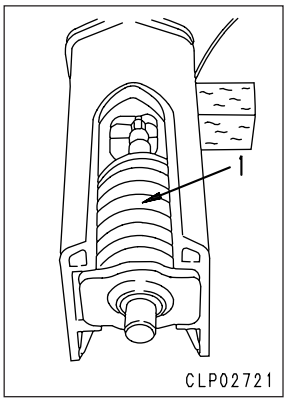
1. Remove idler assembly. For details, see REMOVAL OF IDLER ASSEMBLY.

2. Pull out recoil spring assembly (1) and remove.

※ 1

⚠ Be careful not to damage the grease fitting when removing.





INSTALLATION OF RECOIL SPRING ASSEMBLY

- Carry out installation in the reverse order to removal.

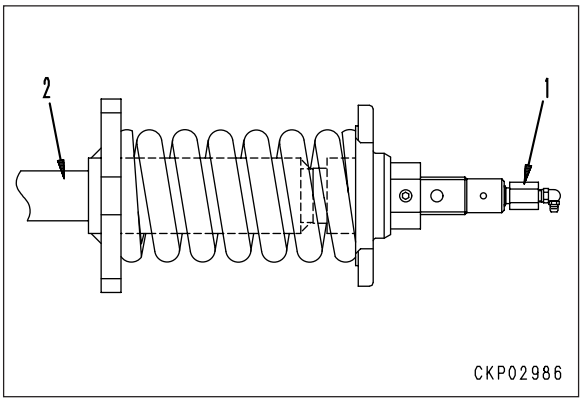
※ 1

★ Install the grease fitting facing the outside of the chassis.

DISASSEMBLY OF RECOIL SPRING ASSEMBLY

1. Piston

1) Remove valve (1).
2) Remove piston (2).



2. Recoil spring

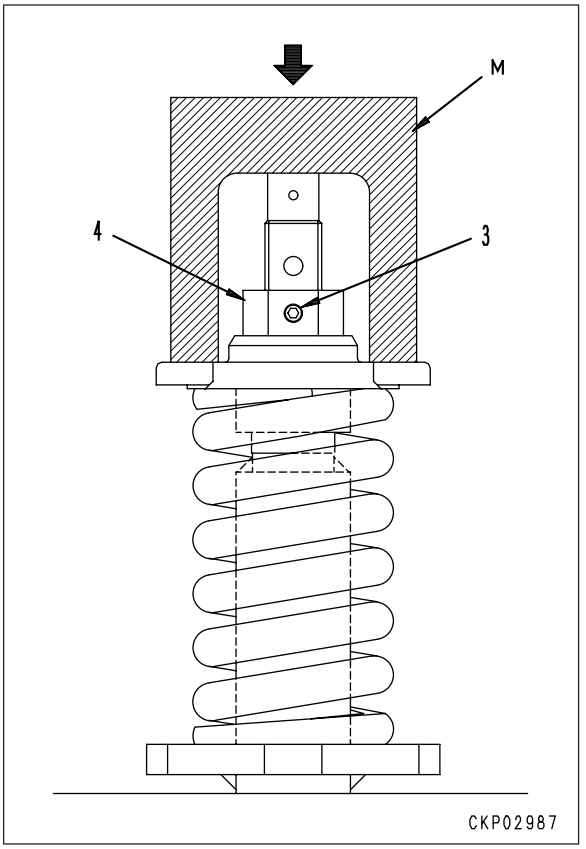
1) Using tool **M**, set recoil spring to press.

⚠ The recoil spring is under large installed load, so be sure to set the tool properly. Failure to do this is dangerous.

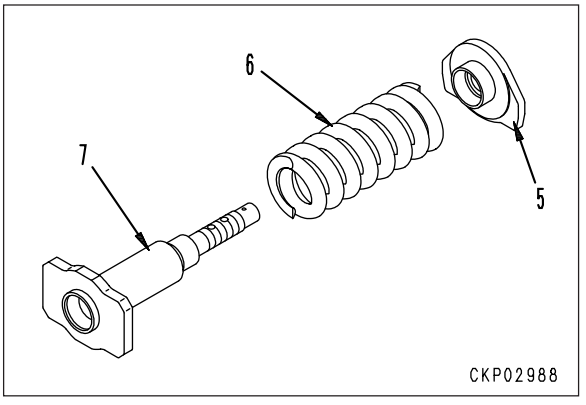
2) Apply hydraulic pressure slowly to compress spring, then remove screw (3), and remove nut (4).
   ★ Compress the spring to a point where the nut becomes loose.
   ★ Installed load of spring:

kN {kg}

Model	Rubber shoe	Steel shoe
PC30R, 35R	30.9 {3,151}	19.7 {2,008}
PC40R, 45R	42.4 {4,326}	26.9 {2,748}

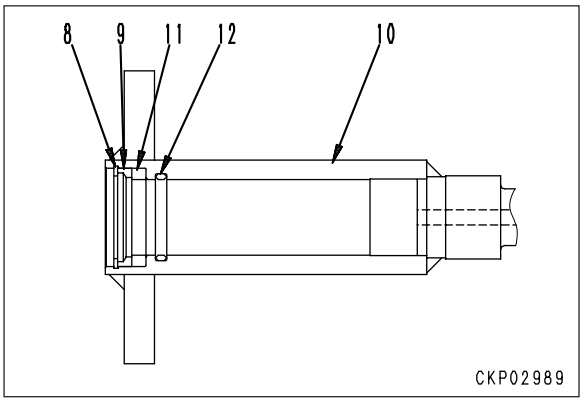


3) Release the hydraulic pressure slowly and allow spring to extend, then remove stopper (5) and spring (6) from cylinder assembly (7).
   ★ Free length of spring :
   PC30R, 35R : 275 mm
   PC40R, 45R : 302 mm



3. Cylinder

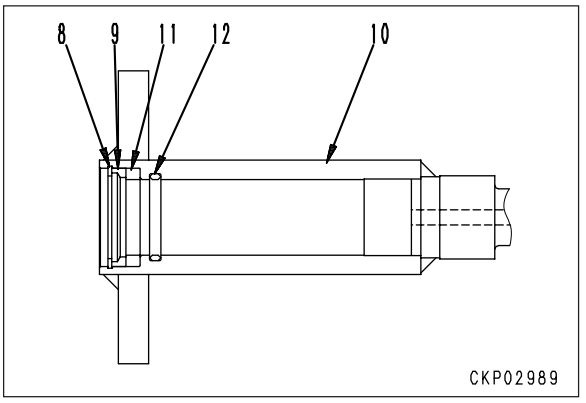
1) Remove snap ring (8), then remove spacer (9) from cylinder (10).
2) Remove dust seal (11).
3) Remove O-ring (12).



ASSEMBLY OF RECOIL SPRING ASSEMBLY

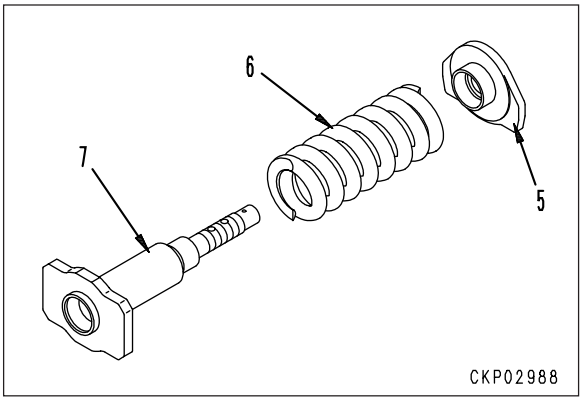
1. Cylinder

1) Install O-ring (12) to cylinder (10).
2) Install dust seal (11).
3) Fit spacer (9) and secure with snap ring (8).



2. Recoil spring

1) Assemble cylinder assembly (7), spring (6), and stopper (5).



2) Using tool **M**, set recoil spring to press.
   ⚠ The recoil spring is under large installed load, so be sure to set the tool properly. Failure to do this is dangerous.
3) Apply hydraulic pressure slowly to compress spring, then fit nut (4) and install screw (3).
   ★ Installed height of spring:

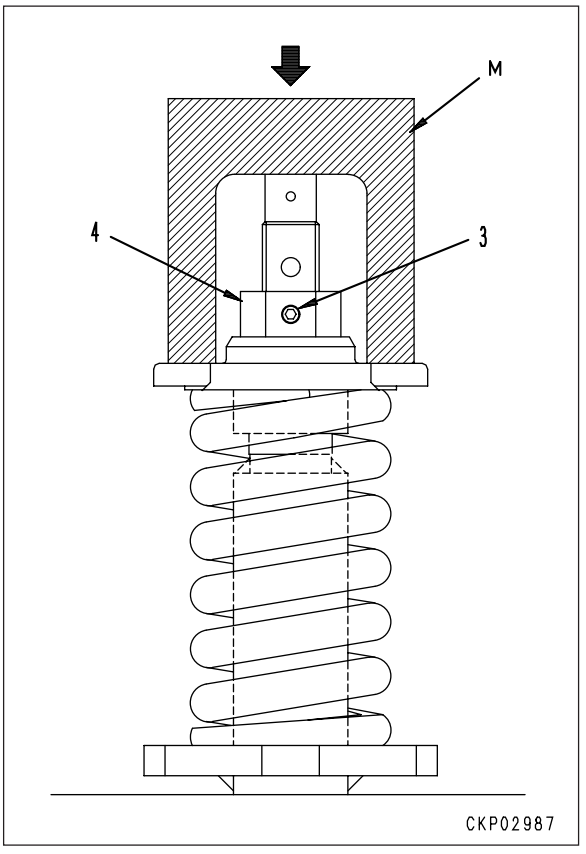
Model	Rubber shoe	Steel shoe
PC30R, 35R	188.1 mm	213.1 mm
PC40R, 45R	202.2 mm	238.2 mm

   ★ Installed load of spring:

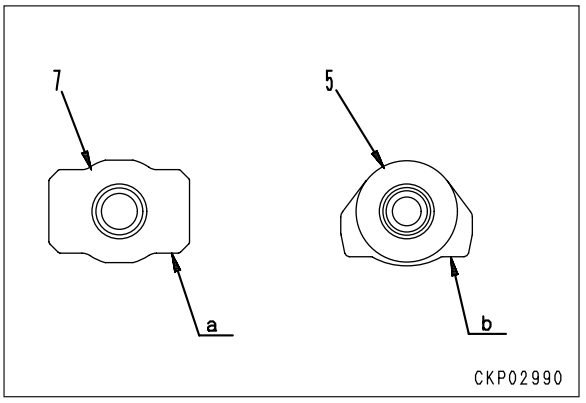
kN {kg}

Model	Rubber shoe	Steel shoe
PC30R, 35R	30.9 {3,151}	19.7 {2,008}
PC40R, 45R	42.4 {4,326}	26.9 {2,748}

   ★ The mounting hole for the screw is at the top for the steel shoe and at the bottom for the rubber shoe.

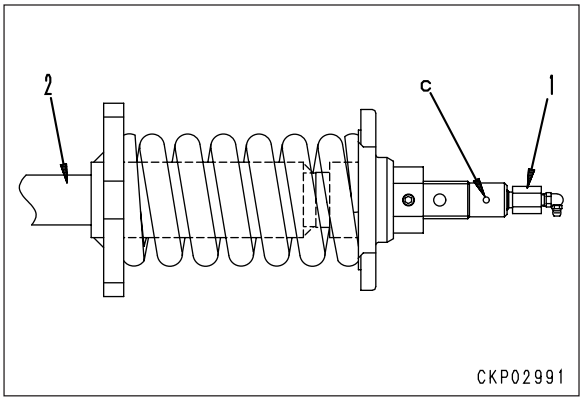


★ After assembling the recoil spring, check that the out-of-parallel between surface **a** of cylinder (7) and surface **b** of stopper (5) is less than 0.5 mm.



3. Piston

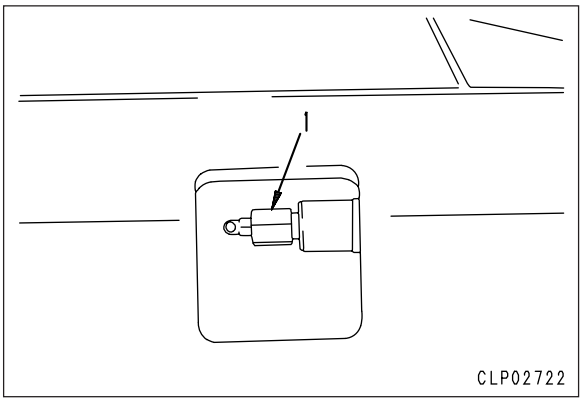
1) Tighten plug (1) temporarily.
   ★ Grease will come out from grease hole **c**, so tighten completely, then turn back approx. 2 turns.
2) Add approx. 120 cc of grease (G2-LI) inside cylinder.
3) Assemble cylinder (2) and push in until grease comes out from grease hole **c**.
4) When grease comes out, tighten valve (1).
   ★ After tightening the valve, check that the grease fitting is facing the outside of the chassis.



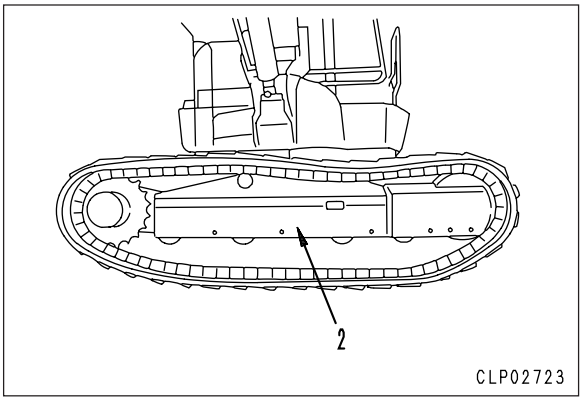
REMOVAL OF TRACK ROLLER ASSEMBLY

1. Loosen valve (1) to relieve track shoe tension.
※ 1

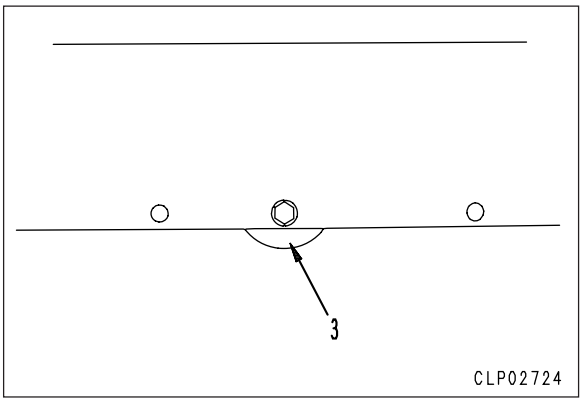

The recoil spring cylinder is under extremely high pressure. Never loosen the valve more than one turn.
If the grease does not come out easily, move the machine backwards and forwards.



2. Swing upper structure 90°, then use work equipment to raise track frame (2).
★ Raise the blade before raising the track frame.



3. Remove track roller assembly (3). ※ 2



INSTALLATION OF TRACK ROLLER ASSEMBLY

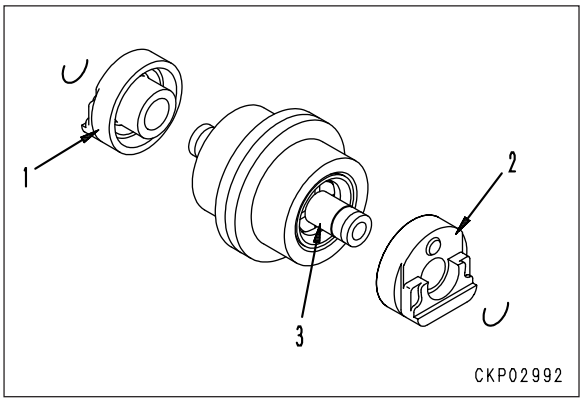
- Carry out installation in the reverse order to removal.

※ 1
★ Adjust the track shoe tension. For details, see TESTING AND ADJUSTING, Testing and adjusting track shoe tension.

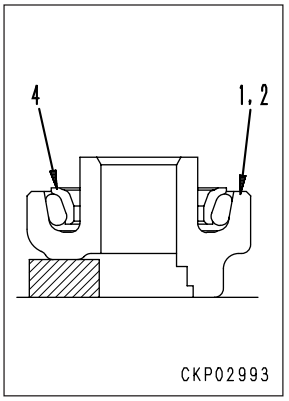
※ 2
Track roller assembly mounting bolt : **Thread tightener (LT-2)**

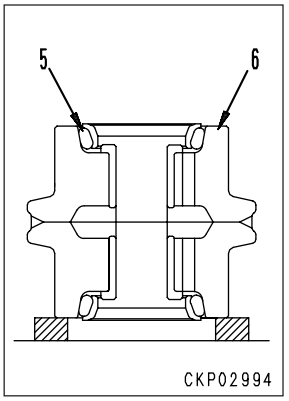
DISASSEMBLY OF TRACK ROLLER ASSEMBLY

1. Remove snap ring, then remove collars (1) and (2).
2. Remove shaft (3).

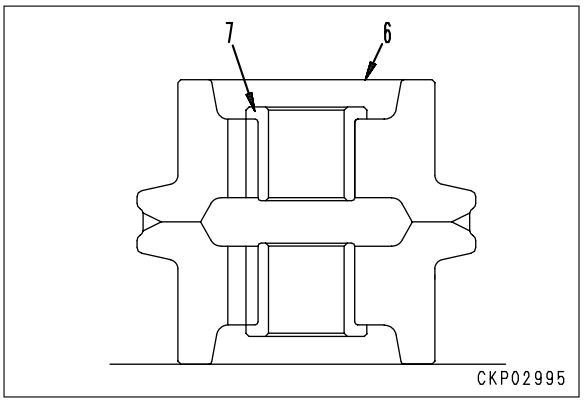


3. Remove floating seal (4) from collars (1) and (2).
4. Remove 2 floating seals (5) from roller (6).





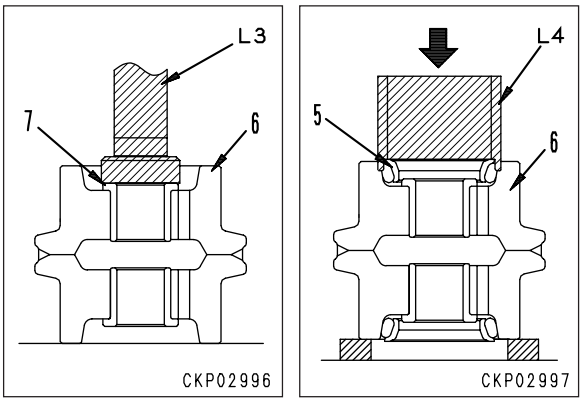
5. Remove 2 bushings (7) from roller (6).



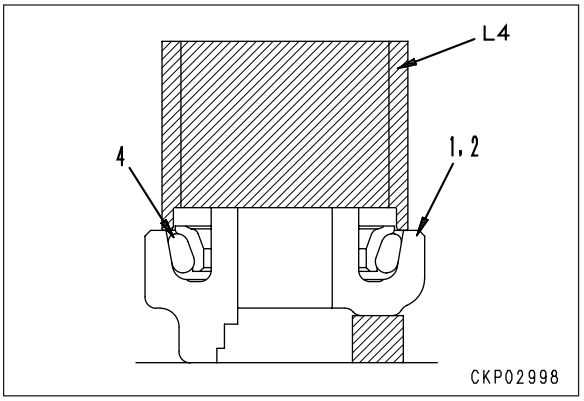
ASSEMBLY OF TRACK ROLLER ASSEMBLY

1. Using tool **L3**, press fit 2 bushings (7) to roller (6).

2. Using tool **L4**, install 2 floating seals (5) to roller (6).
   - ★ Wash and remove all grease and oil from the O-ring and O-ring contact surface, then dry the parts.
   - ★ Coat the sliding surface of the floating seal with engine oil (EO30-CD), and be careful not to let any dirt or dust get stuck to it.



3. Using tool **L4**, install floating seals (4) to collars (1) and (2).
   - ★ Wash and remove all grease and oil from the O-ring and O-ring contact surface, then dry the parts.
   - ★ Coat the sliding surface of the floating seal with engine oil (EO30-CD), and be careful not to let any dirt or dust get stuck to it.



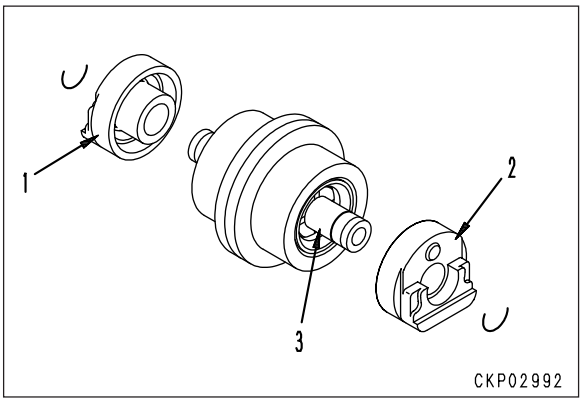
4. Fit O-ring and install shaft (3) to roller.

5. Fit collar (2) and secure with snap ring.

6. Fill inside of roller with engine oil.

   Inside of roller : **Approx. 40 cc (EO30-CD)**

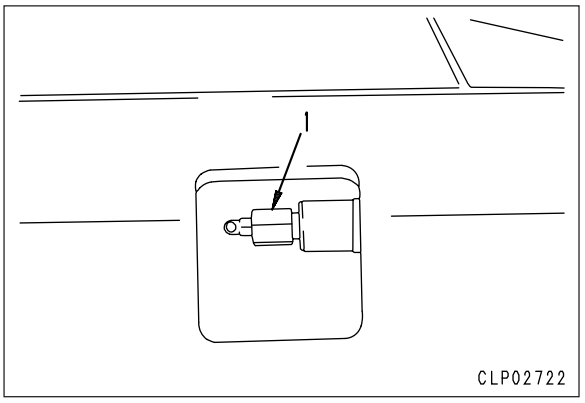
7. Fit collar (1) and secure with snap ring.



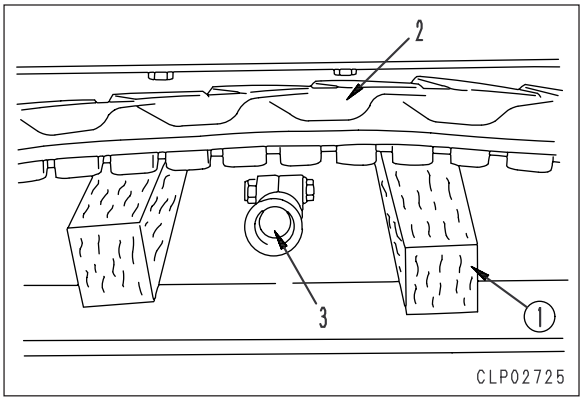
REMOVAL OF CARRIER ROLLER ASSEMBLY

1. Loosen valve (1) to relieve track shoe tension. ※ 1

   ⚠ The recoil spring cylinder is under extremely high pressure. Never loosen the valve more than one turn.
   If the grease does not come out easily, move the machine backwards and forwards.



2. Push up track (2) to a height where carrier roller can be removed, then set block ① in position.
3. Remove carrier roller assembly (3). ※ 2



INSTALLATION OF CARRIER ROLLER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

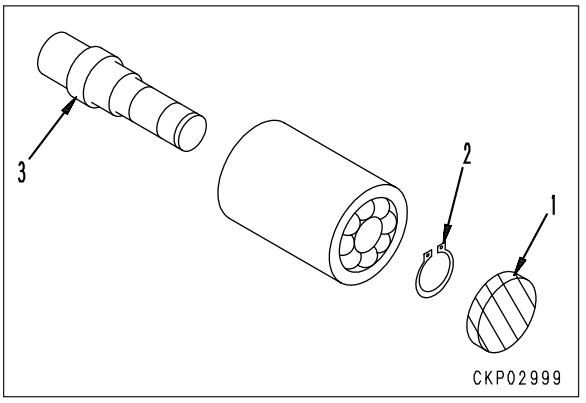
★ Adjust the track shoe tension. For details, see TESTING AND ADJUSTING, Testing and adjusting track shoe tension.

※ 2

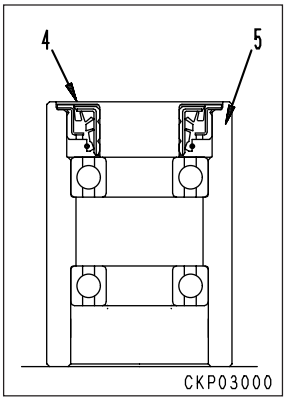
Carrier roller assembly mounting bolt : **Thread tightener (LT-2)**

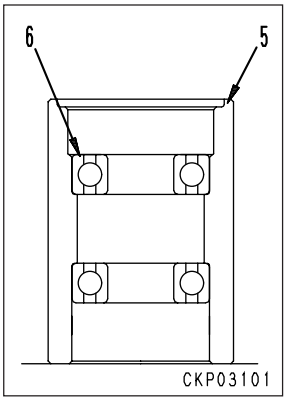
DISASSEMBLY OF CARRIER ROLLER ASSEMBLY

1. Remove cap (1).
2. Using snap ring pliers, remove snap ring (2).
3. Remove shaft (3).



4. Remove dust seal (4) from roller (5).
5. Remove 2 ball bearings (6) from roller (5).





ASSEMBLY OF CARRIER ROLLER ASSEMBLY

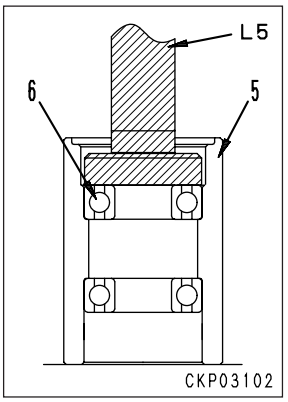
1. Using tool **L5**, press fit 2 ball bearings (6) to roller (5).

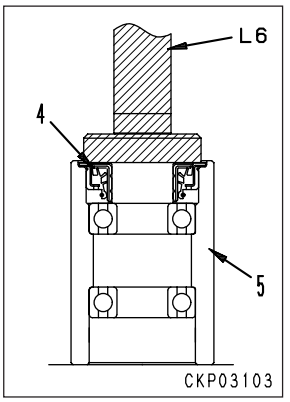
   Fill the ball portion of the bearing with grease (Albania EP-2 or equivalent)

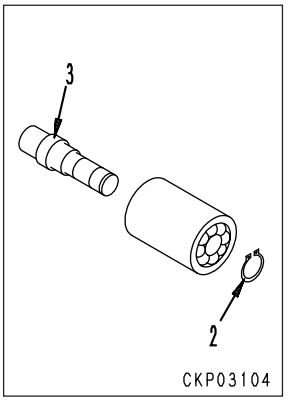
2. Using tool **L6**, press fit dust seal (4) to roller (5).
3. Fill inside of roller with grease.

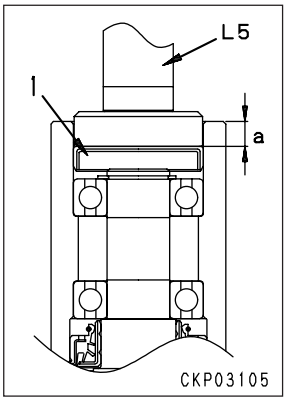
   Inside of roller : **Approx. 30 cc (Albania EP-2 or equivalent)**

4. Install shaft (3) to roller.
5. Using snap ring pliers, install snap ring (2).
   ★ Install the snap ring so that the edge on the inside faces the tip of the shaft.
6. Using tool **L5**, press fit cap (1).
   ★ Cap press-fitting depth **a** : 10 mm







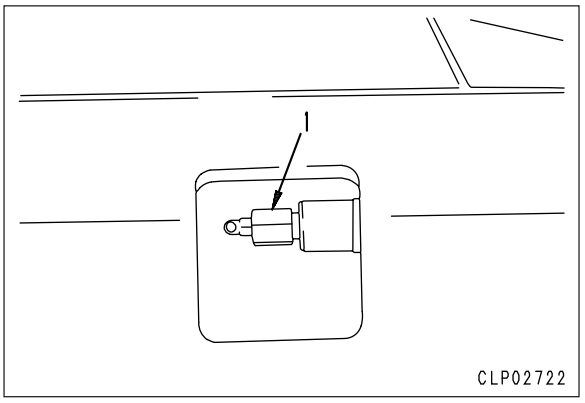


REMOVAL OF RUBBER SHOE ASSEMBLY

1. Loosen valve (1) to relieve track shoe tension.

※ 1

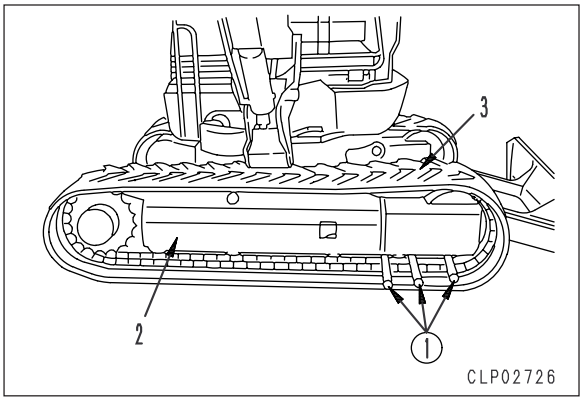
⚠ The recoil spring cylinder is under extremely high pressure. Never loosen the valve more than one turn.
If the grease does not come out easily, move the machine backwards and forwards.



2. Swing upper structure 90°, then use work equipment to raise track frame (2) slightly.
   ★ Raise the blade before raising the track frame.

3. Using pipes ①, remove rubber shoe assembly (3).
   ★ Fit the pipes inside the rubber shoe assembly, rotate the rubber shoe assembly in reverse to raise the rubber shoes from the idler, then slide to the outside to remove the rubber shoe assembly.

5 kg Rubber shoe assembly :
130 kg (PC30R, 35R)
230 kg (PC40R, 45R)



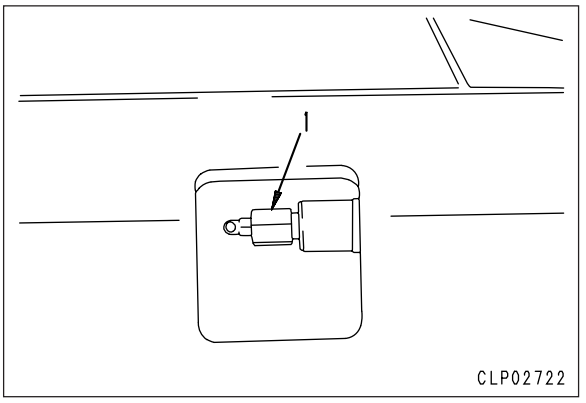
INSTALLATION OF RUBBER SHOE ASSEMBLY

- Carry out installation in the reverse order to removal.

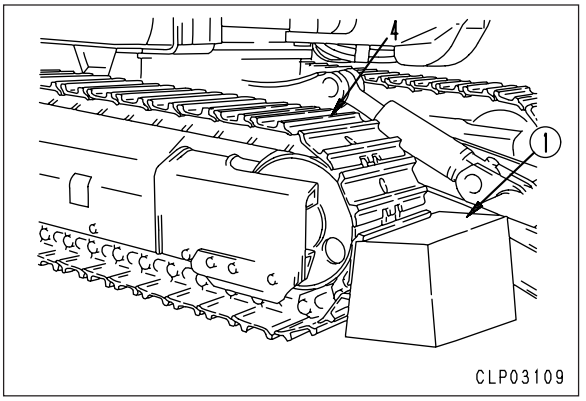
※ 1
   ★ Adjust the track shoe tension. For details, see TESTING AND ADJUSTING, Testing and adjusting track shoe tension.

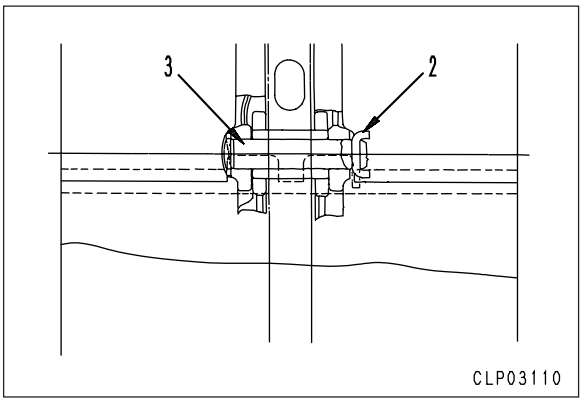
REMOVAL OF STEEL SHOE ASSEMBLY (PC30R, 35R)

1. Loosen valve (1) to relieve track shoe tension.
   ※ 1
   ⚠ The recoil spring cylinder is under extremely high pressure. Never loosen the valve more than one turn.
   If the grease does not come out easily, move the machine backwards and forwards.



2. Move position of master pin towards front of machine, then set block ① to track shoe.
   ★ Move the machine backwards or forwards so that the master pin is at the top of the idler.
3. Bend back lock pin (2) on one side and remove it.
   ※ 2
4. Remove master pin (3).
5. Remove steel shoe assembly (4).
   ⚠ Start the engine and move the machine slowly in reverse to lay out the steel shoe assembly.
   kg Steel shoe assembly : **170 kg**





INSTALLATION OF STEEL SHOE ASSEMBLY (PC30R,35R)

- Carry out installation in the reverse order to removal.

※ 1
★ Adjust the track shoe tension. For details, see TESTING AND ADJUSTING, Testing and adjusting track shoe tension.

※ 2
★ Bend the lock pin after installing.

REMOVAL OF STEEL SHOE ASSEMBLY (PC40R, 45R)

1. Loosen valve (1) to relieve track shoe tension.
   ※ 1
   ⚠ The recoil spring cylinder is under extremely high pressure. Never loosen the valve more than one turn.
   If the grease does not come out easily, move the machine backwards and forwards.

2. Move position of master pin towards front of machine, then set block ① to track shoe.
   ★ Move the machine backwards or forwards so that the master pin is at the top of the idler.

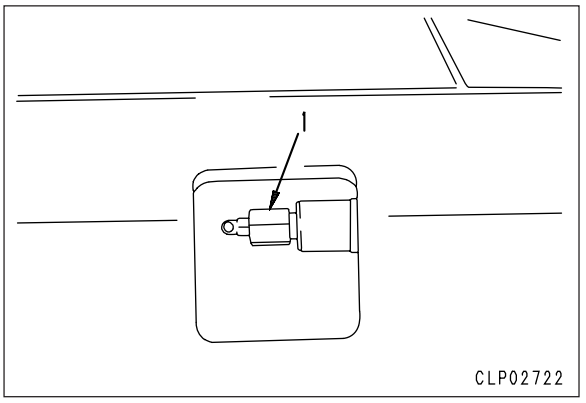
3. Using tool **R**, remove master pin (2). ※ 2

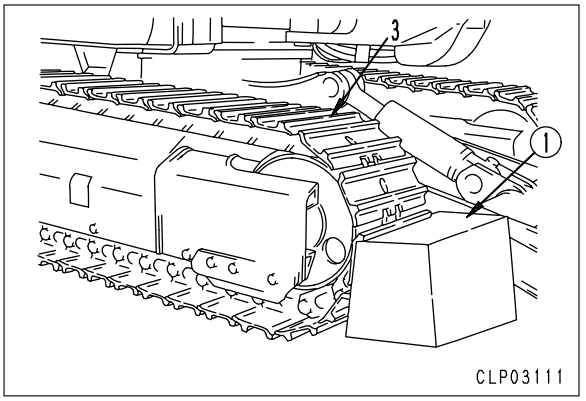
4. Remove tool **R**.

5. Remove steel shoe assembly (3).

   ⚠ Start the engine and move the machine slowly in reverse to lay out the steel shoe assembly.

   kg Steel shoe assembly : **270 kg (PC40R)**
   300 kg (PC45R)



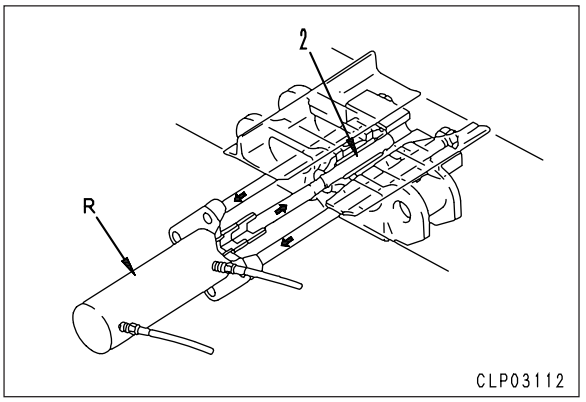


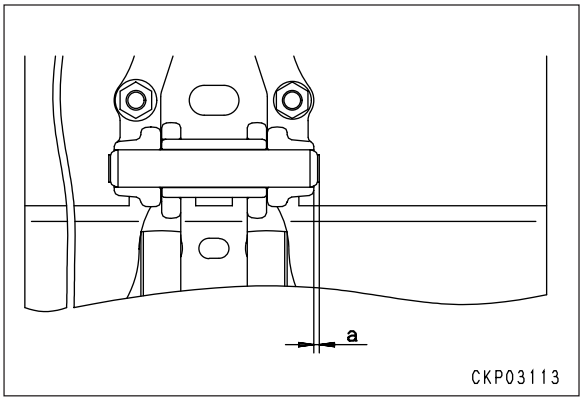
INSTALLATION OF STEEL SHOE ASSEMBLY (PC40R,45R)

- Carry out installation in the reverse order to removal.

※ 1
★ Adjust the track shoe tension. For details, see TESTING AND ADJUSTING, Testing and adjusting track shoe tension.

※ 2
★ Use tool **R** and press fit so that protrusion **a** of the master pin is uniform on the left and right.
  - Protrusion **a** of master pin (left and right): 3.25 mm

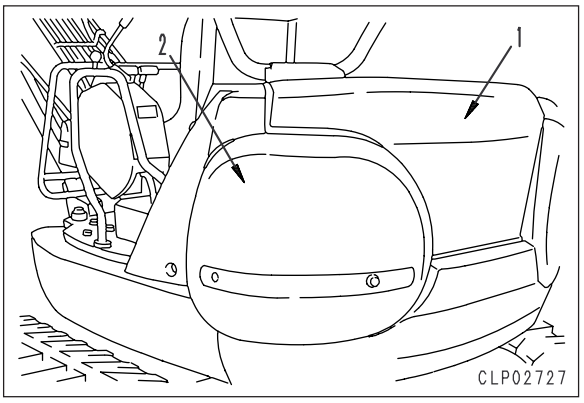


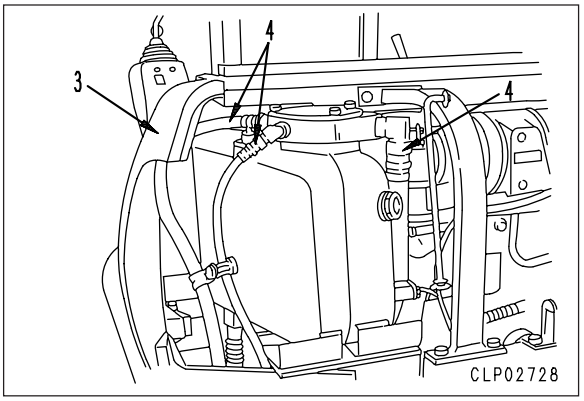


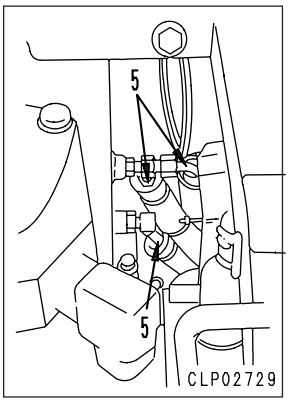
REMOVAL OF HYDRAULIC TANK ASSEMBLY

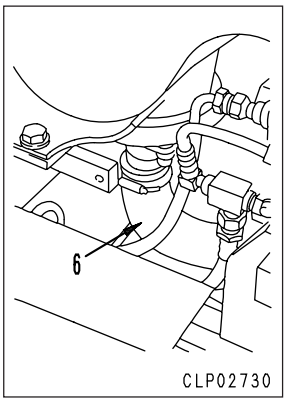
⚠ Release the remaining pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic tank.

1. Drain hydraulic oil.
   Hydraulic tank : **Approx. 33 ℓ**
2. Remove engine hood (1).
3. Lift off left protector (2).
   kg Left protector : **40 kg**
4. Remove left cover (3).
   ★ On the operator's cab specification machine, to prevent damage to the left cover, raise the cab slightly or put a thin cloth between the cab and left cover when removing.
5. Disconnect 3 top hoses (4).
   ★ Disconnect the hose clamps also.
6. Disconnect 3 hoses (5) at right side.
7. Disconnect bottom hose (6). ※ 1
8. Lift off hydraulic tank assembly (7).
   kg Hydraulic tank assembly : **35 kg**









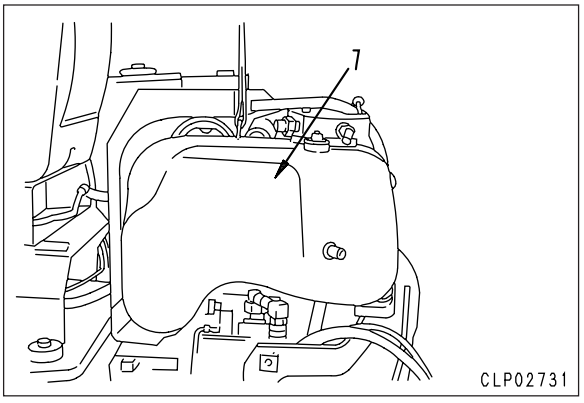
INSTALLATION OF HYDRAULIC TANK ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm Bottom hose clamp :
5.9 ± 0.49 Nm {60 ± 5 kgcm}

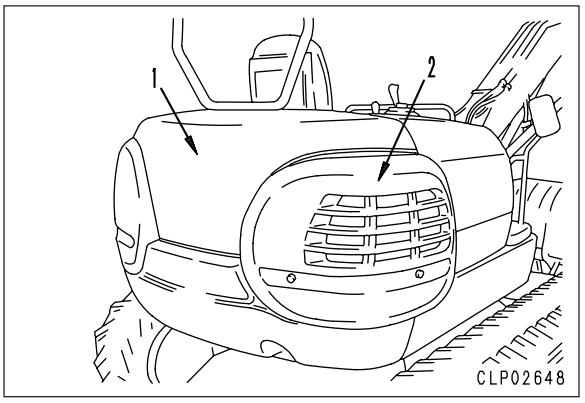
- **Refilling with oil (hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
  Hydraulic tank : **Approx. 33 ℓ (EO10W-CD)**
- **Bleeding air**
  Bleed the air from the hydraulic circuit. For details, see TESTING AND ADJUSTING, Bleeding air.

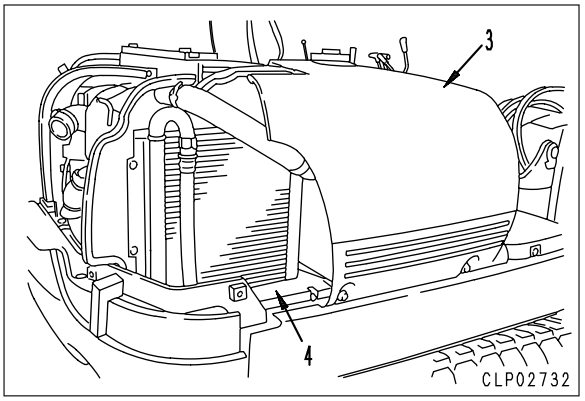


REMOVAL OF HYDRAULIC COOLER ASSEMBLY

⚠ Release the remaining pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic tank.

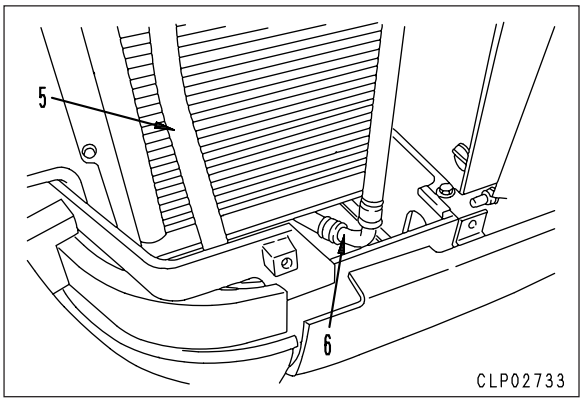
1. Drain hydraulic oil.
   Hydraulic tank : **Approx. 33 ℓ**
2. Remove engine hood (1).
3. Lift off right protector (2).
   Right protector : **40 kg**
4. Remove right cover (3).
   ★ Remove the inspection cover at the top of the radiator also.
5. Remove adiabatic cover (4).
6. Disconnect inlet hose (5) and outlet hose (6).
7. Remove hydraulic cooler assembly (7).

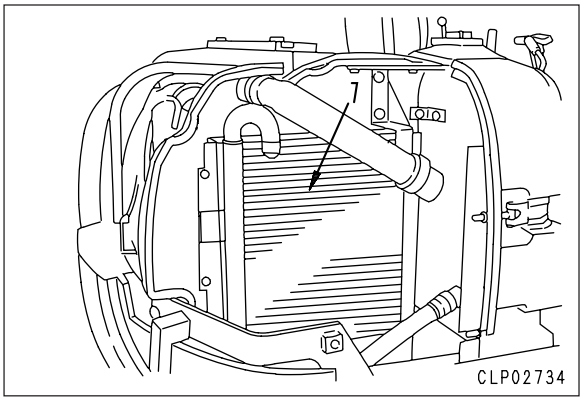




INSTALLATION OF HYDRAULIC COOLER ASSEMBLY

- 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.
  Hydraulic tank : **Approx. 33 ℓ (EO10W-CD)**
- **Bleeding air**
  Bleed the air from the hydraulic circuit. For details, see TESTING AND ADJUSTING, Bleeding air.

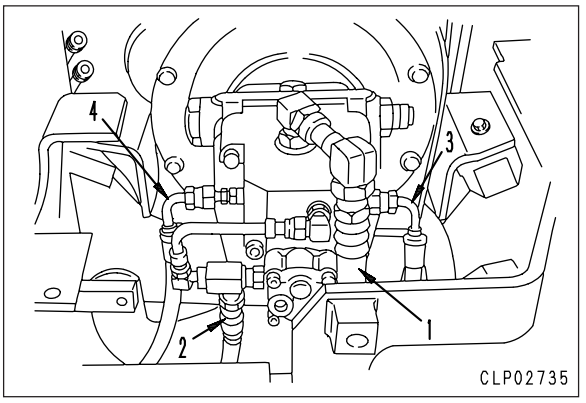




REMOVAL OF HYDRAULIC PUMP ASSEMBLY

1. Remove hydraulic tank assembly. For details, see REMOVAL OF HYDRAULIC TANK ASSEMBLY.
2. Disconnect outlet hoses (1) and (2).
3. Disconnect pilot hoses (3) and (4).
4. Using eyebolt ①, lift off hydraulic pump assembly (5). ※ 1

   kg Hydraulic pump assembly : **30 kg**

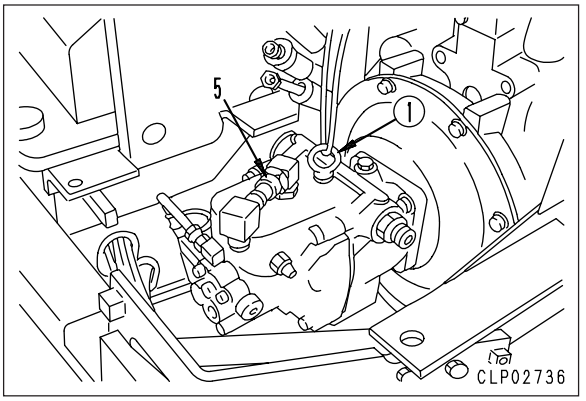


INSTALLATION OF HYDRAULIC PUMP ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

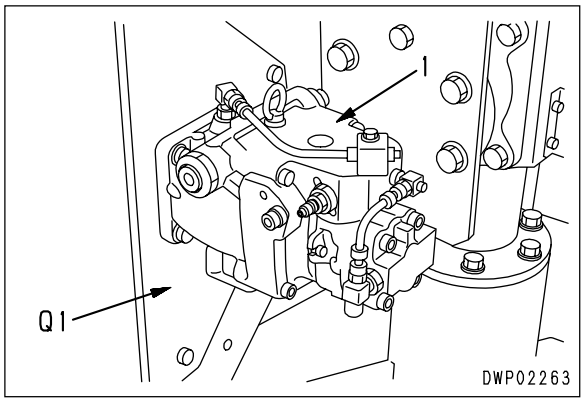
Shaft spline portion :
Molybdenum disulphide grease (LM-P)



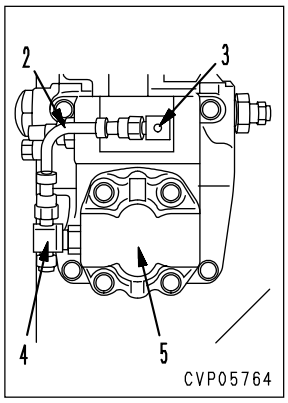
DISASSEMBLY OF MAIN PUMP ASSEMBLY

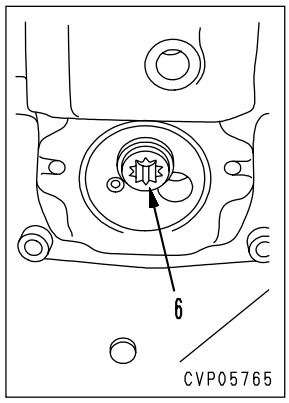
LPV45

1. Hydraulic pump assembly
Set hydraulic pump assembly (1) to tool **Q1**.

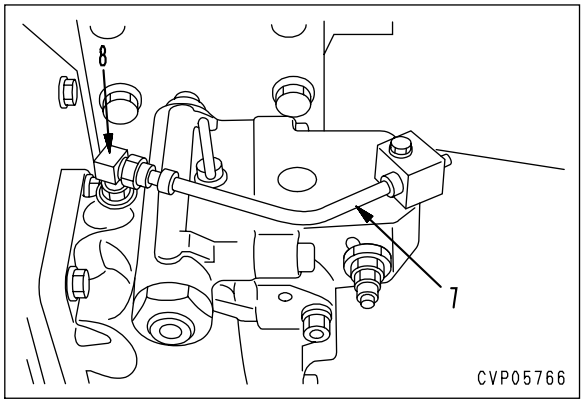


2. Gear pump assembly
1) Remove tube (2), then remove elbows (3) and (4).
2) Remove gear pump assembly (5).
3) Remove coupling (6).

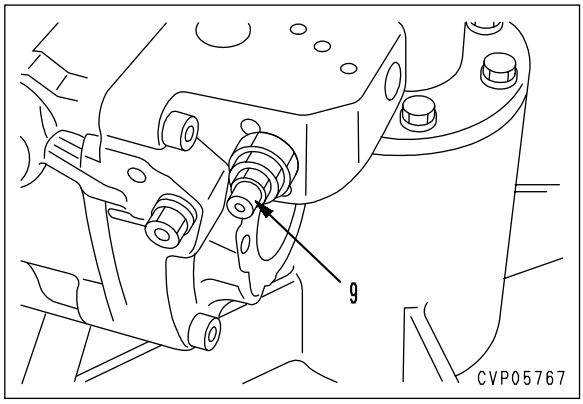




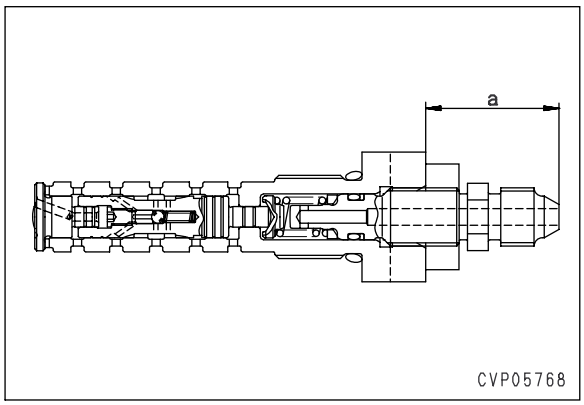
3. Air bleed tube
Remove tube (7), then remove elbow (8).



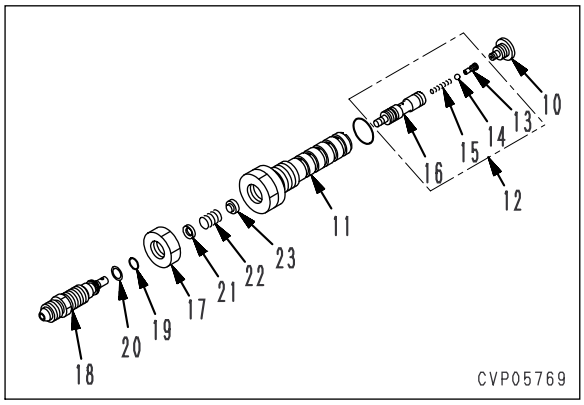
4. LS valve assembly
1) Remove LS valve assembly (9).



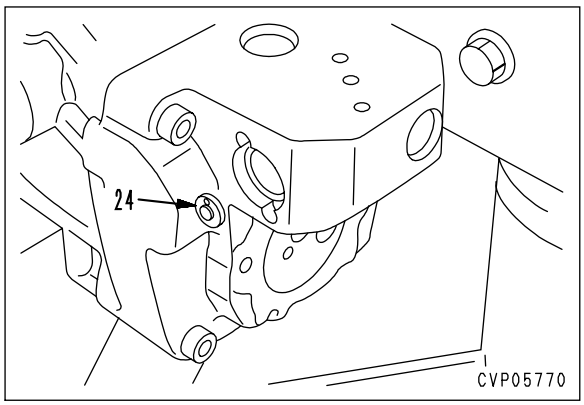
2) Disassemble LS valve assembly as follows.
★ Measure screwed-in depth **a** of the plug before disassembling.



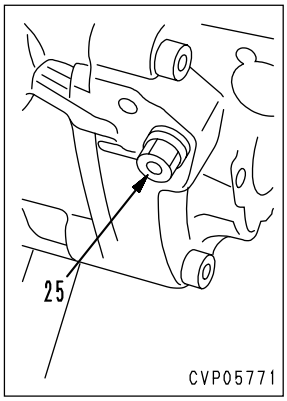
i) Remove piston (10) from sleeve (11).
ii) Remove spool assembly (12).
iii) Remove plug (13), then remove ball (14) and spring (15) from spool (16).
iv) Loosen nut (17), then remove plug (18).
v) Remove O-ring (19) and backup ring (20) from plug (18).
vi) Remove seat (21), spring (22), and seat (23).

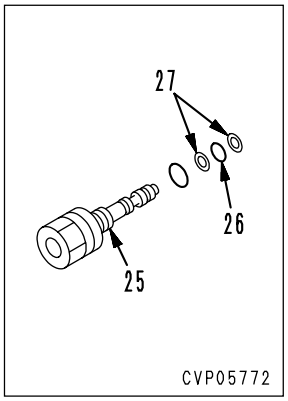


3) Remove seat (24).



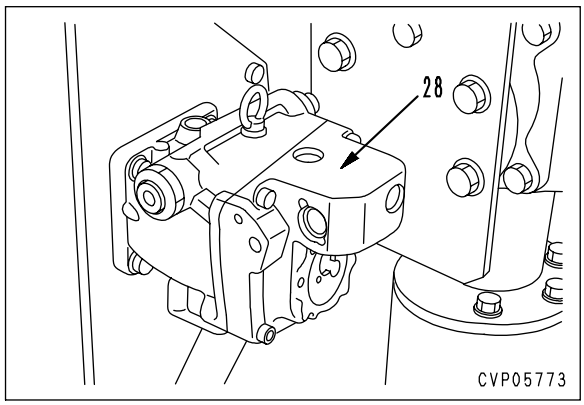
5. Orifice plug
1) Remove orifice plug (25).
2) Remove O-ring (26) and 2 backup rings (27) from orifice plug (25).



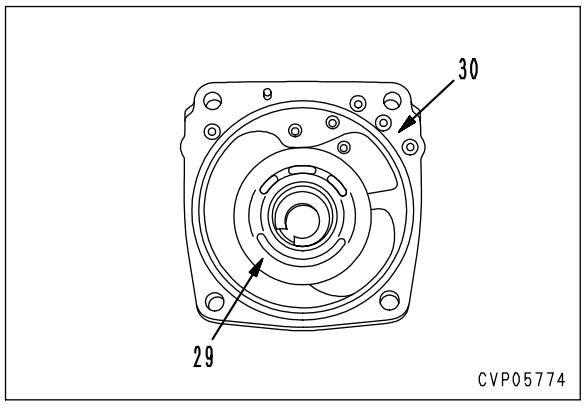


6. End cap assembly

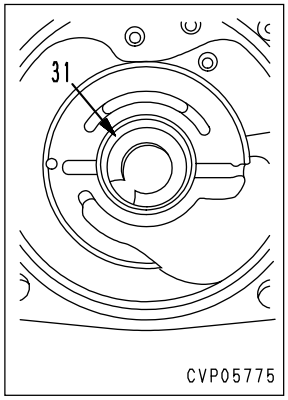
1) Remove end cap assembly (28).
   ★ The valve plate may be stuck to the cylinder block, so be careful when removing.

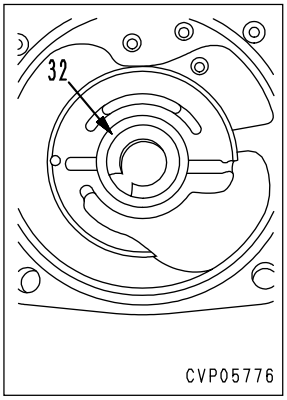


2) Disassemble end cap assembly as follows.
   i) Remove valve plate (29) from end cap (30).



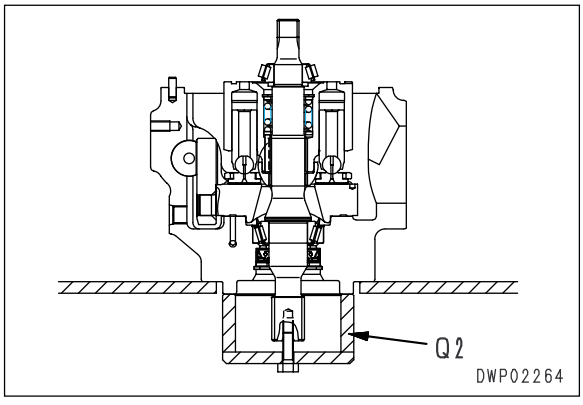
   ii) Remove bearing outer race (31).
   iii) Remove spacer (32).



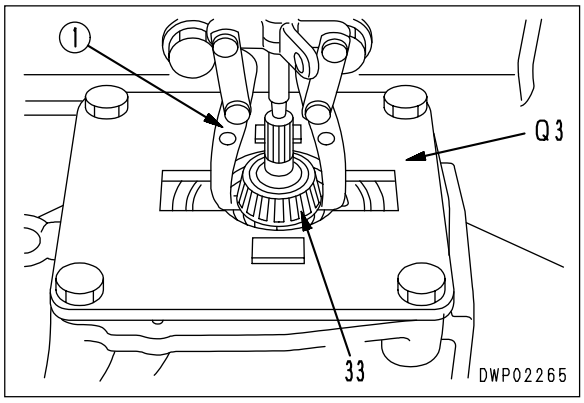


6. Cylinder block, piston assembly

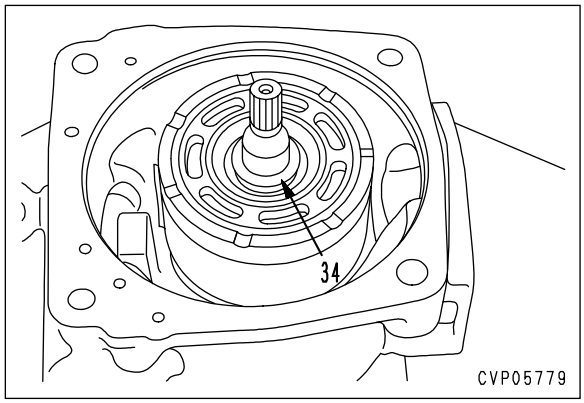
1) Using tool **Q2**, hold shaft in position.
   ★ Do not remove the tool until removing the shaft.



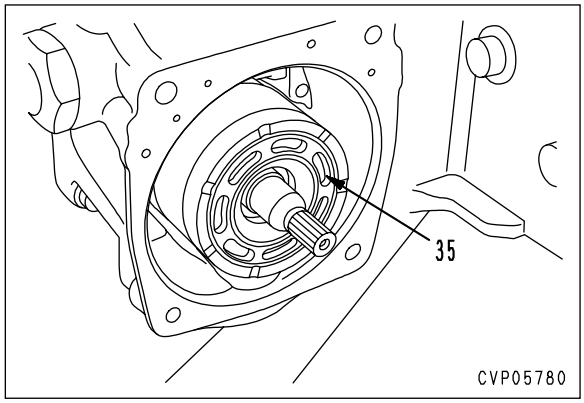
2) Using tool **Q3**, push down cylinder block.
   ★ Set the tool so that the side with the welded plate is facing the cylinder block. Use gum tape or cloth to prevent the tool and cylinder block from coming into direct contact.
   ★ The cylinder block sinks in only 4 – 5 mm, so do not tighten the bolt more than necessary.



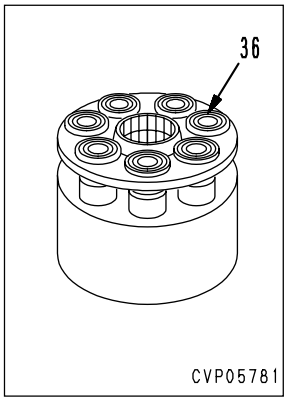
3) Using puller ①, remove bearing inner race (33).
   ★ Rotate the bearing cage and check that the teeth of the puller are not applied to the cage while removing.
4) Remove spacer (34).

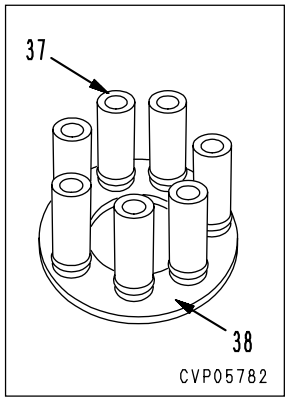


5) Remove cylinder block and piston assembly (35).
   ★ To ensure that the cylinder block and piston assembly come off together as one unit, set the case facing slightly down when removing.

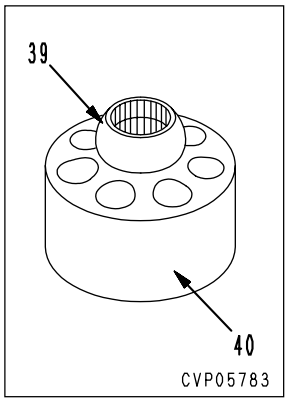


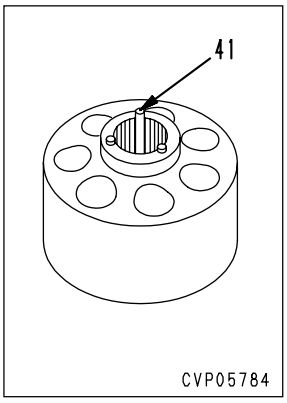
6) Disassemble cylinder block and piston assembly as follows.
   i) Remove piston assembly (36).
   ii) Remove 7 pistons (37) from shoe retainer (38).



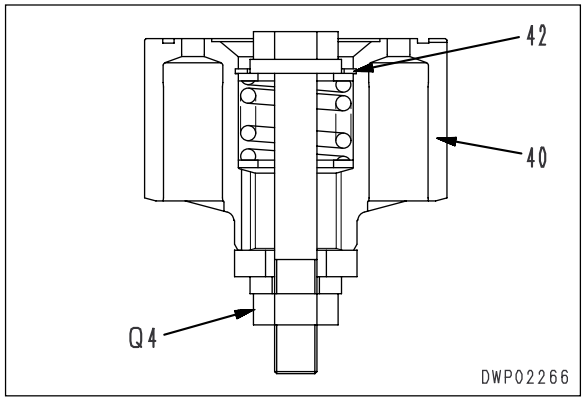


iii) Remove retainer guide (39) from cylinder block assembly (40).
iv) Remove 3 pins (41).

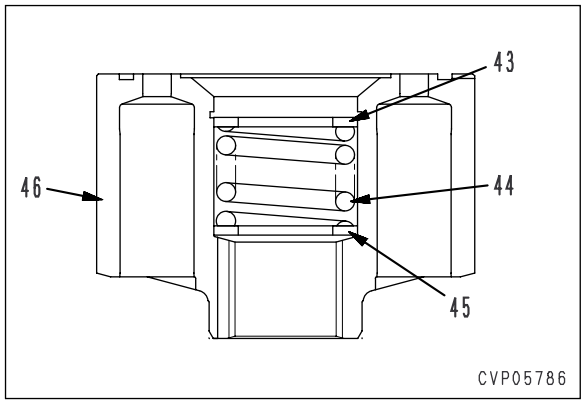




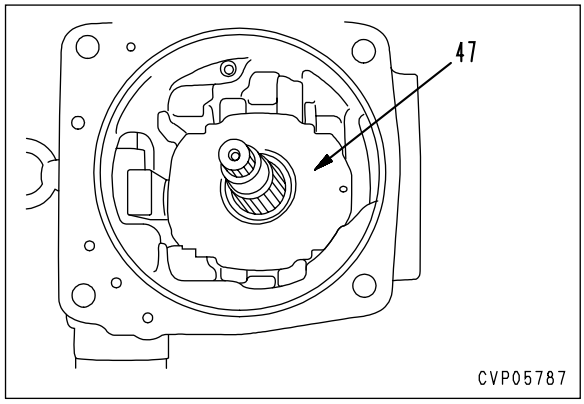
v) Set tool **Q4** to cylinder block assembly (40) and compress spring.
vi) Remove snap ring (42), then remove tool **Q4**.



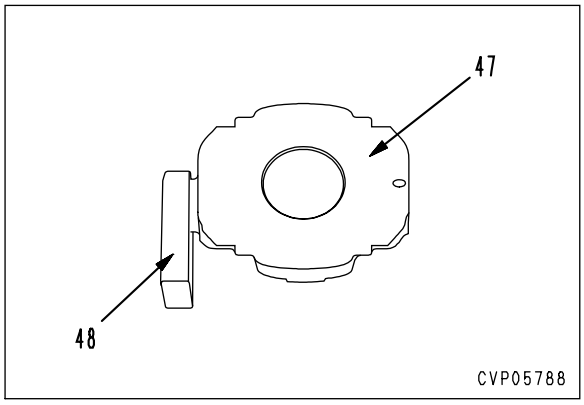
vii) Remove washer (43), spring (44), and washer (45) from cylinder block (46).



8. Rocker cam
1) Remove rocker cam (47) together with slider.

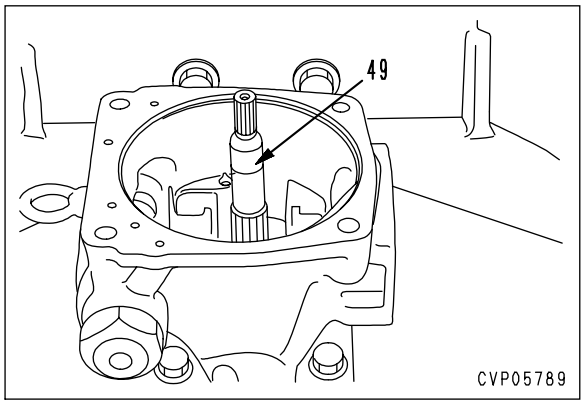


2) Remove slider (48) from rocker cam (47).

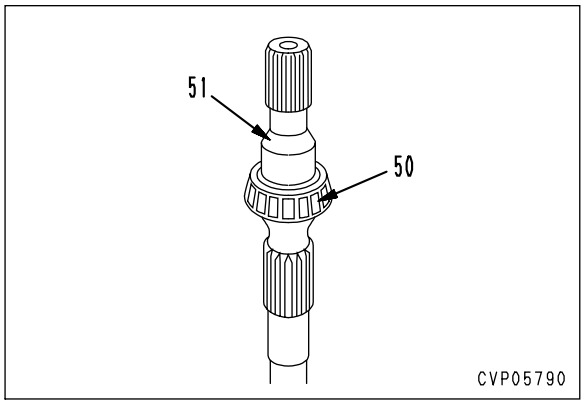


9. Shaft assembly

1) Remove tool **Q2**, then remove shaft assembly (49).

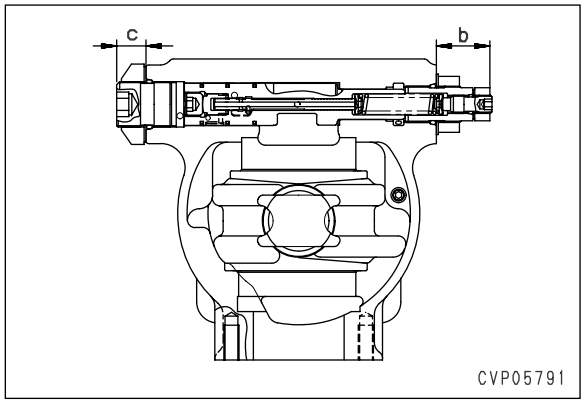


2) Remove bearing inner race (50) from shaft (51).

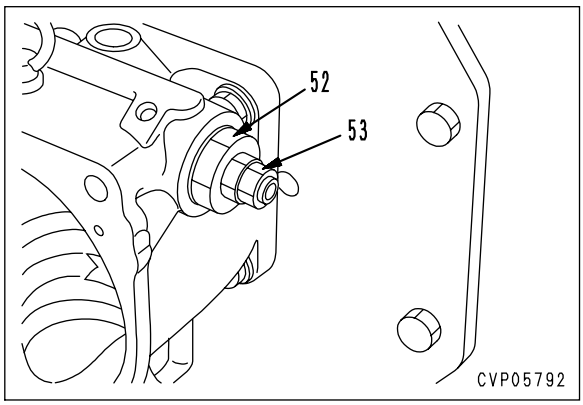


10. PC valve, servo piston assembly

★ Before disassembling, measure adjustment dimension **b** of the minimum swash plate angle and adjustment dimension **c** of the maximum swash plate angle.

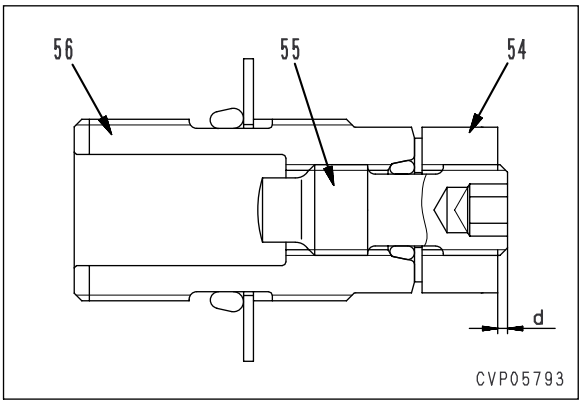


1) Remove nut (52), then remove plug assembly (53).

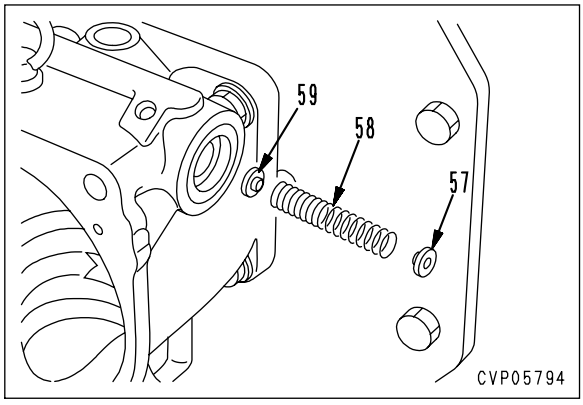


2) Disassemble plug assembly (53) as follows.
   ★ Measure screwed-in dimension **d** of the plug before disassembling.

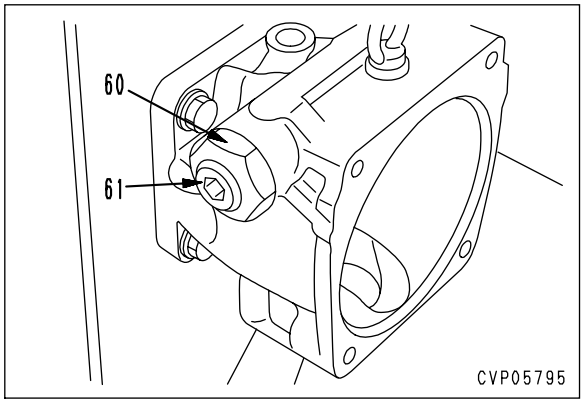
   Remove nut (54), then remove plug (55) from plug (56).



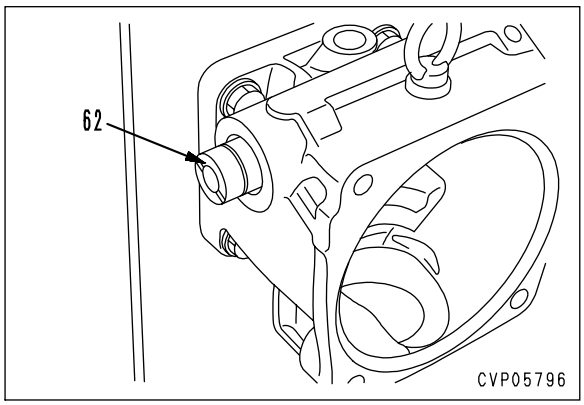
3) Remove seat (57), spring (58), and seat (59).



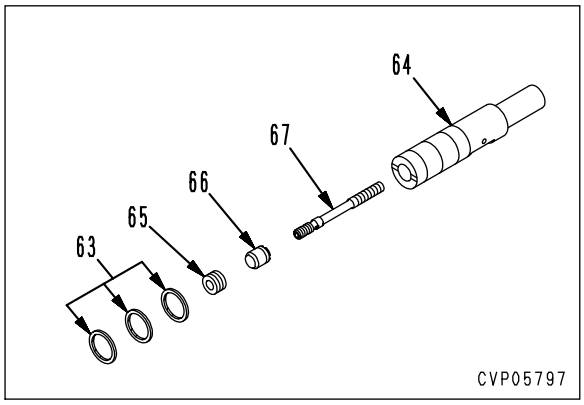
4) Loosen nut (60), then remove bolt (61).
   ★ The nut and bolt form a set, so keep them together as a set and be careful not to mix them.



5) Remove PC valve and servo piston assembly (62).

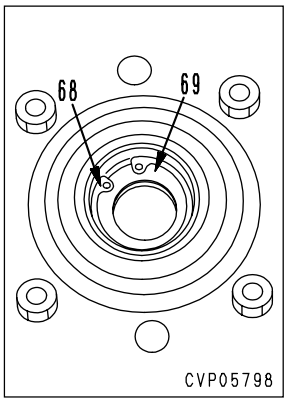


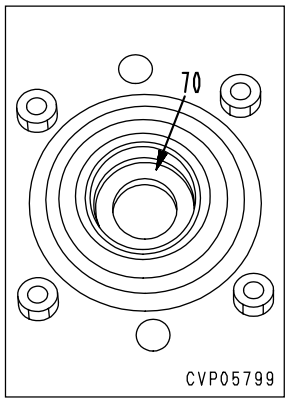
6) Disassemble PC valve and servo piston assembly as follows.
   i) Remove 3 seals (63) from piston (64).
   ii) Remove plug (65).
   iii) Remove plug (66) and piston (67).



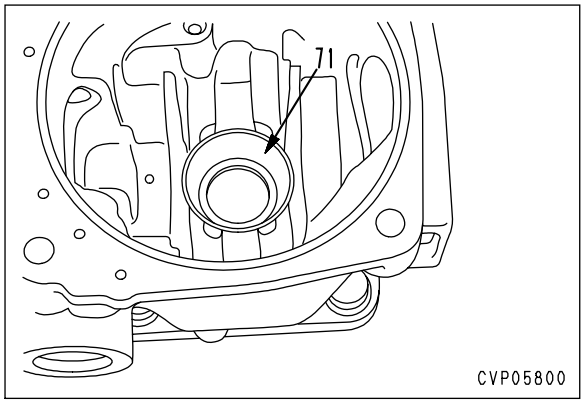
11. Pump case

1) Remove snap ring (68), then remove spacer (69).
2) Remove oil seal (70).





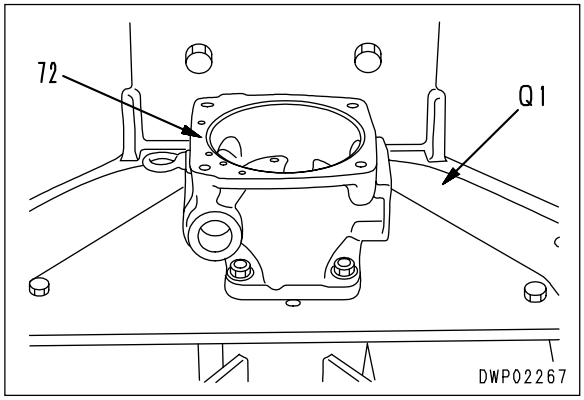
3) Remove bearing outer race (71).



ASSEMBLY OF MAIN PUMP ASSEMBLY

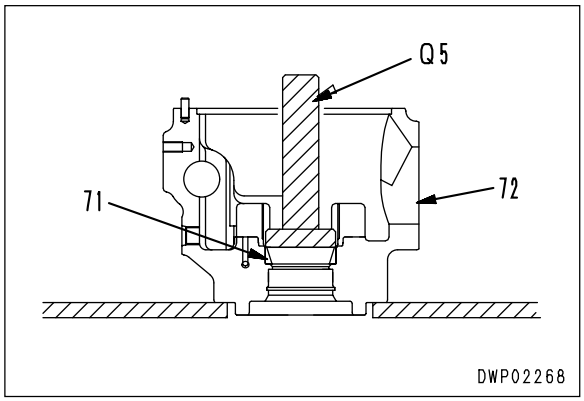
LPV45

★ 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) Pump case and rocker cam
2) Cylinder block and valve plate
3) Valve plate and end cap



1. Pump case
1) Set pump case (72) to tool **Q1**.
2) Using tool **Q5**, press fit bearing outer race (71) to case (72).

Outside circumference of bearing:
Grease (G2-LI)

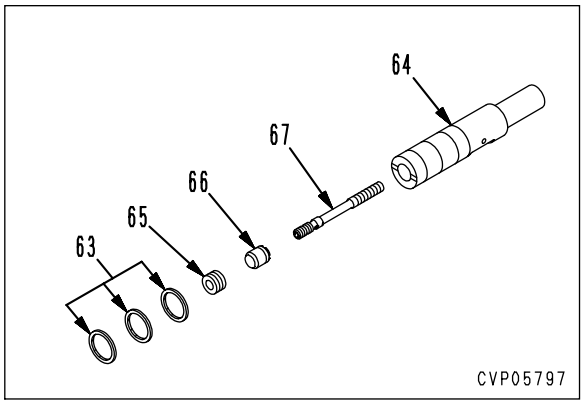


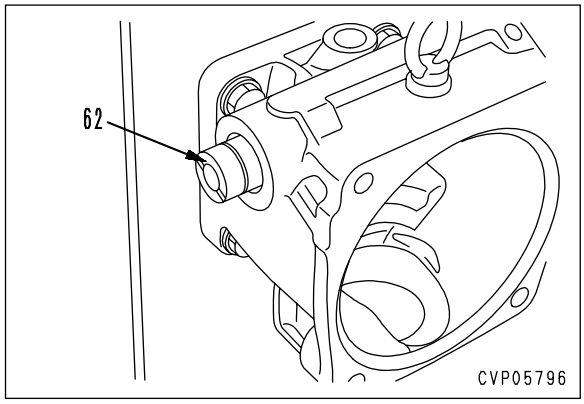
2. PC valve, servo piston assembly
1) Assemble PC valve and servo piston assembly as follows.
i) Assemble piston (67) and plug (66) to piston (64).
★ Assemble piston (67) so that the end with more oil grooves is on the inside of piston (64).
ii) Install plug (65).

Threaded portion:
Thread tightener
(Loctite #638 or equivalent)

kgm Plug: **58.8 – 73.5 Nm {6.0 – 7.5 kgm}**

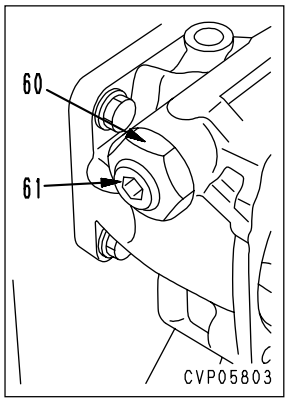
iii) Install 3 seals (63).
★ To make sure that the seals fit the piston, wrap them with tape to hold in position for 2 hours.
2) Assemble PC valve and servo piston assembly (62).

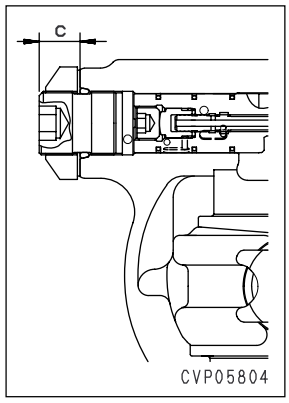




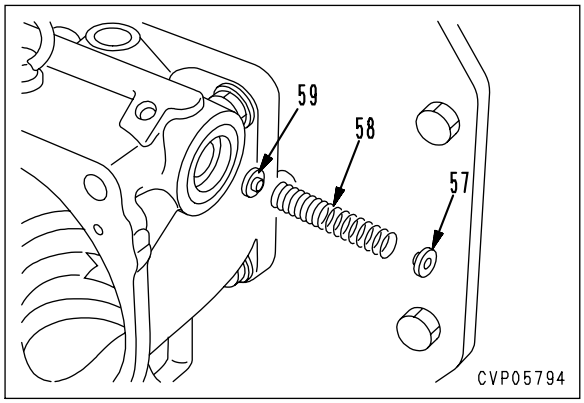
3) Fit O-ring, screw in bolt (61), then secure with nut (60).
   ★ Set to adjustment dimension **c** for the maximum swash plate angle measured during disassembly.
   • Standard adjustment dimension:
   For PC30R, 35R: 17.6 mm
   For PC40R, 45R: 19.4 mm

   kgm Nut: **196 – 245 Nm {20 – 25 kgm}**



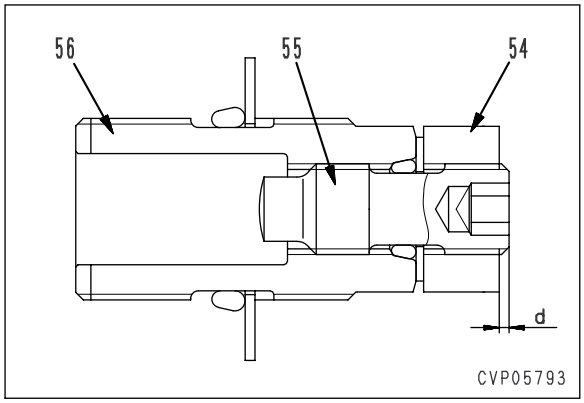


4) Assemble seat (59), spring (58), and seat (57).
   ★ Assemble the spring with the narrow coil width facing the servo piston.
   ★ Coat all parts thinly with grease to prevent them from falling out, and bring them into tight contact.



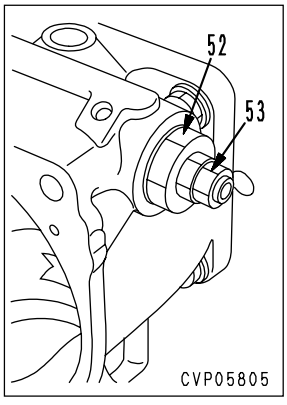
5) Assemble plug assembly as follows.
   Assemble plug (56) to plug (55), then secure with nut (54).
   ★ Set to screwed-in dimension **d** for the plug measured during disassembly.
   • Standard screwed-in dimension:
   1.3 mm

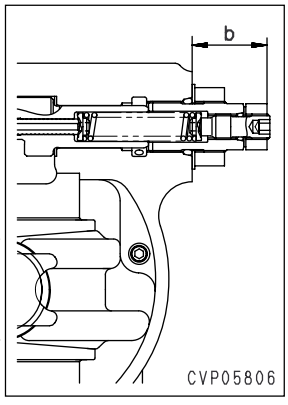
   kgm Nut: **24.5 – 34.3 Nm {2.5 – 3.5 kgm}**



6) Fit O-ring, screw in plug assembly (53), then secure with nut (52).
   ★ Set to adjustment dimension **b** for the minimum swash plate angle measured during disassembly.
   • Standard adjustment dimension **b**:
   35.4 mm

   kgm Nut: **98 – 118 Nm {10 – 12 kgm}**

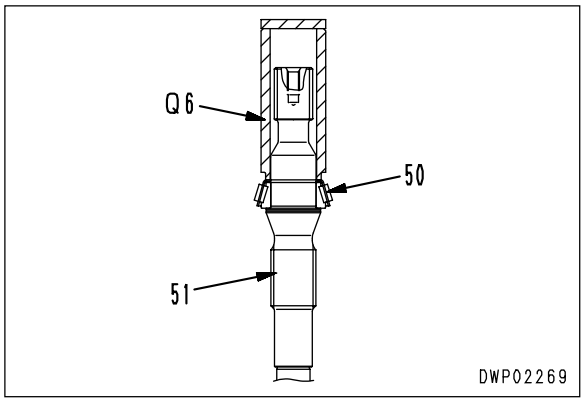




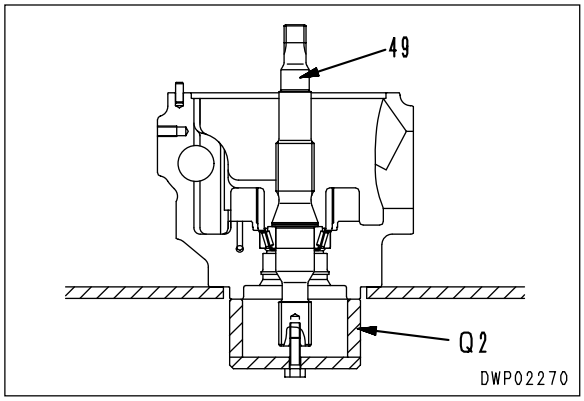
3. Shaft assembly

1) Using tool **Q6**, press fit bearing inner race (50) to shaft (51).

Inside circumference of bearing: **Grease (G2-LI)**

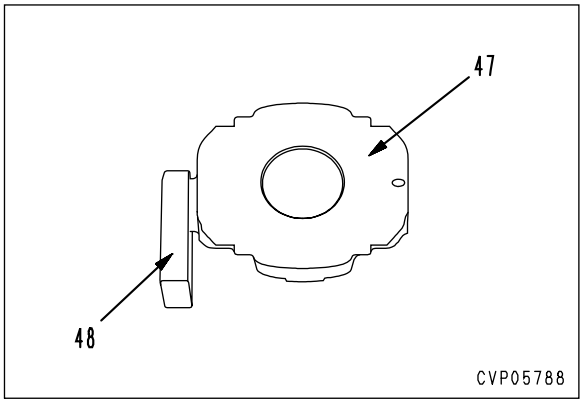


2) Install shaft assembly (49), and secure with tool **Q2**.
   ★ Do not remove the tool until press fitting the bearing inner race.

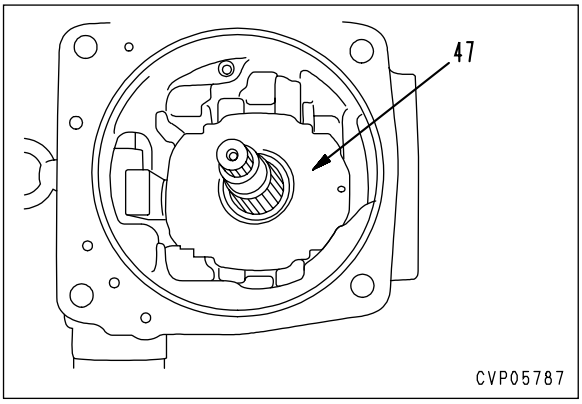


4. Rocker cam

1) Install slider (48) to rocker cam (47).
   ★ Install the slider so that the chamfered side of the shaft hole faces the rocker cam.

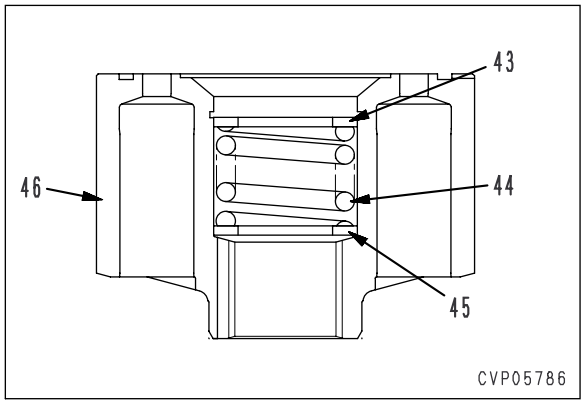


2) Install rocker cam (47) and slider as one unit.
   ★ Check that the sliding surface of the pump case and rocker cam are fitted together securely.

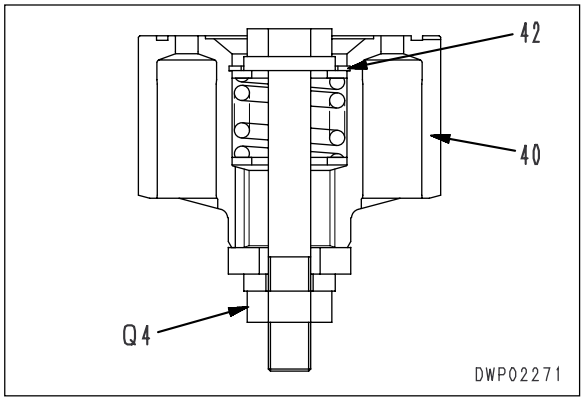


5. Cylinder block, piston assembly

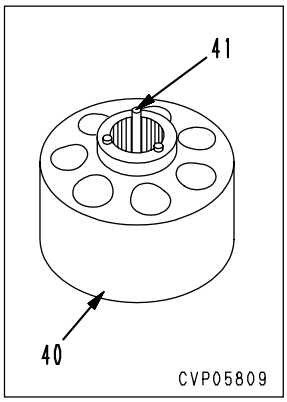
1) Assemble cylinder block and piston assembly as follows.
   i) Set washer (45), spring (44), and washer (43) to cylinder block (46).

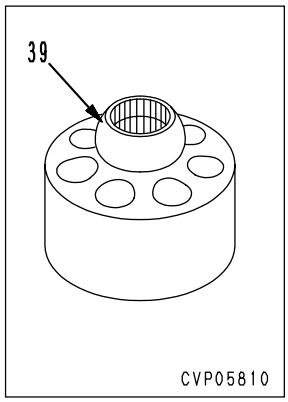


   ii) Set tool **Q4** to cylinder block assembly (40) and compress spring.
   iii) Fit snap ring (42), then remove tool **Q4**.

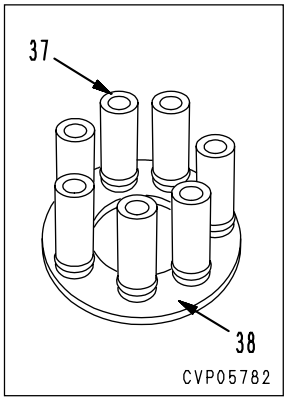


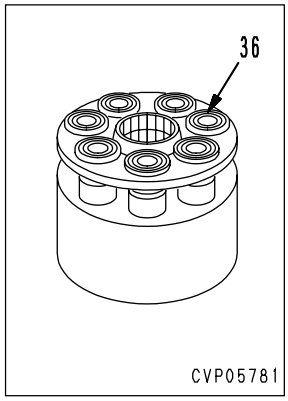
   iv) Assemble 3 pins (41) to cylinder block assembly (40).
      ★ Coat the pins thinly with grease to prevent them from falling out when they are assembled to the pump case, and bring into tight contact with the cylinder block.
   v) Install retainer guide (39).



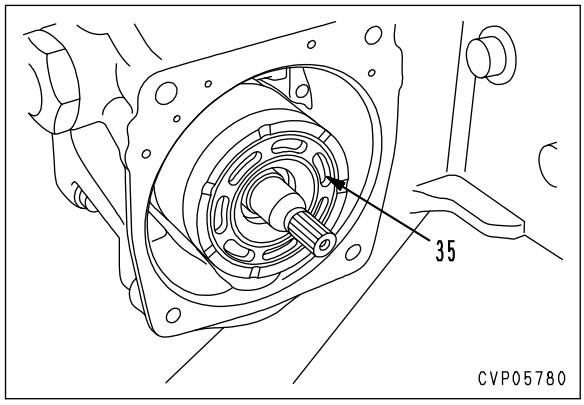


   vi) Assemble 7 pistons (37) to shoe retainer (38).
   vii) Assemble piston assembly (36) to cylinder block assembly.

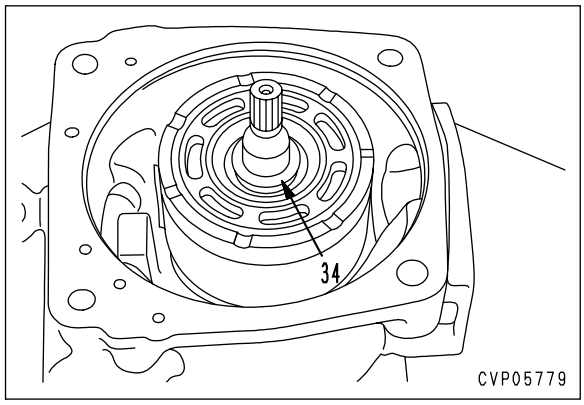




2) Install cylinder block and piston assembly (35).
★ Check that the spline of the shaft and cylinder block is meshed and that the sliding portion of the rocker cam and piston shoe are in tight contact.



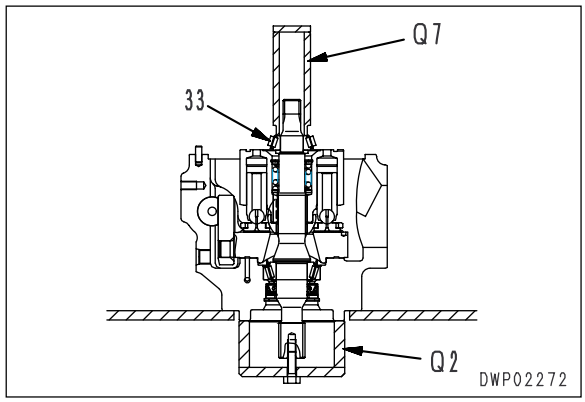
3) Install spacer (34).



4) Using tool **Q7**, press fit bearing inner race (33) to shaft.

Inside circumference of bearing:
Grease (G2-LI)

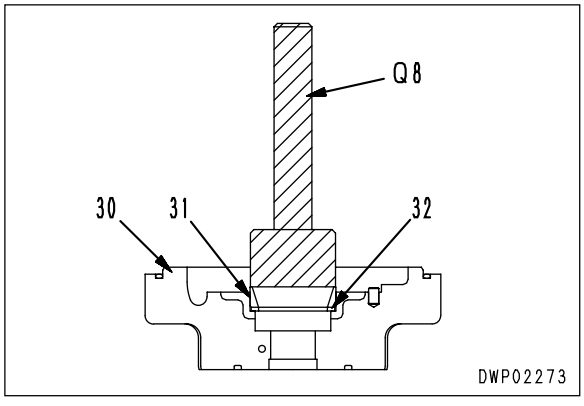
5) Remove tool **Q2**.



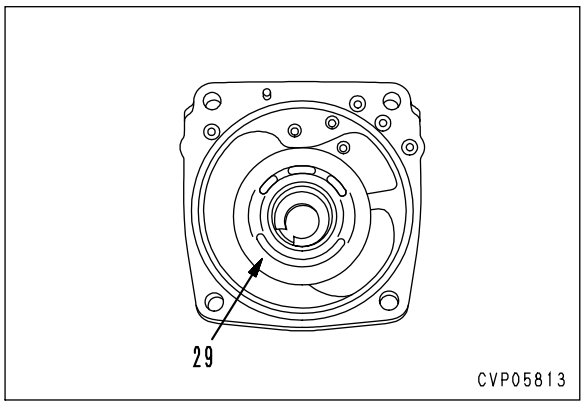
6. End cap assembly

1) Assemble end cap assembly as follows.
i) Assemble spacer (32) to end cap (30).
★ The spacer is a selected part, so temporarily assemble a spacer of standard thickness (1.6 mm). Carry out adjustment of the thickness when measuring the end play.
• Shim thickness:
1.6 – 2.2 mm (units of 0.1 mm)
ii) Using tool **Q8**, install bearing outer race (31).

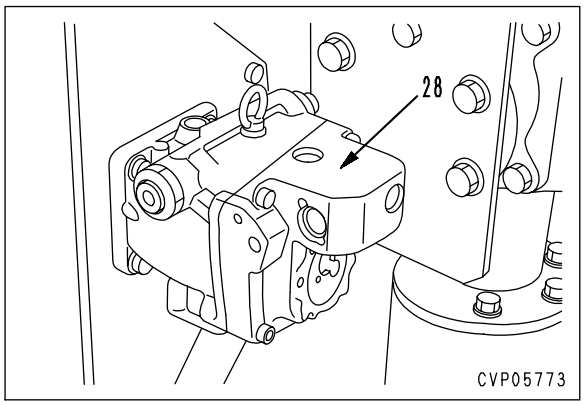
Outside circumference of bearing:
Grease (G2-LI)



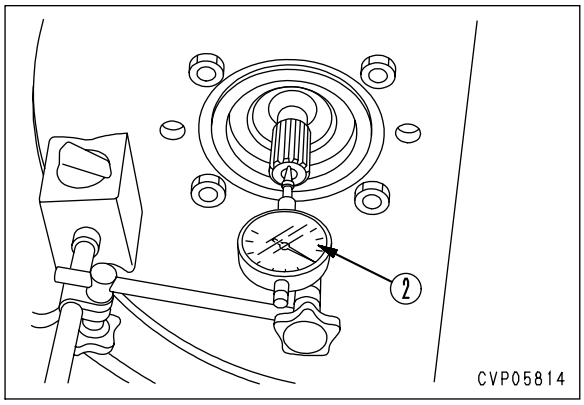
iii) Install valve plate (29).
★ Align the pin groove at the valve plate end and the pin at the end cap end, and check that the valve plate and end cap are in tight contact.



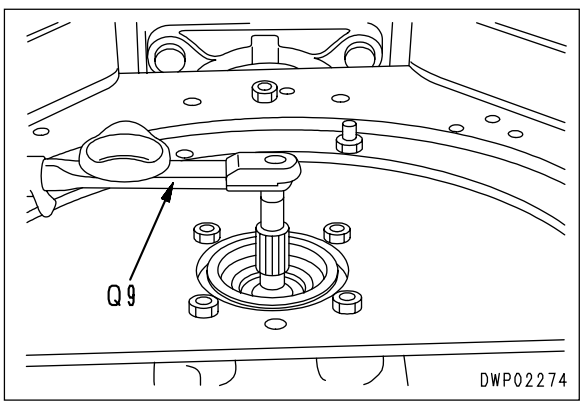
2) Fit O-ring and install end cap assembly (28).
Mating surface of pump case:
Gasket sealant (LG-5 or LG-7)
kgm Mounting bolt:
98 – 123 Nm {10 – 12.5 kgm}



3) Measure end play of shaft as follows.
i) Set dial gauge ② to tip of shaft.
ii) Apply a force of 980 – 1078 N {100 – 110 kg} to shaft and measure end play.
• Permissible range for end play:
0.05 – 0.25 mm
★ If the end play is more than the permissible range, change the thickness of the spacer inside the end cap to adjust the end play.



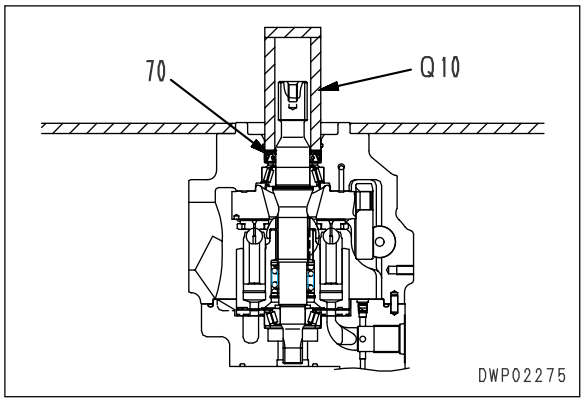
4) Using tool **Q9**, measure rotating torque of shaft.
★ Rotate the shaft at a constant speed (3 – 5 sec/1 turn) and measure the rotating torque.
• Rotating torque:
6.86 – 20.6 Nm {0.7 – 2.1 kgm}
(Torque variation range:
Max. 2.94 Nm {0.3 kgm})
★ If the rotating torque is not normal, disassemble again and look for the cause.



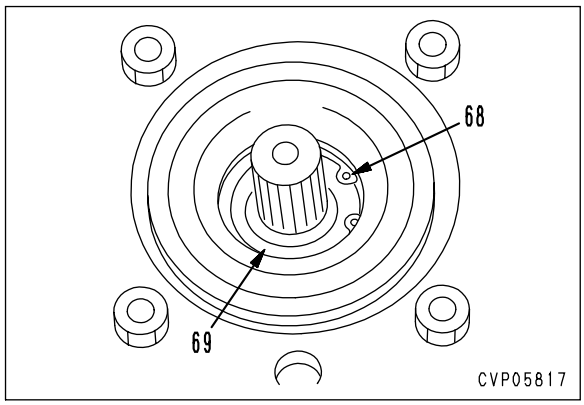
7. Oil seal

1) Using tool **Q10**, press fit oil seal (70).

Lip of oil seal: **Grease (G2-LI)**



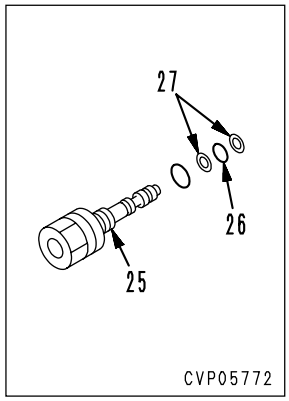
2) Fit washer (69) and install snap ring (68).

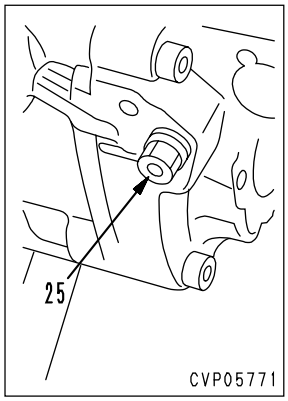


8. Orifice plug

1) Install 2 backup rings (27) and O-ring (26) to orifice plug (25).
2) Fit O-ring and install orifice plug (25).

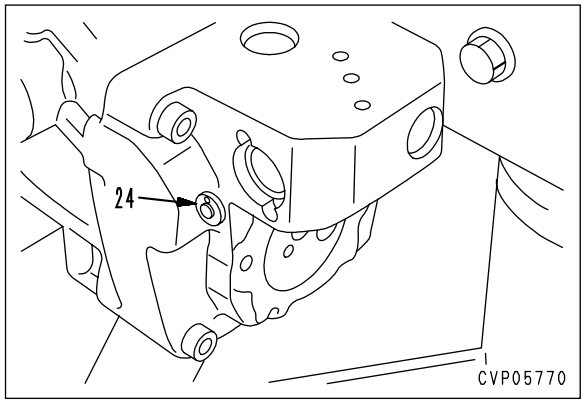
kgm Orifice plug:
19.6 – 27.5 Nm {2.0 – 2.8 kgm}



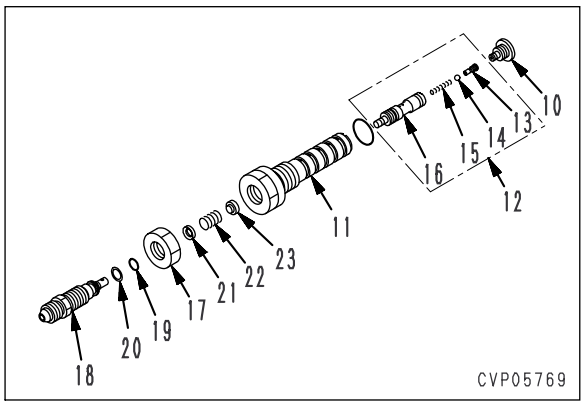


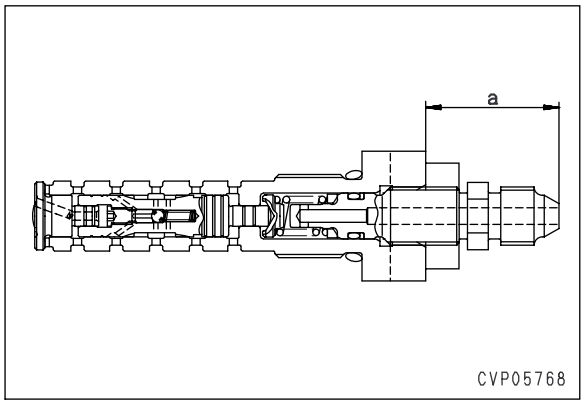
9. LS valve assembly

1) Assemble seat (24).

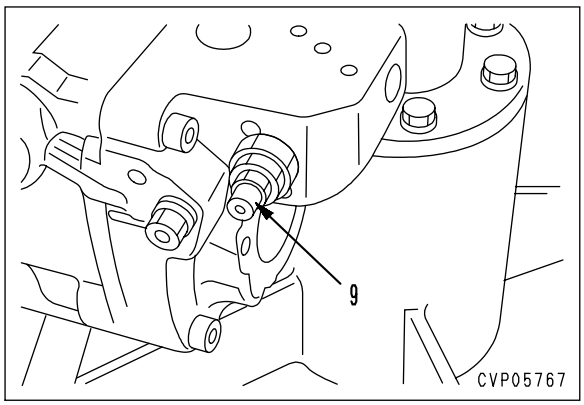


2) Assemble LS valve assembly as follows.
   i) Assemble seat (23), spring (22), and seat (21) to sleeve (11).
   ii) Assemble O-ring (19) and backup ring (20) to plug (18).
      ★ Install the O-ring and backup ring in the position shown in the diagram on the right.
   iii) Install plug (18) to sleeve (11), then secure with nut (17).
      ★ Set to screwed-in dimension **a** for the plug measured during disassembly.
      • Standard screwed-in dimension **a**: 32 mm
      kgm Nut: **49 – 69 Nm {5 – 7 kgm}**
   iv) Assemble spring (15), ball (14), and plug (13) to spool (16).
      Threaded portion: **Thread tightener (Loctite #638 or equivalent)**
      kgm Plug: **2.94 – 5.88 Nm {0.3 – 0.6 kgm}**
   v) Assemble spool assembly (12) to sleeve (11).
   vi) Assemble piston (10).

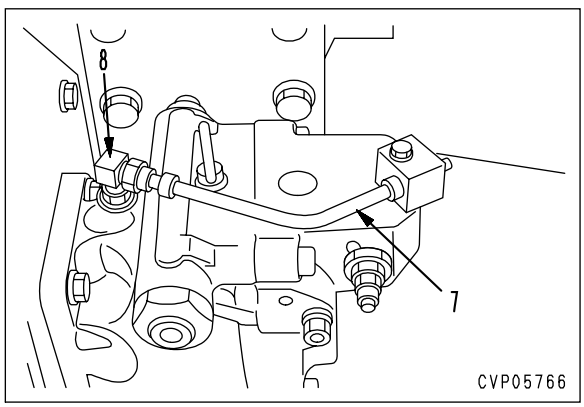




3) Fit O-ring and install LS valve assembly (9).
   kgm LS valve assembly: **49 – 59 Nm {5 – 6 kgm}**



10. Air bleed tube
Fit elbow (8) and install tube (7).
kgm Elbow nut : **29.4 – 39.2 Nm {3.0 – 4.0 kgm}**
kgm Mounting bolt: **27.5 – 34.3 Nm {2.8 – 3.5 kgm}**



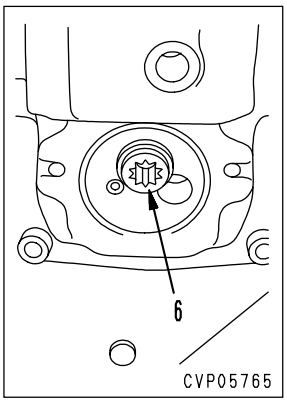
11. Gear pump assembly

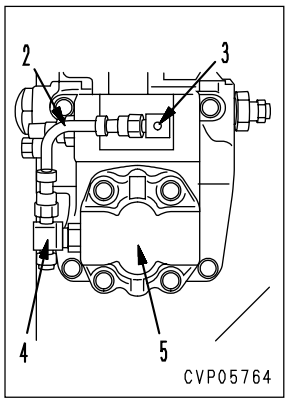
1) Install coupling (6).
2) Install gear pump assembly (5).

   kgm Mounting bolt :
   27 – 34Nm {2.8 – 2.5kgm}

3) Fit elbows (4) and (3), then install tube (2).

   kgm Elbow (4): **58.8 – 78.4Nm {6.0 – 8.0kgm}**
   Elbow (3): **29.4 – 39.2Nm {3.0 – 4.0kgm}**
   Tube: **19.6 – 29.4Nm {2.0 – 3.0kgm}**



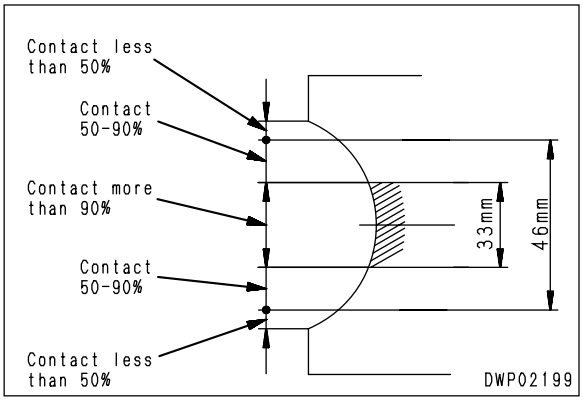


CHECKING CONTACT BETWEEN PARTS

★ 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) Pump case and rocker cam
2) Cylinder block and valve plate
3) Valve plate and end cap

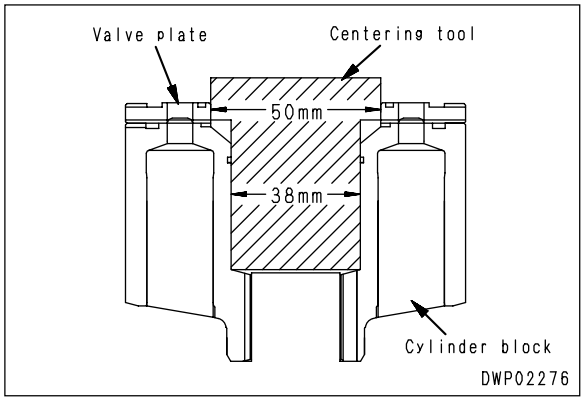
1. Pump case and rocker cam

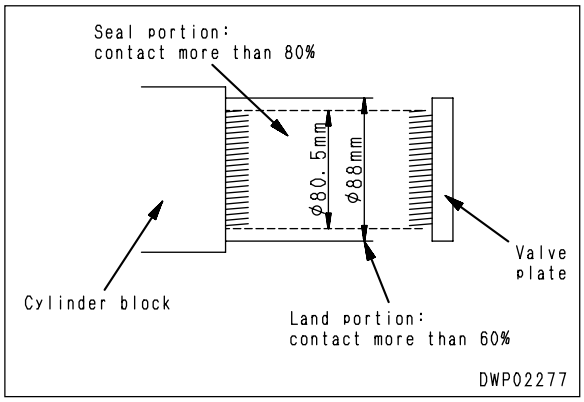
1) Remove all oil and grease from parts to be checked.
   ★ Do not wipe with a cloth.
2) Paint pump case with inspection paint, then put rocker cam on top.
   ★ Coat thinly with paint.
3) Push rocker cam with a force of 39.2 – 49.0 N {4 – 5 kg} against pump case, and move it between maximum swash plate angle on one side and maximum swash plate angle on other side. Repeat this process 2 or 3 times.
4) Remove rocker cam, transfer contact surface to a tape, and check contact surface.
   ★ The standard for the contact is as given below.
      (1) Within 33 mm of center (center portion): Contact of more than 90%
      (2) Range from center portion 33 – 46 mm: Contact of 50% – 90%
      (3) Not within width of 46 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

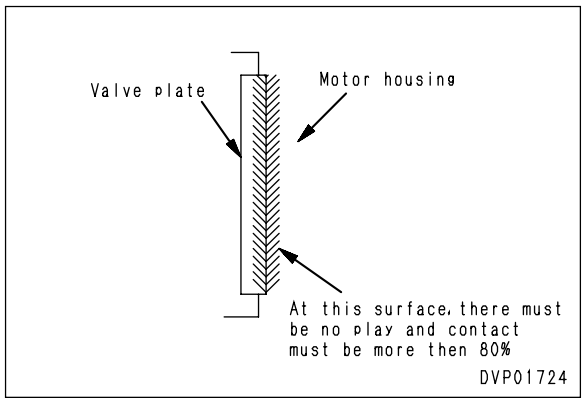
1) Make centering tool for cylinder block and valve plate.
   ★ The tool can be made from plastic, bakelite or any other soft material.
2) Remove all oil and grease from parts to be checked.
   ★ Do not wipe with a cloth.
3) Paint cylinder block with inspection paint, then put tool and valve plate on top.
   ★ Coat thinly with paint.
4) Push valve plate with a force of 39.2 – 49.0 N {4 – 5 kg} against cylinder block, turn valve plate 90°, then turn it back to original position. Repeat this process 2 or 3 times.
5) Remove valve plate, transfer contact surface to a tape, and check contact surface.
   ★ The standard for the contact is as given below.
   (1) Seal portion (range within ϕ80.5 mm): Contact of more than 80% and no break around whole circumference
   (2) Land portion (range more than ϕ88 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 parts to be checked.
   ★ Do not wipe with a cloth.
2) Paint end cap with inspection paint, then put valve plate on top.
   ★ Coat thinly with paint.
3) Push valve plate with a force of 39.2 – 49.0 N {4 – 5 kg} against end cap, turn valve plate 90°, then turn it back to original position. Repeat this process 2 or 3 times.
4) Remove valve plate, transfer contact surface to a tape, and check 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.

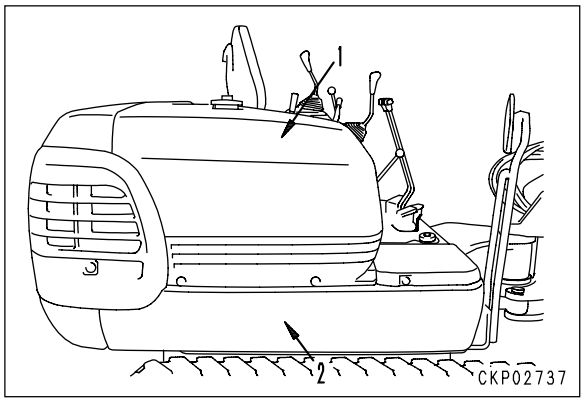


REMOVAL OF CONTROL VALVE ASSEMBLY

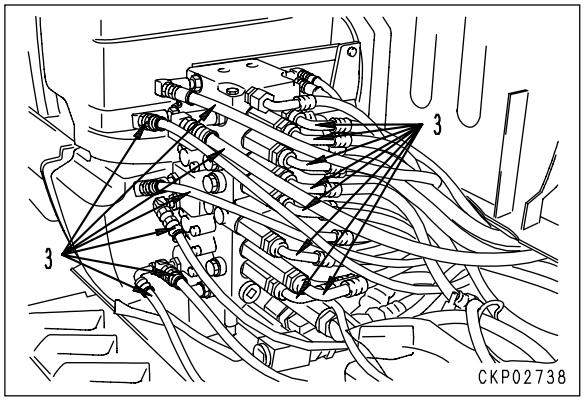
⚠ Release the remaining pressure in the hydraulic circuit and hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit and Releasing remaining pressure in hydraulic tank.

1. Remove right cover (1).
   ★ Remove the inspection cover of the top of the radiator also.

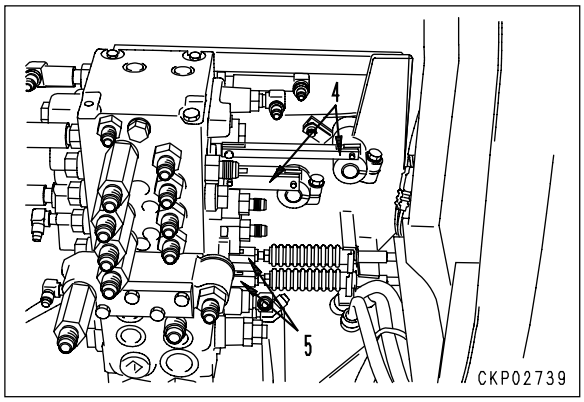
2. Remove right side cover (2).



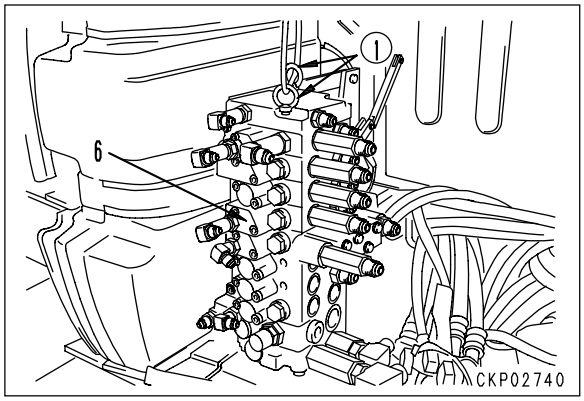
3. Disconnect left and right pilot hoses and main hoses (3). ※1
   ★ It may be necessary to remove some of the nipples in order to remove all the main hoses at the front of the control valve.
   ★ After disconnecting the hoses and removing the nipples, fit tags to distinguish them.



4. Disconnect control linkage yokes (4) at 2 places and control cable yokes (5) at 2 places. ※2



5. Using 2 eyebolts ①, lift off control valve assembly (6).
   kg Control valve assembly : **40 kg**



INSTALLATION OF CONTROL VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

kgm O-ring boss type nipple:

Nm {kgm}

Thread size	Tightening torque
14 × 1.5	34.3 ± 4.9 {3.5 ± 0.5}
18 × 1.5	$93.1^{+9.8}_{-14.7}$ { $9.5^{+1}_{-1.5}$}
20 × 1.5	$93.1^{+9.8}_{-14.7}$ { $9.5^{+1}_{-1.5}$}
24 × 1.5	$142.1^{+9.8}_{-14.7}$ {$14.5^{+2}_{-2.5}$}

※ 2

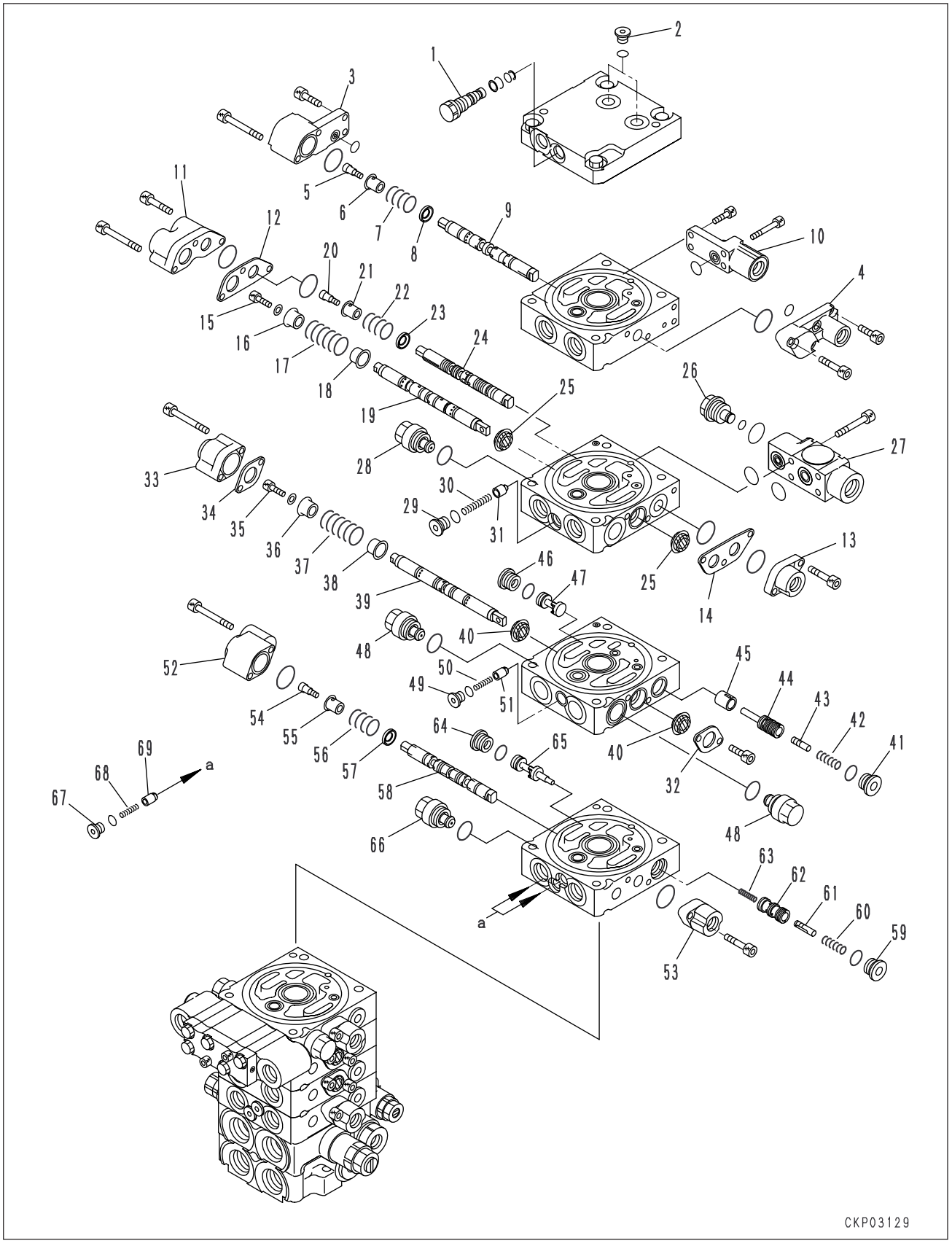
★ Adjust the blade control lever, travel control lever, and swing control pedal. For details, see TESTING AND ADJUSTING, Adjusting control lever and pedal.

- **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 hydraulic circuit. For details, see TESTING AND ADJUSTING, Bleeding air.

DISASSEMBLY OF CONTROL VALVE ASSEMBLY

CONTROL VALVE TOP (1/2)



★ Do not remove the long connecting bolt at the bottom of the control valve.
Remove the short connecting bolt at the top of the control valve when adding a service valve.
★ The spools and pressure compensation valves (both the flow control valves and reducing valves) are not interchangeable between blocks, so be sure to mark them when disassembling.
★ Do not remove the plug at the end of the spool.
★ The pressure of the central safety valve cannot be set when it is mounted on the machine, so do not disassemble it.

1. Top cover
1) Remove plug (1).
★ In some cases there is pressure remaining in the central safety valve circuit, so loosen the plug slowly.
★ Remove the O-ring and backup ring.

2) Remove 2 plugs (2).

2. Swing control valve
1) Remove cases (3) and (4).

2) Remove bolt (5).
★ Loosen the bolt with the spool still assembled inside the valve.

3) Remove retainer (6), spring (7), and retainer (8).

4) Remove spool (9).

5) Remove block (10).

3. Blade & breaker control valve
1) Remove case (11) and plate (12).

2) Remove case (13) and plate (14).

3) Remove bolt (15).
★ Loosen the bolt with the spool still assembled inside the valve.

4) Remove retainer (16), spring (17), and retainer (18).

5) Remove spool (19).

6) Remove bolt (20).
★ Loosen the bolt with the spool still assembled inside the valve.

7) Remove retainer (21), spring (22), and retainer (23).

8) Remove spool (24).

9) Remove 2 seals (25).

10) Remove plug (26).

11) Remove block (27).

12) Remove suction valve assembly (28).

13) Remove plug (29), then remove spring (30) and plug (31).

4. Boom swing control valve
1) Remove plate (32).

2) Remove case (33) and plate (34).

3) Remove bolt (35).
★ Loosen the bolt with the spool still assembled inside the valve.

4) Remove retainer (36), spring (37), and retainer (38).

5) Remove spool (39).

6) Remove 2 seals (40).

7) Remove plug (41), then remove spring (42), piston (43), valve (44), and spacer (45).

8) Remove plug (46), then remove valve (47).

9) Remove 2 suction valve assemblies (48).

10) Remove plug (49), then remove spring (50) and valve (51).

5. Bucket control valve
1) Remove cases (52) and (53).

2) Remove bolt (54).
★ Loosen the bolt with the spool still assembled inside the valve.

3) Remove retainer (55), spring (56), and retainer (57).

4) Remove spool (58).

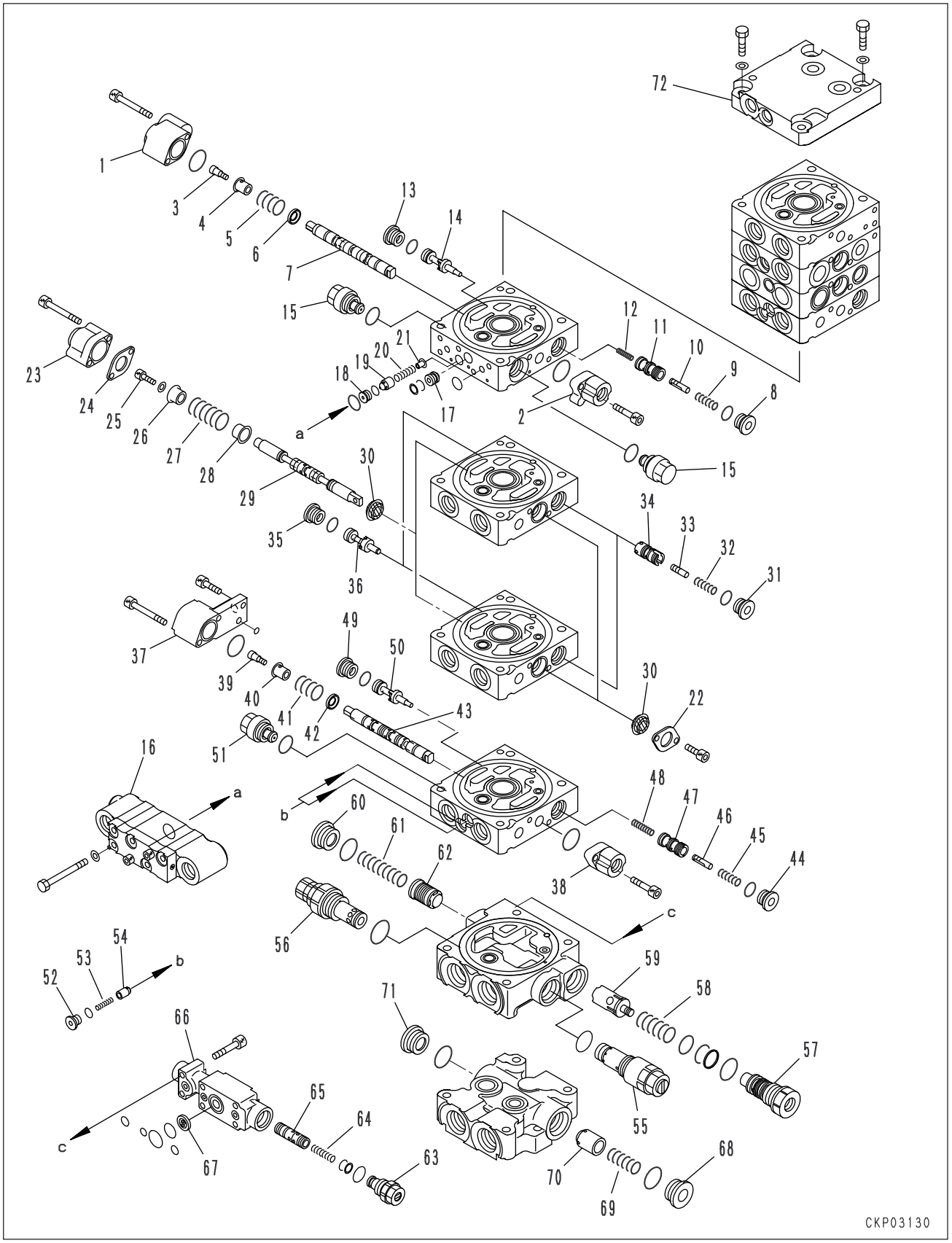
5) Remove plug (59), then remove spring (60), piston (61), valve (62), and spring (63).

6) Remove plug (64), then remove valve (65).

7) Remove suction valve assembly (66).

8) Remove plug (67), then remove spring (68) and valve (69).
   ★ Remove 2 sets.

(2/2)



6. Boom control valve

1) Remove cases (1) and (2).

2) Remove bolt (3).
   ★ Loosen the bolt with the spool still assembled inside the valve.

3) Remove retainer (4), spring (5), and retainer (6).

4) Remove spool (7).

5) Remove plug (8), then remove spring (9), piston (10), valve (11), and spring (12).

6) Remove plug (13), then remove valve (14).

7) Remove 2 suction valve assemblies (15).

8) Remove boom lock valve assembly (16).

9) Remove plug (17).
   ★ Remove the O-ring and backup ring.

10) Remove seat (18), valve (19), spring (20), and retainer (21).

7. R.H. travel control valve & L.H. travel control valve

★ Disassemble the L.H. and R.H. travel control valves in the same way.

1) Remove plate (22).

2) Remove case (23) and plate (24).

3) Remove bolt (25).
   ★ Loosen the bolt with the spool still assembled inside the valve.

4) Remove retainer (26), spring (27), and retainer (28).

5) Remove spool (29).

6) Remove 2 seals (30).

7) Remove plug (31), then remove spring (32), piston (33), and valve (34).

8) Remove plug (35), then remove valve (36).

8. Arm control valve

1) Remove cases (37) and (38).

2) Remove bolt (39).
   ★ Loosen the bolt with the spool still assembled inside the valve.

3) Remove retainer (40), spring (41), and retainer (42).

4) Remove spool (43).

5) Remove plug (44), then remove spring (45), piston (46), valve (47), and spring (48).

6) Remove plug (49), then remove valve (50).

7) Remove suction valve assembly (51).

8) Remove plug (52), then remove spring (53) and valve (54).
   ★ Remove 2 sets.

9. Main relief valve

Remove main relief valve assembly (55).
★ For details of further disassembly, see Disassembly of main relief valve assembly.

10. Central safety valve

Remove central safety valve assembly (56).
★ Remove the O-ring and backup ring.

11. Unload valve

Remove plug (57), then remove spring (58) and spool (59).
★ Remove O-ring and backup ring.

12. Self pressure reducing valve

1) Remove plug (60), then remove spring (61) and valve (62).

2) Remove pilot relief valve assembly (63).
   ★ For details of further disassembly, see Disassembly of pilot relief valve assembly.

3) Remove spring (64) and spool (65).

4) Remove block (66), then remove filter (67).

13. Cooler check valve

1) Remove plug (68), then remove spring (69) and valve (70).

2) Remove plug (71).

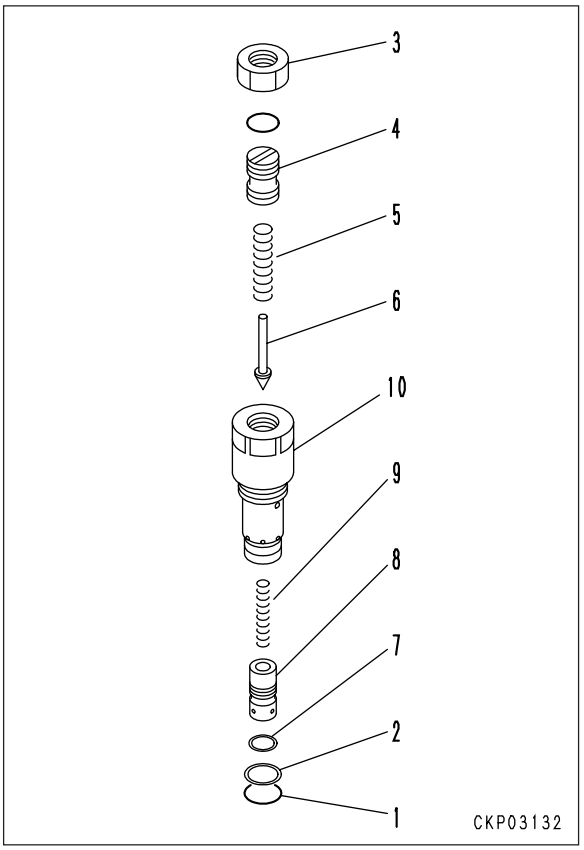
14. Top cover

★ When adding a service valve, remove cover (72).

DISASSEMBLY OF MAIN RELIEF VALVE ASSEMBLY

★ When the adjustment screw is loosened, the set pressure will change, so before disassembling, measure the protrusion from the nut of the adjustment screw.

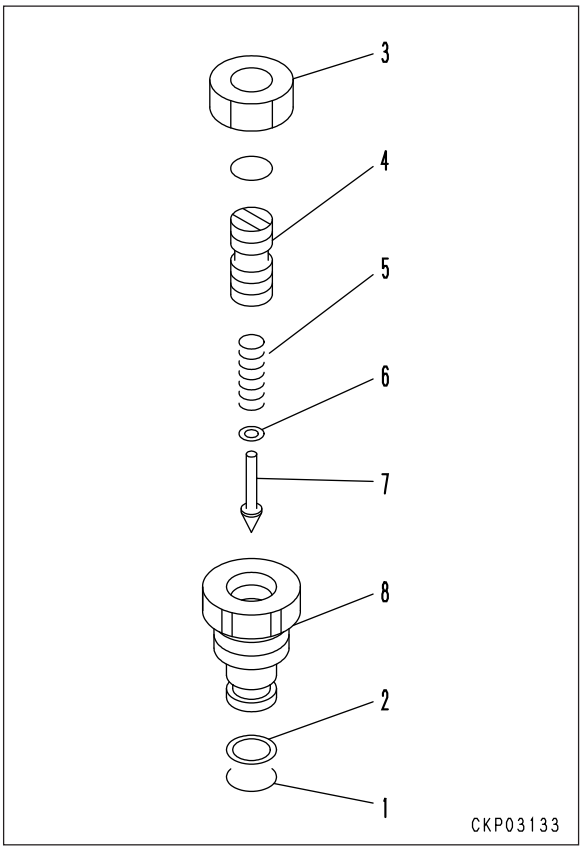
1. Remove O-ring (1) and backup ring (2).
2. Remove nut (3).
3. Remove screw (4), then remove spring (5) and poppet (6).
4. Remove ring (7), then remove valve (8) and spring (9).



DISASSEMBLY OF PILOT RELIEF VALVE ASSEMBLY

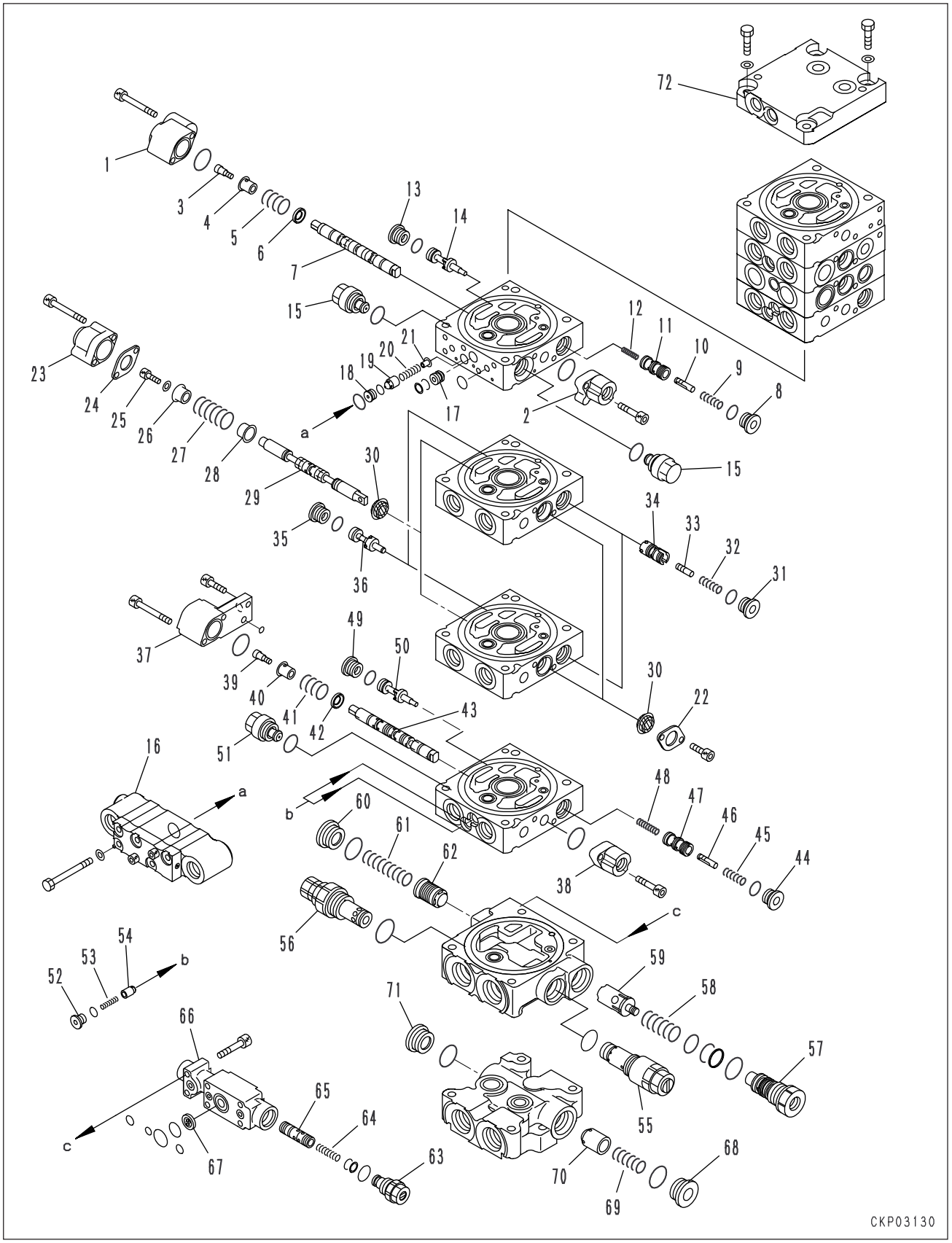
★ When the adjustment screw is loosened, the set pressure will change, so before disassembling, measure the depth from the nut of the adjustment screw.

1. Remove O-ring (1) and backup ring (2).
2. Remove nut (3).
3. Remove screw (4), then remove spring (5), washer (6), and poppet (7).



ASSEMBLY OF CONTROL VALVE ASSEMBLY

CONTROL VALVE BOTTOM (1/2)



★ The spools and pressure compensation valves (both the flow control valves and reducing valves) are not interchangeable between blocks, so align the marks made during disassembly when assembling.

1. Top cover

★ If the top cover was removed during disassembly, install it as follows.

Fit O-ring to block end and install cover (72).

kgm Mounting bolt :
31.85 ± 2.45 Nm {3.25 ± 0.25 kgm}

2. Cooler check valve

1) Fit O-ring and install plug (71).

kgm Plug : **68.6 ± 9.8 Nm {7 ± 1 kgm}**

2) Assemble valve (70) and spring (69), then fit O-ring and install plug (68).

kgm Plug : **68.6 ± 9.8 Nm {7 ± 1 kgm}**

3. Self pressure reducing valve

1) Assemble filter (67) to block, then fit O-ring and install block (66).

kgm Mounting bolt :
11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

2) Assemble spool (65) and spring (64).

3) Fit O-ring and install pilot relief valve assembly (63).

kgm Pilot relief valve assembly :
66.15 ± 7.35 Nm {6.75 ±0.75 kgm}

★ For details of assembly, see Assembly of pilot relief valve assembly.

4) Assemble valve (62) and spring (61), then fit O-ring and install plug (60).

kgm Plug : **127.4 ± 9.8 Nm {13 ± 1 kgm}**

4. Unload valve

Assemble spool (59) and spring (59), then fit O-ring and backup ring, and install plug (57).

kgm Plug : **127.4 ± 9.8 Nm {13 ± 1 kgm}**

5. Central safety valve

Fit O-ring and backup ring, then install central safety valve assembly (56).

kgm Central safety valve assembly :
147 ± 10 Nm {15 ± 1 kgm}

6. Main relief valve

Fit O-ring and install main relief valve assembly (55).

kgm Main relief valve assembly :
53.9 ± 4.9 Nm {5.5 ± 0.5 kgm}

★ For details of assembly, see Assembly of main relief valve assembly.

7. Arm control valve

1) Assemble valve (54) and spring (53), then fit O-ring and install plug (52).

kgm Plug :
11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

★ Install 2 sets.

2) Install suction valve assembly (51).

kgm Suction valve assembly :
53.9 ± 4.9 Nm {5.5 ± 0.5 kgm}

3) Assemble valve (50), then fit O-ring and install plug (49).

kgm Plug :
56.35 ± 7.35 Nm {5.75 ± 0.75 kgm}

4) Assemble spring (48), valve (47), piston (46), and spring (45), then fit O-ring and install plug (44).

kgm Plug :
56.35 ± 7.35 Nm {5.75 ± 0.75 kgm}

5) Assemble spool (43).

★ Be careful to assemble in the correct direction.

6) Assemble retainer (42), spring (41), and retainer (40) to spool, then install bolt (39).

★ Tighten the bolt with the spool assembled inside the valve.

kgm Bolt :
8.35 ± 1.45 Nm {0.85 ± 0.15 kgm}

7) Fit O-rings and install cases (38) and (37).

kgm Mounting bolt :
11.25 ± 1.45 Nm {1.15 +± 0.15 kgm}

8. R.H. travel control valve & L.H. travel control valve

★ Assemble the L.H. and R.H. travel control valves in the same way.

1) Assemble valve (36), then fit O-ring and install plug (35).

kgm Plug :
56.35 ± 7.35 Nm {5.75 ± 0.75 kgm}

2) Assemble valve (34), piston (33), and spring (32), then fit O-ring and install plug (31).

kgm Plug :
56.35 ± 7.35 Nm {5.75 ± 0.75 kgm}

3) Press fit 2 seals (30).

4) Assemble spool (29).
★ Be careful to assemble in the correct direction.

5) Assemble retainer (28), spring (27), and retainer (26) to spool, then install bolt (25).
★ Tighten the bolt with the spool assembled inside the valve.

kgm Bolt :
8.35 ± 1.45 Nm {0.85 ± 0.15 kgm}

6) Install plate (24) and case (23).

kgm Mounting bolt :
11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

7) Install plate (22).

kgm Mounting bolt :
11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

9. Boom control valve

1) Assemble retainer (21), spring (20), and valve (19), then fit O-ring and install seat (18).

2) Fit O-ring and backup ring, then install plug (17).

3) Fit O-ring and install boom lock valve assembly (16).

kgm Mounting bolt :
11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

4) Fit O-ring and install 2 suction valve assemblies (15).

kgm Suction valve assembly :
53.9 ± 4.9 Nm {5.5 ± 0.5 kgm}

5) Assemble valve (14), then fit O-ring and install plug (13).

kgm Plug :
56.35 ± 7.35 Nm {5.75 ± 0.75 kgm}

6) Assemble spring (12), valve (11), piston (10), and spring (9), then install plug (8).

kgm Plug :
56.35 ± 7.35 Nm {5.75 ± 0.75 kgm}

7) Assemble spool (7).
★ Be careful to assemble in the correct direction.

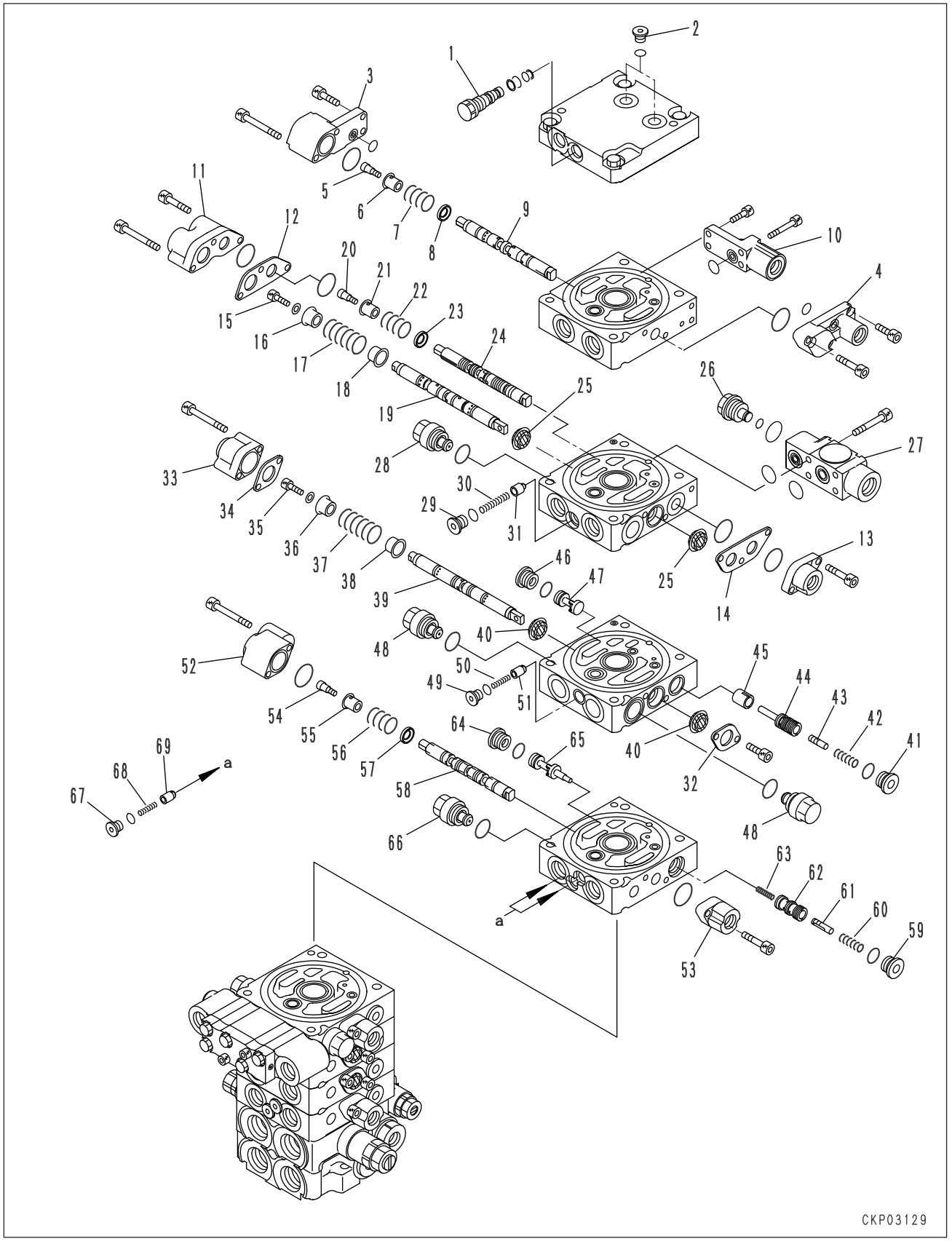
8) Assemble retainer (6), spring (5), and retainer (4) to spool, then install bolt (3).
★ Tighten the bolt with the spool assembled inside the valve.

kgm Bolt :
8.35 ± 1.45 Nm {0.85 ± 0.15 kgm}

9) Fit O-ring and install case (2) and plate (1).

kgm Mounting bolt :
11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

(2/2)


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
a
a
CKP03129

10. Bucket control valve

1) Assemble valve (69) and spring (68), then fit O-ring and install plug (67).

kgm Plug :
11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

★ Install 2 sets.

2) Fit O-ring and install suction valve assembly (66).

kgm Suction valve assembly :
53.9 ± 4.9 Nm {5.5 ± 0.5 kgm}

3) Assemble valve (65), then fit O-ring and install plug (64).

kgm Plug :
56.35 ± 7.35 Nm {5.75 ± 0.75 kgm}

4) Assemble spring (63), valve (62), piston (61), and spring (60), then install plug (59).

kgm Plug :
56.35 ± 7.35 Nm {5.75 ± 0.75 kgm}

5) Assemble spool (58).
★ Be careful to assemble in the correct direction.

6) Assemble retainer (57), spring (56), and retainer (55) to spool, then install bolt (54).
★ Tighten the bolt with the spool assembled inside the valve.

kgm Bolt :
8.35 ± 1.45 Nm {0.85 ± 0.15 kgm}

7) Fit O-rings and install cases (53) and (52).

kgm Mounting bolt :
11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

11. Boom swing control valve

1) Assemble valve (51) and spring (50), then fit O-ring and install plug (49).

kgm Plug :
11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

2) Fit O-rings and install 2 suction valve assemblies (48).

kgm Suction valve assembly :
53.9 ± 4.9 Nm {5.5 ± 0.5 kgm}

3) Assemble valve (47), then fit O-ring and install plug (46).

kgm Plug :
56.35 ± 7.35 Nm {5.75 ± 0.75 kgm}

4) Assemble spacer (45), valve (44), piston (43), and spring (42), then fit O-ring and install plug (41).

kgm Plug :
56.35 ± 7.35 Nm {5.75 ± 0.75 kgm}

5) Press fit 2 seals (40).

6) Assemble spool (39).
★ Be careful to assemble in the correct direction.

7) Assemble retainer (38), spring (37), and retainer (36) to spool, then install bolt (35).
★ Tighten the bolt with the spool assembled inside the valve.

kgm Bolt :
8.35 ± 1.45 Nm {0.85 ± 0.15 kgm}

8) Install plate (34) and case (33).

kgm Mounting bolt :
11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

9) Install plate (32).

12. Blade & breaker control valve

1) Assemble valve (31) and spring (30), then fit O-ring and install plug (29).

kgm Plug :
11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

2) Fit O-ring and install suction valve assembly (28).

kgm Suction valve assembly :
53.9 ± 4.9 Nm {5.5 ± 0.5 kgm}

3) Fit O-ring and install block (27).

kgm Mounting bolt :
11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

4) Fit O-ring and install plug (26).

kgm Plug : **53.9 ± 4.9 Nm {5.5 ± 0.5 kgm}**

5) Press fit 2 seals (25).

6) Assemble spool (24).
★ Be careful to assemble in the correct direction.

7) Assemble retainer (23), spring (22), and retainer (21) to spool, then install bolt (20).
   ★ Tighten the bolt with the spool assembled inside the valve.

   kgm Bolt :
   8.35 ± 1.45 Nm {0.85 ± 0.15 kgm}

8) Assemble spool (19).
   ★ Be careful to assemble in the correct direction.

9) Assemble retainer (18), spring (17), and retainer (16) to spool, then install bolt (15).
   ★ Tighten the bolt with the spool assembled inside the valve.

   kgm Bolt :
   8.35 ± 1.45 Nm {0.85 ± 0.15 kgm}

10) Fit O-rings and install plate (14) and case (13).

   kgm Mounting bolt :
   11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

11) Fit O-rings and install plate (12) and case (11).

   kgm Mounting bolt :
   11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

13. Swing control valve

1) Install block (10).

   kgm Mounting bolt :
   11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

2) Assemble spool (9).
   ★ Be careful to assemble in the correct direction.

3) Assemble retainer (8), spring (7), and retainer (6) to spool, then install bolt (5).
   ★ Tighten the bolt with the spool assembled inside the valve.

   kgm Bolt :
   8.35 ± 1.45 Nm {0.85 ± 0.15 kgm}

4) Fit O-rings and install cases (4) and (3).

   kgm Mounting bolt :
   11.25 ± 1.45 Nm {1.15 ± 0.15 kgm}

14. Top cover

1) Fit O-rings and install 2 plugs (2).

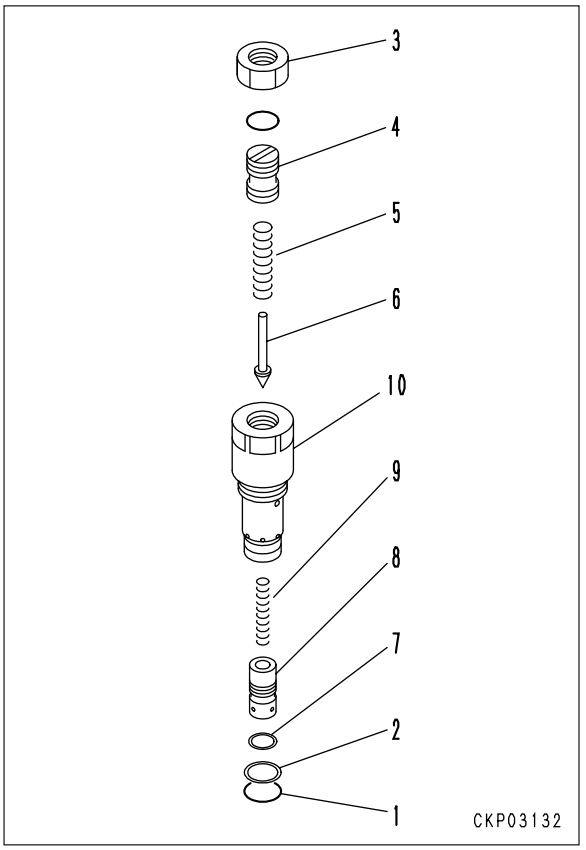
2) Fit O-ring and backup ring, then install plug (1).

   kgm Plug : **39.2 ± 4.9 Nm {4 ± 0.5 kgm}**

ASSEMBLY OF MAIN RELIEF VALVE

★ To make the set pressure the same as before disassembly, set the protrusion from the nut of the adjustment screw to the dimension measured before disassembly.
After installing the control valve assembly to the machine, check the set pressure again. For details, see TESTING AND ADJUSTING.

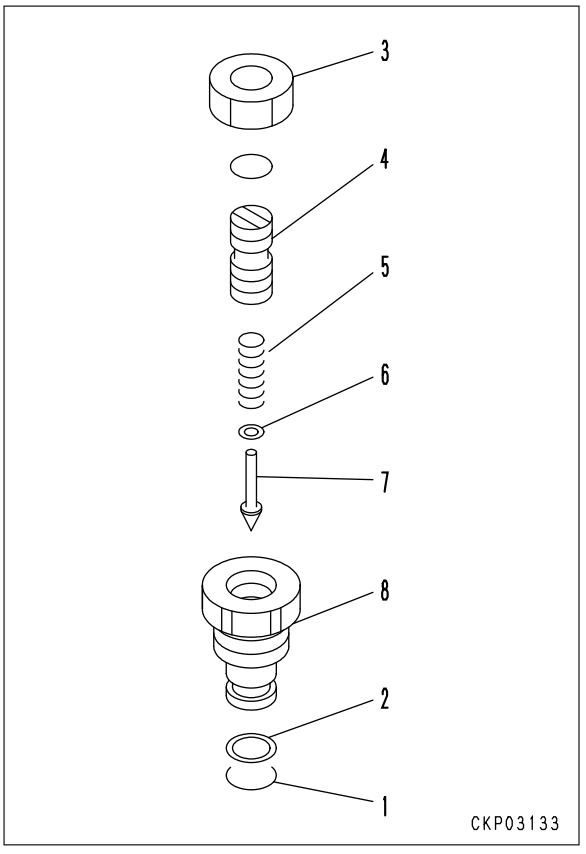
1. Assemble spring (9) and valve (8) to sleeve (10), then secure with ring (7).
2. Assemble poppet (6) and spring (5), then fit O-ring and install screw (4).
3. Install nut (3).
   kgm Nut : **68.7 ± 9.8 Nm {7 ± 1 kgm}**
4. Install O-ring (1) and backup ring (2).



ASSEMBLY OF PILOT RELIEF VALVE

★ To make the set pressure the same as before disassembly, set the depth from the nut of the adjustment screw to the dimension measured before disassembly.
After installing the control valve assembly to the machine, check the set pressure again. For details, see TESTING AND ADJUSTING.

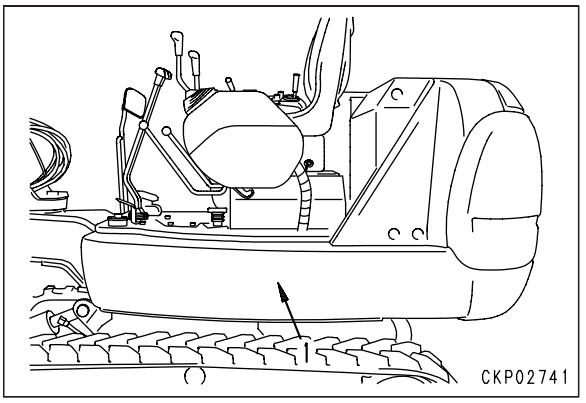
1. Assemble poppet (7), washer (6), and spring (5) to sleeve (8), then fit O-ring and install screw (4).
2. Install nut (3).
3. Install O-ring (1) and backup ring (2).

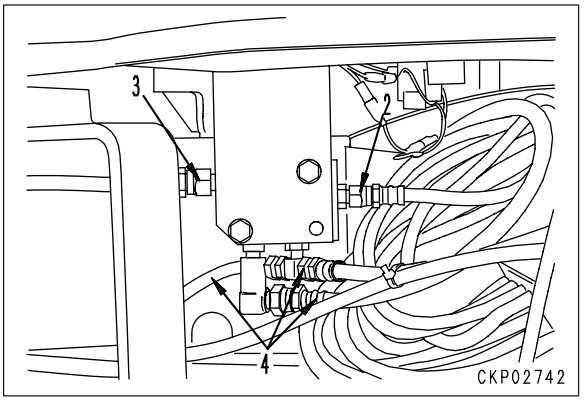


REMOVAL OF 2-SPOOL SOLENOID VALVE ASSEMBLY

⚠ Release the remaining pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic tank.

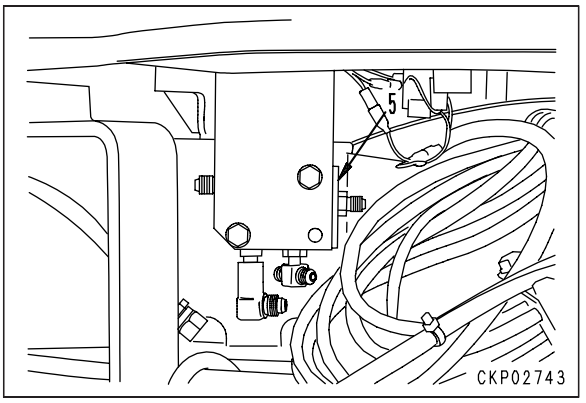
1. Remove left side cover (1).
2. Disconnect inlet hose (2) and drain hose (3).
   ★ Fit blind plugs in the hoses.
3. Disconnect 3 outlet hoses (4).
4. Remove 2-spool solenoid valve assembly (5).





INSTALLATION OF 2-SPOOL SOLENOID 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.

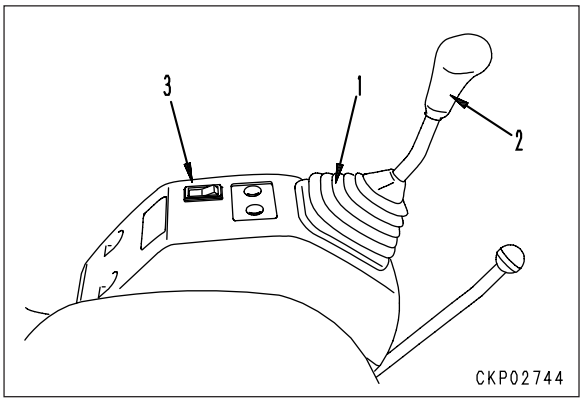


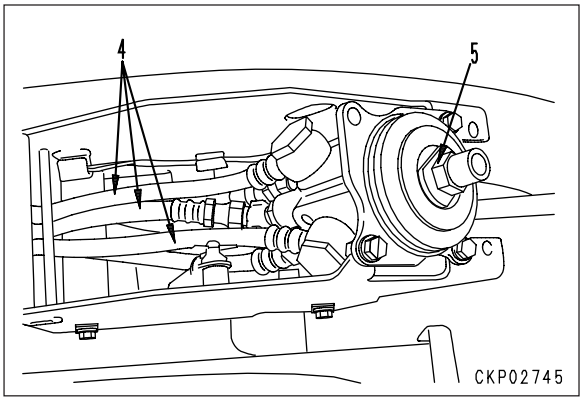
REMOVAL OF LEFT PPC VALVE ASSEMBLY

⚠ Release the remaining pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic tank.

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

1. Disconnect boot (1) from cover, and remove lever (2). ※ 1
2. Remove cover (3).
   ★ On the operator's cab specification machine, the connector of the wiper switch is connected under the cover, so disconnect it.
3. Disconnect 6 hoses (4). ※ 2
4. Remove left PPC valve assembly (5).





INSTALLATION OF LEFT PPC VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

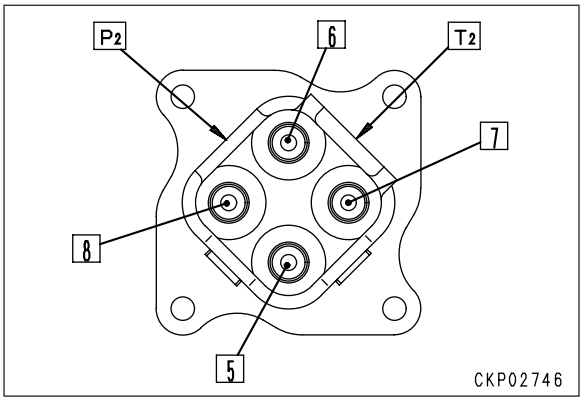
kgm Lever mounting bolt :
66.15 ± 7.35 Nm {6.75 ± 0.75 kgm}

※ 2

★ The hoses are marked with number tapes, so align as shown in the diagram on the right, then connect.

kgm Port P eye joint :
39.2 ± 4.9 Nm {4 ± 0.5 kgm}

- **Refilling with oil (hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.



REMOVAL OF RIGHT PPC VALVE ASSEMBLY

⚠ Release the remaining pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic tank.

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

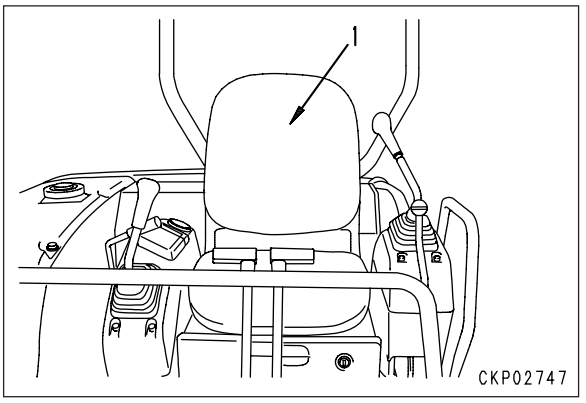
1. Disconnect operator's seat (1).

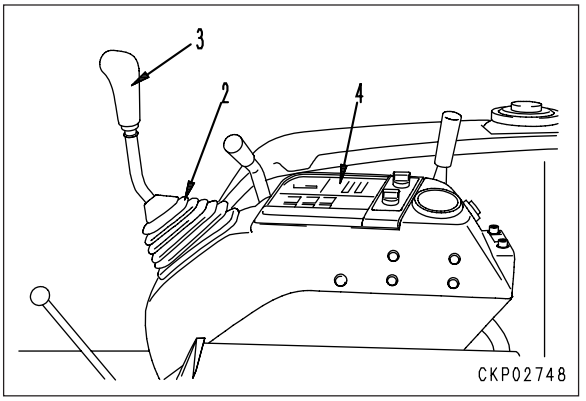
2. Disconnect boot (2) from cover, and remove lever (3). ※ 1
   ★ Disconnect the 2 horn switch connectors.

3. Remove cover (4).
   ★ Disconnect the two PPC lock switch connectors under the cover, and move towards the engine hood.

4. Disconnect 6 hoses (5). ※ 2

5. Remove right PPC valve assembly (6).





INSTALLATION OF RIGHT PPC VALVE ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

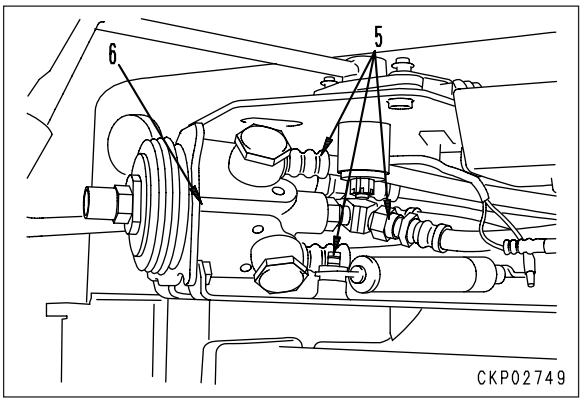
kgm Lever mounting bolt :
66.15 ± 7.35 Nm {6.75 ± 0.75 kgm}

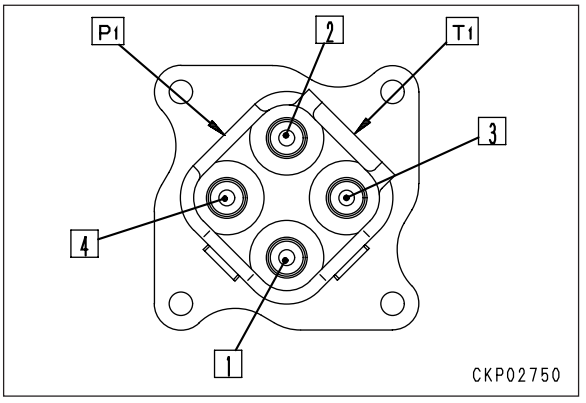
※ 2

★ The hoses are marked with number tapes, so align as shown in the diagram on the right, then connect.

kgm Port P eye joint :
39.2 ± 4.9 Nm {4 ± 0.5 kgm}

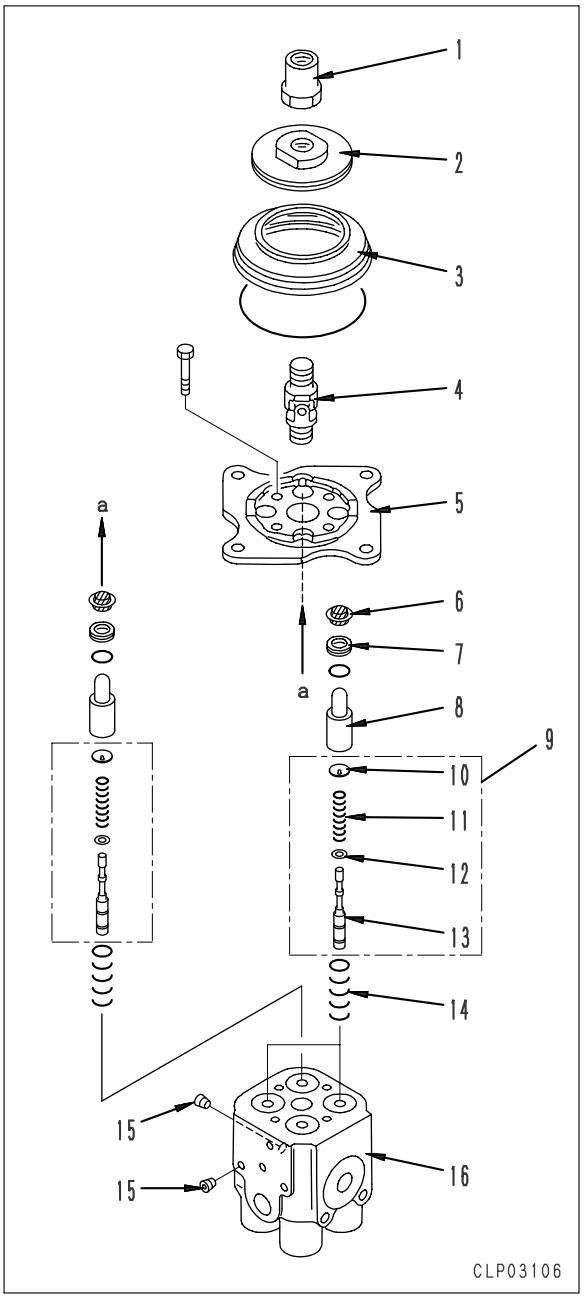
- **Refilling with oil (hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.



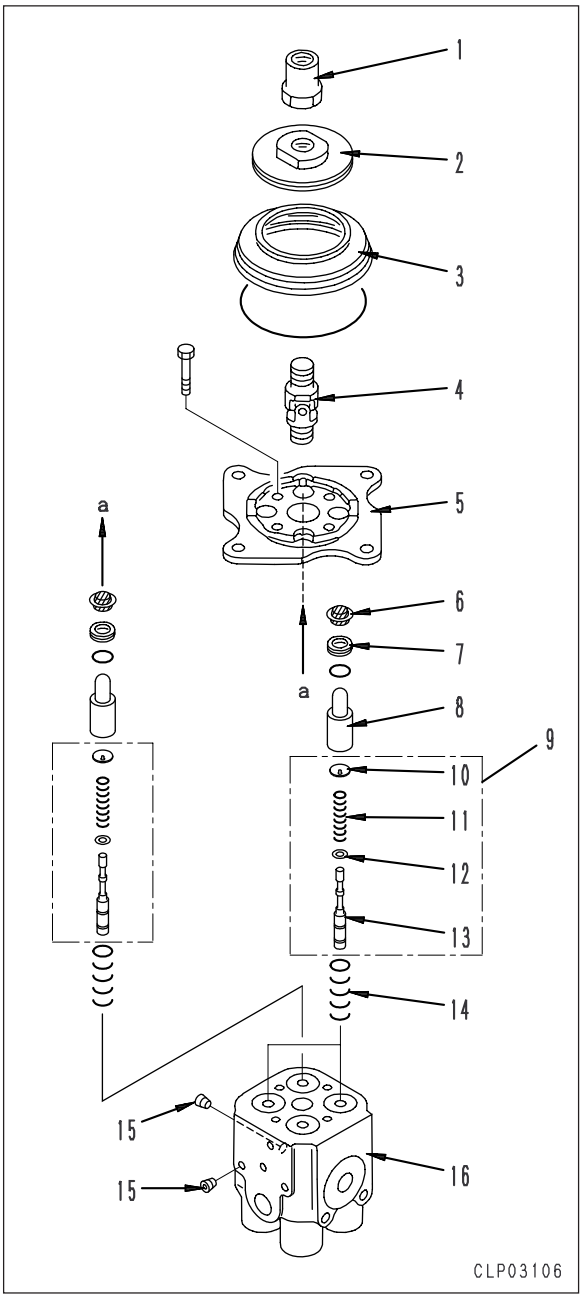


DISASSEMBLY OF PPC VALVE ASSEMBLY

1. Remove nut (1), then remove disc (2) and boot (3).
2. Remove joint (4).
3. Remove plate (5).
4. Remove seal (6) and collar (7).
5. Remove piston (8).
6. Remove valve assembly (9).
7. Remove retainer (10), then disassemble spring (11), shim (12), and valve (13).
   ★ Check the number and thickness of the shims, and keep in a safe place.
8. Remove spring (14).
   ★ There are 2 types of spring, so check the mounting position.
9. Remove 2 plugs (15) from body (16).



ASSEMBLY OF PPC VALVE ASSEMBLY



1. Install 2 plugs (15) to body (16).

   kgm Plug : **17.64 ± 3.92 Nm {1.8 ± 0.4 kgm}**

2. Assemble spring (14).
   ★ There are 2 types of spring, so check the number of coils when assembling.

Port position	No. of coils
P1 • P2	11
P3 • P4	9

3. Assemble shim (12) and spring (11) to valve (13), then secure with retainer (10).
   ★ Assemble the spring with the small inside diameter facing the shim.
   - Inside diameter of small diameter end : ø 4.9 mm
   - Inside diameter of large diameter end : ø 5.5 mm

4. Assemble valve assembly (9) to body (16).

5. Assemble piston (8).

   Outside diameter of piston and inside diameter of body : **Grease (G2-LI)**

6. Fit O-ring and install collar (7).

7. Install seal (6).

8. Install plate (5).

   kgm Mounting bolt : **13.25 ± 1.45 Nm {1.35 ± 0.15 kgm}**

9. Install joint (4).
   ★ Remove all grease and oil from the male thread of the joint and female thread of the body, and dry the parts. Then coat the female thread of the body at 2 places with 1 drop each of thread tightener (Loctite 262 or equivalent).

   kgm Joint : **44.1 ± 4.9 Nm {4.5 ± 0.5 kgm}**

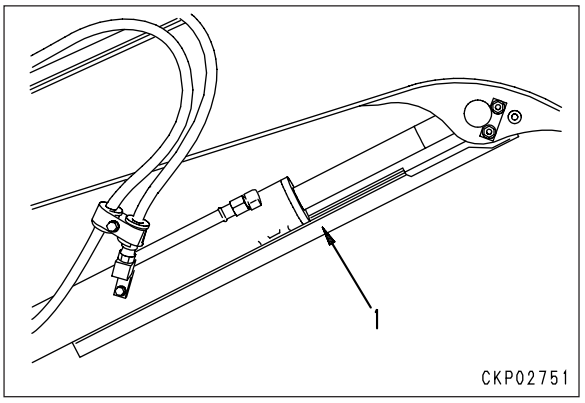
10. Fit boot (3) and disc (2), and install nut (1).
    ★ Tighten until the disc contacts the 4 pistons, then hold the disc in position and tighten the nut.
    (Be careful not to move the piston.)

    kgm Nut : **112.7 ± 14.7 Nm {11.5 ± 1.5 kgm}**

REMOVAL OF BOOM CYLINDER ASSEMBLY

⚠ Start the engine, extend the arm cylinder and bucket cylinder fully, then lower the work equipment completely to the ground.

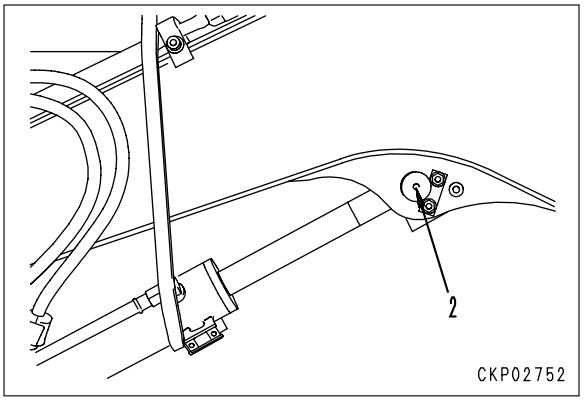
1. Remove cover (1).



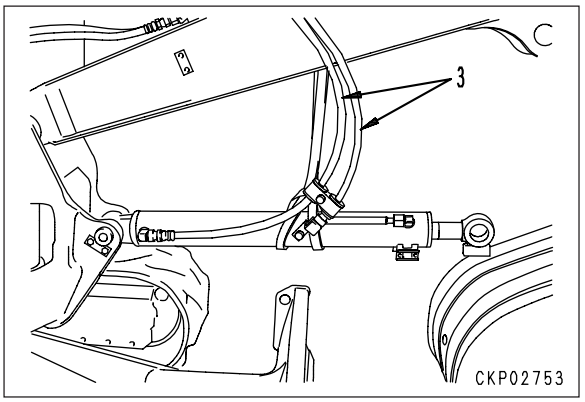
2. Sling boom cylinder assembly and remove head pin (2). ※ 1
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.

   ⚠ Start the engine, and retract the piston rod, then tie the 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.

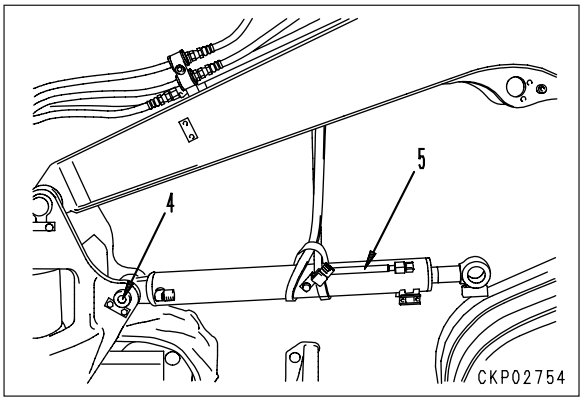


3. Disconnect 2 hoses (3).



4. Remove bottom pin (4), then lift off boom cylinder assembly (5). ※ 2
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.

   kg Boom cylinder assembly :
   35 kg (PC30R, 35R)
   45 kg (PC40R, 45R)



INSTALLATION OF BOOM CYLINDER ASSEMBLY

- Carry out installation in the reverse order to removal.

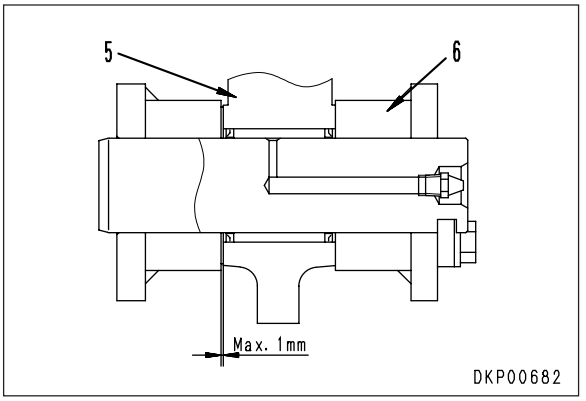
※ 1

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)

Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the head of boom cylinder (5) and boom (6) is less than 1 mm.
  - Shim thickness : 1 mm



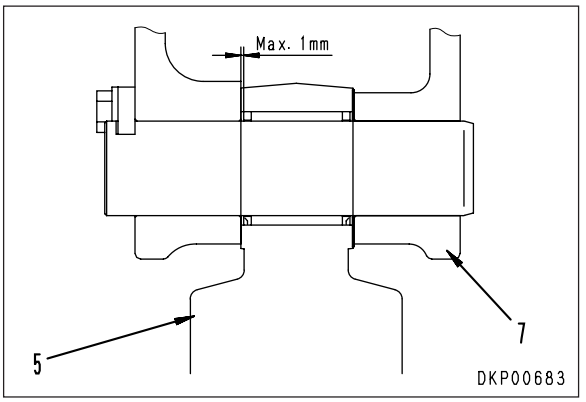
※ 2

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)

Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the bottom of boom cylinder (5) and boom swing bracket (7) is less than 1 mm.
  - Shim thickness : 1 mm

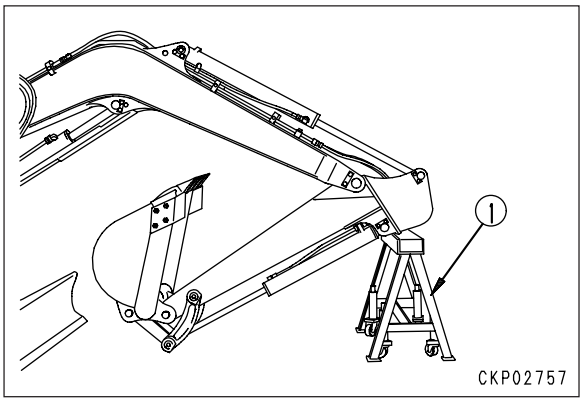


- **Refilling with oil (hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

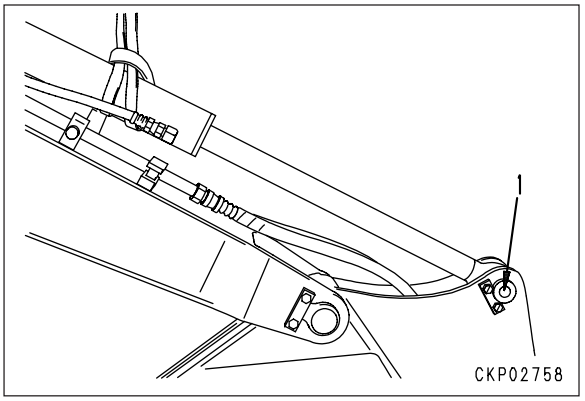
- **Bleeding air**
  Bleed the air from the boom cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.

REMOVAL OF ARM CYLINDER ASSEMBLY

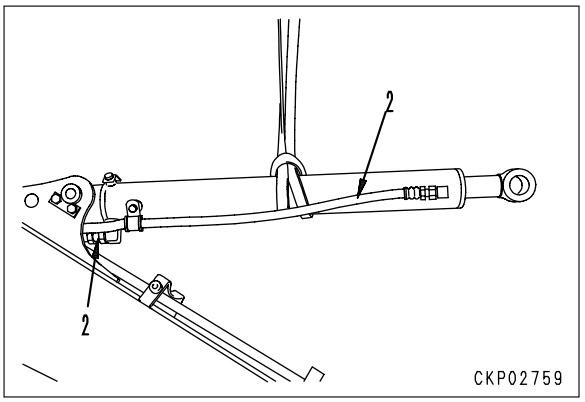
⚠ Start the engine, extend the arm cylinder to just before the end of its stroke, then set the arm on top of stand ①, then lower the bucket link to the ground.



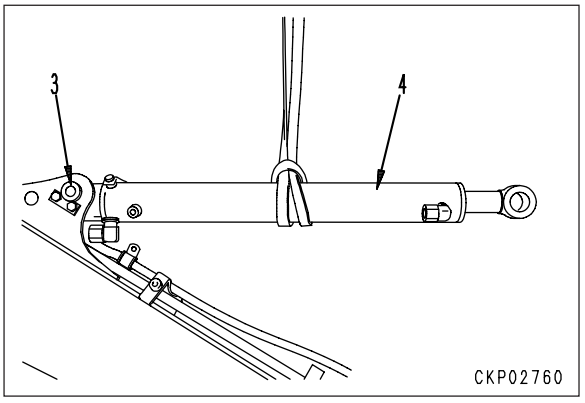
1. Sling arm cylinder assembly and remove head pin (1). ※ 1
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.
   ⚠ Start the engine, and retract the piston rod, then tie the piston rod with wire to prevent it from coming out.
   ⚠ Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.



2. Disconnect 2 hoses (2).



3. Remove bottom pin (3), then lift off arm cylinder assembly (4). ※ 2
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.
   kg Arm cylinder assembly :
   30 kg (PC30R, 35R)
   40 kg (PC40R, 45R)



INSTALLATION OF ARM CYLINDER ASSEMBLY

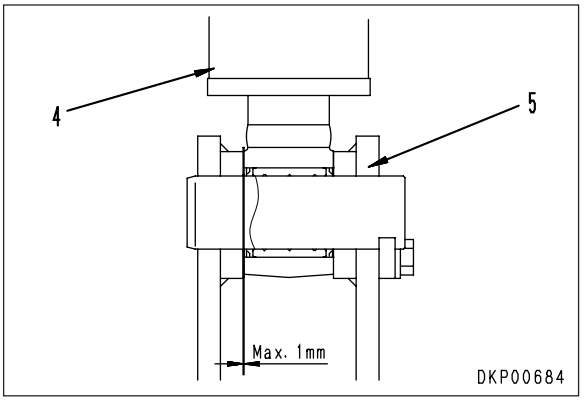
- Carry out installation in the reverse order to removal.

※ 1

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)
Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the head of arm cylinder (4) and arm (5) is less than 1 mm.
  - Shim thickness : 1 mm

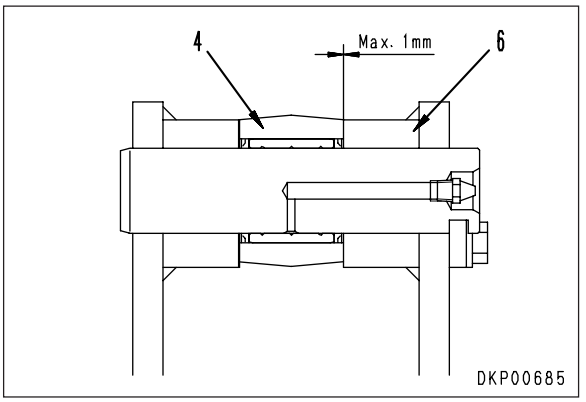


※ 2

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)
Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the bottom of arm cylinder (4) and boom (6) is less than 1 mm.
  - Shim thickness : 1 mm

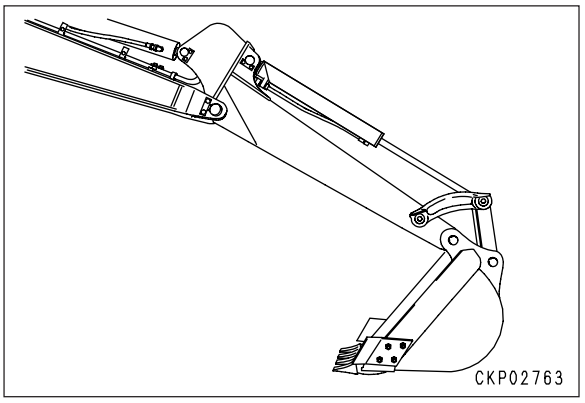


- **Refilling with oil (hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

- **Bleeding air**
  Bleed the air from the boom cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.

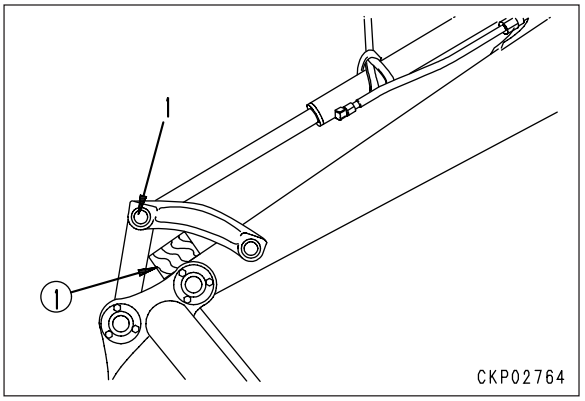
REMOVAL OF BUCKET CYLINDER ASSEMBLY

⚠ Start the engine, set the bottom of the bucket horizontal, then lower the bucket completely to the ground.

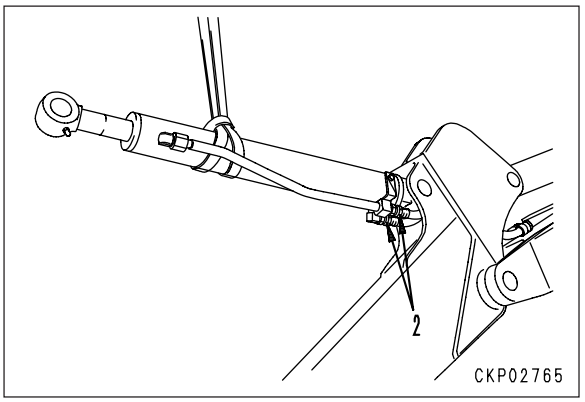


1. Set block ① between link and arm.

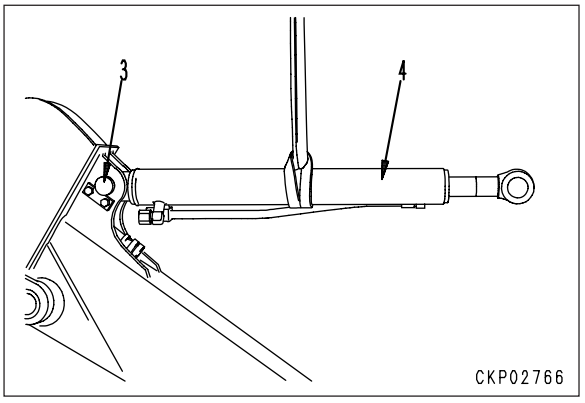
2. Sling bucket cylinder assembly and remove head pin (1). ※ 1
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.
   ⚠ Start the engine, and retract the piston rod, then tie the piston rod with wire to prevent it from coming out.
   ⚠ Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.



3. Disconnect 2 hoses (2).



4. Remove bottom pin (3), then lift off bucket cylinder assembly (4). ※ 2
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.
   kg Bucket cylinder assembly :
   25 kg (PC30R, 35R)
   30 kg (PC40R, 45R)



INSTALLATION OF BUCKET CYLINDER ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)

Greasing after assembling:
Molybdenum disulphide grease (LM-G)

kgm Pin mounting bolt
PC30R, 35R :
276.85 ± 31.8 Nm {28.25 ± 3.25 kgm}
PC40R, 45R :
548.8 ± 58.8 Nm {56 ± 6 kgm}

★ Install the shims.
- Shim thickness : 2.5 mm (× 2)

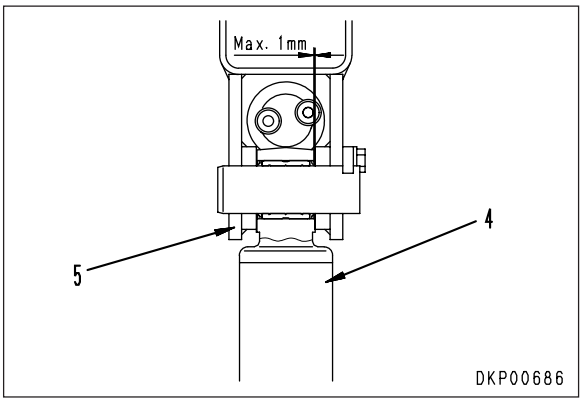
※ 2

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)

Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the bottom of bucket cylinder (4) and arm (5) is less than 1 mm.
- Shim thickness : 1 mm



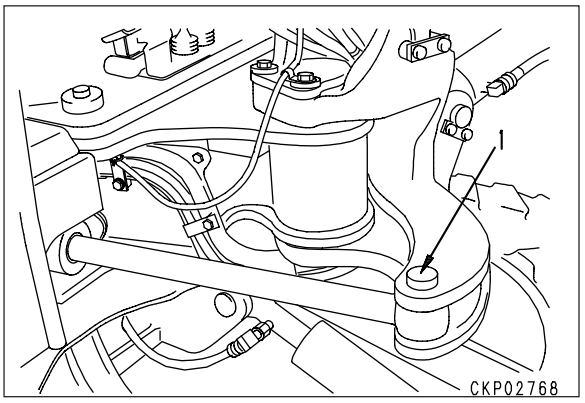
- **Refilling with oil (hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

- **Bleeding air**
  Bleed the air from the bucket cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.

REMOVAL OF BOOM SWING CYLINDER ASSEMBLY

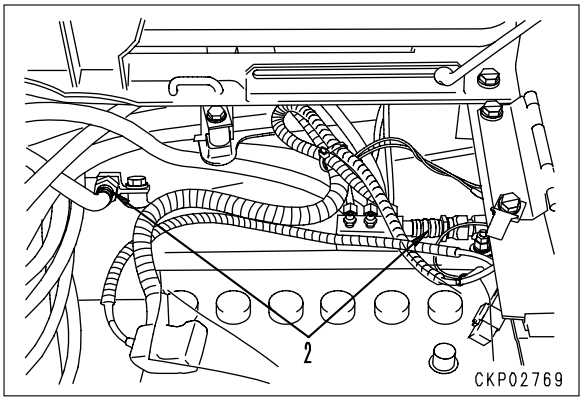
⚠ Start the engine, extend the boom swing cylinder to just before the end of the stroke, then lower the work equipment completely to the ground.

1. Remove head pin (1). ※ 1
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.
   ⚠ Start the engine, and retract the piston rod, then tie the piston rod with wire to prevent it from coming out.
   ⚠ Operate the boom swing pedal several times to release the remaining pressure in the hydraulic circuit.



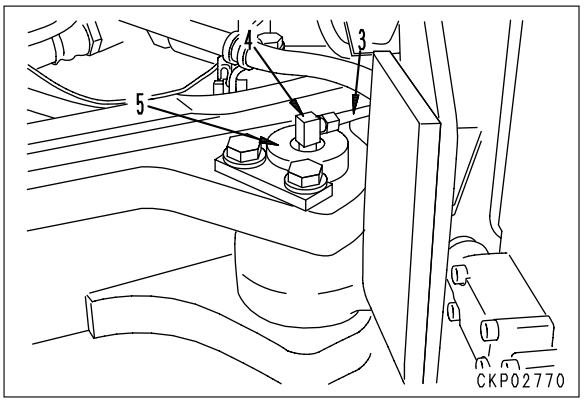
2. Remove fuel tank assembly. For details, see REMOVAL OF FUEL TANK ASSEMBLY.

3. Disconnect 2 hoses (2).

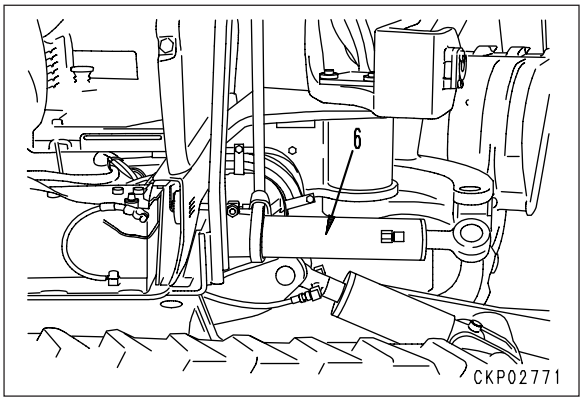


4. Disconnect grease pipe (3), and remove nipple (4).

5. Sling boom swing cylinder assembly, and remove bottom pin (5). ※ 2
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.



6. Pull out boom swing cylinder assembly (6) from revolving frame, then lift off.
   kg Boom swing cylinder assembly :
   35 kg (PC30R, 35R)
   45 kg (PC40R, 45R)



INSTALLATION OF BOOM SWING CYLINDER ASSEMBLY

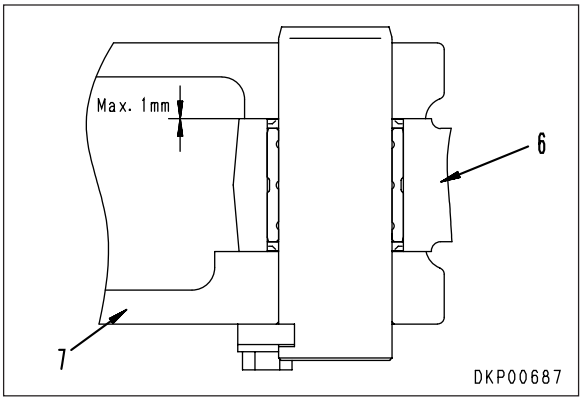
- Carry out installation in the reverse order to removal.

※ 1

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)
Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the head of boom swing cylinder (6) and boom swing bracket (7) is less than 1 mm.

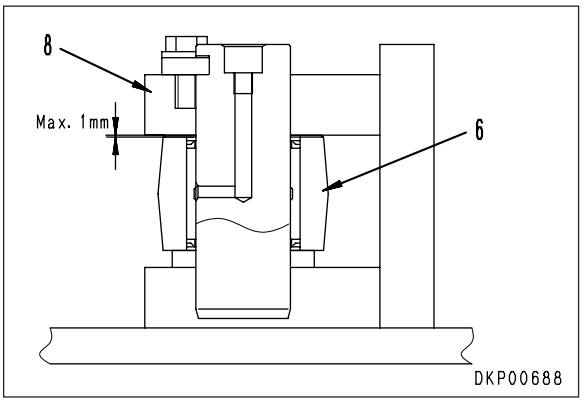


※ 2

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)
Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the bottom of boom swing cylinder (6) and revolving frame (8) is less than 1 mm.
  - Shim thickness : 0.5 mm, 1 mm



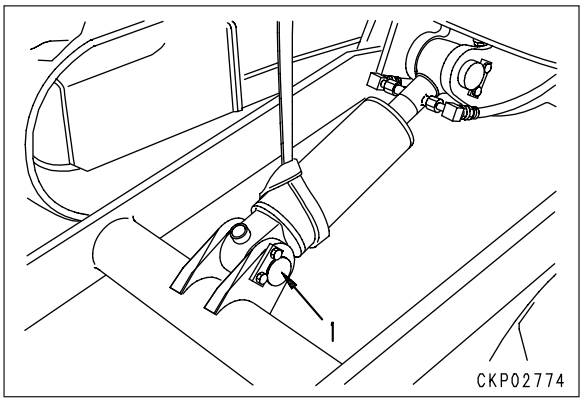
- **Refilling with oil (hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

- **Bleeding air**
  Bleed the air from the boom swing cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.

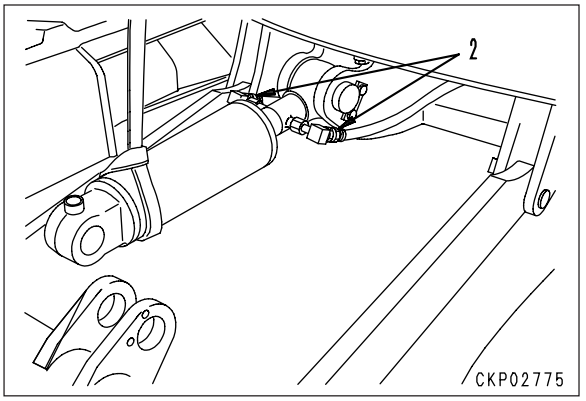
REMOVAL OF BLADE CYLINDER ASSEMBLY

⚠ Start the engine, swing the upper structure 90°, then lower the work equipment and blade completely to the ground.

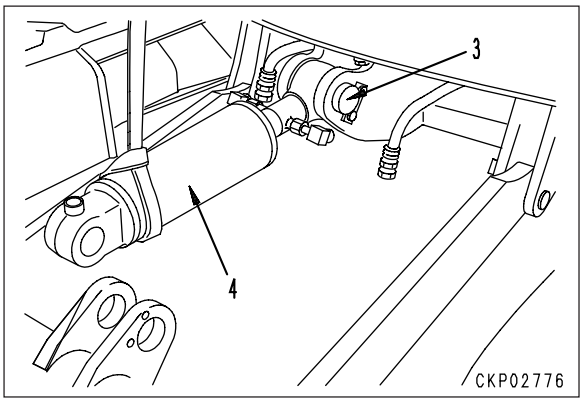
1. Sling blade cylinder assembly and remove bottom pin (1). ※ 1
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.
   ⚠ Start the engine, and retract the piston rod, then tie the piston rod with wire to prevent it from coming out.
   ⚠ Operate the blade control lever several times to release the remaining pressure in the hydraulic circuit.



2. Disconnect 2 hoses (2).



3. Remove head pin (3), then lift off blade cylinder assembly (4). ※ 2
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.
   kg Blade cylinder assembly :
   25 kg (PC30R, 35R)
   35 kg (PC40R, 45R)



INSTALLATION OF BLADE CYLINDER ASSEMBLY

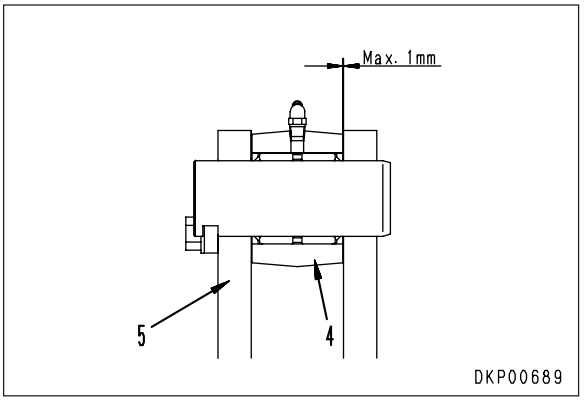
- Carry out installation in the reverse order to removal.

※ 1

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)
Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the bottom of blade cylinder (4) and blade (5) is less than 1 mm.

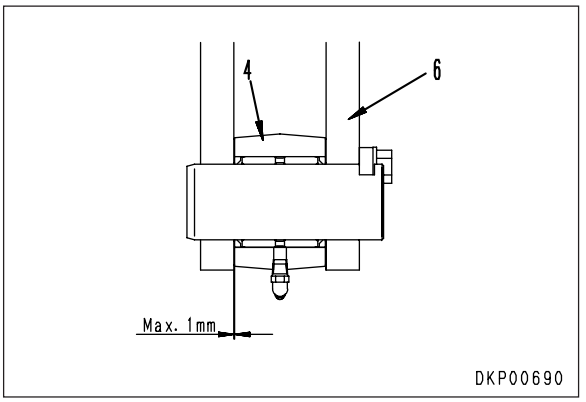


※ 2

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)
Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the head of blade cylinder (4) and track frame (6) is less than 1 mm.
  - Shim thickness : 1 mm



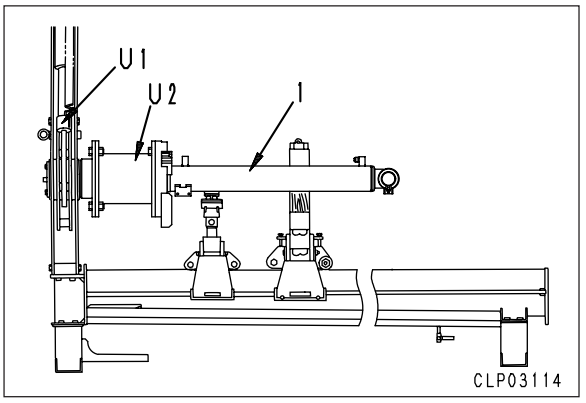
- **Refilling with oil (hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

- **Bleeding air**
  Bleed the air from the blade cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.

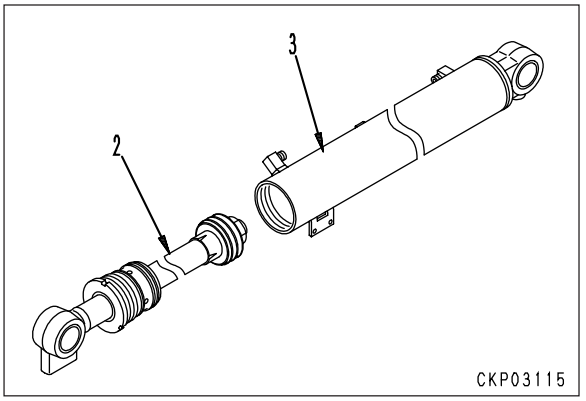
DISASSEMBLY OF HYDRAULIC CYLINDER ASSEMBLY

1. Piping
Remove cylinder piping.

2. Piston rod assembly
1) Set cylinder assembly (1) to tool **U1**.
2) Using tool **U2**, loosen cylinder head.



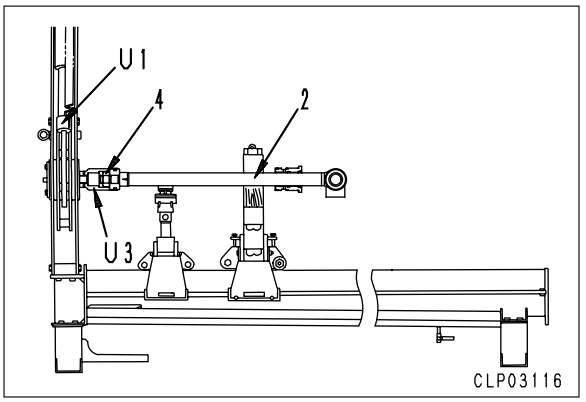
3) Remove piston rod assembly (2) from cylinder (3).



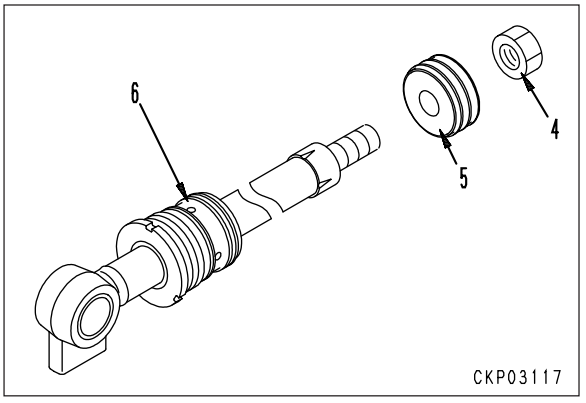
3. Piston assembly
1) Set piston rod assembly (2) to tool **U1**.
2) Using tool **U3**, remove piston nut (4).
★ Width across flats of piston nut

(mm)

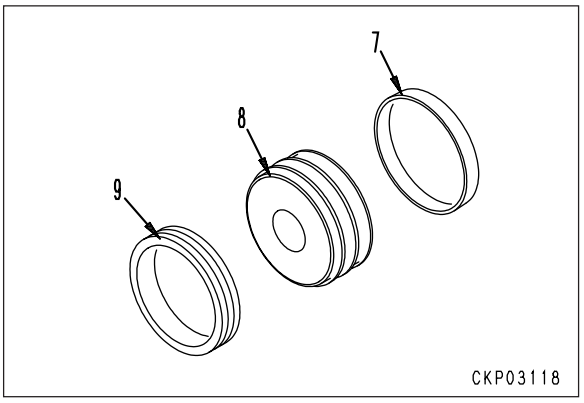
Model	Boom	Arm	Bucket	Swing	Blade
PC30R	46	46	41	46	50
PC35R	46	50	46	46	50
PC40R	55	55	46	55	55
PC45R	55	55	50	55	55



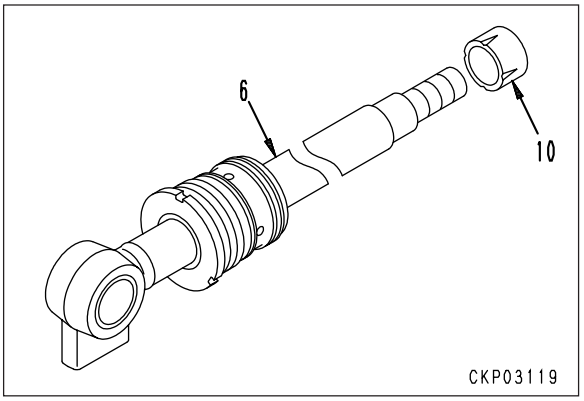
3) Remove piston assembly (5) from piston rod (6).



4) Disassemble piston assembly as follows.
   i) Remove wear ring (7) from piston (8).
   ii) Remove piston ring (9).

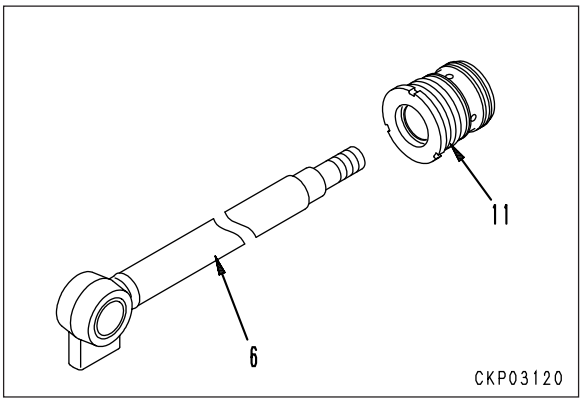


5) Remove cushion plunger (10) from piston rod (6).
   ★ Boom cylinder only

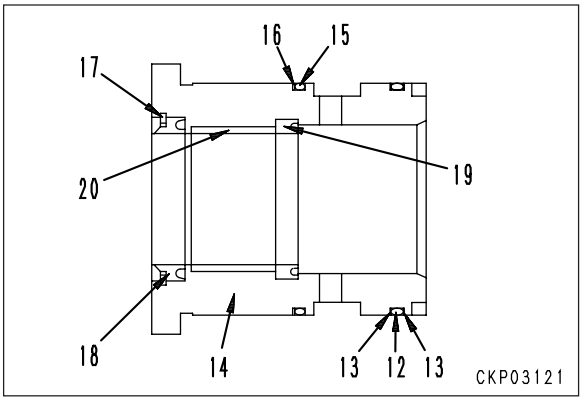


4. Cylinder head assembly

1) Remove cylinder head assembly (11) from piston rod (6).

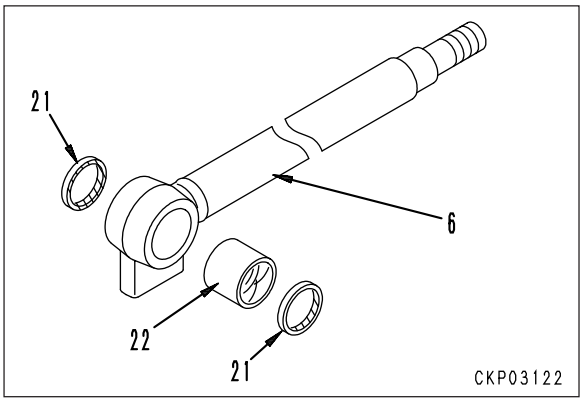


2) Disassemble cylinder head assembly as follows.
   i) Remove O-ring (12) and 2 backup rings (13) from cylinder head (14).
      ★ Boom cylinder only
   ii) Remove O-ring (15) and backup ring (16).
   iii) Using snap ring pliers, remove snap ring (17).
   iv) Remove dust seal (18).
   v) Remove rod packing (19).
   vi) Remove bushing (20).



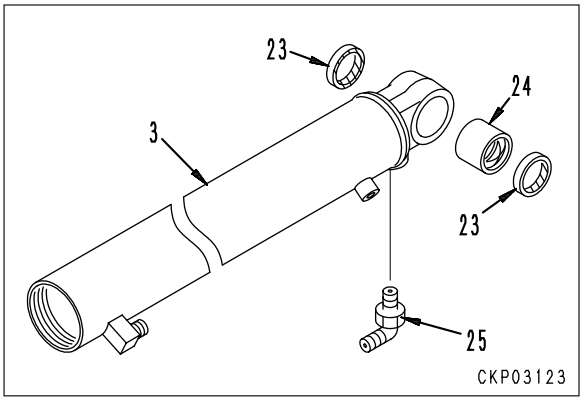
5. Piston rod

1) Remove 2 dust seals (21) from piston rod (6).
2) Remove bushing (22).



6. Cylinder

1) Remove 2 dust seals (32) from cylinder (3).
2) Remove bushing (24).
3) Remove elbow (25).
   ★ Arm cylinder only

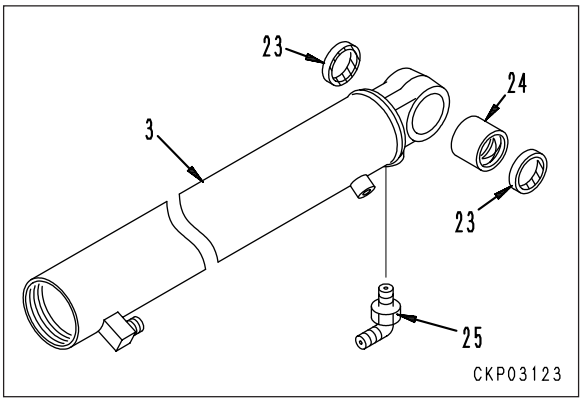


ASSEMBLY OF HYDRAULIC CYLINDER ASSEMBLY

1. Cylinder

1) Fit O-ring and install elbow (25) to cylinder (3).
   - ★ Arm cylinder only
   - ★ Install with the tip of the elbow facing the cylinder head.

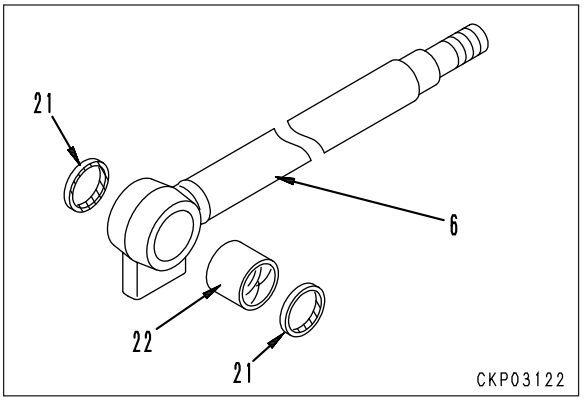
   kgm Elbow :
   PC30R, 35R :
   90.65 ± 12.25 Nm {9.25 ± 1.25 kgm}
   PC40R, 45R :
   139.65 ± 22.05 Nm {14.25 ± 2.25 kgm}



2) Press fit bushing (24).
3) Press fit 2 dust seals (23).

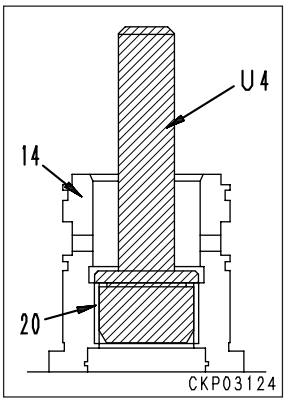
2. Piston rod

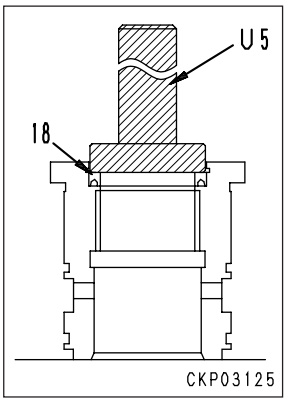
1) Press fit bushing (22) to piston rod (6).
2) Press fit 2 dust seals (21).



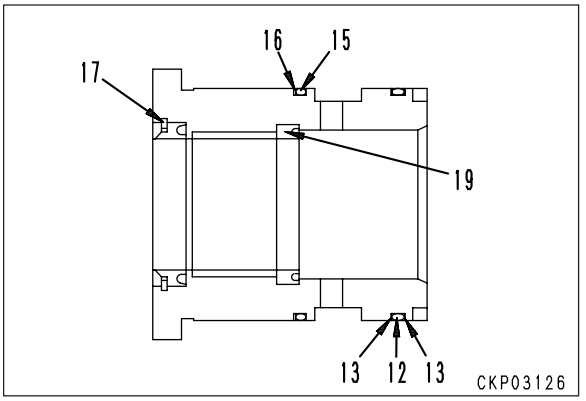
3. Cylinder head assembly

1) Assemble cylinder head assembly as follows.
   i) Using tool **U4**, press fit bushing (20) to cylinder head (14).
   ii) Using tool **U5**, press fit dust seal (18).

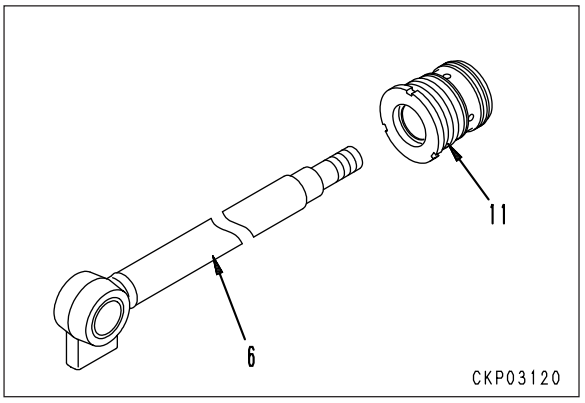




   iii) Using snap ring pliers, install snap ring (17).
   iv) Install rod packing (19).
   v) Install O-ring (15) and backup ring (16).
      - ★ Align the direction of installation with the diagram on the right.
   vi) Install O-ring (12) and 2 backup rings (13).
      - ★ Boom cylinder only

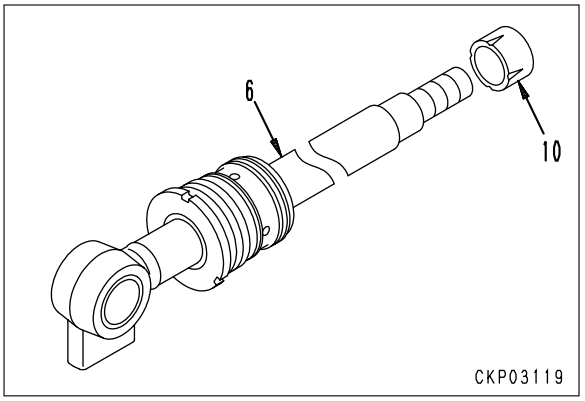


2) Fit O-ring and install cylinder head assembly (11) to piston rod (6).

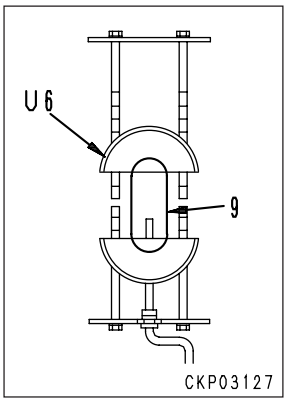


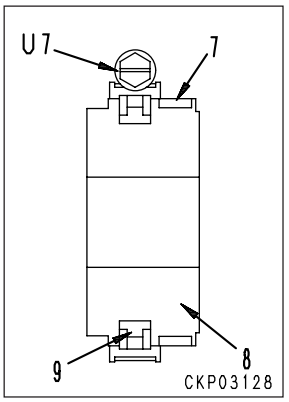
4. Piston assembly

1) Install cushion plunger (10) to piston rod (6).
   ★ Boom cylinder only

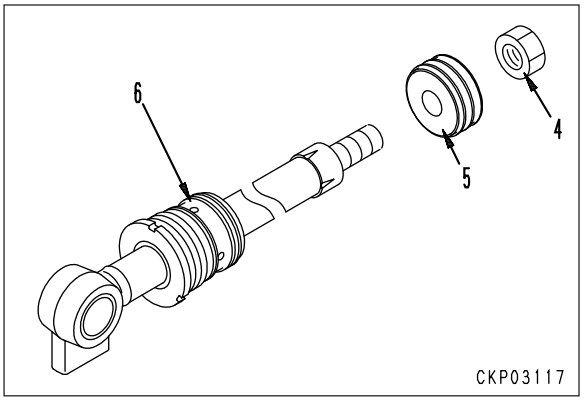


2) Assemble piston assembly as follows.
   i) Using tool **U6**, expand piston ring (9).
      ★ Set the piston ring on tool **U6** and turn the handle 8 – 10 times to expand the ring.
   ii) Install piston ring (9) to piston (8).
   iii) Using tool **U7**, compress piston ring (9).
   iv) Install wear ring (7).





3) Install piston assembly (5) to piston rod (6).



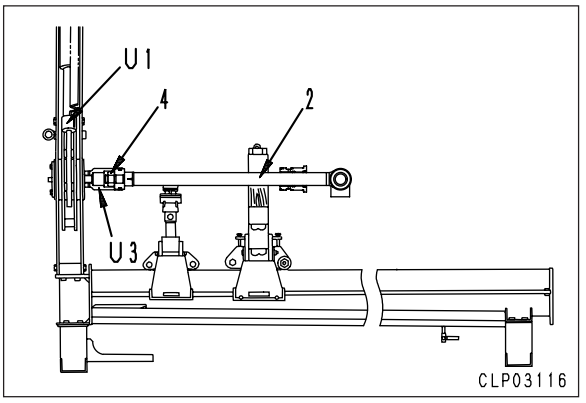
4) Set piston rod assembly (2) to tool**U1**.
5) Using tool **U3**, install piston nut (4).
★ Width across flats of piston nut

(mm)

Model	Boom	Arm	Bucket	Swing	Blade
PC30R	46	46	41	46	50
PC35R	46	50	46	46	50
PC40R	55	55	46	55	55
PC45R	55	55	50	55	55

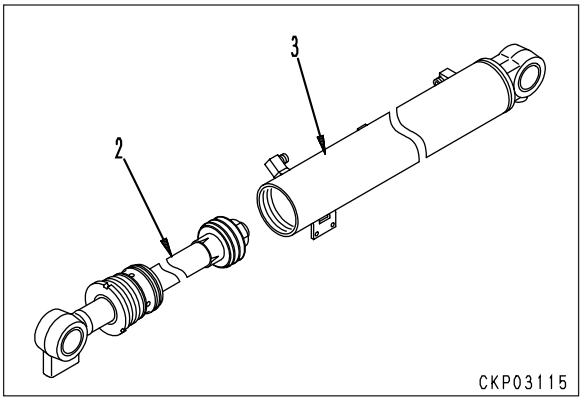
Piston nut : **Thread tightener (Loctite 262 or equivalent)**

kgm Piston nut : **See table below**



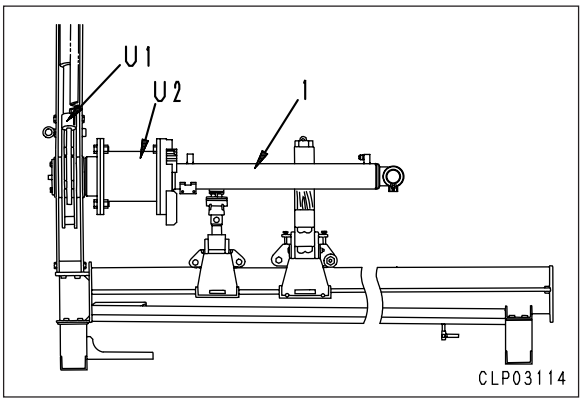
5. Piston rod assembly
1) Install piston rod assembly (2) to cylinder (3).
2) Set cylinder assembly (1) to tool **U1**.
3) Using tool **U2**, tighten cylinder head.

kgm Cylinder head : **See table below**



6. Piping
Install cylinder piping.

kgm Sleeve nut :
Width across flats 24 mm :
78.5 ± 19.6 Nm {8 ± 2 kgm}
Width across flats 30 mm :
127.5 ± 19.6 Nm {13 ± 2 kgm}
Width across flats 32 mm :
225.6 ± 29.4 Nm {23 ± 3 kgm}



kgm Piston nut tightening torque :

Nm {kgm}

Model	Boom	Arm	Bucket	Swing	Blade
PC30R	785±78.5 {80±8}	912±62 {93±9.3}	618±62 {63±6.3}	912±91 {93±9.3}	1,080±110 {110±11}
PC35R	785±78.5 {80±8}	1,250±130 {127±12.7}	785±78.5 {80±8}	912±91 {93±9.3}	1,080±110 {110±11}
PC40R	1,250±30 {127±12.7}	1,420±140 {145±14.5}	1,080±110 {110±11}	1,670±170 {170±17}	1,420±140 {145±14.5}
PC45R	1,250±130 {127±12.7}	1,670±170 {170±17}	1,080±110 {110±11}	1,670±170 {170±17}	1,420±140 {145±14.5}

kgm Cylinder head tightening torque :

Nm {kgm}

Boom	Arm	Bucket	Swing	Blade
569±57 {58±5.8}	569±57 {58±5.8}	441±44 {45±4.5}	637±63.7 {65±6.5}	677±67.6 {69±6.9}
588±59 {60±6}	677±67.6 {69±6.9}	490±49 {50±5}	637±63.7 {65±6.5}	677±67.6 {69±6.9}
677±67.6 {69±6.9}	726±72.6 {74±7.4}	647±64.7 {66±6.6}	677±67.6 {69±6.9}	942±94.2 {96±9.6}
677±67.6 {69±6.9}	863±86.3 {88±8.8}	677±67.6 {69±6.9}	735±73.5 {75±7.5}	942±94.2 {96±9.6}

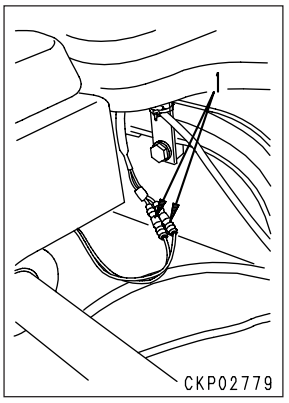
REMOVAL OF WORK EQUIPMENT ASSEMBLY

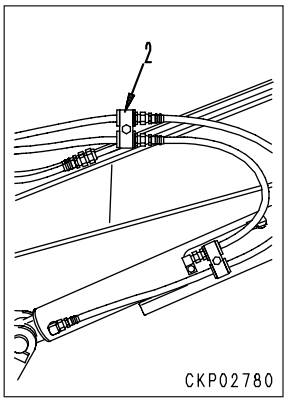
⚠ Start the engine, extend the arm cylinder and bucket cylinder fully, then lower the work equipment completely to the ground.

⚠ Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.

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

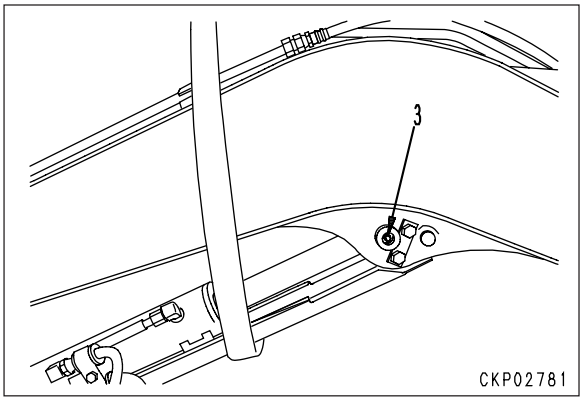
1. Disconnect 2 front lamp connectors (1).





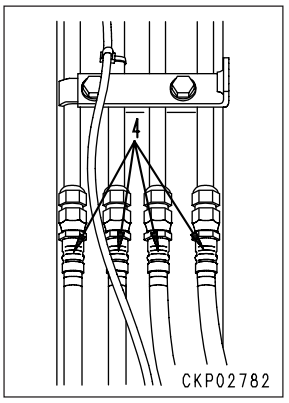
2. Disconnect hose clamp (2).

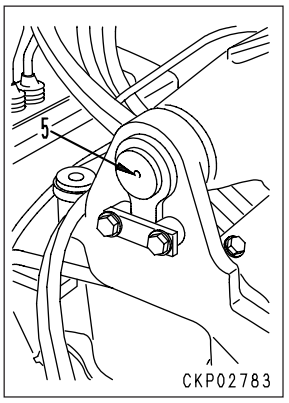
3. Sling boom cylinder, and remove head pin (3). ※ 1
   - ★ If there are shims installed, check the number and thickness, and keep in a safe place.
   - ⚠ After removing, start the engine and retract the piston rod, then lower it on top of the blade.



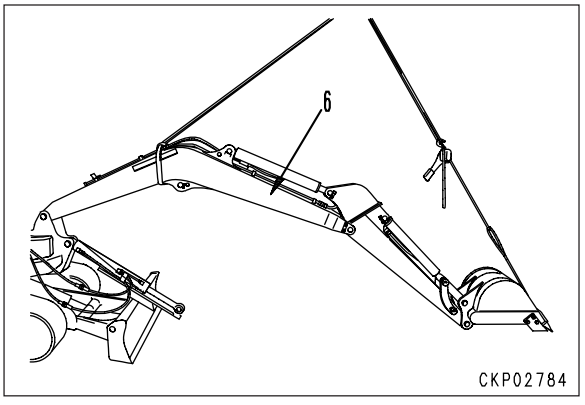
4. Disconnect 4 hoses (4).

5. Sling work equipment assembly, and remove boom foot pin (5). ※ 2
   - ★ If there are shims installed, check the number and thickness, and keep in a safe place.





6. Lift off work equipment assembly (6).
   - kg Work equipment assembly :
     290 kg (PC30R)
     320 kg (PC35R)
     420 kg (PC40R)
     450 kg (PC45R)



INSTALLATION OF WORK EQUIPMENT ASSEMBLY

- Carry out installation in the reverse order to removal.

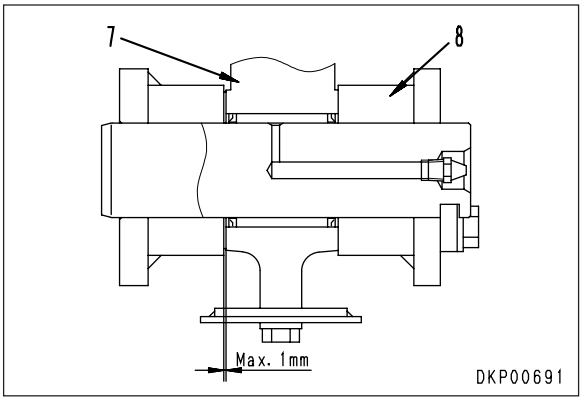
※ 1

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)

Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the head of boom cylinder (7) and boom (8) is less than 1 mm.
- Shim thickness : 1 mm



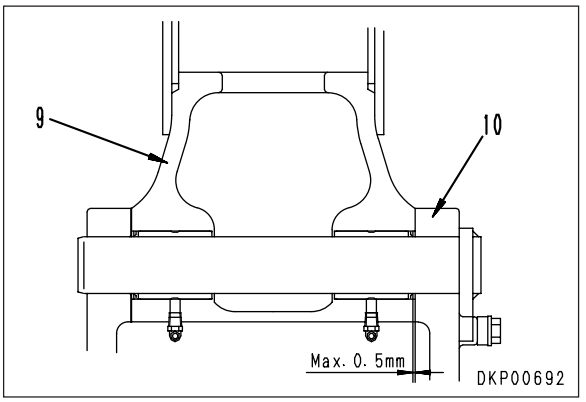
※ 2

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)

Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the foot of boom (9) and boom swing bracket (10) is less than 0.5 mm.
- Shim thickness : 0.5 mm



- **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 arm cylinder and bucket cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.

REMOVAL OF BUCKET ASSEMBLY

⚠ Start the engine, set the back face of the bucket facing down, then lower the work equipment completely to the ground.

1. Remove link pin (1). ※ 1

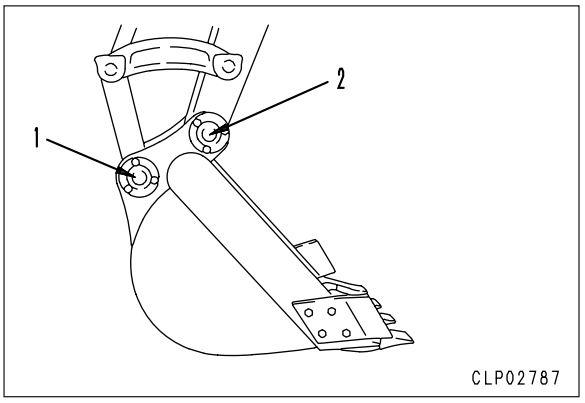
   ⚠ Start the engine and retract the bucket cylinder.

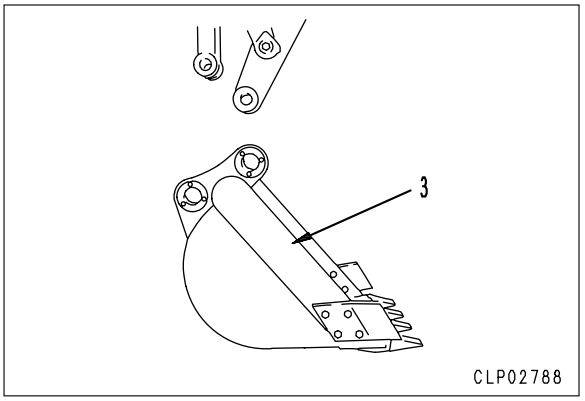
2. Remove arm top pin (2). ※ 2

3. Remove bucket assembly (3).

   ⚠ Start engine, then raise the work equipment slowly and disconnect the bucket assembly and arm.

   kg Bucket assembly : **80 kg (PC30R)**
   90 kg (PC35R)
   110 kg (PC40R)
   120 kg (PC45R)





INSTALLATION OF BUCKET ASSEMBLY

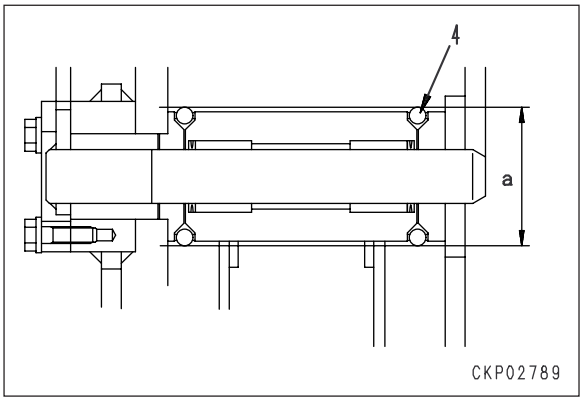
- Carry out installation in the reverse order to removal.

※ 1 ※ 2

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)
Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Measure outside diameter a of bucket play adjustment ring (4), and if it has reached the service limit given below, replace it with a new part.
Measure at a point away from the end gap of the ring.
- Service limit **a** : 83.5 mm
  Dimension **a** of new part :
  85.0 mm (reference)



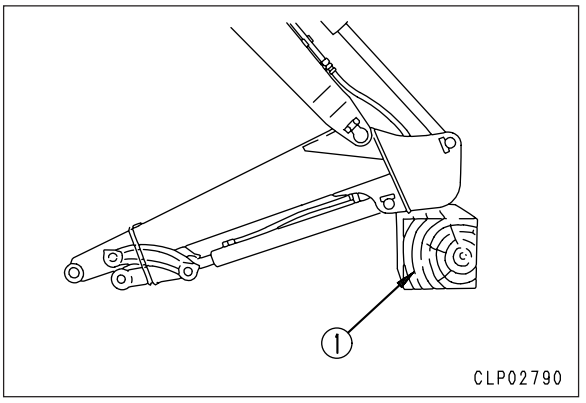
REMOVAL OF ARM ASSEMBLY

1. Remove bucket assembly. For details, see REMOVAL OF BUCKET ASSEMBLY.

2. Tie link to arm with wire.

3. Set work equipment in position.

   ⚠ Start the engine, pull in the arm to just before the end of its stroke, then lower the arm on top of block ①.



4. Set block ② between arm cylinder and boom.

5. Remove head pin (1). ※ 1
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.

   ⚠ Start engine and retract the arm cylinder.

   ⚠ Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.

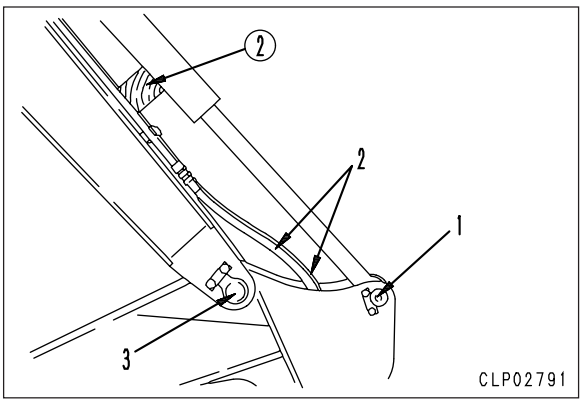
6. Disconnect 2 hoses (2).

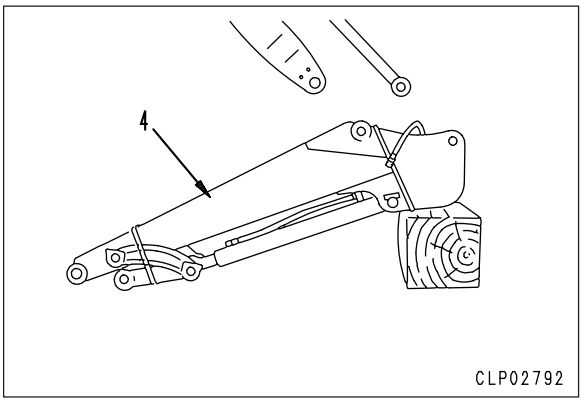
7. Remove boom top pin (3). ※ 2
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.

8. Remove arm assembly (4).

   ⚠ Start engine, then raise the boom slowly and disconnect the arm assembly and boom.

   kg Arm assembly : **90 kg (PC30R)**
   110 kg (PC35R)
   140 kg (PC40R)
   160 kg (PC45R)





INSTALLATION OF ARM ASSEMBLY

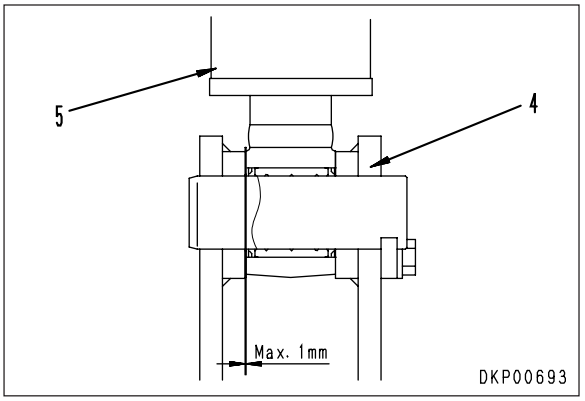
- Carry out installation in the reverse order to removal.

※ 1

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)
Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the head of arm cylinder (5) and arm (4) is less than 1 mm.
- Shim thickness : 1 mm

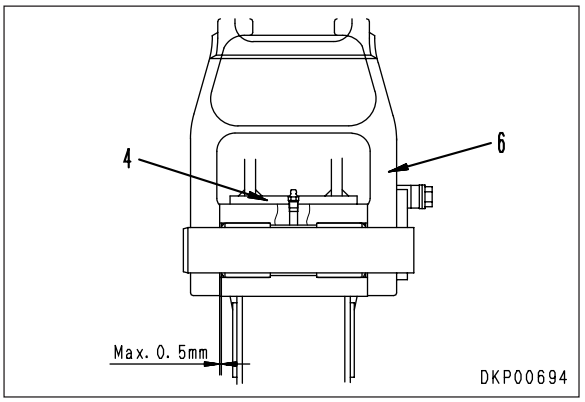


※ 2

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)
Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between arm (4) and boom (6) is less than 0.5 mm.
- Shim thickness : 0.5 mm

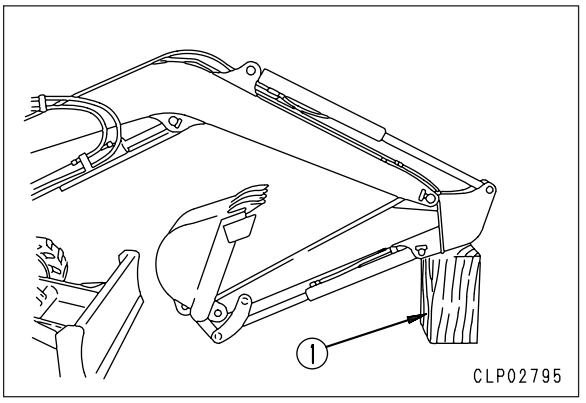


- **Refilling with oil (hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

- **Bleeding air**
  Bleed the air from the bucket cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.

REMOVAL OF BUCKET, ARM ASSEMBLY

⚠ Start the engine, operate the bucket cylinder to the end of its stroke and the arm cylinder to a point just before the end of its stroke, and lower the arm on top of block ①.



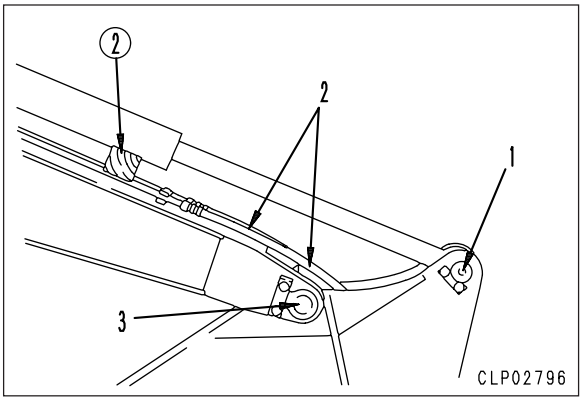
1. Set block ② between arm cylinder and boom.
2. Remove head pin (1). ※ 1
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.

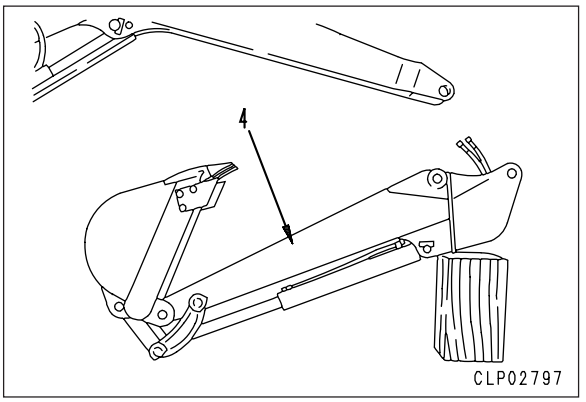
   ⚠ Start engine and retract the arm cylinder.

   ⚠ Release the remaining pressure in the hydraulic circuit. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic circuit.
3. Disconnect 2 hoses (6).
4. Remove boom top pin (3). ※ 2
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.
5. Remove bucket and arm assembly (4).

   ⚠ Start engine, then raise the boom slowly and disconnect the bucket and arm assembly from the boom.

   kg Bucket, arm assembly : **170 kg (PC30R)**
   200 kg (PC35R)
   250 kg (PC40R)
   280 kg (PC45R)





INSTALLATION OF BUCKET, ARM ASSEMBLY

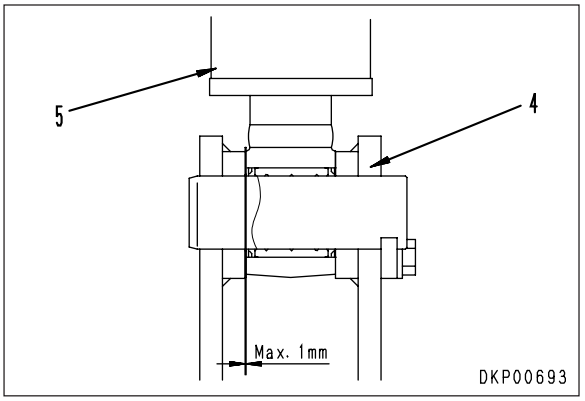
- Carry out installation in the reverse order to removal.

※ 1

When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)
Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the head of arm cylinder (5) and arm (4) is less than 1 mm.
- Shim thickness : 1 mm

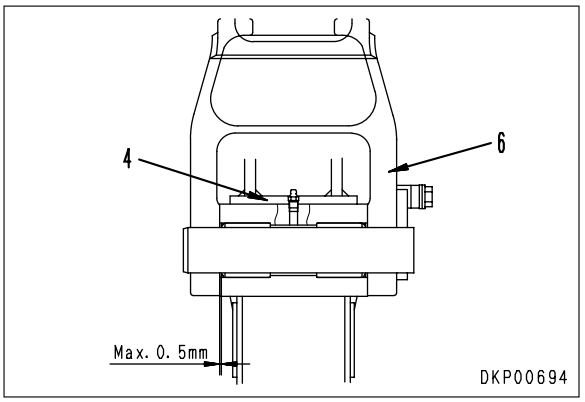


※ 2

When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)
Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between arm (4) and boom (6) is less than 0.5 mm.
- Shim thickness : 0.5 mm



- **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 bucket cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.

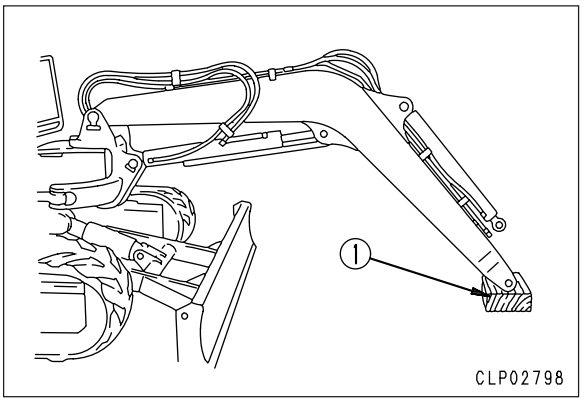
REMOVAL OF BOOM ASSEMBLY

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

1. Remove bucket and arm assembly. For details, see REMOVAL OF BUCKET, ARM ASSEMBLY.

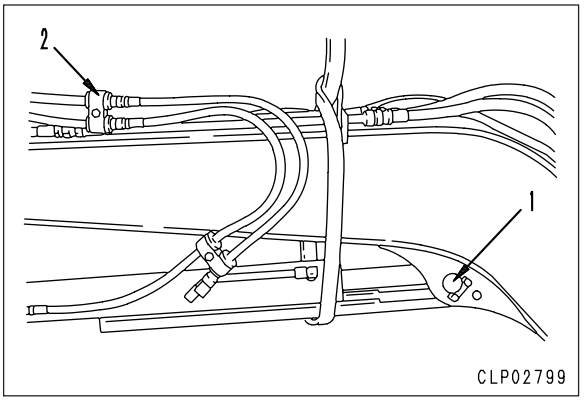
2. Set work equipment in position.

   ⚠ Start the engine and lower the boom on top of block ①.



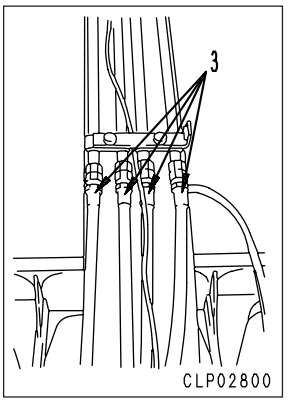
3. Sling boom cylinder and remove head pin (1). ※ 1
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.
   ⚠ Start the engine and retract the boom cylinder, then lower it on top of the blade.

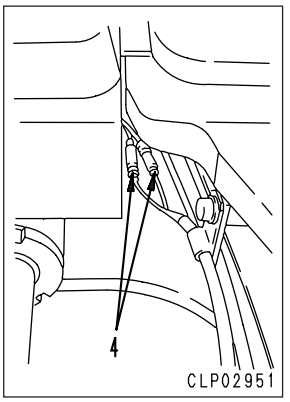
4. Disconnect hose clamp (2).



5. Disconnect 4 hoses (3).

6. Disconnect 2 front lamp connectors (4).

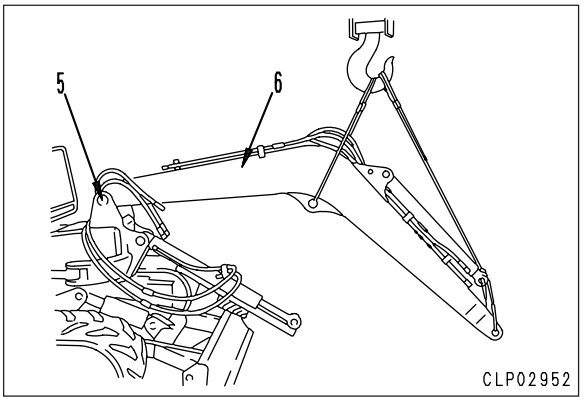




7. Sling boom assembly and remove boom foot pin (5). ※ 2
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.

8. Lift off boom assembly (6).

   kg Bucket, arm assembly : **170 kg (PC30R)**
   180 kg (PC35R)
   240 kg (PC40R)
   250 kg (PC45R)



INSTALLATION OF BOOM ASSEMBLY

- Carry out installation in the reverse order to removal.

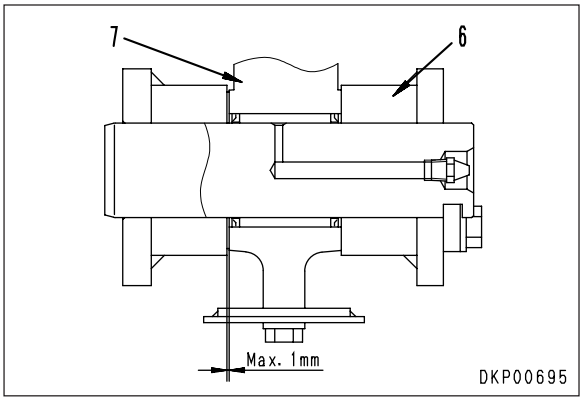
※ 1

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)

Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the head of boom cylinder (7) and boom (6) is less than 1 mm.
- Shim thickness : 1 mm



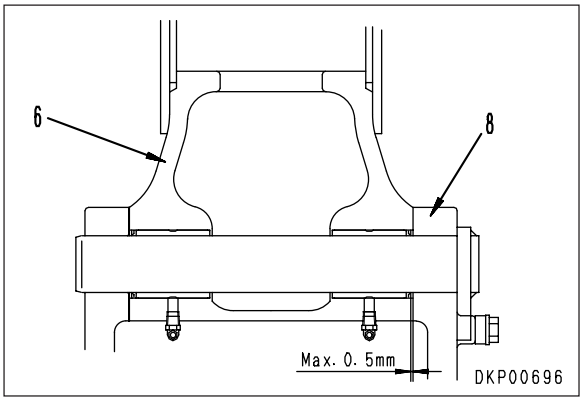
※ 2

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)

Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the foot of boom (6) and boom swing bracket (8) is less than 0.5 mm.
- Shim thickness : 0.5 mm



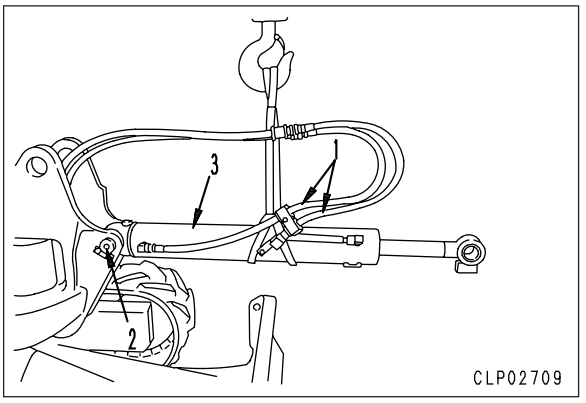
REMOVAL OF BOOM SWING BRACKET ASSEMBLY

1. Remove work equipment assembly. For details, see REMOVAL OF WORK EQUIPMENT ASSEMBLY.

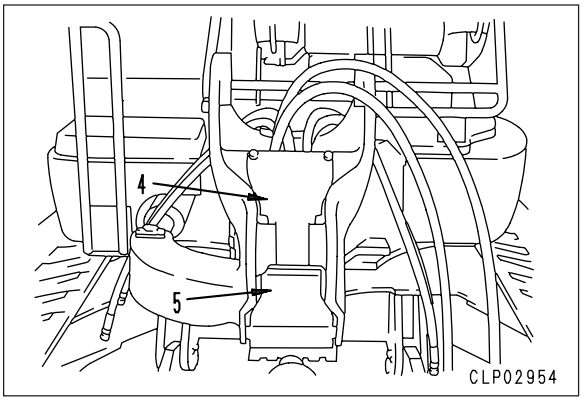
2. Disconnect 2 hoses (1).

3. Sling boom cylinder assembly (2), then remove bottom pin (2), and remove boom cylinder assembly (3). ※ 1
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.

   kg Boom cylinder assembly :
   35 kg (PC30R, 35R)
   45 kg (PC40R, 45R)

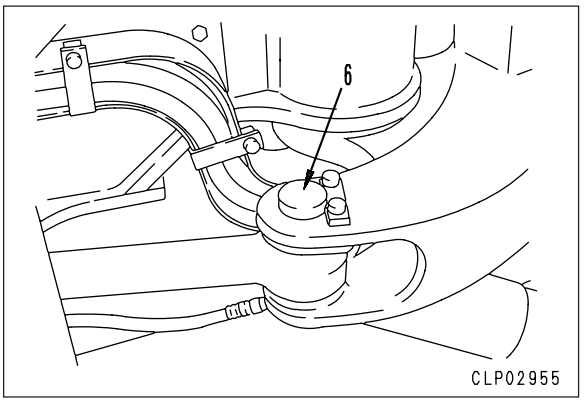


4. Remove covers (4) and (5).
   ★ Move the 6 hoses towards the front of the boom swing bracket.



5. Set block under boom swing cylinder and remove head pin (6). ※ 2
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.

   ⚠ Start the engine and retract the boom swing cylinder.

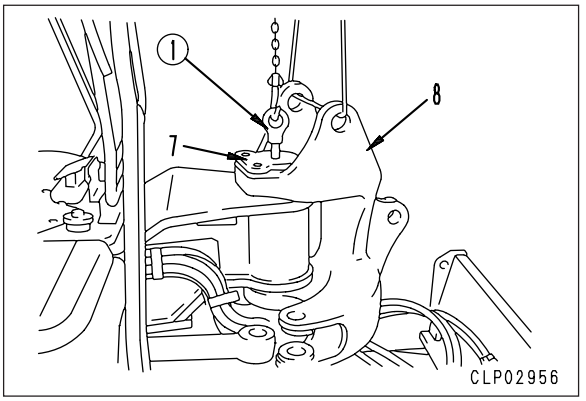


6. Sling boom swing bracket assembly, then using eyebolt (1), remove pin (7).

   kg Pin : **30 kg**

7. Lift off boom swing bracket assembly (8). ※ 3
   ★ If there are shims installed, check the number and thickness, and keep in a safe place.

   kg Boom swing bracket assembly :
   70 kg (PC30R, 35R)
   100 kg (PC40R, 45R)



INSTALLATION OF BOOM SWING BRACKET ASSEMBLY

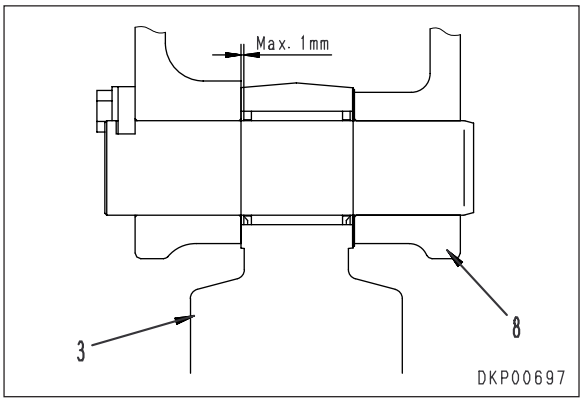
- Carry out installation in the reverse order to removal.

※ 1

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)
Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the bottom of boom cylinder (3) and boom swing bracket (8) is less than 1 mm.
- Shim thickness : 1 mm

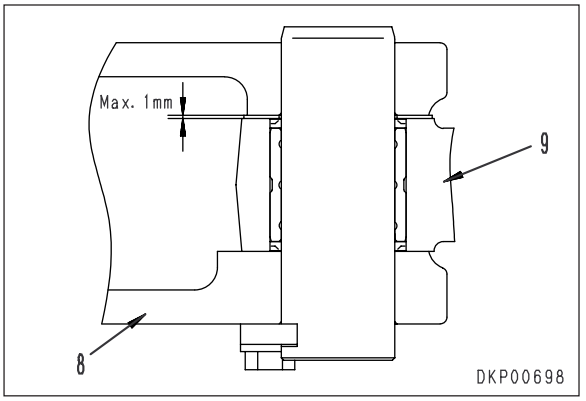


※ 2

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)
Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the head of boom swing cylinder (9) and boom swing bracket (8) is less than 1 mm.
- Shim thickness : 1 mm

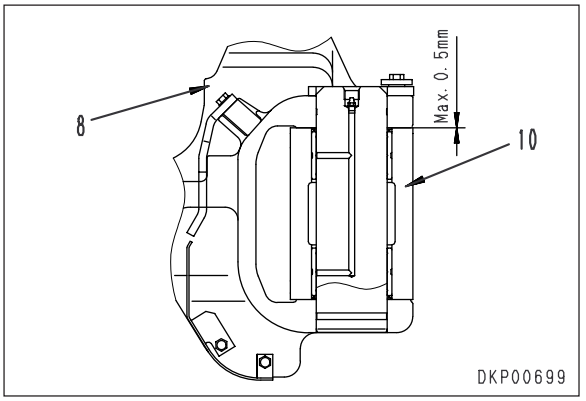


※ 3

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)
Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the boom swing bracket (8) and revolving frame (10) is less than 0.5 mm.
- Shim thickness : 0.5 mm



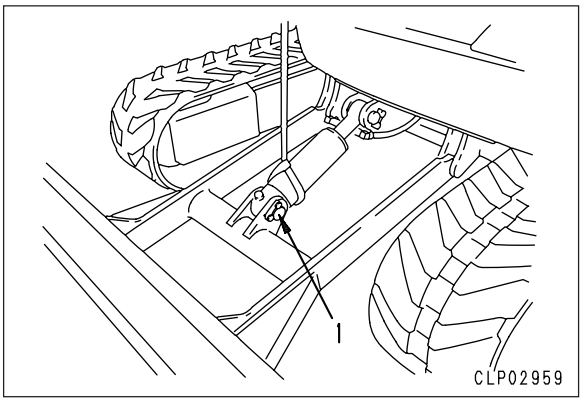
- **Bleeding air**
  Bleed the air from the boom cylinder. For details, see TESTING AND ADJUSTING, Bleeding air.

REMOVAL OF BLADE ASSEMBLY

⚠ Stop the engine, swing the upper structure 90°, then lower the work equipment and blade completely to the ground.

1. Sling blade cylinder and remove bottom pin (1). ※ 1

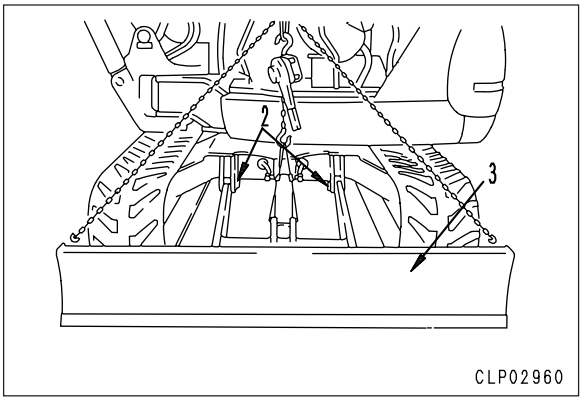
   ⚠ Start the engine, then retract the blade cylinder and lower the blade cylinder to the ground.



2. Sling blade assembly and remove 2 blade pins (2). ※ 2

3. Remove blade assembly (3).

   kg Blade assembly : **170 kg (PC30R, 35R)**
   210 kg (PC40R, 45R)



INSTALLATION OF BLADE ASSEMBLY

- Carry out installation in the reverse order to removal.

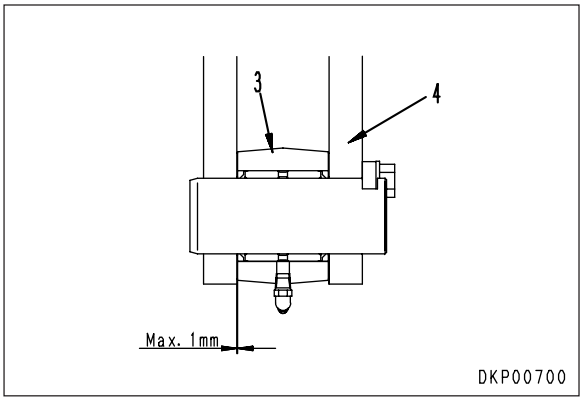
※ 1

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)

Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between the bottom of boom cylinder (4) and blade (3) is less than 1 mm.
- Shim thickness : 1 mm



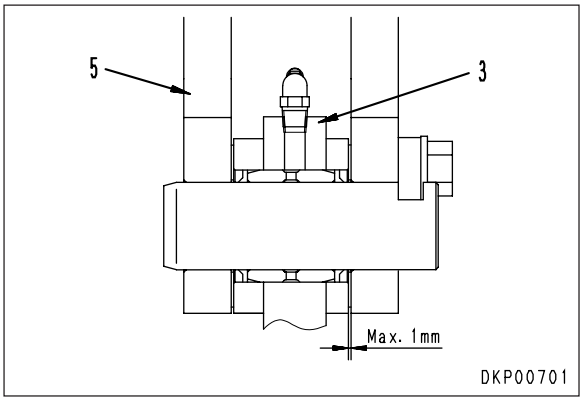
※ 2

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling :
Molybdenum disulphide grease (LM-P)

Greasing after assembling:
Molybdenum disulphide grease (LM-G)

★ Adjust the shim thickness so that the clearance between blade (3) and track frame (5) is less than 1 mm.
- Shim thickness : 1 mm

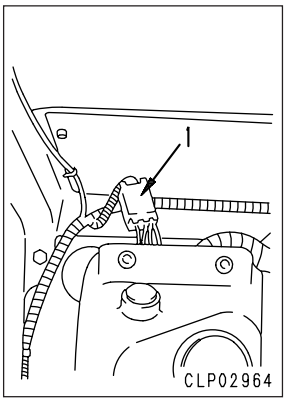


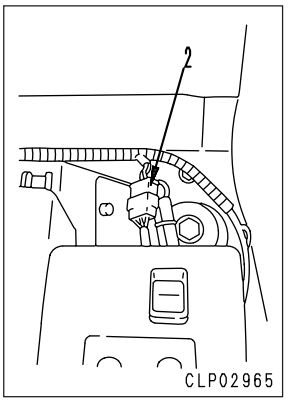
REMOVAL OF OPERATOR'S CAB ASSEMBLY

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

1. Disconnect wiring connectors (1) and (2).

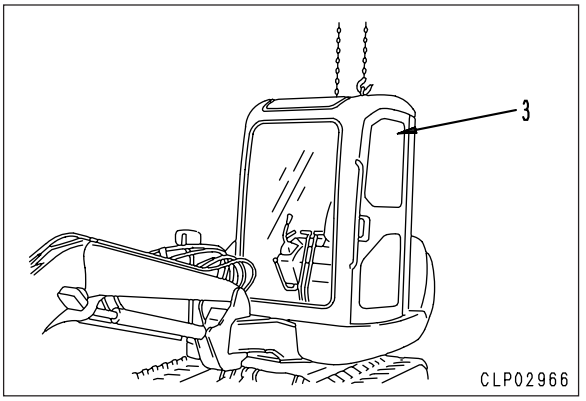
2. Lift off operator's cab assembly (3).
   ★ There are 4 types of length for the mounting bolts, so check the mounting positions when removing.
   kg Operator's cab assembly : **180 kg**





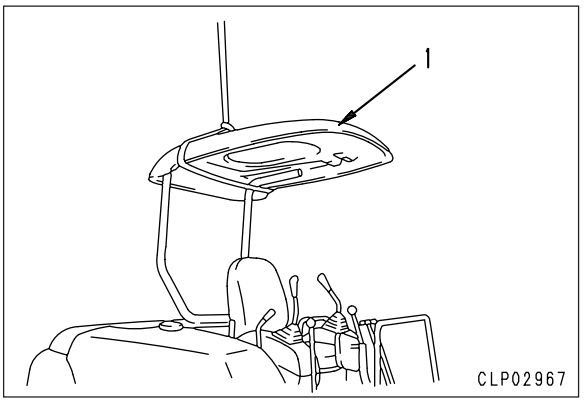
INSTALLATION OF OPERATOR'S CAB ASSEMBLY

- Carry out installation in the reverse order to removal.



REMOVAL OF CANOPY ASSEMBLY

1. Lift off canopy assembly (1).
   kg Canopy assembly : **35 kg**



INSTALLATION OF CANOPY ASSEMBLY

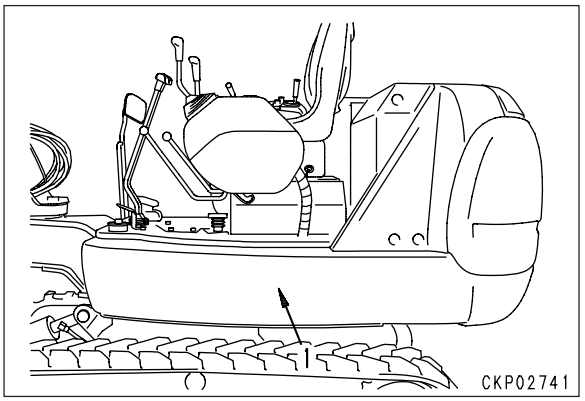
- Carry out installation in the reverse order to removal.

REMOVAL OF FLOOR FRAME ASSEMBLY

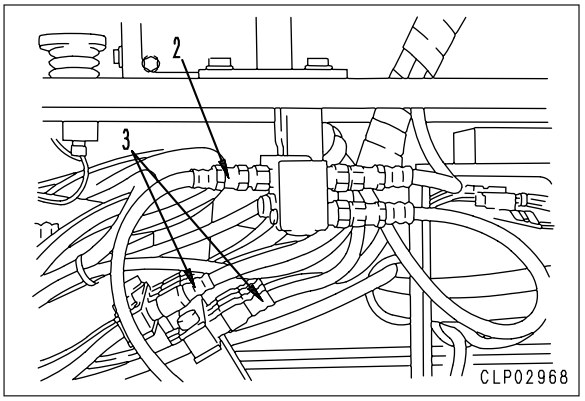
⚠ Disconnect the cable from the negative (–) terminal of the battery.

⚠ Release the remaining pressure in the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing remaining pressure in hydraulic tank.

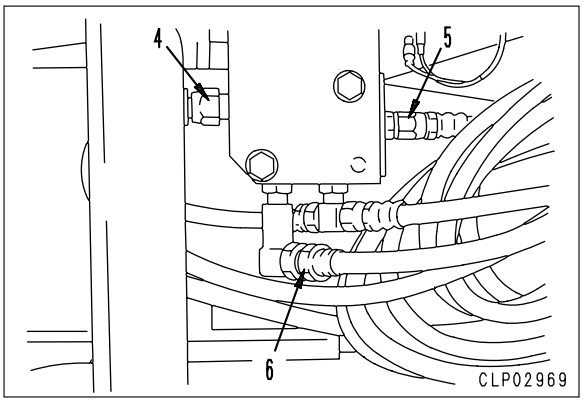
1. Remove operator's cab assembly. For details, see REMOVAL OF OPERATOR'S CAB ASSEMBLY.
   - ★ Operator's cab specification machine only
     Remove canopy assembly. For details, see REMOVAL OF CANOPY ASSEMBLY.
   - ★ Canopy specification machine only



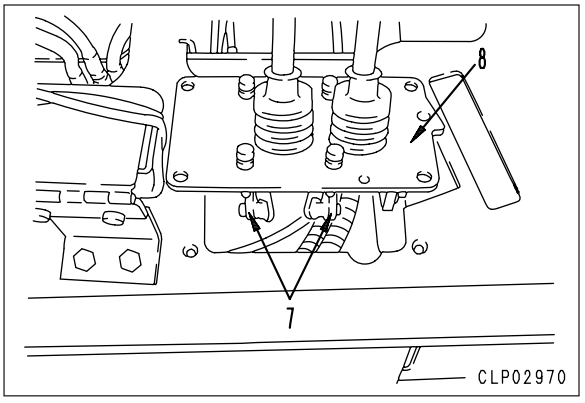
2. Remove 2 floor frame covers.
3. Remove left side cover (1).
4. Disconnect hose (2).
   - ★ Fit a blind plug.
5. Disconnect 8 PPC hoses (3). ※ 1



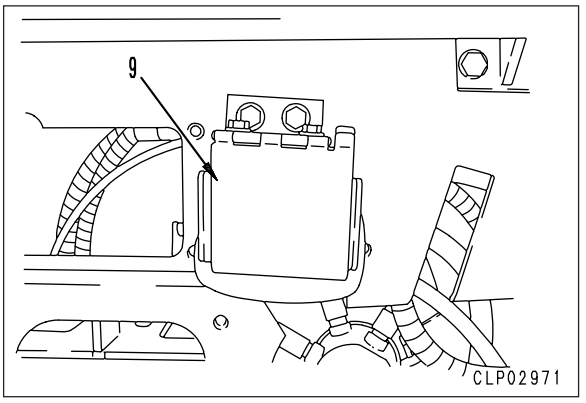
6. Disconnect drain hose (4).
   - ★ Fit a blind plug.
7. Disconnect pump hose (5) and travel boost hose (6).



8. Disconnect travel cables (7), and remove travel lever stand assembly (8). ※ 2
   - ★ Disconnect the travel cable from the floor frame also.

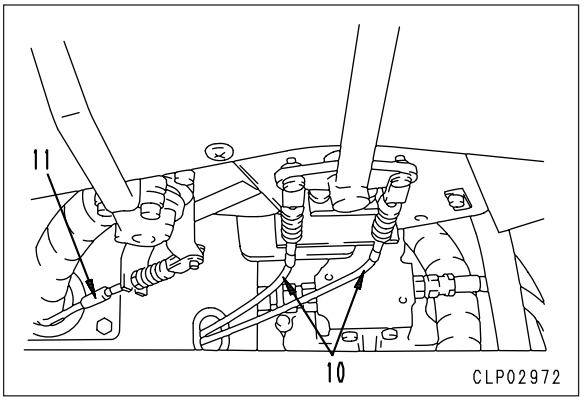


9. Disconnect boom swing pedal assembly (9) and lower on top of revolving frame.

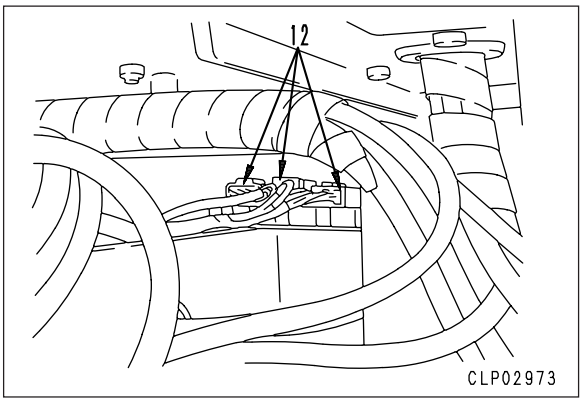


10. Disconnect 2 blade cables (10). ※ 3

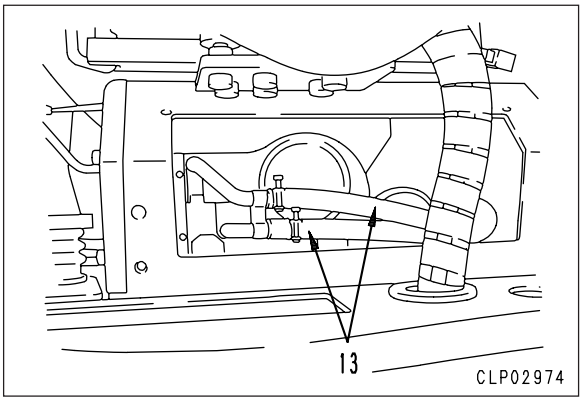
11. Disconnect fuel cable (11). ※ 4



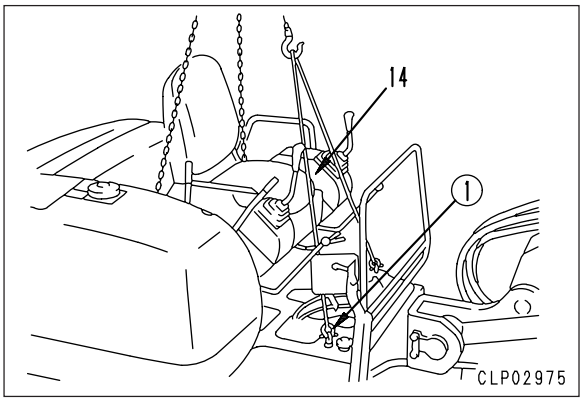
12. Disconnect 3 wiring connectors (12).



13. Remove heater cover and disconnect heater hoses (13).
    - ★ Operator's cab specification machine only
    - ★ Close the stop valve at the engine end.



14. Using eyebolts ①, remove floor frame assembly (14).
    ★ There are cable clamps and hose clamps behind the floor frame, so remove them.
    kg Floor frame assembly : **130 kg**

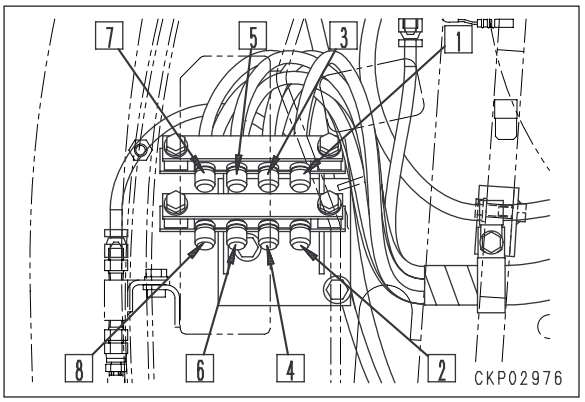


INSTALLATION OF FLOOR FRAME ASSEMBLY

- Carry out installation in the reverse order to removal.

※ 1

★ The hoses are marked with number tapes, so align as shown in the diagram on the right, then connect.



※ 2 ※ 3 ※ 4

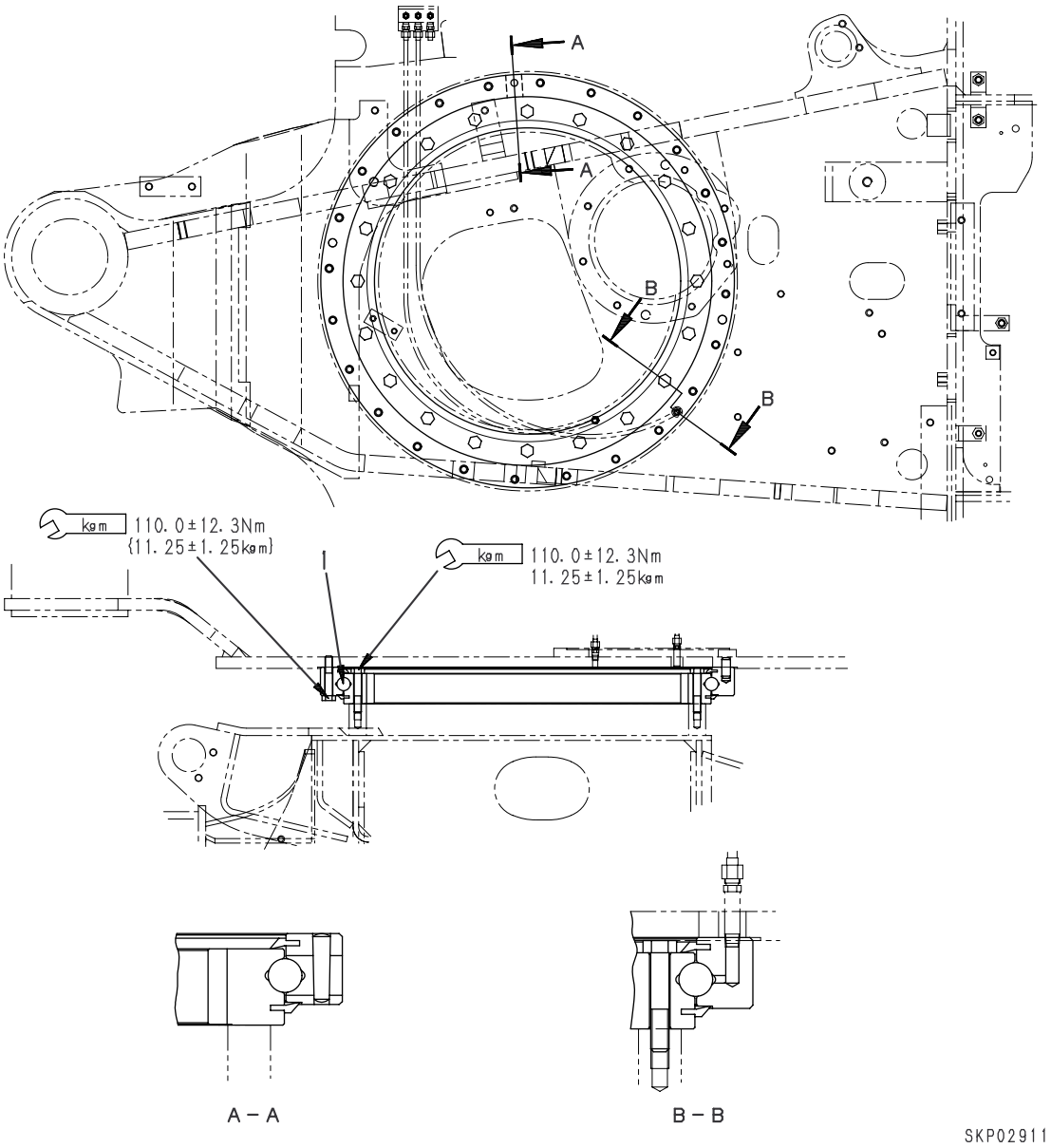
★ Adjust the travel cable, blade cable, and fuel cable. For details, see TESTING AND ADJUSTING, Adjusting control lever and pedal.

- **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.

40 MAINTENANCE STANDARD

Swing circle 40- 2
Swing machinery 40- 4
Sprocket 40- 6
Track frame, recoil spring 40- 8
Idler 40-10
Track roller 40-11
Carrier roller 40-12
Track shoe 40-13
Center swivel joint 40-18
Hydraulic pump 40-19
Work equipment, swing PPC valve 40-20
Swing motor 40-21
9-spool control valve 40-22
Hydraulic cylinder 40-28
Work equipment 40-32

SWING CIRCLE



Unit: mm

No.	Check item	Criteria		Remedy
		Standard clearance	Clearance limit	
1	Clearance of bearing in axial direction	0.03 – 0.13	0.23	Replace

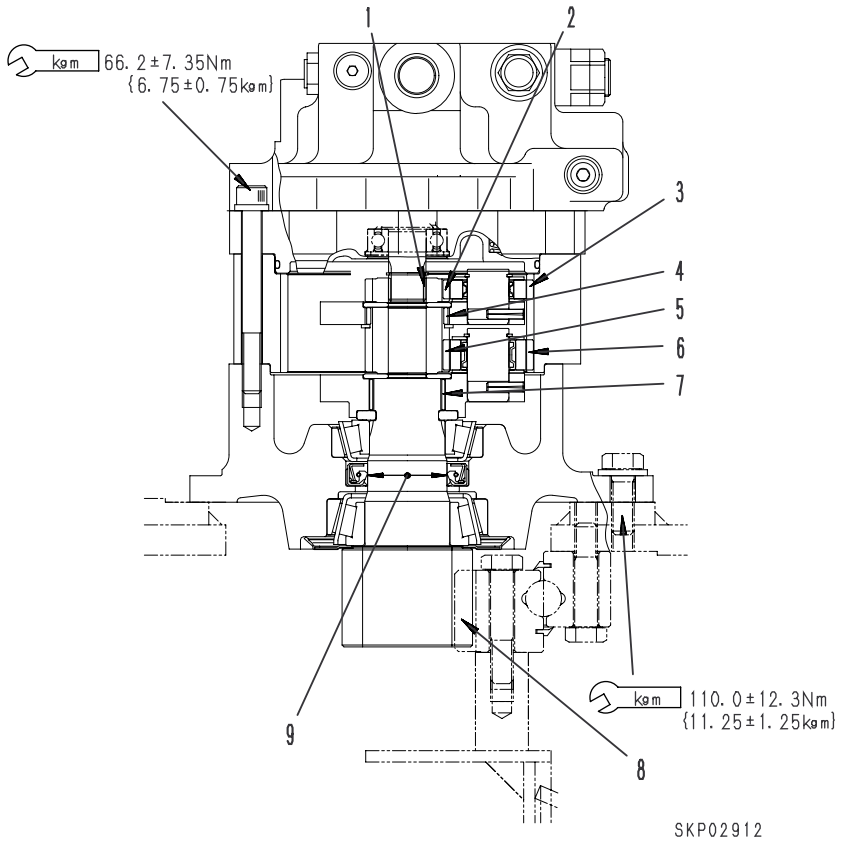
SWING MACHINERY

PC30R-8
PC35R-8

Unit: mm

No.	Check item	Criteria		Remedy
1	Backlash between swing motor shaft and No. 1 sun gear	Standard clearance	Clearance limit	Replace
		0.04 – 0.11	—	
2	Backlash between No. 1 sun gear and No. 1 planetary gear	0.09 – 0.25	0.6	
3	Backlash between No. 1 planetary gear and ring gear	0.10 – 0.33	0.6	
4	Backlash between No. 1 planetary carrier and No. 2 sun gear	0.10 – 0.21	—	
5	Backlash between No. 2 sun gear and No. 2 planetary gear	0.09 – 0.25	0.6	
6	Backlash between No. 2 planetary gear and ring gear	0.10 – 0.33	0.6	
7	Backlash between No. 2 planetary carrier and swing pinion	0.07 – 0.21	—	
8	Backlash between swing pinion and swing circle	0.17 – 0.72	2.0	
9	Wear of oil seal contact surface of swing pinion collar	Standard size	Repair limit	Repair hard chrome plating or replace
		$\phi 42_{-0.074}^{0}$	—	

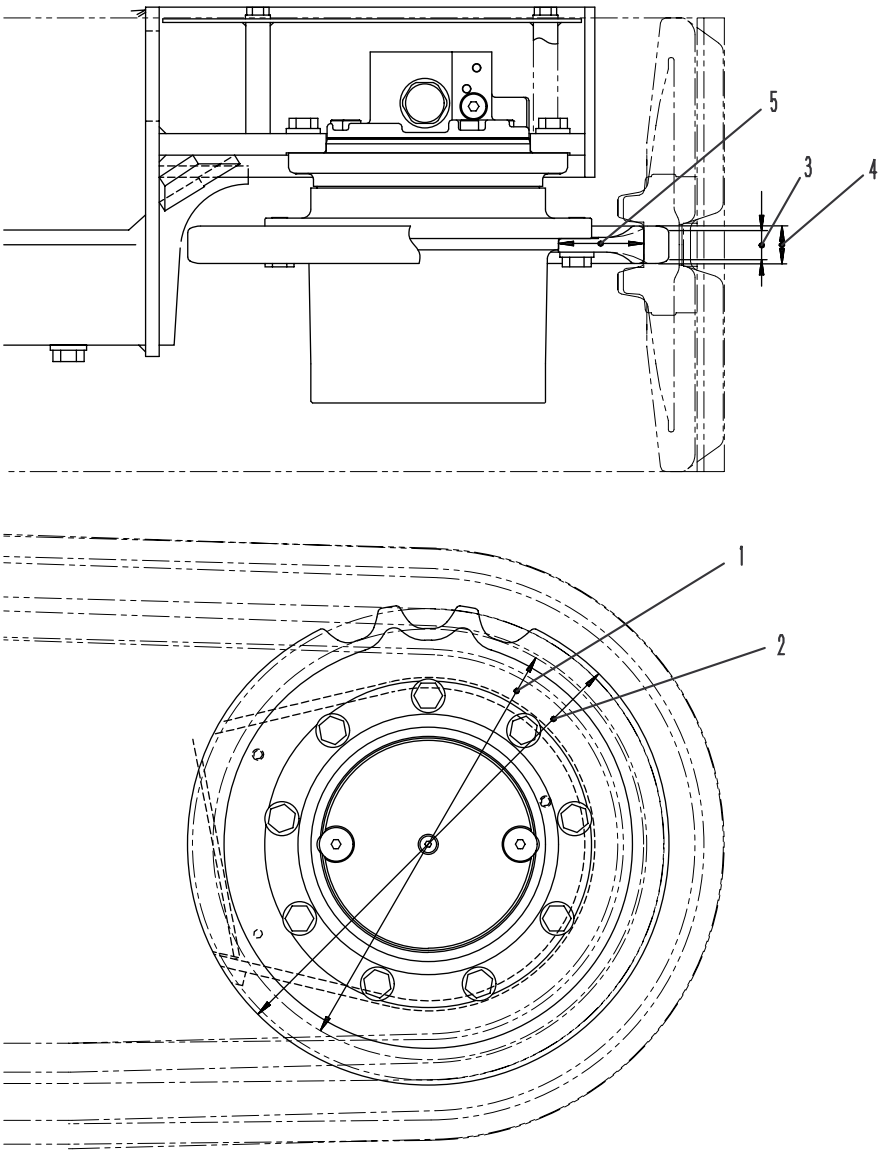
PC40R-8
PC45R-8



Unit: mm

No.	Check item		Criteria		Remedy
1	Backlash between swing motor shaft and No. 1 sun gear		Standard clearance	Clearance limit	Replace
			0.04 – 0.11	—	
2	Backlash between No. 1 sun gear and No. 1 planetary gear		0.12 – 0.28	0.6	
3	Backlash between No. 1 planetary gear and ring gear		0.14 – 0.38	0.6	
4	Backlash between No. 1 planetary carrier and No. 2 sun gear		0.10 – 0.26	—	
5	Backlash between No. 2 sun gear and No. 2 planetary gear		0.12 – 0.28	0.6	
6	Backlash between No. 2 planetary gear and ring gear		0.14 – 0.38	0.6	
7	Backlash between No. 2 planetary carrier and swing pinion		0.07 – 0.21	—	
8	Backlash between swing pinion and swing circle	PC40R	0.21 – 0.84	2.0	
		PC45R	0.14 – 0.73	2.0	
9	Wear of oil seal contact surface of swing pinion collar		Standard size	Repair limit	Repair hard chrome plating or replace
			$\phi 52_{-0.074}^{0}$	—	

SPROCKET

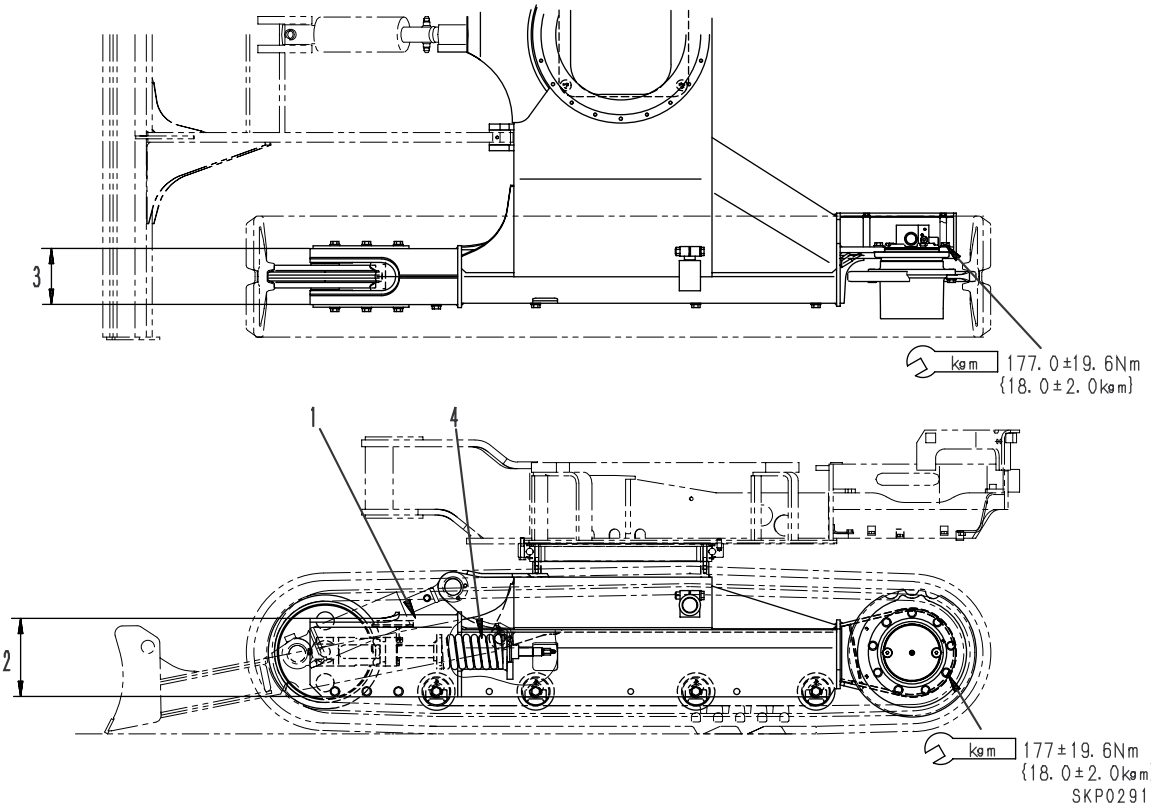


Unit: mm

No.	Check item		Criteria			Remedy
		Model	Standard size	Repair limit	Repair limit	
1	Wear of diameter of sprocket tooth root	PC30R PC35R	344.3	+1.0 −2.0	332	
		PC40R PC45R	380.37	+1.0 −2.0	368	
2	Wear of diameter of sprocket tooth tip	PC30R PC35R	386.2	+1.5	374	
		PC40R PC45R	423.99	0 −3	412	
3	Wear of width of sprocket tooth tip	PC30R PC35R	20	—	18	Rebuild or replace
		PC40R PC45R	26	—	24	
4	Wear of width of sprocket tooth root	PC30R PC35R	27	+0.5 −1.0	24	
		PC40R PC45R	33	+0.5 −1.0	30	
5	Thickness of metal at sprocket tooth root	PC30R PC35R	67.15	+0.983 −2.150	61.0	
		PC40R PC45R	75.185	+0.983 −2.150	69.0	

TRACK FRAME, RECOIL SPRING

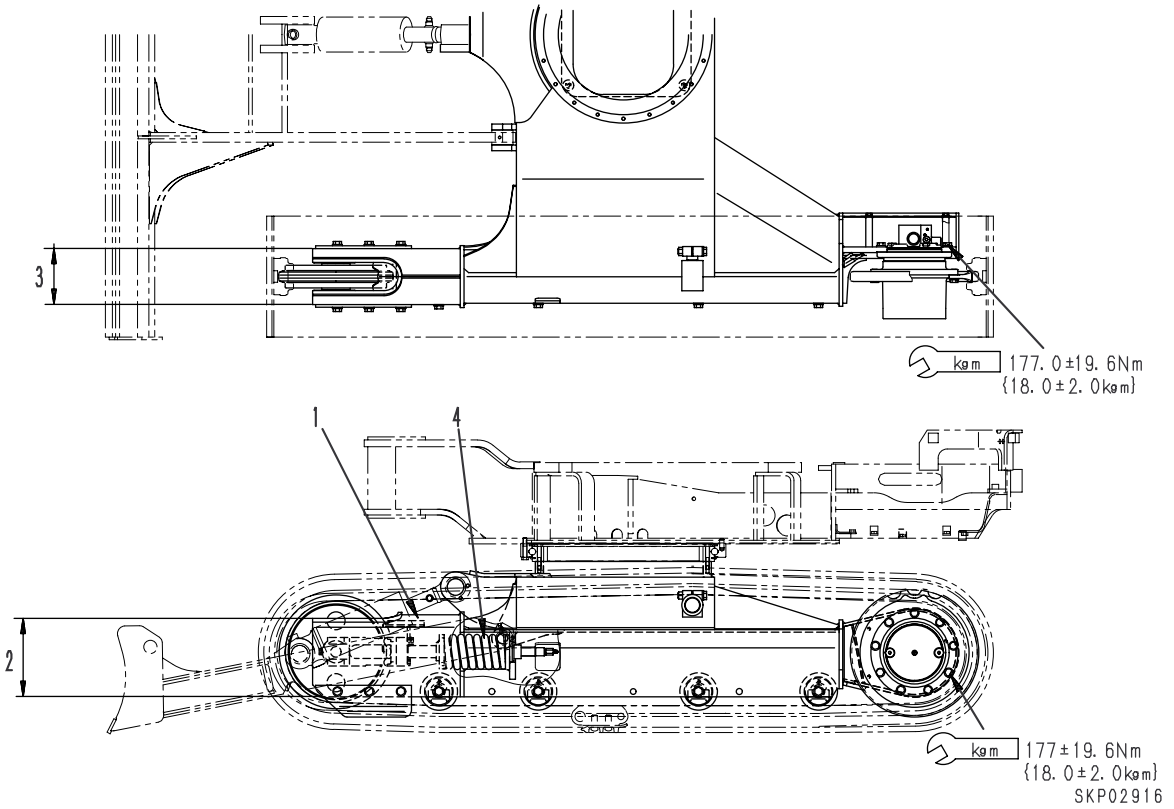
RUBBER SHOE



Unit: mm

No.	Check item		Criteria					Remedy
1	Deformation of frame			Repair limit				Correct
			Curvature	5 (for length of 1,000)				
			Twisting	5 (for level length of 300)				
			Opening of idler	5				
2	Top-bottom width of idler guide portion			Standard size	Repair limit			Rebuild
			Track frame	96	100			
			Idler support	94	90			Rebuild or replace
3	Left-right width of idler guide portion		Track frame	161	165			Rebuild
			Idler support	159	155			Rebuild or replace
4	Recoil spring		Standard size			Repair limit		Replace
			Free length	Installed length	Installed load	Free length	Installed load	
		PC30R PC35R	257	188.1	30.9 kN {3,151 kg}	251.5	28.4 kN {2,899 kg}	
		PC40R PC45R	302	202.2	42.4 kN {4,326 kg}	294.0	30.9 kN {3,980 kg}	

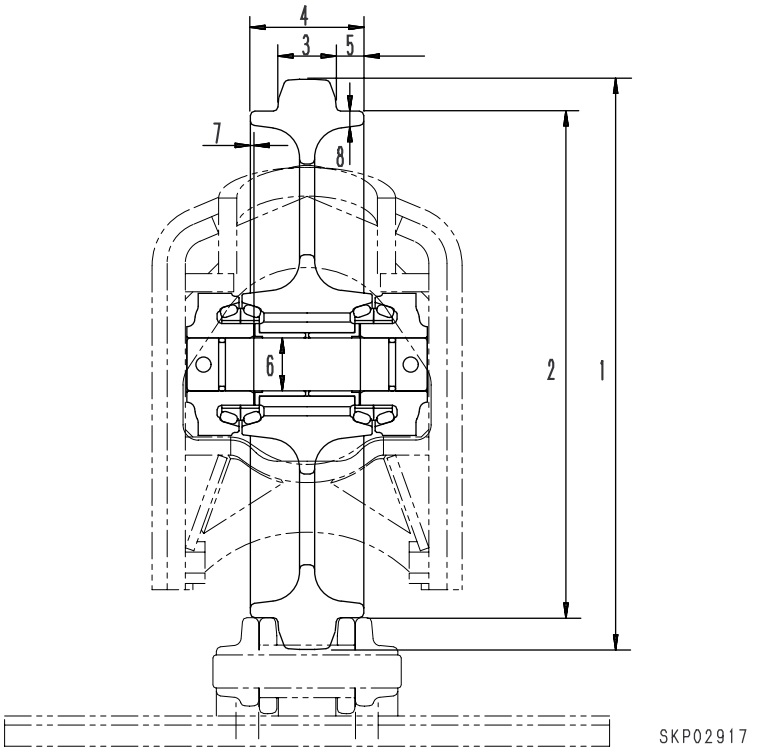
DOUBLE SHOE, TRIPLE SHOE, SWAMP SHOE, ROAD LINER



Unit: mm

No.	Check item		Criteria					Remedy
1	Deformation of frame			Repair limit				Correct
			Curvature	5 (for length of 1,000)				
			Twisting	5 (for level length of 300)				
			Opening of idler	5				
2	Top-bottom width of idler guide portion			Standard size	Repair limit			Rebuild
			Track frame	96	100			
			Idler support	94	90			Rebuild or replace
3	Left-right width of idler guide portion		Track frame	161	165			Rebuild
			Idler support	159	155			Rebuild or replace
4	Recoil spring		Standard size			Repair limit		Replace
			Free length	Installed length	Installed load	Free length	Installed load	
		PC30R PC35R	257	213.1	19.7 kN {2,008 kg}	252.2	17.5 kN {1,787 kg}	
		PC40R PC45R	302	238.2	26.9 kN {3,748 kg}	295.0	24.0 kN {2,446 kg}	

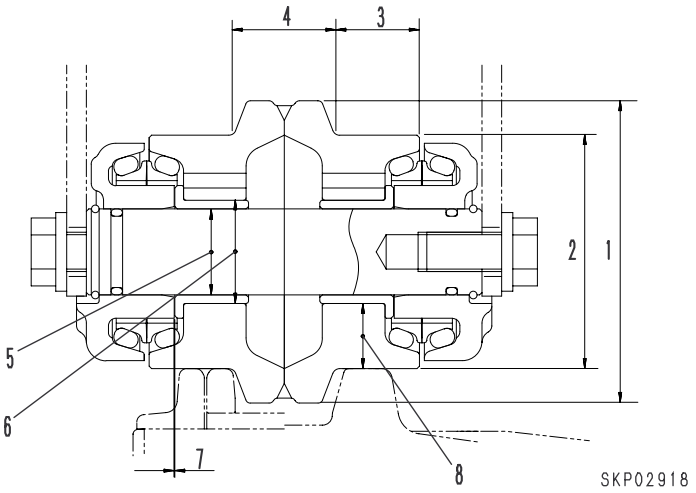
IDLER



Unit: mm

No.	Check item		Criteria					Remedy
1	Outside diameter of protruding portion		Standard size		Repair limit			Rebuild or replace
		PC30R, 35R	347		339			
		PC40R, 45R	377		369			
2	Outside diameter of tread	PC30R, 35R	305		297			
		PC40R, 45R	335		327			
3	Width of protruding portion	PC30R, 35R	28		20			
		PC40R, 45R	39		31			
4	Overall width	PC30R, 35R	64		59			
		PC40R, 45R	75		70			
5	Width of tread		18		22			Replace
6	Clearance between idler shaft and bushing		Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
			35	–0.025 –0.064	–0.142 –0.080	0.105 – 0.206	1.5	
7	Side clearance of idler		Standard size		Repair limit			
			0.25		1.0			
8	Thickness of metal on idler tread (center of tread width)	PC30R, 35R	8.6		4.6			Rebuild or replace
		PC40R, 45R	10.3		6.3			

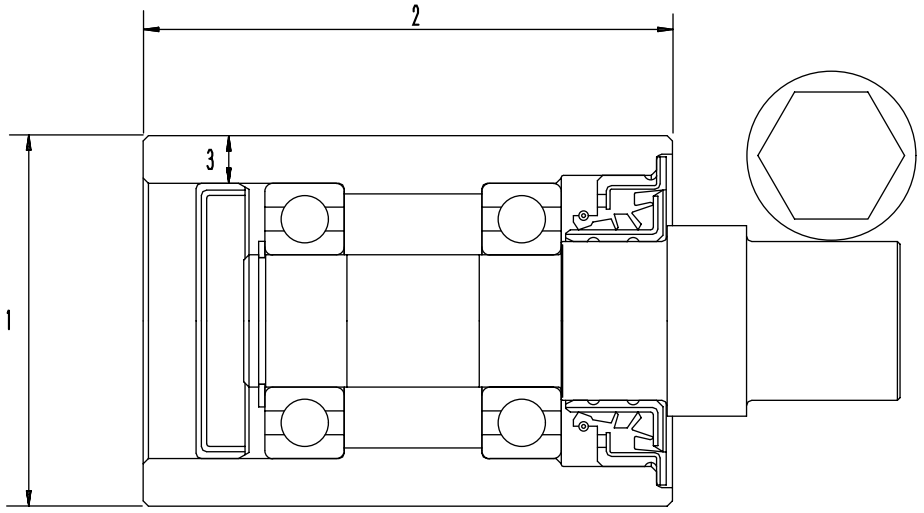
TRACK ROLLER



Unit: mm

No.	Check item		Criteria					Remedy
1	Outside diameter of protruding portion		Standard size			Repair limit		Rebuild or replace
		PC30R, 35R	112			106		
		PC40R, 45R	123			117		
2	Outside diameter of tread	PC30R, 35R	85			77		
		PC40R, 45R	95			87		
3	Width of tread	PC30R, 35R	34			37		
		PC40R, 45R	34.5			37.5		
4	Width of flange	PC30R, 35R	26			20		
		PC40R, 45R	41			35		
5	Clearance between shaft and bushing		Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
		PC30R, 35R	25	0 –0.013	+0.183 +0.144	0.144 – 0.196	1.5	
		PC40R, 45R	35	–0.025 –0.054	+0.142 +0.080	0.105 – 0.192		
6	Interference between roller and bushing		Standard size	Tolerance		Standard interference	Interference limit	
				Shaft	Hole			
		PC30R, 35R	32	–0.073 –0.048	+0.030 0	0.018 – 0.073	—	
		PC40R, 45R	42	–0.079 –0.054		0.024 – 0.079	—	
7	Side clearance of shaft		Standard clearance			Clearance limit		
		PC30R, 35R	0.20			0.74		
		PC40R, 45R	0.25			0.81		Replace bushing
8	Thickness of metal at track roller tread		Standard size			Repair limit		Rebuild or replace
			26.5			22.5		

CARRIER ROLLER



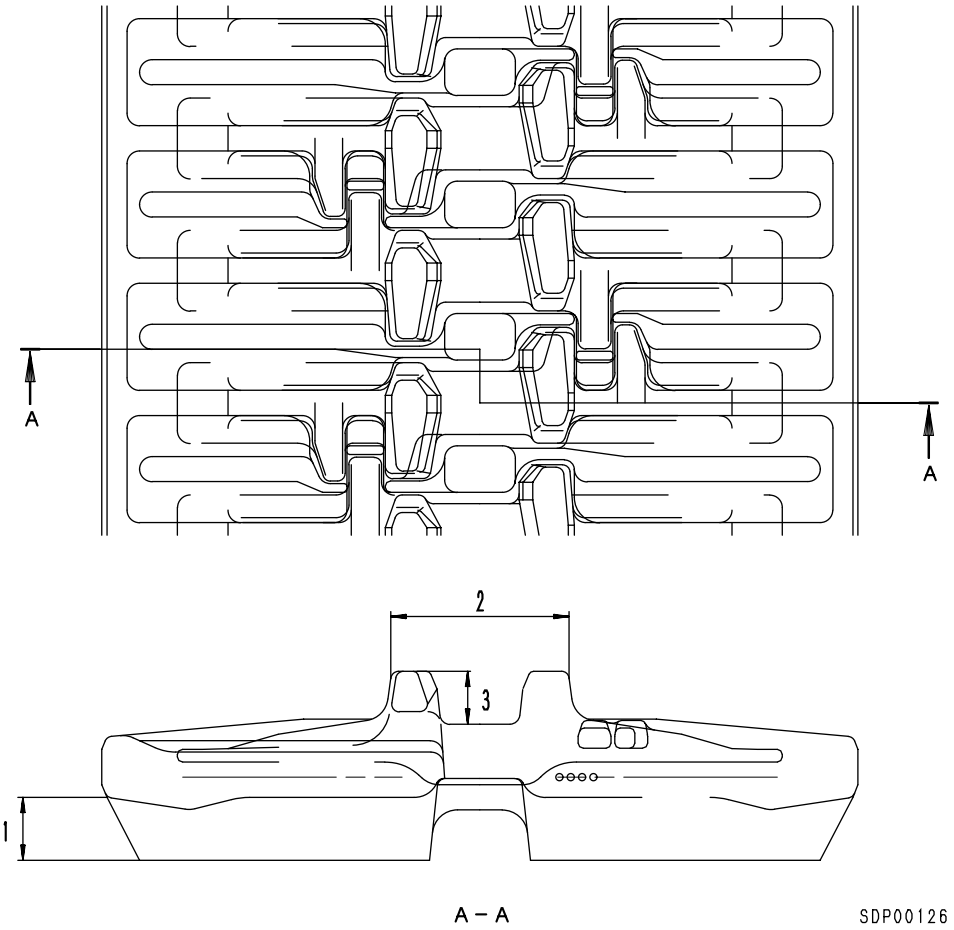
SKP02919

Unit: mm

No.	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Outside diameter of tread	70	65	Rebuild or replace
2	Width of tread	100	—	—
3	Thickness of metal at carrier roller tread	9	6.5	Rebuild or replace

TRACK SHOE

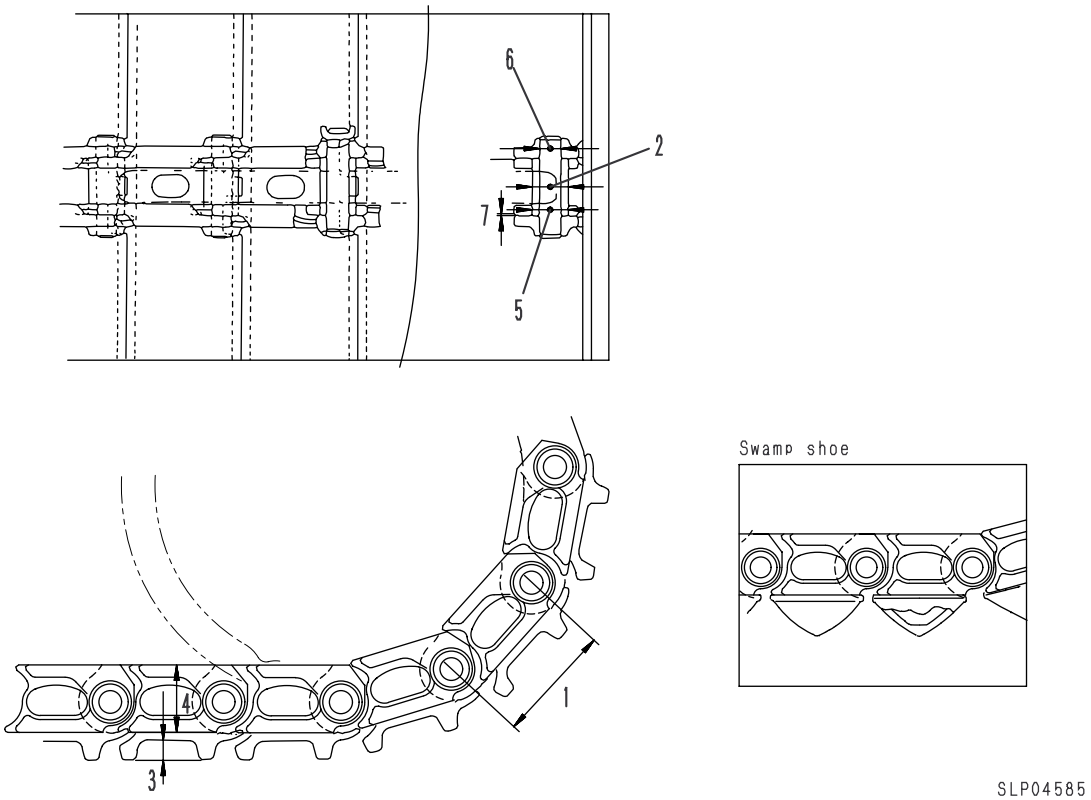
RUBBER SHOE



Unit: mm

No.	Check item		Criteria			Remedy
1	Wear of lug height		Standard size: 25	Repair limit: 5		Rebuild or replace
2	Wear of roller guard portion	PC30R PC35R	70	62		Replace
		PC40R PC45R	86	68		Rebuild or replace
3	Wear of sprocket meshing portion		Standard size	Repair limit	Repair limit	Rebuild or replace
		PC30R PC35R	21	±0.5	25	
		PC40R PC45R	23		27	

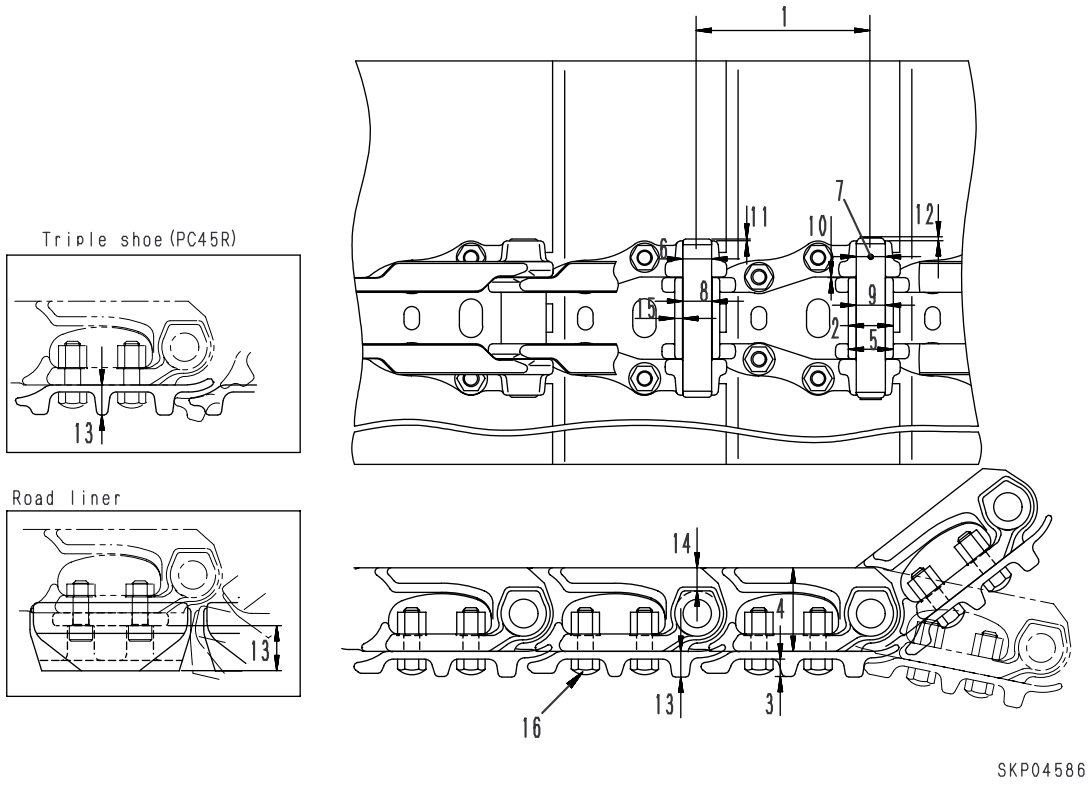
DOUBLE SHOE, SWAMP SHOE
PC30R, 35R



Unit: mm

No.	Check item		Criteria					Remedy
1	Link pitch		Standard size: 102	Turnover limit: —	Repair limit: 107			If over repair limit, replace bushing or pin, or replace whole link assembly
2	Outside diameter of bushing		32	—	26			
3	Grouser height		Standard size		Repair limit			Weld lug or replace
		Double	16.5		10			
		Swamp	40		33			
4	Link height		61		55			Rebuild or replace
5	Interference between bushing and link		Standard size: 32	Tolerance: Shaft +0.15 +0.12	Tolerance: Hole +0.05 0	Standard interference: 0.07 – 0.16	Interference limit: —	Replace
6	Interference between regular pin and link		19	+0.15 +0.12	+0.05 0	0.07 – 0.16	—	
7	Clearance between master pin and link		Standard size: Shaft 18.93 Hole 19	Tolerance: Shaft +0.15 0	Tolerance: Hole +0.05 0	Standard clearance: 0.02 – 0.12	Clearance limit: —	
8	Clearance between regular pin and bushing		Shaft 18.93 Hole 19.5	+0.15 +0.12	±0.2	0.15 – 0.58	—	
9	Clearance between master pin and bushing		Shaft 18.93 Hole 19.5	+0.05 0	±0.2	0.32 – 0.77	—	
10	Clearance of link mating surface		Standard clearance (one side): 0.2 – 0.9	Standard clearance (both sides): 0.4 – 1.8	Clearance limit (one side): —			Adjust
11	Protrusion of regular pin		1.5					
12	Thickness of metal of grouser		Standard size		Repair limit			Weld lug or replace
		Double	22.5		16			
		Swamp	12		5			
13	Thickness of metal at link (bushing press-fitting portion)		15.5		9.5			Rebuild or replace
14	Thickness of metal of bushing		6.25		3.25			Turn or replace

TRIPLE SHOE, ROAD LINER
PC40R, 45R



Unit: mm

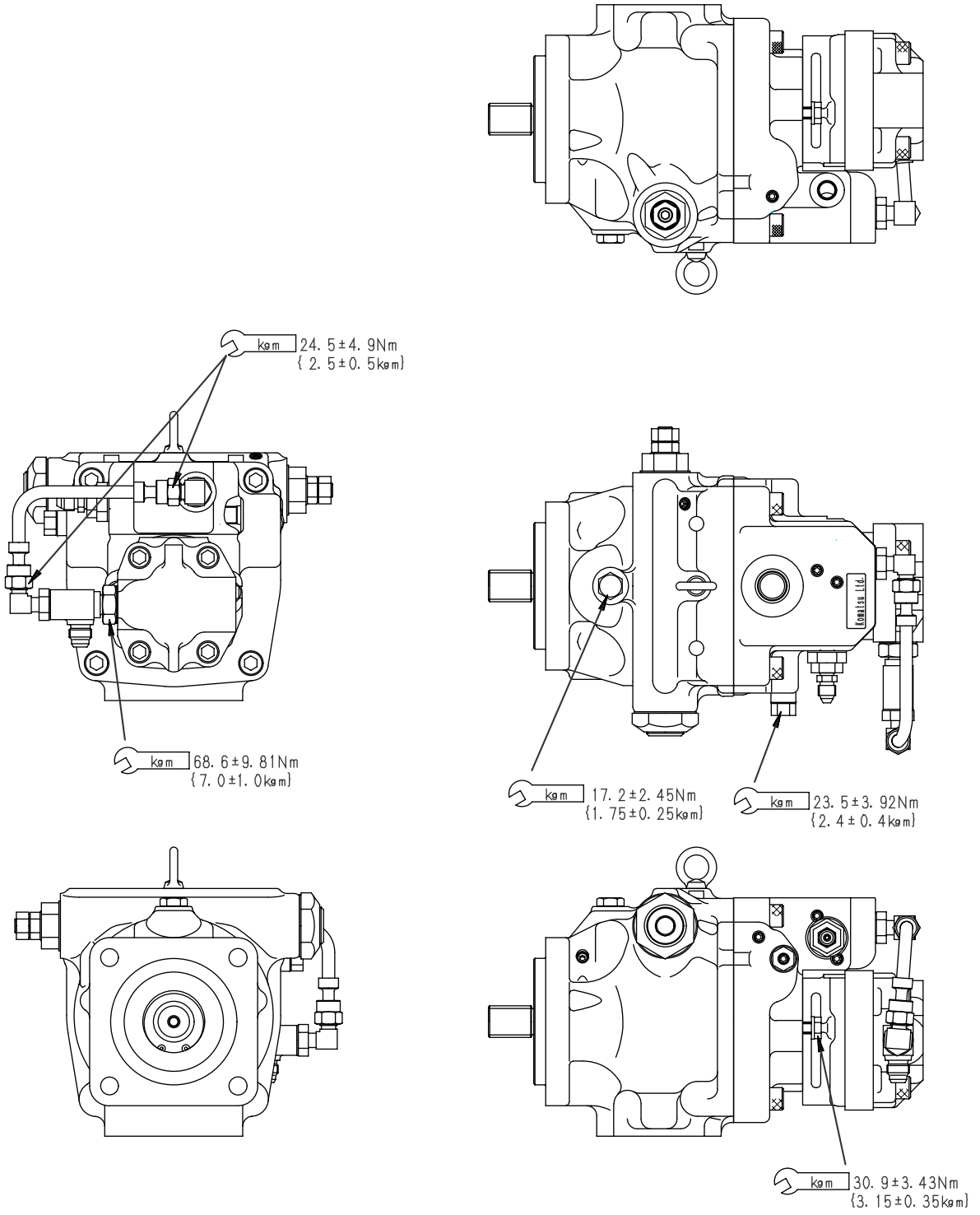
No.	Check item		Criteria					Remedy
1	Link pitch		Standard size		Turnover limit		Repair limit	It is possible to turn bushing and pin and use until turning limit is reached. If over repair limit, replace bushing or pin, or replace whole link assembly
			135		138		143	
2	Outside diameter of bushing		35		32		29	
3	Grouser height		Standard size		Repair limit			
		Triple	PC40R 14 PC45R 18		10			Weld lug or replace
		Road liner	35		17			Replace
4	Link height		65		59			Rebuild or replace
5	Interference between bushing and link		Standard size	Tolerance		Standard interference	Interference limit	Replace
				Shaft	Hole			
			Shaft 35 Hole 34.85	+0.030 0	+0.040 0	0.110 – 0.180	—	
6	Interference between regular pin and link		Shaft 22.5 Hole 22.3	+0.060 0	+0.052 0	0.148 – 0.260	—	
7	Interference between master pin and link		Shaft 22.5 Hole 22.3	–0.030 –0.070	+0.0552 0	0.078 – 0.170	—	
8	Clearance between regular pin and bushing		Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
			Shaft 22.5 Hole 22.9	+0.060 0	±0.2	0.140 – 0.600	—	
9	Clearance between master pin and bushing		Shaft 22.5 Hole 22.9	–0.200 –0.400	±0.2	0.400 – 1.000	—	
10	Clearance of link mating surface		Standard clearance (one side)		Standard clearance (both sides)		Clearance limit (one side)	Adjust
			0.7 – 1.4		1.4 – 2.8		—	
11	Protrusion of regular pin		1.5					
12	Protrusion of master pin		3.25					
13	Thickness of metal of grouser		Standard size		Repair limit			
		Triple	PC40R 20 PC45R 24		16			Weld lug or replace
		Road liner	—		—			Replace
14	Thickness of metal at link (bushing press-fitting portion)		18.075		12.075			Rebuild or replace
15	Thickness of metal of bushing		6.05		3.05			Turn or replace
16	Tightening torque of shoe bolt		137 ± 19.6 Nm {14 ± 2 kgm}					Tighten

CENTER SWIVEL JOINT

Unit: mm

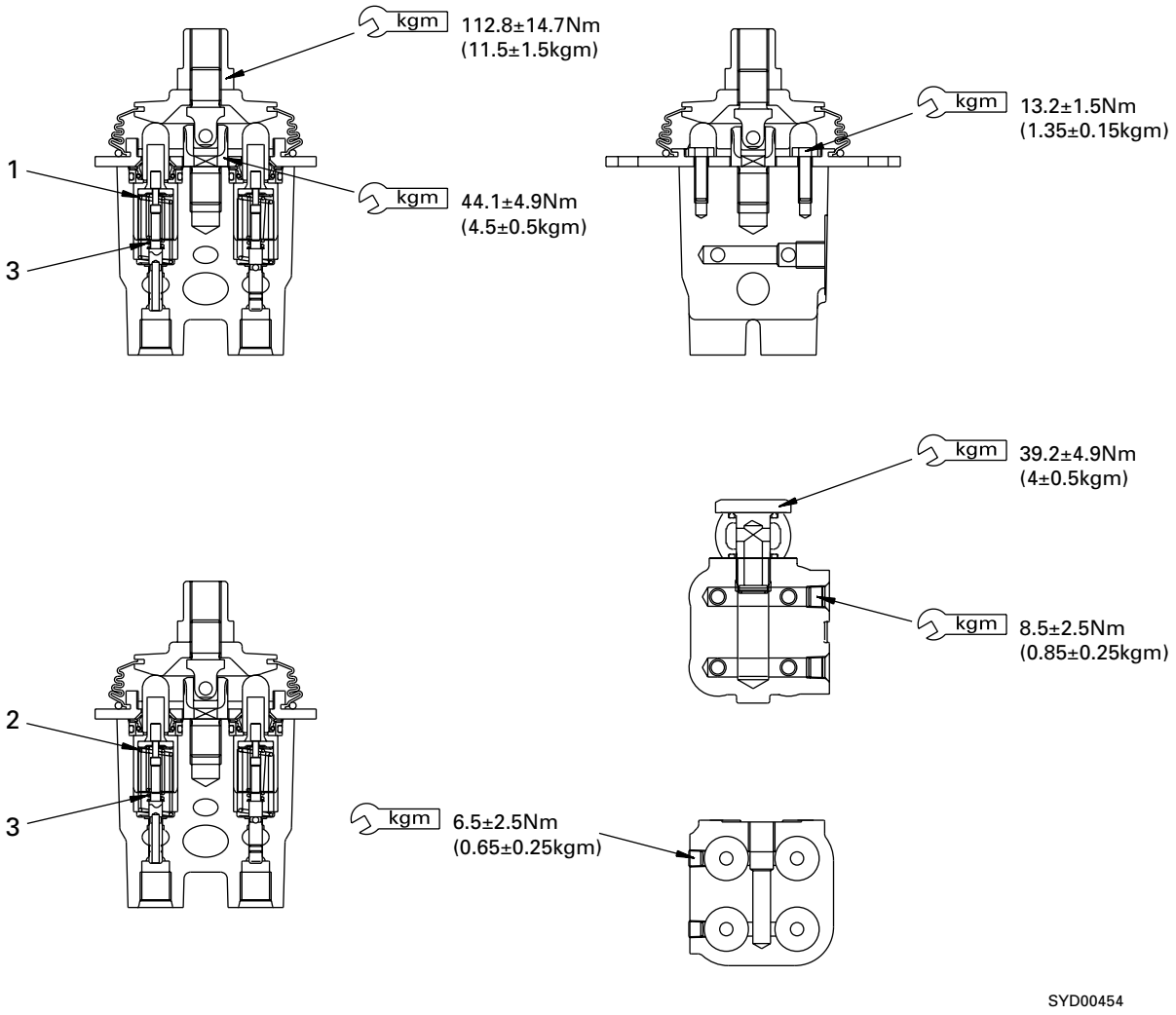
No.	Check item	Criteria			Remedy
		Standard size	Standard clearance	Repair limit	
1	Clearance between rotor and shaft	60			Replace

HYDRAULIC PUMP



SKP02923

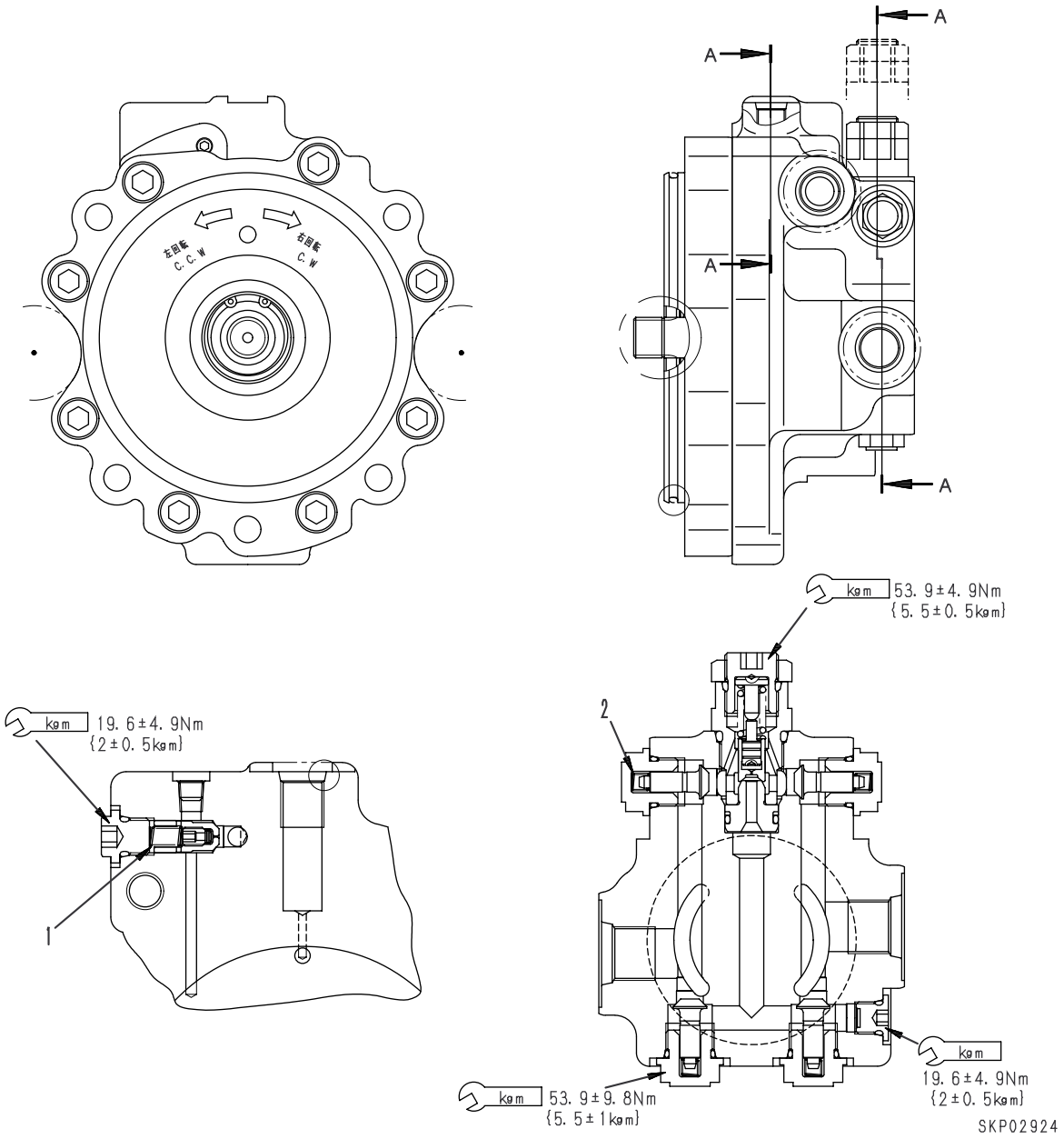
WORK EQUIPMENT, SWING PPC VALVE



Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length × OD	Installed length	Installed load	Installed length	Installed load	
1	Centering spring (for P3, P4)	42.4 × 15.5	34	29.4 N {3.0 kg}	—	23.5 N {2.4 kg}	Replace spring if damaged or deformed
2	Centering spring (for P1, P2)	44.4 × 15.5	34	39.2 N {4.0 kg}	—	31.4 N {3.2 kg}	
3	Metering spring	26.5 × 8.2	24.9	16.7 N {1.7 kg}	—	13.7 N {1.4 kg}	

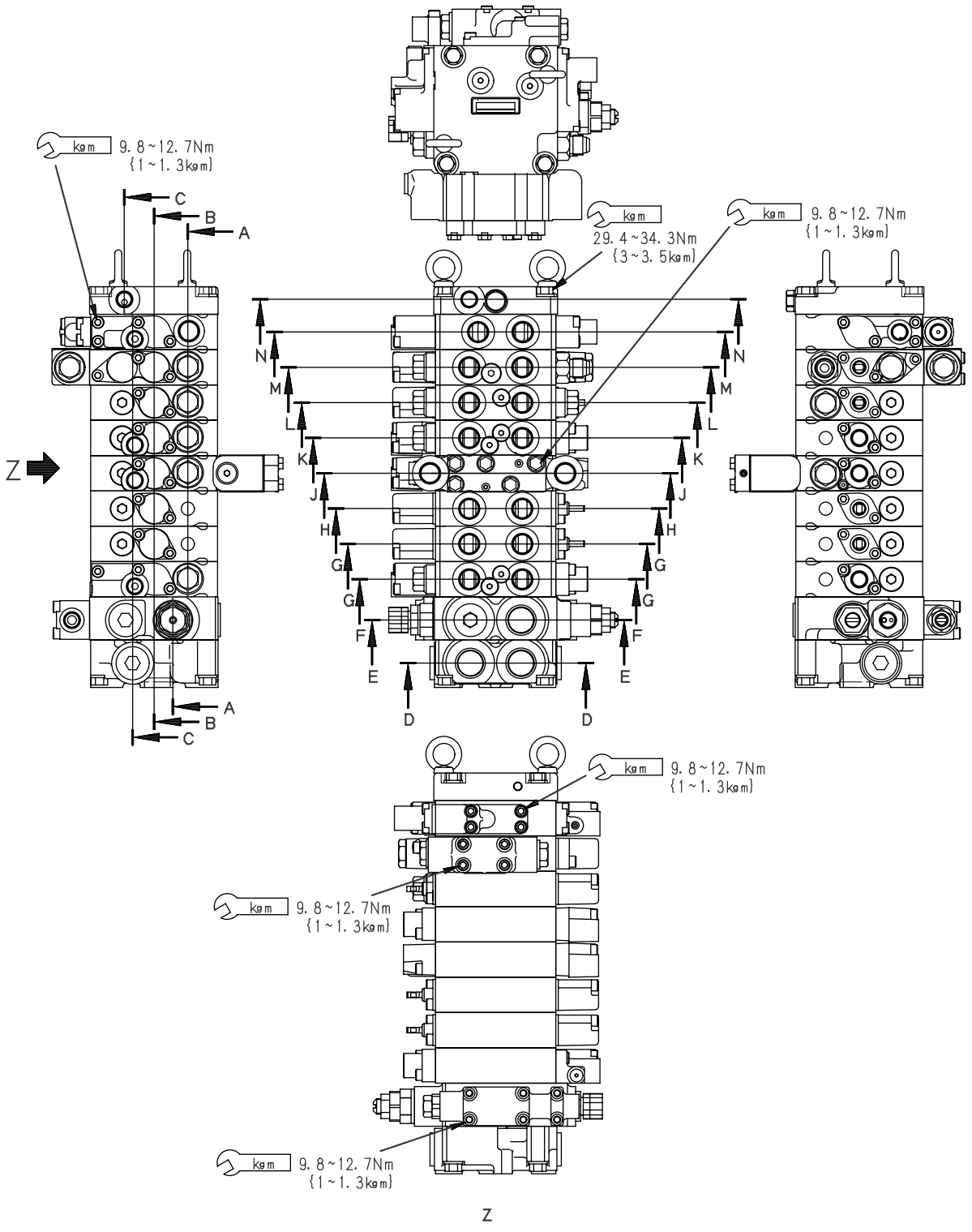
SWING MOTOR

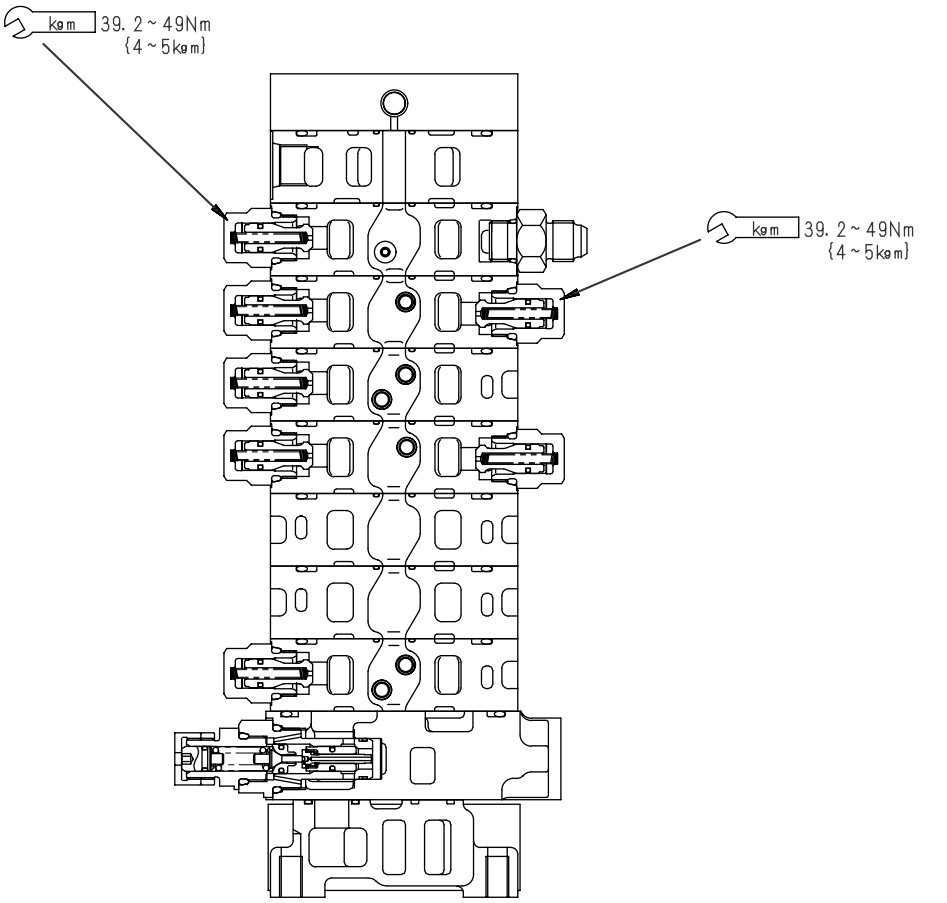


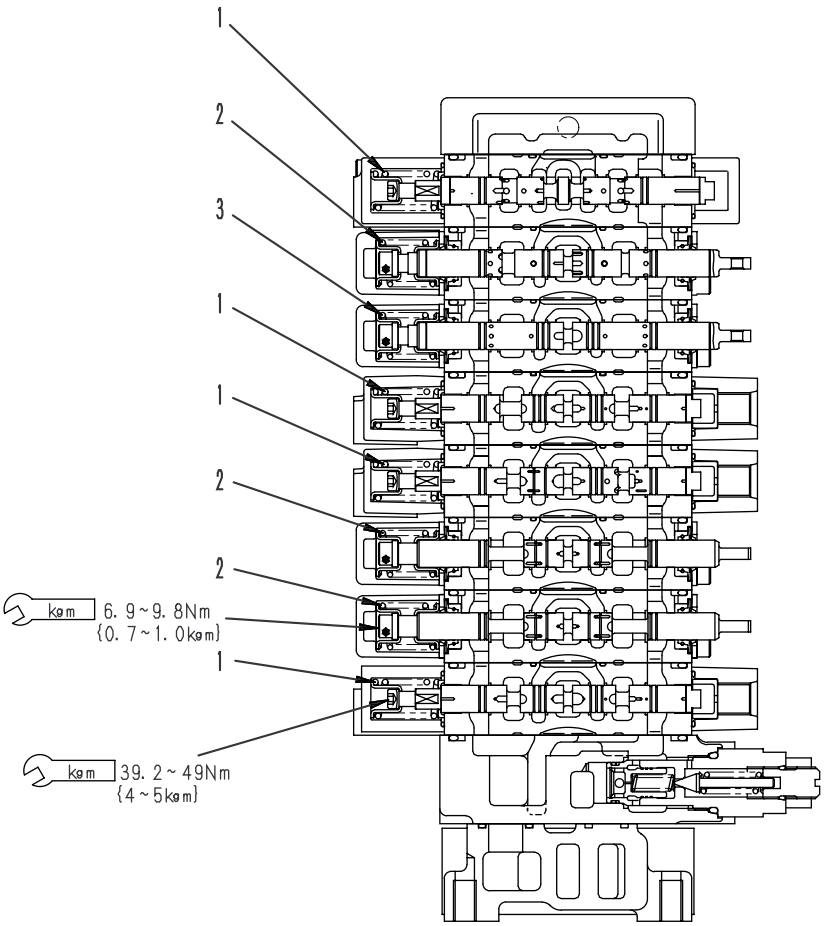
Unit: mm

No.	Check item	Criteria				Remedy
		Standard size			Repair limit	
1	Timer valve spring	Free length × OD	Installed length	Installed load	Installed load	Replace spring if damaged or deformed
		12.6 × 6.5	10.5	19.6 N {0.2 kg}	1.47 N {0.15 kg}	
2	Valve return spring	13.0 × 6.5	7.0	3.43 N {0.35 kg}	2.55 N {0.26 kg}	

9-SPOOL CONTROL VALVE




kgm 39.2~49Nm
{4~5kgm}
kgm 39.2~49Nm
{4~5kgm}
A – A
SKP02926

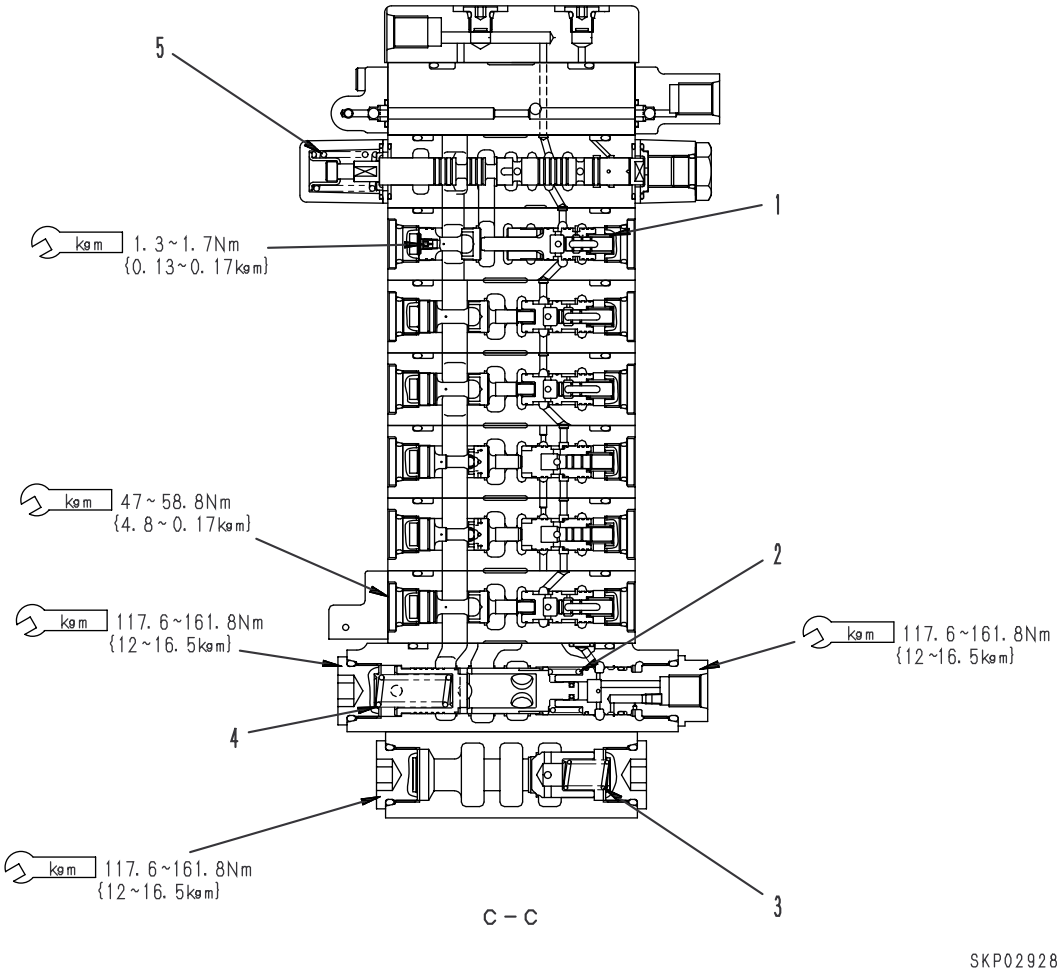


B – B

SKP02927

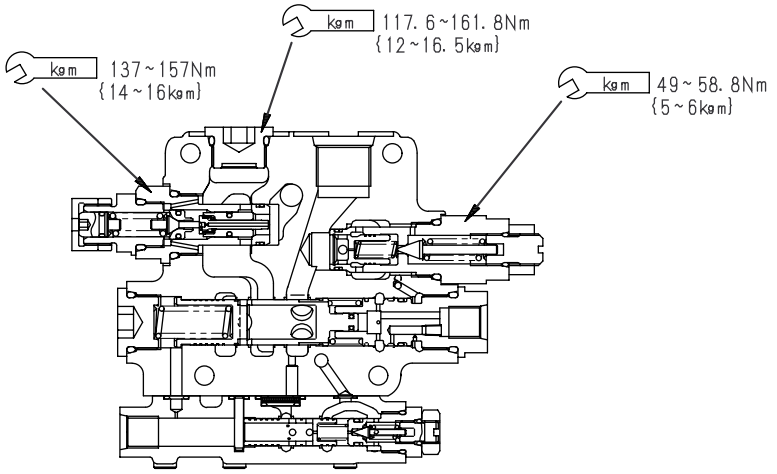
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length × OD	Installed length	Installed load	Installed length	Installed load	
1	Spool return spring (boom, arm, bucket, swing)	29 × 17.5	28.5	22.6 N {2.3 kg}	—	18.1 N {1.8 kg}	Replace spring if damaged or deformed
2	Spool return spring (blade, travel)	46.2 × 20	25.4	98 N {10 kg}	—	78.4 N {8.0 kg}	
3	Spool return spring (boom swing)	42 × 20	25.4	74.5 N {7.6 kg}	—	59.6 N {6.1 kg}	

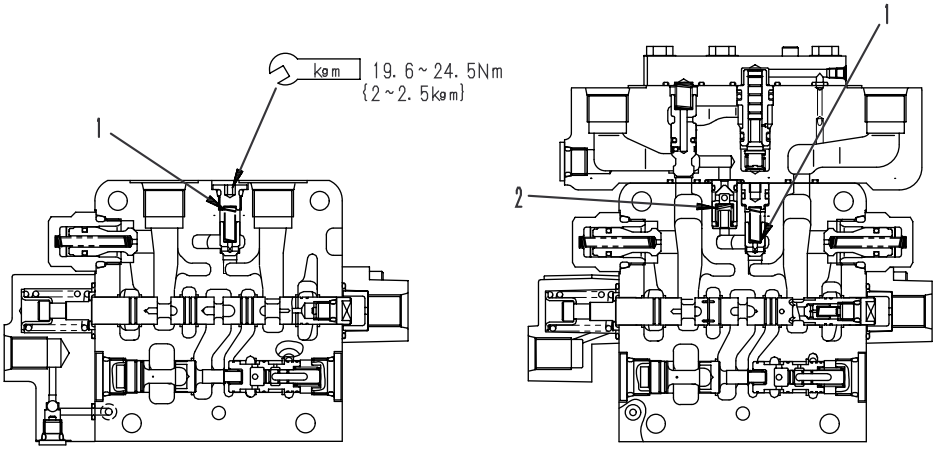


Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Pressure compensation valve spring	Free length × OD	Installed length	Installed load	Installed length	Installed load	Replace spring if damaged or deformed
		20 × 8.4	12	6.86 N {0.7 kg}	—	5.49 N {0.56 kg}	
2	Unload valve spring	28.57 × 19.2	15	193.2 N {19.7 kg}	—	154.6 N {15.8 kg}	
3	Cooler check valve spring	27.2 × 13.2	21	78.8 N {8.04 kg}	—	63 N {6.43 kg}	
4	Self-pressure reducing valve sequence valve spring	40.5 × 14.3	35.5	88.2 N {9.0 kg}	—	70.6 N {7.2 kg}	
5	Spool return spring (breaker)	29 × 17.5	28.5	22.6 N {2.3 kg}	—	18.1 N {1.8 kg}	



E – E

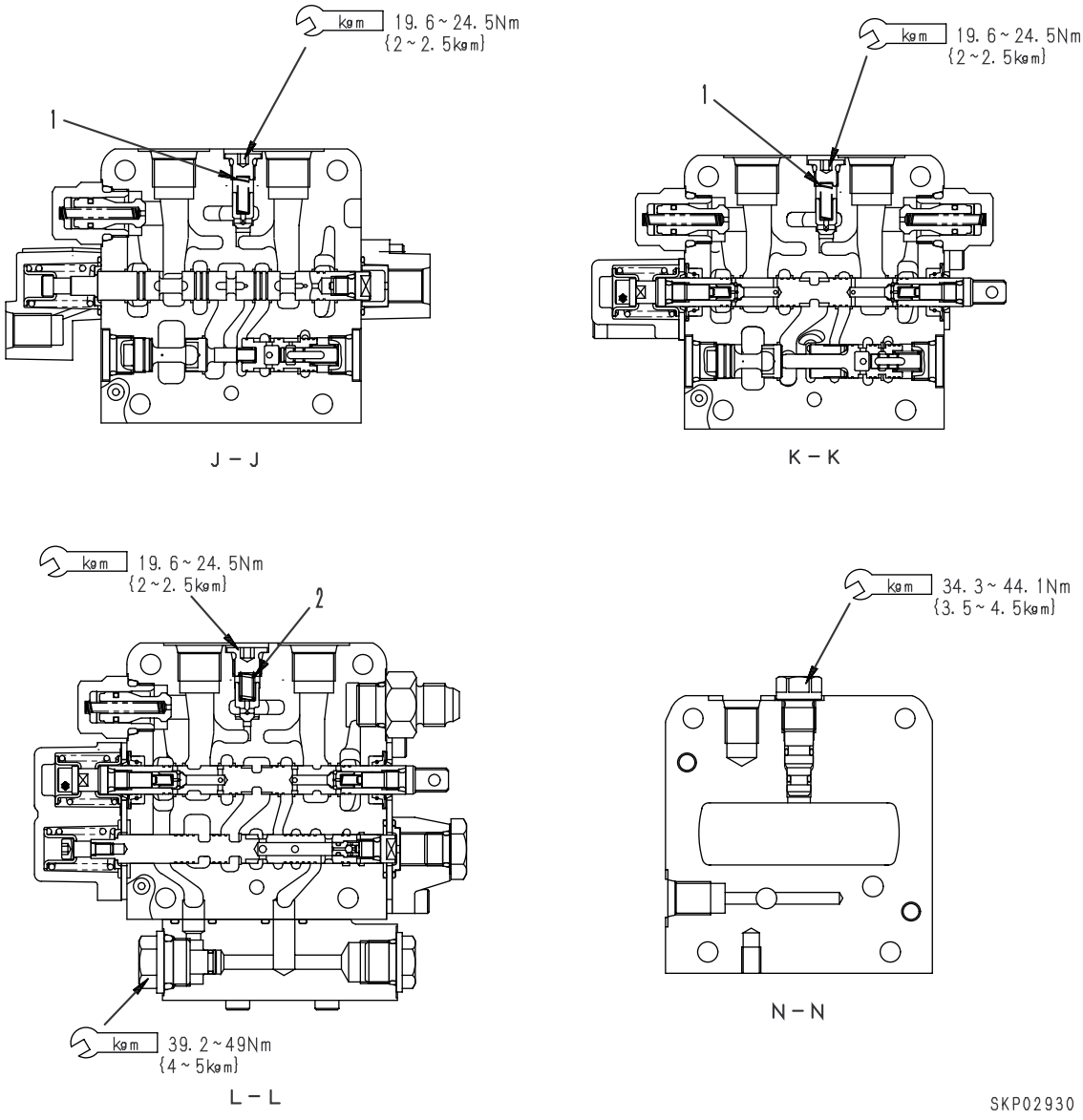


F – F H – H

SKP02929

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Check valve spring	Free length × OD	Installed length	Installed load	Installed length	Installed load	Replace spring if damaged or deformed
		21.9 × 5	15.8	1.96 N {0.2 kg}	—	1.57 N {0.16 kg}	
2	Check valve spring	13.7 × 7.6	9.8	13.83 N {1.41 kg}	—	11.1 N {1.13 kg}	

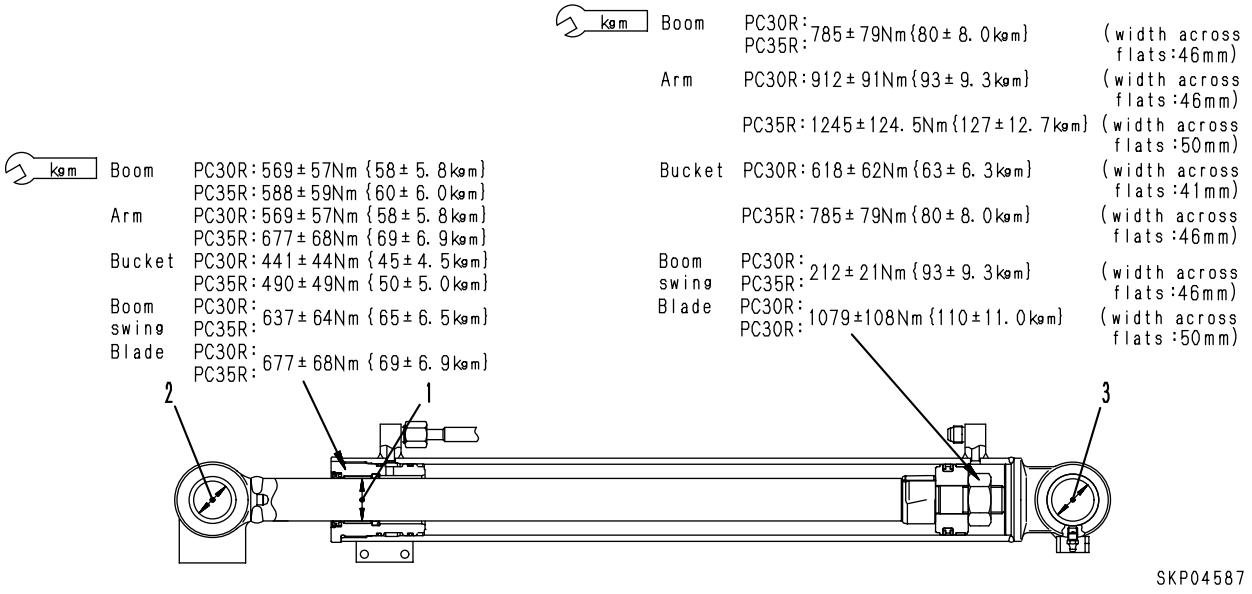


Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Check valve spring (bucket, boom swing)	Free length × OD	Installed length	Installed load	Installed length	Installed load	Replace spring if damaged or deformed
		21.9 × 5	15.8	1.96 N {0.2 kg}	—	1.57 N {0.16 kg}	
2	Check valve spring (blade)	13.97 × 6.5	11.8	19.7 N {2.01 kg}	—	15.8N {1.61 kg}	

HYDRAULIC CYLINDER

PC30R, 35R



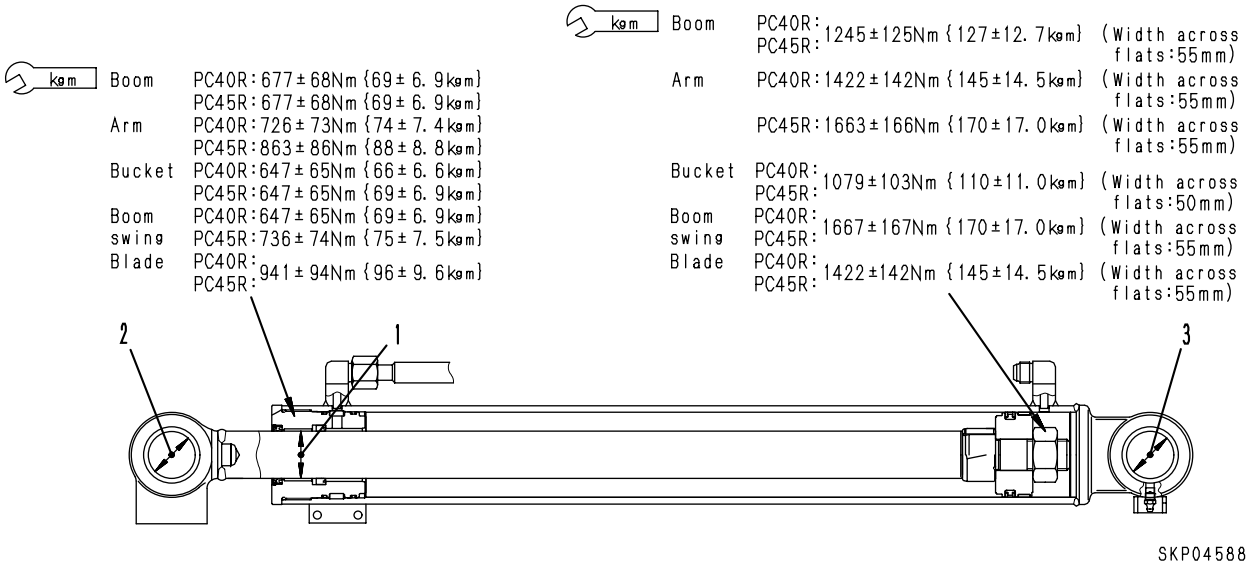
Unit: mm

No.	Check item	Criteria							Remedy
		Cylinder	Model	Standard size	Tolerance		Standard clearance	Clearance limit	
					Shaft	Hole			
1	Clearance between piston rod and bushing	Boom	PC30R PC35R	45	–0.025 –0.087	+0.152 +0.007	0.032 – 0.239	0.539	Replace bushing
		Arm	PC30R	40	–0.025 –0.087	+0.132 +0.006	0.031 – 0.219	0.519	
			PC35R	45	–0.025 –0.087	+0.152 +0.007	0.032 – 0.239	0.539	
		Bucket	PC30R PC35R	40	–0.025 –0.087	+0.132 +0.006	0.031 – 0.219	0.519	
		Boom swing	PC30R PC35R	45	–0.025 –0.087	+0.125 +0.007	0.032 – 0.239	0.539	
		Blade	PC30R PC35R	45	–0.025 –0.087	+0.152 +0.007	0.032 – 0.239	0.539	

Unit: mm

No.	Check item	Criteria					Remedy
		Cylinder	Model	Standard size	Tolerance Hole	Clearance limit	
2	Clearance between piston rod support shaft and bushing	Boom	PC30R PC35R	40	+0.142 +0.080	1.0	Replace bushing
		Arm	PC30R PC35R	40	+0.142 +0.080	1.0	
		Bucket	PC30R PC35R	35	+0.142 +0.080	1.0	
		Boom swing	PC30R PC35R	45	+0.128 +0.075	1.0	
		Blade	PC30R PC35R	50	+0.142 +0.080	1.0	
3	Clearance between cylinder bottom end support shaft and bushing	Boom	PC30R PC35R	45	+0.128 +0.075	1.0	Replace bushing
		Arm	PC30R PC35R	40	+0.142 +0.080	1.0	
		Bucket	PC30R PC35R	35	+0.142 +0.080	1.0	
		Boom swing	PC30R PC35R	45	+0.142 +0.080	1.0	
		Blade	PC30R PC35R	50	+0.142 +0.080	1.0	

PC40R, 45R



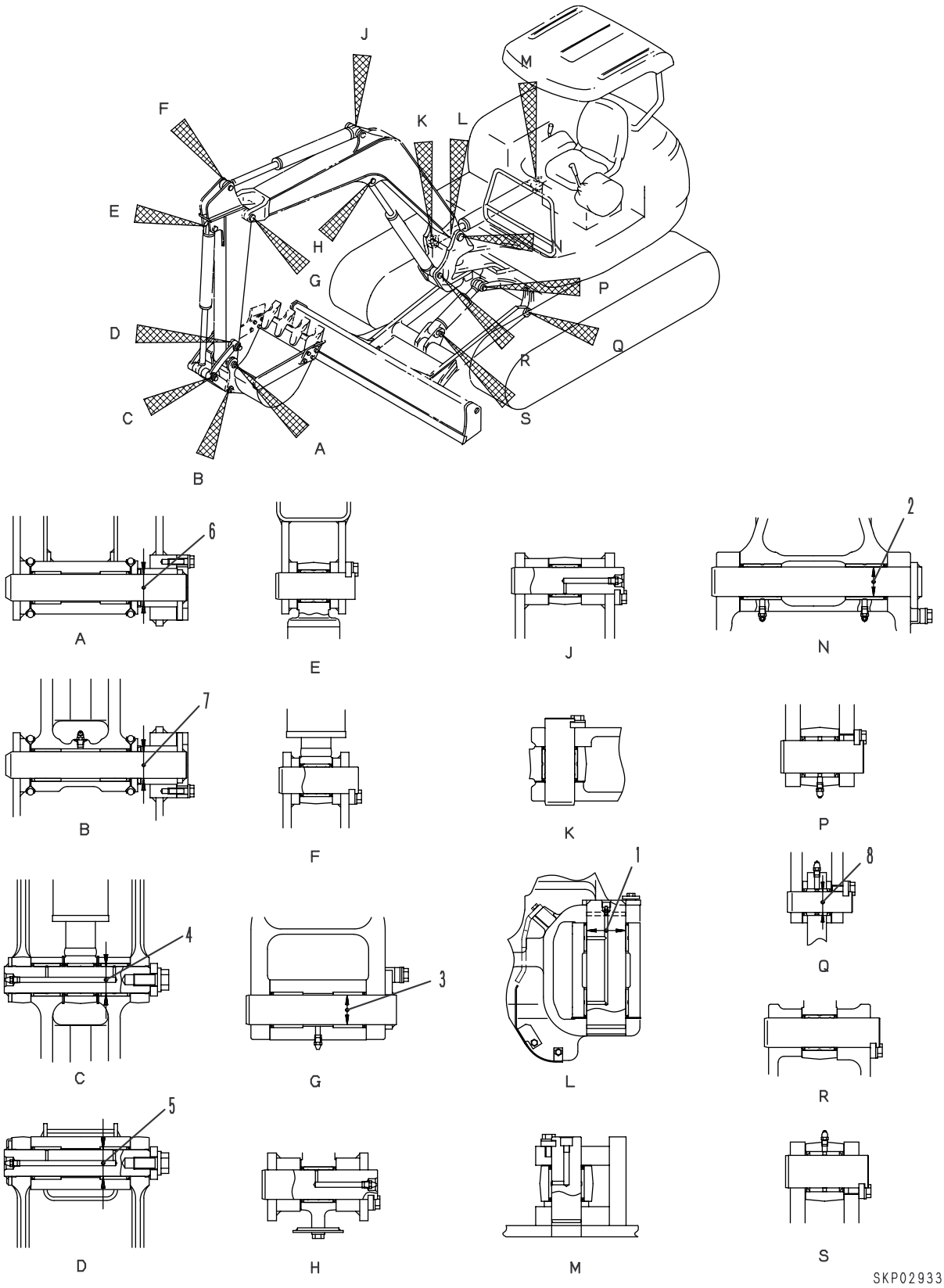
Unit: mm

No.	Check item	Criteria							Remedy
		Cylinder	Model	Standard size	Tolerance		Standard clearance	Clearance limit	
					Shaft	Hole			
1	Clearance between piston rod and bushing	Boom	PC40R PC45R	50	–0.025 –0.087	+0.164 +0.007	0.032 – 0.251	0.551	Replace bushing
		Arm	PC40R	50	–0.025 –0.087	+0.164 +0.006	0.032 – 0.251	0.551	
		Bucket	PC40R	45	–0.025 –0.087	+0.152 +0.007	0.032 – 0.239	0.539	
			PC45R	50	–0.025 –0.087	+0.164 +0.007	0.032 – 0.251	0.551	
		Boom swing	PC40R PC45R	50	–0.025 –0.087	+0.164 +0.006	0.032 – 0.251	0.551	
		Blade	PC40R PC45R	50	–0.025 –0.087	+0.164 +0.007	0.032 – 0.251	0.551	

Unit: mm

No.	Check item	Criteria					Remedy
		Cylinder	Model	Standard size	Tolerance Hole	Clearance limit	
2	Clearance between piston rod support shaft and bushing	Boom	PC40R PC45R	50	+0.142 +0.080	1.0	Replace bushing
		Arm	PC40R PC45R	45	+0.128 +0.075	1.0	
		Bucket	PC40R PC45R	45	+0.142 +0.080	1.0	
		Boom swing	PC40R PC45R	50	+0.142 +0.080	1.0	
		Blade	PC40R PC45R	55	+0.174 +0.100	1.0	
3	Clearance between cylinder bottom end support shaft and bushing	Boom	PC40R PC45R	50	+0.142 +0.080	1.0	Replace bushing
		Arm	PC40R PC45R	45	+0.142 +0.080	1.0	
		Bucket	PC40R PC45R	45	+0.128 +0.075	1.0	
		Boom swing	PC40R PC45R	50	+0.142 +0.080	1.0	
		Blade	PC40R PC45R	55	+0.174 +0.100	1.0	

WORK EQUIPMENT

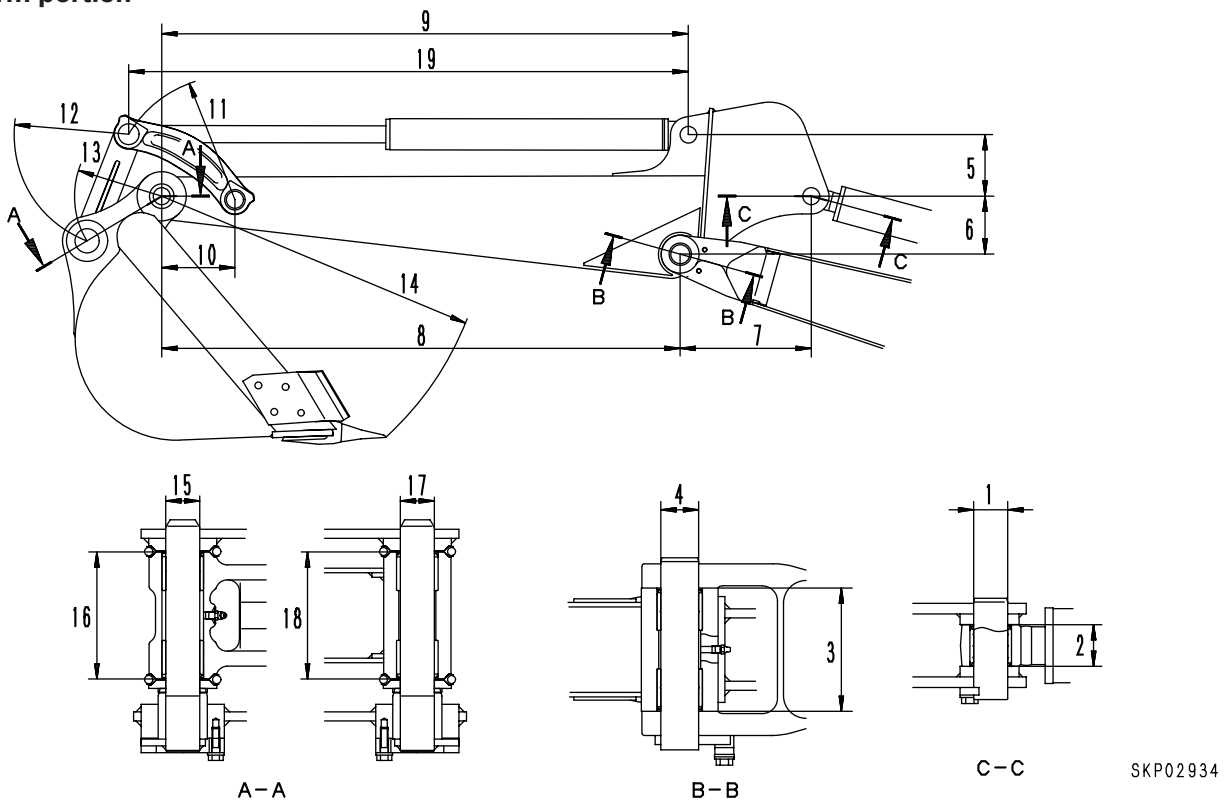


Unit: mm

No.	Check item	Criteria						Remedy
		Model	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between bushing and mounting pin of revolving frame and boom swing bracket	PC30R PC35R	100	–0.036 –0.090	+0.207 +0.120	0.156 – 0.297	1.0	Replace
		PC40R PC45R	110		+0.204 +0.128	0.164 – 0.294		
2	Clearance between bushing and mounting pin of boom swing bracket and boom	PC30R PC35R	45	–0.025 –0.064	+0.128 +0.075	0.100 – 0.192	1.0	
		PC40R PC45R	50		+0.142 +0.080	0.105 – 0.206		
3	Clearance between bushing and mounting pin of arm and boom	PC30R PC35R	40	–0.025 –0.064	+0.142 +0.080	0.105 – 0.206	1.0	
		PC40R PC45R	50					
4	Clearance between link bushing and mounting pin of link and bucket cylinder	PC30R PC35R	35	–0.170 –0.230	–0.003 –0.052	0.118 – 0.227	1.0	
		PC40R PC45R	45		–0.012 –0.065	0.105 – 0.218		
5	Clearance between bushing and mounting pin of arm and link	PC30R PC35R	35	–0.170 –0.230	–0.003 –0.052	0.118 – 0.227	1.0	
		PC40R PC45R	45		–0.012 –0.065	0.105 – 0.218		
6	Clearance between bushing and mounting pin of arm and bucket	PC30R PC35R	35	–0.170 –0.230	–0.003 –0.052	0.118 – 0.227	1.0	
		PC40R PC45R	45		–0.012 –0.065	0.105 – 0.218		
7	Clearance between bushing and mounting pin of link and bucket	PC30R PC35R	35	–0.170 –0.230	–0.003 –0.052	0.118 – 0.227	1.0	
		PC40R PC45R	45		–0.012 –0.065	0.105 – 0.218		
8	Clearance between bushing and mounting pin of track frame and blade	PC30R PC35R	35	–0.025 –0.087	+0.142 +0.080	0.105 – 0.229	1.0	
		PC40R PC45R						

DIMENSIONS OF WORK EQUIPMENT

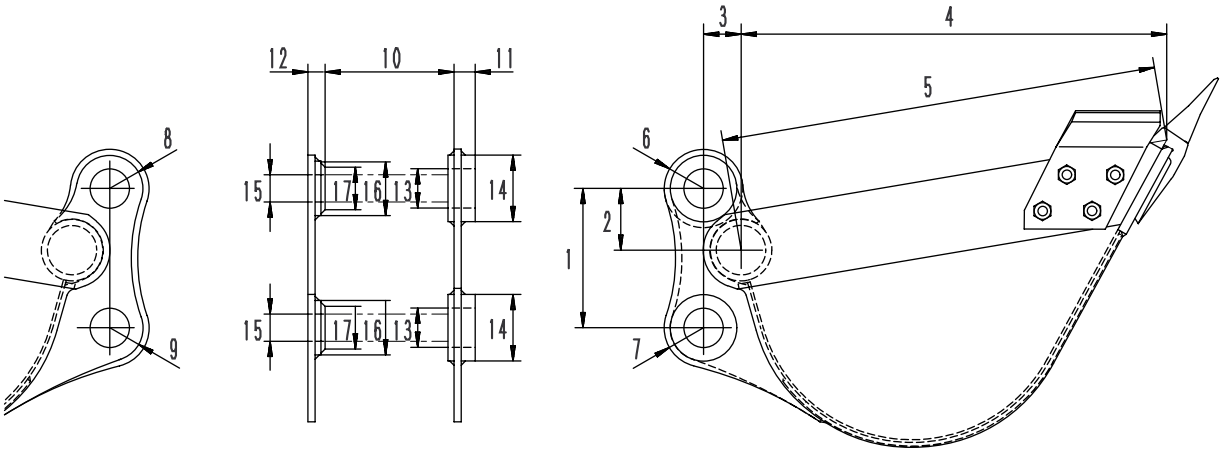
1. Arm portion



Unit: mm

NO.		PC30R-8	PC35R-8	PC40R-8	PC45R-8
1		ϕ 40	ϕ 40	ϕ 45	ϕ 45
2		50	50	55	55
3		130	130	163	163
4		ϕ 40	ϕ 40	ϕ 50	ϕ 50
5		157.4	163.2	162.9	177.1
6		98	106.3	153.3	149.3
7		254.8	330.8	346.6	371.1
8		1,165.9	1,135.9	1,371.5	1,472.4
9		1,187.6	1,189.8	1,392.6	1,386.5
10		163.4	163.6	193.5	193.6
11		280	280	330	330
12		256	256	303	303
13		194.6	194.6	230.3	230.3
14		754	754	871	871
15		ϕ 35	ϕ 35	ϕ 45	ϕ 45
16		143.5	143.5	168	168
17		ϕ 35	ϕ 35	ϕ 45	ϕ 45
18		143.5	143.5	168	168
19	Min.	780	780	900	900
	Max.	1,270	1,270	1,480	1,480

2. Bucket portion



SKP02943

Unit: mm

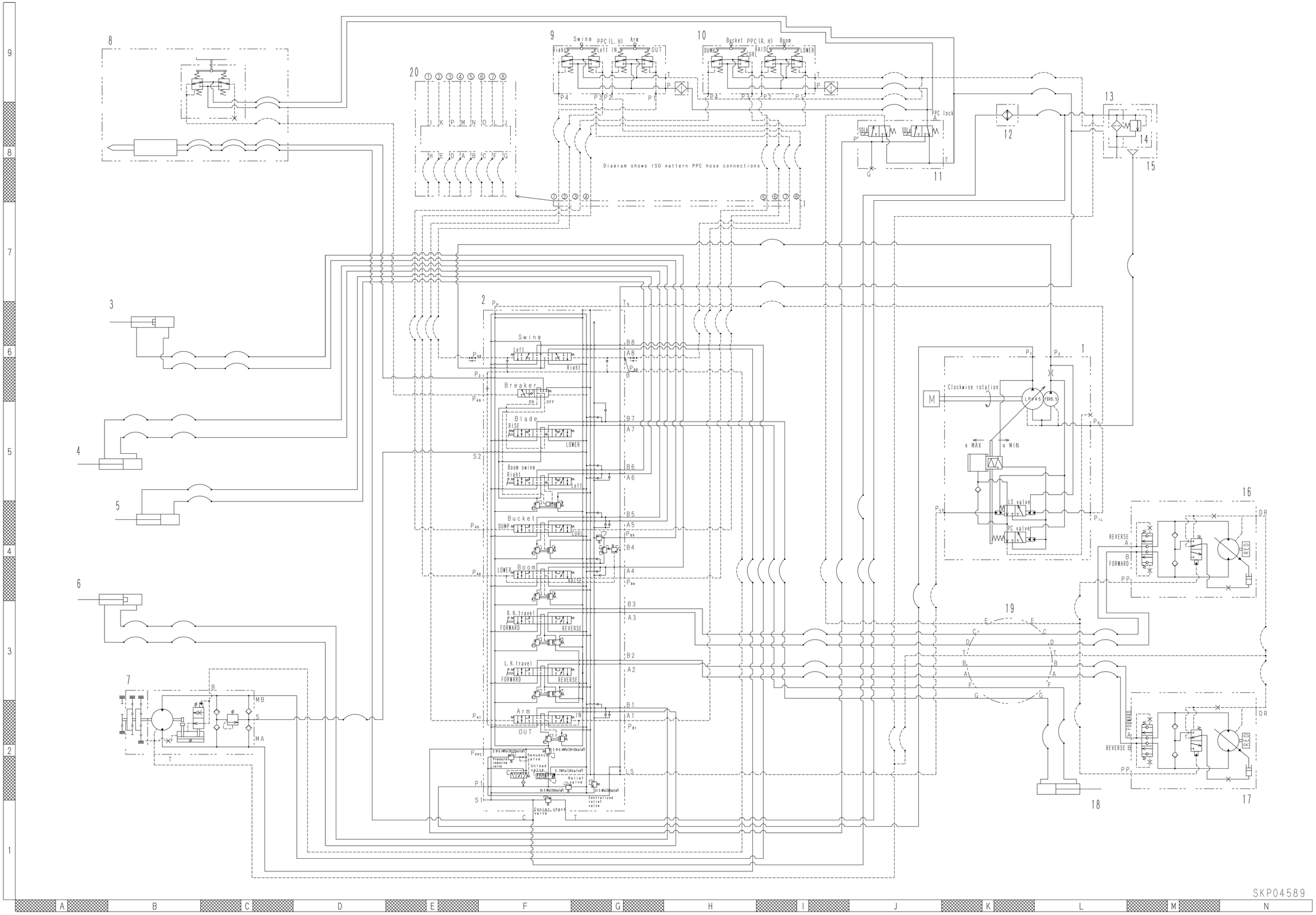
NO.	PC30R-8	PC35R-8	PC40R-8	PC45R-8
1	194.6	194.6	230.3	230.3
2	87.4	87.4	102.1	120.1
3	55.6	55.6	62.2	62.2
4	603	603	703.7	703.7
5	617.1	617.1	724.2	724.2
6	57.5	57.5	65	65
7	57.5	57.5	65	65
8	50	50	55	55
9	50	50	55	55
10	176.5	176.5	203	203
11	39	39	45	45
12	28	28	28.5	28.5
13	ϕ 55	ϕ 55	ϕ 65	ϕ 65
14	ϕ 95	ϕ 95	ϕ 110	ϕ 110
15	ϕ 35	ϕ 35	ϕ 45	ϕ 45
16	ϕ 80	ϕ 80	ϕ 90	ϕ 90
17	ϕ 60.5	ϕ 60.5	ϕ 70.5	ϕ 70.5

90 OTHER

Hydraulic circuit diagram (PC30R-8) 90- 3
Hydraulic circuit diagram (PC35R-8) 90- 5
Hydraulic circuit diagram (PC40R-8) 90- 7
Hydraulic circuit diagram (PC45R-8) 90- 9
Electrical circuit diagram 90-11
Hydraulic piping drawing 90-13
System diagram drawing 90-15

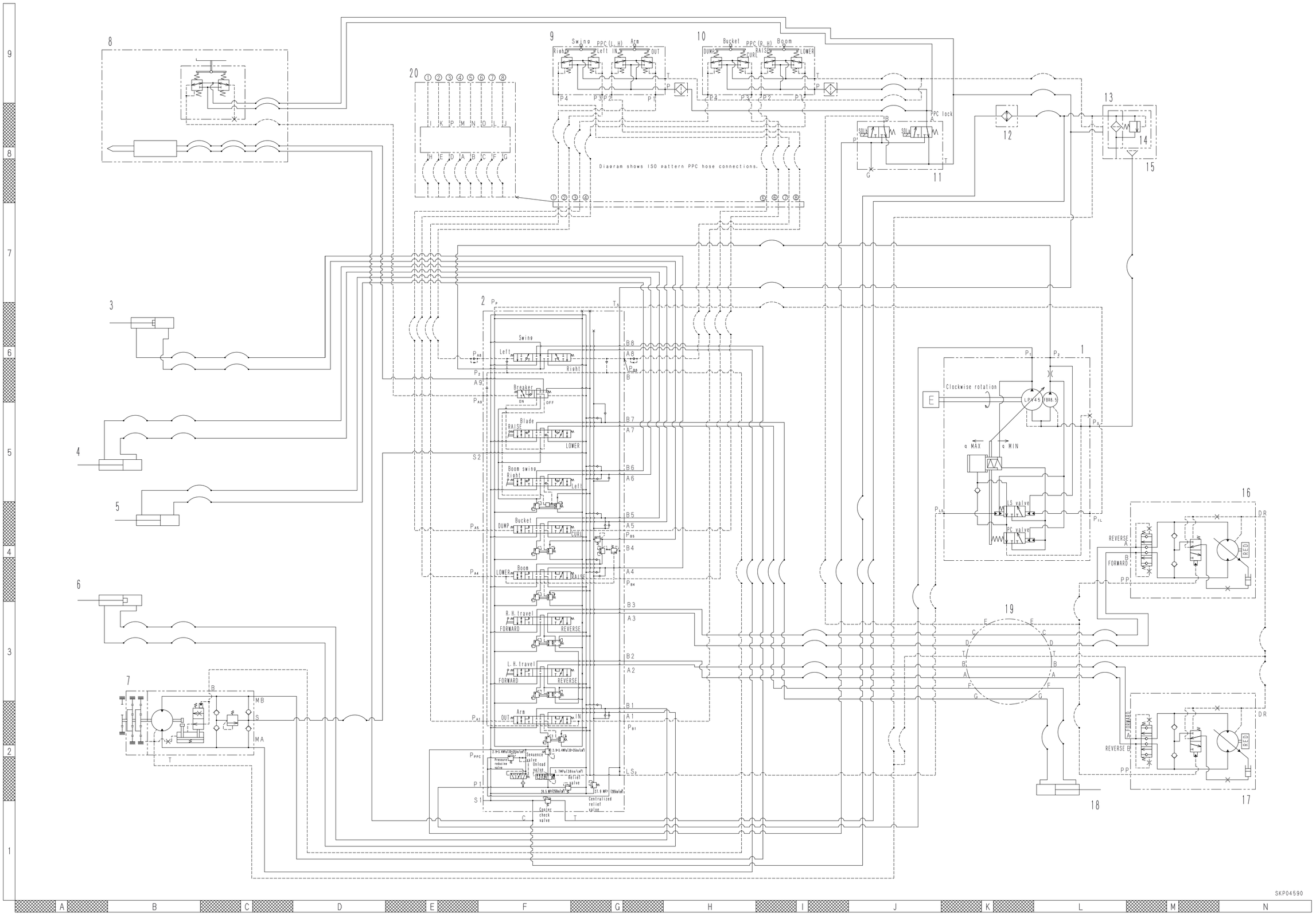
HYDRAULIC CIRCUIT DIAGRAM

PC30R-8



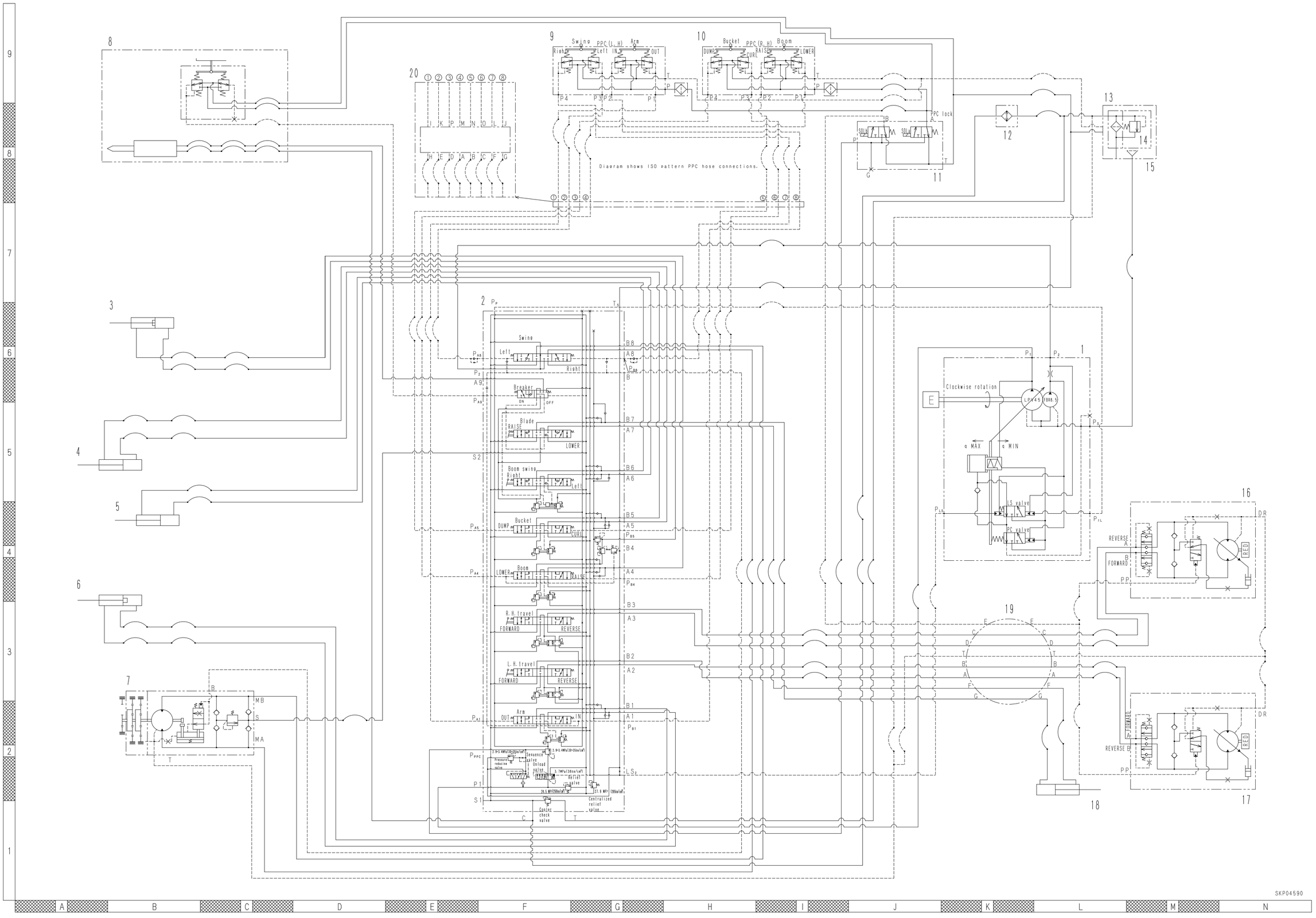
HYDRAULIC CIRCUIT DIAGRAM

PC35R-8



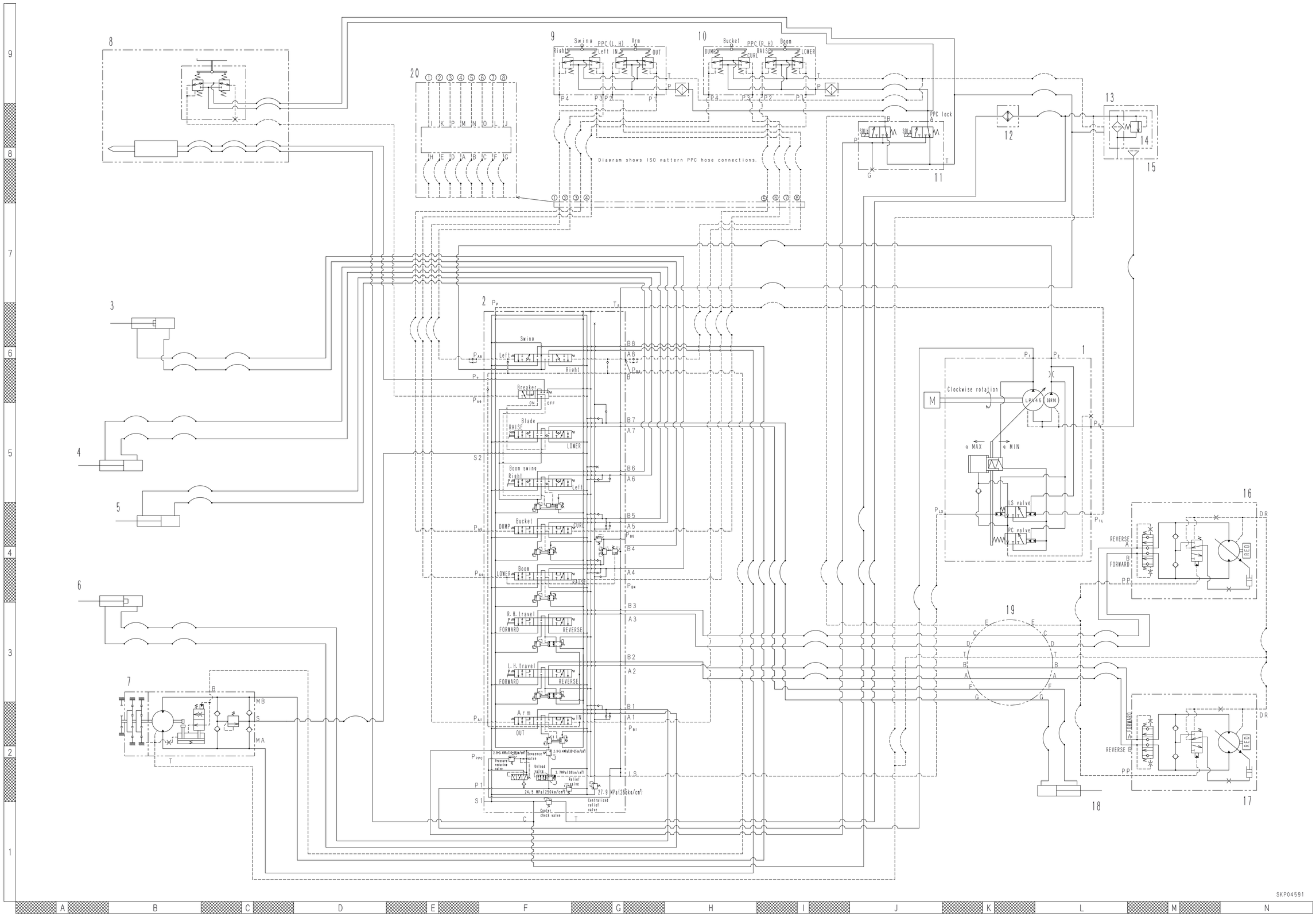
HYDRAULIC CIRCUIT DIAGRAM

PC35R-8



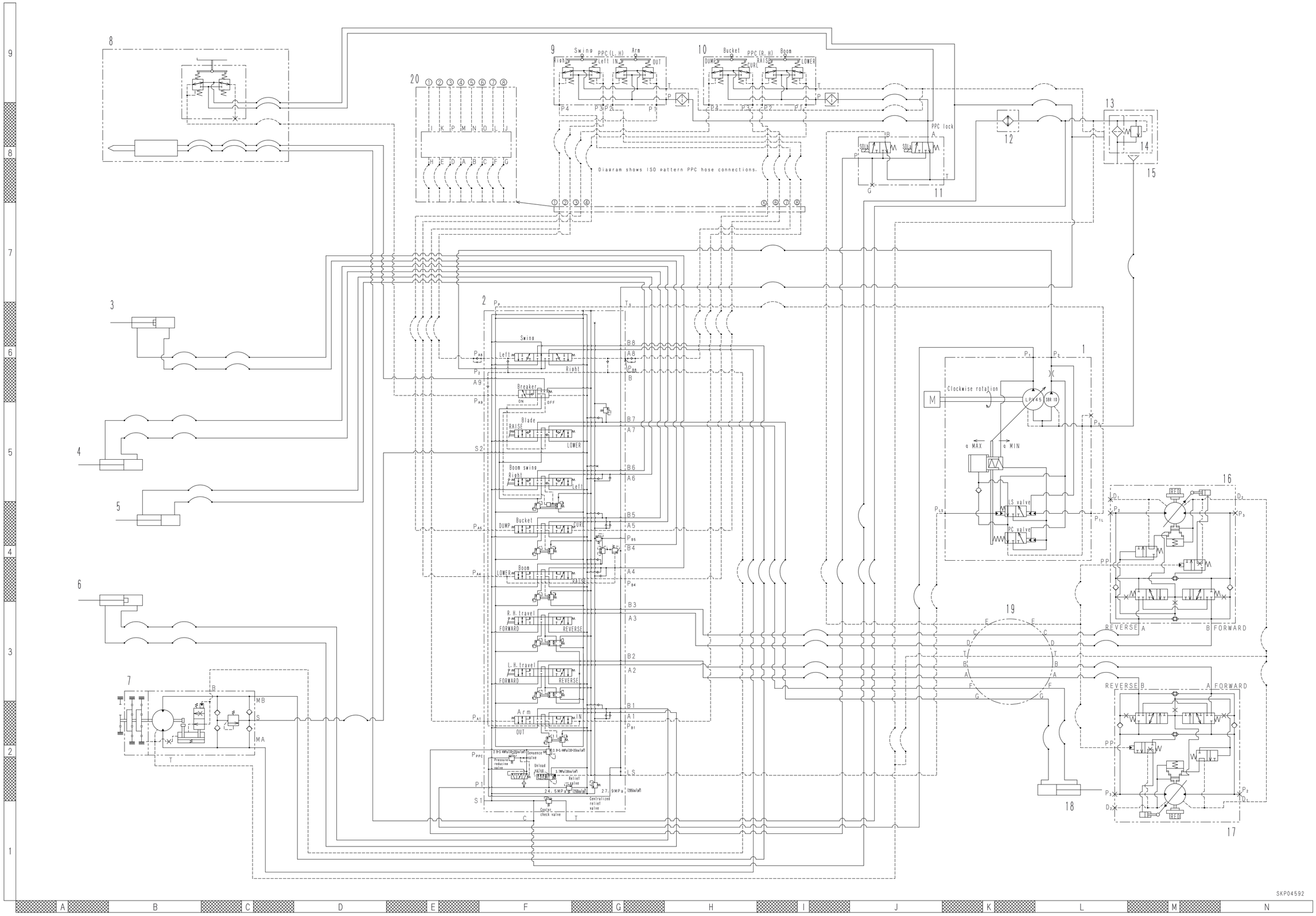
HYDRAULIC CIRCUIT DIAGRAM

PC40R-8

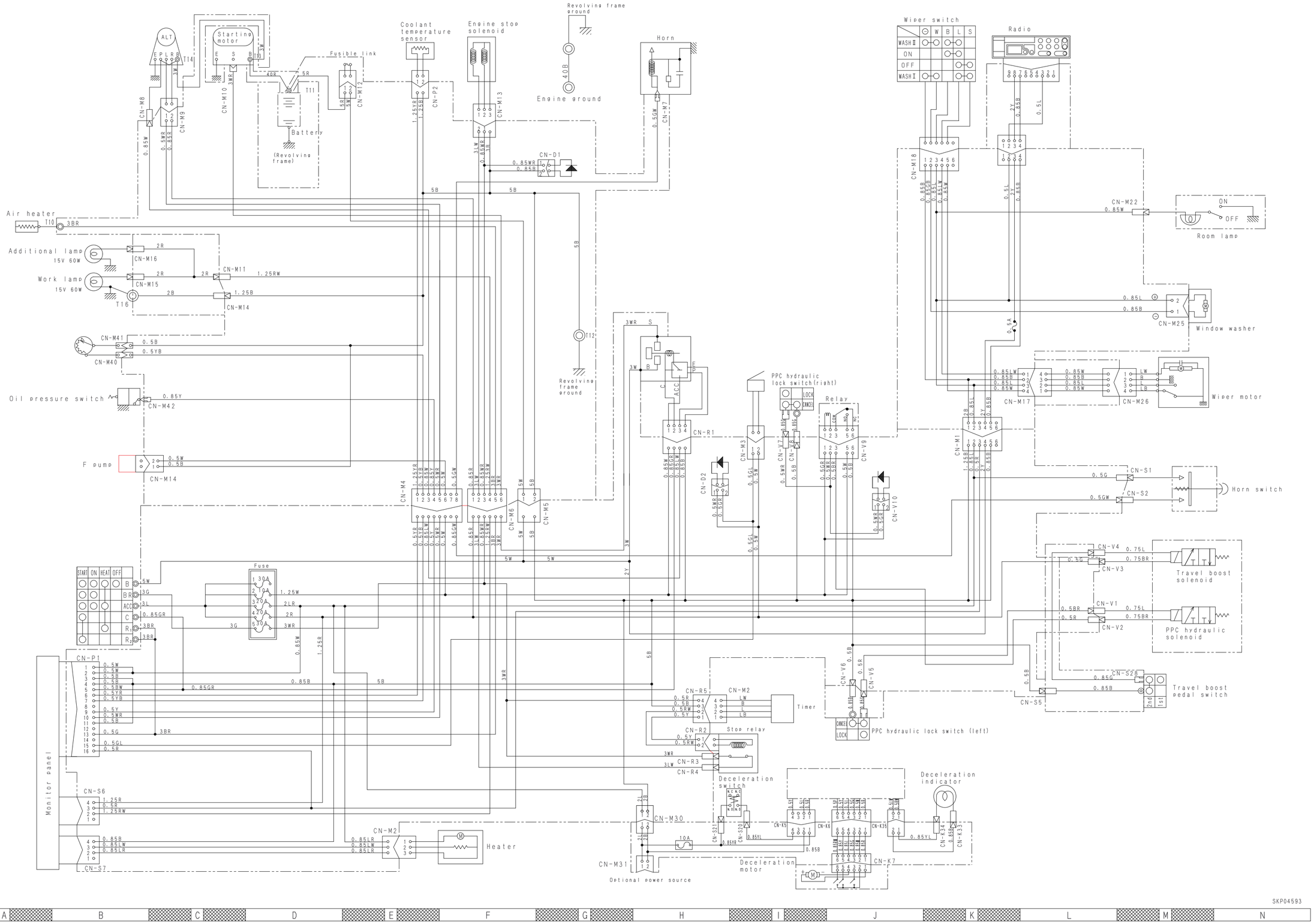


HYDRAULIC CIRCUIT DIAGRAM

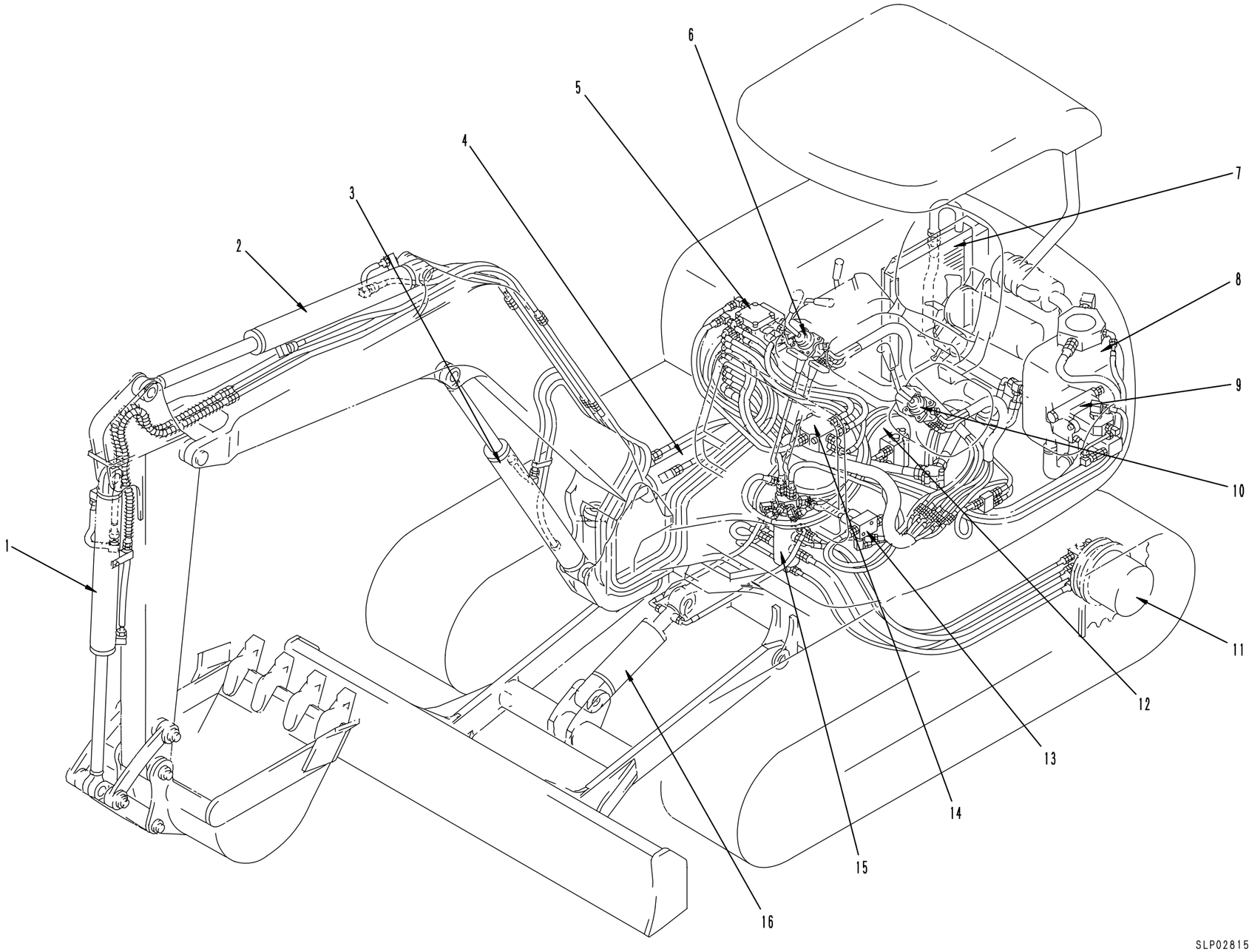
PC45R-8



ELECTRICAL CIRCUIT DIAGRAM



HYDRAULIC PIPING DRAWING



1. Bucket cylinder
2. Arm cylinder
3. Boom cylinder
4. Boom swing cylinder
5. 9-spool control valve
6. R.H. PPC valve
7. Oil cooler
8. Hydraulic tank
9. Hydraulic pump
10. L.H. PPC valve
11. L.H. travel motor
12. R.H. travel motor
13. Solenoid valve
14. Swing motor
15. Swivel joint
16. Blade cylinder

SYSTEM DIAGRAM DRAWING

