SHOP MANUAL

KOMATSU

PC600-7
PC600LC-7

MACHINE MODEL	SERIAL No.
PC600-7	**20001 and up**
PC600LC-7	**20001 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.
- PC600, 600LC-7 mount the KOMATSU SA6D140E-3 engine.
  For details of the engine, see the 140-3 Series Engine Shop Manual.

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CONTENTS

SAFETY
SAFETY NOTICE

IMPORTANT SAFETY NOTICE

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

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

GENERAL PRECAUTIONS

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

1. Before carrying out any greasing or repairs, read all the precautions given on the decals which are fixed to the machine.
2. When carrying out any operation, always wear safety shoes and helmet. Do not wear loose work clothes, or clothes with buttons missing.
   - Always wear safety glasses when hitting parts with a hammer.
   - Always wear safety glasses when grinding parts with a grinder, etc.
3. If welding repairs are needed, always have a trained, experienced welder carry out the work. When carrying out welding work, always wear welding gloves, apron, hand shield, cap and other clothes suited for welding work.
4. When carrying out any operation with two or more workers, always agree on the operating procedure before starting. Always inform your fellow workers before starting any step of the operation. Before starting work, hang UNDER REPAIR signs on the controls in the operator's compartment.
5. Keep all tools in good condition and learn the correct way to use them.
6. Decide a place in the repair workshop to keep tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt or oil on the floor. Smoke only in the areas provided for smoking. Never smoke while working.

PREPARATIONS FOR WORK

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

PRECAUTIONS DURING WORK

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

FOREWORD
GENERAL

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

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

STRUCTURE AND FUNCTION

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

TESTING AND ADJUSTING

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

DISASSEMBLY AND ASSEMBLY

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

MAINTENANCE STANDARD

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

OTHERS

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

NOTICE

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

HOW TO READ THE SHOP MANUAL

VOLUMES

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

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

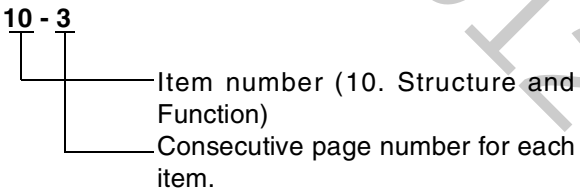
These various volumes are designed to avoid duplicating the same information. Therefore, to deal with all repairs for any model , it is necessary that chassis, engine, electrical and attachment volumes be available.

DISTRIBUTION AND UPDATING

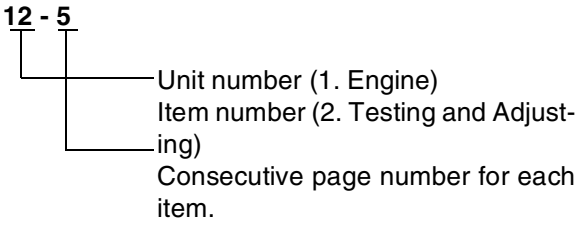
Any additions, amendments or other changes will be sent to KOMATSU distributors. Get the most up-to-date information before you start any work.

FILING METHOD

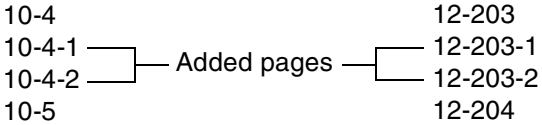
1. See the page number on the bottom of the page. File the pages in correct order.
2. Following examples show how to read the page number.
   Example 1 (Chassis volume):



   Example 2 (Engine volume):



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



REVISED EDITION MARK

When a manual is revised, an edition mark (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.
kg	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:

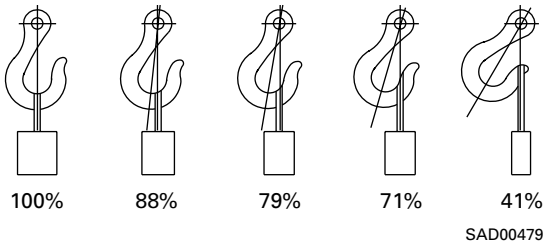
Wire ropes
(Standard "Z" or "S" twist ropes without galvanizing)

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

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

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

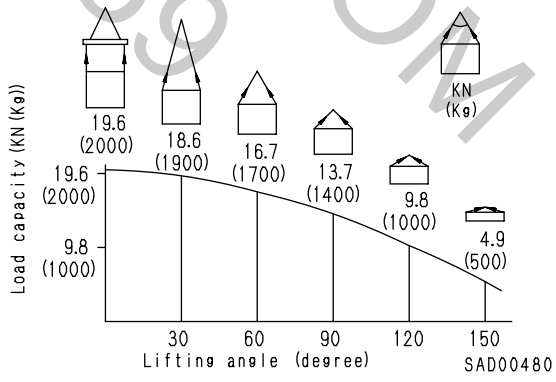
Slinging near the edge of the hook may cause the rope to slip off the hook during hoisting, and a serious accident can result. Hooks have maximum strength at the middle portion.



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

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

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



METHOD OF DISASSEMBLING, CONNECTING PUSH-PULL TYPE COUPLER

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

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

Disconnection

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

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

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

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

Connection

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

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

Type 1

Fig. 1

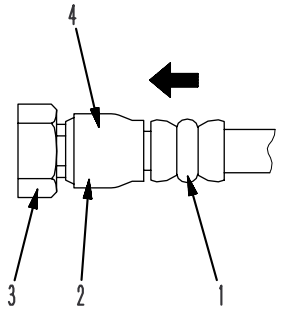


Fig. 2

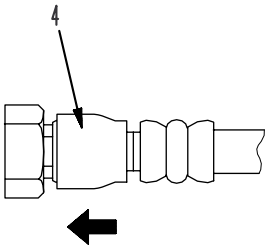


Fig. 3

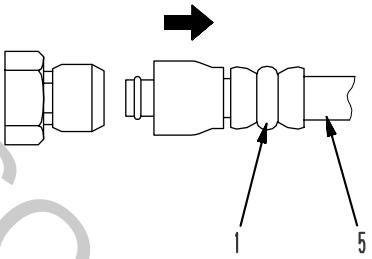


Fig. 4

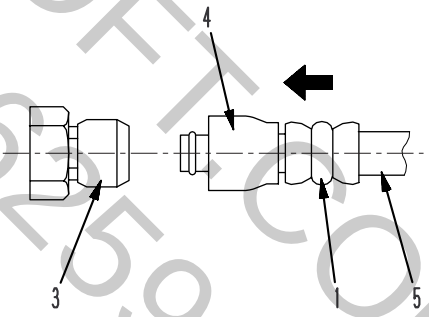
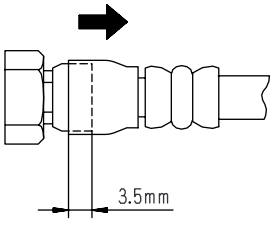


Fig. 5



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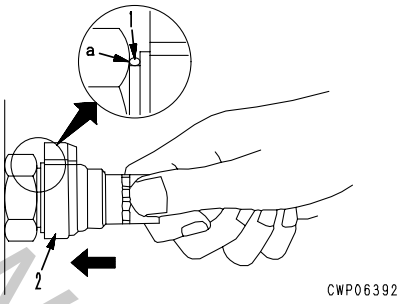
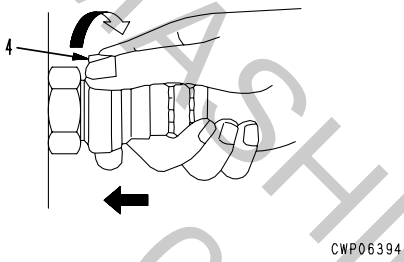
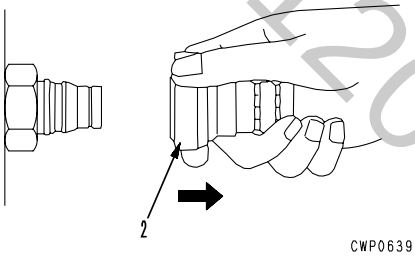
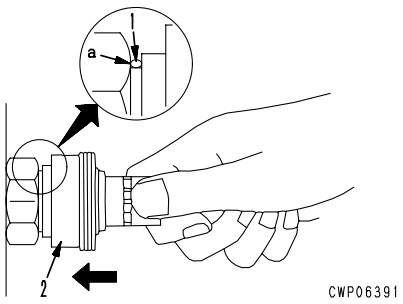
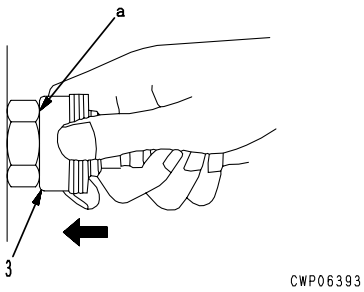
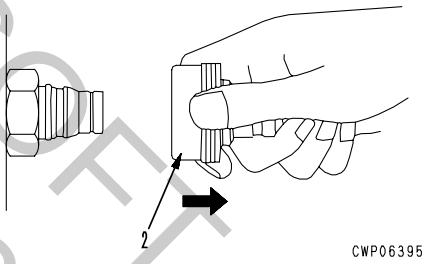
<table>
<tr><th></th><th>Type 2</th><th>Type 3</th></tr>
<tr><td>Disassembly</td><td>
1) Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface a of the hexagonal portion at the male end.


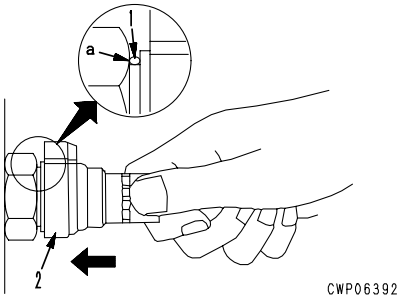
2) Hold in the condition in Step 1), and turn lever (4) to the right (clockwise).


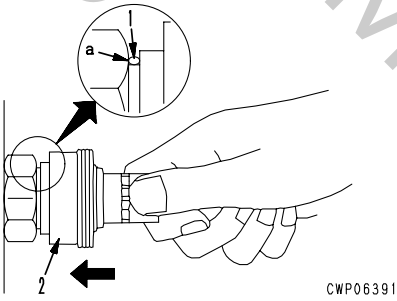
3) Hold in the condition in Steps 1) and 2), and pull out whole body (2) to disconnect it.


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


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


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


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


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


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

COATING MATERIALS

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

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

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

STANDARD TIGHTENING TORQUE

STANDARD TIGHTENING TORQUE TABLE (WHEN USING TORQUE WRENCH)

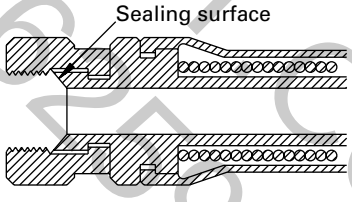
★ In the case of metric nuts and bolts for which there is no special instruction, tighten to the torque given in the table below.

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

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

TABLE OF TIGHTENING TORQUES FOR FLARED NUTS

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



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

TABLE OF TIGHTENING TORQUES FOR SPLIT FLANGE BOLTS

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

Thread diameter	Width across flat	Tightening torque	
mm	mm	Nm	kgm
10	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.

Norminal 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.

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

TIGHTENING TORQUE FOR 102 ENGINE SERIES

1) BOLT AND NUTS

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

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

2) EYE JOINTS

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

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

3) TAPERED SCREWS

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

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

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

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

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

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

ELECTRIC WIRE CODE

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

CLASSIFICATION BY THICKNESS

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

CLASSIFICATION BY COLOR AND CODE

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

CONVERSION TABLE

METHOD OF USING THE CONVERSION TABLE

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

EXAMPLE

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

1. Convert 55 mm into inches.
   (1) Locate the number 50 in the vertical column at the left side, take this as Ⓐ, 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
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90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to Pound

1 kg = 2.2046 lb

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

Liter to U.S. Gallon

1ℓ = 0.2642 U.S. Gal

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

Liter to U.K. Gallon

1ℓ = 0.21997 U.K. Gal

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

kgm to ft. lb

1 kgm = 7.233 ft. lb

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

kg/cm² to lb/in²

1kg/cm² = 14.2233 lb/in²

	0	1	2	3	4	5	6	7	8	9
0	0	14.2	28.4	42.7	56.9	71.1	85.3	99.6	113.8	128.0
10	142.2	156.5	170.7	184.9	199.1	213.4	227.6	241.8	256.0	270.2
20	284.5	298.7	312.9	327.1	341.4	355.6	369.8	384.0	398.3	412.5
30	426.7	440.9	455.1	469.4	483.6	497.8	512.0	526.3	540.5	554.7
40	568.9	583.2	597.4	611.6	625.8	640.1	654.3	668.5	682.7	696.9
50	711.2	725.4	739.6	753.8	768.1	782.3	796.5	810.7	825.0	839.2
60	853.4	867.6	881.8	896.1	910.3	924.5	938.7	953.0	967.2	981.4
70	995.6	1010	1024	1038	1053	1067	1081	1095	1109	1124
80	1138	1152	1166	1181	1195	1209	1223	1237	1252	1266
90	1280	1294	1309	1323	1337	1351	1365	1380	1394	1408
100	1422	1437	1451	1465	1479	1493	1508	1522	1536	1550
110	1565	1579	1593	1607	1621	1636	1650	1664	1678	1693
120	1707	1721	1735	1749	1764	1778	1792	1806	1821	1835
130	1849	1863	1877	1892	1906	1920	1934	1949	1963	1977
140	1991	2005	2020	2034	2048	2062	2077	2091	2105	2119
150	2134	2148	2162	2176	2190	2205	2219	2233	2247	2262
160	2276	2290	2304	2318	2333	2347	2361	2375	2389	2404
170	2418	2432	2446	2460	2475	2489	2503	2518	2532	2546
180	2560	2574	2589	2603	2617	2631	2646	2660	2674	2688
190	2702	2717	2731	2745	2759	2773	2788	2802	2816	2830
200	2845	2859	2873	2887	2901	2916	2930	2944	2958	2973
210	2987	3001	3015	3030	3044	3058	3072	3086	3101	3115
220	3129	3143	3158	3172	3186	3200	3214	3229	3243	3257
230	3271	3286	3300	3314	3328	3343	3357	3371	3385	3399
240	3414	3428	3442	3456	3470	3485	3499	3513	3527	3542

Temperature

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

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

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

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

1°C = 33.8°F

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

UNITS

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

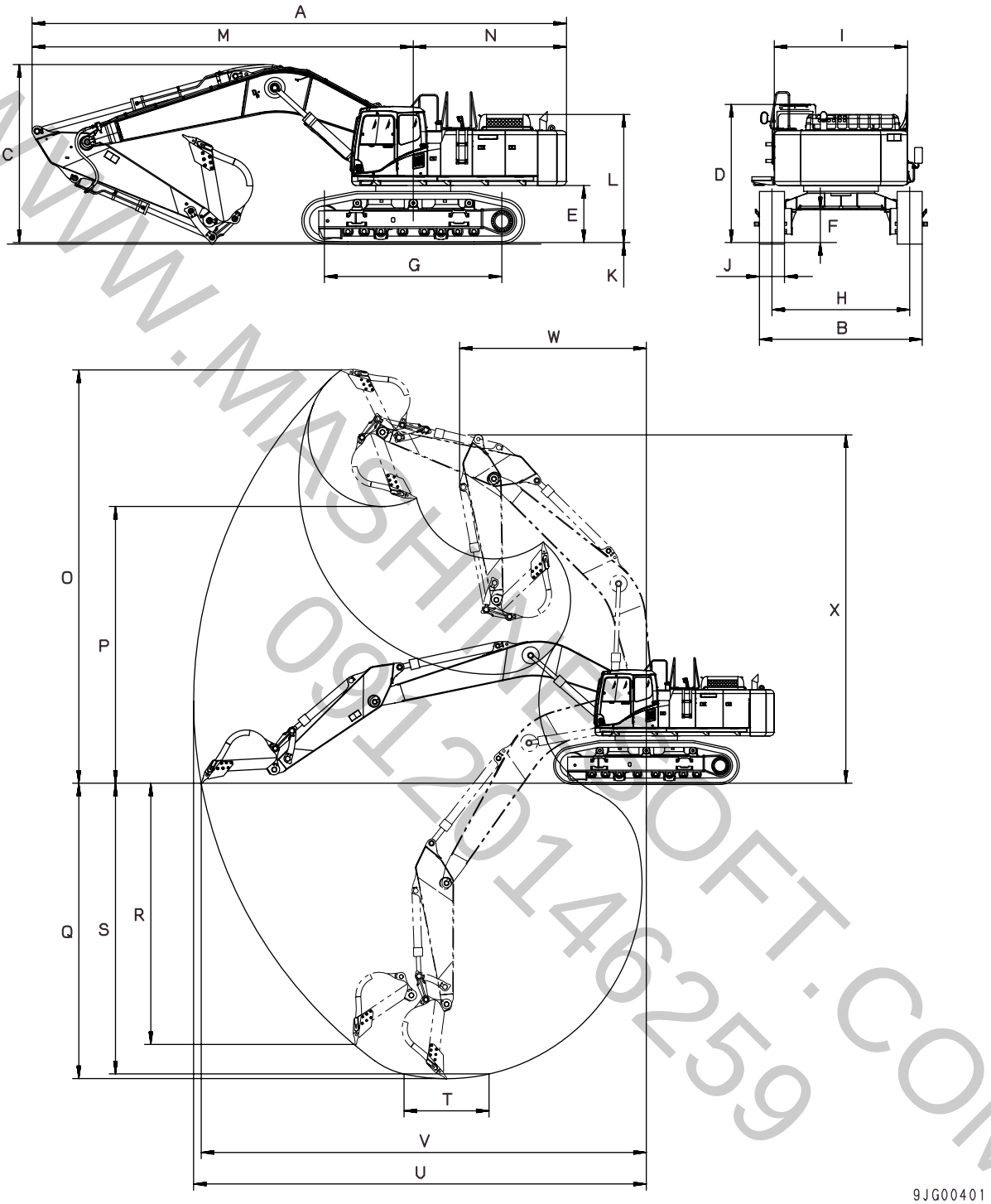
Example:

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

01 GENERAL

SPECIFICATION DRAWINGS

BACKHOE SPECIFICATION



Unit: mm

Machine model	PC600-7	PC600LC-7
Serial Number	20001 and up	20001 and up
A	12,810	12,810
B	3,900	3,900
C	4,300	4,300
D	3,290	3,290
E	1,365	1,365
F	780	780
G	4,250	4,600
H	3,300	3,300
I	3,195	3,195
J	600	600
K	37	37
L	3,070	3,070
M	9,135	9,135
N	3,675	3,675
O	11,880	11,880
P	7,960	7,960
Q	8,490	8,490
R	7,510	7,510
S	8,360	8,360
T	2,440	2,440
U	13,020	13,020
V	12,800	12,800
W	5,370	5,370
X	10,020	10,020

SPECIFICATIONS

PC600-7

Machine model				PC600-7	
Serial Number				20001 and up	
Bucket capacity			m^3	2.7	
Weight of machine			kg	56,600	
Performance	Working ranges	Max. digging depth	mm	8,490	
		Max. vertical wall depth	mm	7,510	
		Max. digging reach	mm	13,020	
		Max. reach at ground level	mm	12,800	
		Max. digging height	mm	11,880	
		Max. dumping height	mm	7,960	
	Max. digging force		kN {kg}	294.3 {30,000}	
	(using power max. function)			(316.9 {32,300})	
	Swing speed		rpm	8.3	
	Swing max. slope angle		deg.	17	
	Travel speed		km/h	Low speed: 3.0	
				High speed: 4.9	
	Gradeability		deg.	35	
	Ground pressure (standard triple grouser shoe width: 600 mm)		kPa {kg/cm^2}	100 {1.02}	
Dimensions	Overall length (for transport)		mm	12,810	
	Overall width		mm	3,195	
	Overall width of track		mm	3,900	
	Overall height (for transport)		mm	4,300	
	Overall height to top of cab		mm	3,290	
	Ground clearance of counterweight		mm	1,365	
	Min. ground clearance		mm	780	
	Tail swing radius		mm	3,800	
	Min. swing radius of work equipment		mm	5,370	
	Height of work equipment at min. swing radius		mm	10,020	
	Length of track on ground		mm	4,250	
	Track gauge		mm	3,300	
	Height of machine cab		mm	3,070	

Machine model				PC600-7	
Serial Number				20001 and up	
Engine	Model Type			KOMATSU SA6D140E-3 4-cycle, water-cooled, in-line, vertical, direct injection, with turbocharger and aftercooler (water cooled)	
	No. of cylinders – bore × stroke		mm	6 – 140 × 165	
	Piston displacement		ℓ {cc}	15.24 {15,240}	
	Performance: Flywheel horsepower		kW/rpm {HP/rpm}	287/1,800 {384/1,800}	
	Performance: Max. torque		Nm/rpm {kgm/rpm}	1,755/1,400 {179/1,400}	
	Performance: Max. speed at no load		rpm	1,950	
	Performance: Min. speed at no load		rpm	825	
	Performance: Min. fuel consumption		g/kW•h {g/HP•h}	214 {160}	
	Starting motor Alternator Battery			24V, 11 kW 24V, 50A 12V, 175 Ah × 2	
	Radiator core type			CWX-5	
Undercarriage	Carrier roller			3 on each side	
	Track roller			8 on each side	
	Track shoe			Assembly-type triple grouser, 49 on each side	
Hydraulic system	Hydraulic pump: Type			Variable displacement piston type: HPV95+95 × 2, gear type: SAL(2)56 + (2)8	
	Hydraulic pump: Delivery		ℓ /min	Piston type: 410 × 2, gear type: 137	
	Hydraulic pump: Set pressure		MPa {kg/cm^2}	Piston type: 34.3 {350}, gear type: 2.9 {30}	
	Control valve: Type × No.			4-spool + 5-spool type × 1	
	Control valve: Control method			Hydraulic	
	Hydraulic motor: Travel motor			KMV335ADT, Piston type (with brake valve, shaft brake): × 2	
	Hydraulic motor: Swing motor			KMF90ABE-3, Piston type (with safety valve, shaft brake, reverse prevention valve): × 2	
	Hydraulic cylinder			Boom	Arm	Bucket
	Hydraulic cylinder: Type			Double-acting piston	Double-acting piston	Double-acting piston
	Hydraulic cylinder: Inside diameter of cylinder		mm	185	200	185
	Hydraulic cylinder: Diameter of piston rod		mm	120	140	120
	Hydraulic cylinder: Stroke		mm	1,725	2,045	1,425
	Hydraulic cylinder: Max. distance between pins		mm	4,182	4,933	3,577
	Hydraulic cylinder: Min. distance between pins		mm	2,457	2,888	2,152
	Hydraulic tank Hydraulic filter Hydraulic cooler			Box-shaped, sealed Tank return side Air cooled		

PC600LC-7

Machine model				PC600LC-7	
Serial Number				20001 and up	
Bucket capacity			m^3	2.7	
Weight of machine			kg	57,600	
Performance	Working ranges	Max. digging depth	mm	8,490	
		Max. vertical wall depth	mm	7,510	
		Max. digging reach	mm	13,020	
		Max. reach at ground level	mm	12,800	
		Max. digging height	mm	11,880	
		Max. dumping height	mm	7,960	
	Max. digging force (using power max. function)		kN {kg}	294.3 {30,000} (316.9 {32,300})	
	Swing speed		rpm	8.3	
	Swing max. slope angle		deg.	17	
	Travel speed		km/h	Low speed: 3.0 High speed: 4.9	
	Gradeability		deg.	35	
	Ground pressure (standard triple grouser shoe width: 600 mm)		kPa {kg/cm^2}	95 {0.97}	
Dimensions	Overall length (for transport)		mm	12,810	
	Overall width		mm	3,195	
	Overall width of track		mm	3,900	
	Overall height (for transport)		mm	4,300	
	Overall height to top of cab		mm	3,290	
	Ground clearance of counter-weight		mm	1,365	
	Min. ground clearance		mm	780	
	Tail swing radius		mm	3,800	
	Min. swing radius of work equipment		mm	5,370	
	Height of work equipment at min. swing radius		mm	10,020	
	Length of track on ground		mm	4,600	
	Track gauge		mm	3,300	
	Height of machine cab		mm	3,070	

Machine model			PC600LC-7		
Serial Number			20001 and up		
Engine	Model		KOMATSU SA6D140E-3		
	Type		4-cycle, water-cooled, in-line, vertical, direct injection, with turbocharger and aftercooler (water cooled)		
	No. of cylinders – bore × stroke	mm	6 – 140 × 165		
	Piston displacement	ℓ {cc}	15.24 {15,240}		
	Performance: Flywheel horsepower	kW/rpm {HP/rpm}	287/1,800 {384/1,800}		
	Performance: Max. torque	Nm/rpm {kgm/rpm}	1,755/1,400 {179/1,400}		
	Performance: Max. speed at no load	rpm	1,950		
	Performance: Min. speed at no load	rpm	825		
	Performance: Min. fuel consumption	g/kW•h {g/HP•h}	214 {160}		
	Starting motor		24V, 11 kW		
	Alternator		24V, 50A		
	Battery		12V, 175 Ah × 2		
	Radiator core type		CWX-5		
Undercarriage	Carrier roller		3 on each side		
	Track roller		9 on each side		
	Track shoe		Assembly-type triple grouser, 52 on each side		
Hydraulic system	Hydraulic pump: Type		Variable displacement piston type: HPV95+95 × 2, gear type: SAL(2)56 + (2)8		
	Hydraulic pump: Delivery	ℓ /min	Piston type: 410 × 2, gear type: 137		
	Hydraulic pump: Set pressure	MPa {kg/cm^2}	Piston type: 34.3 {350}, gear type: 2.9 {30}		
	Control valve: Type × No.		4-spool + 5-spool type × 1		
	Control valve: Control method		Hydraulic		
	Hydraulic motor: Travel motor		KMV335ADT, Piston type (with brake valve, shaft brake): × 2		
	Hydraulic motor: Swing motor		KMF90ABE-3, Piston type (with safety valve, shaft brake, reverse prevention valve): × 2		
	Hydraulic cylinder		Boom	Arm	Bucket
	Hydraulic cylinder: Type		Double-acting piston	Double-acting piston	Double-acting piston
	Hydraulic cylinder: Inside diameter of cylinder	mm	185	200	185
	Hydraulic cylinder: Diameter of piston rod	mm	120	140	120
	Hydraulic cylinder: Stroke	mm	1,725	2,045	1,425
	Hydraulic cylinder: Max. distance between pins	mm	4,182	4,933	3,577
	Hydraulic cylinder: Min. distance between pins	mm	2,457	2,888	2,152
	Hydraulic tank		Box-shaped, sealed		
	Hydraulic filter		Tank return side		
	Hydraulic cooler		Air cooled		

WEIGHT TABLE

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

Unit: kg

Machine model	PC600-7	PC600LC-7
Serial Number	20001 and up	20001 and up
Engine assembly	2,305	2,305
• Engine	1,720	1,720
• PTO (incl. lubricating piping)	258	258
• Hydraulic pump	327	327
Radiator, oil cooler assembly	306	306
Hydraulic tank filter assembly (excl. hydraulic oil)	493	493
Fuel tank (excl. fuel)	503	503
Revolving frame	4,345	4,345
Operator's cab	293	293
Operator's seat	35	35
Counterweight	10,750	10,750
Swing machinery	724	724
Control valve	304	304
Swing motor	61 × 2	61 × 2
Travel motor	268 × 2	268 × 2
Center swivel joint	43	43
Track frame assembly (Excluding step, roller guard, shoe assembly, and lower piping)	15,152	15,664
• Center frame	3,998	3,998
• Track frame	2,207 × 2	2,355 × 2
• Swing circle	1136	1,136
• Idler	342 × 2	342 × 2
• Idler cushion	452 × 2	452 × 2
• Carrier roller	50 × 6	50 × 6
• Track roller	108 × 16	108 × 18
• Final drive (incl. travel motor)	994 × 2	994 × 2

Unit: kg

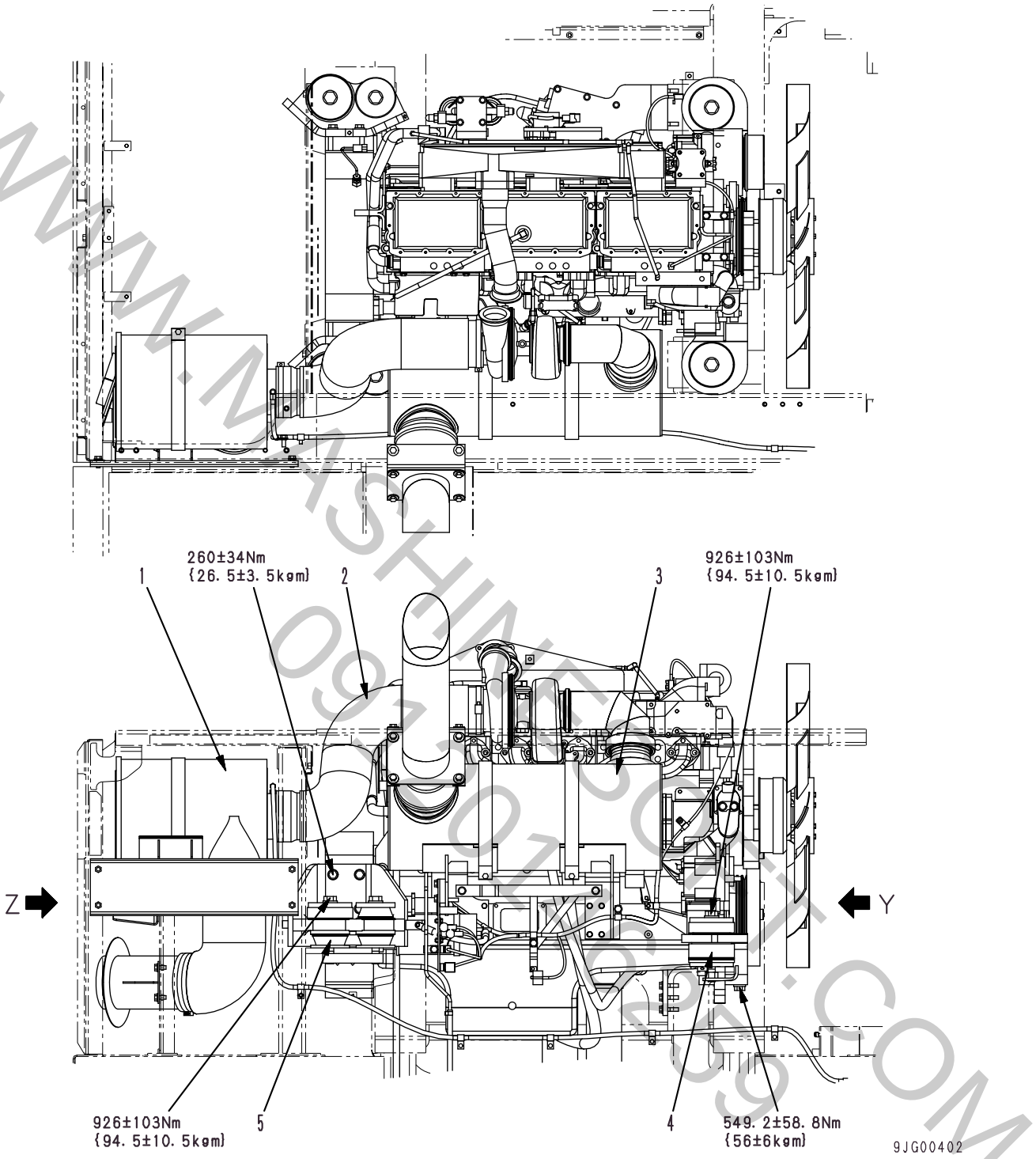
Machine model	PC600-7	PC600LC-7
Serial Number	20001 and up	20001 and up
Track shoe assembly		
• Standard triple grouser shoe (600 mm)	5,930	6,290
• Wide triple grouser shoe (750 mm)	6,750	7,170
Boom assembly	4,820	4,820
Arm assembly	3,240	3,240
Bucket assembly	2,510	2,510
Boom cylinder assembly	522 × 2	522 × 2
Arm cylinder assembly	770	770
Bucket cylinder assembly	469	469
Link assembly (large)	584	584
Link assembly (small)	—	—
Boom pin	149 + 26 × 2 + 76 + 104 + 36	149 + 26 × 2 + 76 + 104 + 36
Arm pin	32 + 55	32 + 55
Bucket pin	55 + 62	55 + 62
Link pin	45 × 2	45 × 2

FUEL, COOLANT AND LUBRICANTS

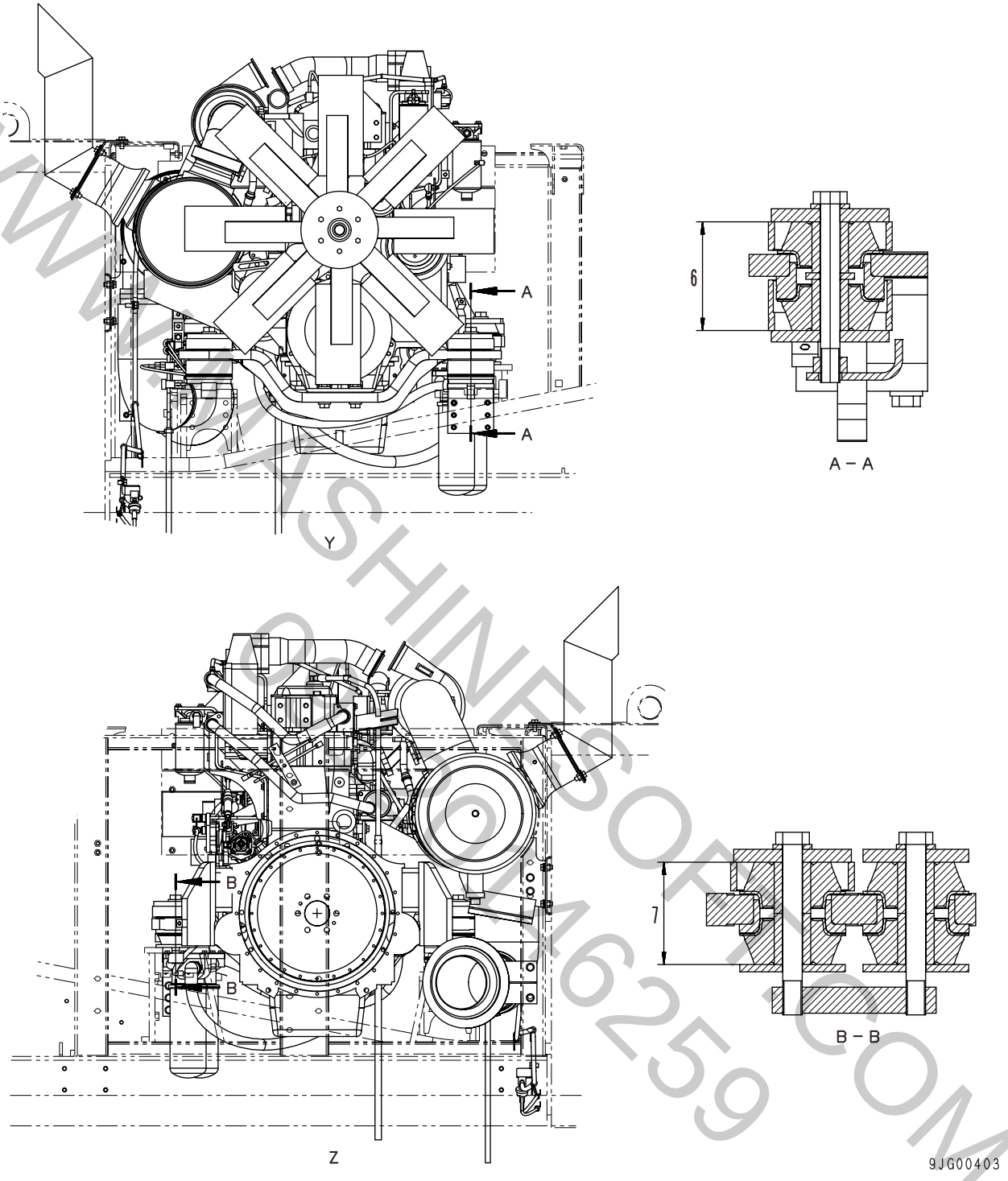
RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE	CAPACITY (ℓ)	
		–22 –4 14 32 50 68 86 104°F –30 –20 –10 0 10 20 30 40°C	Specified	Refill
Engine oil pan	Engine oil	SAE 30 SAE 10W SAE 10W – 30 SAE 15W – 40	42	37
PTO case		SAE 30 SAE 10W	6	6
Swing machinery case (each)		SAE 30	13	13
Final drive case (each)			10.5	10
Hydraulic system		SAE 10W	520	360
Fuel tank	Diesel fuel	ASTM D975 No.2 ASTM D975 No.1	880	—
Cooling system	Water	Add antifreeze	57	—

10 STRUCTURE, FUNCTION AND MAINTENANCE STANDARD

PARTS RELATED TO ENGINE



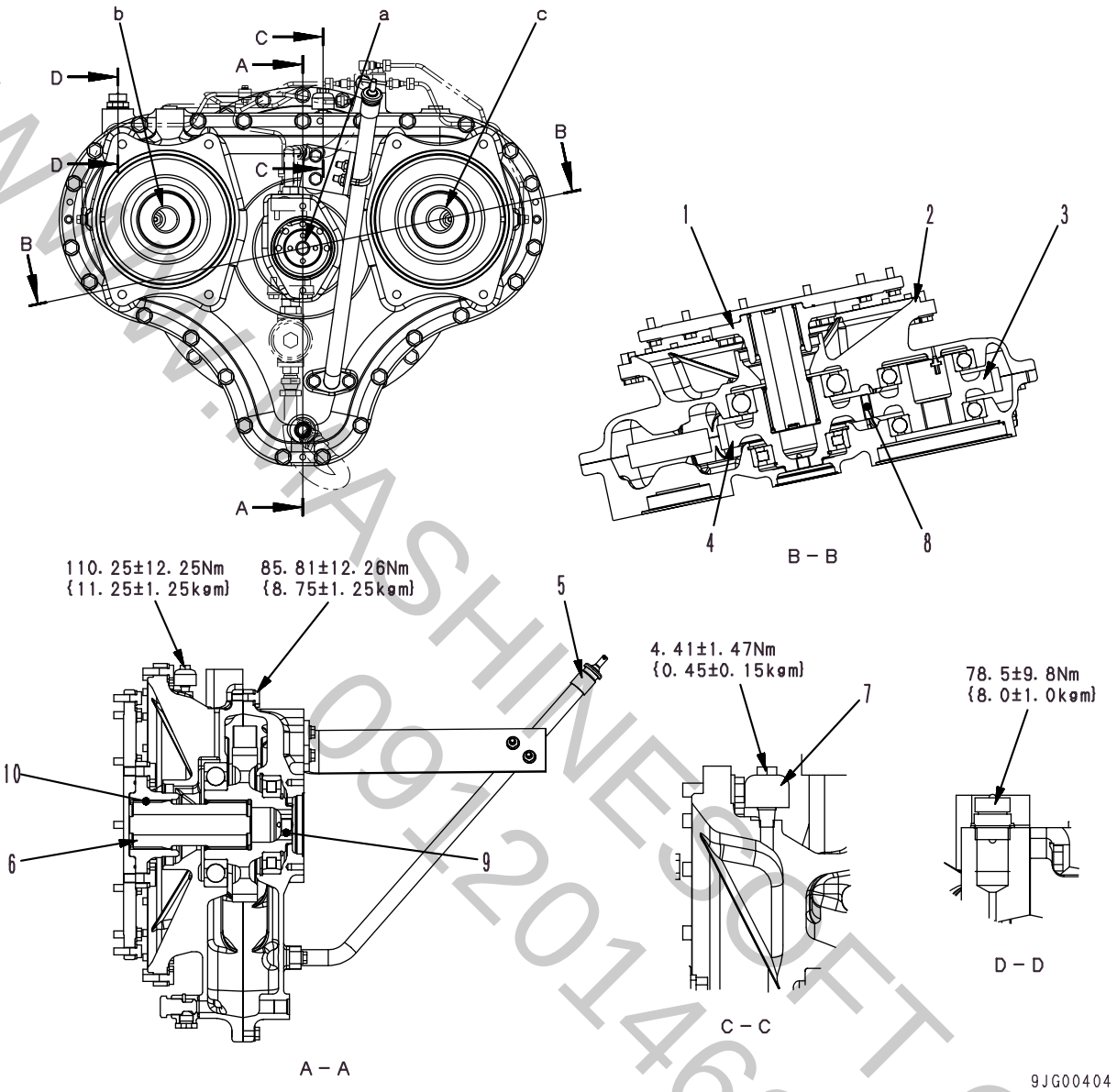
1. Air cleaner
2. Intake connector
3. Muffler
4. Front engine mount
5. Rear engine mount



Unit: mm

No.	Check item	Criteria		Remedy
6	Free height of front mount rubber	Standard size	Repair limit	Replace
		126	—	
7	Free height of rear mount rubber	134	—	

PTO



1. Connection plate
2. PTO case
3. Driven gear (No. of teeth: 40)
4. Drive gear (No. of teeth: 36)
5. Oil level gauge
6. Main shaft
7. Breather

a. Center of crankshaft (Center of SAL56 shaft)
b. Center of HPV95+95 shaft
c. Center of HPV95+95 shaft

Specifications

Lubricating oil: 6 ℓ

Reduction ratio: Input shaft (SAL56 shaft) = 1

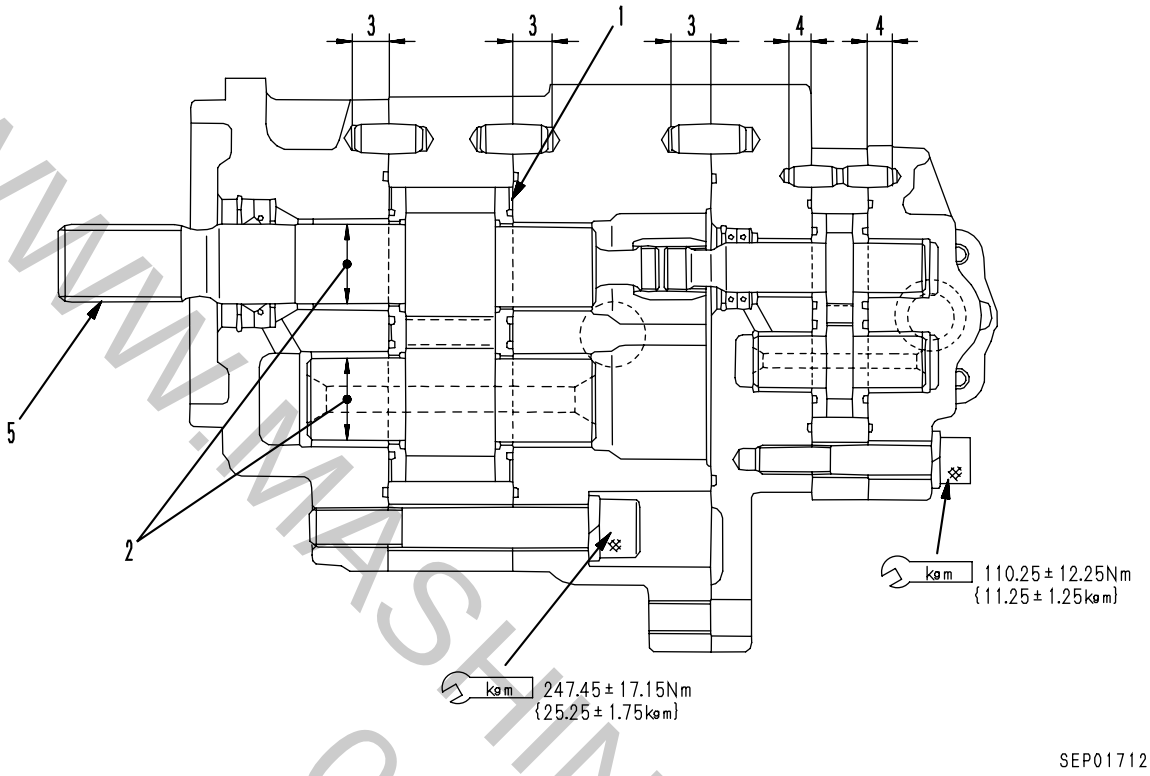
$$\text{HPV95+95 shaft} = \frac{36}{40} = 0.9$$

Unit: mm

No.	Check item	Criteria		Remedy
8	Backlash between drive gear and driven gear	Standard clearance	Clearance limit	Adjust
		0.23 – 0.74	—	
9	Backlash of SAL56 pump input shaft	0.273 – 0.374	—	
10	Backlash between main shaft and plate	0.081 – 0.226	—	

CONTROL AND PTO LUBRICATION PUMP

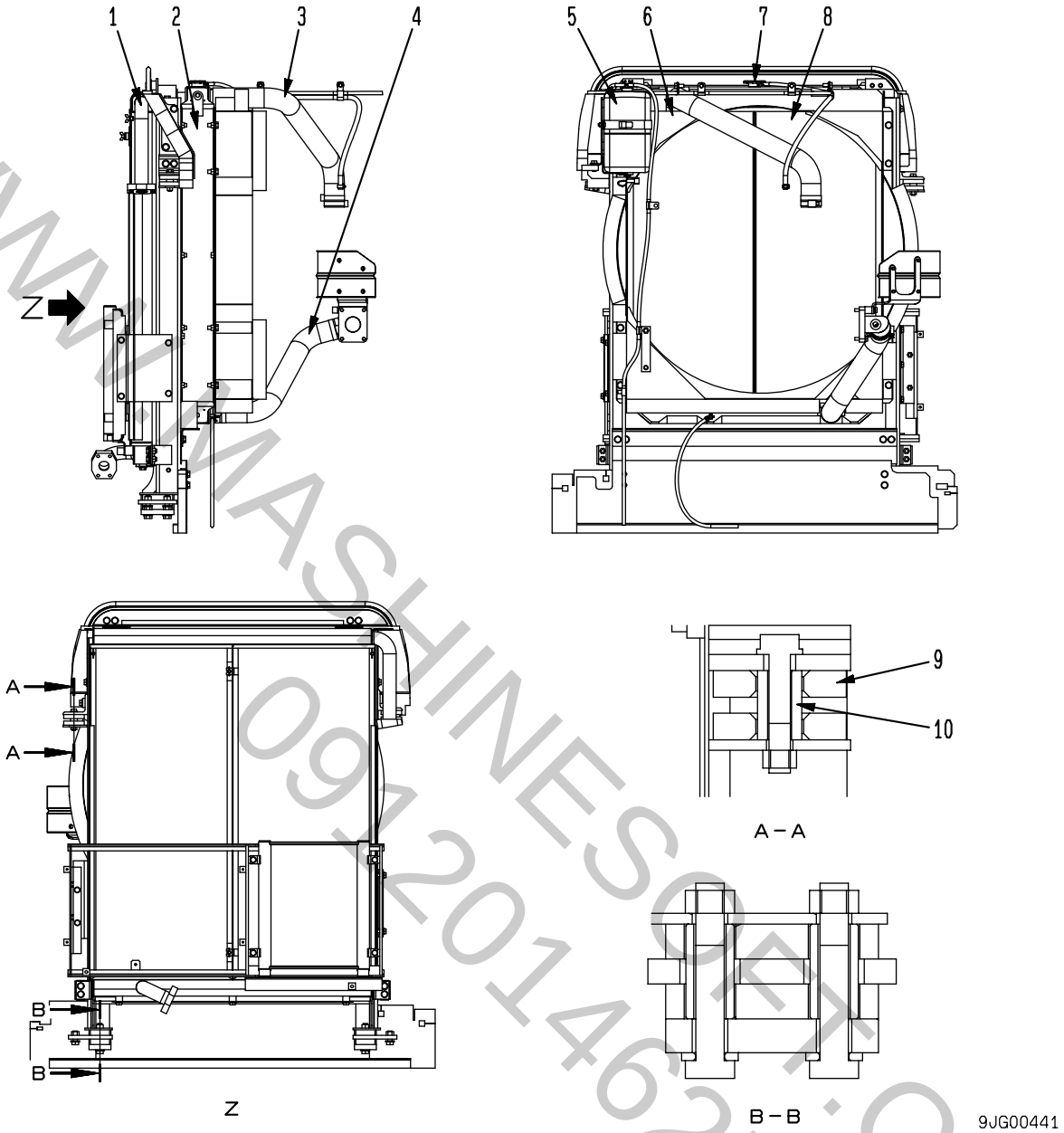
SAL56 + 8



Unit: mm

No.	Check item		Criteria				Remedy
1	Clearance between gear case and side plate	Model	Standard clearance		Clearance limit		Replace
		SAL56	0.13 – 0.18		0.22		
		SAL8	0.10 – 0.15		0.19		
2	Clearance between bearing inner dia. and gear shaft outer dia.	SAL56	0.067 – 0.125		0.20		
		SAL8	0.067 – 0.125		0.20		
3	Pin insertion depth		Standard size	Tolerance		Repair limit	
			12	0 –0.5		—	
4			12	0 –0.5		—	
5	Spline shaft rotation torque		—				—
—	Delivery Oil: EO10-CD Oil temp.: 45 – 55°C	SAL56	Speed (rpm)	Delivery pressure (MPa {kg/cm^2})	Standard delivery (ℓ/min.)	Delivery limit (ℓ/min.)	
			2,500	2.9 {30}	134	124	
		SAL8	2,500	2.9 {30}	19	17	

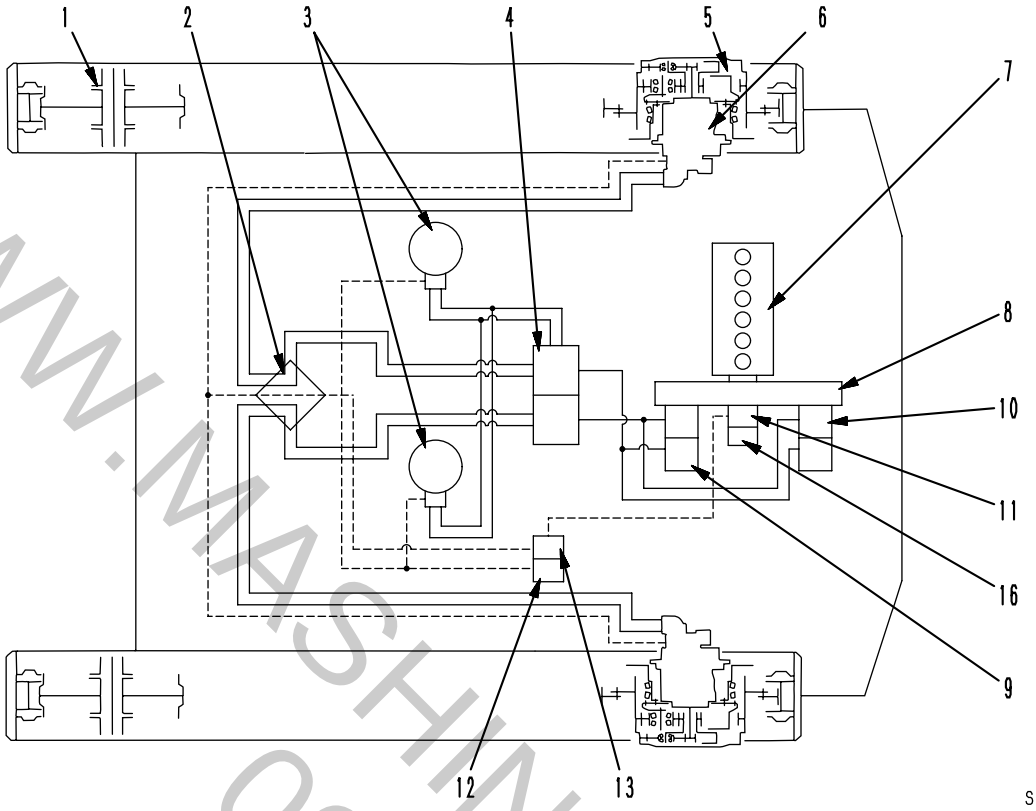
RADIATOR, OIL COOLER

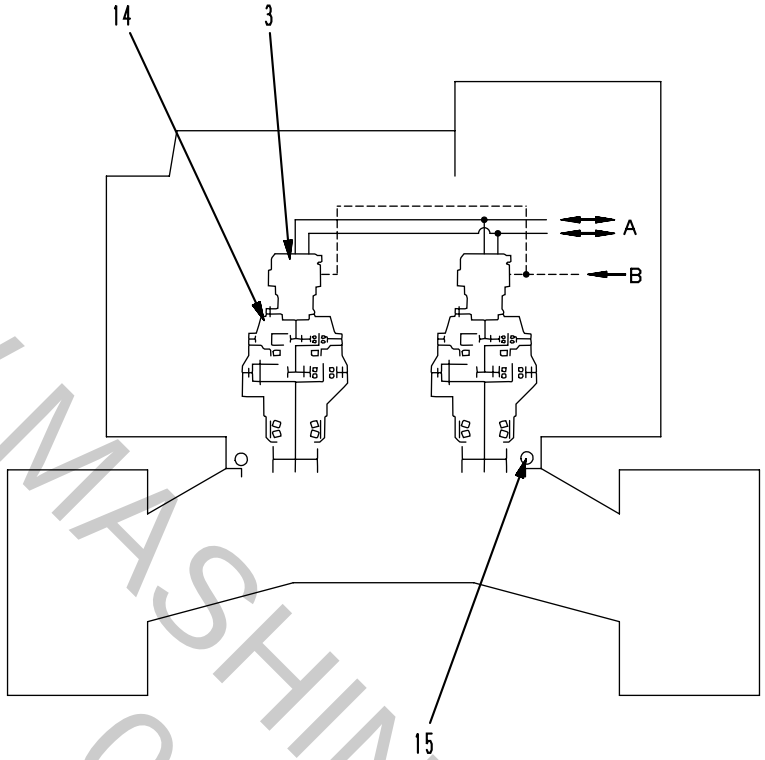


1. Oil cooler
2. Radiator
3. Radiator inlet hose
4. Radiator outlet hose
5. Reservoir tank
6. Shroud
7. Radiator cap
8. Fan
9. Cushion
10. Collar

Specifications
Radiator: CWX-5
Oil cooler: J-5

POWER TRAIN



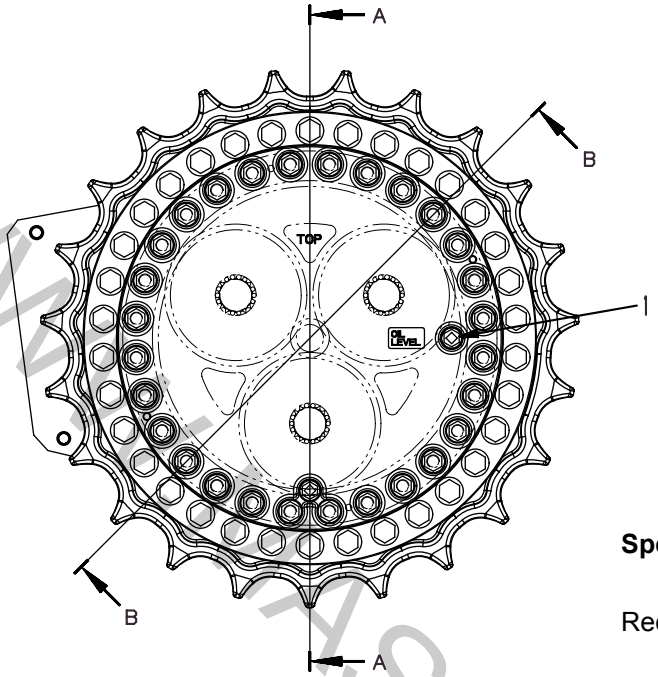


SUP06717

1. Idler
2. Center swivel joint
3. Swing motor (KMF90ABE-3)
4. Control valve
5. Final drive, sprocket
6. Travel motor (KMV335ADT)
7. Engine
8. PTO
9. No. 1 pump (HPV95+95)
10. No. 2 pump (HPV95+95)
11. Control pump (SAL56)
12. Swing brake solenoid valve
13. Travel speed solenoid valve
14. Swing machinery
15. Swing circle
16. PTO lubrication pump

A. Control valve
B. Swing brake solenoid valve

FINAL DRIVE

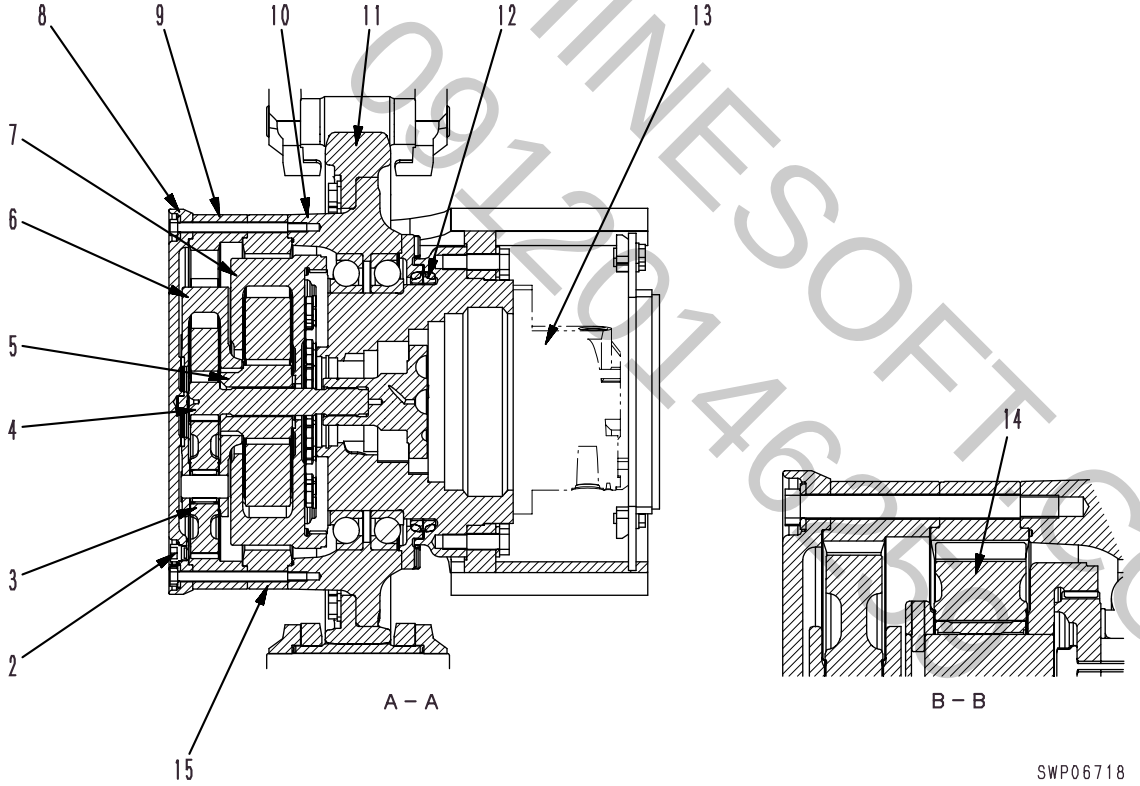


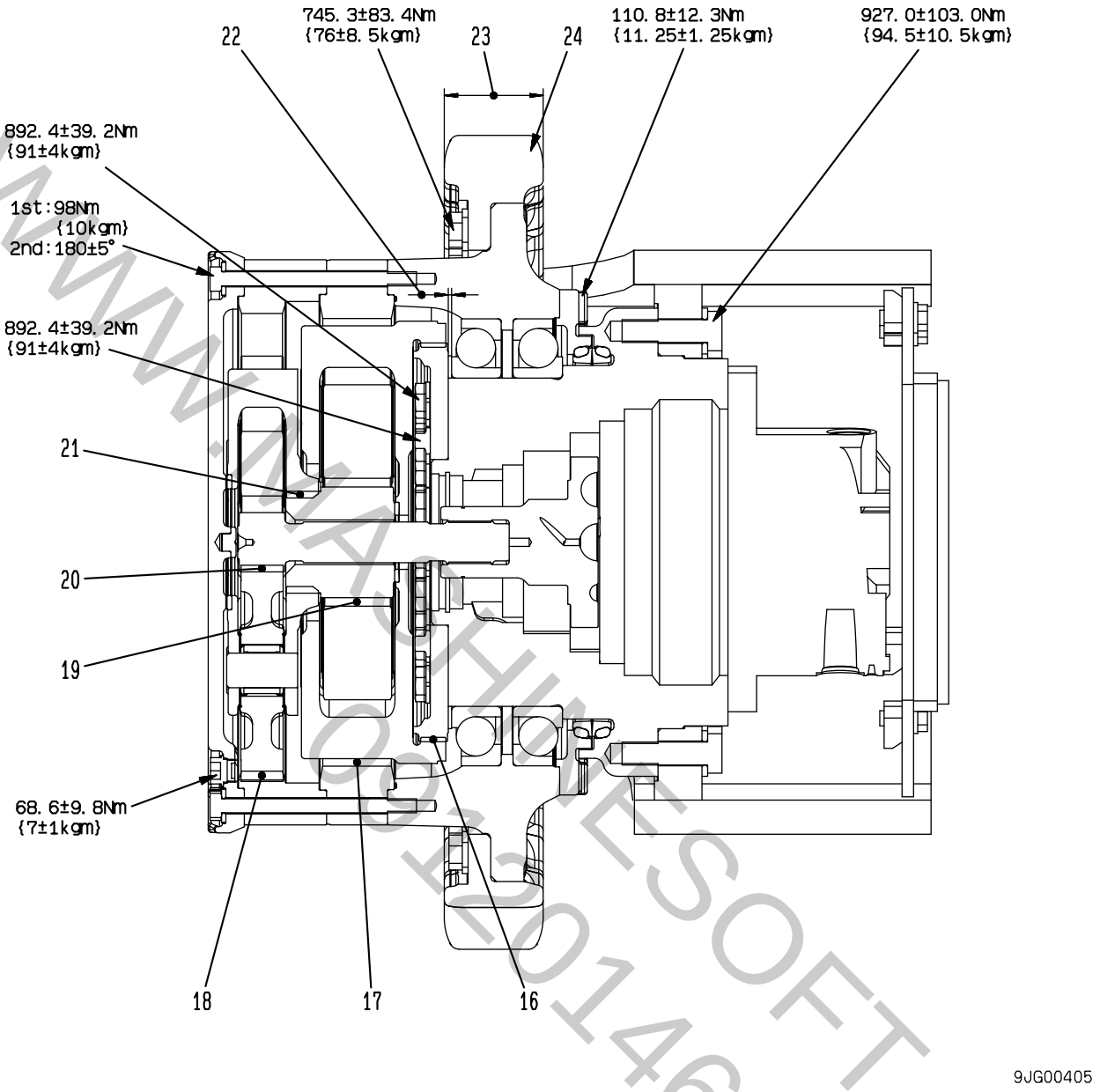
1. Level plug
2. Drain plug
3. No. 1 planetary gear (No. of teeth: 50)
4. No. 1 sun gear (No. of teeth: 12)
5. No. 2 sun gear (No. of teeth: 14)
6. No. 1 planetary carrier
7. No. 2 planetary carrier
8. Cover
9. No. 1 ring gear (No. of teeth: 114)
10. Hub
11. Sprocket
12. Floating seal
13. Travel motor
14. No. 2 planetary gear (No. of teeth: 27)
15. No. 2 ring gear (No. of teeth: 70)

Specifications

Reduction ratio: $-\left(\frac{12+114}{12}\right) \times \left(\frac{14+70}{14}\right) + 1$

$= -62.000$

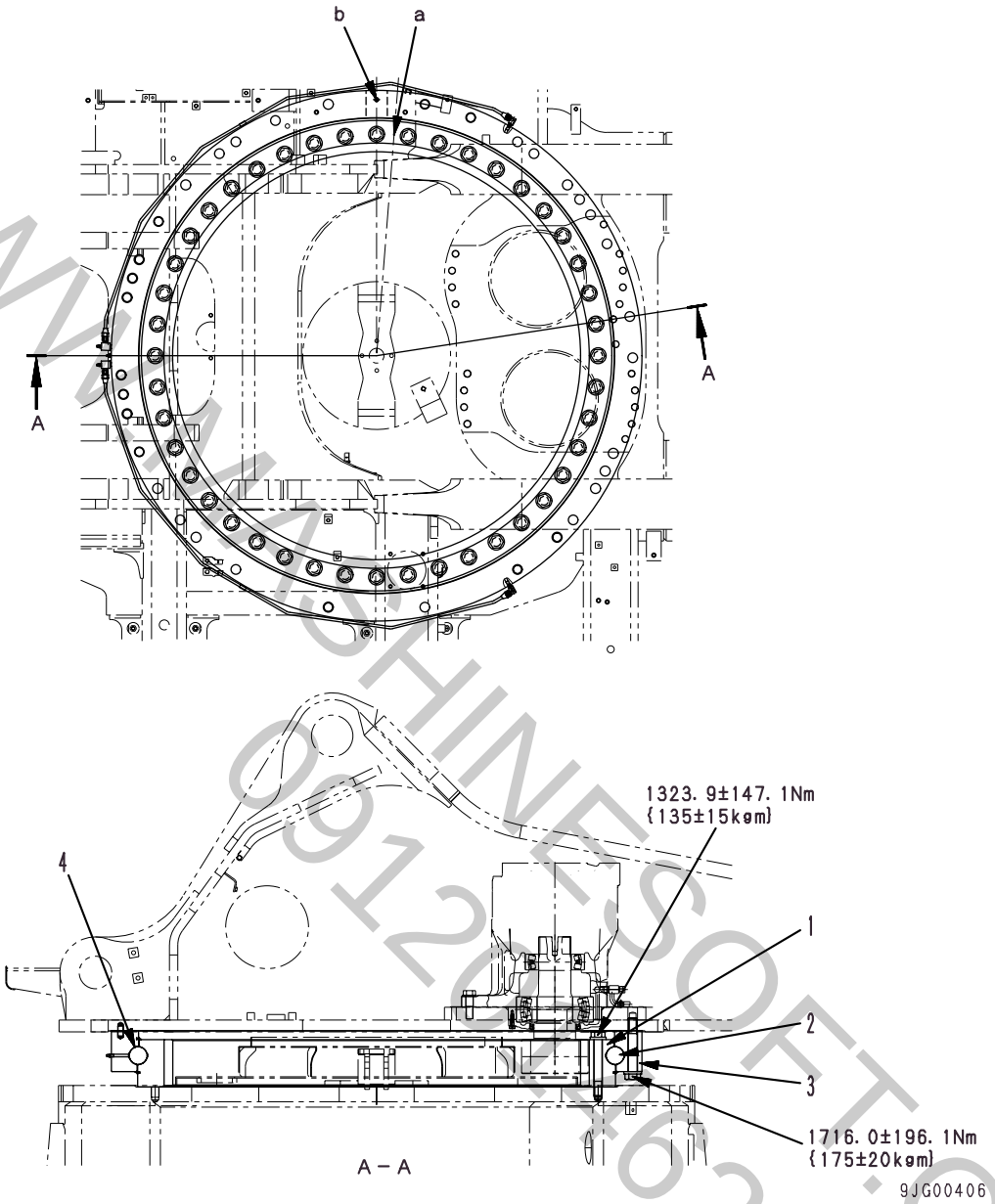




Unit: mm

No.	Check item	Criteria		Remedy
16	Backlash between No. 2 planet carrier and motor	Standard clearance	Clearance limit	Replace
		0.06 – 0.21	—	
17	Backlash between No. 2 planet gear and No. 2 ring gear	0.21 – 0.69	1.10	
18	Backlash between No. 1 planet gear and No. 1 ring gear	0.18 – 0.63	1.10	
19	Backlash between No. 2 sun gear and No. 2 planet gear	0.17 – 0.62	1.00	
20	Backlash between No. 1 sun gear and No. 1 planet gear	0.14 – 0.45	1.00	
21	Backlash between No. 1 planet carrier and No. 2 sun gear	0.16 – 0.56	1.00	
22	End play of sprocket shaft	0.10 – 0.15	—	
23	Sprocket tooth width	Standard size	Repair limit	Rebuild or replace
		104	101.5	
24	Wear of sprocket teeth	Repair limit: 6		Replace

SWING CIRCLE



1. Swing circle inner race (No. of teeth:100)
2. Ball
3. Swing circle outer race

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

Specifications

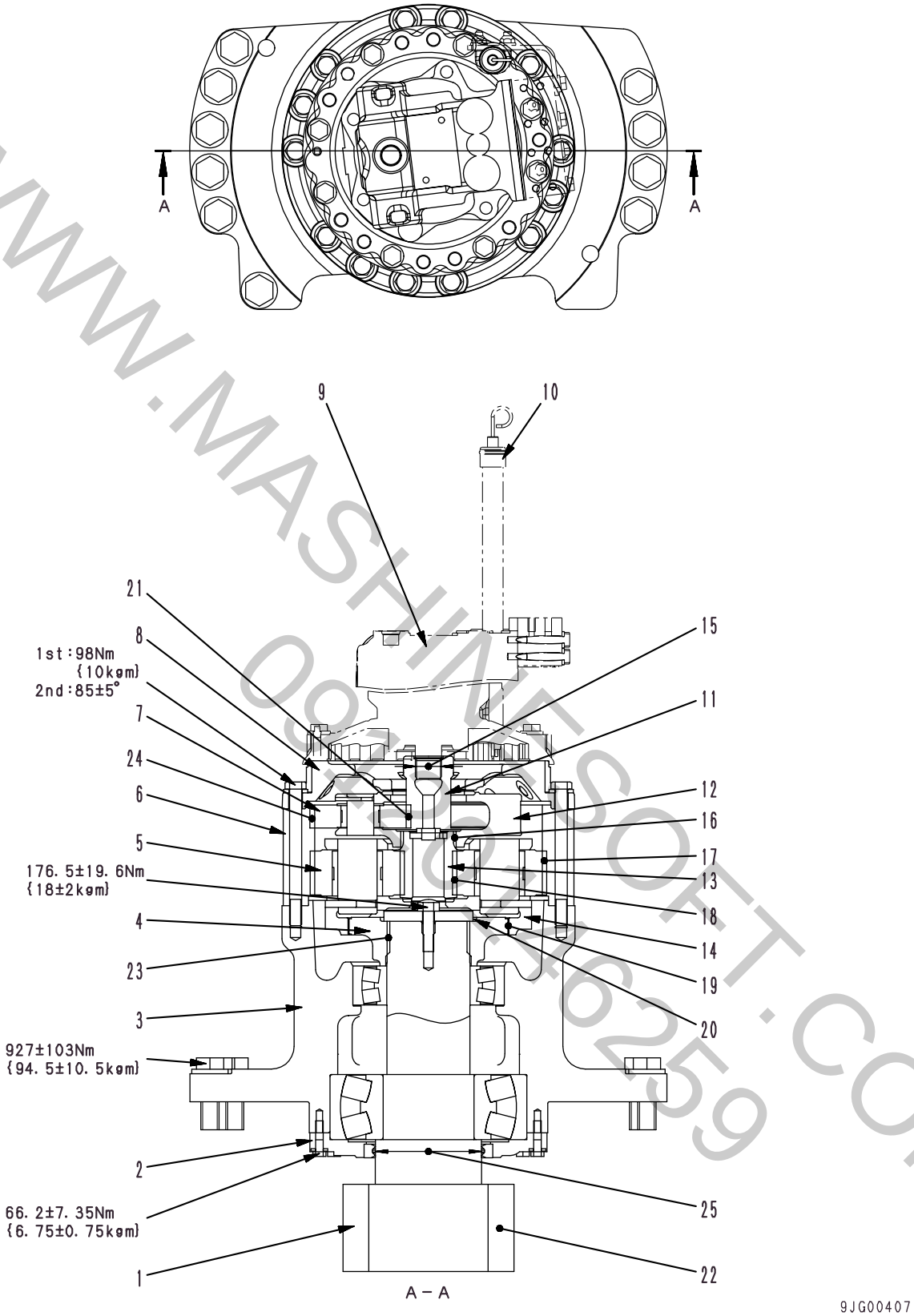
Reduction raito: $-\frac{100}{13} = -7.692$

Amount of grease: 31 ℓ (G2-LI)

Unit: mm

No.	Check item	Criteria		Remedy
4	Clearance of bearing in axial direction (when mounted on machine)	Standard clearance	Clearance limit	Replace
		0.10 – 0.25	3.2	

SWING MACHINERY



1. Swing pinion (No. of teeth: 13)
2. Cover
3. Case
4. Coupling
5. No. 2 planetary gear (No. of teeth: 36)
6. Ring gear (No. of teeth: 95)
7. No. 1 planetary gear (No. of teeth: 39)
8. Cover
9. Swing motor
10. Oil level gauge
11. No. 1 sun gear (No. of teeth: 16)
12. No. 1 planetary carrier
13. No. 2 sun gear (No. of teeth: 21)
14. No. 2 planetary carrier

Specifications

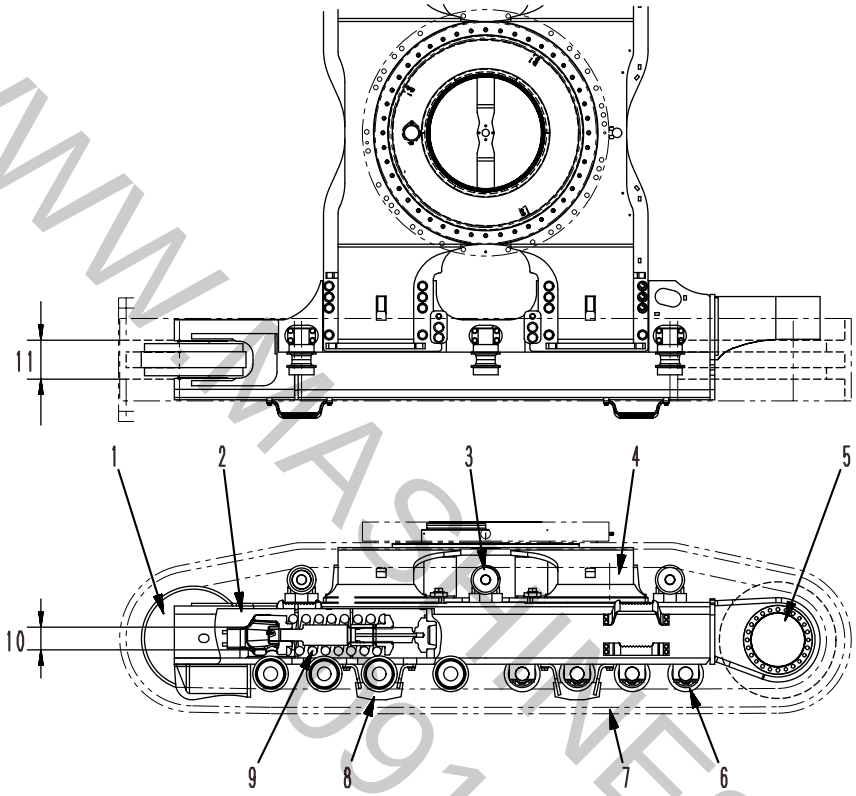
Reduction raito: $\frac{16+95}{16} \times \frac{21+95}{21}$

$= 38.321$

Unit: mm

No.	Check item	Criteria		Remedy
15	Backlash between swing motor shaft and No. 1 sun gear	Standard clearance	Clearance limit	Replace
		0.15 – 0.49	—	
16	Backlash between No. 1 planet carrier and No. 2 sun gear	0.38 – 0.66	1.20	
17	Backlash between No. 2 planet gear and ring gear	0.17 – 0.57	1.00	
18	Backlash between No. 2 sun gear and No. 2 planet gear	0.15 – 0.49	0.90	
19	Backlash between No. 2 planet carrier and coupling	0.06 – 0.25	—	
20	Clearance between plate and coupling	0.38 – 0.82	—	
21	Backlash between No. 1 sun gear and No. 1 planet gear	0.15 – 0.49	1.00	
22	Backlash between swing pinion and swing circle	0 – 0.126	2.00	
23	Backlash between coupling and swing pinion	0.07 – 0.23	—	
24	Backlash between No. 1 planet gear and ring gear	0.15 – 0.57	1.10	
25	Wear of swing pinion oil seal contact surface	Standard size	Repair limit	Repair hard chrome plating replace
		$140.3^{0}_{-0.100}$	—	

TRACK FRAME, RECOIL SPRING



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

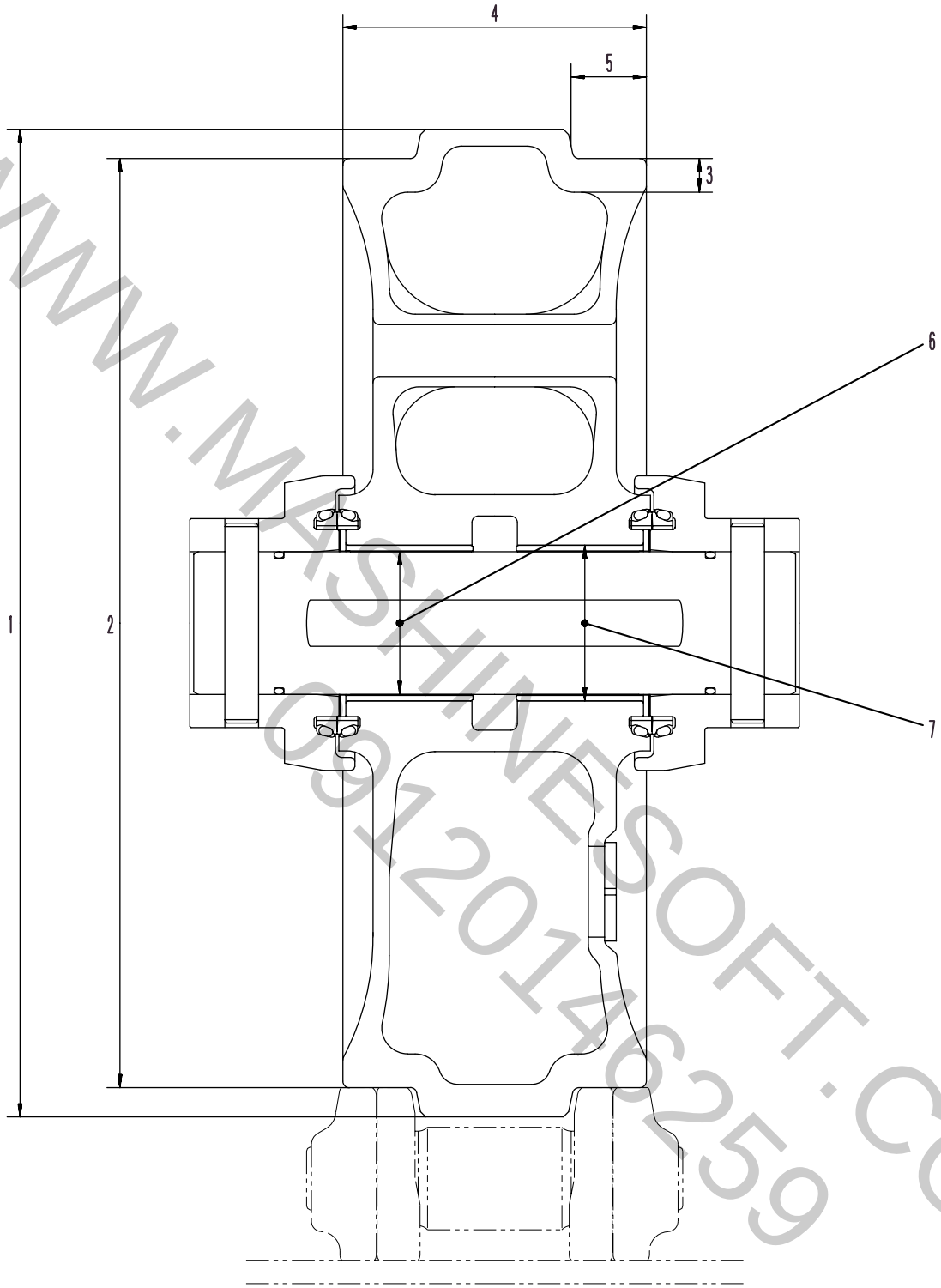
- The dimensions and number of track rollers may differ according to the model, but the basic structure is the same.
- No. of track rollers.

Model	No. of rollers (each side)
PC600-7	8
PC600LC-7	9

Unit: mm

No.	Check item	Criteria					Remedy
9	Recoil spring	Standard size			Repair limit		Replace
		Free length x OD	Installed length	Installed load	Free length	Installed load	
		859 x 299	715	292 kN {29,770 kg}	—	233.6 kN {23,816 kg}	
10	Top-to-bottom width of idler guide			Standard size	Tolerance	Repair limit	Rebuild or replace
		Track frame		163.5	163.5^{+4}_{0}	167.5	
		Idler support		161	161^{+1}_{0}	159	
11	Left-to-right width of idler guide	Track frame		329	329^{+4}_{0}	334	
		Idler support		324	—	322	

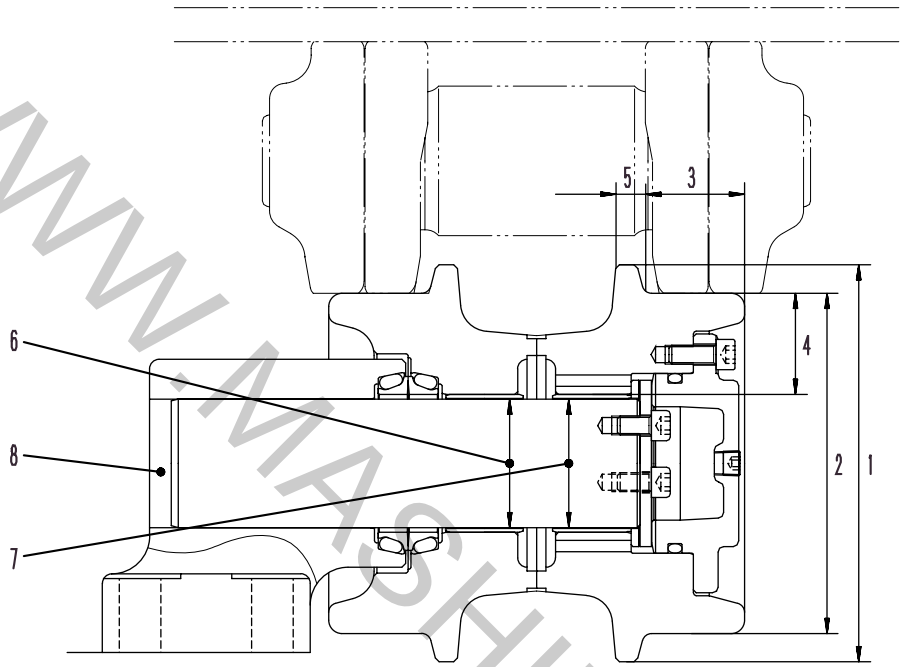
IDLER



Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of protruding part	Standard size			Repair limit		Rebuild or replace
		761			—		
2	Outside diameter of tread surface	716			704		
3	Thickness of tread	22.5			—		
4	Overall width	234			—		
5	Width of tread	56			—		Replace bushing
6	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
		110	–0.120 –0.207	+0.480 +0.420	0.540 – 0.687	1.5	
7	Interference between idler and bushing	Standard size	Tolerance		Standard interference	Interfer-ence limit	
			Shaft	Hole			
		120	+0.067 +0.037	–0.036 –0.136	0.073 – 0.203	—	

CARRIER ROLLER

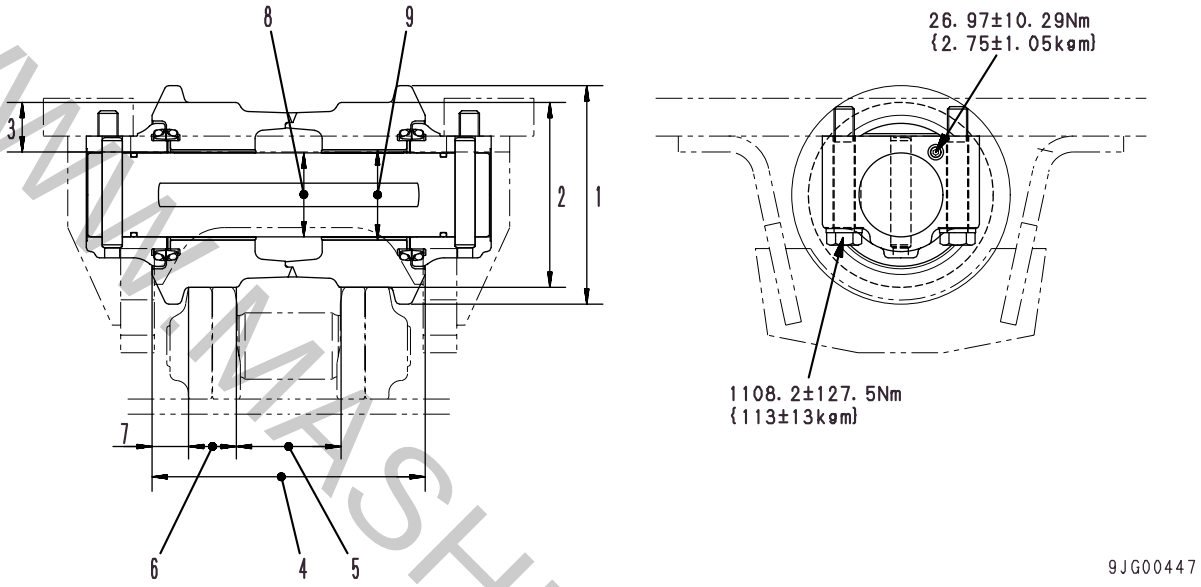


SJP06773

Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of flange	Standard size			Repair limit		Replace
		210			—		
2	Outside diameter of tread	180			170		
3	Width of tread	53			—		
4	Thickness of tread	53.5			—		
5	Width of flange	15			—		
6	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
		68	+0.09 +0.07	+0.43 +0.18	0.09 – 0.36	—	
7	Interference between roller and bushing	Standard size	Tolerance		Standard interference	Interfer-ence limit	
			Shaft	Hole			
		73	+0.38 +0.33	+0.24 +0.21	0.09 – 0.17	—	
8	Play of roller in axial direction	Standard clearance			Clearance limit		
		0.62 – 0.93			—		

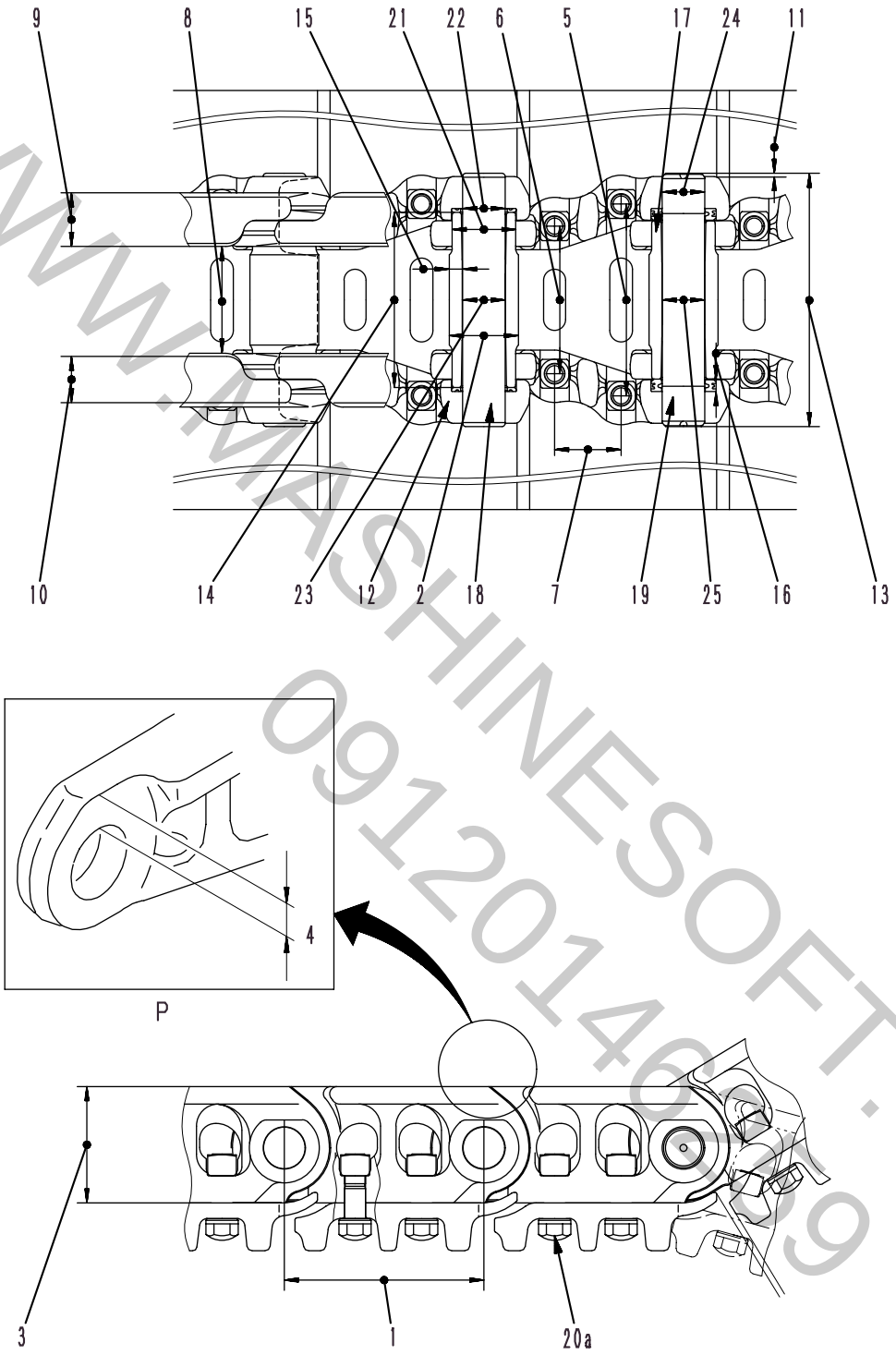
TRACK ROLLER



Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of flange	Standard size			Repair limit		Rebuild or replace
		260			—		
2	Outside diameter of tread surface	220			208		
3	Thickness of tread	56.2			—		
4	Overall width	325			—		
5	Inside width	120					
6	Width of tread	63					
7	Width of flange	39.5					
8	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace bushing
			Shaft	Hole			
		100	–0.140 –0.207	+0.390 +0.330	0.470 – 0.597	1.5	
9	Interference between roller and bushing	Standard size	Tolerance		Standard interference	Interfer-ence limit	
			Shaft	Hole			
		107.6	+0.067 +0.037	+0.020 –0.015	0.017 – 0.082	—	

TRACK SHOE



SJP06775

★ P Portion shows the link of buhing press fitting end.

Unit: mm

No.	Check item		Criteria			Remedy
1	Link pitch		Standard size	Repair limit		Reverse or replace
			228.6	231.6		
2	Bushing outside diameter		Standard size	When turned		
				Normal load	Impact load	
			72.5	67.5	—	
3	Link height		Standard size	Repair limit		Rebuild or replace
			133	123		
4	Thickness of link metal (bushing press-fitting portion)		33.75	23.75		Replace
5	Shoe bolt pitch		219.8			
6			169			
7			76.2			
8	Link	Inside width	122.4			Repair or replace
9		Overall width	61.4			
10		Tread width	54.5			
11	Protrusion of pin		3.7			Adjust or replace
12	Protrusion of regular bushing		9.6			
13	Overall length of pin		290			
14	Overall length of bushing		200.6			
15	Thickness of bushing metal		14.7			
16	Thickness of spacer		—			
17	Press-fitting force	Bushing	127.4 – 274.4 kN {13 – 28 ton}			—
18		Regular pin	254.8 – 303.8 kN {26 – 31 ton}			
*19		Master pin	205.8 – 254.8 kN {21 – 26 ton}			

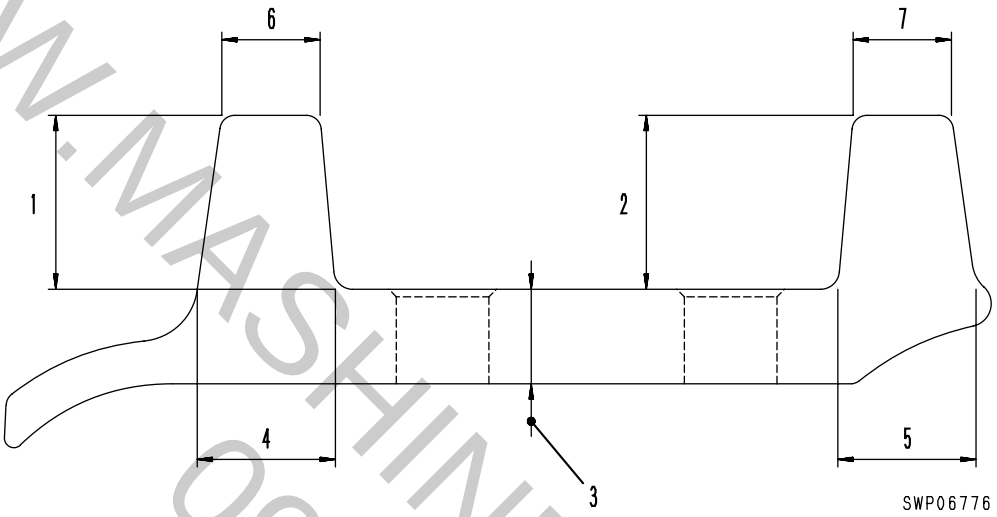
*:Dry type track link

Unit: mm

No.	Check item		Criteria				Remedy
20	Shoe bolt	a. Regular link	Tightening torque (Nm {kgm})		Additional tightening angle (deg.)		Retighten
			784.5±78.5 {80±8}		120±10		
		b. Master link	Tightening torque (Nm {kgm})	Additional tightening angle (deg.)		Lower limit torque (Nm {kgm})	
			—	—		—	
	No. of shoes (each side)		PC600-7: 49 PC600LC-7: 52				—
21	Interference between bushing and link		Standard size	Tolerance		Standard interference	Adjust or replace
				Shaft	Hole		
			72.9	+0.050 0	–0.326 –0.400	0.326 – 0.450	
22	Interference between regular pin and link		48.8	+0.180 +0.080	–0.318 –0.380	0.318 – 0.480	
23	Clearance between regular pin and bushing		Standard size	Tolerance		Standard clearance	
				Shaft	Hole		
			49.6	–0.62 –0.72	+0.6 0	0.72 – 1.22	
*24	Interference between master pin and link		Standard size	Tolerance		Standard interference	
				Shaft	Hole		
			48.8	+0.030 0	–0.318 –0.380	0.238 – 0.330	
*25	Clearance between master pin and bushing		Standard size	Tolerance		Standard clearance	
				Shaft	Hole		
			49.2	–0.65 –0.75	+0.60 0	0.65 – 1.35	

*: Dry type track link

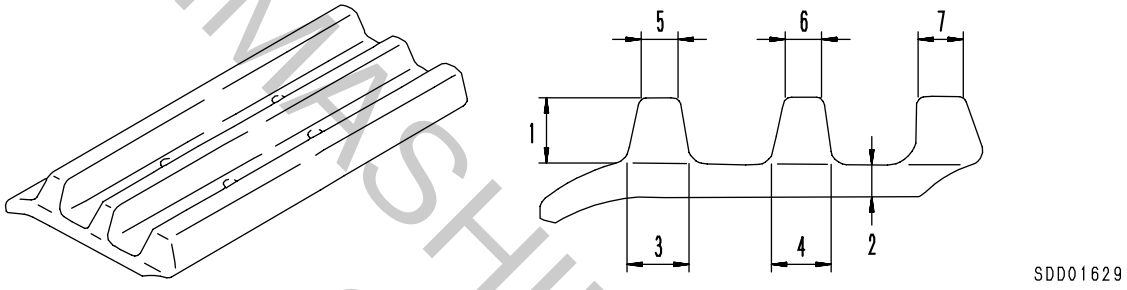
DOUBLE SHOE



Unit: mm

No.	Check item	Criteria		Remedy
1	Height	Standard size	Repair limit	Rebuild or replace
		46	25	
2	Height	46		
3	Thickness	25		
4	Length at bottom	36.5		
5		36.5		
6	Length at top	26		
7		26		

TRIPLE GROUSER SHOE



Unit: mm

No.	Check item	Criteria		Remedy
1	Height	Standard size	Repair limit	Rebuild or replace
		37	25	
2	Thickness	18		
3	Length of bottom	33		
4		27		
5	Length at tip	25.5		
6		17.5		
7		23.5		

Standard shoe

Item \ Model	PC600-7	PC600LC-7
Shoe width (mm) (triple shoe)	600	600
Link pitch (mm)	228.6	228.6
No. of shoes (each side)	49	52

Selection of track shoe

- Select the most suitable track shoe from the following table

	PC600-7		PC600LC-7	
	Specifications	Category	Specifications	Category
Standard	600 mm triple	A	600 mm triple	A
If equipped	700 mm triple	B	—	—
If equipped	750 mm triple	B	750 mm triple	B
If equipped	900 mm triple	B	900 mm triple	B

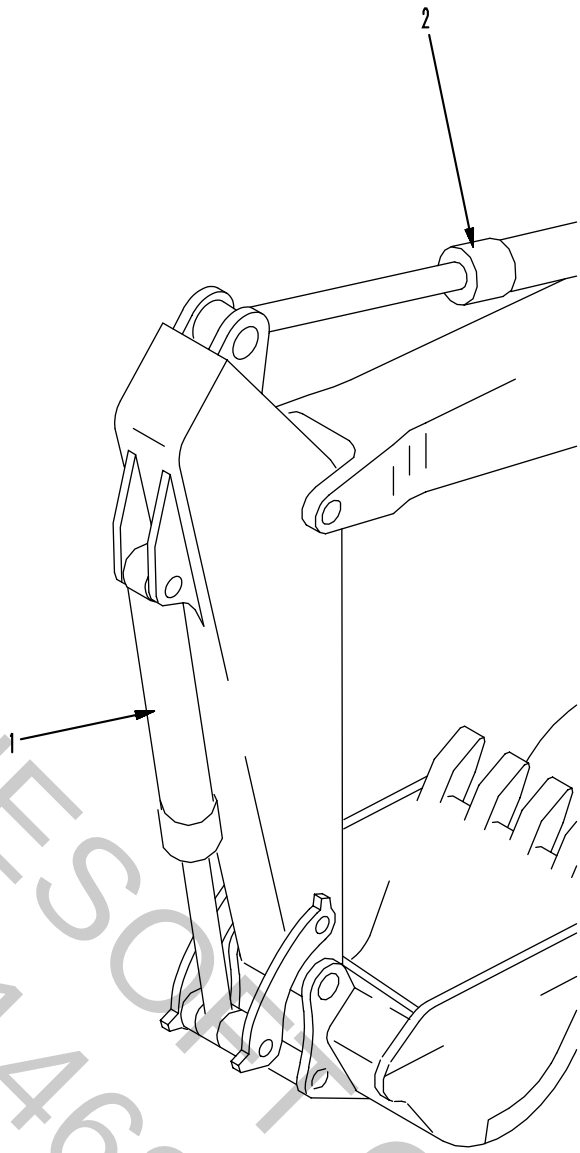
Category	Use	Precautions when using
A	Rocky ground, normal river soil	• Travel in Lo speed when traveling on rough ground with obstacles such as large boulders and fallen trees.
B	Normal soil, soft land	• Cannot be used on rough ground where there are large obstacles such as boulders and fallen trees. • Travel in Hi speed only on flat ground; when it is impossible to avoid traveling over obstacles, lower the travel speed to approx. half of Lo speed.
C	Extremely soft ground (swampy ground)	• Use only for ground where “A” and “B” sink and are impossible to use. • Cannot be used on rough ground where there are large obstacles such as boulders and fallen trees • Travel in Hi speed only on flat ground; when it is impossible to avoid traveling over obstacles, lower the travel speed to approx. half of Lo speed.
D	Paved surface	• The shoes are flat, so they have low gradeability
E	Paved surface	• The shoes are made of rubber, so be careful when traveling on rough ground

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

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

HYDRAULIC PIPING DRAWING

1. Bucket cylinder
2. Arm cylinder
3. Boom cylinder
4. Center swivel joint
5. Swing motor
6. Oil cooler
7. Control valve
8. PPC shuttle valve
9. Hydraulic filter
10. Hydraulic pump
11. L.H. travel motor
12. Hydraulic tank
13. PPC safety lock valve
14. L.H. PPC valve
15. R.H. PPC valve
16. Travel PPC valve
17. Boom holding valve
18. Accumulator
19. Active solenoid valve (swing)
20. Solenoid valve assembly
    - 20A. Swing brake solenoid valve
    - 20B. Travel speed solenoid valve
    - 20C. Pump merge/flow divider solenoid valve
    - 20D. Boom Hi 2-stage safety solenoid valve
    - 20E. Active solenoid valve (boom)



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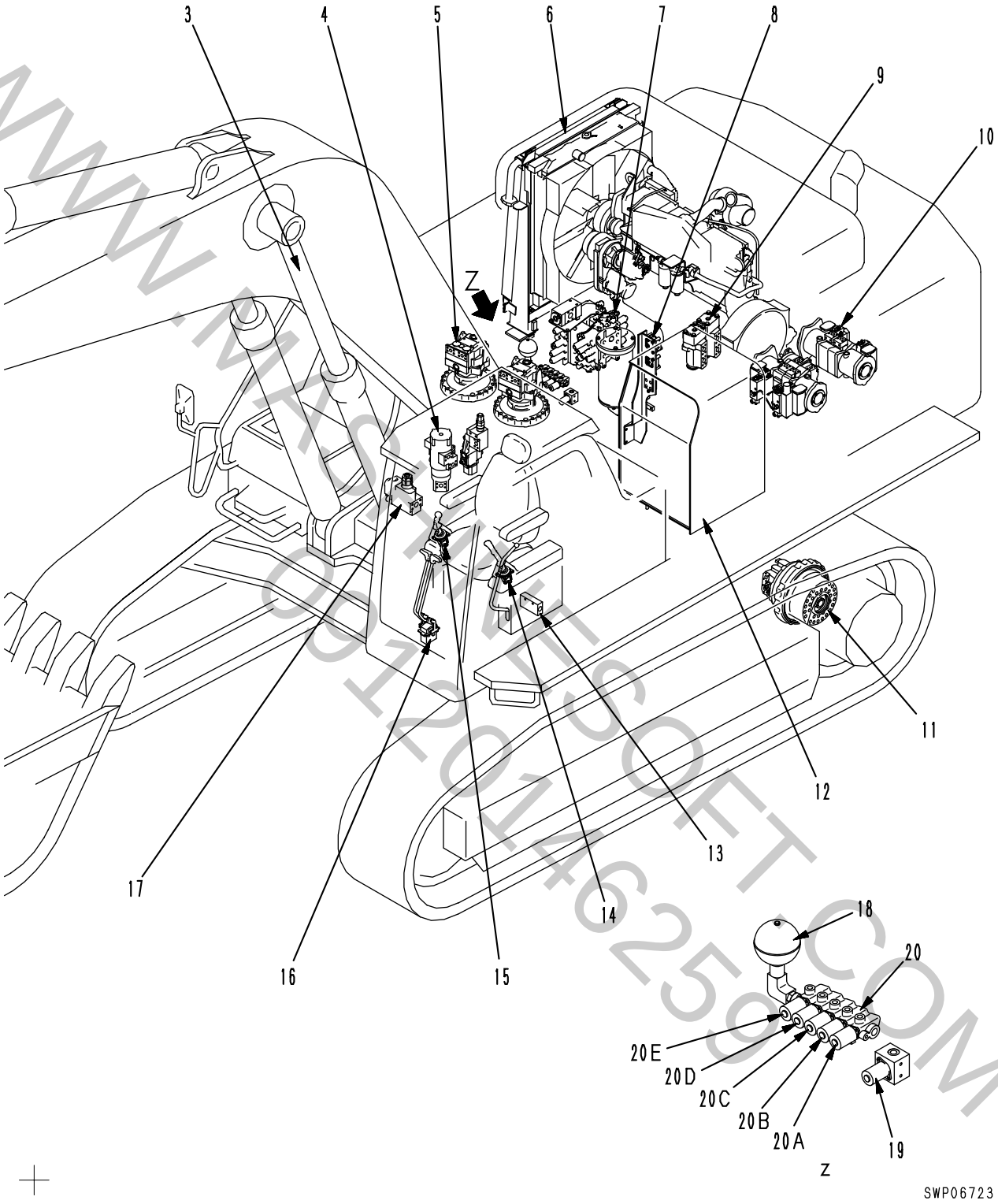
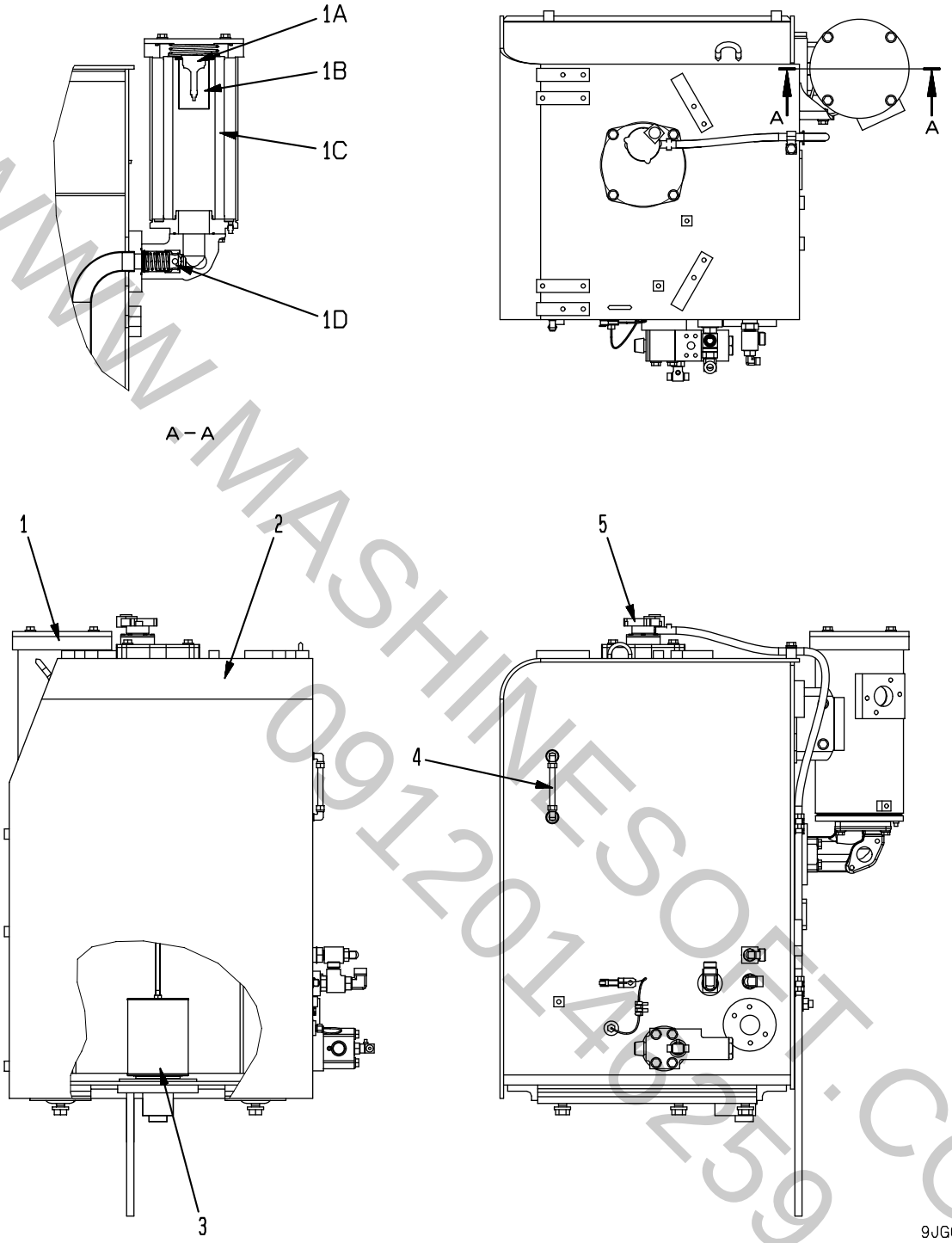


HYDRAULIC TANK, HYDRAULIC FILTER



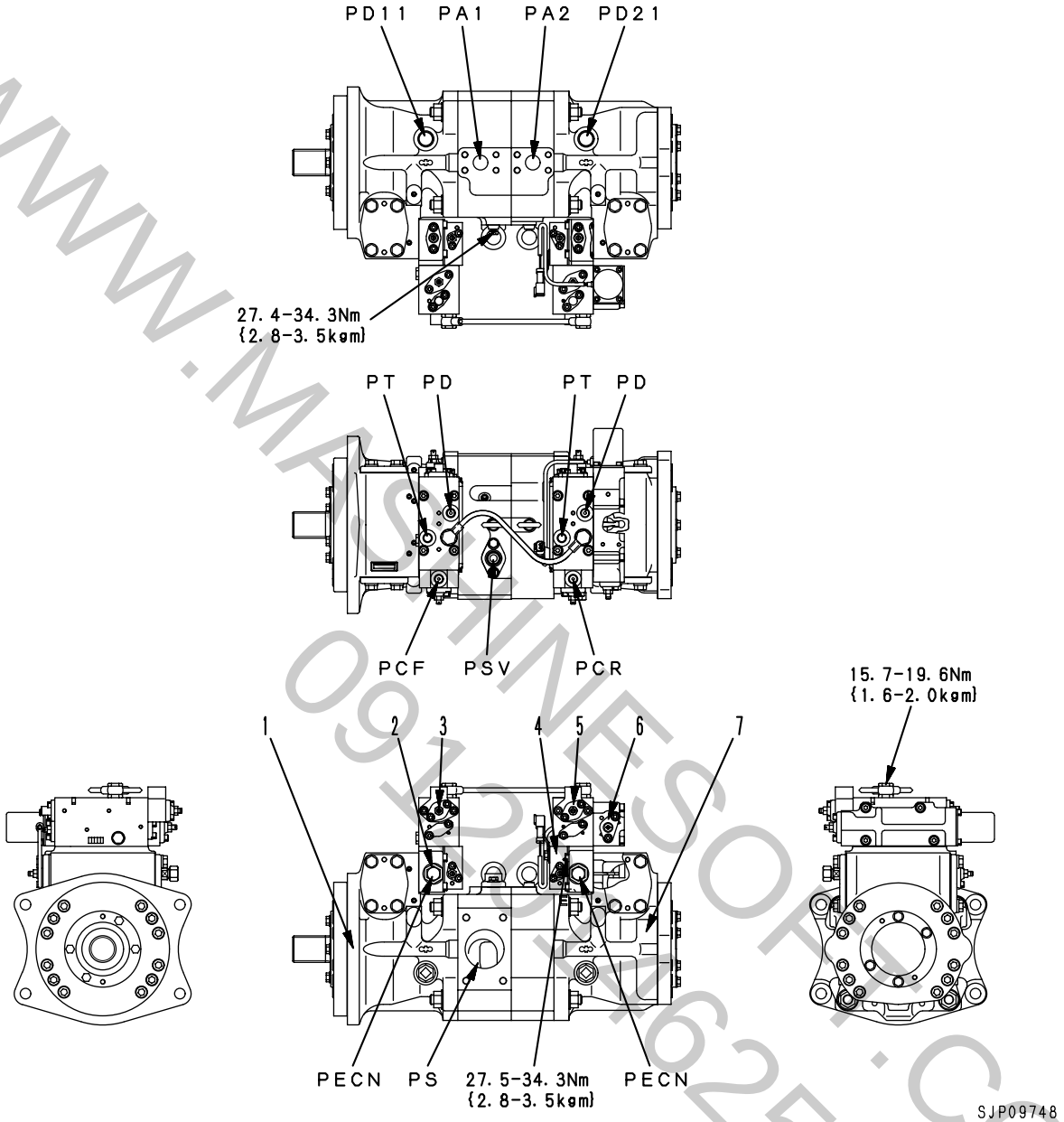
1. Hydraulic filter
   1A. Bypass valve
   1B. Strainer
   1C. Element
   1D. Cooler check valve
2. Hydraulic tank
3. Suction strainer
4. Sight gauge
5. Oil filler cap

Specifications
Tank capacity: 500 ℓ
Amount of oil inside tank: 380 ℓ (at H level)

Safety valve
- Relief cracking pressure: 16.7 ± 6.9 kPa
  {0.17 ± 0.07 kg/cm^2}
- Suction cracking pressure: 0 – 0.49 kPa
  {0 – 0.005 kg/cm^2}
- Bypass valve set pressure: 0.15 ± 0.03 MPa
  {1.5 ± 0.3 kg/cm^2}

HYDRAULIC PUMP (PISTON PUMP)

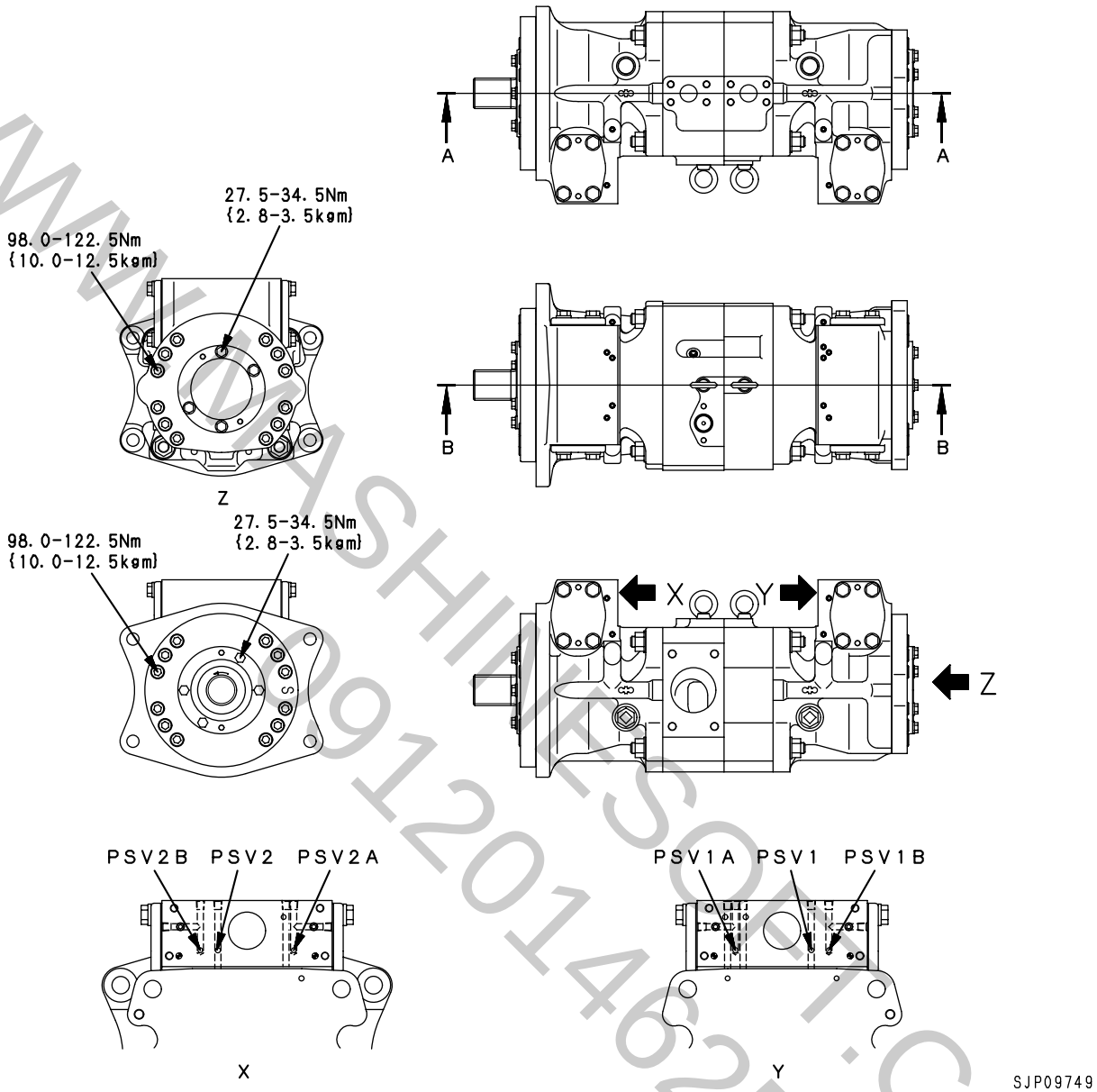
No. 1 MAIN PUMP
MODEL: HPV95+95



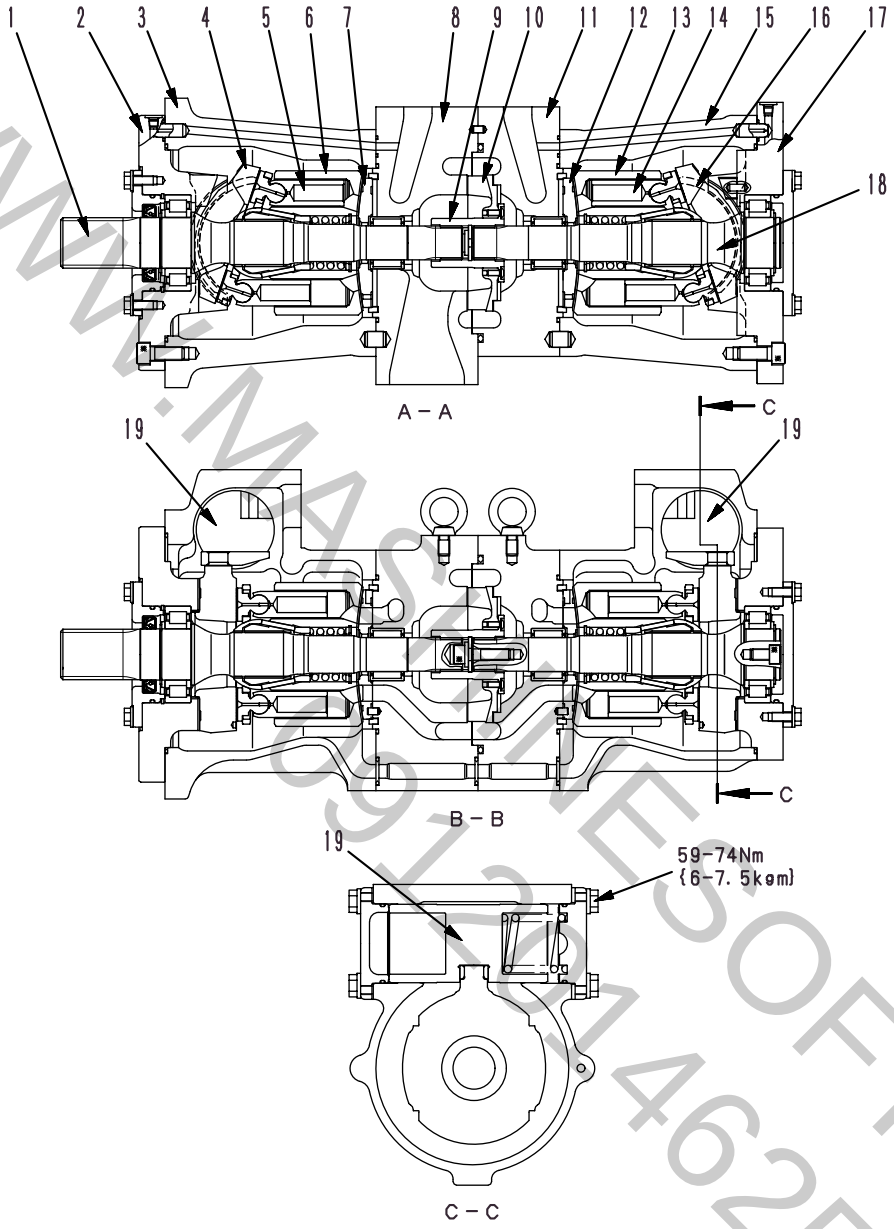
PA1 : Front pump discharge port
PA2 : Rear pump discharge port
PD11 : Drain port
PD21 : Drain port
PCF : CO selector pilot port
PCR : CO selector pilot port
PD : Jet sensor downstream pressure IN port
PS : Pump suction port
PT : Jet sensor upstream pressure IN port
PSV : Servo basic pressure IN port
PECN : CO+NC valve output pressure output port

1. Front pump
2. Front servo valve
3. Front CO+NC valve
4. Rear servo valve
5. Rear CO+NC valve
6. TVC valve
7. Rear pump

No. 1 main pump



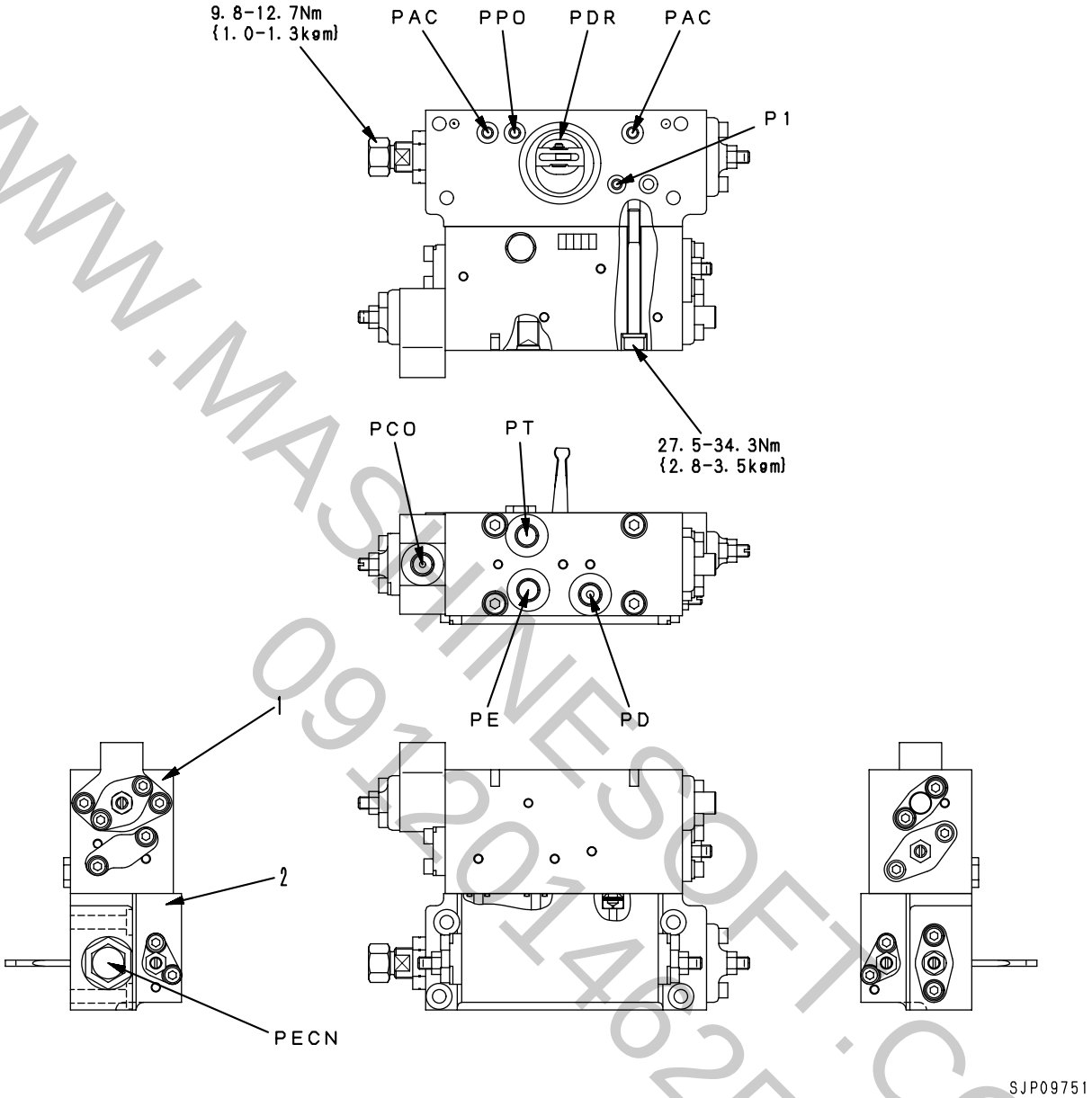
PSV1 : Servo valve basic pressure port
PSV2 : Servo valve basic pressure port
PSV1A : Servo piston output port
PSV1B : Servo valve output port
PSV2A : Servo piston output port
PSV2B : Servo valve output port



1. Front shaft
2. Front cradle
3. Front case
4. Rocker cam
5. Piston
6. Cylinder block
7. Valve plate
8. Front end cap
9. Coupling
10. Impeller
11. Rear end cap
12. Valve plate
13. Cylinder block
14. Piston
15. Rear case
16. Rocker cam
17. Rear cradle
18. Rear shaft
19. Servo piston

SERVO VALVE

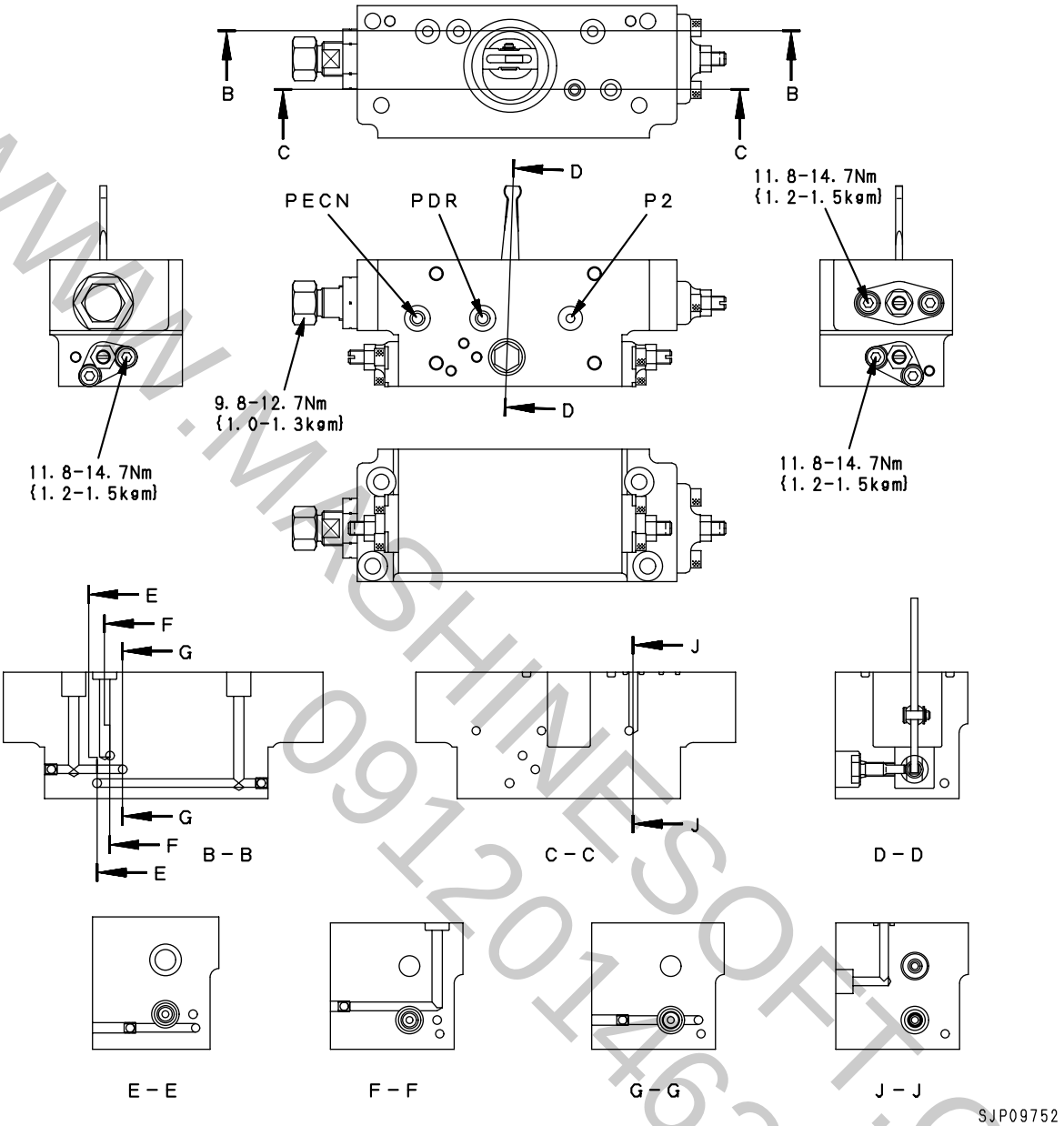
1. Servo valve assembly (No. 1 front)



P1 : Main pump pressure IN port
PE : TVC valve output pressure front, rear interconnection port
PCO : CO selector pilot port
PD : Jet sensor downstream pressure IN port
PT : Jet sensor upstream pressure IN port
PAC : Servo actuator port
PDR : Servo valve drain OUT port
PPO : Servo basic pressure IN port
PECN : CO+NC valve output pressure output port

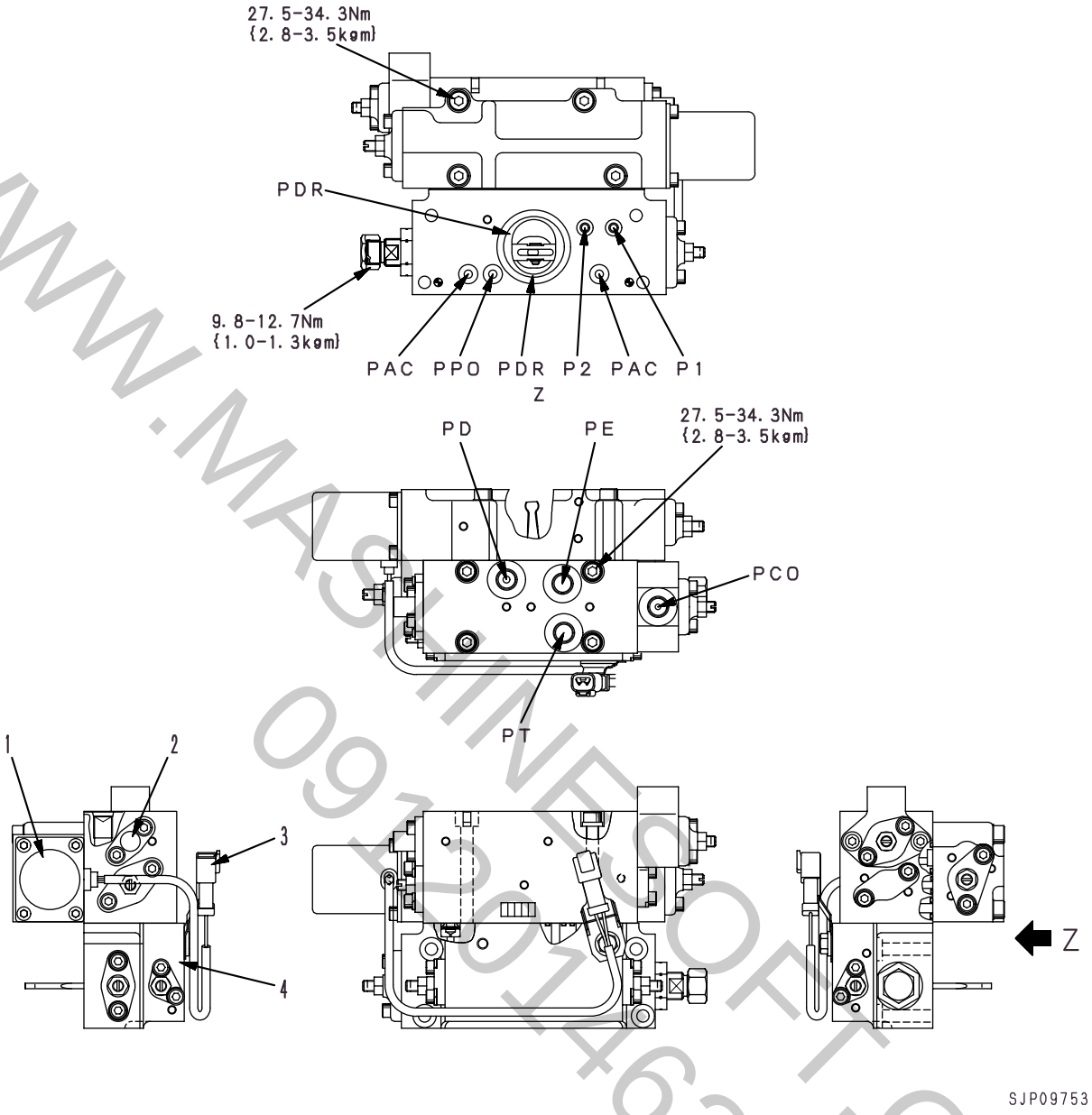
1. CO+NC valve
2. Servo valve

2. Servo valve (No. 1 front)



P2 : Main pump pressure OUT port
PDR : CO+NC valve drain IN port
PECN : CO+NC valve output pressure IN port

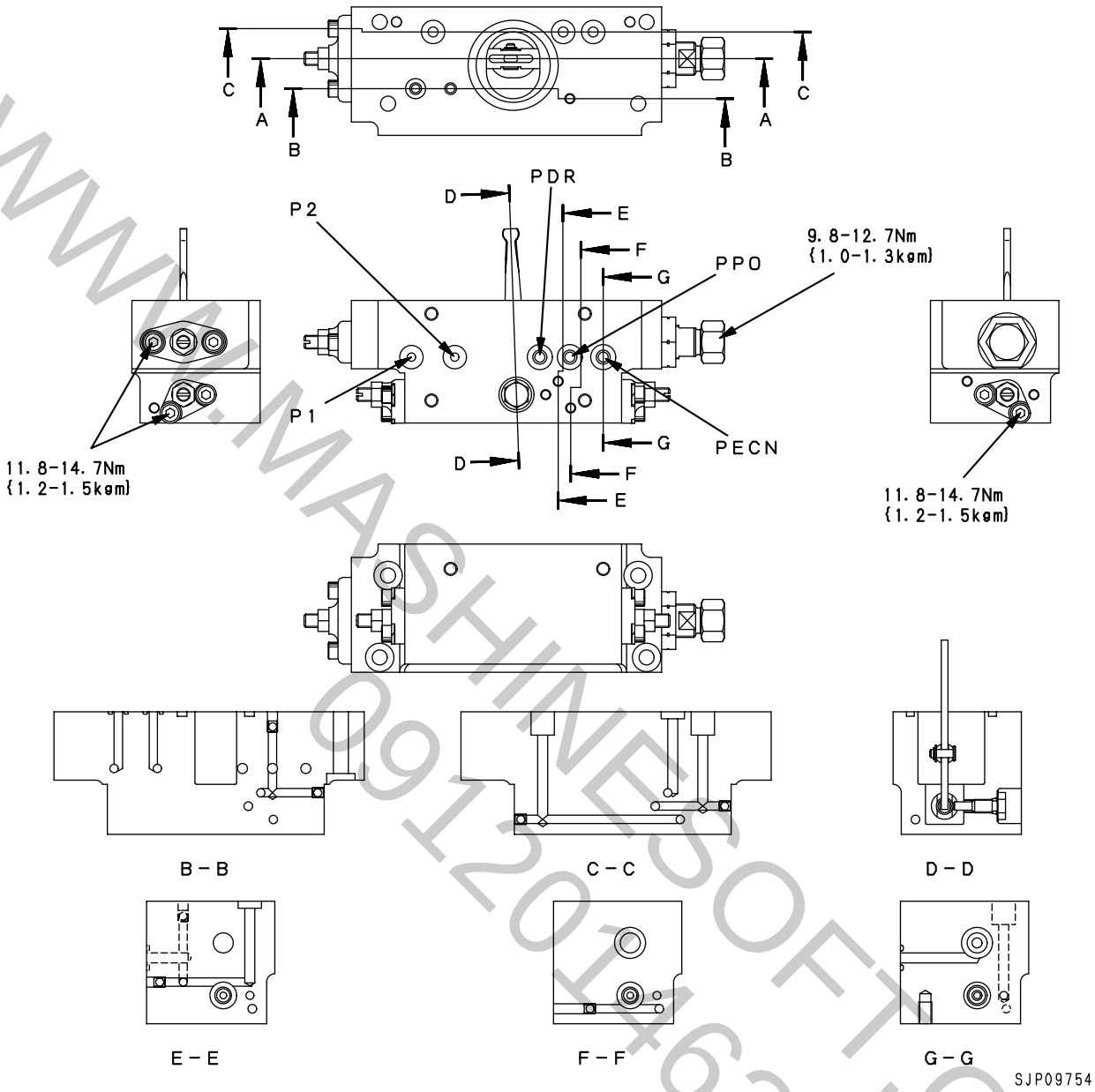
3. Servo valve assembly (No. 1 rear)



P1 : Main pump pressure IN port
P2 : Main pump pressure IN port
PCO : CO selector pilot port
PAC : Servo actuator port
PDR : Servo valve drain OUT port
PPO : Servo basic pressure IN port
PD : Jet sensor downstream pressure IN port
PE : TVC valve output pressure front, rear interconnection port
PT : Jet sensor upstream pressure IN port

1. TVC valve
2. CO+NC valve
3. Connector
4. Servo valve

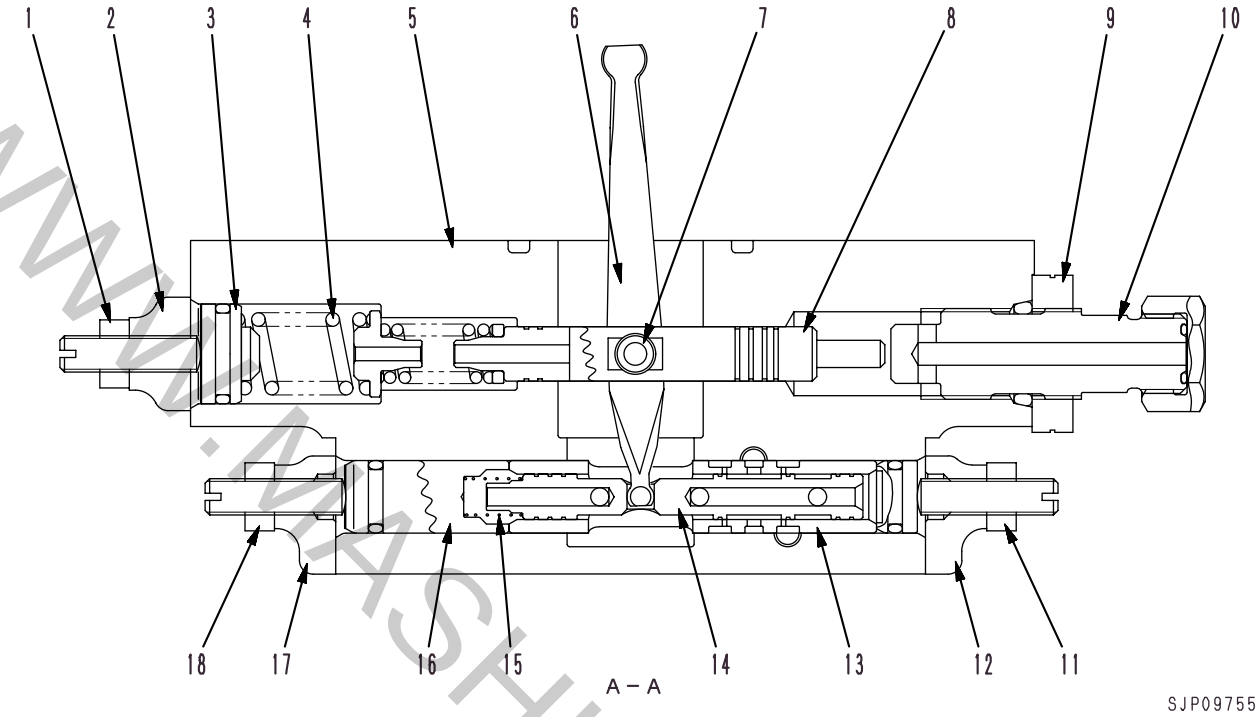
4. Servo valve (No. 1 rear)



P1 : Main pump pressure OUT port
P2 : Main pump pressure OUT port
PDR : CO+NC valve drain IN port
PPO : Servo basic pressure OUT port
PECN : CO+NC valve output pressure IN port

Structure

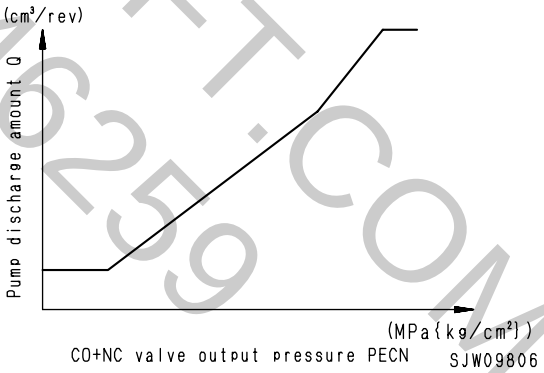
(The following illustration shows the servo valve for No. 1 rear.)



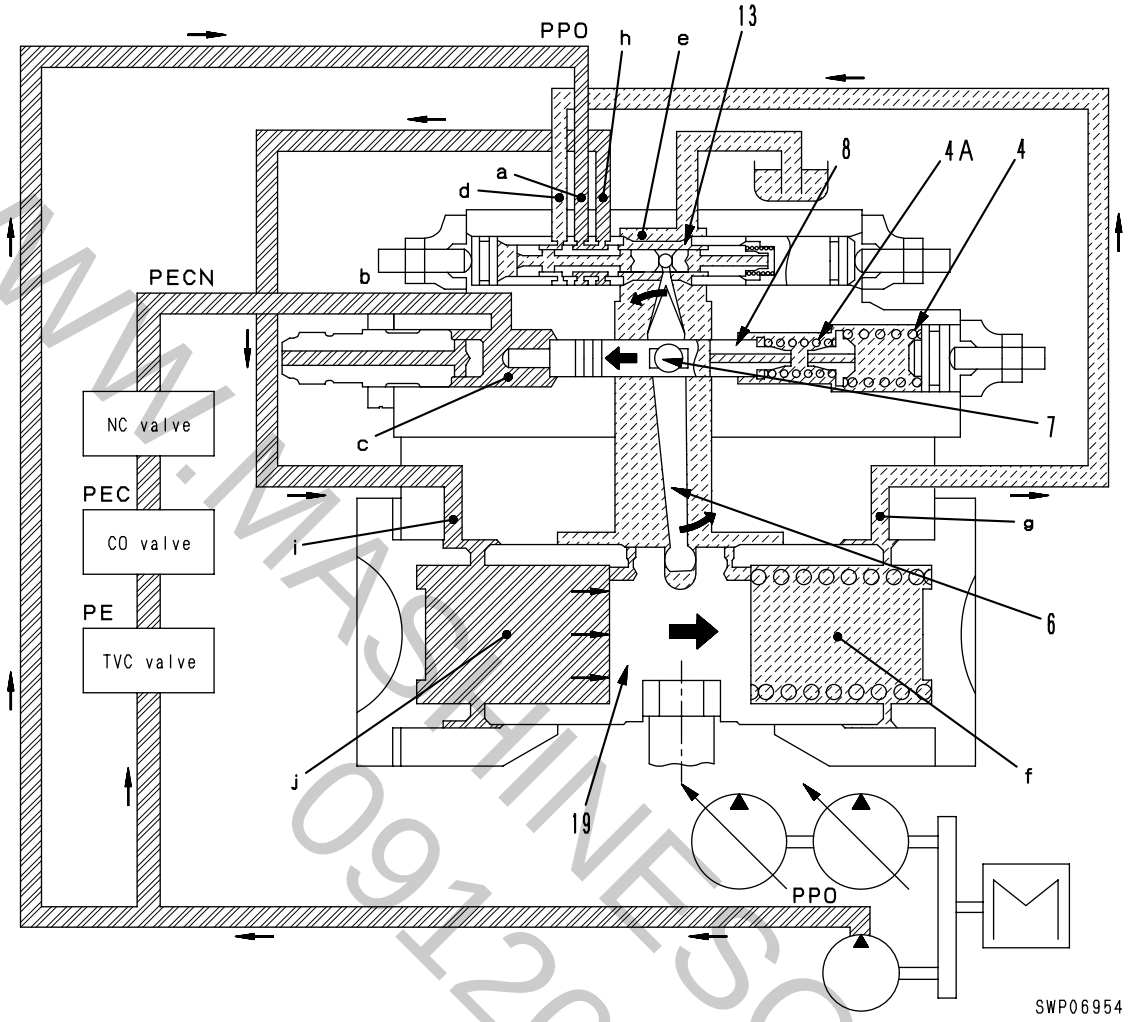
1. Locknut
2. Cover
3. Plug
4. Spring
5. Valve body
6. Arm
7. Pin
8. Piston
9. Locknut
10. Plug
11. Locknut
12. Cover
13. Sleeve
14. Piston
15. Spring
16. Plug
17. Cover
18. Locknut

Function

Discharge amounts **Q1** and **Q2** of main pumps **P1** and **P2** are controlled individually by the respective servo valves. The relationship between pump discharge amount **Q** and input signal **PECN** to the servo valve is as shown in the graph on the right. **Q** varies in proportion to **PECN.**



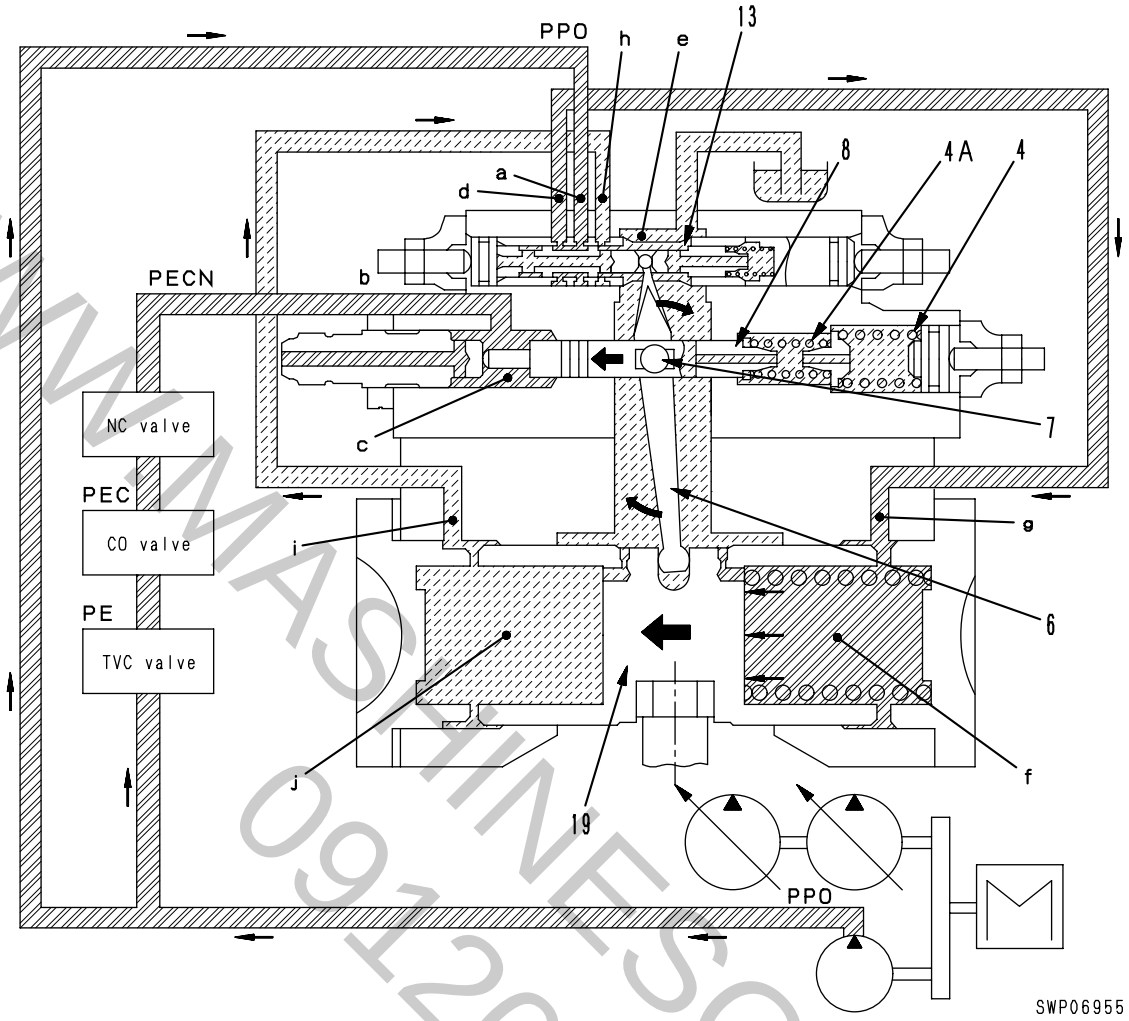
1) Operation in direction of increase of pump discharge amount (max. angle)



Operation

- The control pump pressure **PPO** is taken to port **a**.
- Signal pressure **PECN** from the NC valve is taken from port **b** to chamber **c**.
- When signal pressure **PECN** rises, piston (8) is pushed to the right by the pressure in chamber **c**, and stops at a point where it balances the pressure of springs (4) and (4A).
- At the same time, arm (6) uses servo piston (19) as a fulcrum and sways to the right in the same way as piston (8). This moves guide spool (13) to the right.
- When guide spool (13) moves, port **a** and port **d** are closed and port **d** is connected to drain chamber **e**. As a result, servo piston chamber **f** is also interconnected with drain chamber **e** through port **g** and port **d**.
- At the same time, port **a** is interconnected with port **h**, so the pressure oil flows through port **i** to servo piston chamber **j**, pushes servo piston (19) to the right, increases the swash plate angle in the main piston pump and increases the pump discharge amount.
- When servo piston (19) moves, arm (6) rotates counterclockwise with its center at pin (7) and moves guide spool (13) to the left. Port **a**, port **d** and port **h** close, so the discharge increases by an amount that matches signal pressure **PECN**.

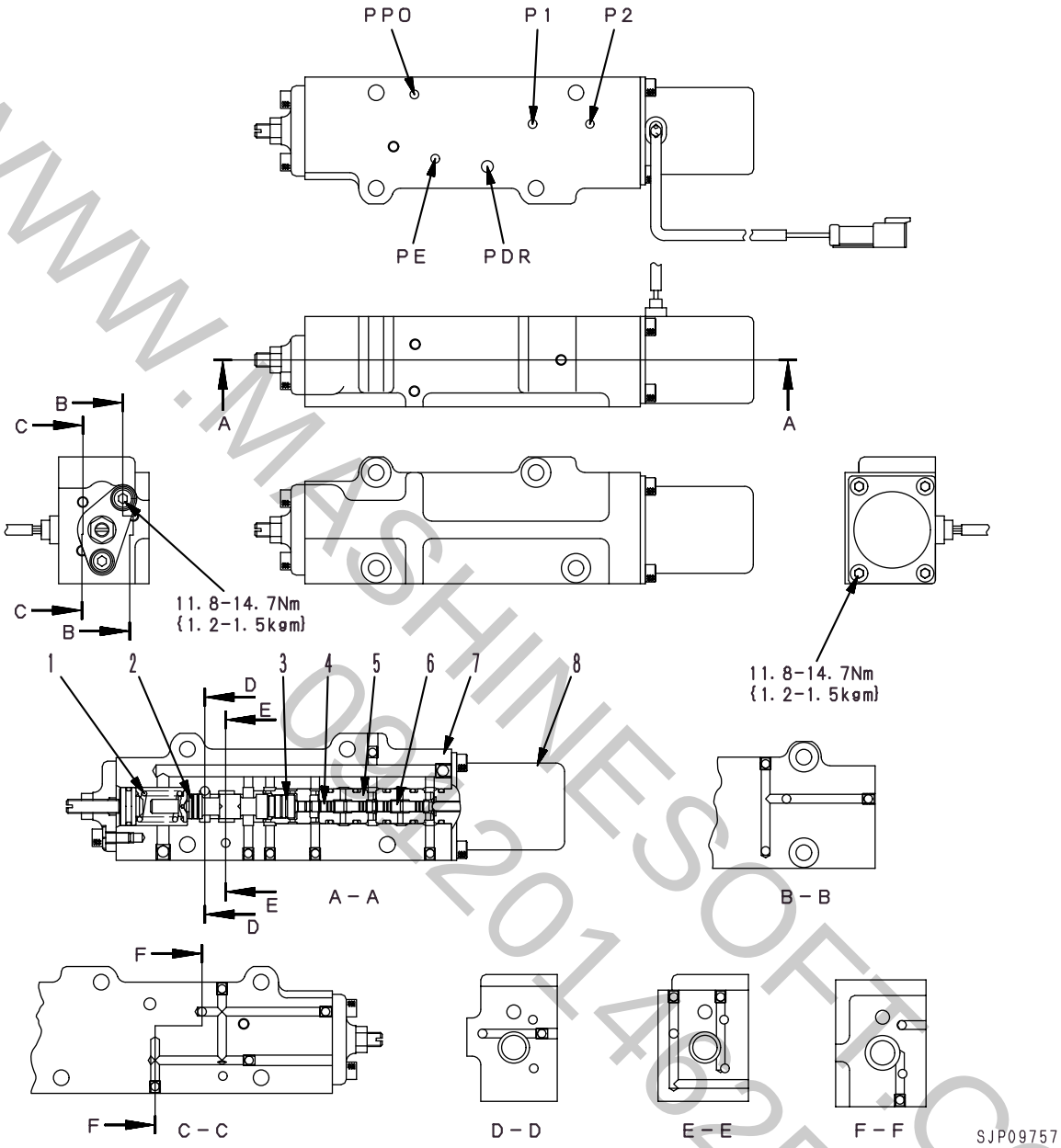
2) Operation in direction of decrease of pump discharge amount (min. angle)



Operation

- When signal pressure **PECN** goes down, piston (8) moves to the left and stops at a point where the pressure in chamber **c** balances the pressure of springs (4) and (4A).
- At the same time, arm (6) uses servo piston (19) as a fulcrum and sways to the left in the same way as piston (8). This moves guide spool (13) to the left.
- When guide spool (13) moves, port **a** and port **h** are closed and port **h** is connected to drain chamber **e**. As a result, servo piston chamber **j** is also interconnected with drain chamber **e** through port **i** and port **h**.
- At the same time, port **a** is interconnected with port **d**, so the oil flows through port **g** to servo piston chamber **f**, pushes servo piston (19) to the left, decreases the swash plate angle in the main piston pump and decreases the pump discharge amount.
- When servo piston (19) moves, arm (6) rotates counterclockwise with its center at pin (7). Guide spool (13) is moved to the right and closes port **a**, port **d** and port **h**, so the discharge decreases by an amount that matches signal pressure **PECN**.

TVC VALVE



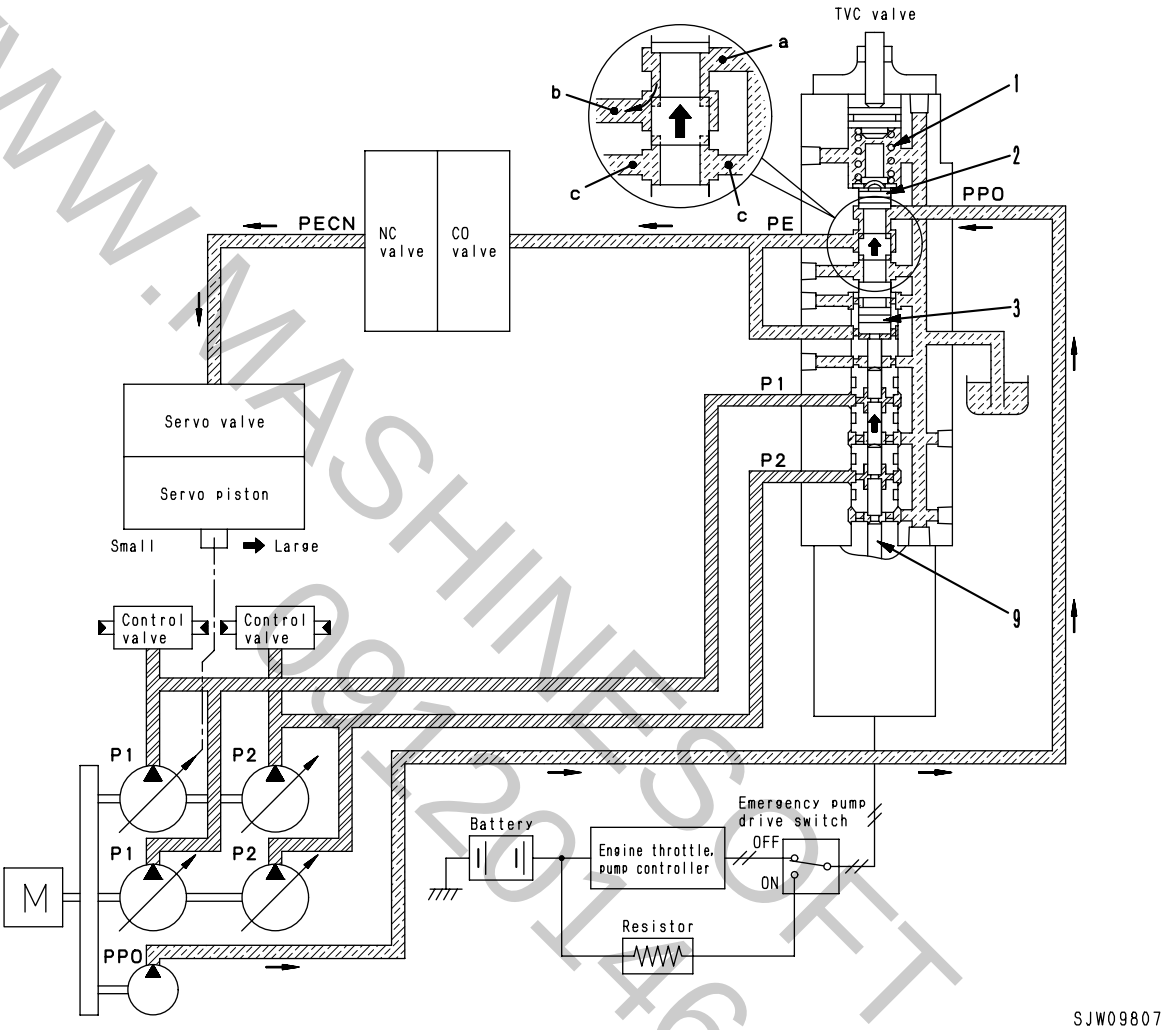
PPO : Servo basic pressure IN port
P1 : Main pump pressure IN port
P2 : Main pump pressure IN port
PDR : TVC valve drain OUT port
PE : TVC valve output pressure OUT port

1. Spring
2. Spool
3. Piston
4. Piston
5. Sleeve
6. Piston
7. Body
8. Solenoid

Function

- When the power mode is A-mode or E-mode, the pump discharge amount is set properly with the command current sent from the controller according to the engine speed.
- When the emergency pump drive switch is turned ON, the pump discharge amount is controlled according to the pump discharge pressure (load) by sensing the oil pressure at constant pump absorption torque.

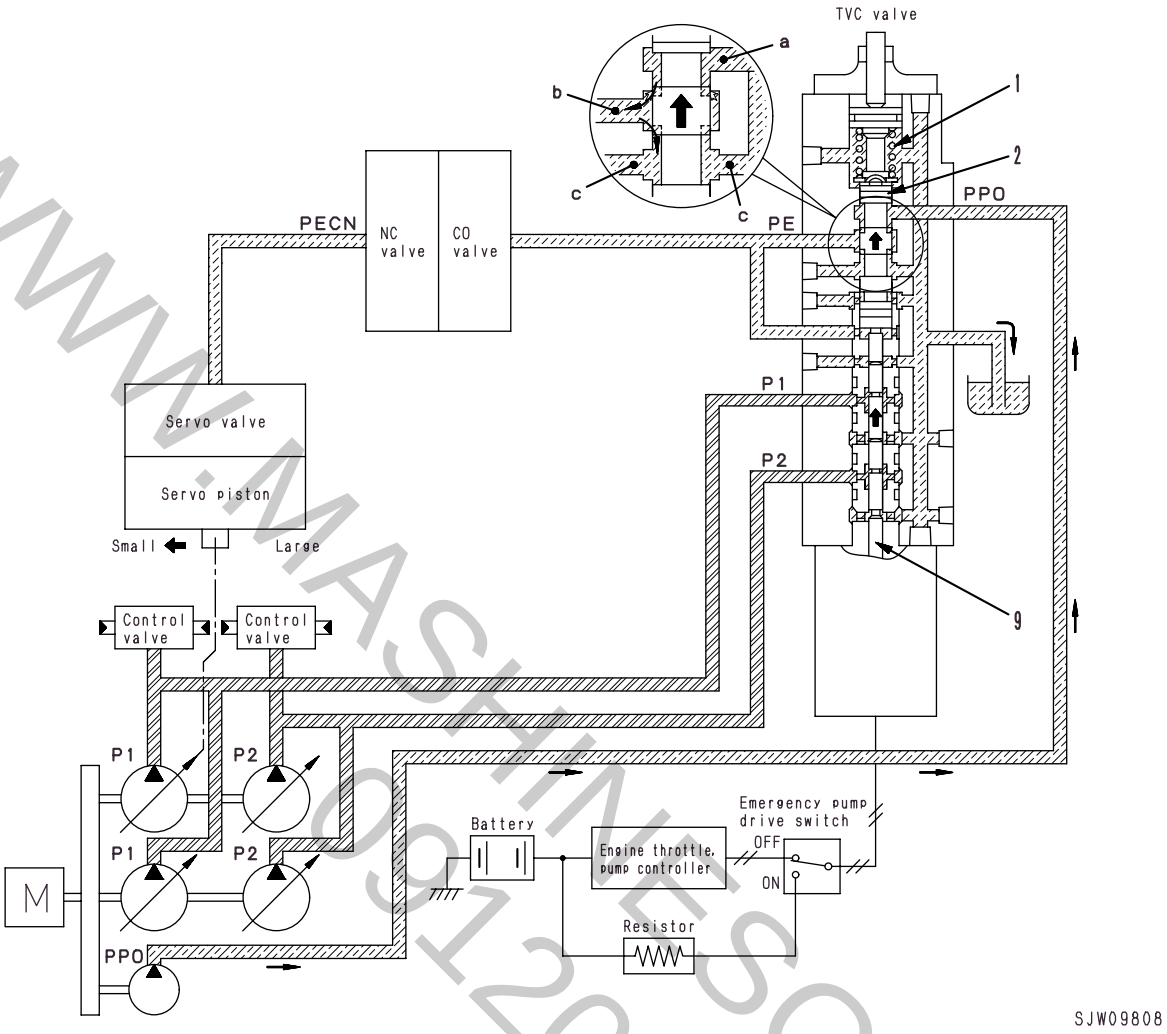
1) When command current value from controller is small in A and E mode



Operation

- The command current sent from the controller actuates solenoid push pin (9) and spool (2) moves. When this happens, spool (2) stops at a point where it balances the total of the force of spring (1), the force of push pin (9), and the force of TVC output pressure **PE** acting on piston (3). At this time, since the command current and the force of push pin (9) are small, spool (2) is balanced on the lower side.
- As a result, ports "**a**" and "**b**" are opened almost fully and almost all the oil from the control pump is output as TVC valve output pressure **PE**. Then, TVC valve output pressure **PE** and signal pressure **PECN** increase, thus the pump discharge amount increases.

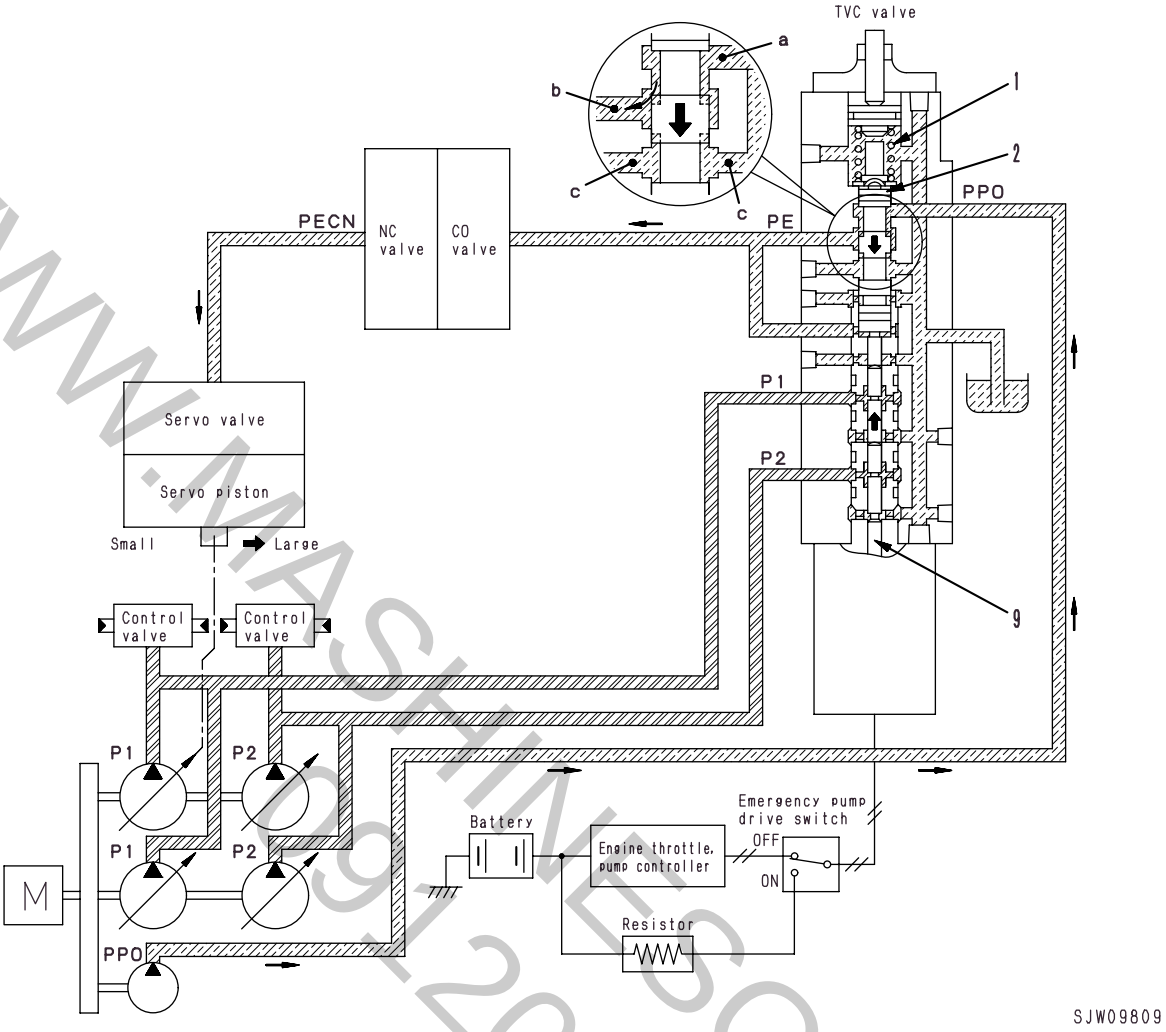
2) When command current value from controller is large in A and E mode



Operation

- The command current sent from the controller moves push pin (9), which moves spool (2). Spool (2) stops at a position where it is balanced with spring (1). At this time, since the command current and the force of push pin (9) are large, spool (2) is balanced on the upper side.
- As a result, the oil flow from the control pump is reduced between ports "**a**" and "**b**" and the open areas of port "**b**" and port "**c**" (drain port) increase. Then, TVC valve output pressure **PE** and signal pressure **PECN** lower, thus the pump discharge amount decreases.

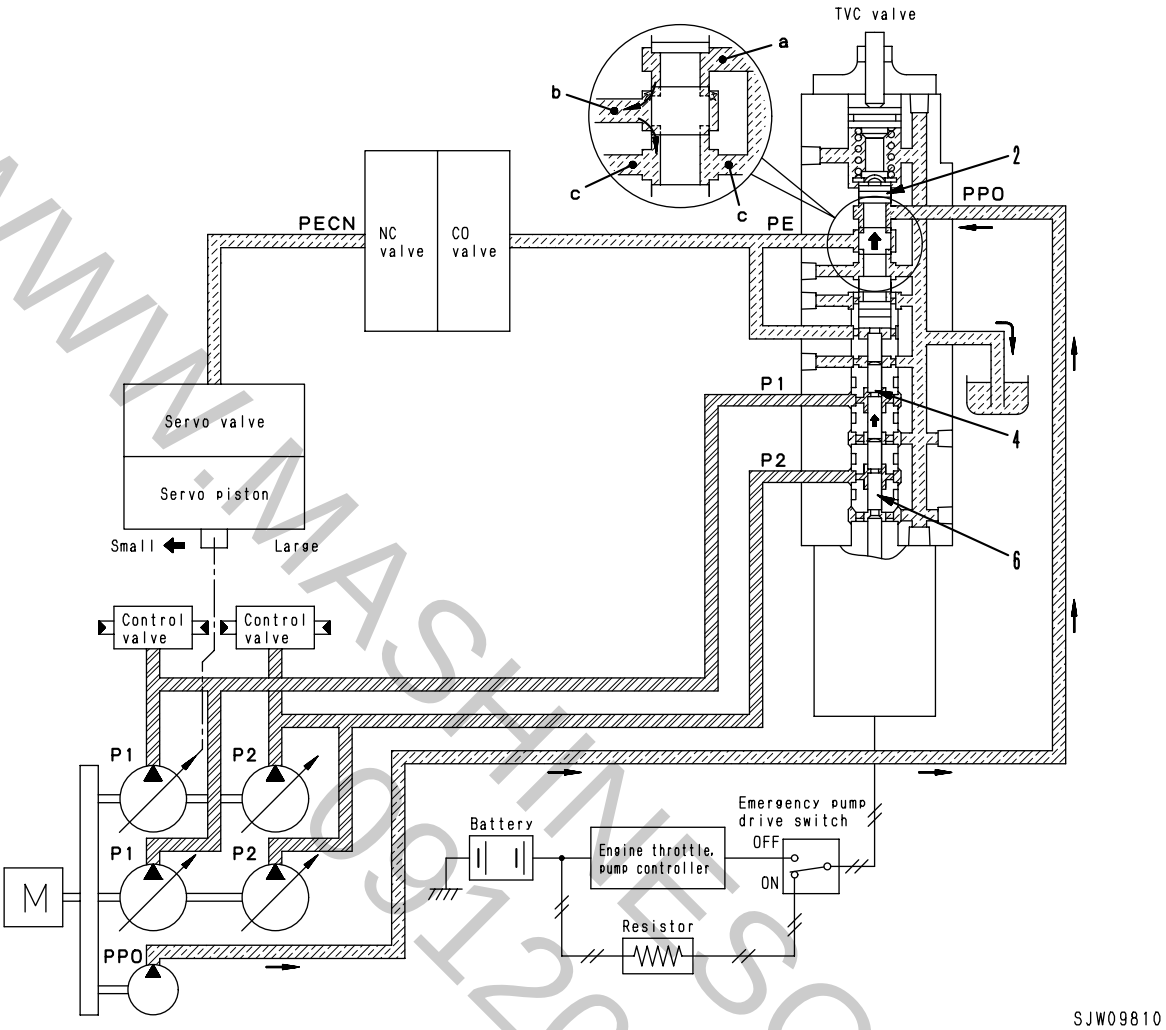
3) When emergency pump drive switch is turned ON and pump load is small



Operation

- If the emergency pump drive switch is turned ON, the command current increases and the force of solenoid push pin (9) becomes larger. As a result, spring (1) is kept compressed.
- Since main pump discharge pressures **P1** and **P2** are low, spring (1) keeps pressing spool (2) down. As a result, control pump discharge pressure **PPO** becomes equal to TVC valve output pressure **PE**. At this time, TVC valve output pressure **PE** and the pump discharge amount increase.

4) When emergency pump drive switch is turned ON and pump load is large

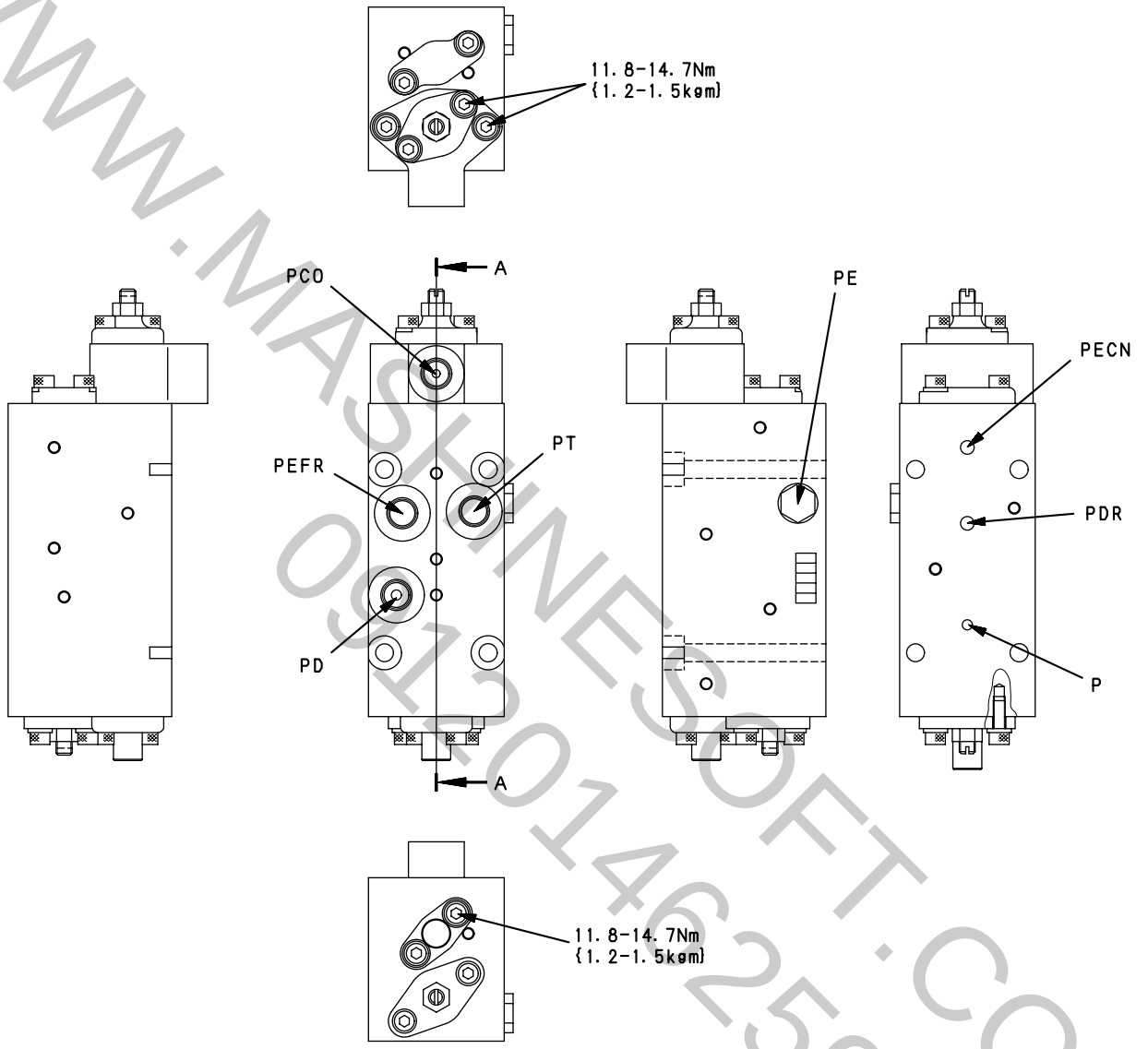


Operation

- When main pump discharge pressure **P1** (or **P2**) increases, spool (2) is moved up by piston (4) or piston (6). As a result, the flow of oil from port **a** to port **b** is throttled by the notch in the spool. At the same time, the area of the opening at port **b** and port **c** (drain port) becomes larger. In this way, TVC valve output pressure **PE** goes down, and the pump discharge amount decreases.

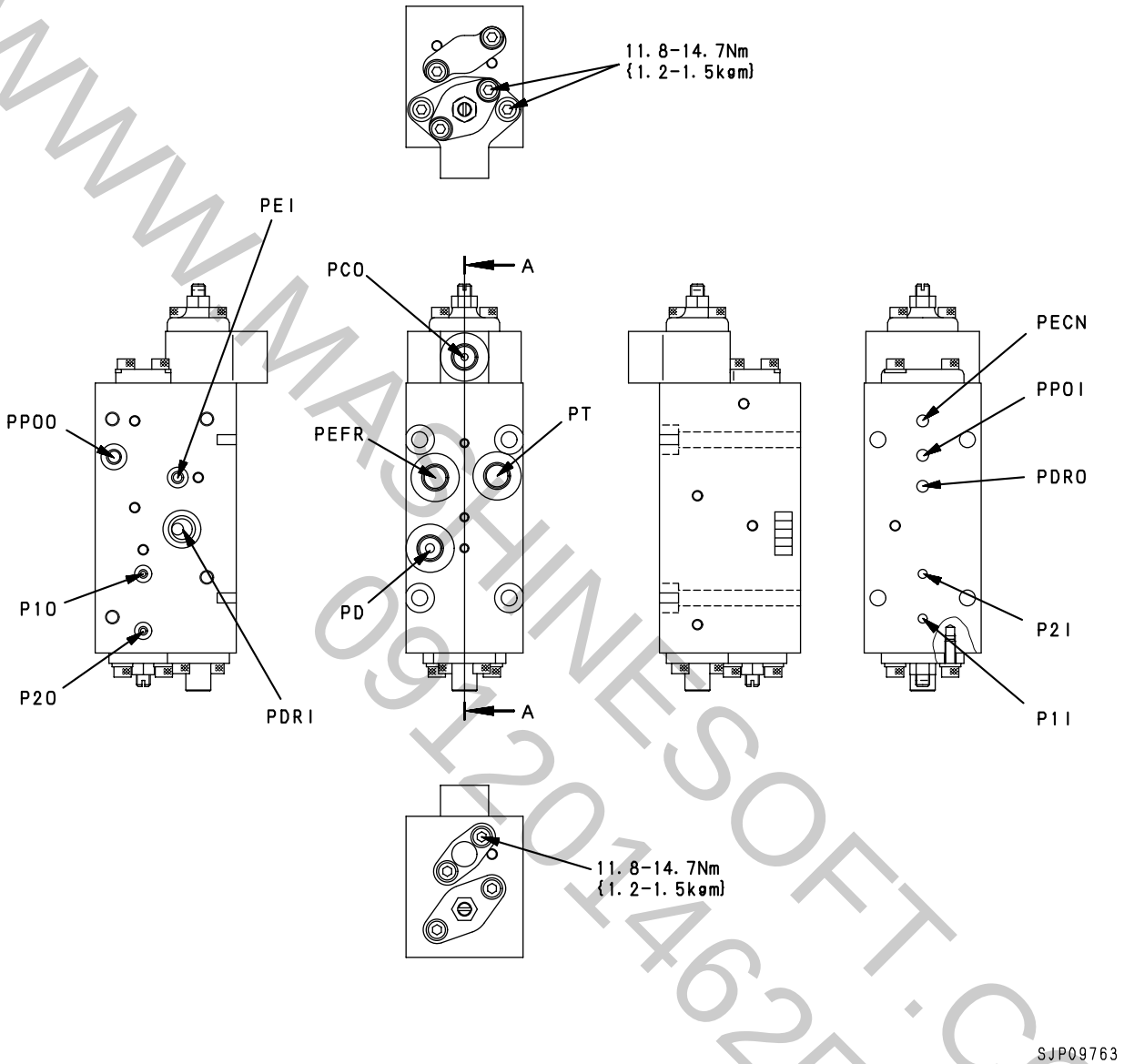
CO+NC VALVE

1. CO+NC valve (No. 1 front)

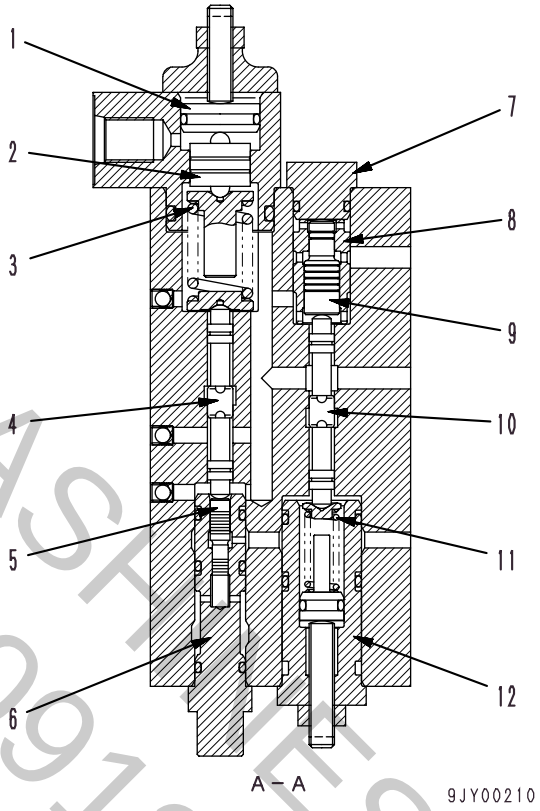


P : Main pump pressure IN port
PEFR : TVC valve output pressure front, rear interconnection port
PE : TVC valve output pressure detection port
PCO : CO selector pilot port
PD : Jet sensor downstream pressure IN port
PT : Jet sensor upstream pressure IN port
PDR : CO+NC valve drain OUT port
PECN : CO+NC valve output pressure OUT port

2. CO+NC valve (No. 1 rear)



P1I : Main pump pressure IN port (front)
P1O : Main pump pressure OUT port
P2I : Main pump pressure IN port (rear)
P2O : Main pump pressure OUT port
PEFR : TVC valve output pressure front, rear interconnection port
PEI : TVC valve output pressure IN port
PCO : CO selector pilot port
PD : Jet sensor downstream pressure IN port
PT : Jet sensor upstream pressure IN port
PDRI : TVC valve drain IN port
PDRO : CO+NC valve drain OUT port
PPOI : Servo basic pressure IN port
PPOO : Servo basic pressure OUT port
PECN : CO+NC valve output pressure OUT port



CO valve
1. Plug
2. Piston
3. Spring
4. Spool
5. Piston
6. Plug

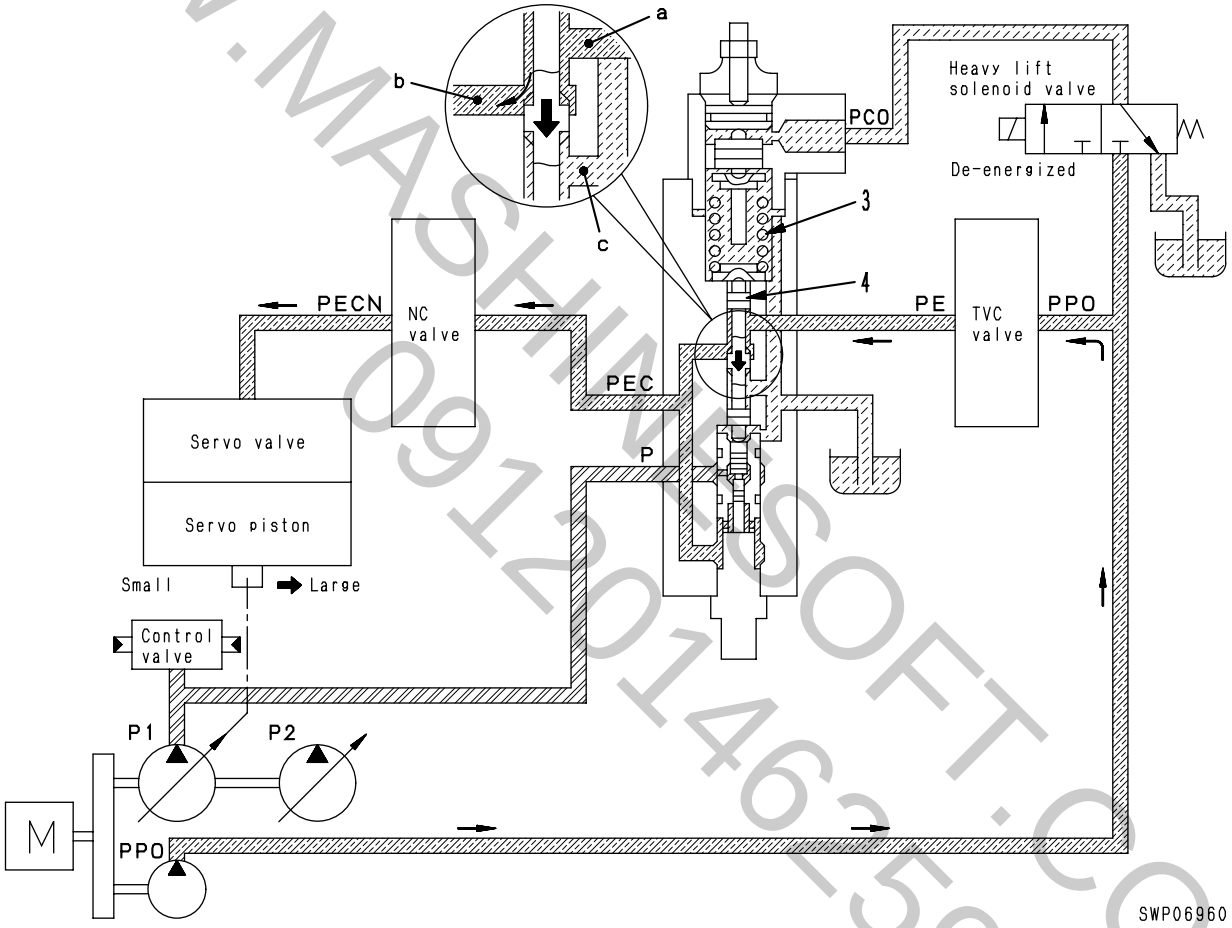
NC valve
7. Plug
8. Sleeve
9. Piston
10. Spool
11. Spring
12. Plug

3. CO valve

Function

- When the load becomes large during operations and the main pump discharge pressure rises to a point close to relief pressure, the cut-off function of the CO valve acts to reduce the pump discharge in order to reduce relief loss.
- At the same time, it has a cut-off cancel function actuated by the pilot pressure from the heavy-lift solenoid valve.
- The CO valve is controlled by balancing the spring with the total of main pump discharge pressure **P** and CO valve output pressure **PEC**.

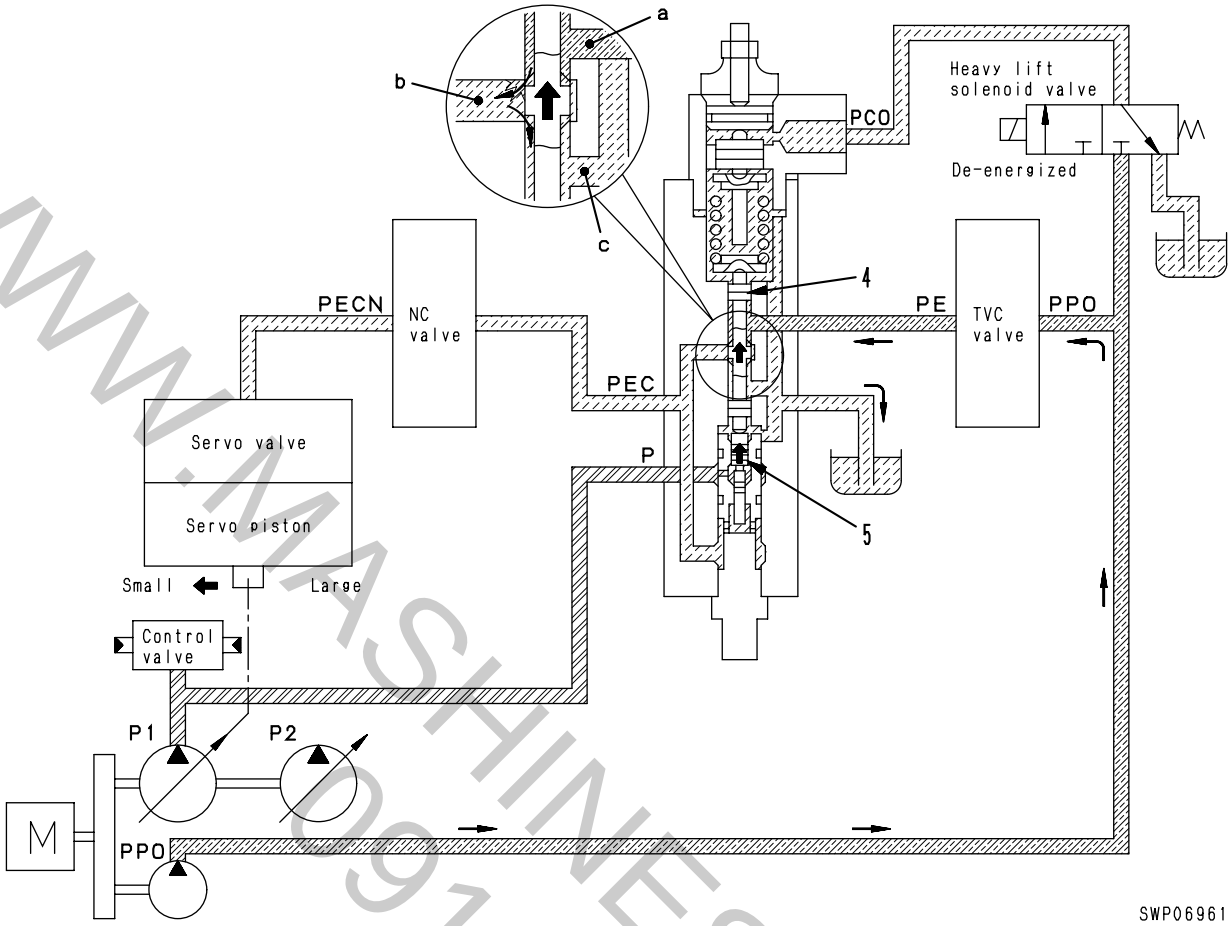
1) When main pump discharge pressure is lower than relief pressure



Operation

- Spool (4) is pressed down by spring (3). As a result, ports "**a**" and "**b**" are opened fully, and TVC valve output pressure **PE** is equal to CO valve output pressure **PEC**. Accordingly, CO valve output pressure **PEC**, signal pressure **PECN**, and pump discharge amount become maximum.

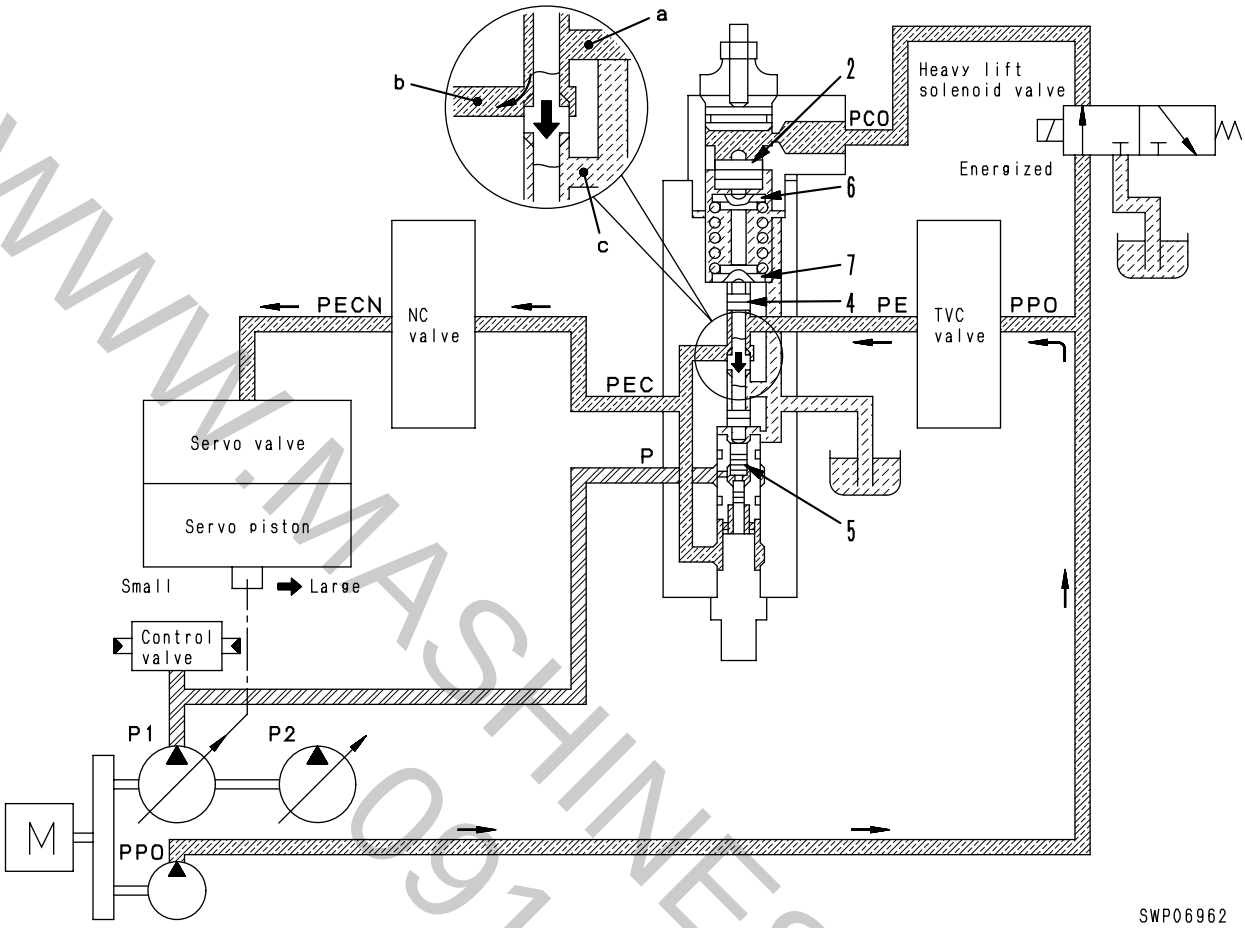
2) When main pump discharge pressure becomes close to relief pressure



Operation

- If the load increases and main pump discharge pressure **P** increases near to the relief pressure, main pump discharge pressure **P** presses piston (5). At the same time, CO valve output pressure **PEC** presses piston (5) and spool (4) moves up.
- As a result, oil flow from port "**a**" to port "**b**" is reduced by the notch of the spool and the open areas of port "**b**" and port "**c**" (drain port) increase. Accordingly, CO valve output pressure **PEC** and signal pressure **PECN** lower and the pump discharge amount becomes minimum.

3) When cut-off function is canceled by heavy-lift solenoid valve



Operation

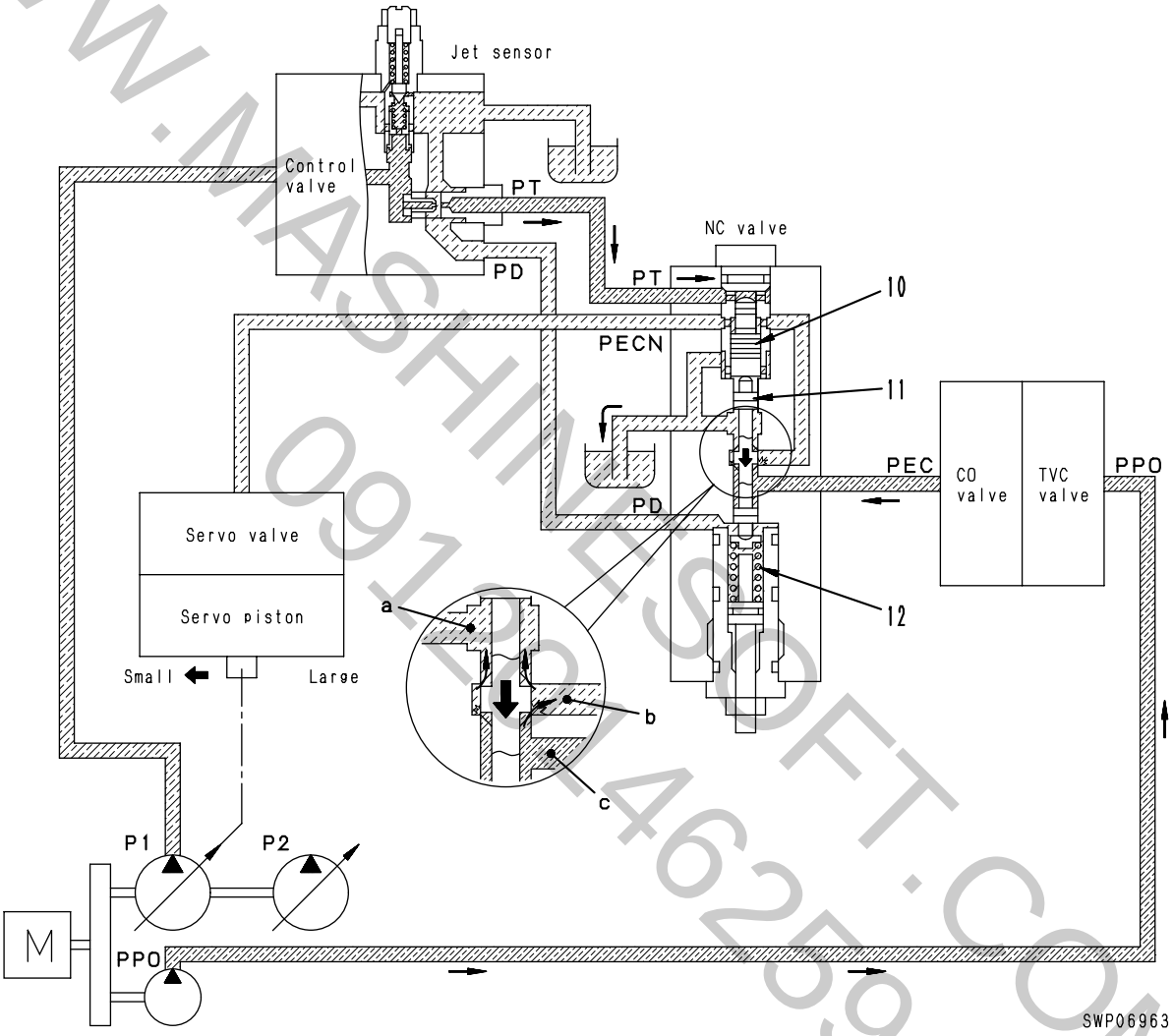
- If the heavy lift solenoid valve is turned ON, its pilot pressure **PCO** is lead in the port and piston (2) is pressed down. Accordingly, seat (6) touches seat (7) and locks spool (4).
- As a result, even if main pump discharge pressure **P** increases to the relief pressure, spool (4) does not operate. Accordingly, CO valve output pressure **PEC** keeps maximum and the pump discharge amount does not decrease.

4. NC valve

Function

- The NC valve controls the main pump discharge amount to reduce the neutral loss and fine control loss according to the moving distance of the control valve spool.
- The main pump discharge amount is controlled by balance of the sum of jet sensor upstream pressure **PT** and NC valve output pressure **PECN** and the sum of the force of NC valve spring (12) and jet sensor downstream pressure **PD**.
- The jet sensor senses the flow of the oil returning through the control valve to the tank and use it as **PT** and **PD** of the NC valve.

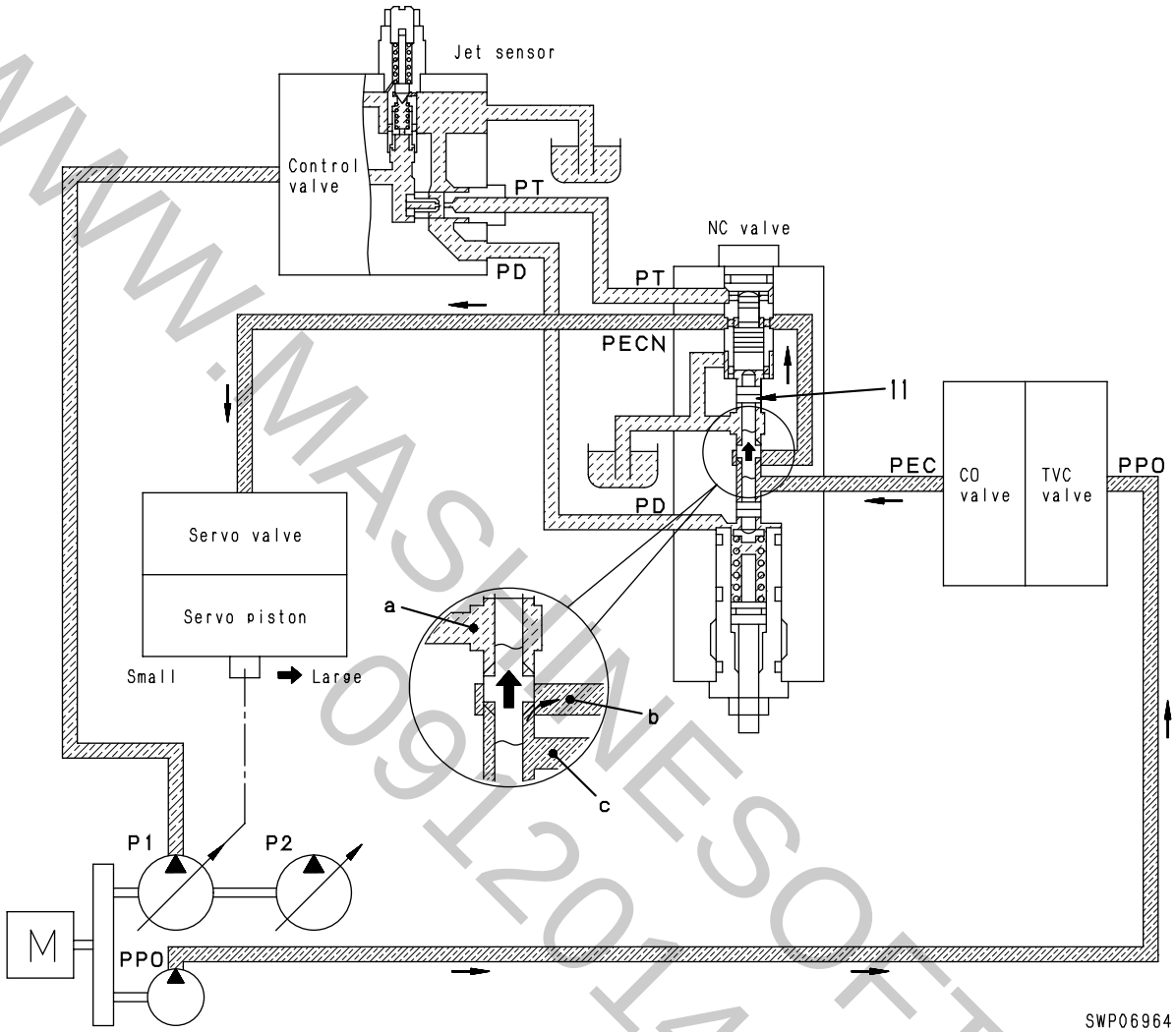
1) When control valve is at neutral



Operation

- When the control valve is at neutral, jet sensor differential pressure (**PT** – **PD**) becomes the maximum, and the force of jet sensor output pressure **PT** pushing piston (10) becomes larger than the total of the force of spring (12) and the force of jet sensor output pressure **PD** pushing the bottom of spool (11).
- As a result, spool (11) is pushed down, so the flow from port **c** to port **b** is throttled, and the area of the opening of port **b** and port **a** (drain port) becomes larger. In this way, NC valve output pressure **PECN** becomes the minimum, and the main pump discharge amount also becomes the minimum.

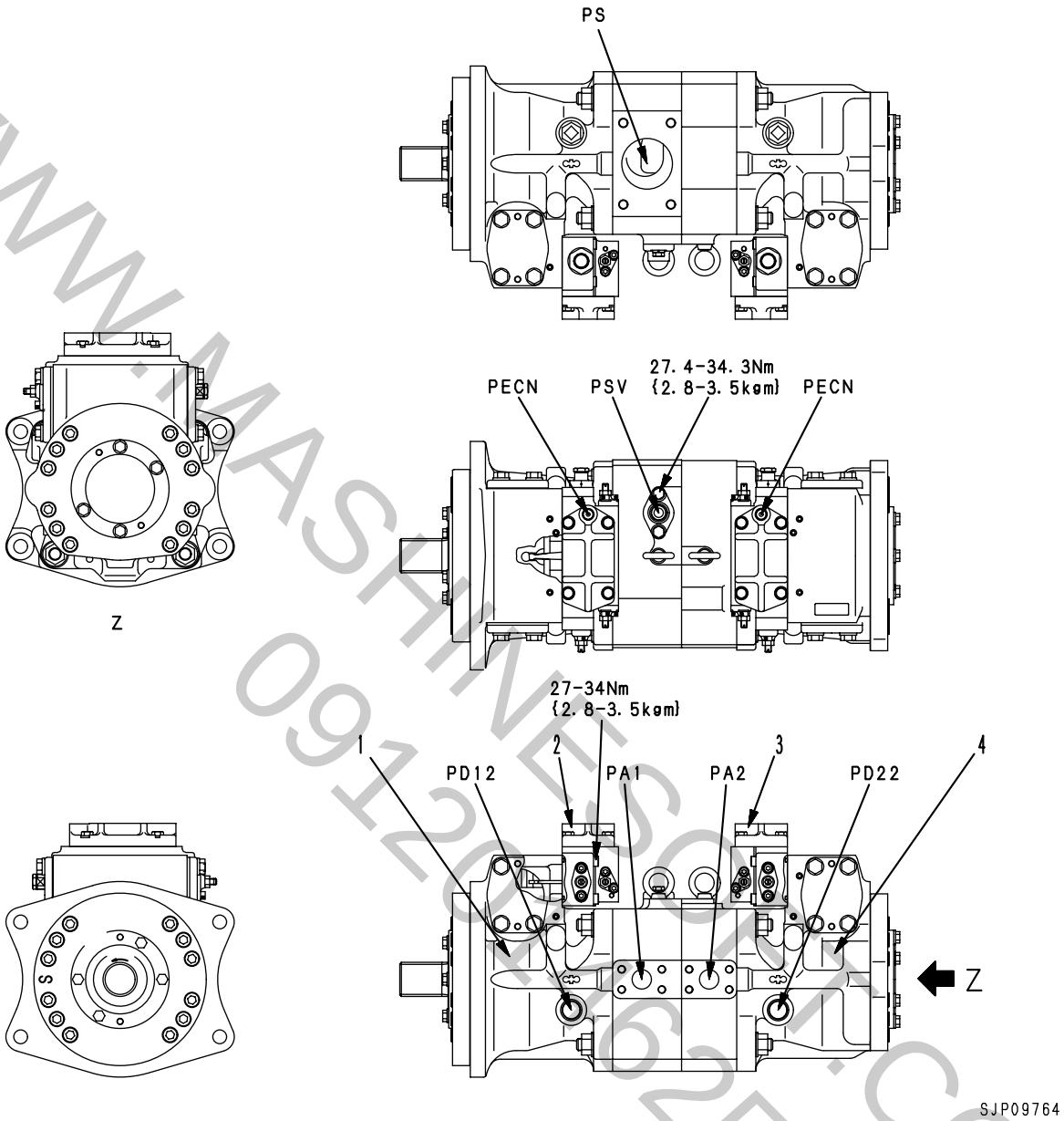
2) When control lever is operated



Operation

- When the control lever is moved, the jet sensor differential pressure (**PT** – **PD**) goes down in accordance with the movement of the control lever. Spool (11) is pushed up, and the area of the opening of port **c** and port **b** becomes larger. In this way, NC valve output pressure **PECN** becomes larger and the discharge amount from the main pump increases. In other words, the pump discharge amount increases according to the amount that the control lever is operated.

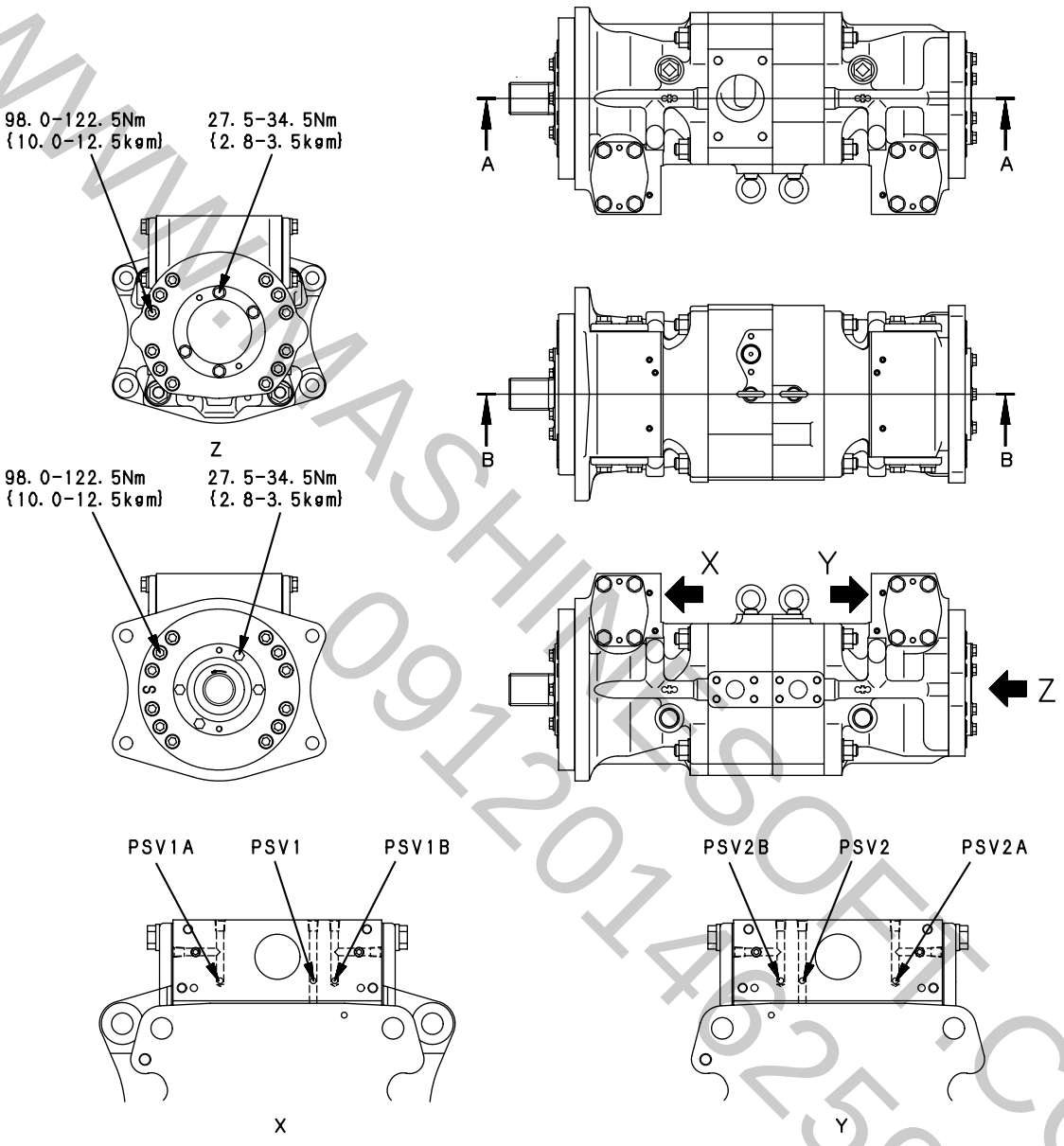
No. 2 MAIN PUMP
MODEL: HPV95+95



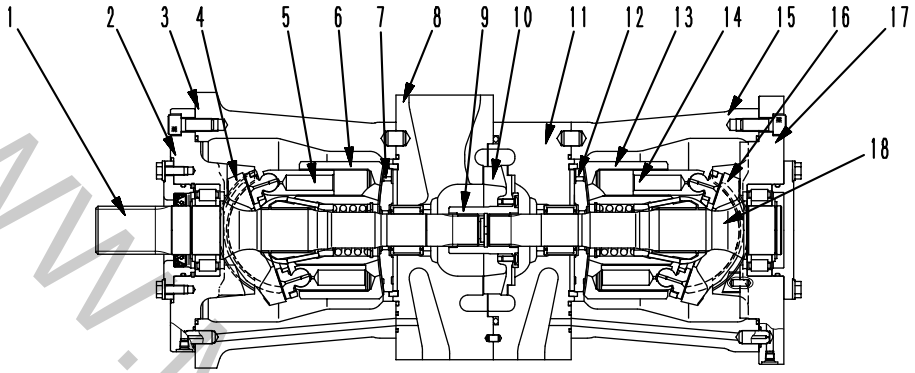
PA1 : Front pump discharge port
PA2 : Rear pump discharge port
PD12 : Drain port
PD22 : Drain port
PS : Pump suction port
PSV : Servo basic pressure IN port
PECN : CO+NC valve output pressure port

1. Front pump
2. Front servo valve
3. Rear servo valve
4. Rear pump

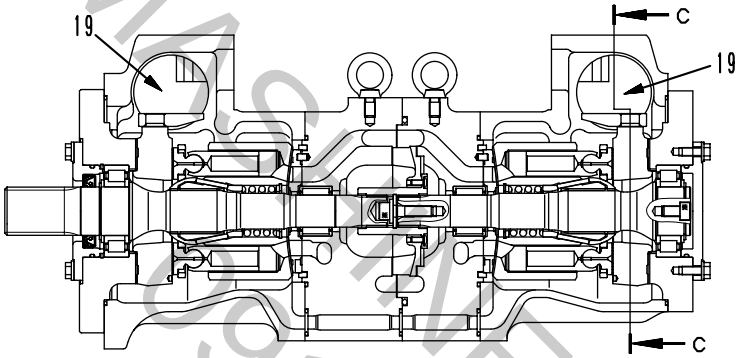
No. 2 main pump



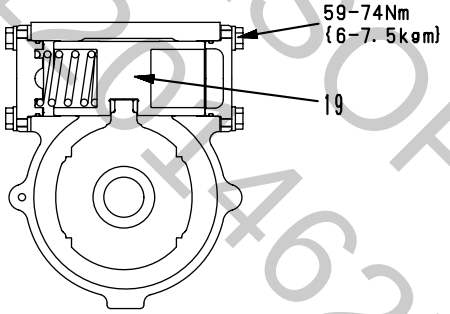
PSV1 : Servo valve basic pressure port
PSV2 : Servo valve basic pressure port
PSV1A : Servo piston output port
PSV1B : Servo valve output port
PSV2A : Servo piston output port
PSV2B : Servo valve output port



A – A



B – B



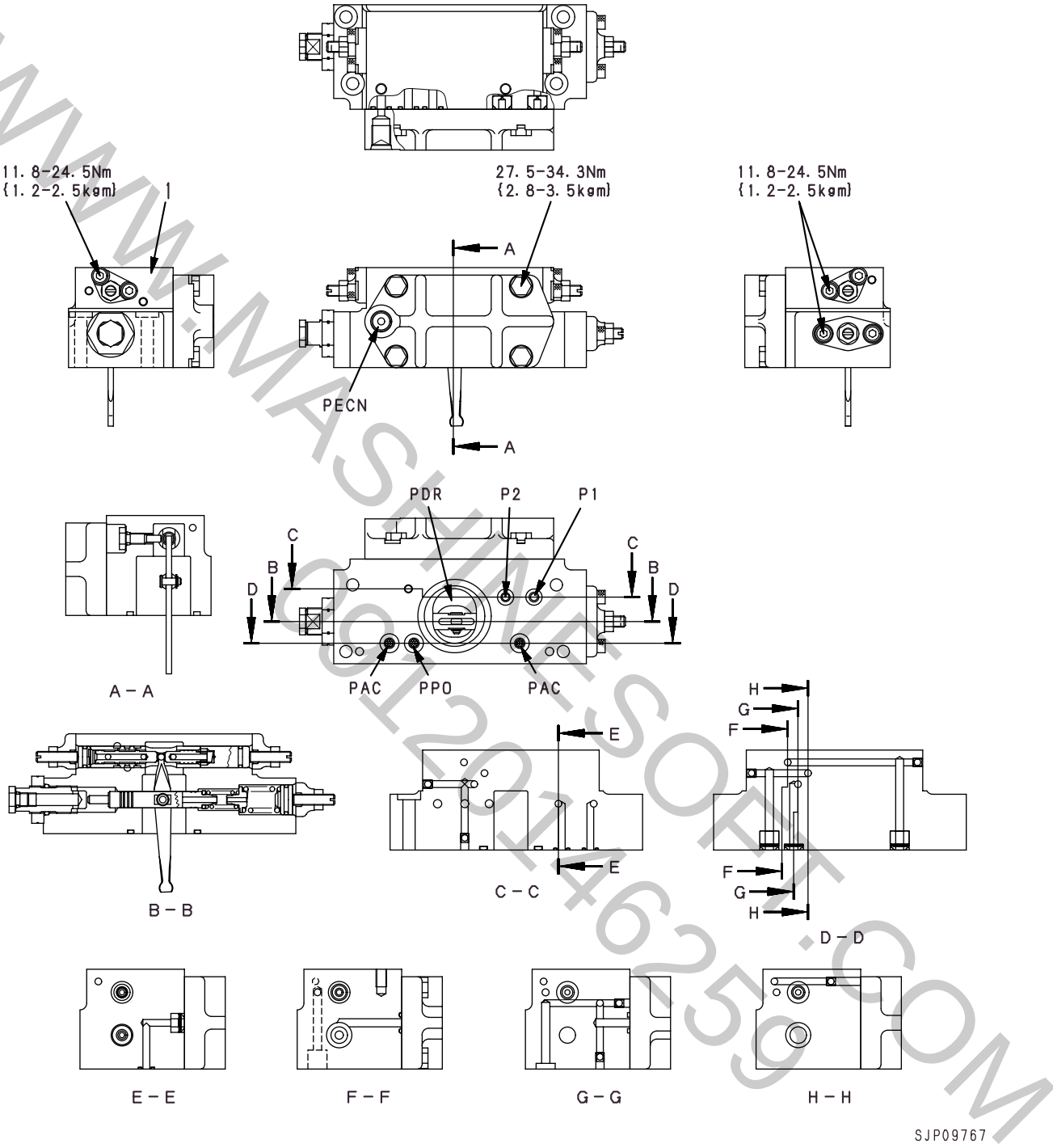
C – C

SJP09766

1. Front shaft
2. Front cradle
3. Front case
4. Rocker cam
5. Piston
6. Cylinder block
7. Valve plate
8. Front end cap
9. Coupling
10. Impeller
11. Rear end cap
12. Valve plate
13. Cylinder block
14. Piston
15. Rear case
16. Rocker cam
17. Rear cradle
18. Rear shaft
19. Servo piston

SERVO VALVE

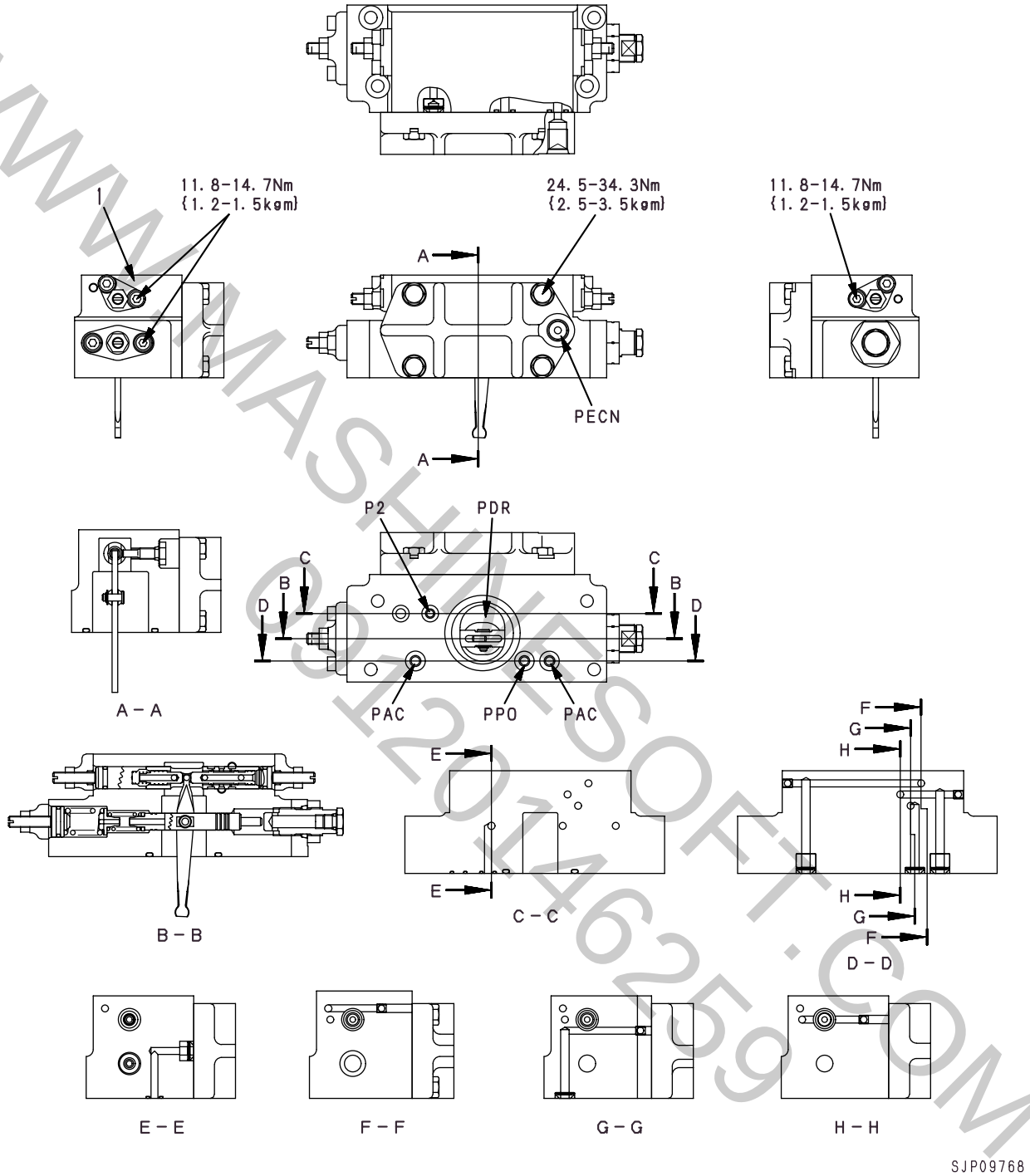
1. Servo valve (No. 2 front)



P1 : Main pump pressure IN port
P2 : Main pump pressure IN port
PAC : Servo actuator port
PDR : Servo valve drain OUT port
PPO : Servo basic pressure IN port
PECN : CO+NC valve output pressure IN port

1. Servo valve

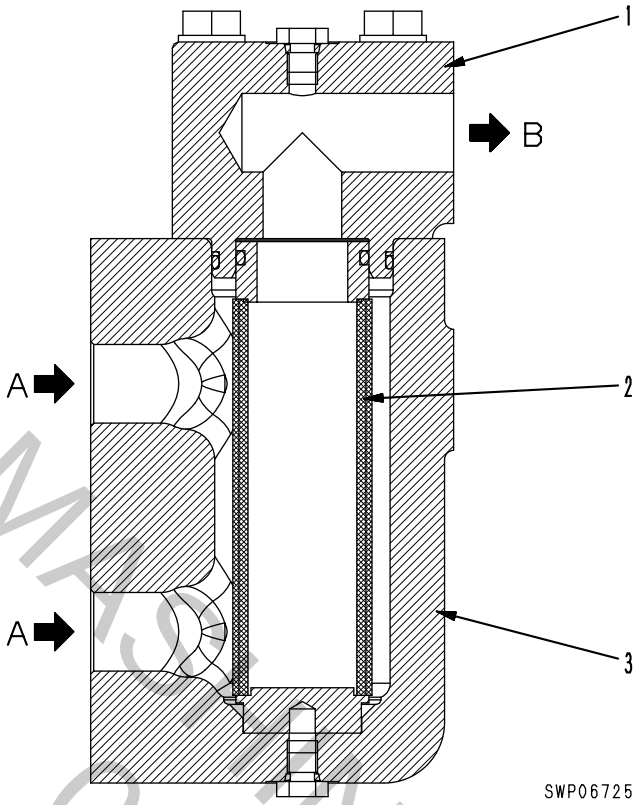
2. Servo valve (No. 2 rear)



P2 : Main pump pressure IN port
PAC : Servo actuator port
PDR : Servo valve drain OUT port
PPO : Servo basic pressure IN port
PECN : CO+NC valve output pressure IN port

1. Servo valve

LINE OIL FILTER



1. Cover
2. Element
3. Case

A: From main pump
B: To control valve

Outline
There are two line oil filters installed to the discharge side of the main pump. They protect the circuit and equipment by removing all dirt and dust from the oil.

CONTROL VALVE

Outline

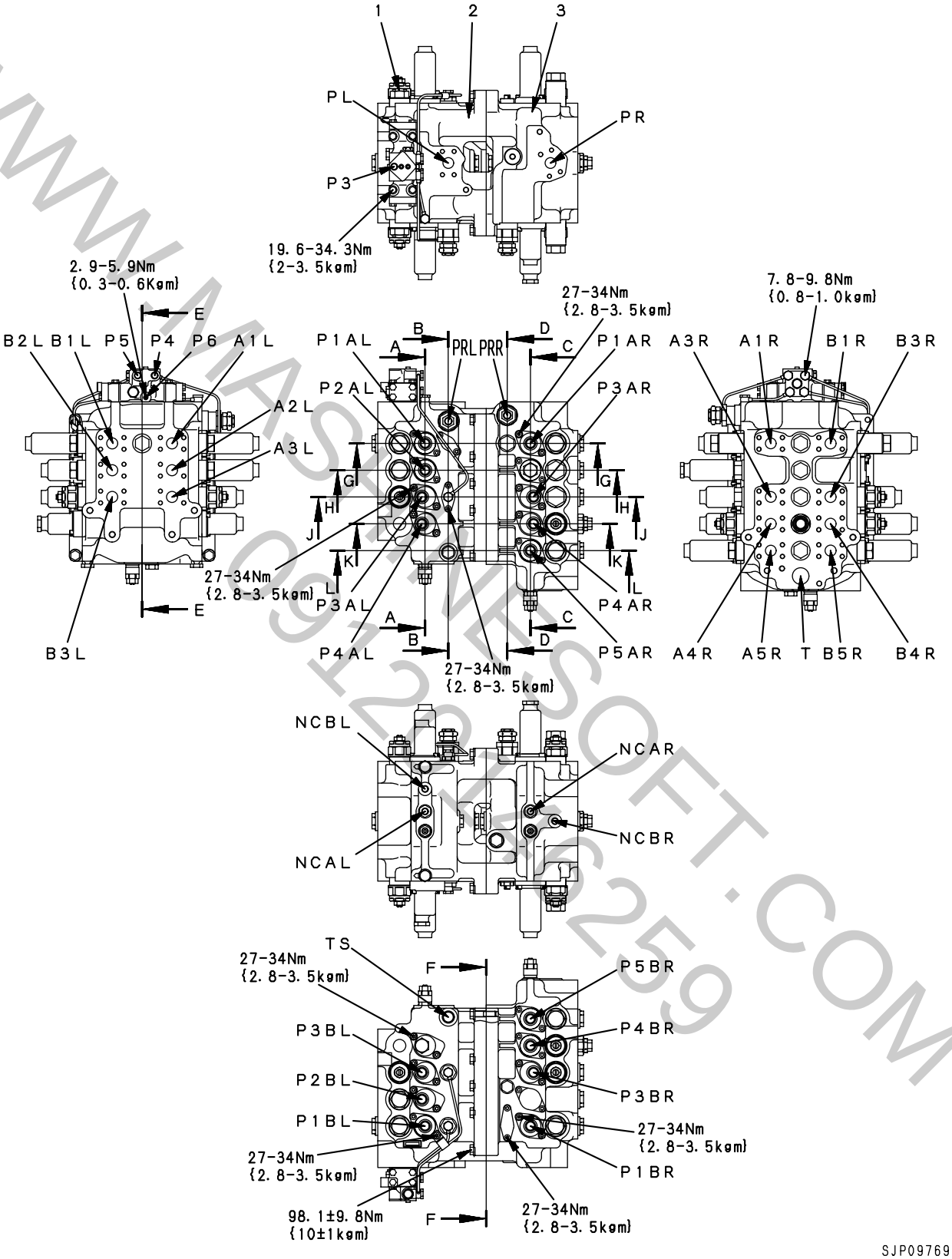
- This control valve consists of a 4-spool valve and a 5-spool valve, and a travel shuttle valve is also installed to it. Furthermore, a straight-travel valve, arm throttle valve, and swing priority valve are built in.
- The 4-spool and 5-spool valves are connected by bolts to form one unit, and internal merging of the oil flow makes it even more compact and easy to maintain.

A1L : To L.H. travel motor PB port
A2L : To boom cylinder bottom
A3L : To bucket cylinder head
A1R : To swing motor MA port
A3R : Service
A4R : To arm cylinder head
A5R : To R.H. travel motor PA port
B1L : To L.H. travel motor PA port
B2L : To boom cylinder head
B3L : To bucket cylinder bottom
B1R : To swing motor MB port
B3R : Service
B4R : To arm cylinder bottom
B5R : To R.H. travel motor PB port
NCAL : To rear NC valve
NCBL : To rear NC valve
NCAR : To front NC valve
NCBR : To front NC valve
P3 : From arm PPC shuttle valve
P4 : From boom, bucket PPC shuttle valve
P5 : From swing PPC shuttle valve
P6 : Work equipment oil pressure switch

P1AL : From L.H. travel PPC valve
P2AL : From boom PPC valve
P3AL : From bucket PPC valve
P4AL : From arm PPC valve
P1AR : From swing PPC valve
P3AR : Service
P4AR : From arm PPC valve
P5AR : From R.H. travel PPC valve
P1BL : From L.H. travel PPC valve
P2BL : From boom PPC valve
P3BL : From bucket PPC valve
P1BR : From swing PPC valve
P3BR : Service
P4BR : From arm PPC valve
P5BR : From R.H. travel PPC valve
PL : From rear main pump
PR : From front main pump
PRL : From 2-stage relief solenoid valve
PRR : From 2-stage relief solenoid valve
T : To tank
TS : To tank

1. Travel shuttle valve
2. 4-spool valve
   (straight-travel valve, arm throttle valve built in)
3. 5-spool valve (swing priority valve built in)

4-spool valve + 5-spool valve (with travel shuttle valve)



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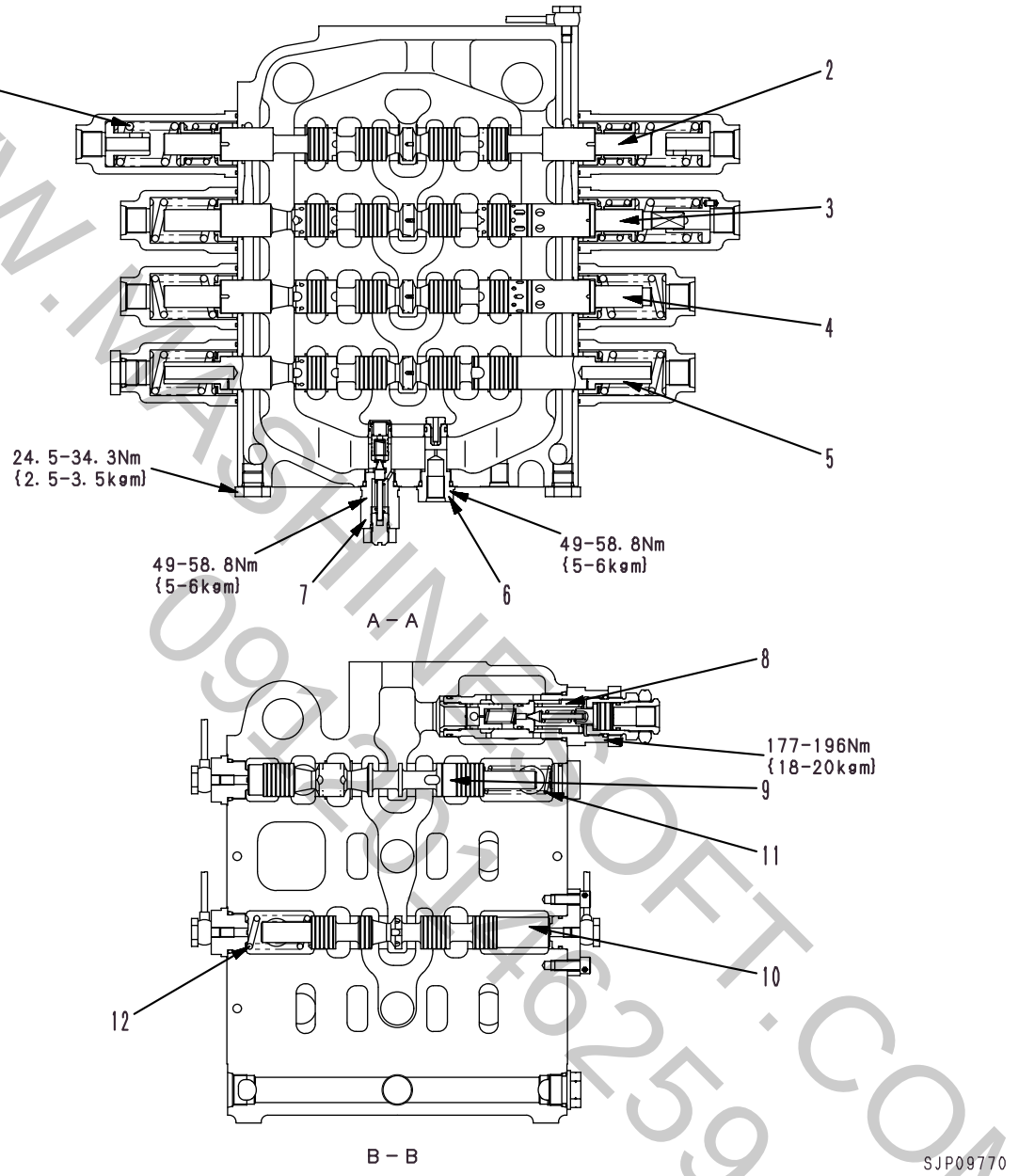
Cross-sectional diagram
(1/4)

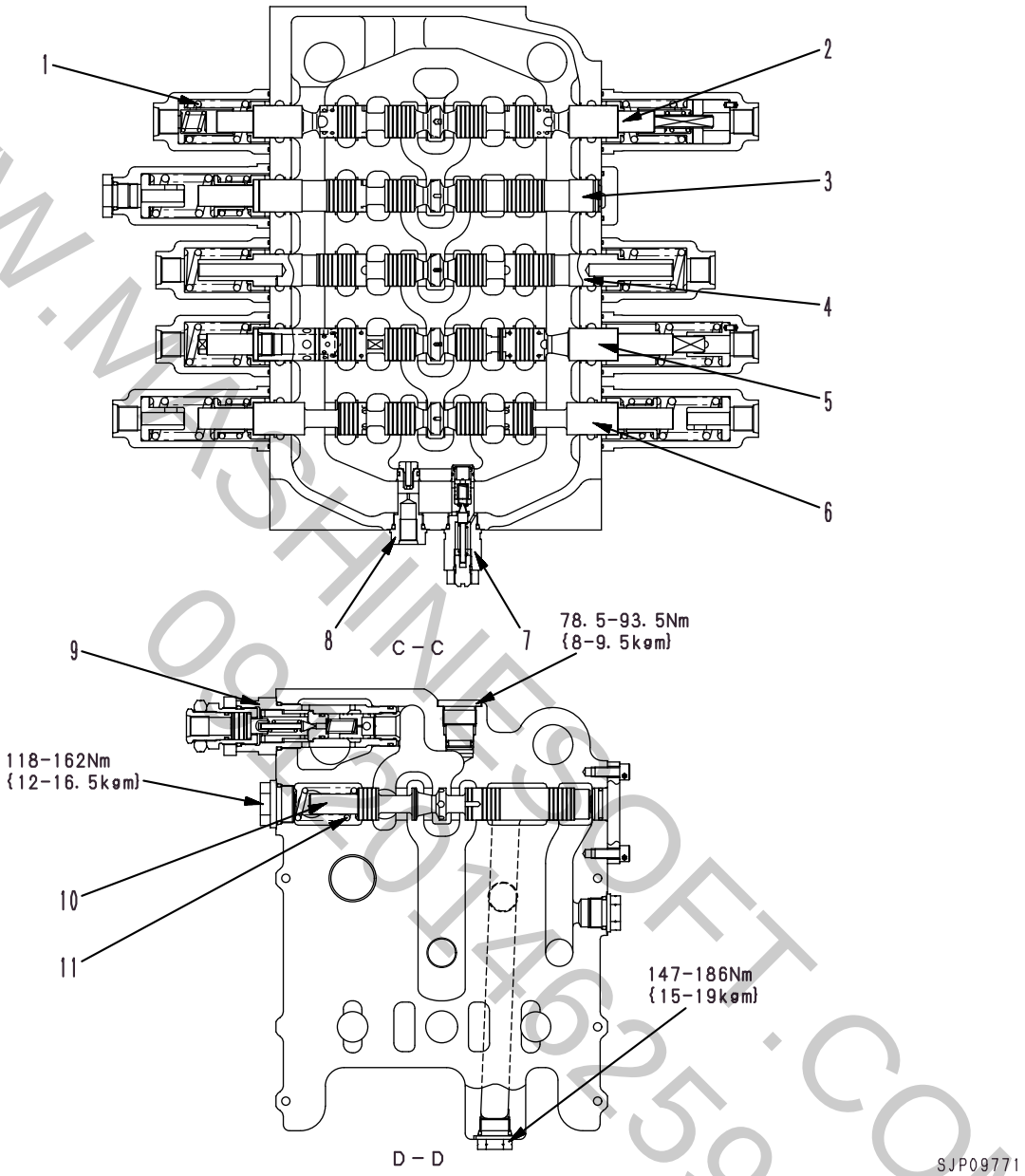


1. Spool return spring
2. Spool (L.H. travel)
3. Spool (boom Lo)
4. Spool (bucket Lo)
5. Spool (arm Hi)
6. Jet sensor orifice
7. Jet sensor relief valve
8. Main relief valve
9. Spool (straight-travel)
10. Spool (arm throttle)

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
11	Spool return spring	Free length x OD	Installed length	Installed load	Free length	Installed load	Replace spring if damaged or deformed
		87.6 x 21.2	54.5	192 N {19.6 kg}	—	154 N {15.7 kg}	
12	Spool return spring	58.1 x 26.5	52.5	324 N {33.0 kg}	—	259 N {26.4 kg}	

(2/4)

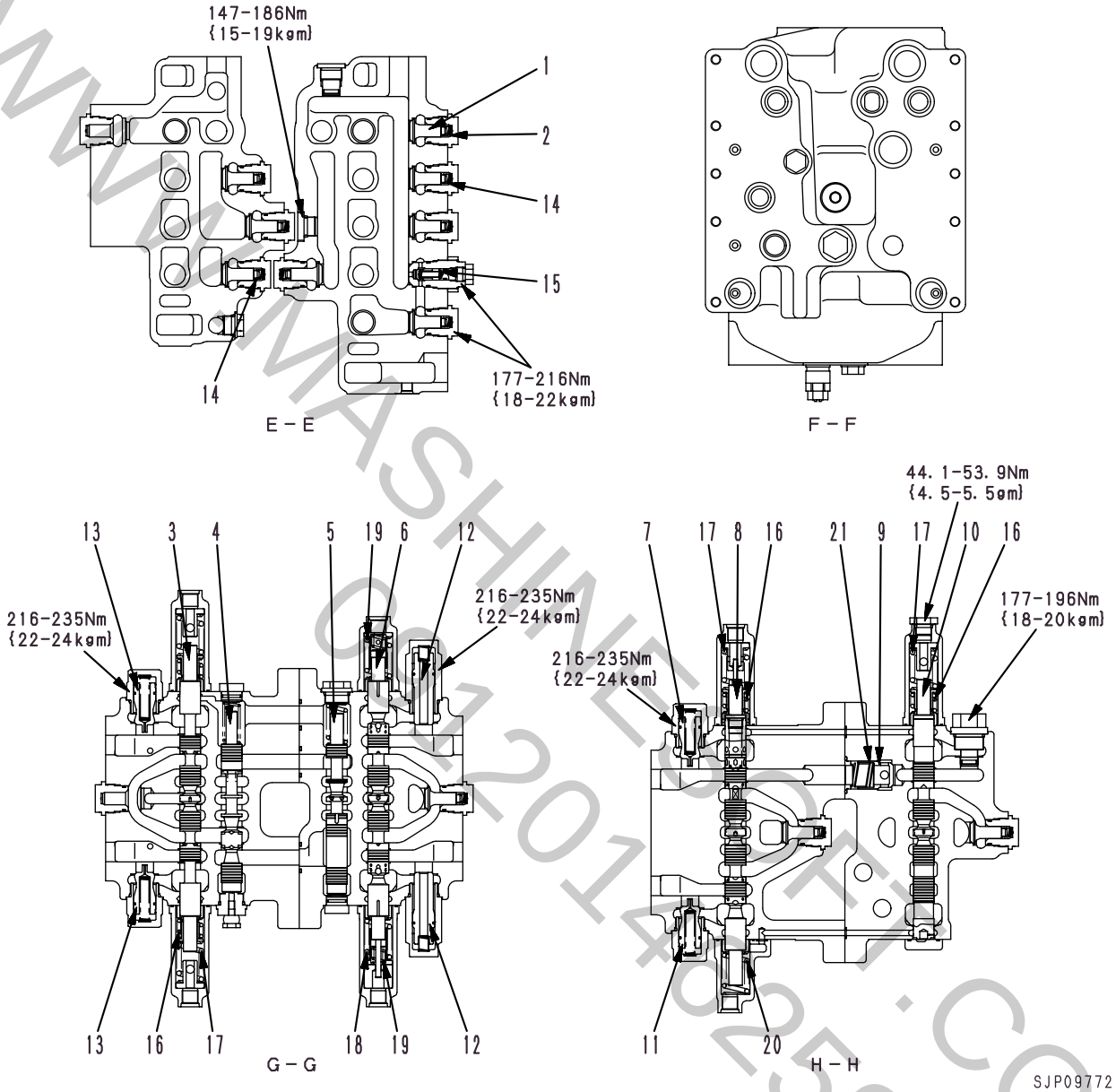


1. Spool return spring
2. Spool (swing)
3. Spool (boom Hi)
4. Spool (service / bucket Hi)
5. Spool (arm Lo)
6. Spool (R.H. travel)
7. Jet sensor relief valve
8. Jet sensor orifice
9. Main relief valve
10. Spool (swing priority)

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
1	Spool return spring	Free length x OD	Installed length	Installed load	Free length	Installed load	Replace spring if damaged or deformed
		53.8 x 26.5	52.5	104 N {10.6 kg}	—	83.4 N {8.50 kg}	

(3/4)



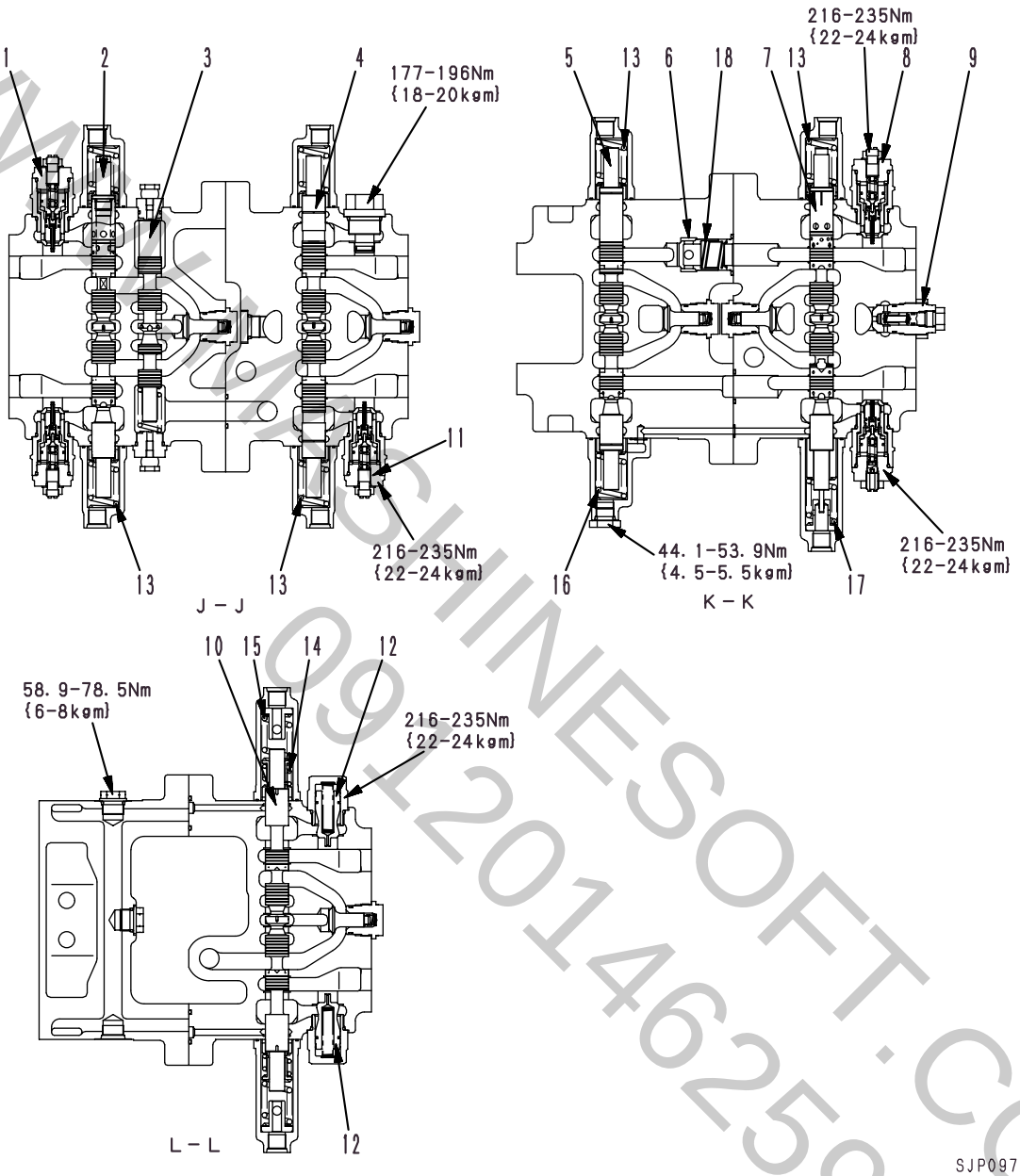
1. Check valve
2. Check valve spring
3. Spool (L.H. travel)
4. Spool (straight-travel)
5. Spool (swing priority)
6. Spool (swing)
7. Suction valve
8. Spool (boom Lo)
9. Check valve
10. Spool (boom Hi)
11. Suction valve
12. Suction valve
13. Suction valve

(5/6)

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
14	Check valve spring	Free length x OD	Installed length	Installed load	Free length	Installed load	
		20.8 x 12.2	13.5	12.7 N {1.3 kg}	—	10.2 N {1.04 kg}	
15	Check valve spring	31.8 x 7.6	26.5	0.98 N {0.10 kg}	—	0.78 N {0.08 kg}	
16	Spool return spring	30.7 x 32.5	26.5	255 N {26.0 kg}	—	204 N {20.8 kg}	Replace spring if damaged or deformed
17	Spool return spring	54.0 x 34.2	52.0	255 N {26.0 kg}	—	204 N {20.8 kg}	
18	Spool return spring	54.8 x 34.0	53.5	125 N {12.7 kg}	—	100 N {10.2 kg}	
19	Spool return spring	21.0 x 16.9	18.2	207 N {21.1 kg}	—	—	
20	Spool return spring	54.9 x 34.0	53.5	125 N {12.7 kg}	—	100 N {10.2 kg}	
21	Check valve spring	55.9 x 30.2	29.0	7.85 N {0.80 kg}	—	6.28 N {0.64 kg}	

(4/4)

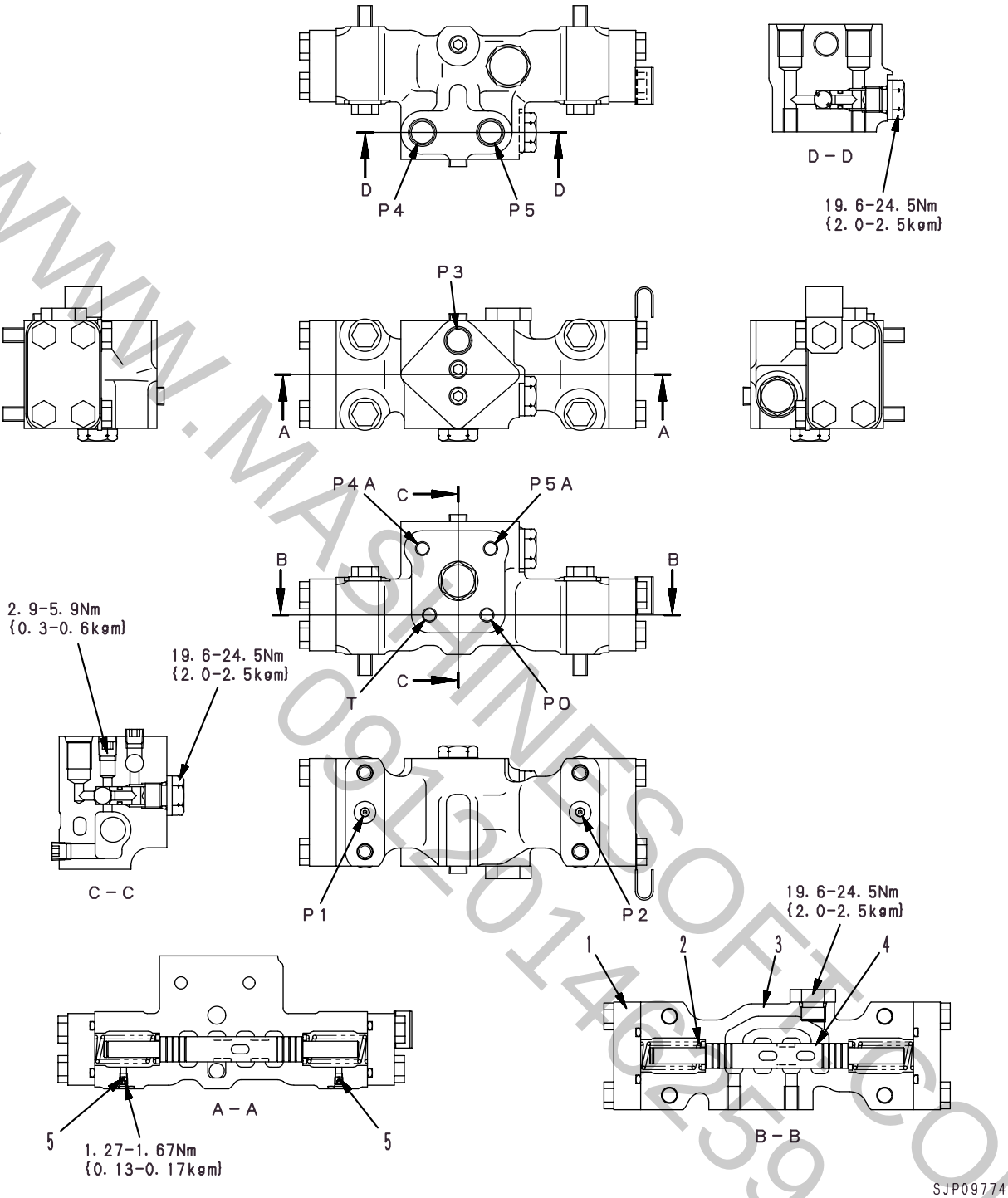


1. Suction-safety valve
2. Spool (bucket Lo)
3. Spool (arm throttle)
4. Spool (service / bucket Hi)
5. Spool (arm Hi)
6. Check valve
7. Spool (arm Lo)
8. Suction-safety valve
9. Check valve
10. Spool (R.H. travel)
11. Suction-safety valve
12. Suction valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
13	Spool return spring	Free length x OD	Installed length	Installed load	Free length	Installed load	Replace spring if damaged or deformed
		54.8 x 34.0	53.5	125 N {12.7 kg}	—	100 N {10.2 kg}	
14	Spool return spring	30.7 x 32.5	26.5	255 N {26.0 kg}	—	204 N {20.8 kg}	
15	Spool return spring	54.0 x 34.2	52.0	255 N {26.0 kg}	—	204 N {20.8 kg}	
16	Spool return spring	54.8 x 34.0	53.5	125 N {12.7 kg}	—	100 N {10.2 kg}	
17	Spool return spring	54.9 x 34.0	53.5	125 N {12.7 kg}	—	100 N {10.2 kg}	
18	Check valve spring	55.9 x 30.2	29.0	7.85 N {0.80 kg}	—	6.28 N {0.64 kg}	

TRAVEL SHUTTLE VALVE



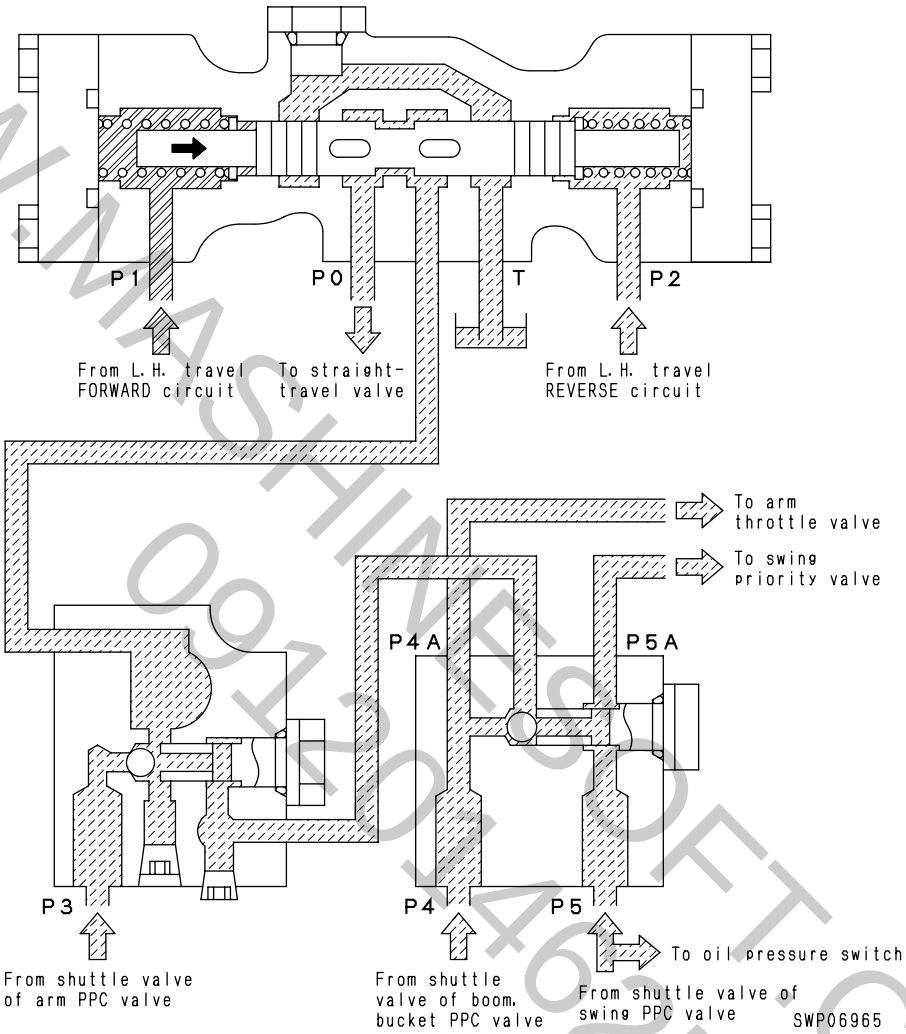
P0 : To straight-travel valve
P1 : From L.H. travel valve A1L port
P2 : From L.H. travel valve B1L port
P3 : From arm shuttle valve
P4 : From boom, bucket shuttle valve
P5 : From swing shuttle valve
P4A : To arm throttle valve
P5A : To swing priority valve
T : To tank

1. Cover
2. Spool return spring
3. Body
4. Spool
5. Orifice

Function

- The travel shuttle valve is installed to the top of the 4-spool valve control valve. It brings the PPC valve pressures from the L.H. travel, work equipment, and swing. It also sends pilot pressure to the straight-travel valve when the travel and work equipment or travel and swing are operated at the same time.

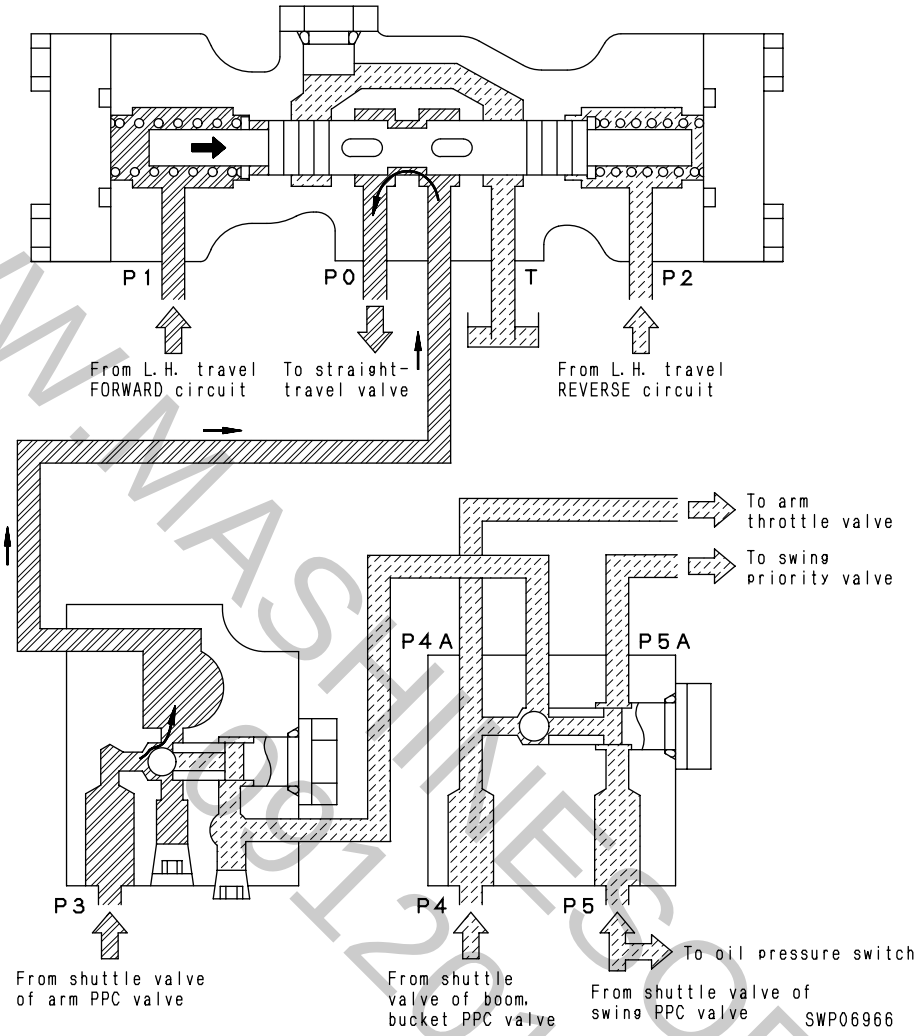
1) When control valve is at neutral



Operation

- When the travel FORWARD is operated, pilot pressure oil flows from the L.H. travel circuit to port **P1** and pushes the spool to the right. Ports **P3**, **P4**, and **P5** are interconnected with port **P0** through the groove in the spool to the straight-travel valve.
- However, when the work equipment and swing control levers are at HOLD, the pilot pressure oil from the PPC valve does not flow, so it also does not flow to the straight-travel valve.
- When the travel reverse is operated, the pressure oil is sent to port **P2** and pushes the spool to the right.

2) During simultaneous operation



Operation

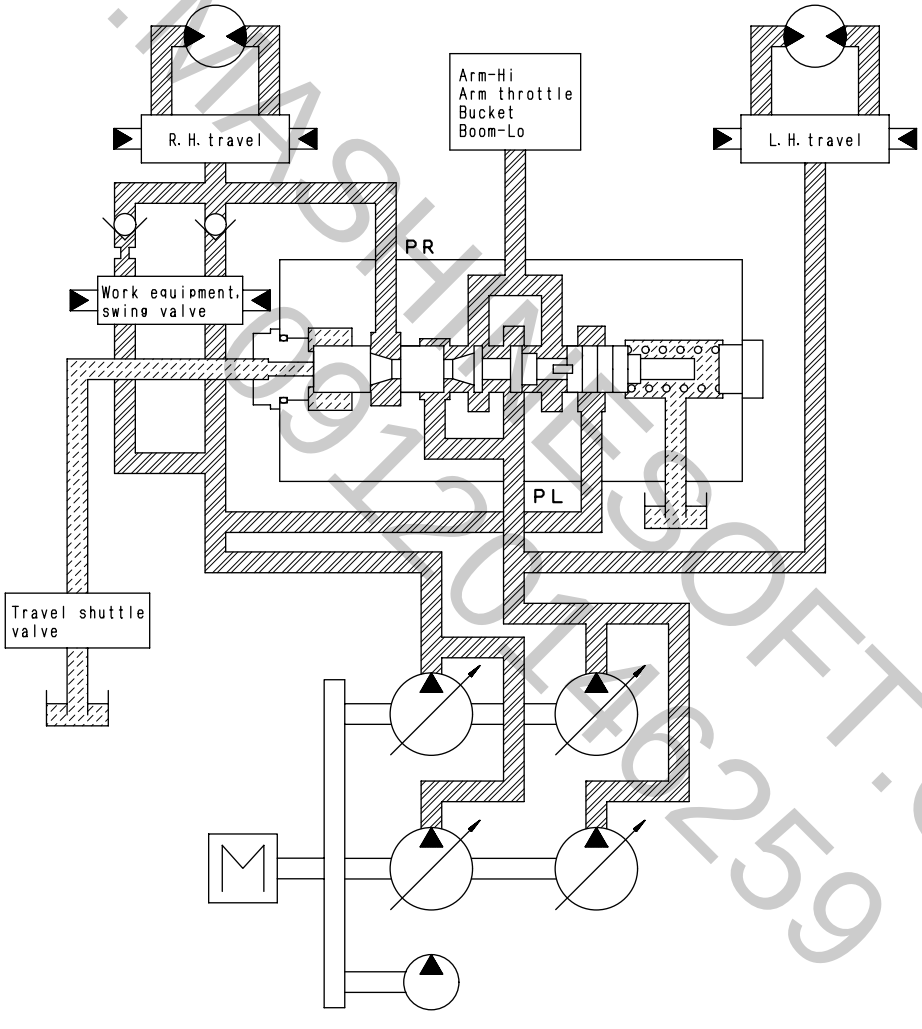
- When the arm and travel FORWARD are operated at the same time, pilot pressure oil flows from the L.H. travel circuit to port **P1** and pushes the spool to the right.
- When the arm is operated, pilot pressure oil also flows to port **P3** from the arm PPC shuttle valve. This passes through the groove in the spool and port **P0**, and flows to the straight-travel valve.
- The pilot pressure oil from the swing PPC shuttle valve flows from port **P5** → port **P0** → straight-travel valve, and the pilot pressure oil from the boom and bucket PPC shuttle valves flows from port **P4** → port **P0** → straight-travel valve.

STRAIGHT-TRAVEL VALVE

Function

- When the travel is operated at the same time as the boom, arm, or bucket, the pressure oil flowing to the left and right travel circuits is divided and sent to the boom, arm, or bucket circuit.
- If the oil in one travel circuit is divided off, the amount of oil supplied to the travel motor will be less than in the travel circuit which is not divided, so the drop in the supply of oil to the travel motor will cause the machine to deviate.
- To prevent this, the straight-travel valve is switched to interconnect the left and right travel circuits. This ensures that the amount of oil supplied to the left and right travel motors is equal.
- As a result, the left and right travel motors both rotate at the same speed, and there is little travel deviation.

1) When travel is operated independently

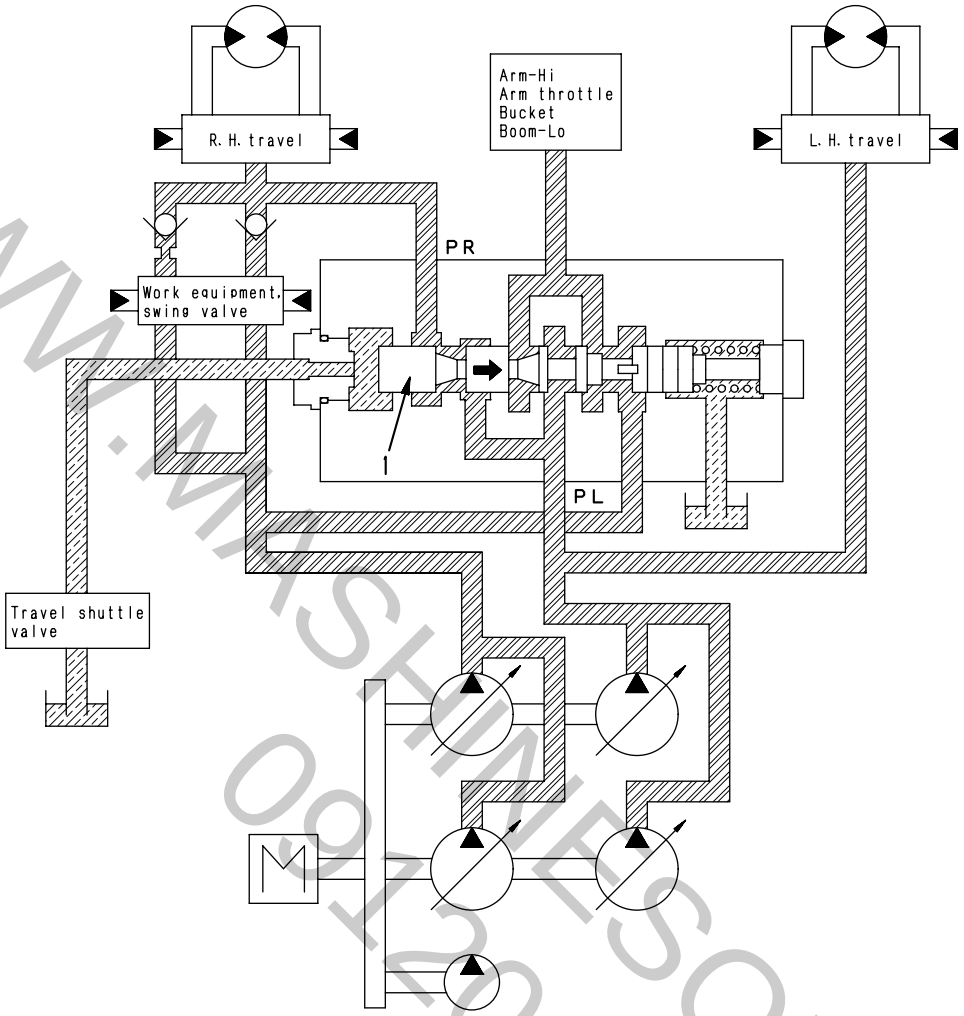


SJW09811

Operation

- No pilot pressure flows from the travel shuttle valve, so the straight-travel valve is not actuated.
- Because of this, port **PL** (L.H. travel circuit) and port **PR** (R.H. travel circuit) are not interconnected, and each circuit remains independent.

2. When travel and work equipment are operated at same time



Operation

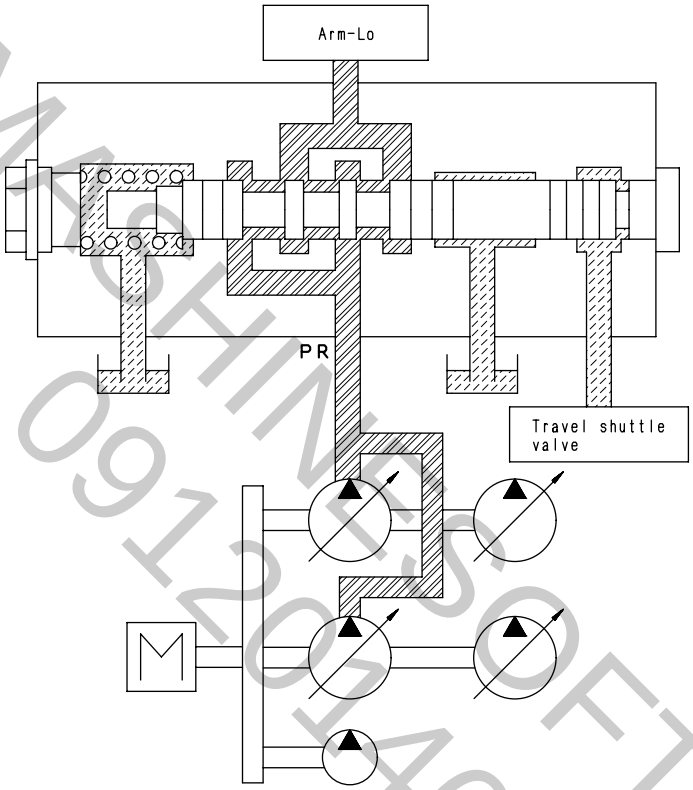
- The pilot oil from the travel shuttle valve presses the spool of straight travel valve (1).
- Accordingly, port **PL** is connected to the right and left travel motors and oil of the same quantity is fed to the right and left travel motors. Since the right and left travel motors rotate at the same speed, the machine deviates less.

SWING PRIORITY VALVE

Function

- When the swing and arm are operated at the same time, a large amount of the pressure oil flows to the arm circuit where the load is small, so little pressure oil flows to the swing circuit.
- This makes the arm speed too fast for the swing speed, and causes poor combination in simultaneous operation.
- To overcome this, the swing priority valve is actuated to throttle the pressure oil flowing to the arm Lo control valve in order to restrict the arm speed and improve the simultaneous operation performance.

1) When swing is at HOLD

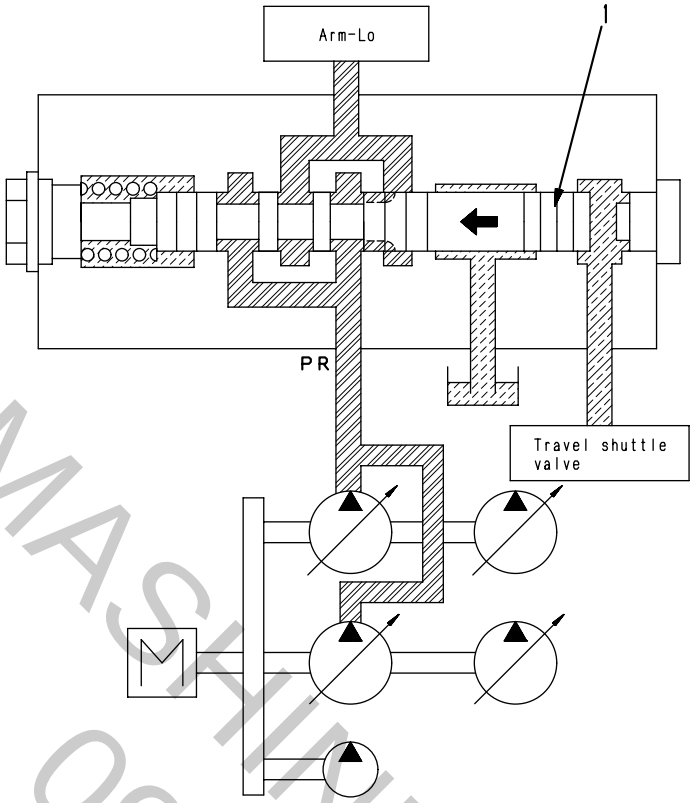


SJW09813

Operation

- No pilot pressure oil flows from the travel shuttle valve, so the swing priority valve is not actuated.
- For this reason, all the pressure oil from the front main pump passes through port **PR** and flows to the arm Lo control valve.

2. When swing is operated



SJW09814

Operation

- When the swing is operated, the pilot pressure oil from the travel shuttle valve pushes spool (1) of the swing priority valve to the left.
- As a result, the pressure oil flowing from the front main pump through port **PR** to the arm Lo control valve is throttled, and the arm speed is restricted to improve the simultaneous operation performance.

ARM THROTTLE VALVE

Function

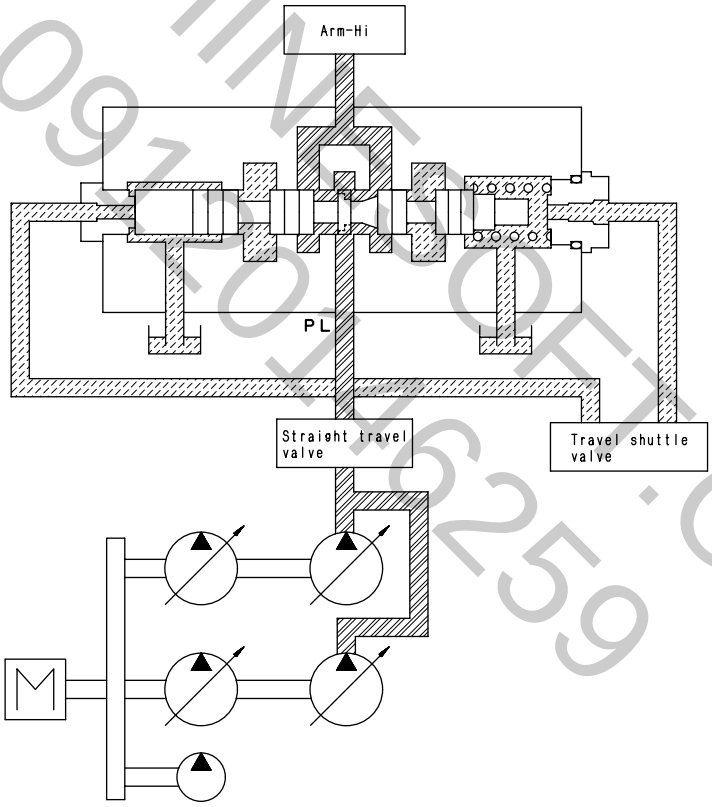
When arm and boom are operated at same time

- When the arm and boom are operated at the same time, a large amount of the pressure oil flows to the arm circuit where the load is small, so little pressure oil flows to the boom circuit.
- This makes the arm speed too fast for the boom speed, and causes poor combination in simultaneous operation. This is a particular problem when the arm OUT and boom RAISE are operated at the same time.
- To overcome this, the arm throttle valve is actuated to throttle the pressure oil flowing to the arm Hi control valve in order to restrict the arm speed and improve the simultaneous operation performance.

When arm and bucket are operated at same time

- The arm is actuated by the merged flow from two pumps and the bucket is actuated by the oil from one pump.
- In this condition, if the arm and bucket are operated at the same time, a large amount of the pressure oil flows to the arm circuit, so little pressure oil flows to the bucket circuit. This makes the arm speed too fast for the bucket speed, and causes poor combination in simultaneous operation. This is a particular problem when the arm OUT and bucket CURL are operated at the same time.
- To overcome this, the arm throttle valve is actuated to throttle the pressure oil flowing to the arm Hi control valve in order to restrict the arm speed and improve the simultaneous operation performance.

1) When arm is operated independently

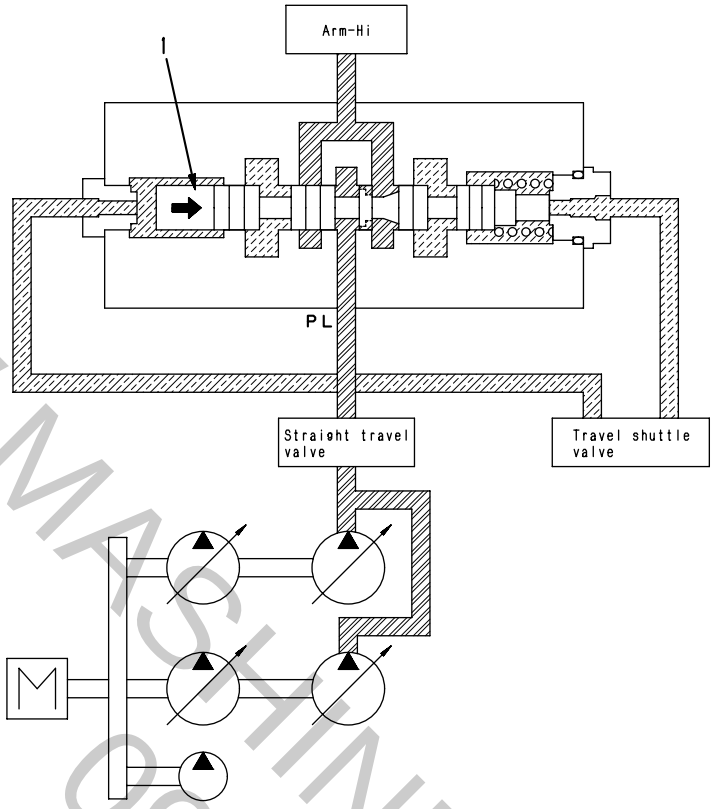


SJW09815

Operation

- No pilot pressure oil flows from the travel shuttle valve, so the arm throttle valve is not actuated.
- For this reason, all the pressure oil from the rear main pump passes through port **PL** and flows to the arm Hi control valve.

2. When arm and boom or bucket are operated at same time



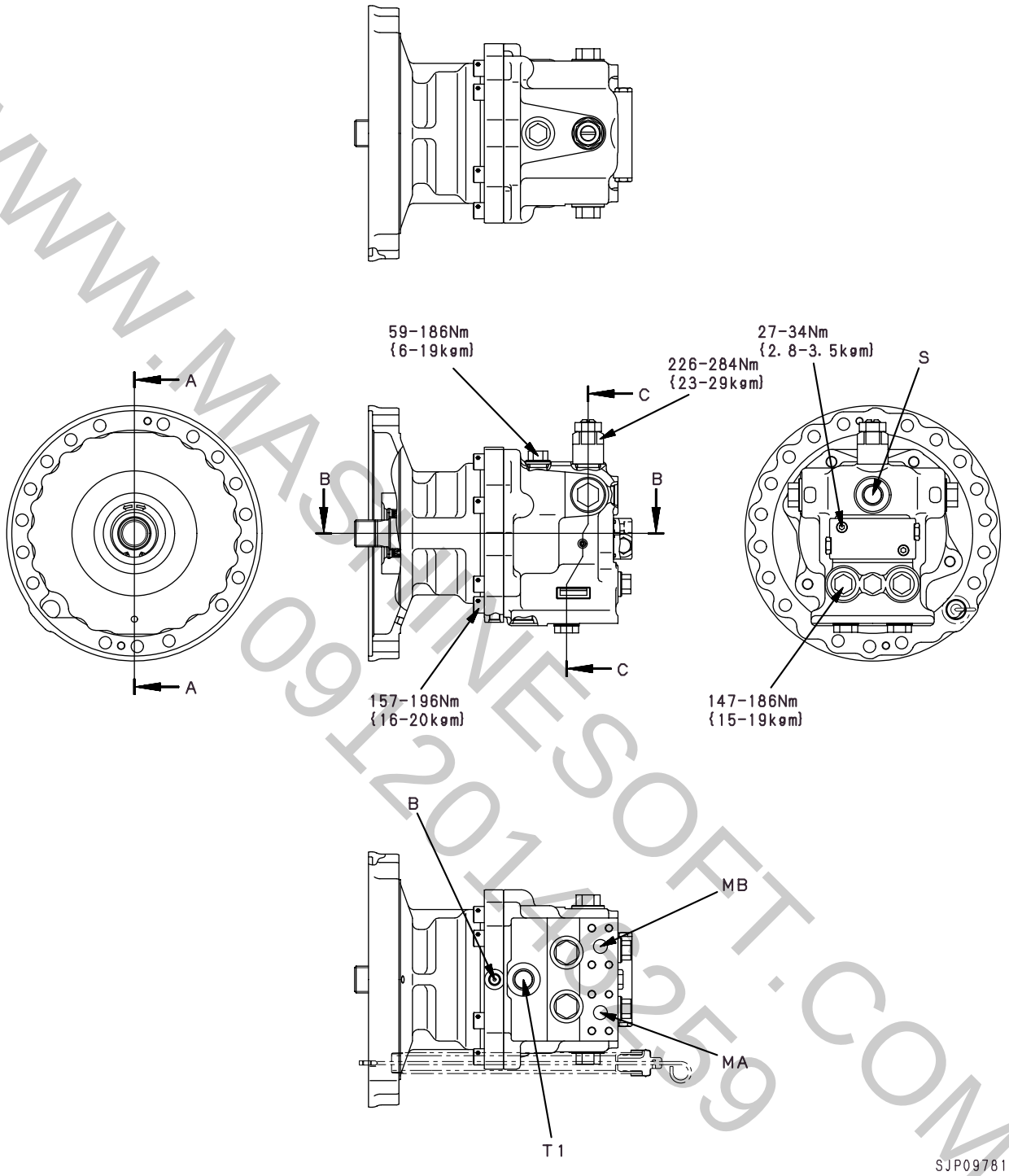
SJW09816

Operation

- When the arm and boom or bucket are operated at the same time, the pilot pressure oil from the travel shuttle valve pushes spool (1) of the arm throttle valve to the right.
- As a result, the pressure oil flowing from the rear main pump to the arm Hi control valve is throttled, and the arm speed is restricted to improve the simultaneous operation performance.

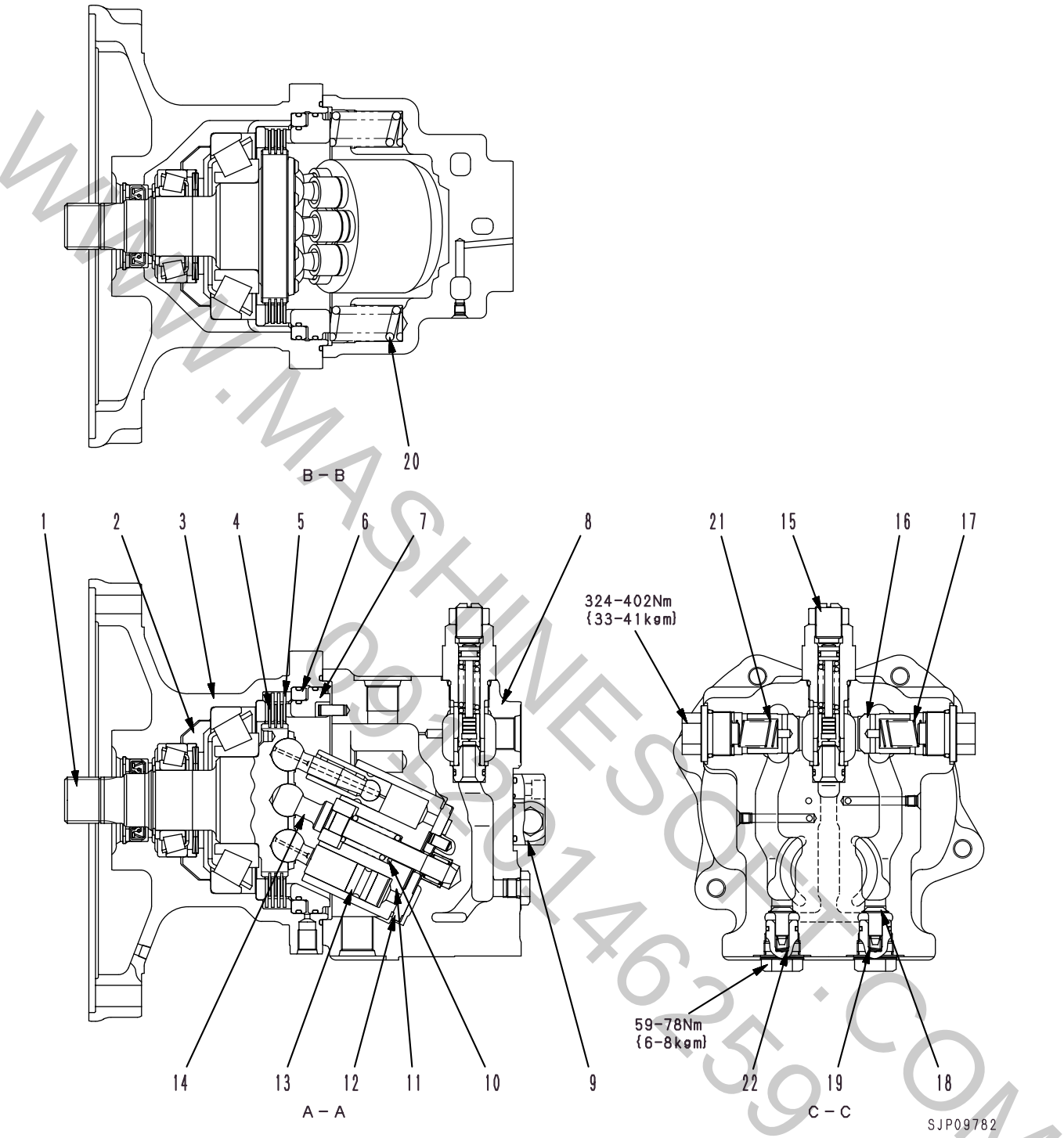
SWING MOTOR

MODEL: KMF90ABE-3 (with reverse prevention valve)



T1 : To tank
S : From control valve
MA : From control valve
MB : From control valve
B : From swing brake solenoid valve

Specifications
Model: KMF90ABE-3
Theoretical delivery: 87.8 cc/rev
Safety valve set pressure: 25.5 MPa {260 kg/cm²}
Rated speed: 2,320 rpm
Brake release pressure: 2.06 MPa {21.0 kg/cm²}



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

Unit: mm

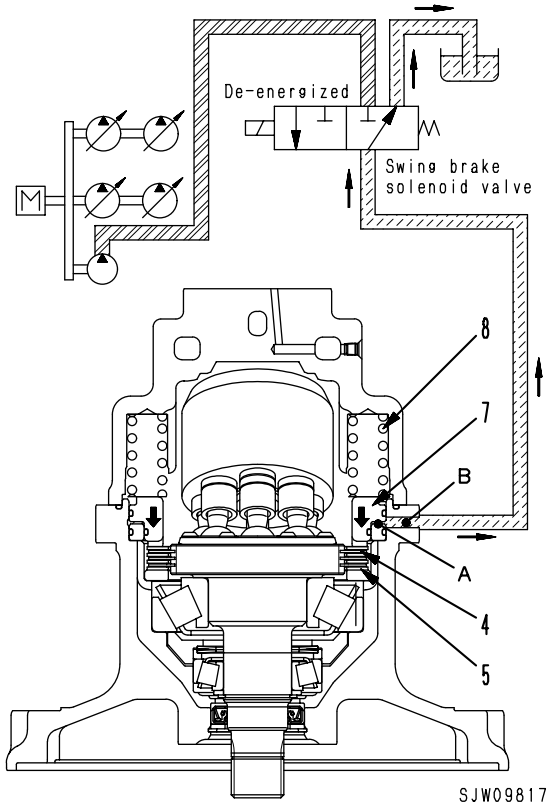
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
21	Check valve spring	Free length x OD	Installed length	Installed load	Free length	Installed load	Replace spring if damaged or deformed
		62.5 x 20.0	39	3.04 N {0.31 kg}	—	2.45 N {0.25 kg}	
22	Shuttle valve spring	16.4 x 8.9	11.5	13.7 N {1.4 kg}	—	11 N {1.12 kg}	

SWING BRAKE

Operation

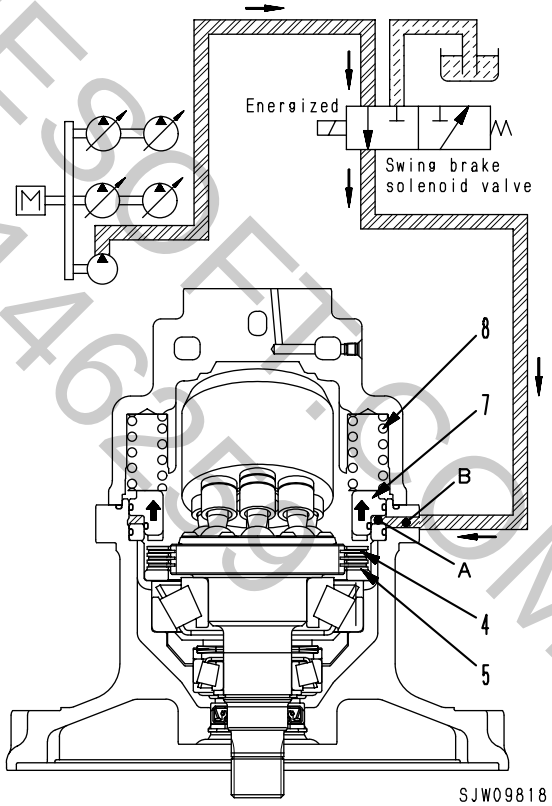
1. When swing brake solenoid valve is de-energized

- If the swing brake solenoid valve is de-energized, the flow of pressurized oil from the control pump is shut off, and port **B** is connected to the tank circuit.
- As a result, brake piston (7) is pushed down by brake spring (8), pushes disc (4) and plate (5) together, and the brake is applied.



2. When swing brake solenoid valve is energized

- When the swing brake solenoid valve is energized, the valve is switched, and pressurized oil from the control pump enters port **B** and flows to brake chamber **A**.
- The pressurized oil entering chamber **A** overcomes brake spring (8) and brake piston (7) moves up. As a result, disc (4) and plate (5) are separated and the brake is released.



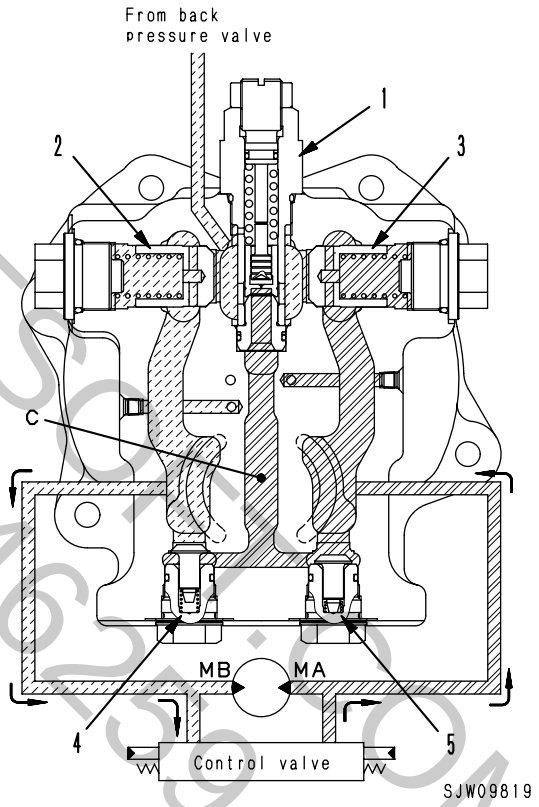
SAFETY VALVE

Outline
- The safety valve portion consists of check valves (2) and (3), shuttle valves (4) and (5), and relief valve (1).

Function
- When the swing is stopped, the outlet port circuit of the motor is closed by the control valve, but the motor continues to be turned by the inertia of the swing. As a result, the pressure at the outlet port of the motor becomes abnormally high and there is danger that the motor will be damaged.
- The safety valve is installed to prevent this problem. It acts to release the abnormally high pressure oil from the outlet port (high-pressure side) of the motor and send it to the back pressure valve and prevent damage to the motor.

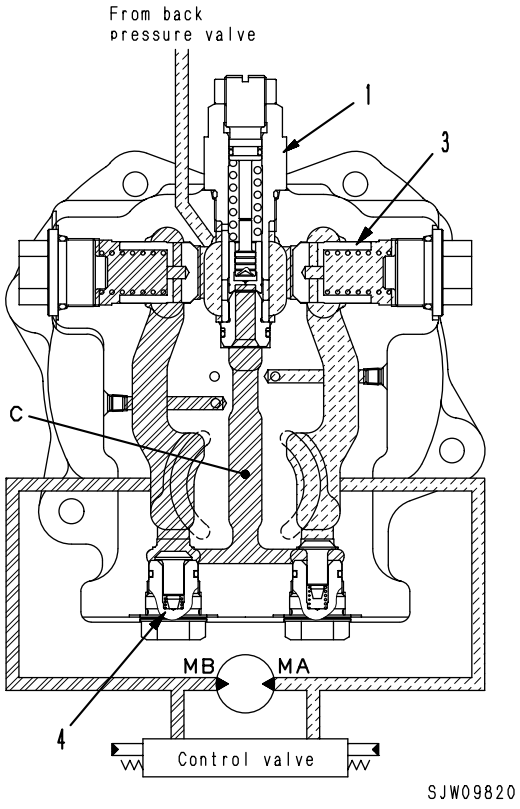
Operation

1. When starting swing
- If the swing control lever is operated to swing to the right, the pressurized oil from the pump passes through the control valve and is supplied to port **MA**.
- When this happens, the pressure at port **MA** rises and starting force is generated in the motor, so the motor starts to turn. The oil from the outlet port of the motor flows from port **MB** through the control valve and returns to the tank.

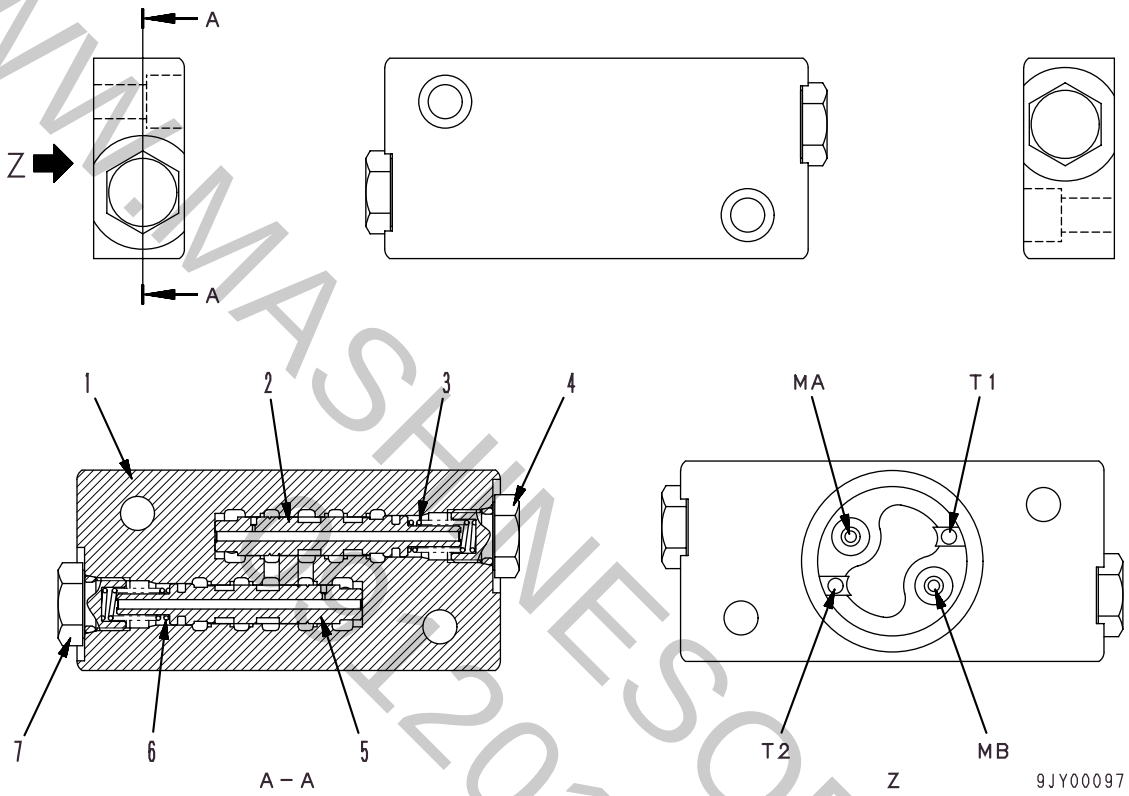


2. When stopping swing

- When the swing control lever is returned to the neutral position, no more pressurized oil is supplied from the pump to port **MA**. At the same time, the oil from the outlet port of the motor returns from the control valve to the tank, and the circuit is closed. The pressure at port **MB** rises, and rotating resistance to the motor is generated, so the brake starts to take effect.
- If the pressure at port **MB** rises higher than the pressure at port **MA**, shuttle valve (4) is pushed and chamber **C** becomes the same pressure as port **MB**. The pressure then rises to the set pressure of relief valve (1). In this way, a high brake torque is generated in the motor, and the motor stops.
- When relief valve (1) is being actuated, the relieved oil and oil from back pressure valve is supplied to port **MA** through check valve (3) to prevent cavitation at port **MA**.



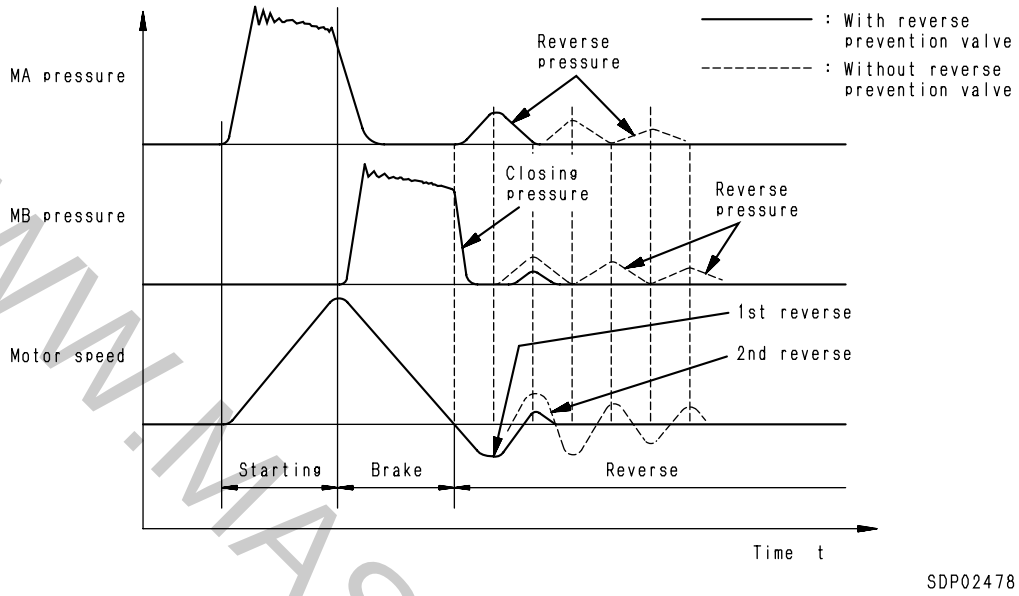
REVERSE PREVENTION VALVE



MA : Port
T1 : Port
MB : Port
T2 : Port

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

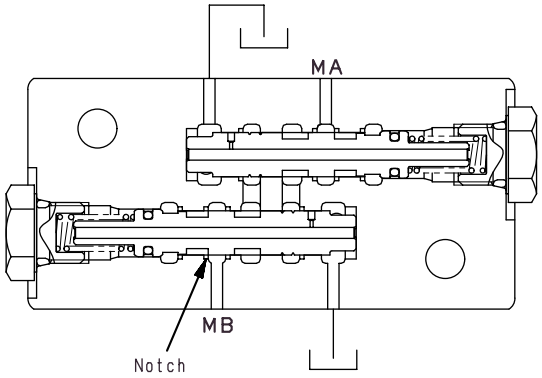
Explanation of effect



1. Function

When the swing is stopped, this valve reduces the rocking motion of the swing body due to the inertia of the swing body, backlash of the machinery system, the compressibility of the hydraulic oil, etc.

This valve is effective to prevent the cargo from being spilled when the swing is stopped as well as to shorten recycle time (excellent in the positioning accuracy and the next operation can be started quickly).



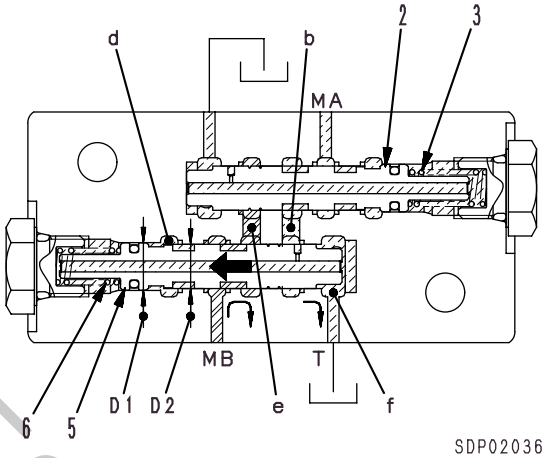
SDP02479

2. Operation

1) When the braking pressure is present at the port MB

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

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



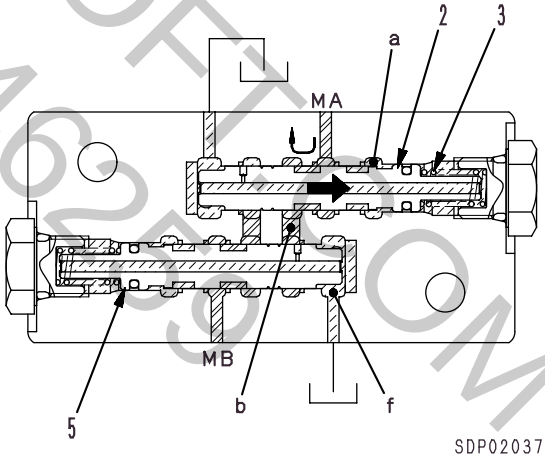
SDP02036

2) When the motor stopped temporarily

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

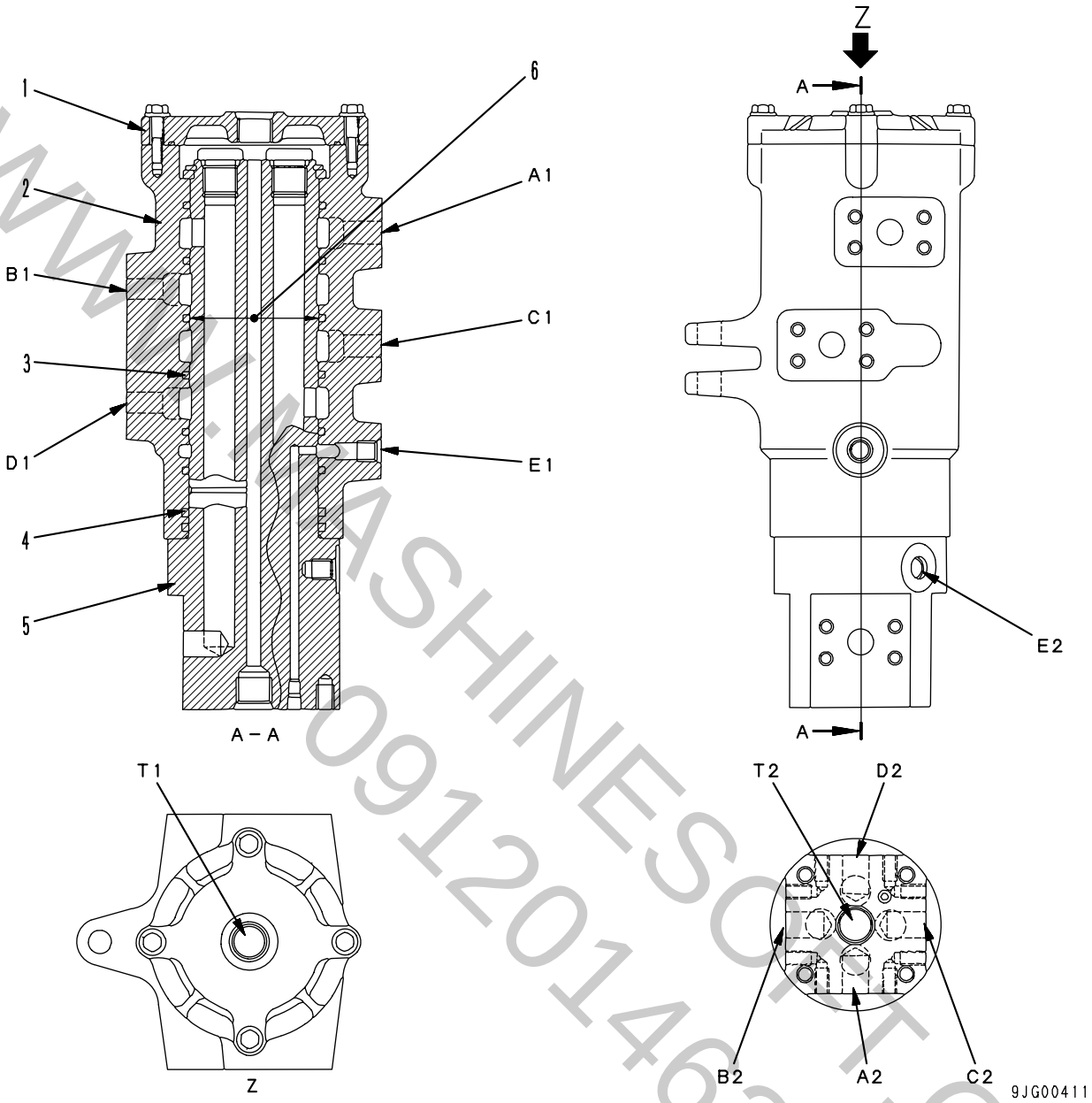
On this occasion, the reverse pressure is generated at port **MA** side. This pressure at port **MA** is introduced to chamber **a**, and spool (2) makes a stroke motion to the right, pressing spring (3), and the interconnection of **MA** to **b** is established.

Also, the interconnection of **b** to **f** is established through the drill hole and the reverse pressure at port **MA** is bypassed to port **T**, thereby preventing the second reversal.



SDP02037

CENTER SWIVEL JOINT



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

A1. From control valve port **A5R**
A2. To R.H. travel motor port **PB**
B1. From control valve port **A1L**
B2. To L.H. travel motor port **PA**
C1. From control valve port **B5R**
C2. To R.H. travel motor port **PA**

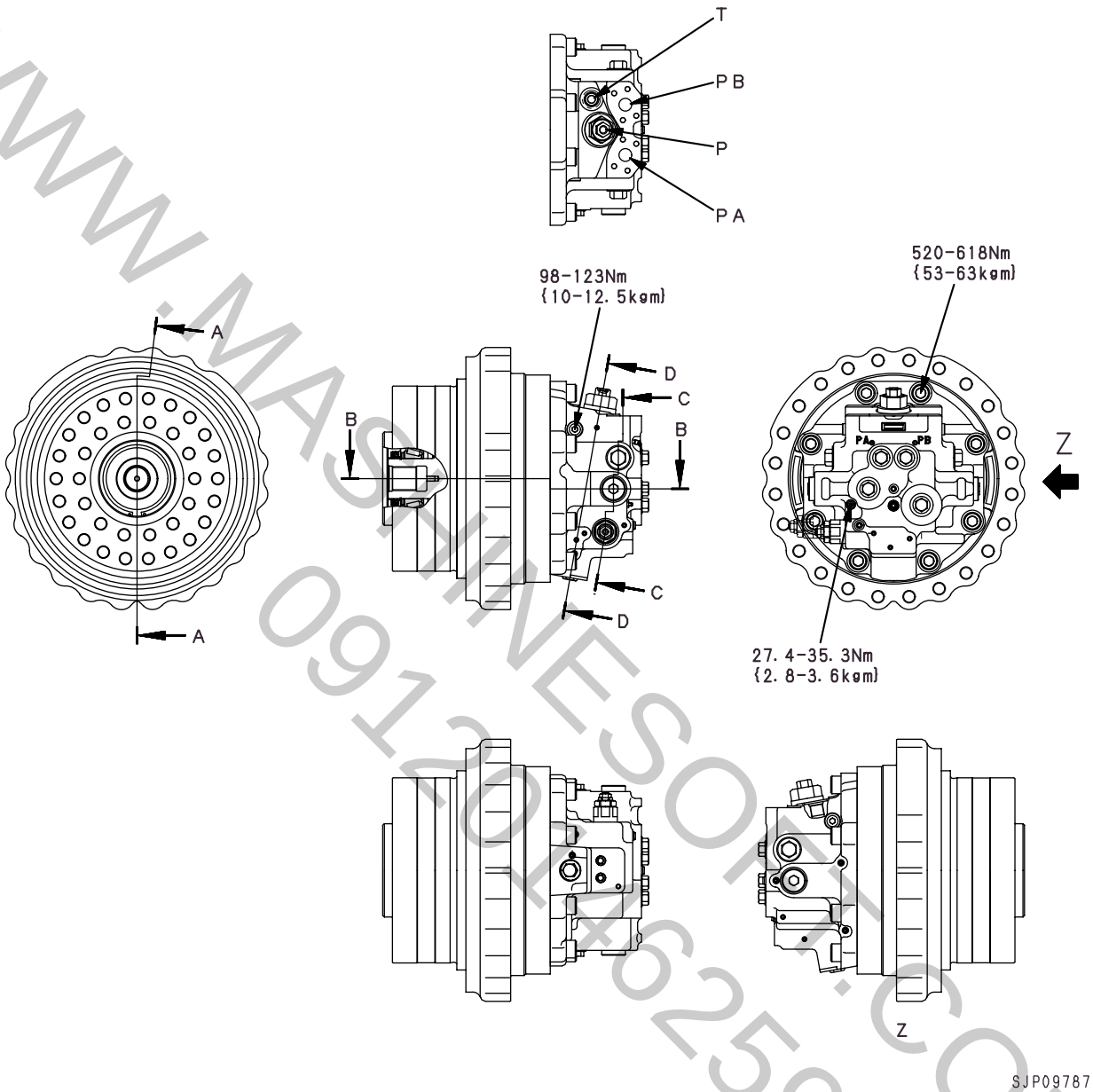
D1. From control valve port **B1L**
D2. To L.H. travel motor port **PB**
E1. From travel speed EPC valve
E2. To L.H. and R.H. travel motors port **P**
T1. To tank
T2. From L.H. and R.H. travel motors port **T**

Unit: mm

No.	Check item	Criteria			Remedy
6	Clearance between rotor and shaft	Standard size	Standard clearance	Clearance limit	Replace
		90	0.056 – 0.105	0.111	

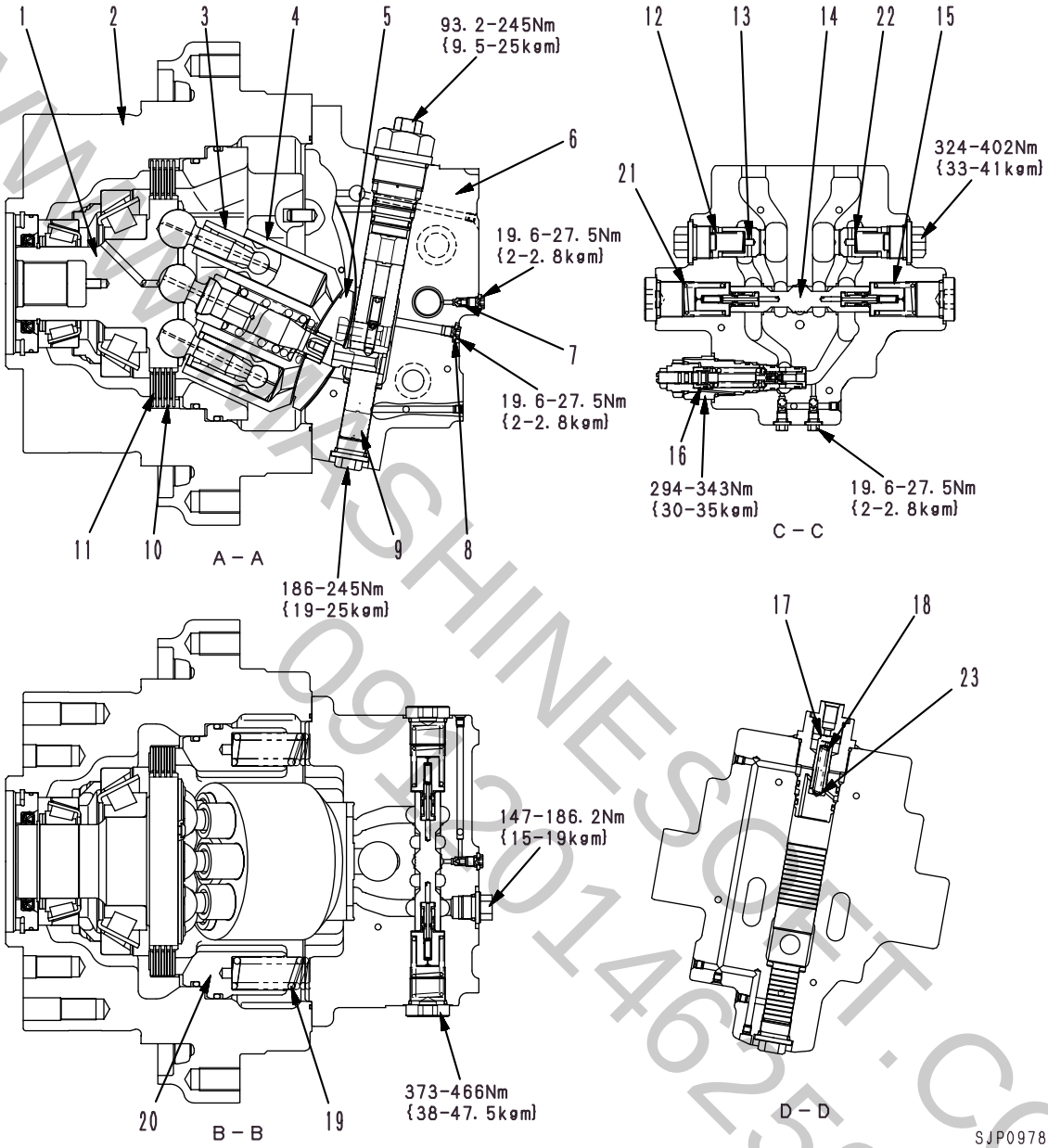
TRAVEL MOTOR

MODEL: KMV335ADT



P :From travel speed solenoid valve
T :To tank
PA :From control valve
PB :From control valve

Specifications
Model: KMV335ADT
Theoretical delivery: Minimum 217 cc/rev
Maximum 336 cc/rev
Brake release pressure:
1.27 ± 0.39 MPa {13.0 ± 4.0 kg/cm²}
Travel speed selector pressure:
0.93 ± 0.25 MPa {9.50 ± 2.50 kg/cm²}

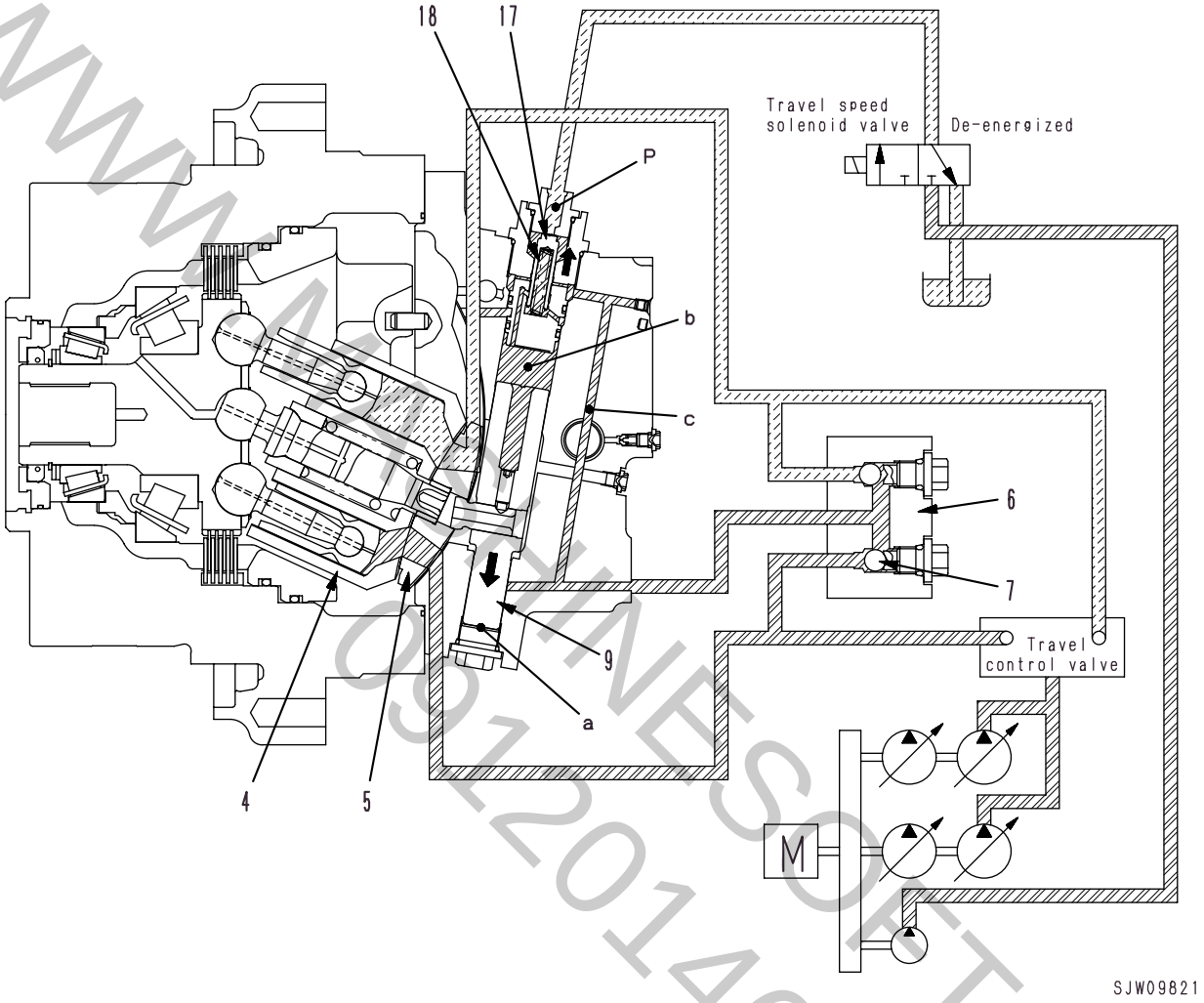


1. Output shaft
2. Motor case
3. Piston
4. Cylinder block
5. Valve plate
6. End cover
7. Slow return valve
8. Plug
9. Regulator piston
10. Plate
11. Disc
12. Check valve spring
13. Check valve
14. Counterbalance valve
15. Spool return spring
16. Safety valve
17. Regulator valve
18. Spring
19. Brake spring
20. Brake piston

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
21	Spool return spring	Free length x OD	Installed length	Installed load	Free length	Installed load	Replace spring if damaged or deformed
		62.5 x 32	42.0	427 N {43.5 kg}	—	341 N {34.8 kg}	
22	Check valve spring	62.5 x 20.0	39.0	3.04 N {0.31 kg}	—	2.45 N {0.25 kg}	
23	Regulator piston spring	55.0 x 9.0	50.0	98.1 N {10.0 kg}	—	78.5 N {8.0 kg}	

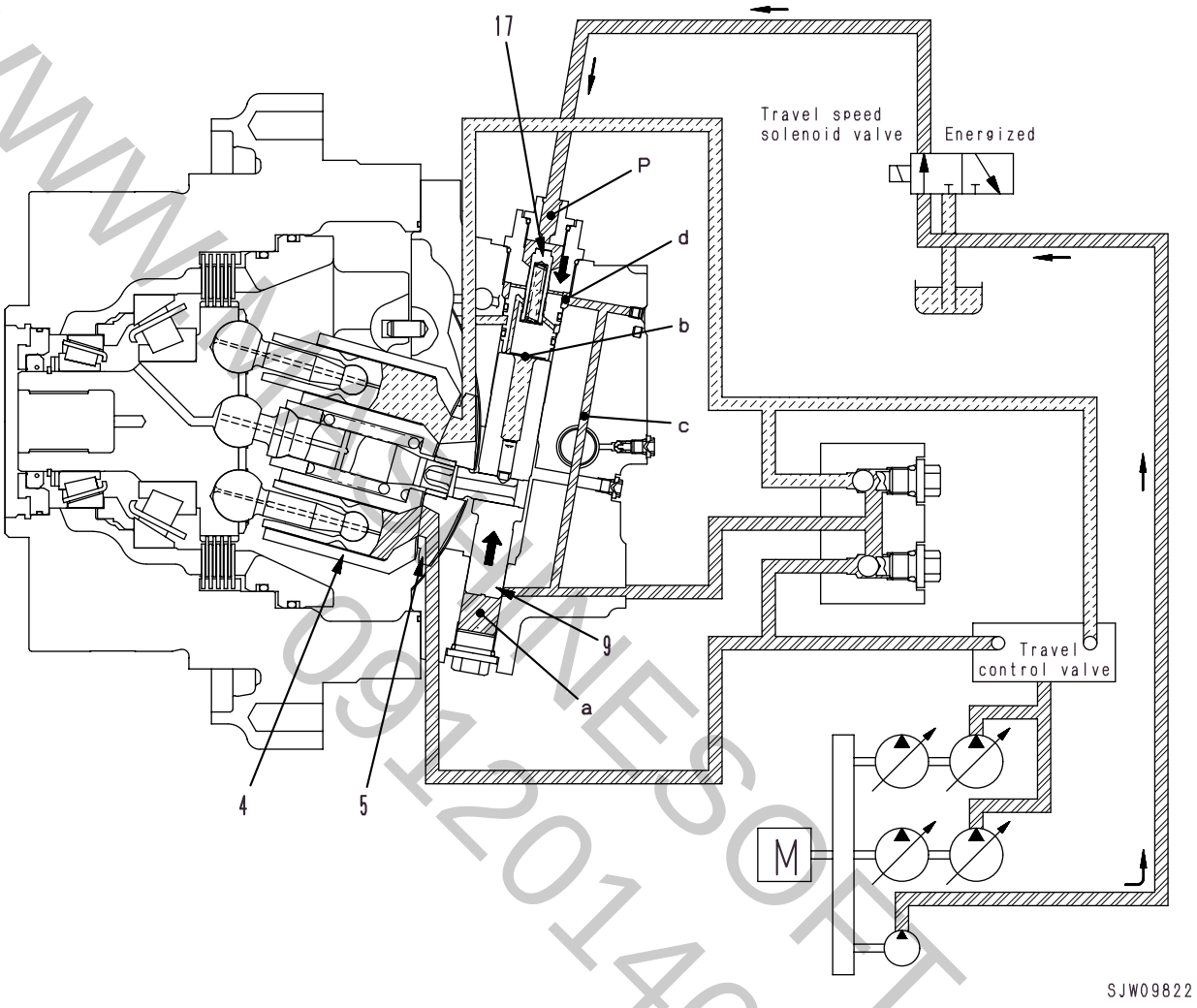
1. At low speed (motor swash plate angle at maximum)



Operation

- When the solenoid valve is de-energized, the pilot pressure oil from the control pump does not flow to port **P**. For this reason, regulator valve (17) is pushed upward in the direction of the arrow by spring (18).
- The main pressure oil from the control valve pushes shuttle valve (7), goes through end cover (6), and acts on chamber **a** of regulator piston (9). At the same time, the main pressure passes through passage **c** and acts on chamber **b** through regulator valve (17).
- Because of this, propulsion force equal to the difference in area of chambers **a** and **b** (**Ab** – **Aa**) of regulator piston (9) acts in a downward direction.
- As a result, valve plate (5) and cylinder block (4) move in the maximum swash plate angle direction, the motor capacity becomes the maximum, and the system is set to low speed.

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

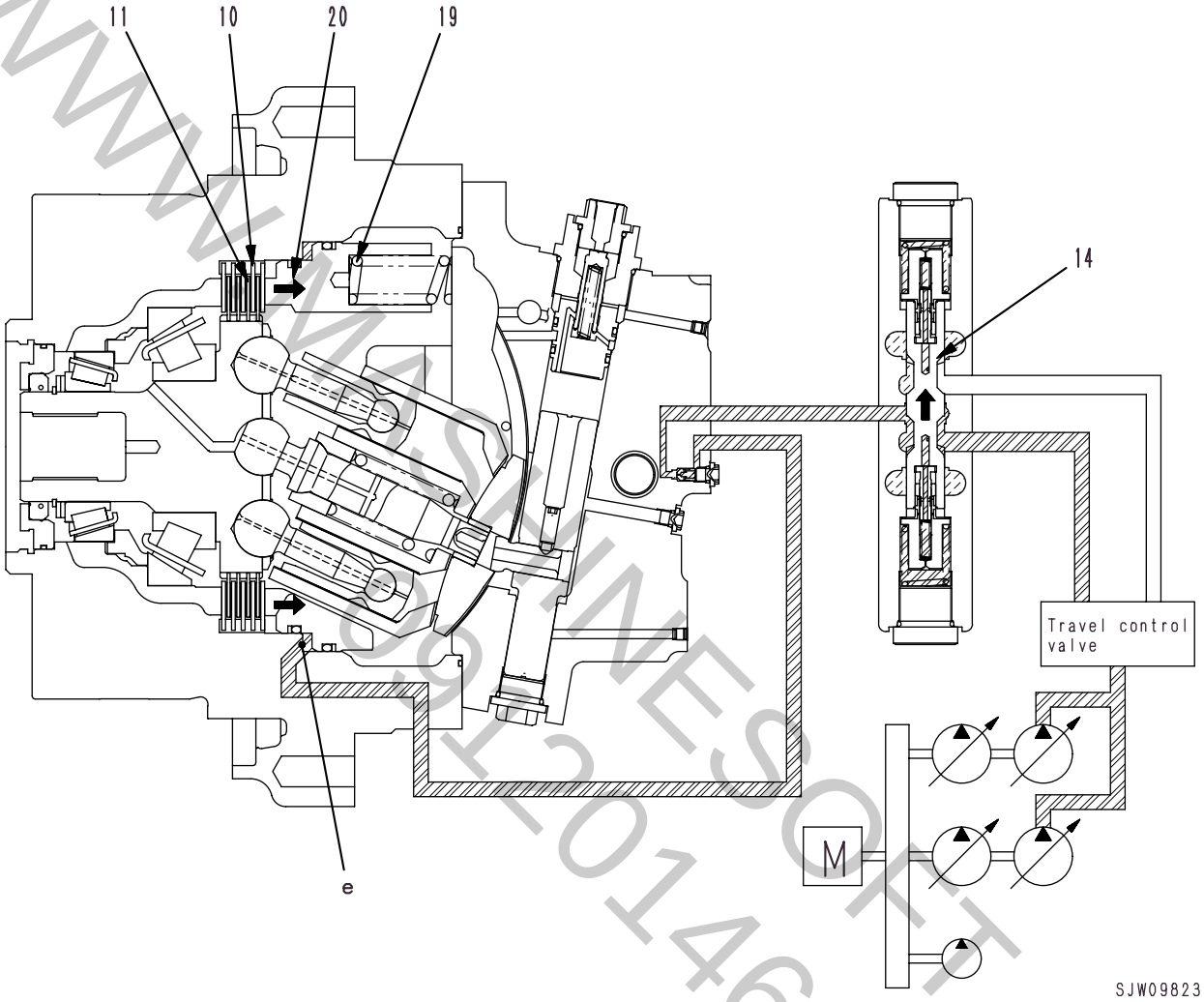


Operation

- When the solenoid valve is energized, the pilot pressure oil from the control pump flows to port **P**, and pushes regulator valve (17) down.
- Because of this, the main pressure oil and the oil in chamber **d** is shut off by regulator valve (17), and the oil in chamber **b** is drained inside the case.
- A propulsion force generated by the pressure oil in chamber **a** of regulator piston (9) then acts upward.
- As a result, valve plate (5) and cylinder block (4) move in the minimum swash plate angle direction, the motor capacity becomes the minimum, and the system is set to high speed.

PARKING BRAKE

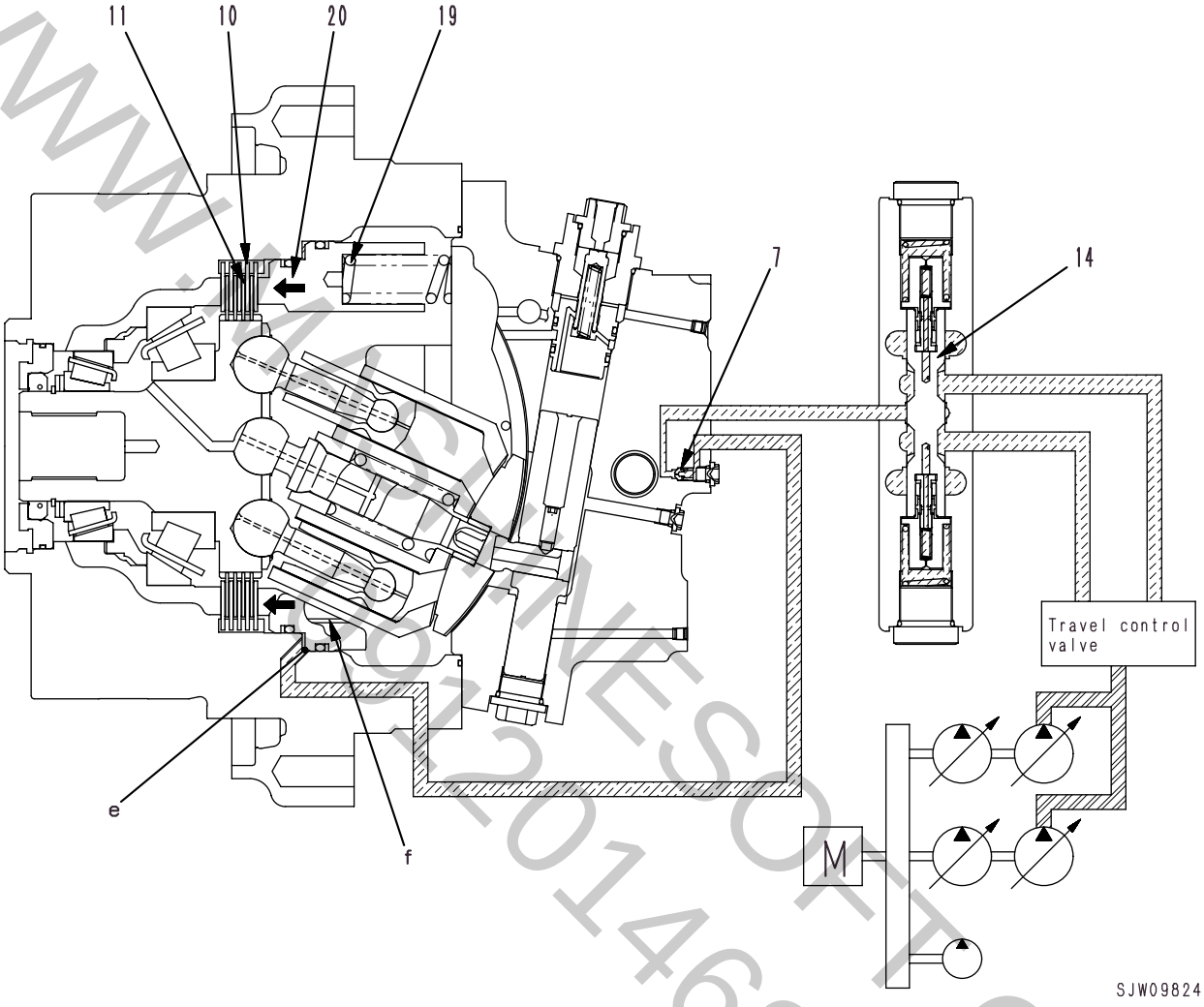
1. When starting to travel



Operation

- When the travel lever is operated, the pressurized oil from the pump actuates counterbalance valve spool (14), opens the circuit to the parking brake, and flows into chamber **e** of brake piston (20). It overcomes the force of spring (19), and pushes piston (20) to the right.
- When this happens, the force pushing plate (10) and disc (11) together is lost, so plate (10) and disc (11) separate and the brake is released.

2. When stopping travel



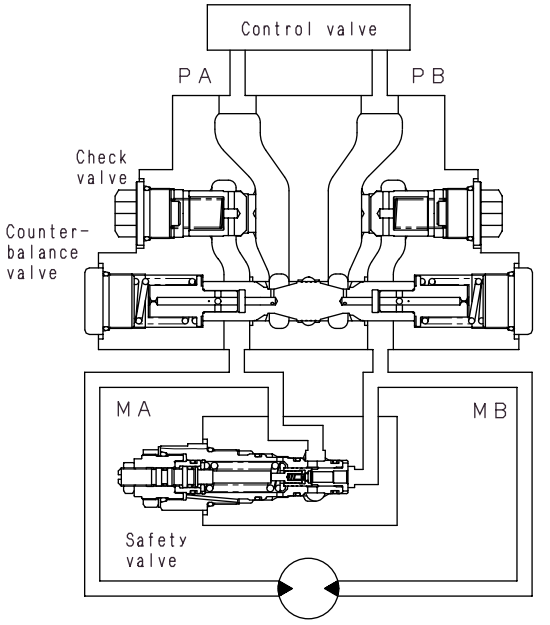
Operation

- When the travel lever is placed in neutral, counterbalance valve spool (14) returns to the neutral position and the circuit to the parking brake is closed.
- The pressurized oil in chamber **e** of brake piston (20) passes through the throttle of slow return valve (7) until spool (14) of the counterbalance valve returns to neutral.
- When spool (14) of the counterbalance valve returns to the neutral position, the oil is drained inside the case from the throttle **f** of brake piston (20) and brake piston (20) is pushed fully to the left by spring (19).
- As a result, plate (10) and disc (11) are pushed together, and the brake is applied.
- A time delay is provided by having the pressurized oil pass through a throttle in slow return valve (7) when the brake piston returns, and this ensures that the brake is applied after the machine stops.

BRAKE VALVE

Operation of brake valve

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



SWP06981

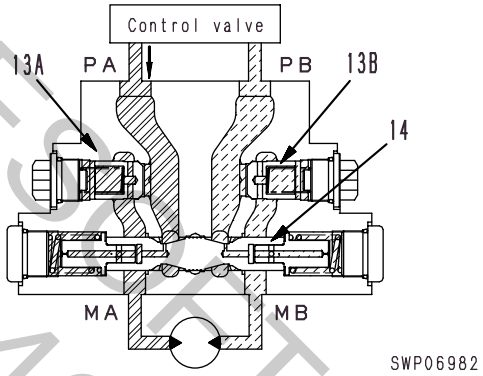
1. Counterbalance valve, check valve

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).

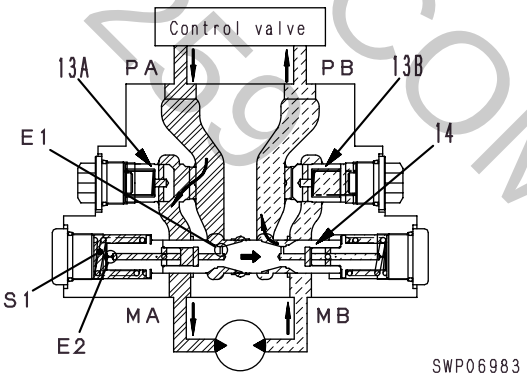
Operation when pressurized oil is supplied

- When the travel lever is operated, the pressurized oil from the control valve is supplied to port **PA**. It pushes open check valve (13A) and flows from motor inlet port **MA** to motor outlet port **MB**. However, the motor outlet port is closed by check valve (13B) and spool (14), so the pressure at the supply side rises.



SWP06982

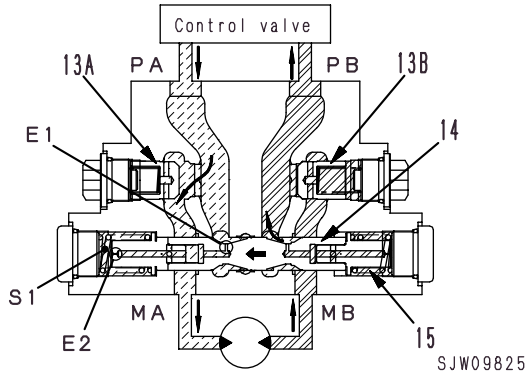
- The pressurized oil at the supply side flows from orifice **E1** in spool (14) and orifice **E2** in the piston to chamber **S1**. When the pressure in chamber **S1** goes above the spool switching pressure, spool (14) is pushed to the right.
  As a result, port **MB** and port **PB** are connected, the outlet port side of the motor is opened, and the motor starts to rotate.



SWP06983

Operation of brake when traveling downhill

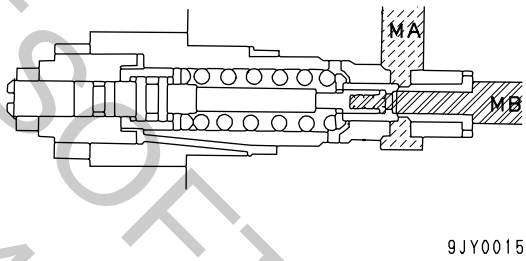
- If the machine tries to run away when traveling downhill, the motor will turn under no load, so the pressure at the motor inlet port will drop, and the pressure in chamber **S1** through orifices **E1** and **E2** will also drop.
  When the pressure in chamber **S1** drops below the spool switching pressure, spool (14) is returned to the left by spring (15), and outlet port **MB** 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.



2. Safety valve (2-direction operation, 2-stage set safety valve)

Function

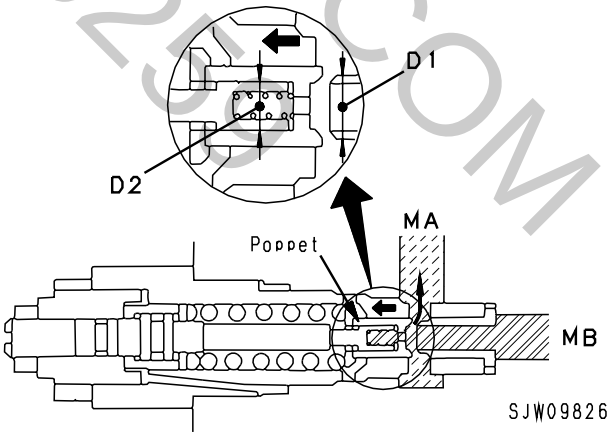
- When travel is stopped (or when traveling downhill), the circuits at the inlet and outlet ports of the motor are closed by the counterbalance valve. However, the motor is rotated by inertia, so the pressure at the outlet port of the motor will become abnormally high and will damage the motor or piping. The safety valve acts to release this abnormal pressure and send it to the inlet port side of the motor to prevent damage to the equipment.



Operation in both directions

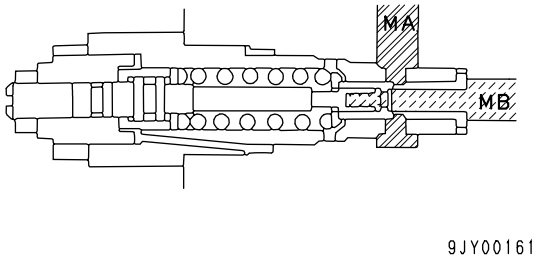
1) When pressure in chamber MB has become high (when rotating clockwise)

- When the travel is stopped (or when traveling downhill), chamber **MB** in the outlet port circuit is closed by the check valve of the counterbalance valve, but the pressure at the outlet port rises because of inertia.
- If the pressure goes above the set pressure, the force produced by the difference in area between **D1** and **D2** [$\pi/4(D1^2 - D2^2)$ x pressure] overcomes the force of the spring and moves the poppet to the left, so the oil flows to chamber **MA** in the circuit on the opposite side.



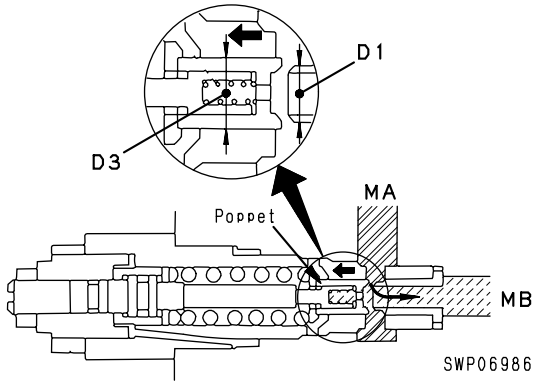
2) When pressure in chamber MA has become high (when rotating counterclockwise)

- When the travel is stopped (or when traveling downhill), chamber **MA** in the outlet port circuit is closed by the check valve of the counterbalance valve, but the pressure at the outlet port rises because of inertia.



9JY00161

- If the pressure goes above the set pressure, the force produced by the difference in area between **D1** and **D3** [$\pi/4(D3^2 - D1^2)$ x pressure] overcomes the force of the spring and moves the poppet to the left, so the oil flows to chamber **MB** in the circuit on the opposite side.

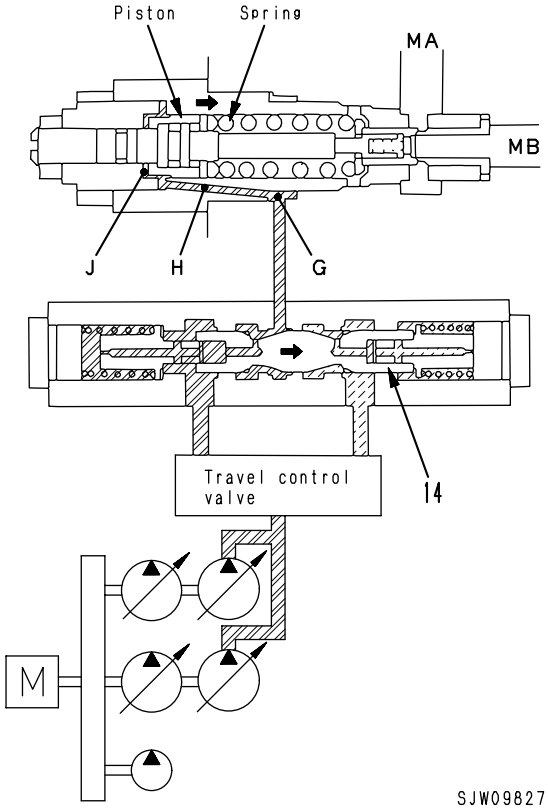


SWP06986

SET PRESSURES VARYING MECHANISM

1. When starting travel (high-pressure setting)

- When the travel lever is operated, the pressurized oil from the pump actuates counterbalance valve spool (14), and opens the pilot circuit to the safety valve. The oil passes from chamber **G** to passage **H** and flows into chamber **J**, pushes the piston to the right, and compresses the spring to make the set load larger.
- Because of this, the set pressure of the safety valve is switched to the high pressure setting, and a large drawbar pull is made available.

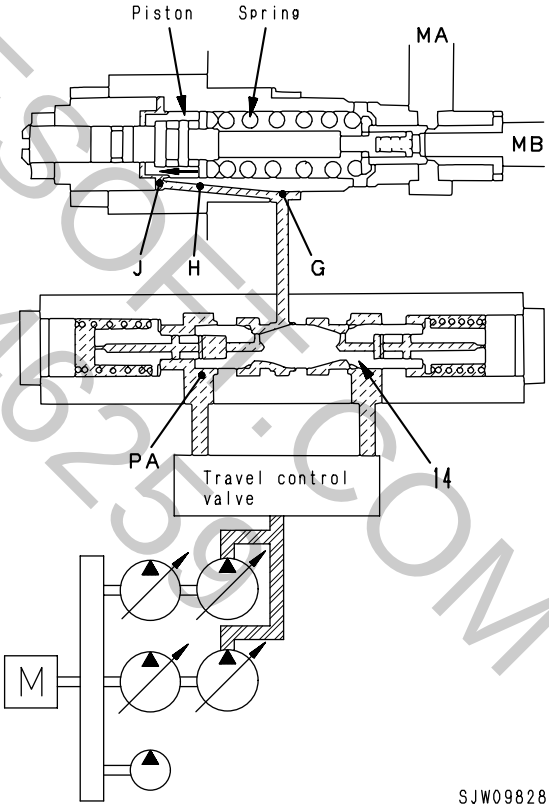


2. When stopping travel (low-pressure setting)

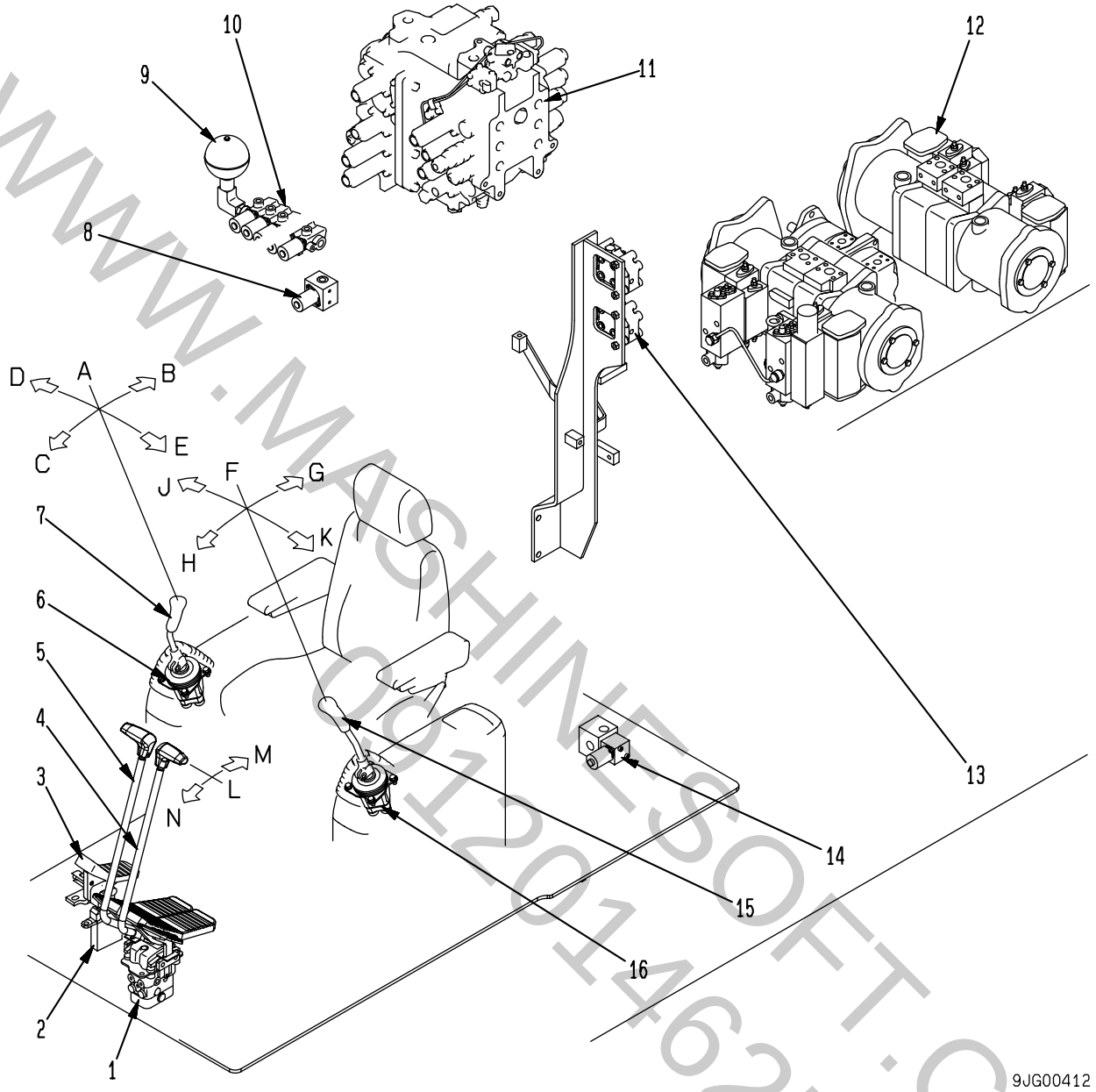
- When the travel lever is placed at neutral, the pressure in chamber **PA** drops and counterbalance valve spool (14) returns to the neutral position.
- While the counterbalance valve spool is returning to the neutral position, the pressurized oil in chamber **J** passes through passage **H**, and escapes to chamber **PA** from chamber **G**. The piston moves to the left, and the set load becomes smaller.
- Because of this, the set pressure of the safety valve is switched to the low-pressure setting and relieves the shock when reducing speed.

Set pressure of safety valve

High-pressure setting (at starting and traveling)	: 37.8 MPa{385 kg/cm^2}
Low-pressure setting (at stopping)	: 27.5 MPa{280 kg/cm^2}



VALVE CONTROL

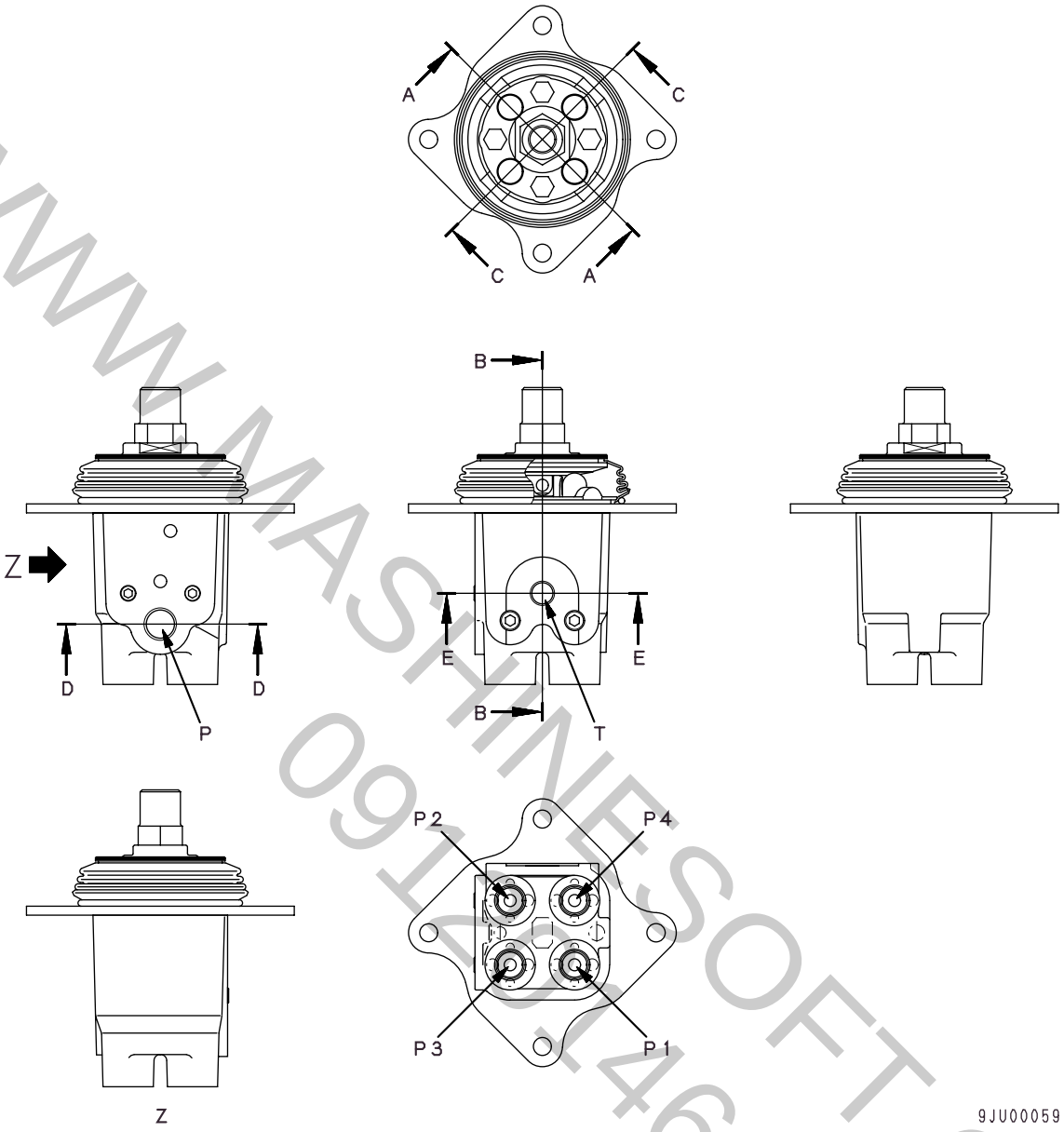


Lever positions

1. Travel PPC valve
2. Service PPC valve
3. Service pedal
4. L.H. travel lever
5. R.H. travel lever
6. Right PPC valve
7. Right work equipment lever
8. Solenoid valve
9. Accumulator
10. Solenoid valve
11. Control valve
12. Hydraulic pump
13. Shuttle valve
14. PPC safety lock solenoid valve
15. Left work equipment lever
16. Left PPC valve

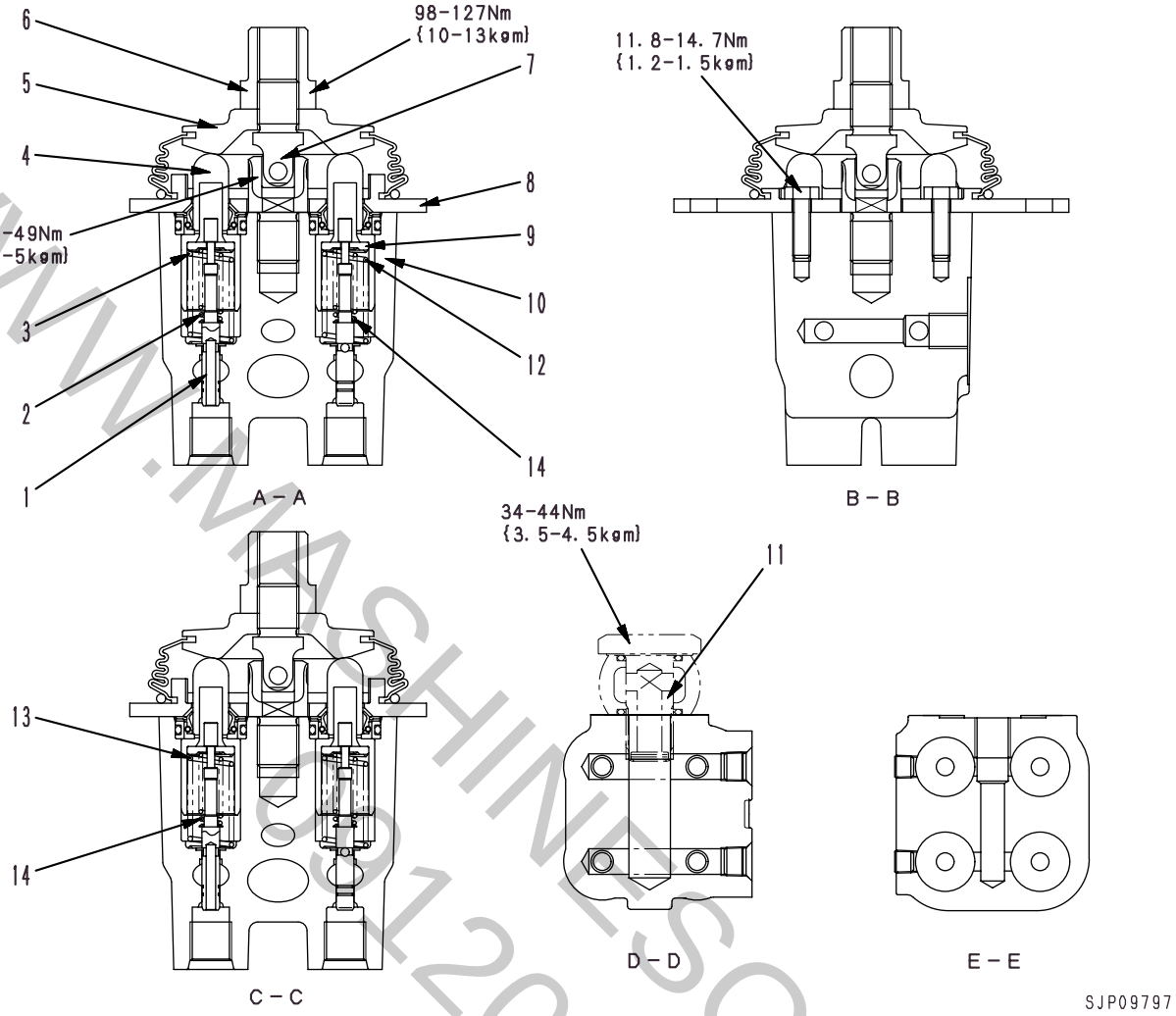
A. NEUTRAL
B. Boom RAISE
C. Boom LOWER
D. Bucket DUMP
E. Bucket CURL
F. NEUTRAL
G. Arm IN
H. Arm OUT
J. Swing right
K. Swing left
L. NEUTRAL
M. Travel REVERSE
N. Travel FORWARD

WORK EQUIPMENT, SWING PPC VALVE



P : From safety lock solenoid valve
T : To tank

P1 :L. H. PPC: Arm OUT/R.H. PPC: Boom LOWER
P2 :L. H. PPC: Arm IN/R.H. PPC: Boom RAISE
P3 :L. H. PPC: Right swing/R.H. PPC: Bucket CURL
P4 :L. H. PPC: Left swing/R.H. PPC: Bucket DUMP



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

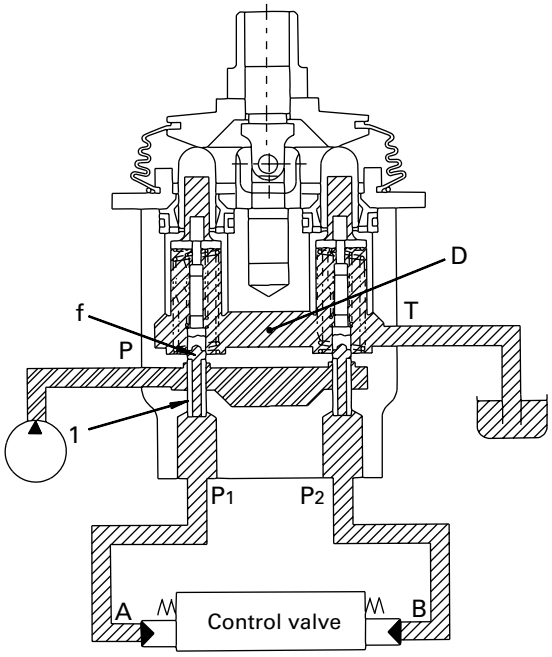
Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
12	Centering spring (for P3, P4)	Free length x OD	Installed length	Installed load	Free length	Installed load	Replace spring if damaged or deformed
		38.7 x 15.5	34	9.81 N {1.0 kg}	—	7.85 N {0.8 kg}	
13	Centering spring (for P1, P2)	42.5 x 15.5	34	17.7 N {1.8 kg}	—	14.1 N {1.44 kg}	
14	Metering spring	26.5 x 8.2	24.9	16.7 N {1.7 kg}	—	13.3 N {1.36 kg}	

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)

SBP00275

2. Fine control (neutral → fine control)

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

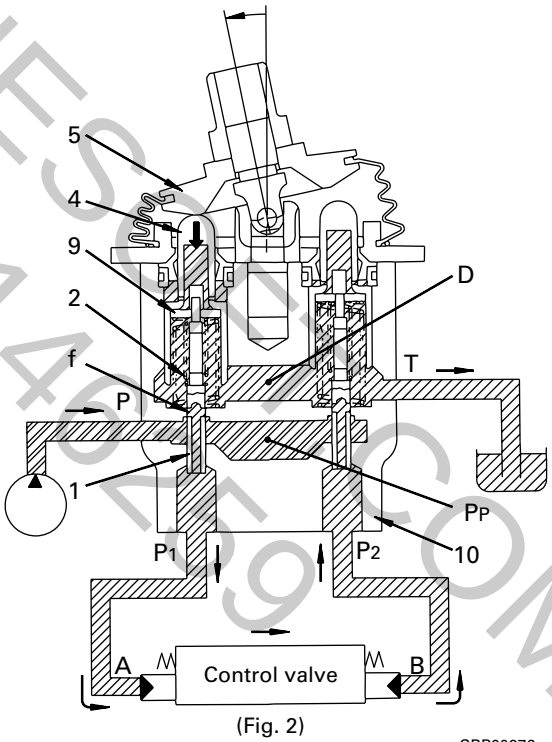
When this happens, fine control hole **f** is shut off from drain chamber **D**. At almost the same time, it is connected to pump pressure chamber **PP**, and the pilot pressure of the control pump is sent from port **A** through fine control hole **f** to port **P1**.

When the pressure at port **P1** rises, spool (1) is pushed back. Fine control hole **f** is shut off from pump pressure chamber **PP**. At almost the same time, it is connected to drain chamber **D**, so the pressure at port **P1** escapes. As a result, spool (1) moves up and down until the force of metering spool (2) is balanced with the pressure of port **P1**.

The relationship of the positions of spool (1) and body (10) (fine control hole **f** is in the middle between drain hole **D** and pump pressure chamber **PP**) does not change until retainer (9) contacts spool (1).

Therefore, metering spring (2) is compressed in proportion to the travel of the control lever, so the pressure at port **P1** also rises in proportion to the travel of the control lever.

In this way, the spool of the control valve moves to a position where the pressure of chamber **A** (same as pressure at port **P1**) and the force of the return spring of the control valve spool are balanced. (Fig. 2)



(Fig. 2)

SBP00276

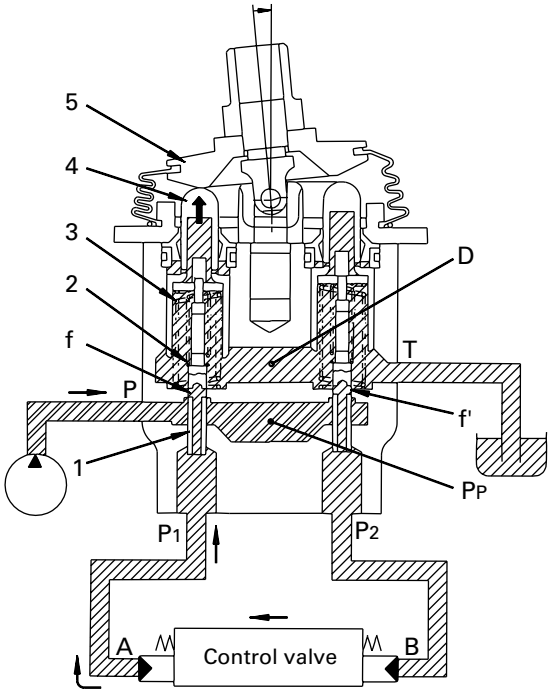
3. Fine control (control lever returned)

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 the oil. (Fig. 3)



(Fig. 3)

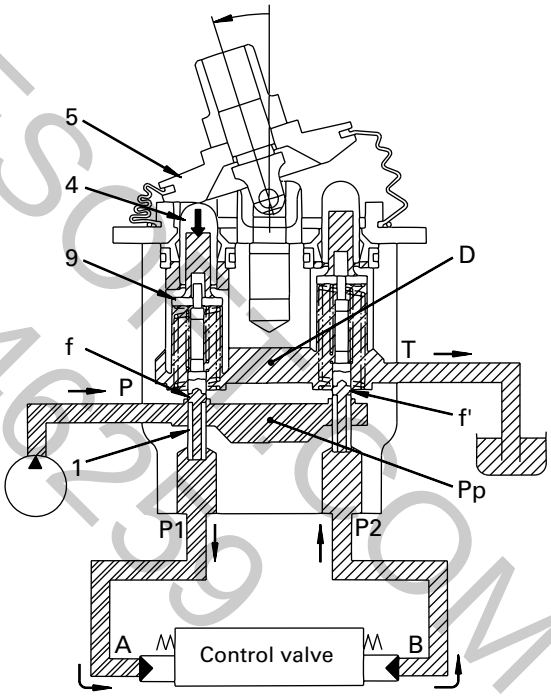
SBP00277

4. At full stroke

Disc (5) pushes down piston (4), and retainer (9) pushes down spool (1). Fine control hole **f** is shut off from drain chamber **D**, and is connected to pump pressure chamber **PP**.

Therefore, the pilot pressure oil from the control pump passes through fine control hole **f** and flows to chamber **A** from port **P1** to push the control valve spool.

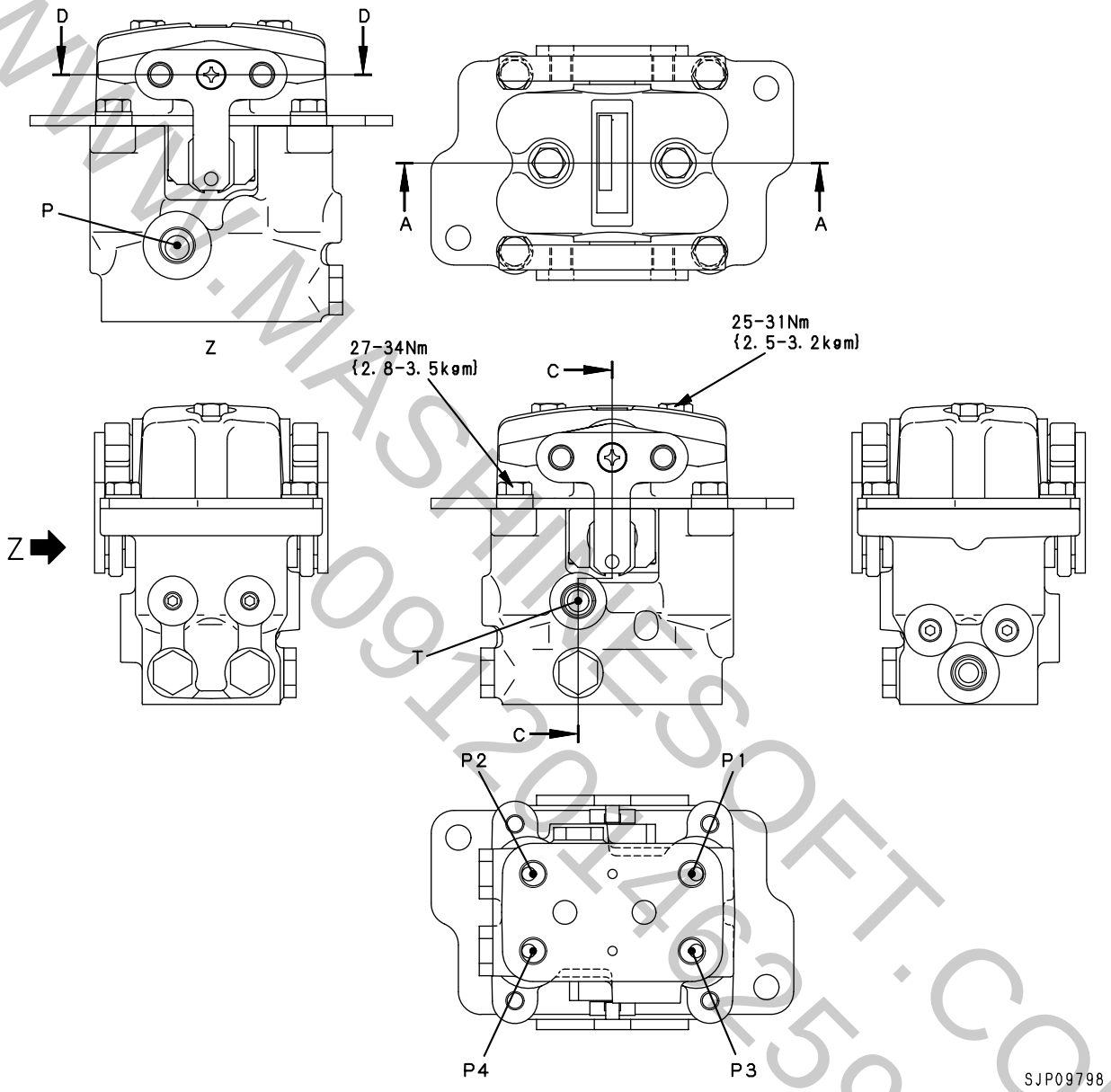
The return oil from chamber **B** passes from port **P2** through fine control hole **f´** and flows to drain chamber **D**. (Fig. 4)



(Fig. 4)

SBP00278

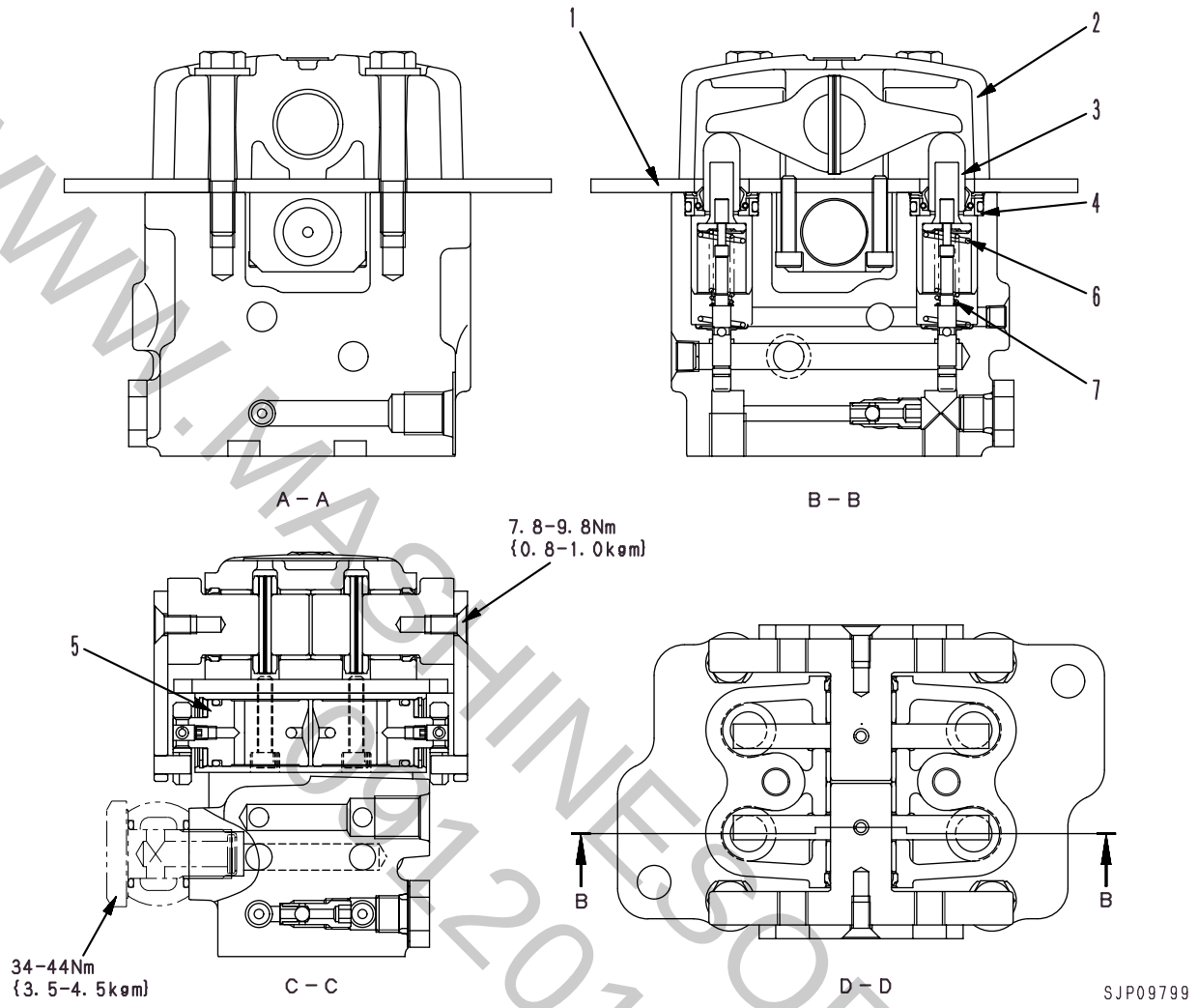
TRAVEL PPC VALVE



P : From main pump
T : To tank

P1 : L.H. travel REVERSE
P2 : L.H. travel FORWARD
P3 : R.H. travel REVERSE
P4 : R.H. travel FORWARD

★ The travel PPC valve operates similarly to the work equipment and swing PPC valves.

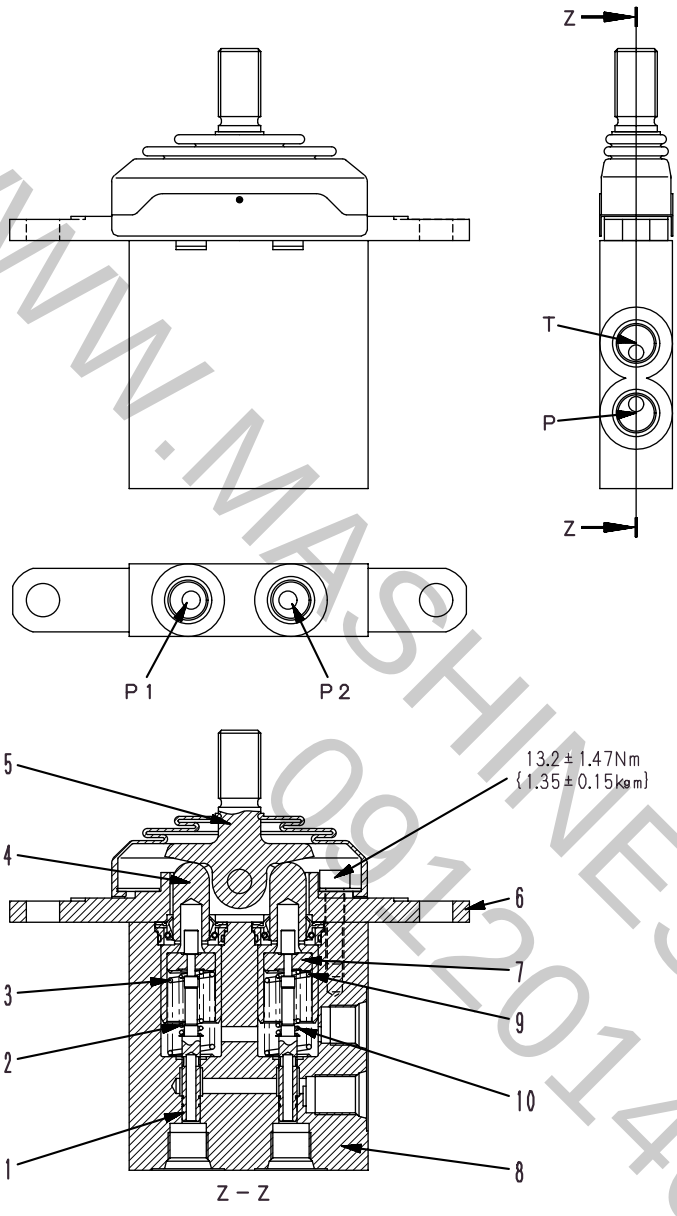


1. Plate
2. Body
3. Piston
4. Collar
5. Valve

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
6	Centering spring	Free length x OD	Installed length	Installed load	Free length	Installed load	Replace spring if damaged or deformed
		48.6 x 15.5	32.5	108 N {11 kg}	—	86.3 N {8.8 kg}	
7	Metering spring	26.5 x 8.15	24.9	16.7 N {1.7 kg}	—	13.7 N {1.4 kg}	

SERVICE PPC VALVE



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

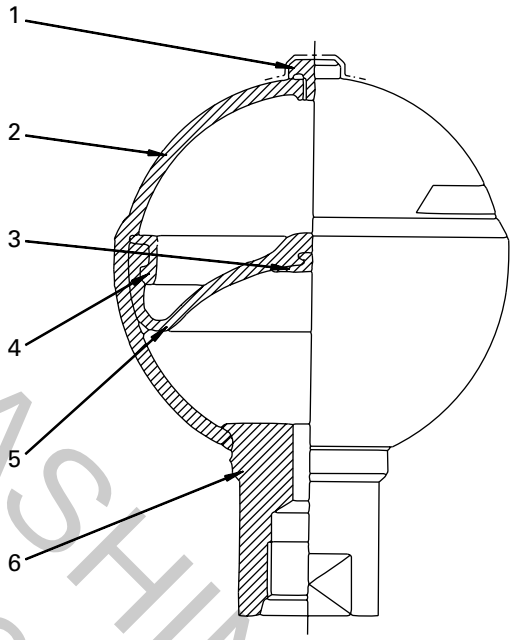
T : To tank
P : From main pump
P1 : Port
P2 : Port

★ The service PPC valve operates similarly to the work equipment and swing PPC valves.

Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
9	Centering spring	Free length x Outside Diameter	Installed length	Installed load	Free length	Installed load	Replace spring if damaged or deformed
		33.9 x 15.3	28.4	124.5 N {12.7 kg}	—	100 N {10.2 kg}	
10	Metering spring	22.7 x 8.1	22	16.7 N {1.7 kg}	—	13.7 N {1.4 kg}	

PPC ACCUMULATOR

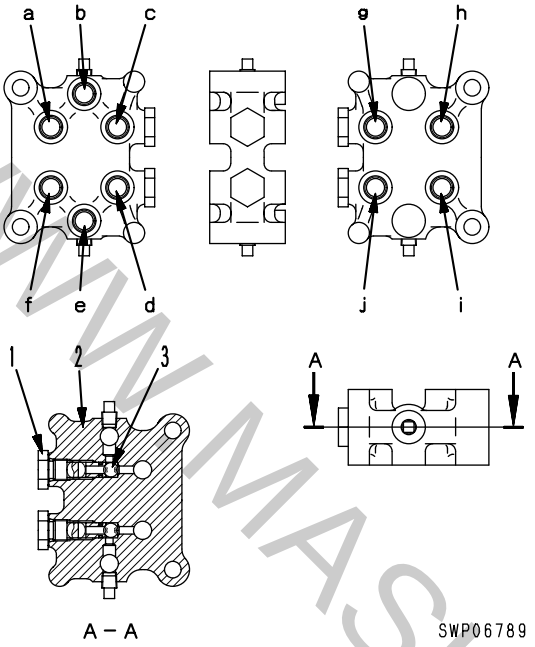


Specifications
Actual gas volume: 500 cc

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

PPC SHUTTLE VALVE

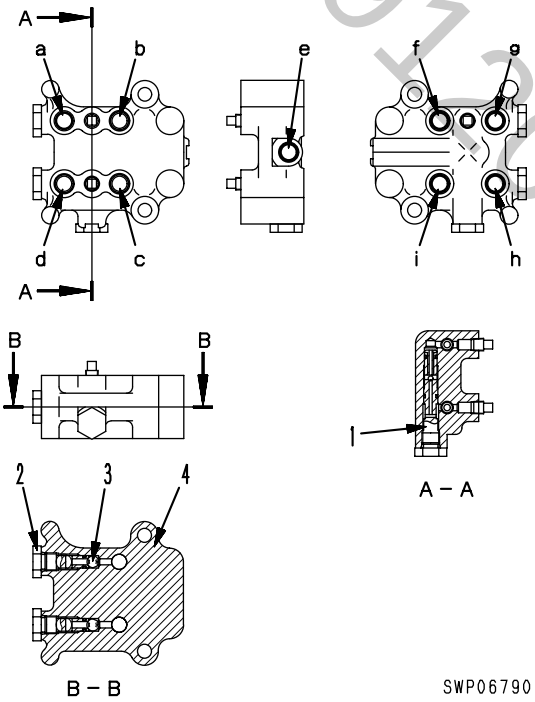
For arm, swing



1. Plug
2. Body
3. Ball

a. P1B port (right swing)
b. P5 port (travel shuttle valve)
c. P2B port (left swing)
d. P4B port (arm OUT)
e. P6 port (travel shuttle valve)
f. P3B port (arm IN)
g. P2A port (left swing)
h. P1A port (right swing)
i. P3A port (arm IN)
j. P4A port (arm OUT)

For boom, bucket

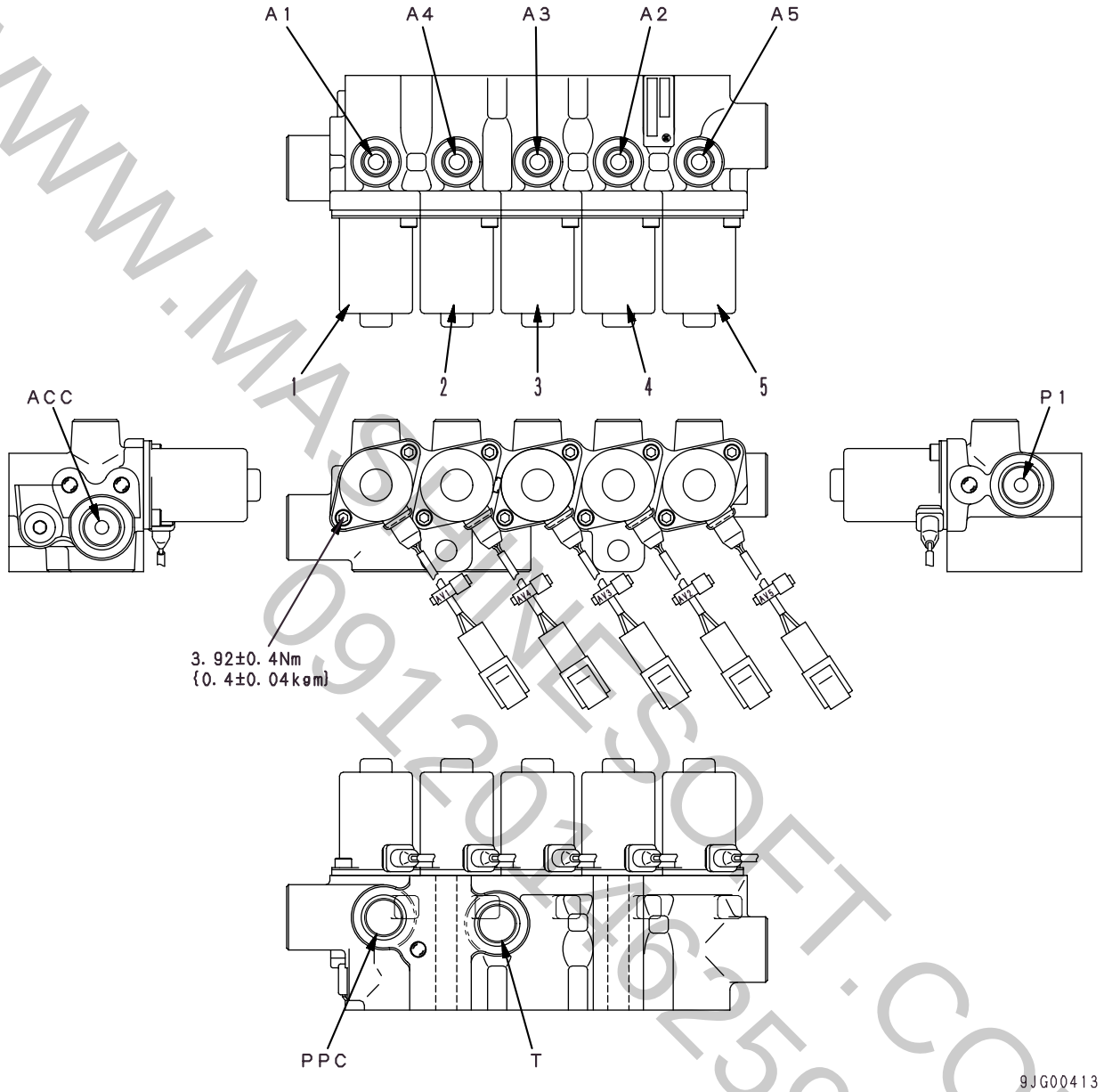


1. Plug assembly
2. Plug
3. Ball
4. Body

a. P1A port (bucket DUMP)
b. P3A port (bucket CURL)
c. P4A port (boom LOWER)
d. P2A port (boom RAISE)
e. P5 port (travel shuttle valve)
f. P3B port (bucket CURL)
g. P1B port (bucket DUMP)
h. P2B port (boom RAISE)
i. P4B port (boom LOWER)

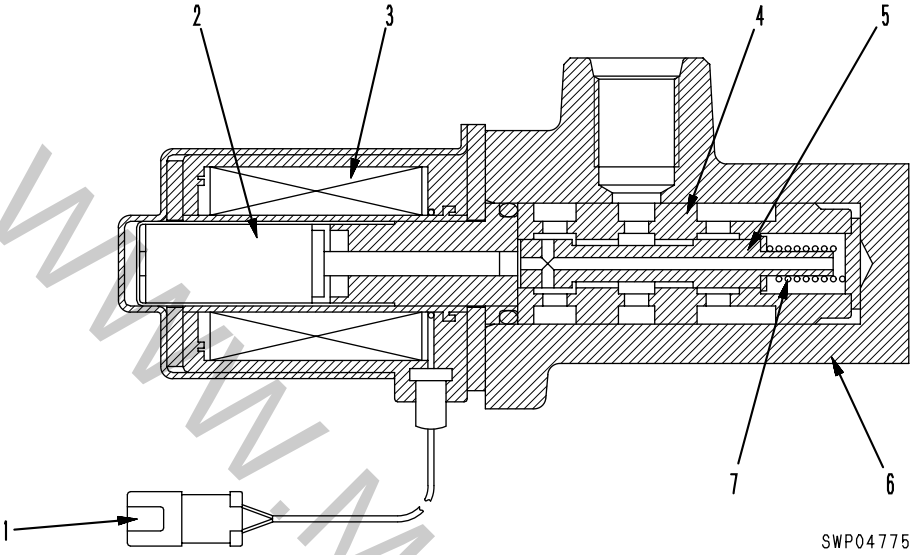
SOLENOID VALVE

FOR CO CANCEL, 2-STAGE RELIEF, BOOM HI 2-STAGE SAFETY VALVE, TRAVEL SPEED, SWING BRAKE SOLENOID VALVE



1. CO cancel solenoid valve
2. 2-stage relief solenoid valve
3. Boom Hi 2-stage safety valve solenoid valve
4. Travel speed solenoid valve
5. Swing brake solenoid valve

T : To tank
A1 : To No. 1 pump (NC valve)
A2 : To left and right travel motors
A3 : To boom LOWER 2-stage safety valve
A4 : To main valve (relief valve)
A5 : To swing motor
P1 : From control pump
ACC : To accumulator
PPC : To PPC valve

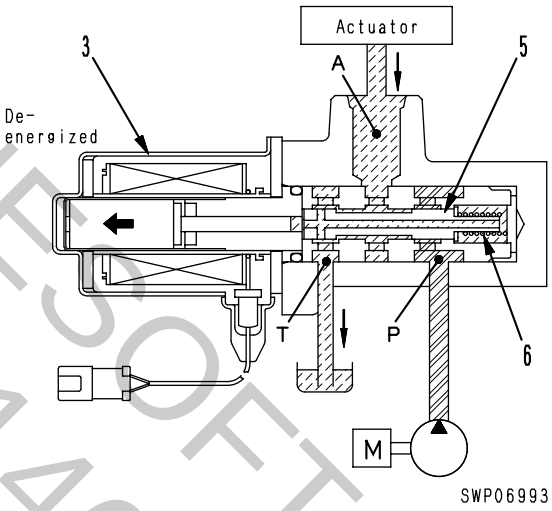


1. Connector
2. Movable core
3. Coil
4. Cage
5. Spool
6. Block
7. Spring

Operation

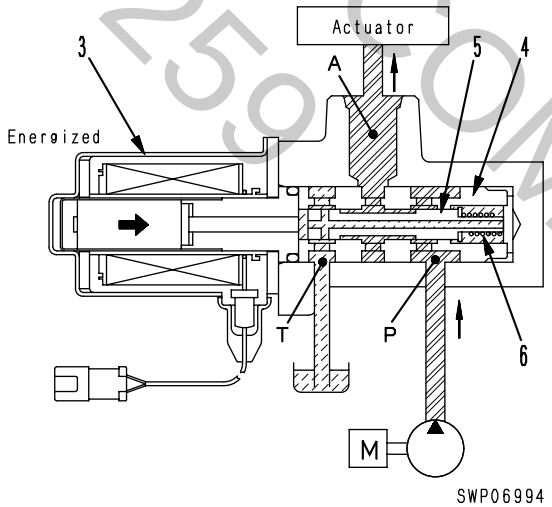
When solenoid is de-energized

- When the signal current does not flow from the PPC lock switch or swing lock switch, solenoid (3) is de-energized.
  For this reason, spool (5) is pushed fully to the left by spring (6).
  As a result, the circuit between ports **P** and **A** closes and the pressurized oil from the control pump does not flow to the actuator.
  At the same time, the pressurized oil from the actuator flows from port **A** to port **T**, and is then drained to the tank.

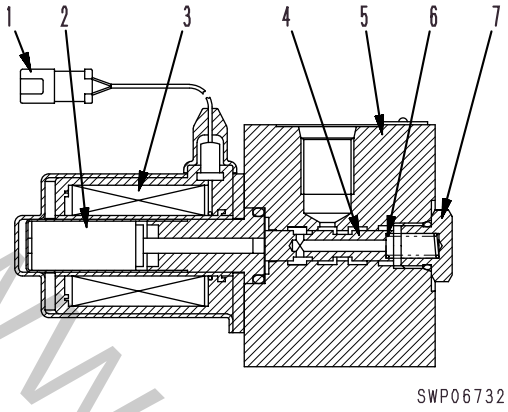


When solenoid is energized

- When the signal current flows from the PPC lock switch or swing lock switch to solenoid (3), solenoid (3) is energized.
  For this reason, spool (5) is pushed to the right in the direction of the arrow.
  As a result, the pressurized oil from the control pump flows from port **P** through the inside of spool (5) 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.



BUCKET CURL HI CANCEL

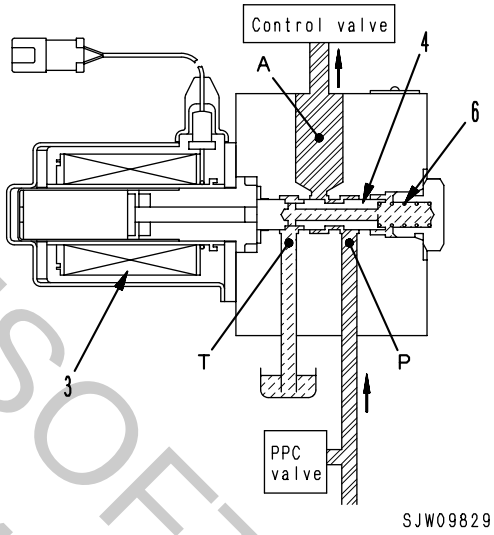


1. Connector
2. Movable iron core
3. Coil
4. Spool
5. Body
6. Spring
7. Plug

Operation

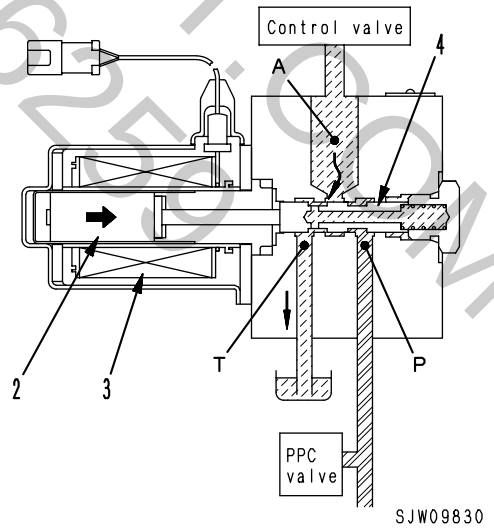
When solenoid is de-energized

- The signal current does not flow from the controller, so coil (3) is de-energized.
  For this reason, spool (4) is returned to the neutral position by spring (6).
  As a result, the circuit between ports **P** and **A** is connected, and the pressurized oil from the PPC valve flows to the control valve.

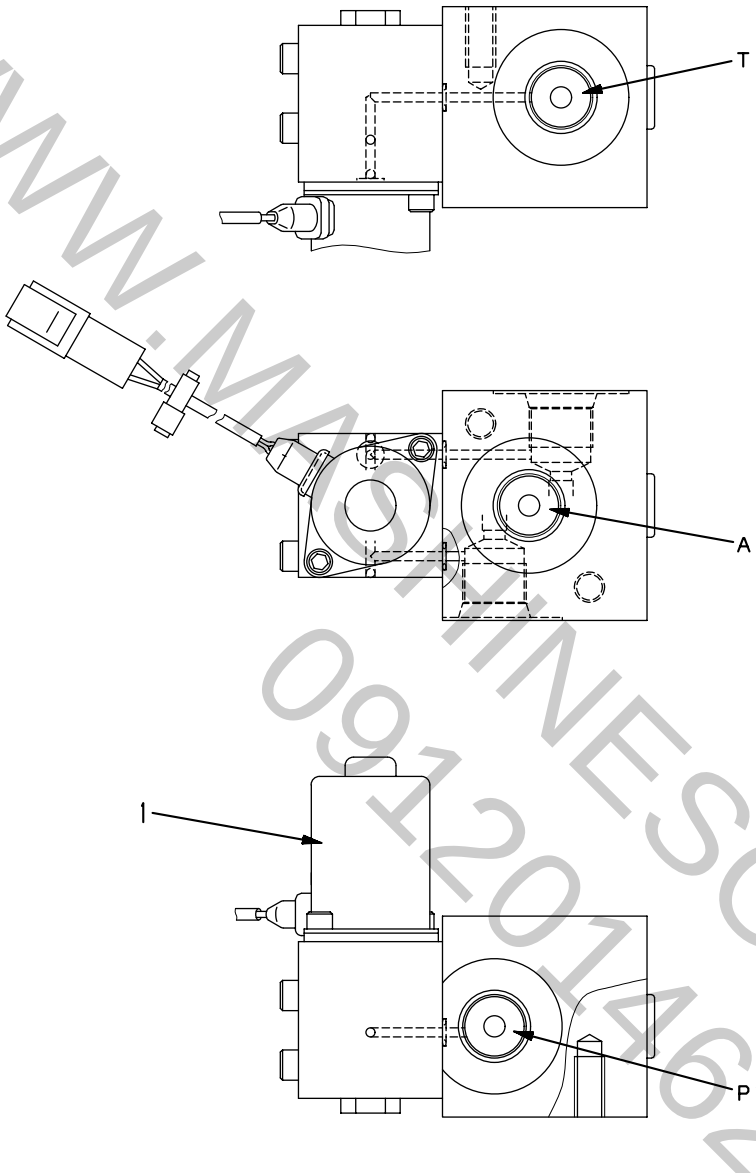


When solenoid is energized

- When the signal current flows from the controller to coil (3), coil (3) is energized and movable iron core (2) is pushed to the right in the direction of the arrow.
- For this reason, spool (4) is also pushed to the right in the direction of the arrow.
  As a result, port **P** is closed, and the pressure oil from the control pump does not flow to the control valve.
  At the same time, port **A** and port **T** are interconnected, and the oil from the control valve is drained to the tank.

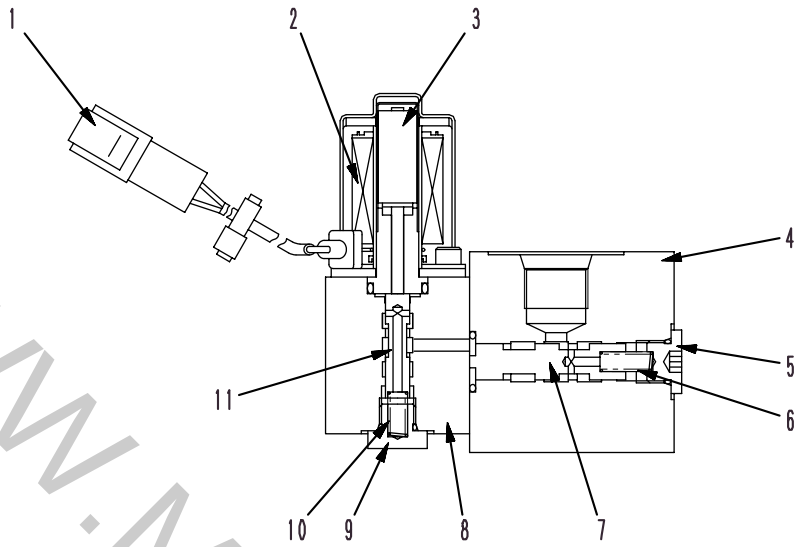


For safety lock (under cab)



1. Safety lock solenoid valve

T : To tank
A : To port P of work equipment PPC valve
To port P of travel PPC valve
P : From control pump



9JG00079

1. Connector
2. Solenoid
3. Variable iron core
4. Body
5. Plug
6. Spring
7. Spool
8. Body
9. Plug
10. Spring
11. Spool

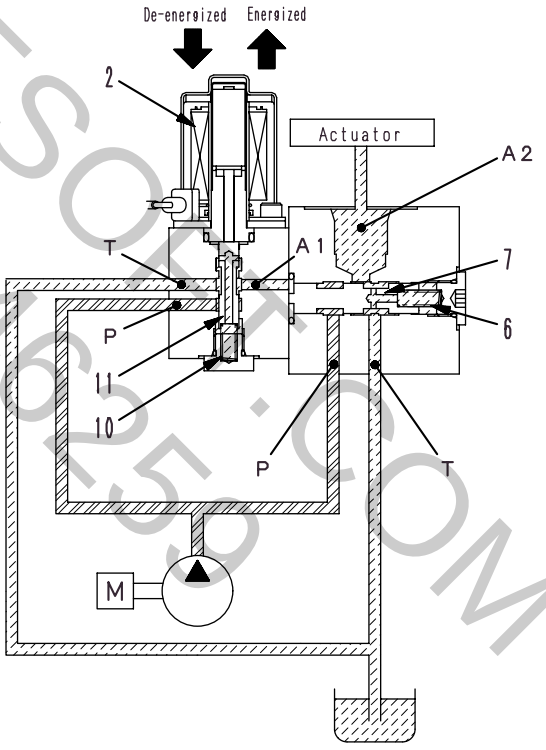
Operation

When solenoid is de-energized

- No signal current flows from the PPC hydraulic lock switch, so solenoid (2) is de-energized.
- Accordingly, spool (11) is pushed up and spool (7) is pushed to the left by spring (6).
- As a result, port **P** is closed, so pressure oil from the control pump does not flow to the actuator.
  At the same time, the oil from the actuator flows from port **A2** to port **T** and is drained to the tank.

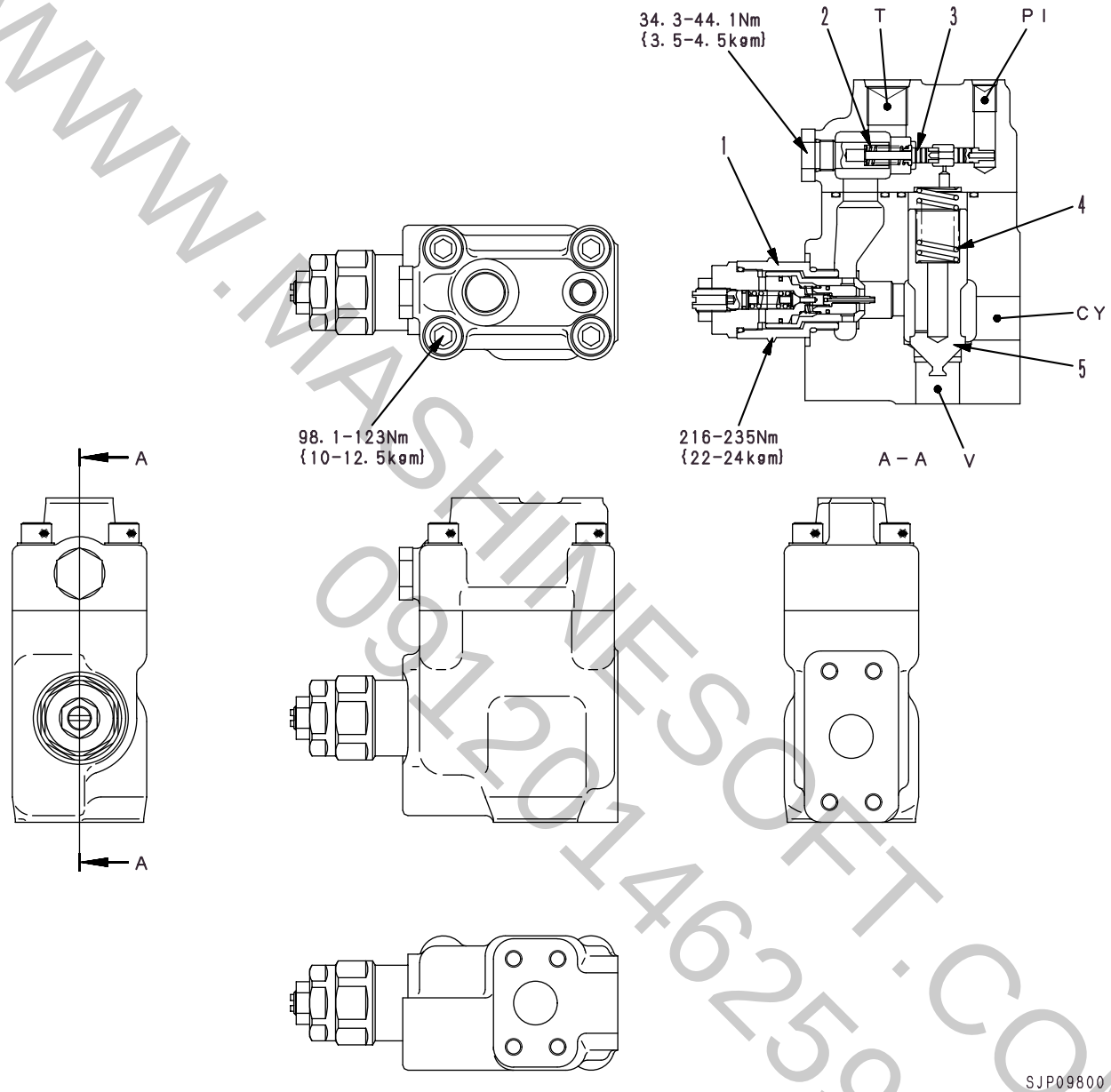
When solenoid is energized

- When the signal current flows from the PPC hydraulic lock switch to solenoid (2), solenoid (2) is energized.
- Accordingly, spool (11) is pushed down and the pressure oil from the control pump flows through port **P** to port **A1** and spool (7) is pushed to the right.
- As a result, pressure oil from the control pump flows from port **P** to port **A2**, and then flows to the actuator.
  At the same time, port **T** is closed, so the oil does not flow to the tank.



SJP09436

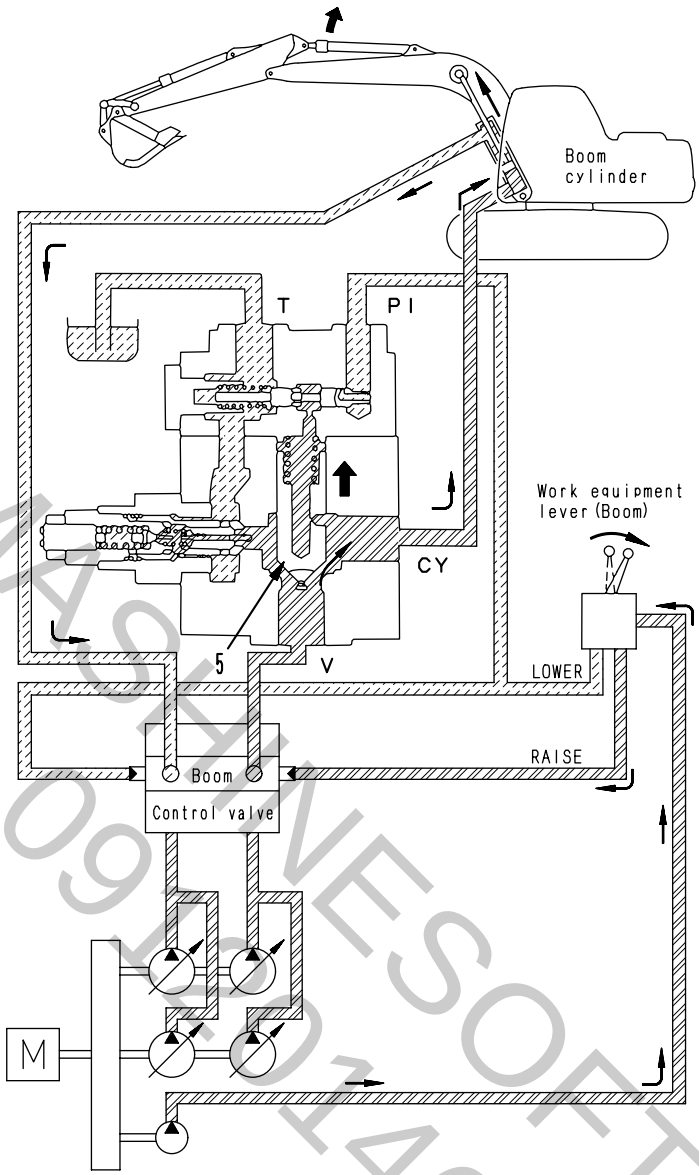
BOOM HOLDING VALVE



1. Safety-suction valve
2. Pilot spring
3. Pilot spool
4. Poppet spring
5. Poppet

T : To tank
V : From control valve
CY : To boom cylinder bottom
PI : From PPC valve (pilot pressure)

1. At boom RAISE

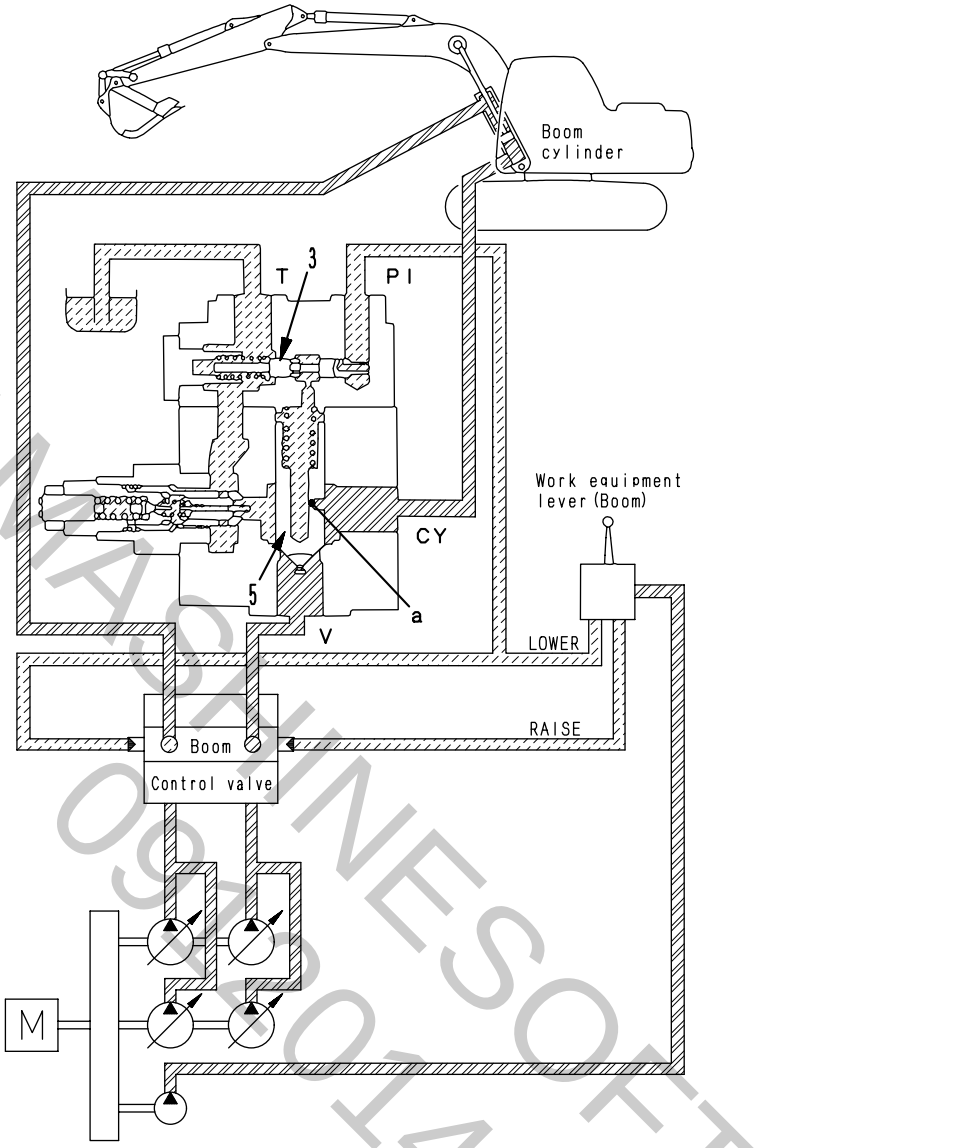


SJW09831

Operation

- When the boom is raised, the main pressure from the control valve pushes poppet (5) up. Because of this, the main pressure from the control valve passes through the valve and flows to the bottom end of the boom cylinder.

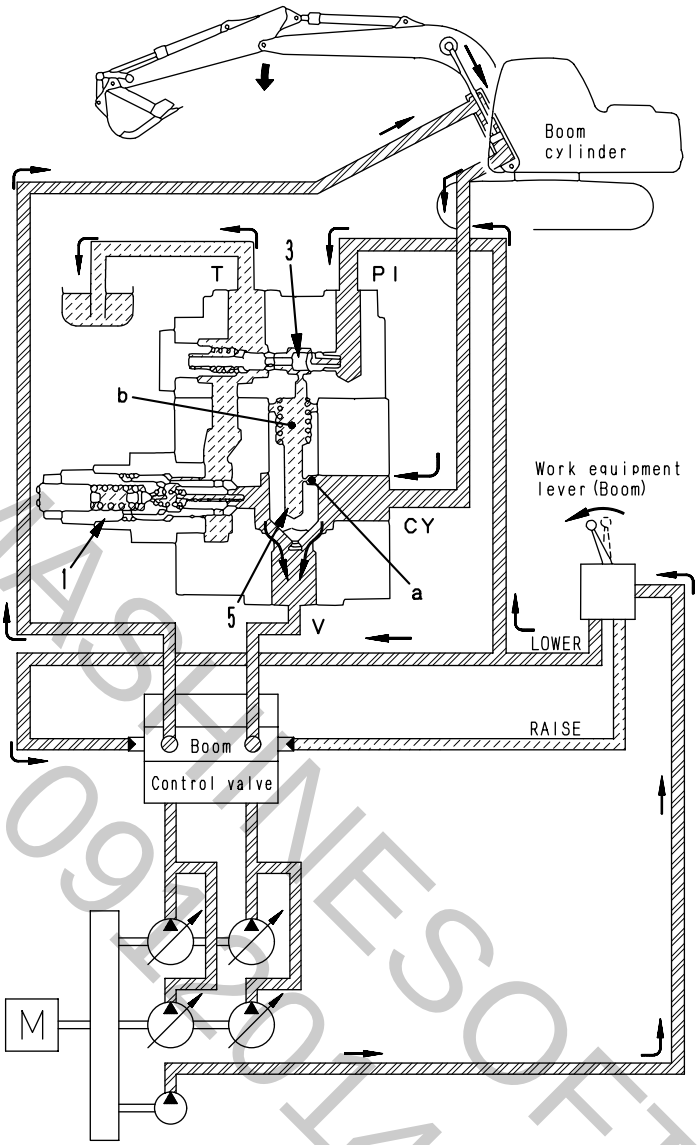
2. Boom lever at HOLD



Operation

- 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 (5). At the same time, the oil flowing into poppet (5) through orifice **a** of poppet (5) is closed by pilot spool (3).
  As a result, the boom is held in position.

3. At boom LOWER

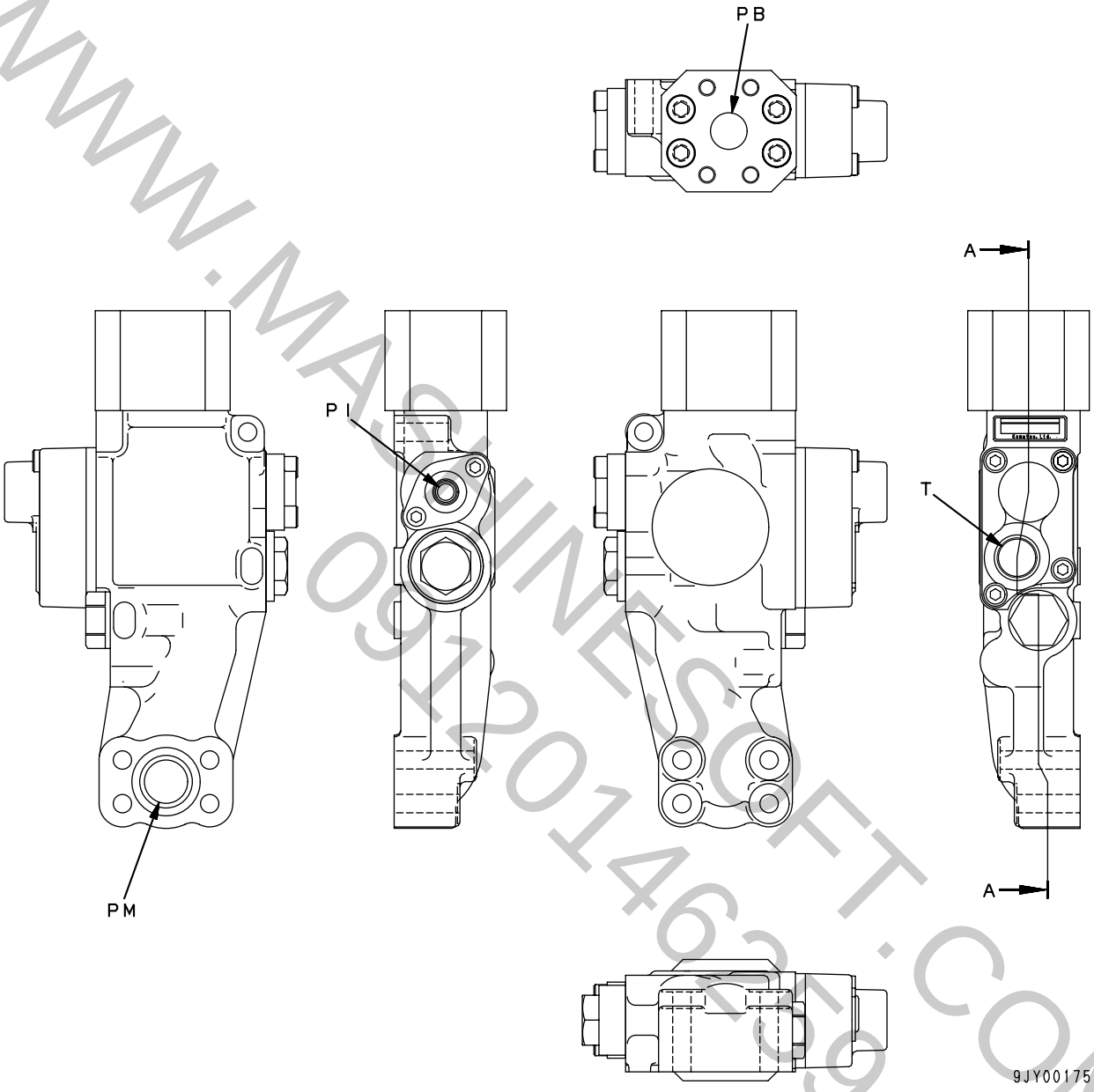


SJW09833

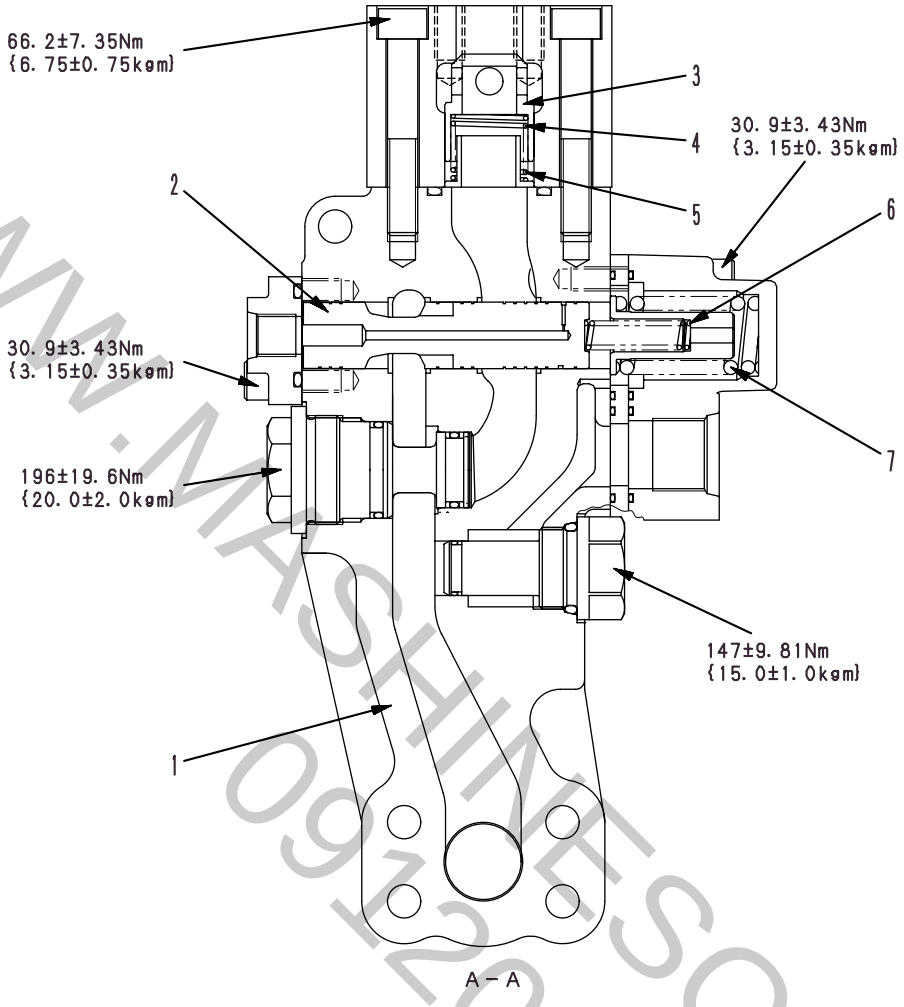
Operation

- When the boom is lowered, the pilot pressure flows to port **PI** from the PPC valve pushes pilot spool (3) and the pressurized oil in chamber **b** inside the poppet is drained.
  When the pressure at port **CY** rises because of the pressurized oil from the bottom end of the boom cylinder, the pressure of the pressurized oil in chamber **b** is lowered by orifice **a**.
  If the pressure in chamber **b** drops below the pressure at port **CY**, poppet (5) opens, the pressurized oil flows from port **CY** to port **V**, and then flows to the control valve.
  If any abnormal pressure is generated in the circuit at the bottom end of the boom cylinder, safety valve (1) is actuated and drain oil from port **CY** to port **T**.

BOOM LOWER REGENERATION VALVE



T : To tank
PB : From boom cylinder bottom
PM : From boom cylinder head
PI : From boom LOWER PPC valve



1. Body
2. Spool
3. Check valve
4. Spring

Unit: mm

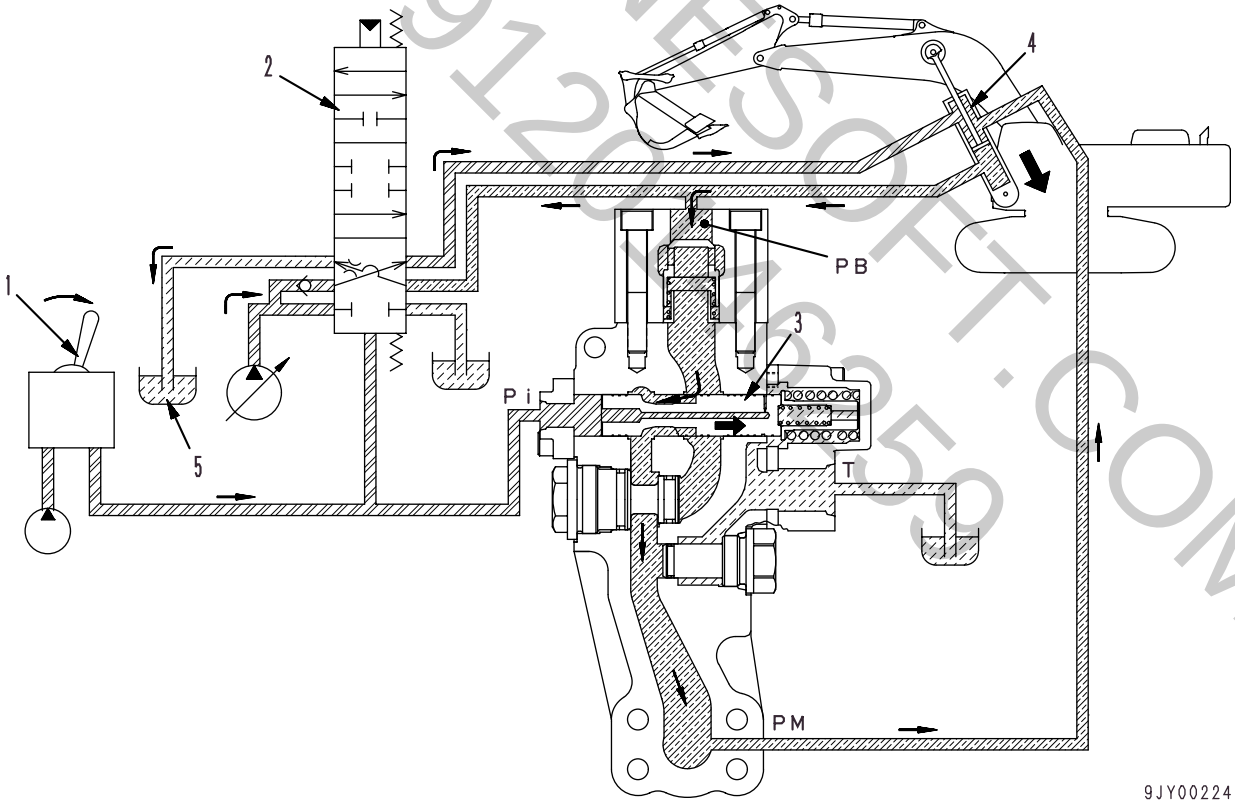
No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
5	Spring (check valve)	Free length x OD	Installed length	Installed load	Free length	Installed load	Replace spring if damaged or deformed
		83.5 x 25.5	22	29.4 N {3.0 kg}	—	23.5 N {2.4 kg}	
6	Spool return spring (small)	41.1 x 9.6	35	58.8 N {6.0 kg}	—	47.1 N {4.8 kg}	
7	Spool return spring (large)	49.4 x 25.7	47	207 N {21.1 kg}	—	166 N {16.9 kg}	

Function

- When the boom is lowered, some of the oil drained from the bottom end of the boom cylinder is circulated to the cylinder head to increase the lowering speed of the boom.

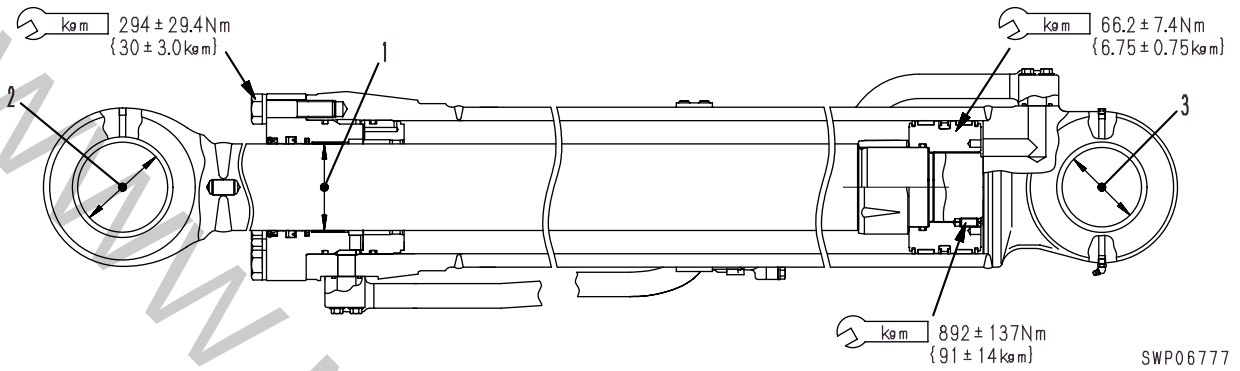
Operation

- When control lever (1) is operated to the LOWER position, PPC pressure flows and boom Lo spool (2) moves to the LOWER position. At the same time, regeneration valve spool (3) is moved by the PPC pressure from port **Pi**. As a result, the head and bottom ends of boom cylinder (4) are interconnected through ports **PB** and **PM**.
- When this happens, the oil from the cylinder bottom passes through the control valve and returns to tank (5). Some of the oil enters port **PB** of the regeneration valve and flows from port **PM** to the cylinder head to increase the lowering speed of the boom.
- The boom cylinder has a large volume, and during compound operations, the oil flow from the pump to the cylinder head is insufficient, so this action prevents any vacuum from forming inside the circuit.

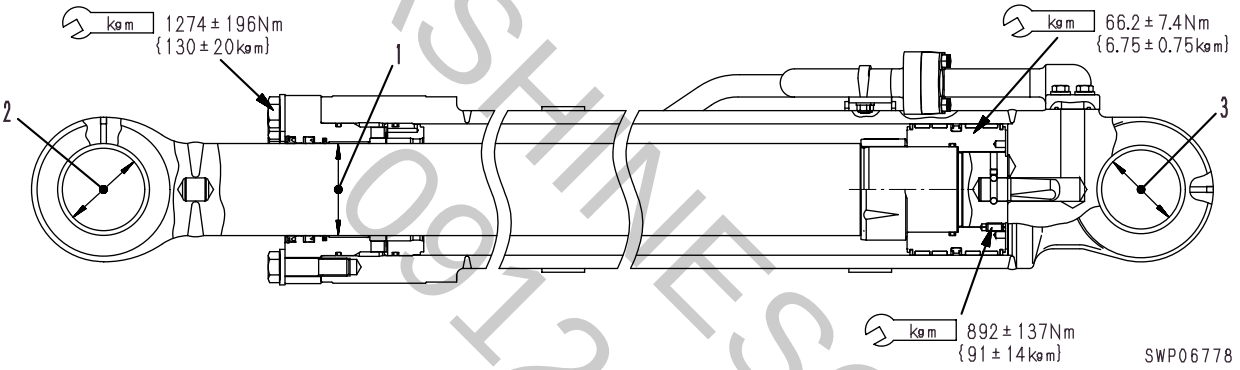


HYDRAULIC CYLINDER

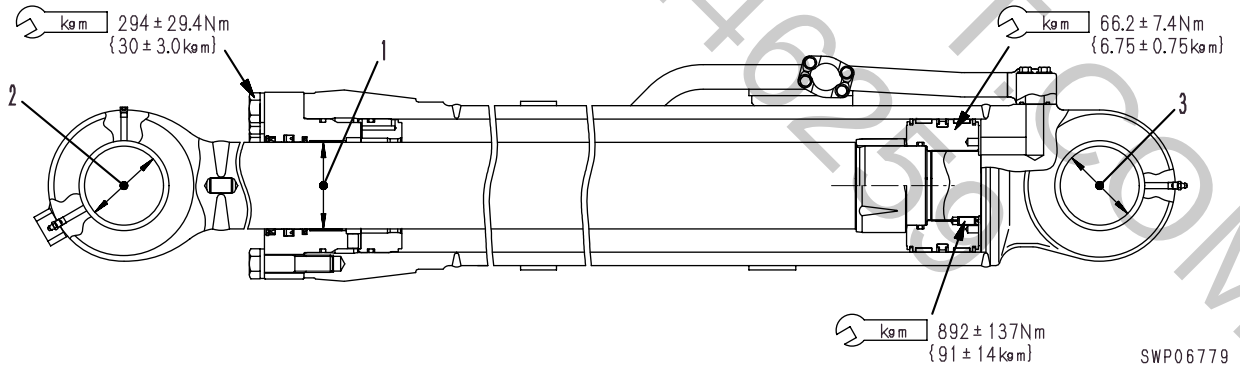
BACKHOE SPECIFICATION
BOOM CYLINDER



ARM CYLINDER



BUCKET CYLINDER

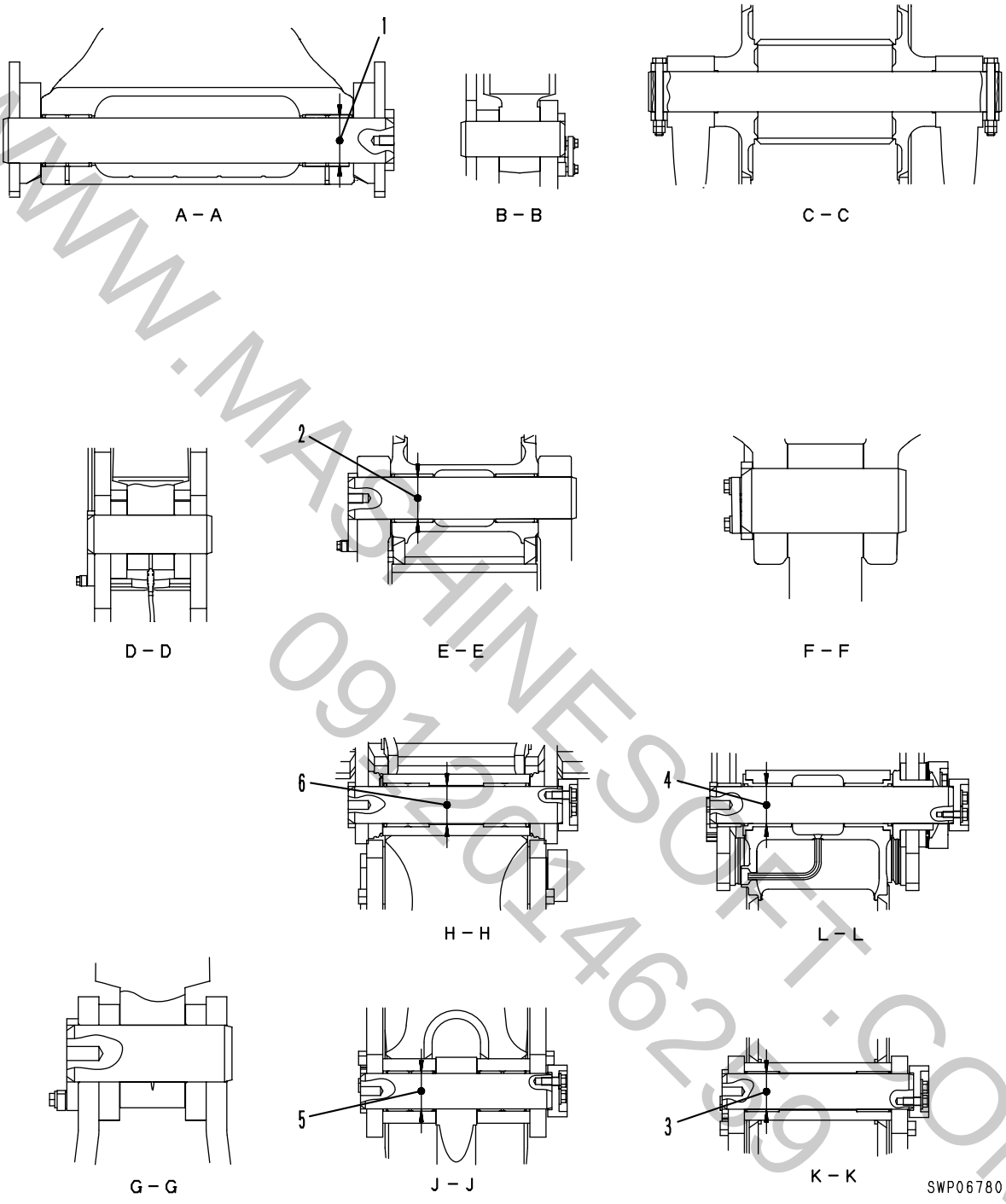


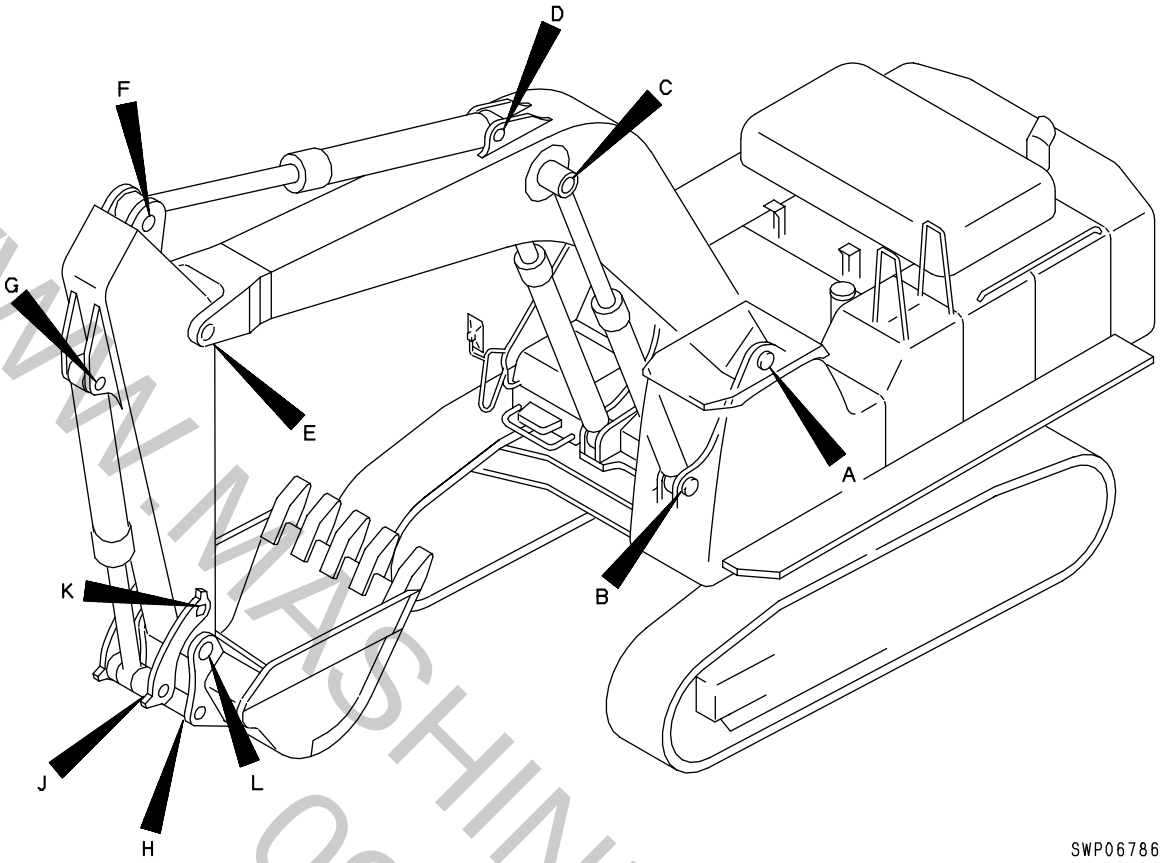
Unit: mm

No.	Check item		Criteria					Remedy
		Name of cylinder	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston rod and bushing	Boom	120	–0.036 –0.090	+0.263 +0.048	0.084 – 0.353	0.453	Replace bushing
		Arm	140	–0.043 –0.106	+0.256 +0.039	0.082 – 0.362	0.662	
		Bucket	120	–0.036 –0.090	+0.263 +0.048	0.084 – 0.353	0.453	
2	Clearance between piston rod support shaft and bushing	Boom	125	–0.043 –0.106	+0.495 +0.395	0.438 – 0.601	1.5	Replace pin, bushing
		Arm	125	–0.043 –0.106	+0.495 +0.395	0.438 – 0.601	1.5	
		Bucket	110	–0.036 –0.090	+0.457 +0.370	0.406 – 0.547	1.5	
3	Clearance between cylinder bottom support shaft and bushing	Boom	110	–0.036 –0.090	+0.151 +0.074	0.110 – 0.241	1.5	
		Arm	120	–0.036 –0.090	+0.457 +0.370	0.406 – 0.547	1.5	
		Bucket	110	–0.036 –0.090	+0.457 +0.370	0.406 – 0.547	1.5	

WORK EQUIPMENT

BACKHOE SPECIFICATION





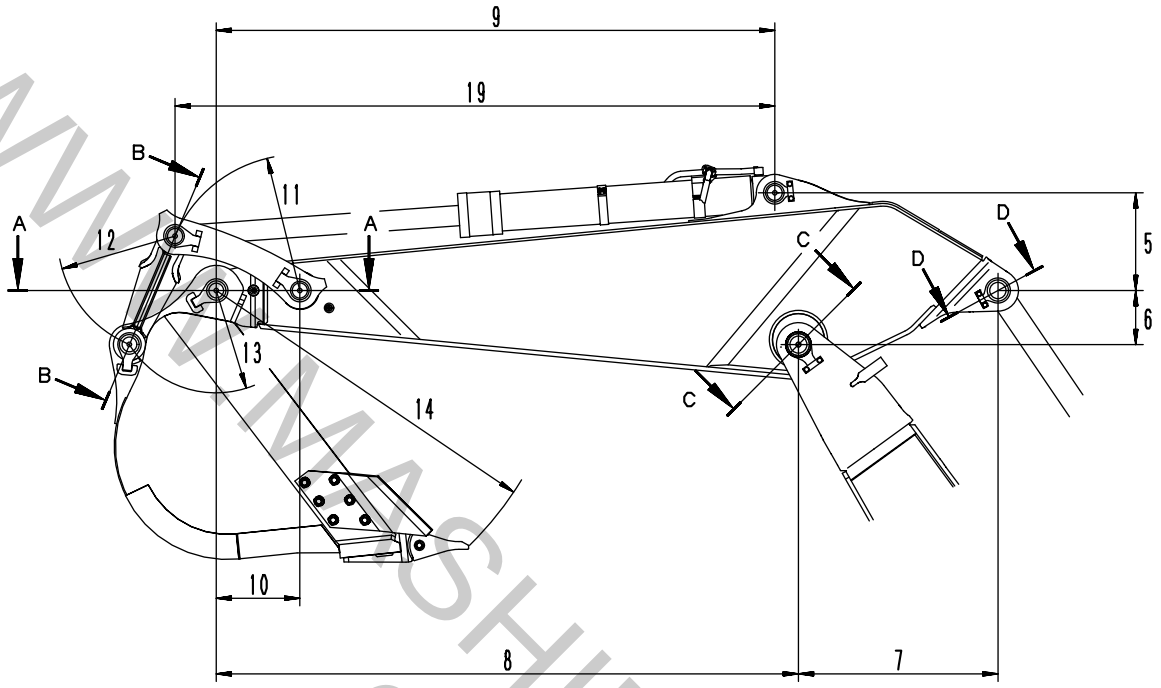
Unit: mm

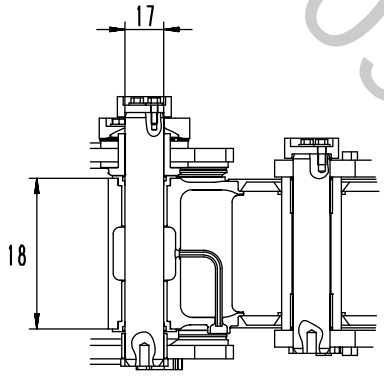
No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between bushing and mounting pin of boom and revolving frame	140	–0.043 –0.106	+0.148 +0.057	0.100 – 0.254	1.5	Replace
2	Clearance between bushing and mounting pin of boom and arm	130	–0.043 –0.106	+0.407 +0.325	0.368 – 0.513	1.5	
3	Clearance between bushing and mounting pin of arm and link	110	–0.036 –0.090	+0.360 +0.284	0.320 – 0.450	1.5	
4	Clearance between bushing and mounting pin of arm and bucket	115	–0.036 –0.090	+0.326 +0.223	0.259 – 0.416	1.5	
5	Clearance between bushing and mounting pin of link and link	110	–0.036 –0.090	+0.354 +0.275	0.311 – 0.444	1.5	
6	Clearance between bushing and mounting pin of link and bucket	115	–0.036 –0.090	+0.382 +0.279	0.315 – 0.472	1.5	
7	Bucket clearance	0.5 – 1.0					Adjust shims

DIMENSIONS OF WORK EQUPMENT

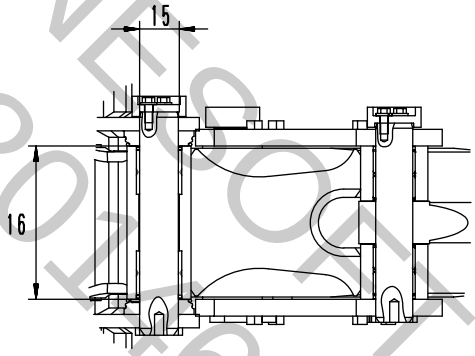
BACKHOE SPECIFICATION

1. ARM

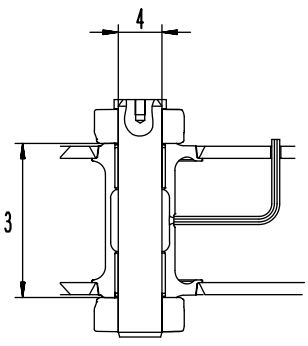




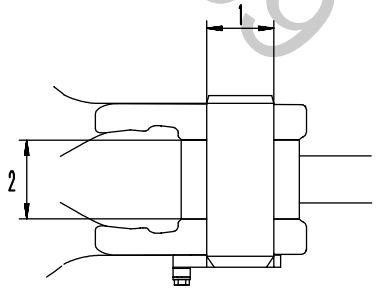
A – A



B – B



C – C



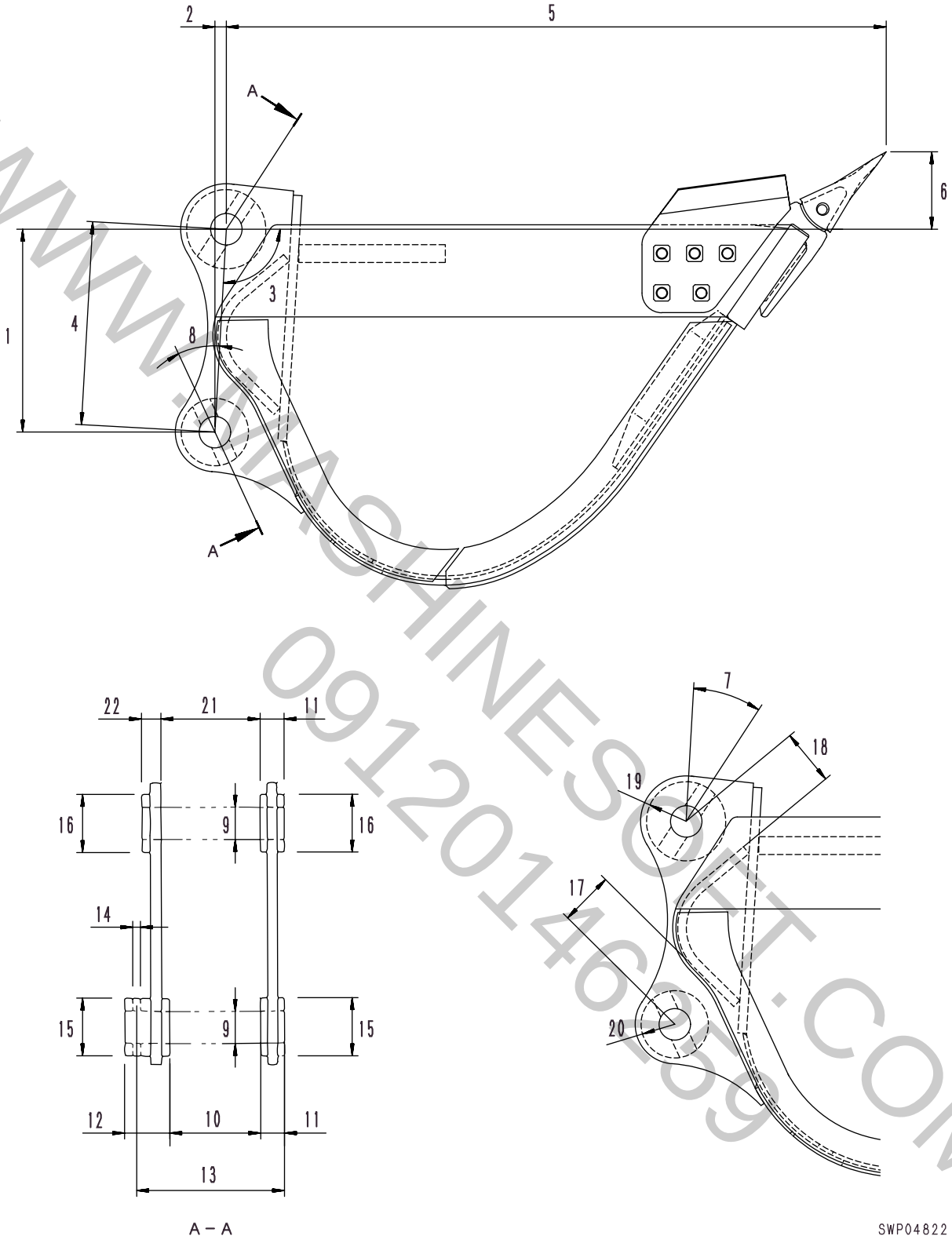
D – D

9JG00448

Unit: mm

No. \ Model		PC600, PC600LC-7			
		2.9 m Arm	3.5 m Arm	4.3m Arm	5.2m Arm
1		125	125	125	125
2		148	148	148	148
3		458	458	458	458
4		130	130	130	130
5		499	582	627.7	666.9
6		460.6	321.7	338	352
7		1,188.9	1,187.2	1,182.7	1,178.6
8		2,863.2	3,465.2	4,256.6	5,188.1
9		3,624	3,324.2	3,315.9	3,308.2
10		471.3	497.6	497.6	497.6
11		910	810	810	810
12		700	700	700	700
13		678	608	608	608
14		2,169	2,138	2,138	2,138
15		115	115	115	115
16		457 ± 1	457 ± 1	457 ± 1	457 ± 1
17		115	115	115	115
18	Arm as individual part	$448\ ^{0}_{-0.5}$	$448\ ^{0}_{-0.5}$	$448\ ^{0}_{-0.5}$	$448\ ^{0}_{-0.5}$
	When press-fitting bushing	464	464	464	464
19	Min.	2,360	2,152	2,152	2,152
	Max.	3,990	3,577	3,577	3,577

2. BUCKET



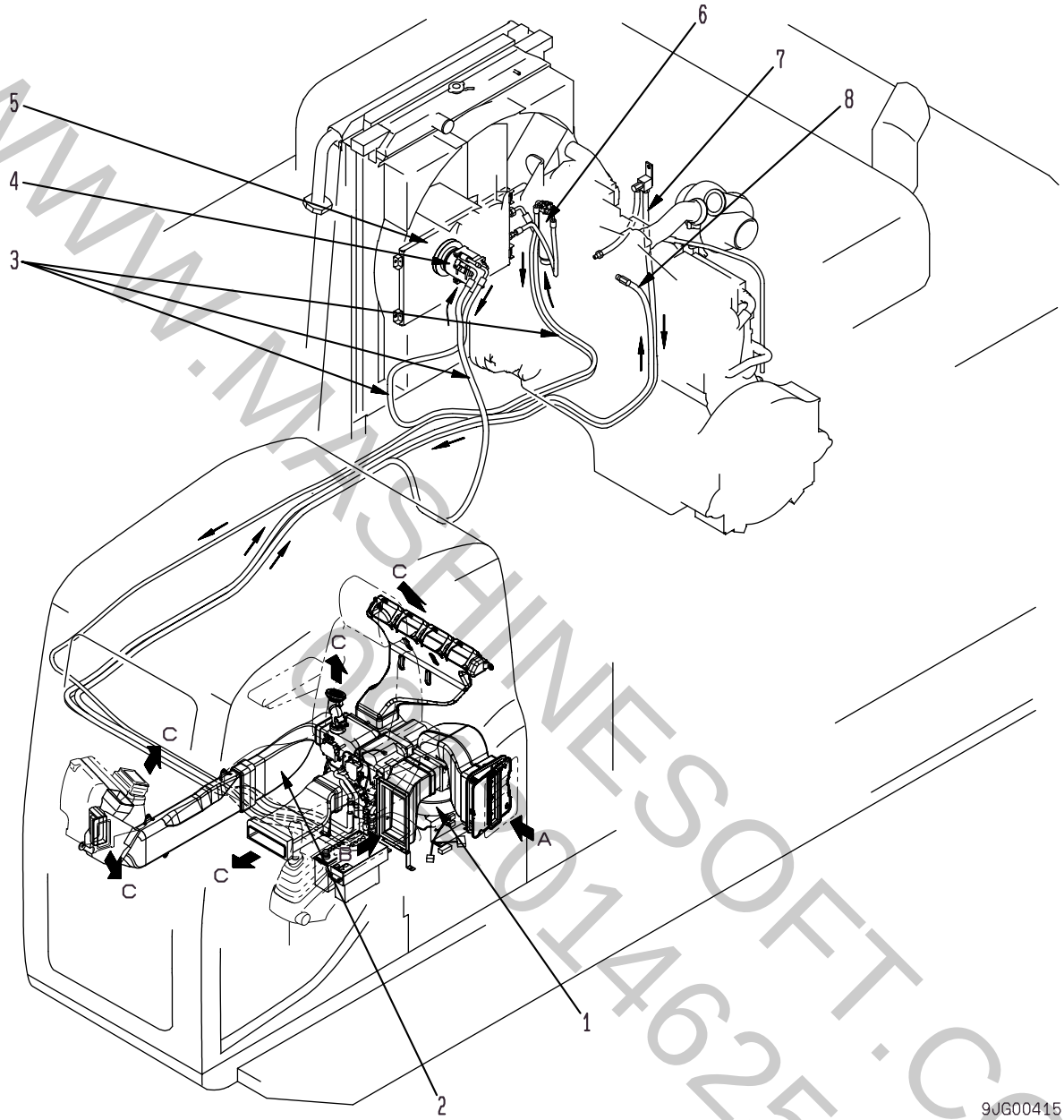
Unit: mm

Model / No.	PC600-7, PC600LC-7	
	2.0 m^3, 2.3m^3, 2.7m^3 Bucket	3.5 m^3 Bucket
1	605.2 ± 0.5	665 ± 0.5
2	58.1 ± 0.5	132.5 ± 0.5
3	95.5°	101.3°
4	608	678
5	2,119.9	2,150.4
6	277.9	278.4
7	–	–
8	–	–
9	ø115	ø115
10	457 ± 1	457 ± 1
11	80.5	80.5
12	84.5	84.5
13	626	626
14	–	–
15	–	–
16	ø260	ø260
17	123.9	178.8
18	202.4	182.3
19	ø240	ø240
20	ø208	ø208
21	488.5 ± 1	488.5 ± 1
22	79	79

AIR CONDITIONER

AIR CONDITIONER PIPING

For the electric circuit diagram of the air conditioner, see Chapter 90.



1. Air conditioner unit
2. Duct
3. Refrigerant piping
4. Air conditioner compressor
5. Condenser
6. Receiver tank
7. Hot water return piping
8. Hot water pickup piping

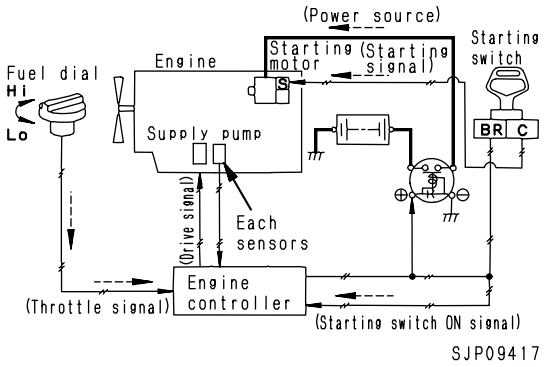
A : Fresh air
B : Recirculated air
C : Hot air/cold air

ENGINE CONTROL

1. Operation of system

Starting engine

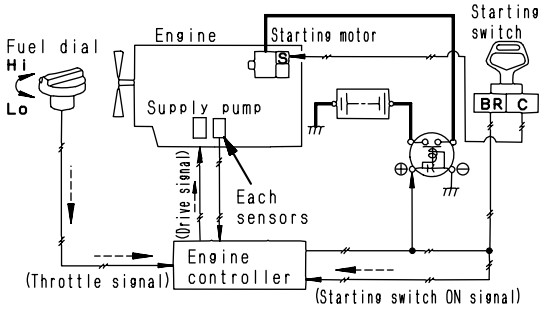
- When the starting switch is turned to the START position, the starting signal flows to the starting motor, and the starting motor turns to start the engine.
  When this happens, the engine controller checks the signal from the fuel control dial and sets the engine speed to the speed set by the fuel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



SJP09417

Engine speed control

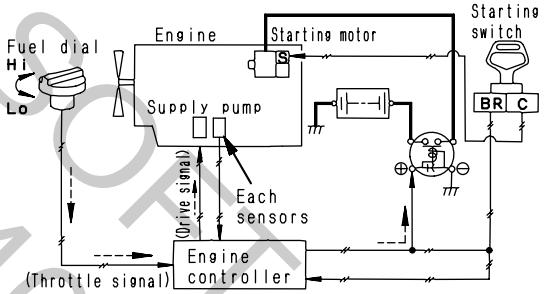
- The fuel control dial sends signal voltages to the engine controller according to its angle.
  The engine controller sends drive signals to the supply pump according to the signal voltages received from the fuel control dial and controls the fuel injection pump to control the engine speed.



SJP09418

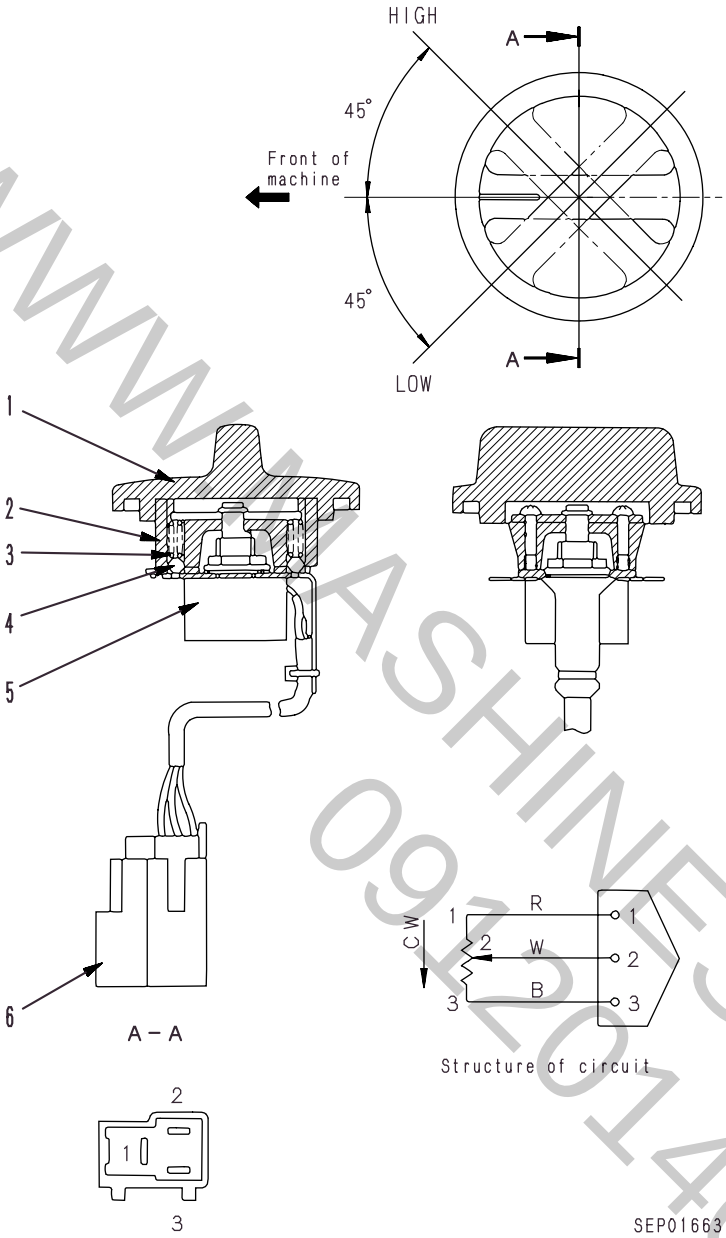
Stopping engine

- When the engine controller detects that the starting switch is at the STOP position, it cuts the signal to the supply pump drive solenoid to stop the engine.



SJP09419

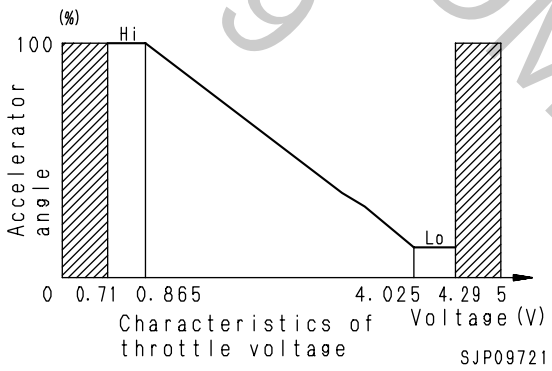
2. Components of system
Fuel control dial



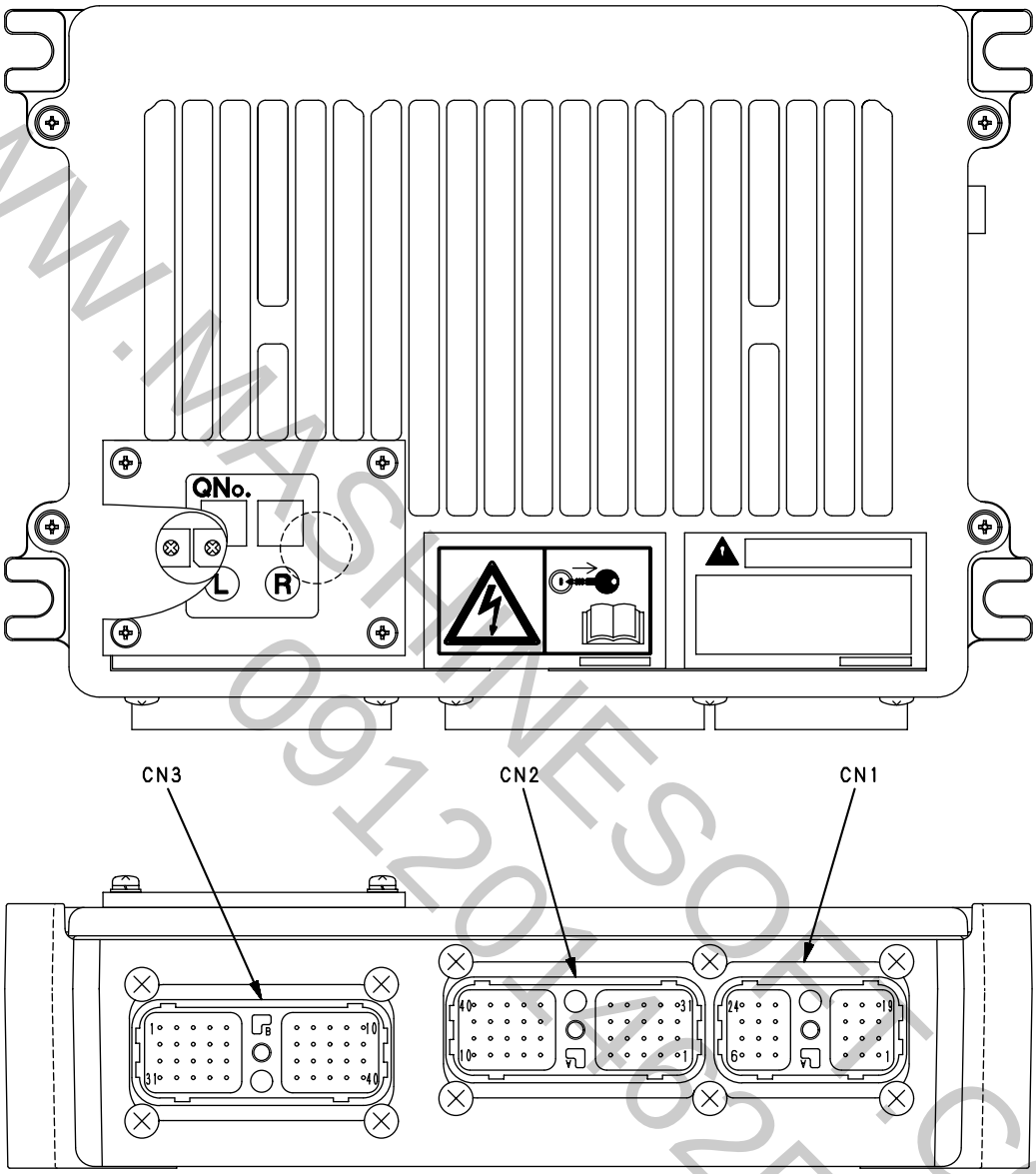
1. Knob
2. Dial
3. Spring
4. Ball
5. Potentiometer
6. Connector

Function

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



3. Engine controller



Input and output signals

CN1 [CN-E11]

Pin No.	Signal name	Input/ Output
CN1-1	POWER (+24V constant)	
CN1-2	POWER (+24V constant)	
CN1-3	Model selection 1	Input
CN1-4	GND	
CN1-5	NC	Input
CN1-6	NC	Output
CN1-7	GND	
CN1-8	GND	
CN1-9	NC	Input
CN1-10	GND	
CN1-11	NC	Input
CN1-12	NC	Output
CN1-13	Key switch (ACC)	Input
CN1-14	NC	Input
CN1-15	Engine oil pressure switch (For high pressure)	Input
CN1-16	(Memory clear)	
CN1-17	Model selection 3	Input
CN1-18	NC	Output
CN1-19	Key switch (ACC)	Input
CN1-20	Starting switch (C)	Input
CN1-21	Engine oil pressure switch (For low pressure)	Input
CN1-22	NC	Input
CN1-23	Model selection 2	Input
CN1-24	NC	Output

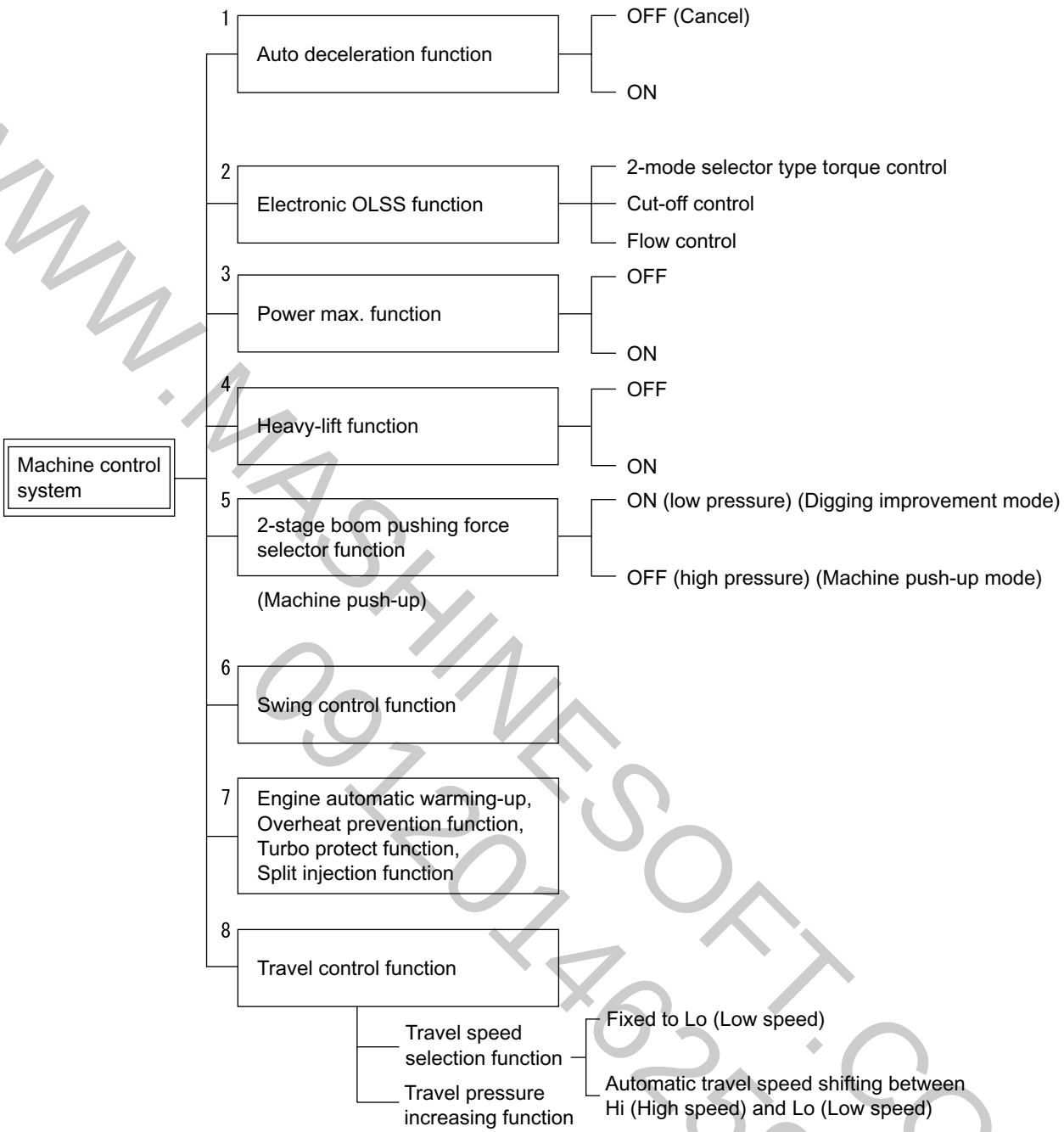
CN2 [CN-E12]

Pin No.	Signal name	Input/ Output
CN2-1	GND	
CN2-2	NC	
CN2-3	NC	Input
CN2-4	RS232C_RX1	Input
CN2-5	NC	
CN2-6	NC	
CN2-7	NC	Input
CN2-8	NC	Input
CN2-9	Sensor 5V power supply 2	Output
CN2-10	Fuel control dial	Input
CN2-11	S_NET_SHIELD GND	
CN2-12	CAN_SHIELD	
CN2-13	NC	Output
CN2-14	RS232C_TX1	Output
CN2-15	G_SHIELD (GND)	
CN2-16	Ne_SHIELD (GND)	
CN2-17	Fuel temperature sensor	Input
CN2-18	NC	Input
CN2-19	Sensor 5V power supply 1	Output
CN2-20	Boost pressure sensor	Input
CN2-21	S_NET (+)	Input/ Output
CN2-22	CAN (L)	Input/ Output
CN2-23	NC	
CN2-24	(FWE_switch)	Input
CN2-25	G pulse (–)	Input
CN2-26	Ne pulse (–)	Input
CN2-27	Water temperature sensor (High)	Input
CN2-28	NC	Input
CN2-29	Analog GND	
CN2-30	NC	Input
CN2-31	S_NET (+)	Input/ Output
CN2-32	CAN (H)	Input/ Output
CN2-33	NC	
CN2-34	GND (232C_GND)	
CN2-35	G pulse (+)	Input
CN2-36	Ne pulse (+)	Input
CN2-37	Water temperature sensor (Low)	Input
CN2-38	NC	Input
CN2-39	Analog GND	
CN2-40	Common rail pressure sensor	Input

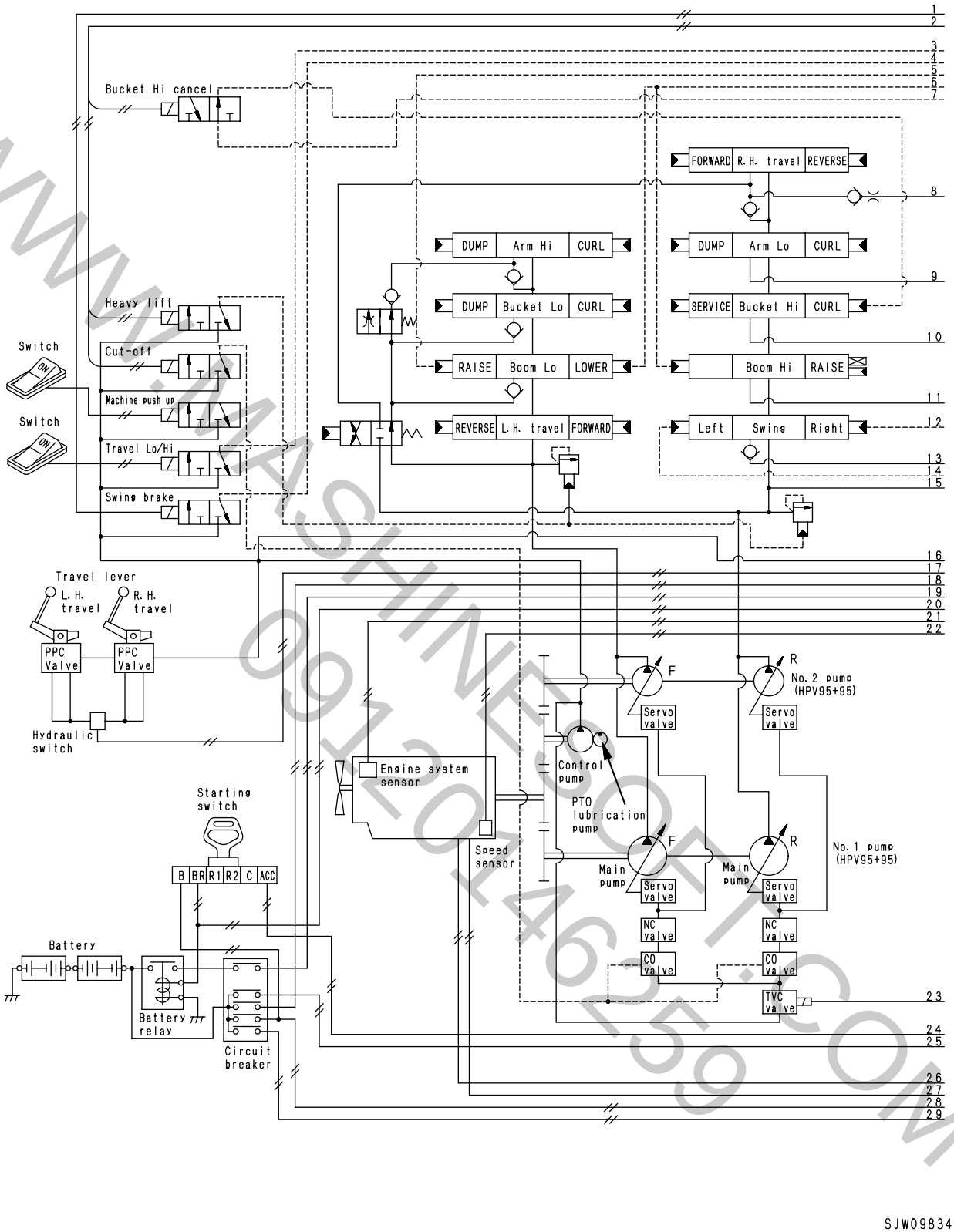
CN3 [CN-E13]

Pin No.	Signal name	Input/ Output
CN3-1	Power supply for power	
CN3-2	Power supply for power	
CN3-3	NC	
CN3-4	NC	
CN3-5	Injector #3 (+)	Output
CN3-6	Injector #2 (+)	Output
CN3-7	NC	Input
CN3-8	(Output mode selection 1 (Test mode))	Input
CN3-9	(Lever neutral flag (Test mode))	Input
CN3-10	(Engine rotation pulse output)	Output
CN3-11	Power GND	Input
CN3-12	Supply pump 1 (+)	Output
CN3-13	Supply pump 2 (+)	Output
CN3-14	Injector #1 (+)	Output
CN3-15	Injector #3 (–)	Output
CN3-16	Injector #2 (–)	Output
CN3-17	NC	Input
CN3-18	(Output mode selection 2 (Test mode))	Input
CN3-19	NC	Input
CN3-20	(Q command output)	Output
CN3-21	Power supply for power	
CN3-22	Supply pump 1 (–)	Output
CN3-23	Supply pump 2 (–)	Output
CN3-24	Injector #1 (–)	Output
CN3-25	Injector #6 (+)	Output
CN3-26	Injector #4 (+)	Output
CN3-27	NC	Output
CN3-28	NC	Input
CN3-29	NC	Input
CN3-30	GND	
CN3-31	Power GND	
CN3-32	Power GND	
CN3-33	Injector #5 (–)	Output
CN3-34	Injector #5 (+)	Output
CN3-35	Injector #6 (–)	Output
CN3-36	Injector #4 (–)	Output
CN3-37	NC	Output
CN3-38	NC	Input
CN3-39	NC	Input
CN3-40	GND	

MACHINE CONTROL SYSTEM



MACHINE CONTROL SYSTEM DIAGRAM



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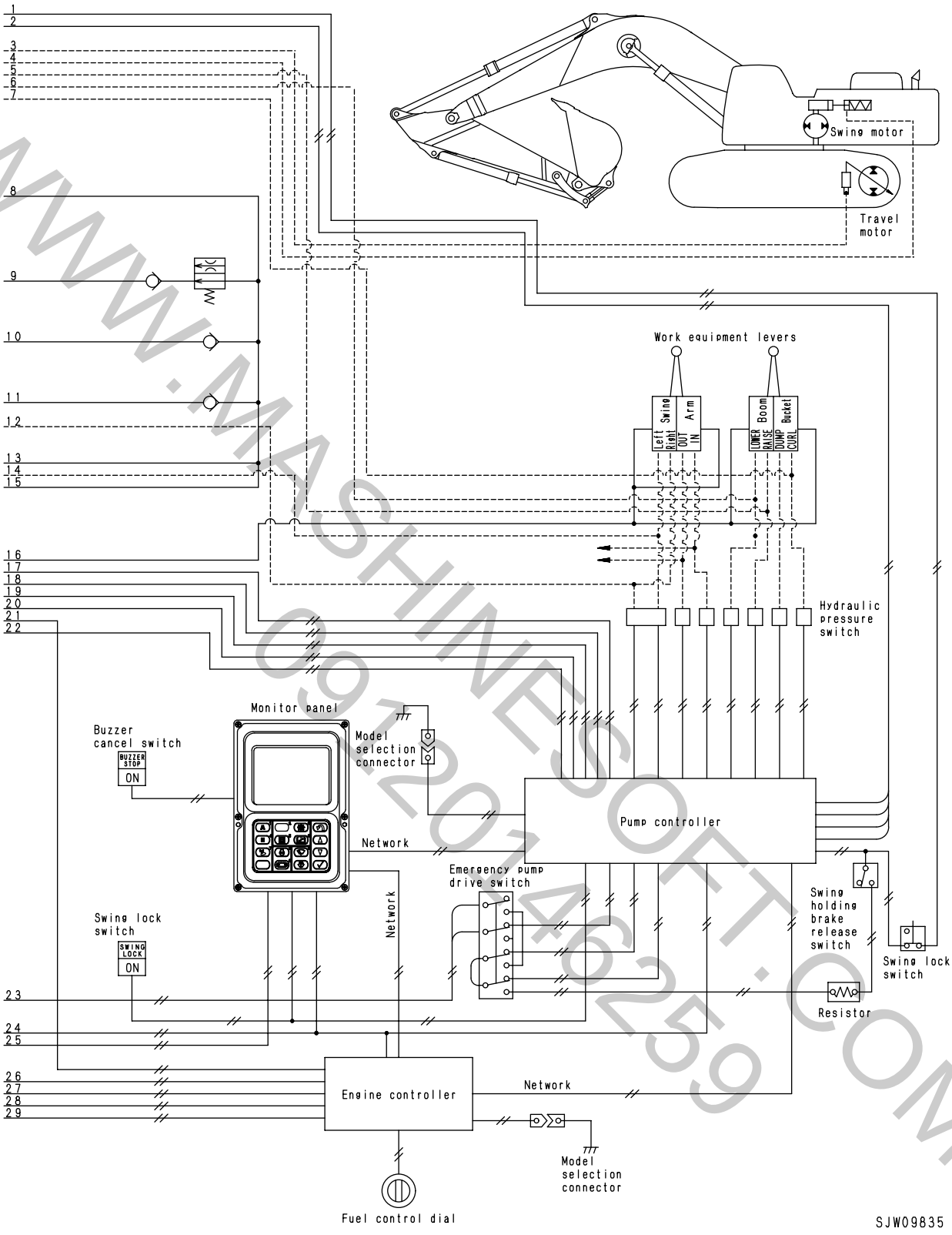
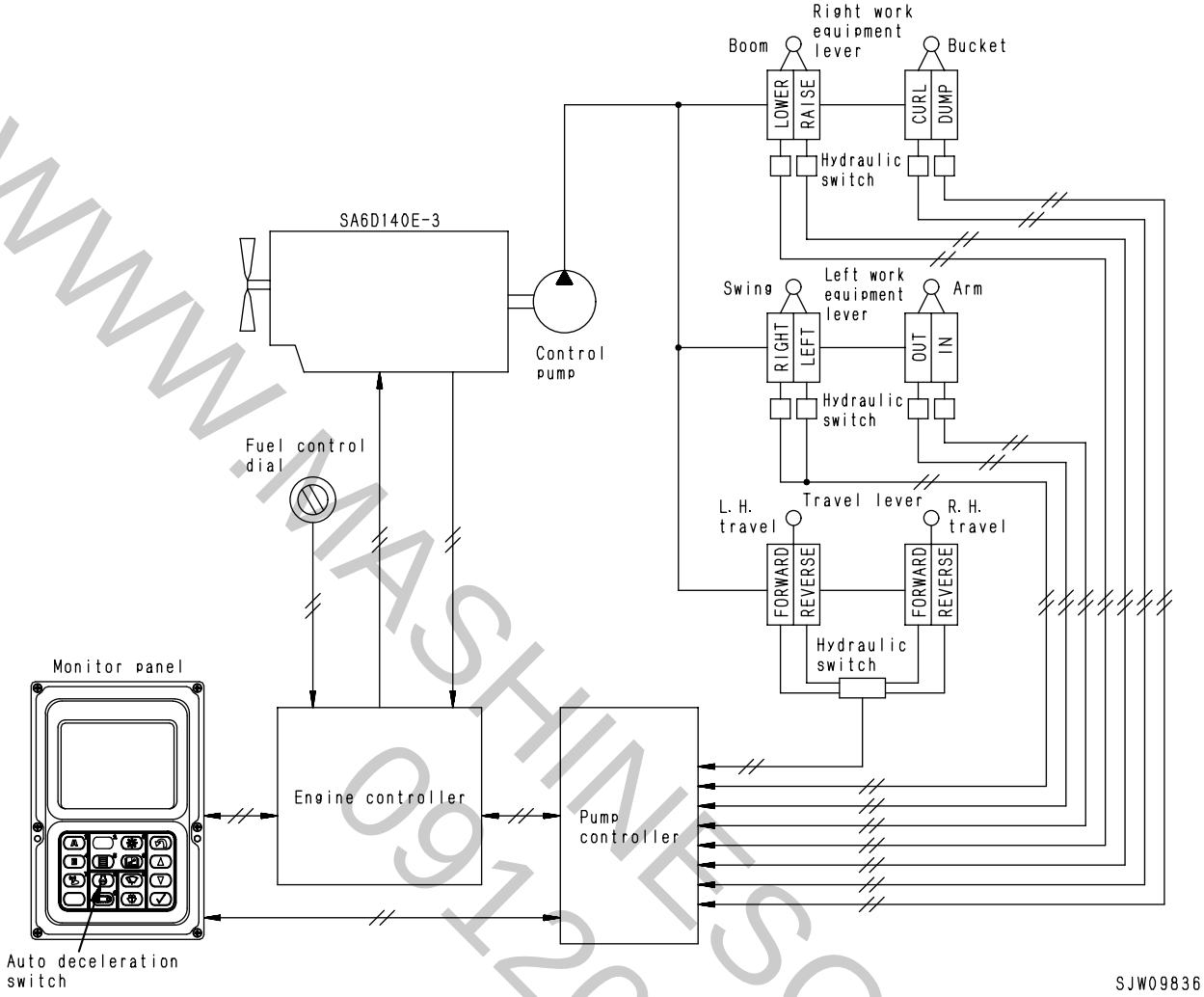


1. Auto deceleration function



Function

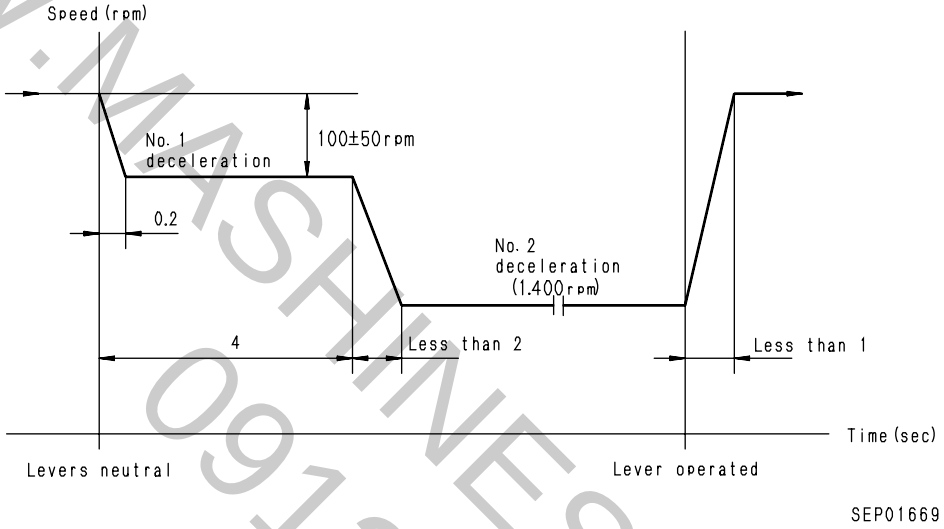
- If all the control levers are at neutral when waiting for work or waiting for a dump truck, the engine speed is automatically reduced to a midrange speed to reduce fuel consumption and noise.
- If any lever is operated, the engine speed returns immediately to the set speed.

Operation

1. When auto-deceleration switch is turned ON

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

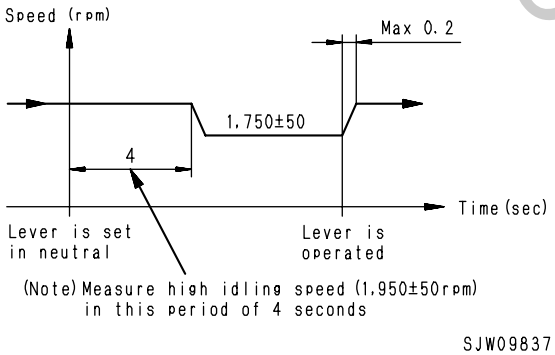
When control lever is operated
- If any control lever is operated when the engine speed is at No. 2 deceleration, the engine speed will immediately rise to the speed set by the fuel control dial.



2. When auto-deceleration switch is turned OFF

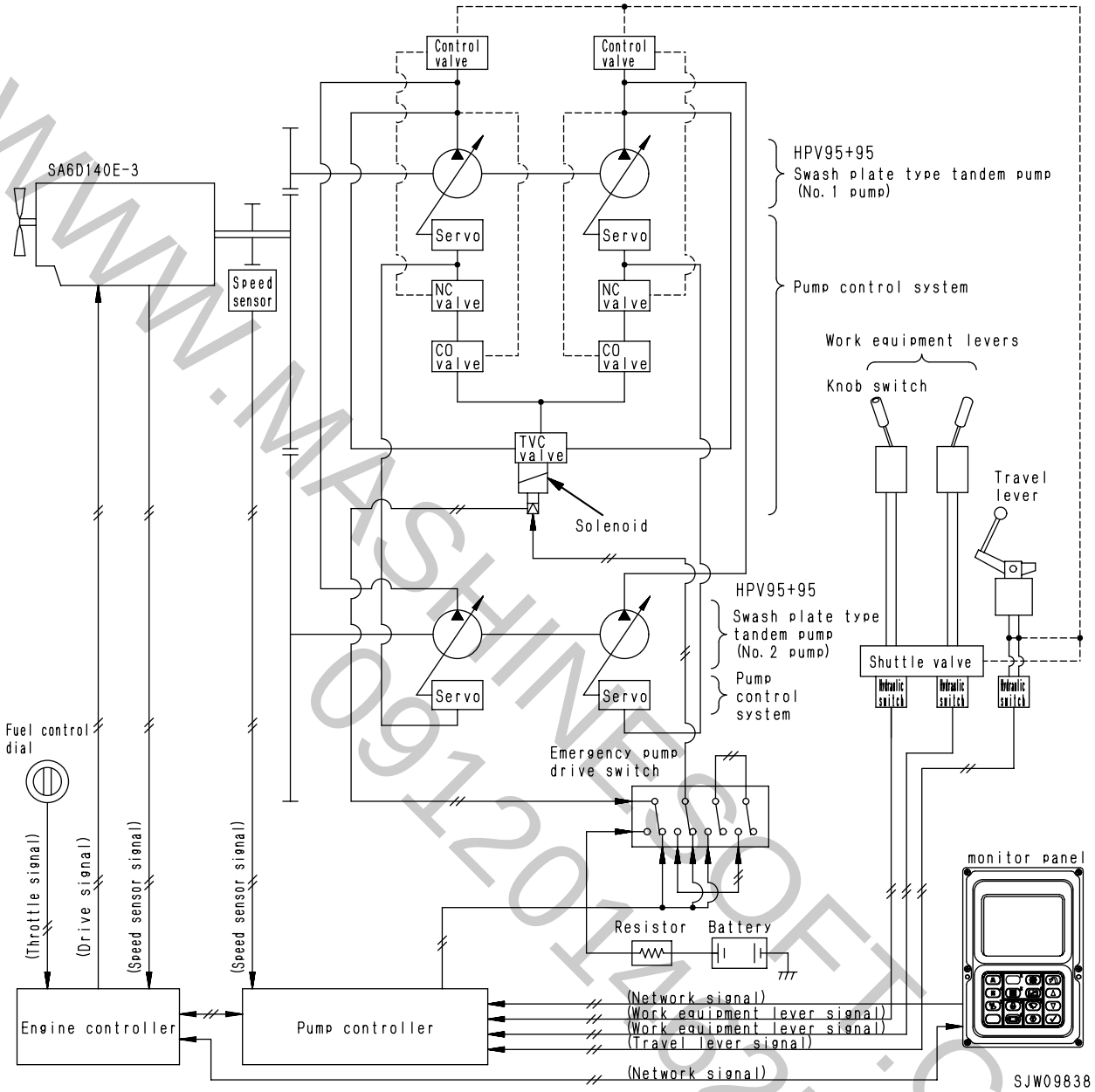
Control lever at neutral
- If the engine is running at a speed above 1,750 rpm and all the control levers are returned to neutral, the engine speed drops to approx. 1,750 rpm after 4 seconds and is kept at that speed until a lever is operated.

When control lever is operated
- If any control lever is operated under the condition shown at left (after the engine speed drops to approx. 1,750 rpm), the engine speed will immediately rise to the speed set by the fuel control dial.



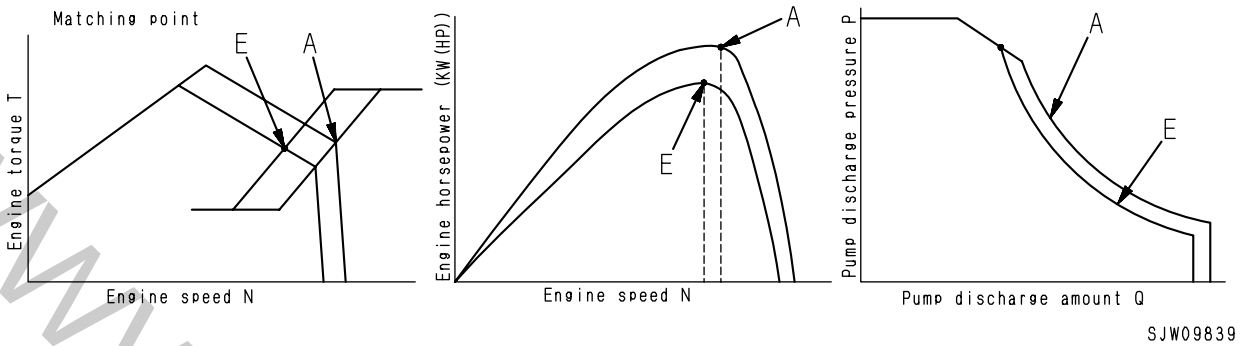
2. Electronic OLSS function

Pump control system



- Interconnected control of all pumps is carried out by one TVC valve.
- A mode: Total horsepower control by engine speed sensing
  E mode: Total horsepower control by engine speed sensing
- Emergency pump drive circuit:
  Constant torque control

1) Control method in each mode
A, E mode



- Matching point in A, E mode: Rated output point

Model / Mode	PC600, PC600LC-7
A	287 kW/1,800 rpm {385 HP/1,800 rpm}
E	247 kW/1,720 rpm {331 HP/1,720 rpm}

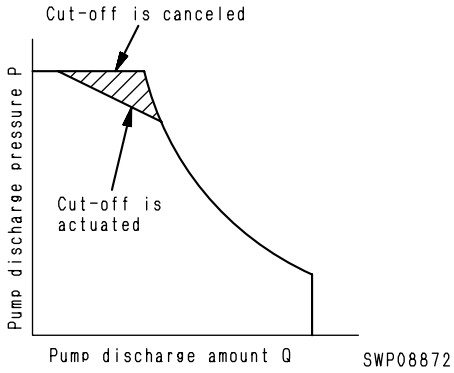
- When the load on the pump rises and the pressure rises, the engine speed goes down.
  At this time, the pump discharge is reduced and the engine speed is set about the rated output point. If the pressure lowers, the pump discharge is increased until the engine speed is set about the rated output point.
  By repeating this control, the engine can always be used at near the rated output point.
- Compared with the A mode, which provides the maximum output, the E mode lowers the engine output to provide matching at a point which gives better fuel consumption efficiency than the A mode.

2) Cut-off function

- If the load during operation increases and the pump discharge pressure rises to near the relief pressure, the main pump cut-off valve is actuated to reduce the relief loss.

3) Cut-off cancel function

- The cut-off cancel function acts to stop the operation of the cut-off function in order to ensure the pump flow when close to the relief pressure, thereby preventing any drop in speed.
- The actuation and cancellation of the cut-off function is set automatically by operating the power max. switch, travel lever, and heavy lift switch.



- Cut-off function and actuation of each switch

Switch / Function	Working mode switch		Travel lever		Heavy lift		Power max. switch		Swing lock switch	
	A	E	ON	OFF	ON	OFF	ON	OFF	ON	OFF
Cut-off function	Actuated	Actuated	Cancel	Actuated	Cancel	Actuated	Cancel	Actuated	Cancel	Actuated

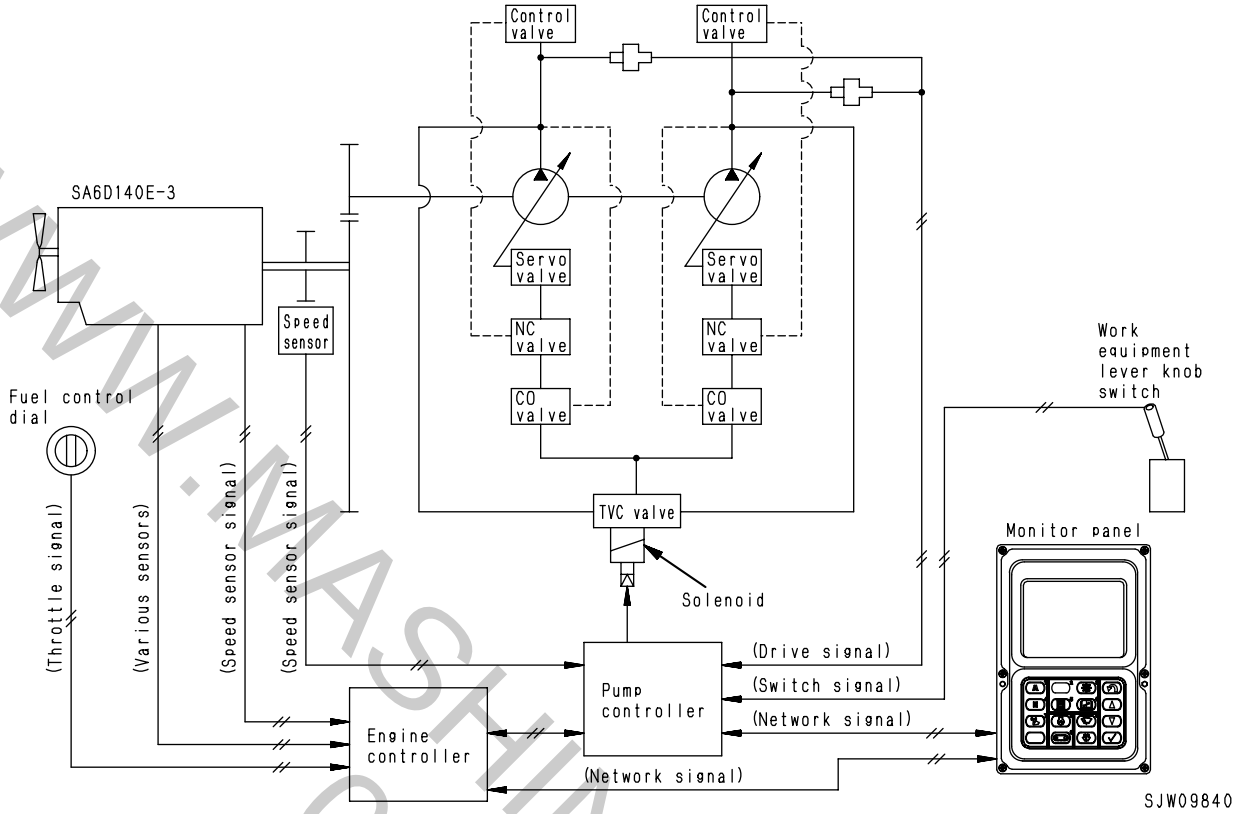
4) 2-stage relief function

- When the power max. switch is ON, if the travel lever is operated and the heavy lift switch is ON, the pilot pressure of the 2-stage relief valve raises the set pressure of the main relief valve from 31.9 MPa {325 kg/cm^2} to 34.3 MPa {350 kg/cm^2} to increase the digging and travel power.

	Power max. switch		Travel lever		Heavy lift switch (Note 1)	
	ON	OFF	Operated	Neutral	ON	OFF
Main relief valve set pressure MPa {kg/cm^2}	34.3 {350}	31.9 {325}	34.3 {350}	31.9 {325}	34.3 {350}	31.9 {325}

Note 1: Actuated when the heavy lift switch is ON and the boom RAISE is operated independently

3. Power max. function

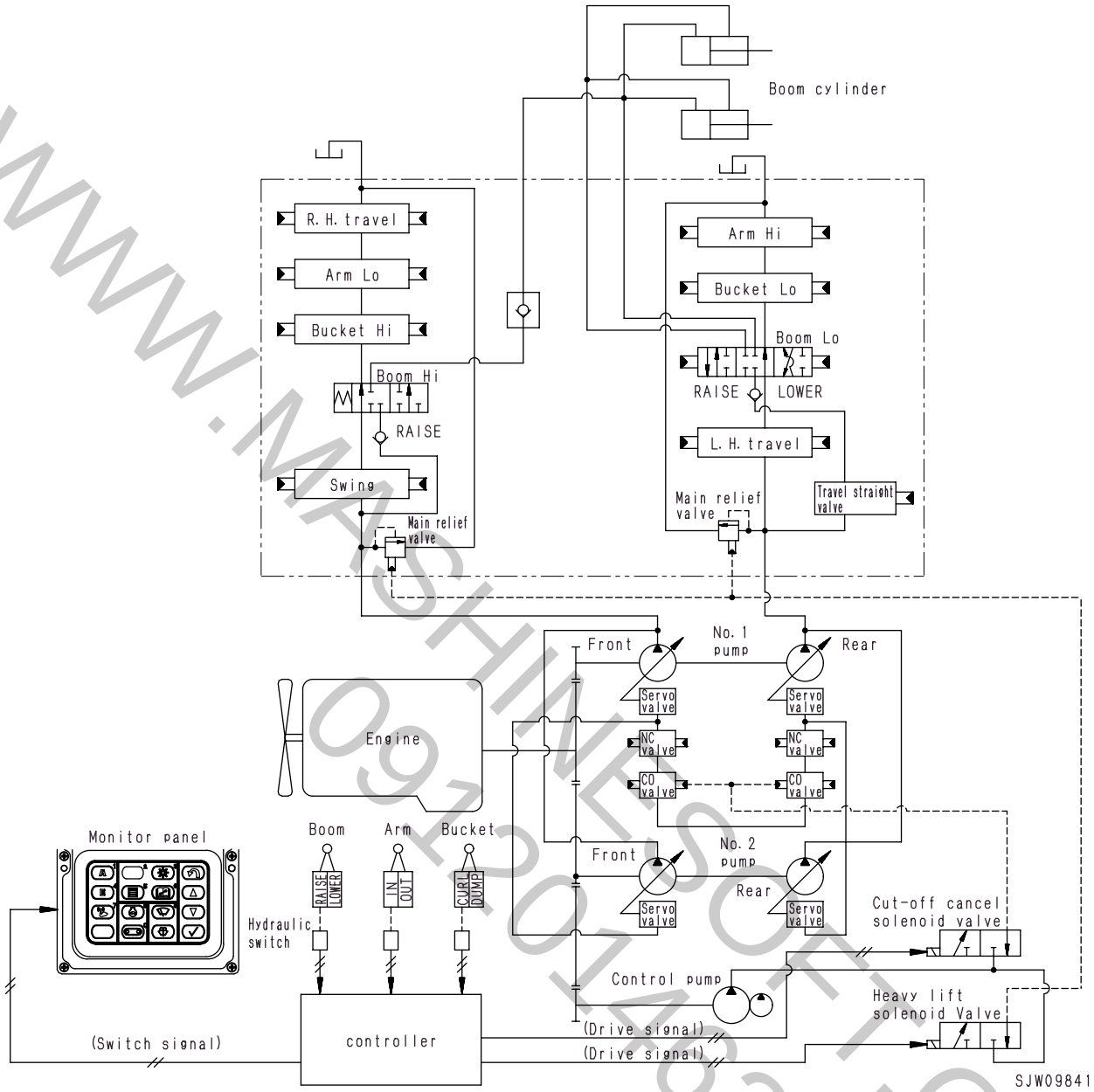


Function

- This is a function to increase the power for a fixed period when the L.H. knob switch is oprerated. It makes it possible to obtain a sudden burst of power to match the working conditions.
- If knob switch on the work equipment control lever is turned ON, the following functions are actuated.

Mode, function \ Power max. switch	OFF	ON
CO function	Actuated	Canceled
Main relief valve Pressure	31.9 MPa {325 kg/cm²}	34.3 MPa {350 kg/cm²}
Operating time	—	Canceled after 8.5 sec even when kept pressed

4. Heavy-lift function



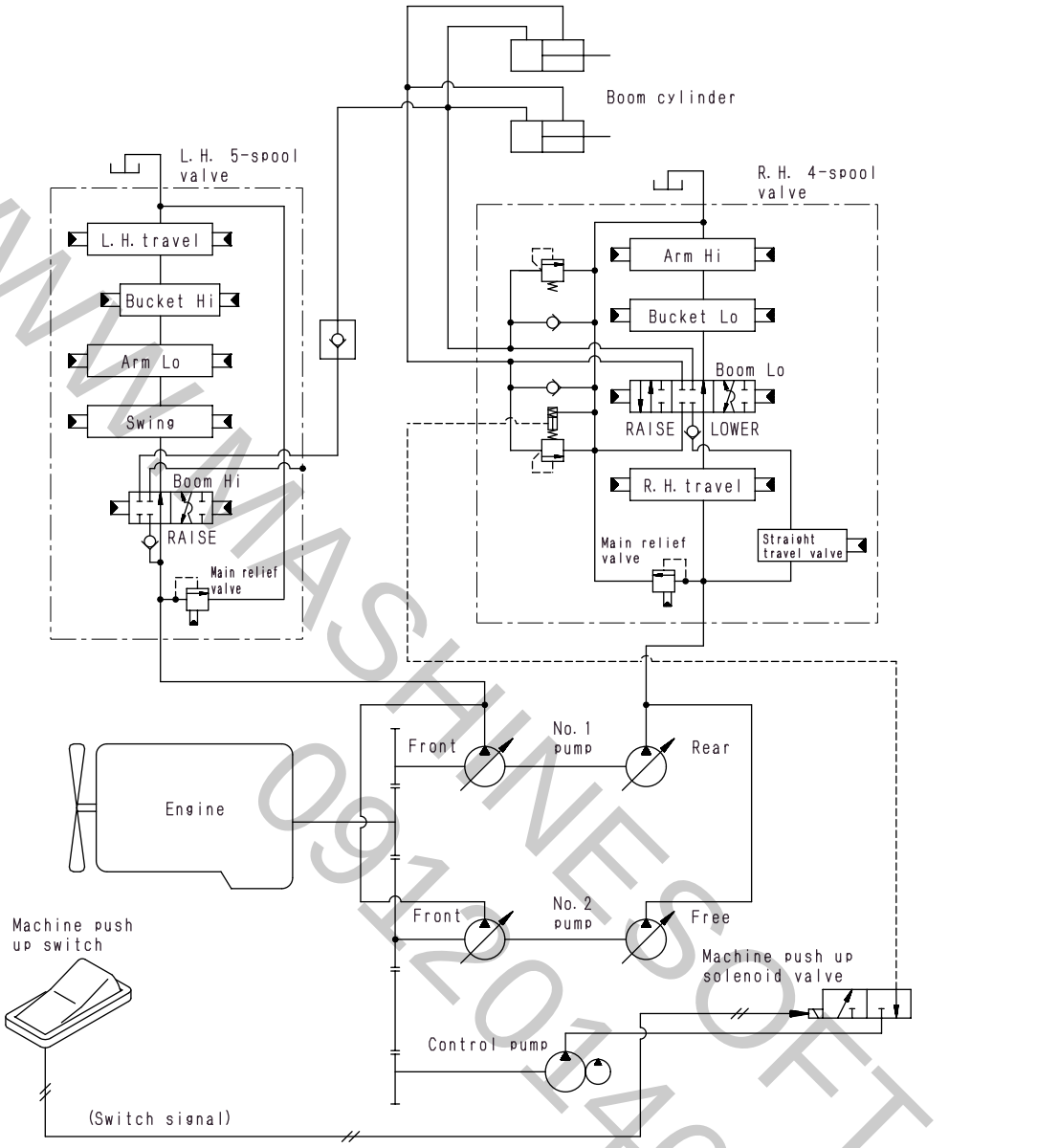
Outline

- This function increases the boom lifting power by approx. 8%.
- It can be actuated only when the boom RAISE is being actuated independently. If the arm IN and bucket DUMP are operated at the same time, the heavy-lift function is automatically canceled.

Operation

Heavy-lift switch	Lever operation		Heavy-lift solenoid valve	Main relief valve set pressure	CO valve	Boom lifting force
	Boom RAISE	Operate arm or bucket				
OFF	Operated	—	De-energized	31.9 MPa {325 kg/cm^2}	Actuated	Normal
ON	Operated	Neutral	Energized	34.3 MPa {350 kg/cm^2}	Canceled	8% up
		Operated	If the arm IN or bucket DUMP are operated during boom RAISE operations, this function is automatically canceled, and the condition becomes the same as when the switch is turned OFF.			Normal

5. 2-stage boom pushing force selector function

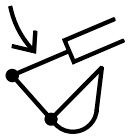


Outline

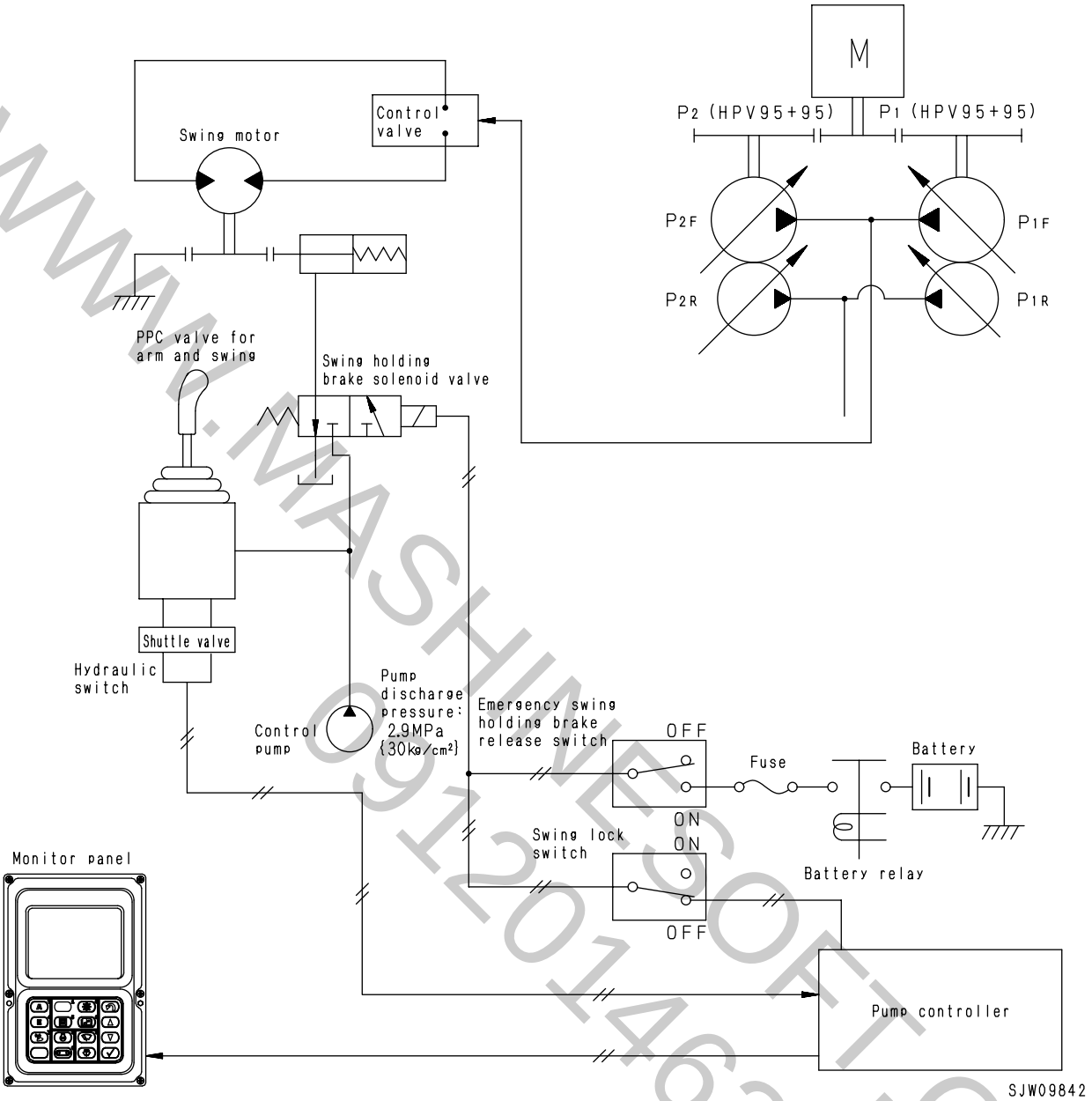
- This function switches the pushing force of the boom. It is aimed to provide both increased digging efficiency by reducing the digging resistance of the boom, and increased ease of operation by increasing the thrusting force for excavation, digging square holes, carrying out twist turns, or escaping from soft ground.

Operation

- This function acts to change the set pressure of the safety valve at the boom cylinder end of the R.H. 4-spool control valve boom Lo in 2 ways: to low pressure (14.7 MPa {150 kg/cm^2}) and high pressure (33.3 MPa {340 kg/cm^2}.

Mode	Machine push-up switch	Machine push-up solenoid valve	Safety valve set pressure	Effect
Boom pushing force (low mode)	 NDP00178	Energized	14.7 MPa {150 kg/cm^2}	By reducing the boom pushing force, it is made easier for the boom to escape automatically in the RAISE direction and to reduce the number of times that the boom is operated. At the same time it also makes the digging operation smoother.
Boom pushing force (high mode)	 NDP00179	De-energized	33.3 MPa {340 kg/cm^2}	By increasing the thrust force for boom LOWER, the ease of operation is improved for excavation, digging square holes, carrying out twist turns, or escaping from soft ground.

6. Swing control function



Function

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

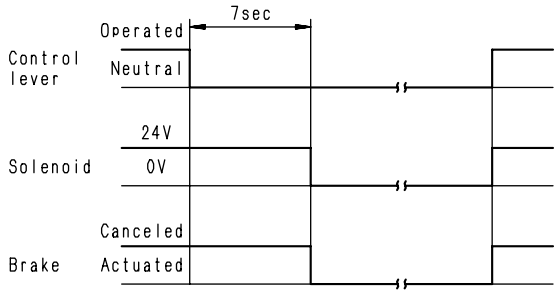
Swing lock, swing holding brake function

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

★ Swing brake solenoid valve
For details of the structure and function, see SOLENOID VALVE.

★ Swing motor
For details of the structure and function, see SWING MOTOR.

Actuation

Mode	Swing lock switch	Swing lock monitor	Swing brake solenoid valve	Actuation
Swing holding brake	OFF	OFF	See diagram on right	When swing and work equipment levers are placed at neutral, swing brake is applied after approx. 7 sec; when any swing or work equipment lever is operated, brake is canceled and swing can be operated freely. • Time chart 
Swing brake	ON	ON	De-energized	Swing lock is actuated and swing is held in position. Even when swing lever is operated, swing lock is not canceled and swing does not move.

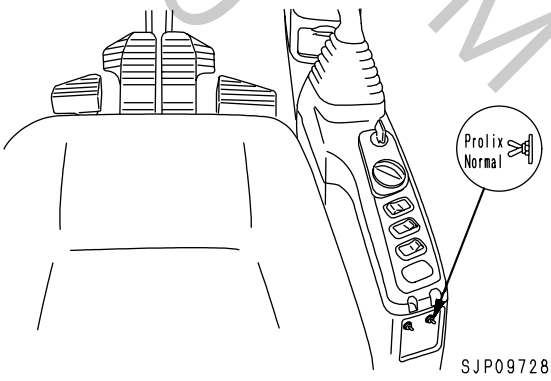
Operation of swing lock prolix switch

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

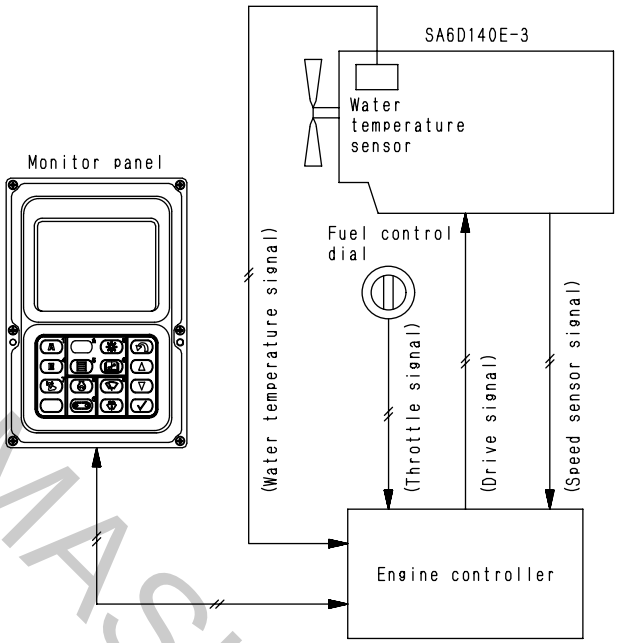
★ Even when the swing lock prolix switch is turned ON, the swing lock switch stays ON and the swing brake is not canceled.

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

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



7. Engine automatic warming-up, overheat prevention function, turbo protect function, split injection function



SJW09844

Function

- If the water temperature is low, this automatically raises the engine speed to warm up the engine after it is started. In addition, if the water temperature rises too high during operations, it reduces the load of the pump to prevent overheating.
- To protect the turbocharger bearing during cold weather, the engine speed is kept below the fixed speed when the engine is started. In addition, to improve the starting ability, a small amount of fuel is injected two or more times before the main injection.

1) Engine automatic warming-up function
- After the engine is started, if the engine coolant temperature is low, the engine speed is automatically raised to warm up the engine.

Conditions for actuation (both are necessary)	Actuation
Coolant temperature: Less than 30°C Engine speed: Less than 1200 rpm	Engine speed: 1200 rpm

Conditions for cancellation (any one)		Cancellation
Automatic	Coolant temperature: 30°C or above Automatic warming-up time: 10 minutes or more	Engine speed: As desired
Manual	Fuel control dial: Held at more than 70% of full throttle for more than 3 seconds	

2) Engine overheat prevention function
- This function protects the engine by lowering the pump load and engine speed to prevent overheating when the engine coolant temperature has risen too high.
- This system is actuated at 105°C and above.

Actuation condition	Actuation, remedy
Water temperature: 105°C and above (Water temperature gauge: Red range)	Working mode : In any mode Engine speed : Low idling Monitor warning lamp : Lights up Alarm buzzer : Sounds

Cancel condition
Water temperature : Below 105°C Fuel control dial : Return temporarily to low idling position
• When the above conditions are met, the system returns to the condition before the overheat prevention function was actuated (manual reset).

3) Turbo protection function
Function to protect turbocharger bearing during cold weather by keeping engine speed below fixed speed when engine is started.

Actuation condition

Engine water temperature	Turbo protect time (sec)
More than +10°C	0
+10°C to –10°C	Gradually changes between 0 and 5
Less than –10°C	5

Engine speed: 1000 rpm

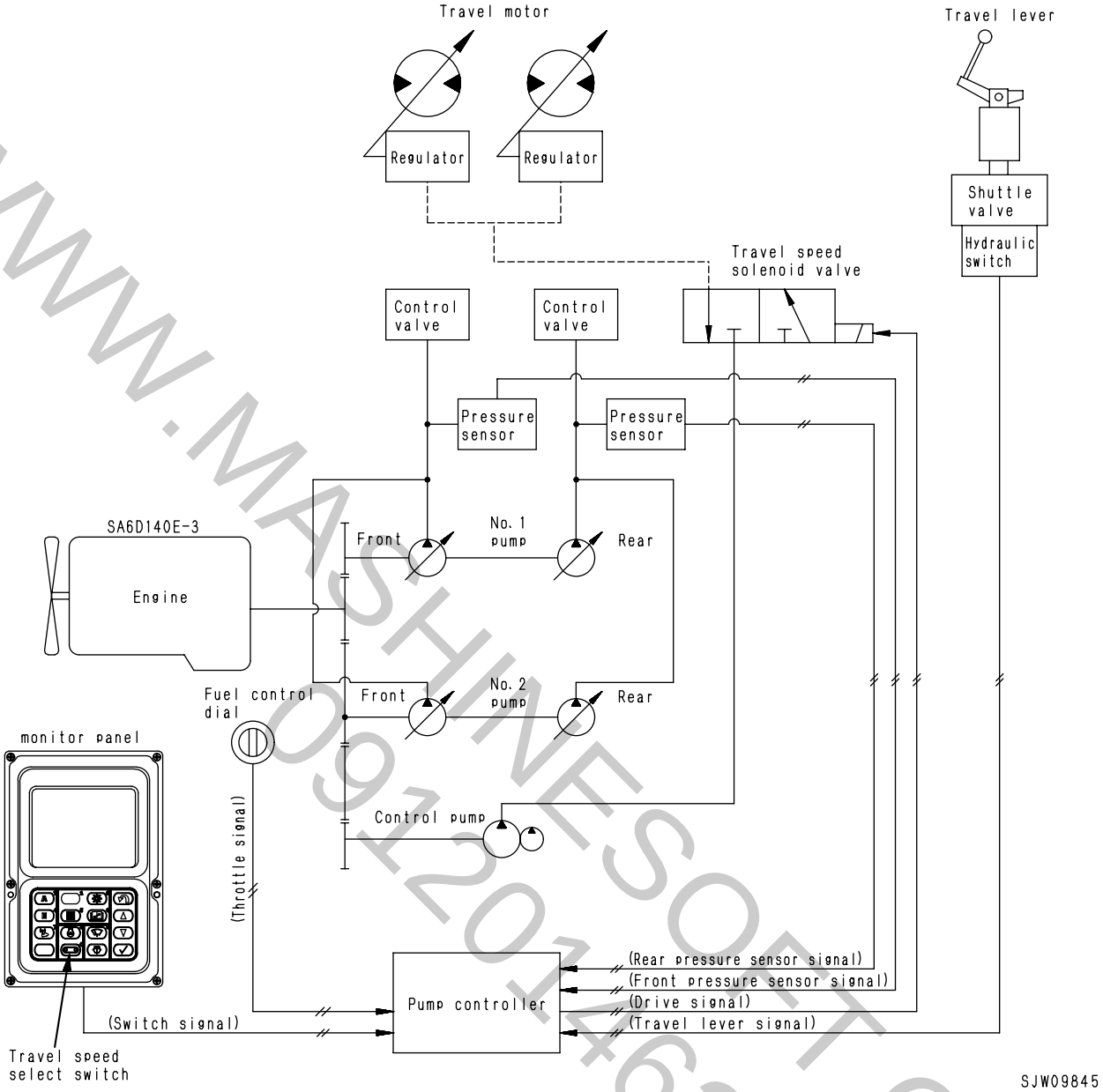
Even if the fuel control dial is operated during the above time, the engine speed will not change. After the set time passes, the operation moves to the automatic warming up function in Step 1).

4) Split injection function
To improve the ease of starting in cold weather, a small amount of fuel is injected two or more times within the set time after calculating in the table below before starting the main injection.
As a result, the lower idling speed during this time becomes slightly higher.

Actuation condition

Water temperature	Split injection time (sec)
More than 20°C	0
20°C to –30°C	0 – 15
Less than –30°C	15

8. Travel control function



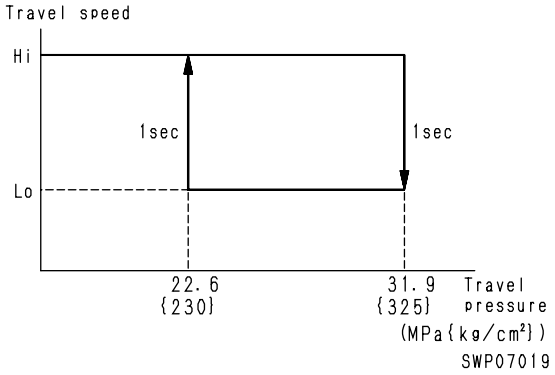
Outline

- The pump absorption torque is increased when traveling to increase the drawbar pull.
- Switching between manual and automatic travel speed selection is used to improve the travel performance.

Travel speed selection function

1) Manual selection using travel speed switch
   If the travel speed switch is set to Lo, Hi, the pump controller controls the pump flow and motor volume at each speed range as shown on the right to switch the travel speed.
2) Automatic selection according to engine speed
   If the engine speed is reduced to below 1,400 rpm by the fuel control dial:
   - If the machine is traveling in Lo, it will not shift even if Hi is selected.
   - If the machine is traveling in Hi, it will automatically shift to Lo.
3) Automatic selection according to pump discharge pressure
   If the machine is traveling with the travel speed switch at Hi, and the load increases, such as when traveling up a steep hill, if the travel pressure continues at 31.9 MPa (325 kg/cm²) for more than 1.0 sec, the pump volume is automatically switched and the travel speed changes to Lo.
   (The travel speed switch stays at Hi.)
   The machine continues to travel in Lo, and when the load is reduced, such as when the machine travels again on flat ground or goes downhill, and the travel pressure stays at 22.6 MPa {230 kg/cm²} or less for more than 1.0 sec, the pump volume is automatically switched and the travel speed returns to Hi.

Travel speed switch	Lo (Low speed)	Hi (High speed)
Motor volume	Max.	Min
Travel speed (km/h)	3.0	4.9



Travel pressure increasing function

Outline

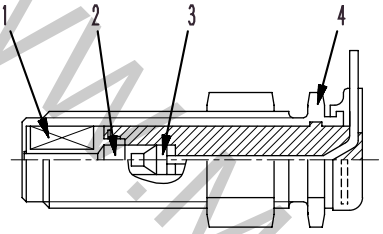
- To maintain the drawbar pull when traveling, the cut-off is canceled and the main relief pressure is raised from 31.9 MPa{325 kg/cm²} to 34.3 MPa {350 kg/cm²}.

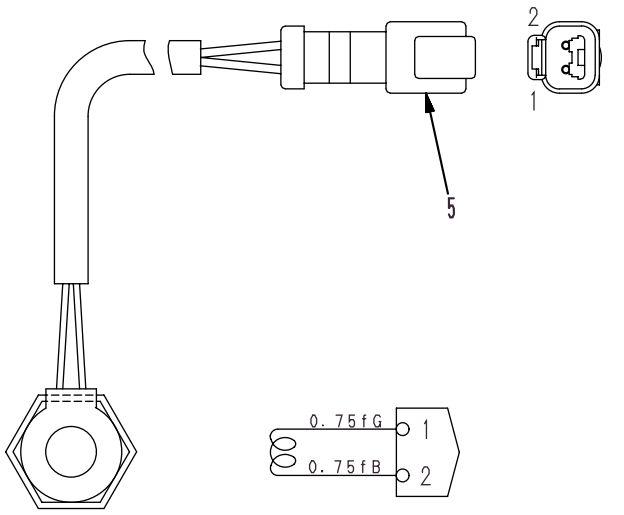
Operation

	Pressure increase solenoid valve	Main relief valve set pressure	Cut-off cancel solenoid valve	CO valve
When traveling	Energized	34.3 MPa {350 kg/cm²}	Energized	Canceled
When not traveling	De-energized	31.9 MPa {325 kg/cm²}	De-energized	Actuated

Components of system

1) Engine speed sensor





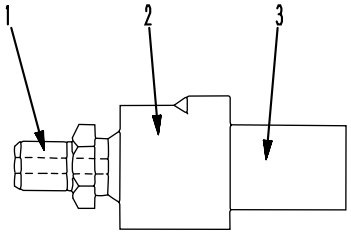
SJP08345

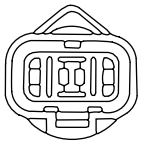
1. Wire
2. Magnet
3. Terminal
4. Housing
5. Connector

Function

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

2) PPC hydraulic switch

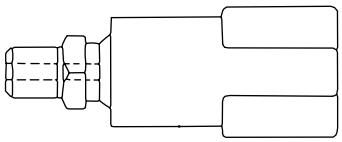


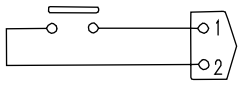


1. Plug
2. Switch
3. Connector

Specifications

Composition of points: N.O. points
Actuation (ON) pressure:
0.5 ± 0.1 MPa {5.0 ± 1.0 kg/cm²}
Reset (OFF) pressure:
0.3 ± 0.05 MPa {3.0 ± 0.5 kg/cm²}





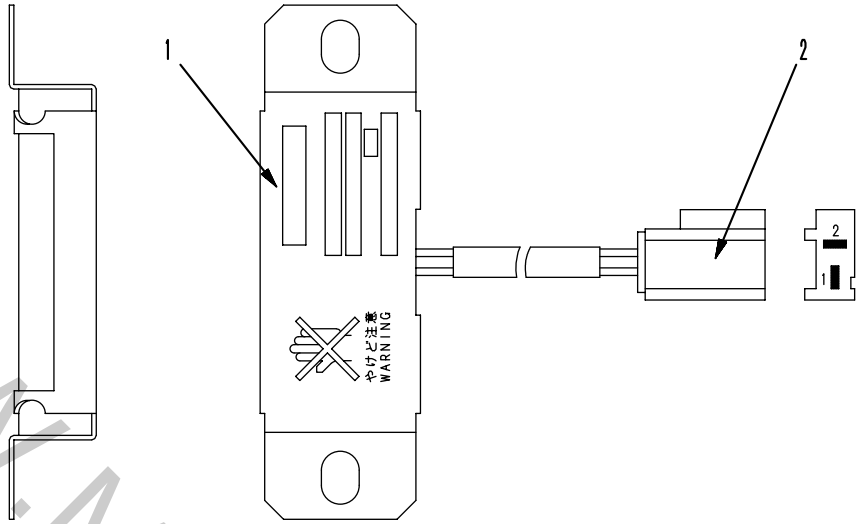
Structure of circuit

SEP01692

Function

- There are 12 switches installed to the PPC block. The operating condition of each actuator is detected from the PPC pressure, and this is sent to the engine controller and pump controller.

3) TVC prolix resistor



9JG00107

1. Resistor
2. Connector

Specification
Resistance: 20 Ω

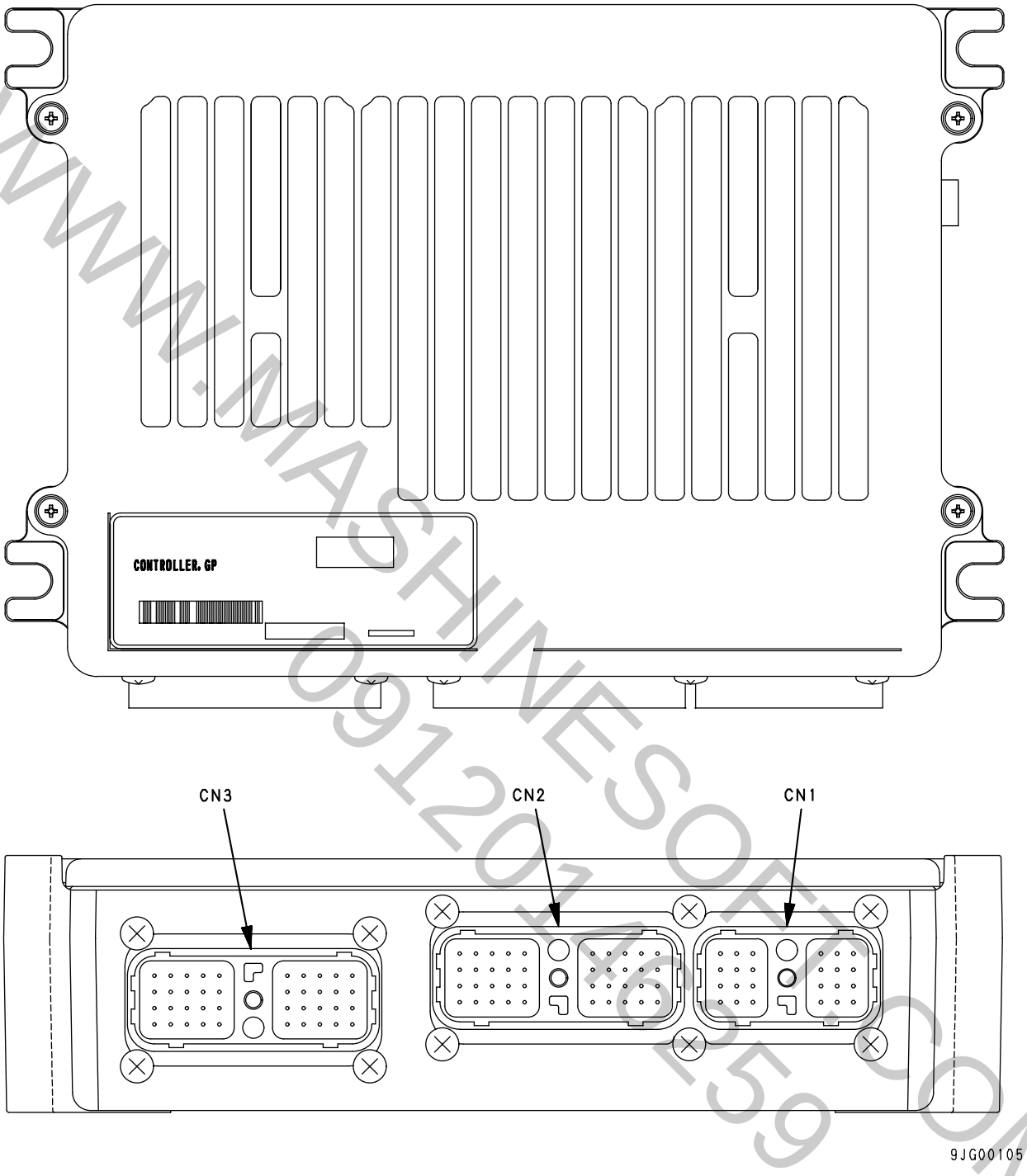
Function
- This resistor acts to allow a suitable current to flow to the TVC solenoid when the TVC prolix switch is ON.
- No current flows when the TVC prolix switch is OFF.

4) Fuel control dial, engine controller
★ See ENGINE CONTROL.

5) Monitor panel
★ See MONITOR SYSTEM.

6) TVC valve
★ See HYDRAULIC PUMP.

7) Pump controller



Input and output signals

CN1 [CN-C01]

Pin No.	Signal name	Input/ Output
CN1-1	NC	Input
CN1-2	R pump pressure sensor	Input
CN1-3	NC	Input
CN1-4	NC	
CN1-5	(Auto grease controller trouble)	Input
CN1-6	NC	Input
CN1-7	NC	Input
CN1-8	F pump pressure sensor	Input
CN1-9	NC	Input
CN1-10	GND (SIG)	
CN1-11	Knob switch	Input
CN1-12	NC	Input
CN1-13	NC	Input
CN1-14	NC	Input
CN1-15	NC	Input
CN1-16	NC	Output
CN1-17	Key switch (Terminal C)	Input
CN1-18	NC	Input
CN1-19	NC	Input
CN1-20	NC	Input
CN1-21	NC	
CN1-22	Sensor power supply (+5V)	Output
CN1-23	Key switch (Terminal Acc)	Input
CN1-24	Stop light switch	Input

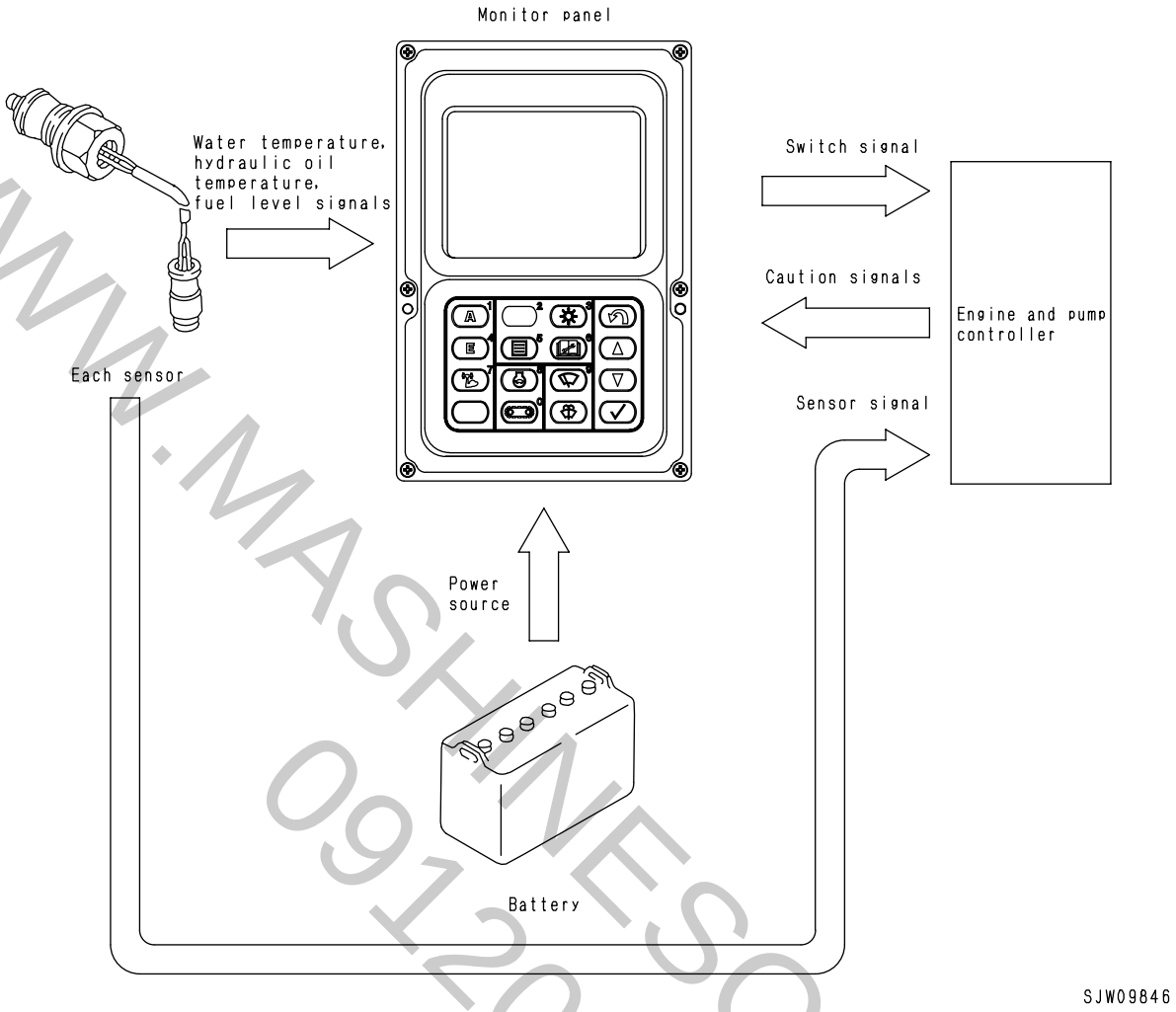
CN2 [CN-C02]

Pin No.	Signal name	Input/ Output
CN2-1	NC	Output
CN2-2	Swing prolix switch	Input
CN2-3	NC	Input
CN2-4	RS232C-R × D	Input
CN2-5	(Overload sensor (ON/OFF))	Input
CN2-6	NC	Input
CN2-7	Model selection 4	Input
CN2-8	NC	Output
CN2-9	NC	Output
CN2-10	NC	Input
CN2-11	NC	Output
CN2-12	CAN_SH	
CN2-13	NC	Input
CN2-14	RS232C-T × D	Output
CN2-15	NC	Input
CN2-16	NC	Input
CN2-17	Model selection 3	Input
CN2-18	NC	Output
CN2-19	NC	Output
CN2-20	NC	Input
CN2-21	S_NET	Input/ Output
CN2-22	CAN0_L	Input/ Output
CN2-23	NC	Input/ Output
CN2-24	FWE switch	Input
CN2-25	Horn switch	Input
CN2-26	NC	Input
CN2-27	Model selection 2	Input
CN2-28	NC	Input
CN2-29	NC	
CN2-30	NC	Input
CN2-31	GND (S_NET_GND)	
CN2-32	CAN0_H	Input/ Output
CN2-33	NC	Input/ Output
CN2-34	GND (RS232C)	
CN2-35	Service valve pressure switch	Input
CN2-36	NC	Input
CN2-37	Model selection 1	Input
CN2-38	Swing lock switch	Input
CN2-39	Engine speed sensor (GND)	
CN2-40	Engine speed sensor	Input

CN3 [CN-C03]

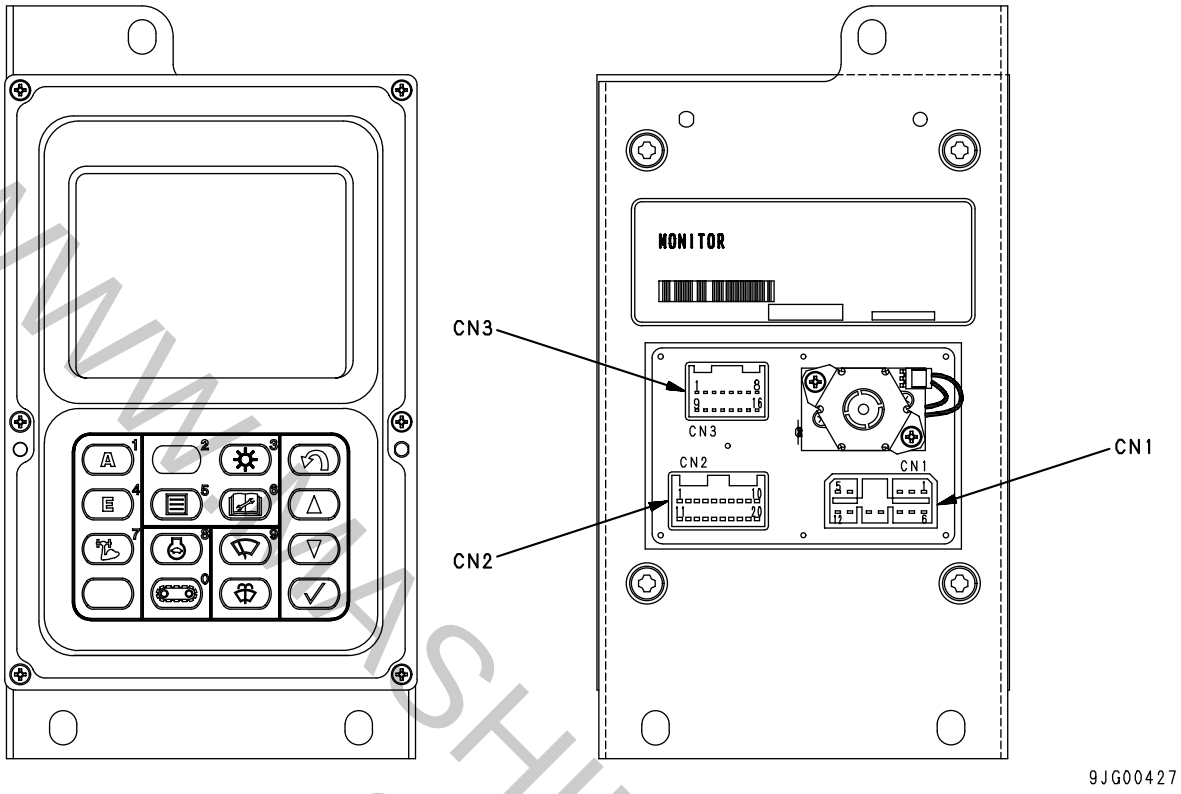
Pin No.	Signal name	Input/ Output
CN3-1	VB (Controller PWR)	Input
CN3-2	VIS (Solenoid PWR)	Input
CN3-3	TVC solenoid (–)	Input
CN3-4	Battery relay drive	Output
CN3-5	Step light power holding relay	Output
CN3-6	NC	Output
CN3-7	Bucket Hi cancel solenoid	Output
CN3-8	Travel alarm	Output
CN3-9	Bucket CURL pressure switch	Input
CN3-10	Boom RAISE pressure switch	Input
CN3-11	VB (Controller PWR)	Input
CN3-12	VIS (Solenoid PWR)	Input
CN3-13	NC	Input
CN3-14	VB (Controller PWR)	Input
CN3-15	Step light drive relay	Output
CN3-16	TVC solenoid (+)	Output
CN3-17	CO cancel solenoid	Output
CN3-18	NC	Output
CN3-19	Bucket DUMP pressure switch	Input
CN3-20	Boom LOWER pressure switch	Input
CN3-21	GND (Controller GND)	Input
CN3-22	NC	Input
CN3-23	NC	Input
CN3-24	VB (Controller PWR)	Input
CN3-25	Flash light drive relay	Output
CN3-26	NC	Output
CN3-27	Travel Hi/Lo selector solenoid	Output
CN3-28	2-stage relief solenoid	Output
CN3-29	Swing pressure switch	Input
CN3-30	Arm IN pressure switch	Input
CN3-31	GND (Controller GND)	Input
CN3-32	GND (Controller GND)	Input
CN3-33	GND (Controller GND)	Input
CN3-34	NC	
CN3-35	NC	Output
CN3-36	NC	Output
CN3-37	Swing holding brake solenoid	Output
CN3-38	NC	
CN3-39	Travel pressure switch	Input
CN3-40	Arm OUT pressure switch	Input

MONITOR SYSTEM



- The monitor system monitors the condition of the machine with sensors installed on various parts of the machine. It processes and immediately displays the obtained information on the panel notifying the operator of the condition of the machine.
  The panel is roughly divided as follows.
  1. Monitor section to output alarms when the machine has troubles
  2. Gauge section to display the condition constantly (Coolant temperature, hydraulic oil temperature, fuel level, etc.)
- The monitor panel also has various mode selector switches and functions to operate the machine control system.

MONITOR PANEL



Outline

- The monitor panel has the functions to display various items and the functions to select modes and electric parts.
  The monitor panel has a CPU (Central Processing Unit) in it to process, display, and output the information.
  The monitor display unit consists of LCD (Liquid Crystal Display). The switches are flat sheet switches.

Input and output signals

CN1

Pin No.	Signal name	Input/ output
1	Key switch (Battery)	Input
2	Key switch (Battery)	Input
3	Washer motor output	Output
4	Key switch (Terminal C)	Input
5	Wiper contact W (Lower wiper contact P)	Input
6	GND	
7	GND	
8	VB + (24 V)	Input
9	Wiper motor (+) <Upper wiper motor (+)>	Output
10	Wiper motor (–) <Lower wiper motor (–)>	Output
11	NC	Input
12	Wiper contact P (Upper wiper contact P)	Input

CN2

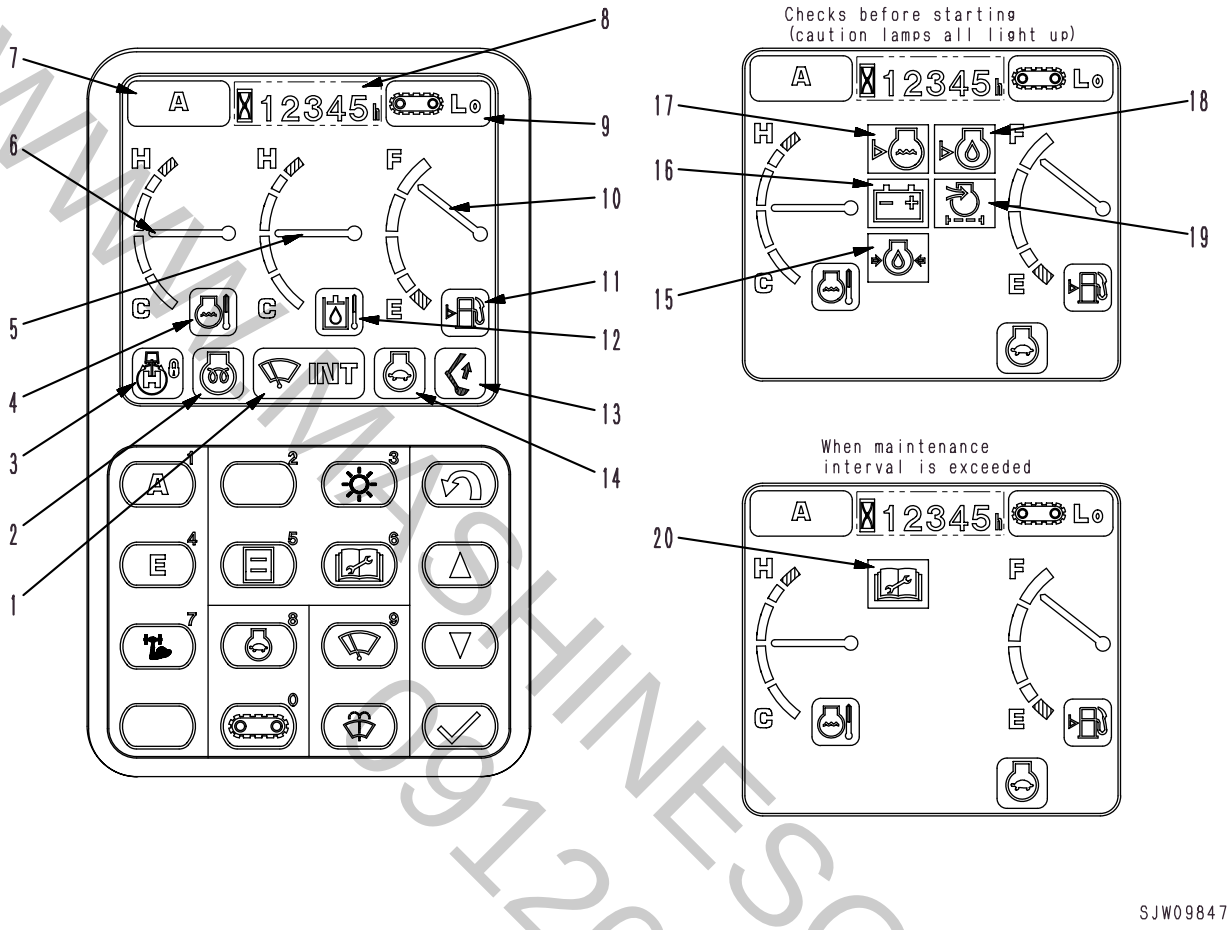
Pin No.	Signal name	Input/ output
1	NC	Input
2	Fuel	Input
3	Radiator water level	Input
4	NC	Input
5	Air cleaner clogging sensor	Input
6	NC	Input
7	NC	Input
8	Engine oil level sensor	Input
9	Network (S-NET signal)	Input/ output
10	Network (S-NET signal)	Input/ output
11	Charge level	Input
12	Hydraulic oil temperature (Analog)	Input
13	GND (For analog signal)	
14	Personal code relay (Lo)	Input
15	Window limit switch <Lower wiper switch>	Input
16	Buzzer cancel	Input
17	Swing lock	Input
18	Preheating	Input
19	Light switch	Input
20	Network (S-NET GND)	

CN3

Pin No.	Signal name	Input/ output
1	NC	Input
2	NC	Input
3	NC	Input
4	NC	Input
5	NC	Input
6	NC	Input
7	NC	Input
8	NC	Input
9	NC	Input/ output
10	NC	Input/ output
11	NC	Input
12	NC	Input
13	GND	
14	GND (Shield)	Input
15	CAN (+)	Input
16	CAN (–)	Input

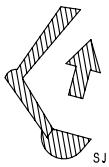
MONITOR CONTROL, DISPLAY PORTION

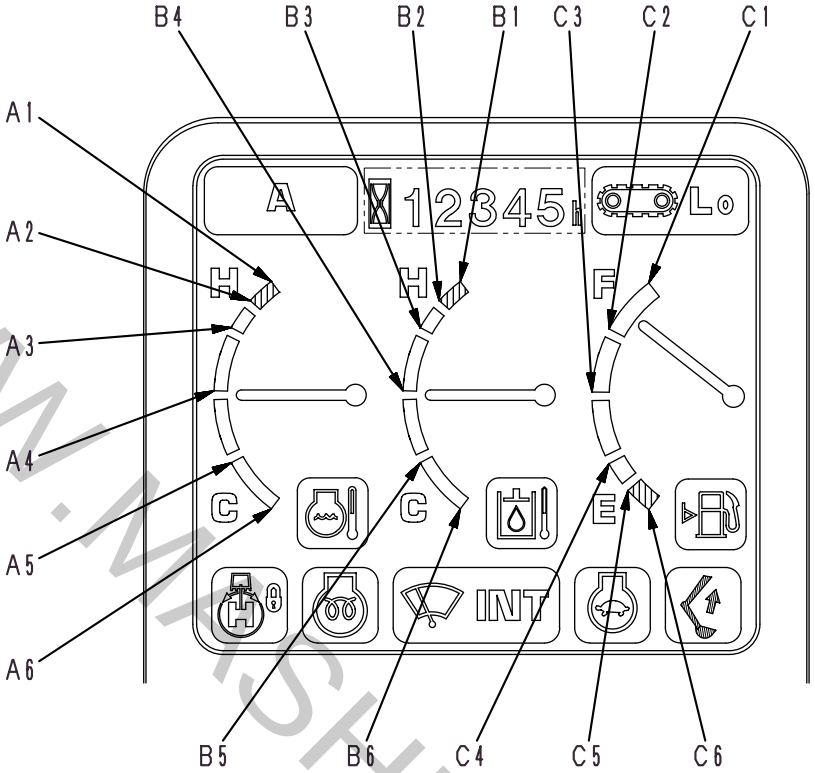
MONITOR PORTION



1. Wiper motor
2. Preheating monitor
3. Swing lock monitor
4. Engine water temperature monitor
5. Hydraulic oil temperature gauge
6. Engine water temperature gauge
7. Working mode monitor
8. Service meter
9. Travel speed monitor
10. Fuel gauge
11. Fuel level monitor
12. Hydraulic oil temperature monitor
13. Power Max. monitor
14. Auto-deceleration monitor
15. Radiator water level caution
16. Battery charge caution
17. Engine oil pressure caution
18. Engine oil level caution
19. Air cleaner clogging
20. Maintenance time warning caution

MONITOR ITEMS AND DISPLAY

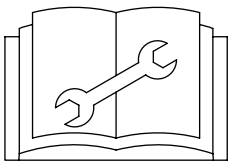
<table>
<tr><th>Symbol</th><th>Display item</th><th>Display method</th></tr>
<tr><td> 
SAT00098</td><td>Swing lock</td><td>
<table>
<tr><th>Swing lock switch</th><th>Swing holding brake release switch</th><th>Swing lock monitor</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>OFF</td><td>ON</td><td>Flashes</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td></tr>
</table>
</td></tr>
<tr><td> 
SAP00526</td><td>Preheating</td><td>
<table>
<tr><th>Continuous set time</th><th>Preheating monitor status</th></tr>
<tr><td>Up to 30 sec.</td><td>ON</td></tr>
<tr><td>From 30 sec. to 40 sec.</td><td>Flashes</td></tr>
<tr><td>More than 40 sec.</td><td>OFF</td></tr>
</table>
</td></tr>
<tr><td> 
SJP08778</td><td>Power Max.</td><td>
<table>
<tr><th>Power Max. switch status</th><th>Power Max. monitor status</th></tr>
<tr><td>Being pressed</td><td>Lights up but goes out after approx. 9 sec. when kept pressed</td></tr>
<tr><td>Not being pressed</td><td>Flashes</td></tr>
</table>
</td></tr>
<tr><td></td><td>Engine water temperature
Hydraulic oil temperature
Fuel level</td><td>See gauge display on the next page</td></tr>
</table>



SJP08779

Gauge	Range	Temperature, volume	Indicator	Buzzer sound
Engine water temperature (°C)	A1	105	Red	○
	A2	102	Red	
	A3	100	Green	
	A4	80	Green	
	A5	60	Green	
	A6	30	White	
Hydraulic oil temperature (°C)	B1	105	Red	○
	B2	102	Red	
	B3	100	Green	
	B4	80	Green	
	B5	40	Green	
	B6	20	White	
Fuel level (ℓ)	C1	524	Green	
	C2	382	Green	
	C3	249	Green	
	C4	138	Green	
	C5	101	Green	
	C6	84	Red	

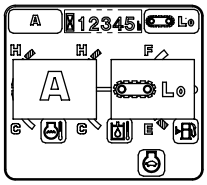
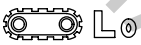
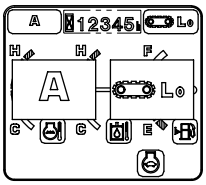
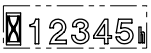
Checks before starting (caution lamps all light up), when maintenance interval is exceeded.
If the checks before starting or maintenance interval is exceeded items light up, the display of the hydraulic oil temperature gauge and the hydraulic oil temperature monitor are stopped, and the following cautions are displayed.

Symbol	Display item	Check before starting item	When engine is stopped	When engine is running
 SAP00519	Engine oil pressure	●	—	When abnormal, lights up and buzzer sounds
 SAP00522	Battery charge	●	—	Lights up when abnormal
 SAP00520	Radiator water level	●	Lights up when abnormal	When abnormal, lights up and buzzer sounds
 SAP00523	Engine oil level	●	Lights up when abnormal	—
 SAP00521	Air cleaner clogging	●	—	Lights up when abnormal
 SJP08780	Maintenance		Lights up when there is a warning. Lights up for only 30 sec. after key is turned ON, then goes out.	

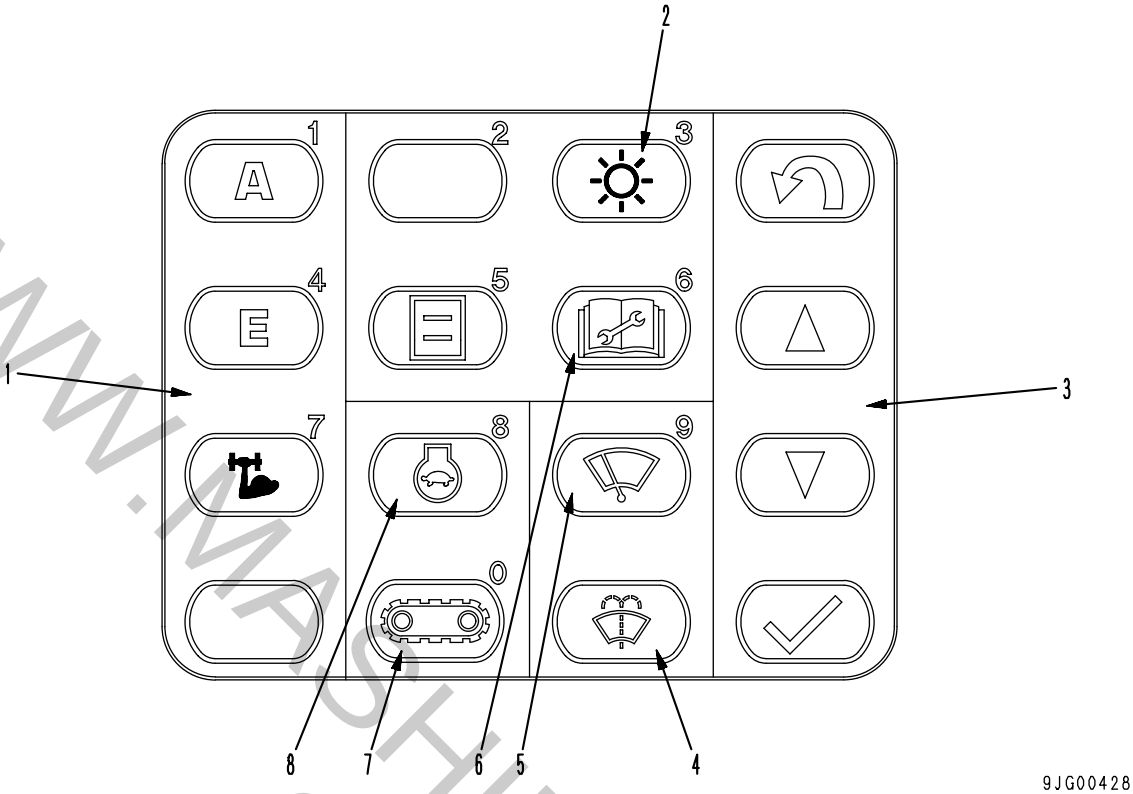
The problems that have occurred are displayed in order from the left.

When the above cautions are displayed, if the hydraulic oil temperature is high or low, only the symbol is displayed.

Condition of hydraulic oil	Color of symbol
Low temperature (below B6 or equivalent)	Black on white background
Normal (B6 – B2)	No display
High temperature (above B2)	White on red background

Display category	Symbol	Display item	Display range	Display method
Monitor	 SJP08781	Wiper	ON → INT → OFF	Displays set condition
	 SJP08782	Working mode	 A, E, P, B SJP09459	Displays set mode
	 SJP08783	Travel speed	 Lo, Hi SJP09460	Displays set speed
	 SJP08784	Auto-decelera-tion	ON ⇔ OFF	Displays actuation status
Service meter	 SJP08785	Service meter indicator	When service meter is working	Lights up when service meter is working

SWITCHES



1. Working mode selector switch
2. Display brightness, contrast adjustment switch
3. Control switch
4. Window washer switch
5. Wiper switch
6. Maintenance switch
7. Travel speed selector switch
8. Auto-deceleration switch

- **Working mode selector switch**
  The condition of the machine changes according to the switch that is pressed (Shown in the figure at right). It is possible to check the condition on the working mode monitor display. The relationship between each working mode and the monitor display is shown in the table on the right.

Switch that is pressed	Display	Working mode status after setting
[A]	A	A mode (default)
[E]	E	E mode
 SJP09461	 SJP09461	Heavy-lift mode

- **Maintenance switch**
  Check the condition of the maintenance items. (For details, see MAINTENANCE FUNCTION.)

- **Auto-deceleration switch**
  Each time the auto-deceleration switch is pressed, the auto-deceleration function is switched ON/OFF.
  Use the auto-deceleration monitor display to check the present condition.
  When the working mode switch is operated to switch the working mode, it is automatically set to ON.

- **Travel speed selector switch**
  Each time the travel speed selector switch is pressed, the travel speed changes.
  Lo → Hi → Lo ……
  Use the travel speed monitor display to check the present condition.
  The relationship between the set speed and the monitor display is shown in the table on the right.

Display	Setting
Crawler symbol + Lo	Low speed (default)
Crawler symbol + Hi	High speed

- **Wiper switch**
  Each time the wiper switch is pressed, the wiper setting changes OFF → INT → ON → OFF → ……
  Use the wiper monitor display to check the present condition.
  The relationship between the wiper setting and the monitor display is as shown in the table on the right.

Display	Setting	Wiper actuation status
None	OFF	Stowing stopped or now stowing
Wiper symbol + INT	INT	Intermittent actuation
Wiper symbol + ON	ON	Continuous actuation

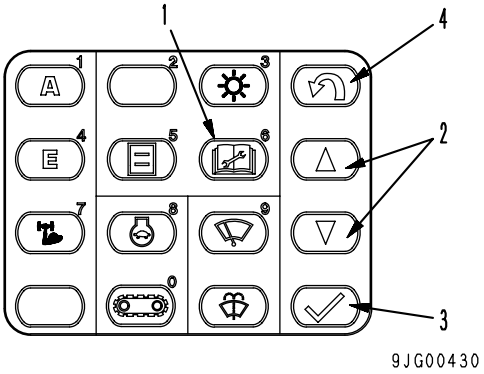
- **Window washer switch**
  While the switch is being pressed, window washer liquid is sprayed out. There is a time delay before the wiper starts.

- **Control switch**
  This is used for control when using the maintenance function or select function.
  (For details, see each function.)

- **Display brightness, contrast adjustment switch**
  Use this switch when adjusting the display brightness and contrast.
  (For details, see each function.)

MAINTENANCE FUNCTION

When the maintenance time for replacement, inspection, or filling has approached for the 10 maintenance items, press maintenance switch (1) and the caution display (yellow or red) appears on the monitor display for 30 seconds after the key is turned ON to remind the operator to carry out lubrication maintenance.



★ Maintenance items

No.	Item	Replacement interval (hours)
01	Engine oil	500
02	Engine oil filter	500
03	Fuel filter	500
04	Hydraulic filter	1,000
05	Hydraulic tank breather	1,000
06	Corrosion resistor	1,000
07	Damper case oil	1,000
08	Final case oil	2,000
09	Machinery case oil	1,000
10	Hydraulic oil	5,000

★ The above replacement intervals are set for each item, and the time remaining to maintenance is reduced as the machine is operated.
The content of the caution display differs according to the ramaining time. The relationship is as shown in the table below.

Display	Condition
None	Remaining time for maintenance for all items is more than 30 hours
Notice display (black symbol displayed on yellow background)	There is one or more items with less than 30 hours remaining time for maintenance
Warning display (wiper symbol displayed on red background)	There is one or more items with less than 0 hours remaining time for maintenance

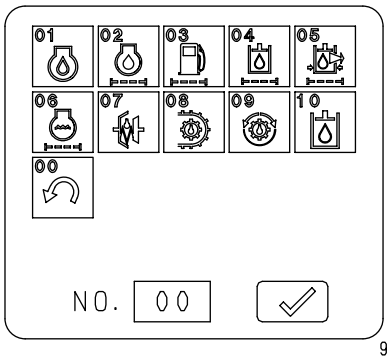
METHOD OF CHECKING STATUS

MAINTENANCE ITEMS

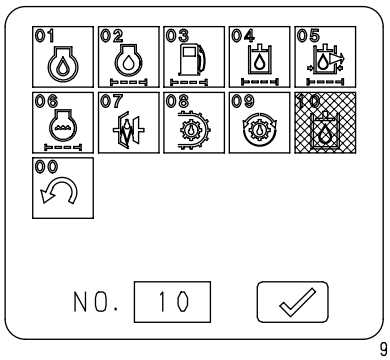
★ Operate as follows when on the operator screen.

1. Press maintenance switch (1) and switch to the maintenance list display screen.
   ★ The maintencance items are displayed as symbols on the screen.

2. Press control switch (2), or use the 10-key pad to input the number (01 – 10, 30, 31) of the maintenance item to select the item.
   ★ The cursor moves and the item is highlighted.
   ★ The display method is the same as described on the previous page (relationship between remaining time and caution display). If the remaining time is less than 30 hours, the item is displayed in yellow, and if it is less than 0 hours, it is displayed in red.



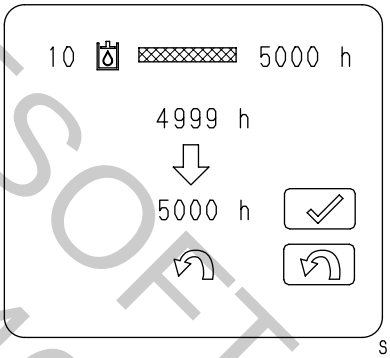
9JG00431



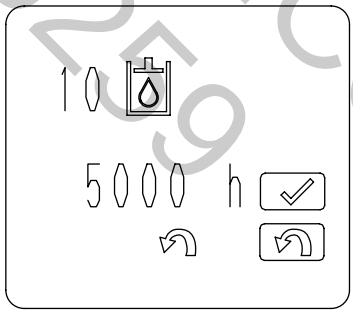
9JG00432

MAINTENANCE OPERATION

1. After completing the selection, press input confirmation switch (3).
   The screen will change to the maintenance reset screen.
2. Use the maintenance reset screen to check the content, and if there is any problem, press input confirmation switch (3) to move to the check screen.
   If the wrong item is selected, press return switch (4) to return to the maintenance list screen.
3. Check the content on the check screen, and if there is no problem, press input confirmation switch (3) to reset the maintenance time.
   After the reset is completed, the screen returns to the maintenance list display screen. To check the remaining time, or if the wrong item is selected, press return switch (4) to return to the maintenance list screen.
   ★ The check screen shows the symbol for the maintenance item and the set time in large letters.
   ★ The background color of the symbol for the item where the maintenance item was reset is the same as the background of the screen, so it is possible to check that it has been reset.



SJP08798



9JH02385

BRIGHTNESS, CONTRAST ADJUSTMENT FUNCTION

This function is used to adjust the brightness and contrast of the display.

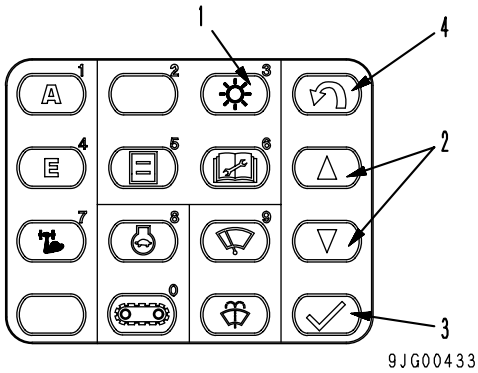
Adjustment method

★ Operate as follows when on the operator screen.

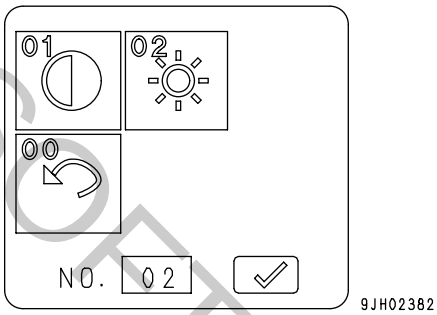
1. Press display brightness/contrast adjustment switch (1) and switch to the adjustment screen.

★ Relationship between menu symbol and content.

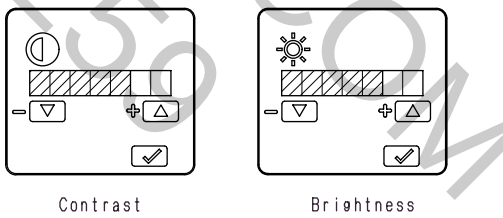
No.	Symbol	Content
00	Return mark	Return
01	SJP08935	Contrast
02	SJP08936	Brightness



2. Press control switch (2), or use the 10-key pad to input the number (00 – 02) to select either contrast or brightness.
   After completing the selection, press input confirmation switch (3) and return to the adjustment screen.
   Then press return switch (4) or use the 10-key pad to set to [00] and press input confirmation switch (3) to return to the normal screen.
3. Press control switch (2) and adjust the brightness and contrast as desired.



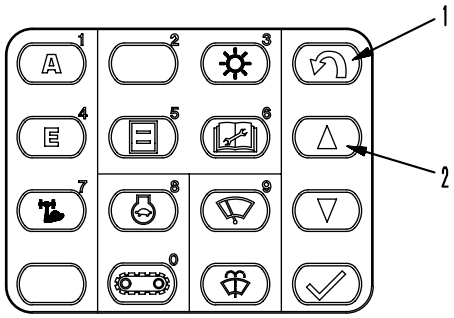
Control switch	Actuation
SJP08933	Flow level bar graph extends to the right
SJP08934	Flow level bar graph retracts to the left



SJP08937

SERVICE METER CHECK FUNCTION

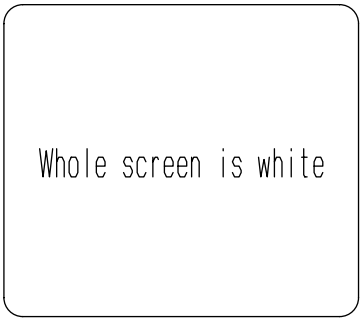
- When the starting switch is at the OFF position, keep return switch (1) and control switch (2) of the monitor pressed at the same time, and the service meter is shown on the display.
- This display is shown only while the two switches are being pressed. When the switches are released, the display goes out.
  Note that it takes 3 – 5 seconds after the switches are pressed for the service meter display to appear.



9JG00434

DISPLAY LCD CHECK FUNCTION

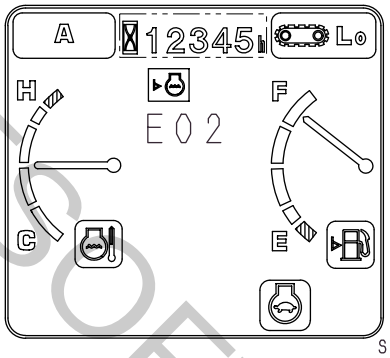
- On the password input screen or on the normal screen, if monitor return switch (1) and working mode (A) switch are kept pressed at the same time, all the LCD display will light up and the whole screen will become white, so the display can be checked.
  If any part of the display is black, the LCD is broken.



SJP08943

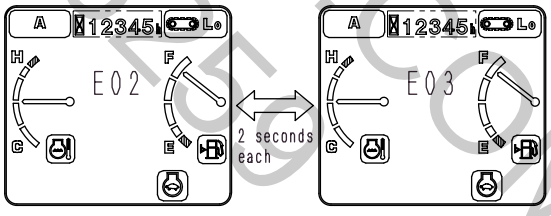
USER CODE DISPLAY FUNCTION

- If there is any problem in operating the machine, the user code is displayed on the monitor to advise the operator of the steps to take.
  This code display appears on the operator screen.
- On the operator screen, the user code is displayed on the portion for the hydraulic oil temperature gauge.



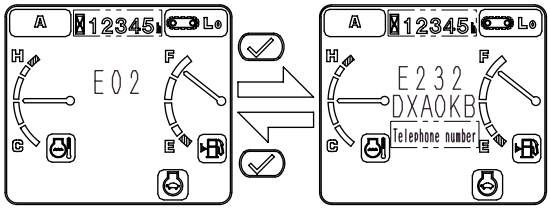
SJP08810

- If more than one user code is generated at the same time, the user codes are displayed in turn for 2 seconds each to display all the user codes.



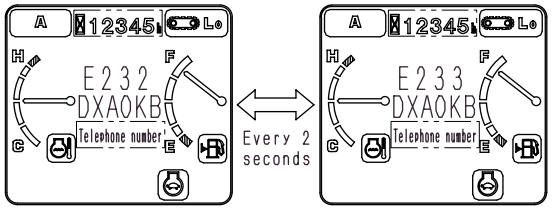
SJP08945

- While the user code is being displayed, if the input cnfirmation switch is pressed, the service code and failure code can be displayed.



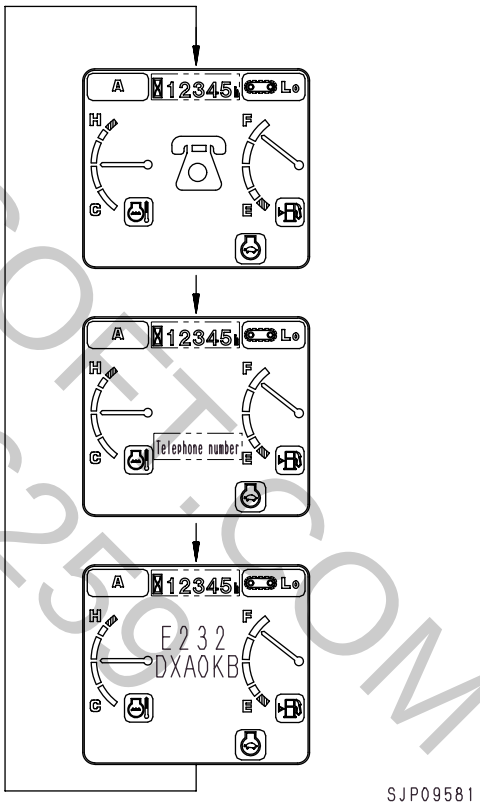
SJP09579

- If there is more than one service code or failure code, the display switchs every 2 seconds and displays all the service codes/failure codes that caused the user code to be displayed.
  Even if service codes/failure codes have occurred, if they did not cause the user code to be displayed, this function does not display them.



SJP09580

- If the telephone number has been set using the telephone number input on the service menu, it is possible to switch on the service code/failure code and display the telephone symbol and telephone number.
  For details of inputting and setting the telephone number, see SPECIAL FUNCTIONS OF MONITOR PANEL in the TESTING AND ADJUSTING section.



SJP09581

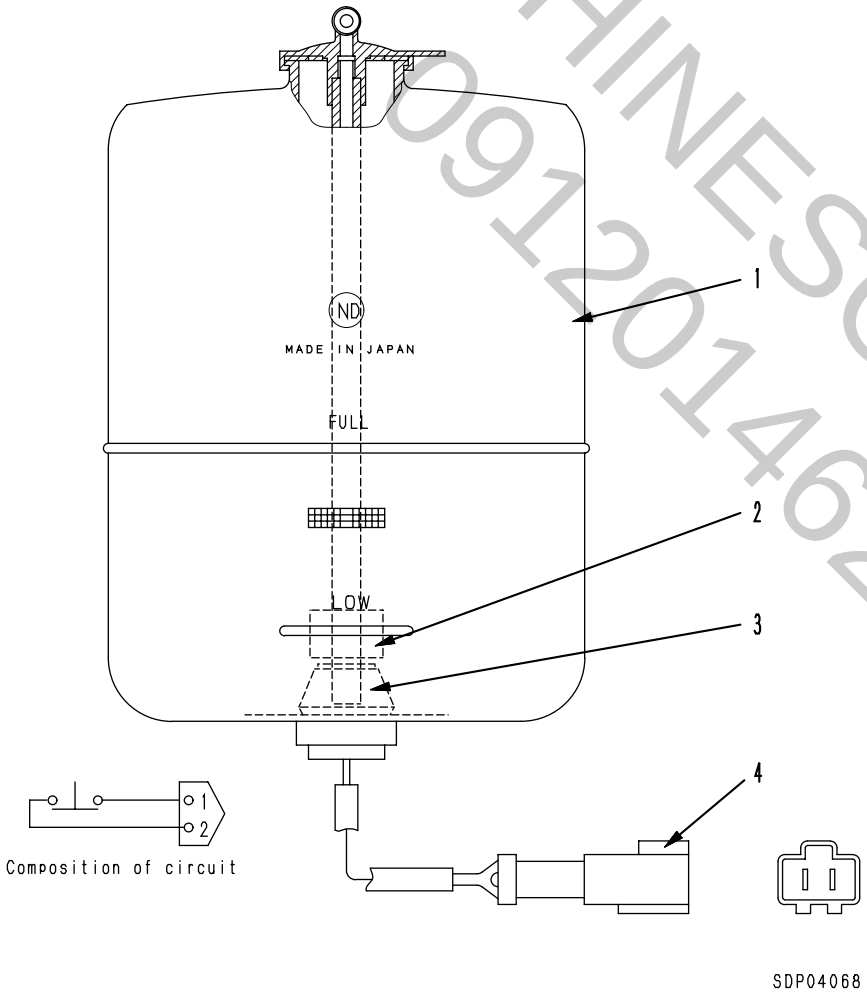
SENSORS

- The signals from the sensors are input directly to the engine controller and the pump controller monitor.

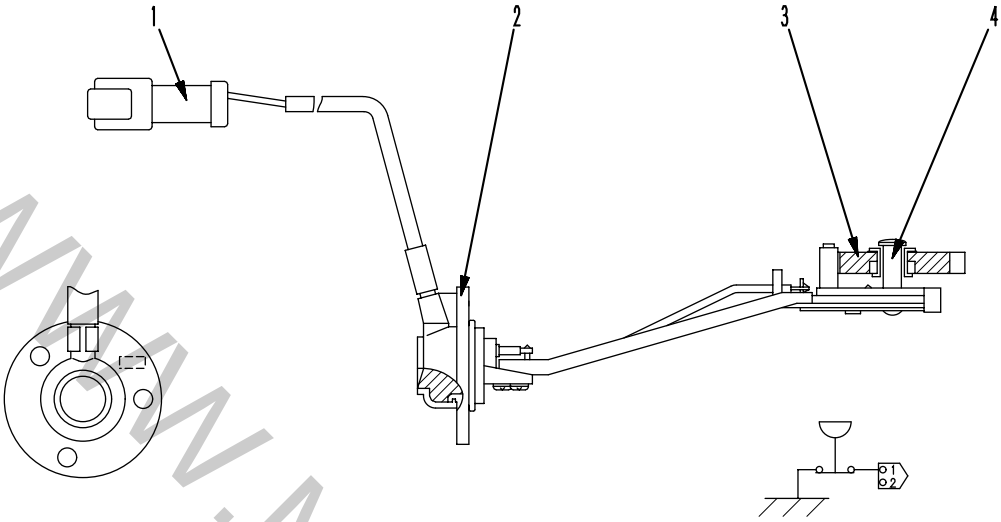
The contact type sensors are always connected at one end to the chassis GND.

Name of sensor	Type of sensor	When normal	When abnormal	Input controller
Coolant level	Contact type	ON (closed)	OFF (open)	Monitor
Engine oil level	Contact type	ON (closed)	OFF (open)	Monitor
Engine oil pressure	Contact type	ON (closed)	OFF (open)	Engine controller
Coolant temperature	Resistance type	—	—	Engine controller
Fuel level	Resistance type	—	—	Monitor
Air cleaner clogging	Contact type	OFF (open)	ON (closed)	Monitor
Hydraulic oil temperature	Resistance type	—	—	Monitor
Main pump oil pressure	Analog	—	—	Pump controller

Coolant level sensor



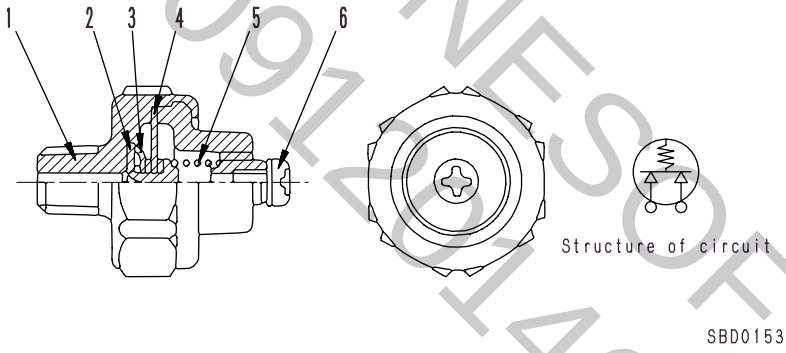
Engine oil level sensor



SJP08349

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

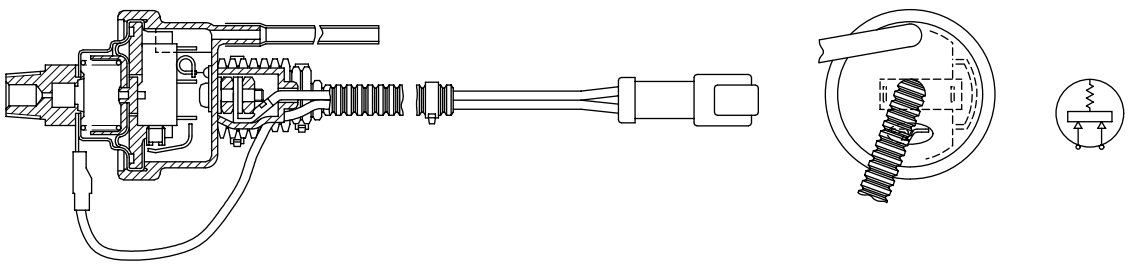
Engine oil pressure sensor



SBD01537

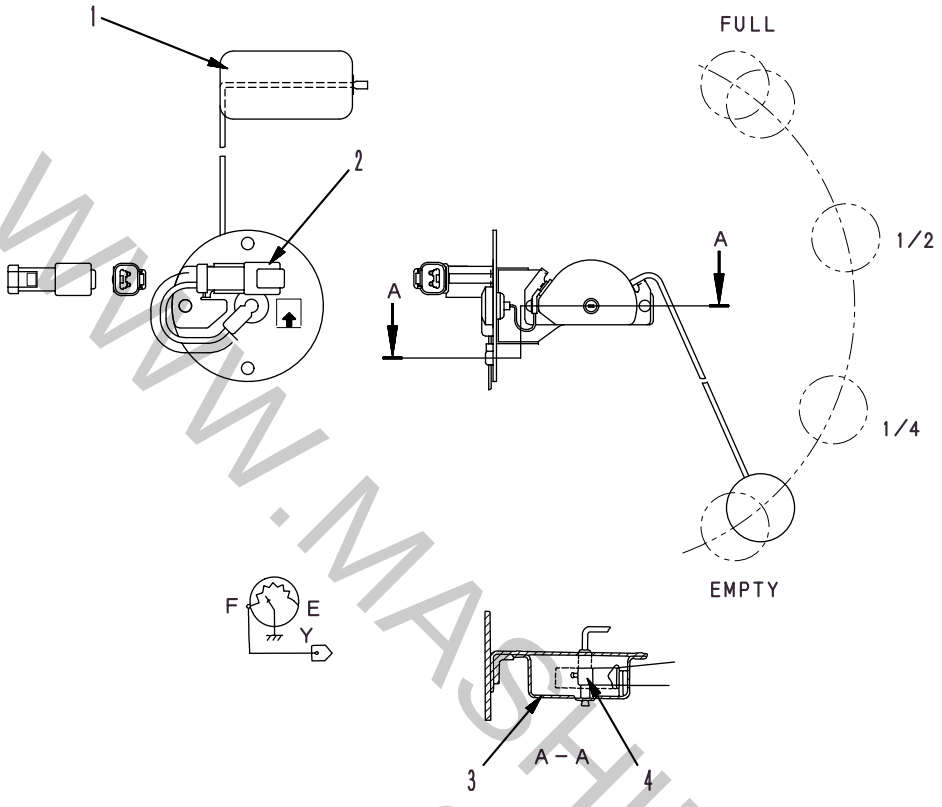
1. Plug
2. Contact ring
3. Contact
4. Diaphragm
5. Spring
6. Terminal

Air cleaner clogging sensor



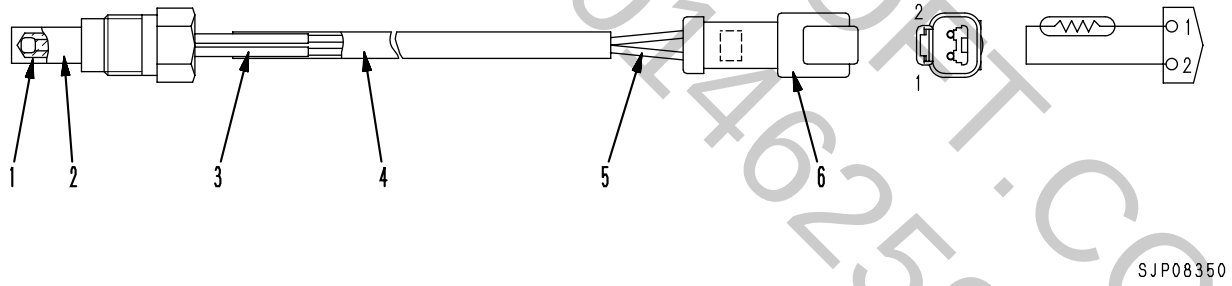
SXP08415

Fuel level sensor



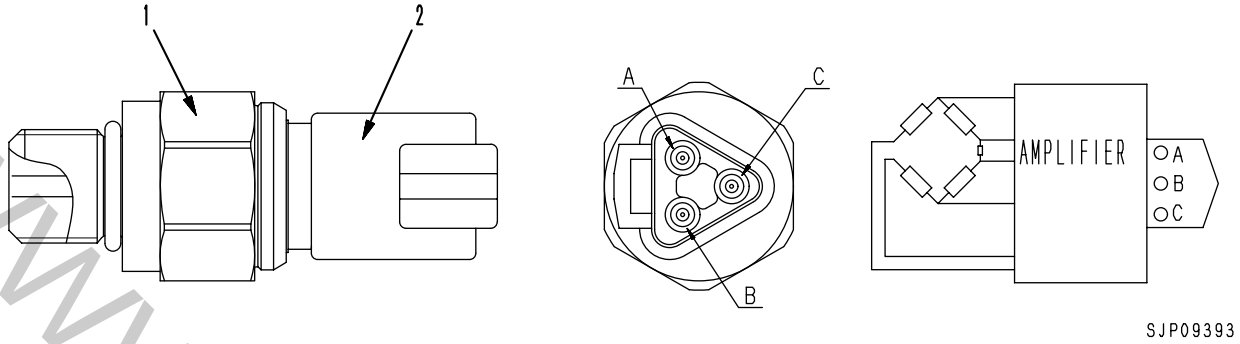
1. Float
2. Connector
3. Cover
4. Variable resistor

Coolant temperature sensor
Hydraulic oil temperature sensor



1. Thermistor
2. Body
3. Tube
4. Tube
5. Wire
6. Connector

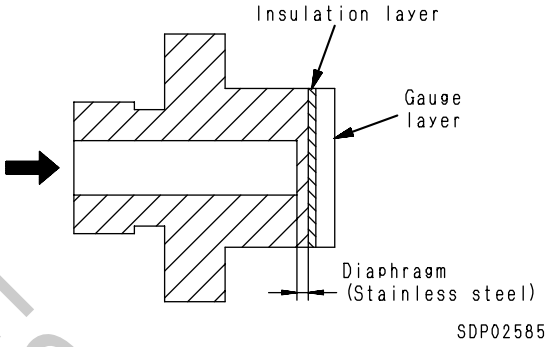
Main pump oil pressure sensor (0 – 49.0 MPa {0 – 500 kg/cm²})



1. Sensor
2. Connector

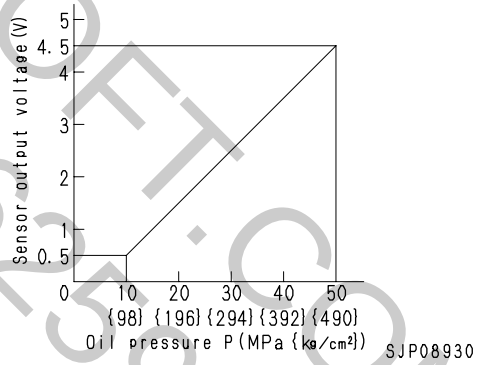
FUNCTION

- The pump pressure sensor is installed to the inlet circuit of the control valve. It converts the pump discharge pressure into a voltage and transmits it to the pump controller.



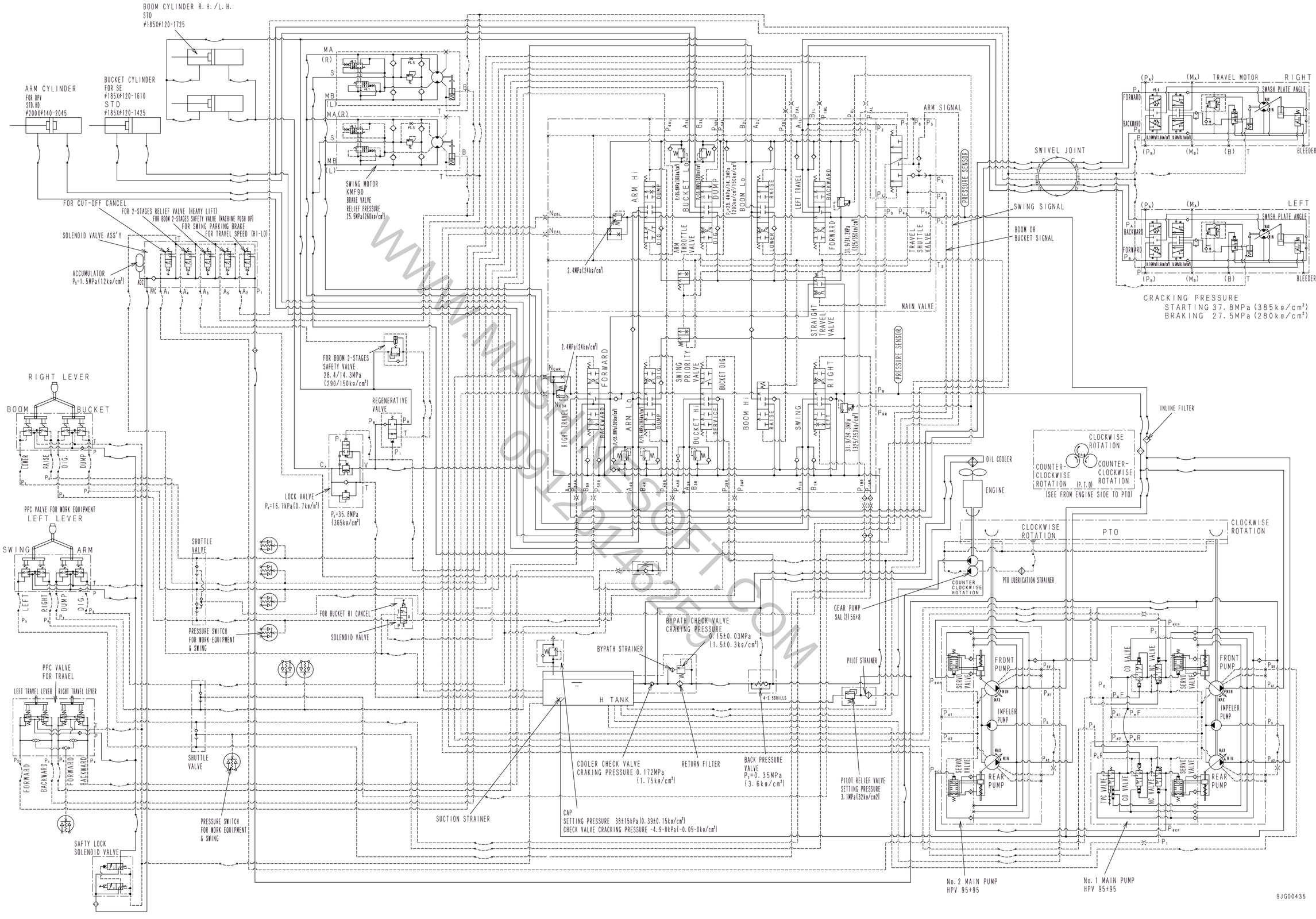
OPERATION

- The oil pressure applied from the pressure intake part presses the diaphragm of the oil pressure sensor, the diaphragm is deformed.
- The gauge layer facing the diaphragm measures the deformation of the diaphragm by the change of its resistance, then converts the change of the resistance into a voltage and transmits it to the amplifier (voltage amplifier).
- The amplifier amplifies the received voltage and transmits it to the and pump controller.
- Relationship between pressure **P** (MPa {kg/cm²}) and output voltage (V) is as follows.
  V = 0.08 {0.008} x P + 0.5

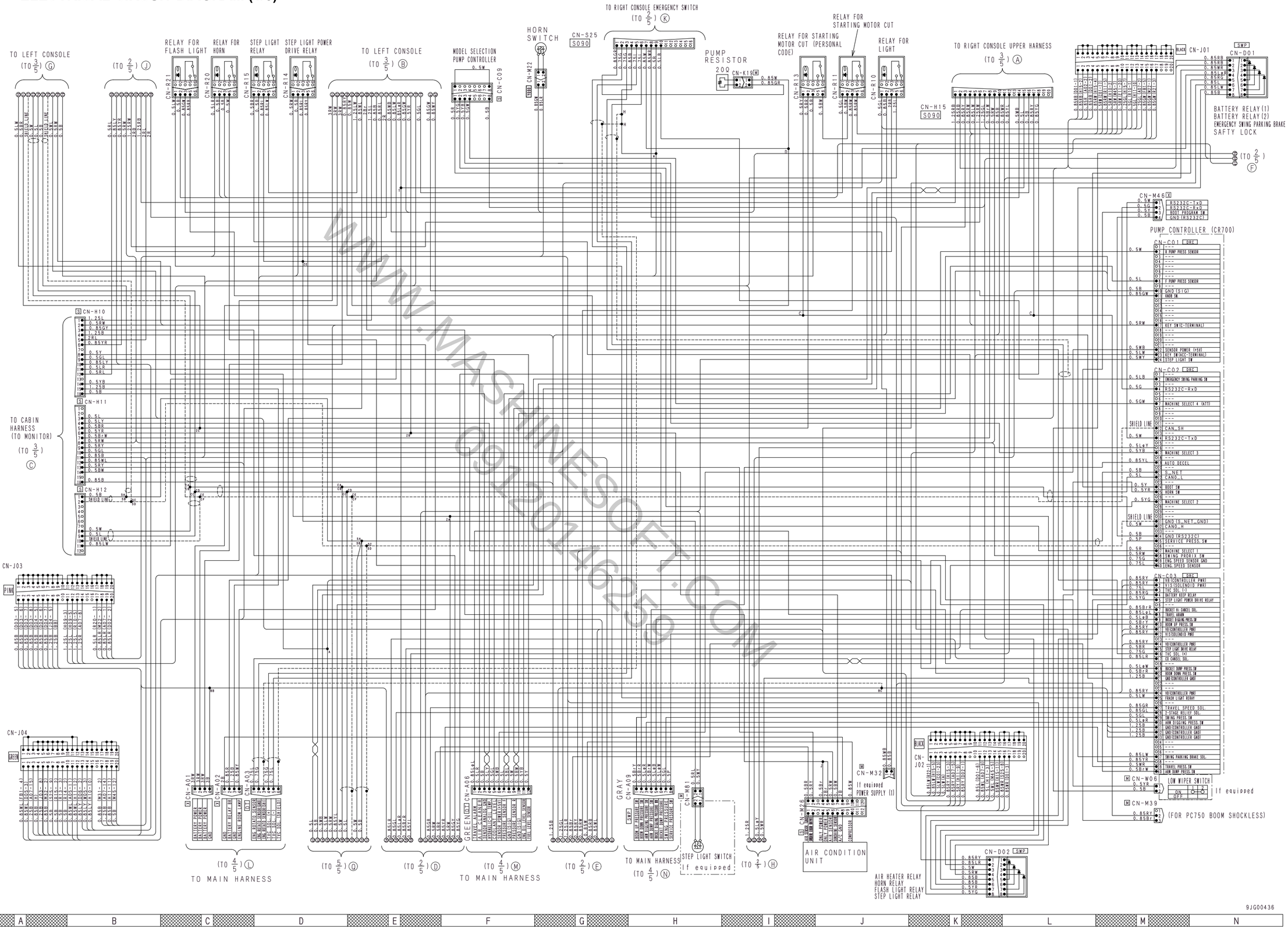


90 OTHERS

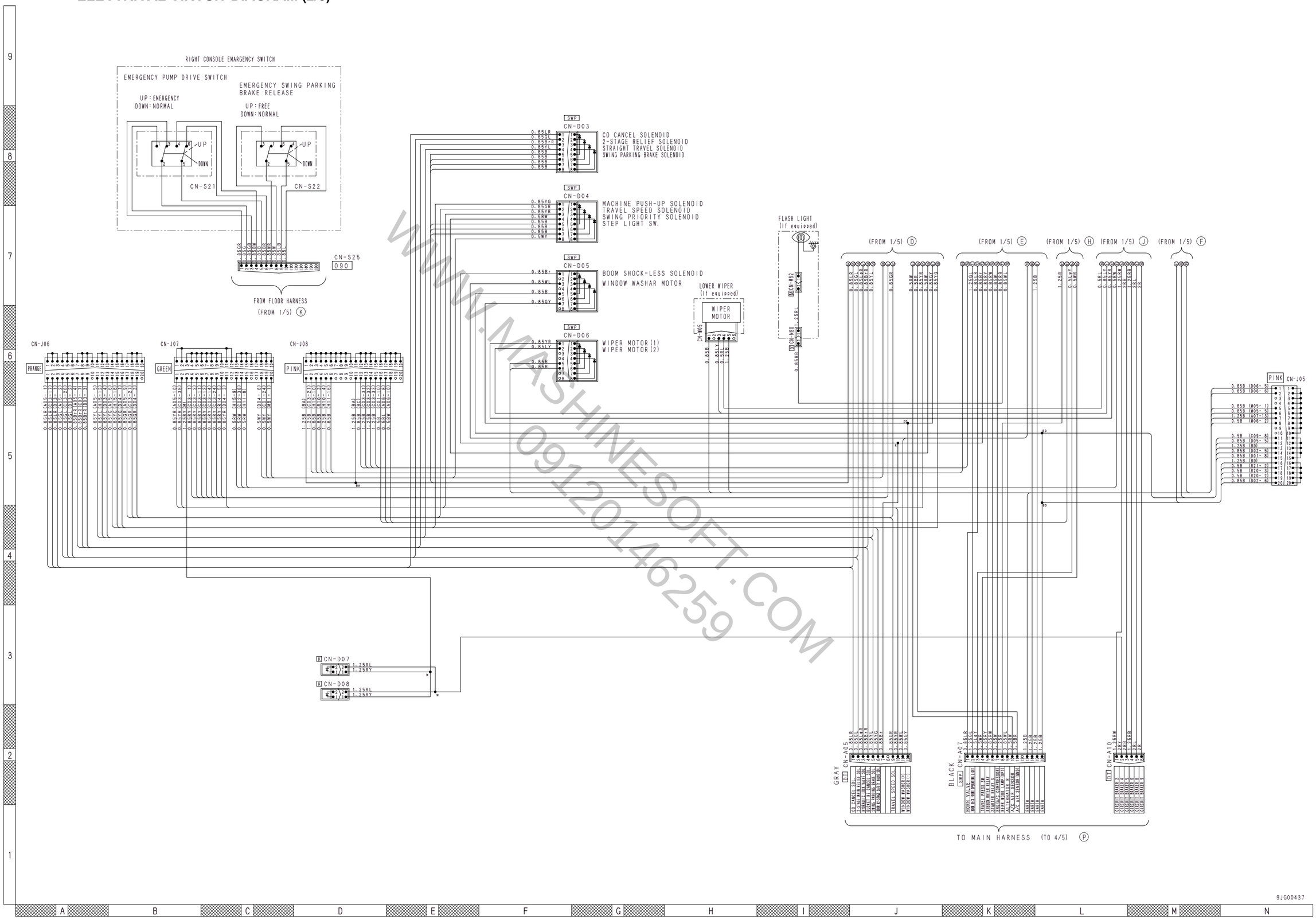
HYDRAULIC CIRCUIT DIAGRAM



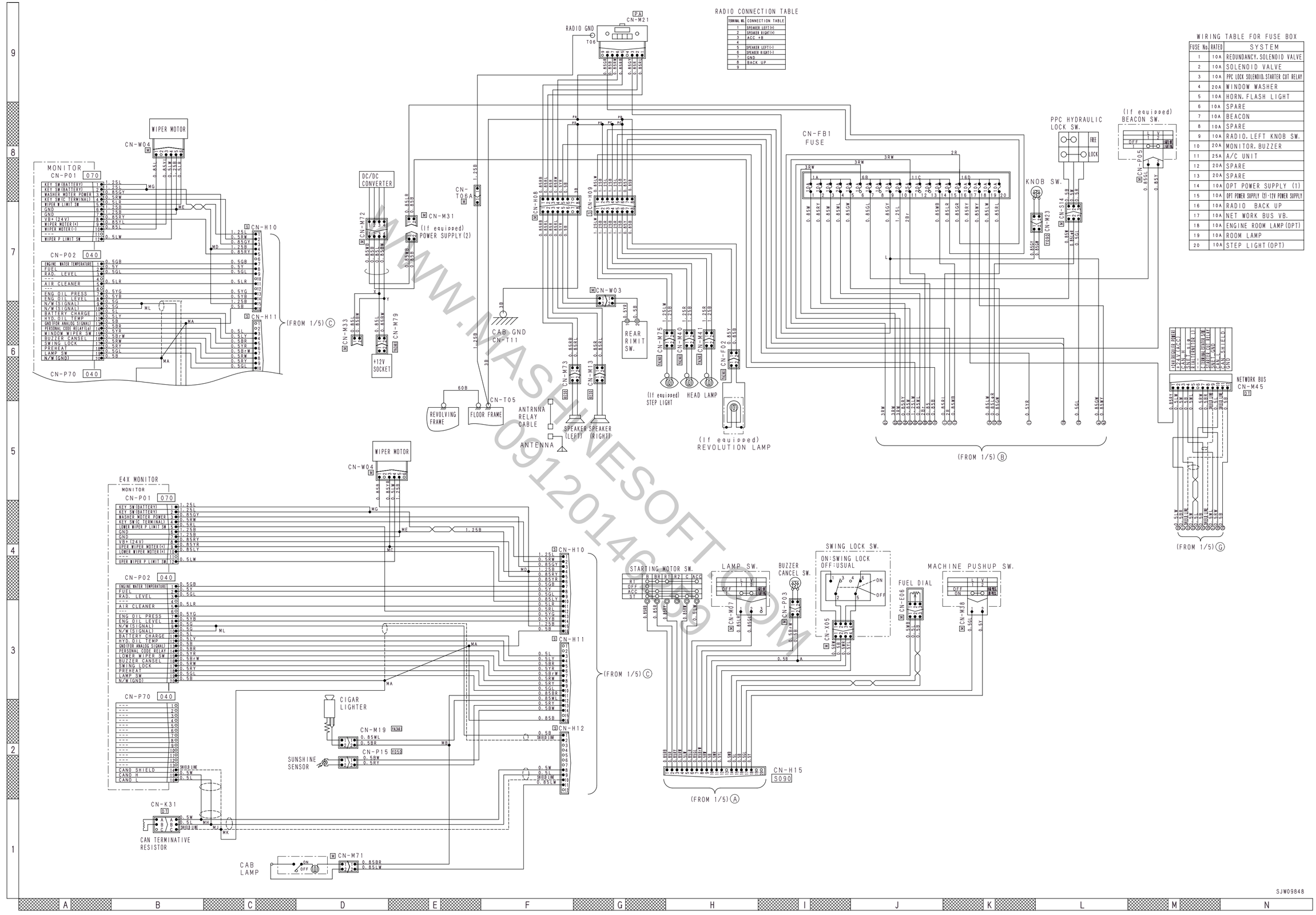
ELECTRICAL CIRCUIT DIAGRAM (1/5)



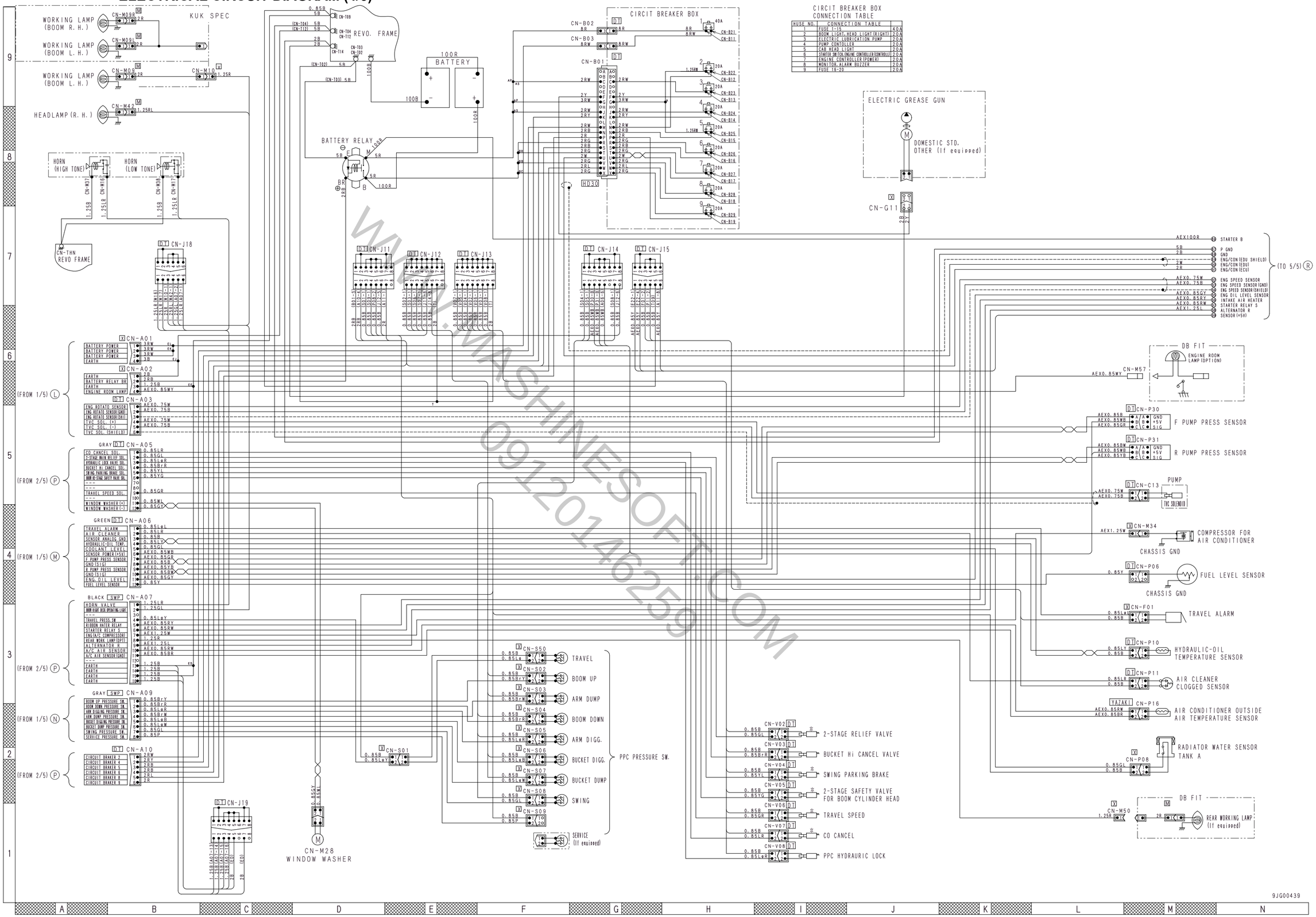
ELECTRICAL CIRCUIT DIAGRAM (2/5)



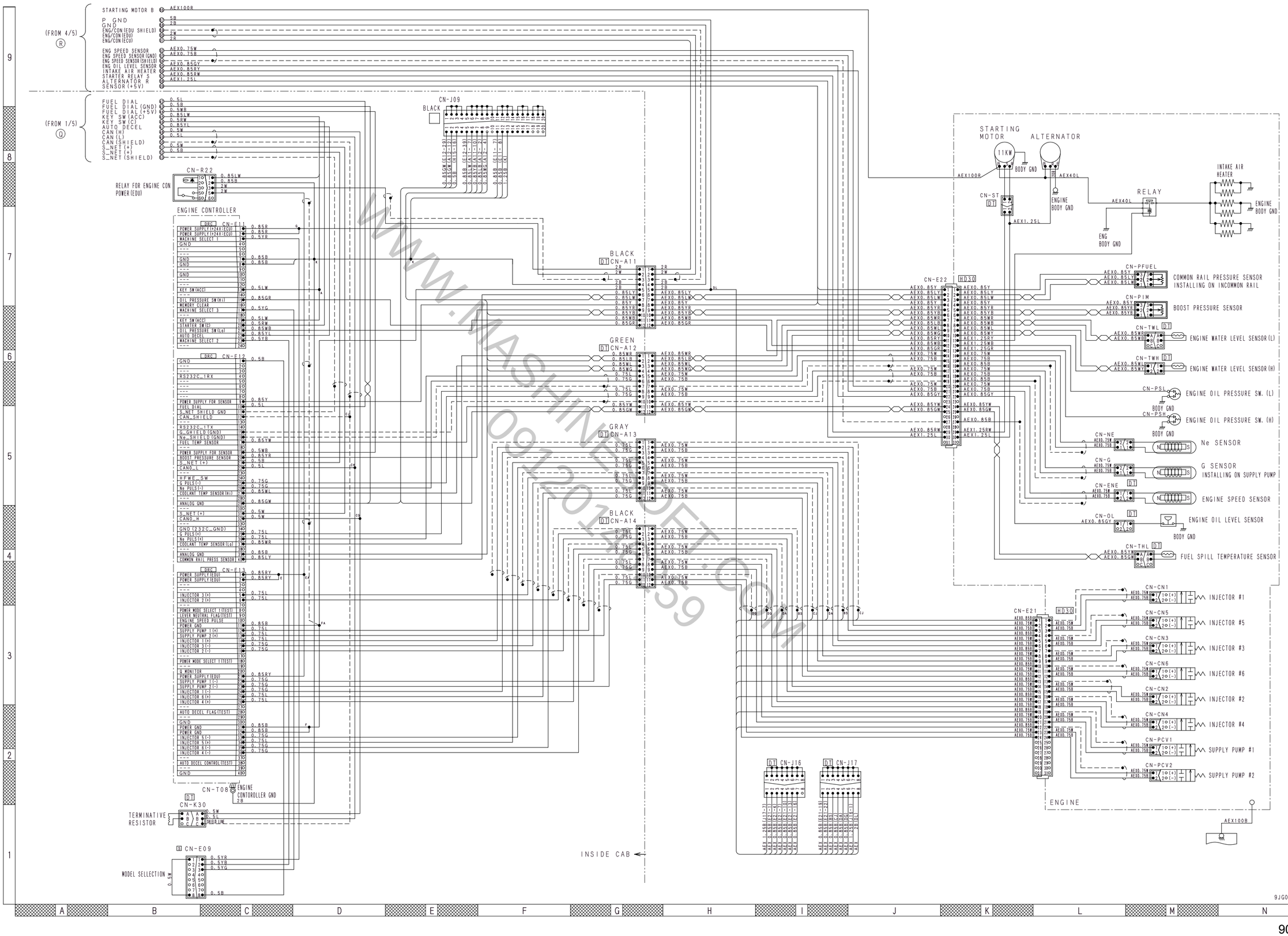
ELECTRICAL CIRCUIT DIAGRAM (3/5)



ELECTRICAL CIRCUIT DIAGRAM (4/5)



ELECTRICAL CIRCUIT DIAGRAM (5/5)



ELECTRICAL CIRCUIT FOR AIR CONDITIONER