Service Guide for 25V4

MINI EXCAVATOR

IHI

- This service guide covers check, adjustment, and maintenance of main parts on this machine.
- Chapter A describes the necessary numeric values and information for maintenance covered throughout the manual.
- Chapter B describes measurement, maintenance, adjustment required for troubleshooting and check.
- Chapter C describes installation of optional features and other items.
- For engine check, adjustment, and maintenance, please refer to the separate "Engine Maintenance Manual".

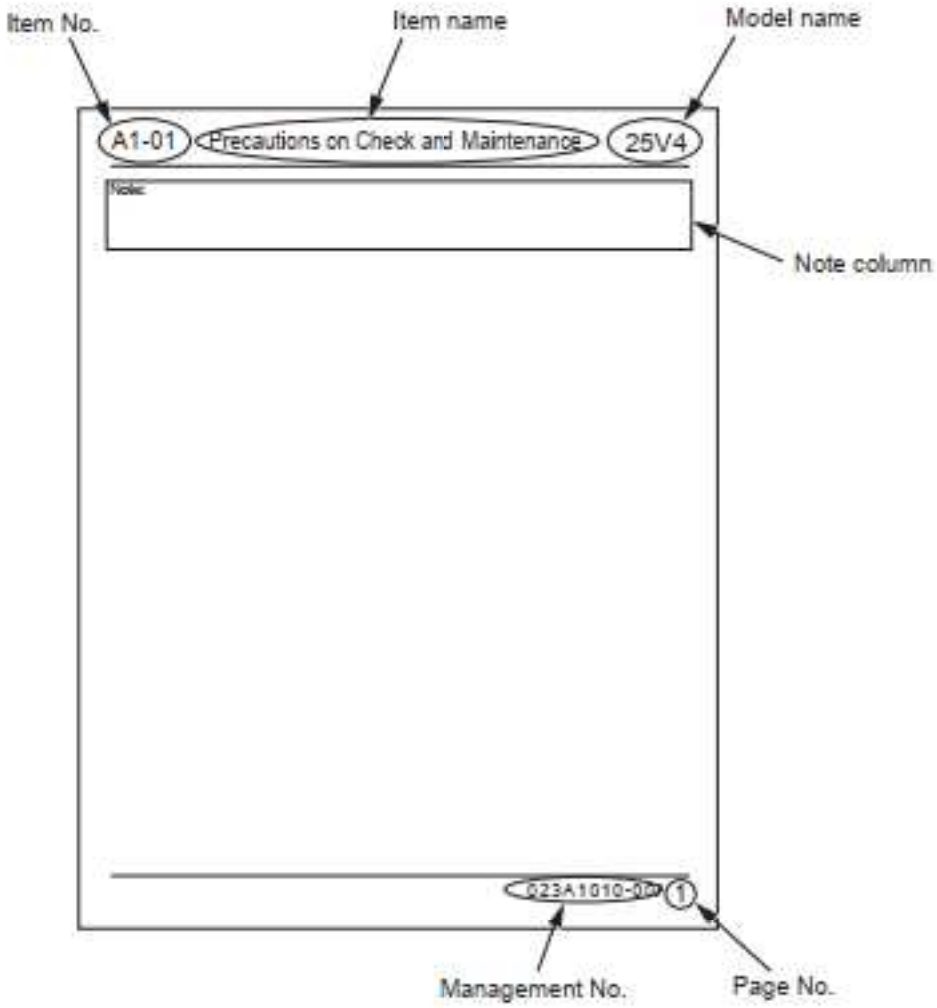
⚠ CAUTION

- Audience of this manual is those who have basic skills and knowledge on hydraulic shovels. Other people without such skills and knowledge may not be able to achieve maintenance according to this manual.
- It is prohibited to transfer or sell this manual to any third party or prepare copies.

How to Use This Manual

This document uses a form of loose-leaf to support machine improvements and maintenance techniques that evolve day by day. Sequential issue of revisions and additional items allows for always providing the latest maintenance information.

Page Organization



Item No.: A1-01*

Chapter – Section – Sequential No. – Variation of the item (None for the first, then A, B, C...)

Management No.: 023A1010-00

Model – Chapter – Section – Item no. – Variation of the item (0 for the first, then A, B, C...) – Revision number of the item

Page No.: Page for each item

Note column: The applicable machine number, specifications, and other precautions are entered. It is provided on the first page only as required.

How to Issue Revisions/Additions

For this manual, additions/revisions are issued for each item.

Revisions are limited to the cases below.

- Correction of incorrect characters, sentences, contents, etc.
- Addition to description, etc.

If description or instructions do not match the work contents as a result of design changes, new items are additionally issued.
In this case, the original item is followed by A, B, C... as a sequential code for easy understanding.
The target machine number, specifications, etc. are entered in the Note column.

For items in and after Contents, a revision of Contents will be issued for both revision and addition. As a result, you can check the latest manual by viewing Contents.
For whether Contents are the latest version, advise with Customer Support Department, Documents Group about the revision number of the Contents management number.

Contents management number 0 2 3 0 0 0 0 0 - 0 0
↑
Revision No.

Note: Oct. 24, 2014 B2-16 is deleted because of error in writing. B3-01 and B3-02 are added.

A1 General Information

■ **Understand the check/maintenance method!**

Before starting check/maintenance, read and understand "Check/Maintenance Section" carefully. Paying attention to safety, perform check/maintenance.

■ **Do not perform maintenance for the moving machine.**

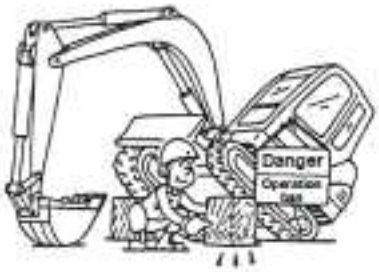
To prevent from being crushed or caught, lower the bucket on the ground and stop the engine. If the work is required inevitably, keep full contact with the operator.

■ **Perform check/maintenance on a flat ground.**

If the machine is operated on a slope, turn and running may be activated by the dead weight and personnel may be caught. On a rigid and flat ground, lower the working devices such as bucket on the ground.

■ **Maintenance under the machine**

Simple jack-up of the working machine may cause the main body to catch personal body. Use supports and blocks under the crawler to secure the space.

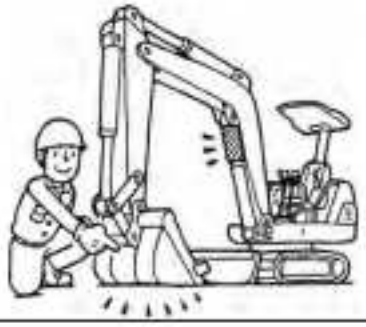


■ **Indication of check/maintenance**

Post a "Check/maintenance" warning plate on a visible position of the door or operating lever so that other people will not touch the machine inadvertently.

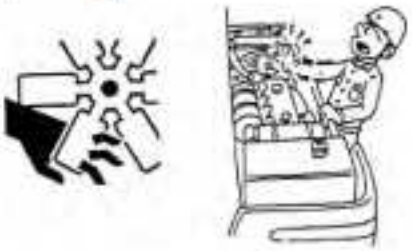
■ **Holding the working machine**

Removal of the hydraulic hose or pin removal for repair while the working machine is up may result in a dangerous state such as oil jetting out or fall of the working machine. Be sure to lower the working machine on the ground or support the machine with safety supports or blocks.



■ **Do not perform maintenance while the engine is running.**

Touching the rotating or moving part such as the fan belt may catch or cut personal body. Be sure to stop the engine.

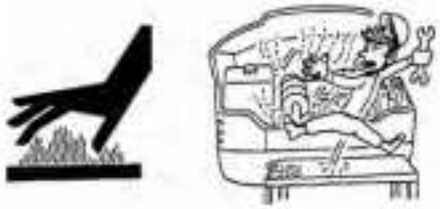


■ **Relieve the internal pressure from the hydraulic system before maintenance.**

If the pipe or hose is removed without removing the internal pressure from the hydraulic system, the pressurized oil may jet out. Before starting the work, relieve the internal pressure.

■ **The engine is hot after the machine stops.**

Do not touch the engine or muffler immediately after the machine stops. Each part is hot and therefore a burn may be caused. After each part is cooled down, start check/maintenance.



■ **Precautions on shoe tension adjustment**

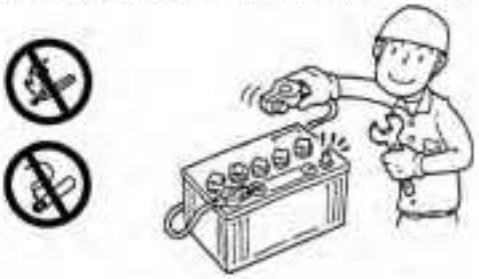
- Since a high pressure is provided in the shoe adjusting device, grease or valve may jet out of the supply port and this is dangerous unless the maintenance procedure is followed.
- When loosening the shoe tension, do not put your face, hand, leg, or body in front of the valve.

■ **Do not open the radiator cap when it is hot.**

If the cap is removed when the radiator water temperature is high, hot steam may jet out and a burn may be caused. Therefore, do not open the cap. After the water temperature drops, loosen the radiator cap slowly to reduce the pressure.

■ **Handling of battery, etc.**

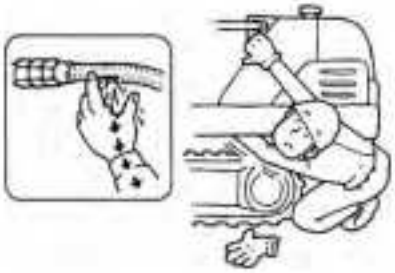
- Before maintenance of the electrical system or welding, remove the (-) terminal of the battery.



- The battery generates combustible gas and ignition/explosion may be caused. Since diluted sulfuric acid is used as the battery liquid, special care must be taken to handling.

■ **Precautions on high-pressure oil**

High-pressure jetted out oil sticking on your skin or coming in your eyes is dangerous.



If the oil sticks to your skin, medical treatment is required immediately.

■ **Precautions on fire**

- Do not put fire close upon fuel refilling.
- Stop the engine before fuel refilling.
- Do not put fire close when you are using light oil for washing parts.

■ **Use of protectors**

During the grinding work or pin or tooth removal work, chips may come in your eyes and injury may be caused. Wear the protection glasses and protection helmet for the work.

■ **Precautions on maintenance at a high place**

- Do not climb on the boom of the working machine because the step position is bad and you may fall.
- Use the stepladder, stool, etc. for the work.

■ **Time of check/maintenance**

For the time of check/maintenance, perform maintenance according to the time read from the hour-meter.

If any failure is found in daily check, etc., make a repair immediately.

This manual indicates the check/maintenance time in the normal running state.

For a bad work environment or severe running, perform check/maintenance earlier.

■ **Use genuine parts.**

For replaceable parts and oils/greases to be used, be sure to use genuine parts.

Use oils and greases with viscosity matching the air temperature.

■ **Perform important check/maintenance at a Sales and Services Shop.**

Ask the Sales and Services Shop for the work requiring professional knowledge and skills such as replacement of electronic parts (e.g. controller) or oil pressure adjustment.

■ **Wash the machine and then perform check/maintenance.**

Wash the machine cleanly and then perform check/maintenance.

Particularly, clean the pipe joint, grease nipple, and oil supply port and avoid entry of dust.

■ **Precautions on car washing**

Do not put water on electrical parts upon car washing.

- Monitor and electrical parts in the operator cab
- Do not apply steam, etc. directly to the battery, connectors, and sensors.

■ **Be careful of entry of water and dust.**

- Use the clean oil, grease, and container.
- Do not refill with the fuel by removing the strainer from the fuel supply port.
- Refill with or replace the oil in a dust-free place to avoid dust entry.

■ **Disassembly of electronic parts prohibited**

Never disassemble electronic parts (e.g. controller).

■ **Precautions on repair by welding**

- Turn the power off. (Disconnect the battery ⊖ terminal.)
- If electronic parts such as the controller have been installed, remove them.
- Do not put a seal or bearing between the part to be welded and grounding.
- Avoid installing the grounding wire on the pin or hydraulic cylinder of the working machine. The best way is to provide the grounding wire on or near the material to be welded.

If the air temperature drops, a starting trouble or freezing of the coolant may occur. Prepare for the cold season as described below.

■ Fuel

In winter season, the fuel may be frozen and starting the engine may be difficult in cold districts. Use the fuel (light oil) matching the air temperature.

Light oil freezing temperature (according to JIS K2204)

Type of light oil	Freezing temperature	Remarks
No.1	-5°C or lower	General use
No.2	-10°C or lower	
No.3	-20°C or lower	Cold districts
Special No.3	-30°C or lower	

■ Coolant

This machine is shipped from the factory by mixing the long-life coolant (LLC) upon shipping (Density: 50%). The freezing temperature is -35°C.

Replace the long-life coolant every 2 years (in autumn of the second year).

■ Lubrication oils/greases

Replace the engine oil and hydraulic oil with the ones with viscosity matching the outer air temperature. For the specified viscosity, see "A2-07 Oil/Grease, Fuel, Coolant".

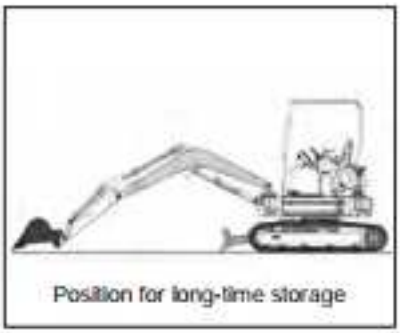
■ Battery

In the cold season, the current discharged at the start is high and the battery capability is degraded. In the state close to discharge, the battery liquid may be frozen. Set the state close to fully charged and pay attention to heat insulation for starting in the next morning. Refill with the distilled water immediately before starting to avoid freezing.

■ Post-work precautions

- To prevent the hydraulic cylinder rod seal from being damaged, remove mud and water from the cylinder rod.
- To prevent chassis parts from being frozen, park the vehicle on a dry, rigid ground or on plates put on the ground.
- To prevent the fuel from being frozen, drain away water from the water sedimentor.

⚠ IMPORTANT **During long-time storage, keep the position as shown at right to prevent rust from being generated on the cylinder rod.**



Position for long-time storage

■ **Before storage**

- Wash/clean each part.
- Supply oil/grease or replace oil for each part.
- Coat grease on the exposed part of the hydraulic cylinder piston rod.
- Store the machine indoors. If the machine is inevitably being left outdoors, select a well-draining, well-ventilated place with less moisture. Put plates on the ground and cover the machine with vinyl sheet, etc.
- Remove the battery, charge it fully, and store it or remove the minus terminal.

■ **During storage**

⚠ CAUTION

If rust-preventive operation is inevitably being performed indoors, open windows and entrances for ventilation to prevent gas poisoning.

- While the machine stops for a long time, run a series of operations including traveling, swing, and working machine motions at a low speed after warming up once a month for rust prevention and lubrication.
- Before running the working machine, wipe off the grease coated on the hydraulic cylinder rod.

■ **After storage**

- Supply oil/grease to each part. Check the coolant volume and refill with the coolant if necessary.
- Wipe off the grease coated on the hydraulic cylinder rod.
- After the engine is started, repeat operations of traveling, swing, and working machine operation several times after warming up for idling of each part.

Units used in this document comply with the SI Units.

• What is SI Units?

SI is an abbreviation of **Système International d'Unites** in French representing the International Unit System, which was established to unify various unit systems used by countries internationally.

Basically, this is an extension of "metric units" that have been used in Japan, etc.

As one of main features, the units of "mass" and "force" that have been used identically are explicitly distinguished from each other and the unit of "force" is N (Newton).

The "weight" represented in the SI Units is "mass" multiplied by "standard gravity acceleration" and its concept is different from that of "weight" that has been idiomatically used.

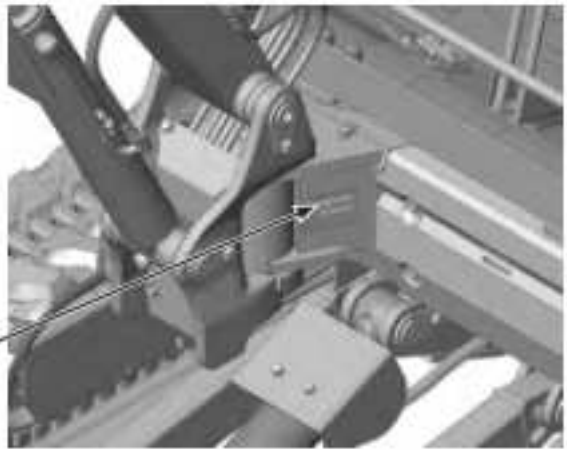
Volume name	Measuring unit	Remarks
Mass	kg	For the machine mass, running mass, etc. kg is used. For the rated total load list for the crane work, t is used.
Force (tensile force, compressive force, load, etc)	N	1 kgf = 9.80665 N For the excavating force and traction force, kN is used. The width for rounding is 5 or 10 N
Torque/bending moment	N·m	1 kg·m = 9.80665 N·m Tightening torques for bolts, etc. are included. The width for rounding is 5 or 10 N·m.
Stress/strength	MPa	1 kgf/mm^2 = 9.80665 MPa The width for rounding is 5 or 10 MPa.
Pressure	MPa	1 kg/cm^2 = 0.0980665 MPa The hydraulic pressure is represented in MPa, and the grounding pressure in kPa. The value is rounded to the first place below decimal point.
Charpy impact strength	J/cm^2	1 kgf·m/cm^2 = 9.80665 J/cm^2 Rounded to an integer.
Output	kW	1PS = 0.7355 kW Rounded to an integer.
Heat quantity	J	1cal = 4.18605 J Rounded to an integer.
Dynamic viscosity	cm^2/s	1 St = 1 cm^2/s
Rotation speed	min^{-1}	For the turn speed and engine rotation speed, min^{-1} is used.
Length	μm, mm, m, km	For machine dimensions, mm is used. For the crane working radius, m is used. For the boom length, m is used.
Area	mm^2, cm^2, m^2	
Volume	mm^3, cm^3, L, m^3	For the volume of water and oils, L is used (i.e. l (el) is hard to distinguish from 1 (one)). For the engine exhaust volume, mL is used. For the bucket capacity, m^3 is used.
Angle	°	
Time	s, min, h	

A2 Machine Body Information

- The check/maintenance method and parts may vary depending on the time of manufacture.
- Before the start of maintenance or order placement of parts, be sure to confirm the serial number.
- Serial numbers of this machine and the engine are marked on the positions shown below.

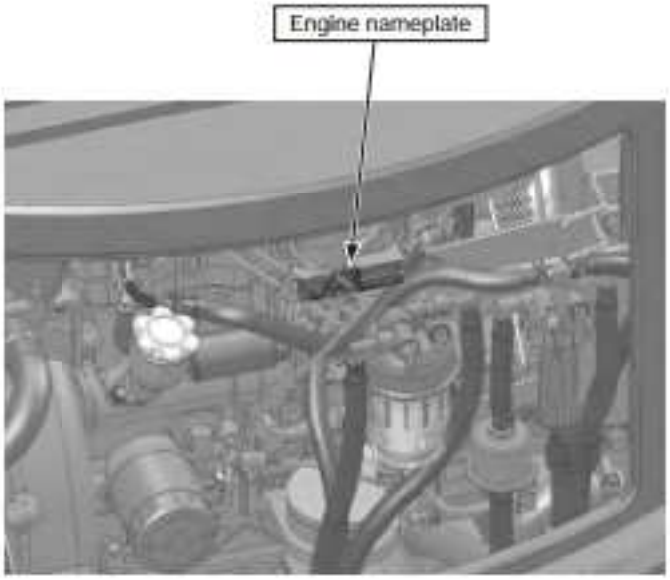
This machine

On "Complete machine marking plate", the model and serial number are punched.



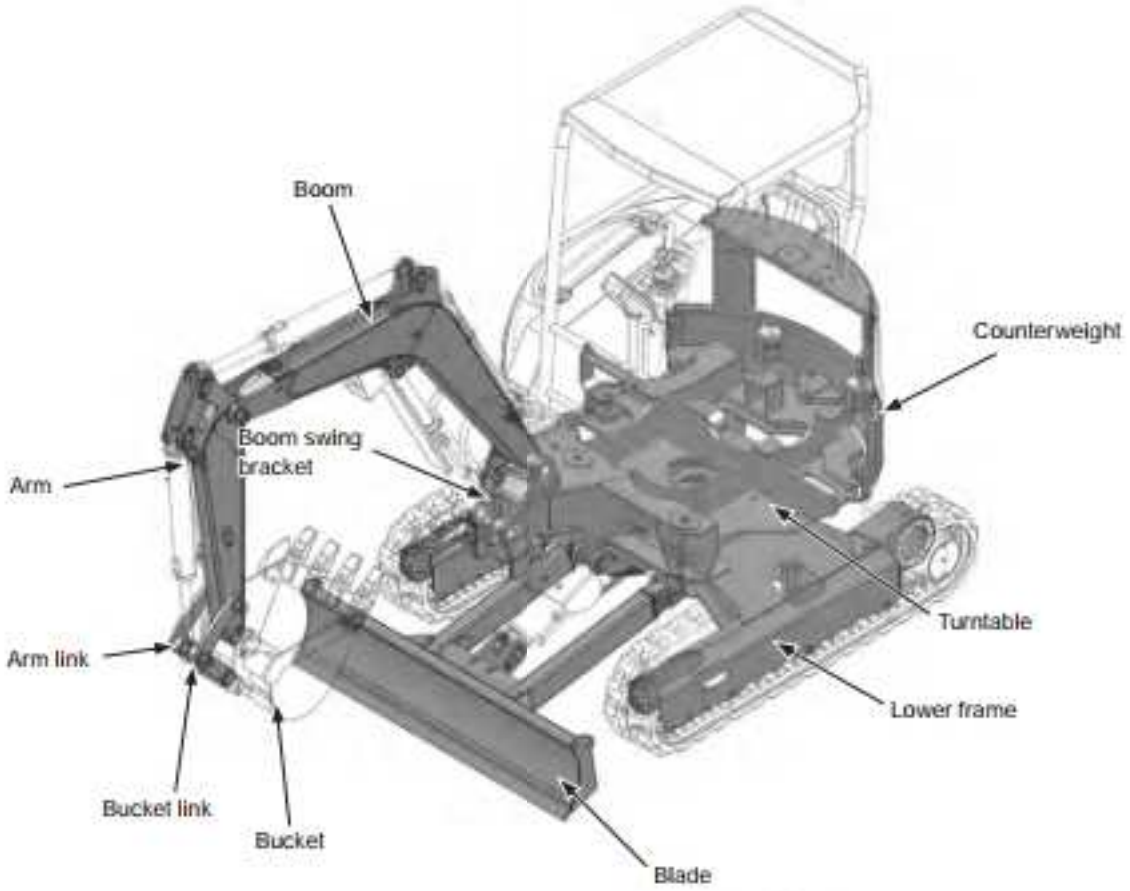
Engine

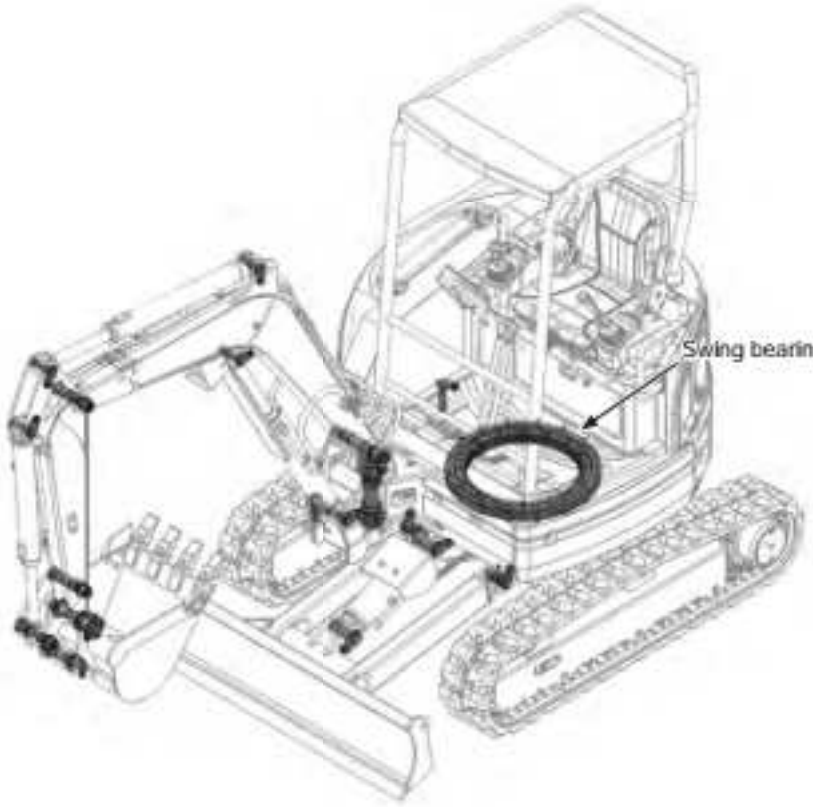
On "Engine nameplate", the model and engine serial number are punched.



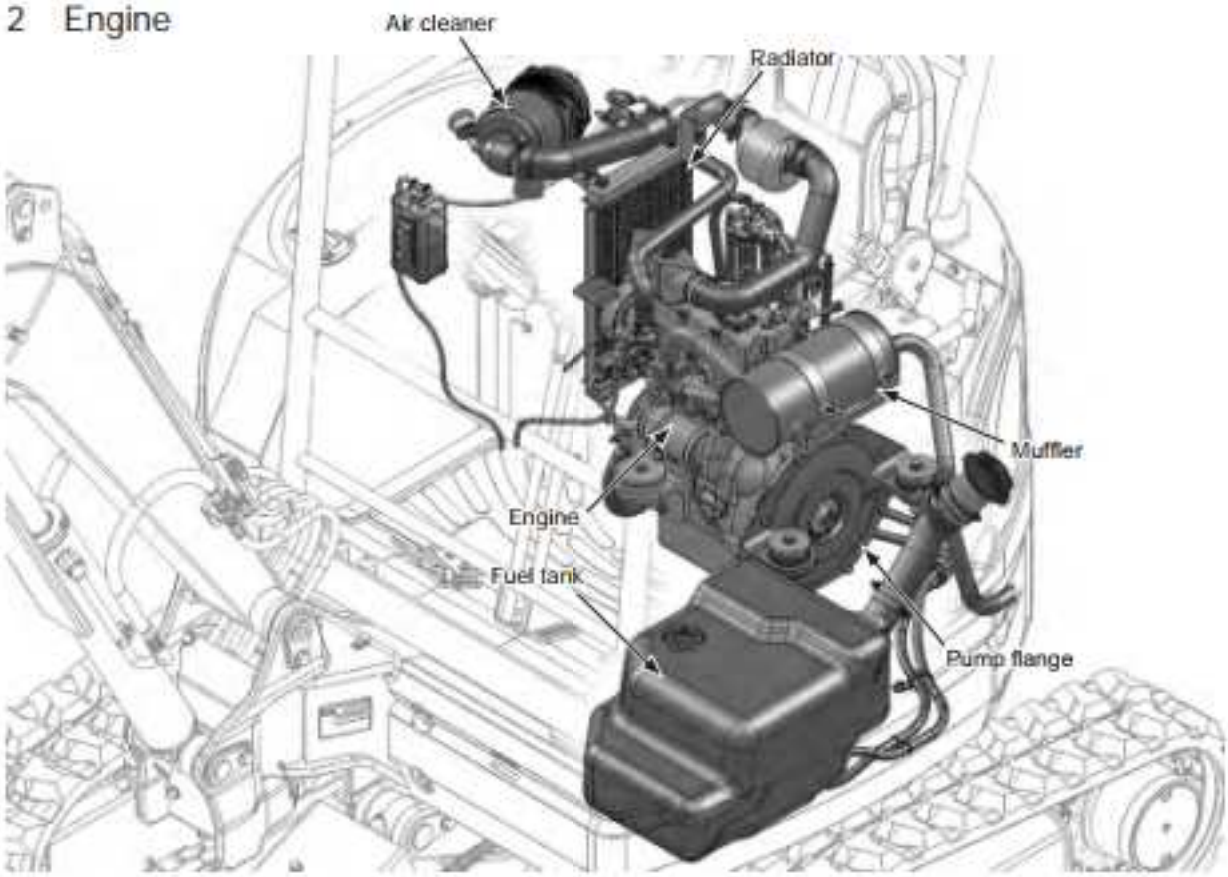
Contents

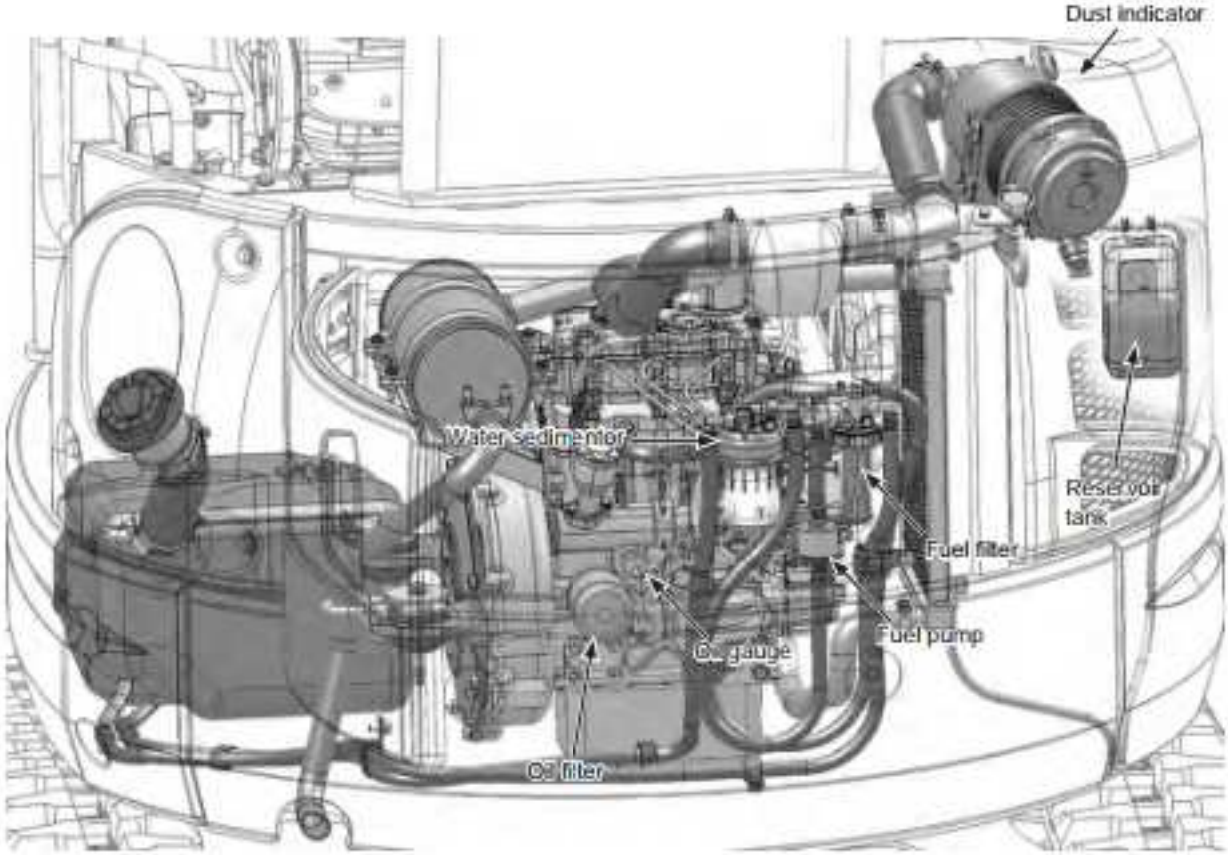
1 Frame


Boom
Counterweight
Boom swing bracket
Arm
Turntable
Arm link
Lower frame
Bucket link
Bucket
Blade

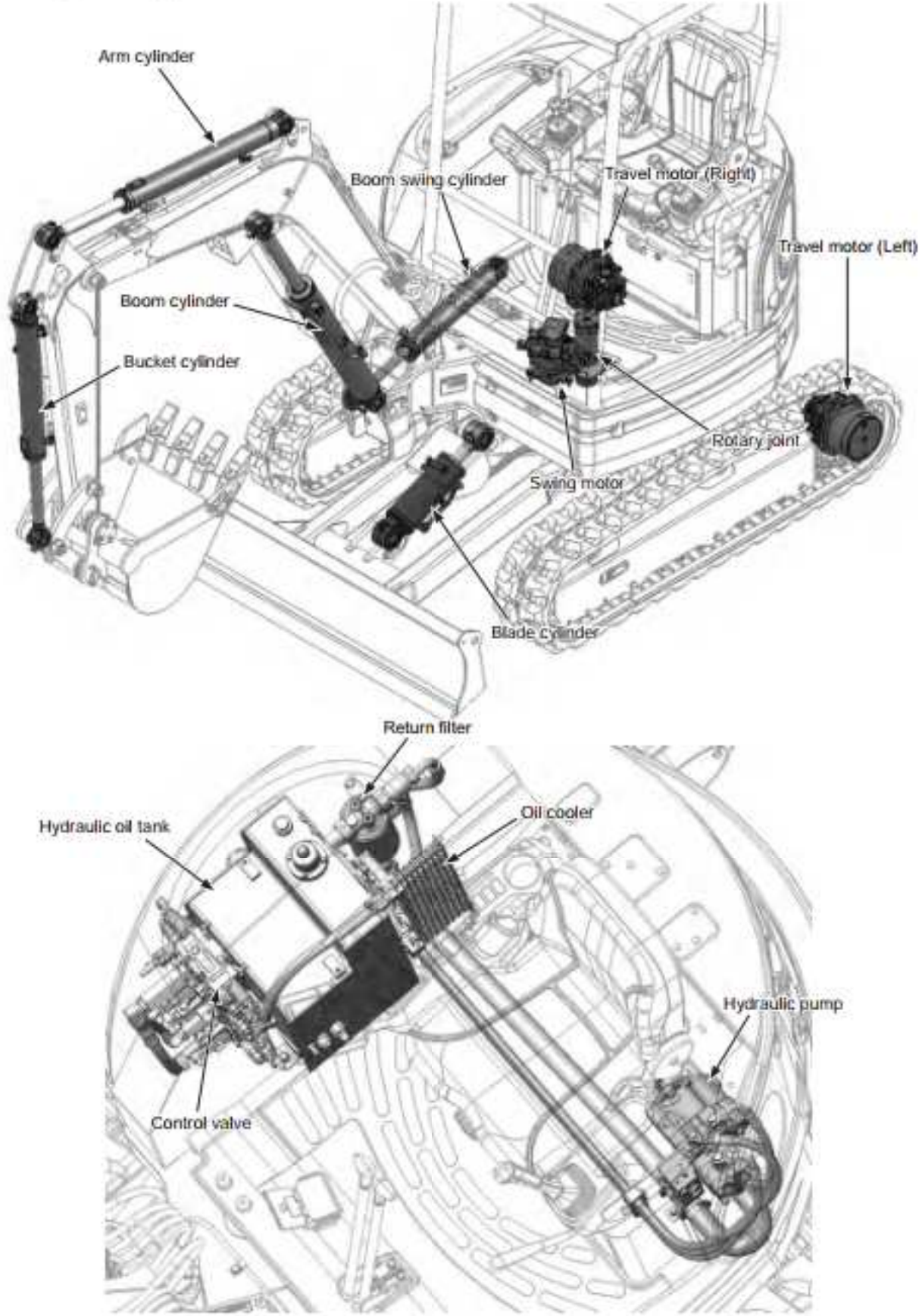

Swing bearing

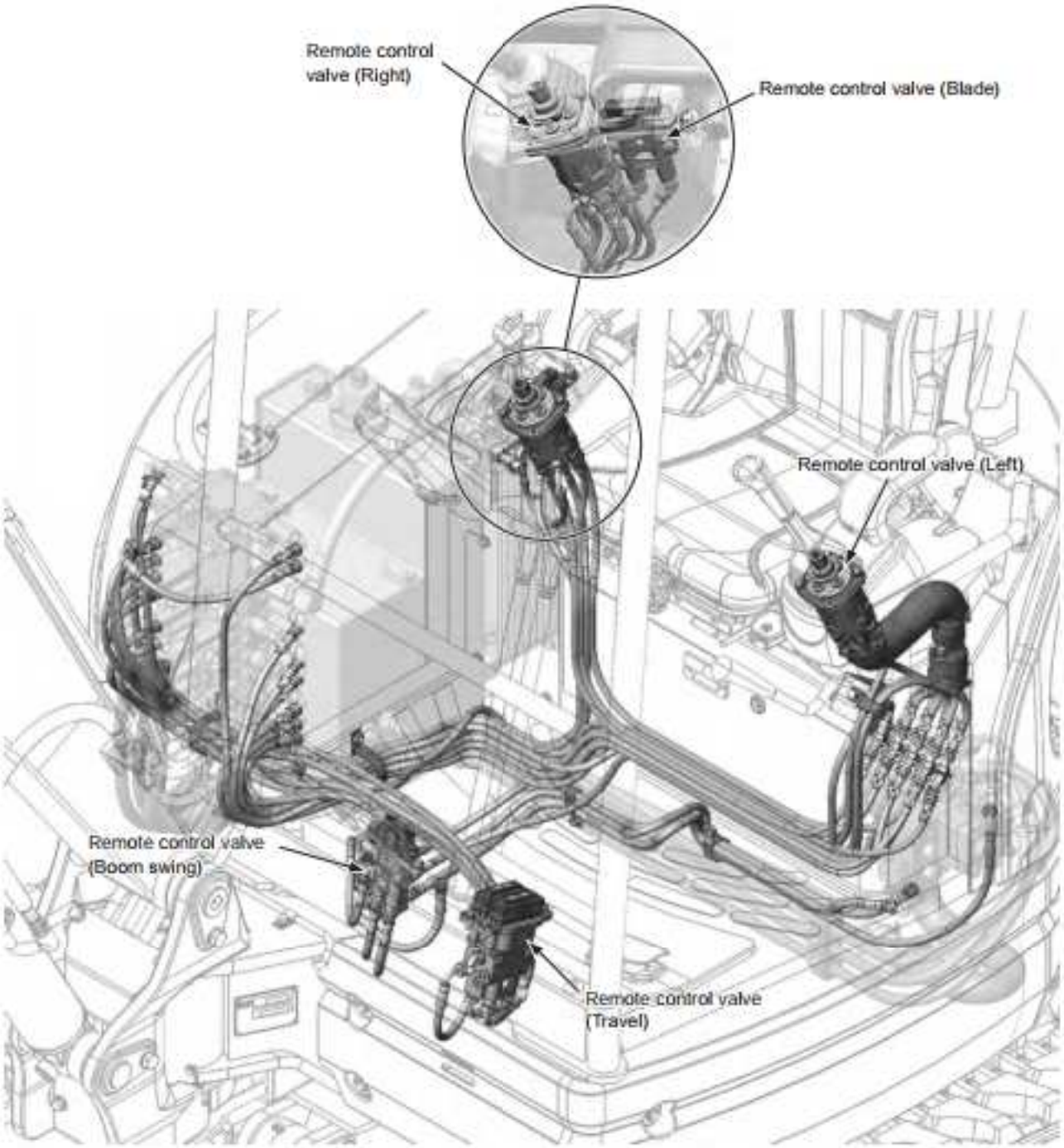
2 Engine


Air cleaner
Radiator
Muffler
Engine
Fuel tank
Pump flange

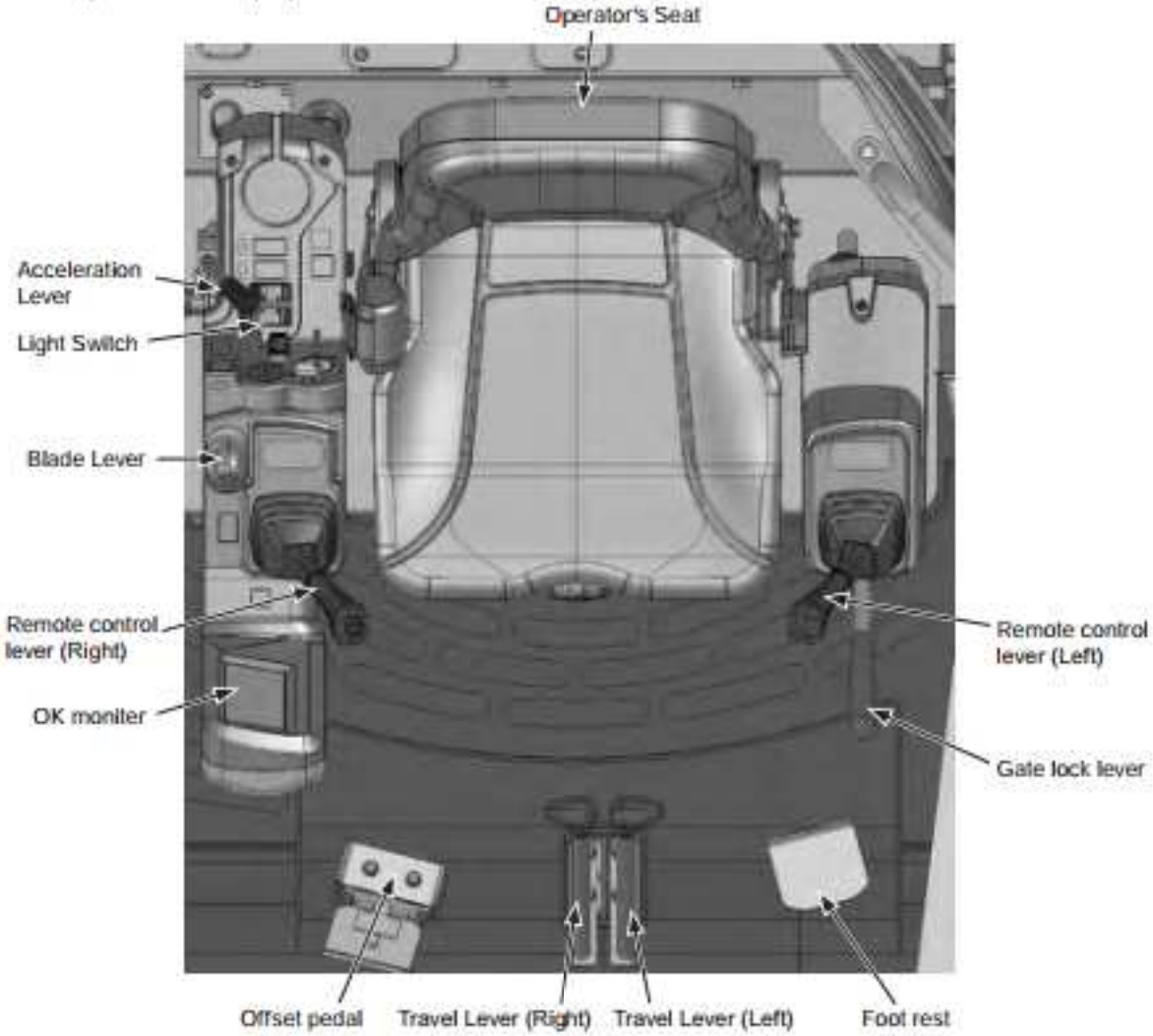

Dust indicator
Water sedimentor
Reservoir tank
Fuel filter
Fuel pump
Oil gauge
Oil filter

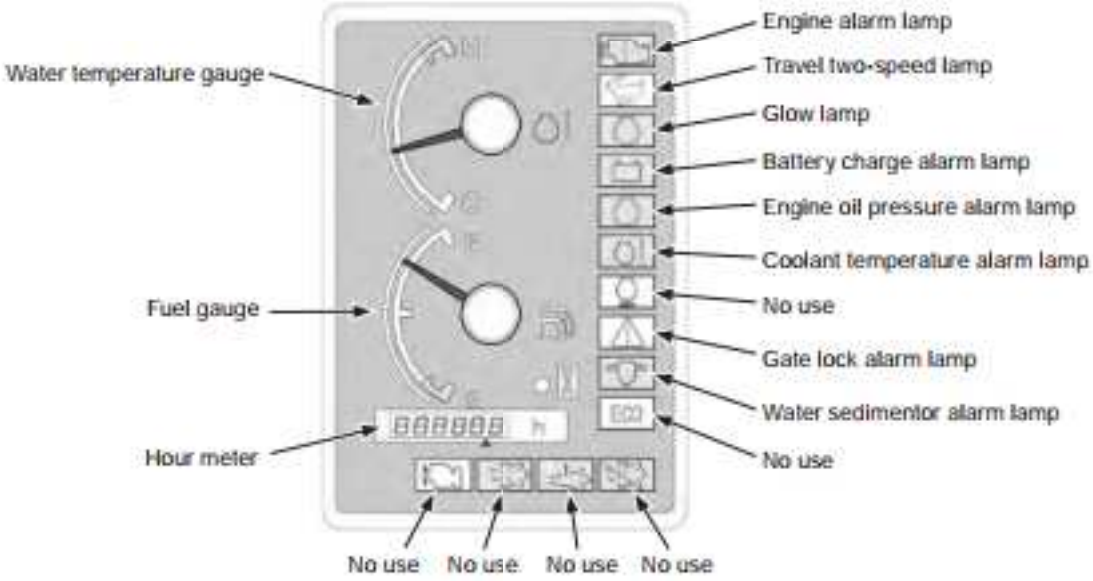
3 Hydraulic parts




Remote control valve (Right)
Remote control valve (Blade)
Remote control valve (Left)
Remote control valve (Boom swing)
Remote control valve (Travel)

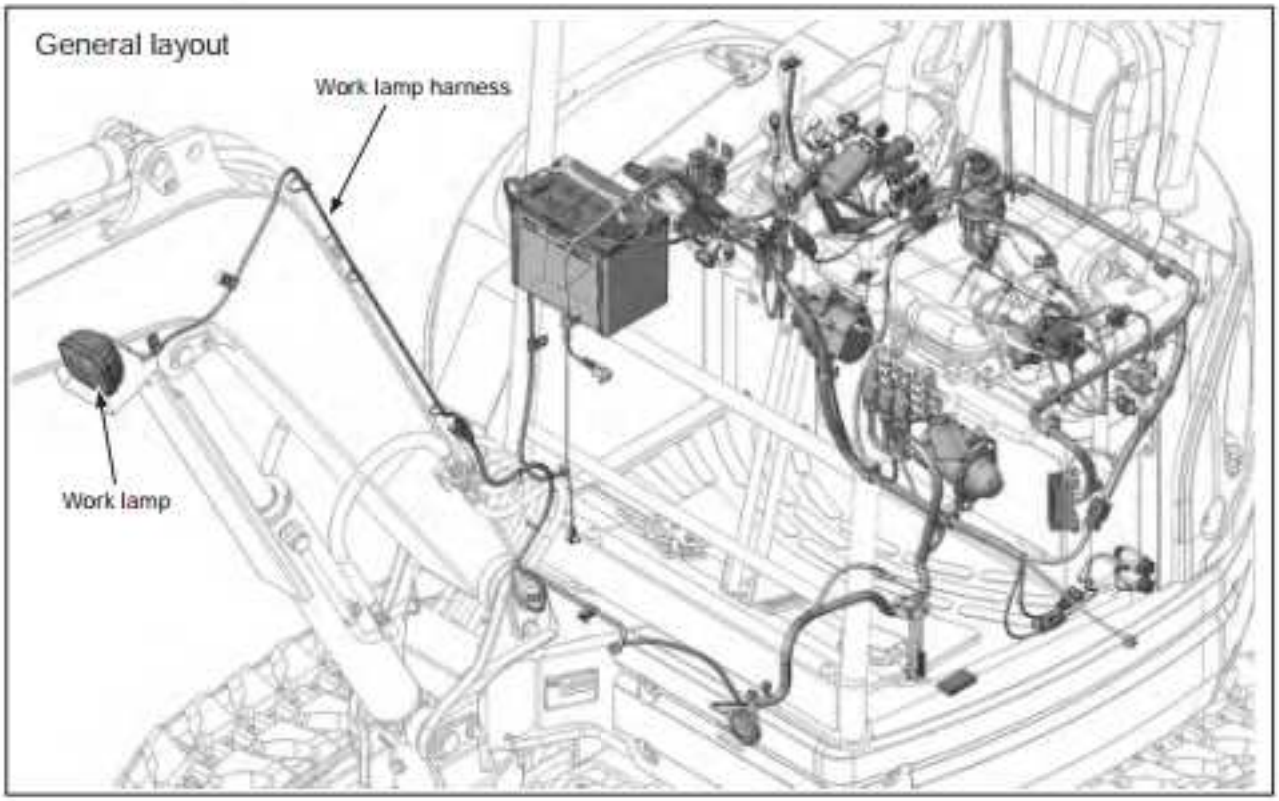
4 Operation equipment

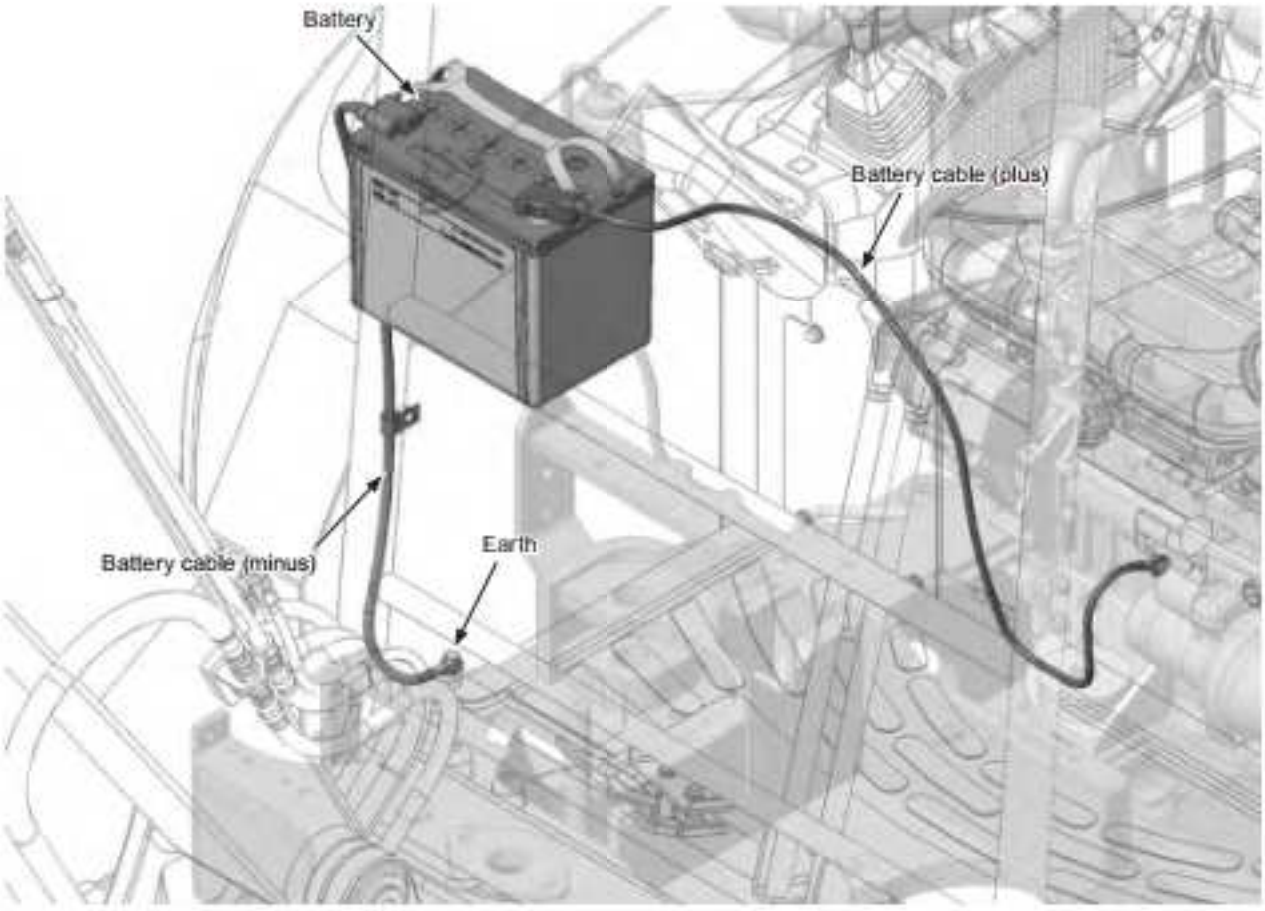


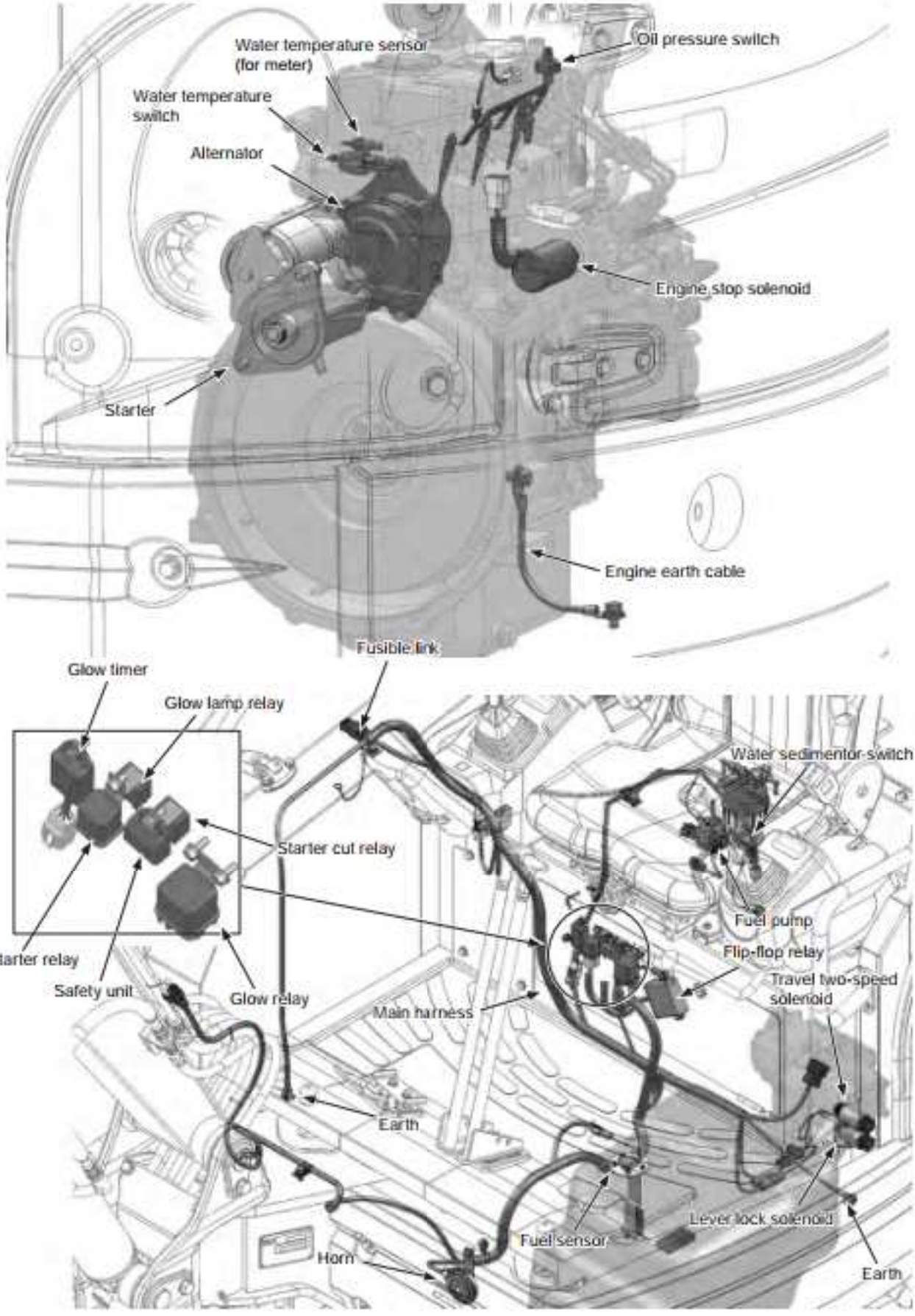


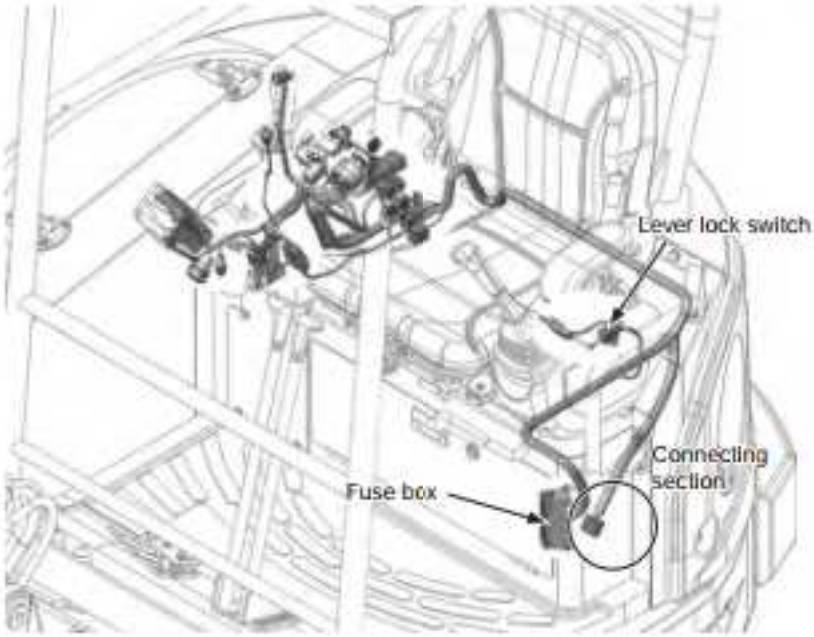
OK monitor

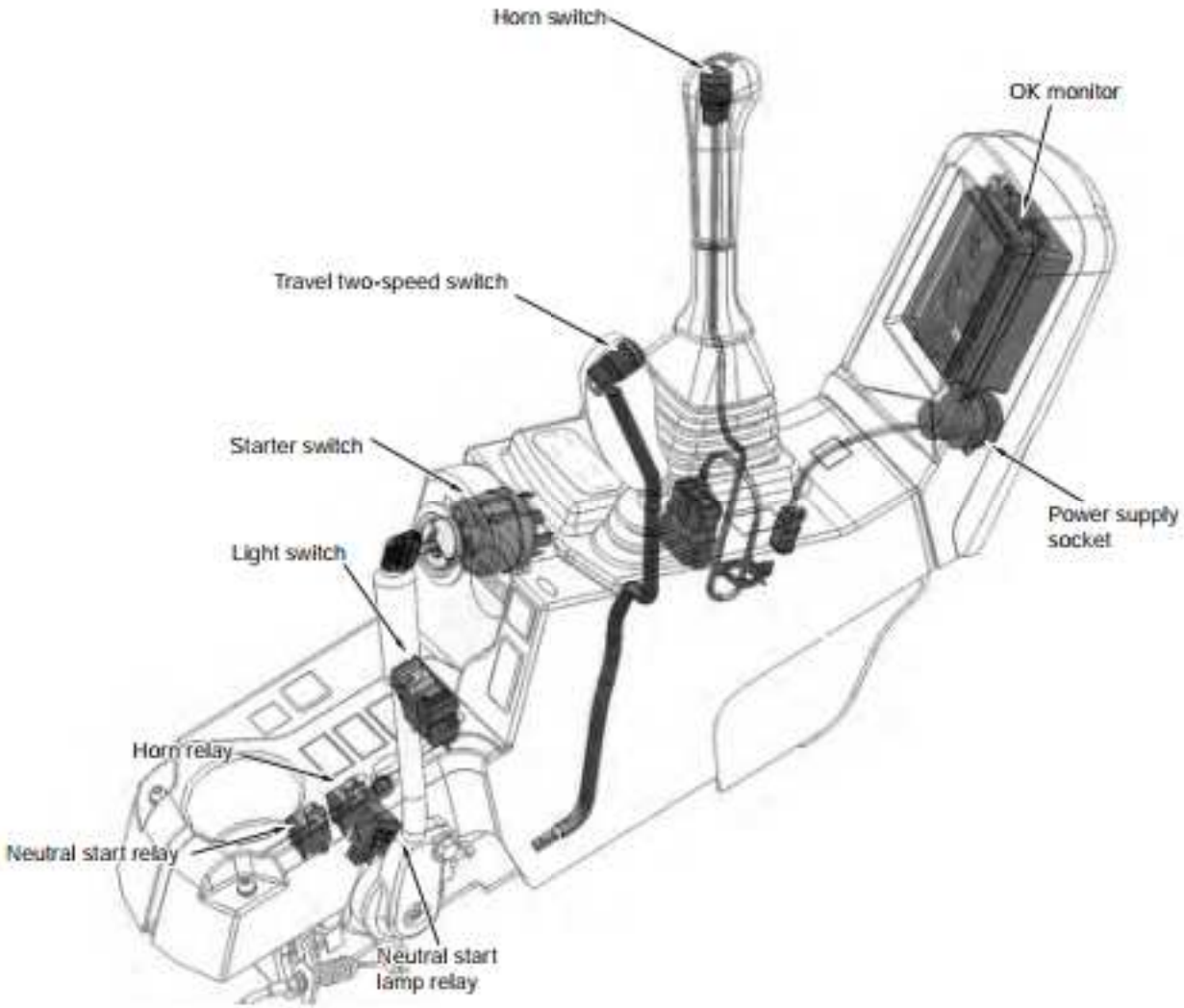
5 Electrical parts



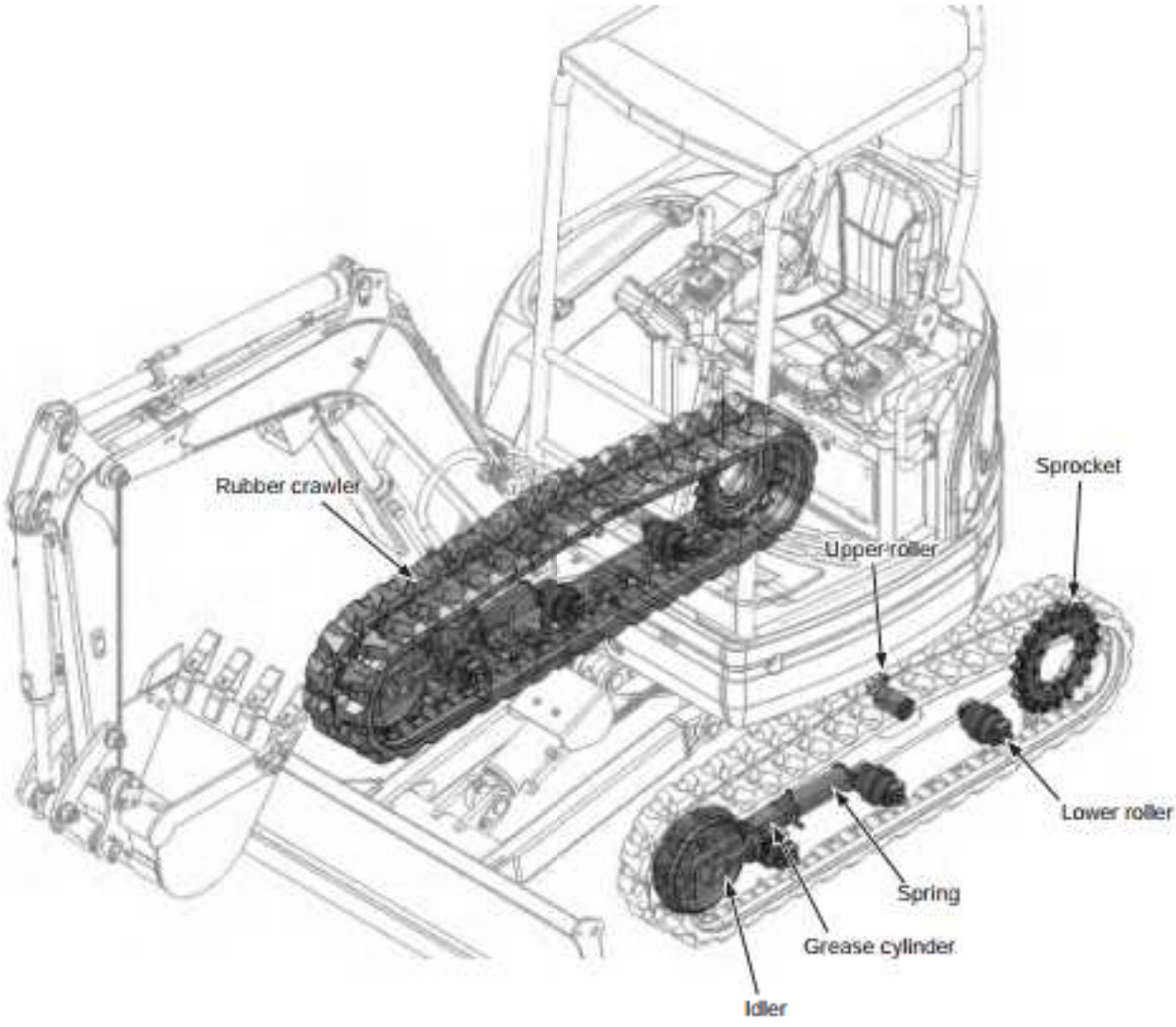



Water temperature sensor (for meter)
Oil pressure switch
Water temperature switch
Alternator
Engine stop solenoid
Starter
Engine earth cable
Fusible link
Glow timer
Glow lamp relay
Water sedimentor switch
Starter cut relay
Fuel pump
Flip-flop relay
Starter relay
Travel two-speed solenoid
Safety unit
Glow relay
Main harness
Earth
Lever lock solenoid
Fuel sensor
Horn
Earth


Lever lock switch
Connecting section
Fuse box


Horn switch
OK monitor
Travel two-speed switch
Starter switch
Light switch
Power supply socket
Horn relay
Neutral start relay
Neutral start lamp relay

6 Travel equipment



■ Speed and hill-climbing ability

Swing speed	9.0 min^{-1}	
Travel speed (low/high)	2.5 / 4.4 km/hr	
Hill-climbing ability	58% (30°)	

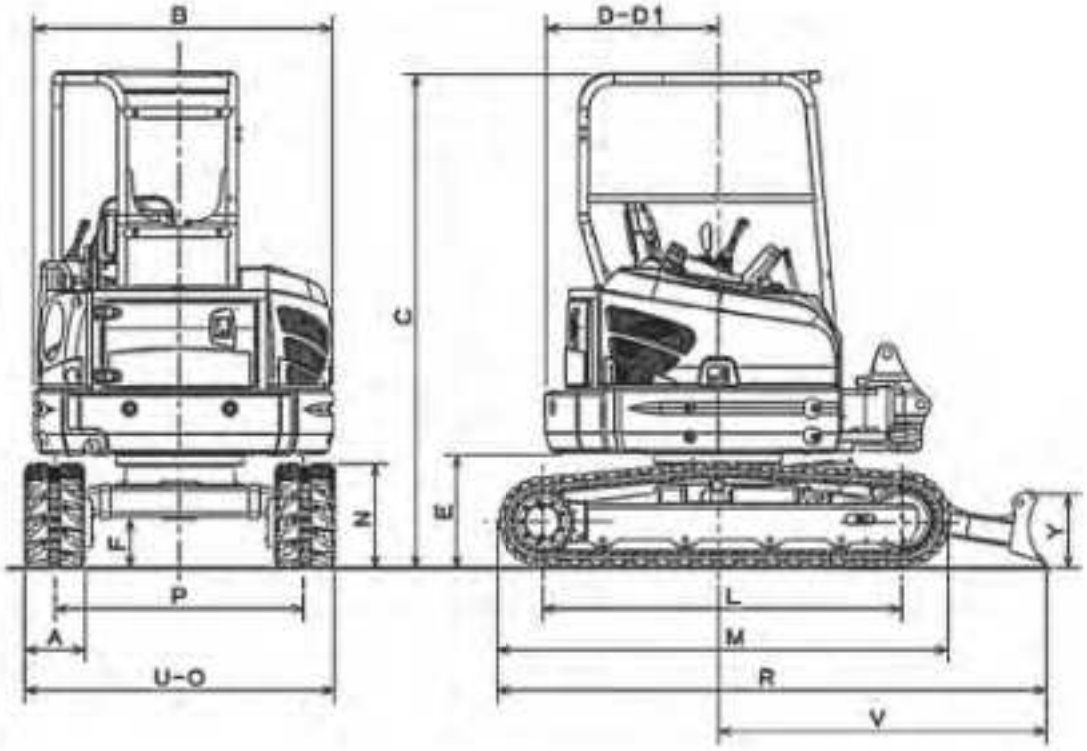
■ Engine

Maker	IHI Shibaura Machinery Corporation	
Name	S773-C	
Type	4-cycle water-cooled head valve serial excess flow type	
Number of cylinders - diameter × stroke	3 −ϕ77mm × 81 mm	
Total exhaust volume	1.131 L	
Rated output	13.6 kW / 2400 min^{-1}(18.5ps/2400rpm)	DIN6271B (13.1 kW / 2400 min^{-1})
Maximum torque	62.4 N•m / 1900 min^{-1}(6.4kgf•m/1900rpm)	
Fuel consumption (rated)	280 g / kW•h(179g/psh)	
Fuel tank capacity	42 L	
Starter	12 V – 2.0 kW	
Battery	12 V – 55 AH	85D26L
Alternator	12 V – 40A	
Lubricating oil quantity	Max. 4.2 L Min. 2.8 L	
Coolant capacity	4.4 L (only for engine itself 1.9 L)	

■ Mass

			Two-post canopy	Four-post canopy	Cab
Machine mass	kg	250mm Rubber shoe	2450	2480	2630
		250mm Steel shoe	2580	2610	2760
Machine body mass	kg	250mm Rubber shoe	1870	1900	2050
		250mm Steel shoe	2000	2030	2180
Average grounding pressure	kPa	250mm Rubber shoe	30	31	33
		250mm Steel shoe	32	33	34

■ Main body external dimensions



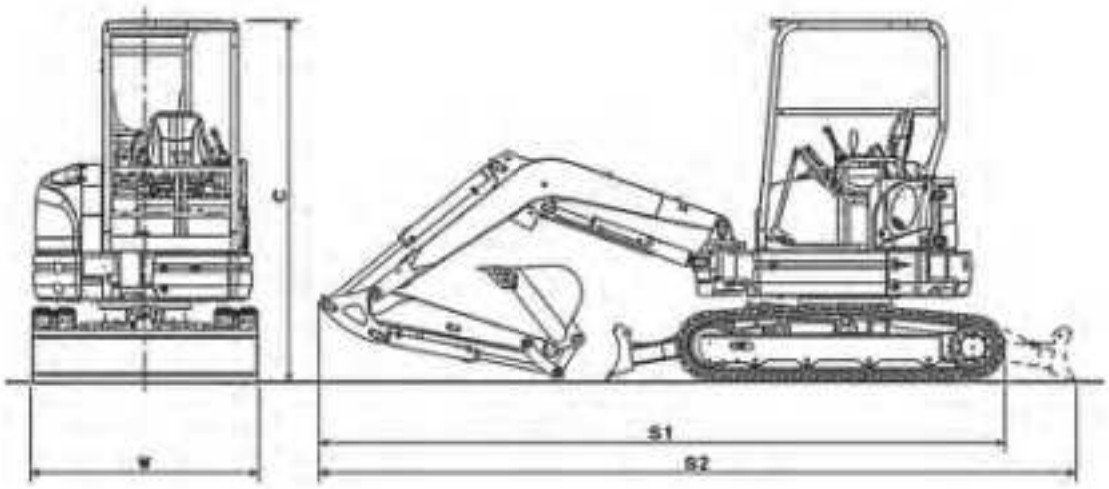
Unit:mm

			Two-post canopy	Four-post canopy	Cab
B	Upper structure overall width		1500	1500	1520
C	Overall height	250mm Rubber shoe	2480	2460	2460
		250mm Steel shoe	2485	2465	2465
D	Tail end swing radius		775	775	875
D1	Swing body tail end distance		775	775	775
E	Swing body rear lower end height	250mm Rubber shoe	550	550	550
		250mm Steel shoe	555	555	555
F	Ground clearance	250mm Rubber shoe	300	300	300
		250mm Steel shoe	305	305	305
Y	Blade height		380	380	380
U	Blade width		1550	1550	1550
V	Blade ground contact position		1490	1490	1490

Unit: mm

Name / Crawler specification	Distance between tumbler centers	Crawler overall length	Crawler height	Crawler overall width	Distance between crawler centers	Crawler shoe width	Shoe pitch	Number of shoe	Undercarriage overall length	Crawler bearing area JIS (cm²)
	L	M	N	O	P	A	-	-	R	-
250mm Rubber shoe	1460	1900	495	1550	1300	250	52.5	78×2	2360	8070
250mm Steel shoe	1480	1930	505	1550	1300	250	101.6	40×2	2375	8155

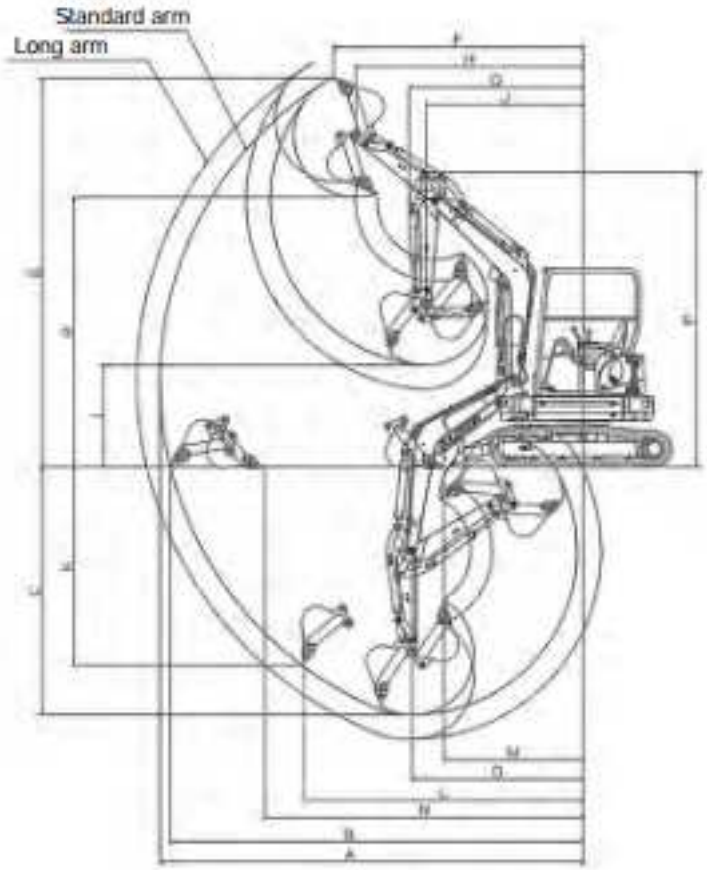
■ Dimensions upon transportation



Unit: mm

			Two-post canopy	Four-post canopy	Cab
Attachment specification			Standard	Standard	Standard
Bucket capacity (m^3) New JIS			0.08	0.08	0.08
S1	Overall length (Blade in front)		4000	4000	4000
S2	Overall length (Blade in rear)		4620	4620	4620
C	Overall height	250mm Rubber shoe	2480	2460	2460
		250mm Steel shoe	2485	2465	2465
W	Overall width		1550	1550	1550

(1) Standard/Long arm



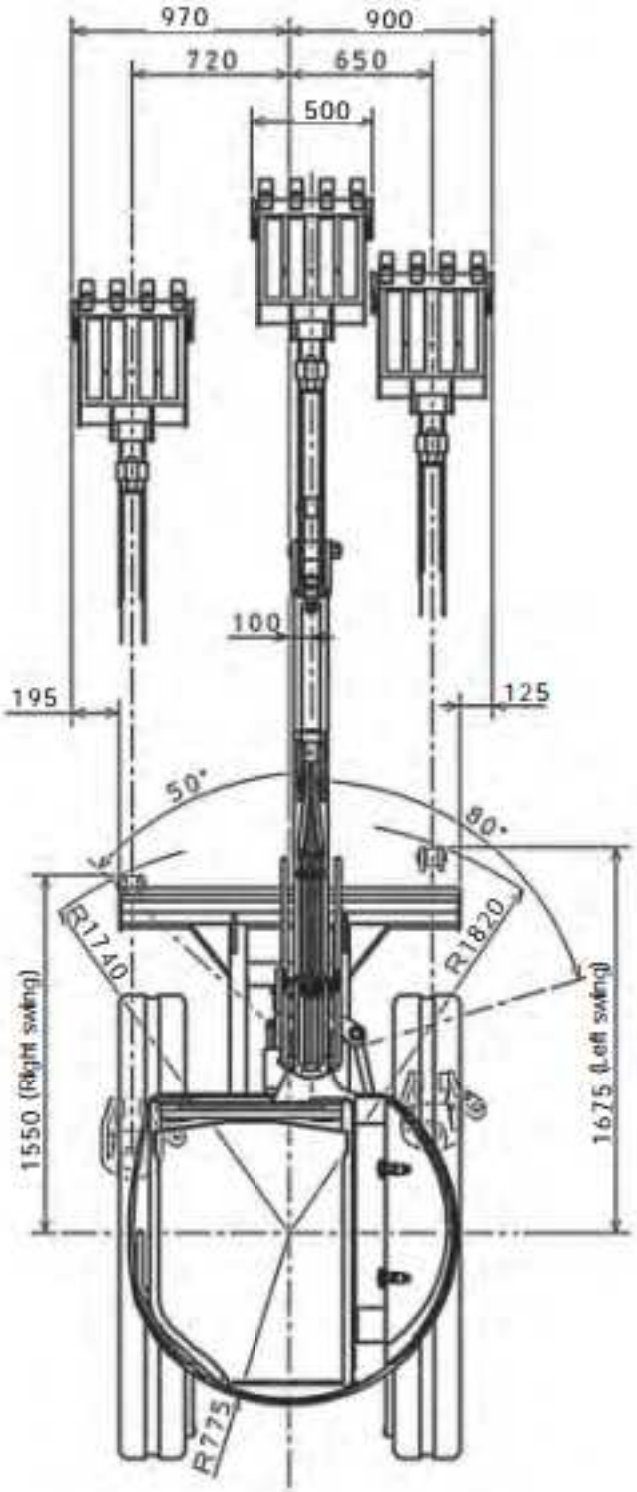
⚠ CAUTION

When digging deep at the blade side, the boom cylinder sometimes interferes with the blade.

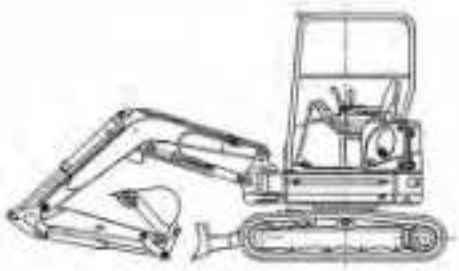
Unit: mm

No.	Name	Standard arm	Long arm
	Standard mounted bucket capacity (m^3) New JIS	0.08	0.06
A	Maximum digging radius	4560	4840
B	Maximum floor level digging radius	4400	4700
C	Maximum digging depth (without blade)	2440	2740
D	Radius against maximum digging depth	1930	1930
E	Maximum digging height	4220	4410
F	Radius against maximum digging height	2730	2960
G	Maximum dump height	2900	3090
H	Radius against maximum dump height	2470	2700
I	Minimum dump height	1120	830
J	Radius against minimum dump height	1850	1910
K	Maximum vertical digging depth	1840	2120
L	Radius against maximum vertical digging depth	3170	3270
M	Minimum floor level digging radius	1550	1440
N	Maximum digging distance with floor	3380	3670
O	Minimum front swing radius	2030	2090
	(Swing in right)	1740	1790
	(Swing in left)	1820	1880
P	Height against minimum front swing radius	3190	3190
Arm length		1100	1400
Boom length		2000	2000

(2) Side groove digging work range



1. Mass upon transportation



Shoe/cab type	Mass (kg)
Rubber shoe, four-post canopy	2480
Steel shoe, four-post canopy	2610
Rubber shoe, two-post canopy	2450
Steel shoe, two-post canopy	2580
Rubber shoe, cab	2630
Steel shoe, cab	2760

2. Base machine

Shoe/cab type	Mass (kg)
Rubber shoe, four-post canopy	2190
Steel shoe, four-post canopy	2320
Rubber shoe, two-post canopy	2160
Steel shoe, two-post canopy	2290
Rubber shoe, cab	2340
Steel shoe, cab	2470

This mass is not the machine body mass but includes water, fuel, blade, etc.

3. Upper machine

Type	Mass (kg)
Four-post canopy	1290
Two-post canopy	1260
Cab	1440

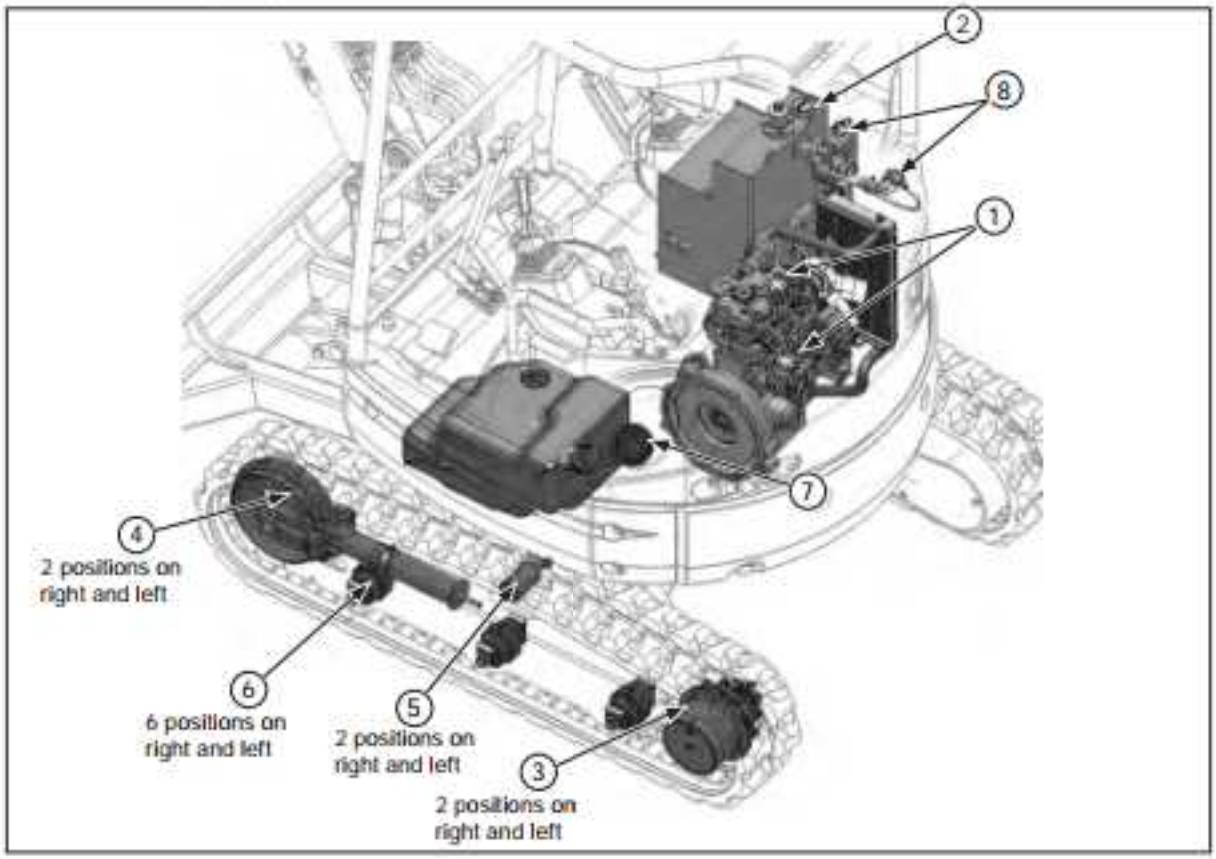
4. Lower machine

Type	Mass (kg)
Rubber shoe	900
Steel shoe	1030

5. Hoe attachment

Type	Mass (kg)
Standard	290
Long	310

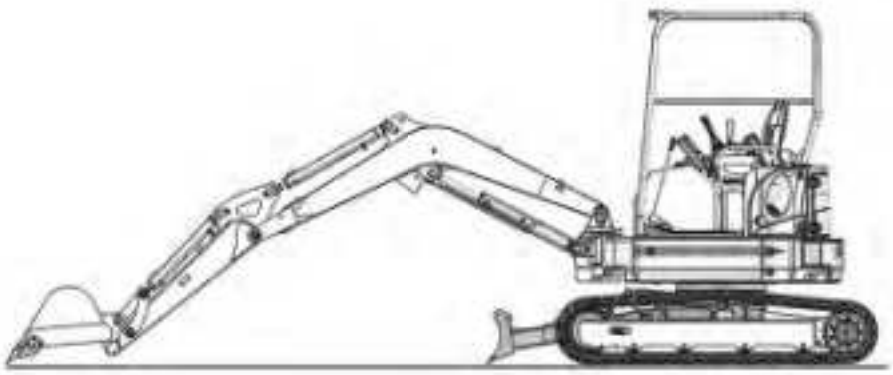
1 List of oil, fuel, and coolant



* Depending on air temperature, follow the table.

	Location	Type	Grade	Use depending on air temperature -30 -20 -10 0 10 20 30 40	Required volume
1	Engine oil pan	Engine oil	API-CD	SAE10W-30 SAE15W-40	Maximum : 4.2 L Minimum : 2.8 L
2	Hydraulic oil tank	Hydraulic oil	Wear-resistant	ISO-VG46 ISO-VG32	*Note 1 Full system : 50 L Tank level : 33 L
3	Travel reduction gear	Gear oil	API GL-4	SAE90	0.35 L × 2
4	Front idler	Gear oil	API GL-4	SAE90	0.08 L × 2
5	Upper roller	Engine oil	API-CD	SAE30	0.045 L × 2
6	Lower roller	Gear oil	API GL-4	SAE90	0.08 L × 6
7	Fuel tank	Light oil	JIS	JIS No.2 JIS No.3 JIS Special No.3	42 L
8	Cooling system	Water	LLC	Long life coolant (LLC) added * Note 2	Engine : 1.9 L Full volume : 4.4 L

Note 1: The full system oil volume means that the hydraulic oil is supplied to the standard position on the hydraulic tank oil level gauge with the position shown in the figure.



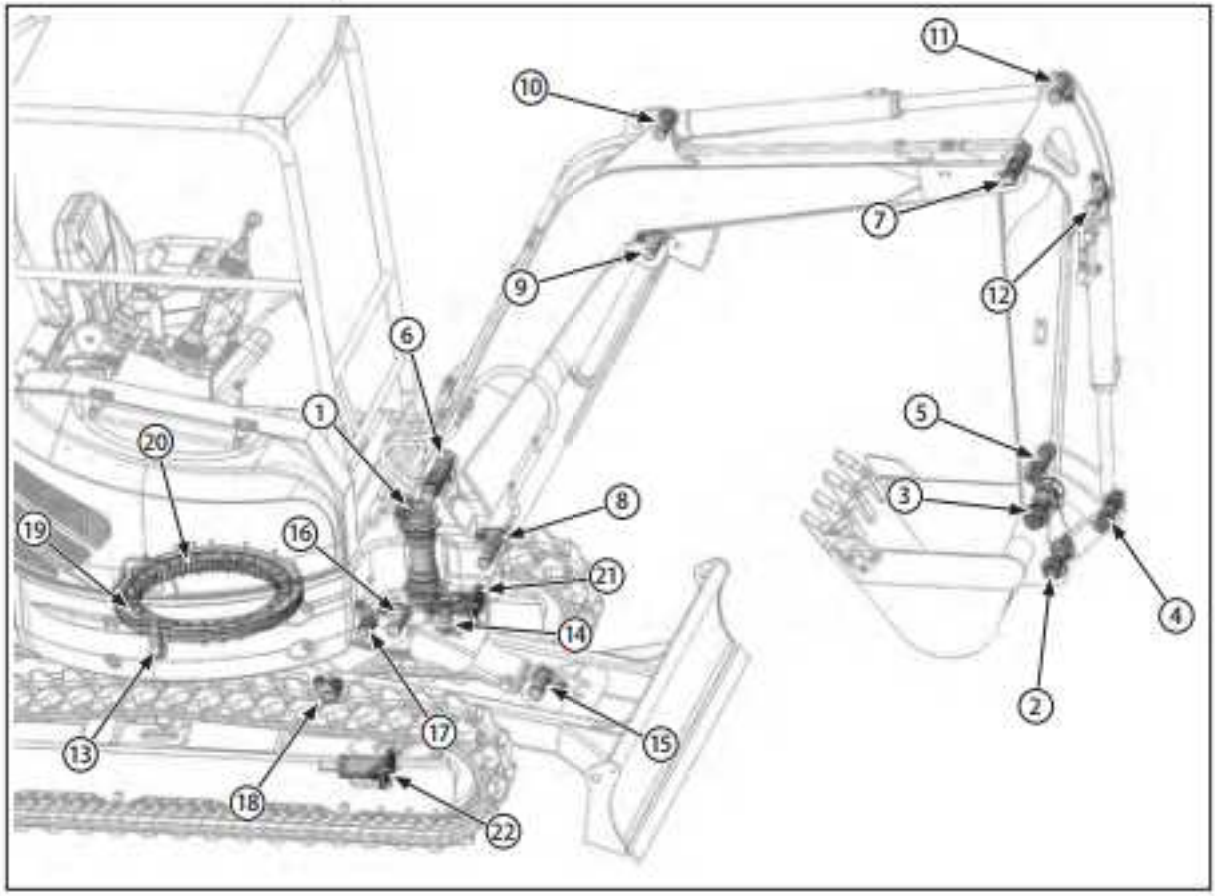
Note 2: The mixed quantity should be 50%.

Lowest outer air temperature (°C)		-35
Mixing percentage (%)		50
Mixed volume (L)	Coolant (L)	2.2
	Water (L)	2.2
Coolant, Full volume: 4. 4L		Engine body : 1.9L, Radiator, etc. : 2.0L, Tank : 0.5L

2 List of check/replacement cycle for oil, fuel, and coolant

1	Engine oil pan	Engine oil	Check and refill every day. Replace 50 hours after the initial use and then replace every 250 hours.
2	Hydraulic oil tank	Hydraulic oil	Check and refill every day. Replace every 1,000 hours.
3	Travel reduction gear	Gear oil	Replace 50 hours after the initial use. Check and refill every 500 hours. Replace every 1,000 hours.
4	Front idler	Gear oil	Replace upon disassembly/repair.
5	Upper roller	Engine oil	Unreplaceable (Replace the assembly of upper roller.)
6	Lower roller	Gear oil	Replace upon disassembly/repair.
7	Fuel tank	Light oil	Drain water from the water sedimentor every day. Drain water from the tank every 50 hours.
8	Cooling system	Water	Check and refill every day. Replace every 2 years.

3 List of lubricated positions



1	Swing bracket pin	Lubricate every 50 hours.
2	Bucket pin	
3	Bucket pin	
4	Bucket cylinder head pin	
5	Arm link pin	
6	Boom foot pin	
7	Boom top pin	
8	Boom cylinder foot pin	
9	Boom cylinder head pin	
10	Arm cylinder foot pin	
11	Arm cylinder head pin	
12	Bucket cylinder foot pin	
13	Boom swing cylinder foot pin	
14	Boom swing cylinder head pin	
15	Blade cylinder foot pin	
16	Blade cylinder head pin	
17	Blade pin (left)	
18	Blade pin (right)	
19	Swing bearing	
20	Swing gear	Lubricate every 500 hours.
21	Grease cylinder (left)	For crawler tension adjustment. Lubricate upon adjustment/replacement of the crawler tension.
22	Grease cylinder (right)	

Use Extreme-Pressure Grease (EP) No.2.

1 General tightening torque

Unless torque is specified for screws, tighten them according to the table below.

1-1 Tightening torque of metric screw (10T)

Bolt size	Wrench size (mm)	Tightening torque	
		Metric coarse heat-treated bolt (N•m)	Metric fine heat-treated bolt (N•m)
M8	13	23	25
M10	17	47	50
M12	19	83	91
M14	22	134	135
M16	24	206	220
M20	30	412	450
M24	36	715	813

1-2 Tightening torque of piping taper screw

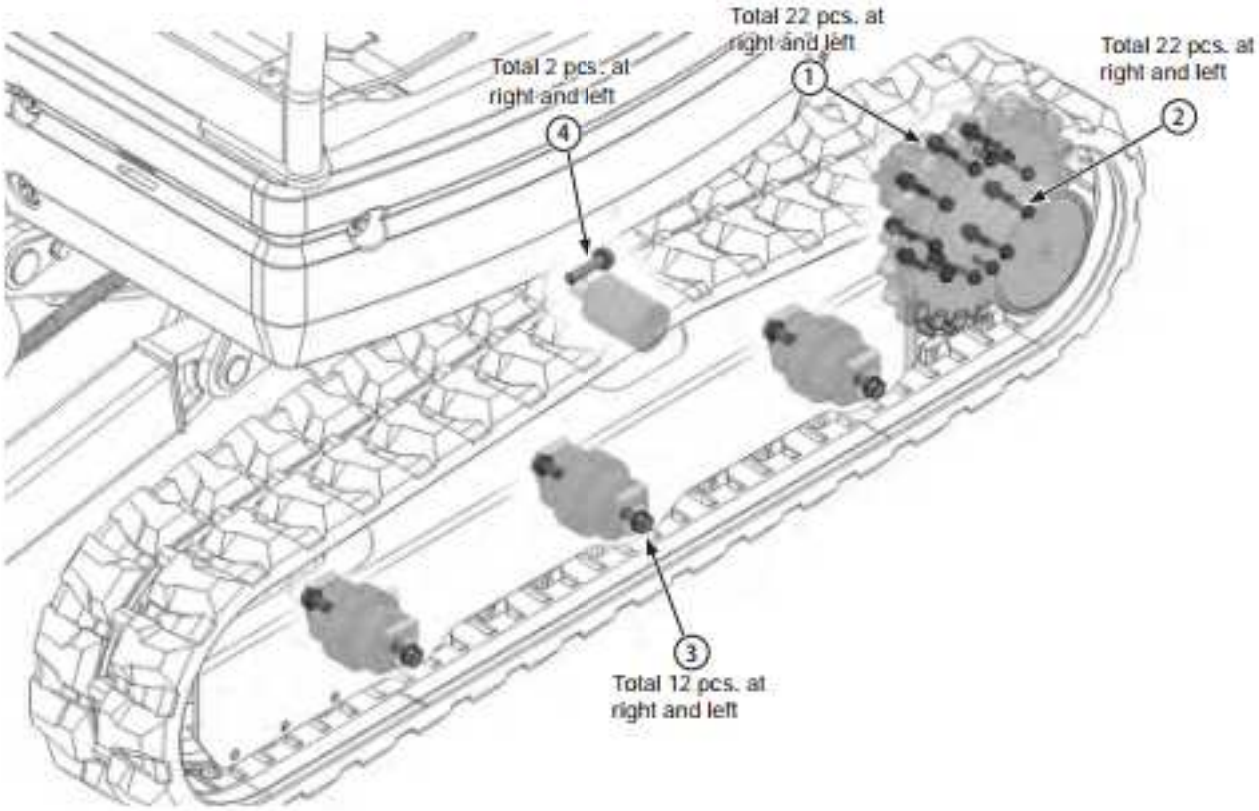
Pipe thread nominal diameter	Tightening torque (N•m)
1/4	19.6 – 39.2
3/8	29.4 – 58.8
1/2	58.8 – 98.0
3/4	117.6 – 166.6
1	137.2 – 205.8
1-1/4	166.6 – 254.8
1-1/2	205.8 – 294.0
2	245.0 – 343.0

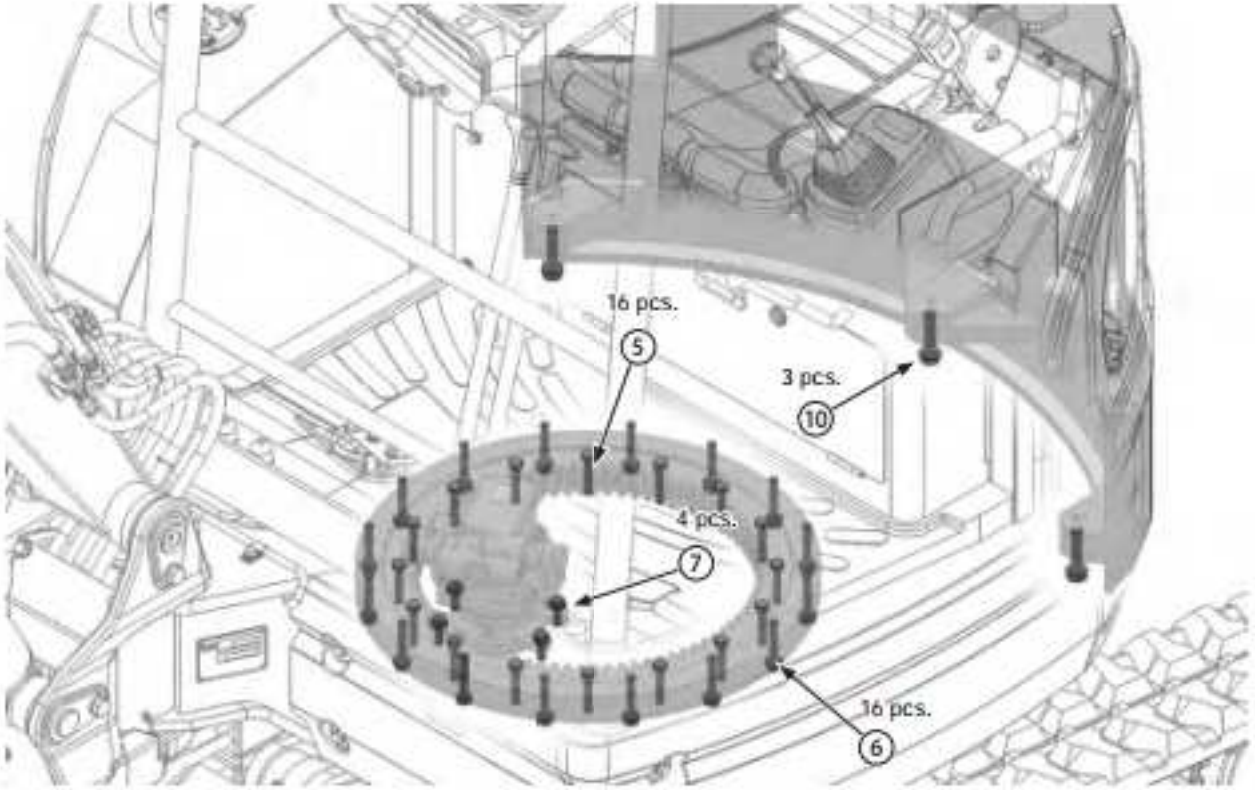
1-3 Tightening torque of rubber hose union nut

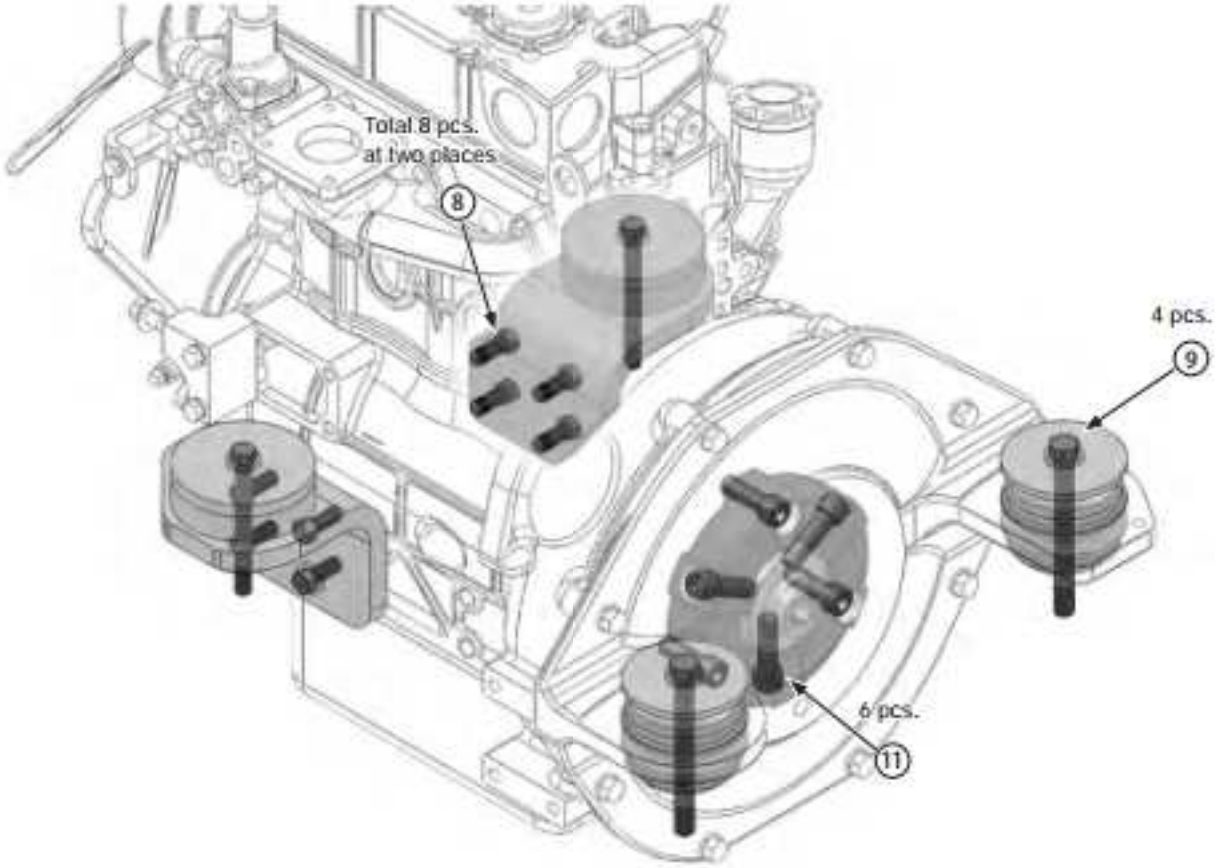
Hose size (inch)	Tightening torque (N•m)
1/4"	25
3/8"	49
1/2"	59
3/4"	118
1"	137
1-1/4"	167

2 Position to be tightened by the specified torque

When removing and retightening the bolts shown in the figure, follow the specified torque and conditions.

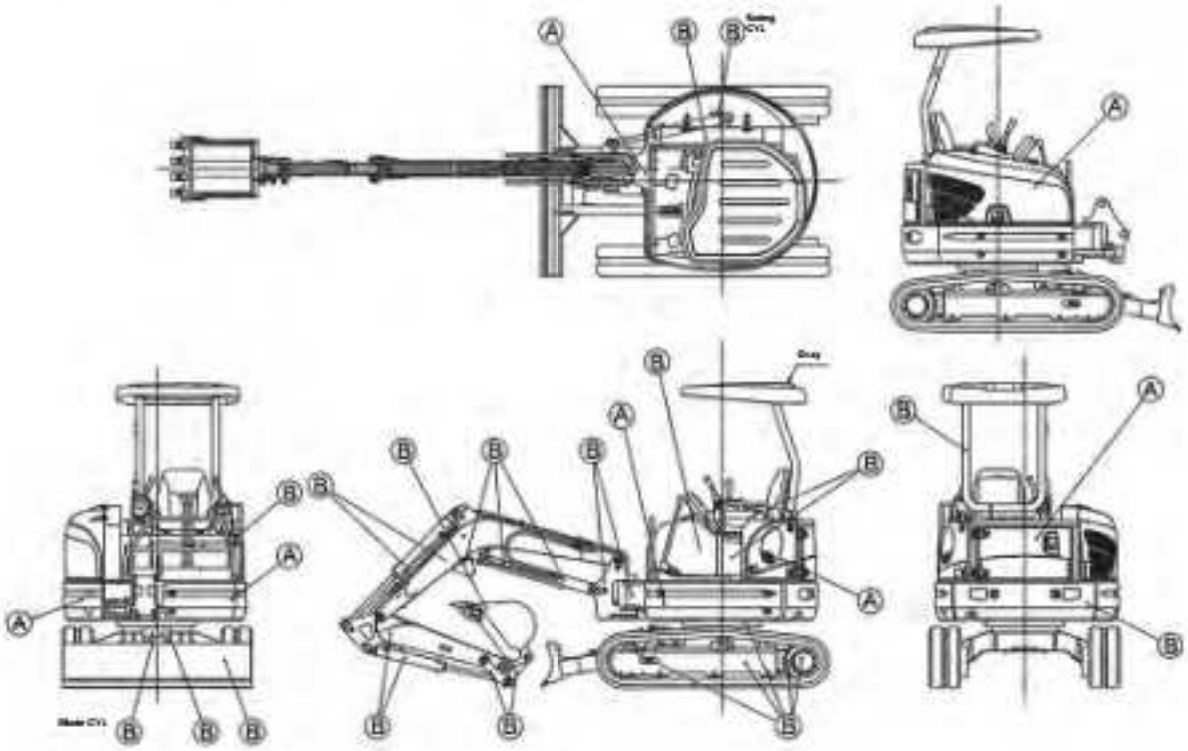






Code	Position	Bolt nominal diameter	Wrench to be used (mm)	Tightening torque (N·m)	Other conditions
1	Travel motor	M10	Hexagonal wrench (width across flat: 8)	71	Apply the screw lock.
2	Drive sprocket	M10	14	71	Apply the screw lock.
3	Lower roller	M16	24	245	Apply molybdenum disulfide grease.
4	Upper roller	M16	24	241	†
5	Swing bearing (Inner)	M12	19	108	†
6	Swing bearing (Outer)	M12	19	108	†
7	Swing motor	M12	19	108	†
8	Engine vibration-proof rubber bracket	M12	19	106	†
9	Engine vibration-proof rubber	M12	19	97	Apply the screw lock.
10	Counterweight	M16	24	241	Apply molybdenum disulfide grease.
11	Coupling	M12	Hexagonal wrench (width across flat: 10)	88	Accessory of coupling

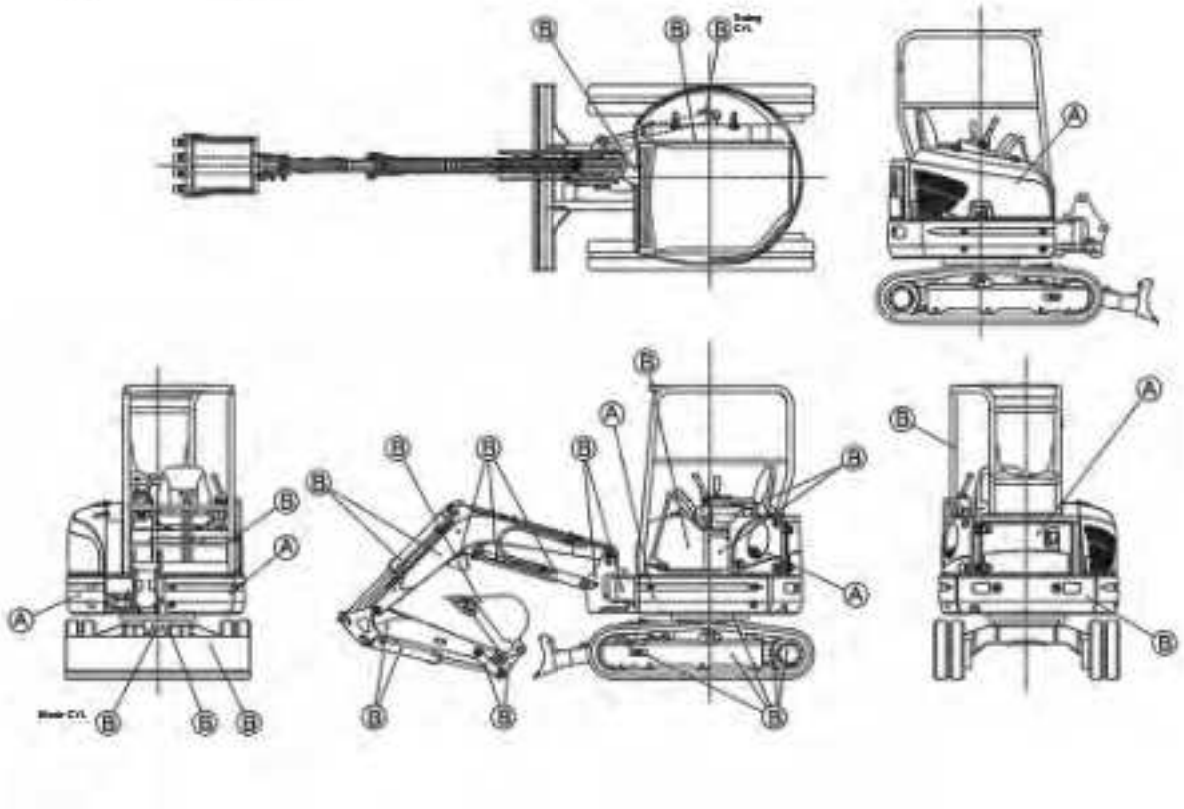
Two-post canopy specification



	A	B
Name	Light-green	Dark-gray
Munsell No.	2.5BG 6/10	N-3.0

Note: Do not coat the following parts: rubber parts, sponge parts, catch metal fixtures, hydraulic hose, cylinder rod, rod packing, ATT plating pin, air cleaner, muffler and exhaust pipes.

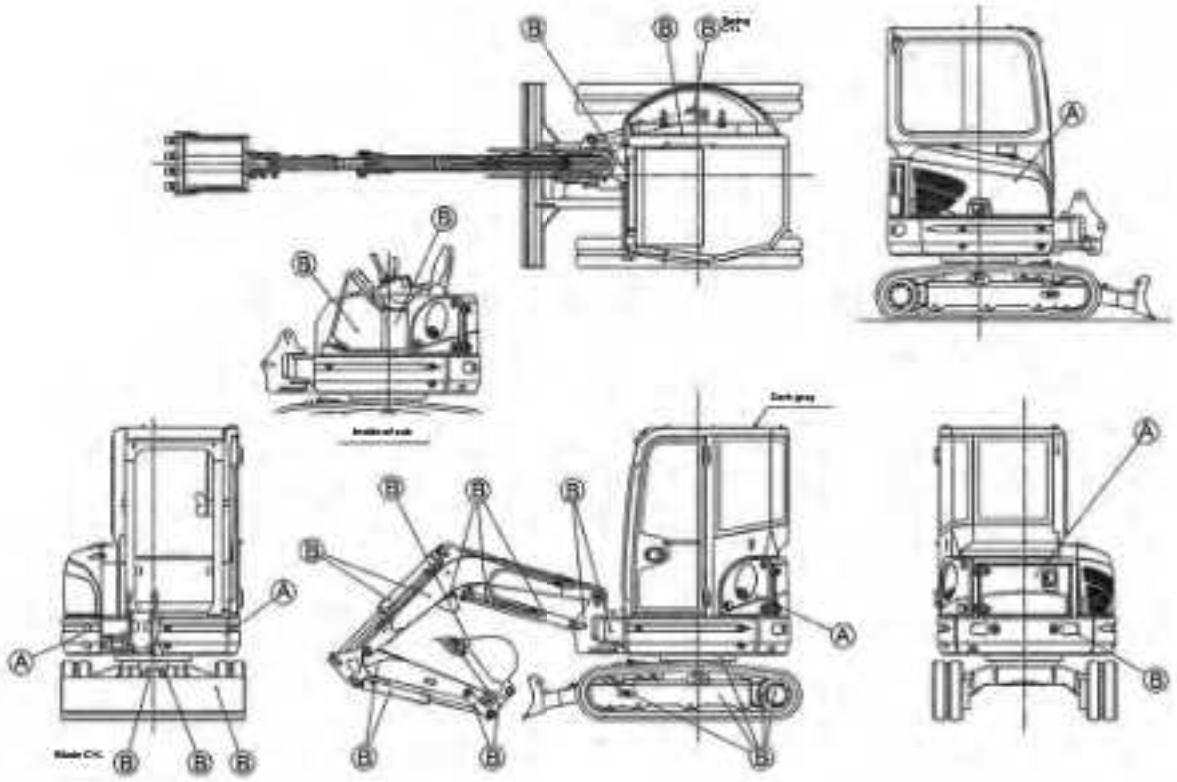
Four-post canopy specification



	A	B
Name	Light-green	Dark-gray
Munsell No.	2.5BG 6/10	N-3.0

Note: Do not coat the following parts: rubber parts, sponge parts, catch metal fixtures, hydraulic hose, cylinder rod, rod packing, ATT plating pin, air cleaner, muffler and exhaust pipes.

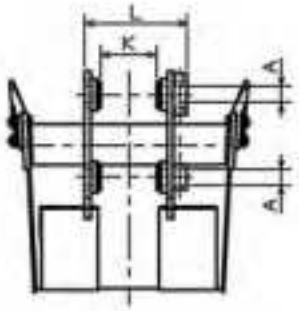
Cab specification



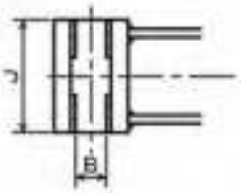
	A	B
Name	Light-green	Dark-gray
Munsell No.	2.5BG 6/10	N-3.0

Note: Do not coat the following parts: rubber parts, sponge parts, catch metal fixtures, hydraulic hose, cylinder rod, rod packing, ATT plating pin, air cleaner, muffler and exhaust pipes.

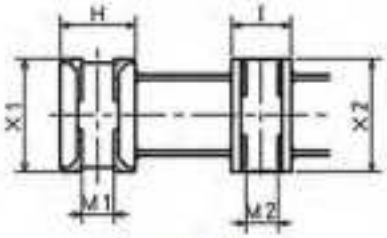
1 Dimensions relating to mounting of breaker, etc.



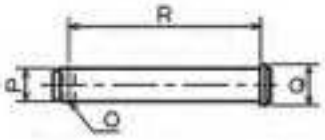
Bucket



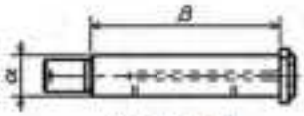
Bucket link



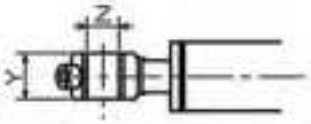
Arm point boss



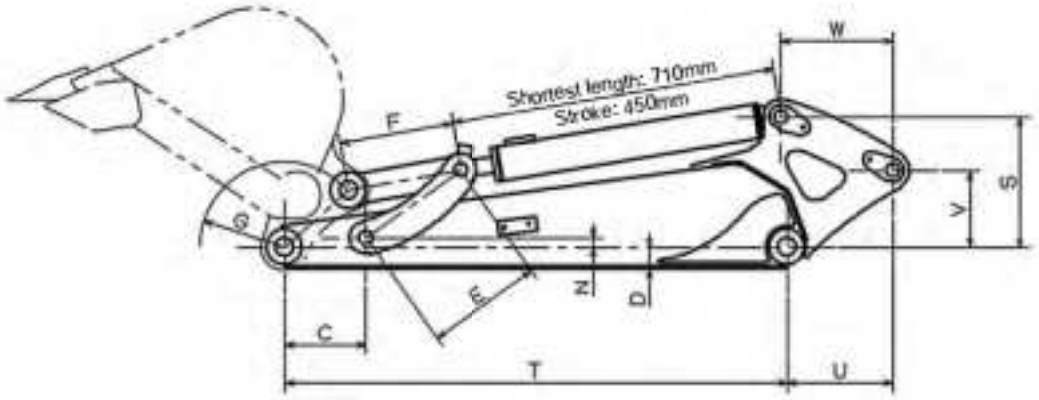
Bucket pin



Arm link pin



Bucket cylinder rod



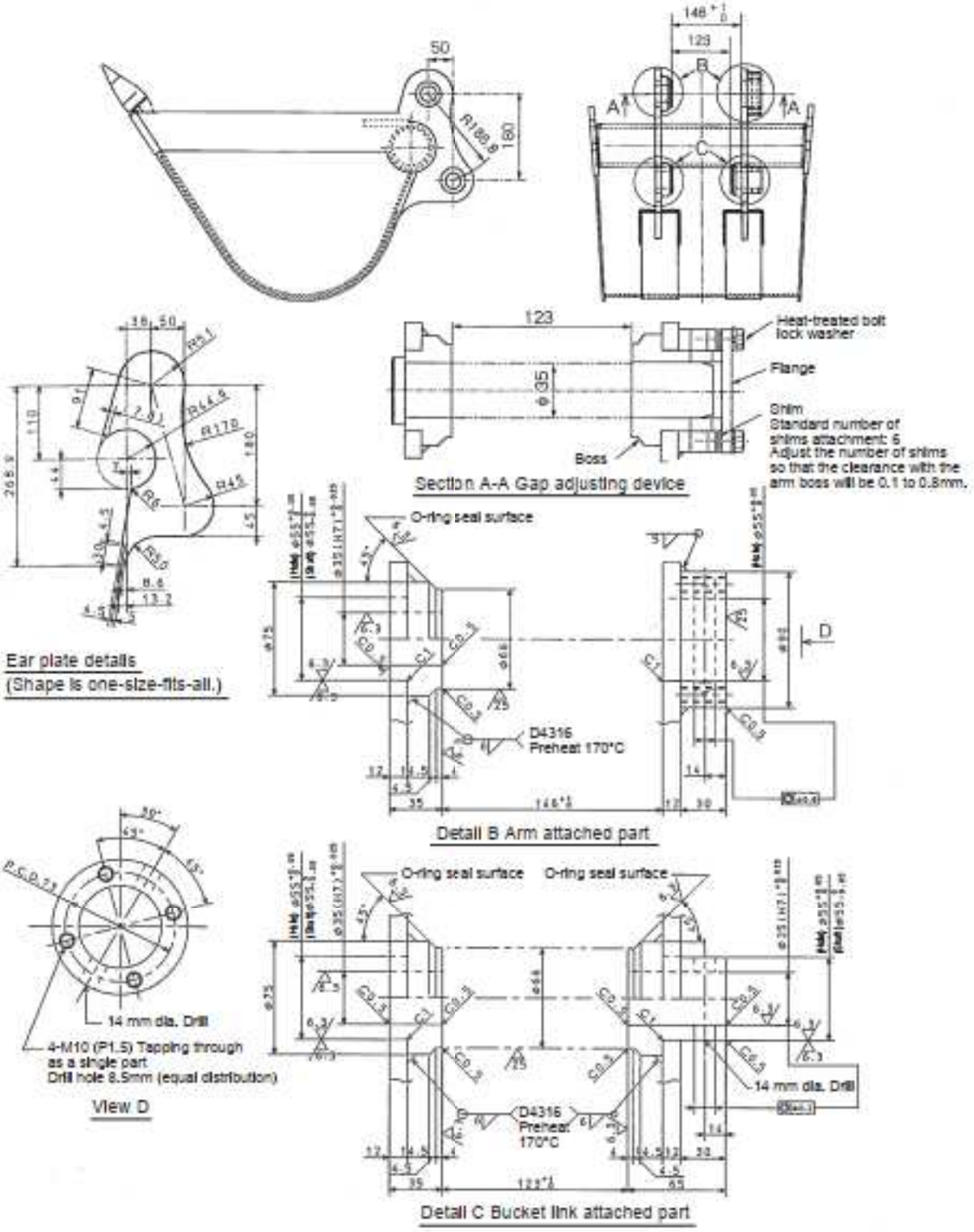
Code	A (hole)	B (hole)	C	D	E	F	G	H	I
Dimension (mm)	ϕ35	ϕ35	178	47	255	250	187	ϕ82	ϕ65

Code	J	K	L	M1(hole)	M2(hole)	N	O	P	Q
Dimension (mm)	123	123	223	ϕ35	ϕ35	20	ϕ13	ϕ35	ϕ45

Code	R	S	T	U	V	W	X1	X2	Y
Dimension (mm)	209	283	1100	232	166	245	123	123	50

Code	Z	α	β
Dimension (mm)	ϕ35	ϕ35	159

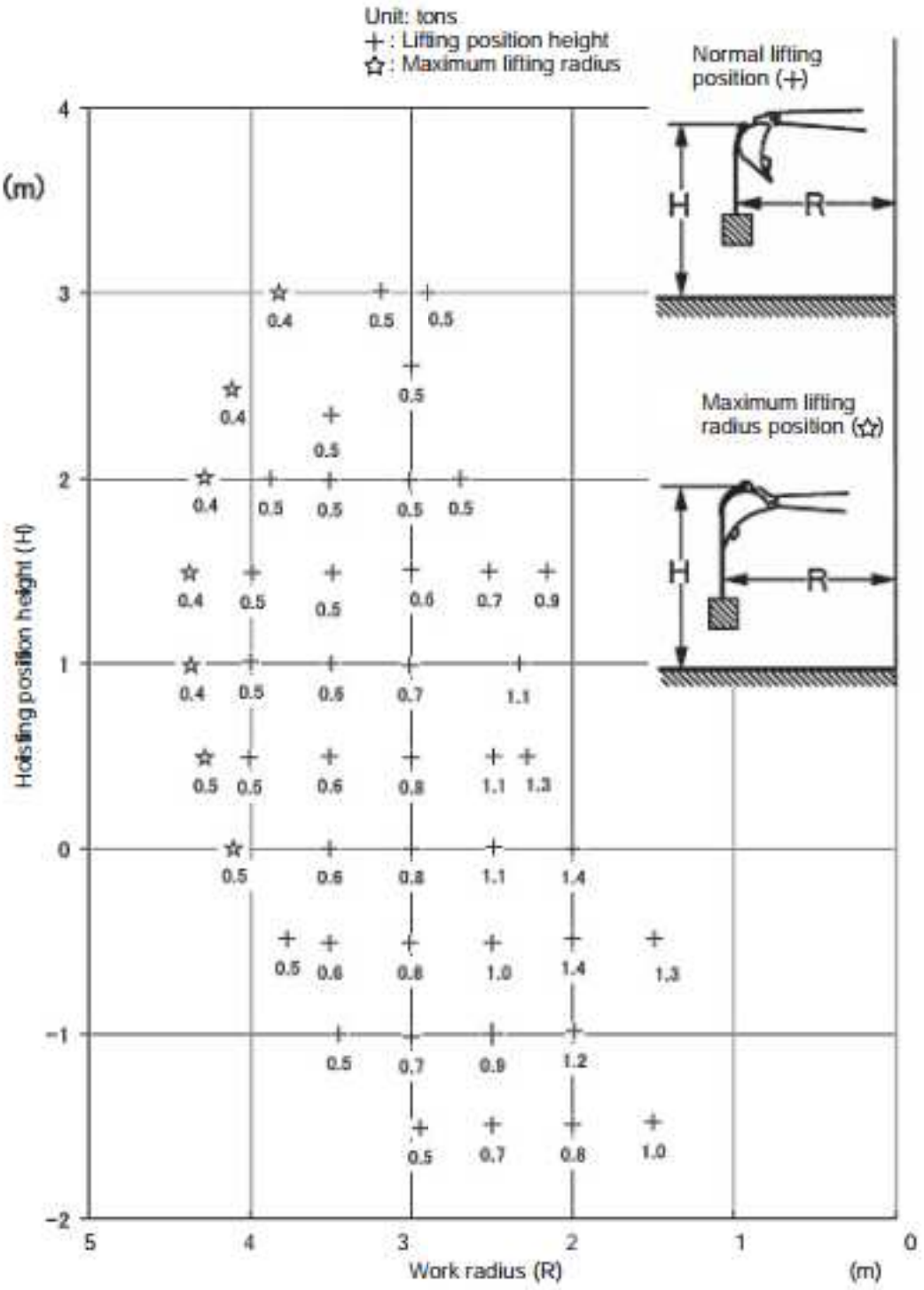
2 Ear plate dimensions



Lifting capacity by boom cylinder (SAE type)

Forward lifting, blade fulcrum, with standard arm

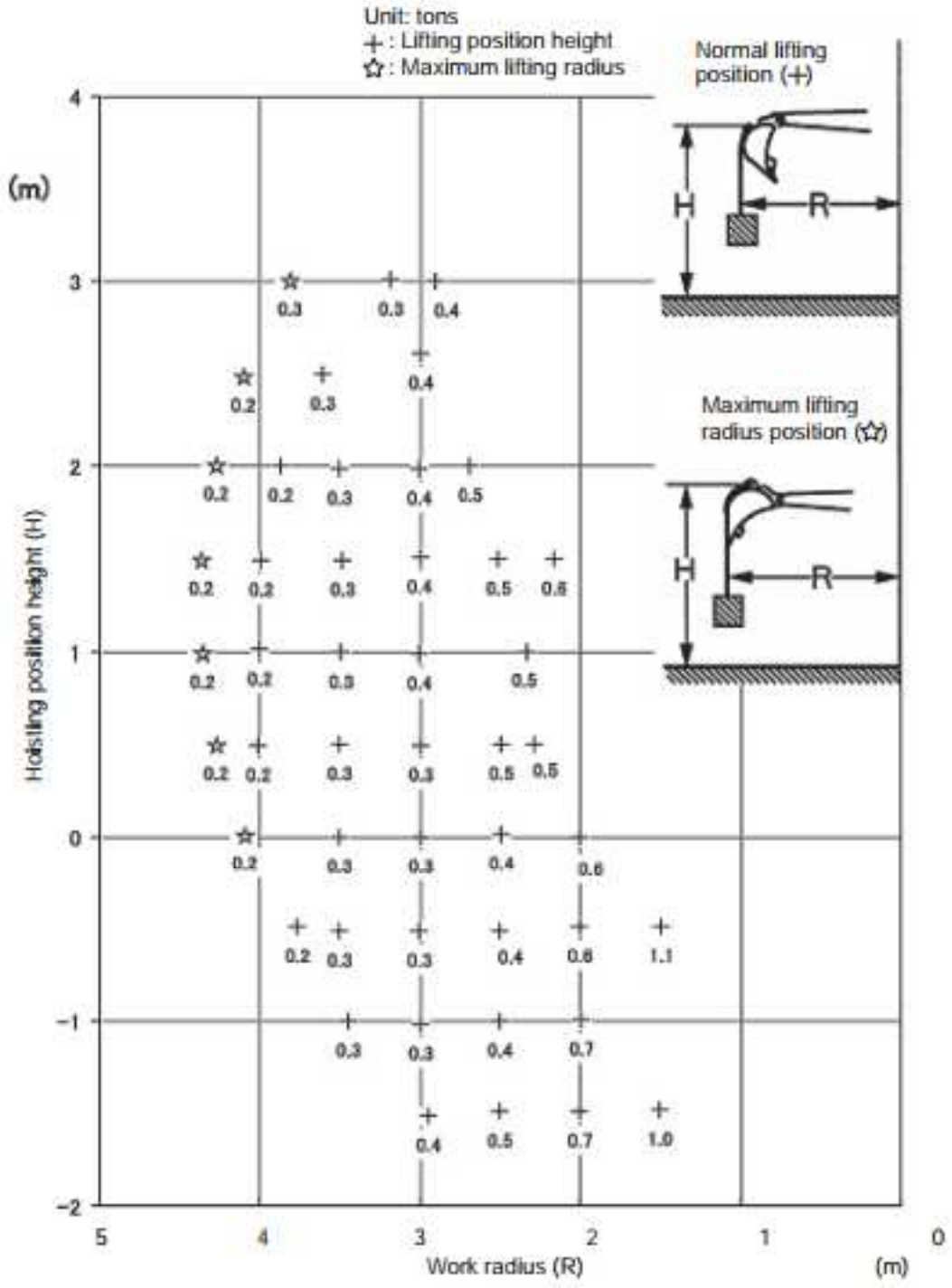
(Note) The lifting load in this table is 75% of the tipping load or 87% of the load upon relief, whichever is smaller.



Lifting capacity by boom cylinder (SAE type)

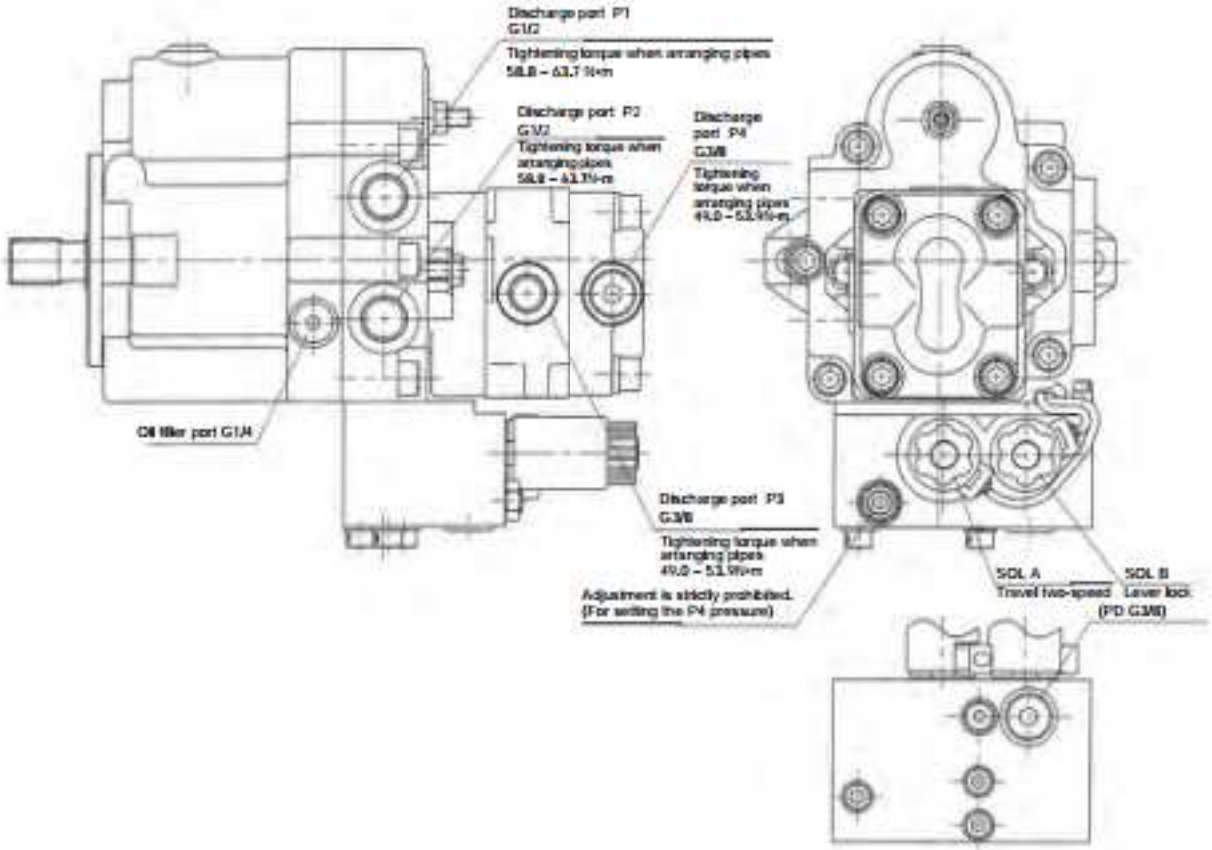
Side lifting, with standard arm

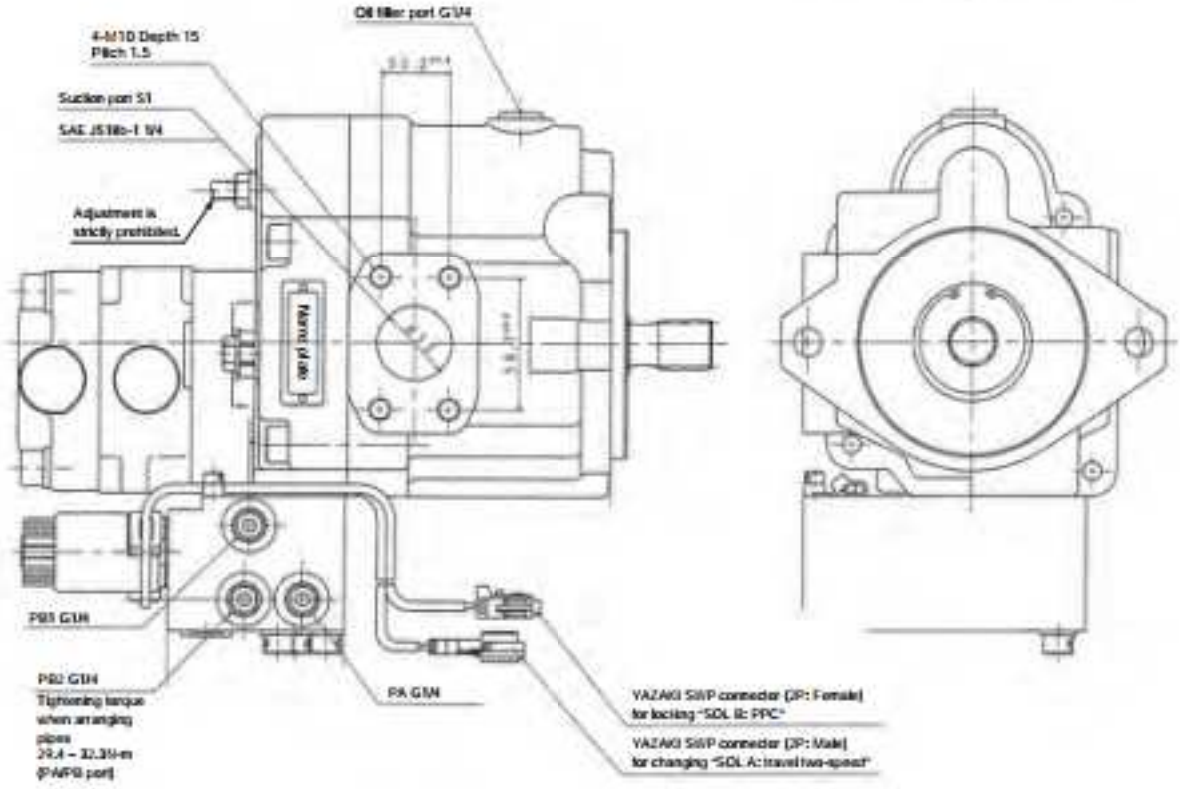
(Note) The lifting load in this table is 75% of the tipping load or 87% of the load upon relief, whichever is smaller.



A3 Component Information (Hydraulic Components)

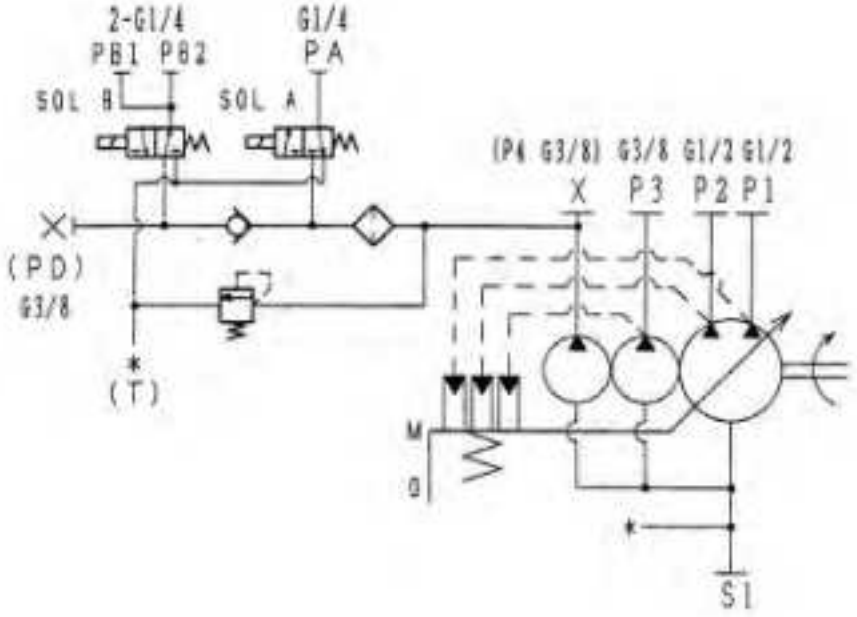
1 External view



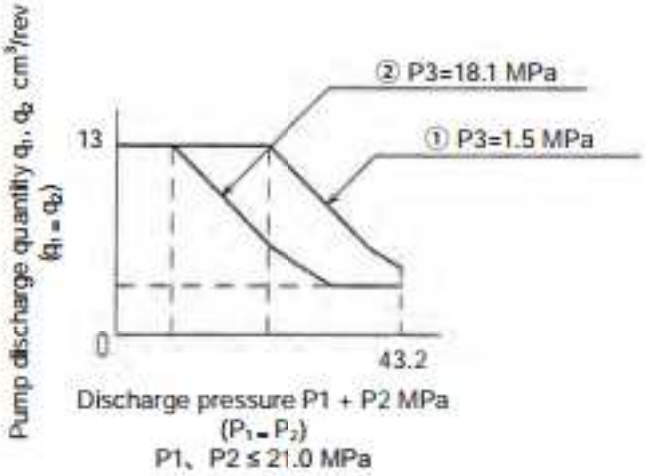


Mass: 24 kg

2 Hydraulic symbols



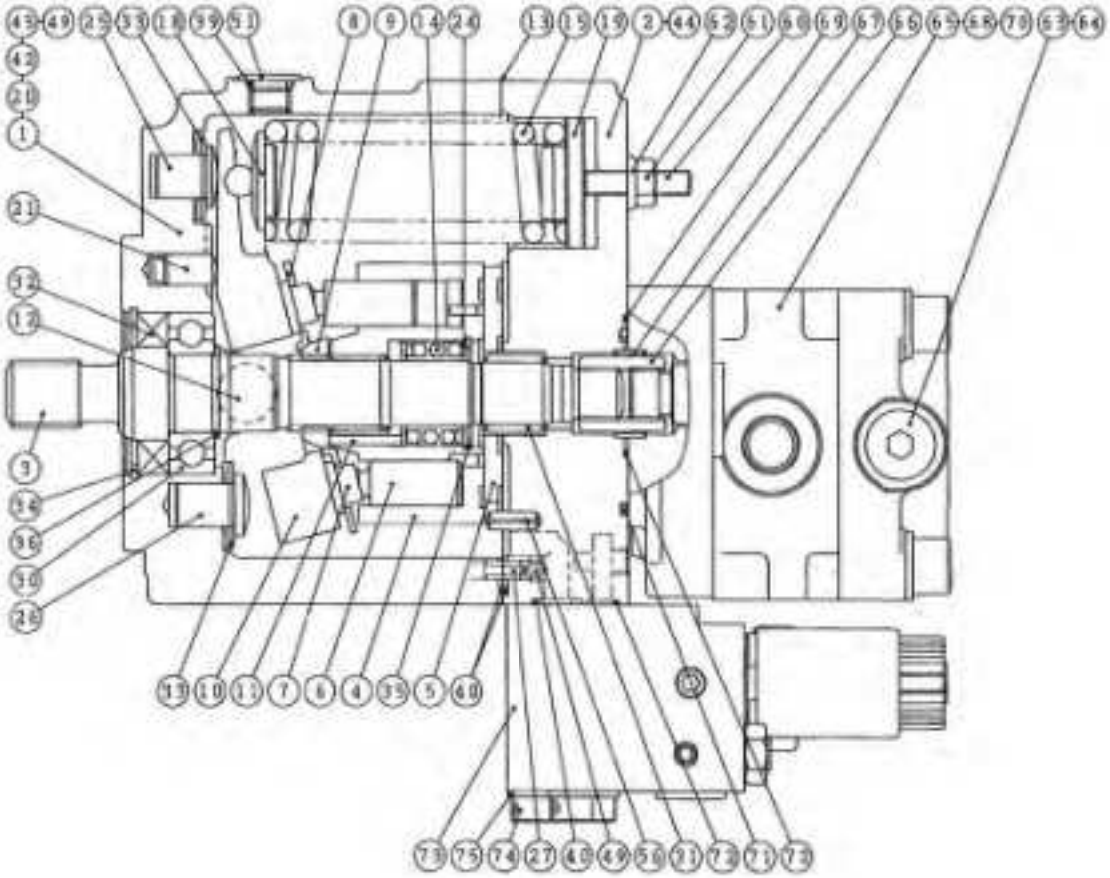
3 P-Q chart



4 Specifications

Pump capacity cm³/rev	12 + 12 + 8 + 4.5 (P1 + P2 + P3 + P4)
Rotation direction	Clockwise rotation (as viewed from the shaft edge)

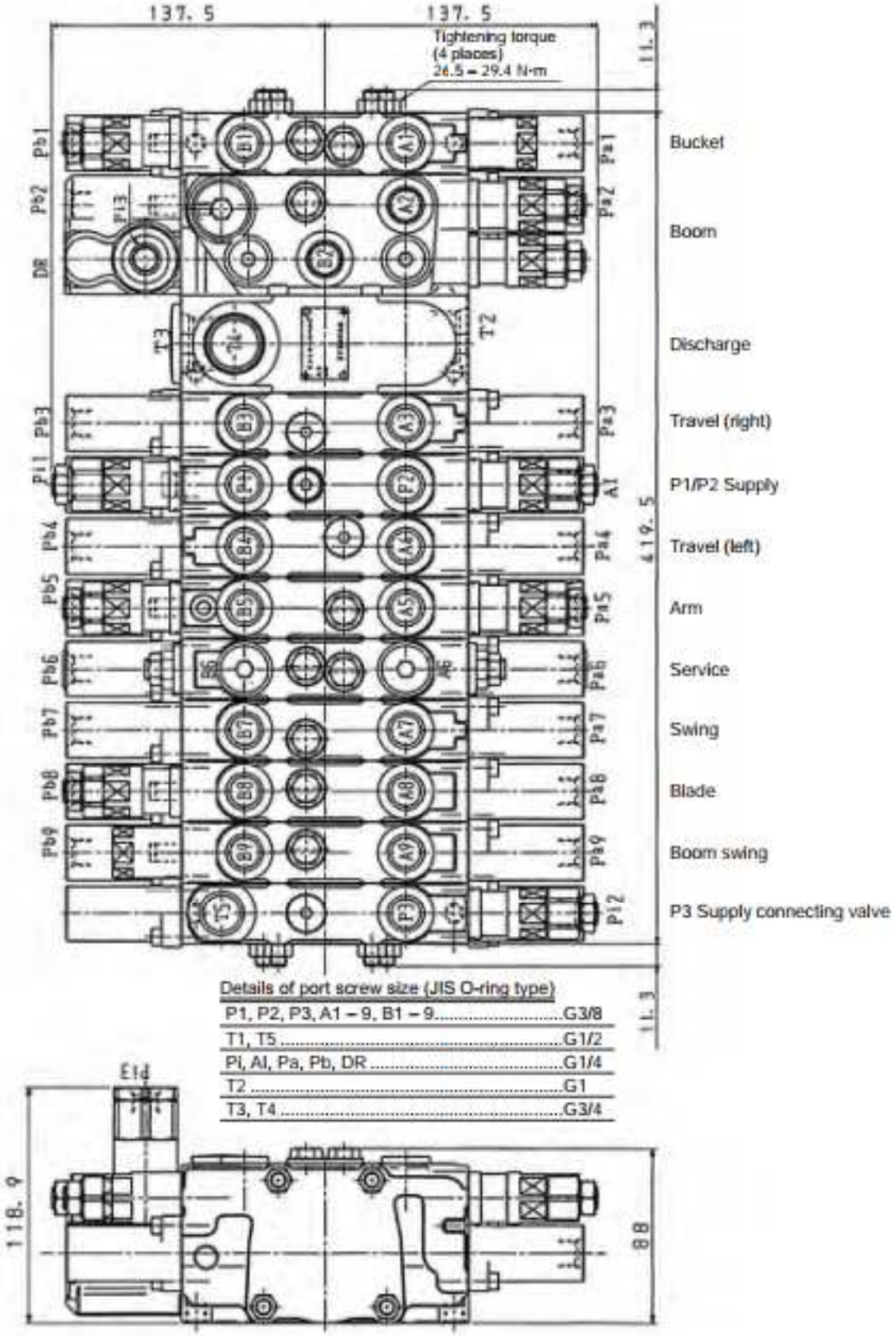
5 Hydraulic symbols



6 Parts list

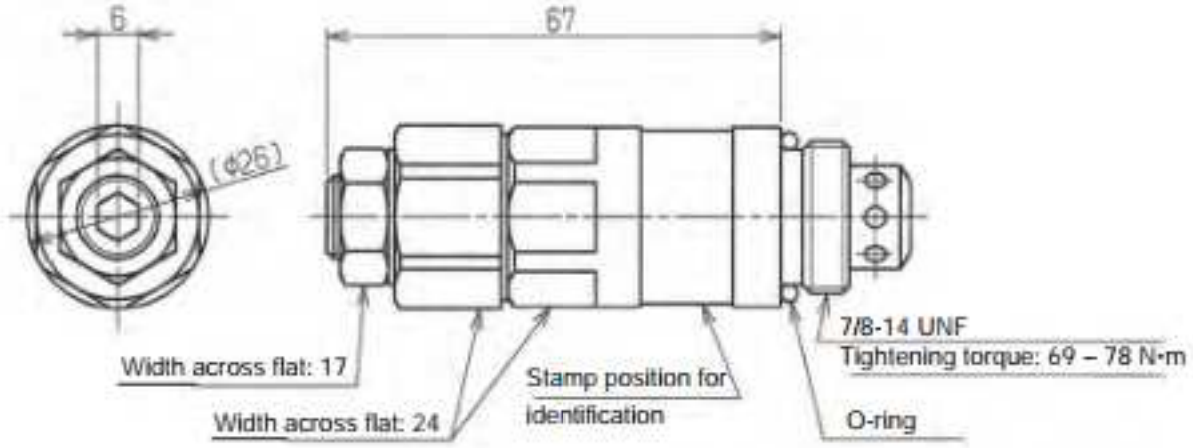
No.	Name	Q'ty
1	Body S	1
2	Body H	1
3	Shaft	1
4	Cylinder barrel	1
5	Valve plate	1
6	Piston	10
7	Shoe	10
8	Shoe holder	1
9	Barrel holder	1
10	Swash plate	1
11	Needle	3
12	Oscillation pin	2
13	Packing	1
14	Spring C	1
15	Spring T1	1
16	Missing number	-
17	Missing number	-
18	Spring holder	1
19	Spring guide	1
20	Pin	1
21	Rod	1
22	Missing number	-
23	Missing number	-
24	Retainer	2
25	Stopper pin A	1
26	Stopper pin B	1
27	Hole pin	1
28	Missing number	-
29	Missing number	-
30	Ball bearing	1
31	Needle bearing	1
32	Oil seal	1
33	Disk spring	4
34	Snap ring	1
35	Snap ring	1
36	Snap ring	1
37	Missing number	-
38	Missing number	-
39	O-ring	1
40	O-ring	3
41	Missing number	-
42	Plug	1
43	O-ring	1
44	Socket head bolt	5
45	Missing number	-
46	Missing number	-
47	Missing number	-
48	Missing number	-
49	Socket head plug	5
50	Missing number	-
51	Plug	1
52	Missing number	-
53	Missing number	-
54	Missing number	-
55	Missing number	-
56	Spring pin	1
57	Missing number	-
58	Missing number	-
59	Missing number	-
60	Socket head setscrew	1
61	Hex. nut	1
62	Seal washer	1
63	Plug	1
64	O-ring	1
65	Gear pump	1
66	Coupling	1
67	Collar	1
68	Hex. bolt	2
69	O-ring	1
70	Washer	2
71	O-ring	1
72	O-ring	2
73	Valve block Ass'y	1
74	Socket head bolt	3
75	Spring washer	3

1 External view

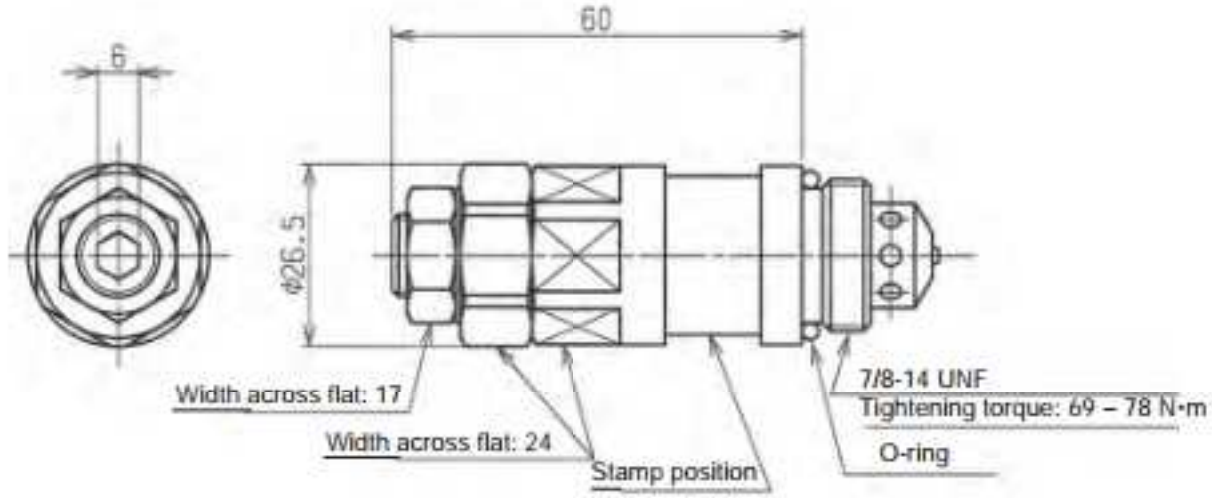


Mass: 32 kg

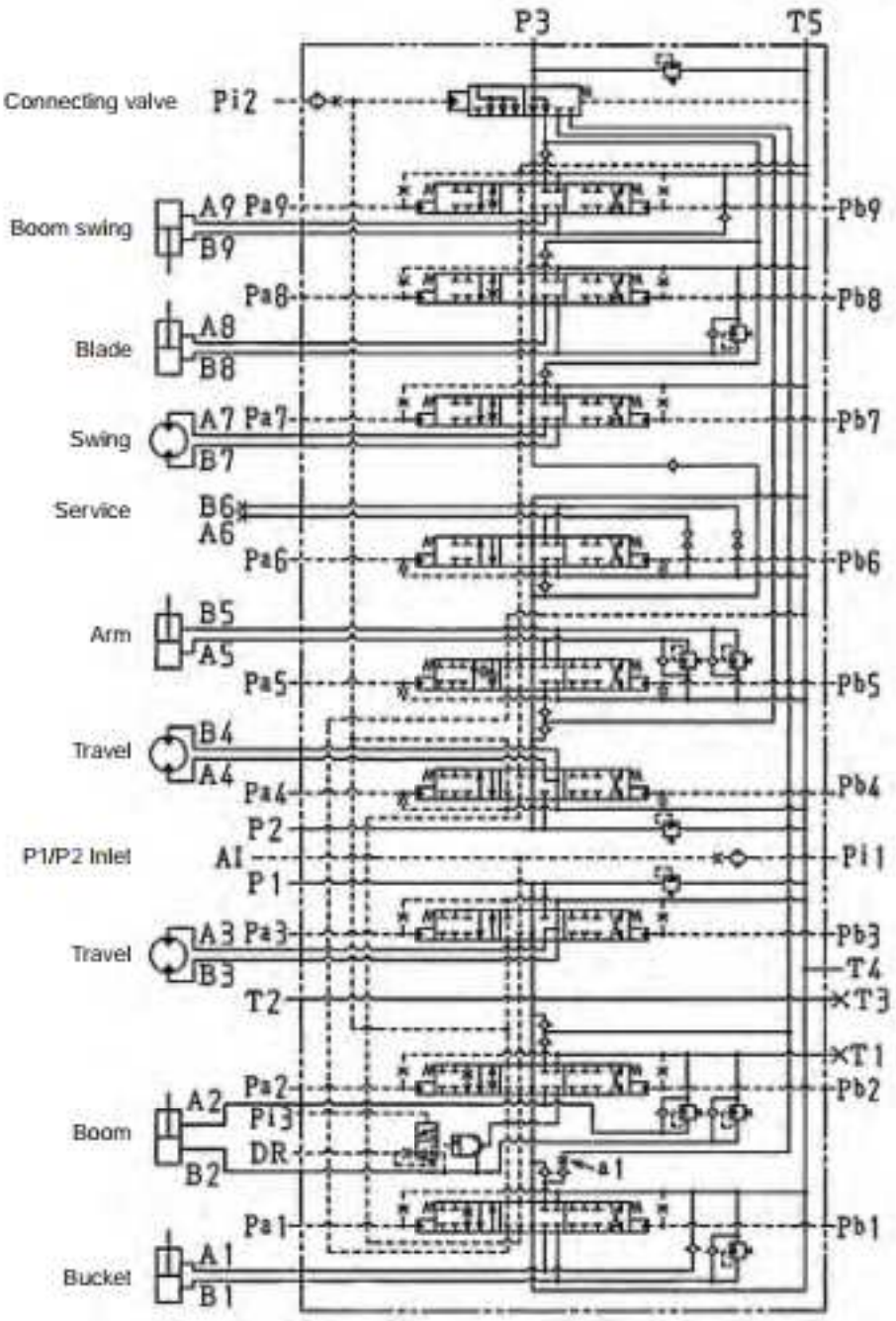
Main relief valve



Overload relief valve

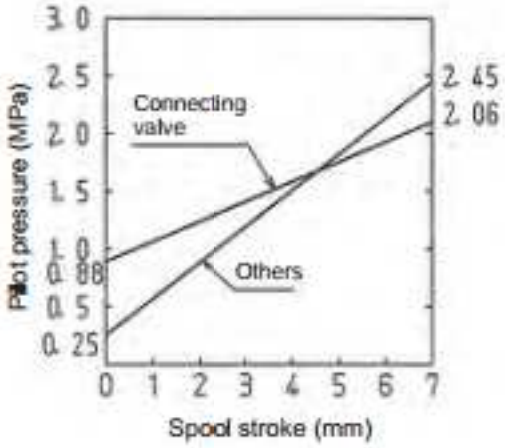


2 Hydraulic symbols



3 Characteristic chart

Spool pressure reception characteristics



4 Specifications

• Relief valve setting pressure

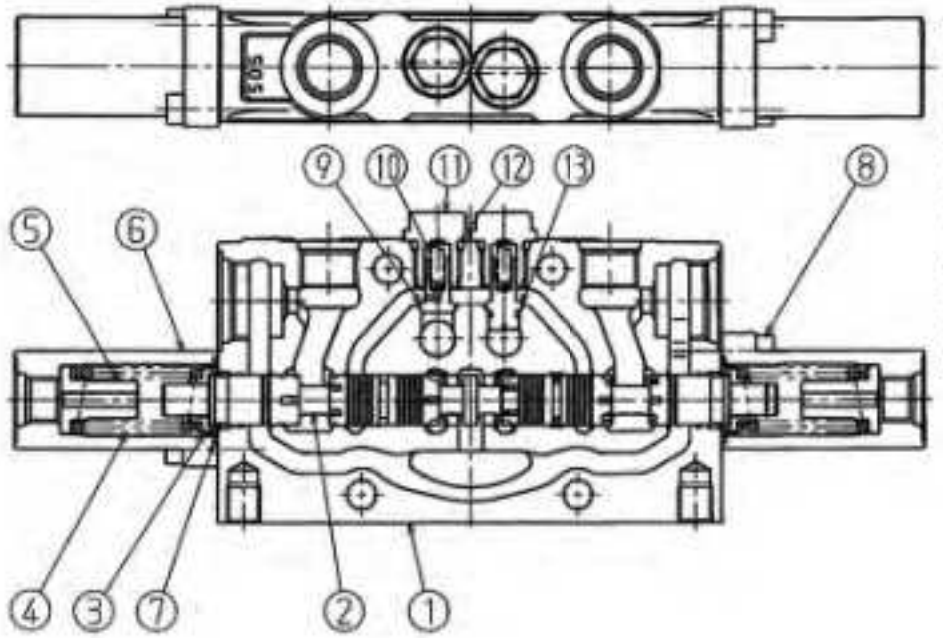
P1 : 21.6 $^{+0.3}$ MPa, at 29L/min
P2 : 21.6 $^{+0.3}$ MPa, at 29L/min
P3 : 18.1 $^{+0.3}$ MPa, at 19L/min

• Overload relief valve setting pressure

B1 : 24.5 $^{+0.3}$ MPa, at 5L/min
A2 : 23.5 $^{+0.3}$ MPa, at 5L/min
B2 : 23.5 $^{+0.3}$ MPa, at 5L/min
A5 : 23.5 $^{+0.3}$ MPa, at 5L/min
B5 : 23.5 $^{+0.3}$ MPa, at 5L/min
B8 : 22.6 $^{+0.3}$ MPa, at 5L/min

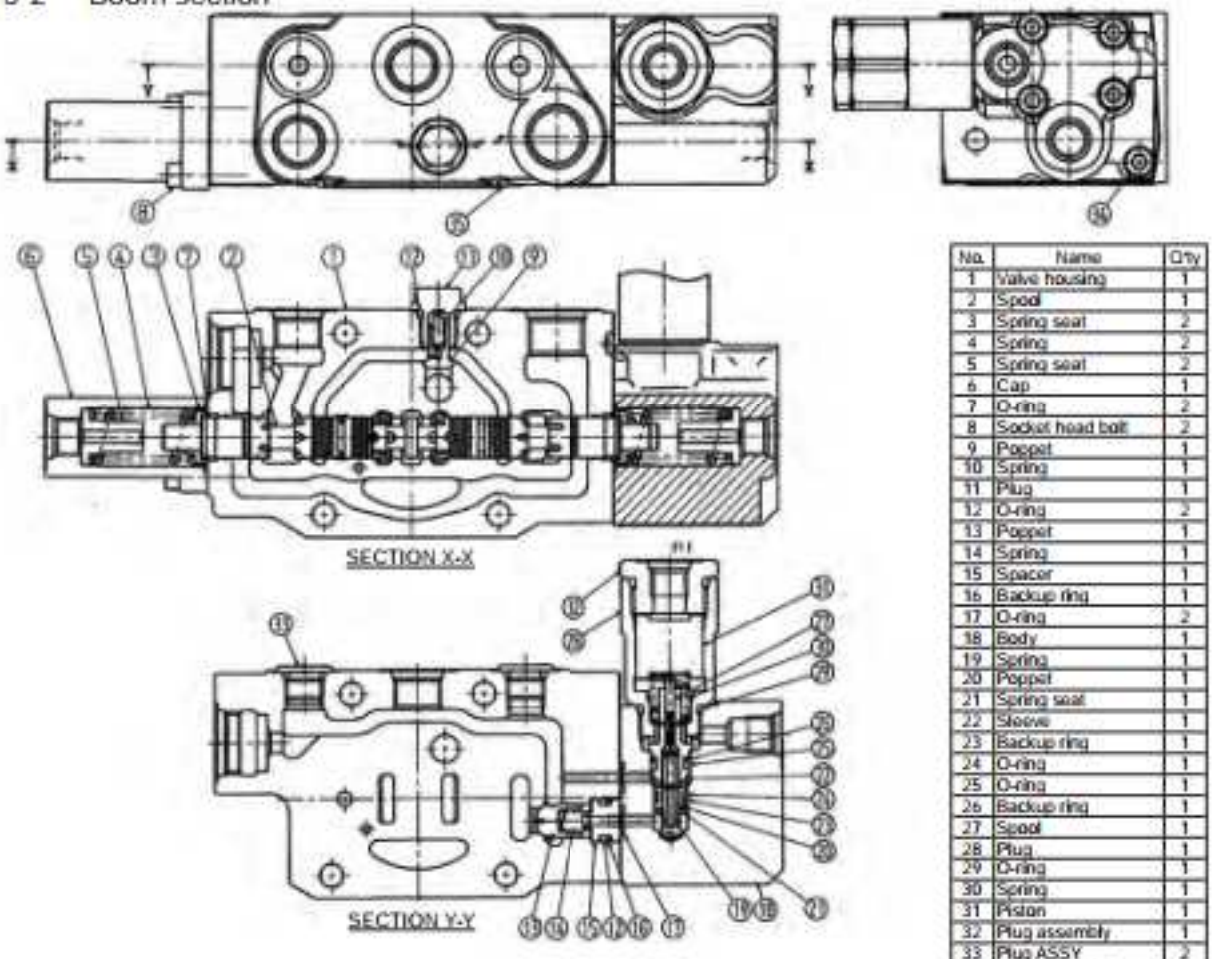
5 Cross-sectional view

5-1 Bucket section



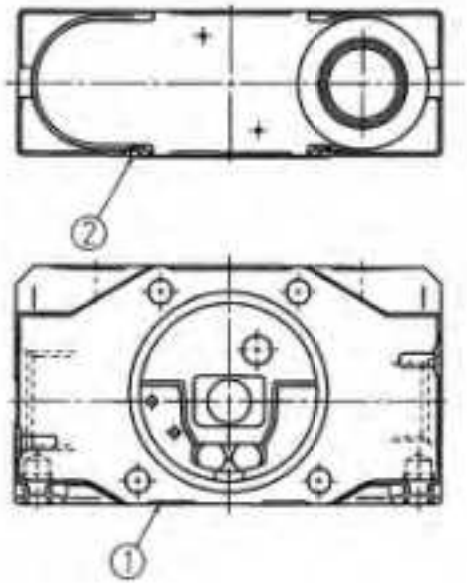
No.	Name	Q'ty
1	Valve housing	1
2	Spool	1
3	Spring seat	2
4	Spring	2
5	Spring seat	2
6	Cap	2
7	O-ring	2
8	Socket head bolt	4
9	Poppet	1
10	Spring	2
11	Plug	2
12	O-ring	2
13	Poppet	1

5-2 Boom section



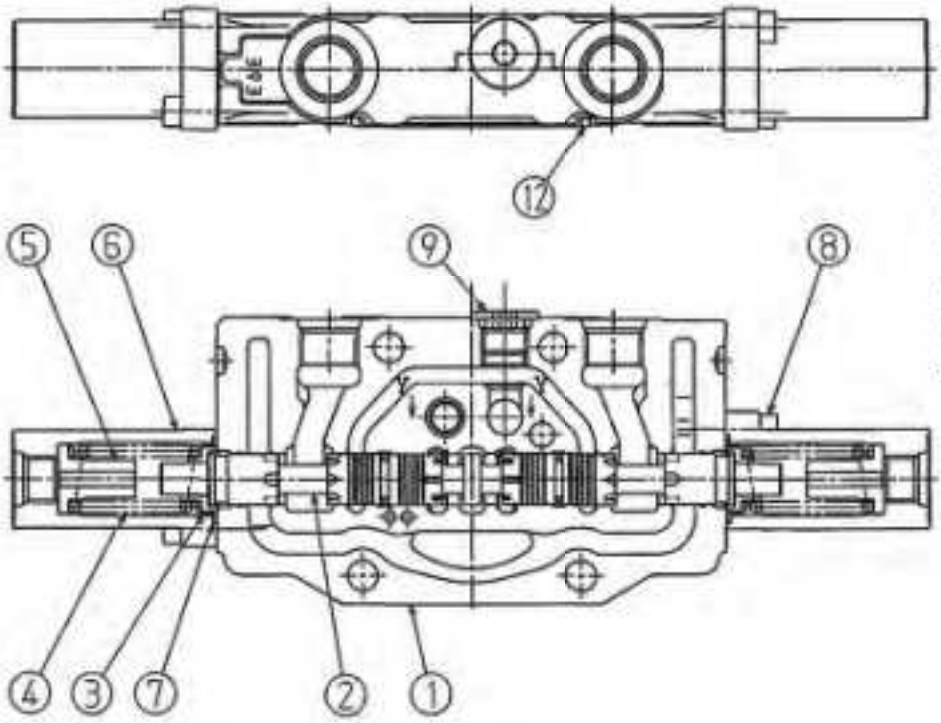
No.	Name	Q'ty
1	Valve housing	1
2	Spool	1
3	Spring seat	2
4	Spring	2
5	Spring seat	2
6	Cap	1
7	O-ring	2
8	Socket head bolt	2
9	Poppet	1
10	Spring	1
11	Plug	1
12	O-ring	2
13	Poppet	1
14	Spring	1
15	Spacer	1
16	Backup ring	1
17	O-ring	2
18	Body	1
19	Spring	1
20	Poppet	1
21	Spring seat	1
22	Sleeve	1
23	Backup ring	1
24	O-ring	1
25	O-ring	1
26	Backup ring	1
27	Spool	1
28	Plug	1
29	O-ring	1
30	Spring	1
31	Piston	1
32	Plug assembly	1
33	Plug ASSY	2
34	Socket head bolt	5
35	O-ring	1

5-3 Outlet section

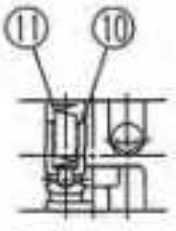


No.	Name	Q'ty
1	Outlet housing	1
2	O-ring	1

5-4 Travel (left) section

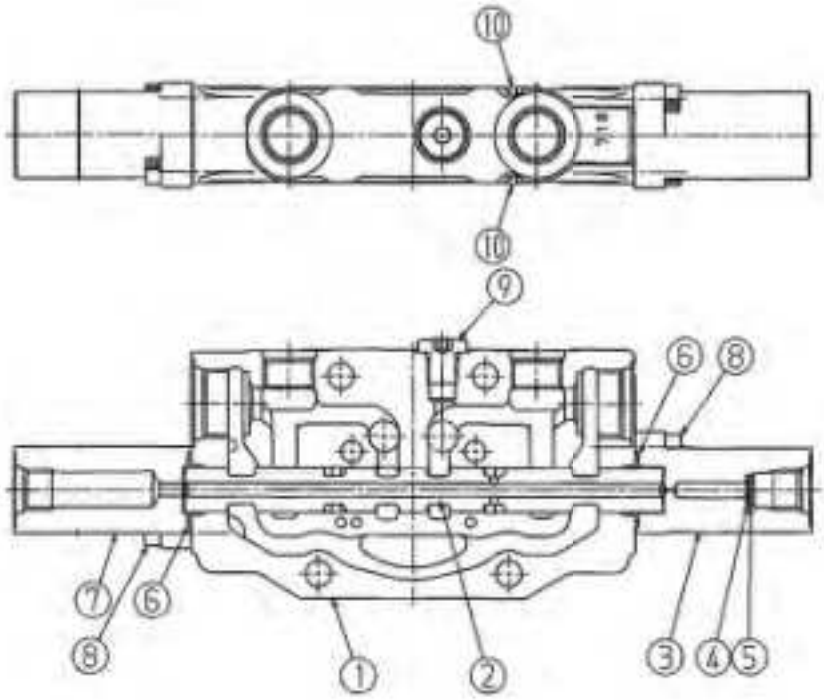


No.	Name	Q'ty
1	Valve housing	1
2	Spool	1
3	Spring seat	2
4	Spring	2
5	Spring seat	2
6	Cap	2
7	O-ring	2
8	Socket head bolt	4
9	Plug ASSY	1
10	Poppet	1
11	Spring	1
12	O-ring	1



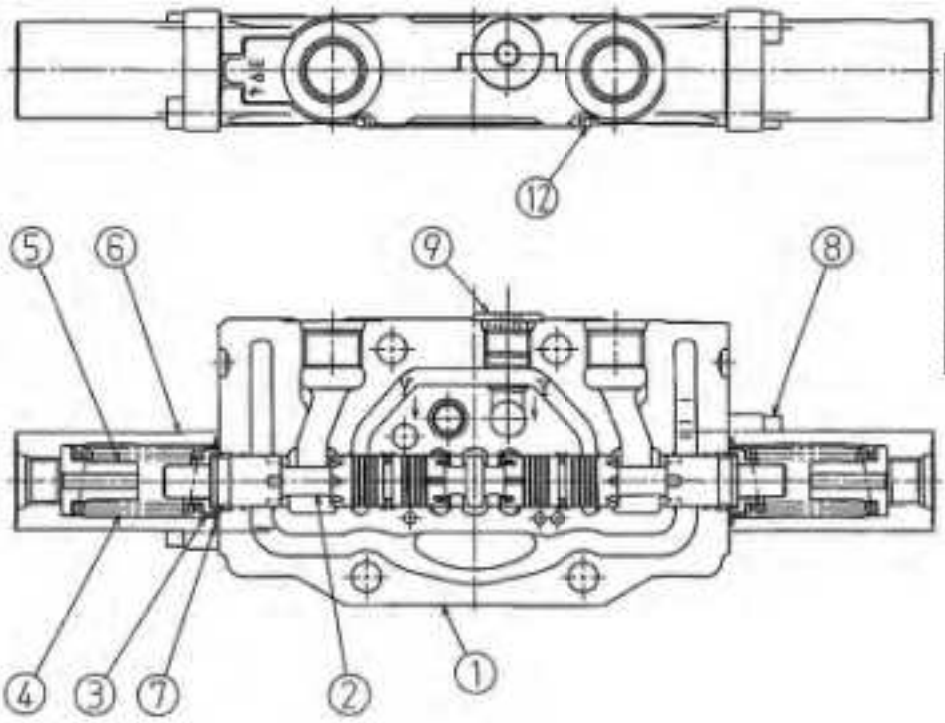
SECTION Y-Y

5-5 P1/P2 Supply section

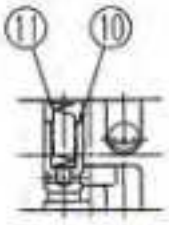


No.	Name	Q'ty
1	Spacer housing	1
2	Spool	1
3	Cap	1
4	Filter	1
5	Washer	1
6	O-ring	2
7	Cap	1
8	Socket head bolt	4
9	Plug assembly	1
10	O-ring	2

5-6 Travel (right) section

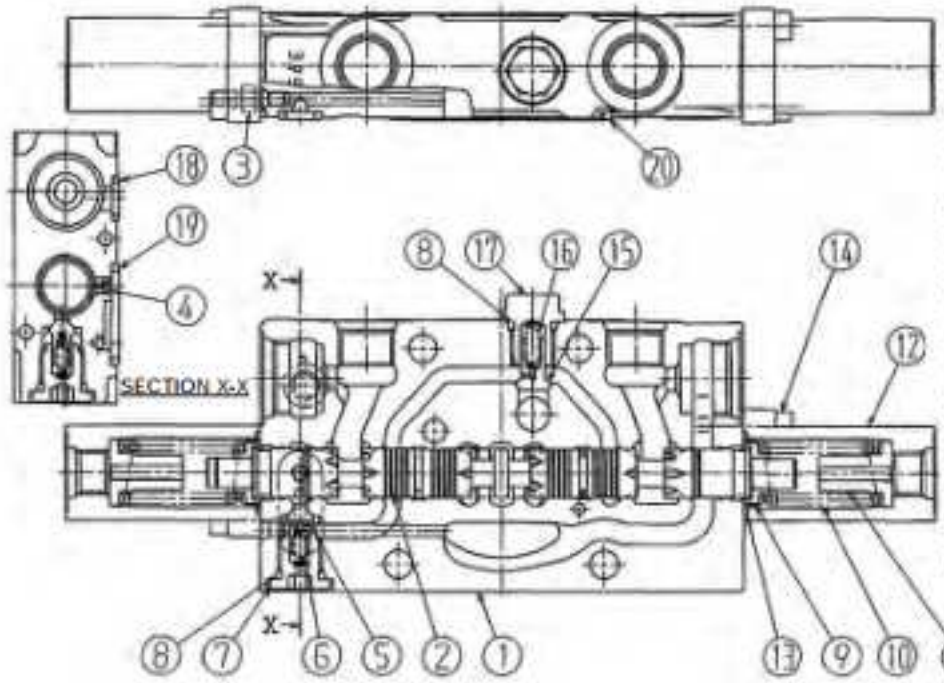


No.	Name	Q'ty
1	Valve housing	1
2	Spool	1
3	Spring seat	2
4	Spring	2
5	Spring seat	2
6	Cap	2
7	O-ring	2
8	Socket head bolt	4
9	Plug ASSY	1
10	Poppet	1
11	Spring	1
12	O-ring	1



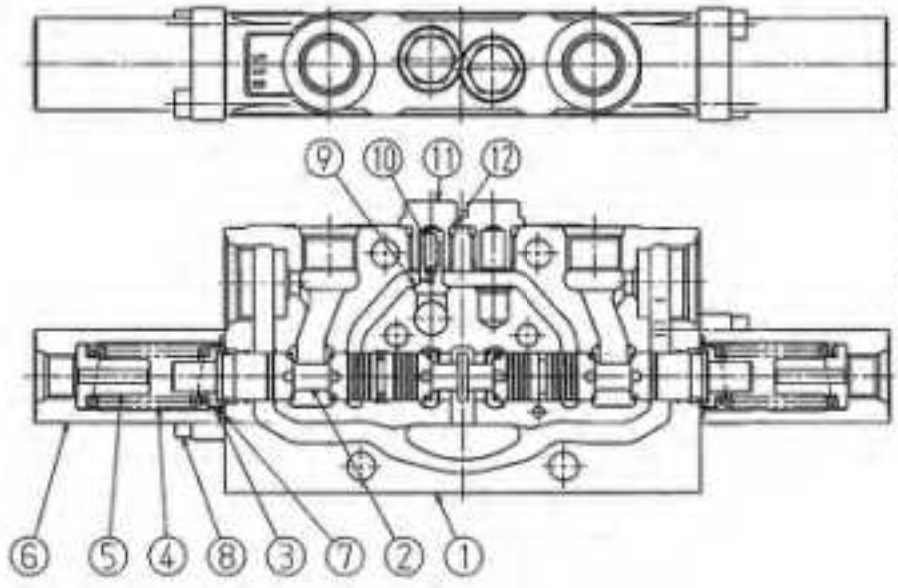
SECTION Y-Y

5-7 Arm section



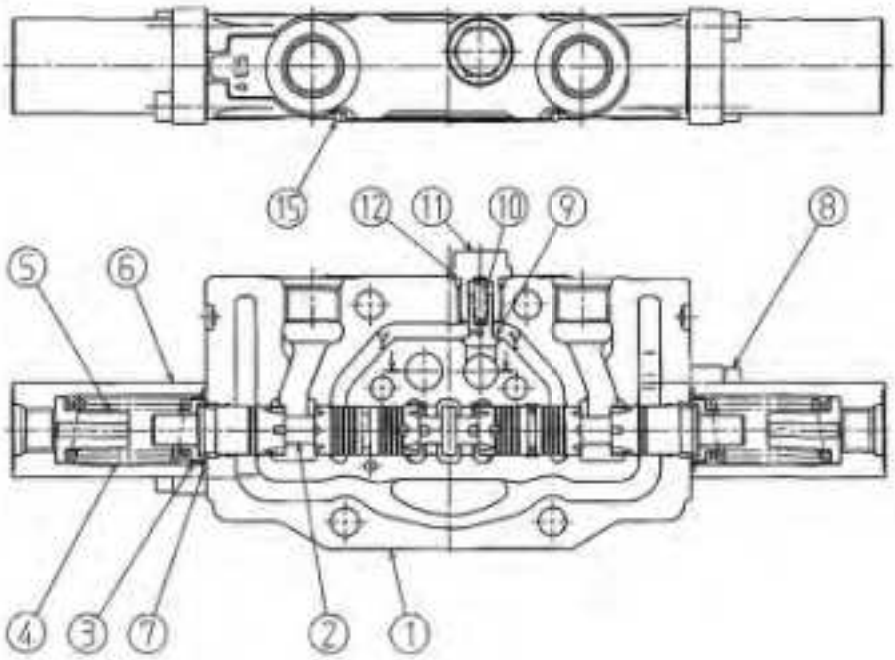
No.	Name	Q'ty
1	Valve housing	1
2	Spool	1
3	Plug	1
4	Orifice plug	1
5	Poppet	1
6	Spring	1
7	Plug	1
8	O-ring	2
9	Spring seat	2
10	Spring	2
11	Spring seat	2
12	Cap	2
13	O-ring	2
14	Socket head bolt	4
15	Poppet	1
16	Spring	1
17	Plug	1
18	O-ring	1
19	O-ring	1
20	O-ring	1

5-8 Service section



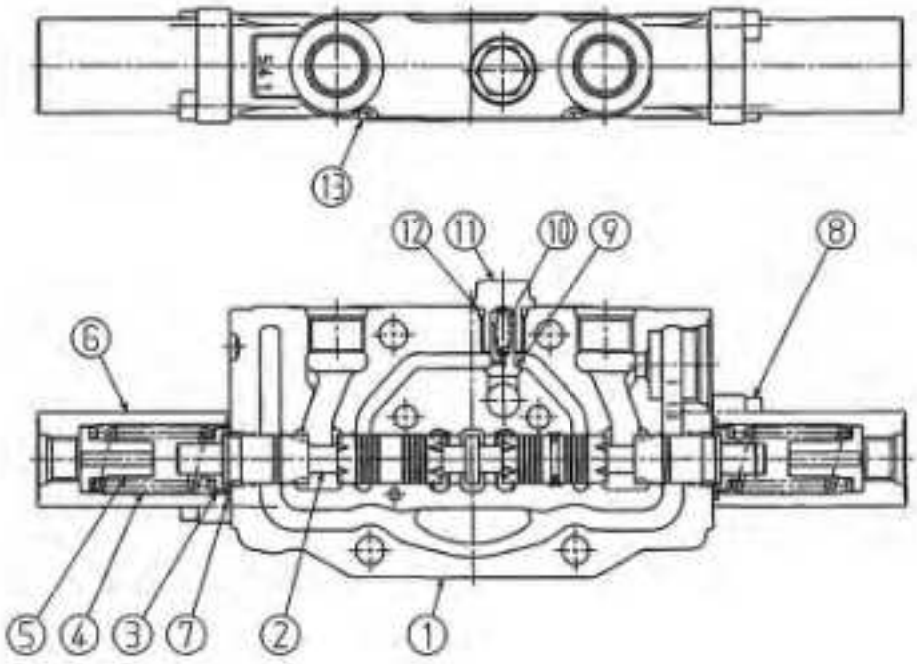
No.	Name	Q'ty
1	Valve housing	1
2	Spool	1
3	Spring seat	2
4	Spring	2
5	Spring seat	2
6	Cap	2
7	O-ring	2
8	Socket head bolt	4
9	Poppet	1
10	Spring	1
11	Plug	2
12	O-ring	2

5-9 Swing section



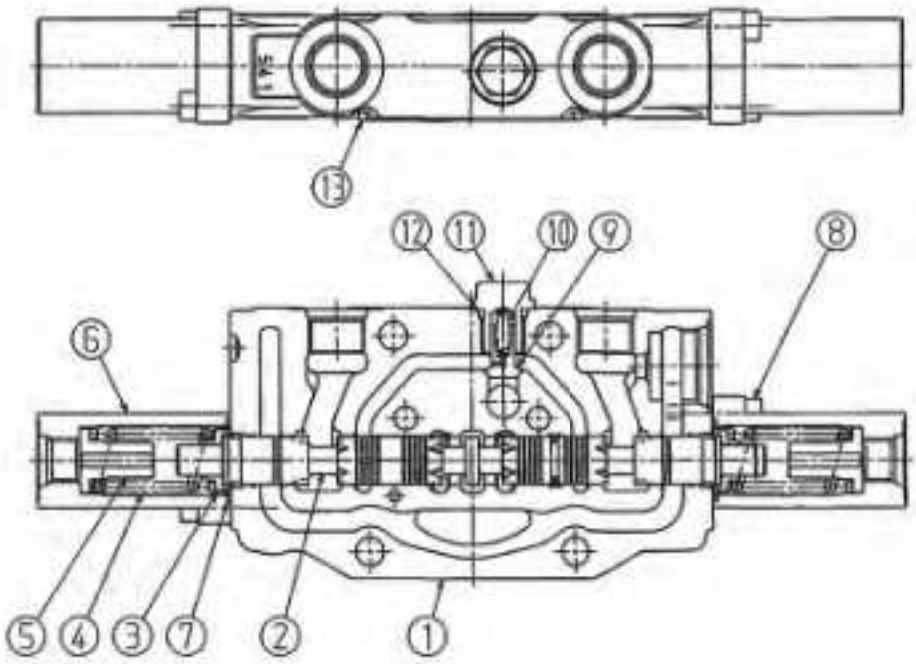
No.	Name	Q'ty
1	Valve housing	1
2	Spool	1
3	Spring seat	2
4	Spring	2
5	Spring seat	2
6	Cap	2
7	O-ring	2
8	Socket head bolt	4
9	Poppet	1
10	Spring	1
11	Plug	1
12	O-ring	1
13	Poppet	1
14	Spring	1
15	O-ring	1

5-10 Blade section



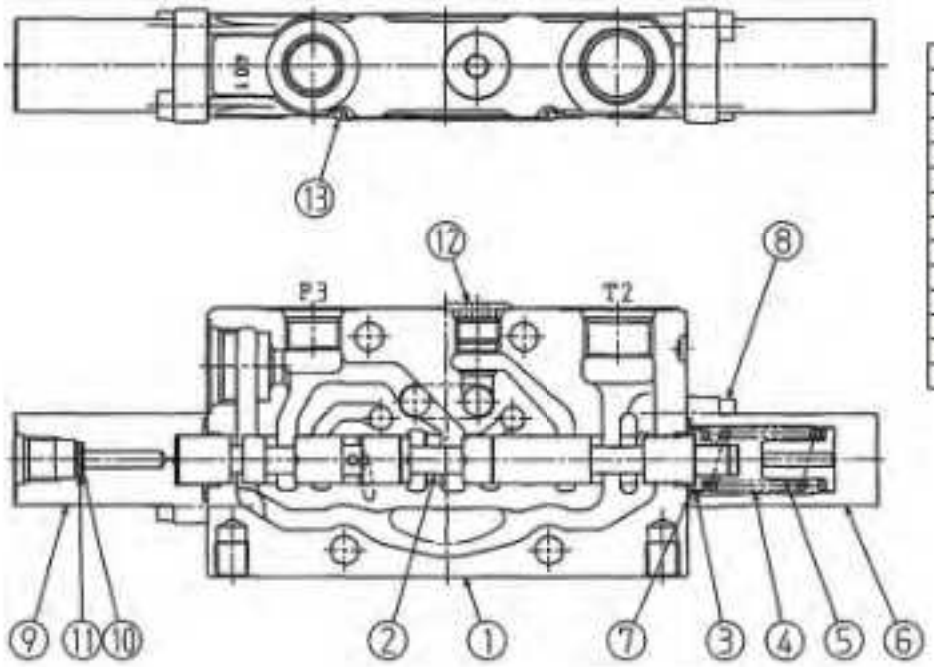
No.	Name	Q'ty
1	Valve housing	1
2	Spool	1
3	Spring seat	2
4	Spring	2
5	Spring seat	2
6	Cap	2
7	O-ring	2
8	Socket head bolt	4
9	Poppet	1
10	Spring	1
11	Plug	1
12	O-ring	1
13	O-ring	1

5-11 Boom swing section



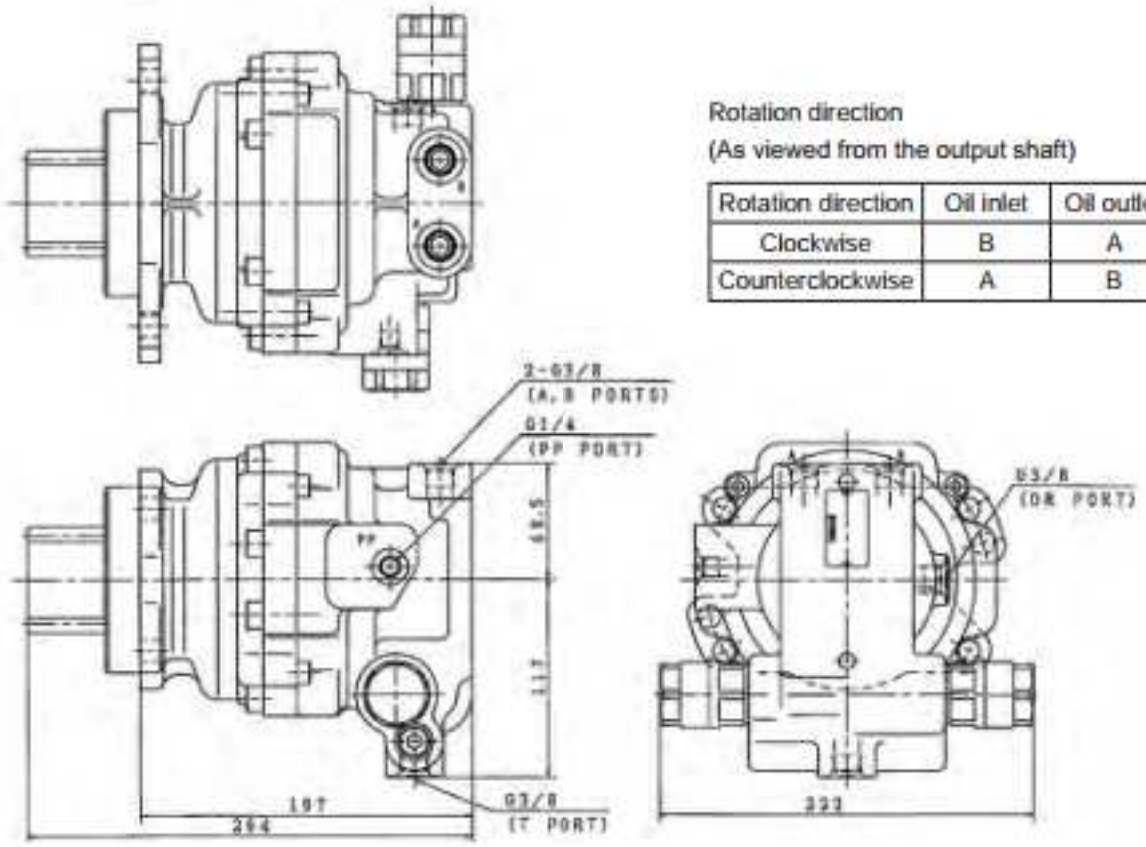
No.	Name	Q'ty
1	Valve housing	1
2	Spool	1
3	Spring seat	2
4	Spring	2
5	Spring seat	2
6	Cap	2
7	O-ring	2
8	Socket head bolt	4
9	Poppet	1
10	Spring	1
11	Plug	1
12	O-ring	1
13	O-ring	1

5-12 P3 Supply/Connecting valve section



No.	Name	Q'ty
1	Valve housing	1
2	Spool	1
3	Spring seat	1
4	Spring	1
5	Spring seat	1
6	Cap	1
7	O-ring	2
8	Socket head bolt	4
9	Cap	1
10	Filter	1
11	Washer	1
12	Plug ASSY	1
13	O-ring	1

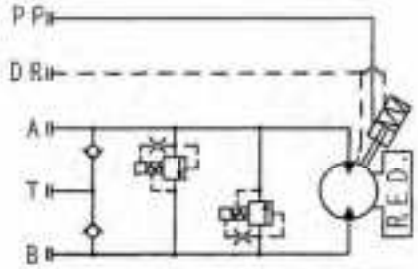
1 External view



Rotation direction
(As viewed from the output shaft)

Rotation direction	Oil inlet	Oil outlet
Clockwise	B	A
Counterclockwise	A	B

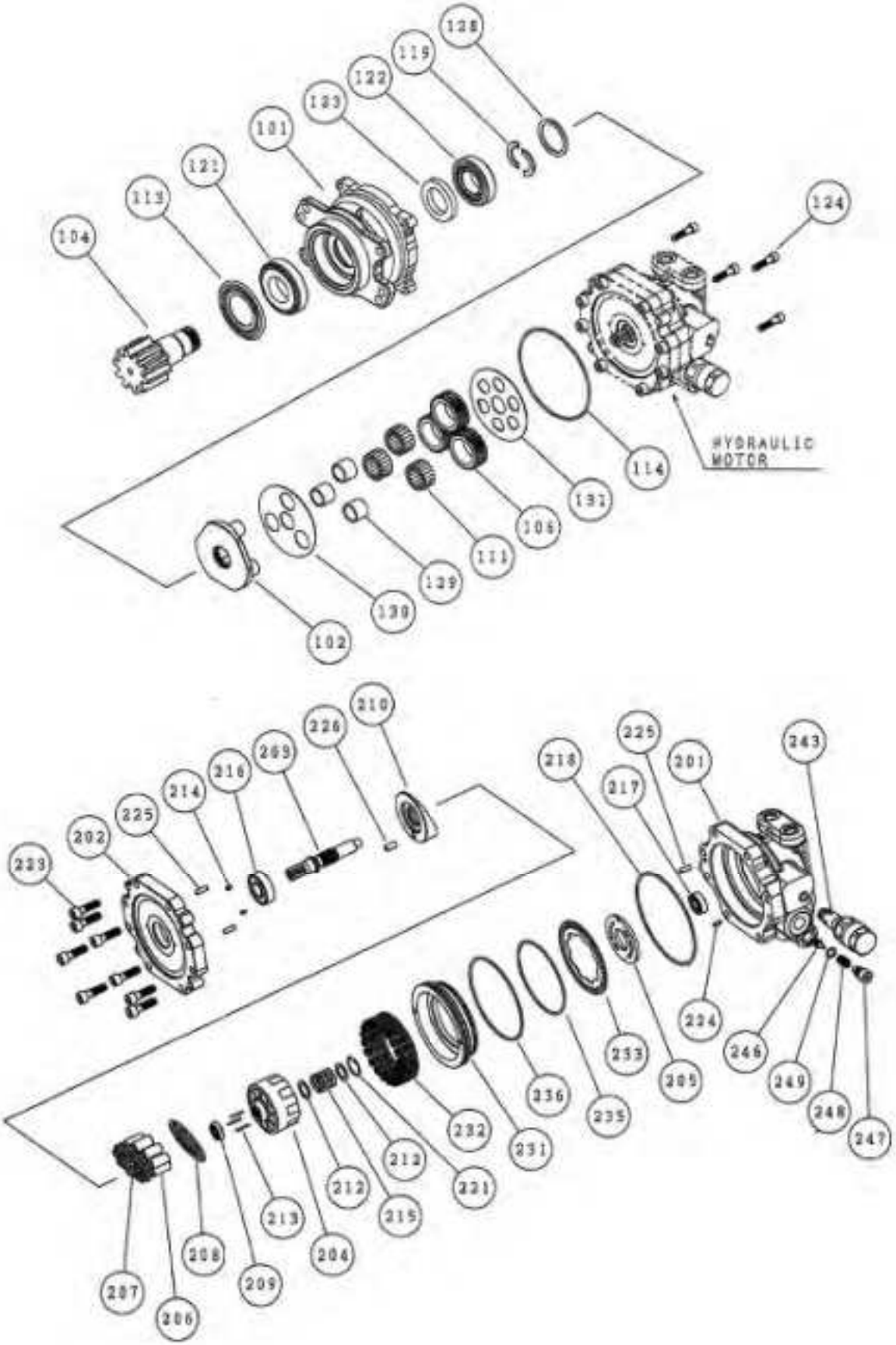
2 Hydraulic symbols

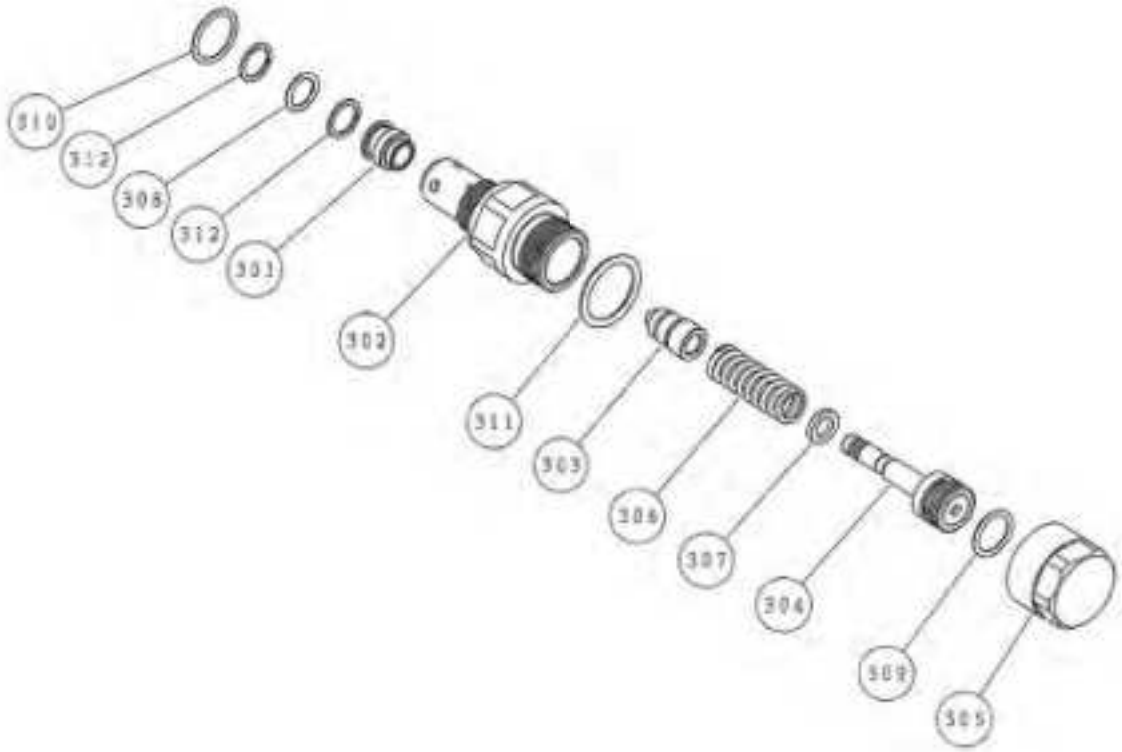


3 Specifications

Equivalent capacity			221 cm^3/rev
Reduction gear	Speed reduction ratio		1/10
Hydraulic motor	Capacity		22.1 cm^3/rev
Parking brake	Releasing pressure	Minimum value	2.5 MPa
		Maximum value	4.9 MPa
Relief valve (single unit)	Set pressure		15.7 MPa at 24L/min
	Cracking pressure		13.2 (or more) MPa at 1L/min
Mass			Approx. 24kg

4 Disassembly drawing





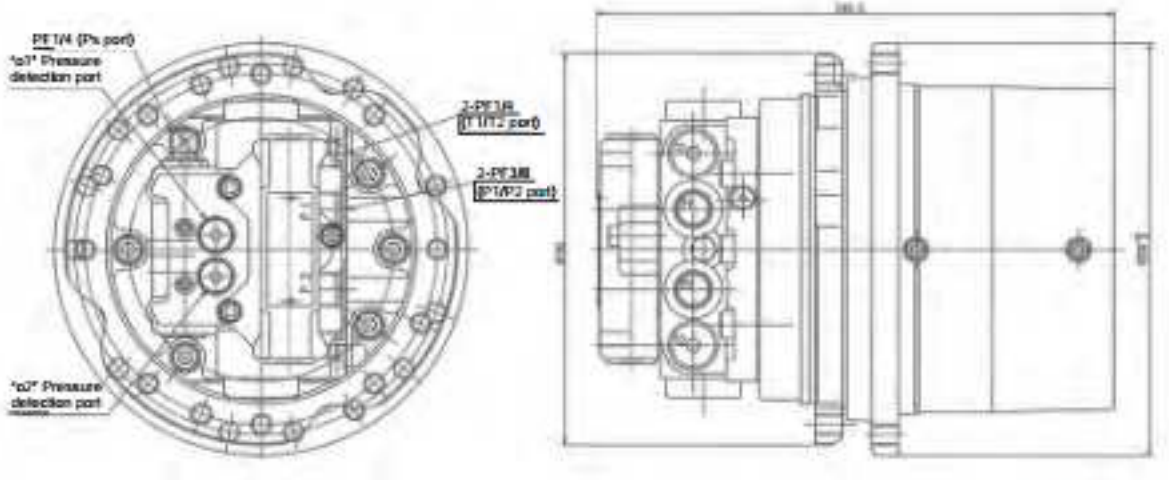
6 Parts list

No.	Name	Qty
	REDUCTION GEAR	1set
101	BODY	1
102	CARRIER 1	1
104	PINION SHAFT	1
106	B1 GEAR	3
111	NEEDLE	54
113	RING SEAL	1
114	O RING	1
119	PRE-ROAD COLLAR	2
121	BEARING	1
122	BEARING	1
123	OIL SEAL	1
124	SCREW	4
128	RING	1
129	RING	3
130	THRUST PLATE 1	1
131	THRUST PLATE 2	1

No.	Name	Qty
	HYDRAULIC MOTOR	1 set
201	BODY H	1
202	PLATE S	1
203	SHAFT	1
204	CYLINDER BARREL	1
205	VALVE PLATE	1
206	PISTON	9
207	SHOE	9
208	SHOE HOLDER	1
209	BARREL HOLDER	1
210	SWASH PLATE	1
212	RETAINER	2
213	PIN	3
214	FILTER	2
215	SPRING C	1
216	BEARING	1
217	BEARING	1
218	O RING	1
221	SNAP RING	1
223	SCREW	8
224	SPRING PIN	1
225	PIN	3
226	PIN	1
231	BRAKE PISTON	1
232	SPRING ASSY	1
233	DISK PLATE	1
235	O RING	1
236	O RING	1
243	RELIEF VALVE	2
246	CHECK VALVE	2
247	PLUG	2
248	SPRING	2
249	O RING	2

No.	Name	Qty
	RELIEF VALVE ASSY	2 sets
301	SEAT	1
302	RETAINER	1
303	POPPET	1
304	PISTON	1
305	CAP	1
306	SPRING	1
307	SPACER	*
308	O RING	1
309	O RING	1
310	O RING	1
311	O RING	1
312	BACK UP RING	2

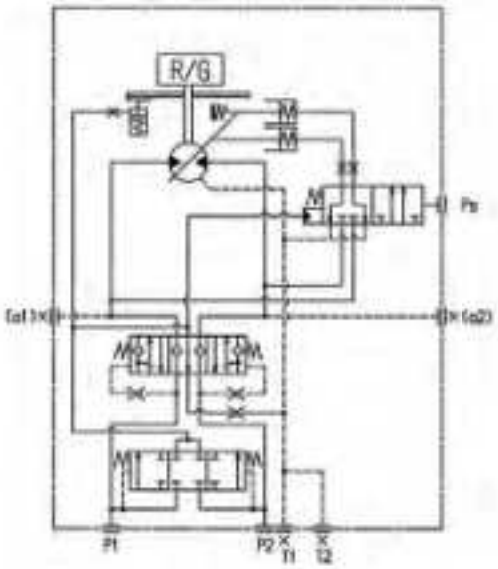
1 External view



Oil quantity: 0.35L
Oil type: Gear oil
API GL-4 SAE 90

Oil supply/drain • level port position

2 Hydraulic symbols

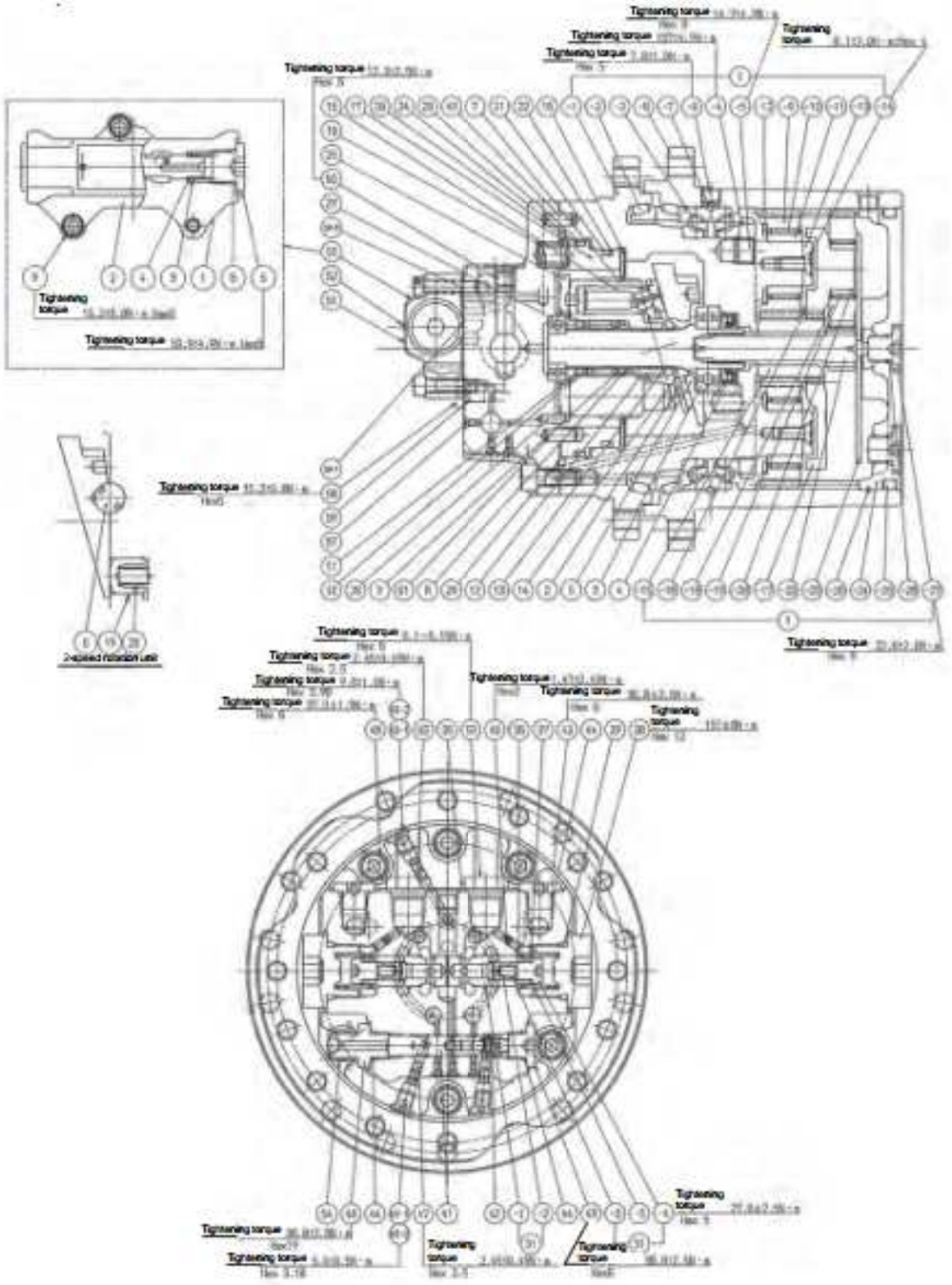


3 Specifications

Reduction gear	Maximum output torque		2660 N·m
	Maximum output rotary speed		37.2 / 74.5 min^{-1}
	Speed reduction ratio		1 / 42.958
Hydraulic motor	Capacity		18.0 / 9.0 cm^3/rev
	Maximum use pressure		21.6 MPa
	Maximum output rotary speed		1598 / 3200 min^{-1}
	Maximum flow rate		28.8 L/min
	Two-speed change pressure		3.40 MPa
	Parking brake	Static friction torque	55.9 N·m
		Release pressure	1.4 MPa

Mass : 22 kg

4 Cross-sectional view



5 Parts list

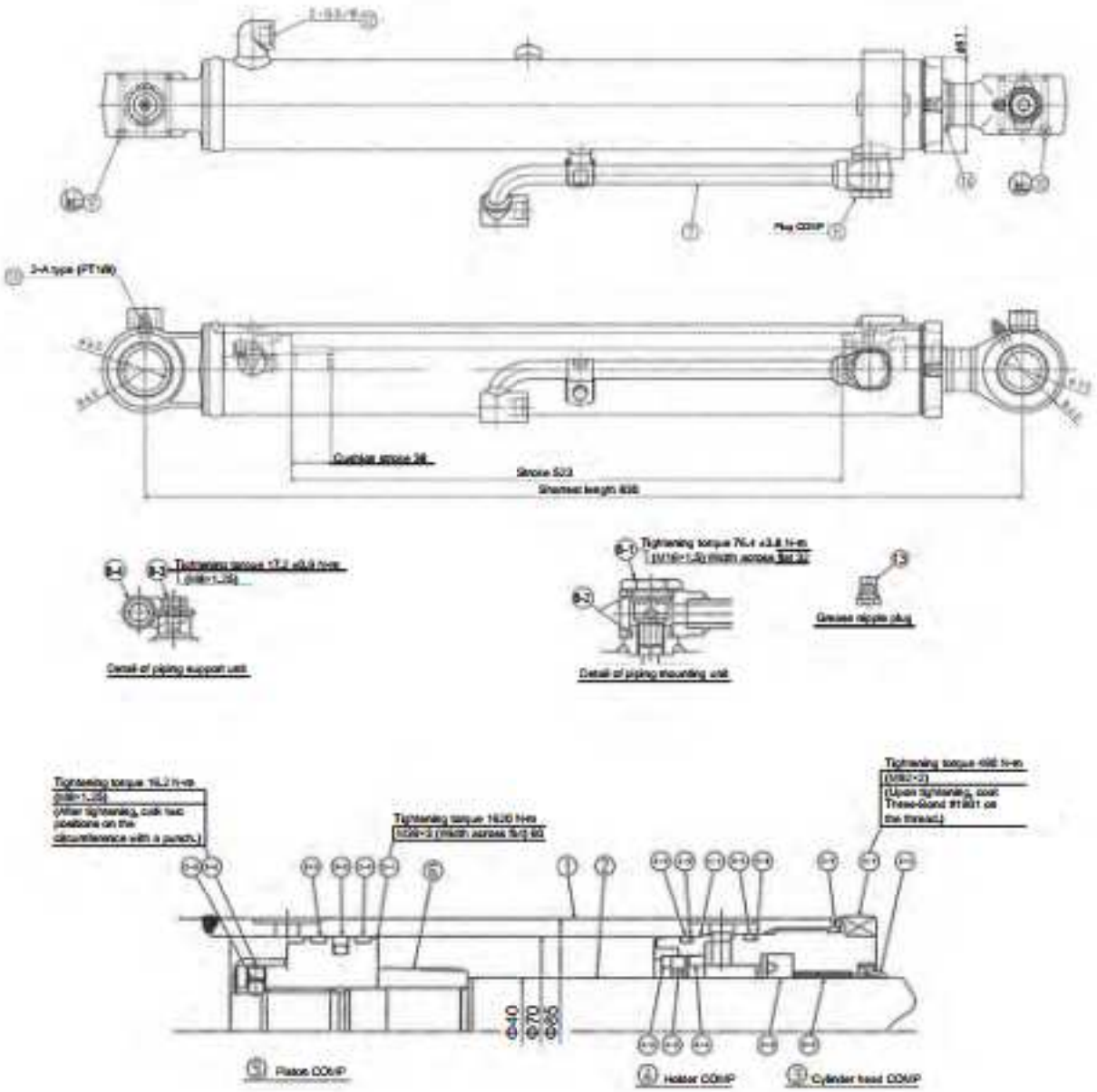
No.	Name	Qty
1	Reduction gear	1
1-1	Flange holder	1
1-2	Floating seal	2
1-3	Angular bearing	1
1-4	Ring nut	1
1-5	Plug	2
1-6	Housing	1
1-7	Steel ball	109
1-8	Socket head plug	2
1-9	Planetary gear B	4
1-10	Needle bearing	4
1-11	Inner race	4
1-12	Thrust washer	4
1-13	Thrust plate	1
1-14	Screw	4
1-15	Sun gear	1
1-16	Snap ring	1
1-17	Holder	1
1-18	Planetary gear	3
1-19	Cage & Roller	3
1-20	Inner race	3
1-22	Drive gear	1
1-23	Thrust plate	1
1-23	Thrust plate	1
1-23	Thrust plate	1
1-24	Cover	1
1-25	O-ring	1
1-26	Wire	1
1-27	Plug	2
1-28	O-ring	2
2	Shaft	1
3	Ball bearing	1
4	Oil seal	1
5	Swash plate	1
6	Steel ball	2
7	Cylinder block	1
8	Spring seat	1
9	Spring	1
10	Washer	1
11	Snap ring	1
12	Pin	3
13	Retainer holder	1
14	Retainer plate	1
15	Piston ASSY	9
16	Disk plate	1
17	Brake piston	1
18	Spring	10
19	Piston	2
20	Spring	2
21	O-ring	1
22	Backup ring	1
23	O-ring	1
24	Backup ring	1
25	Valve plate	1
26	Pin	1
27	Ball bearing	1
28	O-ring	1
29	O-ring	4
30	Base plate	1

No.	Name	Qty
31	Spool ASSY	1
31-1	Spool	1
31-2	Check valve	2
31-3	Spring	2
31-4	Plug	2
31-5	O-ring	2
36	Spring seat	2
37	Spring	2
38	Cap	2
39	O-ring	2
40	Orifice	2
41	Spool	1
40-1	Spool A	1
40-2	Spool C	1
42	Spring	1
43	Plug	3
44	O-ring	4
45	Plug	3
45-1	Plug	3
45-2	Plug	3
46	Plug	1
47	Orifice	4
48	Socket head bolt	6
49	Pin	2
50	Valve ASSY	1
50-1	Valve body	1
50-2	Spool	1
50-3	Spring	2
50-4	Spring seat	2
50-5	Plug	2
50-6	O-ring	2
50-7	O-ring	3
50-8	O-ring	1
50-9	Socket head bolt	3
51	Name plate	1
52	Drive screw	2
53	Shipping plug	2
54	Shipping plug	1
57	Plug	6
58	Plug	2
59	O-ring	2
60	Plug	1
61	Pin	2
62	Orifice	1

Contents

1 Boom cylinder

1-1 External view



Mass : 25.5 kg

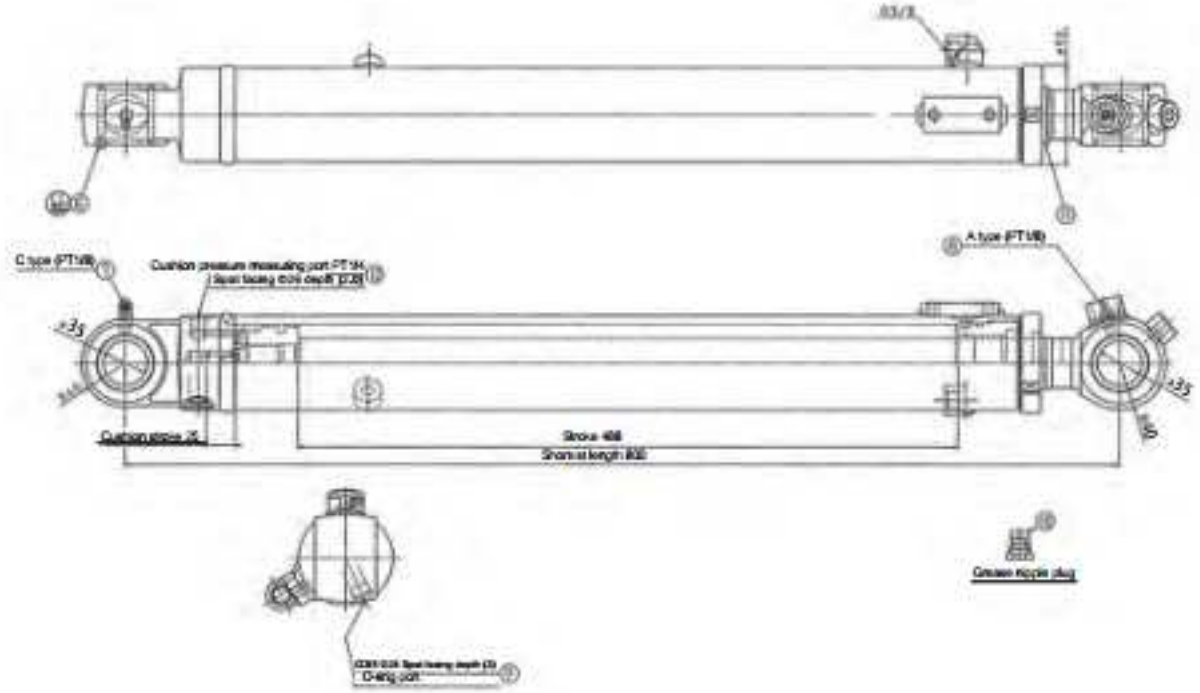
1-3 Parts list

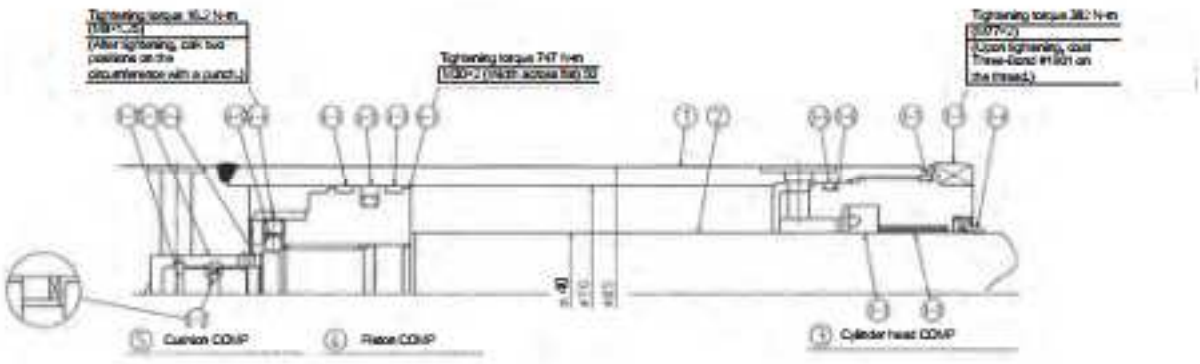
No.	Name	Q'ty
1	CYL tube ASSY	1
1-1	Cylinder tube	1
1-2	Cylinder bottom	1
1-3	Elbow	1
1-4	Boss	1
1-5	Boss	1
1-6	Boss	1
1-7	Plate	1
1-8	Nipple cover	1
1-9	Pin bush	1
1-10	Boss	1
2	Piston rod ASSY	1
2-1	Rod FC	1
2-2	Rod head	1
2-3	Boss	1
2-4	Pin bush	1
3	Cylinder head COMP	1
3-1	Cylinder head	1
3-2	Bush	1
3-3	U-ring	1
3-4	Wiper ring	1
3-5	O-ring	1
3-6	Backup ring	1
3-7	O-ring	1
4	Holder COMP	1
4-1	Holder	1
4-2	Spacer	1
4-3	Cushion seal	1
4-4	Collar	1
4-5	O-ring	1
4-6	Backup ring	1

No.	Name	Q'ty
5	Piston COMP	1
5-1	Piston	1
5-2	Seal ring ASSY	1
5-3	Slide ring	2
5-4	Setscrew	1
5-5	Steel ball	1
6	Cushion bearing	1
7	Pipe ASSY	1
7-1	Pipe	1
7-2	Joint	1
7-3	Joint	1
8	Plug COMP	1
8-1	Plug	1
8-2	O-ring	2
8-3	Upset bolt	1
8-4	Pipe holder	1
9	Dust seal	2
10	Dust seal	2
11	Grease nipple	2
12	Plug	2
13	Plug	2
14	Cap	1

2 Arm cylinder

2-1 External view





Mass : 25 kg

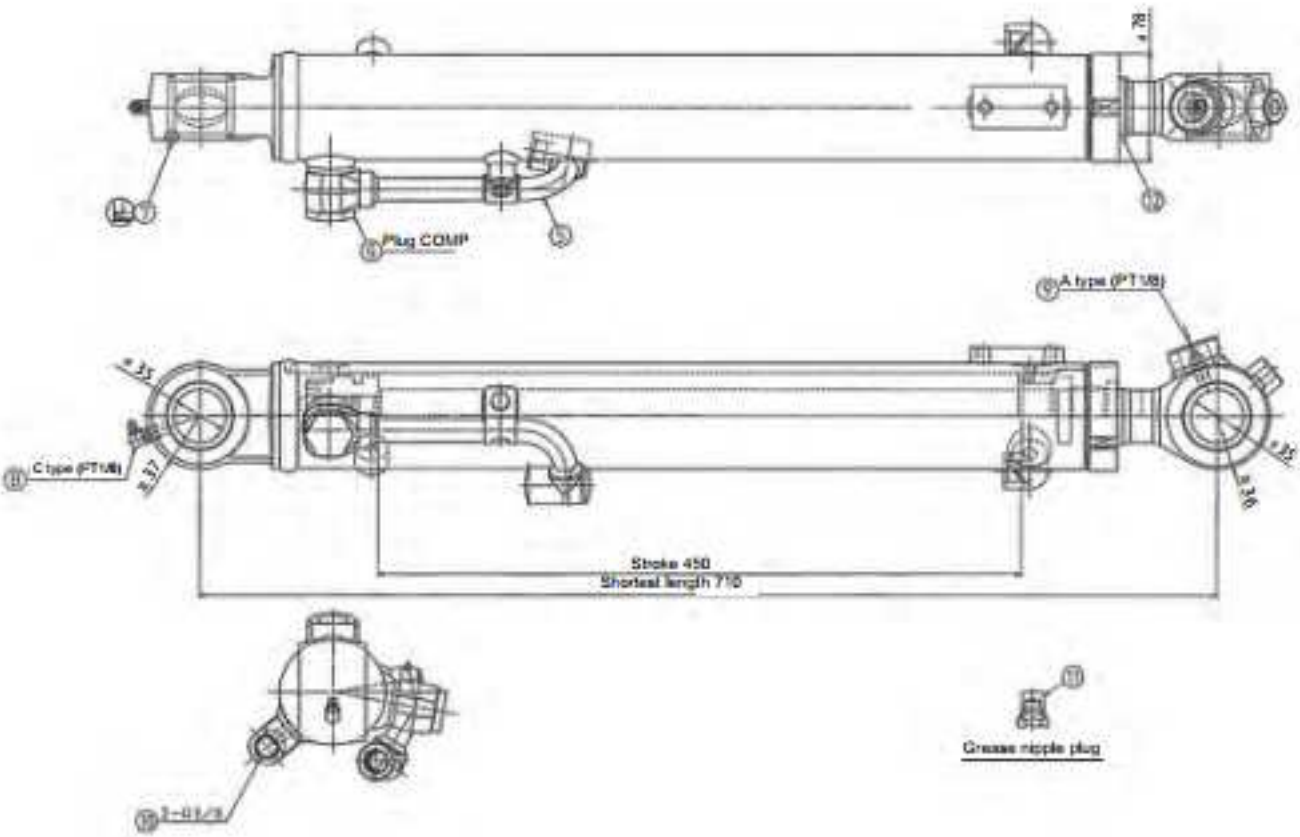
2-3 Parts list

No.	Name	Q'ty
1	CYL tube ASSY	1
1-1	Cylinder tube	1
1-2	Cylinder bottom	1
1-3	Elbow	1
1-4	Boss	1
1-5	Plate	1
1-6	Pin bush	1
2	Piston rod ASSY	1
2-1	Rod FC	1
2-2	Rod head	1
2-3	Nipple cover	1
2-4	Boss	1
2-5	Pin bush	1
3	Cylinder head COMP	1
3-1	Cylinder head	1
3-2	Bush	1
3-3	U-ring	1
3-4	Wiper ring	1
3-5	O-ring	1
3-6	Backup ring	1
3-7	O-ring	1

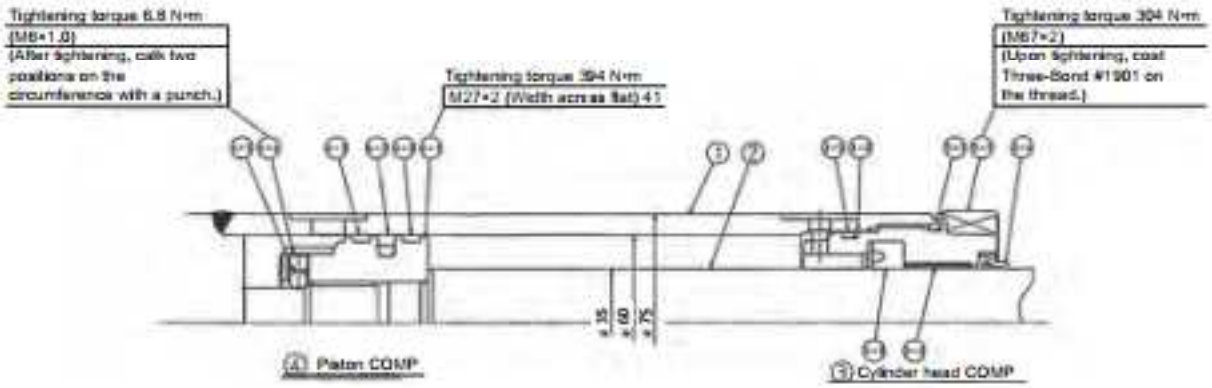
No.	Name	Q'ty
4	Piston COMP	1
4-1	Piston	1
4-2	Seal ring ASSY	1
4-3	Slide ring	2
4-4	Setscrew	1
4-5	Steel ball	1
5	Cushion COMP	1
5-1	Cushion bearing	1
5-2	Cushion seal	1
5-3	Stopper	2
5-4	Snap ring	1
6	Dust seal	4
7	Grease nipple	1
8	Grease nipple	1
9	Plug	2
10	Plug	2
11	Cap	1

3 Bucket cylinder

3-1 External view



3-2 Cross-sectional view



Mass : 18 kg

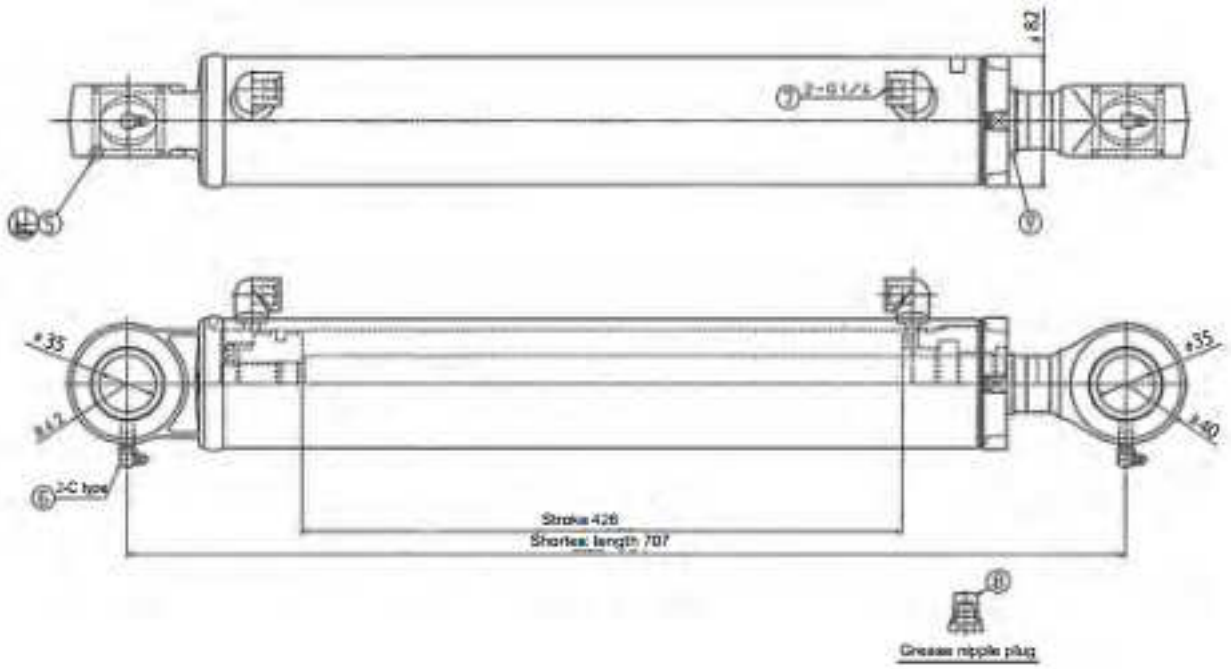
3-3 Parts list

No.	Name	Q'ty
1	CYL tube ASSY	1
1-1	Cylinder tube	1
1-2	Cylinder bottom	1
1-3	Boss	1
1-4	Elbow	1
1-5	Boss	1
1-6	Boss	1
1-7	Plate	1
1-8	Pin bush	1
2	Piston rod ASSY	1
2-1	Rod FC	1
2-2	Rod head	1
2-3	Nipple cover	1
2-4	Boss	1
2-5	Pin bush	1
3	Cylinder head COMP	1
3-1	Cylinder head	1
3-2	Bush	1
3-3	U-ring	1
3-4	Wiper ring	1
3-5	O-ring	1
3-6	Backup ring	1
3-7	O-ring	1

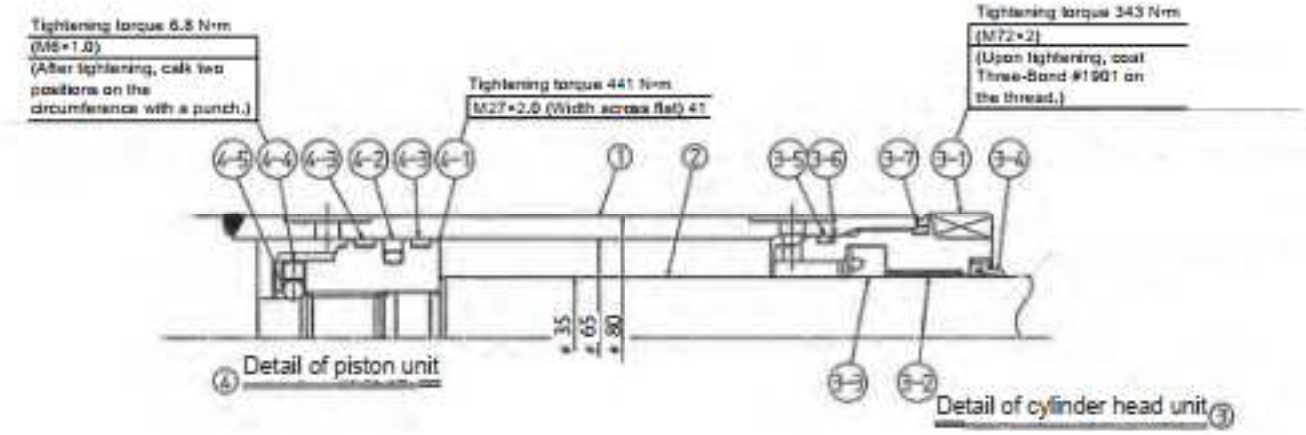
No.	Name	Q'ty
4	Piston COMP	1
4-1	Piston	1
4-2	Seal ring ASSY	1
4-3	Slide ring	2
4-4	Setscrew	1
4-5	Steel ball	1
5	Pipe ASSY	1
5-1	Pipe	1
5-2	Joint	1
5-3	Joint	1
6	Plug COMP	1
6-1	Plug	1
6-2	O-ring	2
6-3	Upset bolt	1
6-4	Pipe holder	1
7	Dust seal	4
8	Grease nipple	1
9	Grease nipple	1
10	Plug	2
11	Plug	2
12	Cap	1

4 Boom swing cylinder

4-1 External view



4-2 Cross-sectional view



Mass : 19.5 kg

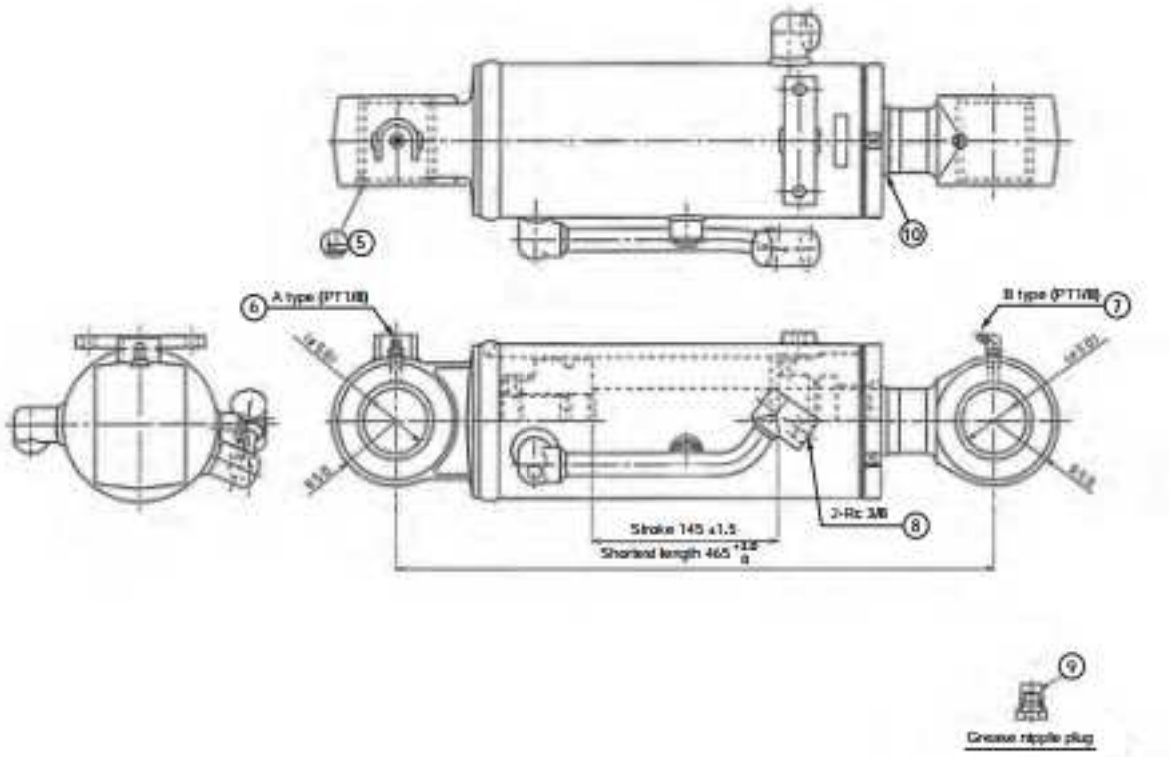
4-3 Parts list

No.	Name	Q'ty
1	CYL tube ASSY	1
1-1	Cylinder tube	1
1-2	Cylinder bottom	1
1-3	Elbow	2
1-4	Pin bush	1
2	Piston rod ASSY	1
2-1	Rod FC	1
2-2	Rod head	1
2-3	Pin bush	1
3	Cylinder head COMP	1
3-1	Cylinder head	1
3-2	Bush	1
3-3	U-ring	1
3-4	Wiper ring	1
3-5	O-ring	1
3-6	Backup ring	1
3-7	O-ring	1
4	Piston COMP	1
4-1	Piston	1
4-2	Seal ring ASSY	1
4-3	Slide ring	2
4-4	Setscrew	1
4-5	Steel ball	1

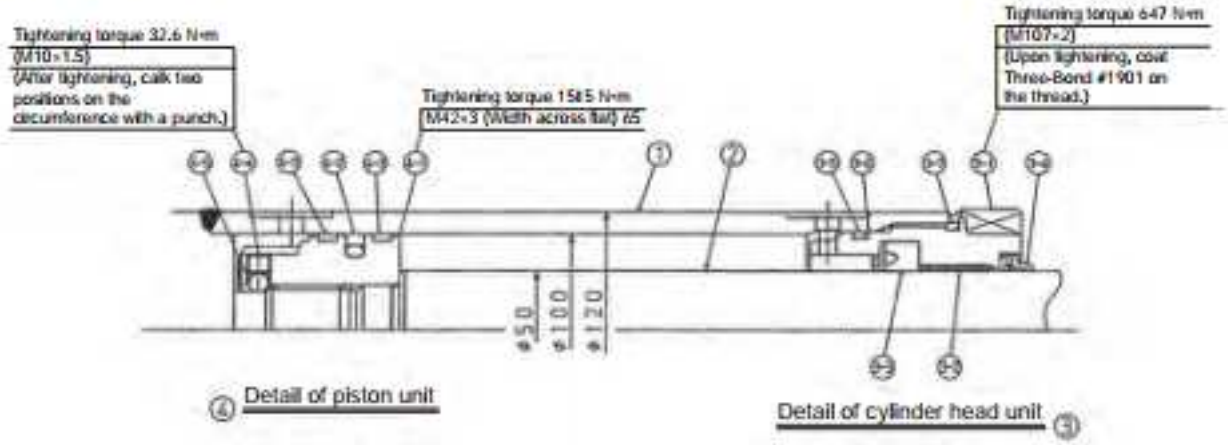
No.	Name	Q'ty
5	Dust seal	4
6	Grease nipple	1
7	Plug	2
8	Plug	2
9	Cap	1

5 Blade cylinder

5-1 External view



5-2 Cross-sectional view



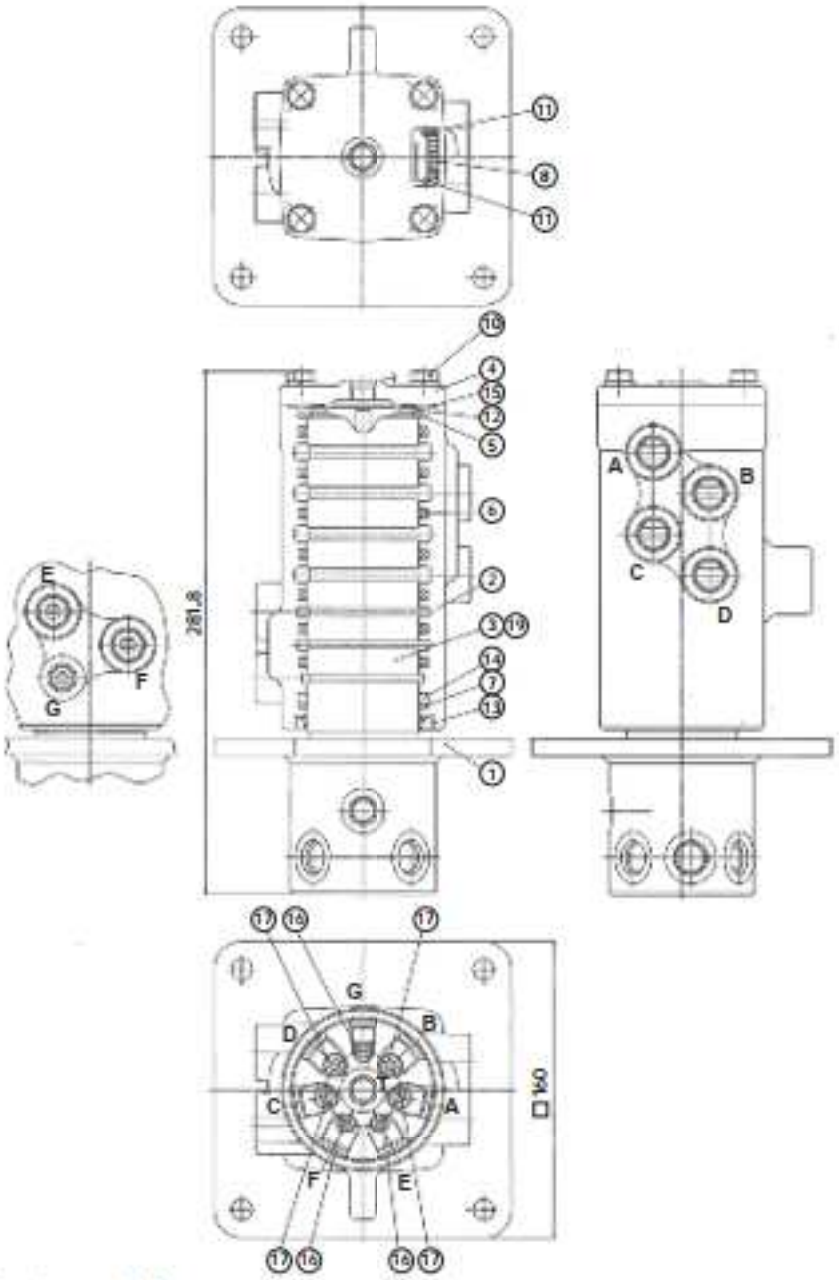
Mass : 29 kg

5-3 Parts list

No.	Name	Q'ty
1	CYL tube ASSY	1
1-1	Cylinder tube	1
1-2	Cylinder bottom	1
1-3	Boss	1
1-4	Elbow	1
1-5	Pipe	1
1-6	Joint	1
1-7	Pipe holder	1
1-8	Plate	1
1-9	Plate	1
1-10	Boss	1
1-11	Nipple cover	1
1-12	Pin bush	1
2	Piston rod ASSY	1
2-1	Rod FC	1
2-2	Rod head	1
2-3	Pin bush	1
3	Cylinder head COMP	1
3-1	Cylinder head	1

No.	Name	Q'ty
3-2	Bush	1
3-3	U-ring	1
3-4	Wiper ring	1
3-5	O-ring	1
3-6	Backup ring	1
3-7	O-ring	1
4	Piston COMP	1
4-1	Piston	1
4-2	Seal ring ASSY	1
4-3	Slide ring	2
4-4	Setscrew	1
4-5	Steel ball	1
5	Dust seal	4
6	Grease nipple	1
7	Grease nipple	1
8	Plug	2
9	Plug	2
10	Cap	1

1 External view/Cross-sectional view



Tightening torque table

⑩ Hexagonal bolt (M8)	10.8 ±1.08 N·m
⑯ Socket head plug (PT1/8)	8.83 ±0.88 N·m
⑰ Socket head plug (PT1/4)	19.6 ±1.96 N·m

Port thread size (for hub/shaft)

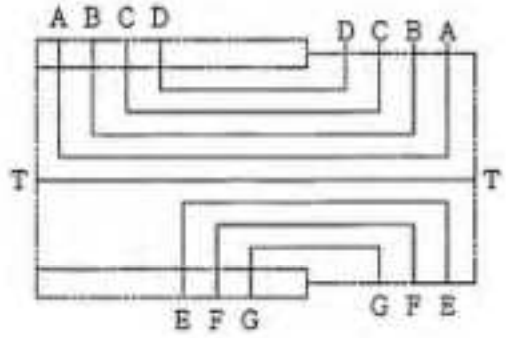
A – F :	PF3/8 (JIS B2351 O-ring seal)
G, T :	PF1/4 (JIS B2351 O-ring seal)

Mass : 11.9 kg

2 Parts list

No.	Name	Q'ty
1	Flange	1
2	Body	1
3	Shaft	1
4	Cover	1
5	Washer, thrust	1
6	Seal, oil	7
7	Ring, backup	1
8	Plate, name	1
9		
10	Hexagonal bolt	4
11	Rivet screw	2
12	Snap ring	1
13	Seal, dust	1
14	O-ring	1
15	O-ring	1
16	Socket head plug	3
17	Socket head plug	4

3 Hydraulic symbols



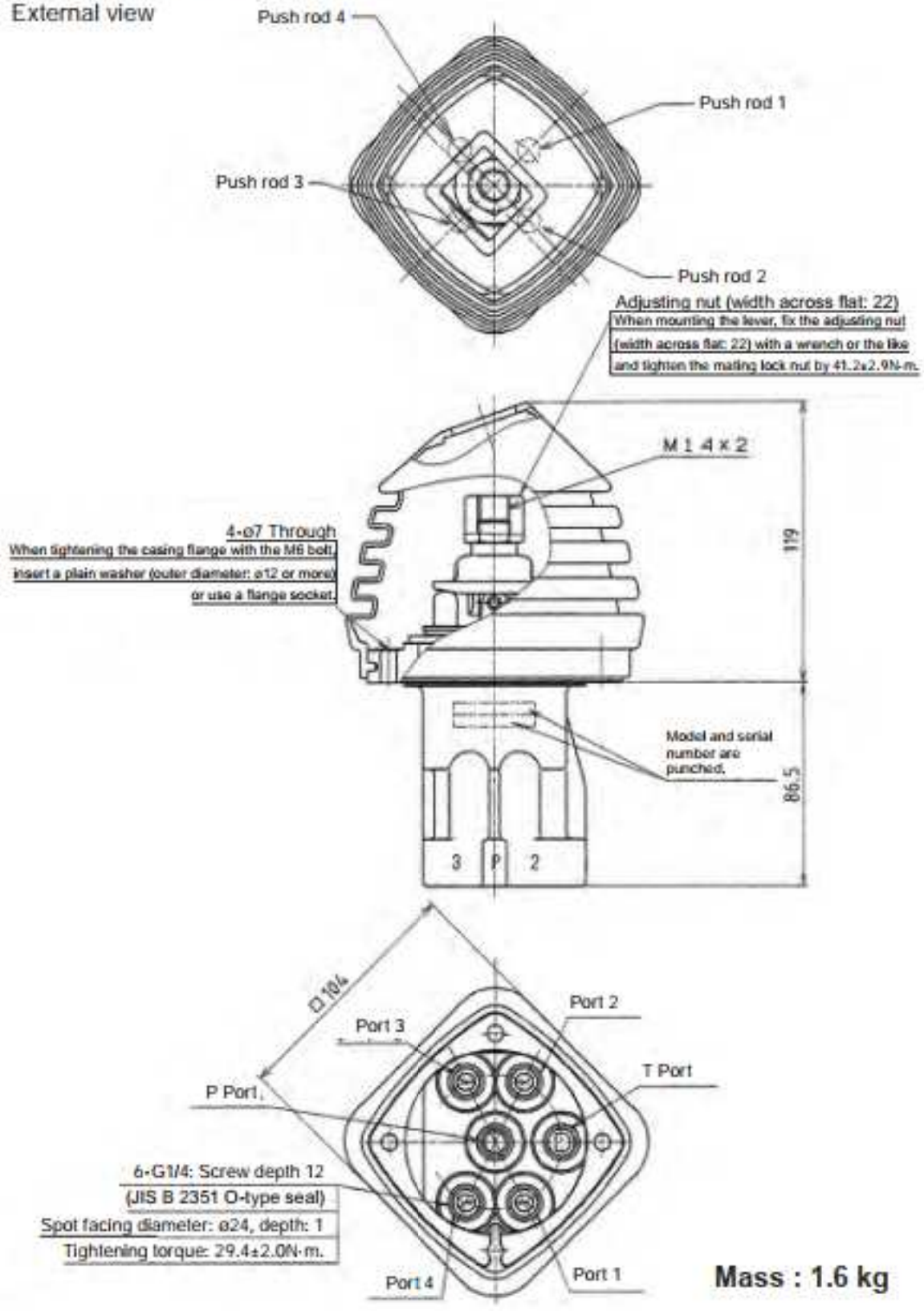
Contents

1 Joystick remote control valve

Note:

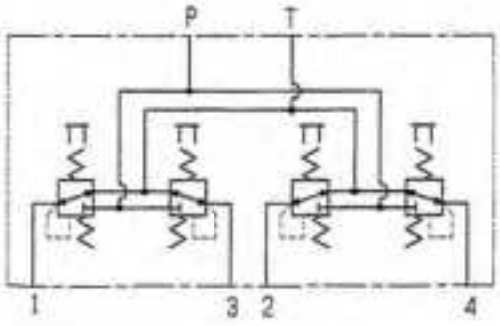
One valve can be used for the right and left. The figure below shows "When used at the right side". To use this at the left side, turn the bellows in 180°.

1-1 External view

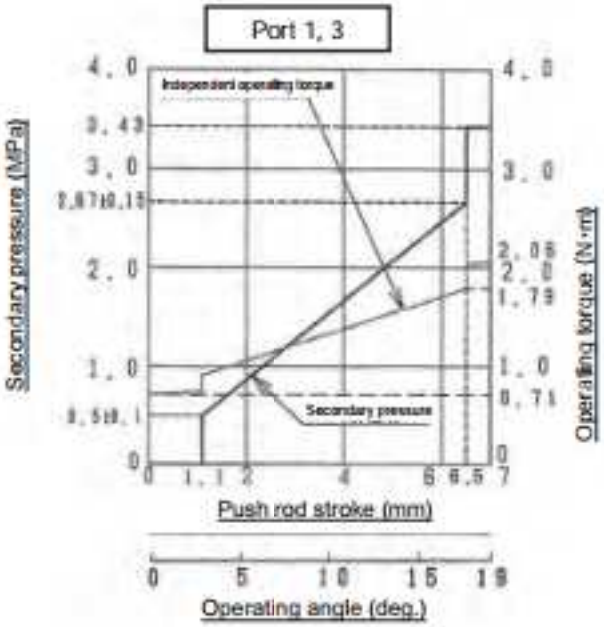


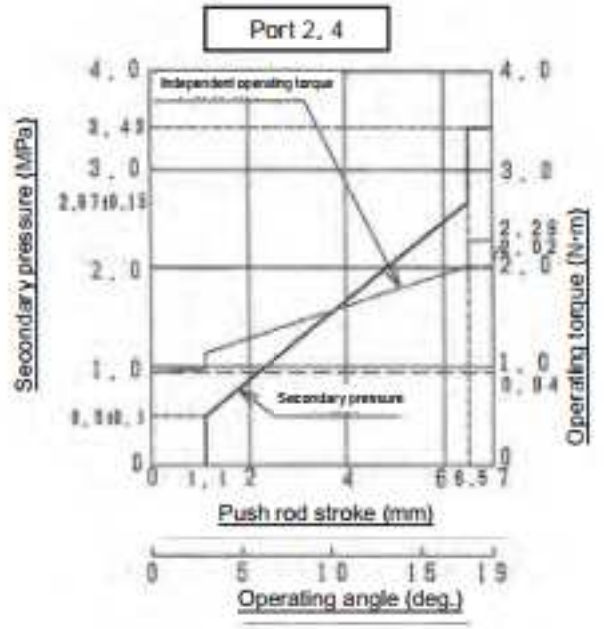
Mass : 1.6 kg

1-2 Hydraulic symbols

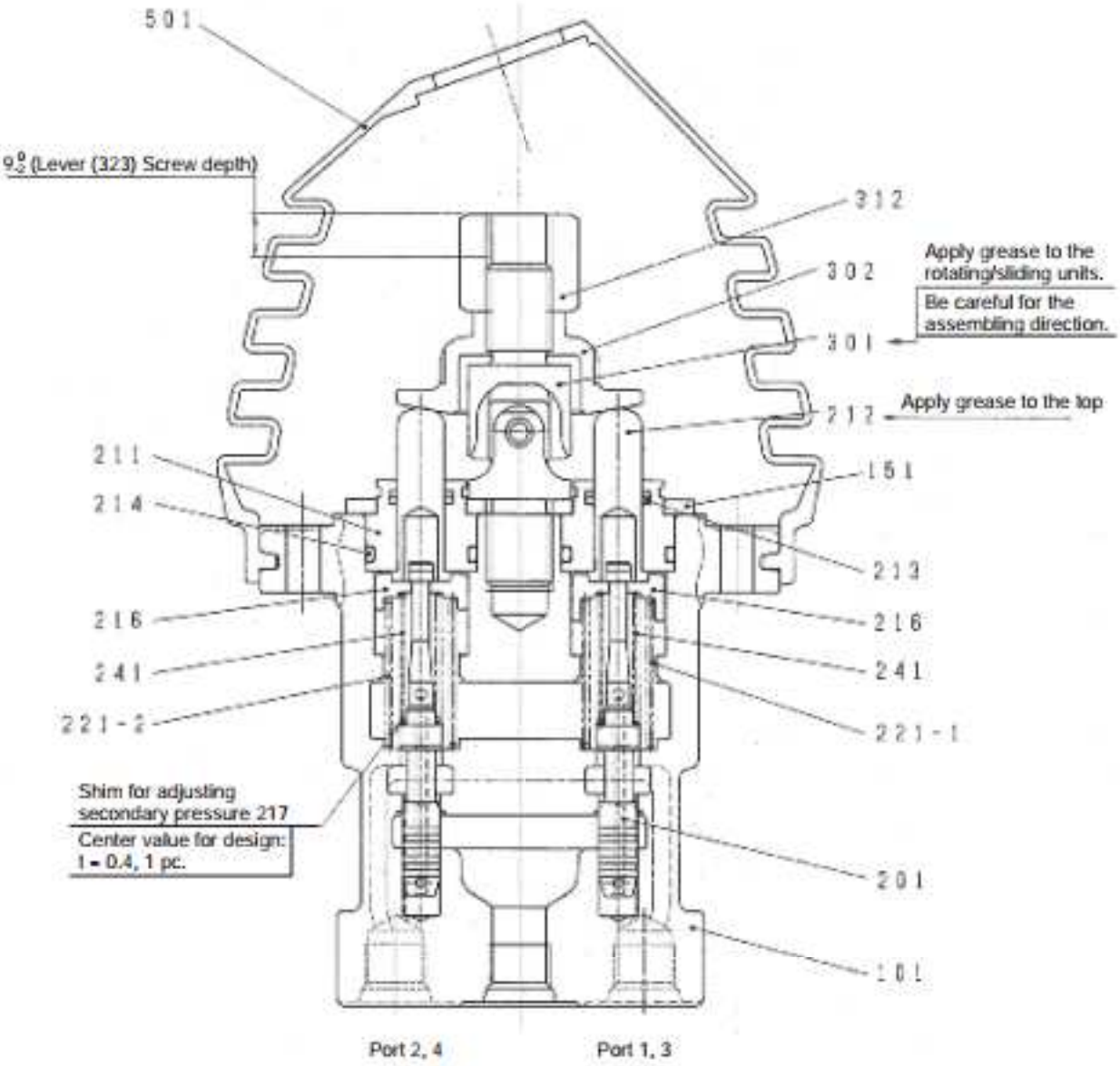


1-3 Control diagram





1-4 Internal structure



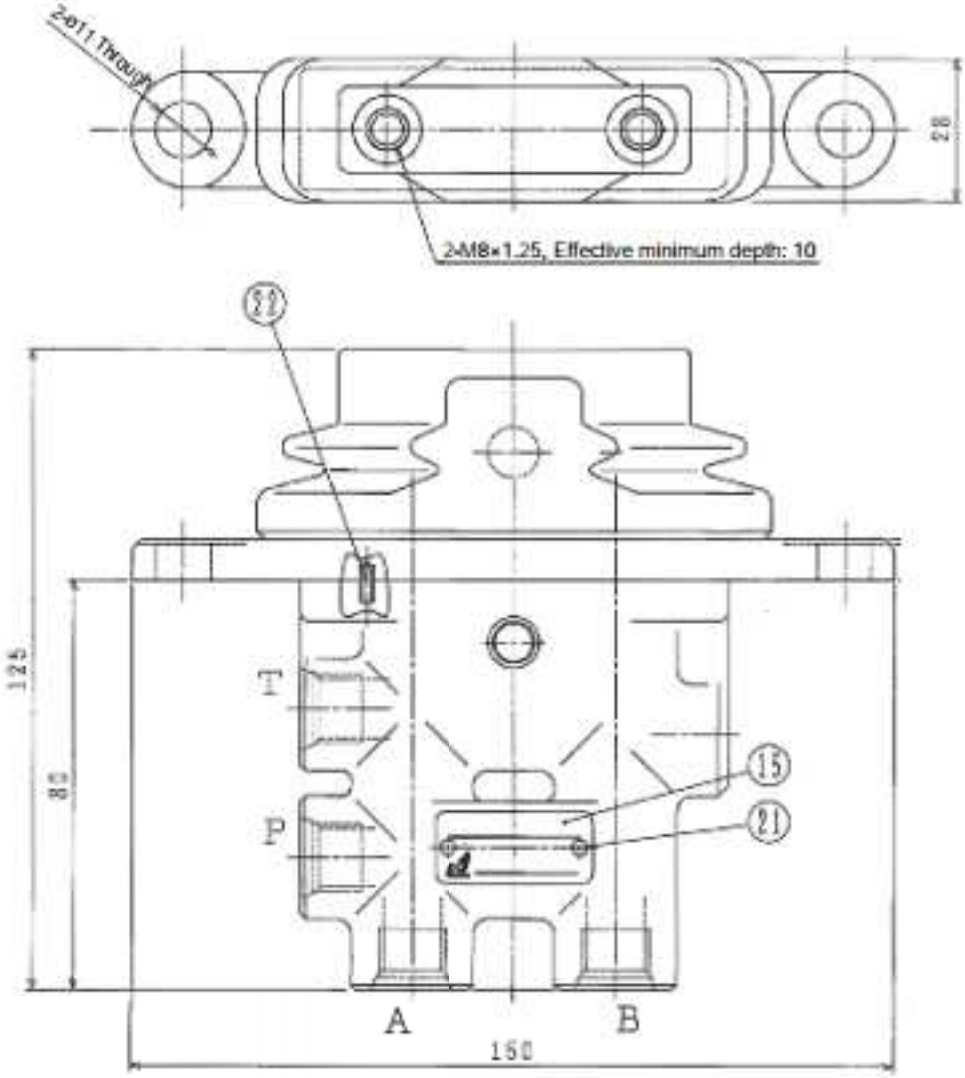
No.	Name	Q'ty
101	Casing	1
151	Plate	1
201	Spool	4
211	Plug	4
212	Push rod	4
213	Seal	4
214	O-ring	4
216	Spring seat	4
217	Washer 2	4
221-1	Spring	2
221-2	Spring	2
241	Spring	4
301	Joint	1
302	Disk	1
312	Adjusting nut	1
501	Bellows	1

Tightening torque table

301	M14	47.1 ±2.9 N•m
302, 312	M14	68.6 ±4.9 N•m

2 Remote control valve for boom swing/blade

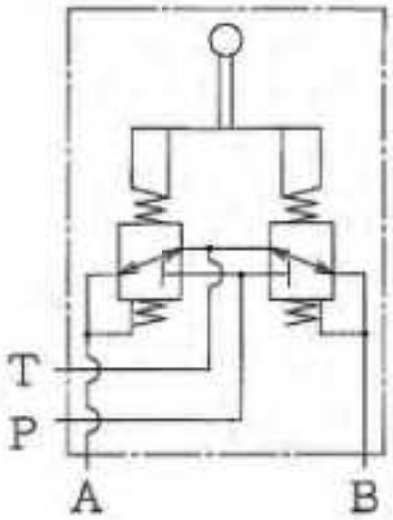
2-1 External view



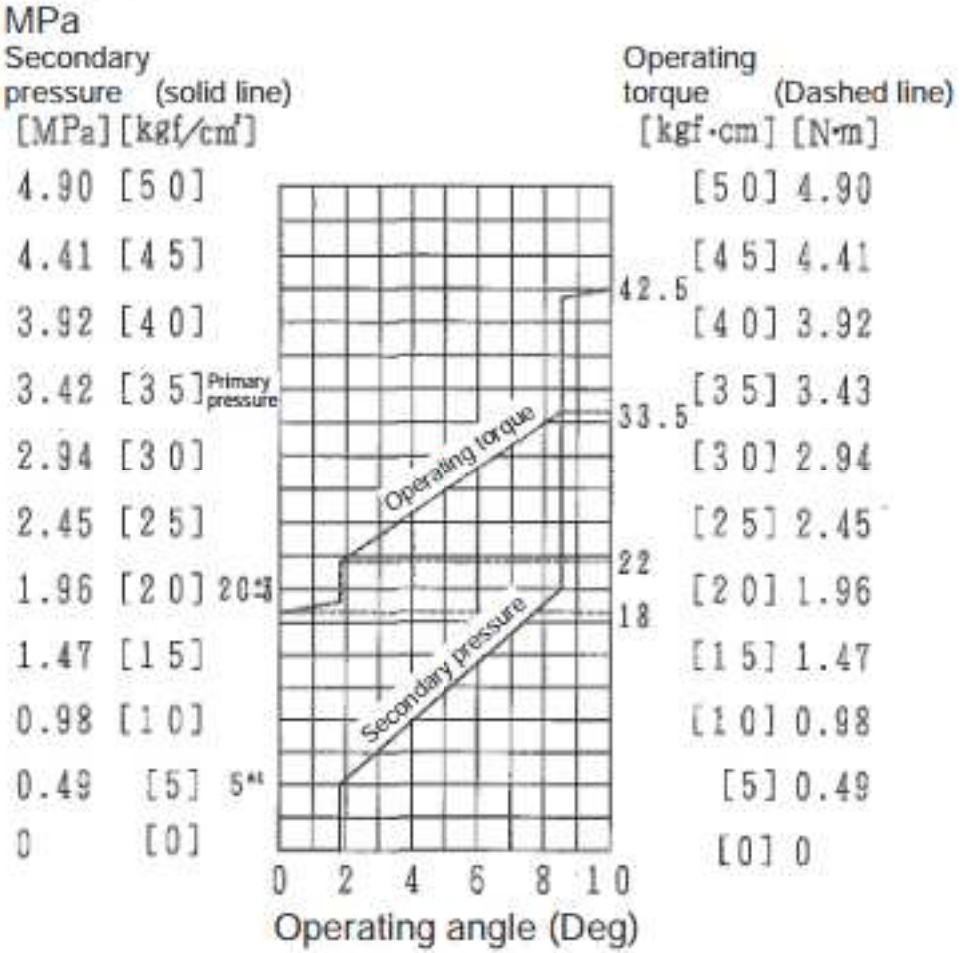
Port thread size: PF1/4 (JIS B2351 O-ring seal)

Mass : 0.65 kg

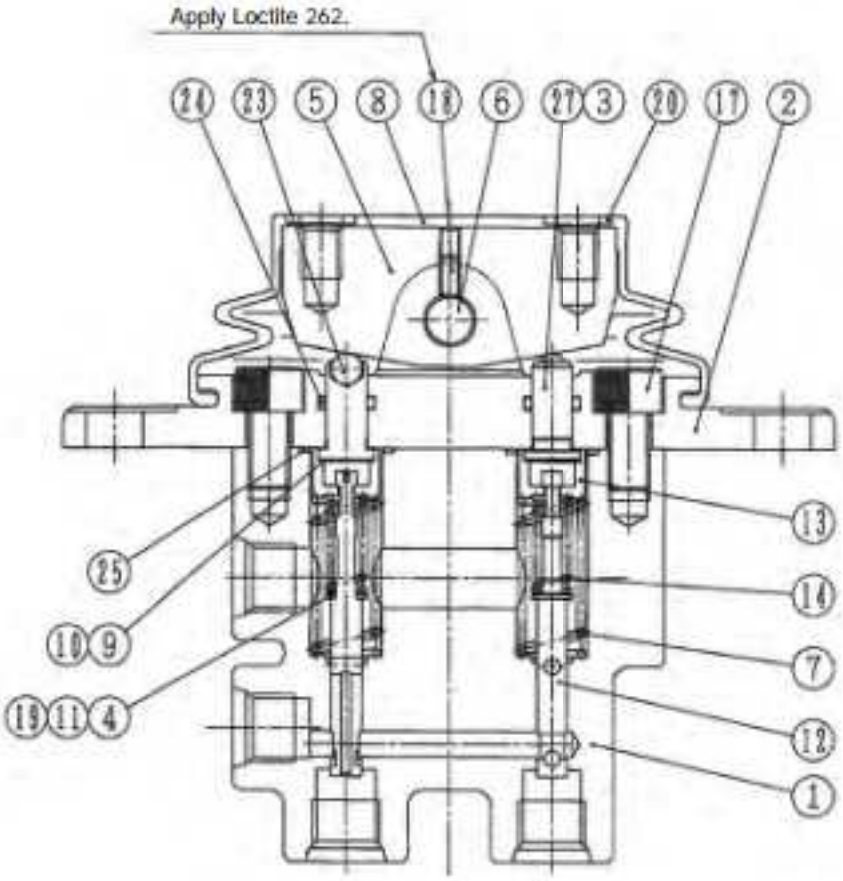
2-2 Hydraulic symbols



2-3 Control diagram



2-4 Internal structure



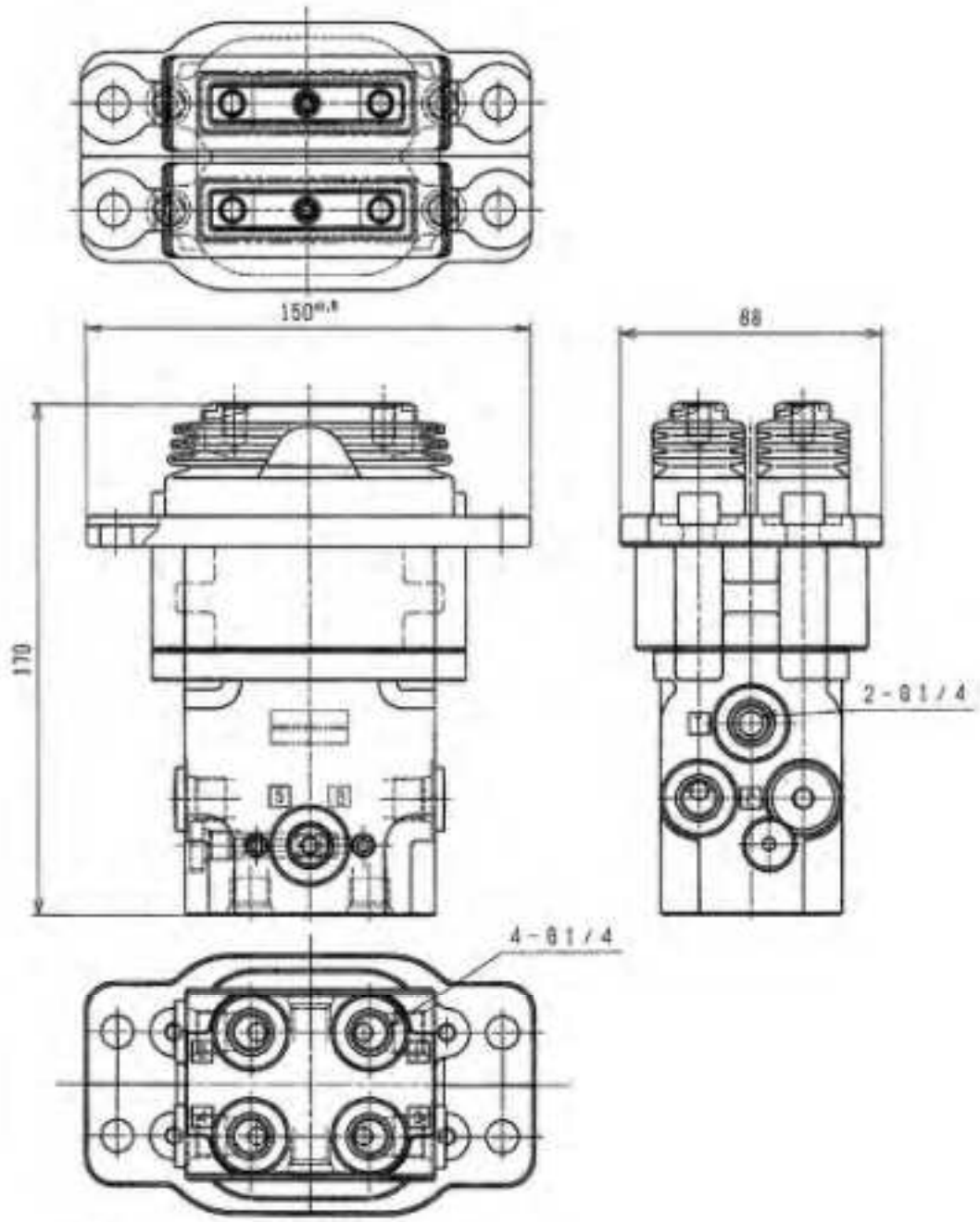
No.	Name	Qty
1	Body	1
2	Cover	1
3	Pusher	2
4	Shim	2
5	Cam	1
6	Pin	1
7	Spring, compression	2
8	Boot	1
9	Shim	2
10	Shim	2
11	Shim	2
12	Spool	2
13	Holder, spring	2
14	Spring, compression	2
15	Plate, name	1
16		
17	Socket head bolt	2
18	Set screw	1
19	Plain washer	2
20	Plain washer	2
21	Rivet screw	2
22	Spring pin	2
23	Steel ball	2
24	O-ring	2
25	O-ring	2
26		
27	Pusher, ass'y	2

Tightening torque table

(17) Socket head bolt	10.8 ±1 N·m
(18) Set screw	4.9 ±1 N·m
Tightening the screw for M8	23.5 ±2 N·m
Tightening the nipple for PF1/4	24.5 ±2 N·m

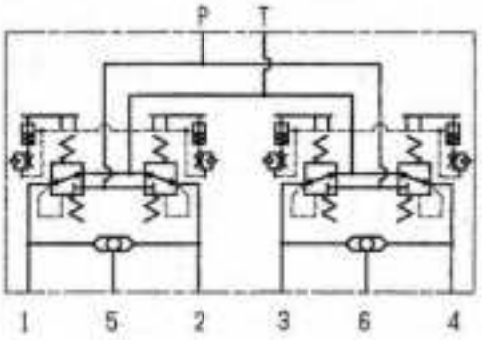
3 Remote control valve for travel

3-1 External view

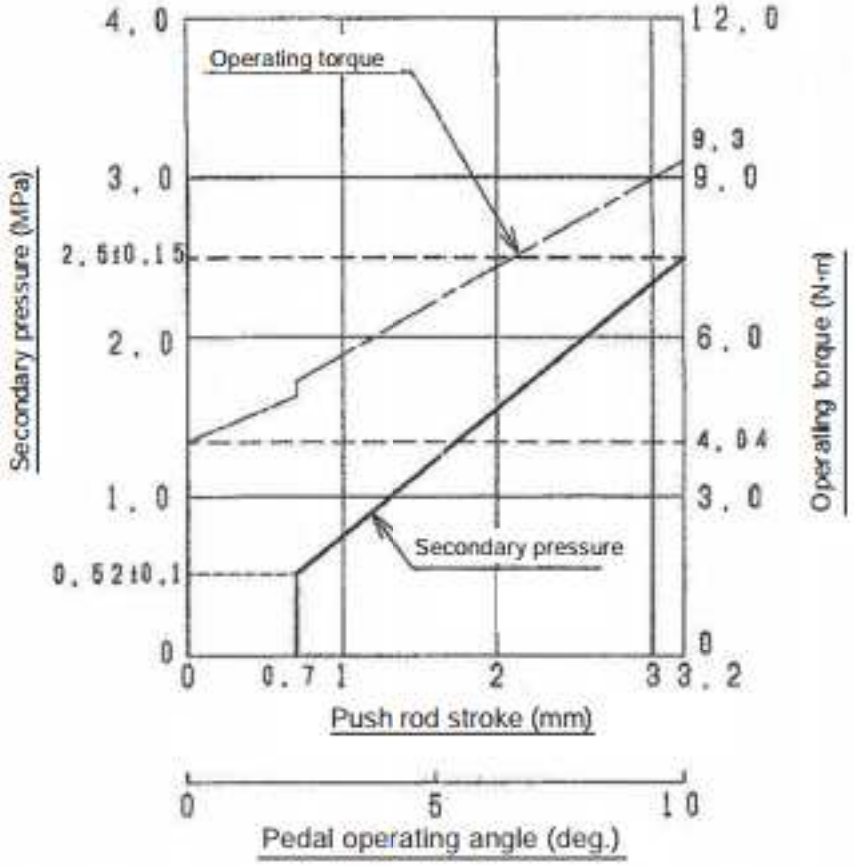


Mass : 3.9 kg

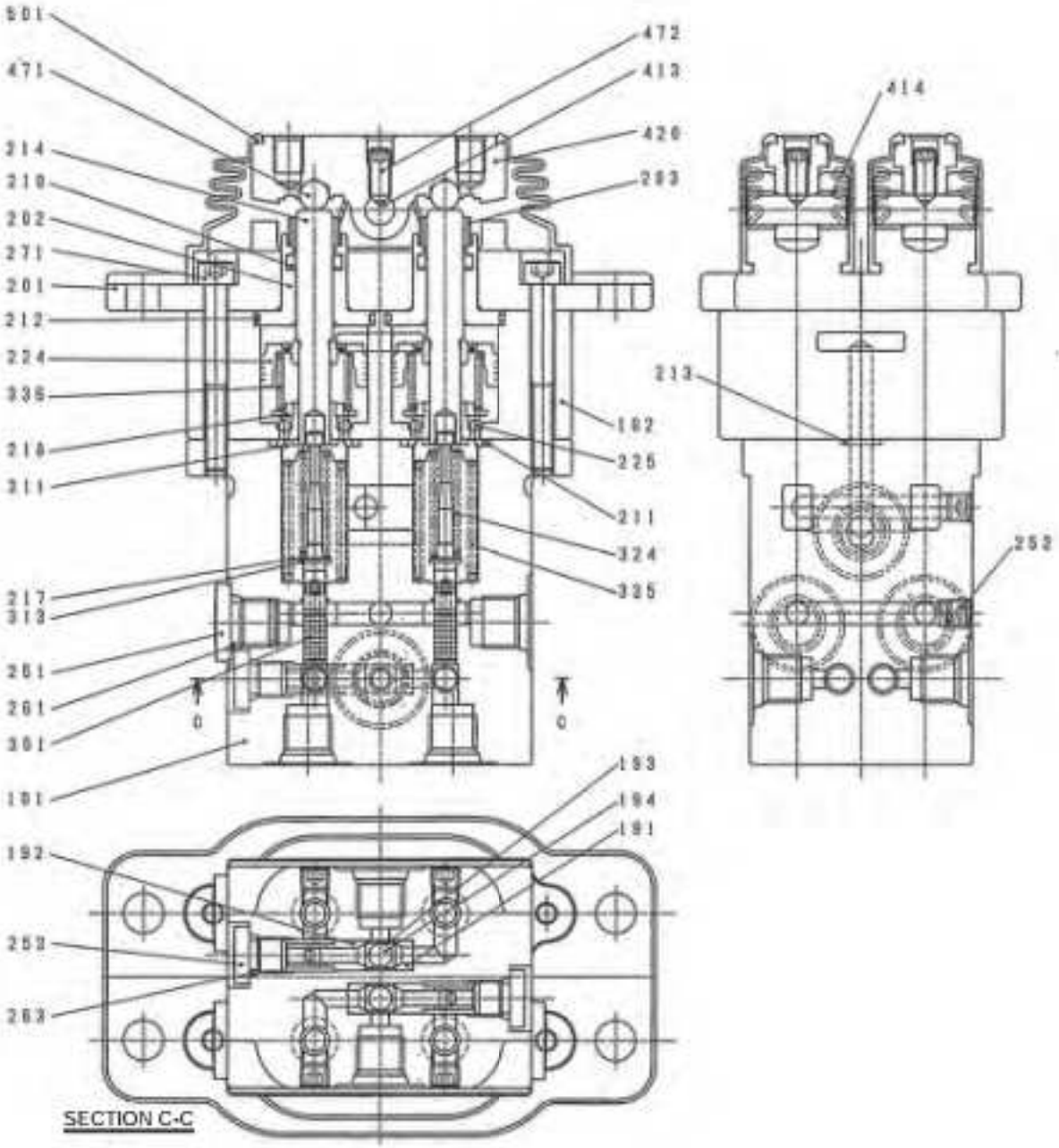
3-2 Hydraulic symbols



3-3 Control diagram



3-4 Internal structure



No.	Name	Q'ty
101	Casing	1
102	Casing (damper)	1
191	Seat 1	2
192	Seat 2	2
193	Pusher	2
194	Steel ball	2
201	Cover	2
202	Plug	4
203	Grease cup	4
210	Packing	4
211	O-ring	4
212	O-ring	4
213	O-ring	2
214	Push rod	4
217	Shim	4
218	Spring seat	4
224	Piston 2D055	4
225	Steel ball	12
251	RO plug	3
252	Plug	6
253	RO plug	2
261	O-ring	3
263	O-ring	2
271	Socket head bolt	4
301	Spool	4
311	Spring seat	4
313	Washer	4
324	Spring	4
335	Spring	4
336	Spring	4
413	Cam shaft	2
414	Pusher	4
420	Cam	2
471	Steel ball	4
472	Socket head setscrew	2
501	Bellows	2

Tightening torque table

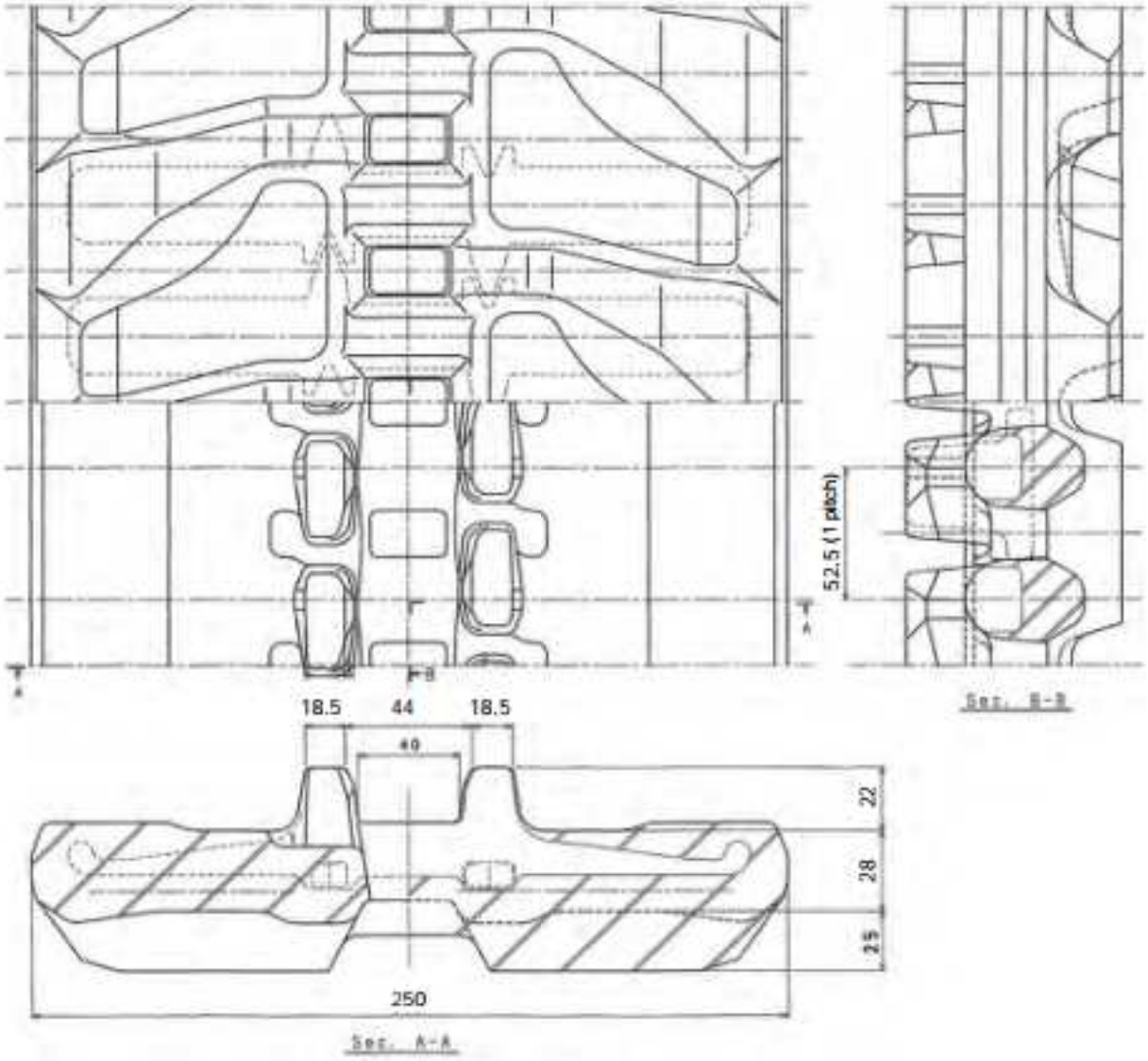
271	M6	8.8 ±0.8 N·m
251	G1/4	29.4 ±2.0 N·m
252	NPTF1/16	6.9 ±1 N·m
253	G1/8	11.8 ±1.0 N·m
472	M6	6.9 ±1.0 N·m (Apply Loctite #241.)

A4 Equipment Information (Other Than Hydraulic Equipment)

Contents

1 Rubber crawler

1-1 External dimensions

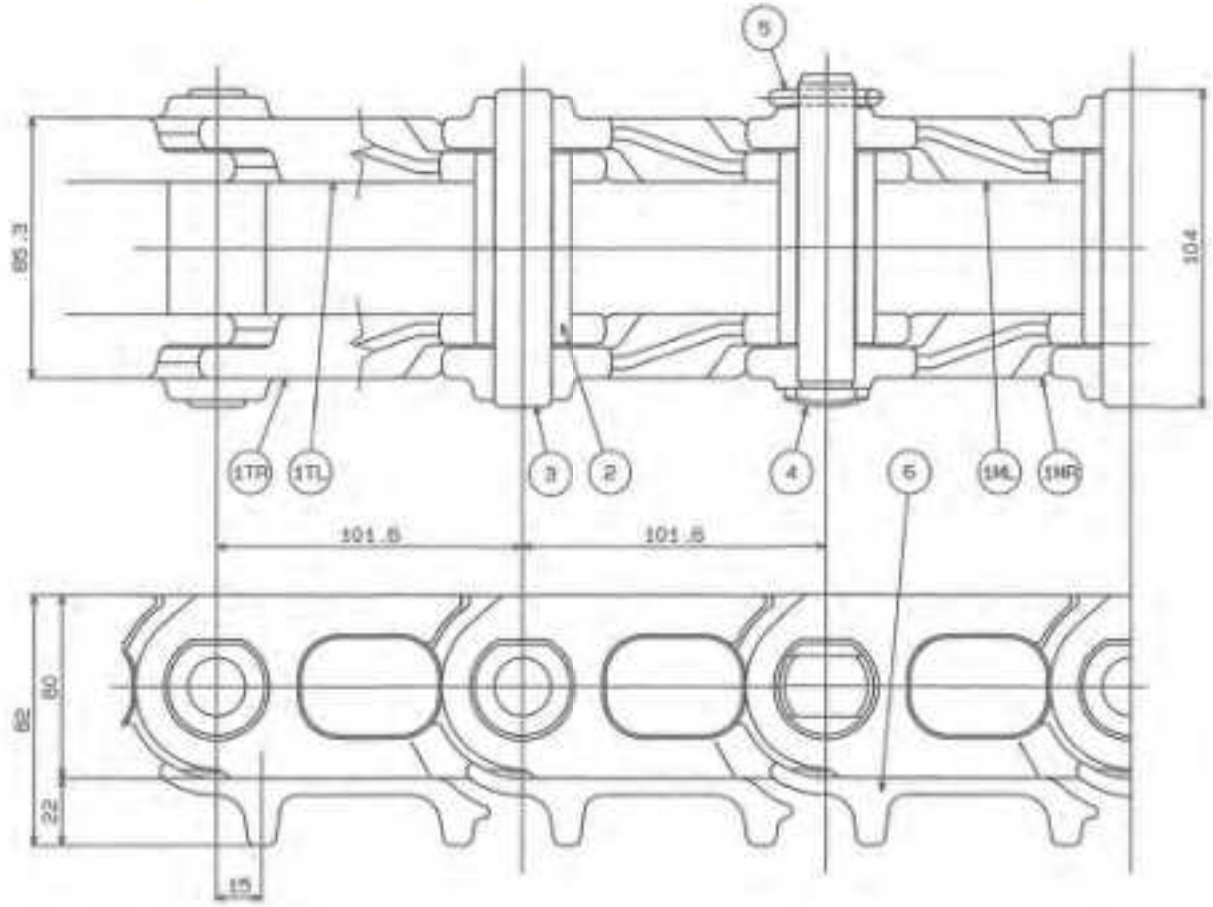


1-2 Specifications

1. Circumferential length at rubber crawler center	4095 mm(52.5^{P} × 78)
2. Mass	97 kg/pc.

2 Steel crawler

2-1 External dimensions

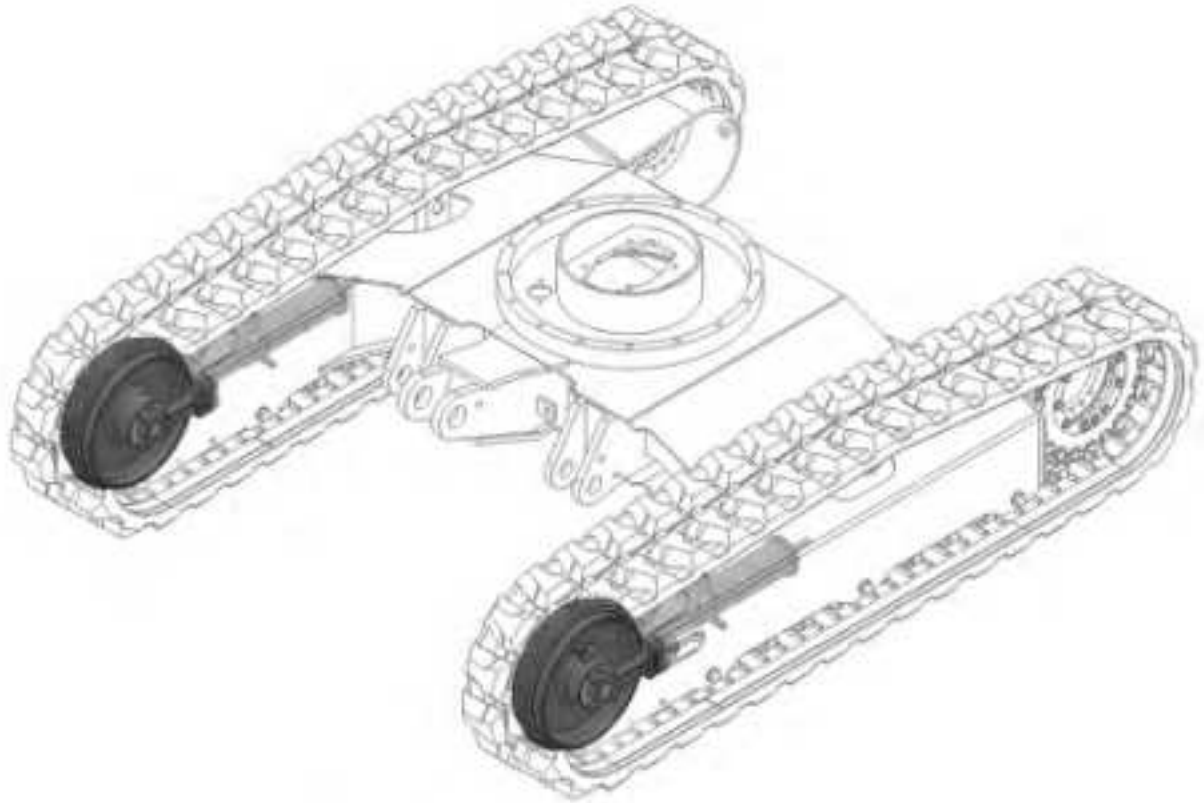


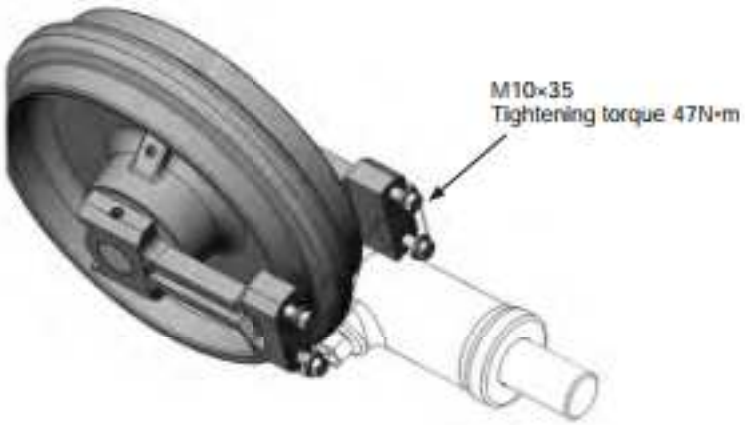
2-2 Parts list

No.	Name	Q'ty
1TR	Track link	39
1TL	Track link	39
1MR	Master link	1
1ML	Master link	1
2	Track bushing	40
3	Track pin	39
4	Master pin	1
5	Set pin	1
6	Shoe L=250	40

"Q'ty" means "quantity for one steel crawler".

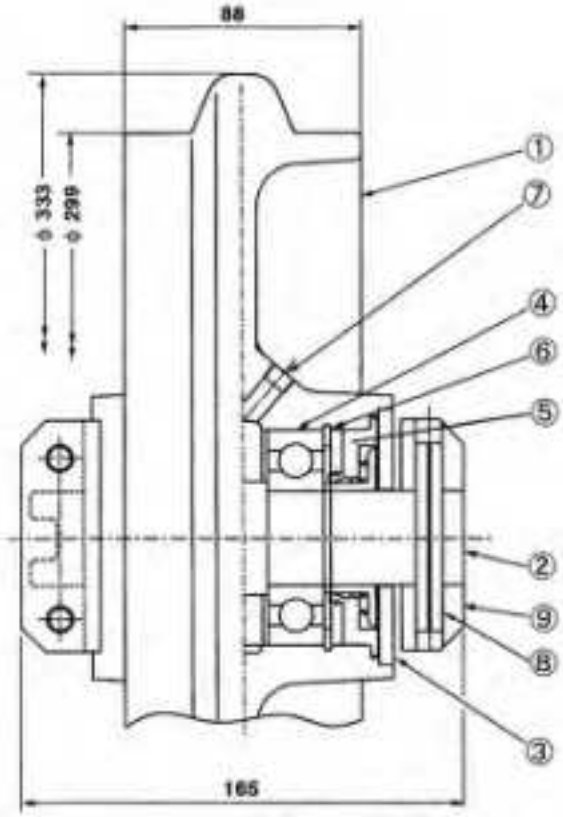
Mass : 145.5 kg





Notes:

1. Before mounting the bearing block in the front idler assembly, coat grease on the slide surface with the frame.
2. When mounting the front idler assembly to the frame, the oil supply plug side must be outside.



No.	Name	Q'ty
1	Front idler	1
2	Shaft	1
3	Washer	2
4	Bearing	2
5	Oil seal	2
6	Snap ring	2
7	Plug	1
8	Spring pin	2
9	Bearing block	2

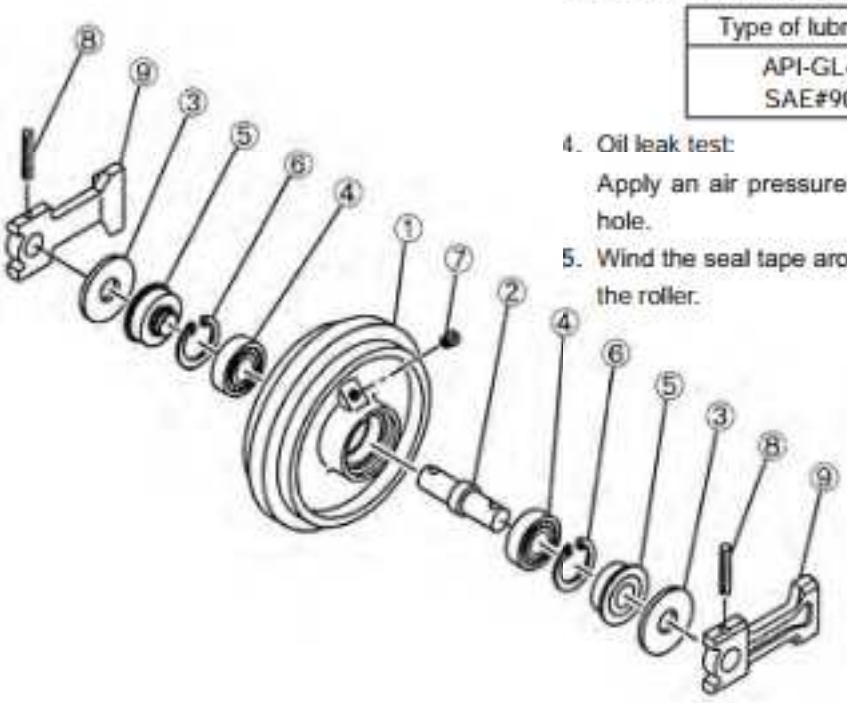
③ (Press-fit with the 1.5×15°chamfered section at inside.)

Notes:

1. Before mounting, clean the parts well to prevent foreign matters from entering the units.
2. Apply oil to the inner and outer diameters of the seal and then press-fit it. Fill the gap between the lips of seal with grease.
3. After assembling, supply the lubricant.

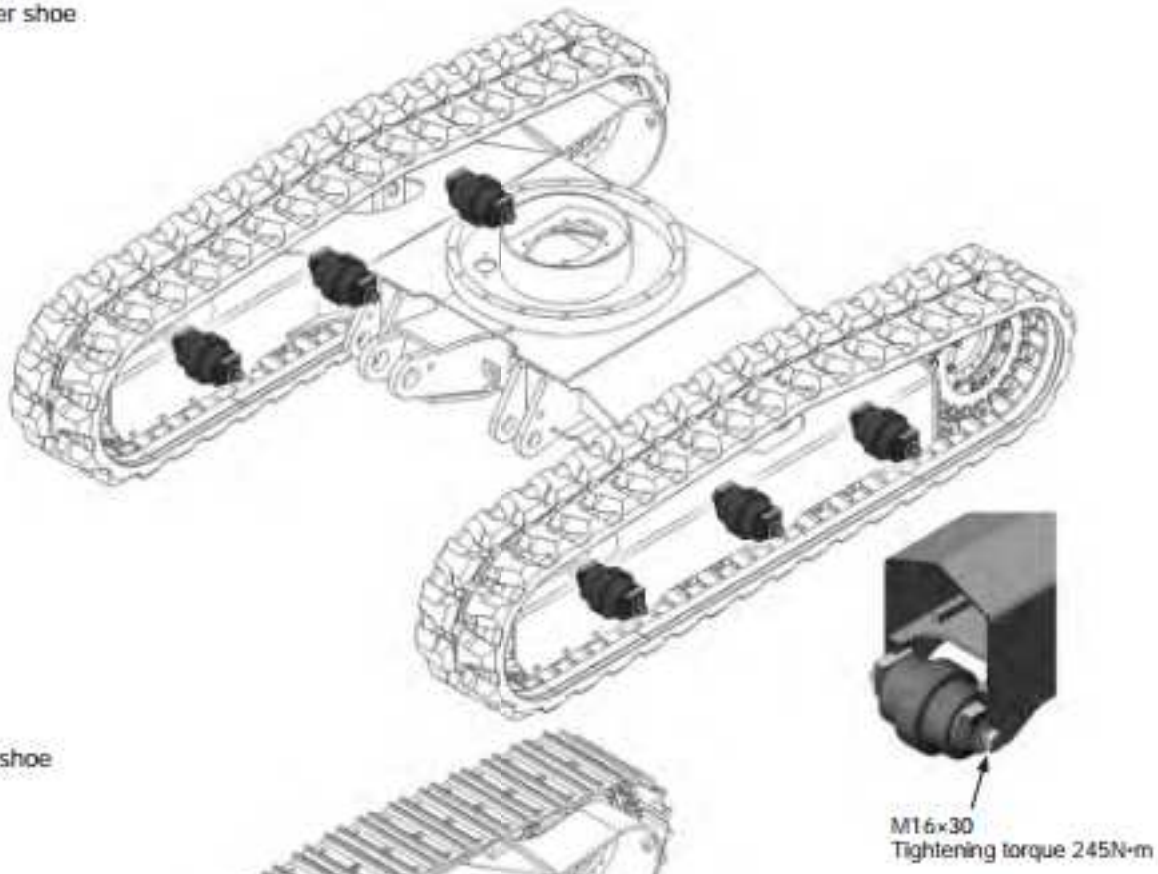
Type of lubricant	Capacity
API-GL4 SAE#90	80 cc

4. Oil leak test:
   Apply an air pressure of 98kPa through the (7) plug hole.
5. Wind the seal tape around the plug (7) and mount it to the roller.

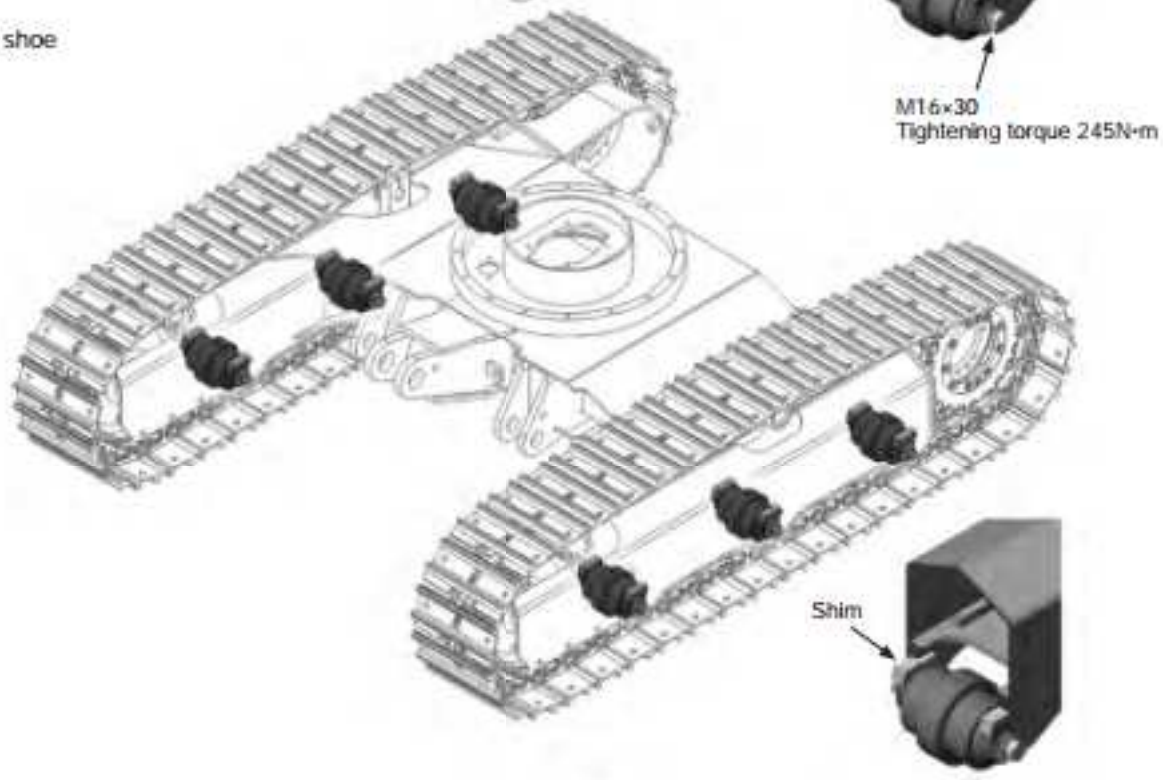


Mass : 25.9 kg

Rubber shoe

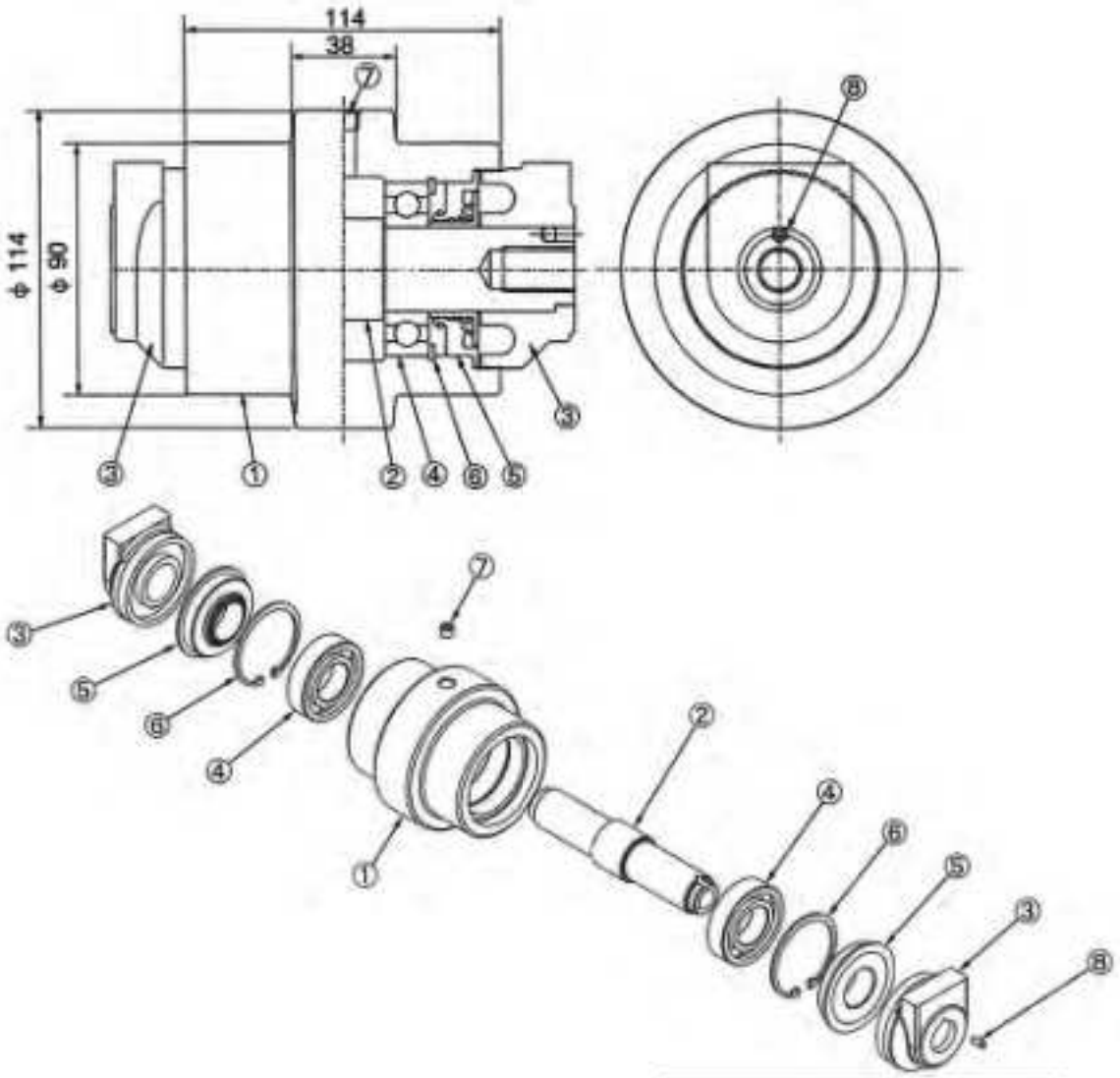


Steel shoe



Tighten the bolt under the condition that the lower roller mounting surface is tightly in contact with the crawler frame.
Tightening torque: 245 N·m

In the case of steel shoe, put a shim (thickness: 9mm) into the gap between frame and shaft. Under the condition that the mounting surfaces are tightly in contact with each other, tighten the bolt.



No.	Name	Q'ty
1	Guide roller	1
2	Shaft	1
3	Collar	2
4	Bearing	2
5	Oil seal	2
6	Snap ring	2
7	Plug	1
8	Spring pin	1

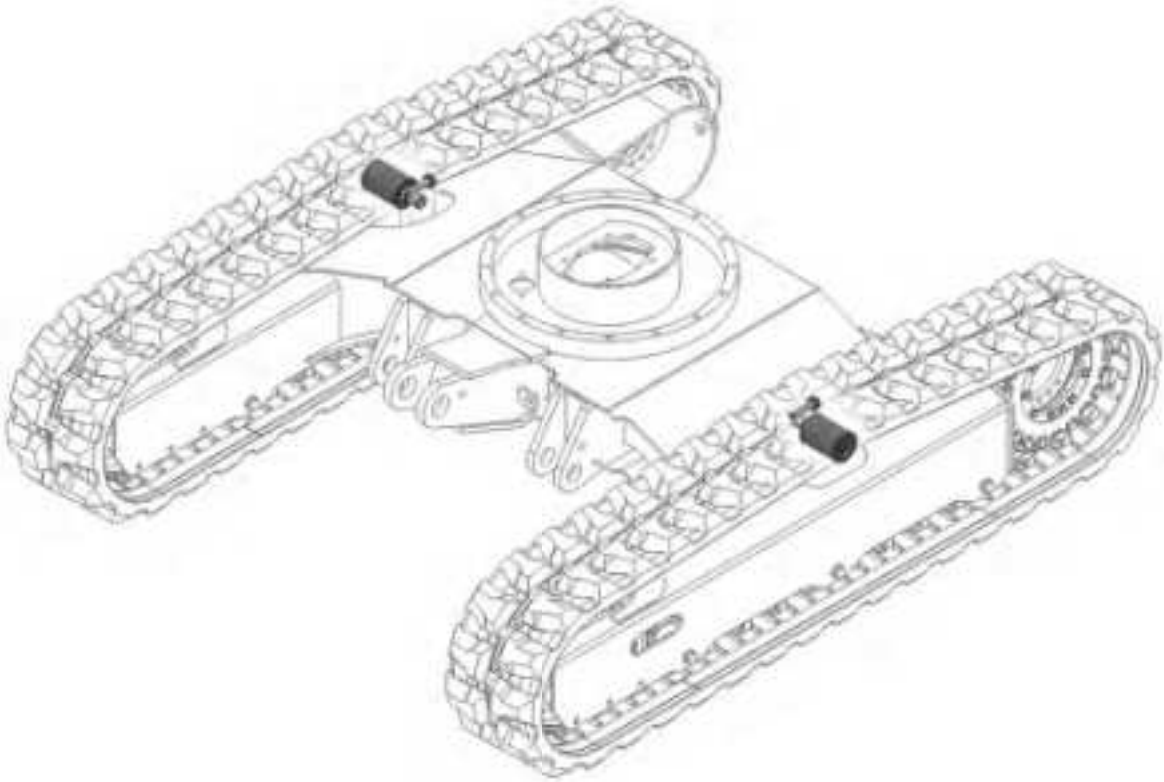
Notes:

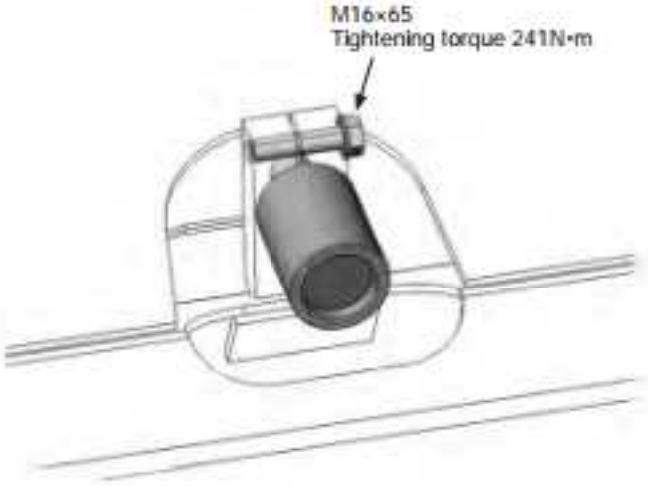
1. Before mounting, clean the parts well to prevent foreign matters from entering the units.
2. Apply oil to the inner and outer diameters of the seal and then press-fit it. Fill the gap between the lips of seal with grease.
3. After assembling, supply the lubricant.

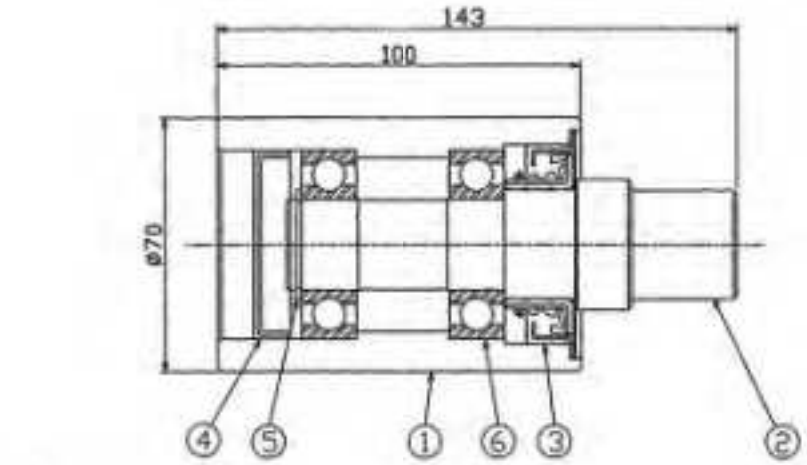
Type of lubricant	Capacity
API-GL4 SAE#90	80 cc

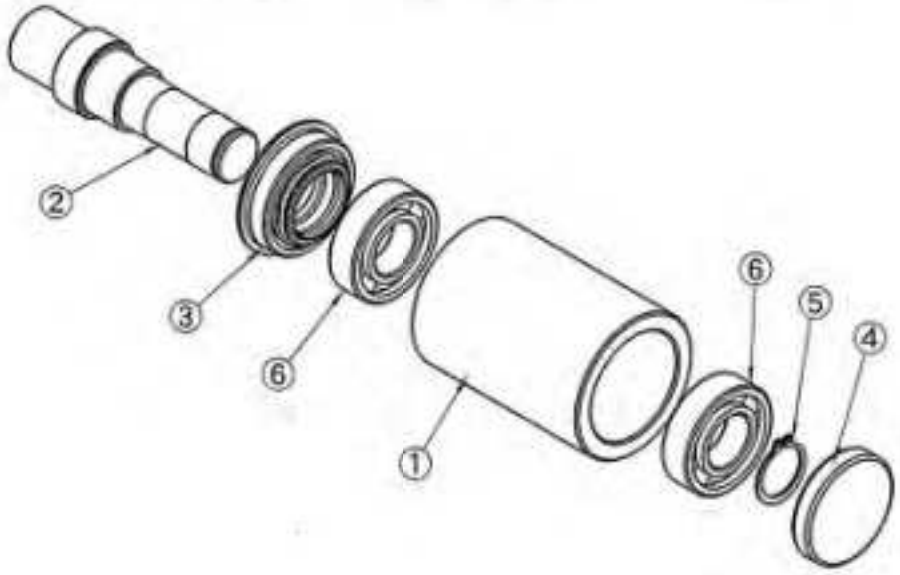
4. Oil leak test:
   Apply an air pressure of 98kPa through the (7) plug hole.
5. Wind the seal tape around the plug (7) and mount it to the roller.

Mass : 6.0 kg




M16×65
Tightening torque 241N·m





Notes:

1. Before mounting, clean the parts well to prevent foreign matters from entering the units.
2. Apply oil to the inner and outer diameters of the seal and then press-fit it. Fill the gap between the lips of seal with grease.
3. After assembling, supply the lubricant.

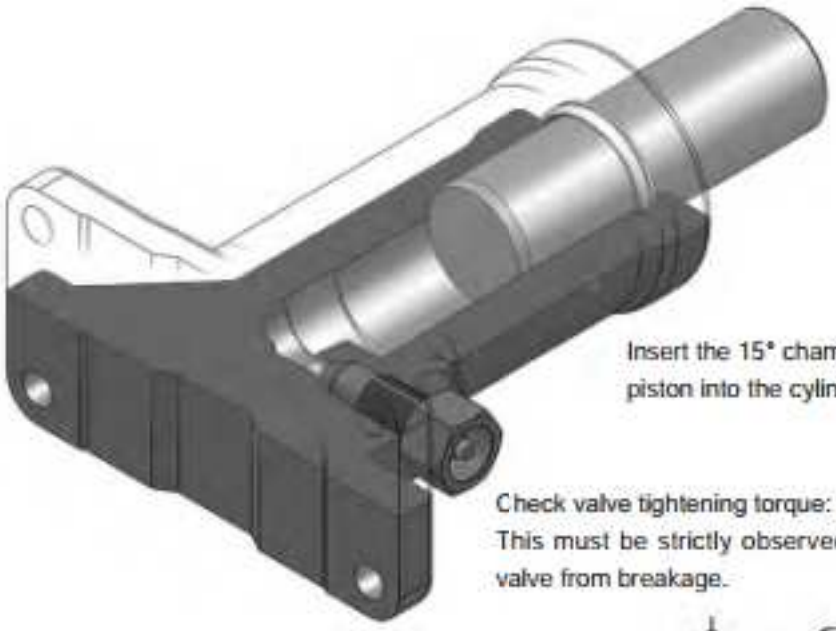
Type of lubricant	Capacity
API-CD SAE#30	45 cc

No.	Name	Q'ty
1	Roller	1
2	Shaft	1
3	Oil seal	1
4	Cap	1
5	Snap ring	1
6	Bearing	2

Mass : 5.0 kg

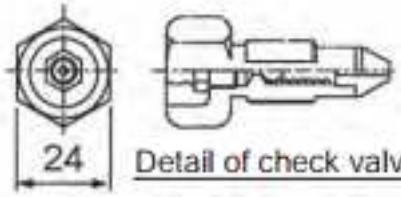
Notes:

1. For the grease cylinder, the oil supply port side must be outside.
2. When loosening the shoe, be sure to loosen the check valve to discharge the grease from the inside. Do not loosen the grease nipple because the high-pressure grease jets out to cause a dangerous status.

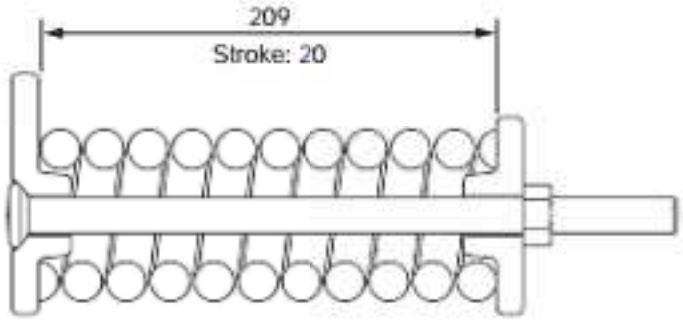


Insert the 15° chamfered side of piston into the cylinder.

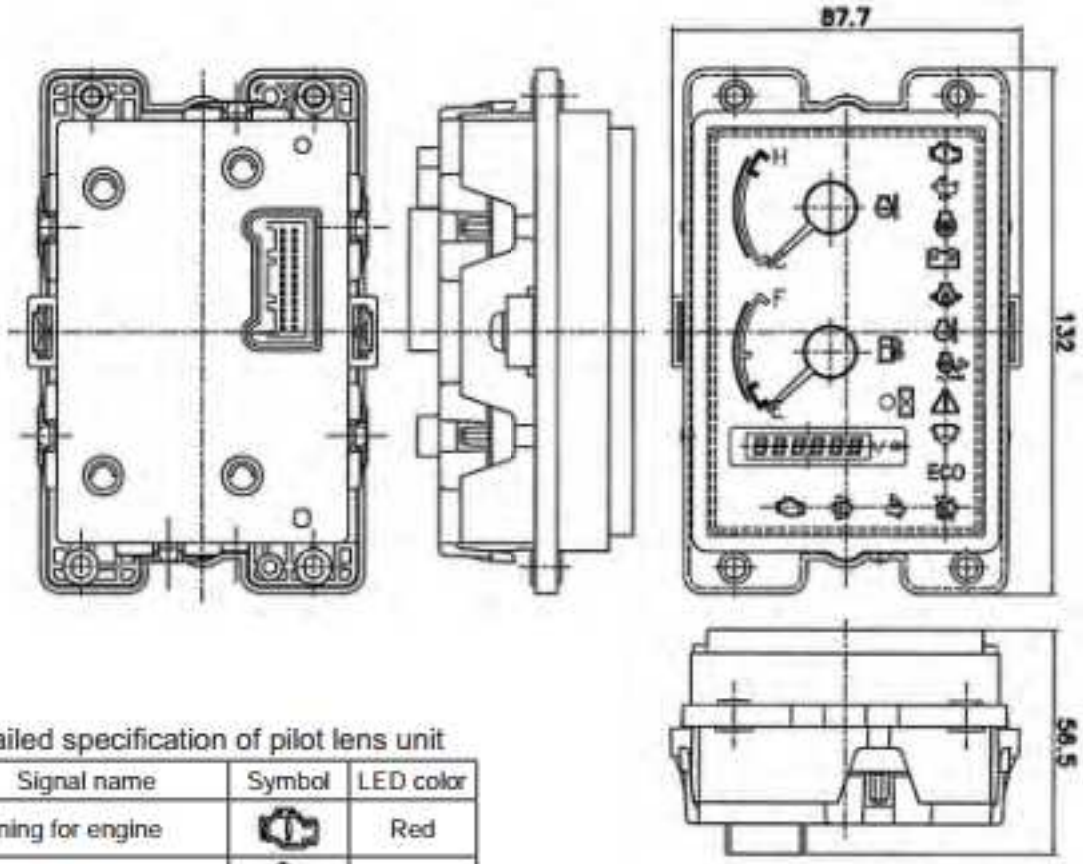
Check valve tightening torque: 55.8 – 68.6 N•m
This must be strictly observed to prevent the check valve from breakage.



Detail of check valve



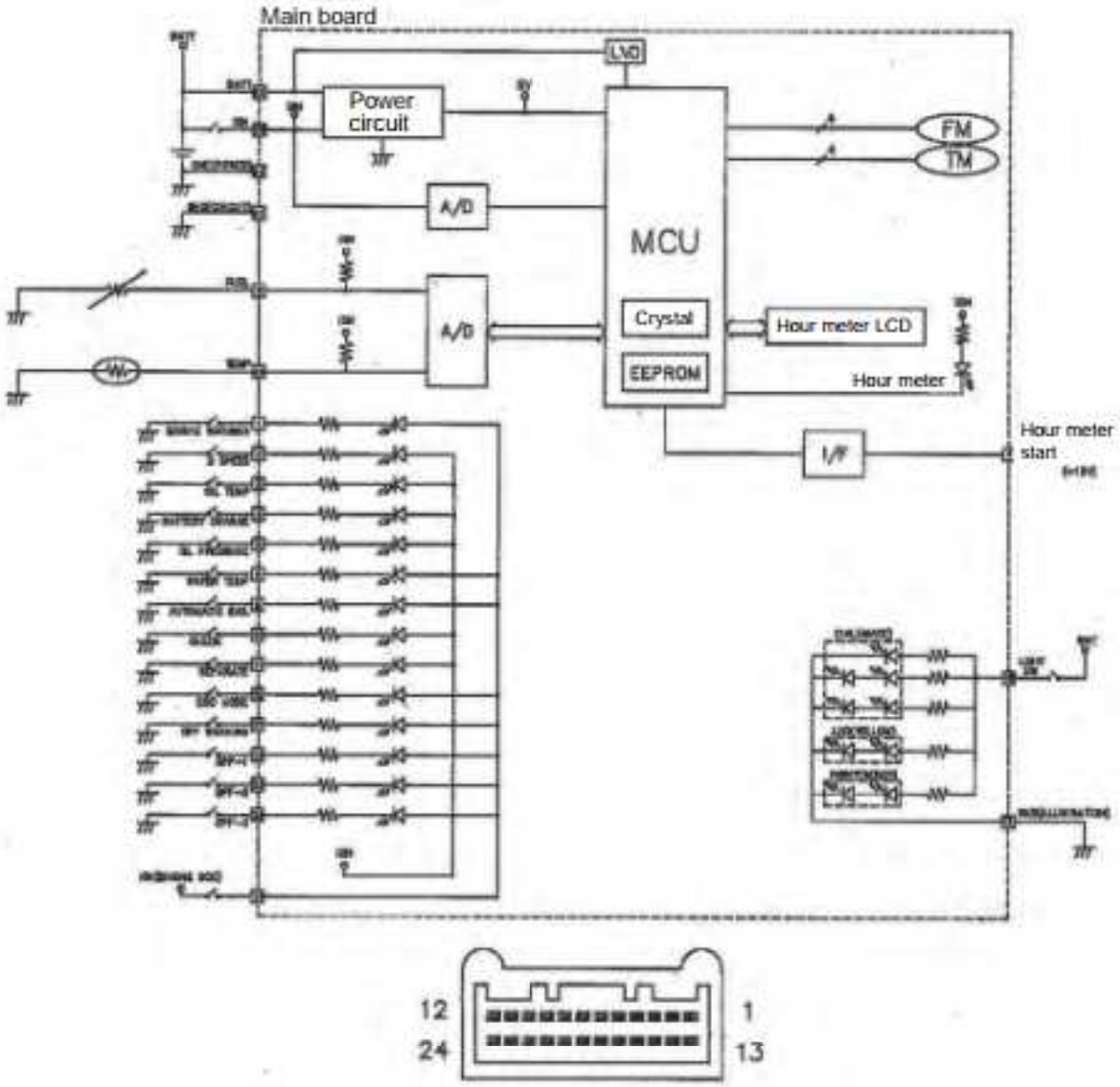
1 External view/Cross-sectional view



Detailed specification of pilot lens unit

Signal name	Symbol	LED color
Warning for engine		Red
Two-speed		Yellow
Oil temperature		Red
Battery charge		Red
Oil pressure		Red
Water temperature		Red
Auto-idling	n/min	Green
Check		Yellow
Separation		Red
Eco (ecology) mode	ECO	Green
Warning for DPF		Yellow
DPF-1		Yellow
DPF-2		Yellow
DPF-3		Yellow

2 Connection diagram

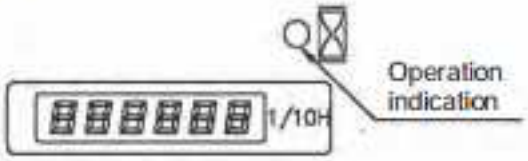


No.	Signal name	No.	Signal name
1	Warning for engine	13	GND (illumination)
2	Two-speed	14	GND (power)
3	Oil temperature	15	GND (circuit)
4	Battery charge	16	Temperature
5	Oil pressure	17	Warning for DPF
6	Fuel	18	Light switch
7	Hour meter start	19	Battery
8	Water temperature	20	IGN
9	Auto-idling	21	IGN (Engine ECU)
10	Check	22	DPF-1
11	Separation	23	DPF-2
12	Eco (ecology) mode	24	DPF-3

3 Meter reference values

3-1 Hour meter

3-1-1 Hour meter LCD



3-1-2 Check voltage: DC12.0V ±0.3V

Check temperature: 20 ±0.5°C

3-1-3 LCD specification

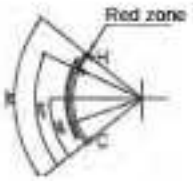
1) IGN is turned on/off. The indication is always ON.
2) When IGN is turned on and the hour meter signal is received, the LCD counts time.
3) The indication range is 0 to 999999 (1/10H). When the value exceeds this range, "999999 (1/10H)" is indicated.
4) The accuracy about time is ±0.1%.
5) Resolution: 0.1H
6) The LCD consists of 7 sections and time is indicated with a 6-digit number. (The indication shifts to the rightmost end.)
7) When the battery is consumed, the data is saved in the memory for at least 25 years.

3-1-4 Indicator LED for hour meter operation

1) When the hour meter begins to count, the LED is lit.
2) The LED color is green and the operation cycle is 2 seconds (0.5Hz).
3) When the hour meter is OFF, the LED is turned off.

3-2 Water temperature meter

3-2-1 Tolerance of indication

Indication (°C)	50	67	105	135	Indication scale
Unit resistance (Ω)	153.9	51.9 – 27.4	23.9	10.8	
Display (°)	0	38	62	76	
Tolerance (°)	±8.0	±3.5	±3.5	–	

3-2-2 Check voltage: DC12.0V ±0.3V

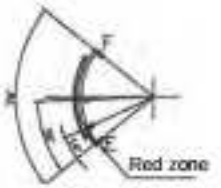
Check temperature: 20 ±0.5°C

3-2-3 Braking characteristics of water temperature meter

When the machine is left at Point C for 1 minute and then the load resistance is instantaneously moved from Point C to H, it takes 2 ±0.8 seconds to pass Point OH.

3-3 Fuel meter

3-3-1 Tolerance of indication

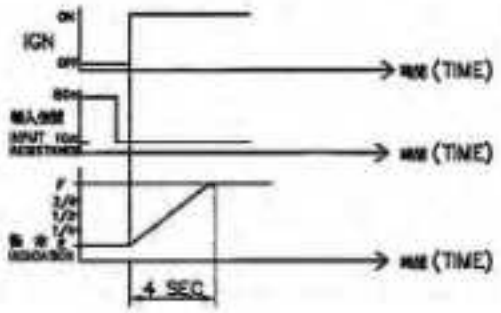
Indication	F	1/2	E	Indication scale
Unit resistance (Ω)	10	38	80	
Display (°)	76	36	0	
Tolerance (°)	5±2	±3.0	-2±1	

3-3-2 Check voltage: DC12.0V ±0.3V

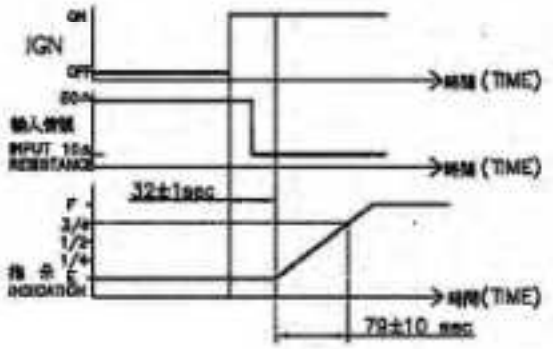
Check temperature: 20 ±0.5°C

3-3-3 Characteristics of fuel meter

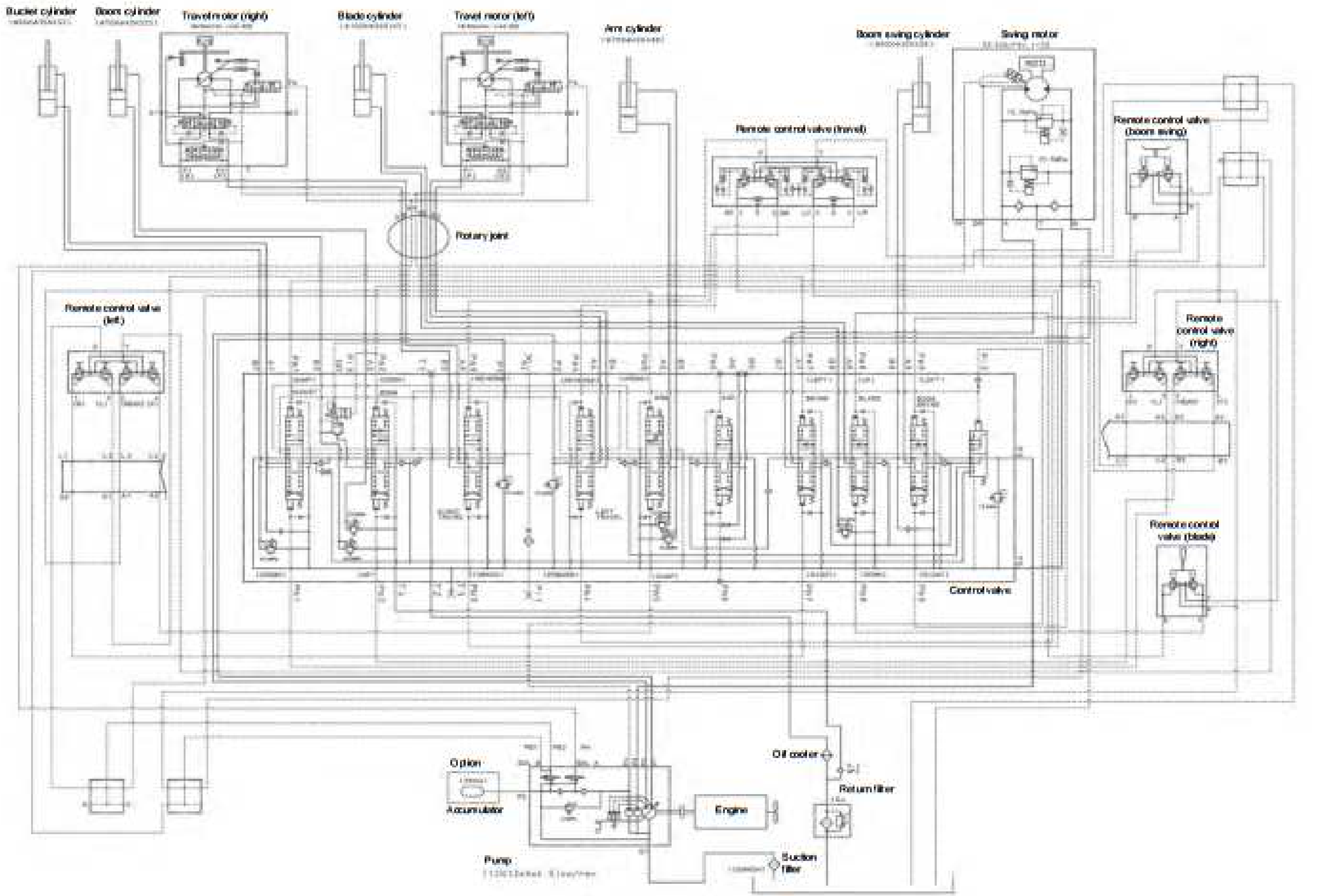
1) When the load resistance is moved from Point E (80Ω) to Point F (10Ω) while IGN is OFF, it takes maximum 4 seconds to move from Point E to Point F.



2) When 32 ±1 seconds have passed since IGN was ON and the load resistance is instantaneously moved from Point E (80Ω) to Point F (10Ω), it takes 79±10 seconds to pass Point 3/4.

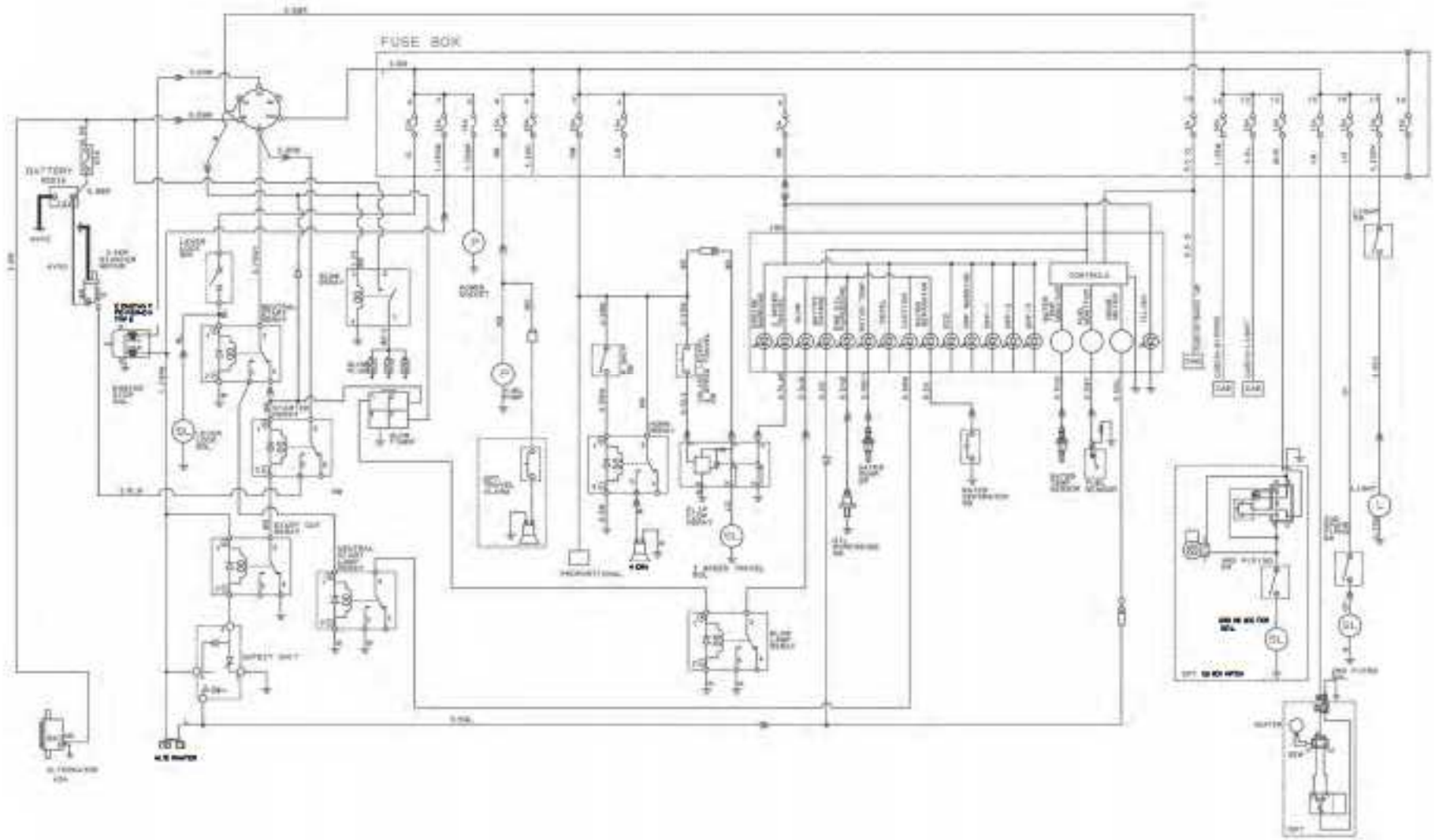


A5 Circuit Diagram

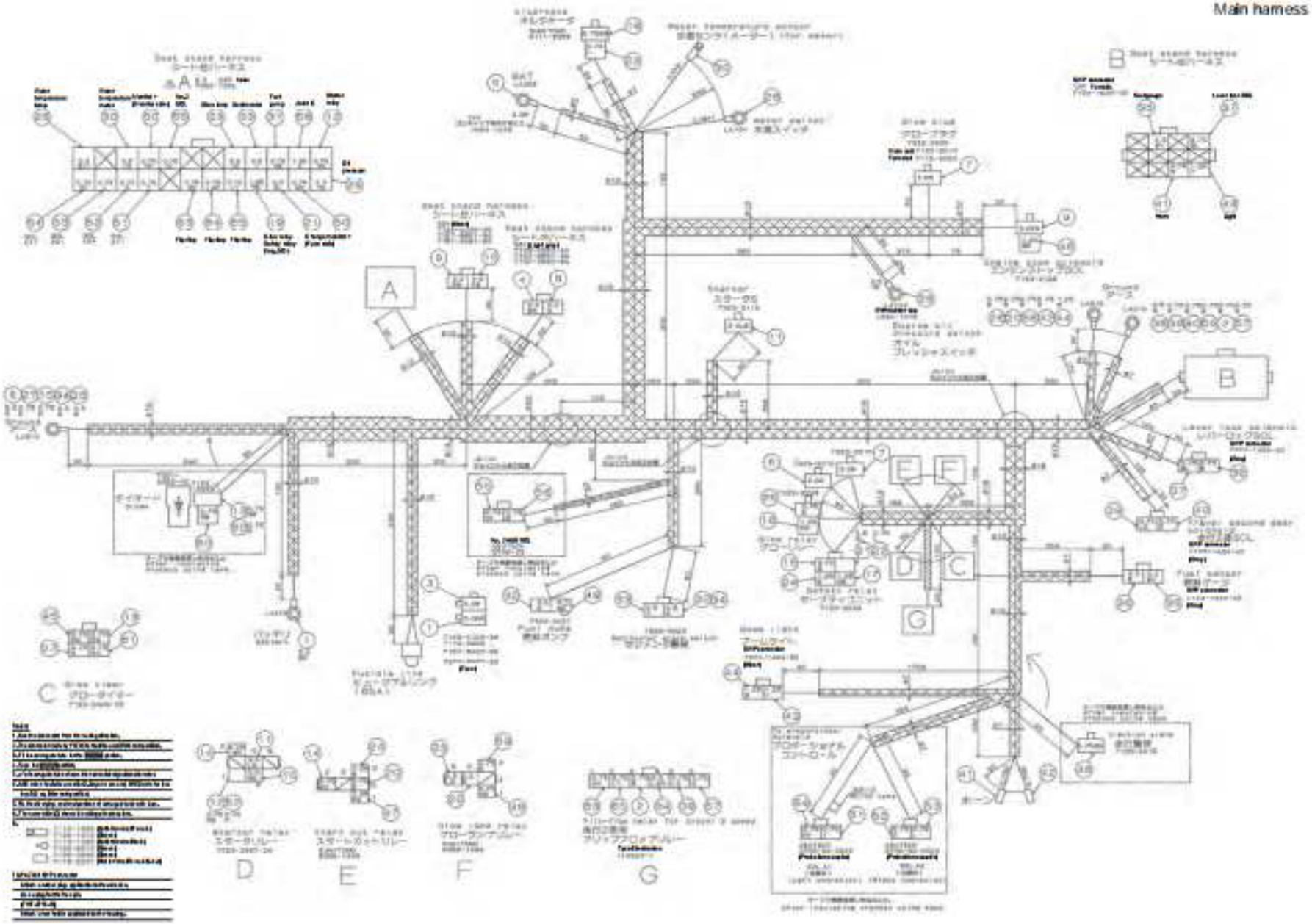

Bucket cylinder
Boom cylinder
Travel motor (right)
Blade cylinder
Travel motor (left)
Arm cylinder
Boom swing cylinder
Swing motor
Remote control valve (travel)
Remote control valve (boom swing)
Rotary joint
Remote control valve (left)
Remote control valve (right)
Remote control valve (blade)
Control valve
Option
Accumulator
Pump
Engine
Oil cooler
Return filter
Suction filter

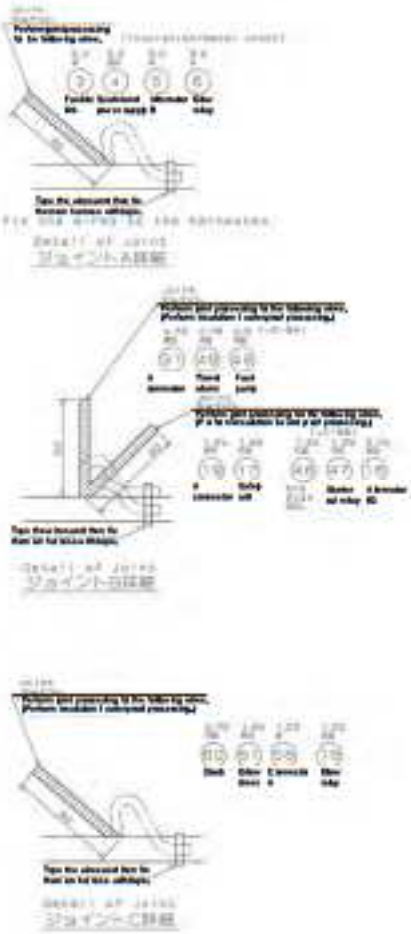
Key switch connection diagram

	B	BR	ACC	R1	R2	C
Preheat	○	○	○	○		
OFF	○					
ON	○	○	○			
Start	○	○	○		○	○

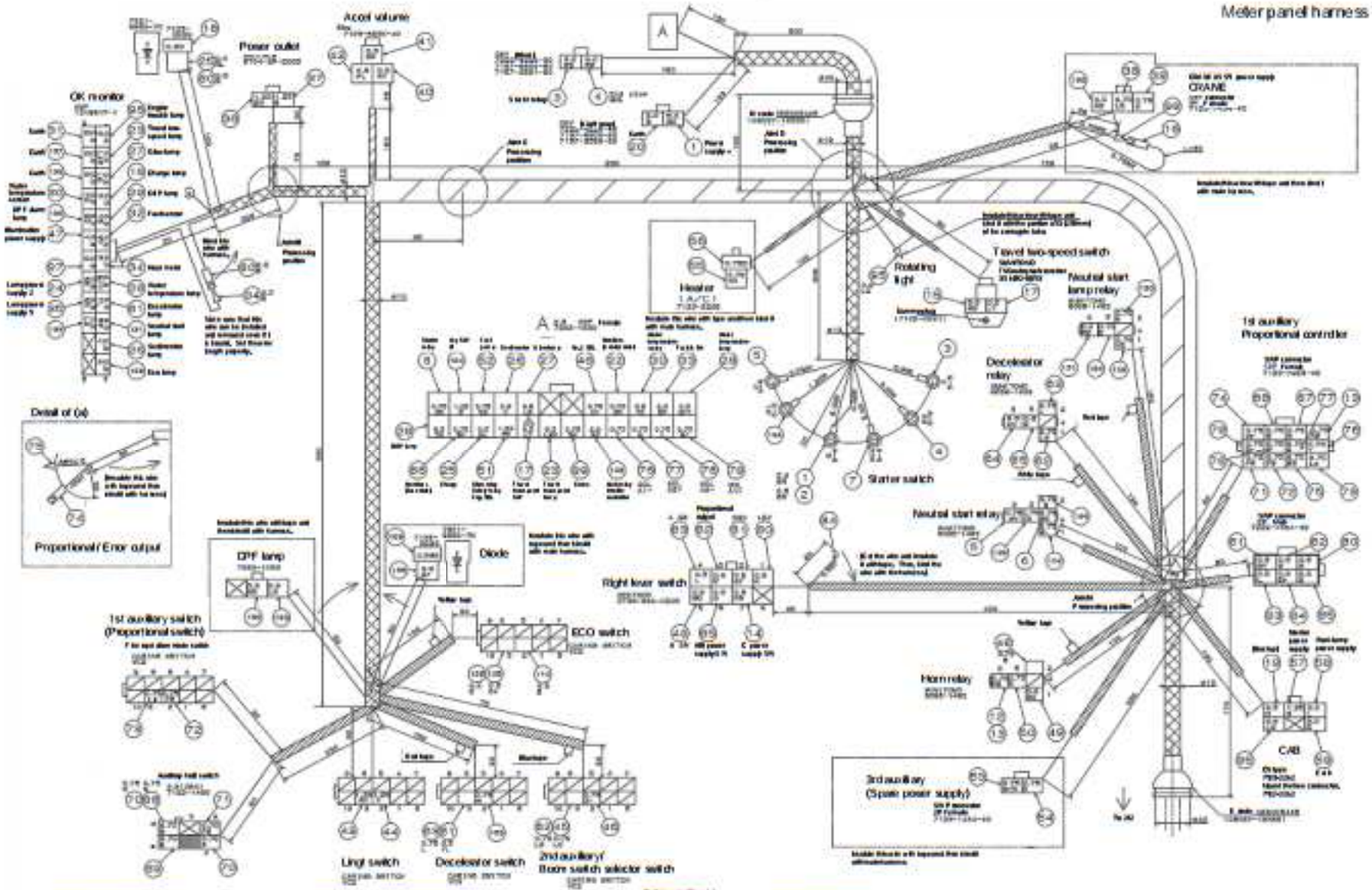


Main harness 1/2

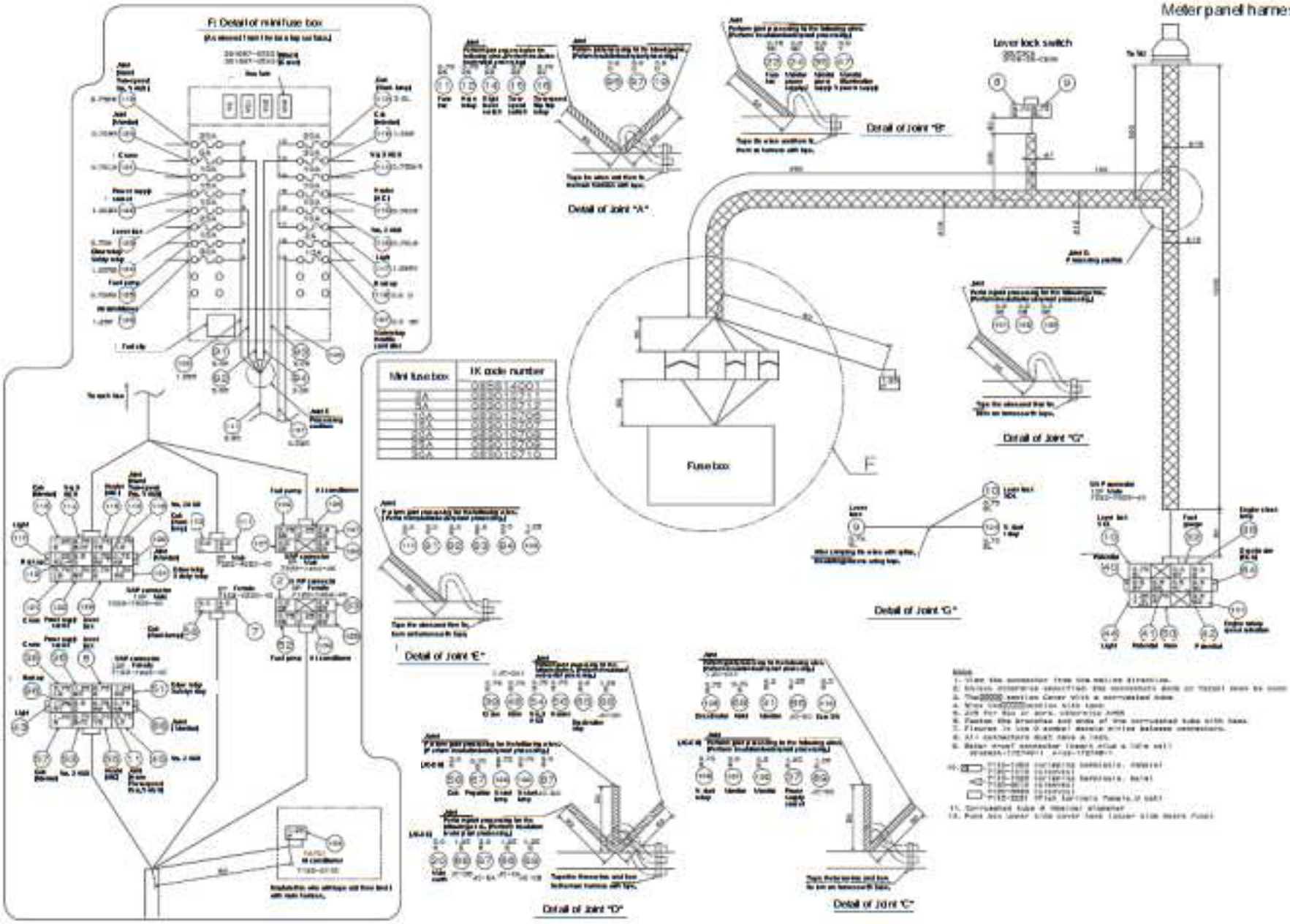




Meter panel harness 1/2



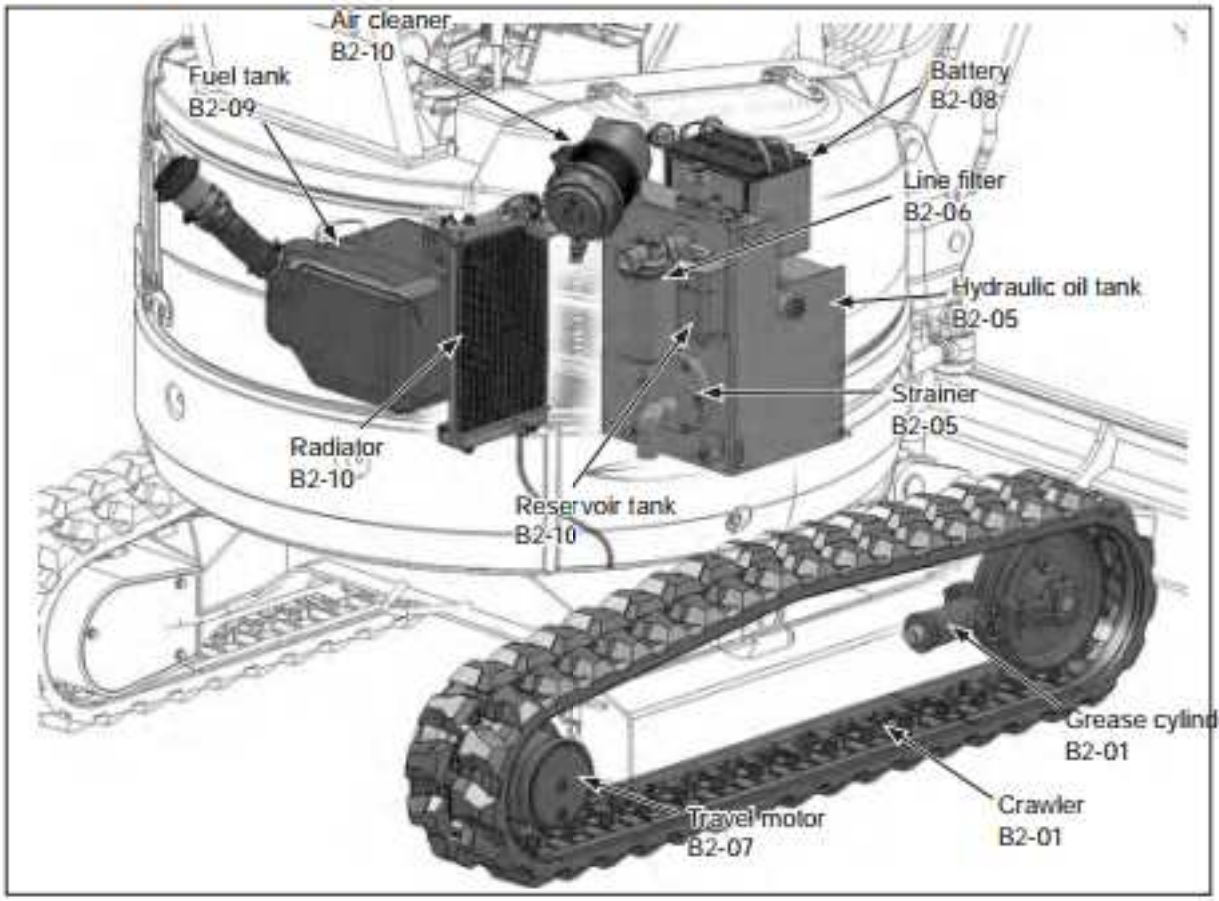
Meter panel harness 2/2

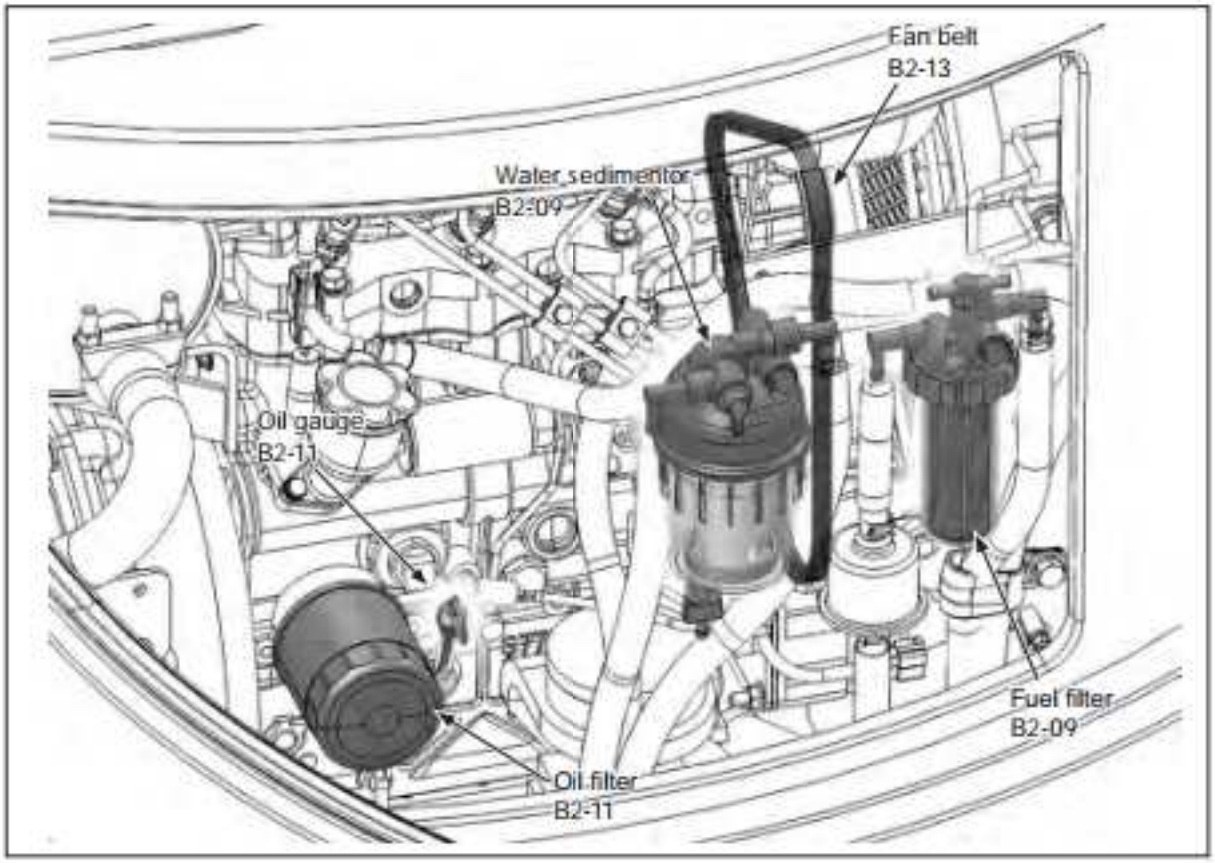


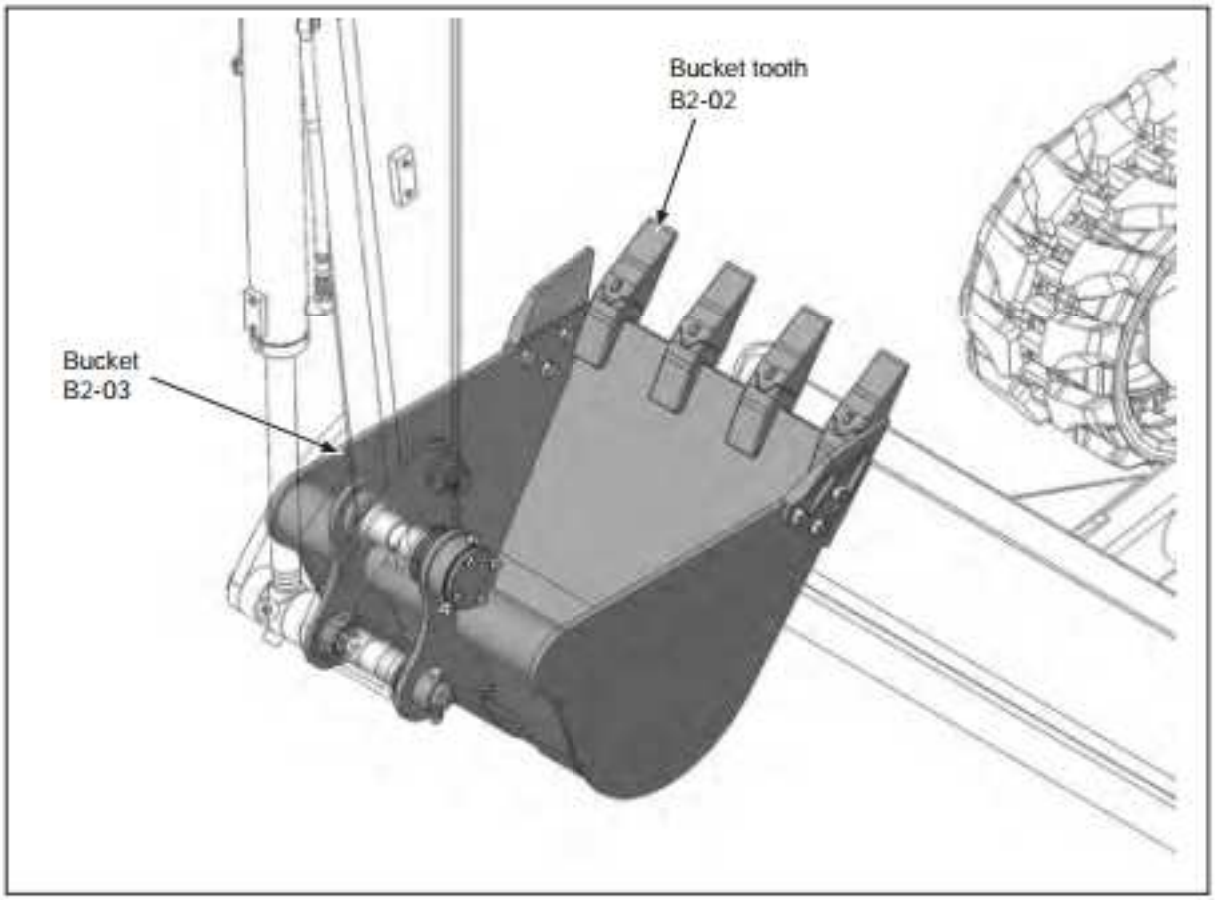
B1 General Maintenance

Parts shown in the figure require periodic check/replacement.
For work details, please see each item in section 2.
For the check cycle, see B1-02

Codes in the lower row are maintenance method item numbers




Fan belt
B2-13
Water sedimentor
B2-09
Oil gauge
B2-11
Fuel filter
B2-09
Oil filter
B2-11


Bucket tooth
B2-02
Bucket
B2-03

△: Inspection/Adjustment ○: Replacement

Class	Check/maintenance part	Contents of check/ maintenance	Interval of check/maintenance								
			Every day	50h	100h	250h	500h	1000h	1500h	2000h	As required
Lubrication	Attachment	Greasing		△							
	Boom swing			△							
	Blade			△							
	Swing bearing			△							
	Swing ring gear						△				
Bucket	Bucket tooth	Replace		△							○
	Bucket	Replace		△							○
	Clearance	Adjust		△							
Crawler	Rubber shoe	Check wear & deterioration	△								○
	Shoe tension	Check & adjust									△
Reduction gear	Travel reduction gear	Check oil leak	△								
		Check oil qty & refill					△				
		Change oil		○ First				○			
Hydraulic system	Hydraulic oil tank	Check oil qty & refill	△								
		Change hydraulic oil/ Clean the tank						○*1			
	Suction strainer	Clean						△			
	Return filter	Replace cartridge		○ First			○*2				
	Hydraulic equipment	Check oil leak	△								
	Hydraulic devices	Check oil leak	△								

*1: When breaker is used: 600 hours

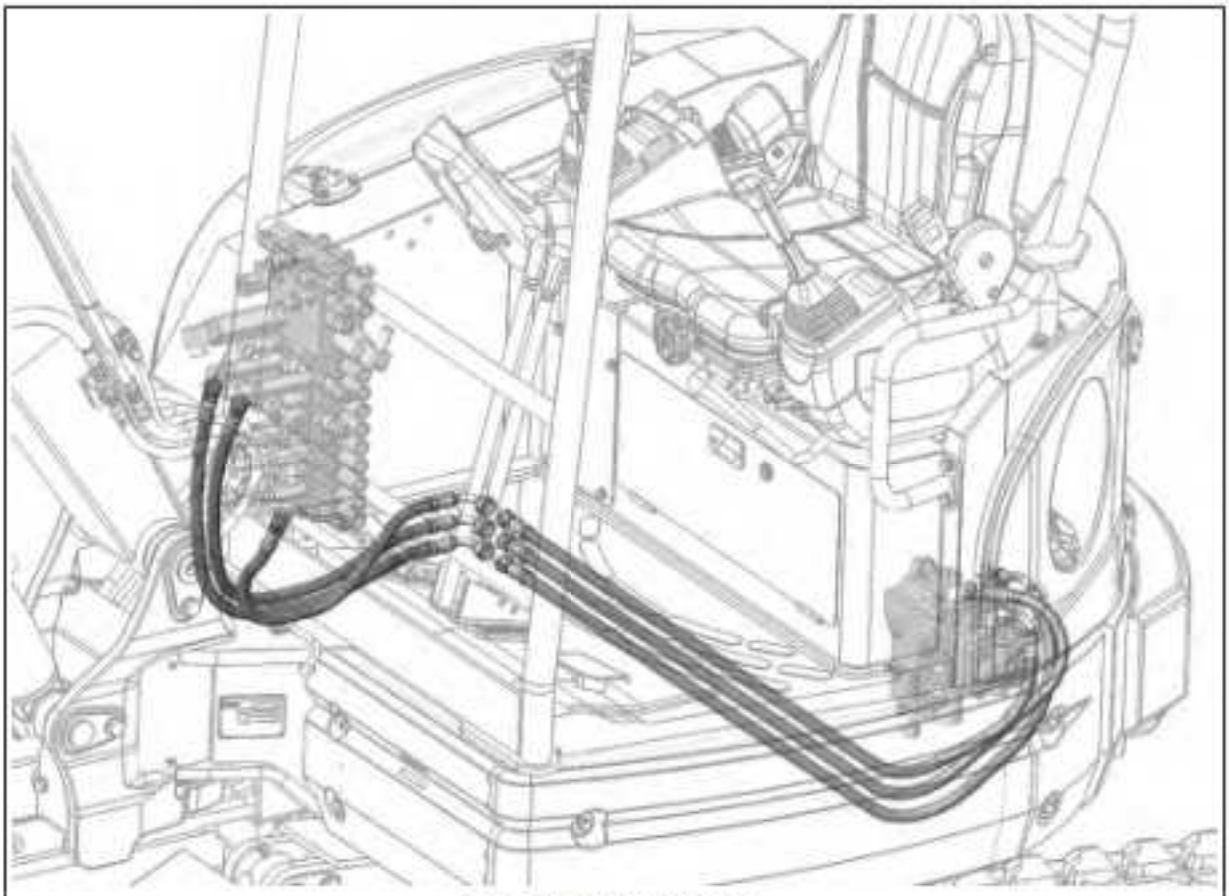
*2: When breaker is used: 100 hours

Class	Check/maintenance part	Contents of check/ maintenance	Interval of check/maintenance								
			Every day	50h	100h	250h	500h	1000h	1500h	2000h	As required
Lubrication system	Engine oil	Check oil qty & refill	△								
		Change		○ First		○					
	Oil filter	Replace		○ First		○					
Fuel system	Fuel tank	Check oil qty & refill	△								
	Water sedimentor	Check	△								
		Clean/ Replace element					△				○
	Fuel filter	Replace					○				
Cooling system	Sub tank	Check coolant qty & re-fill	△								
	Radiator	Clean						△			
		Change coolant						○ or one year			
	Radiator fins/ Oil cooler fins	Check & Clean				△					
	Fan belt	Adjust tension		△ First	△						
		Check cracks		△ First	△						○
Suction system	Air cleaner	Check dust indicator	△								
		Check element/Clean		△ First	△						
		Replace element					○				
Hoses	Fuel hose/ Radiator hose/ Hydraulic hose	Check leak & replace.	△							○ or two years	
Engine system	Governor lever	Check & adjust.	△			△					
	Inteke valve & exhaust valve head	Adjust clearance						△			
	Fuel injection system	Check/Clean/ Check functioning							△		

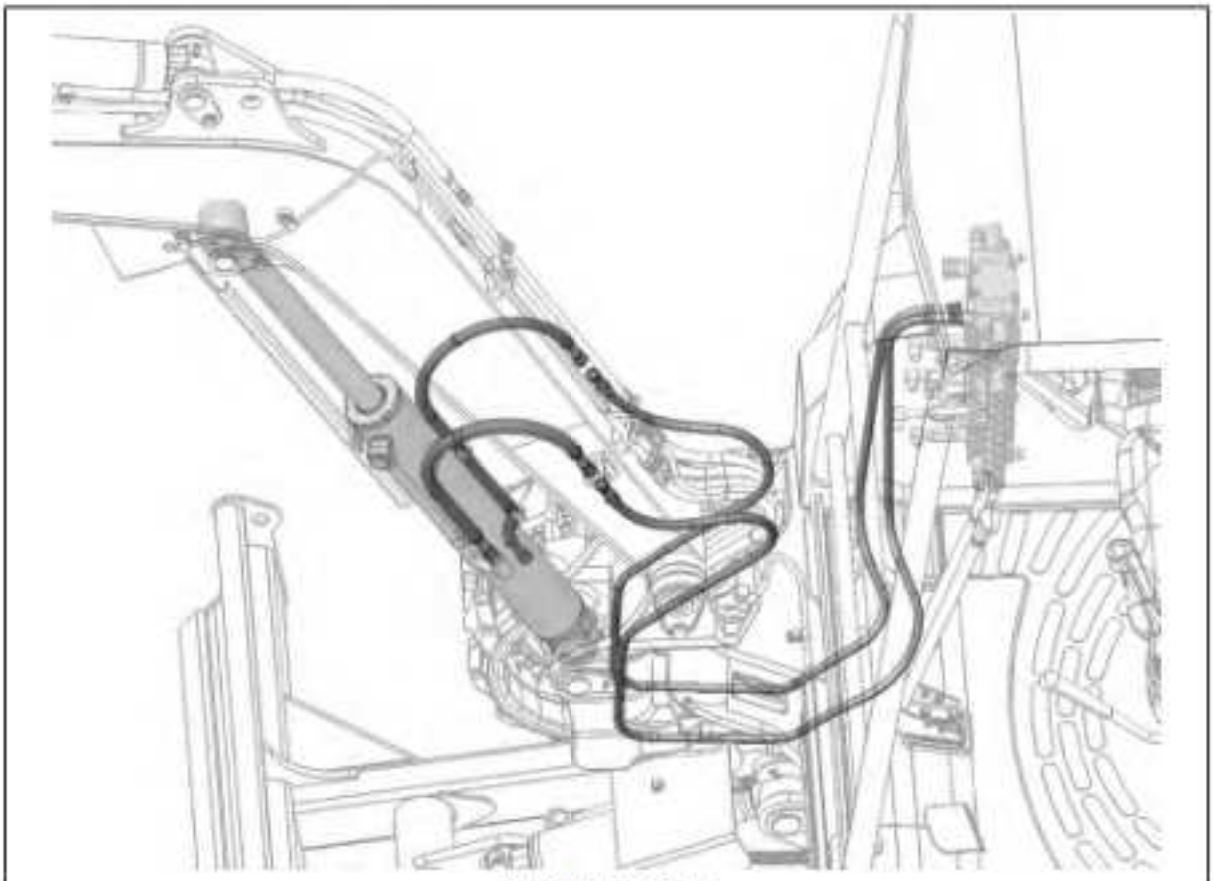
Class	Check/maintenance part	Contents of check/ maintenance	Interval of check/maintenance								
			Every day	50h	100h	250h	500h	1000h	1500h	2000h	As required
Electrical system	Fuse	Replace									○
	Fusible link	Replace									○
	Battery	Check battery liquid qty & refill		△							
		Clean terminal					△				
Bolt tightening point		Retightening		△ First							△

- The important parts shown below that are especially related to safety and fire disasters should be replaced **every 2 years**.
- For these parts, the material may be changed due to aging or degradation, wear, or fatigue may be caused as a result of repeated use. Then, serious accidents may occur.
- For these parts, it is hard to judge the remaining life from the appearance inspection or the feeling of driving.
- These parts should be replaced with new ones on a regular basis to maintain the full function even though any particular abnormality is not found.
- Even before the replacement time, these parts should be repaired or replaced immediately after any abnormality is found.
- If any abnormality is found on the hydraulic hose or joint other than the periodically replaced parts, retightening or replacement should be performed.

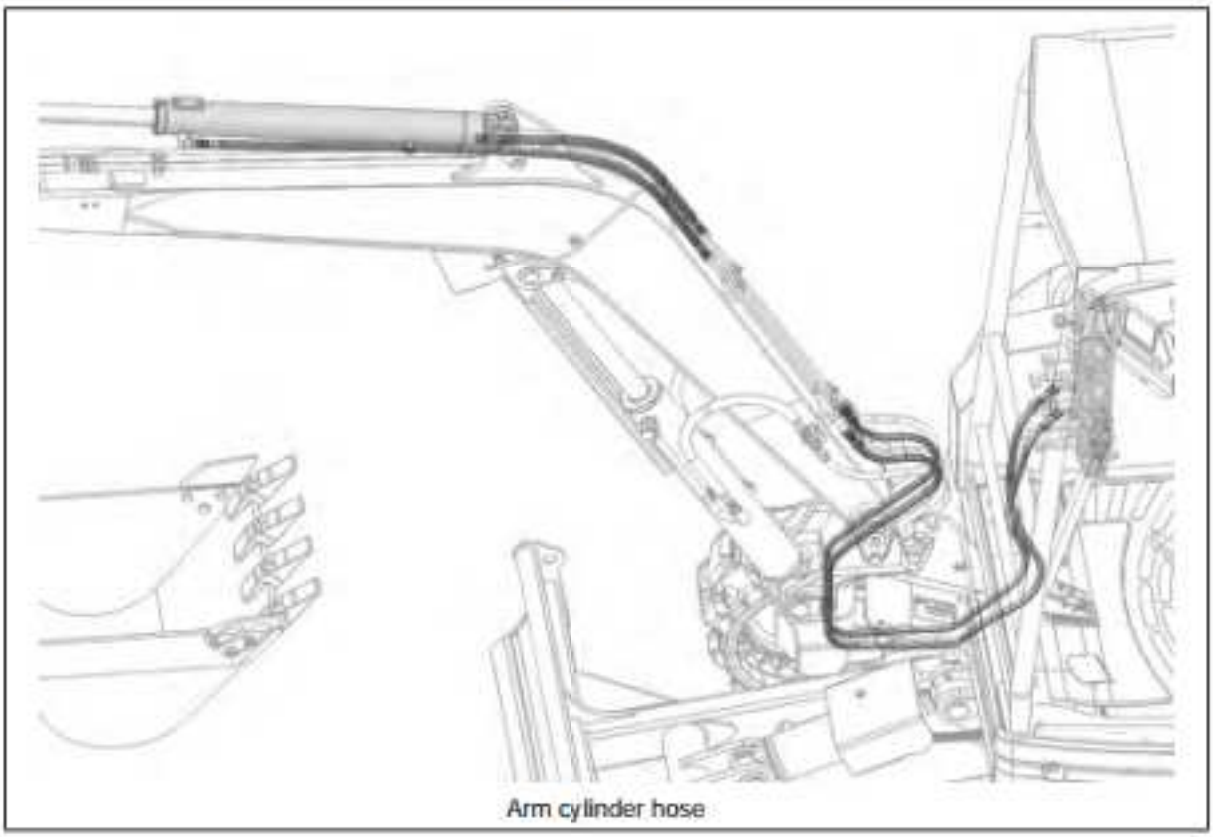
Periodically replaced parts



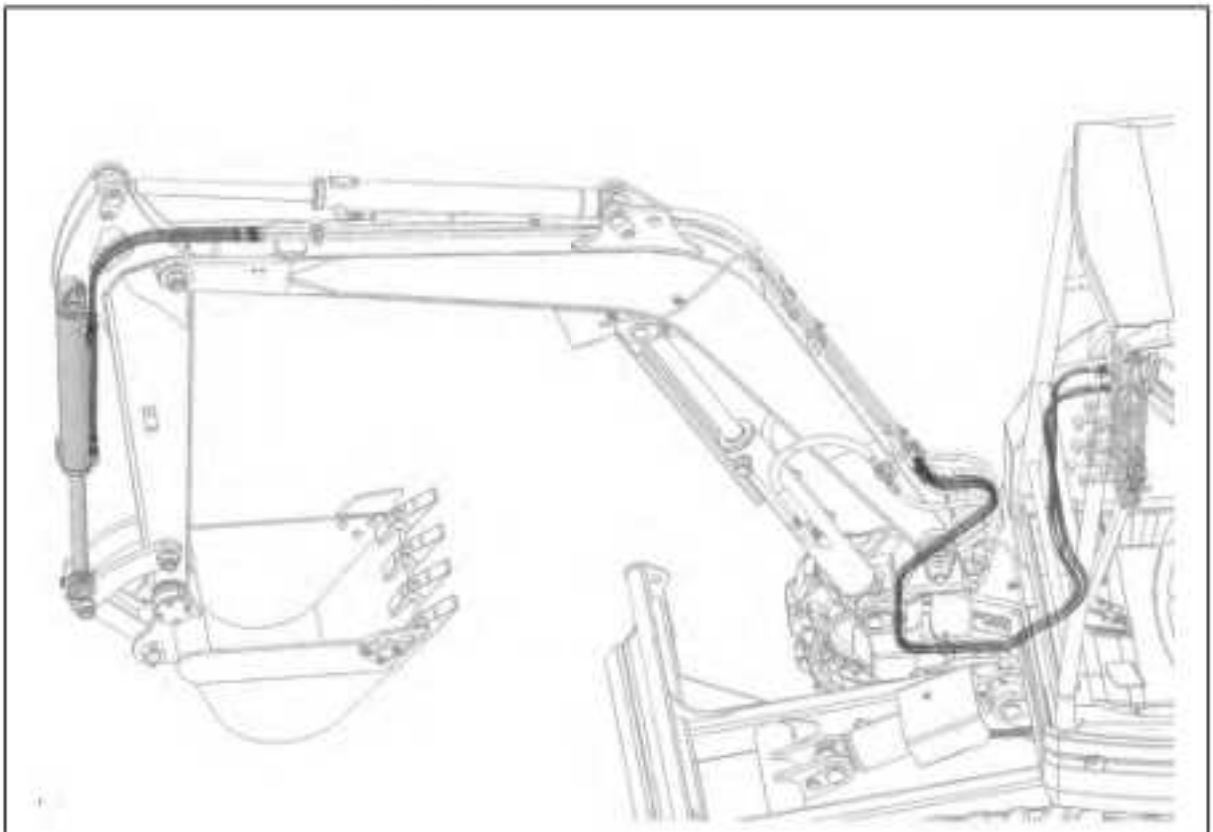
Pump - Control valve hose



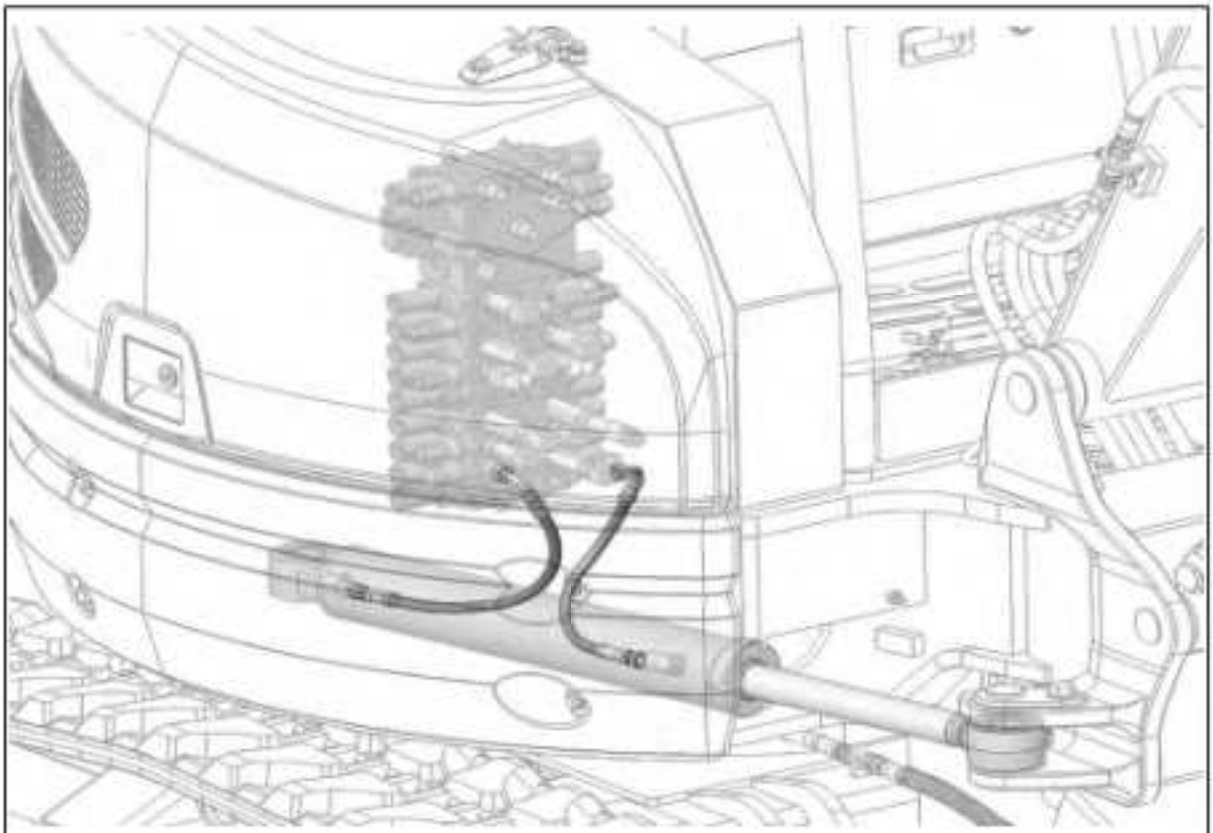
Boom cylinder hose



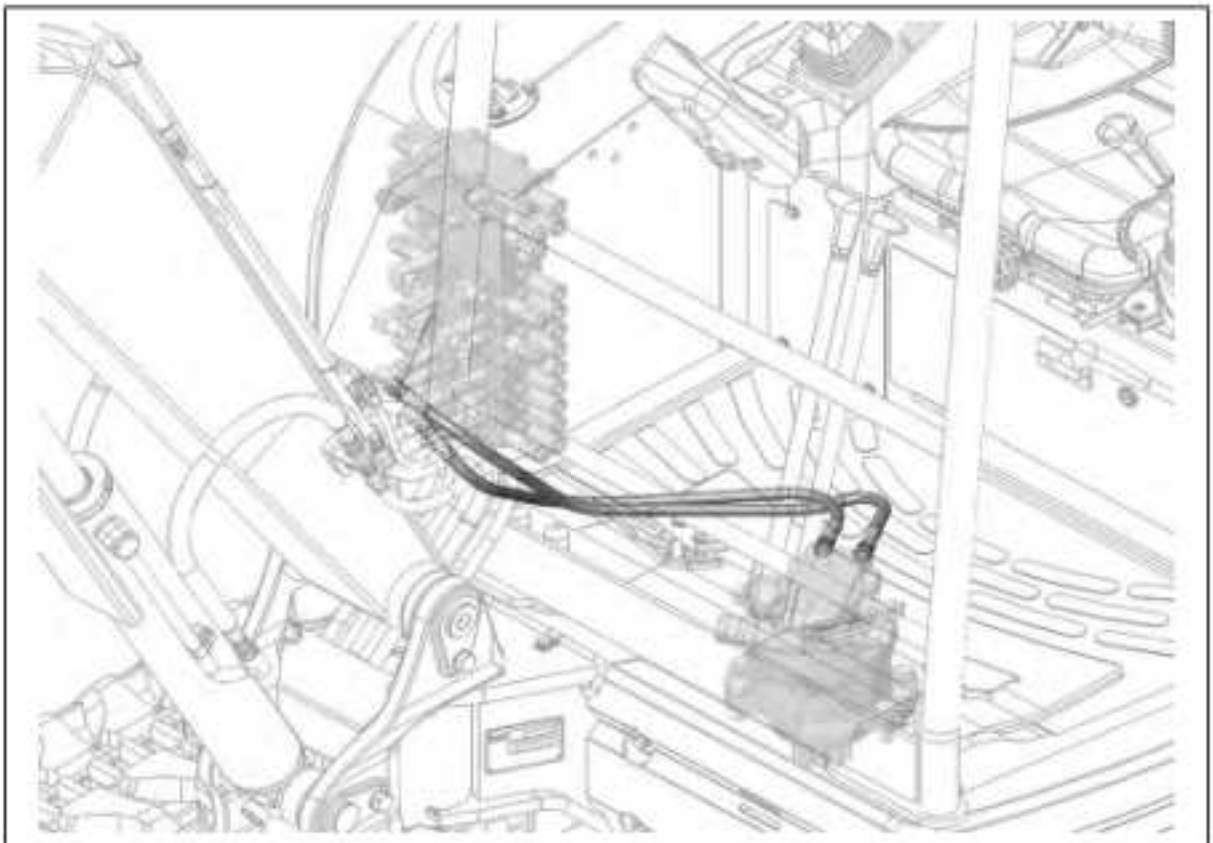
Arm cylinder hose



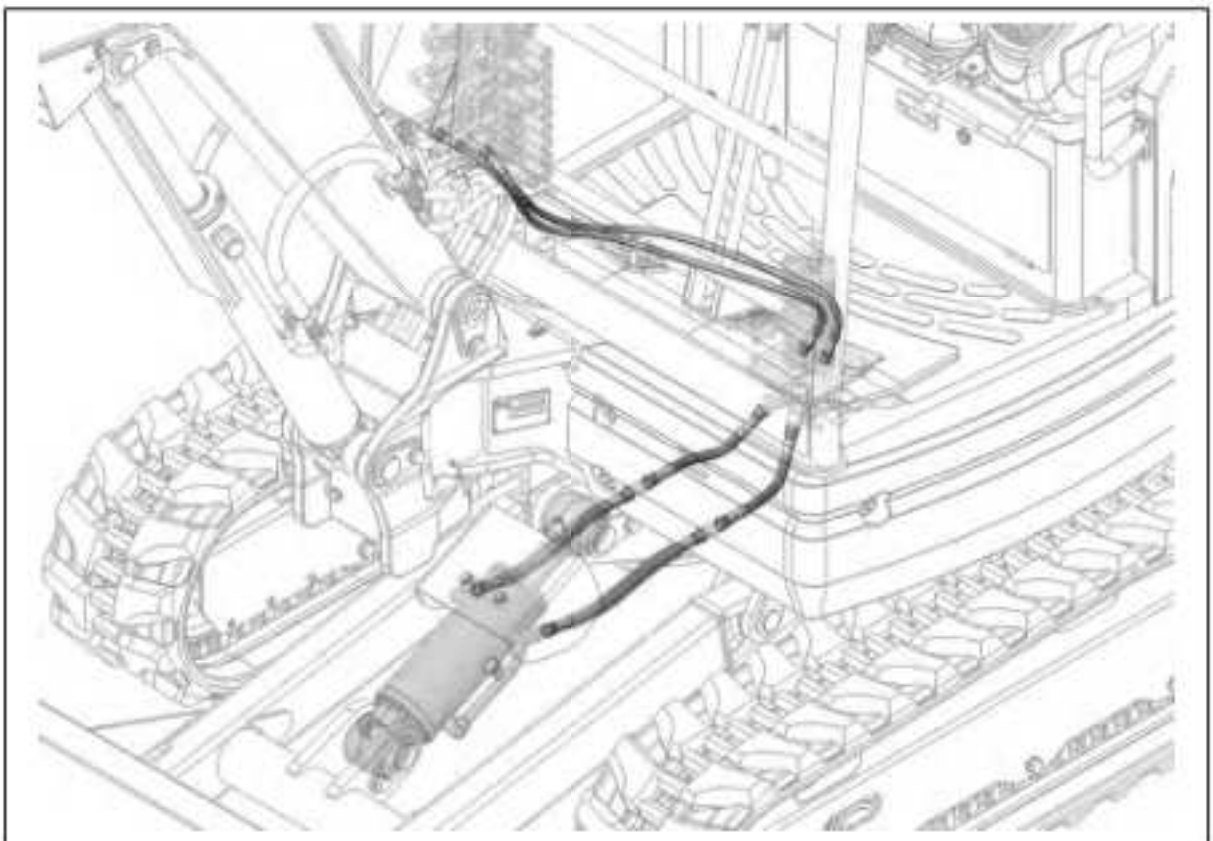
Bucket cylinder hose



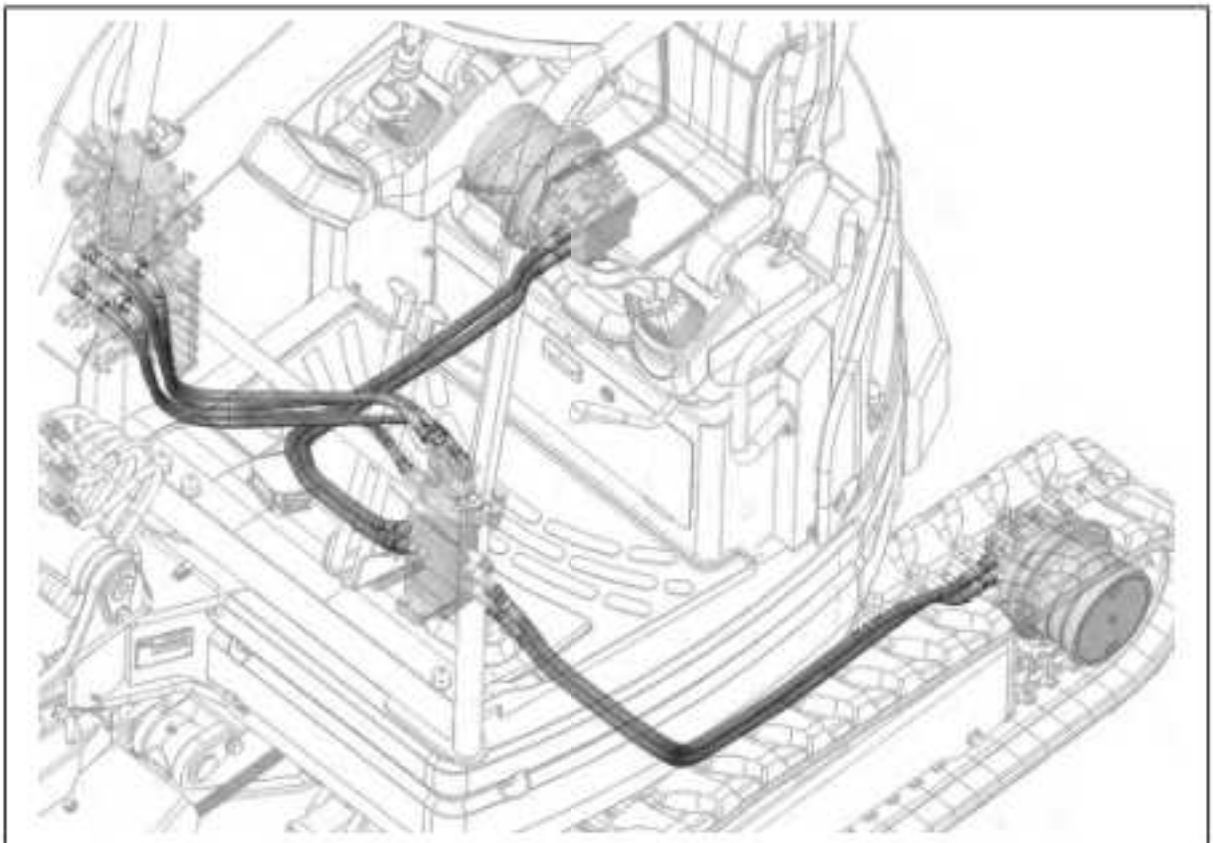
Boom swing cylinder hose



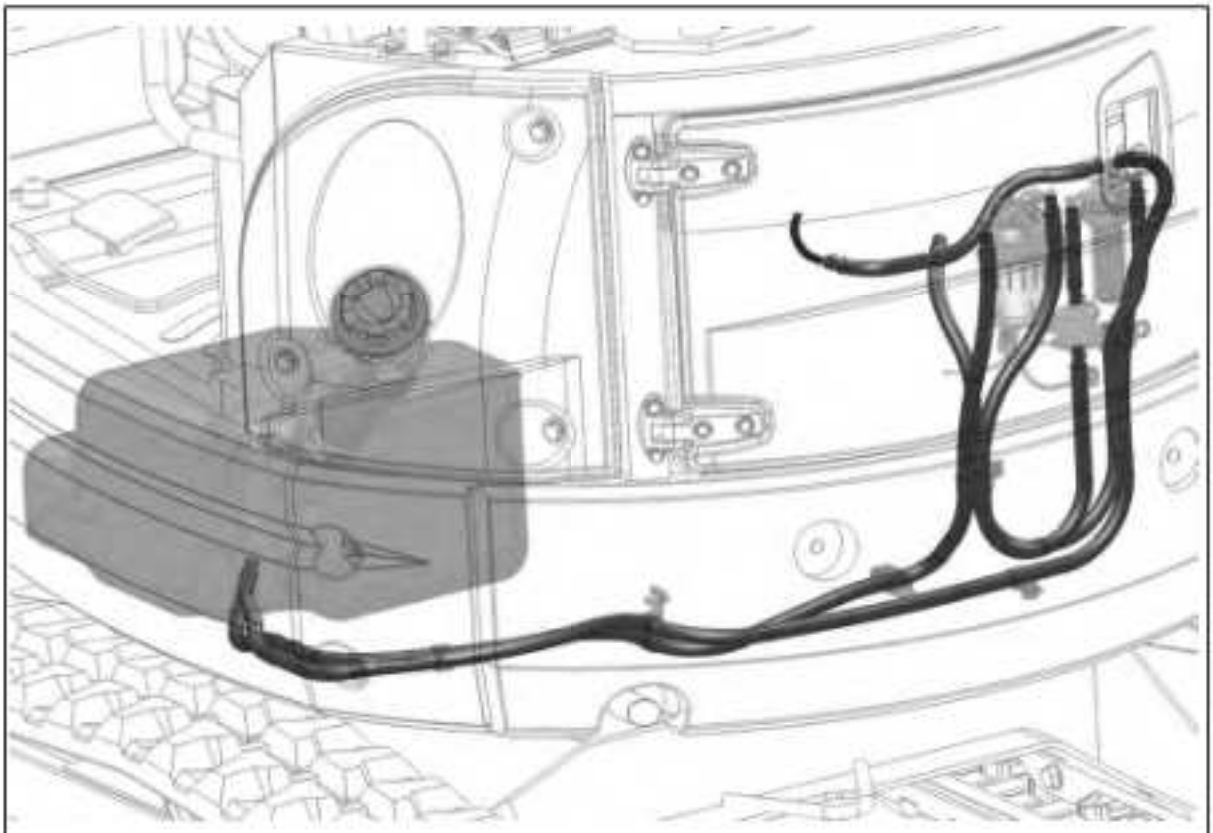
Swing motor hose



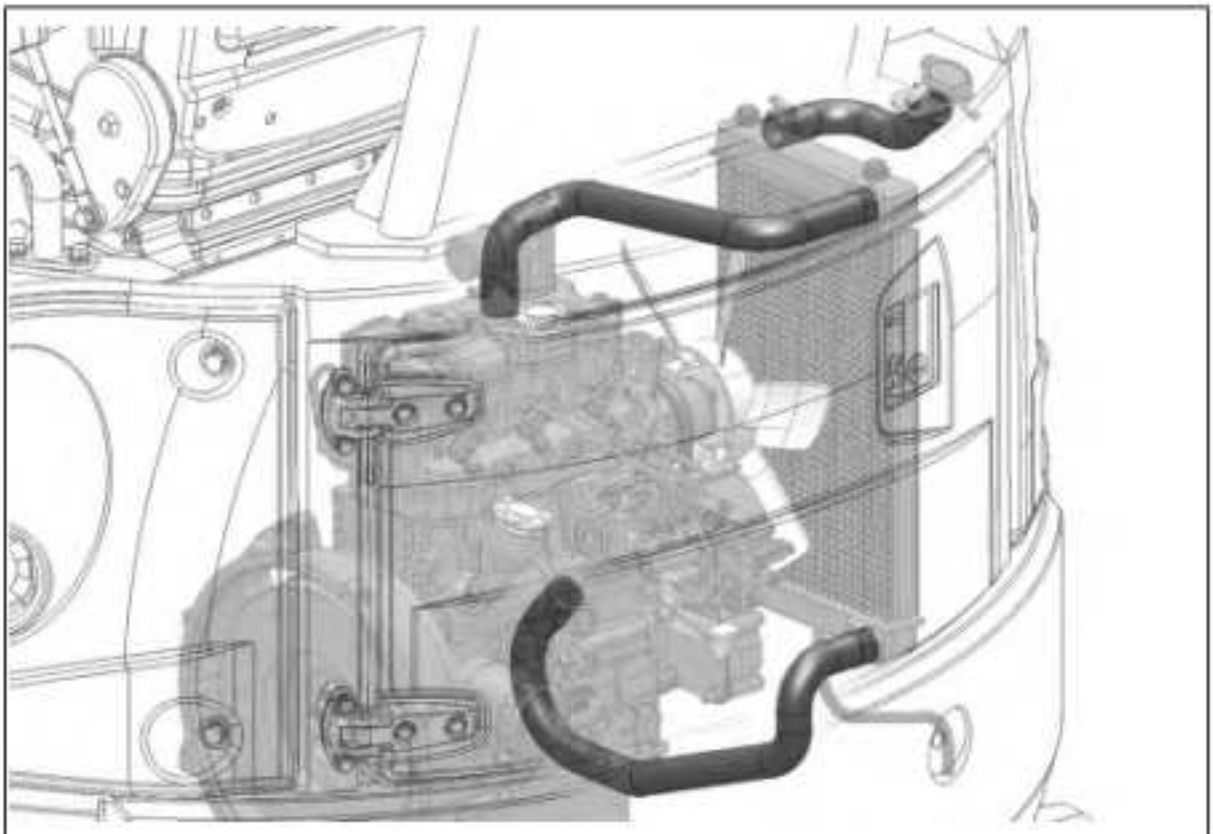
Blade cylinder hose



Travel motor hose



Fuel hose



Radiator hose

1. Cautions for measuring

(1) Measurement Location

① Set the machine on the flat and solid ground.
② For natural lowering amount during traveling and swinging, the place should be sloped in 15°.
③ Clearing space for the attachment to swing with maximum reach.
④ Clearing flat and solid ground where the machine can run 10 m straight.
⑤ Safety measures such as "Keep Off" should be in place for the measurement.

(2) Measuring Instruments

① Stop watch
② Scale
③ Thermometer
④ Inclination gauge
⑤ Pen, notebook, chalk and felt pen
⑥ Pressure gauge
⑦ Engine tachometer

(3) Measurement condition

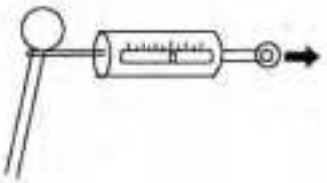
The hydraulic oil temperature must be 50 ± 5°C for measuring.

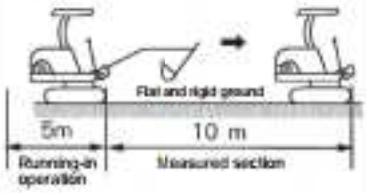
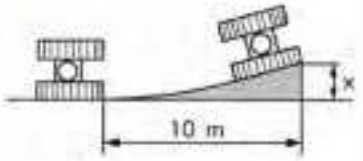
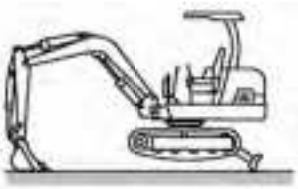
(4) Measurement result

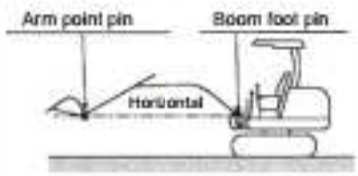
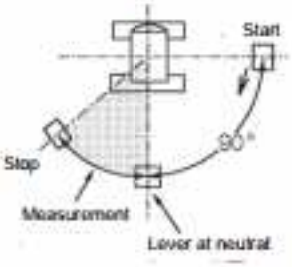
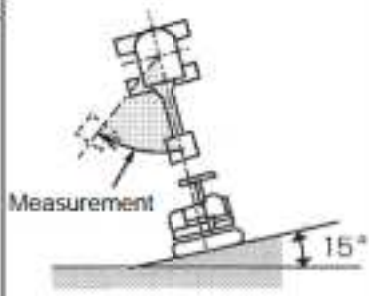
Compare the measurement result with the function data. If the result is out of the tolerance, repair the machine.

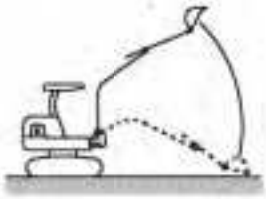
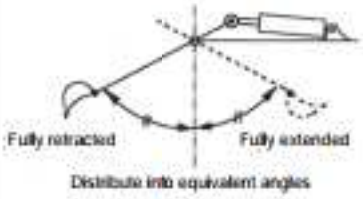
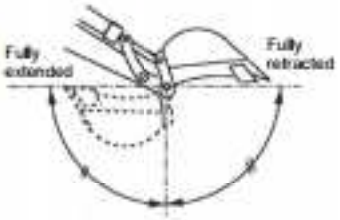
2 Measuring method

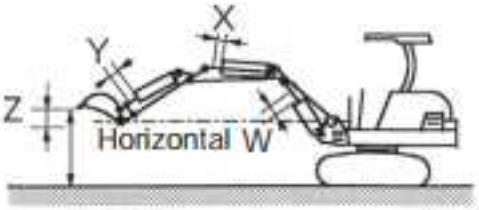
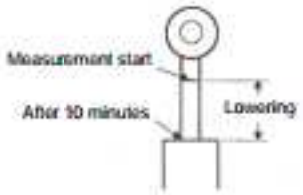
Measurement should be performed three times for each time. If a measured value is significantly different from the rest, measurement should be performed once more and an average of three closer values should be taken.

Item		Unit	Method	Remarks
Engine	Rated revolution	min^{-1}	• Refer to JIS D 1005.	• At a high land, the output generally reduces approximately 10% per 1000 m. • The rated revolution is the revolution provided for the engine's rated output. The revolution is approximately 6 to 8% higher without load.
	Rated output	kW		
	Maximum torque	N•m		
	Maximum revolution without load	min^{-1}		
	Minimum revolution without load	min^{-1}		
Oil pressure	Boom	MPa	Refer to "Oil Pressure Measurement and Adjustment".	• If the oil temperature is lower, the pressure is indicated higher. If the engine revolution is lower, the pressure is indicated lower. Therefore, the reference values should be observed. • Note that, since the swing pressure is the set value on the bench, a line resistance is provided on the actual machine and, as a result, the pressure is indicated higher on the gauge.
	Arm			
	Bucket			
	Swing			
	Travel			
	Boom swing			
	Blade			
Operation force of operation lever	Boom	kgf	• Engine: Stopped • Oil temperature: 50 ±5°C • Measurement: Set a spring balance below the lever grip for measurement. • Read the maximum value to the stroke end. 	• Check the lever, link lubrication, stroke adjustment (lever stopper), link ball shakiness, and bolt/nut loosening in advance and perform maintenance if necessary. • Do not pull exceeding the lever stroke. • If the oil temperature is lower, the slide resistance increases and the lever becomes heavier.
	Arm			
	Bucket			
	Swing			
	Travel			
	Boom swing			
	Blade			
	Throttle pulling			
	Throttle pushing			

	Item	Unit	Method	Remarks
Travel	Travel speed	sec/10m	☆ Time required for 10 m travel after a 5 m running-in operation 	• Full change-over of the travel valve (spool stroke check/adjustment) • The shoe tension should be identical between the right and left and within the standard range. Be sure to perform running-in operation. • Remove the soil and sand from the shoe link.
	Straight running	mm/10m	☆ A turn upon 10 m straight running after a 5 m running-in operation 	• Full change-over of the travel valve (spool stroke check/adjustment) • Particularly, the road surface should be flat and rigid. If a slope, soft ground, or convexity/concavity exists, the turn becomes larger. • The shoe tension should be identical between the right and left and within the standard range. • Remove soil and sand from the shoe link.
	Natural lowering during travel	mm/5 minutes	☆ Natural lowering of the machine after 5 minutes 	• Do not stop the engine. Otherwise, the motor becomes free from oil, the brake does not work, and overrun may occur. Therefore, care must be taken.
	Crawler belt rotation speed	sec/5 rotations	☆ Time required for 5 rotations after 1 idle rotation 	• Full change-over of the travel valve (spool stroke check/adjustment) • The shoe tension should be identical between the right and left and within the standard range. • Remove soil and sand from the shoe link.

	Item	Unit	Method	Remarks
Swing	Motion after swing stop (brake working angle)	degrees	• Measurement position The bucket/arm cylinder is fully retracted. The line connecting the boom foot and arm point is horizontal above the ground surface.  • Measurement ☆ At the 90° swing position, release the lever to make it neutral. Measure the subsequent motion angle. 	
	Time required for swing	sec/2 rotations	• Measurement ☆ Time required for 2 rotations after 1 rotation	
	Natural lowering during swing	degrees/ 5 minutes	• Measurement position The bucket/arm cylinder is fully retracted. The line connecting the boom foot and arm point is parallel with the slope. • Measurement Angle of lowering after 5 minutes 	

Item		Unit	Method	Remarks
Boom cylinder	Up (bucket grounded → cylinder fully extended) Down (cylinder fully extended → bucket grounded)	sec	• Measurement position The bucket/arm cylinder is fully retracted. • Measurement ☆ Cylinder working time 	• To the front of the cushion for Up (excluding the cushion stroke) • Until the bucket is grounded for Down (Return the lever immediately before grounding so that the bucket will not hit the ground.)
Arm cylinder	Cylinder extended (arm pulling) Cylinder retracted (arm pushing)	sec	• Measurement position  • Measurement ☆ Time required for the cylinder full stroke	• To the front of the cushion for pulling (excluding the cushion stroke) To the stroke end for the cylinder without cushion • To the stroke end for pushing
Bucket cylinder	Cylinder extended (digging with bucket) Cylinder retracted (releasing soil from bucket)	sec	• Measurement position  • Measurement ☆ Time required for the cylinder full stroke	• The position should divide the rotation into approximately same angles.

Item		Unit	Method	Remarks
Natural lowering of cylinder	Boom cylinder retraction	mm/10 minutes	• Measurement position The bucket/arm cylinder is fully retracted. The line connecting the boom foot and arm point is horizontal above the ground.  • Measurement ☆ Rod length changed after 10 minutes With a felt pen, mark on the cylinder rod and measure the movement after 10 minutes.  	
	Arm cylinder extension			
	Bucket cylinder extension			
	Bucket tooth end lowering			

3 Performance check criteria/permissible value

Reference values refer to the performance of a new vehicle.

The machine performance is gradually degraded during long-time use and deviation from reference values occurs. Many factors are involved with degradation of a performance item, so recovery of performance back to the original reference value is difficult by simply replacing some parts.

Therefore, a **permissible value** is defined for reference of performance judgment.

The **permissible value** is determined based on experience to cause no problem in actual work if the corresponding performance is achieved.

Upon adjustment/repair, consider the time, cost, etc. and set the performance **within the range between the permissible value and reference value.**

⚠ CAUTION

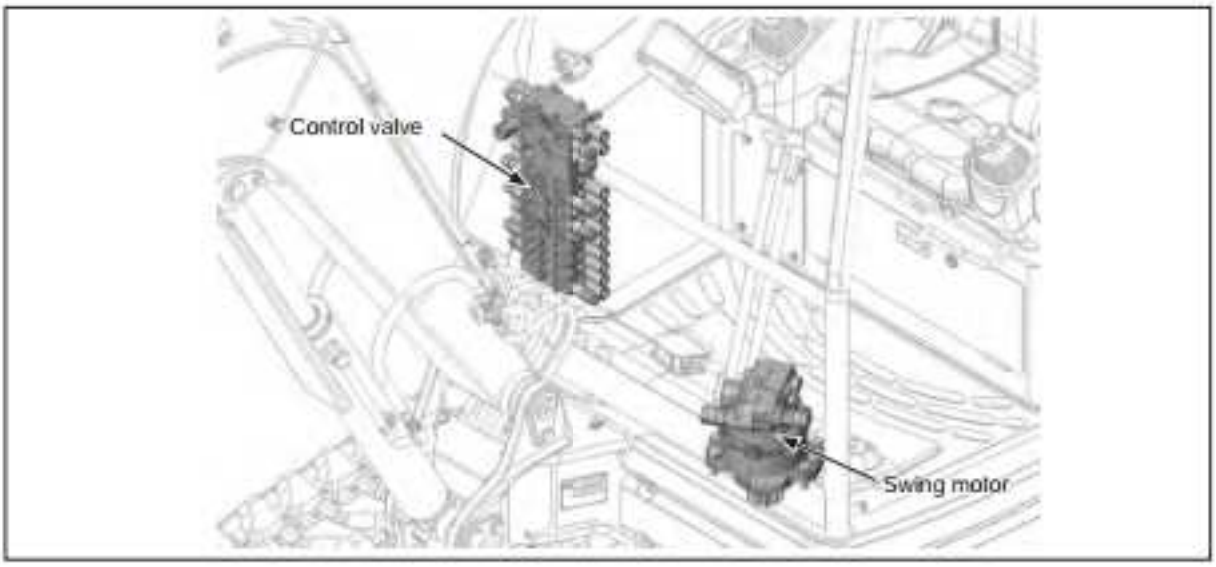
The reference/permissible values indicated in this document are targeted for the standard type machine. For the non-standard type, please contact us.

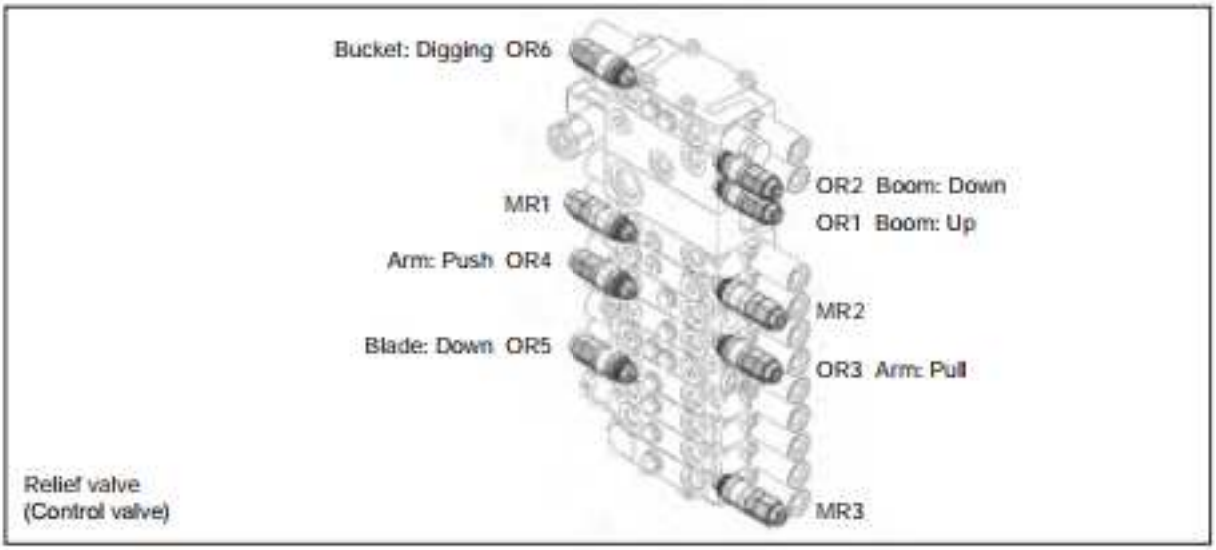
Item		Unit	Reference value	Permissible value
Engine	Rated revolution	min^{-1}	2400	—
	Rated output	kW	13.6	-5%
	Maximum torque	N•m	62.4	-5%
	Maximum revolution without load	min^{-1}	2500	±100
	Minimum revolution without load	min^{-1}	1170	±50
Oil pressure	Boom	MPa	$21.6^{+0.5}_{-0}$	$^{+0.5}_{-1.0}$
	Arm		$21.6^{+0.5}_{-0}$	$^{+0.5}_{-1.0}$
	Bucket		$21.6^{+0.5}_{-0}$	$^{+0.5}_{-1.0}$
	Swing		$15.7^{+0.5}_{-0}$	$^{+0.5}_{-1.0}$
	Travel		$21.6^{+0.5}_{-0}$	$^{+0.5}_{-1.0}$
	Boom swing		$18.1^{+0.5}_{-0}$	$^{+0.5}_{-1.0}$
	Blade		$18.1^{+0.5}_{-0}$	$^{+0.5}_{-1.0}$
Operation force of operation lever	Boom	kg	1.8 ±0.3	±0.5
	Arm		1.8 ±0.3	±0.5
	Bucket		1.5 ±0.3	±0.5
	Swing		1.5 ±0.3	±0.5
	Travel		1.5 ±0.5	±0.7
	Boom swing		8.0 ±0.5	±0.7
	Blade		2.4 ±0.5	±0.7
	Throttle		2.2 ±0.4	±0.7

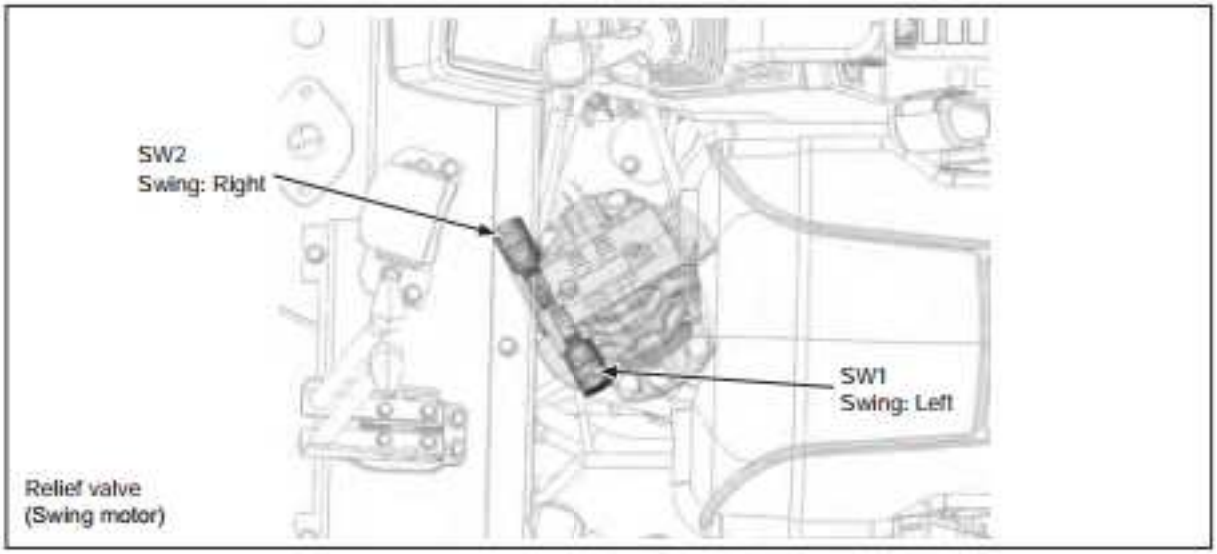
Item				Unit	Reference value	Permissible value
Travel	Travel speed	Rubber shoe	High-speed	sec/10 m	8.6 ±1.0	10.0
			Low-speed		14.7 ±1.0	16.0
		Steel shoe	High-speed		8.6 ±1.0	10.0
			Low-speed		14.7 ±1.0	16.0
	Straight running			mm/10 m	500 or less	700
	Lowering on a slope			mm/5 minutes	0	100 or less
	Time required for 5 rotations of crawler belt		High-speed	sec/5 rotations	15.3 ±2.0	18.8
			Low-speed		29.2 ±2.0	31.7
Swing	Motion after swing stop			degrees	25 ±10	35
	Time required for swing			sec/2 rotations	13.5 ±0.7	15
	Lowering on a slope			degrees/5 minutes	0	0
Cylinder speed	Boom		Up	sec	2.7 ±0.5	3.2
			Down		2.4 ±0.5	2.9
	Arm		Pull		2.6 ±0.5	3.1
			Push		2.5 ±0.5	3.0
	Bucket		Dig		2.7 ±0.5	3.2
			Dump		1.8 ±0.5	2.3
	Boom swing		Left		4.8 ±0.8	5.6
			Right		4.8 ±0.8	5.6
	Blade		Up		2.9 ±0.5	3.4
			Down		3.7 ±0.5	4.2
Natural lowering	Boom cylinder			mm/10 minutes	0	6
	Arm cylinder				10 or less	20
	Bucket cylinder				6 or less	12
	Bucket end				100	300 or less

Contents

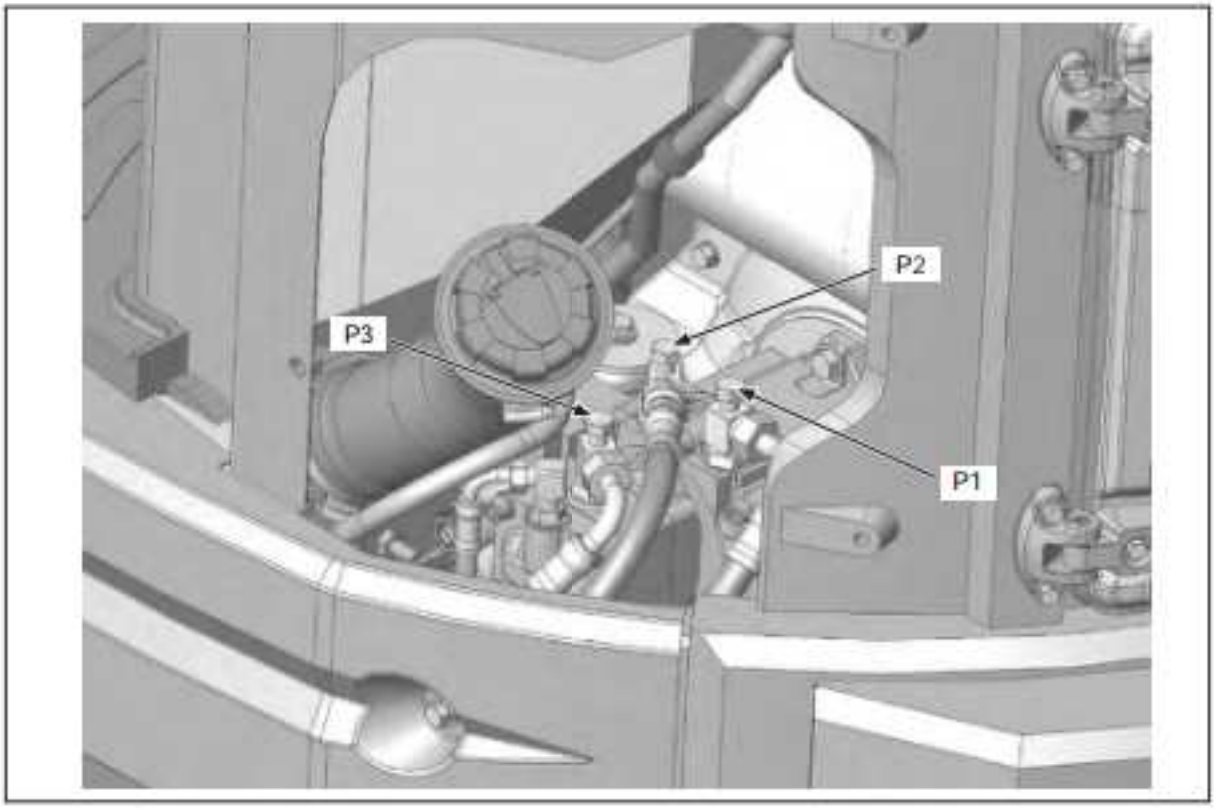
1 Location of Relief Valve

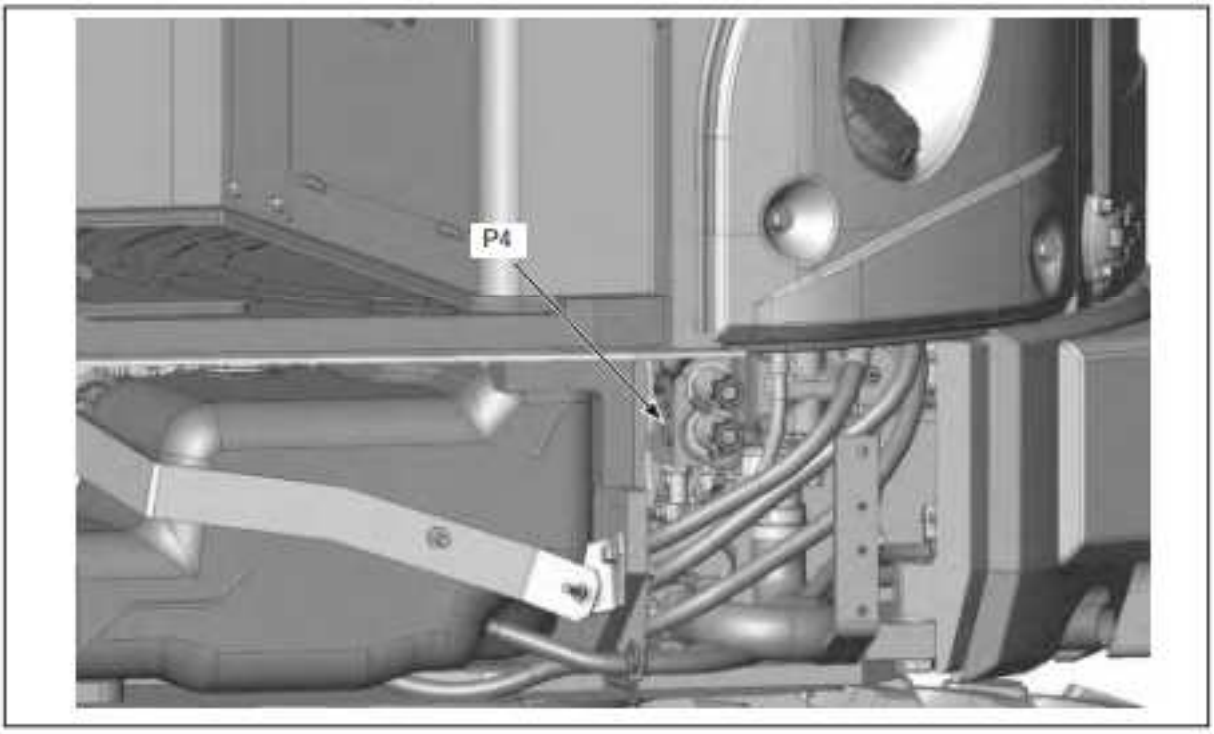






2 Location of Measuring Port





3 Relief Valve Set Pressure and Measuring Conditions

Relief valve		Gauge port	Valve position	Set reference value MPa	Remarks
Main	Boom/Bucket	P1	MR1	21.6 ±0.3	At rated rotation of engine
	Arm/Service	P2	MR2	21.6 ±0.3	At rated rotation of engine
	Swing/Blade/Boom swing	P3	MR3	18.1 ±0.3	At rated rotation of engine
Overload	Boom (up)	P1	OR1	23.5 ±0.3 at 5L/min	See measurement/adjustment items.
	Boom (down)		OR2		
	Arm (pull)	P2	OR3		
	Arm (push)		OR4		
	Blade (down)	P3	OR5	22.6 ±0.3 at 5L/min	
	Bucket (digging)	P1	OR6	24.5 ±0.3 at 5L/min	
Brake	Swing	P3	*1 SW1 SW2	15.7 ±0.5 at 24L/min	At low speed rotation of engine
Remote control relief valve		P4	PP	3.4 $^{+0.3}_{0}$	At engine rotation 1000 mm^{-1}

*1: SW1/2 (relief valve for swing) cannot be adjusted. If it malfunctions, replace or overhaul it.

Port size

P1 ..... Rc 1/4
P2 ..... Rc 1/4
P3 ..... Rc 1/4
P4 ..... G 3/8 O-ring

Measure and adjust pressure when oil temperature is 50±5°C.

⚠ CAUTION

Since the high-temperature and high-pressure hydraulic oil is dangerous, relieve the pressure from the hydraulic oil tank before installing/removing the coupler. Install the coupler before the oil temperature rises and remove it after the oil temperature falls sufficiently.

4 Measuring Tools

The following kit is recommended.

Oil pressure measuring gauge kit

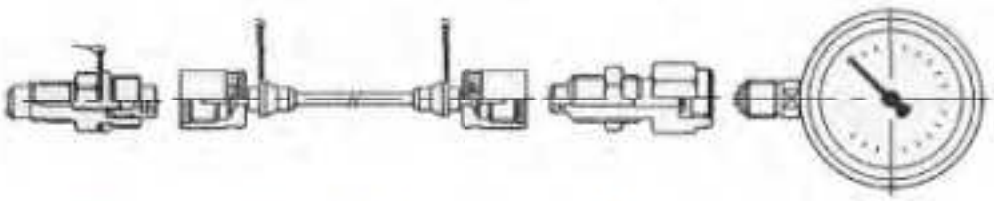
Part No. 598014102

	Product name	Specification	Q'ty
Standard kit	Pressure gauge	40MPa	2
	Pressure gauge	6MPa	1
	High-pressure hose	4m	2
	High-pressure hose	1m	1
	Pressure gauge connector	For connecting pressure gauge and hose	3
	Coupling	G1/4	3
	Coupling	R1/4	3
	Coupling	R1/8	2
	Special case	Kit storing box	1

Added option

Name	Part No.
Pressure gauge 40MPa	500 – 42.400
Pressure gauge 6MPa	500 – 42.060
Coupling (R1/8)	100 – 51.000
Coupling (R1/4)	100 – 42.001
Coupling (G1/4)	100 – 52.000
Hose (1m)	200 – 16.100
Hose (4m)	200 – 16.400

Name	Part No.	Specification
Adapter 1/4"	407295301	Rc1/4: Hole
Adapter 3/8"	407295302	
Adapter 1/2"	407295303	
Adapter 3/4"	407295304	
Adapter 1"	407295305	
Adapter UNF6/19	D06028600	

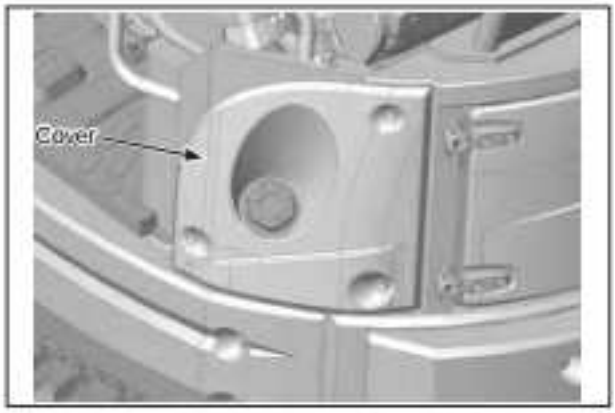


Coupling High-pressure hose Pressure gauge connector Pressure gauge

5 Measurement/Adjustment of Main Relief Valve Set Pressure

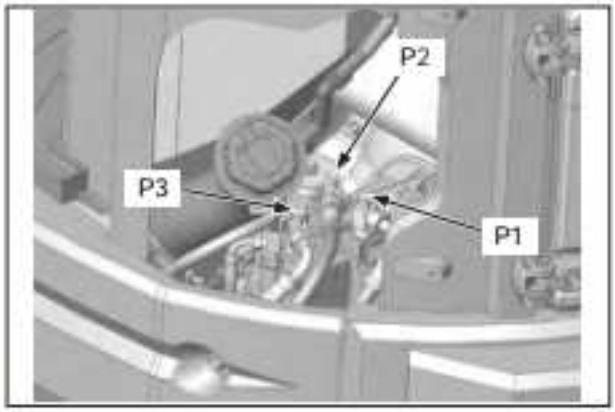
○ Measurement

Remove the cover.



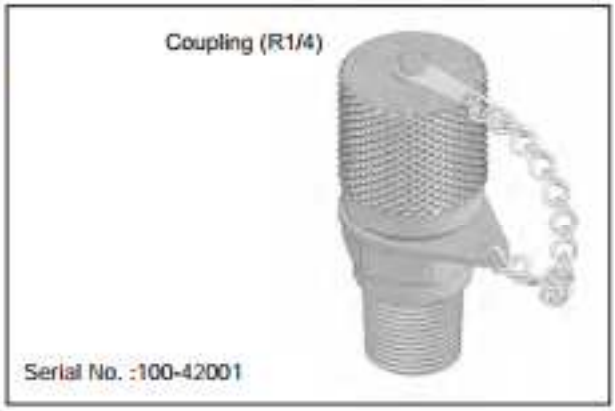
Remove the plug and attach the coupling. Then, connect the measuring gauge.

MR1 measurement P1
MR2 measurement P2
MR3 measurement P3



Start the engine and increase the rotation to the maximum.
Operate the cylinder on each relief valve circuit to the stroke end and relieve the relief valve.

MR1 measurement .. Boom or bucket cylinder
MR2 measurement .. Arm cylinder
MR3 measurement .. Boom swing cylinder



Read the gauge value.

If the measured value deviates from the set value, perform adjustment.

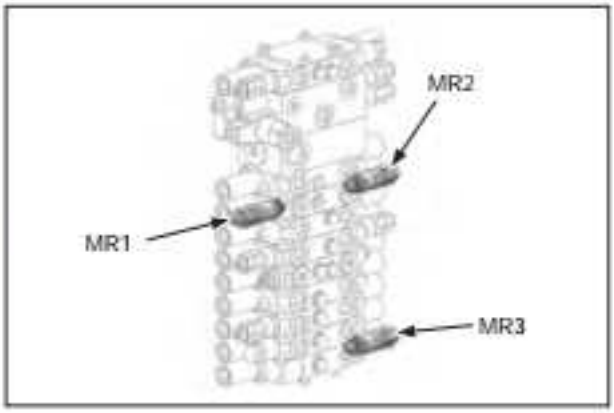
⚠ CAUTION

When a large amount of pressure leaks from the cylinder, a low relief pressure is indicated. If it seems that the leak occurs, disconnect the hose from the cylinder, block with a plug and then measure the pressure.

○ Adjustment

⚠ CAUTION

Adjust the main relief valve pressure in the state of pressure measurement.

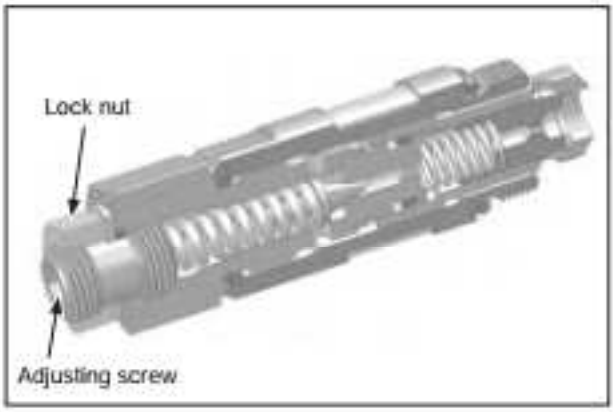


Loosen the lock nut.
Turn the adjusting screw with a hexagonal wrench and adjust the pressure based on your intuition.
(Approx. 9.8MPa is changed by one turn of adjusting screw.)

Right turn ..... The pressure rises.
Left turn..... The pressure falls.

⚠ CAUTION

Decide the adjusting position as tightening the adjusting screw.



Fasten with the lock nut and measure the pressure.

Repeat the procedure mentioned above until the set value is obtained.

⚠ CAUTION

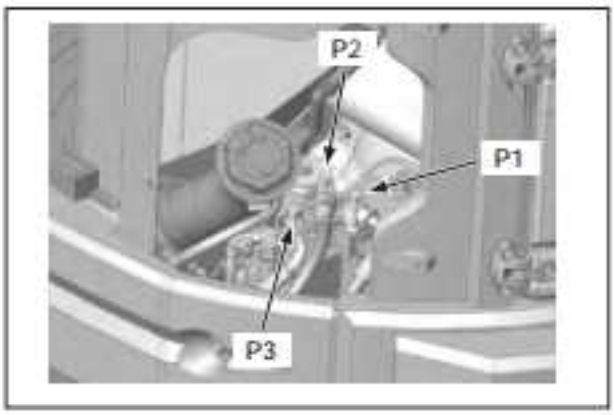
If the pressure is not changed though you turn the adjusting screw, maybe the cause is not the fatigued spring but the adjusting valve or pressure-adjusting valve which is eccentrically worn or dust or stuffing. Remove the relief valve and then disassemble and overhaul it.

6 Measurement/Adjustment of Overload Relief Valve Set Pressure

○ Measurement

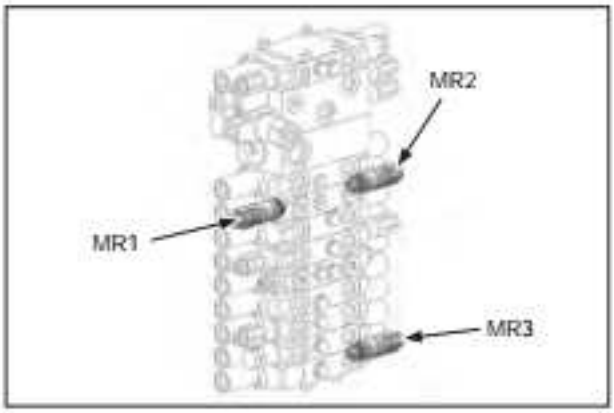
Install the measuring gauge.

OR1 (boom up) measurement.....P1
OR2 (boom down) measurement.....P1
OR3 (arm pull) measurement.....P2
OR4 (arm push) measurement.....P2
OR5 (blade down) measurement.....P3
OR6 (bucket-dig) measurement.....P1



Set the main relief pressure temporarily.

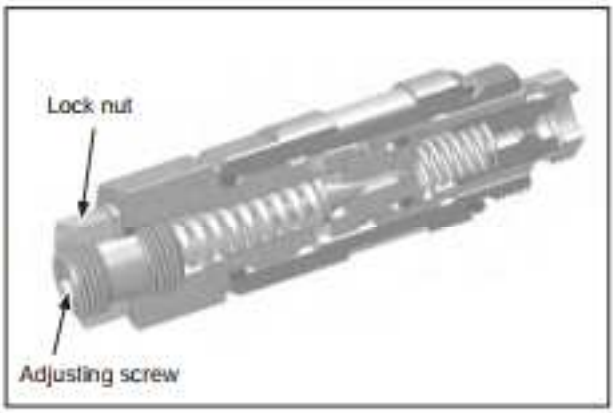
OR1 (boom up) measurement.....MR1
OR2 (boom down) measurement.....MR1
OR3 (arm pull) measurement.....MR2
OR4 (arm push) measurement.....MR2
OR5 (blade down) measurement.....MR3
OR6 (bucket-dig) measurement.....MR1



Loosen the lock nut, turn the adjusting screw clockwise by 180 degrees, and tighten the lock nut for fastening.

⚠ CAUTION

After measurement is completed, perform readjustment according to the main relief valve pressure adjusting method.



Start the engine and set the rotation to "**idling**". Operate the cylinder on each relief valve circuit to the stroke end and relieve the relief valve.

⚠ CAUTION

The flow amount at the overload relief valve setting is 5L/min. If the flow amount is large, the relief pressure is high. Be sure to measure the pressure in the idling status.

Read the gauge value.

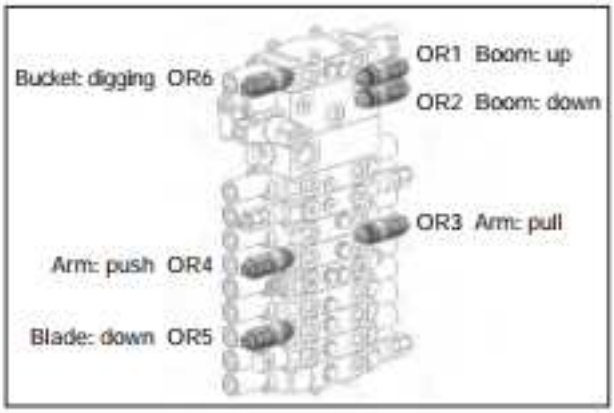
If the measured value deviates from the set value, perform adjustment.

Readjust the main relief valve pressure.

○ Adjustment

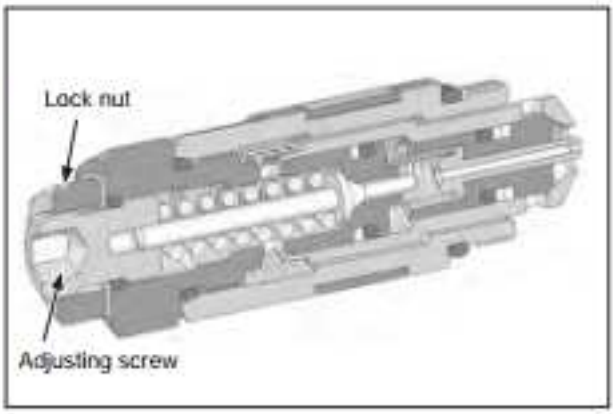
⚠ CAUTION

Adjust the overload relief valve pressure in the state of pressure measurement.
The main relief valve must be temporarily adjusted.



Loosen the lock nut.
Turn the adjusting screw with a hexagonal wrench and adjust the pressure based on your intuition.
(Approx. 9.8MPa is changed by one turn of adjusting screw.)

Right turn ..... The pressure rises.
Left turn..... The pressure falls.



⚠ CAUTION

Decide the adjusting position as tightening the adjusting screw.

Fasten with the lock nut and measure the pressure.

Repeat the procedure mentioned above until the set value is obtained.

⚠ CAUTION

If the pressure is not changed though you turn the adjusting screw, maybe the cause is not the fatigued spring but the adjusting valve or pressure-adjusting valve which is eccentrically worn or dust or stuffing. Remove the relief valve and then disassemble and overhaul it.

⚠ CAUTION

After measurement is completed, perform readjustment according to the main relief valve pressure adjusting method.

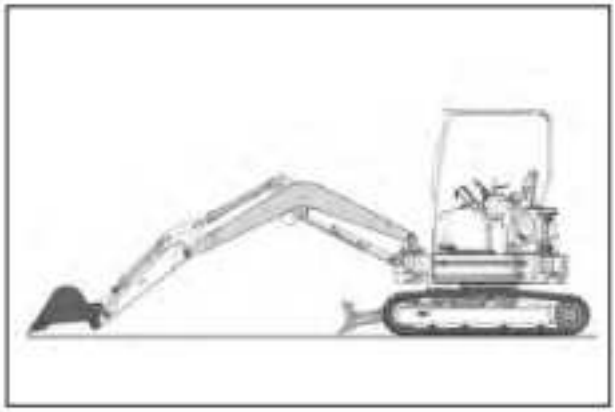
7 Measurement/Adjustment of Swing Brake Relief Valve Set Pressure

○ Measurement

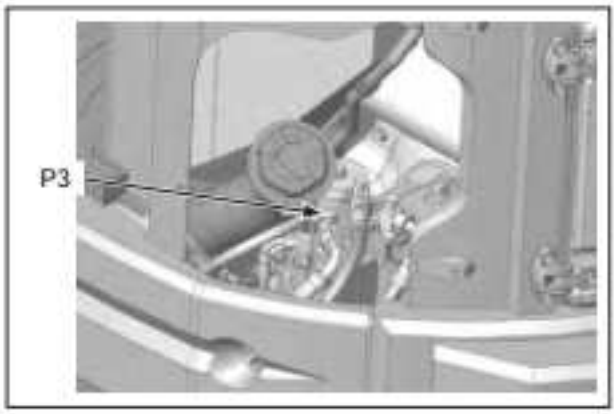
⚠ CAUTION

Before measurement of the swing brake relief valve, measure the main relief valve pressure and make sure that the pressure is normal.

With the position shown at right, let the bucket blade bite the ground surface to fasten it so that the upper machine cannot swing.

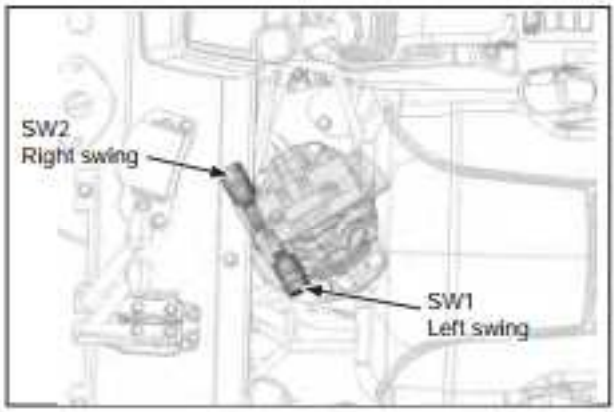


As the main relief valve measurement, remove the covers.
Install the measuring gauge on the P3 port.



Start the engine and set the rotation to "idling".
Operate the swing operation lever slowly to the stroke end and relieve the relief valve.

SW1 measurement..... Left swing
SW2 measurement..... Right swing

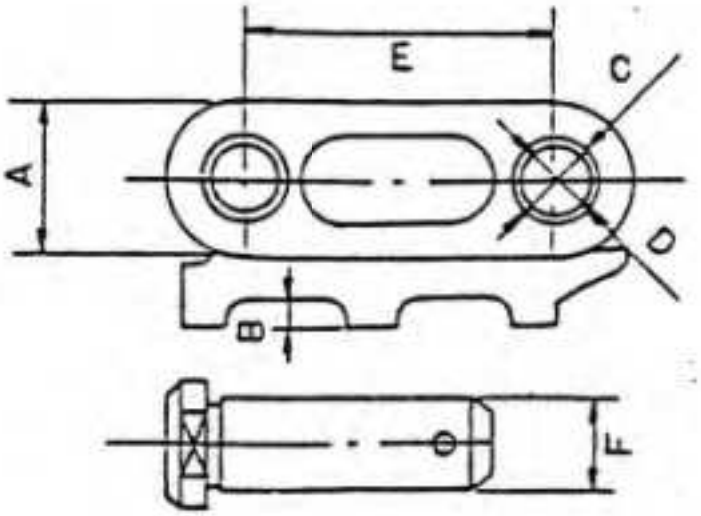


Read the gauge value

If the measured value deviates from the set value, replace or overhaul the relief valve.

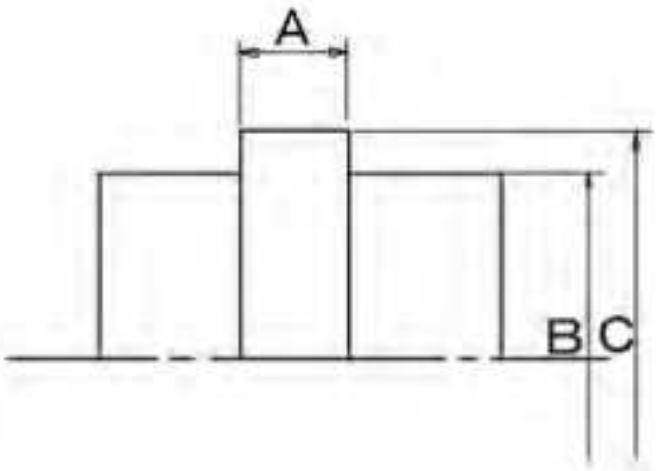
1 Chassis Parts

1-1 Steel crawler



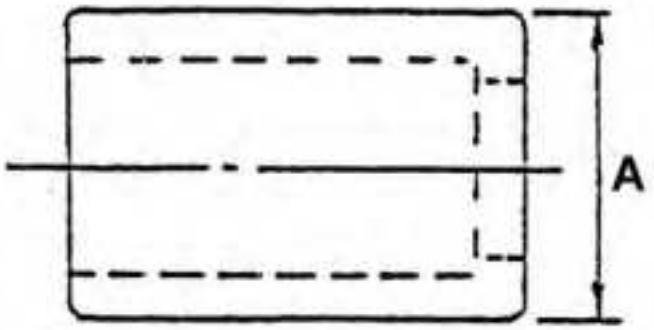
Item		Unit	Reference dimension	Permissible value	Action to be taken
Link height (A)		mm	60	58	○ Sample one link. ○ If the permissible value is exceeded again, replace the crawler.
Grouser height (B)			16.5	10	
Bushing	Outside diameter (C)		32.2	30	
	Inside diameter (D)		19.5	21.5	
Link pitch (E)			101.6	103.6	
Master pin diameter (F)			19.17	17.17	

1-2 Lower roller



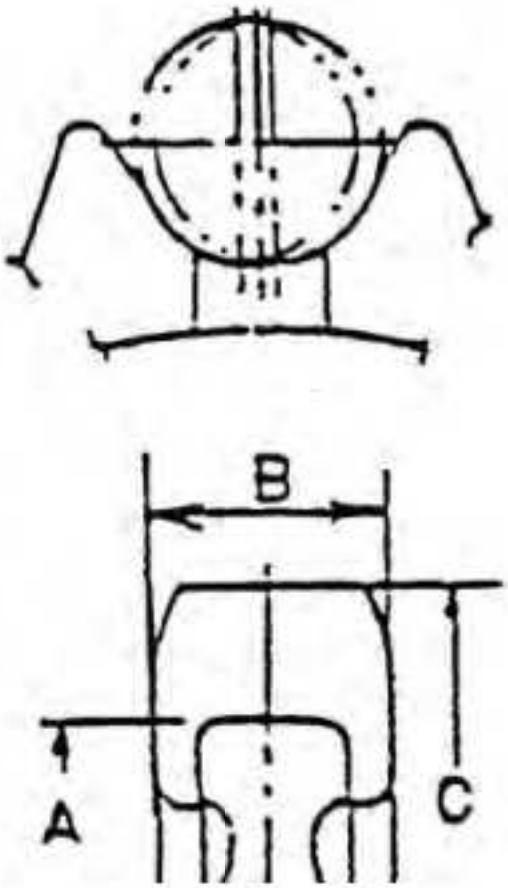
Item	Unit	Reference dimension	Permissible value	Action to be taken
Boss width (A)	mm	38	34	Replace.
Tread outside diameter (B)		90	80	
Boss outside diameter (C)		114	104	
Roller axial play		0.5	0.9	Replace the ball bearing.

1-3 Upper roller



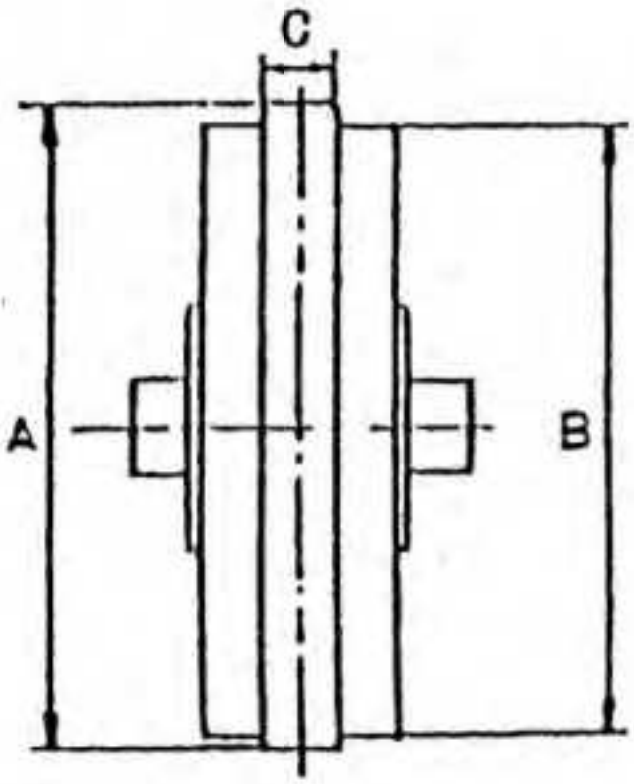
Item	Unit	Reference dimension	Permissible value	Action to be taken
Tread outside diameter (A)	mm	70	66	Replace.
Roller axial play (B)		0.3	0.9	

1-4 Sprocket



Item	Unit	Reference dimension	Permissible value	Action to be taken
Root diameter (A)	mm	312.1	302	Replace.
Tooth width (B)		36	31	
Outside diameter (C)		352	342	

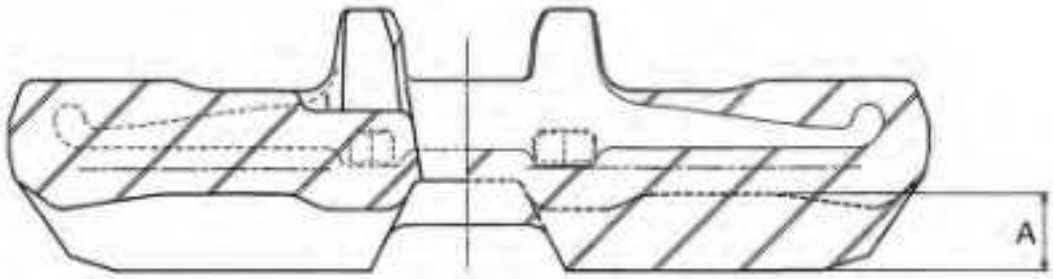
1-5 Idler



Item	Unit	Reference dimension	Permissible value	Action to be taken
Boss outside diameter (A)	mm	333	323	Replace.
Tread outside diameter (B)		299	289	
Boss width (C)		38	34	
Shaft axial play		0.5	0.9	

1-6 Rubber crawler

When the lug height is beyond the permissible value, replace the rubber crawler.



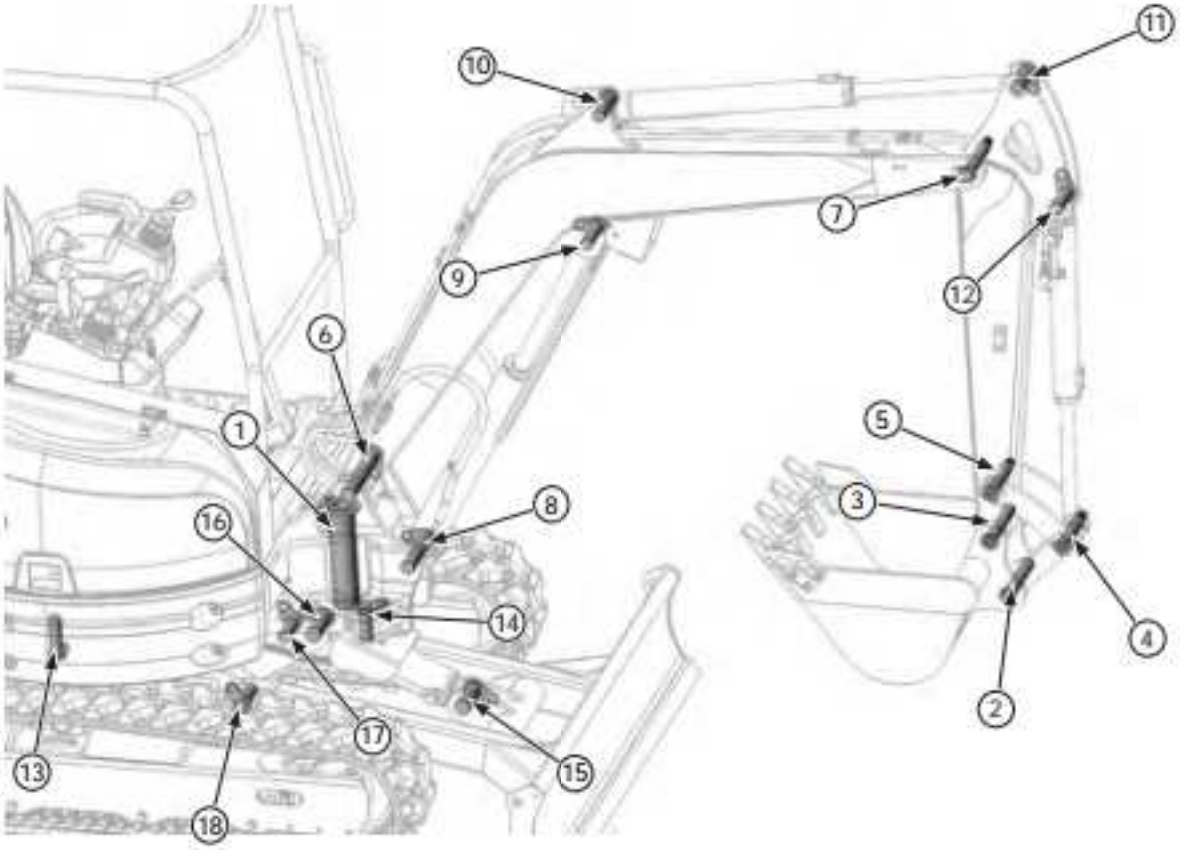
(mm)

	Reference dimension	Permissible value
A	25	5

The status mentioned below is the use limit and the rubber crawler must be replaced.

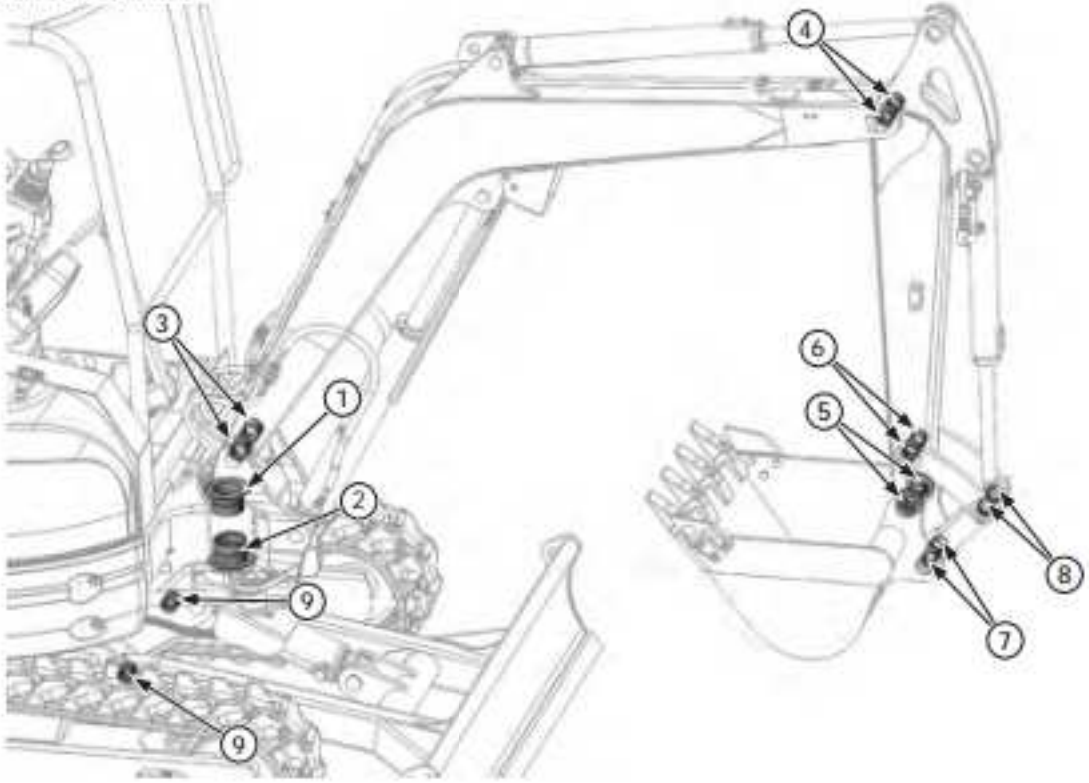
1. The rubber is worn or damaged and so the steel cord is exposed.
2. Half or more of the steel cord layer at one side is broken.
3. The core metal of rubber crawler is separated at one place or more.

2 Work Machine



	Name	Reference diameter (mm)	Permissible value	Action to be taken
1	Swing bracket pin	70	Permissible gap: 1.0 mm	Replace.
2	Bucket pin	35		
3	Bucket pin	35		
4	Bucket cylinder head pin	35		
5	Arm link pin	35		
6	Boom foot pin	45		
7	Arm foot pin	40		
8	Boom cylinder foot pin	40		
9	Boom cylinder head pin	40		
10	Arm cylinder foot pin	40		
11	Arm cylinder head pin	40		
12	Bucket cylinder foot pin	40		
13	Boom swing cylinder foot pin	35		
14	Boom swing cylinder head pin	35		
15	Blade cylinder foot pin	50		
16	Blade cylinder head pin	50		
17	Blade pin (left)	40		
18	Blade pin (right)	40		

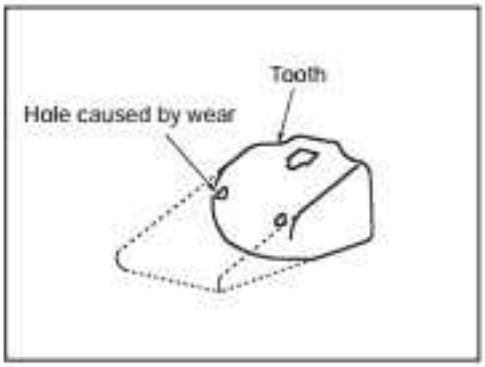
Bushing (except cylinder)



	Name	Reference diameter (mm)	Permissible value	Action to be taken
1	Swing bracket bushing (upper)	70	+0.5mm	Replace.
2	Swing bracket bushing (lower)	70		
3	Boom foot bushing	45		
4	Arm foot bushing	40		
5	Arm head bushing	40		
6	Arm link bushing	40		
7	Bucket link bushing (bucket side)	40		
8	Bucket link bushing (cylinder side)	35		
9	Blade bushing	40		

■ Use limit of bucket tooth

When the tooth is worn and a hole can be made on it, replace it.



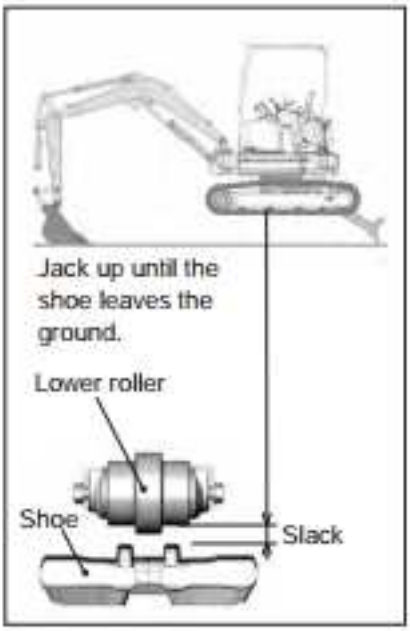
B2 Maintenance Method

■ Crawler shoe tension check/adjustment

⚠ WARNING

Since the shoe tension is checked with the body lifted, a very dangerous state may occur if the body is dropped by mistake during check. Never move the machine during measurement.

Growth of shoe wear or looseness depends on the situation of the work site.
If the loosened shoe is used, slip-off of the crawler shoe may be caused.
Check/adjust the tension as required.



1. Check

(1) Using the work machine and blade, lift the main body until the shoe leaves the ground.

(2) Measure the clearance between the tread of the second lower roller from the sprocket and the shoe tread.

Clearance: 10 to 20 mm for the rubber shoe
30 to 50 mm for the steel shoe

These reserve standard tensions.

2. Adjustment

⚠ WARNING

- Since the grease cylinder contains a high pressure, loosening too much may cause the grease to jet out or check valve ① to pop out.
- When loosening the check valve, loosen it slowly and, when grease comes out, do not loosen any more.
- Never loosen grease nipple ②.
- Do not put your face or hand close to the check valve.

● When setting the crawler shoe:

(1) With a grease gun, supply grease from the grease nipple on check valve ①.

(2) Turn the crawler and then check the shoe tension. If the tension is not proper, re-adjustment is required.

● When reducing the tension

(1) Remove mud around the front idler.

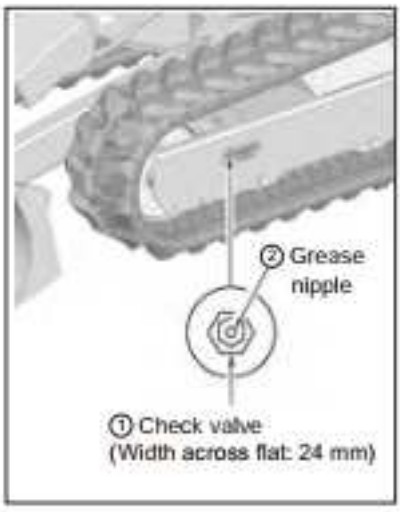
(2) Loosen check valve ① slowly and, when grease comes out, do not loosen any more.

(3) If grease comes out poorly, turn the crawler slightly back and forth.

(4) If the shoe slack becomes proper, tighten check valve ①.

⚠ IMPORTANT **Tighten check valve ① at a torque of 59 to 69 N•m. Avoid overtightening.**

(5) Turn the crawler and then check the shoe tension. If the tension is not proper, re-adjustment is required.



■ Rubber crawler check

1. Lug height

Replace with a new one when the remaining lug height is 5 mm or smaller.

2. Steel cord exposure

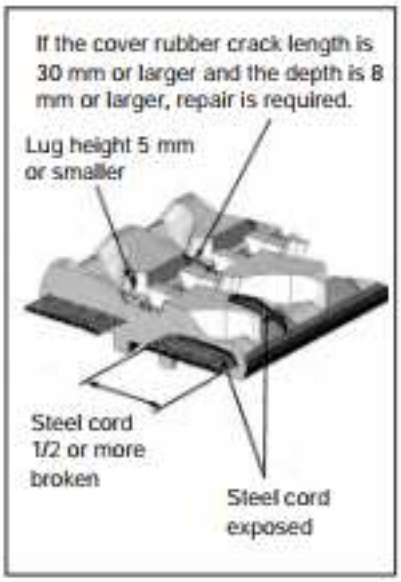
If the steel cord is exposed as a result of the wear or damage of rubber, replace with a new one.

3. Rubber crawler steel cord is broken

If a half or more of the one-side steel cord layer is broken, immediate replacement is required.

⚠ CAUTION

If the rubber crawler is left in this state, the rubber crawler may be suddenly broken during work and a serious accident may occur.



4. Repairing cover rubber flaws

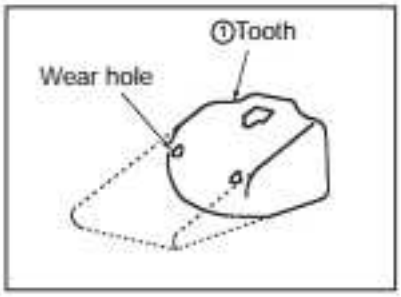
If the flaw length is at least 30 mm and the depth is at least 8 mm, repair is required.
If the steel cord is visible, immediate repair is required regardless of the flaw size.

⚠ CAUTION

If this state is left unchanged, water may enter, rust will be generated on the steel cord, and the rubber crawler may be broken.

5. Slip-off of rubber crawler core metal

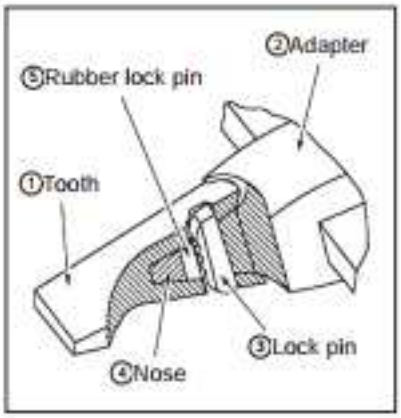
If the rubber crawler core metal slips off at one or more positions, replace the rubber crawler with a new one.



⚠ CAUTION

- Before replacing the bucket tooth, put the bucket on a block and stop the engine.
- When knocking the lock pin in, fragments may fly and personal injury may occur. Before the work, put on protectors such as the protection glasses, helmet, gloves, etc.

⚠ IMPORTANT **If tooth ① is worn out and the hole is likely to grow, replace the tooth.**
Replace tooth ① before wear of adapter ② begins.

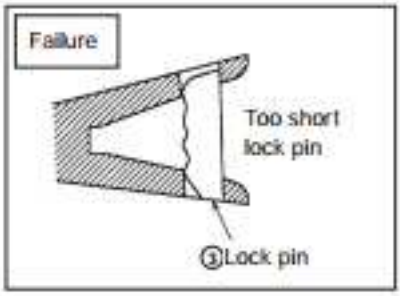


(1) With the hammer and removing tool, knock off lock pin ③ and remove the tooth.

(2) Remove mud from nose ④.

(3) Check the removed lock pin ③ and rubber lock pin ⑤. If lock pin ③ is too short or rubber is broken and the ball is coming out from rubber lock pin ⑤, replace with a new one.

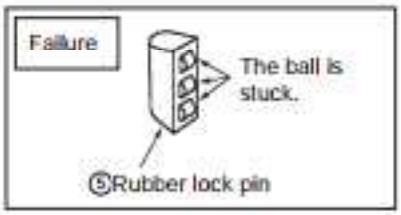
It is recommended to replace the rubber lock pin each time the tooth is replaced.



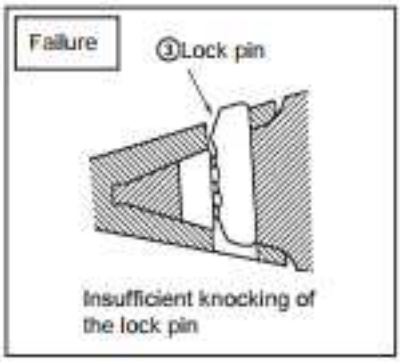
(4) Attach rubber lock pin ⑤ on the nose.

(5) Insert tooth ① into nose ④.

(6) With a hammer, knock in lock pin ③ to the same level as the surface of tooth ①. If knocking is insufficient, tooth ① may slip down.



(7) Make sure that tooth ① is fastened securely.



The standard bucket of this machine is equipped with a bucket clearance adjusting mechanism to prevent shakiness.
If shakiness becomes extremely large during use, perform adjustment as described below.

(1) Let the back of the bucket lightly touch the ground, swing the bucket slightly to the right, and make the arm end press the inside of the clearance adjusting part.

(2) Stop the engine.

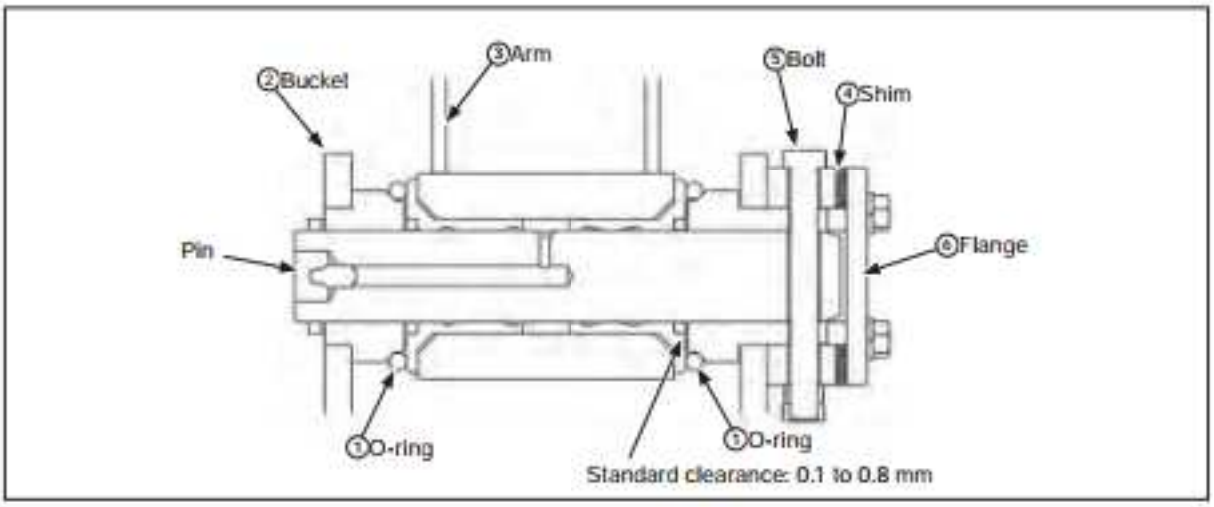
(3) Move O-ring ① onto the boss and measure the mounting clearance between bucket ② and arm ③.

(4) If the clearance is 1 mm or larger, remove shim ④ and make adjustment. Thickness of shim ④ is 0.8 mm. If the clearance is 0.8 mm or smaller, do not remove the shim because the clearance will be lost.

(5) Remove three bolts ⑤ and remove shim ④ inside flange ⑥ according to shakiness (wear).

(6) Attach flange ⑥ and tighten three bolts ⑤.

(7) Measure the mounting clearance. The standard clearance is 0.1 to 0.8 mm.



IMPORTANT **If the mounting clearance is a negative value, abnormal wear of the boss contact surface between the arm and bucket will be caused. Therefore, be sure to reserve the clearance.**

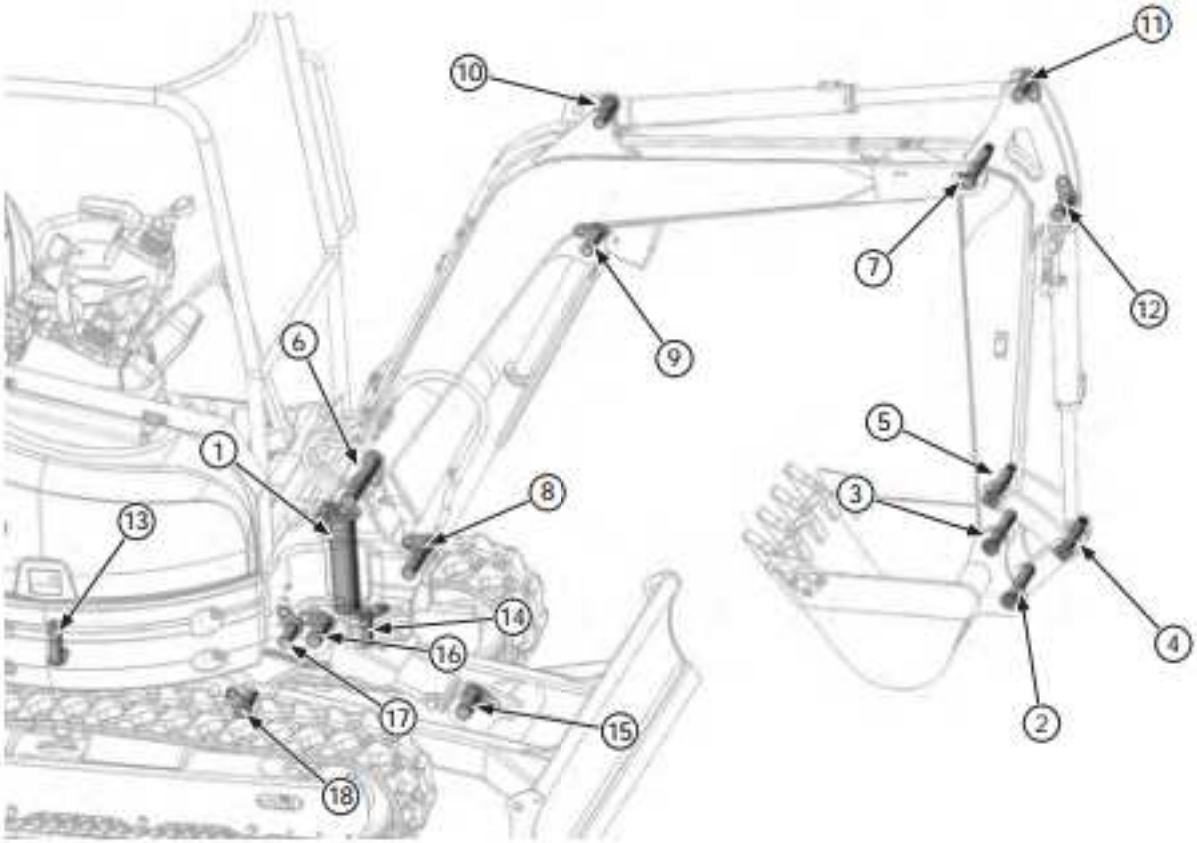
Use Extreme Pressure Grease (EP) No. 2.

Contentes

1 Attachment/Dozer Blade Pin

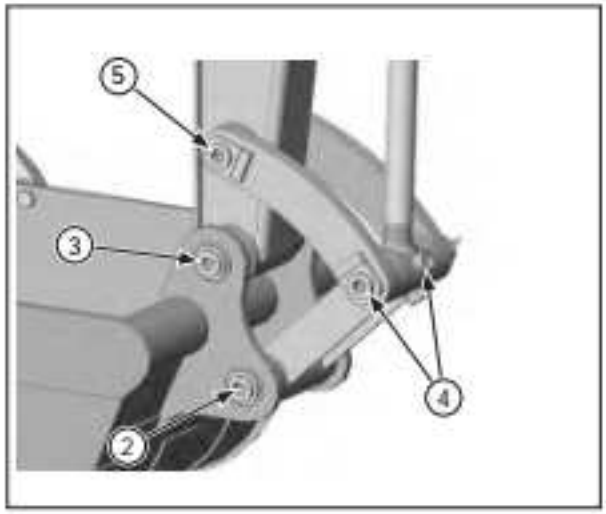
The units (including the hydraulic cylinder mounting section) are connected with 19 pins.
The grease nipple peculiar to each unit is provided. Apply grease with a grease gun periodically.

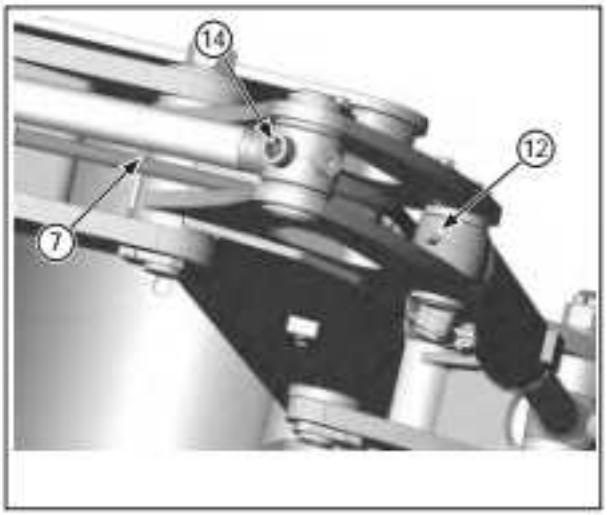
1-1 Pin location and name

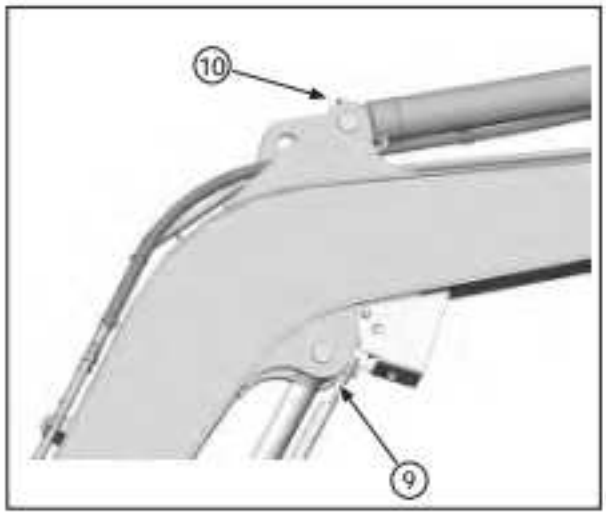


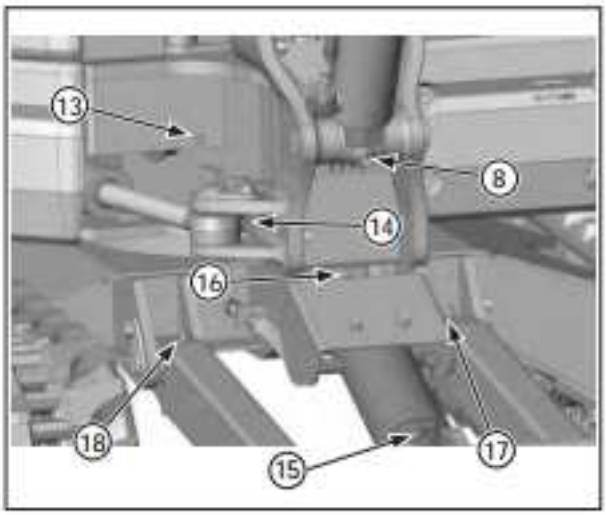
	Name		Name
1	Swing bracket pin	10	Arm cylinder foot pin
2	Bucket pin	11	Arm cylinder head pin
3	Bucket pin	12	Bucket cylinder foot pin
4	Bucket cylinder head pin	13	Boom swing cylinder foot pin
5	Arm link pin	14	Boom swing cylinder head pin
6	Boom foot pin	15	Blade cylinder foot pin
7	Arm foot pin	16	Blade cylinder head pin
8	Boom cylinder foot pin	17	Blade pin (left)
9	Boom cylinder head pin	18	Blade pin (right)

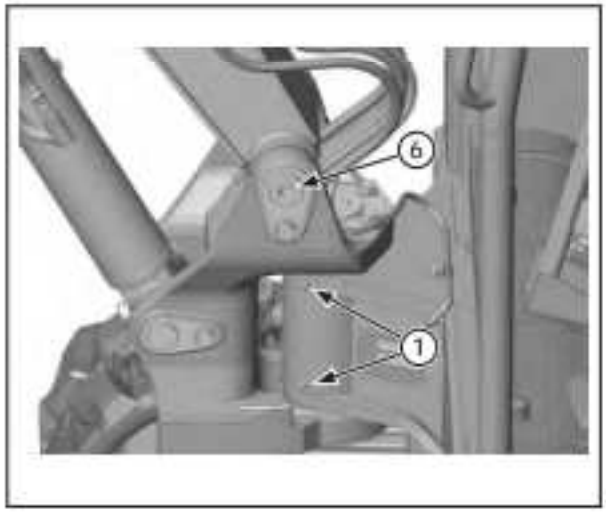
1-2 Greasing location (Grease nipple location. The number is the pin number in the preceding page.)











1-3 Greasing

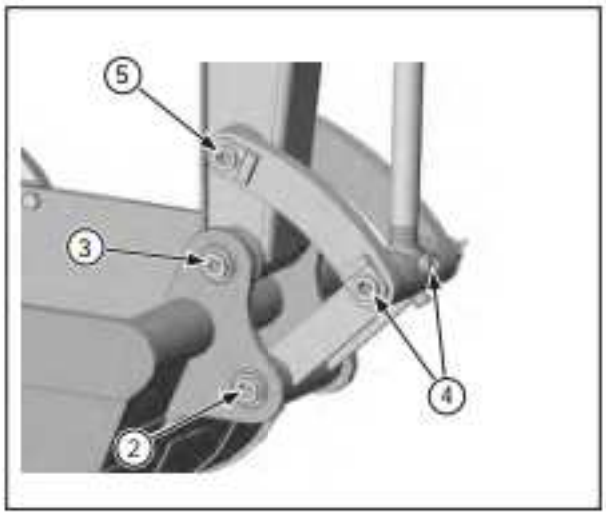
(1) Lower the work machine to the ground and stop the engine.

(2) With a grease gun, supply grease from the grease nipples until old grease comes out of the clearance.

(3) After greasing, wipe off the old grease that has come out.

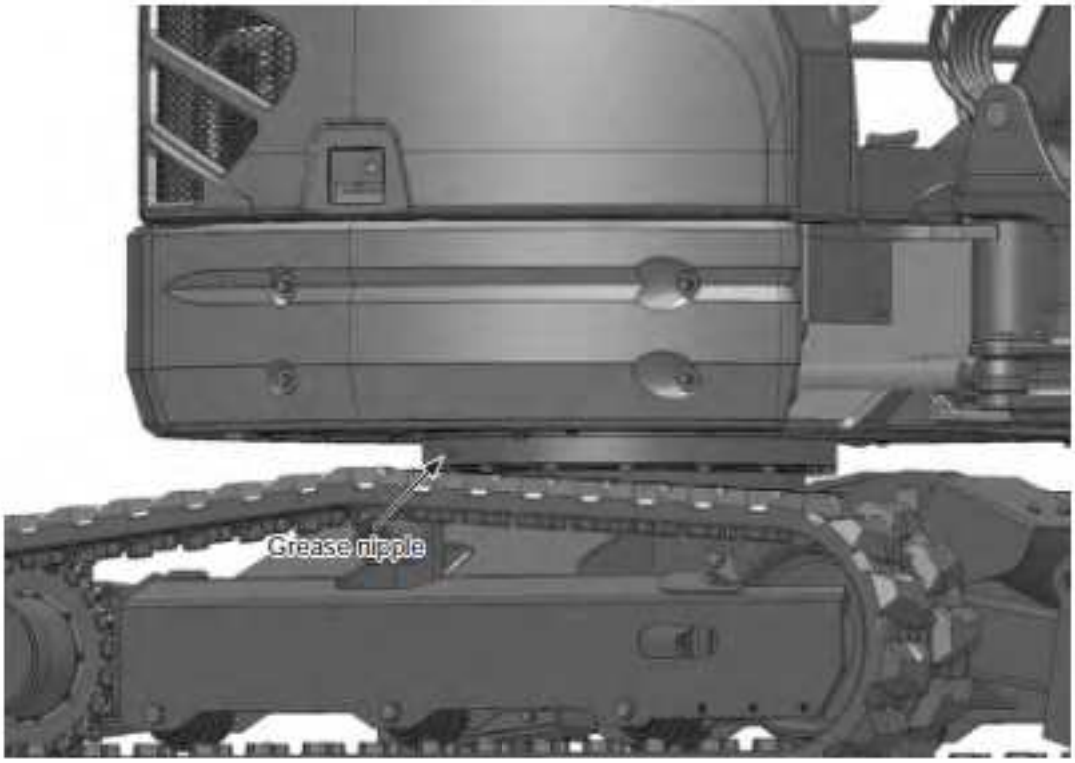
Interval for greasing: 50 hours

IMPORTANT **For 5 positions around the bucket, be sure to supply grease before underwater excavation regardless of the maintenance time.**



2 Swing Bearing

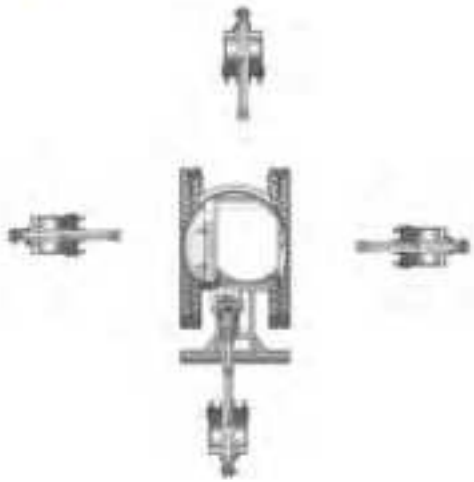
2-1 Grease nipple location



2-2 Greasing

1. Lower the bucket to the ground and stop the engine.
2. With a grease gun, supply grease through the grease nipple by 3 - 5 strokes.
3. Each time the upper machine is swung in about 90°, supply grease. Repeat greasing until it swings by one round.

Because the swing bearing diameter is large, grease is not circulated in the whole unit even if greasing is done from one position. Change the position by swinging in 90° , stop swinging and supply grease.



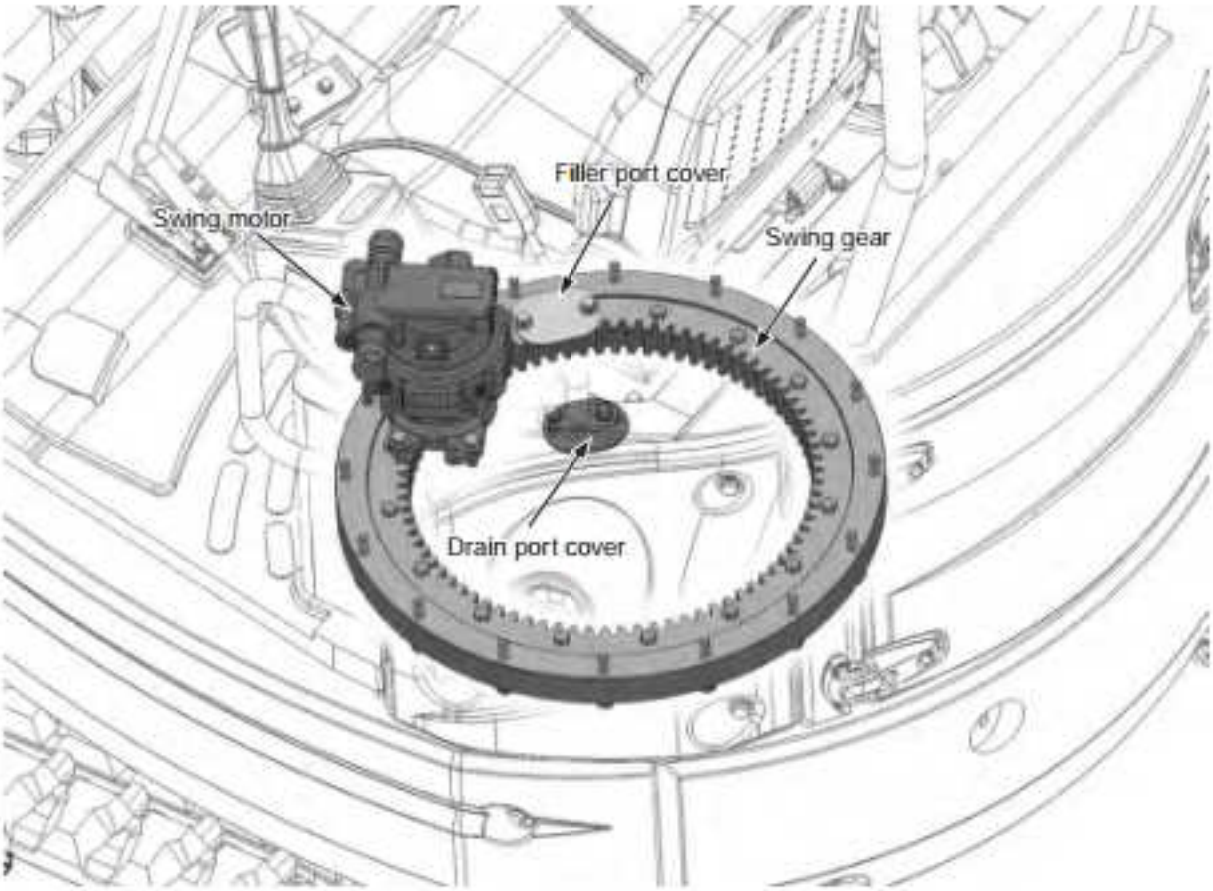
Interval for greasing: 50 hours

⚠ WARNING

If you supply grease while the machine is swinging, you may be caught by it. To avoid danger, stop swinging and then supply grease.

3 Swing Gear

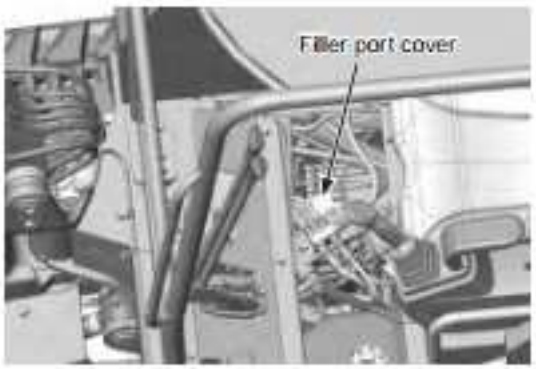
3-1 Check/filler port and drain port



3-2 Check/greasing

1. Lower the bucket to the ground and stop the engine.

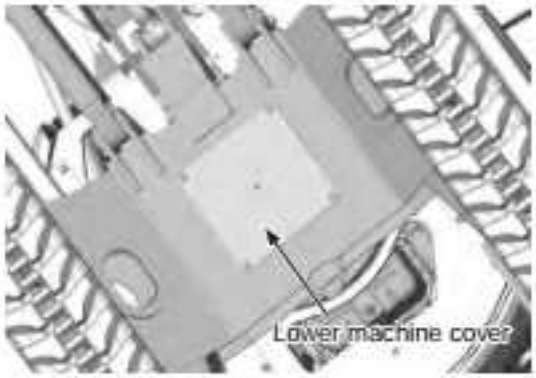
2. Remove the filler port cover on the upper machine side. Check if grease is supplied enough on the swing gear.
   If grease is insufficient on the tooth, supply grease with about 0.5kg as standard.

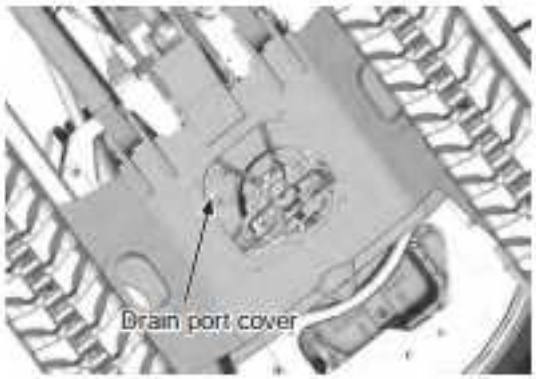


Interval for checking/greasing: 500 hours

3. If grease is whitish due to the mixed water or mud, replace the total volume of grease with new one. Remove the lower machine cover and the drain port cover and drain away the old grease. Attach the drain port cover again and supply new grease from the filler port.

Total grease volume: 3.7L





4. After swinging a few times, make sure that grease is fully supplied to the ring gear. Then, attach the lower machine cover and the filler port cover on the upper machine.

1 Hydraulic oil volume check/refilling

⚠ CAUTION

1. Do not run the machine if the hydraulic oil is below the "L" level.
2. If the hydraulic oil is refilled exceeding the "H" level, loosen drain plug ③ and discharge the extra oil.

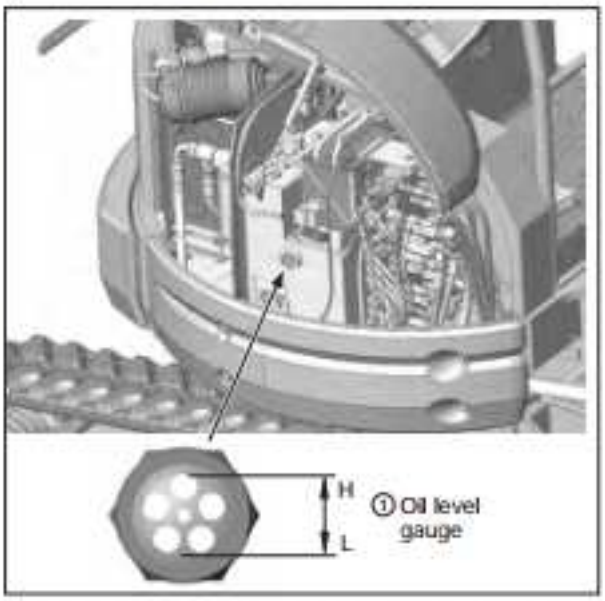
(1) Put the machine on a flat location, ground the blade, fully retract the arm and bucket cylinders, lower the boom and ground the bucket, and stop the engine.

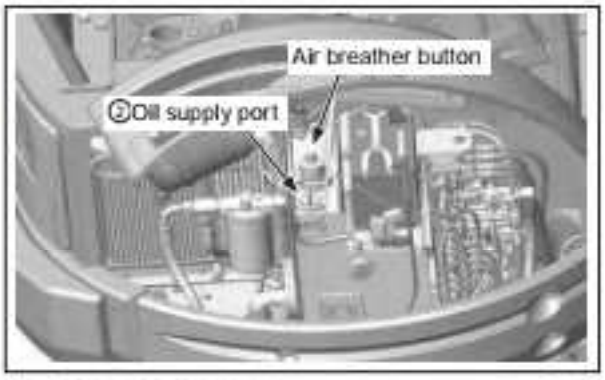
(2) Check oil level gauge ①. The oil level should be between H and L. Since the oil level varies depending on the oil temperature, the following should be used for reference:

- Near the L level before running (oil temperature 10 to 30°C)
- Near the H level during running (oil temperature 50 to 80°C)

(3) If the hydraulic oil is below the L level, refill the hydraulic oil from oil supply port ②. Before removing the oil supply port ②, press the air breather button and relieve the pressure.


Position for hydraulic oil level check





2 Hydraulic oil replacement and strainer cleaning

⚠ CAUTION

- Oil is hot immediately after movement. Touching may result in a burn. Start the work after oil is cooled down.
- Be sure to perform the work after the pressurized air in the hydraulic oil tank is relieved.

(1) Perform turning so that the drain plug on the hydraulic oil tank will be on the middle between the right and left crawlers.

(2) Fully retract the arm and bucket cylinders, lower the boom, and ground the bucket.

(3) Ground the blade and stop the engine.

(4) Remove oil supply plug ① on the hydraulic oil tank.

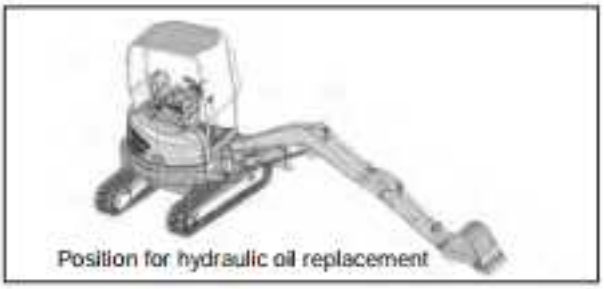
(5) Put an oil receiving container below the drain plug on the bottom of the hydraulic oil tank, remove drain plug ②, and discharge the oil. After discharging, tighten drain plug ②.

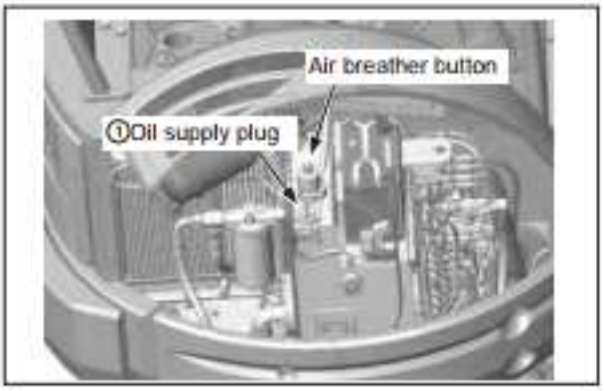
(6) Remove the cover ③.

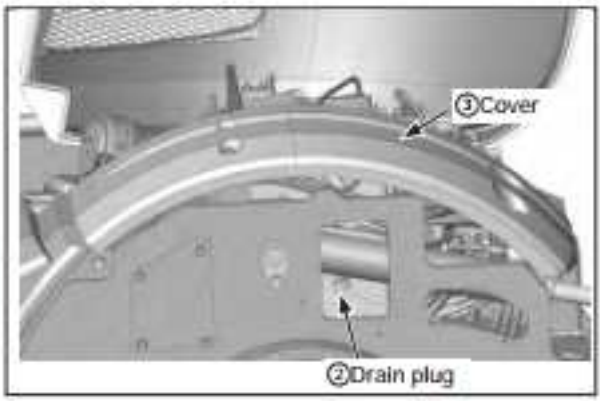
(7) Remove the hose ④, loosen the bolt ⑤ and remove the strainer cover ⑥.

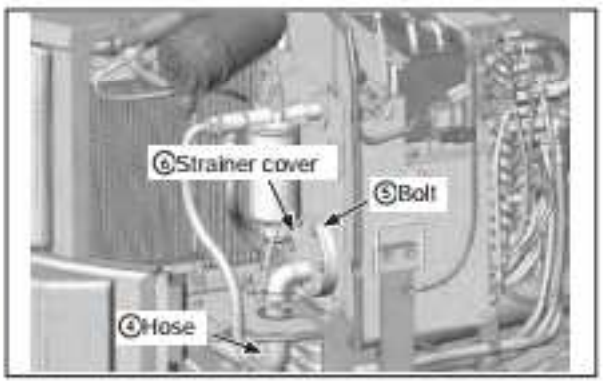
(8) Remove dust from strainer ⑦, clean the strainer, and assemble it.

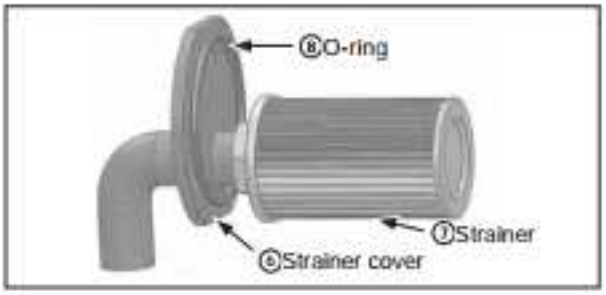
(9) Fasten strainer cover ⑥ with bolt ⑤ and attach hose ④.


Position for hydraulic oil replacement



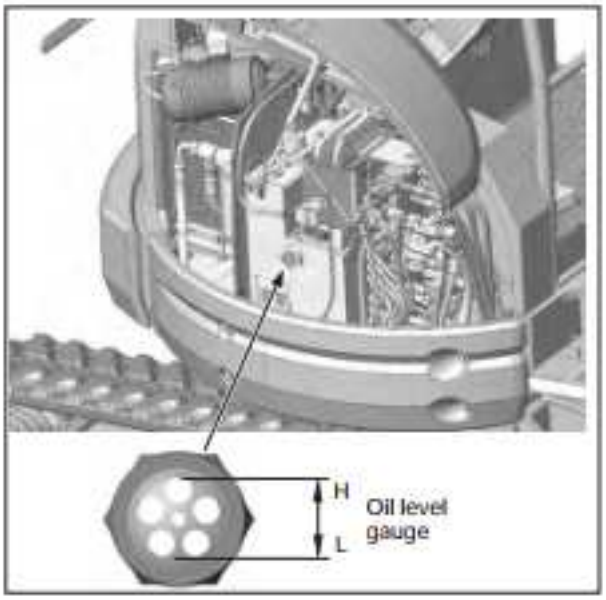






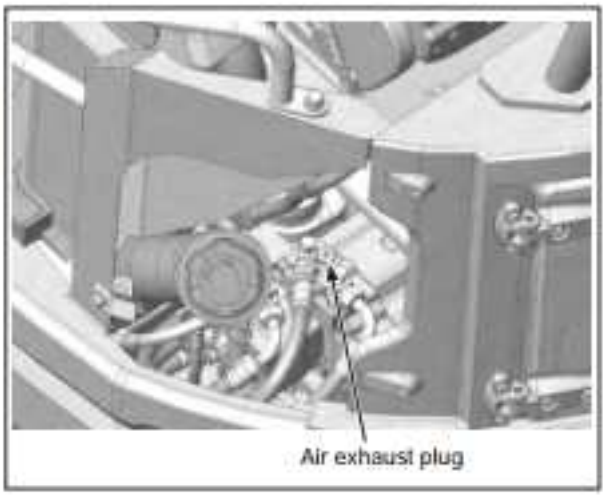
(10) Supply the specified volume of hydraulic oil from the oil supply port. Be sure that the hydraulic oil is between H and L on level gauge.

(11) Exhaust air from the hydraulic pump.
Remove the air exhaust plug. Make sure that air is exhausted from the plug hole and oil comes out.



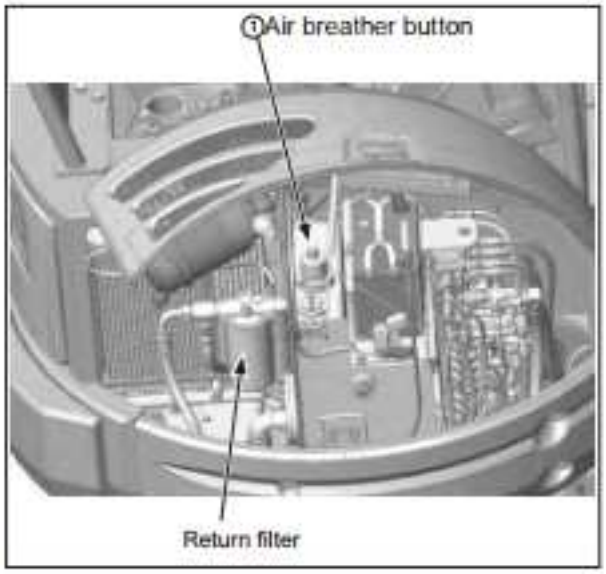
IMPORTANT **Unless air is exhausted, seizure may occur on the hydraulic pump. When replacing the hydraulic oil or hydraulic pump, be sure to exhaust air from the hydraulic pump.**

(12) Run the engine for a few minutes in low idling. Then, check the oil level in the level check position. If the oil is insufficient, refill.



⚠ CAUTION

- Oil is hot immediately after movement. Start the work after the oil is cooled down.
- The hydraulic oil tank is pressurized with air. Removing the filter cartridge immediately will cause the oil to jet out and it is dangerous, so be sure to stop the engine, press the air breather button and relieve the internal pressure before removal.



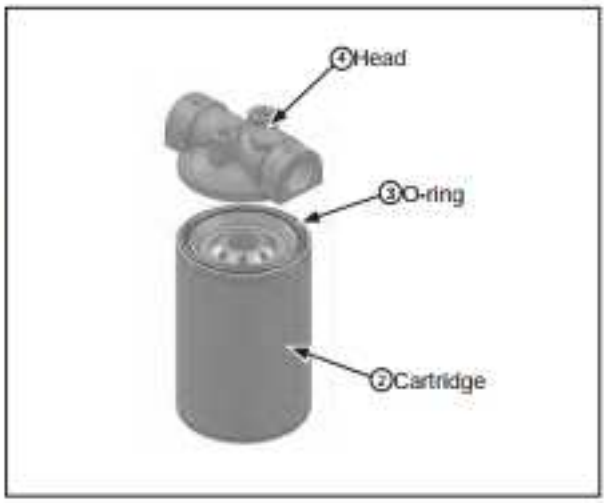
(1) Put the work machine on the ground and stop the engine.

(2) Press the air breather button ① to relieve the internal air in the tank.

(3) With a filter wrench, turn filter cartridge ② counterclockwise and remove it.

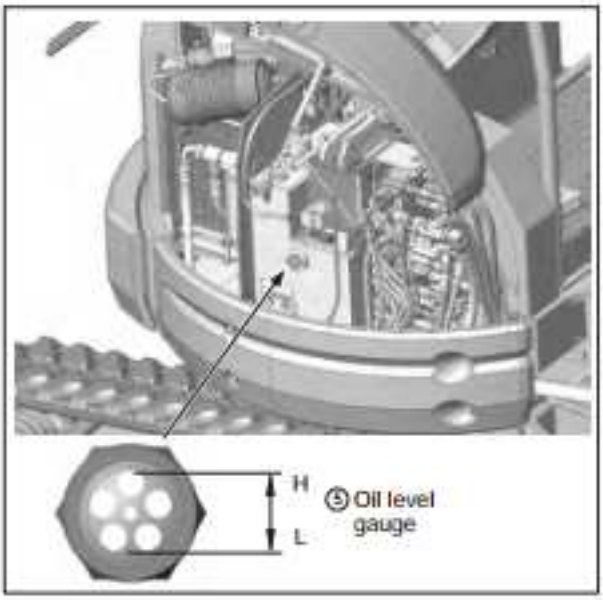
(4) Thinly coat the hydraulic oil to the O-ring ③ of the new cartridge and tighten it with a filter wrench.

(5) Start the engine and make sure that oil does not leak



(6) Put the work machine in the oil level check posture and check the level.
The oil should be between "H" and "L" on the level gauge ⑤.
If the oil is not sufficient, replenish the hydraulic oil.

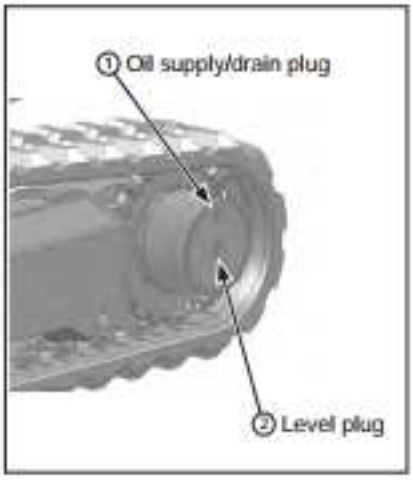
Posture for checking the hydraulic oil level



1 Oil level check/refilling

⚠ CAUTION

The gear case, oil, etc. are hot immediately after the stop of driving.
Start the work after they are cooled down.



(1) Set oil supply/drain plugs ① at the highest position and stop the engine.

(2) Put an oil receiving container below level plug ②.

(3) With a hexagonal wrench, remove level plug ②. If the oil is on the lower edge of the plug hole, the oil volume is appropriate.

(4) If the oil is not sufficient, remove the oil supply/drain plug ① and replenish the oil through the oil supply hole until it spills out of the level hole.

(5) Clean the removed plugs and then attach them.

2 Oil replacement

(1) Set the oil supply/drain plugs ① at the lowest position and stop the engine.

(2) Put an oil receiving container below oil supply/drain plug ①.

(3) With a hexagonal wrench, remove level plug ② and oil supply/drain plug ① for discharging oil.

(4) Start the engine. Slowly turn the travel motor until the oil supply/drain hole is at the highest position.

(5) Refill with oil from the oil supply/drain hole until oil spills out of the level hole.

(6) Clean the removed plugs and then attach them.

For the oil type/amount, refer to "A2-07".

■ Battery handling

⚠ WARNING

- Combustible hydrogen gas is generated from the battery. Since ignition or explosion may be caused, never put fire close nor generate spark.
- Never put metal materials such as tools and combustible materials on or near the battery. Short-circuiting will result in ignition or explosion.
- The battery liquid (diluted sulfuric acid) may cause blindness or burns. If it adheres on your eye, skin, or clothes, wash and remove it immediately with a large amount of water and accept medical treatment.
- When handling the battery, be sure to put on protection glasses.
- While the engine is rotating, never remove the battery cable.

● Battery liquid refilling

If you check the indicator and <LIQUID INSUFFICIENT> is indicated, or if you check the liquid level on the side of the battery and the liquid level is about to reach LOWER LEVEL, be sure to remove the cap on each cell and refill with the liquid to UPPER LEVEL. Do not refill exceeding UPPER LEVEL.

● Battery terminal cleaning

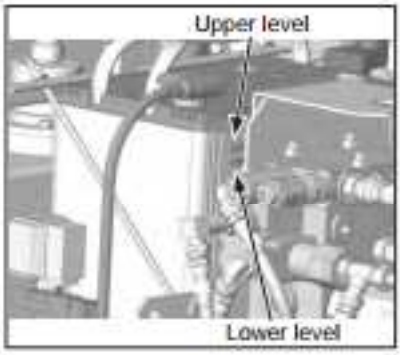
⚠ IMPORTANT

- **Be sure to stop the engine before starting the work.**
- **During work, be careful not to cause short-circuiting of the ⊕ and ⊖ connectors on the battery with tools, etc.**
- **When removing battery connectors from the terminal, remove the ⊖ connector first. When attaching, attach the ⊖ connector last.**
- **Tighten securely so that looseness will not occur on the terminal side.**

(1) Remove dirt or corrosion from the terminal. (If white powder is deposited on the terminal as a result of corrosion, dip cloth into warm water and then use the cloth to wipe the white powder off.)

(2) If excessive corrosion exists on the terminal, remove the terminal and polish it with wire brush and sandpaper.

(3) After cleaning and tightening, thinly coat grease on the terminal.



Indication by the indicator

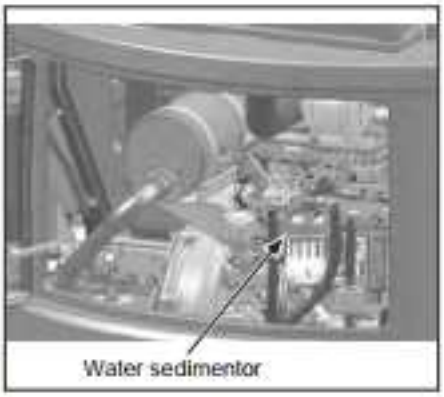
Shows the charged state and liquid level state for reference.

- Good (Blue)
- Charging required (Red)
- Liquid insufficient (White)

■ Water sedimentor check

⚠ CAUTION

- Perform this work after each part of the engine is cooled down.
- Do not put fire close.
- Since spilled light oil may result in fire disasters, wipe it off carefully.


Water sedimentor

If float ① of the water sedimentor is floating, water is accumulated below the float. Drain water before the float contacts the bottom of filter ②.

(1) Stop the engine.

(2) Loosen drain valve ③ until water flows out.

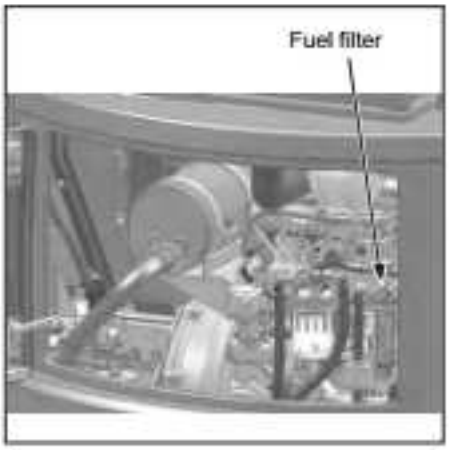
(3) When water is drained and the float reaches the bottom of the cup, close drain valve ③.

(4) Purge air from the water sedimentor. Turn the starter switch key to "Start" (ON) and leave it for approximately 20 seconds. The automatic air purge unit purges air automatically and allows the engine to be started.

■ Fuel filter element replacement

⚠ CAUTION

- Perform this work after each part of the engine is cooled down.
- Do not put fire close.
- Since spilled light oil may result in fire disasters, wipe it off carefully.



(1) Close the fuel cock ①.

(2) Loosen the ring nut ② and remove the cup ③.

(3) Remove the element ⑤ from the body ④.

(4) Wash the cup with the fuel oil.

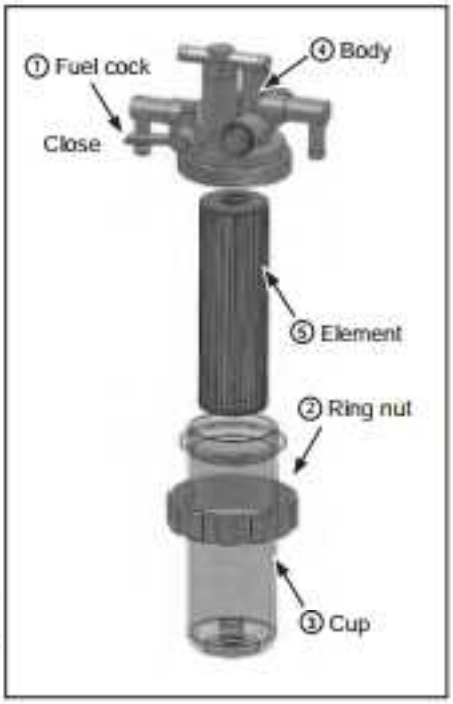
(5) Attach a new element to the body.

(6) Put the O-ring on the cup and attach the cup to the body. If the O-ring is damaged, replace it.

(7) Tighten the ring nut.

(8) When you have replaced the element, exhaust air.

(9) Make sure that the fuel does not leak.



● Air purging method

If the element is replaced or the fuel tank is emptied, air comes in the circuit and the fuel does not flow. Therefore, air purging is required.

(1) Fill the fuel tank with the fuel.

(2) Turn the starter switch key to "Start" (ON) and leave it for approximately 20 seconds.

(3) The automatic air purge unit purges air automatically and allows the engine to be started.

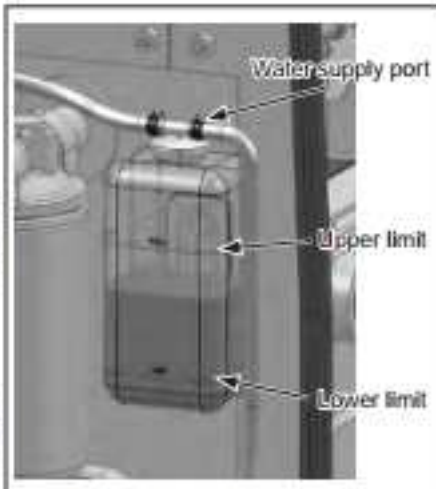
■ Check/refilling

⚠ WARNING

In normal cases, do not open the radiator cap. Check the coolant with the reservoir tank only if the engine is cold.

(1) Open the engine cover and check to see if the level of coolant in the reservoir tank is between FULL and LOW. If the level is lower, refill with coolant to the FULL level from the water supply port of the reservoir tank.

(2) If the reservoir tank is empty, stop the engine and check for water leak and check the water level in the radiator. If the level is lower, refill the radiator and reservoir tank with the coolant.



Reservoir tank level

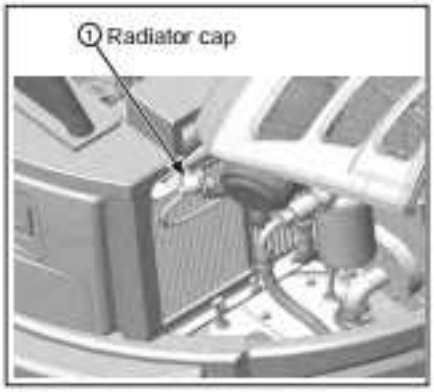
■ Replacement

⚠ CAUTION

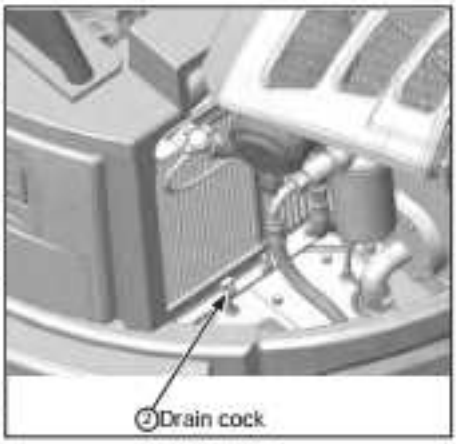
- Immediately after the engine is stopped, the coolant is hot. Draining the coolant immediately may result in a burn. Drain the coolant after the engine is cooled down.
- If the water temperature in the radiator is high, do not remove the cap.
  After the water is cooled down, turn the cap slowly to relieve the pressure from the radiator and then remove the cap.

(1) Put the work machine on the ground and stop the engine.

(2) Remove radiator cap ①.



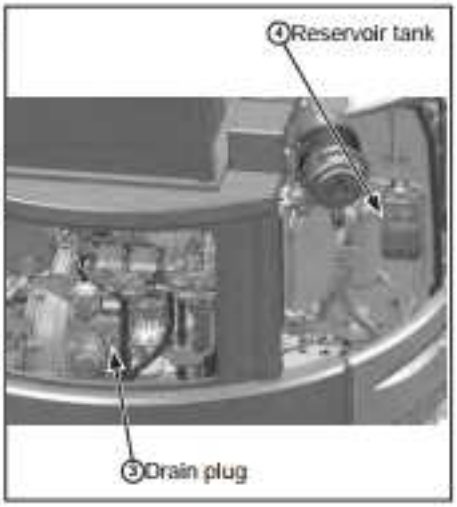
(3) Open drain cock ② on the bottom of the radiator to drain water.
Then, remove drain plug ③ of the cylinder block to drain water.



(4) Close drain cock ② and drain plug ③. Put in service water and cleanser (radiator cleaner). Run the engine for approximately 10 minutes at a slightly higher rotation than low idling.

(5) Stop the engine and open drain cock ② and drain plug ③ to drain water.

(6) After water is drained, close drain cock ② and drain plug ③ to supply service water.



(7) Open drain cock ② and drain plug ③ and set the engine to low idling. While adjusting the supplied water volume so that the radiator will always be full of water, perform washing with water for 10 minutes.

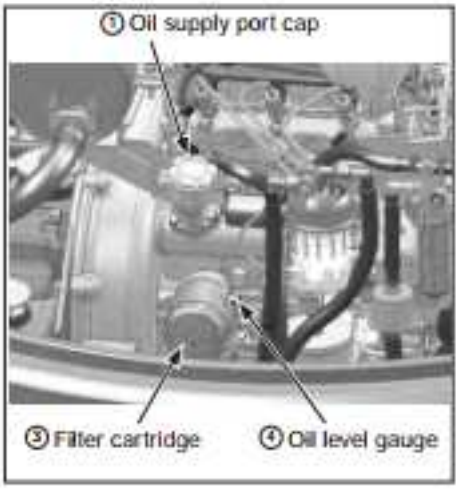
(8) Close drain cock ② and drain plug ③ and fill with the coolant consisting of the service water and long-life coolant to the lower edge of the radiator water supply port.

(9) Run the engine for 5 minutes in low idling and then stop it. The water level drops because the internal air is purged. Refill with the coolant to near the water supply port and close the cap.

(10) Drain the coolant from reservoir tank ④. Wash the inside of the tank. Fill with the coolant consisting of the service water and long-life coolant to the FULL mark.

■ Engine oil volume check/refilling

(1) Remove the oil level gauge and wipe it with dry cloth. Then, fully insert it and remove it calmly.
(2) If the level is between the upper and lower limits on the level gauge, the oil volume is appropriate. If the oil does not reach the lower limit, refill with the engine oil from the oil supply port.
(3) If the oil is above the upper limit, remove the extra volume from the drain plug and check the oil level again.



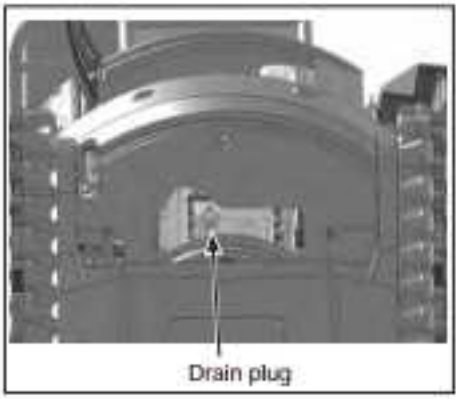
⚠ IMPORTANT

- **Before check, set the machine horizontal.**
- **To check after the engine is started, start checking at least 10 minutes after the engine stops.**
- **Do not start the engine if the oil level is above the upper limit or below the lower limit.**

■ Engine oil and oil filter replacement

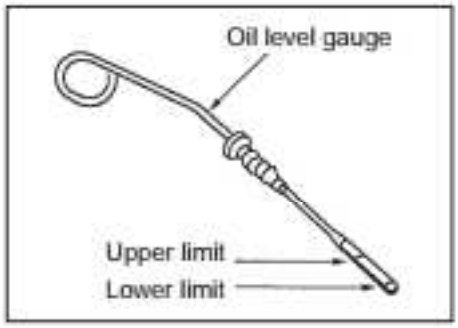
⚠ CAUTION

Oil is hot and a burn may occur immediately after movement. Start the work after the oil is cooled down.



● Engine oil draining

(1) Stop the engine.
(2) Put a drain oil receiver below drain plug ② of the engine.
(3) Clean around oil supply port cap ① so that foreign matters will not come in. Then, remove oil supply port cap ①.
(4) Remove drain plug ② slowly so that oil will not splash, for oil draining.
(5) Check the drained oil. If the drained oil has much metal powder or foreign matters, it is necessary to overhaul the engine. (Refer to the engine service manual.)



● Filter cartridge replacement

(1) With a filter wrench, turn filter cartridge ③ counterclockwise and remove it.

(2) Remove dust, etc. from the cartridge mounting surface.

(3) Thinly coat the engine oil on the gasket of the new cartridge.

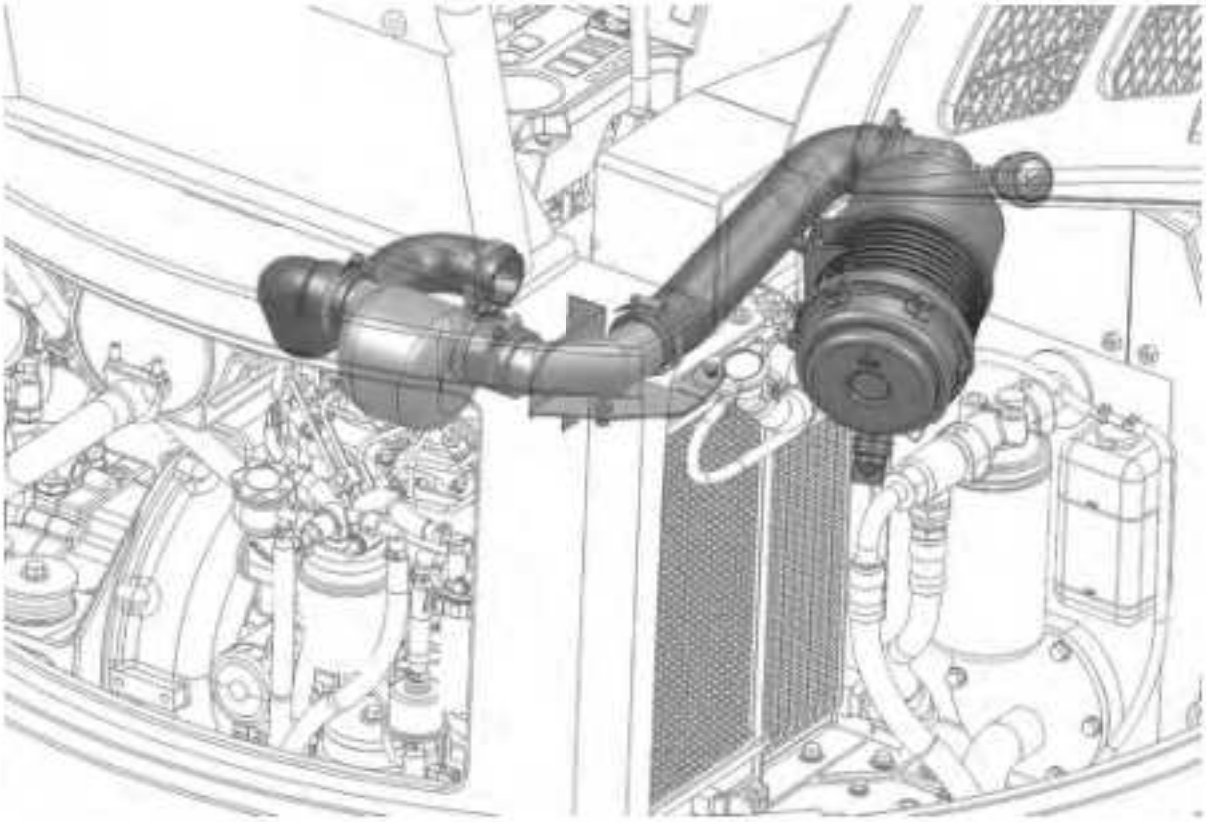
(4) Screw in the cartridge by hand. After the gasket contacts the seal surface, tighten by approximately 3/4 turn with a filter wrench.

● Engine oil refilling

(1) Attach drain plug ②.

(2) From oil supply port ①, refill with the engine oil to the level between the upper limit and lower limit on level gauge ④.

(3) Run the engine in idling for several minutes then stop it. Check the engine oil volume 10 to 20 minutes later. If the volume is insufficient, refill with the engine oil to the specified level.



⚠ CAUTION

- Be sure to clean/replace the air cleaner after the engine stops. If this work is done while the engine is rotating, dust is absorbed and the engine may be damaged.
- When cleaning the element using the compressed air, put on protection glasses because dust may enter your eyes and it is dangerous.

⚠ IMPORTANT

- **If the element is dirty with oily smoke, soot, oil, etc., replace with a new element regardless of the replacement cycle.**
- **Do not hit, knock, or drop the element.**
- **If it is found in daily check that dust indicator shows the red signal, clean or replace element regardless of the maintenance cycle.**

Cleaning: Every 250 hours or when the dust indicator shows the red signal.

Replacement: When the air cleaner has been cleaned up to five times or when one year has passed since the last replacement or when the dust indicator shows the red signal right after cleaning.

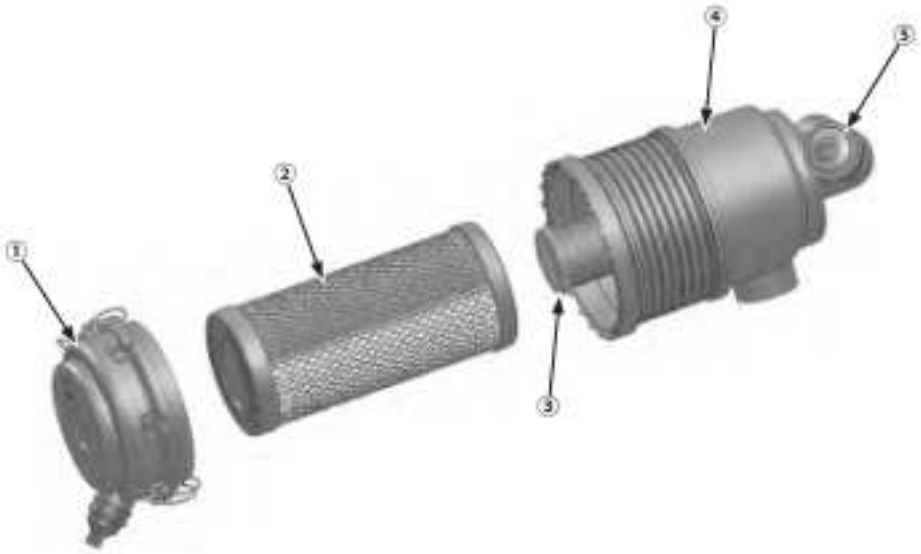
1 Dust indicator check

(1) Check to see if the red signal is emitted from dust indicator ① in the air cleaner suction pipe.

(2) If the red signal is emitted, clean or replace the element immediately.

(3) After the element is cleaned or replaced, press the reset button on dust indicator ① to reset the red signal.

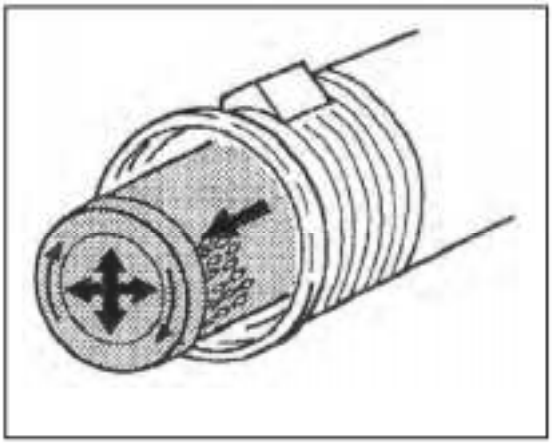
2 Air cleaner element cleaning



(1) Stop the engine.

(2) Remove the cover ① and take out the outer element ②.
Don't remove the inner element ③. The inner element will not be cleaned and reused.

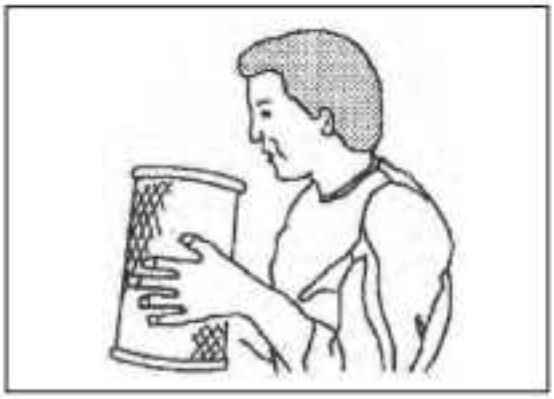
(3) To remove the outer element, move the its edge up and down and right and left or turn it. Gradually pull out the element not to disperse dust.



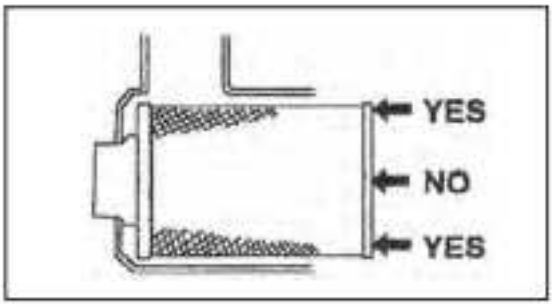
(4) Clean the inside of the cover and body ④.

(5) From the inside of the element, blow the dry compressed air (0.29 - 0.49 MPa) in the vertical direction along the fold of the filter paper. Then, blow the air from the outside and then blow from the inside again to remove dust from the surface.

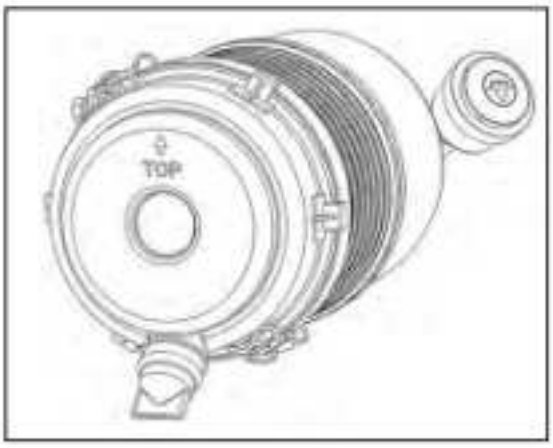
(6) With a light spotted from the inside of the element, check the filter paper. If the filter paper is broken, the paper has pin holes (particularly thin parts), or the packing is broken, replacement is required.



(7) After cleaning is completed, attach element. Push not the edge center but the edge outer circumference of the element securely to attach it.

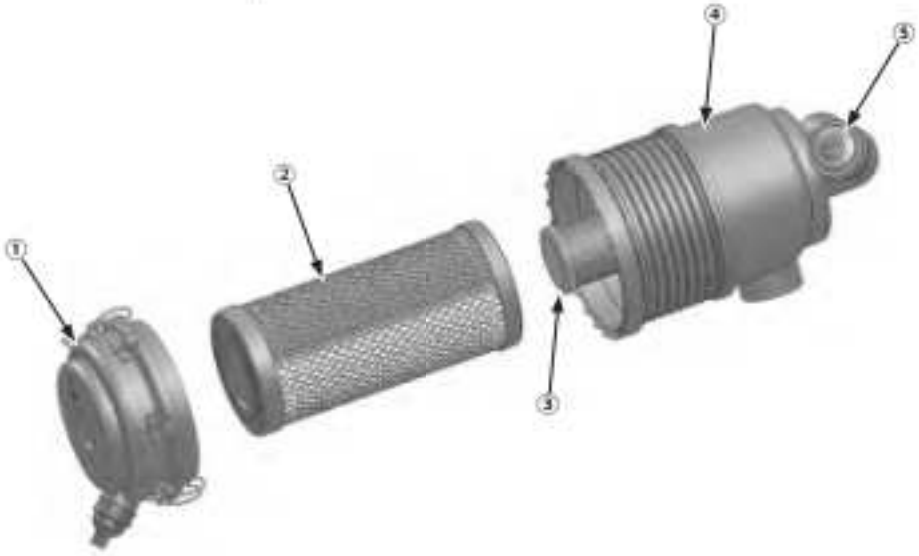


(8) With the arrow (↑) on cover ① facing up, attach the cover and fasten it with the clamp.



(9) Press the button on dust indicator ⑤ to reset the red signal.

3 Air cleaner element replacement

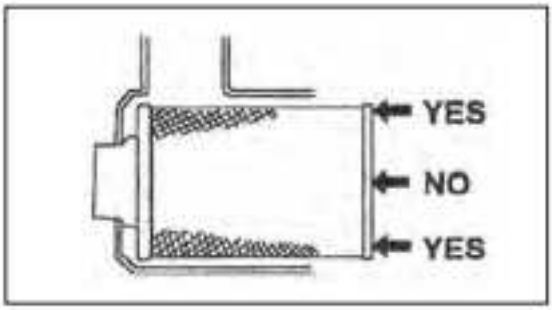


(1) Stop the engine.

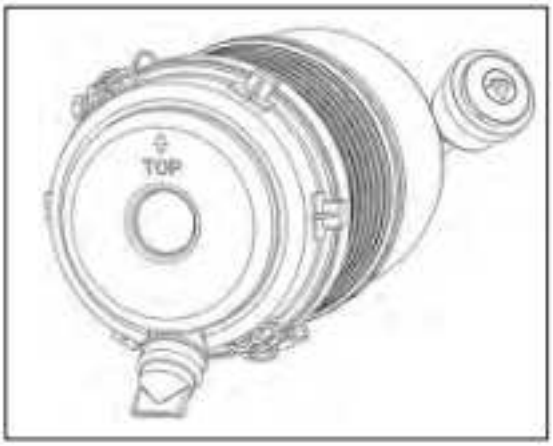
(2) Remove the cover ①. Take out the outer element ② and inner element ③.

(3) Clean the inside of the cover and body ④.

(4) Attach the new inner and outer elements in turn. Push not the edge center but the edge outer circumference of the element securely to attach it.



(5) With the arrow (↑) on cover ① facing up, attach the cover and fasten it with the clamp.



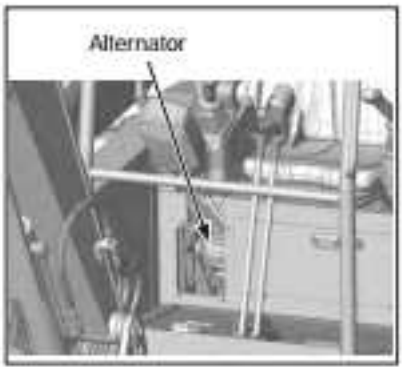
(6) Press the button on dust indicator ⑤ to reset the red signal.

⚠ CAUTION

- Perform this work after each part of the engine is cooled down.
- Stop the engine and remove the starter switch key.

⚠ IMPORTANT

- **If the belt is excessively tensed, the bearing or belt will be damaged earlier than usual.**
- **If the elongated belt does not have the adjusting allowance or if the belt has a cut or crack, replace it.**
- **After you have replaced the belt, run the engine at high speed for 30 minutes. Then, check and adjust the belt tension.**

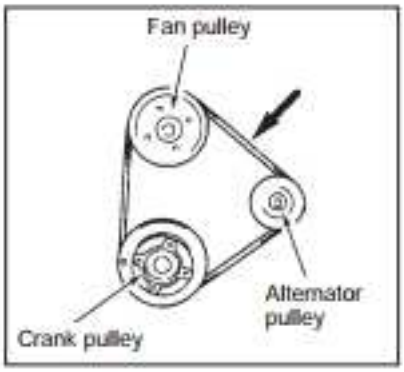


● Check

(1) Remove the check port cover so that you can see the alternator.

(2) Press the middle position between the fan pulley and alternator with your thumb (approximately 98 N). A deflection of approximately 10 mm is appropriate.

(3) If the belt has flaws or cracks, replace the belt.



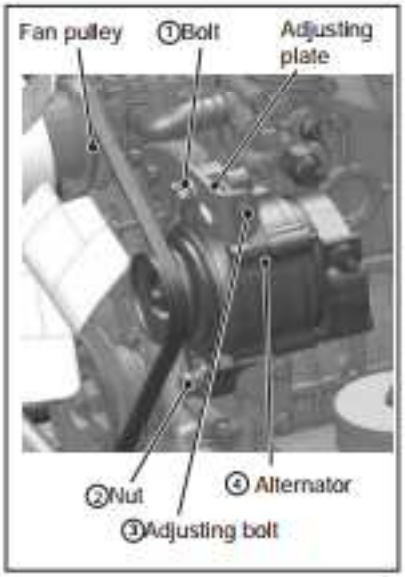
● Adjustment

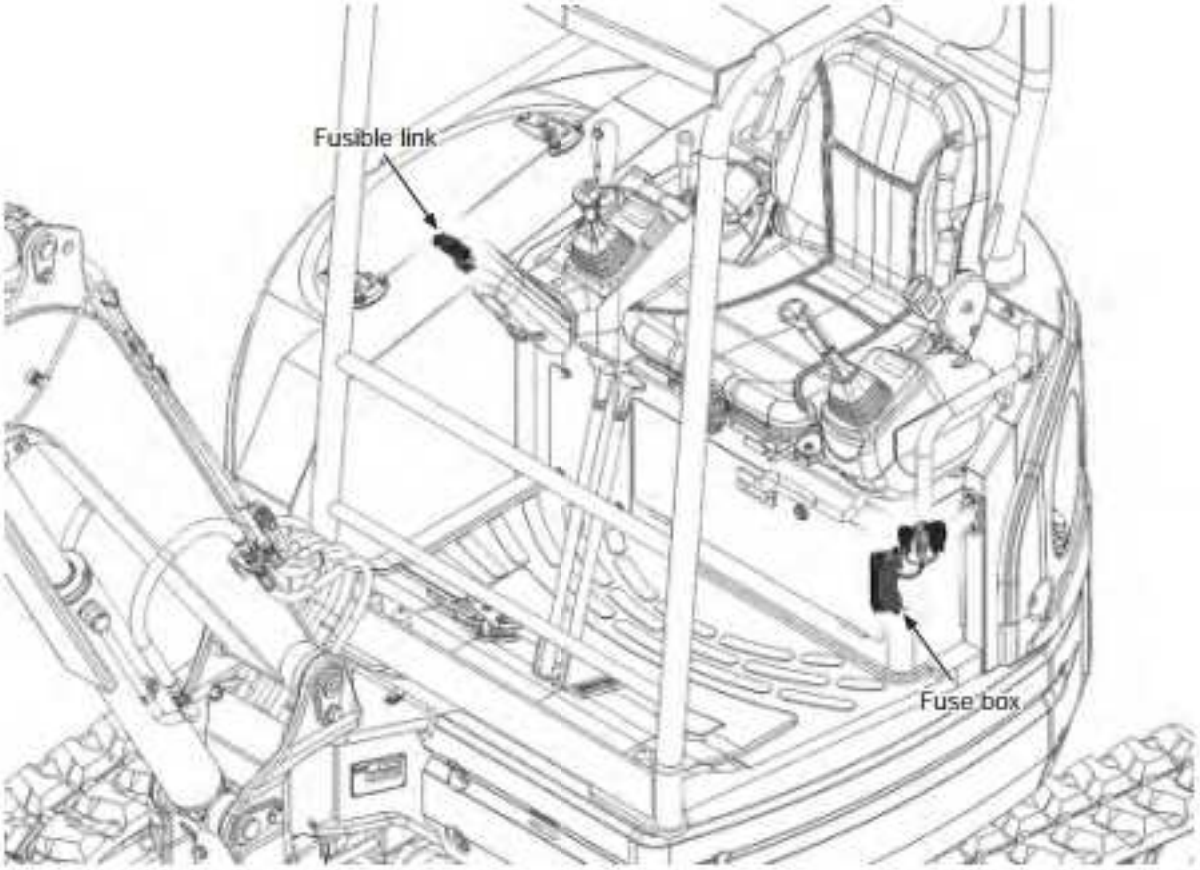
(1) Loosen bolt ① and nut ②.

(2) Turn adjusting bolt ③ and move alternator ④ so that the belt tension will result in a deflection of approximately 10 mm (98 N).

(3) Tighten bolt ① and nut ②.

(4) If the belt is elongated and there is no more adjusting allowance, replace the belt.



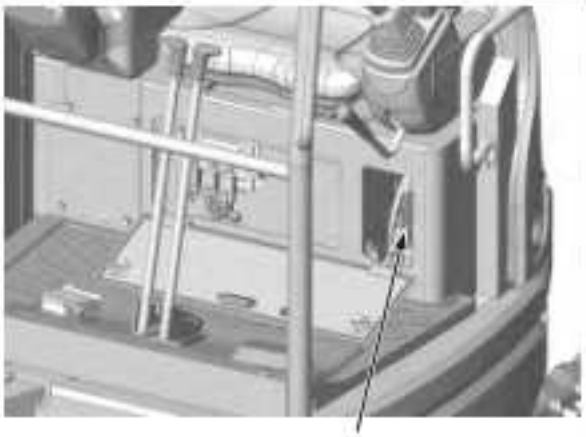


- As the cause of melting of the fuse or fusible link, circuit short-circuiting, component damages, etc. are considered. Detect the cause, make repair, and replace the fuse.
- Before replacing the fuse, be sure to set the starter switch to the stop (OFF) position.
- Be sure to install the fuse and fusible link with the specified capacities. Never use steel wire, wrapping foil, etc.

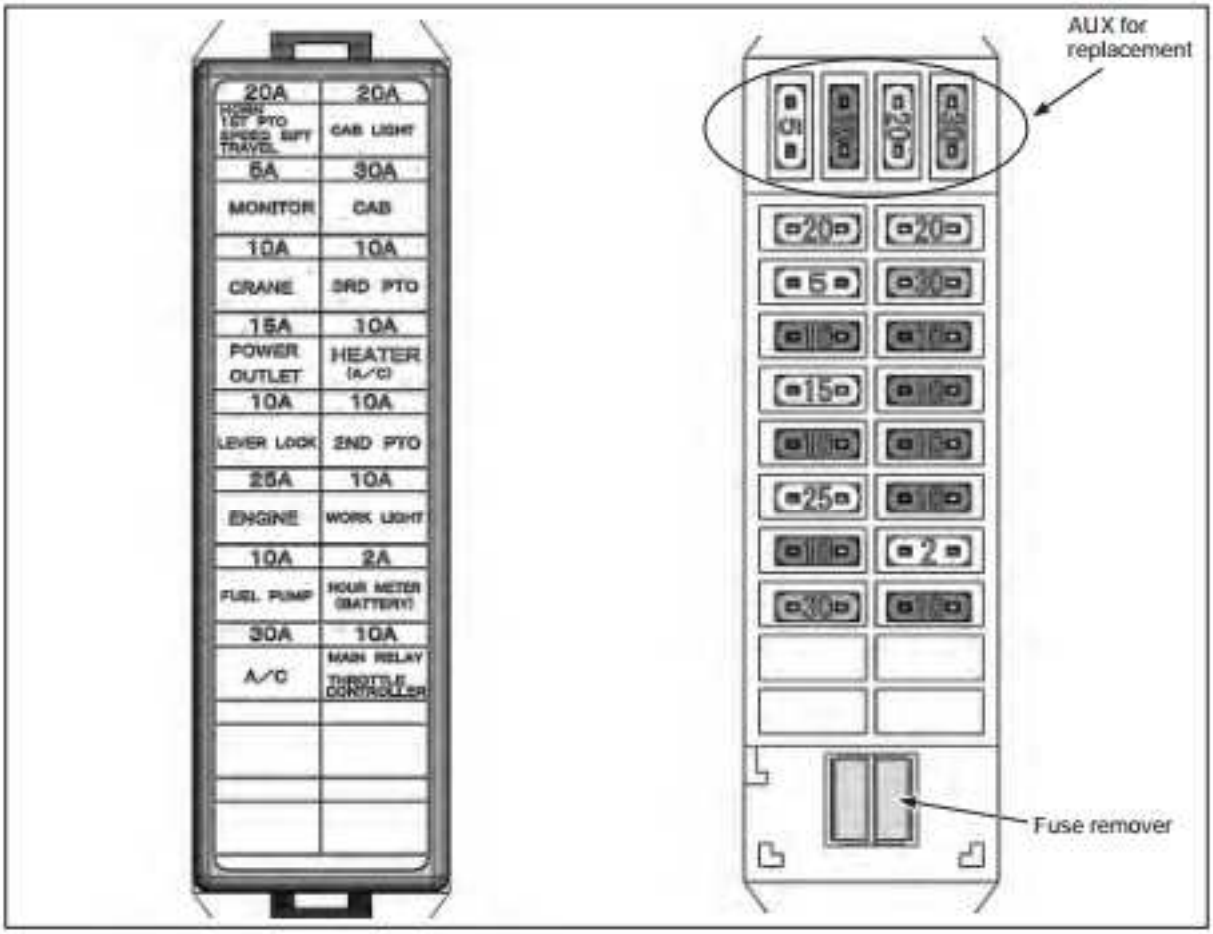
Contents

1 Fuse Replacement

- Before replacing the fuse, be sure to set the starter switch to the stop (OFF) position.
- Don't use steel wire, wrapping foil, etc. instead of fuse. The wire may be overheated or burned to cause a fire.
- When the fuse has blown out right after replacement, it is probable that the harness or component malfunctions (e.g. short-circuiting). Find out the cause and repair the trouble part at once.



1-1 Components supported by fuses



Search for the inactive component in the correspondence table on the cover to find out the relevant fuse.

Fuse

2A Gray

5A Brownish-red

10A Red

15A Blue

20A Yellow

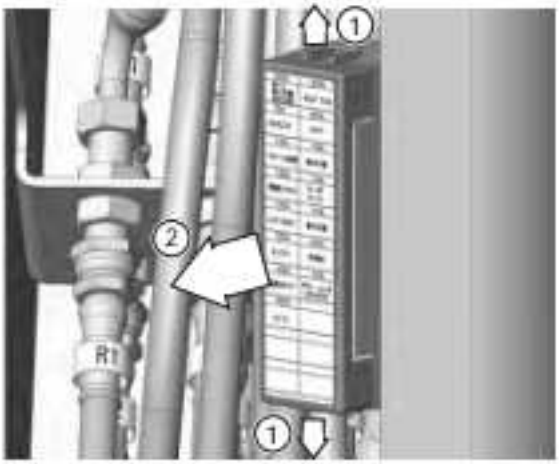
25A Water-clear

30A Green

1-2 Replacement

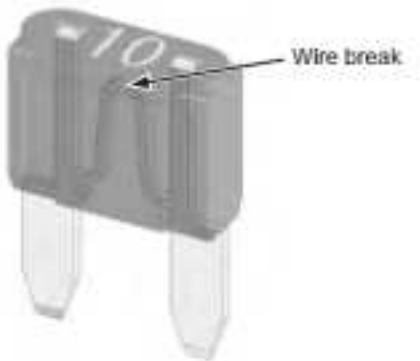
Make sure that the starter switch is at the stop (OFF) position.
(The key is perpendicular to the forward direction.)

Unlock the latch of the fuse box cover. Pull the cover forward and remove it.



With a fuse remover, take off the fuse of the problem component.

Check the fuse for wire break.



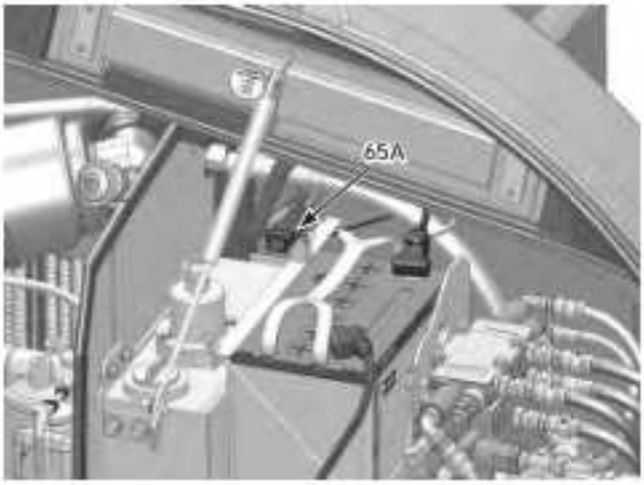
If there is not wire break, it is probable that the harness or component malfunctions (e.g. short-circuiting). Find out the cause and repair the trouble part at once.

Replace the broken fuse with a new one of the same capacity. (If you use the auxiliary fuse, supply a new auxiliary fuse.)

2 Fusible link replacement

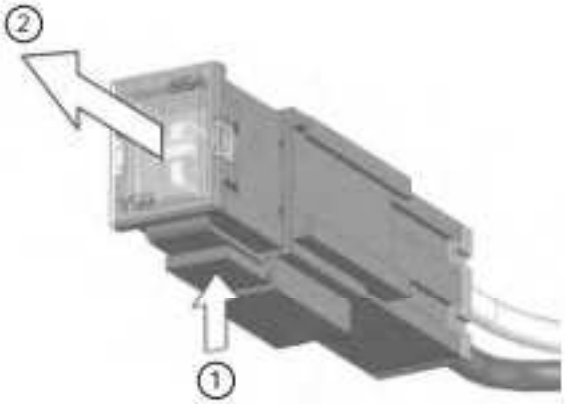
If you set the starter switch to "Start" (ON) and the power is not turned on, it is probable that the fusible link on the circuit from battery to starter switch is broken by an accident (e.g. short-circuiting of circuit). Remove the fusible link and check it. If the fusible link has blown out, repair the problem part and replace the fusible link.

2-1 Relevant units

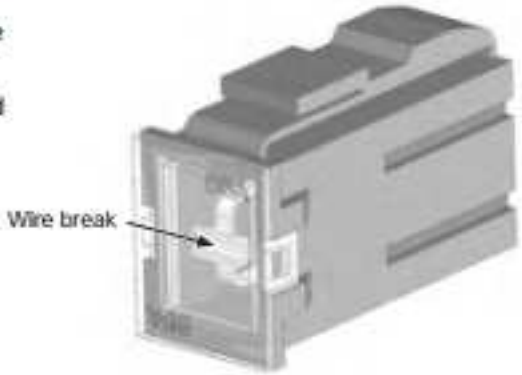


Replacement

Push in the lock of the fusible link (①) and pull it up (②). The fusible link can be removed.



Check for wire break from the window on the fusible link end surface.
If wire break has occurred, repair the problem part and replace the fusible link with a new one.

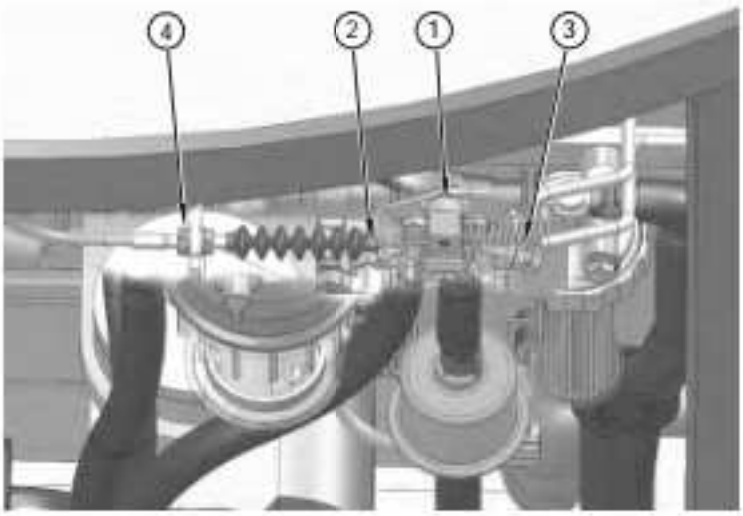


⚠ CAUTION

- When checking the engine and when handling the compressed air or high-pressure water, be sure to wear the eye protection tools. Your eyes may be injured by dust, dispersed substance, compressed air, high-pressure water or steam.
- Unless you can observe this caution, tiny injury may be caused.

- Blow off dust from the fin with the compressed air (200kPa or less).
  Be careful not to damage the fin with the compressed air.
- When there is a lot of dust on the fin, use a neutral cleanser and tap water to clean the fin.

⚠ IMPORTANT **Use high-pressure water and compressed air with as low pressure as possible (200kPa). Don't use a wire brush to clean the fin. The fin will be damaged.**



(1) When the accelerator is at each of the high speed and low speed positions, check if the governor lever ① at the engine side contacts with the limit bolt at the high speed side ② and low speed side ③.

(2) If the governor lever does not contact with the high or low speed limit bolt, adjust the accelerator wire.

(3) Loosen the screw ④ of the accelerator wire mounting fixture and move the wire fixing position so that the governor lever can contact with the high and low speed limit bolts.

⚠IMPORTANT **Do not change the minimum and maximum no-load rotary speed by adjusting the limit bolts. The safety and performance of the machine may be lowered or the service life of the product may be shortened.**

B3 Disassembly/Assembly

1. General cautions for disassembly/assembly

Pay attention to the following points when disassembling/assembling.

① Perform the work in a clean place. Be careful to prevent the swing motor from dust, paint scrap or water. Prepare a clean container which will receive the disassembled parts.
② Before disassembling, remove dust from the outside of swing motor and, using a wire brush or others, remove the paint at the joints between the units.
③ Before disassembling, place a mark on each part so that the parts can be set at the original positions when assembling.
④ Handle the disassembled parts carefully not to damage them.
⑤ Fully wash the disassembled parts with wash oil.
⑥ Check the disassembled parts for abnormal wear or seizure. Remove burr with a sandpaper, etc.
⑦ Replace seals and snap rings with new ones.

2. Disassembly/assembly procedure

The disassembly/assembly procedure of swing motor (PCR-3B) will be explained in this chapter.
Swing motor consists of two blocks as shown below. The disassembly/assembly of each block will be explained.
For disassembling/assembling, refer to the operation manual and parts list.

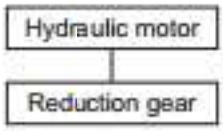
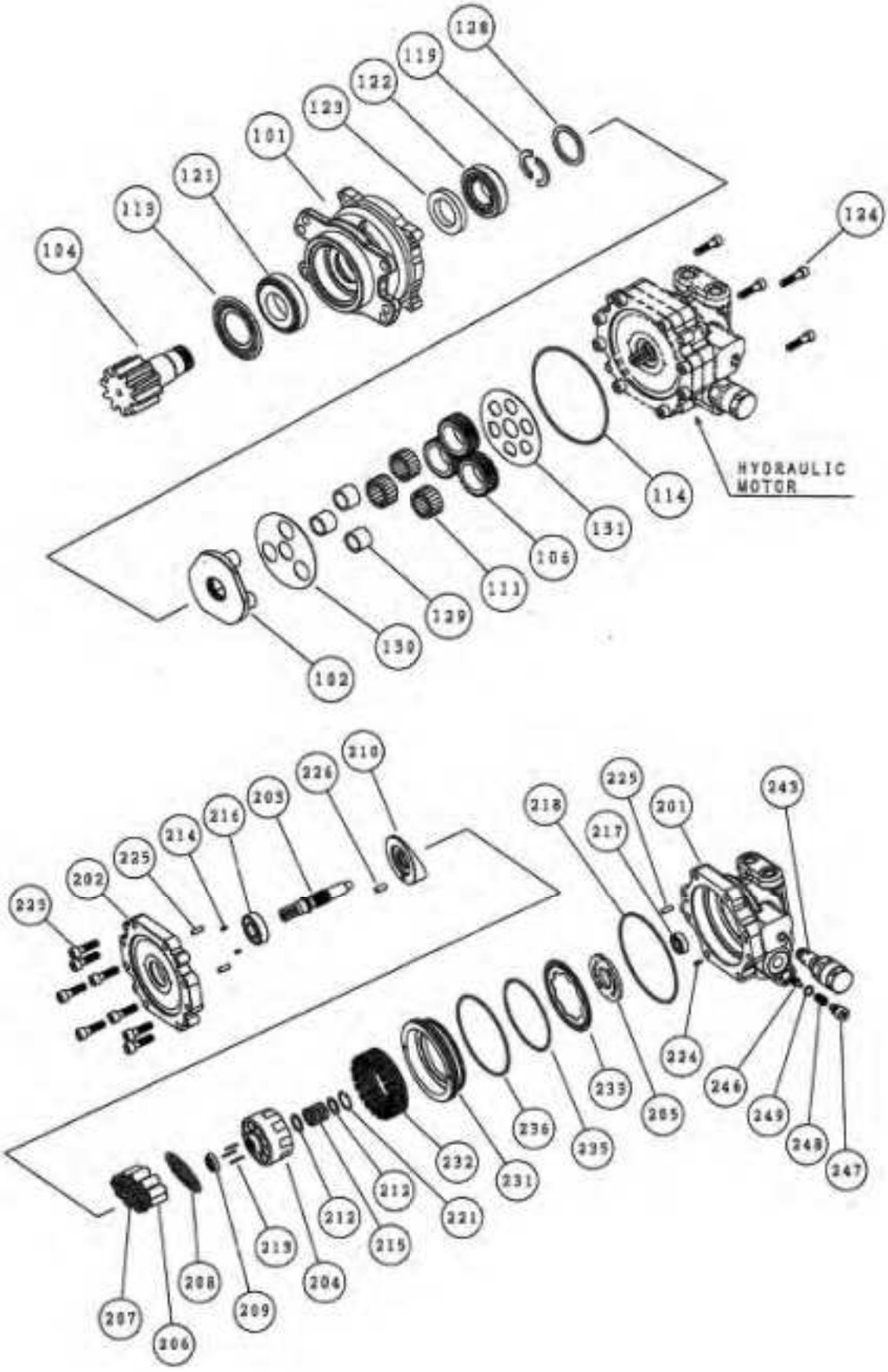


Fig. 1: Block diagram

Necessary tools for disassembly/assembly

No.	Tools to be used	
1	Manual torque wrench: Preset type	45N (JIS B4650)
2		90N (JIS B4650)
3	Socket head bit for the above wrench	Width across flat 5
4		Width across flat 6
5		Width across flat 8
6	Manual torque wrench: Single-function type	T=147.1±14.7N•m Width across flat 36
7	Allen wrench	Width across flat 5
8		Width across flat 6
9		Width across flat 8
10	Wrench	Width across flat 36
11	Slotted screwdriver	Width 6 – 10
12	Snap ring pliers	ϕ28 for hole
13		ϕ22 for shaft
14	Hammer	
15	Plastic hammer	
16	Others	Grease
17		Oil (Specified hydraulic oil)
18		Wire brush
19		Sandpaper
20		Screw lock (Three-Bond #1305)

Exploded view

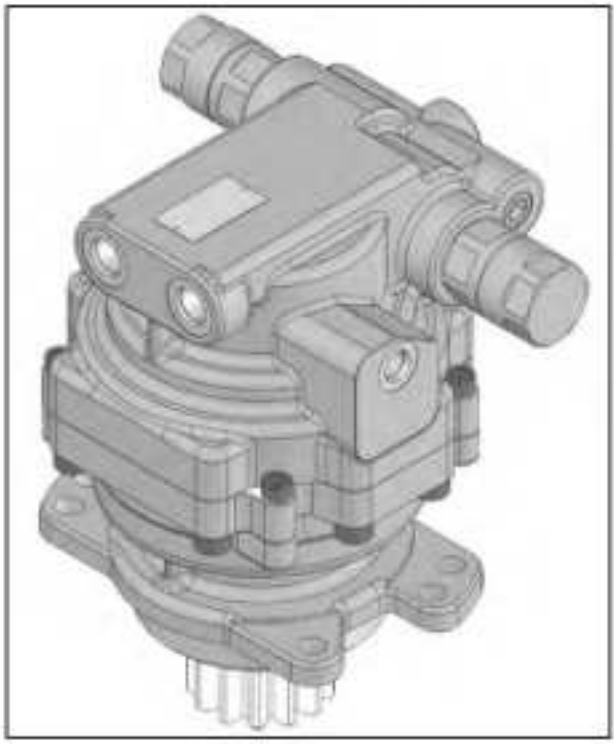


Disassembly

1. Hydraulic motor

Step 1

Loosen the socket head bolt (124) and remove the hydraulic motor Ass'y from the reduction gear.



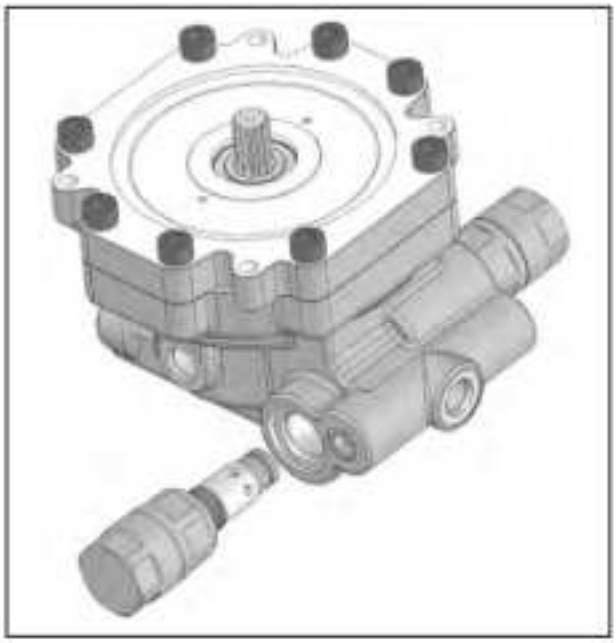
Tool

Allen wrench: 6mm

- When removing the hydraulic motor Ass'y from the reduction gear, open the drain port.
- If it is difficult to remove the hydraulic motor Ass'y, insert a slotted screwdriver or the like to the mating surface with the reduction gear. If burr or others occur, remove them completely.

Step 2

Remove the relief valve Ass'y.



Tool

Wrench: 36mm

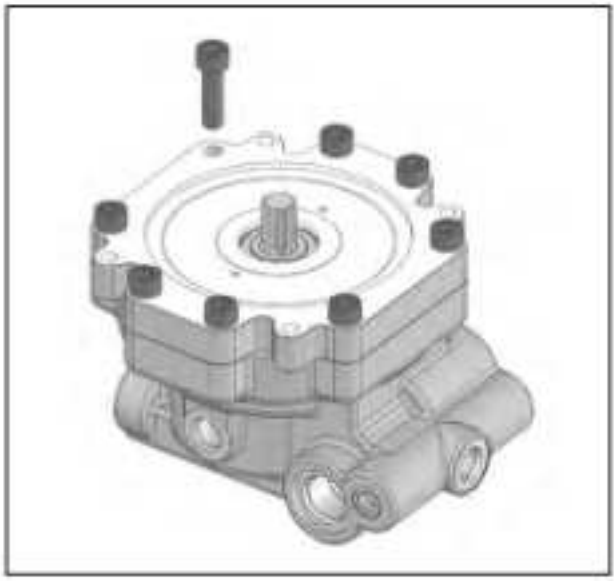
- Do not disassemble the relief valve Ass'y if not necessary.

Step 3

Loosen and remove the socket head bolt (223).

Tool

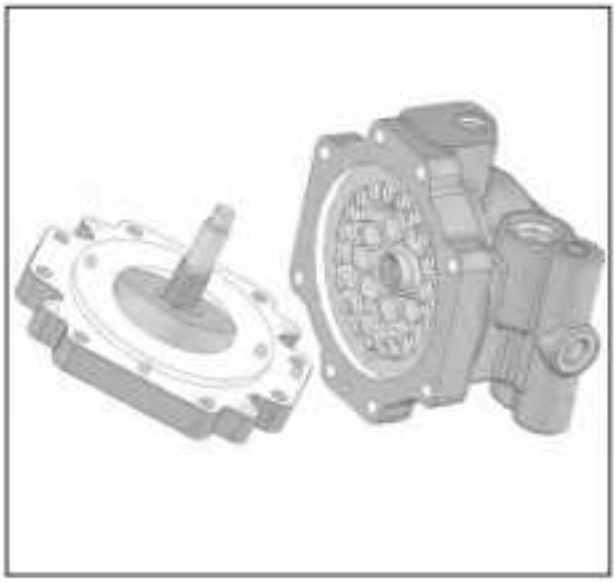
Allen wrench: 8mm



Step 4

Remove the plate S (202).

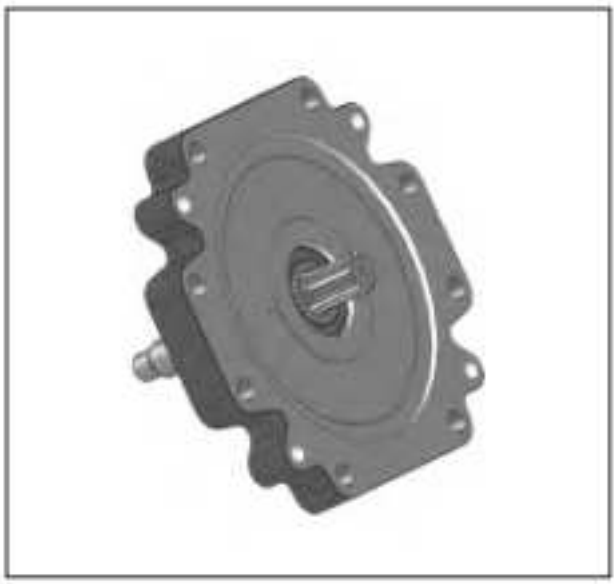
- Be careful not to drop the swash plate (210).



Step 5

Remove the swash plate (210) and shaft kit from the plate S (202).

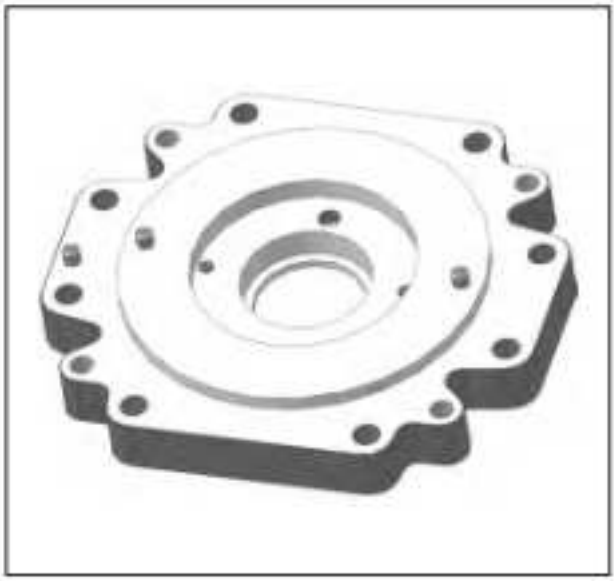
- If it is difficult to remove the shaft, lightly tap it from the end surface of the opposite side with a plastic hammer.
- The bearing (216) is press-fitted to the shaft. Don't remove the bearing except when replacing the bearing.



Step 6

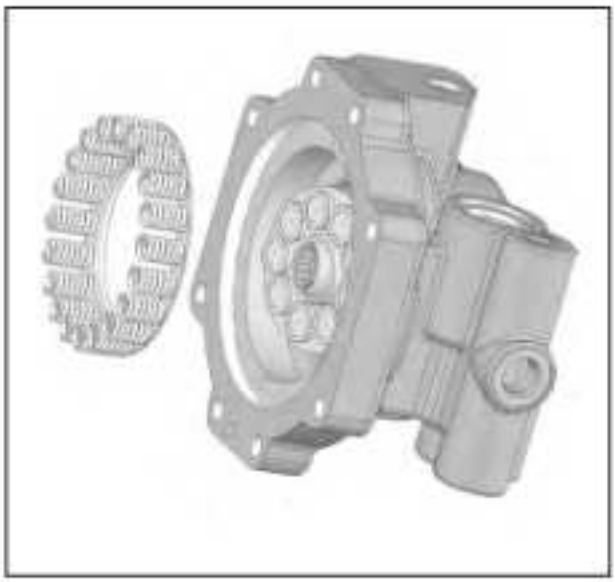
Remove the filter (214) and parallel pin (225) from the plate S (202).

- Filter (214): 2 pc.
- Parallel pin (225): 3 pcs.



Step 7

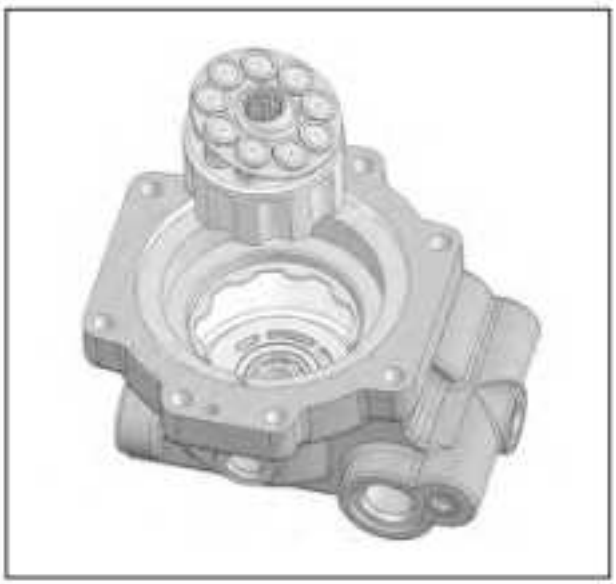
Remove the spring Ass'y (232) from the body H (201).



Step 8

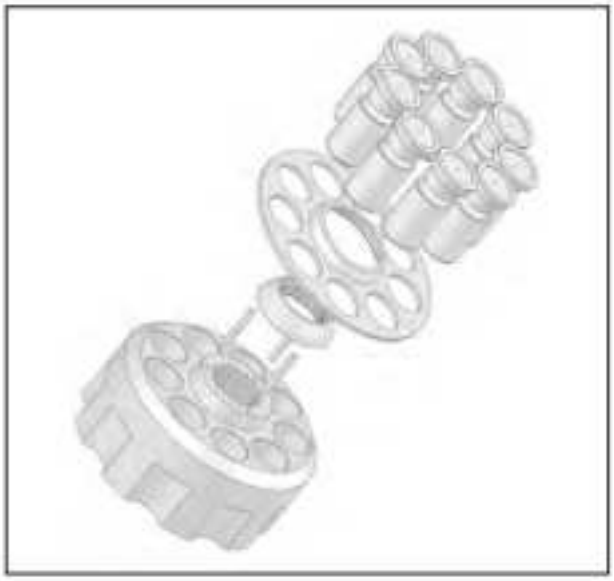
Remove the cylinder barrel kit.

- Small parts may be scattered. Be careful not to lose them.



Step 9

Remove the piston (206)/shoe (207) Ass'y, shoe holder (208), barrel holder (209) and pin (213).



Step 10

Remove the snap ring (221), retainer (212) and spring C (215).

Step 11

Remove the brake piston (231) from the body H (201). Then, remove the O-rings (235 & 236).

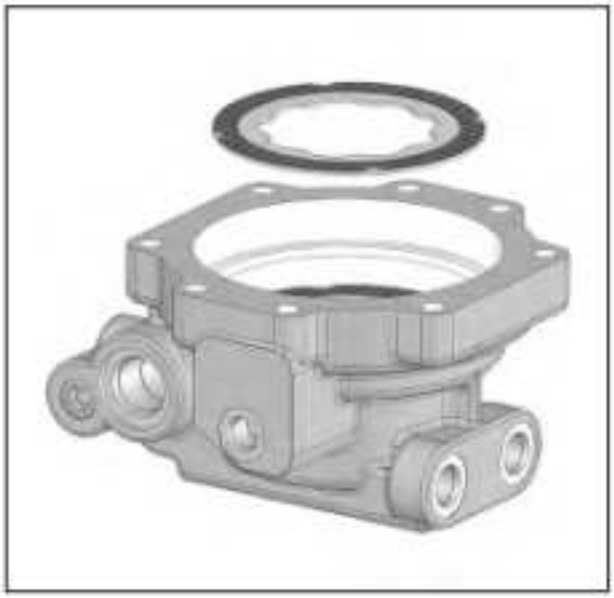
Inject air from the PP port gradually, and the brake piston can be removed.

⚠ CAUTION

Inject air gradually to prevent the brake piston from jumping out suddenly.

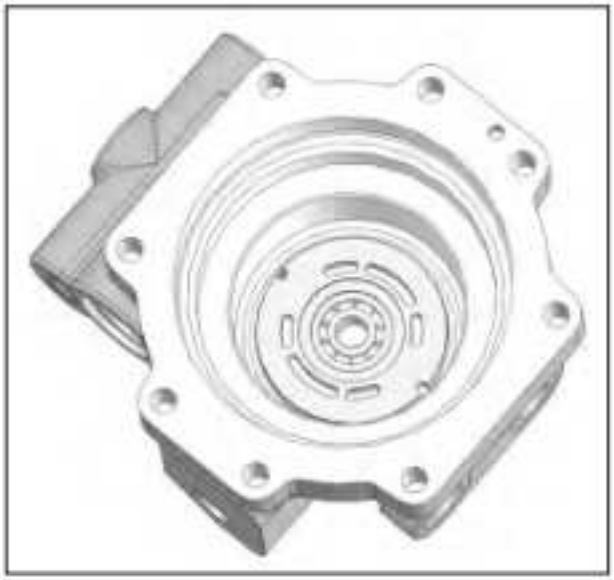
Step 12

Remove the disk plate (233).



Step 13

Remove the valve plate (205).



Step 14

Loosen the plug (247). Remove the check valve (246) and spring (248). (2 places)

Tool:

Allen wrench : 8mm

Step 15

Remove the deep-grooved ball bearing (217) and spring pin (224).

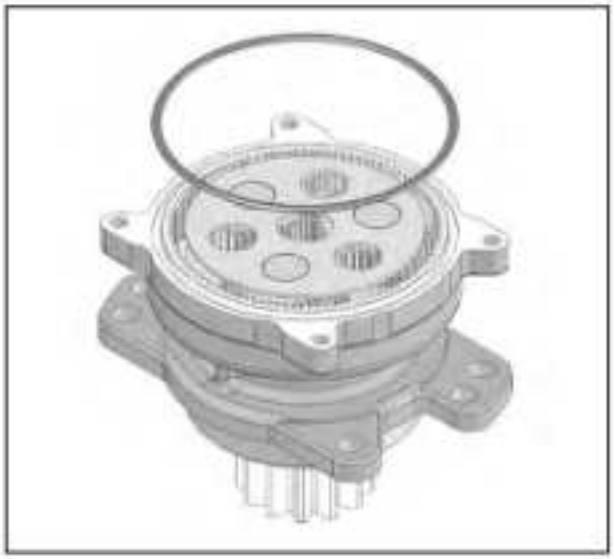
⚠ CAUTION

- The deep-grooved ball bearing is press-fitted. Don't remove it if not necessary.
- When removing the bearing, be careful not to damage the grounding surface on the valve plate of the body H.

2. Reduction gear

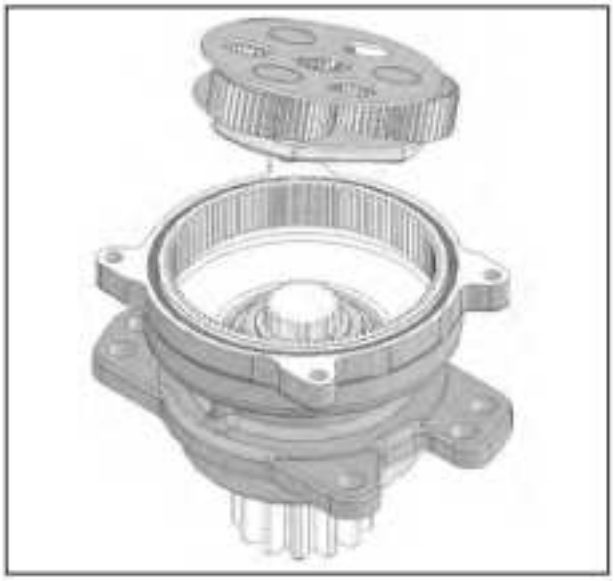
Step 1

Remove the O-ring (114).



Step 2

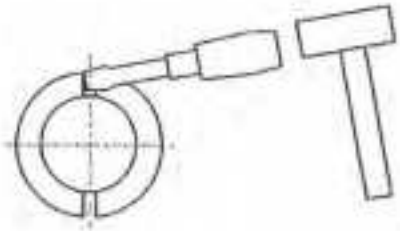
Remove the carrier Ass'y.

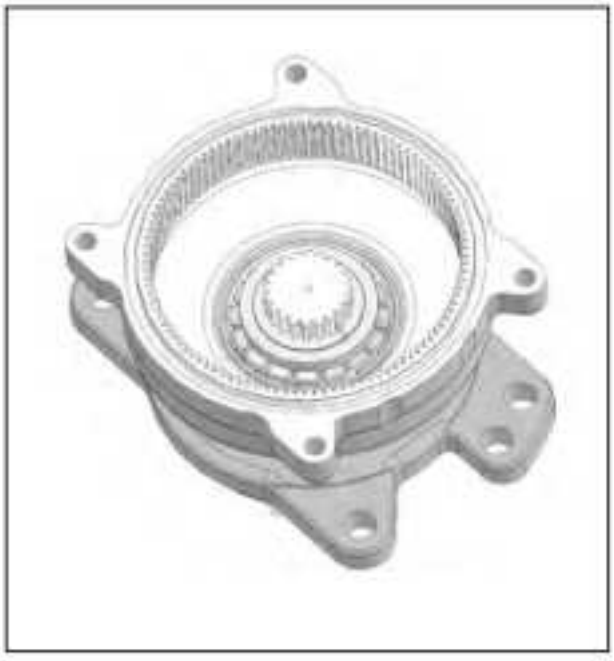


Step 3

Remove the ring (128) and precompression collar (119).

- Put the tip of a slotted screwdriver or the like in the gap of two precompression collars. Tap the screwdriver with a hammer to remove the precompression collars.
- The gap against the bearing has already been adjusted. Don't remove the ring and precompression collars if not necessary.

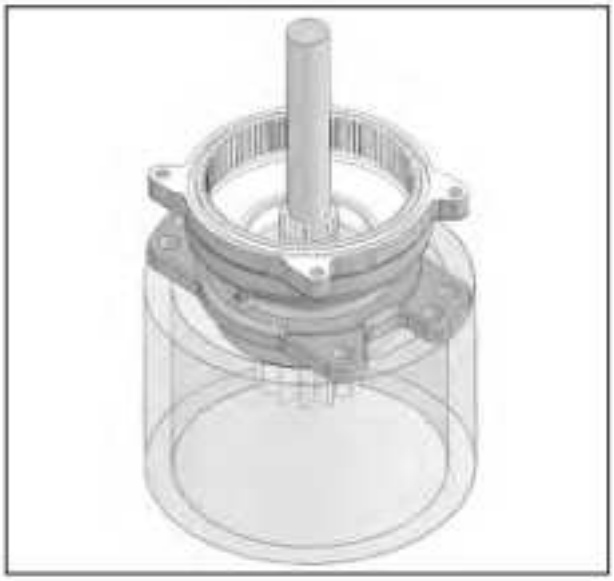




Step 4

Remove the pinion Ass'y.

- To ensure the removal allowance of pinion shaft, place a pad of about 130mm on the flange unit. Push the end surface of pinion shaft (104) with a press or the like to remove the pinion Ass'y.
- The gap against the bearing has already been adjusted. Don't remove the pinion Ass'y if not necessary.



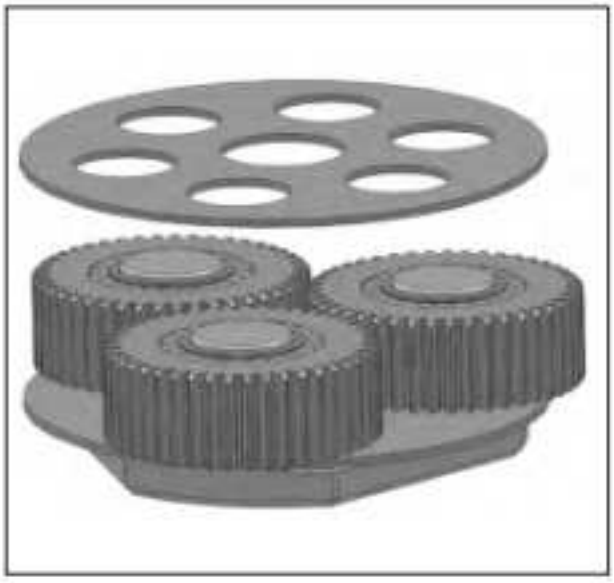
Step 5

Remove the outer rings of bearings (121 & 122) and oil seal (123).

- It is difficult to remove the outer rings of bearings (121 & 122). Don't remove them if not necessary.
- Don't reuse the oil seal.
- The inner ring of bearing (122) comes off of itself.

Step 6

Remove the thrust plate 1 (131) from the carrier Ass'y.

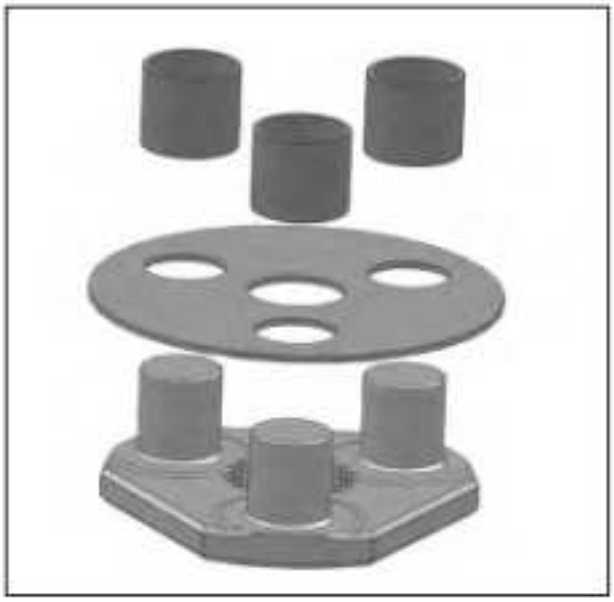


Step 7

Remove the b1 gear (106) and roller 1 (111) from the carrier Ass'y.

Step 8

Remove the inner ring 1 (129) and thrust plate 1 (130) from the carrier Ass'y.



Step 9

Remove the inner ring of bearing (121) and ring seal (113) from the pinion Ass'y.

- The inner ring of bearing (121) is press-fitted. Don't remove it if not necessary.
- Don't reuse the ring seal (113).

Assembly

1. Hydraulic motor

Step 1

Press-fit the deep-grooved ball bearing (217) and spring pin (224) to the body H (201).

Step 2

Mount the check valve (246), spring (248) and plug (247) onto the body H (201). (2 places)

Tools:

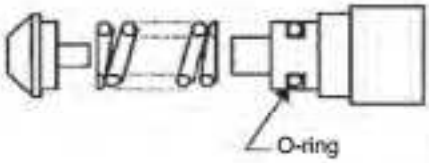
Allen wrench: 8mm

Manual torque wrench

⚠ CAUTION

Thinly coat grease to O-ring (249) and mount the parts as taking care not to catch the seals.

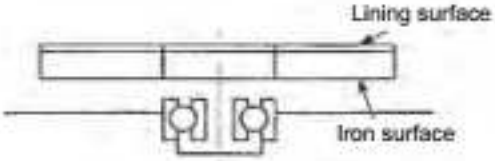
- Plug tightening torque: 58.8±2.9N•m

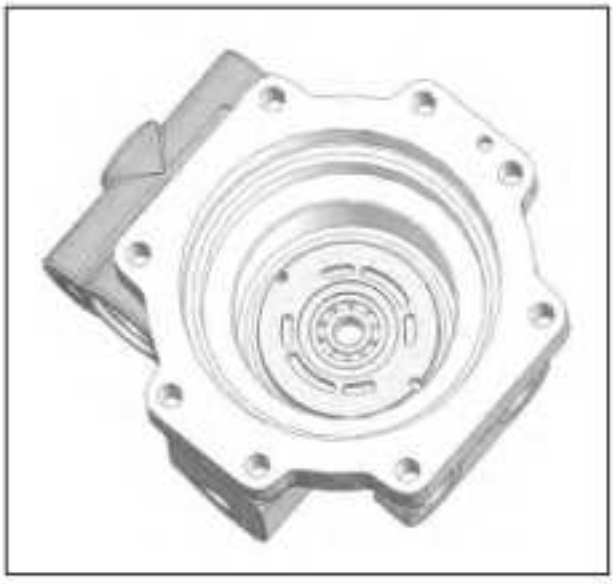


Step 3

Mount the valve plate (205).

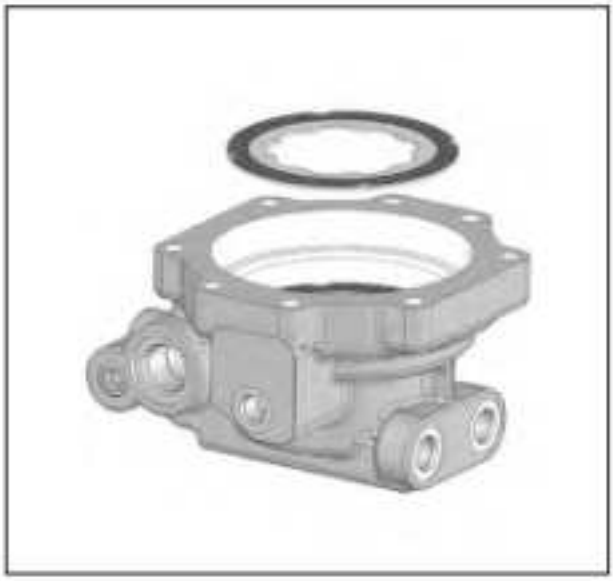
- Mount the valve plate (205) with its iron surface at the lower side.





Step 4

Mount the disk plate (233).



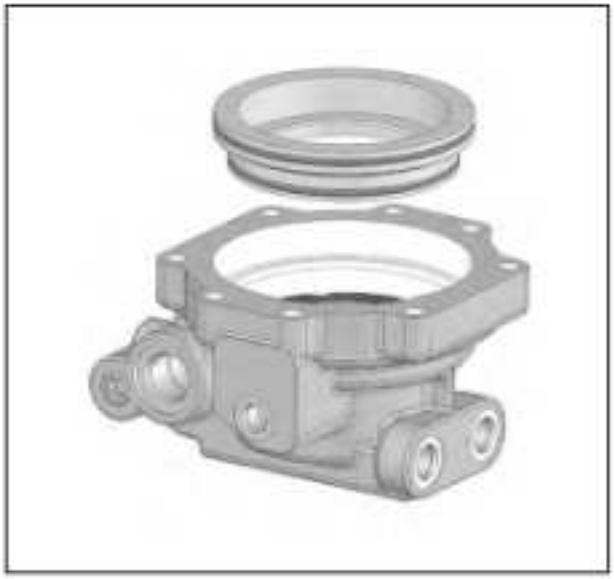
Step 5

Attach O-rings (235 & 236) to the brake piston (231) to make the brake piston Ass'y. Then, mount this Ass'y onto the body H (201).

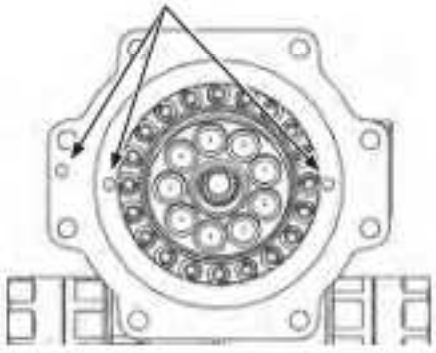
- Mount the brake piston Ass'y onto the plate S on which three parallel pins (225) are mounted. Align the brake piston Ass'y with the pin hole positions shown in the figure below and mount the Ass'y onto the body H (201). Then, tighten the brake piston Ass'y with the socket head bolts gradually to press-fit the piston. At the same time, make sure that the O-rings are not protruded, damaged or stained.
- Before mounting the brake piston Ass'y, coat grease to the surface of plate S to prevent the brake piston Ass'y from falling off.
- After mounting, remove the plate S.

⚠ CAUTION

Thinly coat grease to O-ring and mount the parts as taking care not to catch the seals.



Pin hole position



Step 6

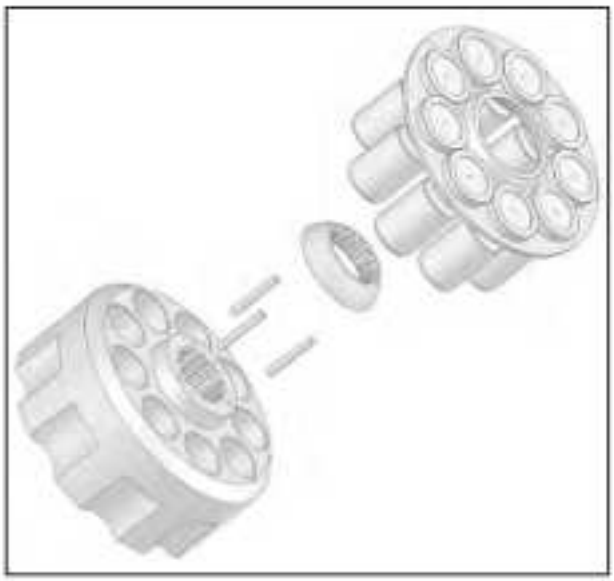
Mount the retainer (212) and spring C (215) onto the cylinder barrel (204) and fix them with the snap ring (221).

Step 7

Mount the piston (206)/shoe (207) Ass'y onto the shoe holder (208) to make the shoe holder Ass'y.

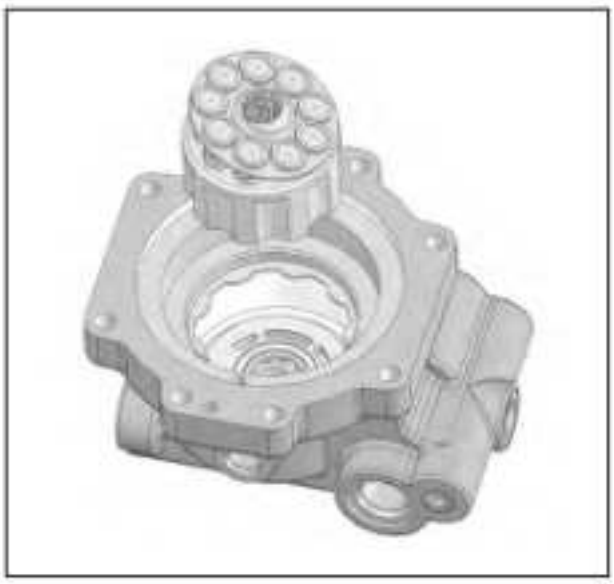
Step 8

Insert three pins (213) into the cylinder barrel (204). Use the shoe holder Ass'y and barrel holder (209) to make the cylinder barrel Ass'y.



Step 9

Insert the cylinder barrel Ass'y into the body H (201) as aligning the Ass'y with the groove on the disk plate.



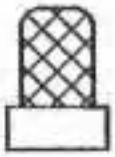
Step 10

Mount the spring Ass'y (232).

Step 11

Mount one filter (214) and three parallel pins (225) onto the plate S (202).

Mounting direction



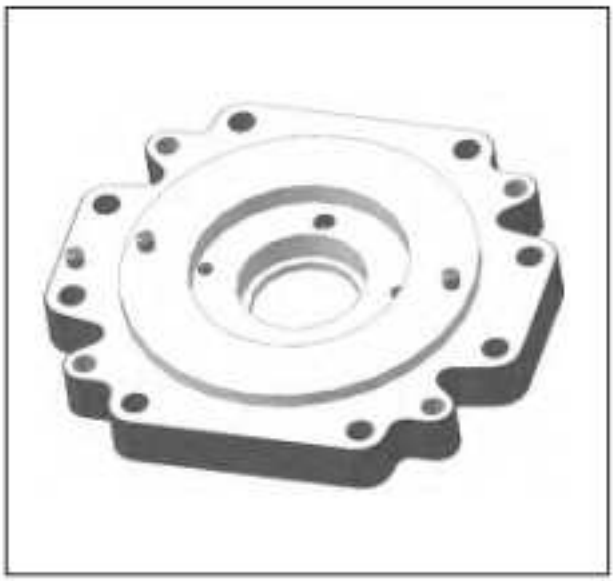
← Inlet of insertion hole

← The innermost of insertion hole (reduction gear side)

- Lightly tap the parallel pin with a plastic hammer to insert it.

⚠ CAUTION

Pay attention to the protrusion amount of the pin.
Protrusion amount: 8mm

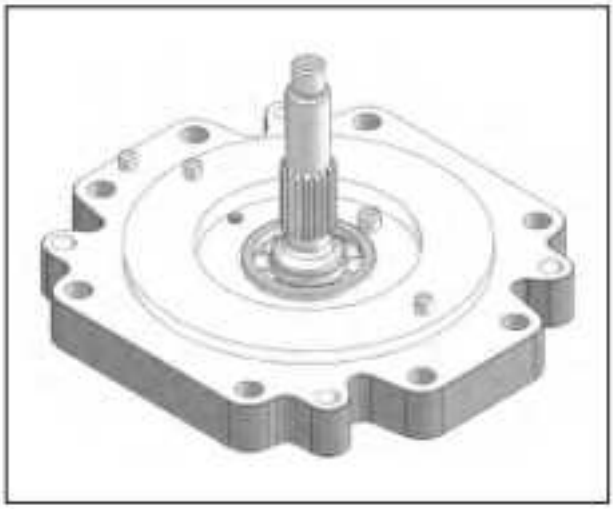


Step 12

Press-fit the bearing (216) into the shaft (203) to make the shaft Ass'y.

Step 13

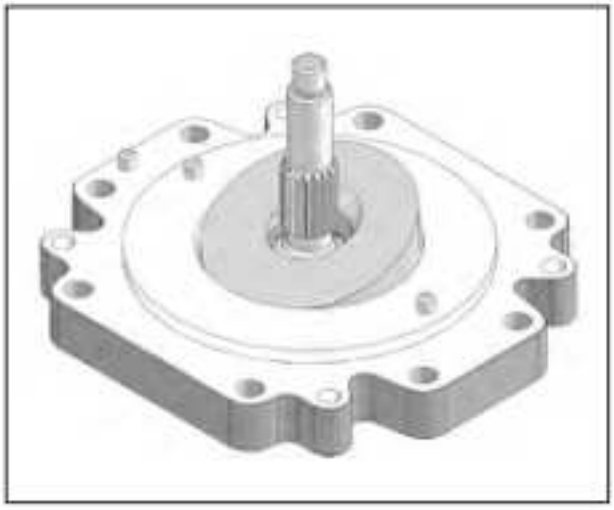
Mount the shaft Ass'y onto the plate S (202).



Step 14

Mount the swash plate (210) onto the plate S (202).

- Before mounting the swash plate, coat grease to the surface of plate S to prevent the swash plate from falling off.

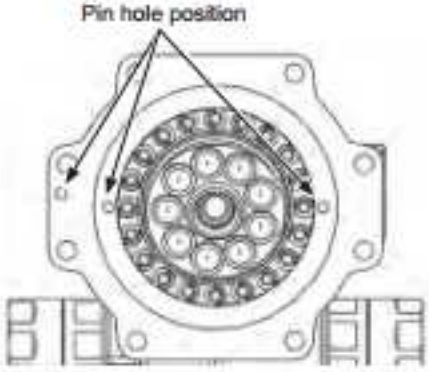


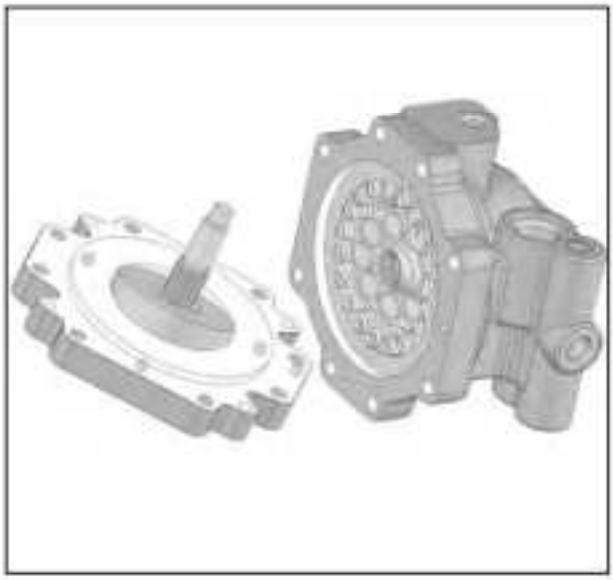
Step 15

Combine the body H (201) with the plate S (202).

- Align the serration on the shaft, which is mounted on the plate S, with the serration on the cylinder barrel Ass'y, which is mounted on the body H. Then, mount the plate S onto the body H.
- Mount the plate S so that the pins on the plate S can be put into the pin holes shown in the figure below.

Pin hole position





Step 16

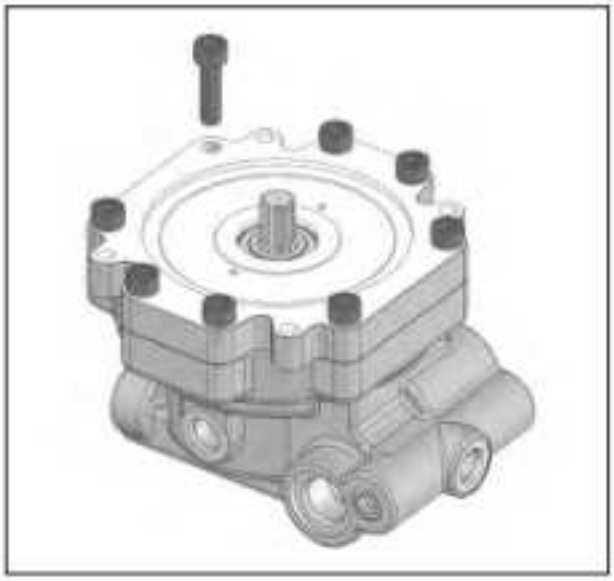
Tighten the plate S with the socket head bolts (223).

Tools:

Allen wrench: 8mm

Manual torque wrench

Tightening torque: 58.8 ±2.9N•m



Step 17

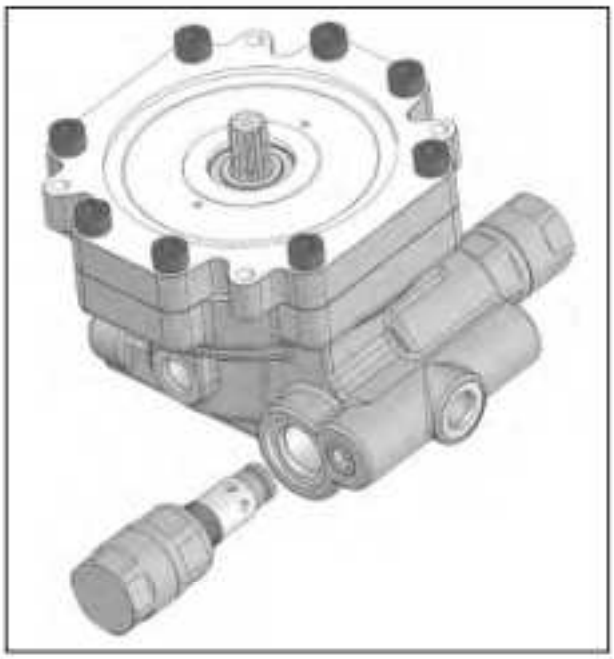
Mount the relief valve Ass'y.

Tools:

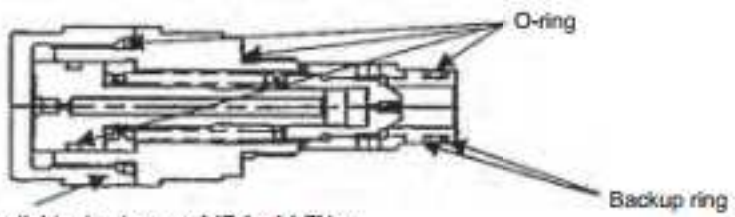
Wrench: 36mm

Manual torque wrench

Tightening torque: 147.1 ±14.7N•m



When disassembling, replace the O-rings and backup rings shown in the figure below with new ones and tighten the cap by the following torque.



Cap tightening torque: 147.1 ±14.7N•m

2. Reduction gear

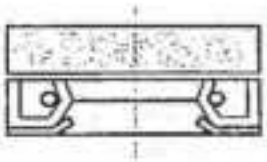
Step 1

Press-fit the oil seal (123) to the main unit (101).

⚠ CAUTION

Pay attention to the oil seal mounting direction. Place a patch and press-fit the oil seal not to be inclined.

- Outer diameter of patch: ø77.5

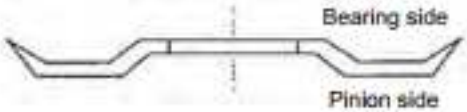


Step 2

Attach the ring seal (113) to the pinion shaft (104).

⚠ CAUTION

Mounting direction of ring seal

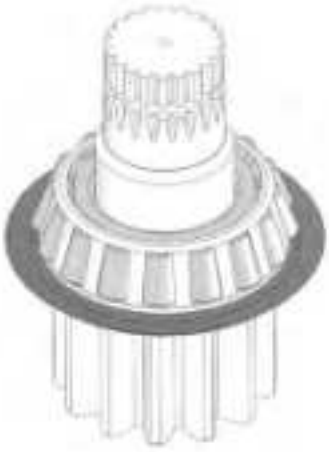


Step 3

Press-fit the inner ring of bearing (121) to the pinion shaft (104) to make the pinion Ass'y.

⚠ CAUTION

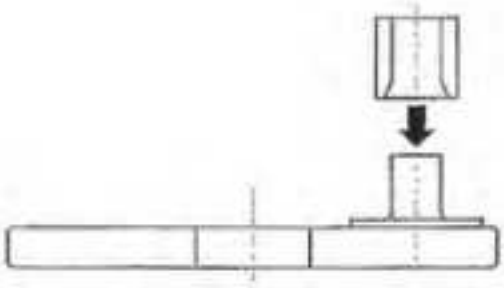
After press-fitting, coat grease to the roller surface of bearing and roll the roller to pervade the grease on the whole roller.

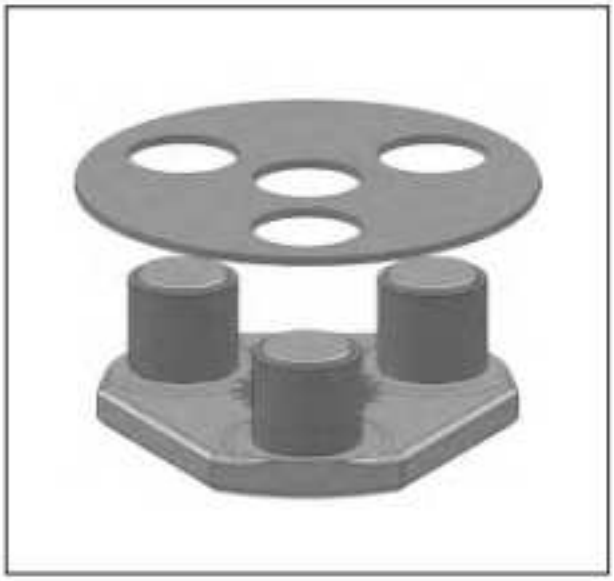


Step 4

Mount the inner ring 1 (129) and thrust plate 1 (130) onto the pin of carrier (102) in this order. (4 places)

- Mounting direction of inner ring 1
  Mount the inner ring 1 with its chamfered surface at the bottom.

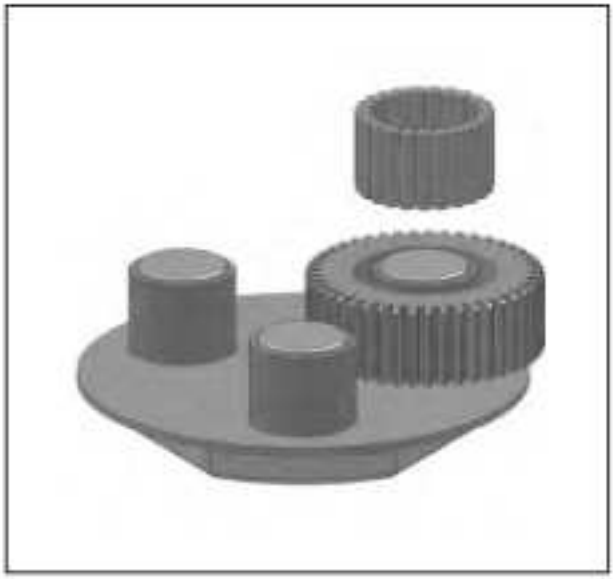




Step 5

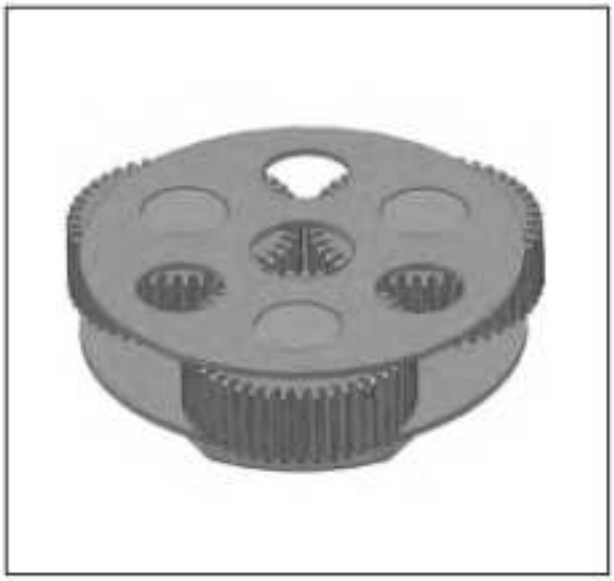
Mount the b1 gear (106) and roller 1 (111) onto the pin of carrier 1 in this order.

- b1 gear (106): 3 pcs.
- Roller (111): 23 pcs./1 pc. of b1 gear



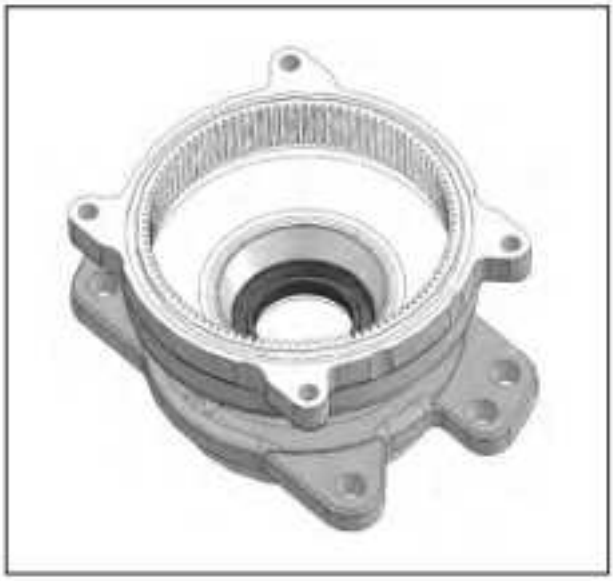
Step 6

Mount the thrust plate 1 (131) to make the carrier Ass'y.



Step 7

Press-fit the outer ring of bearing (122) into the main unit (101).



Step 8

Press-fit the outer ring of bearing (121) into the main unit (101).

Step 9

Apply grease to the portion where the bearing (121) will be mounted on the main unit (101).

⚠ CAUTION

Grease amount: Approx. 80% of space

Step 10

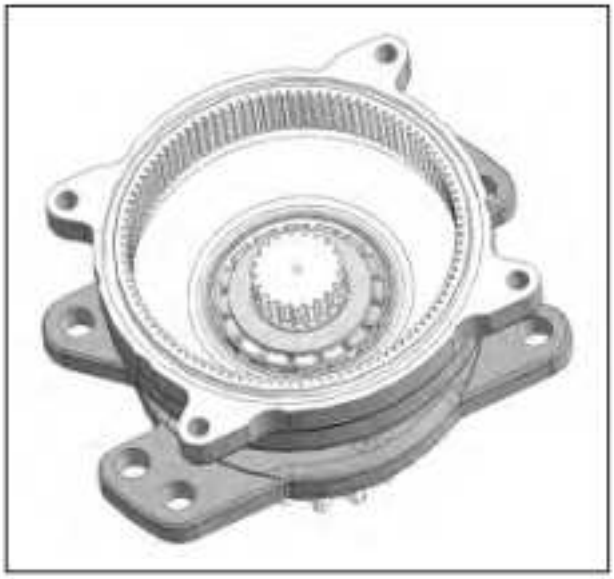
Insert the pinion shaft (104) into the main unit (101).

⚠ CAUTION

Be careful not to damage the lip of oil seal.

Step 11

Reverse the main unit (101) and press-fit the inner ring of bearing (122).

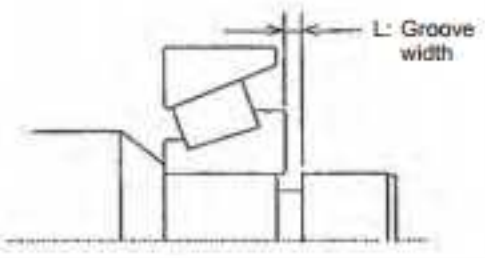


Step 12

Mount the two precompression collars (119).

⚠ CAUTION

The thickness of precompression collar must be 0 to +0.05mm against the really measured width "L" between the end surface of bearing and the groove end surface of pinion shaft.

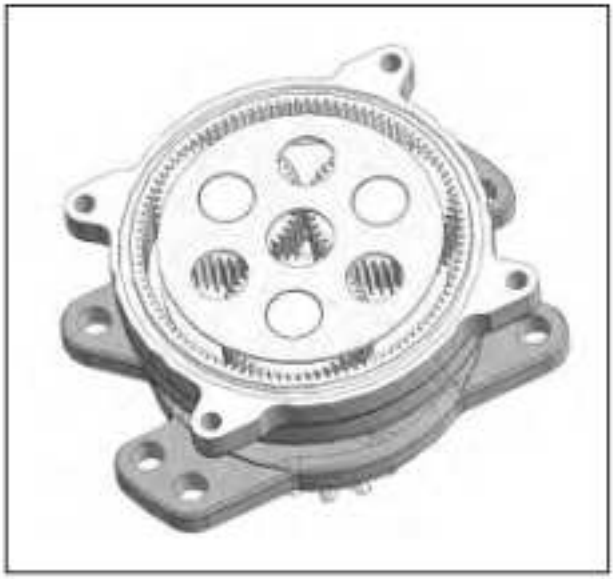


Step 13

Mount the fixing ring (128).

Step 14

Align the carrier Ass'y with the spline of pinion shaft (104) and mount this Ass'y.



Step 15

Mount the O-ring (114) onto the main unit (101).

Step 16

Pour the hydraulic oil, which should be used in a real machine, into the main unit (101).

Hydraulic oil

ISO VG46 or SAE-10W-CD or its equivalent

Oil amount

Up to 2 - 3mm below the upper end surface of thrust plate 2

⚠ CAUTION

If the hydraulic oil adheres to the mating surface, wipe off the oil.

Step 17

Mount the hydraulic motor onto the main unit and tighten it with the socket head bolt (124).

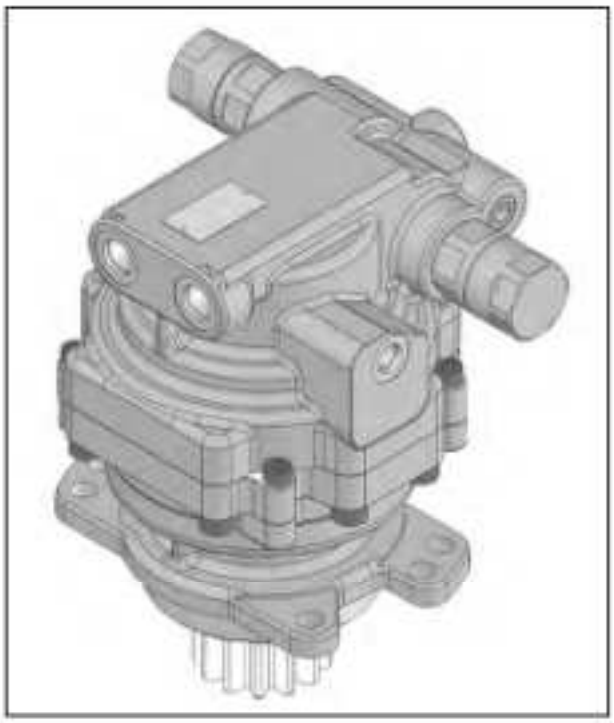
Tools:

Allen wrench: 6mm

Manual torque wrench

Tightening torque: 29.4 ±2.9N•m

- Insert the hydraulic motor's shaft to be engaged with the S2 gear.
- Apply the screw lock (Three-Bond #1305) to the socket head bolt.



1. Outline

Remote control valve adopts the reducing valve system. Four reducing valves, which control the secondary pressure, are built in one casing. The pressure is output by adjusting the tilt of the operation unit.

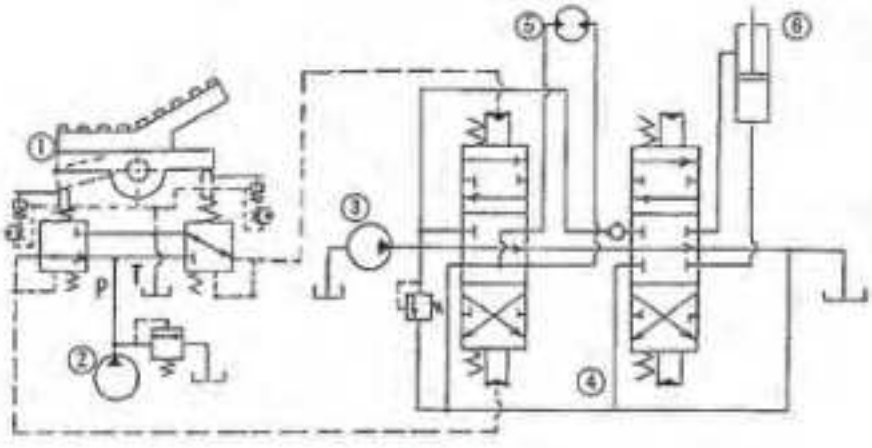
2. Specifications

Primary pressure	Maximum pressure 6.9 MPa
Secondary pressure	0.64 – 2.45 (Maximum control pressure) MPa
Allowable back pressure	Maximum 0.29 MPa
Rated flow rate	10 L/min
Operation angle	12.4°(Difference between right and left should be 0.4° or less at neutral position or stroke end)
Operation torque	Valve 2.62 – 8.61 N•m
	Damper 12.9 N•m at 0.0275 m/s
Mass	3.9 kg
Piping	To obtain good responsiveness, a pipe with inner diameter of ø8 and length of about 3m is necessary. The return oil must be directly returned to the tank not to be influenced by back pressure.

3. Operation

In the remote control valve with the built-in damper (hereinafter, remote control valve with damper), the damping function is incorporated in the valve's main unit to prevent hunting (lever hunting) of the man-machine system.

The operation of the remote control valve with damper is classified into two sections, "(1) reducing valve unit" and "(2) damping mechanism of operation unit", and it will be explained according to the hydraulic circuit diagram shown below, the assembly cross-sectional view and the damping operation diagram. The diagram below shows a typical example to use the remote control valve.



Hydraulic circuit diagram

1	Remote control valve	4	Control valve
2	Pilot pump	5	Hydraulic motor
3	Main pump	6	Hydraulic cylinder

(1) Reducing valve unit

[1] In neutral status

The spool (301) is pushed up by the reset spring (355) via the spring seat (311) to be at the neutral position shown on the assembly cross-sectional view.

Consequently the output port is connected to only Port T due to the spool change function. The pressure of Output Ports 1 & 2 is the same as Port T.

[2] When the remote control valve operation unit is tilted from the neutral status

When the cam (420) is turned clockwise on the assembly sectional-view, the push rod (214) at the Port 1 side is pushed down. The spool at the Port 1 side is moved down via the spring seat, the secondary pressure setting spring (324), shim (217) and washer (313). Port P is connected to Port 1 and the oil supplied by the pilot pump flows into Port 1 to generate pressure.

When the pressure at Port 1 rises to be equivalent to the secondary pressure setting spring force, which is set by tilting the operation unit, the hydraulic force applied to the spool is balanced with the secondary pressure setting spring force. So, the output pressure of Port 1 is kept at a fixed value. The spool at the Port 2 side is kept at neutral position. The oil from the control valve is discharged via Port T.

In some type of remote control valve, when the operation unit is near the maximum angle, the push rod contacts the spool top directly to push in the spool forcedly. So, Port P makes contact with the output port to have the same pressure.

(2) Damping mechanism of operation unit

[1] In neutral status

The push rod is pushed up by the damping spring (336) via the piston (224) to be at the position shown on the assembly cross-sectional view.

[2] When the operation unit is tilted from the neutral status (Refer to Fig. 1 of "[4] Damping operation diagram".)

When the cam is turned clockwise on the assembly cross-sectional view, the push rod at the Port 1 side is pushed down and the piston is moved down.

At the same time, the oil in the damping piston chamber is discharged from the throttle hole of piston and pressure is generated. This pressure generates the damping force.

The push rod at the Port 2 side is moved up by the damping spring via the piston.

At the same time, the oil of the tank chamber is absorbed into the damping piston chamber through the ball check unit (3 places), which consists of steel balls (225). The oil outside the piston chamber is discharged through the passage, which connects the casing's top edge to Port T.

[3] When reversing the operation unit from the fully tilted status (Refer to Fig. 2 of "[4] Damping operation diagram".)

When the cam is turned counterclockwise after fully turning it clockwise on the assembly cross-sectional view, the push rod at the Port 2 side is pushed down and the piston is moved down.

At the same time, as mentioned above, the oil in the damping piston chamber is discharged through the throttle hole of the piston and pressure is generated. This pressure generates the damping force.

The push rod at the Port 1 side is moved up by the reset spring (335) and the damping spring.

At the same time, the oil of the tank chamber is absorbed into the damping piston chamber through the ball check unit (3 places), which consists of steel balls. The oil outside the piston chamber is discharged through the passage, which connects the casing's top edge to Tank Port.

The damping force works by tilting the operation unit from the neutral position to the fully tilted position and vice versa.

[4] Damping operation diagram

1) When moving the lever from the neutral status to the stroke end

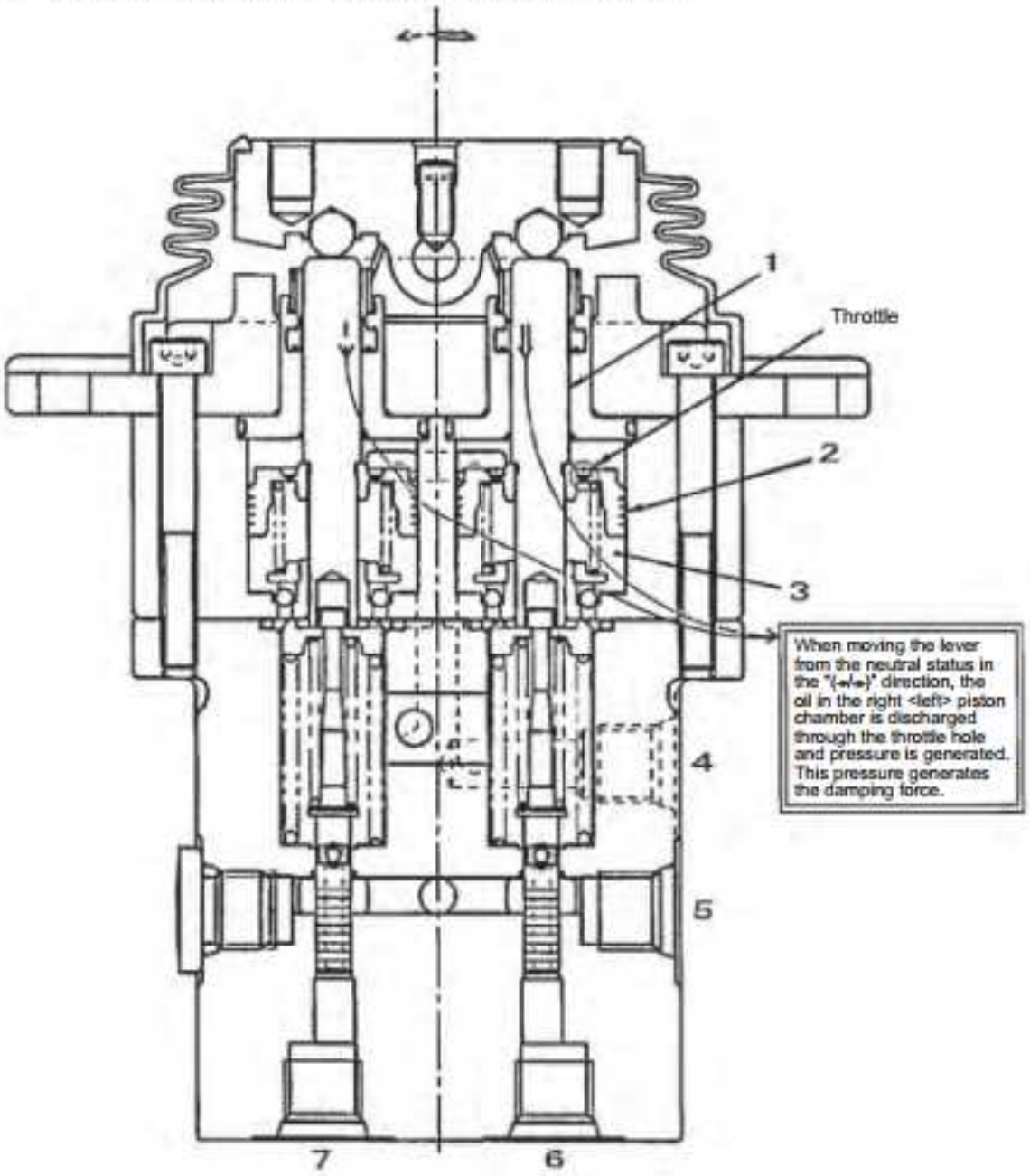


Fig. 1

1	Push rod	5	Port P
2	Piston	6	Port 1 (3)
3	Piston chamber	7	Port 2 (4)
4	Port T		

2) Operation when the lever is tilted fully and when reversing the lever from the fully tilted status

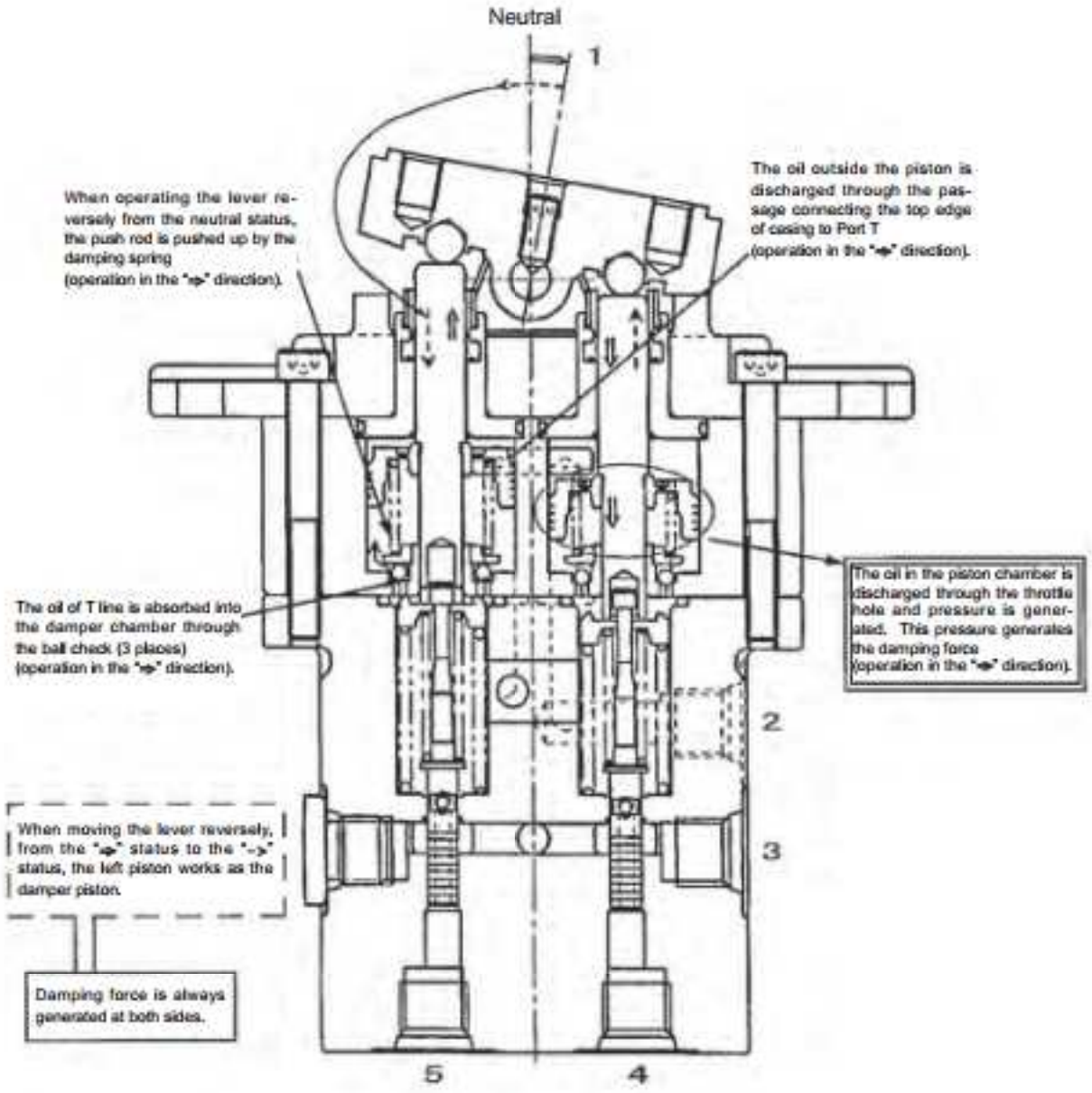


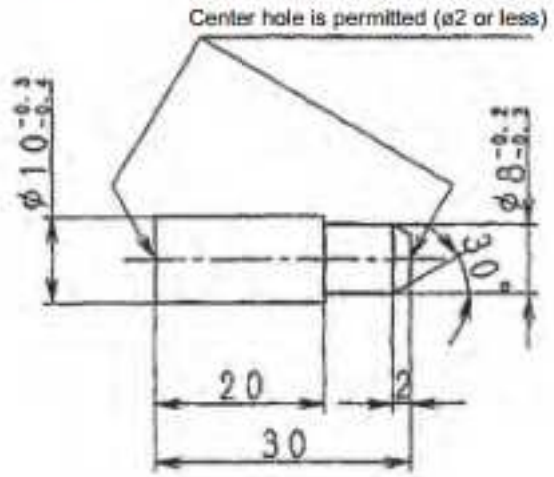
Fig. 2

1	Full stroke
2	Port T
3	Port P
4	Port 1 (3)
5	Port 2 (4)

4. Maintenance

(1) Special jig for disassembly/assembly

[1] Special jig 1 (for removing bush)



(2) Disassembly

1) Preparation

1. Prepare a work table meeting the following conditions.
   - It has a space enough to put the parts;
   - It is solid and stable;
   - It does not allow the parts to drop or move during the work.
2. Prepare tools and materials.

※ 2) General cautions for work

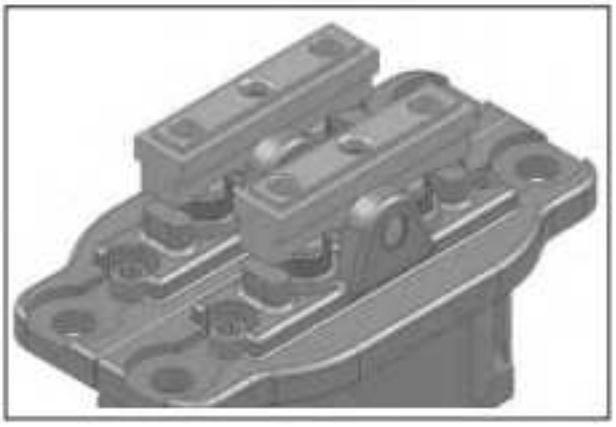
1. The parts are precisely manufactured. Handle them very carefully not to hit them each other or drop them.
2. If you tap or twist the parts, which cannot be removed easily, forcedly during the work, they are burred or broken. So, the parts cannot be mounted or the oil leak or the lowered performance is caused. Carry out the work patiently with care.
3. If the unit is left in the disassembled status or if disassembling is stopped midway, the parts may be rusted by moisture or dust. If you are compelled to stop the work midway, be careful to prevent rust and dust.

3) Disassembly

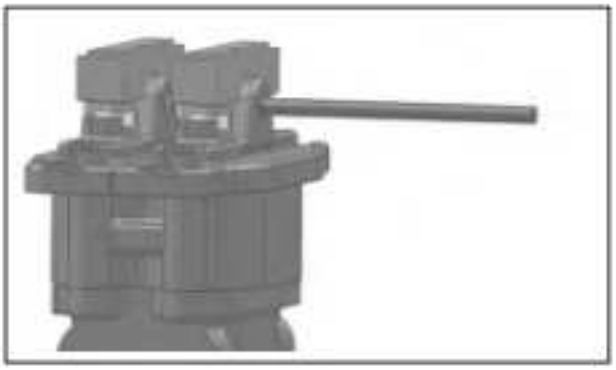
1. Wash the remote control valve with white kerosene.
   - Apply a blind plug to each port.
2. Using an impact board, fix the remote control valve on a vise.
   Separate the bellows (501) from the cover (201) and remove it upward.

3. Apply an Allen wrench to the socket head setscrew (472) and loosen it.

⚠ Loctite #241 is applied to the setscrew and the loosening torque is large. Be careful when loosening.



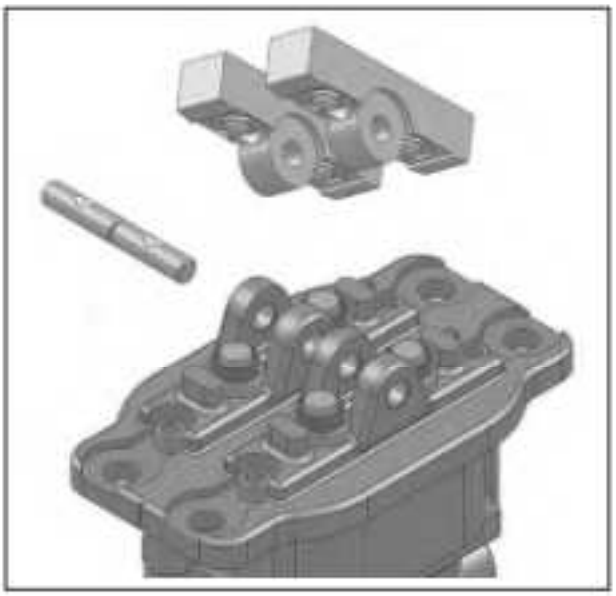
4. Put a round bar (ø7 or less) on one edge of cam shaft (413). Lightly tap the round bar with a hammer to remove the cam shaft.



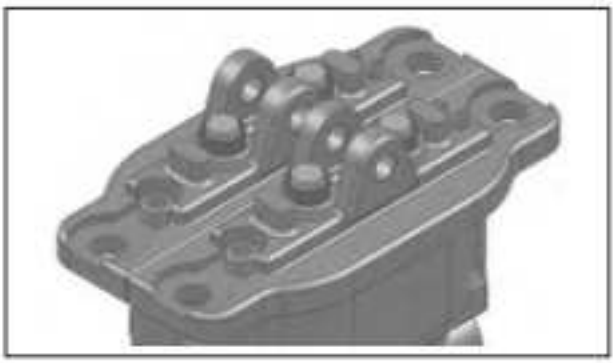
5. Remove the cam (420) with steel ball (471) as an Ass'y.

※ Record the positional relation of cam and cover (201).

⚠ When removing the cam, the push rod (214) sometimes jumps out. Be careful.



6. Apply an Allen wrench to the socket head bolt (271). Loosen and remove the socket head bolt.

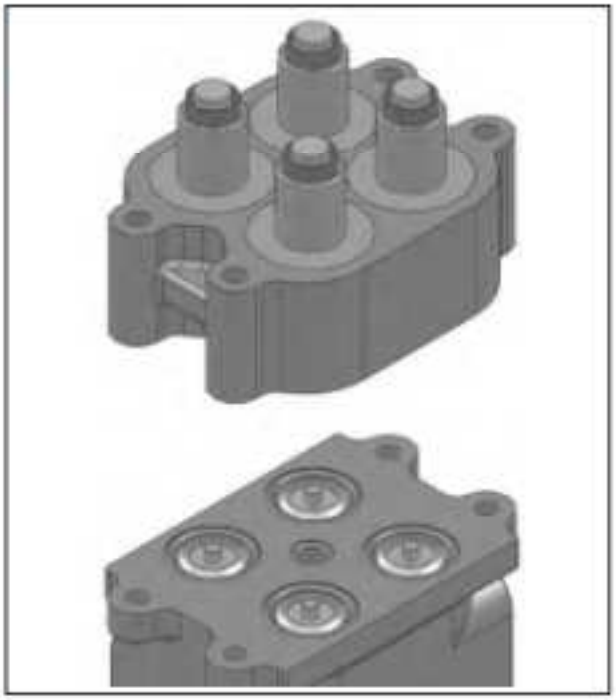


7. Remove the cover (201).

※ Record the positional relation of cover and casing (102).

⚠ When removing the cover, the push rod (214) and plug (202) sometimes jump out due to damping spring (336). Be careful. (Plug is put in the casing by the slide resistance of O-ring (212) only.)

8. Remove the casing upper Ass'y and fix it on the vise.
   - Record the positional relation of casing (damper) (102) and casing (101).

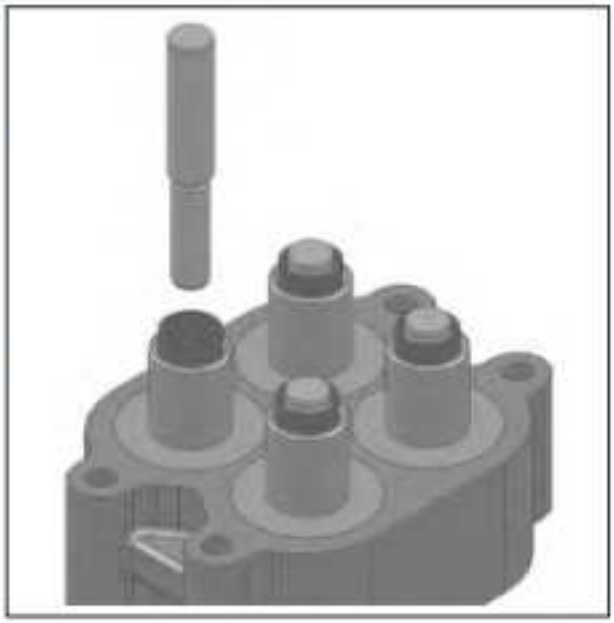


9. Remove the push rod (214) from the plug (202).

※ Record the positional relation of plug and push rod.

※ Be careful not to damage the push rod surface.

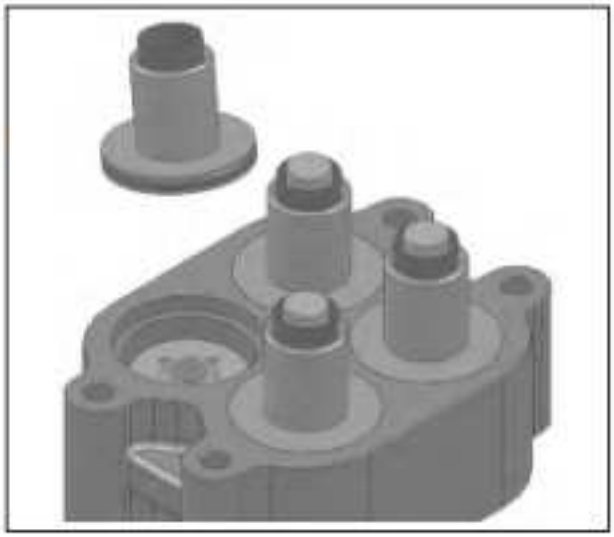
⚠ When removing the push rod, the plug sometimes jumps out. Be careful.



10. Remove the plug with grease cup (203), packing (210) and O-ring (212).

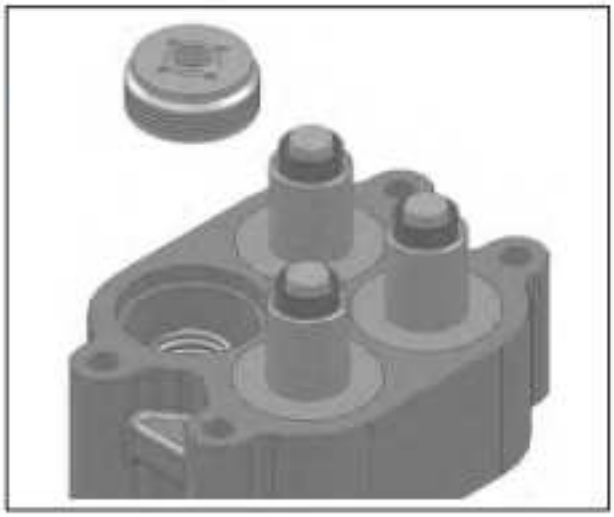
※ Record the positional relation between plug and casing.

⚠ When removing the plug, the piston sometimes jumps out due to damping spring. Be careful.



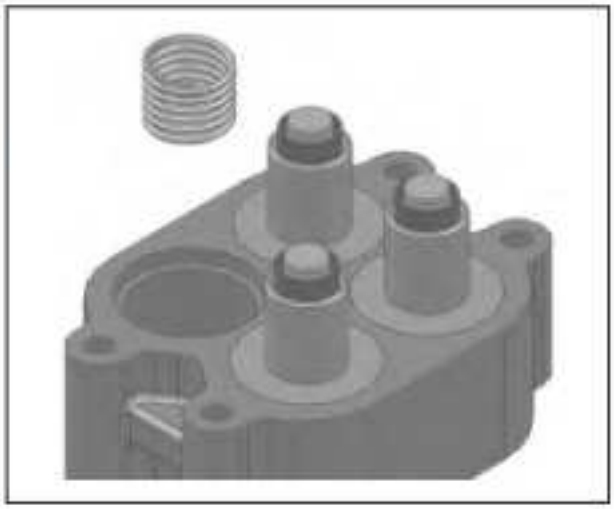
11. Remove the piston (224).

※ Record the positional relation of piston and casing hole.



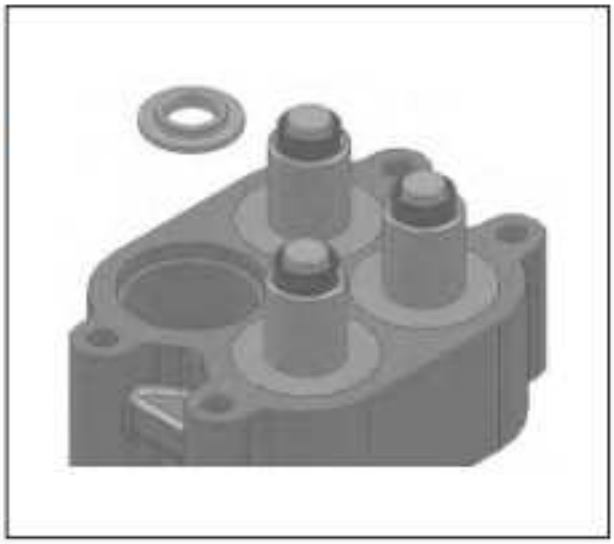
12. Take out the damping spring (336) from the casing.

※ Record the positional relation of damping spring and casing hole.



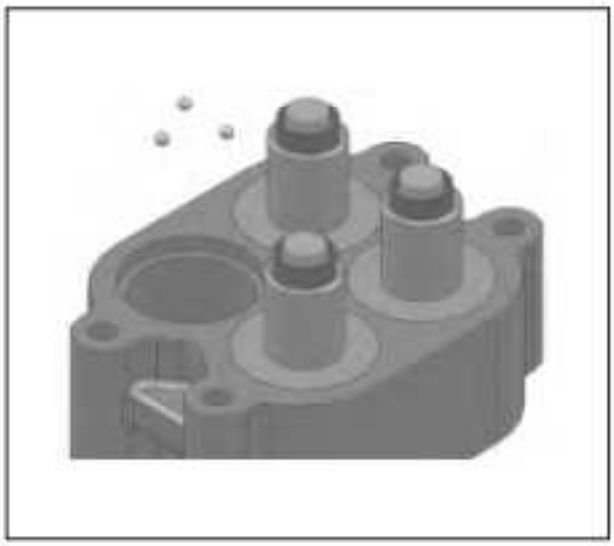
13. Take out the spring seat (218) from the casing.

※ Record the positional relation of spring seat and casing hole.



14. Using a magnet or others, take out the steel ball (255).

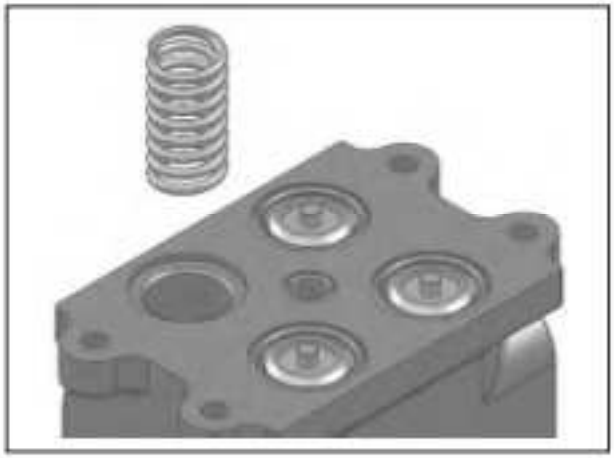
※ Be careful not to lose the steel ball.



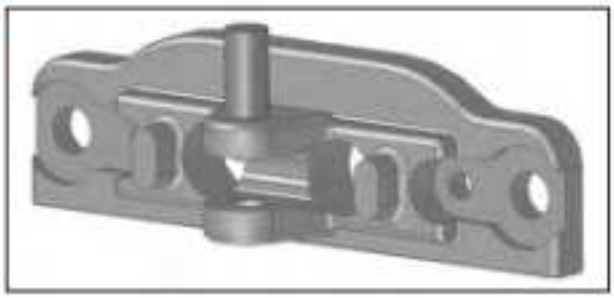
15. Fix the lower casing Ass'y on the vise. Remove the O-rings (211 & 213) from the casing (101).

16. Remove the reducing valve Ass'y and the reset spring (335) from the casing.

※ Record the positional relation against the casing hole.



17. Place the cover (201) transversely on a flat table. Put the special tool 1 to the bush (414). Lightly tap the tool with a hammer to remove the bush.



18. Disassemble the reducing valve Ass'y as mentioned below: Push in the spring seat (311). As bending the secondary pressure setting spring (324), move the spring seat sidewise and remove the reducing valve Ass'y from the spool (301) through the larger hole.

※ Be careful not to damage the spool surface.

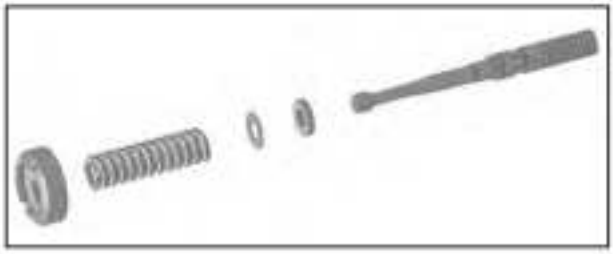
※ Don't move down the spring seat by 4mm or more.

※ Regard the above-mentioned parts as an Ass'y until assembling.

19. Separate the spool (301), spring seat (311), secondary pressure setting spring (324), shim (217) and washer (313).

※ Regard these parts as an Ass'y until assembling.

※ Washer 2 should be used for the preset adjustment of secondary pressure setting spring. The thickness of washer 2 is changed for each spool Ass'y. Sometimes washer 2 is not used.



20. Remove the grease cup (203) from the plug (202).

21. Remove the packing (210) from the plug (202).To remove the packing (210), use a small slotted screwdriver or the like.

※ Be careful not to damage the plug inside.

22. Remove the O-ring (212) from the plug.

23. Wash the parts.
    - Wash each part in the rough-washing container which contains white kerosene. (Rough washing)

※ Before washing, dip the parts in white kerosene well until dust or oil floats. If you wash the stained parts in the oil first, they may be damaged.

※ If white kerosene is dirty, the parts will be damaged to affect the performance adversely after reassembling. Control the contamination of white kerosene well.

※ Put the parts in the finish-washing container which contains white kerosene. As turning slowly, wash not only the outside but also the inside of each part well. (Finish washing) Wipe off white kerosene from each part with a clean waste cloth.

※ If you dry the washed parts with compressed air, the parts will be damaged or rusted by dust or water in the air. Don't dry the parts with compressed air.

24. Anticorrosive treatment
    Apply anticorrosive to the parts.

※ If you leave any part as it is after washing, it will be rusted and will not operate properly after reassembling.

(3) Assembly

1) Preparation

1. Prepare a work table, tools and materials in the same way as disassembly.

※ 2) General cautions for work

1. Observe "General cautions for work" of "Disassembly".
2. Before assembling, remove metal pieces and foreign matters from all parts. In addition, make sure that each part is not burred or dented. If any part is burred or dented, remove the burr or dent with an oilstone.
3. As a rule, O-ring and packing must be replaced with new ones.
4. When attaching O-ring and packing, be careful not to damage them.
   (To smooth O-ring and packing, coat grease to them a little.)
5. When mounting the parts, using grease is allowed to prevent the parts from falling off.
6. Tighten bolts by the torque mentioned on the assembly cross-sectional view.
7. After assembly is completed, attach plugs to all ports to prevent dust.

3) Assembly

1. Attach the washer (313), shim (217), secondary pressure setting spring (324) and spring seat (311) to the spool (301) in this order.

※ The washer should be used for the preset adjustment of secondary pressure setting spring. The thickness of the washer is changed for each spool Ass'y. Sometimes the washer is not used.

2. Pass the spool (301) through the larger hole of the spring seat (311). Push in the spring seat. As bending the secondary pressure setting spring, move the spring seat sidewise to mount the spring.

※ Be careful not to damage the spool surface.

※ Don't move down the spring seat by 4mm or more.

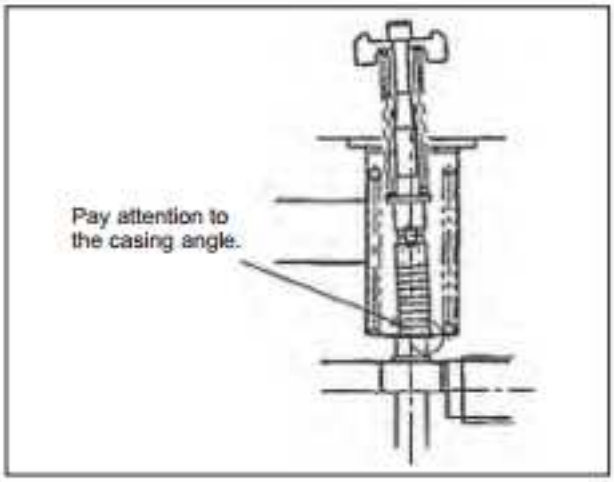
3. Fix the casing (101) onto a vise. Attach the reset spring (335) to the casing (101).

※ Attach the spring to the same position as before disassembling.

4. Attach the reducing valve sub Ass'y, which has been completed as the sub Ass'y in Step 1 to 2, to the casing (101).

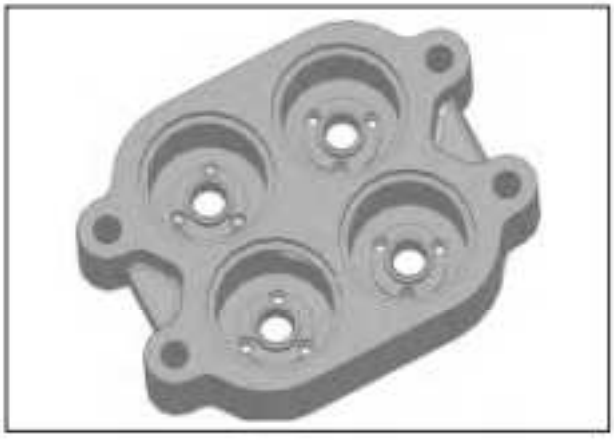
※ Attach the sub Ass'y to the same position as before disassembling.

※ When mounting the reducing valve sub Ass'y, do not hit the spool lower edge against the casing's corner violently.



5. Attach the O-rings (211 & 213) to the casing (101).

6. Fix the upper casing (102) onto a vise. Attach the steel ball (225) to the casing.



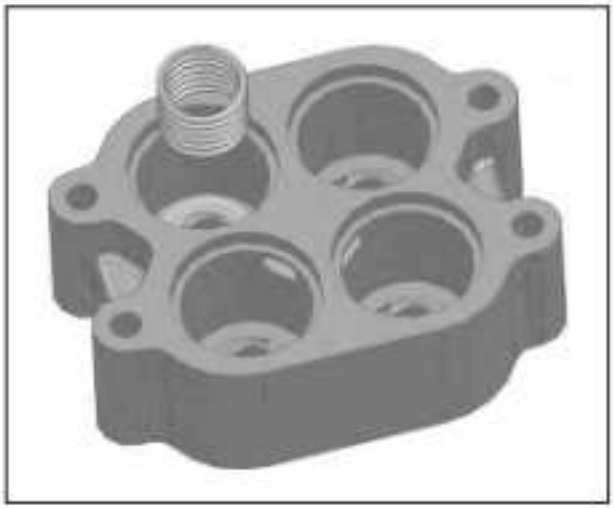
7. Using tweezers or the like, attach the spring seat (218) to the casing (102).

※ Attach the spring seat to the same position as before disassembling.

8. Attach the damping spring (336) to the casing.

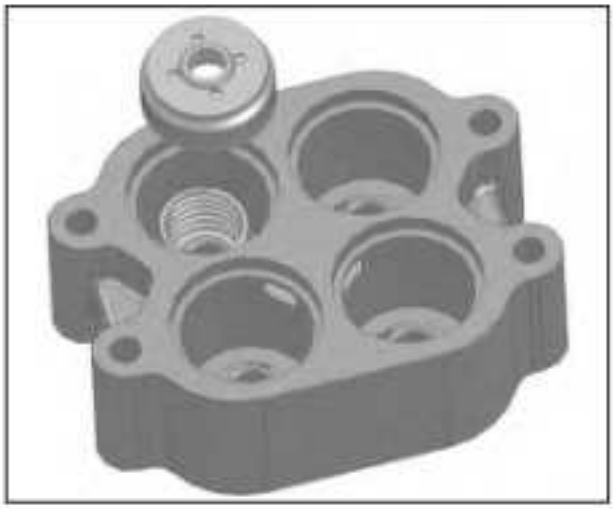
※ Attach the damping spring to the same position as before disassembling.

※ The damping spring must not run on the spring seat (218).



9. Attach the O-ring (212) to the piston (224).

※ Attach the O-ring to the same position as before disassembling.

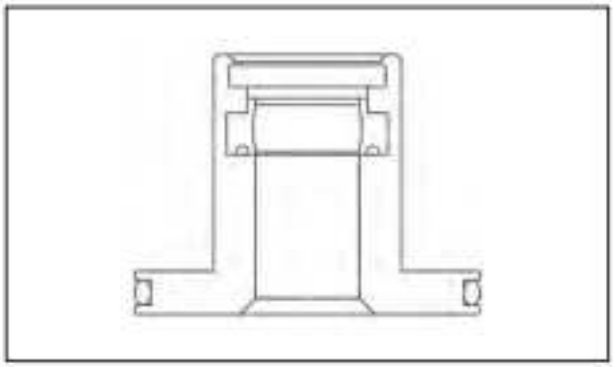


10. Attach the O-ring (212) to the plug (202).

11. Attach the packing (210) to the plug.

※ When attaching the packing, be careful for its direction. (Refer to the figure below.)

※ Before attaching the packing, thinly coat grease to it.



12. Attach the grease cup (203) to the plug.

13. Attach the push rod (214) to the plug.

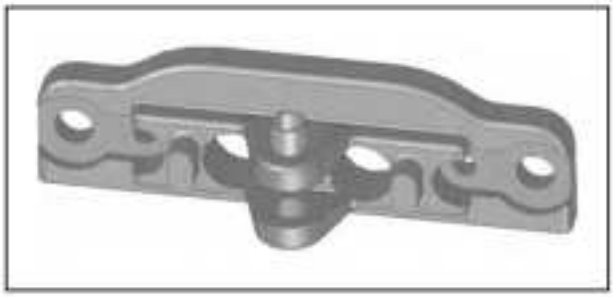
※ Before attaching the push rod, coat the hydraulic oil to its surface.

※ Do not insert the push rod strongly, or the lip of the packing may be damaged.

14. Attach the push rod sub Ass'y, which has been completed as the sub Ass'y in Step 10 to 13, to the casing.

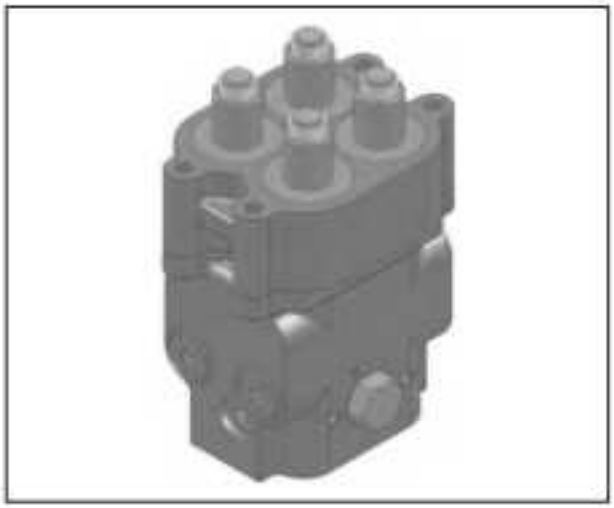
15. Place the cover (201) transversely on a flat table. Using the special jig 1, press the bush (414). Using a hammer, lightly tap the jig to press-fit the bush.

※ Be careful not to protrude the bush edge from the cover inside.



16. Fix the lower cover Ass'y, which has been completed as the Ass'y in Step 1 to 5, onto a vise. Mount the upper cover Ass'y, which has been completed as the Ass'y in Step 6 to 14, onto the lower cover Ass'y.

※ Mount the upper cover Ass'y to the same position as before disassembling.



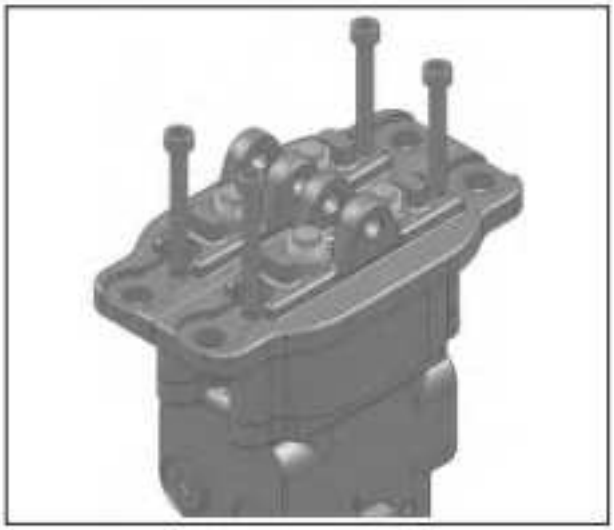
17. Attach the cover to the casing.

※ Attach the cover to the same position as before disassembling.

※ The cover moves up due to the damping spring (336). Be careful.

18. Tighten the socket head bolt (271) by the specified torque.

※ Be careful to keep the cover horizontal.



19. Attach the cam (420) to the cover (201).

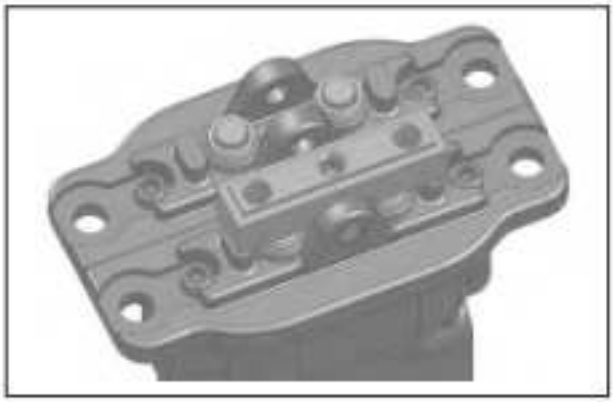
※ Attach the cam to the same position as before disassembling.

20. As pressing the cam (420), insert the cam shaft (413) from the outside.

Coat grease to the cam shaft and shaft unit.

21. Apply Loctite #241 or its equivalent to the surface of the socket head setscrew (472).

22. Tighten the socket head setscrew (472) by the specified torque.



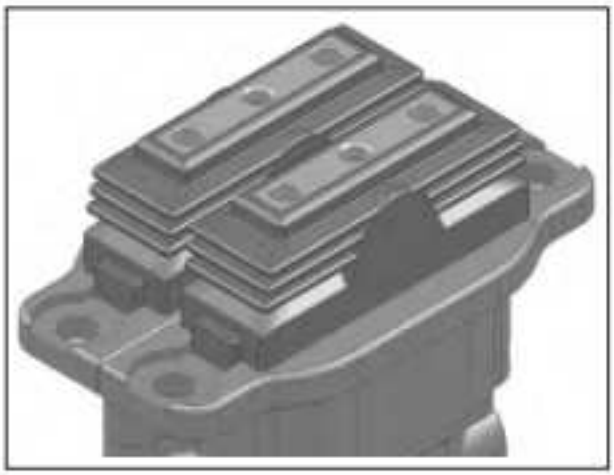
23. Tilt the cam (420) and coat grease to the top of push rod (214). Pour grease into the grease cup (203) of plug (202).

※ Coat and pour grease with a soft spatular thing not to damage the surface of push rod and plug.

24. Fit the upper edge of bellows (501) to the cam (420). Then, fit the lower edge to the groove of cover (201).

※ Before fitting the lower edge of bellows to the groove of cover, spray the anticorrosive oil to the internal parts of bellows.

※ If bellows is not securely fitted to the groove or if it is mounted under the twisted status, the dustproof and waterproof characteristics will be deteriorated. Be careful.



5. Trouble shooting

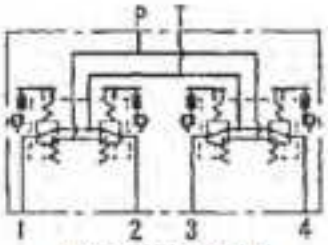
It is not easy to locate the trouble place. The following table describes the probable problems. Repair is difficult. Refer to the probable causes and remedial measures in the table.

The following table describes general phenomena, probable causes and remedial measures. But, in many cases, the machine trouble is caused not by only one defective part but by the relation between one part and others. You should bear in mind that other remedial measures except those in the table are sometimes needed.

The following table does not show all of probable causes and remedial measures. Under certain circumstances, the person in charge of repair must not only obey the instructions of the table but also examine the troubles and causes independently.

Phenomenon	Cause	Remedial measure
Secondary pressure does not rise.	1. Primary pressure is not sufficient. 2. The secondary pressure setting spring (324) is fatigued. 3. The gap between spool and casing is abnormally large. 4. The operation unit has play.	1. Ensure the primary pressure. 2. Replace the secondary pressure setting spring with a new one. 3. Replace the spool Ass'y and casing Ass'y with new ones. 4. Perform disassembling/assembling and replace the parts of operation unit with new ones.
Secondary pressure is not stable.	1. Sliding parts are scratched. 2. Tank line pressure is changed. 3. Air is mixed in the pipes.	1. Correct the scratched parts. 2. Return the oil to the oil tank directly. 3. Exhaust air by several operations.
Secondary pressure is high.	1. Tank line pressure is high. 2. Sliding parts are scratched.	1. Return the oil to the oil tank directly. 2. Correct the scratched parts.
Damping is not effective.	1. Air is accumulated in the piston chamber. 2. Sliding parts are scratched. 3. Damping spring (336) is fatigued. 4. The gap between damping spring (224) and casing (102) is abnormally large. 5. Check valve does not operate properly. 6. The throttle hole of damping piston (224) is abnormally large.	1. Exhaust air by several operations. 2. Correct the scratched parts. 3. Replace the damping spring with a new one. 4. Replace the damping piston Ass'y and casing Ass'y with new ones. 5. Disassemble and examine the check valve unit. 6. Replace the damping piston with a new one.
Damping torque is heavy.	1. Sliding parts are scratched. 2. The throttle hole of damping piston (224) is clogged.	1. Correct the scratched parts. 2. Correct or replace the damping piston.

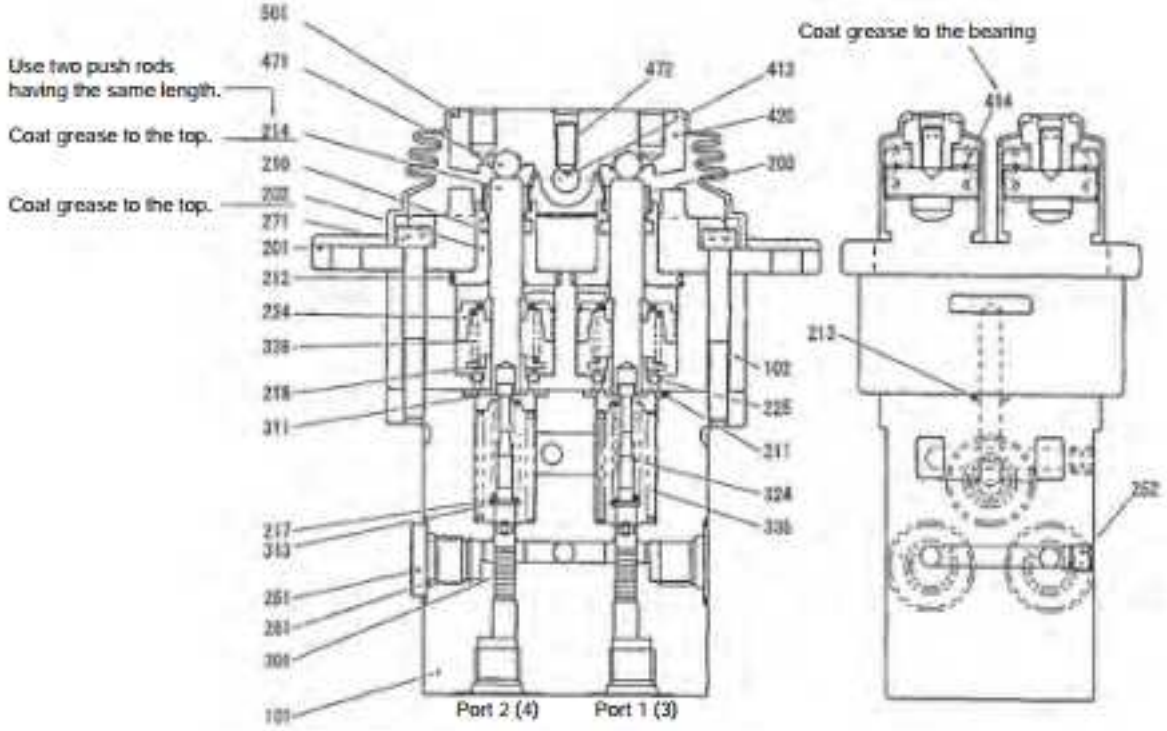
6. Remote control valve: Assembly cross-sectional view



Hydraulic symbols

Tightening torque table

No.	Screw size	Tightening torque
271	M6	8.8 ±0.8 N•m
251	G 1/4	29.4 ±2.0 N•m
252	NPTF 1/16	6.9 ±1.0 N•m
472	M6	6.9 ±1.0 N•m Apply Loctite #241.



No.	Name	Q'ty	No.	Name	Q'ty
101	Casing	1	252	Plug	2
102	Casing (damper)	1	261	O-ring	3
201	Cover	2	271	Socket head bolt	4
202	Plug	4	301	Spool	4
203	Grease cup	4	311	Spring seat	4
210	Packing	4	313	Washer	4
211	O-ring	4	324	Spring	4
212	O-ring	4	335	Spring	4
213	O-ring	2	336	Spring	4
214	Push rod	4	413	Cam shaft	2
217	Shim	4	414	Bush	4
218	Spring seat	4	420	Cam	2
224	Piston 2D055	4	471	Steel ball	4
225	Steel ball	12	472	Socket head setscrew	2
251	R0 Plug	3	501	Bellows	2

C Option

Contents

Refer to "A5-02 Electrical Wiring Diagram/Wire Harness" for the electrical circuit of switch, controller, solenoid and others.

1 Types of auxiliary piping

In this model, five types of auxiliary piping are set as option by combining three systems.

1-1 Auxiliary piping system

● **No. 1 auxiliary piping**

Application:	Used to operate the breaker, demolishing fork and others. The special section for control valve is provided as standard equipment.
Operating method:	Use the pedal or the proportional switch on the right operation lever.
Pressure and flow rate:	Up to 18.1MPa, Maximum flow rate: 48.0L/min Up to 21.6MPa, Maximum flow rate: 28.8L/min

● **No. 2 auxiliary piping**

Application:	Used when the oil pressure source is needed for others except the breaker, demolishing fork or the like (e.g. when slide arm is used together). This piping system is not installed as a single unit.
Operating method:	To use this piping system, change the swing cylinder circuit with the seesaw switch on the console. Use the swing pedal for operating this system. This piping system is not installed as a single unit.
Pressure:	20.6MPa
Maximum flow rate:	19.2L/min

● **No. 3 auxiliary piping**

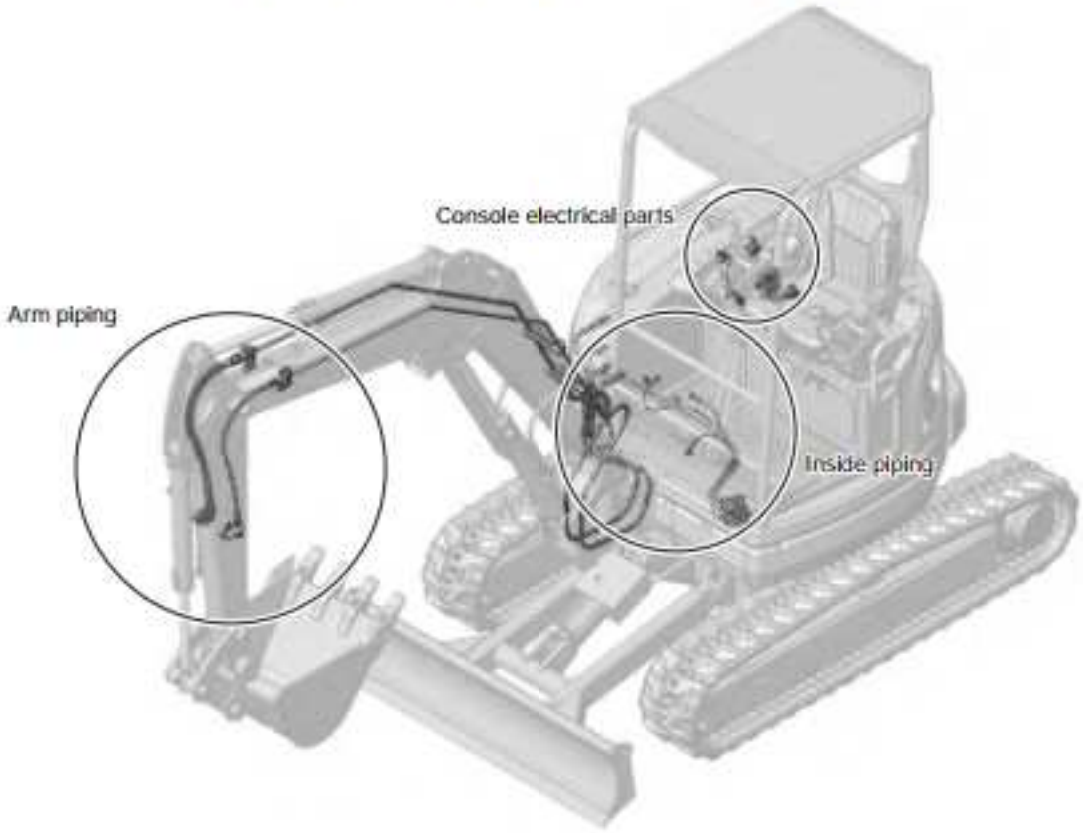
Application:	Used for the line of the quick hitch opening/closing pressure. This piping system is not used for a power source.
Operating method:	Set ON/OFF with the seesaw switch on the console. The safety lock switch is provided.
Pressure:	3.4MPa

1-2 Type for installing

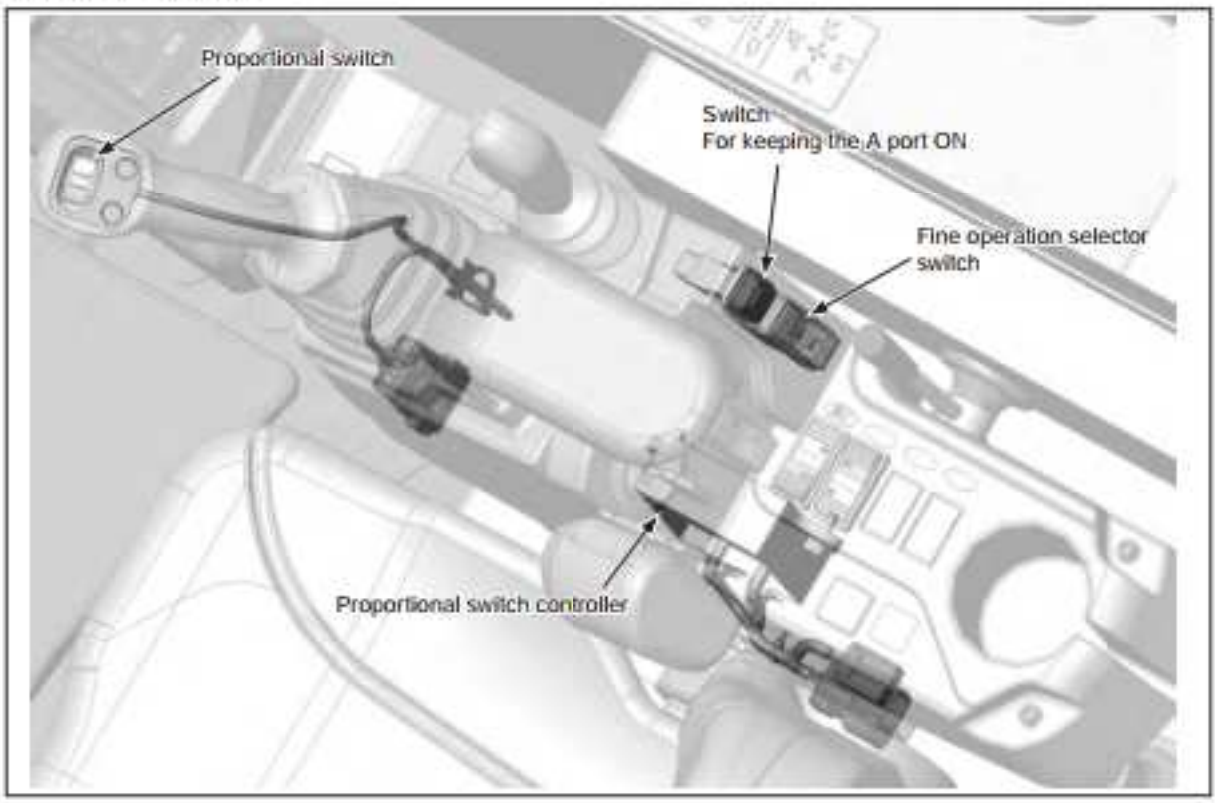
- No. 1 auxiliary piping system as a single unit (Proportional) (Refer to "2-1".)
- No. 1 and No. 2 auxiliary piping systems as a set (No. 1 proportional) (Refer to "2-2".)
- No. 1 and No. 3 auxiliary piping systems as a set (No. 1 proportional) (Refer to "2-3".)
- No. 1, No. 2 and No. 3 auxiliary piping systems as a set (No. 1 proportional) (Refer to "2-4".)
- No. 3 auxiliary piping system as a single unit (Refer to "2-5".)
- No. 1 auxiliary piping system as a single unit (Pedal operation/with stop valve) (Refer to "2-6".)
- No. 1 and No. 3 auxiliary piping systems as a set (No. 1 pedal operation/with stop valve) (Refer to "2-7".)
- No. 1 auxiliary piping system as a single unit (Proportional/with stop valve) (Refer to "2-1".)
- No. 1 and No. 3 auxiliary piping systems as a set (No. 1 proportional/with stop valve) (Refer to "2-3".)

2 Details of each type

2-1 No. 1 auxiliary piping system as a single unit (Proportional)



Console electrical parts

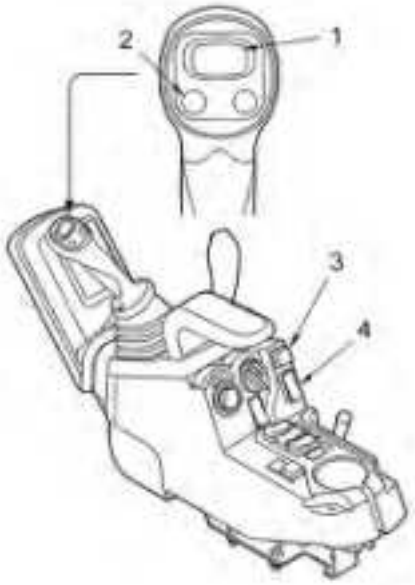


Operating method

Switch name and relevant work

No.	Name	Work	
		Breaker	Demolishing fork
1	No. 1 auxiliary proportional lever	○	○
2	No. 1 auxiliary one-touch button	○	○
3	No. 1 auxiliary flow rate hold switch	○	–
4	No. 1 auxiliary flow rate limit switch	–	○

When you do not use the No. 1 auxiliary flow rate limit switch and No. 1 auxiliary flow rate hold switch, set them to OFF.



When using the breaker

1. Connect the supply hose to the pipe at the left side of arm and the return hose to the pipe at the right side.
2. Set the mark (6) on the selector valve vertically.
3. Press the No. 1 auxiliary one-touch button (2) to operate the breaker.
   The pressure oil of the maximum pump flow rate at the current engine rotary speed is fed.
   It is also possible to operate the breaker by sliding the No. 1 auxiliary proportional lever (1) leftward.
4. Release the switch, and the breaker stops.
5. Use the No. 1 auxiliary flow rate hold switch (3) when discharging the pressure oil continuously.
   ON (Lamp is ON) : It is possible to perform continuous operation. By pressing the No. 1 auxiliary one-touch button once, you can supply the pressure oil continuously to the auxiliary pipe at the left side.
   OFF (Lamp is OFF) : The continuous operation is canceled.

IMPORTANT **Be sure to set the mark on the selector valve as instructed in this manual.**
If the mark is set wrongly, the machine and breaker will be damaged.

When using the demolishing fork

1. Connect the hoses to the right and left pipes of arm.

2. Set the mark (6) on the selector valve horizontally.

3. Slide the No. 1 auxiliary proportional lever (1) rightward and leftward to operate the demolishing fork.
   - Sliding leftward : Supplies the pressure oil to the left pipe of arm.
   - Sliding rightward : Supplies the pressure oil to the right pipe of arm.

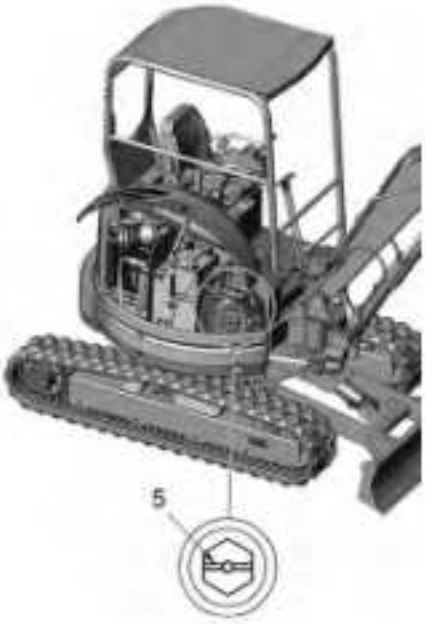
   The flow rate is changed by the sliding amount.

   It is also possible to operate the demolishing fork by pressing the No. 1 auxiliary one-touch button (2).

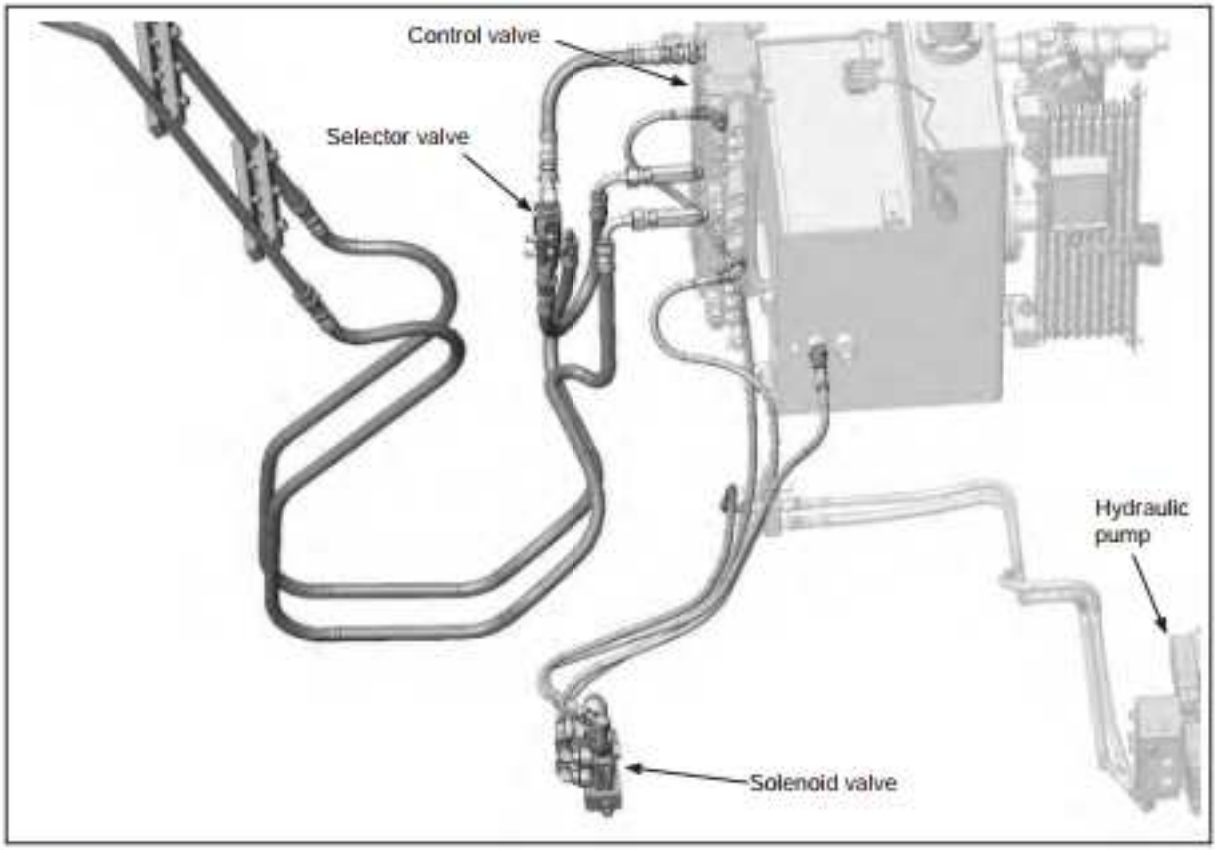
4. When performing the fine operation
   Press the "ON" side of No. 1 auxiliary flow rate limit switch (4). Then, operate the No. 1 auxiliary proportional lever. Press the "OFF" side, and the flow rate is set as before.

IMPORTANT

Be sure to set the mark on the selector valve as instructed in this manual.
If the mark is set wrongly, the pressure oil is not supplied to the right pipe of arm.

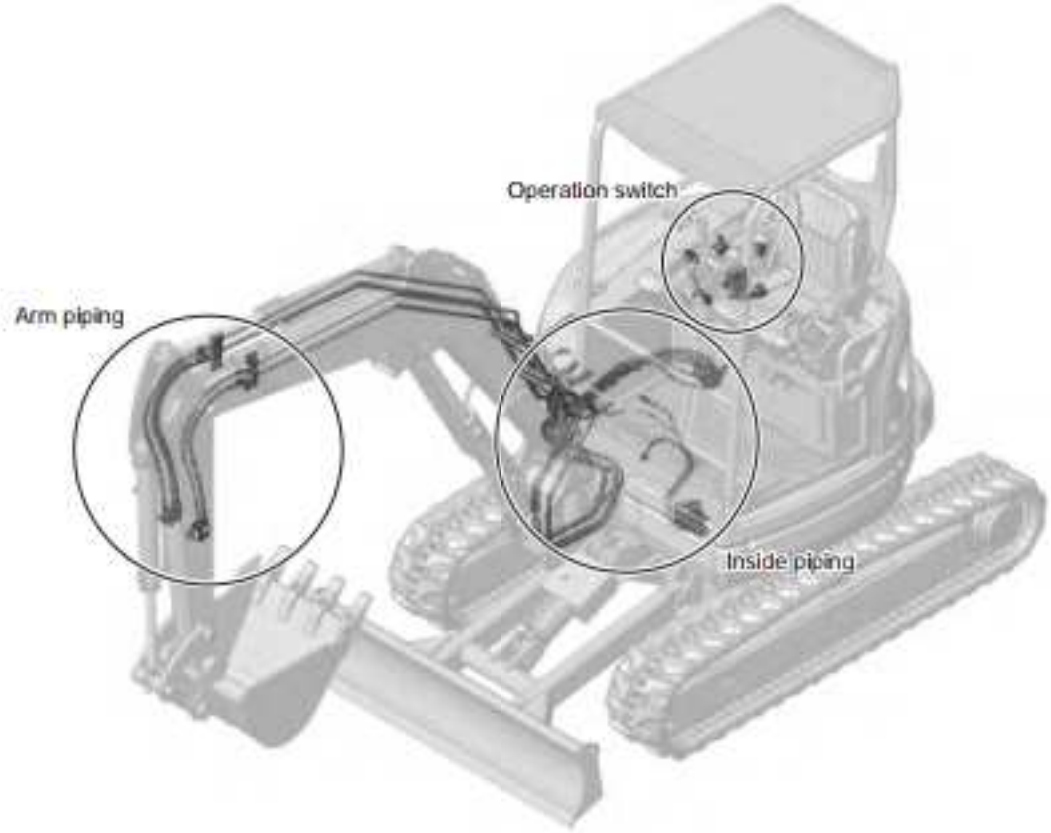


Inside piping

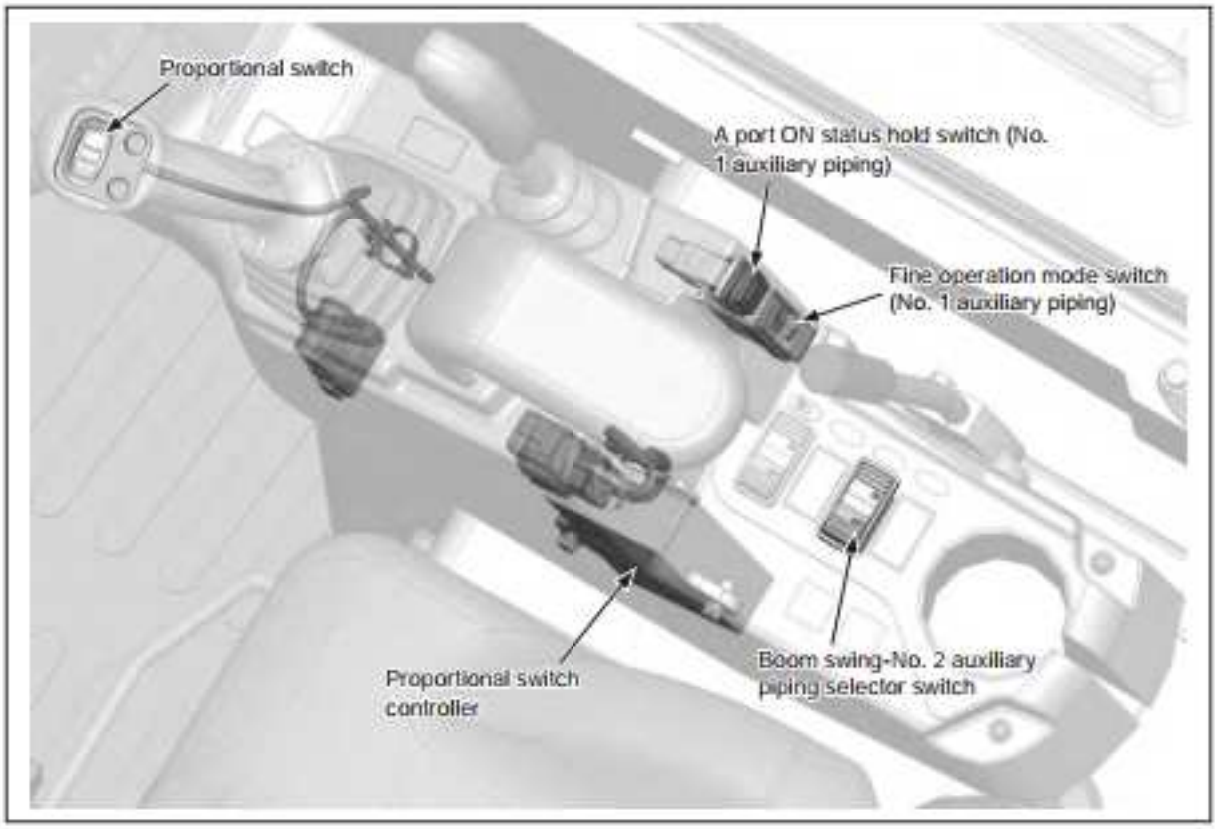


Arm piping

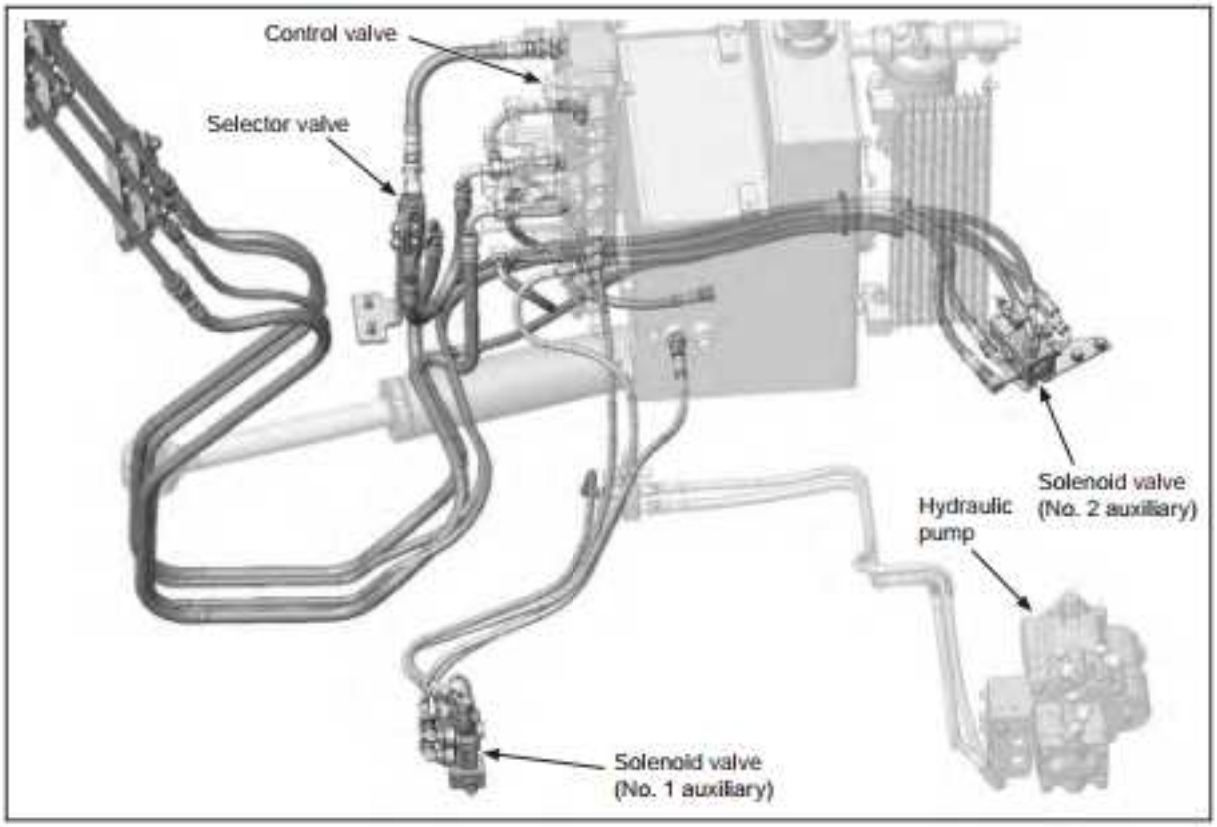
2-2 No. 1 and No. 2 auxiliary piping systems as a set (No. 1 proportional)



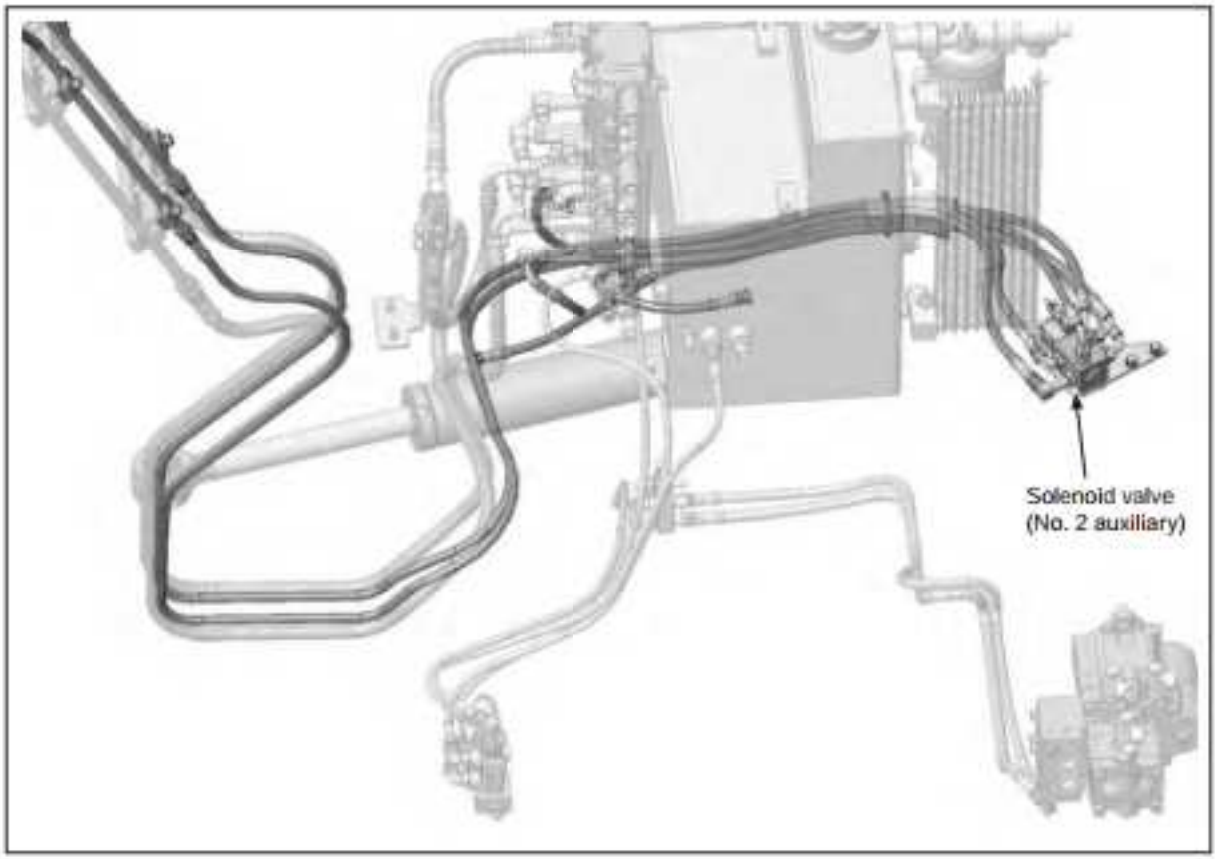
Operation switch



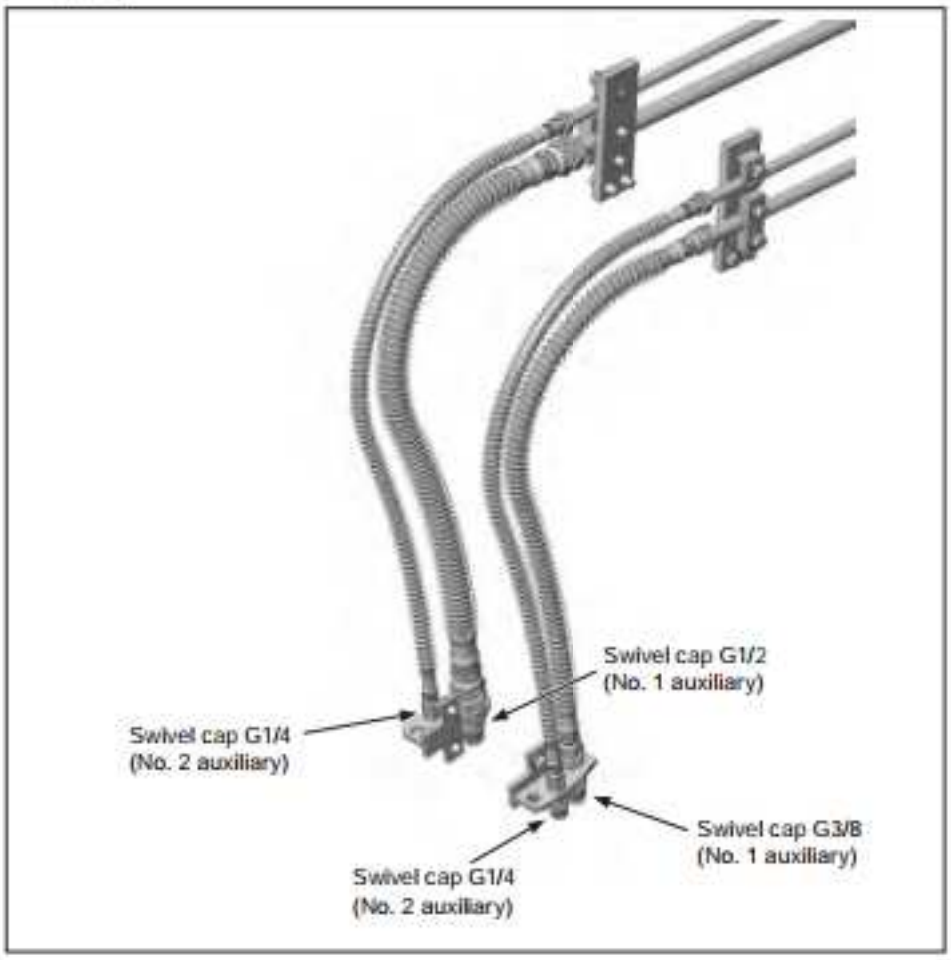
Inside piping



Inside piping (No. 2 auxiliary piping section)

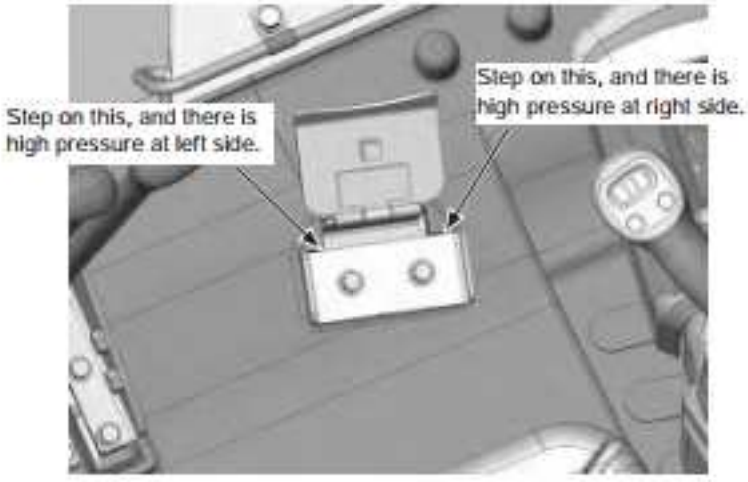


Arm piping

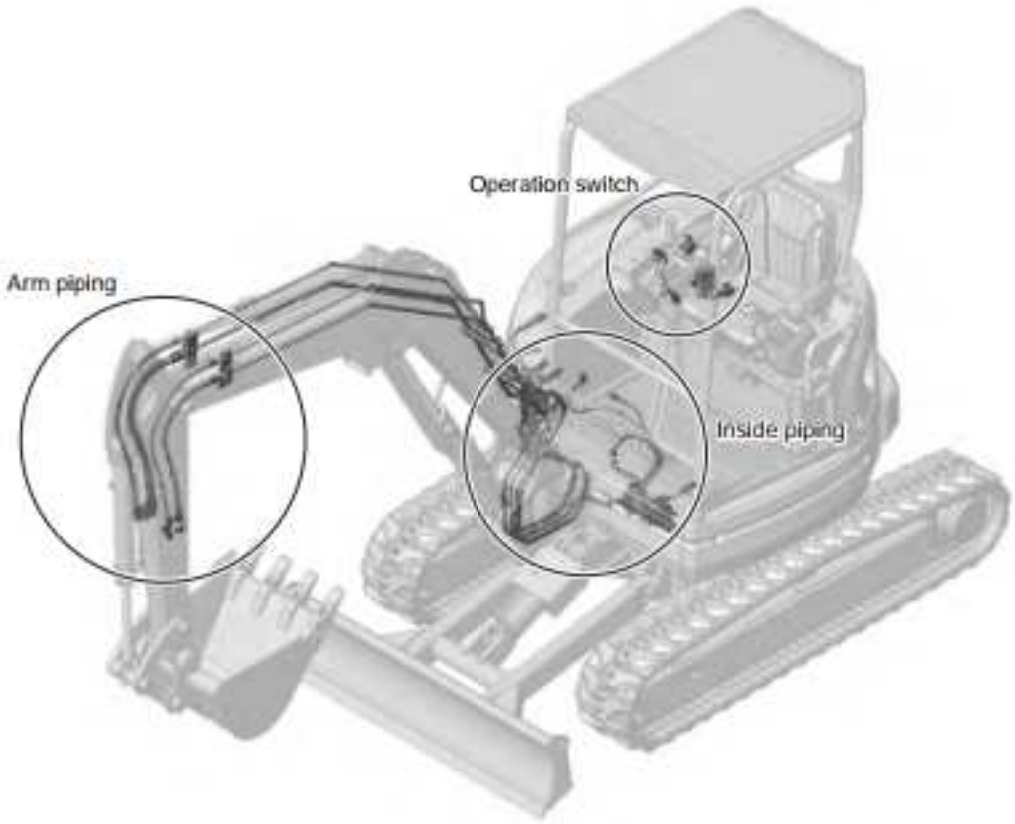


Operating method of No. 2 auxiliary piping

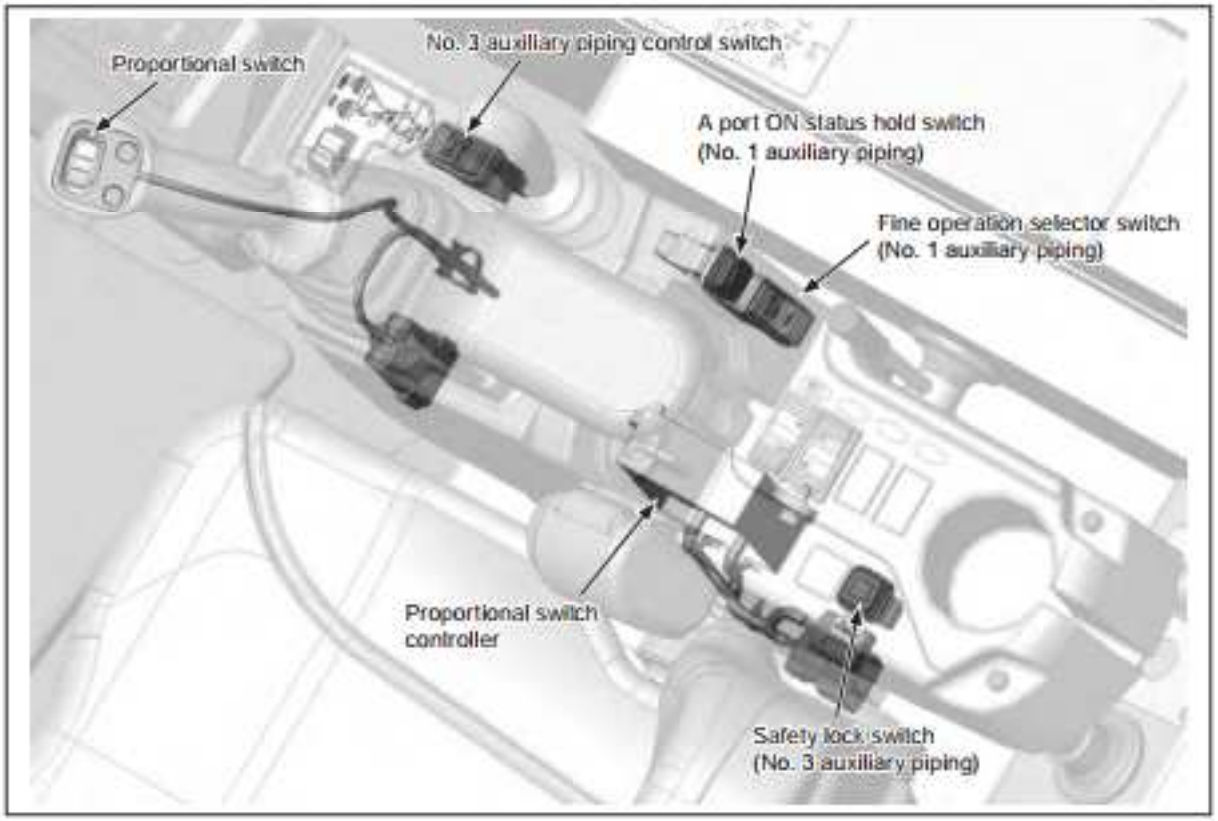
1 Set "Boom swing-No. 2 auxiliary piping selector switch" to ON.
2 Step on the right side of swing pedal, and high pressure is generated in the right pipe of boom.
3 Step on the left side of swing pedal, and high pressure is generated in the left pipe of boom.



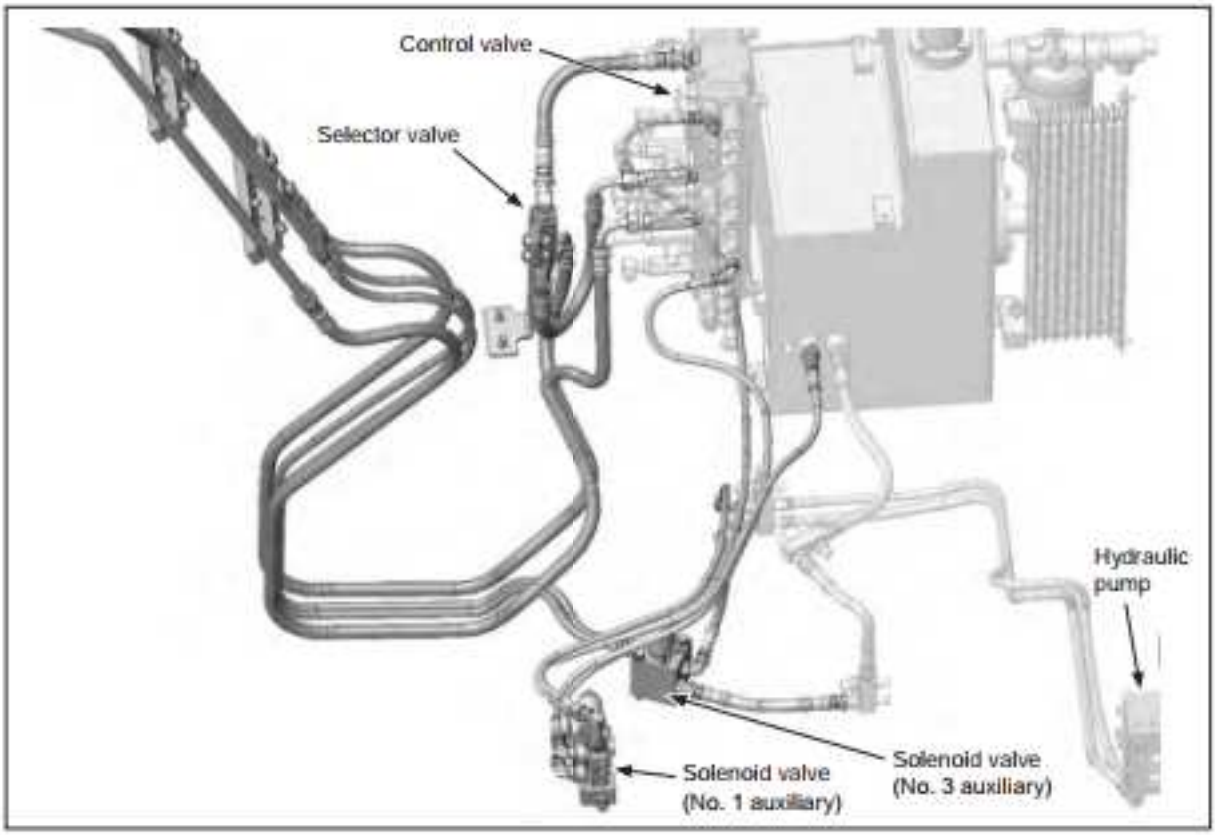
2-3 No. 1 and No. 3 auxiliary piping systems as a set (No. 1 proportional)



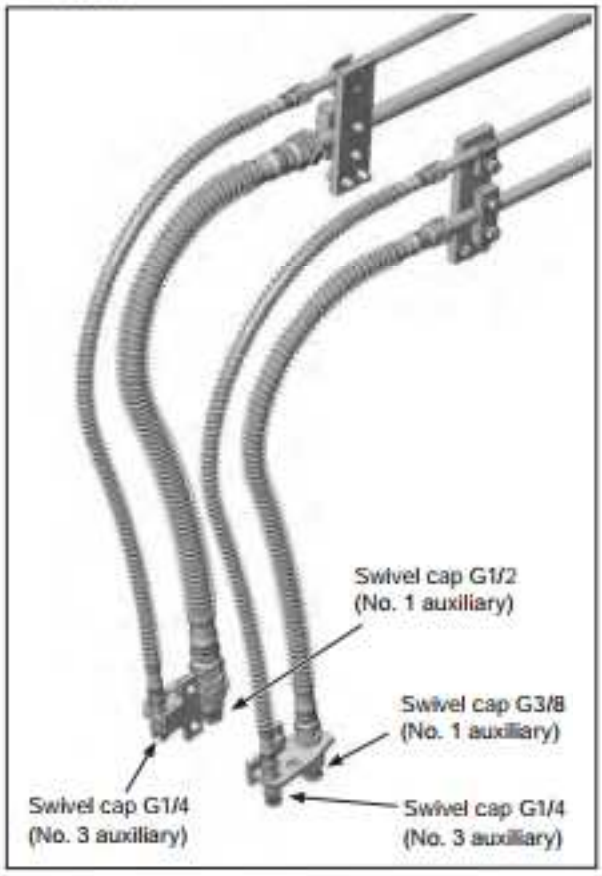
Operation switch

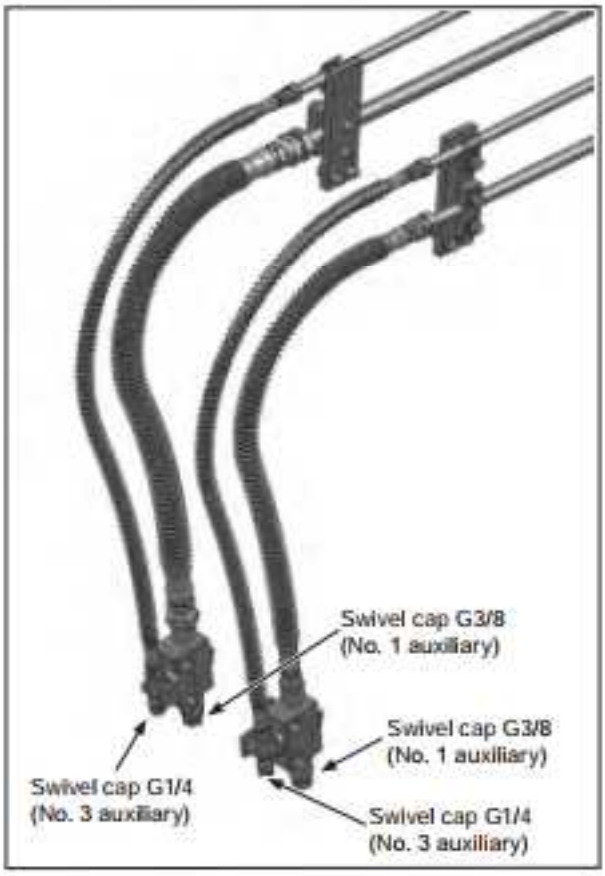


Inside piping

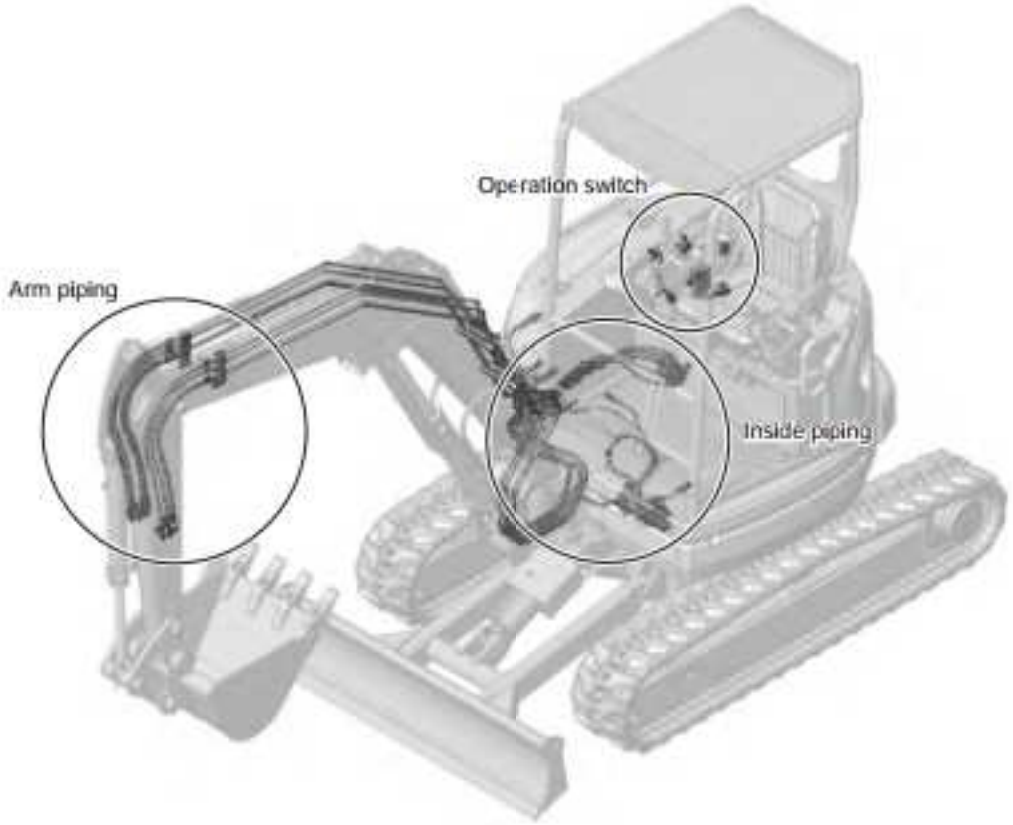


Arm piping

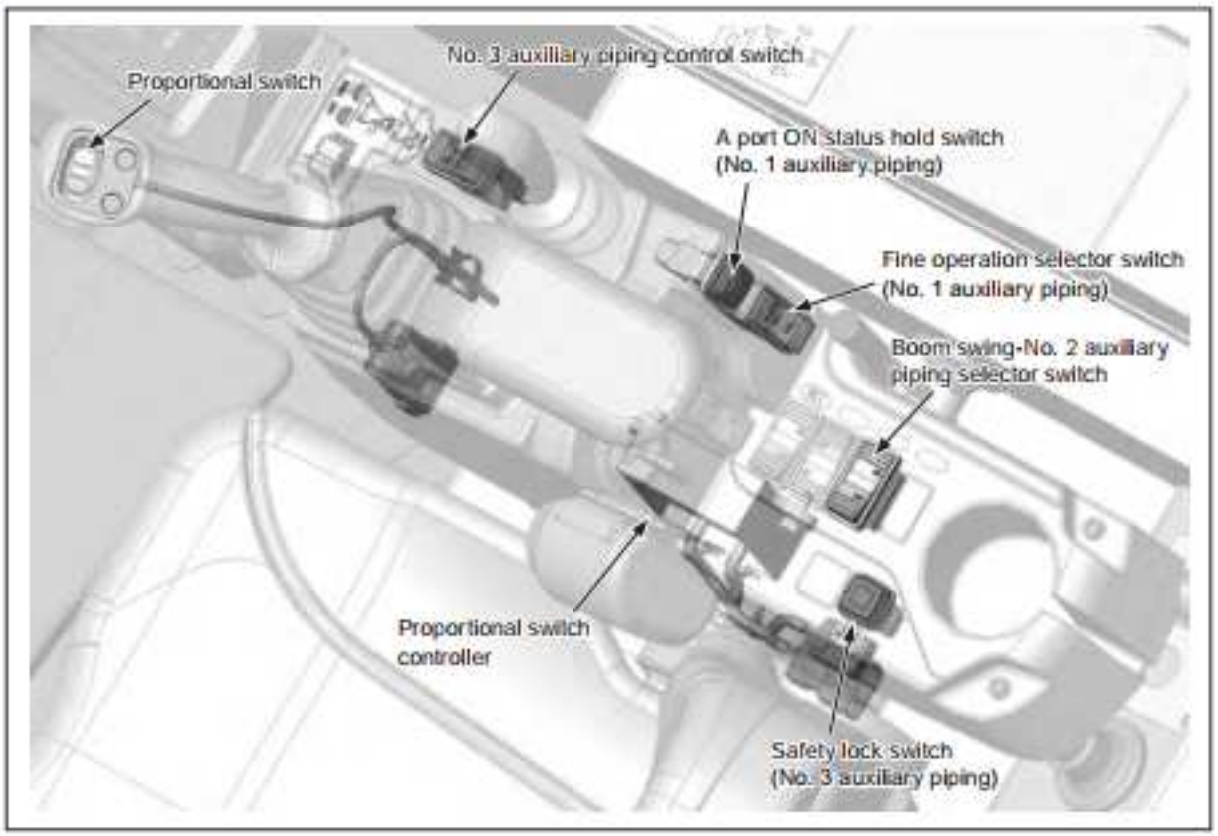




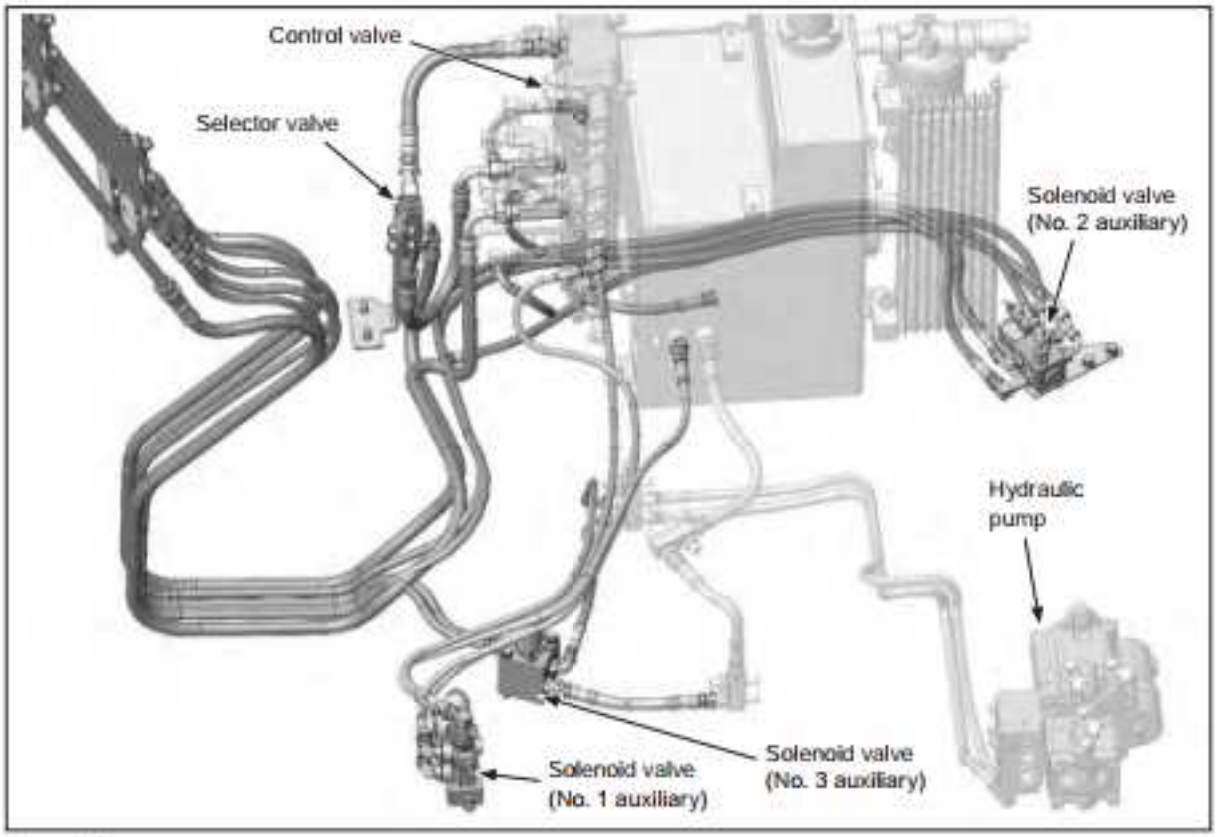
2-4 No. 1, No. 2 and No. 3 auxiliary piping systems as a set (No. 1 proportional)



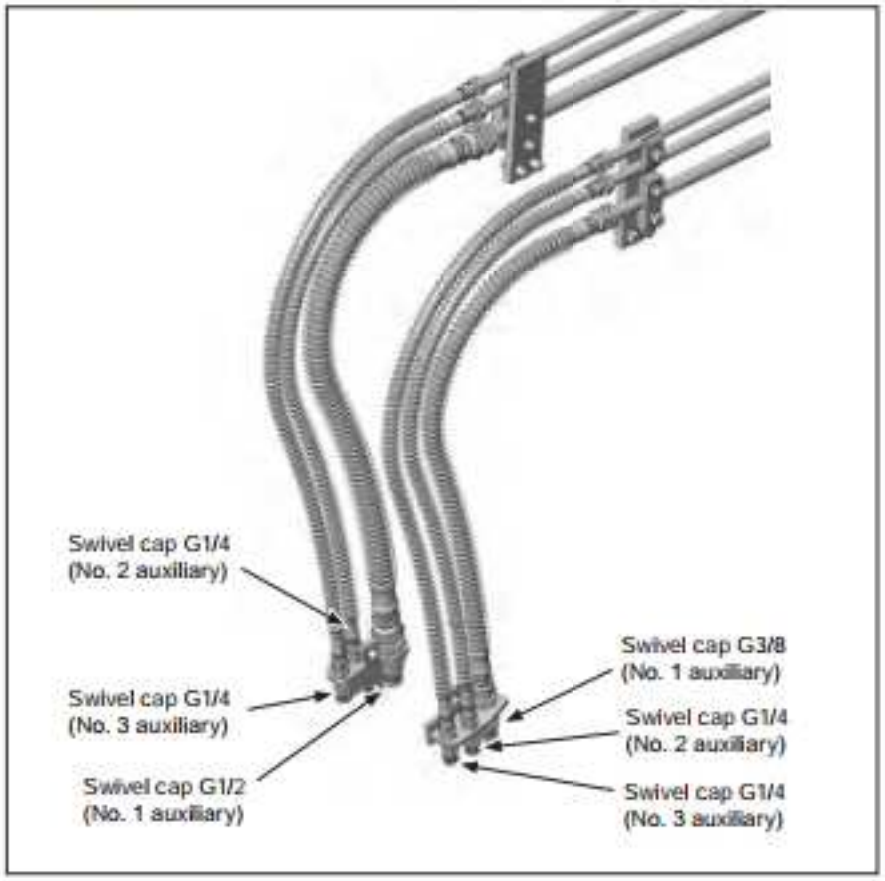
Operation switch



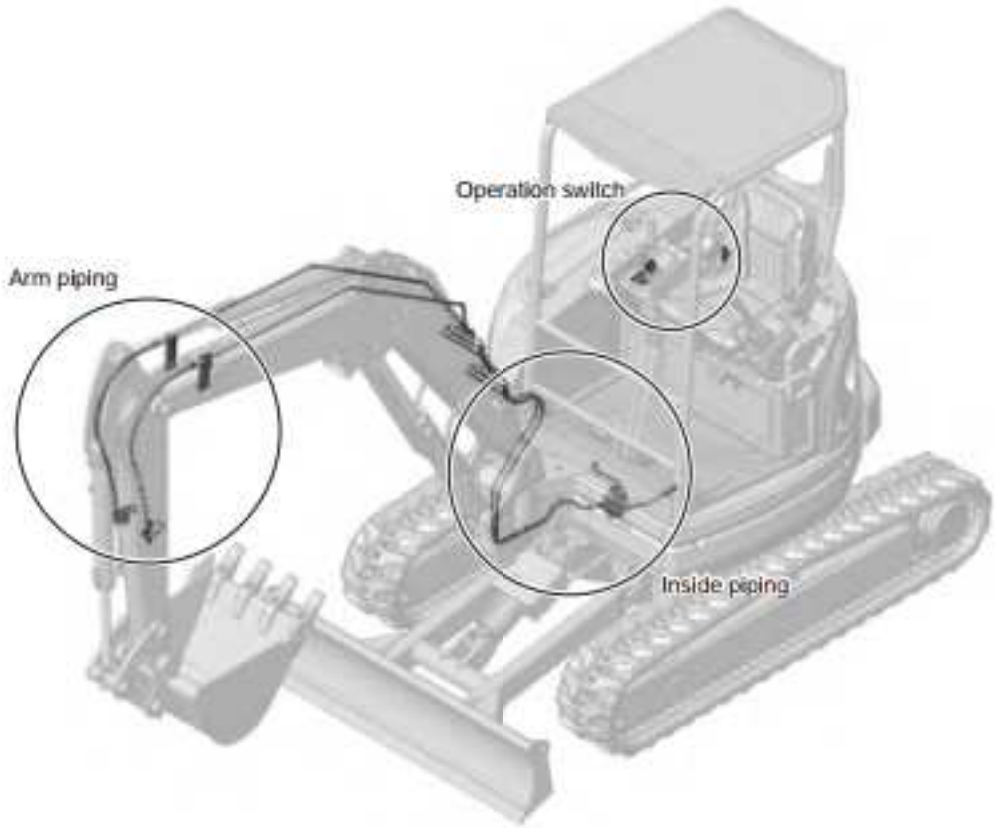
Inside piping



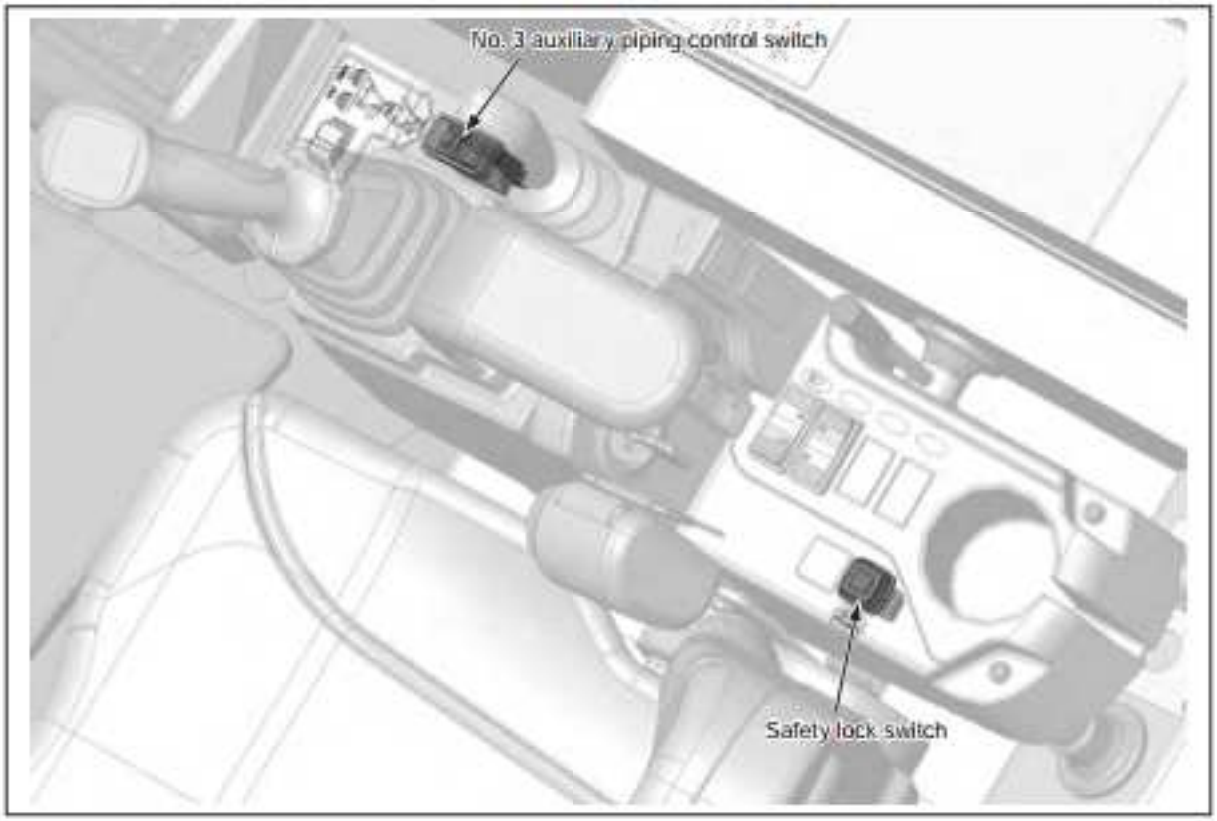
Arm piping



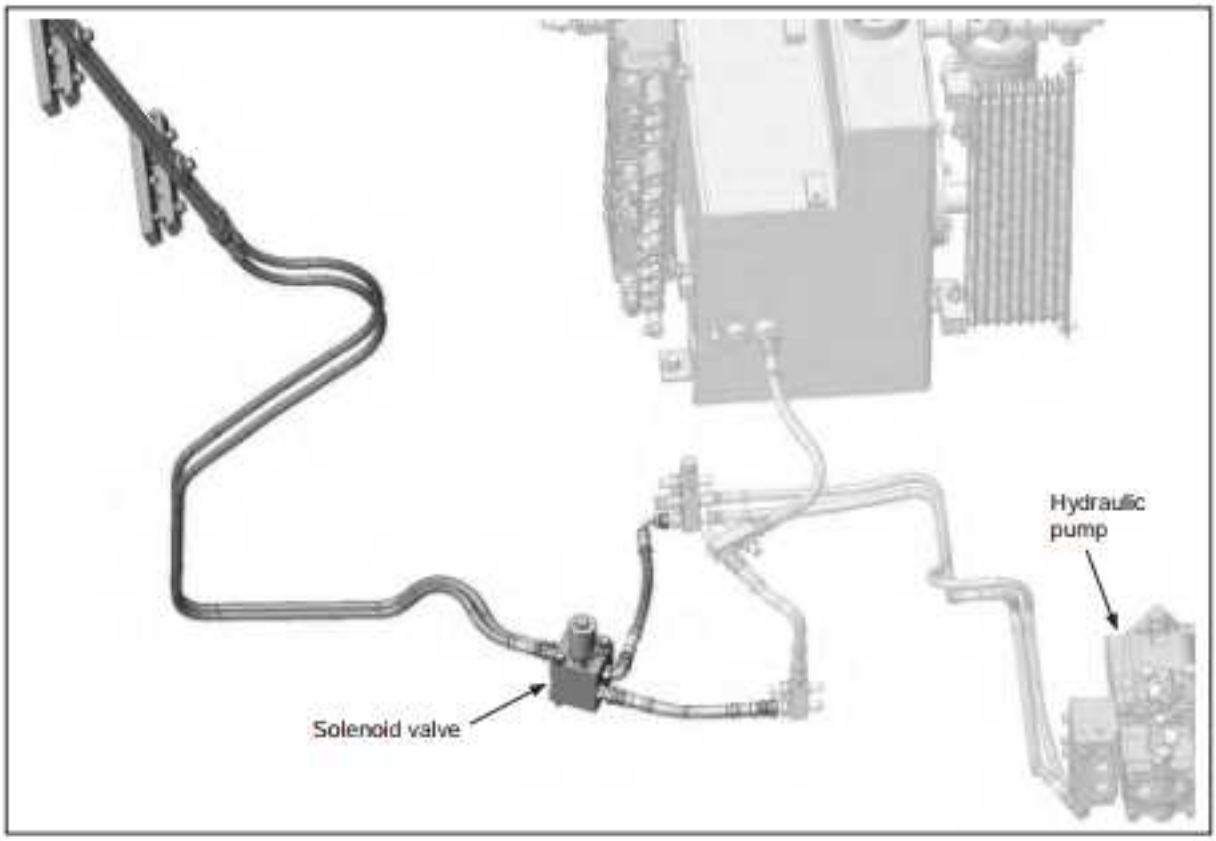
2-5 No. 3 auxiliary piping system as a single unit



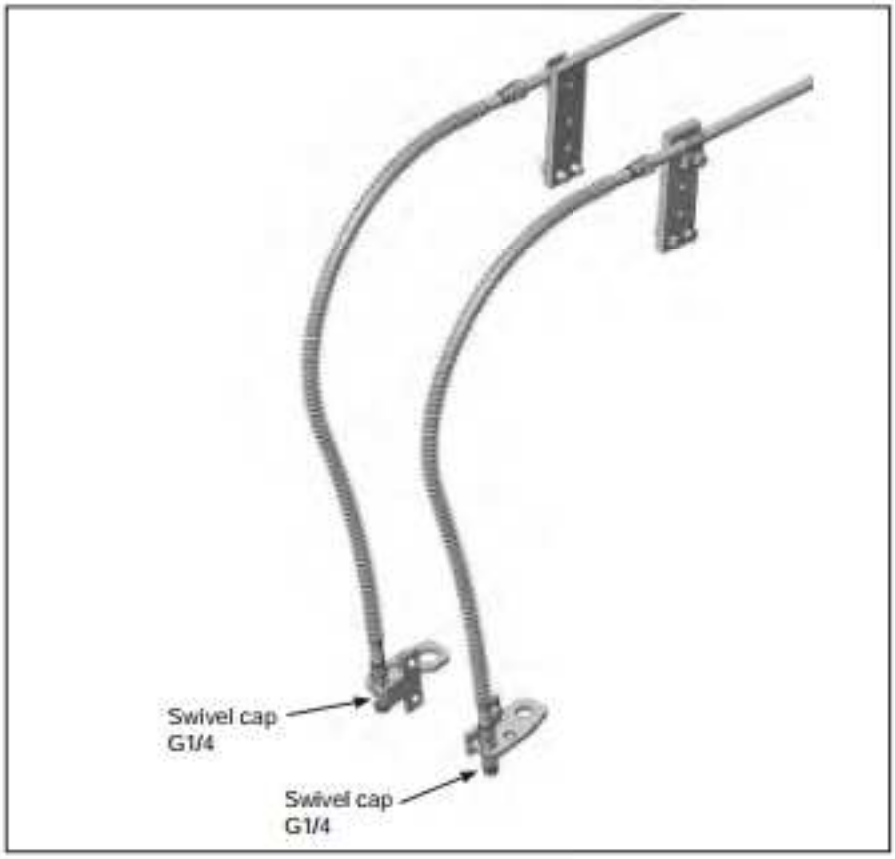
Operation switch



Inside piping



Arm piping



Operating method of No. 3 auxiliary piping (Installing/removing quick hitch)

○ Installing

1 When connecting and fixing the quick hitch, pressure is high at one side and is low at the other side. Connect the high-pressure side to the left piping of arm and the low-pressure side to the right piping.

2 Start the engine. Sit on the seat and set the safety lever to ON.

3 Press the safety lock switch to be ON. At the same time the buzzer keeps sounding.

4 Set "No. 3 auxiliary piping switch" to "FREE", and the solenoid is charged with electricity. High pressure is generated at the right pipe of arm and low pressure is generated at the left pipe. The quick hitch is unlocked.

5 Operate the boom and arm to set the quick hitch on the attachment which is the mate for connection.

6 Set "No. 3 auxiliary piping switch" to "LOCK". High pressure is generated at the left pipe of arm and low pressure is generated at the right pipe. The quick hitch is locked.

7 Press the safety lock switch again. Make sure that the switch is OFF and the buzzer stops sounding.

○ Removing

1 Put the attachment stably on a flat ground.

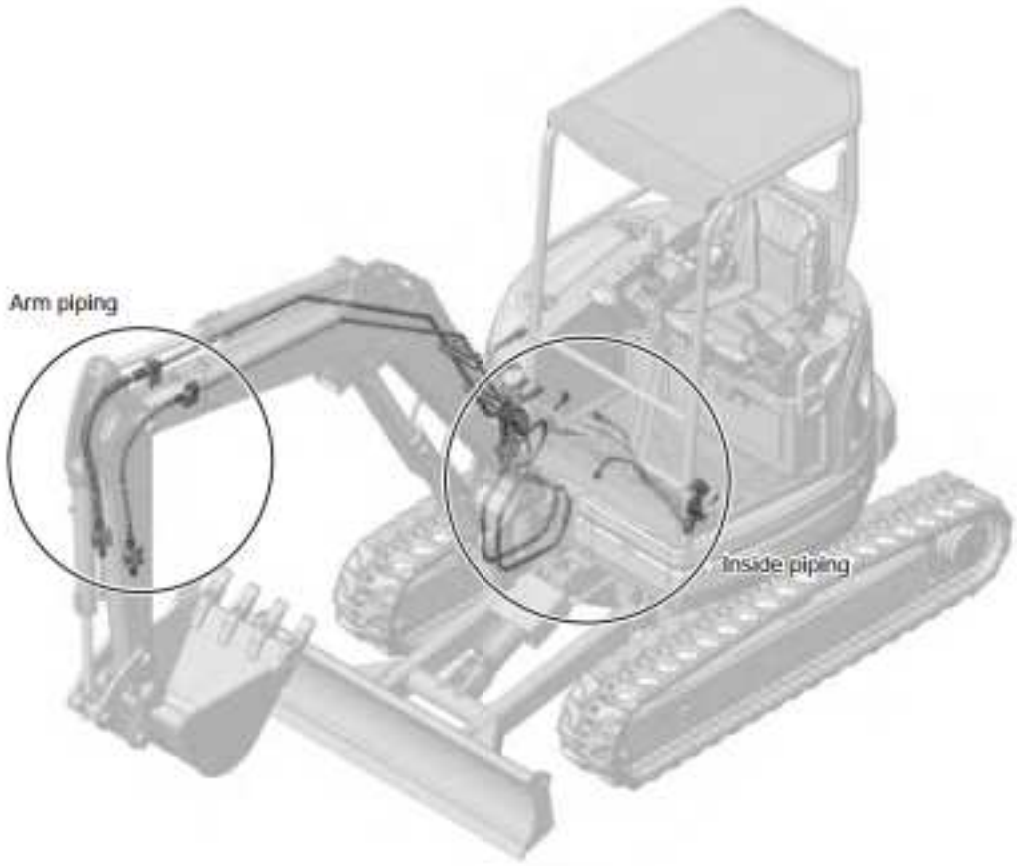
2 Press the safety lock switch to be ON. At the same time the buzzer keeps sounding.

3 Set "No. 3 auxiliary piping switch" to "FREE", and the solenoid is charged with electricity. High pressure is generated at the right pipe of arm and low pressure is generated at the left pipe. The quick hitch is unlocked.

4 Remove the quick hitch from the attachment which is the mate for connection.

5 Press the safety lock switch again. Make sure that the switch is OFF and the buzzer stops sounding.

2-6 No. 1 auxiliary piping system as a single unit (Pedal operation/with stop valve)



Operating method

When using the breaker

1. Connect the supply hose to the pipe at the left side of arm and the return hose to the pipe at the right side.

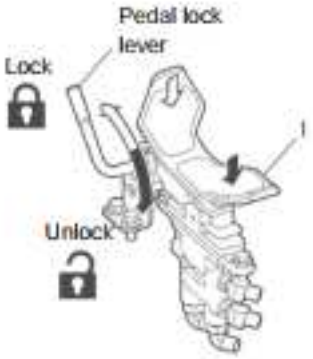
2. Set the mark (2) on the selector valve vertically.

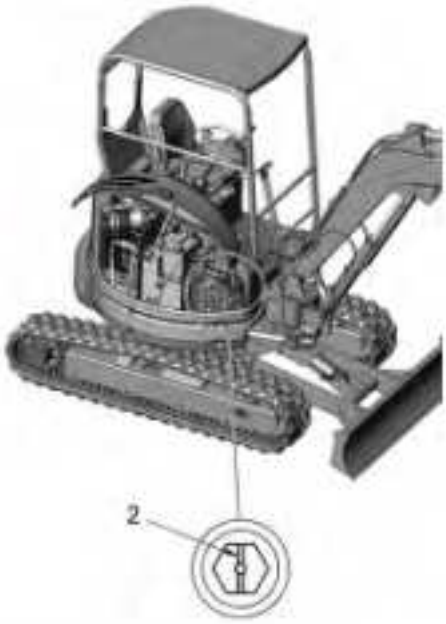
3. Set the pedal lock lever to the "unlock" position.

4. Step on the front side of auxiliary pedal (1) to operate the breaker.

5. Release the pedal, and the breaker stops.

6. Set the pedal lock lever to the "lock" position under the condition that you are stepping on the front side of auxiliary pedal. The pressure oil is discharged continuously.





IMPORTANT

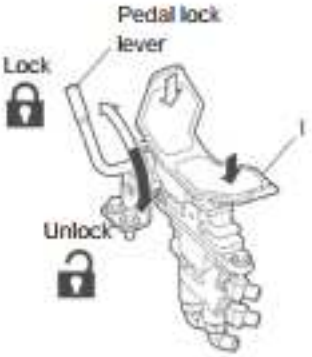
Be sure to set the mark on the selector valve as instructed in this manual.
If the mark is set wrongly, the machine and breaker will be damaged.

When using the demolishing fork

1. Connect the hoses to the right and left pipes of arm.

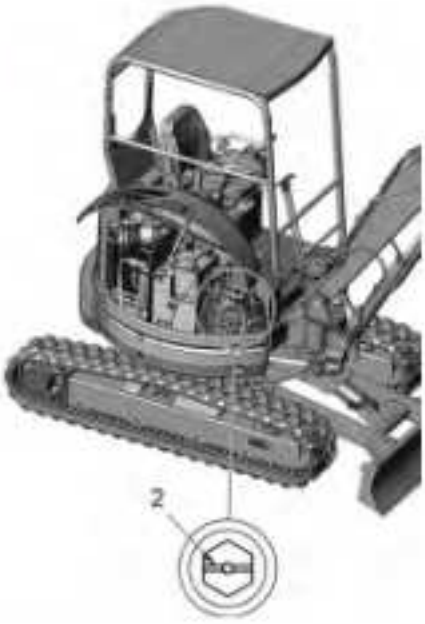
2. Set the mark (2) on the selector valve horizontally.

3. Step on the front and rear sides of auxiliary pedal (1) to operate the demolishing fork.
   - Stepping on the front side:
     Supplies the pressure oil to the left pipe of arm.
   - Stepping on the rear side:
     Supplies the pressure oil to the right pipe of arm.

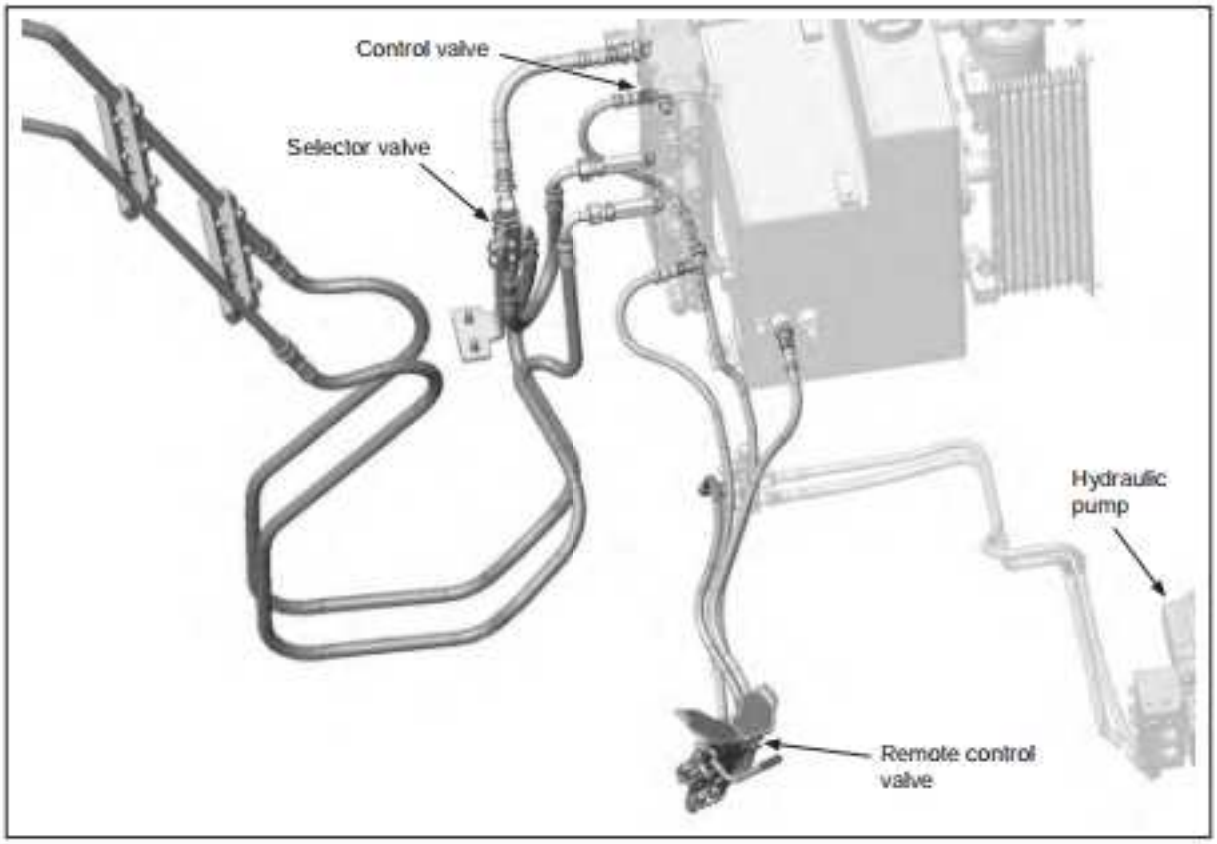


IMPORTANT

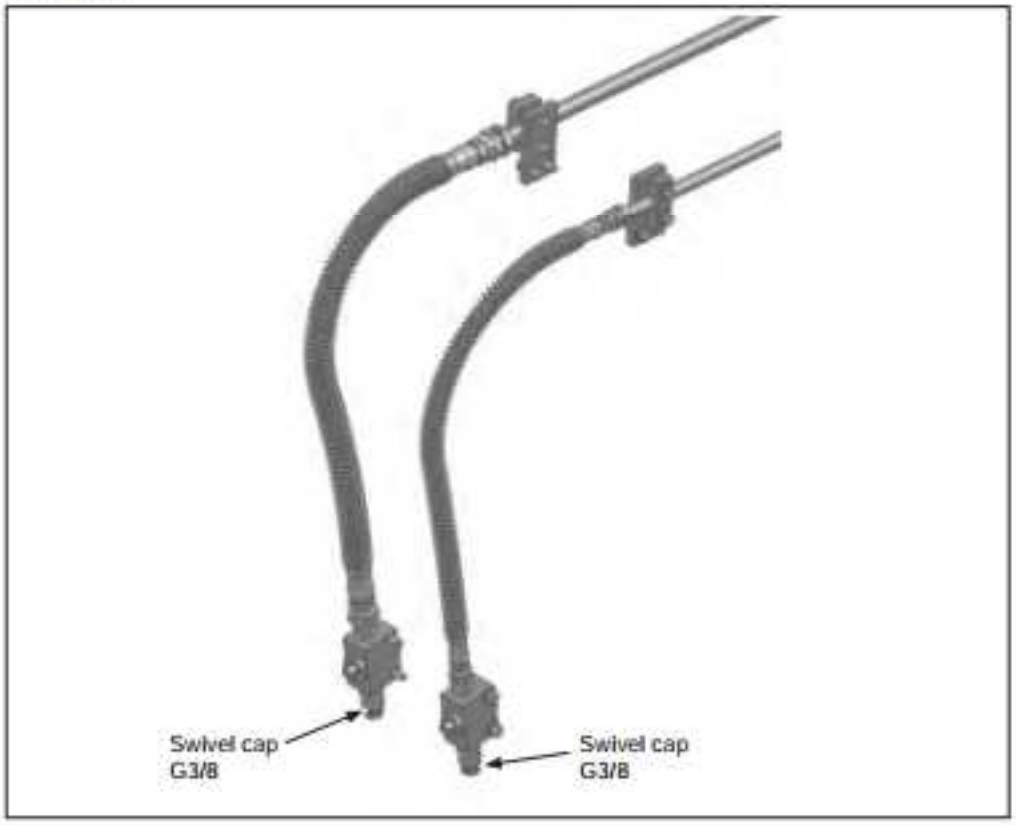
Be sure to set the mark on the selector valve as instructed in this manual.
If the mark is set wrongly, the pressure oil is not supplied to the right pipe of arm.



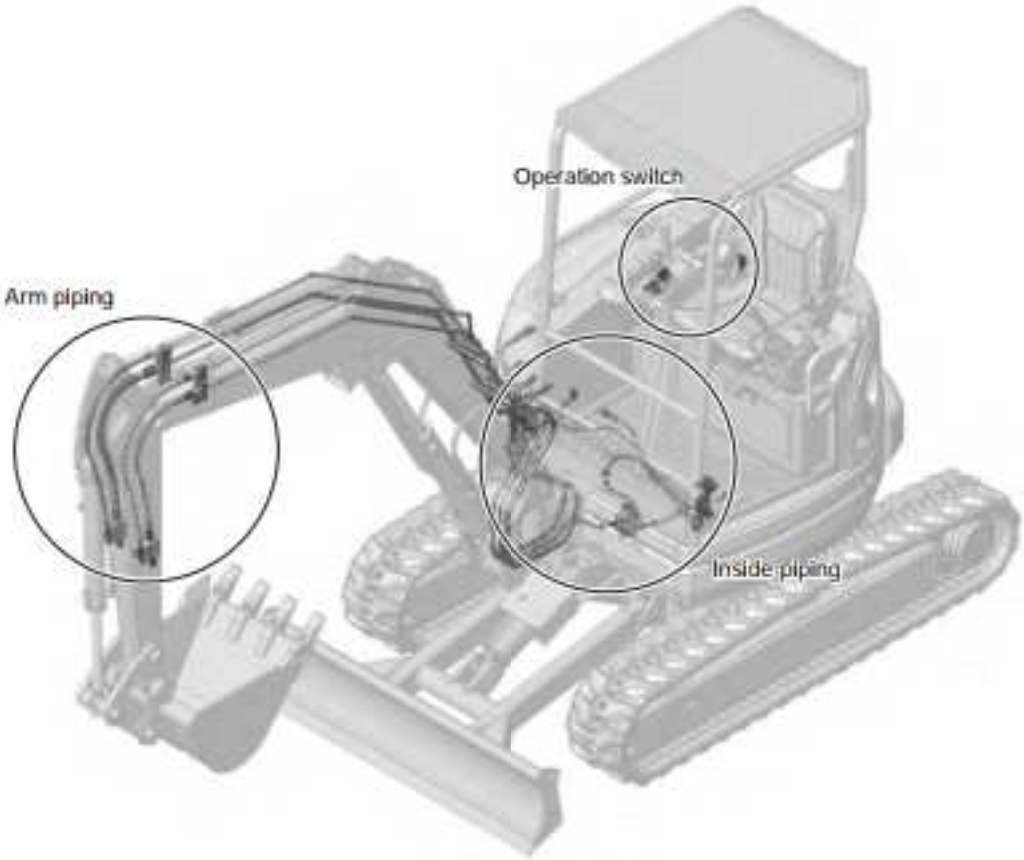
Inside piping



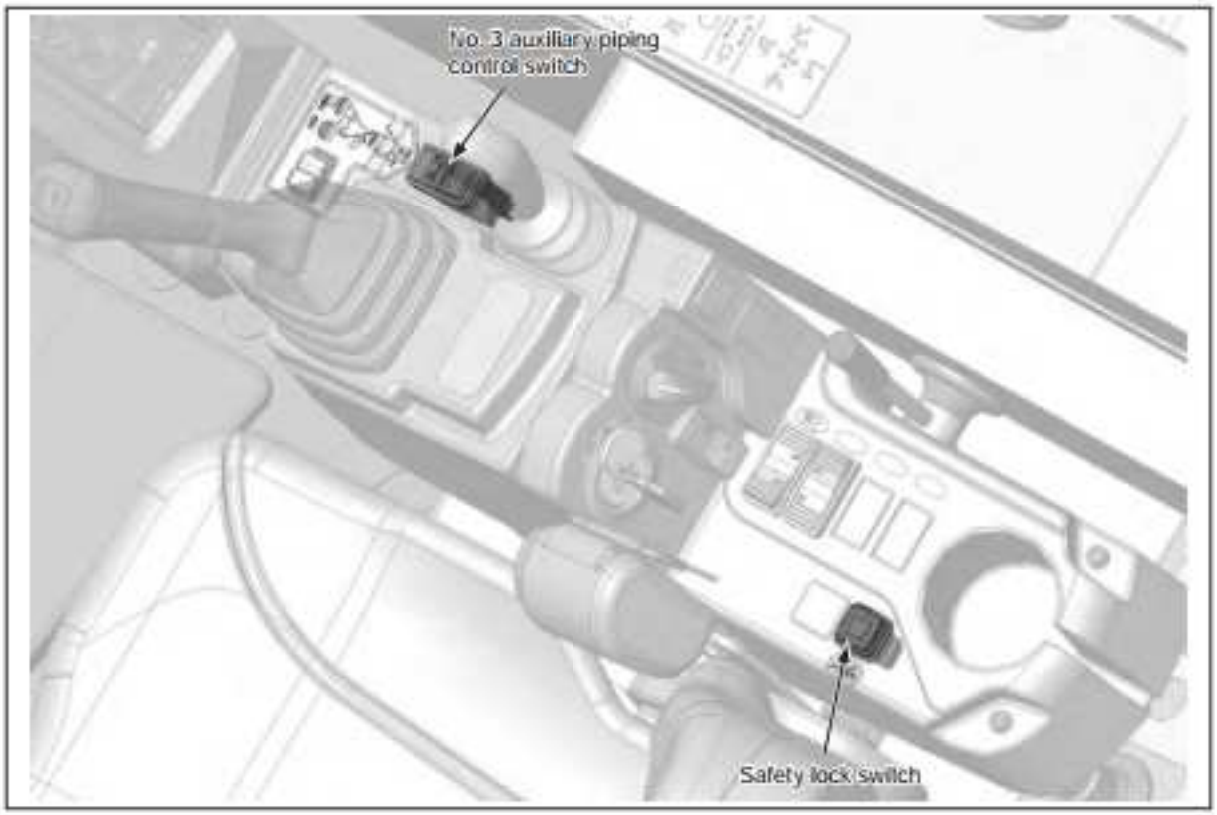
Arm piping



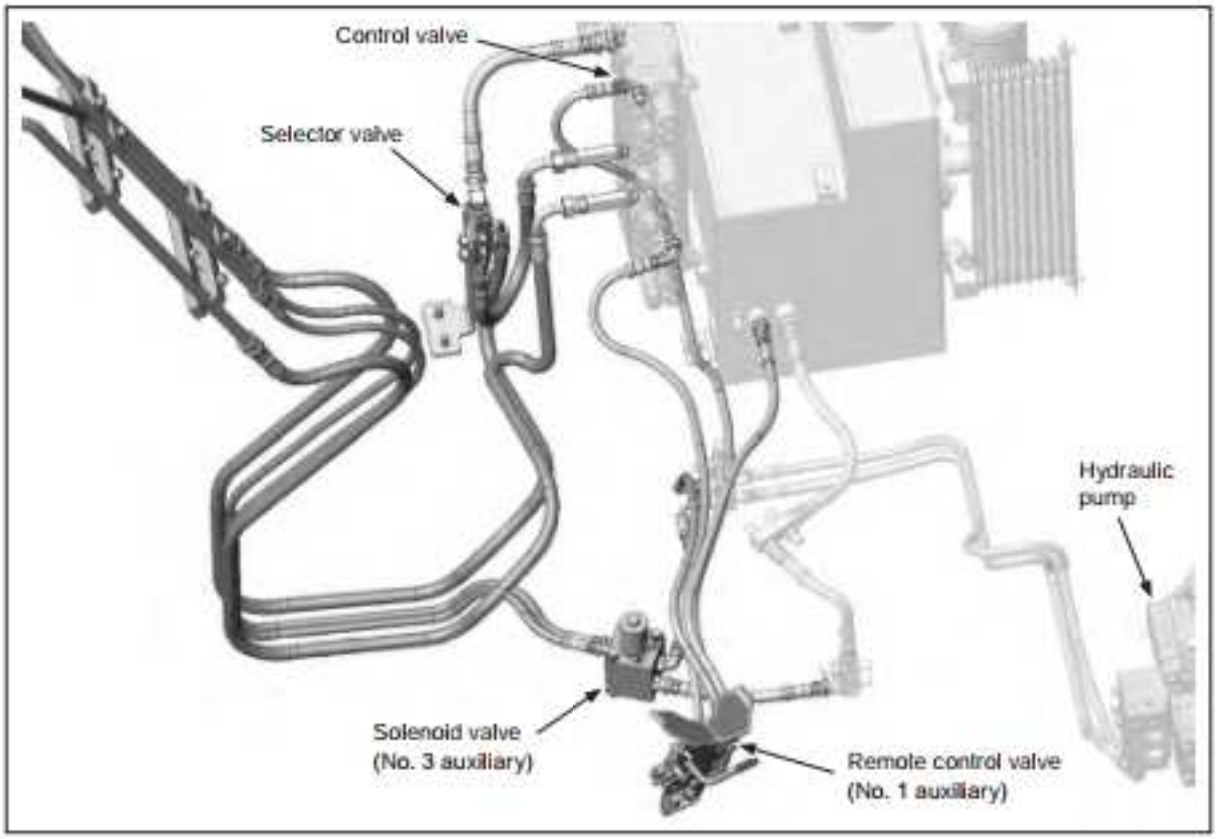
2-7 No. 1 and No. 3 auxiliary piping systems as a set (No. 1 pedal operation/with stop valve)



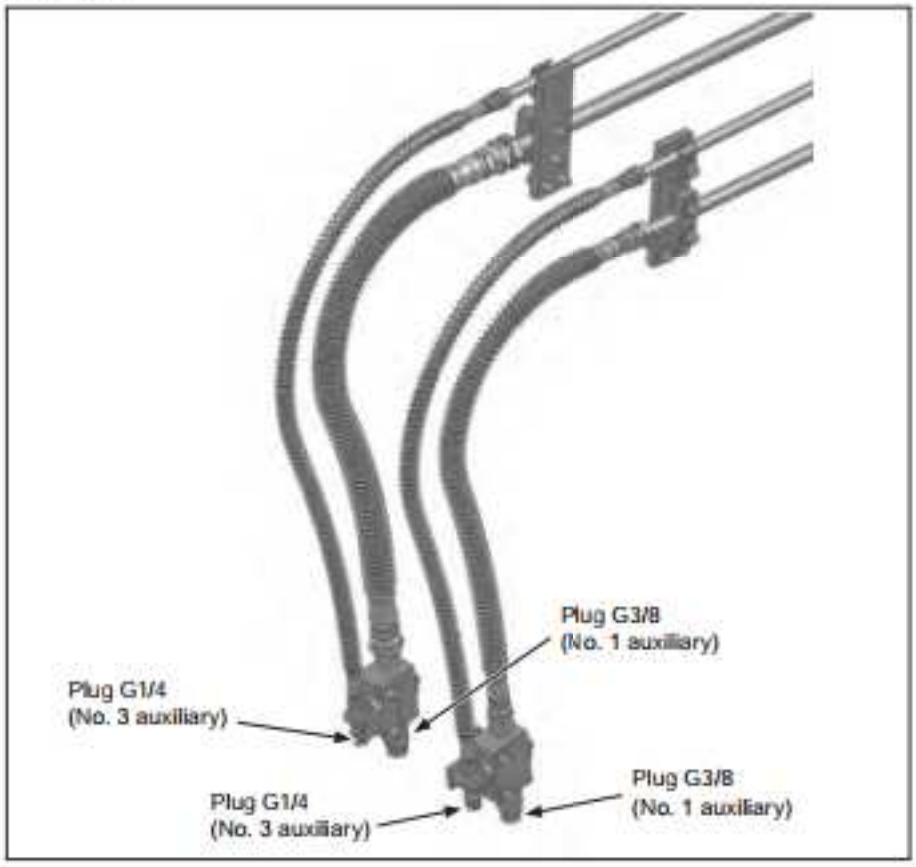
Operation switch



Inside piping

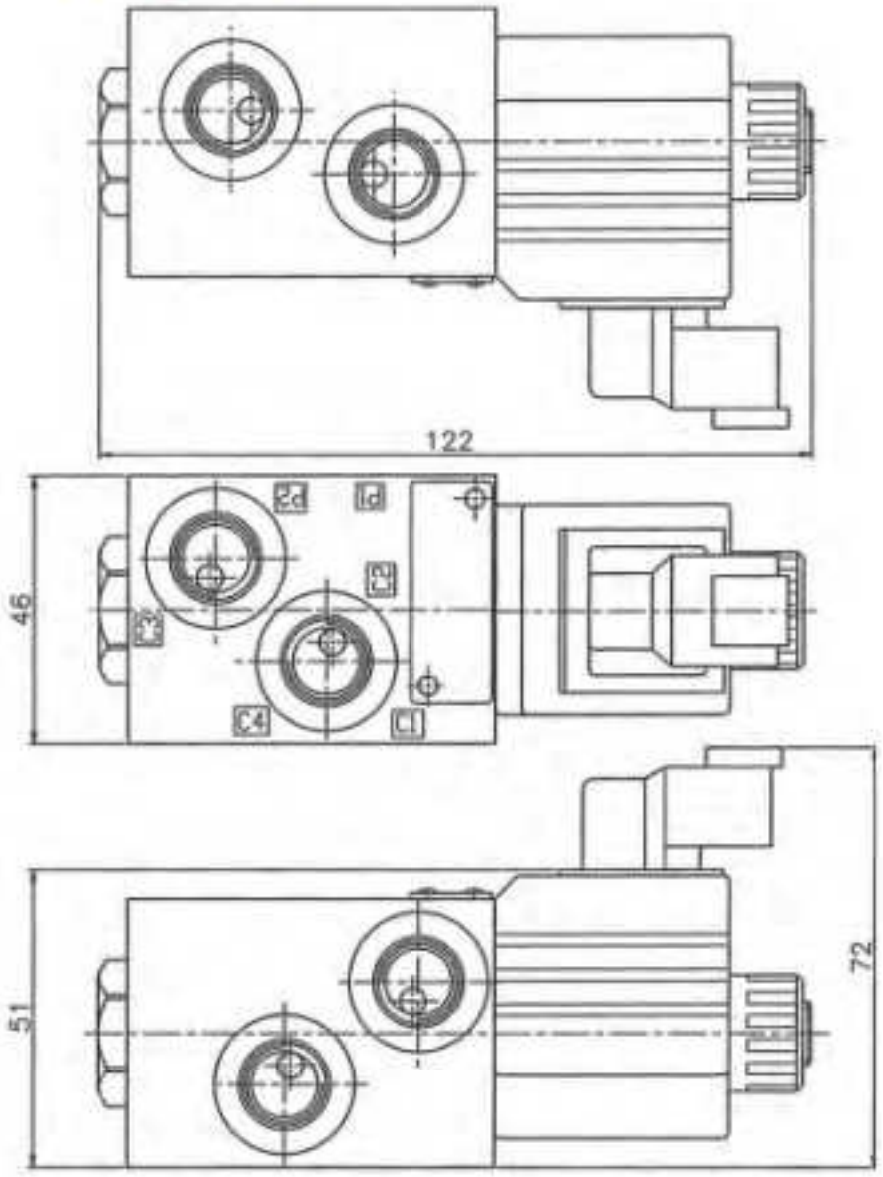


Arm piping

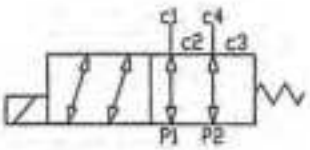


3 Hydraulic equipment

3-1 No. 2 auxiliary piping solenoid valve

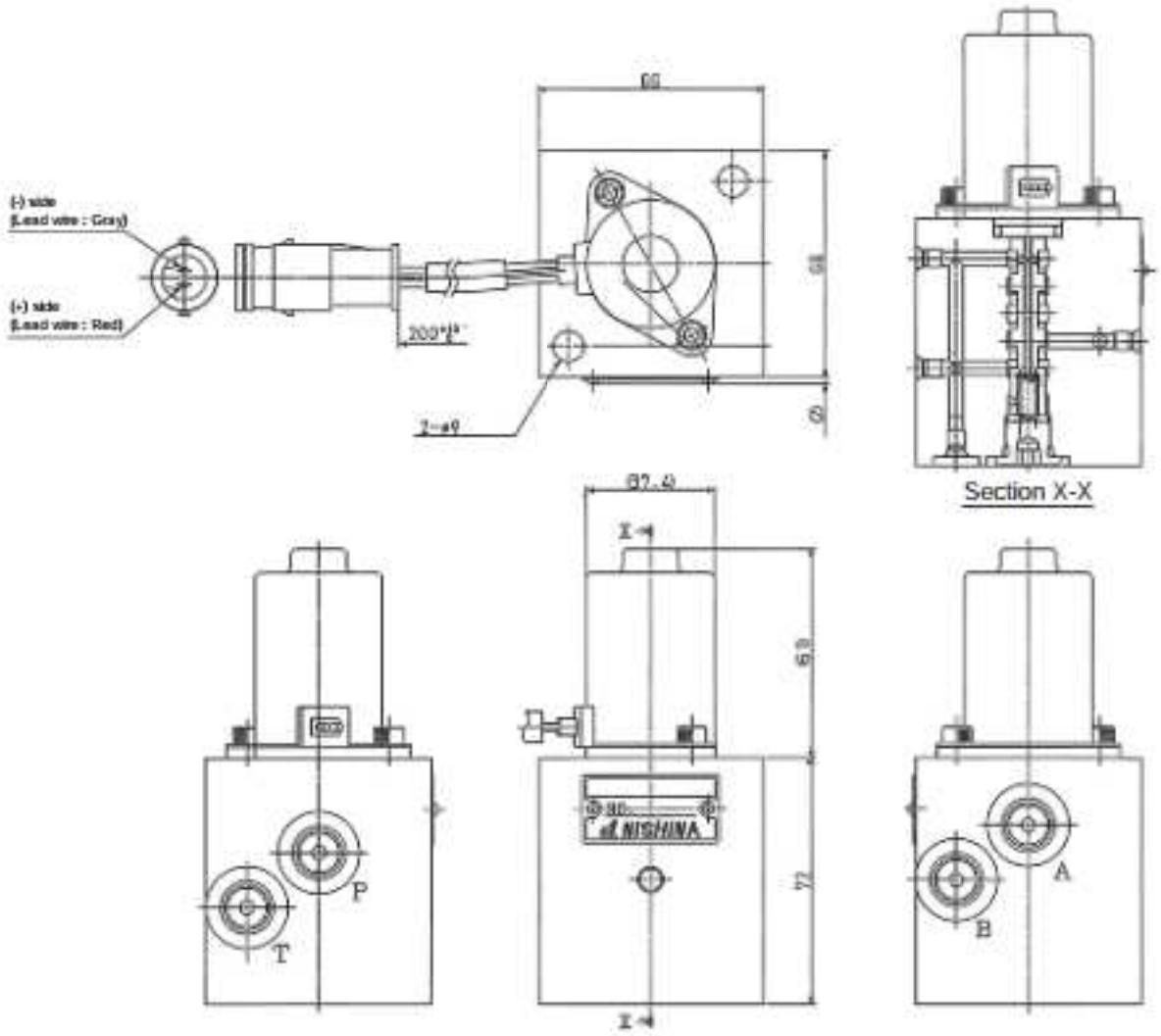


Port size and shape:
P1, P2, C1, C2, C3, C4 : G1/4 O-ring

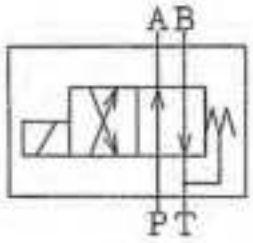


Circuit diagram

3-2 No. 3 auxiliary piping solenoid valve

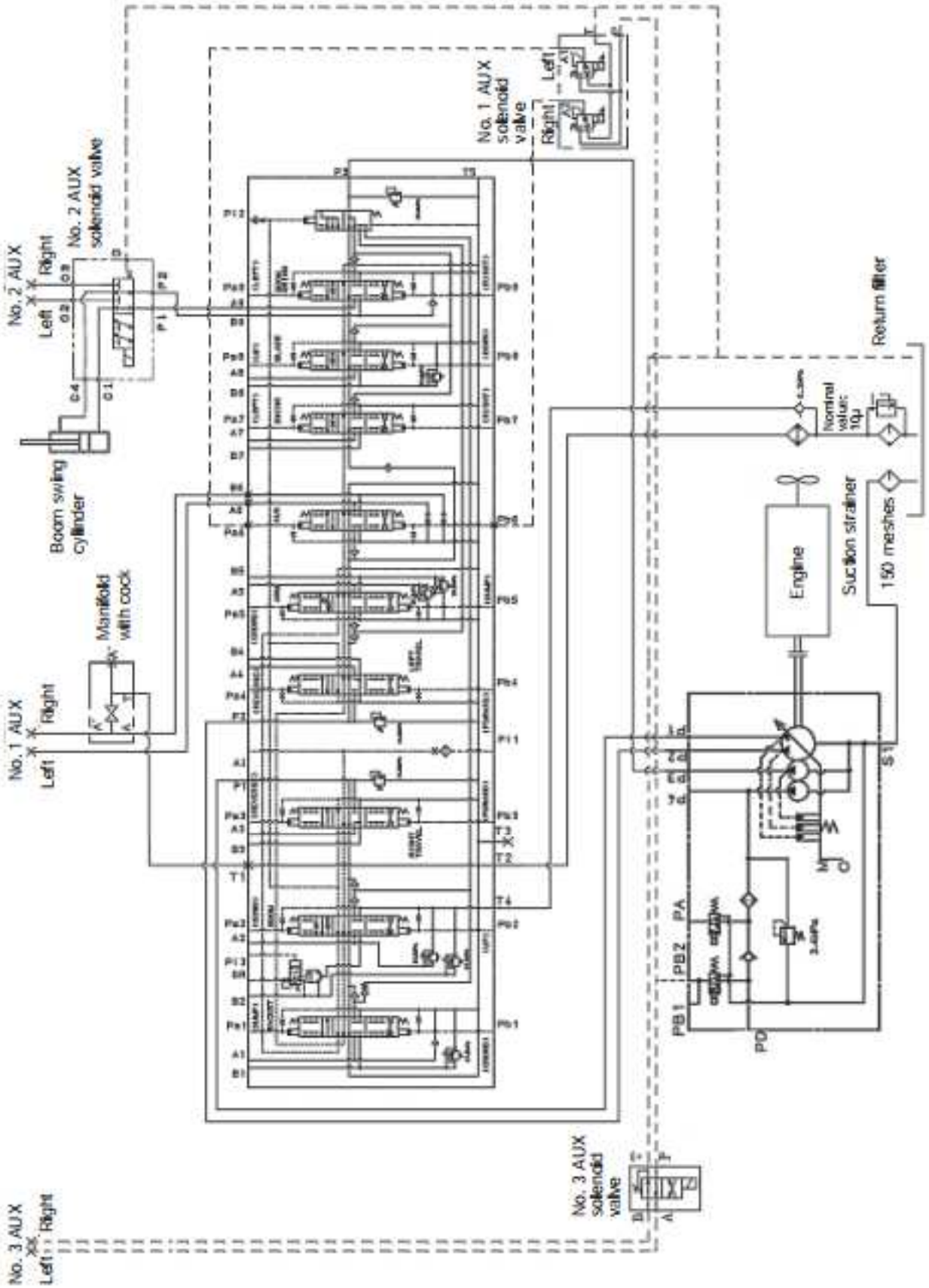


Port size and shape:
P, A, B, T: G1/4 O-ring



Circuit diagram

4 Hydraulic circuit diagram



When operating No. 1 auxiliary pedal