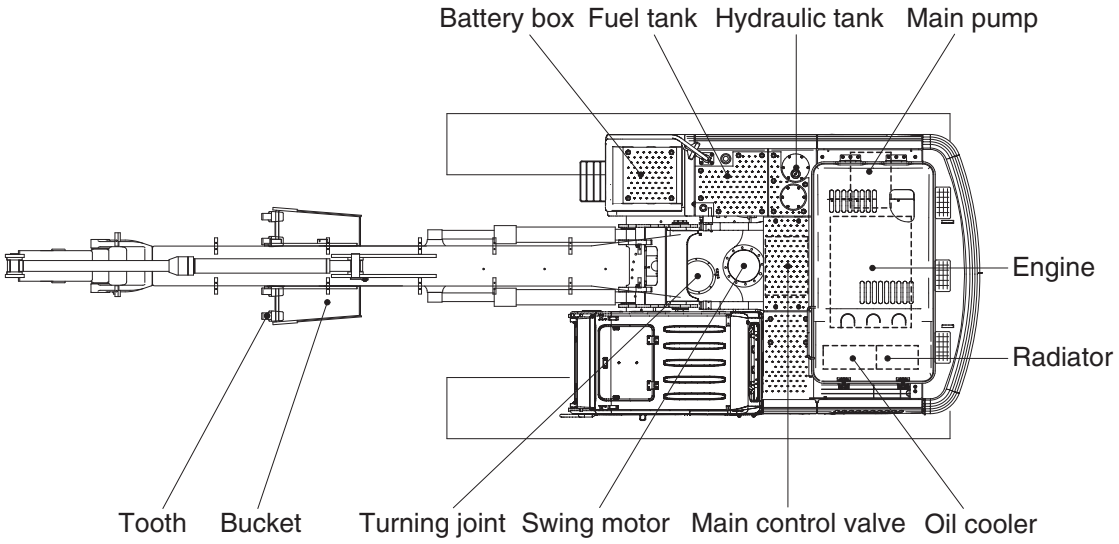
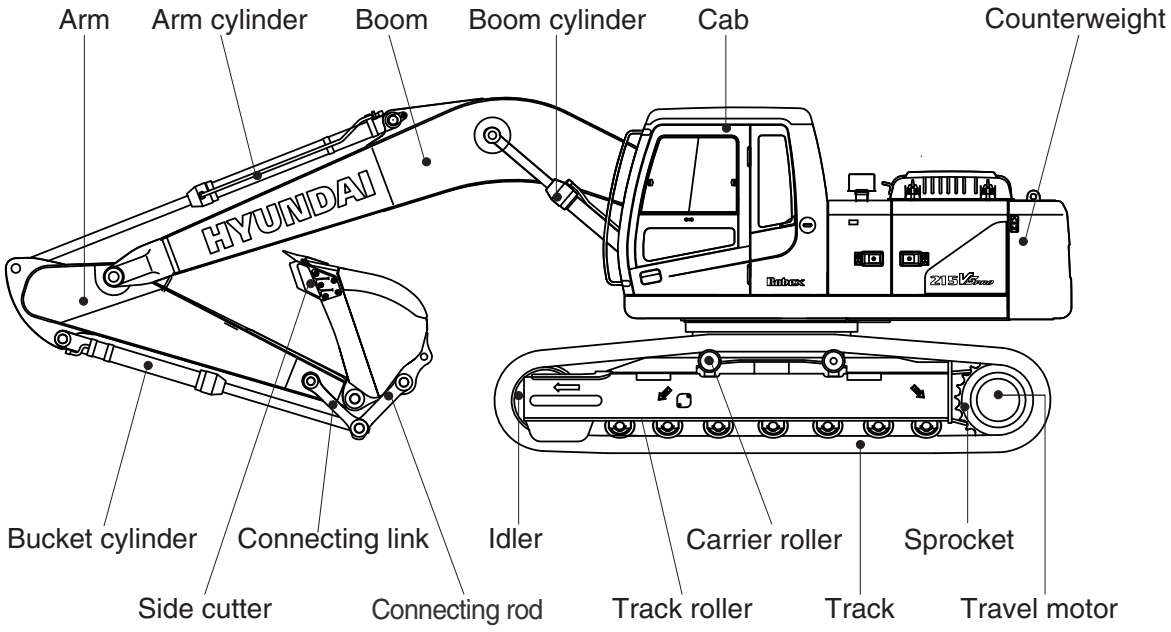
CONTENTS

SECTION 1 GENERAL

GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENT





7) REMOTE CONTROL VALVE

Item		Specification
Type		Pressure reducing type
Operating pressure	Minimum	6.5 kgf/cm^2
	Maximum	26 kgf/cm^2
Single operation stroke	Lever	61 mm
	Pedal	123 mm

8) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	ø 120 × ø 85 × 1290 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	ø 140 × ø 95 × 1510 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	ø 120 × ø 80 × 1055 mm
	Cushion	Extend only

※ Discoloration of cylinder rod can occur when the friction reduction additive of lubrication oil spreads on the rod surface.

※ Discoloration does not cause any harmful effect on the cylinder performance.

9) SHOE

Item		Width	Ground pressure	Link quantity	Overall width
R215VSPRO	Standard	600 mm (24")	0.47 kgf/cm^2 (6.81 psi)	46	2800 mm (9' 2")

10) BUCKET

Item		Capacity		Tooth quantity	Width	
		SAE heaped	CECE heaped		Without side cutter	With side cutter
R215VS PRO	STD	1.00 m^3	0.86 m^3	5	1315 mm	1410 mm
	OPT	0.92 m^3	0.80 m^3	5	1178 mm	1275 mm

(3) Valve block group

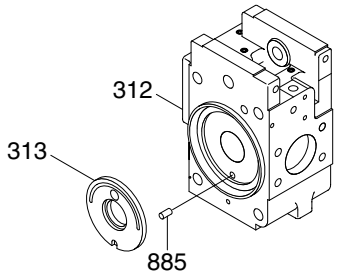
The valve block group consists of valve block (312), valve plate (313) and valve plate pin(885).

The valve plate having two melon-shaped ports is fixed to the valve block and feeds and collects oil to and from the cylinder block.

The oil changed over by the valve plate is connected to an external pipeline by way of the valve block.

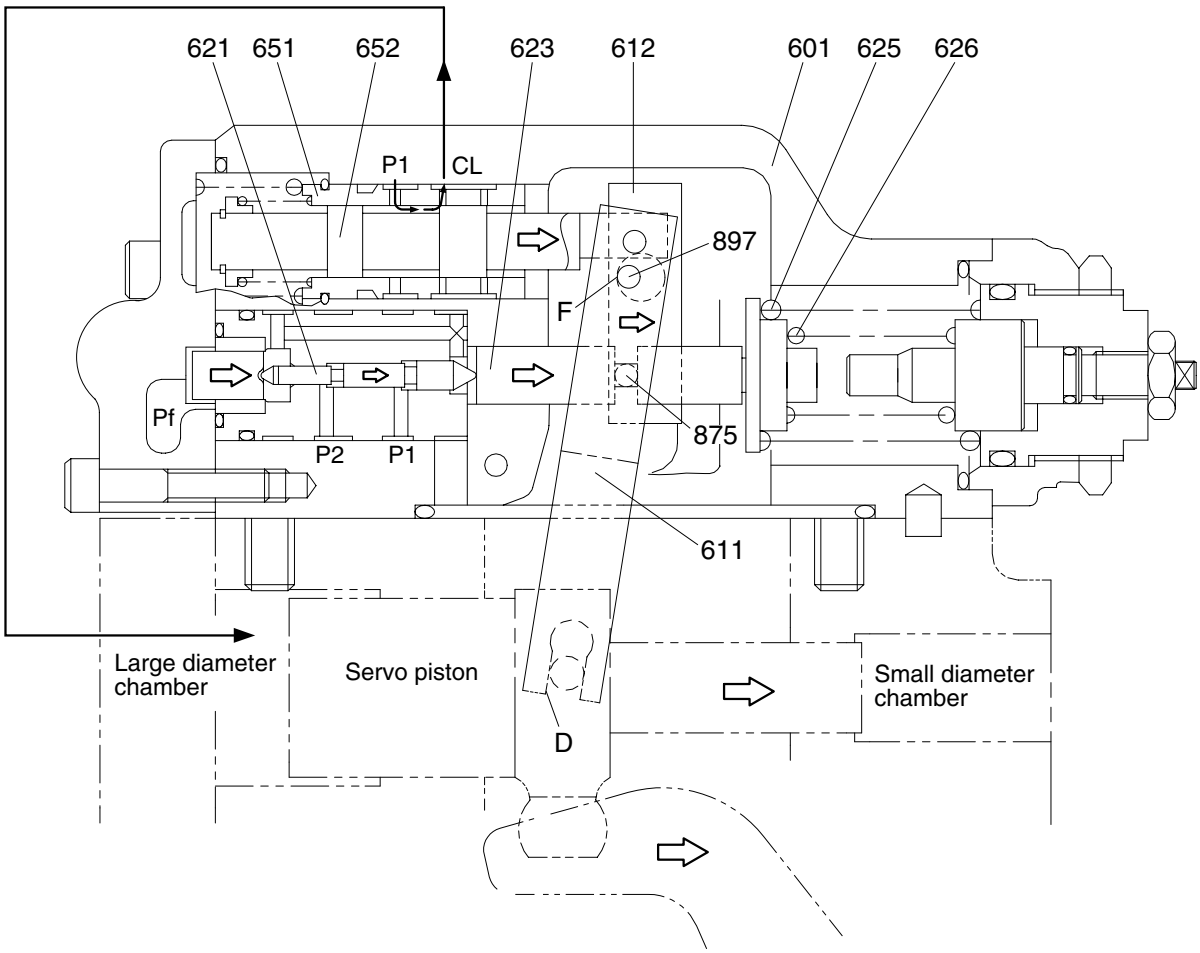
Now, if the drive shaft is driven by a prime mover (electric motor, engine, etc), it rotates the cylinder block via a spline linkage at the same time. If the swash plate is tilted as in Fig (previous page) the pistons arranged in the cylinder block make a reciprocating motion with respect to the cylinder block, while they revolve with the cylinder block.

If you pay attention to a single piston, it performs a motion away from the valve plate (oil sucking process) within 180 degrees, and makes a motion towards the valve plate (or oil discharging process) in the rest of 180 degrees. When the swash plate has a tilting angle of zero, the piston makes no stroke and discharges no oil.

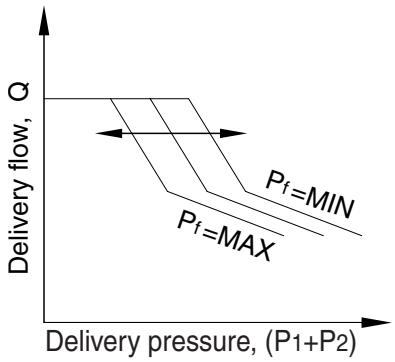


(3) Variable horsepower control

Variable horsepower control can be obtained by supplying pilot pressure.



The set horsepower valve is shifted by varying the command current level of the proportional pressure reducing valve attached to the pump.
Only one proportional pressure reducing valve is provided.
However, the secondary pressure Pf (power shift pressure) is admitted to the horsepower control section of each pump regulator through the pump's internal path to shift it to the same set horsepower level.

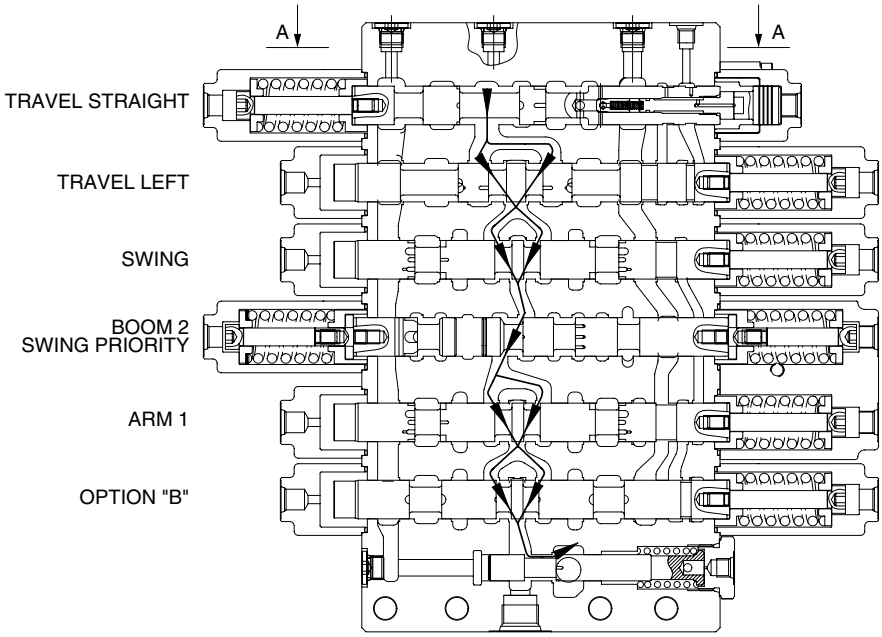


This function permits arbitrary setting of the pump output power, thereby providing the optimum power level according to the operating condition.
The power shift pressure Pf controls the set horsepower of the pump to a desired level, as shown in the figure.
As the power shift pressure Pf rises, the compensating rod (623) moves to the right via the pin (898) and compensating piston (621).
This decreases the pump tilting angle and then the set horsepower in the same way as explained in the overload preventive function of the horsepower control. On the contrary, the set horsepower rises as the power shift pressure Pf falls.

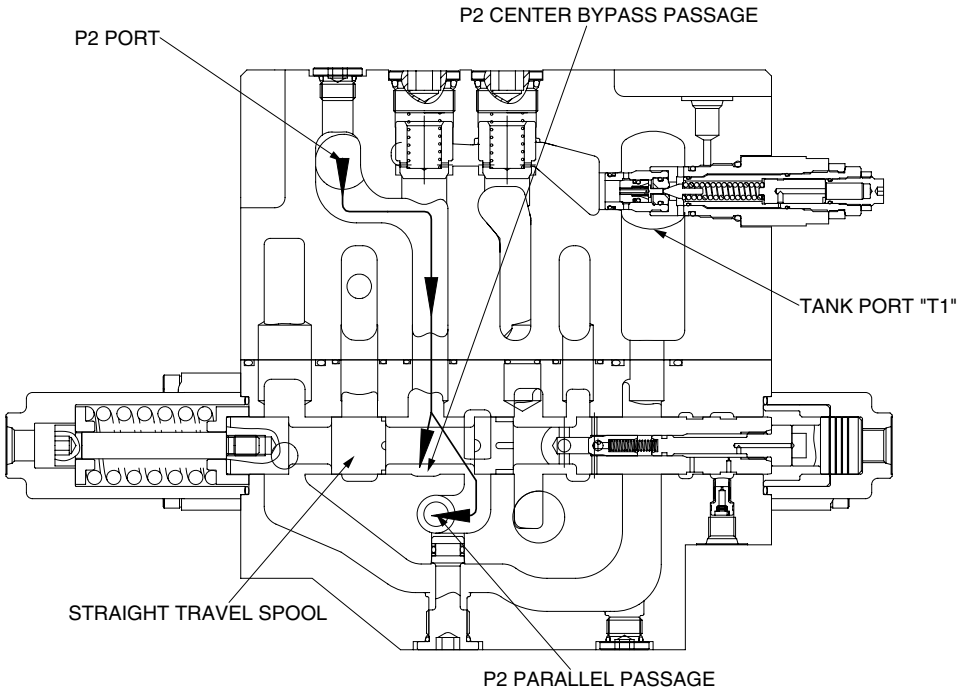
(2) P2 SIDE

The hydraulic fluid from pump flows into the main control valve through the inlet port "P2", pass the land of the straight travel spool, into the P2 bypass passage and P2 parallel passage.

When the straight travel spool is in neutral position, the bypass passage is not shut off. Then the hydraulic fluid from the pump P2 is directed to the tank through the bypass passage of spools : travel left, swing, boom 2 & swing priority, arm 1, option "B" and option "C" of bypass passage summation, and the negative relief valve of P2, the tank passage and the tank port "T1".



P2 spool section



SECTION A - A

(2) BUCKET OUT OPERATION

① Bucket operation only

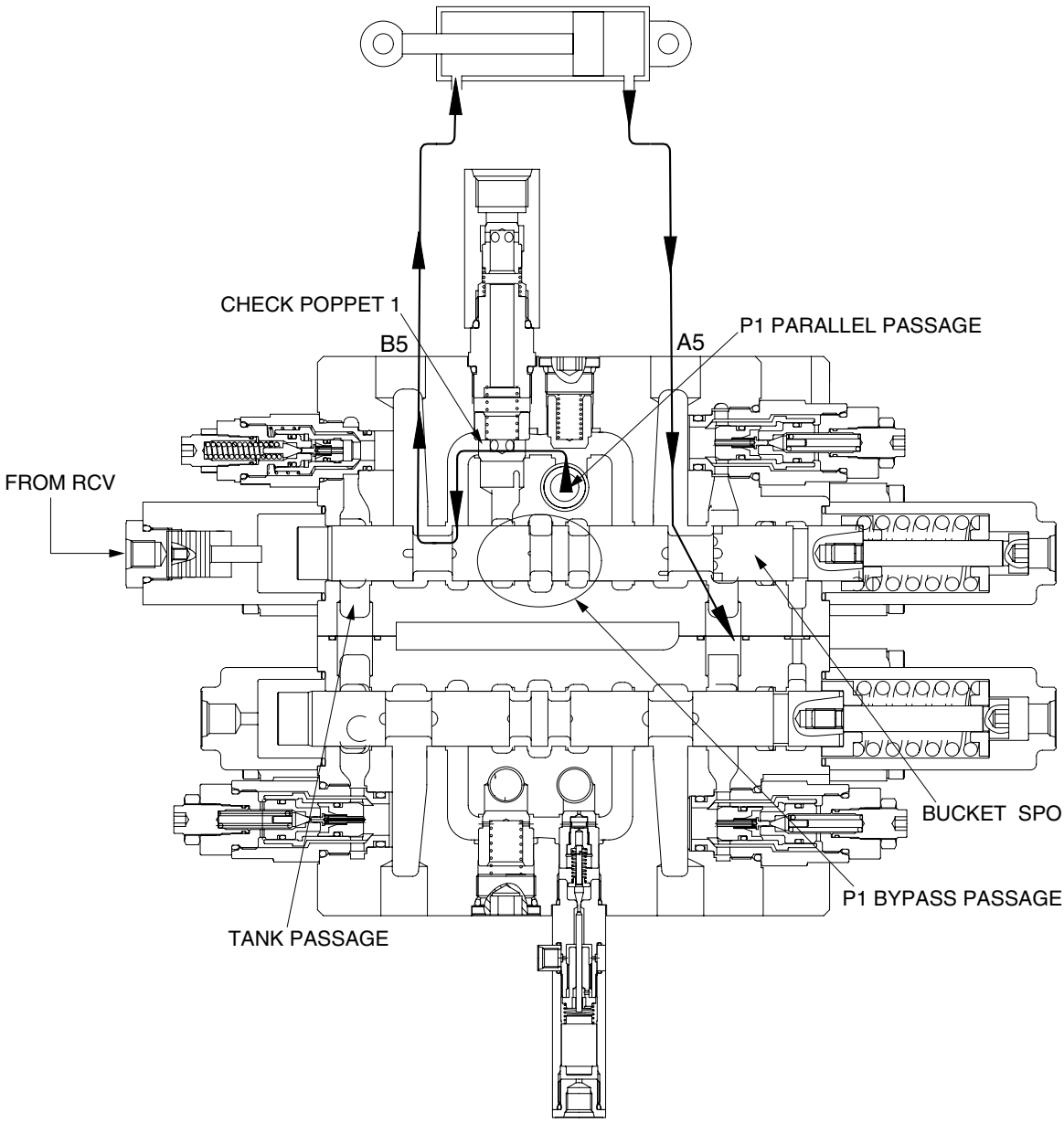
During the bucket out operation, the pilot secondary pressure from RCV is supplied to port of the spring opposite side and shifts the bucket spool in the left direction.

The bypass passage is shut off by the movement of the spool and the hydraulic fluid from pump P1 entered P1 parallel passage and is directed to the port B5 through the check1.

The return flow from the rod side of the bucket cylinder returns to the hydraulic oil tank through the tank passage and the port A5.

② Bucket operation with arm or boom operation

When combined operation, the same as above.



11) NEGATIVE RELIEF VALVE OPERATION

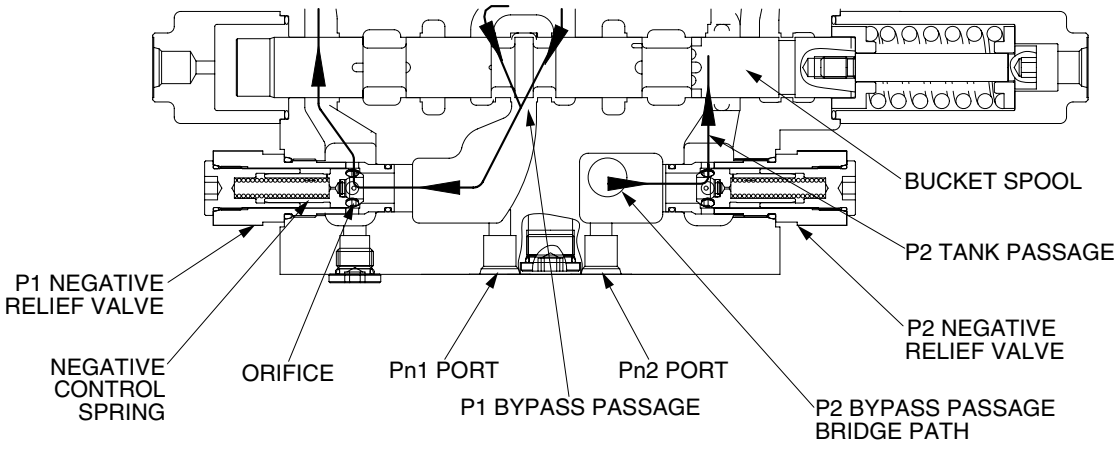
When no function is being actuated on P1 side, the hydraulic fluid from the pump P1, flows into the tank passage through the bypass passage and orifice. The restriction caused by this orifice thereby pressurizes. This pressure is transferred as the negative control signal pressure Pn1 to the pump P1 regulator.

It controls the pump regulator so as to minimize the discharge of the pump P1.

The bypass passage is shut off when the shifting of one or more spools and the flow through bypass passage became zero. The pressure of negative control signal becomes zero and the discharge of the pump P1 becomes maximum.

The negative control pressure reaches to the set level, the hydraulic fluid in the passage pushes open negative control valve and escapes into the return passage.

For the pump P2 the same negative control principle.



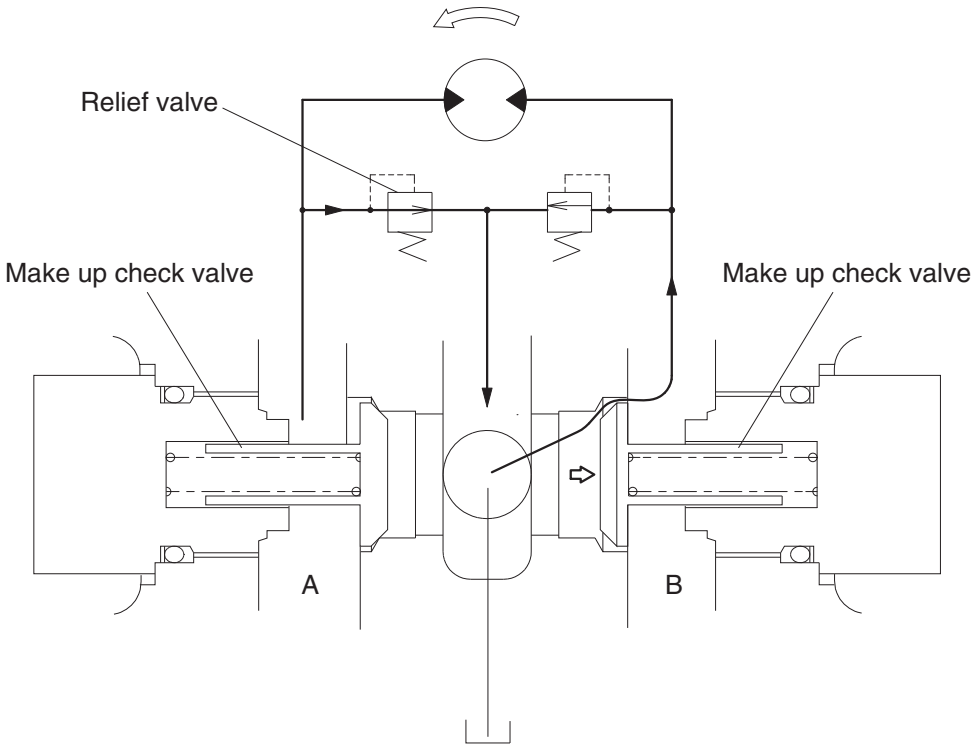
2) MAKE UP VALVE

In the system using this type of motor, there is no counter balance functioning valve and there happens the case of revolution exceeding hydraulic supply of motor. To prevent the cavitation caused by insufficient oil flow there is a make up valve to fill up the oil insufficiency.

A make up valve is provided immediately before the port leading to the hydraulic oil tank to secure feed pressure required when the hydraulic motor makes a pumping action. The boost pressure acts on the hydraulic motor's feed port via the make up valve.

Pressurized oil into the port B, the motor rotate counterclockwise.

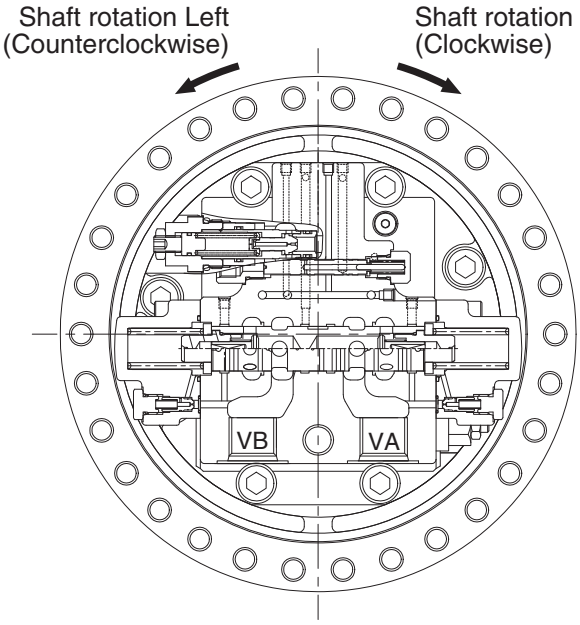
If the plunger of MCV moves neutral position, the oil in the motor is drain via left relief valve, the drain oil run into motor via right make up valve, which prevent the cavitation of motor.



3. OPERATION

1) MOTOR

High pressure oil delivered form hydraulic pump is led to inlet port that is provided in the brake valve portion and, through the rear cover (34) and valve plate (28), led to cylinder block (18).
The oil flow and direction of shaft rotation are indicated in table.



Inlet port	Outlet port	Direction of shaft rotation (viewing from rear cover)
VB	VA	Right (clockwise)
VA	VB	Left (counterclock wise)

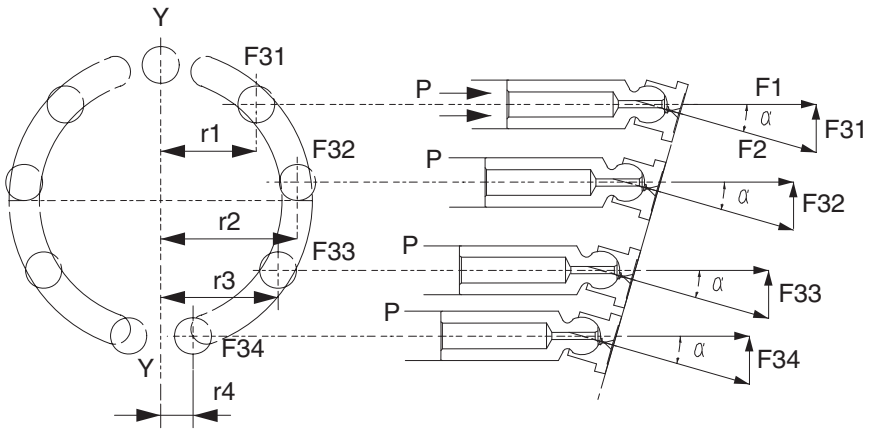
As shown in below figure, high pressure oil is supplied to the pistons which are on one side of the line Y-Y that connects upper and lower dead points and produces force F1.

$F1 = P \times A$ (P : pressure, A : area of piston section)

The swash plate (17) with inclined angle of α divides this force F1 into thrust force F2 and radial force F31-34.
This radial force is applied to axis Y-Y as turning force and generate drive torque of T.

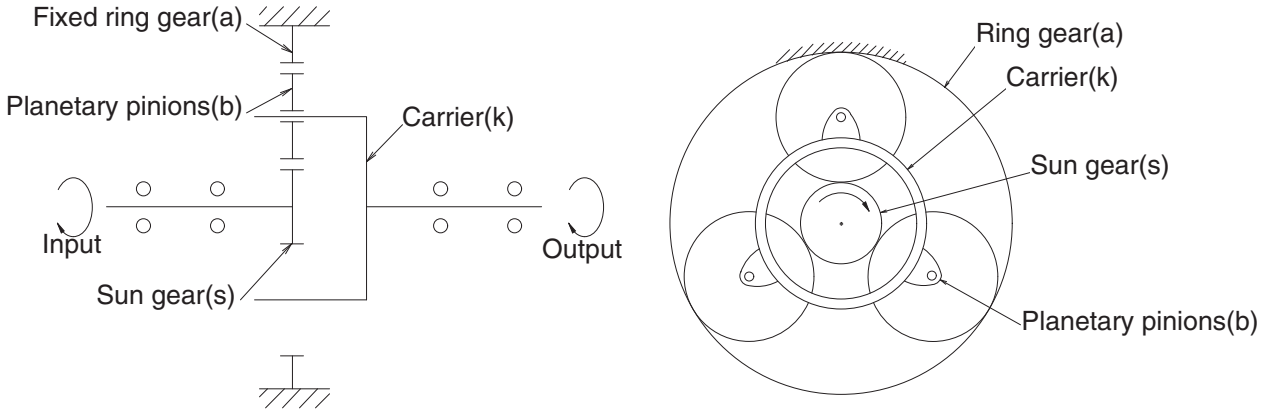
$T = r_1 \cdot F31 + r_2 \cdot F32 + r_3 \cdot F33 + r_4 \cdot F34$

This drive torque is transmitted via cylinder block (18) to driving shaft (8).

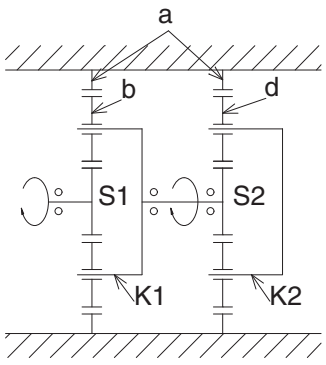


6) REDUCTION GEAR

Reduction unit slows down the rotating speed of motor and converts motor torque to strong rotating force.
This reduction unit utilizes two stages, planetary reduction system.
Planetary reduction system consists of sun gear, planetary gears, (planetary) carriers, and ring gear.
When the sun gear (s) is driven through input shaft, planetary pinions (b), rotating on their center, also move, meshing with fixed ring gear (a), around sun gear (s).
This movement is transferred to carrier (k) and deliver the torque.
This mechanism is called planetary gear mechanism.



When the sun gear **S1** is driven by input shaft, planetary action occurs among gears **S1**, **a** and **b** and revolution of gear **b** transfers the rotation of carrier **K1** to second sun gear **S2**, and also evokes planetary action between gear **S2, a** and **d**.
This time, because carrier **K2** is fixed to frame, gear **d** drives ring gear **a** and then ring gear **a** rotates to drive sprocket.



2. FUNCTION

1) FUNDAMENTAL FUNCTIONS

The pilot valve is a valve controls the spool stroke, direction, etc of a main control valve. This function is carried out by providing the spring at one end of the main control valve spool and applying the output pressure (secondary pressure) of the pilot valve to the other end.

For this function to be carried out satisfactorily, the pilot valve is composed of the following elements.

(1) Inlet port (P) where oil is supplied from hydraulic pump.

(2) Output port (1, 2, 3 & 4) to apply pressure supplied from inlet port to ends of control valve spools.

(3) Tank port (T) necessary to control the above output pressure.

(4) Spool to connect output port to inlet port tank port.

(5) Mechanical means to control output pressure, including springs that work on the above spools.

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (8) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output spool to determine the output pressure.

The spring (6) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (14) is inserted and can slide in the plug (21).

For the purpose of changing th displacement of the push rod through the cam (27) and adjusting nut (32) are provided the pedal that can be tilted in any direction around the fulcrum of the cam (27) center.

The spring (10) works on the casing (1) and spring seat (7) and tries to return the push rod (14) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

This also has the effect of a reaction spring to give appropriate control feeling to the operator.

SECTION 4 ELECTRICAL SYSTEM

3. CHARGING CIRCUIT

When the starter is activated and the engine is started, the operator releases the key switch to the ON position.

Charging current generated by operating alternator flows into the battery through the battery relay [CR-1].

The current also flows from alternator to each electrical component and controller through the fuse box.

1) OPERATING FLOW

(1) Warning flow

Alternator "L" terminal → I/conn [CN-2 (13)] → I/conn [CN-5 (8)] → CMCU [CN-56 (67)] → Cluster charging warning lamp(Via serial interface)

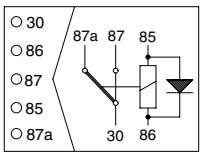
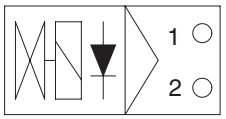
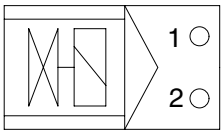
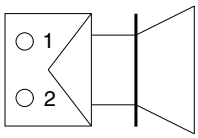
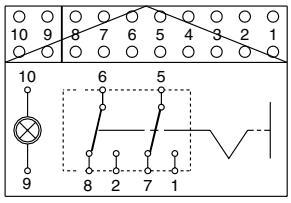
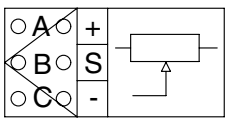
(2) Charging flow

Alternator "B^+" terminal → Battery relay → Battery(+) terminal
Battery relay → Fusible link [CN-60] → Master switch [CS-74] → Fuse box

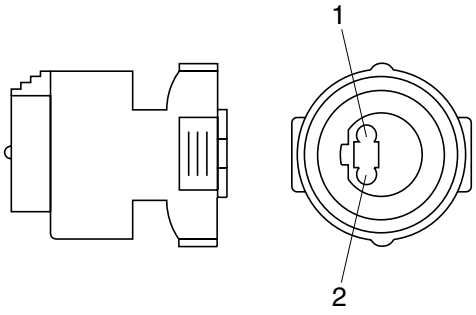
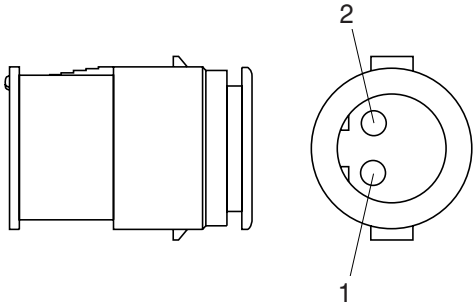
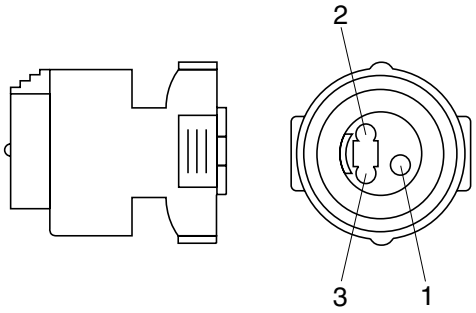
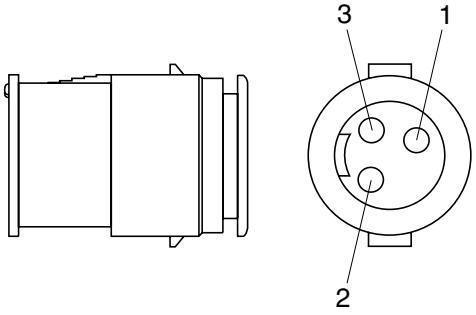
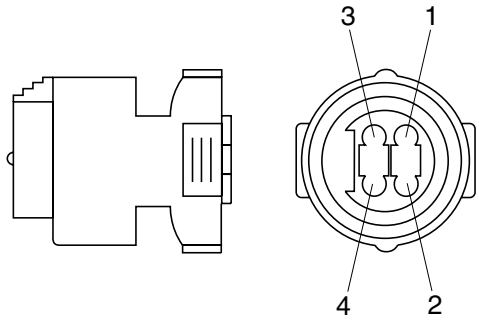
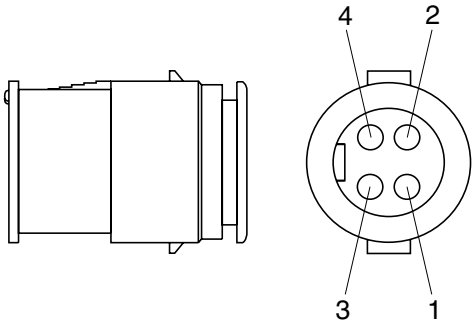
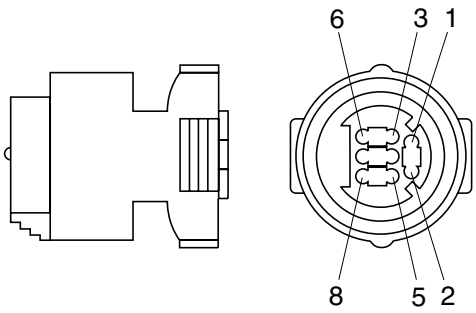
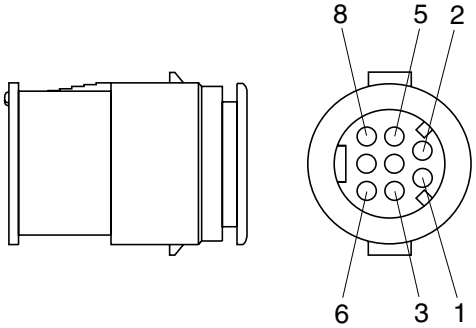
2) CHECK POINT

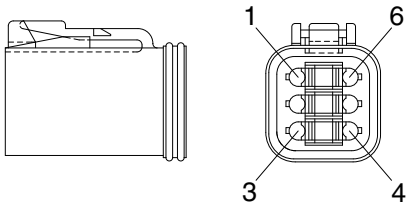
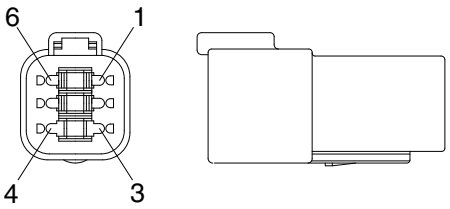
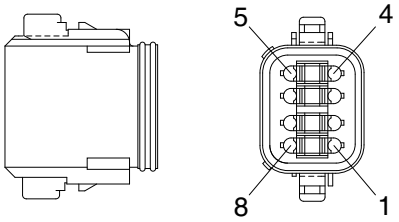
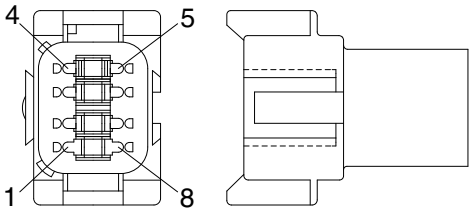
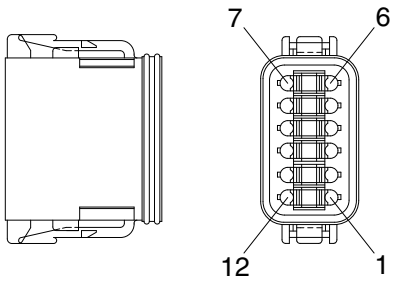
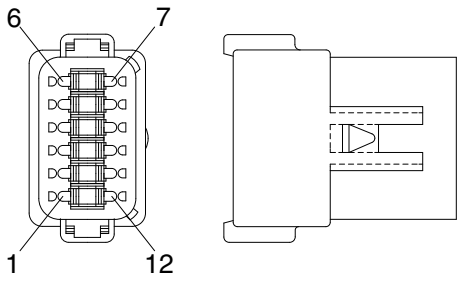
Engine	Start switch	Check point	Voltage
Run	ON	① - GND (battery voltage) ② - GND (battery relay) ③ - GND (alternator B^+ terminal) ④ - GND (alternator L terminal) ⑤ - GND (CMCU)	20~30V

※ GND : Ground

Part name	Symbol	Specifications	Check
Relay	 CR-2 CR-5 CR-7 CR-13 CR-15 CR-35 CR-46	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 85-86) 0 Ω (for terminal 30-87a) ∞ Ω (for terminal 30-87)
Solenoid valve	 CN-68 CN-66 CN-70 CN-140	24V 1A	※ Check resistance Normal : 15~25 Ω (for terminal 1-2)
EPPR valve	 CN-75	700mA	※ Check resistance Normal : 15~25 Ω (for terminal 1-2)
Speaker	 CN-23(LH) CN-24(RH)	20W	※ Check resistance Normal : A few Ω
Switch (locking type)	 CS-23 CS-27 CS-50 CS-54 CS-67 CS-82 CS-83 CS-84	24V 8A	※ Check contact Normal ON : 0 Ω (For terminal 1-5, 2-6) ∞ Ω (For terminal 5-7, 6-8) OFF : ∞ Ω (For terminal 1-5, 2-6) 0 Ω (For terminal 5-7, 6-8)
Accel dial	 CN-142	-	※ Check resist Normal : About 5k Ω (for terminal A-C) ※ Check voltage Normal : About 5V (for terminal A-C) : 2~4.5V (for terminal C-B)

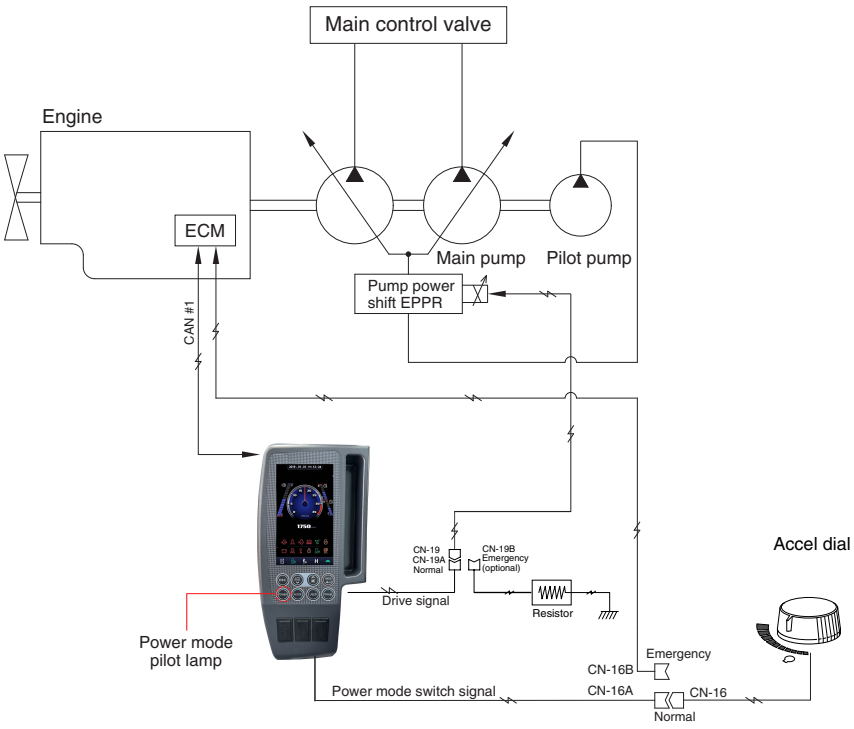
2) J TYPE CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

No. of pin	Receptacle connector (female)	Plug connector (male)
6	 DT06-6S	 DT04-6P
8	 DT06-8S	 DT04-8P
12	 DT06-12S	 DT04-12P

GROUP 2 MODE SELECTION SYSTEM

1. POWER MODE SELECTION SYSTEM



Mode selection system (micro computer based electro-hydraulic pump and engine mutual control system) optimizes the engine and pump performance.

The combination of 3 power modes (M, H, S) and accel dial position (10 set) makes it possible to use the engine and pump power more effectively corresponding to the work conditions from a heavy and great power requesting work to a light and precise work.

Power mode	Application	Engine rpm				Power shift by EPPR valve			
		Standard		Option		Standard		Option	
		Unload	Load	Unload	Load	Current (mA)	Pressure (kgf/cm^2)	Current (mA)	Pressure (kgf/cm^2)
M	Max mode	1900±50	-	1950±50	-	-	10(~3)	-	8 (~3)
H	Heavy duty power	1800±50	-	1850±50	-	-	12(~5)	-	10(~5)
S	Standard power	1700±50	-	1750±50	-	-	15(~8)	-	13(~8)
Auto decel	Engine deceleration	1000±50	-	-	-	-	40±2	-	-
One touch decel	Engine quick deceleration	850±50	-	-	-	-	40±2	-	-
Key start	Key switch start position	850±50	-	-	-	-	40±2	-	-

※ Power shift (Standard/Option) can be changed by "Service menu" in "Management" on the cluster.

3. MACHINE ERROR CODES TABLE

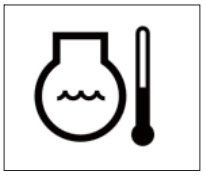
FAULT CODE	SPN	FMI	SPN-FMI Description
1	341	6	Motor Driving Status for Engine Governor Actuator - Current Above Normal Or Grounded Circuit
2	340	3	Potentiometer Voltage for Engine Governor Actuator - Voltage Above Normal, Or Shorted To High Source
3	140	6	Main Pump EPPR Valve Current - Current Above Normal Or Grounded Circuit
5	167	6	Travel Speed Solenoid - Voltage Below Normal, Or Shorted To Low Source
10	701	3	Hour-Meter - Voltage Below Normal, Or Shorted To Low Source
11	714	3	Acceleration Dial Voltage - Voltage Above Normal, Or Shorted To High Source
12	120	0	Main Pump 1(P1) Pressure - Data Valid But Above Normal Operational Range
13	121	0	Main Pump 2(P2) Pressure - Data Valid But Above Normal Operational Range
14	200	0	P1_P2_EPPR_VALVE_PRESSURE_MEASUREMENT
16	341	5	Motor Driving Status for Engine Governor Actuator - Current Below Normal Or Open Circuit
18	140	5	Main Pump EPPR Valve Current - Current Below Normal Or Open Circuit
20	167	4	Travel Speed Solenoid - Voltage Below Normal, Or Shorted To Low Source
25	701	4	Hour-Meter - Voltage Below Normal, Or Shorted To Low Source
26	714	4	Acceleration Dial Voltage - Voltage Below Normal, Or Shorted To Low Source
27	120	4	Main Pump 1(P1) Pressure - Voltage Below Normal, Or Shorted To Low Source
28	121	4	Main Pump 2(P2) Pressure - Voltage Below Normal, Or Shorted To Low Source
29	200	4	P1 & P2 EPPR Valve Pressure (Measurement) - Voltage Below Normal, Or Shorted To Low Source
32	722	4	Travel Alarm Buzzer - Voltage Below Normal, Or Shorted To Low Source
33	707	1	Alternator Voltage - Data Valid But Below Normal Operational Range
34	705	1	(MCU Input)Battery Voltage - Data Valid But Below Normal Operational Range
35	705	0	(MCU Input)Battery Voltage - Data Valid But Above Normal Operational Range
36	840	2	Cluster Communication Status - Data Erratic, Intermittent Or Incorrect
38	327	6	Anti-Restart Relay - Current Above Normal Or Grounded Circuit
41	101	4	Hydraulic Oil Temperature - Voltage Below Normal, Or Shorted To Low Source
42	301	4	Fuel Level - Voltage Below Normal, Or Shorted To Low Source
44	127	0	Boom Up Pilot Pressure - Data Valid But Above Normal Operational Range
45	101	3	Hydraulic Oil Temperature - Voltage Above Normal, Or Shorted To High Source
46	301	3	Fuel Level - Voltage Above Normal, Or Shorted To High Source
48	127	4	Boom Up Pilot Pressure - Voltage Below Normal, Or Shorted To Low Sourc
56	722	6	Travel Alarm Buzzer Current Above Normal Or Grounded Circuit
72	841	2	ECM Communication Status - Data Erratic, Intermittent Or Incorrect

Some error codes are not applied to this machine

5) WARNING LAMPS

※ The warming lamp lights ON and the buzzer sounds when the machine has a problem.
In this case, press the buzzer stop switch and buzzer stop, but the warming lamp lights until the problem is cleared.

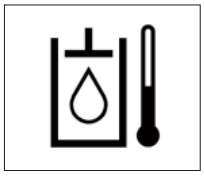
(1) Engine coolant temperature



① The lamp is ON and the buzzer sounds when the cooling water temperature is over the reference temperature (105°C)

② Check the cooling system when the lamp keeps ON.

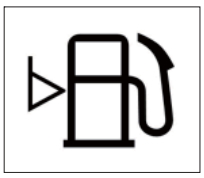
(2) Hydraulic oil temperature



① The lamp is ON and the buzzer sounds when the cooling water temperature is over the reference temperature (105°C)

② Check the cooling water level if this warning lamp is ON.

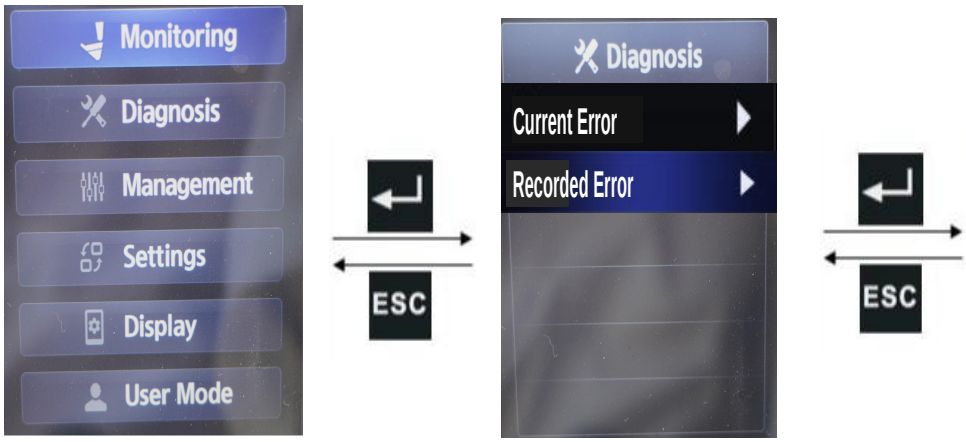
(3) Fuel level

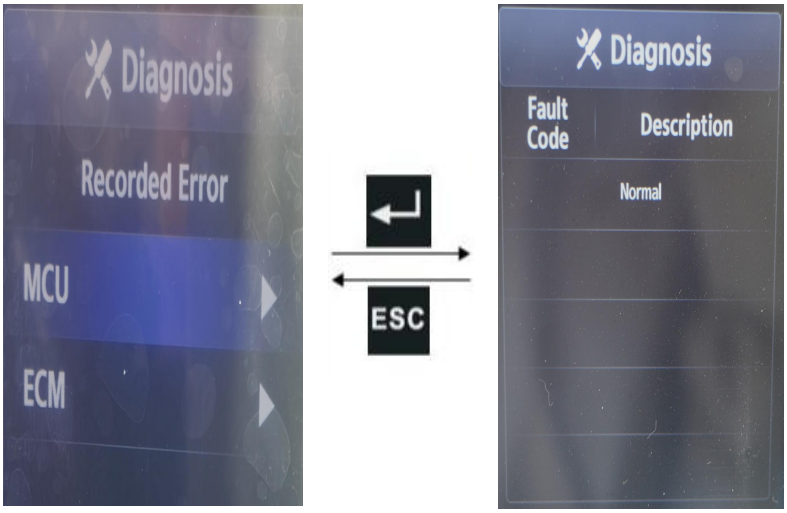


① This warning lamp pops up and the buzzer sounds when the level of fuel is below 31 ℓ (8.2 U.S. gal).

② Fill the fuel immediately when the lamp blinks.

b. Recorded Error





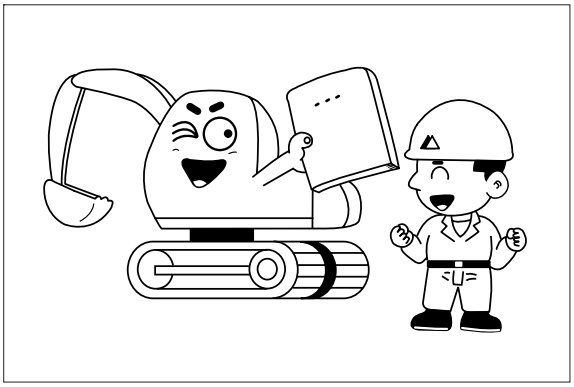
- You can check past CMCU or engine ECM failures.

2. DIAGNOSING PROCEDURE

To carry out troubleshooting efficiently, the following steps must be observed.

STEP 1. Study the machine system

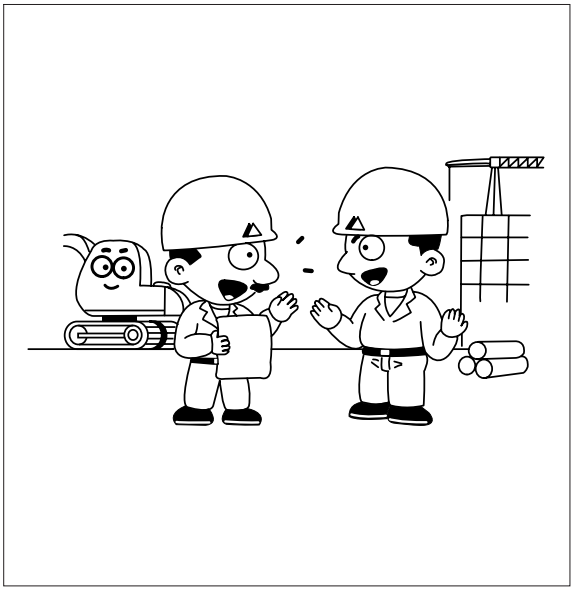
Study and know how the machine is operating, how the system is composing, what kinds of function are installed in the machine and what are specifications of the system components by the machine service manual.
Especially, deepen the knowledge for the related parts of the trouble.



STEP 2. Ask the operator

Before inspecting, get the full story of malfunctions from a witness --- the operator.

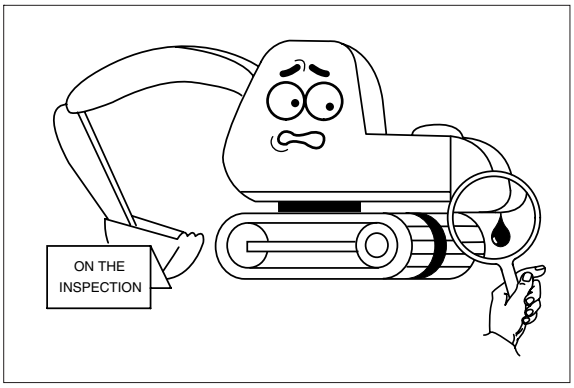
1) How the machine is used and when it is serviced?
2) When the trouble was noticed and what work the machine was doing at that time?
3) What is the phenomenon of the trouble? Was the trouble getting worse, or did it come out suddenly for the first time?
4) Did the machine have any troubles previously? If so, which parts were repaired before.



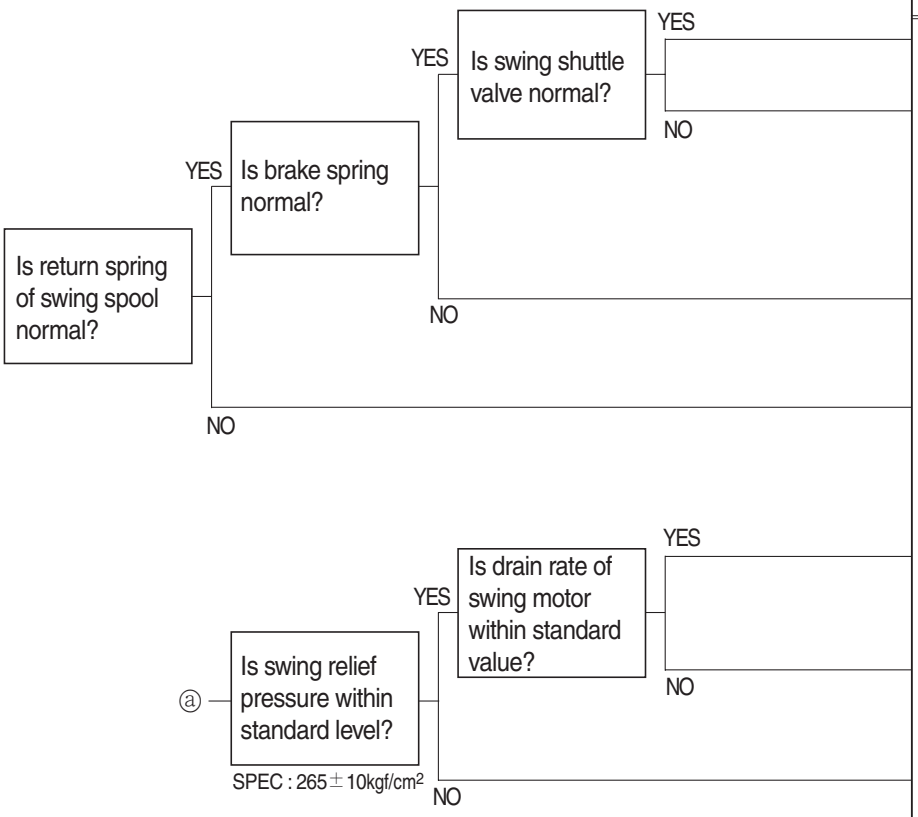
STEP 3. Inspect the machine

Before starting troubleshooting, check the machine for the daily maintenance points as shown in the operator's manual.

And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.

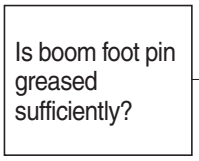


5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE



Cause	Remedy
ⓐ	
Shuttle valve is faulty.	Disassemble and replace.
Brake spring is faulty.	Disassemble and replace.
Return spring of swing control valve is faulty.	Disassemble and replace.
Swing port relief valve is faulty.	Disassemble and repair or replace.
Swing motor is broken.	Disassemble and repair.
	Adjust swing relief valve pressure or replace swing relief valve.

6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED



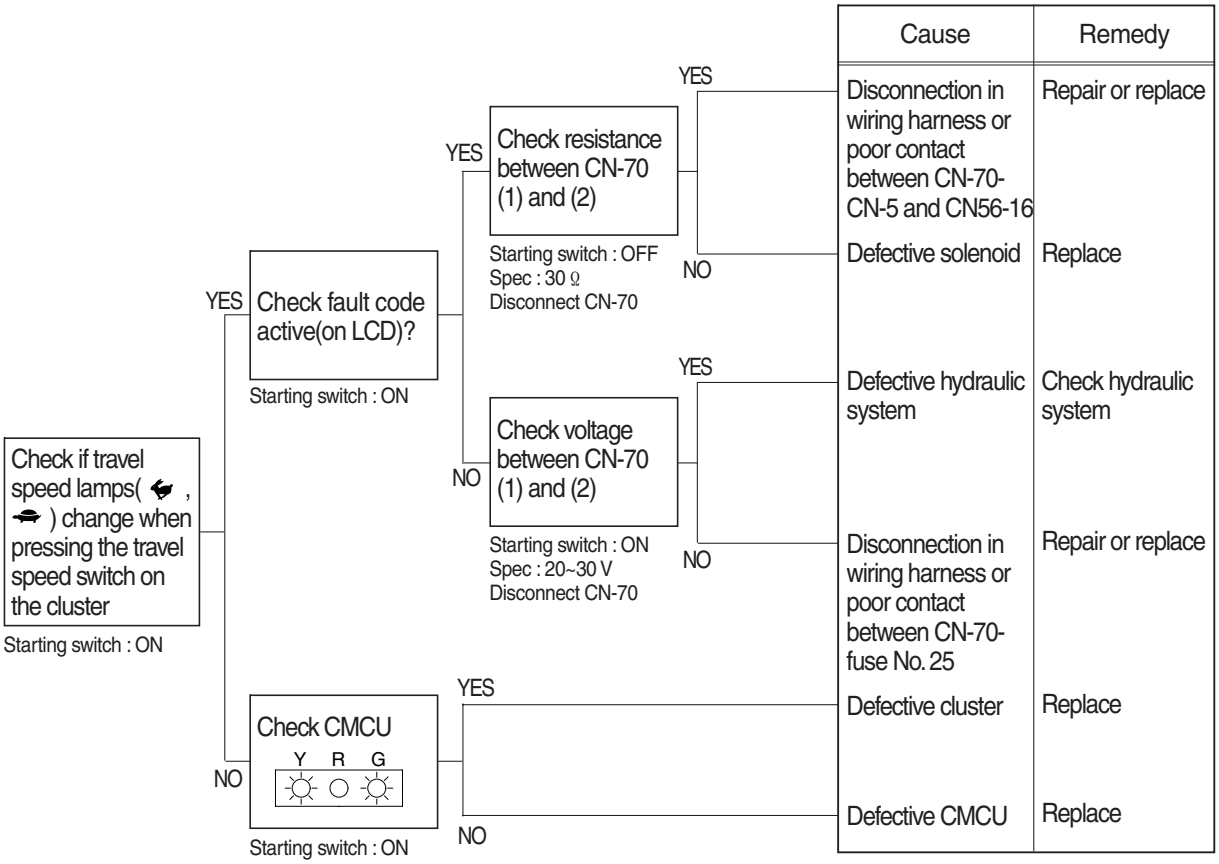
YES

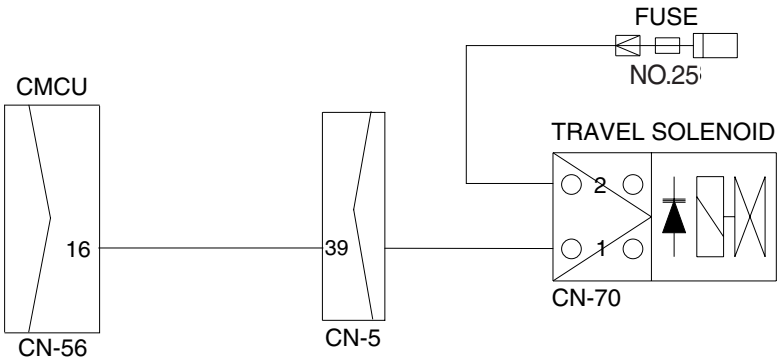
NO

Cause	Remedy
	Frictional noise occurs between the sliding faces of boom cylinder's oil seal and boom proper. ※ Frictional noise will disappear if they are kept used.
Boom foot pin has run out of grease.	Supply grease to it. ※ If seizure is in an initial stage, supply sufficient grease. If seizure is in a grown state, correct it by paper lapping or with an oil stone.

9. WHEN TRAVEL SPEED 1, 2 DOES NOT OPERATE

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and fuse No. 25 burnt out.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.

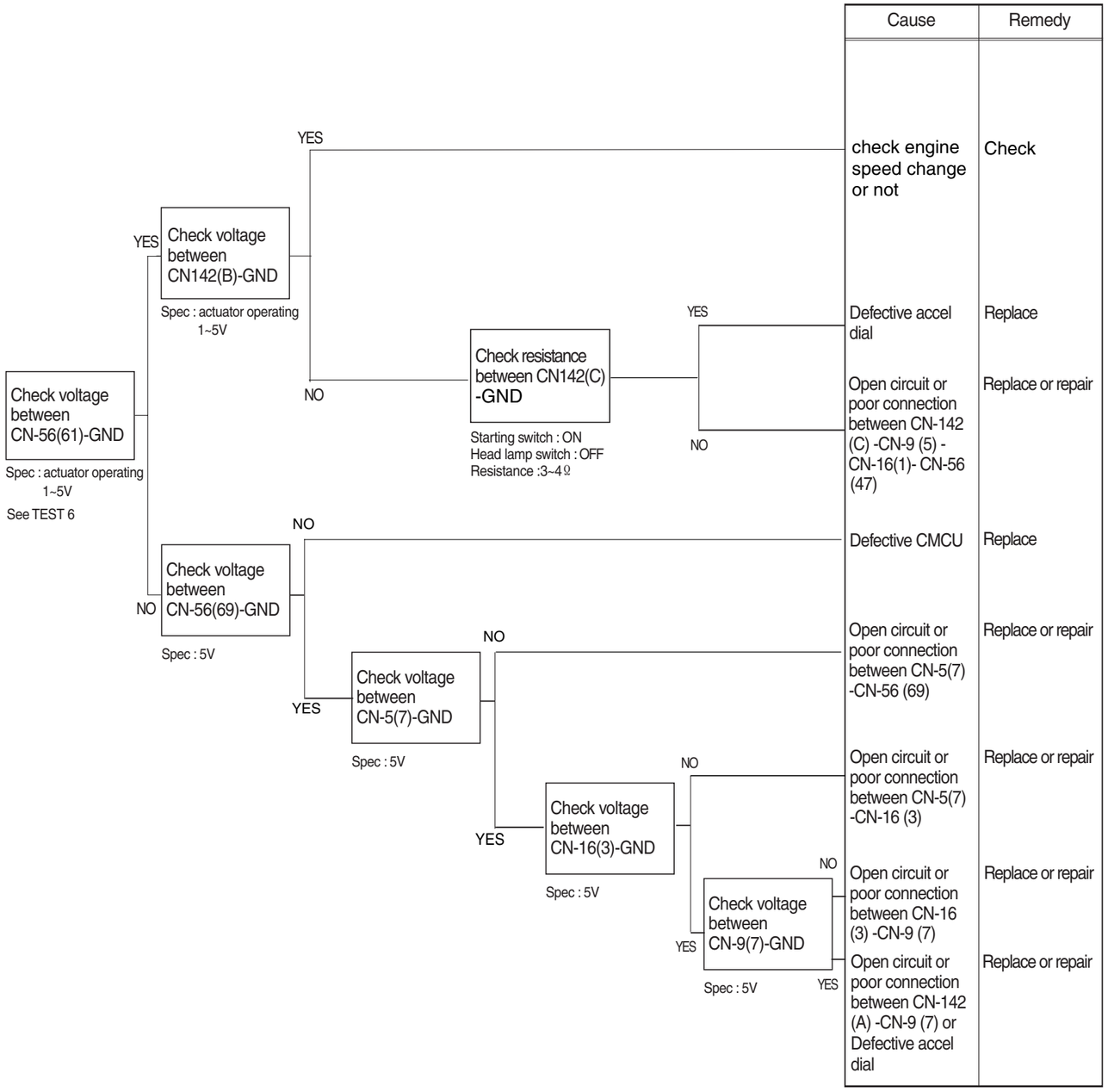


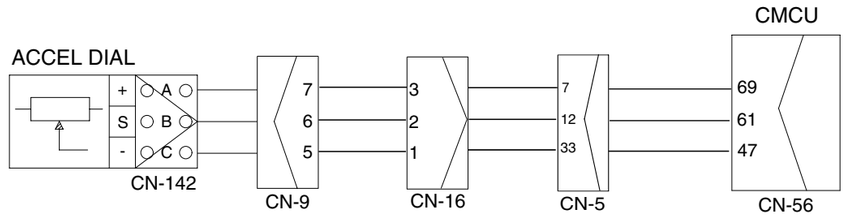


3. MALFUNCTION OF ACCEL DIAL

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE

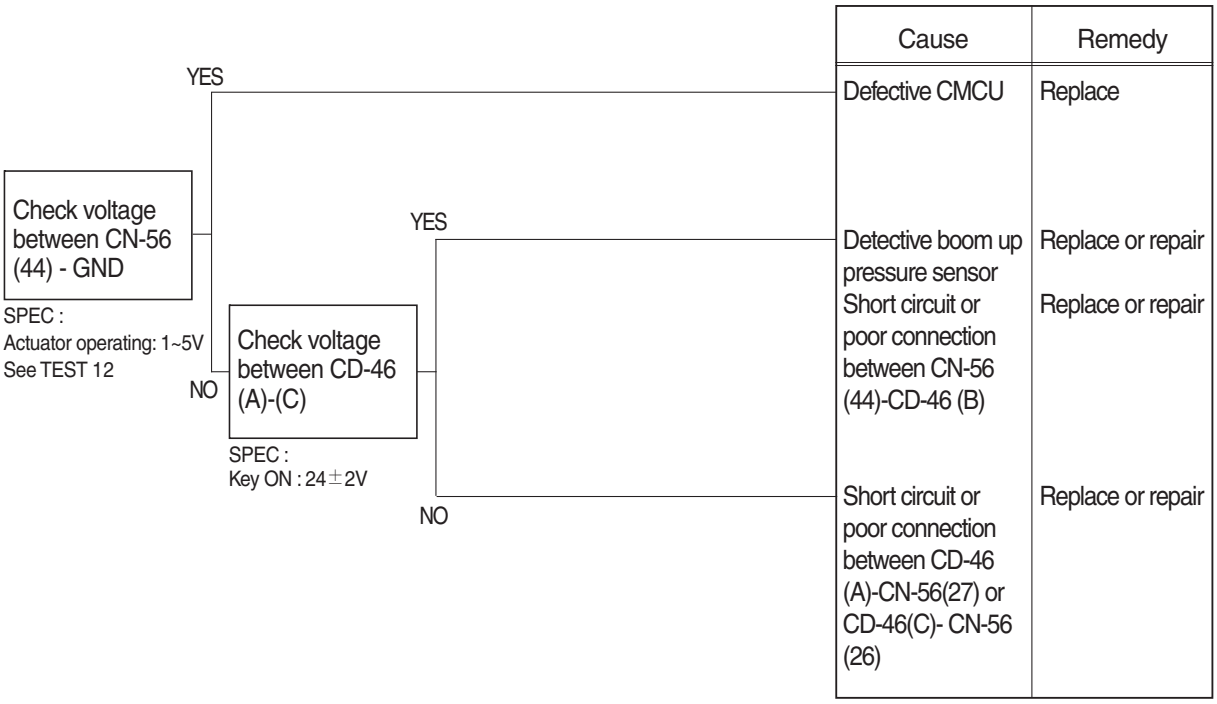




9. MALFUNCTION OF BOOM UP PRESSURE SENSOR

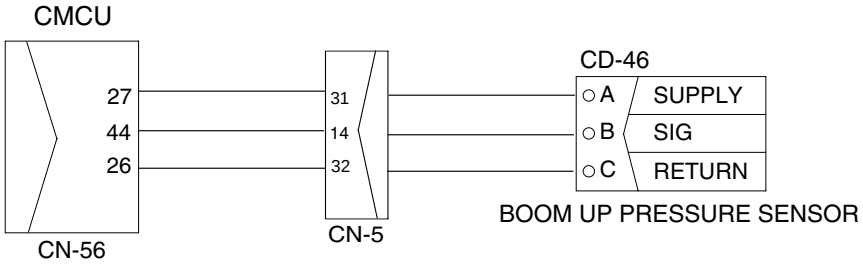
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective CMCU	Replace
Detective boom up pressure sensor	Replace or repair
Short circuit or poor connection between CN-56 (44)-CD-46 (B)	Replace or repair
Short circuit or poor connection between CD-46 (A)-CN-56(27) or CD-46(C)- CN-56 (26)	Replace or repair

Wiring diagram



4) TRACK REVOLUTION SPEED

(1) Measure the track revolution cycle time with the track raised off ground.

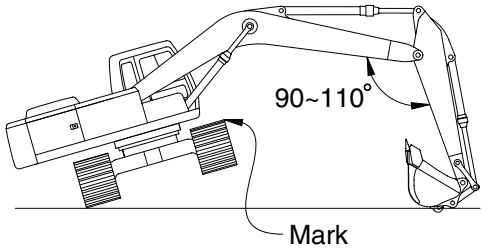
(2) Preparation

① Adjust the tension of both side tracks to be equal.

② On the track to be measured, mark one shoe with chalk.

③ Swing the upperstructure 90° and lower the bucket to raise the track off ground. Keep the boom-arm angle between 90 to 110° as shown. Place blocks under machine frame.

④ Keep the hydraulic oil temperature at 50±5˚C.



(3) Measurement

① Select the following switch positions.

- Travel mode switch : 1 or 2 speedPower
- mode switch : M mode
- Auto idle switch : OFF

② Operate the travel control lever of the raised track in full forward and reverse.

③ Rotate 1 turn, then measure time taken for next 3 revolutions.

④ Raise the other side of machine and repeat the procedure.

⑤ Repeat steps ③ and ④ three times and calculate the average values.

(4) Evaluation

The revolution cycle time of each track should meet the following specifications.

Unit : Seconds / 3 revolutions

Model	Travel speed	Standard
R215VSPRO	1 Speed	25.4±2.0
	2 Speed	17.0±2.0

15) SWING PARKING BRAKE RELEASING PRESSURE

(1) Preparation

① Stop the engine.

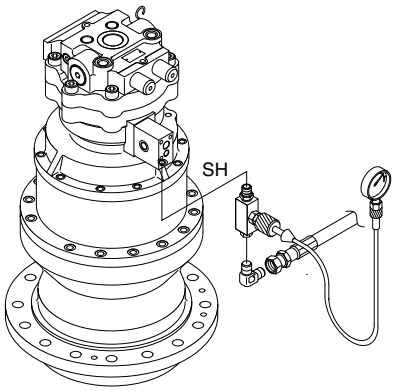
② Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.

③ The pressure release L wrench to bleed air.

④ Install a connector and pressure gauge assembly to swing motor SH port, as shown.

⑤ Start the engine and check for oil leakage from the adapter.

⑥ Keep the hydraulic oil temperature at 50±5˚C.



(2) Measurement

① Select the following switch positions.

· Power mode switch : M mode

② Operate the swing function or arm roll in function and measure the swing brake control pressure with the brake disengaged. Release the control lever to return to neutral and measure the control pressure when the brake is applied.

Repeat step ② three times and calculate the average values.

(3) Evaluation

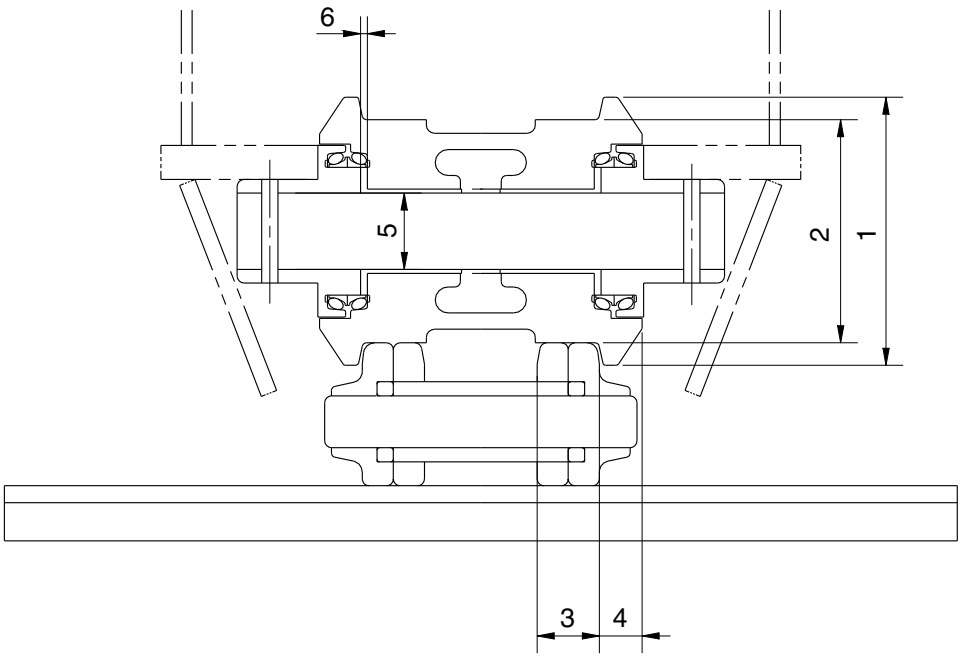
The average measured pressure should be within the following specifications.

Unit : kgf / cm^2

Model	Description	Standard	Remarks
R215VSPRO	Cracking	20.9	
	Full stroke	35.5	

1. TRACK

1) TRACK ROLLER



Unit : mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="4">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of flange</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="5">Rebuild or replace</td></tr>
<tr><td colspan="2">Ø185</td><td colspan="2">–</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">Ø150</td><td colspan="2">Ø138</td></tr>
<tr><td>3</td><td>Width of tread</td><td colspan="2">45</td><td colspan="2">51</td></tr>
<tr><td>4</td><td>Width of flange</td><td colspan="2">29</td><td colspan="2">-</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Clearance between shaft and bushing</td><td colspan="2">Standard size & tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="3">Replace bushing</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>Ø65 0 -0.03</td><td>Ø65 +0.37 +0.32</td><td>0.32 ~ 0.4</td><td>2.0</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Side clearance of roller (both side)</td><td colspan="2">Standard clearance</td><td colspan="2">Clearance limit</td><td rowspan="2">Replace</td></tr>
<tr><td colspan="2">0.23 ~ 1.32</td><td colspan="2">2.0</td></tr>
</table>

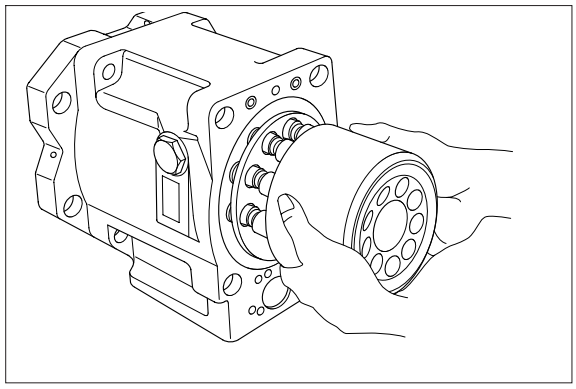
GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (engine-bracket)	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
2		Engine mounting bolt (bracket-frame, FR)	M20 × 2.5	55 ± 3.5	398 ± 25
3		Engine mounting bolt (bracket-frame, RR)	M24 × 3.0	97 ± 7.0	702 ± 51
4		Radiator mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
5		Coupling mounting socket bolt	M18 × 2.5	32 ±1.0	231 ±7.2
6		Fuel tank mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
7	Hydraulic system	Main pump housing mounting bolt	M10 × 1.5	4.8 ± 0.3	34.7 ± 2.2
8		Main pump mounting socket bolt	M20 × 2.5	42 ± 4.5	304 ± 32.5
9		Main control valve mounting nut	M12 × 1.75	12.3 ± 1.3	89.0 ± 9.4
10		Hydraulic oil tank mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
11		Turning joint mounting bolt, nut	M12 × 1.75	12.3 ± 1.3	89.0 ± 9.4
12	Power train system	Swing motor mounting bolt	M20 × 2.5	58.4 ± 5.8	422 ± 42
13		Swing bearing upper part mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
14		Swing bearing lower part mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
15		Travel motor mounting bolt	M16 × 2.0	23 ± 2.5	166 ± 18.1
16		Sprocket mounting bolt	M16 × 2.0	26 ± 3.0	188 ± 21.7
17	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	29.7± 3.0	215 ± 21.7
18		Track roller mounting bolt	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
19		Track tension cylinder mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
20		Track shoe mounting bolt, nut	M20 × 1.5	78 ± 8.0	564 ± 57.9
21		Track guard mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
22	Others	Counterweight mounting bolt	M36 × 3.0	337 ± 33	2440 ± 72.3
23		Cab mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
24		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8

(7) Pull cylinder block (141) out of pump casing (271) straightly over drive shaft (111). Pull out also pistons (151), set plate (153), spherical bush (156) and cylinder springs (157) simultaneously.

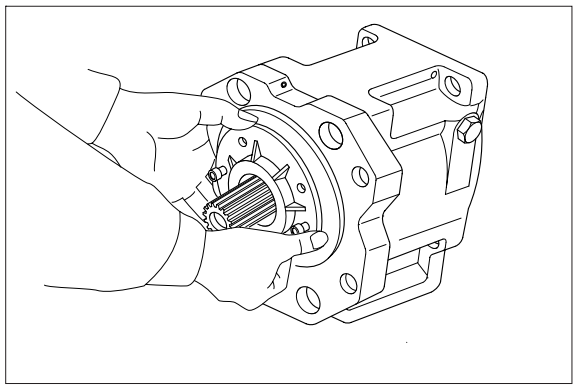
※ Take care not to damage sliding surfaces of cylinder, spherical bushing, shoes, swash plate, etc.



(8) Remove hexagon socket head bolts (406) and then seal cover (F, 261).

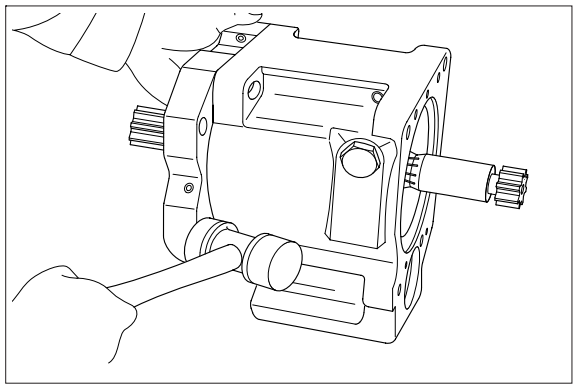
※ Fit bolt into pulling out tapped hole of seal cover (F), and cover can be removed easily.

※ Since oil seal is fitted on seal cover (F), take care not to damage it in removing cover.

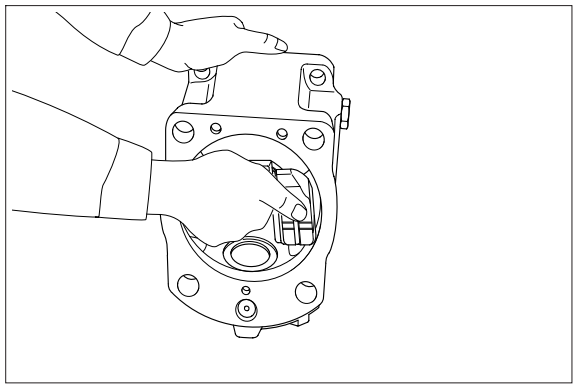


(9) Remove hexagon socket head bolts (408) and then seal cover (R, 262).
In case fitting a gear pump, first, remove gear pump.

(10) Tapping lightly fitting flange section of swash plate support (251) on its pump casing side, separate swash plate support from pump casing.

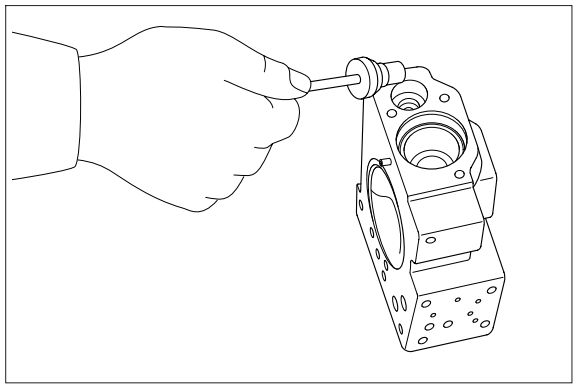


(11) Remove shoe plate (211)and swash plate (212) from pump casing (271).

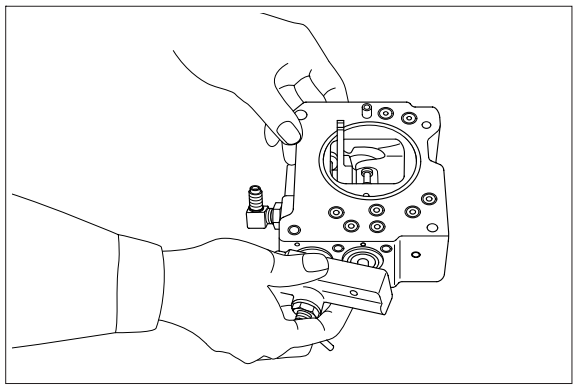


(5) After removing cover (C, 629) subassembly, take out outer spring (625), inner spring (626) and spring seat (C, 624) from compensating section.
Then draw out adjusting ring (Q, 645), pilot spring (646) and spring seat (644) from pilot section.

※ Adjusting ring (Q,645) can easily be drawn out with M4 bolt.



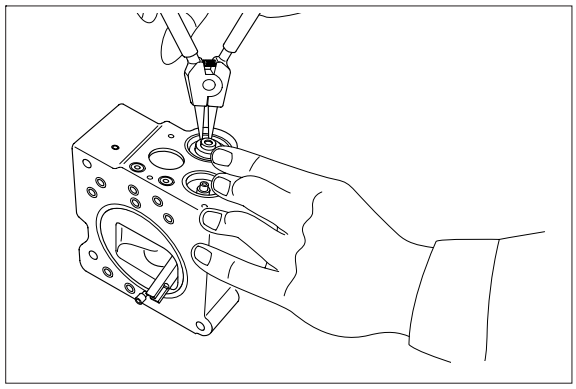
(6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641).
After removing pilot cover, take out set spring (655) from pilot section.



(7) Remove snap ring (814) and take out spring seat (653), return spring (654) and sleeve (651).

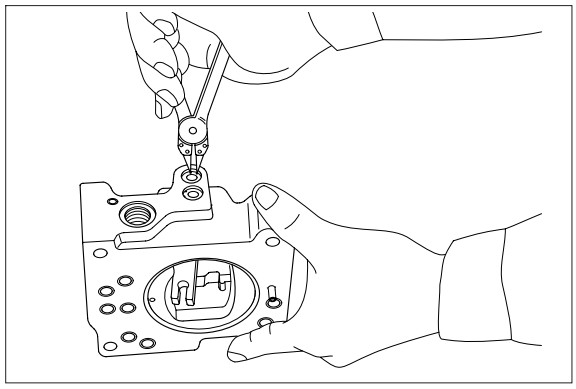
※ Sleeve (651) is fitted with snap ring (836).

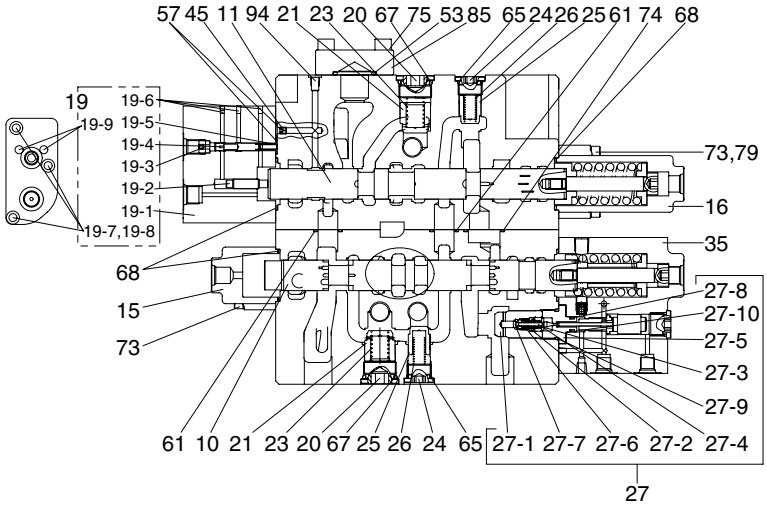
※ When removing snap ring (814), return spring (654) may pop out.
Take care not to lose it.



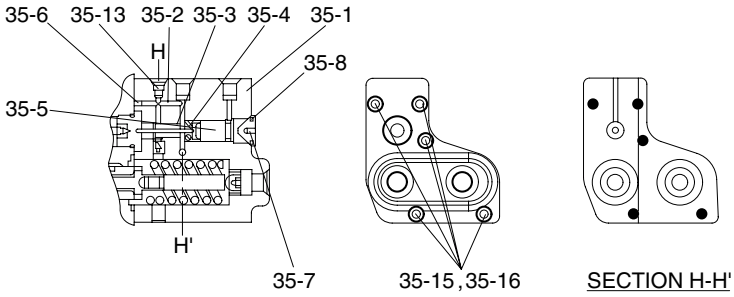
(8) Remove locking ring (858) and take out fulcrum plug (614) and adjusting plug (615).

※ Fulcrum plug (614) and adjusting plug (615) can easily be taken out with M6 bolt.





E-E' (ARM & ARM REGENRATION)



35 DETAIL (HOLDING ASSY)

10	Spool-arm	27	Poppet-lock valve	35-13	Plug
11	Spool-arm regeneration	27-1	Poppet	35-15	Socket bolt
15	Cover-pilot A	27-2	Spring	35-16	Spring washer
16	Cover-pilot B1	27-3	Poppet guide	45	Orifice-plug
19	Arm-regeneration	27-4	Pilot poppet	53	Flange
19-1	Block-regeneration	27-5	Poppet seat	56	O-ring
19-2	Piston-cut off	27-6	C-ring	57	O-ring
19-3	Stopper-regeneration	27-7	Restrictor-lock valve	61	O-ring
19-4	Spool-regeneration	27-8	O-ring	65	O-ring
19-5	Spring-regeneration	27-9	O-ring	66	O-ring
19-6	Plug	27-10	Back up ring	67	O-ring
19-7	Socket bolt	35	Holding kit-A2	68	O-ring
19-8	Spring wahser	35-1	Block-H/D P2	70	Back-up ring
19-9	Pin-regeneration	35-2	Piston 1-holding	73	Hex socket head bolt
20	Plug	35-3	Guide piston-holding	74	O-ring
21	Poppet 1-check valve	35-4	Spring 1-lock valve	75	Socket bolt
23	Spring 1-check valve	35-5	Piston 2-holding	79	Washer
24	Plug	35-6	Plug	85	O-ring
25	Poppet 2-check valve	35-7	Plug		
26	Spring 2-check valve	35-8	Plug		

(2) Assembly

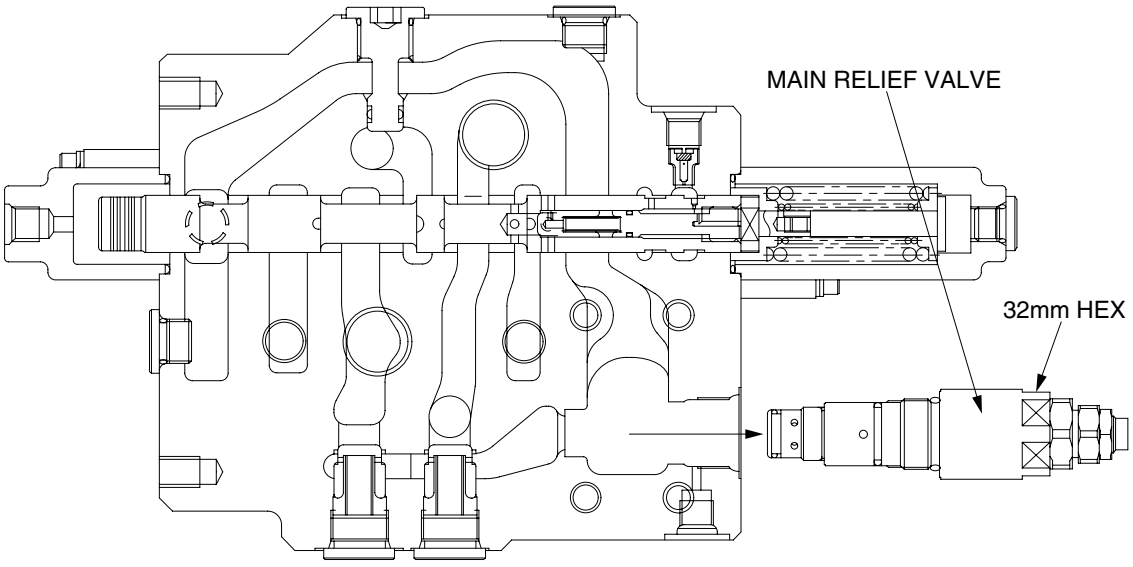
Explanation only is shown for the assembly, refer to the figures shown in the previous disassembly section.

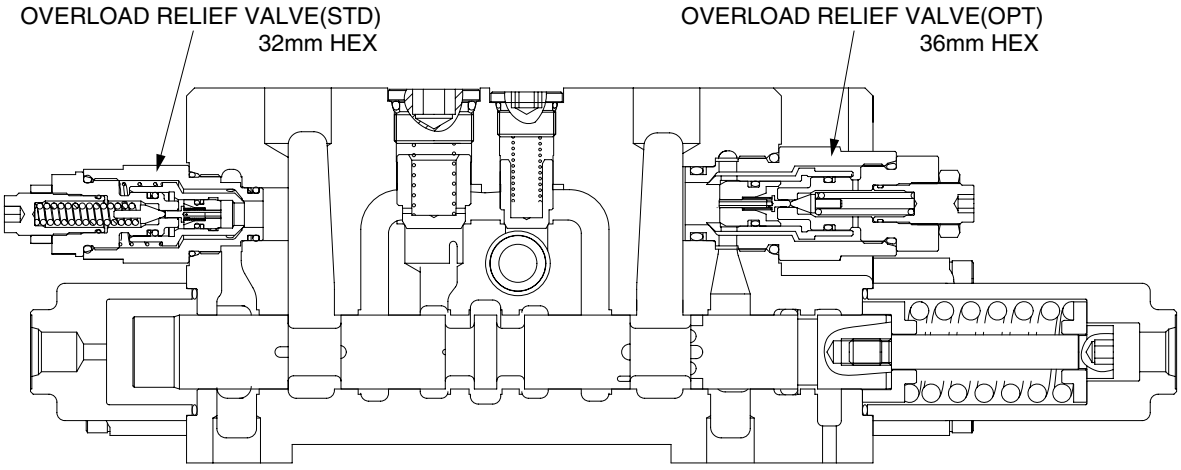
① Main relief and overload relief valve

Fix the valve body to suitable work bench.

Install main relief valve and overload relief valve into the body and tighten to the specified torque by 32 mm torque wrench.

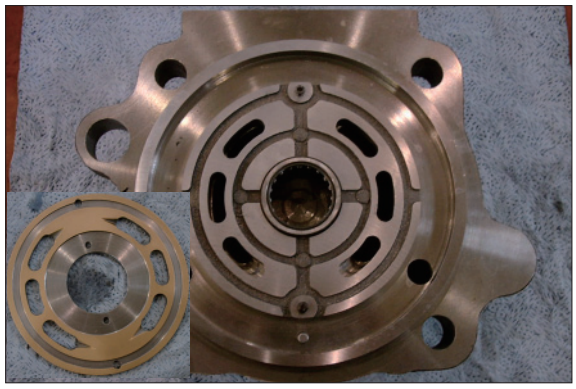
· Tightening torque : 8~9 kgf·m (57.8~65.1 lbf·ft)



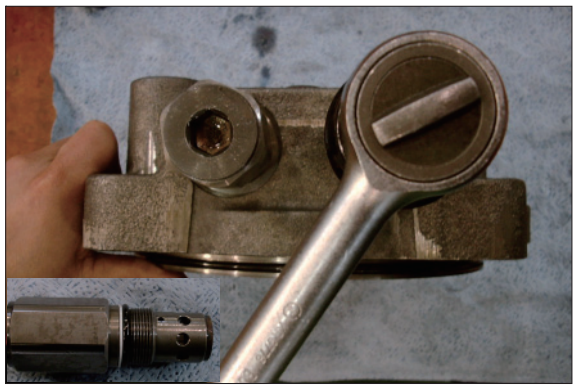


(3) Disassemble rear cover assy sub

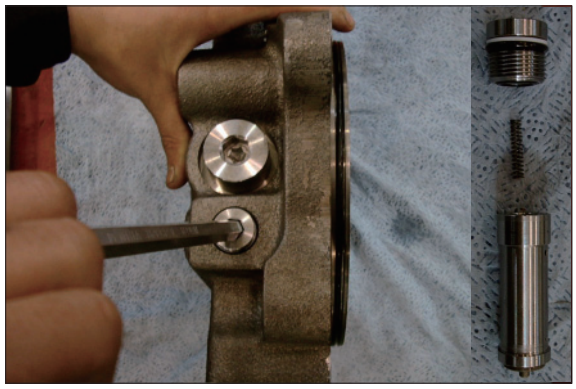
① Disassemble pin (8, 23), valve plate (24) from rear cover (21).



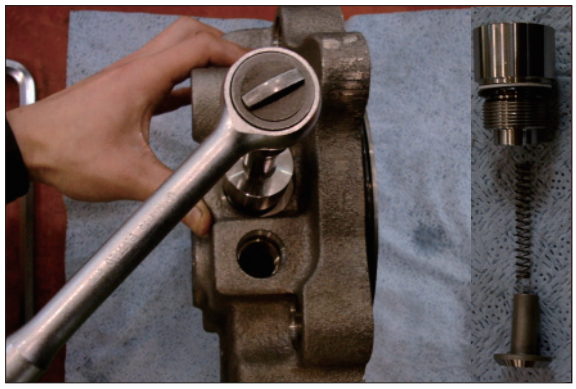
② Using a torque wrench, disassemble relief valve assy (33) 2 set from rear cover (21).



③ After disassembling plug with a L-wrench from rear cover (21), disassemble respectively back up ring, O-ring, O-ring, spring, anti-inversion valve assy (34)



④ Disassemble make up check valve assy with a torque wrench from rear cover (21).



3. REMOVAL AND INSTALL OF REDUCTION GEAR

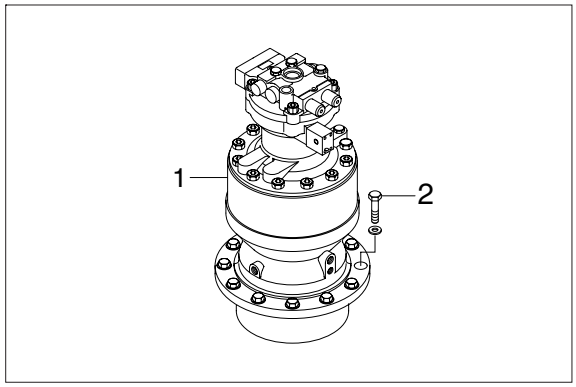
1) REMOVAL

(1) Remove the swing motor assembly.
For details, see removal of swing motor assembly.

(2) Sling reduction gear assembly (1) and remove mounting bolts (2).

(3) Remove the reduction gear assembly.
· Reduction gear device weight : 180 kg (396 lb)

2) INSTALL



(1) Carry out installation in the reverse order to removal.
· Tightening torque : 58.4±6.4 kgf · m (422±46.3 lbf · ft)

1. REMOVAL AND INSTALL

1) REMOVAL

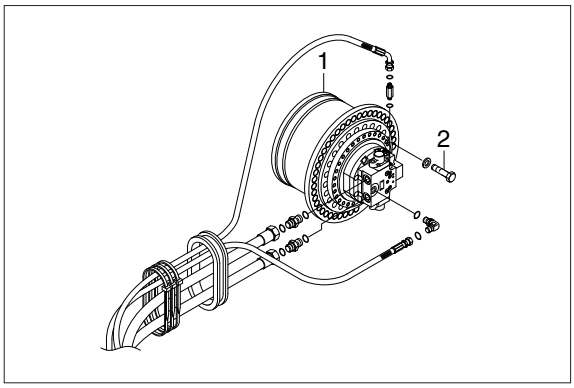
(1) Swing the work equipment 90° and lower it completely to the ground.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.



(4) Remove the track shoe assembly.
For details, see **removal of track shoe assembly.**

(5) Remove the cover.

(6) Remove the hoses.
※ Fit blind plugs to the disconnected hoses.

(7) Remove the bolts and the sprocket.

(8) Sling travel device assembly (1).

(9) Remove the mounting bolts (2), then remove the travel device assembly.
· Weight : 305 kg (670 lb)

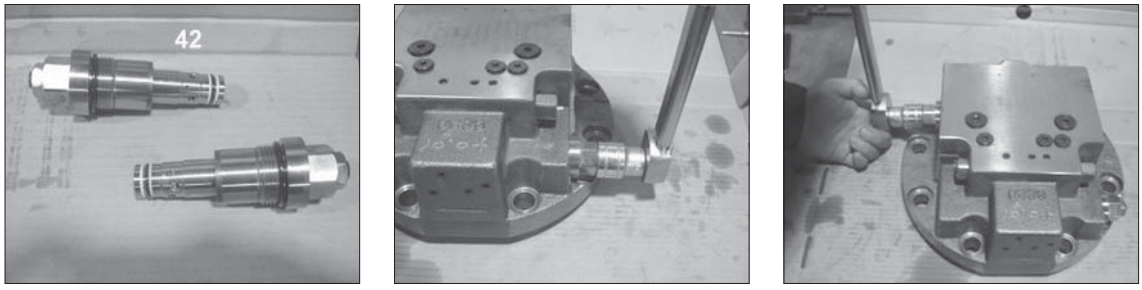
2) INSTALL

(1) Carry out installation in the reverse order to removal.

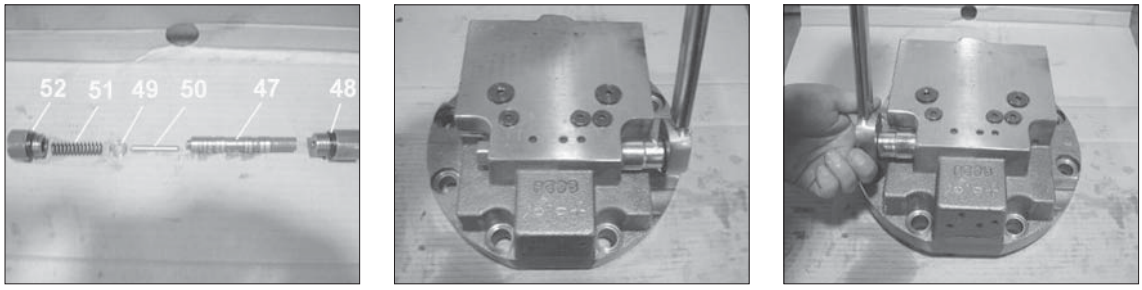
(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

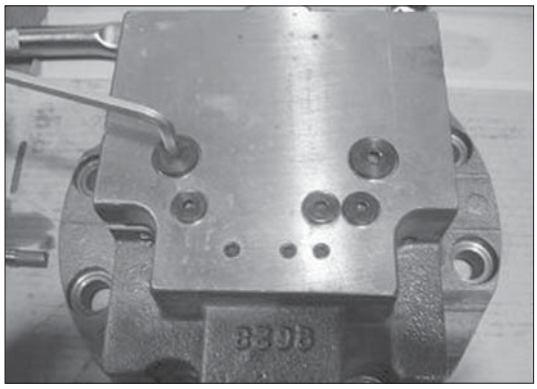
(19) Disassemble the relief valve (42, 2EA) from the rear cover (34) by using the torque wrench.



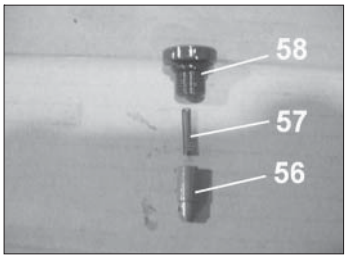
(20) Disassemble both side of the plug (48) and connector (52) from the rear cover (34) by using the torque wrench and then disassemble the spring (51), spring seat (49), parallel pin (50) and spool (47) in order.

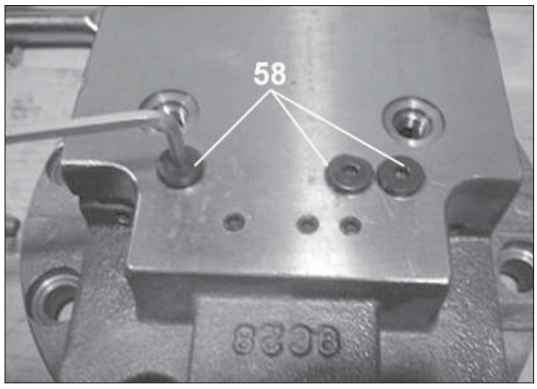


(21) Disassemble the plug (60) from the rear cover.



(22) Disassemble the plug (58) and then disassemble the spring (57) and check valve (56) from the rear cover in order.





6. DISASSEMBLING

1) GENERAL INSTRUCTIONS

⚠ **Combustibles such as white kerosene are used for washing parts.**
These combustibles are easily ignited, and could result in fire or injury.
Be very careful when using.

⚠ **Internal parts are coated with gear oil during disassembling and are slippery.**
If a part slips off from your hand and fails, it could result in bodily injury or could damage the park.
Be very careful when handling.

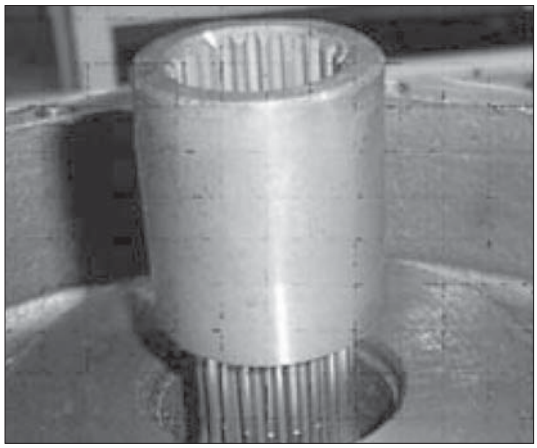
(1) Therefore, disassembling and assembling works should be performed on the clean place where dusts hardly gather.
Tools and kerosene to wash parts should also be clean and handled with great care.

(2) Bofore disassembling, review the sectional drawing and prepare the required parts, depending on the purpose and the range of disassembling.
Seals, O-rings, etc., if once disassembled, are not reusable.
There are some parts that should be replaced as a subassembly.
Consult with the parts manual in advance.

⚠ **Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.**

10) ASSEMBLING COUPLING

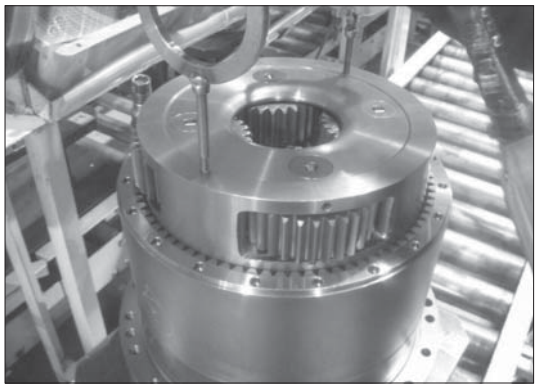
(1) Install coupling on spline of the motor.



11) ASSEMBLING NO.2 CARRIER SUB ASSEMBLY

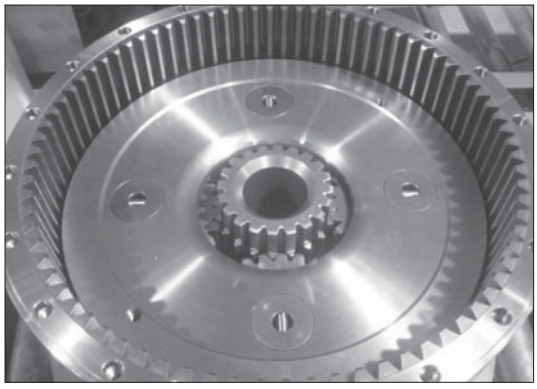
(1) Install M10 eye-bolt on No.2 carrier assembly.
(2) Lift No.2 carrier assembly and then, slowly put it down on ring gear.
(3) Rotate planetary gear by hands and install on ring gear.
(4) Rotate No.2 carrier assembly by hands and install on motor.

※ Match pin hole of No.2 carrier with main (A, B) port of motor.



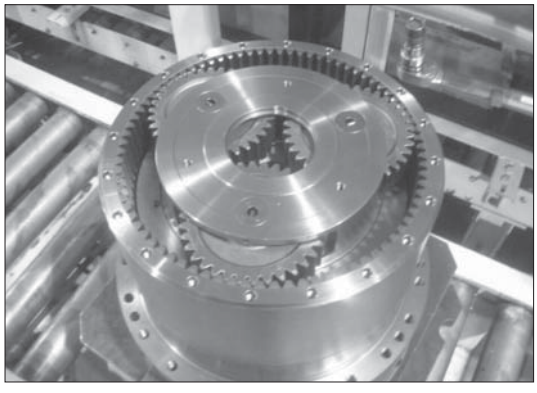
12) ASSEMBLING NO.2 SUN GEAR

(1) Install No.2 sun gear on the No.2 planetary gear, matching teeth of them.



13) ASSEMBLING NO.1 CARRIER SUB ASSEMBLY

(1) Install M10 eye-bolt on No.1 carrier assembly.
(2) Lift No.1 carrier assembly and then, slowly put it down on ring gear.
(3) Rotate planetary gear by hands and install on ring gear.
(4) Rotate No.1 carrier assembly by hands and install on No.2 sun gear.



(16) Cleaning of parts

① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).

※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.

※ If this kerosene is polluted, parts will be damaged and functions of reassembled valve will be degraded.
Therefore, control cleanliness of kerosene fully.

② Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides (finish cleaning).

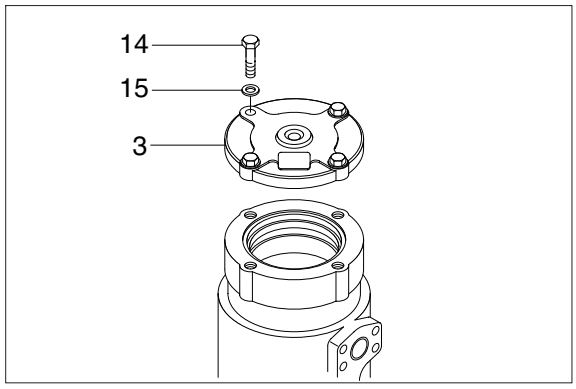
※ Do not dry parts with compressed air, since they will be damaged and/or rusted by dust and moisture in air.

(17) Rust prevention of parts

Apply rust-preventives to all parts.

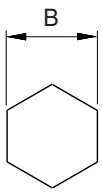
※ If left as they after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

(7) Install cover (3) to body (1) and tighten bolts (14).
- Torque : 10~12.5 kgf · m
(72.3~90.4 lbf · ft)



2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tools		Remark
Allen wrench	6	
	8	
	14	
	17	
Spanner	7	
	8	
(-) Driver	Small and large sizes	
Torque wrench	Capable of tightening with the specified torques	

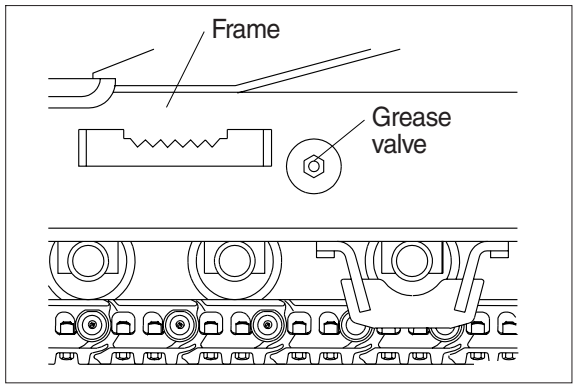
(2) Tightening torque

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Socket head bolt	Bucket cylinder	23	M16	23±2.0	166±14.5
		31	M10	5.4±0.5	39.1±3.6
	Boom cylinder	23	M16	23±2.0	166±14.5
		31	M10	5.4±0.5	39.1±3.6
	Arm cylinder	23	M18	32±3.0	232±21.7
		34	M12	9.4±1.0	68±7.2
Lock nut	Bucket cylinder	20	-	100±10	723±72.3
	Boom cylinder	20	-	100±10	723±72.3
	Arm cylinder	20	-	150±15	1085±108
Piston	Bucket cylinder	14	-	150±15	1085±108
	Boom cylinder	14	-	150±15	1085±108
	Arm cylinder	14	-	200±20	1447±145

3. TRACK ROLLER

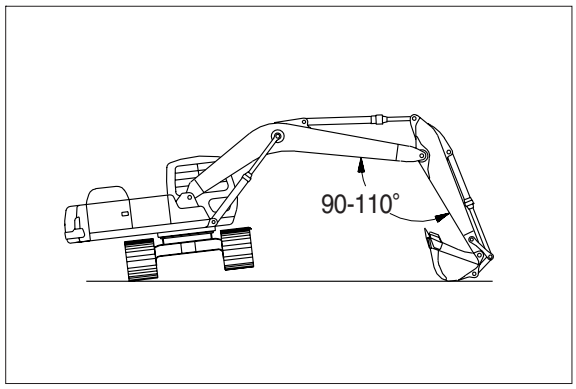
1) REMOVAL

(1) Loosen tension of the track link.



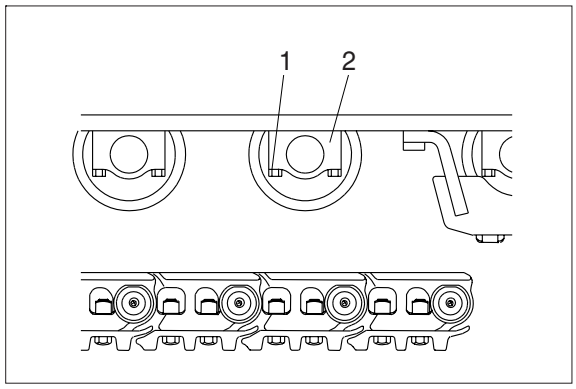
(2) Using the work equipment, push up track frame on side which is to be removed.

※ After jack up the machine, set a block under the unit.



(3) Remove the mounting bolt (1) and draw out the track roller (2).

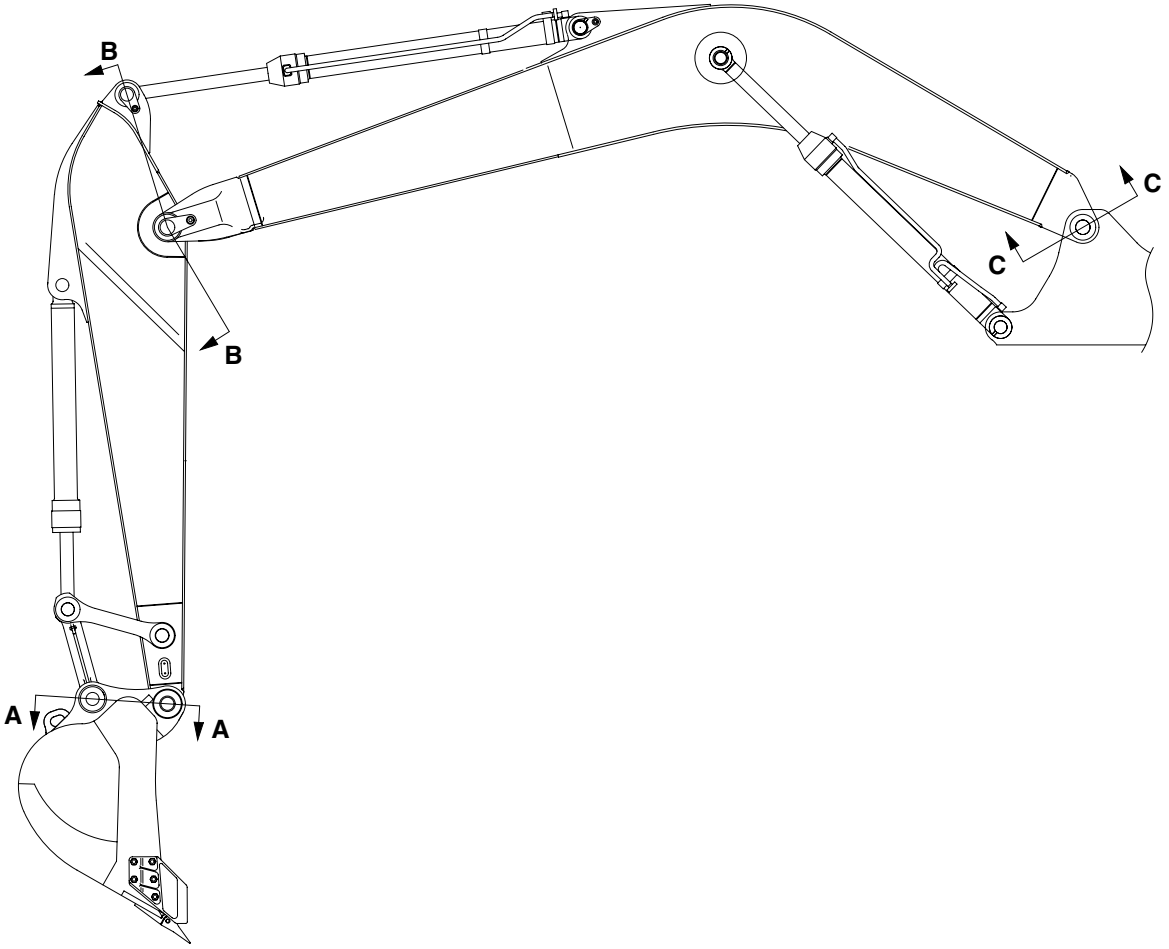
· Weight : 40 ㎏ (90 ㏪)

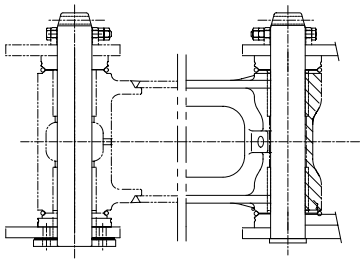


2) INSTALL

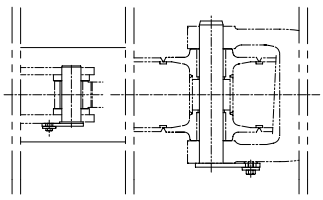
(1) Carry out installation in the reverse order to removal.

1. STRUCTURE

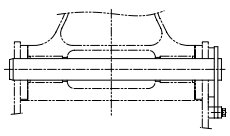




SECTION A

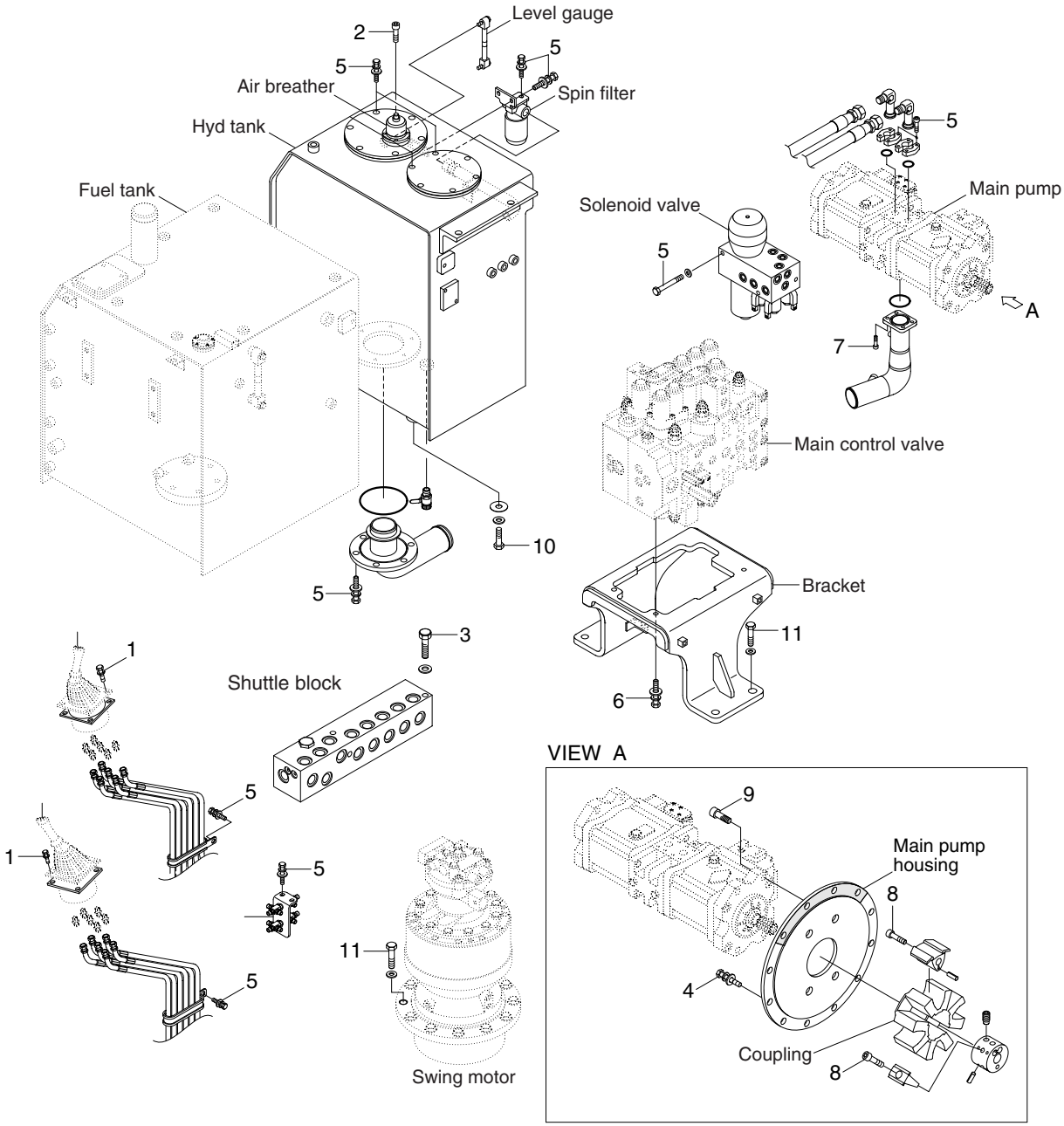


SECTION B



SECTION C

1. HYDRAULIC COMPONENTS MOUNTING 1



· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 6×1.0	1.44±0.3	10.4±2.2
3	M 8×1.25	2.5±0.5	18.1±3.6
4	M10×1.5	4.8±0.3	34.7±2.2
5	M10×1.5	6.9±1.4	49.9±10.1
6	M12×1.75	12.3±1.3	89±9.4

Item	Size	kgf · m	lbf · ft
7	M12×1.75	14.7±2.2	106±15.9
8	M18×2.5	32±1.0	231±7.2
9	M20×2.5	42±4.5	304±32.5
10	M20×2.5	46±5.1	333±36.9
11	M20×2.5	58.4±6.4	422±46.3