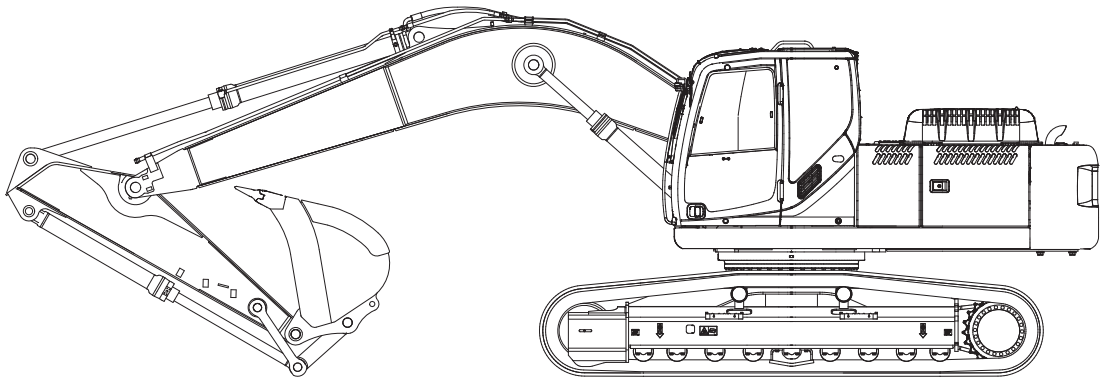
SERVICE MANUAL

E385C

Crawler Excavators



Print no. 47374920A
1st Edition
English 06/12

NEW HOLLAND CONSTRUCTION

SAFETY RULES

GENERALITIES

Read the Operator's manual carefully before starting, operating, maintaining, fuelling or servicing the machine.

Carefully read the explanation to each and all safety signs in the special section of this Manual before starting, operating, maintaining, fuelling or servicing the machine.

Machine-mounted safety decals are colour coded yellow with black borders when they refer to points where special ATTENTION must be paid and failure to observe them may cause a serious DANGER to the integrity of machine operators.

It is fundamental that all machine operators know very well the meaning of each safety plate as this considerably decreases operating hazards and accidents.

Do not allow unauthorised personnel to operate or service this machine.

Do not wear rings, wrist watches, jewellery, loose or hanging garments, such as ties, torn clothing, scarves, unbuttoned or unzipped jackets that can get caught in moving parts. Wear certified safety clothes such as: hard hat, no-slip footwear, heavy gloves, ear protection, safety glasses, reflector vests, respirators every time the job requires it. Ask your employer about safety regulations in force and protective equipment.

Always keep the operator’s compartment, step plates, grab-rails and handles clean and clear of foreign objects, oil, grease, mud or snow to minimise the danger of slipping or stumbling. Remove mud or grease from your shoes before operating the machine.

Do not jump on or off the machine. Always keep both hands and one foot, or both feet and one hand in contact with steps and/or grab rails.

Do not use controls or hoses as hand holds. Hoses and controls are movable parts and do not provide solid support. Besides, controls may be inadvertently moved and cause unexpected movement of the machine or its attachments.

Never operate the machine or its attachments from any position other than sitting in the driver’s seat. Keep head, body, limbs, hands and feet inside the operator’s compartment at all times to reduce exposure to external hazards.

Be careful of possible slippery conditions of the steps and hand rails as well as of the ground around the machine. Wear protective boots or shoes with the soles made of highly no-slip rubber

Do not leave the machine until it has come to a complete stop.

Always check height, width and weight limitations which may be encountered in the working site and ensure the machine does not exceed them.

Assess exact paths of gas ducts, water mains, telephone lines, sewers, overhead and underground electric lines and all other possible obstacles.

Such paths should be opportunely defined by competent Authorities. If necessary, require that the service is interrupted or said installations are moved prior to starting the work.

Define the rear upperstructure swing area and provide for opportune barriers to prevent access into it.

Never exceed machine lifting capacity.

Remain within the limits shown in the loading capacity chart which located on the machine.

STARTING

Never start or operate a failed machine. Walk all around the machine before mounting.

Before operating the machine, make sure that any possible dangerous condition has been properly removed. Before starting machine, always check that all controls are in the neutral position and the safety lever is in the LOCK position. Immediately report any malfunction of parts or systems to the maintenance managers for proper action.

Prior to starting the engine, check, adjust and lock the driver’s seat for maximum riding comfort and control accessibility. Prior to operating the machine and/or its attachments, check that bystanders are outside the machine operating range. Sound the horn.

Obey all hand signals, safety indications and signs.

Due to the presence of flammable fluids, never check fuel level, refuel, charge the batteries in the presence of smoking materials, open flames or sparks.

Adjust all rear-view mirrors for maximum visibility of the area behind the machine.

Ensure that engine speed is appropriate to the job to be carried out.

If any hydraulic control or system exhibits erratic performance or responds abnormally, have the machine checked for air in the system.

Air in these circuits may cause incorrect movements with consequent accident hazard. Refer to the Operator's manual about corrective action to be taken.

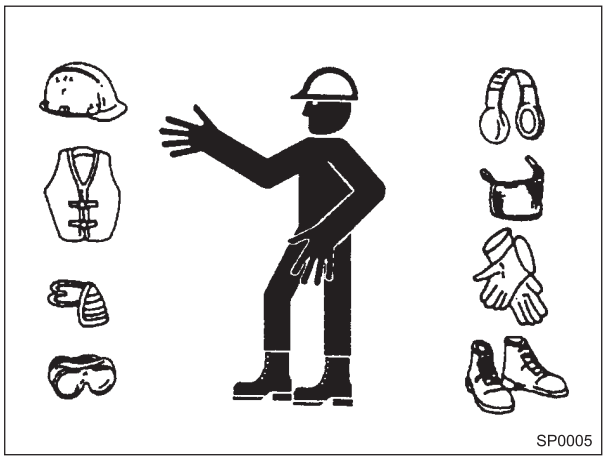
WEAR PROTECTIVE CLOTHING

Wear close fitting safety shoes, hard hat and working clothes. Put on protective glasses, face shields, ear protection and gloves. When necessary, wear reflective vest.

Avoid wearing loose clothing, jewelry, or other items that can catch on control levers or other parts of the machine.

Do not wear headphones while operating the machine.

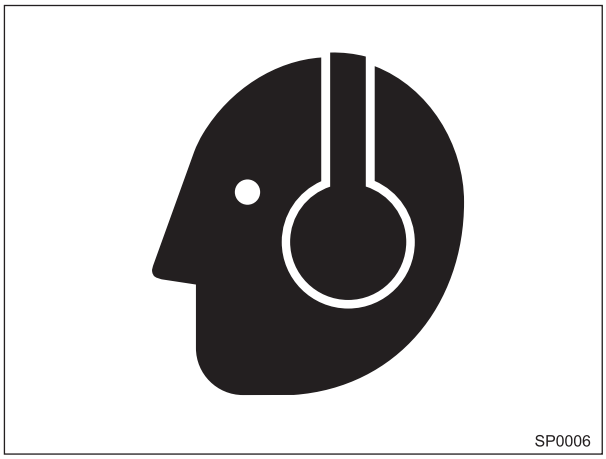
Work clothing that has come in contact with oil could catch fire. Change clothes immediately.


SP0005

PROTECT AGAINST NOISE

Prolonged exposure to loud noise can cause impairment or loss of hearing.

- Wear a suitable hearing protection such as earmuffs or earplugs to protect objectionable or uncomfortably loud noise.


SP0006

INSPECT THE MACHINE

Inspect the machine carefully every day or workshift by an attentive visual inspection of machine outside prior to starting it to prevent damages and personal injuries.


SP0007

SAFETY LOADS MOVING

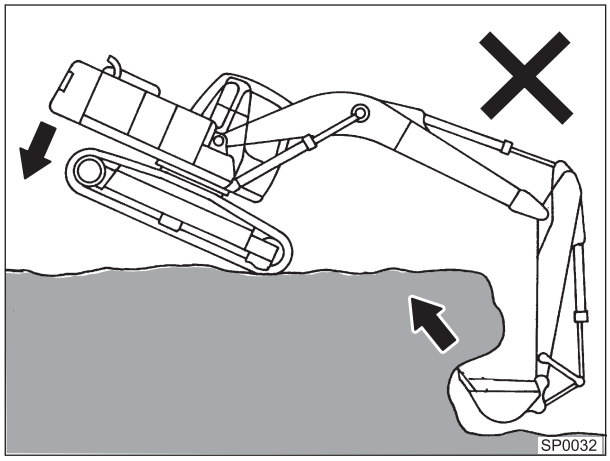
The excavator is a machine designed specifically to perform digging/loading works, thus it must not be used to handle suspended loads. In the event, under exceptional conditions, it becomes necessary to handle materials, the following indications must be strictly implemented:

- The machine must be equipped compulsorily with the appropriate variant provided upon request. Also, totally comply with the safety precautions for the operation of the excavator as a lifting equipment.
- Secure the loads to be raised using cables or chains fastened with appropriate hooking mechanisms.
- Never hook cables or chains to the bucket teeth.
- Nobody should be allowed to remain under the raised load or within the excavator operating range for any reason whatever.
- Never exceed specified loading capacity. Incorrect fastening of slings or chains may cause boom/arm failure or failure of the lifting means with consequent bodily injuries and even death.
- Always ensure that slings and chains used for lifting are adequate to the load and in good condition.
- All loading capacities are referred to the machine on a level surface and should be disregarded when working on a slope.
- In any case, comply with the current national or local regulations on this matter.

AVOID EXCESSIVE DIGGING EFFORTS

Operate the machine complying with the load limits in accordance with the "table of lifting loads" located inside the cab.

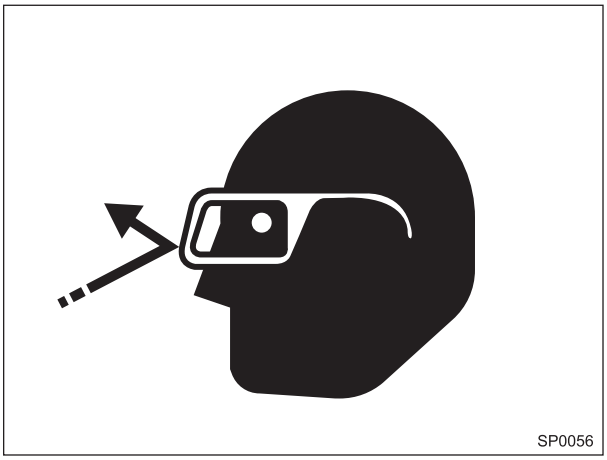
- Do not exceed the prescribed load limits.
- Do not use the strength of the attachment to travel or move the machine.
- Do not try digging exploiting the mass of the machine.



PROTECT AGAINST FLYING DEBRIS

If flying debris hit eyes or any other part of the body, serious injury may result.

- Guard against injury from flying pieces of metal or debris; wear goggles or safety glasses.
- Keep bystanderds away from the working area before striking any object.


SP0056

FIRE PREVENTION

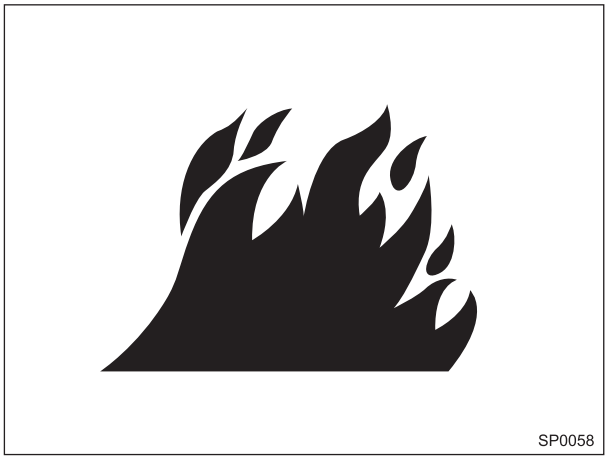
Handle fuel with care: it is highly flammable. If fuel ignites, an explosion and/or a fire may occur, possibly resulting in serious injuty or death.

- Do not refuel the machine while smoking or when near open flame or sparks.
- Always stop the engine before refuelling the machine.
- Fill the tank outdoors.


SP0057

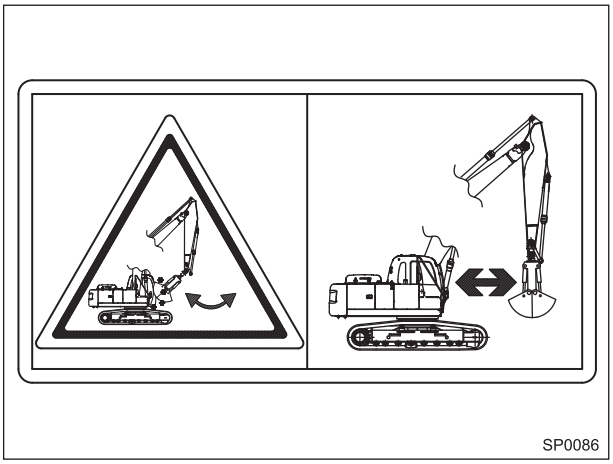
All fuels, most lubrificants, and some antifreeze fluids are flammable.

- Store flammable fluids well away from fire hazards.
- Do not burn or puncture pressurized containers.
- Do not store oily rags; they can ignite and burn spontaneously.


SP0058

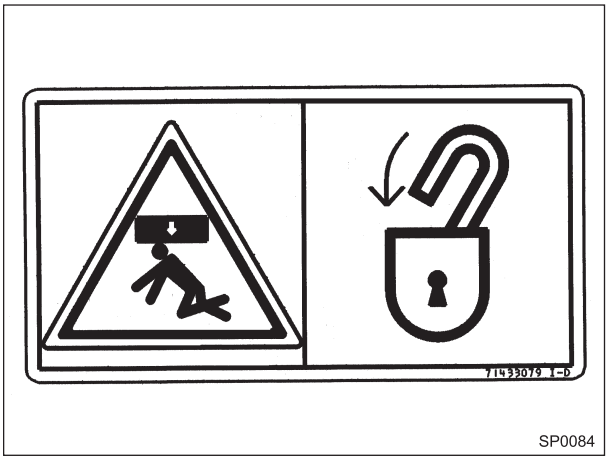
7 - Special equipment movement decal

It shows the danger represented by the special equipment hitting the cab.
Pay special attention as no stops are provided to prevent this problem.



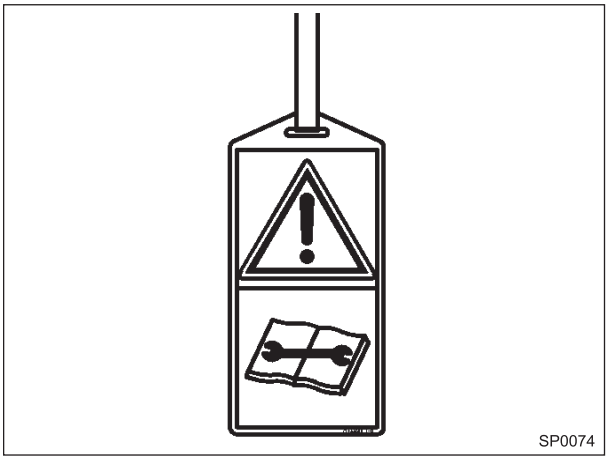
8 - Lock windscreen decal

Risk of injuries deriving from the windscreen not being locked or being improperly locked in the open position.
Always make sure that the windscreen is locked.

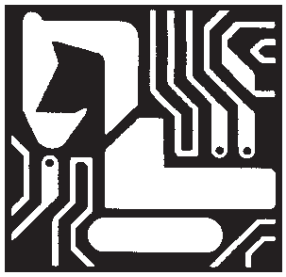


9 - Maintenance in progress tag

Maintenance staff is obliged to apply the tag that indicates that the machine is not fully efficient and warns about maintenance staff being located in not visible positions. This tag should be applied to the left-hand control lever, safety lever or cab door.



SYSTEM



CONTENTS

FEEDING

Type	Electron type
Injection sequence	1-4-2-6-3-5

BATTERY

Turkey - Middle East - Africa

Voltage	2 x 12 V
Capacity	2 x 160 Ah

Russian Federation

Voltage	2 x 12 V
Capacity	2 x 176 Ah

STARTER MOTOR

Maker	SAWAFUJI
Voltage	24 V
Output	5 kW

ALTERNATOR

Maker	SAWAFUJI
Voltage	24 V
Output	60 A

1. PREFACE

This chapter explains only those related to the electro hydraulic conversion as mechatro control. This chapter summarizes the mechatro system and the function of the mechatro controller related apparatuses. Regarding the conditions before and after each conversion, refer to the hydraulic system and the electric system.

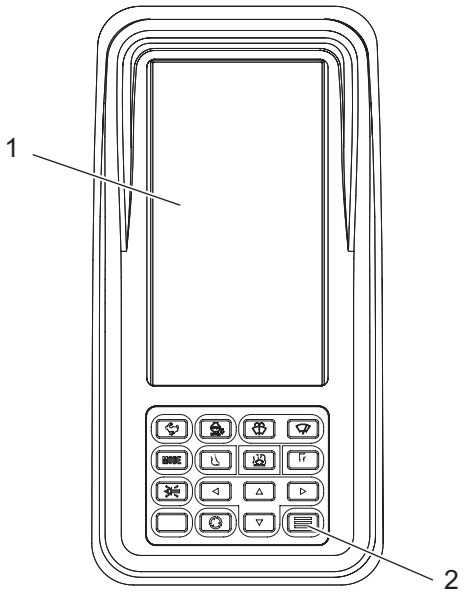
1. Recirculation and conflux (Low loading)
   1) On starting arm-in operation, arm-in operating pilot secondary pressure is input to arm 1 spool, arm 2 spool and low pressure sensor.
   2) The output voltage of low pressure sensor is input to mechatro controller and the mechatro controller processes pilot signal and outputs command according to the input voltage to P1 and P2 proportional valves, P1 and P2 unload proportional valves and reverse proportional valve for arm-in 2 spool.
      In case of combined operation, the pilot pressure other than arm-in operation is input to low pressure sensor and the output voltage is input to mechatro controller. And the mechatro controller processes pilot signal according to the combined operation and outputs command, which is different from the arm-in independent operation, to P1 pump proportional valve, P1 unload proportional valve and reverse proportional valve for arm-in 2 spool.
   3) Primary pressure of reverse proportional valve for arm-in 2 spool is arm-in pilot secondary pressure and it switches arm 2 spool by proportional secondary pressure according to command. (Arm 2 spool controls recirculation rate and conflux rate.)
      The other proportional valves output proportional secondary pressure according to command from mechatro controller. These proportional valves change the delivery rate of P1, P2 pump, and switch P1, P2 unload valve.
   4) The arm 1 spool is switched according to original oil pressure command, and P1, P2 pumps, P1, P2 unload spools and arm 2 spool are switched according to the command output by mechatro controller, and consequently the return oil from the arm cylinder rod side is recirculated in P1 and P2 pumps delivery oil during arm operation.
2. Recirculation cut
   The voltage output by high pressure sensor on P2 side is input to mechatro controller, and when the load is raised during arm operation the mechatro controller processes pilot signal processing according to the pressure detected by high pressure sensor and outputs command to cut recirculation into reverse proportional valve for arm-in 2 spool.
   The reverse proportional valve for arm-in 2 spool outputs pilot secondary pressure according to the command output by mechatro controller and switches arm 2 spool to recirculation cut position, and consequently recirculation passage is blocked.

1. Judgment travel straight
   1) During travel operation (right and left), pilot pressure switches each travel spool and is input to low pressure sensor on carrying out attachment system operation.
   2) Mechatro controller decides as travel straight on receiving the input according to the combination shown in the table from the low pressure sensor and turns travel straight signal on.
   3) On turning travel straight signal on, the following commands are output to each proportional valve.
2. Operation of each proportional valve
   (Basically attachment operation is actuated by P1 pump and travel operation is actuated by P2 pump in travel straight condition.)
   1) Travel straight proportional valve outputs switching pressure according to the high priority select pressure in the attachment system operating (Boom, arm, bucket, swing, option) pilot pressure during operation.
   2) P1 unload proportional valve outputs switching pressure according to the high priority select pressure in the attachment system operating pilot pressure during operation.
   3) P2 unload proportional valve outputs switching pressure according to the high priority select in the travel operating pilot pressure during operation.
   4) P1 pump proportional valve outputs switching pressure according to the high priority select pressure in the attachment system operating pilot pressure during operation.
   5) P2 pump proportional valve outputs switching pressure according to the high priority select in the travel operating pilot pressure during operation.

ATT operation	Boom	Arm	Bucket	Swing	Option
In travel operation (P1)	○		○		
In travel operation (P2)		○		○	○

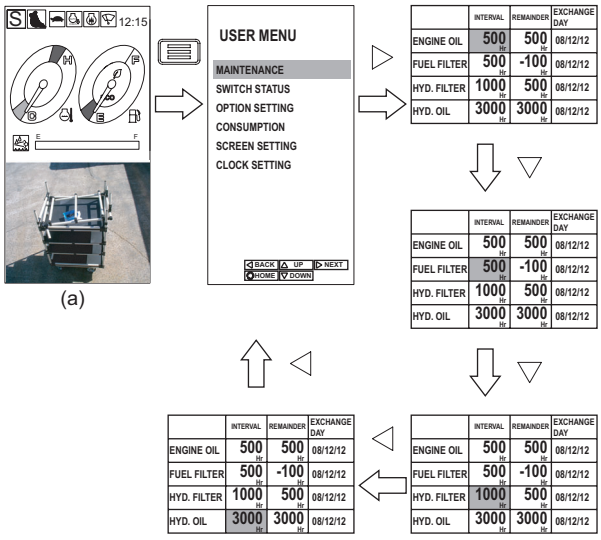
6. Maintenance screen displays

This screen displays the remaining time to the end of recommended replacement/change interval specified for filter/oil.



SMC0281

This display shows the recommended replacement time of engine oil, time for next engine oil change and date of previous engine oil change.
For the initial set value of recommenced replacement/change time, see the following table.



(a)

SMC0282

Replacement interval

Item	Default
Engine oil	500 Hr
Fuel filter	500 Hr
Hydraulic oil filter	1,000 Hr
Hydraulic oil	5,000 Hr

This menu is available for confirmation of the following items.
The maintenance screen changes each time the screen change switch is pressed.

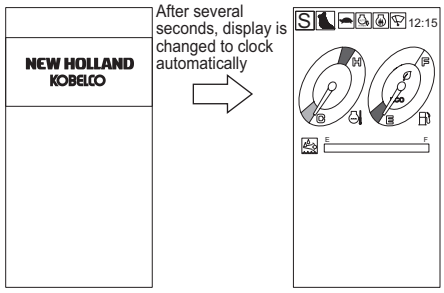
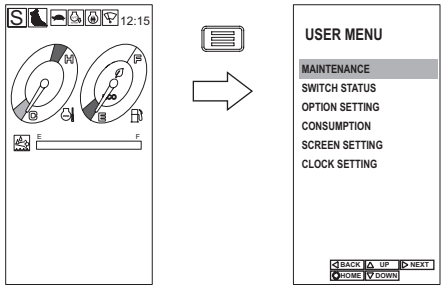
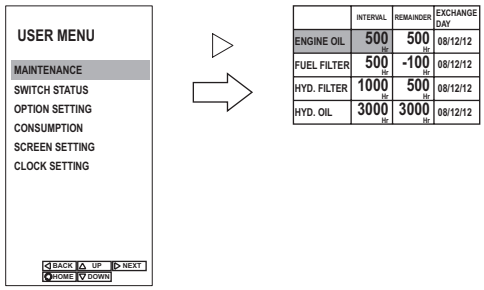
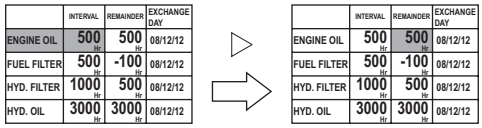
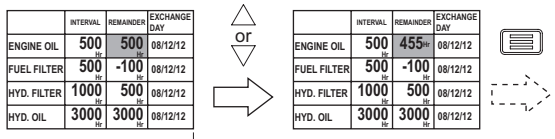
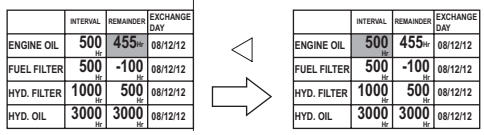
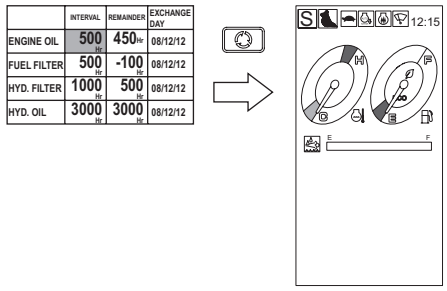
1.
Remaining time display to the engine oil change
This display shows the remaining time of "INTERVAL, REMAINING TIME, EXCHANGE DAY".

	INTERVAL	REMAINDER	EXCHANGE DAY
ENGINE OIL	500 Hr	500 Hr	08/12/12
FUEL FILTER	500 Hr	500 Hr	08/12/12
HYD. FILTER	1000 Hr	1000 Hr	08/12/12
HYD. OIL	5000 Hr	5000 Hr	08/12/12

No.	Displays	Contents
6	NO.6 P.SENSOR PROPO-V	
	C-1 PUMP 1	
	3.5V 32.6M	Sensor voltage / Pressure converted value
	C-2 PUMP 2	
	3.5V 32.6M	Sensor voltage / Pressure converted value
	C-3 BOOM-HEAD	
	3.5V 32.6M	Sensor voltage / Pressure converted value
	C-4 BOOM-ROD	
	3.5V 32.6M	Sensor voltage / Pressure converted value
	E-1 P1 PUMP	
	COMP. 600mA 4.5M	Set value in computer / Converted value from pressure
	MEAS. 600mA 4.5M	Measured value / Converted value from pressure
	POWER SHIFT 100mA	Power shift
	FLOW RATE 100L	Flow rate of pump P1
	E-2 P2 PUMP	
	COMP. 600mA 4.5M	Set value in computer / Converted value from pressure
	MEAS. 600mA 4.5M	Measured value / Converted value from pressure
	POWER SHIFT 100mA	Power shift
	FLOW RATE 100L	Flow rate of pump P2
7	NO.7 PROPO-VALVE	
	D-1 P1 UN-LOAD(BP-CUT)	
	COMP. 600mA 4.5M	Set value in computer / Converted value from pressure
	MEAS. 600mA 4.5M	Measured value / Converted value from pressure
	D-2 P2 UN-LOAD(BP-CUT)	
	COMP. 600mA 4.5M	Set value in computer / Converted value from pressure
	MEAS. 600mA 4.5M	Measured value / Converted value from pressure
	D-3 S-TRAVEL	
	COMP. 600mA 4.5M	Set value in computer / Converted value from pressure
	MEAS. 600mA 4.5M	Measured value / Converted value from pressure
	D-6 ARM IN-2-SPEED	
	COMP. 600mA 4.5M	Set value in computer / Converted value from pressure
	MEAS. 600mA 4.5M	Measured value / Converted value from pressure
	E-3 OPT RELIEF 1	
	COMP. 600mA 14.5M	Set value in computer / Converted value from pressure
	MEAS. 600mA 14.5M	Measured value / Converted value from pressure
	E-4 OPT RELIEF 2	
	COMP. 600mA 14.5M	Set value in computer / Converted value from pressure
	MEAS. 600mA 14.5M	Measured value / Converted value from pressure
8	NO.8 SENSOR,SWITCH	
	H-9 FUEL LEVEL	
	4.5V 90%	Fuel level
	H-10 HYD.OIL TEMP	
	4.5V 30 ℃	Hydraulic oil temperature
	GLOW OFF	Glow switch
	AIR FILTER LIVE	Air filter clogging
	WATER SEPA. LIVE	Water separator clogging
	ENG OIL FILTER LIVE	Engine oil filter clogging
	FRONT WINDOW OFF	Front window open/close switch
	DOUBLE FLOW ON	Conflux/Single flow select switch
	KPSS SW OFF	KPSS switch
	HEATER OFF	Command from air heater
	ENG OIL LEVEL LIVE	Engine oil level
	COOLANT LEVEL LOW	Coolant level
	FUEL DIST 9999	Fuel dist
	FUEL TEMP -100 ℃	Fuel temperture
9	NO.9 SOL.VALVE	
	F-4 OPT SELECT	
	COMP. OFF	Set value in computer
	MEAS. OFF	Measured value (Feed back value)
	SPOOL POS. NIB	Spool position
	SELECT SWITCH NIB	Mode of selector valve
	F-5 FAN PUMP	
	COMP. OFF	Set value in computer
	MEAS. OFF	Measured value
	F-6	
	COMP. OFF	Set value in computer
	MEAS. OFF	Measured value
10		
12	NO.12 PROPO-VALVE	
	D-11 P1 I-TRAVEL	
	COMP. 600mA 4.5M	Set value in computer / Converted value from pressure
	MEAS. 600mA 4.5M	Measured value / Converted value from pressure
	D-12 P2 I-TRAVEL	
	COMP. 600mA 4.5M	Set value in computer / Converted value from pressure
	MEAS. 600mA 4.5M	Measured value / Converted value from pressure
	D-14 FAN DRIVE	
	COMP. 600mA 4.5M	Set value in computer / Converted value from pressure
	MEAS. 600mA 4.5M	Measured value / Converted value from pressure
	D-15	
	COMP. 600mA 4.5M	Set value in computer / Converted value from pressure
	MEAS. 600mA 4.5M	Measured value / Converted value from pressure
	D-16	
	COMP. 600mA 4.5M	Set value in computer / Converted value from pressure
	MEAS. 600mA 4.5M	Measured value / Converted value from pressure

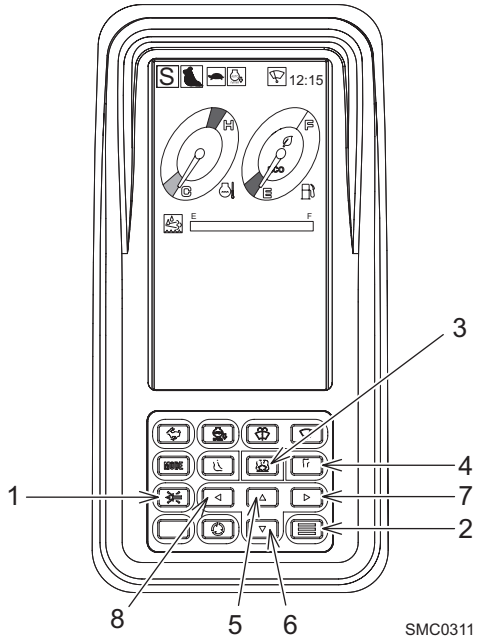
No.	Displays	Contents
13	NO.13 PRESS.SENSOR	
	B-11	
	3.5V 12.6M	Sensor voltage / Pressure converted value
	B-12	
	3.5V 12.6M	Sensor voltage / Pressure converted value
	B-13	
	3.5V 12.6M	Sensor voltage / Pressure converted value
	B-14	
	3.5V 12.6M	Sensor voltage / Pressure converted value
	B-15	
	3.5V 12.6M	Sensor voltage / Pressure converted value
	B-18 DOZER 1	
	3.5V 12.6M	Sensor voltage / Pressure converted value
	B-19 DOZER 2	
	3.5V 12.6M	Sensor voltage / Pressure converted value
	B-20	
	3.5V 12.6M	Sensor voltage / Pressure converted value
	C-5	
	3.5V 12.6M	Sensor voltage / Pressure converted value
	C-6	
	3.5V 12.6M	Sensor voltage / Pressure converted value
	C-7	
	3.5V 12.6M	Sensor voltage / Pressure converted value
	C-8	
	3.5V 12.6M	Sensor voltage / Pressure converted value
14	NO.14 DIGITAL INPUT	
	DI1 OFF	ON/OFF indication (DI1–DI14: See Mechatro controller connector)
	DI2 OFF	ON/OFF indication
	DI3 OFF	ON/OFF indication
	DI4 OFF	ON/OFF indication
	DI5 OFF	ON/OFF indication
	DI6 OFF	ON/OFF indication
	DI7 OFF	ON/OFF indication
	DI8 OFF	ON/OFF indication
	DI9 OFF	ON/OFF indication
	DI10 OFF	ON/OFF indication
	DI11 OFF	ON/OFF indication
	DI12 OFF	ON/OFF indication
	DI13 OFF	ON/OFF indication
	DI14 OFF	ON/OFF indication
	DI15 OFF	ON/OFF indication
	DI16 OFF	ON/OFF indication
	DI17 OFF	ON/OFF indication
	DI18 OFF	ON/OFF indication
	DI19 OFF	ON/OFF indication
	DI20 OFF	ON/OFF indication
	DI21 OFF	ON/OFF indication
	DI22 OFF	ON/OFF indication
	DI23 OFF	ON/OFF indication
	DI24 OFF	ON/OFF indication
	DI25 OFF	ON/OFF indication
	DI26 OFF	ON/OFF indication
15	NO.15 DIGITAL INPUT	
	DI27 OFF	ON/OFF indication
	DI28 OFF	ON/OFF indication
	I29 OFF	ON/OFF indication
	DI30 OFF	ON/OFF indication
	DI31 OFF	ON/OFF indication
	DI32 OFF	ON/OFF indication
	DI33 OFF	ON/OFF indication
	DI34 OFF	ON/OFF indication
	DI35 OFF	ON/OFF indication
	DI36 OFF	ON/OFF indication
	DI37 OFF	ON/OFF indication
	DI38 OFF	ON/OFF indication
	DI39 OFF	ON/OFF indication
	DI40 OFF	ON/OFF indication
	DI41 OFF	ON/OFF indication
	DI42 OFF	ON/OFF indication

SMC0295

Procedure	Operating Procedure	Display on Multidisplay
1	Turn starter key switch ON.	
2	Press "MENU SWITCH" located on the multi-display, the display changes to "USER MENU" display.	
3	Press "NEXT" switch once to enter into "MAINTENANCE". At this time, "INTERVAL" box is indicated in blue.	
4	Press "NEXT" switch once more, and "REMAINING TIME" box is indicated in blue.	
5	Using switch "DOWN" or "UP", and get the desired time until the replacement. Press "MENU SWITCH" once to return to default setting time.	
6	Press "NEXT" switch to fix the value.	
7	Press "Screen Change Switch" once, and the display returns to main display (a).	

2.5 Procedure of setting a flow rate and a option relief pressure at Nibbler/Breaker mode

1: Buzzer Stop Switch
2: Menu Switch
3: Nibbler Mode Switch
4: Breaker Mode Switch
5: Up Arrow Switch
6: Down Arrow Switch
7: Next Arrow Switch
8: Back Arrow Switch



According to some kind of attachment, it is required to change the flow rate and relief pressure for service circuit.
Regarding the adjustment of flow rate and relief pressure for Nibbler and Breaker, the settings of 10 patterns are available.

			SET 1	SET 2	SET 3	SET 4	SET 5	SET 6	SET 7	SET 8	SET 9	SET 10
Nibbler (Crusher)	Flow rate	L/min	588	530	470	410	350	294	270	240	210	180
	Pressure A	MPa	Not set yet	Not set yet	Not set yet	Not set yet	Not set yet	25	Not set yet	Not set yet	Not set yet	Not set yet
	Pressure B	MPa	Not set yet	Not set yet	Not set yet	Not set yet	Not set yet	25	Not set yet	Not set yet	Not set yet	Not set yet

			SET 1	SET 2	SET 3	SET 4	SET 5	SET 6	SET 7	SET 8	SET 9	SET 10
Breaker	Flow rate	L/min	294	270	240	210	180	150	120	90	60	30
	Pressure B	MPa	30	Not set yet	Not set yet	Not set yet	Not set yet	Not set yet	Not set yet	Not set yet	Not set yet	Not set yet

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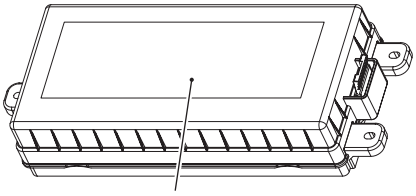
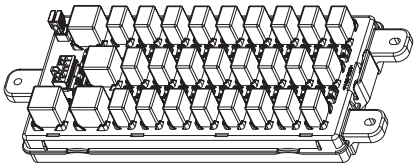
Both Nibbler are set in conditions "SET 6" as factory default in the above table at shipping.
Both Breaker are set in conditions "SET 1" as factory default in the above table at shipping.
* The meaning of "Not set yet" shows that 50MPa as pressure is temporary value.

Set the flow rate and relief pressure in accordance with next procedure.

3. Relay & fuse box (symbol E-1)
   1) General view

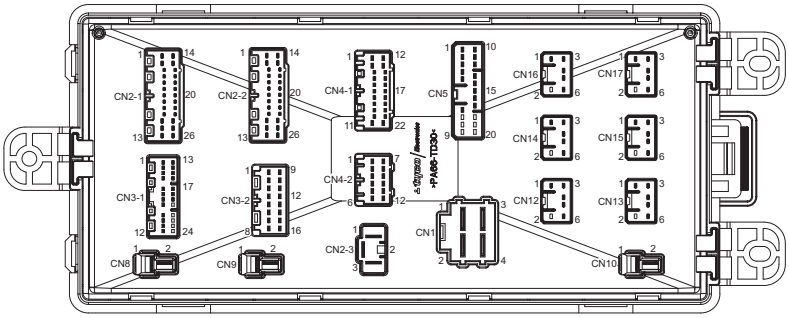


LABEL

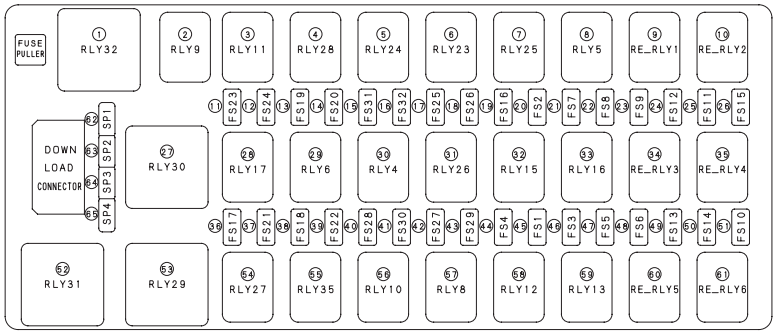


(Overhead view of box)

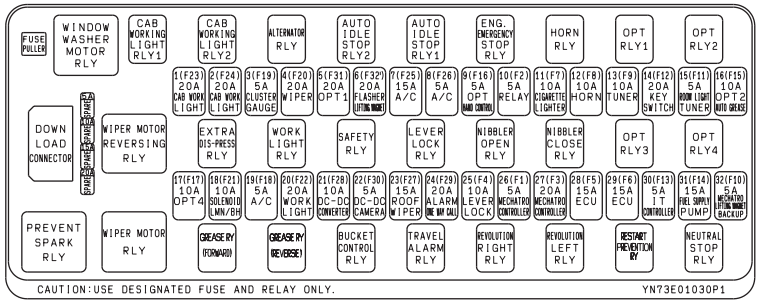
INSIDE



LOCATION OF CONNECTORS (Seen from backside)



LOCATION OF RELAY & FUSE



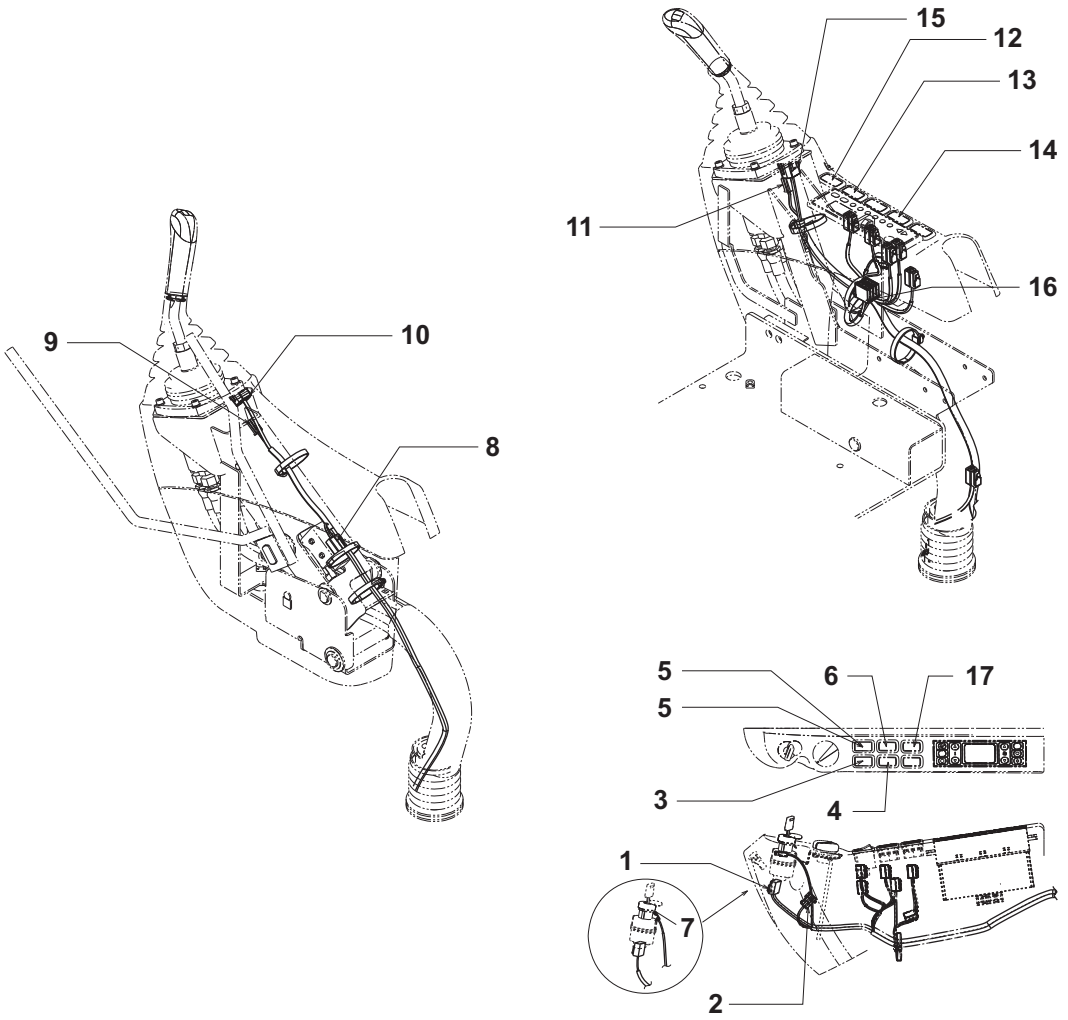
LABEL OF RELAY & FUSE BOX

Note) These circles indicate the parts which are used in standard specification

No.	CODE IN CIRCUIT	PARTS NAME	
65	SP4	MINI FUSE (20A)	○
64	SP3	MINI FUSE (15A)	○
63	SP2	MINI FUSE (10A)	○
62	SP1	MINI FUSE (5A)	○
61	RE_RLY6	MICRO RELAY (V23074A2002A403)	
60	RE_RLY5	MICRO RELAY (V23074A2002A403)	
59	RLY13	MICRO RELAY (V23074A2002A403)	
58	RLY12	MICRO RELAY (V23074A2002A403)	
57	RLY8	MICRO RELAY (V23074A2002A403)	
56	RLY10	MICRO RELAY (V23074A2002A403)	
55	RLY35	MICRO RELAY (V23074A2002A403)	
54	RLY27	MICRO RELAY (V23074A2002A403)	
53	RLY29	MINI RELAY	○
52	RLY31	MINI RELAY	○
51	FS10	MINI FUSE (5A)	○
50	FS14	MINI FUSE (15A)	○
49	FS13	MINI FUSE (5A)	○
48	FS6	MINI FUSE (15A)	○
47	FS5	MINI FUSE (15A)	○
46	FS3	MINI FUSE (20A)	○
45	FS1	MINI FUSE (5A)	○
44	FS4	MINI FUSE (10A)	○
43	FS29	MINI FUSE (20A)	○
42	FS27	MINI FUSE (15A)	○
41	FS30	MINI FUSE (5A)	○
40	FS28	MINI FUSE (10A)	○
39	FS22	MINI FUSE (20A)	○
38	FS18	MINI FUSE (5A)	○
37	FS21	MINI FUSE (10A)	○
36	FS17	MINI FUSE (10A)	○
35	RE_RLY4	MICRO RELAY (V23074A2002A403)	
34	RE_RLY3	MICRO RELAY (V23074A2002A403)	
33	RLY16	MICRO RELAY (V23074A2002A403)	
32	RLY15	MICRO RELAY (V23074A2002A403)	
31	RLY26	MICRO RELAY (V23074A2002A403)	○
30	RLY4	MICRO RELAY (V23074A2002A403)	○
29	RLY6	MICRO RELAY (V23074A2002A403)	○
28	RLY17	MICRO RELAY (V23074A2002A403)	
27	RLY30	MINI RELAY	○
26	FS15	MINI FUSE (10A)	○
25	FS11	MINI FUSE (5A)	○
24	FS12	MINI FUSE (20A)	○
23	FS9	MINI FUSE (10A)	○
22	FS8	MINI FUSE (10A)	○
21	FS7	MINI FUSE (10A)	○
20	FS2	MINI FUSE (5A)	○
19	FS16	MINI FUSE (5A)	○
18	FS26	MINI FUSE (5A)	○
17	FS25	MINI FUSE (15A)	○
16	FS32	MINI FUSE (20A)	○
15	FS31	MINI FUSE (20A)	○
14	FS20	MINI FUSE (20A)	○
13	FS19	MINI FUSE (5A)	○
12	FS24	MINI FUSE (20A)	○
11	FS23	MINI FUSE (20A)	○
10	RE_RLY2	MICRO RELAY (V23074A2002A403)	
9	RE_RLY1	MICRO RELAY (V23074A2002A403)	
8	RLY5	MICRO RELAY (V23074A2002A403)	○
7	RLY25	MICRO RELAY (V23074A2002A403)	○
6	RLY23	MICRO RELAY (V23074A2002A403)	○
5	RLY24	MICRO RELAY (V23074A2002A403)	○
4	RLY28	MICRO RELAY (V23074A2002A403)	○
3	RLY11	MICRO RELAY (V23074A2002A403)	
2	RLY9	MICRO RELAY (V23074A2002A403)	
1	RLY32	MINI RELAY	○

SMC1209

Platform wiring harness

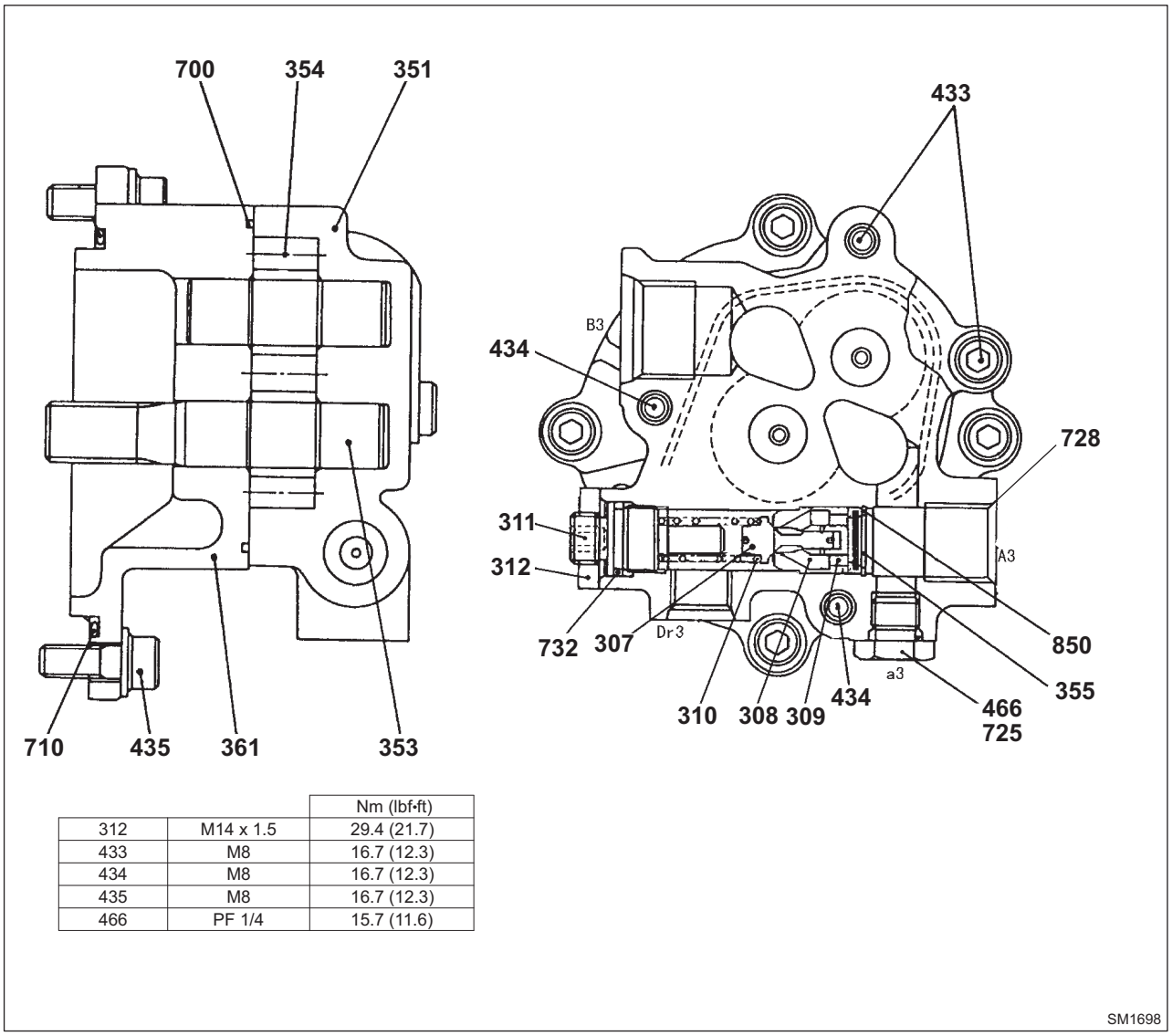


SMC1184

1 - Starter switch (SW-1)
2 - Engine speed throttle (SE-16)
3 - Work light switch (SW-55)
4 - Connector for cab work light (SW-26)
5 - Over load alarm select switch (SW-12)
Indipendent travel switch (SW-37)
6 - "Heavy Lift" switch (SW-35) (opt.)
7 - Starter switch (GND) (SW-1)
8 - Connector for lever lock (SW-11)
9 - Connector for horn (SW-10)
10 - Connector for extra function (slider) (SW-100)
11 - Connector for Power Boost (SW-20)
12 - Rotary lamp switch (SW-40)
13 - Pressure release switch (SW-96)
14 - Quick coupling switch (SW-64)
15 - Connector for nibbler open/close (slider) (SW-99)
16 - Connector for radio (E-7)
17 - Travel alarm switch (SW-13) (opt.)
Grease switch (SW-60) (opt.)

COMPONENT OPERATION

GEAR PUMP (FOR PILOT)

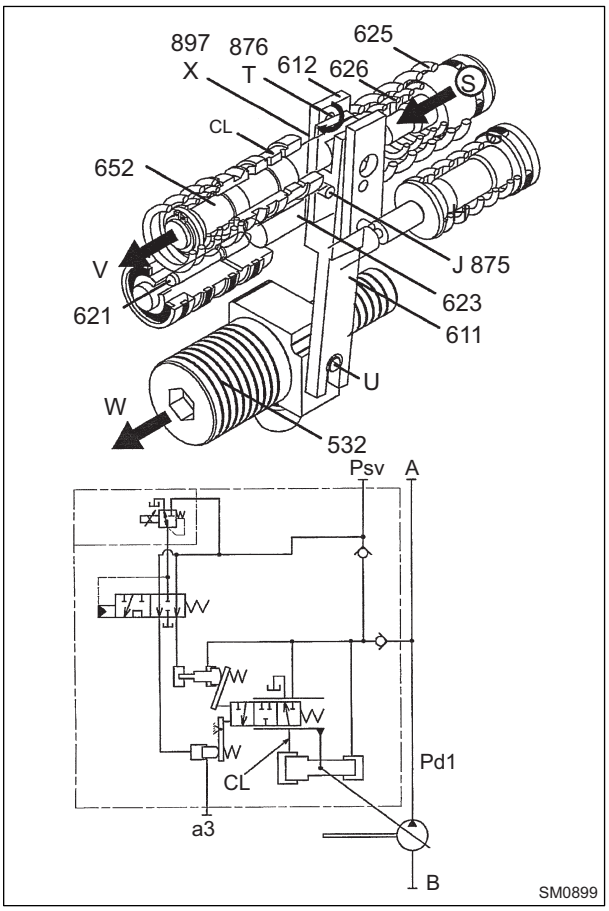


		Nm (lbf·ft)
312	M14 x 1.5	29.4 (21.7)
433	M8	16.7 (12.3)
434	M8	16.7 (12.3)
435	M8	16.7 (12.3)
466	PF 1/4	15.7 (11.6)

307 - Poppet
308 - Seat
309 - Ring
310 - Spring
311 - Adjust screw
312 - Lock nut; M14×1.5
351 - Gear case
353 - Drive gear
354 - Driven gear
355 - Filter
361 - Front case
433 - Flange socket; M8×40 (Q.ty 2)
434 - Flange socket; M8×55 (Q.ty 2)
435 - Flange socket; M8×20 (Q.ty 4)
466 - Vp plug; PF1/4
700 - Ring
710 - O-Ring 1B G95
725 - O-Ring 1B P11
728 - O-Ring 1B P18
732 - O-Ring 1B P16
850 - Locking ring
a3 - Gauge port; PF1/4 16 Nm (11.8 lbf·ft)
A3 - Delivery port; PF3/8 34.3 Nm (25.3 lbf·ft)
B3 - Suction port; PF3/4 73.5 Nm (54.2 lbf·ft)
Dr4 - Drain port; PF3/8 34.3 Nm (25.3 lbf·ft)

Flow rate recovery operation

Because the compensating rod (**623**) is pushed towards (**S**) with the force of outer spring (**625**) and inner spring (**626**) with reduction of self pump delivery pressure Pd1, and moves to the position the spring force of outer spring (**625**) and inner spring (**626**) balances the delivery pressure Pd1. The movement of compensating rod is transferred to lever 1 (**612**) through pin (**875**), and rotates at (**T**) fulcrum in arrow direction.
Furthermore the lever 1 (**612**) movement is transferred to feedback lever (**611**) through pin (**897**) and rotates at (**T**) fulcrum in the same arrow direction as (**N**). Consequently the spool (**652**) connected to feedback lever moves towards (**V**). As the spool moves towards (**V**), CL port is open and connected to tank port, the pressure of servo piston large bore diameter chamber is released and the servo piston (**532**) moves towards (**W**) with delivery pressure Pd1 in small bore diameter chamber, and consequently the flow rate is raised. Since the feed back lever is connected to servo piston and spool, the feed back lever rotates at (**X**) fulcrum with the movement of the servo piston towards (**W**), consequently the spool is returned to the original position. With this movement, the opening of spool sleeve gradually closes, and the servo piston stops at the position the opening closes completely.



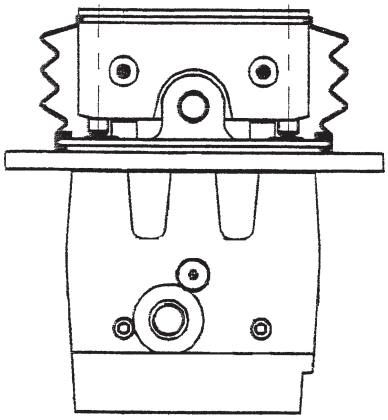
PRIORITY MECHANISM OF LOW TILT ANGLE (LOW FLOW RATE) COMMAND

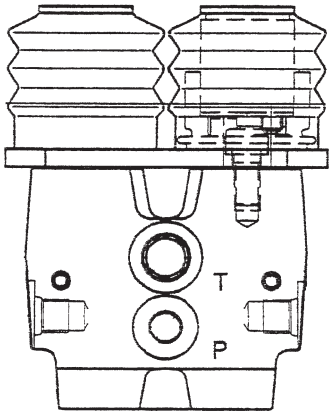
As the said explanation, the tilting commands of flow rate control and power control are transferred to feedback lever (**611**) and spool (**652**) through the large bore section of lever 1 (**612**) and lever 2 (**613**), but because the pin (**dia 5**) is extruded in large bore (**dia 9**), pin (**897**) on the side where making tilt angle smaller contacts with it, consequently the bore (**dia 9**) of lever on the side where larger tilt angle command is given is free without contact with pin (**897**). In this mechanical selecting manner, the command on the side of low tilt angle of the flow rate control and power control has a priority.

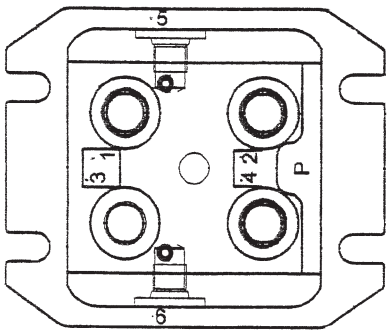
PILOT VALVE (TRAVEL)

OUTLINE

Outside view





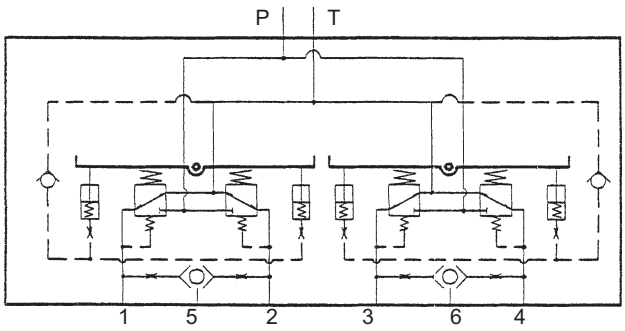


Port size	Tightening torque N·m (lbf·ft)	Port name	Function
PF3/8	30 (22)	1	LH travel forward port
		2	LH travel reverse port
		3	RH travel forward port
		4	RH travel reverse port
		T	Tank port
PF1/4	16.7 (12.3)	5	LH travel pressure sensor port
		6	RH travel pressure sensor port
		P	Pilot primary pressure port

SM0596

Specifications

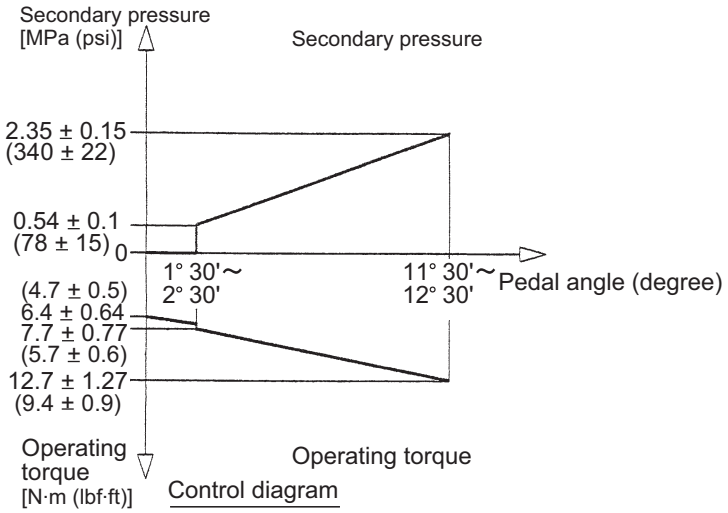
Type	6TH6NRZ
Primary pressure	4.9MPa (711psi)
Secondary pressure	0.54~2.35MPa (78~341 psi)
Rated flow	25 L/min (6.6 gal/min)
Weight	Approx. 8kg (18 lbs)



Hydraulic symbol

SM0597

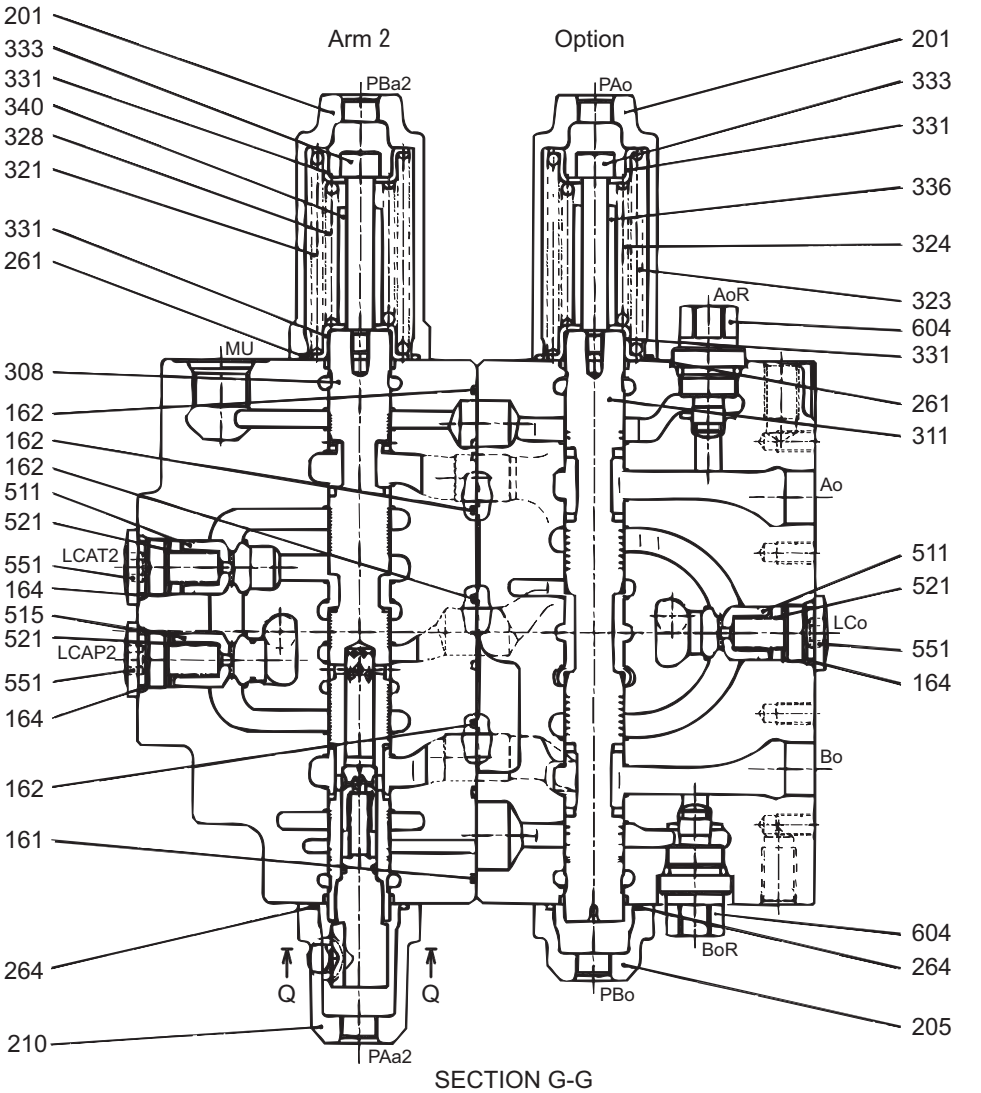
Performance characteristics



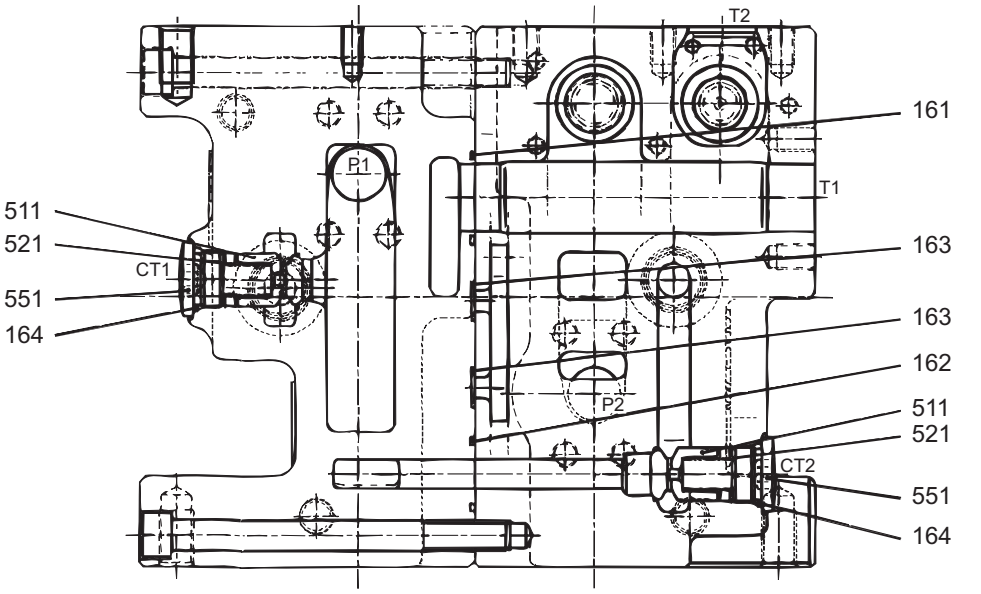
Control diagram

SM0598

Control valve (5/6)



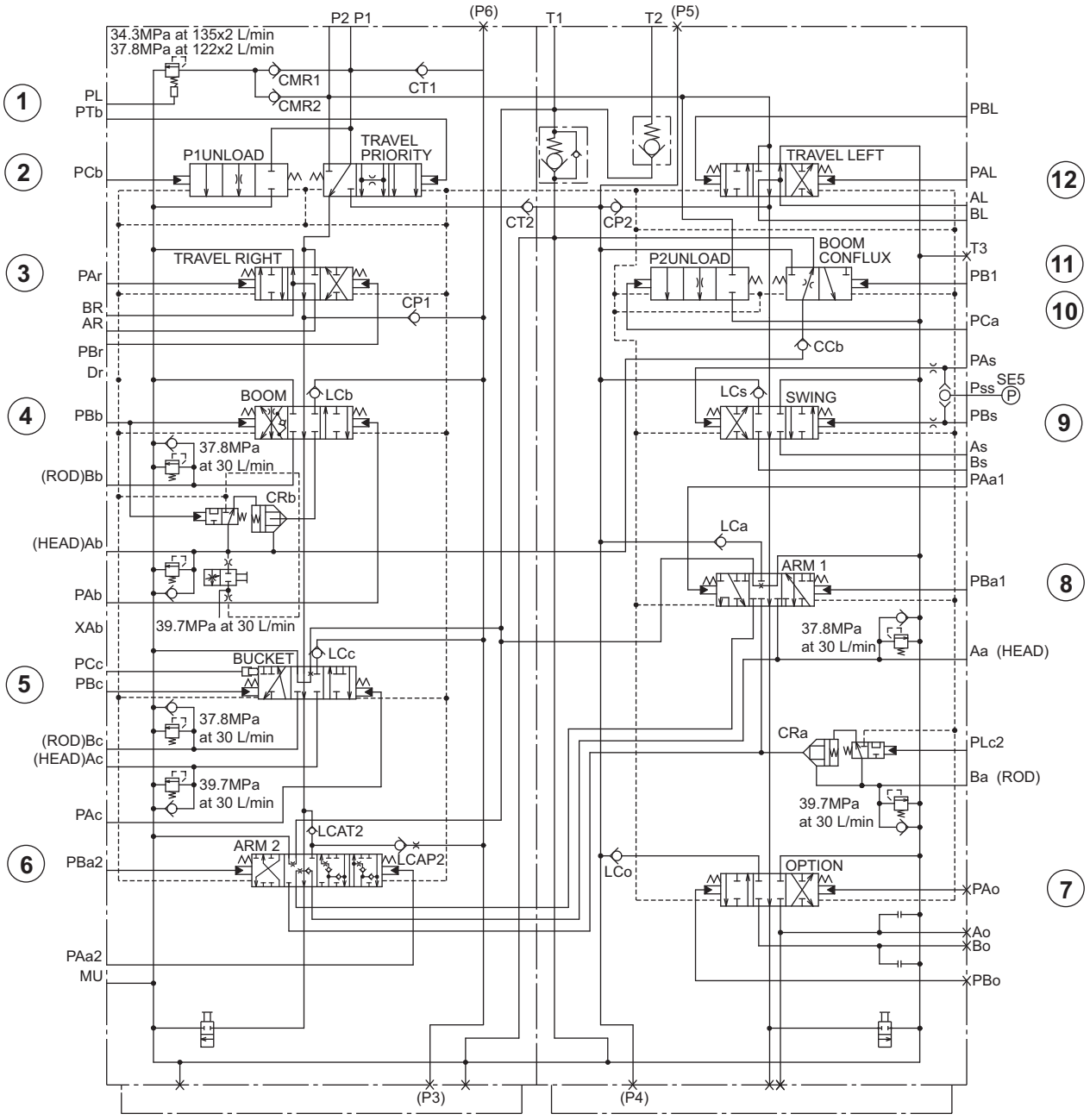
SECTION G-G



SECTION H-H

SMC0579

HYDRAULIC CIRCUIT DIAGRAM



SMC1189

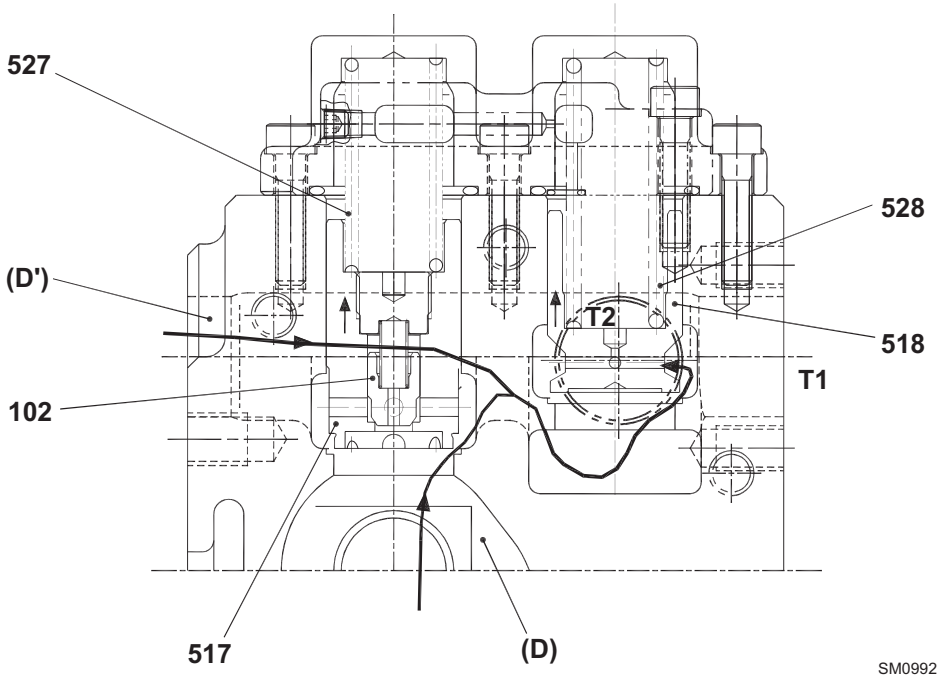
1- **Travel priority**
2- **P1 Unload**
3- **Travel right**
4- **Boom**
5- **Bucket**
6- **Arm 2**
7- **Option**
8- **Arm 1**
9- **Swing**
10- **P2 Unload**
11- **Boom conflux**
12- **Travel left**

b) In arm in operation (At light load: arm recirculation function)
On starting arm in operation, the pilot pressure enters ports PAa1 and PLc2, and arm 1 spool (**302**) moves leftward against the force of springs (**321**) (**322**), and simultaneously the secondary pressure of solenoid proportional valve [X2] acts on port PCa and switches unloading spool (**310**). At the same time, since the spool of lock valve selector (**211**) is switched, the spring chamber of lock valve poppet CRar (**514**) is connected to the drain circuit and the retention of poppet (**514**) is released.
And the pilot pressure enters PAa2 through solenoid proportional valve [XR], and arm2 spool (**308**) moves leftward against the force of springs (**321**) (**328**) and the secondary pressure of solenoid proportional valve [X1] acts on port PCb and switches unloading spools (**309**). But in light load operation, because the solenoid proportional valve [XR] actuates and arm 2 spool (**308**) stays in the position of circuit (**I**).
The hydraulic oil delivered by hydraulic pump P2 flows into parallel passage (**56**), pushes and opens load check valve LCa (**511**), and flows into port (**Aa**) through between the perimeter of arm 1 spool (**302**) and casing through U-shaped passage. In the meantime, the hydraulic oil delivered by hydraulic pump P1 flows through center by-pass passage (**52**) and pushes and opens load check valve LCAT2 (**511**) and enters U-shaped passage, and also the oil from parallel passage (**53**) pushes and opens load check valve LCAP2 (**515**) provided with orifice and flows into U-shaped passage. And then the hydraulic oil flows through between the perimeter of arm 2 spool (**308**) and casing from U-shaped passage and enters port (**Aa**) through casing inside passage (**HH**) and confluences the hydraulic oil from hydraulic pump P2 side.
The conflux hydraulic oil is supplied to arm cylinder head side (**H**) through port (**Aa**).
In the meantime, the return oil from arm cylinder rod side (**R**) enters the control valve through port (**Ba**). Because the retention of lock valve poppet CRar (**514**) which is located on this side of arm 1 spool (**302**) is released, the return oil pushes and opens lock valve poppet CRar (**514**) and enters AR chamber. The return oil in AR chamber is led to arm 2 spool (**308**) through arm 1 spool (**302**) and casing inside passage (**RR**), but because arm 2 spool (**308**) does not connect to low pressure passage (**D**) at circuit (**I**), the entire flow rate flows into arm 1 spool (**302**).
The return oil from chamber AR passes through the perimeter of arm 1 spool (**302**) and casing, and flows through casing inside passage (**RH**) and is led to the inside of arm 2 spool (**308**) through circular notch (**a**) of arm 2 spool (**308**). In light load operation, since the return oil contains higher pressure than that of arm cylinder head side (**H**) with the self weight of arm, etc. the hydraulic oil inside of arm 2 spool (**308**) passes through check valve (**317**) and flows into casing inside passage (**HH**) and the supplied to arm cylinder head side (**H**) again. (Arm recirculation function).
And a part of the return oil wich was led to arm 2 spool (**308**) passes through check valve (**319**), and flows through boost check valve (**517**) through load pressure circuit (**D**) and returns to the hydraulic tank through tank port T1.

b) **By-pass check valve**

Even if the pressure at tank port T1 goes up due to the sudden change of return flow rate, the by-pass check valve actuates and prevents the pressure at tank port T1 from going up higher than the specified pressure, and consequently the oil cooler and filter located between tank port T1 and the hydraulic tank are protected from possible damage.

When the pressure at tank port T1 goes up to the pressure added by spring (**528**), by-pass check valve (**518**) is pushed and opens against the force of spring (**528**), and the hydraulic oil in tank port T1 directly returns to the hydraulic tank through tank port T2.

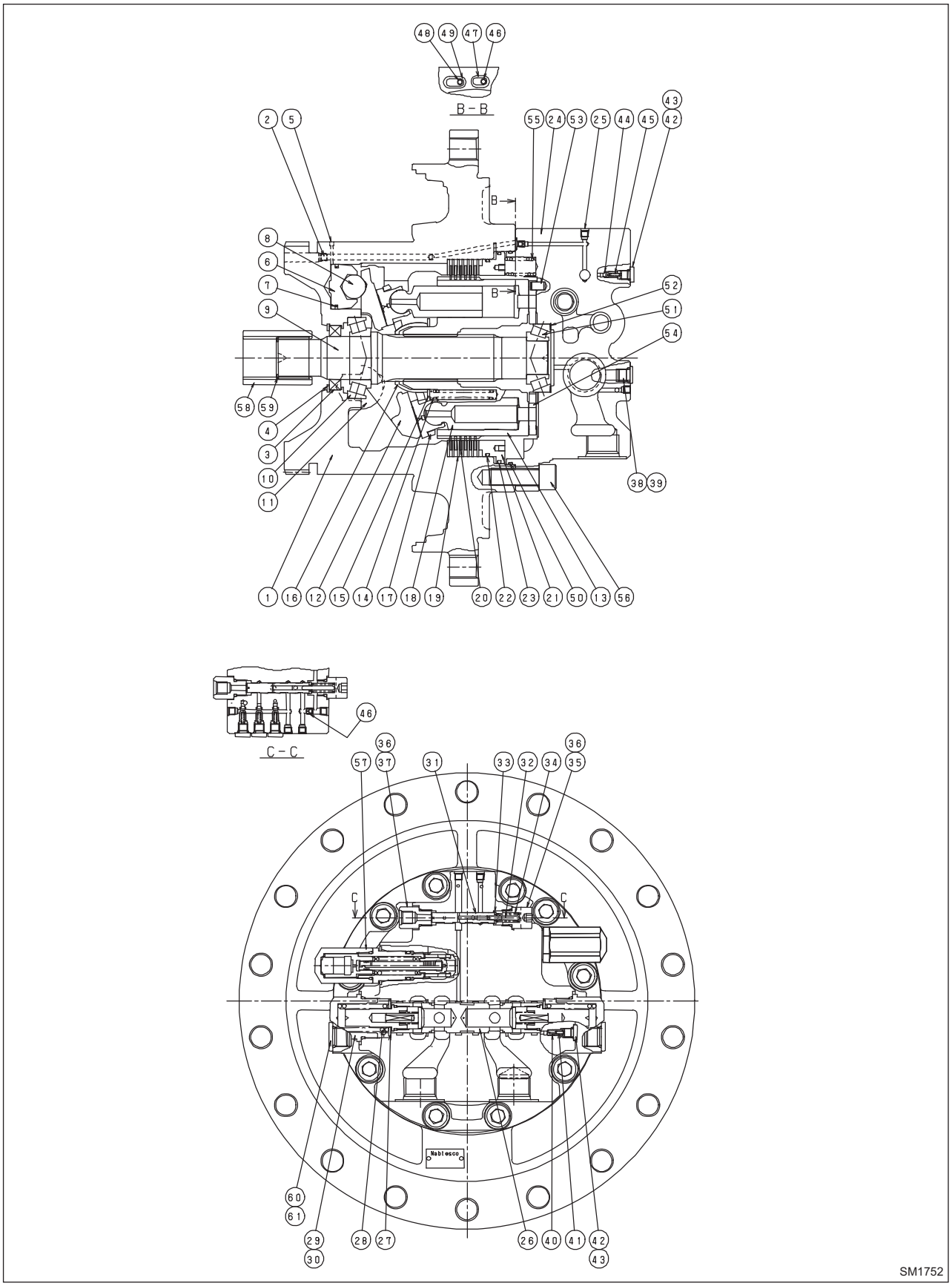


By-pass check valve operation

Tightening torque N•m (lbf•ft)	No.	Parts	Q'ty	Tightening torque N•m (lbf•ft)	No.	Parts	Q'ty
	1	Pinion	1		21	Ring	1
	2	Pinion shaft	1		22	Thrust washer	6
	3	#1 Sungear	1		23	Thrust washer	8
	4	#1 Planetary pinion	3		24	Snap ring	1
	5	#1 Spider assy	1		25	Snap ring	3
	6	#2 Sungear	1		26	Spring pin	4
	7	#2 Planetary pinion	4	539 ± 54 (398 ± 40)	27	Capscrew M20x200	12
	8	Ring gear	1		28	Grease fitting	1
	9	#2 Spider assy	1		29	Relief fitting	1
	10	Shaft	4	69.1 ± 4.4 (51 ± 3)	30	Tube	1
	11	Needle bearing	11	69.1 ± 4.4 (51 ± 3)	31	Elbow	1
	12	Roller bearing	1	69.1 ± 4.4 (51 ± 3)	32	Plug	1
	13	Roller bearing	1		33	Cap	2
	14	Oil seal	1	279 ± 30 (206 ± 22)	34	Capscrew	3
	15	Housing	1				
	16	Oil seal	1		35	Shim t=0.1	1
	17	Sleeve	1		36	Shim t=0.2	1
	18	Sleeve	1		37	Shim t=0.3	1
	19	Plate	1		38	Shim t=0.5	1
	20	Plate	1				

CONSTRUCTION

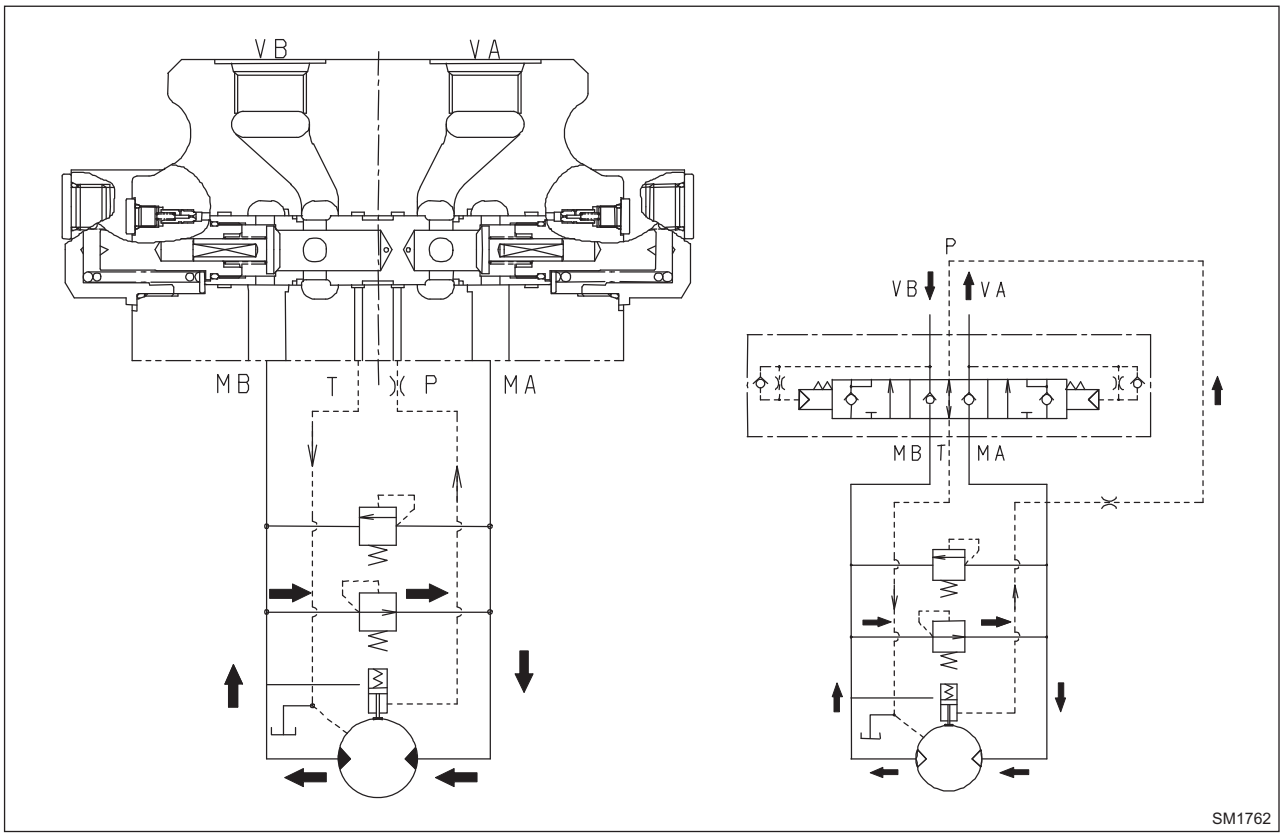
Travel motor



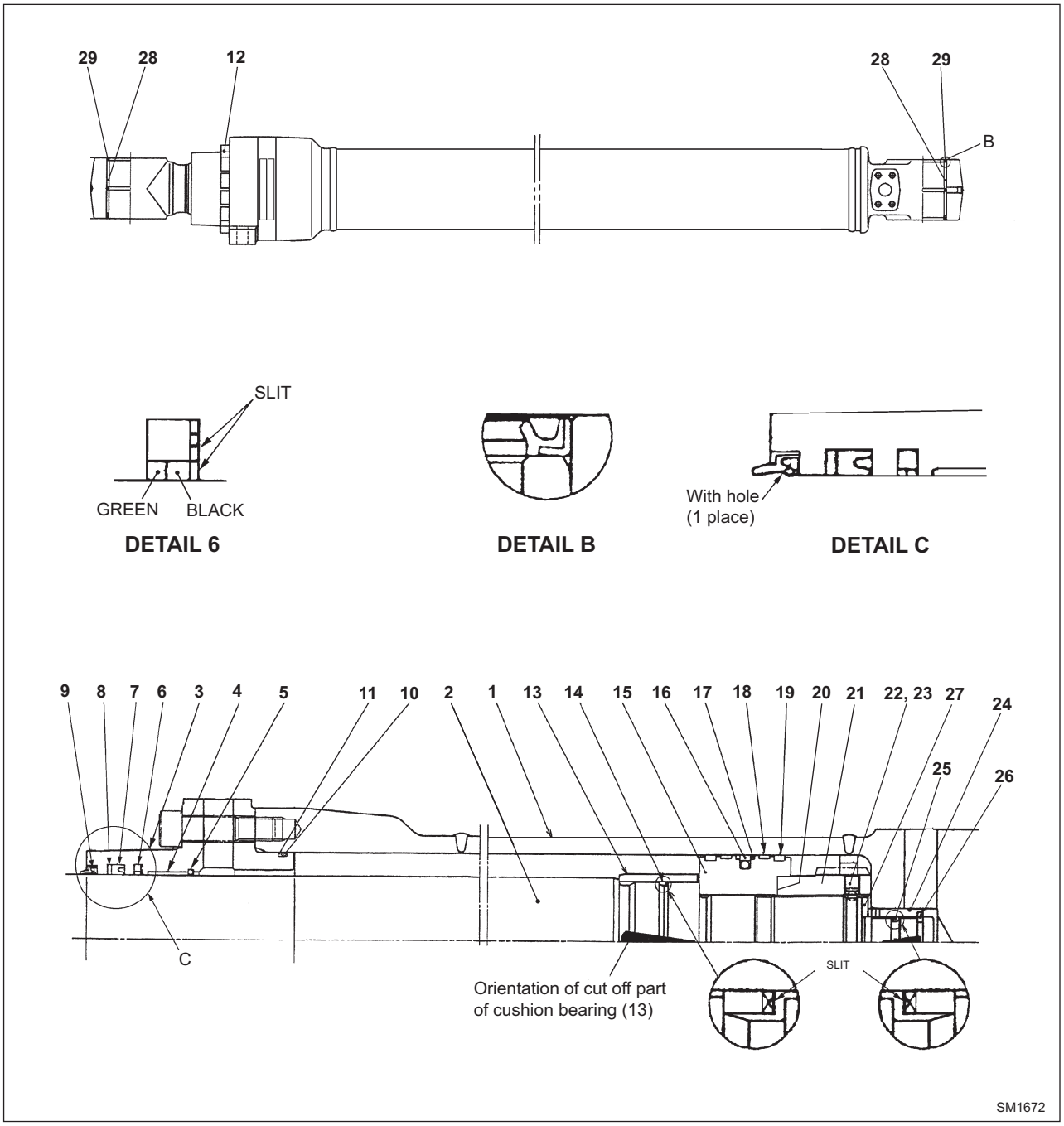
At stop operation

If the selector valve is brought back to neutral while the hydraulic motor is rotating to cut off the oil supply and the **VA** and **VB** ports are connected with the tank, the pressures of the pilot chamber at both ends of the spool are equalized. Then the spool returns to neutral position by the spring action. This closes the **MA→VA** passage. However, since the hydraulic motor tries to rotate by inertia load, the hydraulic motor makes pumping action to discharge the hydraulic oil to the **MB** port. Since the passage is shut off, the pressure rises, the relief valve operates and the hydraulic motor is decelerated gradually to a complete stop.

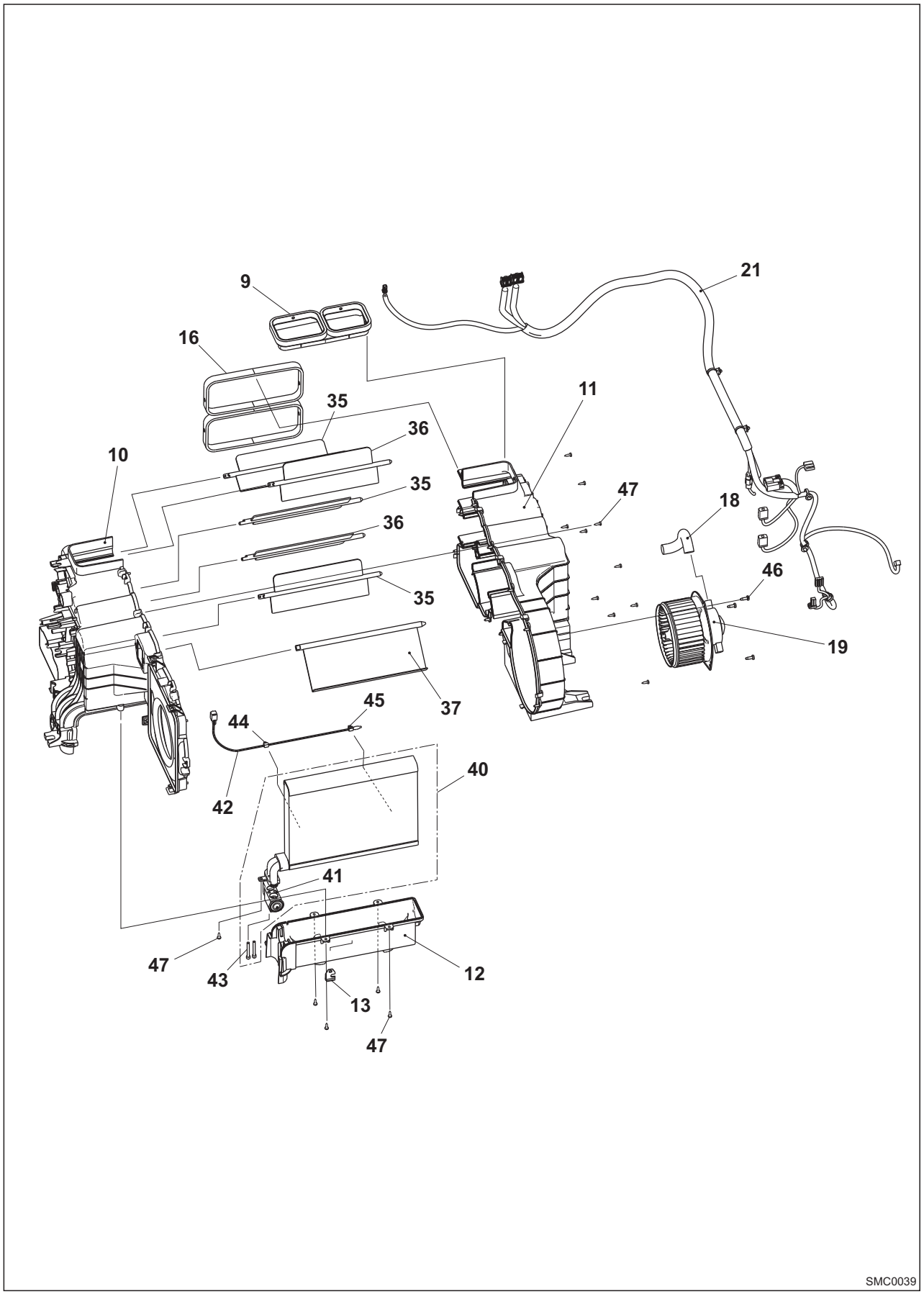
The release pressure for the negative brake falls slowly by the restrictor. The brake falls into an operating condition which causes the hydraulic motor to stop mechanically.



Arm cylinder

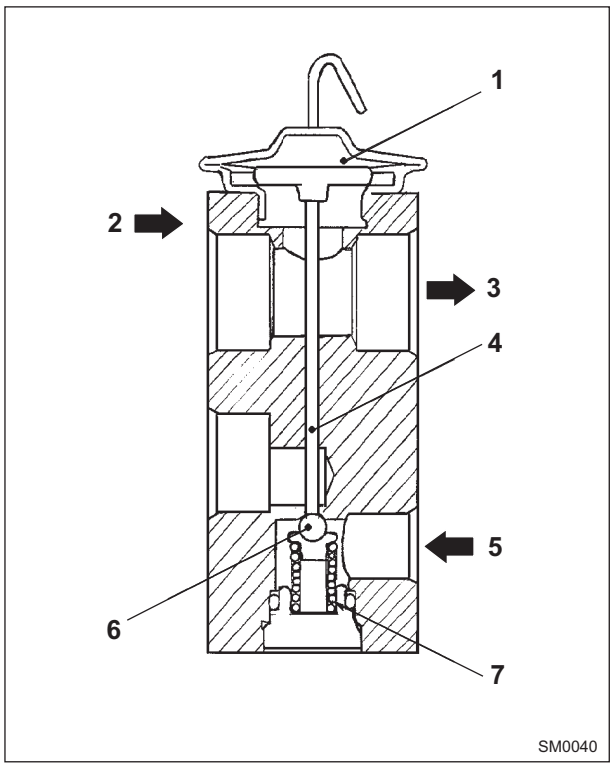


1- **Cylinder tube**
2- **Piston rod**
3- **Rod cover**
4- **Bushing**
5- **Snap ring**
6- **Buffer ring**
7- **U-Ring**
8- **Backup ring**
9- **Wiper ring**
10- **O-Ring**
11- **Backup ring**
12- **Socket bolt;** M22x95 (Q.ty 12) 711 Nm (524 lbf.ft)
13- **Cushion bearing**
14- **Cushion seal**
15- **Piston**
16- **Seal ring**
17- **Backup ring** (Q.ty 2)
18- **Slide ring** (Q.ty 2)
19- **Slide ring** (Q.ty 2)
20- **Shim**
21- **Nut** M95 x 4 17000 Nm (12538 lbf·ft)
22- **Set screw;** M16 x 2 96.6±18.2 Nm (71.2±13.4 lbf·ft)
23- **Steel ball**
24- **Cushion bearing**
25- **Cushion seal**
26- **Stopper** (Q.ty 2)
27- **Snap ring**
28- **Pin bushing** (Q.ty 2)
29- **Wiper ring** (Q.ty 4)

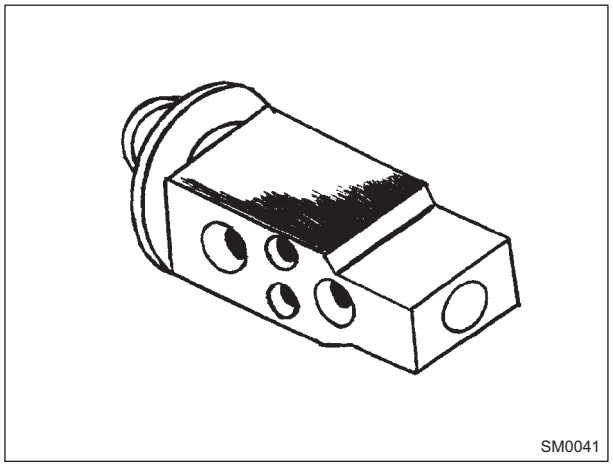


Air conditioner unit (2/2)

The figure beside shows how the block type expansion valve is constructed. The temperature sensing part is provided in the shaft of the expansion valve to directly detect the refrigerant temperature at the outlet of the evaporator.
The diaphragm contains R134a in saturated state. The pressure in the diaphragm changes according to the temperature detected by the sensor. The change in the pressure causes the force acting upon the diaphragm to vary accordingly.
The high-pressure high-temperature liquid refrigerant that is fed from the receiver side reduces the pressure abruptly as it passes through the valve (throttling action). On that occasion, part of the refrigerant evaporates by the very heat of the refrigerant and cooled off. The result is that low-pressure low-temperature damp refrigerant vapor is fed to the evaporator.
The opening of the valve is determined by the balance between the pressure (low) of the evaporator side, the action of the adjust spring and the pressing force of the diaphragm (the temperature of the refrigerant at the outlet of the evaporator to be sensed by the temperature sensor). The feed rate is controlled automatically so that under the pressure in the evaporator, the refrigerant is properly overheated (3 ~ 8 degrees) and goes out of the evaporator. This action is carried out by sensing the refrigerant temperature at the outlet of the evaporator as against the inlet pressure of the evaporator and consequently controlling the feed rate of the refrigerant.
This means that if the refrigerant pressure drop in the evaporator is excessive, it is difficult to control the overheating or the feed rate of the refrigerant. For this reason, the smaller the pressure drop of the evaporator, the better.
The expansion valve senses the pressure and the temperature at the outlet of the evaporator and controls the overheating of the refrigerant and the refrigerant supply to the evaporator more securely. The air-conditioner of this machine adopts a block type expansion valve.



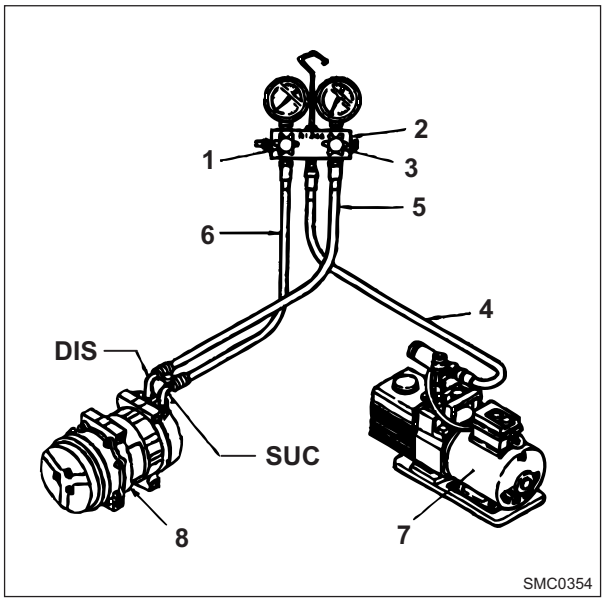
1 - Diaphragm
2 - Evaporator side
3 - Refrigerant outlet
4 - Shaft
5 - Refrigerant inlet
6 - Ball valve
7 - Spring



CHARGING PROCEDURE

VACUUM MAKING OPERATION

1. Close high pressure valve (**3**) and low pressure valve (**1**) on gauge manifold (**2**).
2. Connect the charging hoses [red (**5**) and blue (**6**)] with the service valves (**8**) of the compressor.
   Red hose (**5**):
   High pressure side (HI) of the gauge manifold --> high pressure side (DIS) of compressor
   Blue hose (**6**):
   Low pressure side (LO) of gauge manifold --> low pressure side (SUC) of compressor



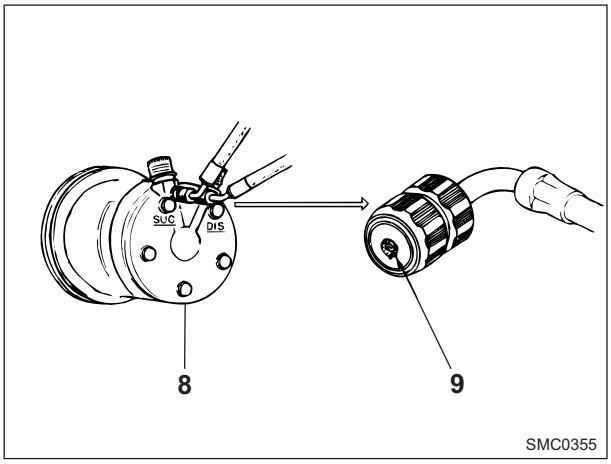
CAUTION

*Do not mistake the high pressure hose for the low pressure hose in any circumstances when connecting them. Put the hose in firmly till a clicking sound is heard. Connect the quick release joint of the charging pipe with the service valve of the compressor. If the charging hose is connected in the opposite direction, mini-valve (**9**) of the compressor fails to open.*

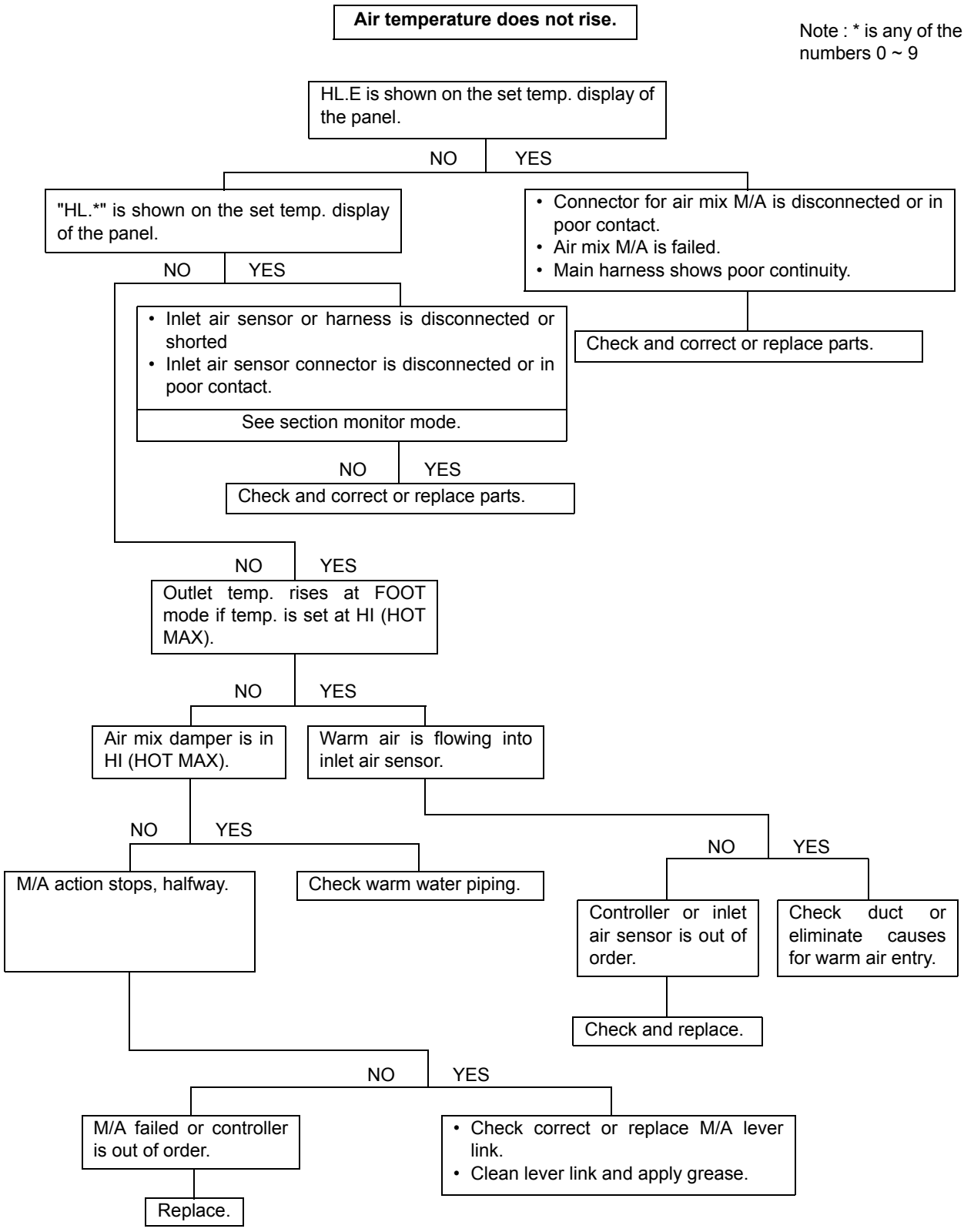
3. Connect the center valve of the gauge manifold with charging hose (**4**) of the vacuum pump (**7**).

CAUTION: *some kinds of gauge manifolds are not equipped with an open/close valve in the center.*

4. Open high pressure valve (**3**) and low pressure valve (**1**) of gauge manifold (**2**).
5. Turn on the switch of the vacuum pump and make vacuum for more than 30 minutes.
6. When vacuum making for a specified duration is over (degree of vacuum : less than - 750 mmHg), close the high pressure valve (**3**) and the low pressure valve (**1**) of the gauge manifold (**2**).
7. Then turn off the vacuum pump.
8. Close the high pressure valve (**3**) and the low pressure valve (**1**) of the gauge manifold (**2**), leave it as it is for more than five minutes and make sure that the gauge indication does not return toward 0.



CAUTION: *If the gauge indication goes toward 0, there is somewhere that is leaking. Retighten pipe joints, make vacuum again and make sure of no leakage.*

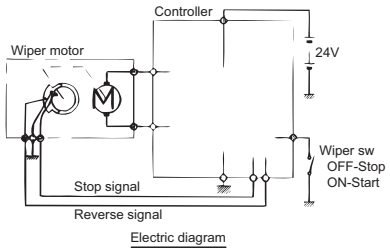
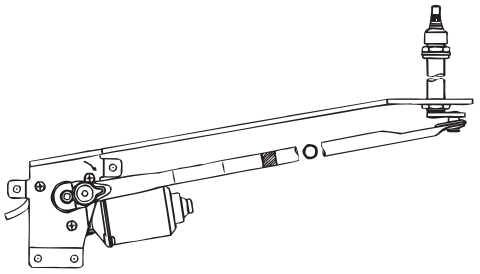

Air temperature does not rise.
Note : * is any of the numbers 0 ~ 9
HL.E is shown on the set temp. display of the panel.
NO
YES
"HL.*" is shown on the set temp. display of the panel.
• Connector for air mix M/A is disconnected or in poor contact.
• Air mix M/A is failed.
• Main harness shows poor continuity.
NO
YES
Check and correct or replace parts.
• Inlet air sensor or harness is disconnected or shorted
• Inlet air sensor connector is disconnected or in poor contact.
See section monitor mode.
NO
YES
Check and correct or replace parts.
NO
YES
Outlet temp. rises at FOOT mode if temp. is set at HI (HOT MAX).
NO
YES
Air mix damper is in HI (HOT MAX).
Warm air is flowing into inlet air sensor.
NO
YES
M/A action stops, halfway.
Check warm water piping.
NO
YES
Controller or inlet air sensor is out of order.
Check duct or eliminate causes for warm air entry.
Check and replace.
NO
YES
M/A failed or controller is out of order.
Replace.
• Check correct or replace M/A lever link.
• Clean lever link and apply grease.

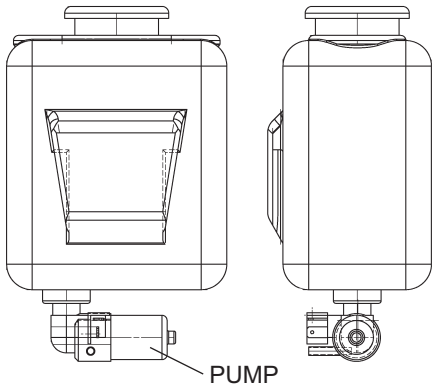
ELECTRICAL EQUIPMENT

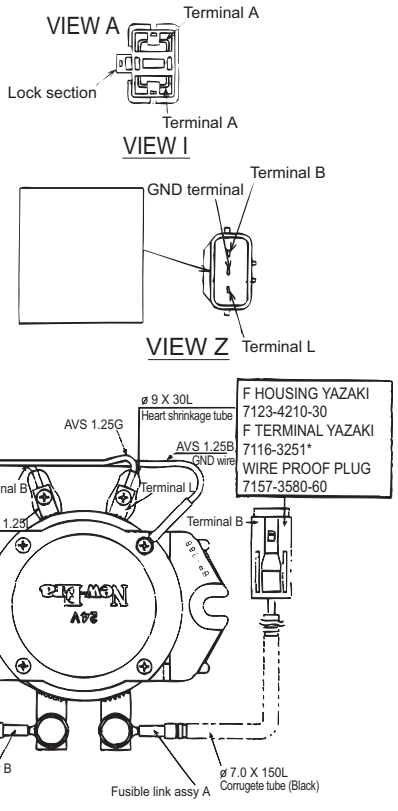
ELECTRICAL EQUIPMENT LIST

Group	Code	Part Name	Part No.
(C) Controller	C - 1	Mechatro controller	YN22E00425F1
	C - 2	Gauge cluster	YN59S00028F4
	C - 4	Air-con controller (including panel)	LQ20M01328P1
	C - 5	Coolant level controller	
(D) Diode	D - 4	Diode	YN02D01001P1
	D - 5	Diode	Accessory of relay box
	D - 6	Diode	↑
	D - 9	Diode	↑
	D - 10	Diode	↑
	D - 12	Diode	↑
	D - 13	Diode	↑
	D - 14	Diode	↑
	D - 15	Diode	↑
	D - 16	Diode	↑
	D - 17	Diode	↑
	D - 18	Diode	YN02D01001P1
	D - 19	Diode	↑
	D - 20	Diode	↑
	D - 21	Diode	↑
	D - 22	Diode	↑
	D - 23	Diode	↑
	D - 25	Diode	YN02D01001P1
(E) Electric fittings	E - 1	Fuse and Relay box	YN24E00016F3
	E - 2	Alternator	
	E - 3	Hour meter	LQ58S00002P1
	E - 5	Horn high	87357734
	E - 6	Horn low	87565344
	E - 7	Radio	87752823
	E - 8	Speaker left	LQ54S00003S002
	E - 9	Speaker right	↑
	E - 10	Receiver dryer	LQ54S00005P1
	E - 11	Air-con compressor	72203934
	E - 12	Battery	71421589, 82027430
	E - 21	Engine pre-heating	
	E - 22	DC-DC Converter	84130880
	E - 23	24V SOCKET	87524810
	E - 26	Fuse box	87565333
	E - 27	Potentiometer "Emergency mode"	87526094
	E - 46	Rearview camera	YN55S00009F1
	E - 63	DC-DC Converter (camera)	YN77S00040P1
(L) Light	L - 1	Boom work light (LH)	87555081
	L - 2	Frame work light (RH)	LB80S00001F1
	L - 5	Room light	LC02C00037F1
	L - 6	Boom work light (RH)	87555081
(M) Motor	M - 1	Starter motor	-
	M - 3	Wiper motor	LQ53C00003S001
	M - 4	Washer motor	422702800

Code No. Parts Name Parts No. Use	Specifications	Description

M - 3 Motor LQ53C00003S001 Wiper motor	 Electric diagram	

M - 4 Motor (Tank) 422702800 Window washer	Rated voltage: DC 24V Injection flow: 1.2L (0.32 gal) / min or more Capacity: 1.5L (0.4 gal) Time rated: Max. continuous 60 sec. Injection nozzle: ϕ 1 X 2 pcs.	

R - 1 Relay 87559395 Battery relay	Rated voltage / current: At start 24V2000A(0.1 sec) At charge 28V100A(Continuous) Exciting current: 0.4A or less / 24V Contact pressure: 37.2N {8.4 lb} or more Closed circuit voltage: 16V or less Open circuit voltage: 7V or less Insulation resistance: 3MΩ or more/500V megger	

SMC1200

OPERATIONAL PERFORMANCE TEST

CONTENTS

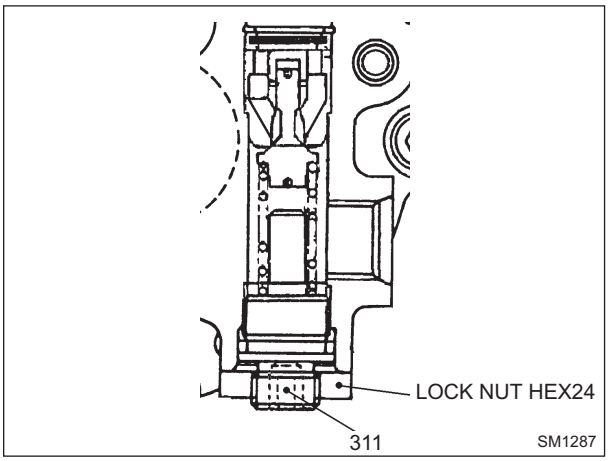
Procedure for adjusting relief valve

PILOT RELIEF VALVE

Adjust it with adjust screw (**311**).

: 24 mm
: 29.4 N•m (22 lbf•ft)
: 6 mm

No. of turns of adjust screw	Pressure change MPa (psi)
1 turn	Approx. 2.1 (305)

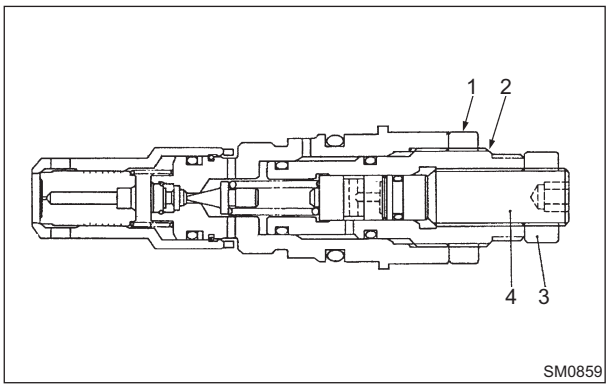


2-STAGE MAIN RELIEF VALVE

(Commom for travel and ATT sections)

Start from the boosting side, first. Loosen nut (**1**), adjust the pressure with adjusting screw (**2**) and tighten nut (**1**) after completion of the adjustment on the boosting side.
Then, loosen nut (**3**), adjust the pressure on the standard side with adjusting screw (**4**) and tighten nut (**3**) after completion of the adjustment.

: 32 mm
: 27.4~31.4 N•m (20~23 lbf•ft)
: 22 mm
: 27.4~31.4 N•m (20~23 lbf•ft)
: 19 mm Adjust screw
: 6 mm



No. of turns of adjust screw	Pressure change MPa (psi)
Boosting side 1 turn	Approx. 17.6 (2560)
STD side 1 turn	Approx. 17.6 (2560)

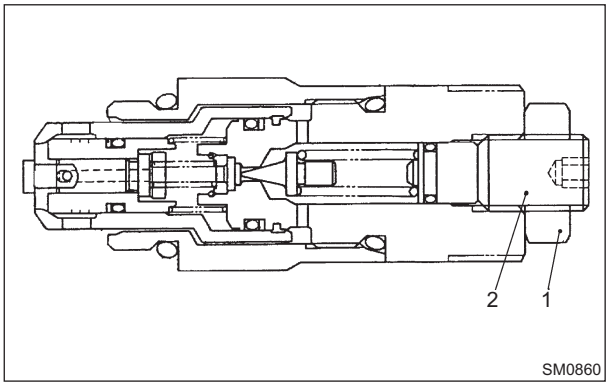
OVER LOAD RELIEF VALVE

(Boom, bucket, arm sections)

Loosen lock nut (**1**) and adjust it with adjust screw (**2**).

: 22 mm
: 27.4~31.4 N•m (20~23 lbf•ft)
: 6 mm

No. of turns of adjust screw	Pressure change MPa (psi)
1 turn	Approx. 17.7 (2560)



MEASURING ATTACHMENT OPERATING PERFORMANCES

Operating time of cylinders

PURPOSE

Measure the operating time of the arm, positioning and bucket and confirm the performances between the hydraulic pump and the cylinder of the attachment drive system.

CONDITIONS

Hydraulic oil temperature: 45~55°C (113~131°F)
Engine revolution: Hi idle
Operating time excluding the cushion stroke.

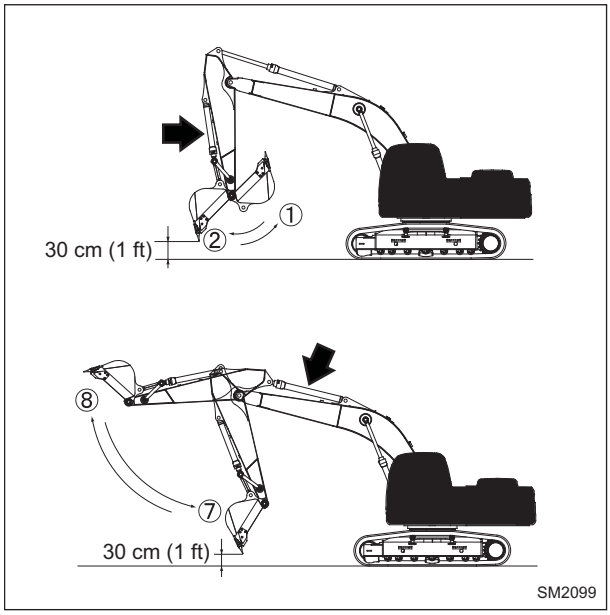
PREPARATION

Firm level ground with the bucket empty.

MEASUREMENT

Arm in and out, positioning in and out, bucket digging and dump

In a position in which the tooth of the bucket rises to a level of about 30cm (1ft) above ground, measure the full stroke operating time required with the arm, the positioning and bucket operating levers at full stroke.



Cylinder Operating time Unit : sec

Measuring position	Standard value	Reference value for remedy	Service limit
1	2.8~3.4	3.6~4.3	4.6~
2	1.7~2.3	2.1~2.9	3.0~
7	3.4~4.0	4.4~5.1	5.6~
8	3.1~3.7	3.9~4.7	5.0~

OTHER PRECAUTIONS

1. In the event of a failure, there is case where the adjustment may not be performed normally.
   First serve the machine, and perform the adjustment work.
2. In the condition where large load is constantly applied to engine, the adjustment could not be performed normally.

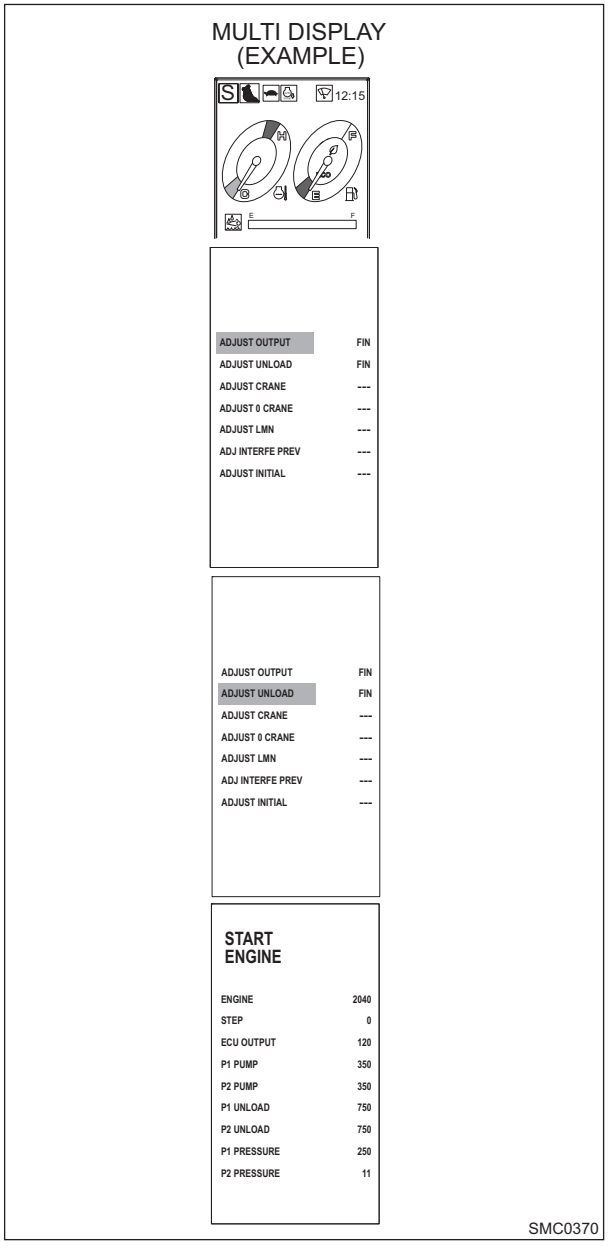
NOTE: *for machines equipped with lifting magnet, turn the generator OFF.*

WHEN THE ADJUSTMENT OF UNLOADING VALVE ONLY IS PERFORMED ("C" ADJUSTMENT)

In the event where only unloading valve and unloading proportional valve are replaced, perform the adjustment of unloading valve only.

PROCEDURE

1. Turn starter switch ON keeping the work mode selector switch on the gauge cluster pressed, and hold it for 5~10 seconds, and then release it.
   (If the engine is started, the following indication is not displayed. Therefore do not start the engine.)
2. Keep buzzer stop switch on gauge cluster pressed for 5 seconds and release it and the screen for selection of adjustment type is displayed. And "ADJUST" is displayed.
   When adjustment data is not entered in mechatro controller, "READY" is indicated. If the adjustment operation is once performed, "FIN" is indicated. And the lever lock solenoid is automatically released, disabling all operations.
3. Change the adjusting items with up arrow switch (▲) and down arrow switch (▼), and select "ADJUST UNLOAD".
   Like the output adjustment, when adjustment data is not entered in mechatro controller, "READY" is indicated. If the adjustment operation is once performed, "FIN" is indicated.
4. Press menu switch on gauge cluster to display "START ENG".
   "ENGINE SPEED", P1, P2 "PUMP PRESSURE" and "STEP" (acceleration command voltage) are indicated.



Error Code	Trouble	Described page
B024	Short-circuit of boom down pressure sensor	T5-1-11
B032	Incorrect output of arm out pressure sensor	T5-1-12
B033	Disconnection of arm out pressure sensor	T5-1-12
B034	Short-circuit of arm out pressure sensor	T5-1-13
B042	Incorrect output of arm in pressure sensor	T5-1-13
B043	Disconnection of arm in pressure sensor	T5-1-14
B044	Short-circuit of arm in pressure sensor	T5-1-15
B052	Incorrect output of bucket digging pressure sensor	T5-1-16
B053	Disconnection of bucket digging pressure sensor	T5-1-16
B054	Short-circuit of bucket digging pressure sensor	T5-1-17
B062	Incorrect output of bucket dump pressure sensor	T5-1-17
B063	Disconnection of bucket dump pressure sensor	T5-1-18
B064	Short-circuit of bucket dump pressure sensor	T5-1-18
B072	Incorrect output of swing pressure sensor	T5-1-19
B073	Disconnection of swing pressure sensor	T5-1-19
B074	Short-circuit of swing pressure sensor	T5-1-20
B092	Incorrect output of travel right pressure sensor	T5-1-20
B093	Disconnection of travel right pressure sensor	T5-1-21
B094	Short-circuit of travel right pressure sensor	T5-1-22
B102	Incorrect output of travel left pressure sensor	T5-1-23
B103	Disconnection of travel left pressure sensor	T5-1-23
B104	Short-circuit of travel left pressure sensor	T5-1-24
B113	Disconnection of pressure sensor of optional selector positioning	T5-1-25
B114	Short-circuit of pressure sensor of optional selector positioning	T5-1-26
B162	Incorrect output of P1 optional side pressure sensor	T5-1-26
B163	Disconnection of P1 side optional pressure sensor	T5-1-27
B164	Short-circuit of P1 side optional pressure sensor	T5-1-28
B172	Incorrect output of P2 optional side pressure sensor	T5-1-28
B173	Disconnection of P2 side optional pressure sensor	T5-1-29
B174	Short-circuit of P2 side optional pressure sensor	T5-1-29
C012	Incorrect output of P1 pump pressure sensor	T5-1-30
C013	Disconnection of P1 pump pressure sensor	T5-1-30
C014	Short-circuit of P1 pump pressure sensor	T5-1-31
C022	Incorrect output of P2 pump pressure sensor	T5-1-31
C023	Disconnection of P2 pump pressure sensor	T5-1-32
C024	Short-circuit of P2 pump pressure sensor	T5-1-32
C033	Disconnection of boom head pressure sensor	T5-1-33
C034	Short-circuit of boom head pressure sensor	T5-1-33
C043	Disconnection of boom rod pressure sensor	T5-1-34
C044	Short-circuit of boom rod pressure sensor	T5-1-34
D012	Failure of output transistor ON at P1 unload proportional valve	T5-1-35
D013	Disconnection of P1 unload proportional valve	T5-1-35
D022	Failure of output transistor ON at P2 unload proportional valve	T5-1-36
D023	Disconnection of P2 unload proportional valve	T5-1-37
D032	Failure of output transistor ON at travel straight proportional valve	T5-1-37
D033	Disconnection of travel straight proportional valve	T5-1-38

Table 17

Error code	**B034**		
Trouble	Arm-out pressure sensor's power source is shortcut.		
Judging condition	The input voltage from arm-out pressure sensor is 4.7 V or more.		
Symptom	Shock at stopping of arm-out is great.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to constant current. (Current when all operation is in neutral.) Only on independent operation of boom-up, set output of P1, P2 unload proportional valves to 750mA.		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	5	B-3 ARM OUT
	Screen No.		
	Screen No.		

	Checking object	Checking contents and remedy
1	• Arm-out pressure sensor SE-8	When B034 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between arm-out pressure sensor and controller CN-131F CN-101F	When B034 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller	Check that the error is corrected after replacement of controller.

Table 18

Error code	**B042**		
Trouble	Arm-in pressure sensor outputs error.		
Judging condition	After starter switch ON and engine does not start yet. And the input voltage from the arm-in pressure sensor after starter switch ON is in the range of 1.4V or more to less than 4.7V.		
Symptom	The arm-in operability becomes poor.		
Control in the event of failure	Normal control.		
Returned in normal condition	Not returned automatically under normal condition. Switch the power OFF once and turns on it again.		
Service diagnosis checking screen	Screen No.	5	B-4 ARM IN
	Screen No.		
	Screen No.		

	Checking object	Checking contents and remedy
1	• Arm-in pressure sensor SE-7	When B042 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between arm-in pressure sensor and controller CN-130F CN-101F	When B042 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller	Check that the error is corrected after replacement of controller.

Table 33

Error code	**B102**		
Trouble	Travel left pressure sensor outputs error.		
Judging condition	After starter switch ON and engine does not start yet. And the input voltage from the travel left pressure sensor after starter switch ON is in the range of 1.4 V or more to less than 4.7 V.		
Symptom	The travel left operability becomes poor.		
Control in the event of failure	Normal control.		
Returned in normal condition	Not returned automatically under normal condition. Switch the power OFF once and turns on it again.		
Service diagnosis checking screen	Screen No.	5	B-10 TRAVEL (L)
	Screen No.		
	Screen No.		
Checking object			Checking contents and remedy
1	• Travel left pressure sensor SE-10		When B102 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between travel left pressure sensor and controller CN-302F CN-102F		When B102 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller		Check that the error is corrected after replacement of controller.

Table 34

Error code	**B103**		
Trouble	Travel left pressure sensor's wiring is disconnected.		
Judging condition	The input voltage from Travel left pressure sensor is 0.1 V or less.		
Symptom	The Travel left operability becomes poor.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to constant current. (Current when all operation is in neutral.) Only on independent operation of boom-up, set output of P1, P2 unload proportional valves to 750mA.		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	5	B-10 TRAVEL (L)
	Screen No.		
	Screen No.		
Checking object			Checking contents and remedy
1	• Travel left pressure sensor SE-10		When B103 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between travel left pressure sensor and controller CN-302F CN-102F		When B103 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller		Check that the error is corrected after replacement of controller.

Table 50

Error code	**C033**		
Trouble	Boom head pressure sensor's wiring is disconnected.		
Judging condition	The input voltage from boom head pressure sensor is 0.1 V or less.		
Symptom	Indication load value of High-reach crane becomes abnormal.		
Control in the event of failure	Normal control.		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	6	C-3 BOOM-HEAD
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	• Boom head pressure sensor SE-24	When C033 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between boom head pressure sensor and controller CN-706F CN-104F	When C033 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller	Check that the error is corrected after replacement of controller.

Table 51

Error code	**C034**		
Trouble	Boom head pressure sensor's power source is shortcut.		
Judging condition	The input voltage from boom head pressure sensor is 4.7 V or more.		
Symptom	Indication load value of High-reach crane becomes abnormal.		
Control in the event of failure	Normal control.		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	6	C-3 BOOM-HEAD
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	• Boom head pressure sensor SE-24	When C034 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between boom head pressure sensor and controller CN-706F CN-104F	When C034 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller	Check that the error is corrected after replacement of controller.

Table 66

Error code	**E022**		
Trouble	P2 pump proportional valve and output transistor ON are failure.		
Judging condition	The feed-back value from proportional valve is 1000 mA or more.		
Symptom	The delicate operability of P2 pump related attachment becomes poor.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to 0 mA. (Hydraulic pump emergency mode)		
Returned in normal condition	Not returned automatically under normal condition. Switch the power OFF once and turns on it again.		
Service diagnosis checking screen	Screen No.	6	E-2 PUMP P2
	Screen No.		
	Screen No.		
Checking object			Checking contents and remedy
1	• P2 pump proportional valve PSV-P2		When E022 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it. When replacing of connector is executed, turn off power source once.
2	• Wiring between P2 pump proportional valve and controller CN-142F CN-105F		When E022 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary. When replacing of connector is executed, turn off power source once.
3	• Mechatro controller		Check that the error is corrected after replacement of controller.

Table 67

Error code	**E023**		
Trouble	P2 pump proportional valve's wiring is disconnected.		
Judging condition	The feed-back value from proportional valve is 100 mA or less. (If output is 100 mA or less, judging is not done.)		
Symptom	The delicate operability of P2 pump related attachment becomes poor.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to 0 mA. (Hydraulic pump emergency mode)		
Returned in normal condition	Not returned automatically under normal condition. Switch the power OFF once and turns on it again.		
Service diagnosis checking screen	Screen No.	6	E-2 PUMP P2
	Screen No.		
	Screen No.		
Checking object			Checking contents and remedy
1	• P2 pump proportional valve PSV-P2		When E023 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it. When replacing of connector is executed, turn off power source once.
2	• Wiring between P2 pump proportional valve and controller CN-142F CN-105F		When E023 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary. When replacing of connector is executed, turn off power source once.
3	• Mechatro controller		Check that the error is corrected after replacement of controller.

Table 82

Error code		**G042**		
Trouble		Mechatro controller direct input speed sensor and received data from engine controller are overrun.		
Judging condition		Engine rpm input is 3000 rpm or more. (Only trouble history).		
Symptom		Operate without problem.		
Control in the event of failure		Normal control		
Returned in normal condition		It returns automatically in normal condition.		
Service diagnosis checking screen		Screen No.	2	G-3 MEAS 1 (for mechatro controller)
		Screen No.	2	G-3 MEAS 2 (receive from engine controller)
		Screen No.		
Checking object				Checking contents and remedy
1	• Engine speed sensor SE-13			Measure the resistance between terminals of speed sensor. Normal value: 1.6~2.0k Ω .
2	• Wiring between engine speed sensor and controller CN-136F CN-106F			Check wiring for possible failure according to the wiring checking procedure and repair it if necessary. Especially check wiring for false disconnection and noise included.
3	• Wiring between ECU engine speed sensor and controller pressure sensor and controller			Check wiring for possible failure according to the wiring checking procedure and repair it if necessary. Especially check wiring for false disconnection and noise included.
4	• Mechatro controller			Check that the error is corrected after replacement of controller. (Controller is broken by only applying power to grounding of signal).
5	• Engine controller			Check that the error is corrected after replacement of controller.

Table 83

Error code		**G043** When cranking is executed for five seconds or more, this error code might be displayed. In case that the engine does not start, check by the table of section "Troubleshooting (by trouble) - 3. Engine". Execute the following check when the error code G043 is displayed after starting the engine		
Trouble		Mechatro controller direct input speed sensor and received data from engine controller are disconnected.		
Judging condition		Voltage of alternator is 24V or more, and speed sensor and receipt data from engine controller indicate excess low engine rpm.		
Symptom		Engine speed down may cause extension by abrupt loading.		
Control in the event of failure		Enter 0 rpm for engine speed. Enter 0 for ESS power shift command.		
Returned in normal condition		It returns automatically in normal condition.		
Service diagnosis checking screen		Screen No.	2	G-3 MEAS 1 (for mechatro controller)
		Screen No.	2	G-3 MEAS 2 (receive from engine controller)
		Screen No.		
Checking object				Checking contents and remedy
1	• Engine speed sensor SE-13			Measure the resistance between terminals of speed sensor. Normal value: 1.6~2.0k Ω .
2	• Wiring between engine speed sensor and controller CN-136F CN-106F			Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Wiring between ECU engine speed sensor and controller pressure sensor and controller			Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
4	• Mechatro controller			Check that the error is corrected after replacement of controller. (Controller is broken by only applying power to grounding of signal).
5	• Engine controller			Check that the error is corrected after replacement of controller.

Table 98

Error code	**K014**		
Trouble	Battery relay contact welded.		
Judging condition	The power 24 V is continuously supplied to controller for 40 seconds or more while the key switch ON signal turned OFF.		
Symptom	The power on the battery relay secondary side does not turn OFF even if the key switch is turned OFF.		
Control in the event of failure	Normal control with key switch OFF.		
Returned in normal condition	Turn key switch ON. Or when the power supply 24 V to mechatro controller is stopped.		
Service diagnosis checking screen	Screen No.	4	K-1 AIS RELAY 2
	Screen No.	4	K-3 KEY SWITCH OFF
	Screen No.		

	Checking object	Checking contents and remedy
1	• Battery relay R-1 CN-256F	Turn key switch off and disconnect the connector (CN-256F) on the battery relay coil. If 24 V power lives on battery relay secondary side, check on battery relay for failure and replace it if failed.
2	• Auto idle stop relay 2 R-24 • Alternator relay R-28	Turn off the key switch, and remove the connector (CN-256F) on the battery relay coil side. If power of battery relay on secondary side falls, remove either auto idling stop relay 2 or alternator relay. The failure may be occurred in case where the power falls after the relay was removed, and therefore check on the relay unit and replace it with new one if failed.
3	• Wiring between auto idle stop relay/alternator relay and controller CN-109F, CN2-1 • Fuse& relay box E-1	When K014 is left displayed with the relay removed. Check that no power 24 V is produced on relay (-) line according to the wiring checking procedure and replace it if necessary. When no failure found after checking on wiring and K014 is left displayed Replace fuse/relay box.
4	• Mechatro controller	Check that the error is corrected after replacement of controller.

Table 108

Error code	**R184**		
Trouble	Safety lock lever relay error.		
Judging condition	The mechatro controller output line to safety lock lever relay is short-circuited with the power source.		
Symptom	Safety lock lever timer does not actuate.		
Control in the event of failure	Relay output is stopped.		
Returned in normal condition	When the power is OFF.		
Service diagnosis checking screen	Screen No.	4	K-4 LOCK LEVER
	Screen No.		
	Screen No.		

	Checking object	Checking contents and remedy
1	• Safety lock lever relay R-26	When error R184 is cancelled after removing of safety lock lever relay, check relay unit for failure, replace it with new one if failed. When resistance between relays (1) and (2) is Ω , it is in abnormal condition. 
2	• Wiring between safety lock lever relay and controller CN-109F, CN2-2 • Fuse & relay box E-1	When R184 is left displayed with the relay removed Check that no power 24 V is produced on relay (-) line according to the wiring checking procedure and replace it if necessary. When no failure found after checking on wiring and R184 is left displayed. Replace fuse/relay box.
3	• Mechatro controller	Check that the error is corrected after replacement of controller.

No.	Sections	Contents/normal value		Corrective action, others
16	Main relief valve <Trouble> Relief pressure is low.	Check set pressure	• See Service Diagnosis Data List Operation No.3 boom up full lever and relief	Reset or replace
17	Over load relief valve <Trouble> Relief pressure is low.	Visual check (Head side)	Pressure is 32 MPa or more in boom up full lever and high idling. Free from dust entered in over load relief valve. Seat is free from abnormality	When only relief pressure of boom up is low, replace valve

6. Slow boom down, insufficient power for lifting up body

No.	Sections	Contents/normal value		Corrective action, others
1	Boom down pressure sensor	Carry out service diagnosis	• See Service Diagnosis Data List Operation No.5 boom down full lever & in operation	Check and replace pressure sensor. Check remote control valve.
2	Remote control valve	Measure remote control pressure of boom down directly	Check that pressure is 3.0 MPa or more in boom down full lever and high idling operation	Check remote control valve When equipped with multi control valve, check it while changing lever pattern.
3	Actual measuring current value of P1 unload proportional valve	Carry out service diagnosis	P1 unload valve (cut valve) • See Service Diagnosis Data List Operation No.5 boom down full lever & in operation	In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
4	Secondary pressure of P1 unload proportional valve	Measure the proportional valve secondary pressure directly at the ports A7 of 8 sections solenoid block.	Check that P1 unload secondary pressures are within the range of 1.1 to 1.4 MPa in boom down full lever and high idling operation	Replace proportional valve
5	Actual measuring current value of P1 pump proportional valve	Carry out service diagnosis	• No.6 E-1 P1 pump • See Service Diagnosis Data List Operation No.5 boom down full lever & in operation	In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
6	Secondary pressure of P1 pump proportional valve	Measure the pump proportional valve secondary pressure directly (Ports a3, a4)	Check that P1 pump proportional valve pressures are within the range of 1.9 to 2.5 MPa in boom down full lever and high idling operation	Replace proportional valve
7	Actual measuring current value of travel straight proportional valve	Carry out service diagnosis	Check that the value is not change regardless of operation • See Service Diagnosis Data List Operation No. 1 Operation is nil Operation No.18 Travel right full lever & idling Operation No.19 Travel left full lever & idling	• Check pressure sensor of travel • In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.

No.	Sections	Contents/normal value		Corrective action, others
5	Shuttle valve <Trouble> Pilot pressure is low.	Visual check	No contamination on spool cover (short side) and orifice No damage on spool cover (long side) and shuttle	Clean or replace
6	Pump pressure sensor	Carry out service diagnosis for P2 pump pressures in operation	• See Service Diagnosis Data List Operation No.11 Swing full lever and in operation	Check high pressure sensor
7	Actual measuring current value of P2 unload proportional valve	Carry out service diagnosis	• No.7 D-2 P2 unload valve (cut valve) • See Service Diagnosis Data List Operation No.11 Swing full lever & in operation	In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
8	Secondary pressure of P2 unload proportional valve	Measure the proportional valve secondary pressure directly at the ports A5 of 8 sections solenoid block	Check that P2 unload secondary pressures are within the range of 0.5 to 1.2 MPa in swing full lever and high idling operation	Replace proportional valve
9	Actual measuring current value of P2 pump proportional valve	Carry out service diagnosis	• No.6 E-2 P2 pump • See Service Diagnosis Data List Operation No.11 Swing full lever & in operation	In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
10	Secondary pressure of P2 pump proportional valve	Measure the pump proportional valve secondary pressure directly (Ports a3, a4)	Check that P2 pump proportional valve pressure is 2.7 MPa or more in swing full lever and high idling operation	Replace proportional valve
11	Actual measuring current value of travel straight proportional valve (Check this trouble by only swing operation)	Carry out service diagnosis	Check that the value is not change regardless of operation • See Service Diagnosis Data List Operation No. 1 Operation is nil Operation No.18 Travel right full lever & idling Operation No.19 Travel left full lever & idling	• Check pressure sensor of travel • In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
12	Secondary pressure of travel straight proportional valve (Check this trouble by only swing operation)	Measure directly the proportional valve secondary pressure at the ports A6 (travel straight) of 8 sections solenoid block	0.8 MPa or less in high idling operation regardless of neutral/operation	Replace proportional valve

No.	Sections	Contents/normal value		Corrective action, others
7	P1 by-pass cut valve <Trouble> Only P1 pressure is low.	Visual check	No problem for sliding ability of main poppet and no contamination on orifice No problem for sliding ability of internal piston (Check it through PBp2 port.)	Clean or replace
8	Relief pressure	Check set pressure	• See Service Diagnosis Data List Operation No.16 P2 side OPT full lever and relief (Set value of factory shipment is 24.5 MPa.)	Reset or replace
9	Remote control valve	Check targeted remote control valve	Check sealing ability of shuttle valve and entry of dust in orifice.	Replace
10	Travel straight spool <Trouble> P1 pressure is high.	Visual check	When removing, free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface Spring is free from breakage.	Replace (Check on the casing side for damage)
11	Spool for optional attachment <Trouble> P1, P2 pressures are high.	Visual check	When removing, free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface Spring is free from breakage.	Replace (Check on the casing side for damage)
12	Over load relief valve	Check targeted spool visually	Free from dust entered in over load relief valve Seat is free from abnormality.	Replace

3. ENGINE

Factors / Trouble		Checking														
		Filters						Liquid					Leak, clogging			
		Shortage of fuel level	Air cleaner clogged	Fuel filter clogged	Oil filter clogged	Fan belt slipped, fan pulley worn	Breather hose crushed or clogged	Improper fuel in use	Coolant level	Oil level of oil pan	Contamination of water and fuel with oil	Poor or deteriorated battery	Leak, clogging of fuel system and intruding of air	Engine oil leak	Air leak between turbocharger and intake manifold	Muffler clogged
Faulty starting	Poor starting ability (Takes a long time)		○	○								○	○			
	Faulty engine starting/engine does not rotate											○				
	Faulty engine starting/engine rotates but no exhaust gas (No fuel injection)	○		○				○					○			
	Faulty engine starting/exhaust gas is emitted but engine does not start (With fuel injection)		○	○				○				○	○			
Insufficient rotation	Engine poor run-up (Low follow-up ability)		○	○									○			
	Rotation in bad condition (hunting)	○		○									○			
Poor output	Engine stalled during operation	○		○									○			
	Output is lowered		○	○				○					○		○	
	Overheating					○			○							
Other failures	Exhaust smoke is black		○					○							○	○
	Exhaust smoke is white							○		○						
	Lager oil consumption (or blue exhaust gas)						○							○		
	Early contamination of oil				○		○	○			○					○
	Larger fuel consumption		○										○		○	○
	Intruding of oil in coolant, back flow, reduction of coolant quantity															
	Hydraulic pressure down (Monitor lights up)				○					○						
	Oil quantity increased (Intruding of water and fuel)												○			
	Vibration															

PRECAUTIONS FOR DISASSEMBLY AND ASSEMBLY

PREPARATIONS FOR DISASSEMBLY

- Thoroughly wash the machine before bringing it into the shop. Bringing a dirty machine into the shop may cause machine components to be contaminated during disassembling/assembling, resulting in damage to machine components, as well as decreased efficiency in service work.
- Be sure to thoroughly understand all disassembling/assembling procedures beforehand, to help avoid incorrect disassembling of components as well as personal injury.
- Check and record the items listed below to prevent problems from occurring in the future.
    1. The machine model, machine serial number, and hour meter reading.
    2. Reason for disassembly (symptoms, failed parts, and causes).
    3. Clogging of filters and oil, water or air leaks, if any.
    4. Capacities and condition of lubricants.
    5. Loose or damaged parts.
- Prepare the necessary tools to be used and the area for disassembling work.
- Wear appropriate clothing, safety shoes, safety helmet, goggles, and clothes with long sleeves.
- Confirm the position of first-aid kit and fire extinguisher, and also where to make contact for emergency measure and ambulance to prepare for accidents and fire.
- Attach "Don’t operate" tag to control lever, and begin a meeting before starting the work.

DISASSEMBLING AND ASSEMBLING HYDRAULIC EQUIPMENT

- Before removing pipes, release the pressure of hydraulic oil tank, or open the cover on the return side to tank, and take out the filter.
- Drain the oil in the removed pipes into pan to prevent the oil from spilling on the ground.
- Pipes with plugs or caps to prevent oil leaking, entry of dust, etc.
- Clean the outside surface of equipment, etc. before disassembling, and drain hydraulic oil and gear oil before putting them on working.

DISASSEMBLING HYDRAULIC EQUIPMENT

- Since performance and function of hydraulic equipment after disassembly and assembly results in immunity from responsibility on the manufacture’s side, disassembly, assembly and modification without permission are strictly prohibited.
- If it is unavoidably necessary to disassemble and modify, it should be carried out by experts or personnel qualified through service training.
- Make match mark on parts for reassembling.
- Before disassembling, read Disassembling Instruction in advance, and determine if the disassembly and assembly are permitted or not.
- For parts which are required to use jig and tools, don’t fail to use the specified jig and tools.
- For parts which can not be removed in the specified procedure, never force removal. First check for the cause.
- Inspecting parts. Measure the wear of parts and clearance, and record the measured values.
- If an abnormality is detected, repair or replace the parts.
- The removed parts should be put in order and tagged so as to install on proper places without confusion.
- For common parts, pay attention to the quantity and places.

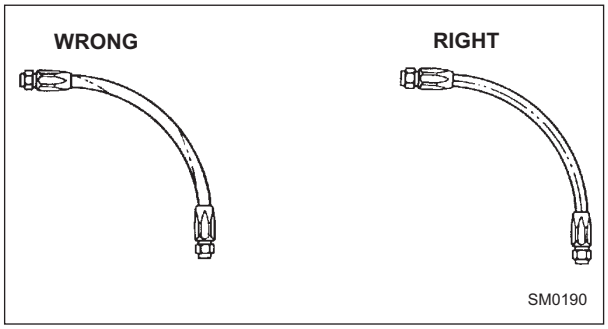
REASSEMBLING HYDRAULIC EQUIPMENT

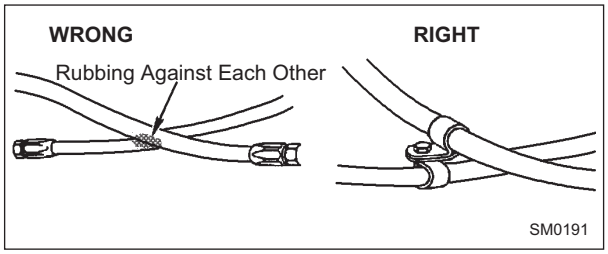
- During the parts cleaning, ventilate the room.
- Remove adhering oil by compressed air, and apply hydraulic oil or gear oil, and then assemble them.
- Replace the removed O-ring, back-up rings and oil seal with new ones, and apply gear oil on them before assembling.
- Removes dirt and water on the surface on which liquid sealant are applied, decrease them, and apply liquid sealant on them.
- Before assembling, remove rust preventives on new parts.
- Use special tools to fit bearings, bushing and oil seal.
- Assemble parts matching to the marks.
- After completion, check that there is no omission of parts.

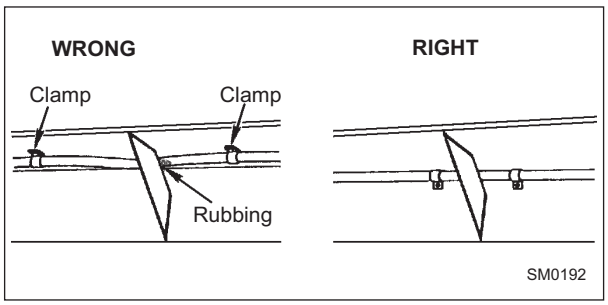
Connecting Hose

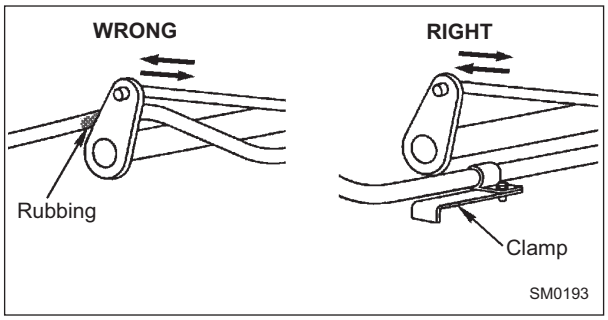
WARNING

1. *When replacing hoses, be sure to use only genuine parts. Using hoses other than genuine hoses may cause oil leakage, hose rupture or separation of fitting, possibly resulting in a fire on the machine.*
2. *Do not install hoses kinked. Application of high oil pressure, vibration, or an impact to a kinked hose may result in oil leakage, hose rupture or separation of fitting.*
   Utilize print marks on hoses when installing hoses to prevent hose from being installed kinked.
3. *If hoses rub against each other, wear to the hoses will result, leading to hose rupture. Take necessary measures to protect hoses from rubbing against each other.*
   Take care that hoses do not come into contact with moving parts or sharp objects.





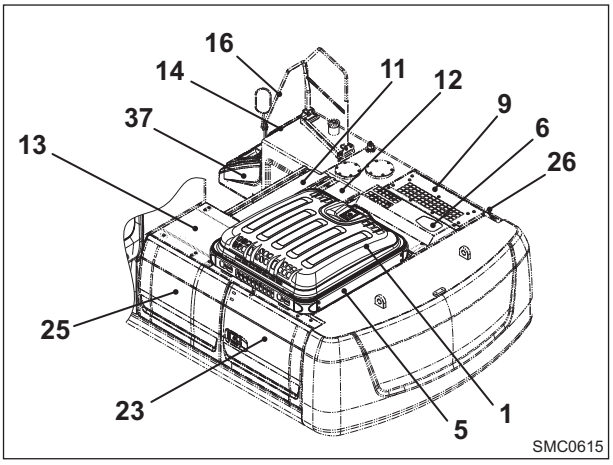




REMOVAL AND INSTALLATION OF THE GUARD

Preparation for removal

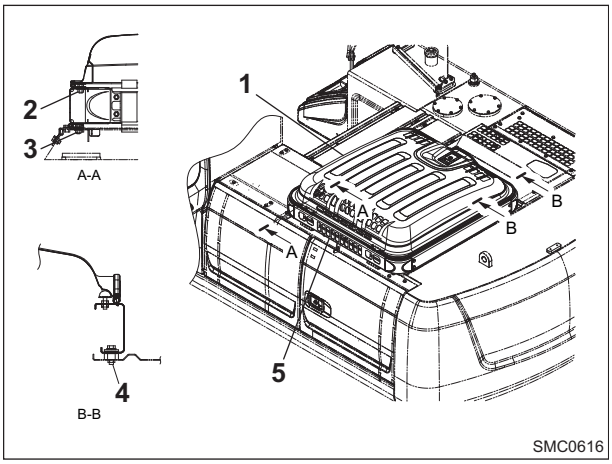
1. Remove guard in the following procedure. Remove the guards in the order of (**1**) --> (**5**) --> (**6**) --> (**9**) --> (**11**) --> (**12**) --> (**13**) --> (**14**) --> (**16**) --> (**23**) --> (**25**) --> (**26**) --> (**37**).
2. All the locked cover, open them using starter key.



Removal of the guard

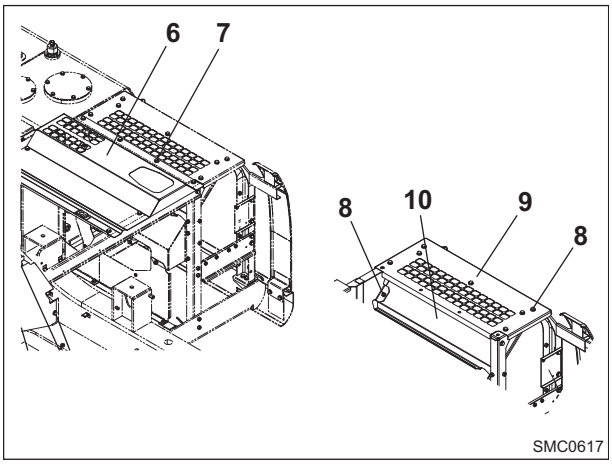
1) Remove bonnet assy (**1**), (**5**).

1. Unlock and open bonnet (**1**).
2. Remove 4 nuts (**2**) M12.
   : 19 mm
3. Remove bonnet (**1**).
   Weight: 31.5 kg (69.5 lbs)
4. Remove 4 nuts (**3**) M12 and 2 sems bolts (**4**) M12x45.
   : 19 mm
5. Remove bonnet (**5**).
   Weight: 21 kg (46.3 lbs)

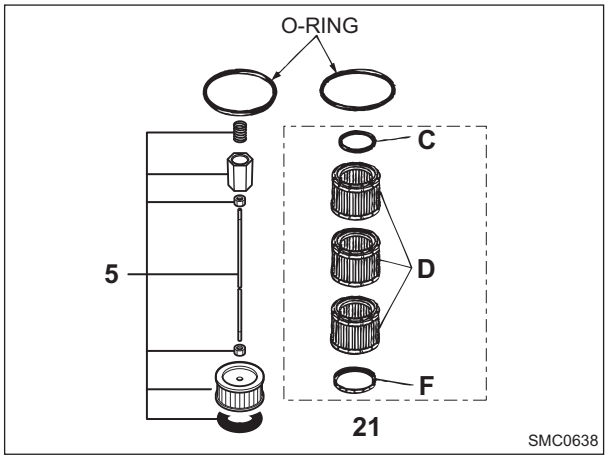


2) Remove guard (**6**) and guard (**9**), (**10**).

1. Remove 8 sems bolts (**7**) M12x25.
   : 19 mm
2. Remove guard (**6**).
   Weight: 15 kg (33 lbs)
3. Remove 6 sems bolts (**8**) M12x25.
   : 19 mm
4. Remove guard (**9**).
   Weight: 10 kg (22 lbs)
5. Remove 5 sems bolts (**8**) M12x25.
   : 19 mm
6. Remove guard (**10**).
   Weight: 6 kg (13 lbs)



7. Assembling return element.
   Assemble filter element by the use of element kit (**21**).
8. Install return element (**7**).
9. Install suction strainer (**5**).
10. Tighten sems bolts (**3**) M10x25 that attach tank covers (**4**), (**6**).
11. : 46.5 ± 4.6 Nm (34.3 ± 3.4 lbf.ft)



NOTE:

1. *Three elements (**7D**) are used as one set.*
2. *Replace O-ring (**7C**) and packing (**7F**) with new ones respectively.*

CAUTION

Replace O-ring fitted on the back side of tank cover with new one.

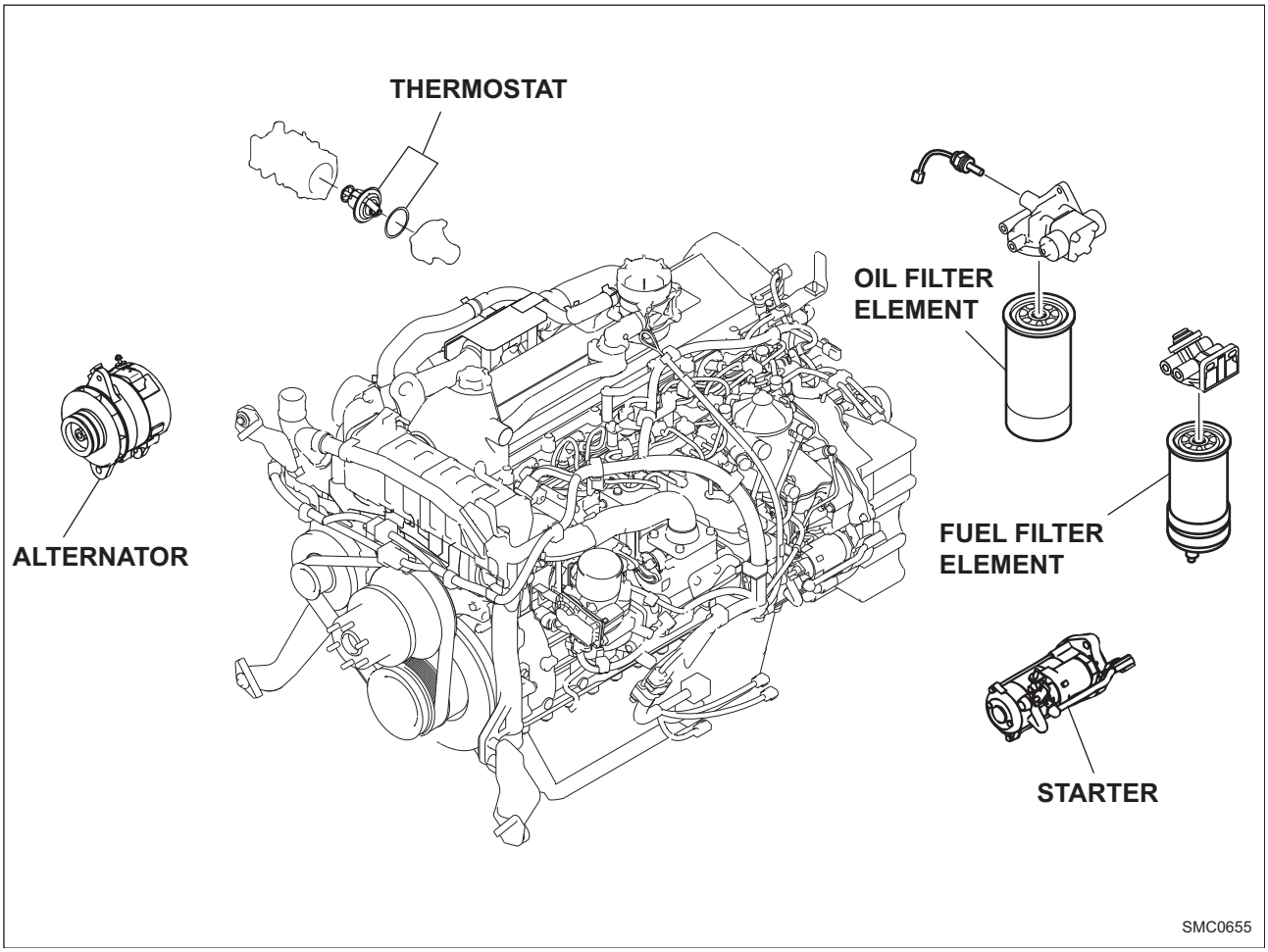
REMOVAL AND INSTALLATION OF ENGINE

Preparation for removing

1. Remove battery ground.
2. Remove bonnet and guard. Remove under cover.
3. Remove air cleaner hose.
4. Remove counterweight.
5. Remove radiator hose and inter-cooler hose.
6. Remove fuel hose and heater hose, and if necessary disconnect air-con hose.
7. If necessary, remove pump, muffler and radiator.
8. Remove harness connector.
   - 8.1 Remove E/G ground cable.
   - 8.2 Starter cable-Starter B terminal.
   - 8.3 Remove the connector that connects the upper harness with the engine and ECU harness.
   - 8.4 Upper harness

     P22 Alternator B terminal
     CN-136 E/G speed sensor
     CN-141, CN142 P1, P2 Pump proportional valve
     CN-139, CN-140 P1, P2 pump pressure sensor
     M-1 Starter motor C terminal

NOTE: *prepare a stand, which withstands the weight of the engine assy and can place the removed engine firmly.*



NOTE: *the number in a rectangle represent adjust screws. Do not tamper with the adjust screws as much as possible.*

4 - Gear pump
5 - PTO gear case
111 - Shaft(F)
113 - Shaft(R)
116 - 1st gear
123 - Roller bearing (Q.ty 2)
124 - Needle bearing (Q.ty 2)
127 - Bearing spacer (Q.ty 3)
141 - Cylinder block (Q.ty 2)
151 - Piston (Q.ty 18)
152 - Shoe (Q.ty 18)
153 - Retainer (Q.ty 2)
156 - Spherical bushing (Q.ty 2)
157 - Cylinder spring (Q.ty 18)
211 - Shoe plate (Q.ty 2)
212 - Swash plate (Q.ty 2)
214 - Tilting bushing (Q.ty 2)
251 - Swash plate support (Q.ty 2)
261 - Seal cover (F)
271 - Pump casing (Q.ty 2)
312 - Valve block
313 - Valve plate (R)
314 - Valve plate (L)
325 - Sensor block
326 - Cover
401 - Socket bolt ; M20X210 (Q.ty 8)
406 - Socket bolt ; M8X20 (Q.ty 4)
407 - Socket bolt ; M6X55 (Q.ty 3)
414 - Socket bolt ; M10X20 (Q.ty 4)
466 - VP plug ; PF1/4 (Q.ty 2)
467 - VP plug ; PF3/8 (Q.ty 2)
468 - VP plug ; PF3/4 (Q.ty 4)
490 - Plug ; NPTF1/16 (Q.ty 32)
531 - Tilt pin ; M24X2 (Q.ty 2)
532 - Servo piston ; M24X2 (Q.ty 2)
534 - Stopper (L) (Q.ty 2)
535 - Stopper (S) (Q.ty 2)
546 - Spacer (Q.ty 2)
548 - Feed back pin (Q.ty 2)
702 - O-ring ; 1B G35 (Q.ty 2)
710 - O-ring ; 1B G95 (Q.ty 2)
717 - O-ring ; 1B G145 (Q.ty 4)
724 - O-ring ; 1B P8 (Q.ty 16)
725 - O-ring ; 1B P11 (Q.ty 9)
727 - O-ring ; 1B P14 (Q.ty 3)
728 - O-ring ; 1B P24 (Q.ty 4)
732 - O-ring ; 1B P18 (Q.ty 2)
774 - Oil seal
789 - Backup ring P18 (Q.ty 2)
792 - Backup ring G35 (Q.ty 2)
806 - Nut ; M16 (Q.ty 2)
808 - Nut ; M20 (Q.ty 2)
824 - Stop ring (Q.ty 2)
885 - Valve plate pin (Q.ty 2)
886 - Spring pin (Q.ty 4)
901 - Eye bolt ; M10 (Q.ty 2)
953 - Socket screw ; M16X35 (Q.ty 2)
954 - Set screw ; M20 (Q.ty 2)

NOTE: *marks W, X, Y, Z in the figure show the position where regulator is installed.*

TROUBLESHOOTING

Locating causes of troubles

The pump is usually fitted with a regulator, auxiliary valves and auxiliary pumps, and this makes fault location extremely difficult. However, faults would be found out easily if the following check items were attended to.

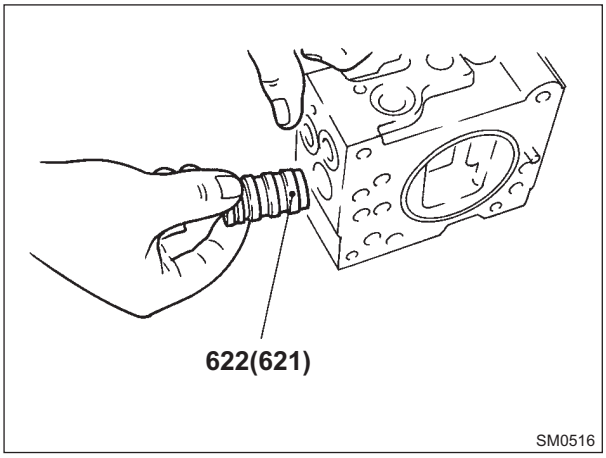
1. Inspecting the filter and drain oil
   Inspect the filter element to check for abnormal contaminations. Some metallic particles will be deposited on it as the shoe and the cylinder wear off. In case metallic particles are found in large quantity, the elements may be damaged. In that case check the drain oil in the pump casing as well.
2. Checking for abnormal vibration and sound
   Check that the pump does not vibrate and make an abnormal sound.
   Check that the hunting of the regulator and the attached valveAfs relief valve are of regular frequency. In case vibration and sound are abnormal, the pump may be making a cavitation or internally broken.
3. When two pumps are used
   In case two single pumps or motors are used or when a double pump is used. change pump pipelines. This will make clear that the pumps are faulty or the circuit after the pumps is faulty.
4. Pressure measurements
   If the problem is related to control functions, avoid disassembling the pumps carelessly, but look for causes by measuring pressures.

Troubleshooting

1. Overloading to engine

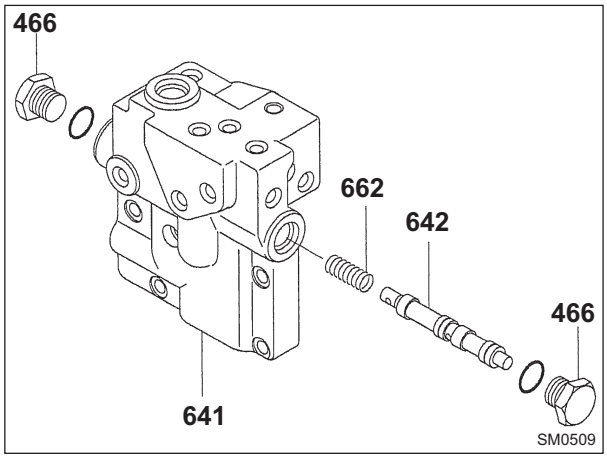
Cause	Remedy	Remarks
1. Revolution and pressure are higher than set values.	1) Set pressure to specified value.	
2. Regulator torque is set higher than normal.	2) Readjust regulator.	2) Refer to Regulator Manual.
3. Pump’s internal parts are seized or broken.	3) Replace damaged parts.	3) Check filter and drain oil to see if abnormal wear particles are present.
4. Regulator is piped incorrectly.	4) Pipe regulator correctly.	

11. Assemble set spring (**655**) into the spool hole. Place compensating piston (**621**) and piston casing (**622**) into the compensating hole and attach pilot cover (**641**) with socket bolts (**438** and **439**).
    : 5 mm
    : 12 Nm (8.8 lbf•ft)



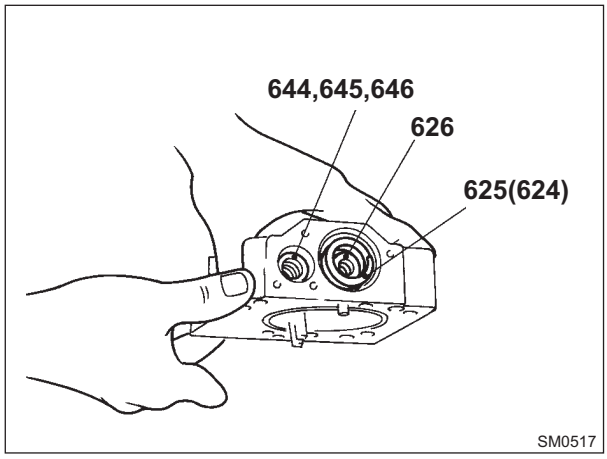
12. Assemble spool (**642**) and spring (**662**) into pilot cover (**641**) and tighten VP plugs (**466**).
    : 19 mm
    : 36 Nm (26.6 lbf•ft)

13. Put spring seat (**644**), pilot spring (**646**) and adjust stem (**645**) into the pilot hole. Then assemble spring seat (**624**), inner spring (**626**) and outer spring (**625**) into the compensating hole.



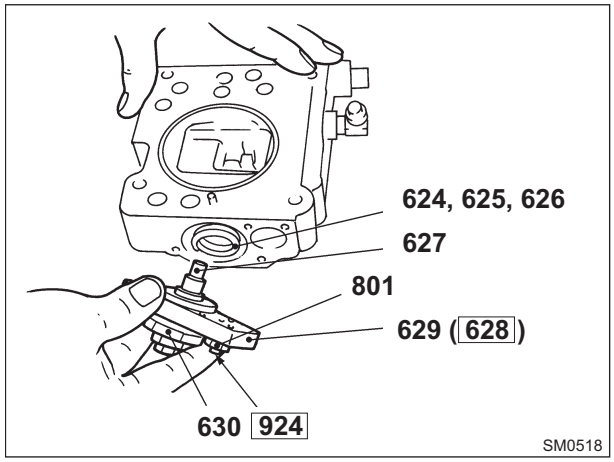
NOTE: *do not mistake the direction of the spring seat.*

14. Attach cover (**629**) fitted with adjust screws (**628**), adjust stem (**627**), lock nut (**630**), nut (**801**) and socket bolt (**924**). Then fasten them with socket bolts (**438**).
    : 5 mm
    : 12 Nm (8.8 lbf•ft)

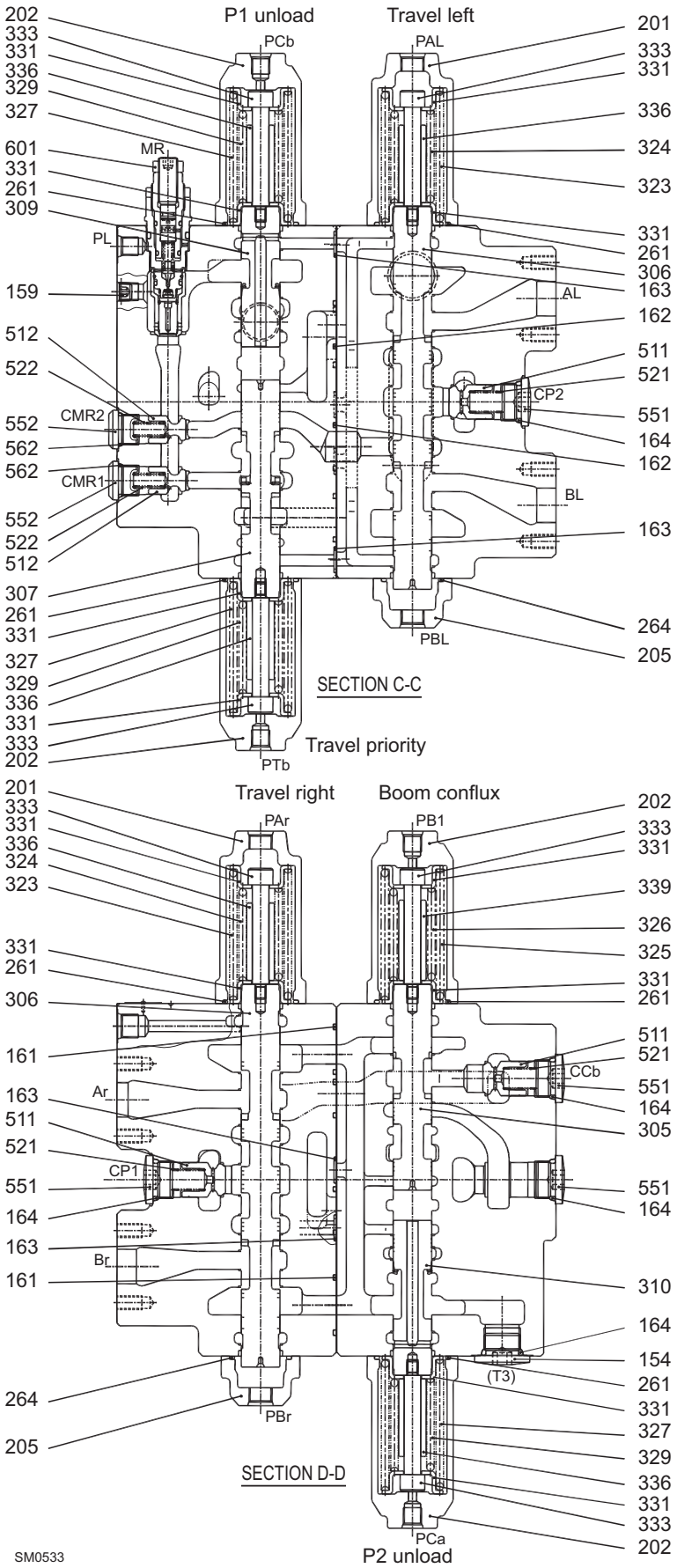


15. Attach block cover (**656**) and tighten screws (**438**).
    : 5 mm
    : 12 Nm (8.8 lbf•ft)

16. Install the regulator on the pump and fasten socket bolt (**412** and **413**).
    :6 mm
    : 29 Nm (21.4 lbf•ft)

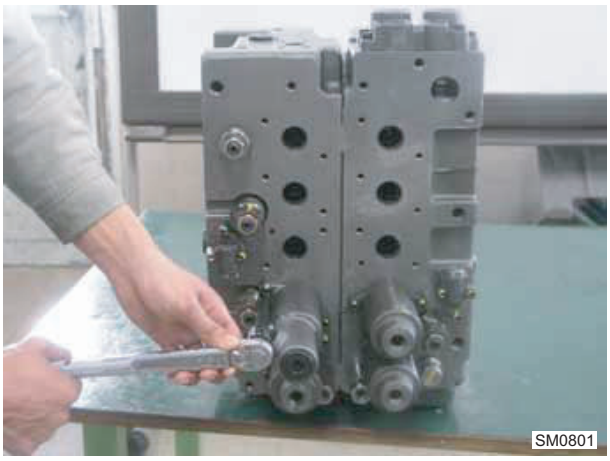


Control valve (3/6)



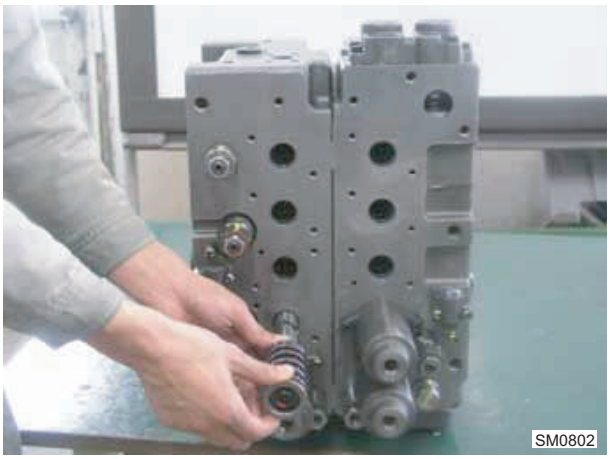
6. Disassembling bucket spool

6.1 Loosen socket bolts (**273**) and remove bucket spring cover (**209**) and O-ring (**261**).



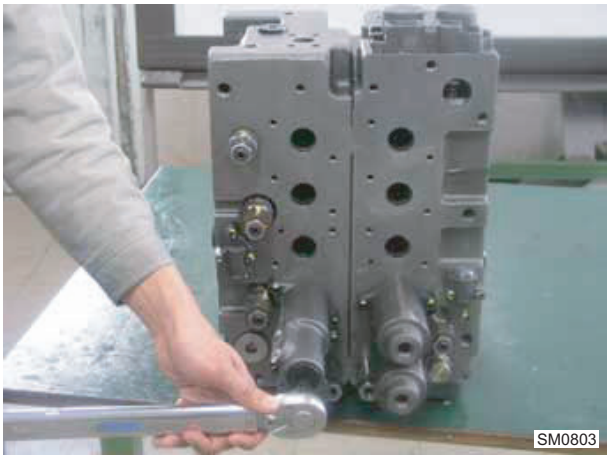
6.2 Draw out the assy of bucket spool (**304**), spring seat (**331**), springs (**321**), (**322**), stopper (**336**) and bolt (**333**) from casing B (**102**).

ATTENTION: *when drawing out the spool assy, use care so as not to score casing B (**102**).*



6.3 Fix the bucket spool assy with vise via a protective plate (aluminum plate, etc.) and remove bolt (**333**). Then separate spring seat (**331**), springs (**321**), (**322**) and stopper (**336**) from bucket spool (**304**).

6.4 When needed to disassemble the spring cover of bucket spool, loosen plug (**551**) with casing B (**102**) installed. After removed cover (**209**) from casing B (**102**), remove plug (**551**) and then take out piston (**216**).



Assembling relief valve and relief valve hole plug assembly

1. Tighten main relief valve (**601**), port relief valves (**602**), (**603**) and relief valve hole plug assembly (**604**) in respective place to the specified torque.

ATTENTION: *Assemble it giving attention to the label attached when disassembling to prevent mistake because the port relief valves (**602**), (**603**) are similar in shape.*

Assembling P2 unload spool

1. Hold the mid section of P2 unload spool (**310**) with vise provided with protection plate (aluminum plate, etc.), fit spring seat (**331**), springs (**327**), (**329**) and stopper (**336**) and tighten bolt (**333**) to the specified torque.

NOTE:

- *apply Loctite #262 when tightening bolt (**333**).*
- *take care not to deform P2 unload spool (**310**) because of careless over clamping.*

2. Place P2 unload spool assembly in casing A (**101**).

ATTENTION: *Place P2 unload spool assembly in casing A (**101**) carefully. Do not squeeze it into place.*

3. Attach spring cover (**202**) with O-ring (**261**) attached to the spring side of P2 unload spool assembly and tighten socket bolt (**273**) to the specified torque.

Assembling travel priority spool

1. Hold the mid section of travel priority spool (**307**) with vise provided with protection plate (aluminum plate, etc.), fit spring seat (**331**), springs (**327**), (**329**) and stopper (**336**) and tighten bolt (**333**) to the specified torque.

NOTE:

- *apply Loctite #262 when tightening bolt (**333**).*
- *Take care not to deform travel priority spool (**307**) because of careless over clamping.*

2. Place travel priority spool assembly in casing B (**102**).

ATTENTION: *place travel priority spool assembly in casing B (**102**) carefully. Do not squeeze it into place.*

3. Attach spring cover (**202**) with O-ring (**261**) attached to the spring side of travel priority spool assembly, and tighten socket bolt (**273**) to the specified torque.

REMOVAL AND INSTALLATION OF SWING DEVICE

WARNING

Hydraulic oil, at the end of a work shift, can be very hot and can cause, when spilling, potentially serious burns. Prior to beginning any intervention, make sure that the oil and components are cooled-off.
The hydraulic oil tank cap can be ejected, if the pressure is not released from the tank. Press the valve located on the hydraulic oil tank to release any residual pressure present in the tank itself.
Check that the lifting devices (hooks, chains, etc.) are in perfect conditions without any sign of excessive wear and appropriate to hold the weight of load.

Preparation

1. Park the machine on a firm, level surface.

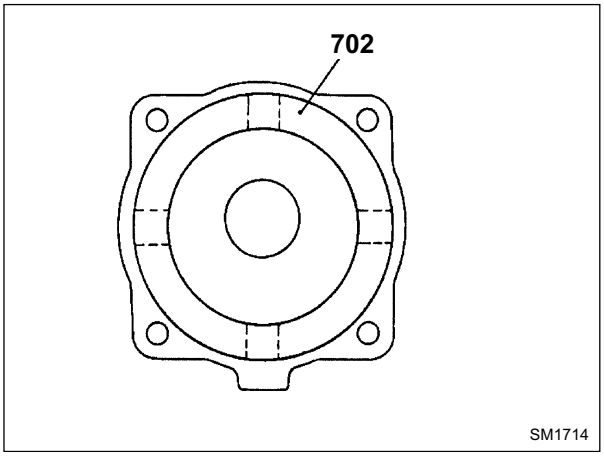
2. To drain the hydraulic pressure from the Hydraulic System, refer to procedure “Releasing the hydraulic pressure” at page T2-1-60.

3. Cut-off the engine. Press the valve located on the hydraulic oil cap to release any residual pressure present in the tank itself.

11. Fit O-Rings (**706** and **707**) to casing (**301**). In that case, if the O-rings are coated with grease, they are hard to tear off when brake piston (**702**) is inserted.

12. Assemble brake piston (**702**) into casing (**301**).

13. Assemble brake spring (**712**) into brake piston (**702**). Make sure that the spring is placed securely in the spot faced part of the brake piston.



NOTE: *this operation is necessary only where roller bearing (**444**) is removed.*

14. Insert the outer race of roller bearing (**444**) into valve casing (**303**), while lightly tapping the steel rod placed on the outer race, using a hammer.

15. Assemble valve plate (**131**) into valve casing (**303**) and fit O-Ring (**472**) in it.

16. Install valve casing (**303**) to casing (**301**) and fasten them with socket bolts (**401**).


: 17 mm
: 431 Nm (320 lbf·ft)

17. Fit plunger (**351**) and spring (**355**) to valve casing (**303**). Then tighten the plug (**469**) fitted with O-Ring (**488**) against valve casing (**303**).


: 17 mm
: 539 Nm (398 lbf·ft)

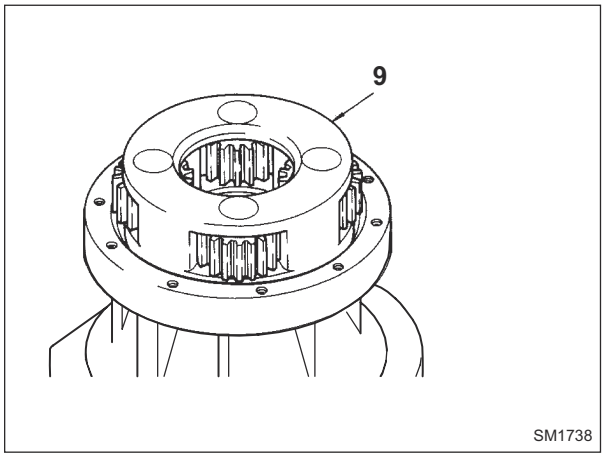
18. Fit relief valve (**51**) to valve casing (**303**).


: 41 mm
: 177 Nm (130.5 lbf·ft)

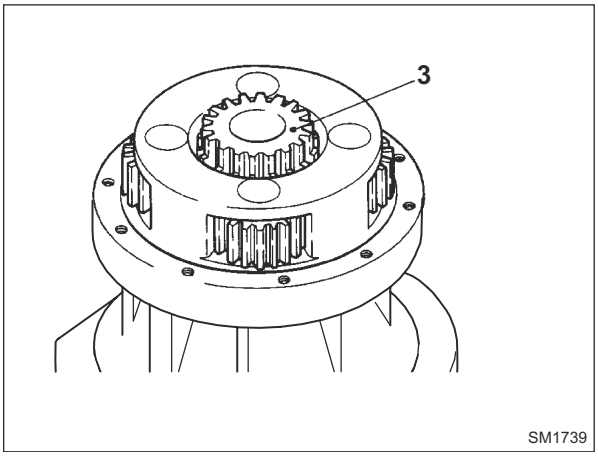
19. Fit anti-reaction sub valve (**52**) to valve casing (**303**).


: 6 mm
: 29 Nm (21.4 lbf·ft)

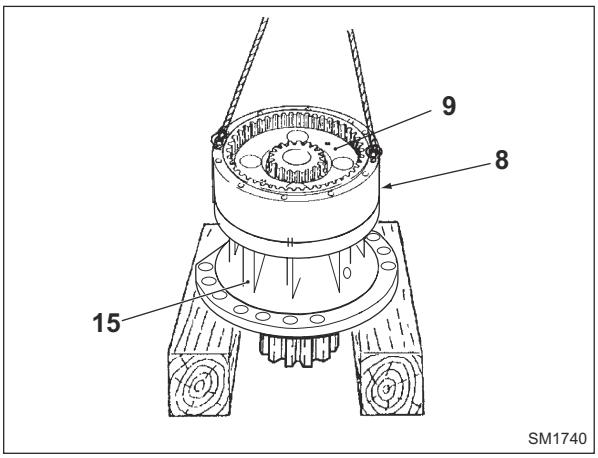
20. Insert spider assembly second reduction (**9**) in spline axis of shaft (**2**).



21. Install sun gear second reduction (**3**) with the spline facing upward.

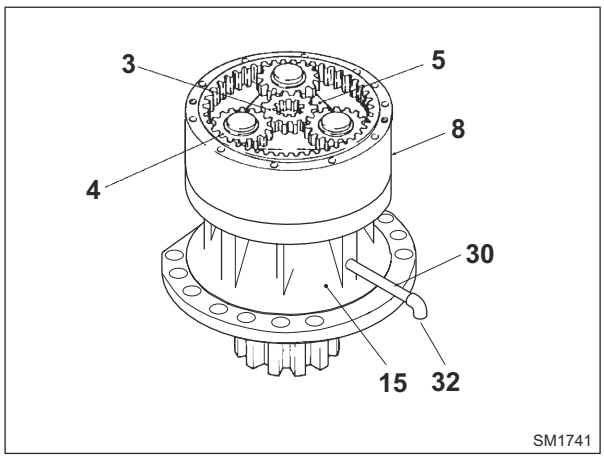


22. Apply a thin film of sealant Loctite #515 to the matching surface of housing (**15**) and ring gear (**8**) and assemble them. Align the gear teeth according to the matching marks.



23. Mesh spider assembly first reduction (**5**) with ring gear (**8**) and set them in place.
24. Mesh sun gear first reduction (**3**) with pinion first reduction (**4**) and set them in place.
25. Fit drain tube (**30**) and plug (**32**).

    : 10 mm
26. Fill with 7.4 L (2.0 gal) of gear oil SAE90 (API Service Grade GL-4).



REMOVAL AND INSTALLATION OF TRAVEL PILOT VALVE

WARNING

Possible leakages of fluids under pressure could penetrate the skin, causing serious injuries.
Prevent these dangers, discharging the pressure before disconnecting hydraulic pipes or other pipes.
Hydraulic oil, at the end of a work shift, can be very hot and can cause, when spilling, potentially serious burns.
Prior to beginning any intervention, make sure that the oil and components are cooled-off.
The hydraulic oil tank cap can be ejected, if the pressure is not released from the tank. Press the valve located on the hydraulic oil tank to release any residual pressure present in the tank itself.
Check that the lifting devices (hooks, chains, etc.) are in perfect conditions without any sign of excessive wear and appropriate to hold the weight of load.

Preparation

1. Park the machine on a firm, level surface.
2. To drain the hydraulic pressure from the Hydraulic System, refer to procedure "Releasing the hydraulic pressure" at page. T2-1-60.
3. Cut-off the engine. Press the valve located on the hydraulic oil cap to release any residual pressure present in the tank itself.

Removal

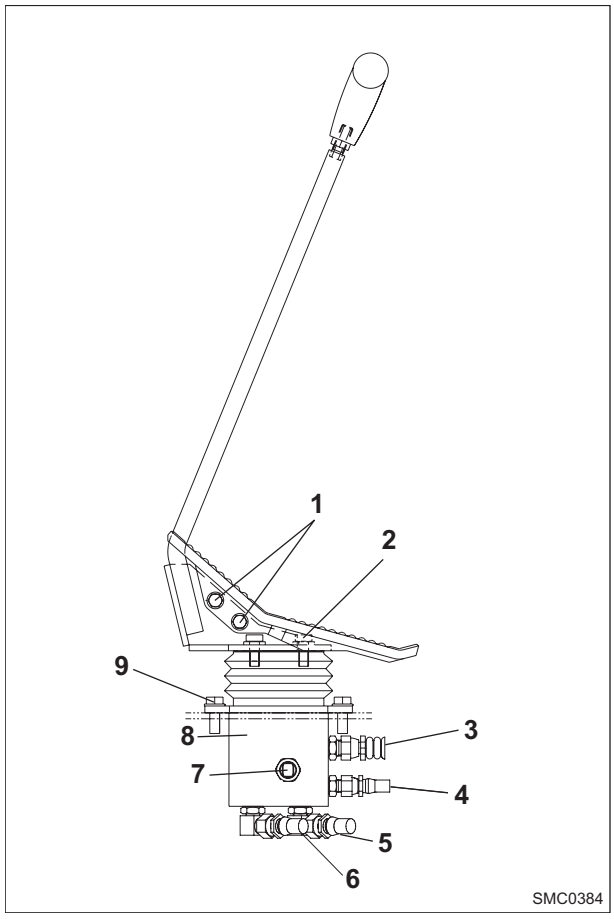
1. Loosen screws M12x30 (Q.ty 6) and remove the cover under the cab.
   Weight: 5 kg (11 lbs)
   : 19 mm
2. Remove the floor mat in the cab.
3. Remove the pedal removing securing screws (**1**) M8x25 (Q.ty 4) then remove the levers, removing securing screws (**2**) M10x25 (Q.ty 4).
   : 13, 17 mm
4. Disconnect pressure sensors (**7**) from body (**8**).
   : 24 mm

ATTENTION: *attach an identification tag on each hose to aid in reassembly.*

5. Disconnect pipes (from **3** through **6**) of body (**8**).
   : 19, 22 mm

NOTE: *attach a cap on each of disconnected hose ends.*

6. Remove body (**8**) removing securing screws (**9**) M10x30 (Q.ty 4) complete with washers.
   : 17 mm

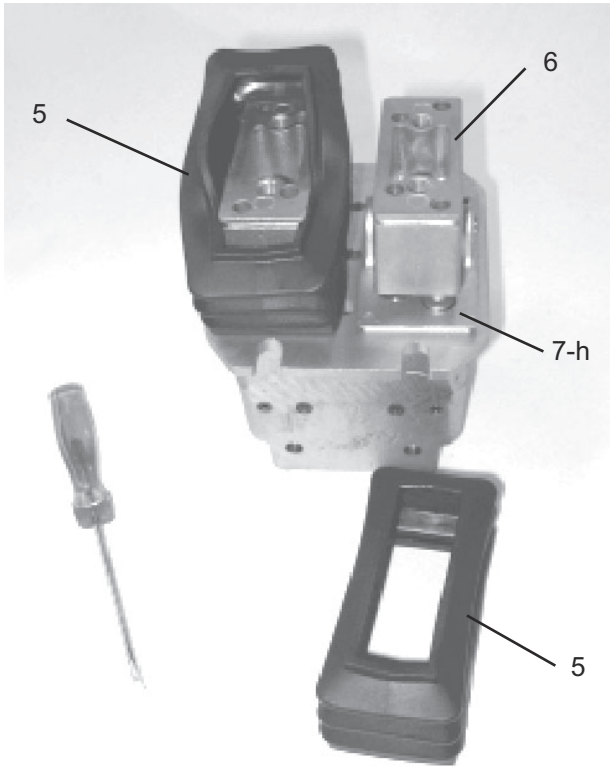


DISASSEMBLY AND ASSEMBLY

1. Boot replacement

NOTE: *the pilot control unit does not need to be removed from the machine to perform this operation.*

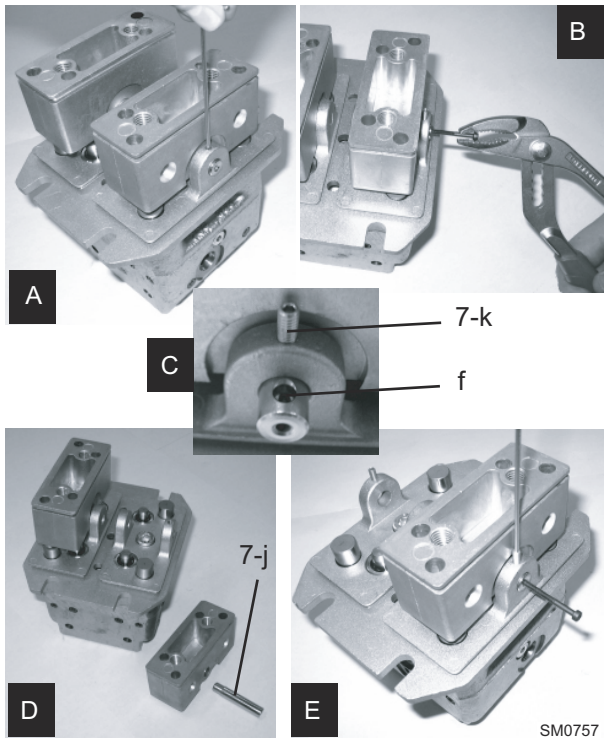
1) Remove both faulty boots.
(using a flat screw driver if necessary)
2) Replace both boots with a new one.
* Reassembly:
• First fit the lower part of the rubber boot (**5**) on the retaining plate (**7-h**) between the 2 switch plate (**6**)
• Then put the lower part in the external groove of the retaining plate.
• Finish by fitting the upper part of the rubber boot on the switch plate.



SM0756

2. Switch plate removal

1) Remove:
• The pilot control unit from the machine
• Both rubber boots
2) Remove the screw (**7-k**) locking the axis using a 2 mm socket wrench. (See Fig. SM0757 A)
* Reassembly:
• Apply a droplet of Loctite #262 on the locking screw thread.
• Torque: 1.2 Nm (0.89 lbf·ft)
3) Fit a M3 screw on the switch plate axis (**7-j**) in order to remove it (Using pliers if necessary). (See Fig. SM0757 B)
* Reassembly:
• Position the axis so that the hole (**f**) is aligned with the locking screw (**7-k**) as shown on the picture (See Fig. SM0757 C)
4) Mark out the position of the switch plate before removing it.
5) Repeat the operation for the second switch plate.
6) Reassemble parts in reverse order.



SM0757

REMOVAL AND INSTALLATION OF SWING BEARING

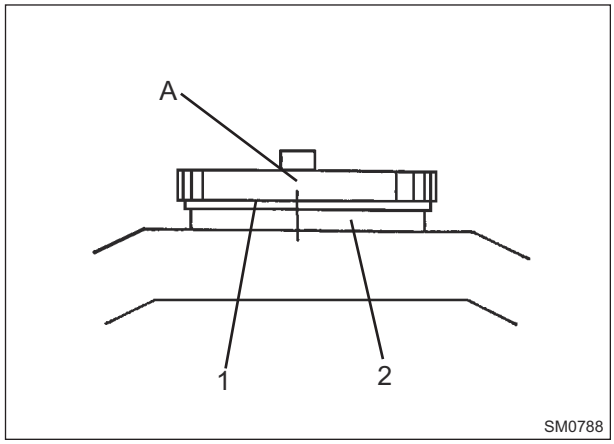
WARNING

Wear close-fitting clothing and safety equipment appropriate to the job. Use tools appropriate for the job to be performed. Always ensure that slings and chains used for lifting are adequate to the load and in good condition.

Before removing the swing bearing, the upperstructure must be removed first. For removal and installation of the upperstructure, refer to “Remove and Install Main Frame” section. In this section, the procedure starts on the premise that the upperstructure has already been removed.

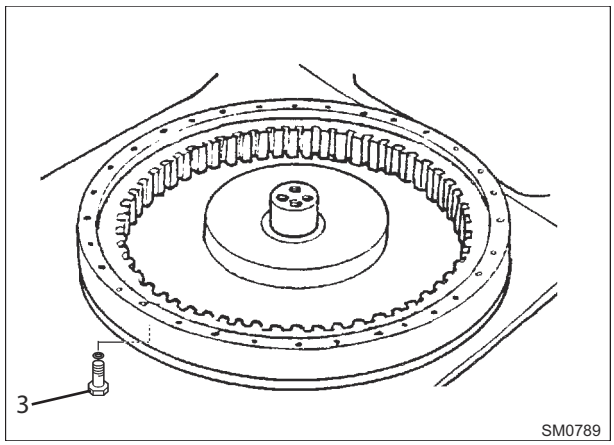
Removal

1. Put alignment marks on (**A**) swing bearing (**1**) and track frame (**2**).



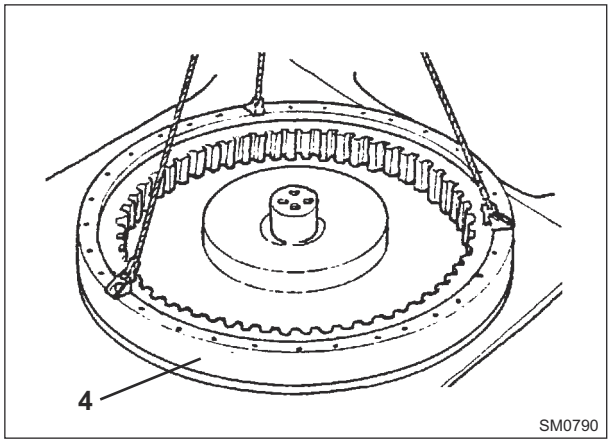
2. Remove screws M24 (**3**) (Q.ty 36) and the relevant washers (Q.ty 36).

: 36 mm



ATTENTION: *swing bearing weight: 550 kg (1213 lbs).*

3. Attach lifting tools hoist swing bearing (**4**) and remove it.



Determining the shim thickness for taper roller bearing

ATTENTION: *this operation is necessary when any of casing (**1**), rear cover (**2**), shaft (**9**) and bearings (**32**), (**31**) has been replaced*.

1. Measure the dimension (**E**) in the assembling condition as shown in figure.

ATTENTION: *make sure that shaft (**9**) is perpendicularly positioned*.

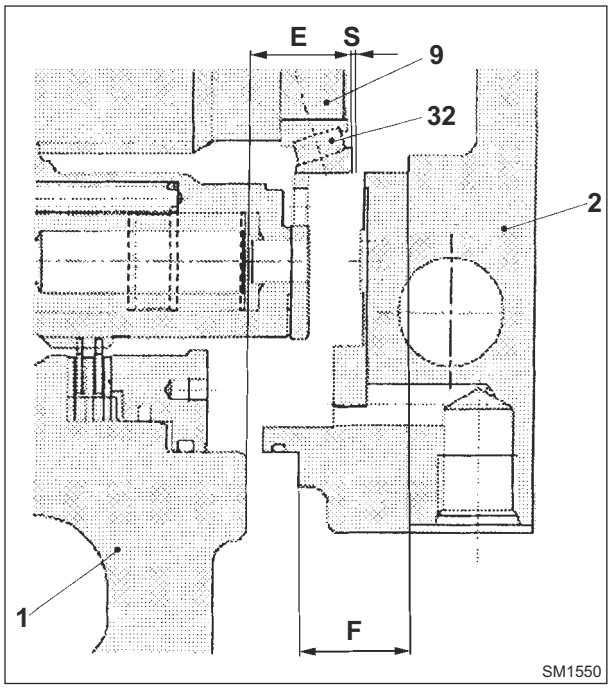
2. Measure the dimension (**F**) on the rear cover side.

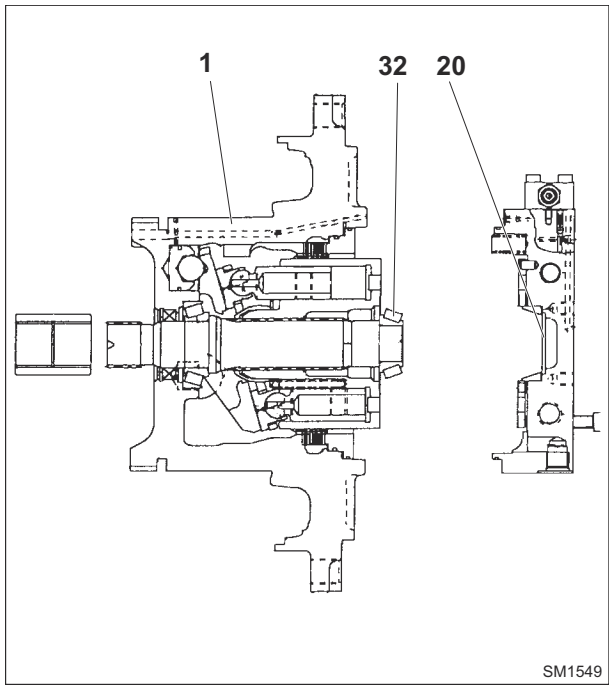
NOTE: *measure four different points on the circumference and calculate the average value.*

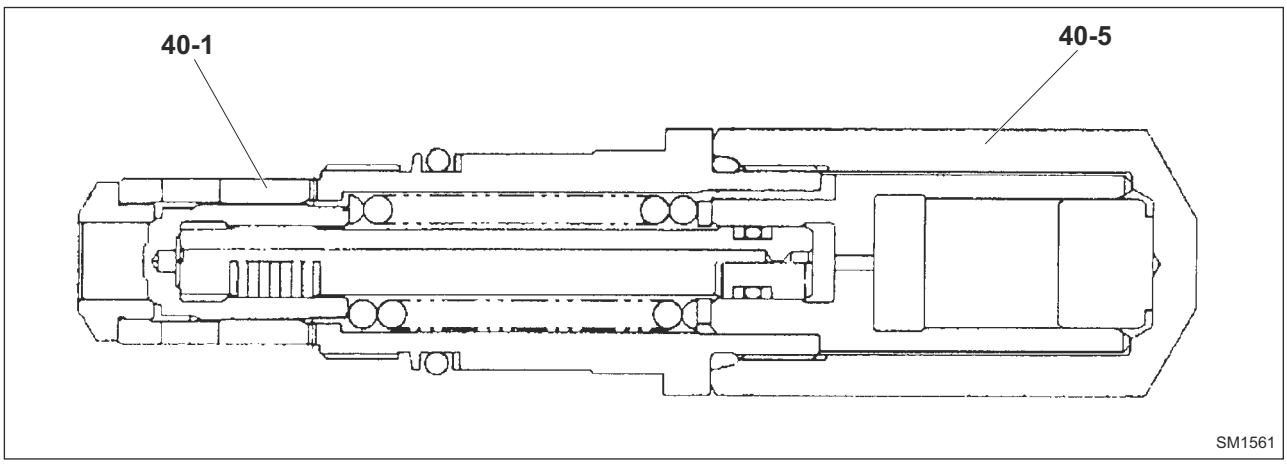
3. Suppose the thickness of shim (**20**) to be used is "S", the clearance "Y" is as below:
   Y=F-(E+S)

4. Choose one or two shims that make the clearance "Y" 0 ÷ 0.1mm (0.004 in)

5. Disassembling the overload valve
   a. Remove the overload valve as an assembly, utilizing the opposing faces of the hexagon of socket (**40-1**).
   b. The overload valve is handled as an assembly, but in case it must be disassembled remove cap (**40-5**) from socket (**40-1**) and pull out the internal parts.





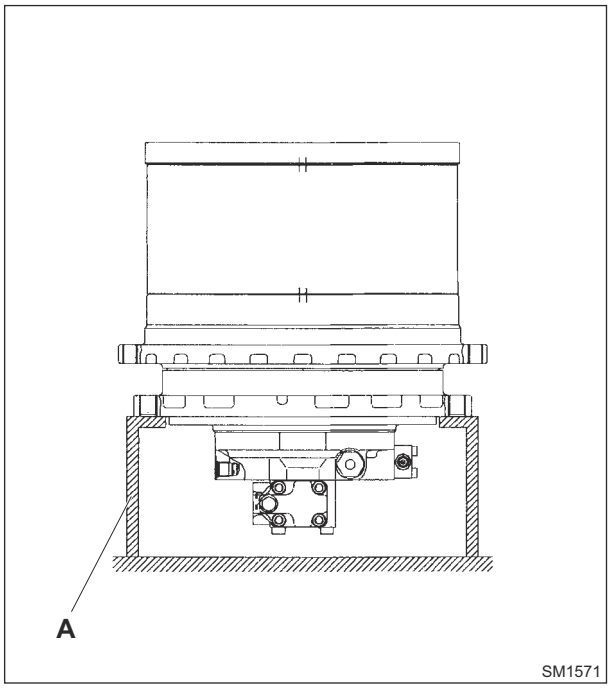


Disassembly of the reduction unit

1. Mounting the travel unit to the stand (**380001830**).

   a. Remove three M10 socket bolts (**24**) on cover (**1**) at equal spacings. Put eye bolts and lift it. Then install the travel unit so the cover comes up and the motor faces down.

ATTENTION: *take care so you do not pinch your hand between parts and drop parts.*

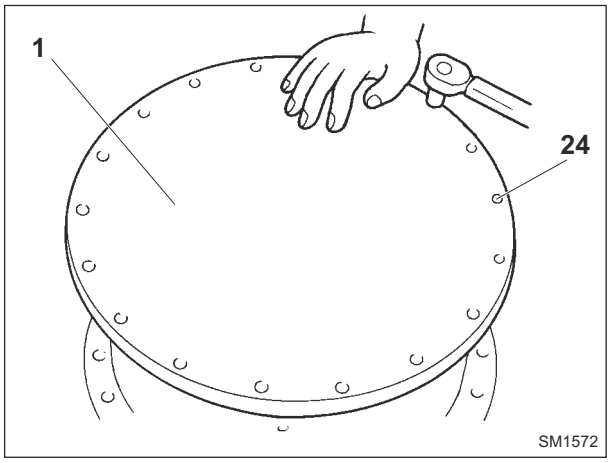


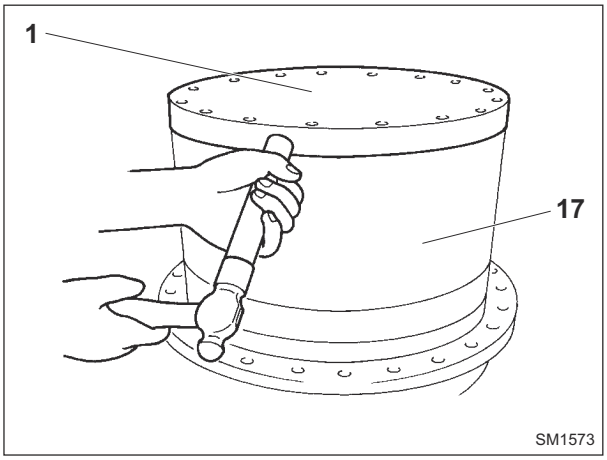
2. Removing the cover

   a. Take off the remaining M10 socket bolts (**24**).

      : 8 mm

   b. The contact surfaces of cover (**1**) and ring gear (**17**) are coated with sealing compound. Therefore, remove cover (**1**) by placing a block of wood on the protruding edge of the cover (**17**) and knocking it with a hammer.





MAINTENANCE STANDARD

INSPECTION BEFORE REASSEMBLY

1. Thrust washer
   a. Check to see that there is no seizure, abnormal wear or uneven wear.
   b. Check that the wear not exceed an allowable value.

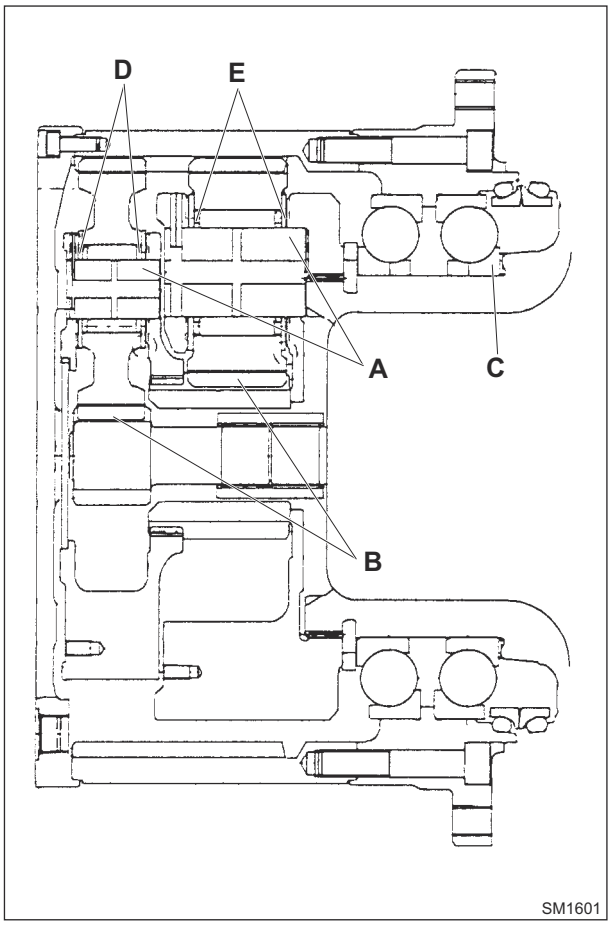
2. Gears
   a. There is no pitching and seizure on the gear tooth surface.
   b. Inspect that the root of gears is not cracked by liquid penetrant examination technique.

SERVICING PARTS

The following are reference values by which the serviceability of used parts is determined. Since these serve as general reference, it is recommended that the extent of disassembly be decided depending upon performances, excessive damage or discoloration of components, the purpose of disassembly and remaining service life that is expected.

3. Bearing
   Turn it by hand and check to see that it turns without unusual sound and resistance.

4. Floating seal
   Inspect that the moving parts and O-Rings are not scored.



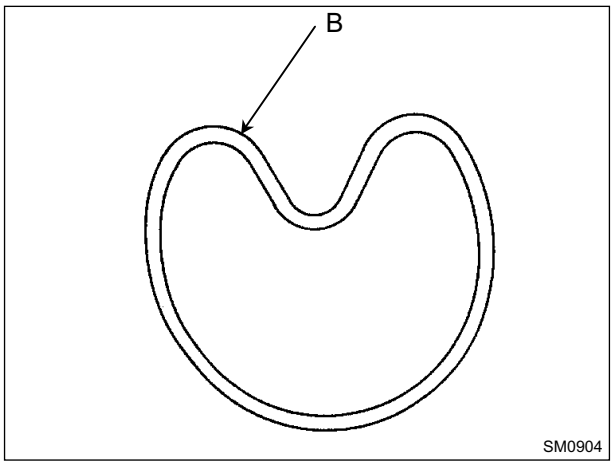
Maintenance Standard

Code	Item	Standard value	Allowable value	Remedy
A	Planetary shaft is worn.	To be smooth, no abnormal wear and seizure.	←	Replace 3 shafts as a set.
B	Tooth face and root condition	To be smooth, no abnormal wear and seizure.	No pitching over Ø 1.6 mm (0.063)and no crack at root of gear.	Replace 3 planetary gears as a set.
C	Thrust clearance of angular bearing innerrace	-0.08 mm (0.0031 in) [Interference] to +0.02 mm (0.0008 in) [Clearance]	←	Replace shims. [See.1.8 (6)]
D	Thickness of thrust washer 1	3.5 ± 0.2 mm (0.1378 ± 0.0079 in)	Wear 0.1 mm	Replace
E	Thickness of thrust washer 2	5.5 ± 0.2 mm (0.2165 ± 0.0079 in)	Wear 0.1 mm	Replace

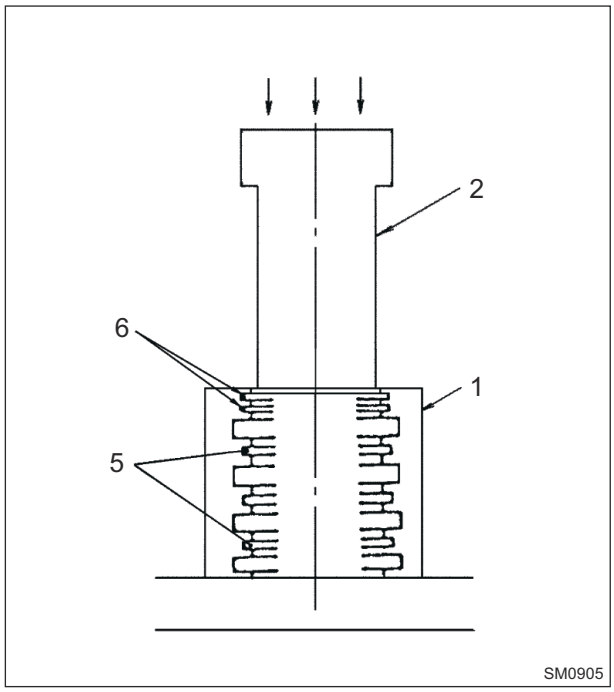
Assembly

Prior to assembly, clean each parts (excluding the O- Ring and slipper ring), and arrange in the sequence of assembly.

1. Make sure that oil and grease remains have been completely removed.
2. Apply grease on the groove where are seated the O- Ring (**6**).
3. Apply hydraulic oil to O-ring (**13**) thinly and insert it into O-ring groove. Check the twist of O-ring.
4. Slipper ring (**B**) is assembled, after first inserting the backup ring, by slightly-distorting the shape as shown in figure. Also after inserting all of the seals, be certain that these are installed in the seal groove by use of the spatula.
5. Assemble seal (**5**) by the same procedure above mentioned, after removing grease, hydraulic oil and vaseline from the groove of the seal. Seals (**5**) have no back-up ring.
6. Lightly coat the outer circumference of stem (**2**) and the inner surface of body (**1**) with grease or vaseline and slowly insert stem (**2**) into body (**1**).



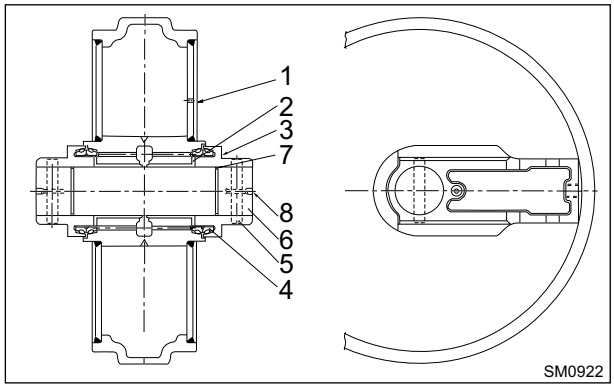
NOTE: *If stem (**2**) is pressed in too fast, the seal may be damaged. Do it slowly. The clearance between body (**1**) and stem (**2**) is about 0.1 mm. Push stem straight along the shaft center.*



*A: Push with both hands

DISASSEMBLY AND ASSEMBLY
FRONT IDLER ASSY

NOTE: *mass of front idler assembly with bracket: 213 kg (470 lbs).*

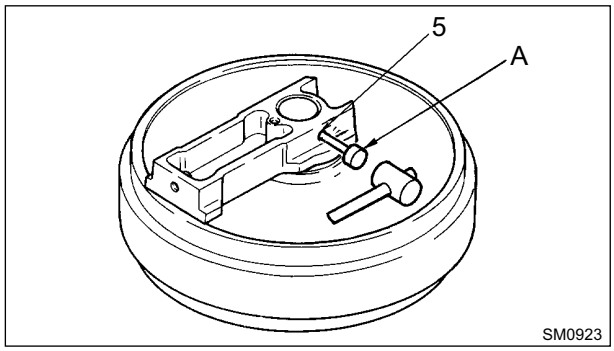


Disassembly

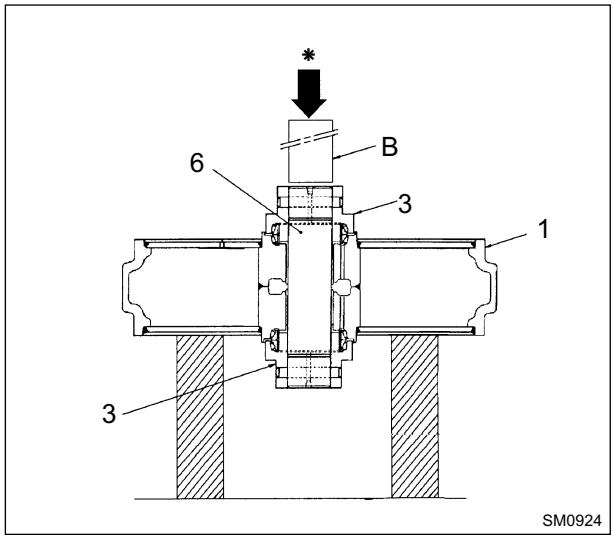
1. Remove plug (**8**) on the side of collar (**3**) to drain oil.

   : 5 mm

2. To remove pin (**5**) apply pin push bar (**A**) (**380001051**) to the top of pin, and push out striking bar lightly by hammer.

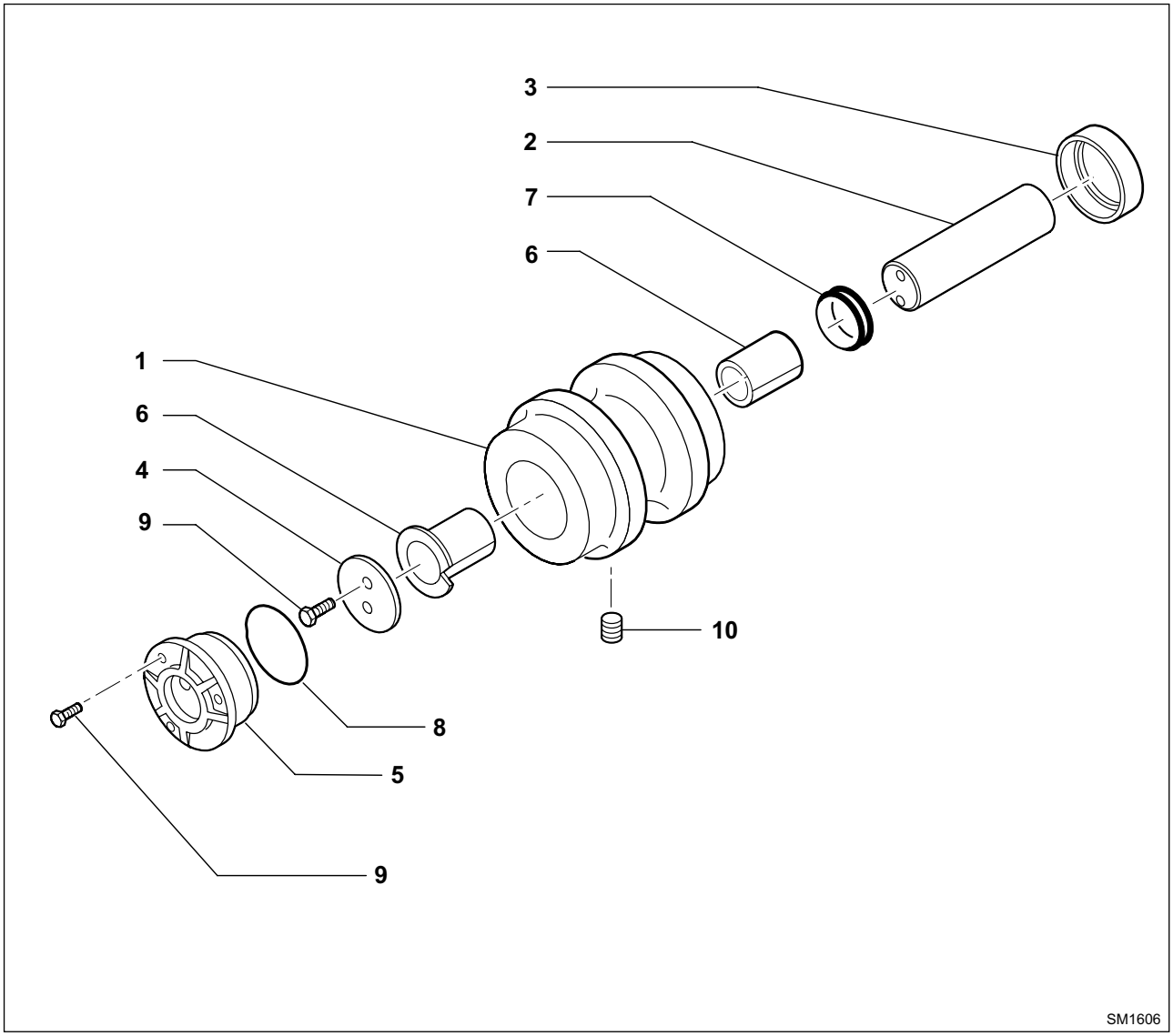


3. Put idler on repair stand. Apply push-out jig on shaft (**B**) (**380001052**), push out shaft (**6**) with collar (**3**), then remove collar (**3**).



*** : Push with press**

DISASSEMBLY & ASSEMBLY OF THE UPPER ROLLER

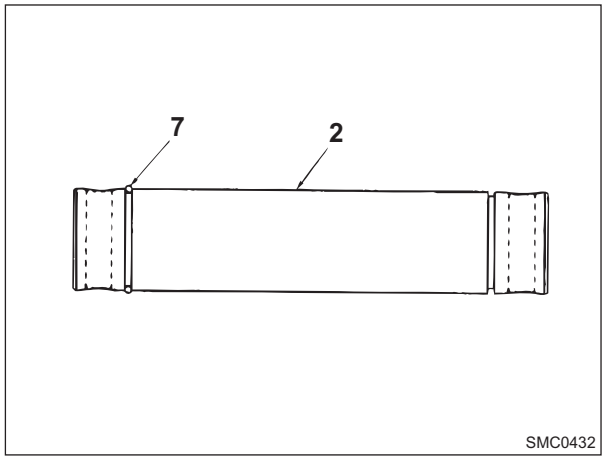


1 - Roller
2 - Shaft
3 - Collar
4 - Thrust washer
5 - Cover
6 - Bushing
7 - Floating seal
8 - O-ring
9 - Socket bolt M12x30 (Q.ty 5)
10 - Plug

Assembly

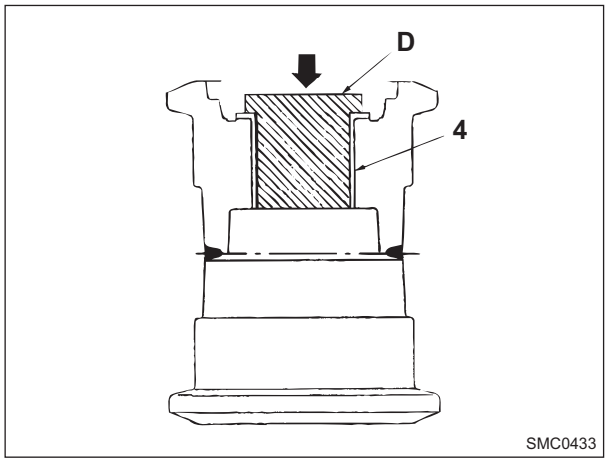
1. Grease O-ring (**7**) and install it to groove on shaft (**2**).

NOTE: *replace O-ring with new one without fail at reassembling.*



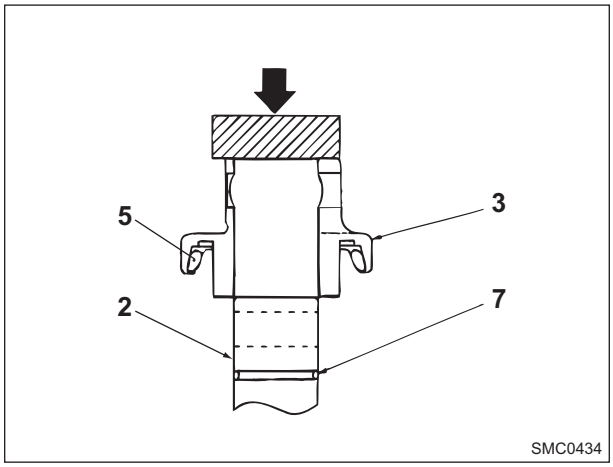
2. Fit bushing (**4**) into jig (**D**), align inner hole of roller (**1**) and bushing (**4**) and press fit it vertically into the idler, using a press with a 5 ton (11000 lbs) load.

NOTE: *apply molybdenum disulfide grease on press fit section of bushing, and press fit it in ordinary temperature.*

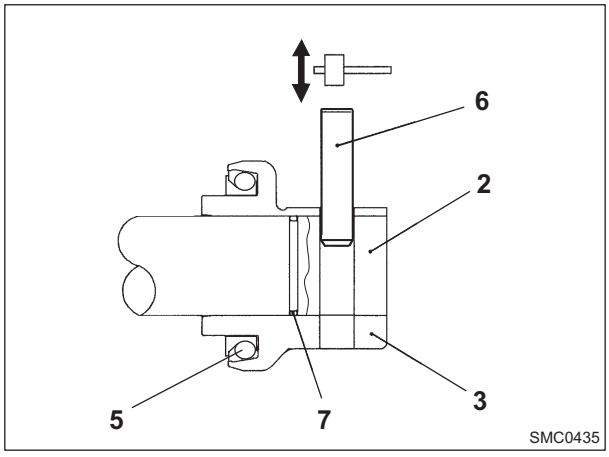


3. Fit O-ring (**7**) to the one side of shaft (**2**) mating pin hole of collar (**3**) on which floating seal (**5**) is fit with pin hole of shaft (**2**) in advance. Use the press of capacity 17 ton (37500 lbs) or more.

NOTE: *care should be taken not to damage O-ring (**7**) while press-fitting collar (**3**) to shaft (**2**).*



4. Press-fit pin (**6**) to pin hole on aligning pin holes of shaft (**2**) and collar (**3**).



FRONT ATTACHMENT

CONTENTS

Group 1 - Front attachment

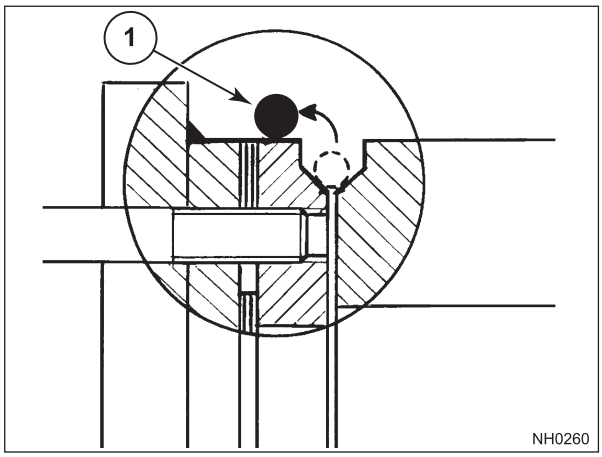
REPLACEMENT OF BUCKET

CAUTION

- *Replace the bucket on firm level ground. Pay close attention to safety.*
- *When aligning the pin bores, DO NOT INSERT YOUR HAND OR FINGERS into the bores. It may cause severe injury. Align the bores visually or using a tool.*
- *Hold the removed bucket in the stable condition.*

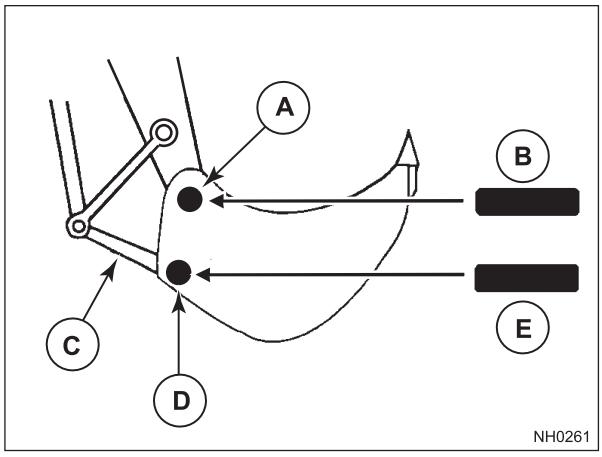
Removing the bucket

- Place the machine on a firm and flat surface and rest the bucket on the ground in a stable position.
- Place O-rings (**1**) out of the relevant seats. Remove the pins and the retaining rings of the pins.
- Remove pin (**E**) and pin (**B**); then remove the bucket.



Installing the bucket

- Using a suitable hoist, place the bucket on the same level as the tracks.
- Position the O-Rings (**1**)outside their seats.
- Using the arm cylinder control and boom cylinder control make small vertical and horizontal movements to insert pivot pin (**B**) connecting the bucket to the arm into hole (**A**).
- Use the bucket cylinder control to align the connecting rod (**C**) to hole (**D**) and insert pivot pin (**E**).
- Secure pivot pins using lock pins and retaining rings and reposition the O rings into their seats.



ATTENTION: *during the removal of the bucket, take care that the pin are not contaminated by dirt, sand etc. After the reinstallation of the bucket, provide grease to the pins through the appropriate fittings.*

Bucket play adjustment

Bucket play (**g**) is adjusted by opportunely changing total shims installed.

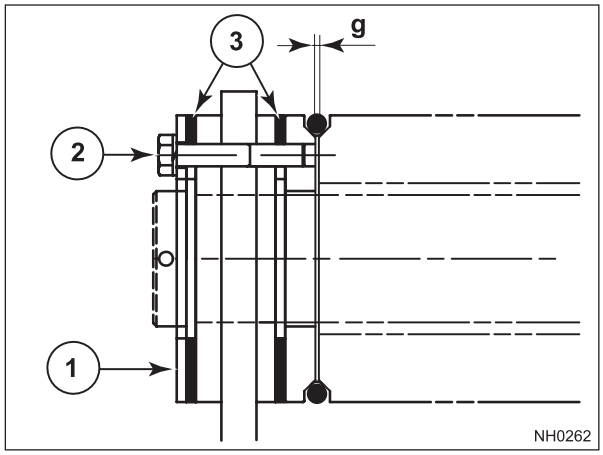
NOTE: *bucket play (**g**) should be 0.5 (0.02 in) to 1.5 mm (0.059 in).*

If bucket play (**g**) exceeds the specified value, increase adjust shims as follows:

- loosen the three bolts (**2**) taking care to retrieve the washers. Slide out the ring (**1**);
- Add adjust shims (**3**) until compensating the play (**g**);
- Install the ring (**1**), and tighten securing bolts (**2**).

: 30 mm

: 181 ± 20 Nm (133 ± 14.7 lbf·ft)



7. Install shims (**6**) and insert pin (**5**).

8. Install stopper (**4**), tighten bolts (**3**) and lock nuts (**2**):
   : 30 mm
   : 181 ± 20 Nm (133 ± 14.7 lbf·ft)

9. Connect lubrication hoses (**1**) to boom cylinder rod.
   : 17 mm
   : 20 Nm (14.7 lbf·ft)

10. Using a grease gun, inject grease via nipples (**10**).

11. Install the other boom cylinder following the same procedure.

NOTE: *fill the hydraulic oil tank with hydraulic oil to the specified level. Run the engine at idle. Check hose connections for any oil leakage.*

ATTENTION: *bleed air from hydraulic circuit.*