[illegible]

RIPARAZIONI

E485C

Crawler Excavator

Escavatore cingolato

Tier IV

[illegible]

NEW HOLLAND CONSTRUCTION

[illegible]

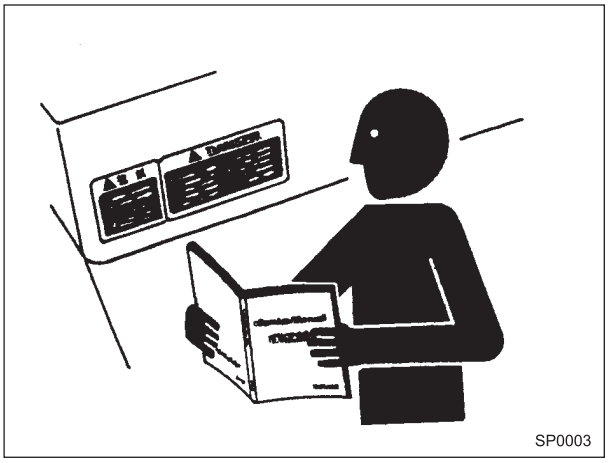
E485C

[illegible]

[illegible]

NEW HOLLAND CONSTRUCTION

FOLLOW SAFETY PRECAUTIONS


SP0003

Carefully read and observe all safety decals on the machine and read all safety precautions in this Manual.

Safety decals should be installed, maintained, and replaced when necessary.

- If a safety decal or this Manual are damaged or missing, obtain a replacement from your Dealer in the same way you order a spare part (be sure to detail machine model and serial number upon ordering).

Learn how to operate the machine and its controls correctly and safely.

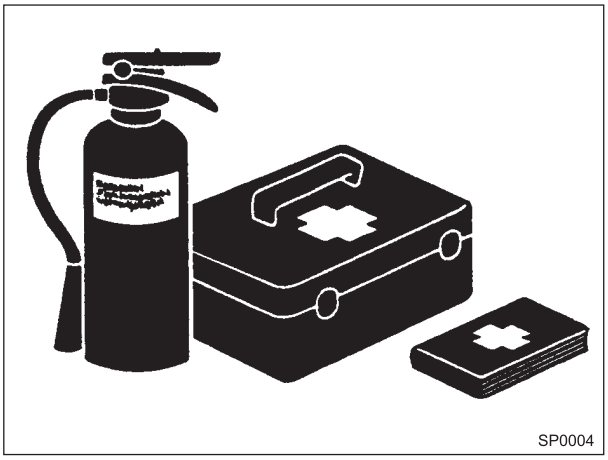
Allow only trained, qualified, authorised personnel to operate the machine.

Keep the machine in proper working conditions.

- Unauthorised changes to the machine may impair function and/or safety and affect machine life.

Safety messages in this Chapter are intended to illustrate basic safety procedures of the machine. However, it is impossible for these safety messages to cover every hazardous situation you may encounter. If you have any doubts, consult your direct supervisor prior to operating or servicing the machine.

PREPARE FOR EMERGENCIES


SP0004

Be prepared if a fire starts or an accident occurs.

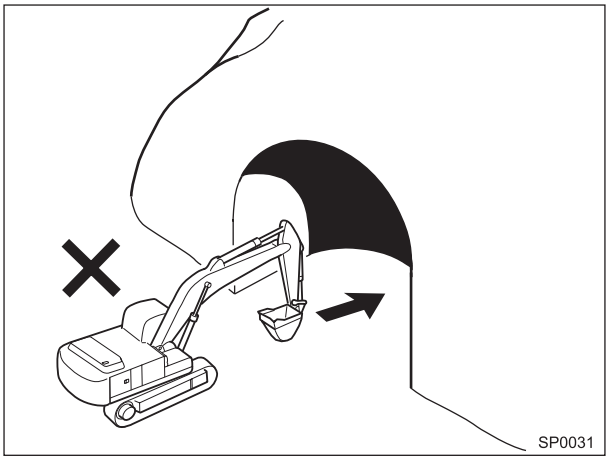
- Keep the first-aid kit and fire extinguisher on hand.
- Thoroughly read and understand the label attached to the fire extinguisher to use it properly.
- Establish emergency priority procedures to cope with fires and accidents.
- Keep emergency numbers for doctors, ambulance service, hospitals and fire department posted near the telephone.

NEVER MOVE THE BUCKET OVER ANY ONE

Never lift, move, or swing bucket above anyone or a truck cab. Serious injury or machine damage may result due to bucket load spill or due to collision with the bucket.

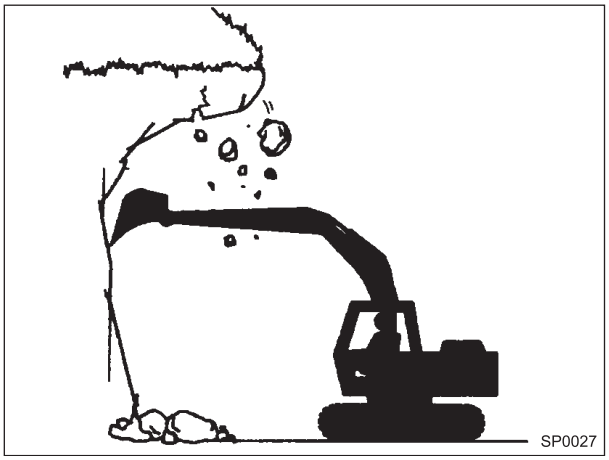
DO NOT OPERATE IN TUNNELS

Do not operate the machine in enclosed spaces or, in any case, without appropriate ventilation. Operations in tunnels or underground sites where potential explosive conditions exist are not allowed. There is a danger for explosions and potentially deadly injuries.



NEVER UNDERCUT A HIGH BANK

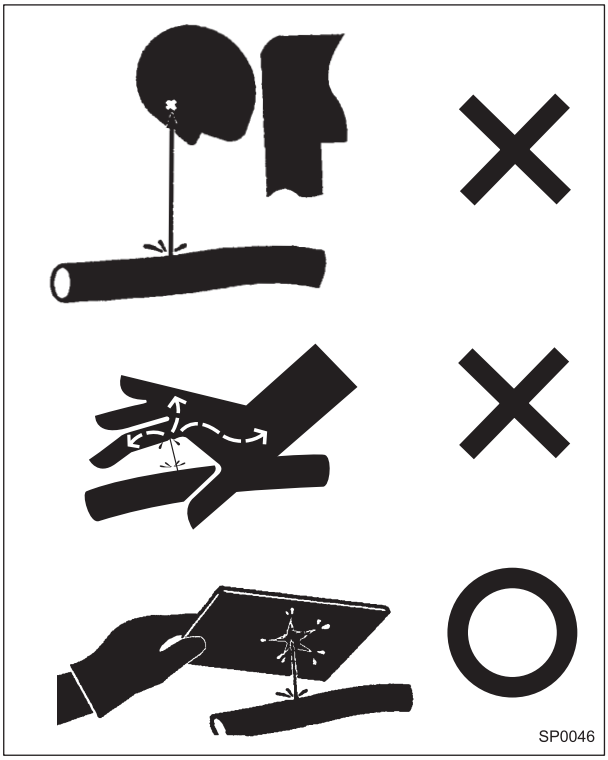
The edges could collapse or a land slide could occur causing serious injury or death.



AVOID HIGH-PRESSURE FLUIDS

Fluids such as diesel fuel or hydraulic oil under pressure can penetrate the skin or eyes causing serious injury, blindness or death.

- Avoid this hazard by relieving pressure before disconnecting hydraulic or other lines.
- Tighten all connections before applying pressure.
- Search for leaks with a piece of cardboard; take care to protect hands and body from high-pressure fluids. Wear a face shield or goggles for eye protection.
- In an accident occurs, see a doctor familiar with this type of injury immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.



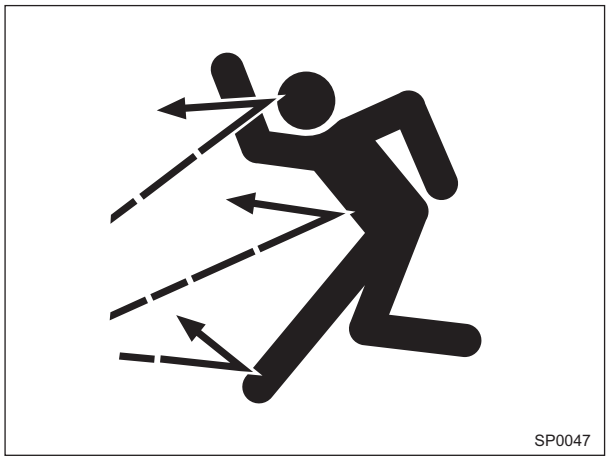
PREVENT PARTS FROM FLYING OFF

Grease in the track adjuster is under high pressure. Failure to follow the precautions below may result in serious injury, blindness, or death.

- Never attempt to remove grease fitting or valve assembly.
- As pieces may fly off, be sure to keep body and face away from valve.

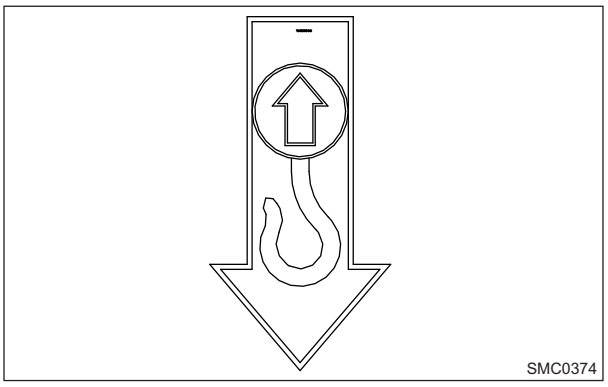
Travel reduction gears are under pressure.

- As pieces may fly off, be sure to keep body and face away from air release plug to avoid injury. Reduction gear oil is hot. Wait for gear oil to cool down, then gradually loosen the air release plug to release pressure.



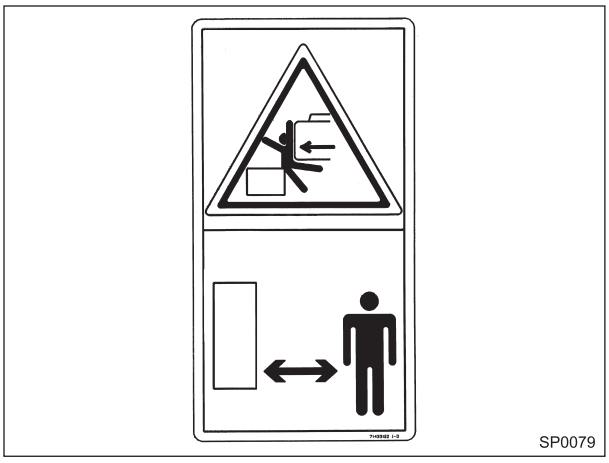
4 - Lifting point decal

Fastening means must be attached here when the machine is to be lifted.



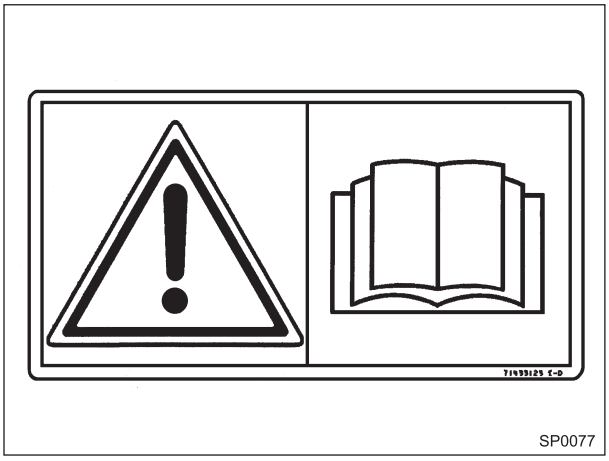
5 - Counterweight operating range decal

Ensure that any person near the working site is outside the swing area before starting or operating the machine. Sound the horn before beginning swing operation.



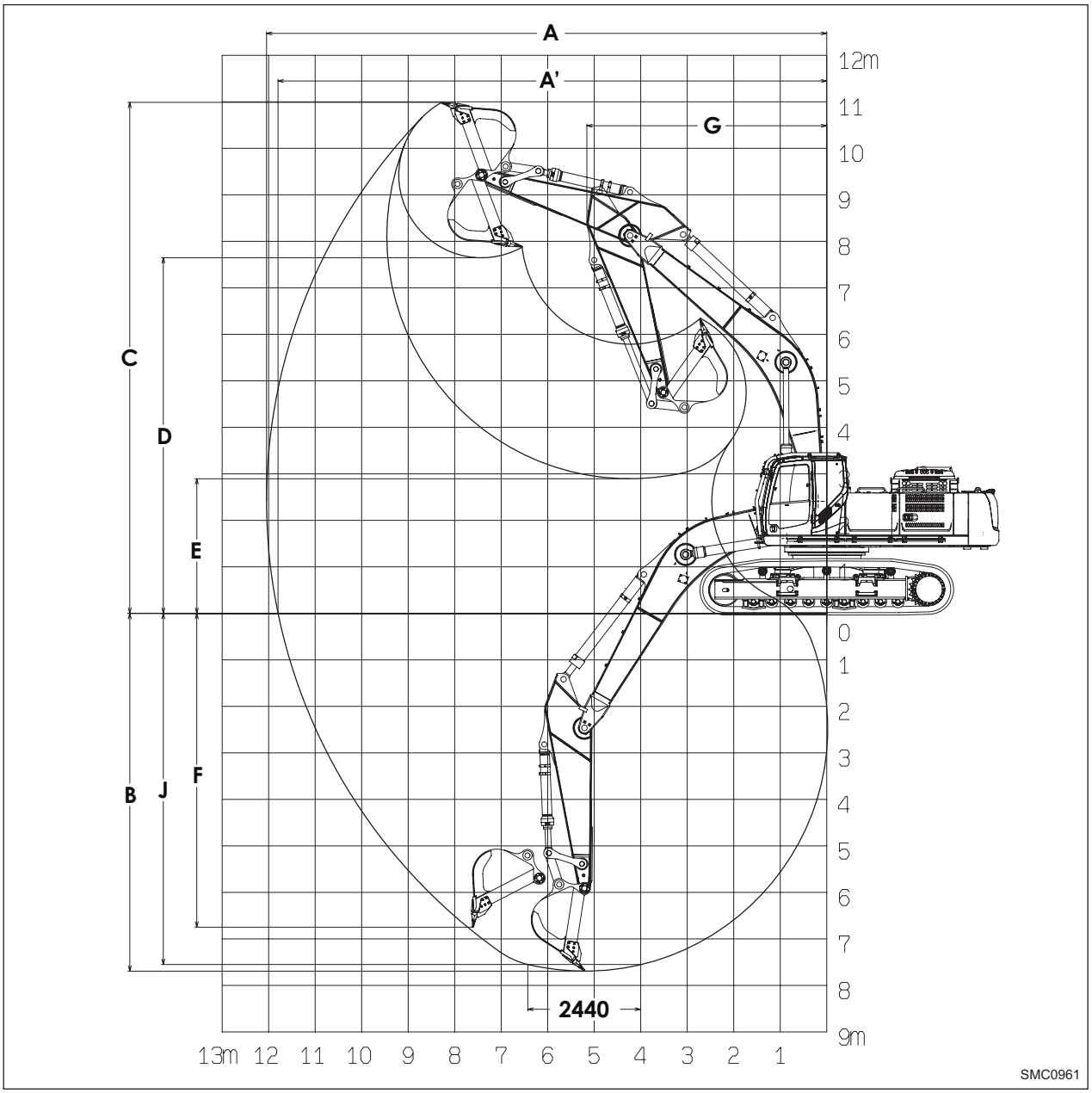
6 - Read the operator's manual decal

Carefully read the operator’s manual prior to starting, operating, servicing, refuelling or carrying out any other work on the machine. Pay special attention to the instructions regarding safety, operation and maintenance to prevent risks or injury during usage or when carrying out maintenance operations on the machine.



DIGGING DATA

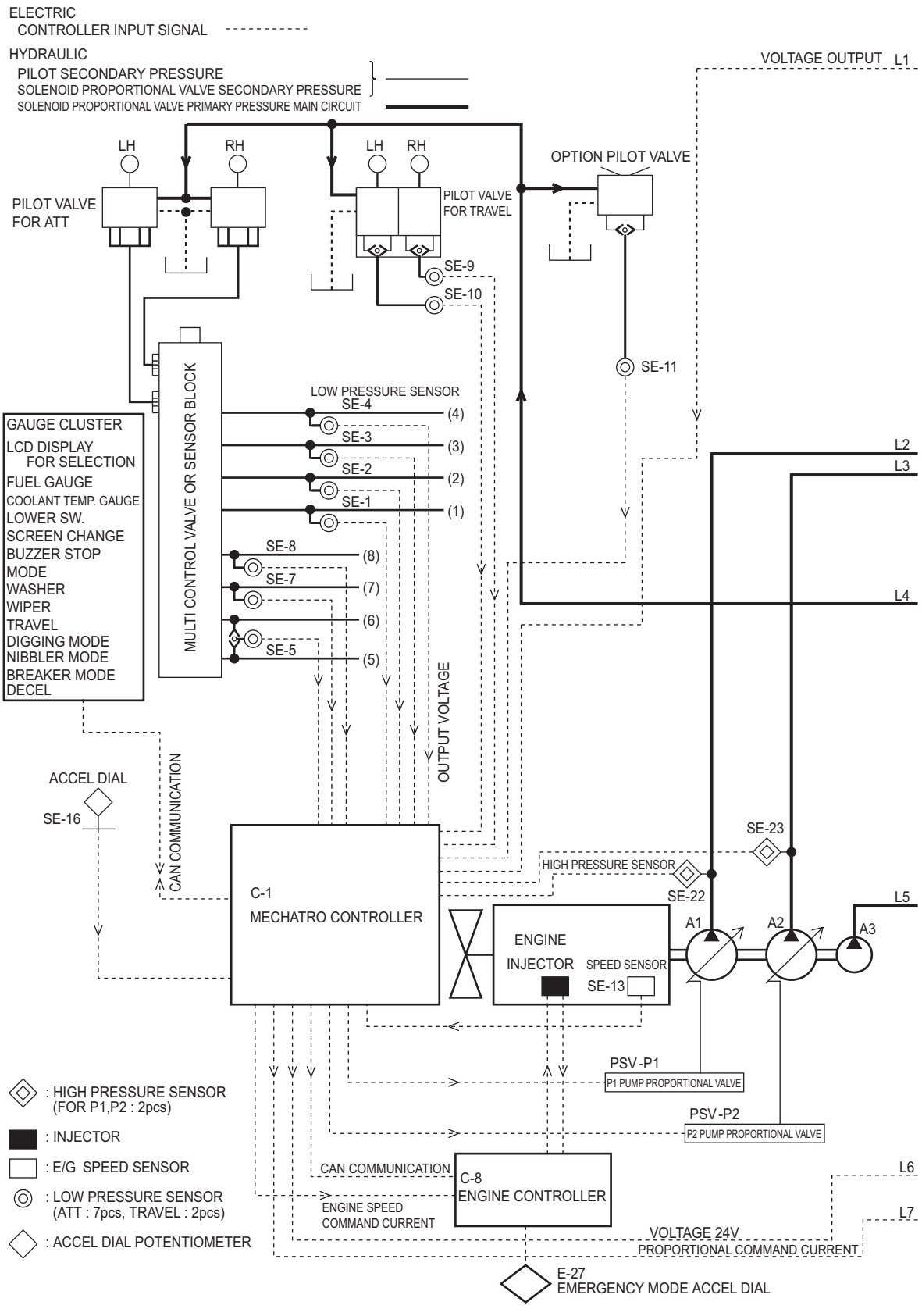
LCH Version



Arm		2900	3450	4040
		mm	mm	mm
A	Maximum digging reach	11520	12050	12540
A'	Maximum digging reach at ground level	11260	11800	12310
B	Maximum digging depth	7140	7690	8280
C	Maximum digging height	10730	10990	11050
D	Maximum damping clearance	7400	7650	7740
E	Minimum damping clearance	3440	2890	2300
F	Maximum vertical wall digging depth	6140	6750	7140
G	Minimum swing radius	5220	5160	5170
J	2440 mm level digging depth	6980	7550	8150

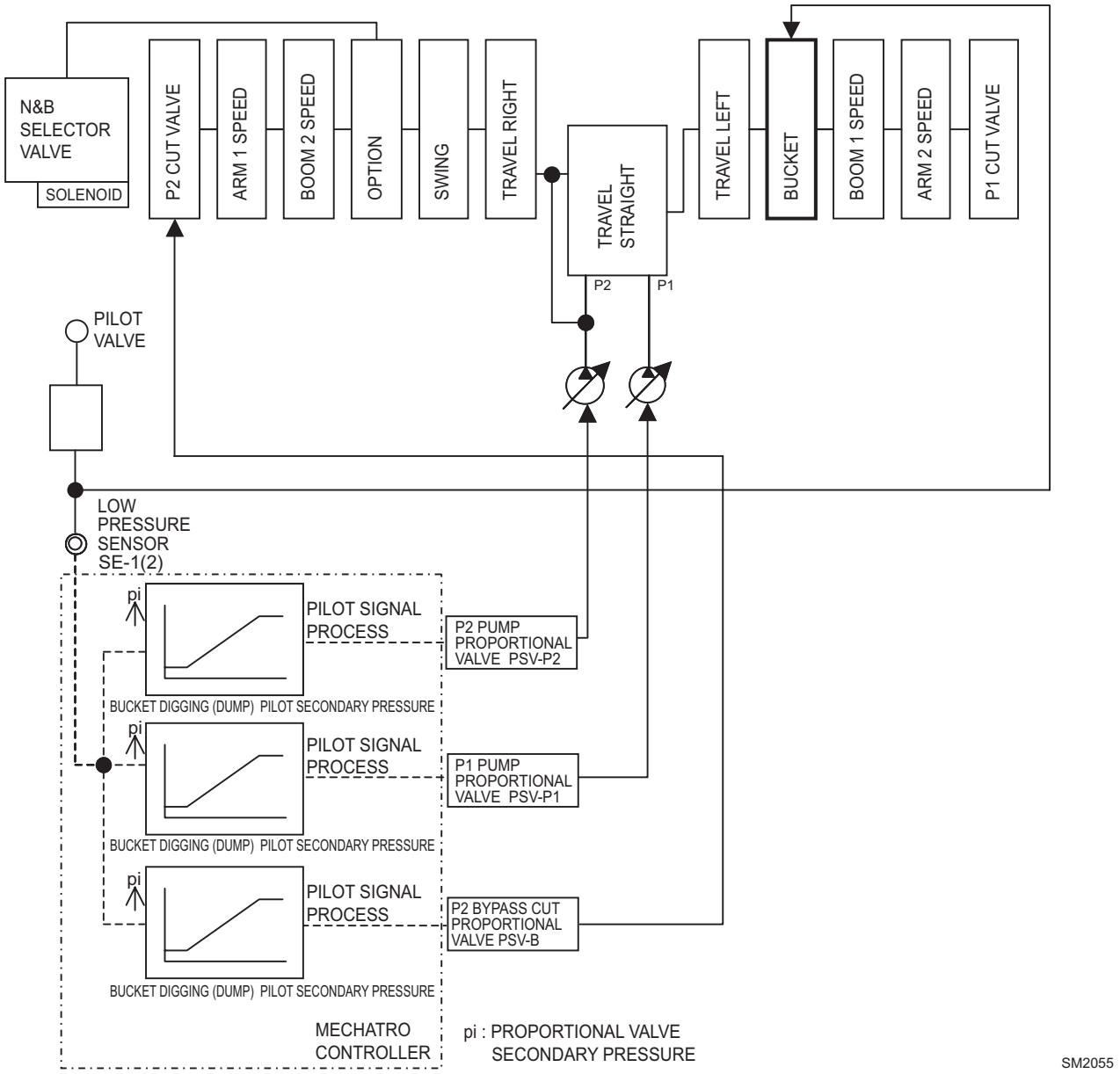
2 SUMMARY OF MECHATRO CONTROL SYSTEM

2.1 MECHATRO CONTROL SYSTEM IN GENERAL



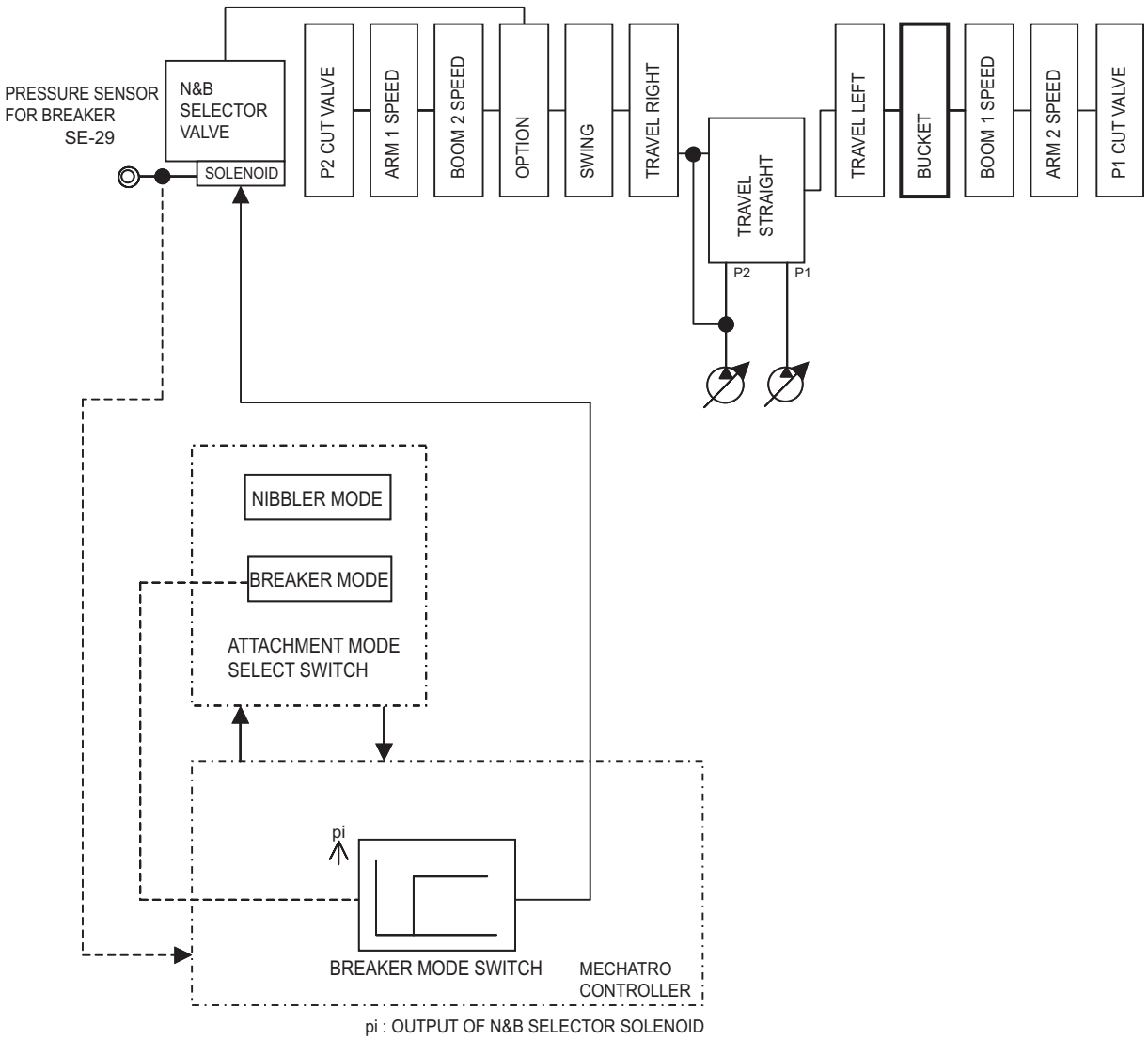
SMC0894

2.7 BUCKET DIGGING (DUMP) CONFLUX CONTROL

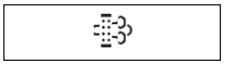
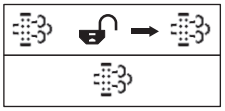
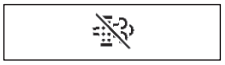


1. On starting bucket digging (dump) operation, bucket digging (dump) operating pilot pressure switches bucket spool and is input to low pressure sensor.
2. The output voltage of low pressure sensor is input to mechatro controller and the mechatro controller processes pilot signal and outputs command according to the input voltage to P1 and P2 pump proportional valves and P2 bypass cut proportional valve.
3. Each proportional valve outputs pilot secondary pressure according to the command output by mechatro controller and changes P1 and P2 pump delivery rate and switches P2 bypass cut valve of the control valve.
4. P2 pump delivery oil confluxes into parallel passage of the center section because the center bypass passage of P2 is blocked.

2.12 N&B SWITCH CONTROL (OPTION)



1. Nibbler circuit
   1) Select Nibbler mode by pressing nibbler mode switch located on gauge cluster.
   2) Nibbler display appears on gauge cluster.
   3) The return oil from the nibbler passes through selector valve and option spool and led to tank line of main control valve.
   4) When selecting Nibbler mode through select switch, the breaker pressure sensor has not function to output. It is in normal when there is no output from sensor in Nibbler mode, and in cases of other than above, error display is output to gauge cluster.
2. Breaker circuit
   1) Select Breaker mode by pressing breaker mode switch located on gauge cluster.
   2) Breaker display appears on gauge cluster.
   3) The return oil from the breaker passes through selector valve and directly returns into hydraulic oil tank.
   4) When selecting Breaker mode through select switch, the breaker pressure sensor outputs signal. It is in normal when there is an output from sensor in Breaker mode, and in cases of other than above, error display is output to gauge cluster.

Priority	Level (*)	Screen	Condition	Warning Condition					Trouble History Code
				Only Key ON	Engine Run	Buzzer sounds			
						Type (**)	Auto Stop	Manual Stop	
A	1	DATA COMMUNICATION ERROR	Data from Mechatro controller is not received	O	O	3	x	O	
	1	SWING BRAKE DISENGAGED	The swing parking brake switch is turned ON	O	O	2	O	O	W001
	1	ENGINE STOP	Engine is stopped after engine oil pressure low warning	O		1	O	x	
	2	FAIL DRAIN HYD. PRESSURE	Impossible to drain hyd. Pressure	O	O	1	x	O	
	2	DRAINING HYD. PRESS.	Possible to drain hyd. Pressure		O	4	x	O	
B	1	CAUTION ATTACHMENT	The selector valve (OPT) is malfunction		O	2	x	O	W009
	2	POWER BOOST ON	The power boost switch is turn ON	O	O	-			
	2	FINISH WARM-UP	After finishing warming up control		O	2	O	x	
	2		Automatic regeneration may not be completed. The regeneration needs to be performed manually.	-	O	3	-	O	
	2		Exhaust gas post cleaning system is regenerating. The same icon is displayed during automatic or manual regeneration.	-	O	-	-	-	
	2		Engine is stopped or safety lever is placed in **UNLOCK** position while the manual regeneration is performing.	-	O	2	-	-	
	2		Exhaust gas post cleaning device cannot be regenerated.	-	O	2	-	-	
	3	LOW ENG OIL PRESS.	Low engine oil pressure		O	2	x	O	W005
			Disconnection	O					
	3	HIGH ENG. WATER TEMP.	The engine water is more than 105 °C	O	O	3	x	O	W006
	3	LOW ENG WATER LEVEL	The warter engine coolant reservoir is low	O	O	3	x	O	W004
	3	CLOGGED AIR FLTR	The air filter is clogged	O	O	3	x	O	W008
	3	(SELF DIAGNOSIS SCREENS)	According to the self diagnosis control	O	O	3	x	O	
	3	PREHEAT	The heater relay contact is faulty	O	O	3		O	W011
	4	CHARGE ERROR	No signal from the alternator		O	-			
	4	LOW FUEL LEVEL	The fuel level is less than 10 %	O	O	-			
	5	AUTO WARMING UP	The auto warming up control is activated		O	-			
	5	CHANGE ENG OIL	The remaining time is reached zero huors	O	O	-			
	5	LIFT UP LOCK LEVER BEFORE ENGINE START	Safety lever is in unlock position and starter switch is turned to START or ON position. The engine does not start.	O	-	-	-	-	
	5	CHANGE FUEL FLTR	The remaining time for the replacement of the fuel filter reaches 0 .	O	-	-	-	-	
	5	CHANGE HYD. OIL FLTR	The remaining time for the replacement of the hydraulic oil filter reaches 0 .	O	-	-	-	-	
	5	CHANGE HYD. OIL	The remaining time for the replacement of the hydraulic oil reaches 0 .	O	-	-	-	-	

(*) 1: these extremely influence safety and the machine performance
2: these warn the machine control mode is switched
3: fatal failure
4: normal priority warning
5: low priority message

(**) 1: Continuation
2: Beep ON 0.2 sec. OFF 0.3 sec.
3: Beep ON 0.5 sec. OFF 0.5 sec.
4: Beep ON 0.5 sec. OFF 1.0 sec.

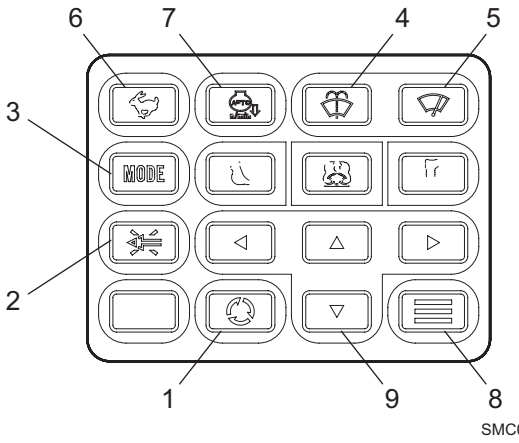
Operation No.5 : Boom down in full lever operation & in operation H mode Hi idle		
No.31 BOOM		
C-1	P1-PRES	5.0~9.0 M
C-2	P2-PRES	0.2~2.0 M
E-1	P1-PSV	650~681 mA
E-2	P2-PSV	350 mA
D-1	P1-UL(BPC)	300 mA
D-2	P2-UL(BPC)	300 mA
B-1	BOOM RAISE	0.0 M
B-2	BOOM LOWER	3.0 M
G-3	ENG SPEED	1800~2000
	POWER SHIFT	0 mA

Operation No.6 : Arm-in in full lever operation & relief H mode Hi idle		
No.32 ARM, SWING		
C-1	P1-PRES	30.5~33.5 M
C-2	P2-PRES	30.5~33.5 M
E-1	P1-PSV	470~585 mA
E-2	P2-PSV	470~585 mA
D-1	P1-UL(BPC)	300 mA
D-2	P2-UL(BPC)	300 mA
D-3	S-TRAVEL	350 mA
D-6	ARM-IN-2	200 mA
B-3	ARM OUT	0.0 M
B-4	ARM IN	3.0 M
B-1	BOOM RAISE	0.0 M
B-7	SWING	0.0 M
G-3	ENG SPEED	1800~2000
	POWER SHIFT	0 mA

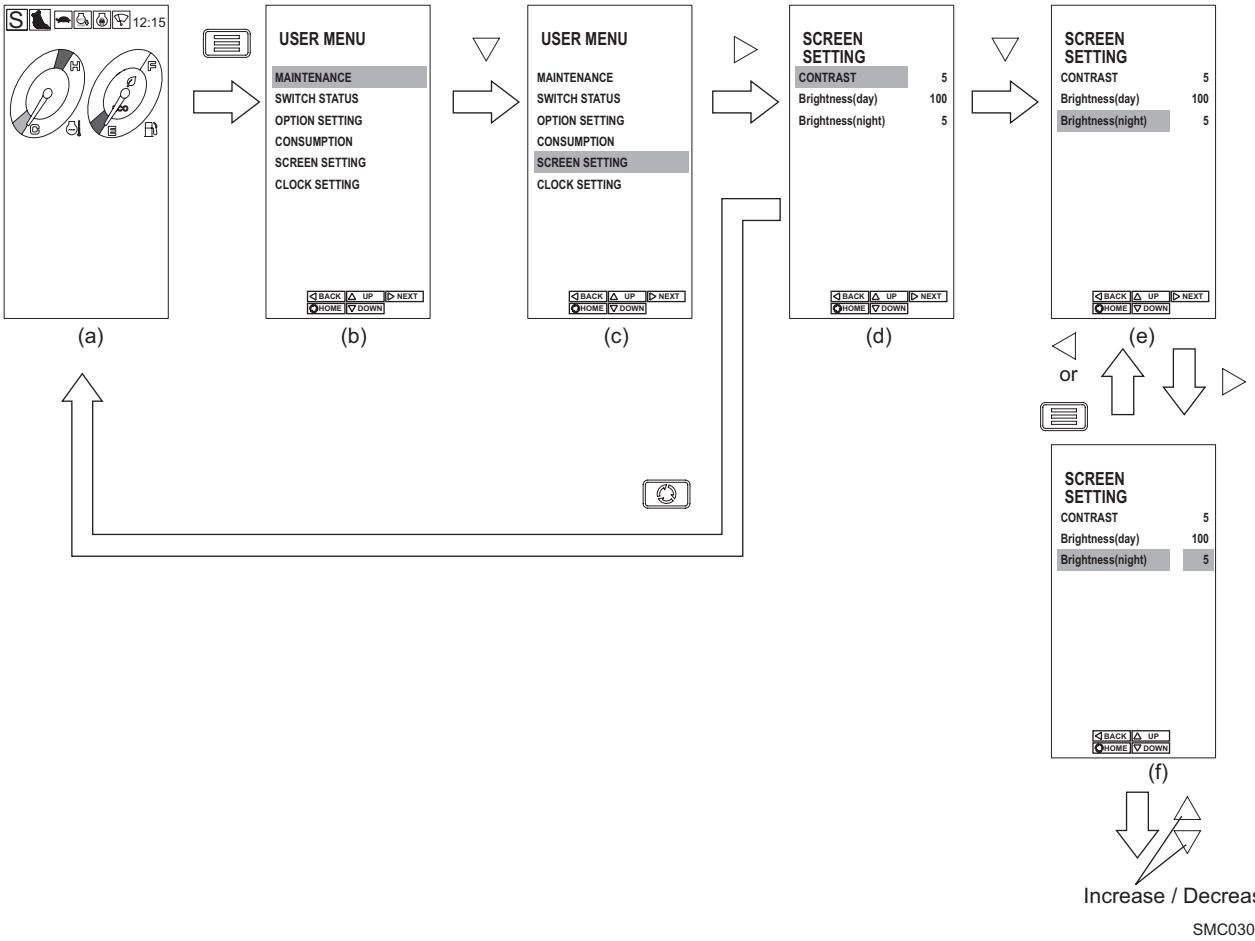
Operation No.7 : Arm-in in full lever operation & in operation H mode Hi idle		
No.32 ARM, SWING		
C-1	P1-PRES	5.0~9.0 M
C-2	P2-PRES	5.0~9.0 M
E-1	P1-PSV	720~750 mA
E-2	P2-PSV	720~750 mA
D-1	P1-UL(BPC)	300 mA
D-2	P2-UL(BPC)	300 mA
D-3	S-TRAVEL	350 mA
D-6	ARM-IN-2	200 mA
B-3	ARM OUT	0.0 M
B-4	ARM IN	3.0 M
B-1	BOOM RAISE	0.0 M
B-7	SWING	0.0 M
G-3	ENG SPEED	1800~2000
	POWER SHIFT	0 mA

4) Brightness (Night) Adjustment

1: Screen Change Switch
2: Buzzer Stop Switch
3: Work Mode Select Switch
4: Washer Switch
5: Wiper Switch
6: Travel Speed Select Switch
7: Auto Accel Switch
8: Menu Switch
9: Arrow Switch



SMC0302



SMC0306

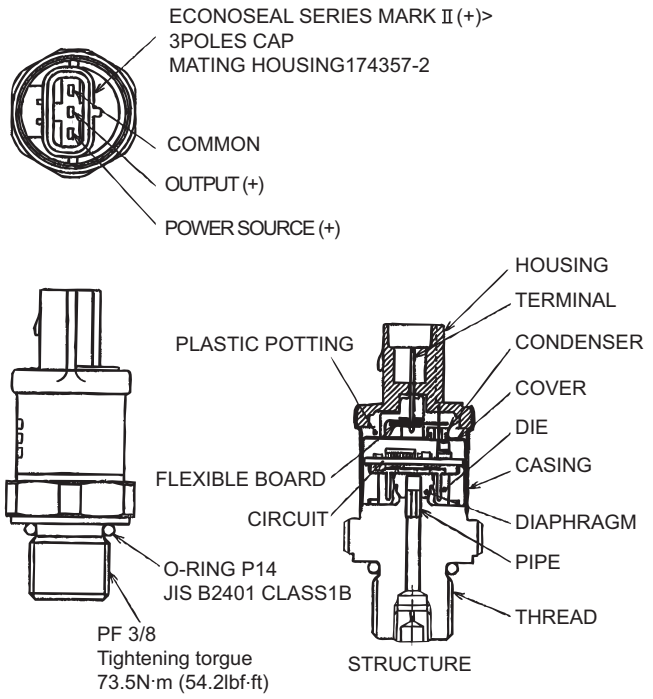
1. After turning starter key switch ON, the main screen (a) is appeared. And press "Menu Switch" to enter into "USER MENU" display (b).
2. Move cursor to "SCREEN SETTING" display. Press "NEXT" to select "SCREEN SETTING" display (d).
3. Move cursor to "Brightness (night)" display. Press "NEXT" to select "Brightness (night)" value and brightness (night) setting display (f) is indicated.
4. Using cursor, and get the desired values. Step of adjustable range is from 1 to 100.
   Example: 1 (Dark) to 10 (Bright)
   * Default is set to 5.
5. After adjustment, press "Menu Switch" and the adjusted values are stored as memory and "SCREEN SETTING" is completed. Press "Screen Change Switch", and the display returns to main display.

Connector No.	Pin No.	Port name	Function	Input/putput	Signal level
CN102	1	GA	Travel right	Input	0V
	2	A8			0.5~4.5V
	3	+5VA			Power output 5V
	4	+5VA	Travel left	Input	Power output 5V
	5	A9			0.5~4.5V
	6	GA			0V
	7	GA	Acceleration	Input	0V
	8	A10			0.5~4.5V
	9	+5VA			Power output 5V
	10	+5VA	P1 option	Input	Power output 5V
	11	A13			0.5~4.5V
	12	GA			0V
	13	GA	P2 option	Input	0V
	14	A14			0.5~4.5V
	15	+5VA			Power output 5V
	16	+5VA	Spare	Input	Power output 5V
	17	A27			0.5~4.5V
	18	GA			0V
	19	GA	Spare	Input	0V
	20	A28			0.5~4.5V
	21	+5VA			Power output 5V
	22	D1 37	Indipendent translation	Input	GND / OPEN

Connector No.	Pin No.	Port name	Function	Input/putput	Signal level
CN103	1	GA	Swing	Input	0V
	2	A			0.5~4.5V
	3	+5VA			Power output 5V
	4	+5VA	P1 pump	Input	Power output 5V
	5	A11			0.5~4.5V
	6	GA			0V
	7	GA	P2 pump	Input	0V
	8	A12			0.5~4.5V
	9	+5VA			Power output 5V
	10	+5VA	Lifting arm potentiometer	Input	Power output 5V
	11	A15			0.5~4.5V
	12	GA			0V
	13	GA	Penetration arm potentiometer	Input	0V
	14	A16			0.5~4.5V
	15	+5VA			Power output 5V
	16		Reserved		

SMC0714

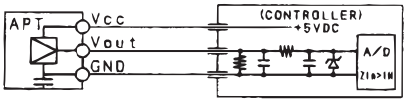
4) High pressure sensor : LS52S00015P1



SPECIFICATION :
PRESSURE RANGE : 0～50 MPa (0～7110 psi)
POWER SOURCE VOLTAGE : 5.0+0.5V DC
OUTPUT : 1/10Vs-9/10Vs
(Vs=5V DC 0.5～4.5V DC)
INSURANCE RESISTANCE : 100M Ω OR MORE
(BETWEEN CASING AND ALL IN/OUT
TERMINALS AT 50V DC MEGGER)

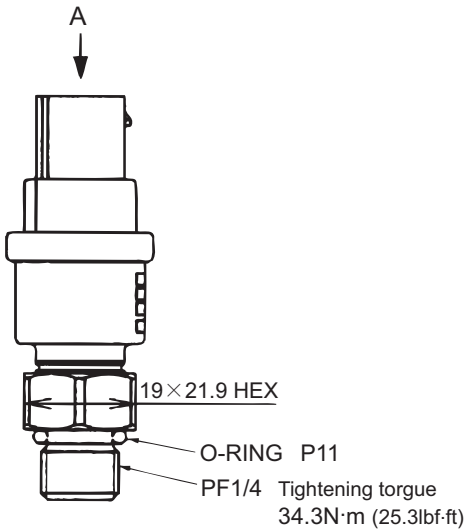
ELECTRIC CONNECTING DIAGRAM

(Ex. Construction of internal controller)



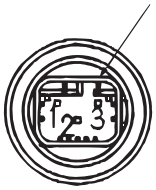
SMC0323

5) Low pressure sensor : LC52S00019P1



DETAIL OF SENSOR CONNECTOR

AMP MQS CONNECTOR 3 POLE (B TYPE)
OPPOSITE CONNECTOR (FEMALE)
HOUSING : 2-967642-1
TERMINAL (GOLD PLATED) : 965906-5



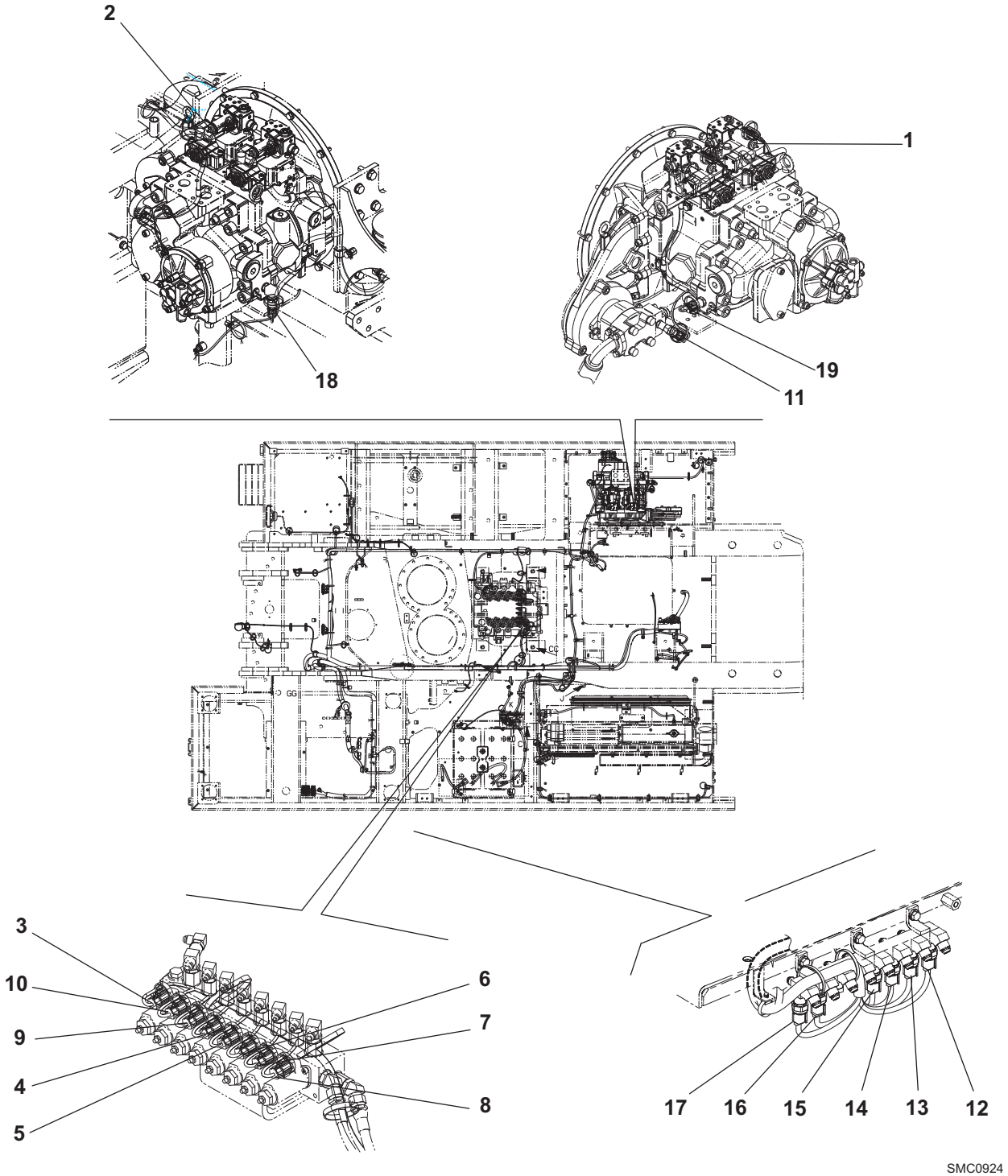
CONNECTOR TERMINAL POSITION
TERMINAL No.
1－COM
2－OUT PUT (+)
3－POWER (+)

VIEW A

SPECIFICATION :
PRESSURE RANGE : 0～3.0 MPa (0～448 psi)
RATED VOLTAGE : 5.0+0.5V DC
INSURANCE RESISTANCE : 100MΩ OR MORE
(BETWEEN BODY AND EACH TERMINAL AT
50V DC MEGGER)

SMC0324

D – HYDRAULIC SYSTEM ELECTRICAL COMPONENTS (1)



1 - Pump P2 proportional solenoid valve (PSV-P2)
2 - Pump P1 proportional solenoid valve (PSV-P1)
3 - Lever lock solenoid valve (SV-4)
4 - Power boost solenoid valve (SV-2)
5 - P2 Unload proportional solenoid valve (PSV-B)
6 - Travel priority prop. solenoid valve (PSV-C)
7 - P1 Unload proportional solenoid valve (PSV-D)
8 - Arm 2 inverse prop. solenoid valve (PSV-A)
9 - Two speed select solenoid valve (SV-3)
10 - Swing parking brake solenoid valve (SV-1)
11 - Extra pressure sensor (SE-28)
12 - Bucket digging sensor (SE-1)
13 - Bucket dump sensor (SE-2)
14 - Boom raising sensor (SE-3)
15 - Boom lowering sensor (SE-4)
16 - Arm in sensor (SE-7)
17 - Arm out sensor (SE-8)
18 - Pump P1 sensor (SE-22)
19 - Pump P2 sensor (SE-23)

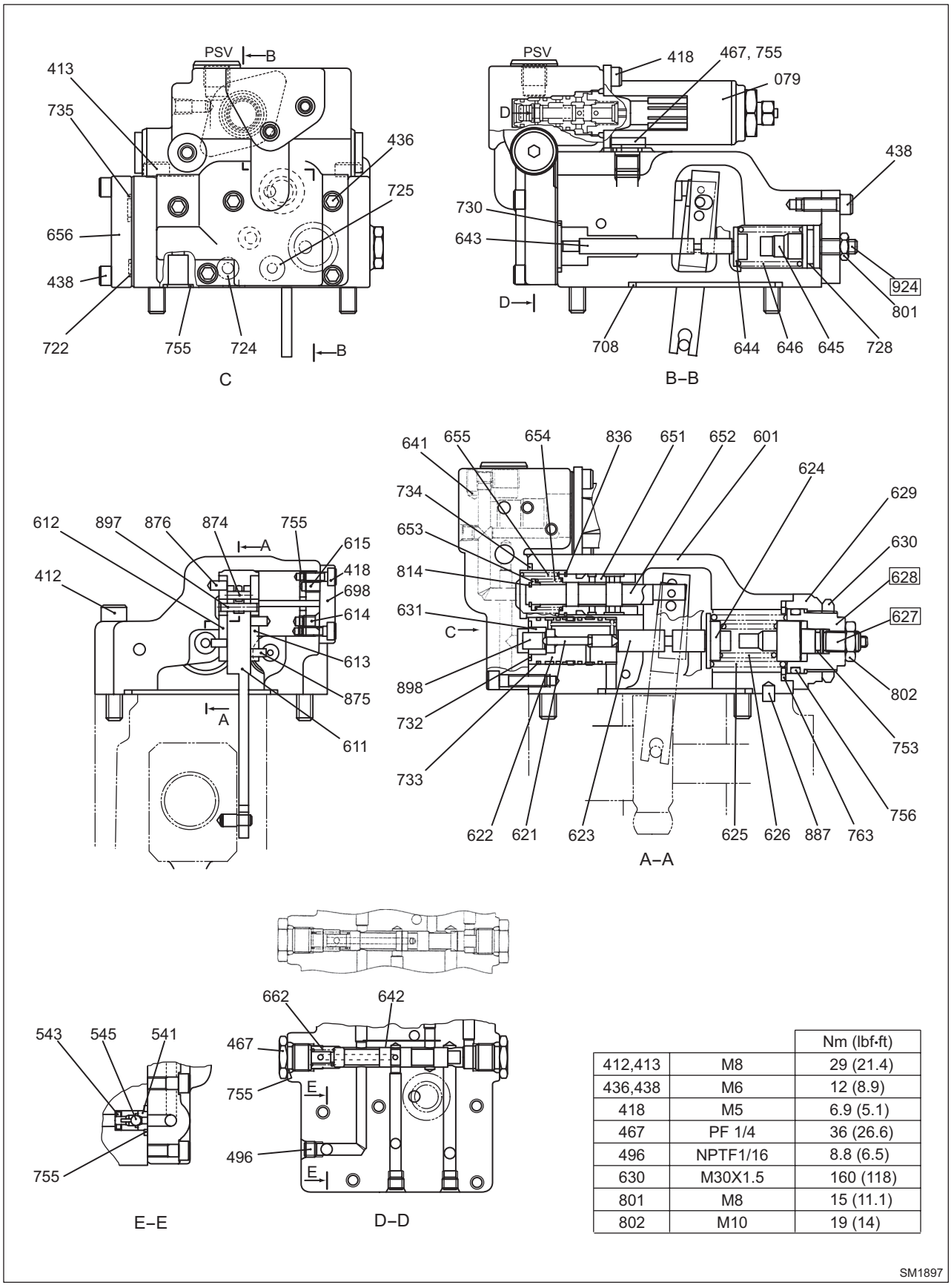
Group 7 - Cylinders

Group 8 - Air conditioner system

Group 9 - Electrical Equipment

REGULATOR

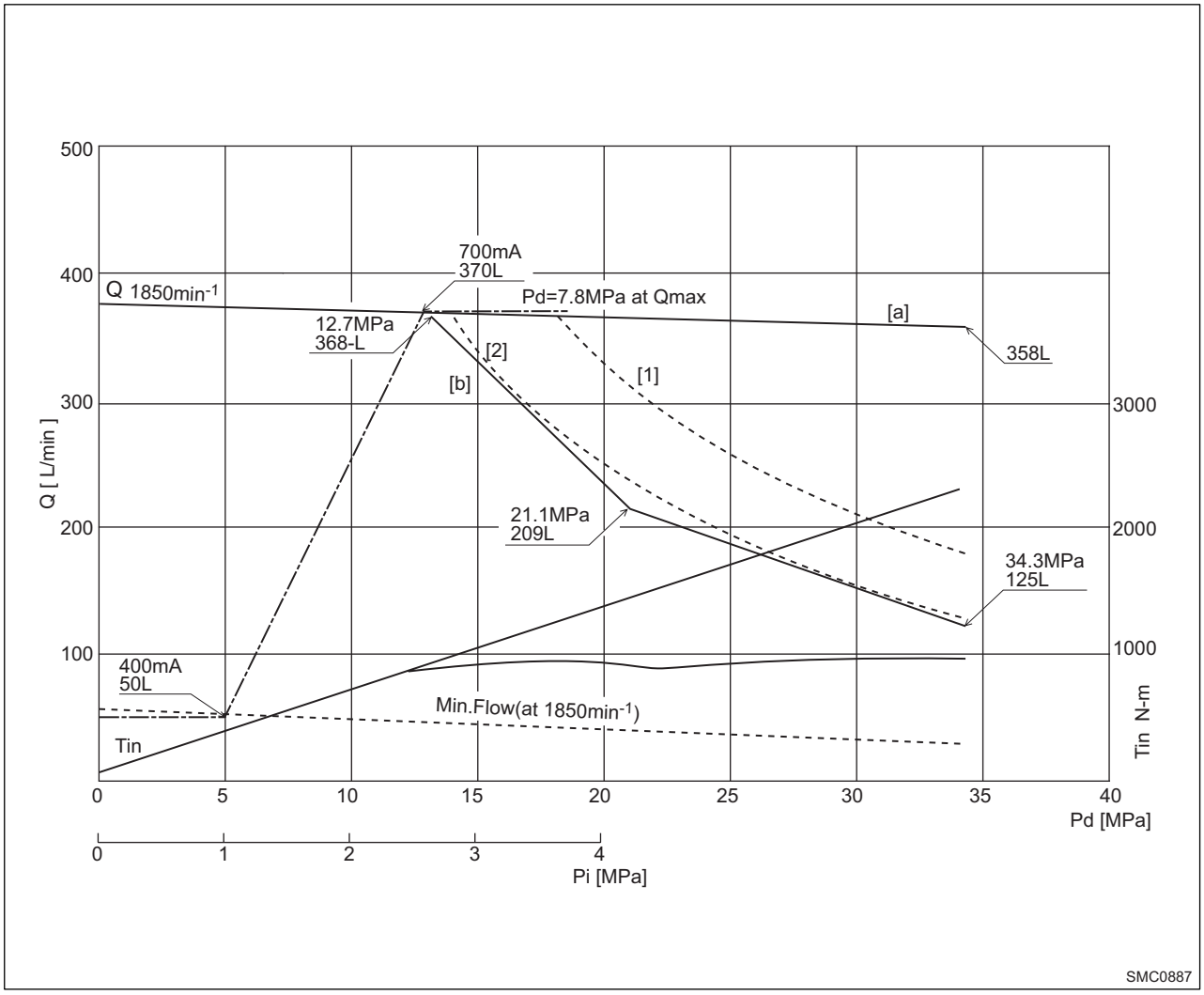
Construction



		Nm (lbf·ft)
412,413	M8	29 (21.4)
436,438	M6	12 (8.9)
418	M5	6.9 (5.1)
467	PF 1/4	36 (26.6)
496	NPTF1/16	8.8 (6.5)
630	M30X1.5	160 (118)
801	M8	15 (11.1)
802	M10	19 (14)

SM1897

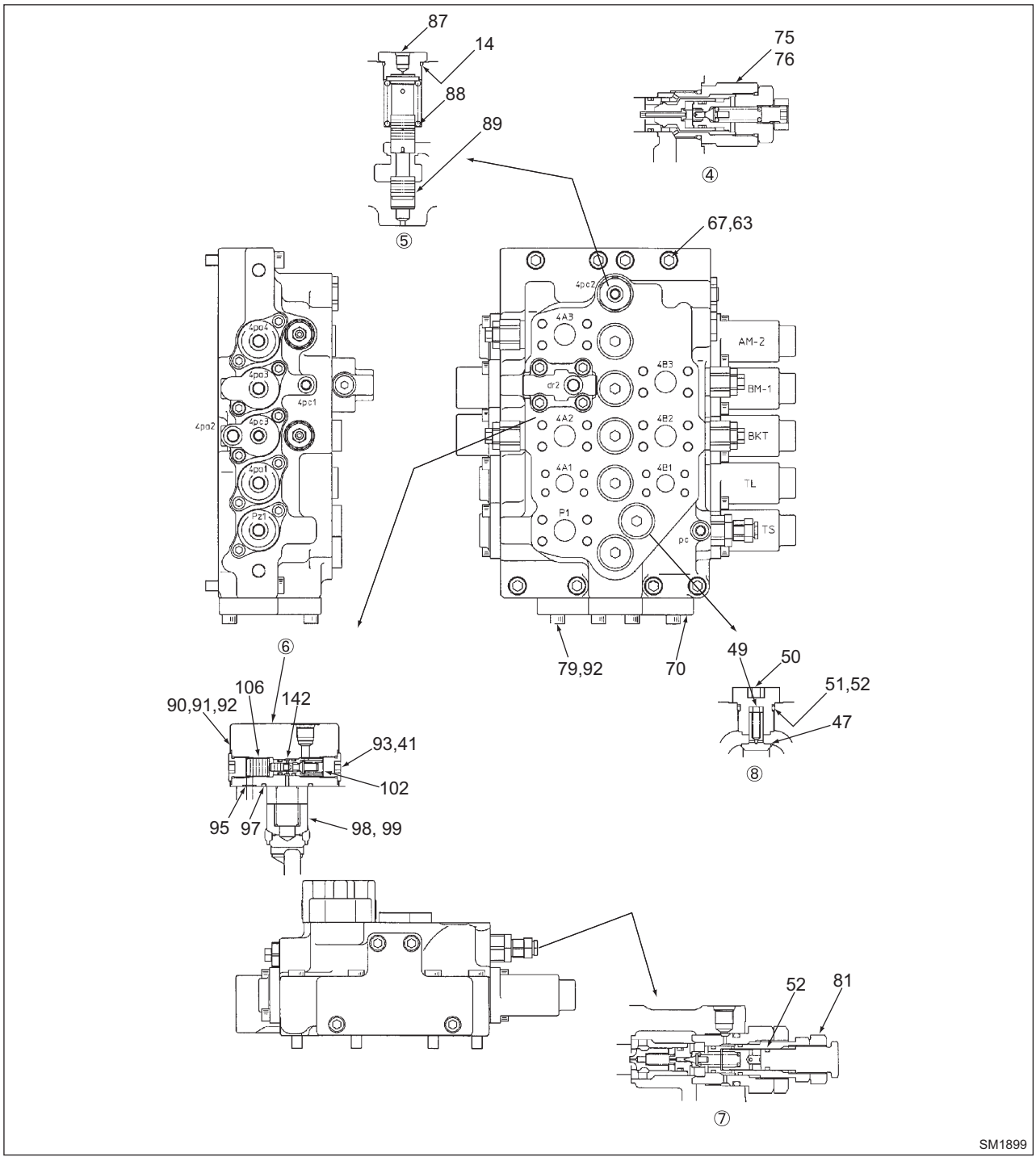
CONTROL CURVE OF PUMP



Two pumps loaded:
[1] 257 kW E/G horse power
[2] 198 kW at emergency mode

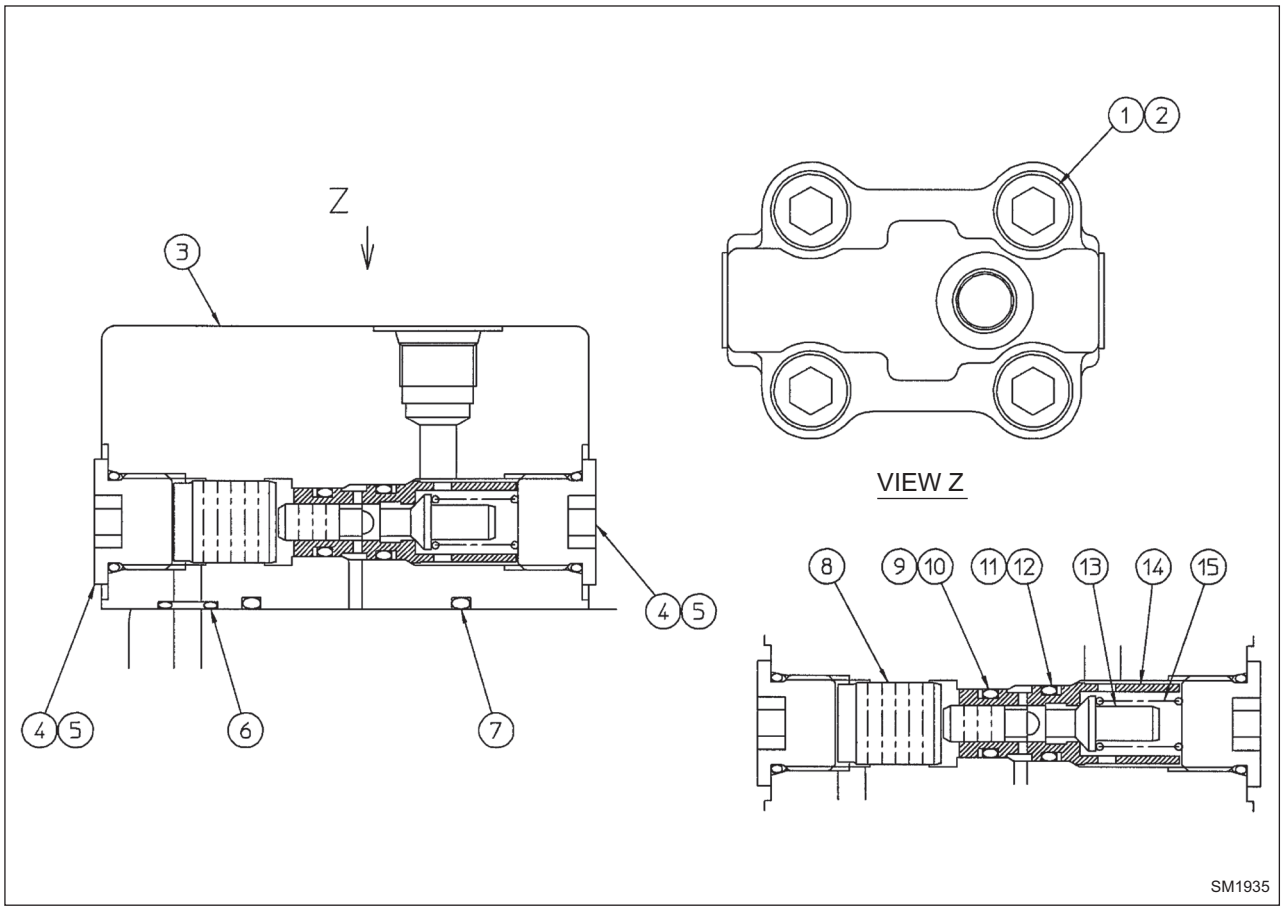
Input revolution: 1850 min^{-1}
Input horsepower: 257 kW
Input torque: 1327 Nm

CONSTRUCTION

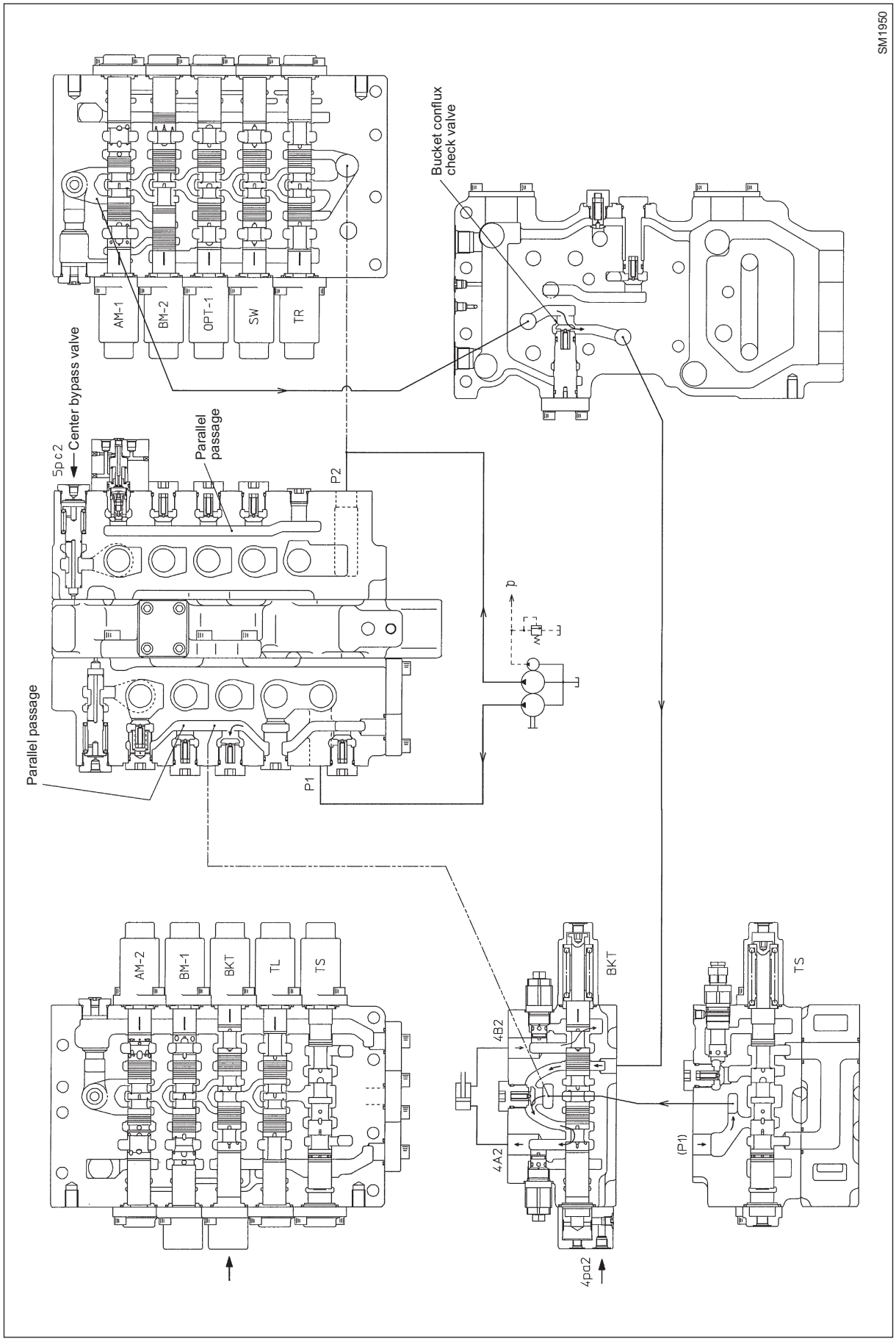


④ **Over load relief valve (BM-1, BKT)**
⑤ **Center by pass valve (OPT Conflux)**
⑥ **Load holding valve pilot**
⑦ **Main relief valve**
⑧ **Check valve**

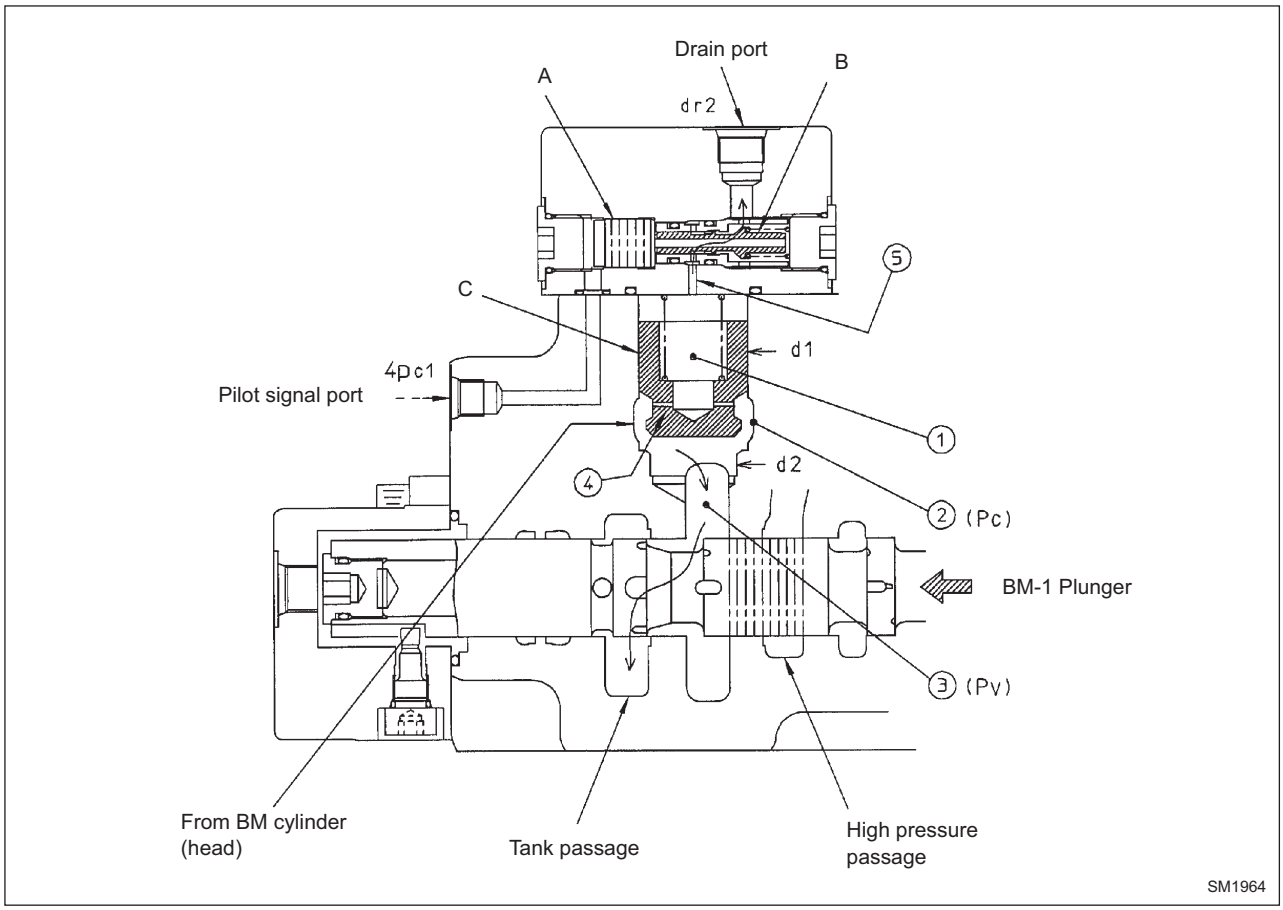
Load holding valve pilot (AM-1, BM-1)



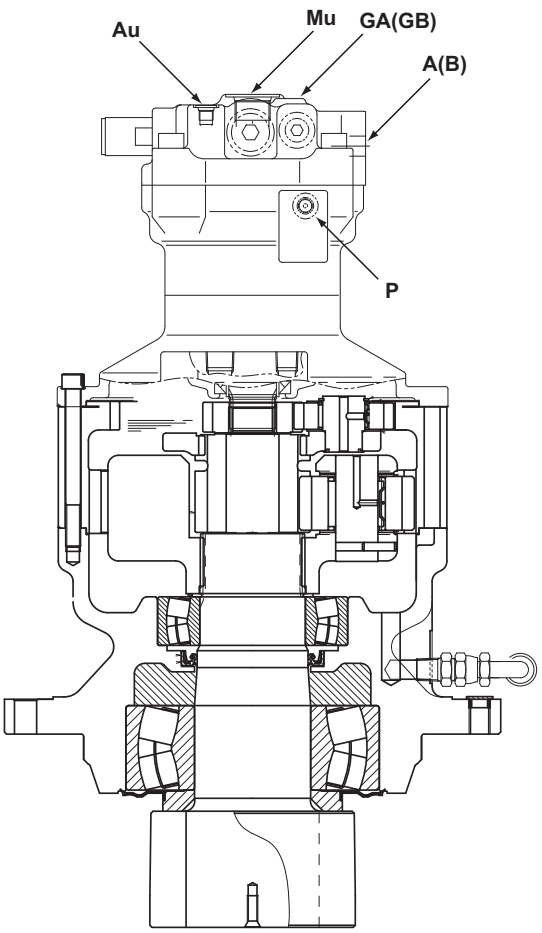
1 - Socket bolt (Q.ty 4)
2 - Washer (Q.ty 4)
3 - Cover
4 - Plug (Q.ty 2)
5 - O-Ring (Q.ty 2)
6 - O-Ring
7 - O-Ring
8 - Piston
9 - Back-up ring
10 - O-Ring
11 - O-Ring
12 - Back-up ring
13 - Poppet
14 - Sleeve
15 - Spring



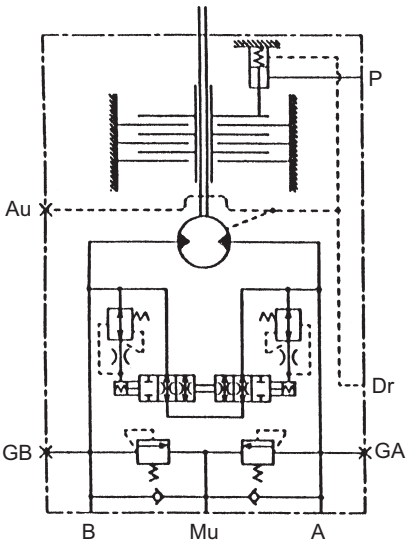
BUCKET FLOW SUMMATION CIRCUIT



2.2. Boom-down operation (pilot signal **4pc1**: ON)
Piston "**A**" and poppet "**B**" is switched by the pilot pressure, the passage "**5**" is connected to the drain port "**dr2**".
Then the pressure of the chamber "**1**" comes to lower than that of the core "**2**", and the pressure of the core "**2**" acts on the differential area (**d1**, **d2**) to push up the poppet "**C**".
Return oil from "**BM**" cylinder flows into the tank passage through the core "**3**".



SM1973

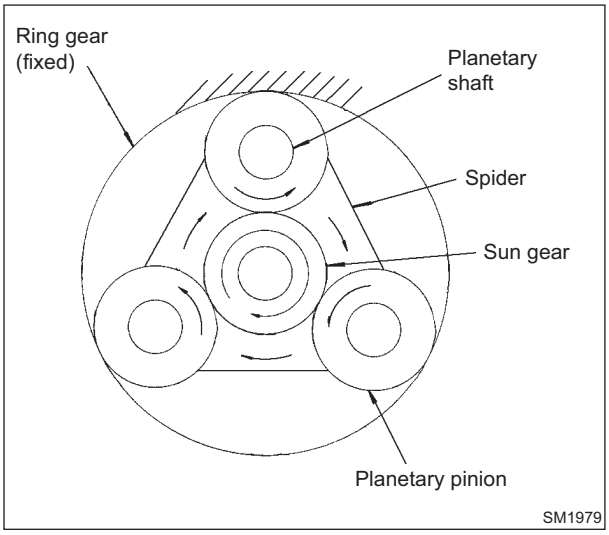


Hydrailic diagram

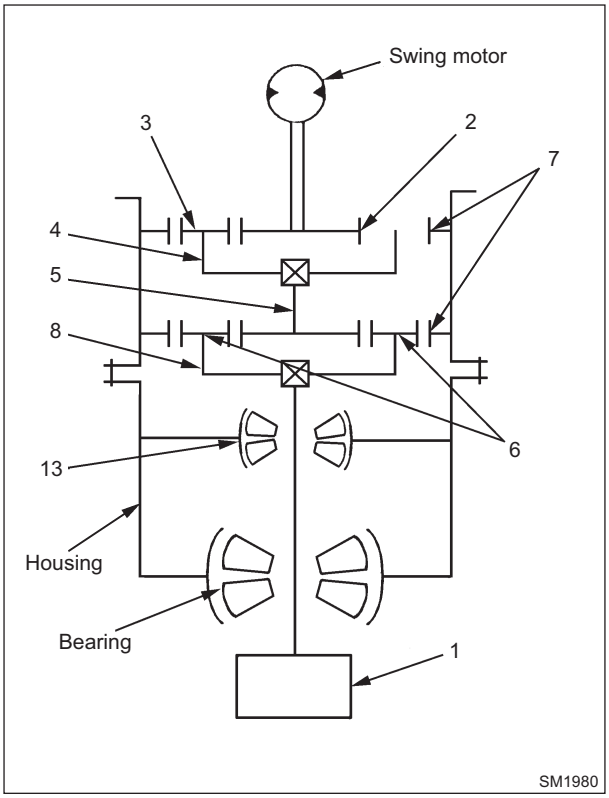
SM1974

Swing reduction unit

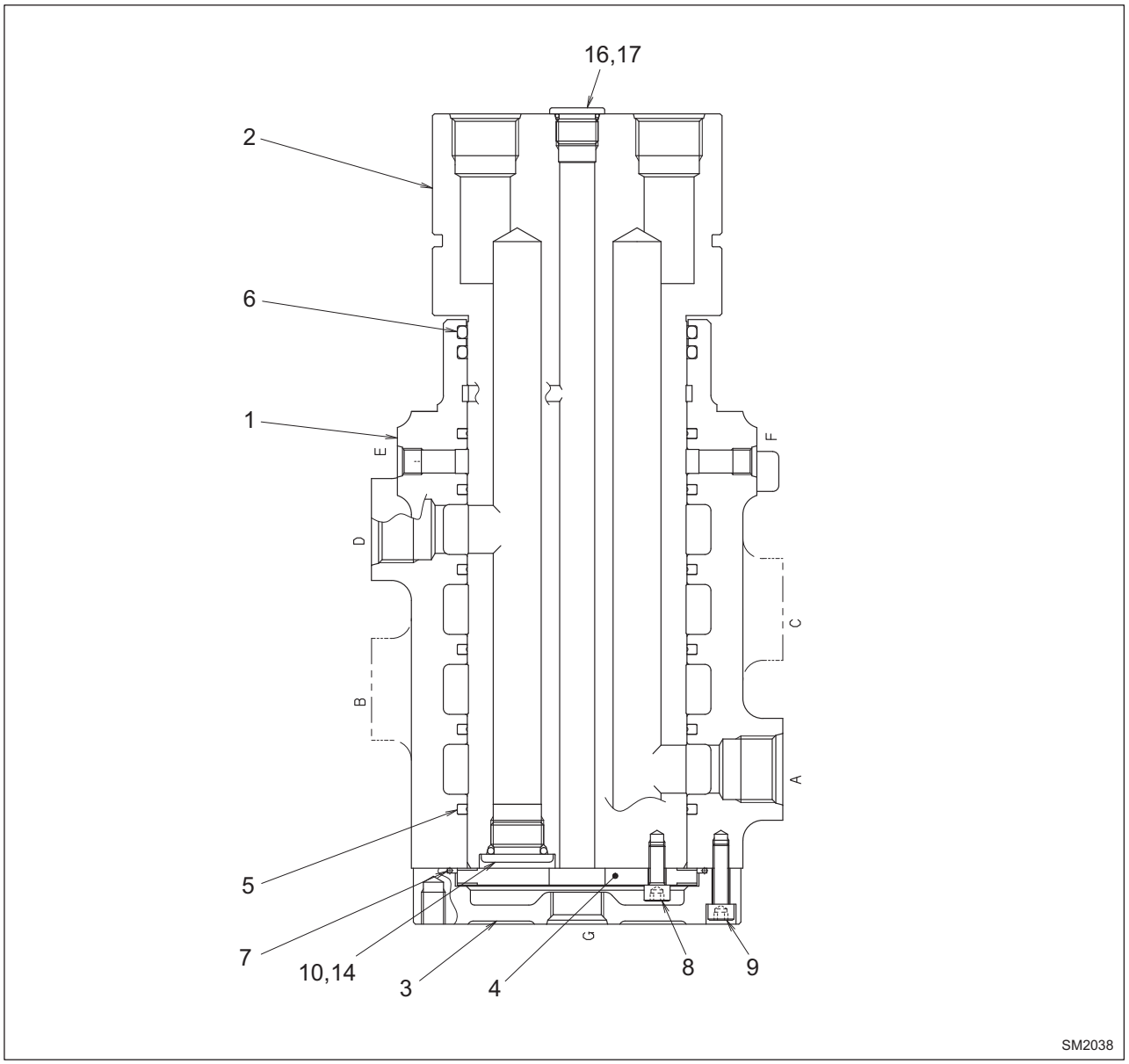
The swing reduction unit is used to reduce the rotating speed which is transmitted by the hydraulic motor and to convert it to the strong turning effort (torque).
This swing speed reduction unit is equipped with planetary speed reducing mechanism.
The planetary mechanism is made up of sun gear, planetary pinion, planetary shaft, spider and ring gear, as shown.
For the operation of the 1st stage planetary, the hydraulic motor rotates #1 sun gear (**2**). Sun gear (**2**) is engaged with planetary pinion (**3**) and rotates, but since ring gear (**7**) is fixed, planetary pinion (**3**) revolves about sun gear (**2**) with the planetary shaft and spider (**4**).



The role of spider is to hold the planetary pinion and planetary shaft and transmits the power from the planetary pinion to the spider through the planetary shaft.
The #1 spider (**4**) is linked with #2 sun gear (**5**) by the involute spline, and transmits the power to the 2nd stage planetary mechanism.
For the operation of the 2nd stage planetary, the power is transmitted to sun gear (**5**) → planetary pinion (**6**) → spider (**8**) similarly to the 1st stage.
The #2 spider (**8**) is linked with pinion shaft (**1**) by the involute spline, and pinion shaft (**1**) is engaged with the swing gear fixed on the undercarriage (lower frame) and rotates.

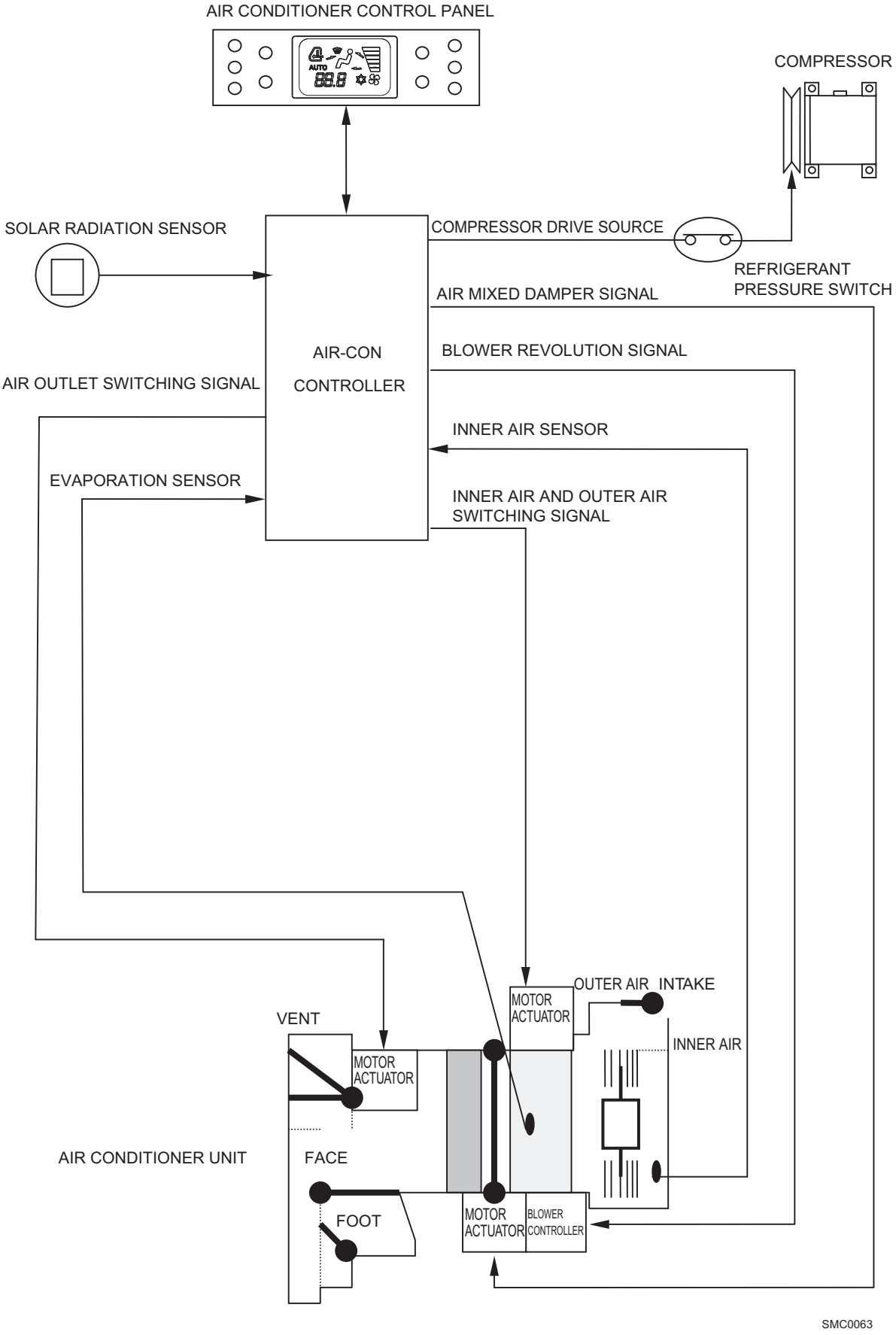


CONSTRUCTION



1- Body
2- Stem
3- Cover
4- Thrust plate
5- Seal (Q.ty 6)
6- O-Ring (Q.ty 2)
7- O-Ring
8- Capscrew; M8x20 (Q.ty 2) 30.4 Nm (22.4 lbf·ft)
9- Capscrew; M8x30 (Q.ty 4) 30.4 Nm (22.4 lbf·ft)
10- Plug (Q.ty 4)
11- Plug
14- O-Ring (Q.ty 4)
16- Plug
17- O-Ring

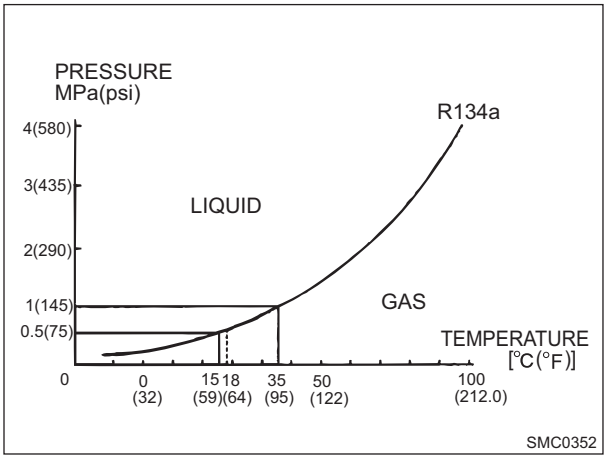
AUTO AIR CONDITIONER SYSTEM OUTLINE



CHARACTERISTICS OF REFRIGERANT

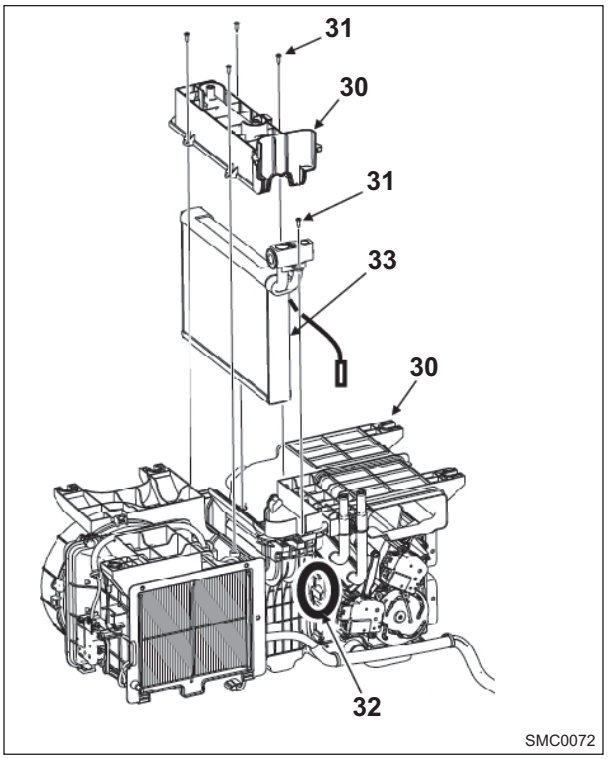
In general, the fluid (general term of gas and liquid) has the following qualities:

1. As a gas under certain pressure is cooled down, it begins to condensate at a certain temperature to take a liquid state. The temperature at which condensation begins is unique to each substance (fluid) at a given pressure. The temperature determined by a given pressure is called saturation temperature.



2. Inversely to 1. above, the pressure at which a gas condenses for a temperature is determined. This pressure is called saturation pressure.
   Figure above illustrates the relationships between the saturation temperature and the saturation pressure in the case of refrigerant R134a used in the air-conditioner. At the temperature and the pressure on the lower righthand side of the curve in above figure the refrigerant take a gaseous state, while at the temperature and the pressure on the upper lefthand side of the curve, the refrigerant takes a liquid state.
   Let us think of a case where an air-conditioner is operated in the midst of summer. As the refrigerant evaporates, it absorbs evaporation heat from the air of the compartment. In order to cool the inside of the compartment down to 25°C (77°F), the refrigerant must transform (evaporate) from a liquid to a gaseous state at a lower temperature. It can be seen from the above figure that R134a under a pressure above the atmospheric pressure is capable of cooling the inside of the compartment sufficiently. (If a refrigerant that requires a pressure below the atmospheric pressure to cool it to a required temperature is used, air is mixed into the circuits, thereby deteriorating the performance of the cooling unit.) In the process in which gaseous refrigerant is brought back to a liquid state, the refrigerant is cooled and condensed by the outer air exceeding 35°C (95°F).
   Accordingly the refrigerant is capable of condensing at a pressure exceeding 1 MPa (145 psi), as seen from the above figure.

9. Disassembly and assembly of evaporator
   1) Turn HVAC unit (**30**) upside down.
   2) Loosen 5 tapping screws (**31**).
   3) Disconnect connector of evaporator sensor (**32**).
   4) Pull out evaporator (**33**).
   5) Assemble the evaporator in the reverse order of disassembly.



CAUTION

To avoid damage, pull out evaporator sensor cord from groove of HVAC unit carefully.

10. Disassembly and assembly of expansion valve
    1) Loosen 2 socket bolts (**34**).
    2) Remove expansion valve (**35**).

CAUTION

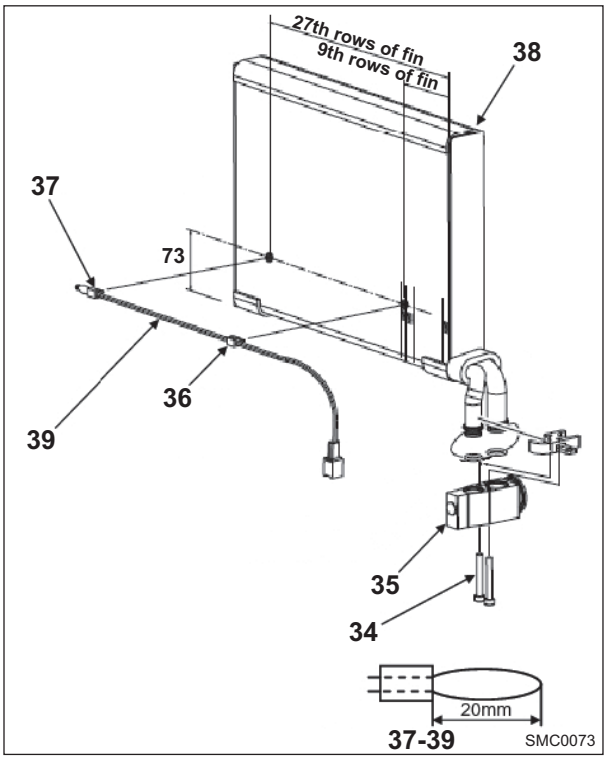
Do not exert excessive load on piping.

    3) Assemble the expansion valve in the reverse order of disassembly.
    4) Prior to assembly, apply PAG oil to O-ring.

CAUTION

Breakage of O-ring causes gas leak.

11. Disassembly and assembly of evaporator sensor (**39**)
    1) Remove harness holder (**36**) and thermistor holder (**37**) from evaporator (**38**).



CAUTION

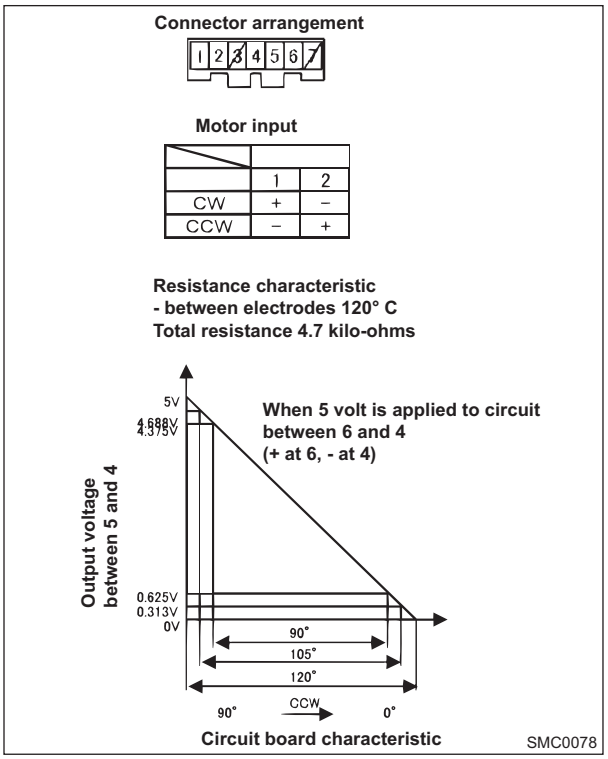
To avoid trouble, do not pull cord forcibly.

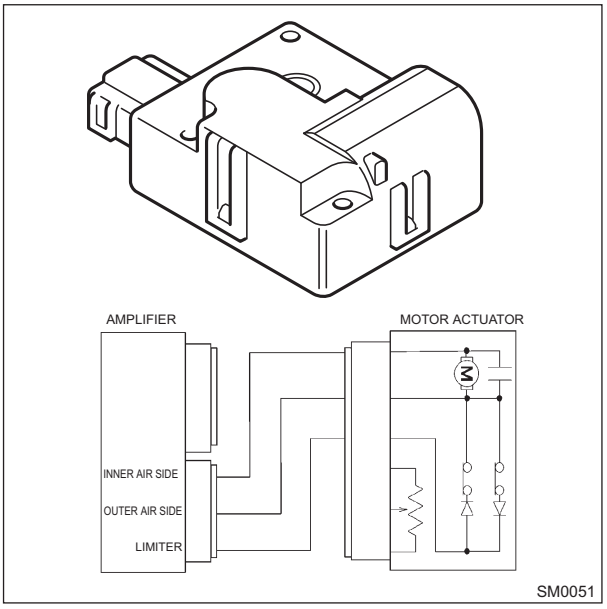
    2) Assemble the evaporator sensor in the reverse order of disassembly.
    3) Install the harness holder and thermistor holder as shown.
    4) Install the tip of sensor and thermistor holder as shown.

CAUTION

When the sensor cord is loose-fitted, the cord is caught by door.

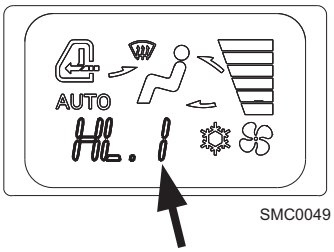
5. Mode actuator
   Mode actuator is located in outlet of air conditioner unit. And it opens or closes mode door through link motion.
   The mode actuator incorporates potentiometer which is switched by linked shaft with actuator. When the target air mix door position is determined through the temperature control switch, the control unit reads the level of potentiometer of the actuator. And it determines the rotating direction of motor in either normal or reverse rotation. And the motor rotates, the contact point is detached or the output signal of control unit turns OFF, the motor stops.
6. The actuator for air inlet / outlet (12V)
   The actuator for inlet and outlet air mode select is installed on the blower intake unit, and opens and closes inlet or outlet air damper through the link motion. The actuator for inlet and outlet air mode select incorporates position detection switch which is switched with the movement of shaft of the actuator.
   When the inlet and outlet damper position is set by the inlet and outlet switch on the control panel, the control unit reads the signal of the position detection switch in the actuator and determines the rotation direction of motor in either normal rotation or reverse rotation. And the motor rotates, the position detection switch also rotates and makes it stop at the set position of the inlet or outlet air damper.





Failures of sensors

1. HL.* is indicated on 3 digits segment.



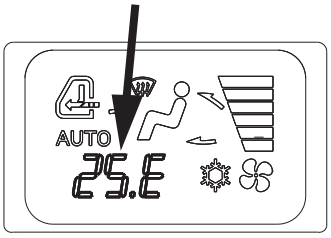
SMC0049

Check the inner air sensor or the harness for disconnection and short circuit, and also connectors for disconnection.

(* is any of the numbers 0 to 9.)

2. **E and mark is shown on display.

(** is displayed leaving the present set temperature value.)



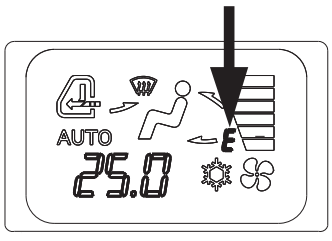
SMC0050

Check evaporator sensor or the harness for disconnection and short circuit, and also connectors for disconnection.

Note:The above displays in items 1) and 2) are indicated by 3 digits segment when error occurred under the condition the panel ON/OFF switch is ON.
And, after correction of failure if the panel ON/OFF switch is switched from OFF to ON, the error indication is released.

Communication error of control amplifier and panel

1. E is indicated on the only use segment of display.



SMC0051

Check the harness of control amplifier and panel for disconnection, and connectors for poor connection.

Code No. Parts Name Parts No. Use	Specifications	Description

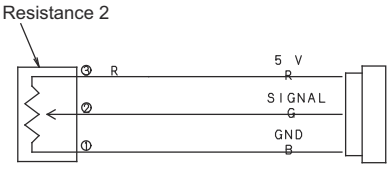
E - 27

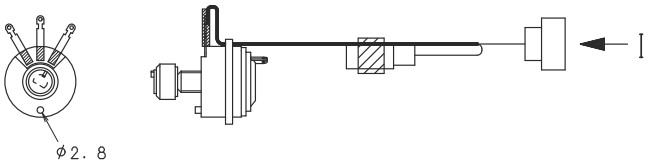
Potentio meter

87526094

"Emergency mode"

Rated voltage		DC 5V
Parts	Resistance 2 E-27	TOCOS RA30YME20FB202





3MA-CNA (L)
HOUSING : 172131-5
TERMINAL : 170340-1
VIEW I

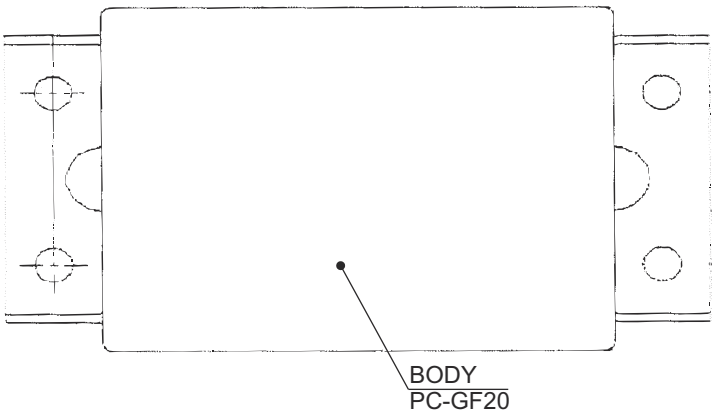
E - 63

DC-DC Converter (for camera)

YN77S00040P1

DC24V → DC8V

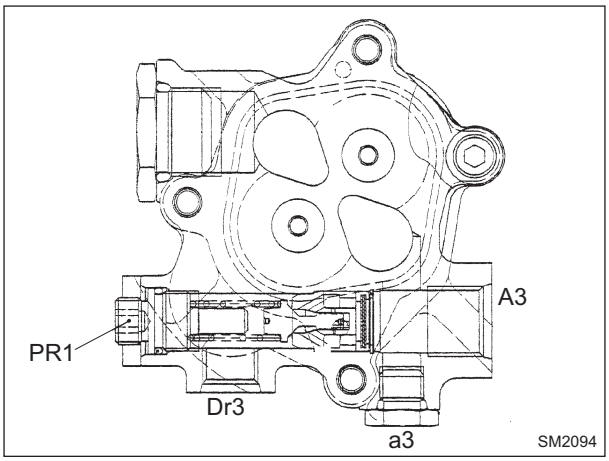
Use conditions power-supply voltage	+20~32V



SMC0720

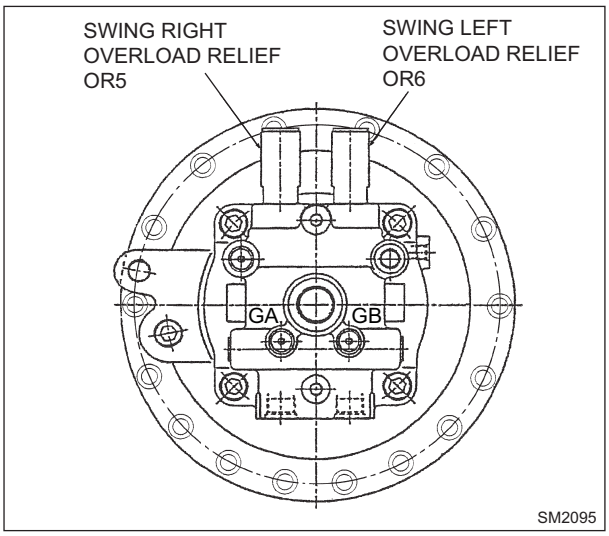
PILOT RELIEF VALVE

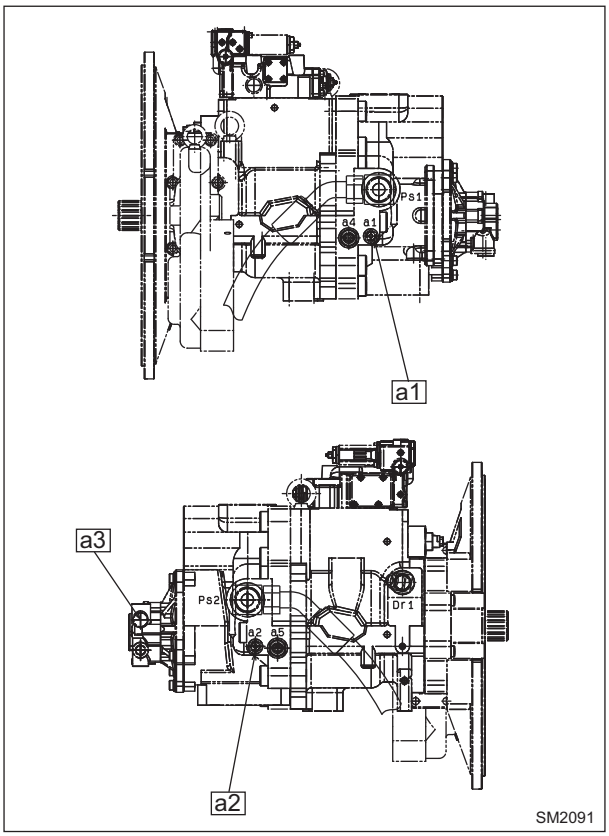
The pilot relief valve PR1 is located on the gear pump that is attached to the main pump.



SWING OVER LOAD RELIEF

The swing motor is equipped with plugs GA, GB for pressure measurement, but the measurement is carried out using gauge ports (**a1**) and (**a2**).
(This drawing shows the swing motor right side use.)

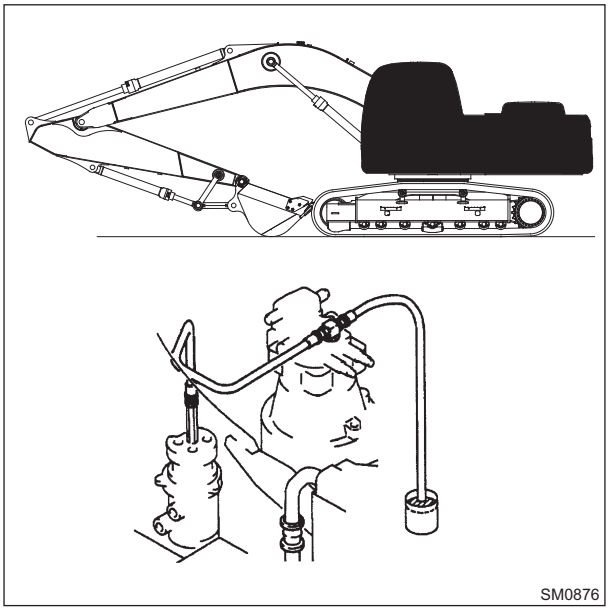




Drain rate of swing motor

PURPOSE

Measure the drain rate of the swing motor and confirm the performances of the swing motor.



CONDITIONS

Hydraulic oil temperature: 45~55°C (113~131°F)
Firm, level ground
Engine revolution: Hi idle

PREPARATION

1. Stop the engine.
2. Release pressure from inside the hydraulic circuit.
3. Disconnect the swing motor drain hose from its end returning to the hydraulic oil tank and take oil in a container.
4. Put a plug to the tank side.

MEASUREMENT AT SWING LOCK

1. Start the engine and put the side faces of bucket against the inside of the right or left shoe plates.
2. Relieve the swing motor at full stroke of the swing motion.
3. Collect the amount of drained oil in a container for 30 seconds.

Drain rate of swing motor Unit : L(gal)/30sec

Measuring position	Standard value	Reference value for remedy	Service limit
Drain rate	1.5 (0.40)	3.0 (0.79)	4.5 (1.19)

Operations in the event of a failure of equipment of mechatro controller

ENGINE EMERGENCY MODE

When the trouble occurs and the control of engine is impossible, the engine speed can be controlled by operating emergency acceleration (E-27) provided on the seat rear side.

Operating procedure:

1. Set the emergency acceleration to NORMAL position.
2. Start engine.
3. Turn the emergency acceleration to HI side and control the engine speed.
4. When stopping the engine, set the emergency acceleration to NORMAL position before stopping.

Never increase the engine speed immediately after starting engine. It is dangerous.
To avoid this danger, repeat the above procedure, or the engine speed does not increase.
When the machine does not operate, set the emergency acceleration to NORMAL position.

PUMP EMERGENCY MODE

In the event where a failure of P1 or P2 pump proportional valve represented in items of self diagnosis is indicated on multi display provided on the gauge cluster, the full power control of pump and positive control through mechatro controller are unavailable. Then the P1 and P2 pumps are automatically switched to emergency mode, making the operation with the power shift control of pump and the constant power control by means of self-pressure possible. But be careful that, at emergency mode, the accuracy of inching becomes poor, the frequency of engine down is increased, and the engine stalls in LOW speed condition.

CAUTION

The emergency mode should be used in only case of emergency. We recommend that the defective section is repaired by troubleshooting as early as possible.

2. CLASSIFICATION OF FAILURE AND TROUBLESHOOTING

Classify failures into the following 3 types and carry out the troubleshooting.

No.	Classes of failure	Troubleshooting
A	When error code after self-diagnosis is displayed on gauge cluster	Carry out troubleshooting according to the error code.
B	When no failure is detected currently but error code after self diagnosis is remained in trouble history	When it is hard to recreate the failure situation, cancel the data in the history and reproduce the failed situation or suppose the cause according to the troubleshooting by error code, and then repair it.
C	When error code after self diagnosis is not displayed or is not remained in the history	• Carry out troubleshooting according to instructions in Chapter T5-2 "TROUBLESHOOTING BY TROUBLE". • Carry out troubleshooting according to instructions in Chapter T5-3 "TROUBLE DIAGNOSIS MODE".

3. THE BLOWN FUSE OF MECHATRO CONTROLLER

If the fuse of mechatro controller has blown, the following display appears on the gauge cluster.

(1) The blown fuse of mechatro controller

a. Blown fuse 5A of mechatro controller :
"DATA COMMUNICATION ERROR" is displayed on the gauge cluster in the condition where the controller program is not executed.

b. Blown fuse 20A of mechatro controller
The controller functions normally but the power supply applied when the controller drives the solenoid, etc. stops.
Many error codes are displayed on the gauge cluster.
D013, D023, D033, D063,
E013, E023, F021

4. TROUBLESHOOTING BY ERROR CODE

When error code was displayed on the gauge cluster with the aid of self-diagnosis display function, carry out the troubleshooting referring to applicable page in the contents of error codes.

Error Code	Trouble	Described page
A025	Pump propo. valve adjustment (B adjustment) is not adjusted yet or is failed.	T5-1-5
A035	Unload valve adjustment (C adjustment) is not adjusted yet or is failed.	T5-1-6
A215	Written data of ROM adjustment data is incorrect.	T5-1-6
A225	Writing of ROM adjustment data is incorrect.	T5-1-7
A235	Written data of ROM hour meter data is incorrect.	T5-1-7
A245	Writing of ROM hour meter data is incorrect.	T5-1-8
A255	Writing of proportional valve adjustment data is incorrect.	T5-1-8
B012	Incorrect output of boom up pressure sensor	T5-1-9
B013	Disconnection of boom up pressure sensor	T5-1-9
B014	Short-circuit of boom up pressure sensor	T5-1-10
B022	Incorrect output of boom down pressure sensor	T5-1-10
B023	Disconnection of boom down pressure sensor	T5-1-11

Table 15

Error code	**B032**		
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 sensor after starter switch ON is in the range of 1.4 V or more to less than 4.7 V.		
Symptom	The arm-out 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-3 ARM OUT
	Screen No.		
	Screen No.		

	Checking object	Checking contents and remedy
1	• Arm-out pressure sensor SE-8	When B032 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 B032 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 16

Error code	**B033**		
Trouble	Arm-out pressure sensor's wiring is disconnecting.		
Judging condition	The input voltage from arm-out pressure sensor is 0.1 V or less.		
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 B033 is cancelled and other error occurs 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 B033 is displayed 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 32

Error code	**B094**		
Trouble	Travel right pressure sensor's power source is shortcut.		
Judging condition	The input voltage from Travel right pressure sensor is 4.7 V or more.		
Symptom	The Travel right 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-9 TRAVEL (R)
	Screen No.		
	Screen No.		

	Checking object	Checking contents and remedy
1	• Travel right pressure sensor SE-9	When B094 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 right pressure sensor and controller CN-301F CN-102F	When B094 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 48

Error code	**C023**		
Trouble	P2 pump pressure sensor's wiring is disconnected.		
Judging condition	The input voltage from P2 pump pressure sensor is 0.1 V or less.		
Symptom	The delicate operability of P2 pump related attachment becomes poor.		
Control in the event of failure	Set P2 pump pressure to 25 MPa and control pump.		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	6	C-2 PUMP P2
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	• P2 pump pressure sensor SE-23	When C023 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 P2 pump pressure sensor and controller CN-140F CN-103F	When C023 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 49

Error code	**C024**		
Trouble	P2 pump pressure sensor's power source is shortcut.		
Judging condition	The input voltage from P2 pump pressure sensor is 4.7 V or more.		
Symptom	The delicate operability of P2 pump related attachment becomes poor.		
Control in the event of failure	Set P2 pump pressure to 25 MPa and control pump.		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	6	C-2 PUMP P2
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	• P2 pump pressure sensor SE-23	When C024 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 P2 pump pressure sensor and controller CN-140F CN-103F	When C024 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 65

Error code	**E013**		
Trouble	P1 pump proportional valve's wiring is disconnected.		
Judging condition	The feed-back value from proportional valve is 100 mA or less. (If output is 100mA 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.		
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-1 PUMP P1
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	• P1 pump proportional valve PSV-P1	When E013 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 P1 pump proportional valve and controller CN-141F CN-105F	When E013 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 80

Error code	**G032**		
Trouble	Mechatro controller direct input speed sensor is overrun.		
Judging condition	Engine rpm input is 3000 rpm or more. (Only trouble history).		
Symptom	Operate without problem.		
Control in the event of failure	Receive rpm from engine controller and control the rpm.		
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 option selector solenoid valve and controller CN-136F CN-105F	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	• Mechatro controller	Check that the error is corrected after replacement of controller.

Table 81

Error code	**G033**		
Trouble	Mechatro controller direct input speed sensor, Disconnection.		
Judging condition	Voltage of alternator is 12 V or more, and speed sensor indicates excess low engine rpm.		
Symptom	Operate without problem.		
Control in the event of failure	Receive rpm from engine controller and control the rpm.		
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	• Mechatro controller	Check that the error is corrected after replacement of controller. (Controller is broken by only applying power to grounding of signal.).

Table 96

Error code	**I211**		
Trouble	Reception of CAN1 communication is abnormal. (Passive error)		
Judging condition	Reception from gauge cluster can not receive correctly.		
Symptom	Switch operation of gauge cluster can not be done.		
Control in the event of failure	Normal control		
Returned in normal condition	Normal control		
Service diagnosis checking screen	Screen No.		
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	-Wiring between gauge cluster and controller CN-601F CN-106F	Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
2	-Mechatro controller	Check that the error is corrected after replacement of controller.

Table 97

Error code	**I213**		
Trouble	Reception of CAN2 communication is abnormal. (Time-out)		
Judging condition	Reception from gauge cluster can not receive correctly.		
Symptom	Switch operation of gauge cluster can not be done.		
Control in the event of failure	Normal control		
Returned in normal condition	Normal control		
Service diagnosis checking screen	Screen No.		
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	-Wiring between gauge cluster and controller CN-601F CN-106F	Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
2	-Mechatro controller	Check that the error is corrected after replacement of controller.

Table 107

Error code	**R164**		
Trouble	Auto idle stop relay 2 relay error.		
Judging condition	The mechatro controller output line to auto idle stop relay 2 is short-circuited with the power source.		
Symptom	Power source for mechatro controller often turns off. Auto idle stop relay 2 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-1 AIS RELAY 2
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	• Auto idle stop relay 2 relay R-24	When error is cancelled after removing of auto idle stop relay 2, check relay unit for failure, replace it with new one if failed. When resistance between relays (1) and (2) is 0 Ω , it is in abnormal condition. 
2	• Wiring between auto idle stop relay 2 and controller CN-109F, CN2-2 • Fuse & relay box E-1	When R164 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 R164 is left displayed. Replace fuse/relay box.
3	• Mechatro controller	Check that the error is corrected after replacement of controller.

3. Move at lever neutral position

No.	Sections	Contents/normal value		Corrective action, others
1	Pilot pressure sensor	Carry out service diagnosis	Check that targeted pilot pressure of sensor is 0MPa in high idling	Check remote control valve
2	Remote control valve	Check targeted remote control valve	Check that spool is free from abnormal damage and spring is free from breakage	Replace
3	Main spool	Check targeted spool visually	Check that spool is free from abnormal damage and spring is free from breakage	Replace
4	Over load relief valve	Check targeted spool visually	Free from dust entered in port relief valve. Seat is free from abnormality	Replace
5	Lock valve poppet (in case of boom and arm)	Check targeted poppet visually	Seat is free from abnormality	Replace
6	Lock valve selector (in case of boom and arm)	Exchange lock valve selector of boom/arm and boom/arm	Check that the trouble is reversed	Replace
7	Holding valve spool for boom (in case of boom)	Check that smooth sliding of spool in sleeve	Free from abnormal resistance against sliding	Replace Do not pull spool out of sleeve forcibly.
8	Holding valve relief valve for boom (in case of boom)	Check targeted spool visually	Filter free from abnormal contamination	Replace
9	Cylinder	Check targeted cylinder visually	Make sure of no problem of seals by disassembling and investigation	Replace cylinder or seals

4. Poor fine operability

No.	Sections	Contents/normal value		Corrective action, others
1	Pressure sensor	Carry out service diagnosis	• See Service Diagnosis Data List Operation No. 1 Operation is nil • All low pressure sensors are 0MPa to 0.1 MPa	Replace pressure sensor
2	Unload solenoid proportional valve (Travel straight proportional valve)	Carry out service diagnosis	• No.21 D-06 • At normal: OFF • At pressure release: ON	Check controller for possible failure.
3	Secondary pressure of unload solenoid proportional valve (Travel straight proportional valve)	Measure the secondary pressure of unload proportional valve directly (A port)	• At normal: 0 Mpa • At pressure release: 4 MPa or more	Replace solenoid proportional valve.
4	Actual measuring current value of P1/P2 pump proportional valve	Carry out service diagnosis	• No.9 E-1 P1 pump E-2 P2 pump • See Service Diagnosis Data List Operation No. 1 Operation is nil	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
18	Over load relief valve	Check targeted spool visually	Free from dust entered in over load relief valve. Seat is free from abnormality.	Replace

10. Bucket dump is slow

No.	Sections	Contents/normal value		Corrective action, others
1	Bucket dump pressure sensor	Carry out service diagnosis	• See Service Diagnosis Data List Operation No.14 Bucket dump full lever and relief	Check and replace pressure sensor Check remote control valve
2	Remote control valve	Measure directly remote control pressure of bucket dump	Check that pressure is 3.0 MPa or more in bucket dump full lever and high idling operation	Check remote control valve When equipped with multi control valve, check it while changing lever pattern
3	Pump pressure sensor	Carry out service diagnosis for P1, P2 pump pressures in operation.	• See Service Diagnosis Data List Operation No.15 Bucket dump full lever and in operation	When there is difference between P1 and P2 pump pressures, check high pressure sensor
4	Unload solenoid proportional valve (Travel straight proportional valve)	Carry out service diagnosis	• No.21 D-06 • At bucket dump : OFF • At pressure release: ON	Check controller for possible failure.
5	Secondary pressure of unload solenoid proportional valve (Travel straight proportional valve)	Measure the secondary pressure of unload proportional valve directly (A port)	• At bucket dump: 0 Mpa • At pressure release: 4 MPa or more	Replace solenoid proportional valve
6	Actual measuring current value of P1/ P2 pump proportional valve.	Carry out service diagnosis	• No.9 E-1 P1 pump E-2 P2 pump • See Service Diagnosis Data List Operation No.15 Bucket dump 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.
7	Secondary pressure of P1, P2 pump proportional valve	Measure the pump proportional valve secondary pressure directly (Ports a6, a7)	Check that P1 pump proportional valve pressures is 1.6 MPa or more and P2 pump proportional valve pressure is 1.6 MPa in bucket dump full lever and high idling operation.	Replace proportional valve
8	Actual measuring current value of P2 bypass cut proportional valve	Carry out service diagnosis	• See Service Diagnosis Data List Operation No.14 Bucket dump full lever & relief	In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
9	Secondary pressure of P2 bypass cut proportional valve	Measure directly the proportional valve secondary pressure at the port A5 (Bypass cut) of 8 sections solenoid block	Check that travel straight secondary pressure is 2.7 MPa or more in bucket dump full lever and high idling operation	Replace proportional valve

20. Breaker works slowly and power is poor (In case of conflux, check P1 side bypass valve and pump)

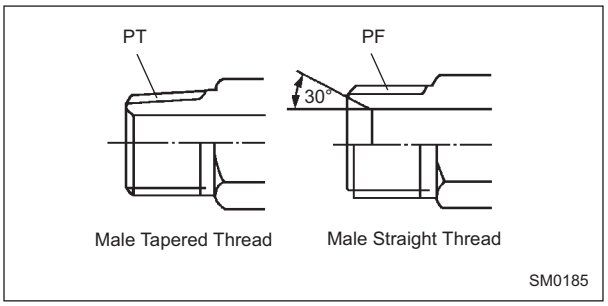
No.	Sections	Contents/normal value		Corrective action, others
1	Pressure sensor for optional attachment	Carry out service diagnosis	• See Service Diagnosis Data List Operation No.16 P2 side OPT full lever and relief	Check and replace pressure sensor Check remote control valve
2	Remote control valve	Measure directly remote control pressure of travel right and left	Check that pressure is 2.1 MPa or more in optional attachment full lever and high idling operation	Check remote control valve
3	Unload solenoid proportional valve (Travel straight proportional valve)	Carry out service diagnosis	• In optional operation: OFF • At pressure release: ON	Check controller for possible failure.
4	Secondary pressure of unload solenoid proportional valve (Travel straight proportional valve)	Measure the secondary pressure of unload solenoid proportional valve directly (A port)	• In optional operation full lever: 0 Mpa • At pressure release: 4 MPa or more	Replace solenoid proportional valve
5	Actual measuring current value of travel straight proportional valve	Carry out service diagnosis	• See Service Diagnosis Data List Operation No.16 P2 side OPT full lever and relief (Set value of factory shipment is 24.5 MPa.) Check that the current value does not change, regardless of operations.	• Check voltage of low pressure sensor other than sensor for optional attachment • 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 travel straight proportional valve (Check by optional operation only)	Measure directly the proportional valve secondary pressure at the ports A6 (travel straight) of 8 sections solenoid block	Check that travel straight secondary pressure is 0.8 MPa or less, regardless of neutral lever position or operation.	Replace proportional valve
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)

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															

Screwed-In Connection

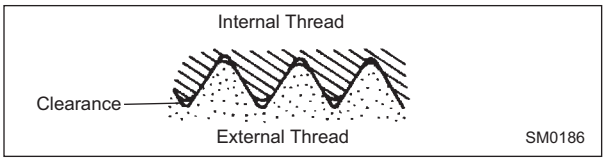
ATTENTION: *many types of screwed-in connections are used for hose connections.*
Be sure to confirm that the thread pitch and thread type (tapered or straight) are the correct type before using any screw-in connection.



Male Tapered Thread	
Wrench Joint Body	**Tightening Torque (Nm)**
17, 19	34
22	49
27	93
36, 32	157
41	205
50	320
60	410

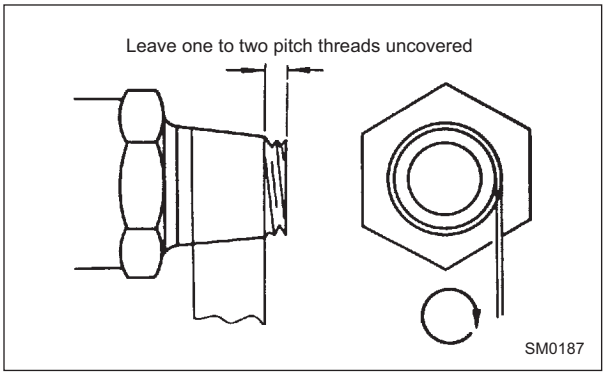
Seal Tape Application

Seal tape is used to seal clearances between male and female threads, so as to prevent any leakage between threads.
Be sure to apply just enough seal tape to fill up thread clearances. Do not overwrap.



- Application Procedure

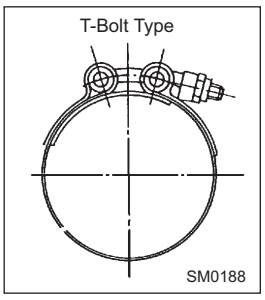
  Confirm that the thread surface is clean, free of dirt or damage.
  Apply seal tape around threads as shown. Wrap seal tape in the same direction as the threads.

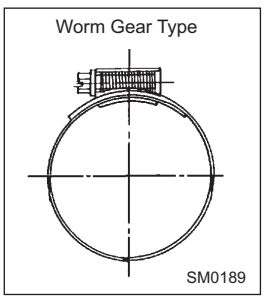


Low-Pressure-Hose Clamp Tightening Torque

Low-pressure-hose clamp tightening torque differs depending on the type of clamp.
See below for correct tightening torque of each type of low-pressure-hose clamp.

T-Bolt Type Band Clamp:
4.4 Nm (0.45 kgf m)
Worm Gear Type Band Clamp:
5.9 a 6.9 Nm (0.6 a 0.7 kgf m)

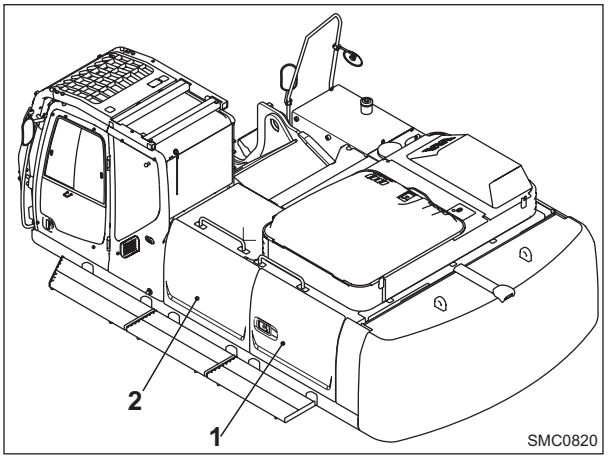


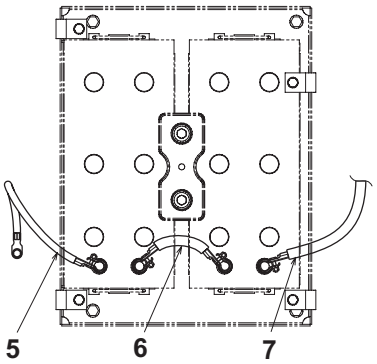


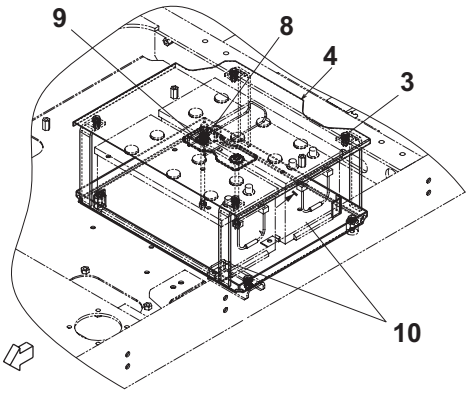
REMOVAL AND INSTALLATION OF THE BATTERY

Removal of the battery

1. Open left panel (**1**) with starter key.
2. Open left panel (**2**).
3. Fix it with stay.
4. Loosen capscrews (**3**) M10x30 and remove battery cover (**4**).
   : 17 mm
5. Remove cable (**5**) [between the earth and battery (-)].
   Always remove (-) terminal first and install it at last.
   : 13 mm
6. Remove cable (**6**) [between battery (+) and (-)].
   : 13 mm
7. Remove cable (**7**) [between battery (+) and battery relay].
   : 13 mm
8. Loosen 2 capscrews (**8**) M10x235.
   : 17 mm
9. Remove plate (**9**).
10. Remove battery (**10**).







CAUTION

Follow the battery removal order.
Start removing battery from grounding side and finish attaching to grounding side. If this order is missed, short-circuits may occur.

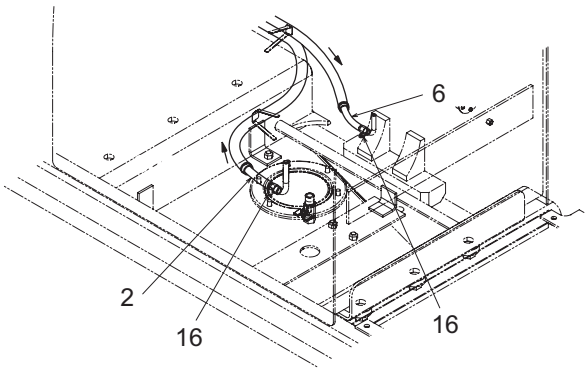
Installation of the battery

1. Install the battery in the reverse order of removing.
   Hold down plate (**9**) against battery (**10**) and tighten capscrew (**8**).
   : 17 mm
   : 10.8 ± 1.1 Nm (8 ± 0.8 lbf·ft)
2. Install grounding cable (**5**) last. Especially care must be taken that the grounding face is free from painting, rust, etc.
   : 13 mm
3. Install battery cover (**4**), tightening capscrews (**3**) M10x30.
   : 17 mm
   : 39.1 ± 3.9 Nm (28.9 ± 2.9 lbf·ft)

REMOVAL AND INSTALLATION OF THE FUEL TANK

Preparation for removal

1. Unlock cap (**B2**) with a starter key and open it.
2. Loosen valve (**A7**) under the tank (**B1**) and drain fuel.
   Capacity of tank: 638 L (169 gal)
3. Loosen 5 machine screw (**A4**) and remove the connector for level sensor (**A5**).
4. Loosen clip (**16**) and drawn out hoses (**2**) and (**6**).
5. Put in plugs that match the hose bore.

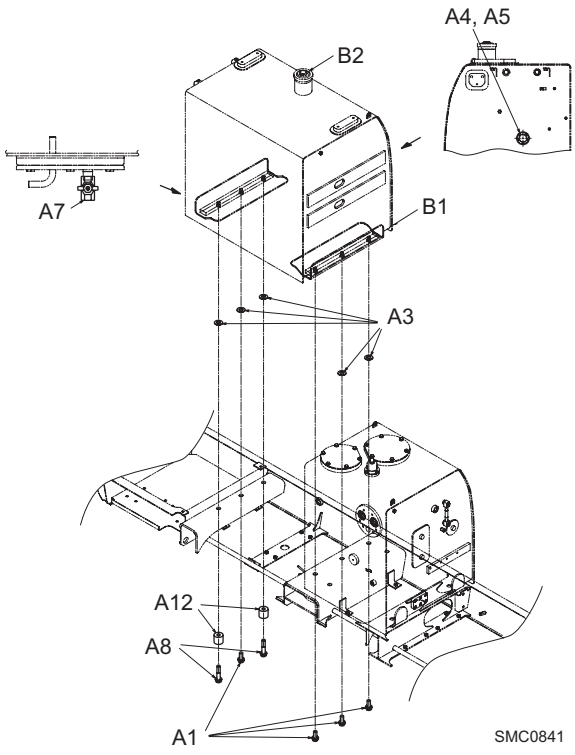


SMC0840

Removal of the fuel tank

1. Remove 4 capscrews (**A1**) M20x50 and 2 capscrews (**A8**) M20x100.
   : 30 mm
2. Hook the wire to the lifting eye on the fuel tank (**B1**) and remove the fuel tank.
   Weight: 217 kg (598 lbs)
3. Remove shims (**A3**) and collars (**A12**).

NOTE: *record the shim locations.*



SMC0841

Installation of the fuel tank

1. Installing is done in the reverse order of removing.
   Tank attaching bolt (**A1**) M20x50, (**A8**) M20x100.
   Apply Loctite #262
   : 30 mm

CAUTION

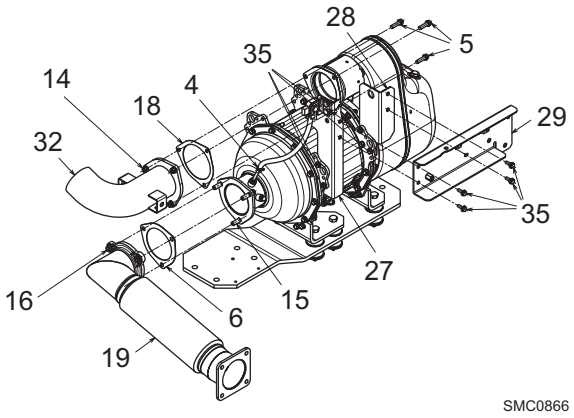
*If the gap (looseness) between tank mount and frame exceeds 1 mm (0.04 in), adjust the gap with shim (**9**) and tighten capscrews (**8**) to install the tank.*

2. Tightening torque:

Tightening position	Tightening torque Nm (lbf·ft)
Capscrew M20 - (A1), (A8)	370 ± 37 (273 ± 27)
Machine screw M5 - (4)	1.96 ± 0.2 (1.44 ± 0.15)
Valve - (2)	34 ± 1.7 (25 ± 1.25)

(4) Remove exhaust tube (**19**), (**32**).

1. Remove 3 bolts (**15**).
2. Remove exhaust tube (**19**).
3. Remove 3 bolts (**5**).
4. Remove 2 capscrews (**36**) M10X25.
5. Remove exhaust tube (**32**).
6. Remove 2 sems-bolts (**32**) M8X25. (Fig. Removing sensor (**2**))
   : 13mm
7. Remove bracket (**30**).



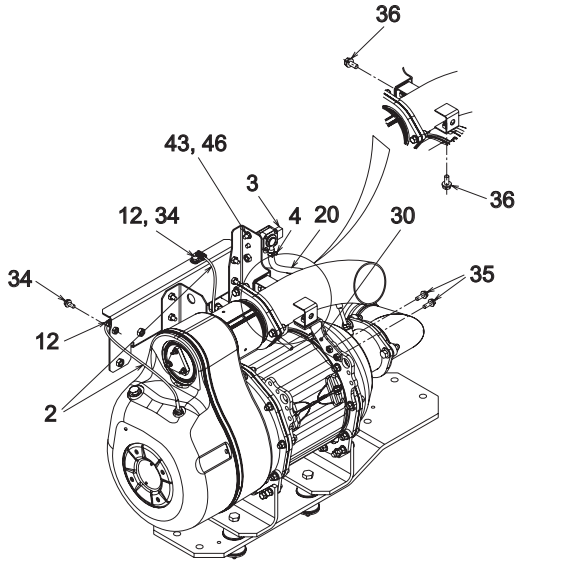
SMC0866

(5) Remove sensor (**2**).

1. Remove 2 sems-bolts (**34**) M8X20.
2. Remove 2 clips (**12**).
3. Remove 2 sensor (**2**).

(6) Remove hose (**20**).

1. Remove clip of sensor (**3**) side, DPF side.
2. Remove hose (**20**).



SMC0867

(7) Remove sensor (**3**).

1. Remove 2 nuts (**43**) M8.
   : 13 mm
2. Remove sensor (**3**).

(8) Remove bracket (**29**).

1. Remove 4 sems-bolts (**35**) M8X25.
   : 13 mm
2. Remove bracket (**29**).

Installation of counterweight

NOTE: *approx. weight of counterweight: 10000 kg (22050 lbs).*

1. Attach lifting tools to eye-bolts of counterweight.

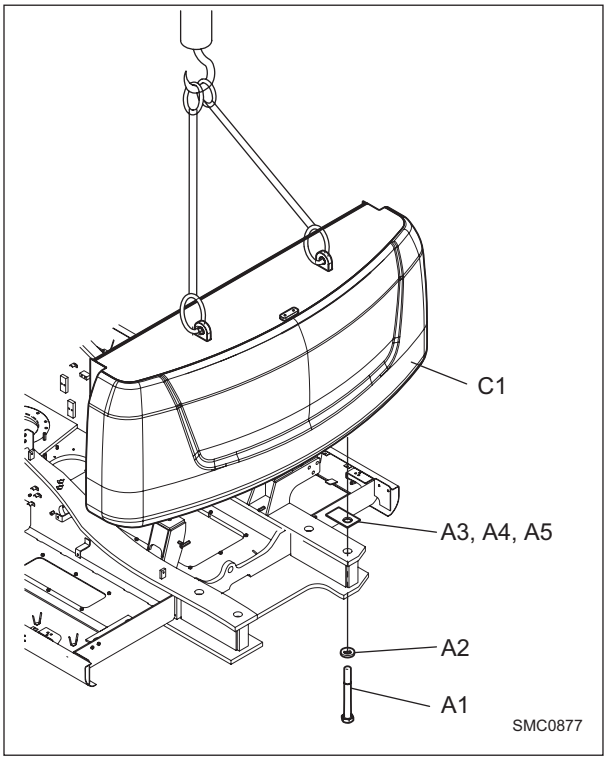
2. Install shim (**4**), (**5**), (**6**) onto the frame as it was.

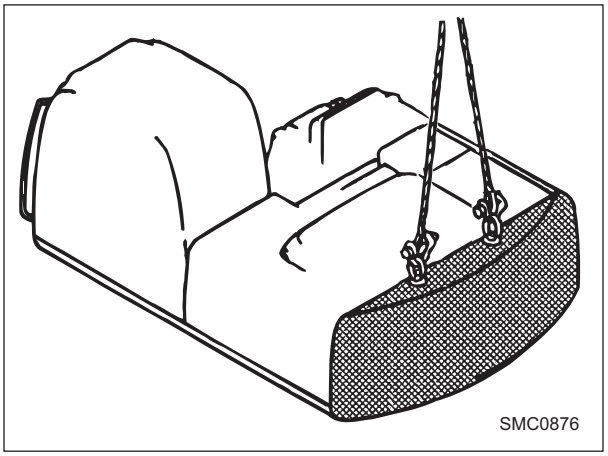
3. Lift counterweight and install it onto the frame.

4. Install bolts (**3**) and washers to counterweight and tighten temporarily.
   : 70 mm

5. Remove wire rope.
   Tighten the bolts (**3**) with a power wrench and torque wrench.
   : 70 mm
   : 4500 Nm (3319 lbf·ft)

6. Install bonnet assy (**1**), (**2**).





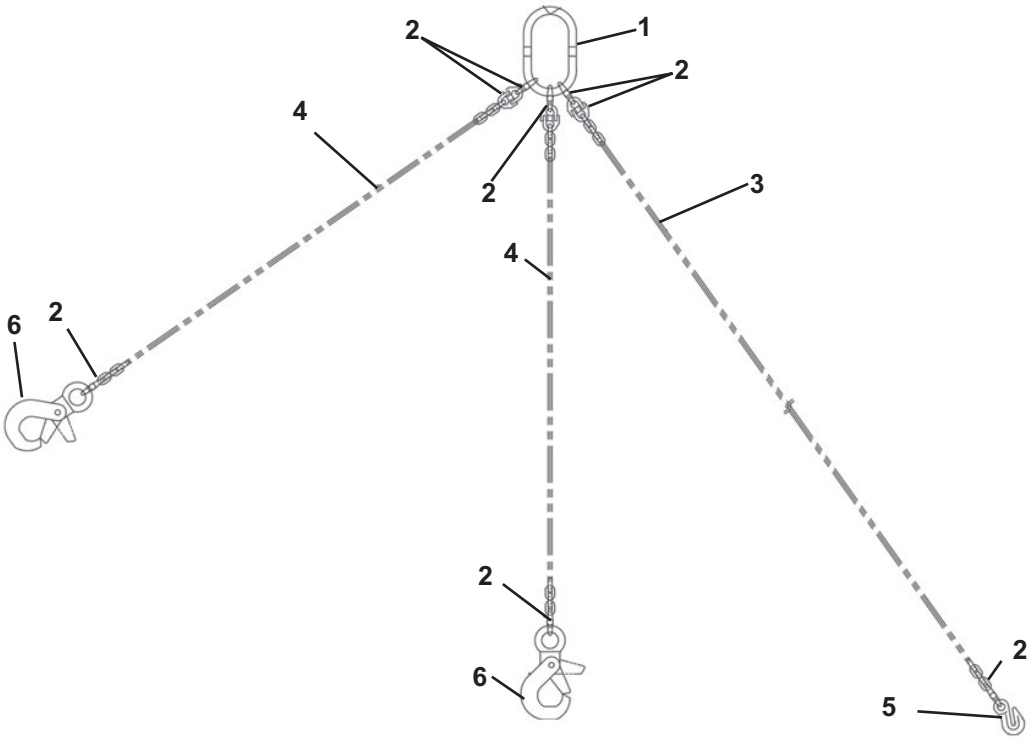
REMOVAL AND INSTALLATION OF UPPER FRAME

Removal of upper frame

NOTE: *approximate mass of upper frame:*
- 6000 kg (13200 lbs)

1. Attach a chain block (**1**), (of the type illustrated in the figure SM1402), to the boom foot side and the rear of the upper frame.
2. Adjust chains lengths to level the frame.

ATTENTION: *make sure rear chains do not touch engine.*



SM1402

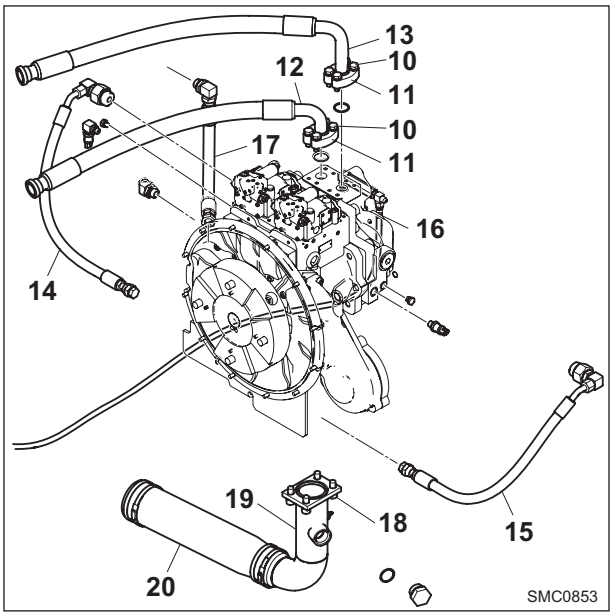
N.	Item	Quantity	Type
1	Master link H	1	KITO HL050
2	High coupling HC	12	KITO HC020
3	Chain	2	Ø 10x 3,8 m (12 ‘ 6”)
4	Chain	2	Ø 10x 2,5 m (4 ‘ 11”)
5	Grab hook H	2	KITO HH020
6	Hook	2	KITO HJ050

7. Fasten hoses (**12**) and (**13**) on the delivery side with half clamp (**11**) and capscrew M14x45 (**10**).
   - : 22 mm
   - : 121 Nm (89 lbf·ft)

8. Install hose (**16**).
   - : 22 mm
   - : 49 Nm (36 lbf·ft)

9. Install hose (**17**).
   - : 36 mm

10. Install suction hose (**20**) with 4 capscrews M16x35 (**18**).
    - : 14 mm
    - : 143 Nm (105 lbf·ft)

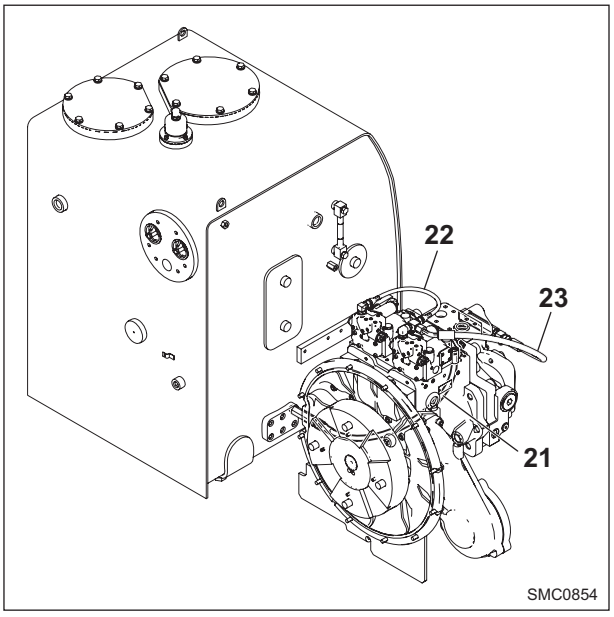


Install the other hydraulic piping:

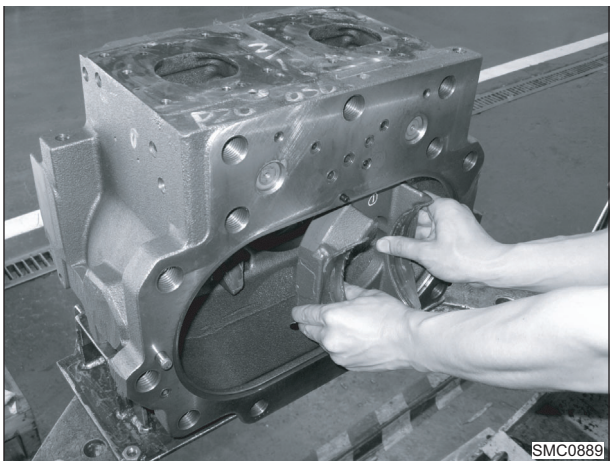
11. Install hose (**22**) between ports Psv1 and Psv2.
    - : 19 mm
    - : 29 Nm (22 lbf·ft)

12. Install hose (**23**) between filter and port Psv1.
    - : 22 mm

13. Install drain hose (**21**) between ports P1 and A3.
    - : 22 mm



16. Remove swash plate supports (**251**, **252**) frompump casing (**271**).



17. If necessary, remove stopper (L) (**534**), stopper (**S**) (**535**), servo piston (**532**), tilting pin (**531**) andservo cover (**536**) from pump casing (**271**).
    - In removing tilting pin (**531**), use a protector toprevent pin head from being damaged.
    - Since adhesive (No.1305N of Threebond make) isapplied to fitting areas of tilting pin (**531**) and servopiston (**532**), take care not to damage servo piston (**532**).
    - Do not loosen hexagon nut (**806**) on servo cover (**536**).

    If loosened, flow setting will be changed.

Assembly

1. For reassembling reverse the disassembling procedures, paying attention to the following items.
    a. Do not fail to repair the parts damaged during disassembling, and repair replacement parts in advance.
    b. Clean each part fully with cleaning oil and dry it with compressed air.
    c. Do not fail to apply clean working oil to sliding surfaces, bearings, etc. before assembling them.
    d. In principle, replace seal parts, such as o-rings, oil seals, seat packing etc.
    e. Apply grease to O-rings, seat packing in assembling them because they tend to come off. For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with specified torques in thismaintenance manual.
    f. In case of parallel type pump, rotating directions of drive shaft and driven shaft are different. Take care not to mix up parts of the drive shaft side with those of the driven shaft side.
    g. In order to avoid mixing up regulator of drive side with that of driven side, mark each of them.

2. Select place suitable for assembling.
    - Select clean place.
    - Spread rubber sheet, cloth or so on workbenchtop to prevent parts from being damaged.
    - Fix pump casing (**271**) by using thread 2-M10-L16in assembling.

041 - Check valve (Q.ty 2)
079 - Solenoid proportional reducing valve
412 - Socket bolt M8×50 (Q.ty 2)
413 - Socket bolt M8×70 (Q.ty 2)
418 - Socket bolt M5×12 (Q.ty 2)
436 - Socket bolt M6×25 (Q.ty 5)
438 - Socket bolt M6×20 (Q.ty 8)
466 - Plug PF 1/4 (Q.ty 3)
496 - Plug (Q.ty 18)
541 - Seat
543 - Stopper
545 - Steel ball
601 - Casing
611 - Feed back lever
612 - Lever 1
613 - Lever 2
614 - Fulcrum plug
615 - Adjust plug
621 - Compensating rod
622 - Piston case
623 - Compensating rod
624 - Spring seat
625 - Outer spring
626 - Inner spring
627 - Adjust stem
628 - Adjust screw
629 - Cover
630 - Lock nut M30×1.5
631 - Sleeve
641 - Pilot cover
642 - Spool
643 - Pilot piston
644 - Spring seat
645 - Stelo di regolazione
646 - Pilot spring
651 - Sleeve
652 - Spool
653 - Spring seat
654 - Return spring
655 - Set spring
656 - Block cover
662 - Spring
698 - Cover
708 - O-Ring
722 - O-Ring (Q.ty 3)
724 - O-Ring (Q.ty 8)
725 - O-Ring
728 - O-Ring
730 - O-Ring
732 - O-Ring
733 - O-Ring
734 - O-Ring
735 - O-Ring
753 - O-Ring
755 - O-Ring (Q.ty 7)
756 - O-Ring
763 - O-Ring
801 - Nut M8
802 - Nut M10
814 - Snap ring
836 - Snap ring
874 - Pin Ø 4×11.7 L
875 - Pin Ø 4×8 L (Q.ty 2)
876 - Pin Ø 5x8 L (Q.ty 2)
887 - Pin
897 - Pin Ø 5×19 L
898 - Pin Ø 11.5x11.8 L
924 - Socket bolt M8×20

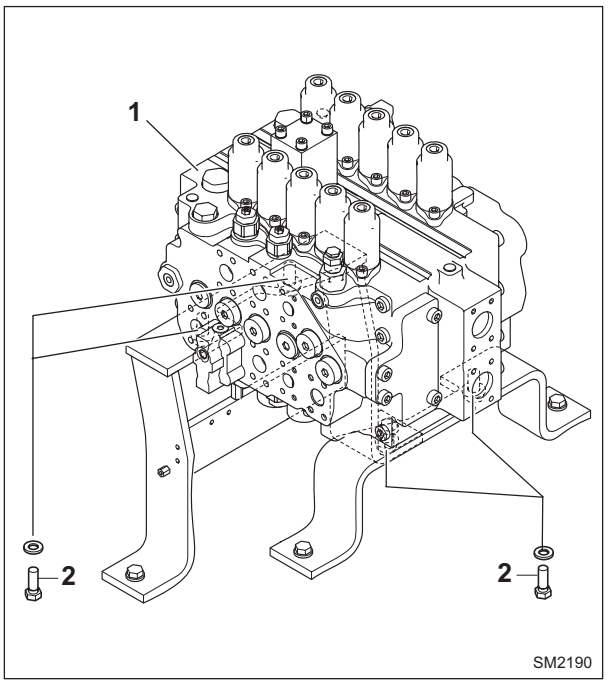
NOTE: *the number in a rectangle represent adjust screws. Do not tamper with the adjust screws as much as possible.*

Tightening torque of bolt, plug and nut		
No.	Thread size	Tightening torque Nm (lbf·ft)
412, 413	M8	29 (21.4)
436, 438	M6	12 (8.8)
418	M5	6.9 (5.1)
466	PF 1/4	36 (26.6)
496	NPTF1/16	8.8 (6.5)
630	M30x1.5	160 (118)
801	M8	15 (11.0)
802	M10	19 (14)

Installation of control valve

1. Install control valve (**1**) to frame and tighten the bolts (**2**).
   : 30 mm
   : 431 ± 43 Nm (318 ± 31.8 lbf•ft)

2. Connect all hoses, pipes and connectors to the control valve.



Thread	Ports	Connector / Bolt			Hose nut	
		Type	Opposing flats	Tightening torque Nm (lbf·ft)	Opposing flats	Tightening torque Nm (lbf·ft)
G1/4	4pc1, 4pc2, 4pc3, 5pc1, 5 pc2, 5pc3, a, b, c, dr1, dr4, dr5, pc	ORS Joint	19	36.3 ± 1.96 (26.7 ± 1.4)	19	29 ± 2 (21.4 ± 1.4)
G3/8	4pa1~4, 4pb1~4, Pz1, dr2, Pz2, 5pa1~5, 5pb1~5, dr3		22	73.5 ± 4.9 (54.2 ± 3.6)	22	49 ± 5 (36.1 ± 3.7)
G1	RS1, RS2		41	255 ± 25.5 (188 ± 18.8)	41	137 (101)
M12	R1, R2	Capscrew	19	81.9 ± 8.4 (60.4 ± 6.2)		
M12	4A1, 4B1, 5A1, 5B1, 5A2, 5B2	Sems bolt	10	98.1 ± 9.8 (72.3 ± 7.2)		
M14	P1, P2, 4A2, 4B2, 4A3, 4B3, 5A3, 5B3, 5A5, 5B5		12	147 ± 14.7 (108 ± 10.8)		

3. Install the panel protecting the control valve using the relevant securing screws.
   : 19 mm
   : 80 Nm (59 lbf·ft)

ASSEMBLY AND DISASSEMBLY OF CONTROL VALVE

PREPARATION FOR DISASSEMBLY

General cautions

- Since hydraulic components are finished for precision with small clearance, it is necessary to disassemble them in a clean and not dusty place. Use clean tools and cleaning oil and handle components with sufficient care.
- If the control valve is removed from the machine, clean ports thoroughly and put a plug in each port so as to prevent entry of dust and water. When installing the control valve back to the machine, do not remove plugs until the valve is properly piped.
- Study the structural drawing before beginning work and prepare necessary parts according to the purpose and the scope of the operation. Some parts are not available loosely but in assemblies. Therefore, prepare parts beforehand according to the Parts Manual

Cautions in disassemly

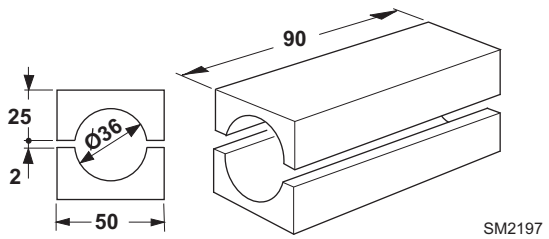
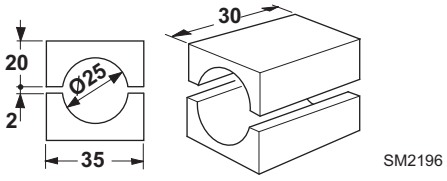
- Since components are finished to high precision, handle them with sufficient care. Use care so as not to bump components against each other or drop them.
- Do not strike or twist components by force even if they are tight, or the components develop burrs or are broken. This makes the components impossible to be assembled and results in oil leakage and deterioration in performances. Therefore, handle components with full care.
- Attach a tag to each component so it is reassembled in a correct position.
- Once disassembled, do not reuse O-rings and backup rings. Remove them with the tip of a steel wire shaped in a spatula. Take care so the groove is not scored.
- If parts are left, as they are halfway during disassembly or after disassembly, they may rust due to moisture and dust. When interrupting work for unavoidable reason, use care so as to prevent parts from rusting, or being exposed to dust.

Replacing the main plungers

- Since the main plunger is selectively fitted to the housing, it is designated as “not service part”. Therefore, note that in principle the main plunger cannot be replaced in the field. In case the plunger must be replaced fore some reason, inform us with the model and the manufacturing number that are stamped on the nameplate.

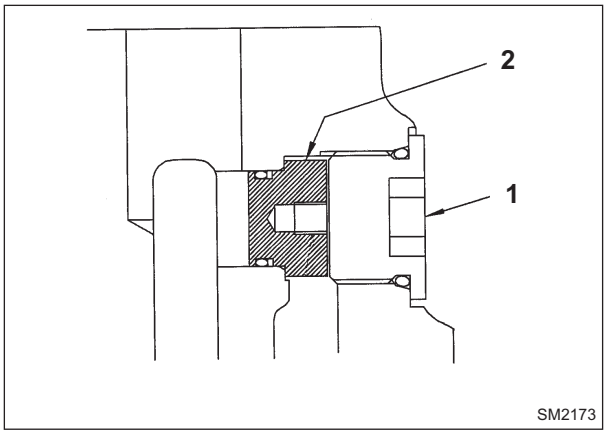
Tools

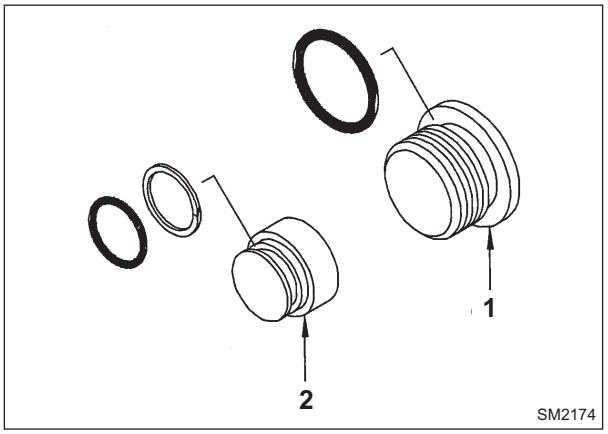
Prepare the following tools before disassembling the control valve.

No.	Tools	Q.ty	Remarks
a	Vise	1	
b	Box and wrench	1 of each size	22 mm, 27 mm, 32 mm, 36 mm, 41 mm, 46 mm.
c	Allen wrench	1 of each size	5 mm, 6 mm, 10 mm, 12 mm, 14 mm, 17 mm, 19 mm
d	Pincers	1	
e	Holder for main plunger (**A**)	1	
f	Holder for priority valve poppet assembly (**G**)	1	

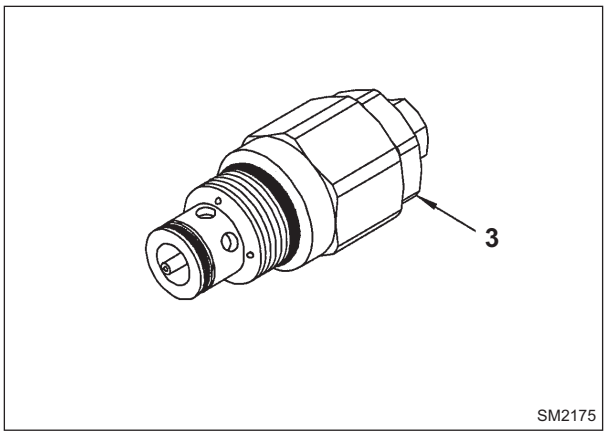
Disassembling the plug for over load relief

1. Remove cap (**1**), then draw out plug (**2**).
   : 17 mm

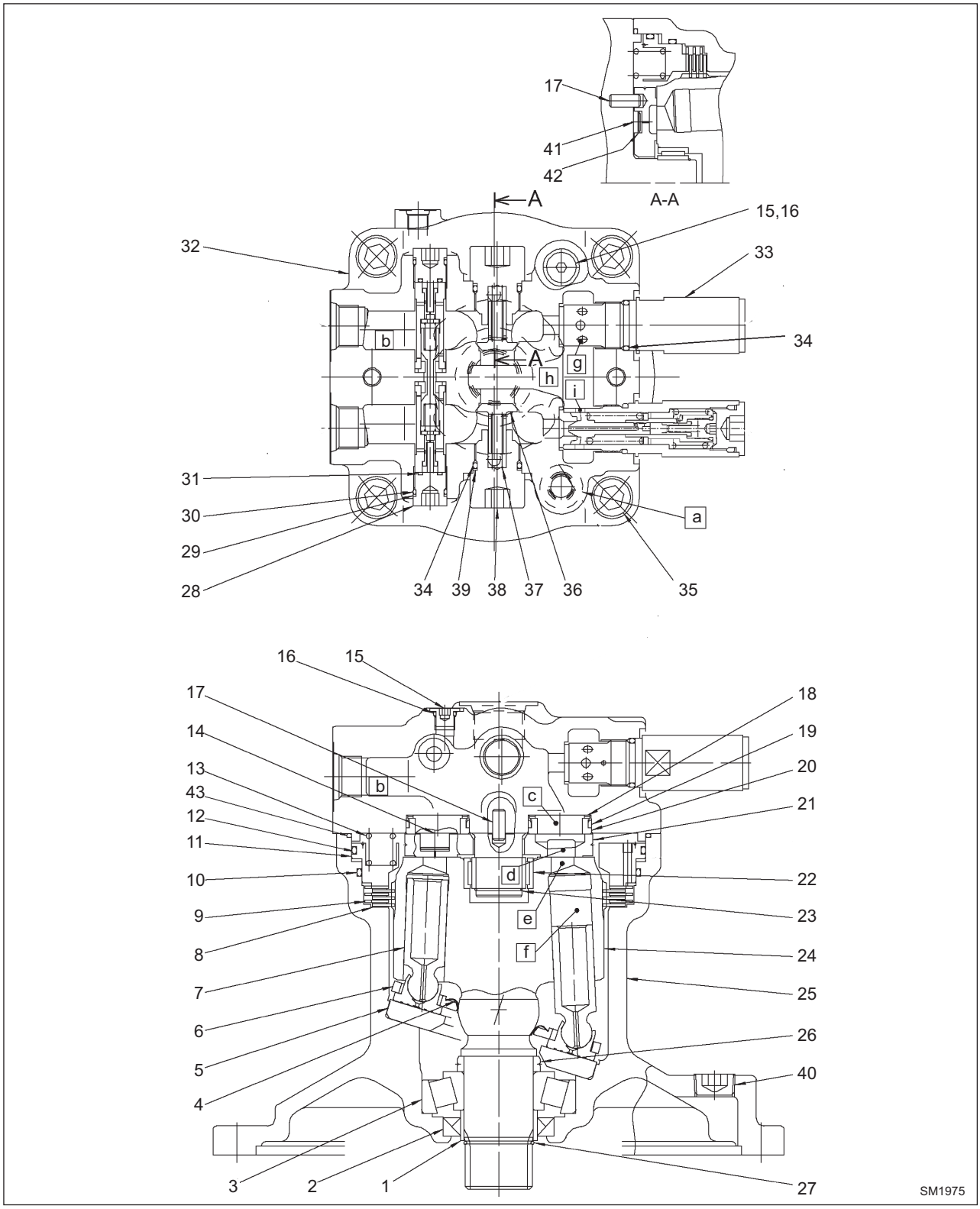




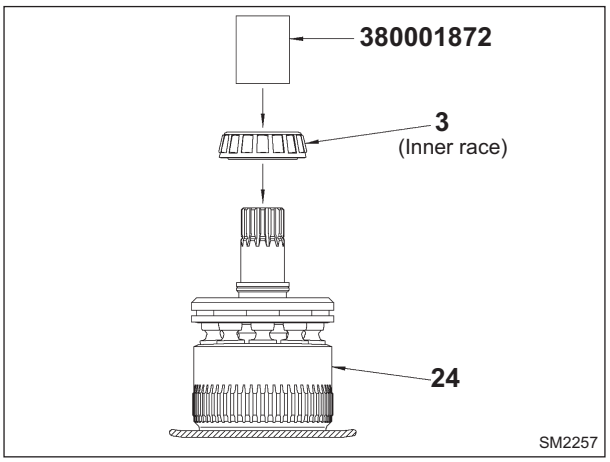
2. Attach the setup over load relief valve (**3**). Then tighten to specified torque.
   : 36 mm
   : 78.5 Nm (58 lbf·ft)



DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

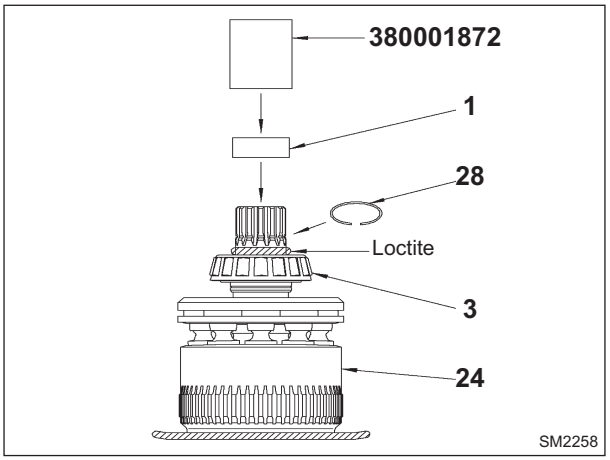


e. Assemble inner race of taper roller bearing (**3**) to cylinder (**24**).



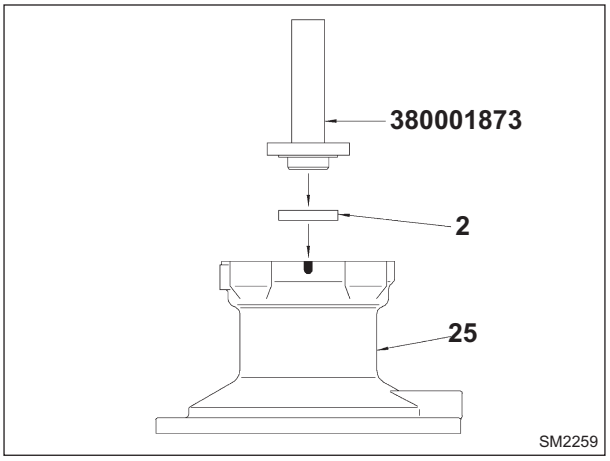
ATTENTION: *end surface of cylinder (**24**) is sliding face. So, protect the surface with a soft cloth against damage.*

f. Apply Loctite (**515** or **518**) to bearing mounting area of inner race of cylinder (**24**) lightly.
Assemble inner ring (**1**) and retaining ring (**27**) to cylinder (**24**).

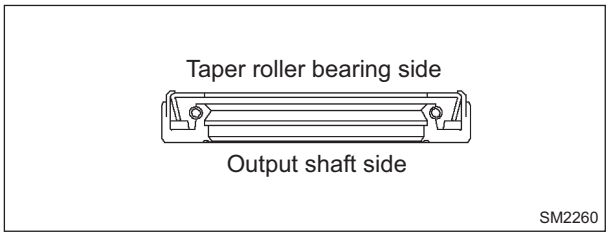


ATTENTION: *be careful not to attach a bond to the roller of bearing (**3**).*
*Wipe off the bond which came out between a inner ring (**1**) and bearing (**3**).*

3. Assembly of oil seal.
Apply three bond (kk "1211") of white color on outer surface of oil seal (**2**) and use the seal press insertion jig (**380001873**) to press it into housing (**25**).



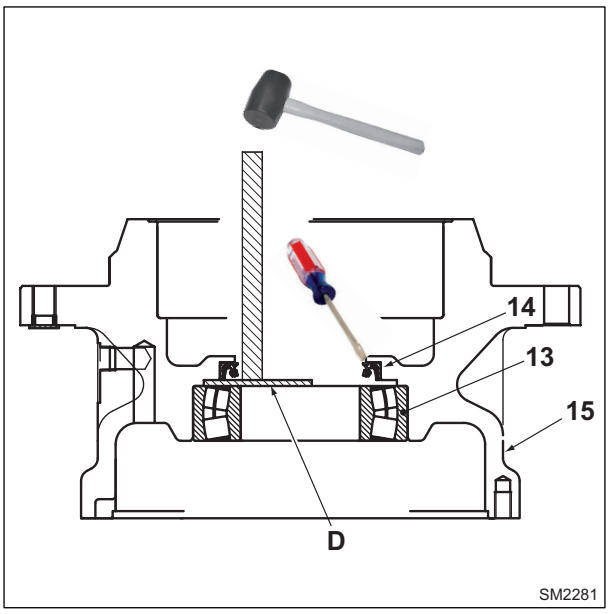
ATTENTION: *be cautions of assembling direction of oil seal (**2**).*



8. Set housing (**15**) as shown in the figure, insert jig (**D**) between bearing (**13**) and oil seal (**14**) and remove bearing (**13**) by striking from the upper side.

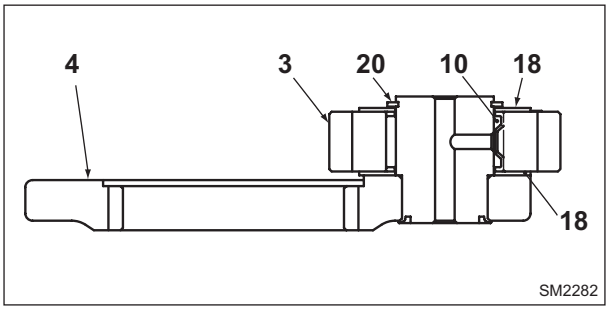
9. Remove oil seal (**14**) from housing (**15**).

NOTE: *do not use the removed oil seal and bearing.*



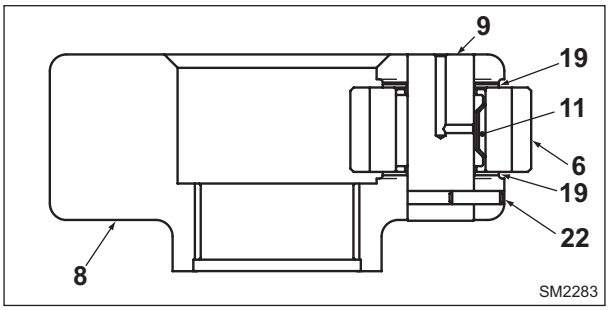
10. Disassembling #1 spider assy:
    a. Remove retaining ring (**20**) with a plier.
    b. Remove thrust washer (**18**), #1 planetary pinion (**3**) and needle bearing (**10**).

NOTE: *the shaft attached to spider assembly (**4**) is caulked. When replacing parts, replace the spider assy as a set.*
*Pinions (**3**) can not be replaced individually. Replace them in a set of four.*



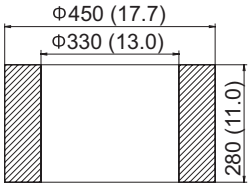
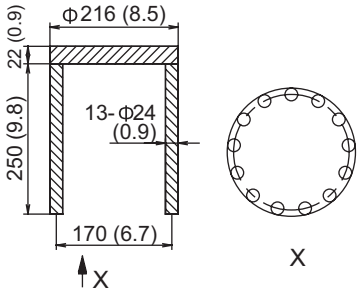
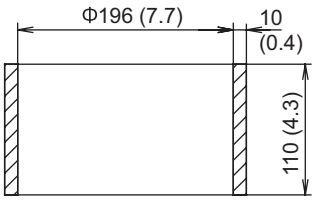
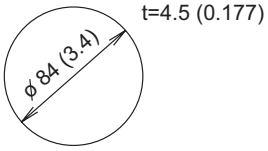
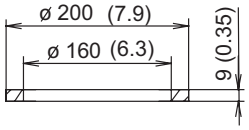
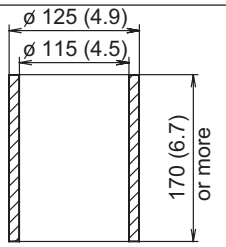
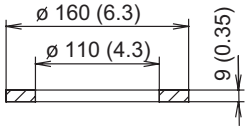
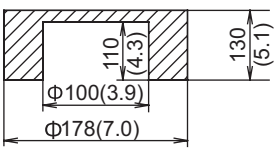
11. Disassembling #2 spider assy:
    a. Draw out spring pin (**22**).
    b. Draw out shaft (**9**) from #2 spider assy (**8**) and remove trust washer (**19**), #2 planetary pinion assy (**6**), and needle bearing (**11**).

NOTE: *pinions (**6**) can not be replaced individually. Replace them in a set of four.*



b) Special tools for swing reduction unit

Unit : mm (in)

Code	Tool name	Remarks
(A)	Stand	Material : mild steel 
(B)	Spherical bearing (13) removing jig	Material : mild steel 
(C)	Spherical bearing (12) removing jig	Material : mild steel 
(D)	Spherical bearing (12) removing jig	Material : mild steel 
(E)	Oil seal (16) installing jig	Material : mild steel 
(F)	Spherical bearing (12) press-fit jig	Material : mild steel 
(G)	Oil seal (14) intalling jig	Material : mild steel 
(H)	Spherical bearing (13) press-fit jig	Material : mild steel 

SM2300

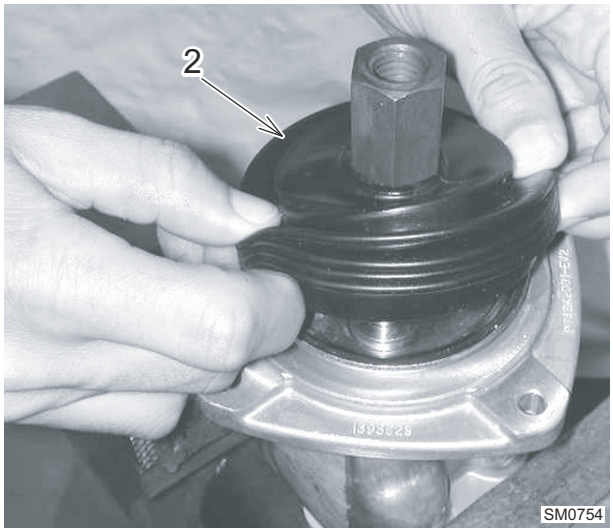
DISASSEMBLY RIGHT AND LEFT PILOT VALVE

Be sure to thoroughly read "Precautions for Disassembly and Assembly" on page W1-1-1 before starting the disassembly work.

NOTE: *replace O-Ring every disassembly operations, as a rule.*

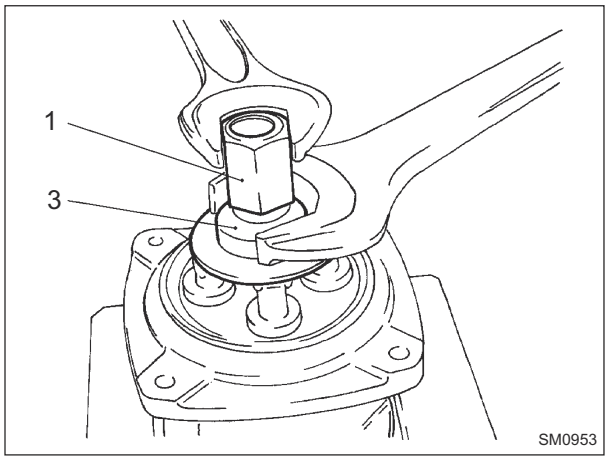
1. Plug each port of pilot valve, and clean it with kerosine.
   P Port : PF 1/4”
   1÷4 Port and T: PF 3/8”

2. Fix pilot valve with vise, via a protective plate (Alminum plate etc.), and remove boot (**2**).



3. Remove adjusting nut (**1**) applying spanners to adjusting nut (1) and circular plate (**3**).
   : 22, 32 mm

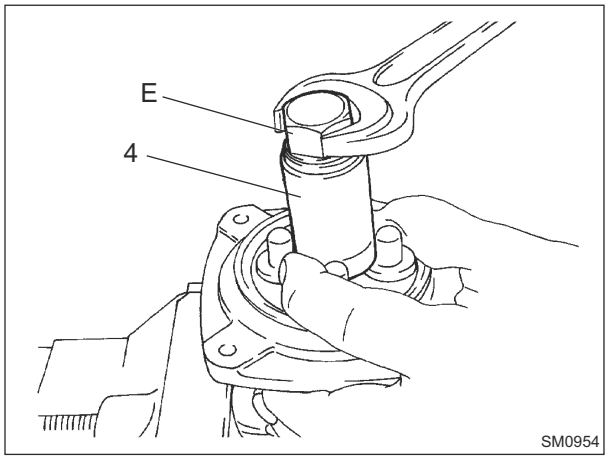
4. Remove circular plate (**3**).
   : 32 mm



5. Turn joint (**4**) in counterclockwise with jig (**E**) (**380001055**) to remove it.
   : 24 mm

WARNING

*When the force of return springs (**15**) is high, never loosen joint (**4**). If loosened, it might result in jumping out of plate (**5**) plug (**7**) and push rod (**9**). Remove joint (**4**) pressing plate (**5**) downward with two fingers.*



- A: Squeeze the seal (**12-x**) between your fingers to obtain a 8-shape.
- B, C: Insert the seal (**12-x**) ithin the groove with your fingers (lip in bottom position).
- D: Push the seal (**12-x**) against the side using the round head of a small socket wrench.

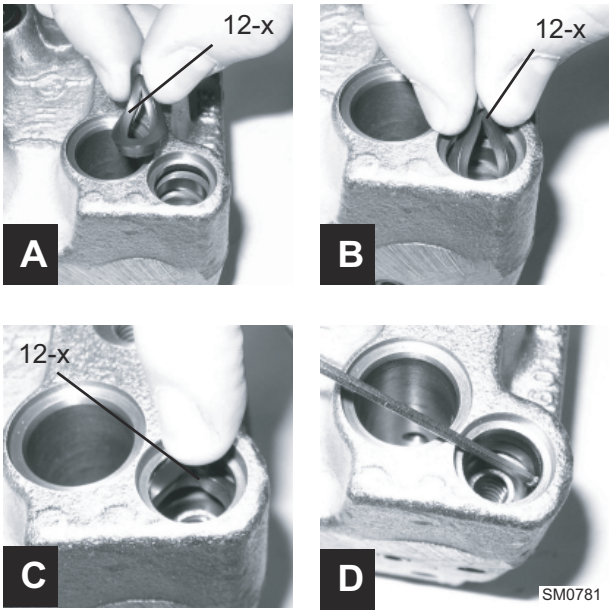
ATTENTION: *during the reassembly, make sure the seal (**12-x**) is correctly positionned, and pay attention not to damage nor twist it.*

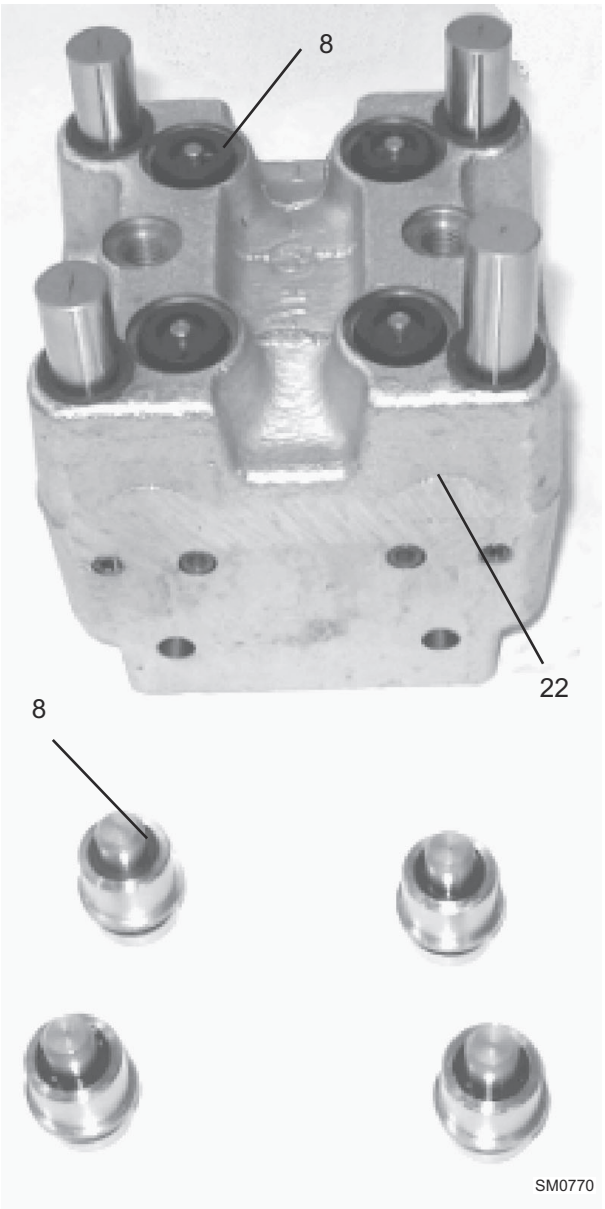
5) Repeat the operation for the other 3 assemblies.
6) Extract the damping springs (**13**) from the body (**22**) (using flat nose pliers).
7) Inspect the damping springs (**13**). If defects are detected, replace the 4 springs.
8) Reassemble parts in reverse order.

6. Guide/plunger and regulation unit replacement.
   1) Remove
      - The pilot control unit from the machine.
      - Both rubber boots
      - Both switch plates
      - The retaining plate
   2) Guide/plunger replacement:
      - Insert the end of a thin screwdriver between the guide and the body (**22**), carefully lift the guide to remove it from the body.

NOTE: *hold the guides with the other hand during the extraction operation to limit the effect of the return spring.*

3) Remove the guide / plunger assembly.
4) Repeat the operation for the other 3 sub-assemblies.
5) Visually check that the guides / plungers are in good condition. If defects are present, replace the 4 sub-assemblies.

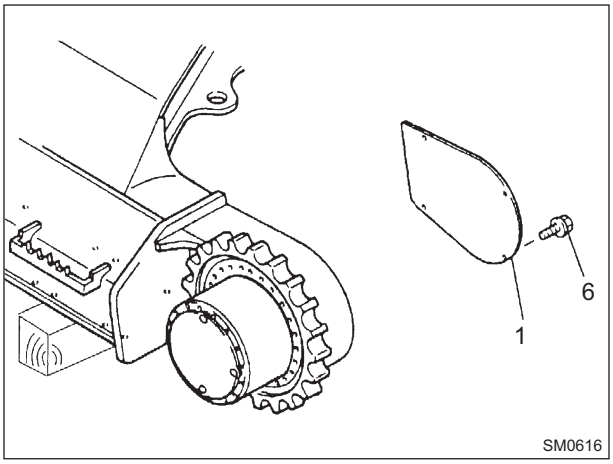




REMOVING

Preparation for removal

1. Remove crawler, lift up crawler frame using attachment, and put it on square timbers to float and stabilize.



Removing cover

2. Remove sems bolt (**6**) M12x25 and also remove covers (**1**).

: 19 mm

3. Preparation of oil pan.

Removing hydraulic pipe

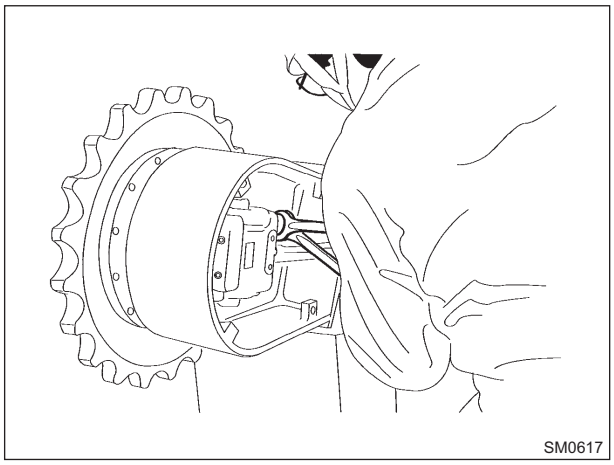
4. Release pressure from travel circuit, and bleed air in hydraulic oil tank, then remove all pipes connecting to travel motor. Then plug up all pipes and joint section to protect them from entry of dust.

: 19 mm

: 27 mm

: 32 mm

: 41 mm



REPLACEMENTS

The pieces that are subject to general wear and tear are the following.

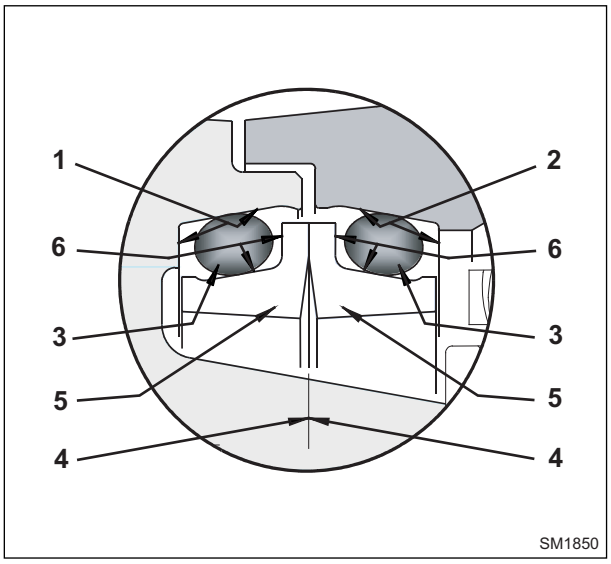
- Gears
- Bearings
- All the seals

Replace the used or irregular parts respecting the following steps.

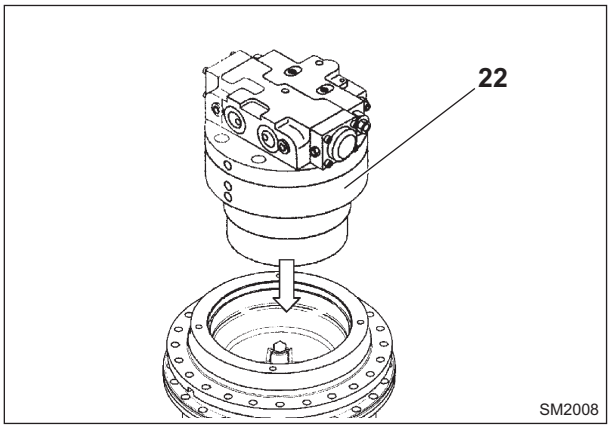
1. Accurately remove dirt, and in particular properly clean the seals, bearings and locking rings seating.
2. Lubricate the parts before connecting them.
3. In the case of damaged gears, for example a planetary, do not proceed to replace the individual gear but the entire reduction assembly.
4. When reconnecting a part always replace all the seals involved.
5. Replace all the damaged parts with original spare parts and doing so follow all the steps given in the following paragraph.

ASSEMBLY

1. Makeready of the lifetime seal
   Instructions to properly assemble the lifetime seal:
   a. Carefully clean the seats (**1** and **2**) using, if necessary, metal brushes or solvent (surfaces in contact with or (**3**) must be perfectly clean and dry).
   b. Make sure that sealing surfaces (**4**) of metal rings (**5**) are free from scratches, dinges or foreign substances; metal ring surfaces must be perfectly clean and dry.
   c. Carefully clean the lapped surface (**4**) of metal rings (**5**) and remove dust or fingerprints. Then lubrificate them with a thin oil film, taking care not to oil the other components.

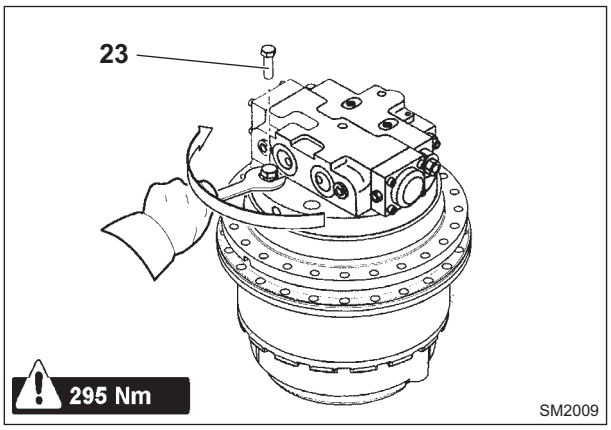


32. By using an eyebolt M12 UNI ISO 3266 tightened on the motor base plate, assemble the hydraulic motor (**22**).



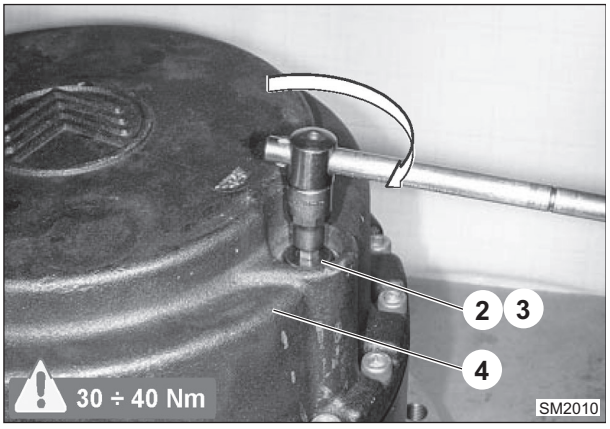
33. Tighten the four hexagonal head screws M18x60 (**23**).

: 295 Nm (218 lbf·ft)



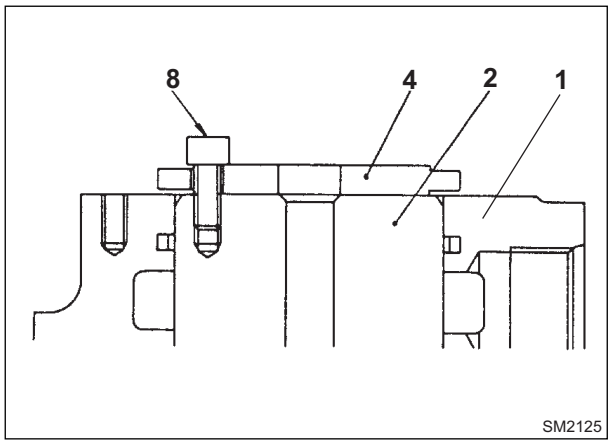
34. Fill the gearbox with the lubricant oil as shown in the Operation and Maintenance Instruction Manual. Place washers (**3**). Tighten the plugs M22x1.5 (**2**) into the oil draining-filling holes of the end cover (**4**).

: 35 ± 5 Nm (25.8 ± 3.7 lbf·ft)



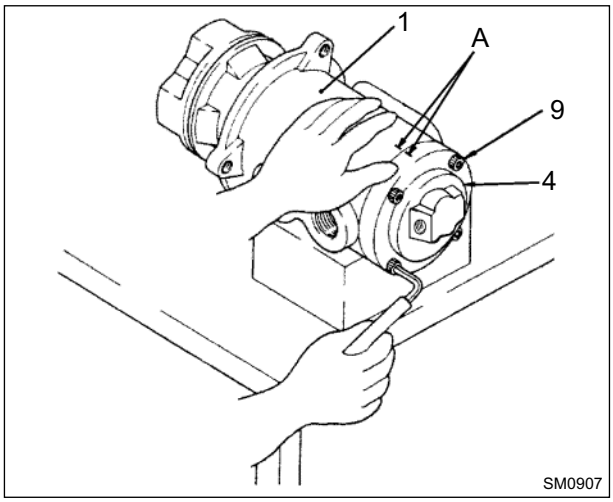
6. While holding stem (**2**) and body (**1**), match the hole of thrust plate (**4**) and the stem (**2**) hole.
7. Next, after removing any oil from the thread of socket bolts (**8**), coat them with Loctite 242 and tighten to stem (**2**).

: 6 mm
: 30.4 Nm (22.4 lbf·ft)



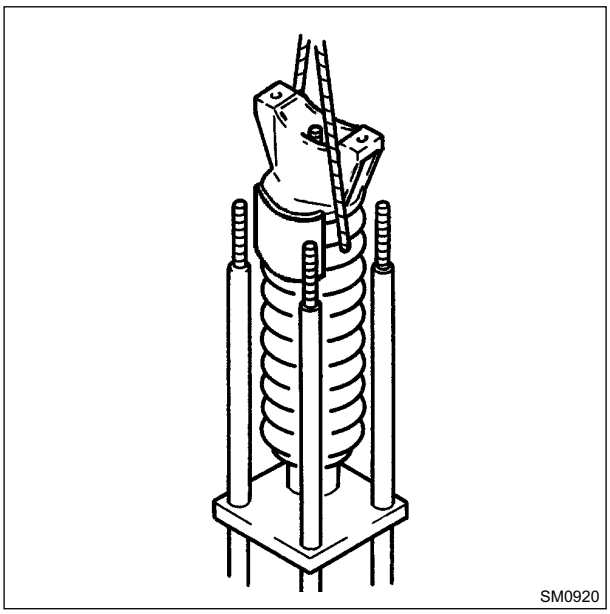
8. After installing O-Ring (**7**) to cover (**3**) and aligning the matching marks of the cover (**3**) and body (**1**), coat socket bolts (**9**) with Loctite 242 and tighten them which will then complete assembly.

: 6 mm
: 30.4 Nm (22.4 lbf·ft)



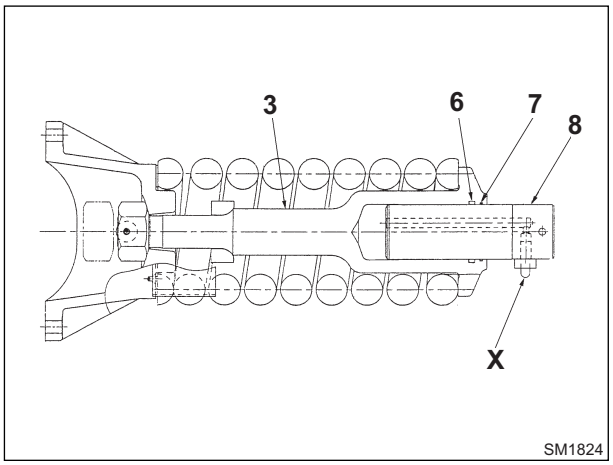
5. Remove idler adjuster assy from jig (**380001029**).

NOTE: *track adjuster weight:304 kg (670 lbs).*

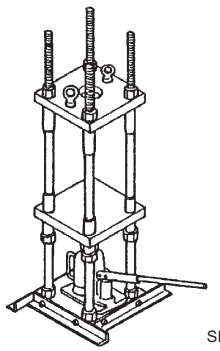


6. Apply grease on the oil seal (**6**) and seal (**7**), then fit on the grease cylinder (**3**).
7. Fill up grease in cylinder (**3**), remove the grease nipple from piston (**8**) in order to discharge the inside air, and press in the piston by hand.
8. Direct grease nipple hole downward to make air discharge easier.
9. Tighten grease nipple (**X**) to piston (**8**).

: 19 mm
: 70 Nm (51.6 lbf·ft)



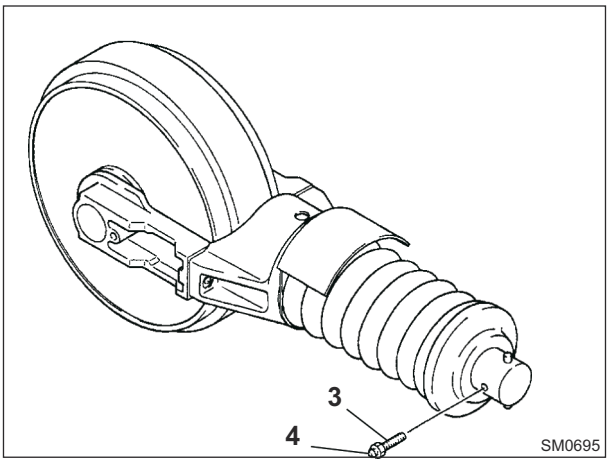
TOOL TABLE

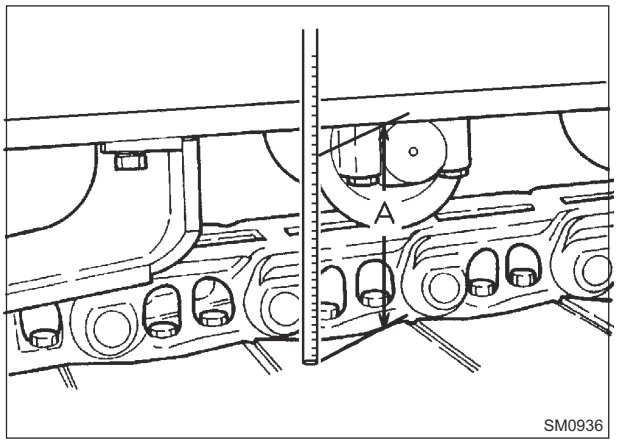
TOOL NO.	DESCRIPTION	FIGURE
380001029	Jig stand track adjuster	 SM2131

4. Tighten valve (**1**).
   : 19 mm
   : 58.8 ± 9.6 Nm (43.3 ± 7 lbf·ft)
5. Supply grease to valve (**3**) throught nipple (**4**) to adjust tracks tension.

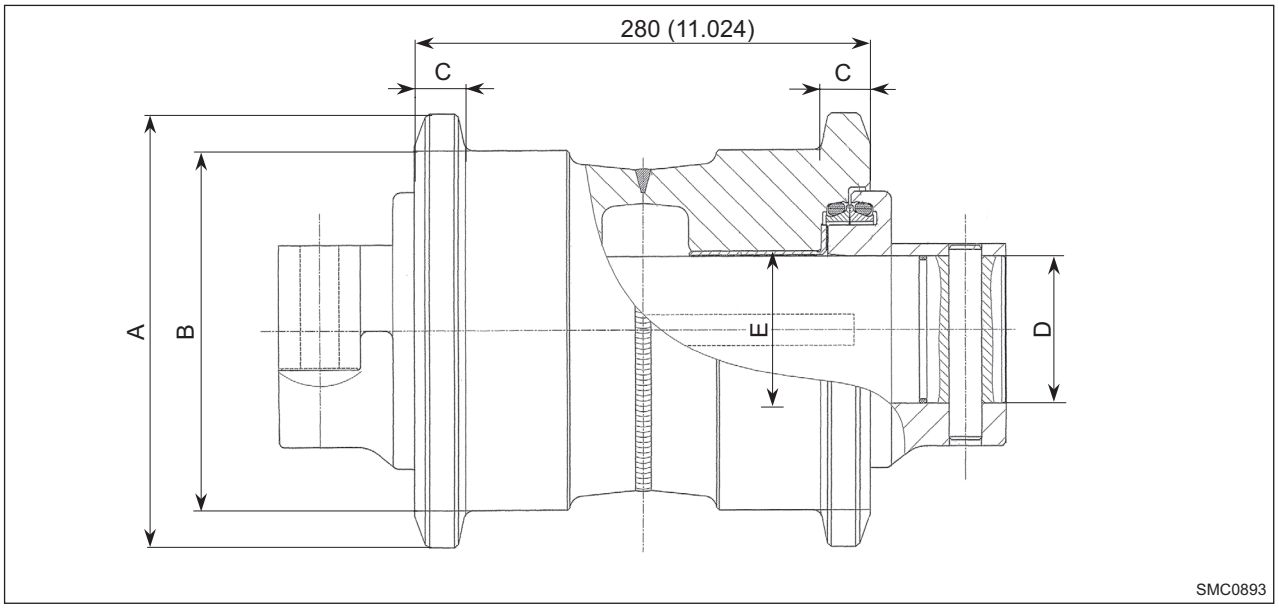
   Track sag specifications (**A**): 390 to 440 mm

NOTE: *check track sag after thoroughly removing soil stuck on the track area by washing.*





LOWER ROLLER MAINTENANCE STANDARD



Unit: mm (in)

No.	ITEM	STANDARD VALUE			REPAIRABLE LEVEL	SERVICE LIMIT	REMEDY
A	Diameter of flange	ø 265 (10.43)			-	-	Reinforcement weld, repair or replace
B	Treat diameter	ø 220 (8.66)			ø 205 (8.07)	ø 204 (8.03)	
C	Flange width	31 (1.22)			-	-	
D	Clearance between shaft and bushing (Wrapped bushing)	Basic dimension	Tolerance		Fit	Fit	Replace bushing
		ø 90 (3.5433)	Shaft	- 0.060 (-0.0024) - 0.090 (-0.0035)	Clearance 0.7 (0.0276)	Clearance 1.0 (0.0394)	
E	Interference between roller and bushing	ø 94 (3.7007)	Hole	± 0.030 (± 0.0012)	Interference 0.01 (0.0004)	Clearance 0	
F	Oil	Engine oil SAE 30; Q.ty: 0.48 kg (1.06 lbs)					Refill
H	Plug (8)	Execute air leak test at 0.2 MPa (29 psi) before tightening the plug.					
	Roller rotation	Rotates smoothly by hand					Reassembly

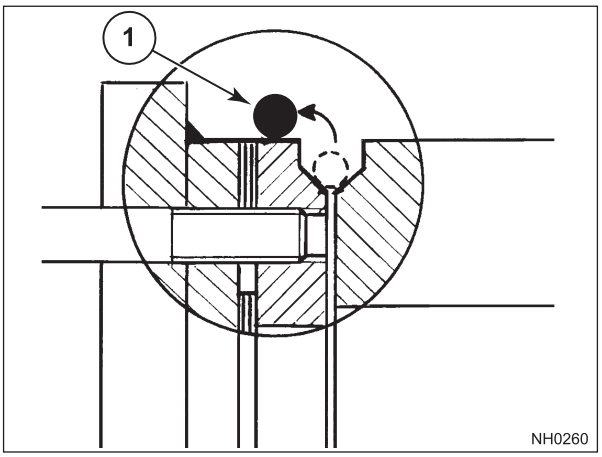
REPLACEMENT OF BUCKET

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.*

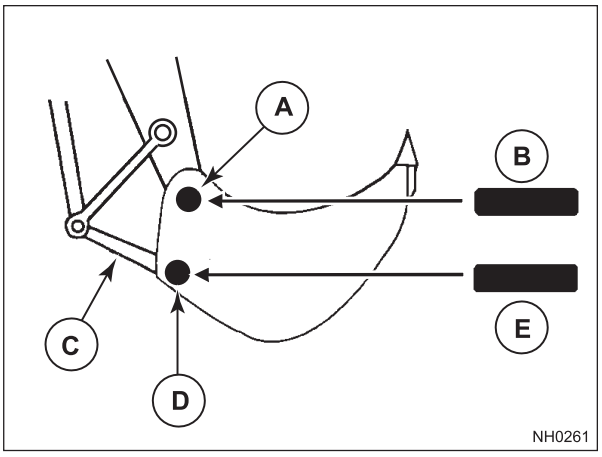
Removing the bucket

- 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.

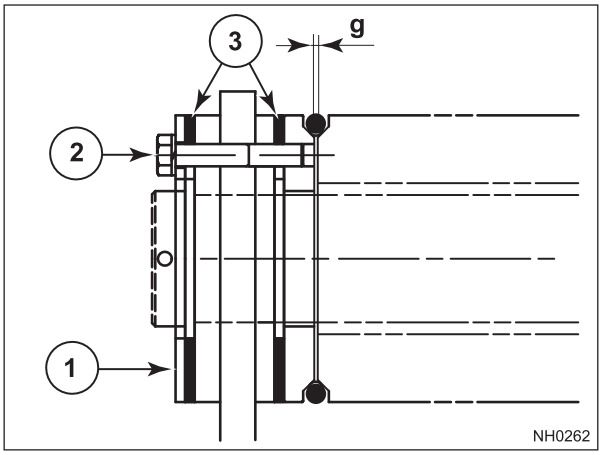
NOTE: *bucket play (**g**) should be 0.5 (0.020 in) to 1.5 mm (0.059 in).*

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)



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

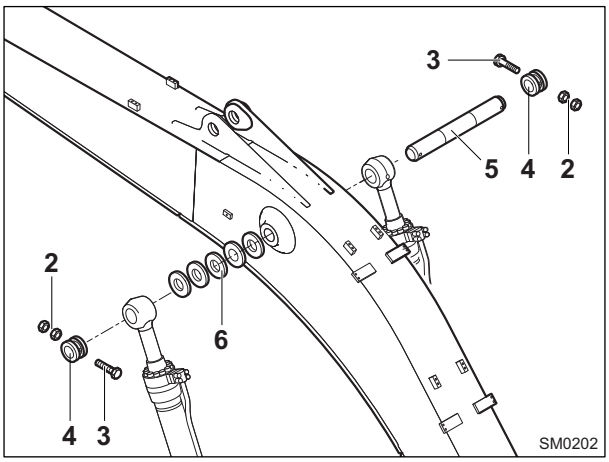
7. Install stopper (**4**), tighten bolts (**3**) and lock nuts (**2**):
   : 30 mm
   : 181 ± 20 Nm (133 ± 14.7 lbf·ft)

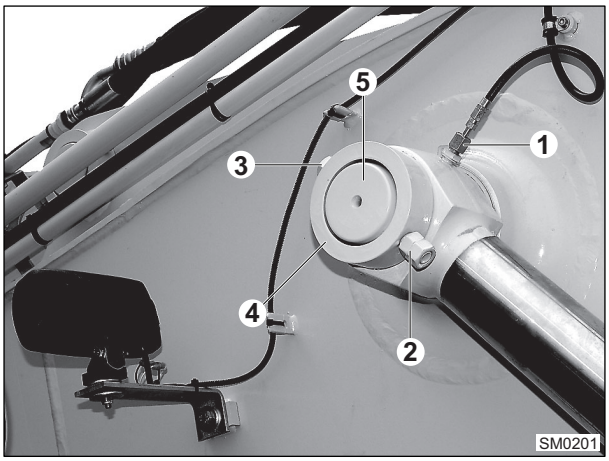
8. Connect lubrication hoses (**1**) to boom cylinder rod.
   : 17 mm
   : 20 Nm (14.7 lbf·ft)

9. 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.*





Special tools

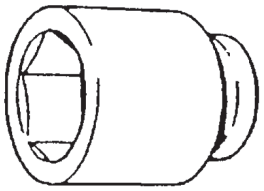
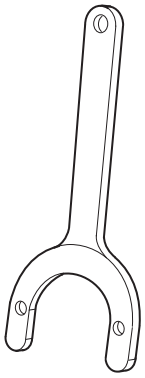
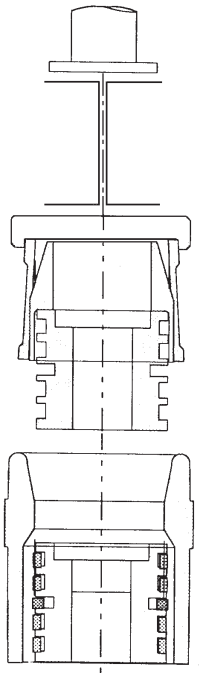
Piston nut socket wrench: XXXXXXXXX for boom cylinders (130 mm) (5.12 in) XXXXXXXXX for bucket cylinder (130 mm) (5.12 in) Use nut loosening/tightening workbench: XXXXXXXXX	 SM1366
XXXXXXXXX Wrench for installation and removal of the arm cylinder piston	 SM1888
Tools kit seals installation: XXXXXXXXX for boom cylinders XXXXXXXXX for bucket cylinder	 SM1369

FIGURE C

After the piston is pushed (**II**), the lubricant is moved to the left side of the delivery piston (**I**) and moved from the right pressure chamber of the delivery piston (**I**) to outlet 4.

Subsequently, the delivery pistons (**II**) and (**III**) are pushed and the lubricant delivered to outlets 5 and 6.

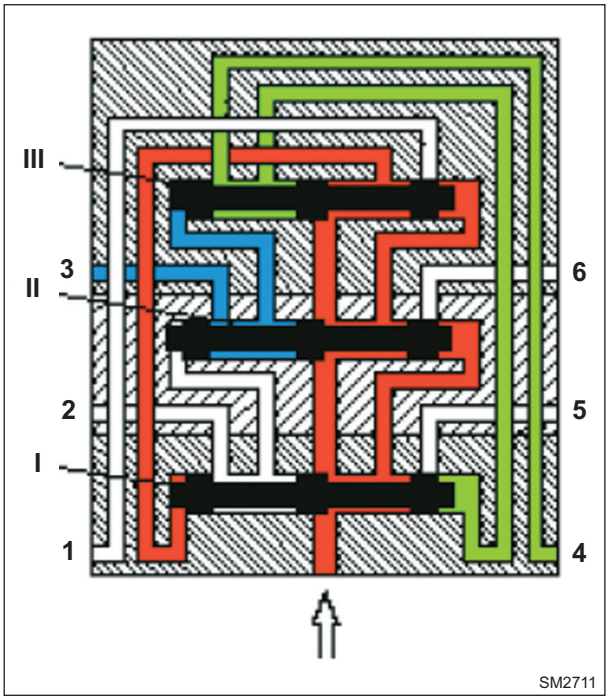
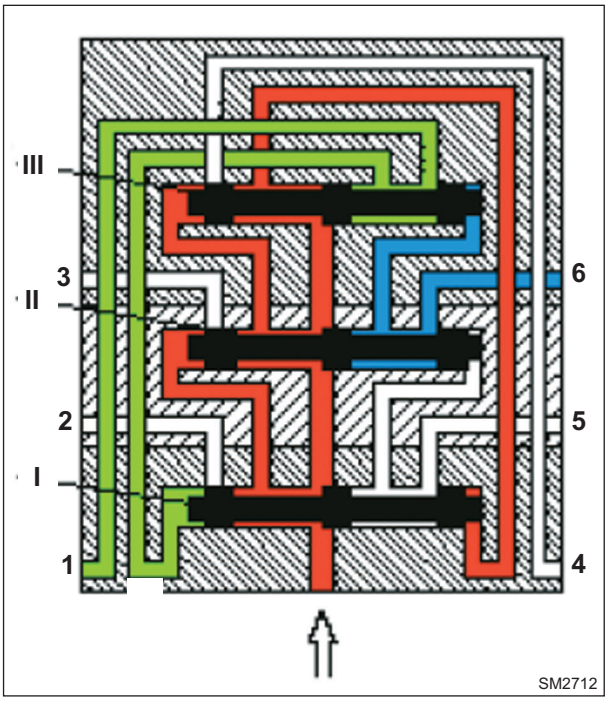


FIGURE D

After the delivery piston is pushed (**III**), the lubricant is moved to the right side of the delivery piston (**I**) pushing the lubricant out of the left pressure chamber of the delivery piston (**I**) to outlet 1.

A new progressive piston distributor cycle then begins. The described function repeats itself as long as lubricant is supplied to the progressive distributor.



Pressure ducts
Already conveyed
Subsequent delivery stroke

Repair of a distributor when blocked

ATTENTION: *the repair work has to be done under maximum cleanliness.*

- Remove the distributor (**1**) from the system.
- Noting the sequence of section its.
- Remove the plugs (**2**) from the piston holes and move the pistons from (do not expel them), then re-insert the plugs (**2**).
- Check the next distributor section until the piston being blocked is identified.
- Push the piston of the blocked section unit outside and check the drilling of the section unit and the piston surface for scratches and deficiencies. Replace section units affected by serious deficiencies.

NOTE: *pistons are not interchangeable!*

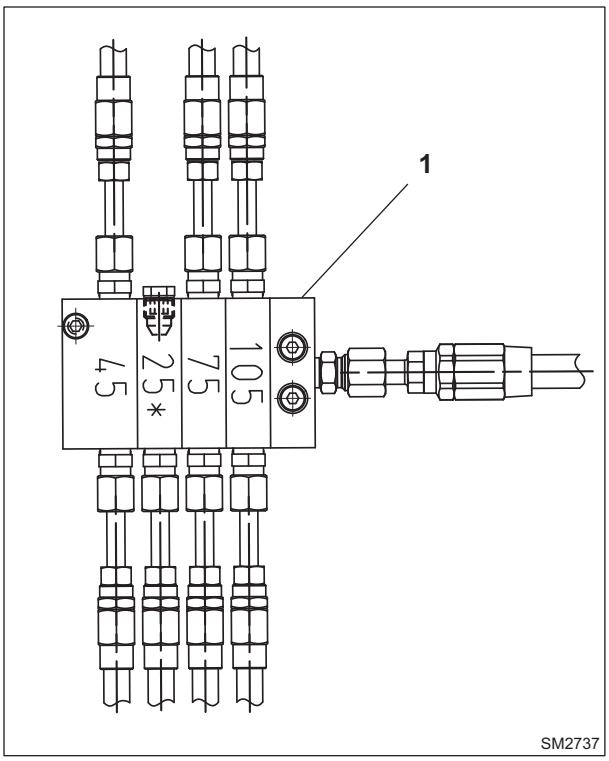
Deposits of hardened grease detected at pistons and drillings of section units must be eliminated by washing and blowing. The drillings in section units must be free of residues of grease.
This should be checked by use of some thin wire.

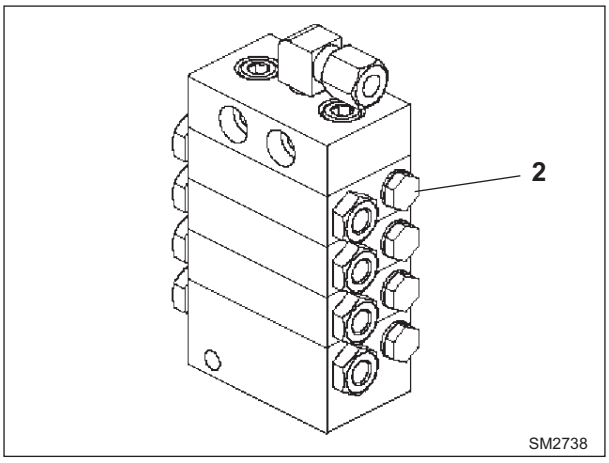
NOTE: *hardening of grease indicates that the lubricant being used is not suitable for the central lubrication system. Ask for advice by the supplier of the lubricant.*

After having checked all section units, re-assemble the distributor complying with the sequence noted down previously.

ATTENTION: *in order to preclude jamming of pistons, tighten the tie rods applying the torque usually concerned for the screw size MX-F: 12 Nm (8.85 lbf·ft).*

- Check the distributor for correct operation, using oil or grease.
- Install the distributor in the system.
- Start operating the system and check it for correct operating pressure.





4. HOLDING VALVE FOR BOOM & ARM (OPTION)

HOLDING VALVE FOR BOOM
The holding valve for boom prevents the boom falling in case of head side cylinder piping breaks.

HOLDING VALVE FOR ARM
The holding valve for arm prevents the arm falling in case of rod side cylinder piping breaks.

HYDRAULIC CIRCUIT READING KEY

Item	Component name
55	Holding valve for boom cylinders
56	Holding valve for arm cylinder

10. BOOM CIRCUIT

This section describes the boom raise conflux operation.

10.1 Boom up pilot circuit

10.2 Boom up 2 pumps conflux main circuit in C/V

10.1 BOOM RAISE PILOT CIRCUIT

(1) Operation:

1) If boom up operation is performed, the secondary pilot proportional pressure from the right pilot valve (10) gets out of port 4 and acts upon the low pressure sensor (SE3). At the same time, the pressure acts upon the 4pa3 and 5pb4 ports.
2) The secondary pressure which enters the 4pa3 port of C/V (2) shifts the boom spool. The secondary pressure which enters the 5pb4 port shifts the boom 2-speed spool.

10.2 BOOM UP 2 PUMPS CONFLUX MAIN CIRCUIT IN C/V

(1) Purpose:
Boom up speed up

(2) Principle:
Confluxing oil from 2 pumps

(3) Operation:

1) The oil delivered through A1 port of P1pump flows into C/V (2) P1 port, and branches into bypass circuit and parallel circuit. Since the boom spool is moved and bypass circuit is closed, the oil opens load check valve through parallel circuit and flows into boom spool.
2) Then the oil passes through boom spool, opens lock valve of boom lock valve, and is led into (H) side of boom cylinder through C/V (2) 4A3 port.
3) Meanwhile, the oil delivered from the A2 port of the P2 pump enters the P2 port of C/V (2), and bypass circuit is closed due to movement of boom 2-speed spool. The oil flows from parallel circuit through boom 2-speed spool, and is combined internally with the delivered oil by the P1 pump.
4) The return oil from boom cylinder (R) side flows into tank circuit through boom spool from C/V (2) 4B3 port.

13. COMBINED CIRCUIT

This section describes only the difference in combined operation.

13.1 Boom up / travel, pilot circuit

13.2 Boom up / travel, main circit

13.1 BOOM UP / TRAVEL, PILOT CIRCUIT

(1) Operation:
<Different point of pilot circuit from independent operation>

1) The mechatro controller outputs command current to travel priority solenoid proportional valve (PSV-C) after signal processing, and the solenoid proportional valve outputs secondary pressure and acts on Pz1 port of C/V (2).
2) Then the pressure of Pz1 port switches the travel straight valve two steps.

13.2 BOOM UP / TRAVEL, MAIN CIRCUIT

(1) Purpose:
Even if the attachment is operated, during travel operation, the travel speed does not change.

(2) Principle:
The travel action and the attachment action are actuated by quite different pump.

(3) Operation:

1) P1 pump delivery oil flows through P1 port of C/V (2) and branches off in P1 parallel circuit and travel straight spool.
P2 pump delivery oil flows through P2 port of C/V (2) and branches off in P2 tandem circuit and travel straight spool.
2) The delivery oil flowed into P1 parallel circuit of P1 pump opens check valve and flows in boom 1-speed spool, which exerts on boom up operation.
The delivery oil flowed into travel straight spool of P1 pump opens check valve because the travel straight spool is shifted, and flows in boom 2-speed spool and exerts on boom up operation with the internal oil conflux.
(In travel straight operation, P1 pump delivery oil exerts on swing operation of attachment.)
3) The delivery oil flowed into P2 tandem circuit of P2 pump flows in left travel spool to travel leftward.
The delivery oil flowed into travel straight spool of P2 pump flows in right travel spool because the travel straight spool is shifted and exerts on the right travel operation.
(In travel straight operation, P2 pump delivery oil exerts on travel operations.)
4) However, a portion of the flow is led to the travel straight spool notch restriction. The speed of attachments like travel, boom, etc. is adjusted by the circuit of restriction.

ELECTRICAL SYSTEM DIAGRAM READING KEY (No. 3)

Item	Description	Code
20	Mechatro Controller	C - 1
78	Cluster gauge	C - 2
79	DC - DC converter (for camera)	E - 63
80	Rear camera	E - 46
82	Accel potentio pressure sensor	SE - 16
83	Bucket digging sensor	SE - 1
84	Bucket dump sensor	SE - 2
85	Boom raising sensor	SE - 3
86	Boom lowering sensor	SE - 4
87	Arm in sensor	SE - 7
88	Arm out sensor	SE - 8
89	Swing sensor	SE - 5
90	Travel right sensor	SE - 9
91	Travel left sensor	SE - 10
92	Pump P1 sensor	SE - 22
93	Pump P2 sensor	SE - 23
94	P1 option sensor (2PB)	SE - 20
95	P2 option sensor (Hammer)	SE - 11
96	Fuel level sensor	SE - 15
97	Engine speed sensor	SE - 13
98	Air filter restriction switch	SW - 8
99	Operating lever lock solenoid valve	SV - 4
100	Lever lock switch	SW - 11
101	Selector detect sensor (opt.)	SE - 29
102	Selector solenoid (opt.)	SV - 13
103	Air conditioner ampl.	C - 4
104	Swing parking release switch	SW - 4
105	Swing parking brake solenoid valve	SV - 1
106	Two-speed select solenoid valve	SV - 3
107	Power boost solenoid valve	SV - 2
108	P2 Unload proportional solenoid valve	PSV - B
109	Travel priority proportional solenoid valve	PSV - C
110	P1 Unload proportional solenoid valve	PSV - D
111	Arm two-speed inverse proportional solenoid valve	PSV - A
112	Proportional solenoid valve pump P1	PSV - P1
113	Proportional solenoid valve pump P2	PSV - P2
114	OPT. Relief adjustment proportional solenoid valve 1	PSV - E
115	OPT. Relief adjustment proportional solenoid valve 2	PSV - I
117	Swing priority solenoid	SV - 64
118	Extra dis. Pressure sensor (opt.)	SE - 28
119	Wiper motor	M - 3
120	Washer motor	M - 4
121	Wiper interlock switch	SW - 19
122	Receiver drier	E - 10
123	Air compressor clutch	E - 11
124	Radio	E - 7
125	Antenna	-
126	Speaker left	E - 8
127	Speaker right	E - 9
128	DC – DC converter	E - 22
129	12 V Socket	E - 23
130	Cigarette lighter	E - 14
131	Room light	L - 5

Item	Description	Code
132	Horn "high"	E - 5
133	Horn "low"	E - 6

PLATFORM WIRING HARNESS ASSEMBLY (No.2)