KOBELCO

SERVICE MANUAL

Hydraulic Excavator

SK260-9
SK295-9

84531464

Issued July 2011
1st Edition

APPLICABLE:
SK260-9 . . . . . LL14U1700 and higher ~
SK295-9 . . . . . LB07U0900 and higher ~

likely to be concealed by bushes, undergrowth and such.

Avoid bushes, logs and rocks. Never drive over them, nor over any other surface irregularities that discontinue adherence or traction with the ground, especially near slopes or drop-offs.

Be alert to avoid changes in adherence conditions that could cause loss of control. Work with extreme care on ice or frozen ground and on stepped slopes or near drop-offs.

The word “bulldozing” generally refers to work in virgin rough terrain, characterised by the presence of all the perils and risks listed above. We emphasise the danger represented in these conditions by large tree limbs (possibly falling on the machine) and large roots (which may act as a leverage under the machine when up-rooted and cause the unit to overturn).

Position the machine dependent upon the loading and unloading areas in order to swing leftwards to load to obtain best visibility.

Never use the bucket or attachment as a man lift or carry riders. Never use the machine as a work platform or scaffolding. The machine must not be improperly used for works not consistent with its features (such as pushing railway cars, trucks or other machines).

Always pay attention to people within the machine operating range.

Never move or stop the bucket, other loads or the attachment above ground personnel or truck cabs.

Ensure the truck driver is in a safe place before loading the truck.

Load trucks from side or rear.

Use only the type of bucket recommended considering machine type, materials to be handled, material piling up and loading characteristics, ground type and other typical conditions of the work to be performed.

When transporting a loaded bucket, keep it as rolled-back as possible. Keep boom and arm as low as possible.

Ground speed should be adequate to the load and ground conditions.

The load must always be properly arranged in the bucket; move with extreme care when transporting oversize loads.

Do not lift and move the bucket overhead where persons are standing or working, nor downhill when working on a slope as this would decrease machine stability. Load the bucket from the uphill side.

Loads to be raised using the machine should be exclusively hooked to the hitch specially provided.

The excavator is no lifting and transportation means, therefore it should not be used to position loads accurately. Should it be exceptionally used to lift and lay building components, special caution must be taken as follows:

- The machine must be equipped compulsorily with the appropriate variant provided upon request.
- Secure the loads to be raised using cables or chains fastened with appropriate hooking mechanisms.
- Nobody should be allowed to remain under the raised load or within the excavator operating range for any reason whatever.

Never exceed specified loading capacity. Incorrect fastening of slings or chains may cause boom/arm failure or failure of the lifting means with consequent bodily injuries and even death.

Always ensure that slings and chains used for lifting are adequate to the load and in good condition.

All loading capacities are referred to the machine on a level surface and should be disregarded when working on a slope.

Avoid travelling across slopes. Proceed from uphill downhill and vice-versa. If machine starts slipping sideways when on a slope, lower the bucket and thrust bucket teeth into the ground.

Working on slopes is dangerous. Grade the working area if possible. Reduce work cycle time if it is not possible to grade the working area.

Do not move full bucket or a load from uphill downhill as this would reduce machine stability. Do not work with the bucket turned to the uphill side.

Do not work with the bucket turned uphill as counterweights protruding downhill would reduce machine stability on the slope and increase risk of overturning.

We recommend to work on slopes with the bucket downhill, after checking machine stability with the bucket empty and attachment retracted, by slowly swinging the upper structure by 360°.

Position the carriage at a right angle relative to slopes, hanging walls, etc. to exit the working area easily.

Keep the machine sufficiently far from the ditch edge.

Never dig under the machine.

Should it be necessary to dig under the machine, always ensure that digging walls are opportunely propped up against landslide to prevent the machine from falling into the trench.

Do not swing the upperstructure, raise the load or brake abruptly if not required. This may cause accidents.

Prior to beginning the work near gas distribution mains or other public utilities:

FASTEN SEAT BELT

Should the machine overturn, the operator may become injured and/or thrown from the cab. Not only, the operator may be crushed by the overturning machine resulting in serious injury or even death.

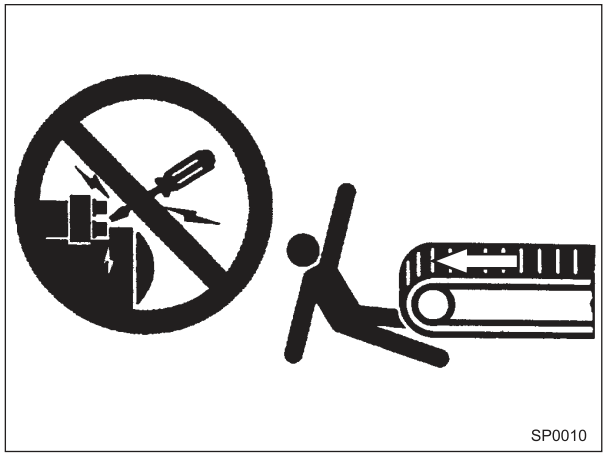
- Prior to operating the machine, thoroughly examine belt webbing, buckle, and attaching hardware. If any item is damaged or worn, replace the seat belt or component before operating the machine.
- Be sure to remain seated with the seat belt securely fastened at all times when the machine is in operation to minimise injury hazard in case of accident.
- After a significant accident, replace the seat belts even though they do not look damaged.


SP0011

OPERATE ONLY FROM THE DRIVER'S SEAT

Inappropriate engine starting procedures may cause the machine unexpected movement, possibly resulting in serious injury and even death.

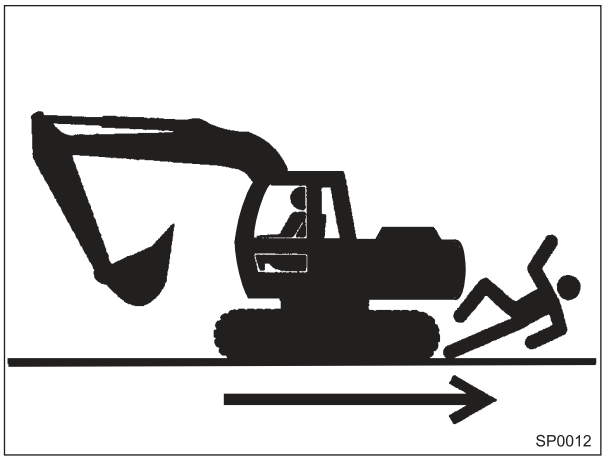
- Start the engine only from the operator’s seat.
- Never start the engine while standing on the track or on the ground.
- Do not start the engine by shorting across starter motor terminals.
- Before starting the engine, ensure that all control levers are in the neutral position.


SP0010

MOVE AND OPERATE MACHINE SAFELY

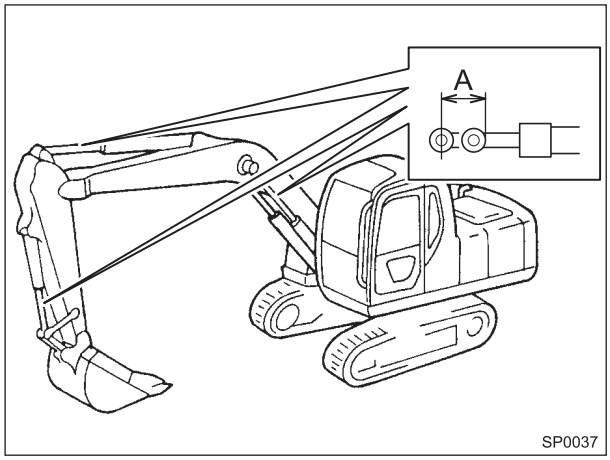
Bystanders can be run over.

- Pay the utmost attention not to run over bystanders.
- Be sure exposed personnel in the area of operation are clear of the machine before moving it or its attachments. Sound horn to inform bystanders that the machine is going to be operated.
- When operating, swinging, or moving the machine in a congested area use a signal man.


SP0012

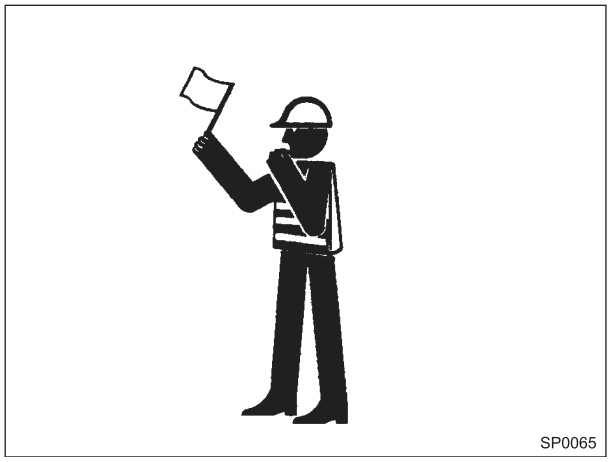
AVOID OPERATING THE CYLINDERS TO FULL STROKE

Do not extend repeatedly the bucket and the arm cylinders full stroke with the purpose of cleaning the bucket from residual materials. This could cause damages to the cylinders. To remove residues from the bucket, use water under pressure or remove them manually.
Tolerance A ≥ 50 mm



PROVIDE SIGNALS FOR JOBS INVOLVING A NUMBER OF MACHINES

For jobs involving several machines, provide signals commonly known by all personnel involved. Also, appoint a signal person to co-ordinate the job site. Make sure that all personnel obey the signal person's directions.

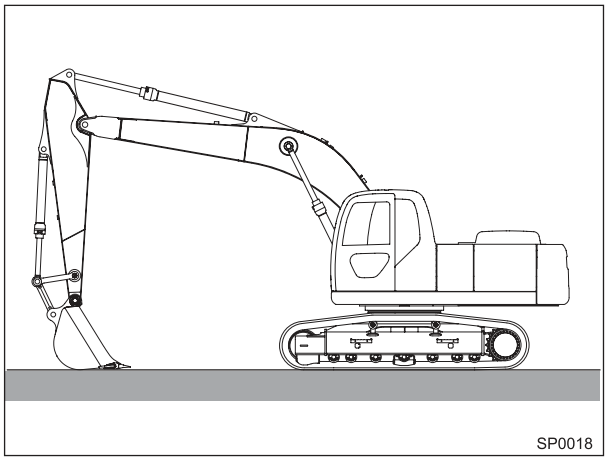


PARK MACHINE SAFELY

To avoid accidents:

- Park machine on a level surface.
- Lower bucket to the ground.
- Pull the safety lever (pilot-control shut-off lever) to the **LOCK** position.
- Turn auto-idle switch off.
- Run engine at slow idle speed without load for 5 minutes.
- Turn key-start switch to **OFF** to stop engine.
- Remove the ignition key from the key switch.

Prior to leaving the machine, close the windows, the cab door and all panels.



TRANSPORTING THE MACHINE UNDER SAFE CONDITIONS

During loading or unloading operations of the machine on a truck or trailer the danger for tipping over is always present.

- Use a truck or trailer appropriate for transporting the machine.
- Secure safely the machine to the trailer with appropriate chains or cables. Please refer to the chapter "**TRANSPORTATION**" of Operator's Manual for the safe loading and unloading procedures.
- Make sure that you comply with National and local regulations when transporting the machine on open roads.

EVACUATING IN CASE OF FIRE

If a fire breaks out, evacuate the machine in the following way:

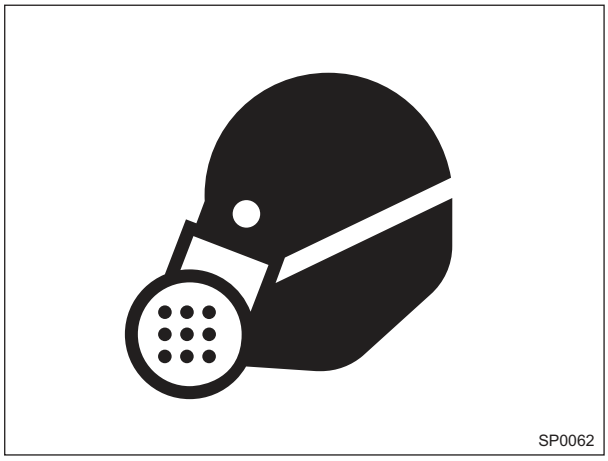
- Stop the engine by turning the ignition key to the **OFF** position.
- Use a fire extinguisher if there is time.
- Exit the machine making use of hand rail and step.


SP0061

BEWARE OF EXHAUST FUMES

Prevent asphyxiation. Engine exhaust fumes can cause sickness or death.

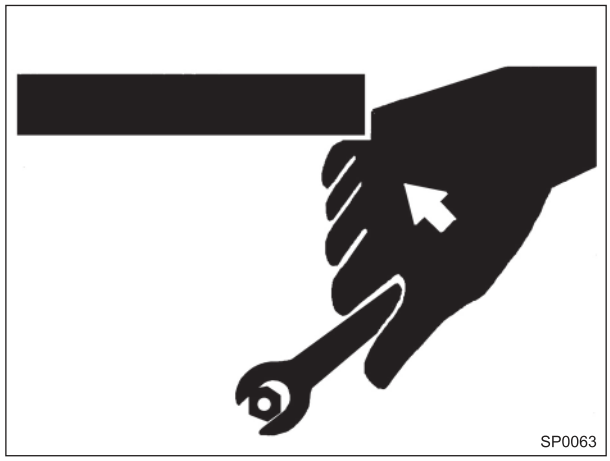
- If you must operate in a building, be sure there is adequate ventilation. Either use an exhaust pipe extension to remove the exhaust fumes or open doors and windows to bring enough outside air into the area.


SP0062

USE APPROPRIATE TOOLS

Use tools appropriate for the job to be performed.

- Inappropriate tools, parts and procedures might generate dangerous conditions.
- Use tools of correct size to tighten or loosening securing elements, in order to avoid injuries caused by a wrench getting out of control.
- Do not use U.S. Standard or British Standard tools on metric fasteners and vice versa.
- Use only genuine spare parts (please refer to the Spare Parts Catalogue).

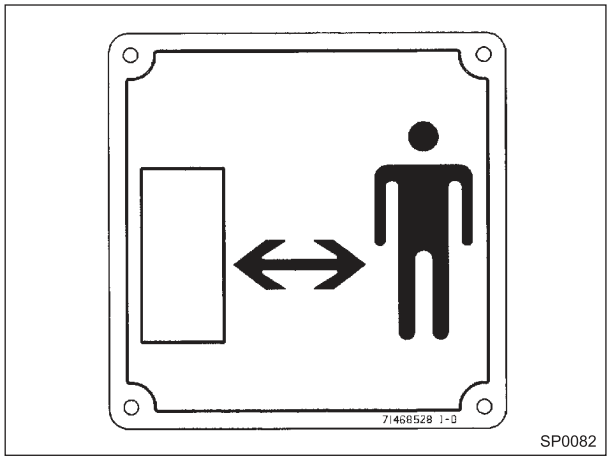

SP0063

13 - Burns warning decal

It indicates that a burns danger exists, since the zone is characterised by high temperature.

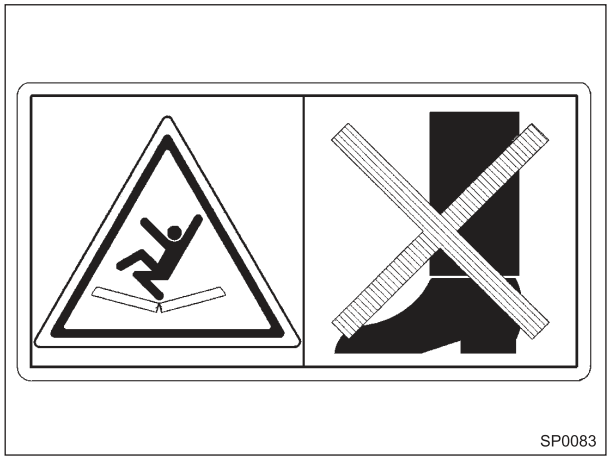
14 - Safety distance decal

Keep at a safe distance from a zone dangerous for personal safety.

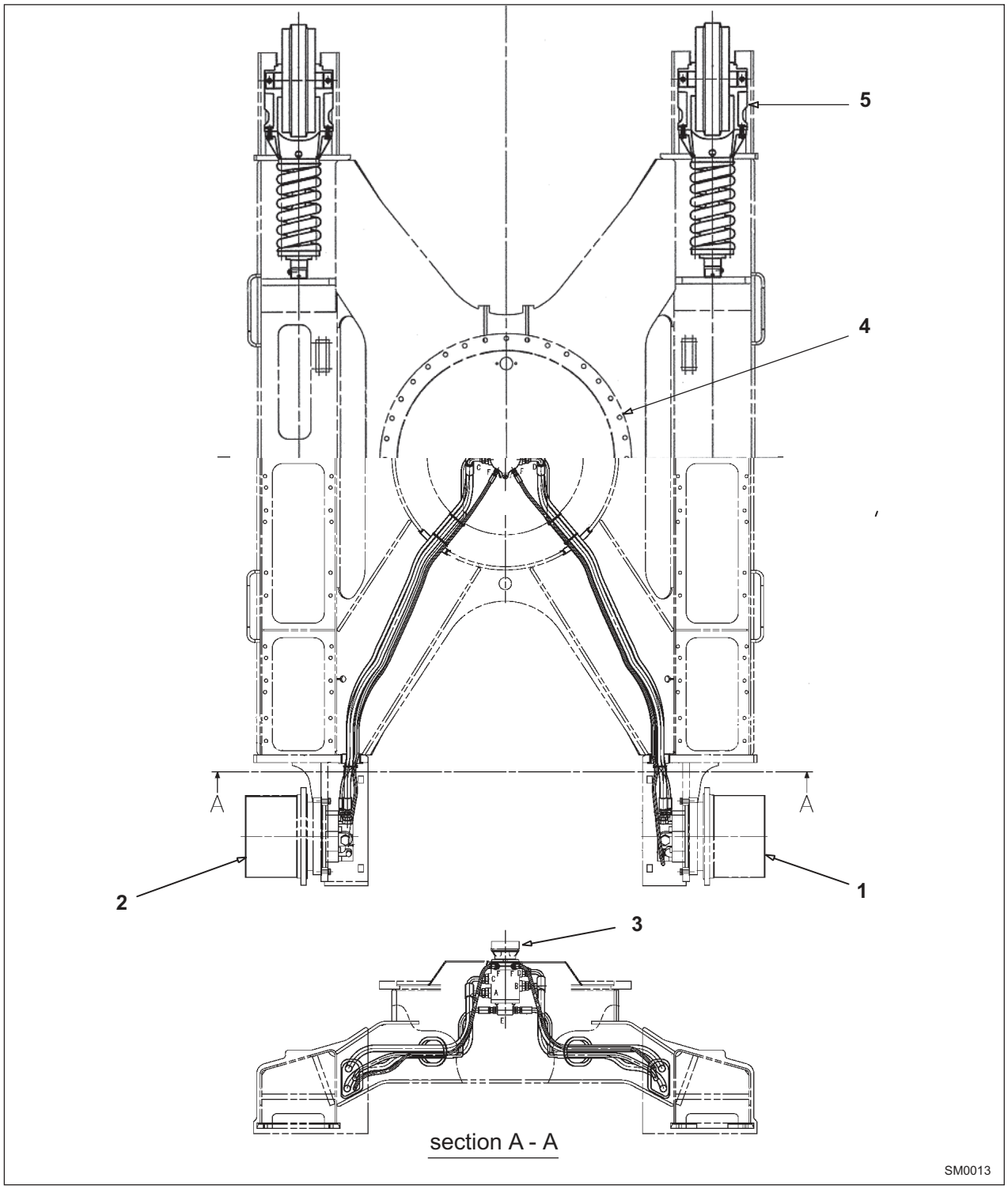


15 - No stepping warning decal

It instructs not to step on the zone where this decal is attached.



Main Components – Under Carriage



1 - Right Travel Motor Unit
2 - Left Travel Motor Unit
3 - Center joint
4 - Swing Gear
5 - Front Idler Assy

PERFORMANCE SK295-9

MAXIMUM CLIMBABLE GRADIENT 70%

SWING SPEED . . . . . .11 rpm

TRAVEL SPEED

Slow	3.6 km/h
Fast	5.8 km/h

ENGINE SPECIFICATIONS SK295-9

MAIN SPECIFICATIONS

Maker	FPT
Model	F4HFE613P*A004
Type	Water-cooled, 4 cycle direct injection type diesel engine with intercooler turbo-charger electric common-rail
Number of cylinders	6 in-line
Bore	104 mm (4.09 in)
Stroke	132 mm (5.19 in)
Total displacement	6728 cm^3 (411 cu-in)
Compression ratio	17:1
Rated output power (at 2100 rpm) (ISO 14396: without fan)	152 kW (207 PS)
Rated output power (at 2100 rpm) (ISO 14396: with fan)	145 kW (197 PS)
Maximum torque (at 1400 rpm) (ISO 14396)	912 Nm (673 lbf*ft)
High idling	2100 rpm
Low idling	800 rpm
Fuel consumption rate	216 g/kWh
Engine oil quantity	18.3 L (4.83 gal)
Weight	580 kg (1279 lbs)

FEEDING

Type	Electric common rail
Injection sequence	1-5-3-6-2-4

BATTERY

Voltage	2 x 12 V
Capacity	2 x 160 Ah

STARTER MOTOR

Maker	BOSCH
Voltage	24 V
Output	4 kW

ALTERNATOR

Maker	BOSCH
Voltage	24 V
Output	70 A

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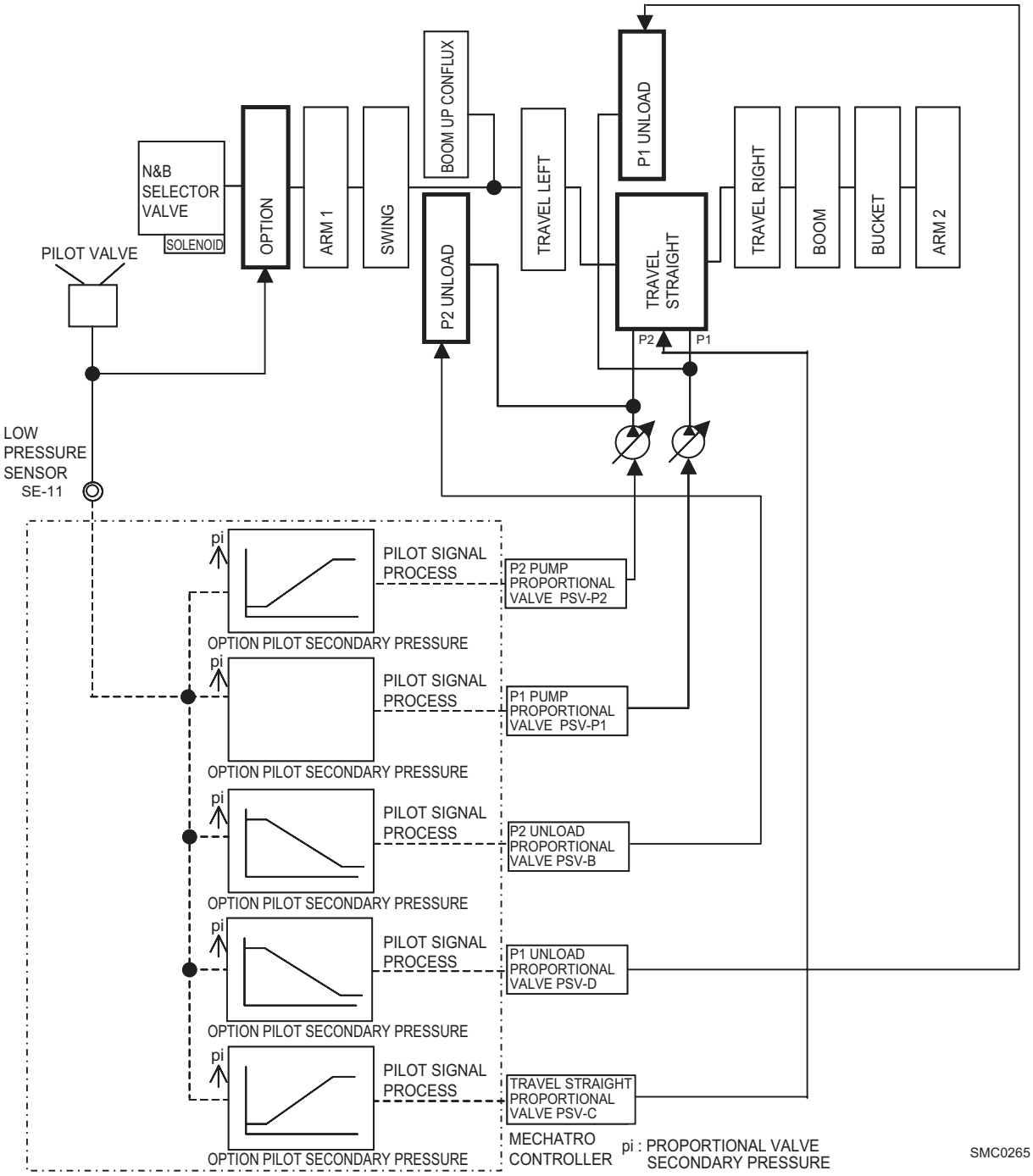
2.14 OPTION CONFLUX CONTROL (OPTION)



1. Using "OPTION SETTING" display located on "USER MENU" screen, the flow rate is adjusted. If the setting flow rate is larger than one pump flow rate, the flow becomes automatically confluent flow.
2. Upon starting option operation, option operating pilot pressure switches option spool and is supplied to low pressure sensor.
3. The output voltage of low pressure sensor is supplied 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, P1 and P2 unload pressure proportional valves and travel straight proportional valve.
4. Each proportional valves output pilot proportional valve secondary pressure according to the command output by mechatro controller and changes P1 and P2 pump delivery rate and switches P1 and P2 unload valves and travel straight valve of the control valve.
5. The parallel passage on P2 side is connected to P1 port because of the travel straight valve switched and P1 pump delivery oil confluxes P2 pump delivery oil because of the P2 unload valve switched.

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 switchis turn ON	O	O	-			
	2	FINISH WARM-UP	After finishing warming up control		O	2	O	x	
	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	DRAIN WATER SEPA	Water in water separator filter is increased	O	O	3	x	O	W010
	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	-			
	4	LOW ENG WATER LEVEL	The water engine coolant reservoir is low	O		-			W004
	5	AUTO WARMING UP	The auto warming up control is activated		O	-			
	5	CHANGE ENG OIL	The remaining time is reached zero Hours	O	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.

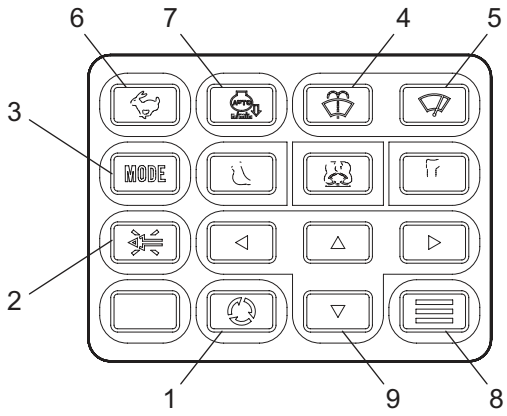
Operation No.5: Boom down in full lever operation & in operation H mode Hi idle		
No.23 BOOM		
C-1	P1-PRES	5.0~9.0 M
C-2	P2-PRES	0.2~2.0 M
E-1	P1-PSV	600~620 mA
E-2	P2-PSV	350 mA
D-1	P1-UL(BPC)	427~477 mA
D-2	P2-UL(BPC)	750 mA
B-1	BOOM RAISE	0.0 M
B-2	BOOM LOWER	3.0 M
G-3	ENG SPEED	2050~2200
	POWER SHIFT	0 mA

Operation No.6: Arm-in in full lever operation & relief H mode Hi idle		
No.24 ARM, SWING		
C-1	P1-PRES	33.0~35.8 M
C-2	P2-PRES	33.0~35.8 M
E-1	P1-PSV	470~585 mA
E-2	P2-PSV	470~585 mA
D-1	P1-UL(BPC)	360 mA
D-2	P2-UL(BPC)	360 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	2050~2200
	POWER SHIFT	0 mA

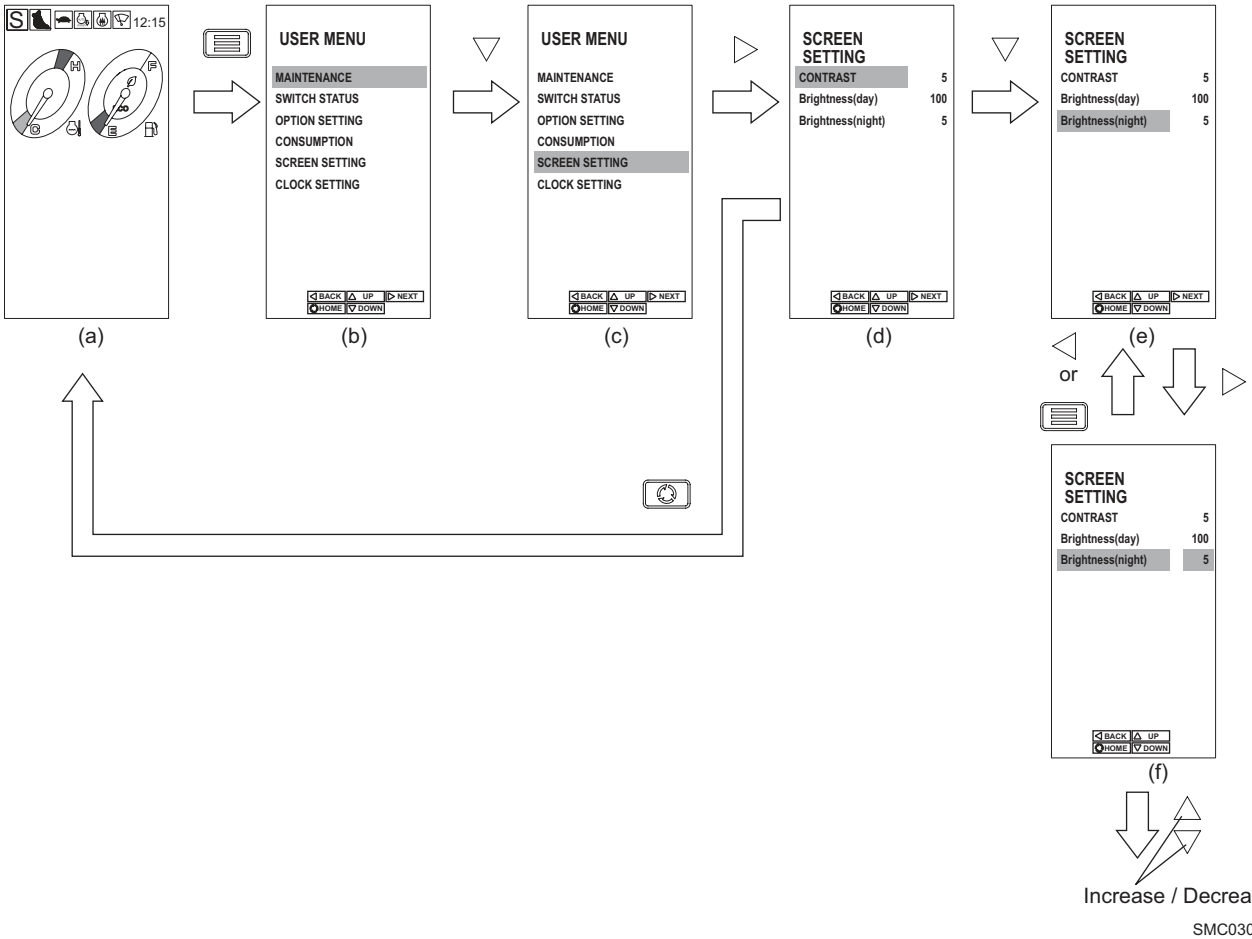
Operation No.7: Arm-in in full lever operation & in operation H mode Hi idle		
No.24 ARM, SWING		
C-1	P1-PRES	9.0~13.0 M
C-2	P2-PRES	9.0~13.0 M
E-1	P1-PSV	750~770 mA
E-2	P2-PSV	750~770 mA
D-1	P1-UL(BPC)	360 mA
D-2	P2-UL(BPC)	360 mA
D-3	S-TRAVEL	350 mA
D-6	ARM-IN-2	395 mA
B-3	ARM OUT	0.0 M
B-4	ARM IN	3.0 M
B-1	BOOM RAISE	0.0 M
B-7	SWING	0.0 M
G-3	ENG SPEED	2050~2200
	POWER SHIFT	0 mA

4) Brightness (Night) Adjustment

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



SMC0302



SMC0306

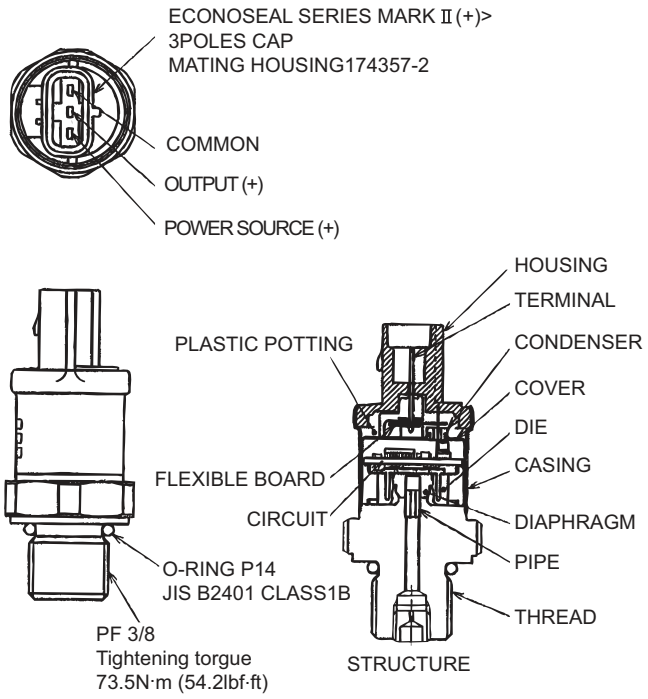
1. After turning starter key switch ON, the main screen (a) is appeared. And press "Menu Button" to enter into "USER MENU" display (b).
2. Move cursor to "SCREEN SETTING" display. Press "NEXT" to select "SCREEN SETTING" display (d).
3. Move cursor to "Brightness (night)" display. Press "NEXT" to select "Brightness (night)" value and brightness (night) setting display (f) is indicated.
4. Using cursor, select 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 Button" and the adjusted values are stored as memory and "SCREEN SETTING" is completed. Press "Screen Change Button", 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	Spare	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	Spare	Input	Power output 5V
	11	A15			0.5~4.5V
	12	GA			0V
	13	GA	Spare	Input	0V
	14	A16			0.5~4.5V
	15	+5VA			Power output 5V
	16		Reserved		

SMC0316

4) High pressure sensor: YN52S00048P1



SPECIFICATION :

PRESSURE RANGE : 0～50 MPa (0～7110 psi)

POWER SOURCE VOLTAGE : 5.0+0.5V DC

OUTPUT : 1/10Vs-9/10Vs

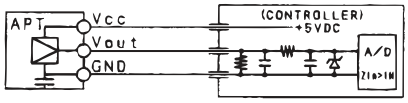
(Vs=5V DC 0.5～4.5V DC)

INSURANCE RESISTANCE : 100M Ω OR MORE

(BETWEEN CASING AND ALL IN/OUT TERMINALS AT 50V DC MEGGER)

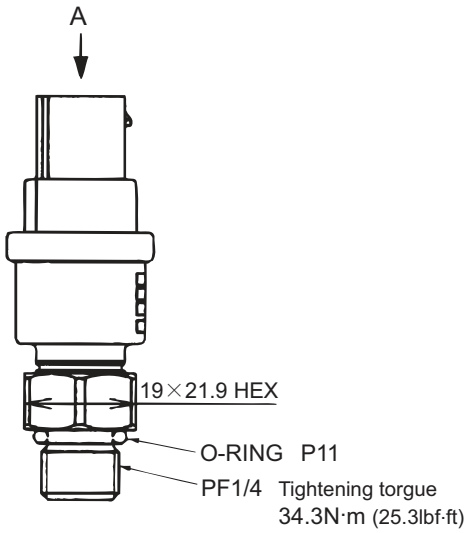
ELECTRIC CONNECTING DIAGRAM

(Ex. Construction of internal controller)



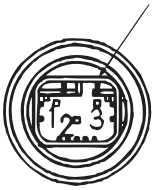
SMC0323

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)

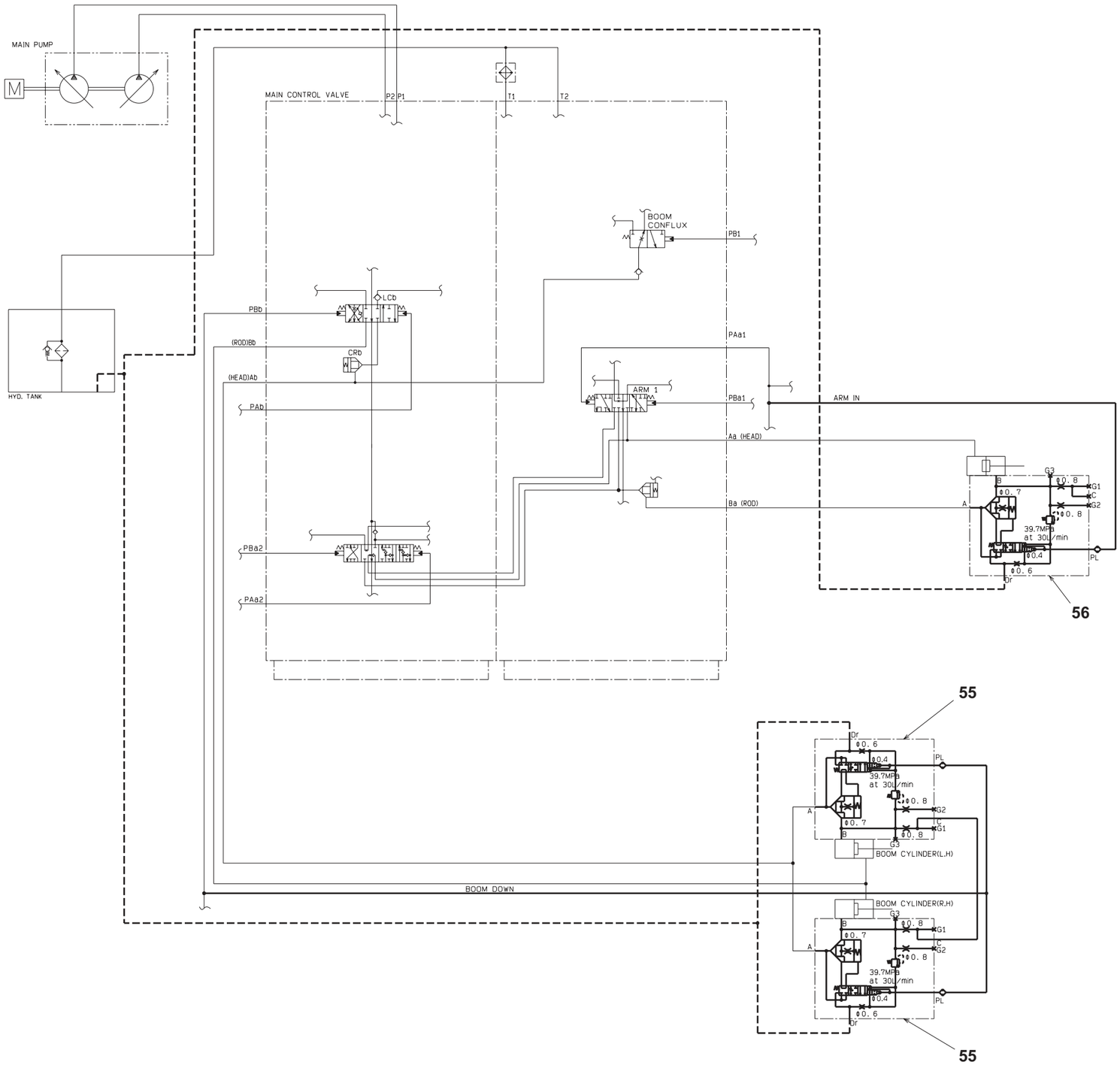
RATED VOLTAGE : 5.0+0.5V DC

INSURANCE RESISTANCE : 100MΩ OR MORE

(BETWEEN BODY AND EACH TERMINAL AT 50V DC MEGGER)

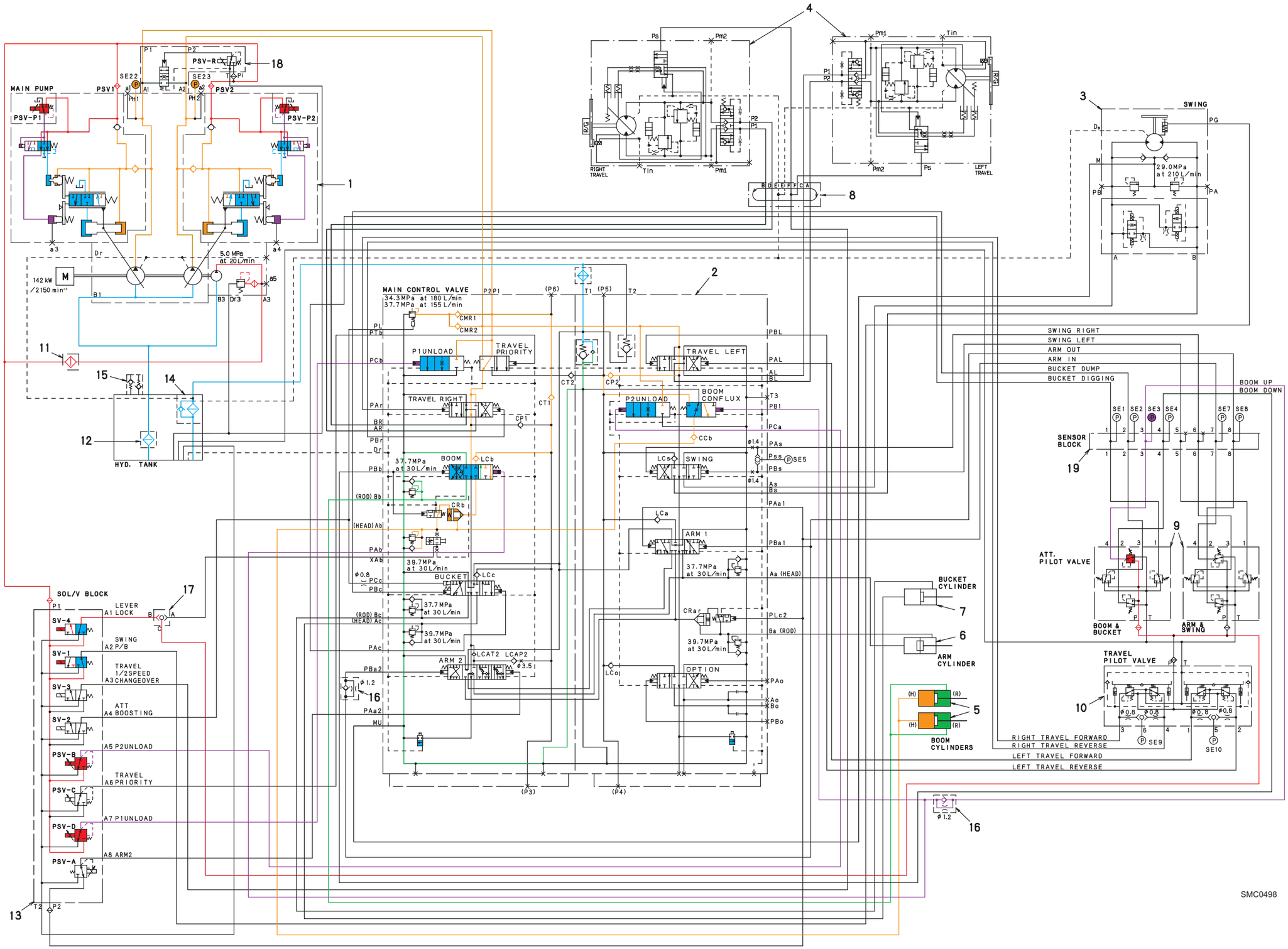
SMC0324

HOLDING VALVE FOR BOOM & ARM HYDRAULIC CIRCUIT

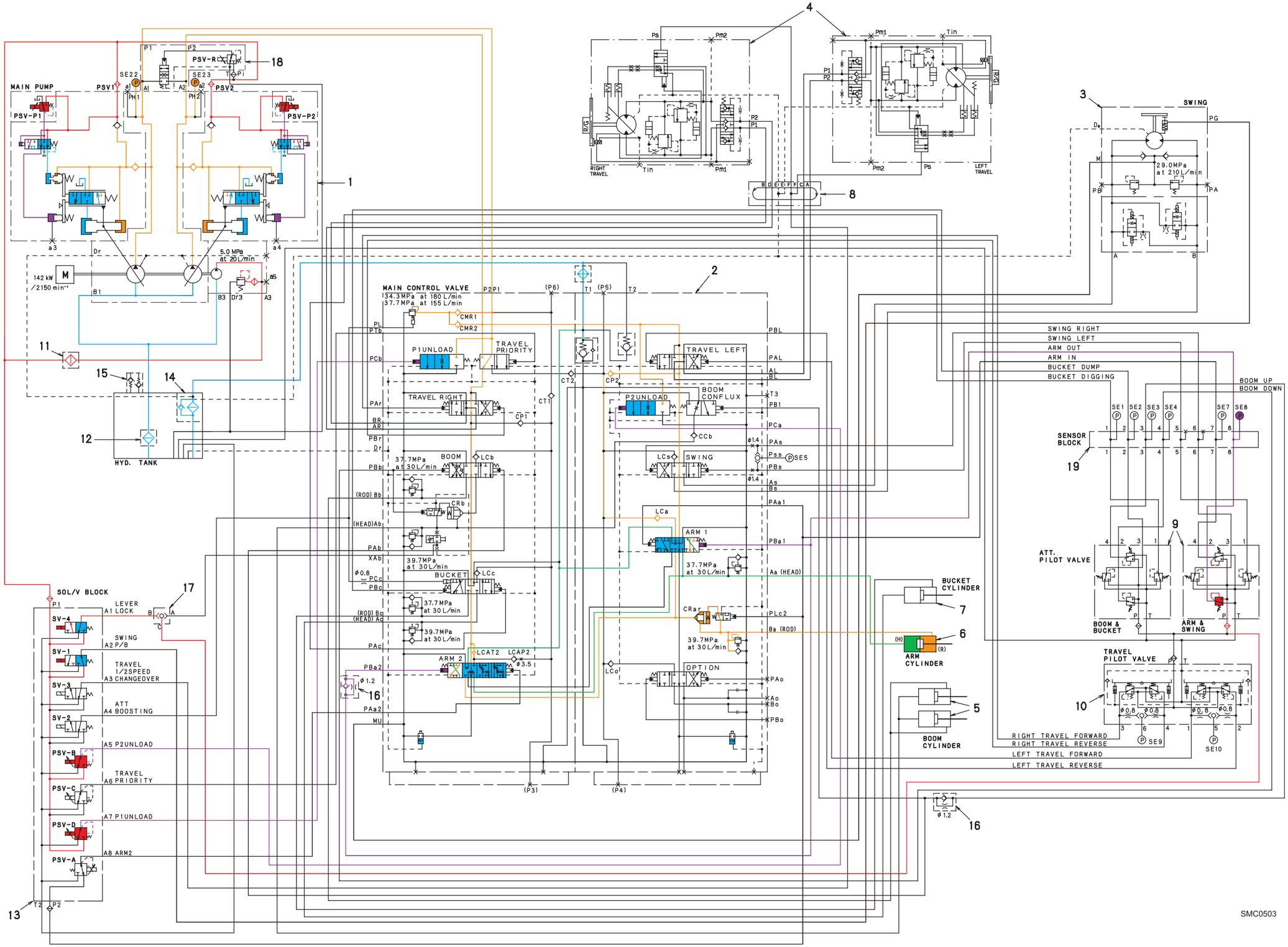


SMC0492

BOOM CIRCUIT: Boom up operation, Confluence function.

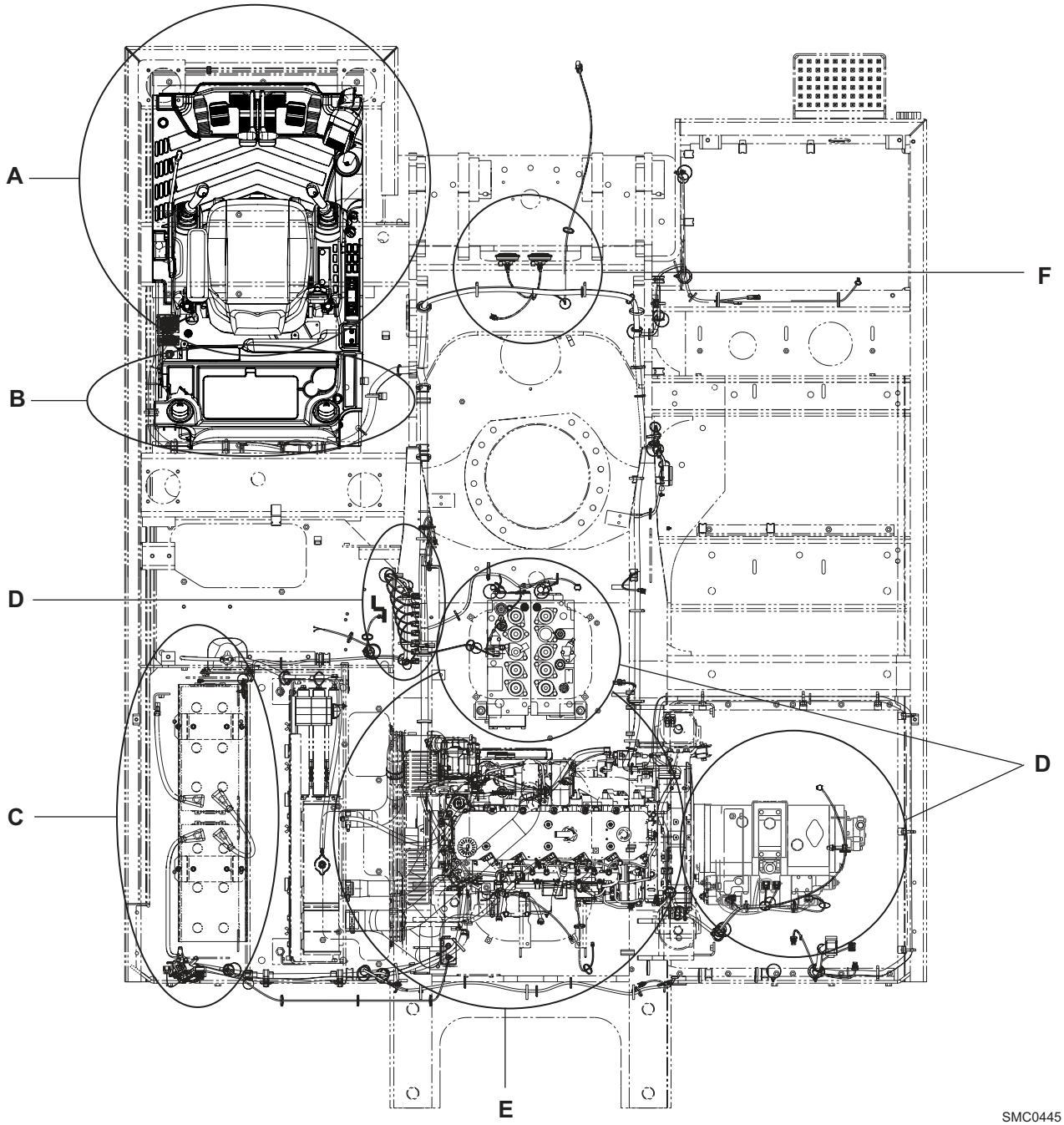


ARM CIRCUIT: Arm out operation, Confluence function



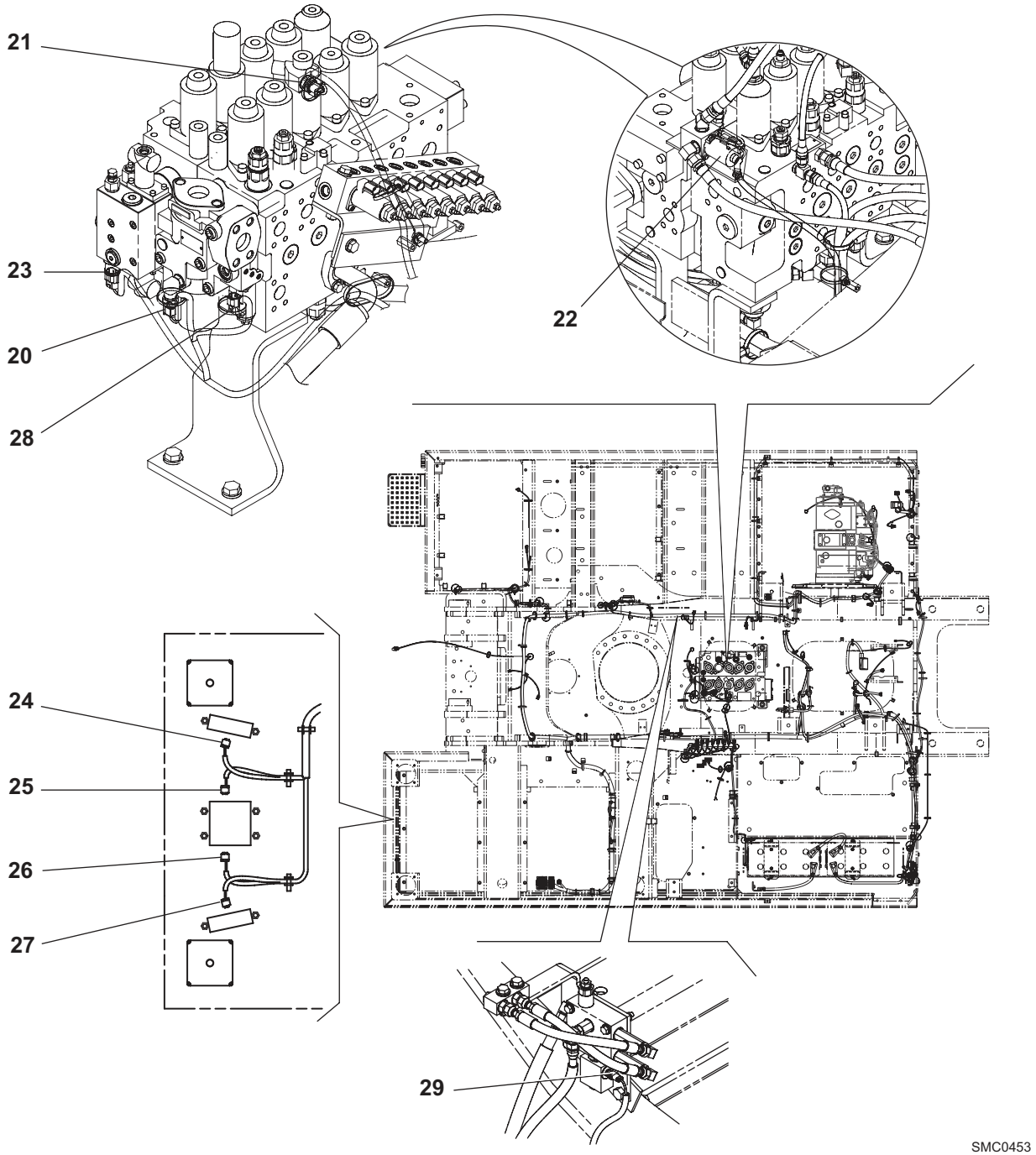
ELECTRICAL SYSTEM MAIN COMPONENTS

ELECTRICAL SYSTEM (Overall system)



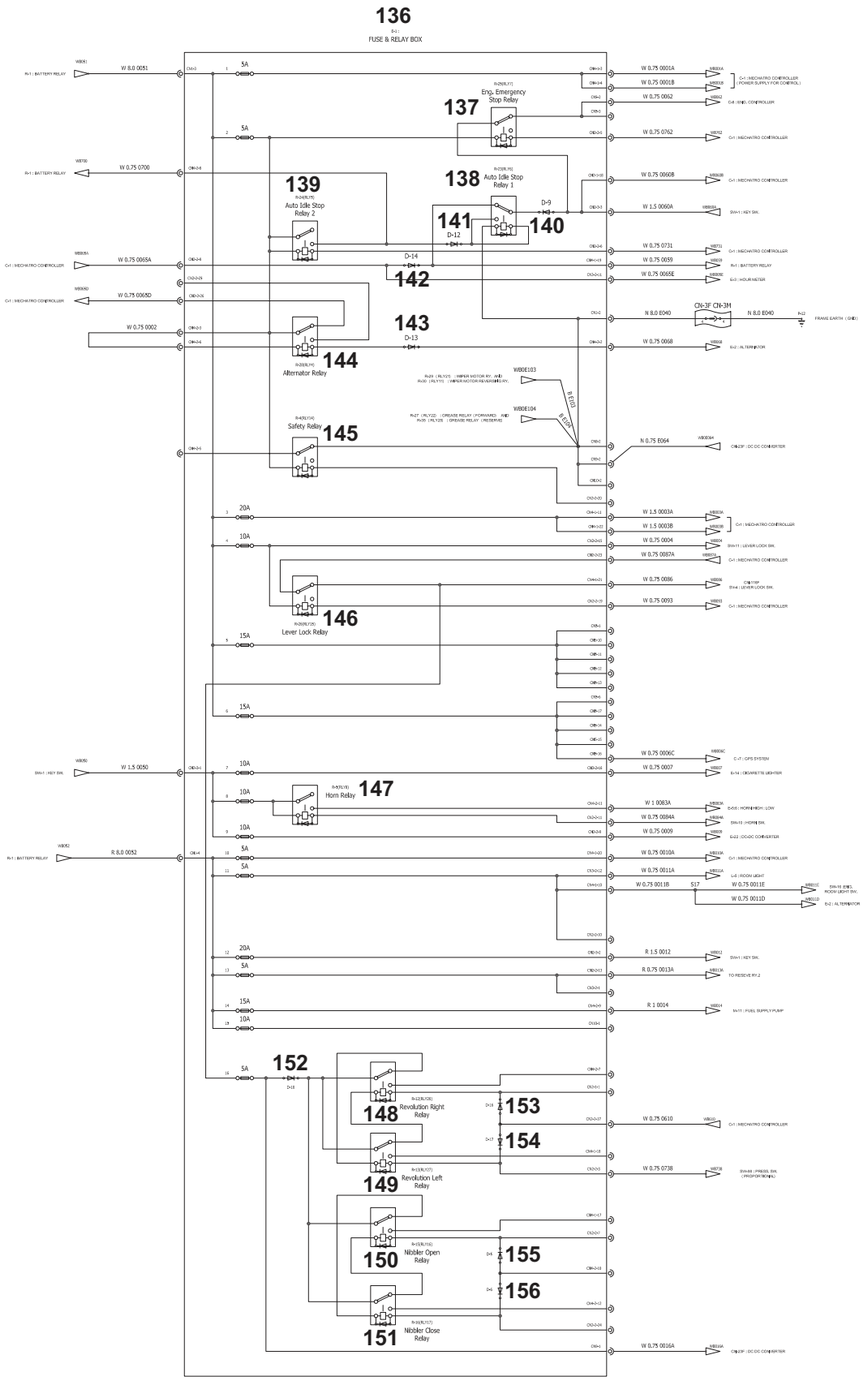
A - Cab Control
B - Mechatro Controller and Fuse & Relay box
C - Batteries, Batteries Relay, Fuse link
D - Hydraulic System Electrical Components
E - Engine Electrical Components
F - Light, Horn, ect

D – HYDRAULIC SYSTEM ELECTRICAL COMPONENTS (2)



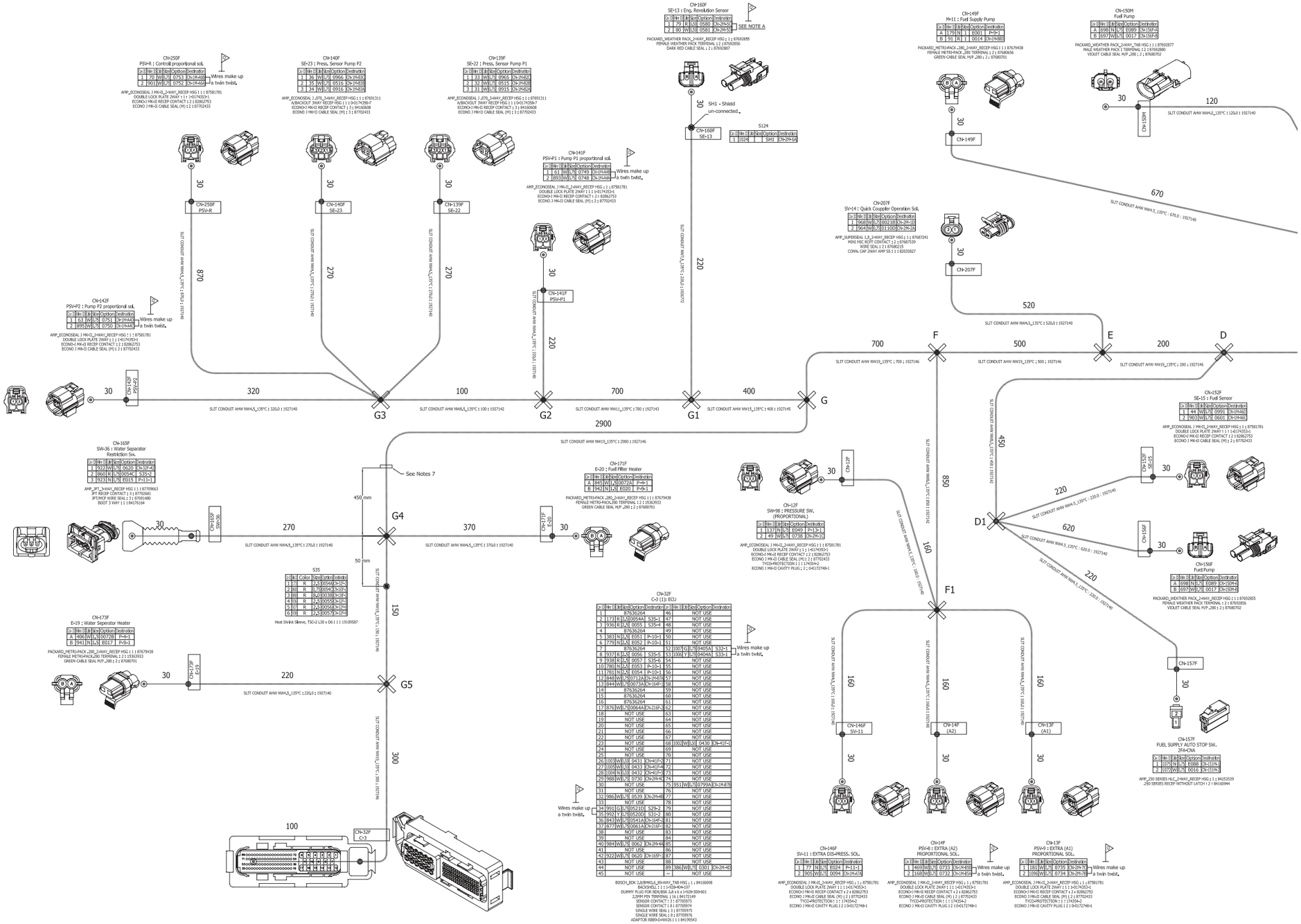
20 - Extra valve selector press sensor (SE-29) (opt.)
21 - Swing sensor (SE-5)
22 - Extra dis-press solenoid valve (SV-11) (opt)
23 - Extra dis-press sensor (SE-28) (opt)
24 - P1 opt. sensor valve (SE-20)
25 - Travel right sensor (SE-9)
26 - Travel left sensor (SE-10)
27 - P2 Opt. sensor valve (SE-11)
28 - Selector B&N solenoid valve (SV-13)
29 - Quick coupler solenoid valve (SV-14) (opt.)

ELECTRICAL SYSTEM DIAGRAM (No. 4)



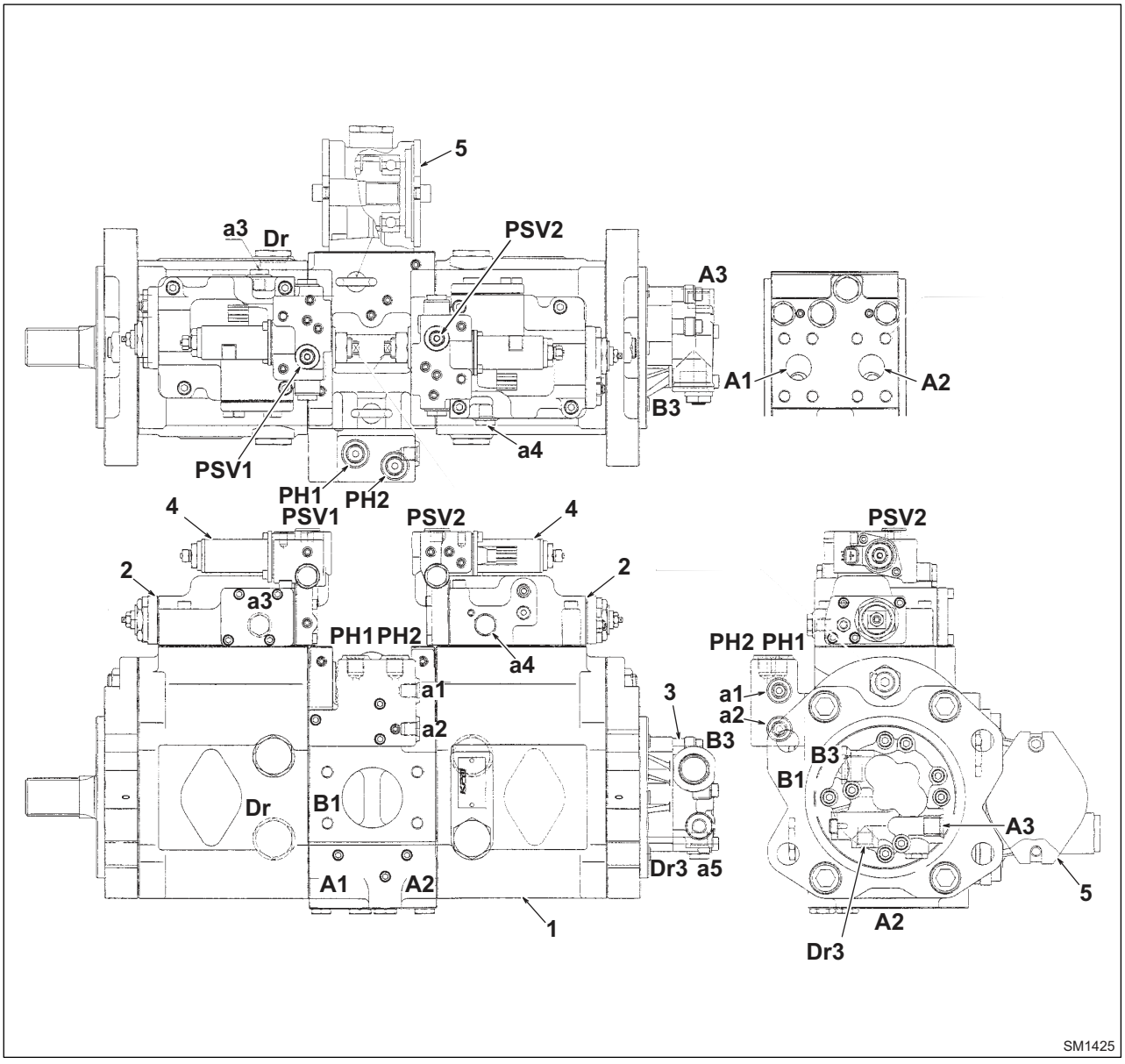
SMC0460

UPPER FRAME WIRING HARNESS ASSEMBLY (No.1)



OUTLINE

General view and hydraulic ports



1 - Main pump assembly
2 - Regulator assembly (Q.ty 2)
3 - Gear pump assembly (for pilot)
4 - Solenoid proportional reducing valve (Q.ty 2)
5 - PTO unit
A1 - Delivery port SAE 6000 psi 1"
A2 - Delivery port SAE 6000 psi 1"
B1 - Suction port SAE 2500 psi 2 1/2"
Dr - Drain port G 3/4-20
PSV1 - Servo assist port G 1/4-13
PSV2 - Servo assist port G 1/4-13
PH1 - Pressure sensor port G 3/8-17
PH2 - Pressure sensor port G 3/8-17
a1 - Gauge port G 1/4-15
a2 - Gauge port G 1/4-15
a3 - Gauge port G 1/4-15
a4 - Gauge port G 1/4-15
a5 - Gauge port G 1/4-14
A3 - Delivery port of gear pump G 1/2-19
B3 - Suction port of gear pump G 3/4-20.5
Dr3 - Drain port of gear pump G 3/8-15

Operation

CONTROL FUNCTION

Electric flow control
- Positive flow control
- Total horsepower control

Emergency mode control
- Hydraulic positive control
- Hydraulic total horsepower control

SUMMARY

The regulator KR3G-YT1K for the in-line type axial piston pump K3V series is composed of the control mechanism as mentioned below:

Electric flow control and positive flow control

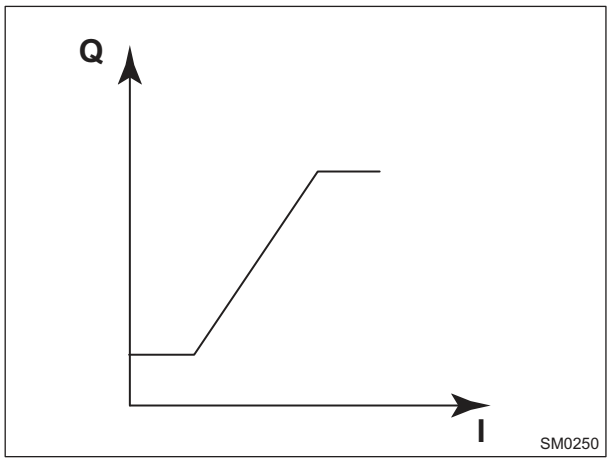
The tilting angle of the pump (delivery rate) is controlled by controlling the current command value of the solenoid proportional reducing valve attached to the regulator. The regulator makes positive flow control (positive control) that increases the delivery rate as the secondary pressure of the solenoid proportional reducing valve rises. Since this function permits the output power of the pump to be varied, it is possible to attain optimum power according to the operating condition. Also, since the pump delivers only the necessary oil flow, the machine does not consume excessive power.

Constant power control at emergency mode

When the electromagnetic proportional pressure-reducing valve cannot output the secondary pressure due to the trouble, the spool for emergency mode is switched automatically, and the control is switched from electric control to hydraulic control (emergency mode).
In emergency mode, the power shift command pressure Pf shifts the power set value. The power shift pressure (secondary pressure of electromagnetic proportional pressure-reducing valve) is led to power control section of regulator on each pump through pump inside passage and shifts respective control to the same power set value.
In the power shifted condition, as self pump delivery pressure Pd1 rises, the pump tilt angle (delivery rate) is automatically reduced; consequently the input torque is controlled to the constant value or less. (When the speed is constant, the input power is also constant.) This pump is controlled by Pd1 only regardless of another delivery pressure. Condition where the power is controlled, the regulator of each pump is controlled to the different tilt angle (delivery rate). Consequently in the condition where the power is controlled, the overloading of engine is automatically prevented regardless of the loading of pump 2. And in normal condition, because the power shift pressure is 0 MPa, the power control is not worked.
With this mechanism, it is possible to obtain proper power for the working condition. This regulator is made up of the above two kinds of control system, but when both controls are actuated together, the low tilt angle (low delivery rate) command precede on mechanical operation described later.

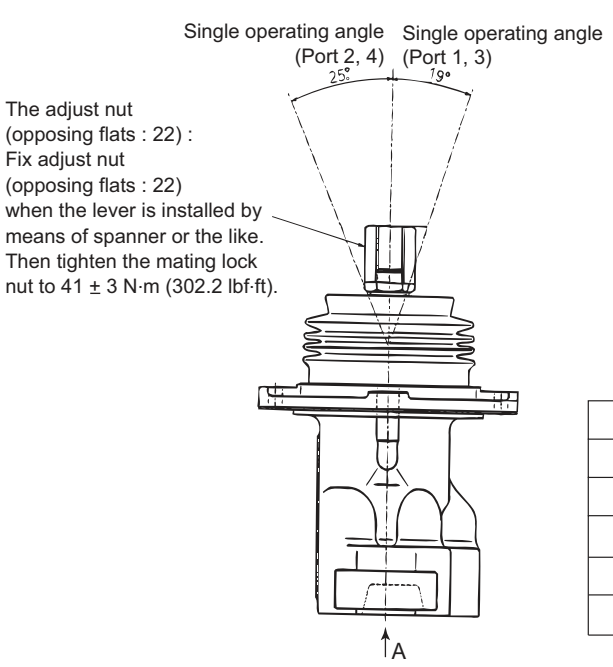
FLOW RATE ELECTRICAL CONTROL

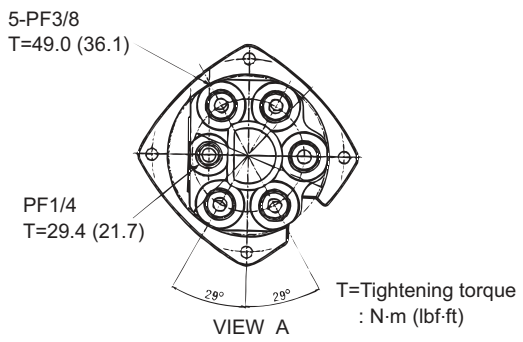
As shown in figure, the delivery rate Q of the pumps is controlled by the input current I (pilot pressure Pi).



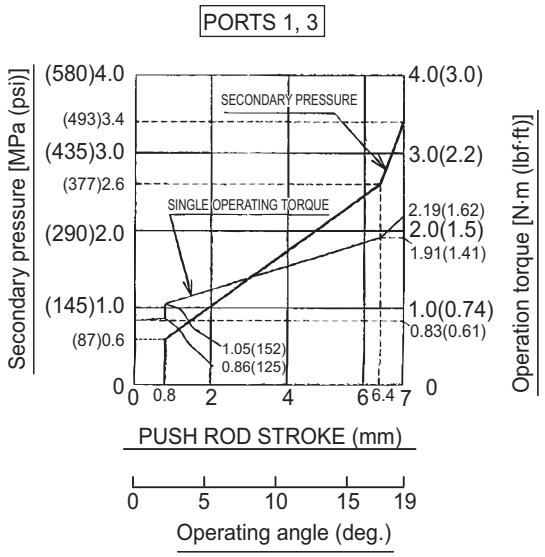
PILOT VALVE (ATT)

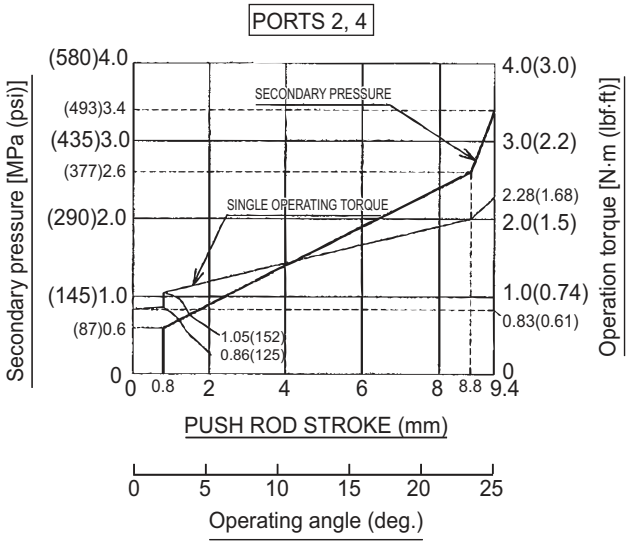
OUTLINE

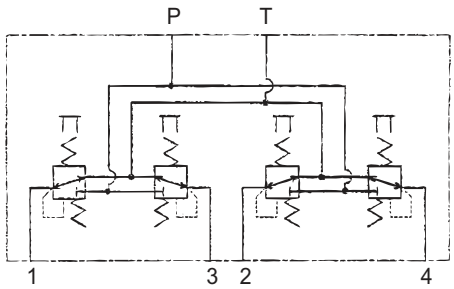




Model	PV48K2058
Operating torque	Refer to the curve below
Max. primary pressure	6.9 MPa (1000 psi)
Primary pressure	5.0 MPa (725 psi)
Rated flow	20 L/min (5.3 gal/min)
Weight	Approx. 1.9 kg (4.2 lbs)







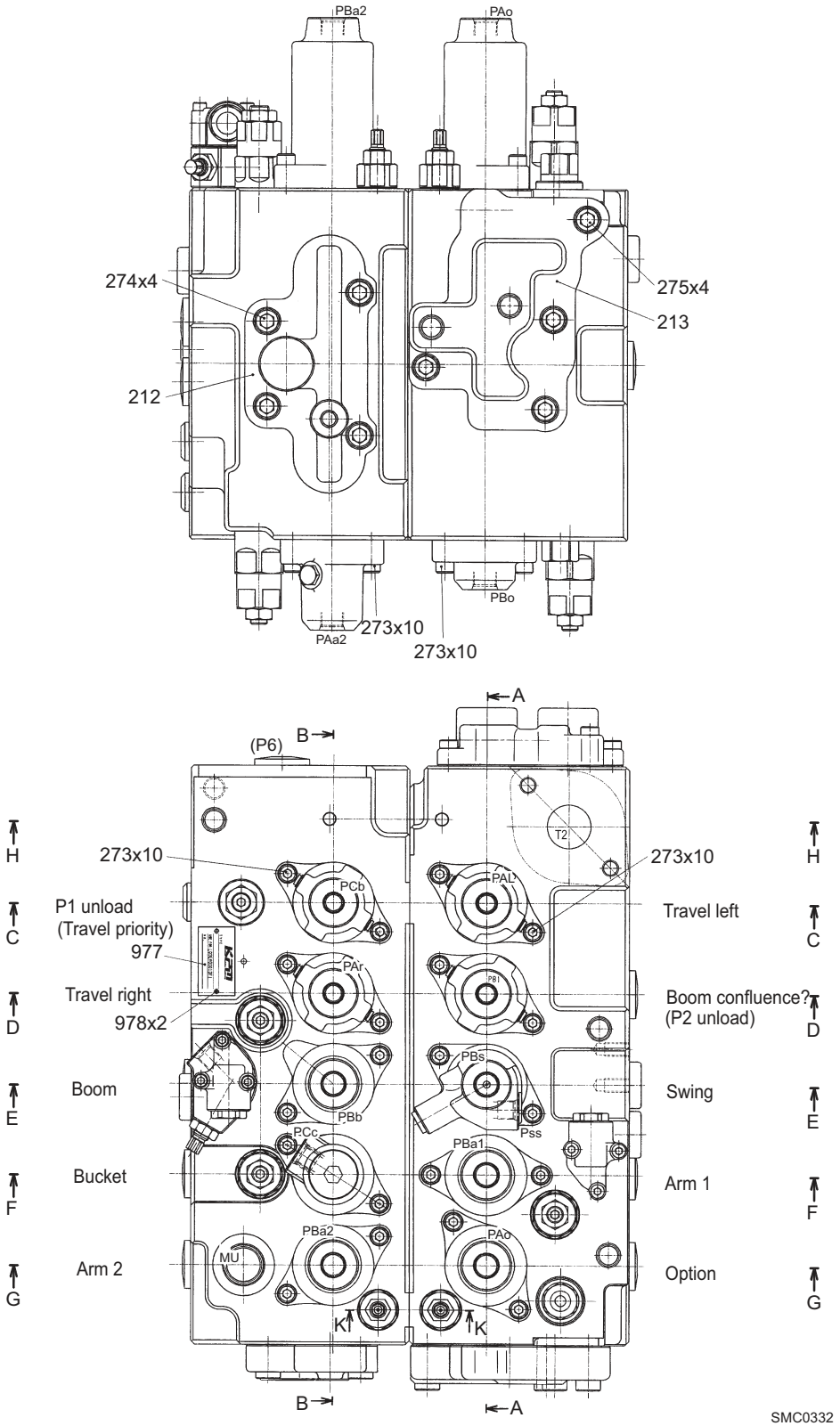
HYDRAULIC SYMBOL

SMC0327

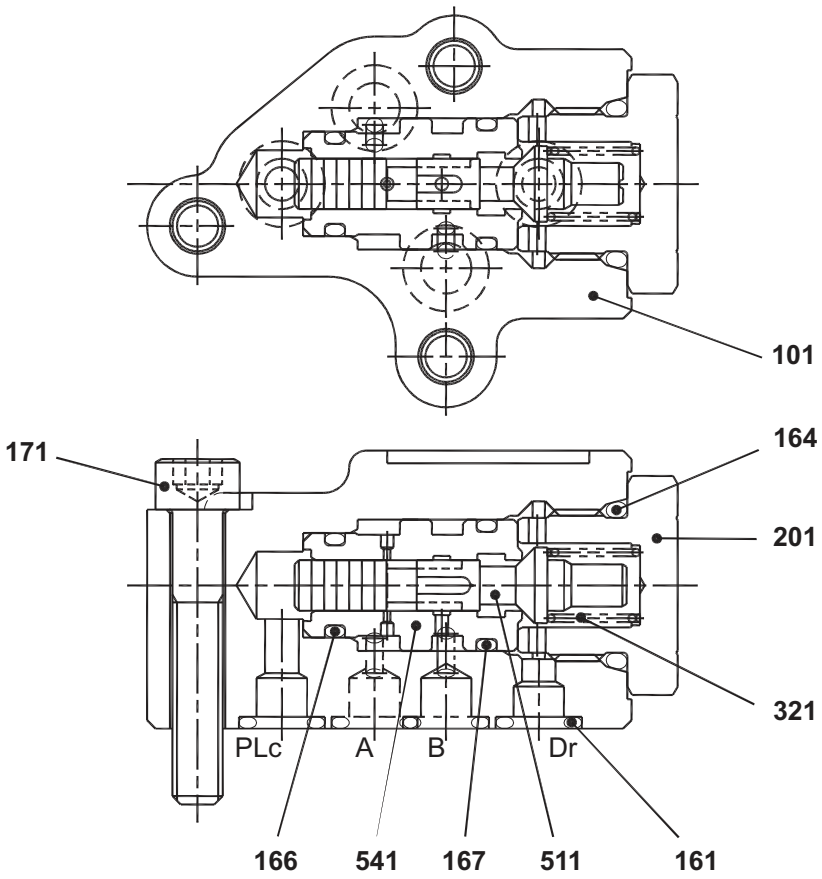
CONSTRUCTION AND OPERATION

Construction

Control valve (1/6)



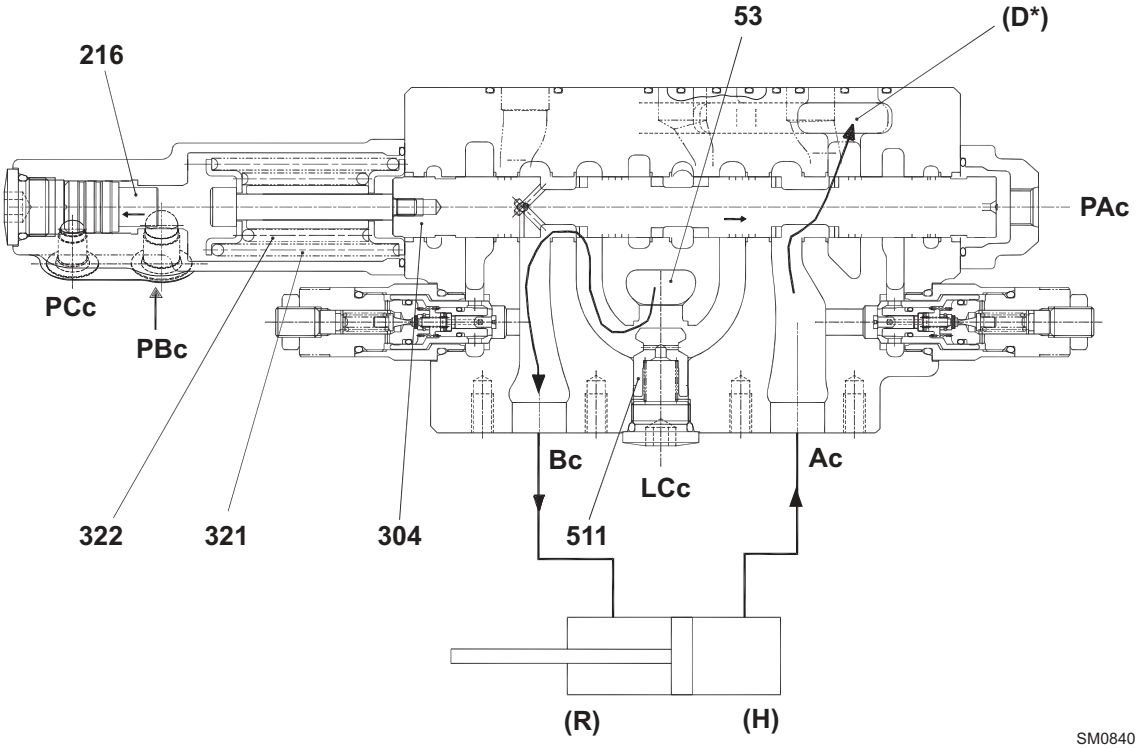
Lock valve selector (211)



Lock valve selector

Tightening torque N•m (lbf•ft)	No.	Parts	Q'ty	Tightening torque N•m (lbf•ft)	No.	Parts	Q'ty
	101	Casing	1	10~14 (7.4~10.3)	171	Socket bolt	3
	161	O-ring	4	49~59 (36~44)	201	Plug	1
	164	O-ring	1		321	Spring	1
	166	O-ring	1		511	Spool	1
	167	O-ring	1		541	Sleeve	1

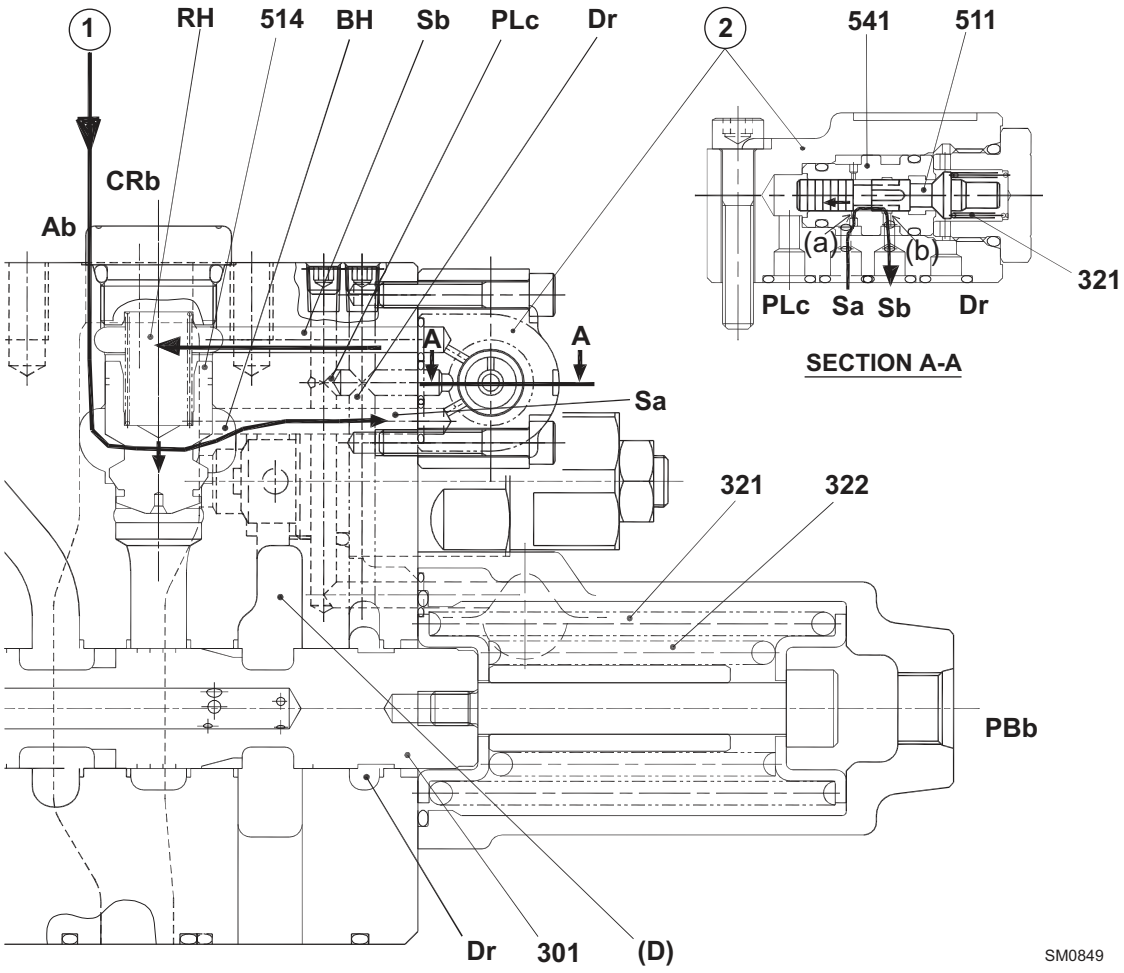
b) In bucket dumping operation
Upon starting a bucket dumping operation, the pilot pressure enters port PBc and bucket spool (**304**) moves rightward the force of springs (**321**) (**322**), and simultaneously the secondary pressure of solenoid proportional valve [XI] acts on port PCb and switches unloading spool (**309**). The hydraulic oil delivered by hydraulic pump P1 flows into parallel passage (**53**), pushes and opens load check valve LCc (**511**), and flows through between the perimeter of bucket spool (**304**) and casing through U-shaped passage, and supplied to bucket cylinder rod side (**R**) through port (**Bc**).
At the same time the return oil from bucket cylinder head side (**H**) passes between the perimeter of bucket spool (**304**) and casing and flows through low pressure circuit (**D**), and returns to the hydraulic tank through tank port T1. The return oil does not pass through boost check valve (**517**).



(D*) Downstream of boost check valve
In bucket dumping operation

8. **Lock valve operation**
The lock valve is housed in between each port of the control valve connected to arm cylinder rod side (**R**) and arm cylinder head side (**H**) and the arm spool and boom spool, and reduces the leaking due to holding pressure caused by each cylinder.

a) At boom spool neutral position (Arm spool makes the same operation.)
When boom spool (**301**) is set to neutral position, spool (**511**) of lock valve selector is held on the left side as shown in the figure. At this position, passages Sa and Sb are connected to each other at the inside of bushing (**541**) and on the perimeter of spool (**511**). Therefore in spring chamber (**RH**) of lock valve poppet, the holding pressure received from boom cylinder head side (**H**) passes from passage Sa to bushing (**541**) spool (**511**) and is connected through passage Sb, consequently the lock valve poppet (**514**) is kept pressed the lower side as shown in the figure and restricts the leaking to the minimum.

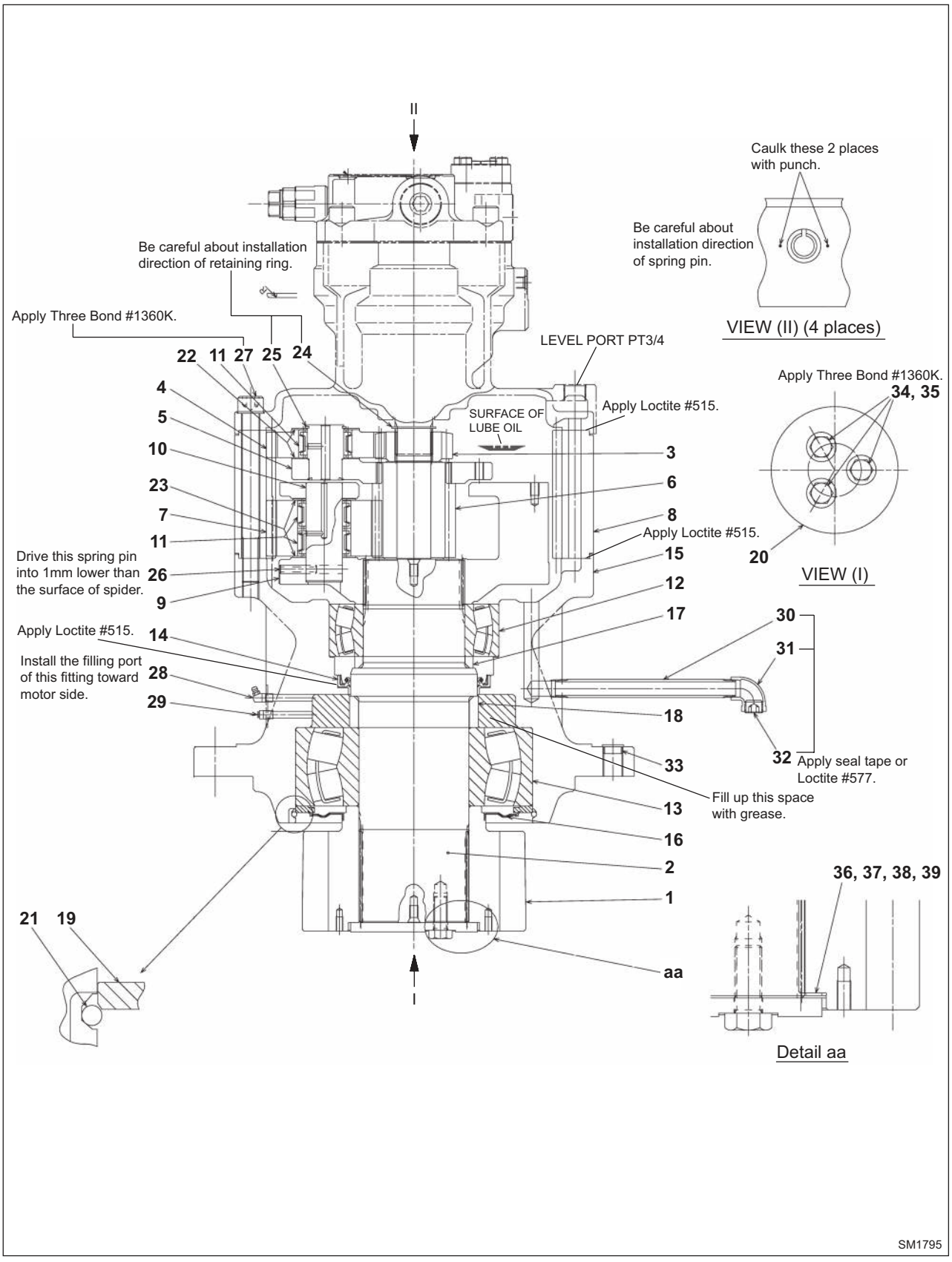


1. Return oil from boom cylinder head
2. Lock valve selector
Lock valve operation (At boom spool neutral position)

Specification

Hydraulic motor	Model		M5X130CHB–10A–54A/295-F
	Type		Swash-plate type, fixed-displacement plunger motor
	Displacement	cm^3 (in^3)	129.2 (7.88)
	Working pressure	MPa (psi)	32.4 (4700)
	Max. flow	L/min (gal/min)	210 (155.5)
	Braking torque	Nm (lbf·ft)	655 (483)
	Release pressure	MPa (psi)	2.5~5.0 (362~725)
	Relief set pressure	MPa (psi)	29 (4205)
	Mass	kg (lbs)	47 (103.6)
Anti-reaction valve block	Type		2KAR6P72/240-712
	Mass	kg (lbs)	2.5 (5.5)
Hydraulic motor assy mass		kg (lbs)	49.5 (109)
Reduction unit	Speed reduction type		Planetary 2-stage
	Reduction ratio		19.286
	Lubricate oil		SAE 80W/90 (API GL-4 Class or GL-5 Class)
	Lubricate oil volume	L (gal)	12 (3.2)
	Mass	kg (lbs)	225 (496)
Total mass		kg (lbs)	Approx. 275 (606)

Swing reduction unit ESK295C



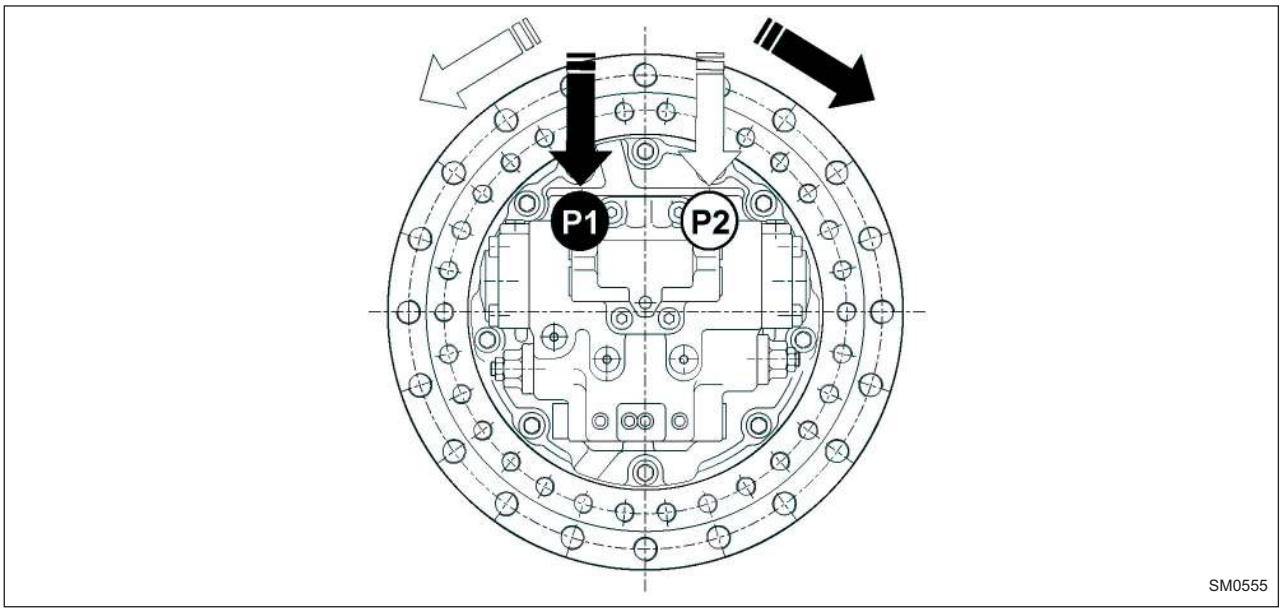
OUTLINE SK260-9

Characteristics

Item		SK260-9
Model		MAG-170VP-3800G-K4
Reduction gear unit		Epicycloidal, two-stage planetary type
Gearbox ratio		1 : 43.246
Travel motor		Two speed, axial piston swash plate type
Displacement	High speed	112.6 cm^3/rev (6.87 in^3/rev)
	Low speed	181.3 cm^3/rev (11.06 in^3/rev)
Maximum flow		210 L/min (56 gal/min)
Rated pressure		34.3 MPa (4973.5 psi)
Parking brake torque		384 Nm (283.2 lbf.ft) or more
Mass		262 kg (577 lbs)

Direction of Rotation

When assembling track drive on machine and connecting the hoses, follow sketch below for proper direction of rotation.



Oil inlet port	Oil outlet port	Direction of rotation
P1	P2	Clockwise
P2	P1	Counterclockwise

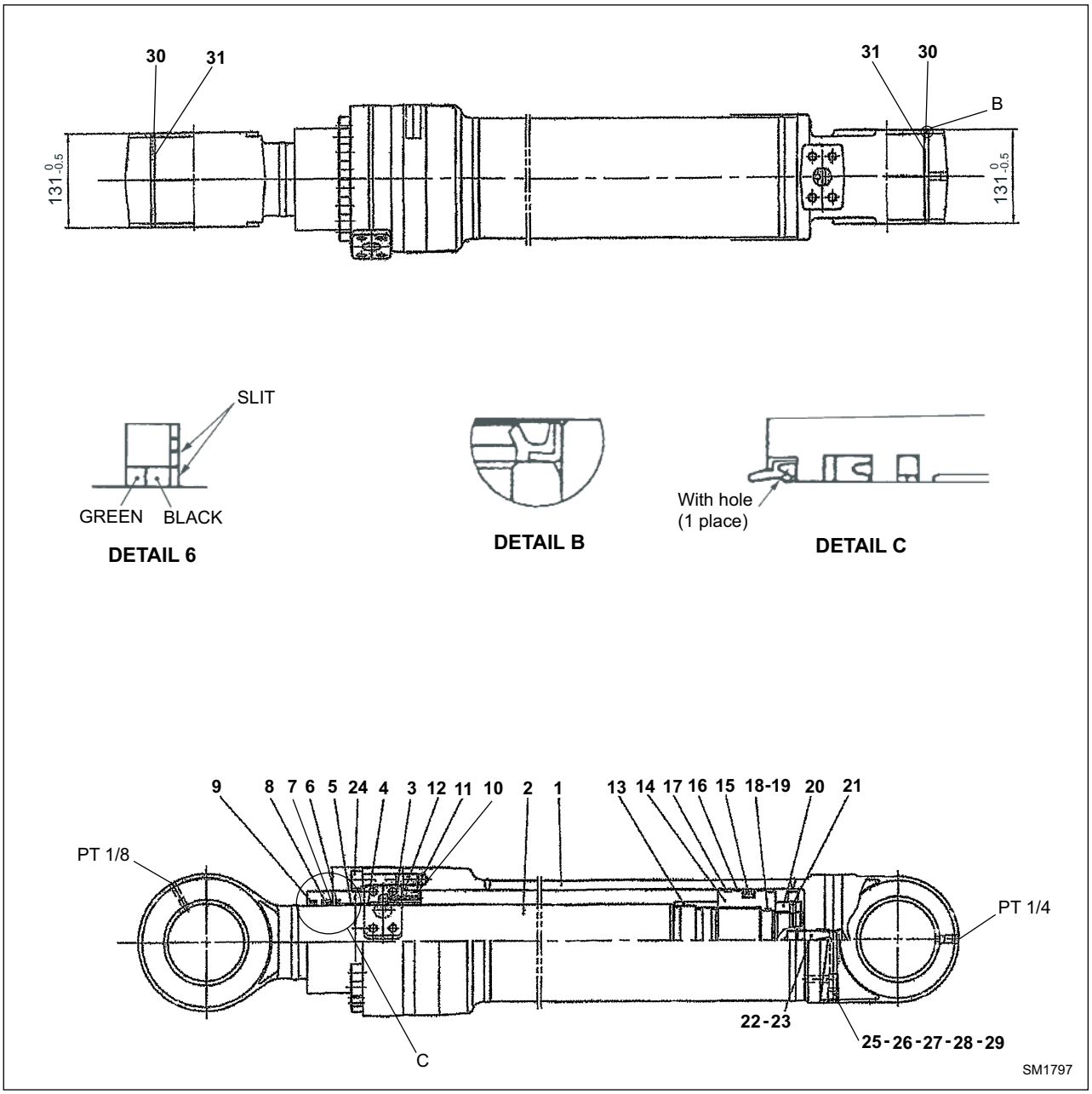
Motor Drain Pressure

Continuous running	Less than 2 bar
Maximum intermittent	Less than 5 bar

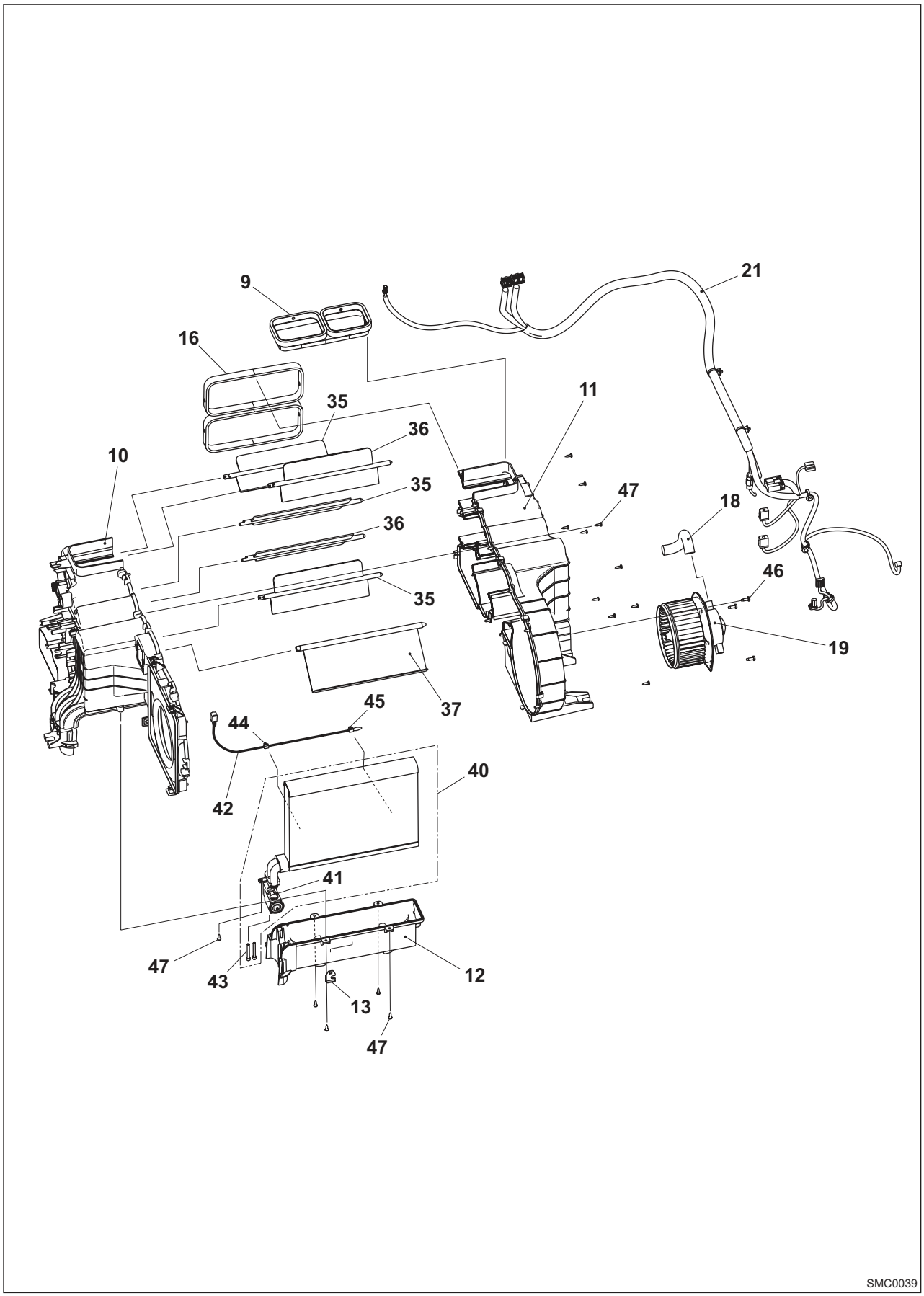
Brake

The track drive is supplied with a safety negative disc brake fitted into the hydraulic motor (parking brake).
The parking brake release is automatically operated when high-pressure oil is supplied to one of the two ports of the hydraulic motor. There is no need for brake external pilot.
The brake technical data is shown on the track drive installation drawing.

Arm cylinder (SK295-9)

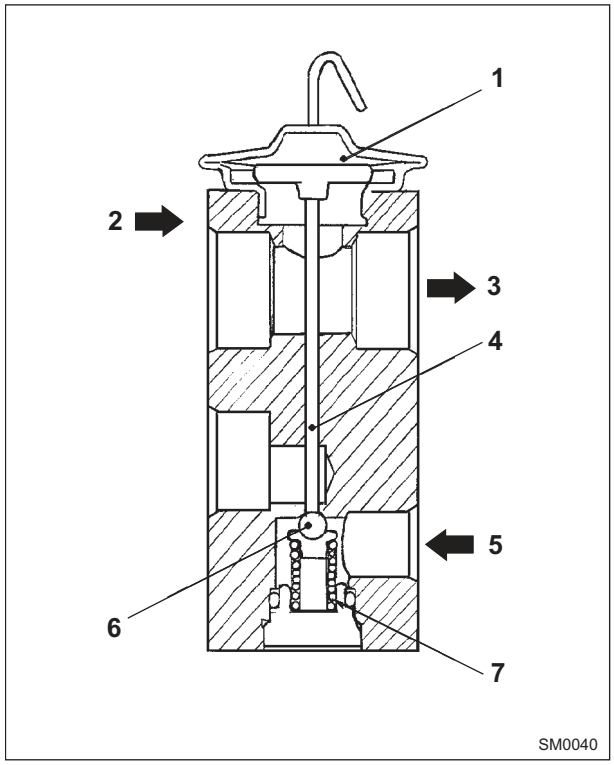


1- Cylinder tube
2- Piston rod
3- Cylinder head
4- Bushing
5- Snap ring
6- Buffer ring
7- U-ring
8- Backup ring
9- Wiper ring
10- O-ring
11- Backup ring
12- O-ring
13- Cushion seal
14- Piston - 981±98 Nm (723.5±72.3 lbf·ft)
15- Seal ring
16- Slide ring (qty 2)
17- Slide ring (qty 2)
18- O-ring
19- Backup ring
20- Nut - 1860±186 Nm (1372±137.2 lbf·ft)
21- Set screw - 14.7 Nm (10.8 lbf·ft)
22- Cushion
23- Ring
24- Socket bolt - (qty 14) 471~491Nm (347.4~362.1 lbf·ft)
25- Orifice
26- Spring
27- Spacer
28- O-Ring
29- Plug
30- Wiper ring (qty 4)
31- Bushing (qty 4)

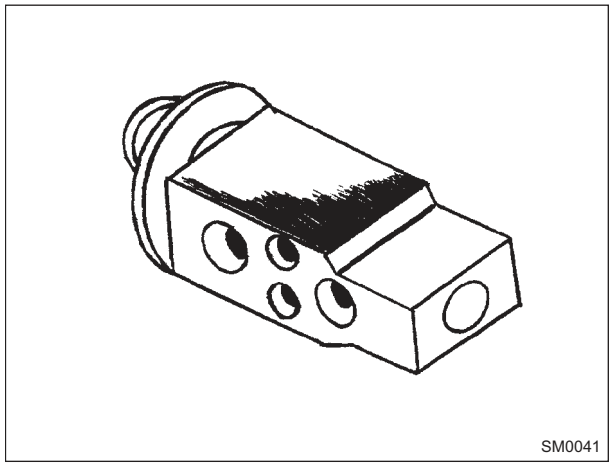


Air conditioner unit (2/2)

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



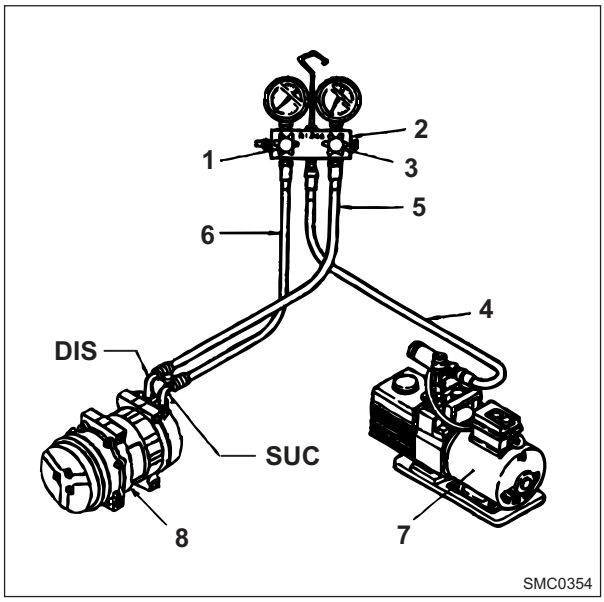
1 - Diaphragm
2 - Evaporator side
3 - Refrigerant outlet
4 - Shaft
5 - Refrigerant inlet
6 - Ball valve
7 - Spring



CHARGING PROCEDURE

VACUUM MAKING OPERATION

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

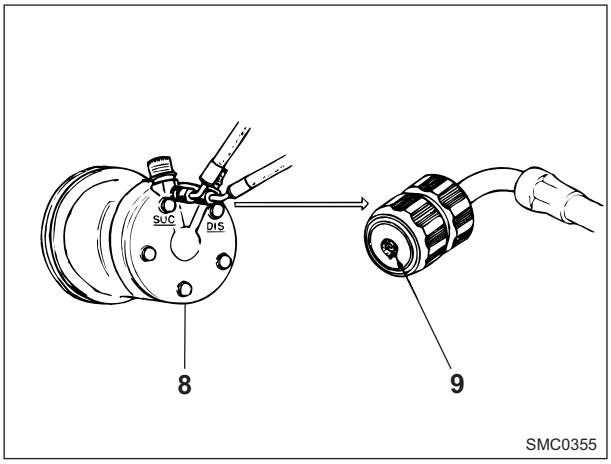


CAUTION

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

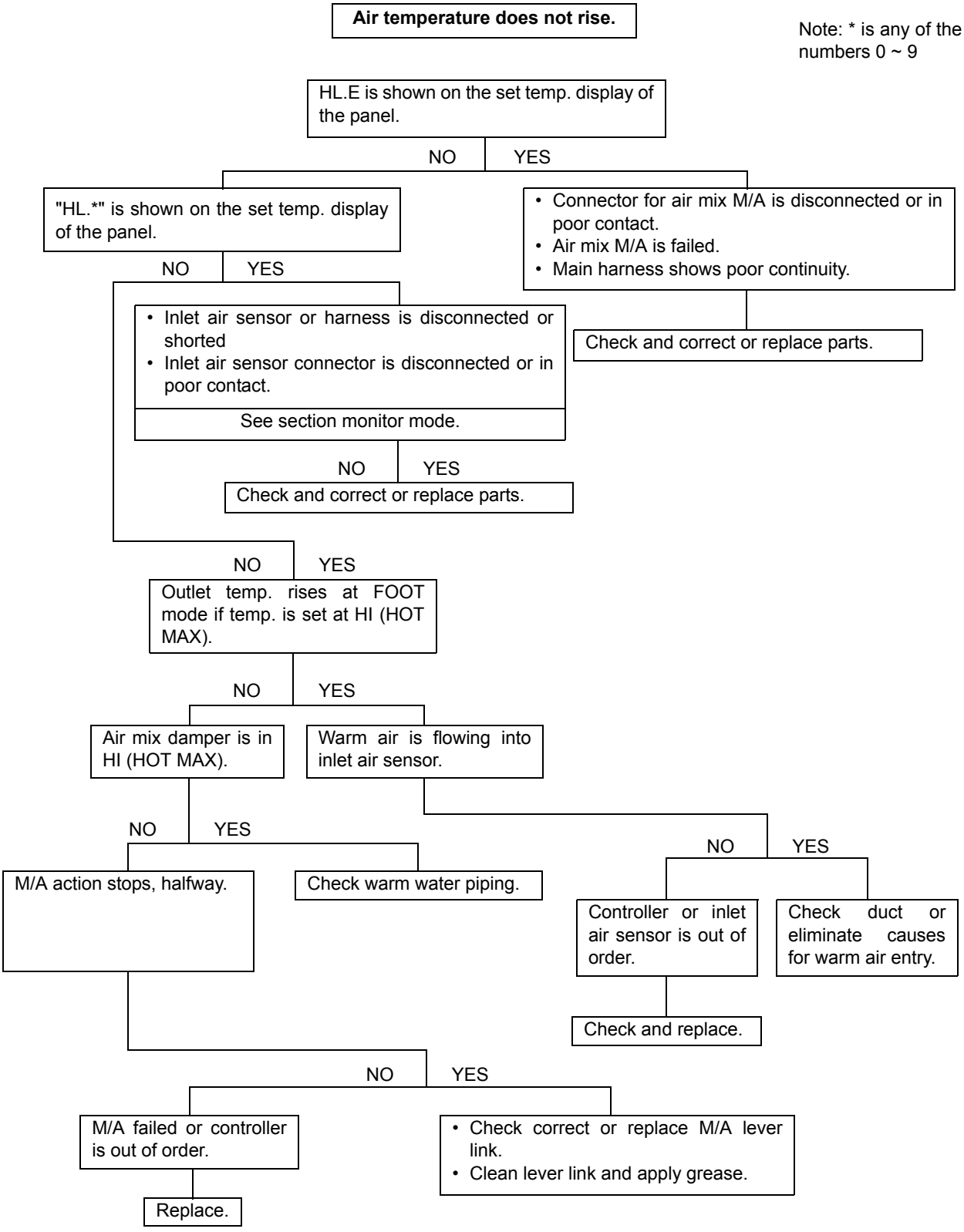
3. Connect the center valve of the gauge manifold with charging hose (**4**) of the vacuum pump (**7**).

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



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

CAUTION: *If the gauge indication goes toward 0, a leak if present in the system. Retighten pipe joints, make vacuum again and verify there in no evidence of leakage.*


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

ELECTRICAL EQUIPMENT

ELECTRICAL EQUIPMENT LIST

Group	Code	Part Name	Part No.
(C) Controller	C - 1	Mechatro controller	YN22E00425F1
	C - 2	Gauge cluster	YN59S00028F1
	C - 4	Air-con controller (including panel)	LQ20M01328P1
(D) Diode	D - 4	Diode	YN02D01001P1
	D - 5	Diode	Accessory of relay box
	D - 6	Diode	?
	D - 9	Diode	?
	D - 10	Diode	?
	D - 12	Diode	?
	D - 13	Diode	?
	D - 14	Diode	?
	D - 16	Diode	?
	D - 17	Diode	?
	D - 18	Diode	YN02D01001P1
	D - 19	Diode	?
	D - 20	Diode	?
(E) Electric fittings	E - 1	Fuse and Relay box	YN24E00016F3
	E - 3	Hour meter	LQ58S00002P1
	E - 5	Horn high	87357734
	E - 6	Horn low	87565344
	E - 8	Speaker left	LQ54S00003S002
	E - 9	Speaker right	?
	E - 10	Receiver dryer	YN54S00041P1
	E - 11	Air-con compressor	72203934
	E - 12	Battery	71421589
	E - 22	DC-DC Converter	84130880
	E - 23	24V SOCKET	LQ81S01001P1
	E - 46	Rearview camera	YN55S00009F1
	E - 63	DC-DC Converter (camera)	YN77S00040P1
(L) Light	L - 1	Boom work light (LH)	87555081
	L - 2	Frame work light (RH)	LB80S00001F1
	L - 5	Room light	LC02C00037F1
	L - 6	Boom work light (RH)	87555081
(M) Motor	M - 1	Starter motor	84377568
	M - 3	Wiper motor	LQ53C00003S001
	M - 4	Washer motor	YN54S00006F1

Code No. Parts Name Parts No. Use	Specifications	Description

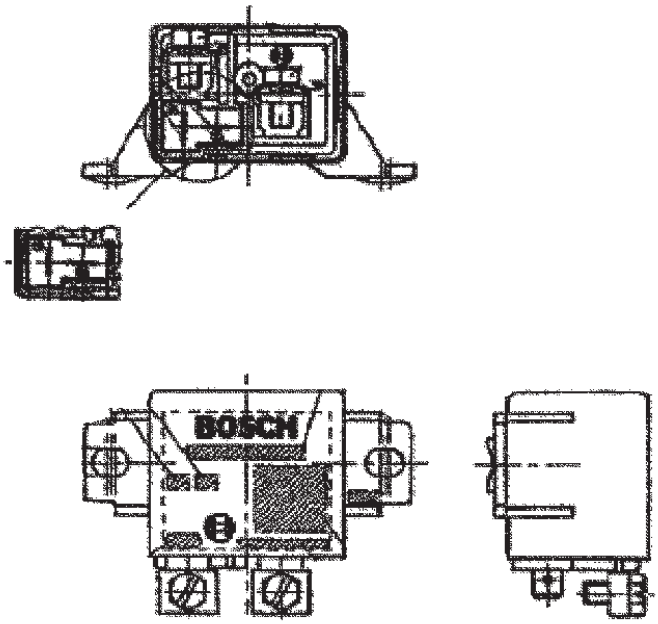
R - 2

Relay

71403889

Starter relay

Nominal voltage	24V
Nominal current	50A
Operating voltage	16-32V



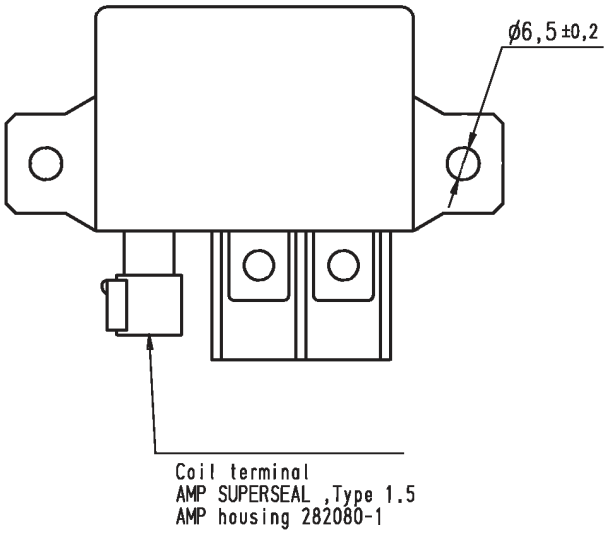
R - 3

Relay

71451677

Glow relay

Nominal voltage	24V
Max continuos current at 23°	150A
at 85°	130A



SMC0557

DEF/AdBlue® quality faults, failures and engine power loss levels

Visual display warning	Indicator light	Indicator light status	Audible alarm	Description
		Active	Active	DEF/AdBlue® quality/concentration is questionable. Drain DEF/AdBlue® tank, clean and refill with approved DEF/AdBlue® solution. No engine power loss.
		Active	Active	DEF/AdBlue® quality/concentration is questionable 60 min after the initial warning. Drain DEF/AdBlue® tank, clean and refill with approved DEF/AdBlue® solution. Up to 65 % torque reduction and 40 % engine speed reduction within 40 min of engine running time.
		Active	Active	DEF/AdBlue® quality/concentration is questionable 220 min after the initial warning. Drain DEF/AdBlue® tank, clean and refill with approved DEF/AdBlue® solution. Up to 80 % torque reduction within 30 min of engine running time.
		Active	Active	Emergency re-start is active. No engine power loss. Engine will shutdown after 30 s of continued operation. Contact your local authorized dealer for repair.

SCR system technical faults, failures and engine power loss levels

Visual display warning	Indicator light	Indicator light status	Audible alarm	Description
		Active	Active	SCR fault/failure detected. Up to 25 % torque reduction within 25 min of engine running time. Contact your local authorized dealer for repair.
		Active	Active	SCR fault/failure detected 90 min after the initial warning Up to 65 % torque reduction and 40 % engine speed reduction within 40 min of engine running time. Contact your local authorized dealer for repair.
		Active	Active	SCR fault/failure detected 240 min after the initial warning. Up to 80 % torque reduction within 30 min of engine running time. Contact your local authorized dealer for repair.
		Active	Active	Emergency re-start is active. No engine power loss. Engine will shutdown after 30 s of continued operation. Contact your local authorized dealer for repair.

PERFORMANCE INSPECTION STANDARD TABLE (SK260-9)

NOTE: ***unless otherwise specified, measure it on "H" mode.***

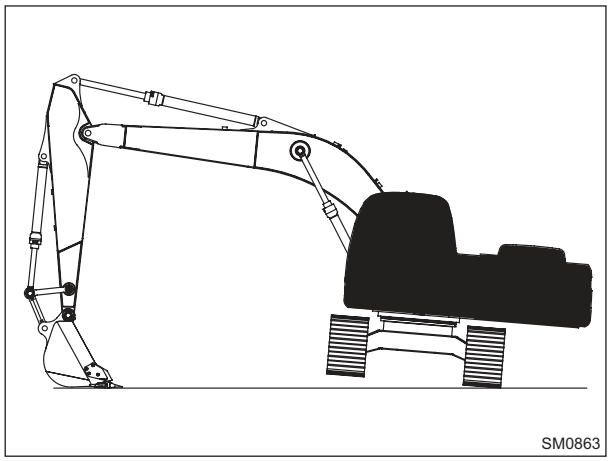
Inspection Item					Measuring Position			Standard Value	Unit	Adjusting Point	Measuring Condition
					Position	Size	Port				
Std. Measuring condition	Cleanliness of hydraulic oil				Hydraulic oil in tank			NAS 9 or less	Class	-	Sampling
	Hydraulic oil temperature				Tank surface			50 ± 5	°C	-	Atmospheric temp 50 °C ~ -10 °C
	Water temperature				Radiator surface			75 ± 15		-	
	Engine speed	H mode Low idle			Measure the engine speed at multi display on the gauge cluster, or measure with diesel speed meter			1000 ± 30	min^{-1}	Adjustment not required	Low throttle
		H mode High idle						2150 ± 30			Full throttle (Hi Idle)
		Auto-Idle						1050 ± 30			Perform all measurements with the air conditioner “OFF”
		S mode High idle						2100 ± 30			
		E mode High idle						2100 ± 30			
Pilot primary pressure circuit					G pump	PF 1/4	a5	$5.0^{+0,5}_{-0}$	MPa	PR1	HI idle
High pressure circuit	Main relief valve pressure	ATT Travel		P1	Main pump		a1	$34.3^{+0.7}_{-0,5}$		MR1	Boom up
				P2			a2				
		Power boost		P1			a1	$37.8^{+1.0}_{-0.5}$		MR1	
				P2			a2				
	Over load relief valve pressure	Boom		H			a1	$39.7^{+0}_{-5.9}$		OR3	Boom up
				R				$37.8^{+0}_{-4.0}$		OR4	Boom down
		Bucket		H			a1	$39.7^{+0}_{-5.9}$		OR1	Bucket digging
				R				$37.8^{+0}_{-4.5}$		OR2	Bucket dump
		Arm		H			a2	$37.8^{+0}_{-4.0}$		OR7	Arm in
				R				$39.7^{+0}_{-5.9}$		OR8	Arm out
		Swing		LH			a2	$28.5^{+4.0}_{+1.0}$		OR5	Swing LH
				RH						OR6	Swing RH
		Travel	RH	Forward			a1	$34.3^{+1,7}_{-0,5}$			Simultaneous Operation of travel RH and LH
				Reverse							
			LH	Forward			a2	$34.3^{+1,7}_{-0,5}$			
				Reverse							

MEASURING TRAVEL PERFORMANCES

Travel Speed

PURPOSES

Measure the travel sprocket revolution and confirm the performances between the hydraulic pump and the travel motor of the travel drive system.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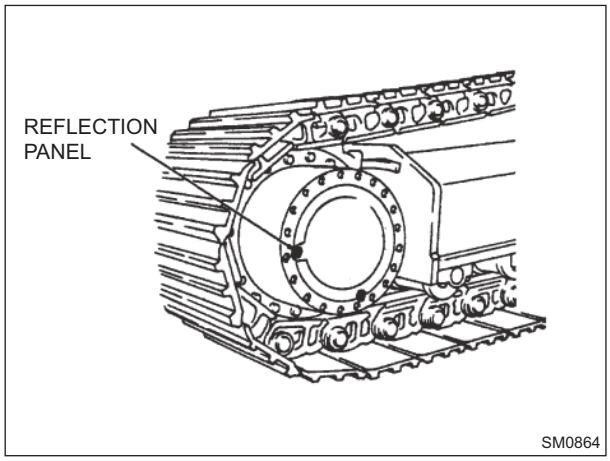
CONDITIONS

Hydraulic oil temperature; 45~55°C (113~131°F)
Crawler on the right and left sides are tensioned evenly.

PREPARATION

Attach the reflection panel with a magnet to the travel motor cover.
Swing the swing frame 90° as shown in Figure, and raise one side of the machine using the attachment.



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MEASUREMENT

Engine revolution: High idle
2-speed travel switch: 1st speed and 2nd speed
Measuring points: Right and left
Method, example:
Measure the revolutions per minute visually.

SK260-9

Sprocket revolution — Unit: min^{-1}

Measurement item		Standard value	Reference value for remedy	Service limit
RH& LH	H mode 1st speed	31.6~28.6	24.6~22.3	20.2 or less
	H mode 2nd speed	50.9~46.0	39.7~35.6	32.2 or less

SK295-9

Sprocket revolution — Unit: min^{-1}

Measurement item		Standard value	Reference value for remedy	Service limit
RH& LH	H mode 1st speed	29.6~26.8	23.0~20.9	18.9 or less
	H mode 2nd speed	47.6~43.1	37.1~33.6	30.3 or less

MEASURING PERFORMANCES OF SWING BEARING

PURPOSE

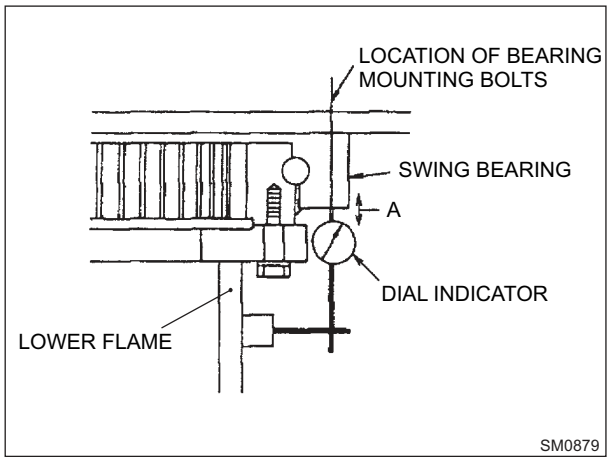
Measure the gap between the lower frame and the bottom face of the swing bearing and estimate the degree of wear of the swing bearing.

CONDITIONS

Firm, level ground
The swing bearing mounting bolts are not loosened.
The swing bearing is lubricated well and not making abnormal sounds while swinging.

PREPARATION

1. Install a dial indicator to the magnetic base and attach it to the lower frame.
2. Swing the upper swing body and the lower frame toward the travel direction. Place the probe on the dial indicator in contact with the bottom surface of the outer race on the swing body side and set the reading at zero.

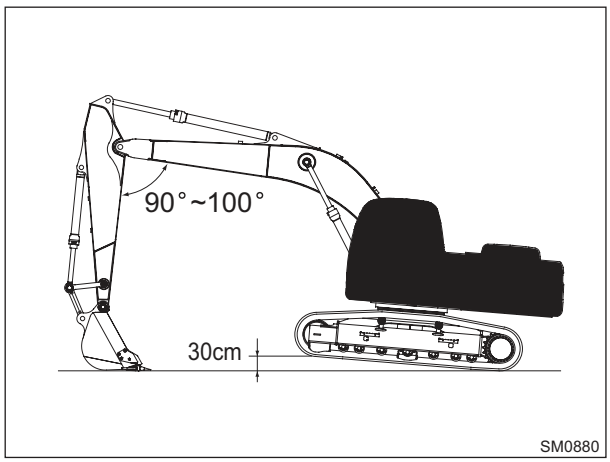


MEASUREMENT
Measuring position 1 and 2

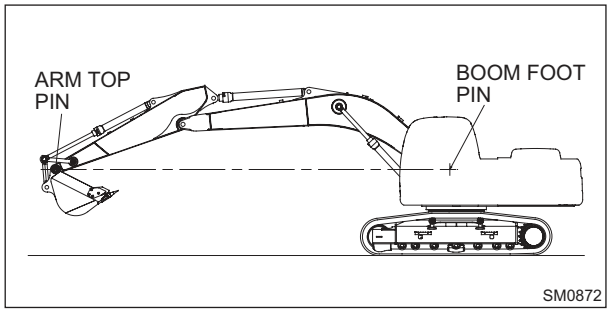
Measure the displacement of the outer race in the axial direction in position 1 [The arm at 90°~110° and the crawler front is lifted by attachment about 30 cm (1 ft)] and in position 2, using a dial indicator.

Axial play of swing bearing — Unit: mm (in)

Measuring position	Standard value	Reference value for remedy	Service limit
A	0.8~1.8 (0.03~0.07)	2.3~3.3 (0.09~0.13)	3.6 (0.14)



Position 1



Position 2

TROUBLESHOOTING

Error Code	Trouble	Described page
R184	Failure of lever lock relay	T5-1-73
R214	Failure of safety relay	T5-1-74

Table 1

Error code				
Trouble				
Judging condition				
Symptom				
Control in the event of failure				
Returned in normal condition				
Service diagnosis checking screen		Screen No.		
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	•			
2	•			
3				

Table 2

Error code		**A025**		
Trouble		Unadjusted engine or failed adjustment of pump proportional valve (B adjustment)		
Judging condition		Pump proportional valve adjustment is missed. Or it is impossible to set the adjusting value within the adjusting range.		
Symptom		Deviated from the rated output, but no problem in normal operation.		
Control in the event of failure		Workable with the default proportional valve output.		
Returned in normal condition		The pump proportional valve adjustment is completed normally.		
Service diagnosis checking screen		Screen No.	6	E-1 P1 PUMP
		Screen No.	6	E-2 P2 PUMP
		Screen No.		
Checking object				Checking contents and remedy
1	• Checking			Carry out pump adjustment (B adjustment). When"ERROR PUMP" was displayed during adjustment, refer to the section "Adjustment procedure - Measures to be taken with the adjustment failed"
2	• Mechatro controller			Check that the error is corrected after replacement of controller.
3				

Table 20

Error code	**B044**		
Trouble	Arm-in pressure sensor's power source is short-circuited.		
Judging condition	The input voltage from arm-in pressure sensor is 4.7 V or more.		
Symptom	Cavitation occurs when working with the arm-in. Horizontal arm pulling can barely be done but if the attachment is pulled in the air, the arm falls first. In this case the bucket will drag on the ground.		
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. Set output of arm 2 arm-in proportional valve to 200 mA.		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	5	B-4 ARM IN
	Screen No.		
	Screen No.		

	Checking object	Checking contents and remedy
1	• Arm-in pressure sensor SE-7	When B044 is cancelled and another error occurs by turning the ignition on after exchanging the connector with another sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between arm-in pressure sensor and controller CN-130F CN-101F	When B044 is displayed with the ignition on after the connector is exchanged with another sensor. Check wiring for possible failure according to the wire checking procedure and repair it if necessary..
3	• Mechatro controller	Check that the error is corrected after replacement of controller.

Table 36

Error code	**B113**		
Trouble	Option selector position detect pressure sensor Open-circuit.		
Judging condition	The input voltage from option selector position detect pressure sensor is 0.1 V or less.		
Symptom	When Breaker mode is selected, option selector valve error is indicated.		
Control in the event of failure	Normal control.		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	9	F-4
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	• Option selector position detect pressure sensor SE-29	When B113 is cancelled and another error occurs by turning the ignition on after exchanging the connector with another sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between option selector position detect pressure sensor and controller CN-162F CN-104F	When B113 is displayed with the ignition on after the connector is exchanged with another sensor. Check wiring for possible failure according to the wire checking procedure and repair it if necessary.
3	• Mechatro controller	Check that the error is corrected after replacement of controller.

Table 54

Error code	**D012**		
Trouble	P1 unload proportional valve and output transistor ON failure.		
Judging condition	The feed-back value from proportional valve is 1000 mA or more.		
Symptom	Optional conflux can not be done.		
Control in the event of failure	Normal control		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	7	D-1 P1 UN-LOAD (BP-CUT)
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	• P1 unload proportional valve PSV-D	When D012 is cancelled and another error occurs by turning the ignition on after exchanging the connector with another sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between P1 unload proportional valve and controller CN-120F CN-105F	When D012 is displayed with the ignition on after the connector is exchanged with another sensor. Check wiring for possible failure according to the wire checking procedure and repair it if necessary.
3	• Mechatro controller	Check that the error is corrected after replacement of controller.

Table 55

Error code	**D013**		
Trouble	P1 unload proportional valve Open-circuit.		
Judging condition	The feed-back value from proportional valve is 100 mA or less. (If output is 100 mA or less, judging is not done.)		
Symptom	Optional conflux can not be done.		
Control in the event of failure	Normal control		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	7	D-1 P1 UN-LOAD (BP-CUT)
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	• P1 unload proportional valve PSV-D	When D013 is cancelled and another error occurs by turning the ignition on after exchanging the connector with another sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between P1 unload proportional valve and controller CN-120F CN-105F	When D013 is displayed with the ignition on after the connector is exchanged with another sensor. Check wiring for possible failure according to the wire checking procedure and repair it if necessary.
3	• Mechatro controller	Check that the error is corrected after replacement of controller.

Table 69

Error code	**E033**		
Trouble	Optional relief adjusting proportional valve 1 Open-circuit.		
Judging condition	The feed-back value from proportional valve is 100mA or less. (If output is 100mA or less, judging is not done.)		
Symptom	Does not relieve at set pressure.		
Control in the event of failure	Normal control		
Returned in normal condition	Normal control		
Service diagnosis checking screen	Screen No.	7	E-3 Optional relief 1
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	-Optional relief adjusting proportional valve 1 PSV-E	When E033 is cancelled and another error occurs by turning the ignition on after exchanging the connector with another sensor. Check sensor unit for possible failure. If failure found, replace it.
2	-Wiring between Optional relief adjusting proportional valve 1 and controller CN-148F CN-105F	When E033 is displayed with the ignition on after the connector is exchanged with another sensor. Check wiring for possible failure according to the wire checking procedure and repair it if necessary.
3	-Mechatro controller	Check that the error is corrected after replacement of controller.

Table 70

Error code	**E042**		
Trouble	Optional relief adjusting proportional valve 2 and output transistor ON failure.		
Judging condition	The feed-back value from proportional valve is 1000mA or more.		
Symptom	Does not relieve at set pressure.		
Control in the event of failure	Normal control		
Returned in normal condition	Normal control		
Service diagnosis checking screen	Screen No.	7	E-4 Optional relief 2
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	-Optional relief adjusting proportional valve 2 PSV-I	When E042 is cancelled and another error occurs by turning the ignition on after exchanging the connector with another sensor. Check sensor unit for possible failure. If failure found, replace it.
2	-Wiring between Optional relief adjusting proportional valve 2 and controller CN-132F CN-106F	When E042 is displayed with the ignition on after the connector is exchanged with another sensor. Check wiring for possible failure according to the wire checking procedure and repair it if necessary.
3	-Mechatro controller	Check that the error is corrected after replacement of controller.

Table 86

Error code	**H023**		
Trouble	Boom angle potentiometer Open-circuit.		
Judging condition	The input voltage from boom angle potentiometer is 0.1 V or less.		
Symptom	Indications of rating load and working radius for the High-reach crane become abnormal.		
Control in the event of failure	Normal control.		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	10	H-2 BOOM
	Screen No.		
	Screen No.		

	Checking object	Checking contents and remedy
1	• Boom angle potentiometer SE-17	Measure the resistance between terminals of boom angle potentiometer. 4.0~6.0k Ω . Turn the potentiometer and measure resistance between signal and GND. Normal value: 0 to max resistance (4.0~6.0)k Ω
2	• Wiring between boom angle potentiometer and controller CN-702F CN-103F	Check wiring for possible failure according to the wire checking procedure and repair it if necessary.
3	• Mechatro controller	Check that the error is corrected after replacement of controller.

Table 100

Error code	**R024**		
Trouble	Wiper motor forward rotation relay error.		
Judging condition	The mechatro controller output line to wiper motor forward rotation relay is short-circuited with the power source.		
Symptom	Wiper does not move.		
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.	19	CW MOTOR RLY
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	• Wiper motor forward rotation relay R-29	When error is cancelled after removing wiper motor forward rotation relay, 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 wiper motor forward rotation relay and controller CN-109F, CN2-1 • Fuse& relay box E-1	When R024 is left displayed with the relay removed. Check that no 24 V power is produced on relay (-) line according to the wire checking procedure and replace it if necessary. When no failure found after checking on wiring and R024 is left displayed. Replace fuse/relay box.
3	• Mechatro controller	Check that the error is corrected after replacement of controller.

TROUBLESHOOTING BY SYMPTOM

1. HYDRAULIC SYSTEM

Preface:
The following list contains troubleshooting categories numbered from 1 to 22.
Identify your current symptom and follow the troubleshooting table in the order listed.

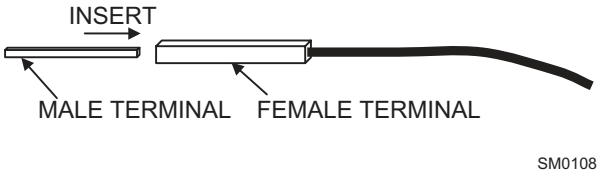
1. Controls do not function/slow
2. Engine shutting down/stalled
3. Unit moving while in the neutral position
4. Precise operator controls not functioning properly
5. Slow boom up, insufficient power
6. Slow boom down, insufficient power for lifting up body
7. Slow arm in, insufficient power
8. Slow independent arm out (in the air)
9. Slow bucket digging
10. Slow bucket dumping
11. Swing operation not functioning/slow
12. Noise during swing operation
13. Swing drifts on a slope while swing control lever is in neutral position
14. Swing drifts when swing operation is stopped
15. Travel speed is slow/poor
16. Travel deviation
17. Travel 1st/2nd speed cannot be switched
18. Unit does not hold position on a slope
19. Machine does not travel straight when both the crawler and attachment are operated simultaneously
20. Slow breaker (crusher) operation, low power
21. Selector valve for option malfunctions: Breaker circuit is not obtained
22. Selector valve for option malfunctions: Nibbler circuit is not obtained

No.	Sections	Contents/normal value		Corrective action, others
11	Secondary pressure of travel straight proportional valve	Directly measure the proportional valve secondary pressure at the ports A6 (travel straight) of 8 section solenoid block	0.8 MPa or less in high idling operation regardless of neutral/operation	Replace proportional valve
12	Remote control valve	Check targeted remote control valve	Check that spool is free from abnormal damage and spring is not broken	Replace
13	Main relief valve <Trouble> Relief pressure is low.	Check set pressure	• See Service Diagnosis Data List Operation No.3 boom up full lever and relief	Reset or replace
14	Over load relief valve <Trouble> P1, P2 pressure is low.	Visual check (Head side)	Pressure is 32 MPa or more in arm in and relief. Free from foreign particles in over load relief valve. Seat is free from abnormality	When only relief pressure of arm in is low, replace valve
15	Over load relief valve <Trouble> P1, P2 pressure is low.	Visual check (Rod side)	Pressure is 32 MPa or more in arm out and relief. Free from foreign particles in over load relief valve. Seat is free from abnormality.	When only relief pressure of arm out is low, replace valve
16	Arm 1 spool <Trouble> P1, P2 pressure is high.	Visual check	Make sure parts slide freely when removing Free from abnormal damage, etc on outside surface Check that spring is not broken.	Replace (Check on the casing side for damage)
17	Arm 2 spool <Trouble> P1, P2 pressure is high or low.	Visual check	Make sure parts slide freely when removing Free from abnormal damage, etc on outside surface Check that spring is not broken.	Replace (Check on the casing side for damage)
18	Check arm 2 spool and recirculation <Trouble> Arm in power is poor.	Disassembly and investigation	Free from abnormal resistance against sliding Check that spring is not broken.	Replace spool assembly
19	Check lock valve poppet <Trouble> Both P1, P2 pressures are high.	Visual check	Free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface	Replace (Check on the casing side for damage)

15. Travel speed is slow/poor

No.	Sections	Contents/normal value		Corrective action, others
1	Travel right and left pressure sensor	Carry out service diagnosis	• See Service Diagnosis Data List Operation No.18 Travel right full lever and idling Operation No.19 Travel left full lever and idling	Check and replace pressure sensor Check remote control valve
2	Remote control valve	Directly measure remote control pressure of travel right and left	Check that pressure is 2.1 MPa or more in travel right (left), forward (reverse) full lever and high idling operation	Check remote control valve
3	Measuring current value of P1/P2 unload proportional valve	Carry out service diagnosis	• No.7 D-1 P1 unload valve (cut valve) D-1 P2 unload valve (cut valve) • See Service Diagnosis Data List Operation No.18 Travel right full lever & idling Operation No.19 Travel left full lever & idling	If a large difference in readings from the actual measured value occurs, check proportional valve and controller for possible failure.
4	Secondary pressure of P1, P2 unload proportional valve	Measure the proportional valve secondary pressure directly at the ports A7 and A5 of 8 section solenoid block	Check that P1/P2 unload secondary pressures are within the range of followings in travel right (left), forward (reverse) full lever and high idling operation Travel right (P1 unload): 0.6 to 1.0 MPa Travel left (P2 unload): 0.6 to 1.0 MPa	Replace proportional valve
5	Measuring current value of P1/P2 pump proportional valve	Carry out service diagnosis	• No.6 E-1 P1 pump E-2 P2 pump • See Service Diagnosis Data List Operation No.18 Travel right full lever & idling Operation No.19 Travel left full lever & idling	If a large difference in readings from the actual measured value occurs, check proportional valve and controller for possible failure.
6	Secondary pressure of P1, P2 pump proportional valve	Measure the pump proportional valve secondary pressure directly (Ports a3, a4)	Check that P1/P2 unload secondary pressures are within the range of followings in travel right (left), forward (reverse) full lever and high idling operation Travel right (P1 pump): 2.7 MPa or more Travel left (P2 pump): 2.7 MPa or more	Replace proportional valve
7	Measuring current value of travel straight proportional valve	Carry out service diagnosis	Check that the value does not change regardless of operation • See Service Diagnosis Data List Operation No. 1 Operation is nil Operation No.18 Travel right full lever & idling Operation No.19 Travel left full lever & idling	• Check voltage of low pressure sensor • If a large difference in readings from the actual measured value occurs, check proportional valve and controller for possible failure
8	Secondary pressure of travel straight proportional valve	Directly measure the proportional valve secondary pressure	0.8 MPa or less in high idling operation regardless of neutral/operation	Replace proportional valve

4. Checking connector terminal for contact.
   Insert male terminal into female terminal, and check that the inserting force is equivalent to other female terminals.
   If looseness is there, replace the female terminal with new one.
   Make sure terminals are clean.



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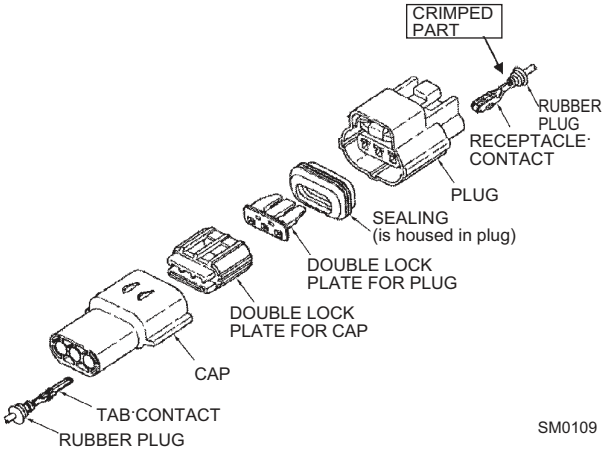
ATTENTION

Do not insert the wrong size male terminal. Using improper terminals may cause loose connections.

5. Caution should be paid when measuring voltage.
   When measuring the power supply of the electric equipment on the connector, measure the voltage between the ground inside of the connector and power terminal.
   Measuring the voltage between frame body grounding and the power source when you are unable to identify the connector ground.
   Voltage may vary when having the connector plugged in versus unplugged. Measure the voltage with each connector plugged in whenever possible.

6. Checking the general view of a connector.
   a. Check the terminals crimped condition.
      Pull one electric cable with the about 3kg force, and make sure that the cable does not come out of the terminal.
      When it does come out, replace the terminal and crimp it again.
   b. Check connector pins for imperfect insertion.
      Check that all pins form a line on the same position as seen from the connector end.
      If pushed back, push it in further through wire inserting hole.
   c. Check connector for water damage.
      Pull out the connector and check that the inside is free from corrosion.
      When corrosion is found, check rubber plug for damage and also that the seal is properly fitted .

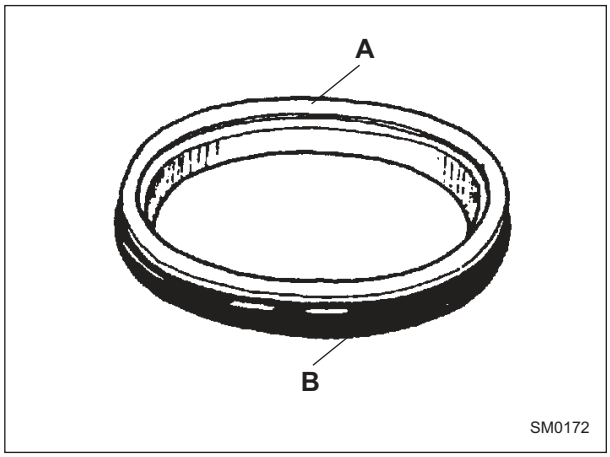


SM0109

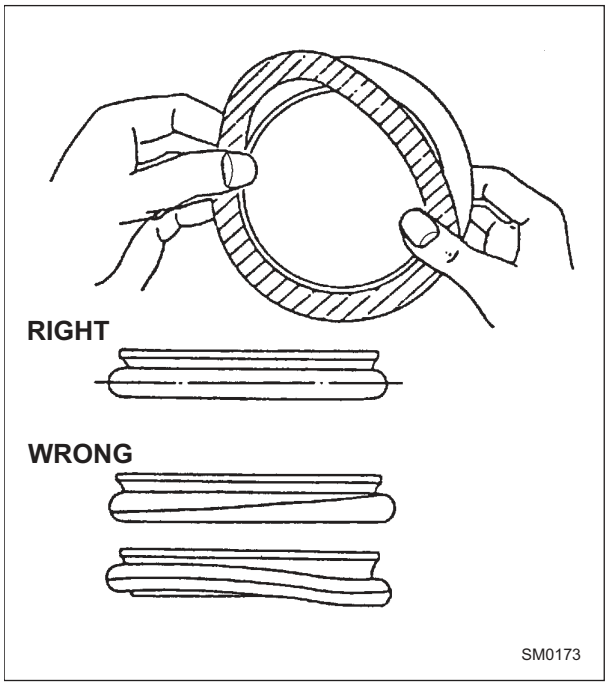
REPAIR INSTRUCTIONS

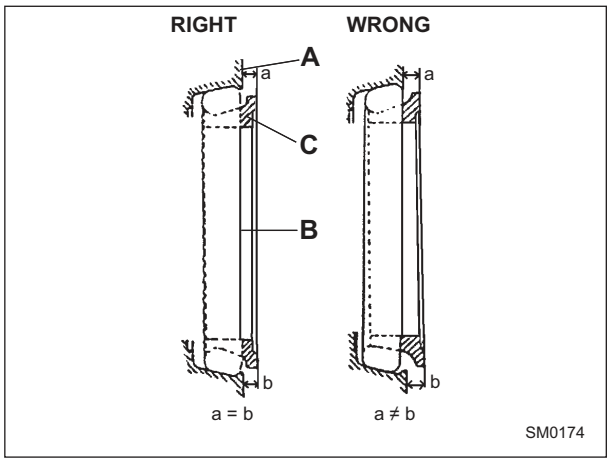
Floating Seal Precautions

1. It is recommended to replace floating seal with a new one. If necessary to reuse floating seal, do the following:
   1) Ensure seal rings remain as matched set with seal ring faces together. Insert a piece of cardboard to protect surfaces.
   2) Inspect seal ring face (**A**) for damage (scuffing, corrosion, deformation, etc.).
   3) Inspect O-ing (**B**) for damage (tears, breaks, deformation, etc.)



2. Ensure components are installed correctly. to avoid leakage or damage. To avoid leakage or damage, do the following:
   1) Clean floating seal and seal mounting bores with acceptable cleaning solvent.
      Use a wire brush to remove contaminants (mud, rust, dirt, etc.).
      Thoroughly dry cleaned parts with compressed air.
   2) Clean floating seal and seal mounting bores, as dust on them tends to enter the floating seal when installing it.
   3) Ensure O-ring is not twisted and installed correctly on seal ring.
   4) After installing floating seal, measure distances (**a**) and (**b**) as shown to verify seal ring surface (**C**) is parallel with mating face. If these distances differ, adjust the O-Ring (**B**) seating.





SECTION 2

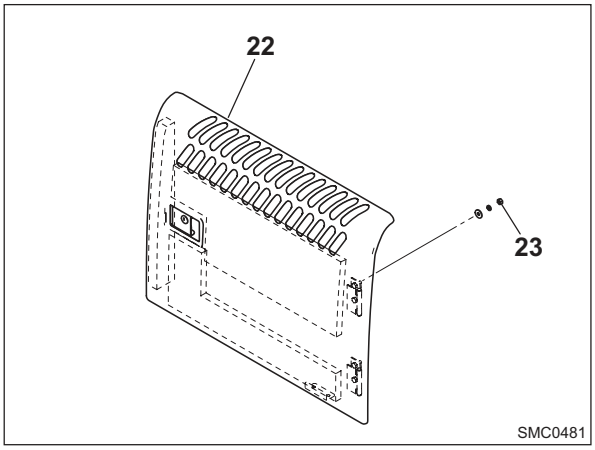
UPPERSTRUCTURE

CONTENTS

Group 1 - Upperstructure

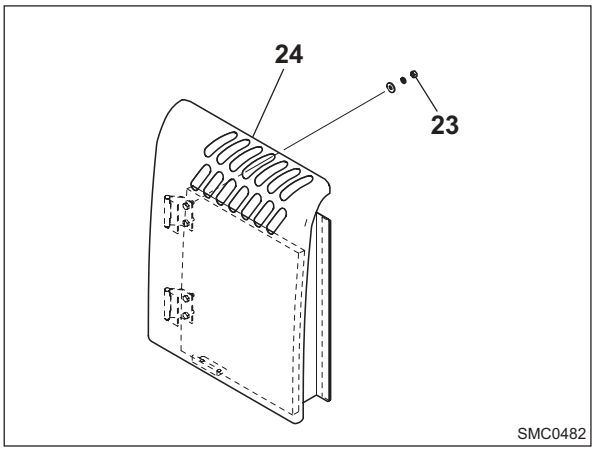
6) Remove panel assembly (**22**).

1. Unlock panel assembly (**22**).
2. Remove 4 nuts (**23**) M10.
   : 17 mm
3. Remove panel assembly (**22**).
   Weight: 16 kg (35 lbs)



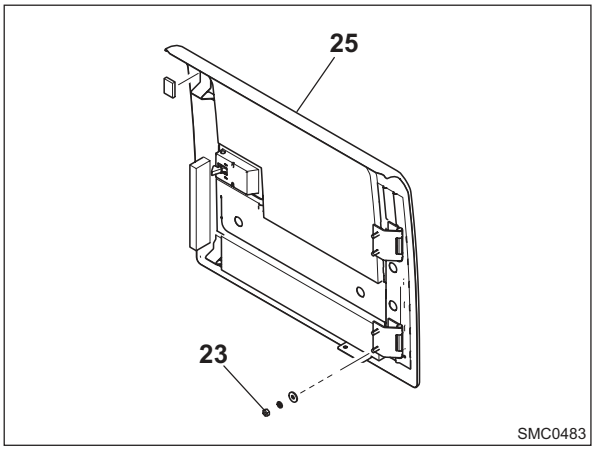
7) Remove panel assembly (**24**).

1. Remove 4 nuts (**23**) M10.
   : 17 mm
2. Remove panel assembly (**24**).
   Weight: 10 kg (22 lbs)

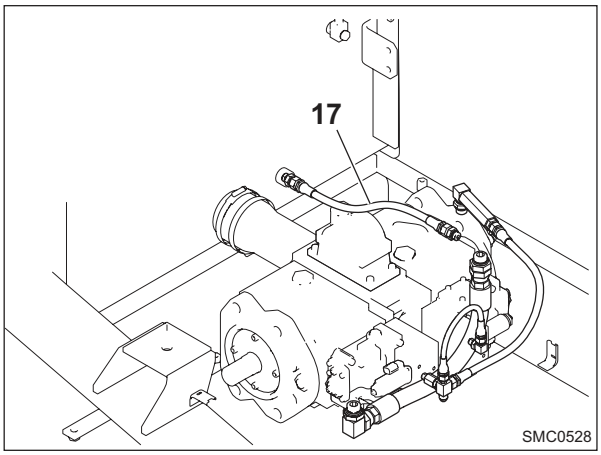


8) Remove panel assembly (**25**).

1. Unlock and open panel assembly (**25**).
2. Remove 4 nuts (**23**) M10.
   : 17 mm
3. Remove panel assembly (**25**).
   Weight: 17 kg (37 lbs)

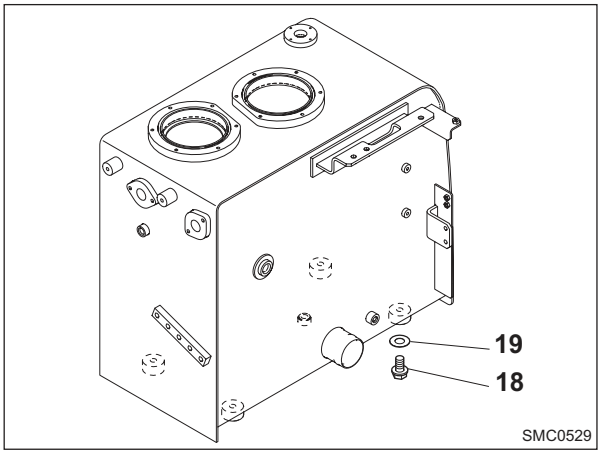


6. Remove drain hose (**17**) of pilot pump.
   : 22 mm



7. Remove 4 capscrews (**18**) M20x40.
   : 30 mm
8. Place a wire sling, using the lifting plate on top of the tank.
   Tank weight: approx. 178 kg (392.5 lbs)
9. Remove shim (**19**).

NOTE: *record the shim locations.*



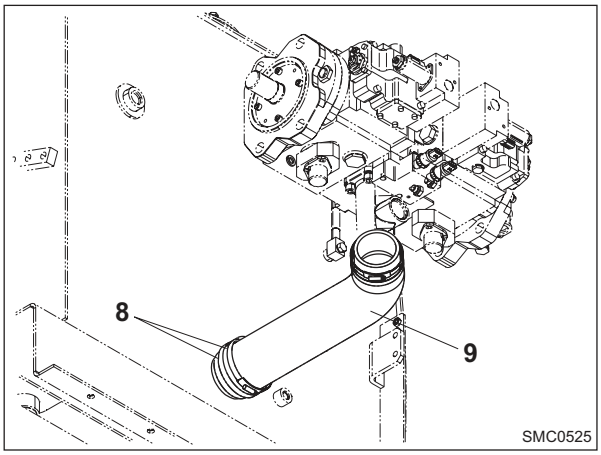
Installation of the hydraulic oil tank

1. Clean hydraulic oil tank.
2. Clean suction hose.
3. Clean mount of tank.
4. Installation is done in the reverse order of removal.
5. Install 4 mounting capscrews (**18**) M20x40 with Loctite #262.
   : 30 mm
   : 370 ± 37 Nm (273 ± 27 lbf.ft)

CAUTION

*If the gap (looseness) between tank mount and frame exceeds 1 mm (0.04 in), adjust the gap with shim (**19**) and tighten capscrew (**18**) to install the tank.*

6. Connection of suction hose (9).
   1) Apply PERMATEX on pipe side of hose connection and insert it.
   2) Put the hose with clip (8).
      : 5.39 ± 0.5 Nm (4 ± 0.4 lbf.ft)



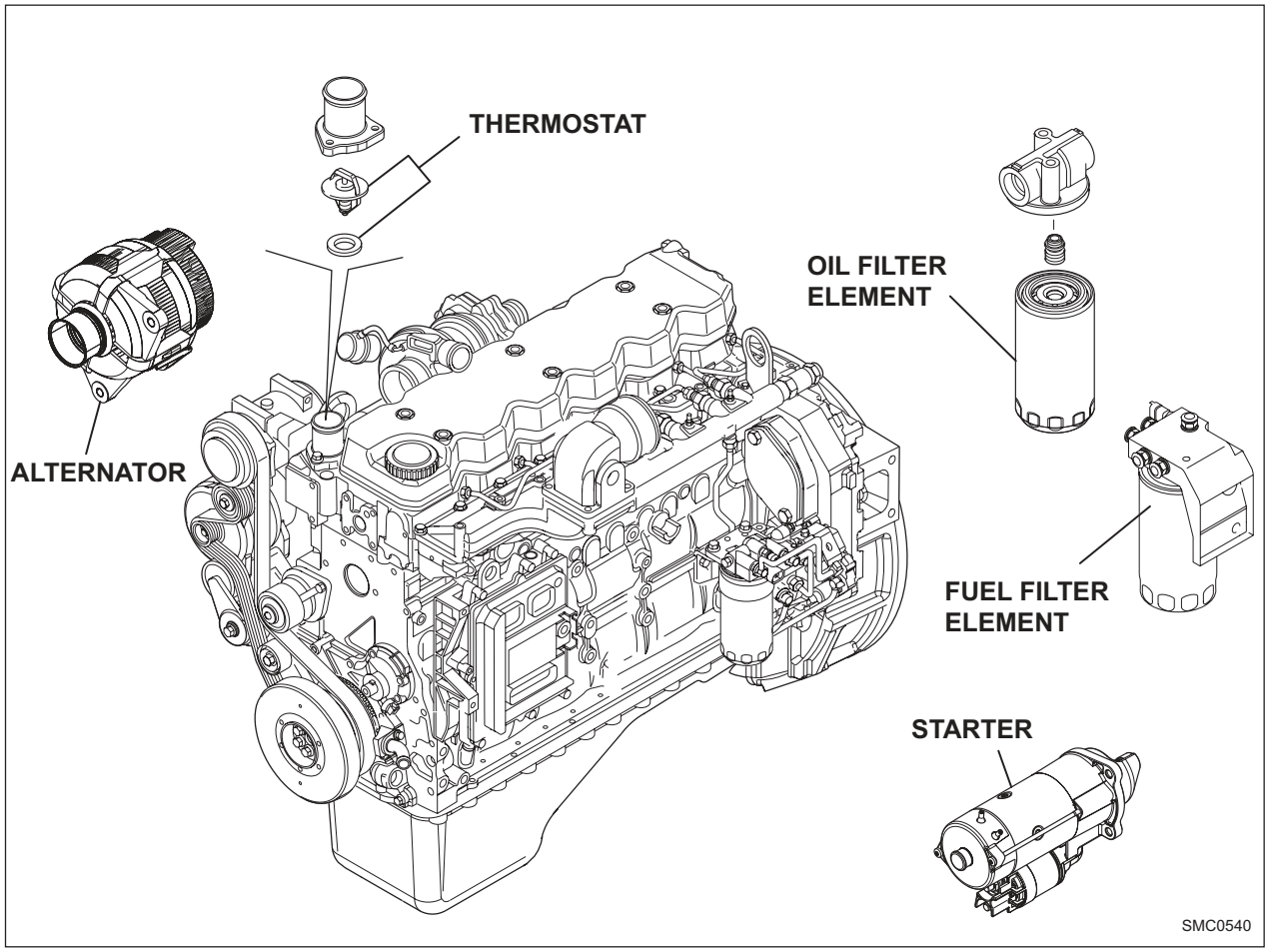
REMOVAL AND INSTALLATION OF ENGINE

Preparation for removal

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

     P1 Alternator B terminal
     CN-160 E/G speed sensor
     CN-141, CN142 P1, P2 Pump proportional valve
     CN-139, CN-140 P1, P2 pump pressure sensor
     M-1 Starter motor C terminal

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

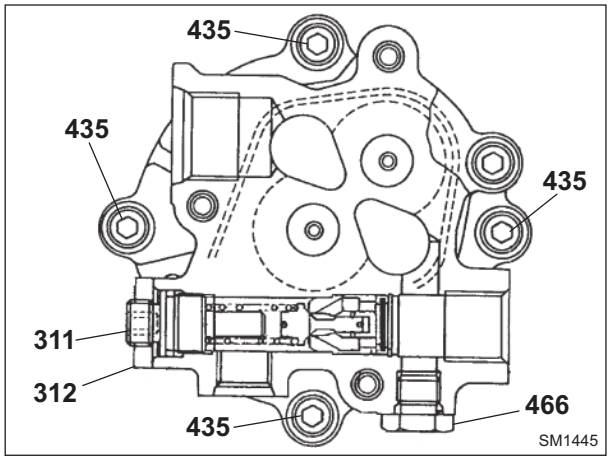


DISASSEMBLY HYDRAULIC PUMP DEVICE

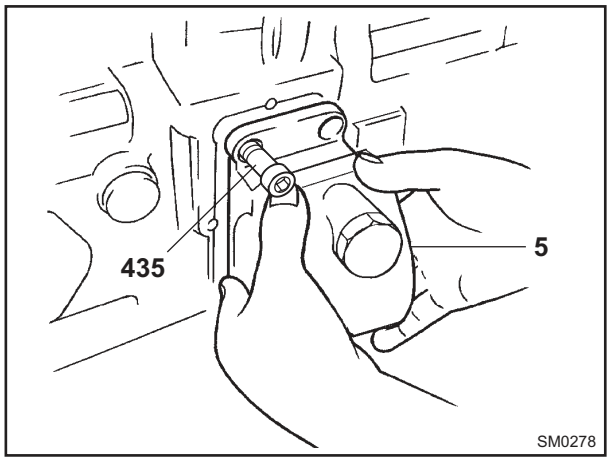
- Ensure disassembly operations are done in clean environment.
  Spread rubber sheet or cloth on work bench to protect parts.
- Clean parts removing dust and rust, etc. on pump surface with wash oil.
- Drain oil from pump casing by by removing drain port plugs (**466** and **468**).
  :19, 36 mm

NOTE: *Drain oil from the plugs of the front pump and the rear pump.*

1. Removing pilot pump.
   Remove the socket bolts (**435**) to remove pilot pump (**4**).
   : 6 mm

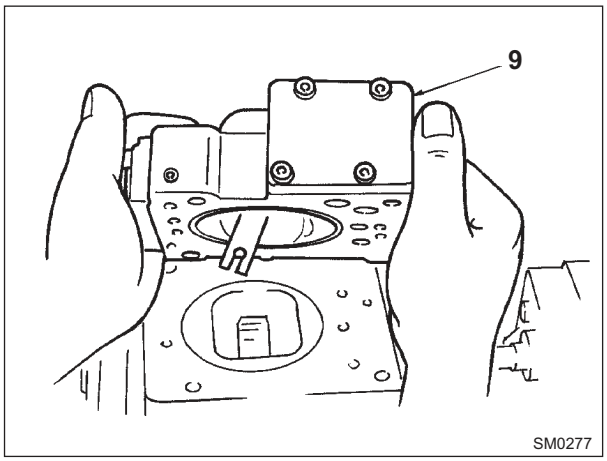


2. Removing PTO gear casing.
   Remove socket bolts (**435**), then remove PTO gear casing (**5**).
   : 8 mm



3. Removing regulator.
   Remove the socket bolts (**412**) and (**413**), then remove regulator (**9**).
   : 6 mm

***NOTE**: Socket bolts (412 and 413) are shown in figure SM0296 on page W2-2-14.*



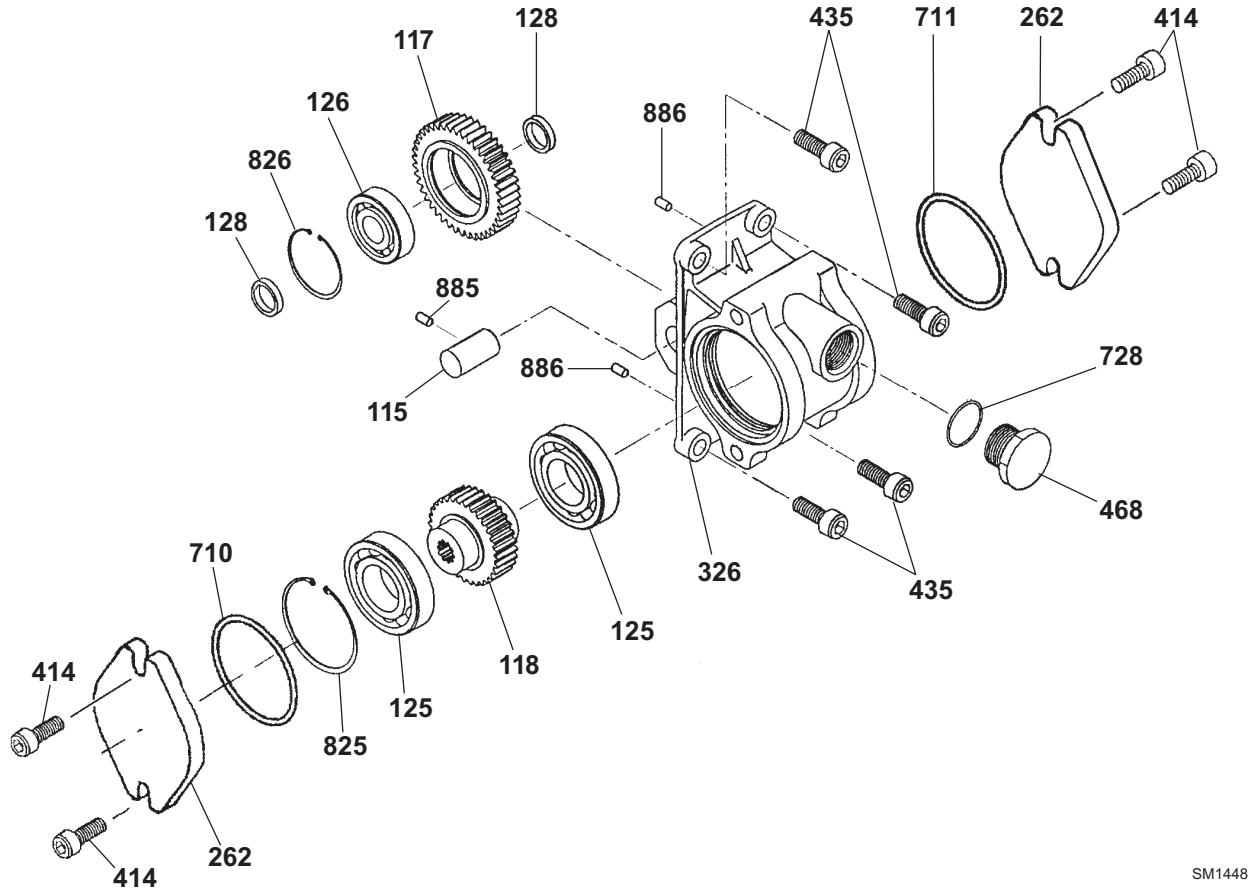
1. Pump oil flow rate is extremely low and delivery pressure is not available.

Cause	Solution	Remarks
1. Regulator is out of order	1) Repair regulator.	1) Refer to Regulator Manual.
2. Pump's internal parts are seized or broken.	2) Replace damaged parts.	2) Check filter and drain oil.
3. Attached pump is out of order	3) Replace damaged parts.	3) Remove attached pump and check shaft joint.
4. Attached valve is out of order.	4) Check attached valve. Particularly poppet, seat and spring.	4) Refer to Manual for Attached Valve.
5. Regulator is piped incorrectly.	5) Pipe correctly.	

2. Abnormal Sound and Vibration

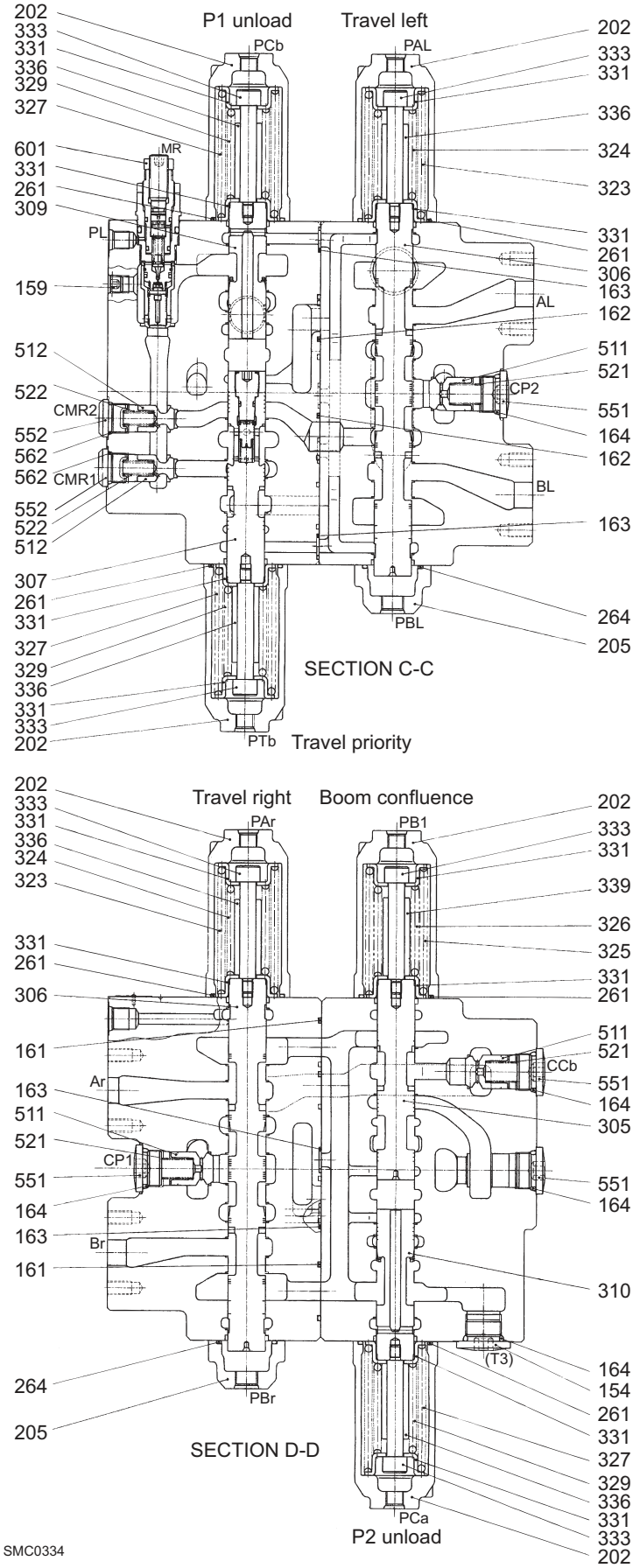
Cause	Solution	Remarks
1. Cavitation	1) Prevent cavitation. Check that hydraulic oil is not clouded.	1-1) The boost pressure is low. 1-2) The attached pump is in trouble. 1-3) The suction pipe is inhaling air. 1-4) The suction resistance is high.
2. Caulked part of shoe is broken.	2) Replace piston shoe and shoe plate.	
3. Cylinder is cracked	3) Replace cylinder.	
4. Pump is installed improperly.	4) Correct installation.	
5. Regulator is hunting.	5) Repair regulator,	5) See Regulator Manual.
6. Relief valve in attached valve is hunting.	6) Repair attached valve.	6) See the Manual for Attached Valve.

DISASSEMBLY AND ASSEMBLY OF PTO GEAR CASING



115 - Idle shaft
117 - 2nd gear
118 - 3rd gear
125 - Ball bearing (qty 2)
126 - Roller bearing
128 - Bearing spacer (qty 2)
262 - Cover (qty 2)
326 - Gear casing
414 - Socket bolt M10×20 (qty 2)
435 - Flange socket M10×20 (qty 4)
468 - VP plug PF3/4
710 - O-Ring
711 - O-Ring
728 - O-Ring
825 - Snap ring
826 - Snap ring
885 - Spring pin
886 - Pin (qty 2)

Control valve (3/6)



6. Disassembling bucket spool

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

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

ATTENTION: *When removing spool assy, use care so as not to score casing B (**102**).*

6.3 Remove bucket spool assembly with vise using a protective plate (aluminum plate, etc.) and remove bolt (**333**). Separate spring seat (**331**), springs (**321**), (**322**) and stopper (**336**) from bucket spool (**304**).

6.4 If disassembly of the bucket spool spring cover is required, loosen plug (**551**) with casing B (**102**) installed. After removing cover (**209**) from casing B (**102**), remove plug (**551**), then remove piston (**216**).

Assembling relief valve and relief valve hole plug assembly

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

ATTENTION: *Port relief valves (**602**), (**603**) are similar in shape. Ensure labeled components are installed correctly.*

Assembling P2 unload spool

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

ATTENTION:

- *Apply Loctite #262 when tightening bolt (**333**).*
- *Use care to prevent clamping damage to P2 unload spool (**310**).*

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

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

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

Assembling travel priority spool

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

ATTENTION:

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

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

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

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

REMOVAL AND INSTALLATION OF SWING DEVICE

WARNING

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

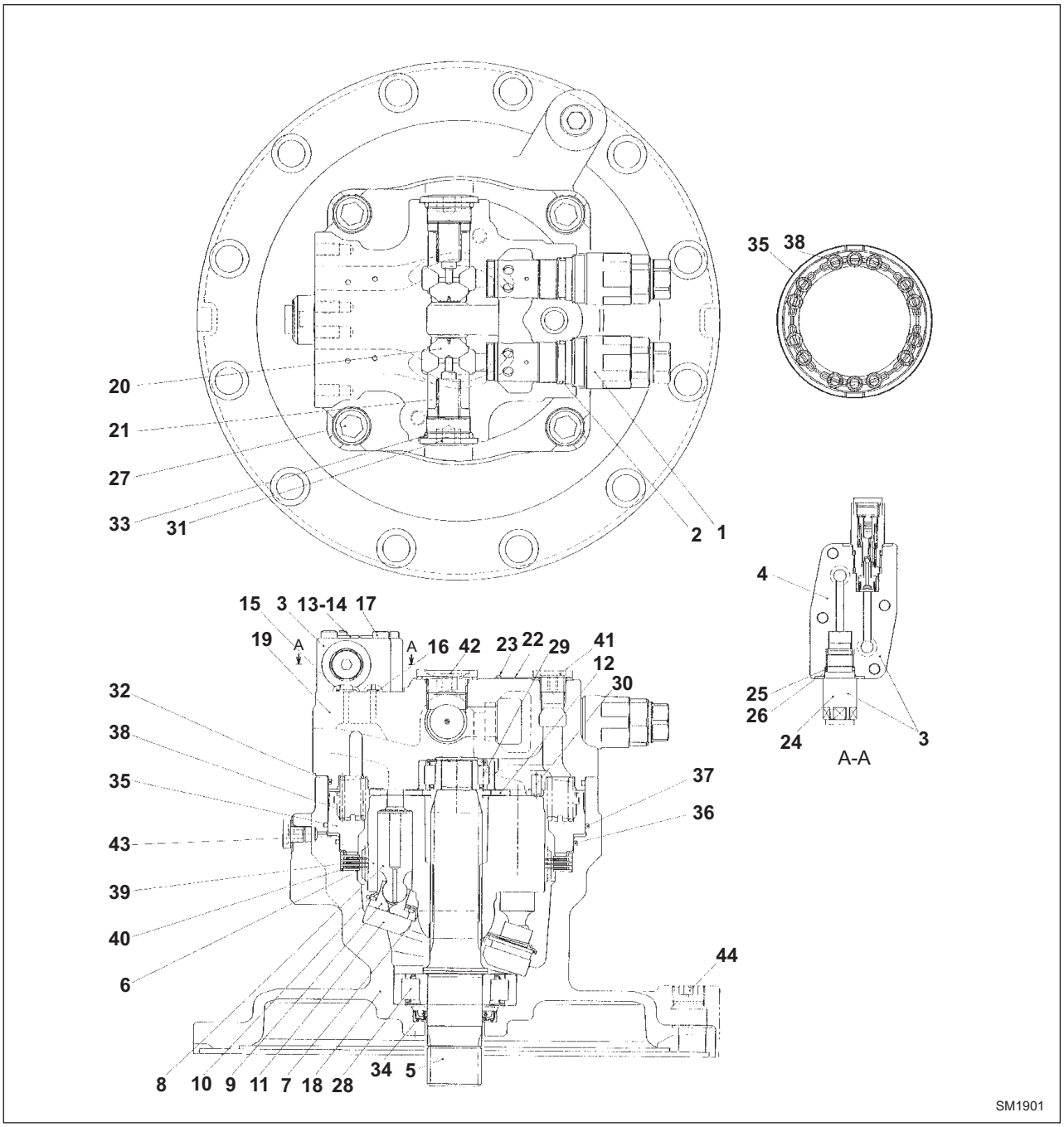
Preparation

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

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

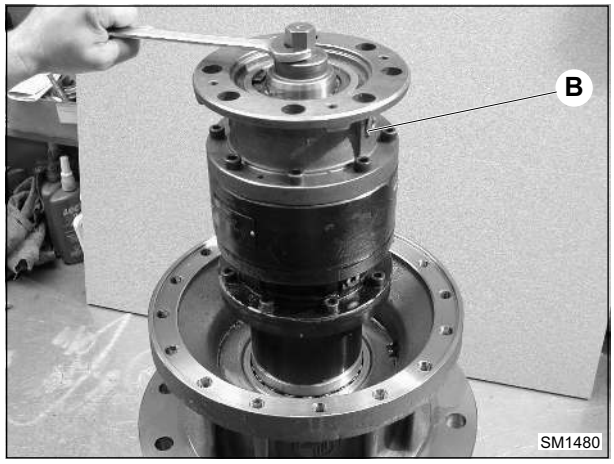
3. Turn engine OFF. Press the valve hydraulic oil cap to release any pressure in tank.

DISASSEMBLY AND ASSEMBLY OF SWING MOTOR ((SK295-9)



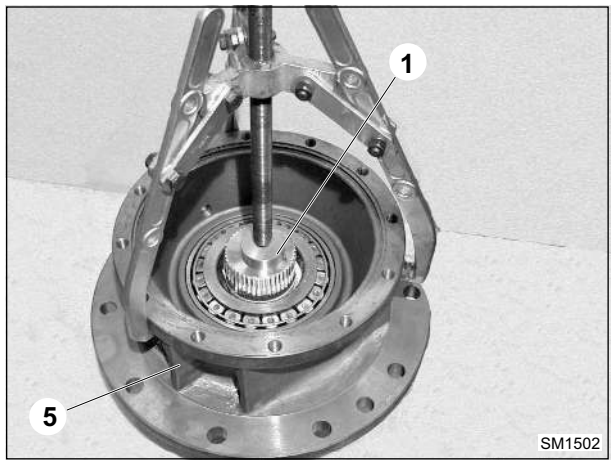
1- Relief valve (qty 2)
2 - O-Ring (qty 2)
3 - Anti-reaction valve sub
4 - Casing for anti-reaction valve
5 - Drive shaft
6 - Cylinder
7 - Spring plate
8 - Piston (qty 9)
9 - Shoe (qty 9)
10 - Set plate
11 - Shoe plate
12 - Valve plate
13 - Plug (qty 2)
14 - O-Ring (qty 2)
15 - O-Ring (qty 2)
16 - O-Ring (qty 2)
17 - Socket bolt (qty 4)
18 - Casing
19 - Valve casing
20 - Plunger (qty 2)
21 - Spring (qty 2)
22 - Name plate
23 - Rivet (qty 2)
24 - Anti-reaction valve (qty 2)
25 - O-Ring (qty 2)
26 - Backup ring (qty 2)
27 - Socket bolt (qty 4)
28 - Roller bearing
29 - Roller bearing
30 - Pin (qty 2)
31 - Plug (qty 2)
32 - O-Ring
33 - O-Ring (qty 2)
34 - Oil seal
35 - Brake piston
36 - O-Ring
37 - O-Ring
38 - Brake spring (qty 14)
39 - Friction plate (qty 3)
40 - Separator plate (qty 4)
41 - Plug
42 - Plug
43 - Plug
44 - Plug

14. Use torque multiplier (**B**) to loosen ring nut (**9**).

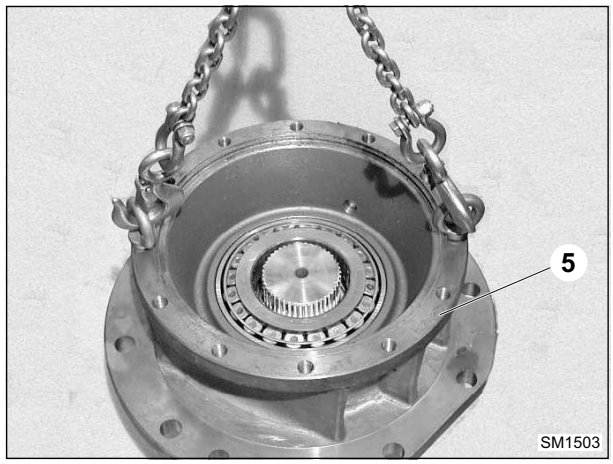


15. Remove ring nut (**9**).

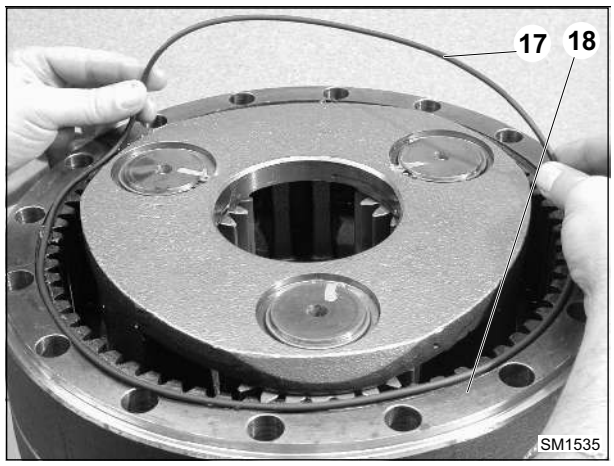
16. Place the puller in the gearbox housing (**5**). Turn screw until the pinion shaft (**1**) is removed.



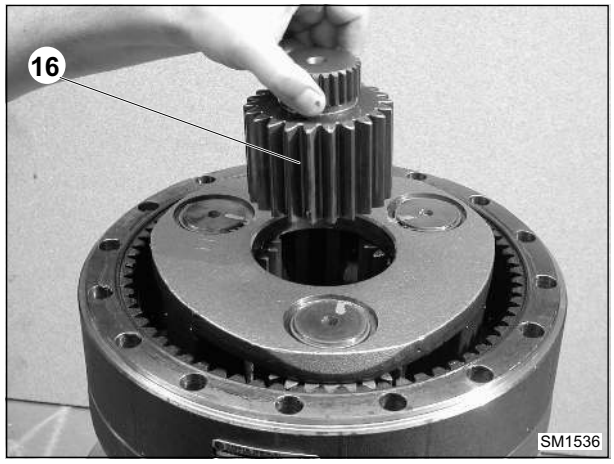
17. Use tackle to raise the gearbox housing (**5**).



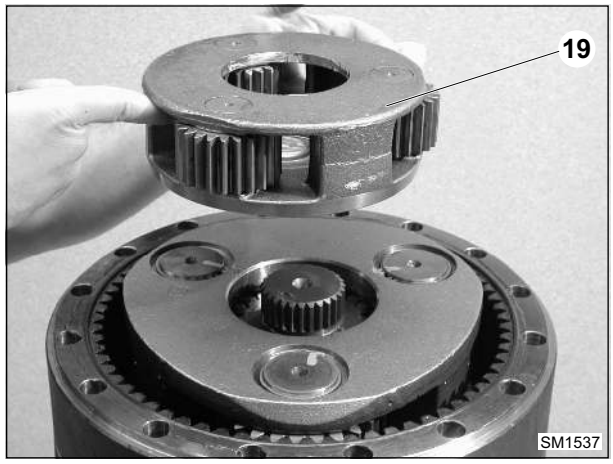
25. Assemble O-ring seal (**17**) into seat in the toothed ring (**18**).



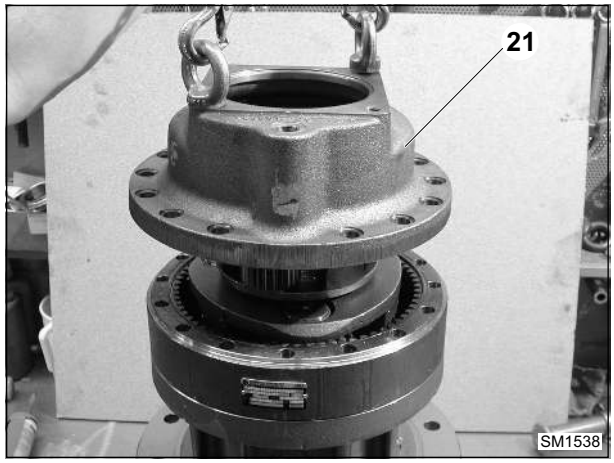
26. Insert 2nd reduction sun gear (**16**).



27. Insert 1st reduction (**19**).

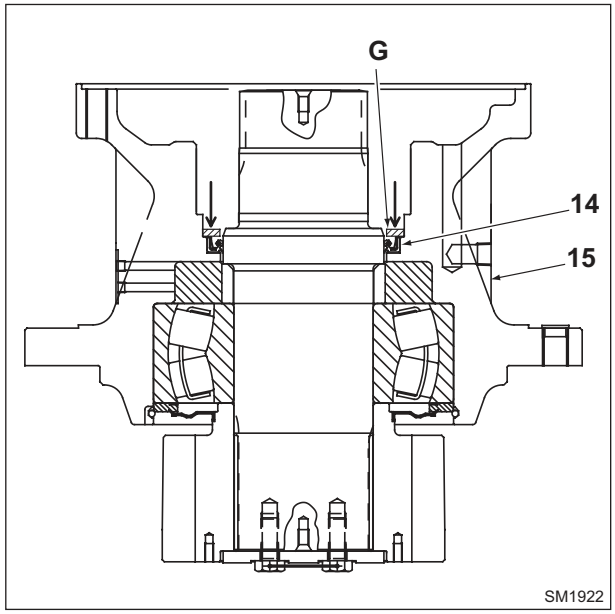


28. Use a tackle to assemble the toothed cover (**21**) respecting the markings set out previously.



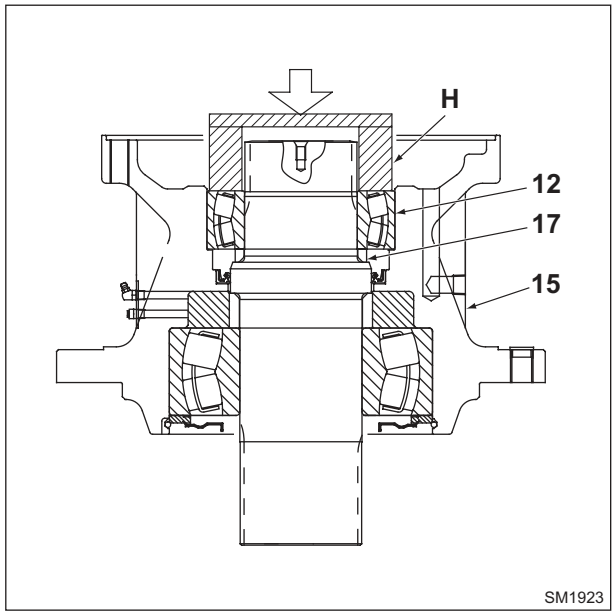
12. Install housing assembly so pinion (**1**) points downward.

13. Install oil seal (**14**) in housing (**15**) using suitable jig (**G**):
    a. Apply Loctite #515 to perimeter of oil seal.
    b. Fill one third (1/3) of the space of the grooveshaped section provided on oil seal (**14**) lip with grease.
    c. Insert seal horizontally paying attention to lip of oil seal to prevent damage.

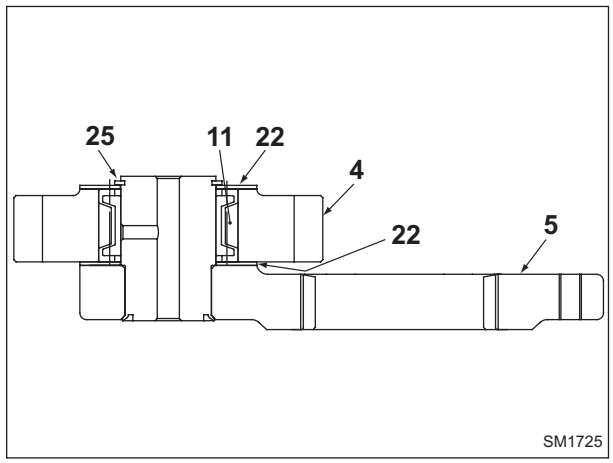


14. Install sleeve (**17**).

15. Press fit spherical bearing (upper) (**12**) onto shaft (**2**) and housing (**15**) using suitable jig (**H**).

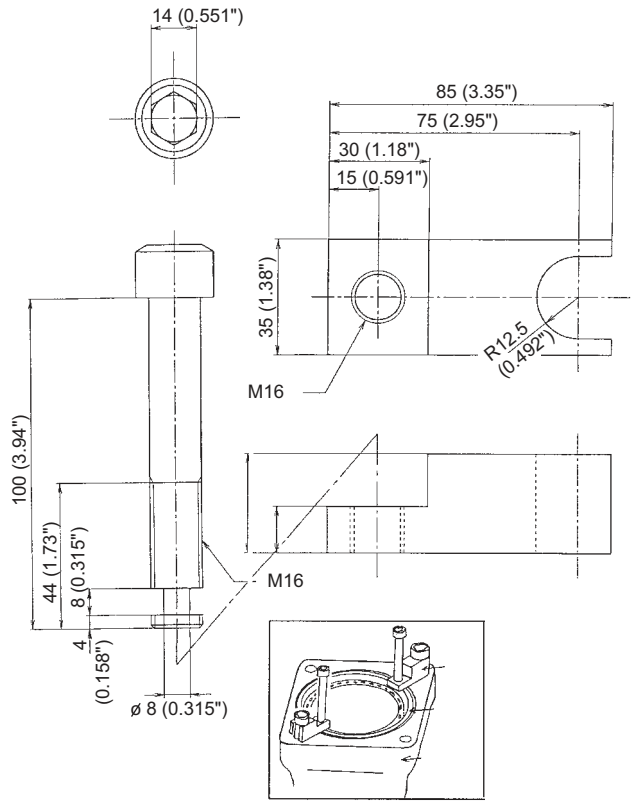
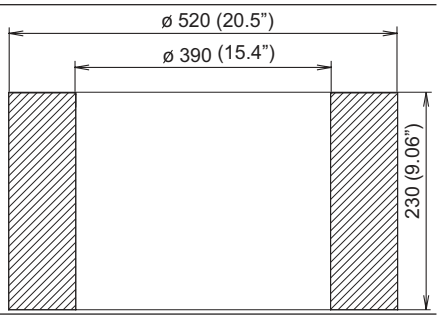
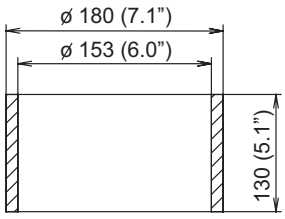


16. Coat bore surface of pinion (**4**) with grease. Place pinion (**4**) on thrust washer (**22**) and assemble needle bearing (**11**) into the bore surface.



TOOL TABLE (SK295-9)

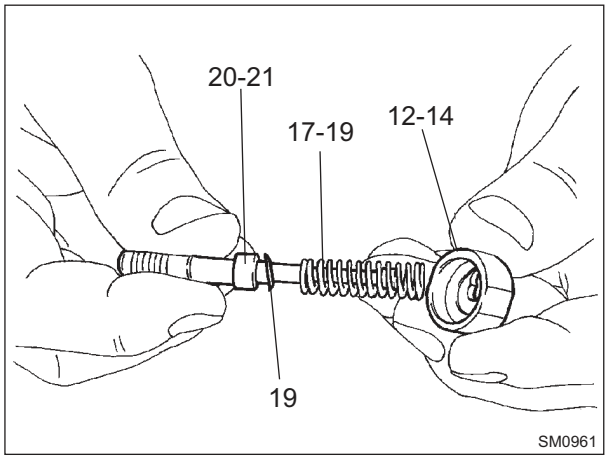
Unit: mm (in)

Item	Description	Note
(A)	Piston brake puller	
(B)	Stand	Material : mild steel 
(C)	Bearing (13) removing jig	Material : mild steel 

SM1924

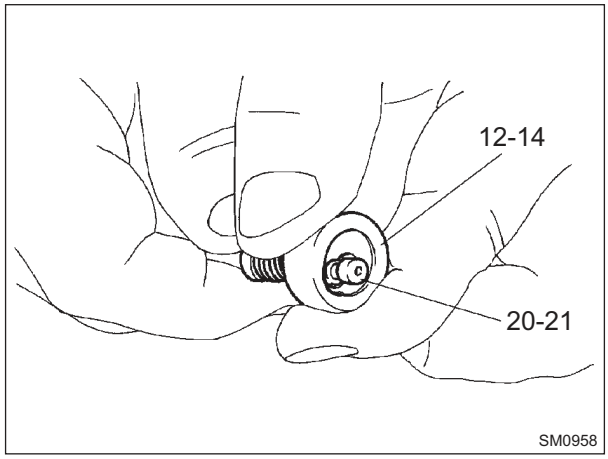
ASSEMBLY RIGHT AND LEFT PILOT VALVE

1. Fit washer 2 (**19**), springs (**17**) and (**18**), spring seats (**12**) and (**14**) to spools (**20**) and **21**).



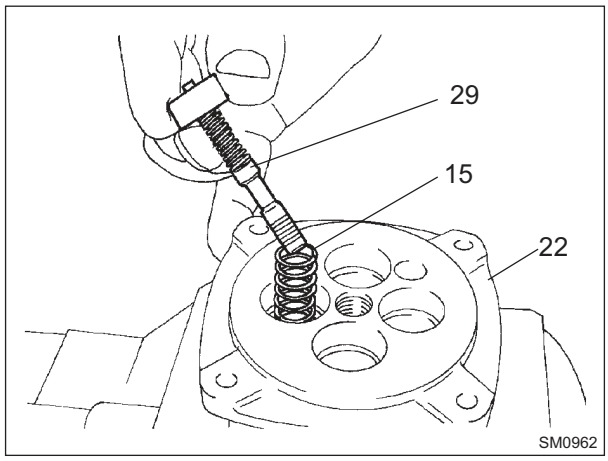
2. Push spring (**17** and **18**) in the range of that the movement of spring seats (**12** and **14**) in a side direction, and install spools (**20**) through the larger hole of spring seat.

ATTENTION: *Do not push spring seat (**12**) down more than 7 mm (0.276 in) (port 1 and 3).*
*Do not push spring seat (**14**) down more than 9,4 mm (0.370 in) or more. (For port 2 and 4).*

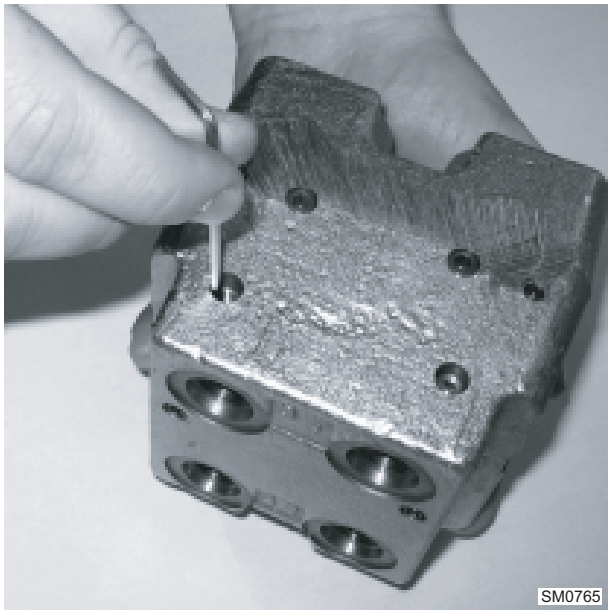


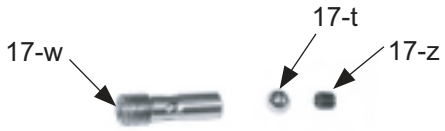
3. Place springs (**15**) into ports 1,3 of casing (**22**). Install pressure reducing valve assembly.
Place spring (**16**) into ports 2,4. Install pressure reducing valve assembly.

NOTE: *Install the removed respective assemblies into respective holes.*



3) Install body upside-down to remove the shuttle valve (**17-w**) and the ball (**17-r**).
4) Unscrew throttle (**17-z**) using a 2.5 mm socket wrench.
   * Reassembly:
   • Hand tighten
5) Repeat the operation for remaining subassemblies.
6) Inspect shuttle valves (**17-w**), balls (**17-r**) and throttles (**17-z**).
   If defects are detected, replace all assemblies.
7) Reassemble parts in reverse order.

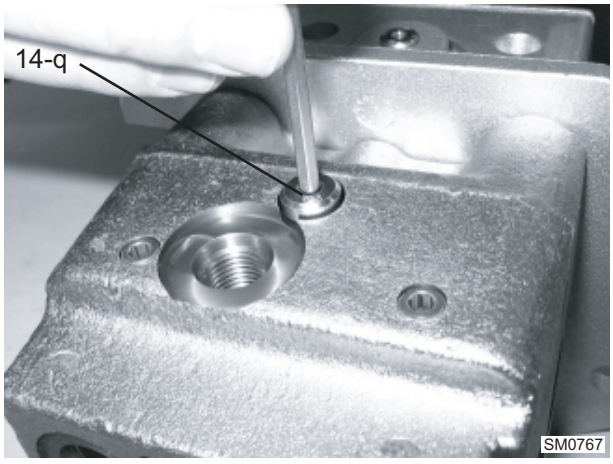




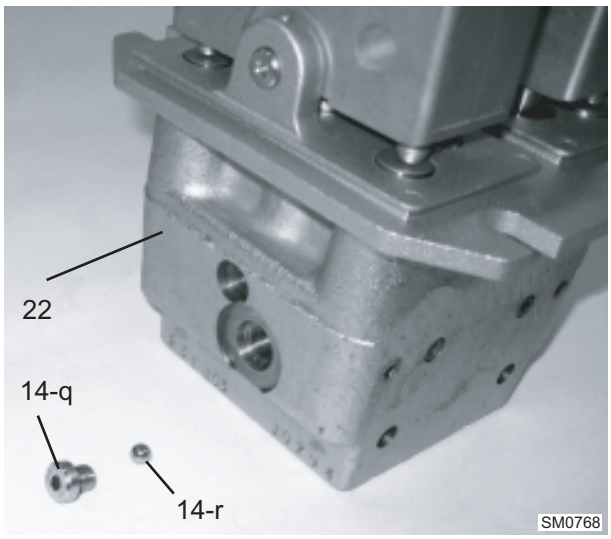
SM0766

9. Check valve kit removal (**14**)
   1) Remove pilot control unit from machine

NOTE: *Pilot control unit does not need to be disassembled to do this operation.*



2) Remove check valve plug (**14-q**) using a 4 mm socket wrench.
   * Reassembly:
   • Drain pilot control unit
   • Torque: 5 Nm (3.7 lbf•ft)
3) Install body (**22**) upside-down to remove the ball (**14-r**).
4) Repeat the operation for the second check valve kit.
5) Inspect the check valve plugs (**14-q**), O-rings and balls (**14-r**). If defects are detected, replace all assemblies.
6) Reassemble parts in reverse order.

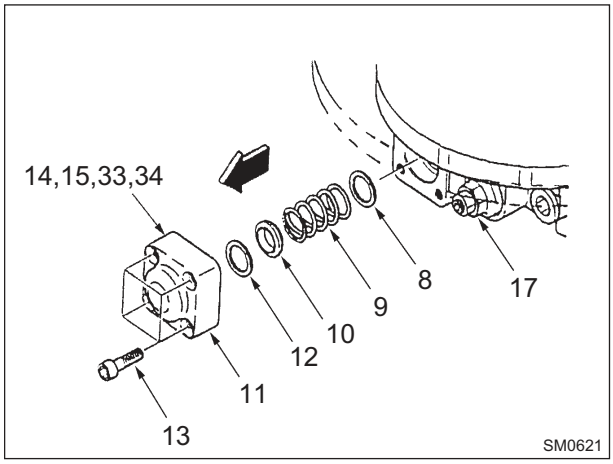


DISASSEMBLY PROCEDURE OF TRAVEL DEVICE

Removing Cap

1. Place the motor on a stable work bench, loosen eight socket bolts (**13**) and remove cap (**11**) with O-ring (**12**).
2. Next, remove spring seat (**10**), spring (**9**) and spring seat (**8**).
3. Then separate plug (**15**), O-ring (**14**), spring (**34**) and ball (**33**).

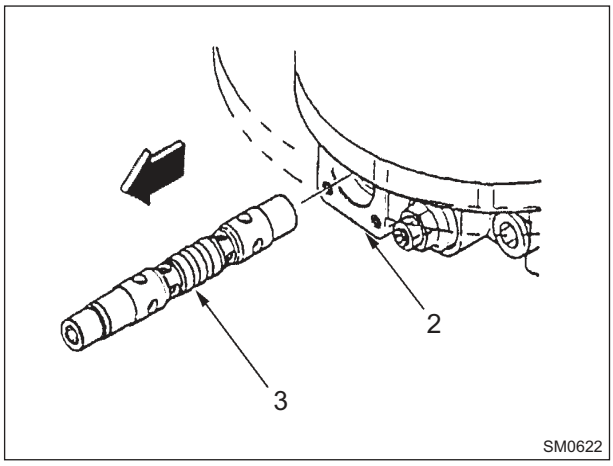
: 10 mm
: 14 mm.



ATTENTION: *cap (**11**) is pressed out by spring (**9**). Therefore, take care of the following*
*- Loosen socket bolts (**13**) evenly all around.*
*- Loosen socket bolts (**13**) holding down cap (**11**).*

Removing Double Counterbalance Plunger

1. Push the end of plunger (**3**) lightly so part of plunger (**3**) comes out of base plate (**2**). Then, hold the end of plunger (**3**) by hand and draw out plunger (**3**) from base plate (**2**) while turning it by hand.

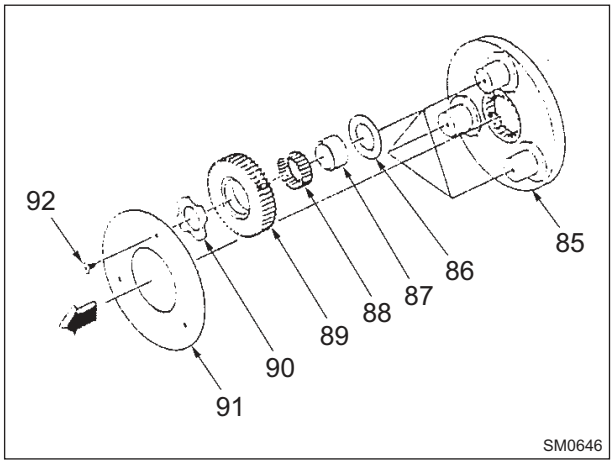


ATTENTION: *plunger (**3**) and base plate (**2**) have a very tight fit. Therefore, pay attention to the following:*
*- if plunger (**3**) gets stuck halfway and does not come out, do not try to force it out. If it is pulled out by force, the bore surface of base plate (**2**) and the outer surface of plunger (**3**) will be scored.*
*- If the plunger gets stuck halfway, do as follows: Put plunger (**3**) back into base plate (**2**) by lightly tapping the end face of it with a plastic mallet. Then make sure the plunger (**3**) moves smoothly and remove plunger (**3**) again turning it by hand.*
*- Do not disassemble plunger (**3**) unless it is necessary; the outer surface of it may be scored at disassembly.*

Removing the 1st Stage Holder Assembly

1. Fix the 1st stage holder assembly in a vise and heat screw (**92**) with a hair dryer and loosen it.
2. Separate screw (**92**), thrust plate (**91**), thrust plate (**90**), planetary gear B (**89**), needle bearing (**88**), inner race (**87**) and thrust plate (**86**), from the holder B, in that order.

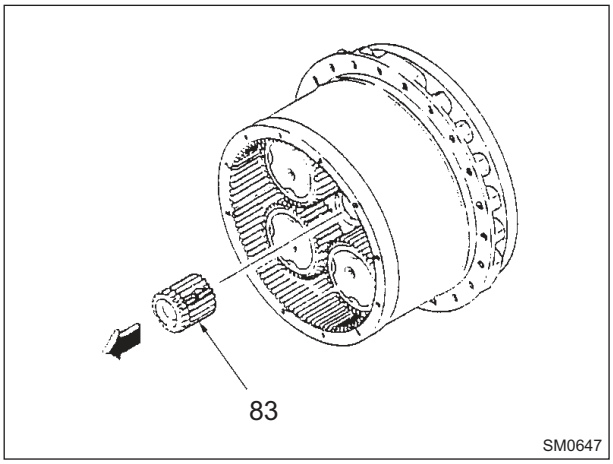
: 8 mm



ATTENTION: *when loosening screw (**92**), exercise care of the following:*
*Screw (**92**) is coated with Loctite and hard to get loose. If you loosen it by force, it is scored and can not be reused. Heat the screw with a hair dryer before loosening it.*

Removing Sun Gear C

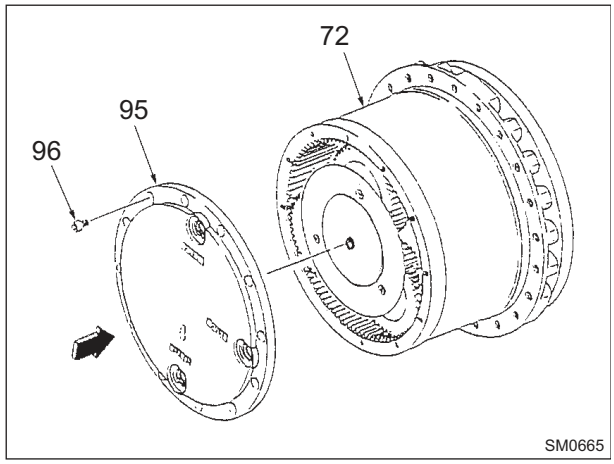
1. Remove sun gear C (**83**).



Attaching Cover

1. Remove foreign matter completely from the matching surface between the end face of housing (**72**) and cover (**95**).
2. Next, thoroughly degrease the matching surface between the end face of housing (**72**) and cover (**95**).
3. Further, apply liquid packing to the corner of the spigot joint on the matching surface side of housing (**72**) on cover (**95**).
4. Match the tapped holes in housing (**72**) with the bolt holes in cover (**95**) and place cover (**95**) in housing (**72**).
5. Finally, attach bolts (**96**) and tighten them to the specified torque.


: 8 mm
: 73.4 Nm (54.1 lb-ft)

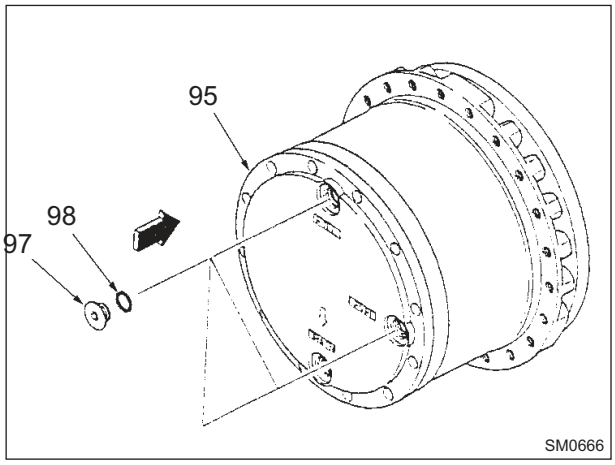


Fitting Plugs

1. Take off O-ring (**98**) from plug (**97**), replace it with a new one and place it in plug (**97**).
2. Then, attach plugs (**97**) to the oil inlet / outlet and the level ports (3 in all) on cover (**95**), and tighten them to the specified torque.


: 12 mm
: 157 Nm (115.8 lb-ft)

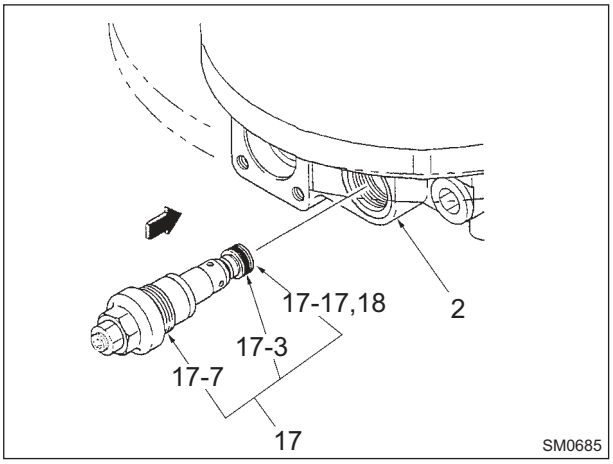
This completes the assembly of the reduction unit. Next comes the assembly of the motor. Assemble it, referring to “Assembling the Motor”.



Assembling Relief Valve

1. Make sure that poppet seat (**17-3**) is placed at the tip of relief valve (**17**).
2. Then assemble relief valve (**17**) to base plate (**2**) and tighten them to the specified torque.

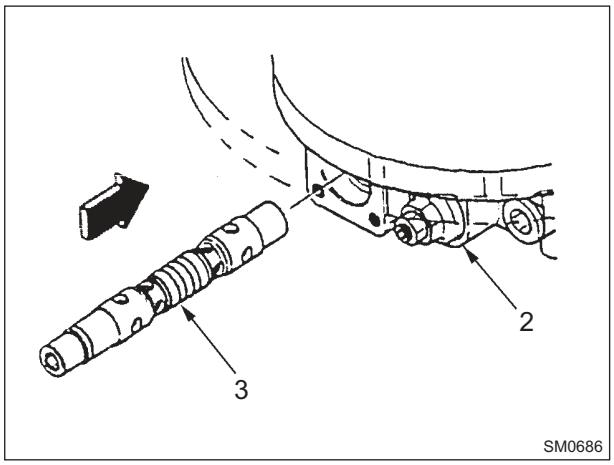
: 27 mm
: 373 Nm (275 lb-ft)



ATTENTION: *replace O-ring (**17-7**) with a new one before assembly.*
*Make sure that O-ring (**17-7**) and backup ring (**17-18**) are fitted to poppet seat (**17-3**).*
*Coat O-ring (**17-17**) and backup ring (**17-18**) with grease before assembly.*

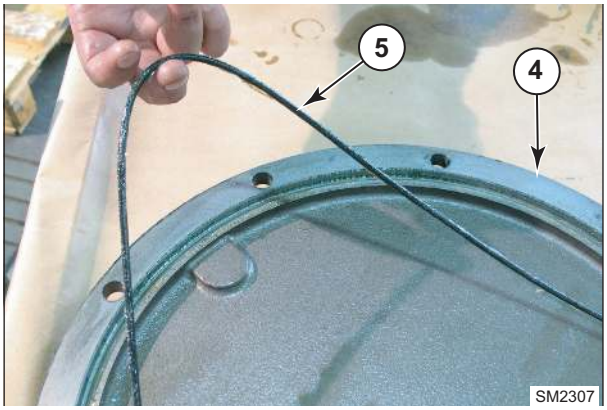
Assembling Counterbalance Valve Plunger

1. Assemble plunger (**3**) to base plate (**2**).

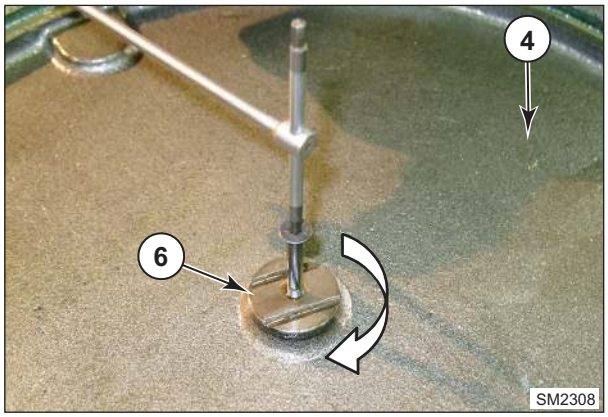


ATTENTION: *assemble the plunger (**3**) to the base plate while turning the plunger.*
*Install plunger (**3**) straight.*
*In case plunger (**3**) gets stuck, do not force it in, tap it lightly with a plastic mallet.*
*Coat the outer surface of plunger (**3**) with hydraulic oil before assembly.*

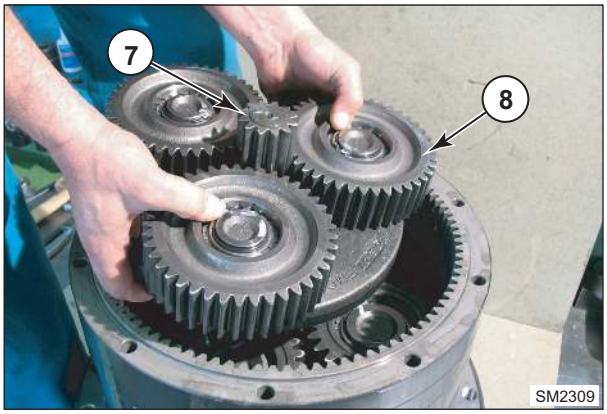
3. Remove the O-Ring seal (**5**) from its seat in the end cover (**4**).



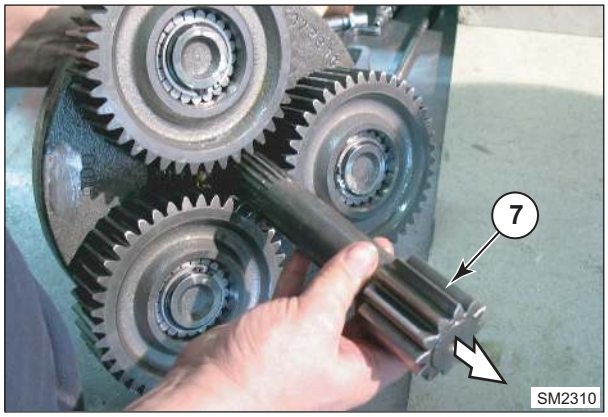
4. Screw a socket head screw M5x20 in the threaded hole of the pad (**6**) in order to remove it from the end cover (**4**).



5. Remove the 1st reduction assembly (**8**) and the 1st stage sun gear (**7**).



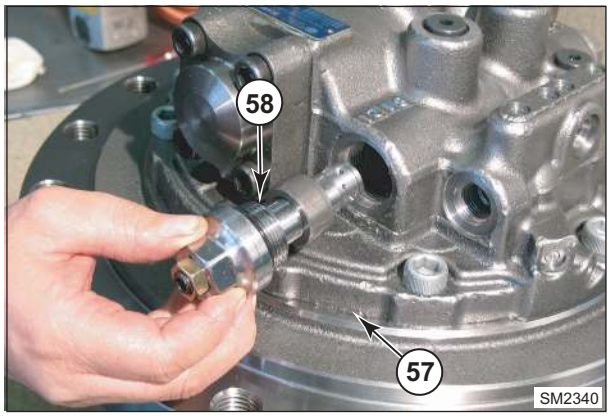
6. Remove the 1st stage sun gear (**7**).



Disassembly of the Relief Valve Assembly

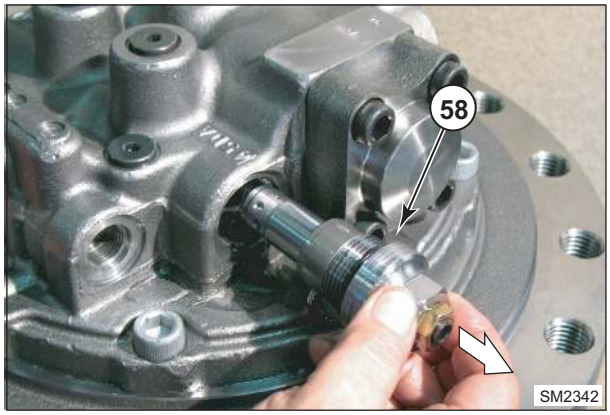
9. Unscrew the 1st relief valve kit (**58**).

10. Remove the 1st relief valve kit (**58**) from its seat in the base plate (**57**).

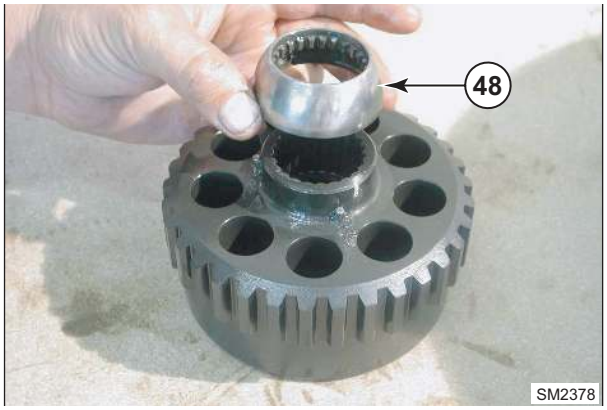


11. Unscrew the 2nd relief valve kit (**58**).

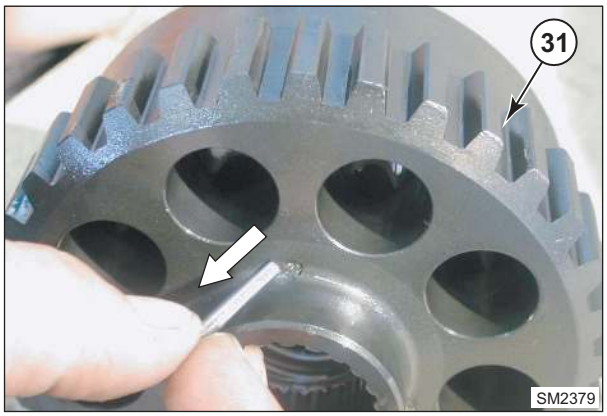
12. Remove the 2nd relief valve kit (**58**) from its seat in the base plate (**57**).



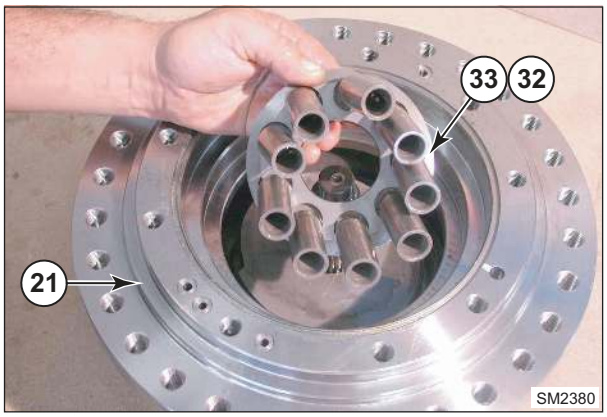
49. Remove the spherical retainer plate holder.



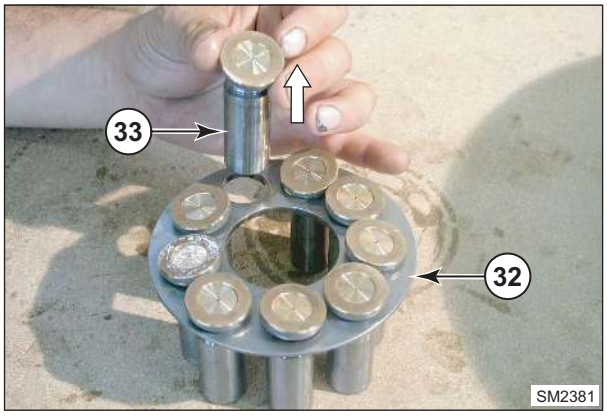
50. Remove 3 pins from their seats in the cylinder block (**31**).



51. Remove the pistons and the retainer plate (**33**-**32**) from the flanged hub (**21**).

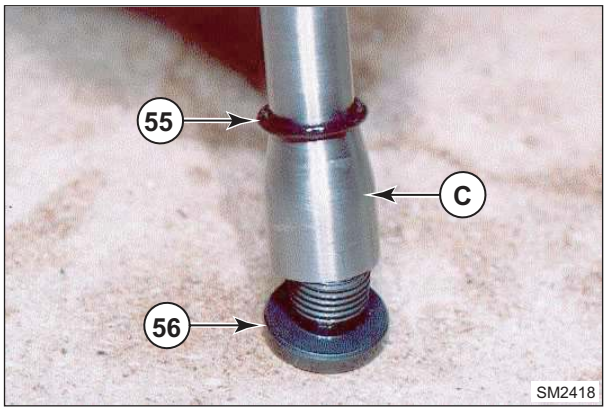


52. Remove the pistons (**33**) from the retainer plate (**32**).

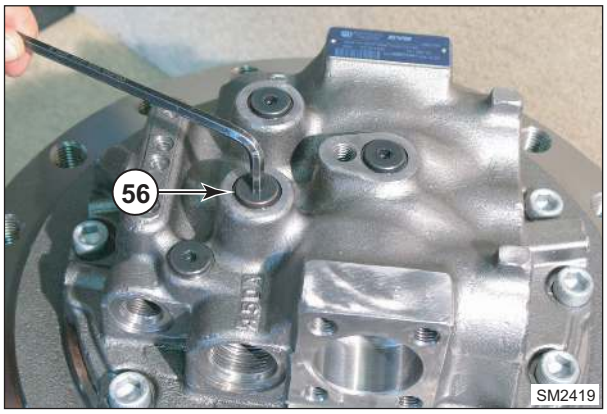


29. Install the base plate (**57**) to flanged hub (**21**) using 10 socket head screws M14x40 (**54**) grade 12.9, tightened by a torque wrench at 235 Nm (173 lb.ft) torque.

30. By using the stopper (**C**) (**6689960810**), assemble the O-ring seals (**55**) in their seats in the plugs (**56**).

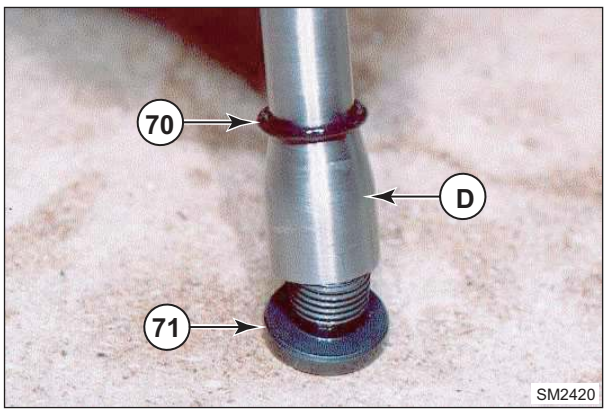


31. Insert the plugs (**56**) and tighten by a torque wrench at 36,8 ± 2,5 Nm (27.1 ± 1.8 lb.ft) torque.



Reassembly of the Flanged Plug Assembly

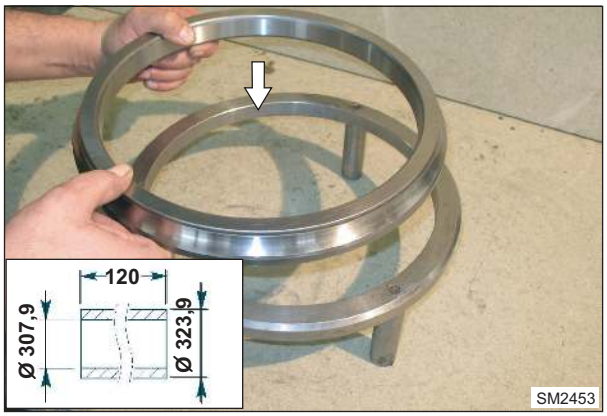
32. By using the stopper (**D**) (**6689960820**), assemble the O-ring seal (**70**) in its seat in the plug (**71**).



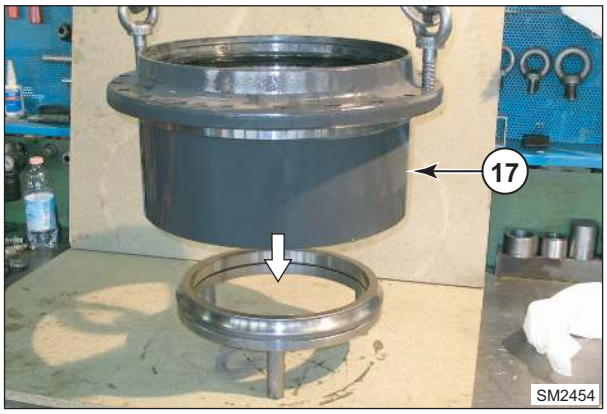
Gearbox Reassembling Method

66. Assemble the balls to the plastic support.

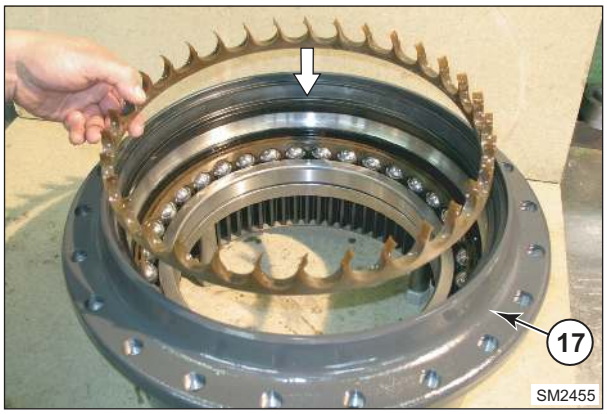
67. Place the bearing inner ring on a spacer.



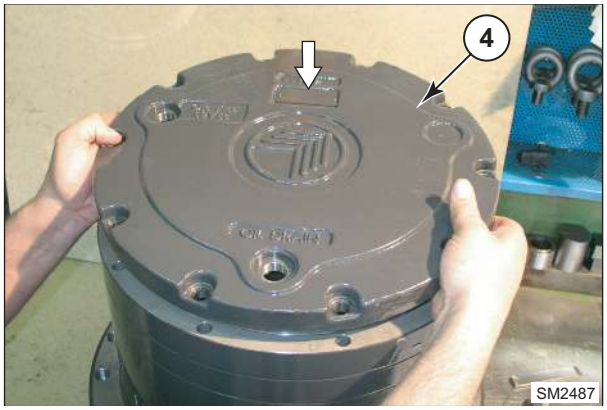
68. Place the gearbox housing (**17**) on the bearing inner ring.



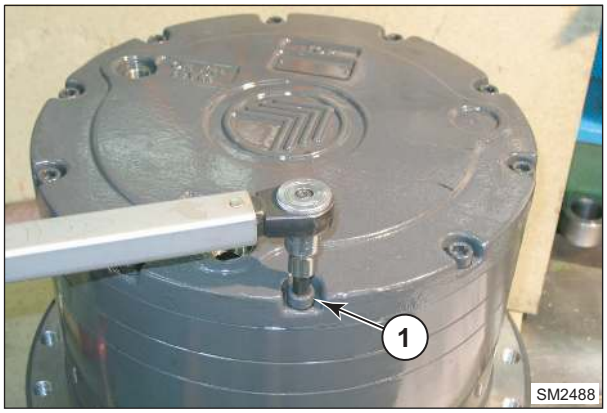
69. Assemble the plastic support in the gearbox housing (**17**).



100. Place the end cover (**4**) on the gearbox housing (**17**).

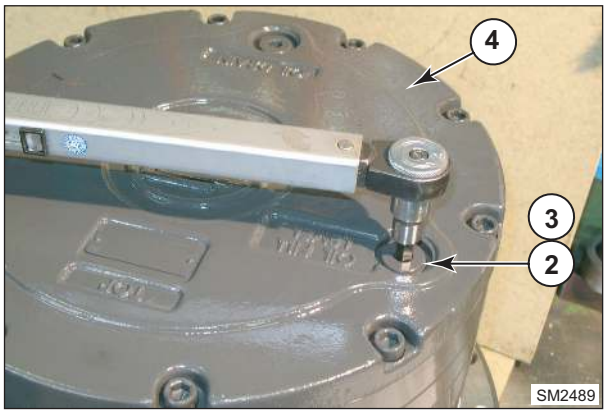


101. Tighten the 10 socket head screws M12x90 (**1**), grade 12.9, with a torque wrench to 143 Nm (105.4 lb.ft) torque.



102. Fill the gearbox with lubricant oil.
Recommended oil type: HYPOIDE 90 (SAE 80W/90 or SAE 85W140 – EP Characteristic: API GL 5 o MIL-L-2105 D).
Gearbox housing capacity: 5 L

103. Insert the washers (**3**) and the plugs (**2**) into the oil drain-filling holes of the end cover (**4**). Tighten the plugs with a torque wrench to 70 ± 10 Nm (51.6 ± 7.4 lb.ft) torque.

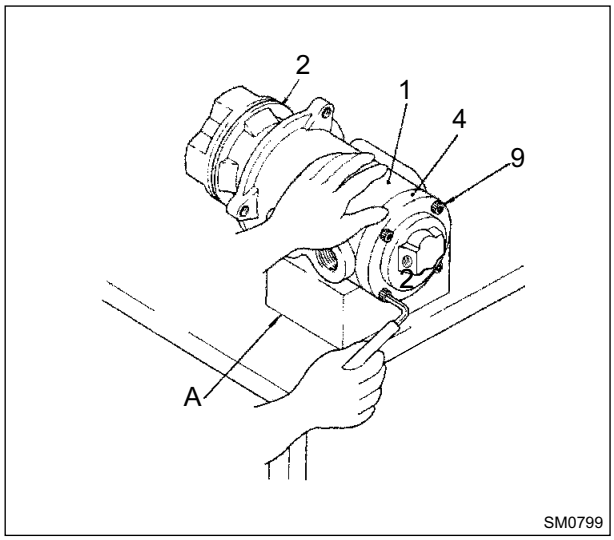


Disassembly

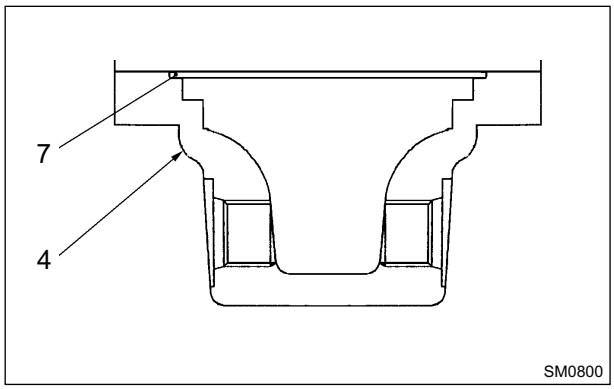
The part numbers used in this disassembly procedure correspond to those of a construction drawing in the figure on page W3-3-4.

1. Mark cover (**4**) and body (**1**) with matching marks for convenient reassembly.
2. Place a 'V' (**A**) block on a work bench, place a swivel joint set on the side, fix it and loosen socket bolt (**9**) by means of a pipe and wrench. Alternately, the swivel joint may be fixed by holding stem (**2**) in a vise.

   : 6 mm

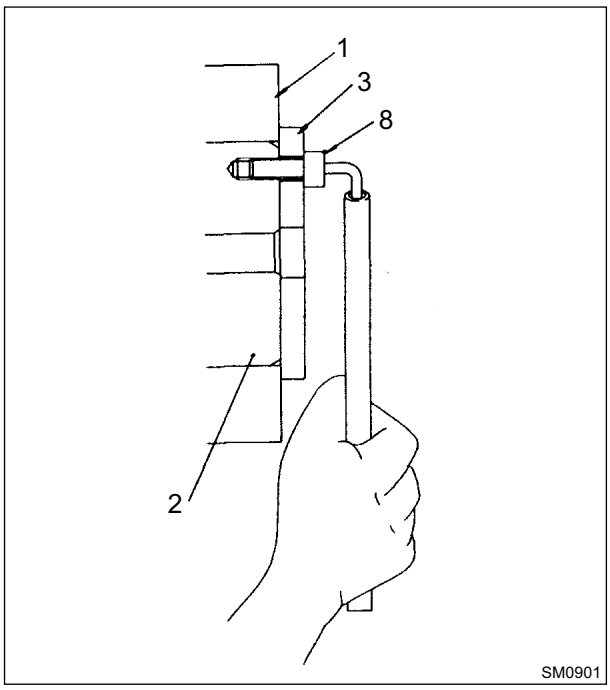


3. Remove cover (**4**) from body (**1**) and remove O-Ring (**7**) from cover (**4**).



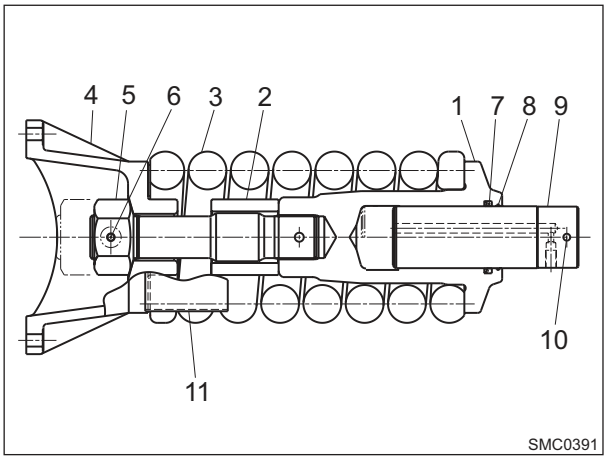
4. Loosen socket bolt (**8**) fastening thrust plate (**3**), in the same manner as the removing of the above-mentioned cover (**4**).
   - When removing thrust plate (**3**) by fixing body (**1**), support the stem (**2**) so it will not fall down.

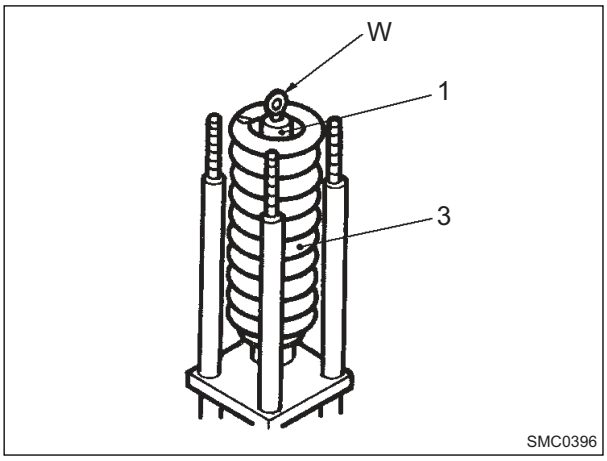
   : 6 mm



Assembly

1. Insert grease cylinder (**1**) and collar (**2**) into spring (**3**) and attach lifting eye nut (W) to screw at the top of the grease cylinder. Lift the grease cylinder by crane and place it in the center of the jig stand upright (**380001029**).





2. Install bracket (**4**) and cover (**11**) on top of spring (**3**).
   Center the rod of grease cylinder (**1**) and the holes in bracket (**4**). Attach the retainer plate (**13**) and four holding-down nuts (**12**). Fasten the nuts evenly all around and fix the idler adjuster assembly to the jig body (**380001029**).

   : 46 mm

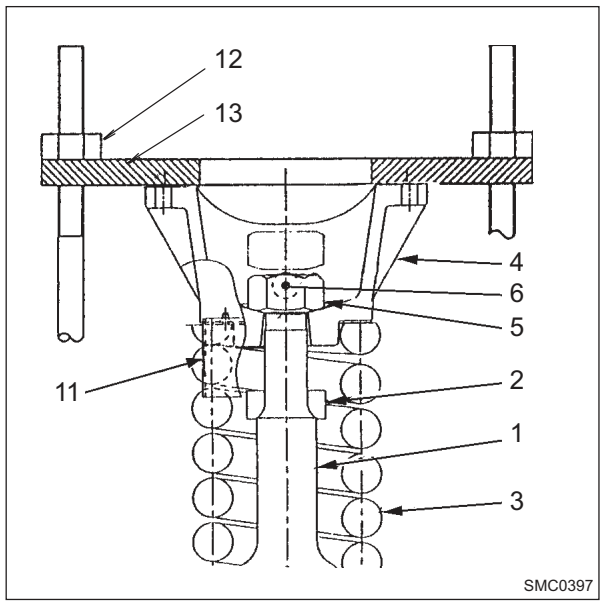
3. Extend the hydraulic jack, compress spring (**3**) to a set length and screw in nut (**5**) to the screwed part at the tip of grease cylinder (**1**).

   Set length of the spring
   440 mm (17.3 in) (SK260-9)
   456.8 mm (1 ft 6 in) (SK295-9)

4. Tighten nut (**5**) till the holes for locking spring pins (**6**) are aligned. Then fit spring pin (**6**).

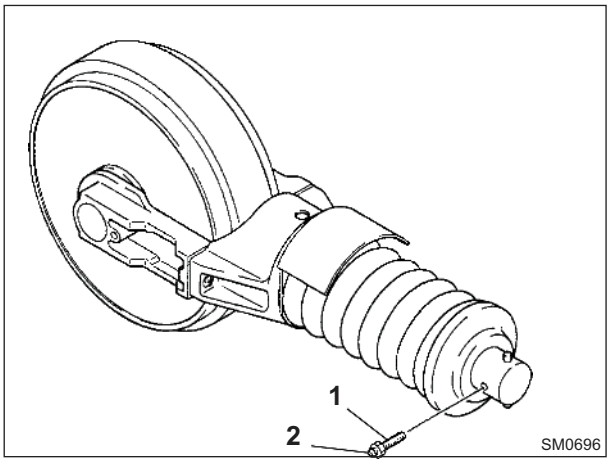
   : 46 mm

   : 75 mm



6. Tighten valve (**1**).

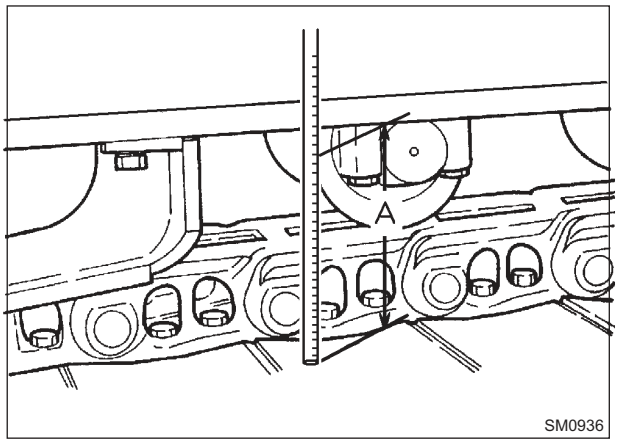
   : 19 mm
   : 70 Nm (51.6 lbf·ft)



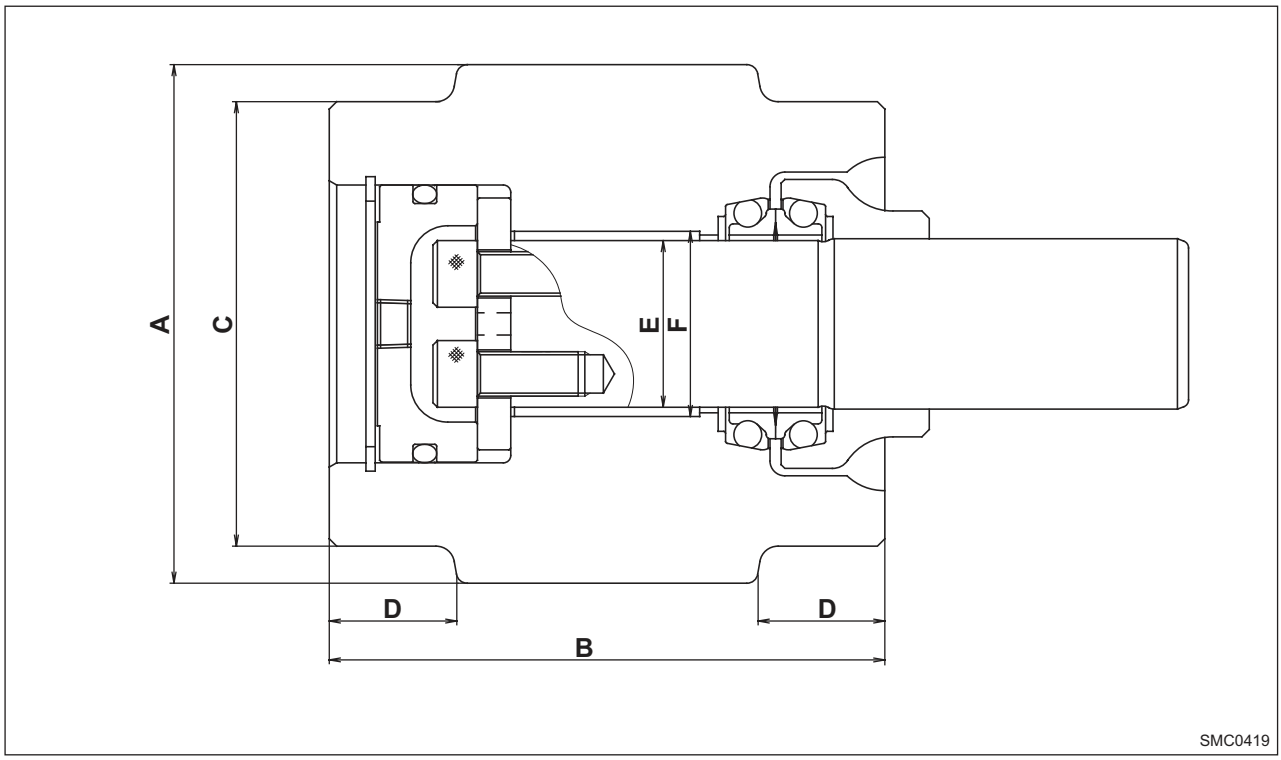
7. Supply grease to valve (**1**) throught nipple (**2**) to adjust tracks tension.

   Track sag specifications (**A**): 320 ÷ 350 mm (12.60 ÷ 13.78 in)

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



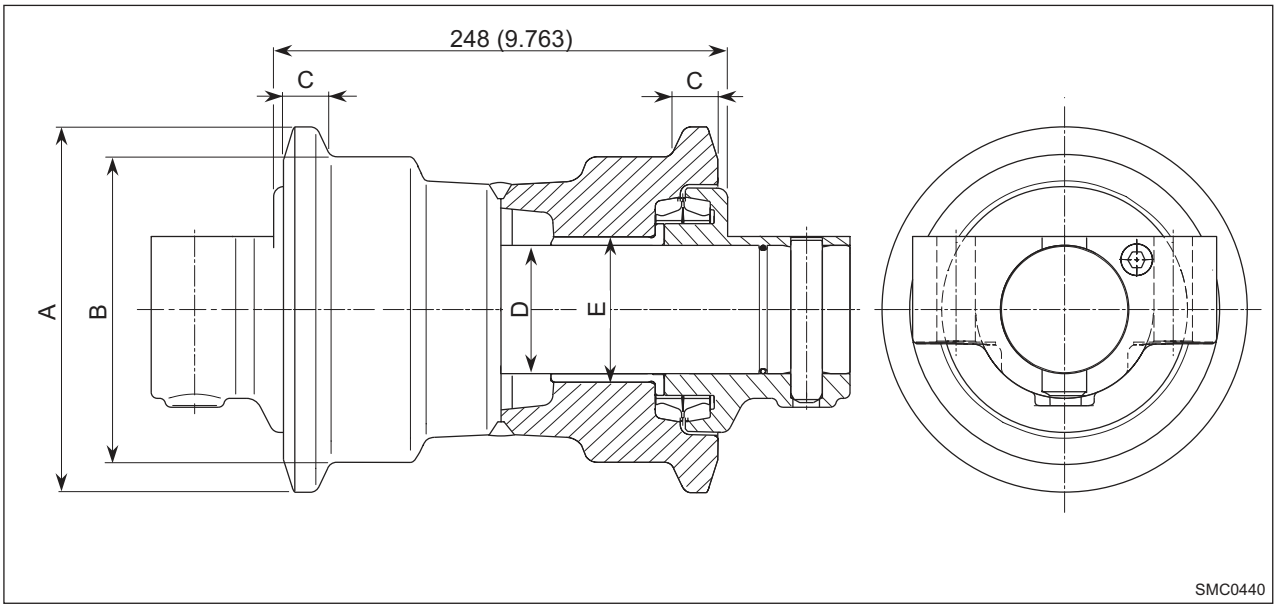
UPPER ROLLER MAINTENANCE STANDARD (SK260-9)



Unit: mm (in)

No.	ITEM	STANDARD VALUE				SERVICE LIMIT	REMEDY
A	Diameter	ø 140 (5.51)				ø 130 (5.12)	Reinforcement weld, repair or replace
B	Width	150 (5.91)				140 (5.51)	
C	Tread dia.	ø 120 (4.72)				ø 110 (4.33)	
D	Tread width	33 (1.30)				29 (1.14)	
E	Clearance between shaft and bushing	Basic dimension	Tolerance		Standard	Limit	Replace bushing
		ø 46 (1.811)	Shaft	- 0.025 (-0.0010) - 0.040 (-0.0016)	Clearance -	Clearance 0.8 (0.0315)	
F	Interference between roller and bushing	ø 50 (1.969)	Hole	+ 0.030 (+0.0012) 0	Interference -	Clearance 0	
	Oil	Engine oil: API grade CD #30; Q.ty: 30 cc (1.83 cu-in)					Refill
	Roller rotation	Rotates smoothly by hand					Reassembly

LOWER ROLLER MAINTENANCE STANDARD (SK295-9SK260-9)



Unit: mm (in)

No.	ITEM	STANDARD VALUE			REPAIRABLE LEVEL	SERVICE LIMIT	REMEDY
A	Diameter of flange	ø 200 (7.874)			-	-	Reinforcement weld, repair or replace
B	Treat diameter	ø 165 (6.496)			ø 150 (5.905)	ø 144 (5.669)	
C	Flange width	26 (1.023)			-	-	
D	Clearance between shaft and bushing (Wrapped bushing)	Basic dimension	Tolerance		Fit	Fit	Replace bushing
		ø 65 (2.55905)	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 69 (2.71653)	Hole	± 0.030 (± 0.0012)	Interference 0.01 (0.0004)	Clearance 0	
F	Oil	Engine oil API grade CD #30; Q.ty: 150~170 cc					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

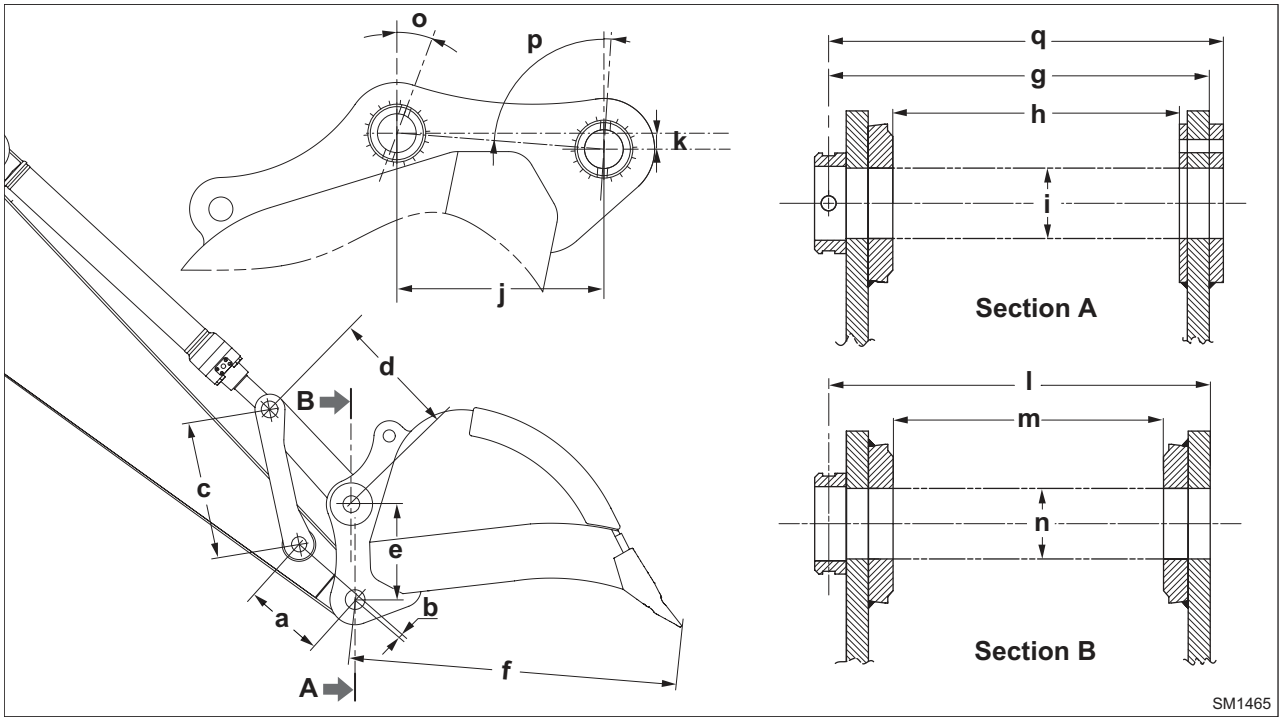
SECTION 4

FRONT ATTACHMENT

CONTENTS

Group 1 - Front attachment

STANDARD DIMENSIONS FOR ARM AND BUCKET CONNECTION - SK260-9



	SK260-9
a	450 (17.72)
b (*)	37 (1.46)
b (**)	36.7 (1.45)
b (***)	37.3 (1.47)
c	695 (27.36)
d	636 (25.04)
e	500 (19.68)
f	1500 (59.06)
g	441 (17.36)
h	347 (13.66)
i	ø90 (ø3.54)
j	498 (19.61)
k	48 (1.89)
l	466 (18.35)
m	327 (12.87)
n	ø90 (ø3.54)
o	45°
p	90°
q	466 (18.35)

(*) Arm: 2160 mm (7 ft 1 in)/2980 mm (9 ft 9 in) Unit: mm (in)
(**) Arm: 2500 mm (8 ft 2 in)
(***) Arm: 3660 mm (12 ft)

10. Loosen lock nuts (**10**), remove bolt (**11**) and stopper (**12**) from boom cylinder frame end. Remove pin (**13**) and shims (**14**).

    : 24 mm

11. Using a hoist, lift boom cylinder. If necessary, remove the other boom cylinder following the same procedure.

Arm Cylinder Disassembly - SK260-9

Be sure to thoroughly read all the precautions for disassembly/assembly work on page W1-1-1 before starting the disassembly procedure.

The disassembly procedure below starts on the premise that the hydraulic lines and the line securing bands have been removed.

NOTE: *arm cylinder mass: 331 kg (730 lbs).*

1. Lift and securely place the cylinder on a workbench using a crane. Be sure that the cylinder is placed horizontally. Drain hydraulic oil from the cylinder.

2. Fully extend cylinder rod (**11**). Secure the rod end using a crane. Remove socket bolts (**8**) from cylinder head (**7**).
   : 17 mm

ATTENTION: *be sure to pull cylinder rod (**11**) straight out to prevent damage to the sliding surfaces.*

3. Pull out cylinder head (**7**) from cylinder tube (**12**) by tapping with a plastic hammer.

4. Secure cylinder rod (**11**) on special tool (**380000812**). Put matching marks between cylinder rod (**11**) and nut (**24**).

5. Remove set screw (**22**) and steel ball (**23**).
   : 12 mm

NOTE: *cut away the mushroomed portion using a drill first, because the set screw was mushroomed with a punch and hammer at two places after it was installed.*

6. Loosen and remove nut (**24**). Remove shim (**21**), piston (**15**), cushion bearing (**13**) and cushion seal (**14**).
   Socket to tighten nut (**24**):
   - 115 mm (**380001018**)

7. Remove seal ring (**17**), slide rings (**19**) and (**20**), O-ring (**18**) and backup rings (**16**) from piston (**15**).

8. Remove cylinder head (**7**) from cylinder rod (**11**).

9. Remove O-Ring (**10**) and backup rings (**9** and **2**) from cylinder head (**7**). Then remove wiper ring (**1**), seal (**3**), buffer ring (**4**), snap ring (**6**) and bushing (**5**).

10. Remove stopper (**28**) from cylinder rod (**11**) using a screw driver. Remove cushion bearing (**27**), cushion seal (**26**) and snap ring (**25**).