HYDRAULIC COMPONENTS

HYDRAULIC PUMP

Item			Main pump	Gear pump for pilot
Pump			K3V112DTP1KMR-YT2K-HV	ZX10LGRZ2-07G
Type			Variable displacement plunger pump: regulator attached type	Fixed displacement type gear pump
Max. displacement capacity		cm^3 (in^3)	110 (6.71) x 2	10 (0.6)
Revolution	Rated	rpm (Clockwise seen from shaft end)	2000	←
Pressure	Rated	MPa (psi)	34.3 (4980)	5.0 (725)
	ATT boost		37.8 (5480)	
Max. flow		L/min (gal/min)	220 (58) x 2 at 7.8 MPa (1130 psi)	20 (5.5)
Max. input Power (at 2000 rpm)		kW (PS)	114 (155)	3.4 (4.6)
Max. input torque (at 1200 rpm)		N·m (lbf·ft)	544 (401)	14.7 (10.8)
Regulator		Model	KR3G-YT2K-V	
		Control function	Electric flow control, positive flow control, total power control at emergency mode and power shift control	
		Others	With solenoid proportional reducing valve (KDRDE5K-31/ 30C50)	
Mass		kg (lb)	143 (315)	

NOTE: *The max. input power and the max. input torque of the main pump include those of the gear pump.*

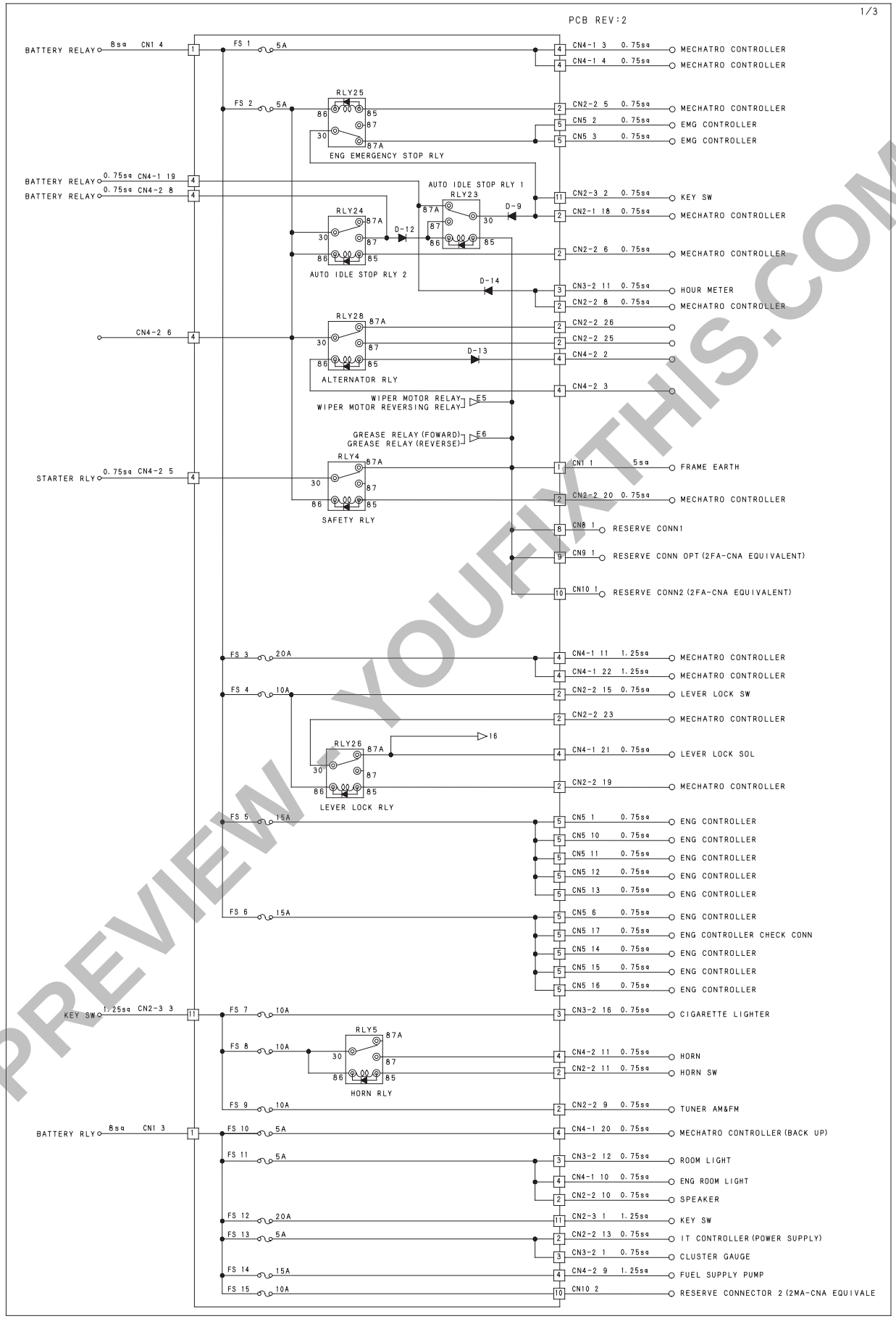
CONTROL VALVE

Item		STD VALVE
Model		KMX15YD/B44141
Max. flow rate	L/min (gal/min)	220 (58) x 2
Main relief valve set pressure	MPa (psi)	34.3 (4970) at 70 x 2 L/min (18.5 x 2 gal/min)
When power boost pressure		37.8 (5480) at 60 x 2 L/min (15.9 x 2 gal/min)
Over load relief valve set pressure	MPa (psi)	
Boom H, Bucket H, Arm R		39.7 (5760) at 30 L/min (8 gal/min)
Boom R, Bucket R, Arm H		37.8 (5480) at 30 L/min (8 gal/min)
Mass	kg (lb)	235 (518.2)

Item		OPT VALVE
Model		KADV22Y / 501103A
Over load relief valve set pressure	MPa (psi)	
Positioner R		39.7 (5760) at 30 L/min (8 gal/min)
Positioner H		37.8 (5480) at 30 L/min (8 gal/min)
Mass	kg (lb)	11 (24.2)

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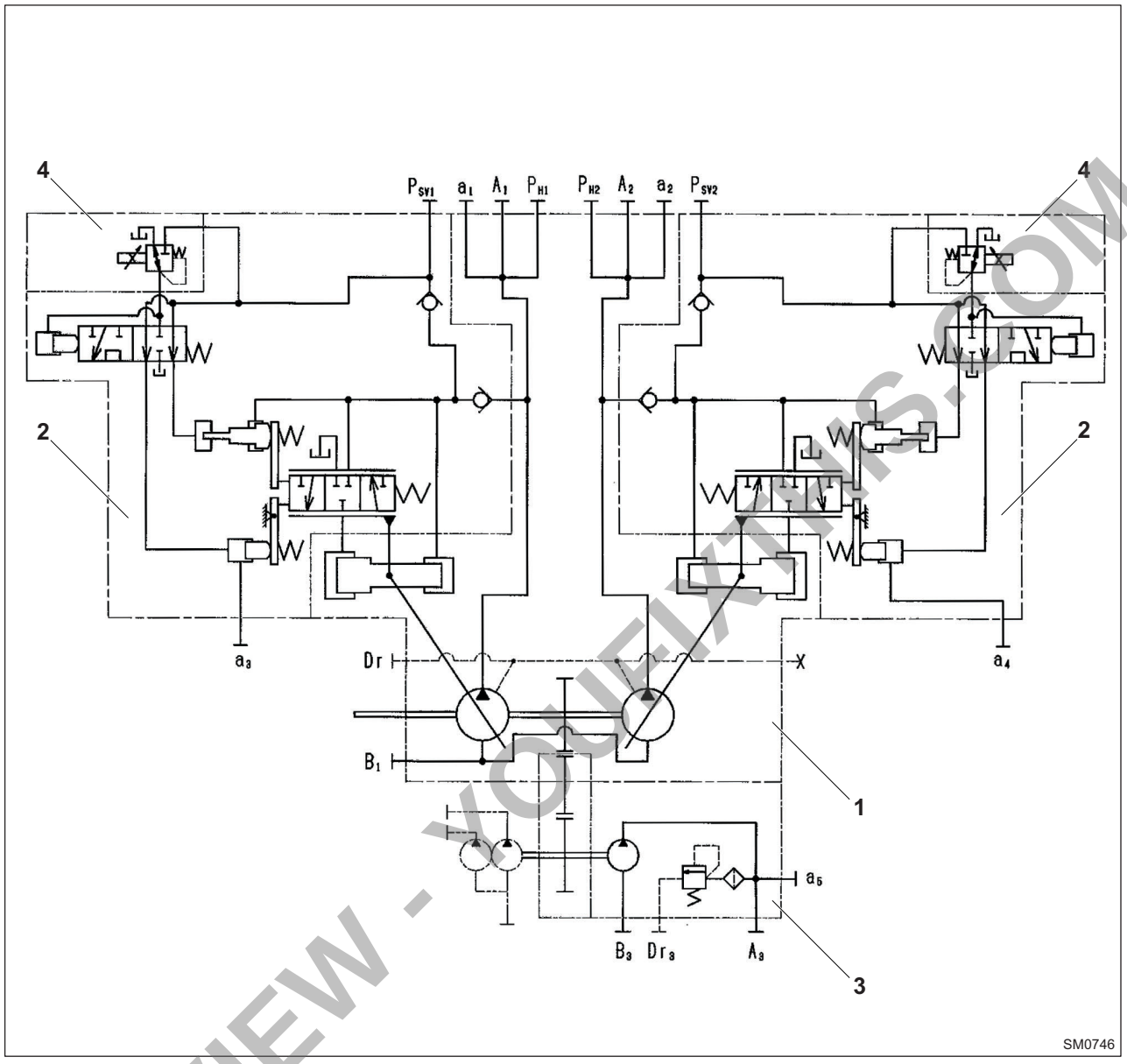
2) Circuit diagram



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Hydraulic circuit diagram



1 - Main pump assy
2 - Regulator assy (Q.ty 2)
3 - Gear pump assy (for pilot)
4 - Solenoid proportional reducing valve (Q.ty 2)

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Table 9

Error code	**B012**		
Trouble	Boom up pressure sensor outputs error.		
Judging condition	After starter switch ON and engine does not start yet. And the input voltage from the sensor after starter switch ON is in the range of 1.4 V or more to less than 4.7 V.		
Symptom	The boom up operability becomes poor.		
Control in the event of failure	Normal control.		
Returned in normal condition	Not returned automatically under normal condition. Switch the power OFF once and turns on it again.		
Service diagnosis checking screen	Screen No.	5	B-1 BOOM RAISE
	Screen No.		
	Screen No.		
Checking object			Checking contents and remedy
1	• Boom up pressure sensor SE-3		When B012 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between boom up pressure sensor and controller CN-126F CN-101F		When B012 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller		Check that the error is corrected after replacement of controller.

Table 10

Error code	**B013**		
Trouble	Boom up pressure sensor's wiring disconnects.		
Judging condition	The input voltage from boom up pressure sensor is less than 0.1 V.		
Symptom	The boom up speed slows down.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to constant current. (Current when all operation is in neutral.) Only on independent operation of boom-up, set output of P1, P2 unload proportional valves to 750mA.		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	5	B-1 BOOM RAISE
	Screen No.		
	Screen No.		
Checking object			Checking contents and remedy
1	• Boom up pressure sensor SE-3		When B013 is cancelled and other error occurs after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between boom up pressure sensor and controller CN-126F CN-101F		When B013 is displayed after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller		Check that the error is corrected after replacement of controller.

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REMOVAL AND INSTALLATION OF UPPERSTRUCTURE

WARNING

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

Preparation

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

Removal of upperstructure

1. Remove the front equipment and the boom cylinders, performing the operations described in the procedure at pages W4-1-1 (Refer to: Section 4 - “Front Attachment”).
2. Remove the operator seat, performing the operations described in the procedure at page W2-1-2.
3. Remove the cab, performing the operations described in the procedure at page W2-1-3.
4. Remove the battery, performing the operations described in the procedure at page W2-1-6.
5. Remove the guard, performing the operations described in the procedure at page W2-1-7.
6. Remove the under cover, performing the operations described in the procedure at page W2-1-12.
7. Remove the DEF/AdBlue® tank, performing the operations described in the procedure at page W2-1-13.
8. Remove the DEF/AdBlue® supply module, filter and shut-off valve, performing the operations described in the procedure at page W2-1-14.
9. Remove the fuel tank, performing the operations described in the procedure at page W2-1-16.
10. Remove the hydraulic oil tank, performing the operations described in the procedure at page W2-1-17.
11. Remove the air cleaner, performing the operations described in the procedure at page W2-1-21.
12. Remove the muffler, performing the operations described in the procedure at page W2-1-22.
13. Remove the counterweight, performing the operations described in the procedure at page W2-1-23.
14. Remove the radiator, performing the operations described in the procedure at page W2-1-25.
15. Remove the engine, performing the operations described in the procedure at page W2-1-29.
16. Disconnect the hoses of swivel joint lower side, performing the operations described in the procedure at page W2-1-32.
17. Remove the upper frame performing the operations described in the procedure at page W2-1-34.

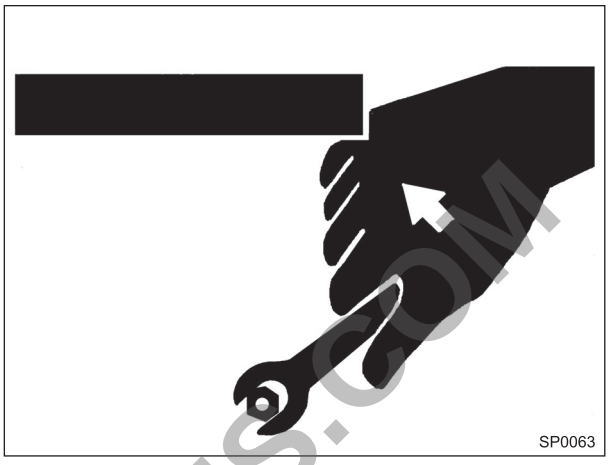
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TORQUE CHART

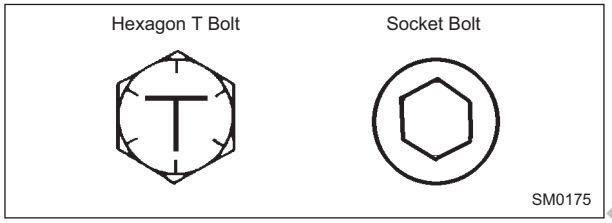
WARNING

Use tools appropriate for the work to be done. Makeshift tools and procedures can create safety hazards. For loosening and tightening nuts and bolts, use the correct tools. Avoid bodily injury caused by slipping wrenches.



Bolt Types

Tighten nuts or bolts correctly to torque specifications. Two kinds of bolts, hexagon bolts T and socket bolt, each made of different material, are used. Make sure to employ the correct bolts and tighten them to specification when assembling the machine or components.



Specified Tightening Torque Chart

Bolt Dia.	Wrench Size	Hexagon Wrench Size	T Bolt, Socket bolt (Nm)
M8	13	6	29.5
M10	17	8	64
M12	19	10	108
M14	22	12	175
M16	24	14	265
M18	27	14	390
M20	30	17	540
M22	32	17	740
M24	36	19	930
M27	41	19	1370
M30	46	22	1910
M33	50	24	2550
M36	55	27	3140

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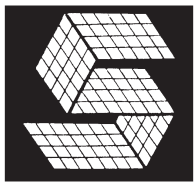
MANUAL INDEX



GENERAL SAFETY INFORMATION

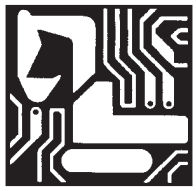
Page

Section 1 SAFETY INFORMATION S1
Section 2 SAFETY PRECAUTIONS S2
Section 3 SAFETY DECALS..... S3

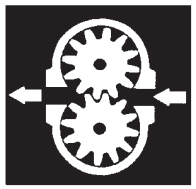


OPERATIONAL PRINCIPLE

Section 1 GENERAL INFORMATION
Group 1 Specifications..... T1-1



Section 2 SYSTEM
Group 1 Mechatro Control System T2-1
Group 2 Hydraulic System..... T2-2
Group 3 Electrical System T2-3



Section 3 COMPONENT OPERATION
Group 1 Hydraulic Pump Assy..... T3-1
Group 2 Pilot Valve T3-2
Group 3 Control Valve T3-3
Group 4 Swing Device T3-4
Group 5 Travel Device T3-5
Group 6 Swivel Joint..... T3-6
Group 7 Cylinders..... T3-7
Group 8 Air Conditioner system..... T3-8
Group 9 Electrical Equipment T3-9
Group 10 Selective Catalytic Reduction T3-10



OPERATIONAL PERFORMANCE TEST

Section 4 OPERATIONAL PERFORMANCE TEST
Group 1 Introduction T4-1
Group 2 Standard Performances T4-2
Group 3 Test Procedures T4-3
Group 4 Mechatro Controller T4-4



TROUBLESHOOTING

Section 5 TROUBLESHOOTING
Group 1 Troubleshooting (by error codes)..... T5-1
Group 2 Troubleshooting (by trouble)..... T5-2

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SAFETY RULES

GENERALITIES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Never exceed machine lifting capacity.

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

STARTING

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

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

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

Obey all hand signals, safety indications and signs.

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

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

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

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

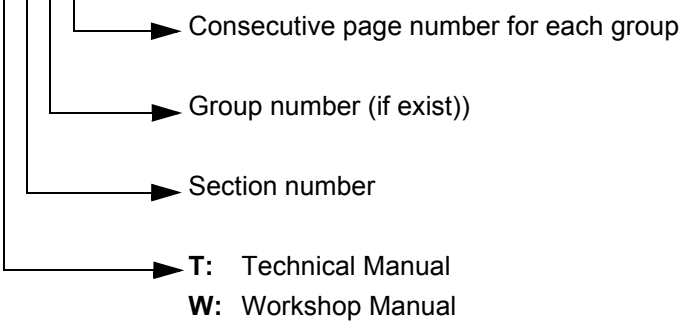
Air in these circuits may cause incorrect movements with consequent accident hazard. Refer to the Operator's manual about corrective action to be taken.

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PAGE NUMBER

- Each page has a number, located on the central lower side of the page. Each page number contains the following information:

Example: **T 1-2-3**



SYMBOLS

In this manual, the following safety alert symbol and signal words are used to alert the reader to the potential for personal injury or machine damage.

This is the safety alert symbol.
When you see this symbol, be alert to the potential for personal injury.
Never fail to follow the safety instructions prescribed along with the safety alert symbol.
The safety alert symbol is also used to draw attentio in to component/part weights.
To avoid injury and damage, be sure to use appropriate lifting techniques and equipment when lifting heavy parts.

UNITS USED

SI Units (International System of Units) are used in this manual.
MKSA system units and English units are also indicated in parentheses just behinds SI units.

Example: 24.5 MPa (250 kgf/cm^2)

A table for conversion from SI units to other system units is shown below for reference purposes.

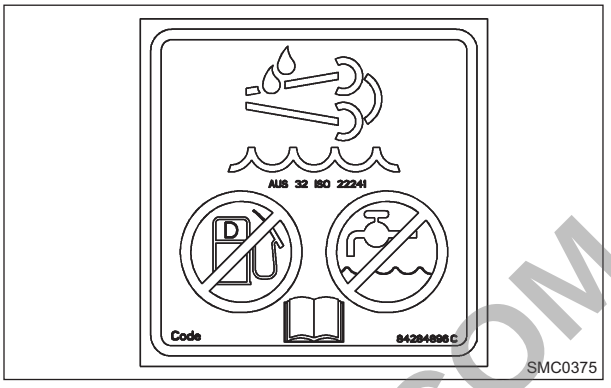
Quantity	To convert from (SI)	Into (Others)	Multiply by
Lenght	mm	in	0.03937
	mm	ft	0.003281
Volume	L	US gal	0.2642
	L	US qt	1.057
	m^3	yd^3	1.308
Mass	kg	lb	2.205
Force	N	kgf	0.10197
	N	lbf	0.2248
Torque	N.m	kgf.m	0.10197
	N.m	lbf.ft	0.7375

Quantity	To convert from (SI)	Into (Others)	Multiply by
Pressure	MPa	kgf/cm^2	10.197
	MPa	psi	145.0
Power	kW	CV-PS	1.360
	kW	HP	1.341
Temperature	°C	°F	°C x 1.8 + 32
Velocity	km/h	mph	0.6214
	min^{-1}	rpm	1.0
Flow rate	L/min	US gpm	0.2642
	mL/rev	cc/rev	1.0

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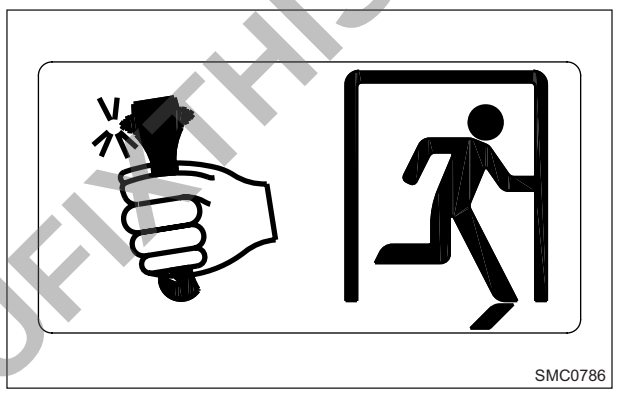
16 - DEF/AdBlue® decal

Only fill the DEF/AdBlue® tank with approved DEF/Ad-Blue® solution. Do not fill with diesel fuel or water.



17 - Emergency exit decal

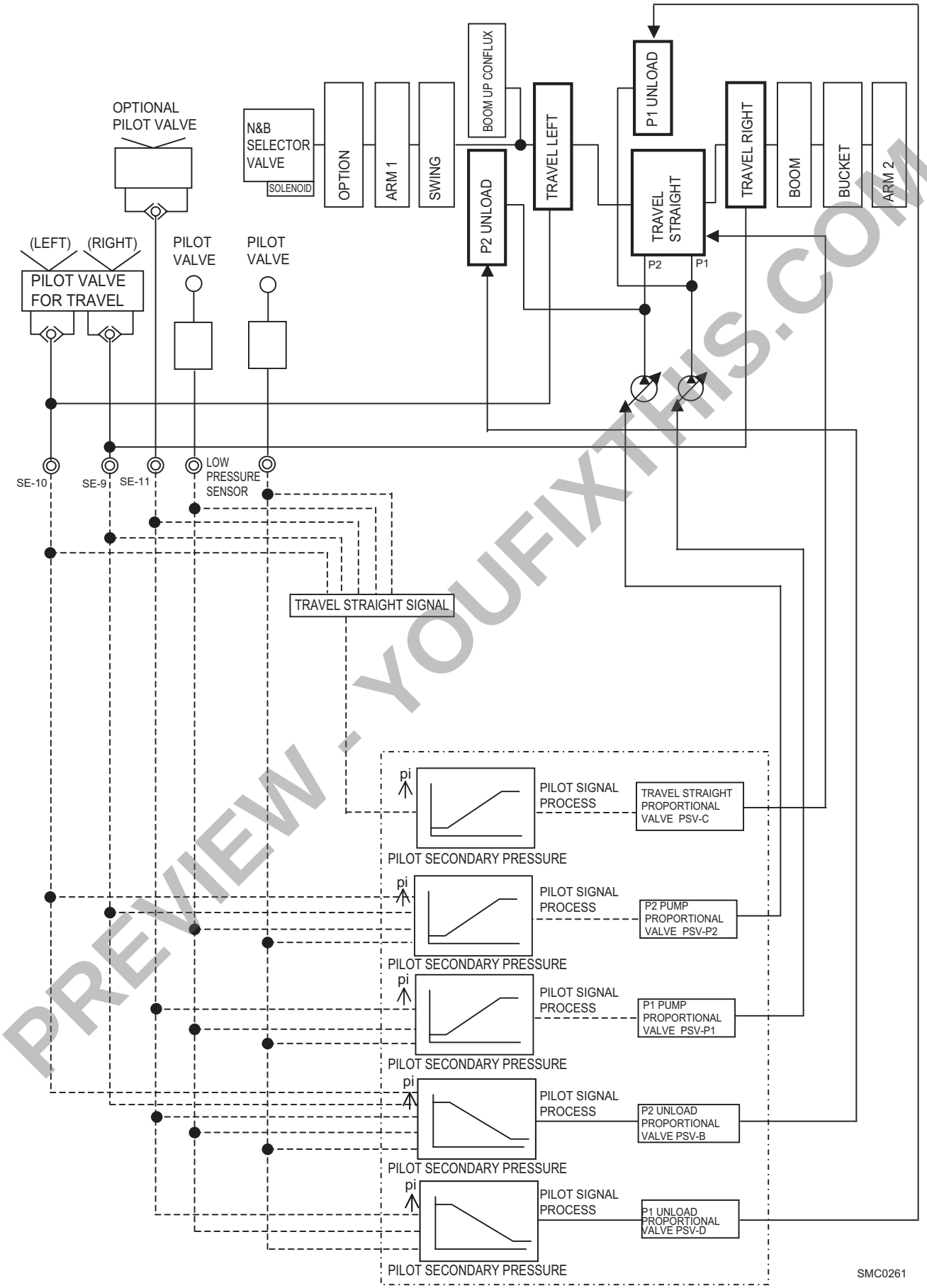
It indicates the alternative opening in case of accident. Break the rear window glass by using the hammer located on the left rear side of the cab.



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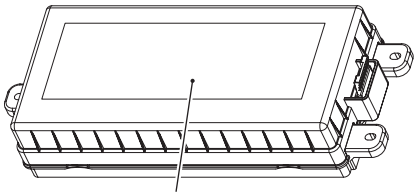
2.11 TRAVEL STRAIGHT CONTROL



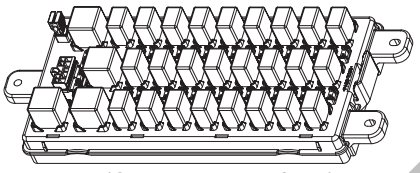
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3. Relay & fuse box (symbol E-1)
   1) General view

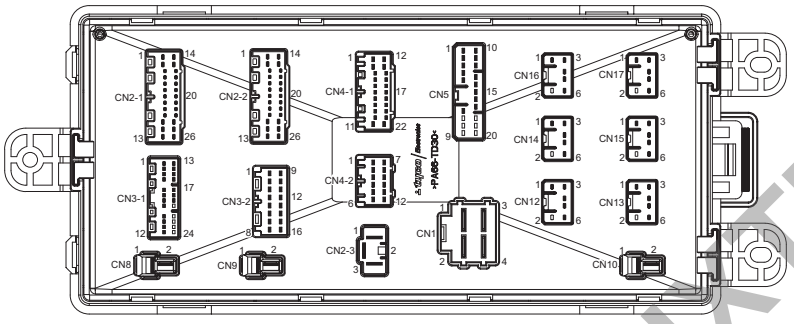


LABEL

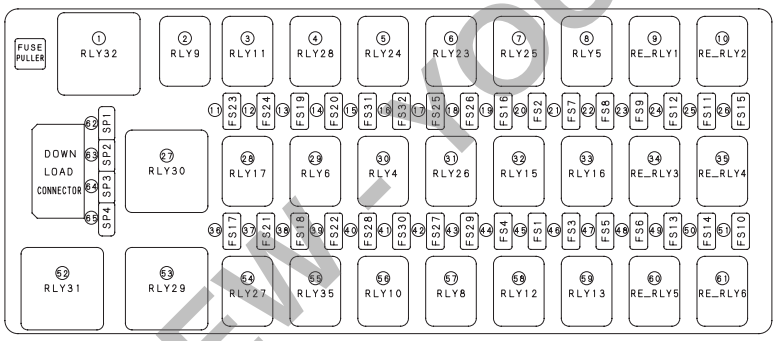


(Overhead view of box)

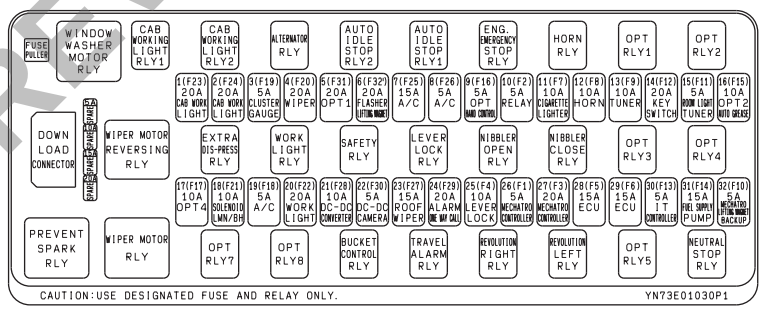
INSIDE



LOCATION OF CONNECTORS (Seen from backside)



LOCATION OF RELAY & FUSE



LABEL OF RELAY & FUSE BOX

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

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

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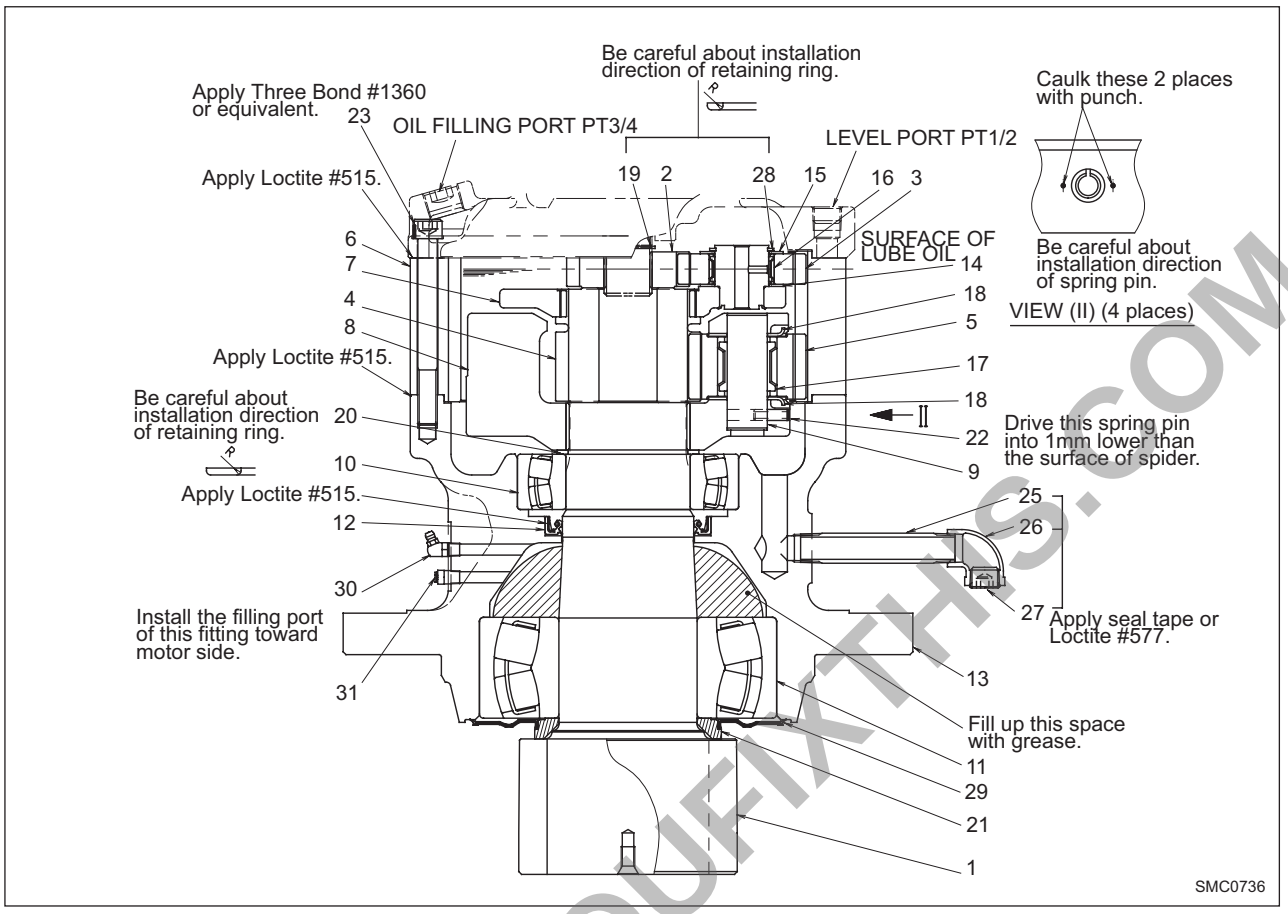
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4. Operation in the area where the tilting angle of the lever is large. (varies with the model)
   If the lever is inclined beyond a certain angle on certain models, the top end of the spool contacts the bottom of the bore of the push rod. This keeps the output pressure connected with the P port pressure.
   Furthermore, on a model in which a spring seat and a spring are built in the push rod, the bottom of the bore of the push rod contacts the spring if the lever is turned beyond a certain angle.
   This causes the secondary pressure gradient to change by the spring action. Thereafter, the bottom of the bore of the push rod contacts the top end of the spring seat, keeping the output pressure connected with the P port.

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Swing reduction unit

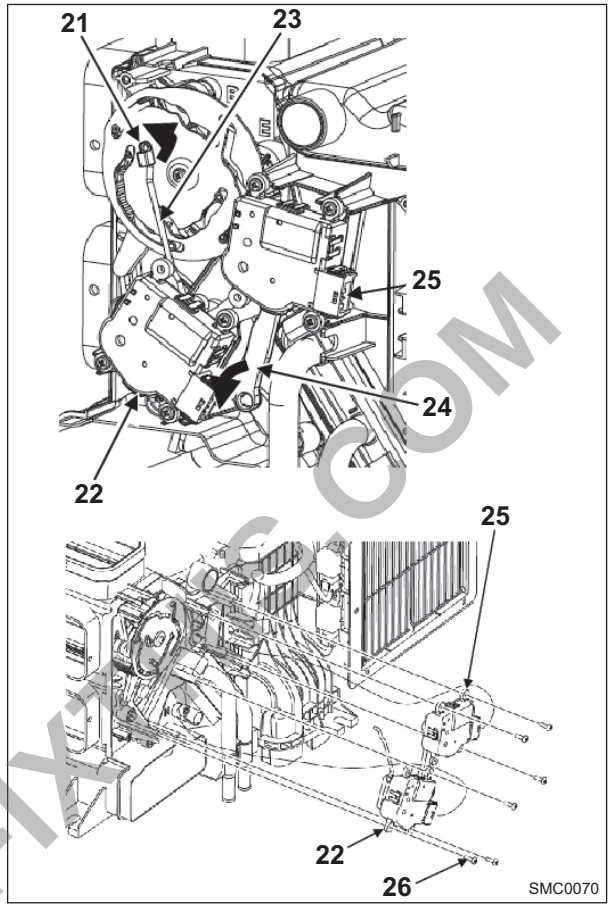


No.	Parts	Q.ty	Tightening torque Nm (lbf•ft)	No.	Parts	Q.ty	Tightening torque Nm (lbf•ft)
1	Pinion shaft	1		17	Needle bearing	4	
2	#1 sungear	1		18	Washer	8	
3	#1 pinion	3		19	Retaining ring	1	
4	#2 sungear	1		20	Retaining ring	1	
5	#2 pinion	4		21	Sleeve	1	
6	Ring gear	1		22	Spring pin	4	
7	Spider assy	1		23	Capscrew; M14X130	11	181 (134)
8	Spider	1					
9	Shaft	4		25	Tube L=130	1	
10	Spherical bearing	1		26	Elbow	1	
11	Spherical bearing	1		27	Plug	1	69.1 (51)
12	Oil seal	1		28	Retaining ring	3	
13	Housing	1		29	Oil seal	1	
14	Thrust washer	3		30	Grease fitting	1	
15	Thrust washer	3		31	Relief fitting	1	
16	Needle bearing	3					

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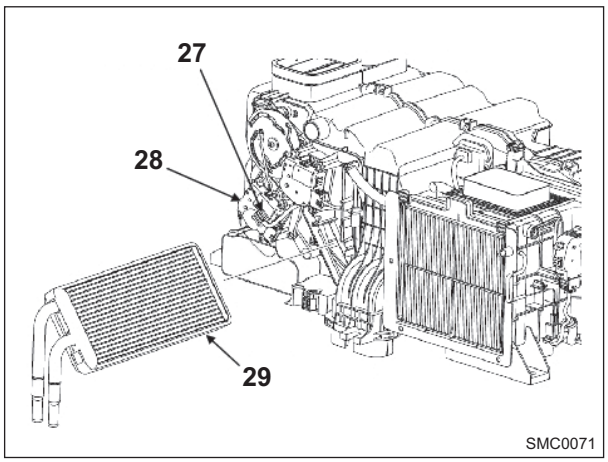
7. Disassembly and assembly of mode actuator and air mix actuator
   1) Remove link cover (**20**). (See figure SMC0069).
   2) Disconnect connector from 2 actuators.
   3) Turn rod latch (**21**) of mode actuator (**22**) in the direction of arrow as shown. And release link rod (**23**).
   4) Twist link bar (**24**) of air mix actuator (**25**) in the direction of arrow as shown. And remove the link rod from damper lever.
   5) Loosen 3 tapping screws (**26**) fixing each actuator.
   6) Remove each actuator as shown.
   7) Assemble the actuators in the reverse order of disassembly.



8. Disassembly and assembly of heater core
   1) Remove link cover (**20**). (See figure SMC0069).
   2) Disconnect connector (**27**) from air mix actuator (**28**).
   3) Remove heater core (**29**).
   4) Assemble the heater core in the reverse order of disassembly.

CAUTION

Do not exert excessive load on piping.



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OPERATIONAL PERFORMANCE TEST



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Table 17

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

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

Table 18

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

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

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Table 98

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

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

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Trouble	Factors	Fuel system				Intake and exhaust system				Lubrication system				Cooling system	
		Failure of injector	Failure of supply pump	Improper fuel injection time	Fuel leak into the head cover	Turbocharger oil drain tube clogged	Seal of turbocharger worn, damaged	Seizing and interference of turbocharger	Damage of EGR cooler	Failure oil pump	Failure of relief valve	Failure of regulation valve	Leak and crush of hydraulic piping	Damage of water pump	Failure of thermostat (Not open)
Faulty starting	Poor starting ability (Takes a long time)	○	○												
	Faulty engine starting/engine does not rotate														
	Faulty engine starting/engine rotates but no exhaust gas (No fuel injection)														
	Faulty engine starting/exhaust gas is emitted but engine does not start (With fuel injection)	○	○												
Insufficient rotation	Engine poor run-up (Low follow-up ability)	○	○						○						
	Rotation in bad condition (hunting)														
Poor output	Engine stalled during operation		○												
	Output is lowered	○	○	○					○						
	Overheating			○										○	○
Other failures	Exhaust smoke is black	○	○						○						
	Exhaust smoke is white	○		○		○	○			○					
	Lager oil consumption (or blue exhaust gas)					○	○						○		
	Early contamination of oil				○	○	○				○				
	Larger fuel consumption	○		○	○										
	Intruding of oil in coolant, back flow, reduction of coolant quantity						○		○						
	Hydraulic pressure down (Monitor lights up)									○	○	○	○		
	Oil quantity increased (Intruding of water and fuel)	○	○		○										
	Vibration	○													

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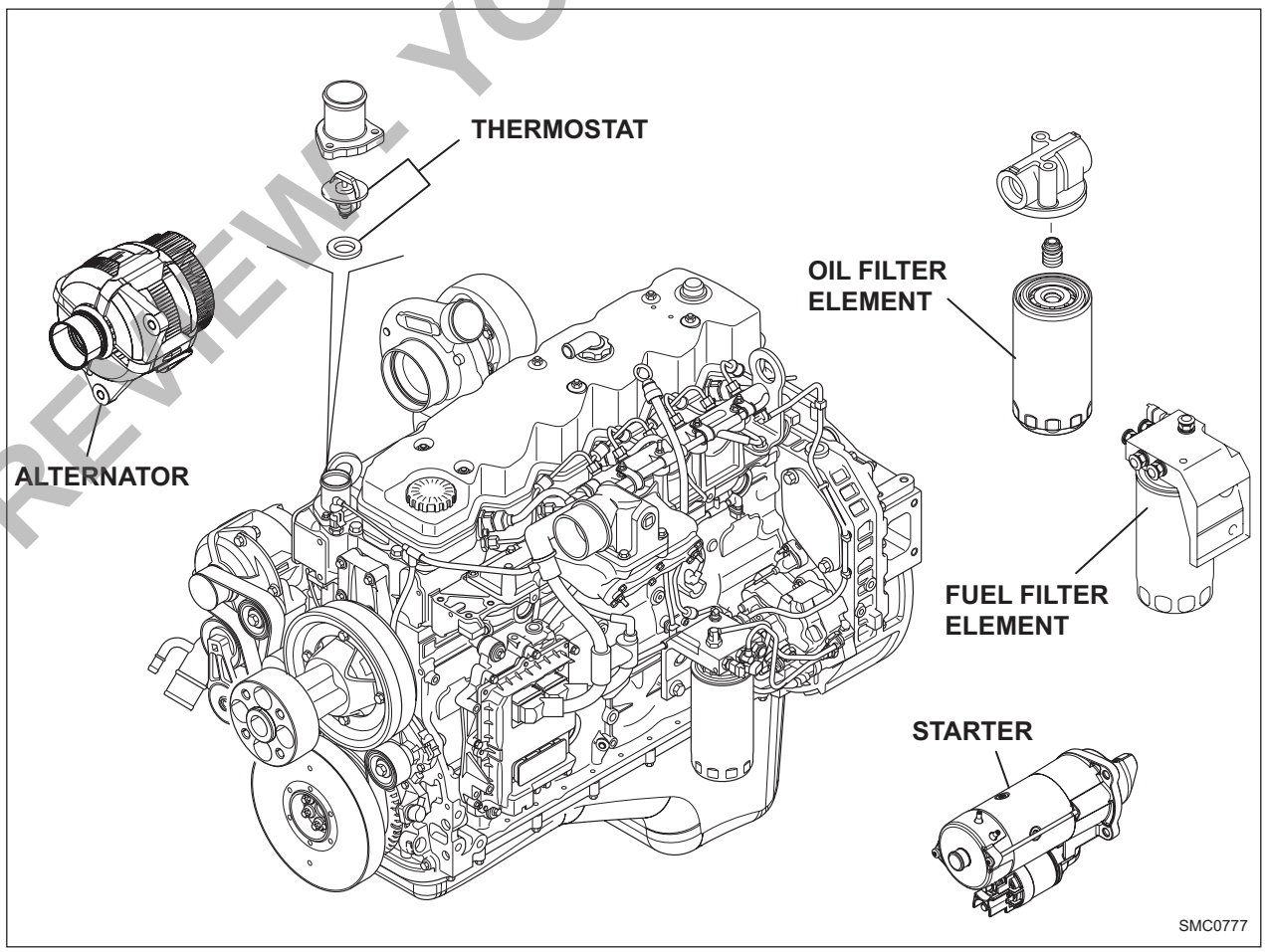
REMOVAL AND INSTALLATION OF ENGINE

Preparation for removing

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

     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

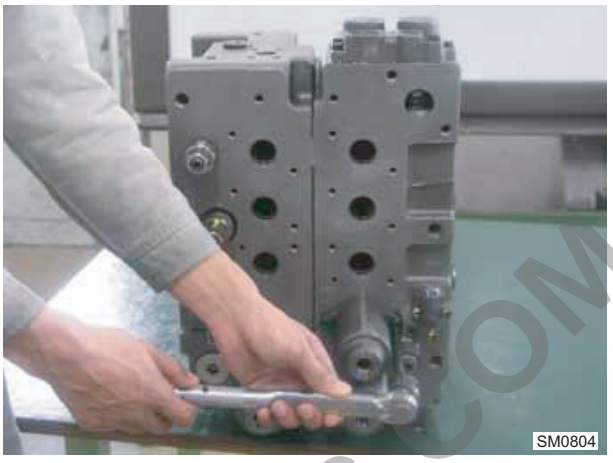
NOTE: *prepare a stand, which withstands the weight of the engine assy and can place the removed engine firmly.*



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7. Disassembling arm 1 spool

7.1 Loosen socket bolts (**273**), and remove spring cover (**201**) and O-ring (**261**) of arm 1 spool.


SM0804

7.2 Draw out the assembly which is consist of arm 1 spool (**302**), spring seat (**331**), spring (**321**, **322**), stopper (**336**) and bolt (**333**) from casing A (**101**).

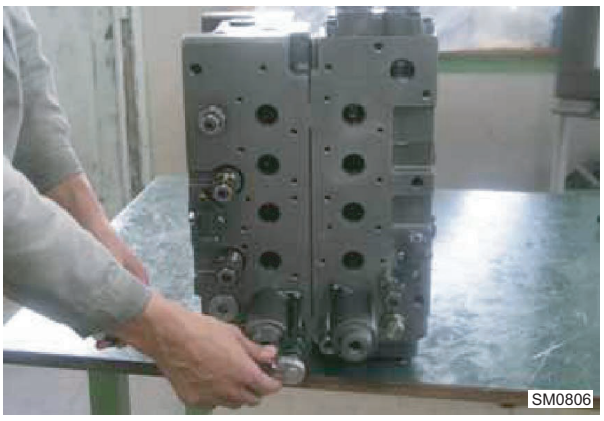
ATTENTION: *when drawing out the spool assy, use care so as not to score casing A (**101**).*

7.3 Fix the arm 1 spool assy with vise via a protective plate (aluminum plate etc.) and remove bolt (**333**). Then remove spring seat (**331**), spring (**321**, **322**) and stopper (**336**) from arm 1 spool (**302**).


SM0805

8. Disassembling arm 2 spool

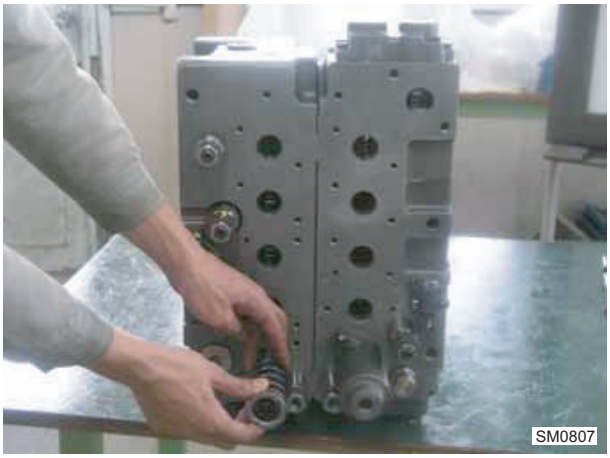
8.1 Loosen socket bolts (**273**), and remove spring cover (**201**) and O-ring (**261**) of arm 2 spool.


SM0806

8.2 Draw out the assembly which is consist of arm 2 spool (**308**), spring seat (**331**), spring (**321**, **328**), stopper (**340**) and bolt (**333**) from casing B (**102**).

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

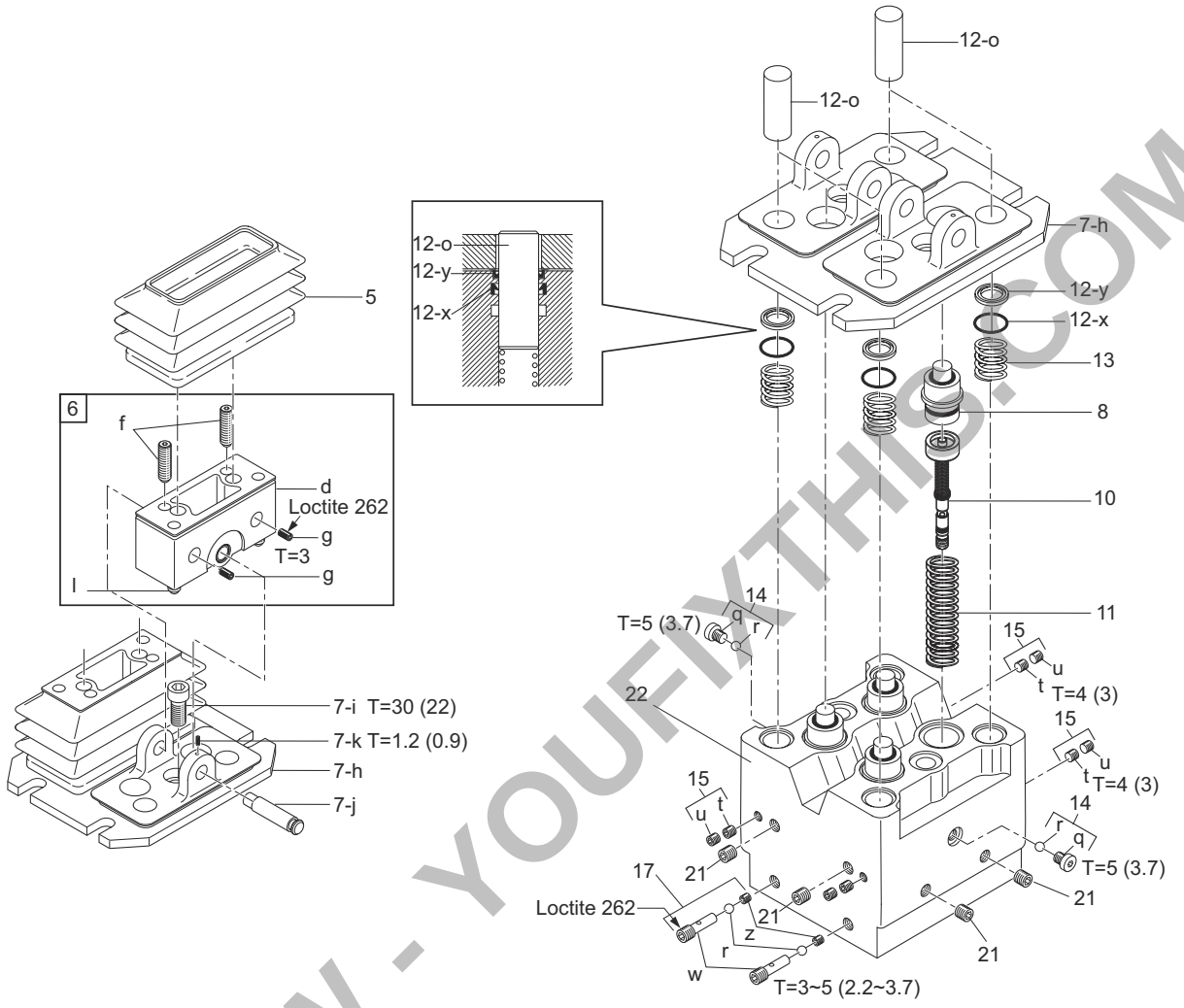
8.3 Fix the arm 2 spool assy with vise via a protective plate (aluminum plate etc.) and remove bolt (**333**). Then remove spring seat (**331**), spring (**321**, **328**) and stopper (**340**) from arm 2 spool (**308**). Do not disassemble arm 2 spool (**308**) further unless there is special reason.


SM0807

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PILOT VALVE (FOR TRAVEL)

CONSTRUCTION



SM0755

NOTE: T=tightening torque Nm (lbf·ft)

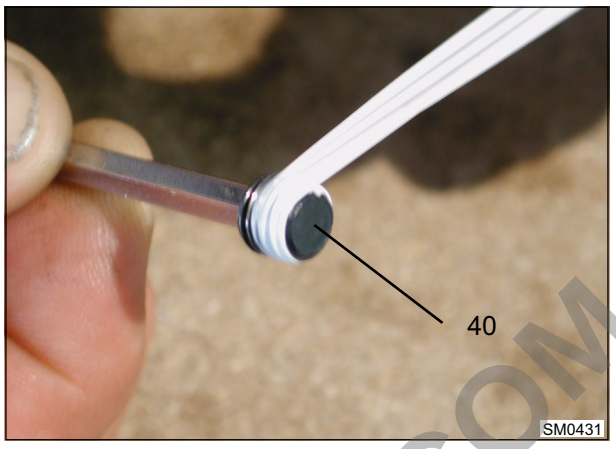
No.	Parts	Q.ty
5	Rubber boots	2
6	Foot pedal (Switch plate)	(2)
6-d	Switch plate	2
6-f	Regulation screw M8×28	4
6-g	Set screw M5x8	4
6-l	Damping screw	4
7	Retaining plate kit	(1)
7-h	Plate	1
7-i	Capscrew M10×20	2
7-j	Shaft	2
7-k	Set screw M4×10	2
8	Flange kit	4
10	Control spool	4
11	Return spring	4
12	Damper flange kit	(4)
12-o	Damper plunger ø14	4

No.	Parts	Q.ty
12-x	Seal ø14×20×3	6
12-y	Wiper ring	6
13	Damper spring	4
14	Check valve kit	(2)
14-q	Plug M8	2
14-r	Ball M6, 35	2
15	Orifice	(4)
15-u	Plug M6	4
15-t	Orifice M6, ø0.6	4
17	Shuttle valve kit	(2)
17-w'	Shuttle valve & orifice	2
17-r	Ball M6, 35	2
17-z	Orifice M5, ø0.8	2
21	Plug	4
22	Valve body	1

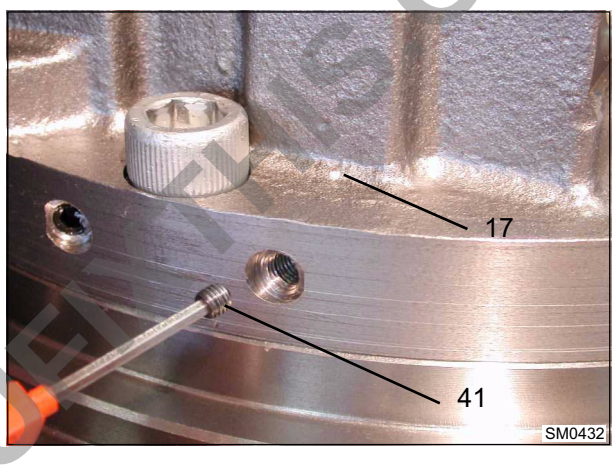
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32. Seal the thread of the orifices and the plugs (**40**) by "Teflon" tape.

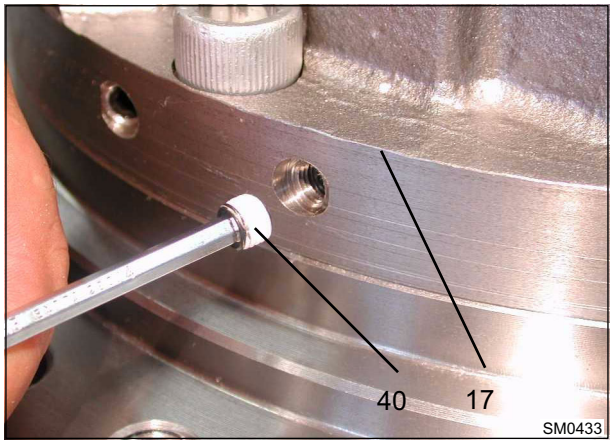
NOTE - *Be sure that the tape is correctly winded around the plugs (**40**).*



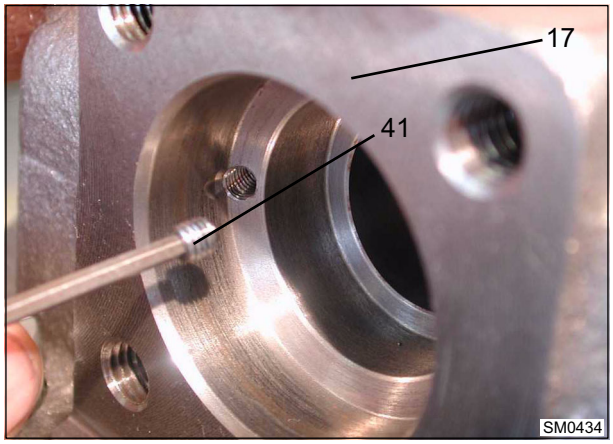
33. Insert the nos. 4 orifices M5 (**41**) in the base plate (**17**) and tighten by a torque wrench at 2.5 ±0.5 Nm torque.
: 2.5 ±0.5 Nm (1.85 ± 0.35 lbf·ft)



34. Insert the plugs (**40**) in the base plate (**17**) and tighten by a torque wrench at 10 ±1 Nm torque.
: 10 ±1 Nm (7.35 ± 0.7 lbf·ft)



35. Tighten the nos. 2 orifices M5 (**41**) in the base plate (**17**) by a torque wrench at 2.5 ±0.5 Nm torque.
: 2.5 ±0.5 Nm (1.85 ± 0.35 lbf·ft)

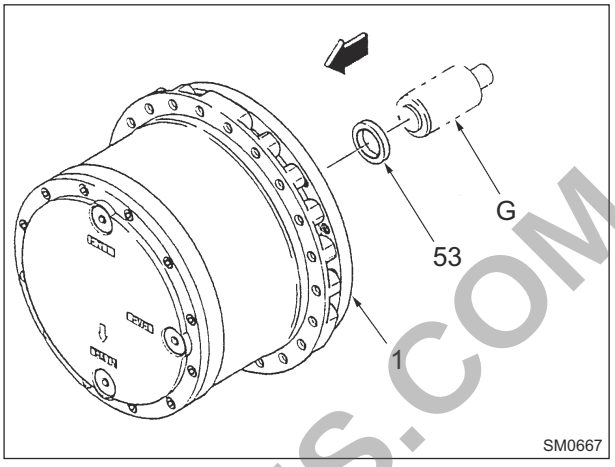


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MOTOR

Fitting oil seal

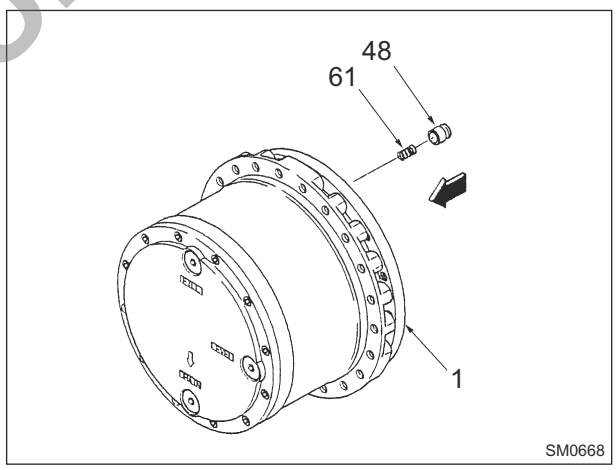
1. Make sure that flange (**1**) is equipped with oil seal (**53**). If not, press oil seal (**53**) into flange (**1**), using the oil seal fixing jig (**G**).



ATTENTION: *before attaching oil seal (**53**), apply grease to the bore surface of flange (**1**) (where the oil seal is placed) and outer diameter surface of oil seal (**53**).*
- *Coat the lip of the bore of oil seal (**53**) with grease and put it in.*
- *Push the oil seal upright. If it is tilted, the outer diameter of oil seal (**53**) will be scored.*
- *Be careful so as not to score the lip of the bore of oil seal (**53**) when fixing it. If the lip is scored, oil leakage may occur and break the inside of the reduction gear while the motor is running.*

Assembling piston 3

1. Place spring (**61**) in the hole where piston assy (**48**) of flange (**1**) is located.
2. Then, mount piston assy (**48**) to flange (**1**).

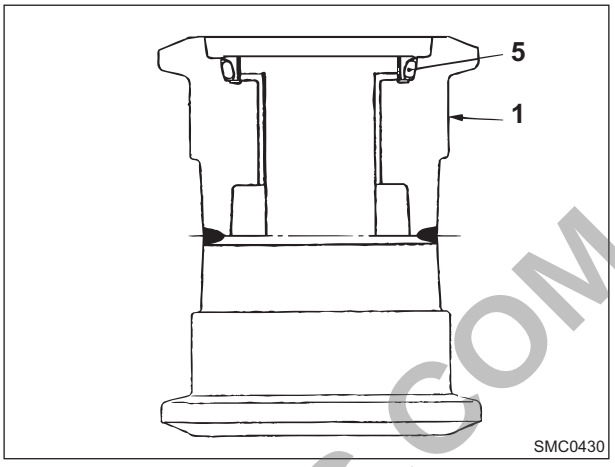


ATTENTION: *place spring (**61**) in the center of the hole.*
*Install piston assy (**48**) with its cylindrical part facing downward.*
*Before assembling piston assy (**48**), apply hydraulic oil to the bore of flange (**1**) and the outer surface of the cylindrical part of piston assy (**48**).*
*After assembling piston assy (**48**), confirm that it moves smoothly.*

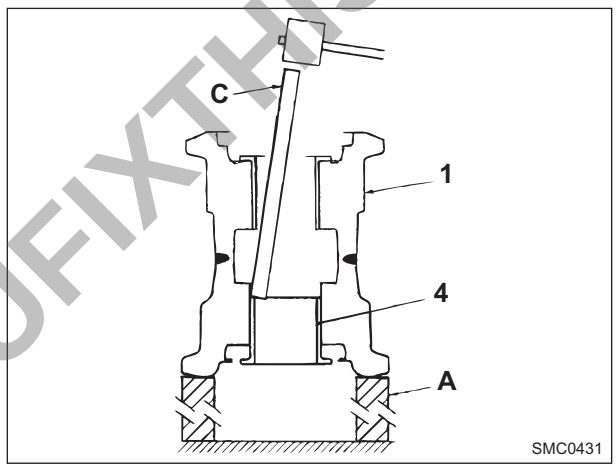
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7. Remove floating seal (**5**) from roller (**1**).



8. Removing bushing (**4**).
   Since thickness of bushing (**4**) is thin [thickness is 2.0 mm (0.079 in)], remove it through lathe or strip it with care, in order not to damage inner hole of roller. When the wear of bushing is not large, place upper roller (**1**) on jig (**A**) for repair stand and apply the end of push-out jig (**C**) on the end face of bushing (**4**), and push it out striking it with mallet.



CAUTION: *hammer the inside surface of roller lightly so as not to damage the surface. Put the extrusion jig (**C**) uniformly over the circumference of bushing (**4**) and extrude it perpendicularly little by little.*

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