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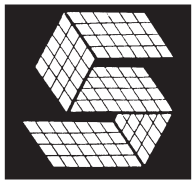
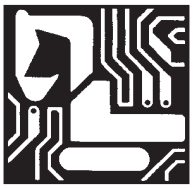
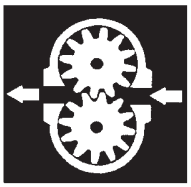
SAFETY PRECAUTIONS



OPERATIONAL PRINCIPLE





OPERATIONAL PERFORMANCE TEST

TROUBLESHOOTING

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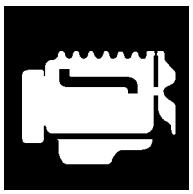


Section 5 ENGINE

RECOGNISE SAFETY INFORMATION

- This is your **SAFETY ALERT SYMBOL**

  - When you see this symbol on your machine or in this Manual, be alert of the potential for personal injury.
  - Follow recommended precautions and safe operating practices.

UNDERSTAND SIGNAL WORDS

- In this Manual you will find the following words referring to different hazard risks:

- DANGER;

- WARNING;

- CAUTION.

These words are always accompanied by the safety alert symbol.

DANGER: indicates an imminent hazardous situation which, if not avoided, will result in death or serious injury.

WARNING: indicated a potential hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION: indicates a potential hazardous situation which, if not avoided, may result in minor or moderate injury.

IMPORTANT: indicates a situation which, if not avoided, may cause damage to the machine.

NOTE: indicates an additional explanation for information purposes.

DANGER

WARNING

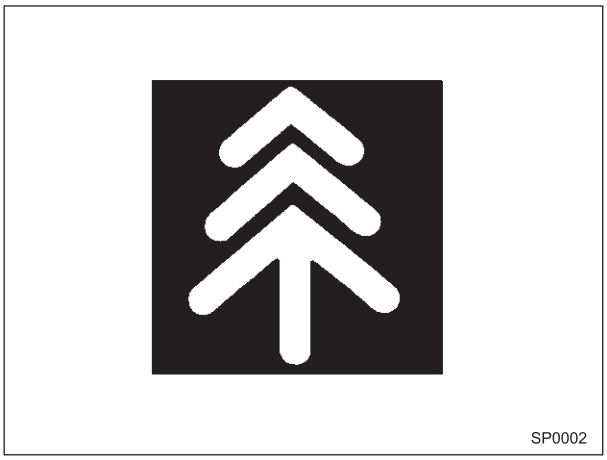
CAUTION

IMPORTANT

NOTE

ENVIRONMENTAL PROTECTION

- This Manual also contains this symbol accompanying instructions for correct behaviour as regards environmental protection.



HYDRAULIC COMPONENTS

HYDRAULIC PUMP

Item			Main pump	Gear pump for pilot
Pump			K5V140DTP1KLR-YTOK-HV	ZX10LGRZ2-07G
Type			Variable displacement plunger pump: regulator attached type	Fixed displacement type gear pump
Max. displacement capacity		cm^3	140 x 2	10
Revolution	Rated	rpm (Clockwise seen from shaft end)	2100	←
Pressure	Rated	MPa (psi)	34.3 (4980)	5.0 (725)
	ATT boost		37.8 (5480)	
Max. flow		L/min (gal/min)	294 (78) x 2 at 7.8 MPa (1130 psi)	21 (5.5)
Max. input Power (at 2000 rpm)		kW (PS)	195 (265)	3.4 (4.6)
Max. input torque (at 1200 rpm)		N m (lbf·ft)	886 (653)	14.7 (10.8)
Regulator		Model	KR3S-YTOK-HV	
		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 (lbs)	143 (315)	

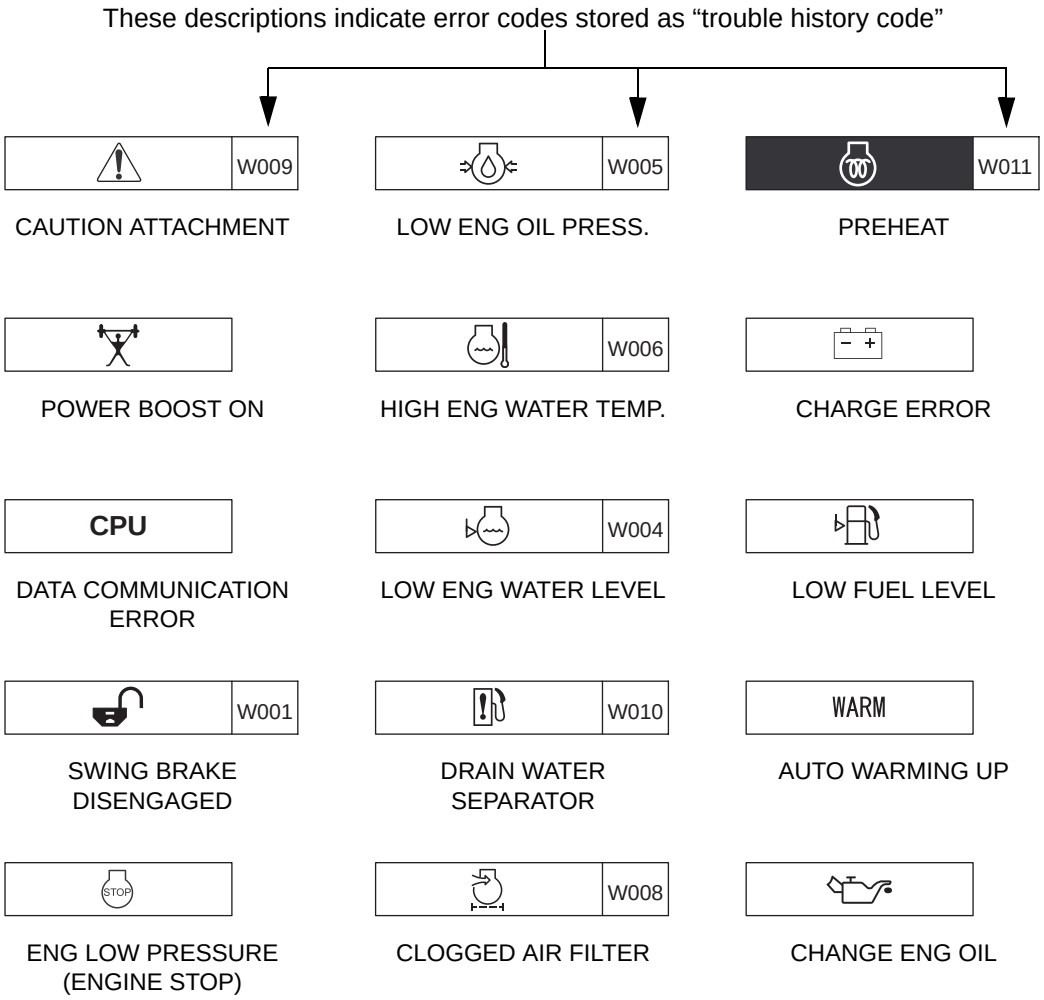
NOTE: *The max. input power and the max. input torque of the main pump include those of the gear pump.*

CONTROL VALVE

Item		STD VALVE
Model		KMX15YD / B44071
Max. flow rate	L/min (gal/min)	294 (78) x 2
Main relief valve set pressure	MPa	34.3 (4970) at 135 x 2 L/min (35.7x2 gal/min)
When power boost pressure		37.8 (5480) at 125 x 2 L/min (33x2 gal/min)
Over load relief valve set pressure	MPa	
Boom H, Bucket H, Arm R	(psi)	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 (lbs)	235 (518)

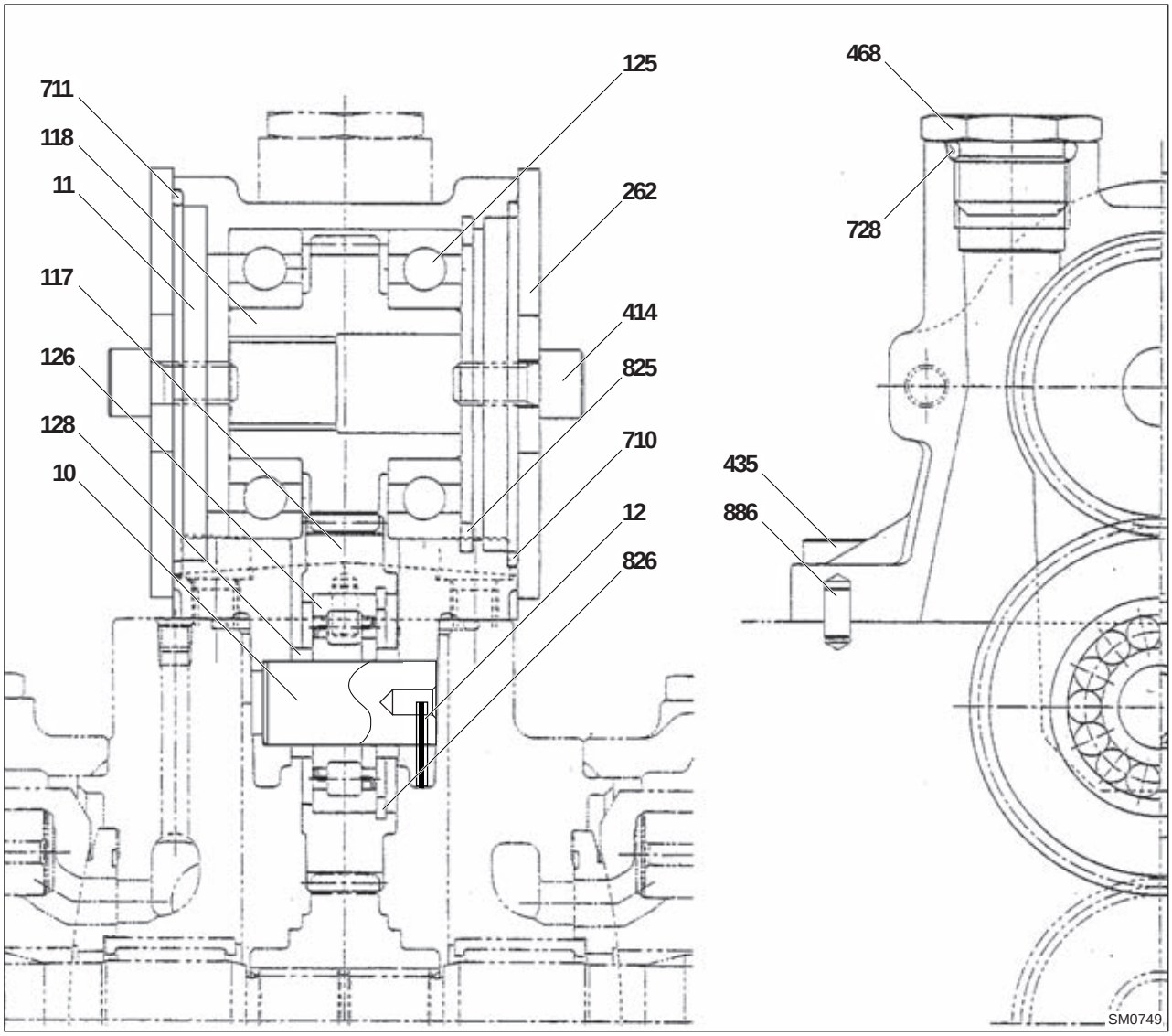
Item		OPT VALVE
Model		KADV22Y / 501103A
Over load relief valve set pressure	MPa	
Positioner R	(psi)	39.7 (5760) at 30 L/min (8 gal/min)
Positioner H		37.7 (5480) at 30 L/min (8 gal/min)
Mass	kg (lbs)	11 (24.2)

- Warning table



NOTE: *Error codes were stored as trouble history, and displayed on the monitor by the trouble history display function.*

PTO GEAR CASE

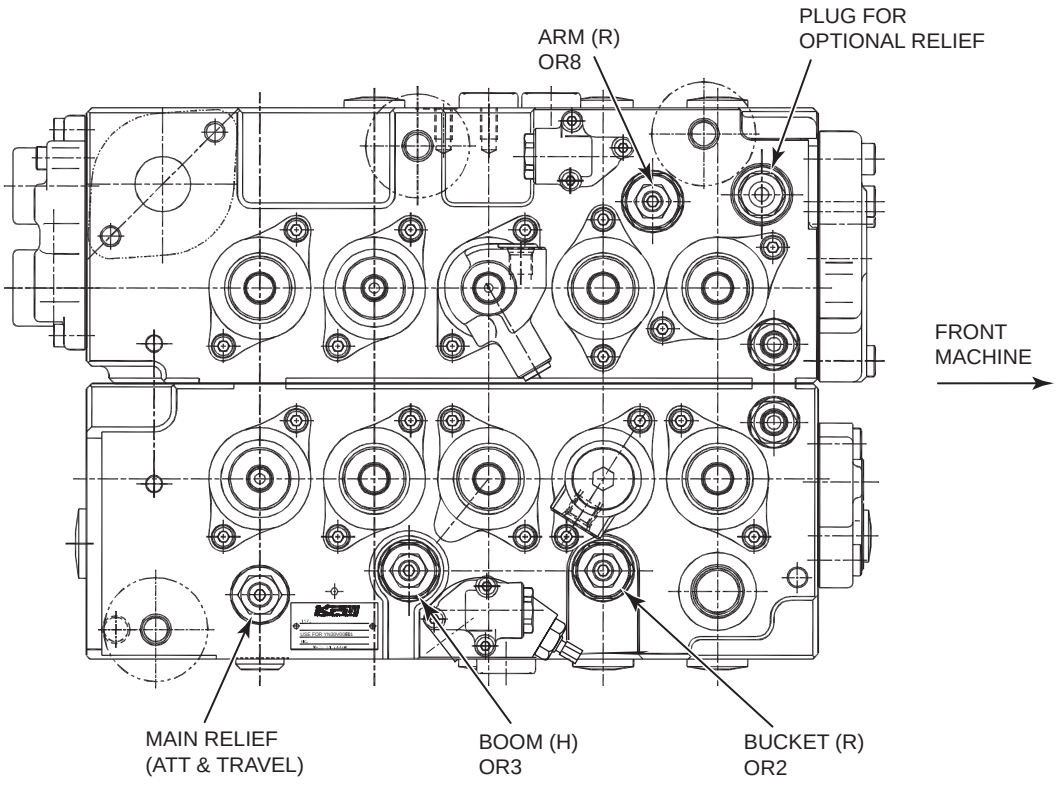


10 - Idle shaft
11 - Gear case
12 - Pin
117 - 2nd gear
118 - 3rd gear
125 - Ball bearing (Q.ty 2)
126 - Roller bearing
128 - Bearing spacer (Q.ty 2)
262 - Cover (Q.ty 2)
414 - Socket bolt; M10x20 (Q.ty 4) 33 Nm (24.3 lbf·ft)
435 - Flange socket; M10×20 (Q.ty 4) 33 Nm (24.3 lbf·ft)
468 - Vp plug: G3/4 74 Nm (54.6 lbf·ft)
710 - O-Ring
711 - O-Ring
728 - O-Ring
825 - Snap ring
826 - Snap ring
886 - Pin (Q.ty 2)

Pressure adjustment position

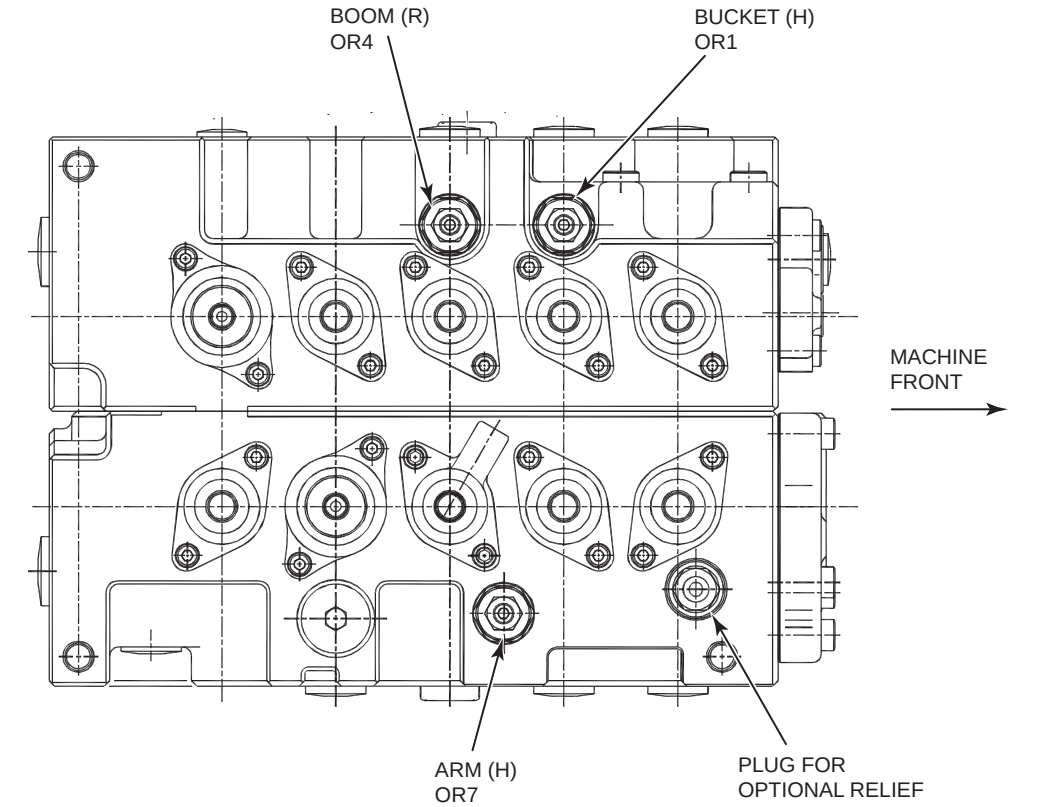
MAIN CONTROL VALVE

Relief valve position on main control valve.



View from the top of the machine

SM0854



View from the bottom of the machine

SM0855

Table 70

Error code	**F021**		
Trouble	Swing parking solenoid valve and output transistor OFF are failure, and grounding is short-circuit.		
Judging condition	The feed-back signal is grounding level while exciting command is output.		
Symptom	Swing parking is not available.		
Control in the event of failure	Normal control.		
Returned in normal condition	The feed-back signal is 24 V level while exciting command is output.		
Service diagnosis checking screen	Screen No.	3	F-2 SWING-BRAKE
	Screen No.		
	Screen No.		
Checking object			Checking contents and remedy
1	• Swing parking solenoid valve SV-1		When F021 is cancelled and other error occurs by exchanging the connector for other solenoid valve. Check solenoid valve unit for possible failure. If failure found, replace it. Check solenoid valve unit for possible failure. If failure found, replace it.
2	• Wiring between swing parking solenoid valve and controller CN-123F CN-105F		When F021 is displayed after the connector is exchanged with other solenoid valve. 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 71

Error code	**F023**		
Trouble	Swing parking solenoid valve and output transistor ON are failure, and disconnection.		
Judging condition	The feed-back signal is 24 V level while exciting command is not output.		
Symptom	Swing parking is not available or is leaving available.		
Control in the event of failure	Normal control.		
Returned in normal condition	The feed-back signal is grounding level while exciting command is output.		
Service diagnosis checking screen	Screen No.	3	F-1 POWER BOOST
	Screen No.		
	Screen No.		
Checking object			Checking contents and remedy
1	• Swing parking solenoid valve SV-1		When F023 is cancelled and other error occurs by exchanging the connector for other solenoid valve. Check solenoid valve unit for possible failure. If failure found, replace it.
2	• Wiring between swing parking solenoid valve and controller CN-123F CN-105F		When F023 is displayed after the connector is exchanged with other solenoid valve. 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 2 - Failure diagnosis Mode-1/Diagnosis and Remedy

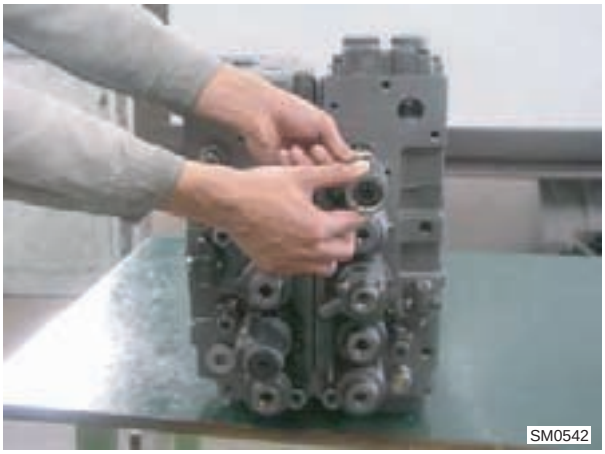
Diagnosis (Display)	Possible cause	Remedy
P2 UN-LOAD PSV NG	Secondary pressure is excessive high against the command	Check P2 unload proportional valve and replace it if necessary
	Secondary pressure is excessive low against the command	
P2 UN-LOAD SPOOL NG	Stuck at full-stroke side	Check P2 unload spool and replace it if necessary
	Stuck at neutral side	
P1 B-P CUT NG	Stuck at closing side	Check P1 by-pass cut valve and replace it if necessary
	Stuck at neutral side	
P2 B-P CUT NG	Stuck at closing side	Check P2 by-pass cut valve and replace it if necessary
	Stuck at neutral side	
P1 PUMP PSV NG	Secondary pressure is excessive high against the command	Check P1 pump proportional valve and replace it if necessary
	Secondary pressure is excessive low against the command	
P1 PUMP NG	Delivery rate is excessive large against the command	Check P1 pump regulator and replace it if necessary. Check P1 pump and replace it if necessary.
	Delivery rate is excessive small against the command	
P2 PUMP PSV NG	Secondary pressure is excessive high against the command	Check P2 pump proportional valve and replace it if necessary
	Secondary pressure is excessive low against the command	
P2 PUMP NG	Delivery rate is excessive large against the command	Check P2 pump regulator and replace it if necessary. Check P2 pump and replace it if necessary.
	Delivery rate is excessive small against the command	
S-TRAVEL PSV NG	Secondary pressure is excessive high against the command	Check travel straight proportional valve and replace it if necessary
	Secondary pressure is excessive low against the command	
S-TRAVEL SPOOL NG	Stuck at full-stroke side	Check travel straight spool and replace it if necessary
	Stuck at neutral side	
PUMP 1 PRESS. SEN-SOR NG	Pressure is recognized lower than it is	Check P1 high pressure sensor and replace it if necessary
PUMP 2 PRESS. SEN-SOR NG	Pressure is recognized lower than it is	Check P2 high pressure sensor and replace it if necessary
MAIN RELIEF NG	Set pressure decreases	Check main relief valve and replace it if necessary
	Set pressure increases	
ENGINE NG	Output is lowered	Check engine and replace it if necessary
E/G R SENSOR NG	Characteristics is misaligned	Check engine speed sensor and replace it if necessary

2. Disassembling the travel spool (left travel and right travel)

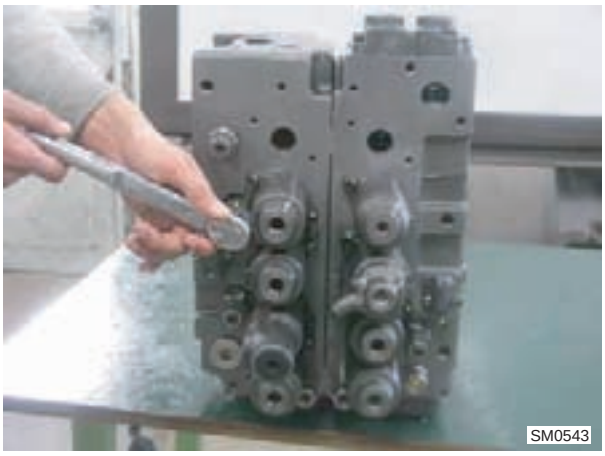
2.1 Loosen the socket bolts (**273**) and remove the spring cover (**201**) and the O-ring (**261**) for travel.

2.2 Draw out the assy of travel spool (**306**), spring seat (**331**), springs (**323**), (**324**), stopper (**336**) and bolt (**333**) from casing A (**101**) or casing B (**102**).

IMPORTANT: *when drawing out the spool assy, take care so as not to score the casing A (**101**) or the casing B (**102**).*

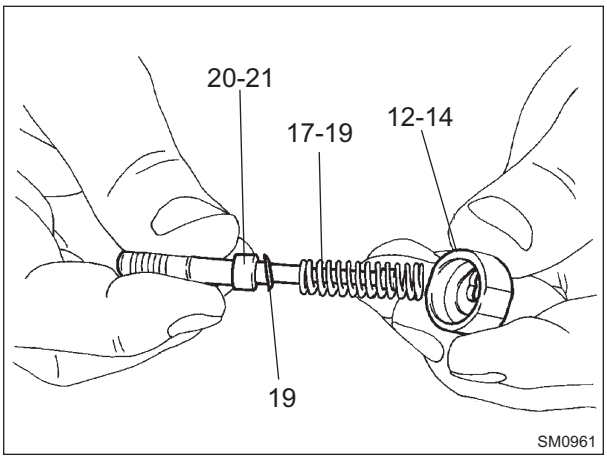


2.3 Fix the travel spool assy with vise via a protective plate (aluminum plate, etc.). Remove bolt (**333**) and separate spring seat (**331**), springs (**323**), (**324**) and stopper (**336**) from travel spool (**306**).



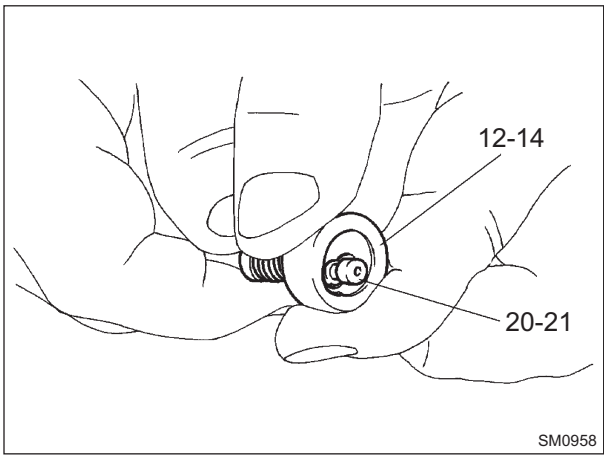
Assembly right and left pilot valve

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



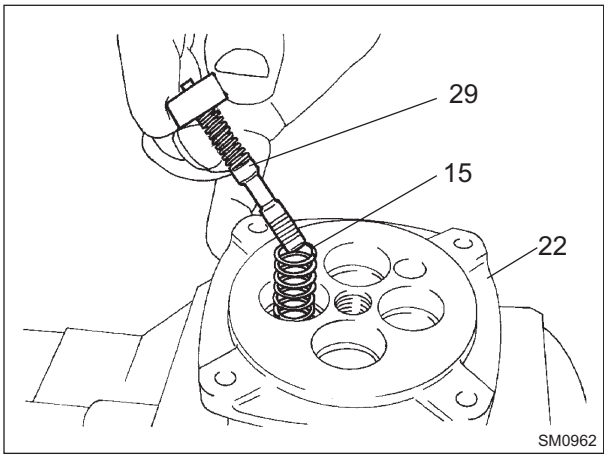
2. Push spring seat 1 (**12**) so that the movement is 7 mm or less, and install spool (**20**) through the large hole of spring seat 1.
   For spring seat 1 (**14**), push spring seat (**14**) in 9.4 mm or less and install spool (**21**).

IMPORTANT: *never push down spring seat (**12**) in 7 mm or more. (For port 1 and 3).*
*Never push down spring seat (**14**) in 9,4 mm or more. (For port 2 and 4).*



3. Place springs (**15**) into ports 1 of casing (**22**), and then install pressure reducing valve assy in it.
   Place spring (**16**) into ports 2,4 and then install pressure reducing valve assy in it.

NOTE: *install the removed respective assy into respective holes.*



Positioner cylinder assembly

1. Install bushing (**5**) to cylinder head (**7**) using a press.
   Special tools for bushing installation (**5**):
   Positioner cylinder: Ø 110 mm (XXXXXXXX)

IMPORTANT: *be sure that the rings are installed correctly.*

2. Install seal (**3**), back-up ring (**2**), elastic ring (**6**) and seal (**4**) on the cylinder front sleeve (**7**).

3. Install wiper ring (**1**) to cylinder head (**7**) using a plastic hammer (**7**).

4. Install O-Rings (**10**) and backup ring (**9**) to cylinder head (**7**).

5. Install O-Ring (**18**), backup ring (**16**) (Q.ty 2), seal ring (**17**), slide ring (**19**) (Q.ty 2), (**20**) (Q.ty 2) to piston (**15**).
   Special tools for seals assembly: (XXXXXXXX)

6. Install cylinder head (**7**) to cylinder rod (**11**).
   Special tools: (XXXXXXXX)

7. Install piston (**15**) to cylinder rod (**11**).

8. Install shim (**21**) to cylinder rod (**11**). Tighten nut (**24**) using special tool (XXXXXXXX).
   Be sure to align the machine mark on the rod with that on the nut.
   Nut Turning Special Tools (**24**):
   - 130 mm (XXXXXXXX)

   : 14300 Nm (10546 lbf·ft)

9. Align the holes on cylinder rod (**11**) and nut (**24**).
   Insert steel ball (**23**) into the hole, and tighten set screw (**22**) into the hole.
   Mushroom the head of set screw (**22**) at two places using a punch and hammer.

   : 12 mm

   : 96.6 ± 18.2 Nm (71.2 ± 13.4 lbf·ft)

IMPORTANT: *be sure to align cylinder rod (**11**) with the center of cylinder tube (**12**) when inserting, in order to avoid damaging the rings.*

10. Secure cylinder tube (**12**) horizontally using a work bench.
    Insert cylinder rod (**11**) into cylinder tube (**12**).

11. Install cylinder head (**7**) to cylinder tube (**12**).
    Tighten socket bolts (**8**).

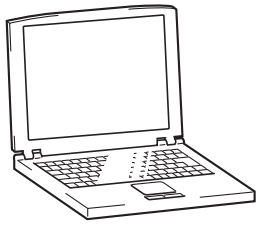
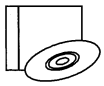
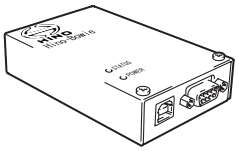
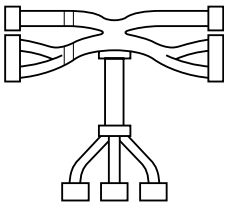
    : 17 mm

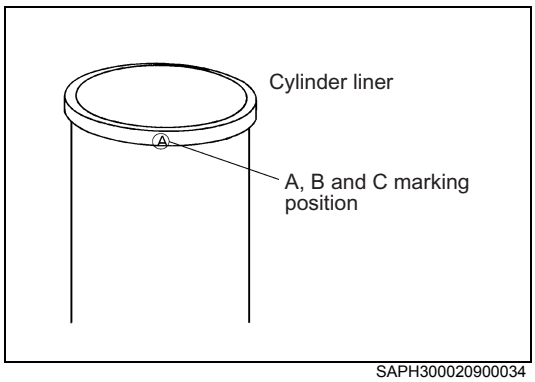
    : 711 Nm (524 lbf·ft)

Engine Failure Diagnosis

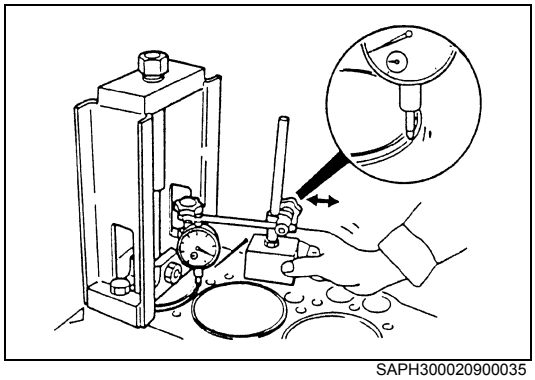
Special tool

JP30002030901013

Shape	Part No.	Name	Remark
	–	Personal computer (DOS-V)	• Operating system(OS):Windows95, Windows98(IE5.0 or later), Windows2000(SP3, IE5.0 or later), WindowsXP(SP1a, IE6.0 or later) • CPU and memory: Conditions that assure operation of the above operating system • Display: 800 x 600, 256 colors or more
		Hino-DX	Failure diagnosis software (CD-ROM)
	380100046	Hino-Bowie (Interface box)	Used together with the cable between the vehicle and Hino-Bowie 380100047
	380100048	Signal check harness	This is installed as interruption between vehicle harness and the ECU. Tester inspection is allowed in energized status.



SAPH300020900034

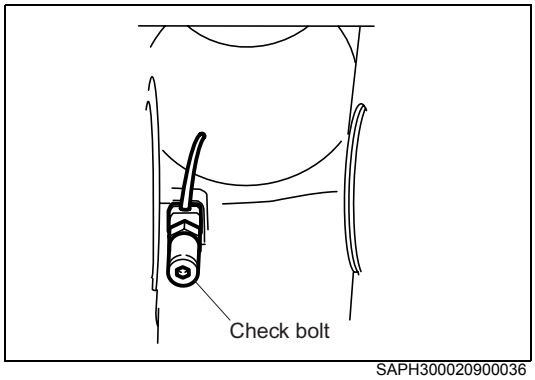

SAPH300020900035

2. Inspection of protrusion at cylinder liner flange

(1) Fix the cylinder liner using a tool.
Tightening torque : 9.8 N·m {100 kgf·cm, 7 lbf·ft}

(2) Measure protrusion of the flange using a dial gauge.
Cylinder liner puller

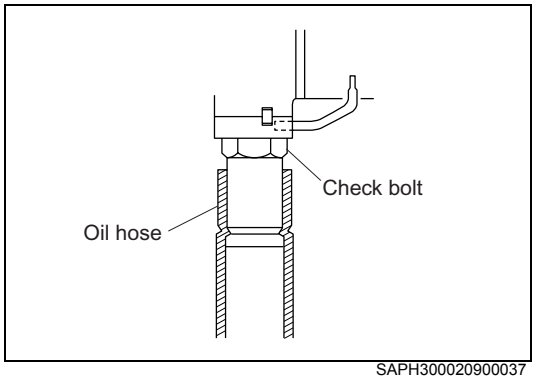
Standard value (mm{in.})	**0.01 - 0.08 {0.0004 - 0.0031}**



SAPH300020900036

3. Inspection and adjustment of cooling jet

(1) Remove the standard oil check valve and install the cooling jet on the cylinder block using a special tool.
Special tool : 380100040 Check bolt



SAPH300020900037

(2) Connect the injection test oil hose from the lower part of the cylinder block to the special tool check bolt.

⚠ **CAUTION** • **Use new engine oil for injection of oil.**

Adjustment of valve clearance

JP30002090706001

1. Precautions before adjustment

⚠ **CAUTION** • **Before adjustment, make sure that bolts of the cylinder head, rocker arm support, nozzle clamp, camshaft housing and camshaft bearing cap are tightened to the specified torque.**

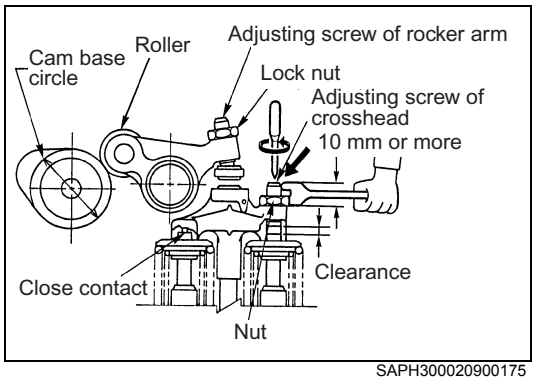
2. Adjustment of valve clearance

(1) Make sure that there is no dirt between the crosshead and the valve stem

(2) Turn the crankshaft in the forward direction and adjust the cylinder to the compression top dead center.

⚠ **CAUTION** • **Make sure that there is a roller on the cam base circle.**

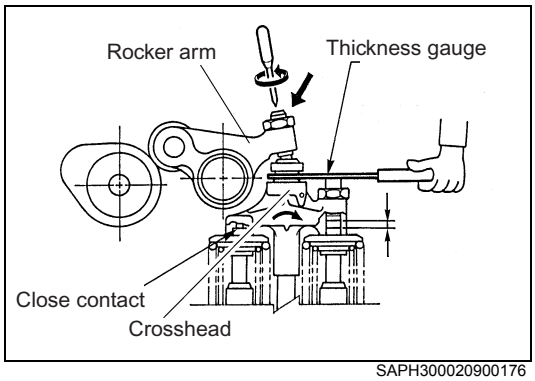
(3) Loosen the adjusting screw and the lock nut of the crosshead completely.



SAPH300020900175

⚠ **CAUTION** • **Provide the adjusting screw protrusion of 10 mm or more from the top surface of the crosshead. If the adjusting screw is not completely separated from the valve stem, correct adjustment is not allowed.**

(4) Insert a thickness gauge between the rocker arm and the crosshead and adjust the clearance with the adjusting screw of the rocker arm. Tighten the lock nut.



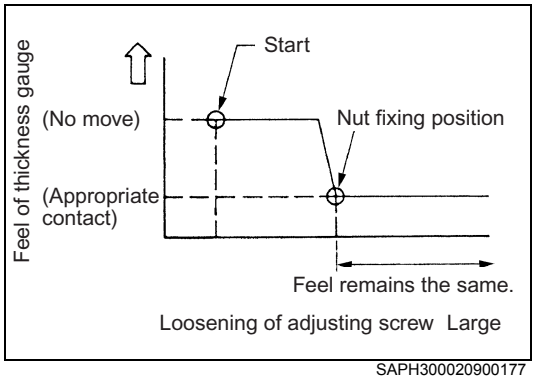
SAPH300020900176

Standard value (cold engine)	**IN**	**0.30mm{0.0118 in.}**
	EX	**0.45mm{0.0177 in.}**

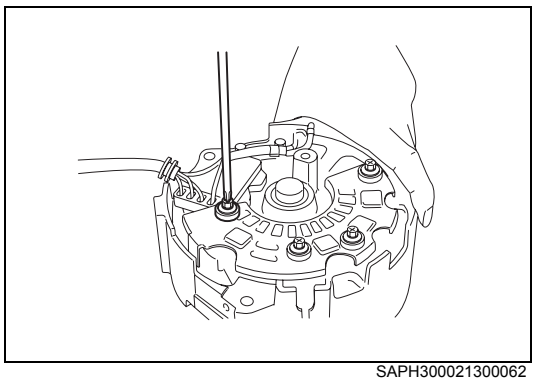
Tightening torque : 25 N·m {250 kgf·cm, 18 lbf·ft}

(5) Loosen the adjusting screw of the crosshead with the thickness gauge inserted. Make sure that feel on the thickness gauge is not lighter.

⚠ **CAUTION** • **If it becomes lighter, make adjustments again from the beginning.**

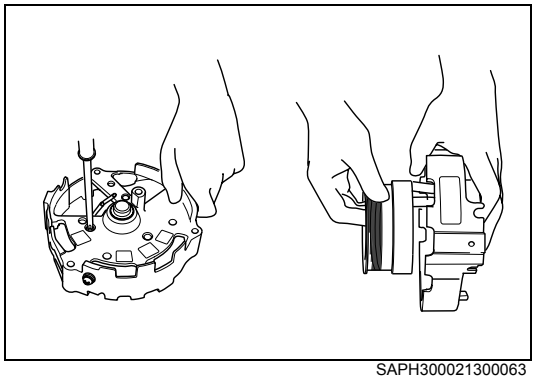


SAPH300020900177

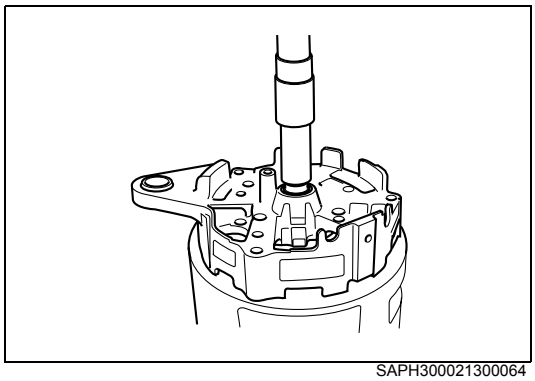

SAPH300021300062

(5) Remove five bolts using a screwdriver and remove the heat sink assembly (plus), heat sink assembly (minus) and regulator all together.

⚠ **CAUTION**
- **Screw lock is used. Since torque is high until bolt is removed, be careful not to damage the groove of the bolt head.**
- **When the rear bracket is reused, clean the screw hole.**


SAPH300021300063

(6) Remove the capacitor.
(7) Remove three bolts with a screwdriver and remove the field coil from the rear bracket.


SAPH300021300064

(8) Remove the roller bearing from the rear bracket using a press, jig A and jig B.

⚠ **CAUTION**
- **Removed bearing must not be reused.**

Inspection of components (60A)

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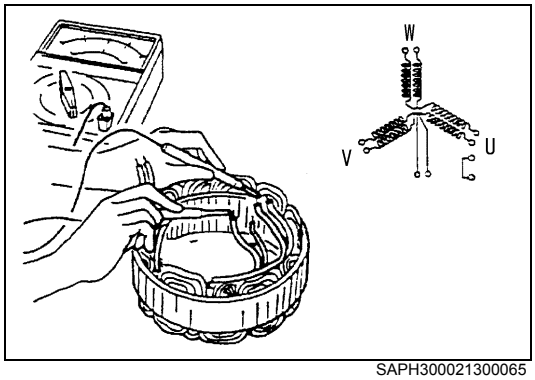

SAPH300021300065

⚠ **CAUTION**
- **Place a rubber mat and perform work on the mat.**

1. Inspection of stator coil and field coil

(1) Measure the resistance between U-V, V-W and W-U terminals of the stator coil using a circuit tester.

Standard value (Ω)	0.15 - 0.17