TO THE READER

• This manual is written for an experienced technician to provide technical information needed to maintain and repair this machine.

- Be sure to thoroughly read this manual for correct information concerning the service procedures.

- If you have any questions or comments, or if you found any errors regarding the contents of this manual, please contact:

NEW HOLLAND KOBELCO
CONSTRUCTION MACHINERY S.p.A.
Strada Settimo, 323
San Mauro Torinese (TO)
10099 ITALIA
PRODUCT SUPPORT
Fax. ++39 011 0077357

ADDITIONAL REFERENCES

• Please refer to the materials listed below in addition to this service manual:

- **Operation and Maintenance Instruction Manual**
- **Parts Catalog**

WORKSHOP MANUAL COMPOSITION

• The Workshop Manual consists of five parts:
- **“Safety Precautions”**
- **“Operational Principle”**
- **“Operational Performance Test”**
- **“Troubleshouting”**
- **“Repair Instructions”**

- The “Safety Precaution” part includes the recommended procedures that, if followed, can avoid the risk of accident for operator and for staff related to the work and maintenance machine operations.

- The “Operational Principle” part includes the technical information concerning the operation of main devices and systems.

- The “Operational Performance Test” part includes the information needed to carry out the machine operational performance test.

- The “Troubleshooting” part includes the technical information needed for troubleshooting and malfunction detection.

- The “Repair Instruction” part includes information needed for maintenance and repair of the machine, tools and devices needed for maintenance and repair, maintenance standards, removal/installation and assembly/disassembly procedures.

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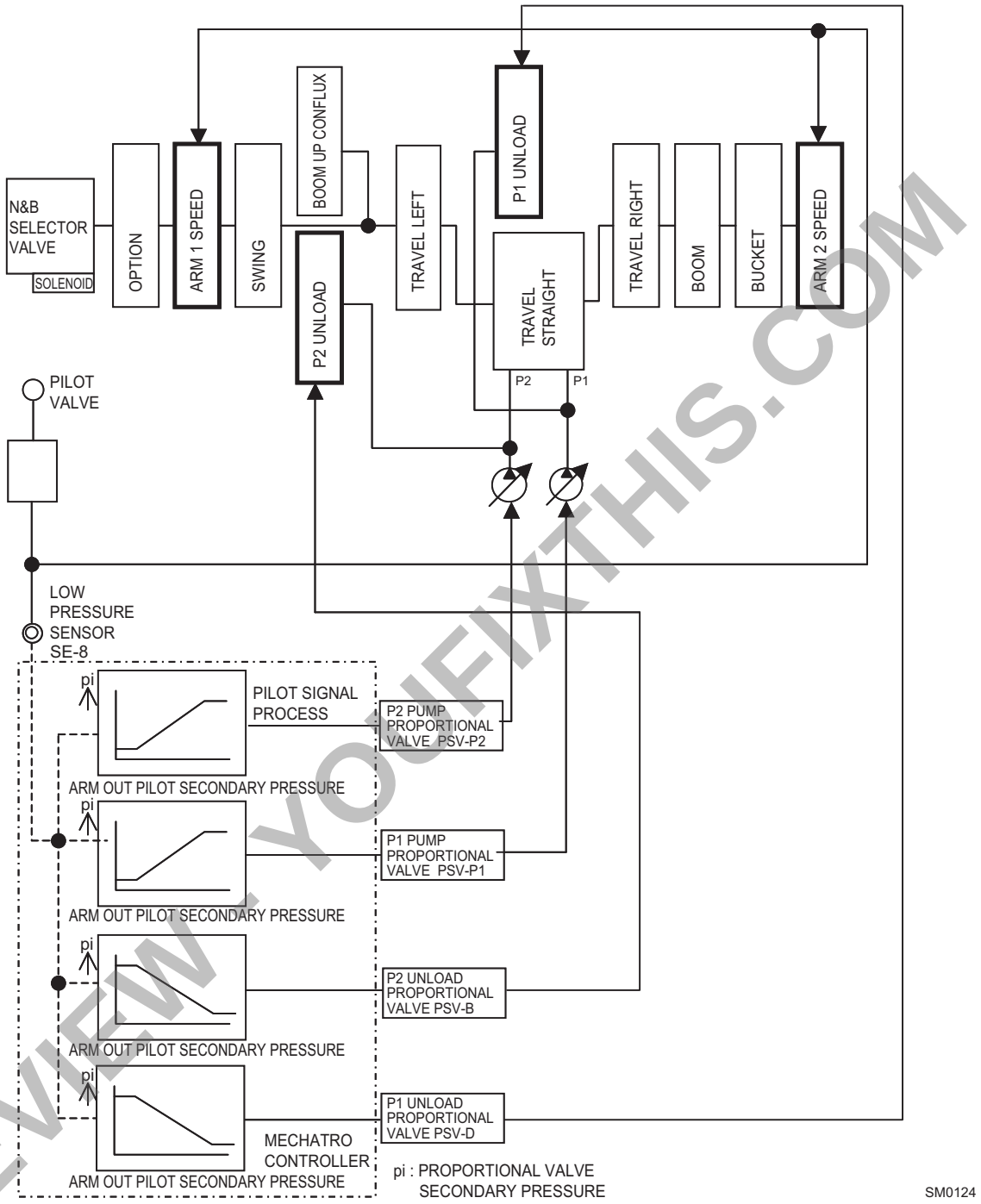
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NOTE:

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2.7 ARM-OUT CONFLUX CONTROL



1. On starting arm-out operation, arm-out operating pilot pressure switches arm 1 spool and arm 2 spool and is input to low pressure sensor.
2. The output voltage of low pressure sensor is input to mechatro controller and the mechatro controller processes pilot signal and outputs command according to the input voltage to P1 and P2 proportional valves and P1 and P2 unload proportional valves.
3. Each proportional valve outputs pilot secondary pressure according to the command output by mechatro controller and changes P1 and P2 pump delivery rate and switches P1 and P2 unload pressure control valves.
4. With original hydraulic pressure command, arm 1 spool and arm 2 spool are switched and also with the command output by mechatro controller, P1 and P2 pumps and P1 and P2 unload valves are switched, and consequently the delivery oil on P2 pump side confluxes delivery oil on P1 pump side during arm-out operation.

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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	Accelation	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	Independent translation	Input	GND / OPEN

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

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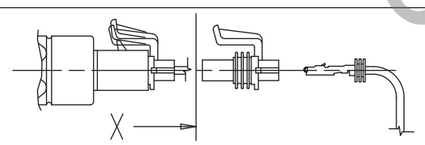
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ECU COMPLETE CABLE LEGEND

WIRE NO	NH HARNESS - CABLAGGIO			FROM	CONNECTION	TO
	WIRE COLOR	WIRE SIZE	WIRE TYPE	DA	COLLEGAMENTO	A
5A	W	0,75	1	CN-1F		CN-5RF
5B	W	0,75	1	CN-1F		CN-5RF
5C	W	0,75	1	CN-1F		CN-5RF
6A	W	0,75	1	CN-3F		CN-5RF
6B	W	0,75	1	CN-2F		CN-5RF
6C	W	0,75	1	CN-2F		CN-5RF
6D	W	0,75	1	CN-6F		CN-5RF
11	R	0,75	1	CN-21M		CN-11F
58A	W	0,75	1	CN-21M		CN-30F
58B	W	0,75	1	CN-3F		CN-30F
58C	W	0,75	1	CN-3F		CN-30F
62A	W	0,5	1	CN-2F		CN-5RF
62B	W	0,5	1	CN-2F		CN-5RF
63	W	0,5	1	CN-2F		CN-21M
304	W	0,5	1	CN-11F		CN-1F
306	L	0,75	3	CN-7F		CN-2F
307	R	0,75	3	CN-7F		CN-2F
SH7	B	0,75	3	CN-7F		CN-2F
308	W	0,5	1	CN-6F		CN-4F
309	W	0,5	1	CN-4F		CN-6F
310	W	0,5	1	CN-4F		CN-6F
311	W	0,5	1	CN-6F		CN-4F
312A	R	1	2	CN-4F		CN-31F
312B	R	1	2	CN-4F		CN-31F
312C	R	1	3	CN-8F		CN-31F
313	L	1	3	CN-8F		CN-4F
SH1	B	1	3	CN-8F		CN-30F
312D	R	1	3	CN-8F		CN-31F
315	L	1	3	CN-8F		CN-4F
SH2	B	1	3	CN-8F		CN-30F
312E	R	1	3	CN-8F		CN-31F
317	L	1	3	CN-8F		CN-4F
SH3	B	1	3	CN-8F		CN-30F
318A	R	1	2	CN-5F		CN-31F
318B	R	1	2	CN-5F		CN-31F
318C	R	1	3	CN-8F		CN-31F
319	L	1	3	CN-8F		CN-5F
SH4	B	1	3	CN-8F		CN-30F
318D	R	1	3	CN-8F		CN-31F
336	L	1	3	CN-8F		CN-5F
SH5	B	1	3	CN-8F		CN-30F
318E	R	1	3	CN-7F		CN-31F
338	L	1	3	CN-7F		CN-5F
SH6	B	1	3	CN-8F		CN-30F
E10	Br	0,75	1	P-2		CN-30F
E8	Br	1	1	P-2		CN-31F
E5	Br	0,75	1	CN-3F		CN-31F
E6	Br	0,5	1	CN-1F		CN-31F
E9	Br	0,5	1	CN-11F		CN-31F
E1	Br	1	1	P-3		CN-5F
E3	Br	1	1	P-3		CN-4F
E2	Br	1	1	P-1		CN-5F
E4	Br	0,75	1	P-1		CN-3F
320	W	0,5	1	CN-4F		CN-6F
321	W	0,5	1	CN-4F		CN-6F
322	W	0,5	1	CN-4F		CN-6F
323	W	0,5	1	CN-5RF		CN-5F
324A	W	0,5	1	CN-9F		CN-5RF
324B	W	0,5	1	CN-9F		CN-4F
324C	W	0,5	1	CN-9F		CN-7F
325	W	0,5	1	CN-7F		CN-4F
326	W	0,5	1	CN-7F		CN-4F
327	W	0,5	1	CN-7F		CN-4F
328	W	0,5	1	CN-7F		CN-5F
330	W	0,5	1	CN-7F		CN-4F
331A	W	0,5	1	CN-9F		CN-4F
331B	W	0,5	1	CN-9F		CN-4F
331C	W	0,5	1	CN-9F		CN-7F
332A	W	0,5	1	CN-5F		CN-30F
332B	W	0,5	1	CN-5F		CN-30F
332C	W	0,5	1	CN-6F		CN-30F
333A	W	0,5	1	CN-5F		CN-30F
333B	W	0,5	1	CN-5F		CN-30F
333C	W	0,5	1	CN-6F		CN-30F
334A	W	0,75	1	CN-31F		CN-3F
334B	W	0,75	1	CN-31F		CN-3F
334C	W	0,75	1	CN-31F		CN-21M
340	W	0,5	1	CN-2F		CN-6F
341	W	0,5	1	CN-4F		CN-6F
350	W	0,5	1	CN-2F		CN-264F
352	W	0,5	1	CN-1F		CN-264F
353	W	0,5	1	CN-4F		CN-264F
520	W	0,5	4	CN-21M		CN-3F
521	R	0,5	4	CN-21M		CN-3F
781	W	0,5	3	CN-21M		CN-1F
782	R	0,5	3	CN-21M		CN-1F
SH8	Y	0,5	3	CN-21M		UN-CONNECTED

SM1878

ASSEMBLY CABLES ON THE CONNECTORS



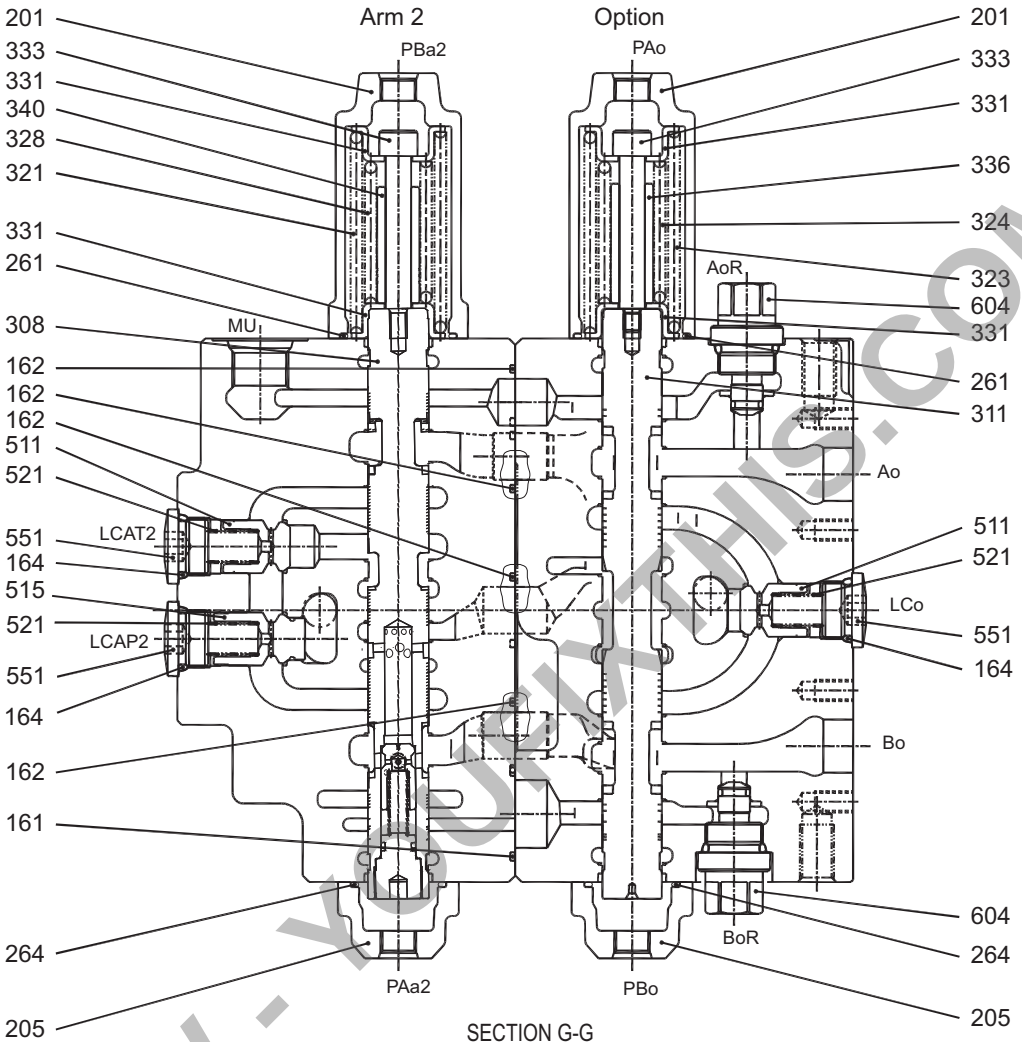
- The connector view on the cable are from “X” side

SM0199

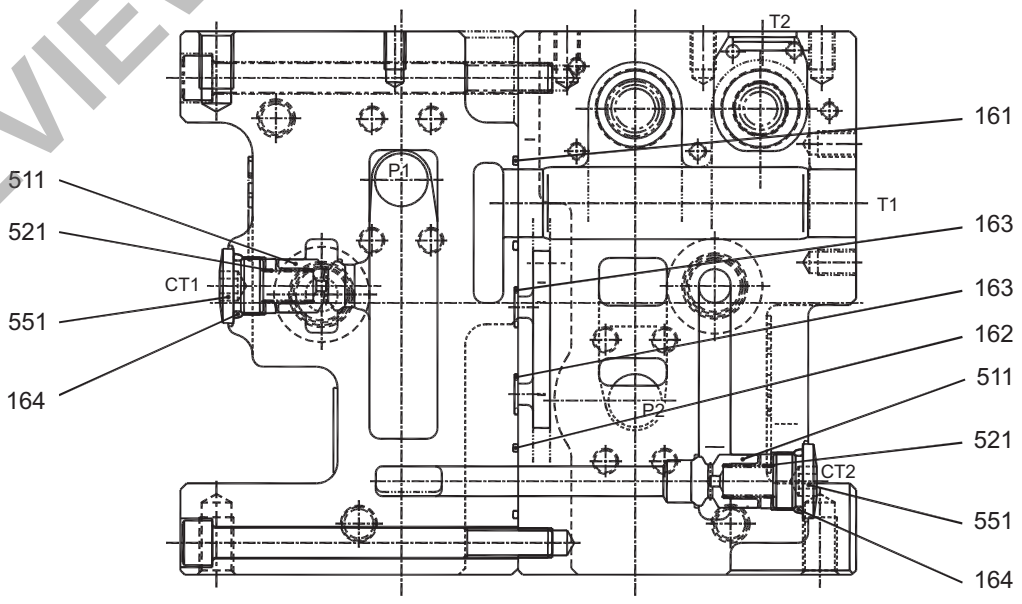
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Control valve (5/6)



SECTION G-G



SECTION H-H

SM0535

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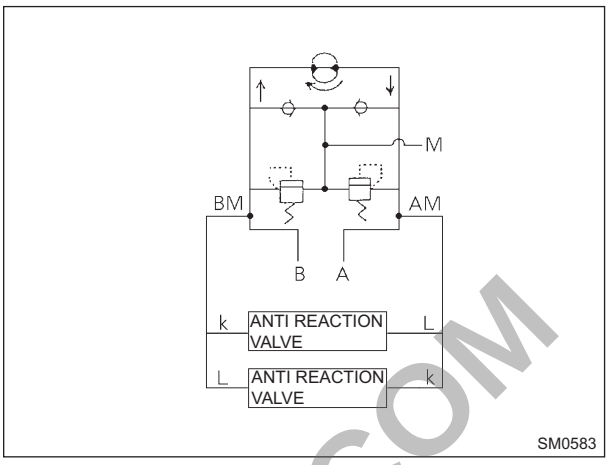
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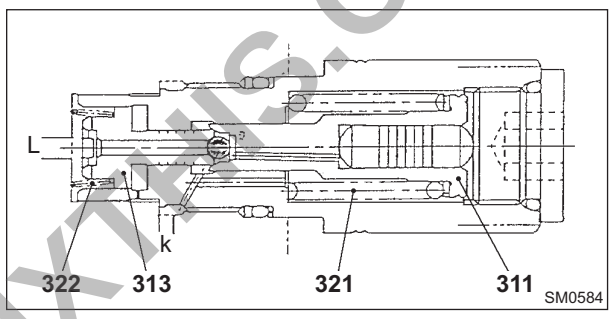
3. Operation of anti-reaction valve

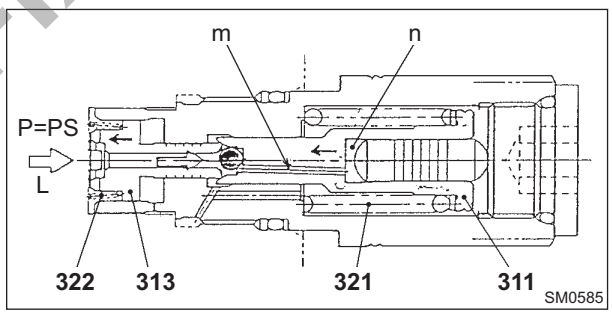
a) Neutral condition
Fig.SM0583 illustrates the relationship between the neutral condition of the anti-reaction valve and the hydraulic circuits. Now, let us consider a braking condition in which brake pressure generates on the **AM** port side.

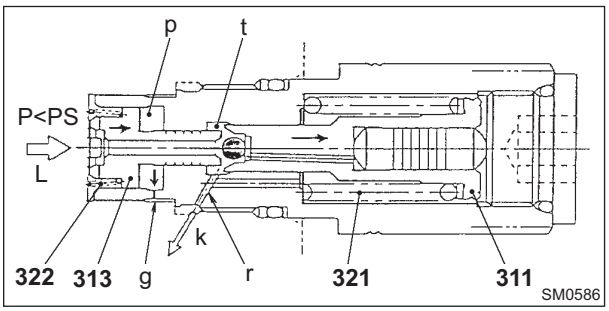
b) When brake pressure occurs:
If pressure (**P**) generates at the **AM** port, it passes through the passage **L**, the hole on the shaft of seat (**313**) and the passage m of plunger (**311**) and is led to the **n** chamber.
When the pressure **P** rises above a value (**Ps**) set by spring (**321**), plunger (**311**) compresses spring (**321**) and shifts it to the left.
Seat (**313**) compresses weak spring (**322**) as pushed by plunger (**311**) and moves to the left.

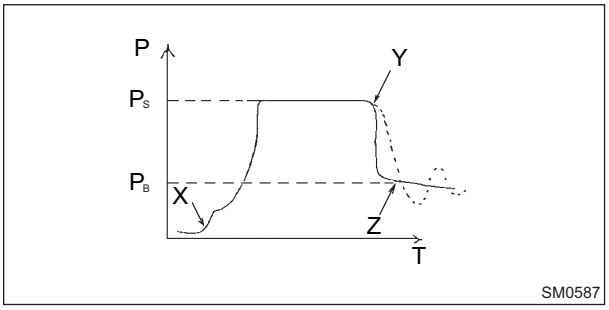
c) At anti-reaction action
When inertia load stops moving (point **Y** Fig. SM0587), brake pressure (**P**) tries to fall.
When **P<Ps**, plunger (**311**) moves toward the right return side by the action of spring (**321**). Seat (**313**) tries to move to the right by the action of spring (**322**), but since chamber **p** provides damping action by orifice **g**, the return of the seat makes a time delay with regard to the return of the plunger.
Consequently, seat **t** opens. This makes a passage connecting the **AM** port and **BM** ports or both ports of the hydraulic motor by way of **→t→r→k**. The result is that the pressures at the **AM** and **BM** ports become equal (**Pb**), falling into the condition at point **Z** in Fig.SM0582. This prevents the hydraulic motor from swing shock by the closing pressure of the **AM** port.







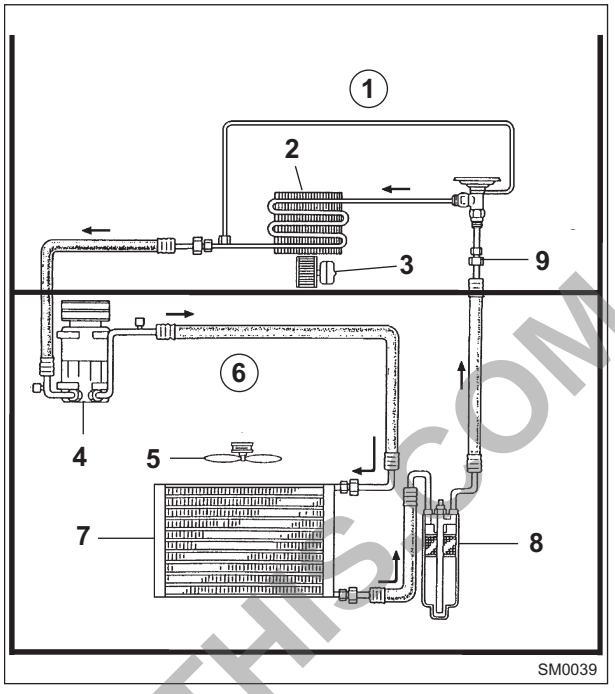




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2. Inversely to 1. above, the pressure at which a gas condenses for a temperature is determined. This pressure is called saturation pressure.
   Figure beside illustrates the relationships between the saturation temperature and the saturation pressure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



1 - Inside of the compartment (cab)
2 - Evaporator
3 - Blower
4 - Compressor
5 - Cooling fan
6 - Inside of engine room
7 - Condenser
8 - Receiver dryer
9 - Expansion valve

Cooling circuit

The figure illustrates the cooling circuit of the car air-conditioner.
In this circuit diagram, the portion that cools the air of the compartment is the evaporator. The object air is cooled off by utilizing the fact that the refrigerant takes heat off the surrounding area as evaporation heat as it evaporates in the cooling circuit. Since the part at which vaporization of the refrigerant takes place is the evaporator, cooled air is constantly delivered to the circumference of the evaporator by the blower fan. In the meantime, liquid refrigerant (slightly wet vaporized refrigerant) is fed into the evaporator, when "cooling" effect is attained. For instance, in order to cool the air to 15 °C, the refrigerant can not absorb evaporation heat from the air unless it evaporates at a temperature lower that 15 °C. For that purpose, it can be seen from the figure that the pressure of the refrigerant in the evaporator must be less than 0.51 MPa.

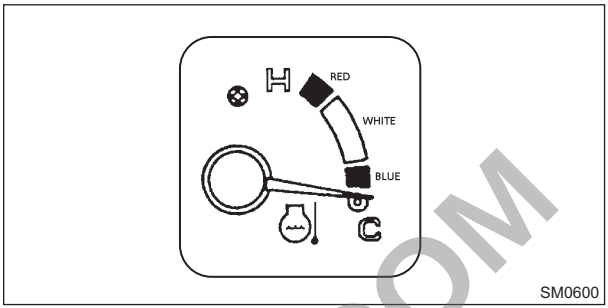
Furthermore, the cooling effect deteriorates unless the feed rate of the refrigerant is controlled so that all of the refrigerant supplied to the evaporator vaporizes and turns into dry vapor.

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MEASUREMENT OF ENGINE SPEED

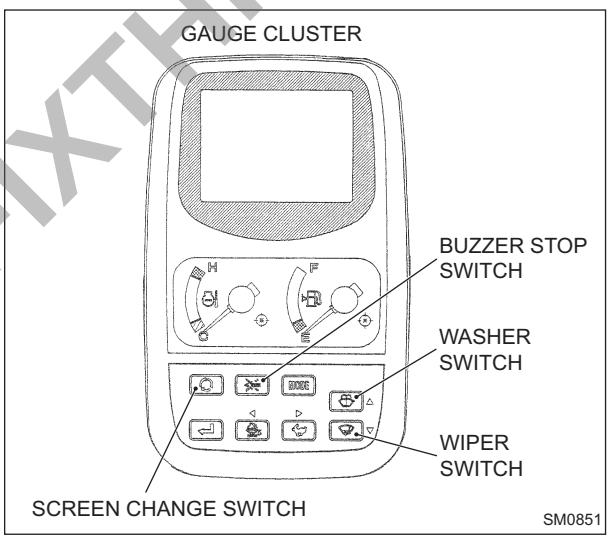
Warming up of engine

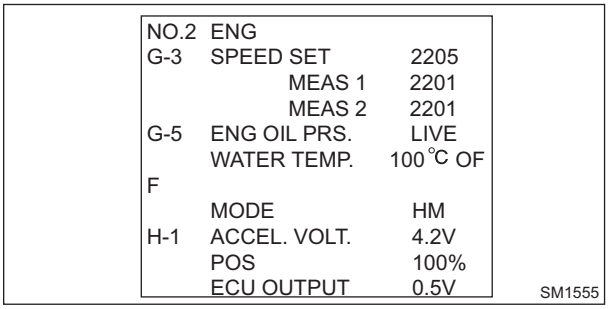
Start engine to raise the coolant temperature of engine to 60 to 90°C (140 to 194°F) at surface of radiator upper tank.
The E/G coolant temperature gauge is used to measure.
The range in white color shows the temperature of approx. 65 to 105°C (149 to 221°F), so confirm that the pointer indicates the temperature within the white range.



Engine speed measured value through service diagnosis

1. Turn "ON" the starter switch with the buzzer stop switch pressed.
2. A program No. and an actual engine revolution are displayed as the No.2 Item.
3. The screen advances like No.2, No.3....each time the "Wiper switch" on the gauge cluster is pushed.
4. The screen returns like No.45, No.44....each time the "Washer switch" is pushed.
5. The display does not disappear unless the starter switch is turned to"OFF".





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Table 13

Error code	**B023**		
Trouble	Boom down pressure sensor's wiring is disconnecting.		
Judging condition	The input voltage from boom down pressure sensor is 0.1 V or less.		
Symptom	The boom down operability becomes poor.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to 0 mA. (Hydraulic pump emergency mode) Set output of P1 unload proportional valve to 0 mA. (Valve emergency mode)		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	5	B-2 BOOM LOWER
	Screen No.		
	Screen No.		

	Checking object	Checking contents and remedy
1	• Boom down pressure sensor SE-4	When B023 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 down pressure sensor and controller CN-127F CN-101F	When B023 is displayed after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller	Check that the error is corrected after replacement of controller.

Table 14

Error code	**B024**		
Trouble	Boom down pressure sensor's power source is shortcut.		
Judging condition	The input voltage from boom down pressure sensor is 4.7 V or more.		
Symptom	The boom down operability becomes poor.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to 0 mA. (Hydraulic pump emergency mode) Set output of P1 unload proportional valve to 0 mA. (Valve emergency mode)		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	5	B-2 BOOM LOWER
	Screen No.		
	Screen No.		

	Checking object	Checking contents and remedy
1	• Boom down pressure sensor SE-4	When B024 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 down pressure sensor and controller CN-127F CN-101F	When B024 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 83

Error code	**H024**		
Trouble	Boom angle potentiometer's power source is shortcut.		
Judging condition	The input voltage from boom angle potentiometer is 0.1 V or less.		
Symptom	Indications of rating load and working radius of 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.	12	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 all 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 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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No.	Sections	Contents/normal value		Corrective action, others
11	Spool for optional attachment <Trouble> P1, P2 pressures are high.	Visual check	When removing, free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface Spring is free from breakage.	Replace (Check on the casing side for damage)
12	Over load relief valve	Check targeted spool visually	Free from dust entered in over load relief valve Seat is free from abnormality.	Replace

21. Option selector valve malfunction: not switched to breaker circuit.
(Indication of failure is displayed. For reference, see "Table 1 - Action of optional selector solenoid valve")

No.	Sections	Contents/normal value		Corrective action, others
1	N&B selector spool	Visual check	When removing, free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface Spring is free from breakage	Replace (Check on the casing side for damage)
2	N&B selector solenoid	Screw for emergency	Check that the error indication is disappeared by turning emergency screw	Replace solenoid valve
3	N&B selector solenoid	Carry out service diagnosis	• No.11 F-4 Option selector is B mode COMP ON, MEAS ON Spool position BRK Selector switch BRK	Check solenoid valve Check harness
4	N&B selector pressure sensor	Carry out service diagnosis	• No.16 B-11 Data List 3.0 MPa at B mode and 0.0 MPa at A mode	Check pressure sensor Check harness

22. Option selector valve malfunction: not switched to nibbler circuit.
(Indication of failure is displayed. For reference, see "Table 1 - Action of optional selector solenoid valve")

No.	Sections	Contents/normal value		Corrective action, others
1	N&B selector spool	Visual check	When removing, free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface Spring is free from breakage.	Replace (Check on the casing side for damage)
2	N&B selector solenoid	Carry out service diagnosis	• No.11 F-4 Option selector is A mode COMP OFF, MEAS OFF Spool position NIB Selector switch NIB	Check solenoid valve Check harness

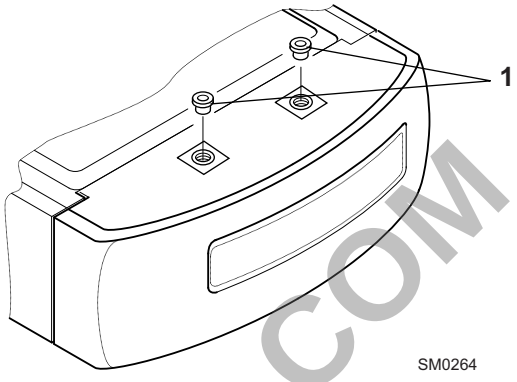
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REMOVAL AND INSTALLATION OF COUNTERWEIGHT

Removal of counterweight

1. Remove plugs (**1**) from the counterweight and attach two M36 eye bolts to the counterweight.

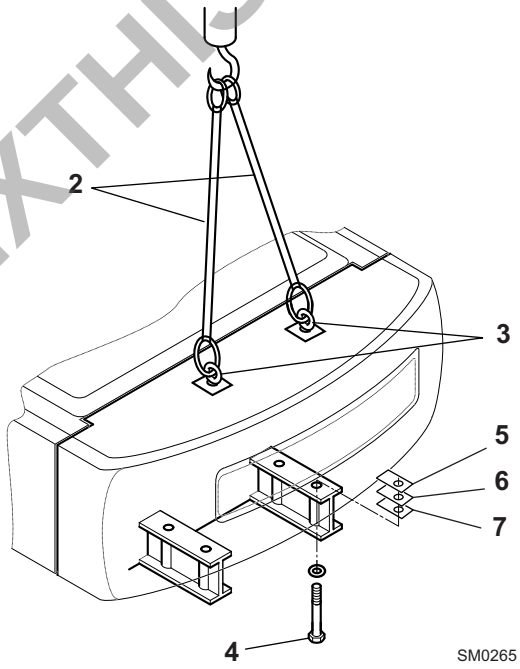


NOTE: *approximate mass of counterweight: 8800 kg*

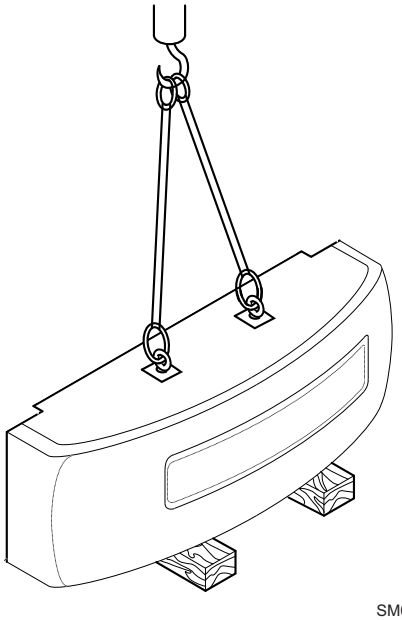
2. Attach wire rope (**2**) to eye-bolts (**3**) using shackles.
   Take out slack of wire rope by applying tension slowly with a crane or hoist.
   Wire with hook:
   Length 1.5 m, dia. more than 16 mm – (2 pcs.).

3. Remove 4 bolts (**4**) M36.
   Lift counterweight using a crane or hoist.
   : 55 mm

4. Remove shim (**5**), (**6**), (**7**) from the frame.



5. Lower the counterweight on proper stand.



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ASSEMBLY AND DISASSEMBLY OF CONTROL VALVE

PREPARATION FOR DISASSEMBLY

General precautions

- As all the hydraulic components are precisely machined, it is essential to carry out disassembly and reassembly in an especially clean location.
- When handling the control valve, take special care to prevent the entry of foreign matter, such as dust or sand.
- Cap each port of the control valve before removing the valve from the machine. Before disassembly, confirm that each cap is in place and then clean the exterior of the assembly.
  Use a workbench. Lay a clean sheet of paper or rubber mat over the workbench.
- When carrying or moving the control valve, hold the body, and never put pressure on a lever, an exposed spool, or the end cover. Handle the valve with care.
- Tests (for relief characteristics, leaks, overload valve setting, flow resistance, etc.) that are desired after disassembly and reassembly require hydraulic testing apparatus.
- For this reason, do not disassemble hydraulic units that you are capable of disassembling but cannot test or adjust.
  Prepare beforehand washing fluid, hydraulic oil, grease, etc.

Tools

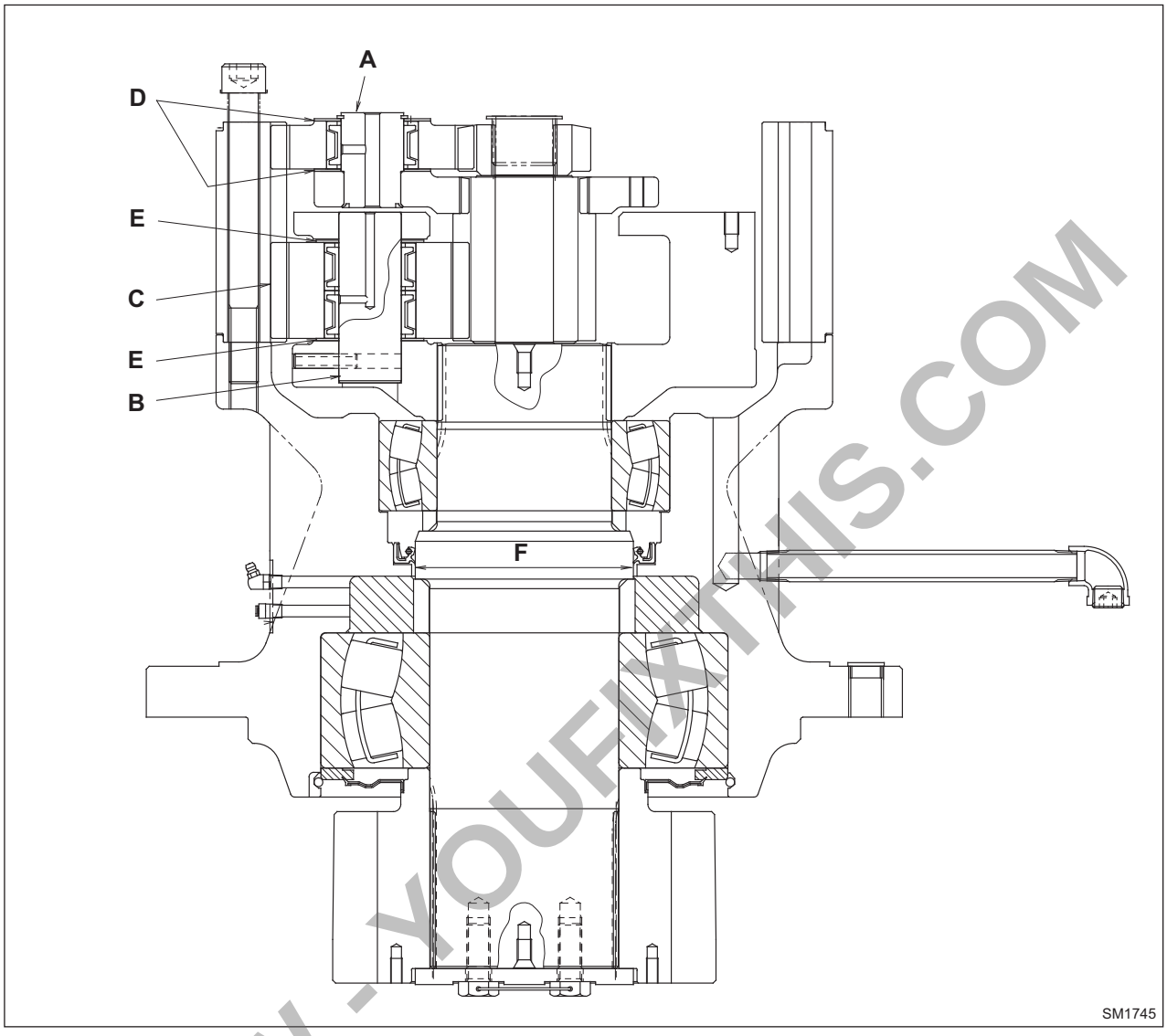
Prepare the following tools before disassembling the control valve.

No.	Tools	Q.ty	Remarks
a	Vise	1	
b	Box and wrench	1 of each size	24 mm, 27 mm, 32 mm
c	Allen wrench	1 of each size	5 mm, 6 mm, 10 mm, 12 mm, 14 mm, 22 mm
d	Spanner	1	32 mm
e	Loctite # 262	1	
f	Spatula	1	
g	Pincers	1	
h	Adjustable wrench	1	

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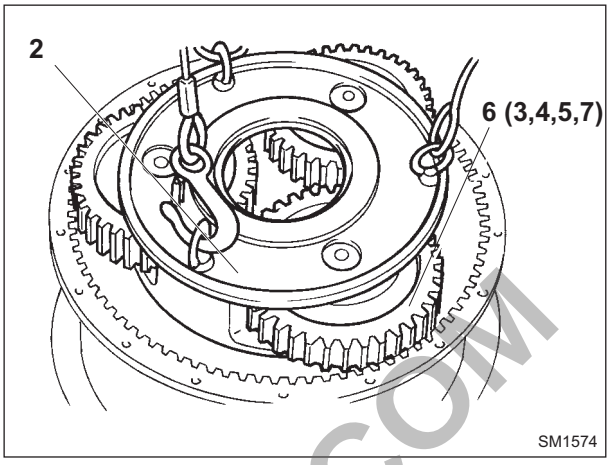
Swing reduction maintenance



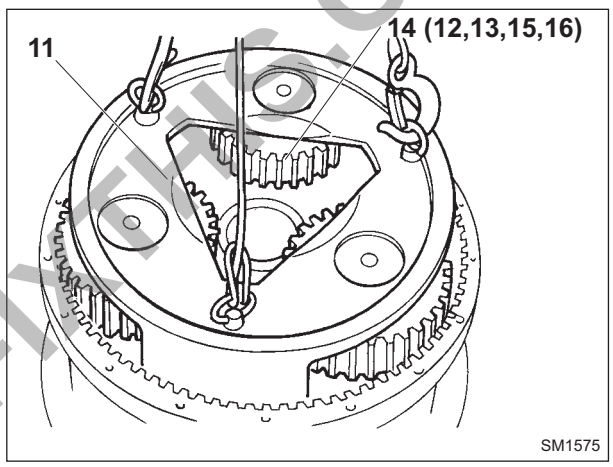
Code	Item		Standard Value (mm)	Service ability Limit (mm)	Remedy
A	Wear in #1 planetary shaft		Ø 43 $^{0}_{-0.009}$ (Ø 1.693 $^{0}_{-0.0004}$)	There shall be no peeling, abnormal wear and seizure	Replace entire spider assy
B	Wear in #2 planetary shaft		Ø 29 $^{0}_{-0.009}$ (Ø 1.142 $^{0}_{-0.0004}$)	There shall be no peeling, abnormal wear and seizure	Replace four shafts as a set
C	Gears	Condition of tooth face	There should be no pitching exceeding 1.6 mm dia, abnormal wear or seizure		Replace (Planetary pinion should be replaced in a set of four)
		Condition of tooth flank	There should be no cracks		
D	Thickness of thrust washer		1,6 $^{+0.1}_{-0.1}$ (0.063 $^{+0.00039}_{-0.00039}$)	1.4 (0.0551)	Replace
E	Thickness of thrust washer		1,6 $^{+0.1}_{-0,1}$ (0.063 $^{+0.00039}_{-0.00039}$)	1.4 (0.0551)	Replace
F	Sleeve (the diameter of the part in contact with oil seal)		Ø150 $^{0}_{-0.1}$ (5.91 $^{0}_{-0.0004}$)	Ø 149.9 (Ø 5.90)	Replace

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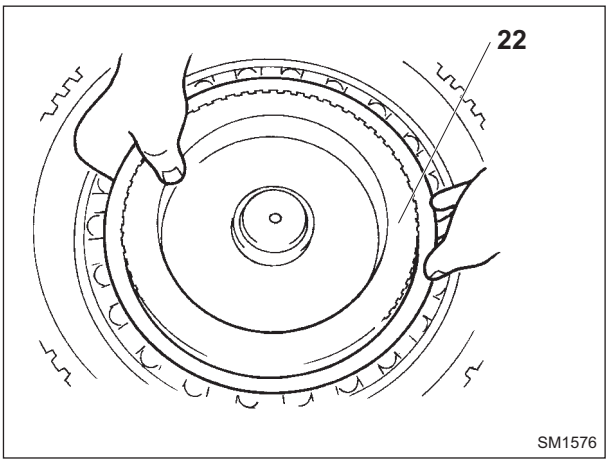
3. Removing carrier 1 assy
   a. Remove thrust plate.
   b. Remove sun gear 1
   c. Place three M10 eye bolt in carrier 1 (**2**) and remove carrier 1 assy (**3, 4, 5, 6, 7**).



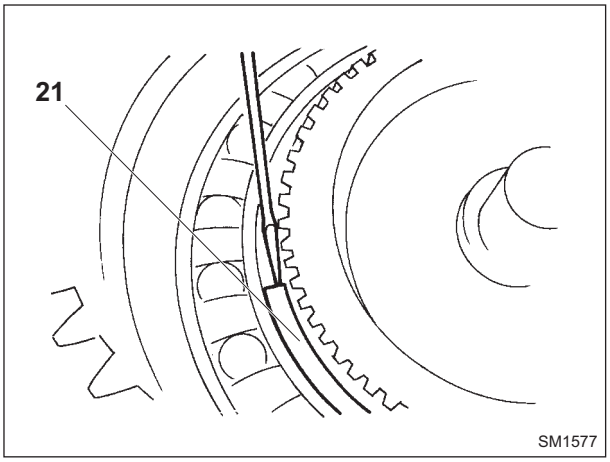
4. Removing carrier 2 assy
   a. Remove sun gear 2.
   b. Place three M10 eye bolt in carrier 2 (**11**) and remove carrier 2 assy (**12, 13, 14, 15, 16**).



5. Removing housing assy
   a. Remove support ring (**22**).

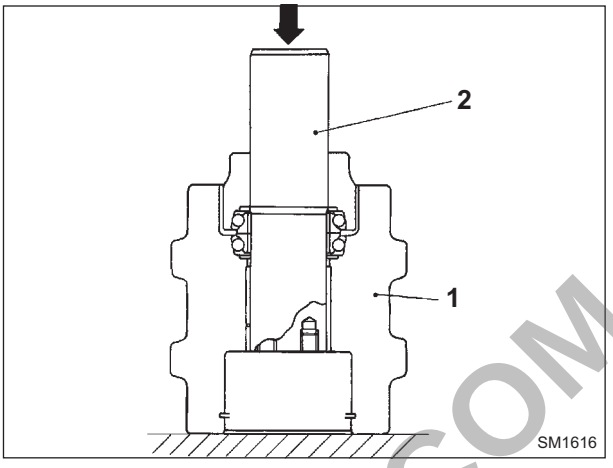


   b. Remove lock washer (**21**) by hammering on a screwdriver that is placed in the split surface.



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6. Coat shaft (**2**) with a thin film of oil and insert it into upper roller (**1**).

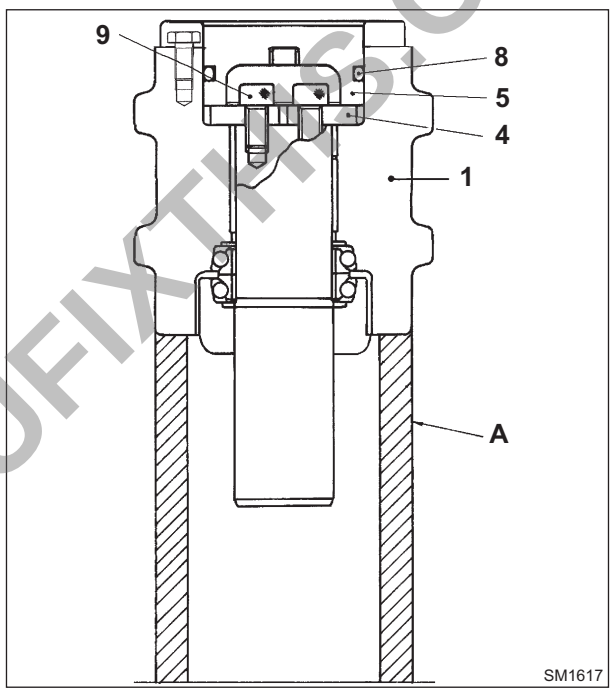


7. Mount upper roller (**1**) on the stand jig (**A**) and attach thrust washer (**4**) to the end face of the shaft with bolt (**9**).
   : 19 mm
   : 132.5 ± 10.5 Nm (97.7 ± 7.7 lbf·ft)

8. Fit O-Ring (**8**) to the groove of cover (**5**).

NOTE: *apply grease to O-Ring.*

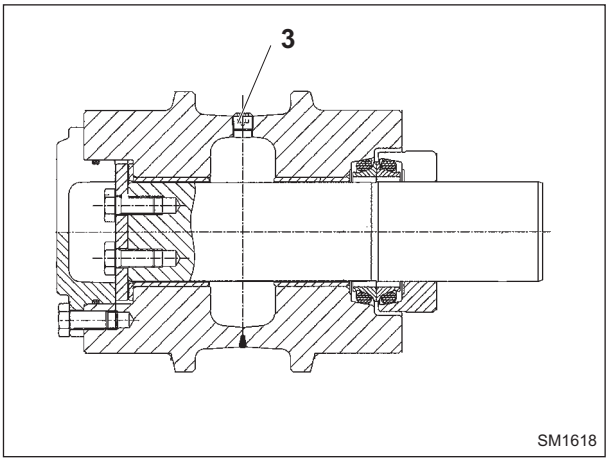
9. Install cover (**5**) to upper roller (**1**) and fix cover with the three screws (**9**).
   : 19 mm
   : 132.5 ± 10.5 Nm (97.7 ± 7.7 lbf·ft)



10. Fill in 366.9 cm^3 (22.39 cu·in) of engine oil through the plug hole (**3**).

11. Wind seal tape around plug (**3**).
   : 6 mm
   : 14.7 ± 4.9 Nm (10.8 ± 3.6 lbf·ft)

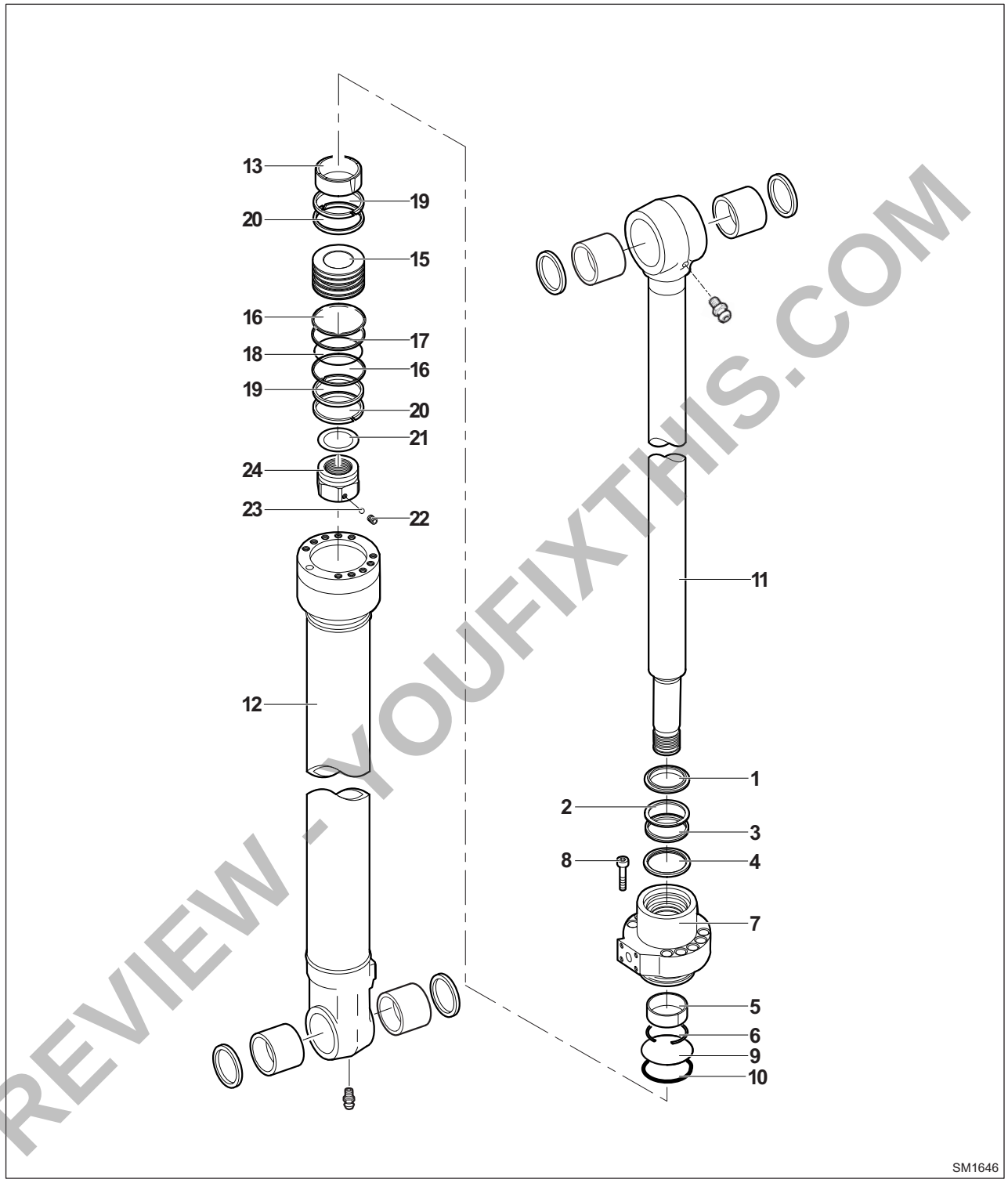
NOTE: *after assembling the upper roller, confirm that oil is not leaking from it and that it rotates smoothly by.*



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CYLINDERS ASSEMBLY AND DISASSEMBLY
Bucket cylinder



1 - Wiper Ring
2 - Backup Ring
3 - Seal
4 - Seal
5 - Bushing
6 - Snap Ring
7 - Cylinder Head
8 - Socket Bolt
(q.ty 10)
9 - Backup Ring
10 - O-Ring
11 - Cylinder Rod
12 - Cylinder Tube
13 - Cushion Bearing
15 - Piston
16 - Backup Ring
(q.ty 2)
17 - Seal Ring
18 - O-Ring
19 - Slide Ring
(q.ty 2)
20 - Slide Ring
(q.ty 2)
21 - Shim
22 - Set Screw
23 - Steel Ball
24 - Nut

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Emission Control

Tightening torque

JP30002020205004

Unit : N·m{kgf·cm, lbf·ft}

Tightening area	Tightening torque	Remark
EGR pipe	57±11{582±116, 42±8}	
EGR valve mounting bolt	68.5{700, 51}	
EGR cooler mounting bolt	37{377, 27}	
EGR cooler - Exhaust manifold	68.5{700, 51}	

Intake

Tightening torque

JP30002020205005

Unit : N·m{kgf·cm, lbf·ft}

Tightening area	Tightening torque	Remark
Intake manifold mounting bolt	28.5{290, 21}	

Engine Mechanical

Standard value

JP30002020205006

Unit : mm {in.}

Inspection item		Standard value	Repair limit	Service limit	Action
Compression pressure		3.4-3.7MPa {35-38kgf/cm^2, 493-237lbf/in.^{2}}	—	2.7MPa {28kgf/cm^2,392lbf/in.^{2}}	
Valve clearance (cold)	IN	0.30 {0.0118}	—	—	
	EX	0.45 {0.0177}	—	—	
Cylinder liner protrusion		0.01 - 0.08 {0.003 - 0.003}	—	—	
Cylinder liner flange width		8{0.314}	—	—	
Cylinder block flange width		8{0.314}	—	—	
Cylinder block inner diameter	A	117 - 117.008 {4.6063 - 4.6066}	—	—	
	B	117.008 - 117.014 {4.6066 - 4.6068}	—	—	
	C	117.014 - 117.022 {4.6068 - 4.6072}	—	—	

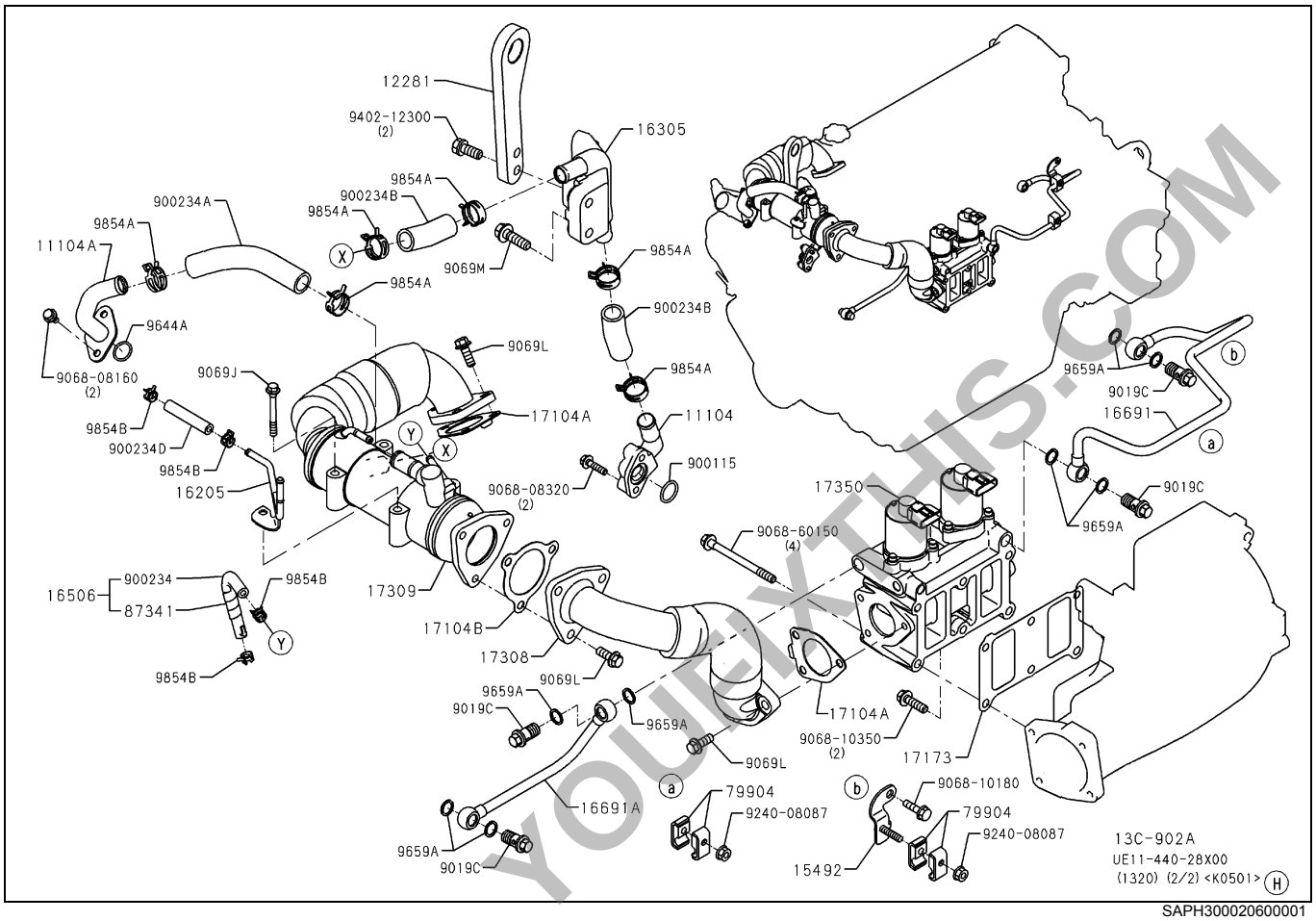
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EGR

Part layout

JP30002060402001



SAPH300020600001

11104	Coolant pipe	17173	Gasket*
11104A	Coolant pipe	17308	EGR pipe
16305	Coolant pipe	17309	EGR cooler assembly
16691	Coolant pipe	17350	EGR valve
16691A	Coolant pipe	900234A	Coolant hose
17104A	Gasket*	900234B	Coolant hose
17104B	Gasket*	9659A	Gasket*

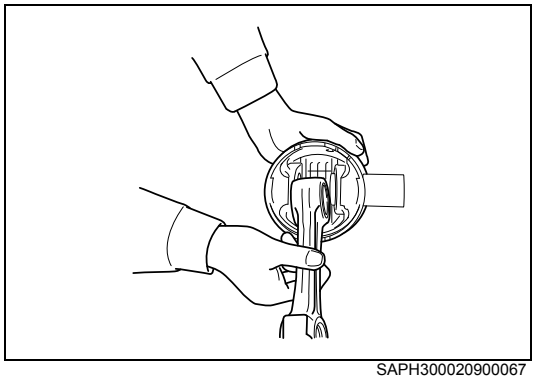
*Parts not to be reused.

Tightening torque

9068-10350	68.5 N·m{700 kgf·cm, 51lbf·ft}	9069L	68.5 N·m{700 kgf·cm, 51lbf·ft} (Exhaust manifold)
9068-60150	68.5 N·m{700 kgf·cm, 51lbf·ft}	9069L	68.5 N·m{700 kgf·cm, 51lbf·ft} (EGR valve – EGR pipe) (EGR cooler – EGR pipe)
9069J	37 N·m{377 kgf·cm, 27lbf·ft}		

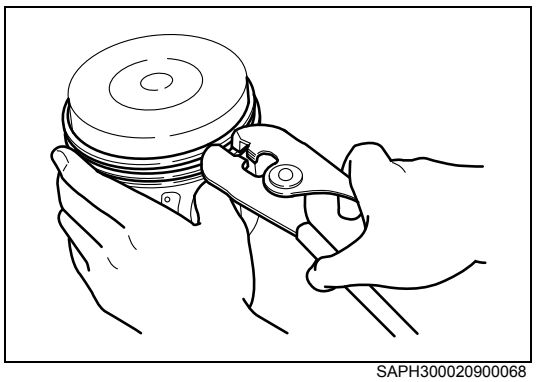
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SAPH300020900067

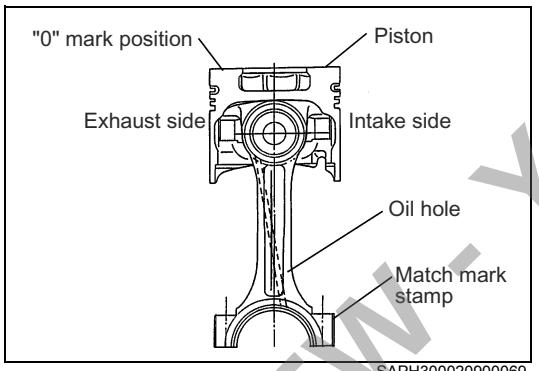
2. Disassembly of piston and connecting rod

(1) Remove the retainer ring using snap ring pliers.
(2) Remove the piston pin using the brass bar and disconnect the piston from the connecting rod.


SAPH300020900068

(3) Remove the piston ring using a tool.

⚠ **CAUTION**
- **Since the piston ring is susceptible to damage, be careful for handling.**
- **Store piston rings for each cylinder number.**
- **Store the piston rings so that the upper and lower surfaces may be identified.**



SAPH300020900069

3. Assembly of piston and connecting rod

(1) Install the piston on the connecting rod so that the "0" mark on the piston may be opposite to the match mark stamp on the connecting rod
(2) Install a new retainer ring using a snap ring pliers.

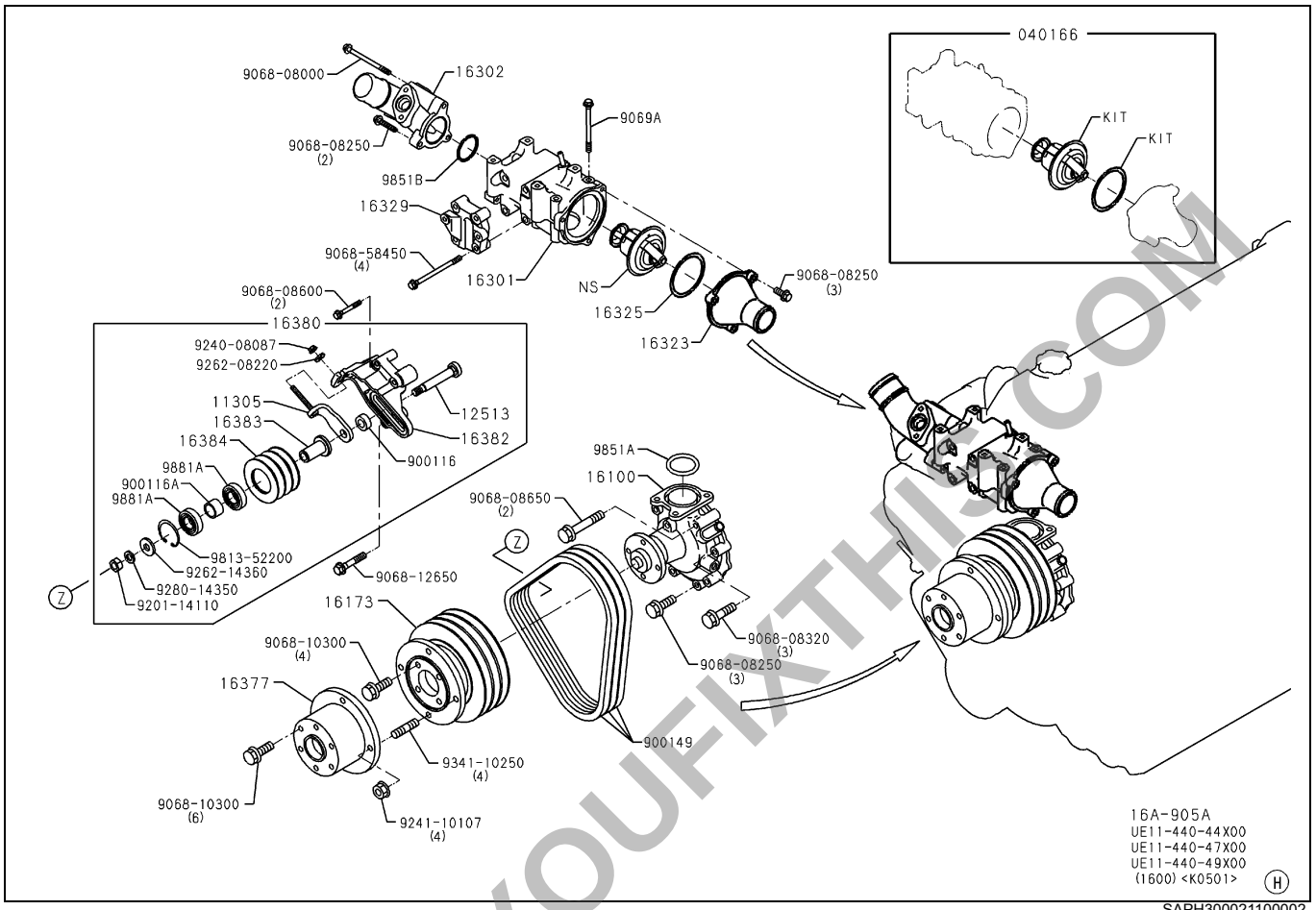
⚠ **CAUTION**
- **Make sure that there is no backlash in the retainer ring.**

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Part layout

JP30002110402001



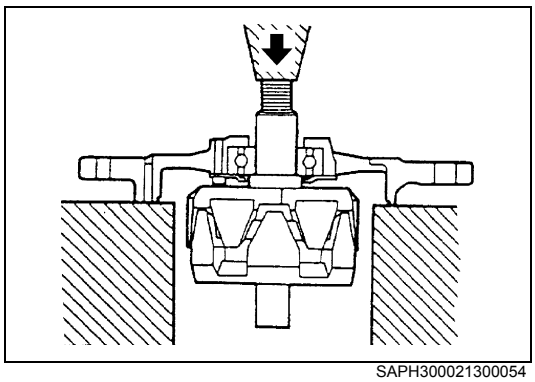
SAPH300021100002

16100	Coolant pump	16323	Thermostat case cover
16301	Thermostat case	16325	Gasket*
16302	Thermostat case cover	9851A	O–ring*

*Parts not to be reused.

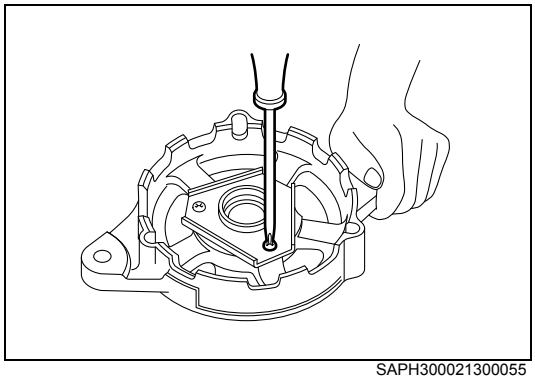
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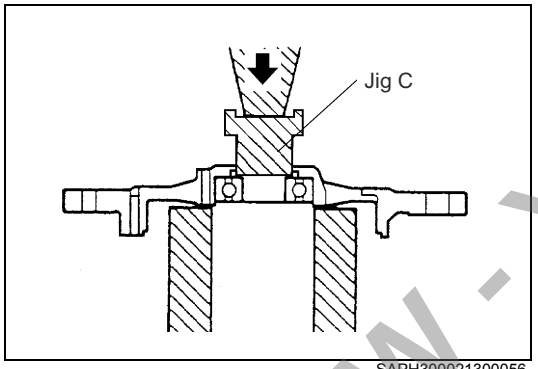

SAPH300021300054

(2) Remove the rotor assembly using a press.

⚠ **CAUTION**
- **Do not damage the end of the thread.**
- **Support the rotor assembly to prevent fall of the rotor assembly.**


SAPH300021300055

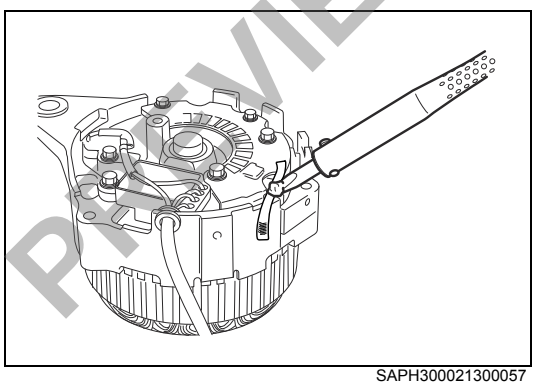
(3) Remove three bolts with a screwdriver and remove the bearing cover.



SAPH300021300056

(4) Remove the ball bearing from the front bracket using a press or jig C.

⚠ **CAUTION**
- **Place jig C at the inner race of the front bearing.**
- **Removed bearing must not be reused.**


SAPH300021300057

3. Disassembly of rear

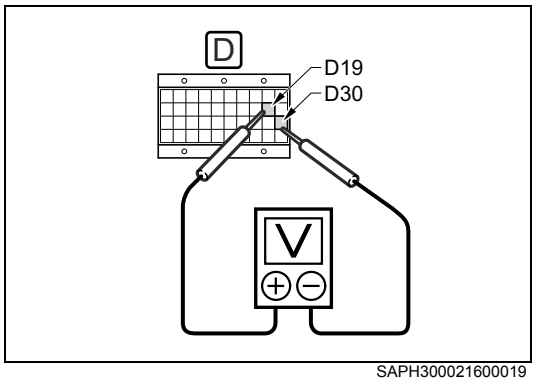
(1) Remove solder of the lead wire connecting the stator coil and the diode using a soldering bit and suction line or a solder suction device

⚠ **CAUTION**
- **At solder of the stator coil and the diode, the end of the diode is clamped. Do not damage the diode by prying. Deformed diode must not be reused.**
- **Perform soldering in a short time (within 5 seconds).**

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3	Measurement of voltage between terminals



SAPH300021600019

1. Set the starter key to "OFF" and connect the connector of the sub-speed sensor.
2. Start the engine and keep idling status.
3. Measure voltage between terminal D19 and terminal D30 of the signal check harness.
4. After measurement, stop the engine.

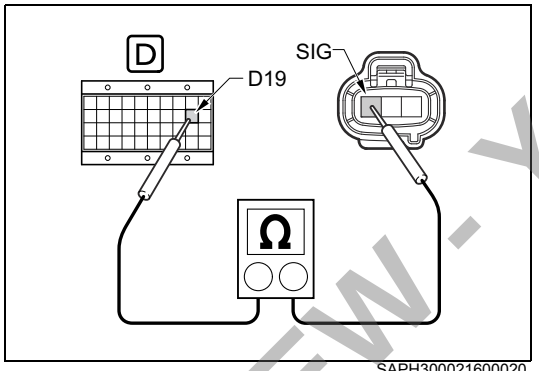
Standard : Pulse waveform of 0 ↔ 5 V

NG → [4] Go to measurement of resistance between terminals.

OK

Engine ECU failure, ECU connector failure

4	Measurement of resistance between terminals



SAPH300021600020

1. Leave the connector of the sub-speed sensor connected.
2. Measure resistance between the No. 1 terminal at the vehicle harness of the sub-speed sensor connector and terminal D19 of the signal check harness.

⚠ **CAUTION** • **The connector of the sub-speed sensor in the figure is viewed from the fitting surface.**

Standard value : 2 Ω or less

NG → Harness failure

OK

Failure of sub-speed sensor

Engine speed main and sub sensor circuit malfunction (DTC code P0335/ diagnosis monitor code 13)

JP30002160601006

1. Inspection item

(1) Take actions of (DTC code P0335/diagnosis monitor code 13) and (DTC code P0340/diagnosis monitor code 12).
"Reference : Engine speed main sensor circuit malfunction (DTC code P0335/diagnosis monitor code 13), Engine ECU, Engine diagnosis code"
"Reference : Engine speed sub sensor circuit malfunction (DTC code P0340/diagnosis monitor code 12), Engine ECU, Engine diagnosis code"

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