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E13C-VV (90/92Z7) SHOP MANUAL
General Information
Engine Diagnosis

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February 2012

SHOP MANUAL

HINO DIESEL ENGINE

E13C-VV

General Information
Engine Diagnosis

(For Kawasaki Wheel Loaders 90Z7 and 92Z7)

Serial No. 90H1-5001 and up
92H1-5001 and up

Warning

JP30ZLE010102001

Observe the following precautions to work safely and to prevent damage to customers' vehicles.

This manual is prepared for qualified service engineers who are recognized as technical experts. Those who are not qualified, who are not appropriately trained, who perform service without appropriate tools or equipment, or who perform service with the way not specified in this manual may not only damage the vehicle, but also put service engineers and surrounding people in danger.

- Appropriate service and repair are essential to ensure safety of service engineers and safety and reliability of machines. Be sure to only use genuine Hino replacement parts.
- Items described in this manual are the procedures to be observed in service and repair. For service and repair according to this procedure, be sure to use the special tools designed for each purpose.
- If a method or a tool not recommended is used, the safety of service engineers as well as the safety and reliability of machines may be compromised. Never use a method or tool that is not recommended.
- This manual shows "Warning" and "Caution" for items that need to be observed so that accidents may not occur during service or repair, or that damage to machine due to improper method may not impair safety and reliability of machines. These instructions cannot give warning for all possible hazards. Note that items with "Warning" or "Caution" are not absolute for safety.

Tightening of engine bolts and nuts

JP30ZLE010102003

1. Tightening torque of general standard bolts

(1) For bolts with seatings

Unit : N·m{kgf·cm, lbf·ft}

Screw diameter x Pitch	7T	9T
M8 x 1.25 (Coarse thread)	28.5 {290, 21}	36 {370, 27}
M10 x 1.25 (Fine thread)	60 {610, 44}	74.5 {760, 55}
M10 x 1.5 (Coarse thread)	55 {560, 41}	68.5 {700, 51}
M12 x 1.25 (Fine thread)	108 {1100, 80}	136 {1390, 101}
M12 x 1.75 (Coarse thread)	97 {990, 72}	125 {1280, 93}
M14 x 1.5 (Fine thread)	171.5 {1750, 127}	216 {2210, 160}
M14 x 2 (Coarse thread)	154 {1570, 114}	199 {2030, 147}
Remark	Bolt with number “7” on the head	Bolt with number “9” on the head

⚠ CAUTION • **8T bolt is in accordance with 7T bolt.**

(2) For bolts with washers

Unit : N·m{kgf·cm, lbf·ft}

Screw diameter x Pitch	4T	7T	9T
M6 x 1 (Coarse thread)	6 {60, 4}	10 {100, 7}	13 {130, 9}
M8 x 1.25 (Coarse thread)	14 {140, 10}	25 {250, 18}	31 {320, 23}
M10 x 1.25 (Fine thread)	29 {300, 22}	51 {520, 38}	64 {650, 47}
M10 x 1.5 (Coarse thread)	26 {270, 20}	47 {480, 35}	59 {600, 43}
M12 x 1.25 (Fine thread)	54 {550, 40}	93 {950, 69}	118 {1200, 88}
M12 x 1.75 (Coarse thread)	49 {500, 36}	83 {850, 61}	108 {1100, 80}
M14 x 1.5 (Fine thread)	83 {850, 61}	147 {1500, 108}	186 {1900, 137}
M14 x 2 (Coarse thread)	74 {750, 54}	132 {1350, 98}	172 {1750, 127}
Remark	Bolt with number “4” on the head Projection bolt Stud with R surface at free end	Bolt with number ”7” on the head Stud with C surface at free end	Bolt with number “9” on the head

⚠ CAUTION • **8T bolt is in accordance with 7T bolt.**

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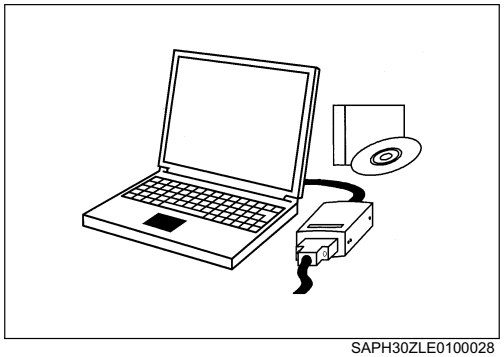
Failure diagnosis using HinoDX

JP30ZLE010301003



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⚠ **CAUTION** **HinoDX is used for inspection and adjustment of the system in addition to failure diagnosis.**

1. HinoDX

(1) With HinoDX, failure of the common rail fuel injection system can be diagnosed. The interface box (Hino-Bowie or DST-i) and the special cable are required for connection to the unit.

Emission Control

Tightening torque

JP30ZLE020701005

Unit:N·m{kgf·cm, lbf·ft}

Tightening area	Tightening torque	Remark
EGR valve mounting bolt	55 {560, 40}	
EGR cooler mounting bolt	55 {560, 40}	Refer to the main text.
	125 {1275, 92}	
EGR pipe mounting bolt or nut	72 {730, 53}	
EGR pipe - EGR valve	55 {560, 40}	
EGR pipe - EGR cooler	125 {1275, 92}	
EGR cooler bracket mounting bolt	68 {700, 50}	

Cooling

Standard value

JP30ZLE020701011

Inspection item	Standard value	Action
Thermostat valve opening temperature	80-84°C {176-183°F}	Replace
Thermostat valve lift (Set temperature 95 °C {203 °F})	10 {0.394} or more	Replace

Tightening torque

JP30ZLE020701012

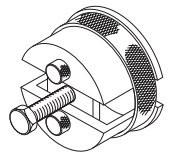
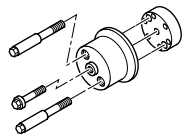
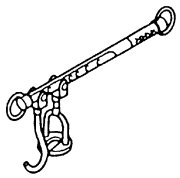
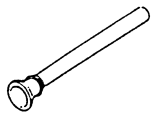
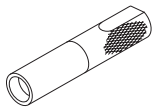
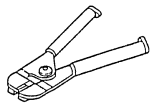
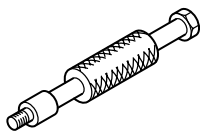
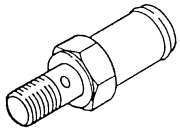
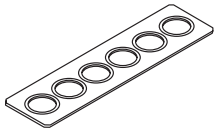
Unit:N·m{kgf·cm, lbf·ft}

Tightening area	Tightening torque	Remark
Thermostat case mounting bolt	55 {560, 40}	
Thermostat case cover mounting bolt	55 {560, 40}	
Coolant pump mounting bolt	97 {990, 72}	
Coolant pump vane assembly mounting bolt	55 {560, 40}	

Engine Mechanical

Special tools

JP30ZLE030901003

Shape	Part No.	Name	Remark
	S0942-02060 (09420-2060)	Puller	For crankshaft front oil seal removal
	S0940-71200 (09407-1200)	Press	For crankshaft front oil seal mounting
	S0947-01120 (09470-1120)	Valve spring press	For assembly/disassembly of Valve spring
	S0943-11010 (09431-1010)	Valve lapping tool	For valve adjustment
	S0947-22190 (09472-2190)	Valve stem seal press	For valve stem seal mounting
	S0944-21131 (09442-1131)	Piston ring expander	For assembly/disassembly of piston ring
	S0942-01442 (09420-1442)	Sliding hammer	For cam idle gear shaft (head) removal
	S0942-01510 (09420-1510)	Sliding hammer	• Main idle gear shaft • For cam idle gear shaft (block) removal
	SZ910-24101 (9011-24265)	Check bolt	For cooling jet inspection and adjustment
	S0944-41770 (09444-1770)	Gauge	For cooling jet inspection and adjustment

Overhaul Criteria

Factors to determine the engine overhaul

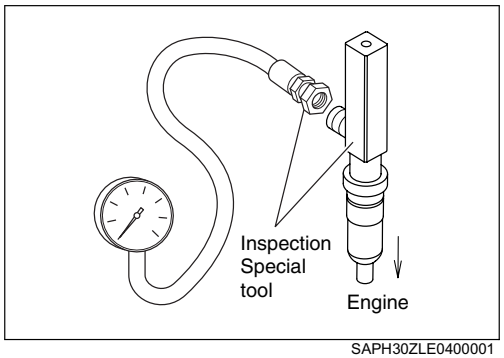
JP30ZLE040702001

NOTICE

- **Measure the compression pressure before disassembly of the engine and record the result. Regular measurement of the compression pressure can tell the engine status.**

1. Preparation before measurement

(1) Charge the battery completely.
(2) Check the valve clearance and adjust it when exceeding the standard value.
(3) Warm the engine and set the water temperature to 80 °C {176 °F}.
(4) Remove the air cleaner.
(5) Remove the head cover.
(6) Remove all injectors.
(7) To prevent spread of engine oil, attach a jig which cuts a head cover in half. (Cut it so that the camshaft may be covered.



SAPH30ZLE0400001

2. Measurement

(1) Install the special tool on the nozzle seat of the cylinder for which the compression pressure is to be measured. Use a nozzle clamp and the clamp mounting bolt.
Special tool : Compression gauge adapter

Part No.	Parts tightened
S0950-81060 (09508-1060)	**Insert into the injector mounting part.**
S0955-21030 (09552-1030) (3/4-16 UNF)	**Select the adapter according to the thread size of the air gauge.**
S0955-21060 (09552-1060) (W16 threads ridges 18)	

(2) Turn the starter and measure the compression pressure.

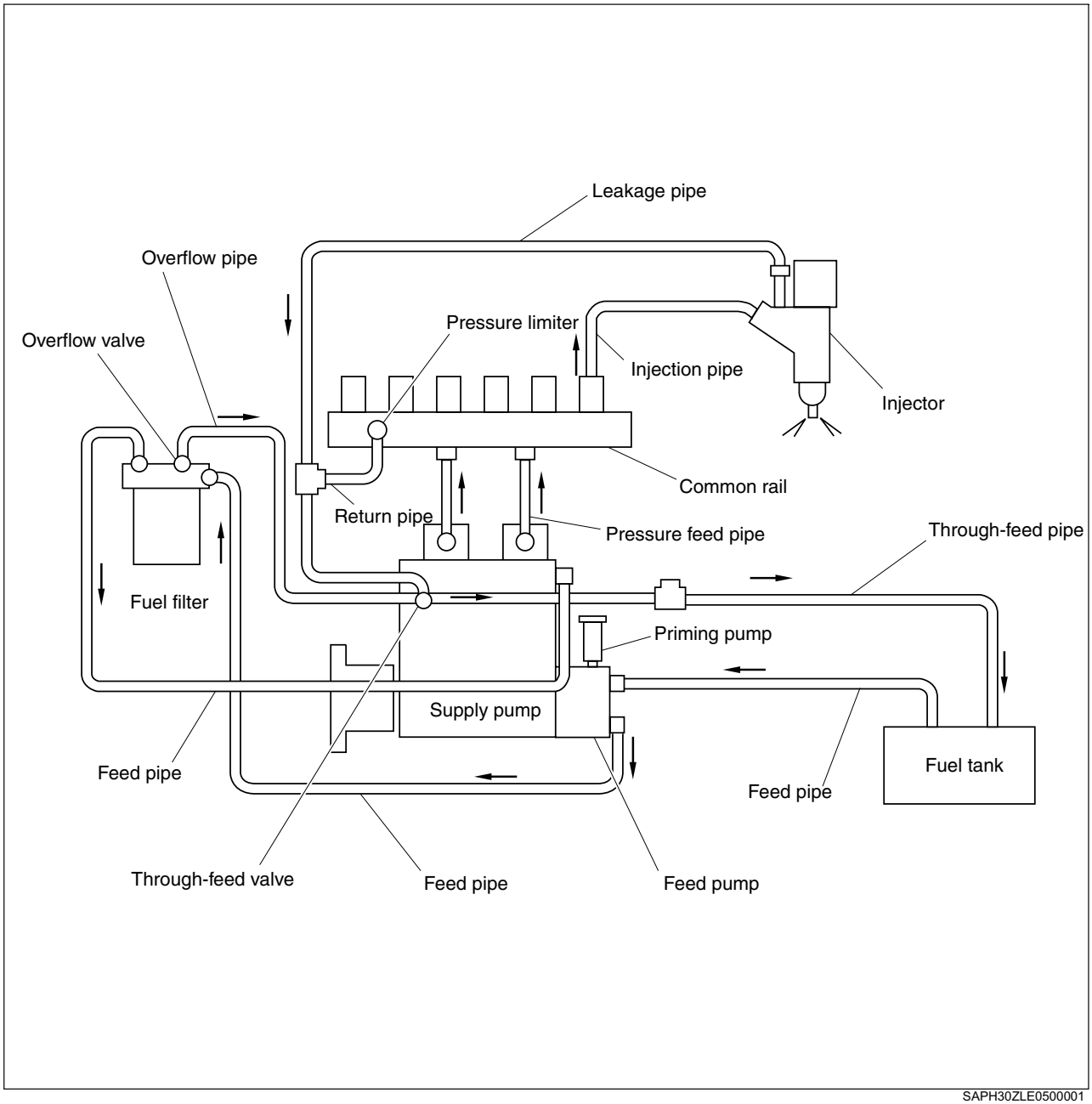
⚠ CAUTION

- **Do not operate the starter for more than 15 seconds.**
- **Since the air cleaner is removed, prevent entry of dirt.**

FUEL SYSTEM

Fuel system diagram

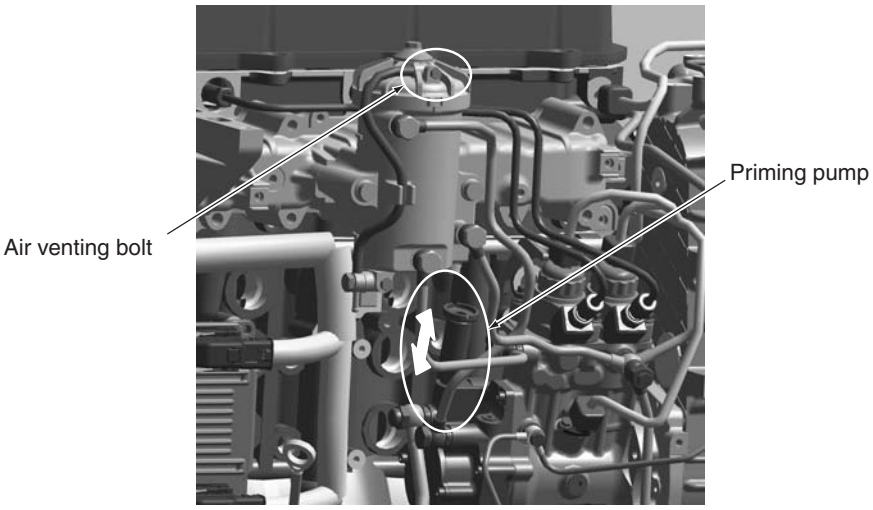
JP30ZLE050805001



SAPH30ZLE0500001

(5) Tighten the fuel filter water drain plug and the joint bolt.
Tightening torque : 6.9±2N·m {70±20kgf·cm, 5±1 lbf·ft} (Water drain bolt)

(6) Operate the priming pump and bleed the air from the system.



SAPH30ZLE0500014

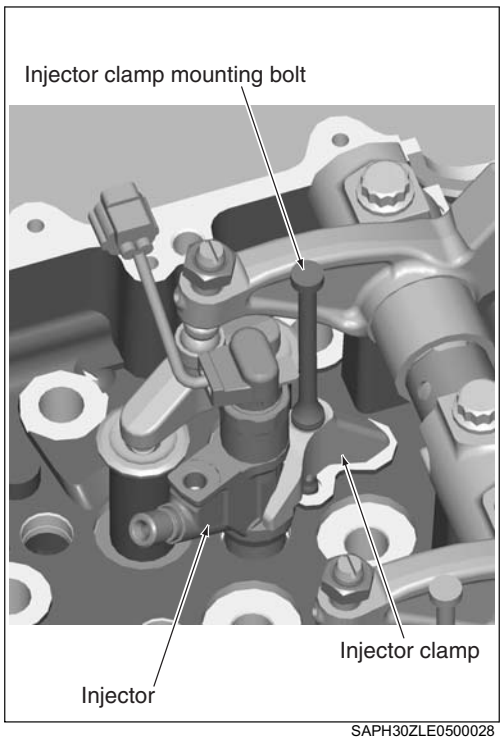
⚠ **CAUTION**
- **Check that the fuel filter air venting plug has been loosened.**

(7) Tighten the fuel filter air venting plug.
Tightening torque : 6.9±2N·m {70±20kgf·cm, 5±1 lbf·ft}

⚠ **CAUTION**
- **After completion of the work, wipe up any fuel which has been spilled and after start of the engine, again confirm that no fuel is leaking.**
- **As air enters into the fuel piping during the work, air bleeding must be performed after completion of the work.**

3. Injector removal

(1) Remove the injector clamp mounting bolts and remove the injectors and the injector clamps.



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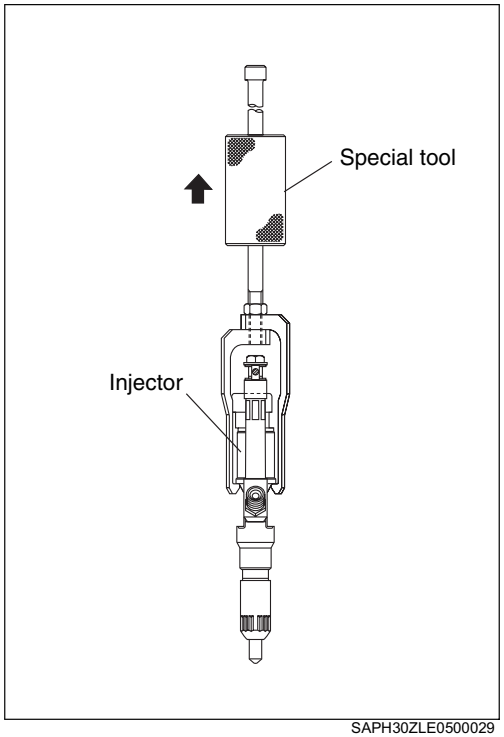


SAPH30ZLE0500029

NOTICE

- **When pulling is difficult, use a special tool for pulling.**

Special tool : S0942-02010 (09420-2010) Puller

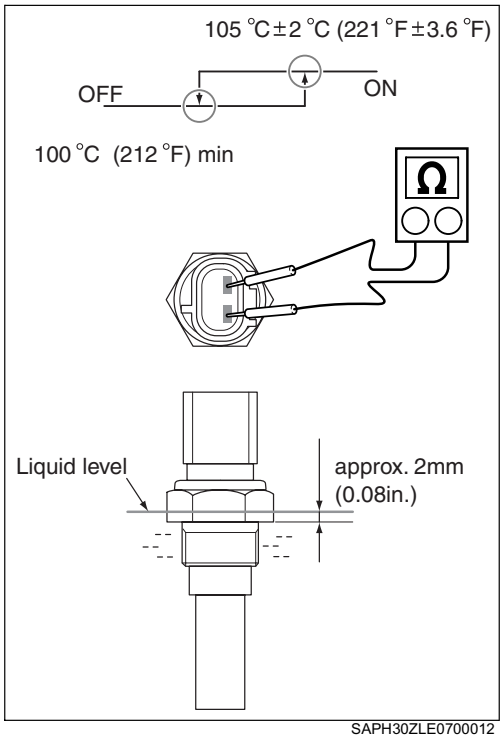
Flow damper

1. Inspection of the flow damper

(1) Start the engine and change the engine revolution from idling to full throttle. Use Hino-DX to check the diagnosis code of the "flow damper operation".
Refer to the "17 Engine diagnosis code, P0263[61], P0266[62], P0269[63], P0272[64], P0275[65], P0278[66]".

(2) If the diagnosis code of the "flow damper operation" is detected, replace the relevant injector and inspect it again.
If replace the injector, must be reprogramming.
Refer to the "Injector replacement".

(3) If reproducible after replacing the injector, replace the common rail.



SAPH30ZLE0700012

4. Inspection of the coolant temperature switch

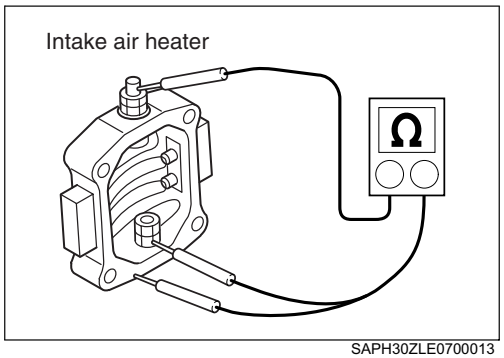
(1) Heat the coolant temperature switch.

NOTICE

- **The liquid used to inspection can use any of the glycerin, the silicon oil, the rapeseed oil, and the anti-freeze.**

(2) Measure continuity between the terminals, using a circuit tester. If it is faulty, replace the coolant temperature switch.

Measurement item	Reference value
105°C ± 2°C {221°F ± 3.6°F} or more	**Conductivity**
100°C {212°F} or less	**No conductivity**

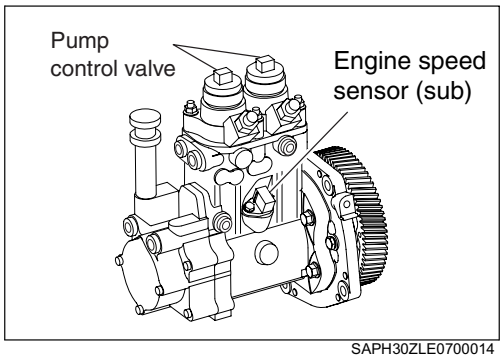


SAPH30ZLE0700013

5. Inspection of the intake air heater

(1) Measure continuity between terminals and the body and the terminal using a circuit tester. If it is faulty, replace the intake air heater.

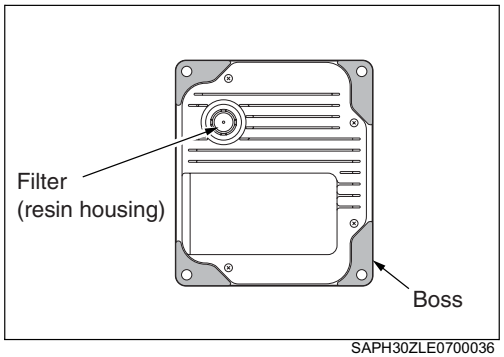
Inspection item	Reference value
Between terminals	**With continuity**
Between the terminal and the body	**Without continuity**



SAPH30ZLE0700014

6. Inspection and replacement of the pump control valve (PCV) and engine speed sensor (Sub)

(1) If the pump control valve (PCV) and the engine speed sensor are faulty, remove them from the engine in the supply pump assembly and request for reinspection at the Denso service shop.



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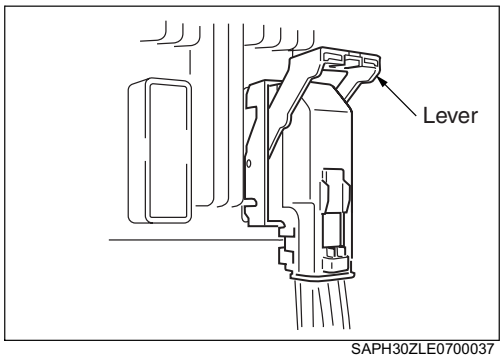
- **Check that there is no dirt on the bosses (4 locations) on the rear of the engine ECU.**
- **Confirm that the filter (resin housing) on the rear of the engine ECU is not broken or contaminated by oil.**

Mounting the engine ECU connector

1. Attaching the engine ECU connector

(1) Check that the harness side connector lever is fully open and place it straight on the engine ECU side connector.



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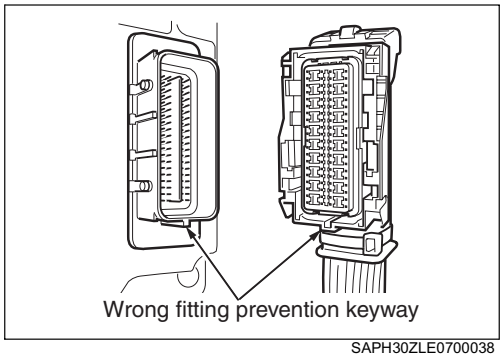
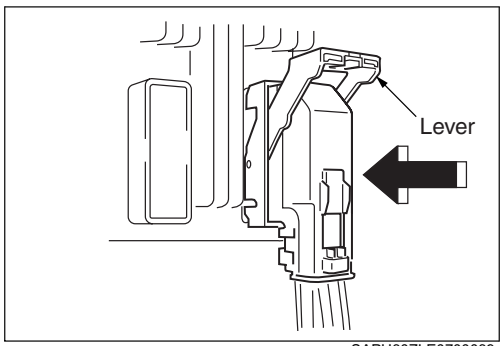
⚠ CAUTION
- **At this time, check that the lever is fully open.**



SAPH30ZLE0700038

NOTICE
- **Check that it is inserted along the wrong fitting prevention keyway.**

(2) Press the upper part of the harness side connector and insert the connector uniformly.



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Cylinder Head

Part layout

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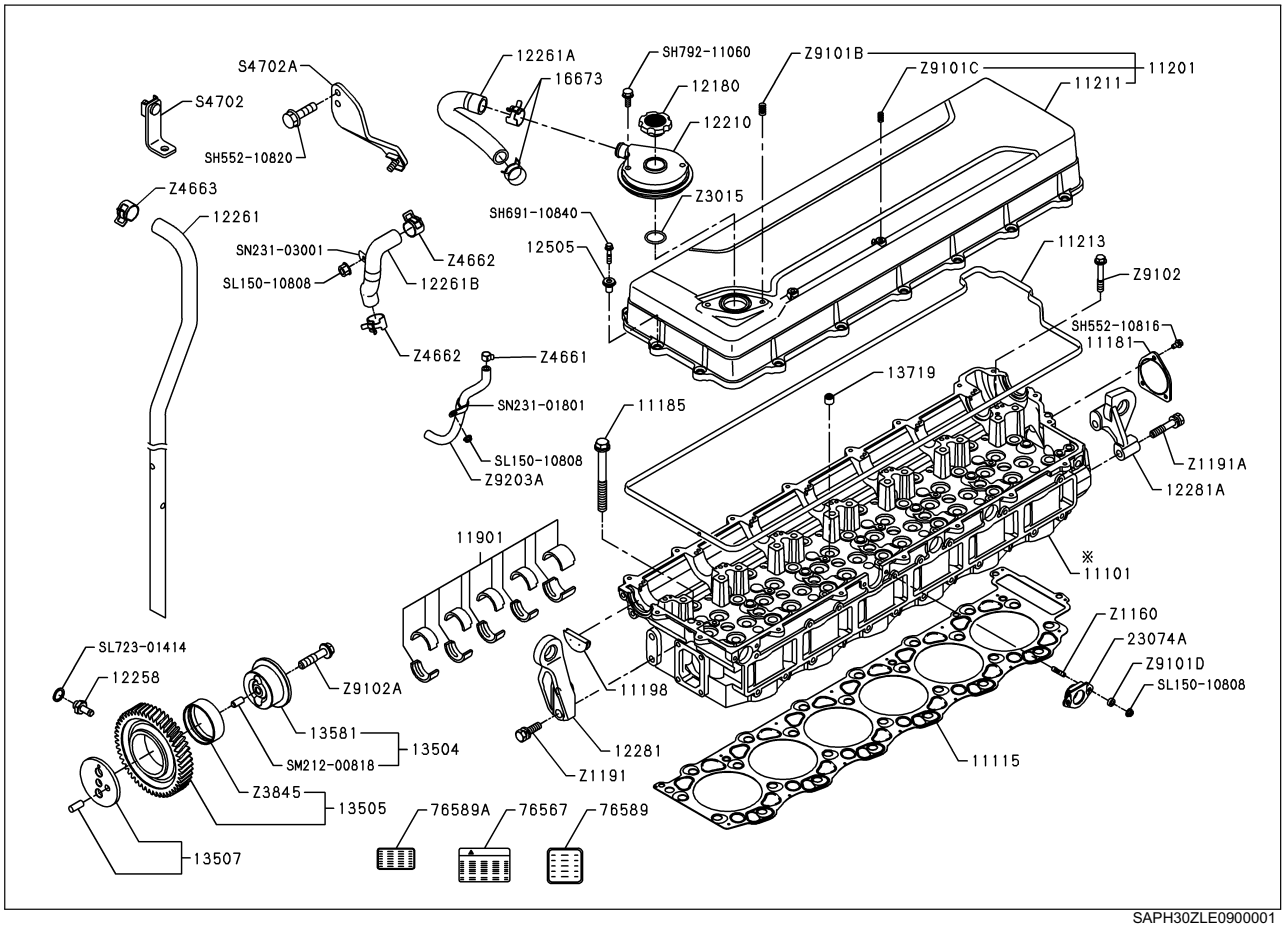

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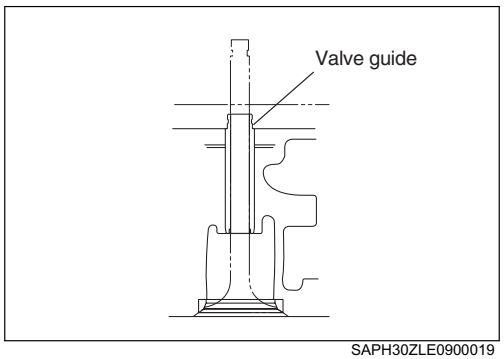
11101	Cylinder head assembly	11213	Head cover gasket*
11115	Cylinder head gasket*	12281	Engine hanger
11181	Cylinder head plate	12281A	Engine hanger
11185	Cylinder head bolt	12505	Silent block
11198	Semicircular plug	13719	Valve stem seal
11201	Cylinder head cover	23074A	Common rail pressure sensor seal*

*Parts not to be reused.

Tightening torque

11185	Cylinder head - Cylinder block: 118N·m {1,200kgf·cm, 87 lbf·ft}+90°+90°	Z9102	Additional bolt 108N·m {1,100kgf·cm, 80 lbf·ft}
SH691-10840	25N·m {250kgf·cm, 18 lbf·ft}		



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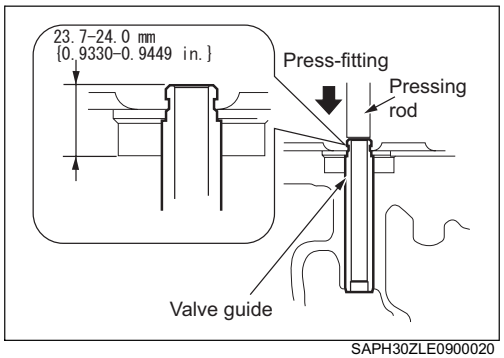
3. Valve guide replacement

(1) Remove the valve stem seal.

(2) Use a brass bar and a press or similar to remove the valve guide.



SAPH30ZLE0900020

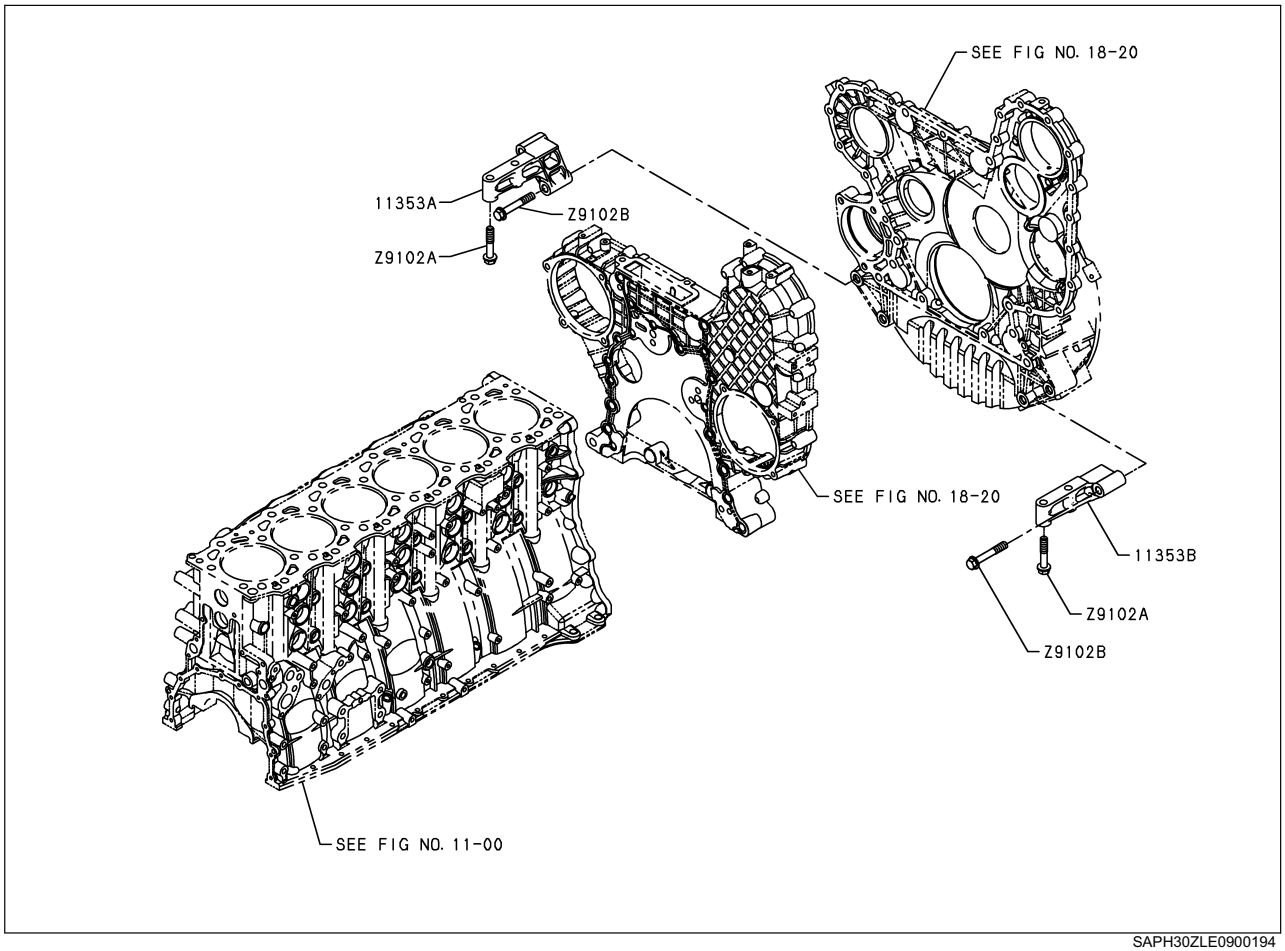
(3) apply engine oil to the outer circumference of the valve guide.

(4) Press in the valve guide to the cylinder head using a press, as shown in the figure.

⚠ **CAUTION** • **At the time of press fitting the valve guide, take care not to damage the valve stem.**

Standard value	**23.7 - 24.0 mm {0.9330-0.9449 in.}**

(5) Install a new valve stem seal.
Refer to the "9 Engine mechanical, Valve system, overhaul".



SAPH30ZLE0900194

11353A	Flywheel housing stay	11353B	Flywheel housing stay

Tightening torque

Z9102A	225N·m {2,300kgf·cm, 166 lbf·ft}	Z9102B	225N·m {2,300kgf·cm, 166 lbf·ft}

Crankshaft rear oil seal and sleeve replacement

1. Flywheel removal

(1) Remove the flywheel.
Refer to the "9 Engine mechanical, Main Moving Parts, Flywheel replacement".

2. Crankshaft rear oil seal removal

(1) Remove the rear oil seal with a pliers.

⚠ **CAUTION** • **Do not reuse the oil seal.**

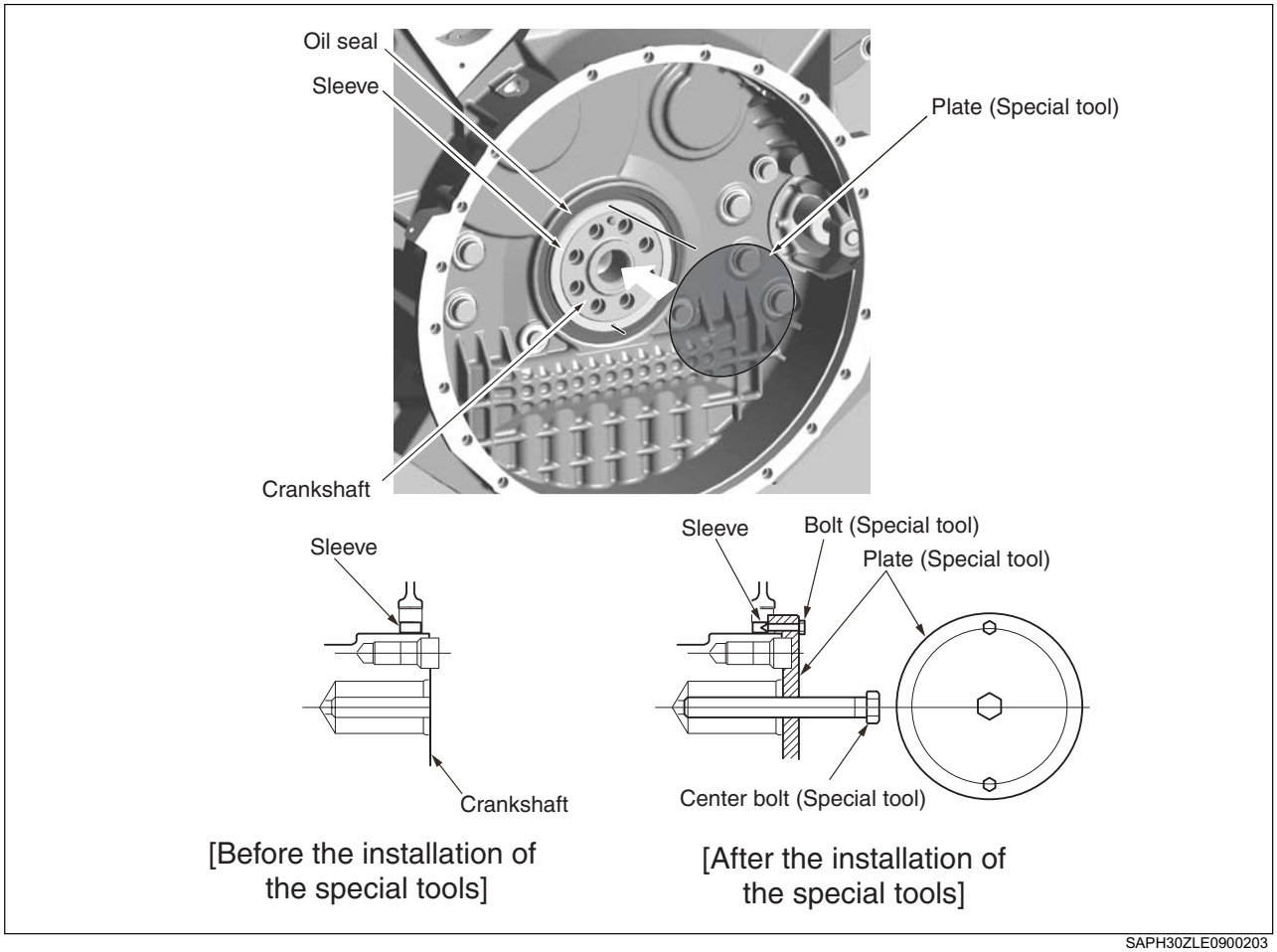
3. Crankshaft rear sleeve removal

(1) Place the plate (Special tool) at the crankshaft and tighten the 2 bolts (Special tool) to the sleeve.

(2) Install the center bolt (Special tool) and tighten it to remove the oil sleeve.

Special tool

Plate	**09223-E0850**
Bolt	**SH111-00635**
Center bolt	**SZ101-12048**

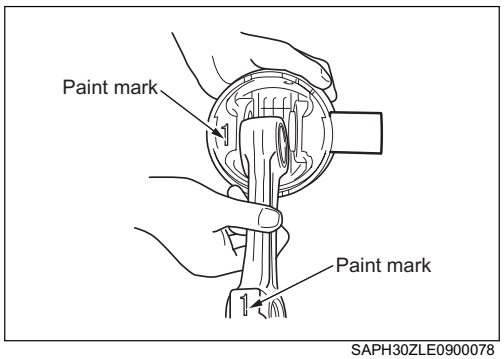


SAPH30ZLE0900203

2. Disassembly of piston and connecting rod

(1) Use snap ring pliers to remove the retainer ring.

(2) Make match marks, and use a brass bar to remove the piston pin and separate piston and connecting rod.



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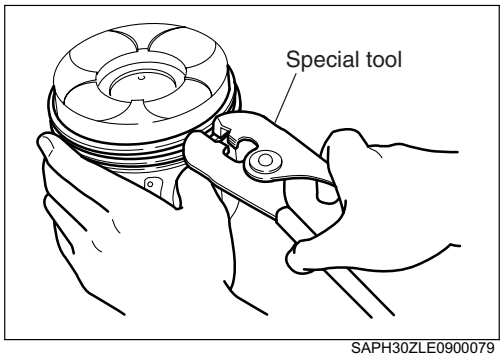


SAPH30ZLE0900079

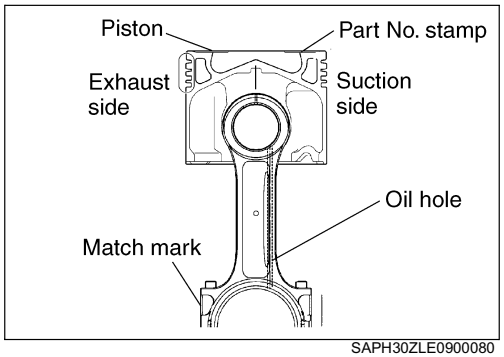
(3) Use the special tool and remove the piston ring.

⚠ **CAUTION**
- **Handle the piston rings with care as they break easily.**
- **Identify and store the piston rings in order of the cylinder numbers.**
- **At the time of storage, take care not to mix the upper and lower surface of the piston rings.**

Special tool : S0944-21131 (09442-1131)
Piston ring expander

3. Assembly of piston and connecting rod

(1) Install the piston so on the connecting rod that the piston part number stamp and the match mark stamp of the connecting rod are on opposite sides.



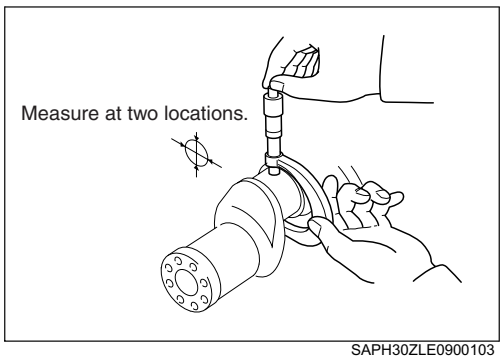
SAPH30ZLE0900080

⚠ **CAUTION**
- **Confirm that the oil hole offset is as shown in the figure.**

Special tool : S0948-21380 (09482-1380)
Piston pin press

(2) Use snap ring pliers to install a new retainer ring.

⚠ **CAUTION**
- **Confirm that there is no looseness of the retainer ring.**



SAPH30ZLE0900103

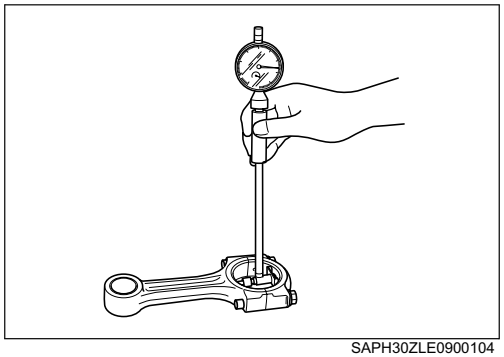
9. Connecting rod oil clearance inspection

(1) Use a micrometer and measure the outer diameter of the crank pin part of the crankshaft.

Standard value (mm{in.})	Operation limit (mm{in.})
90 {3.543}	89.8 {3.5354}

(2) After installing a bearing at the large end of the connecting rod and installing a cap, tighten the connecting rod bolt with the specified torque.

(3) Use a cylinder bore and measure the inner diameter of the bearing at the large end of the connecting rod.


SAPH30ZLE0900104

(4) Calculate the difference between the outer diameter of the crankshaft crank pin and the inner diameter of the connecting rod bearing. Replace the connecting rod bearing if the operation limit is exceeded.

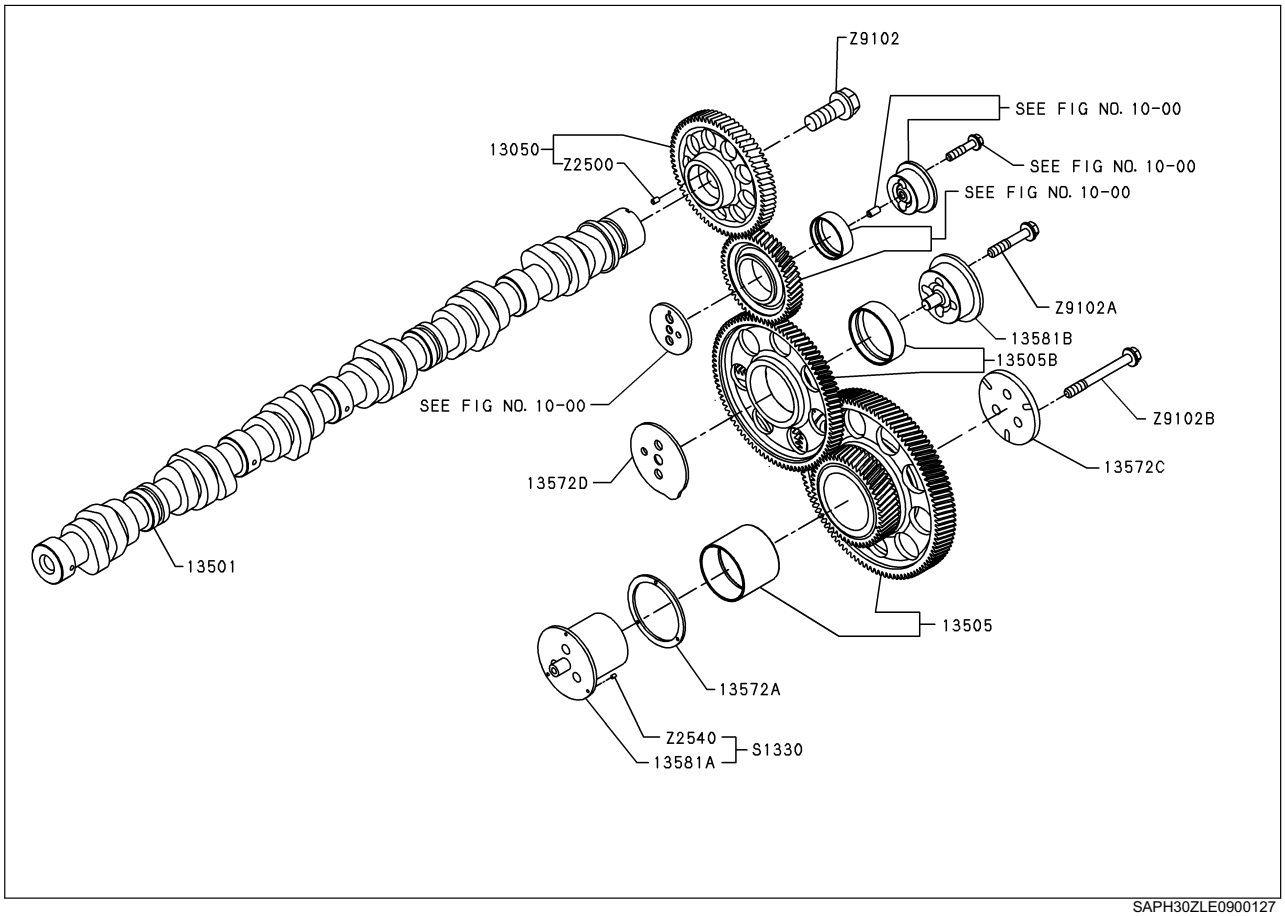
NOTICE • **The crankshaft can be repaired by grinding.**

Standard value (mm{in.})	Operation limit (mm{in.})
0.049-0.100 {0.0019-0.0039}	0.30 {0.0118}

Camshaft and Idle Gear

Part layout

JP30ZLE090402005



SAPH30ZLE0900127

13501	Camshaft assembly	13572C	Idle gear thrust plate
13050	Camshaft gear	13572D	Idle gear thrust plate
13505	Cam idle gear	13581B	Idle gear shaft
13505B	Cam idle gear (Block)	S1330	Idle gear shaft

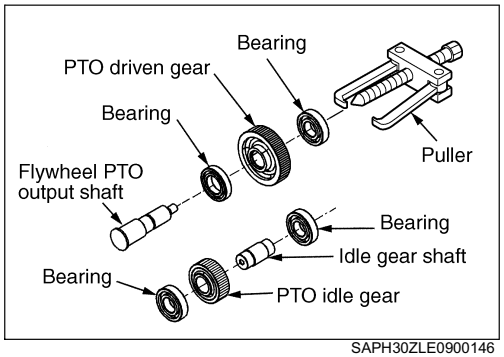
Tightening torque

Z9102	157N·m {1,600kgf·cm, 116 lbf·ft}+43°	Z9102B	59N·m {600kgf·cm, 44 lbf·ft}+45°
Z9102A	59N·m {600kgf·cm, 44 lbf·ft}+45°		

Flywheel PTO disassembly

1. PTO driven gear and PTO idle gear disassembly

(1) Using a puller, remove the bearings and gears from the shafts.

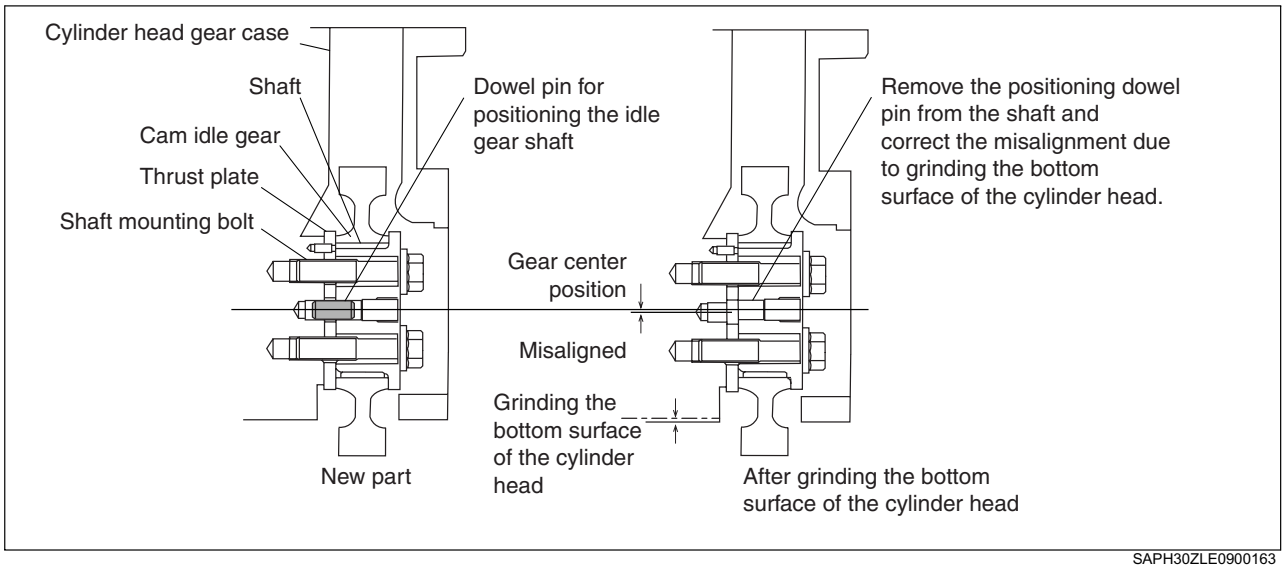


SAPH30ZLE0900146

3. Idle gear position adjustment at the time of polishing the lower surface of the cylinder head or the upper surface of the block

NOTICE

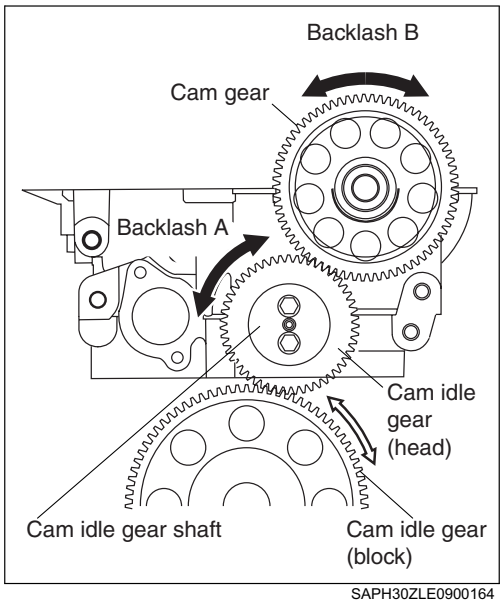
- **When grinding the cylinder head bottom surface or block upper surface, the relative position between the cam idle gear (head) and cam idle gear (block) is close. Therefore, it is necessary to adjust the position of the cam idle gear (head) to ensure proper regular backlash.**
- **By removing the locating dowel pin of the cam idle gear (head) shaft, it is possible to slide the position of the cam idle gear shaft as long as the length of the loose hole of the mounting bolt hole.**



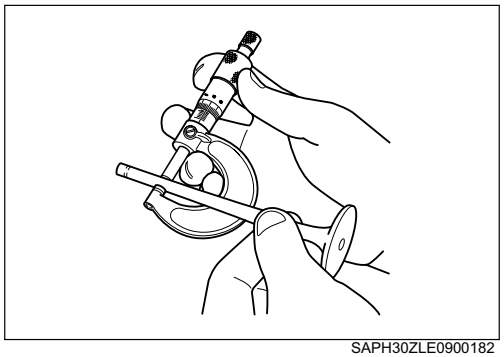
SAPH30ZLE0900163

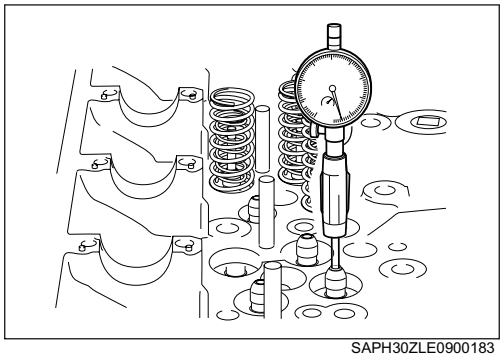
(1) If the flywheel housing is assembled and the backlash of each gear cannot be measured,

a. Before grinding, measure the backlash B of the cam gear and backlash A of the cam idle gear.



SAPH30ZLE0900164


SAPH30ZLE0900182


SAPH30ZLE0900183

7. Oil clearance inspection for valve guide and valve stem

(1) Use a micrometer to measure the outer diameter of the valve stem.

Measurement item	Standard value (mm{in.})	Operation limit (mm{in.})
Intake valve stem	**10 {0.3937}**	**9.85 {0.3878}**
Exhaust valve stem	**10 {0.3937}**	**9.80 {0.3858}**

(2) Use a cylinder bore gauge to measure the inner diameter of the valve guide.

Measurement item	Standard value (mm{in.})
Intake valve guide	**10 {0.3937}**
Exhaust valve guide	**10 {0.3937}**

(3) Calculate the difference between the outer diameter of the valve stem and the inner diameter of the valve guide. Replace valve and valve guide if the operation limit is exceeded.

Measurement item	Standard value (mm{in.})	Operation limit (mm{in.})
Intake valve oil clearance	**0.040-0.077 {0.016-0.0030}**	**0.30 {0.0118}**
Exhaust valve oil clearance	**0.057-0.094 {0.0022-0.0037}**	**0.35 {0.0138}**

2. Stud bolt replacement

(1) If a stud bolt shows corrosion or other defects, use a Torx socket or a commercial stud bolt remover to remove it.

(2) Remove any dirt (sealant etc.) from the female thread on the side of the cylinder head and then clean the thread again with a tap (M10 x 1.5).

(3) Use a Torx socket to screw in a new stud bolt.
Tightening torque : 30 N·m {300 kgf·cm, 22 lbf·ft}

⚠ **CAUTION** • **Please use sufficient care, as tightening with excessive torque can cause the cylinder head to crack etc.**

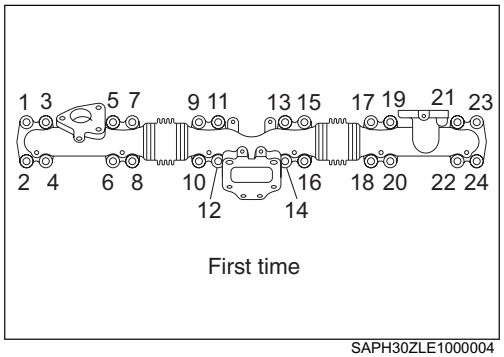
3. Exhaust manifold installation

(1) Replace the gasket with a new one and align the exhaust manifold with the cylinder head.

(2) Tighten the nuts from the left sequentially from the top down.

Tightening torque : 44 N·m {450 kgf·cm, 32 lbf·ft}

⚠ **CAUTION** • **Install the gasket with the coated side (dark gray surface) towards the exhaust manifold.**

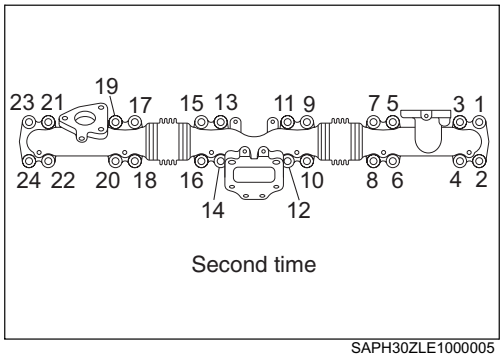


SAPH30ZLE1000004

(3) Tighten the nuts again from the right sequentially from the top down.

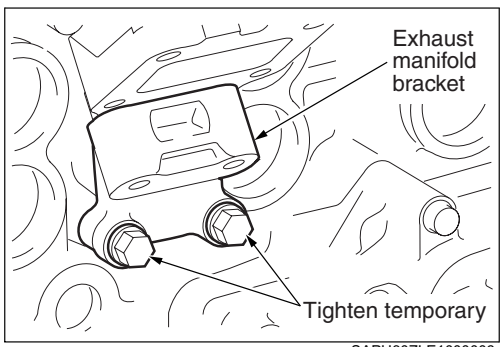
Tightening torque : 59 N·m {600 kgf·cm, 44 lbf·ft}

⚠ **CAUTION** • **Be sure to tighten twice.**



SAPH30ZLE1000005

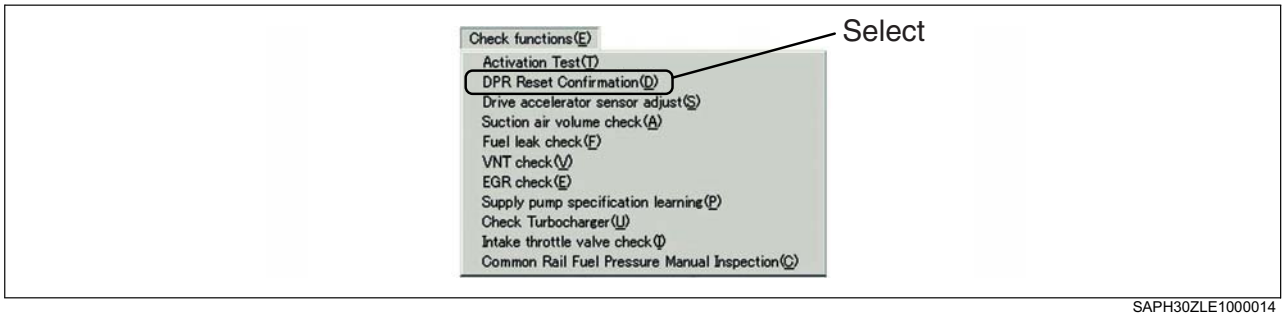
(4) Tighten the bolts (2 pcs.) at the exhaust manifold under side loosely.



SAPH30ZLE1000006

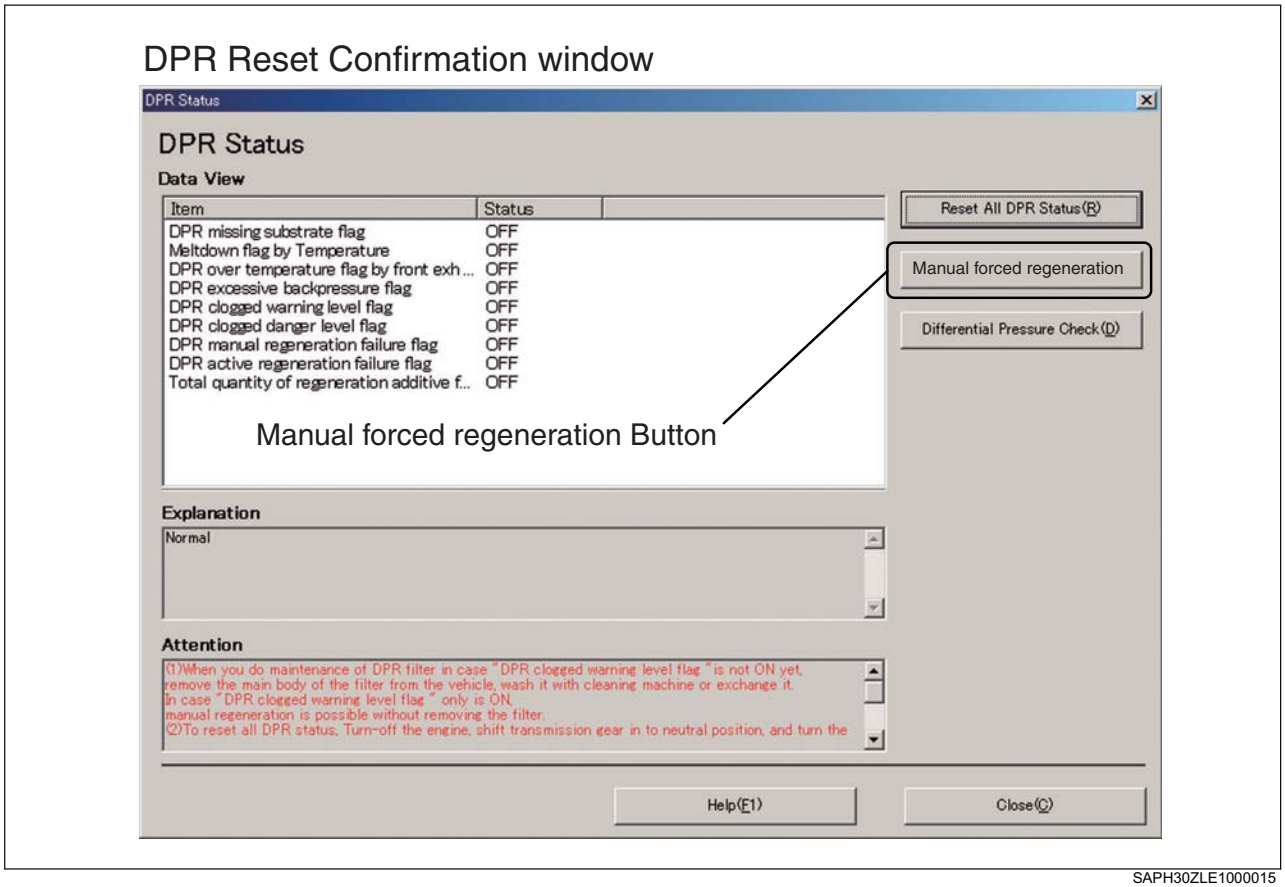
2. Forced regeneration

(1) Select the "DPR Reset confirmation" in the "Check function" menu of HinoDX after system fix is made.
Menu:[Check function]-[DPR Reset Confirmation]

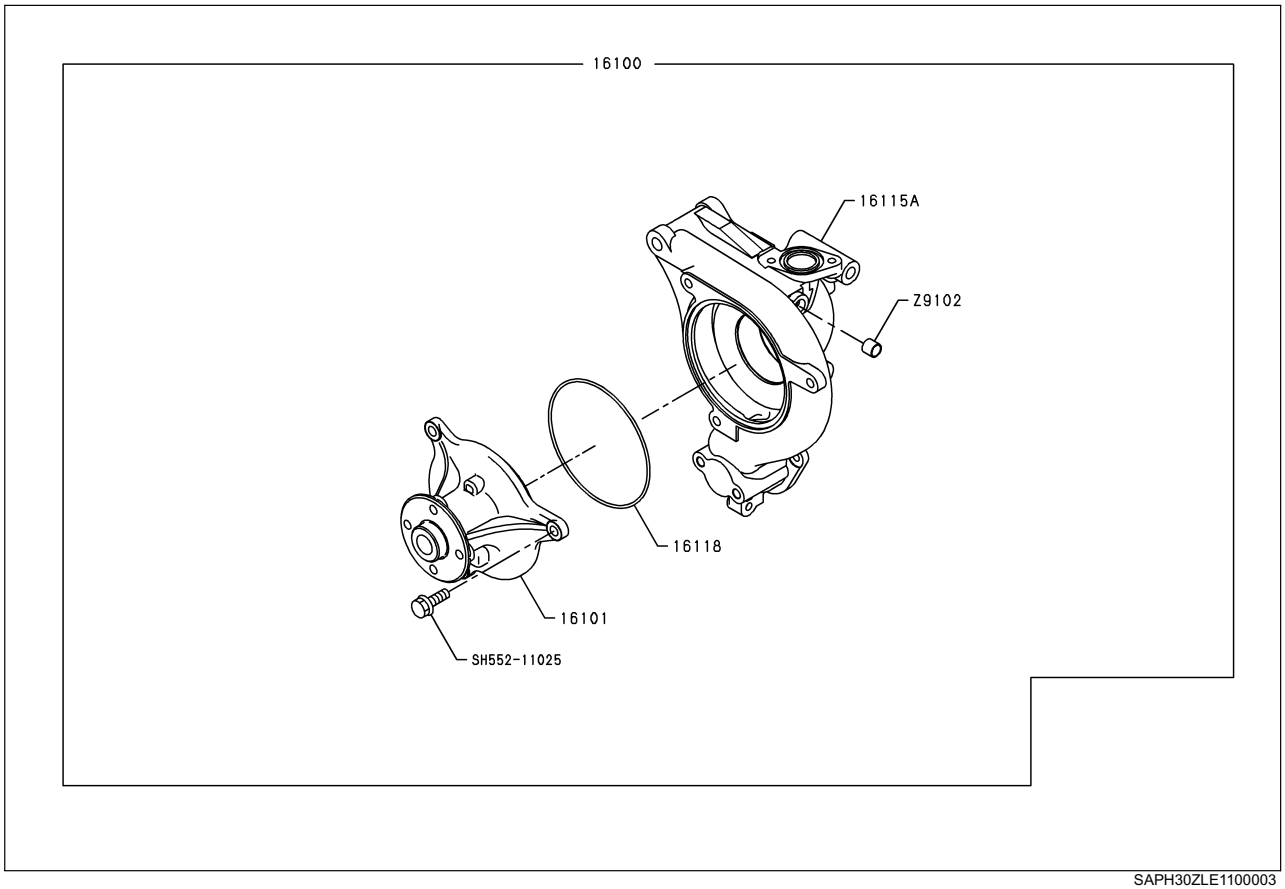


SAPH30ZLE1000014

(2) Forced regeneration is done by the "Forced regeneration" screen.
If you click the "Manual regeneration" Button, DPR Manual regeneration switch will be shown.



SAPH30ZLE1000015



SAPH30ZLE1100003

16100	Pump assembly, water	16118	O-ring*
16101	Case sub assembly, coolant pump	16115A	Coolant pump case

*Parts not to be reused.

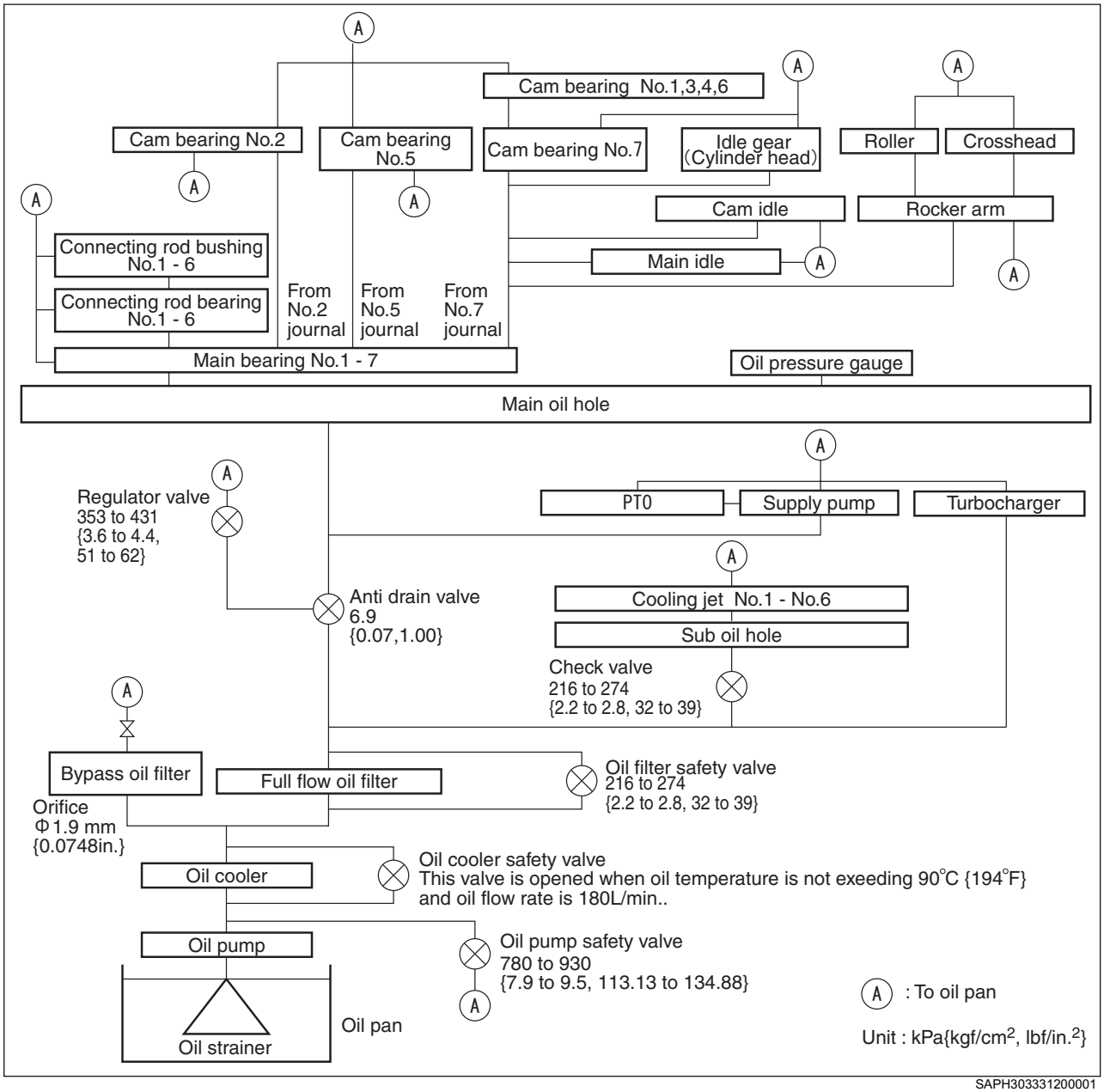
Tightening torque

SH552-11025	55N·m {560kgf·cm, 40 lbf·ft}	

Lubrication System

System drawing

JP30ZLE120805001



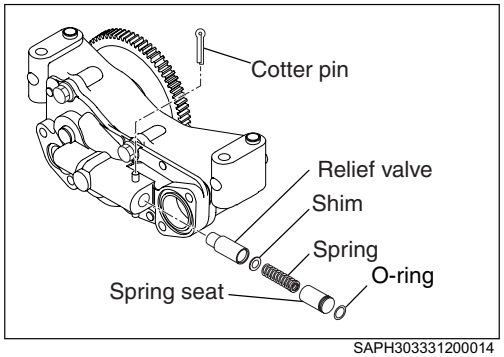
SAPH303331200001

Overhaul

JP30ZLE120703005

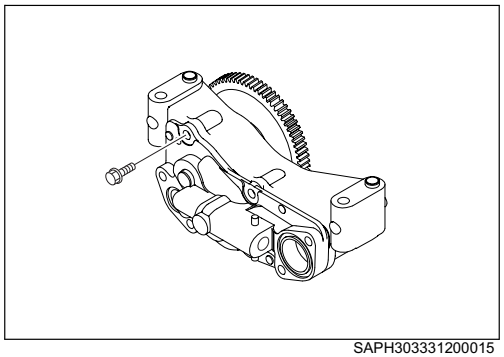
1. Disassembly of oil pump

(1) Remove the cotter pin and remove spring seat, shim, O - ring, spring and relief valve.



SAPH303331200014

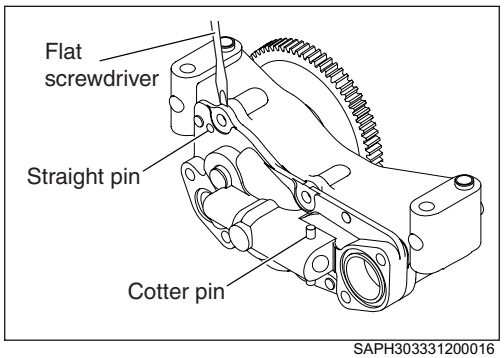
(2) Remove the oil pump body and oil cover mounting bolt.



SAPH303331200015

(3) Insert a flat screwdriver near the straight pin connection part and open the oil pump body.

⚠ **CAUTION** • **Work carefully to prevent damage to the connection surface.**

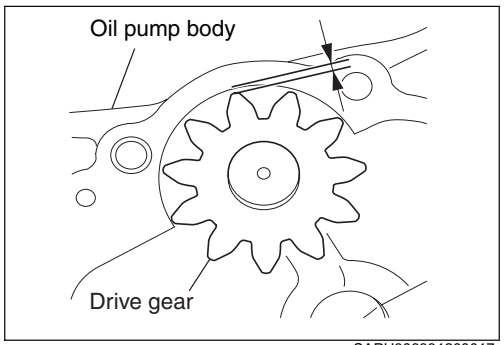


SAPH303331200016

2. Inspection of oil pump

(1) Clearance inspection for drive gear and oil pump body

a. Measure the clearance between drive gear and oil pump body with a thickness gauge. Replace the oil pump assembly if the operation limit is exceeded.



SAPH303331200017

Standard value (mm{in.})	Operation limit (mm{in.})
0.095 - 0.150 {0.0037 - 0.0059}	0.20{0.0079}

Disassembly

JP30333130703001

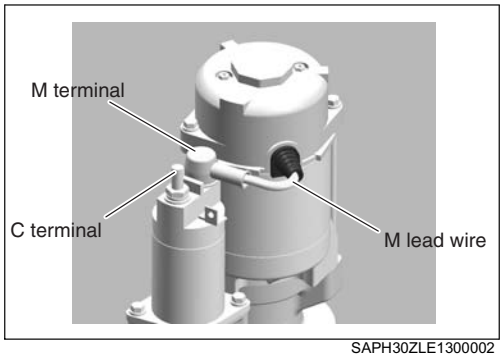
NOTICE **Fix the starter on the working table to ease accessibility.**

1. Removal of the start magnet switch assembly

(1) Remove the cap of the M terminal and C terminal.

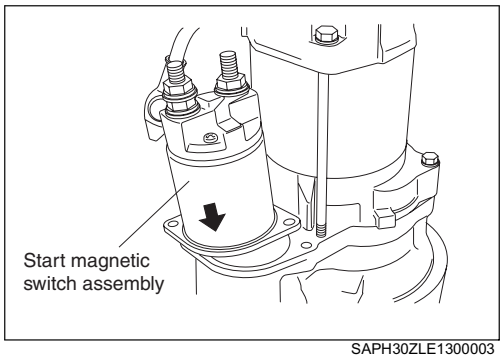
(2) Remove the nut and remove the C lead wire.

(3) Remove the nut and remove the M lead wire.



SAPH30ZLE1300002

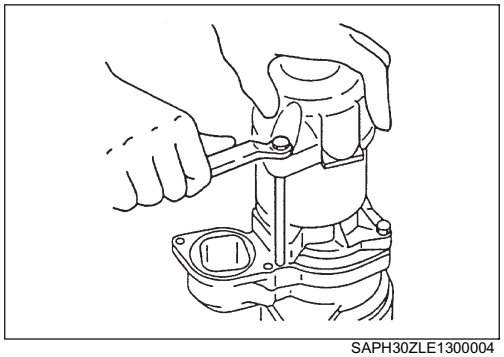
(4) Remove the bolts and remove the start magnetic switch assembly.



SAPH30ZLE1300003

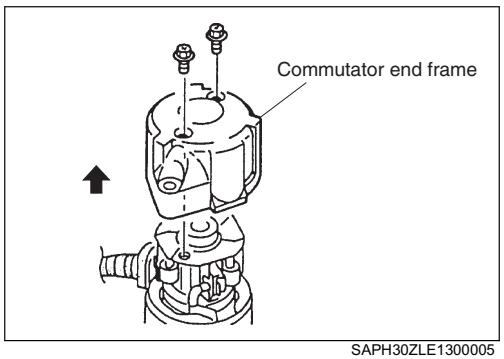
2. Removal of the commutator end frame

(1) Remove the through bolt.

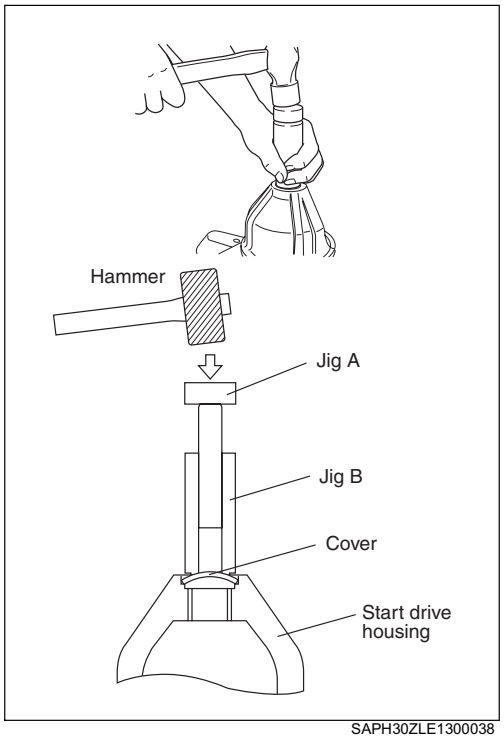


SAPH30ZLE1300004

(2) Remove the bolts and remove the commutator end frame.

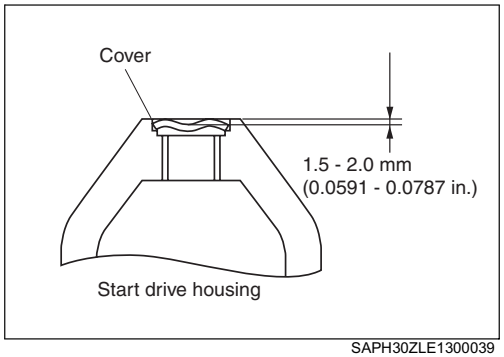


SAPH30ZLE1300005



SAPH30ZLE1300038

(6) Put the jig A, B to the cover from outside of the start drive housing and install the cover tapping with a hammer.



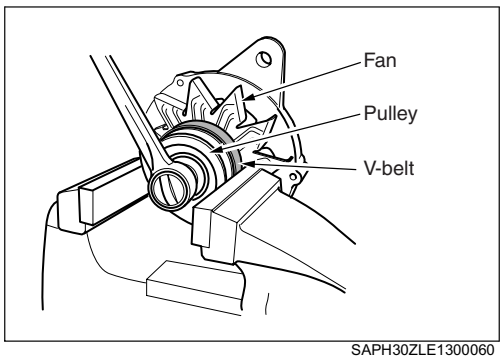
SAPH30ZLE1300039

⚠ **CAUTION**

- **Install the cover to become the depth of 1.5 - 2.0 mm (0.0591 - 0.0787 in.) from the pinion case top.**

2. Disassembly of drive end frame

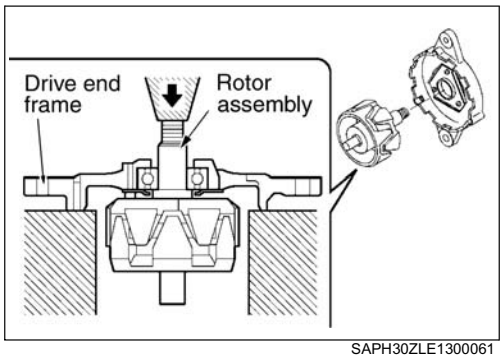
(1) Remove the nuts and remove the pulley, fan and collar.



SAPH30ZLE1300060

⚠ **CAUTION**
- **Tie around a general V –belt in the pulley groove and fix the pulley with a vice.**
- **Do not reuse if outer frame of the pulley was damaged.**

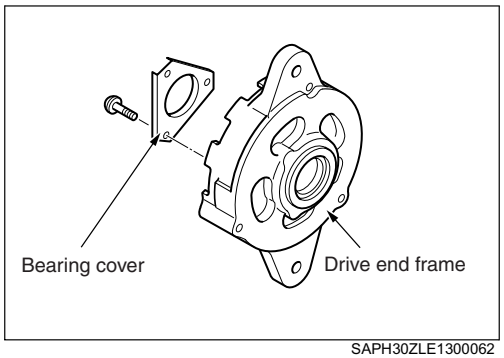
(2) Remove the rotor assembly from the drive end frame using a press.



SAPH30ZLE1300061

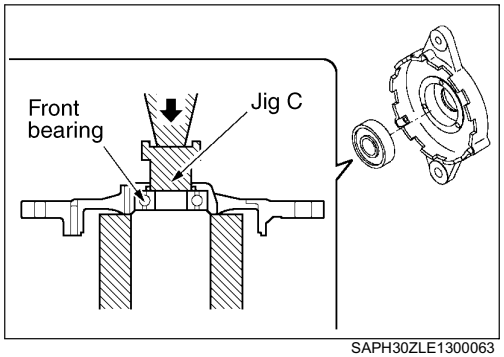
⚠ **CAUTION**
- **Do not damage the end of the thread.**
- **Support the rotor assembly to prevent fall of the rotor assembly.**

(3) Remove the screws (3pcs.) and remove the bearing cover from the drive end frame.



SAPH30ZLE1300062

(4) Remove the front bearing from the drive end frame using a press or jig C.



SAPH30ZLE1300063

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

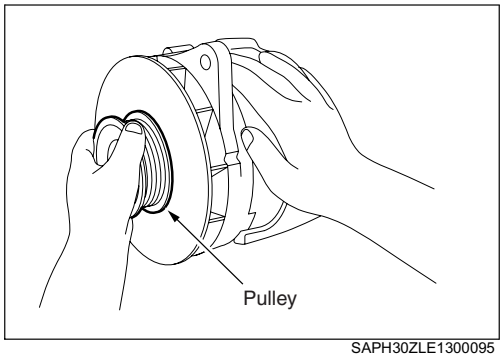
Inspection after assembly (60A)

JP30333130703007

1. Inspection of rotation

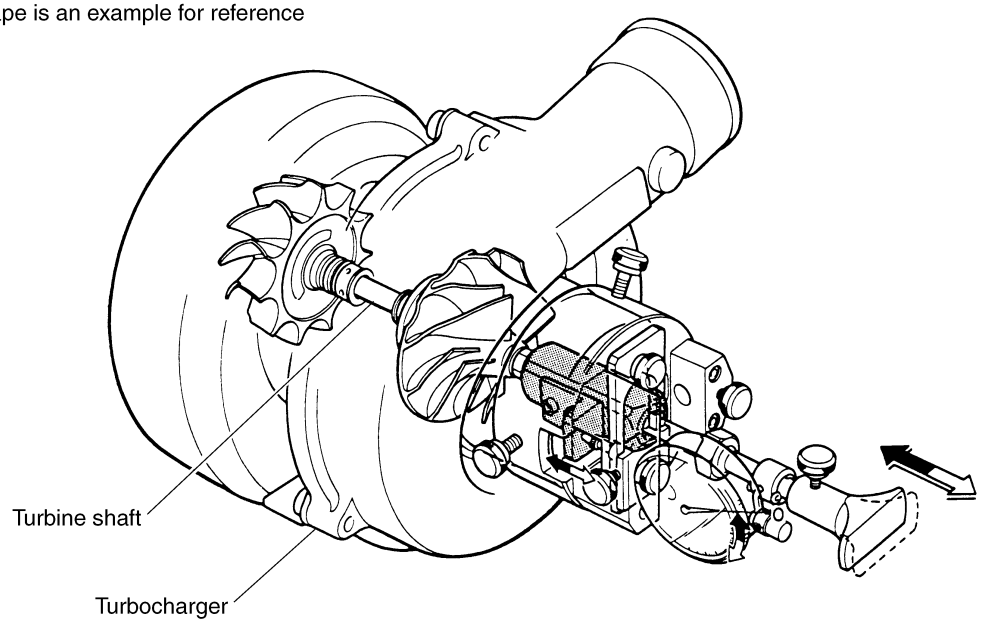
⚠ **CAUTION** • **Place a rubber mat and perform work on the mat.**

(1) Turn the pulley with hand to check if there is no interference with internal parts and if rotation is smooth.



SAPH30ZLE1300095

※ The shape is an example for reference



Measuring the play in axial direction

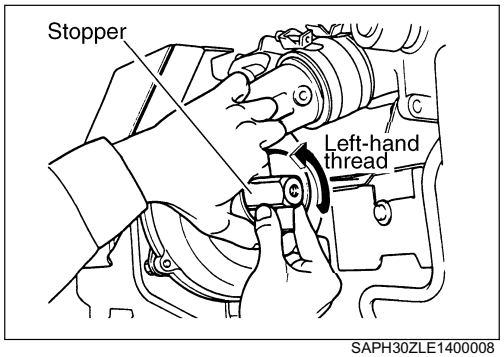
SAPH30ZLE1400007

3. Inspection of the play in radial direction

NOTICE

- **The illustration for play inspection is an example for use of the tool assembly. The parts around the turbocharger in the illustrations differ from the actual engine.**

(1) Screw the stopper into the exposed thread of the lock nut at the tip of the blower impeller.

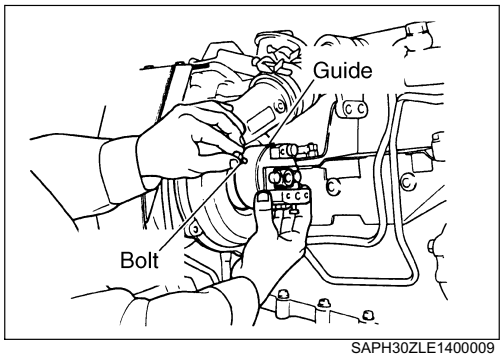


SAPH30ZLE1400008

⚠ CAUTION

- **The stopper has a left-hand thread.**

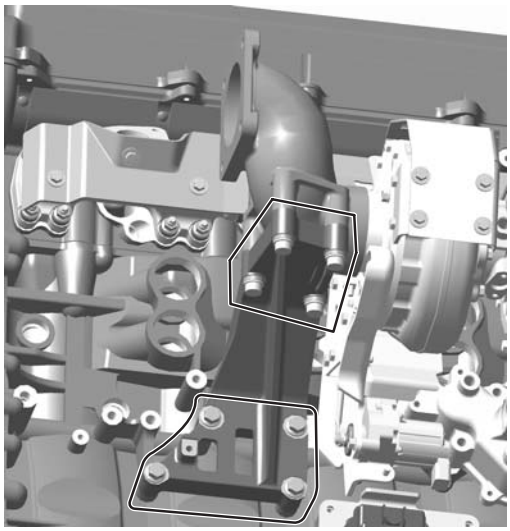
(2) Insert the guide into the air inlet side of the blower case and tighten the bolt to secure it.



SAPH30ZLE1400009

2. Installation of exhaust connector and exhaust connector bracket

(1) Replace the seal ring with a new one and install the exhaust pipe connector with the four bolts on the turbocharger and the bracket.
Tightening torque : 125N·m {1,275 kgf·cm, 92 lbf·ft}

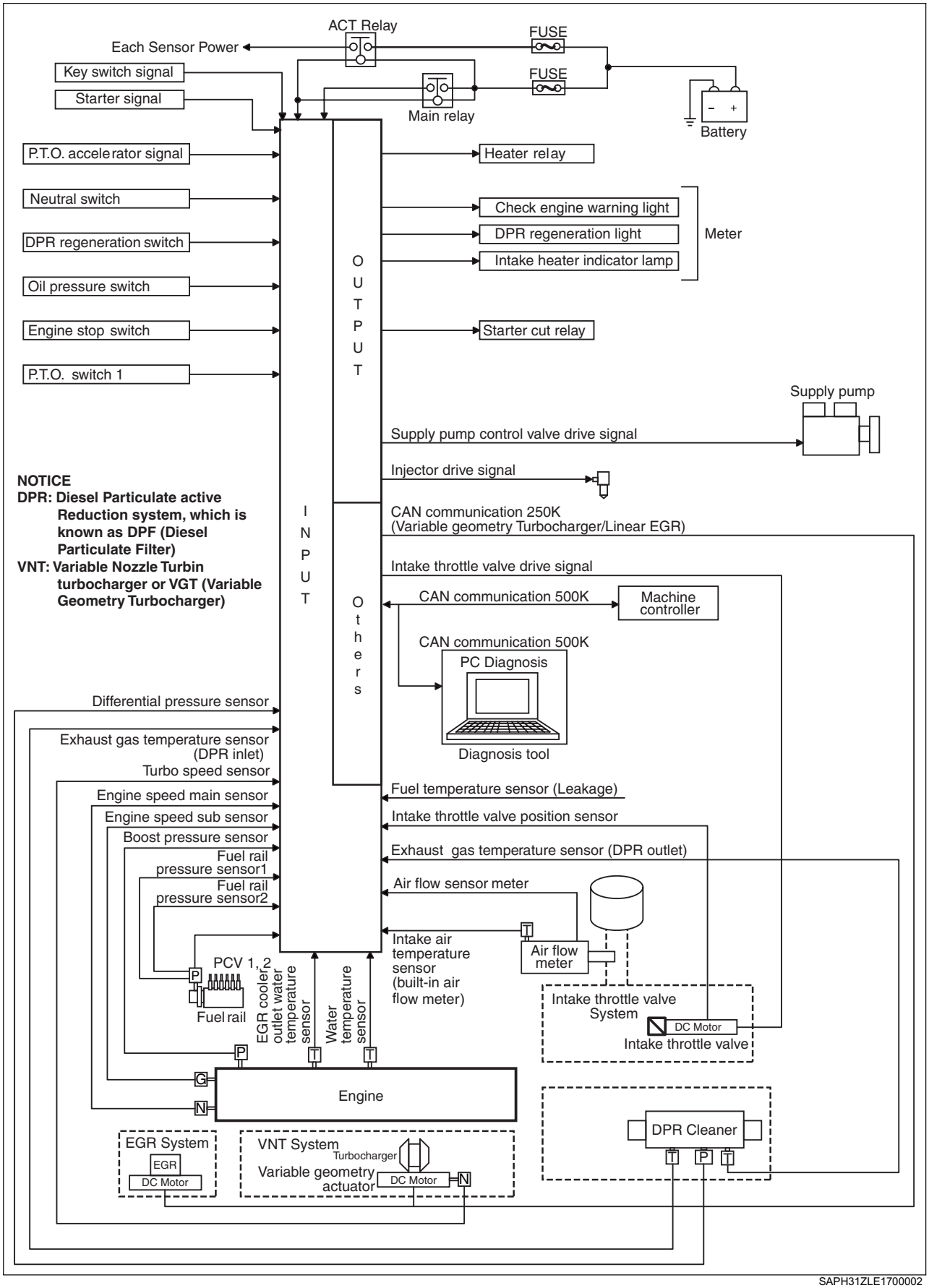


SAPH30ZLE1400023

Status	Cause	Action
Faulty engine start (fuel unit)	Insufficient fuel	Replenish fuel and bleed air from fuel system
	Clogging of fuel system	Clean fuel system.
	Air entering from connection of fuel system	Check sealing parts and replace
	Clogging of fuel filter	Replace fuel filter and air bleeding of fuel system
	Faulty fuel from fuel system	Check and replace sealing parts
	Fuel freezing	Warm up fuel pipes by hot water (60°C {140°F} below)
	Water in fuel tank	Discharge water
	Water in fuel filter	Discharge water
Faulty engine start (lubrication unit)	Excessive viscosity of engine oil	Replace with engine oil with correct viscosity
Faulty engine start (others)	Piston seizure	Replace piston, piston ring and cylinder liner
	Bearing seizure	Replace bearing and crankshaft
	Low compression pressure	Overhaul engine
	Damage to ring gear	Replace ring gear and replace starter pinion gear.
Faulty idling (fuel system)	Insufficient fuel	Replenish fuel and bleed air from fuel system
	Clogging of fuel system	Clean fuel system.
	Air entering from connection of fuel system	Check sealing parts and replace
	Clogging of fuel filter	Replace fuel filter and air bleeding of fuel system
	Faulty fuel from fuel system	Check and replace sealing parts
	Fuel freezing	Warm up fuel pipes by hot water (60°C {140°F} below)
	Water in fuel tank	Discharge water
	Water in fuel filter	Discharge water
Faulty idling (engine)	Faulty valve clearance	Adjustment of valve clearance
	Faulty contact of valve seat	Adjust or replace valve and valve seat.
	Low coolant temperature	Perform warm-up.
	Large variation of compression pressure between cylinders	Overhaul engine
	Training of engine difference not performed after exchange of the engine ECU	Perform training of engine difference after exchange of the engine ECU
Gas leak (head gasket)	Reuse	Replace gasket.
	Damage	Replace gasket.
	Replace gasket.	Replace gasket.

System block diagram

JP31ZLE170803001

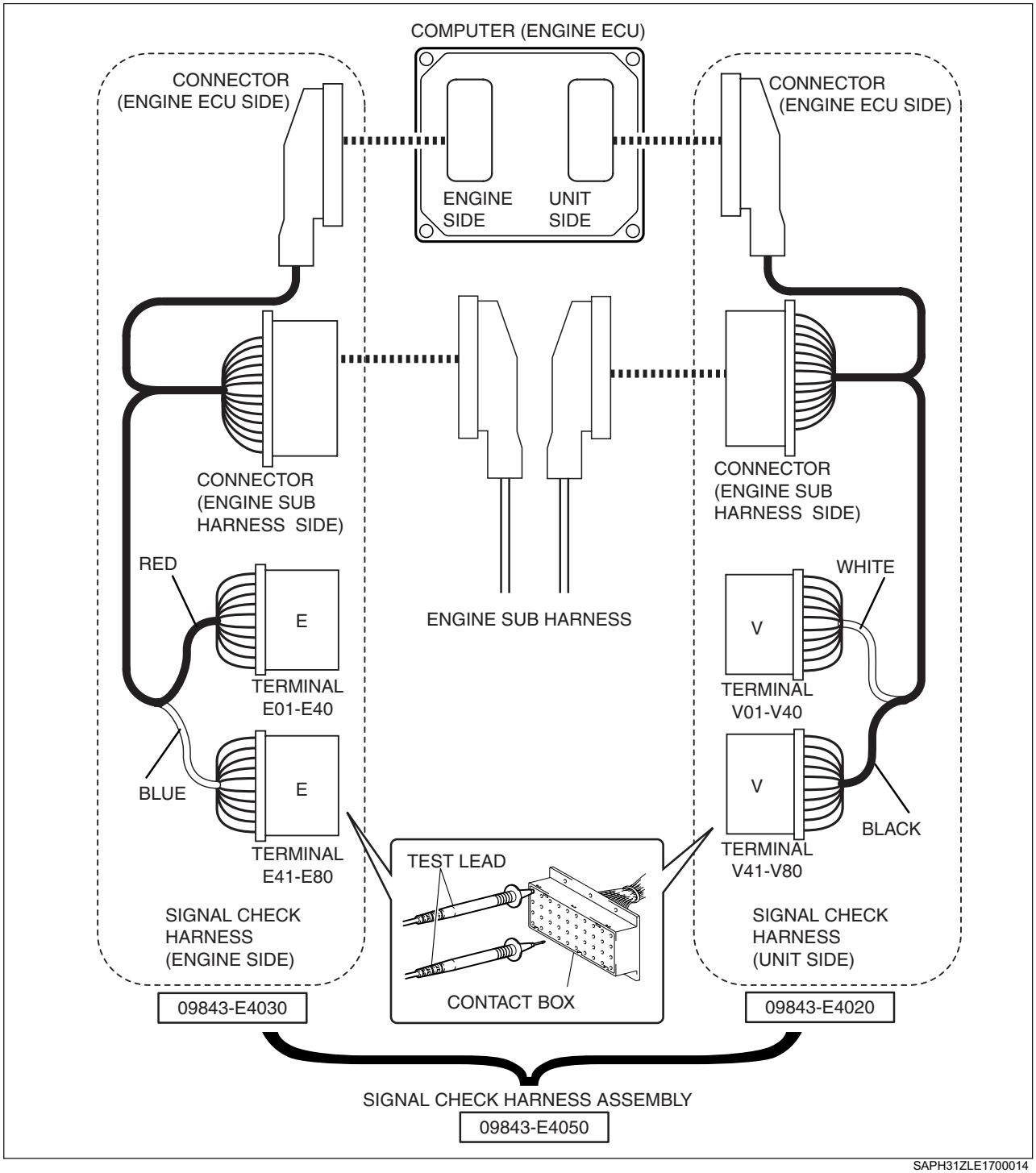


SAPH31ZLE1700002

2. Connection of signal check harness

(1) Set the starter switch to "OFF" and disconnect the connector from the engine ECU.

(2) Connect the signal check harness to the engine ECU and the unit side harness.



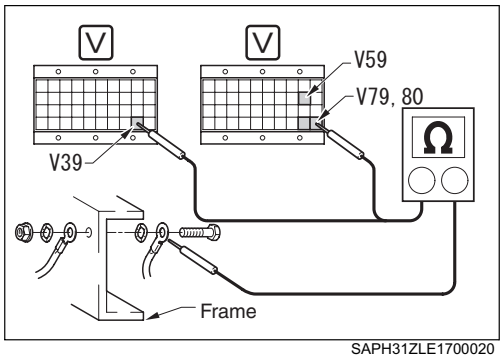
SAPH31ZLE1700014

Special tool : Signal check harness (09843-E4050)

Check the ground

JP31ZLE170601003

1	MEASURING THE RESISTANCE BETWEEN TERMINALS



SAPH31ZLE1700020

1. Set the starter switch to "OFF" and connect the signal check harness.
2. Disconnect the ECU side connector of the signal check harness and measure the resistance between terminals V39, V59, V79, V80 and the terminal (-) of the battery.

Standard value : 1 Ω or less

NG → Disconnection of ground harness, contact failure, etc.

OK

Normal

DTC code P0088 [69]

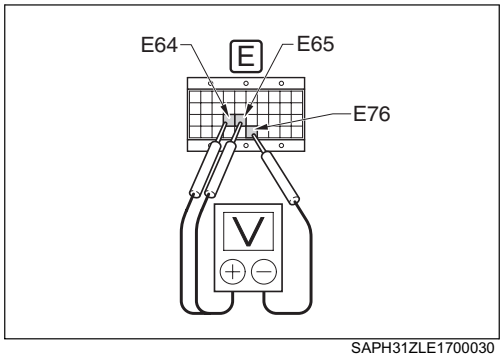
/Excessive common rail pressure

JP31ZLE170601015

1	MEASURING THE VOLTAGE BETWEEN TERMINALS

1. Set the starter switch to "LOCK".
2. Connect the signal check harness on the engine ECU.
3. Set the starter switch to "ON".
4. Measure the voltage between the terminals PCR3 (E64), PCR4 (E65) and AGD2 (E76).

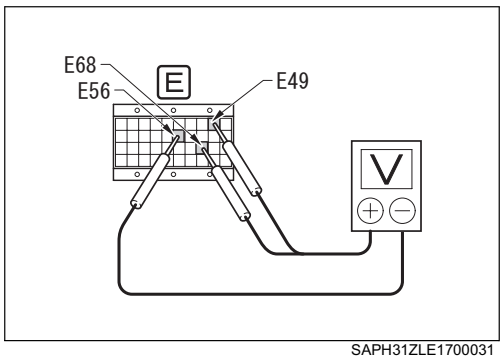
   Standard value: 0.75-0.95 V



SAPH31ZLE1700030

5. Measure the voltage between the terminals PCR2 (E68), PCR1 (E49) and AGD1 (E56).

   Standard value: 1.25-1.45 V



SAPH31ZLE1700031

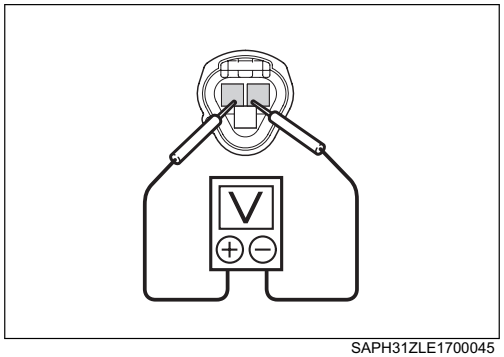
NG

- Bad wiring harness or connectors contact
- Fault in engine ECU

OK

Faulty common rail pressure sensor

2	MEASURING THE VOLTAGE BETWEEN SENSOR TERMINALS



SAPH31ZLE1700045

1. Set the starter switch to "ON".
2. Measure the voltage between the terminals WT+ and WT- of the engine coolant temperature sensor connector (engine sub harness side).

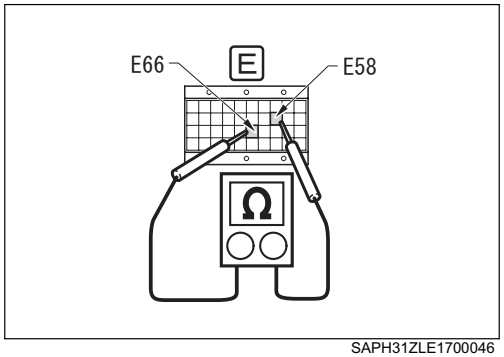
Standard value: 4.5-5.5 V

NG → Proceed to 3

OK →

Bad connectors contact

3	MEASURING THE RESISTANCE BETWEEN TERMINALS



SAPH31ZLE1700046

1. Set the starter switch to "LOCK".
2. Connect the signal check wiring harness on the engine side.
3. Disconnect the connector on the engine ECU side.
4. Measure the resistance between the terminals THW+ (E66) and AGD5 (E58).

Standard value

Resistance	Water temperature (°C{°F})
2.45 kΩ	**20 {68}**
1.15 kΩ	**40 {104}**
584 Ω	**60 {140}**
318 Ω	**80 {176}**

NG →
- Fault in engine coolant temperature sensor
- Fault in wiring harness

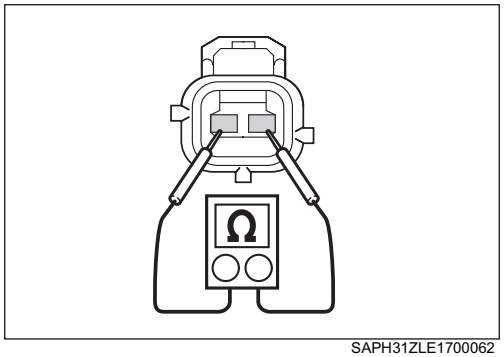
OK →

DTC code P0188 [14]

/Fuel temperature sensor circuit low input

JP31ZLE170601029

1	MEASURING THE VOLTAGE BETWEEN TERMINALS



SAPH31ZLE1700062

1. Set the starter switch to "LOCK". Disconnect the fuel temperature sensor connector.
2. Measure the resistance between the terminals 1 and 2 of the fuel temperature sensor connector (unit side).

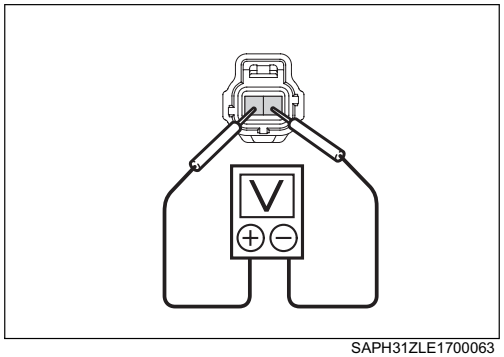
Standard value : 0.75-0.95V

Fuel temperature (°C{°F})	Resistance
-20 {-4}	13.84 to 16.33 kΩ
20 {68}	2.32 to 2.59 kΩ
80 {176}	0.310 to 0.326 kΩ
110 {230}	0.1399 to 0.1435 kΩ

NG → Faulty fuel temperature sensor

OK

2	MEASURING THE RESISTANCE BETWEEN SENSOR TERMINALS



SAPH31ZLE1700063

1. Measure the voltage between the terminals 1 and 2 of the fuel temperature sensor connector (engine sub harness side).

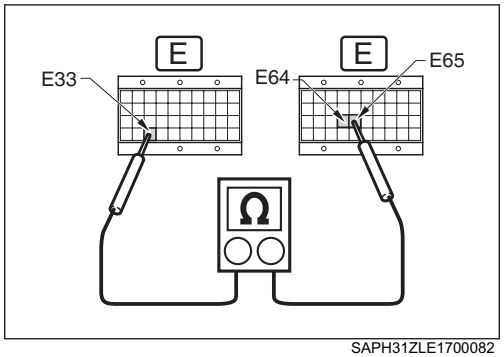
Standard value : 4.5-5.5V

NG → Proceed to 3

OK

Bad contact of connector

4	MEASURING THE RESISTANCE BETWEEN TERMINALS



SAPH31ZLE1700082

1. Disconnect the connector on the engine sub harness side.
2. Connect the signal check wiring harness on the engine ECU side.
3. Measure the resistance between the terminals AVC2 (E33), PCR3 (E64) and PCR4 (E65).

Standard value: 200-250 kΩ

NG → Fault in engine ECU

OK

4	CHECK THE BOOST PRESSURE SENSOR HOSE

1. Check the boost pressure sensor hose for damage.

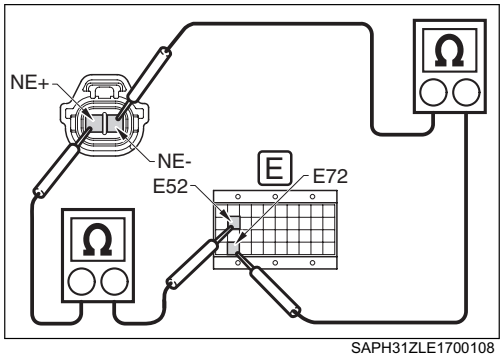
Standard: It is not loose or faulty

NG → Faulty boost pressure sensor hose

OK

INSPECT THE EGR VALVE

2	MEASURING THE RESISTANCE BETWEEN SENSOR TERMINALS



SAPH31ZLE1700108

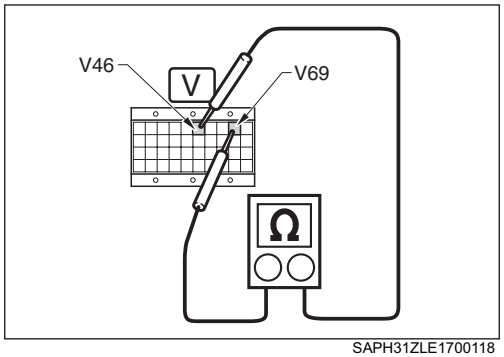
1. Engine speed main sensor connector remains connected.
2. Measure the resistance between NE- main sensor connector (engine sub harness side) and signal check harness NE1- (E72).
   In the same way, measure the resistance between NE+ main sensor connector (engine sub harness side) and signal check harness NE1+ (E52).

   Standard value: Less than 2 Ω

NG → Fault in wiring harness

OK

3	MEASURING THE RESISTANCE BETWEEN TERMINALS



SAPH31ZLE1700118

1. Set the starter switch to "LOCK".
2. Connect the signal check wiring harness on the unit side.
3. Disconnect the connector on the engine ECU side.
4. Measure the resistance between the terminals ET3+ (V69) and ADG9 (V46).

Standard value

Resistance	Temperature (°C{°F})
9.75 kΩ	**50 {122}**
3.77 kΩ	**100 {212}**
1.80 kΩ	**150 {302}**

NG

- Faulty exhaust gas temperature sensor (DPR inlet)
- Fault in wiring harness
- Faulty sensor connector

OK

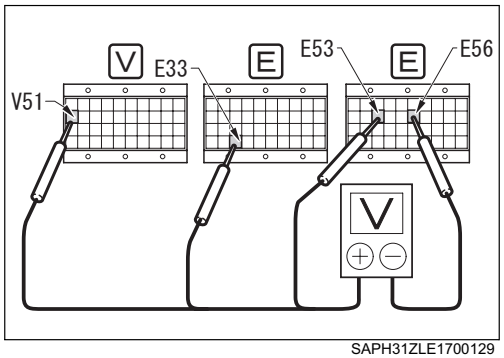
Fault in engine ECU

DTC code P0643 [5]

/ECU sensor supply 1 failure (high)

JP31ZLE170601031

1	MEASURING THE VOLTAGE



SAPH31ZLE1700129

1. Set the starter switch to "LOCK".
2. Connect the signal check harness.
3. Set the starter switch to "ON".
4. Measure the voltage between the terminals AVC2 (E33), GVCC (E53), AVC4 (V51) and AGD1 (E56).

Terminal to measure the voltage	
+ Side	**- Side**
E33	**E56**
E53	
V51	

Standard value: 4.9-5.1 V

NG → Fault in wiring harness

OK

Fault in engine ECU

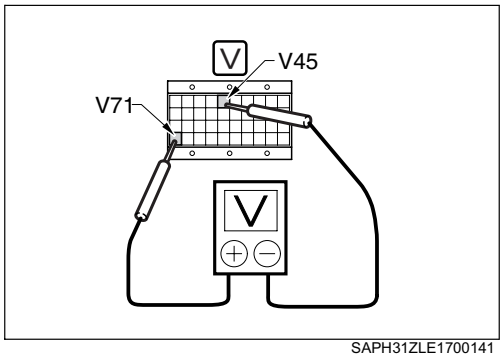
3	MEASURING THE VOLTAGE BETWEEN TERMINALS OF SIGNAL CHECK HARNESS

1. Set the starter switch to "OFF".
2. Connect the signal check harness on the unit side, and set the starter switch to "ON".

⚠ **CAUTION** • **Leave the connector for the emergency accelerator sensor removed.**

3. Measure the voltage between the terminals AVC5 (V71) and ADG7 (V45).

Standard value : 5 ± 0.5 V



SAPH31ZLE1700141

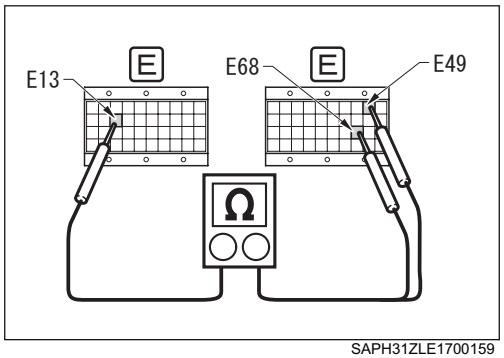
NG
- Fault in engine ECU
- Fault in ECU connector

OK

Fault in harness (5V-GND line)

NOTICE • **If the harness or connector is normal, inspect the emergency accelerator sensor.**

4	MEASURING THE RESISTANCE BETWEEN TERMINALS



SAPH31ZLE1700159

1. Connect the signal check harness connector on the engine ECU side and disconnect the engine sub harness side connector.
2. Measure the resistance between the terminals AVC1 (E13) and PCR1 (E49) PCR2 (E68).

Standard value: 200-250 kΩ

NG → Fault in engine ECU

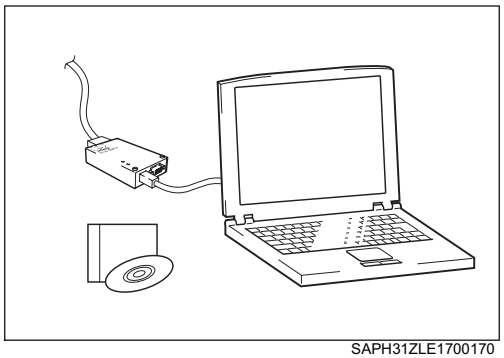
OK

DTC code P1416 [19, 85]

/EGR coolant temperature sensor characteristic abnormal

JP31ZLE170601067

1	INSPECTION ITEM



SAPH31ZLE1700170

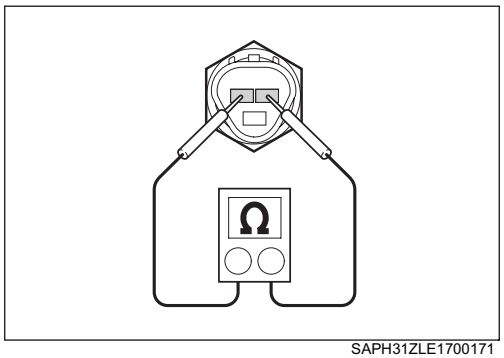
1. Using the HinoDX, verify that the DTC code P0217 [6] is not displayed.

   Standard : No overheat trouble code is displayed

NG → Overheat (cooling system trouble)
Check the cooling system (coolant level, leakage)

OK

2	MEASURING THE RESISTANCE BETWEEN SENSOR TERMINALS



SAPH31ZLE1700171

1. Set the stater key to "LOCK", disconnect the connector of the coolant temperature sensor on EGR cooler.
   Measure the resistance between terminals 1 and 2 of the coolant temperature sensor on EGR cooler (parts side).

   Standard value

Coolant temperature (°C{°F})	Resistance
20 {68}	**2.45**kΩ
40 {104}	**1.15**kΩ
60 {140}	**584**Ω
80 {176}	**318**Ω

Any of the above resistance values will be acceptable.

NOTICE

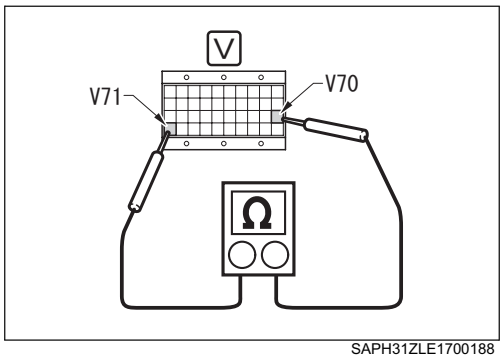
- **The DTC code is displayed when the coolant temperature sensor on EGR cooler is normal and the coolant temperature detect 105°C (221°F) or more.**

NG → Faulty coolant temperature sensor on EGR cooler

OK

Faulty EGR cooler

4	MEASURING THE RESISTANCE BETWEEN TERMINALS



SAPH31ZLE1700188

1. Disconnect the connector on the engine sub harness side and connect the engine ECU side.
2. Measure the resistance between the terminals AVC5 (V71) and EXPS (V70).

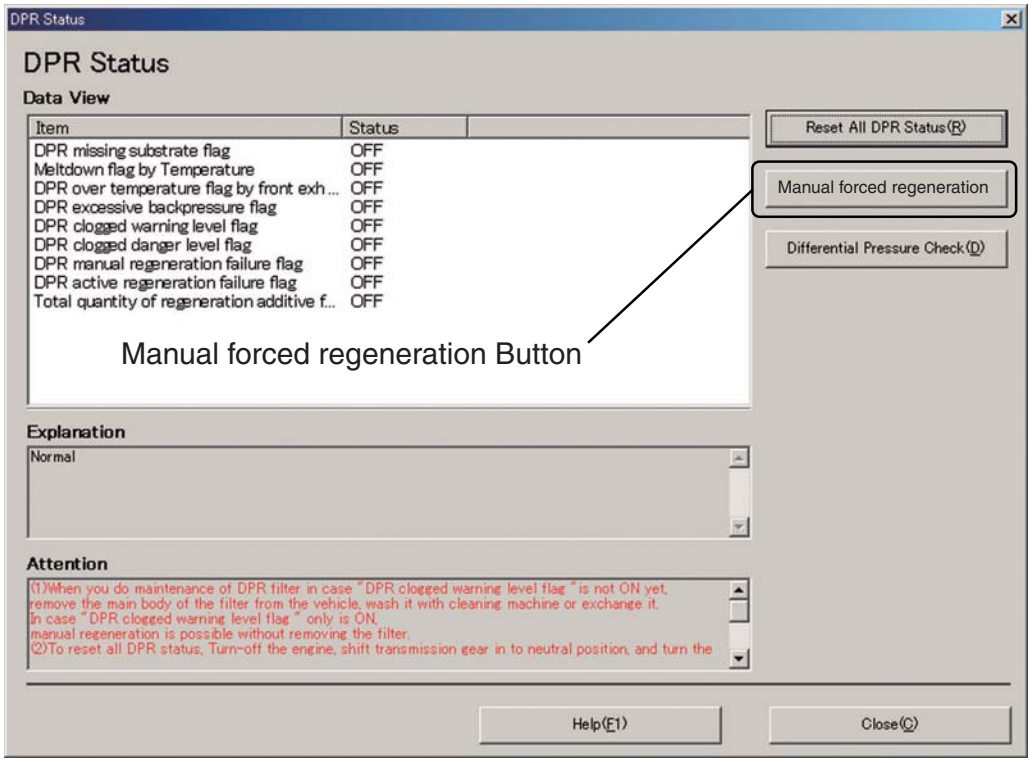
Standard value: 200-250 kΩ

NG → Fault in engine ECU

OK

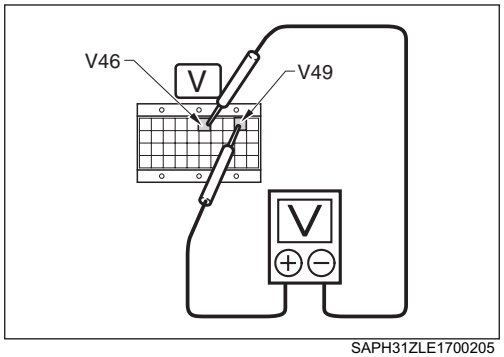
3. Forced regeneration is done from the "Forced regeneration" screen.
   If you click the "Manual regeneration" Button, the DPR Manual regeneration switch will be shown.

DPR Reset Confirmation window



SAPH31ZLE1700198

4	MEASURING THE VOLTAGE BETWEEN TERMINALS



SAPH31ZLE1700205

1. Set the starter switch to "LOCK".
2. Connect the signal check wiring harness on the unit side.
3. Set the starter switch to "ON".
4. Measure the voltage between the terminals ET2+ (V49) and ADG9 (V46).

Standard value: 4.5-5.5 V

NG

- Fault in engine ECU
- Faulty ECU connector

OK

Fault in wiring harness

6. When the manual regeneration is completed, carry out the "Differential Pressure Check".

⚠ **CAUTION**

- **Never park the unit near any flammable material, including high grass or leaves, during manual regeneration.**
- **Extreme heat from the exhaust outlet could cause a fire resulting in personal injury and property damage.**
- **Always keep all flammable materials away from the DPR cleaner (ie. diesel particulate filter or exhaust filter), exhaust pipe and tail pipes.**
- **Never touch the DPR cleaner, exhaust pipe or tail pipe during regeneration. Severe burns and/or other personal injuries could occur.**

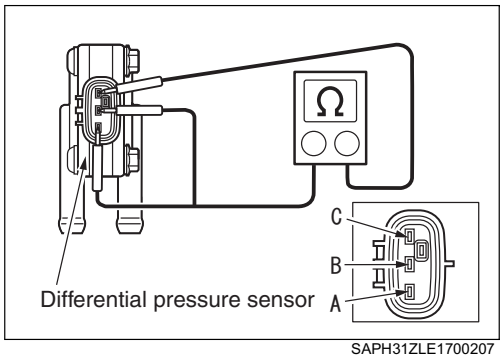
NOTICE

- **Manual regeneration is carried out when the DPR clogged warning level flag is ON in the "DPR Reset Confirmation Window"**
- **When the DPR clogged danger level flag is ON, remove the DPR from the unit and clean it with Hino's recommended cleaner or replace it.**

NG → Replace the DPR cleaner

OK

7	INSPECTION OF THE DIFFERENTIAL PRESSURE



SAPH31ZLE1700207

1. Measure the resistance of the differential pressure sensor with a circuit tester. If the value exceeds the standard value, replace it.

Measurement item	Standard value (kΩ)
A ↔ B	**2 to 15**
B ↔ C	**2 to 15**

NG → Clean or replace the DPR cleaner

OK

Delete the DTC code. Diagnosis is completed.

6. When the manual regeneration is completed, carry out the "Differential Pressure Check".

⚠ **CAUTION**

- **Never park the unit near any flammable material, including high grass or leaves, during manual regeneration.**
- **Extreme heat from the exhaust outlet could cause a fire resulting in personal injury and property damage.**
- **Always keep all flammable materials away from the DPR cleaner (known as diesel particulate filter or DPF), exhaust pipe and tail pipes.**
- **Never touch the DPR cleaner, exhaust pipe or tail pipe during regeneration. Severe burns and/or other personal injuries could occur.**

NOTICE

- **Manual regeneration is carried out when the DPR clogged warning level flag is ON in the "DPR Reset Confirmation Window"**
- **When the DPR clogged danger level flag is ON, remove the DPR from the unit and clean it with Hino's recommended cleaner or replace it.**

NG → Replace the DPR cleaner

OK

There is possibility that the customer forgets to push the switch. Please explain the operation again.