SHOP MANUAL

KOMATSU

140-3 SERIES

DIESEL ENGINE

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HOISTING INSTRUCTIONS

HOISTING

> ⚠ Heavy parts (25 kg or more) must be lifted with a hoist, etc. In the **DISASSEMBLY AND ASSEMBLY** section, every part weighing 25 kg or more is indicated clearly with the symbol kg

- If a part cannot be smoothly removed from the machine by hoisting, the following checks should be made:
  1) Check for removal of all bolts fastening the part to the relative parts.
  2) Check for existence of another part causing interference with the part to be removed.

WIRE ROPES

1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

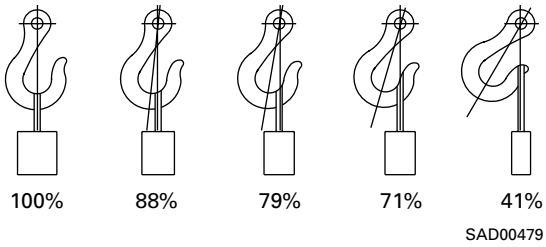
Wire ropes
(Standard "Z" or "S" twist ropes
without galvanizing)

Rope diameter	Allowable load	
mm	kN	tons
10	9.8	1.0
11.5	13.7	1.4
12.5	15.7	1.6
14	21.6	2.2
16	27.5	2.8
18	35.3	3.6
20	43.1	4.4
22.4	54.9	5.6
30	98.1	10.0
40	176.5	18.0
50	274.6	28.0
60	392.2	40.0

★ The allowable load value is estimated to be one-sixth or one-seventh of the breaking strength of the rope used.

2) Sling wire ropes from the middle portion of the hook.

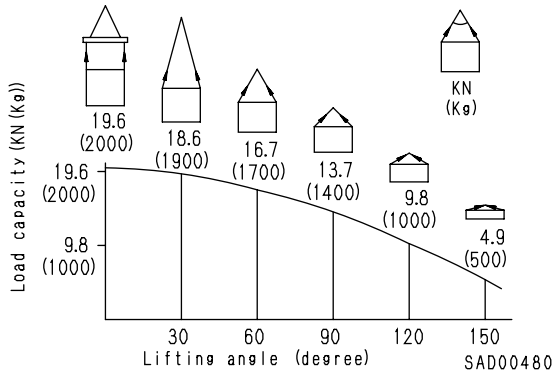
Slinging near the edge of the hook may cause the rope to slip off the hook during hoisting, and a serious accident can result. Hooks have maximum strength at the middle portion.



3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound onto the load.

> ⚠ Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident.

4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook.
When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles. The table below shows the variation of allowable load kN {kg} when hoisting is made with two ropes, each of which is allowed to sling up to 9.8 kN {1000 kg} vertically, at various hanging angles.
When two ropes sling a load vertically, up to 19.6 kN {2000 kg} of total weight can be suspended. This weight becomes 9.8 kN {1000 kg} when two ropes make a 120° hanging angle. On the other hand, two ropes are subjected to an excessive force as large as 39.2 kN {4000 kg} if they sling a 19.6 kN {2000 kg} load at a lifting angle of 150°.



Millimeters to Inches

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to Pound

1 kg = 2.2046 lb

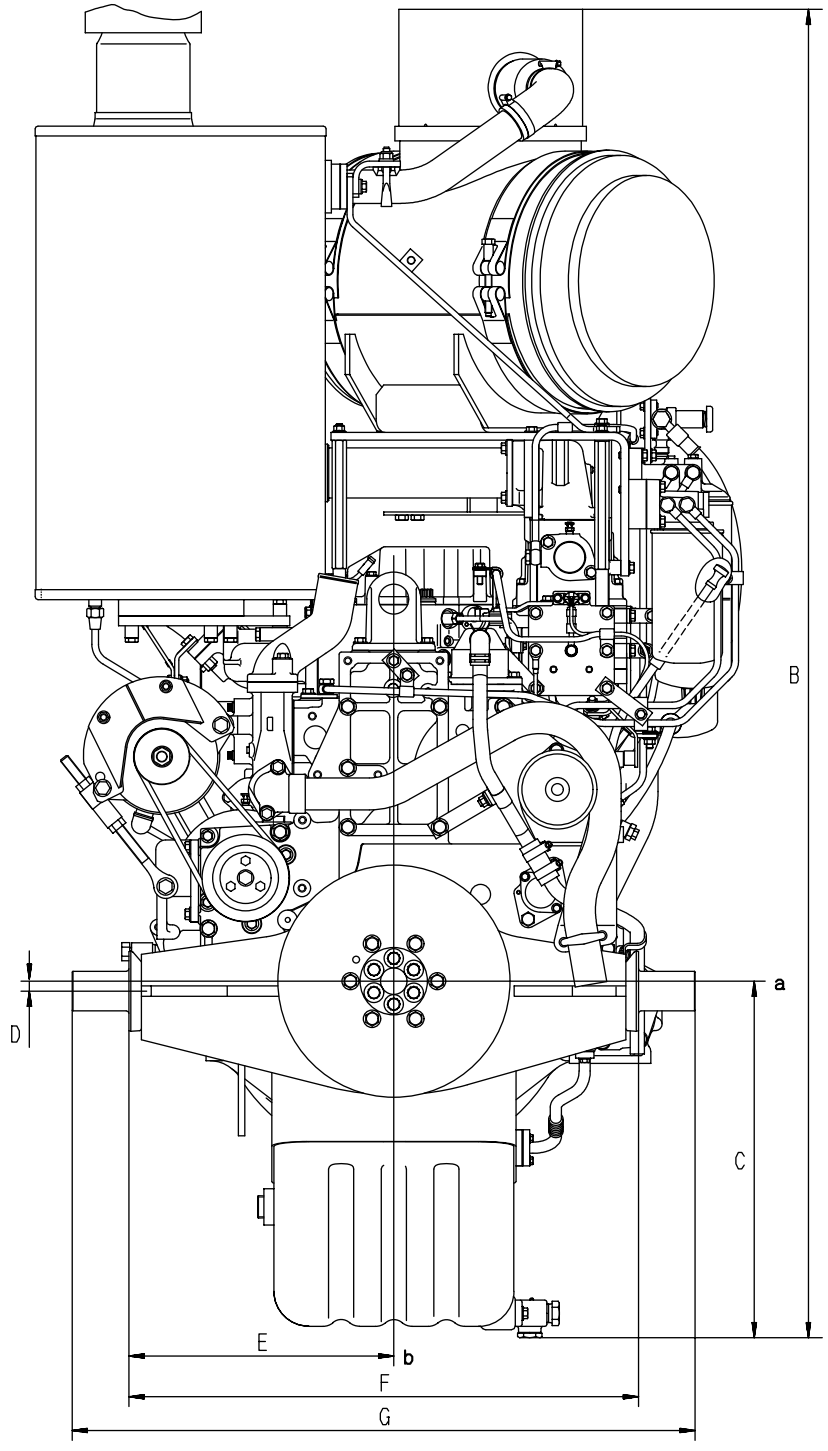
	0	1	2	3	4	5	6	7	8	9
0	0	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

SPECIFICATIONS

Engine			SA6D140E-3		
Machine model			D155AX-5 (110001 – 112349)	D155AX-5 (112350 and up)	WA500-3
No. of cylinders - bore x stroke		mm	6 – 140 x 165		
Piston displacement		ℓ {cc}	15.2 {15,230}		
Firing order		—	1 – 5 – 3 – 6 – 2 – 4		
Dimensions	Overall length	mm	1,499	1,630	1,787
	Overall width	mm	1,054	1,326	970
	Overall height (excl. exhaust pipe)	mm	1,738	1,262	1,670
	Overall height (incl. exhaust pipe)	mm	—	—	—
Performance	Rated horsepower	kW{HP}/rpm	252{338}/1,900 (Gross)	248{332}/1,900 (Gross)	235{316}/2,100 (Net)
	Max. torque	Nm{kgm}/rpm	1,635{166.7}/1,250 (Gross)	1,635{166.7}/1,250 (Gross)	1,370{140}/1,400 (Net)
	High idling speed	rpm	2,100 ± 50	2,100 ± 50	2,350 ± 50
	Low idling speed	rpm	740^{+25}_{0}	740^{+25}_{0}	725 ± 25
	Min. fuel consumption ratio	g/kWh {g/HPh}	205 {153}	205 {153}	207 {154}
Dry weight		kg	1,645	1,618	1,610
Fuel supply pump		—	Denso ECD-U2		
Governor		—	Electronic control type		
Lubricating oil amount (replacement amount)		ℓ	42 (37)	42 (37)	42 (37)
Cooling water		ℓ	26 (Engine only)	26 (Engine only)	26 (Engine only)
Alternator		—	24V, 35A	24V, 60A, 75A	24V, 50A
Starting motor		—	24V, 11kW	24V, 11kW	24V, 11kW
Battery		—	12V 170Ah x 2	12V 170Ah x 2	12V 170Ah x 2
Turbocharger		—	Komatsu KTR110L	Komatsu KTR110L	Komatsu KTR110L
Air compressor		—	—	—	—
Others		—	With aftercooler	With aftercooler	With aftercooler

SDA6D140E-3 FRONT DRAWING

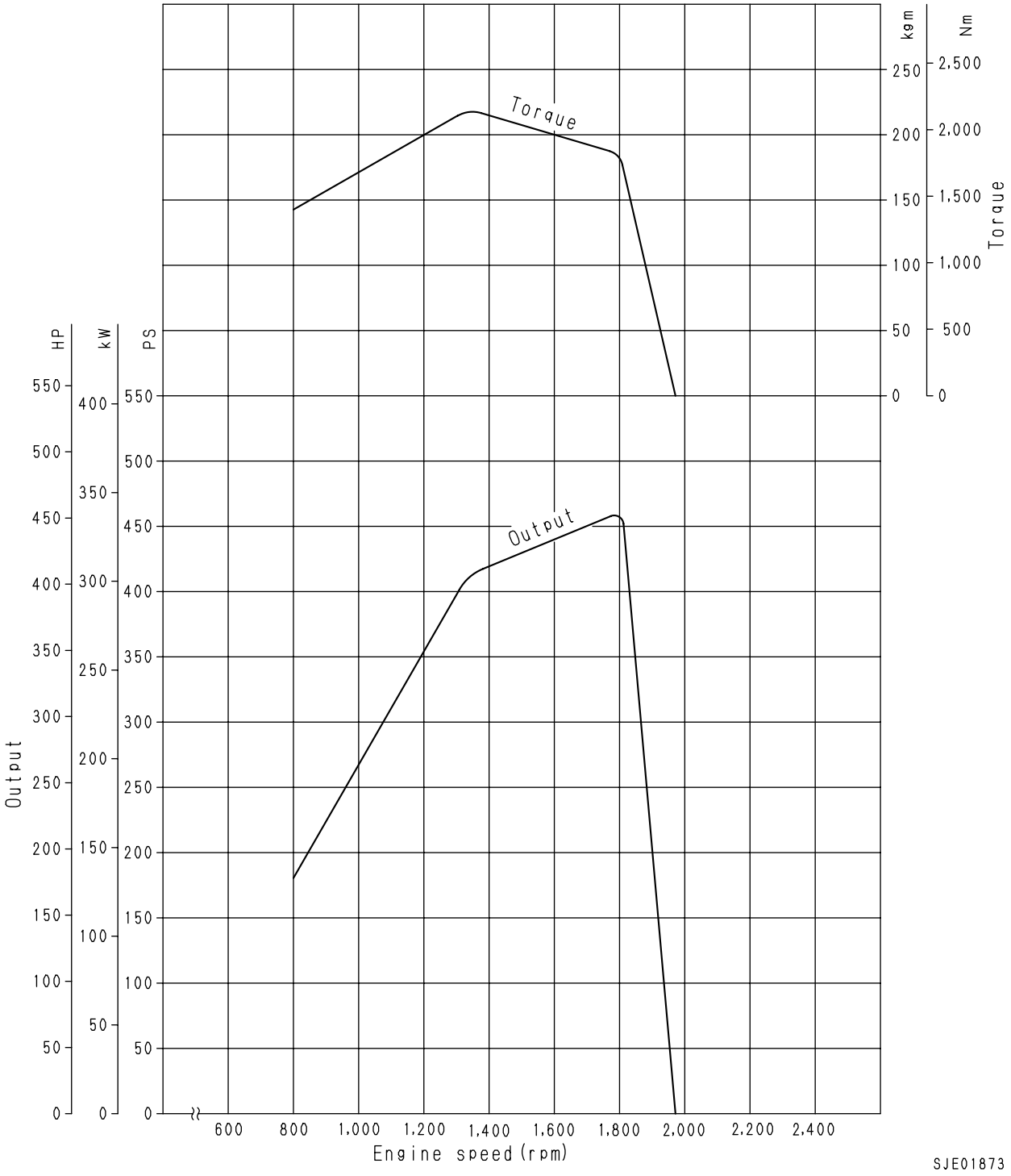
★ The diagram shows the equipment for the D275AX-5.
★ The shape may differ according to the machine model.



a. Crankshaft center
b. Cylinder liner center

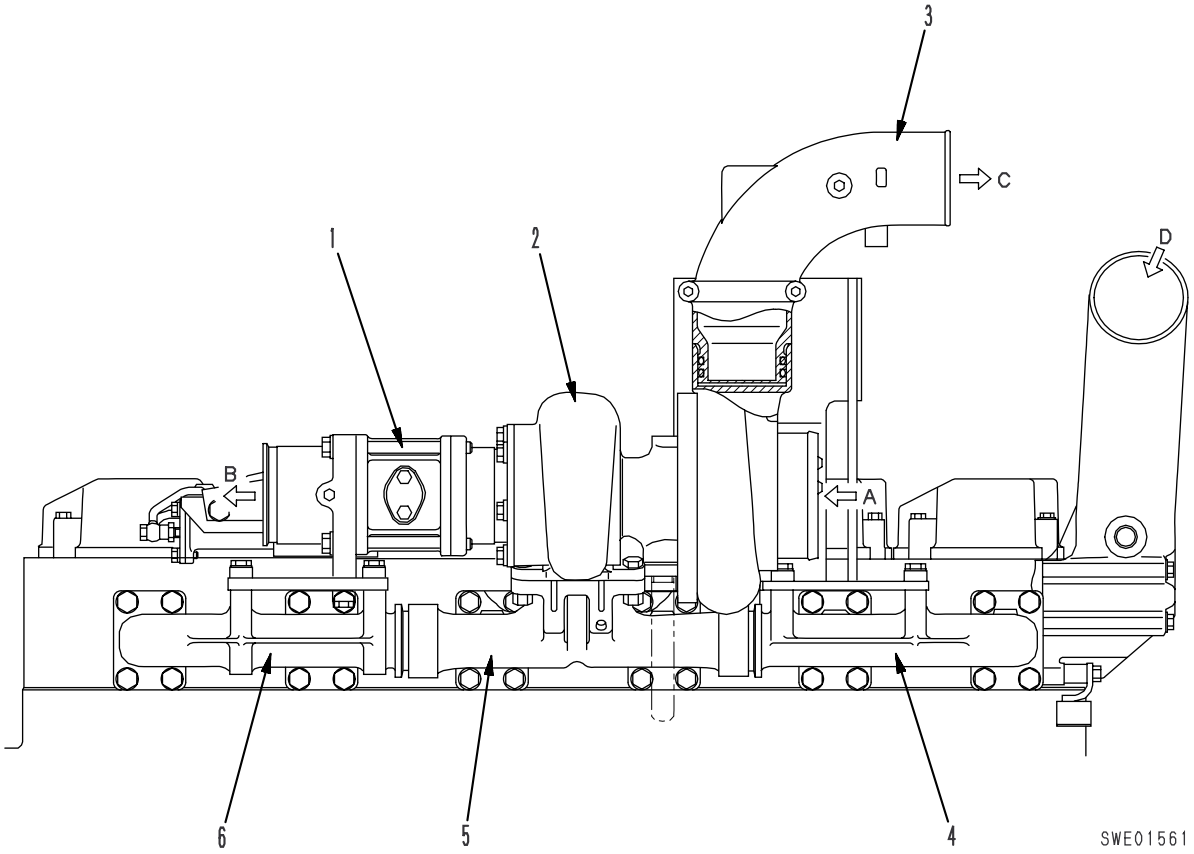
SAA6D140E-3 [For PC750-6, PC750LC-6, PC750-7, PC800-6, PC800-7, PC1800-6]

Rated output: 338kW {454HP} / 1,800 rpm (Net)
Max. torque: 2,138 Nm {218 kgm} / 1,350 rpm (Net)



SAA6D140E-3 (Right side face)

★ The diagram shows the equipment for the HD325-6.
★ Details may change for reasons such as modification.

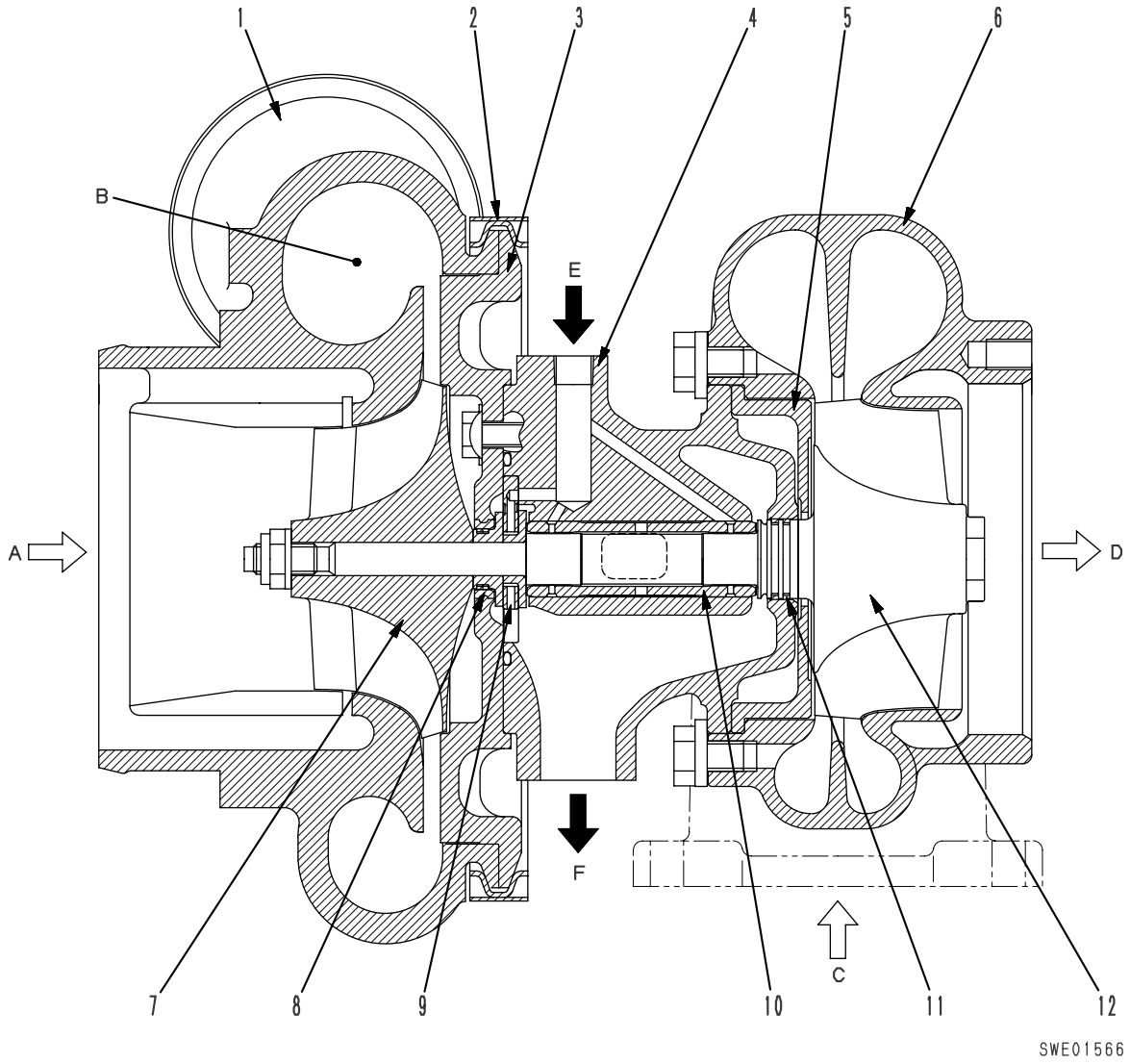


1. Exhaust brake (butterfly type)
2. Turbocharger
3. Intake connector
4. Exhaust manifold (front)
5. Exhaust manifold (center)
6. Exhaust manifold (rear)

A. Intake inlet
B. Exhaust outlet
C. Air supply (between turbocharger and air-cooled aftercooler)
D. Air supply (between air-cooled aftercooler and air supply manifold)

TURBOCHARGER

KTR110L (AIR-COOLED TYPE).

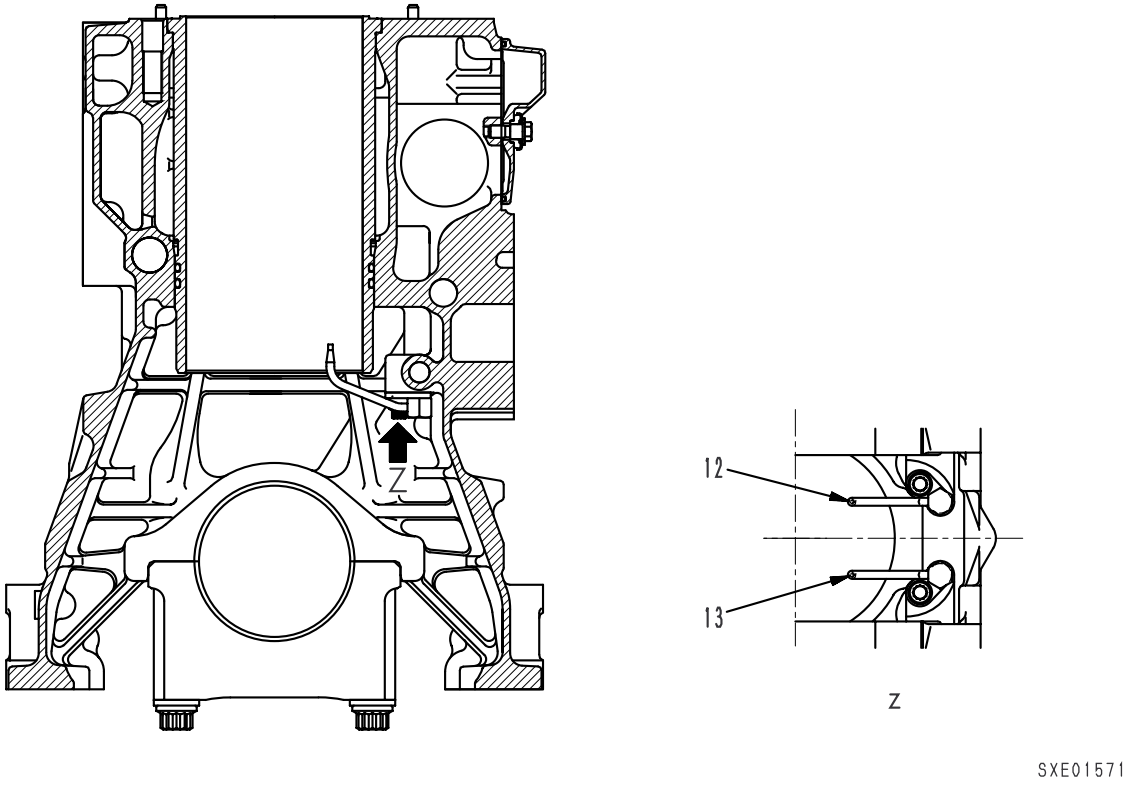


1. Blower housing
2. V-band
3. Diffuser plate
4. Center housing
5. Shroud
6. Turbine housing
7. Turbine impeller
8. Seal ring
9. Bearing
10. Thrust bearing
11. Seal ring
12. Blower impeller

A. Intake inlet
B. Intake outlet
C. Exhaust inlet
D. Exhaust outlet
E. Oil inlet
F. Oil outlet

Specifications

Type: Komatsu KTR110L (air-cooled)
Overall length: 308mm
Overall width: 305mm
Overall height: 287mm
Weight: 24kg



Specifications

Cylinder block
- Crankshaft: 7 bearings
- Camshaft: High cam type, 7 bearings
- Main cap bolt: Plastic range tightening method

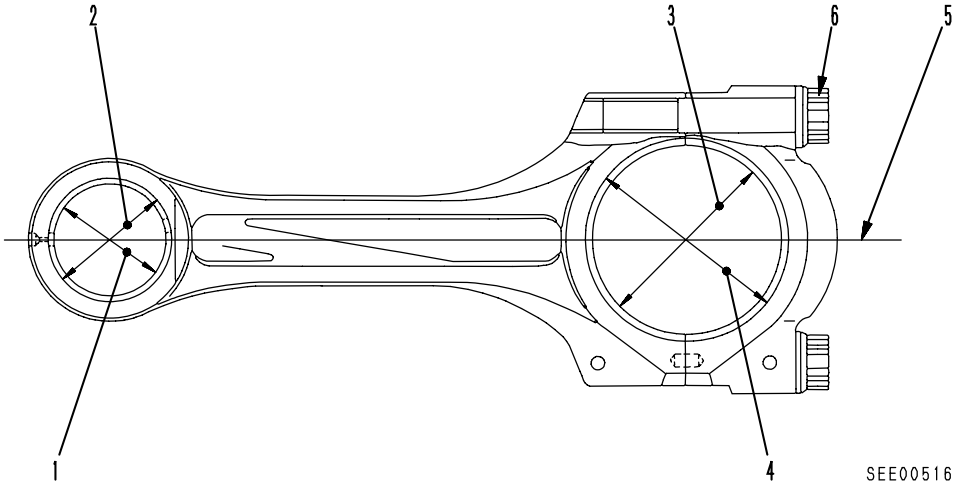
Front seal
- Single lip with dust seal (lay-down seal)

Piston cooling
- With piston cooling nozzle (2 for each cylinder)

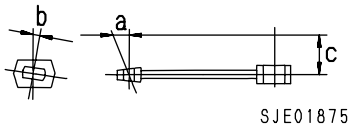
Cylinder liner
- Wet type
- Inside surface machining: Platt honing, Tufttride treatment

Liner ring
- Top: Clevis seal
- Middle: O-ring (ethylene propylene rubber)
- Bottom: O-ring (silicon rubber)

CONNECTING ROD

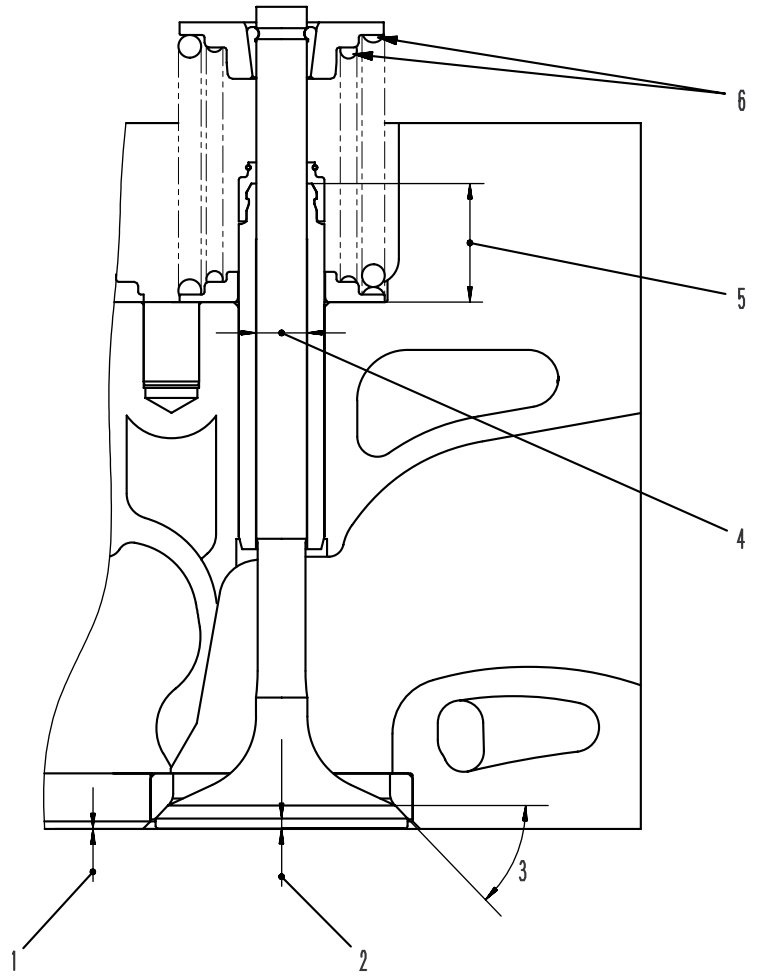


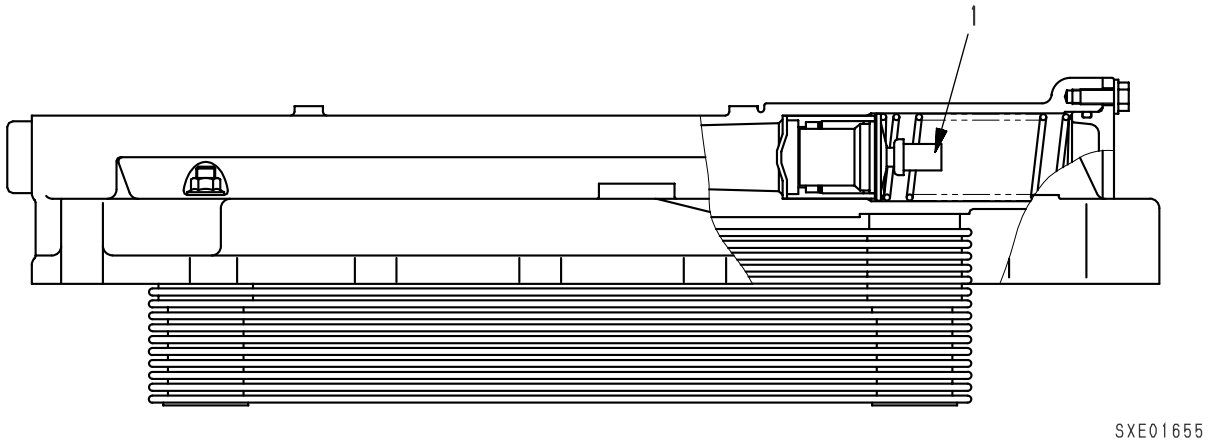
Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="5">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Inside diameter of bushing at connecting rod small end (Treat with reamer after press fitting bushing)</td><td>Standard size</td><td>Tolerance</td><td>Repair limit</td><td colspan="2"></td><td rowspan="2">Replace bushing (New part is supplied as a semi-finished part)</td></tr>
<tr><td>52</td><td>+0.049
+0.030</td><td>52.09</td><td colspan="2"></td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Clearance between bushing at connecting rod small end and piston pin</td><td colspan="2">Standard clearance</td><td colspan="3">Clearance limit</td><td rowspan="2">Replace bushing or piston pin</td></tr>
<tr><td colspan="2">0.030 – 0.055</td><td colspan="3">0.11</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Inside diameter of bushing hole at connecting rod small end</td><td colspan="2">Standard size</td><td colspan="3">Tolerance</td><td rowspan="2">Replace connecting rod</td></tr>
<tr><td colspan="2">57.4</td><td colspan="3">+0.030
0</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Inside diameter of bearing at connecting rod big end</td><td>Standard size</td><td>Tolerance</td><td>Repair limit</td><td colspan="2"></td><td rowspan="2">Replace bearing</td></tr>
<tr><td>90</td><td>+0.042
–0.008</td><td>90.15</td><td colspan="2"></td></tr>
<tr><td rowspan="2">4</td><td>Inside diameter of bearing hole at connecting rod big end (Measure after tightening connecting rod cap bolt with specified torque)</td><td>95</td><td>+0.026
–0.004</td><td>—</td><td colspan="2"></td><td>Replace connecting rod</td></tr>
<tr><td>Thickness of connecting rod bearing</td><td>2.5</td><td>+0.002
–0.008</td><td>—</td><td colspan="2"></td><td>Replace bearing</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Parallelism and twist of connecting rod</td><td colspan="2" rowspan="4"> 
SJE01875</td><td>Item</td><td>Standard size</td><td>Repair limit</td><td rowspan="4">Replace connecting rod</td></tr>
<tr><td>Parallelism a</td><td>0.20</td><td>0.25</td></tr>
<tr><td>Twist b</td><td>0.30</td><td>0.35</td></tr>
<tr><td>Dimension c</td><td>264</td><td>—</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Tightening torque of connecting rod cap mounting bolt (Coat bolt threads and nut seats with engine oil)</td><td>Standard size</td><td>Target (Nm{kgm})</td><td>Range (Nm{kgm})</td><td colspan="2"></td><td rowspan="3">Retighten</td></tr>
<tr><td>1st step</td><td>127.5 {13}</td><td>117.7 – 132.4
{12.5 – 13.5}</td><td colspan="2"></td></tr>
<tr><td>2nd step</td><td>Retighten with 90°</td><td>90 $^{+30°}_{0}$</td><td colspan="2"></td></tr>
<tr><td>—</td><td>Weight of connecting rod</td><td colspan="5">Permissible range:
Variation between weights on the machine max. 154g</td><td>Replace</td></tr>
</table>

★ The connectiong rod cap bolt can be re-used up to a maximum of 5 times. Each time the bolt is re-used, make a punch mark on the bolt head.

VALVE, VALVE GUIDE





Unit: mm

No.	Check item	Criteria	Remedy
1	Lift of thermostat to fully open position	Min 8mm (soak the valve in oil bath at 100ºC for 4 to 5 minutes to check)	Replace
	Opening/closing of thermostat	Check that the valve closes fully when the oil temperature has gone down to 85ºC from 100ºC when the valve was fully open. (Soak the valve in an oil bath for 4 to 5 minutes to check)	

3) Operation

The TWV of the injector is a 2-way valve and consists of inner valve (fixed) (4) and outer valve (variable) (3). It is precisely joined to the same shaft. It forms both the inner and outer seats, and when the TWV is switched ON/OFF, one of the two seats is selected to open.

i) No injection of fuel

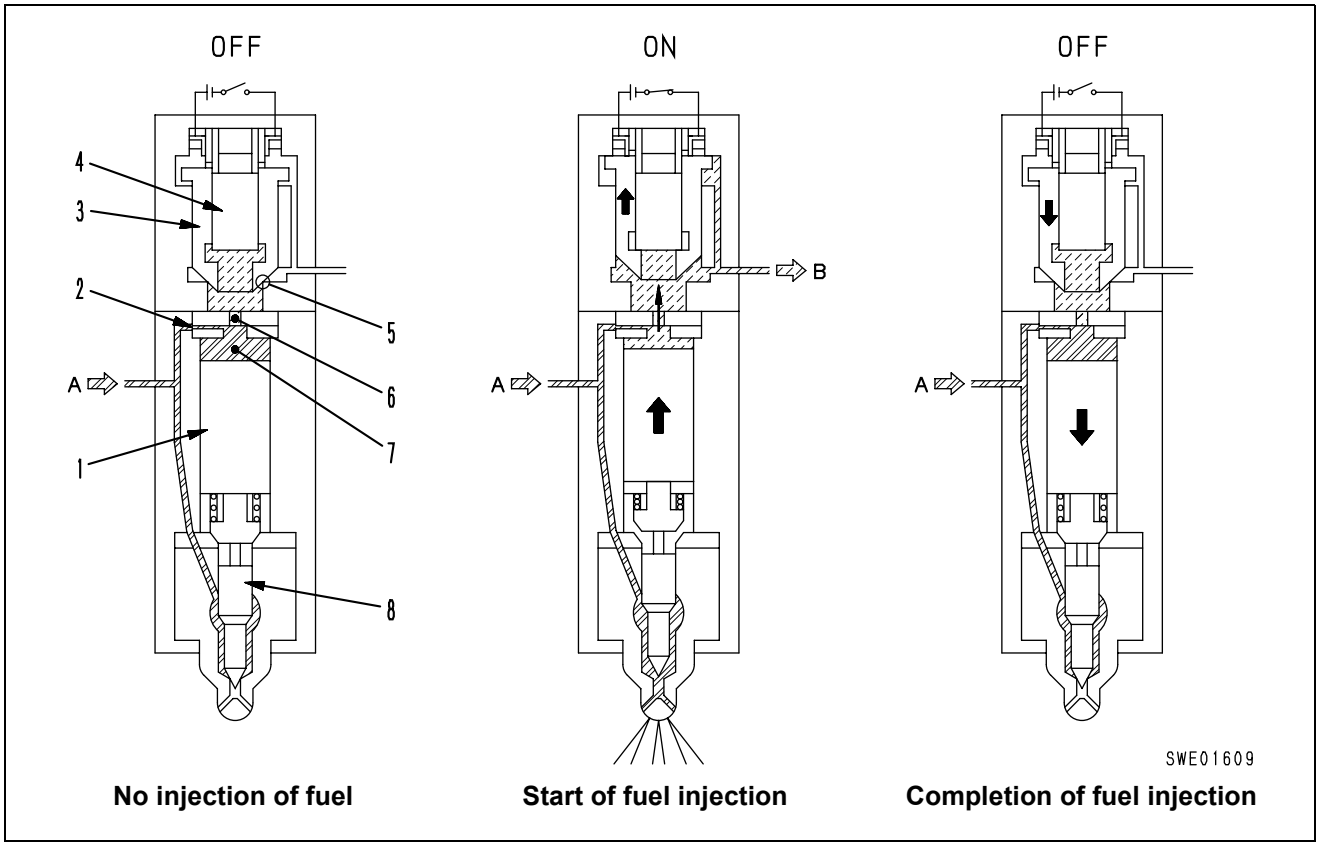
When no electric current is being sent to the solenoid, outer valve (3) is pushed down by the valve spring and the fuel pressure, and outer seat (5) is closed. High pressure from the common rail is applied to control chamber (7), so nozzle (8) is closed and there is no fuel injection.

ii) Start of fuel injection

When electric current starts to flow to the TWV, outer valve (3) is pulled up by the electromagnetic force and outer seat (5) opens. As a result, fuel flows out from the control chamber through orifices (2) and (6), the nozzle needle goes up, and fuel injection starts. Because of the action of orifices (2) and (6), the fuel injection ratio is gradually raised. If electric current continues to be sent, the maximum fuel injection ratio is reached.

iii) Completion of fuel injection

When the flow of electric current to the TWV is stopped, outer valve (3) goes down under the force of the valve spring and the fuel pressure, and outer seat (5) closes. When this happens, the high-pressure fuel in the common rail is suddenly applied to the control chamber, so the nozzle is suddenly closed and a sharp completion of the fuel injection is obtained.

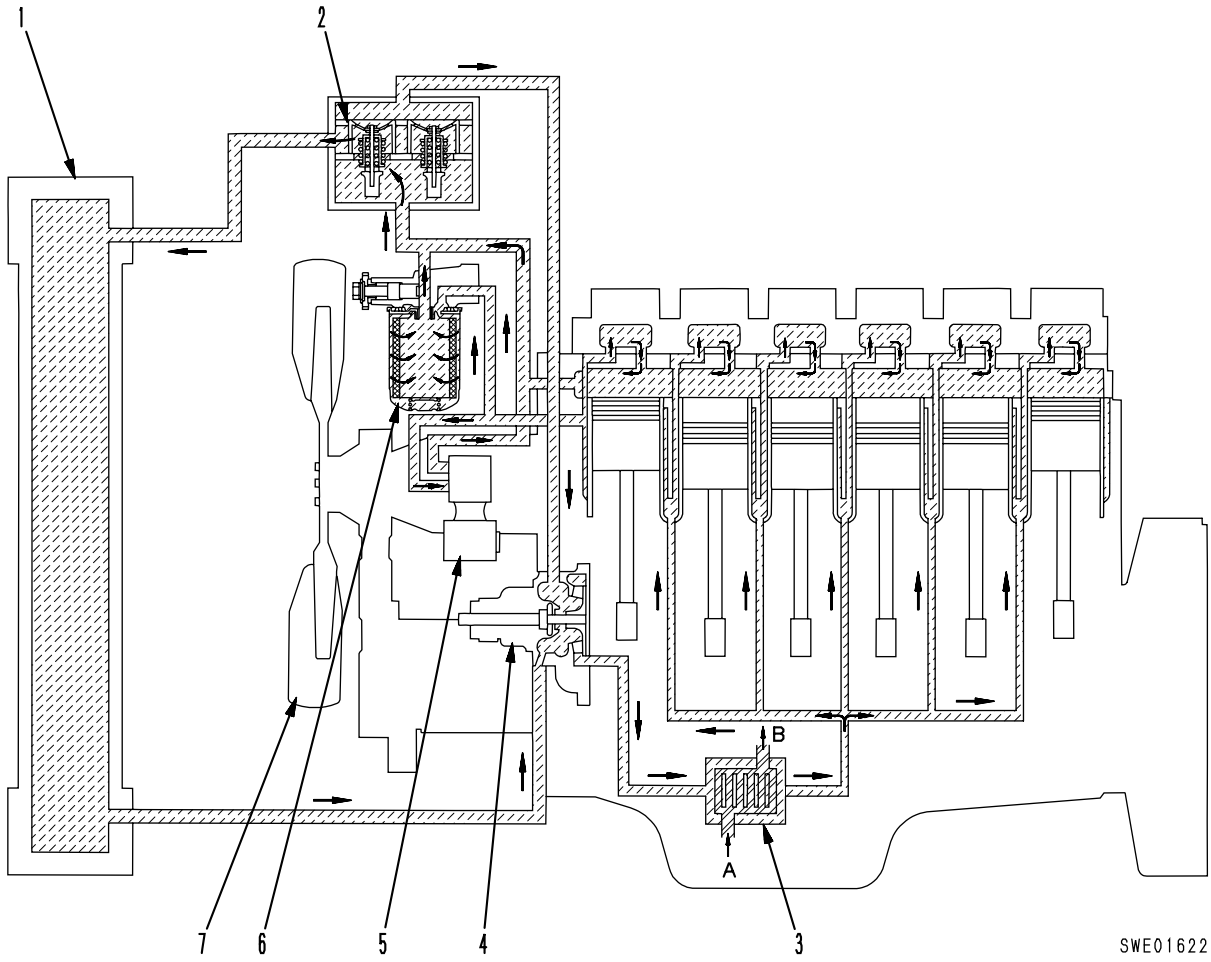


No injection of fuel **Start of fuel injection** **Completion of fuel injection**

1. Hydraulic piston
2. Orifice 1
3. Outer valve
4. Inner valve
5. Outer seat
6. Orifice 2
7. Control chamber
8. Nozzle

A. Common rail (always at high pressure) (18 to 130MPa{180 to 1,330kg/cm^2})
B. Leak

SAA6D140E-3 (for construction equipment, generators)



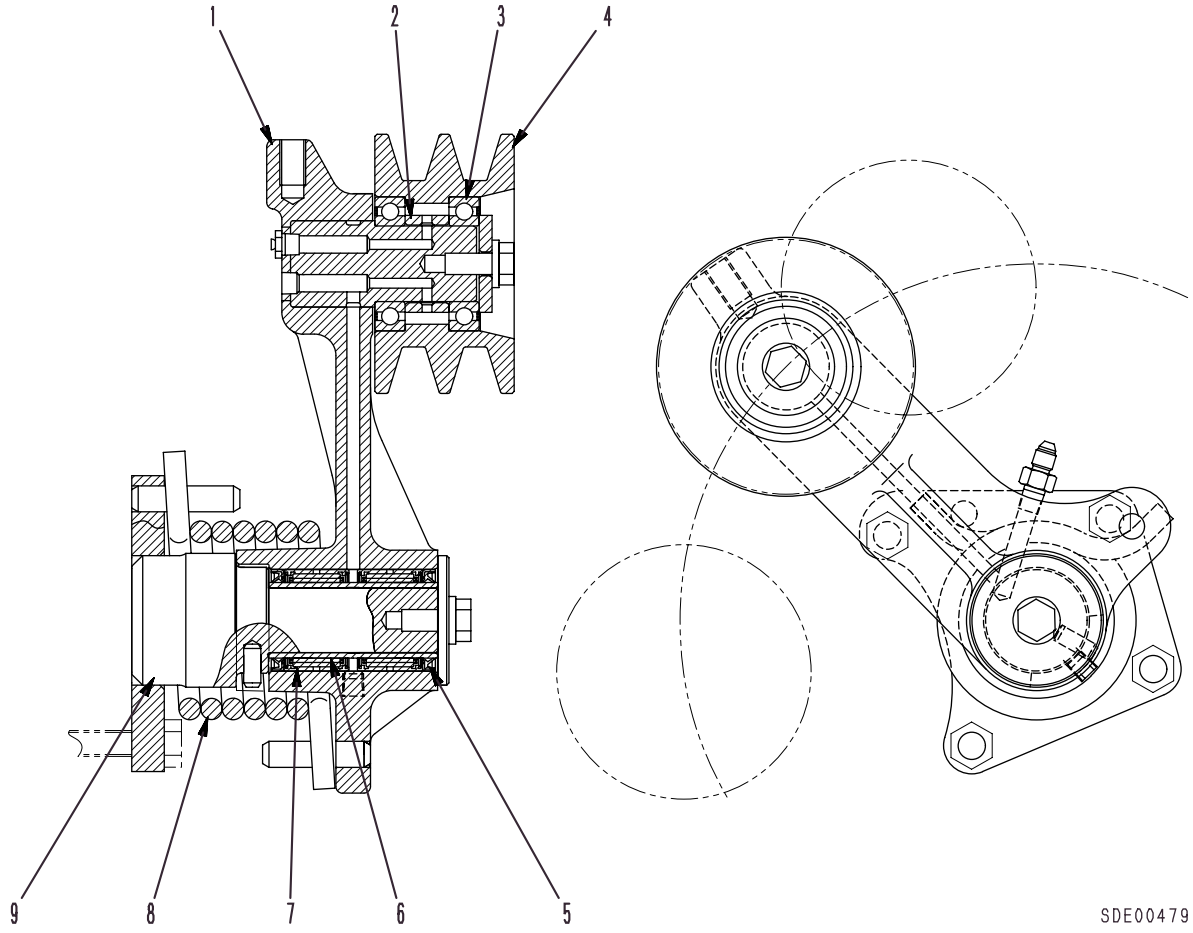
1. Radiator
2. Thermostat
3. Oil cooler
4. Water pump
5. Air compressor
6. Corrosion resistor
7. Cooling fan

A. Oil inlet
B. Oil outlet

TENSION PULLEY

★ The shape may differ according to the machine model.

SA6D140E-3 (D155AX-5) (110001 – 112349)

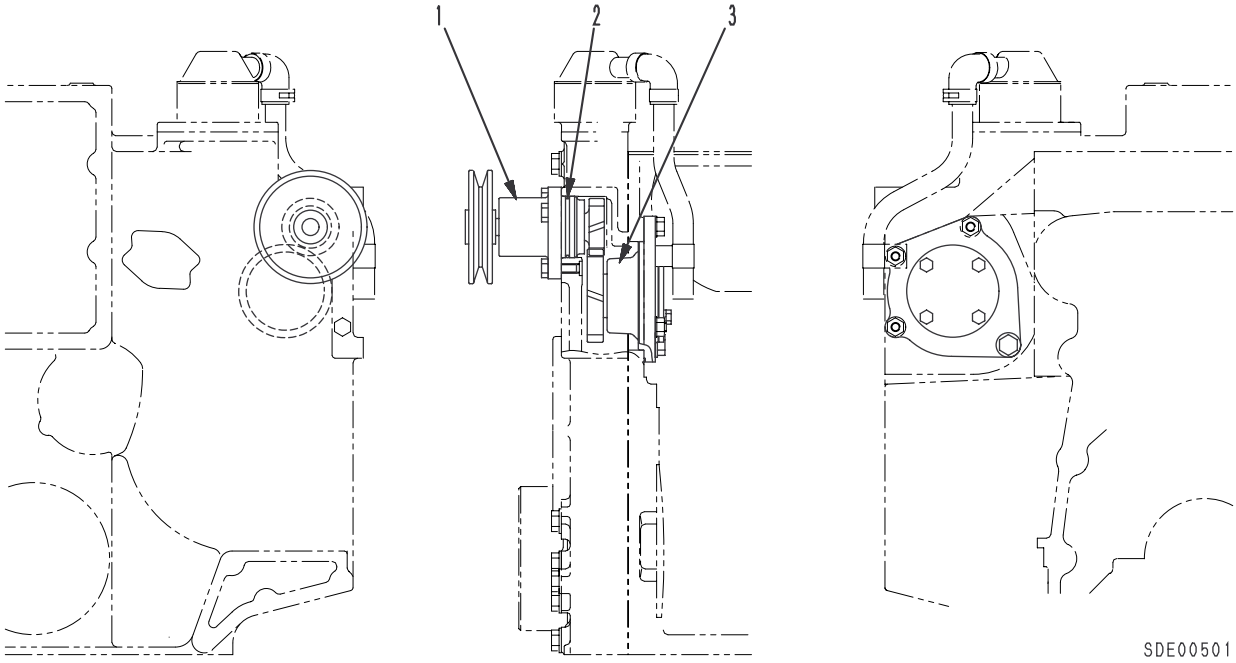


1. Bracket
2. Spacer
3. Ball bearing
4. Tension pulley
5. Oil seal
6. Inner race
7. Needle bearing
8. Coil spring
9. Tension shaft

FRONT PTO

MOUNT

★ The shape may differ according to the machine model.

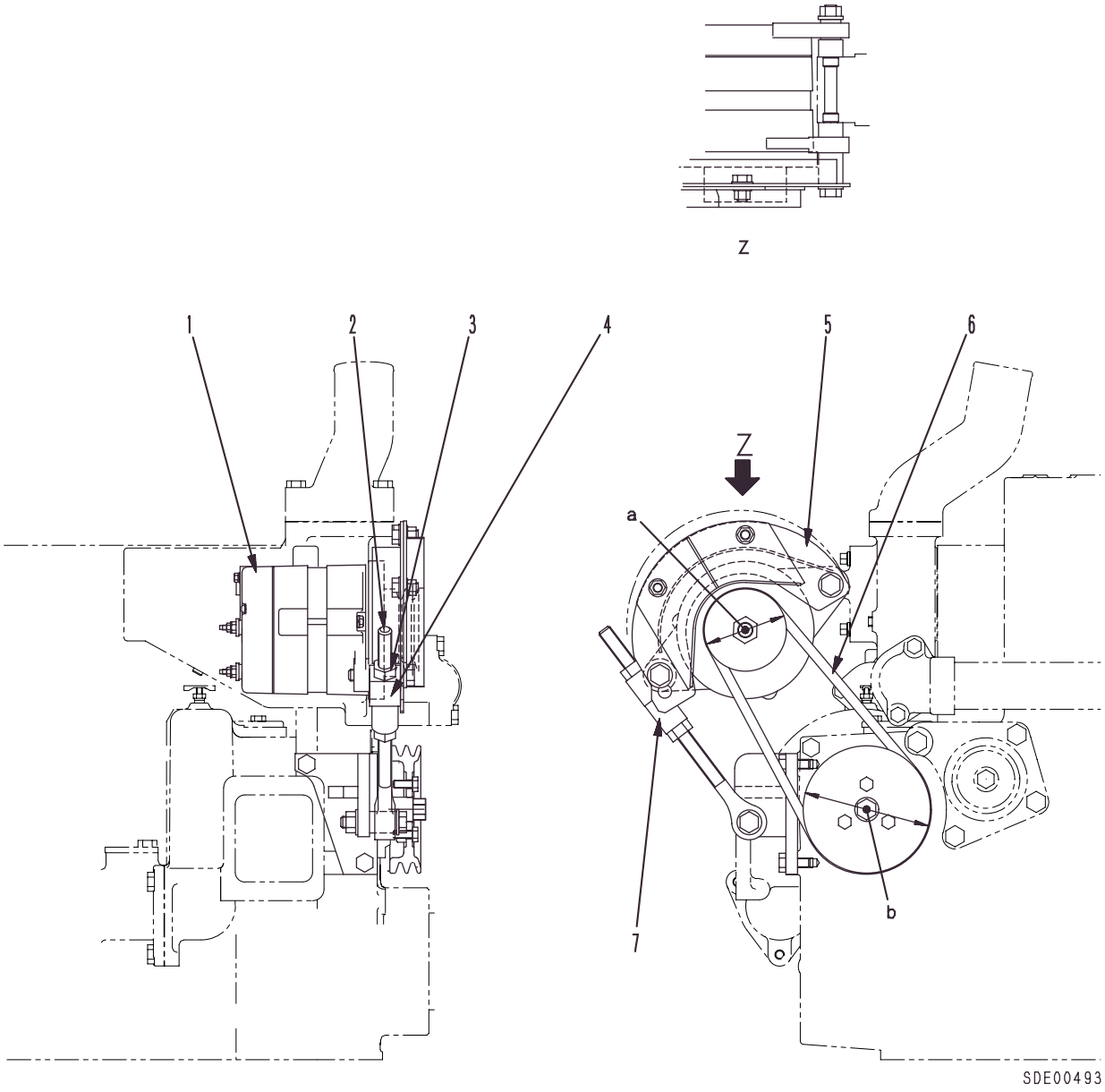


1. Front PTO
2. O-ring
3. Front PTO drive gear assembly

ALTERNATOR

MOUNT

★ The shape may differ according to the machine model.

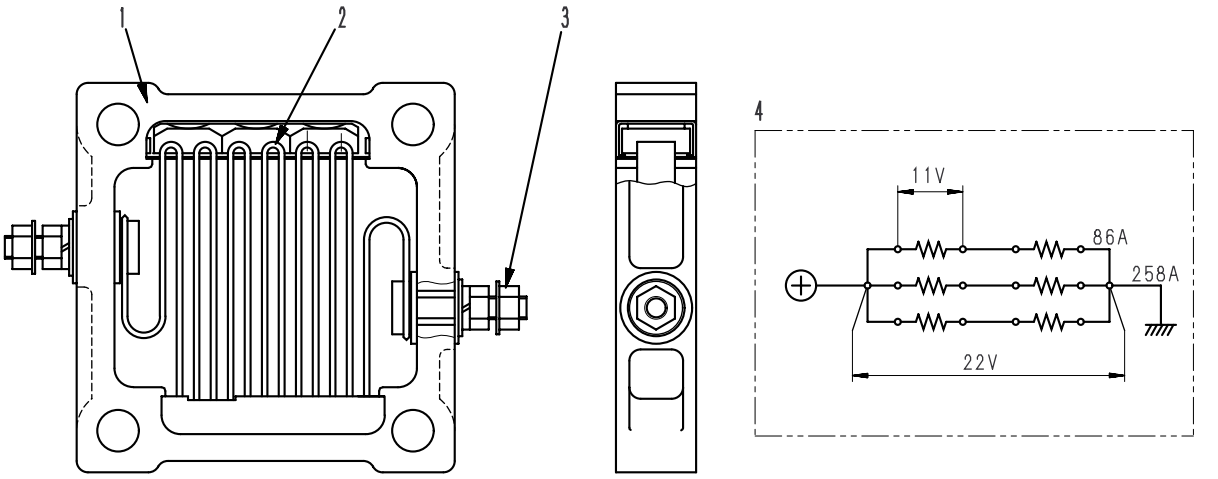


1. Alternator
2. Adjustment rod
3. Nut (x 2)
4. Plate
5. Cover
6. V-belt (x 2)
7. Spacer

a. Outside diameter of alternator pulley: 85mm
b. Outside diameter of alternator drive pulley: 132 mm

For SAA6D140E-3

★ The shape may differ according to the machine model.



SXE01642

1. Body
2. Heater coil
3. Terminal
4. Wiring diagram

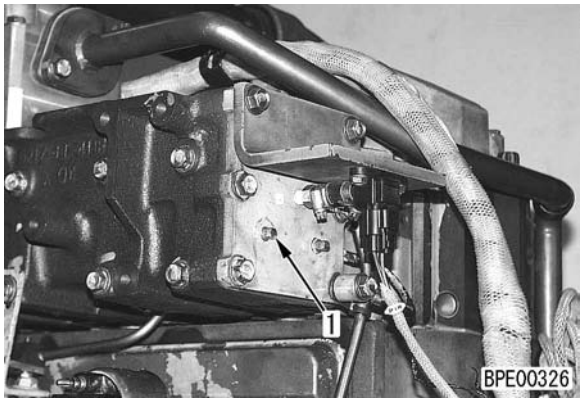
Specifications

Heater type: Electrical intake air heater
- Rated voltage: 22V (DC)
- Load current: 86A

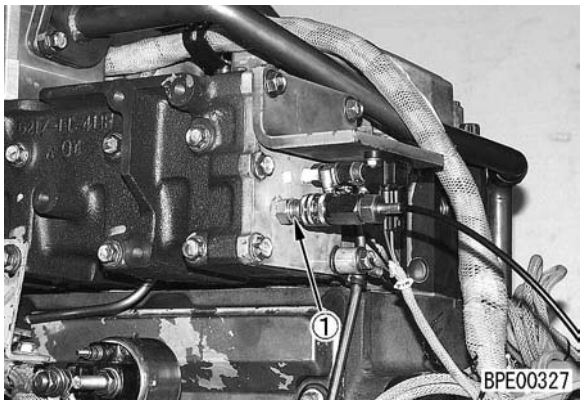
MEASURING INTAKE AIR PRESSURE (BOOST PRESSURE)

⚠ When installing or removing the measuring equipment, be careful not to touch high-temperature parts.

1. Remove air intake pressure measurement plug (1).



2. Fit nipple ① of pressure test kit **A**, then connect to the pressure test kit.



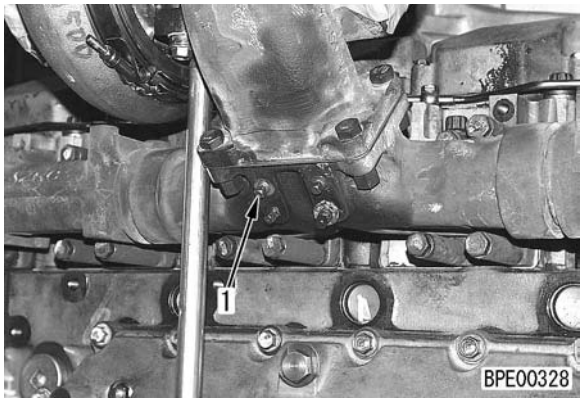
3. Start the engine and measure the intake air pressure when the engine is running at rated horsepower.
★ When measuring with the engine mounted on the machine, measure according to the conditions given in the shop manual for the machine.

4. After completing the measurement, remove the measurement equipment and set to the original condition.

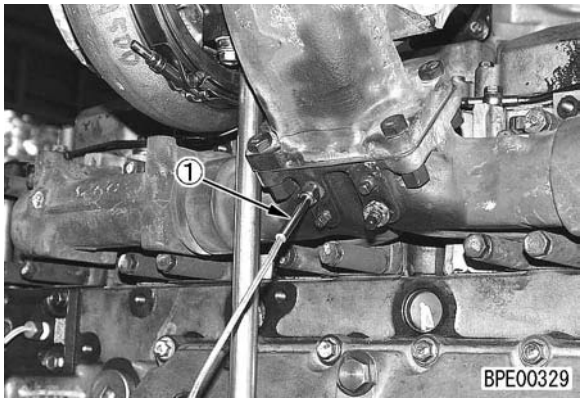
MEASURING EXHAUST TEMPERATURE

⚠ Wait for the exhaust manifold temperature to go down before removing or installing the measuring equipment.

1. Remove exhaust temperature measurement plug (1).



2. Fit sensor ① of digital temperature gauge **B**, then connect to the digital temperature gauge.



3. Start the engine and measure the exhaust temperature when the engine is running at rated horsepower.
★ When measuring with the engine mounted on the machine, measure according to the conditions given in the shop manual for the machine.

4. After completing the measurement, remove the measurement equipment and set to the original condition.

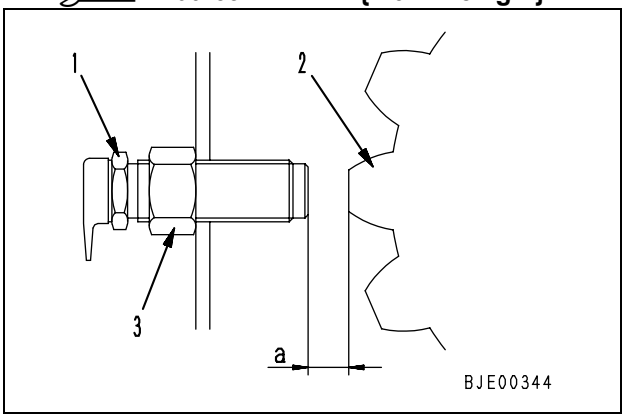
ADJUSTING SPEED SENSOR

★ The G revolution sensor and NE revolution sensor for the common rail type fuel injection system cannot be adjusted.
★ Adjust the speed sensor as follows for the type which uses an electronic system on the machine and detects the signal from the flywheel ring gear.

1. Screw in sensor (1) until the tip contacts the tip of the tooth of flywheel ring gear (2).
★ Check that there is no damage or metal powder on the tip of the sensor when installing.
Thread: **Hydraulic sealant**

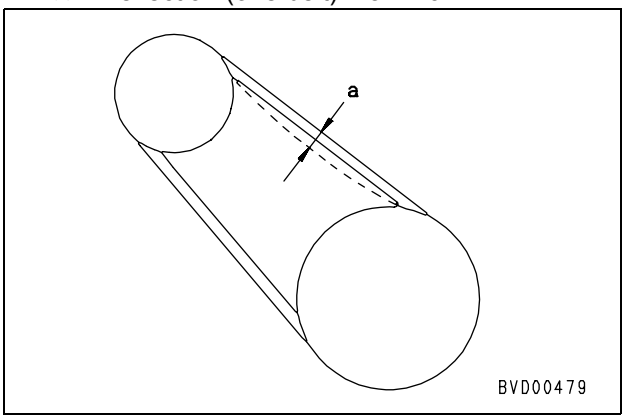
2. Turn sensor (1) back 1/2 – 2/3 turns.
★ This makes a clearance of 0.75 – 1.00 mm between the tip of the sensor and the tip of the gear tooth.

3. Hold sensor (1) in position with nut (3).
Nut: **69 – 74 Nm {7.0 – 7.5 kgm}**

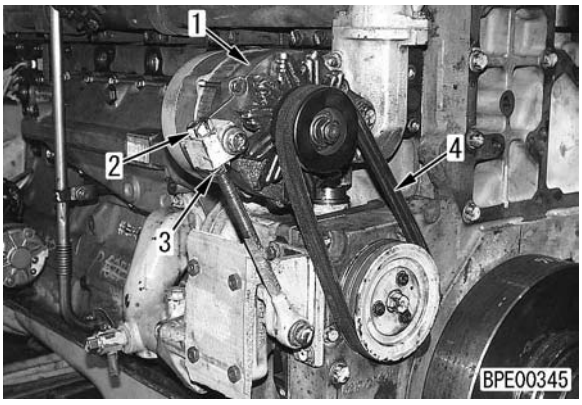


TESTING AND ADJUSTING ALTERNATOR BELT TENSION

1. Inspecting
Measure deflection **a** when the belt is pressed with a finger at a point midway between the alternator pulley and drive pulley.
★ Pushing force: Approx.98 Nm {approx.10 kg}
★ Deflection (one belt): 13 – 16 mm



2. Adjusting
★ This makes a clearance of 0.75 – 1.00 mm between the tip of the sensor and the tip of the gear tooth.
★ If the deflection is not within the specified range, adjust as follows.
1) Loosen 2 mounting bolts of alternator (1) and 1 lock bolt of the bar.
2) Loosen locknut (2), move alternator (1) with adjustment nut (3), and adjust the tension of belt (4).
★ Deflection (one belt): 13 – 16 mm
3) Tighten locknut (2).
4) Tighten 2 mounting bolts of alternator (1) and 1 lock bolt of the bar.
★ After adjusting, check the belt tension again.



Engine	Machine model	Test item	Specification value	Speed (rpm)	Dynamometer load (N {kg})
SDA6D140E-3	D275A-5 D275AX-5	Rated horsepower	332 kW/2,000 rpm (Gross) {446 HP/2,000 rpm} (Gross)	2,000 ± 5	2,150 – 2,290 {219 – 233}
		Max. torque	1,990 Nm/1,400 rpm (Gross) {203 kgm/1,400 rpm} (Gross)	1,400 ± 100	2,700 – 2,860 {275 – 292}
		High idling speed	2,200 ± 50 rpm	2,200 ± 50 rpm	—
		Low idling speed	700 ± 30 rpm	700 ± 30 rpm	—
		Rated horsepower			
		Max. torque			
		High idling speed			
		Low idling speed			
		Rated horsepower			
		Max. torque			
		High idling speed			
		Low idling speed			
		Rated horsepower			
		Max. torque			
		High idling speed			
		Low idling speed			

★ This table shows the standard values using the JIS correction factor

★ The output and torque values in the table are the standard values with the fan removed, so they are different from the specification values.

★ The table shows the standard values with an air cleaner installed, muffler installed, alternator under no load, and air compressor open (when installed).

★ The dynamometer load shows the value for an arm length of 716 mm..

c) Exhaust smoke comes out but engine does not start (Fuel is being injected)

General causes why exhaust smoke comes out but engine does not start

- Lack of rotating force due to defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel

			Causes												
			Clogged air cleaner element	Defective, broken dynamic valve system (valve, rocker lever, etc.)	Worn piston ring, cylinder liner	Improper fuel used	Clogged air breather hole in fuel tank cap	Leakage, clogging, air in fuel system	Clogged fuel filter, strainer	Clogged fuel feed pump strainer	Stuck, seized fuel supply pump plunger	Clogged injector, defective spray	Defective or deteriorated battery	Defective low-temperature water temperature sensor, disconnection	Defective intake air heater system
Questions	Confirm recent repair history														
	Degree of use of machine	Operated for long period			△				△	△		△			
	Suddenly failed to start			◎							◎			○	
	Non-specified fuel is being used										○	○			
	Replacement of filters has not been carried out according to Operation Manual		◎						◎	◎					
	Engine oil must be added more frequently				◎										
	Preheating indicator lamp does not light up during preheating or in low temperatures														◎
Check items	Dust indicator lamp is red		◎												
	Air breather hole in fuel tank cap is clogged						○								
	Rust and water are found when fuel tank is drained								◎	◎					
	When fuel filter is removed, there is no fuel in filter					◎									
	There is leakage from fuel piping							◎							
	When fuel priming pump is operated, there is no response, or operation is too heavy							◎	○	○					
	Starting motor cranks engine slowly												◎		
	When engine is cranked, abnormal noise is heard from around cylinder head			◎											
	When engine is cranked with starting motor,	No fuel comes out even when fuel filter air bleed plug is removed				○			◎	◎					
		When hose at collection portion for spill flow from fuel injector is disconnected, spill flow is small (See Troubleshooting E-26)									◎				
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low											◎			
Troubleshooting	Check air cleaner element directly		●												
	Remove head cover and check directly			●											
	When compression pressure is measured, it is found to be low				●										
	When air is bled from fuel line, air comes out							●							
	Check fuel filter, strainer directly								●						
	Check fuel feed pump strainer directly									●					
	Carry out troubleshooting for E Mode "Fuel supply pump non-force feed"										●				
	Spray condition is poor when fuel injector is tested as individual part											●			
	When specific gravity of electrolyte or voltage of battery is measured, it is found to be low												●		
	Defective water temperature gauge display on machine													●	
	Intake air heater mount does not become warm during preheating														●
		Remedy	Clean	Replace	Replace	Replace	Clean	Correct	Clean	Clean	Replace	Clean	Replace	Replace	Replace

S-12 Oil pressure caution lamp lights up (drop in oil pressure)

General causes why oil pressure drops
- Leakage, clogging, wear of lubricating system
- Defective oil pressure control
- Improper oil used (improper viscosity)
- Deterioration of oil due to overheating

			Causes										
			Worn bearing, journal	Lack of oil in oil pan	Water, fuel in oil	Clogged strainer inside oil pan	Clogged, broken pipe inside oil pan	Defective oil pump	Defective oil pump relief valve	Clogged oil filter	Leaking, crushed, clogged hydraulic piping	Defective oil pressure sensor	Defective oil level sensor
Questions	Confirm recent repair history												
	Degree of use of machine	Operated for long period	△					△		△			
	Oil pressure caution lamp lights up								○	◎			
	Non-specified oil is being used		○							○			
	Replacement of filters has not been carried out according to Operation Manual									◎			
	Condition when oil pressure lamp lights up	Lights up at low idling	◎						○				
		Lights up at low idling and high idling		○		◎	◎	◎	○				
		Lights up on slopes		◎									
		Sometimes lights up							◎			○	○
	Oil temperature caution lamp lights up (machines equipped with lamp)			◎									◎
	Oil level in oil pan is low			◎									
Check items	There is crushing, external leakage from hydraulic piping										◎		
	Oil is cloudy white or smells of diesel oil				◎								
	Metal particles are found when oil is drained		◎										
	Metal particles are found when oil inside oil filter is drained		◎					○					
Troubleshooting	Metal particles are found in oil filter		●		See S-13.								
	Check oil pan strainer pipe directly					●	●						
	Oil pump rotation is heavy, there is play							●					
	Deterioration, damage of valve, spring in oil pump relief valve								●				
	Check oil filter directly									●			
	Carry out troubleshooting for E Mode "Abnormality in oil pressure sensor"											●	
	When oil level sensor is replaced, oil pressure caution lamp goes out												●
		Remedy	Clean	Add	—	Clean	Clean	Replace	Adjust	Clean	Correct	Replace	Replace

2. Table of error codes

Error code	Nature of abnormality	Operation for re-enaction
E-1b	Abnormality in NE revolution sensor system	Start engine.
E-1C	Abnormality in G revolution sensor system	Start engine.
E-20	Abnormality in model selection system	Turn starting switch ON.
E-22	Overrun	Start engine.
E-23	Overheat	Start engine.
E-24	Drop in oil pressure	Start engine.
E-30	Abnormality in idling validation signal system	Turn starting switch ON.
E-31	Abnormality in throttle sensor system	Turn starting switch ON.
E-34	Abnormality in water temperature high-temperature sensor system	Turn starting switch ON.
E-36	Abnormality in oil pressure switch system	Start engine.
E-3C	Abnormality in boost pressure sensor system	Turn starting switch ON.
E-3d	Abnormality in fuel temperature sensor system	Turn starting switch ON.
E-50	Abnormality in preheat relay contact system	Turn starting switch ON.
E-51	Abnormality preheat relay coil system	Turn starting switch ON.
E-54	Short circuit in starting switch signal C	Turn starting switch OFF.
E-56	Abnormality 1 in power source system	Turn starting switch ON.
E-57	Abnormality 2 in power source system	Turn starting switch OFF.
E-5A	Abnormality fuel injection quantity control switch signal	Turn starting switch ON.
E-6A	Abnormality in water temperature low-temperature sensor system	Turn starting switch ON.
E-70	Excess current in fuel supply pump PCV1 system	Turn starting switch ON.
E-71	Excess current in fuel supply pump PCV2 system	Turn starting switch ON.
E-74	Disconnection in fuel supply pump PCV1 system	Turn starting switch ON.
E-75	Disconnection in fuel supply pump PCV2 system	Turn starting switch ON.
E-77	Abnormality in common rail fuel pressure sensor system	Turn starting switch ON.
E-79	Abnormality 1 in common rail fuel high pressure	Start engine.
E-7A	Abnormality 2 in common rail fuel high pressure	Start engine.
E-7b	Fuel supply pump non-force feed 1	Start engine.
E-7C	Fuel supply pump non-force feed 2	Start engine.
E-7d	Abnormality in common rail fuel pressure	Start engine.
E-80	Defective controller	Turn starting switch ON.
E-81	Disconnection in No. 1 fuel injector system	Turn starting switch ON.
E-82	Disconnection in No. 2 fuel injector system	Turn starting switch ON.
E-83	Disconnection in No. 3 fuel injector system	Turn starting switch ON.
E-84	Disconnection in No. 4 fuel injector system	Turn starting switch ON.
E-85	Disconnection in No. 5 fuel injector system	Turn starting switch ON.
E-86	Disconnection in No. 6 fuel injector system	Turn starting switch ON.
E-8A	Short circuit in No. 1, No. 2, No. 3 fuel injector system	Turn starting switch ON.
E-8b	Short circuit in No. 4, No. 5, No. 6 fuel injector system	Turn starting switch ON.

E-1 Error code [E-1b] [Abnormality in NE revolution sensor system]

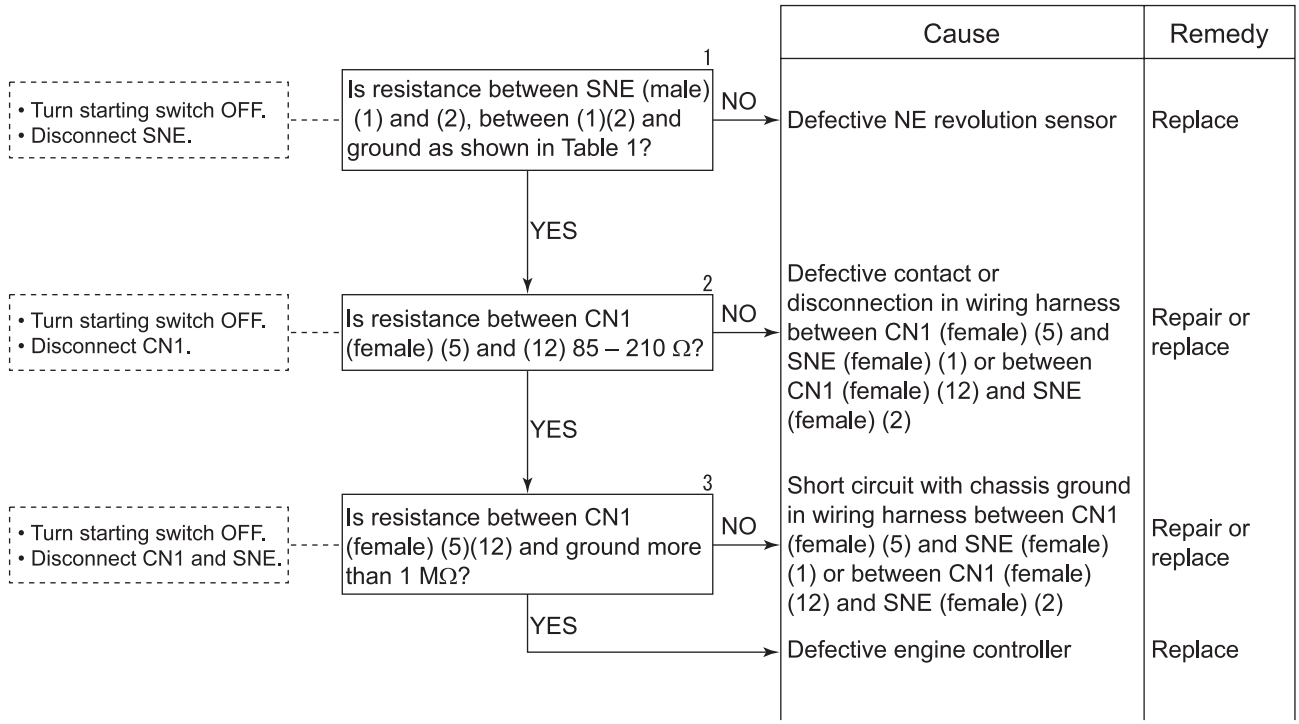
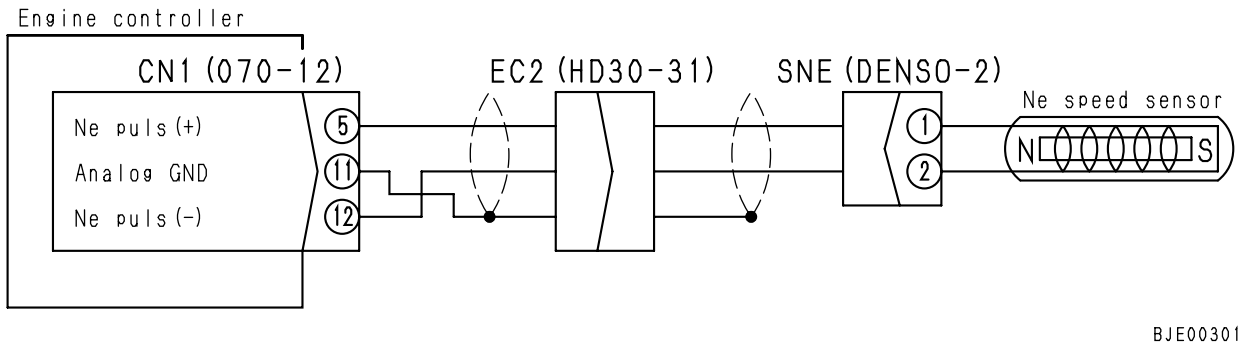


Table 1

SNE (male)	Resistance value
Between (1) and (2)	85 – 210 Ω
Between (1)(2) and ground	Min. 1 MΩ

E-1 Related electrical circuit diagram



E-9 Error code [E-34] [Abnormality in water temperature high-temperature sensor system]

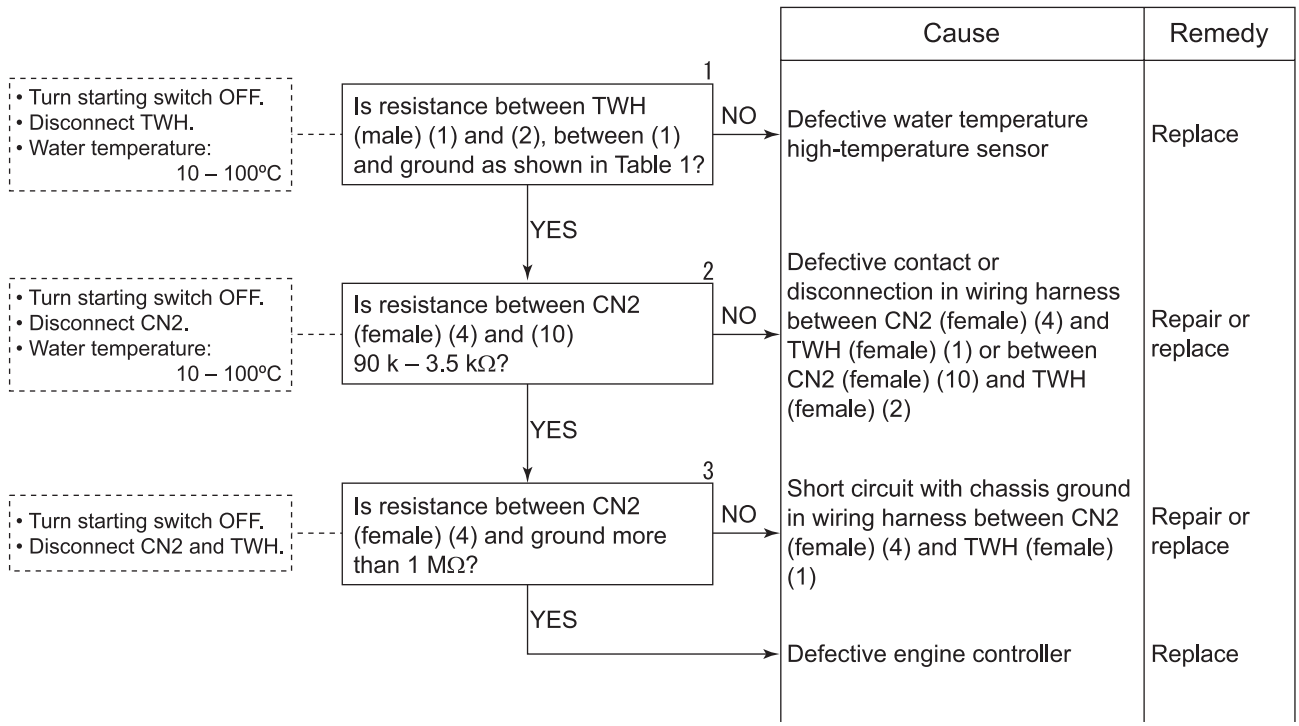
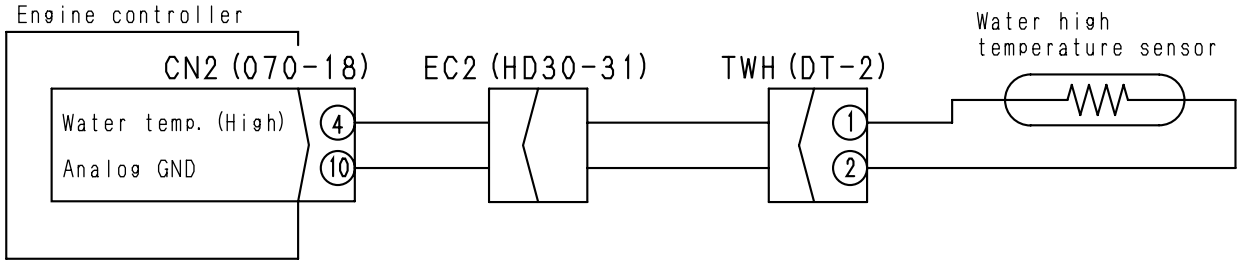


Table 1

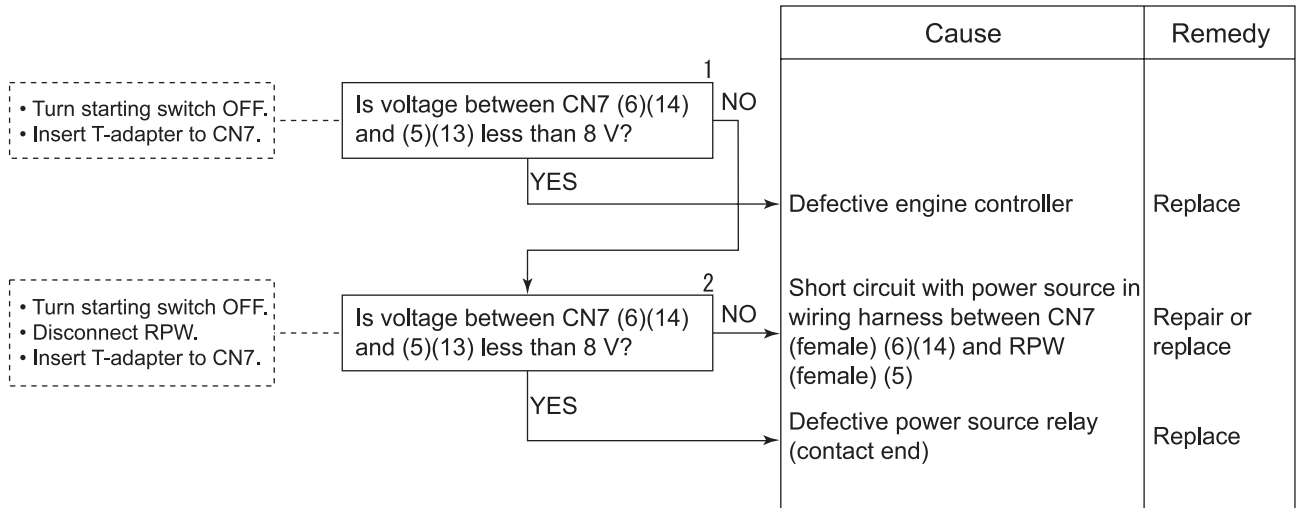
TWH (male)	Resistance value
Between (1) and (2)	90 k – 3.5 kΩ
Between (1) and ground	Min. 1 MΩ

E-9 Related electrical circuit diagram

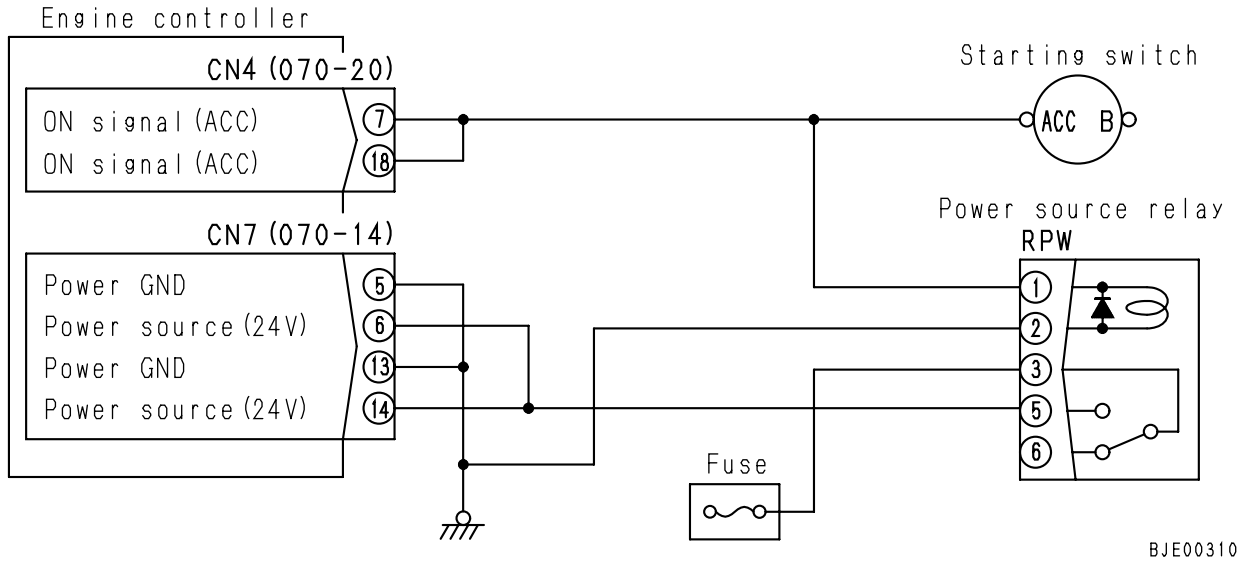


BJE00306

E-17 Error code [E-57] [Power source system abnormality 2]



E-17 Related electrical circuit diagram



Note 1: Carry out inspection, maintenance, and replacement of the filter and strainer as follows.

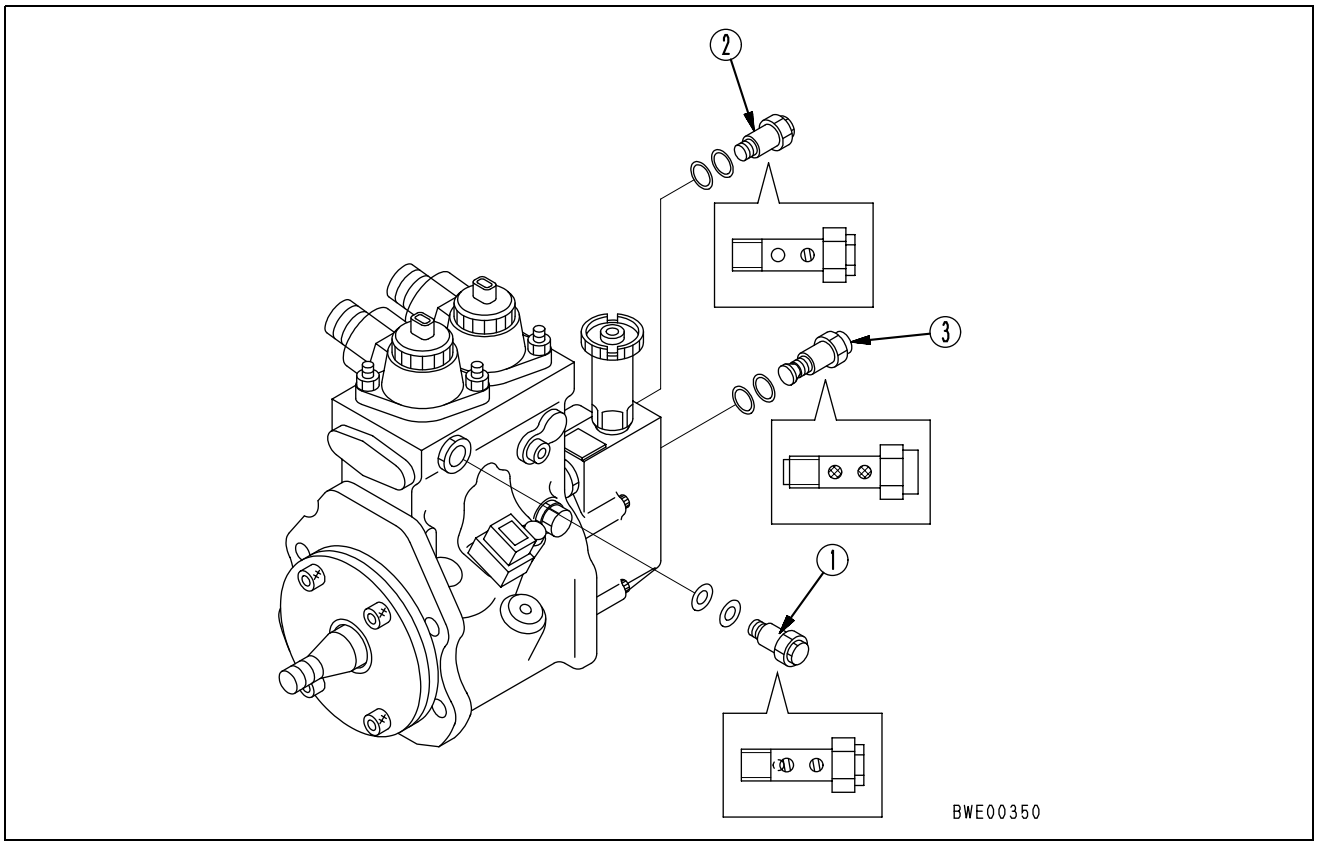
1) Gauze filter
   Disassemble and inspect. If it is clogged, clean it.
2) Strainer on upstream side of gauze filter
   If the gauze filter is clogged, clean the upstream strainer also.
3) Fuel filter
   If the problem is not solved even when Steps 1) and 2) above have been carried out, replace the fuel filter.

Note 2: If the equipment in the low-pressure circuit is defective, inspect the following points.

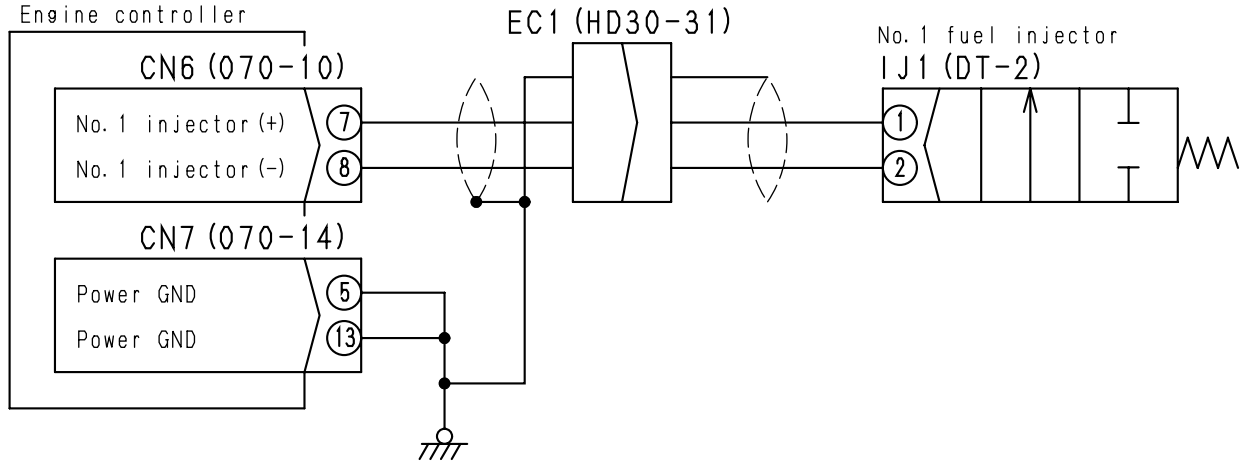
1) Remaining amount of fuel
2) Stuck, worn feed pump
3) Leakage, clogged low-pressure fuel piping
4) Defective operation of bypass valve, mistaken assembly of other parts (see Fig. 1)
5) Fuel entering oil pan (fuel leakage inside head cover)

Fig. 1 Installation position of overflow valve ①, bypass valve ②, fuel inlet port joint (with gauze filter) ③

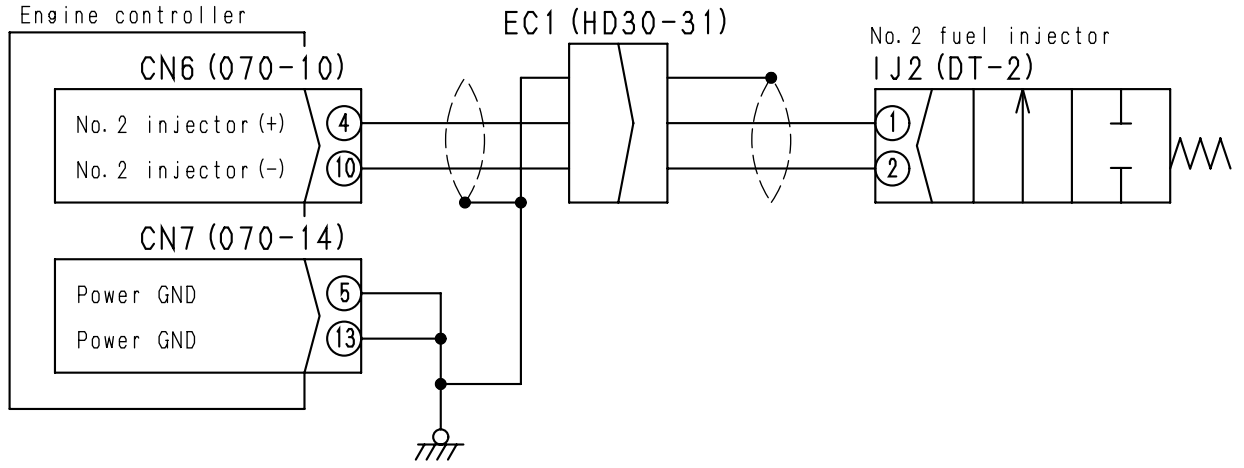
- Overflow valve①: Spring can be seen from hole at nut end
- Bypass valve ②: Gauze filter can be seen from both holes
- Fuel inlet port joint ③: Spring can be seen from both holes



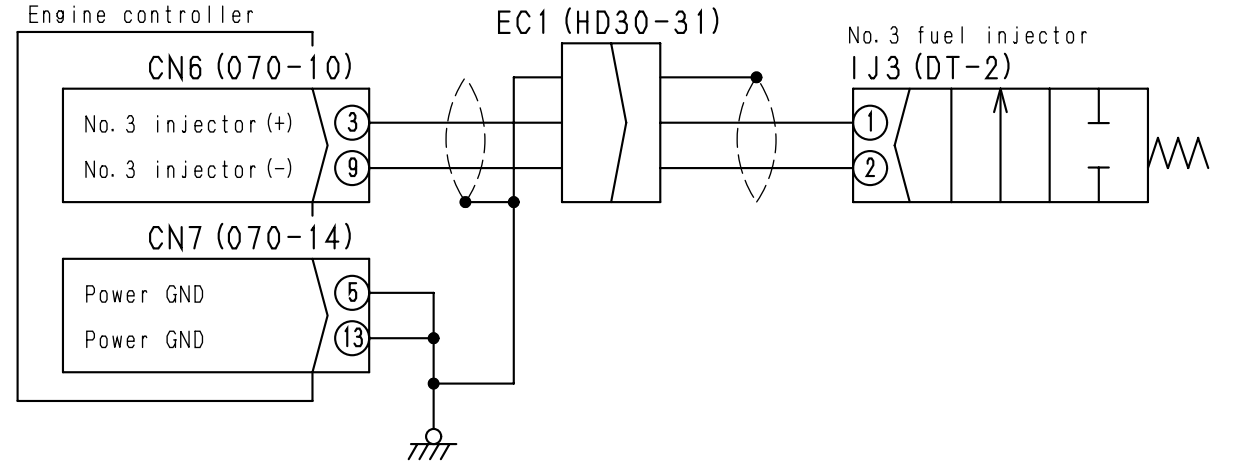
E-35 a), b) Related electrical circuit diagram



E-35 a), c) Related electrical circuit diagram



E-35 a), d) Related electrical circuit diagram

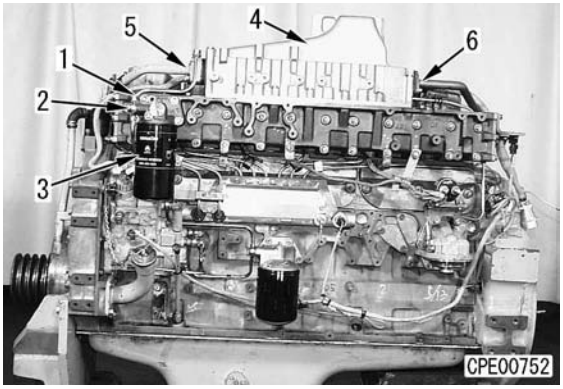


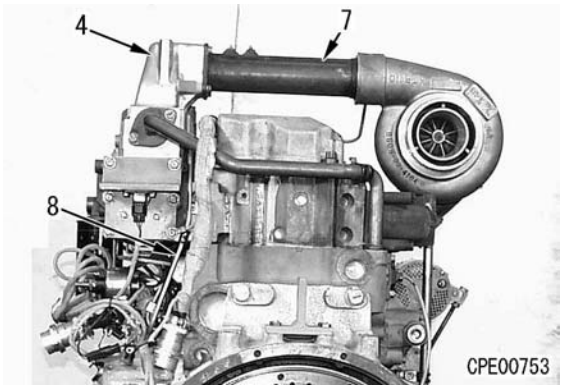
4. Corrosion resistor, aftercooler, and air intake pipe

1) Remove tubes (1) and (2) and 5 mounting bolts of corrosion resistor (3), then remove corrosion resistor (3) (only when it is installed).
2) Remove tubes (5) and (6) of aftercooler (4).
3) Remove the 14 mounting bolts of the aftercooler.

★ The 3 bolts on the head cover side are used to the fuel high-pressure tube clamp, too.

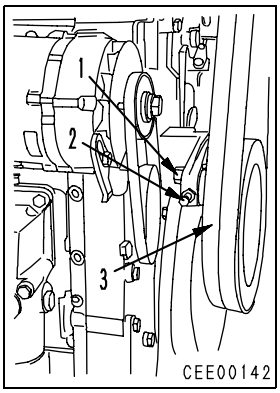
4) Remove the mounting bolts of air intake pipe (7) and turbocharger lubricating oil tube (8), then lift off aftercooler (4).
5) Pull out air intake pipe (7).

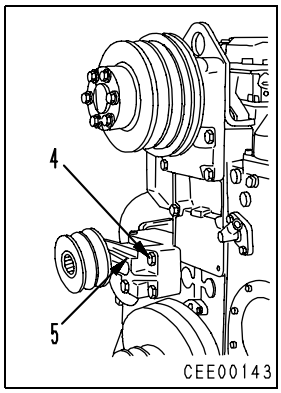




5. Tension pulley assembly

1) Loosen tension pulley mounting nut (1).
2) Loosen adjustment bolt (2) and move the tension pulley inward, then remove fan belt (3).
3) Remove mounting bolt (4) and tension pulley assembly (5).



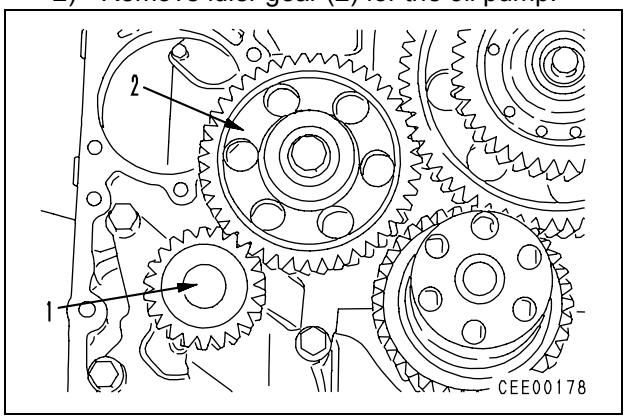


6. Fan pulley assembly

Remove the mounting bolt and the fan pulley assembly.

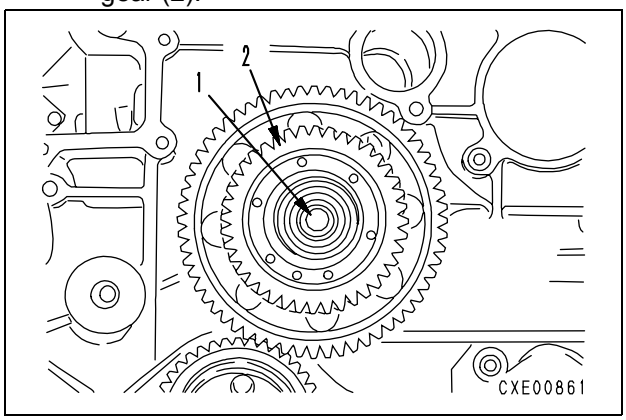
34. Oil pump assembly and idler gear for oil pump

1) Remove oil pump assembly (1).
2) Remove idler gear (2) for the oil pump.



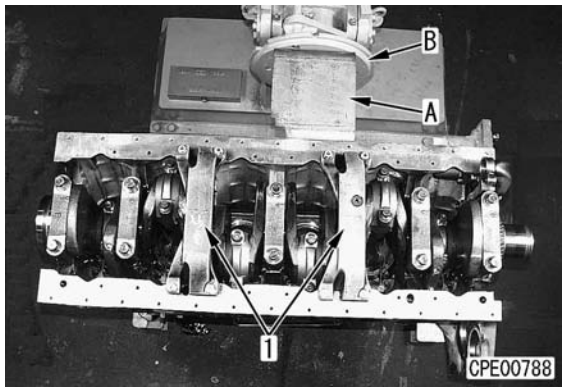
35. Main idler gear

1) Remove mounting bolt (1) and main idler gear (2).



36. Setting to engine overhaul stand and underframes

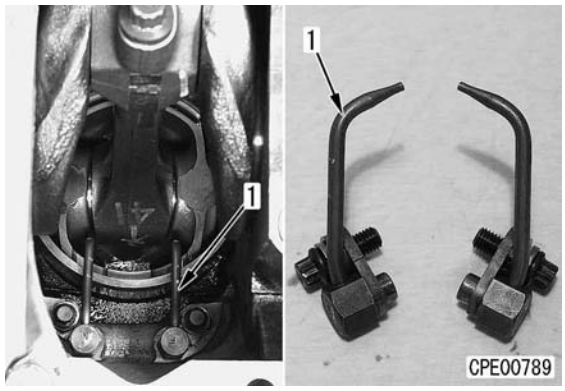
1) Install tool **A** to the cylinder block, then sling and set the engine to tool **B**.
2) Remove the 4 mounting bolts each and 2 underframes (1).



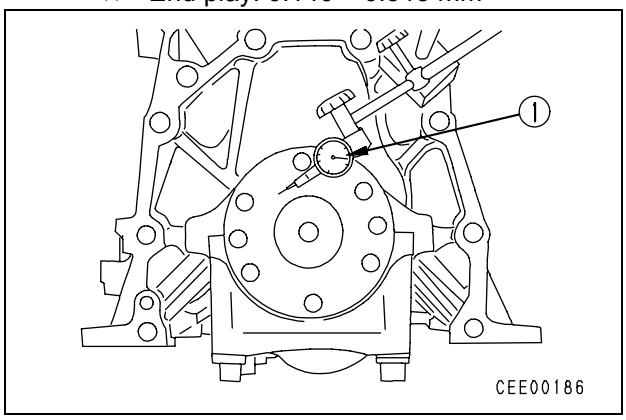
37. Cooling nozzle

1) Remove the mounting bolt and cooling nozzle (1).

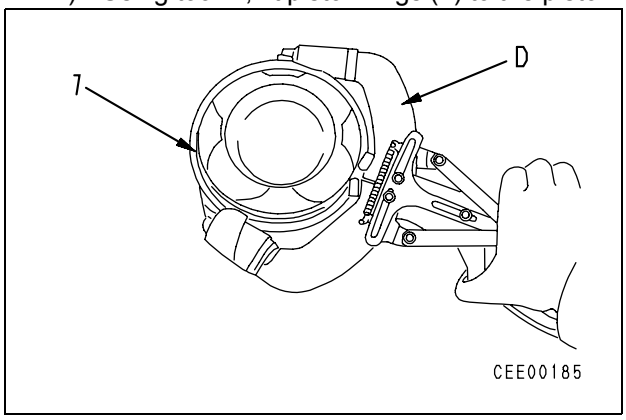
★ Each cylinder has 2 cooling nozzles each. Before pulling out the piston, be sure to remove the cooling nozzles.



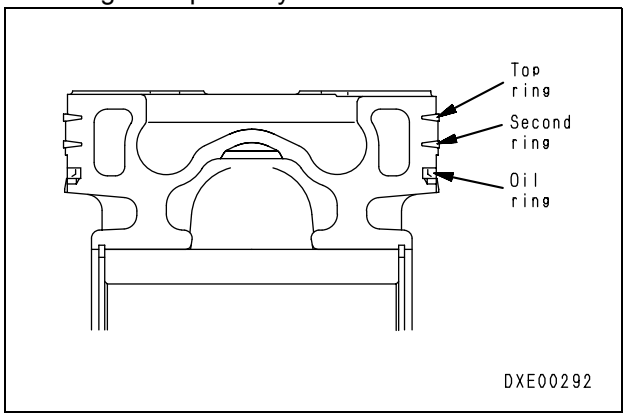
11) Measure the end play of the crankshaft with tool ①.
★ End play: 0.140 – 0.315 mm



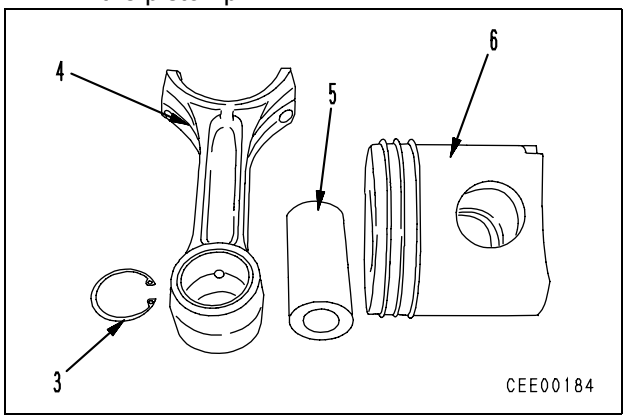
3. Piston and connecting rod assembly
★ Referring to STRUCTURE AND FUNCTION, MAINTENANCE STANDARD, fit the cylinder liner and piston selectively.
• Install the piston and connecting rod assembly according to the following procedure.
1) Using tool **D**, fit piston rings (7) to the piston.



★ Fit each piston ring as shown in the following figure.
★ Fit each piston ring with a stamped mark side up.
★ When fitting the oil ring, fit the expander to the piston, then fit the oil ring. At this time, check that the expander is fitted to the ring groove perfectly.



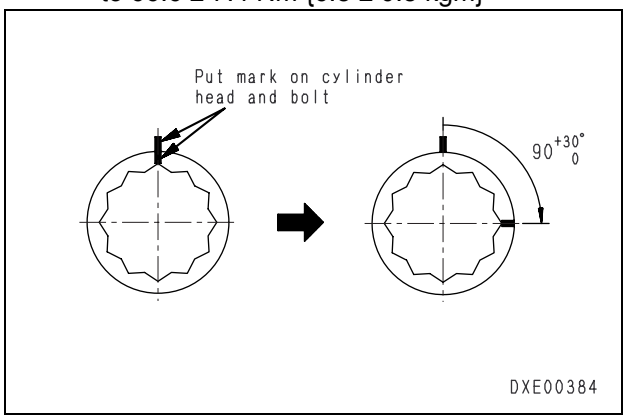
2) Set the piston and connecting rod.
★ Select a piston (6) and a connecting rod (4) having the same stamped cylinder No. on them and set those Nos. in the same direction, then insert piston pin (5) to assemble connecting rod (4) and piston (6).
3) Fit snap rings (3) on both sides to secure the piston pin.



4) Fit the upper bearing metal to the connecting rod, matching the projection of the former to the cut of the latter.
★ Before fitting the bearing metal, make sure that its back side is free from foreign matter.

2) When not using tool **J**
Make marks on the bolts and head with paint, then tighten the bolts by $90^{+30^\circ}_{0}$ in the order of (1) – (6).

★ After tightening bolts (1) – (6), tighten bolt (7) to 66.6 ± 7.4 Nm {6.8 ± 0.8 kgm}



17. Cross head

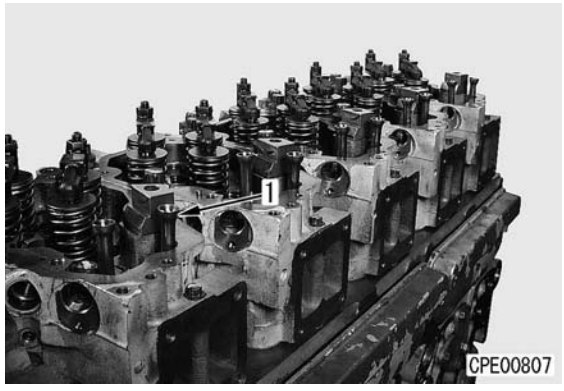
Install cross head (1).

★ Adjust the cross head according to the following procedure.
i) Loosen the locknut and return the adjustment screw.
ii) Holding the top of the cross head lightly, tighten the adjustment screw.
iii) After the adjustment screw touches the valve stem, tighten it further by 20º.
iv) Tighten the locknut.
Locknut:
53 – 64.7 Nm {5.4 – 6.6 kgm}

18. Push rod

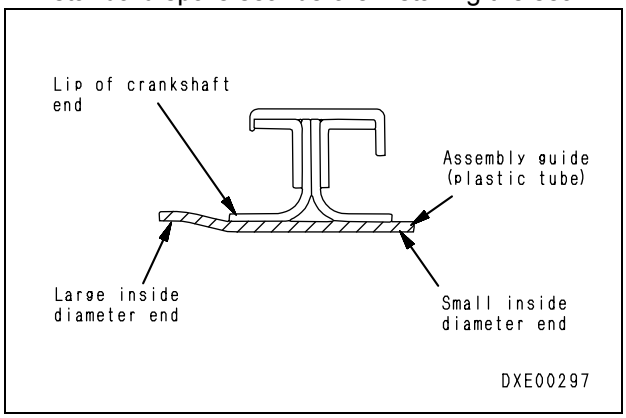
Install push rod (1).

★ Make sure that the push rod is in the cam follower.

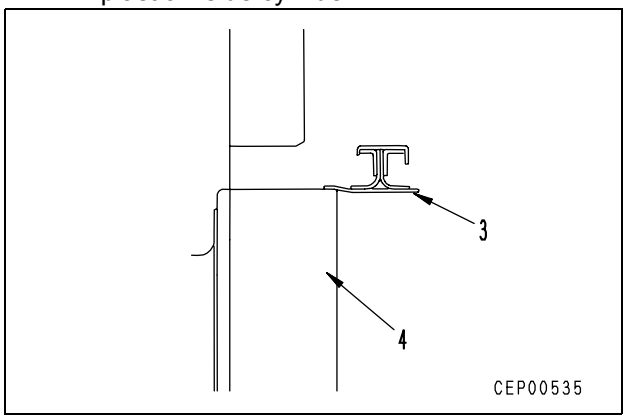


Procedure for installing standard seal

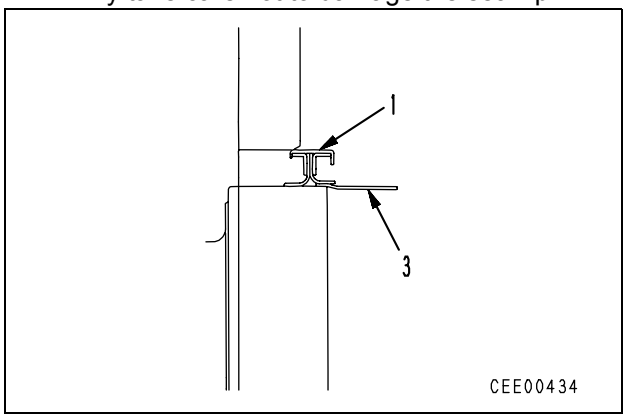
★ Before installing the seal, make sure that the end corners and lip sliding surfaces of the crankshaft and housing are free from flaw, burr, fin, and rust.
★ When installing the seal, do not apply oil or grease to the shaft and seal lip. Wipe off the oil from the shaft.
★ Never remove the inside plastic cylinder of the standard spare seal before installing the seal.



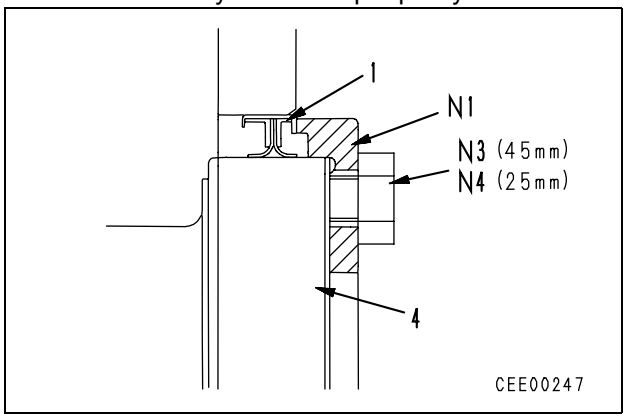
1) Bring the large inside diameter side of plastic inside cylinder (3) to the end of crankshaft (4).
   ★ Take care not to mistake the direction of the plastic inside cylinder.



2) Hold the metal ring of seal (1) with both hands and push it in firmly.
3) After pushing in the seal, remove plastic inside cylinder (3).
   ★ When removing the inside cylinder, extremely take care not to damage the seal lip.



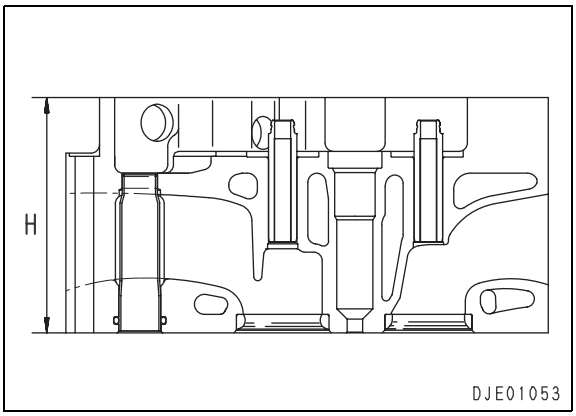
4) Tighten the 3 bolts evenly to press fit seal (1) until the end of tool **N1** reaches the end of crankshaft (4).
   ★ First, tighten tool **N1** until bolt **N3** (45 mm) stops, then tighten **N4** (25 mm).
   ★ When press fitting the seal, take care not to damage the lip on the PTO side with the tool set, etc.
   ★ After press fitting the seal, remove the red sealant layer from its periphery.



GRINDING OF FITTING FACE OF CYLINDER HEAD

1. Grinding

1) Remove the valve seat insert. See the section of replacement of the valve seat insert.
2) Remove the strain and corrosion of the cylinder head by grinding them within the allowable limit of the cylinder head height **H**, then stamp the letter "R" on the left side of the cylinder head.
   - ★ Cylinder head height **H**
     Basic height: 140 ± 0.05 mm
   - ★ Limit after grinding: 139.65 mm
   - ★ Grinding height/time: 0.10 – 0.15 mm
   - ★ Roughness of ground surface: 6 S max.
   - ★ Change of cross level: 0.05 mm max.
   - ★ Grinding limit: 0.3 mm
   - ★ Height difference among cylinder heads of each engine: 0.15 max.
3) Fit an oversize insert one rank larger. See the section of replacing valve seat insert.



2. Check after grinding

Confirm that the sinking distance of the valve is within the standard range. Grind for adjustment, if necessary.

- ★ Standard sinking distance of valve:
  0 ± 0.1 mm