SEN06590-05

Shop Manual

ENGINE

95E -7 SERIES

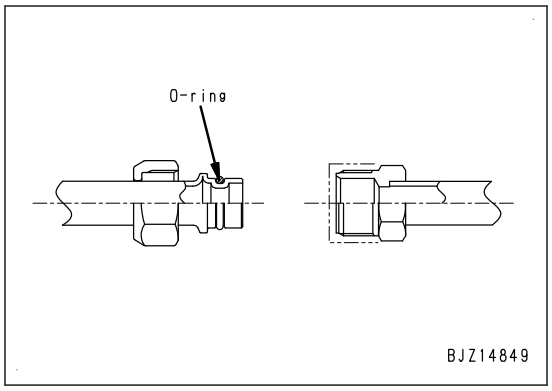
KOMATSU

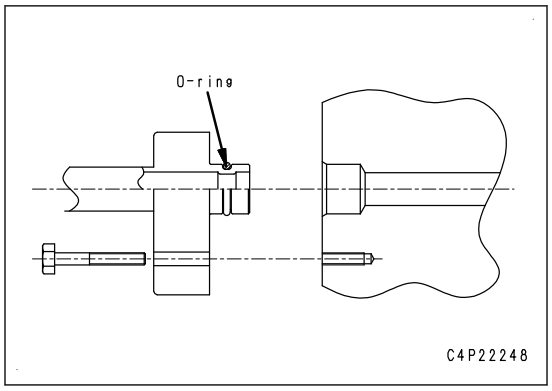
Abbreviation	Actual word spelled out
S/T	Steering
STRG	
SIG	Signal
SOL	Solenoid
STD	Standard
OPT	Option
OP	
PRESS	Pressure
SPEC	Specification
SW	Switch
TEMP	Temperature
T/C	Torque Converter
T/M	Transmission

REMARK

- The figure shows an example of fitting of O-ring.
- An O-ring is fitted to every joint of the air conditioner piping.

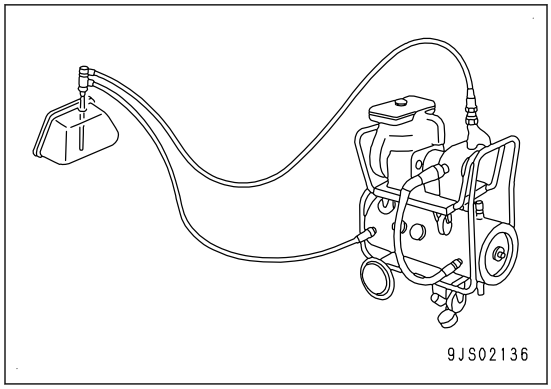
For tightening torques, see THE OTHER INFORMATION, “Precautions for disconnection and connection of air conditioner piping”.





REMARK

The oil cleaning equipment can remove the ultra fine (approximately 3 μm) particles that the filter built in the hydraulic equipment cannot remove. So, it is very effective device.



PRECAUTIONS FOR HANDLING FUEL SYSTEM EQUIPMENT

The machines equipped with common rail fuel injection system (CRI) consists of more precise parts than the parts used in the conventional fuel injection pump and nozzle. If foreign material enters this system, it may cause a failure. Use special care to prevent entry of the foreign material when servicing the fuel system.

Select an appropriate workplace

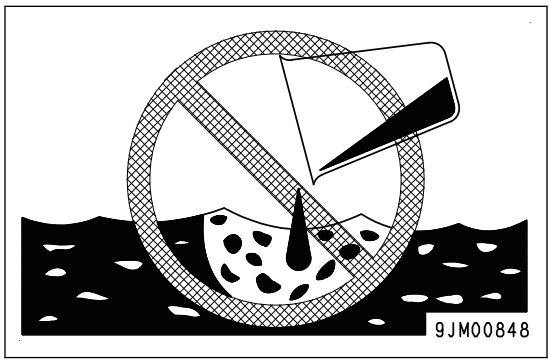
Avoid the work of adding hydraulic oil, replacing filters, or repairing the machine in rainy or windy weather, or in dusty environment.

Sealing the opening

Plug the removed pipes and the openings of the removed components with the caps, tapes, plastic bags, etc. to prevent foreign material from entering.

NOTICE

Do not expose the openings or stuff it, otherwise foreign material may enter or leaked oil may pollute the environment.
Do not discard the oil inconsiderately. Ask the customer for disposal or bring it back to dispose it appropriately.



How to clean parts when dirt is stuck

If any dirt or dust sticks the parts of the fuel system, clean it off thoroughly with clean fuel.

Precautions for replacing fuel filter cartridge

Be sure to use the Komatsu genuine fuel filter cartridge.

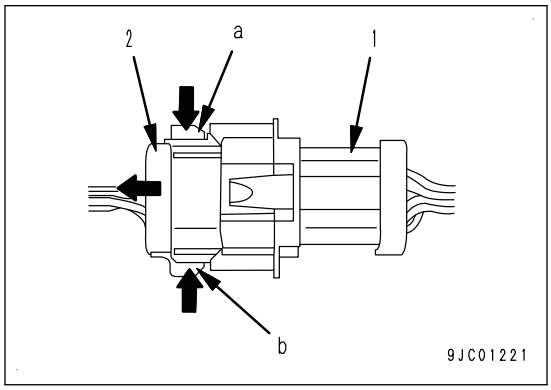
NOTICE

The machine equipped with common rail fuel injection system (CRI) consists of more precise parts than the parts used in the conventional fuel injection pump and nozzle. In order to prevent foreign material from entering this system, the filter employs a specially high performance of filter element. If a filter other than a Komatsu genuine filter is used, fuel system contamination and damage may occur. Therefore Komatsu recommends using only Komatsu fuel filters and install them following the procedures in the shop manual.

METHOD FOR DISCONNECTING AND CONNECTING DEUTSCH CONNECTOR

Method for disconnecting Deutsch connector

While pressing locks (a) and (b) from each side respectively, pull out female connector (2).

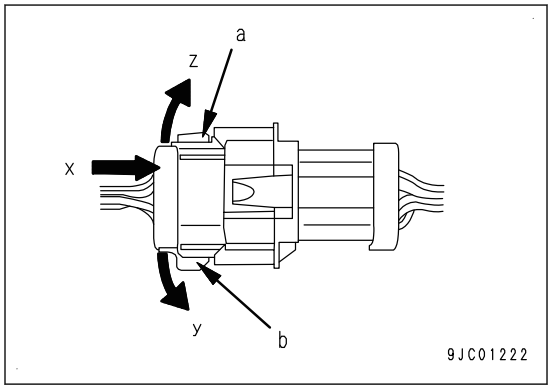


Method for connecting Deutsch connector

1. Push in female connector (2) horizontally, and insert it straight until it clicks. (Arrow: x)
2. In order to check whether locks (a) and (b) are completely inserted, insert female connector (2) by rocking it vertically (in the arrow z direction). (Arrow: x, y, z)

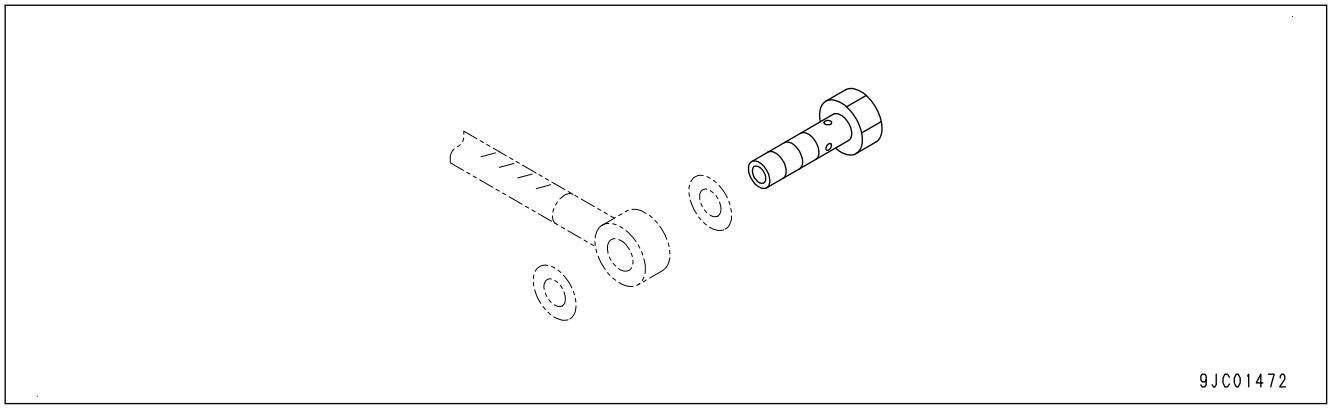
   REMARK

   Lock (a) in the figure is pulled down (not set completely), and lock (b) is set completely.



Types of circuits and color codes

Type of wire		AVS, AV, CAVS						AEX	
Type of circuit	Charge	R	WG	-	-	-	-	R	-
	Ground	B	-	-	-	-	-	B	-
	Start	R	-	-	-	-	-	R	-
	Light	RW	RB	RY	RG	RL	-	O	-
	Instrument	Y	YR	YB	YG	YL	YW	Y	Gr
	Signal	G	GW	GR	GY	GB	GL	G	Br
	Others	L	LW	LR	LY	LB	-	L	-
		Br	BrW	BrR	BrY	BrB	-	-	-
		Lg	LgR	LgY	LgB	LgW	-	-	-
		O	-	-	-	-	-	-	-
		Gr	-	-	-	-	-	-	-
		P	-	-	-	-	-	-	-
		Sb	-	-	-	-	-	-	-
		Dg	-	-	-	-	-	-	-
		Ch	-	-	-	-	-	-	-



Thread diameter (mm)	Tightening torque (Nm {kgfm})
6	8±2 {0.81±0.20}
8	10±2 {1.02±0.20}
10	12±2 {1.22±0.20}
12	24±4 {2.45±0.41}
14	36±5 {3.67±0.51}

Tightening torque table for tapered screws on 102, 107, and 114 series engines (National taper pipe thread (NPT))

REMARK

Tighten the National taper pipe threaded (NPT) screws used on the 102, 107, and 114 series engines to the torques shown in the following table unless otherwise specified.

Material of female screw	In cast iron or steel	In aluminum
Nominal thread size	Tightening torque (Nm {kgfm})	Tightening torque (Nm {kgfm})
$^{1}/_{16}$	15±2 {1.53±0.20}	5±1 {0.51±0.10}
$^{1}/_{8}$	20±2 {2.04±0.20}	15±2 {1.53±0.20}
$^{1}/_{4}$	25±3 {2.55±0.31}	20±2 {2.04±0.20}
$^{3}/_{8}$	35±4 {3.57±0.41}	25±3 {2.55±0.31}
$^{1}/_{2}$	55±6 {5.61±0.61}	35±4 {3.57±0.41}
$^{3}/_{4}$	75±8 {7.65±0.82}	45±5 {4.59±0.51}

Abbreviation	Actual word spelled out	Purpose of use (major applicable machine (*1), or component/system)	Explanation
ICT	Information and Communication Technology	Communication and electronic control	A general term for the engineering and its socially applied technology of information processing and communication.
IMA	Inlet Metering Actuator	Engine	This is a valve that adjusts the fuel intake amount at the pump inlet in order to control the supply pump fuel discharged volume. (Same as IMV)
IMU	Inertial Measurement Unit	Engine	This is a device to detect the angle (or angular velocity) and acceleration of the 3 axes that control motions.
IMV	Inlet Metering Valve	Engine	This is a valve that adjusts the fuel intake amount at the pump inlet in order to control the supply pump combustion discharged volume. (Same as IMA)
KCCV	Komatsu Closed Crankcase Ventilation	Engine	This is a mechanism that burns the blowby gas again by separating oil from blowby gas and returning it to the intake side. It primarily consists of filters.
KCSF	Komatsu Catalyzed Soot Filter	Engine	This is a filter that captures soot in exhaust gas. It is built in to KDPF.
KDOC	Komatsu Diesel Oxidation Catalyst	Engine	This is a catalyst that is used for purifying exhaust gas. It is built in to KDPF or assembled with the muffler.
KDPF	Komatsu Diesel Particulate Filter	Engine	This is a component that is used to purify the exhaust gas. KDOC (catalyst) and KCSF (filter to capture soot) are built-in it. It is installed instead of the conventional muffler.
KTCS	Komatsu Traction Control System	Travel and brake (HM)	This is a function that performs braking with the optimum force and recovers the driving force of the wheels by actuating the inter-axle differential lock when the wheels runs idle while the machine travels on the soft ground.
LCD	Liquid Crystal Display	Machine monitor	This is an image display equipment such as a monitor in which the liquid crystal elements are assembled.
LED	Light Emitting Diode	Electronic parts	This is a semiconductor element that emits light when the voltage is applied in forward direction.
LIN	Local Interconnect Network	Communication and electronic control	This is one of communication standards that are used in the network on the machine.
LS	Load Sensing	Hydraulic system	This is a function that detects differential pressure of pump, and controls discharged volume corresponding to load.
LVDS	Low Voltage Differential Signaling	Communication and electronic control	This is one of communication standards that are used in the network on the machine.
MAF	Mass Air Flow	Engine	This indicates engine intake air flow. This is not used independently but is used as combined with sensor. Mass air flow sensor can be called as MAF sensor.

SPECIFICATIONS: SAA4D95LE-7 (PC130-11)

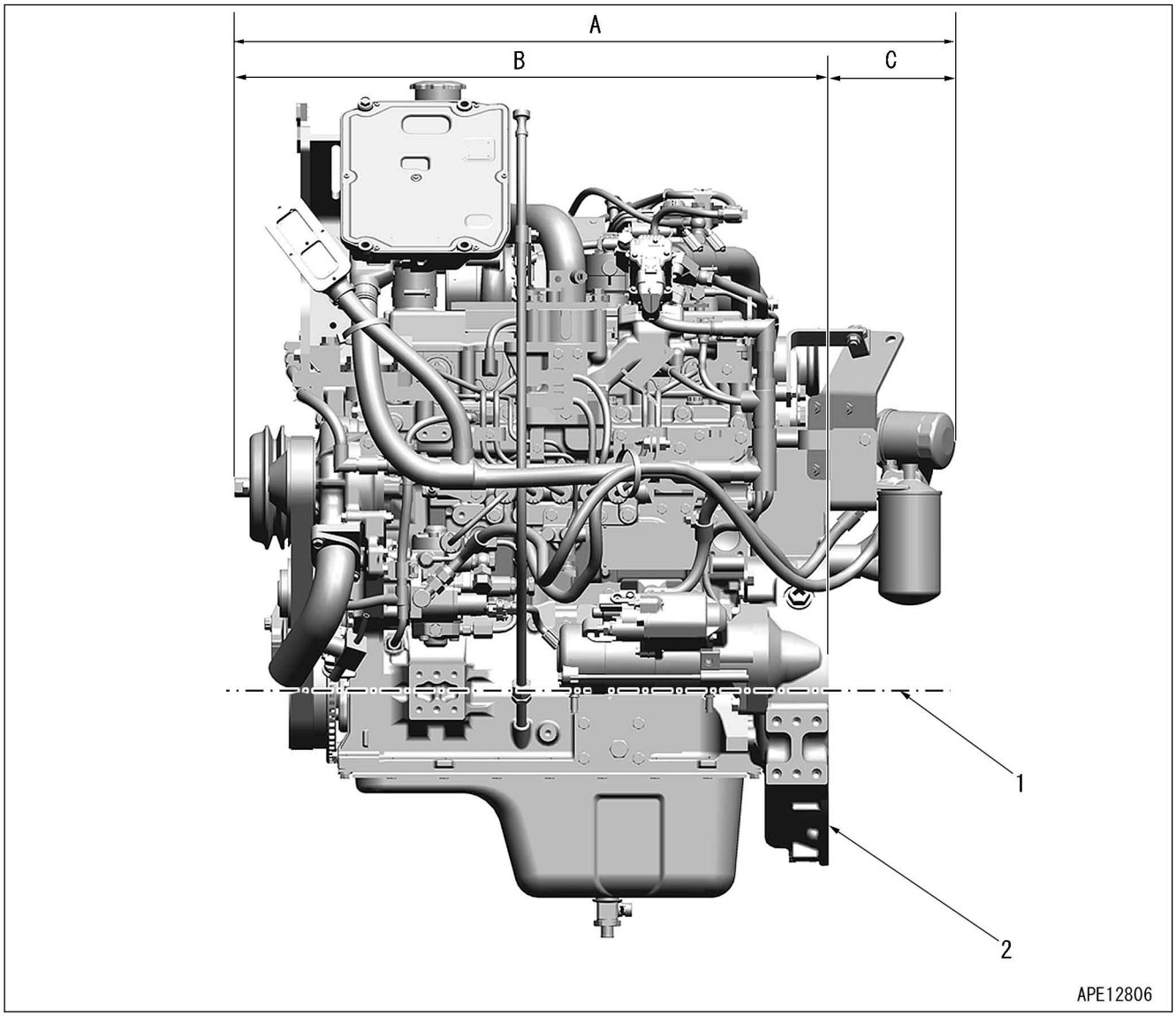
Engine model			SAA4D95LE-7
No. of cylinders - bore x stroke		mm	4-95 x 115
Piston displacement		ℓ {cc}	3.260 {3260}
Firing order		-	1-2-4-3
Dimensions	Overall length	mm	761
	Overall width	mm	706
	Overall height (excluding exhaust pipe)	mm	1163
	Overall height (including exhaust pipe)	mm	-
Performance	Rated horsepower (Gross)	kW {HP}/ min^{-1} {rpm}	72.6 {97.3}/2050{2050}
	Max. torque (Gross)	Nm {kgfm}/ min^{-1} {rpm}	406 {41.3}/1530{1530}
	Max. speed with no load (high idle speed)	min^{-1} {rpm}	2150±60{2150±60}
	Min. speed with no load (low idle speed)	min^{-1} {rpm}	1100±50{1100±50}
	Fuel consumption ratio at rated horsepower	g/kWh {g/HPh}	226 {169}
Dry weight (aftertreatment devices are not included)		kg	430
Fuel injection system		-	High-pressure common rail type
Control of fuel injection system		-	Electronic control type
Quantity of lubricating oil (refill capacity)		ℓ	12.5 (11.5)
Quantity of coolant		ℓ	(5.5 only engine)
Alternator		-	24 V, 60 A
Starting motor		-	24 V, 4.5 kW
Variable flow turbocharger		-	TD04M4t-09KYRCN-SVFT

ENGINE GENERAL VIEW: SAA4D95LE-7 (PC138US-11, PC138USLC-11)

REMARK

The shape may vary depending on the machine models.

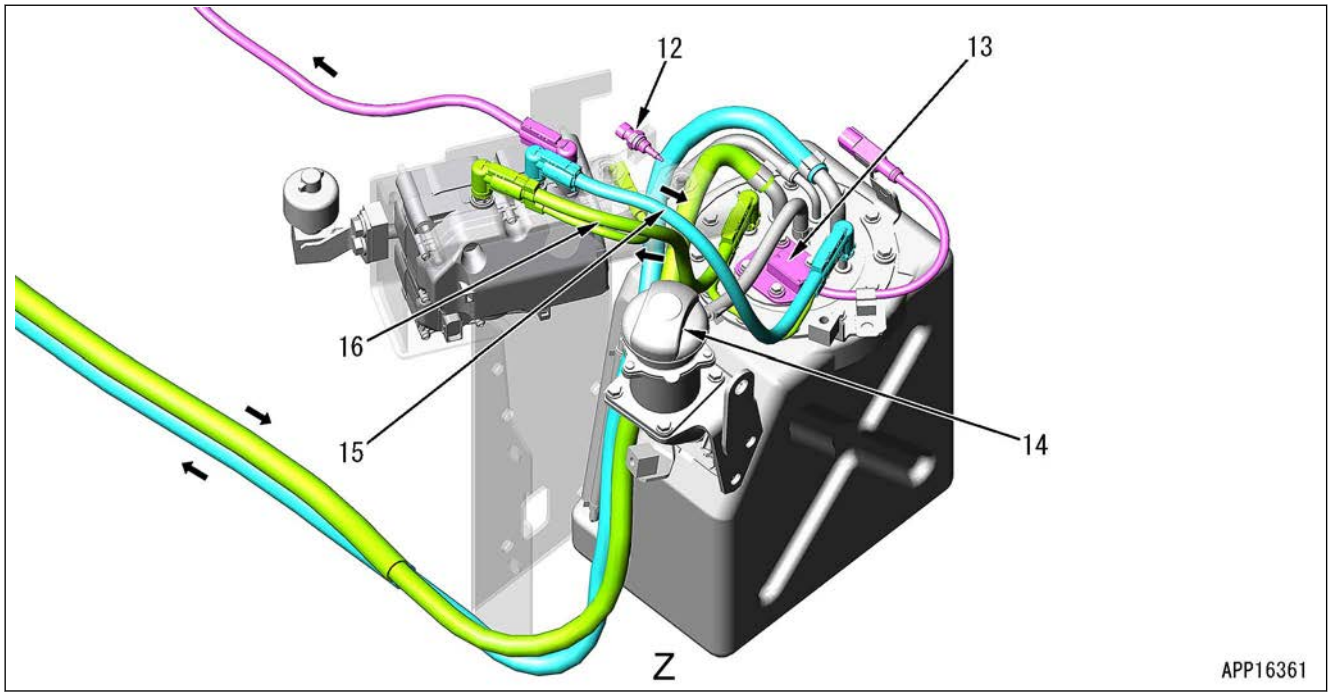
Left side view



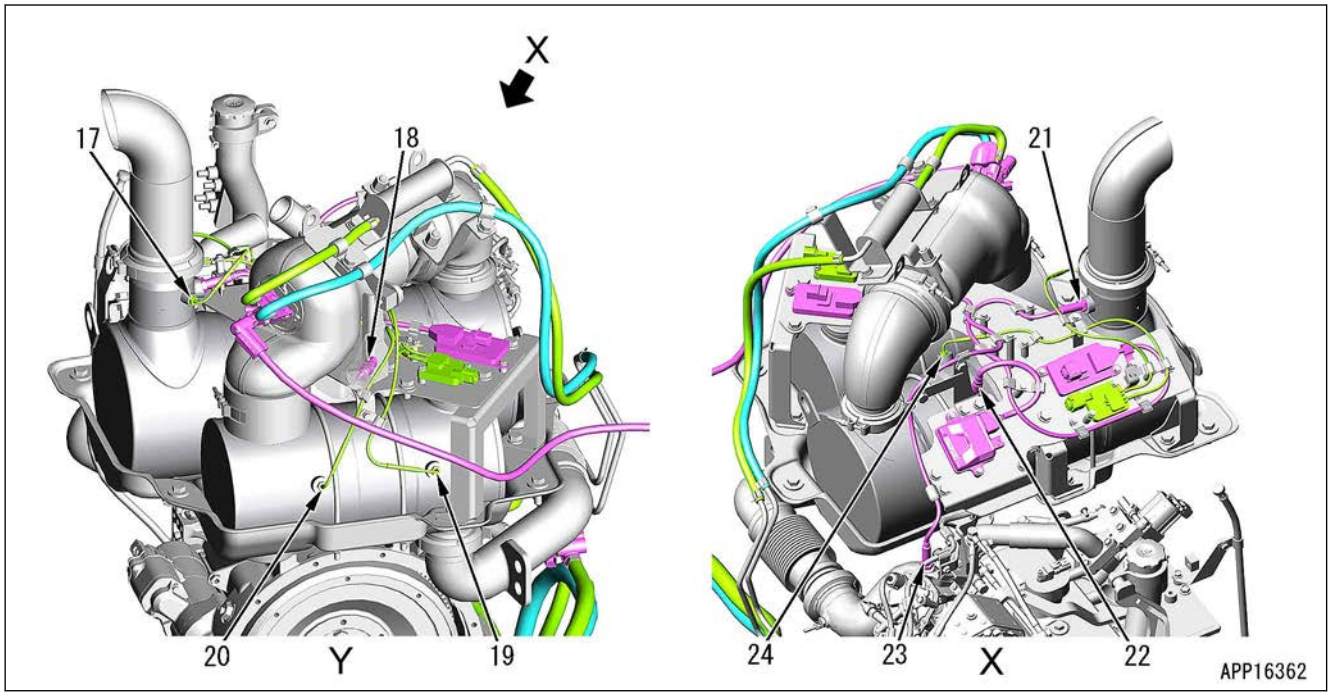
1: Center of the crankshaft
Dimension (A): 924 mm
Dimension (B): 761 mm

2: Rear face of the flywheel housing
Dimension (C): 163 mm

10 STRUCTURE AND FUNCTION



12: Ambient temperature sensor
13: AdBlue/DEF tank sensor
14: AdBlue/DEF filler port
15: AdBlue/DEF return hose
16: AdBlue/DEF suction hose



17: SCR outlet temperature sensor
18: Engine room temperature sensor
19: KDOC inlet temperature sensor
20: KDOC outlet temperature sensor
21: SCR outlet NOx sensor
22: Ammonia sensor
23: Turbocharger outlet NOx sensor
24: SCR temperature sensor

heavily. This may cause difficulties of moving the machine to a safe place for adding AdBlue/DEF or troubleshooting and correcting abnormalities of the Urea SCR system. For temporary remedies from these difficulties the operator can restore engine power for a short time to the deration of “Mild Inducement” through the machine monitor. Note that “Temporary Restoration from Inducement” does not regain full engine power.

- “Temporary Restoration from Inducement” can be activated only when the Urea SCR system is in “Severe Inducement”. The maximum duration is limited to 30 minutes in each restoration operation, and 3 operations are allowed, but “Temporary Restoration from Inducement” is turned off whenever the system advances to “Final Inducement” even if either 30 minutes or 3 operations are not used up. All the abnormalities of the Urea SCR system need to be corrected to regain another restoration capability.
- If all the abnormalities of the Urea SCR system are not corrected when the system is in “Severe Inducement”, the system advances to “Final Inducement” in 1 hour after “Severe Inducement” started and engine speed will be fixed to low idle to disable practical machine operation.
- To activate Temporary Restoration, follow the procedures described below.

  REMARK

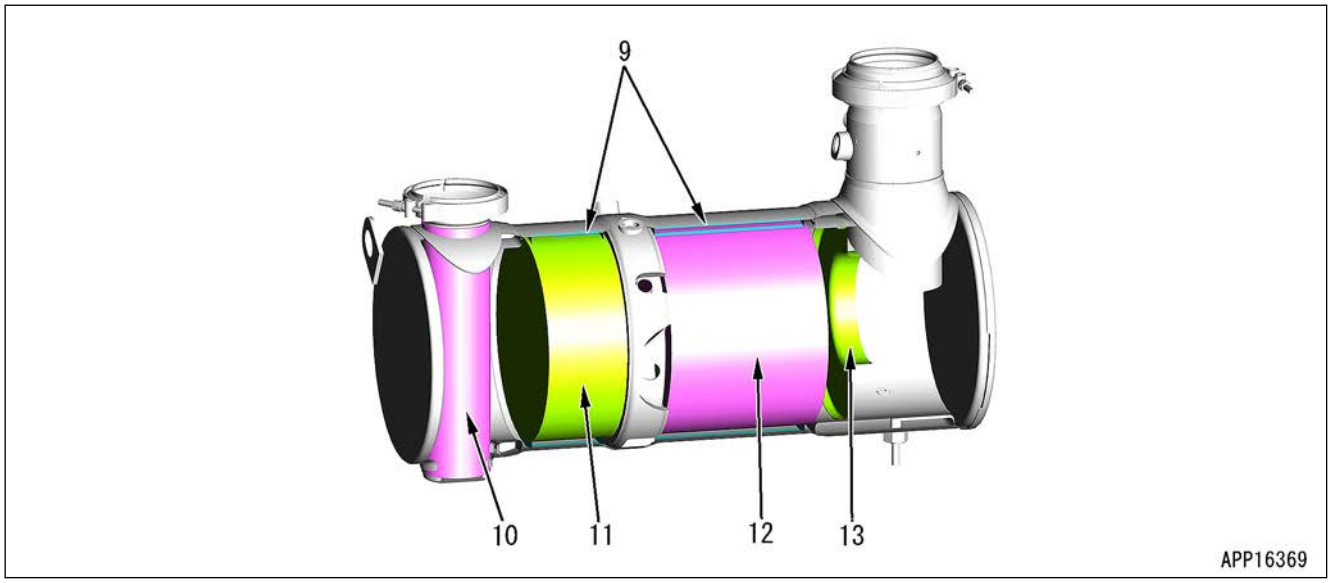
  For the operating procedure on this function, refer to “TEMPORARY RESTORATION FROM INDUCEMENT” on the OPERATION section in the Operation and Maintenance Manual.

INDUCEMENT STRATEGY FOR ABNORMALITY RECURRENCE WITHIN 40 HOURS (FOR NORTH AMERICA)

- The Urea SCR system continuously monitors its operation conditions and stores information on inappropriate operations including malfunctions.
- The stored information is utilized to monitor recurrences of abnormalities, “Abnormality Counter”. “Abnormality Counter” is required by the authorities. The abnormality counting spans 40 hours and it monitors the abnormalities that trigger Inducement other than the amount of AdBlue/DEF in the tank.
- If another abnormality/abnormalities is detected within 40 hours after the previous abnormalities were corrected, regardless of the level of the previous Inducement and whether the new abnormality/abnormalities is the same as the previous ones or not, it is judged as a recurrence.
- If a recurrence occurs, the Inducement strategy will be activated and starts from “Severe Inducement”.
- The duration of “Severe Inducement” in the recurrence is limited to 30 minutes. If the abnormalities are not corrected while Inducement is in “Severe Inducement (30 minutes)”, Inducement will advance to “Final Inducement” and engine speed will be fixed to low idle to disable practical machine operation.

INDUCEMENT STRATEGY WHEN THE AdBlue/DEF LEVEL IN THE TANK BECOMES LOW (FOR EUROPEAN UNION)

- When the AdBlue/DEF level in the tank becomes low, AdBlue/DEF level caution lamp on the machine monitor lights up, the Audible alert sounds, the action level is displayed and Inducement strategy including engine power deration is activated.
- The Inducement strategy progresses in 4 levels from Warning, Continuous Warning, Low-Level Inducement, and Severe Inducement.
- Up to the start of Severe Inducement the start of each warning step is triggered by the amount of AdBlue/DEF in the AdBlue/DEF tank.
- The Inducement strategy status can be checked on “SCR Information” screen of the user menu.
- The table shows warning indications and engine power derations by each Inducement strategy status.



9: Catalyzer hold mat

10: Rectifier tube

11: Upstream SCR catalyst

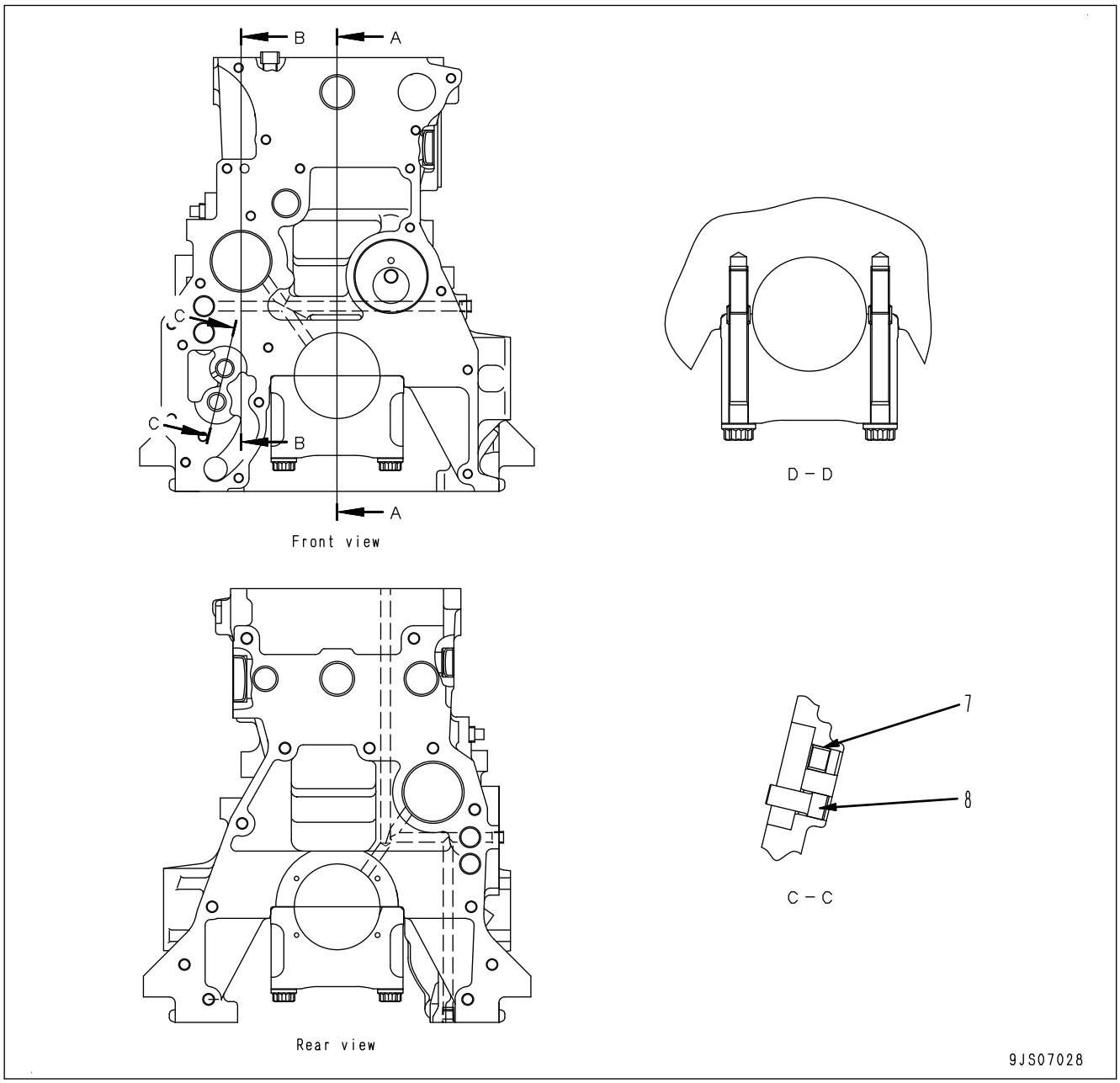
12: Downstream SCR catalyst and ammonia oxidation catalyst (integrated type)

13: Water dam

- SCR assembly consists of rectifier tube (10) equalizing the distribution of flow speed by leading exhaust gas, upstream SCR catalyst (11), downstream SCR catalyst, ammonia oxidation catalyst (integrated type) (12), and water dam (13) which prevents rain water from entering into downstream SCR catalyst and ammonia oxidation catalyst (integrated type) (12) while exhausting gas.
- Ammonia oxidation catalyst (a part of 12) oxidizes ammonia to water and nitrogen with ammonia oxidation catalyst (a part of 12) to prevent ammonia which is supplied to SCR assembly from being released out because SCR catalyst (a part of 12, 11) cannot completely consume it.
- Each 1 piece of SCR temperature sensor (2), SCR outlet temperature sensor (5), ammonia sensor (3), and SCR outlet NOx sensor (4) are installed. These sensors are usable for various troubleshooting, such as they are used to control the feedback of denitration efficiency or they monitor that SCR catalyst properly functions or not.
- Rectifying tube (10) equalizes the distribution of exhaust gas flow speed.
- SCR catalyst (a part of 12, 11) uses the ceramic honeycomb.
- The catalyzer holding mat (9) is made of a specific fiber and protects the ceramic catalyst against vibrations by the engine and the machine body. It also protects the outer periphery of SCR assembly against a heat transfer of the ceramics during operation.
- Water dam (13) is located at the upstream side of the outlet and prevents rainwater from entering into downstream SCR catalyst unit and ammonia oxidation catalyst (integrated type) (12).
- Water baffle (6) is located at the downstream side of the outlet and prevents rainwater at outlet from splashing over the detection part of NOx sensor.

44: Fuel filter
45: Intake manifold
46: Common rail
47: Supply pump

Sectional view



7: Engine oil pump drive shaft bushing 8: Engine oil pump driven shaft

SPECIFICATIONS OF CYLINDER BLOCK

Cylinder block

Crankshaft: 5 bearings

Camshaft part: 3 bearings

Cylinder

Liner-less

Machining of inside surface: Honing

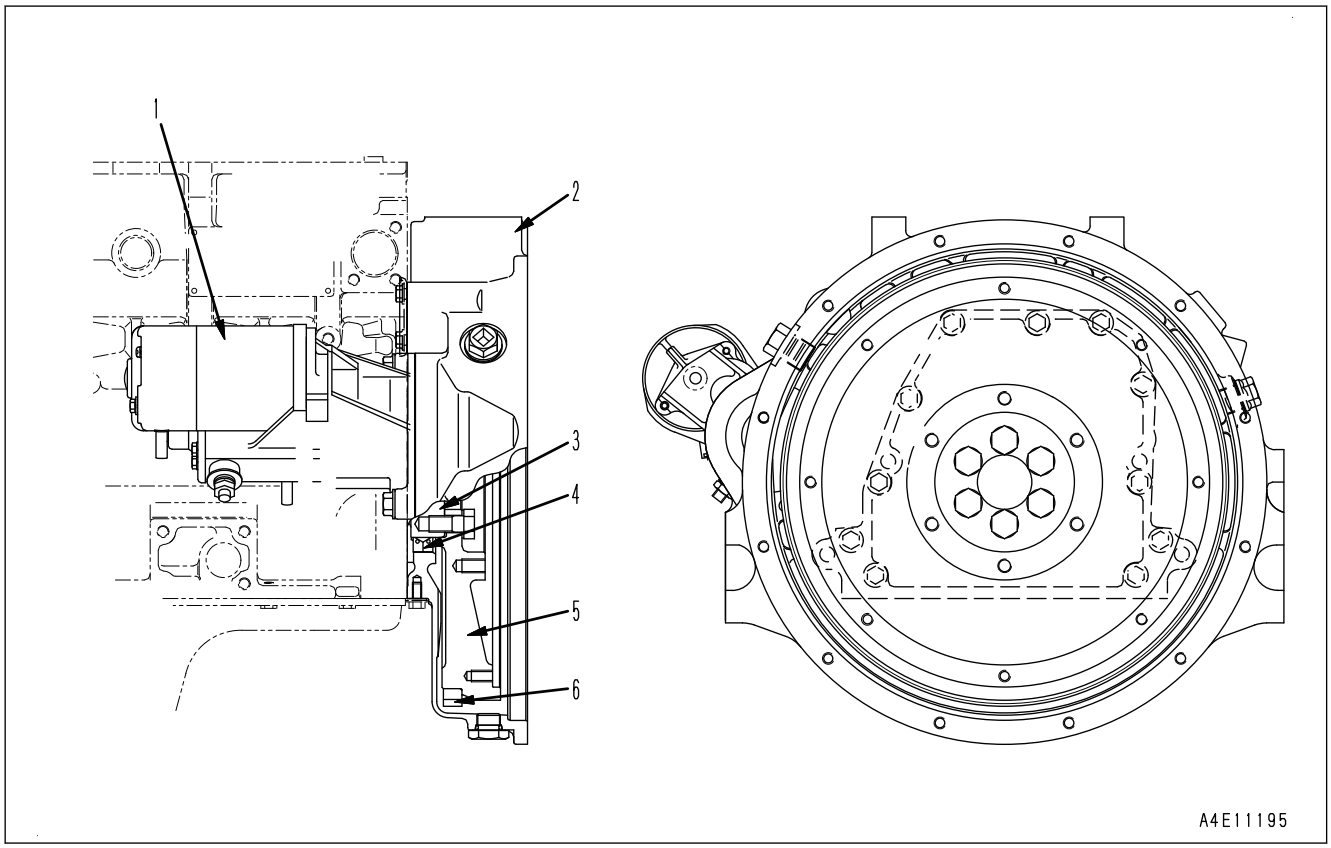
FLYWHEEL AND FLYWHEEL HOUSING

STRUCTURE OF FLYWHEEL AND FLYWHEEL HOUSING

REMARK

The shape may vary depending on the machine models.

General view and sectional view



1: Starting motor
2: Flywheel housing
3: Crankshaft
4: Rear seal
5: Flywheel
6: Ring gear

EGR COOLER

EGR

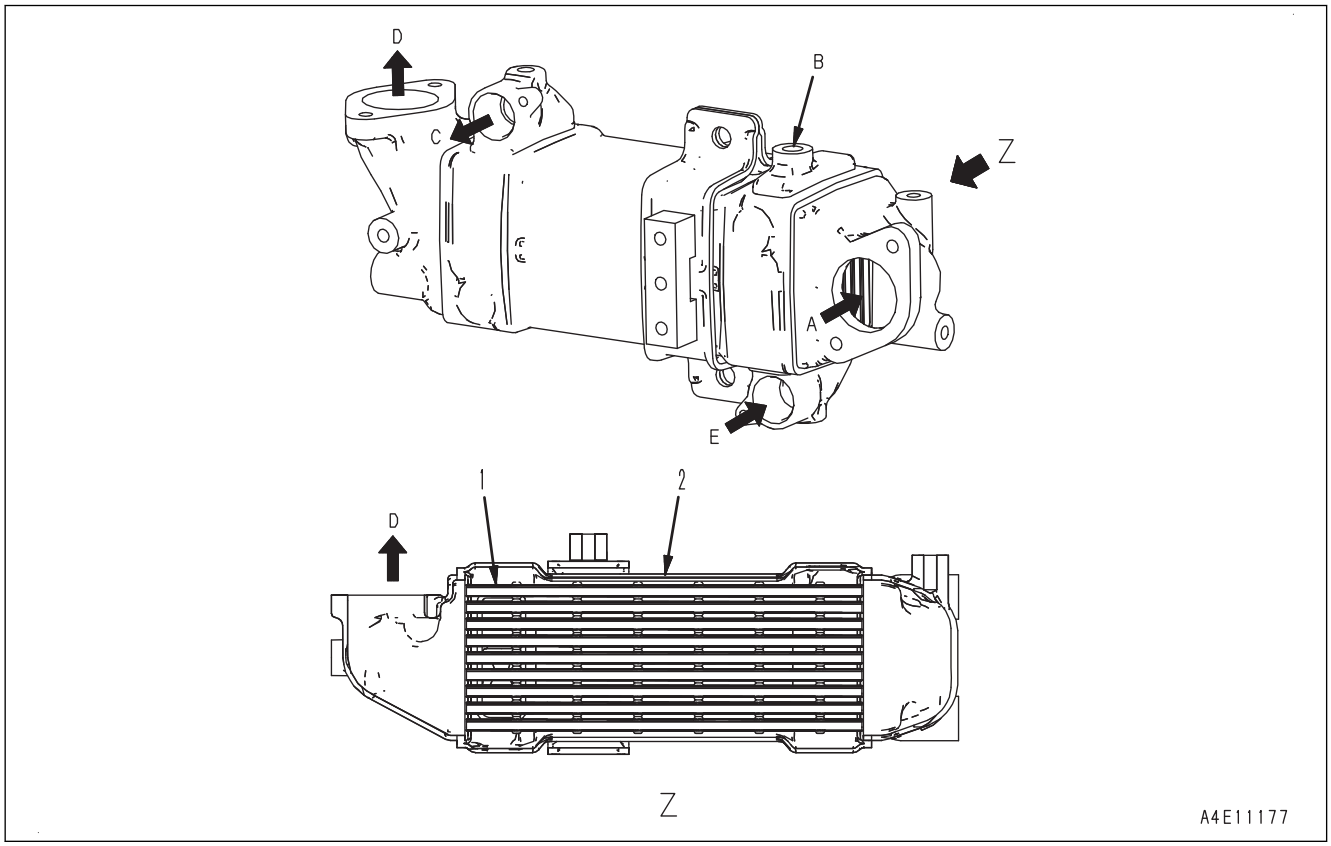
Abbreviation for Exhaust Gas Recirculation

STRUCTURE OF EGR COOLER

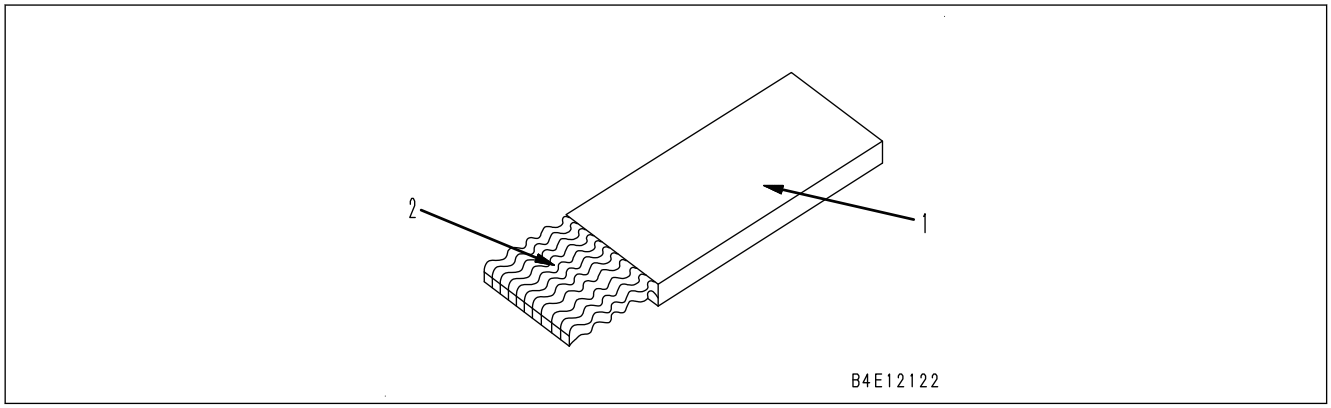
REMARK

The shape is subject to machine models.

General view and sectional view



A: EGR gas inlet
B: Air vent
C: Coolant outlet
D: EGR gas outlet
E: Coolant inlet
1: Tube
2: Shell



1: Flat tube
2: Inner fin

KDOC

KDOC

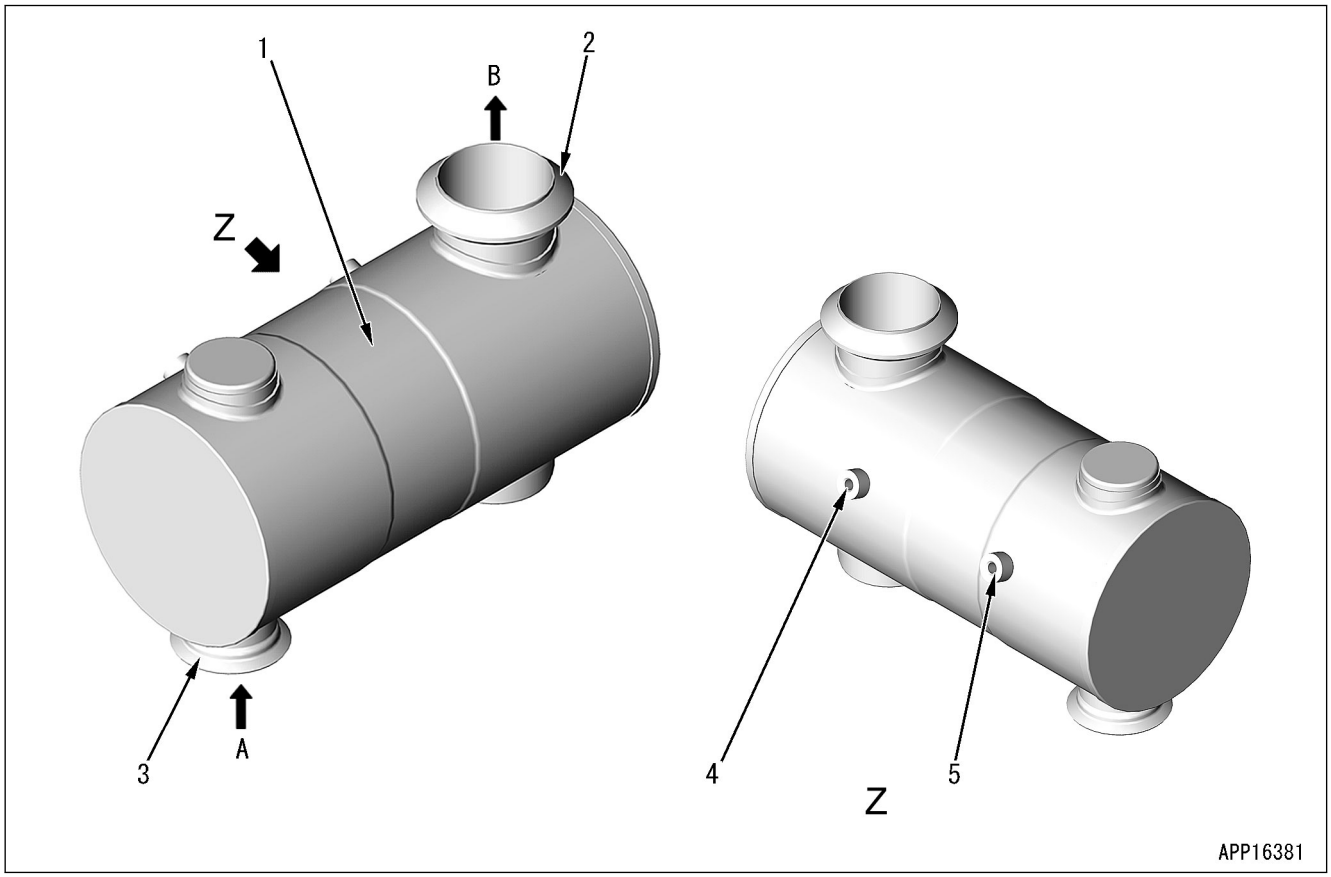
Abbreviation for Komatsu Diesel Oxidation Catalyst

STRUCTURE OF KDOC

REMARK

The shape may vary depending on the machine models.

General view



A: From exhaust throttle valve

B: To AdBlue/DEF mixing pipe

1: KDOC

4: KDOC outlet temperature sensor insertion opening

2: Exhaust gas outlet pipe

5: KDOC inlet temperature sensor insertion opening

3: Exhaust gas inlet pipe

Structure

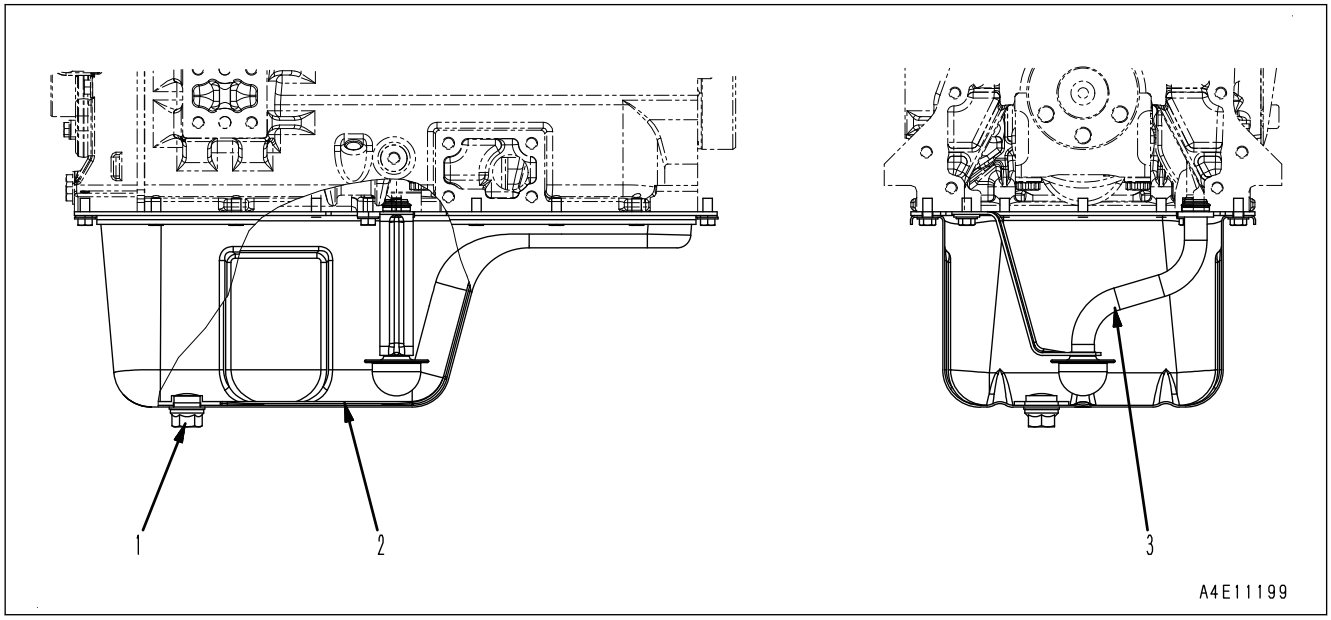
- KDOC consists of the inlet pipe (3) which leads the exhaust gas from the engine, the KDOC (1) which stores the oxidation catalyst, and the outlet pipe (2) which discharges the exhaust gas. All of these parts are welded as a unit.
- KDOC (1) consists of ceramic honeycomb equipped with the oxidation catalyst.
- The ceramic honeycomb is protected with a mat made of special fibers to prevent breakage of the ceramics under the vibration condition of the engine and machine body.
- KDOC inlet temperature sensor and KDOC outlet temperature sensor are installed to the KDOC.
  The two temperature sensors that KDOC oxidation catalyst is functioning normally, and uses those temperatures for troubleshooting of various components.

ENGINE OIL PAN

STRUCTURE OF ENGINE OIL PAN

REMARK

The shape may vary depending on the machine models.



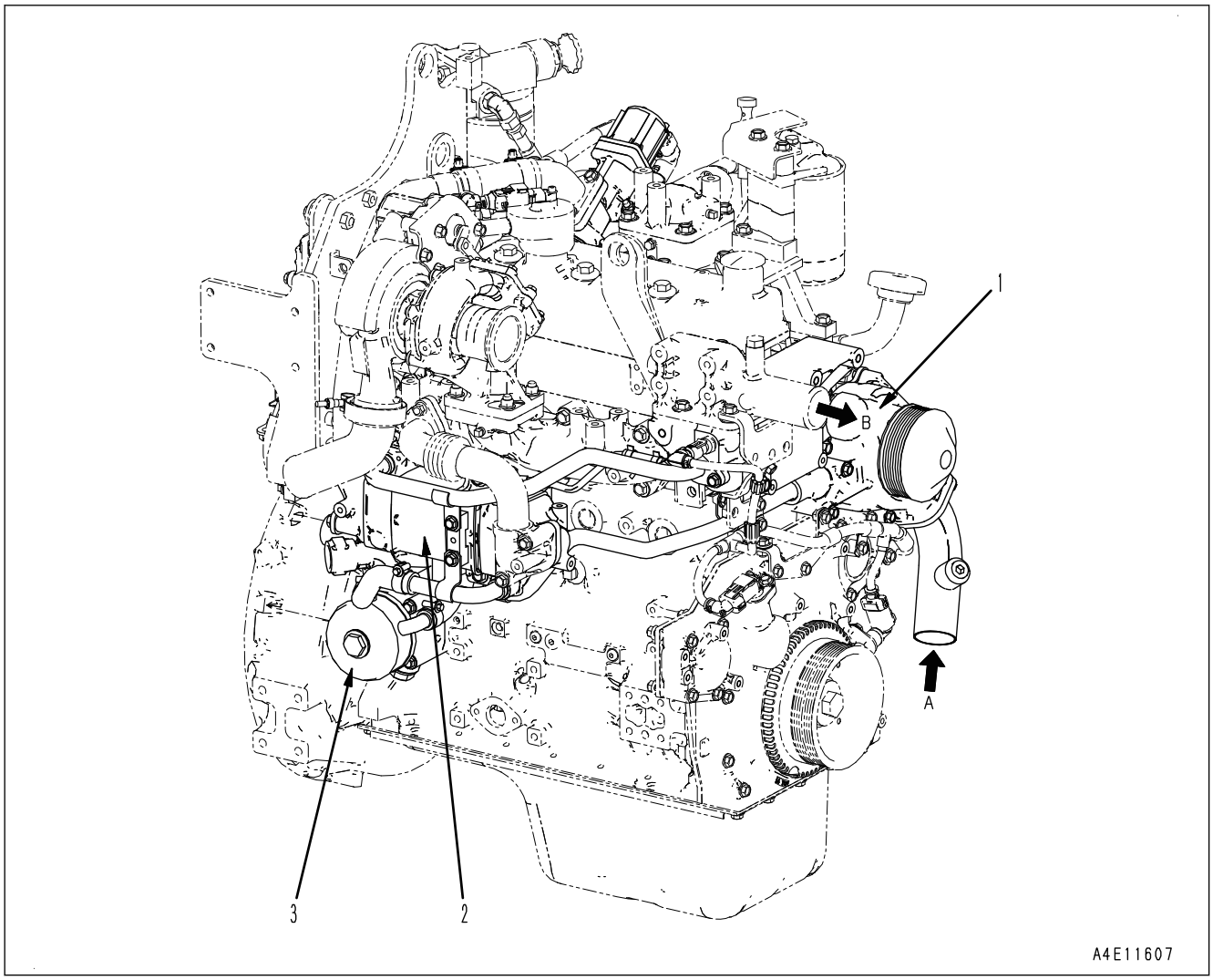
1: Engine oil drain plug
2: Engine oil pan
3: Engine oil suction pipe (with strainer)

COOLING SYSTEM

LAYOUT DRAWING OF COOLING SYSTEM PARTS

REMARK

The shape may vary depending on the machine models.



A: From radiator
B: To radiator
1: Water pump
3: Engine oil cooler
2: EGR cooler

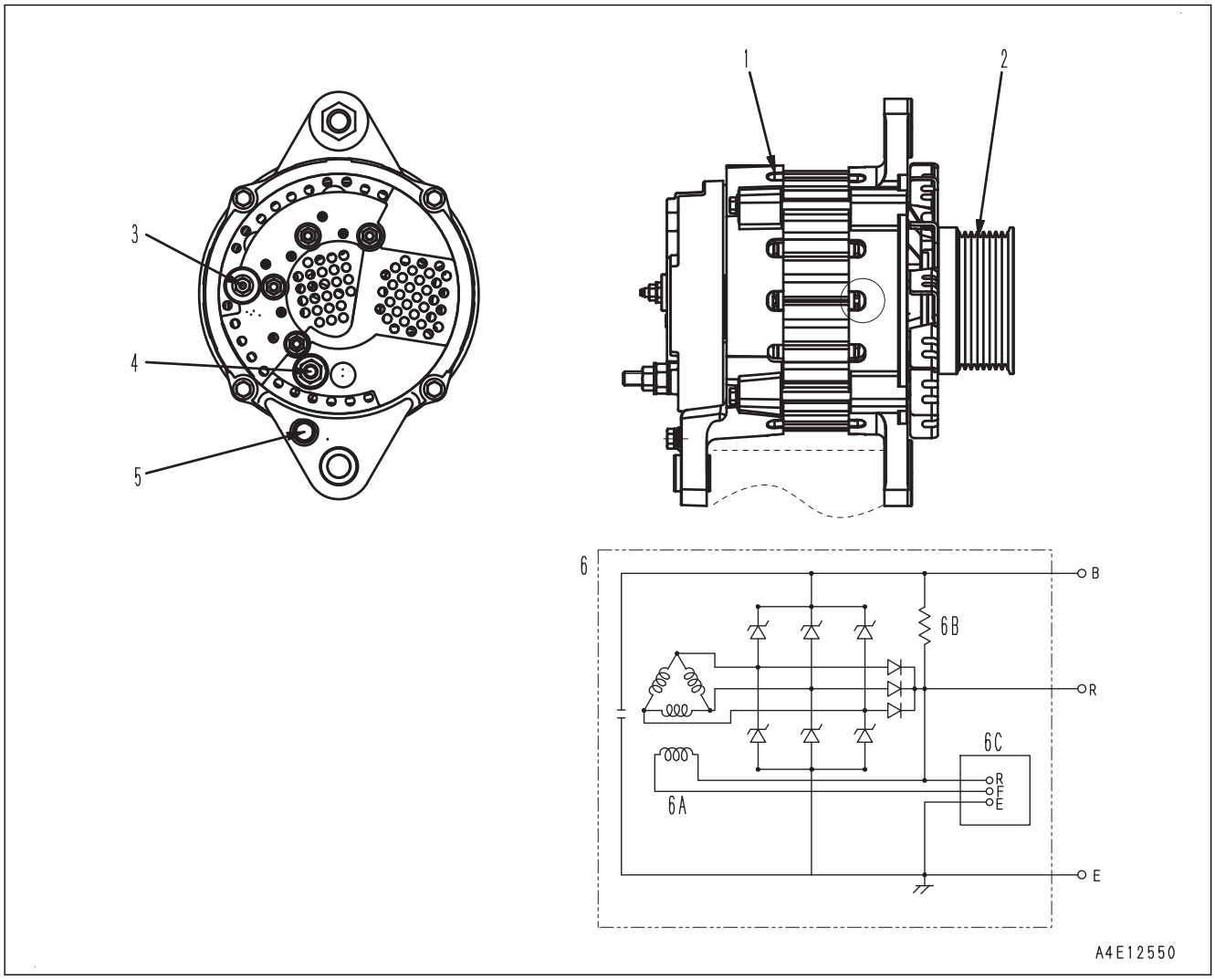
Specifications: 24 V, 60 A
Number of pulley grooves: 8
Outside diameter of pulley: 77.5 mm
Weight: 6.3 kg

STRUCTURE OF ALTERNATOR WITH BUILT-IN REGULATOR (OPEN TYPE, 85A)

REMARK

The shape may vary depending on the machine models.

General view and circuit diagram



1: Alternator (body)
2: Alternator pulley
3: Terminal R
4: Terminal B
5: Terminal E
6: Internal wiring diagram
6A: Field coil
6B: Initial excitation resistance
6C: Regulator

SPECIFICATIONS OF ALTERNATOR WITH BUILT-IN REGULATOR (OPEN TYPE, 85A)

Type: Manufactured by NIKKO DENKI, open type
Specifications: 24 V, 85 A

Pin No.	Signal name	Input and output signals
74	Injector #3 (-)	Ground/Shield/ Return
75	Injector #2 (-)	Ground/Shield/ Return
76	(*1)	-
77	(*1)	-
78	Sensor 5 V power supply	Power supply
79	Sensor 5 V power supply	Power supply
80	Sensor 12 V power supply	Power supply
81	Sensor 5 V power supply	Power supply
82	Sensor 5 V power supply	Power supply
83	Coolant temperature sensor	Input
84	(*1)	-
85	(*1)	-
86	(*1)	-
87	Common rail pressure sensor	Input
88	(*1)	-
89	(*1)	-
90	(*1)	-
91	(*1)	-
92	(*1)	-
93	Datalink 2 (-) (VFT controller)	Communication
94	Datalink 3 (-) (KOMNET/r)	Communication
95	(*1)	-
96	(*1)	-

*1: Never connect these pins. Malfunctions or failures may occur.

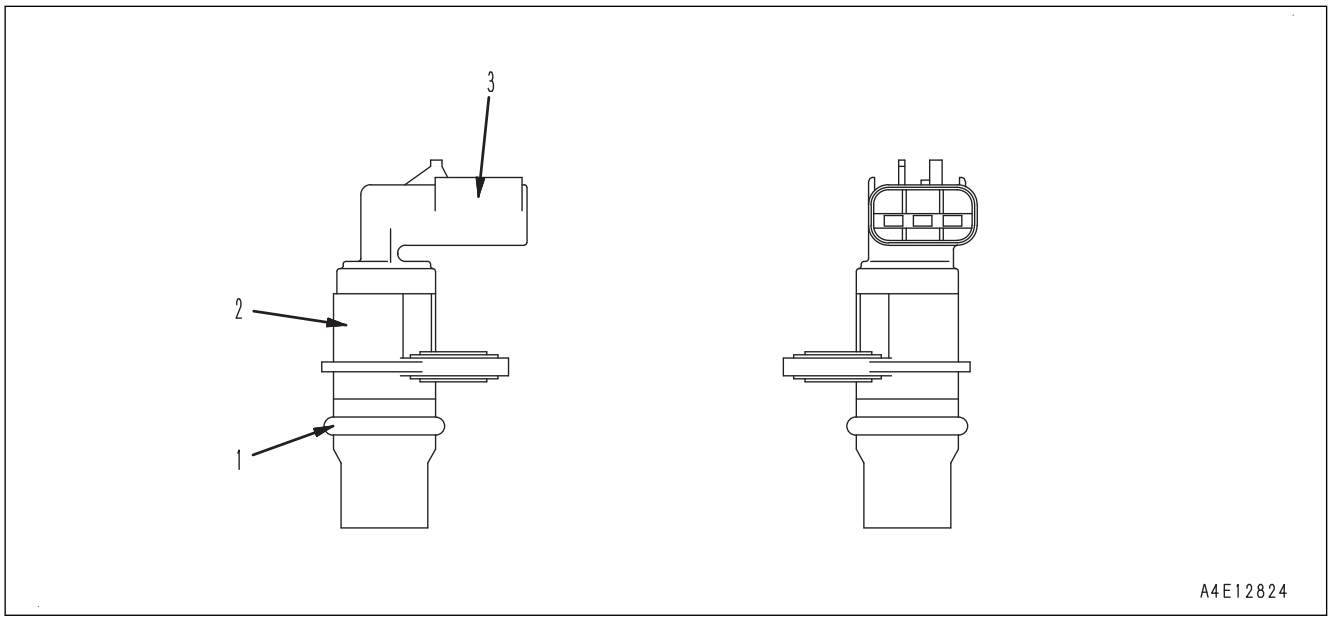
Delphi96Pin“CN-CE02/CN-J2”

Pin No.	Signal name	Input and output signals
1	Power supply (+24 V continuous)	Power supply
2	(*1)	-
3	AdBlue/DEF line heater relay 1	Output
4	(*1)	-
5	ACC (Key SW)	Input
6	AdBlue/DEF pump temperature sensor/ AdBlue/DEF pump driver	Input and output
7	AdBlue/DEF line heater relay 2	Output
8	Sensor 5 V power supply	Power supply
9	Sensor 5 V power supply	Power supply
10	Throttle sensor	Input

STRUCTURE OF NE (CRANKSHAFT) SPEED SENSOR

Attached to the crankshaft pulley part of engine front cover.

General view



1: O-ring (FRAMATOME-3P)
2: Sensor
3: Connector

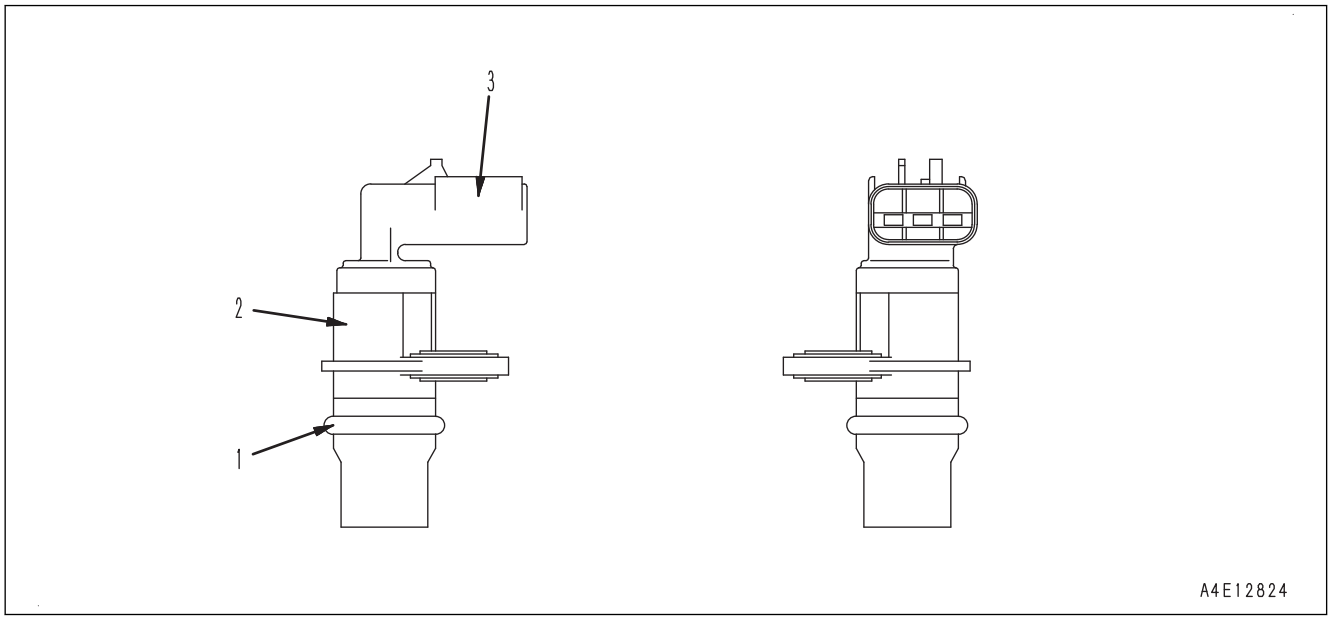
FUNCTION OF NE (CRANKSHAFT) SPEED SENSOR

It outputs pulse voltage by the rotation of the gear.

STRUCTURE OF Bkup (CAMSHAFT) SPEED SENSOR

Attached to the camshaft gear portion of engine front cover.

General view



1: O-ring (FRAMATOME-3P)
2: Sensor
3: Connector

20 STANDARD VALUE TABLE

STANDARD VALUE TABLE FOR ENGINE: SAA4D95LE-7 (PC130-11)

Performance

Engine				SAA4D95LE-7	
Item	Measurement condition		Unit	Standard value for new machine	Repair limit
Engine speed	Engine coolant temperature: 75 to 94 °C	Max. speed with no load (high idle)	min^{-1} {rpm}	2000±50 {2000±50}	-
		Min. speed with no load (Low idle)		1100±50 {1100±50}	-

Air intake and exhaust system

Engine				SAA4D95LE-7	
Item	Measurement condition		Unit	Standard value for new machine	Repair limit
Air intake resistance	Whole speed range		kPa {mmH_2O}	Max. 3.73 {Max. 380}	Max. 7.47 {Max. 762}
Boost pressure	At rated horsepower (gauge pressure)		kPa {mmHg}	-	-
Exhaust temperature	Whole speed range (20 °C)		°C	Max. 650	Max. 700
Exhaust gas color	• Engine coolant temperature: 75 to 94 °C • At rated horsepower • After keeping for 5 seconds at normal condition	At sudden acceleration	Bosch index	Max. 0.5	Max. 2.0
		Max. speed with no load (high idle)		Max. 0.5	Max. 1.5
Valve clearance	Intake valve		mm	0.35	-
	Exhaust valve			0.50	-

Main body

Engine			SAA4D95LE-7	
Item	Measurement condition	Unit	Standard value for new machine	Repair limit
Compression pressure	• Engine oil temperature: 40 to 60 °C • Engine speed: 320 to 360 rpm	MPa {kgf/cm^2}	Min. 2.9 {Min. 30}	Min. 2.0 {Min. 20}
Blowby pressure	At rated horsepower (when KCCV is disconnected)	kPa {mmH_2O}	Max. 0.98 {Max. 100}	Max. 1.47 {Max. 150}

RUNNING-IN STANDARD AND PERFORMANCE TEST STANDARD: SAA4D95LE-7 (PC138US-11, PC138USLC-11)

Running-in standard

Engine		SAA4D95LE-7				
Item		Procedure				
		1	2	3	4	5
Running time	min	2	10	2	3	3
Engine speed	min^{-1} {rpm}	1100{1100}	1100{1100}	1200{1200}	1600{1600}	2050{2050}
Dynamometer load	N{kgf}	0{0}	98{10}	147{15}	245{25}	471{48}
Output	kW{HP}	0{0}	8.1{10.8}	13.2{17.7}	29.4{39.4}	72.6{97.3}

REMARK

- This table shows the values when the fan is not installed.
- The loads for the dynamometer in this table shows the value when the dynamometer arm is 716 mm long.

Performance test standard

Engine		SAA4D95LE-7			
Test item		Rated horsepower	Max. torque	Max. speed with no load	Min. speed with no load
Specification value (Gross value)	-	72.6 kW/2050 rpm {97.3 HP/ 2050 rpm}	406 Nm/1530 rpm {41.4 kgfm/ 1530 rpm}	2150±60 rpm	1100±50 rpm
Engine speed	min^{-1} {rpm}	2050±5{2050±5}	1530±100{1530±100}	-	-
Dynamometer load	N {kgf}	448 to 495 {45.7 to 50.5}	539 to 595 {54.9 to 60.7}	-	-
Output (Gross value)	kW {HP}	69 to 76.2 {92.5 to 102}	-	-	-
Torque (Gross value)	Nm {kgfm}	-	386 to 426 {39.3 to 43.5}	-	-
Fuel consumption	sec/ 200 cc	-	-	-	-
Coolant temperature	°C	75 to 94	75 to 94	75 to 94	75 to 94
Lubricating oil temperature	°C	90 to 120	90 to 120	90 to 120	90 to 120
Lubricating oil pressure	kPa {kgf/cm^2}	340 to 690 {3.5 to 7.0}	-	-	Min. 150 {Min. 1.5}
Exhaust temperature	°C	Max. 640	Max. 670	-	-

RELATED INFORMATION ON DISASSEMBLY AND ASSEMBLY

HOW TO READ THIS MANUAL

This section describes the special tools, work procedures, and safety precautions necessary for removal, installation, disassembly, and assembly of the components and parts. In addition, tightening torques, quantity, and weight of the coating materials, lubricants, and coolant necessary to these works are shown.

Reading the special tools list

- The special tools required for removal and installation work are described in the list as symbols such as A1, ..., X1. Part number, part name, necessity, and quantity are described.
- Details of the special tools are on “SPECIAL TOOLS LIST”. Details of sketches are on “SKETCHES OF SPECIAL TOOLS”. Special tools required for a specified work is also described in each work procedures.
- The symbols used in the table of special tools indicate the following meanings.
  ■: Not substitutable, and work cannot be performed without the tool.
  ●: Very useful tools to use which can be substituted with commercially available tools.

Reading the work procedures

All the necessary information for the work procedure, the precautions and prior knowledge relating to the work procedures is described step by step.

Reading the symbols

Important safety and quality portions are marked with the following symbols so that shop manual is used effectively.

Symbol	Item	Remark
	Danger	This signal indicates an extremely hazardous situation which will result in death or serious injury if it is not avoided.
	Warning	This signal indicates a potentially hazardous situation which will result in death or serious injury if it is not avoided.
	Caution	This signal indicates a potentially hazardous situation which will result in injury or property damage around the machine if it is not avoided.
	Weight	This signal indicates the weight of parts and components, and items which requires great attention to a selection of wires and working posture for slinging work.
	Tightening torque	This signal indicates the tightening torque for portions which requires special care in assembling work.
	Coat	This signal indicates a place to be coated with adhesive, grease, etc. in assembling work.
	Oil and coolant	This signal indicates a place to supply oil, coolant, etc. and the quantity. (*1)
	Draining	This signal indicates a place to drain oil, coolant, etc. and the quantity.

*1:For places to supply oil, coolant, etc. and their quantities, see SPECIFICATIONS “TABLE OF FUEL, COOLANT, AND LUBRICANTS”.

Reading the signal word

Signal word for notice and remark describes the following.

Symbol	Item	Remark
NOTICE	NOTICE	If the precaution of this signal word is not observed, the machine damage or shortening of service life may occur.

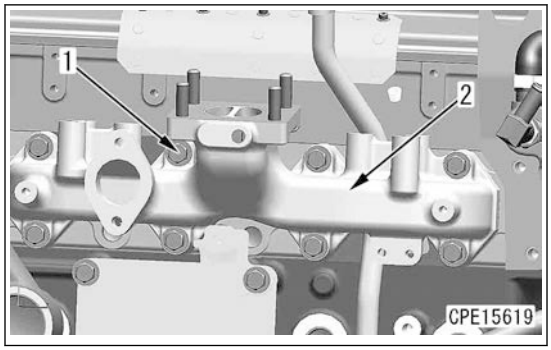
ENGINE SYSTEM

DISASSEMBLE AND ASSEMBLE ENGINE GENERALLY

NOTICE

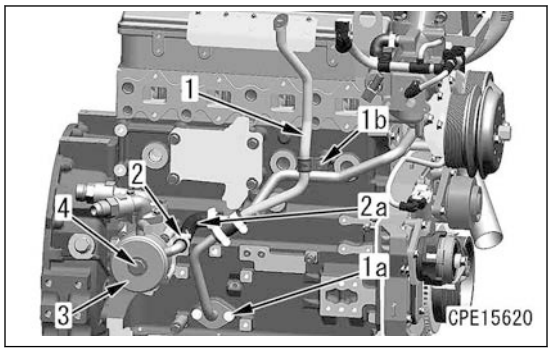
- **Before starting your work, check the shapes, quantity, locations, etc. of the parts depending on the machine model.**
- **Before disassembling the engine, check its parts for cracking, damage, etc. and clean it thoroughly and carefully for accurate inspection of its parts and quick disassembly and assembly.**
- **Before cleaning the engine, carefully seal the openings or remove electric parts and wiring connectors so that water does not enter them.**
- **Clean every parts throughly and check them for dent, scratch and void. Also check that passages of oil and coolant is not clogged, and then assemble them.**

42. Remove the bolts (1) (8 pieces), and remove the exhaust manifold (2).

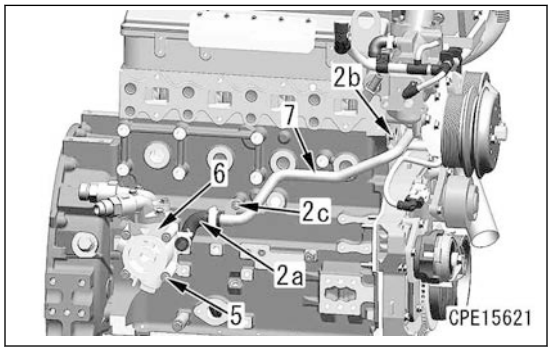


Engine oil cooler and adapter assembly

43. Remove the bolts (1a) (2 pieces) and bolt (1b) (1 piece), and remove the tube (1).
44. Remove the hose clamp (2), and disconnect the hose (2a) from the engine oil cooler (3).
45. Remove the bolt (4), and remove the engine oil cooler (3).



46. Remove the bolt (5), and remove the adapter assembly (6).
47. Remove the bolts (2b) and (2c), and remove the tube (7) together with the hose (2a).



Installing to the engine repair stand

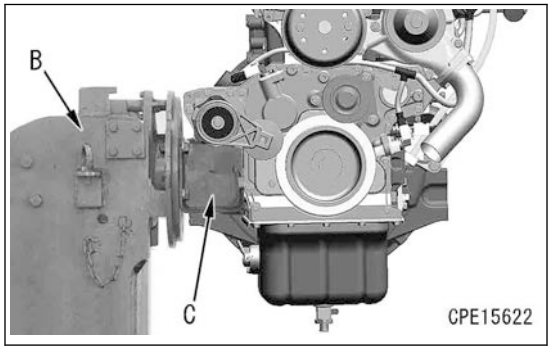
48. Install the bracket (C) to the engine assembly.
49. While slinging the engine assembly together with the bracket (C) as a unit, and install them to the repair stand (B).

    REMARK

    The weight may vary depending on the mounted machine model.

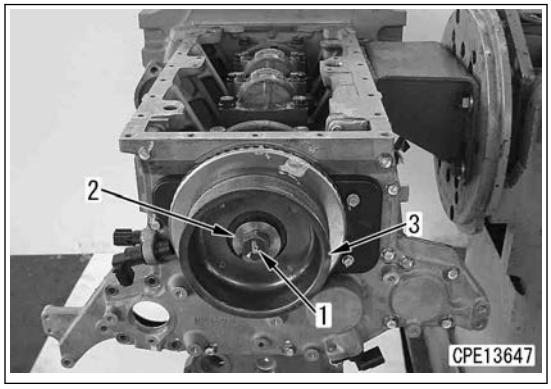
    Engine assembly:

    430 kg



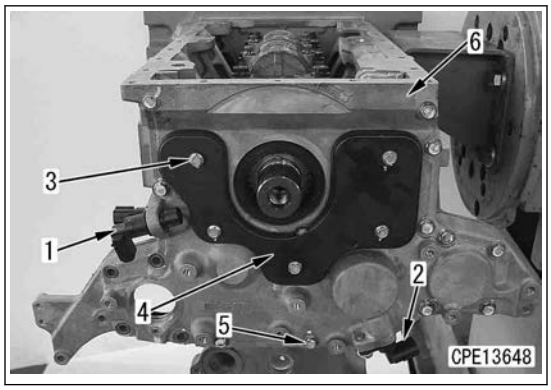
Crankshaft pulley

107. Remove the bolt (1).
108. Remove the plate (2).
109. Remove the crankshaft pulley (3).

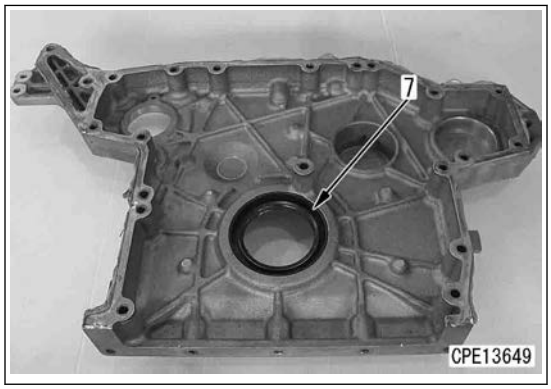


Speed sensor and front cover

110. Remove the crankshaft speed sensor (NE) (1).
111. Remove the cam speed sensor (BKUP) (2).
112. Remove the bolts (3) (5 pieces), and remove the cover (4).
113. Remove the bolts (5) (13 pieces), and remove the front cover (6).

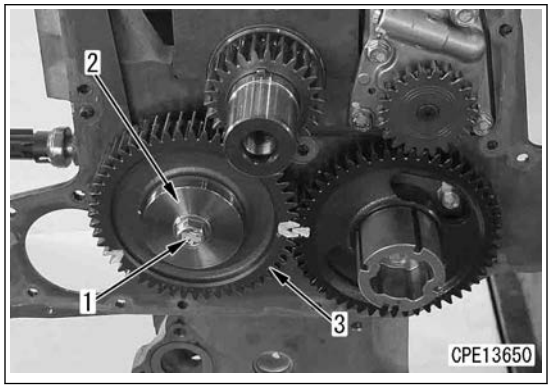


114. Remove the front oil seal (7).



Idler gear

115. Remove the bolt (1) and washer (2), and remove the idler gear (3).



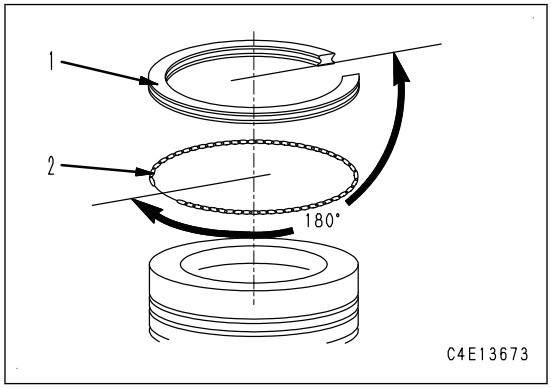
Assembling the piston and connecting rod assembly

12. Install the expander (2) to the oil ring (1).

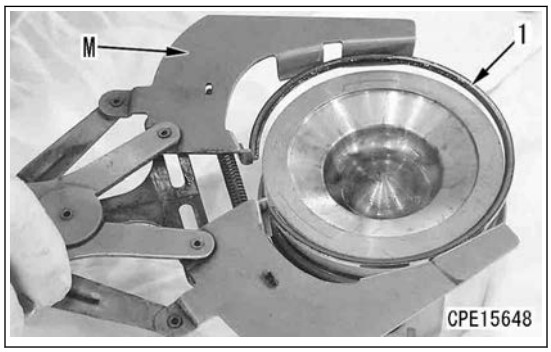
    REMARK

    Fit the oil ring (1) so that its abutment joint is 180 ° away from the connecting portion of the expander (2).

    Be careful not to damage the piston or lose the ring.



13. Install the oil ring (1) to the piston by using the piston ring tool (M).



14. Install the second ring (3) to the piston by using the piston ring tool (M).

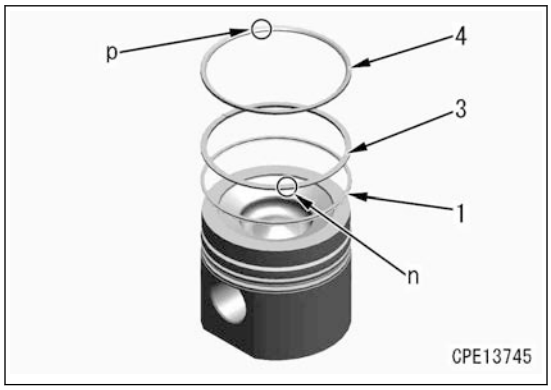
    REMARK

    Install the second ring so that the mark “2R” (n) close to the abutment joint faces upward.

15. Install TOP ring (4) to the piston by using the piston ring tool (M).

    REMARK

    Install TOP ring so that the mark “1R” (p) close to the abutment joint faces upward.



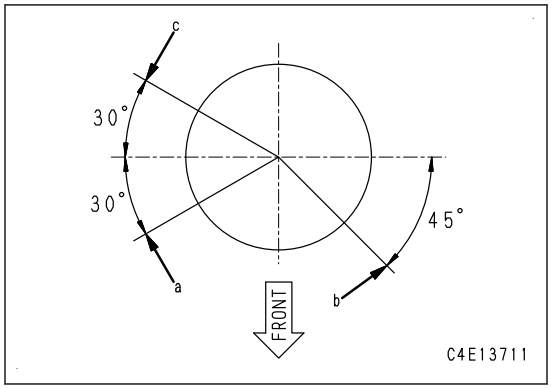
16. Set the abutment joints of the piston rings at the position shown in the figure.

    FRONT: Engine front direction

    (a): Oil ring abutment joint position

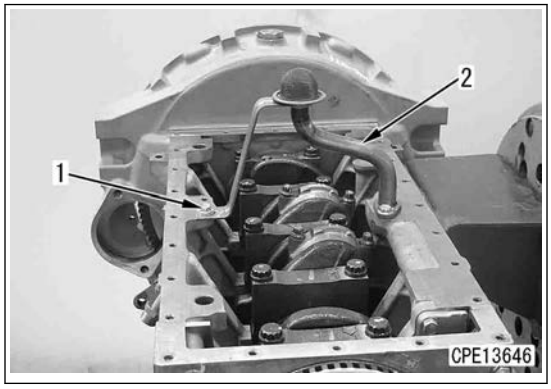
    (b): Second ring abutment joint position

    (c): TOP ring abutment joint position



Oil suction tube

62. Install the oil suction tube (2), and tighten it with the bolt (1).



Engine oil pan

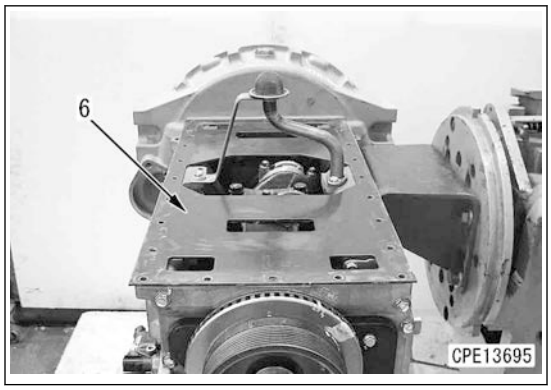
63. Apply liquid gasket to the grounding surfaces of the under plate (6) and cylinder block.

    REMARK

    Apply it to the under plate side.

    Under plate:
    Liquid gasket (LG-7)

64. Install the under plate (6) to the cylinder block.



65. Apply liquid gasket to the grounding surfaces of the engine oil pan (5) and under plate.

    REMARK

    Apply it to the engine oil pan side.

    Engine oil pan:
    Liquid gasket (LG-7)

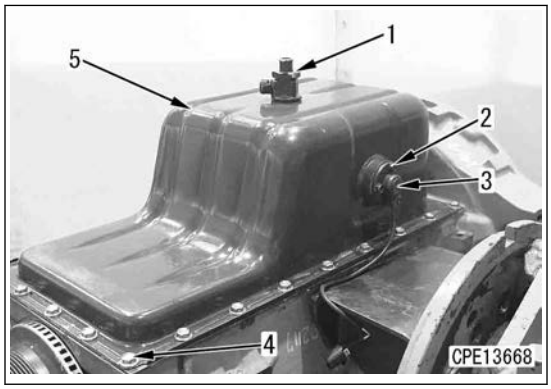
66. Install the engine oil pan (5), and tighten it with the bolt (4).

    Bolt (4):
    29.4 to 34.3 Nm {3.0 to 3.5 kgfm}

67. Install the engine oil level sensor (3) with the bolt (2).

68. Install the engine oil drain valve (1).

    Drain valve (1):
    27.4 to 34.3 Nm {2.8 to 3.5 kgfm}



⚠ **Do not bend the fuel high-pressure pipe to correct before installing.**

⚠ **Komatsu recommends using Komatsu genuine fuel high-pressure pipe clamps and observe the specified tightening torque.**

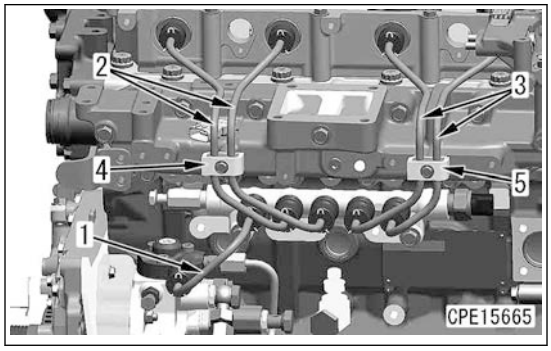
⚠ **Install each fuel high-pressure pipe and wiring harness at least 10 mm apart from each other.**

⚠ **Check the high-pressure pipe for the following, and install it. If the high-pressure pipe has any defect, replace it with a new one since fuel may leak.**

⚠ **Visually check that the taper seal part (a) of the connecting part (2 mm area from the end) is free from the longitudinal slits (b) or the spotty dents (c).**

⚠ **Make sure that the part (d) (the end of the taper seal: 2 mm from the end) is free from steps you can feel by your fingernails (free from fatigue).**

108. Install the fuel high-pressure pipe (1) to the area between the supply pump and common rail inlet.
109. Tighten the fuel high-pressure pipe (2) to the area between the common rail and No.1/No.2 injector lightly.
110. Tighten the fuel high-pressure pipe (3) to the area between the common rail and No.3/No.4 injector lightly.
111. Tighten the injector holder bolt that was lightly tightened in step 93 to the specified torque.



Injector holder mounting bolt:
39.0 to 49.0 Nm {4.0 to 5.0 kgfm}

112. Tighten the fuel high-pressure pipe mounting sleeve nut on the injector side.

Mounting sleeve nut:
39.0 to 44.0 Nm {4.0 to 4.5 kgfm}

NOTICE

- **The sleeve nut must be dry to be tightened.**
- **After tightening, check that O-ring is not projected.**

113. Tighten the fuel high-pressure pipe mounting sleeve nut on the common rail side.

Mounting sleeve nut:
39.0 to 44.0 Nm {4.0 to 4.5 kgfm}

NOTICE

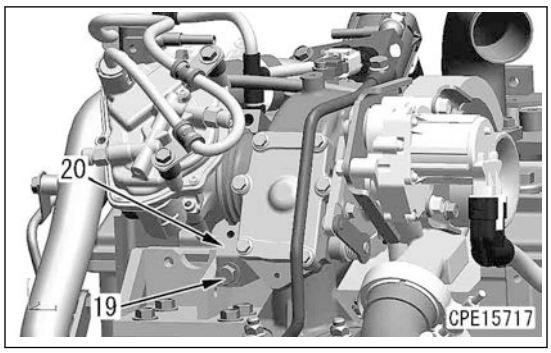
- **The sleeve nut must be dry to be tightened.**
- **After tightening, check that O-ring is not projected.**

114. Install the tube clamps (4) and (5).

168. Tighten the clamp (20) lightly with the bolt (19).

REMARK

Align the matchmarks in the mounting direction (vertical) to install the clamp (18).



169. Tighten the clamp (18) lightly with the bolts (17a) and (17b).

170. Tighten the bolt (19) of the clamp (20) to the specified torque.

Bolt (19):
59 to 74 Nm {6.0 to 7.5 kgfm}

171. Loosen the bolts (17a) and (17b), insert the plate (D) into the clearance on the bottom side of the clamp (18), and tighten the bolt (17a) lightly.

172. Tighten the bolt (17b) and nut (17c) to the specified torque.

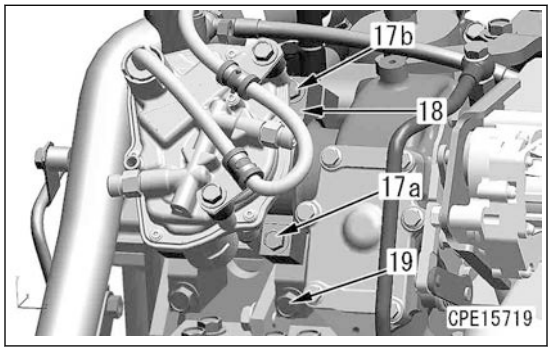
Bolt (17b):
14 Nm {1.5 kgfm}

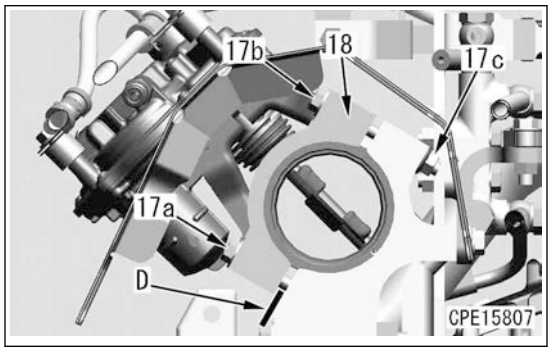
173. Remove the plate (D), and tighten the bolt (17a) to the specified torque.

Bolt (17a):
14 Nm {1.5 kgfm}

174. Retighten the bolts (17b) and (17a).

Bolts (17b),(17a):
27 to 34 Nm {2.8 to 3.5 kgfm}

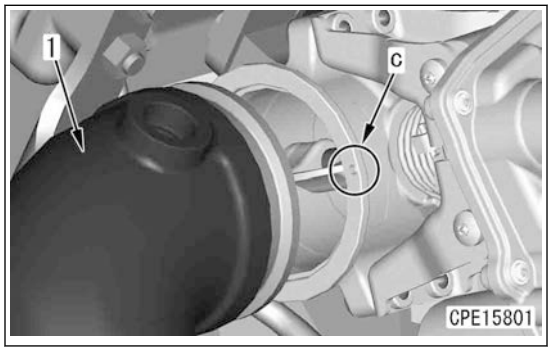




175. Install the exhaust pipe (1).

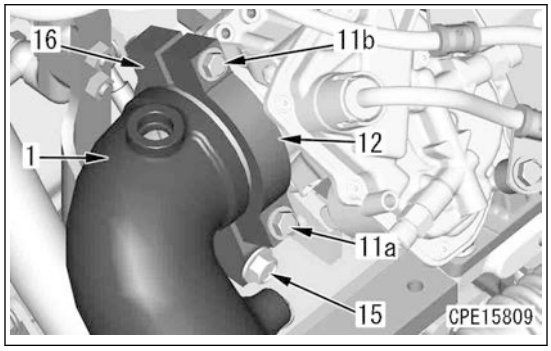
NOTICE

A pin is provided at the installing part (c) of the exhaust pipe (1). Install the exhaust pipe (1) horizontally to the pin.



176. Tighten the lower clamp (16) lightly with the bolt (15).

177. Tighten the upper clamp (12) lightly with the bolts (11b) and (11a).



REMOVE AND INSTALL ENGINE FRONT OIL SEAL

Tools to be used when removing and installing the engine front oil seal

Symbol	Part No.	Part name	Necessity	Q'ty	New/Redesign	Sketch	Details of work
J	Commercially available	Slide hammer	■	1			Removal of front oil seal and rear oil seal
Q	795T-221-1010	Push tool	■	1		○	Press-fit of front oil seal
	790-101-5201	Push tool (kit)	■	1			
	790-101-5271	• Plate		1			
	790-101-5221	• Grip		1			
	01010-51225	• Bolt		1			

METHOD FOR REMOVING ENGINE FRONT OIL SEAL

Fan belt

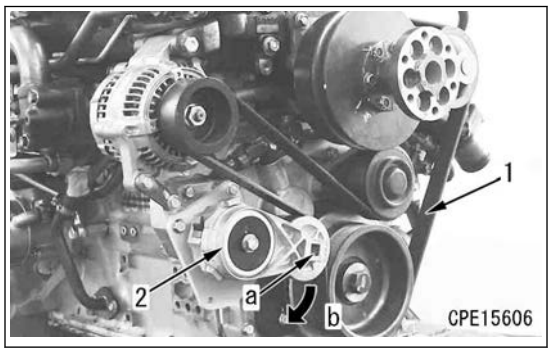
⚠ **Install the wrench to the part (a) of the auto-tensioner (2) securely, and then rotate it. (The spring of the auto-tensioner (2) is strong. If the wrench is loosely installed and rotated, it can accidentally come off and this is extremely dangerous.)**

⚠ **After removing the fan belt (1), slowly and carefully restore the auto-tensioner (2).**

⚠ **Be careful not to get your fingers caught between the pulley and fan belt (1) during work.**

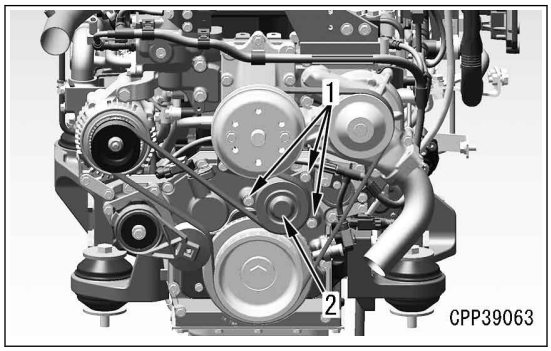
⚠ **Remove the fan belt under the mounting condition if required by referring to DISASSEMBLY AND ASSEMBLY in the shop manual for the mounted machine model.**

1. Insert a wrench in the part (a) (width across flats: 12.7 mm) of the tensioner assembly (2), and rotate it in the direction of the arrow (b) to weaken the fan belt tension.
2. Remove the fan belt (1).



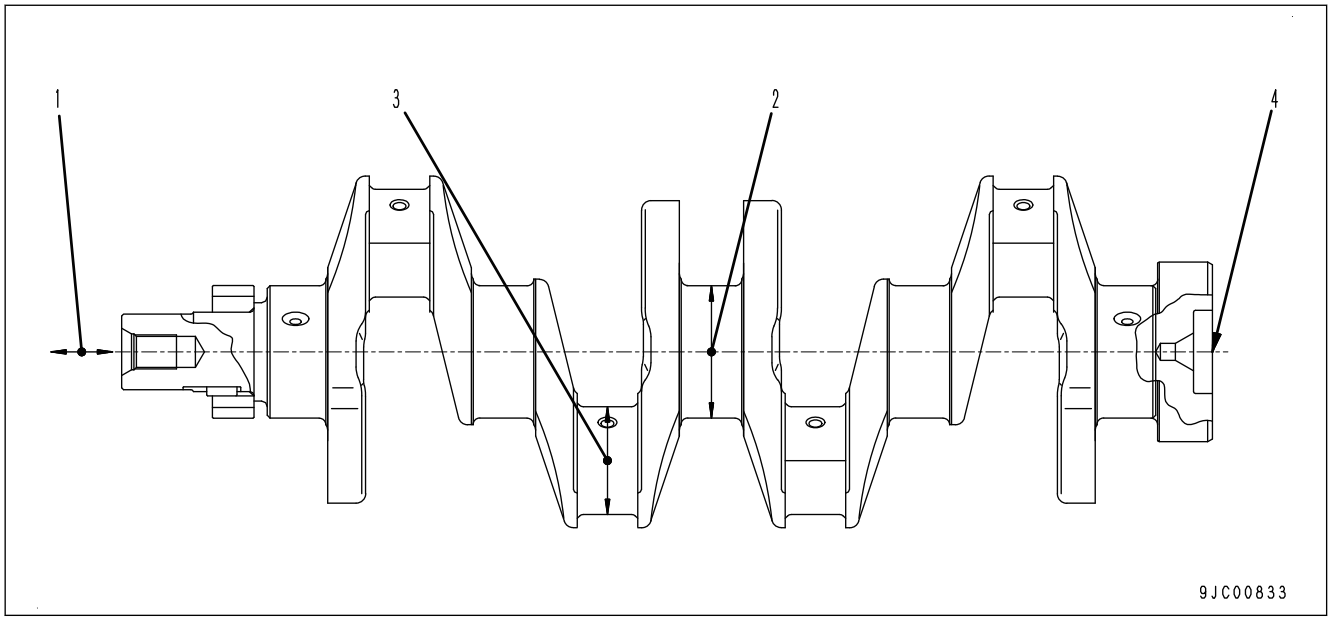
Idler pulley assembly

3. Remove the bolt (1), and remove the idler pulley assembly (2).



Abbreviation	Actual word spelled out	Purpose of use (major applicable machine (*1), or component/system)	Explanation
ICT	Information and Communication Technology	Communication and electronic control	A general term for the engineering and its socially applied technology of information processing and communication.
IMA	Inlet Metering Actuator	Engine	This is a valve that adjusts the fuel intake amount at the pump inlet in order to control the supply pump fuel discharged volume. (Same as IMV)
IMU	Inertial Measurement Unit	Engine	This is a device to detect the angle (or angular velocity) and acceleration of the 3 axes that control motions.
IMV	Inlet Metering Valve	Engine	This is a valve that adjusts the fuel intake amount at the pump inlet in order to control the supply pump combustion discharged volume. (Same as IMA)
KCCV	Komatsu Closed Crankcase Ventilation	Engine	This is a mechanism that burns the blowby gas again by separating oil from blowby gas and returning it to the intake side. It primarily consists of filters.
KCSF	Komatsu Catalyzed Soot Filter	Engine	This is a filter that captures soot in exhaust gas. It is built in to KDPF.
KDOC	Komatsu Diesel Oxidation Catalyst	Engine	This is a catalyst that is used for purifying exhaust gas. It is built in to KDPF or assembled with the muffler.
KDPF	Komatsu Diesel Particulate Filter	Engine	This is a component that is used to purify the exhaust gas. KDOC (catalyst) and KCSF (filter to capture soot) are built-in it. It is installed instead of the conventional muffler.
KTCS	Komatsu Traction Control System	Travel and brake (HM)	This is a function that performs braking with the optimum force and recovers the driving force of the wheels by actuating the inter-axle differential lock when the wheels runs idle while the machine travels on the soft ground.
LCD	Liquid Crystal Display	Machine monitor	This is an image display equipment such as a monitor in which the liquid crystal elements are assembled.
LED	Light Emitting Diode	Electronic parts	This is a semiconductor element that emits light when the voltage is applied in forward direction.
LIN	Local Interconnect Network	Communication and electronic control	This is one of communication standards that are used in the network on the machine.
LS	Load Sensing	Hydraulic system	This is a function that detects differential pressure of pump, and controls discharged volume corresponding to load.
LVDS	Low Voltage Differential Signaling	Communication and electronic control	This is one of communication standards that are used in the network on the machine.
MAF	Mass Air Flow	Engine	This indicates engine intake air flow. This is not used independently but is used as combined with sensor. Mass air flow sensor can be called as MAF sensor.

MAINTENANCE STANDARD OF CRANKSHAFT



Unit: mm

<table>
<tr><th>No.</th><th>Item</th><th colspan="4">Judgment criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">End play</td><td colspan="2">Standard value</td><td colspan="2">Repair limit</td><td rowspan="2">Replace the thrust metal or adjust with the oversized part.</td></tr>
<tr><td colspan="2">0.131 to 0.351</td><td colspan="2">0.40</td></tr>
<tr><td rowspan="8">2</td><td rowspan="6">Outside diameter of the main journal</td><td>-</td><td>Standard dimensions</td><td>Tolerance</td><td>Repair limit</td><td rowspan="7">Adjust with the undersized part or replace</td></tr>
<tr><td>Standard</td><td>70.00</td><td rowspan="5">+0.015
0</td><td>69.86</td></tr>
<tr><td>0.25 (*1)</td><td>69.75</td><td>69.61</td></tr>
<tr><td>0.50 (*1)</td><td>69.50</td><td>69.36</td></tr>
<tr><td>0.75 (*1)</td><td>69.25</td><td>69.11</td></tr>
<tr><td>1.00 (*1)</td><td>69.00</td><td>68.86</td></tr>
<tr><td>Roundness of the main journal</td><td colspan="4">Repair limit: 0.020</td></tr>
<tr><td rowspan="2">Clearance in main journal</td><td colspan="2">Standard clearance</td><td colspan="2">Allowable clearance</td><td rowspan="2">Replace the main metal</td></tr>
<tr><td colspan="2">0.043 to 0.103</td><td colspan="2">0.25</td></tr>
</table>

Unit: mm

<table>
<tr><th>No.</th><th>Item</th><th colspan="5">Judgment criteria</th><th>Remedy</th></tr>
<tr><td rowspan="5">5</td><td rowspan="2">Free height of the valve spring</td><td>Part number (identification)</td><td colspan="2">Standard dimensions</td><td colspan="2">Repair limit</td><td rowspan="5">Replace</td></tr>
<tr><td>6276-41-4410
(Pink)</td><td colspan="2">54.3</td><td colspan="2">49</td></tr>
<tr><td rowspan="2">Installed load of the valve spring</td><td>Part number (identification)</td><td>Installed height</td><td colspan="2">Standard load at installed height</td><td>Allowable load at installed height</td></tr>
<tr><td>6276-41-4410
(Pink)</td><td>34.0</td><td colspan="2">198.1±9.9 Nm
{20.2±1.0 kgf}</td><td>173 Nm
{17.7 kgf}</td></tr>
<tr><td>Perpendicularity of the valve spring</td><td colspan="5">Repair limit: 2°</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Driven height of the valve guide</td><td colspan="3">Standard dimensions</td><td colspan="2">Tolerance</td><td rowspan="2">Repair</td></tr>
<tr><td colspan="3">9</td><td colspan="2">±0.2</td></tr>
</table>