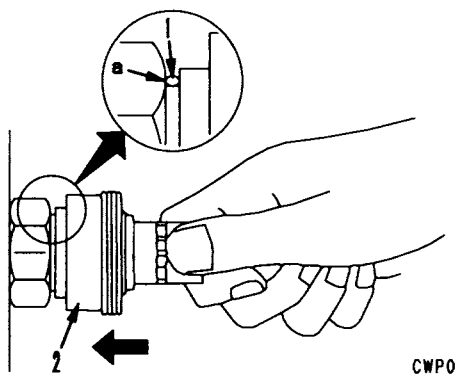
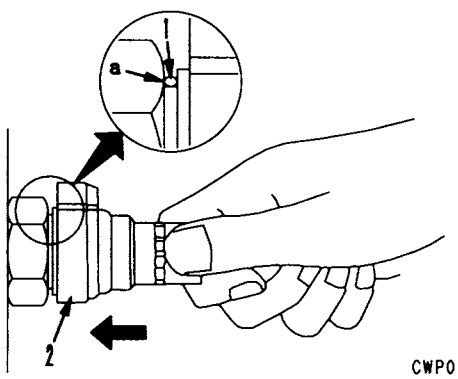
SHOP MANUAL

KOMATSU

12V170-1

SERIES ENGINE

Printed in Japan 09-99(02)

	Type 1	Type 2
Connection	• Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface a of the hexagonal portion at the male end to connect it.  CWP06391	• Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface a of the hexagonal portion at the male end to connect it.  CWP06392

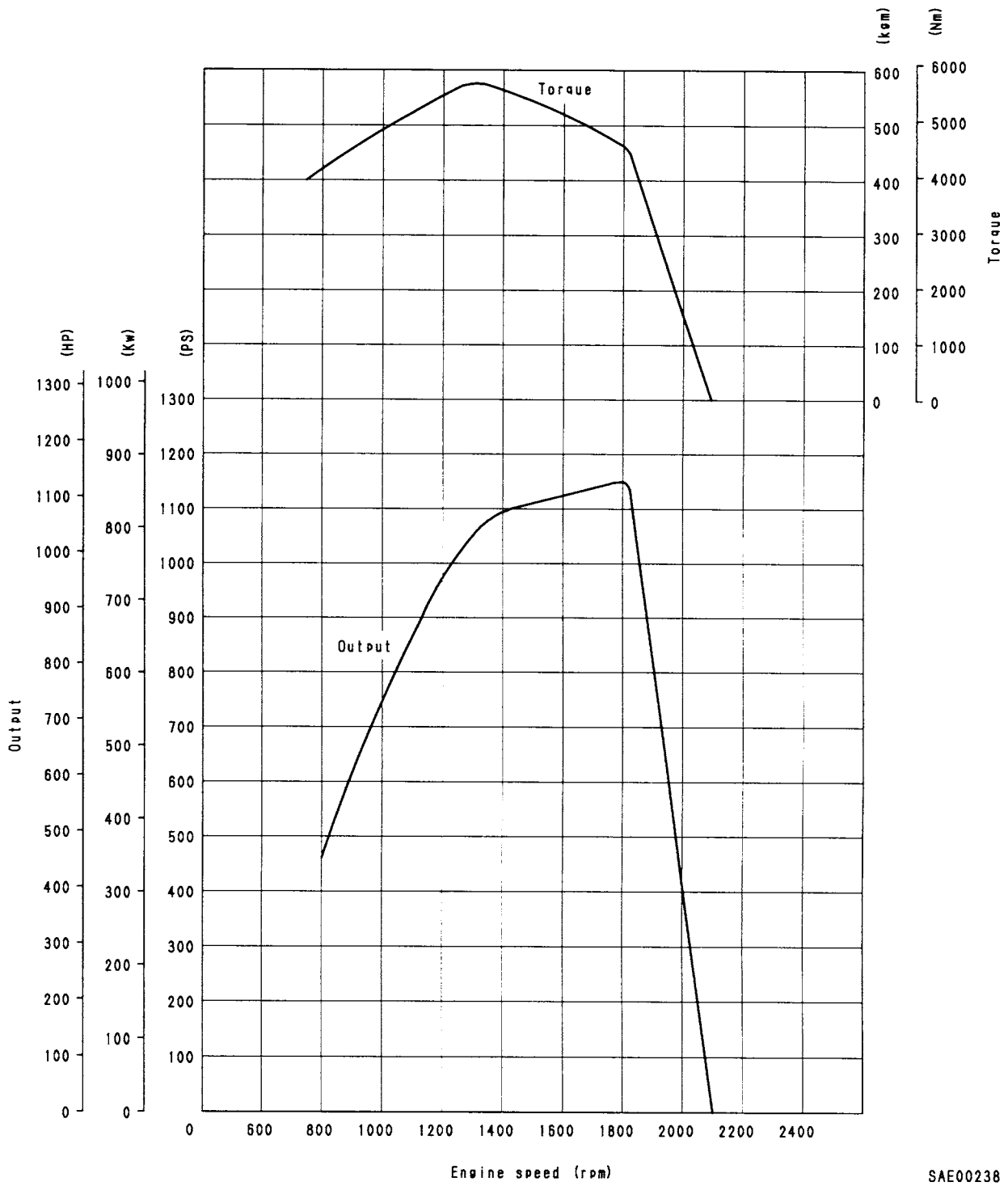
kgm to ft. lb

1 kgm = 7.233 ft. lb

	0	1	2	3	4	5	6	7	8	9
0	0	7.2	14.5	21.7	28.9	36.2	43.4	50.6	57.9	65.1
10	72.3	79.6	86.8	94.0	101.3	108.5	115.7	123.0	130.2	137.4
20	144.7	151.9	159.1	166.4	173.6	180.8	188.1	195.3	202.5	209.8
30	217.0	224.2	231.5	238.7	245.9	253.2	260.4	267.6	274.9	282.1
40	289.3	296.6	303.8	311.0	318.3	325.5	332.7	340.0	347.2	354.4
50	361.7	368.9	376.1	383.4	390.6	397.8	405.1	412.3	419.5	426.8
60	434.0	441.2	448.5	455.7	462.9	470.2	477.4	484.6	491.8	499.1
70	506.3	513.5	520.8	528.0	535.2	542.5	549.7	556.9	564.2	571.4
80	578.6	585.9	593.1	600.3	607.6	614.8	622.0	629.3	636.5	643.7
90	651.0	658.2	665.4	672.7	679.9	687.1	694.4	701.6	708.8	716.1
100	723.3	730.5	737.8	745.0	752.2	759.5	766.7	773.9	781.2	788.4
110	795.6	802.9	810.1	817.3	824.6	831.8	839.0	846.3	853.5	860.7
120	868.0	875.2	882.4	889.7	896.9	904.1	911.4	918.6	925.8	933.1
130	940.3	947.5	954.8	962.0	969.2	976.5	983.7	990.9	998.2	1005.4
140	1012.6	1019.9	1027.1	1034.3	1041.5	1048.8	1056.0	1063.2	1070.5	1077.7
150	1084.9	1092.2	1099.4	1106.6	1113.9	1121.1	1128.3	1135.6	1142.8	1150.0
160	1157.3	1164.5	1171.7	1179.0	1186.2	1193.4	1200.7	1207.9	1215.1	1222.4
170	1129.6	1236.8	1244.1	1251.3	1258.5	1265.8	1273.0	1280.1	1287.5	1294.7
180	1301.9	1309.2	1316.4	1323.6	1330.9	1338.1	1345.3	1352.6	1359.8	1367.0
190	1374.3	1381.5	1388.7	1396.0	1403.2	1410.4	1417.7	1424.9	1432.1	1439.4

SA12V170-1 (FOR D575A-2SD)

Flywheel horsepower: 858 KW (1,150 HP)/1,800 rpm
Maximum torque: 5,658 Nm (577 kgm)/1,300 rpm



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WEIGHT TABLE

Unit: kg

No.	Item	Component	SA12V170-1		
			D575A-2	D575A-2SD	
1	Turbocharger	KTR130	35 x 2 (Water cooled turbo)	35 x 2 (Water cooled turbo)	
		KTR150	—	—	
2	Cylinder head assembly	Cylinder head, valve and valve spring	37	37	
3	Cylinder block assembly	Cylinder block, main bearing cap and cylinder liner	1500	1500	
4	Gear case cover		106	106	
5	Timing gear case		80	80	
6	Oil pan		90	90	
7	Flywheel assembly	Flywheel and ring gear	99	99	
8	Flywheel housing		147	147	
9	Crankshaft assembly	Crankshaft	419	419	
10	Camshaft assembly	Camshaft, cam gear and thrust plate	33	33	
11	Piston and connecting rod assembly	Piston, piston ring, piston pin and connecting rod	21	21	
12	Oil pump		45	45	
13	Fuel injection pump		L row 47 R row 30	L row 47 R row 30	
14	Water pump		33	33	
15	Alternator		13	13	
16	Starting motor		20 x 2	20 x 2	
17	Air compressor		26	26	
18	After cooler		—	—	
19	Oil cooler		148	148	
20	Vibration damper		115	115	
21	Fan		123	123	
22	Filter bracket		127	127	
23	Front support		—	21	
24	Rear support		—	68	
25	Crank pulley		—	29	
26	Tension pulley assembly		—	38	

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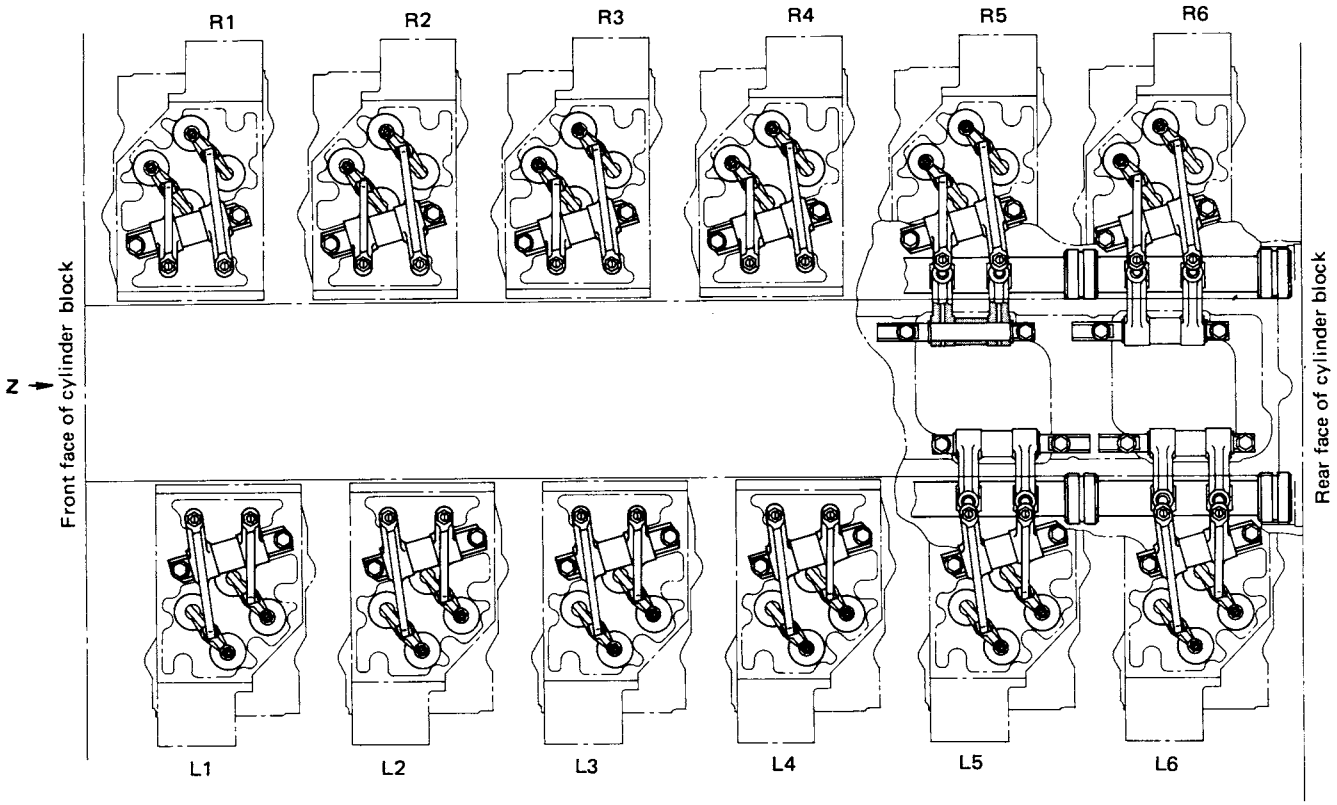
VALVE SYSTEM



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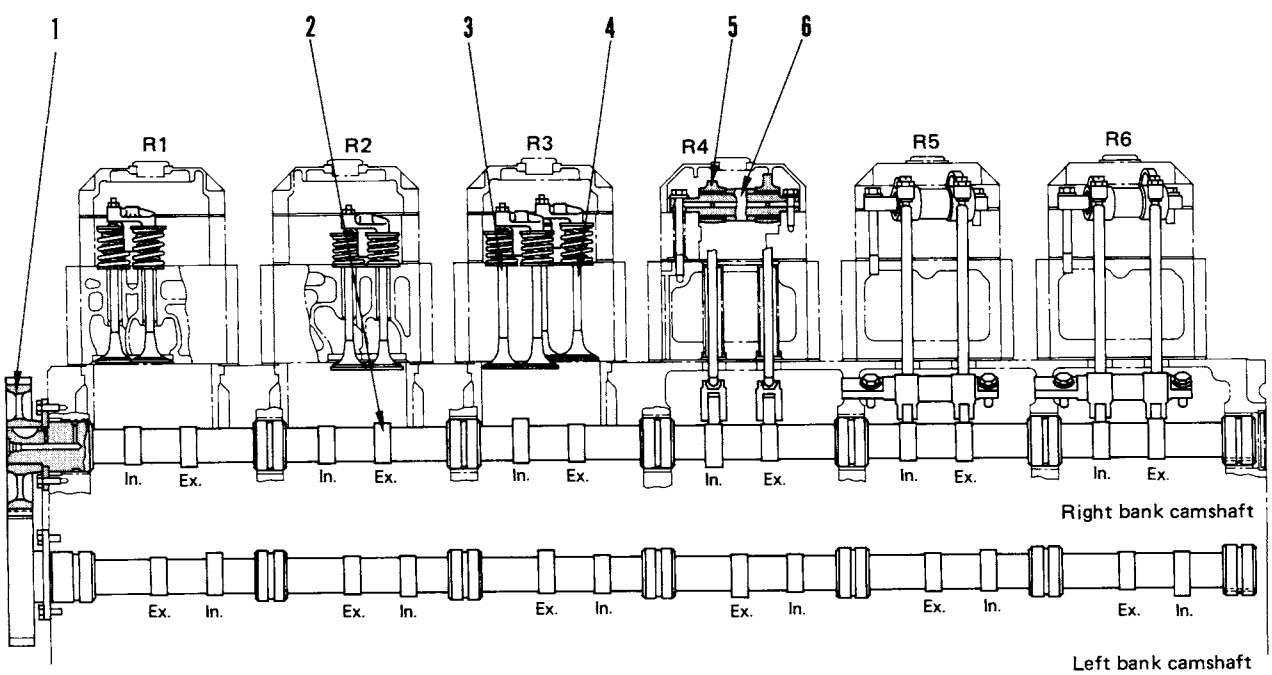
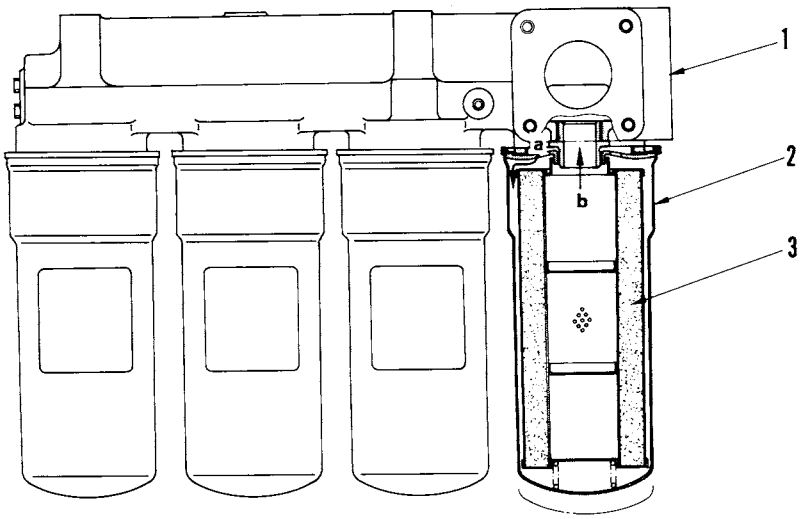


F6166012

OIL FILTER

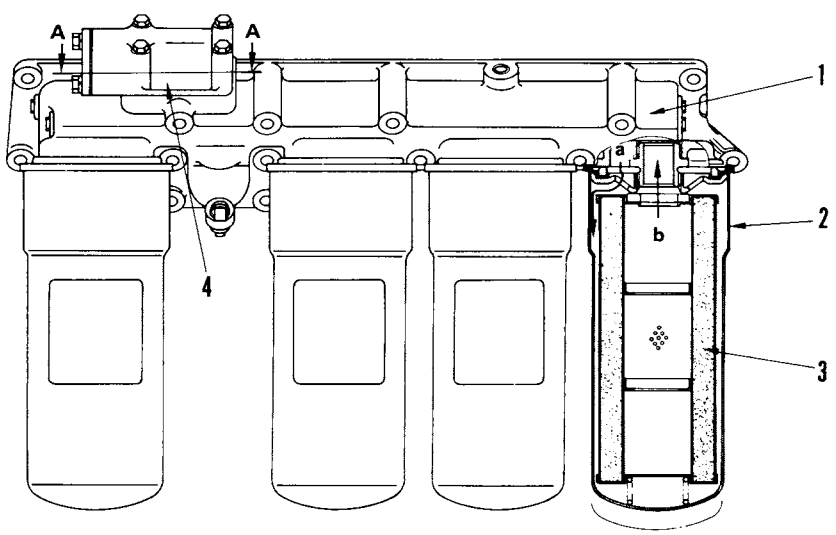
FULL FLOW FILTER (with safety valve)

SA12V170-1 (For D575A-2, D575A-2SD, HD1200-1, HD1200M-1)



F6166024

(For EG1100-1)



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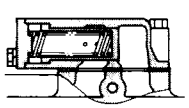

Section A–A

1. Filter bracket
2. Filter case [Cartridge]
3. Filter element [Cartridge]
4. Safety valve (for EG1100)

a. Oil (from oil cooler)
b. Oil (to engine each component)

Full flow

- Filtration area: 0.84 m^2 x 4 sets

Safety valve (for EG1100)

- Cracking pressure (difference pressure): 0.2 ± 0.02 MPa (2.0 ± 0.2 kg/cm^2)

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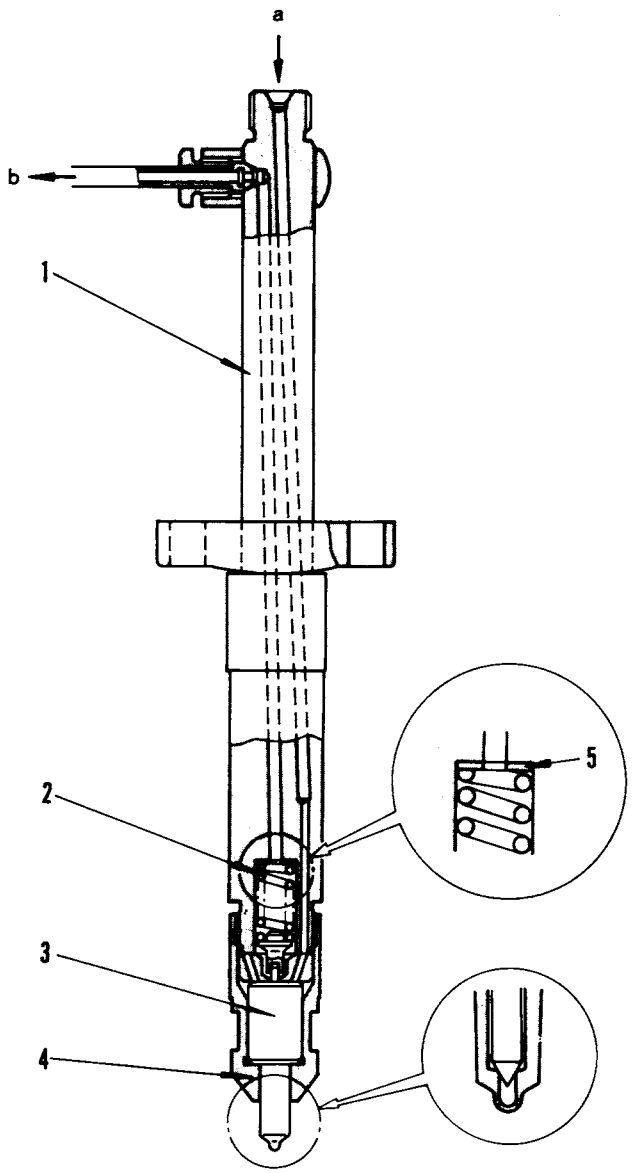
FUEL INJECTION NOZZLE



1. Nozzle holder
2. Nozzle spring
3. Nozzle
4. Retaining cap
5. Adjustment shim

a. Fuel inlet
b. Return-fuel outlet

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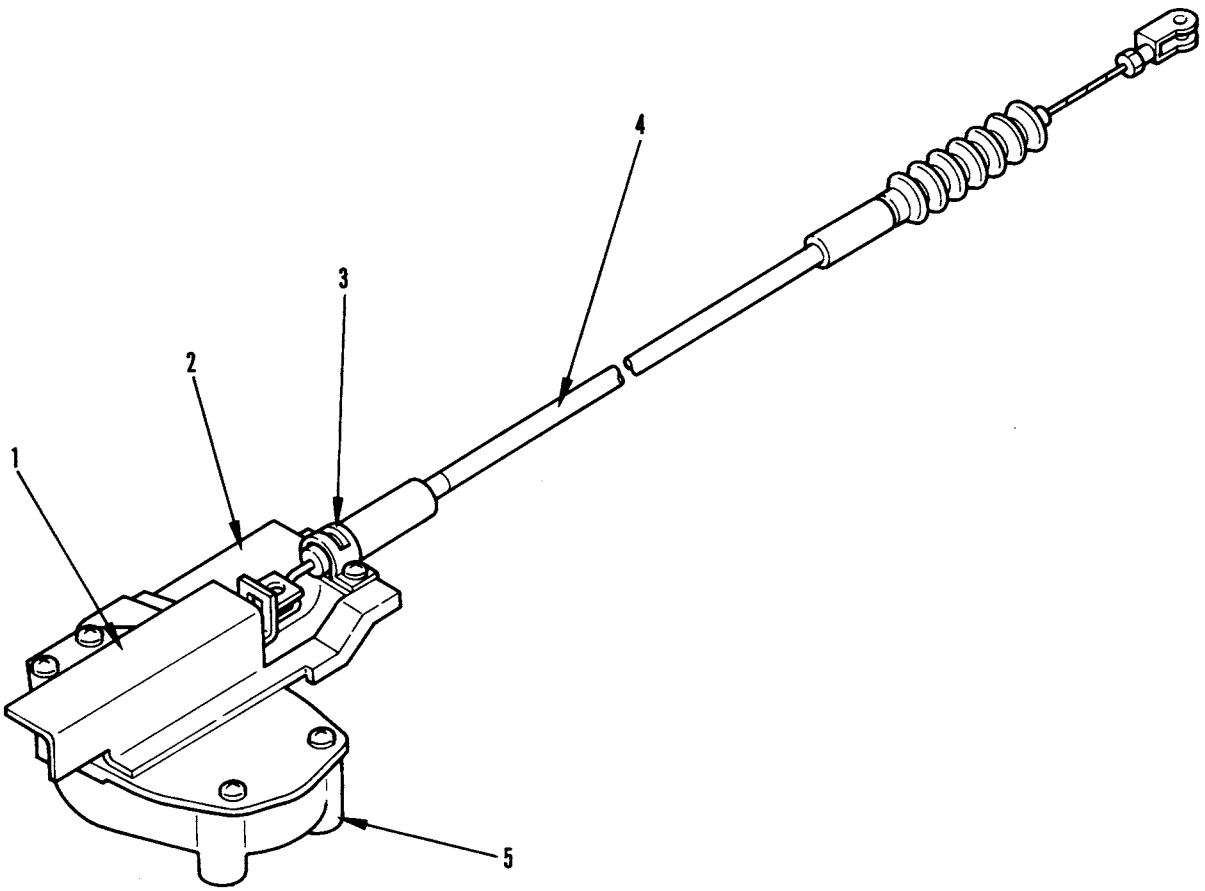
Fuel injection nozzle
- Maker: ZEXEL
- Type: Bosch DLL-S type, multiple hole type
- Nozzle cracking pressure:
  29.4 MPa (300 kg/cm²)

Nozzle cracking pressure
- Adjustment of nozzle cracking pressure is adjusted by upper side shim (5) on nozzle spring (2) after removing retaining cap (4).

STRUCTURAL DRAWING (2/2)



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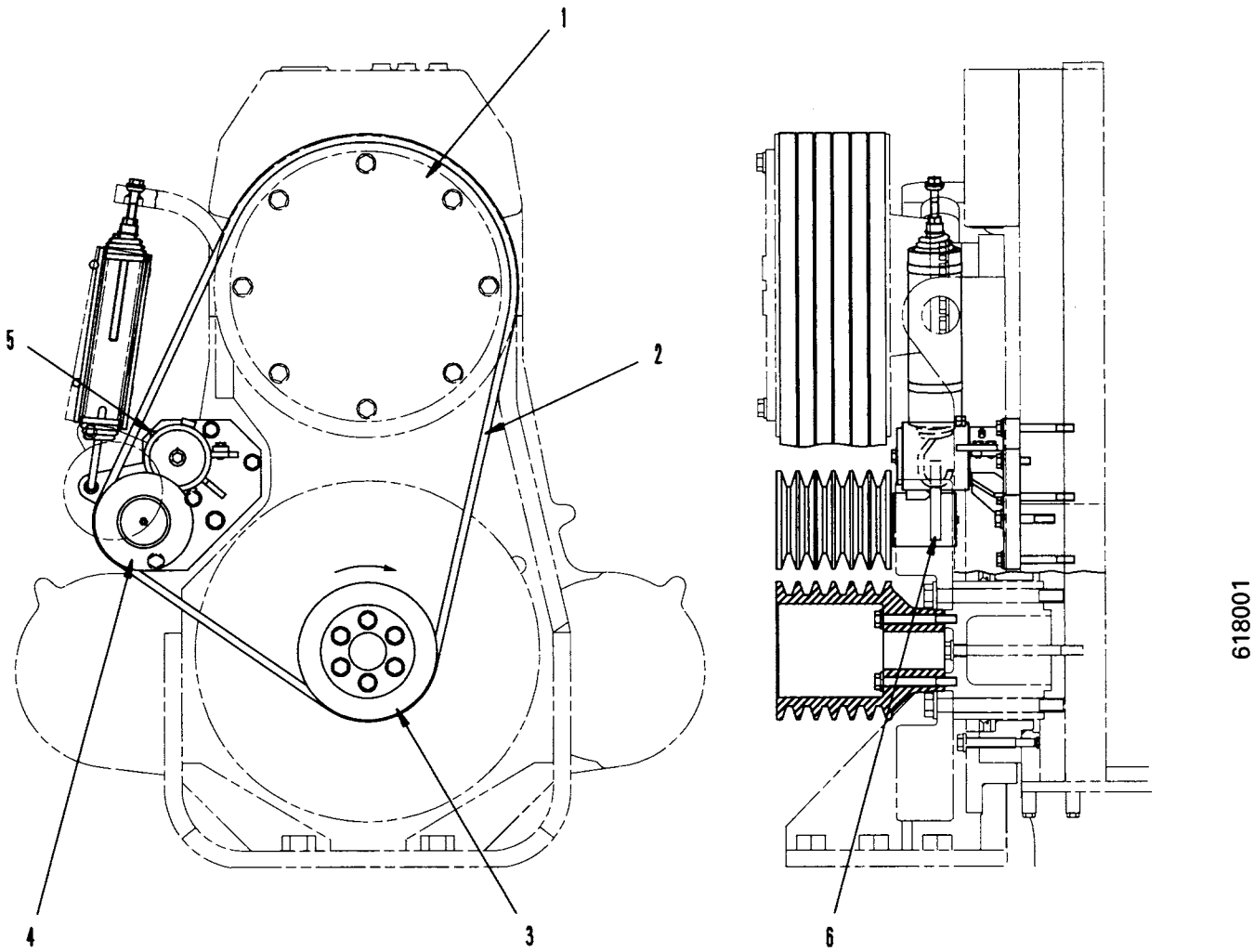
1. Gear cover assembly
2. Motor assembly
3. Cable clamp
4. Cable assembly
5. Gear case assembly

SA12V170-1 (For D575A-2SD)



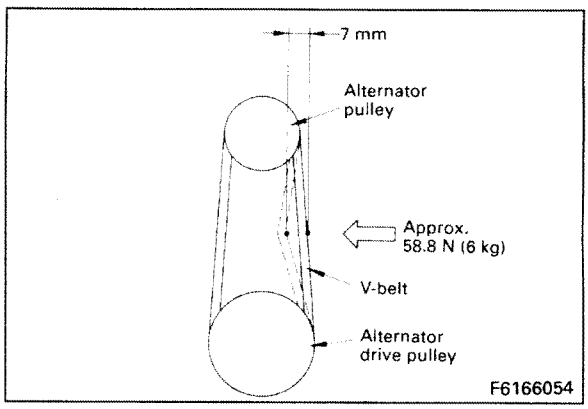
1. Fan pulley
2. Fan belt
3. Crank pulley
4. Tension pulley
5. Grease nipple
6. Bracket

- **Pulley outside diameter**

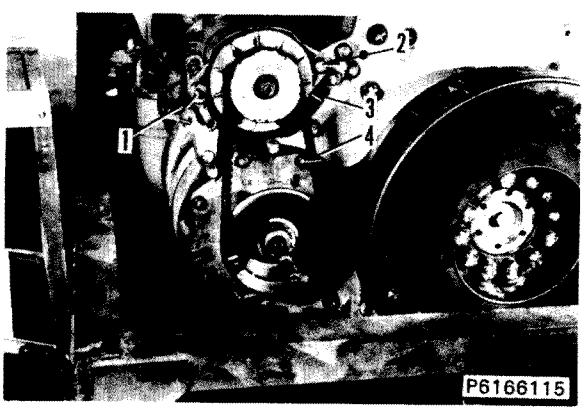
Model	Pulley outside diameter (mm)		
	Fan pulley	Crank pulley	Tension pulley
D575A-2SD	480	221	157

CHECKING AND ADJUSTING ALTERNATOR BELT TENSION

1. **Testing**
   Push the belt (4) at mid-point between the alternator and alternator drive pulley with a force of approx. 58.8 N (6 kg) and measure the distance that the belt sags.



2. **Adjusting**
   1) Loosen alternator mounting bolts (2) and adjustment bolt (1).
   2) Shift the alternator (3) upward with a bar and tighten adjustment bolt (1) while checking the belt tension. Then tighten alternator mounting bolt (2) to the proper belt tension.



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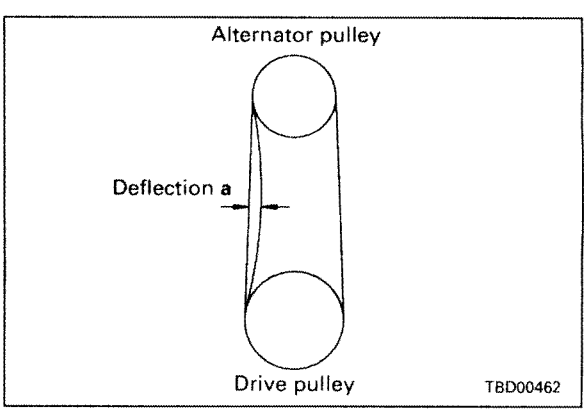
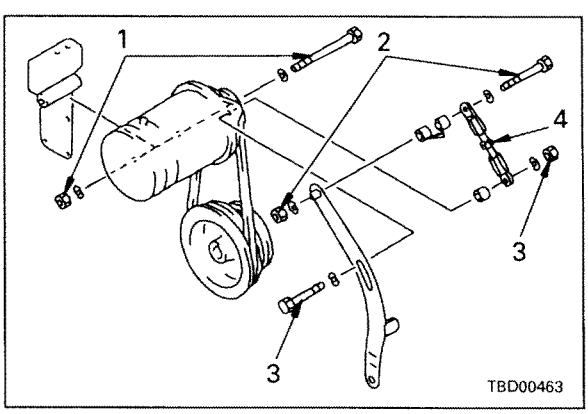
For D575A-2SD

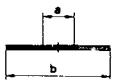
1. **Testing**
   Push a point midway between the alternator pulley and the drive pulley at a pressure of approx. 98.1 N (10 kg) and check deflection **a** of the belt. For details, see STANDARD VALUE TABLE.



2. **Adjusting**
   1) Loosen bolts and nuts (1), (2) and (3).
   2) Turn the turnbuckle (4) so that the belt tension is in standard value.
   3) After adjusting, tighten bolts (1), (2) and (3) securely.



DATA FOR INJECTION PRESSURE ADJUSTMENT SHIMS

Engine model	Shim contour	Shim thickness (Range)	Shim thickness (Interval)
SA12V170-1	 a = 4.5 mm b = 11.5 mm	0.50 – 1.54 mm	0.02 mm

Part No.	Thickness (mm)	Part No.	Thickness (mm)
DK150523-5000	0.50	DK150523-7700	1.04
DK150523-5100	0.52	DK150523-7800	1.06
DK150523-5200	0.54	DK150523-7900	1.08
DK150523-5300	0.56	DK150523-8000	1.10
DK150523-5400	0.58	DK150523-8100	1.12
DK150523-5500	0.60	DK150523-8200	1.14
DK150523-5600	0.62	DK150523-8300	1.16
DK150523-5700	0.64	DK150523-8400	1.18
DK150523-5800	0.66	DK150523-8500	1.20
DK150523-5900	0.68	DK150523-8600	1.22
DK150523-6000	0.70	DK150523-8700	1.24
DK150523-6100	0.72	DK150523-8800	1.26
DK150523-6200	0.74	DK150523-8900	1.28
DK150523-6300	0.76	DK150523-9000	1.30
DK150523-6400	0.78	DK150523-9100	1.32
DK150523-6500	0.80	DK150523-9200	1.34
DK150523-6600	0.82	DK150523-9300	1.36
DK150523-6700	0.84	DK150523-9400	1.38
DK150523-6800	0.86	DK150523-9500	1.40
DK150523-6900	0.88	DK150523-9600	1.42
DK150523-7000	0.90	DK150523-9700	1.44
DK150523-7100	0.92	DK150523-9800	1.46
DK150523-7200	0.94	DK150523-9900	1.48
DK150523-7300	0.96	DK150530-0000	1.50
DK150523-7400	0.98	DK150530-0100	1.52
DK150523-7500	1.00	DK150530-0200	1.54
DK150523-7600	1.02		

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PERFORMANCE TEST CRITERIA

Engine model	Applicable machine	Test item	Specified value (fully equipped)	Engine speed (rpm)	Dynamometer (N (kg)) Arm length 716 mm
SA12V170-1	D575A-2	Flywheel horsepower	783kW/1800rpm (1050HP/1800rpm)	1800 ± 5	6335 – 6707 (646 – 684)
		Max. torque	5001Nm/1300rpm (510kgm/1300rpm)	1300 ± 50	7266 – 7688 (741 – 784)
		High idling speed	2000 ± 50 rpm	2000 ± 50	–
		Low idling speed	650 ± 50 rpm	650 ± 50	–
	D575A-2SD	Flywheel horsepower	863kW/1800rpm (1157HP/1800rpm)	1800 ± 5	6590 – 6894 (672 – 703)
		Max. torque	5658Nm/1300rpm (577kgm/1300rpm)	1300 ± 50	7844 – 8384 (804 – 855)
		High idling speed	2000 ± 50 rpm	2000 ± 50	–
		Low idling speed	650 ± 50 rpm	650 ± 50	–
	HD1200-1	Flywheel horsepower	962kW/2100rpm (1290HP/2100rpm)	2100 ± 5	6237 – 6374 (636 – 650)
		Max. torque	5197Nm/1400rpm (530kgm/1400rpm)	1400 ± 100	7178 – 7325 (732 – 747)
		High idling speed	2350 ± 50 rpm	2350 ± 50	–
		Low idling speed	650 ± 50 rpm	650 ± 50	–

TROUBLESHOOTING

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S-3 Engine does not pick-up smoothly (Follow-up is poor)

General causes why engine does not pick up smoothly

- Insufficient intake of air
- Insufficient supply of fuel
- Improper condition of fuel injection
- Improper fuel used
- Defective injection pump

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

			Cause: Clogged air cleaner element	Clogged fuel filter, strainer	Clogged feed pump strainer	Clogged injection nozzle, defective spray	Defective feed pump	Worn piston ring, cylinder liner	Seized turbocharger, interference	Improper valve clearance	Clogged air breather hole in fuel tank cap	Clogged, leaking fuel piping, air in piping	Defective contact of valve, valve seat	Broken boost compensation diaphragm of injection pump
Questions	Confirm recent repair history													
	Degree of use of machine	Operated for long period	△	△	△			△					△	
	Replacement of filters has not been carried out according to Operation Manual		◎	◎	◎									
	Non-specified fuel is being used			◎	◎	◎	◎							
	Engine oil must be added more frequently							◎						◎
	Rust and water are found when fuel tank is drained			◎	◎									
	Dust indicator is red		◎											
	Noise of interference is heard from around turbocharger								◎					
Check items	Engine pick-up suddenly became poor					○			◎		○	○		
	Color of exhaust gas	Blue under light load						◎						
		Black	◎			◎			◎				○	◎
	Clanging sound is heard from around cylinder head									◎				
	Mud is stuck to fuel tank cap										◎			
	There is leakage from fuel piping											◎		
	High idling speed under no load is normal, but speed suddenly drops when load is applied			◎	◎		○				○			◎
	There is hunting from engine (rotation is irregular)			○	◎	○					○			
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low					◎								
	Blow-by gas is excessive							◎						
Troubleshooting	When air cleaner element is inspected directly, it is found to be clogged		●											
	When fuel filter, strainer are inspected directly, they are found to be clogged			●										
	When feed pump strainer is inspected directly, it is found to be clogged				●									
	Stop fuel injection to one cylinder at a time. If there is no change in engine speed, that cylinder is not working					●								
	When feed pump is inspected directly, it is found to be abnormal						●							
	When compression pressure is measured, it is found to be low							●					●	
	When turbocharger is rotated by hand, it is found to be heavy								●					
	When valve clearance is checked directly, it is found to be outside standard value									●				
	When fuel cap is inspected directly, it is found to be clogged										●			
	When feed pump is operated, operation is too light or too heavy											●		
	Broken boost compensator diaphragm, crushed piping													●
	Remedy		Clean	Clean	Clean	Correct	Replace	Replace	Replace	Adjust	Clean	Correct	Replace	Replace

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S-13 Oil level rises

★ If there is oil in the cooling water, carry to troubleshooting for "Oil is in cooling water".

General causes why oil level rises

- Water in oil (cloudy white)
- Fuel in oil (diluted, and smells of diesel fuel)
- Entry of oil from other component

Legend
○ : Possible causes (judging from Questions and check items)
◎ : Most probable causes (judging from Questions and check items)
△ : Possible causes due to length of use (used for a long period)
● : Items to confirm the cause.

		Cause: Broken oil cooler core, O-ring	Defective nozzle holder sleeve	Broken cylinder head, head gasket	Clogged water pump breather hole, defective seal	Worn, damaged rear seal surface	Defective nozzle holder	Defective part inside injection pump (flange type)	Defective feed pump seal	Damaged liner O-ring, holes made by pitting	Cracks inside cylinder block
Questions	Confirm recent repair history										
	Degree of use of machine: Operated for long period		△		△	△				△	
	There is oil in radiator cooling water	◎	○	○						○	○
	Exhaust smoke is white		◎				○				
	When engine is first started, drops of water come from muffler		◎								
Check items	Leave radiator cap open. When engine is run at idling, an abnormal number of bubbles appear, or water spurts back			◎						○	
	Water pump breather hole is clogged with mud				◎						
	When water pump breather hole is cleaned, water comes out				◎						
	Oil level goes down in clutch, TORQFLOW transmission, or damper chamber					◎					
	Engine oil smells of diesel fuel						○	◎	◎		
Troubleshooting	Pressure-tightness test of oil cooler shows there is leakage	●									
	Pressure-tightness test of cylinder head shows there is leakage		●								
	When compression pressure is measured, it is found to be low			●							
	When water pump is removed and inspected directly, it is found to be abnormal				●						
	When rear seal is inspected directly, it is found to be abnormal					●					
	When nozzle holder is removed and inspected directly, it is found to be abnormal						●				
	Remove injection pump and check directly							●			
	When feed pump is inspected directly, it is found to be abnormal								●		
	Remove oil pan and check directly									●	●
	Remedy	Replace	Replace	Replace	Correct	Replace	Correct	Replace	Replace	Replace	Replace

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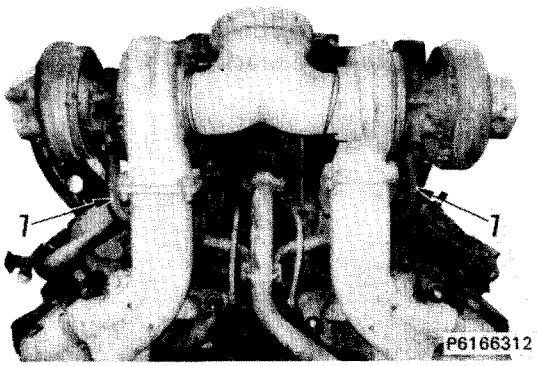
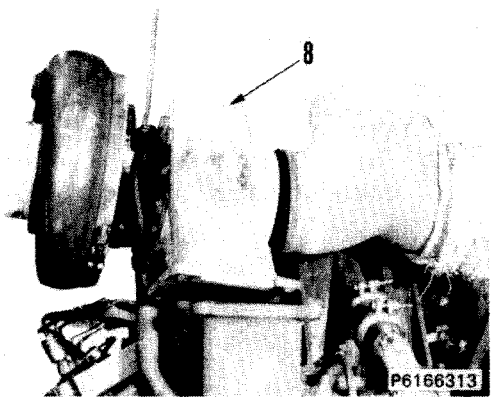
5) Disconnect drain tubes (7).



6) Lift off left bank turbocharger assembly (8).



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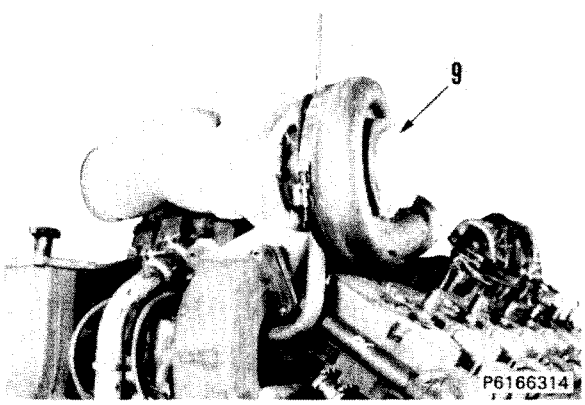
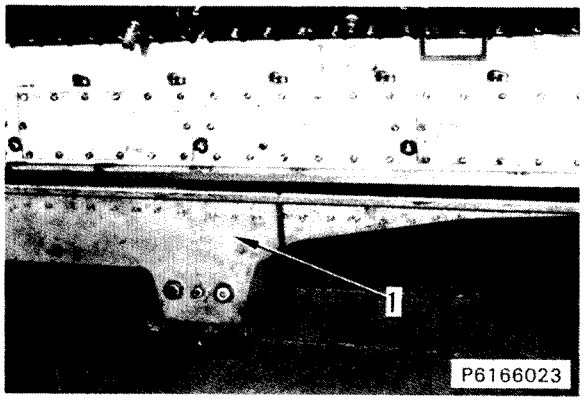
7) Lift off right bank turbocharger assembly (9).



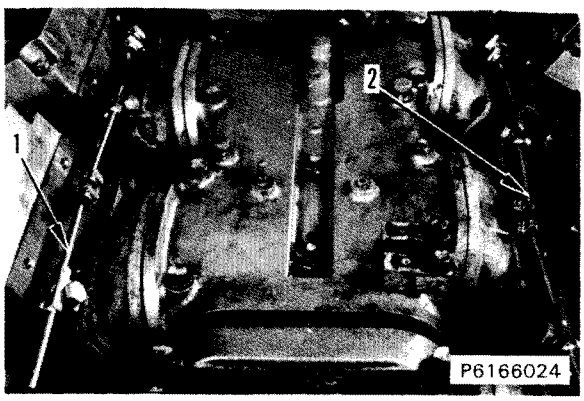
29. Oil pan

1) Sling engine, set with oil pan horizontal on the block.
2) Remove mounting bolts then remove oil pan (1).



30. Air vent tubes

Remove right and left bank air vent tubes (1) and (2).



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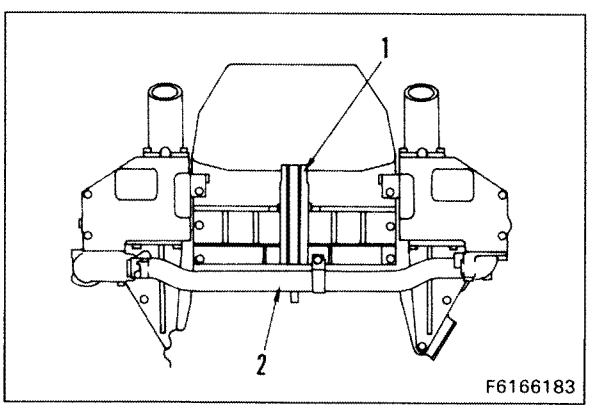
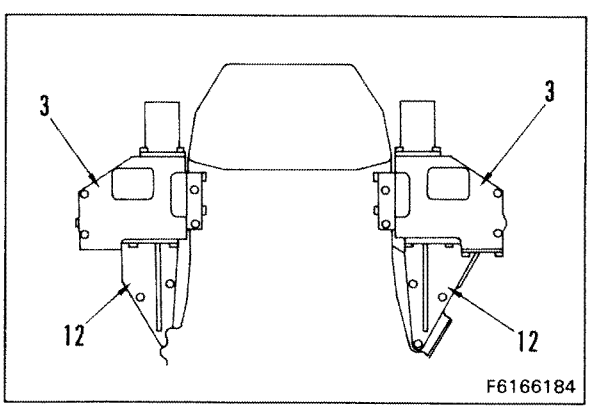
31. Thermostat assembly

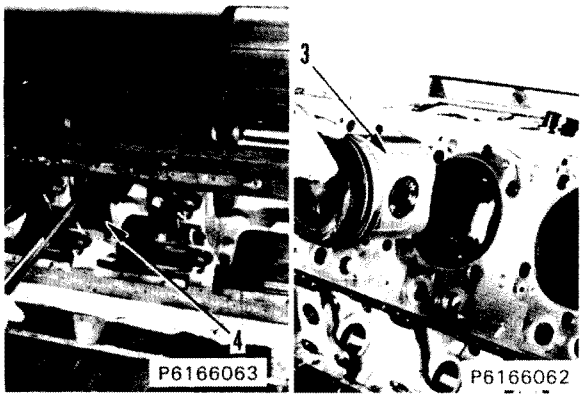
1) Remove bracket (1).
2) Remove tube (2).



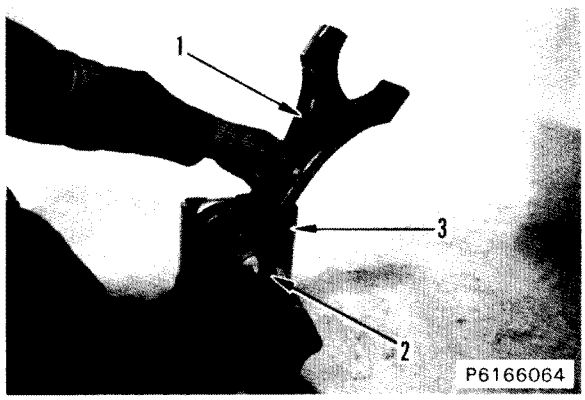
3) Remove left and right thermostats (3).
4) Remove brackets (12).



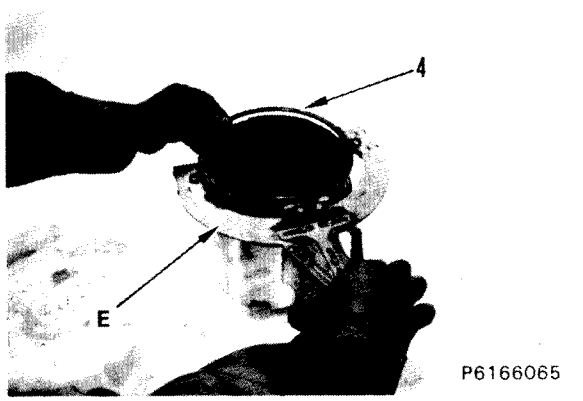
6) Push the piston and connecting rod assembly from the oil pan side with a wooden stick. Hold piston (3) in your hand and remove it from the cylinder head side. During removal, take care not to damage the inner surface of the liner with the connecting rod.
   ★ Rotate the crankshaft until the connecting rod does not contact balancer (4), then remove.
   ★ Keep the connecting rods and caps together, then store them with their corresponding bearings in order to avoid confusion during reassembly.



   ★ Disassemble the piston and connecting rod assembly as follows.
      i) Remove snap ring.
      ii) Pull out piston pin (2) while holding connecting rod (1) in your hand, and separate connecting rod from piston (3).
         ★ If the piston pin does not come out, leave in hot water, then try again.

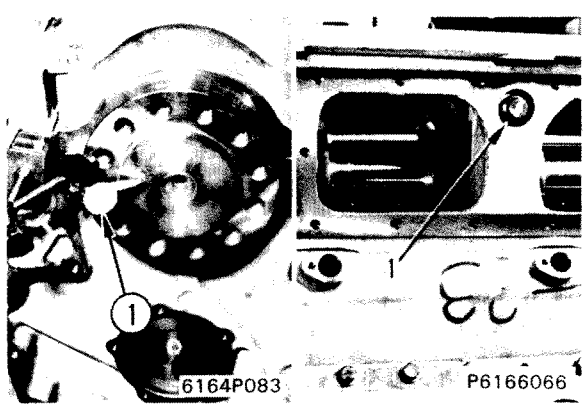


      iii) Remove piston rings (4) using piston ring tool **E**.
         ★ Store the piston, connecting rod, connecting rod bearings, piston rings, and piston pin for every cylinder.



58. Crankshaft

1) Turn the cylinder block, then set the crankshaft upward.
   ★ If necessary, measure the end play of the crankshaft with dial gauge (1) before removing the crankshaft.
2) Remove side bolts (1) of main bearing cap.



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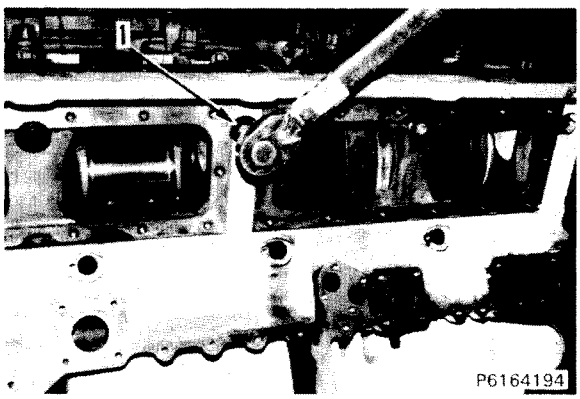
15) Coat the thread and washer of the side bolt (1) with engine oil (SAE #30).
★ Tighten the side bolt as follows.

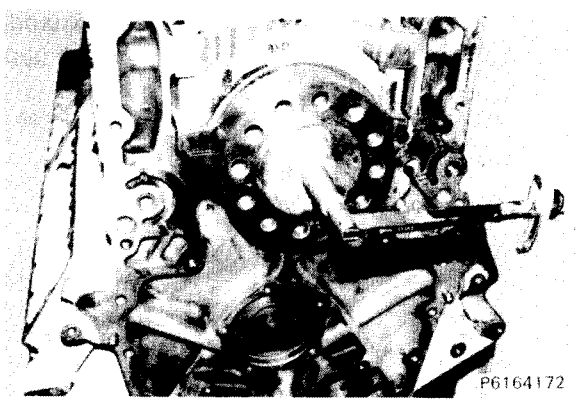
kgm Side bolt:

Nm (kgm)

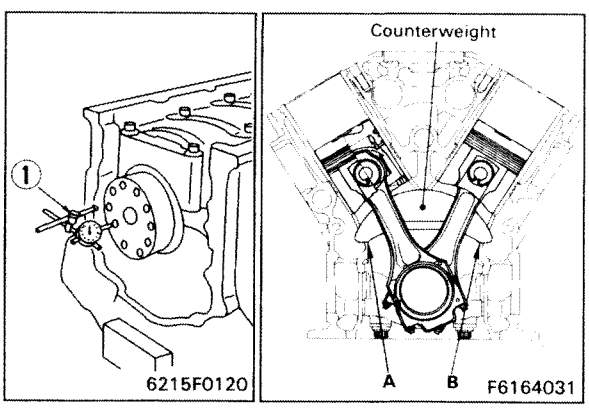
Step	Target	Range
1st	274.6 (28)	245.2—304.0 (25—31)
2nd	559.0 (57)	529.6—588.4 (54—60)
3rd	Loosen completely	
4th	186.3 (19)	156.9—215.7 (16—22)
5th	372.7 (38)	343.2—402.1 (35—41)
6th	559.0 (57)	529.6—588.4 (54—60)



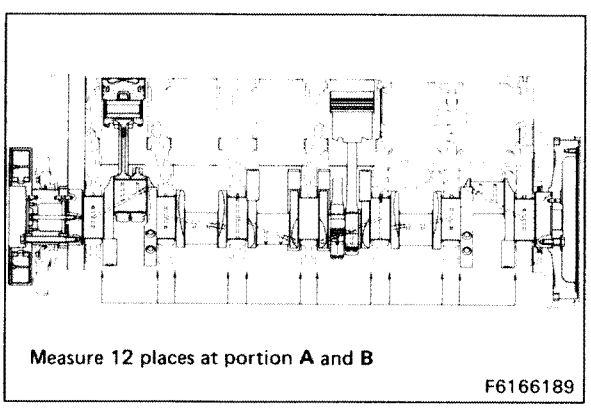
16) Measuring starting torque of crankshaft
i) Screw bolt in center bolt hole, and measure rotating weight of crankshaft.
★ Standard value:
Max.27.5 Nm (2.8 kgm)
★ Check that the crankshaft rotates smoothly.



17) Measure end play of crankshaft with dial gauge (1).
★ End play: 0.140 — 0.32 mm
★ Lever the area between the counterweight bolts when measuring the end play.
★ If it is not within the standard value, adjust according to the maintenance standard.



18) Checking position of counterweight
1) Set the counterweight of the cylinder No. to be measured in the position shown in the diagram on the right.
2) When measuring, use a feeler gauge to measure the clearance between the side surface of the counterweight and the finished surface of the cylinder block at two positions, **A** and **B**, of the counterweight.
3) Measure the counterweight of the other cylinders in the same way.
Standard clearance: Min. 1.1 mm
Difference between dimensions **A** and **B**:
Max. 0.6 mm



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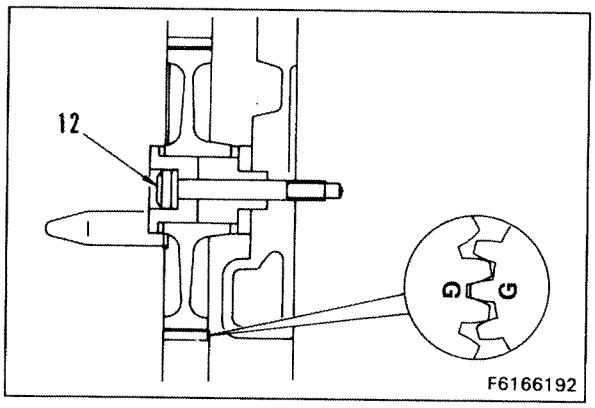
7) Align mark "**G**" of gear (13), then set in position.
8) Tighten bolt (12).

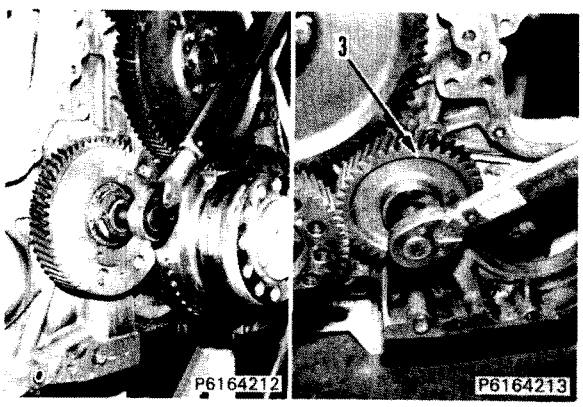
kgm Mounting bolt: 274.6 — 308.9 Nm (28.0 — 31.5 kgm)



9) Coat thread of center bolt with engine oil (SAE30), and tighten bolts.

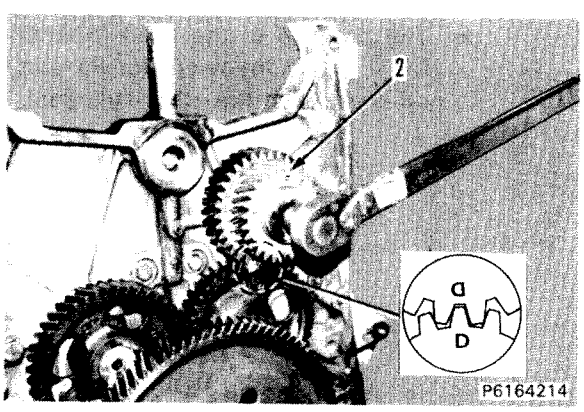
10) Install idler gear (3) for compressor, and tighten center bolts.

kgm Mounting bolt: 274.6 — 308.9 Nm (28.0 — 31.5 kgm)



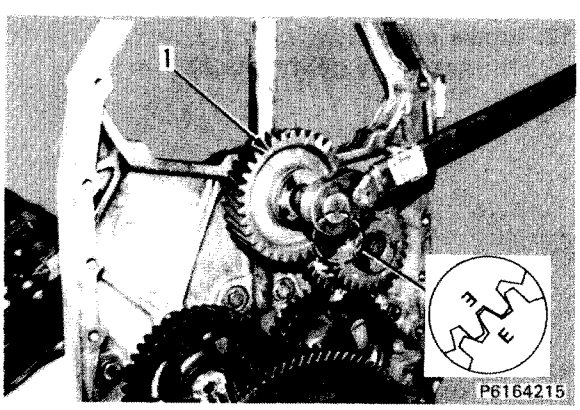
11) Align match mark "**D**", then install idler gear (2) for timer, and tighten bolts.

kgm Mounting bolt: 274.6 — 308.9 Nm (28.0 — 31.5 kgm)



12) Align match mark "**E**", then install idler gear (1) for timer and tighten bolts.

kgm Mounting bolt: 274.6 — 308.9 Nm (28.0 — 31.5 kgm)



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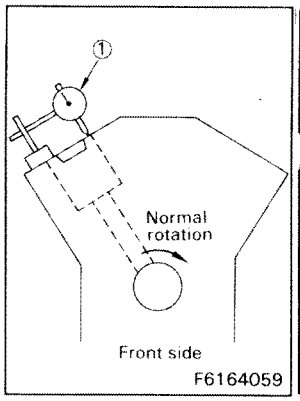
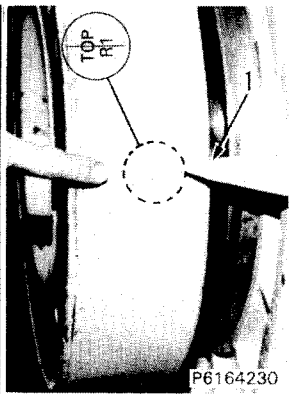
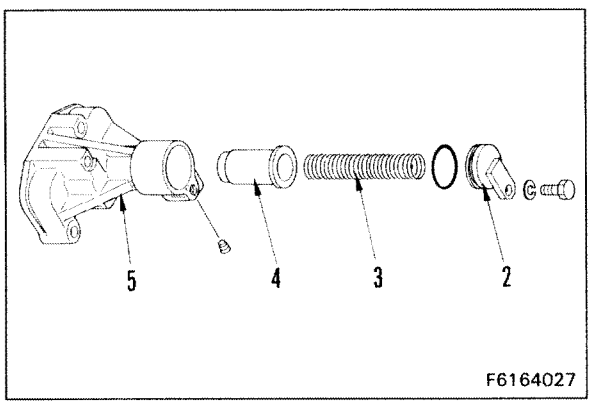
5) Align pointer (1) with "TOP R1" line on vibration damper, and install.
   ★ Set dial gauge (1) in position, rotate the crankshaft in the normal direction to set the crankshaft where the piston of right No. 1 cylinder is at the highest position, then align with the "TOP R1" line.





24. Piston cooling valve
- Assemble piston cooling valve as follows.
  i) Assemble plunger (4) and spring (3) in body (5), then fit O-ring and install plug (2).
     ★ Check that there is no dirt or dust between the plunger and body when assembling.



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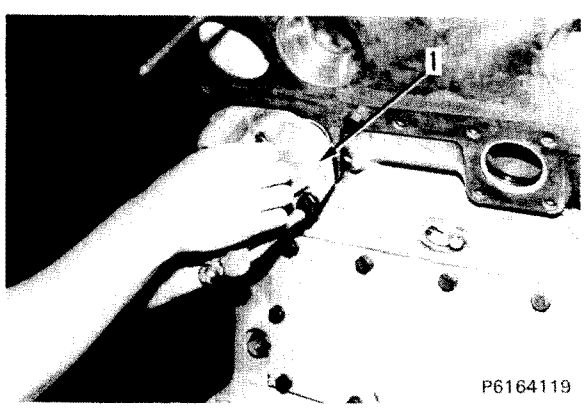
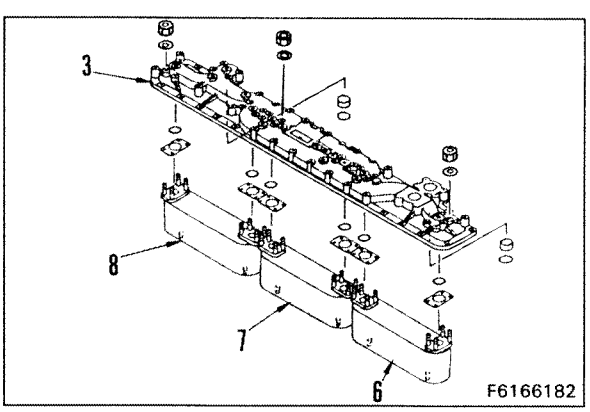
1) Fit grommet to cooling valve and oil cooler mounting plate, and install piston cooling valve (1).

   kgm Mounting bolt: 65.7 ± 6.8 Nm (6.7 ± 0.7 kgm)



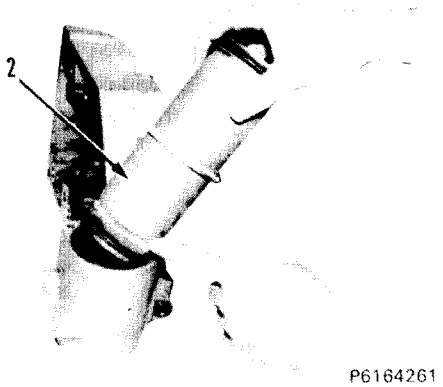
25. Oil cooler assembly
- Assemble oil cooler as follows.
  i) Fit gasket and O-ring to cover (3), then install cores (8), (7) and (6) and tighten with nuts.



2) Fit O-rng and insert water manifold (2) in rocker husing.

O-ring: Rubber lubricant (FR-1) or soapy water.

★ Never coat the O-ring with oil. When assembling, coat with rubber lubricant or soapy water.



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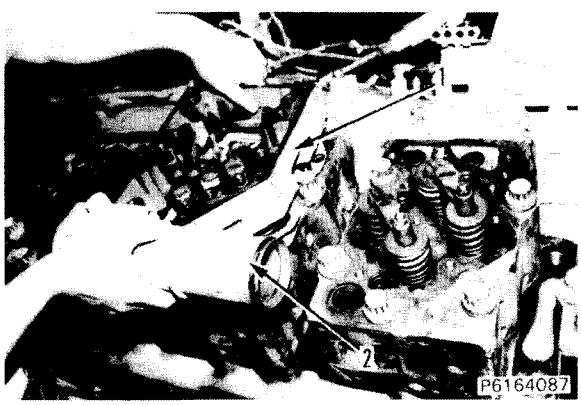
3) Install rocker housing (1).

kgm Mounting bolt: 98.1 ± 4.9 Nm (10.0 ± 0.5 kgm)



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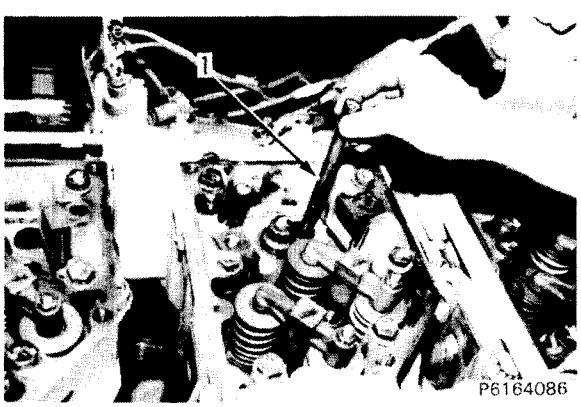
34. Push rod

Install push rod (1).

★ Check that the push rod is fitted securely in the cam follower.



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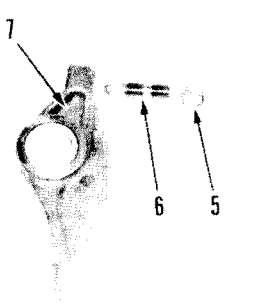
35. Rocker arm assembly

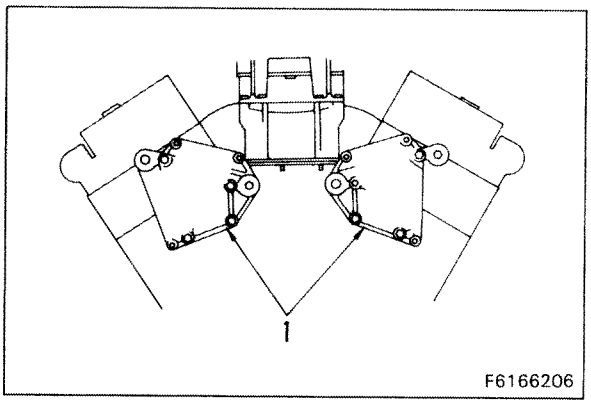
- Assemble the rocker arm as follows.
  - i) Align shaft hole of bushing, and knock in rocker arm (7).
  - ii) Assemble adjustment screw (6) and locknut (5) to rocker arm.
  - iii) Coat rocker shaft with engine oil (SAE #30), and set so that end with plug is facing left (EX end).


P6164084



P6164085

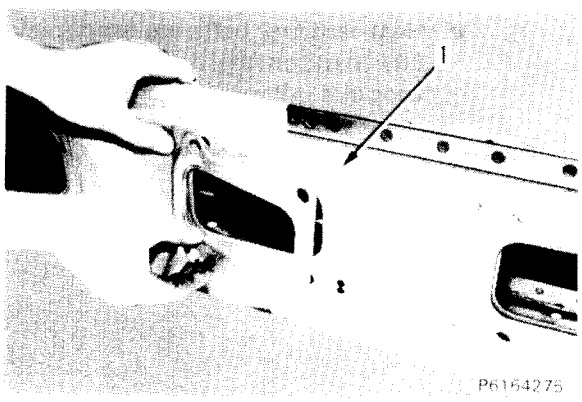
2) Install brackets (1) for exhaust pipe.



52. Exhaust manifold

1) Install gaskets to exhaust plates (1) of left and right banks.
   ★ Stick the gasket to the plate.

2) Tighten exhaust shield plate (1) to rocker case temporarily.
   ★ Set the gasket surface facing the rocker case when installing.



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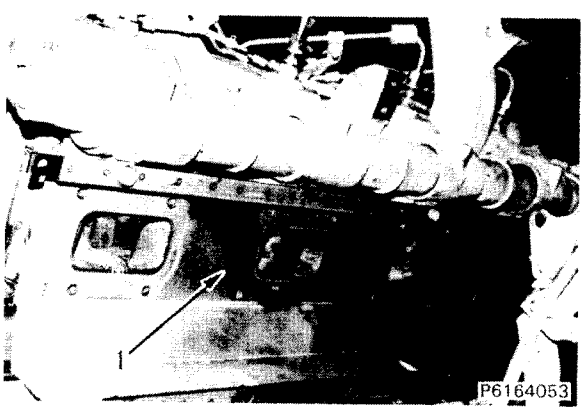
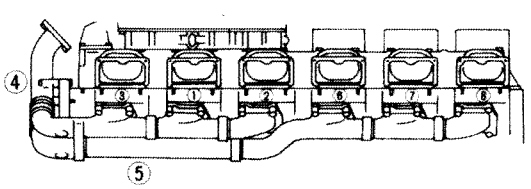
3) Fit gasket to right bank exhaust manifold, then tighten (1) — (8) in order.

   Manifold connection:
   Anti-friction compound (LM-P)
   Mounting bolt:
   Anti-friction compound (LM-P)

   ★ After installing manifold, tighten to the specified torque in the tightening order. For the other manifolds, tighten after installing all.
   ★ Order for tightening exhaust manifold

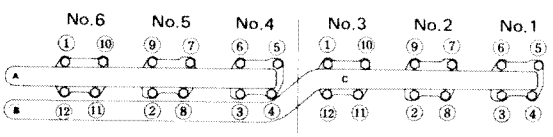


   ★ Heat resistant bolts are used (they have a 660 mark on the head), so be careful to keep the tightening torque.

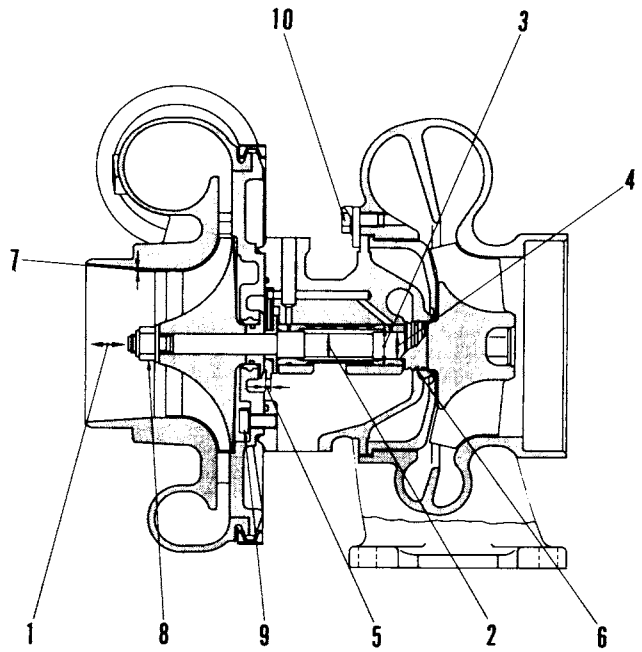


Mounting bolts:

1st step	49.0 ± 9.8 Nm (5 ± 1 kgm)
2nd step	83.3 ± 4.9 Nm (8.5 ± 0.5 kgm)



KTR150 (For EG1100-1)

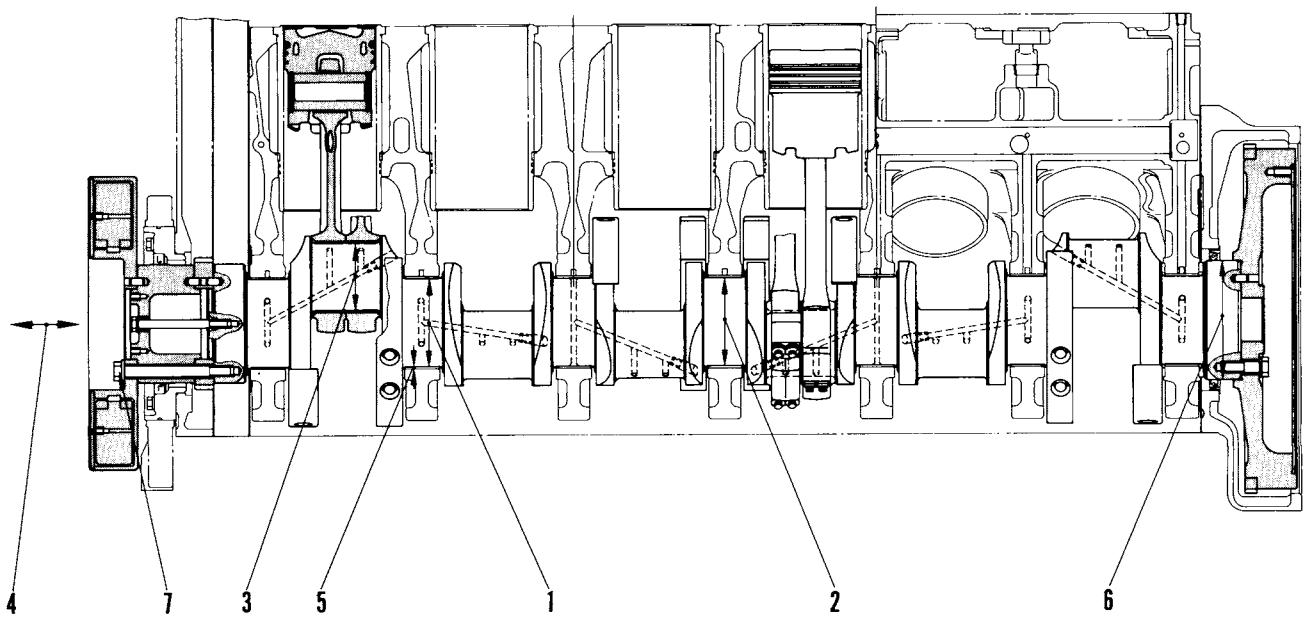


F6166056

Unit: mm

No.	Check item	Criteria					Remedy
1	End play	Standard			Repair limit		Replace parts
		0.08 — 0.13			0.18		
2	Radial play	0.25 — 0.43			0.60		Replace parts
3	Outside diameter of journal bearing. Inner diameter of center housing.	Standard size	Tolerance		Repair limit		Replace
			Shaft	Hole	Shaft	Hole	
		30	- 0.060 - 0.080	+ 0.020 0	29.89	30.04	
4	Inner diameter of journal bearing. Outside diameter of wheel shaft.	20	- 0.030 - 0.045	+ 0.015 0	19.95	20.05	
	Curvature of wheel shaft	Repair limit: 0.010 (total deflection of indicator)					
5	Thickness of thrust bearing	Standard size	Tolerance		Repair limit		
			Shaft	Hole	Shaft	Hole	
		6	- 0.08 - 0.11	+ 0.02 0	5.86	6.04	
6	Thickness of seal ring	3	- 0.08 -0.10	- 0.03 - 0.04	2.85	3.05	
7	Clearance between blower housing and impeller	Tolerance: (min.) 0.20					Replace parts
8	Tightening torque of blower impeller locknut	93.2 ± 4.9 Nm {9.5 ± 0.5 kgm}					Tighten
9	Tightening torque of insert bolt	66.2 ± 7.4 Nm {6.75 ± 0.75 kgm}					
10	Tightening torque of bolt	56.4 ± 2.5 Nm {5.75 ± 0.25 kgm}					
—	Tightening torque of V-band locknut	8.8 ± 1.0 Nm {0.9 ± 0.1 kgm}					

CRANKSHAFT



Tightening order of vibration damper mounting bolt

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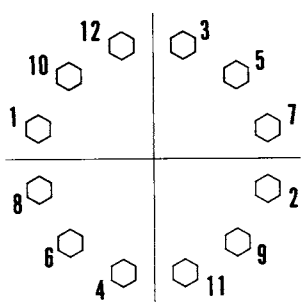

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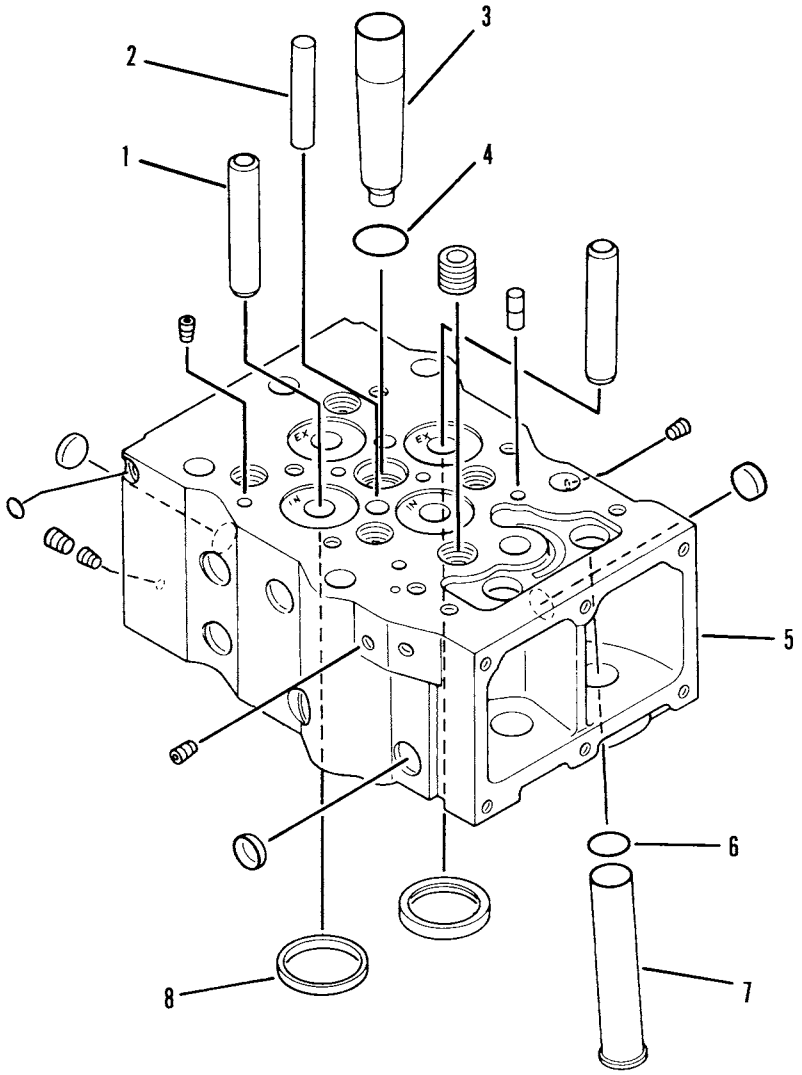
Unit: mm

No.	Check item	Criteria				Remedy
		Size	Standard size	Tolerance	Repair limit	
1	Outside diameter of main journal	S.T.D.	162.00	0 −0.020	161.98	Repair or replace
		0.25 US	161.75		161.73	
		0.50 US	161.50		161.48	
		0.75 US	161.25		161.23	
		1.00 US	161.00		160.98	
	Main journal roundness	Standard		Repair limit		
		0 – 0.010		0.010		

CYLINDER HEAD



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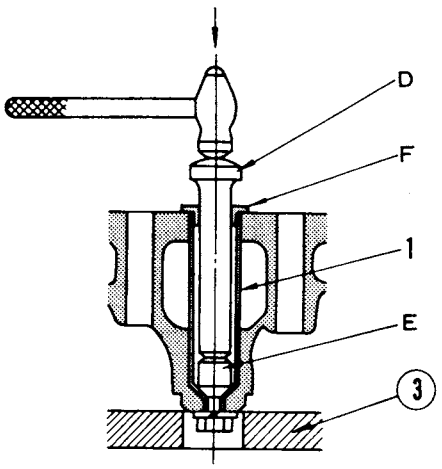
1. Valve guide
2. Closshead guide
3. Fuel injection nozzle sleeve
4. O-ring
5. Cylinder head
6. O-ring
7. Pushrod tube
8. Valve seat insert

4. Calking the sleeve seat face

1) Fit the sleeve seat with sleeve holder **E**.

   kgm Tightening torque for sleeve holder: 19.6 Nm {2 kgm}.

2) Install punch bushing **F** and insert sleeve driver **D**.
3) Place support ③ under the cylinder head to allow the bolt of the sleeve holder to move out.
4) Hit the sleeve driver with a hammer to calk the seat surface.
   ★ Lightly hit with a hammer several times.
5) Remove the sleeve holder and punch bushing.



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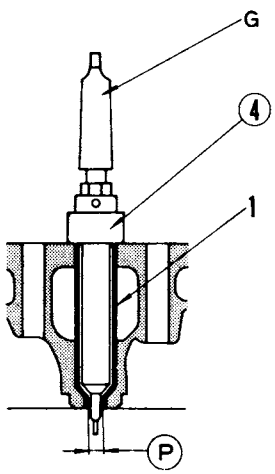
5. Roll-fit the bottom hole of sleeve

- Using sleeve rolling tool **G**, roll-fit bottom hole Ⓟ of sleeve (1).
  ★ Adjust the roll-fitting height with bearing collar ④ so that the shaft of the rolling tool will protrude a little from the bottom hole.
  ★ Install the rolling tool to a radial drilling machine or upright drilling machine to roll-fit with its own weight.
  ★ **Rotating speed: 200 to 300 rpm**



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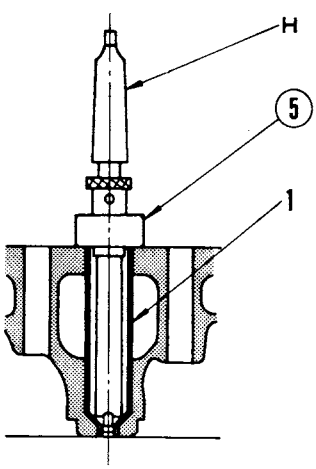
6. Roll-fitting the taper section of sleeve

- Using sleeve expander **H**, roll-fit the taper section of the sleeve.
  ★ Set the roll-fitting amount with stopper ⑤ of the expander.
  ★ Install the expander to a radial drilling machine or upright drilling machine to roll-fit with its own weight.
  ★ **Rotating speed: 200 to 300 rpm**



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2. Grinding couterbore

After grinding the top surface of the cylinder block, measure the depth of the counterbore. If it is not within the standard dimension, or if there are blackened portions on the cylinder liner contact surface of the counterbore (particularly in the front-to-rear direction), or there is speckled wear, and these portions extend over more than half of the contact width of the deck, correct the counterbore depth **L** within the repair limit. After correcting, if the counterbore depth is within 14.05 — 15.525 mm, combine with shims and adjust so that the liner protrusion is 0.07 — 0.15 mm.

★ Counterbore depth **L**:
Standard dimension $14 + \frac{0.05}{0}$ mm
Repair limit: 15.525 mm

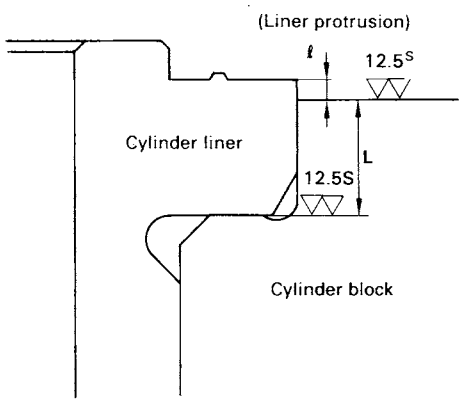
★ Protrusion of cylinder liner ℓ:
Standard value: 0.07 — 0.15 mm

★ Roughness of counterbore: Max. 12.5S

★ Machined shape: In accordance with detail diagram for portion **a**

For the extra amount for counterbore depth **L**, decide a machining amount that will bring the protrusion of the cylindr liner within the standard value.
When grinding within the repair limit in cases where the counterbore depth **L** exceeds the standard dimension, set the machining amount so that one shim can be used for each cylinder as shown in the table below.

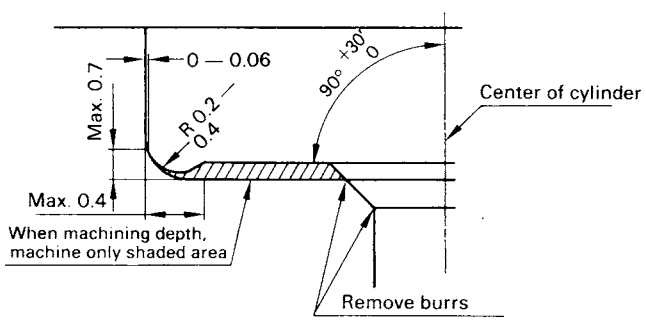
Unit:mm



Detail b

F6164120

Unit:mm



Detail a

F6164121

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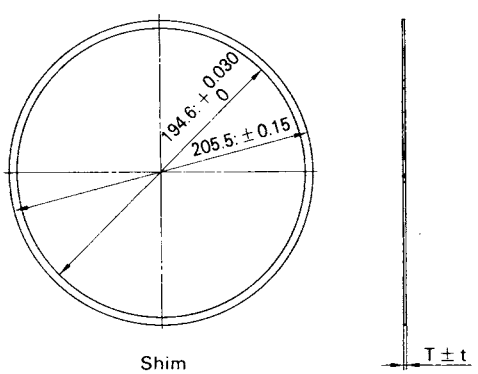
[Reference] Adjustment shims for counterbore depth

Unit: mm

Part No.	T	t	Weight (kg)	Remarks
6162-29-2260	1.50	0.025	0.004	
6162-29-2250	0.80	0.025	0.002	
6162-29-2240	0.50	0.025	0.001	
6162-29-2230	0.26	0.025	0.001	
6162-29-2220	0.20	0.020	0.001	
6162-29-2210	0.16	0.016	0.001	

Unit: mm



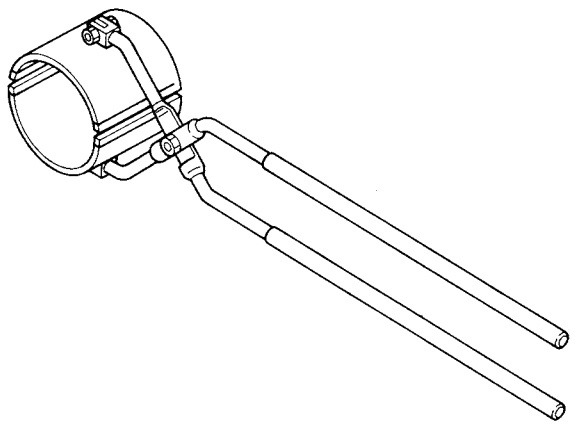
Shim

F6164122

2) When using a work clamp jig for polishing
(When a special polishing machine is not available)
Use a work clamp jig such as shown in the diagram on the right.

i) Use a crankshaft grinding machine under the following polising conditions.
Paper: No. 800
Machining oil: Honing oil
Work speed: 40 rpm

ii) The polishing time for one journal is approx. 6 minutes. Move the clamp the amount of play of the clamp and journal width (approx. 5 mm), and move up and down the journal in the axial direction.
After completing the honing of one journal, replace the paper with new paper.
When honing the pin journal, it is safer to carry out the work with the pin journal at the rotation center.



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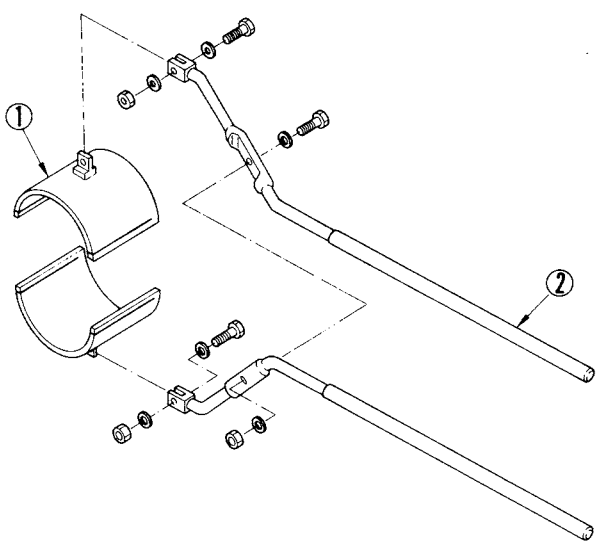
3) Assembly of work clamp jig and method of use

i) Jig for pin journal and jig for main journal
Assemble the clamp jig as shown in the diagram on the right. For details of the component parts, see the drawings on separate pages.



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