



High Temperature and High
Loads Detergency Test
Procedure for Evaluating
Automobile Diesel Engine Oil

KES T – L338

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1. Scope of Application

This standard shall be applied to a testing method for to evaluate the high temperature and high loads detergency of the automobile diesel engine lubricating oil (Engine oil hereinafter).

2. Purpose

The purpose of this standard is to establish a synthetic testing method to evaluate the detergency of the engine oil within its practicality.

3. Definition of Terminology

(1) Detergency

It is cleanness inside the engine by deposits from lacquer⁽¹⁾, carbon⁽²⁾, sludge⁽³⁾, etc.

Note (1) Lacquer is the deposits, which colors are mainly gray or grayish brown that have not received oils, are shaded, glazed, conducted for very long time, and can be removed with smooth cloth.

In addition, it is adhered as very thin layer, is not flammable by firing solvent such as gasoline, and is flammable by other solvents(Benzene, chloroform, kinds of ketone).

⁽²⁾ Carbon is organization structured, has thickness, is black deposits that are not soluble, and is generally not glazed.

⁽³⁾ Sludge is the deposits created from the organic remaining, which the fuel, engine oil, water, etc. are mixed, and its shape is like mud that includes oil element or dried condition. It may be removed by smooth cloth, etc.

(2) Engine oil

Standard oil that can perform the evaluation test correctly.

(3) Brake in

A drive for the appropriate evaluation test in order to operate the detergency test

excluding factors of the engine oil quality, when new engine or important parts are used for the test.

(4) Flushing

When dismantling the engine, perform a short-period drive and clean the lubricant oil with the official oil

(5) Carbon cutting

Prints created on metallic surface of pistons by carbon.

(6) Ring sticking

In the middle of piston rings, a form of the ring moving is proper for a shape (Degree of freedom), however the degree of freedom is interrupted by deposits and carbon cuttings, it does not include the sludge.

4. Apparatus

An engine and a reconstruction of engine for the test, or control device, measuring devices required for the test are as following.

4.1 Official engine

The official engine is the one, which is shown in Figure 1 and has been reconstructed as following.

(1) Oil filter

Use a remodeled product for measurement of difference of the pressure as shown in Figure 1.

(2) Cooling fan

Take out the cooling fan.

(3) Cooler

Take out the cooler.

(4) Thermostat

Take out the thermostat.

(5) Oil jet for piston cooling

Take out the oil jet for piston cooling.

(6) Refrigerant pump

Take out the bypass hose of the refrigerant pump, and block the entrance and the exit of the bypasses of thermostat parts.

(7) Vacuum Pump

Take out the vacuum pump while blocking a mouth of the intake.

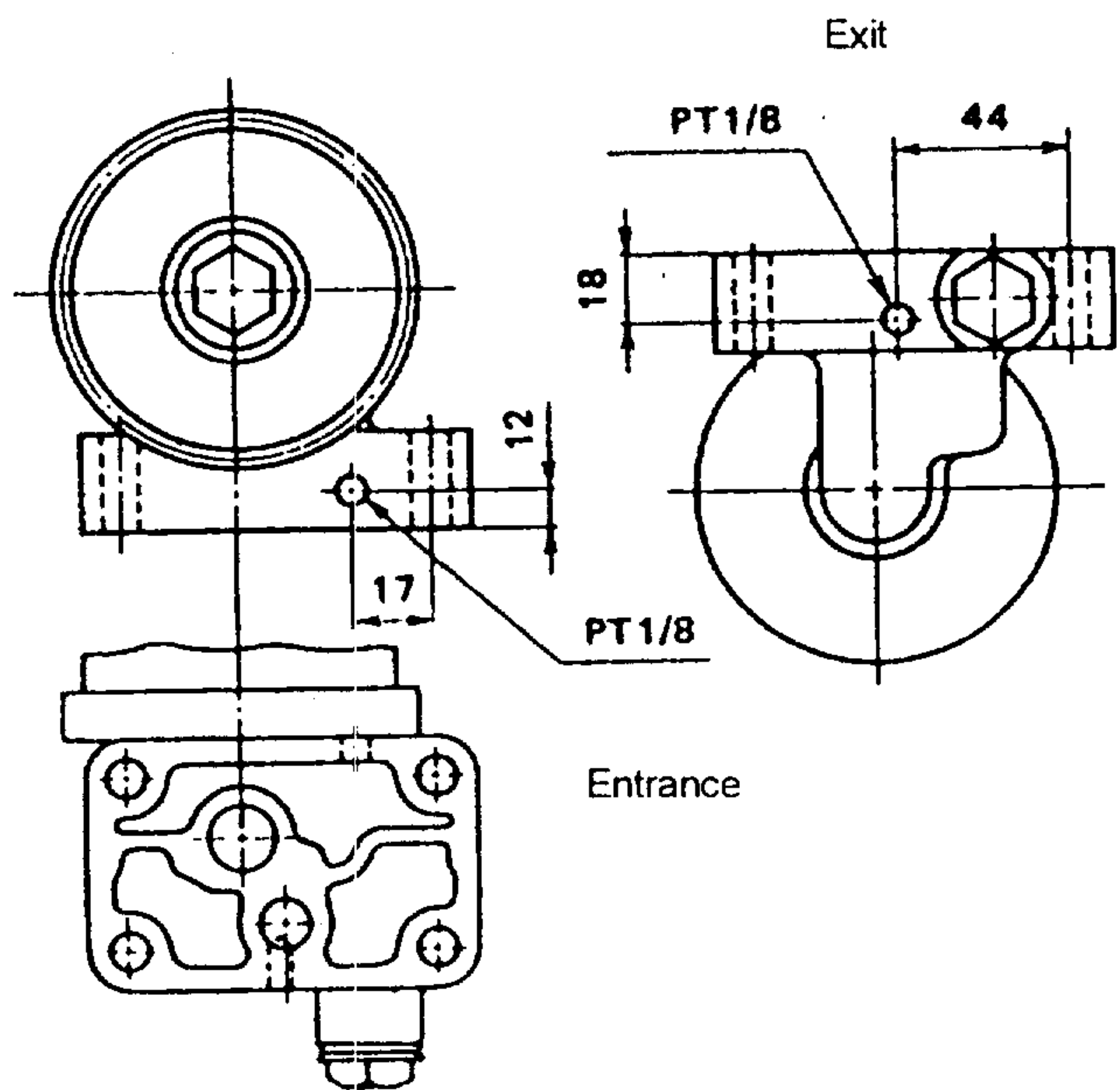


Figure 1. Hole to extract the oil pressure of the oil filter

4.2 Cooling device for oil pan

For the oil, design and attach an injector on the oil-temperature control device as shown in Figure 2.

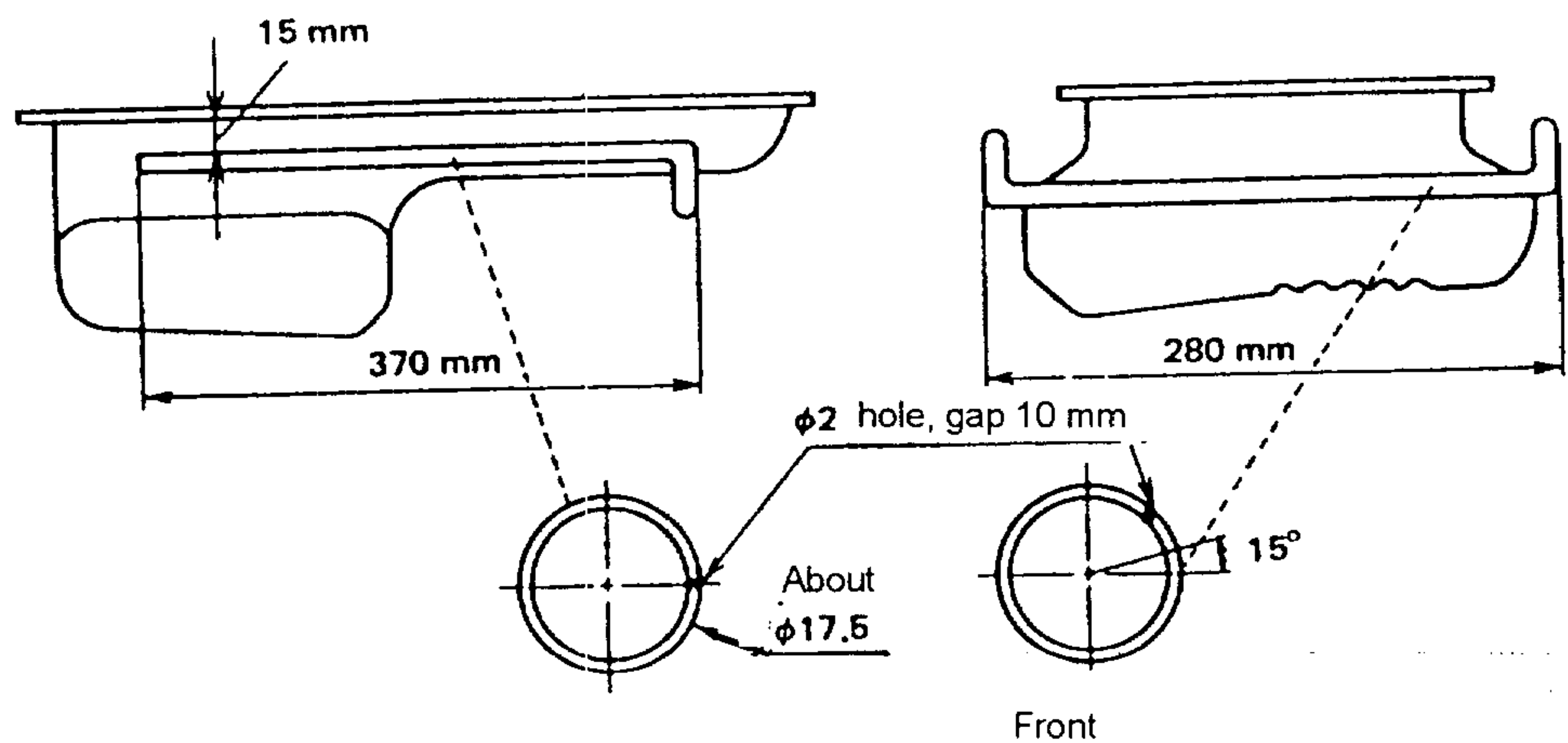


Figure 2. Oil-temperature control device for oil

4.3 Measuring and control devices

Use devices, which sufficiently satisfy test conditions in Table 9 and measurement items in 7.4, for the measuring and the control devices.

4.4 Locations to extract temperature and pressure

Locations to extract the temperature at the exit of the engine refrigerant, the oil temperature concerned with the oil and inside the oil pan, the temperature at an entrance of the fuel, the temperature of intake air, the temperature of the exhaustion, oil pressure of the engine and the exhaust pressure are shown in appendix.

5. Fuel

Use the one, which is specified in JIS K 2204 (Diesel oil) and is proper for performances in Table 1. However, the sulfur shall be within the range of Table 1.

Table 1.

Item		Performance value	Test method
Specific gravity 15 °C		0.830 ~ 0.845	JIS K 2249
Performance classification	Initial	160 ~ 210	JIS K 2254
	10 % point	200 ~ 250	
	50 % point	260 ~ 300	
	90 % point	300 ~ 350	
Mass of carbon residue in 10 % remaining oil %		0.1 ↓	JIS K 2270
Dynamic viscosity(30 °C) mm ² /S (cSt)		2.5 {2.5} ↑	JIS K 2283
Cetane index (Cetane number)		50 (50) ↑	JIS K 2204(2280)
Mass of sulfur %		0.4 ~ 0.5	JIS K 2541

Remark For sulfur adjustment, various things such as natural sulfur, additives (CBDS), etc. are used.

6. Standard Oil

- (1) When using the official engine for the first time or if required for other cases, principally perform the test with the latest standard oil and operate evaluation tests in 8 as arranged.
- (2) Use one kind in Table 2 for the standard oil. Write general performances of the standard oil in Table 3.

Table 2. Kinds of standard oil

Name	Contents	API standard (Reference)
DDI	Engine oil, which purity test result is satisfactory	Equivalent to CD grade

Table 3. General performances of standard oil (Average value)

Item		Standard oil	DDI
Specific gravity 15℃			0.895
Flash point 0℃			258
Dynamic viscosity (4) mm²/S {cSt}	40℃		91.4
	100℃		10.8
Viscosity index			101
Degree of fluidity ℃			- 20
Overall acid value KOH mg/g			2.2
Overall base value KOH mg/g	Hydrochloric acid method		10.3
	Perchloric acid method		12.1
Sulfuric lime Mass %			1.53

7. Testing Method

- 7.1 Preparation for test
- 7.1.1 Preparation for exchange parts

When starting the test, parts indicated in Table 4 are required to be new parts. In addition, exchange parts indicated in Table 5 if necessary.

Table 4. Exchanging parts (New parts)

Name of parts	Number
Cylinder liner	4 units
Sheets near exhaust and intake	4 units each
Exhaust, intake	4 units each
Piston and piston pin	4 sets
Piston ring set	1 set
Crank pin bearing	8 units
Main bearing set	1 set
Thrust watch (Up, Down)	2 sets
Tappet	8 units
Cam shaft	1 unit
Oil filter element	1 unit
Air cleaner element	1 unit
Fuel oil filter element	1 unit
Gasket kit	1 set
Fuel induction nozzle	4 units

Remark : Indicate parts number in Table 2.

Table 5.

Name of parts	Number
Crank shaft	1 units
Connecting load	4 units
Rockershaft assembly	1 set
Valve rocker	8 units
Oil pump assembly	1 unit
Cylinder block	1 unit
Cylinder head	1 unit
A type of cover	1 set
Oil pin	1 unit
A type of gear	1 unit

7.1.2 Measurement of cylinder liner

For the measurement of cylinder liner, insert the liner into the block and measure 4 points of the depths A ~ D by 2 directions indicated in Figure 3, down to the scale of 1 / 1000 mm.

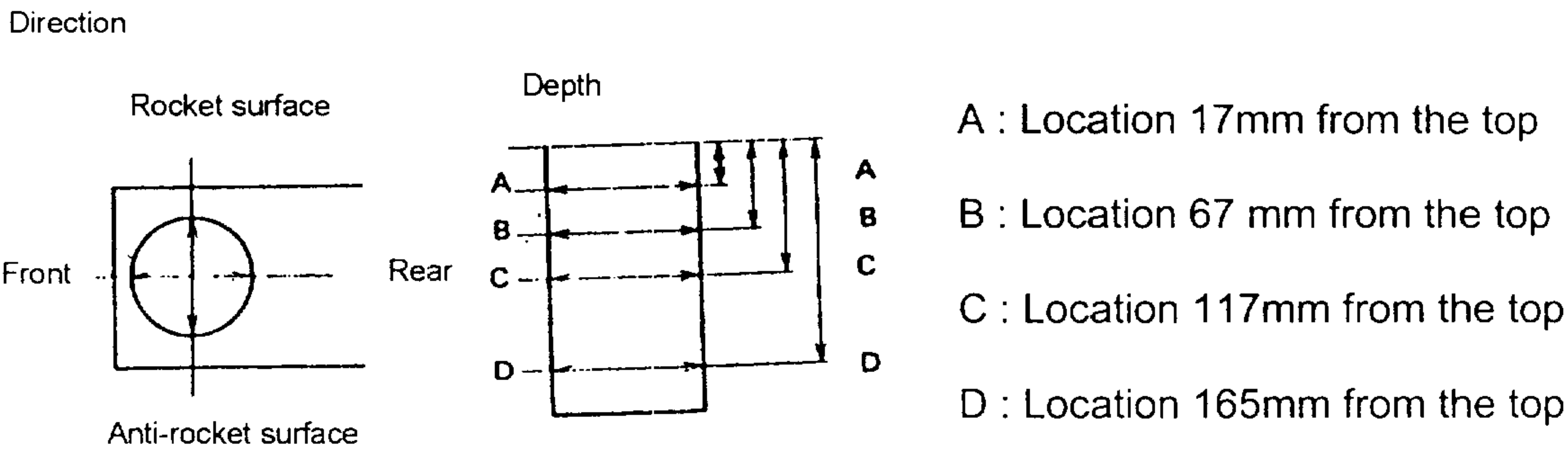


Figure 3. Locations of measurement for cylinder liner

7.1.3 Measurement of piston

Measure the outer diameter of the piston as shown in Figure 4, down to 1 / 1000mm.

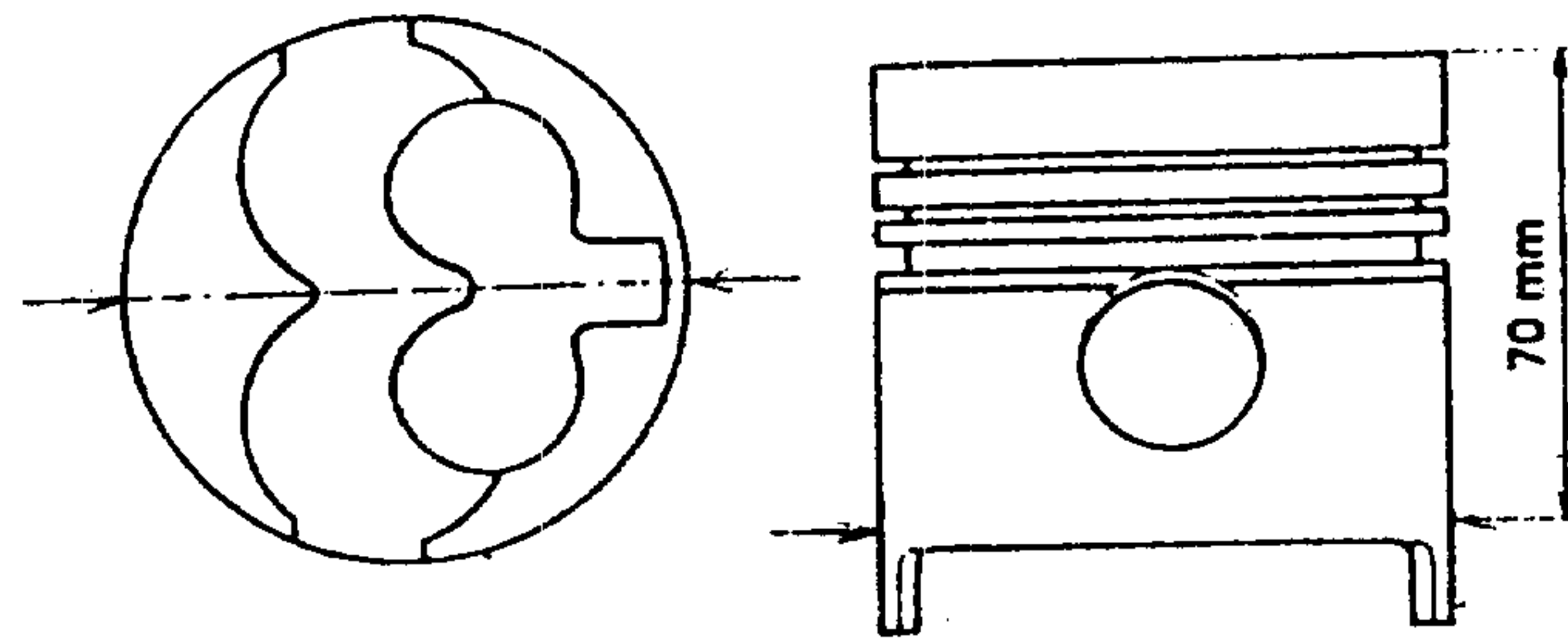


Figure 4. Location of measurement for piston

7.1.4 Measurement of piston ring

Measure the piston ring as following.

- (1) For the piston ring, measure a layer (T'') and thickness (B) at locations a, b and c as shown in 1 / 1000mm as shown in Figure 5.
- (2) After measuring a split gap(C) of the ring, clean with a solvent (Industrial gasoline, petroleum ether or solvent naphtha) and measure the weight down to 0.1 mg of scale. In addition, for the measurement of the split gap(C) of the ring, use the standard liner.

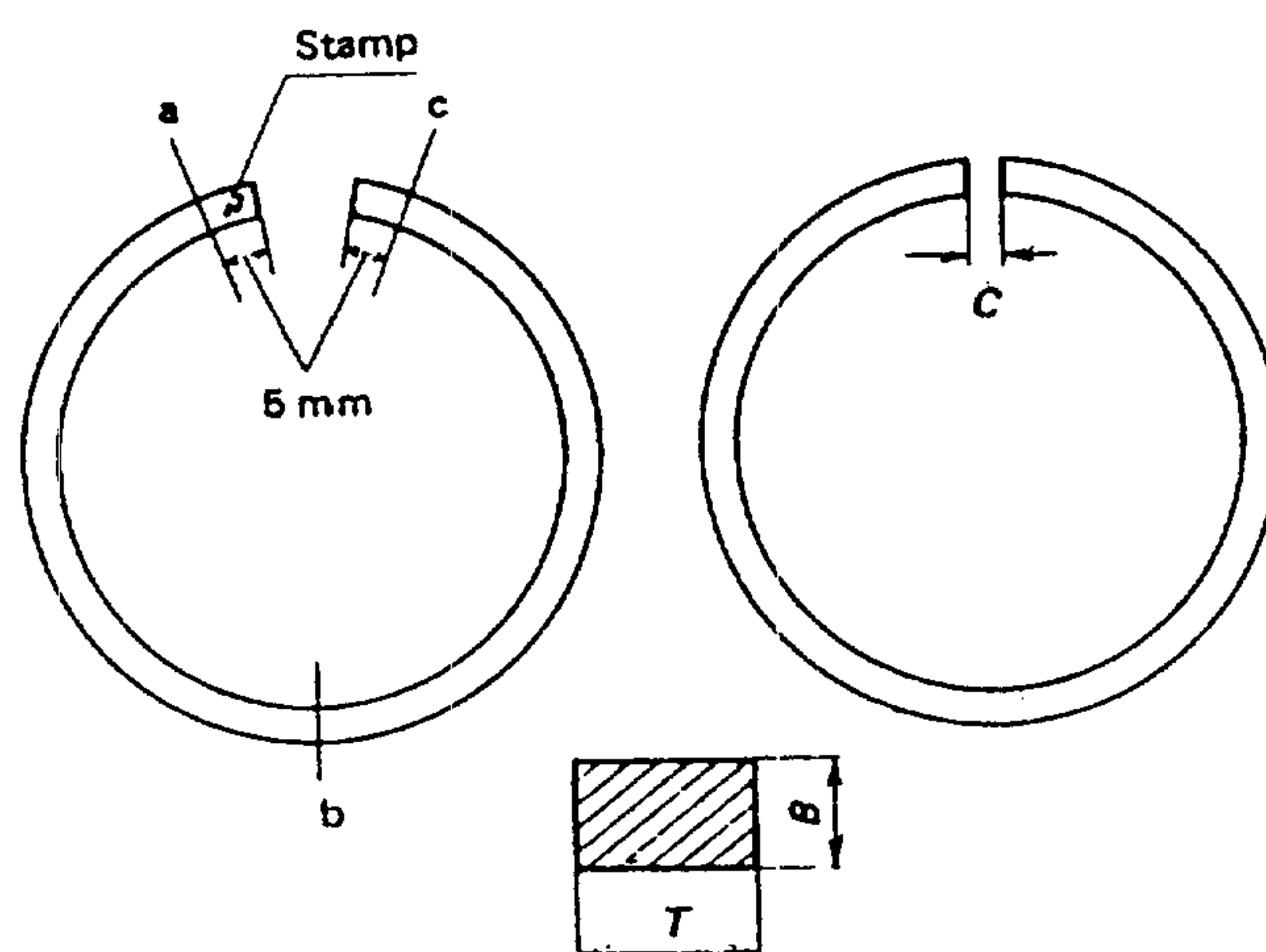


Figure 5. Location of measurement for piston ring

7.1.5 Measurement of bearing

Clean the main bearing and the crank pin bearing sufficiently with the solvent, dry them, and measure the weight to 0.1 mg of the scale.

7.1.6 Measurement of camshaft

For the measurement of the camshaft, measure locations A and B in Figure 6 to 1 / 1000mm of the scale.

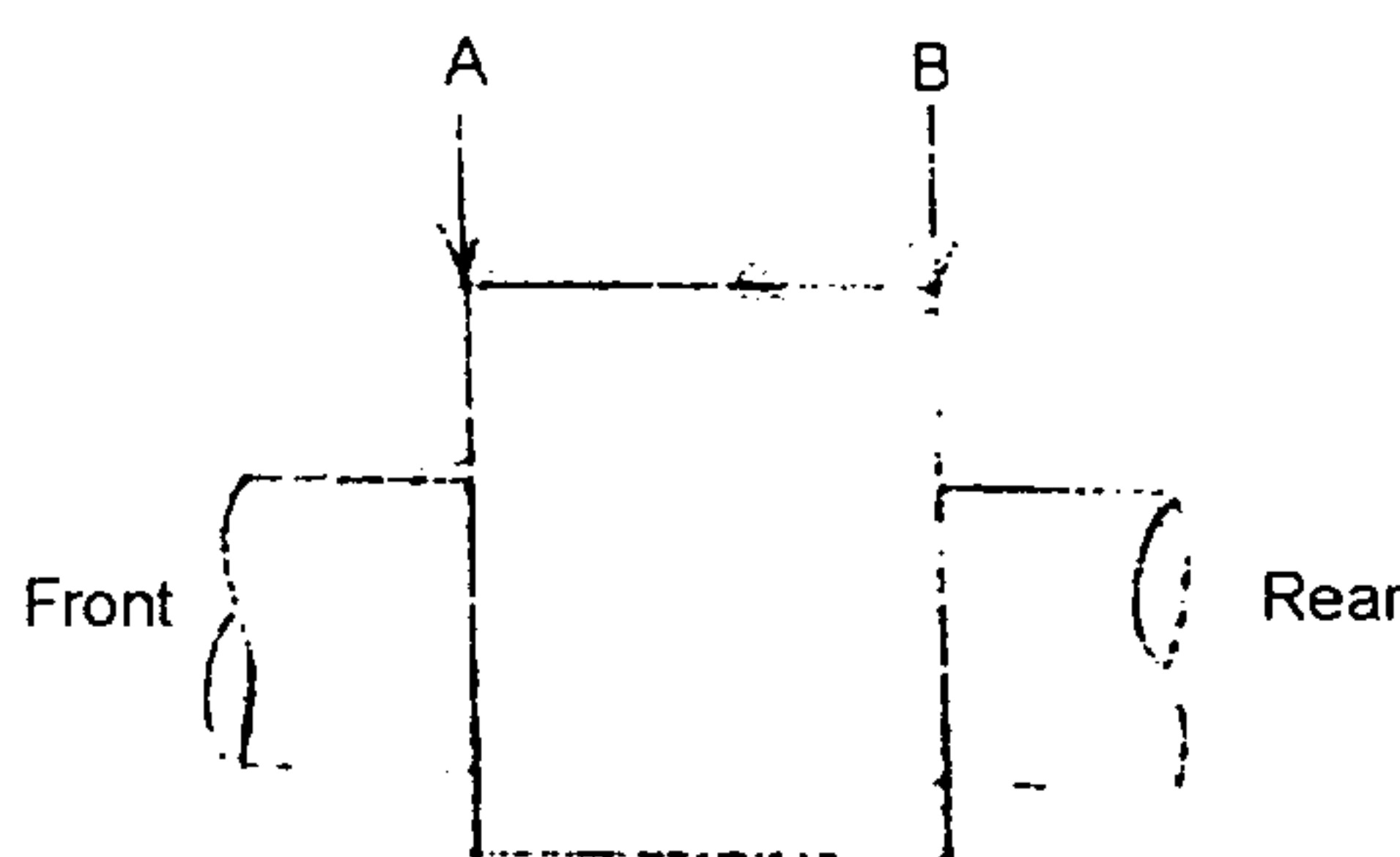


Figure 6. Measurement of cam shaft

7.1.7 Measurement of tappet

For the measurement of the tappet, clean the tappet sufficiently with the solvent, dry it enough, and measure the weight.

7.1.8 Measurement of change of pressure of open nozzle

For the measurement of the change of pressure of the open nozzle, attach the main to the tester and measure the measurement of the change of pressure of the open nozzle after applying the pressure.

7.1.9 Standard values of the cylinder liner, size of the piston and the change of pressure of the open nozzle are as following.

- (1) The differences of inner diameters of the depth, the epicenter, the top and the bottom of the cylinder liner shall be less than 0.04mm.
- (2) The gap between the piston and the cylinder liner shall be 0.065~0.090mm.

For the adjustment of the gap, use the grade to fit.

- (3) For the nozzle, use the one that opens and closes at 9.8 kg f / cm², and has an