

FOREWORD

This shop manual contains the specifications, construction, operation, adjustment and service procedures of the Model D6A diesel engine for service mechanics engaged in servicing of the Hyundai diesel engines.

Please make the most of this shop manual to perform correct servicing and wasteless operations.

Note that some of the contents of this shop manual are subject to change owing to improvements, etc. that may be introduced after publication of the shop manual.

HYUNDAI MOTOR COMPANY
COMMERCIAL ENGINE DEPT
Printed in Korea

HYUNDAI MOTOR COMPANY

COMPILATION OF THIS MANUAL

1. The contents of this shop manual are divided as shown below when edited.

Group No	Group Name	Contents
1	General	General description, outside view photograph and cross section view of engine, specifications, construction and operations
2	Service standards	Engine service standards, service standards table, tightening torque table, sealant and grease table
3	Special tools	Shapes and usages of special tools
4	Determining time to overhaul	Decision on time to overhaul, measurement of compression pressure, troubleshooting
5	Engine adjustment and break-in operation	Inspection and adjustment of valve clearance, inspection and adjustment of fuel injection start timing, engine speed adjustment
6	Removal and installation of auxiliaries	Removal and installation of auxiliaries such as injection pump, starter, alternator, injection pump drive
7	Engine proper	Disassembly, inspection and reassembly of engine proper, including cylinder head, valve mechanism, camshaft, piston, crankshaft, timing gear, flywheel, etc.
8	Inlet and exhaust	Disassembly, inspection and reassembly of air cleaner, turbo-charger, etc.
9	Lubrication	Disassembly inspection and reassembly of lubrication system, including oil pump, oil filter, oil cooler, etc.
10	Cooling	Disassembly, inspection and reassembly of cooling system, including water pump, thermostat, etc.
11	Fuel	Disassembly, inspection and reassembly of fuel system, including injection pump, injection nozzle, fuel filter, etc.
12	Electrical	Inspection of starter, starter relay, alternator, etc.
13	Other equipment	Disassembly, inspection and reassembly of infection pump drive.

2. How to read disassembly and reassembly drawings

- (a) The part names and numbers in the drawings correspond to those in the text. The parts are numbered in the order of disassembly.
- (b) The inspection items to be performed during disassembly operations are shown in the disassembly drawings.
- (c) All tightening torque specifications in the reassembly drawings may be considered "dry" unless "wet" is specified.

3. Definition of terms

(a) Nominal Value(Abbr. : NV)

Shows dimension of single part, mutual clearance between parts or standard performance. Values, however, are rounded off within limits necessary for inspection.

(b) Repair Limit(Abbr. : RL)

Shows that when specified value is reached, repair is necessary, Repair means adjustment, grinding, replacement of bushings, metals and the like, selection of oversize, selection of shim thickness, etc.

(c) Service Limit(Abbr. : SL)

Shows that when specified value is reached, replacement of the parts with new one is necessary.

(d) Basic Diameter(Abbr : BD)

Shows nominal diameter of part to be measured.

4. Unit

The SI unit(International System of Units) is used. Metric notation is jointly shown in parentheses.

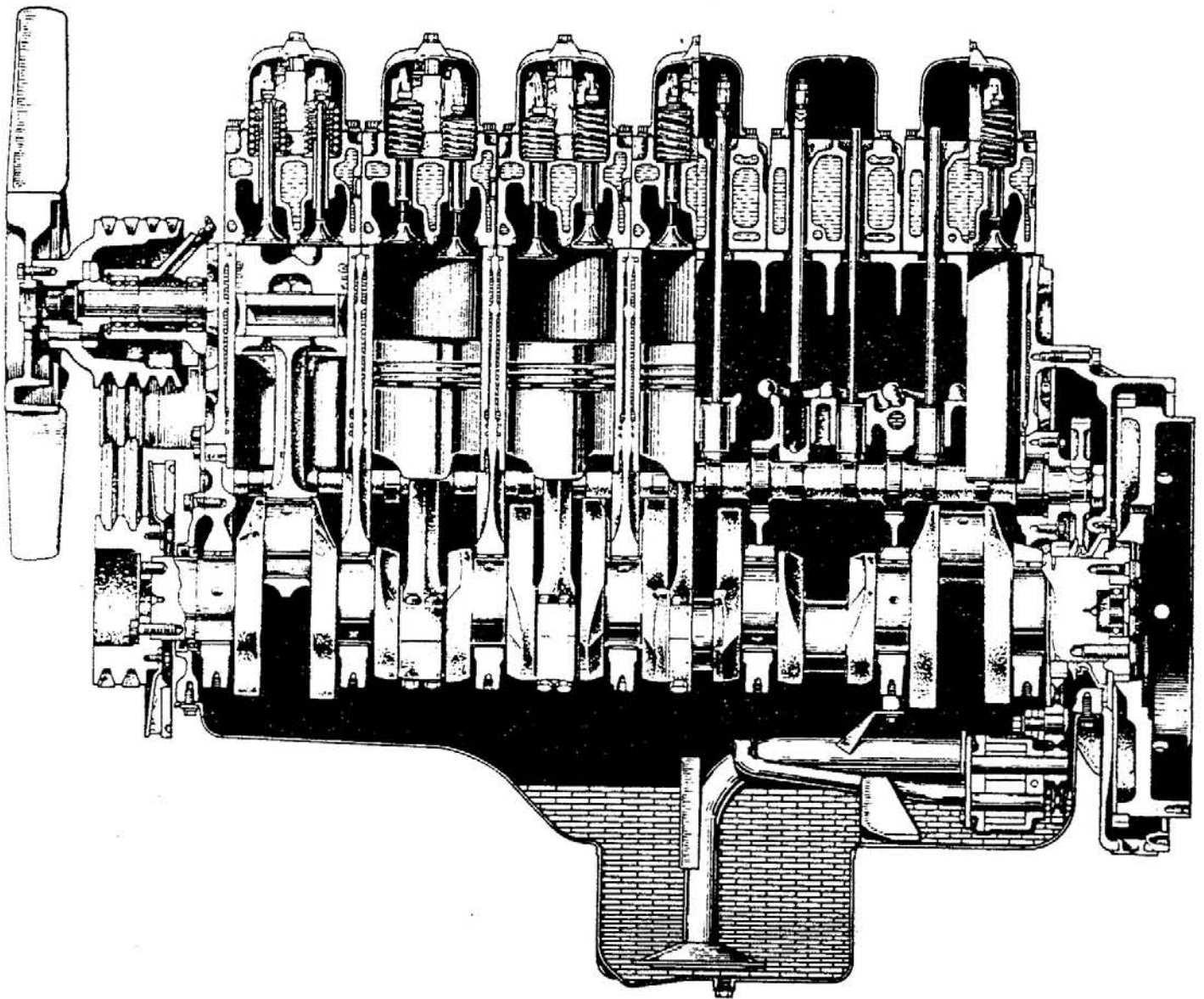
5. Table of Conversion Rate for Foot–pound Units into SI Units

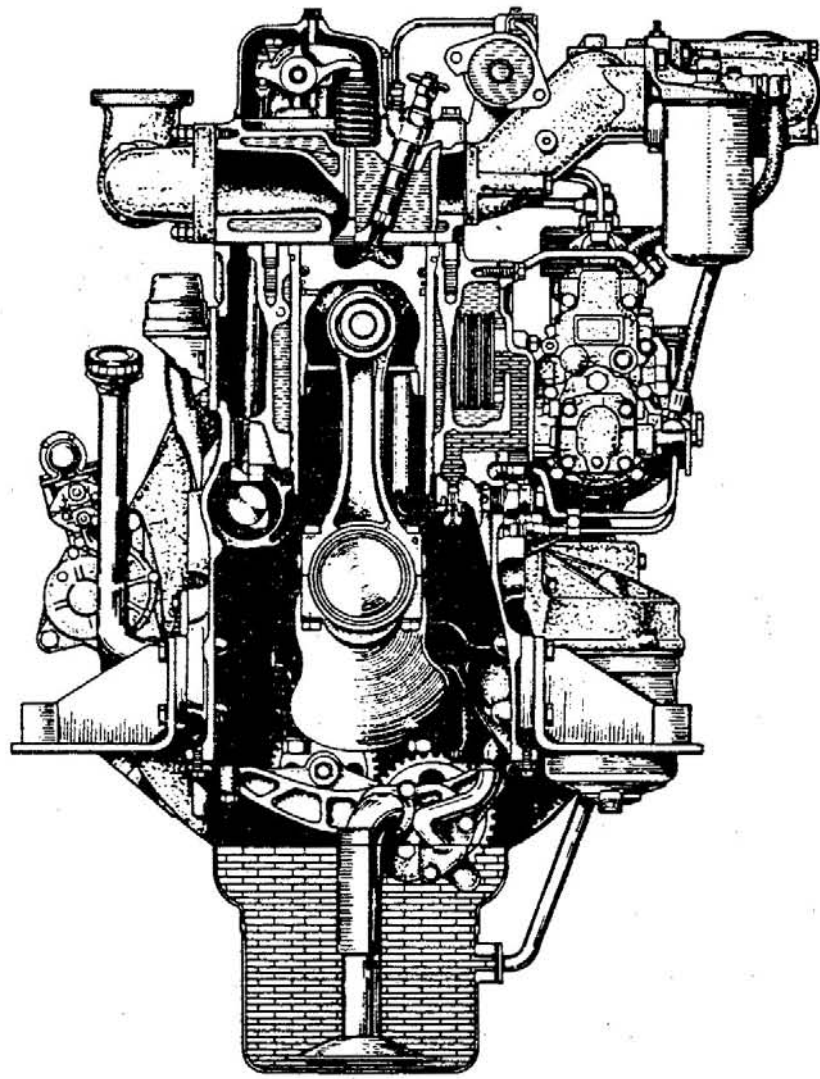
Unit	Sign of SI unit	Sign of foot–pound unit	Conversion rate
Mass quantity of matter	kg	lb	1kg=2.2046 lb
	g	oz	1g=0.035274 oz
Dimension	m	ft.	1m=3.2808 ft.
	mm	in.	1mm=0.03937 in.
Capacity	lit.	gal.	1 lit.=0.2642 gal.(U.S.) 0.220 gal.(Imp.)
	cc	oz	1 cc=0.033814 oz(U.S.) 0.035195 oz(Imp.)
Force	N(Newton)	lbf	1 N=0.2248 lbf
Pressure	kpa(Kilopascal)	lbf/in. ²	1 kpa=0.145 lbf/in. ²
			1 kpa=0.2953 in. Hg
Stress	N/cm ²	lbf/in. ²	1 N/cm ² =1.45 lbf/in. ²
Moment of force	N/m	ft.lbf	1 N/m=0.7375 ft.lbf
Output	kw(kilowatt)	HP	1 kw=1.34 HP
Temperature	°C	°F	t °C=(1.8t °C + 32)°F

1-1 GENERAL DESCRIPTION

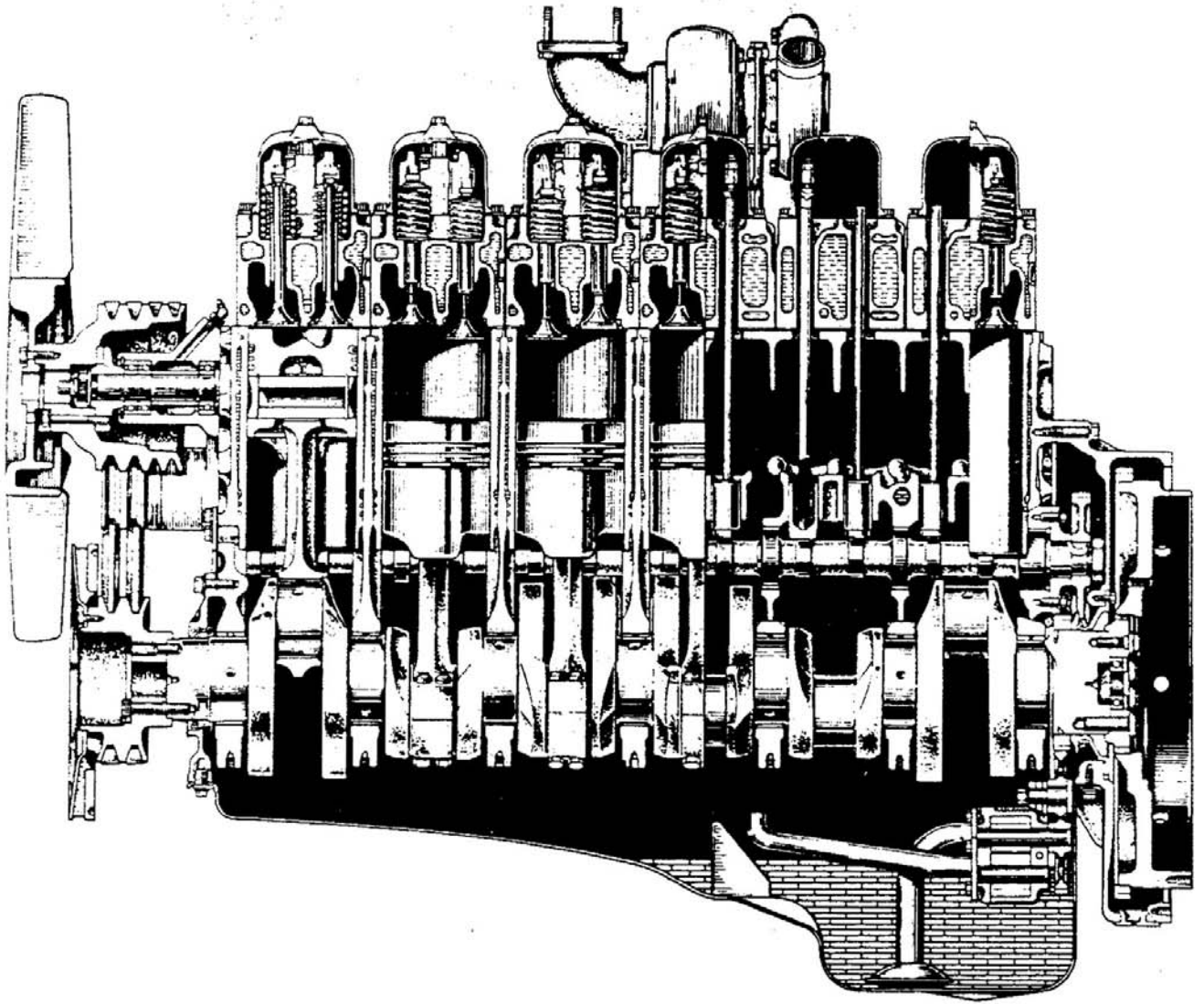
1-1-1 Engine Section Views

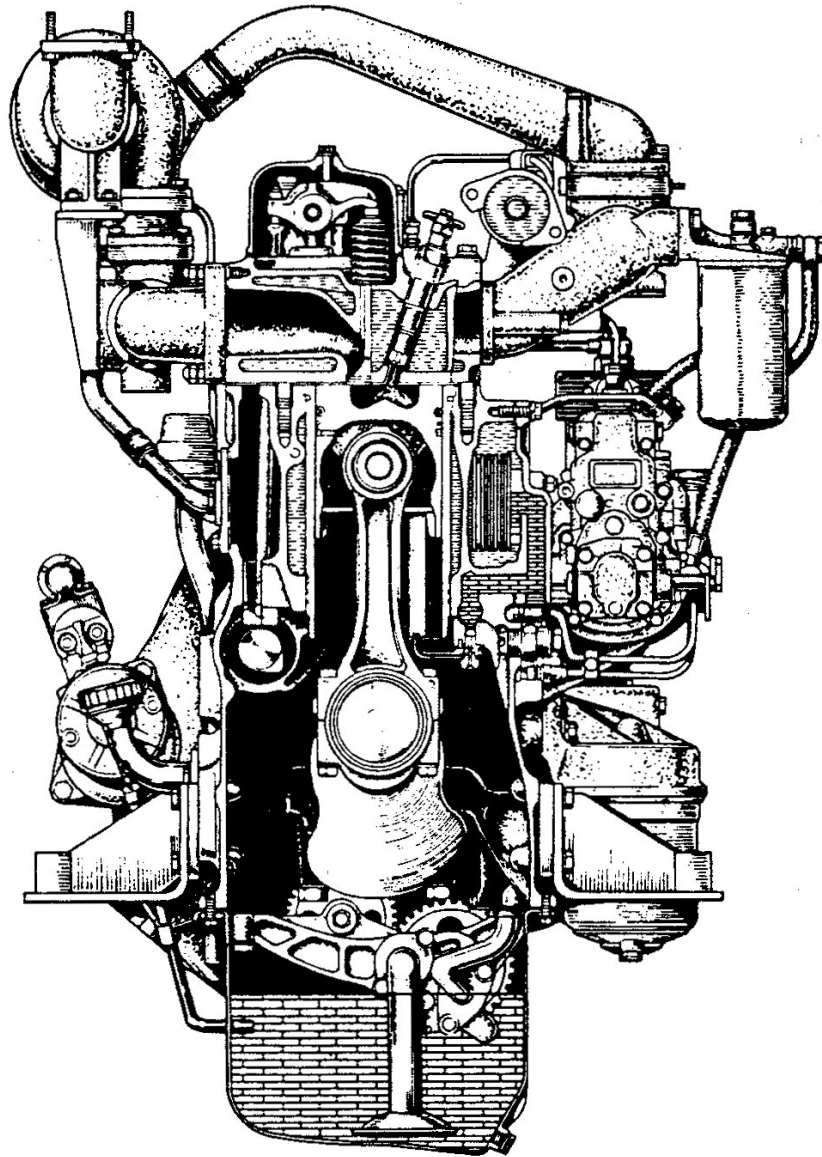
(1) D6AU





(2) D6AZ





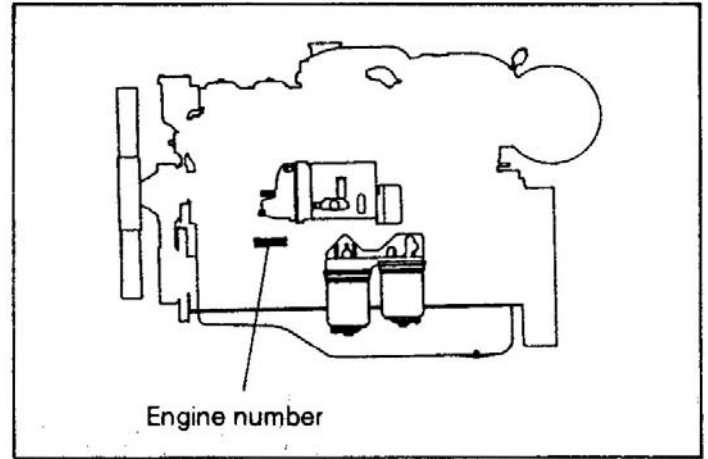
1-1-3 Engine Number, Nameplate

(1) Engine Number

The engine number is stamped on the left side of the crankcase, near the front portion, as shown.

Ex : Model Production year Engine No.
 ↓ ↓ ↓
 D6AU W 123456

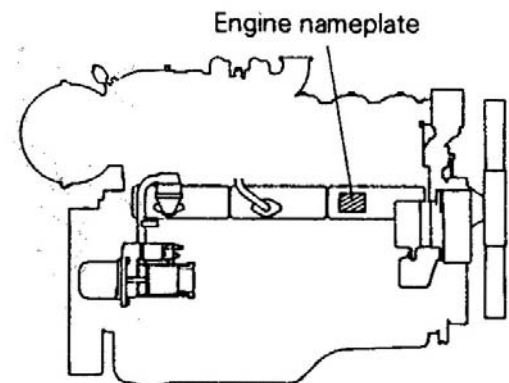
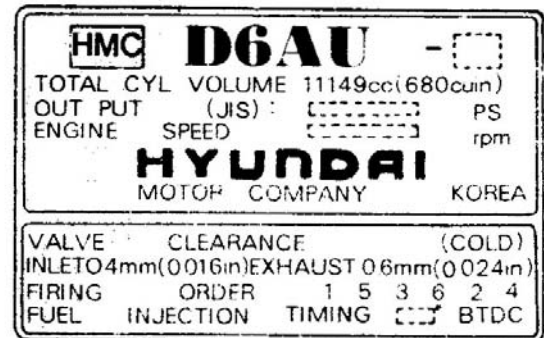
The engine number is important in knowing the history of the engine.



(2) Name plate

The nameplate is bonded to the side cover on the right side of the engine and shows the following.

- Engine Model
- Total Displacement
- Output
- Valve Clearance
- Firing Order
- Fuel Injection Timing



1-2 SPECIFICATIONS

1-2-1 Principal Specifications

Item		Specification		
Engine model		D6AU	D6AZ	D6AC
Type		Water cooled, 4-cycle diesel	Water cooled, 4-cycle diesel	←
Number of cylinders-arrangement		6-in-line	6-in-line	←
Valve mechanism		Overhead Valve	Overhead Valve	←
Combustion chamber		Direct injection type.	Direct injection type.	←
Cylinder bore × stroke	mm	130 × 140	130 × 140	←
Total displacement	cc	11149	11149	←
Compression ratio		17	16	16.5
Firing order		1-5-3-6-2-4	1-5-3-6-2-4	←
Engine dimensions				
Overall length		1612	1607	1289.6
Overall width	mm	924	907	847.5
Overall height	mm	1248	1392	1018
Weight	kg	930	970	970

1-2-2 Specifications of Each Device

Engine proper

Item		Specifications
Cylinder liner	Type	Wet type
Piston	Type	Trunk-shaped, slipper skirt type
Piston rings	Q'ty	Two compression rings One oil ring

Inlet and Exhaust

Item		Specifications
Air cleaner		
Element	Type	Cyclone filter paper type
Turbocharger		D6AZ
	Type	Turbocharger
	Model	Mitsubishi Schwitzer 3LM

Lubrication

Item		Specification			
Engine oil	Quality	[D6AU] API classification "FOR SERVICE CC" or better		[D6AZ(AC)] API classification "FOR SERVICE CD" or better	
		For gen- erators	For con- struction machinery	For gen- erators	For con- struction machinery
Oil pan oil quantity		Approx. 20 lit.	Approx. 23.3 lit.	Approx. 20 lit.	Approx. 23.3 lit.
Oil filter oil quantity		Approx. 3 lit.		Approx. 3 lit.	
Lubricationg system		Oil pump forced feed system Gear Pump forced feed system Ball valve type			
Oil pump	Type				
Relief valve	Type				
Oil filter		Filter paper type			
Full flow filter element type		Filter paper type			
By pass filter element type		Piston valve type with electric contacts			
Oil bypass alarm type		Shell and plate type(multi-plate type)			
Oil cooler	Type	Piston valve type			
Bypass valve	Type	Piston valve type			
Regulator valve	Type	Piston valve type			
Oil jet					
Check valve	Type	Piston valve type			

Cooling

Item	Specification
Cooling system	Water-cooled, forced circulation system
Cooling water quantity (Engine proper)	24 lit.
Water pump	Centrifugal type
Type	V-belt drive
Drive system	
V-belt	(With fan)
Type × quantity	Low edge cog Type B × 1 (for water pump)
	Low edge cog Type C × 2 (for fan drive)
	(Without fan)
	Low edge cog Type C × 1 (for water pump)
Thermostat	Wax pellet type bottom bypass system
Type	
Valve opening temperature × quantity	71°C × 2
Fan	Made of polypropylene, blow-off type
Type	

Fuel

Item	Specification		
	[D6AU]	[D6AZ]	[D6AC]
Injection pump proper			
Type	Boash Type AD	Boash Type P	←
Model	NP-PE6AD 105	NP-PE6P 120	←
Turing direction (as viewed from drive side)	Counter Clockwise	Counter Clockwise	←
Plunger			
Diameter	10.5mm	12mm	←
Governor			
Type	All speed governor	All speed governor	←
Model	RSV	Electric Gov.	←
Feed pump			
Model	NP-FP/KE22ACB	NP-FP/KE-PS	←
Automatic timer			
Type	Mechanical automatic timer	Mechanical automatic timer	←
Model	SA	SP	←
Injection nozzle			
Type	Hole type (1-spring nozzle)	Hole type (2-spring nozzle)	←
No. of orifices	5	5	←
Orifices diameter	0.33mm	0.34mm	←
Orifices angle	154°	150°	←
Injection pressure	220kgf/cm ²	220kgf/cm ²	←
Fuel filter			
type	Cartridge type		

Electrical

Item	Specifications
Voltage-Polarity	24V-(-) ground
Starter	
Type	Solenoid shift Type Reduction starter
Output	24V-5.5kW
Reduction mechanism	Single stage reduction by internal spur gear
Starter relay	
Model	M72S3006
Alternator	
Type	Alternator with built-in IC regulator
Output	24V-40A
Intake air heater	
Type	Electric heating type
Capacity	2.86kW
Heater relay	
Fuse capacity	127A

Automatic stop system (For generators)

Item	Specifications
Stop solenoid	
Type	Solenoid type
Oil pressure switch	
Type	Diaphragm type with built-in electric contacts
Water temp unit	
Type	Wax type with built-in electric contacts

1-3 CONSTRUCTION AND OPERATION

1-3-1 Engine Proper

(1) Combustion Chamber

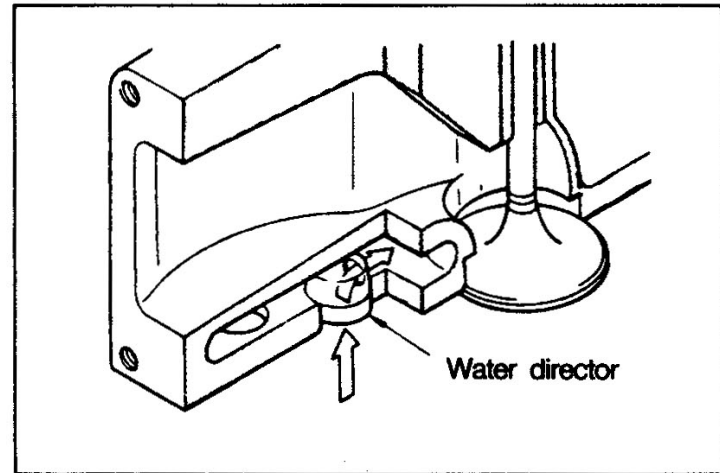
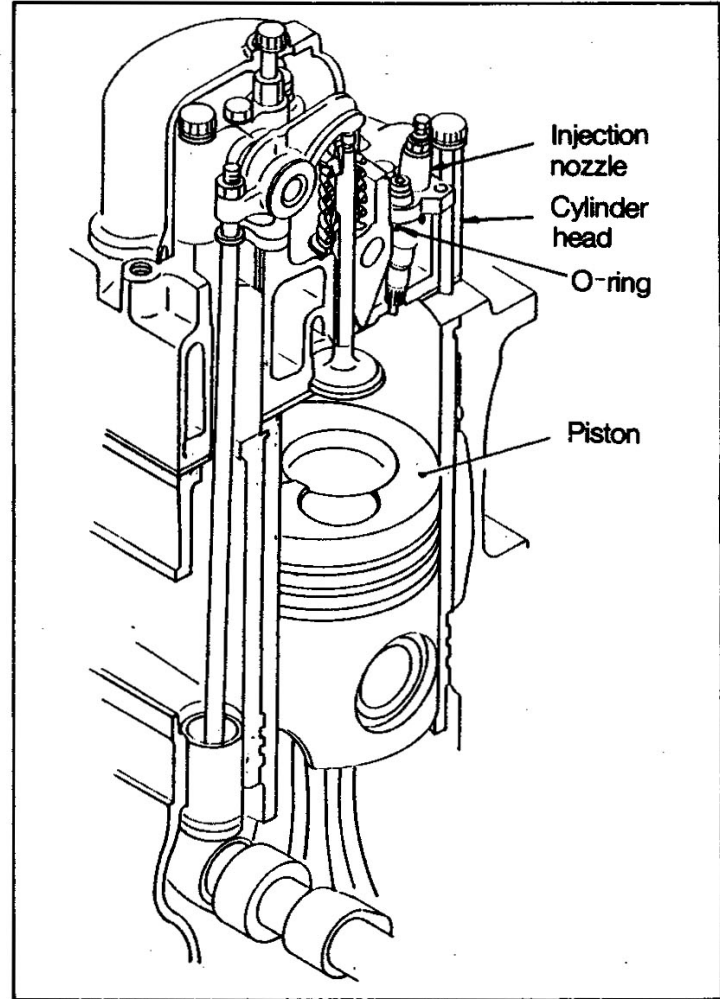
The combustion chamber is formed by the cylinder head and piston top.

The injection nozzle and nozzle tube are mounted to the cylinder head.

The nozzle tube not only holds the nozzle in position but also cools it. Since the outside of the nozzle tube is exposed to the water jacket, the top end of the tube is sealed with an O-ring and the bottom end staked to prevent water leakage.

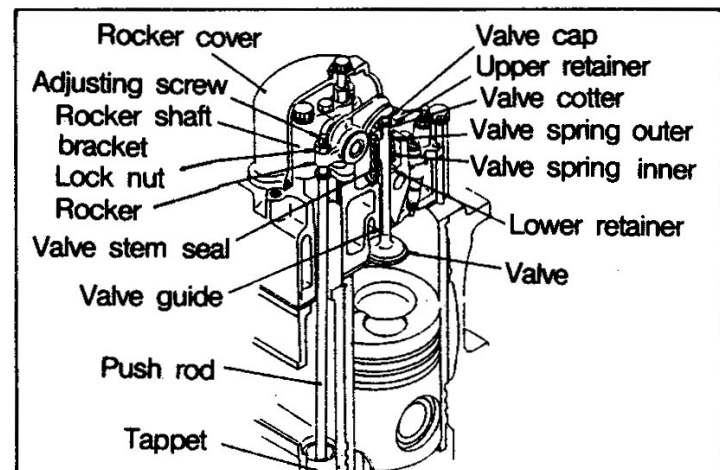
Fuel is directly injected into the combustion chamber where combustion takes place.

Water directors which direct the flow of coolant are installed at the bottom of the cylinder head to provide more effective cooling around the combustion chamber.



(2) Valve Mechanism

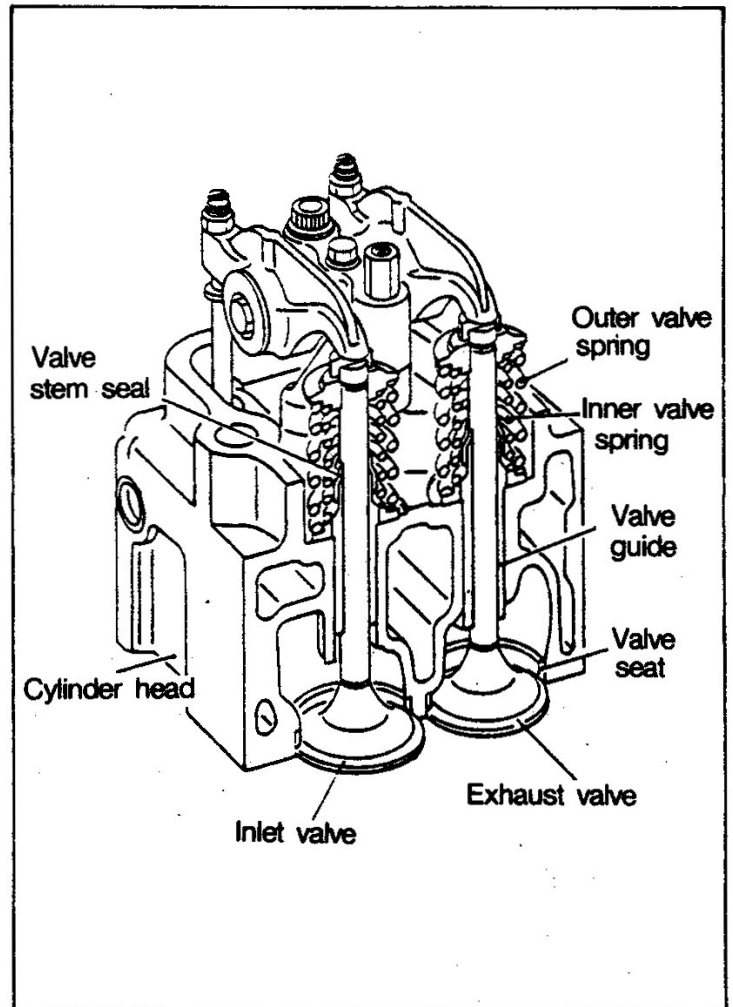
The valve mechanism is an overhead valve (OHV) type and is constructed as shown in illustration at right.



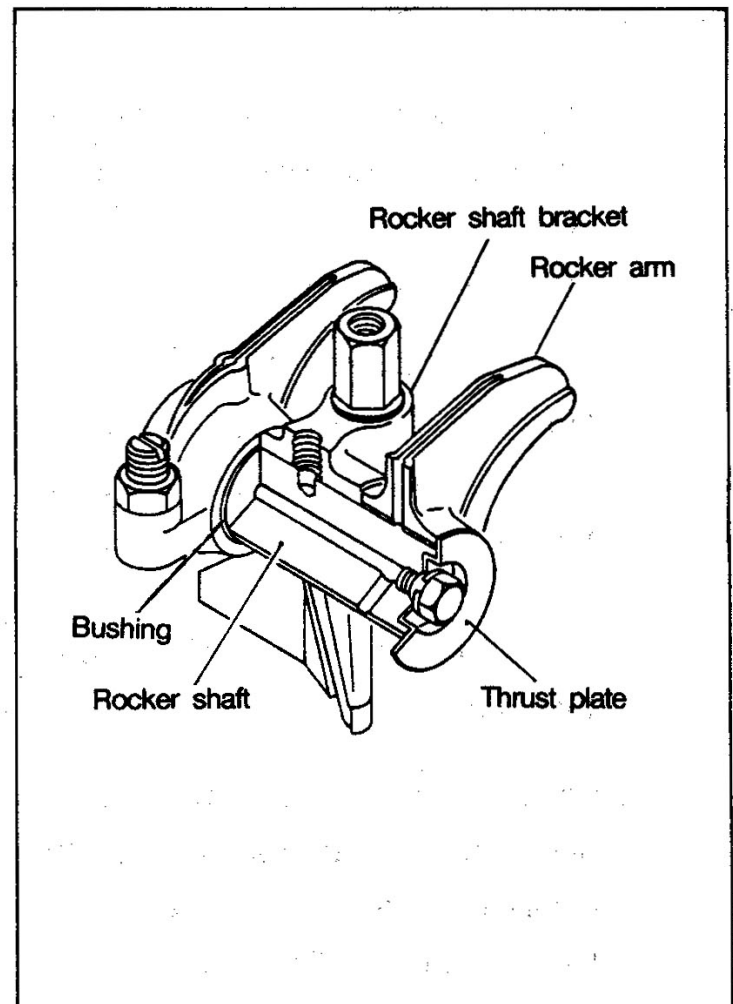
- (a) Both inlet and exhaust valves are made of surface-treated heat-resisting steel. The valve seat angle is 45° .

The valve stem has a valve stem seal which controls the quantity of lubricating oil on the sliding surfaces of valve and valve guide.

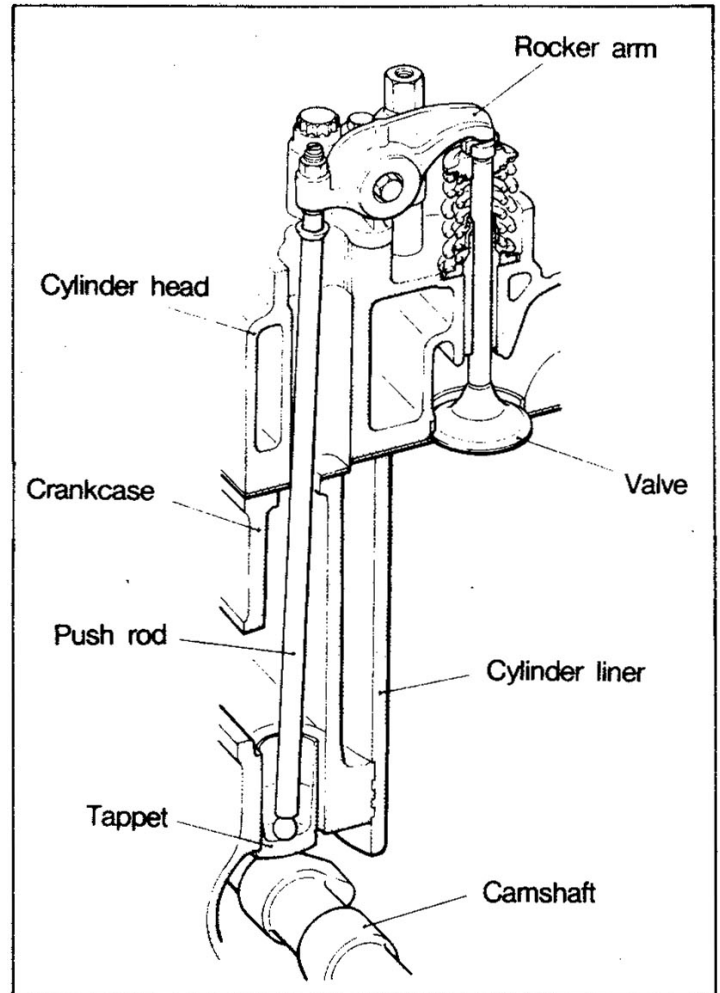
- (b) The valve springs are unequally pitched springs. Two springs, inner and outer, different in coiled direction are installed.



- (c) The rocker and rocker shaft are supported on the rocker shaft bracket and are independently installed for each cylinder. The inlet and exhaust rockers are common parts, and the end sliding portions are quenched. The rocker shaft is a hollow round rod sealed off by thrust plates at both ends. The hollow inside of the shaft constitutes an engine oil passage.

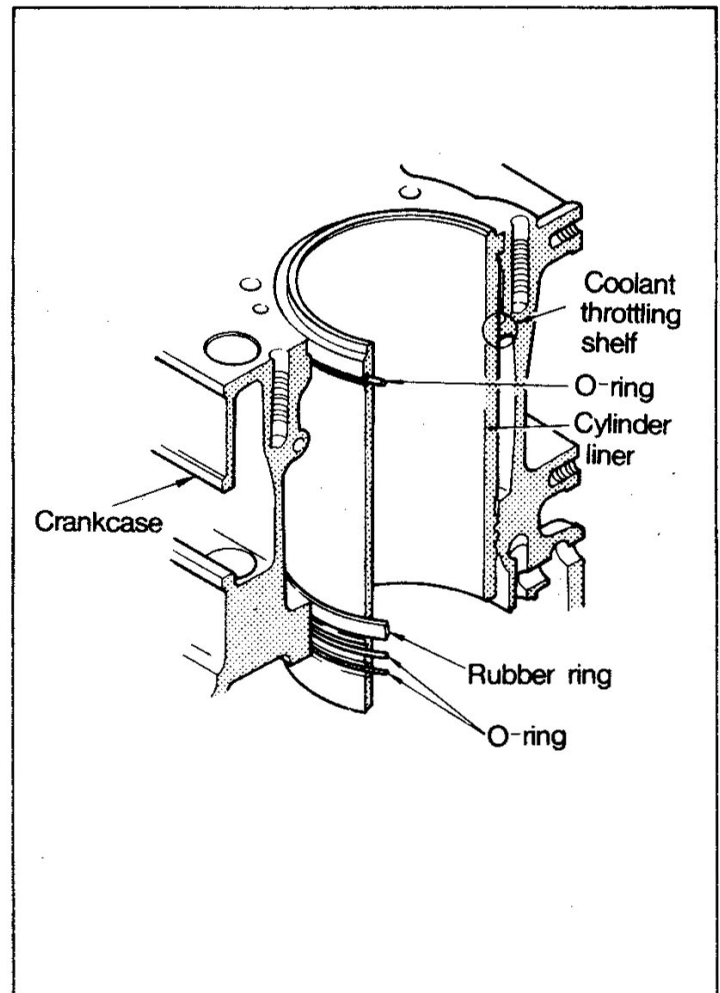


- (d) A steel ball is welded to the bottom end of the push rod and a spherical concave-shaped cup welded to the top end. Both ends are case-hardened.
- (e) The tappet is a cylindrical type, and the portion making contact with the camshaft has a spherical surface. The tappet is removable through the side of the crankcase.
- (f) The cam profile of the camshaft has a special curve. The surface is induction-hardened to improve the performance of the valve mechanism at high speeds and to improve wear resistance.



(3) Crankcase and Cylinder Liner

- (a) The crankcase is made of cast iron, has a high rigidity and is so constructed as to minimize stress concentration and deformation.
- (b) Seven camshaft bushings are installed in the camshaft bearing portions of the crankcase. To facilitate insertion and removal of the camshaft from the rear end of the case, the bearing I.D. is made smaller toward the front.
- (c) Coolant is forced in from the water pump at the left front end of the crankcase. after cooling the oil cooler, the coolant flows through the



water jacket holes to around all cylinders. After cooling the cylinders, the coolant reaches the cylinder head

(d) The cylinder liner is a removable wet type and is press-fitted in the crankcase at the top of the crankcase and at the bottom of the water jacket.

Rubber rings and O-rings are provided at the top and bottom of the cylinder liner to prevent entry of coolant. The water jacket has a throat for higher cooling performance.

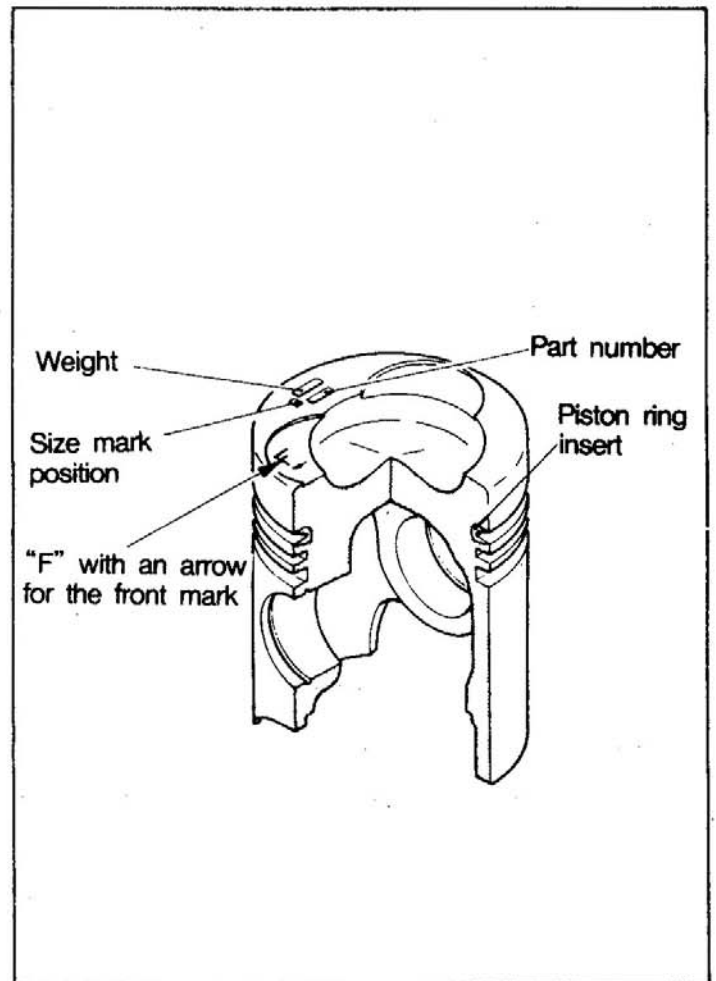
(4) Piston and Piston Ring

(a) Piston

The piston is an aluminum alloy casting. The one for the D6AU has a re-entrant type combustion chamber at the top, whereas the one for the D6AZ has a toroidal type combustion chamber.

A Niresist piston ring insert is cast into the 1st piston ring groove to increase durability.

A size classification mark(oversize dimension on oversize pistons) for selection fit with the cylinder liner, a piston weight and part No., and a front mark "F" and arrow indicating the piston installing direction are stamped on the top surface of the piston.

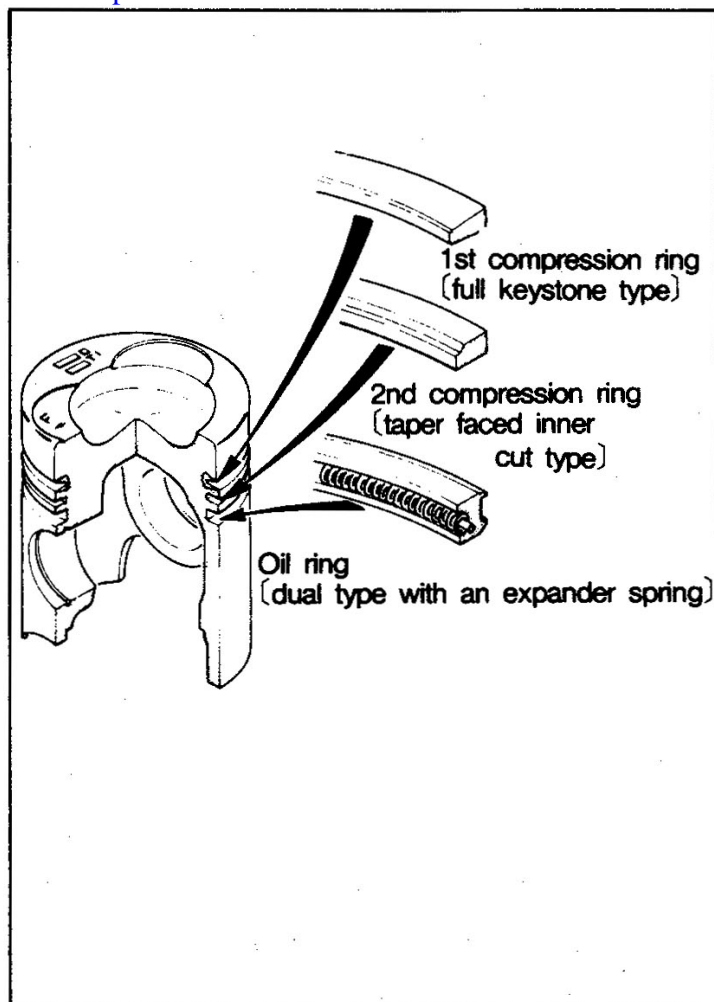


The piston pin is fitted in the piston and connecting rod in fullfloating style with the snap rings fitted at both ends of the piston pin to prevent the pin from slipping off.

(b) Piston ring

The piston rings are three in total ; two compression rings and one oil ring. The sliding surface of each ring is hard chrome plated to improve durability.

The piston rings are shaped as shown. The 1st compression ring is a barrel-faced full keystone type, the 2nd compression ring is a taper faced inner cut type, and the oil ring is a dual type with an expander spring.



(5) Connecting Rod and Connecting Rod Bearing

The connecting rod is I-section die forging and has a high rigidity. A lead bronze bushing is installed in the small end and a split type plain bearing used in the big end.

An oblique oil passage is provided in the stem portion for lubrication of the small end bushing.

The connecting rod and connecting rod cap are coupled by four bolts.

