

VALVES SYSTEM

There are usually two valves in each cylinder named as intake and exhaust valves. The valve system includes timing gear, camshaft, push rod, rocker arm and valves. The intake valve admits air or mixture into the combustion chamber and the exhaust valve permits burned gases to escape from the cylinder.

5.1 VALVE TIMING

Each valve opens and closes once during each cycle at specified times as indicated by a typical valve timing diagram (Figure 5.1). In case of petrol engine, the inlet valve usually opens with the piston at top dead centre and closes after bottom dead centre. On most diesel engines as shown in the figure, the inlet valve opens 13° before the piston is at top dead centre and closes 42° after bottom dead centre to allow more air to be packed in the cylinders. Both inlet and exhaust valves remain closed during the compression and most part of the power stroke. On the power stroke the exhaust valve opens considerably (50°) before bottom dead centre and closes a few degrees (12°) after top dead centre. Therefore, inlet valve remains open for about 235° and exhaust valve for about 242° during one cycle.

There are two common methods of placing valves in tractor engine. In one, called the valve-in-head or overhead or I-head arrangement, both the valves are located in the cylinder head directly above the cylinder (Fig. 5.2). In the other, called the L-head arrangement, both the valves are placed in the engine block at one side of the cylinder.

5.2 VALVE OPERATING COMPONENTS

5.2.1 Camshaft

Valves are operated by a camshaft, which takes its drive from crankshaft through a timing gear. The camshaft converts the rotary motion into linear motion with the help of a metal lobe called as cam. The nose or toe of the cam hits against the tappet and push rod. The camshaft, in addition to valve system also drives oil pump of lubrication system, fuel injection pump (in diesel engine) and rotor of current distributor (in petrol engine).

The camshaft of a 4-stroke diesel engine is driven by timing gear, which rotates at half the speed of crankshaft gear. Thus the camshaft gear has twice as many teeth as the crankshaft gear. These gears carry timing marks and must be opposite to each other in a correctly timed engine.

The camshaft of a two-stroke cycle diesel engine is driven at the same speed as the crankshaft. Therefore, the gears on the camshaft and crankshaft of a two-stroke engine are of the same size.

5.2.2 Valve Tappets

The lifting action of the cam is transmitted to the valve tappet, which is free to move in its guide. The tappet in turn, presses against the lower end of the valve stem or push rod depending upon type of valve arrangement i. e. L-head or I-head respectively.

5.2.3 Push Rod and Rocker Arm

Push rod and rocker arm are found in valve-in-head engines. The motion of tappet is transmitted to the push rod, which hits against one end of the rocker arm. The other end of the arm pushes down the valve stem and opens the valve. A screw for adjusting the valve clearance is located in the rocker arm. Valve clearance is the space between the rocker arm and push rod.

5.2.4 Valve

The valve consists of a flat head with a beveled edge called the head and the stem. The valve opening in the cylinder block or cylinder head has a similar beveled edge called the seat. A strong spring held in place by a retainer holds the valve face tightly against the seat and thus prevents leakage during compression and power strokes. The usual valve beveled face and the seat angle is 45° . However, a 30° angle is frequently used for intake valves.

Head of intake valve is mostly bigger than that of an exhaust valve in order to facilitate entrance of more fuel mixture into engine cylinder in a given time. This can be achieved either by increasing the area of the intake opening or by increasing pressure on the mixture by using turbocharger or supercharger.

5.2.5 Valve Seat Inserts

Normally the valve seat is a part of cylinder block or head, which is casted. Obviously, if a head steel valve is continuously hitting against a cast iron seat under high temperature conditions, there will be rapid wear, burning and corrosion of the seat. Hence most of the engines are now equipped with seat inserts. They are made of a special wear resistant steel alloy and are pressed into place. These inserts wear very little but can be replaced if necessary.

5.2.6 Valve Clearance

In case of overhead or I-head valve arrangement, it is the space allowed between the end of the valve stem and the rocker arm. In case of L-head system, it is the space between the end of the valve stem and the tappet. The valve clearance can be adjusted by using tappet-adjusting screw. The valve clearance is very crucial as it affects the opening and closing times of a valve. Too much clearance will decrease the duration, for which valve remains open, which allows less air or fuel mixture to enter into combustion chamber during suction stroke. While too-little clearance will keep the valve open for longer time than desired causing air to move out during compression stroke resulting into weak compression.