

MCE 451: Automobile Systems Design

1.0 ENGINE

An internal combustion engine is a part of a vehicle that generates the motive force that propels the vehicle by burning its fuel internally.

Reciprocating internal combustion engines is a type of internal combustion engines used as prime movers for most transport vehicles which ply on roads and power generating units used domestically. The combustion of its fuel takes place within the cylinder and the energy in the combustion chamber is transferred to the crankshaft of the engine via the piston and connecting rod. An internal combustion engine in which the energy from the combustion chamber is transferred to the crankshaft by the reciprocating motion of the piston is known as a reciprocating internal combustion engine.

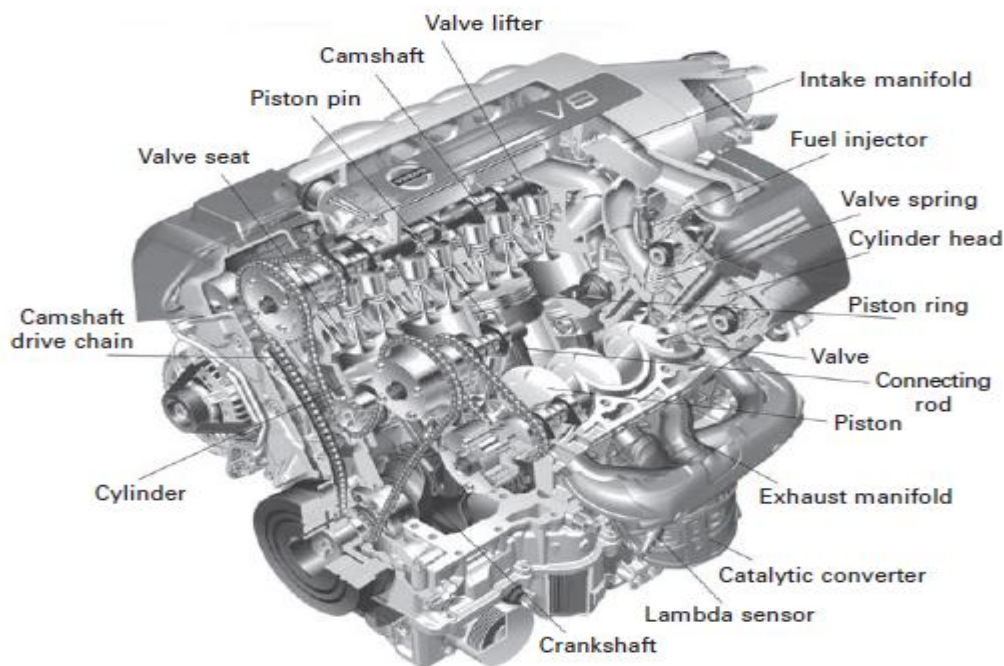


Figure 1.1: The Picture of the Cutaway of a four-stroke cycle petrol engine

Reciprocating internal combustion engines can be classified as two-stroke or four-stroke cycle depending on its cycle of operation and could also be broadly classified as a compression ignition (CI) or a spark ignition engine depending on the mode of combustion of the air-fuel mixture in the combustion chamber.

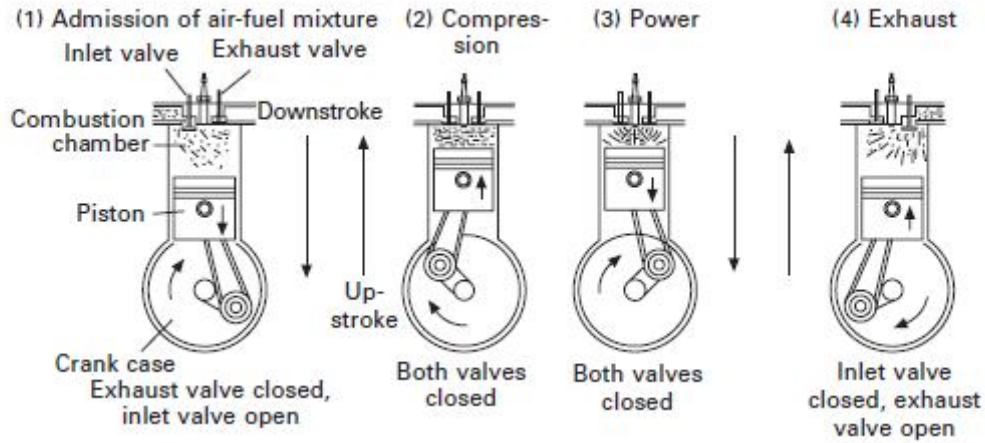


Figure 1.2: The Basic Operation of a Four-Stroke Cycle Engine

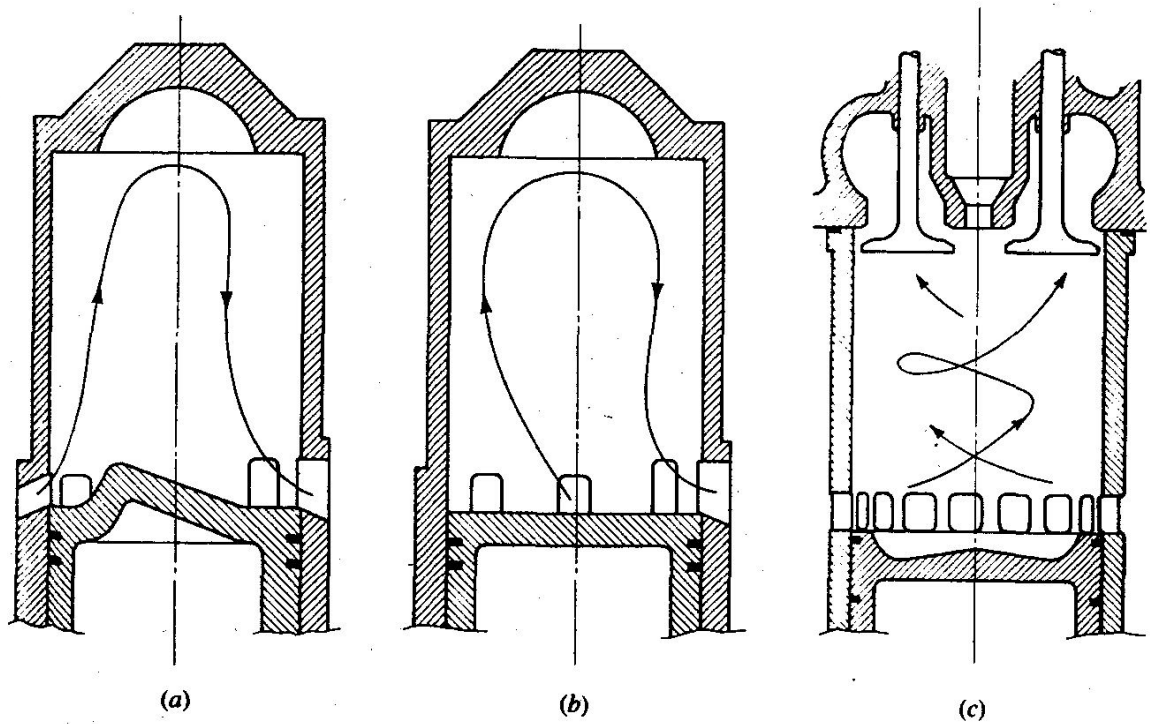


Figure 1.3: Two-stroke cycle engine configurations (a) cross-scavenged (b) loop-scavenged and (c) uniflow-scavenged.

Piston is the reciprocating component of a cylinder bore with the main purpose of transferring the force from the expanding combusting gases to the crankshaft through the connecting rod or con rod as it is also referred to. The piston and its piston rings, form the combustion chamber with the cylinder head, sealing and preventing the combusting/combusted gases from escaping into the crankcase. At ignition of the air-fuel mixture, the combusting gases expand exerting pressure on the piston crown which is

transferred to the rotating crankshaft through the piston pin and the connecting rod. In a two-stroke engine, the piston plays the role of a gas exchange control mechanism (valve).

1.1 MATERIALS FOR ENGINE PARTS

Table 1: Materials for Engine Parts

Part Name	Material
Cylinder block	Gray cast iron, compact graphite cast iron, cast Al alloy Al-Si-Cu-Mg alloy or cast iron with metals for better strength and wear resistance like Mo, Cr, Ni etc.
Piston	Gray cast iron, cast steel, spheroidized graphite cast iron, alloy cast iron, Aluminium alloy etc.
Piston ring	Spring steel and stainless steel, Chilled cast iron, Cr-Mo steel,
Camshaft	iron base sintered metal
Valve	Heat-resistive steel, Ti alloy, SiC ceramics
Valve seat	Iron base sintered metal, cast iron
Valve spring	Spring steel, music wire
Piston pin	Nodular cast iron, Si-Cr steel, stainless steel
Connecting rod	Carbon steel, iron base sintered metal, micro-alloyed steel, spheroidized graphite cast iron
Turbo charger	Niresist cast iron, cast stainless steel, superalloy
Exhaust manifold	High-Si cast iron, niresist cast iron, cast stainless steel, stainless steel tube and sheet
Plain bearing	Al-Si-Sn and Cu-Pb alloys
Catalyst	Pt-Pd-Rh alloy