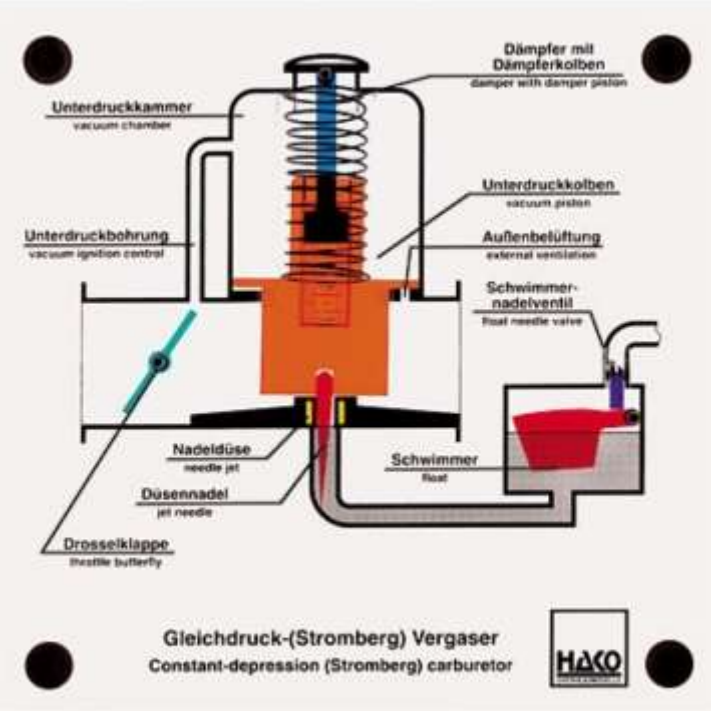
# Constant vacuum carburettor



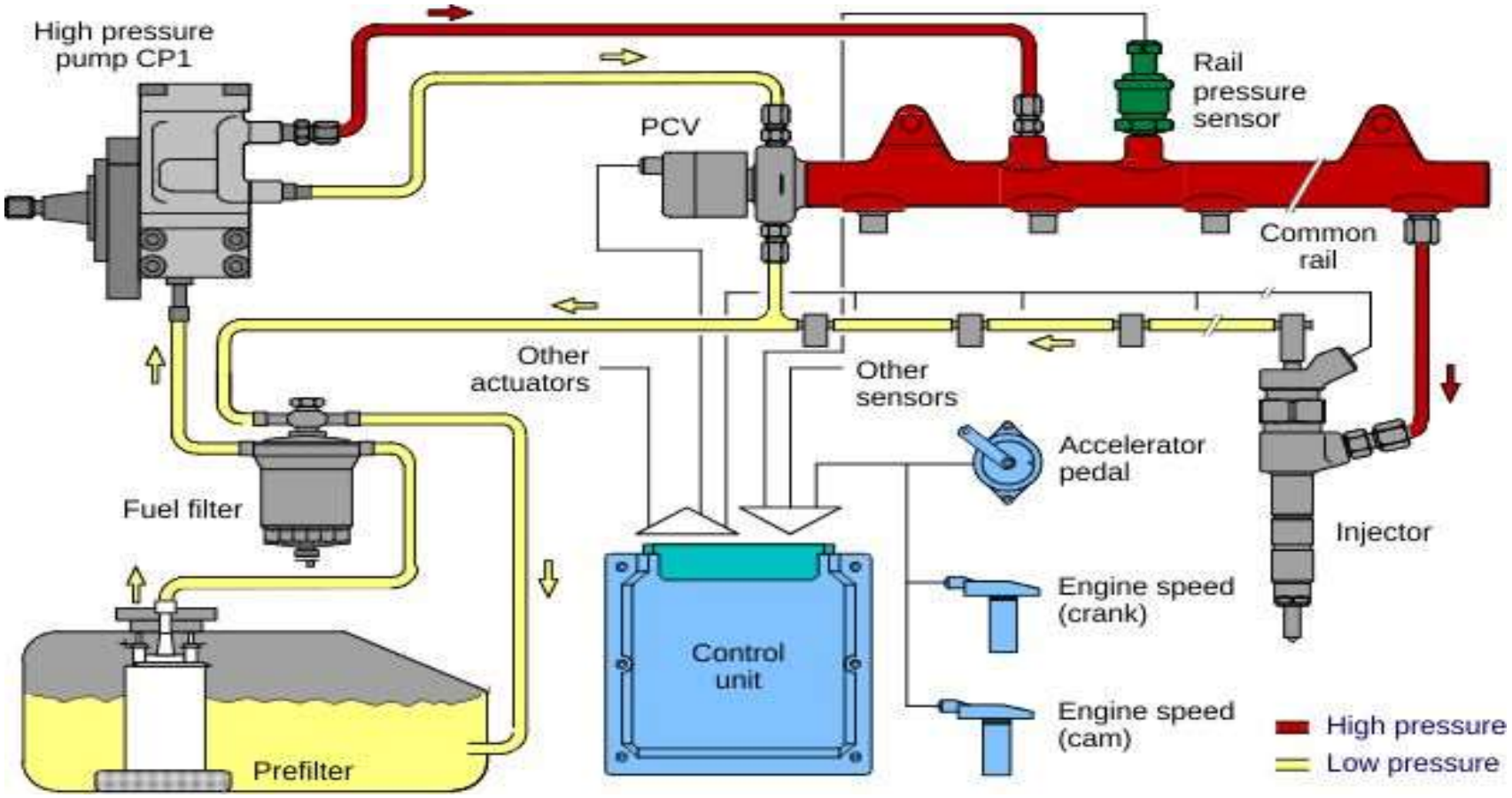
- A constant vacuum carburetor which is also called as a variable choke carburetor, is a carburetor where the areas of fuel and air flow are different according to the requirement of the engine.

- However, in the process, the maintained vacuum is always the same.

# Diesel fuel injection systems

- **There are four primary systems for injecting fuel:**
- Individual pump and injector for each cylinder.
- Combined pump and injector for each cylinder (unit injector type)
- One pump serving injectors for several cylinders (distributor type)
- Pumps in a common housing with injectors for each cylinder (common rail system)
-

# Diesel fuel injection system



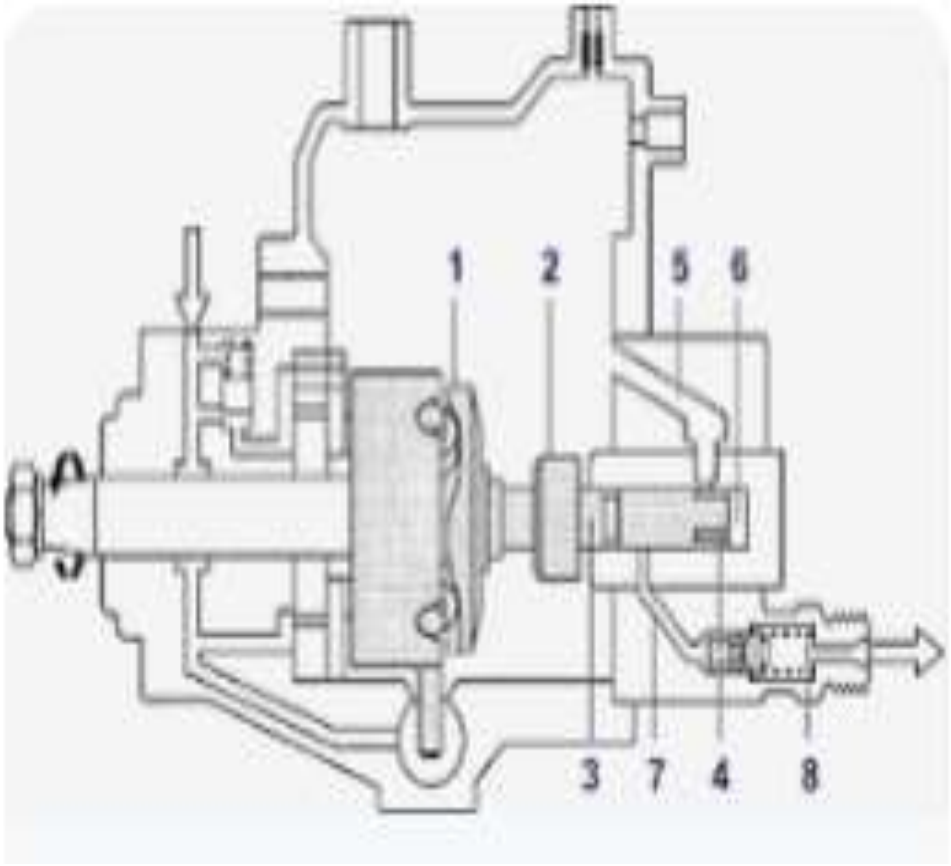
# Jerk pumps


Delivery Valve Spring
Delivery Valve
Inlet Port
Slot
Spill Port
Helix
Plunger
Rack
Barrel
Control Sleeve
Control Flange

- a fuel-injection pump in an oil engine which supplies impulsively an accurately metered charge to the nozzle at the time of the opening of the inlet valve

- The jerk type fuel pump works by drawing fuel from a feed line or fuel tank, then delivering it to the engine cylinders via the engine's fuel injectors.
- The pump is driven by the engine camshaft i.e. it is a cam driven pump, which is connected via gears or a chain to the engine crankshaft via the flywheel.

# Distributor pumps



- Distributor/Rotary Pump System. The distributor pump performs the same function as the in-line injection pump.

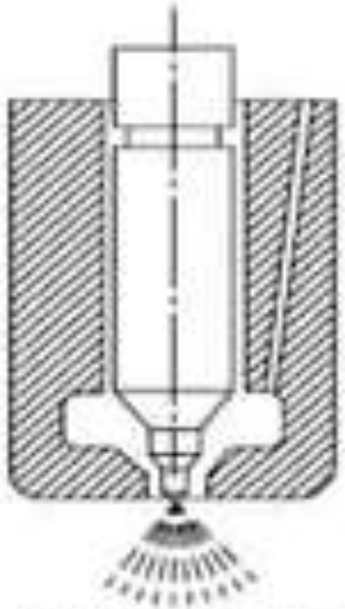
- It allows a precisely metered amount of fuel to be injected into the combustion chamber at the right time for efficient combustion.

# pintle and multihole nozzles

- The throttling pintle nozzle is commonly used in indirect-injected engines. One important characteristic of this type of nozzle is the pintle and its effect on the rate of fuel injection.
- It provides a spray operating at low injection pressures of 8-10MPa. The spray cone angle is generally 60 degree. The main advantage of this nozzle is that it avoids weak injection and dribbling. It prevents the carbon deposition on the nozzle hole.

# Pintle Nozzle

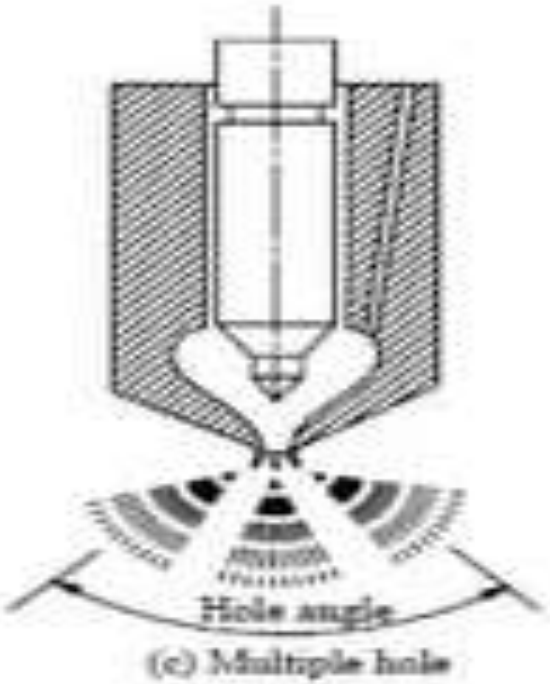
The pintle nozzle has been developed to avoid weak injection and dribbling. The spindle is provided with a pintle capable of protruding in and out. Pintle nozzle results in good atomization and reduced penetration.



(b) Pintle nozzle

# Multi-Hole Nozzle

A multi-hole nozzle, where the number of holes may vary from 4 to 18, allows a proper mixing of air and fuel. The advantage lies with the ability to distribute the fuel properly even with lower air motion within the chamber.



- A coolant is a substance, typically liquid, that is used to reduce or regulate the temperature of a system. An ideal coolant has high thermal capacity, low viscosity, is low-cost, non-toxic, chemically inert and neither causes nor promotes corrosion of the cooling system.

A good coolant will provide the following:

Good heat transfer.
Protection against deposits.
High-temperature protection.
Safe to use with hard waters.
Won’t damage and be neutral with internal components
Reduced foaming tendency.

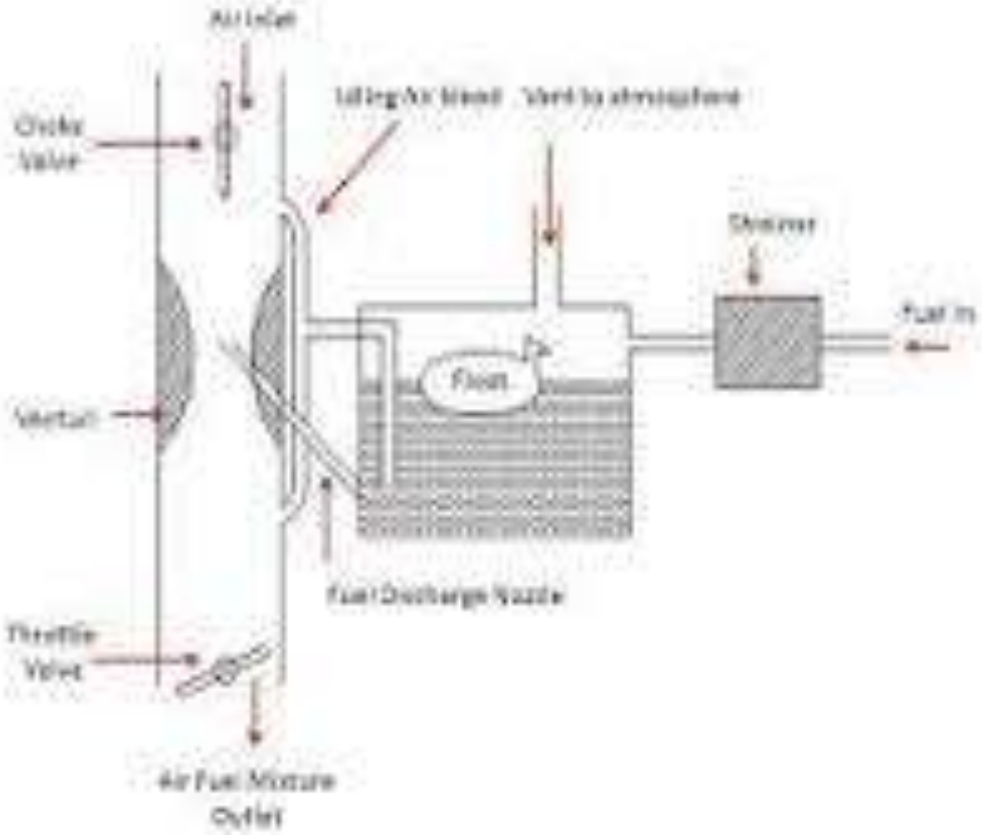
# Requirements of lubrication systems

- It should maintain the required oil film on the cylinder walls to prevent excessive wear of cylinder liners, pistons and rings.
- Reduce the frictional resistance of the engine to a minimum to ensure maximum mechanical efficiency.
- Protect the engine against wear.

- Ensure a uniform and continuous supply of lubricant with a little pressure to each lubrication point, the oil quantity is sufficient, and can be adjusted as needed.
- High working reliability.

# Mist lubrication system

- Mist lubrication system is a very simple type of lubrication. In this system, the small quantity of lubricating oil (usually 2 to 3%) is mixed with the fuel (preferably gasoline). The oil and fuel mixture is introduced through the carburetor.

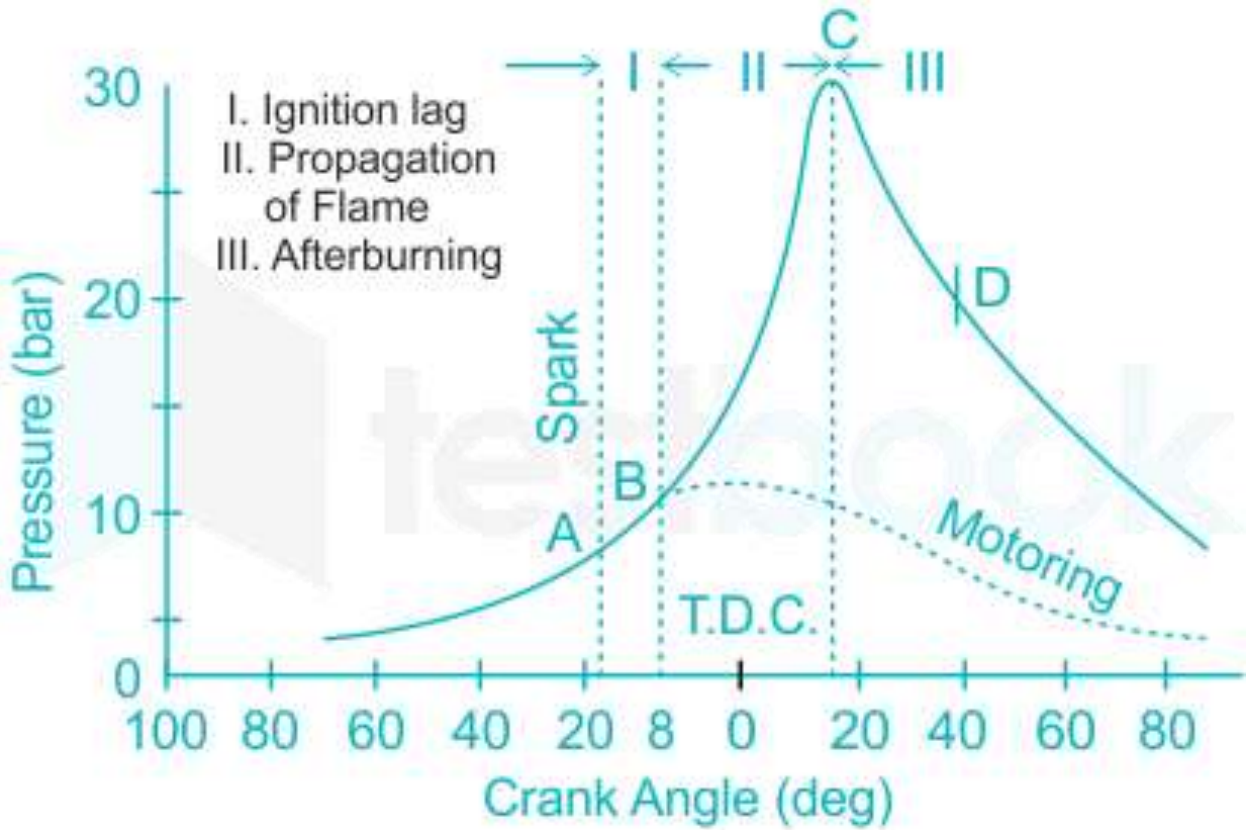

Air Inlet
Choke Valve
Idling Air bleed
Vent to atmosphere
Strainer
Fuel In
Float
Venturi
Fuel Discharge Nozzle
Throttle Valve
Air Fuel Mixture Outlet

# pressure feed  lubrication system

- Pressure lubrication (also known as injection lubrication) is a form of lubrication that uses one or more pumps to deliver oil to the lubrication points.
- The lubricant is distributed throughout the oil circuit.
- It is the most commonly used lubrication in engines.

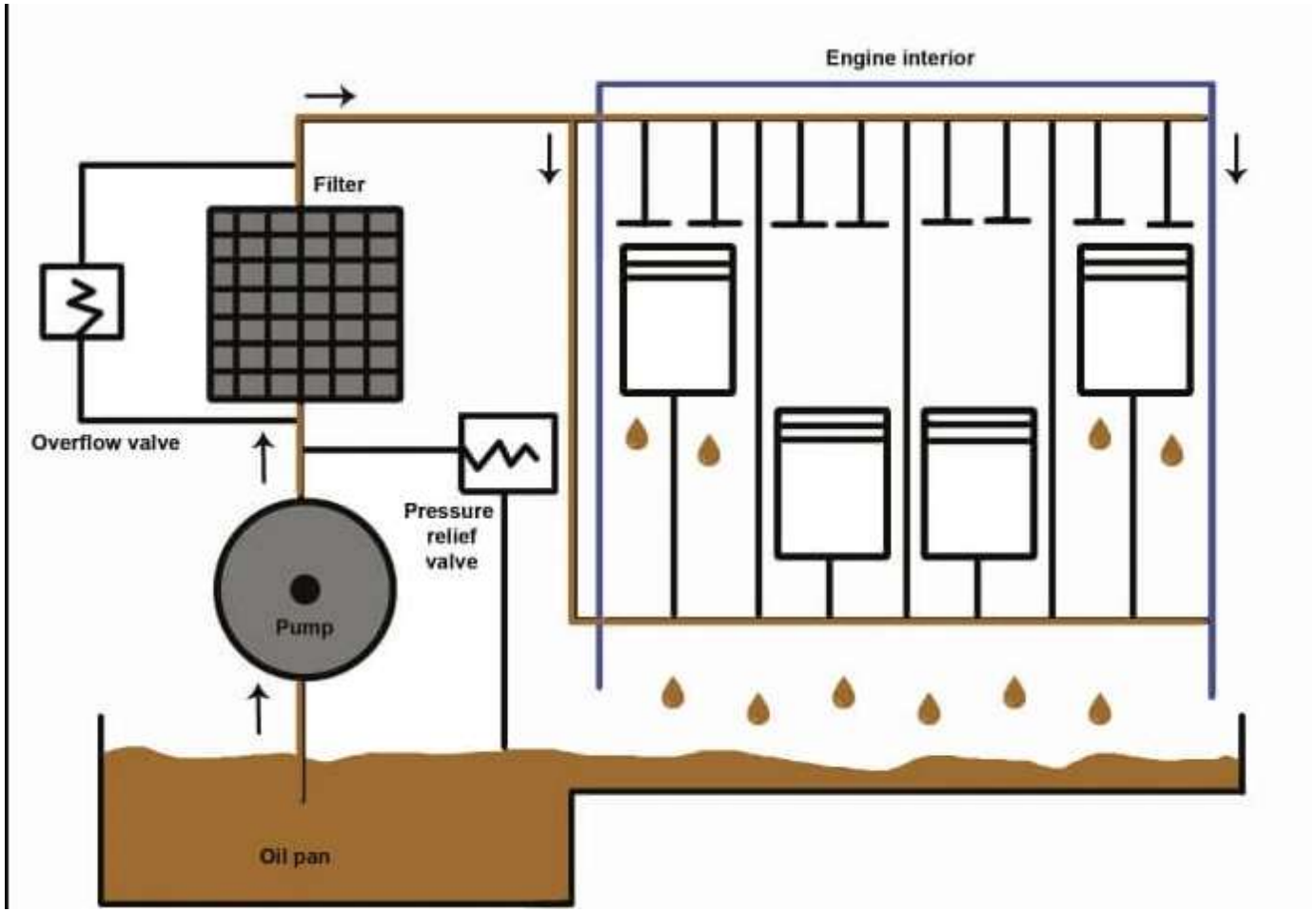
# stages of combustion in si engine

- This combustion process in an IC engine takes place in a homogeneous mixture or heterogeneous mixture based on the type of engine. Stages of combustion in SI engine: Ignition Lag. Flame Propagation.


I. Ignition lag
II. Propagation of Flame
III. Afterburning
I
II
III
C
D
B
A
Spark
Motoring
T.D.C.
Pressure (bar)
30
20
10
0
100 80 60 40 20 8 0 20 40 60 80
Crank Angle (deg)

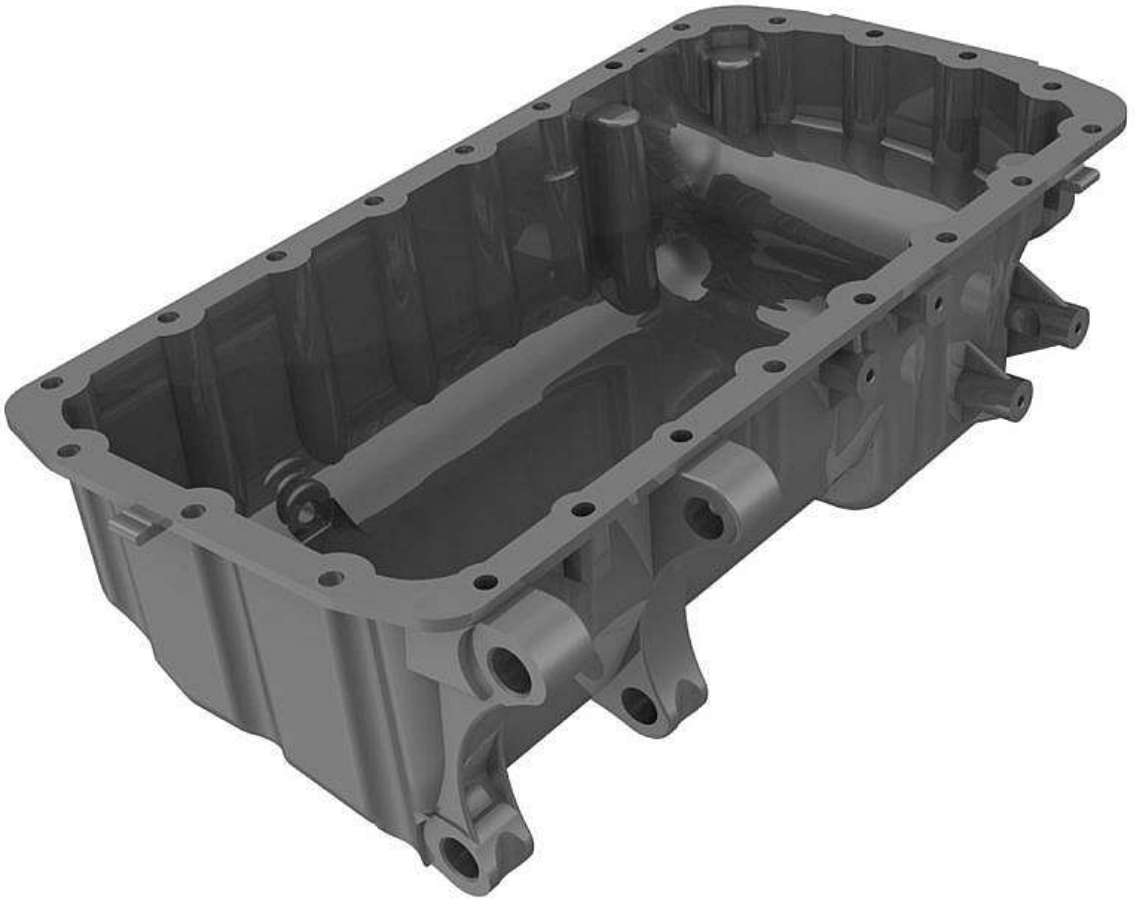
# knock in si engine

- 'Knock' is caused by the self-ignition of the unburned fuel/air mixture after the spark has fired. The associated rapid combustion leads to pressure oscillations and an increase in heat flux that can cause overheating and the failure of components.


Engine interior
Filter
Overflow valve
Pressure relief valve
Pump
Oil pan

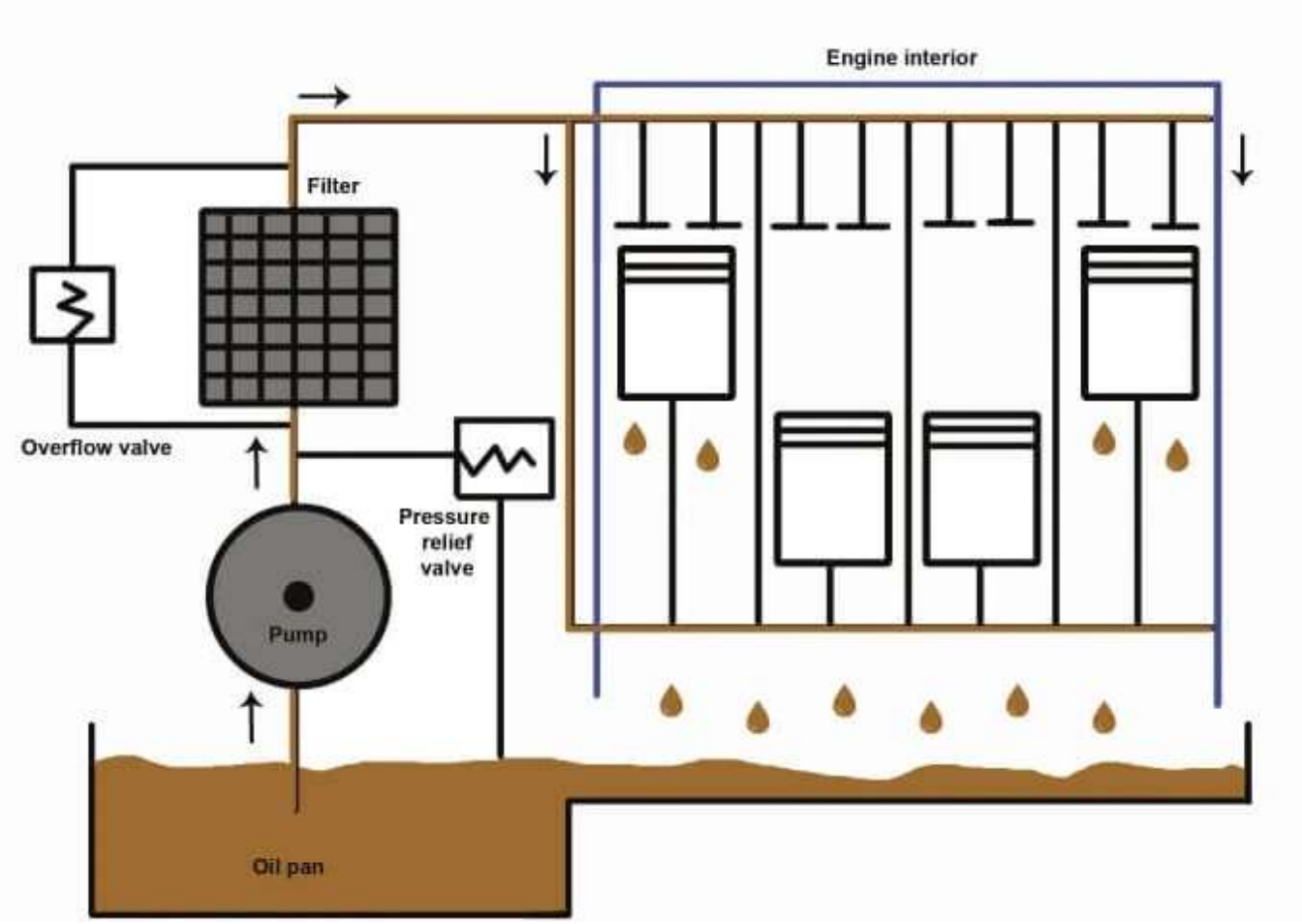
# wet sump lubrication system

- Wet sump stores the engine oil in an oil pan while in case of dry sump, the oil is stored in an external reservoir.
- This means that in wet sumps, a larger base pan is required while for dry sumps, this oil can be stored in a separate reservoir that is located outside the car freeing the space under the hood.



# Dry sump lubrication system

- In dry sump lubrication, the lubricant is stored in a special tank.
- From there, the oil reaches the lubrication points via a pump.
- The oil drips off the lubrication points and forms an oil sump.
- This oil sump is sucked in by a second pump (suction pump) and returned to the tank.


Engine interior
Filter
Overflow valve
Pressure
relief
valve
Pump
Oil pan

# Properties of lubricants

- Viscosity
- Pour point
- Fire point
- Corrosion
- Flash point
- Thermal stability

- **1. Viscosity:** A lubricant's "internal resistance to flow." Higher viscosity lubricants are thick and don't flow, while lower viscosity lubricants have a closer consistency to water and do flow.

- **2. Viscosity Index:** The rate of change in viscosity with changes in temperature. In other words, how much viscosity changes as temperature changes.
  **3. Oxidation Stability:** Oxidation is a reaction that occurs when oxygen is combined with lubricating oil. Variables such as high temperatures, water and acids will accelerate the rate of oxidation. The life of a lubricant is reduced as temperatures increase, leading to varnish and sludge.

- **4. Pour Point:** The lowest temperature at which a lubricant will flow or pour like a liquid. This can differ depending on test conditions.
  **5. Demulsibility:** The ability of a lubricant to separate from water.
  **6. Flash Point:** The temperature at which a lubricant will ignite when heated and mixed with air, but a flame is not sustained.