SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
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DEPARTMENT OF AGRICULTURAL ENGINEERING

23AGB201- TRACTOR AUTOMATIVE ENGINES

II YEAR IV SEM

Topic : Understanding the working principle of a Diesel engine – 4 Stroke compression

DIESEL ENGINE

- The diesel engine, named after Rudolf Diesel, is an internal combustion engine in which ignition of the fuel is caused by the elevated temperature of the air in the cylinder due to mechanical compression; thus, the diesel engine is a so-called compression-ignition engine (CI engine).
  This contrasts with engines using spark plug-ignition of the air-fuel mixture, such as a petrol engine (gasoline engine) or a gas engine (using a gaseous fuel like natural gas or liquefied petroleum gas).
  Diesel engines work by compressing only air, or air plus residual combustion gases from the exhaust (known as exhaust gas recirculation (EGR)).

The diesel engine has the highest thermal efficiency (engine efficiency) of any practical internal or external combustion engine due to its very high expansion ratio and inherent lean burn which enables heat dissipation by the excess air

The torque a diesel engine produces is controlled by manipulating the air-fuel ratio (λ);

The combined cycle gas turbine (Brayton and Rankin cycle) is a combustion engine that is more efficient than a diesel engine, but it is, due to its mass and dimensions, unsuited for vehicles, watercraft, or aircraft.

OPERATING PRINCIPLE

Use of compression ignition, instead of an ignition appartus such as a spark plug.

Internal mixture formation. In diesel engines, the mixture of air and fuel is only formed inside the combustion chamber.

High air-fuel ratio. Diesel engines run at global air-fuel ratios significantly leaner than the stoichiometric ratio.

Diffusion flame: At combustion, oxygen first has to diffuse into the flame, rather than having oxygen and fuel already mixed before combustion, which would result in a premixed flame.

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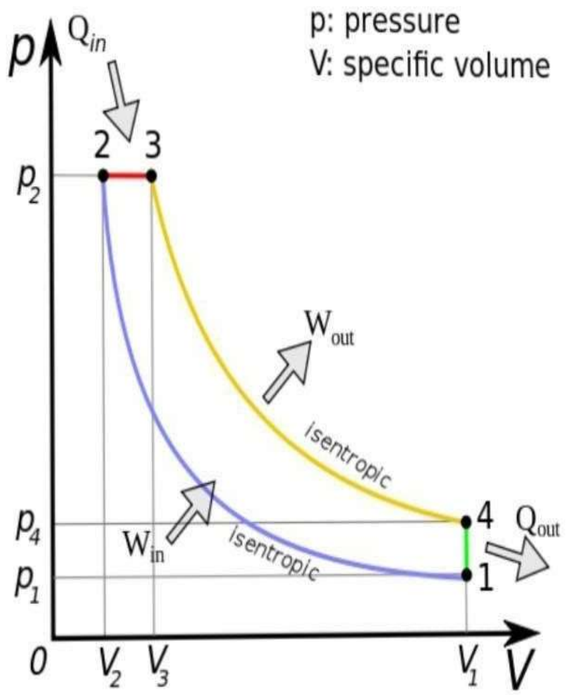
  Heterogeneous air-fuel mixture: In diesel engines, there is no even dispersion of fuel and air inside the cylinder. That is because the combustion process begins at the end of the injection phase, before a homogeneous mixture of air and fuel can be formed.
  Preference for the fuel to have a high ignition performance (Cetane number), rather than a high knocking resistance (octane rating) that is preferred for petrol engines.

THERMODYNAMIC CYCLE



PV diagram for the ideal diesel cycle (which follows the numbers 1–4 in clockwise direction). The horizontal axis is the cylinder volume. In the diesel cycle the combustion occurs at almost constant pressure. On this diagram the work that is generated for each cycle corresponds to the area within the loop.

DIESEL ENGINE MODEL

Diesel engine model left side view

Diesel engine model right side view

Application

Passenger cars:

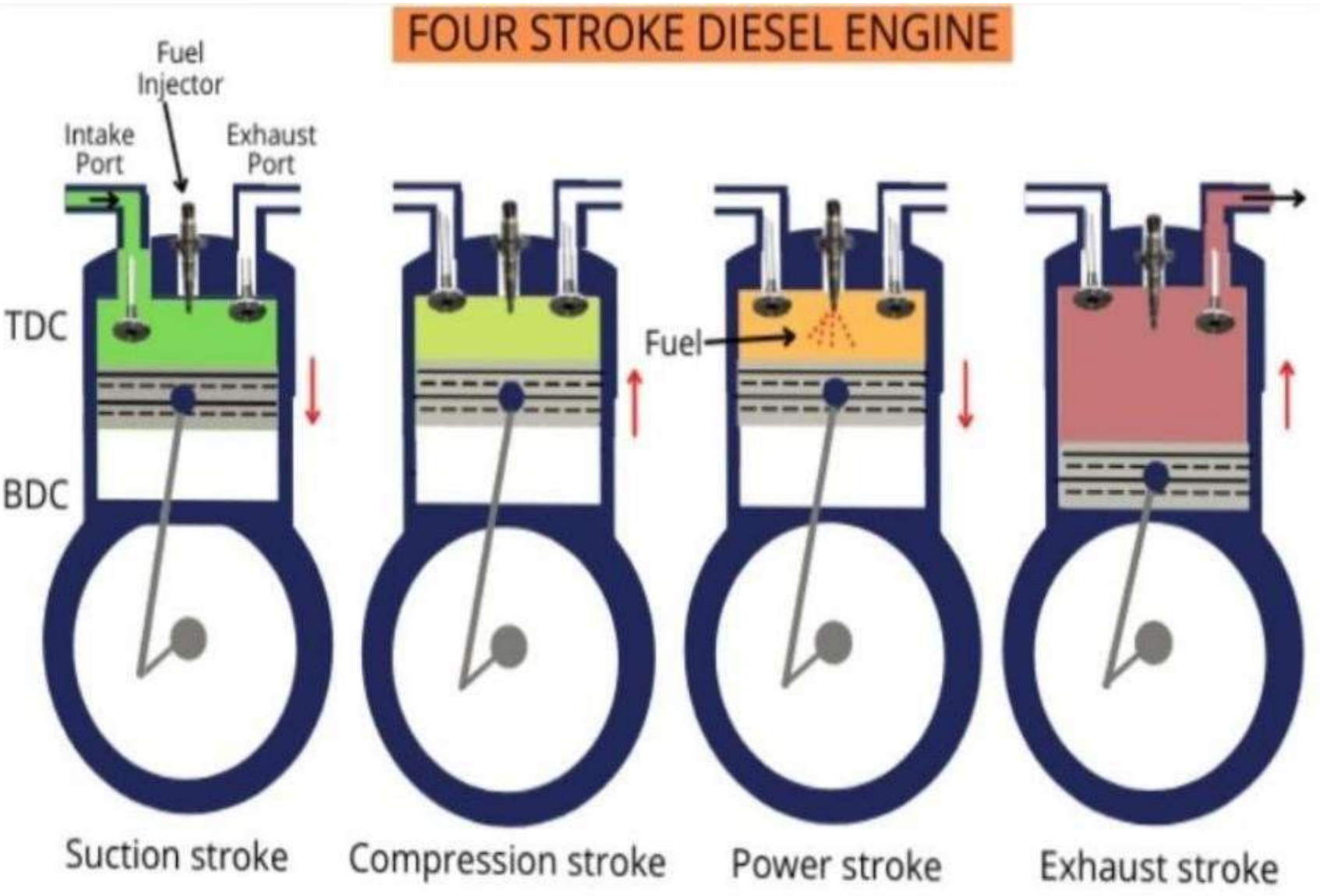
Diesel engines have long been popular in bigger cars and have been used in smaller cars such as superminis in Europe since the 1980s. They were popular in larger cars earlier, as the weight and cost penalties were less noticeable. Smooth operation as well as high low-end torque are deemed important for passenger cars and small commercial vehicles.

Railroad rolling stock

Diesel engines for locomotives are built for continuous operation between refuelings and may need to be designed to use poor quality fuel in some circumstances.[211] Some locomotives use two-stroke diesel engines. Diesel engines have replaced steam engines on all non-electrified railroads in the world.

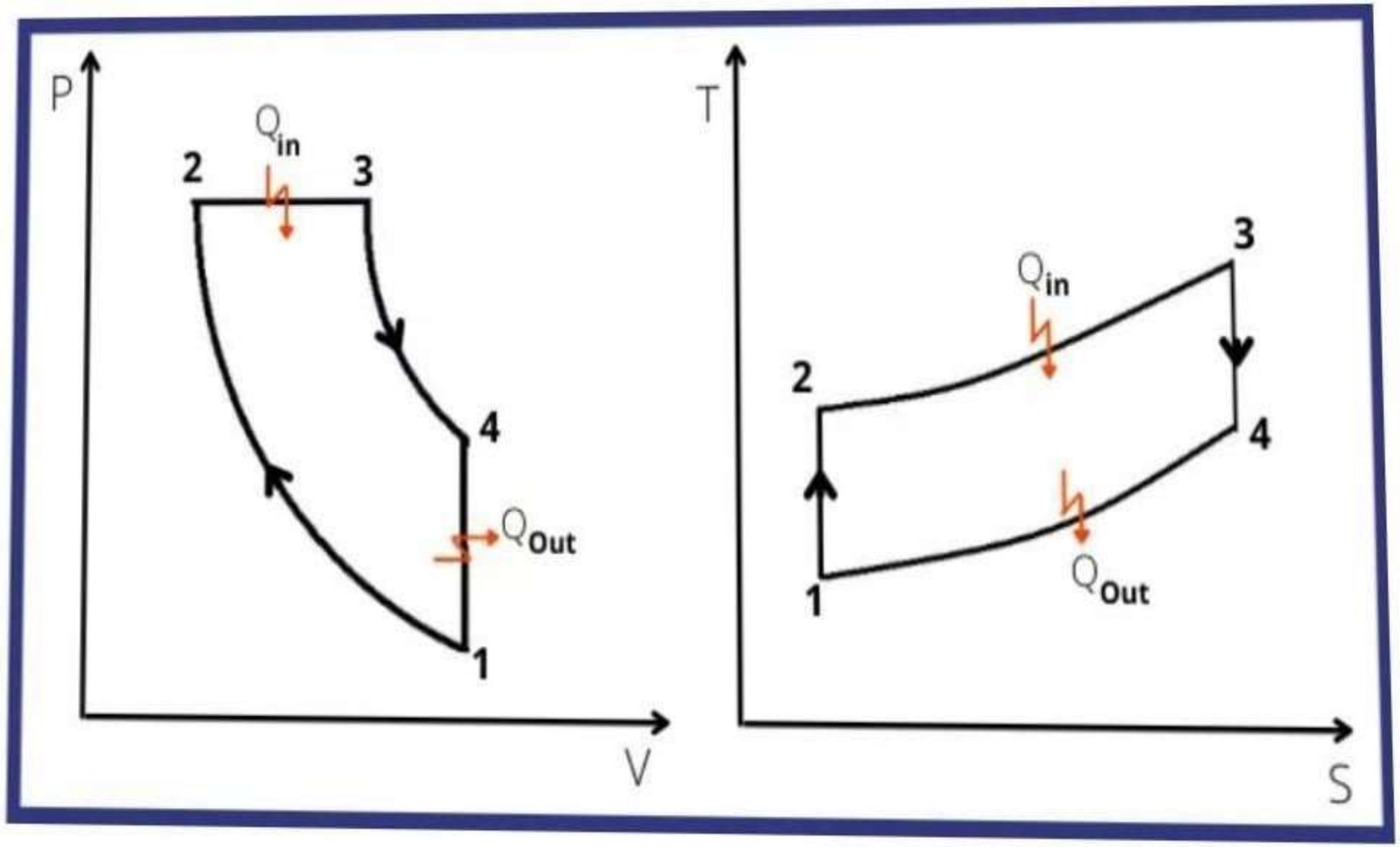
4 STROKE COMPRESSION IN DIESEL ENGINE

- The compression ratio of the Diesel engines is ranging from 16 to 12 where the Petrol engines it will be around 6 to 10. In 4 Stroke Diesel Engine, the Thermodynamic cycle will be completed in the four strokes of the position or the two revolutions of the crankshaft.
- Four stroke diesel engine is also known as the compressed ignition (CI) engine since in this kind of engine the combustion occurs due to the compressing a air more than fuel self-ignition temperature.
- The compression ratio of this engine is higher as compared to SI engine and it not uses the spark plug.
- This engine works on the thermodynamic diesel cycle.In this type of engine the diesel is used as the fuel.


FOUR STROKE DIESEL ENGINE
Fuel Injector
Intake Port
Exhaust Port
TDC
BDC
Fuel
Suction stroke
Compression stroke
Power stroke
Exhaust stroke

Four stroke diesel engine working principle:

The four stroke diesel engine works on the Diesel cycle.



The four processes in the Diesel engine are as follows:-

Process 1-2: Isentropic compression
Process 2-3: Constant pressure heat addition
Process 3-4: Isentropic expansion
Process 4-1: Constant volume heat rejection

Working of disel engine and 4 stroke compression youtube link

- https://youtu.be/w2Lh9YCp6SI
  https://youtu.be/31lrsp77ym0
  https://youtu.be/fTAUq6G9apg
  https://youtu.be/O4km7l_CwLk

Thank you!