RECENT DEVELOPMENT IN INTERNAL COMBUSTION ENGINE

HONDA ECO TECHNOLOGY

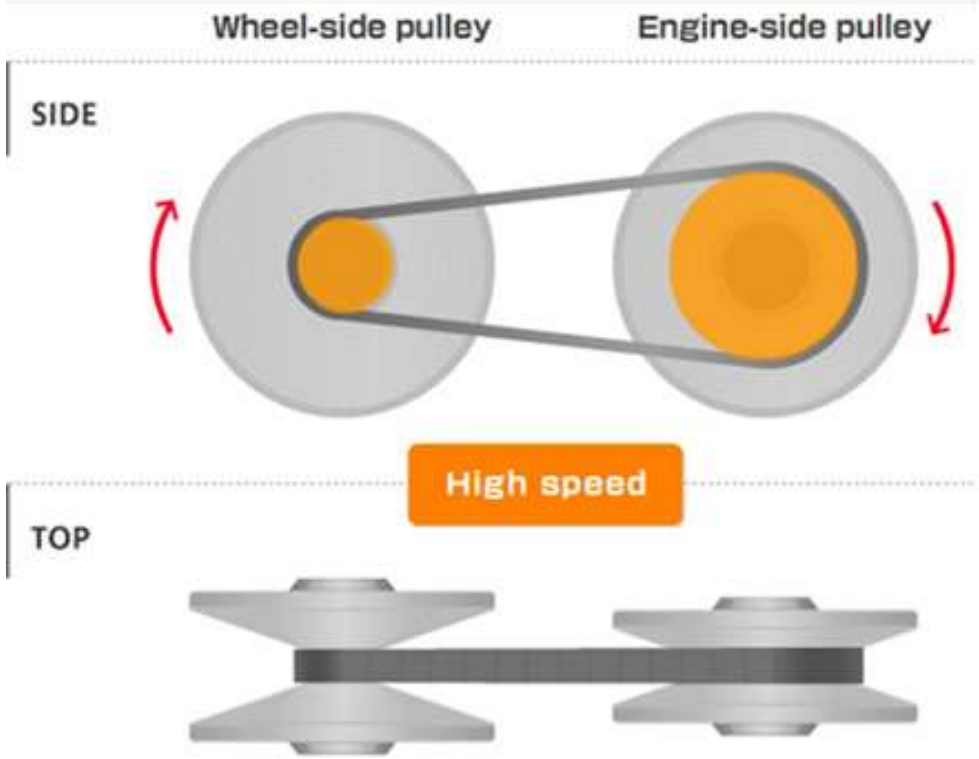
HONDA ECO TECHNOLOGY

In keeping with its strategic approach of Mileage Up for maximizing customer satisfaction, Honda launched the all new Honda Eco technology in 2013, making the Most Fuel Efficient two wheelers in India!

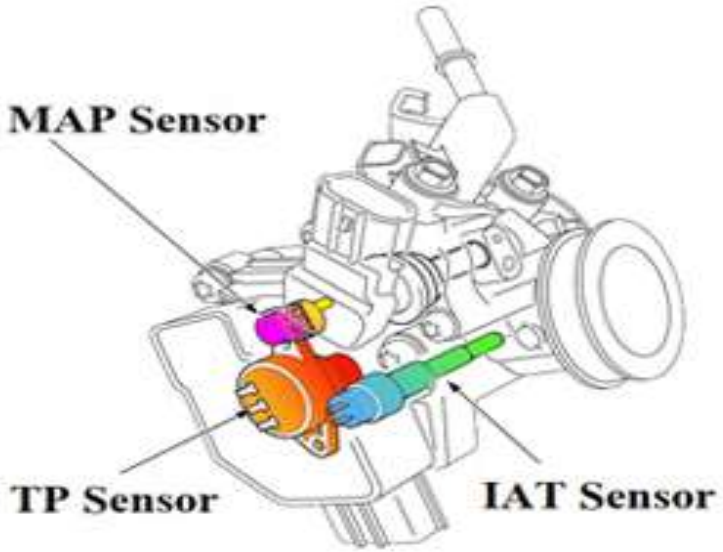
The new Honda Eco Technology boosts fuel efficiency of Honda's products resulting in a Dream Mileage (Mileage based on internal Honda test ride mode that is close to actual city riding conditions).

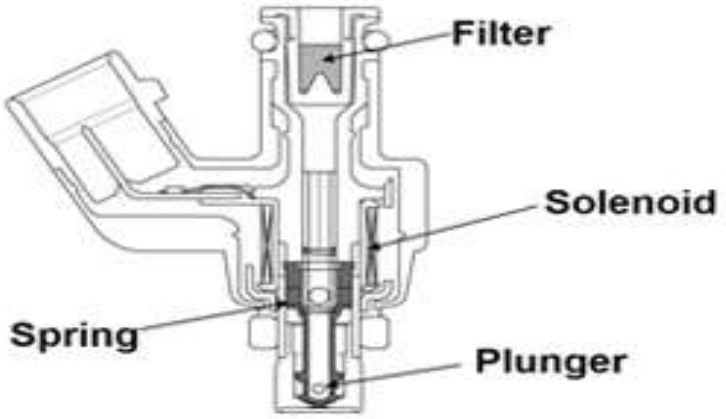
HONDA MATIC TRANSMISSION

- The compact, efficient & oil pressure controlled Honda Matic Transmission is the world's first fully automatic transmission system, which delivers a dynamic combination of torque & excellent accelerator response for a constant and superior driving experience.
- The transmission is being used in Honda's all terrain vehicles.
- Honda is working hard to introduce this Honda matic in two-wheelers.



FUEL INJECTION SYSTEM

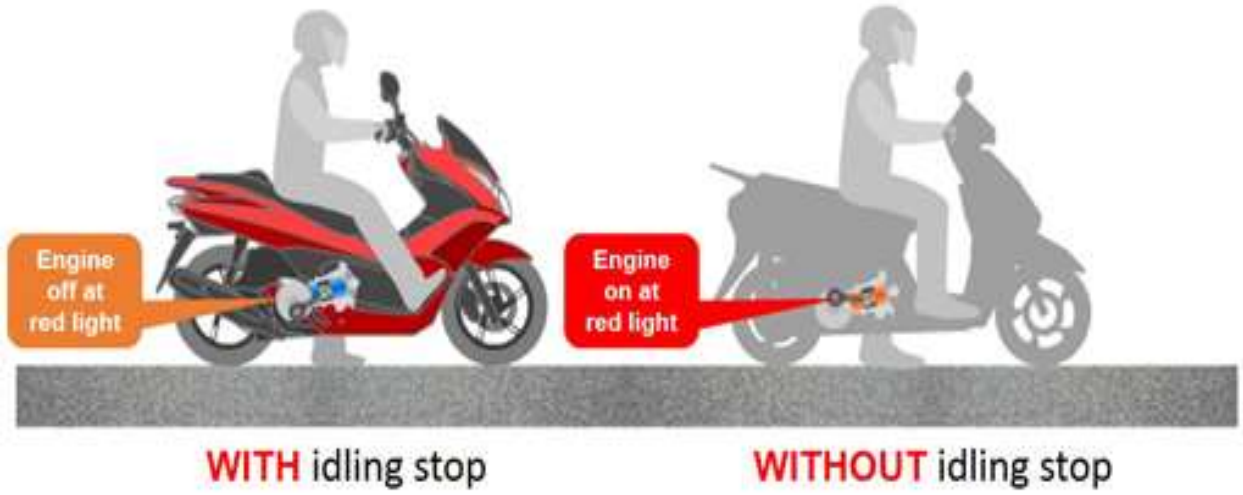




Honda's fuel injection technology is designed to realize ideal combustion, which results in delivering maximum power output, greatly improved fuel efficiency and yet be environment-friendly.

IDLE STOP SYSTEM

- Honda has created an advanced Idle Stop System (Image is on the left side) that reduces fuel consumption while totally blocking out toxic exhaust gas and unwanted noise.
- It enables the engine to stop automatically for 3 seconds after the vehicle stops moving.
- And when the throttle is opened, the vehicle engine restarts and takes off smoothly.



CHANGES DONE BY HONDA ECO TECHNOLOGY

- The revolutionary Honda Eco Technology is the trio of improved combustion, significantly reduced friction and optimized transmission in Honda engine:
- Reduced friction by offset crank, significant weight reduction of reciprocating parts, low tension piston ring and improved bearing oil seal.
- Improved combustion with highly ignitable nickel spark plug and optimized inlet port.
- By optimizing Pulley converter ratio & driving force, the power has been maintained & mileage has been increased.

TREO

MAHINDRA'S BATTERY POWERED THREE WHEELER

WHAT IS TREO?

Mahindra introduces Treo, a revolutionary new range of electric three wheelers. Powered by the most advanced Lithium-ion technology, Mahindra Treo will change the world of three wheelers forever. Treo offers increased savings, superior ride quality and best-in-class comfort for drivers and passengers, along with zero emission technology, for a better tomorrow.

KEY FEATURE OF TREO

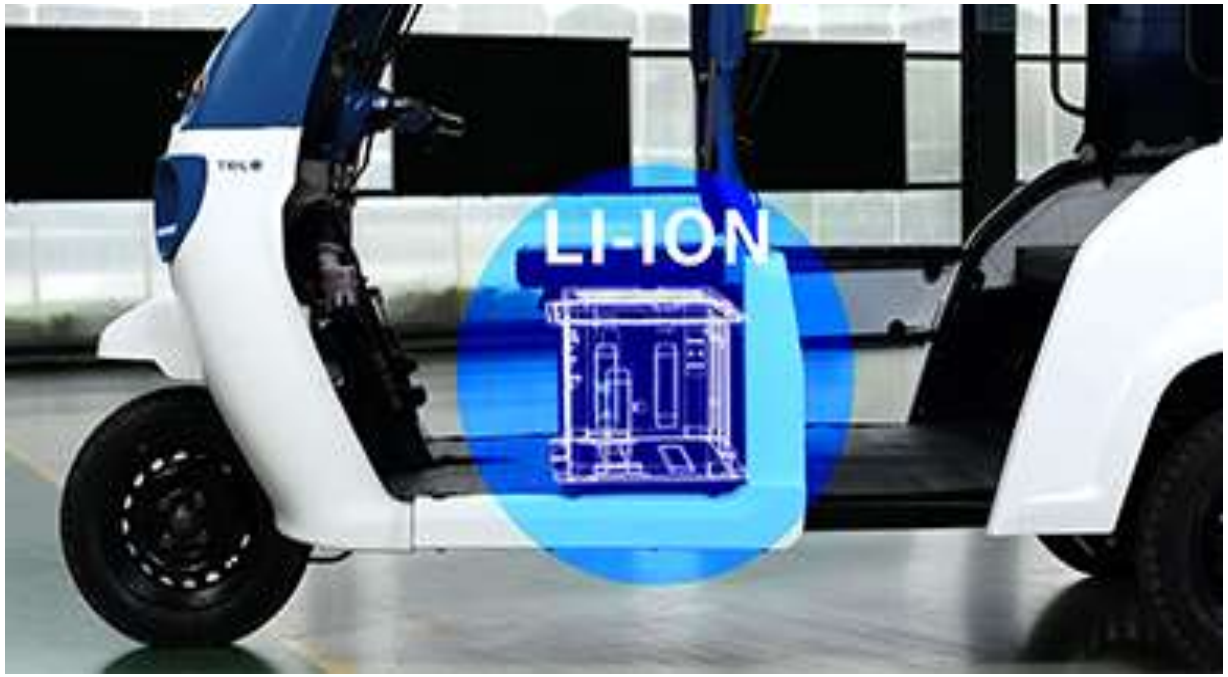
1. Zero tail-pipe emission

- Zero pollution and noiseless drive, making Treo environment friendly.

KEY FEATURE OF TREO

2. Global battery technology

Zero maintenance, lithium-ion battery for more than 5 years of life.



KEY FEATURE OF TREO

3. Cloud based mobility platform

Remote monitoring of range, speed, location and more for Next Generation Mobility* and efficient utilisation of fleet.

KEY FEATURE OF TREO

4. Quick charging

- It is as simple as charging a mobile phone. Just 3 hours & 50 min for a 130 km** range for Treo & 2 hours & 30 min for an 85 km** range for Treo Yaari. A top up during lunch break can add over 32 km*** to the range.

KEY FEATURE OF TREO

5. Regenerative braking system

Kinetic energy generated on braking is fed back into the battery, thereby ensuring minimum wastage of energy.

VEHICLE DIMENSIONS & WEIGHT

Model	MAHINDRA TREO - SFT
Dimensions - Length x Width x Height - mm	2746 x 1350 x 1750
Wheel Base - mm	2050
Turning Radius - m	2.9
Vehicle Kerb Weight – kg	340

PERFORMANCE

Model	MAHINDRA TREO - SFT
Top Speed - km/h	45
Certified Range – km	170
Typical Driving Range – km	130

BATTERY

Model	MAHINDRA TREO - SFT
Battery Type, Voltage	Lithium-ion, 48V
Battery Capacity (Installed) - kWh	7.37
Charging Time 0-100% @Standard Conditions	3 h 50 min

DRIVETRAIN

Model	MAHINDRA TREO - SFT
Peak Power - kW	5.4
Peak Torque - Nm	30
Transmission Type	Direct Drive

SUSPENSION AND BRAKES

Model	MAHINDRA TREO - SFT
Suspension - Front	Helical Spring + Dampener + Hydraulic Shock Absorbe
Suspension - Rear	Rigid Axle, Leaf Spring & Shock Absorber
Brakes - Front/Rear	Hydraulic

Model	MAHINDRA TREO - SFT
Wind Screen & Wiping System	YES
Spare Wheel Provision	YES
Driving Modes - LMH (Low Medium High) Speed	YES
Lockable Glove Box	YES
Grab Handles	YES
12V Socket	YES
Hazard Indicator	YES
Telematics Unit & GPS	YES
15 Amp Off-board Charger	YES

TIMING CONTROL

The efficiency of engine is decided by the timing of its sequential operation.

- Timing of the inlet and exhaust valves
- Timing of the spark in SI engine
- Timing of the fuel injection in IC engine
- Sequential operation of each cylinder in multi cylinder engine

In normal cases these timing are a design parameter set at time of manufacture

The goal of the timing control is to change the timing of engine while its working

VARIABLE VALVE TIMING

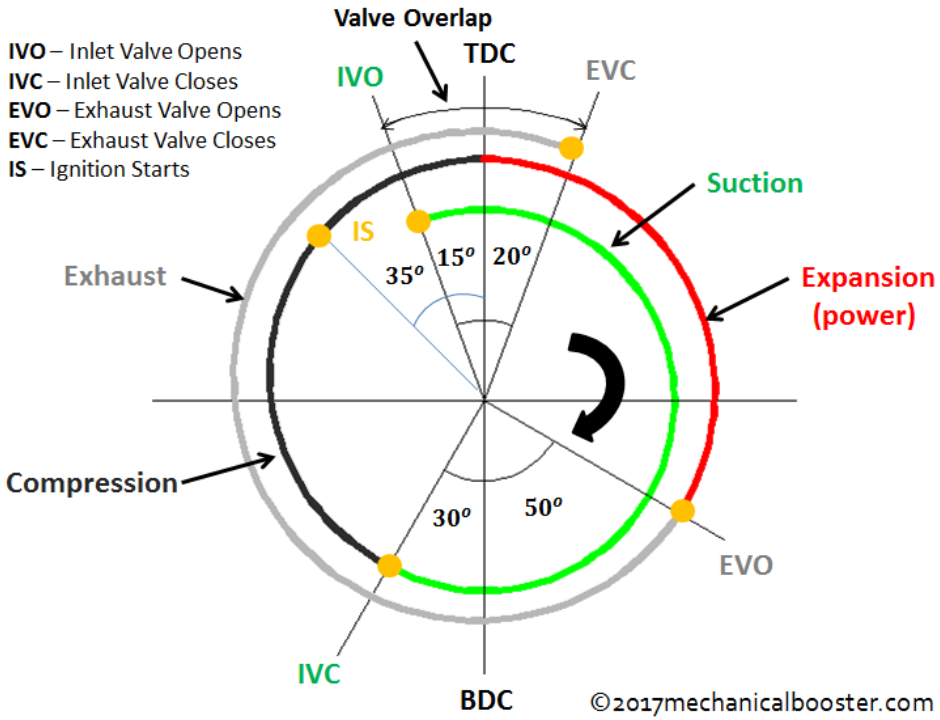
At low RPM, the timing is adjusted or maximum efficiency.

At high RPM, time the valve remains opened is reduced while increasing the opening size.

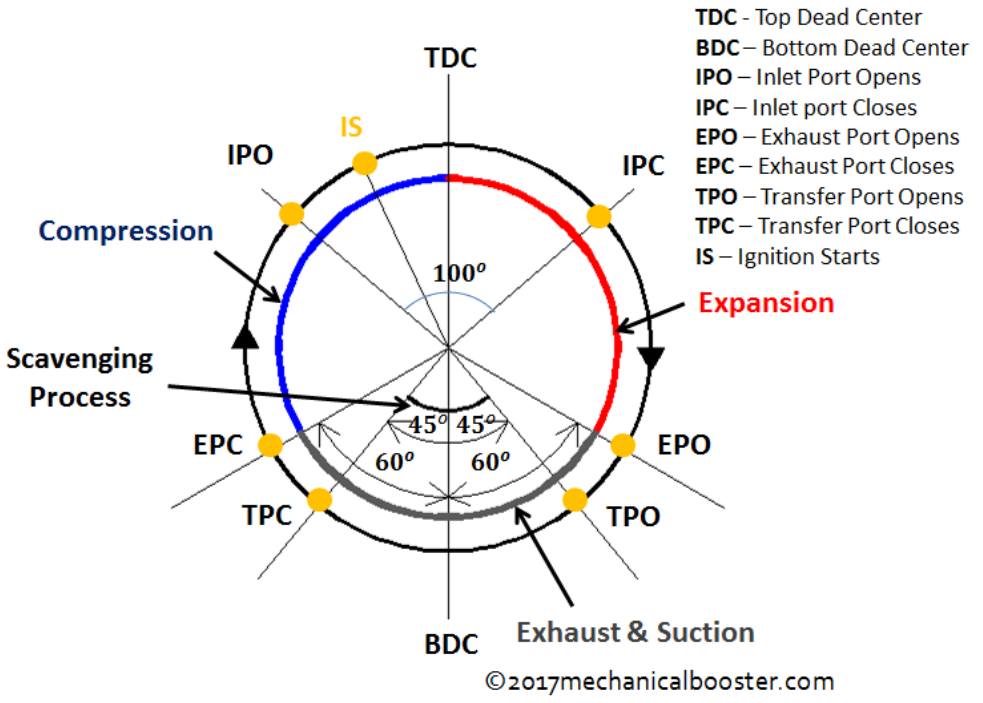
This helps to pump more charge to cylinder without creating backpressure or scavenging.

An electronic system uses a microcontroller to adjust the solenoid valve.

VALVE TIMING DIAGRAM OF 4 AND 2 STROKE



Valve Timing Diagram of 4 Stroke Petrol Engine



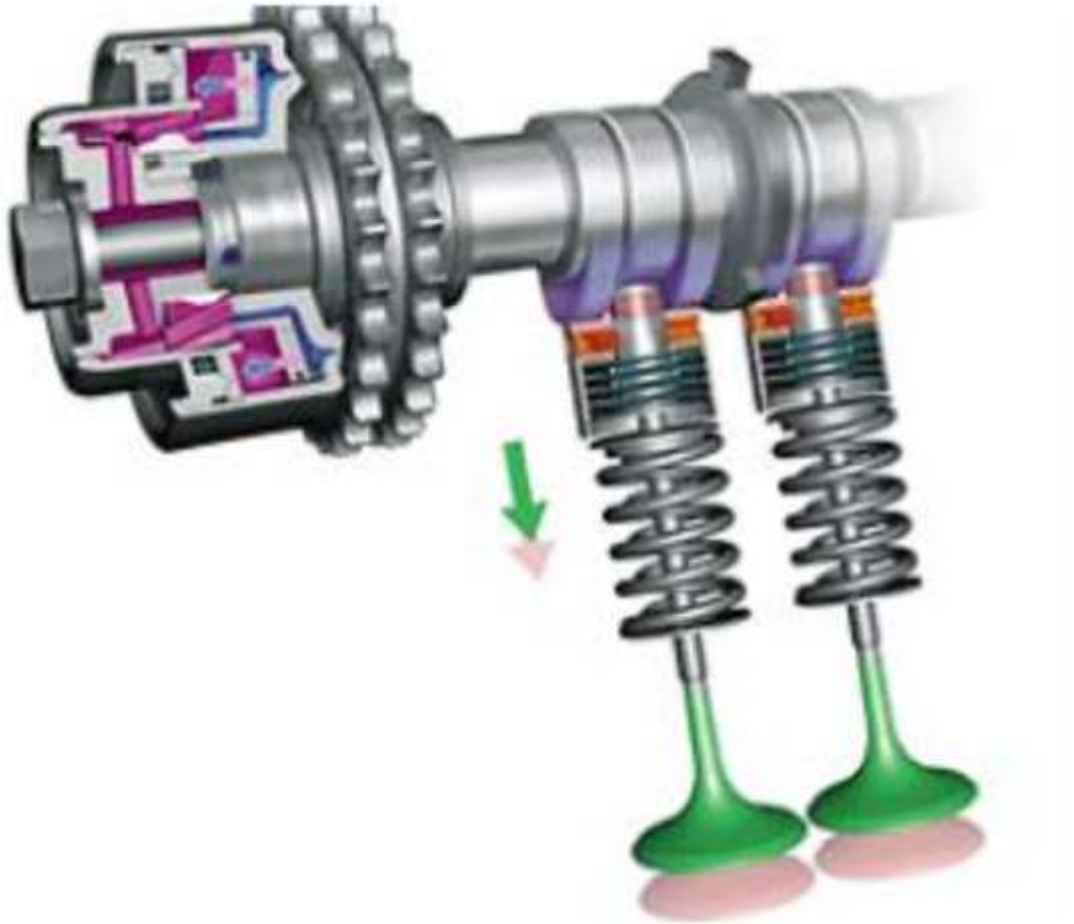
Valve Timing Diagram of 2 Stroke Petrol Engine

ACTIVE VALVE TRAIN

In active valve train, there will be two cams designed for specific road condition.

When the microprocessor detects a rough terrain, the cam used will be the one for more power.

During cruising, the cam is switched to a low power, high efficient cam using a cam tapper.



FULES AND FUEL INJECTION

The fules and its input to the engine highly influences the emission from the engines.

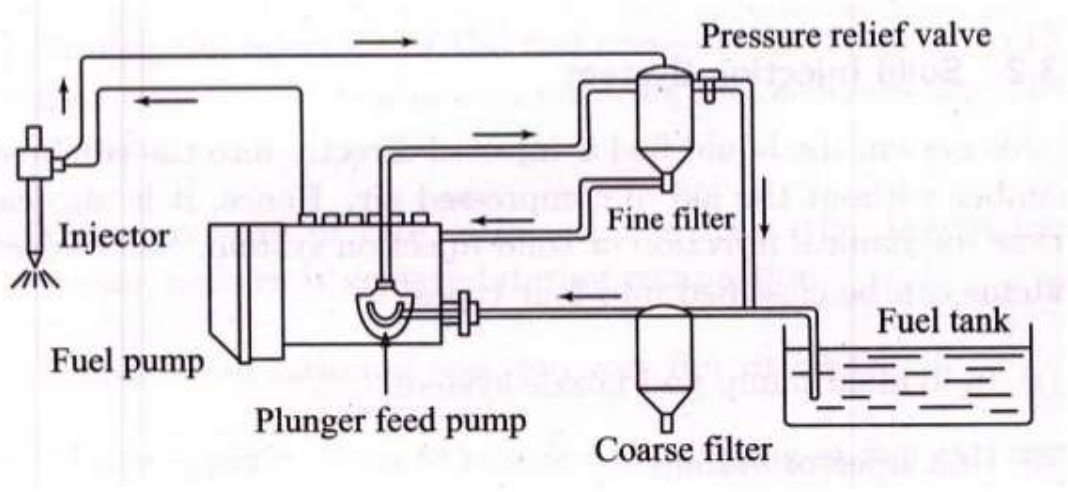
In SI engines a air-fuel mixture called charge is introduced to the cylinder before compression.

In CI engines the fuel is injected after the compression stroke to the cylinder. This helps in attaining higher compression ratio.

In SI engines it is not possible because there is a chance that the fuel may burn before.

I C ENGINES – II : Fuel Injection System

A typical arrangement of various components for solid injection system used in CI engine is shown



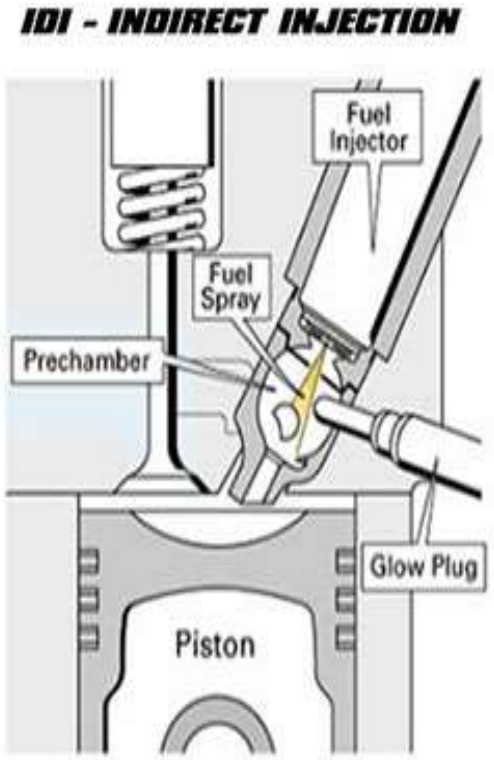
DIRECT INJECTION

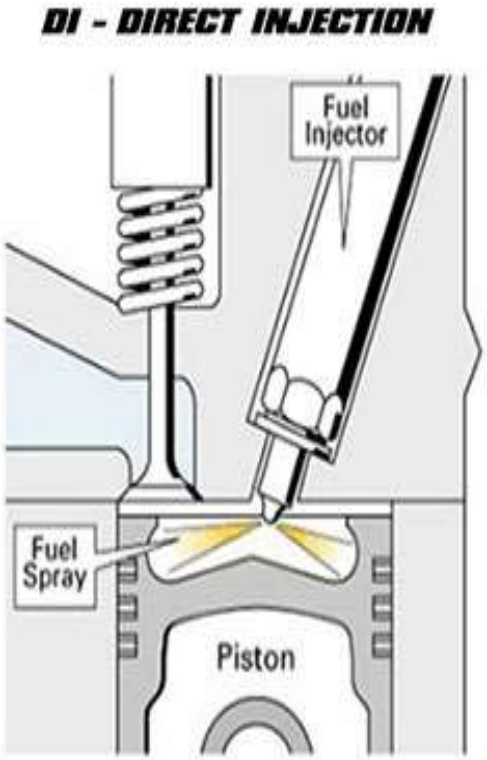
With direct injection, the advancement of CI engines can be obtained in SI engines also.

In direct injection, first the air is filled in the cylinder, then half way through the compression stroke, a small amount of fuel is injected to the cylinder to create a lean mixture.

At the end of compression, jut before the spark the rest of fuel is injected to the head of spark plug.

The burning of fuel occurs in a stratified.





DIRECT INJECTION

Direct injection has many advantages such as

- No need of carburetor
- Easy design of manifold
- Better compression is achievable
- No case of knocking in engines
- Lower NOx emission
- Due to stratified combustion leaner mixture can be used which reduces the fuel consumption

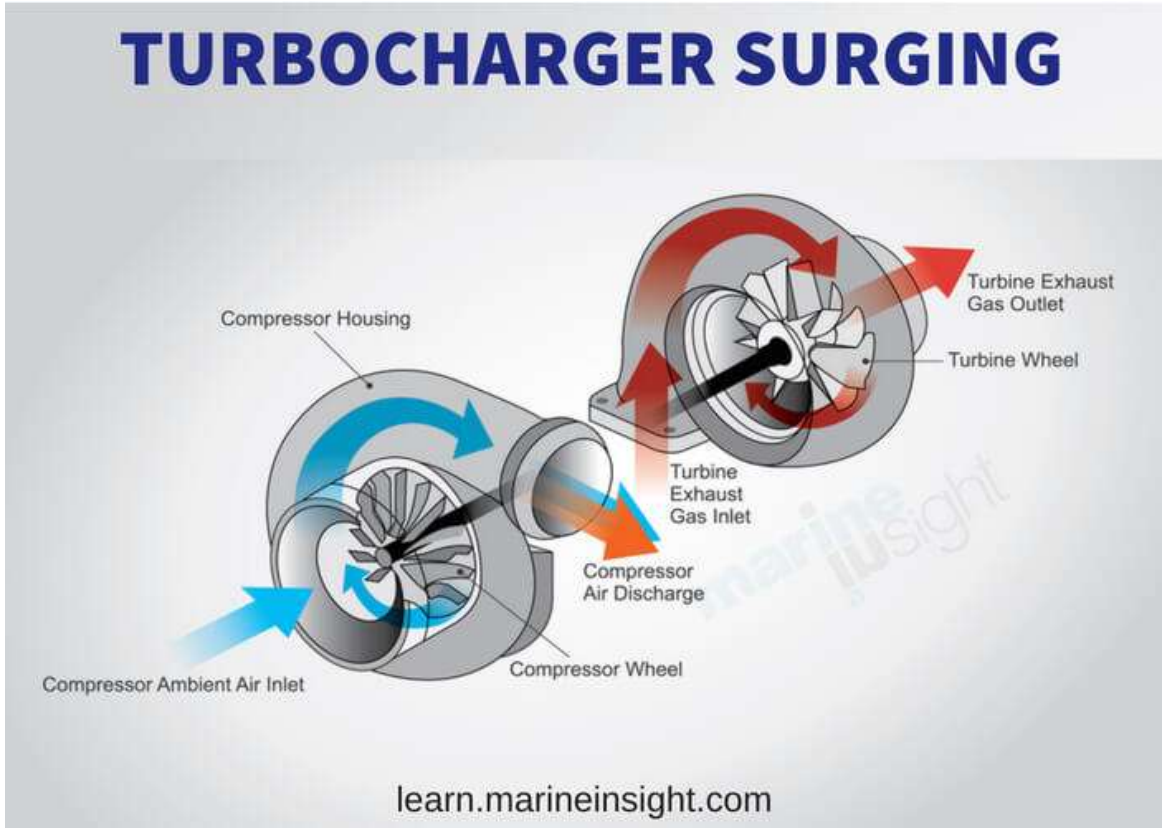
TURBOCHARGER

It is a derived from a supercharger.

Consists of a turbine and a compressor coupled in a shaft.

Instead a using he power from engine to turn the compressor, the exhaust is used to turn the turbine whicj the compressor.

Turbocharger can only act at high velocity exhaust so they need some time to start up in cold start. This time is called as tubo lag.



SUPERCHARGER

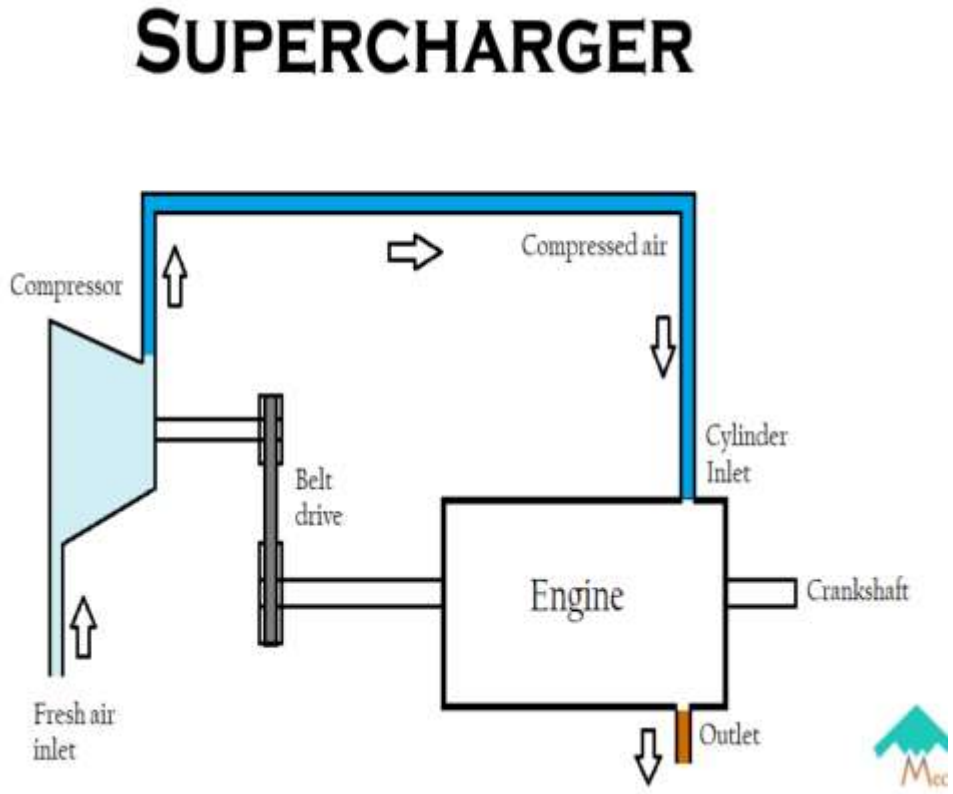
Consists of a compressor coupled to the engine using a belt.

The output is directly connected to the engine.

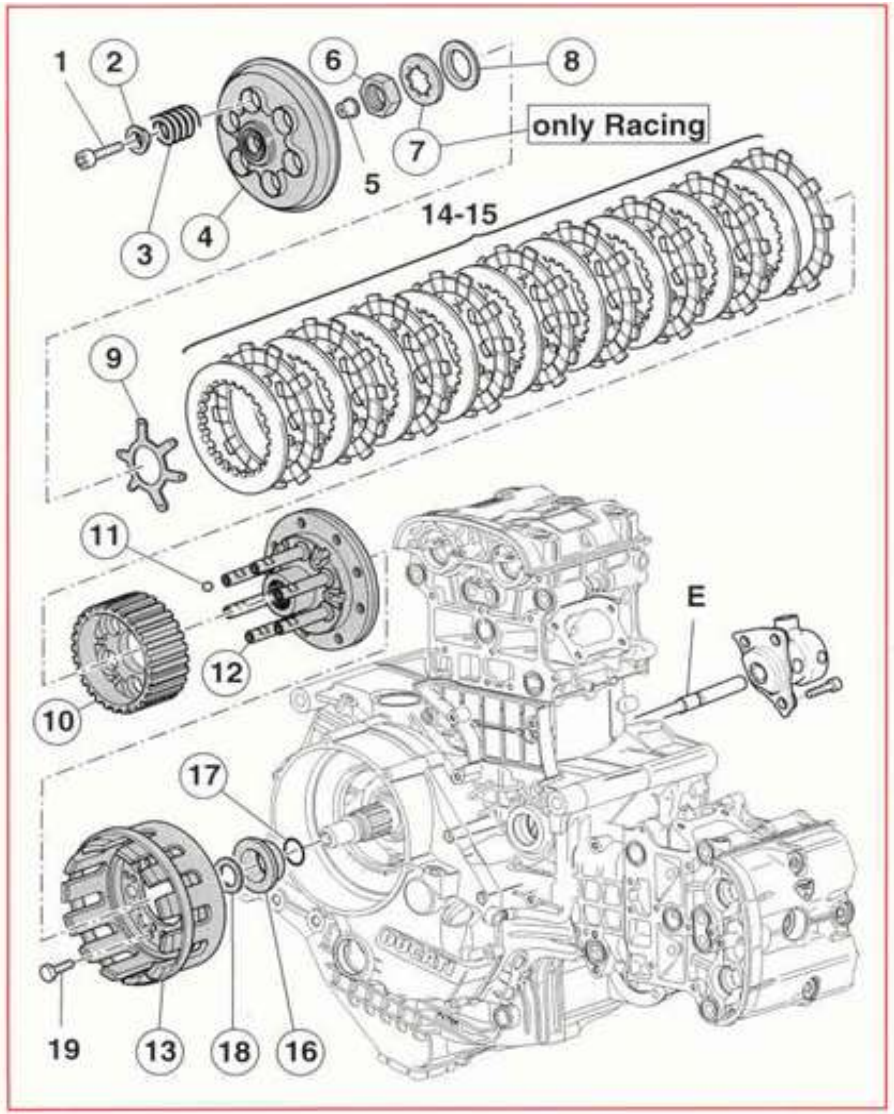
As the engine rotates, the air is sucked in and compressed which is then fed to the cylinders.

Incresed the amount of oxygen give to engine thus helps in better burning.

Is a must in aircrafts flying at high altitudes were air is less dense.



CONSTRUCTION OF A SLIPPER CLUTCH

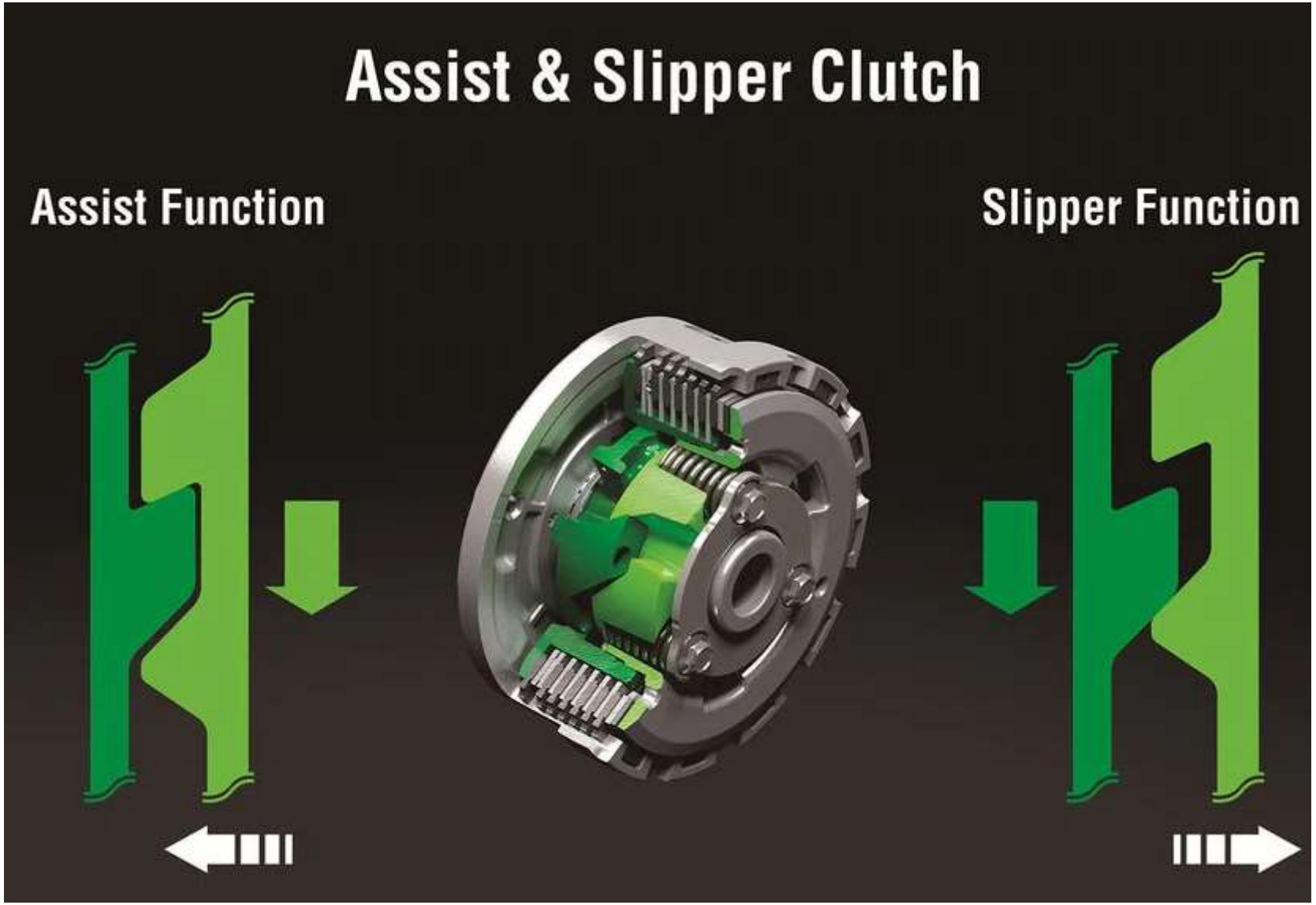


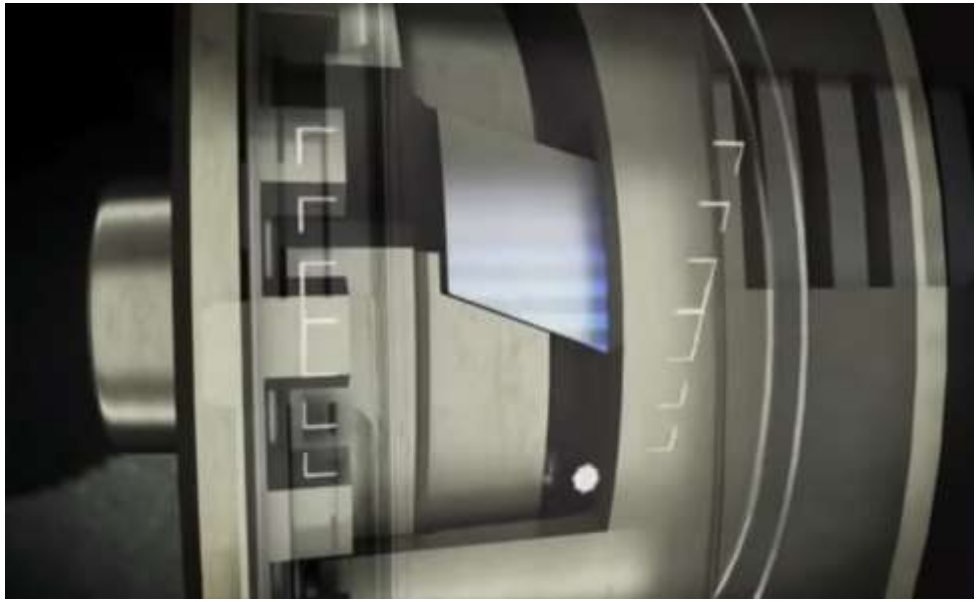
1 Screw
2 Cap
3 Clutch spring
4 Plate pusher
5 Clutch control shaft
6 Nut
7 Safety washer
8 Centering spacer
9 Clutch spring
10 Drum
11 Balls
12 Flange
13 Clutch housing
14 "Racing" version clutch plate pack composed of:
- 9 sintered drive plates
- 4 convex driven plates
- 5 flat driven plates
15 "Road" version clutch plate pack composed of:
- 7 drive plates
- 1 convex driven plate
- 7 flat driven plates
16 Spacer
17 O-ring
18 Bauer washer
19 Screw

- The Slipper Clutch consists of two bases, one with dog clutches and ramps with ball bearings and other with Clutch plates.
- This type of clutch is design to partially disengage or slip when the rear wheel tries to drive the engine faster than it would run under its own power.
- Major changes lie in the Clutch hub and pressure plates.

WORKING OF A SLIPPER CLUTCH

- In normal operation, the flat engagement dogs push on each other, and the clutch drives the motor cycle forward like a normal clutch operation
- During massive deceleration or hard breaking the torque forces the ramps together to absorb engine breaking force the ramps slide up on each other. This action lifts the hub up from the base, in the direction of pressure plate. It sides until the entire braking force is absorbed and then act like a normal clutch.
- Thus, the rider and the bike's engine, both are saved from catastrophic damage.


Assist & Slipper Clutch
Assist Function
Slipper Function



During Normal Operation

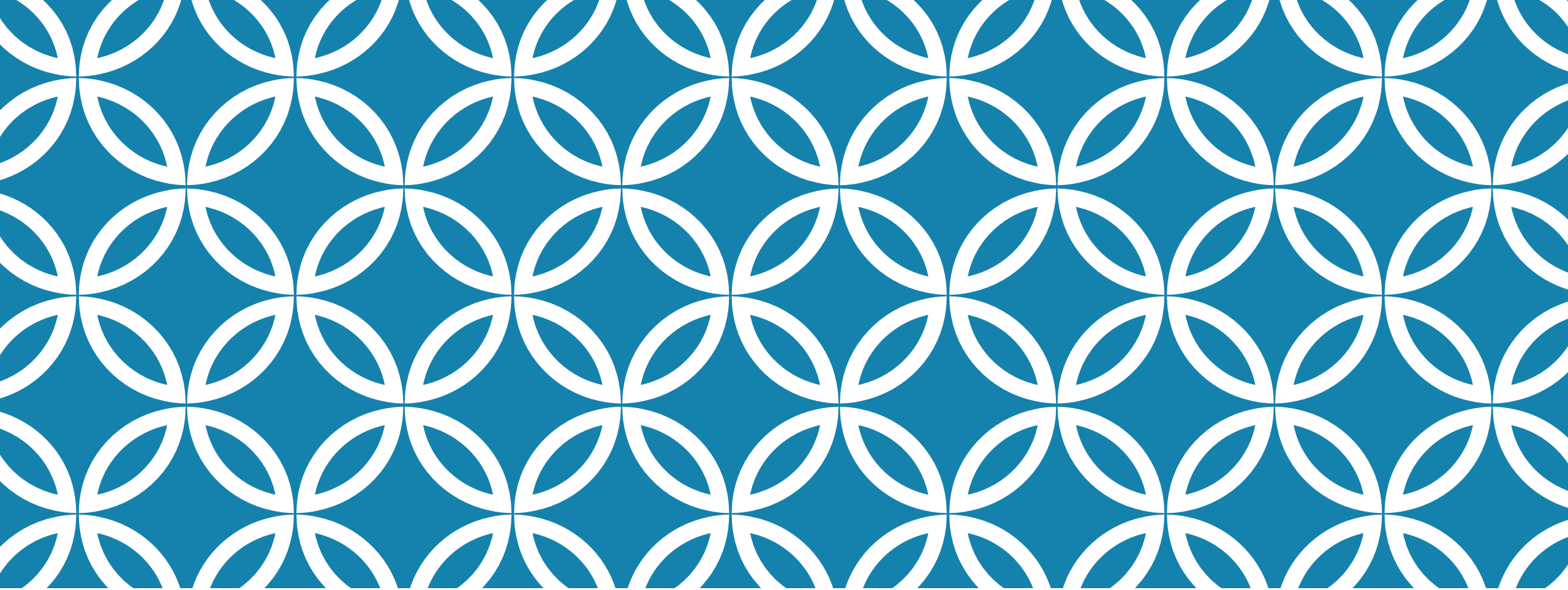
During Down-Shift

ADVANTAGES OF SLIPPER CLUTCH

- Slipper Clutch reduces sudden forces on the inside of the transmission and hence, reduces the wear and tear on the transmission.
- Correctly installed slipper clutch improves performance.
- It can prevent disastrous rear wheel lock up in case of Engine seizure or transmission failure.
- It also reduces work of suspension by absorbing engine braking force hence less bumpy ride while cornering.
- The rider does not need to concentrate on clutch operation which allows him to concentrate on other things like body posture, braking etc. while cornering.

DISADVANTAGES OF SLIPPER CLUTCH

- It's mechanically complex. Some slipper clutches are really complex to install and deal with.
- They are expensive(not against the saving they make by reducing wear and tear of transmission, less suspension movement and increased rider safety/comfort).



DTS-I

Digital Twin sparkplug ignition

NEEDS?

All four strokes

power stroke or expansion stroke which is started via spark plug and it is effective among the other three strokes

Single spark plugs in convetional engines

Bajaj Auto Ltd has done some R&D on the power stroke and invented a new technology named as DTSI (Digital Twin Spark Ignition)

increase the burning efficiency of the fuel and produces more power with less amount of fuel

WORKING PRINCIPLE

the two spark plugs As compared with the single spark fired engines, in twin spark engines the combustion of the air-fuel mixture takes place at optimal level and it produces more power. Because of the use of twin spark plug, the spark produced is more which burns the fuel more efficiently and rapidly. It results in increase of mileage, power and less emission of exhaust gases. The DTS-I engine produces 26% more power as compared with conventional single spark engines of same capacity.

CONSTRUCTION

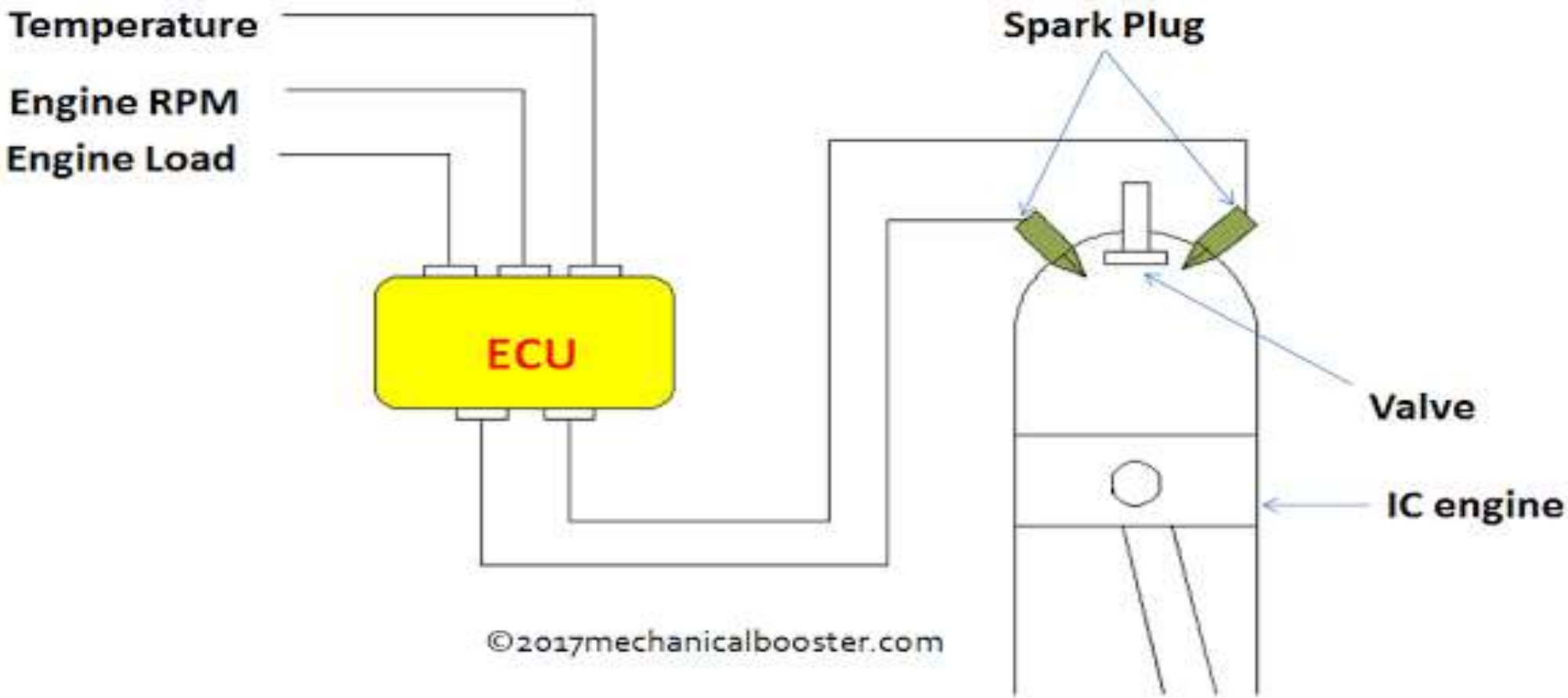
Two main parts

1. ECU:

It is a heart of the DTS-I. ECU consist microprocessor chip with preprogrammed data of Ignition Timings for various engine rpm and engine loads. It controls the firing of spark plugs as per the requirement.

2. Spark plug:

It is a small device placed upon the cylinder head. In DTS-i engine two spark plugs are used for the combustion of fuel. It is an initiator of the power stroke. The electrical energy (High Voltage) transmitted through it and creates a spark in the combustion chamber. Spark plug usually requires a voltage of 12,000-25,000 volt to produce spark.



DTSI Engine Working Principle

WORKING OF DTS-I ENGINE

two spark plugs at the opposite end of engine cylinder head in 90 degrees; instead of one spark plug which is common in a conventional engine. Two spark plugs produces the spark during the power stroke according to input requirement.

According to engine load, RPM and at low-high speed the ECU sends the low and high- frequency pulses to spark plug to perform as per situations. Spark timing of these two spark plugs is controlled digitally. DTS-I engines are known for efficient burning of air-fuel mixer at right time.

COMPARISON WITH CONVENTIONAL ENGINE

Detonation can be reduced: DTSI engine cannot frequently undergo detonation because complete combustion of air-fuel will not create any disturbance between piston and wall.

Better fuel efficiency

Less emission of exhaust gases.

Less vibrations and noise due to smooth function.

Engine breathing performance is easy even at high rpm.

No overheating issue.

Complete combustion, No unburnt issue.

Fast engine response even in winter and cold condition (Two spark plug).

DRAWBACKS

Expensive

Replacement of both spark plug even one is damage (Reason is series in connection , But parallel connection could not be achieved high voltage).

Complex in design.

i-3s Technology

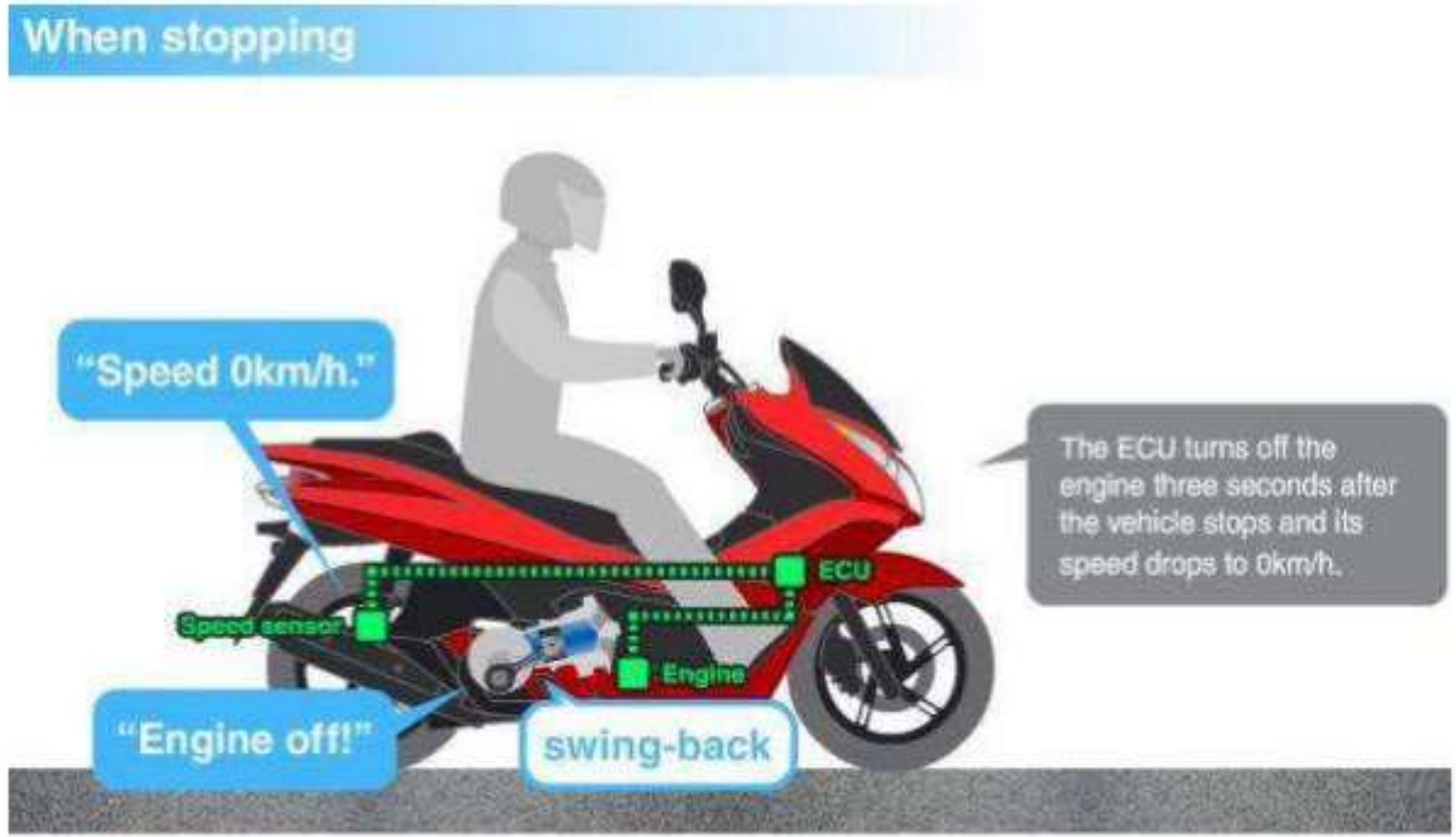
Introduction

- i-3S means **I**dle **S**top **S**tart **S**ystem.
- It is a green technology that automatically shuts engine when idling and turns it on when needed.
- It reduces the fuel consumption effectively and effectively.

Conditions to start engine the automatically:

- Engine speed is zero.
- Vehicle speed is zero.
- Gear box is in neutral.
- Clutch is pressed fully.

Working in two wheeler



Problem without i3s

- Less mileage of vehicles.
- More CO_2 emission causes pollution.
- More fuel consumption.
- More engine noise and vibration when in stand still condition.
- More usage of fuel during idle running of engine.

Advantages of i3s technology

- Fuel consumption is reduced by up to 5%-10%in the city driving.
- Co2 emissions are reduced by up to 7%-8%.
- Engine restarts within 350 milliseconds and in complete silence.
- Implementation cost is not very high.
- Engine stops and starts automatically.
- Eliminates engine noise and vibrations.

THANK YOU