



WELCOME TO GREAVES COTTON LIMITED

BASIC LEVEL TRAINING ON DIESEL ENGINES



To make participants

- 1) Familiar on Greaves History & Business.
- 2) Competent in Basics of Diesel engine.
- 3) Competent in carrying out quality service during commissioning of equipment & schedule maintenance.
- 4) Familiar with Greaves Engine FAB's.

GREAVES
SINCE 1859

TRAINING COURSE CONTENT

- 1) Greaves Company Overview.
- 2) Basics of Diesel Engine – General
 - 1) Systems of engine
 - 2) Components of system & their function
 - 3) Care & Maintenance of System components
- 3) Greaves Engine Familiarization.
- 4) Greaves Engine Features, Advantages & Benefits.
- 5) Greaves Product Maintenance Schedule & Preventive Maintenance.
- 6) Minor troubleshooting, adjustment & repairs of engine.

GREAVES BRIEF HISTORY



1859- James **GREAVES** and **George COTTON** founded the Company

1937- Greaves Cotton entered into a Joint Venture with Crompton Parkinson of England to introduce ceiling fans and a range of other electrical products in India (now known as Crompton Greaves Limited).

1939- Joint Venture with Ruston & Hornsby Ltd., U.K. and started manufacturing diesel engines in India

1947- Pioneering industrialist Mr. Lala Karamchand Thapar bought Greaves Cotton became an Indian Company.

1962- Greaves Power Transmission Unit set up in Pune in collaboration with David Brown Gear Industries, U.K., and pioneered the manufacturing of industrial and marine Gearboxes in India.

1980- Greaves started manufacturing high power MWM diesel engines needed for Gensets and Marine propulsion.

GREAVES BRIEF HISTORY



1986-Greaves Joint Venture with Morganite Crucible Ltd., U.K. to manufacture Silicon Carbide Crucibles. Technical collaboration with BOMAG GmbH, Germany, to manufacture Vibratory Compactors.

1994-Acquired two Plants from Enfield India Ltd., to manufacture Petrol / Kerosene engines.

1996-Launched Transit Mixer and Batching Plants.

2000 - Launched lightweight diesel engine model GL 400, complying with Bharat Stage I (Euro I) emission norms, for three wheelers.

2004 – A Millionth light diesel engine rolled out.

2006 - Greaves opens a new Technology Centre to design and develop new generation engines at Aurangabad.

2007 - Greaves acquires Bukh-Farymann GmbH Diesel, Germany

2012 - Greaves crosses three million mark in light diesel engines

BUSINESS GROUPS



1. AUTOMOTIVE

2. AGRICULTURAL EQUIPMENT

3. CONSTRUCTION EQUIPMENT

4. AUXILIARY POWER

5. INDUSTRIAL ENGINES

6. AFTER MARKET

7. INTERNATIONAL BUSINESS



1. AUTOMOTIVE ENGINES BUSINESS GROUP (AEB)

- Largest Business of the Company
- Produces Highly fuel efficient, Greaves lightweight diesel engines ideal for Automotive applications like 2-wheelers, 3-wheelers, mini cars etc. We are already over 2 million light diesel engines in the market

PRODUCTS

- Single cylinder engine
 - two cylinder engine
- 4.4 to 20 HP**

APPLICATIONS

- These engines with high power-to-weight ratio are also used extensively for portable agricultural pumpsets, gensets, small boats, construction equipments and host of other applications.



Light Engines Unit IV - Aurangabad

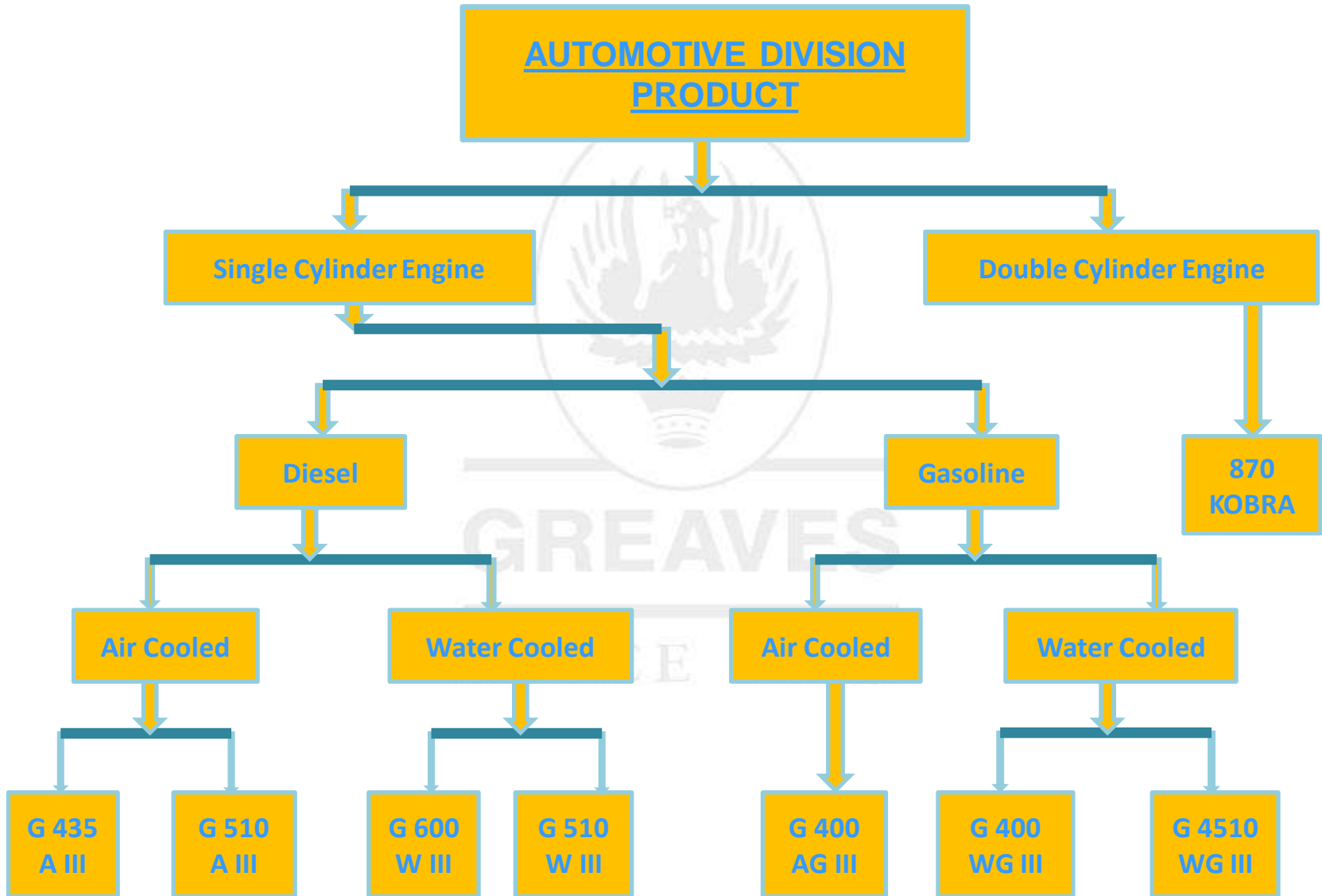


Diesel Engine – GL 435A III



Twin cylinder engine with power pack

AUTOMOTIVE ENGINES BUSINESS GROUP (AEB)



2. FARM EQUIPMENT BUSINESS GROUP (FEB)

PRODUCTS

- Petrol / Kerosene engines & pumpsets
- Portable / Conventional diesel pumpsets
- Power Tillers
- Reapers and Mini agro equipment
- Electric pumpsets



Electric Pumpset



Power Tiller

CORE COMPETENCIES

- Facility to design and develop IC engines / applications
- A wide range of agro equipments that help enhance farm productivity
- Market leader in Petrol / Kerosene engine business

MANUFACTURING FACILITIES

- 2 manufacturing units In Gummidipoondi
- State-of-the-art Machine Shop

CUSTOMERS

Farmers



Assembly

3. CONSTRUCTION EQUIPMENT BUSINESS GROUP (CEB)



PRODUCTS

- Concreting: Concrete mixers, pumps, batching plants, truck mounted pumps and Metro Pump
- Compaction: Vibratory rollers, Pneumatic tyred roller, paver finisher, cold milling machine, stabiliser
- Earthmoving: Motor Grader

APPLICATIONS

Greaves construction equipment are mainly used for construction of roads, bridges, buildings, ready mix concrete applications, etc

CUSTOMERS

- Hindustan Construction Company, L&T ECC, Reliance Infrastructure Limited, Gammon India Limited, IRB Infrastructure Limited, Essar Construction Limited, India Bulls, Shapoorjee Palonji Construction Limited



Transit Mixer



Batching Plant



19 Ton Vibratory Compactor



Mixer Assembly Line

4. INDUSTRIAL ENGINES BUSINESS GROUP

PRODUCTS

- Diesel engines : 1.4 to 1000 HP range
- Dual fuel engines also available

APPLICATIONS

- These engines can be used for various applications like Marine, Agricultural equipment, Fire fighting pumpsets, Mining & construction, Material handling (cranes, forklifts), Rail cars, road sweepers etc.

MANUFACTURING FACILITIES

- Engines are manufactured at state-of-the-art manufacturing facilities in Pune, Aurangabad (Maharashtra), Gummidipoondi and Ranipet (Tamil Nadu)

CUSTOMERS

- Mather & Platt, Pune; Flowmore Pumps, Delhi; CED, Chennai
Pan Agro, Patiala; Raina Engineering, Mumbai.



Marine engine



Twin cylinder engine



G series engine



D series engine

5. AUXILIARY POWER BUSINESS GROUP



PRODUCTS

- Portable Genset in the range of 1-1.5 kVA
- Range: 25 kVA to 500 kVA single unit and upto 2500 kVA in parallel running



Portable Genset

CORE COMPETENCIES

- Fuel - efficient, rugged and reliable gensets compliant with emission norms
- Innovative 125 to 400 kVA dual fuel engines / gensets operating on combined fuels
- Gensets (25 - 520 kVA) specially packaged for international market



G Series Genset

MANUFACTURING FACILITIES

- 1 Manufacturing facility in Pune
- In-house Foundry with specialized skills to cater to a wide range of complex and custom built castings



G series Machining Centre

CUSTOMERS:

- Ramoji Film City , Hyderabad; Tata Motors, Pune; Country INN Suites, Goa; Reliance Fresh, Mumbai; Manipal University



G series Machining Centre

NEXT – BASICS OF DIESEL ENGINE

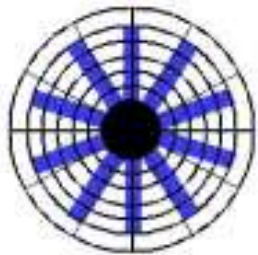
GREAVES

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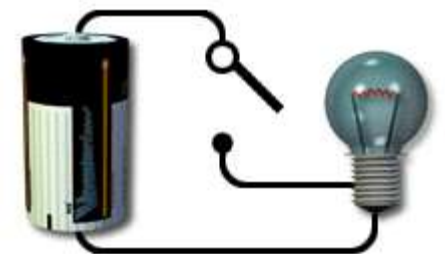


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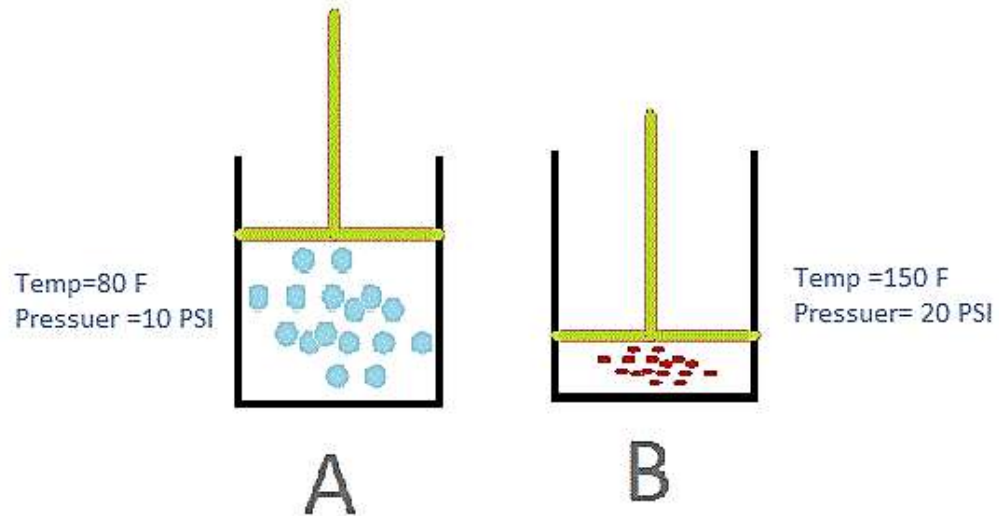
ENERGY SOURCES



CURRENT



WHAT IS ENGINE

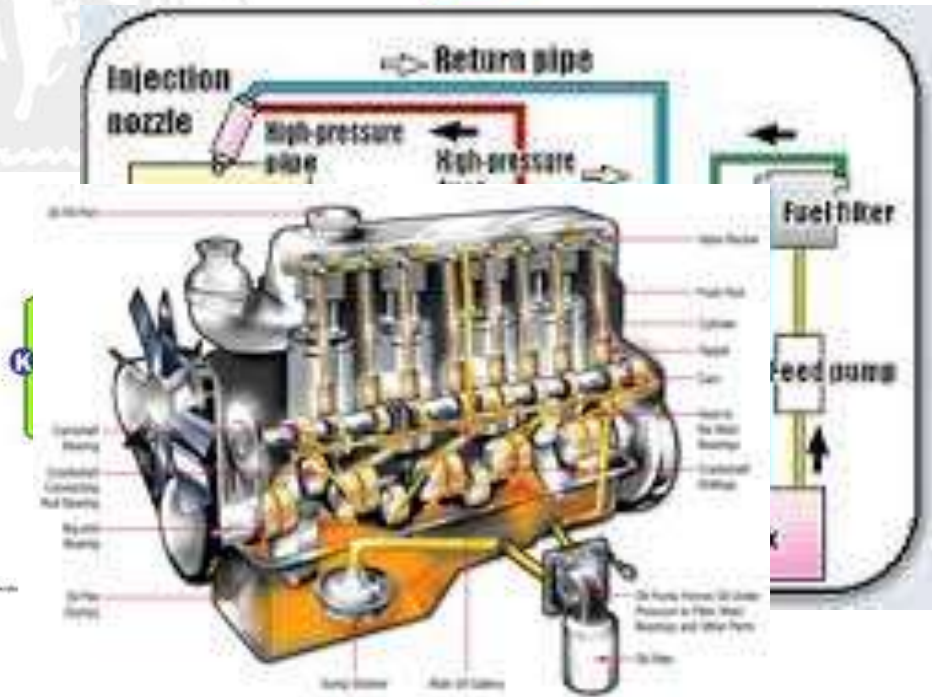
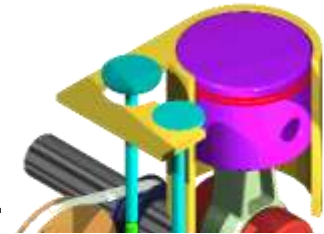


GREAVES

Engine : Machine that Converts Chemical energy of fuel into Heat energy, which is converted into mechanical work.

SYSTEMS OF ENGINE

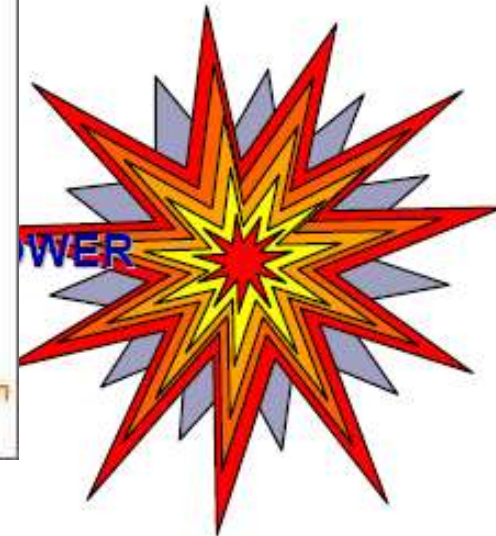
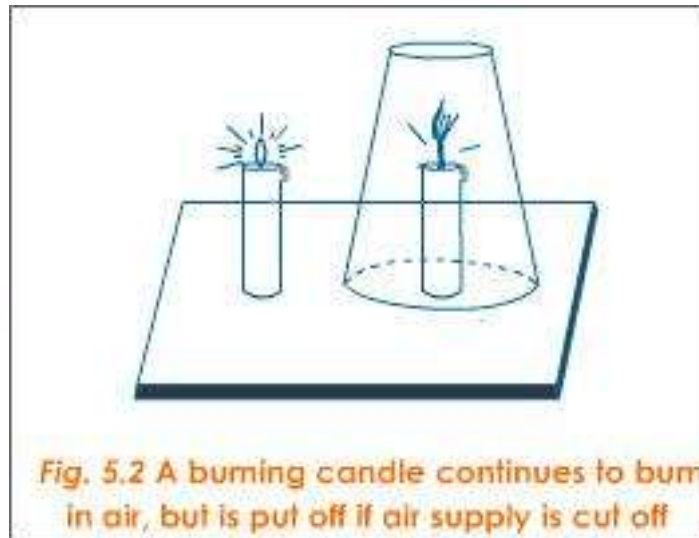
- Engine system – Valve & Power train, Cylinder block & head.
- Air Intake & Exhaust System
- Fuel supply & Injection system
- Lubrication system
- Cooling system
- Engine electrical system



Engine Power

Power developed by an engine is related to air consumption.

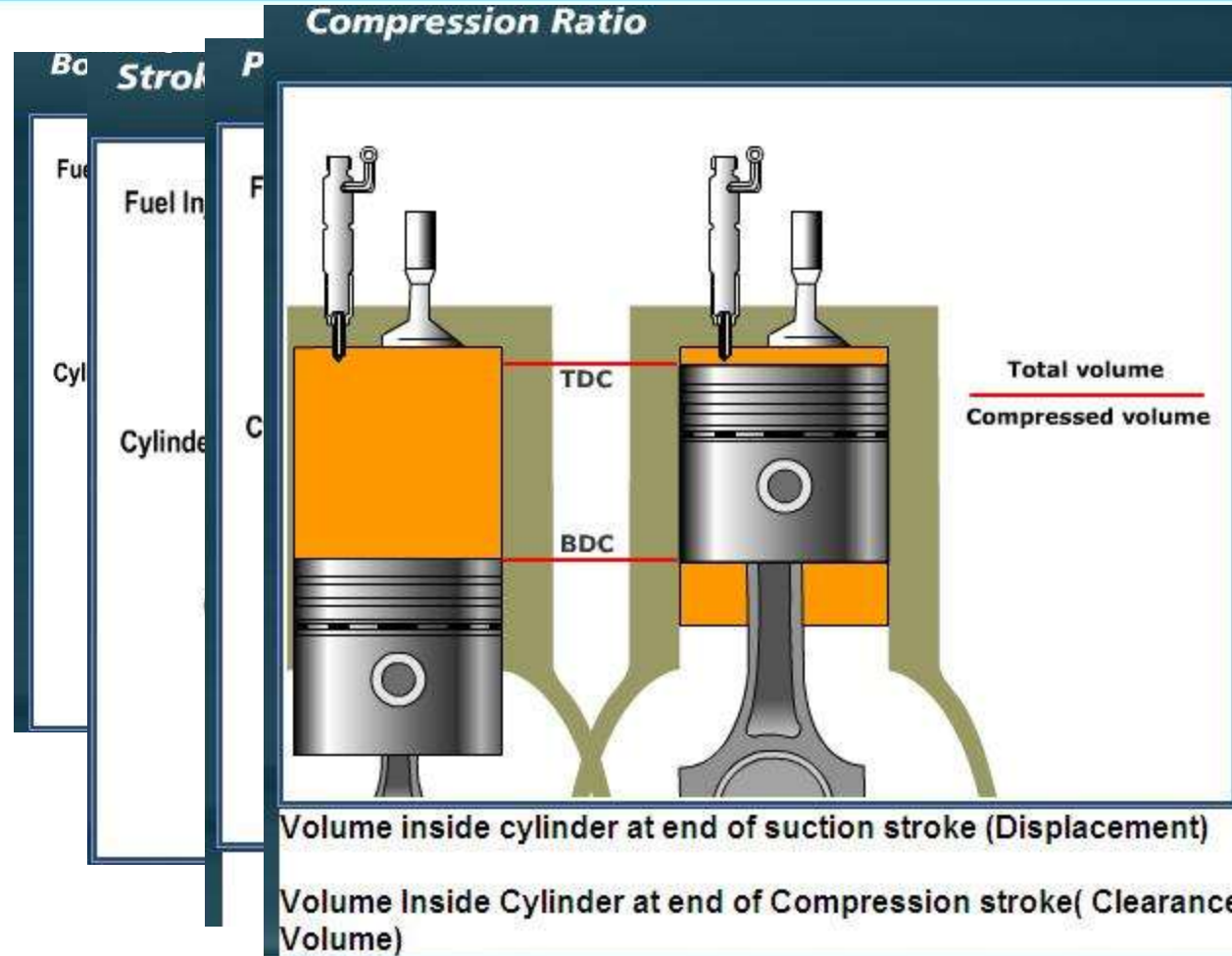
More Air MASS (+ fuel) = More Power



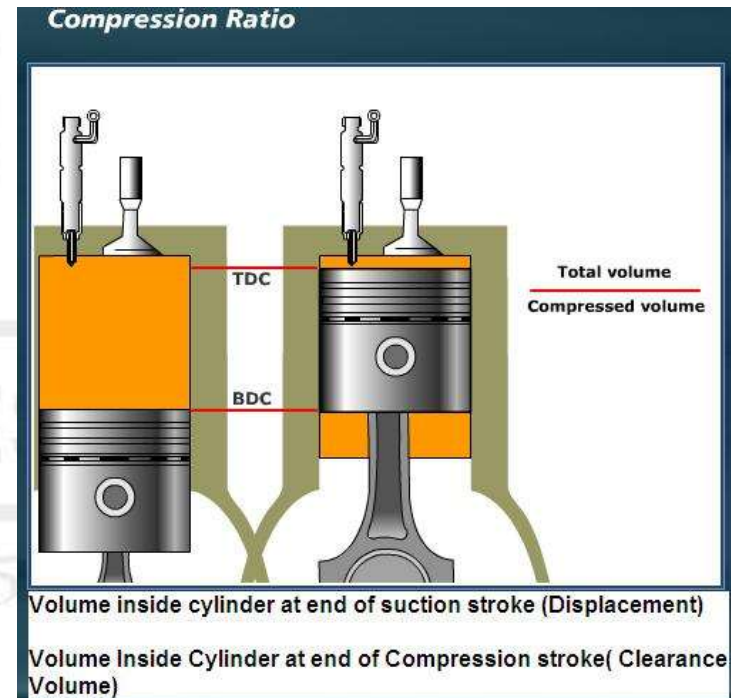
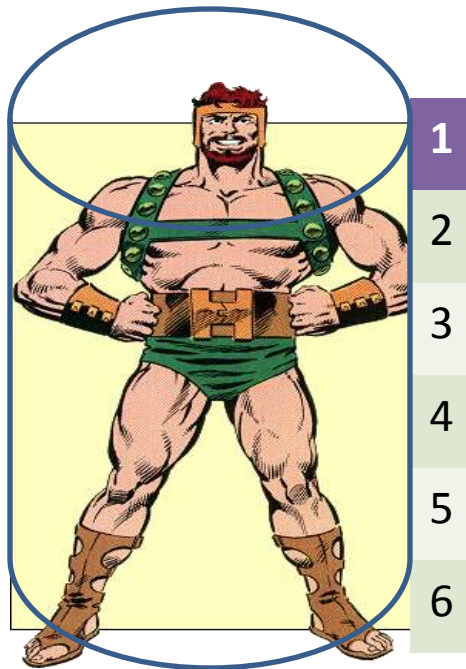
Fuel + **Air**
(Carbon + Hydrogen) + (Nitrogen + Oxygen)



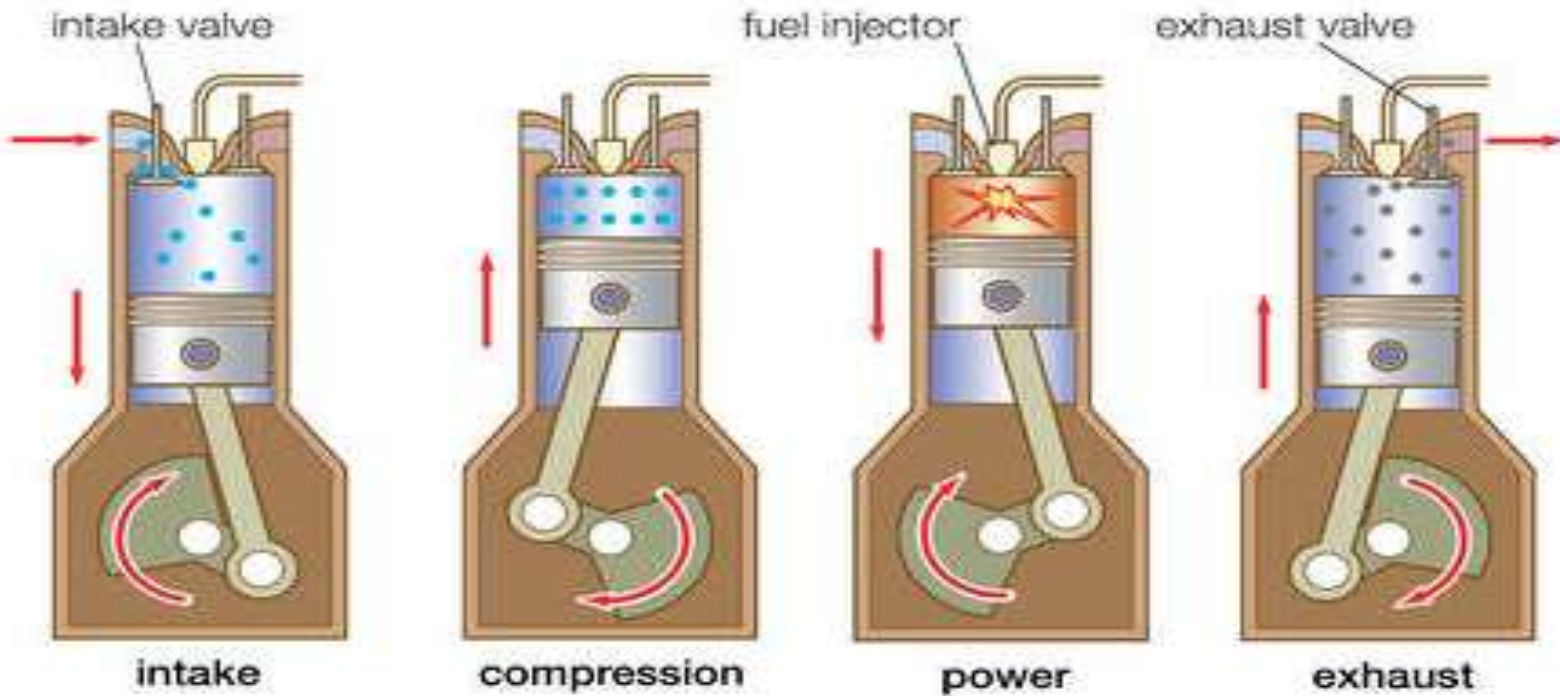
FEW IMPORTANT ENGINE NOMENCLATURE



UNDERSTANDING COMPRESSION RATIO



FOUR STROKES OF DIESEL ENGINE



A four stroke or Diesel/Expansion stroke consists of following stroke illustrated ABOVE

Compression stroke both Inlet & Exhaust valves are kept closed.

Intake / Suction stroke

- During this stroke both Inlet & Exhaust valves are kept closed. This stroke needs to be exhausted condition.
- When the piston travels from TDC to BDC, Inlet valve is opened. In this position exhaust valve is kept closed.
- When the piston travels from BDC to TDC, the air inside the cylinder is compressed. Due to this the temperature of the air rises.
- Due to the downward movement of the piston, clean atmospheric air is sucked through the air cleaner into the cylinder.
- When the piston reaches TDC, the air is compressed completely and its pressure & temperature attains a very high level.
- When the piston reaches BDC, Inlet valve is closed. Fresh air is filled inside the cylinder to operate the engine. This power reaches the flywheel through the crankshaft.

COMPRESSION IGNITION

Compression Ignition

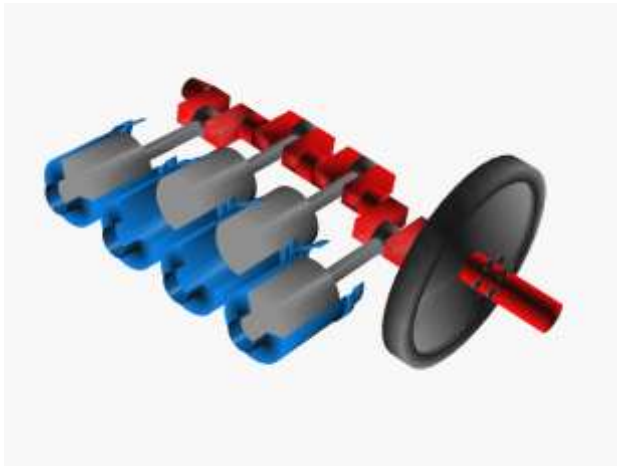


Spark Ignition

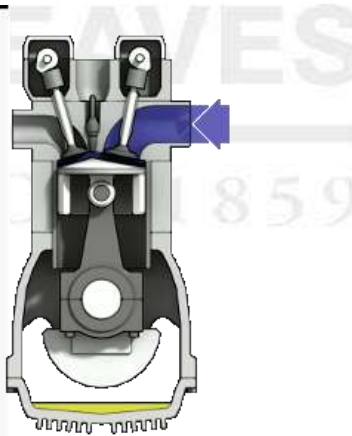
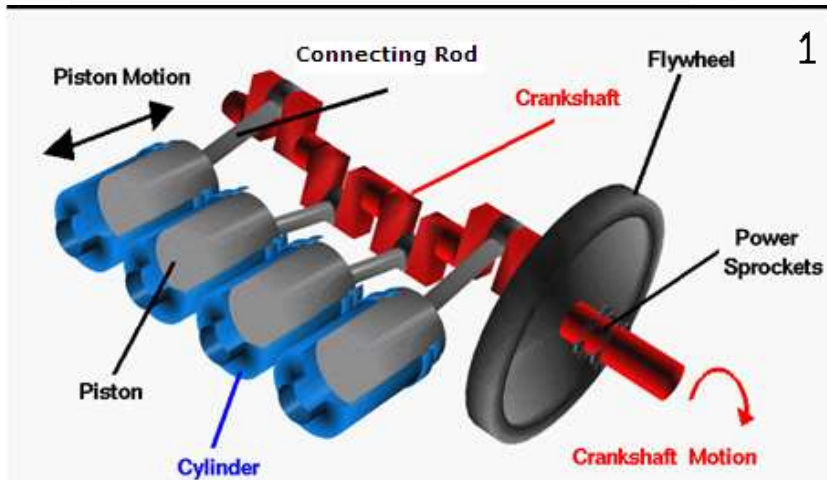


ENGINE INTERNAL SYSTEM

Power train



Valve train



AIR INTAKE SYSTEM

To provide clean & sufficient amount of air to the engine

ATMOSPHERE AIR



AIR FILTER



TURBOCHARGER



AFTER COOLER



INLET MANIFOLD



Define Filtration



➔ Segregation / separating of matter by density, particle size, colour, surface tension, material property etc



WHAT IS MICRON

μm = micrometer or micron

1 μm = 1 thousandth of one millimeter.

40 to 90 μm = human hair diameter.

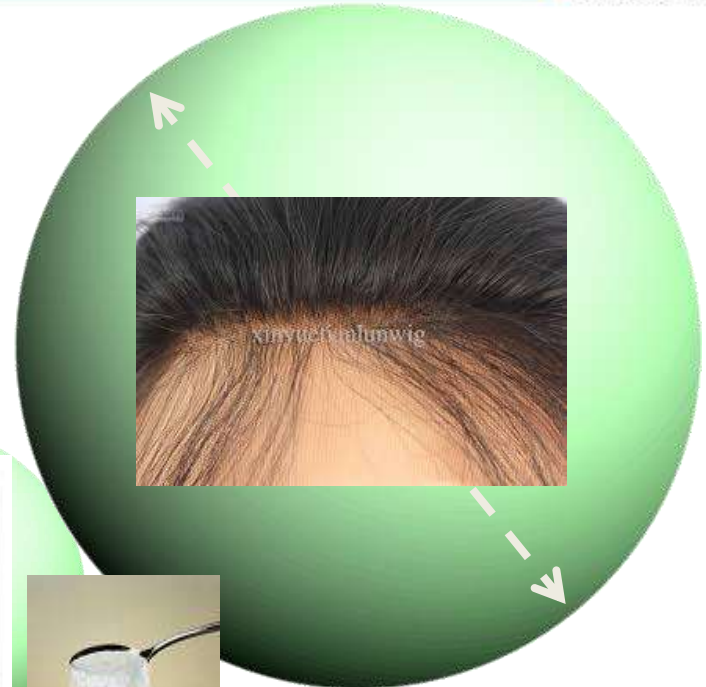
20 μm = grain of table salt.

10 μm = grain talcum powder.



5 μm

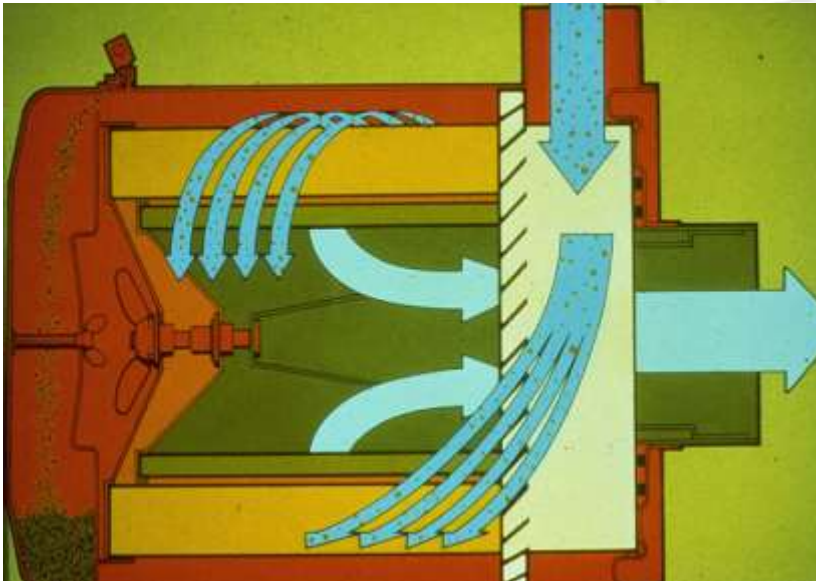
10 μm



Below 40 μm - visible only with magnification

FILTRATION BASICS

- As dirty air passes over the fins, the air swirls in a circular motion which causes the dirt to move to the outside of the housing.
- At the end of the housing is a collection pan for the dirt.
- By keeping the dirt away from the filter we get more service life.
- Cracks in the housing interrupts the flow pattern and causes short filter life and increased filter costs.



FILTRATION BASICS

A few people think that the inner element is a secondary filter. (such as in case of some fuel systems which utilize a primary and secondary fuel filter). They therefore believe the purpose of the inner element is to remove very small contaminant that may pass through the outer filter --- This is an

MISCONCEPTION



Safety Element..... *the safety net*

NOT SECOND STAGE FILTRATION

Safety / inner element

GREAVES

➤ The primary purpose of the inner element is to keep dirt and other contaminant from directly falling into the air intake system of the engine while the outer filter is being serviced.

➤ Hence the inner filter – better stated as “Safety Element” is provided for reasons of insurance, keeping the air intake system SEALED during primary element servicing. Also, in case of primary element failure or malfunction the safety will plug very rapidly causing restriction while providing the necessary safety net to minimize engine damage.

GREAVES ENGINE F.A.B'S



Always Clean from
inside to outside



Never from outside to
inside



Keep a distance between
the nozzle and the element
& air pressure should not
exceed 2 kg/cm²



Do not tap the element



Do not remove safety
element



Check for any holes using the electric bulb test. In case
you see a hole, replace the element.



DUST ENTRY INTO AIR INTAKE SYSTEM WILL LEAD TO

Excessive Dust entry or overheating will lead to

- 1) Excessive wear of piston, piston rings and liners.
- 2) Excessive wear of above components will lead to
 - a) Loss of power with excessive black smoke
 - b) High lube oil consumption
 - c) High Fuel consumption
 - d) Excessive blow by



WAY TO INCREASE ENGINE POWER

Engine Power

Power developed by an engine is related to air consumption.

More Air MASS (+ fuel) = More Power

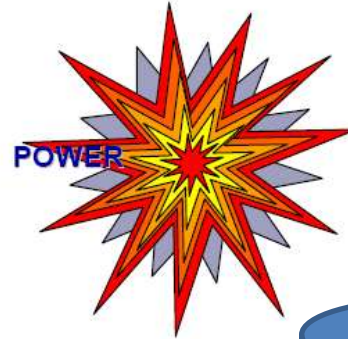


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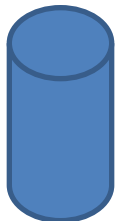
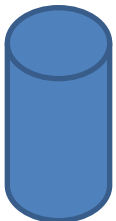
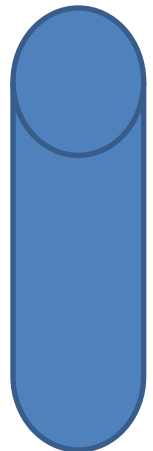
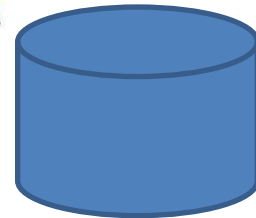
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POWER

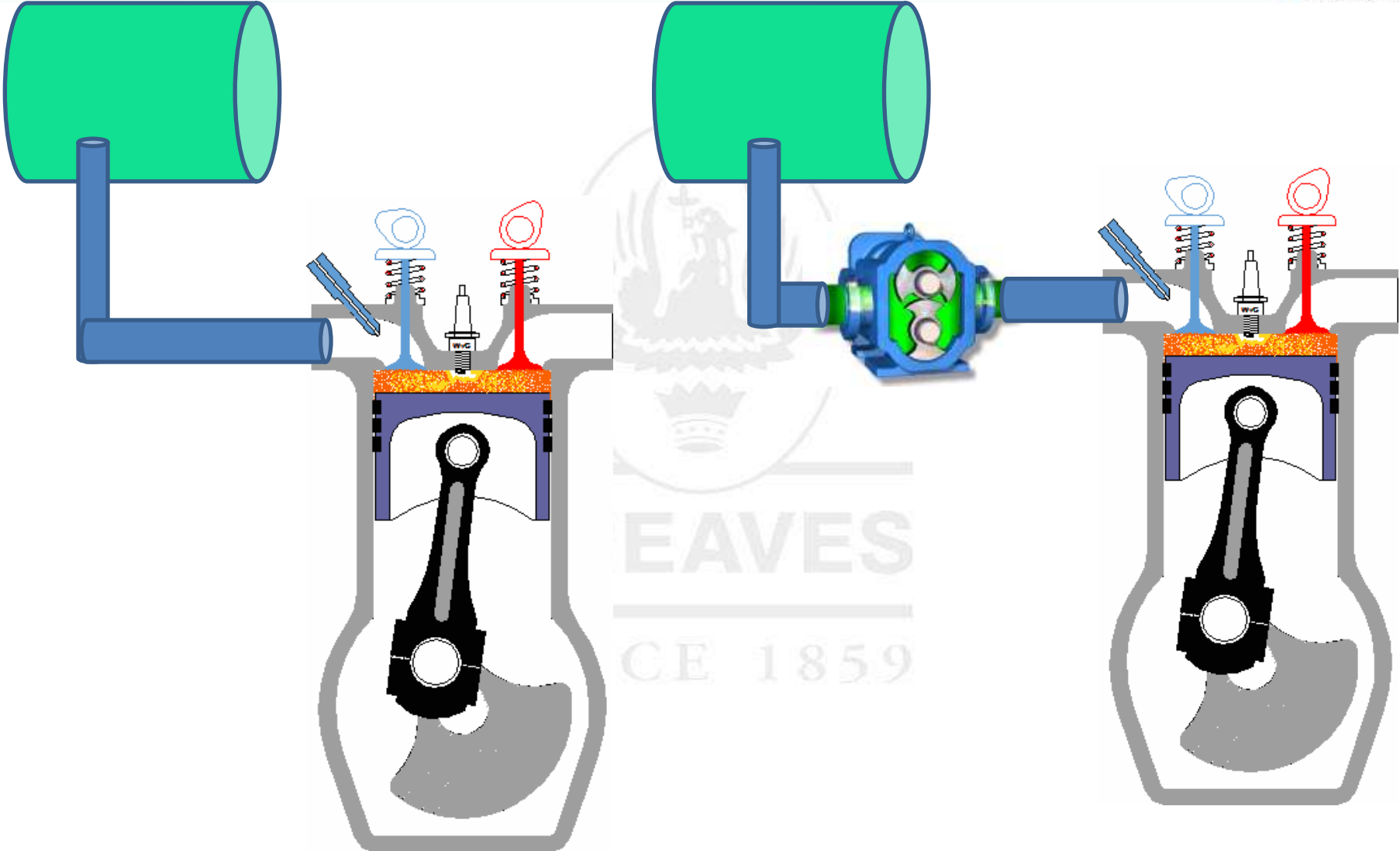


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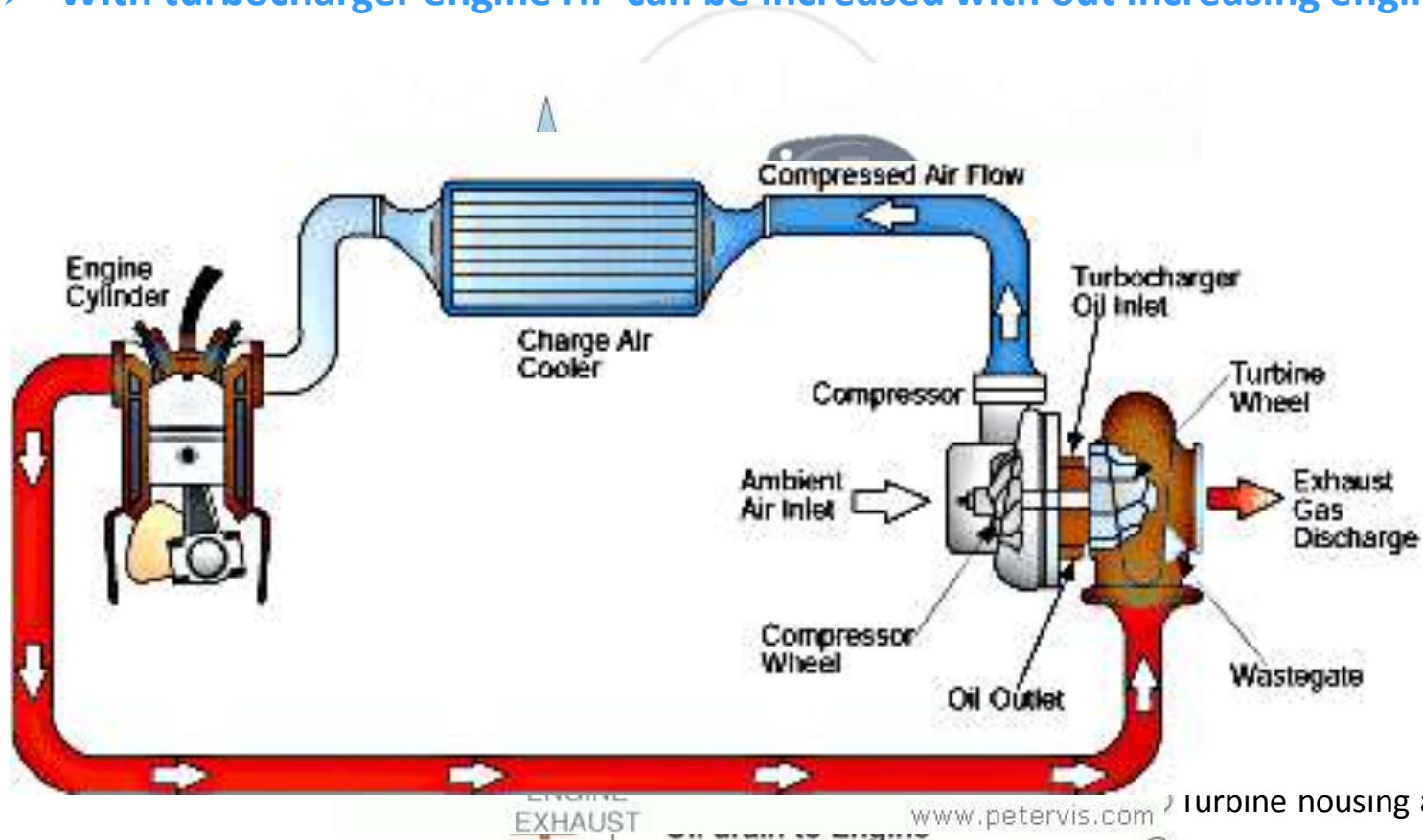


ASPIRATION



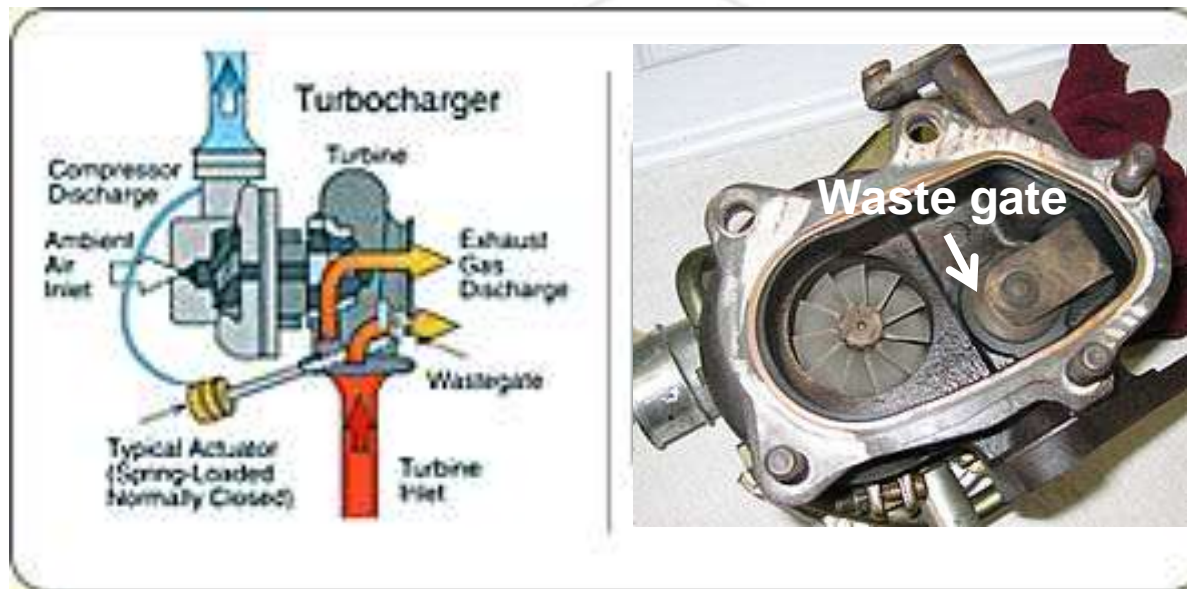
TURBOCHARGER

- Turbocharger in simple is an air supplying pump.
- With turbocharger engine HP can be increased with out increasing engine CC.



Actuator Assy.

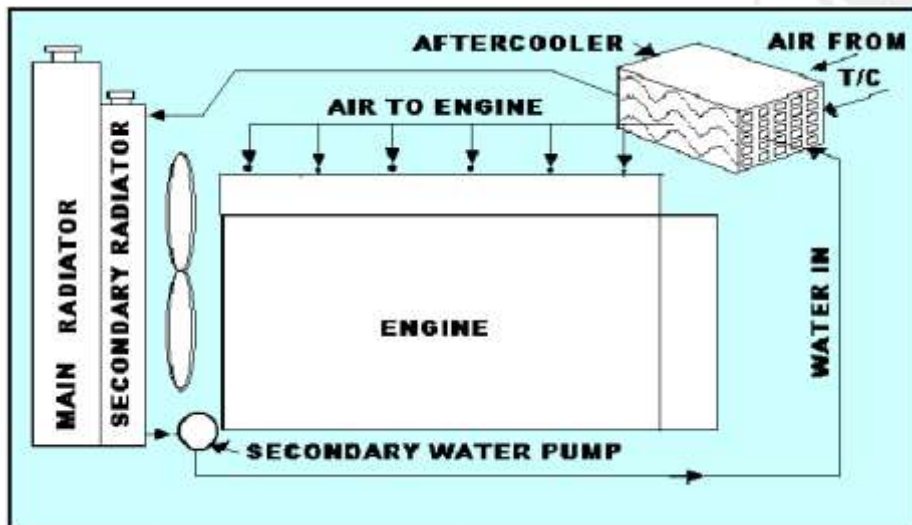
WASTE GATE – SPEED CONTROLLER



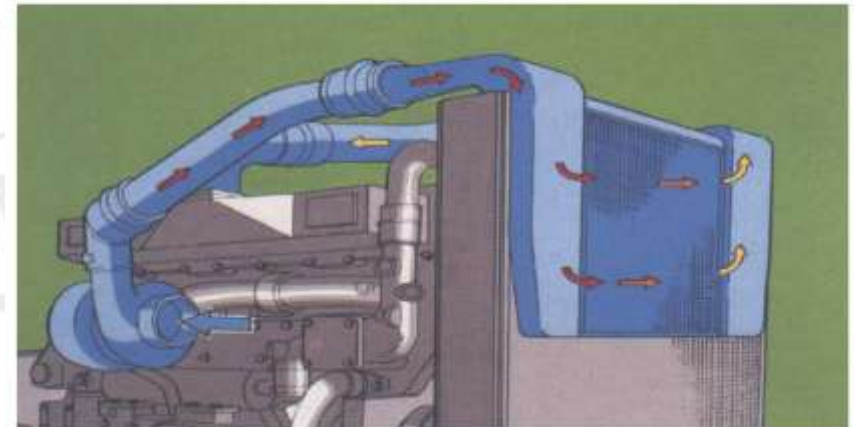
A bypass valve (waste gate/regulator) allows the turbo system to develop peak charge-air pressure for maximum engine boost response while eliminating the chance of excessive manifold pressure (over boost) at high speed.

AFTER COOLER

Need of After cooler : when the AIR is compressed in turbocharger, temperature of air increases so the density of air decreases. Decreased density affects engine power, so hot compressed air from turbocharger is routed through after cooler to reduce air temperature & there by supplying dense air to engine.



Aftercooling [Air to Air]



PRECAUTIONS FOR TURBOCHARGED ENGINES

- 1) On start up, run the engine with out Load for at least 2 minutes.
- 2) Before stopping the engine, run the engine for at least 2 minutes with out load.



OIL CARRY OVER FROM TURBOCHARGER



Oil Leakage - Compressor

An inlet 'depression'(vacuum) greater than 25 in water will 'pull' oil past the compressor end split ring seal.

THIS WILL NOT DAMAGE THE TURBO UNLESS THE THRUST BEARING FAILS.

Typical cause is a blocked air intake filter or collapsed intake pipe.

PROBABLE COMPLAINTS IN TURBOCHARGER

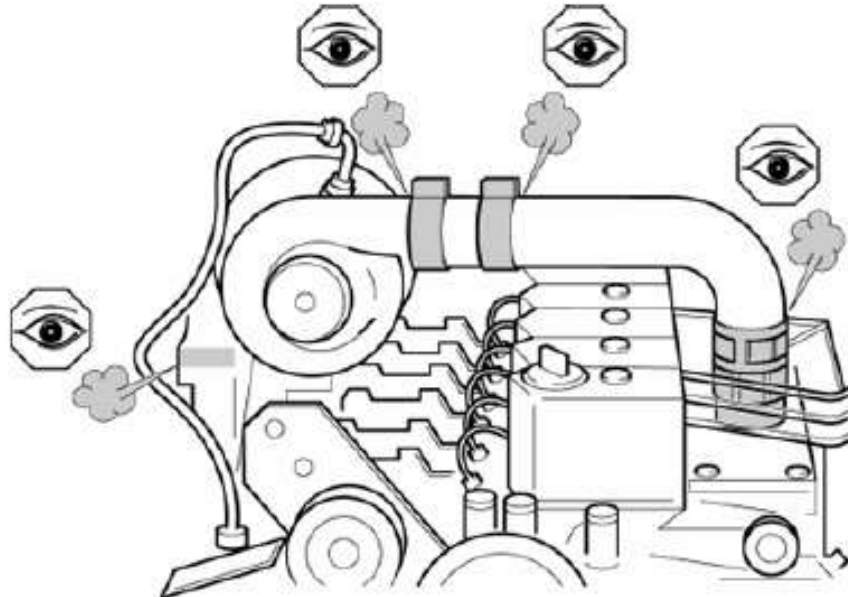
Oil Leak / Smoke

Fitting a Replacement Turbocharger

Start the engine and idle, checking that all air, gas and oil connections are tight and free from leakage.

Tighten any fastenings as required.

Use soapy water to help detect air and gas leaks.



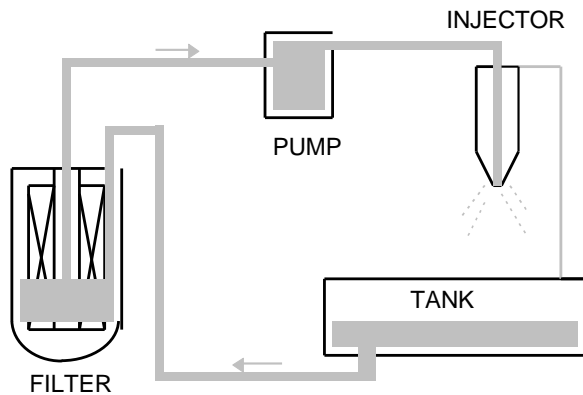
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FUEL SUPPLY & INJECTION SYSTEM



The fuel system supplies, transfers, cleans and delivers fuel to the engines' cylinders to enable combustion, thereby producing power.

The fuel system should meter the exact amount of fuel and deliver the fuel to the injector assembly with precise timing.

The major components of the fuel system that are involved in the fuel delivery process are:

- 1) The fuel tank
- 2) The fuel transfer pump
- 3) The injection pump assembly and injectors
- 4) The fuel filtration system

FIP (FUEL INJECTION PUMP)

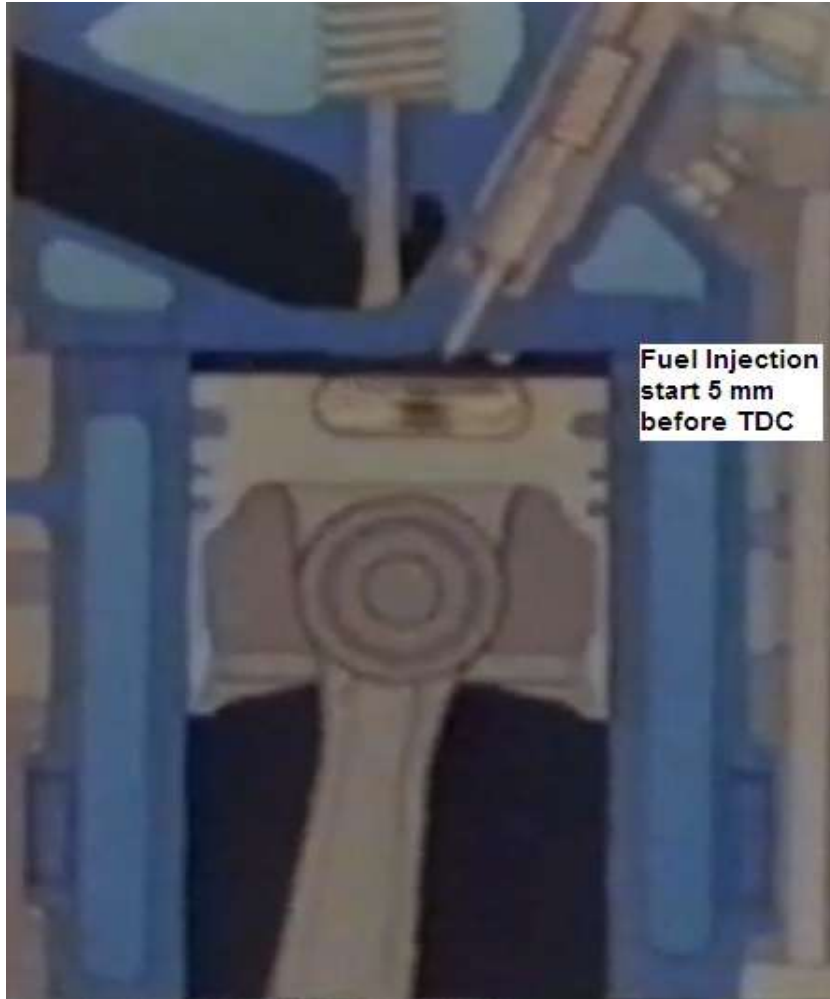


The injection pump assembly moves the fuel to the fuel injectors. The injection pump and injectors controls the volume and timing of this fuel delivery.

Fuel injection pumps are

- 1) Mechanically controlled
- 2) Electronically controlled.

FUEL INJECTION TIMING & SPILL CUT OFF



INJECTOR



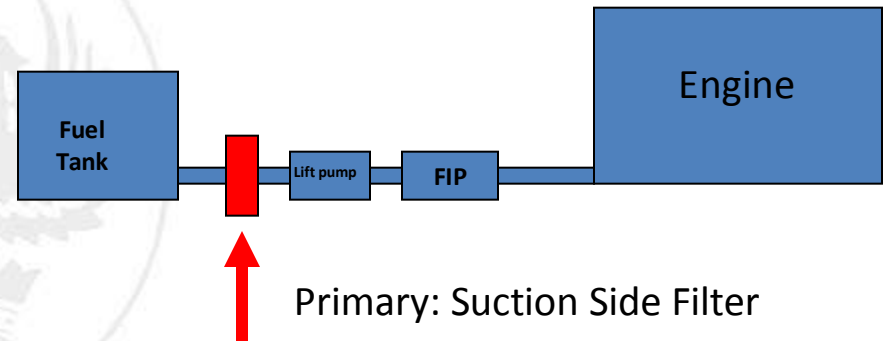
Injector is a device where fuel (diesel) gets atomized (Breaking bigger drops of fuel into small droplets), by which more oxygen will be available for each fuel droplets & small droplets heats up quickly

FUEL FILTRATION

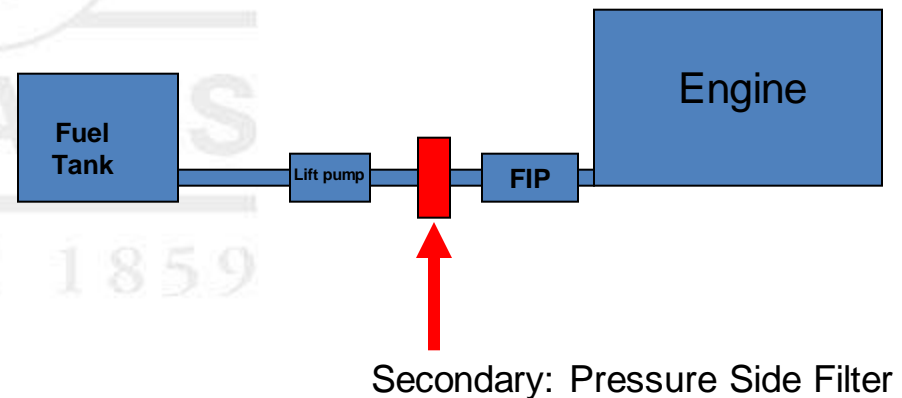
Filtration remove unwanted contaminants from the fuel before it reaches the other system components.

Two basic types of fuel filters are *primary* and *secondary* filters.

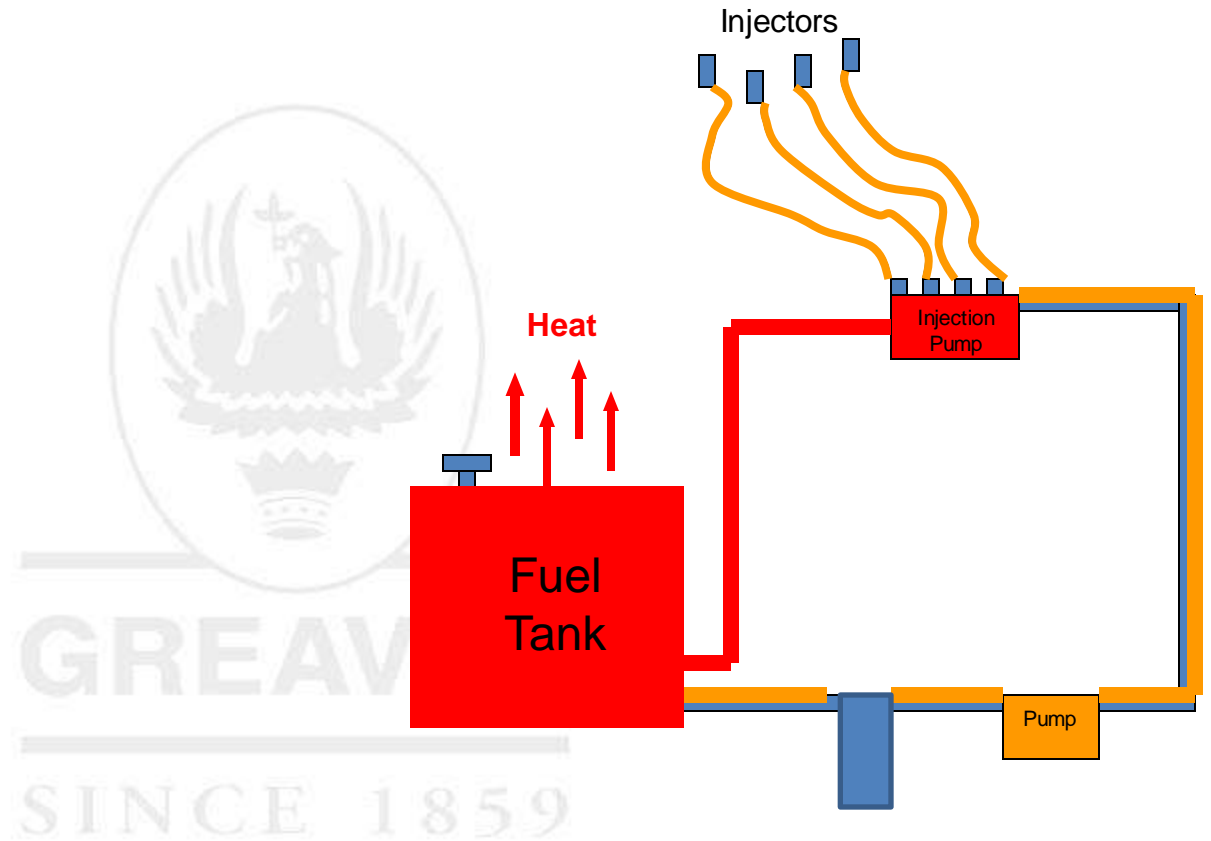
- ❖ Primary fuel filters are located between the fuel tank and the fuel transfer pump.
- ❖ They are know as *suction* side filters, as fuel is sucked through the filter by the pump.
- ❖ Their purpose is to remove contaminants before the fuel flows through the lift pump.



- ❖ Secondary filters are located between fuel lift pump and FIP
- ❖ They are known as *pressure side* filters as fuel is pushed through the filter and pressure is created.
- ❖ Their function is to remove contaminants before the fuel gets to the fuel injection pump and engine.



FUEL SYSTEM LAYOUT

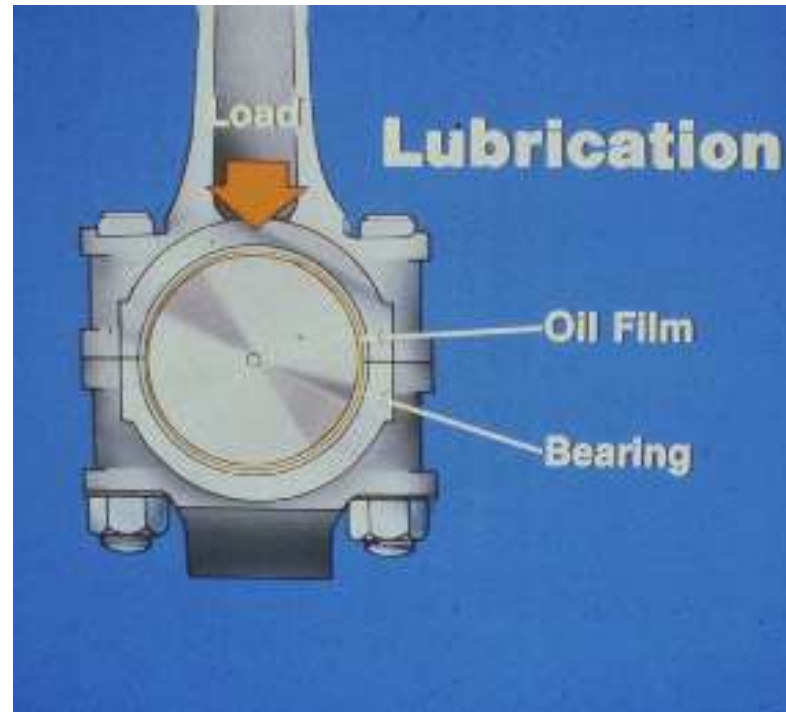


FUNCTIONS OF LUBRICATION

- **Lubricate - Reduce friction and wear**
- **Cooling - Heat transfer media**
- **Sealing - Fills uneven surfaces in eng**



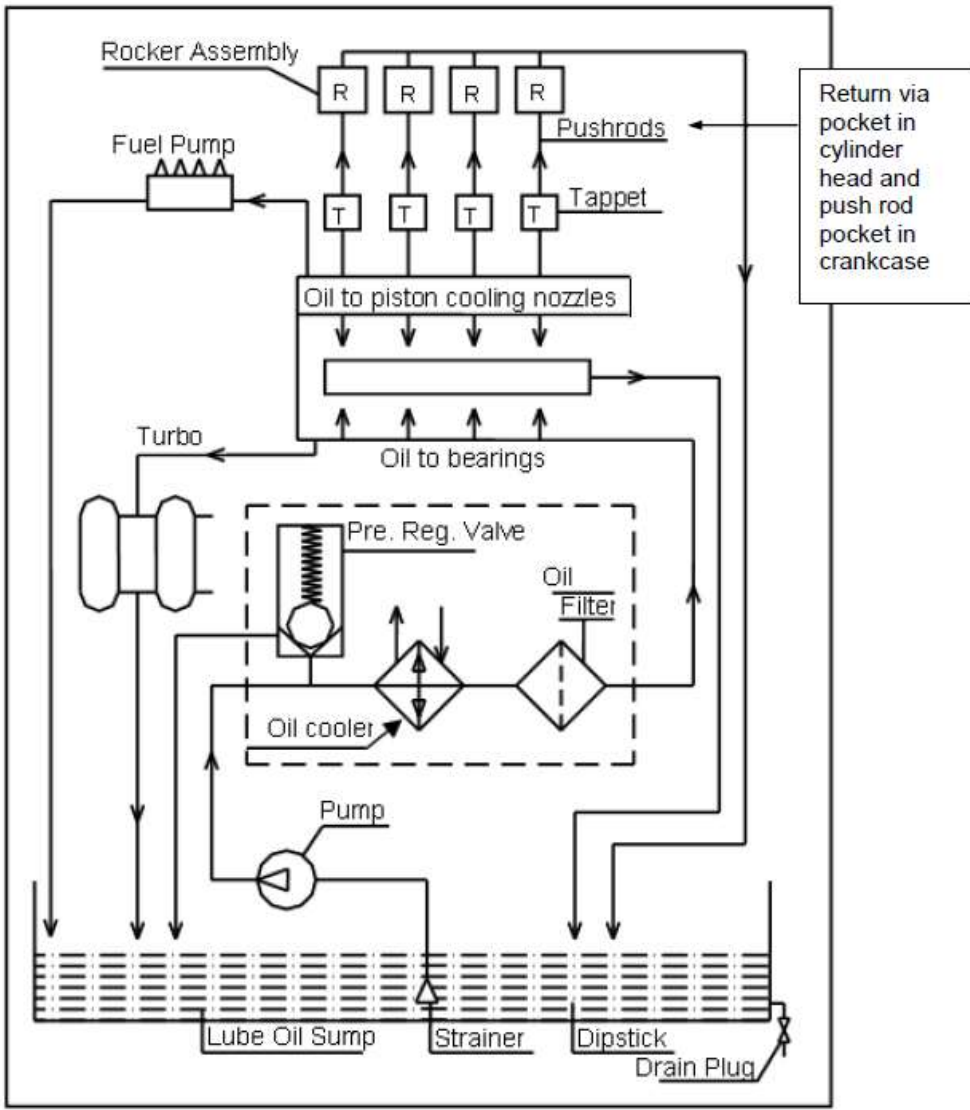
WHO TAKES THE COMBUSTION LOAD



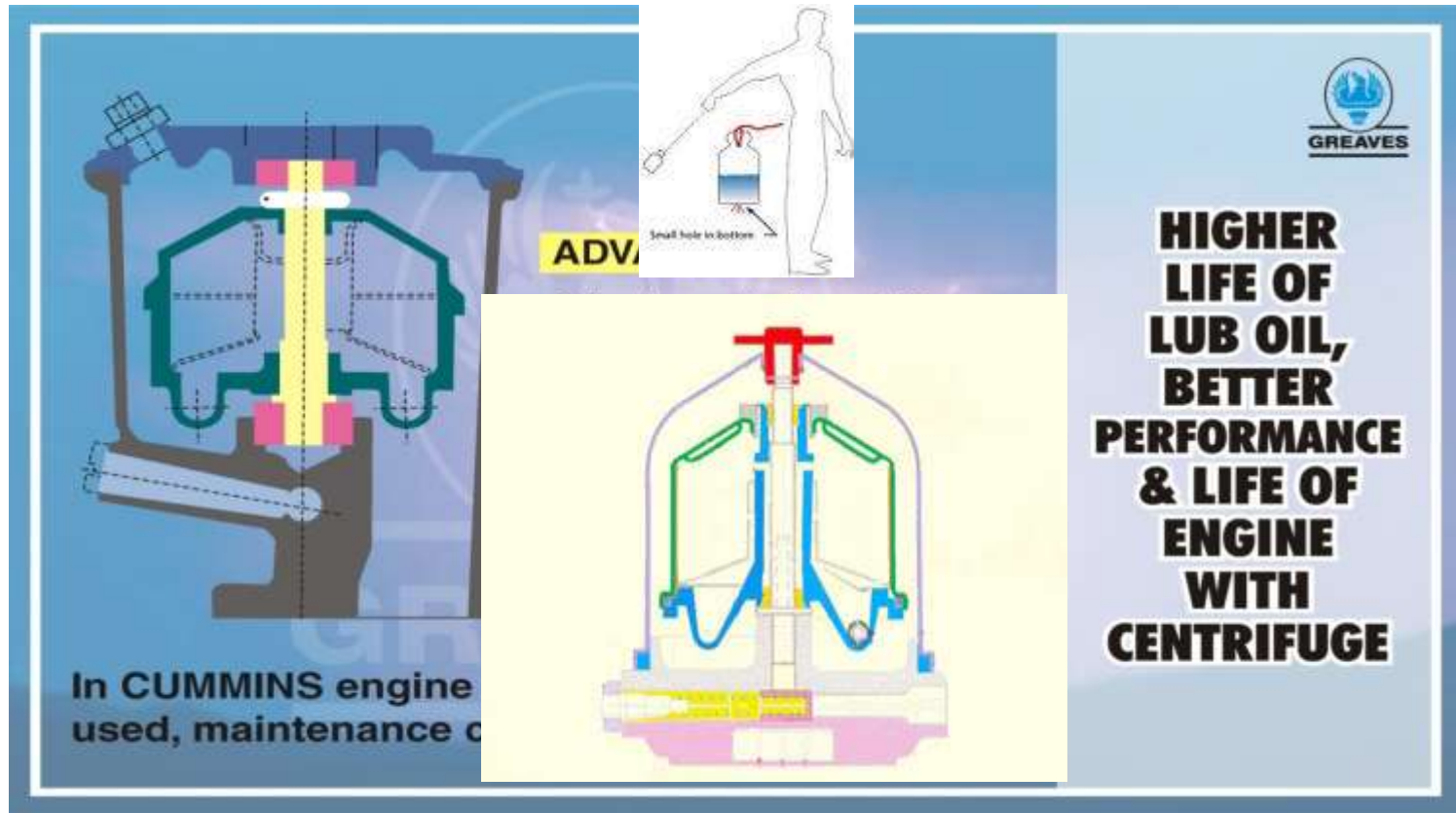
The oil must maintain a lubricating oil film between load bearing surfaces.

In rod bearings this film ranges between 5 and 15 microns in thickness. This film prevents metal to metal contact reducing wear.

LUBRICATION CIRCUIT



CENTRIFUGE OIL CLEANER (SLUDGE REMOVER)



ADV

Small hole in bottom

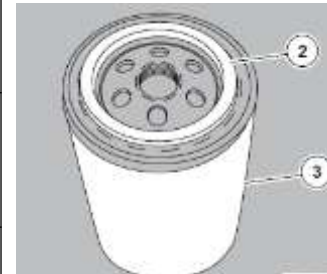
**HIGHER
LIFE OF
LUB OIL,
BETTER
PERFORMANCE
& LIFE OF
ENGINE
WITH
CENTRIFUGE**

In CUMMINS engine used, maintenance c

A Centrifuge is an oil cleansing device, it is not intended to purify foul oil in one pass, but to remove the contaminants from oil that cannot be removed by the lowest rating of washable filter

ENGINE OIL CHANGE PROCEDURE

Recommended Procedure		
A	Engine should be warm	To ensure engine oil drains with possible sediments (Sludge etc.,)
B	Filling oil filter is not recommended	As oil change is happening in dusty environment, engine parts damage is possible
C	In case Oil to be filled into oil filter,	Ensure cleanliness as filling unfiltered oil might lead to premature wear of internal components of engine
D	Apply engine oil on oil filter O ring	This ensures proper sealing & easy removal of filter in future
E	After filling engine oil in sump, dead crank the engine for 10 sec. (by holding mechanical stop lever).	Dead cranking ensures engine oil fill up in all oil galleries of engine & prevent metal to metal contact on start of engine, reduces abnormal wear of engine components
F	Repeat dead cranking for at least 2 times, keeping 10 secs. Gap between the cranks	10 sec. Gap between cranking, allows starter motor internal parts to cools down & avoid damage of starter motor armature



REASONS FOR LOW OIL PRESSURE

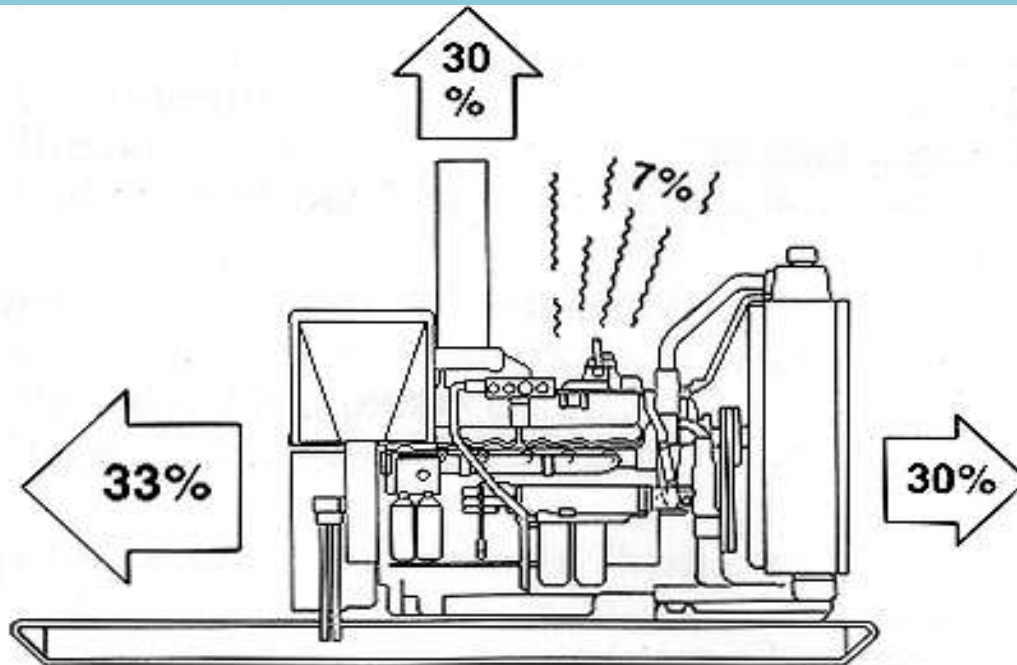
	Check Points	Action
Low Engine Oil pressure	1 Oil pressure switch / transducer defective	Check with Multimeter for continuity, if found defective replace with new one
	2 Very Low Engine oil Level	Check & top up as required
	3 Excessive External Oil leakages	Check for oil leakges, arrest the leakages.
	4 Engine Oil Level is High - Fuel dilution with Engine oil	Take out dipstick & put one or two drops of engine oil on blating paper, if oil is observed quickly by paper, indicates fuel dilution with oil. Also oil would be thin & appears to be darker than normal oil. Reason for dilution could be FIP shaft oil seal / Feed pump shaft seal defective, Injectors dribbling.
	5 Engine Oil filter choked / Clogged	Check for Low oil level indicator warning is ON, if above mentioned parameters found to be OK, check machine history & replace the oil filter.
	6 Engine oil cooler choked / clogged	Check machine service history to ascertain regular services are carried out, replace the cooler element if found choked.
	7 Excessive Internal oil leakages	Ref. Engine repair manual
	8 Pressure relief valve in oil pump stuck in partial open condition	Remove oil pump from engine & check relief valve condition, if found defective replace with new one.
	9 Oil pump defective	Ref. Engine repair manual
	10 Excessive clearance in Main / connecting rod bearings	Ref. Engine repair manual

NEED OF COOLING SYSTEM IN ENGINE

Heat generated from fuel – air combustion

33% - Horsepower
30% - Exhaust
7% - Radiation
30% - Cooling System

The cooling system removes heat to protect the engine.

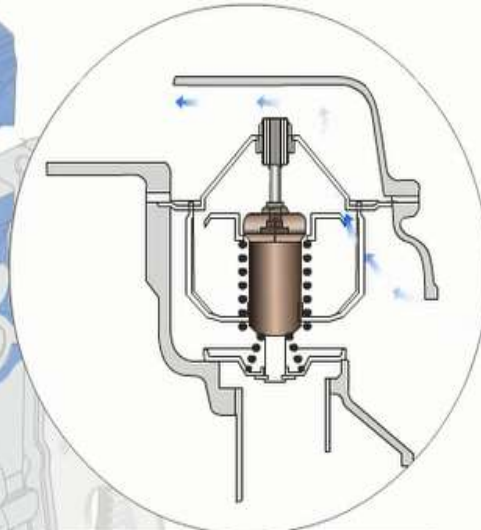
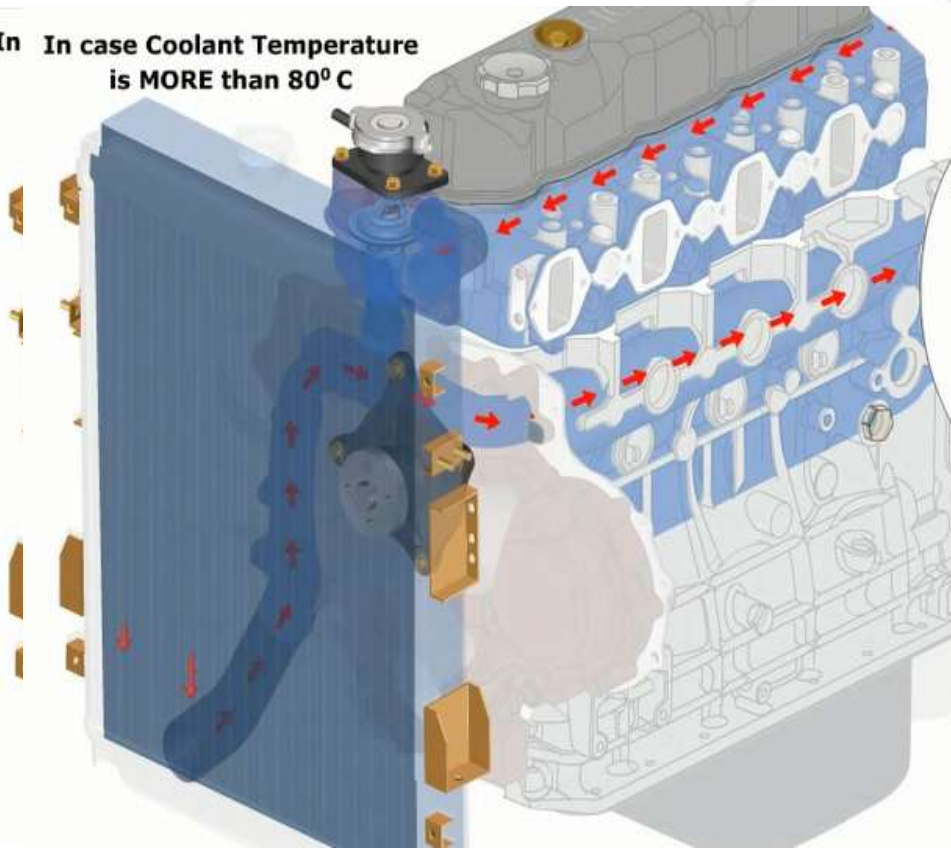


COMPONENTS OF COOLING SYSTEM

- **WATER PUMP** – Circulate / Coolant Flow
- **THERMOSTAT** – Maintain Operating Temperature
- **COOLING FAN** – Sucks Air through radiator fins
- **OIL COOLER** – Cools the engine oil
- **RADIATOR** – Heat changer, coolant temperature exchanged to atmosphere air.
- **RADIATOR PRESSURE CAP** – To Maintain pressure in cooling system, there by increasing boiling point of coolant.
- **Condenser /RECOVERY TANK/DEGASSING TANK** – Receives hot coolant / Vapour from radiator , to condense & returning to cooling system when pressure drops inside radiator.
- **DRIVE BELTS & HOSES** – To drive the water pump & cooling fan.

WHY THERMOSTAT

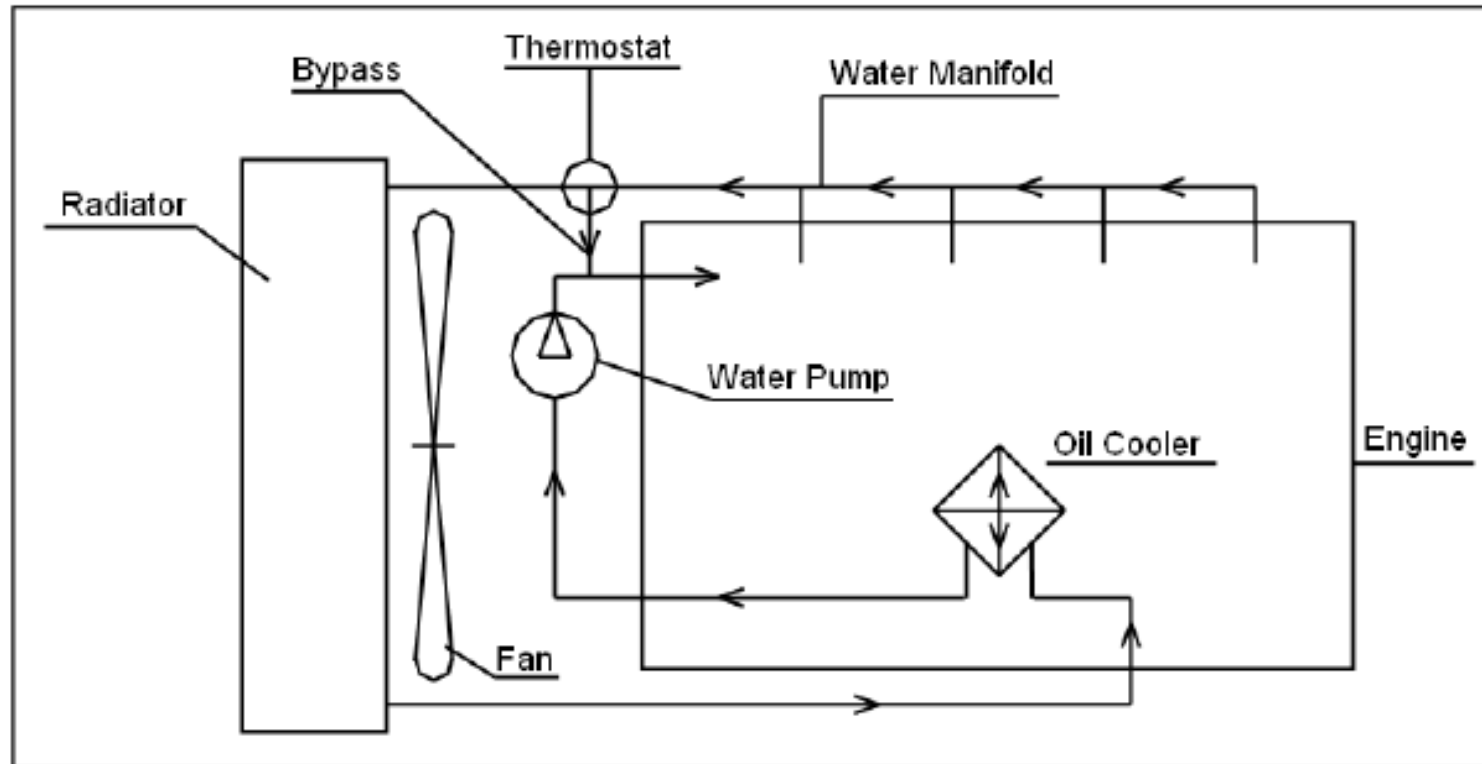
In case Coolant Temperature is MORE than 80° C



Thermostat
Coolant Temperature above 80° C



COOLING CIRCUIT - SAMPLE



SINCE 1859

NEED OF RADIATOR PRESSURE CAP

Pressure		Boiling Point	
psi	bar	deg F	deg C
14.69	1.0	212	100
15	1.0	213	101
16	1.1	216	102
17	1.2	219	104
18	1.2	222	106
19	1.3	225	107
20	1.4	228	109
22	1.5	233	112
24	1.7	238	114
26	1.8	242	117
28	1.9	246	119



- Increase cooling system pressure increases boiling point of water or coolant
- To increase cooling system pressure, radiator pressure cap is used.
- Radiator cap – how it works
 - Pressure valve
 - Vacuum valve

WHY TO USE COOLANT IN COOLING SYSTEM

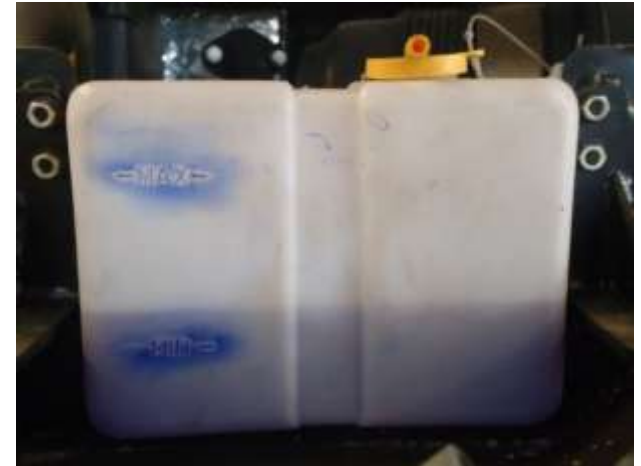
Boiling Point means the temperature at which water converts to gas state from liquid state

Coolant is a mixture of water and **Ethylene Glycol (C₂H₆O₂)**, also known as [Antifreeze](#) & [Anticorrosive](#). By adding ethylene glycol to water, the boiling and freezing points are improved significantly.

- Coolant** – Increase the boiling Point of mixture
 - Boiling point of Pure water = 100° C
 - Boiling Point of 50:50 ratio coolant & water = 106° C
- Anti freeze – Prevent mixture from freezing (icing)
- Anti Rust – Prevent Metal parts from getting rusted



NEED OF COOLANT RESERVOIR



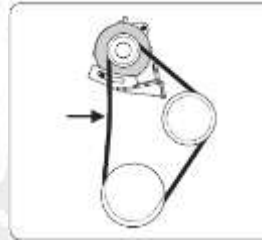
1. Knowing Coolant level without opening radiator cap.
2. Minimize coolant loss
3. Emergency reservoir, in case of coolant loss from radiator or engine.

BASIC CHECKS FOR HIGH COOLANT TEMPERATURE

- Ambient Temperature



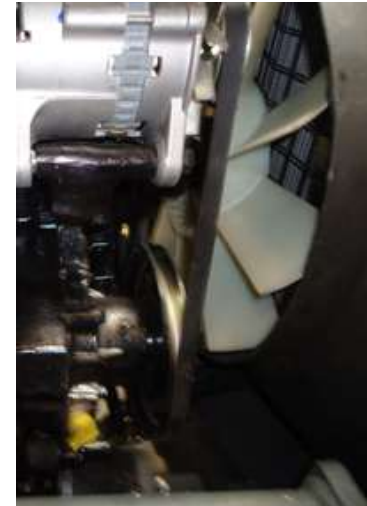
- Fan belt tension



- Radiator fins clogged



- Radiator shroud missing / damaged



NEED FOR EGR

Principles of exhaust gas recirculation (EGR)

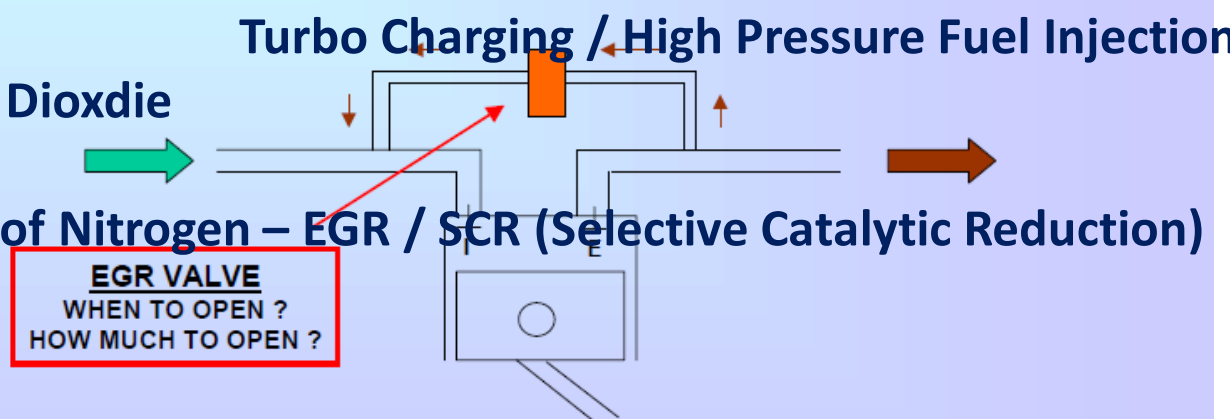
EGR system recirculates part of the burnt exhaust back in to the intake system, to help in reducing the combustion temperatures as well as reducing the quantity of free oxygen.

1. Co – Carbon Monoxide

2. Co₂ – Carbon Dioxide

3. No_x – Oxides of Nitrogen – EGR / SCR (Selective Catalytic Reduction)

4. H₂O - Water





NEXT – GREAVES ENGINE FAMILIARIZATION

GREAVES ENGINE PRODUCT RANGE



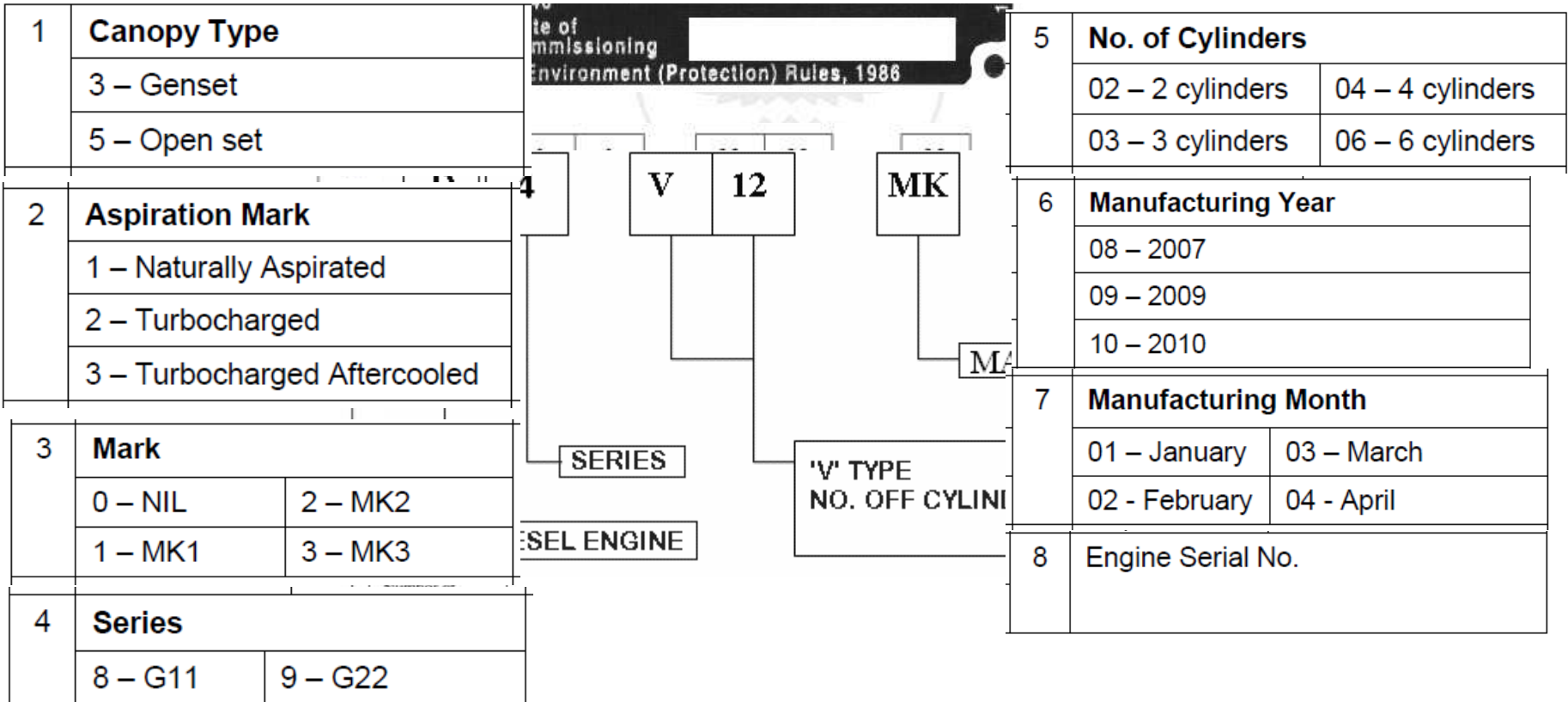
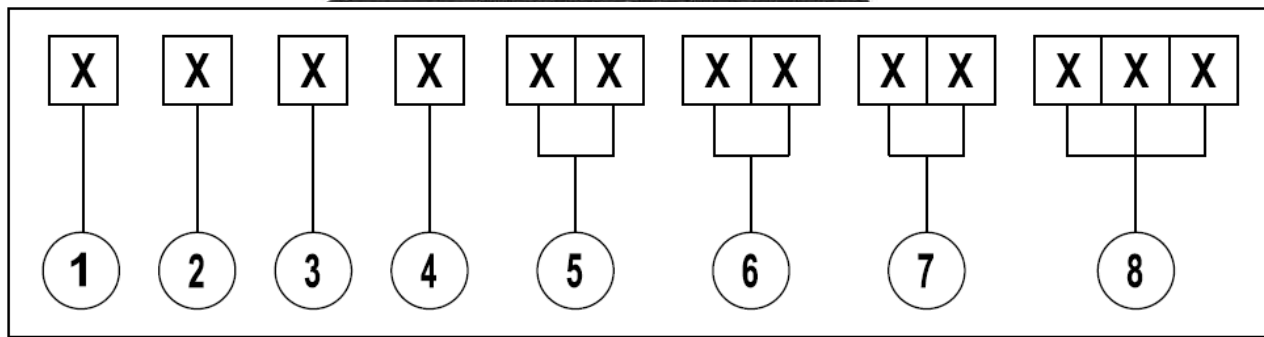
D - SERIES ENGINES



G - SERIES ENGINES



ENGINE NUMBERING LOGIC



D SERIES ENGINE RANGE

D- SERIES ENGINES

D3

**313 HP – 484 HP
1500 RPM**

ENGINE MODEL

TBD3V6 MK II

TBD3V8 MK II

TBD3V12 MK I



D4

**604 HP
1500 RPM**

ENGINE MODEL

TBD4V12

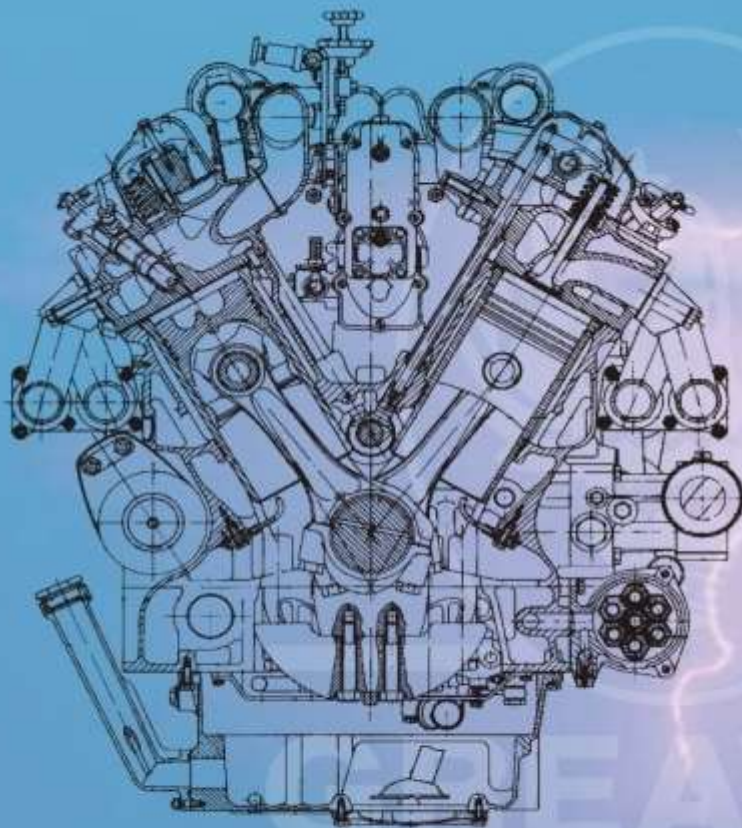
GREAVES
SINCE 1859

D SERIES ENGINE GENSET RANGE

MODEL NO	GROSS BHP @ 1500 rpm	Rating
TBD3V6 MK II	344.3	250 KVA
TBD3V8 MK II	435.6	320 KVA
TBD3V12 MK I	532.4	400 KVA
TBD4V12	664.4	500 KVA

GREAVES
SINCE 1859

D3 SERIES ENGINE



**Inline engines of same HP
are longer in length & height.**

ADVANTAGE :

Shorter in length & height. Shorter length means shorter crankshaft which means sturdier crankshaft.



**SAVE SPACE
& MONEY-
'V' 60°
CONFIGURATION**

D SERIES ENGINE FEATURES



GREAVES
SINCE 1859



CUMMINS NH, NT, VT have common head for 2 or 3 cylinders while Caterpillar engines have one head common for all cylinders which involves costly and time taking repairs.



GREAVES

**INDIVIDUAL
CYLINDER
HEAD -
EASY AND
ECONOMICAL
REPAIRS**

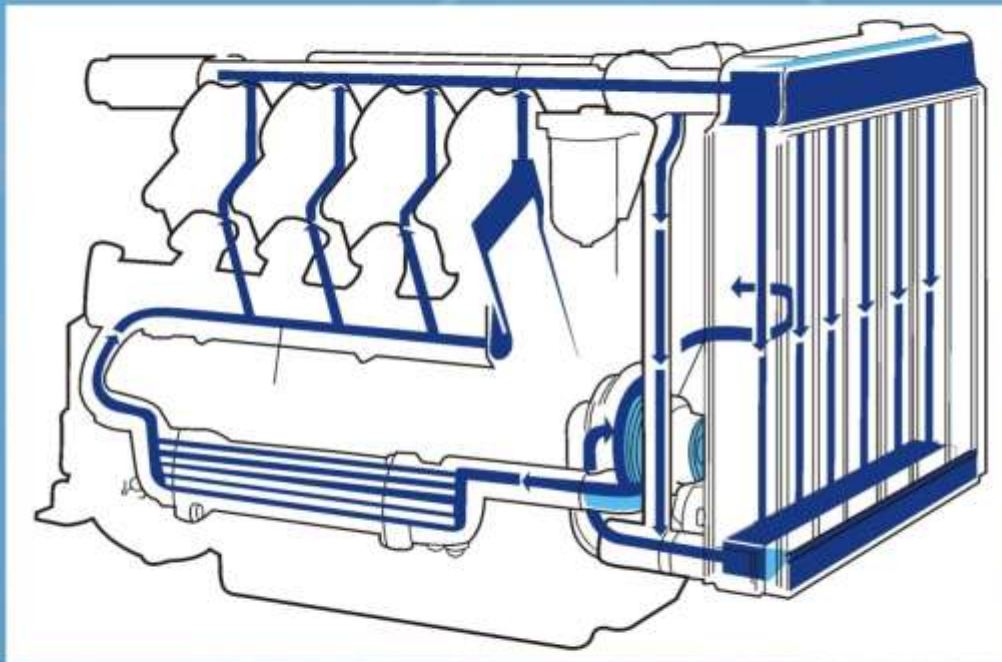
D SERIES ENGINE FEATURES



GREAVES
SINCE 1859



GREAVES

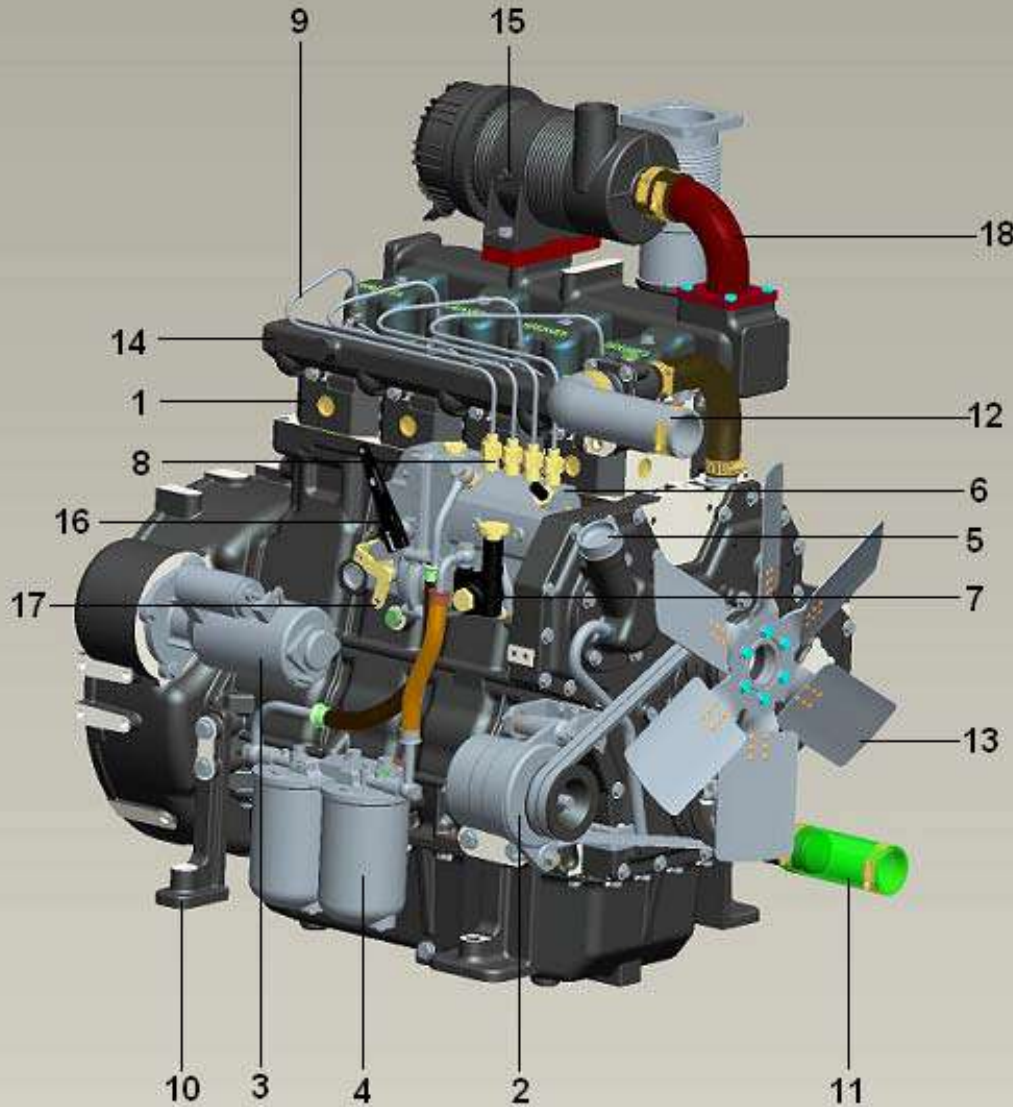


**MOST OF THE OTHER ENGINES HAVE
LINER PITTING PROBLEM DUE TO CAVITATION**

**MOST EFFICIENT
COOLING SYSTEM
HAVING NO
CAVITATION.
NO PITTING
ON LINERS
EVEN AFTER
RUNNING
5000 HOURS.**

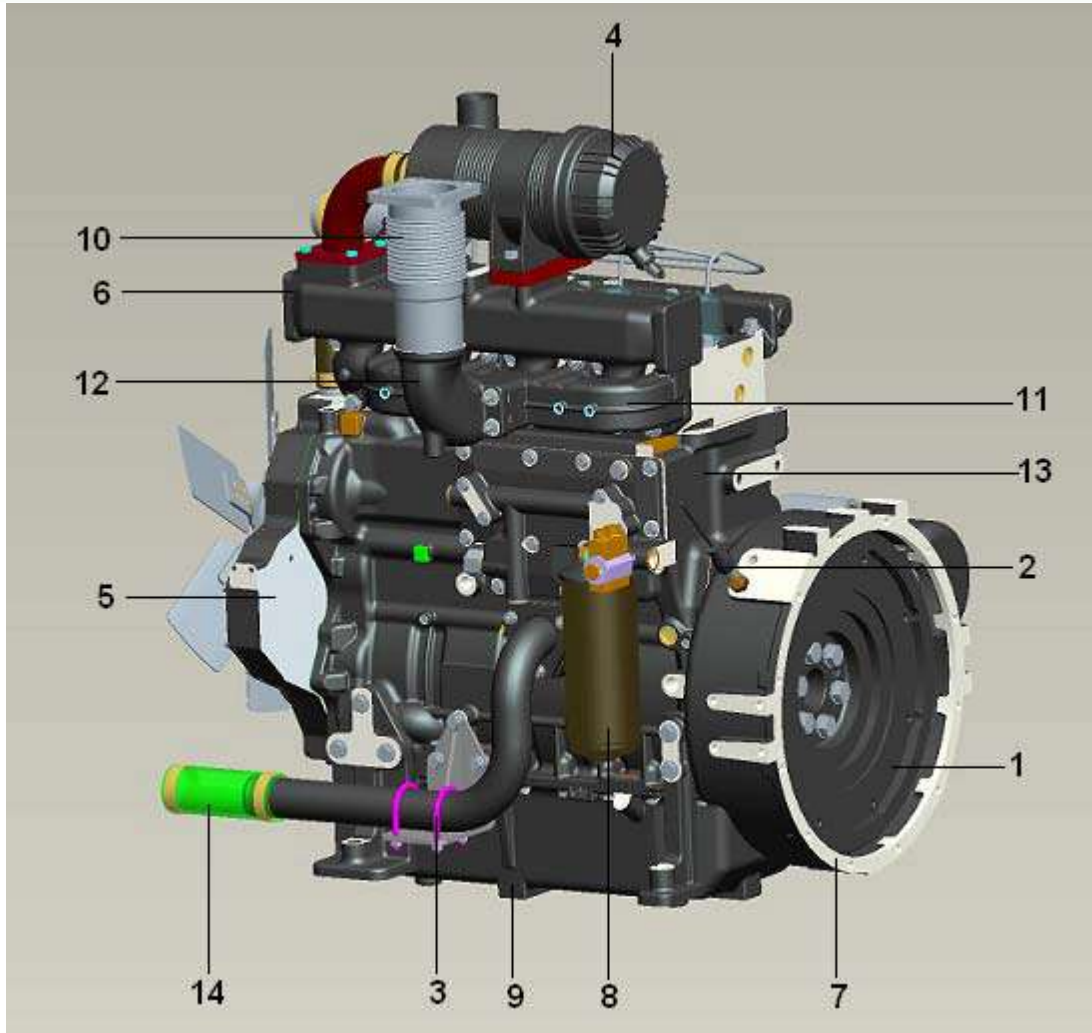
G SERIES ENGINE

ENGINES



1	Cylinder head
2	Battery charging alternator
3	Starter
4	Fuel filter
5	Oil filler cap
6	Fuel pump
7	Fuel feed pump
8	Injector
9	High pressure pipe
10	Engine foot
11	Water in
12	Water out
13	Fan
14	Water inlet manifold
15	Air filter bracket
16	Stop lever
17	Throttle lever
18	Air inlet pipe

G SERIES ENGINE



1	Flywheel
2	Sensor
3	U clamp
4	Air filter
5	Gear end casing
6	Air intake manifold
7	Flywheel housing
8	Lub. oil filter
9	Oil sump
10	Exhaust out let
11	Exhaust manifold
12	Exhaust bend
13	Crank case
14	Radiator Hose

G SERIES ENGINE FEATURES

INTEGRAL PLATE TYPE OIL COOLER

Cartridge type Integral Oil cooler. Lesser connections.
Leakage Eliminated

INTERNAL GEAR DRIVEN WATER PUMP

Eliminates a failure avenue in the engine.

INDIVIDUAL CYLINDER HEADS

Easy Maintenance and greatly reduced engine down times.
Reduced spare cost while replacing.

COMMONALITY OF PARTS

Common working parts right from 3 Cylinder to 6 Cylinder.
Less spares to store for user.



INDEPENDENT FAN MOUNTING

Fan is mounted independent of the water pump.
Enables total flexibility in fan positioning.

AUTOMOTIVE GRADE GEAR TRAIN

Ensure that this engine has the most silent sound map among all competition.

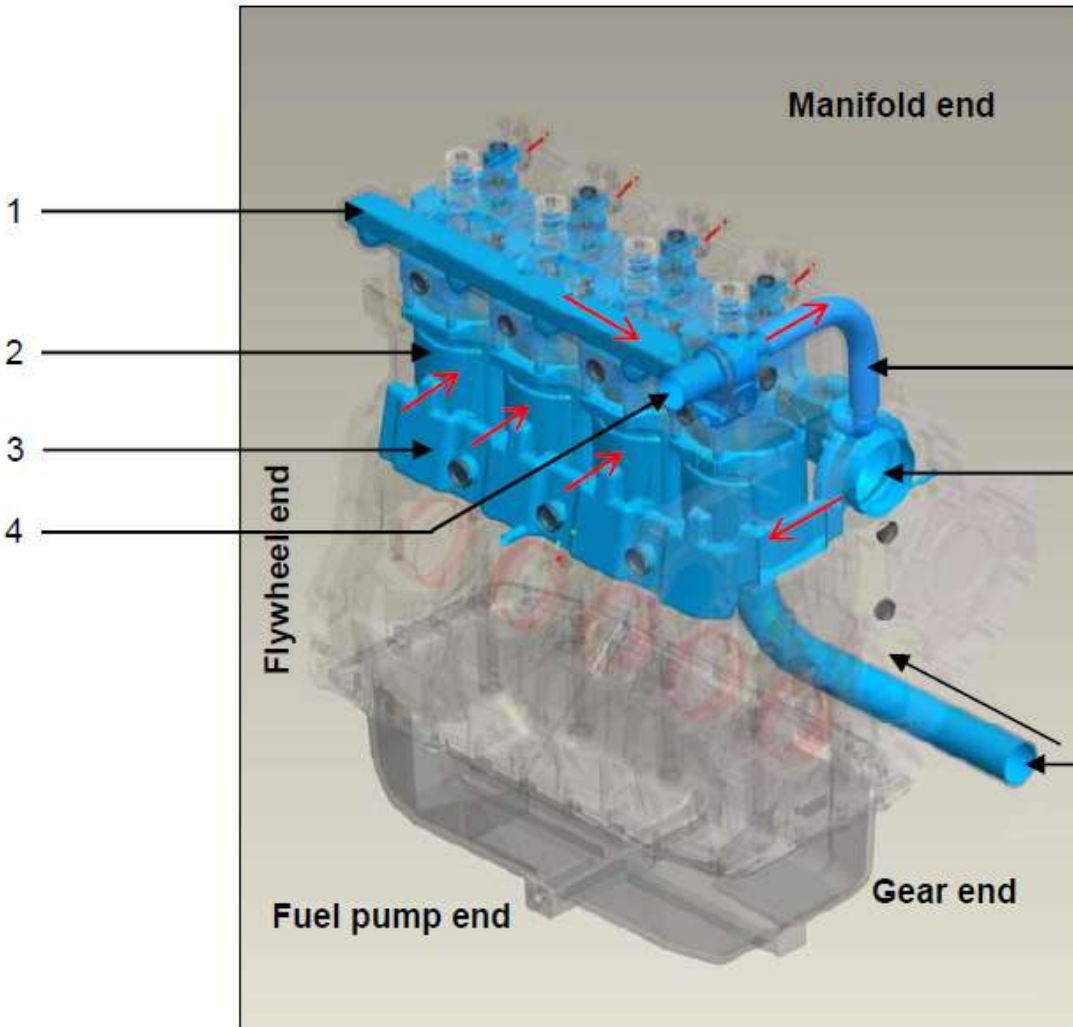
DEEP SKIRTED CRANK CASE

Gives rigidity and Stability to the design of the engine.

TWIN BELT DRIVE FOR FAN

Two belts drive the fan. Ensures extra safety.
Engine runs even if one belt fails.

G SERIES COOLANT FLOW



1	Water outlet manifold
2	Cylinder water cavity
3	Water core
4	Water out

5	Bypass
6	Water pump
7	Water in

7	Bypass
	Water pump
	Water in from radiator
	Oil cooler cavity
	Cylinder head
	Water manifold
9	Weeping hole

COOLING SYSTEM FILLING

- 1) Open the de-aeration plug provided on thermostat housing.
- 2) Open the radiator cap.
- 3) Ensure all hoses are in place & tight.
- 4) Prepare coolant mixture in ratio of 20:80 i.e. 20 distilled water.
- 5) Slowly pour coolant through radiator cap.
- 6) Between pouring Wait for few seconds to allow
- 7) Fill the Coolant until it overflows from de-aeration plug opening.
- 8) Close the de-aeration plug.
- 9) Keep on filling the coolant till it fills up to filler neck in radiator top tank.
- 10) Start the engine with out closing the radiator & run for 2 minutes, so to allow entrapped air to escape.
- 11) Stop the engine, check coolant level in radiator, if found low top up & fit radiator cap firmly.



DRAINING COOLING SYSTEM

- 1) For draining coolant 3 drain plugs are provided in cooling system.
 - 1) The drain plug on oil cooler head is for draining the coolant only up to cylinder head level.
 - 2) The drain plug on crankcase is for draining coolant below cylinder head level.
 - 3) The drain plug on the radiator is for draining coolant from the radiator.
- 2) Drain the coolant in a tray.
- 3) Dispose off the coolant safely in an environment friendly manner.



What is fuel system bleeding : Removal of trapped Air from System

When to bleed fuel system

1. Air lock due to low fuel level, leakages, defective washers etc.,
2. On replacing fuel filters
3. On removal of High pressure pipes
4. In case engine is been stored for long duration

Fuel system Bleeding Procedure

- 1) Check & ensure required fuel level in fuel tank.
- 2) Loosen feed pump knob.
- 3) Loosen bleeding screw on fuel filter head or fuel outlet banjo on FIP
- 4) Operate feed pump manually, till fuel comes out of bleeding screw or banjo & free from air bubbles.
- 5) Once bleeding is done tighten feed pump Knob.



ENGINE PRESERVATION

1. Engine preservation during prolonged period of non-usage

If the period between engine dispatch from Greaves and the installation is more than six months or if a engine is to be non operational for more than twelve months, the engine has to be preserved to avoid damage due to corrosion, dust, and other factors. Preferably a preserved engine should be covered in plastic sheet and stored in cool dry, shaded place.

2. Following instructions are to be followed for engine preservation:

1. Run the engine with clean fuel at rated speed at no load for about 10 minutes. This warms up the engine and the lube oil is circulated all over inside the engine.
2. Stop the engine and immediately drain the oil. Fill up the engine with one of the preservative oils to the low level mark on dipstick. Choose preservative oil from the list given below.
3. Run the engine at rated speed with no load for 5 minutes.
4. Make a clean solution of preservative oil and diesel (1: 5 ratio) and connect the mixture to the fuel pump inlet by gravity feed.
5. Drain the coolant from cooling system. Rinse the system thoroughly with clean water. Fill the cooling system with mixture of water and any of the coolant additives listed - in the requisite ratio.

6. Crank the engine and run it at rated speed with no load for half a minute. Stop the engine.
7. Remove air cleaner, fuel filter and lube oil filter, pack them separately.
8. Drain preservative oil from sump and refit the drain plug. Drain water-preservative mixture from cooling circuit. Treat all unpainted open surfaces with rust preventive coats.
9. Seal all openings with caps, plastic sheets or waterproof paper. Seal the dipstick with the tape.
10. After this point do not rotate the engine.
11. Remove belts and store separately.
12. The battery should be disconnected. Ensure electrolyte level. Charge the battery at regular intervals.
13. Put a mark on the engine indicating date of preservation.
14. Periodically inspect the engine for corrosion, effects of humidity and dirt.
15. The above procedure has to be repeated after every 12 months.

ENGINE DE PRESERVATION

- 1) Remove all seals. Clean up the engine. Remove rust preventive coat.
- 2) Fit air cleaner, fuel filter, Lube oil filter, and belts. Use new filter elements. Apply correct tension to the belts.
- 3) If rubber components (Hoses, belts, etc) are cracked or brittle, replace them.
- 4) Fill up correct grade oil up to the high level mark on dipstick.
- 5) Fill up coolant. Remove trapped air.
- 6) Connect supply of clean fuel. Remove trapped air.
- 7) Fit a charged battery. Check the electrical connections.
- 8) Run the engine at rated speed at no load for 5 minutes. Observe and look for any irregular noise, vibration, etc. If some irregular behavior is observed take corrective actions or call authorized service dealer.
- 9) Start the engine and put it into service.

MINOR TROUBLESHOOTING

- 1) Engine doesn't cranks
- 2) Engine cranks but doesn't start
- 3) Excessive Black smoke
- 4) Excessive White smoke
- 5) High coolant temperature
- 6) High Lube oil consumption
- 7) High fuel consumption

Thank
You

SINCE 1859