

Diesel Engine Power Plant

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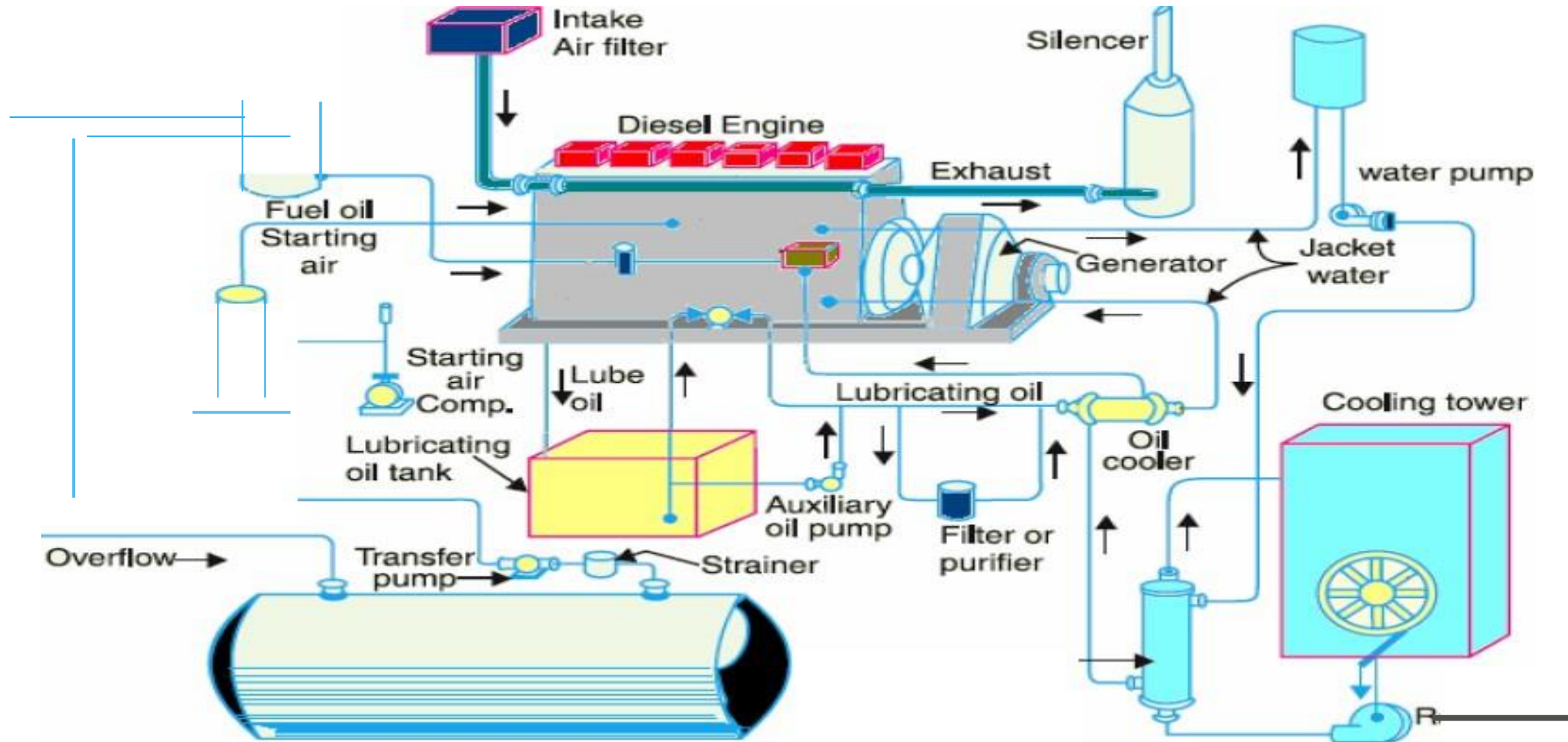
INTRODUCTION

- The two stroke cycle engine is more favored for diesel power plant.
- The air required for the diesel engine is drawn through the air filter from the atmosphere and compressed inside the cylinder.
- The fuel from the diesel engine is drawn through a filter from the all day tank and injected into the cylinder through fuel injectors.
- Because of the high temperature and pressure of the compressed air, the fuel burns and the burnt gases expand to do work on the moving part inside the cylinder called piston.

INTRODUCTION

- This movement of the piston rotates a flywheel and the engine is directly coupled to electric generator.
- The gases after expansion inside the cylinder is exhausted into the atmosphere and passes through a silencer in order to reduce the noise.
- Diesel power plants produce power in the range of 2 to 50MW.
- They are used as standby sets for continuity of supply such as hospitals , telephone exchanges , radio station , cinema theatres and industries (peak load).
- They are suitable for mobile power generation and widely used in railways and ships.

GENERAL LAYOUT



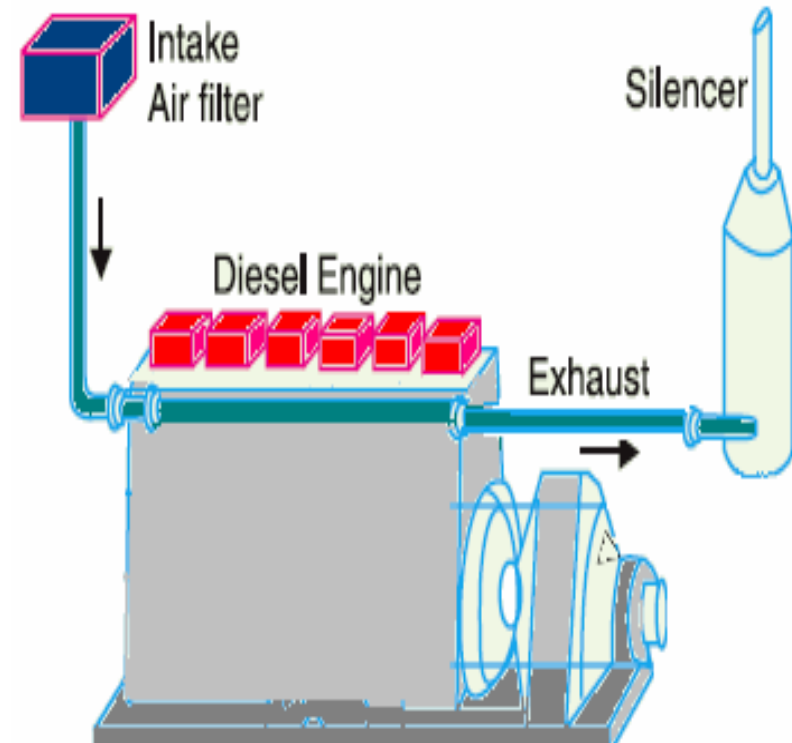
DIESEL PLANT EQUIPMENTS

- Air intake system
- Fuel supply system
- Exhaust system
- Cooling system
- Lubricating system
- Starting system



AIR INTAKE SYSTEM

- The air required for the combustion of fuel inside the diesel engine cylinder is drawn through the air filter. The purpose of the filter is to remove dust from the incoming air.
- Dry filter- may be made of felt , wood or cloth.



AIR INTAKE SYSTEM

Supercharging

- The purpose of supercharging is to raise the volumetric efficiency above that value which can be obtained by normal aspiration.
- The engine is an air pump, increasing the air consumption permits greater quantity of fuel to be added, and results in greater potential output.

AIR INTAKE SYSTEM

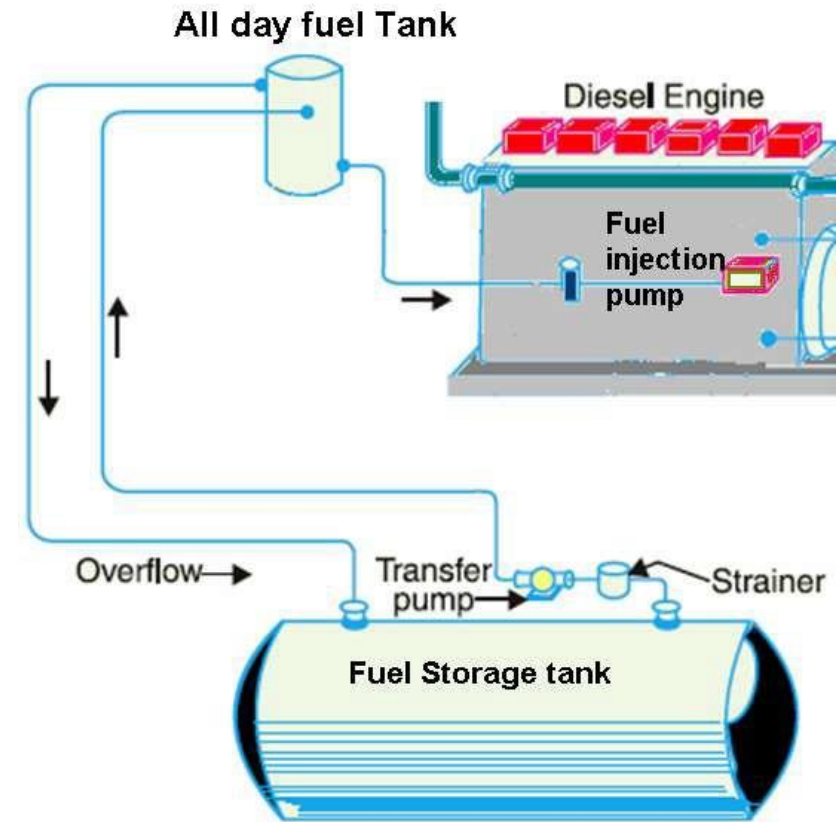
Effects of Supercharging

- The power output of a supercharged engine is higher than its naturally aspirated counterpart.
- The mechanical efficiencies are better than naturally aspirated engines.
- It has higher specific fuel consumption than naturally aspirated engines.

Note: **Specific fuel consumption** is the amount of **fuel consumed** by a vehicle for each unit of power output.

FUEL SUPPLY SYSTEM

- It consists of storage tank, strainers, fuel transfer pump, all day fuel tank, filters and fuel injection pump.
- Fuel is stored in a storage tank from which it is pumped through *strainer* by a transfer pump to a smaller all day tank at daily or short intervals.
- From this tank, fuel oil is passed through filters to further remove suspended impurities. The clean oil is injected into the engine by fuel injection pump.

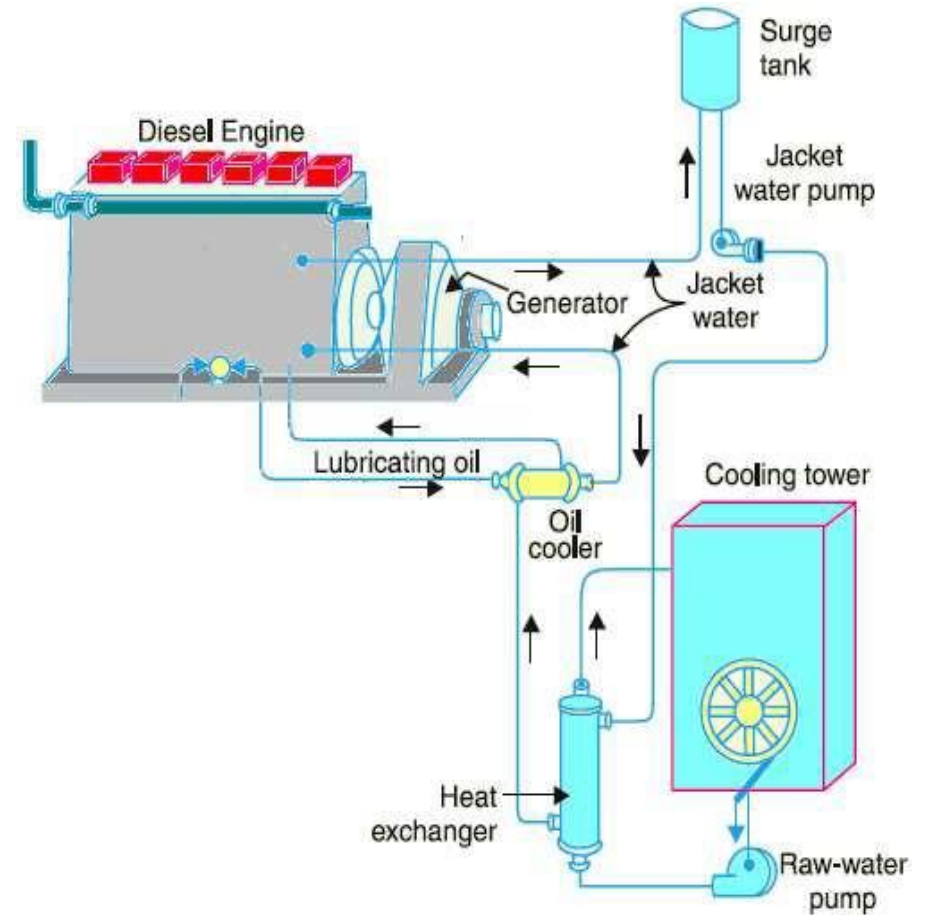


EXHAUST SYSTEM

- This includes the silencers and connecting ducts.
- The exhaust gases coming out of the engine is very noisy. Silencer (muffler) is provide to reduce the noise.
- Exhaust pipe leading out of the building should be short in length with minimum number of bends to provide as low a pressure loss as possible.
- Flexible tubings may be added in exhaust pipe to take care of misalignments and expansion/contraction and also to isolate the system from engine vibrations. Each engine should have its independent exhaust system.
- Where possible, exhaust heat recovery should be made to improve plant thermal efficiency. E.g., air heating, low pressure steam generation in diesel-steam power plant etc

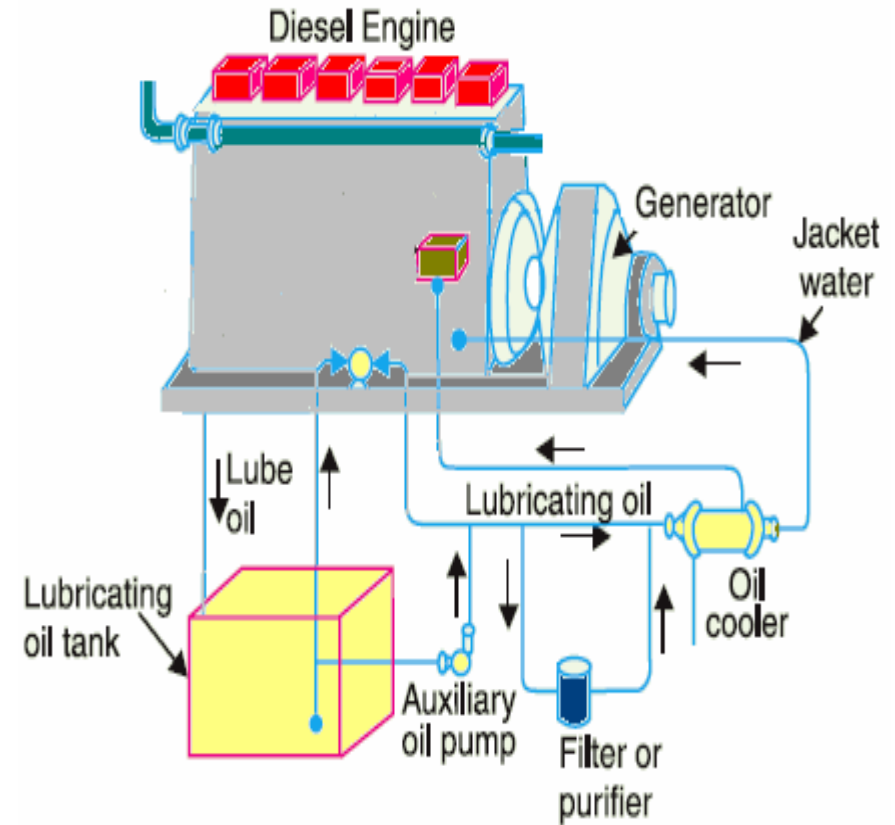
COOLING SYSTEM

- Part of heat released by fuel burning in the engine cylinder passes through the cylinder walls, piston, rings, ... etc. and may cause damage to the system. To keep the temperature of engine parts within safe operating limits, cooling is provided.
- The cooling system consists of a water source, pump and cooling *towers*. The pump circulates water through cylinder and head jacket. The water takes away heat from engine and itself becomes hot. The hot water is cooled by cooling towers and is recirculated for cooling.



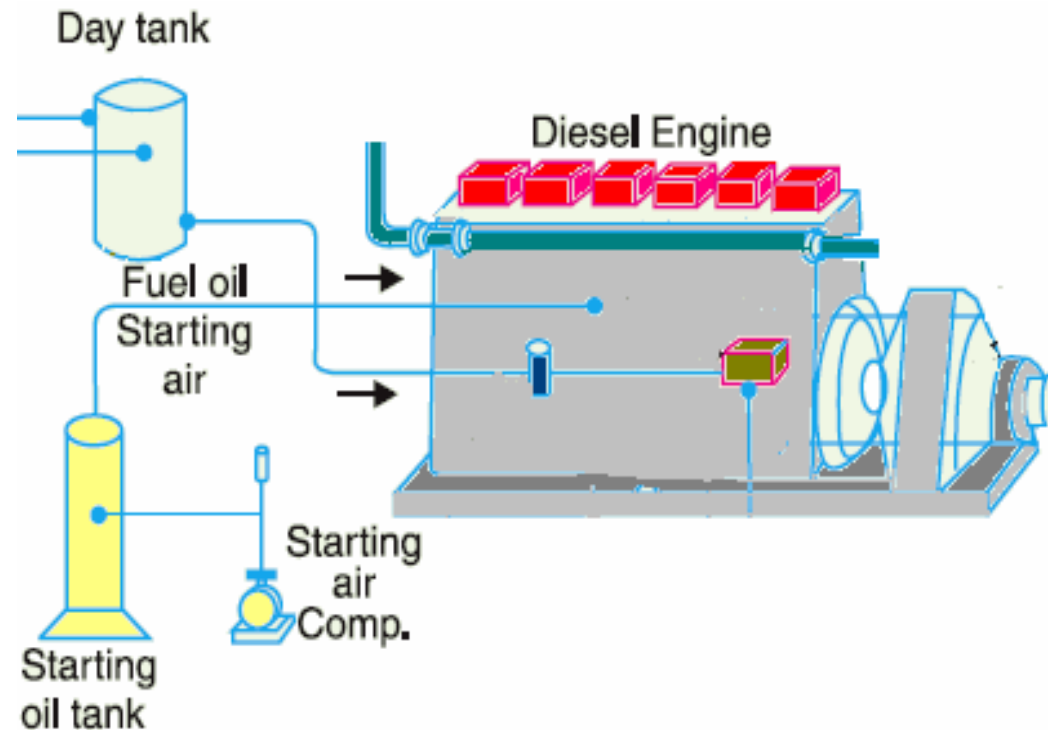
LUBRICATING SYSTEM

- This circuit includes lubricating oil tank , oil pump and oil cooler.
- The purpose of the lubrication system is to reduce the wear of the engine moving parts, parts of the cylinder such as piston, shafts , valves must be lubricated.
- Lubrication also helps to cool the engine.



STARTING SYSTEM

- Diesel engine used in diesel power plant is not self starting .
- The engine is started from cold condition with the help of an Air compressor.



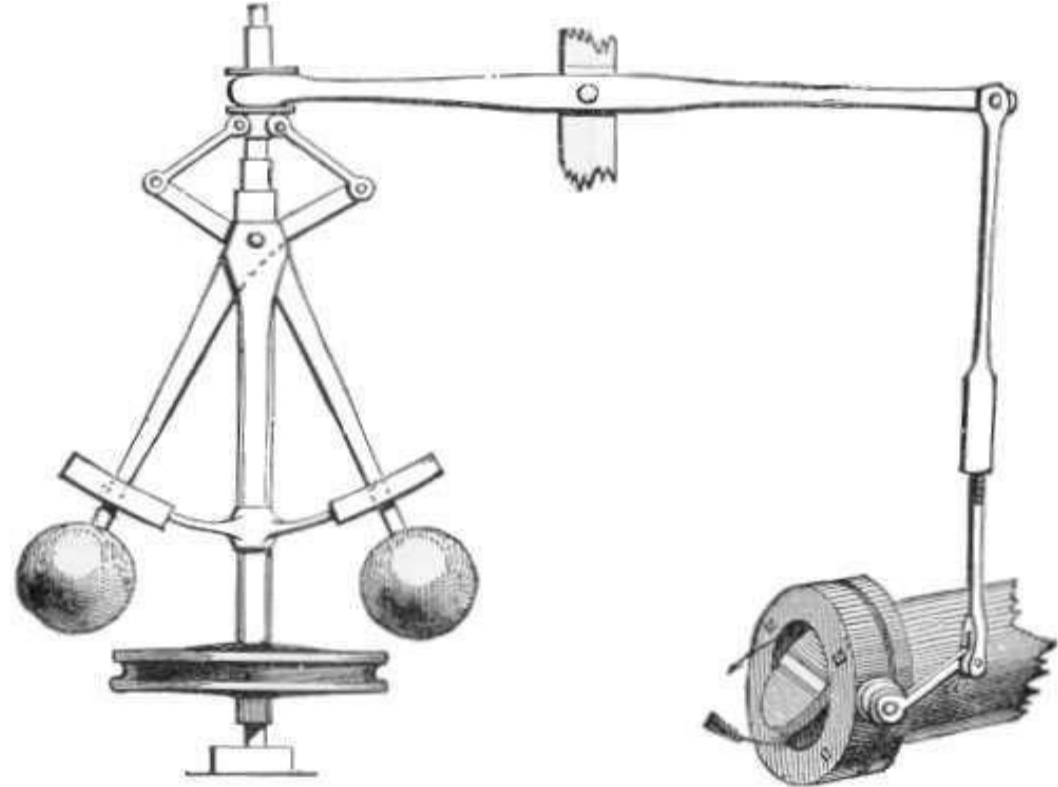
STARTING SYSTEM

Diesel engines have as many different types of starting circuits as there are types, sizes, and manufacturers of diesel engines. Commonly, they can be started by air motors, electric motors, hydraulic motors, and manually. The start circuit can be a simple manual start pushbutton, or a complex auto-start circuit. But in almost all cases the following events must occur for the starting engine to start.

- (a) The start signal is sent to the starting motor. The air, electric, or hydraulic motor, will engage the engine's flywheel.
- (b) The starting motor will crank the engine. The starting motor will spin the engine at a high enough rpm to allow the engine's compression to ignite the fuel and start the engine running.
- (c) The engine will then accelerate to idle speed. When the starter motor is overdriven by the running motor it will disengage the flywheel.

GOVERNING SYSTEM

- The function of the governing system is to maintain the speed of the engine
- This is done generally by varying fuel supply to the engine according to load.
- It is achieved with use of governors



APPLICATION

- 1. Peak load plant:** The diesel plants are used in combination with thermal or hydro-plants as peak load plants. This plant is particularly preferable as peak load plant as it can be started quickly and it has no standby losses as in the case of thermal plants where boilers always must be kept hot.
- 2. Mobile plants:** Mobile diesel plants mounted on skids or trailers can be used for temporary or emergency purposes such as for supplying power to large civil engineering works for supplementing electricity supply systems that are temporarily short of power.
- 3. Stand-by Units:** This can be used as a standby unit to supply part load when required. For example, this can be used with hydro-plant as stand-by unit. If the water available is not sufficient due to reduced rainfall, a diesel station supply power in parallel with hydro-station. The use is made temporarily till the water is available to take the full load.

APPLICATION

4. Emergency plant: The plants used for emergency purposes are at to stand by units, normally idle but are used where power interruption would mean financial loss or danger in key industrial processes, tunnel lighting and operating rooms of hospitals. They are also used for telecommunication and water supply under emergency conditions.

5. Nursery station: When the diesel plant is used to supply the power to a small town in the absence of main grid and which can be moved to another area which needs power on a small scale when the main grid is available is known as "Nursery Station". The main grid cannot extend to every corner of the country till there is enough load. Many times the extension of grid is not possible due to the constructional difficulties. Diesel unit of small capacity can be installed to supply the load to a small town during the process of development and it can be removed to another required place till the main grid for tapping the power is available.

APPLICATION

6. Starting stations: The diesel units are used to run the auxiliaries for starting the large steam plants.

7. Central stations: This can be used as central station where the capacity required is small (**5 to 10 MW**). The limit is generally decided by the cost of the plant and local conditions regarding the availability of fuel and water, space requirements and non-availability of the grid. Small supply units for commercial purposes and public utilities e.g., cinema hall, hospital and municipalities are commonly used in practice.

ADVANTAGES

1. Very simple design also simple installation and occupies less space.
2. Limited cooling water requirement.
3. Diesel power plant are more efficient than steam power in the range of 50MW capacity.
4. Quickly started and put on load.
5. It can respond to varying loads without any difficulty.
6. Smaller storage is needed for the fuel.
7. Layout of power plant is quite simple.
8. There is no problem of ash handling.
9. Less supervision required.

DISADVANTAGES

1. High maintenance, lubrication cost and operating cost.
2. Fuel cost is more.
3. The plant cost per kW is comparatively more.
4. The life of diesel power plant is small due to high maintenance.
5. Noise is a serious problem in diesel power plant.
6. [Diesel power plant](#) cannot be constructed for large scale.