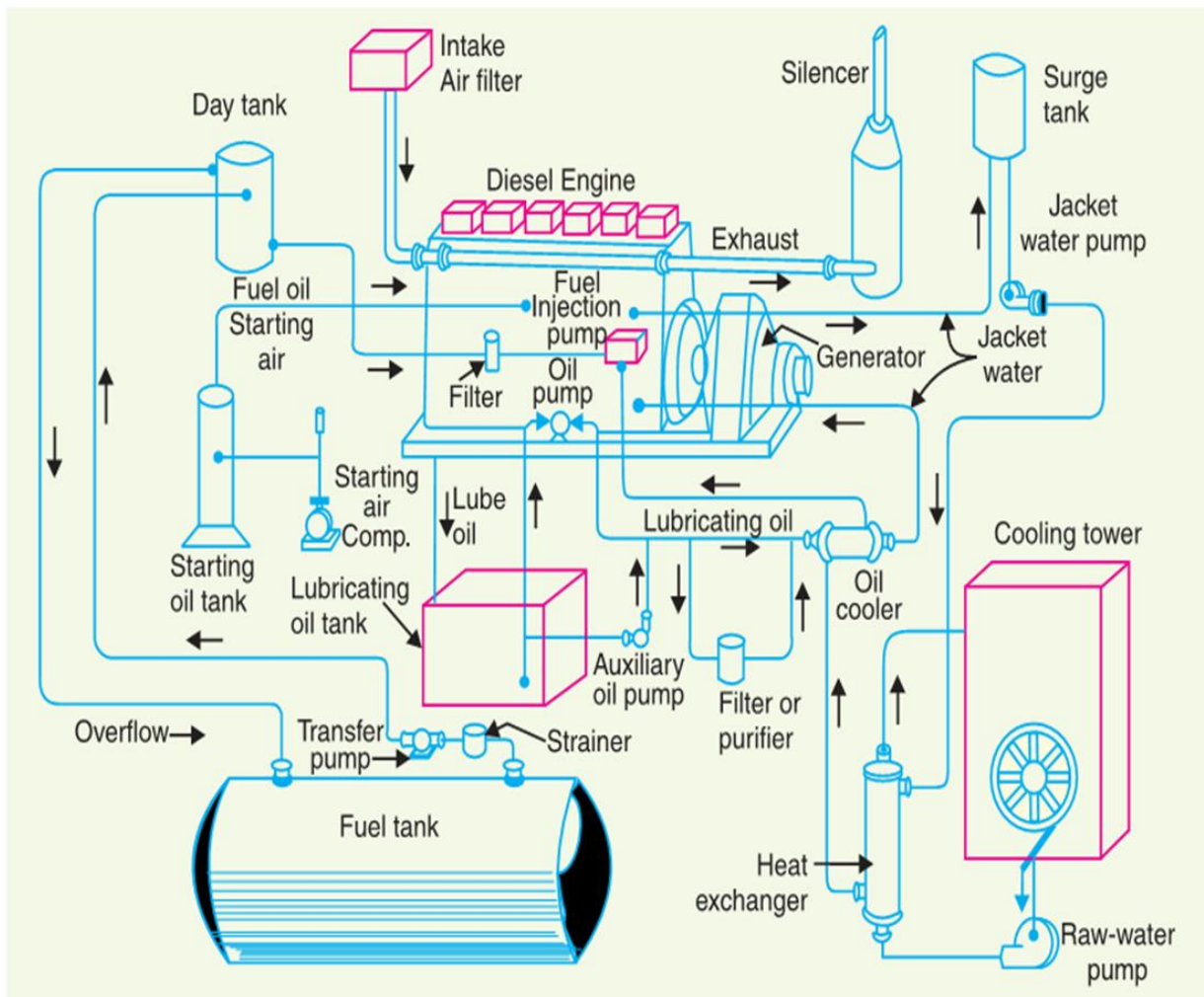


DIESEL ELECTRIC STATION

9th lecture

Schematic Arrangement of Diesel Power Station

Fig. shows the schematic arrangement of a typical diesel power station. Apart from the dieselgenerator set, the plant has the following auxiliaries:



(i) Fuel supply system.

It consists of storage tank, strainers, fuel transfer pump and all day fuel tank. The fuel oil is supplied at the plant site by rail or road. This oil is stored in the storage tank. From the storage tank, oil is pumped to smaller all day tank at daily or short

intervals. From this tank, fuel oil is passed through strainers to remove suspended impurities. The clean oil is injected into the engine by fuel injection pump.

(ii) Air intake system.

This system supplies necessary air to the engine for fuel combustion. It consists of pipes for the supply of fresh air to the engine manifold. Filters are provided to remove dust particles from air which may act as abrasive in the engine cylinder.

(iii) Exhaust system.

This system leads the engine exhaust gas outside the building and discharges it into atmosphere. A silencer is usually incorporated in the system to reduce the noise level.

(iv) Cooling system.

The heat released by the burning of fuel in the engine cylinder is partially converted into work. The remainder part of the heat passes through the cylinder walls, piston, rings etc. and may cause damage to the system. In order to keep the temperature of the engine parts within the 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 the engine and itself becomes hot. The hot water is cooled by cooling towers and is recirculated for cooling.

(v) Lubricating system.

This system minimizes the wear of rubbing surfaces of the engine. It comprises of lubricating oil tank, pump, filter and oil cooler. The lubricating oil is drawn from the lubricating oil tank by the pump and is passed through filters to remove impurities. The clean lubricating oil is delivered to the points which require lubrication. The oil coolers incorporated in the system keep the temperature of the oil low.

(vi) Engine starting system.

This is an arrangement to rotate the engine initially, while starting, until firing starts and the unit runs with its own power. Small sets are started manually by handles but for larger units, compressed air is used for starting. In the latter case, air at high pressure is admitted to a few of the cylinders, making them to act as reciprocating air motors to turn over the engine shaft. The fuel is admitted to the remaining cylinders which makes the engine to start under its own power.

Main Components of Diesel Electric Power Plant:

Q.1) List the main parts of diesel electric power plants.

The essential components of a diesel electric power plant are as follow:

1. Diesel Engine
2. Engine Fuel Supply System
3. Engine Air Intake System
4. Engine Exhaust System
5. Engine Cooling System
6. Engine Lubrication System.
7. Engine Starting System.
8. AC or DC Generators

OPERATING PRINCIPLE

All the gas engines and oil engines operate in the same general way. The working fluid undergoes repeated cycles. A thermodynamic cycle is composed of a series of sequential events in a closed loop on P-V or T-S diagram. A typical cycle has following distinct operations

1. Cylinder is charged
2. Cylinder contents are compressed

3. Combustion (Burning) of charge, creation of high pressure pushing the piston and expansion of products of combustion.

4. Exhaust of spent products of combustion to atmosphere.

The route taken for these steps is illustrated conveniently on P-V diagram and T-S diagram for the cycle.

Various types of Gas Engines and Oil Engines have been developed and are classified on the basis of their operating cycles. Cycles are generally named after their Inventors e.g. Carnot Cycle; Diesel Cycle; Otto Cycle; Sterling Cycle; Bryton Cycle; Dual Cycle, etc.

New cycles are being developed for fuel saving and reduction of pollution.

Two principal categories of IC Engines are:

—Four Stroke Engines

—Two Stroke Engines

In a Four Stroke Engine Cycle, the piston strokes are used to obtain the four steps (intake, compression, expansion, exhaust) and one power stroke in two full revolutions of crankshaft. In a Two Stroke Engine Cycle, one power stroke is obtained during each full revolution of the crankshaft.

This is achieved by using air pressure slightly above atmospheric to blow out exhaust gases out of the cylinder and fill the fresh charge (scavenging). The methods of scavenging include: Crankcase scavenging; blower scavenging. Other methods include Super Charging; Turbo Charging.

APPLICATION OF DIESEL POWER PLANT

Since there are many disadvantage of diesel power plant, although the plant find wide application in the following fields.

1. They are quite suitable for mobile power generation and are widely used in transportation systems consisting of railroads, ships, automobiles and aeroplanes.

2. They can be used for electrical power generation in capacities from 100 to 5000 H.P.

3. They can be used as standby power plants. 4. They can be used as peak load plants for some other types of power plants.

5. Industrial concerns where power requirements are small say of the order of 500 kW, diesel power plants become more economical due to their higher overall efficiency.

PERFORMANCE OF DIESEL ENGINE

The performance of the diesel engine means the power and efficiency. The engine develops as the various parameters of the engine, e.g. piston speed, air-fuel ratio, compression ratio, inlet air-pressure and temperature are varied.

The two usual conditions under which I.C. engines are operated are: (1) constant speed with variable load, and (2) variable speed with variable load. The first situation is found in a.c. generator drives and the second one in automobiles, railway engines and tractors etc. A series of tests are carried out on the engine to determine its performance characteristics, such as: indicated power (I.P.), Brake power (B.P.), Frictional Power (F.P.), Mechanical efficiency (η_m), thermal efficiency, fuel consumption and also specific fuel consumption etc. Below, we shall discuss how these quantities are measured: