

DIESEL ELECTRIC STATION

10th lecture

Use of Diesel Generator in Power Plants

Diesel generators are widely used in most [thermal](#) and [nuclear power stations](#) as an emergency backup power source for the station's critical auxiliary equipment such as cooling pumps, fans, hydraulic units, battery chargers, etc. For example, during a power interruption in a nuclear power plant, it is very necessary to keep the continuous power supply for reactor cooling pumps. There are backup battery banks to keep a continuous supply of the critical equipment. Diesel generators supply the battery chargers and also other auxiliary needs. In [hydropower plants](#), diesel generators may be used to provide emergency power to the spillway gates which are used to prevent the water from flowing from the top of the dam in flood conditions. Diesel generators are also required in the switchyards. Circuit breakers, protective relays, [transformers](#) and communication system that is used to control these devices, all require a backup power source in case of power failure.

Diesel Power Plant

There are many parts of the world where, using diesel generators is the only viable option for providing electrical power to the local population reliably. This is generally due to the geometrical conditions that do not allow the power grid to reach such areas or isolated communities. In such cases, two or more diesel generators operated in parallel are used to provide a reliable power supply to the local population. A **diesel power plant** has more than two generators that operate in parallel. For the parallel operation, the generators are electrically connected in synchronization (matching voltage, frequency and phase). A diesel power plant may or may not be connected to the main power grid.

Maintenance of Diesel Electric Power Plant

At the time of diesel engine or diesel electric power plant, following points are considered during maintenance period.

- a. To maintain the operating condition of diesel engine at every half hour.

- b. To maintain the correct record of the instrument reading in log sheet.
- c. To maintain the record of instrument temperature, pressure, electrical load, flow etc.
- d. To check the level of fuel oil periodically.
- e. Filterized the fuel and remove unwanted impurities.
- f. Clean the fuel tank at regular interval.

DIESEL PLANT OPERATION

When diesel alternator sets are put in parallel, “hunting” or “phase swing may be produced due to resonance unless due care is taken in the design and manufacture of the sets. This condition occurs due to resonance between the periodic disturbing forces of the engine and natural frequency of the system. The engine forces result from uneven turning moment on the engine crank which are corrected by the flywheel effect. “Hunting” results from the tendency of each set trying to pull the other into synchronism and is characterized by flickering of lights.

To ensure most economical operation of diesel engines of different sizes when working together and sharing load it is necessary that they should carry the same percentage of their full load capacity at all times as the fuel consumption would be lowest in this condition. For best, operation performance the manufacturer’s recommendations should be strictly followed.

In order to get good performance of a diesel power plant the following points should be taken care of:

1. It is necessary to maintain the cooling temperature within the prescribed range and use of very cold water should be avoided. The cooling water should be free from suspended impurities and suitably treated to be scale and corrosion free. If the ambient temperature approaches freezing point, the cooling water should be drained out of the engine when it is kept idle.

2. During operation the lubrication system should work effectively and requisite pressure and temperature maintained. The engine oil should be of the correct specifications and should be in a fit. Condition to lubricate the different parts. A watch may be kept on the consumption of lubricating oil as this gives an indication of the true internal condition of the engine.

3. The engine should he periodically run even when not required to be used and should not be allowed to stand idle for more than 7 days.

4. Air litter, oil filters and fuel filters should be periodically serviced or replaced as recommended by the manufacturers or if found in an unsatisfactory condition upon inspection.

5. Periodical checking of engine compression and firing pressures and also exhaust temperatures should be made.

The engine exhaust usually provides a good indication of satisfactory performance of the engine. A black smoke in the exhaust is a sign of inadequate combustion or engine over loading.

The loss of compression resulting from wearing old of moving parts lowers the compression ratio causing inadequate combustion. Taking indicator diagrams of the engine after reasonable intervals can check these defects.

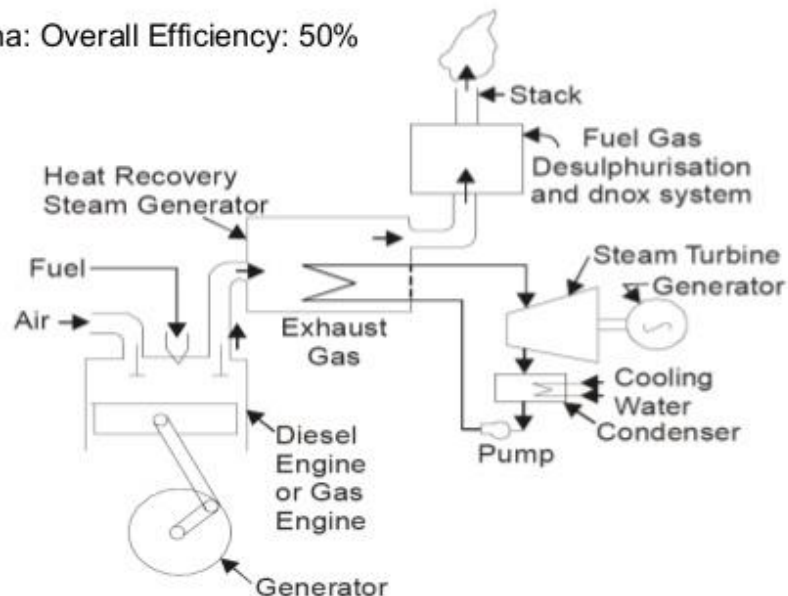
EFFICIENCY OF DIESEL POWER PLANT

The efficiency of a diesel engine plant is enhanced by use of Turbo-compounded diesel engine and Heat Recovery Steam Generator (HRSG) and steam turbine generator.

A 24.8 mW Diesel Engine Generator Plant installed in Macau has two slow speed diesel engine generator units (1985). The overall efficiency of nearly 50% has been demonstrated. The high efficiency has been achieved by use of Turbine Generator, and Steam Turbine operated by exhaust gases of diesel engine (Fig.)

Diesel Engine-Steam Turbine Cogeneration Power Plant

Macau China: Overall Efficiency: 50%



Combined Cycle: Diesel Engine, HRSG (Heat Recovery Stream Generator) and Steam Turbine.

Example 1. A diesel power station has fuel consumption of 0.28 kg per kWh, the calorific value of fuel being 10,000 kcal/kg. Determine (i) the overall efficiency, and (ii) efficiency of the engine if alternator efficiency is 95%.

Example 2. A diesel power station has the following data :

Fuel consumption/day = 1000 kg

Units generated/day = 4000 kWh

Calorific value of fuel = 10,000 kcal/kg

Alternator efficiency = 96%

Engine mech. Efficiency = 95%

Estimate (i) specific fuel consumption, (ii) overall efficiency, and (iii) thermal efficiency of engine.

Example 3. A diesel engine power plant has one 700 kW and two 500 kW generating units. The fuel consumption is 0.28 kg per kWh and the calorific value of fuel oil is 10200 kcal/kg. Estimate (i) the fuel oil required for a month of 30 days and (ii) overall efficiency. Plant capacity factor = 40%.