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Enhance Performance of Diesel Power Plant by Proper Changes in Its Input Fuel Supply and Heat Recovery Systems

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A B S T R A C T

Diesel power plant is a basis need where traditional power plant is not available. Number of natural disasters is happening around the world, but same time electricity supply cannot be achieved in the interior area. So at that place diesel power plant is very important for the supply of emergency services.

Specially at the time of earthquake or volcano eruption or river flood and the area which is very interior at that time conventional power provision, it is not possible to provide help so that medical emergency cannot be fulfilled at the same time. So diesel power plant is very important in that aspect and it can provide instant power to the required place and hospitals.

Also mobile diesel power plants are available that transmit extra power at the time of peak load, so power house can also merge extra power to the national grids. Cetane number is very important factor for the diesel power plant. It is directly related with efficiency of the power plant. Lower Cetane number fuel can damage the overall life of the plant.

Keywords: Diesel power, Octane number, Cetane number, Moisture content, super heating, Water jacket, Fuel ratio, Compression ratio.

1. Introduction.

High quality fuel is required for better generation of electricity and also this power plant has to provide continuous and emergency power supply to the required place. In metro city and industrial area whenever power requirement is at the topmost condition at that time peak load must be satisfied otherwise production of the plant may be stopped and it will effect on the economical condition of the plant in overall area of the manufacturing unit.

Number of provisions is done to increases the efficiency of the plant. Compression ratio of the engine is optimised and also quality of fuel is improved, till number of factors that affect the life of plant and generation capacity of the power house. So in diesel power plant one should have enough idea of the surroundings and also availability and possibility of the fuel storage.

Generally 4 stroke engine is well known for the power generation unit. Till for some specific task 2 stroke diesel engine is preferred. 4 Stroke engine has better thermal efficiency compare to the 2 stroke engine. So overall cost of the plant can be reduced by the better thermal efficiency. Diesel power plant in India is highly demanded in the interior area and also at the places where electricity supply is not continuous.

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Nomenclature

DS	Diesel Engine
Sup-Tem	Superheated Temperature
AC	Alternative current
W-Output	Output work
Cr	Compression ratio
Eff	Efficiency of plant
F- S	Fuel supply
Diesel E	Availability of diesel .
Cool-Rt =	Cooling rate

(%)

2. Mechanism of Electricity generation inside Turbine section

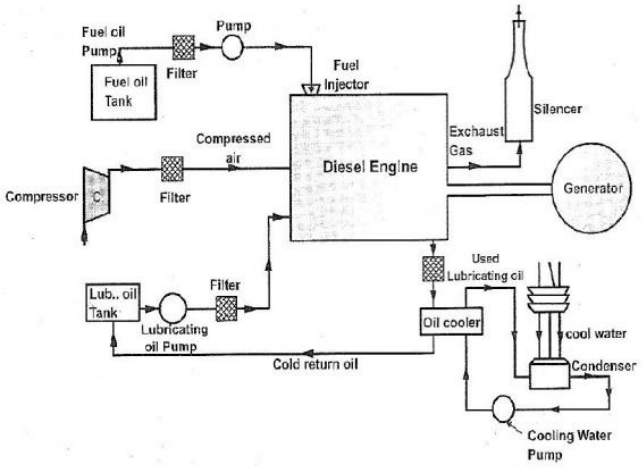

Figure 1 Steam turbine and Generator

In diesel power plant number of operations is performed at a same time, so compression ratio and other parameters are also maintained for better operation. Diesel engine has normally compression ratio of 14 to 20 but sometimes it is going to change as per the requirement. In petrol engine at the time of suction air and fuel both are entering inside the cylinder. This task is performed by Carburettor and air fuel ration is also maintained. But for diesel engine only air is entering and its temperature is also higher than the atmospheric temperature. Fuel will enter near the end of compression stroke. So diesel engine always requires compressor to compress the air and it is bulky compare to the petrol engine.

In this engine air from filter will be allowed to enter inside the engine. Then Fuel injector will inject diesel at the end of compression stroke. As combustion takes place inside the engine and exhaust gases passes through the chimney. Generator is attached to the shaft of the engine and it will produce electricity by converting mechanical energy to electrical energy. Lubricating oil is passed through the condenser and it is cooled by the water. In oil cooler, cooled water is used to cool the hot oil. Then this oil will return to the oil tank. From the oil tank oil will pass to the filter and to the cylinder to cool the engine. For the section of hot compressed air, the separate compressor is arranged and this will compress the air to the decided level. Then air filter is arranger to the path of air to remove dust and dirt particles.

2.1 Working parts of the Unit

1 Diesel Engine

It's a heart of the whole system. In this engine there is variety of 2 stroke and 4 stroke diesel engine. But mostly 4 stroke engine is preferred. Reason to select 4 stroke engines is its higher mechanical efficiency. Also maintenance cost of the 4 stroke engine less compare to the 2 stroke engine. Some time power is required at a frequent time, and then one can go for 2 stroke engine. Basically in this engine there are four stroke suction, compression, expansion and exhaust are taking place. In suction stroke fuel will enter inside the engine. In compression stroke the charge will be compressed. Expansion stroke is used to get the power and exhaust stroke is used to carry out burnt gases from the cylinder.

2. Air filter

Air filter is used to remove dust and other particle that can damage the engine while they mesh with cylinder surface. So it is very important to remove the non required object from the air that is entering to the cylinder. To perform the best work number of layers are arranger in the path of air to remove dirt and surrounding particle.

3. Supercharger

Supercharger is used to improve the efficiency of the engine. It happens that fuel is not burnt due to lack of an oxygen when large amount of fuel is burning inside the engine. So supercharger is used to provide the required amount of oxygen for complete combustion so that carbon monoxide is not generated and one can help the environment by better combustion.

4. Engine self starting management

Engine is started by some other auxiliary system when the engine is higher brake power. Small diesel engine is preferred to run for the bigger engine to start. Shaft of the bigger engine is attached output shaft of smaller engine and it turns when small engine is in working condition. So after all whole unit comes into action and suction stroke takes place for the bigger engine.

2.2 Starting system

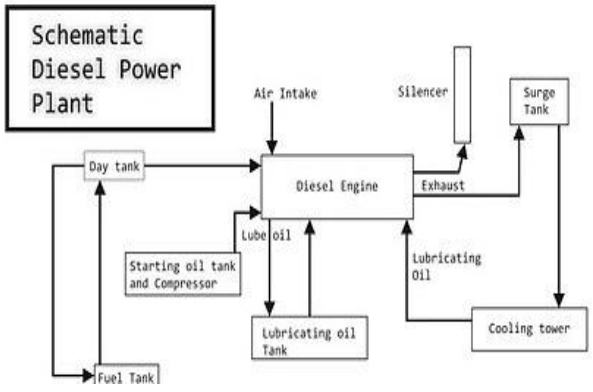

Figure 2 Starting system of power pant

For better working of diesel power plant daily tank and other auxiliary systems are arranged. For initial starting of the plant small engine attached to the main power shaft. Daily tank is also filtered before entering the oil to the engine. In this engine compression ratio is higher therefore fuel is burnt and temperature of the engine is extreme high therefore necessary cooling system is required to cool all the components of diesel power plant.

Proper cooling system is attached in the diesel power plant for cooling of oil and other components. There is also provision of cooling tower to cool the lubricating oil because if oil is not cooled properly then oil will lose its viscosity and proper lubrication of the cylinder will not be carried out and after all the engine will get fail.

3. Point of Benefits as Urgent Power Source

There are number of advantages to use of diesel power plant because in this power plant bio grade diesel can be used and also regular diesel is used. In this plant the diesel is used so it is also important to lubricate all the components like Pistons and rings cylinder ,cylinder liners and all the components which are in working and rotational condition. In this plant there is also provision to use the low grade fuel so some natural fuels and bio fuels can also be used for this power plant.

3.1 Small area requirement

There is no requirement of large area like thermal power plant in this plant one can use less area to install the diesel power plant and also there is no requirement of fuel storage like thermal power plant. In thermal power large bunker is required to store the coal and also proper cooling system is required to cool the coal in the pipes while in diesel power plant there is no requirement of cooling of fuel at the time storage.

3.2 Better output as an urgent basis plant

No other power plant like thermal power plant, nuclear power plant geothermal power plant can give better efficiency and output like diesel power plant within less installation of time. Every power plant requires number of years for full installation of each and every compartment but in diesel power plant developer can install this plant at a site where natural disaster has happened or there is shortage of electrical supply within short time and fulfil the demand of that site as per the requirement.

3.3 Limitations of plant

There is great limitation of diesel power plant is a diesel fuel because now a days cost of the diesel is extreme high so overall cost of the plant can be increased by increasing the price of diesel. Also there are the numbers of components in the diesel power plants that are going to be repaired at three to four months because in this plant there is heavy components and higher compression ratio so components must be changed after a period of time.

3.4 Cooling water systems

The cooling (jacket) water system controls the engine's operating temperature for optimal performance. The system is made up of passages inside the engine block and head. Cooling water system consists of a water pump with motor unit to circulate the coolant, a thermostat to control the temperature of the coolant, a radiator bank or cooling tower (heat sink) to cool the coolant, a pressure regulator to control the pressure in the system, and hoses and pipes to transfer the coolant from the engine to the radiator.

4. Basis ideas to Save Crude Oil

Each and every one knows that there is shortage if crude oil in the coming era, So every country of the world should think about to crude oil for further development. Wind energy solar energy and number of other non conventional energy sources are available that can reduce the consumption of crude oil day by day and one can save the amount of crude oil for future generation. There are some locations where wind and geothermal energy also solar energy and water power energy can't be used due to its geographical location so that diesel power plant has to be installed for the survival of the people. PIL developer can develop new design and the engine and also that can reduce the consumption of diesel in the powerhouse after implementation of supercharger and better air filter and changing the components.

5. Conclusion

Consumption of diesel in the diesel power plant can be reduced by avoiding engine de rating and overheating. There is also one possibility to save the important fuel like diesel by minimising specific fuel consumption and by improving the thermal efficiency of the engine. To increase the thermal efficiency of the engine one should think about the waste heat recovery system of the engine because waste heat directly goes to the atmosphere with higher temperature if one can think to the to recover that heat from the atmosphere and if this heat can be transferred to the required application then efficiency of the plant can be increased by recovering of waste heat.

There is also one chance to reduce the cost of diesel power plant by implementing some things like cost breakdown systems, additional expense systems, technology integration systems and different types of variable and characteristics study systems and also one should find out feasibility and further assessment to carry out some evolution and alternative fuel consumption for the diesel engine.

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