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Internal Assessment Test 2 – Dec. 2021

Sub:	Energy Engineering					Sub Code:	17ME71	Branch:	Mechanical	
Date:	20/12/2021	Duration:	90 mins	Max Marks:	50	Sem / Sec:	7 (2017 scheme)		OBE	

Answer all Questions

		MARKS	CO	RBT
1	Explain with neat sketch Spreader stoker.	[10]	CO1	L2
2	Explain the central or bin system of burning pulverized coal.	[10]	CO1	L2
3	What do you understand by the term draught? Classify types of draughts. Explain with a neat sketch the balanced draught.	[10]	CO1	L2
4	List the applications of diesel electric power plant and explain with neat sketch air intake and exhaust system.	[10]	CO1	L3
5(a)	Explain the different methods of starting the diesel engine.	[5]	CO6	L2
(b)	Explain the different methods of engine cooling.	[5]		

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Date:	20.12.2021	Duration:	90 mins	Max Marks:	50	Sem / Sec:	VII (2017 scheme)		OBE

Scheme of evaluation

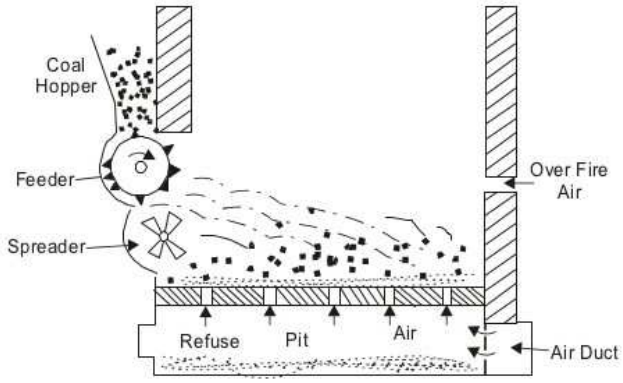
Q.No	Scheme	Marks
1	Schematic of Spreader stoker	4
	Working of Spreader stoker	4
	Main features of spreader stoker	2
2	Schematic of bin system	4
	Working of bin system	4
	Main features of the bin system	2
3	Definition of draught	2
	Classification of draught	3
	Schematic of balanced draught	2
	Working of balanced draught	3
4	Applications of diesel power plant	4
	Working of air intake system with neat sketch	3
	Working of exhaust system with neat sketch	3
5(a)	Explanation of compressed air starter, electric starter and starting using auxiliary engine.	5
5(b)	Explanation of different methods of engine cooling like Natural and forced circulation system.	5

Energy Engineering

IAT 02 solutions

1) Explain with neat sketch Spreader stoker.

A spreader stoker is shown in figure below. In this stoker the coal from the hopper is fed on to a feeder which measures the coal in accordance to the requirements. Feeder is a rotating drum fitted with blades. Feeders can be reciprocating rams, endless belts, spiral worms etc. From the feeder the coal drops on to spreader distributor which spread the coal over the furnace. The spreader system should distribute the coal evenly over the entire grate area. The spreader speed depends on the size of coal.



Advantages: The various advantages of spreader stoker are as follows:

- Its operation cost is low.
- A wide variety of coal can be burnt easily by this stoker.
- A thin fuel bed on the grate is helpful in meeting the fluctuating loads.
- Ash under the fire is cooled by the incoming air and this minimises clinkering.
- The fuel burns rapidly and there is little coking with coking fuels.

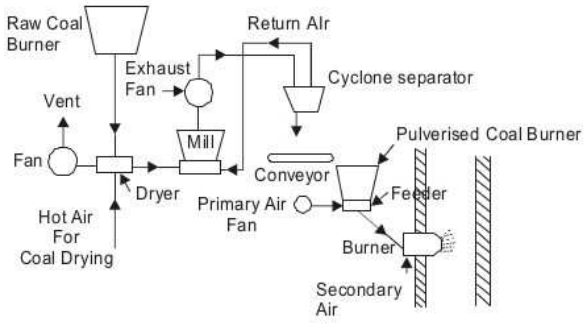
Disadvantages

- The spreader does not work satisfactorily with varying size of coal.
- In this stoker the coal burns in suspension and due to this fly ash is discharged with flue gases which necessitate efficient dust collecting equipment.

2) Explain the central or bin system of burning pulverized coal.

Bin or Central System: Crushed coal from the raw coal bunker is fed by gravity to a dryer where hot air is passed through the coal to dry it. The dryer may use waste flue gases, preheated air or bleeder steam as drying agent. The dry coal is then transferred to the pulverising mill. The pulverised coal obtained is transferred to the pulverised coal bunker (bin). The transporting air is separated from the coal in the

cyclone separator. The primary air is mixed with the coal at the feeder and the mixture is supplied to the burner.



Advantages

- The pulverising mill grinds the coal at a steady rate irrespective of boiler feed.
- There is always some coal in reserve. Thus any occasional breakdown in the coal supply will not affect the coal feed to the burner.

Disadvantages

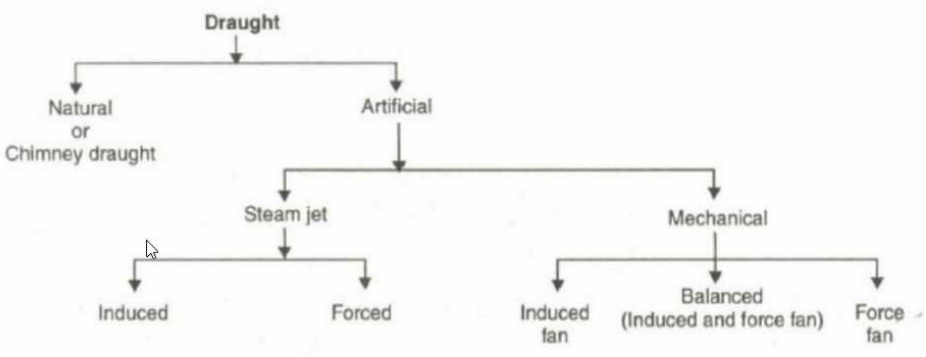
- The initial cost of the system is high
- Coal transportation system is quite complicated.
- The system requires more space.

3) What do you understand by the term draught? Classify types of draughts. Explain with a neat sketch the balanced draught.

Draught is defined as the difference between absolute gas pressure at any point in a gas flow passage and the ambient (same elevation) atmospheric pressure. Draught is plus if Pat < Pgas and it is minus Pat . > Pgas. Draught is achieved by small pressure difference which causes the flow of air or gas to take place. It is measured in millimeter (mm) of water.

The various types of draught systems are as follows:

- Natural draught: Natural draught is created by the difference in weight of column of cold external air and that of a similar column of hot gases in the chimney.
- Mechanical draught: Mechanical draft may be induced, forced or balanced draft and is involves the use of blowers or fans.
- Steam Jet draught.



Classification of draught

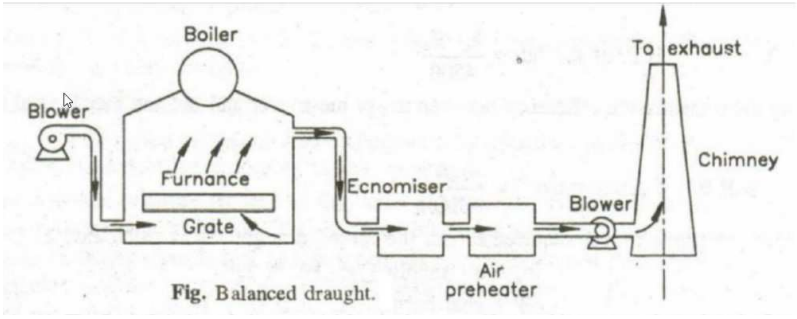


Fig. Balanced draught.

Balanced Draught: Balanced draught system is a combination of induced and forced air through the draught systems. The forced draught fan forces the air through the fuel bed on to the top of grate and the induced draught fan sucks in gases from the boiler side and discharges them to the chimney. This system is used where pressure above fire is slightly below atmospheric.

If the forced draught is used alone, the furnace cannot be opened for firing or inspection because the high pressure air inside the furnace will try to blow out suddenly and there is every chance of blowing out the fire completely and furnace stops. If the induced draught is used alone, then also furnace cannot be opened because cold air will try to move into the furnace. The above two difficulties can be overcome by using balanced draught.

4) List the applications of diesel electric power plant and explain with neat sketch air intake and exhaust system.

Applications of Diesel Engines in Power field: The diesel electric power plants are chiefly used in the following fields.

- Peak load plant: Diesel plants can be used in combination with thermal or hydro-plants as peak load units. They can be easily started or stopped at a short notice to meet peak demand.
- Mobile Plant: Diesel plants mounted on trailers can be used for temporary or emergency purposed such as for supplying power to large civil engineering works.
- Standby unit: If the main unit fails or cannot cope up with the demand, a diesel plant can supply the necessary power. For example, if water available in a hydro-plant is not adequately available due to less rainfall, the diesel station can operate in parallel to generate the short fall in power.

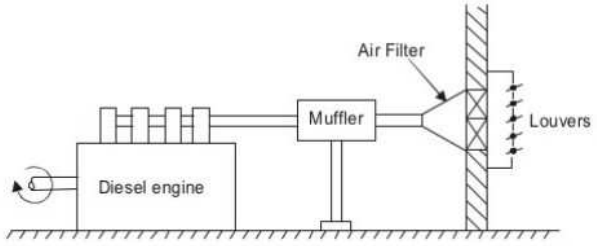
- Emergency Plant: During power interruptions in a vital unit like a key industrial plant or a hospital, a diesel electric plant can be used to generate the needed power.
- Nursery Station: In the absence of main grid, a diesel plant can be installed to supply power in a small town. In course of time, when electricity from the main grid becomes available in the town, the diesel unit can be shifted to some other area which needs power on a small scale. Such a diesel plant is called a "nursery station."
- Starting stations: Diesel units can be used to run the auxiliaries (like Forced draft and Induced draft fans, Boiler feedwater pump) for starting a large steam power plant.
- Central stations: Diesel electric plants can be used as central station where the capacity required is small.

Air Intake system: The air intake system conveys fresh air through pipes or ducts to

- Air intake manifold of four stroke engines
- The scavenging pump inlet of a two stroke engine and
- The supercharger inlet of a supercharged engine

Following precautions should be taken while constructing a suitable air intake system:

- Air intakes may not be located inside the engine room.
- Air should not be taken from a confined space otherwise air pulsations can cause serious vibration problems.
- The air-intake line used should neither have too small a diameter not should be too long.



Air Intake system

Exhaust System of Diesel Power Plant: The purpose of the exhaust system is to discharge the engine exhaust to the atmosphere outside the main building. For designing of exhaust system of a big power plant, following points should be taken into consideration:

- Exhaust noise should be reduced to a tolerable degree.
- To reduce the air pollution at breathing level, Exhaust should be exhausted well above the ground level
- Pressure loss in the system should be reduced to minimum.

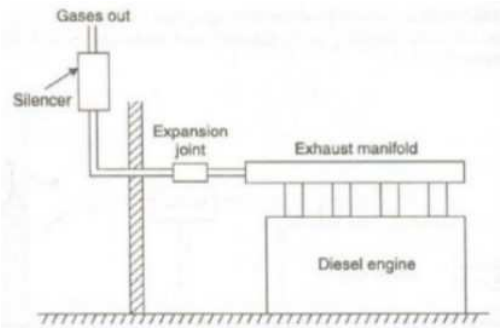
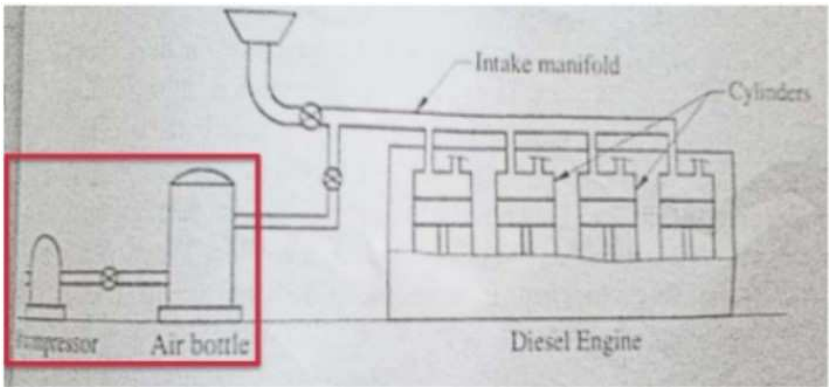


Fig. Exhaust system.

5(a)Explain the different methods of starting the diesel engine.

The various methods used for the starting of diesel engine are as follows:

Compressed Air System: Compressed air system is used to start large diesel engines. In this system compressed air at a pressure of about 20 kg per sq. cm is supplied from an air bottle to the engine an inlet valve through the distributor or through inlet manifold. In a multi-cylinder engine compressed air enters one cylinder and forces down the piston to turn the engine shaft. Meanwhile the suction stroke of some other cylinder takes place and the compressed air again pushes the piston of this cylinder and causes the engine crank shaft assembly to rotate. Gradually the engine gains momentum and by supplying fuel the engine will start running.

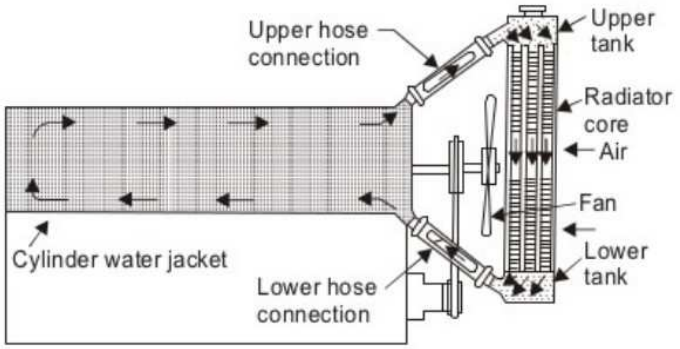


Compressed air starting

Electric Starting: Electric starting arrangement consists of an electric motor which drives a pillion which engages a toothed rim on engine flywheel. Electric power supply for the motor is made available by a small electric generator driven from the engine.

Starting by an Auxiliary Engine: In this method, a small petrol engine is connected to the main engine through a clutch and gear arrangement. Firstly, the clutch is disengaged and petrol engine is started by hand. Then clutch is gradually engaged and the main engine is cranked for starting.

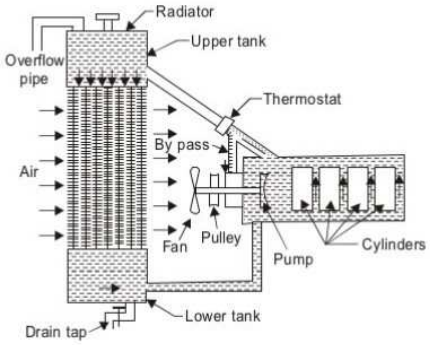
5(b)Explain the different methods of engine cooling.



Natural Circulation Cooling system

Natural Circulation System: The system is closed one and designed so that the water may circulate naturally because of the difference in density of water at different temperatures. The figure below shows a natural circulation cooling system. It consists of water jacket, radiator and a fan. When the water is heated, its density decreases and it tends to rise, while the colder molecules tend to sink. Circulation of water then is obtained as the water heated in the water jacket tends to rise and the water cooled in the radiator with the help of air passing over the radiator either by ram effect or by fan or jointly tends to sink. Arrows show the direction of natural circulation, which is slow.

Forced Circulation Cooling System: Figure below shows forced circulation cooling system that is closed one. The system consists of pump, water jacket in the cylinder, radiator, fan and a thermostat. The coolant (water or synthetic coolant) is circulated through the cylinder jacket with the help of a pump, which is usually a centrifugal type, and driven by the engine. The function of thermostat, which is fitted in the upper hose connection initially, prevents the circulation of water below a certain temperature (usually up to 85°C) through the radiation so that water gets heated up quickly.



Forced Circulation cooling system