

**BOILER OPERATION ENGINEERS EXAMINATION, DEC-2013**  
**BOILERS-I**

Time: 2-1/2 Hrs

Marks: 100

Note:

- 1) Candidates should attempt Six (6) Questions subject to alternative or limitations, if any, mentioned herein or in each question. If more are answered, the last extra answers will be ignored.
- 2) Parts of the same questions must be answered together and must not be interposed by an answer(s) to other question(s)
- 3) Question no. One is compulsory
- 4) Candidates should answer the paper in English only

1. a) Which steam is good for process heating saturated or Super-Heated? And Why? (5)  
 b) What is super heater Starvation? What factors affect the Super heater design in boiler? (5)  
 c) Discuss briefly about Chattering and Hang-up of safety valve (5)  
 d) How do you find Tube Leakage in running boiler? (5)
  
2. a) A safety valve is designed to blow off at a gauge pressure of 0.8 N/mm<sup>2</sup>. The valve is held by a close coiled helical spring of mean coil diameter 180 mm and valve disc diameter is 80 mm. Find the diameter of spring rod if shear stress of rod is 75 N/mm<sup>2</sup>. (8)  
 b) A hollow shaft is to transmit 300 KW at 80 RPM. If shear stress is not to exceed 60 N/mm<sup>2</sup> and internal diameter is 0.6 of the external diameter find the external and internal diameter assuming the max. Torque is 1.4 times the mean torque. (8)
  
3. a) Discuss about Procedure for super heater safety valve pressure setting and drum safety valves pressure setting if the boiler approved working pressure is 105 kg/sq.cms and inlet pressure of steam turbine is 95 kg/sq.cms. (10)  
 b) What is stress relieving? How is it useful in boiler maintenance? (6)
  
4. a) What is boiling mechanism? What are the types of boiling? (6)  
 b) Discuss about Nucleate boiling in detail with a sketch? (10)
  
5. a) What is attemperation and discuss about its purpose? (6)  
 b) A boiler is operating at 100 bar and 535°C with steam flow rate is 105 TPH, the super heater temperature maintained by 2 stage attemperation. Attemperation feed water supplied at 15°C and Super-heated steam temperature of second stage to be maintained at 490°C to maintain the main steam temperature. The first stage attemperation inlet steam temperature is 515°C. Find the attemperation water flow in the first stage attemperation to maintain the outlet at 490°C [Inlet steam enthalpy, spray water enthalpy and outlet steam enthalpy are 3413.63 KJ/Kg, 658.12 KJ/Kg, and 3349.18 KJ/Kg respectively]. (10)
  
6. a) What is the difference between CFBC boiler and PFBC (pressurized Fluidized bed Combustion) boiler? (6)  
 b) What are all the Provisions given in CFBC boiler to maintain the Bed temperature within the range of 800 to 950°C? (6)  
 c) Explain about natural circulation and Forced circulation in details? (6)
  
7. a) What are the safety precautions to be taken before entering into the boiler for maintenance work? (6)  
 b) A boiler working on 100 kg/cm<sup>2</sup>, 535°C. Steam flow is 95 TPH. The Economizer inlet water temperature is 210°C. Find the coal flow in Tonnes per hour when boiler efficiency is 87% and fuel GCV is 3200 Kcal/kg. [Steam enthalpy and water enthalpy are 3464.33 KJ/Kg and 897.631 KJ/Kg respectively] (10)

8. a) Explain the difference between Surface condenser and Air cooled Condensers? (6)
- b) What are the factors affect condenser size (4)
- c) How do you find leakage in Condenser? How condenser leakage affects power plant performance? (6)
9. Answer any FOUR of the following (4x4)
- a) Define Boiler as per the Boilers Act 1923.
- b) Super critical boiler.
- c) Calculate the weight of coal in tones which is stored in a conical shape in the yard if the diameter at base and height are 100 meters are 100 meters and 75 meters respectively. Assumed density of coal is 0.9 kg/m<sup>3</sup>.
- d) How do you prevent Boiler feed pump from vapour lock and cavitation?
- e) Furnace explosion.
- f) Corona effect in Electro-static Precipitator.
- g) Advantages and disadvantages of using Bagasse as fuel.

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**BOILER OPERATION ENGINEERS EXAMINATION, DEC-2013****BOILERS-II**

Marks: 100

Time: 2 1/2 Hrs

Note:

- 1) Candidates should attempt Six (6) questions subject to alternative or limitations, if any, mentioned herein or in each question. If more are answered, the last extra answers will be ignored.
- 2) Parts of the same questions must be answered together and must not be interposed by answer(s) to other question(s).
- 3) Question no. One is compulsory.
- 4) Candidates should answer the paper in English only.

1. a) Briefly discuss about Furnace Safeguard system. (5)  
 b) How three elements drum level control works and discuss about its advantages and disadvantages? (5)  
 c) What is circulating fluidized bed combustion? Discuss with a neat sketch. (10)
2. a) What is an explosion door? And how does it safeguard the boiler? (8)  
 b) What are the reasons for the failure of Reheater tubes and how do you prevent this? (8)
3. a) Explain how do you conclude that Economiser tube leak and detail the procedure for attending it as a Boiler Operation Engineer. (6)  
 b) What is Phosphate hideout in the boiler? Discuss it and how can we prevent it? (10)
4. a) What is Reverse Osmosis? Discuss the RO system with a sketch. (10)  
 b) Why are chlorination and De-Chlorination important in an RO plant? (6)
5. a) How do you find the APH leakage? What are the possible reasons for APH leakage? (6)  
 b) In an Air Pre-heater, Gas inlet is 31 kg/s with 3.5% oxygen in the outlet the oxygen content increases to 4.2%. Find the leakage quantity of air and also find the increase in ID fan load % due to the leakage. (10)
- Here's the text extracted from the image:
6. What are the types of Boiler preservation? Discuss in detail each method and distinguish advantages and disadvantages. (16)
- 7 a) What are the analysis done on Boiler flue gas in environmental point of view and performance point of view? (6)  
 b) What is proximate analysis and ultimate analysis? Why it is required to be analyzed? (10)
8. a) What are the methods of speed control used in BFP for energy saving? Discuss advantages and disadvantages of them? (8)  
 b) Explain about De-aerator. (8)
9. Answer any Four of the following (16)
- a) Discuss about Steam Purity.  
 b) Priming and Foaming.  
 c) Explain Heat Rate and Specific steam consumption.  
 d) Give material specifications of carbon steel and alloy steel pipes used for steam pipeline.  
 e) Briefly discuss about Boiler 'blow down' and '% blow down'.  
 f) Erosion and distortion of tubes in boiler.  
 g) Blending of coal.

**BOILER OPERATION ENGINEERS EXAMINATION, DEC-2013**  
**BOILER DRAWING**

Time: 2 Hrs.

Max. marks: 100

Note: Answer all questions in English.

Read the typical AFBC boiler pressure parts arrangement drawing and answer the following

20 x 2 = 40

1. What is the outside diameter of the steam drum?
2. At what height is the primary super heater outlet header located with reference to the water wall bottom header?
3. How many water wall tubes are provided in the right-side water wall panel?
4. What is the maximum size of the down comer provided in this boiler?
5. At what height is the water drum located with reference to the economizer bottom header?
6. What is the size of the secondary super heater coil tube?
7. How many 25 NB size nozzles are provided on the steam drum?
8. At what angle is the rear water wall panel (where ash is likely to be accumulated) bent with reference to the horizontal axis?
9. What is the gap between the steam drum and water drum if the thickness of the water drum shell is 50 mm?
10. What is the size of the in bed evaporator coil headers?
11. What is the distance between the safety valves on the steam drum?
12. At what distance is the secondary super heater inlet header located with reference to the steam drum centerline?
13. What is the pitch maintained in arranging primary super heater coils?
14. Which tube has the chance of swaging in this boiler?
15. In how many ways is steam entering the primary super heater?
16. What is the size of the tube used for inbed coils?
17. How many economizer coils are provided in this boiler?
18. What is the distance between the attemperator and the steam drum?
19. What is the width of the right-side water wall panel?
20. What is the size of the tube used for the economizer coil?



II. Draw sectional elevation of steam junction valve and name the parts (without dimensions).

OR

Draw sectional elevation of thermodynamic type steam trap and name the parts (without dimensions).

5 + 10 = 15

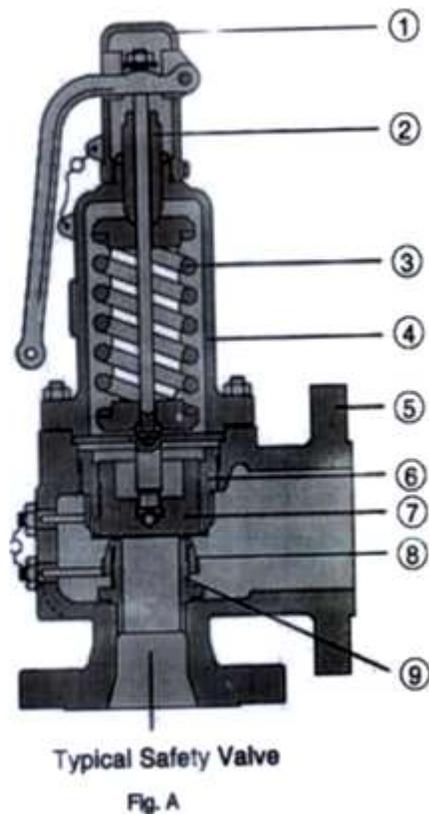
III. Draw schematic line (flow) diagram of reheat system showing superheater, H.P. turbine, L.P. turbine, reheater, etc, using standard symbols.

OR

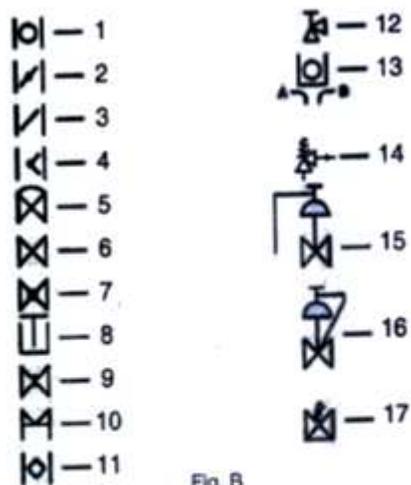
Draw line diagram showing how steam is produced from raw water in a power plant, showing equipment with standard symbols.

15

IV. Name the parts of the safety valve shown in Fig. A.



**VALVE SYMBOLS**



**Typical Weld Joints**

