

**Examination Board of Boilers**  
**(Directorate of Steam Boilers, Maharashtra State)**  
**(Under the Boiler Operation Engineers Rule -2011)**

**Boiler Technology -1**

Date: 26/10/2012  
Duration: 3hrs

Time: 10:30 – 13:30 hrs.

Maximum marks: 100

**General Instructions**

- ✓ The question paper is divided into three sections
- ✓ Answer all questions in section 1, all questions in section 2 and one question from section 3 (Total five questions)
- ✓ Answer should be brief and to the point
- ✓ All Answers of one question should be at one place only

**Section- 1**

- Answer all questions

**QS. 1**

**(10 X 1)**

1. Deaerator is placed at higher elevation
  - a) For good house keeping
  - b) To keep the building cool
  - c) To increase NPSHA and avoid Cavitation in Boiler feed pump ✓
  - d) To vent steam easily
2. Stoichiometric combustible mixture speaks about
  - a) Fuel calorific value
  - b) Temperature of air and fuel
  - c) Unburnt carbon in flue gas
  - d) Theoretical air ✓
3. As per Indian Boiler rule, section- 392, major repair such as fusion weld is to be entrusted to a repairer
  - a) who can satisfy owner regarding quality of welding.
  - b) who can satisfy the boiler Director regarding quality of welding. ✓
  - c) who can satisfy the Manager regarding quality of welding.
  - d) who has qualified welder with him
4. Pressure drop across which type valve is more
  - a) Gate valve
  - b) Butterfly valve

- c) Globe valve ✓
- d) plug valve
- 5. Safety valve is installed at low pressure side of pressure reducing station to
  - a) releases overpressure due to failure of control valve ✓
  - b) Release steam to maintain pressure
  - c) Open during high temperature
  - d) Open during high moisture
- 6. Bed slumping is done in AFBC Boiler to
  - a) reduce Pressure
  - b) reduce temperature
  - c) reduce load ✓
  - d) maintain bed temperature
- 7. Mobrey switch is used to
  - a) Control drum level ✓
  - b) Control fuel flow
  - c) Control air flow
  - d) Control fan speed
- 8. Scoop tube control is used in feed pump to
  - a) Control Vibration
  - b) Current measurement
  - c) Control PH of feed water
  - d) Control drum level ✓
- 9. For easy storage of bagasse
  - a) Bagasse is air dried
  - b) Baling is done ✓
  - c) Bagasse is washed
  - d) Water is sprayed
- 10. Oil burner is used in Pulverised boiler to –
  - a) To reduce soot formation
  - b) To reduce coal consumption
  - c) Stabilize the flame during low load and provide ignition energy during start up ✓
  - d) To increase reheat steam temperature

**Section -2**

- Answer all questions

**QS. 2**

**(5+5+15)**

- a) Diameter of the feed water tank of a boiler is 10 meter and height is 14 meter. If water level is 70% in the tank then calculate the volume of water available in the tank in  $m^3$ .
- b) 305 tons of fuel is consumed in a boiler per hour. If 1150 tonnes of steam is generated in this boiler per hour then calculate evaporation ratio.
- c) Describe the difference (any three)
  - i) Direct and Indirect method of boiler Efficiency calculation
  - ii) Single element and three element drum level control
  - iii) Subcritical critical and supercritical boiler
  - iv) Regenerative and reheat rankine cycle

**QS. 3**

**(5+5+15)**

- a) Following parameters are noted from Ultimate analysis of a coal sample
  - i) Carbon - 50%
  - ii) Sulphur - 2%
  - iii) Hydrogen - 4%
  - iv)  $O_2$  - 1.5%

Calculate theoretical quantity of air required in kg for burning 1 kg coal.

- b) Steam is generated in a boiler at  $110 \text{ kg/cm}^2$  (ab) and  $500^\circ\text{C}$ . Assume drum pressure is equal to steam pressure. Using steam table find
  - i). Saturated steam temperature
  - ii). Degree of superheat
  - iii). Enthalpy of the steam
- c) Describe about any three
  - i) Automatic recirculation valve (ARC) of Boiler feed pump
  - ii) Regenerative air preheater
  - iii) Gauge glass
  - iv) Renewable Energy source for electric power generation

**QS. 4**

**(10+10)**

- a) Write short notes (any two)
  - i) Supercritical Boiler
  - ii) Multi fuel Biomass fired Boiler
  - iii) Annual Inspection and recertification of Boiler
- b) A 200 TPH,  $90 \text{ kg/cm}^2$ ,  $480^\circ\text{C}$  boiler consumes 1050 tons of fuel per day with GCV of 3800 kcal/kg. Feed water inlet temperature is  $140^\circ\text{C}$  and Make up water is negligible. (Enthalpy of steam - 797 kcal/kg)

- i) Calculate efficiency of Boiler by direct method
- ii) Calculate Equivalent evaporation in Tons per hour from and at 100 °C.

**Section -3**

- Answer any one question

**QS. 5**

5+5+5 +5

- i). What are the main equipments used in Coal handling plant of a Pulverised coal fired Boiler
- ii). Describe about ash conveying system of a pulverized coal fired Boiler.
- iii). Why efficiency calculated on LCV basis is higher than efficiency calculated on GCV basis.
- iv). Describe about spray type attemperator to control superheater and reheater temperature.

**QS.6**

5+5+5+5

- i). Describe how bagasse is feed in to boiler
- ii). What precautions are taken during storage of bagasse
- iii). Describe how wash is removed from bagasse fired boiler.
- iv). What are the main Drum internals found in a Bagasse fired boiler.

**QS. 7**

5+5+5+5

- i). Describe the merits of Fluidised boiler
- ii). What is difference between AFBC and CFBC Boiler
- iii). What are the properties of Bed Material and how it is obtained
- iv). What is the main function of Distributer (DB) Plate and air nozzle in a fluidized boiler

**QS.8**

5+5+5+5

- i). How steam is generated in a Waste heat recovery Boiler(WHRB)
- ii). Describe about the Oil handling system of a Oil fired boiler
- iii). Describe different methods adopted for removal of oxygen from Boiler feed water.
- iv). Briefly describe about surface condenser.

\*\*\*\*\* END \*\*\*\*\*

**Examination Board of Boilers**  
**(Directorate of Steam Boilers, Maharashtra State)**  
**(Under the Boiler Operation Engineer's Rule -2011)**

**Boiler Technology - I**

Date: 27/10/2012

Duration: 3hrs.

Time: 10:30 – 13:30 hrs.

Maximum marks: 100

**General Instructions**

- ✓ The question paper is divided into three sections
- ✓ Answer all questions in section-1, all questions from section-2 and one question from section-3 (Total Six questions)
- ✓ Answer should be brief and to the point
- ✓ All Answers of one question should be at one place only

**Section - 1**

- Answer all questions

**QS.1**

(10 x1)

1. Air vent is provided at boiler steam drum to remove air from boiler
  - a) during high pressure condition
  - b) during initial fill up and startup
  - c) during load change
  - d) during high furnace pressure
2. To prevent overheating of superheater tube during starting
  - a) More air is supplied to boiler
  - b) Furnace draft is kept more
  - c) Cold water is supplied to boiler
  - d) Start up vent is kept open till loading of boiler
3. During hot banking, boiler is kept in
  - a) depressurized condition
  - b) pressurized condition
  - c) high air flow condition
  - d) firing condition
4. Soot blowing is carried out in sequential order
  - a) In any direction
  - b) In the direction opposite to flue gas flow
  - c) in the direction of flue gas flow

- d) Alternatively in any direction
5. ESP uses ----- principle to remove fly ash from flue gas
- a) Electrostatic
  - b) Electromagnetic
  - c) Velocity change
  - d) Volume change
6. Acidic or Alkaline nature of boiler water is indicated by
- a) TDS
  - b) Alkalinity
  - c) PH
  - d) Conductivity
7. Excessive blow down
- a) Reduces efficiency
  - b) Increase chemical consumption
  - c) Increases make up water
  - d) All the above
8. Starvation of boiler means
- a) Boiler running in low water condition
  - b) Boiler running at low load
  - c) Boiler fuel quantity is minimum
  - d) Boiler pressure is low
9. Blowdown of a boiler controls
- a) PH of feed water
  - b) Alkalinity of feed water
  - c) Hardness of feed water
  - d) TDS of feed water
10. Preservation of boiler is required
- a) when boiler is not used for longer duration
  - b) During annual shutdown
  - c) After continuous operation of boiler for five years
  - d) at least twice in its life period

## Section- 2

- Answer all questions

**QS. 2**

**(5+5+5 +5)**

- a) Fuel is very precious. Some good operational practices can save fuel in a boiler. Name any five general practices to be adopted in a Boiler for efficient use of fuel for steam generation.
- b) Explain why direct raw water is not used as feed water in a boiler.

- c) Explain about any one treatment process used to convert raw water to boiler feed water.
- d) Name five important parameters of boiler water that is measured to monitor water quality.

**QS. 3**

**(5+5+5+5)**

- a) For safe operation of boiler and to avoid damage to boiler, some automatic interlocks are provided. Name three such interlocks.
- b) Neither excess combustion air nor shortage of combustion air is desirable in a boiler. Explain how efficiency of a boiler is affected in both these cases.
- c) Explain the difference between excess air and excess oxygen.
- d) During initial starting of Boiler there is no steam flow. What precautions are taken to avoid overheating of superheater during that period?

**QS. 4**

**(5+5+5)**

Write short notes (any three)

- a) Total dissolved solids (TDS) in Boiler water.
- b) Electrostatic Precipitator (ESP)
- c) Hot banking of boiler
- d) Acid cleaning of boiler tube

**QS. 5**

**(5+5+5)**

Describe the difference (any three)

- a) Water side scaling and Fire side scaling
- b) Wet preservation and Dry preservation
- c) Furnace ash and fly ash
- d) Carbon steel and Alloy steel

### Section- 3

- Answer any one question

**QS. 6**

**(10+10)**

- a) Explain points to be checked during cold start up of a boiler.
- b) Briefly describe steps of water fillup in an empty Boiler?

**QS. 7**

**(10+10)**

- a) How fuel is adjusted in a pulverized coal fired boiler to increase or decrease load on the boiler? How mill out let temperature is adjusted.
- b) What is the role of oil burner in a pulverized boiler?

QS. 8

(10+10)

- a) How fuel is adjusted in an oil fired boiler to increase or decrease load on the boiler? How oil is heated up?
- b) What is atomization? How it is done and how it helps in burning?

QS. 9

(10+10)

- a) What is bed slumping and why it is required in an AFBC Boiler. What care is to be taken during mixing of slumped bed?
- b) Bed of the fluidized boiler is required to be heated during light up. What methods are adopted for initial heating of bed during cold start up?

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**Examination Board of Boilers**  
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**Engineering Drawing**

Date: 28/10/2012  
Duration: 4 hrs.

Time: 10:30 – 14:30 hrs.

Maximum marks: 100

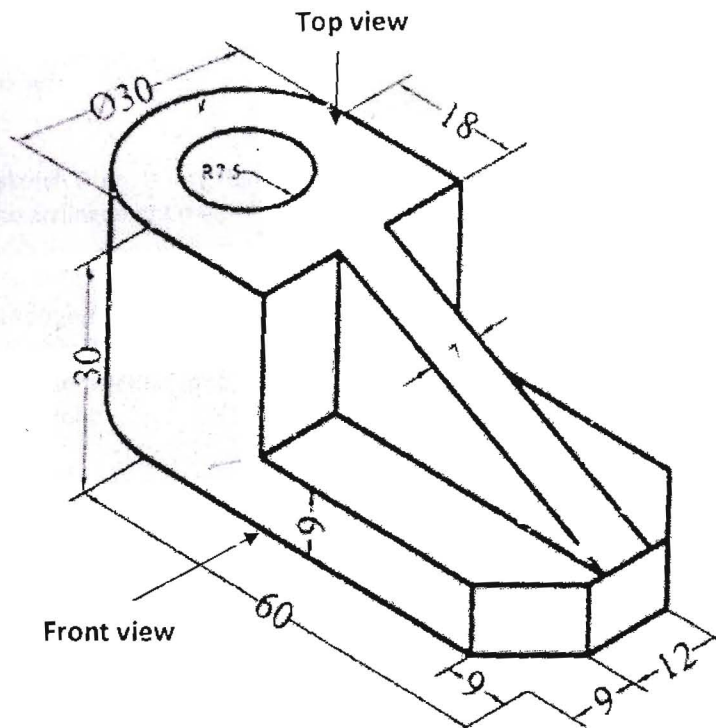
**General Instructions**

- ✓ Answer any five questions
- ✓ Marks are indicated at the right hand side of the question

QS. 1

(10+10)

Draw Front view and Top view of the object given below.








**QS.2**

**(10+10)**

In Piping and instrumentation (P&I) diagram, various symbols are used to represent piping components and instruments.

i) Match the following symbols with the given name

a)		i) Relief valve
b)		ii) Steam trap
c)		iii) Gate valve
d)		iv) Flow orifice
e)		v) Y-type strainer

ii) Draw P&I Diagram of feed water line showing the important piping components and Instruments.

**QS.3**

**(10+10)**

- Neatly sketch Drum level gauge glass and mark important parts.
- Show the arrangement made for safety in case of breakage of glass.

**QS.4**

**(20)**

Draw General arrangement of furnace of a Boiler and show following heat transfer zones.

- Radiation zone
- Radiation + convection zone
- Convection zone

**QS.5**

**(10+10)**

Draw free hand sketches of the following (any two)

- Flow diagram of fuel handling system of any boiler
- Flow diagram of water and steam inside a boiler
- Variable spring support

**QS.6**

**(10+10)**

Neatly draw the following (any two)

- Fusible plug
- Burden tube pressure gauge
- Globe valve