Examination Board Of Boilers
(Maharashtra State)
(*Under The Boiler Operation Engineer's Rule,2011*)

Boiler Technology - 1

Date: 11/2/2012 **Time: 10.30 AM - 1.30 PM**
Max.Marks:100

Note:
- **Attempt Five questions.**
- **Question no.1 is compulsory.**
- **Answers in brief & to the point will attrack more marks.**
- **Draw a neat sketches wherever necessary.**

Q.1] Choose the options & complete the following statements. **(20)**

1] The efficiency of a typical FBC boiler is of the order of

i) 30 % ii) 80 % iii) 70 % iv) 40%

2] For higher boiler efficiencies,the feed water is heated by

i) convective heater ii) recuperator iii) economiser iv) superheater

3] An evaporation ratio(steam to fuel ratio) of an efficient oil fired boiler is in the range of

i) 13-16 ii) 7-9 iii) 1-3 iv) 5-6

4] At which of the following pressure, the enthalpy of evaporation of steam will be highest

i) 4 kg/cm² ii) 20 kg/cm² iii) 12 kg/cm² iv) 8 kg/cm²

5] Stochiometric air required for combustion of Bagasse is about

i) 6 ii) 18 iii) 13.7 iv) 3.2

6] Which is the common coal firing system used in Indian thermal power plant

i) stoker firing ii) pulverised coal firing iii) pressurised bed iv) fluidised bed

7] Deaeration of boiler feed water is referred to us

i) removal of scales by blow down ii) removal of silica iii) removal of dissolved gases iv) phosphate treatment of feed water

8] In industrial applications the type of trap used for main steam lines

i) thermodynamic ii) bimetallic iii) float iv) thermostatic

9] Latent heat at the critical point of a steam phase diagram is

i) 540 kCal/kg ii) infinite iii) zero v) 650 kCal/kg

10) Proper sizing of steam pipeline helps in minimising

I) steam requirement ii) pressure drop iii) temperature drop iv) boiler efficiency

11] The 'Turndown ratio' for oil fired boiler burners is the ratio of

i) air to fuel ii) maximum fuel input to actual fuel inputs iii) maximum air input over minimum air input iv) maximum fuel input over minimum fuel input

12] Presence of sulphur in the boiler fuel leads to

i) corrosion ii) low heat transfer iii) erosion iv) none of the above

13] Increase in stack flue gas temperature of 22°C due to tube fouling or other causes will increase oil consumption in an oil fired boiler by about

i) 4% ii) 3 % iii) 1% iv) 2%

14] The material used to control Sox in the FBC boiler is

i) lime ii) lime stone iii) alumina iv) silica

15] Carpet loss occurs in

i] coal combustion ii) atomisation of oil iii) furnaces iv) coal storage

16] Which fuel requires the lowest amount of excess air for combustion

i) natural gas ii) Furnace oil iii) bagasse iv) pulverised coal

17] The steam generation in a boiler is 16 tonnes for four hrs.The oil consumption for the same period is 1.3 tonnes.The evaporation ratio is

i) 11.5 ii) 12.3 iii) 14 iv) 9.2

18] The purpose of venting air from steam systems is because air is

i) insulator ii) inert substance iii) good conductor iv) dilutant

19] Mineral wool can be applied for temperature range application upto

i) 750°C ii) 1200°C iii) 500°C iv) 950°C

20] The rise in conductivity of boiler feed water indicates

i) drop in the TDS of feed water ii) thermal conductivity of water iii) alkalinity of water iv) rise in the TDS of feed water

Q.2] **(5+4+6+5)**

a) Differentiate between a ball float trap & thermodynamic steam trap.

b) List out various safety interlock system incorporated to operate water tube boiler.

c) Calculate the blowdown rate for a boiler with an evaporation rate of 5 Ton/hr ,if the maximum permissible TDS in boiler water is 3500 ppm & with 17% make up water addition.The Feed water TDS is around 350 ppm.

d) Convert to:

- 160 Delta ° F to ---------- Delta °C
- 80 N/mm² to ---------- Mpa
- 40 HP to ---------- kCal
- 650 mm WC to ---------- kg/cm²
- 250 torr to ---------- mm of Hg

Q.3] **(5+4+5+6)**

a) Draw a neat line diagram of steam PRV station & name all important components.

b) What do you understand by the terms boiler mountings & accessories.Name important mountings & accessories.

c) What are the merits & demerits of artificial draught over natural draught.

d) Steam at a pressure of 15 kg/cm²(g) is flashed to a lower pressure of 2 kg/cm²(g) .If the steam flow rate is 1000 kg/hr.Calculate the % of flash steam & flow rate of flash steam.

Q.4] **(4+4+4+8)**

a) List out various factors affect Boiler performance.

b) Enumerate disadvantages of manual blowdown system.

c) What are the factors to be considered for proper selection of water treatment plant.

d) The following readings were obtained during a boiler trial of 6 hrs.duration.

Mean steam pressure	: 14kg/cm²(g)
Weight of steam generated	: 24000 kg
Mean dryness fraction	: 0.9
Mean feed water temp.	: 28°C
Weight of coal used	: 4800 kg
Calorific value of coal	: 5500 kCal/kg

Calculate i) Factor of equivalent evaporation ii) Equivalent evaporation from & at 100°C
iii) Efficiency of boiler

Q.5] **(4+4+6+6)**

a) What do understand by the terms 3T's applied for complete combustion.

b) Compare the merits & demerits of surface condenser over jet condensers.

c) Find the numbers & diameter of 3000mm long tubes required in a fire tube boiler to get total tube surface area 20 m² & total cross sectional area of 0.07 m² for the flue gas flow.

d) If a shaft has a diameter of 50 mm & the maximum shearing stress is 425 kg/cm². What will be the moment of resistance of shaft to twist .

Q.6] Write short notes on (any four). **(5+5+5+5)**

a) Importance of boiler logbook

b) Balanced draught system

c) Feed water injector

d) Water softening plant

e) Precautions for Bagasse storage

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Boiler Technology - 2

Date: 11/2/2012 **Time: 2.30 PM - 5.30 PM**
Max.Marks: 100

Note:
- **Attempt Five questions.**
- **Question no.1 is compulsory.**
- **Answers in brief & to the point will attrack more marks.**
- **Draw a neat sketches wherever necessary.**

Q.1] State whether the following statements are **True** or **False**. **(10+10)**

A)

a) The best steam for indirect heating in most industrial process is as dry as possible.

b) The major axis of elliptical manhole on the shell should be provided circumferentially.

c) Presence of sulphur in the boiler fuel leads to corrosion.

d) Superheat is the addition of heat to dry saturated steam without increase in pressure.

e) Enthalpy of evaporation is also known as latent heat.

f) SO2 emissions in a FBC boiler fired with high sulphur coal are controlled by adding silica to the bed.

g) The equipment used to remove dirt from steam lines before steam trap is bypass line.

h) The problem of water hammer can be eliminated by positioning the pipe so that there is a continuous slope in the direction of flow.

i) The elements of ultimate analysis of fuel does not include volatile matter.

j) Bomb calorimeter is used for the measurement of specific gravity of liquid fuel.

B) Define the following terms related to Indian Boilers Act.

a) Boiler

b) Feed pipe

c) Economiser

d) Steam pipe

e) Accident

Q.2] **(4+6+5+5)**

a) What it indicates, if boiler chimney emits as follows,

- White smoke
- Hazy brown smoke
- Black smoke

b) Estimate SO2 emission through chimney in kg/year.Data as follows.
Days considered : 330
Fuel used: Furnace oil
Sp. Gravity: 0.94
Sulphur content: 3.8%
Qty. of FO consumption: 4 kl/hr

c) What are the basic requirement of insulating material used in steam piping. Mention any five insulating materials used for steam piping.

d) What parameters are analysed in a proximate & ultimate analysis of coal.

Q.3] **(5+4+6+5)**

a) State various ways to improve efficiency of Bagasse fired boiler.

b) What actions should be taken when some defects has been discovered in the boiler.

c) Coal with 35% ash is fired in a boiler.Coal consumption is 80 tons on a specific Day. Clinker is formed by 2% of the ash sticking to boiler tubes. How many Tons of ash are going out of the boiler on the same day.

d) Compare Pulverised fuel firing with stoker firing with respect to

- Furnace temp.
- Coal size
- Air required
- Emission
- Fuel GCV

Q.4] **(5+5+5+5)**

a) Explain with neat sketch of Orsat Apparatus.

b) List out some of the direct & indirect benefits of waste heat recovery systems.

c) What are the precautions to be taken before starting the fire in boiler

d) Describe with neat sketch the arrangement made for chemical cleaning of water tube boiler with superheater & economiser as integral part.

Q.5] **(4+4+8+4)**

a) State comparison between steam & sonic soot blowing system.

b) List out various reason for loss of fuel in boiler operation.

c) A sample of fuel was found to have the following percentages analysis by weight.Carbon 84% ,Hydrogen 12%, Oxygen 1.5% , Sulphur 4%.
Determine the minimum or theoretical air requirement to burn 1 kg fuel.

d) Water tube boiler is having pr. range 10 - 20 kg/cm²(g) with superheated steam. Write name of material against boiler components.

Q.6] Write short notes on (any four). **(5+5+5+5)**

a) Boiler instruments

b) Off seasonal maintenance of bagasse fired boilers

c) Precautions for storage of coal

d) Preservation of boiler for longer time

e) Key result areas for efficient steam utilisation

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Engineering-Drawing

Date: 12/2/2012 **Time:10.30 AM - 2.30 PM**

Max.Marks: 100

Note : Attempt any FIVE questions.
: Figures to the right indicates full marks.

Q.1] Draw proportionate free hand sketches of following (Any Two). **(20)**
a) Fusible plug
b) Eye Foundation bolt
c) Single riveted lap joint

Q.2] Fig.no.1 shows Front View & Top View of an object. Draw isometric view. **(20)**

Q.3] Make a neat sketch of spring loaded safety valve & identify the different components. **(20)**

Q.4] Draw a neat proportional sketches & name all parts of following (Any Two). **(20)**
a) Bourdon type pressure gauge
b) Water level indicator
c) Feed check Valve

Q.5] Fig.no.2 shows isometric view. Draw the following views using first angle method of projection. **(20)**
a) Elevation looking in the direction of arrow 'X'.
b) Plan
c) Section end view from right hand side (section along A-A)
d) Give all dimensions

Q.6] Draw a PID (Piping & Instrumentation Drawing) of your plant boiler & show all circuits in PID. **(20)**
a) Boiler feed water circuit
b) Steam circuit
c) Air & flue gas circuit
d) Fuel circuit
e) Blow down circuit

Fig NO.1

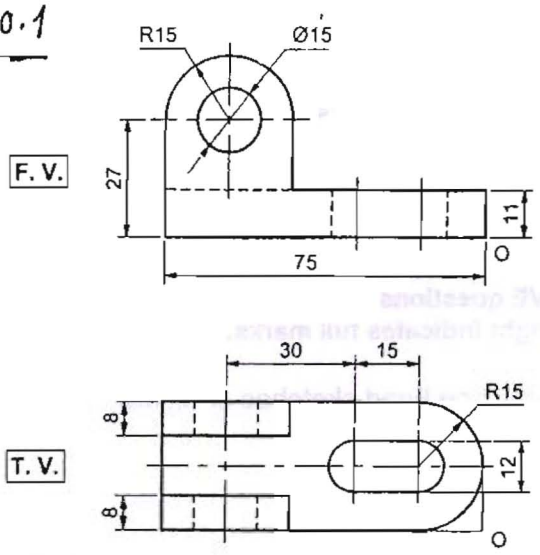

Fig.No.2