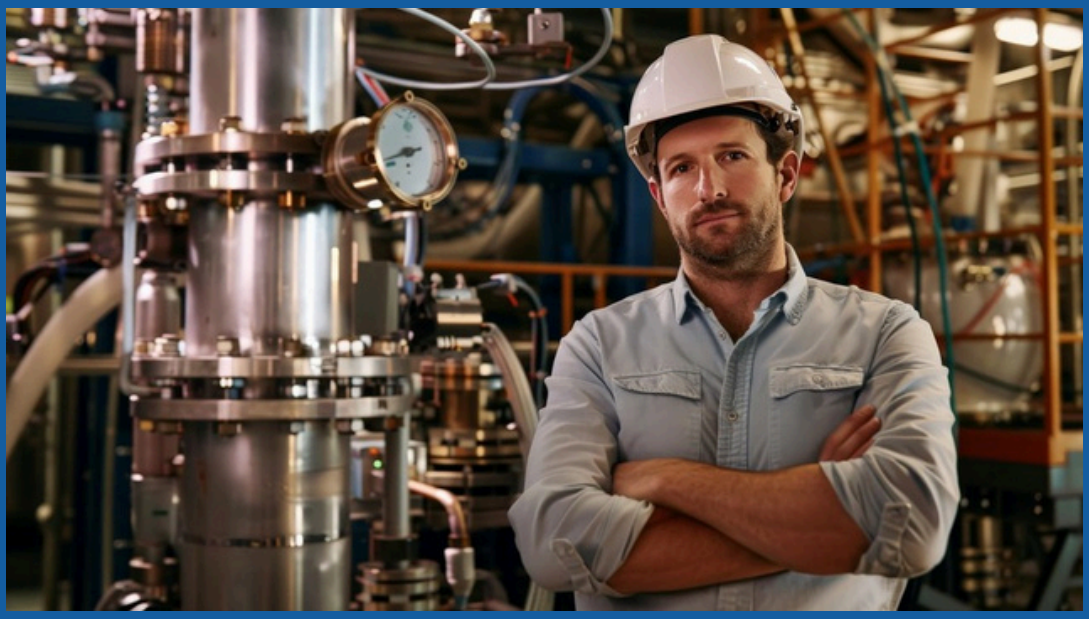
Study Material For Boiler Operation Engineer (BOE) Exams



Theory, Numerical Problems, MCQs and Boiler Drawing Problems from BOE Exams

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CON 1329

EXAMINATION BOARD OF BOILERS

(MAHARASHTRA STATE)

(Under The Boiler Operation Engineer's Rule, 2011)

Boiler Technology –I

7th February 2015

[TIME : 10-00 A.M. to 1-00 P.M.]

(MAX. MARKS : 100)

Notes.—(1) The question paper is divided into *two* sections.
(2) **Section-1** is *compulsory*.
(3) Answer any *four* questions from **Section-2.**
(4) Answer should be brief and to the point.
(5) All Answers of one question should be at one place only.

SECTION-1

Answers *all* questions

Marks

1. (*a*) Choose right answer :— 10

(*i*) Boiling temperature of water depends on—

(*a*) Quality of fuel

(*b*) Quantity of heat added

(*c*) Vessel pressure in which water is heated

(*d*) All of the above.

(*ii*) Safety valve is a . . . . . in the boiler

(*a*) Accessories

(*b*) Mounting

(*c*) Decorative

(*d*) None of the above.

(*iii*) Pressure drop across which type valve is more—

(*a*) Gate valve

(*b*) Globe valve

(*c*) Butterfly valve

(*d*) Safety valve.

(*iv*) Calorific value of fuel oil is higher as compared to other fuel because of . . . . . .

(*a*) Presence of oxygen in it

(*b*) Presence of sulpher in it

(*c*) Presence of volatile organic compounds in it

(*d*) Presence of hydrogen in it.

Marks

(*v*) Function of Deaerator is to . . . . . .

(*a*) Remove dissolved gaseous from the feed water

(*b*) Remove only oxygen from the feed water

(*c*) Remove silica from the feed water

(*d*) None of the above.

(*vi*) Hot air from Air heater . . . . . .

(*a*) improves combustion

(*b*) Increases thermal efficiency of the boiler

(*c*) stabilises fuel combustion

(*d*) All of the above.

(*vii*) Blowdown is required to . . . . . .

(*a*) Control drum pressure

(*b*) Control Boiler water PH

(*c*) Control Alkanity of Boiler water

(*d*) Control Total Dissolved Solids (TDS) of Boiler water.

(*viii*) Scaling in Boiler tube is not desired as it . . . . . .

(*a*) Overheats the tube material and leads to failure

(*b*) Cause obstruction of water circulation causing overheating of tube.

(*c*) Reduces heat transfer and hence, efficiency of the boiler

(*d*) All of the above.

(*ix*) Orsat apparatus is used for . . . . . .

(*a*) Fuel analysis

(*b*) Water analysis

(*c*) Air analysis

(*d*) Flue gas analysis.

(*x*) Attemperation is done to . . . . . .

(*a*) Control of steam pressure

(*b*) Control of steam temperature

(*c*) Control of feed water silica

(*d*) None of the above.

(*b*) Explain the following in **one** or **two** sentence:— 10

(*i*) Dryness fraction of dry saturated steam

(*ii*) Mobrey switch

(*iii*) ARC of boiler feed pump

(*iv*) HGI of coal

(*v*) 3 Ts.

Marks

SECTION-2

Answer any *four* questions. Answer should be short and to the point only:—

2. (*a*) Briefly explain about Boiler Mountings and Boiler Accessories. 4

(*b*) How air preheater improves boiler performance? Describe the working of tubular airheater. 5

(*c*) Efficiency calculated on LCV basis is higher than efficiency calculated on GCV basis. Explain this with suitable example. 5

(*d*) A 250 TPH, 110 kg/cm^2, 500 ^{0}C boiler consumes 1300 tons of fuel per day with GCV of 3800 kcal/kg. Feed water inlet temperature is 140 ^{0}C and Make-up water is negligible. (Enthalpy of steam - 803 kcal/kg)— 6

(*i*) Calculate efficiency of Boiler by direct method

(*ii*) Calculate Equivalent evaporation in Tons per hour from and at 100 ^{0}C .

3. (*a*) Describe the difference :— 4

(*i*) Suspended solids and Total dissolved solids of Water.

(*ii*) Lifting pressure and reset pressure of spring loaded safety valve.

(*b*) Give brief description of the following (any *two*):— 5

(*i*) Sugar test of Boiler feed water

(*ii*) Latent heat

(*iii*) Membrane type water wall

(*iv*) Coal mill.

(*c*) Explain the function of Steam Drum. Write name of four important Drum internals. 5

(*d*) Steam is generated in a boiler at 100 kg/ cm^2 (ab) and 480 ^{0}C. Assume drum pressure is equal to steam pressure. Using steam table find— 6

(*i*) Saturated steam temperature

(*ii*) Degree of superheat

(*iii*) Enthalpy of the steam.

4. (*a*) Explain the following terms (any *two*):— 4

(*i*) Biomass fuel

(*ii*) Buckstay

(*iii*) Gagging of safety valve

(*iv*) Fusible plug.

(*b*) What are the various methods used for flow control of a fan? Among these which are energy efficient methods? 5

(*c*) Explain the term supercritical. What are the main differences in between sub-critical and super-critical Boiler? 5

(*d*) Size of a rectangular water-tank is 5 meter × 8 meter and height is 10 meter. If water level is 70% in the tank, then calculate the volume of water available in the tank in liter. 6

Marks

5. (*a*) Explain the function of steam trap. What tests are carried-out to detect defective traps? 4

(*b*) Explain the various processes in Rankine cycle. 5

(*c*) Describe the difference between (any *two*):— 5

(*i*) Direct and indirect method of efficiency calculation

(*ii*) Sub-critical and Super-critical Boiler

(*iii*) Renewable and Non-renewable energy.

(*d*) Following parameters are noted from ultimate analysis of a coal sample:— 6

(*i*) Carbon—53%

(*ii*) Sulpher—2%

(*iii*) Hydrogen—2%

(*iv*) O_2—1.5%.

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

6. Answer any *four* :— 20

(*a*) Describe the function of Air nozzles in AFBC and CFBC Boiler.

(*b*) Describe about any one of the following external water treatment process . . . . .

- Softener
- DM Plant
- RO Plant

(*c*) What precautions are to be taken during storage of bagasse?

(*d*) Describe the fuel feeding system of a spreader stoker boiler.

(*e*) Describe about scoop control of Boiler feed pump in a PF Boiler.

(*f*) Why spiral wall design is adopted in a Supercritical Boiler? Why Transition header is required in this case?

CON 1330

EXAMINATION BOARD OF BOILERS

(MAHARASHTRA STATE)

(Under The Boiler Operation Engineer's Rule, 2011)

Boiler Technology – II

7th February 2015

[TIME : 2-30 P.M. to 5-30 P.M.]

(MAX. MARKS : 100)

Note :—(1) The question paper is divided into *two* sections.

(2) **Section-1** is *compulsory.*

(3) Answer any *four* questions from **Section-2.**

(4) Answer should be brief and to the point.

(5) All Answers of one question should be at one place only.

Marks

SECTION-1

Answer *all* questions

1. (*a*) State *True* or *False.* :— 5

(i) Bomb calorimeter is used to measure calorific value of fuel

(ii) Hydrazine is used in boiler water for TDS control

(iii) Steam drum air vent is closed before firing of boiler

(iv) Set pressure of Superheater safety valve is kept higher than drum safety valve

(v) Flow regulation of fan by damper control is an energy efficient method.

(*b*) Define following terms in **one** or **two** sentence:— 5

(*i*) Three element control of drum level

(*ii*) Stoichiometric air fuel ratio

(*iii*) Turndown ratio

(*iv*) BMCR

(*v*) Flame impingement.

(*c*) Convert following units as directed:— 10

(*i*) Convert 2300 Kcal into KJ

(*ii*) Convert 1450 psi into kg/cm^2

(*iii*) Convert 1200 mmwc to kg/cm^2

(*iv*) Convert 1 kwh into kcal

(*v*) Convert 23 MPa to kg/cm^2.

[*Turn over*

Marks

SECTION-2

Answer any *four* questions. Answer should be short and to the point only.

2. (*a*) Name four important parameters of boiler water that is measured regularly to monitor water quality. 4

(*b*) List out various losses in a boiler during operation. 5

(*c*) Explain the procedure of annual inspection of boiler for renewal of certificate as per Indian Boiler Regulation (IBR). 5

(*d*) 1500 Tons of coal having 46% Ash is used in a boiler in a particular day. 20% of the ash generated is drained from boiler as bottom ash. Rest of the ash is fly ash. Calculate fly ash generation on that particular day. 6

3. (*a*) Explain the term furnace purging. Why it is required? 4

(*b*) Write about any one of the commonly used ND test method used in boiler house. 5

(*c*) Write suitable material for following for a 100 TPH, 55 kg/cm^2, 500 ^{0}C boiler.— 5

(*i*) Water wall tube

(*ii*) Steam drum

(*iii*) Final super heater tube

(*iv*) Main steam pipe line

(*d*) Specific fuel consumption of a 300 TPH boiler is 0.2 kg of fuel per kg of steam. Calculate yearly net financial burden to the company if cost of fuel increased by 50 rupees per ton. Consider average 90% loading of the boiler and 300 running days in a year. 6

4. (*a*) Name any four general practices to be adopted in boiler operation for efficient use of fuel for steam generation. 4

(*b*) List out some critical parameters to be monitored while boiler is in operation. 5

(*c*) Explain how scaling takes place in boiler tube and How it affects Boiler performance? 5

(*d*) Exhaust flue gas temperature of a Boiler is 142 ^{0}C. If ambient temperature is 28 ^{0}C then calculate energy loss in flue gas per kilogram in kcal/kg. Consider specific heat of flue gas as 0.23 kcal/kg. 6

5. (*a*) What automatic action is taken because of safety interlocks in the following cases in a boiler? 4

(*i*) Drum level very high

(*ii*) Furnace pressure very high

(*iii*) Deaerator level very low

(*iv*) Superheated steam temperature high

(*b*) List out some important field instruments used at boiler along with its purpose. 5

Marks

(*c*) Describe some important reasons of boiler tube failure. What proactive action can be taken to avoid this? 5

(*d*) Efficiency of a 300 TPH Coal fired boiler is 84%. Calculate quantity of coal required per day if the boiler runs in full load. Consider feed water temperature 140 ^{0}C and GCV of coal 3600 Kcal/kg and enthalpy of final superheated steam is 803 kcal/kg. 6

6. Write short notes (any *four*) :— 20

(*a*) Off season maintenance of baggase fired boiler.

(*b*) Controlling mill temperature of PF fired boiler.

(*c*) Bed slumping of AFBC Boiler.

(*d*) Wet mode operation of supercritical boiler.

(*e*) Loop seal of CFBC Boiler.

(*f*) RLA study

(*g*) Hydro test of boiler pressure parts.

CON 1331

EXAMINATION BOARD OF BOILERS

(MAHARASHTRA STATE)

(Under The Boiler Operation Engineer's Rule, 2011)

Engineering Drawing

8th February 2015

[TIME : 10-00 A.M. to 1-00 P.M.]

(MAX. MARKS : 100)

Notes.—(1) Answer any *five* questions.

(2) Marks are indicated at the right hand side of the question

Marks

1. Draw general arrangement of a water tube boiler and show following :— 20

   (*a*) Water wall

   (*b*) Bank tube

   (*c*) Primary superheater

   (*d*) Final superheater

   (*e*) Economiser

   (*f*) Air preheater.

2. Draw the following (any *two*) :— 20

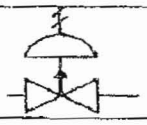
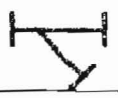
   (*a*) Draw general arrangement of a Deaerator and show all its important components.

   (*b*) Draw P&I diagram of feed water circuit of a boiler.

   (*c*) Draw freehand sketch of a gauge glass.

3. (*a*) Draw P-V and T-S diagram of rankine cycle. 10

   (*b*) Match the following symbols with their name:— 10

a)		i)	Level transmitter
b)		ii)	Steam trap
c)		iii)	Gate valve
d)		iv)	Pneumatic operated control valve
e)		v)	Y -type strainer

[*Turn over*

Marks

4. Draw the following (any *two*) :— 20

   (*a*) Neatly sketch spring loaded safety valve and mark its important parts.

   (*b*) Draw general arrangement drawing of a pressure Reducing and De-superheating Station (PRDS) and show all important components.

   (*c*) Neatly sketch burden tube type pressure gauge and mark important parts.

5. Neatly draw the following (any *two*) :— 20

   (*a*) Globe valve

   (*b*) Single -V and Double -V Butt weld

   (*c*) Steam system of a PF fired power plant showing superheater, re-heater, steam turbine, condenser, HP and LP bypass.

6. Draw Front view and Top view of the object given below :— 20

