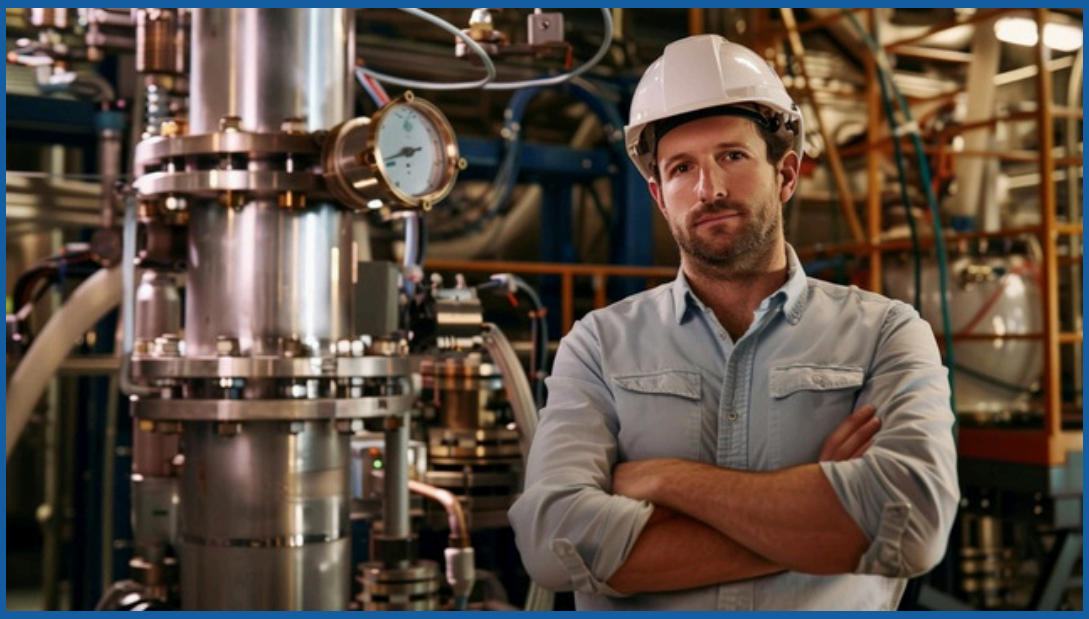
Study Material For Boiler Operation Engineer (BOE) Exams



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

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AP BOE-2017 Papers (Exam held on 09.04.2017)

BOILER OPERATION ENGINEERS EXAMINATION – 2017

Boiler – 1

Time: 2½ hrs. Max. 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 questions 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. Answer all Questions: 10x1=10

A) How many water level gauge glasses are to be provided in super critical Boiler?

B) Forced draught fan is to be installed before air preheater. Why?

C) For the Same Diameter and thickness of the tube, a water tube boiler has _____ heating surface as compared to fire tube Boiler.
a. More b. Less c. Equal d. None

D) What is "AVT" Treatment in Boiler?

E) 12 kg of carbon generates _____ kg of CO (Carbon Monoxide)

F) The Latent heat of steam _____ with increase of pressure

G) The Heat input which will increase the temperature in a substance without changing its phase is called_____

H) What will be the Latent heat of water at Critical Pressure and temperature?

I) What is Triple point of water?

J) In a Basic Rankine Cycle what part of the power plant will represent Iso-Baric Heat Rejection.

1.1 Define Steam Pipe as per the Boilers Act, 1923. 2
1.2 What are the basic reasons for Boiler steam pressure fluctuations? 2
1.3 Clarify the Boiler deterioration at elevated temperature. 2
1.4 What mid-point temperature in Steam pipes? 2
1.5 What is Rifle tube? And what is the use? 2

2 A) In a feed water heater (HP heater), the feed water temperature Inlet-175°C and Outlet-235°C. The steam condensate outlet is 170°C. Calculate the amount of steam flow to the heater and steam at 335°C and 30 Bar. 5

B) How Super Critical Boilers different from subcritical Boiler? 5

C) What is re-heater? What is the advantages of it? How it impact the boiler efficiency? 6

3 A) A Boiler fired with a fuel of 18 MJ/kg GCV. If the fuel Moisture increases from 5% to 15%. Calculate the impact on Boiler efficiency.? 5

B) What are the pre-cautions to be taken during steam line charging from Boiler? 5

C) Write about travelling grate Boiler giving sketch. 6

4 A) What is the upward force (in kgs.) on a safety valve disc of dia. 2.5 inchs, when the Boiler Seam pressure is 135 kg/cm^2. 6

B) What is Drum Level Control and Types? Explain one Control in detail? 10

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5 A) In Boiler during Combustion of fuel 2 types of NOx is formed, What are they? What methods used to control them? 6

B) In a power plant, 120 MW Capacity steam Turbine has been operated with 2 nos. of boilers with each capacity of 250 TPH. Boiler-1 is (old) 78% efficiency and Boiler-2 is new one with 90% efficiency. The Turbine operated at 105% PLF in Peak hours (0800 hrs to 2200hrs) and 80% PLF in Non-Peak hours. Turbine heat rate is 9360 KJ/Kwh. Steam parameters of 125 kg/Cm^2 and 540°C. Feed water temperature of Boiler inlet (final HP heater Outlet) is 240° C. considering the High efficient boiler is operated always at full load, Calculate the fuel Consumption of individual Boilers if the fuel used is 22.5 MJ/Kg? (steam enthalpy – 3450.432 kJ/kg, feed water enthalpy – 1037.52 kJ/kg) 10

6 A) In a Coal Yard, Coal has been stored in a shape of frustum of a Cone. (as shown in **Fig.6A**), and the dimensions are R = 30 m, r = 10 m, h = 22 m, l = 20 m calculate the quantity of coal stored. consider Bulk Density of coal = 1.1 MT/M^3 6

B) A boiler operating with 2 set of fuels. 10
Fuel-1 : Fuel-2 is used in 60% : 40% (mass wise) configuration mix.
Calculate the theoretical air requirement per kg of fuel in boiler inlet.
The fuel details are tabled below.

Parameters	Fuel-1	Fuel-2
C	88.57	39.1
H	3.65	3.04
N	2.43	3.78
S	4.74	0.70
O2	0.05	4.18
Ash	0.66	49.19

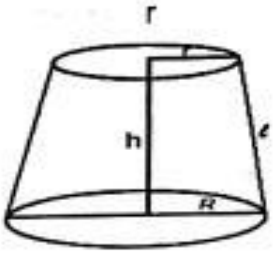

Fig. 6A

7 A) What is boiling mechanism?
What is Departure from Nucleate boiling and Explain? 5

B) What are the types of De-aerators ? Explain any one type with neat sketch? 6

C) What are the pre-cautions to be taken during initial heating of de-aerator? 5

8 A) Explain the precautions to be taken before entering into boiler for shutdown maintenance ? 4

B) What steps do you to take to improve the boiler efficiently? 4

C) Find the horse power if a solid shaft of 65 mm diameter can transmit at 150RPM. The maximum **shear stress** in the shaft is not to exceed 600 kg/cm^2. 5

D) A water main of 2 mts. ID and 2 cms. Thick is subjected to an internal pressure of 15 kg/cm^2. Calculate the circumferential stress. 3

4x4=16

9 Brief about any **FOUR** of the below:

A) Air preheater and its advantages
B) Priming and Foaming
C) Vertical Super heaters
D) FGD – Flue gas de-sulphurisation
E) Boiler Safety Valves
F) Attemperation

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BOILER OPERATION ENGINEERS EXAMINATION – 2017

Boiler – 2

Time: 2½ hrs. Max. Marks: 100

Note:

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3. Question No. **ONE** is Compulsory.
4. Candidates should answer the paper in **ENGLISH** only.

1. Answer all Questions: **10x1= 10**

A) What is SPM?
B) _____ is also known as Na3PO4 ?
C) What parameter is common for Ultimate and proximate analysis of coal ?
D) Up to _____ °C temperature the coal is heated to find inherent moisture ?
E) What is the specification of material that is generally used for steam pipe if saturated steam is the medium.
F) What is the final product when limestone captures Sulphur-di-oxide in a CFBC boiler ?
G) Name the NDT method used to study microstructure of any pressure parts.
H) Name the type of weld joint used to weld spool pieces of super heater coils?
I) What is the instrument used to know the silica content in water ?
J) What is the alloy composition difference in P91 and T91 material ?

1.1) Why de-chlorination is required in RO plant ? 2
1.2) Explain about Ultra Filtration ? 2
1.3) What Protections given in modern ESP's to avoid Human entry when ESP is in charged condition ? 2
1.4) What is the simplest way to find out the APH air leakage in boiler during operation ? 2
1.5) Name any two methods to avoid 'outage corrosion' in the boiler unit ? 2

2. A) What are the pre-cautions to be taken before entering into ESP for maintenance? 6

B) What are the different types of air heaters. Discuss about any one type in detail with sketch? 10

3. A) What are the precautions to be taken in condensers (Surface or ACC as per your power plant) before taking into operation after chemical cleaning? 6

B) What is the Chemical used to remove DO in feed water in you plant? Explain with chemical reaction that how it removes DO from Feed water? Where it is dosed in the feed water system and why it is dosed in that point? 10

4. A) Name the non destructive tests conducted in boiler maintenance and discuss about anyone of the Tests 6

B) How do you improve the efficiency of a Bagasse fired Boiler ? 6

C) Discuss about blending of different fuels ? 4

Contd...2

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5. A) Why Soot blowing is required ? Why some of the CFBC boilers are not provided with Soot blowers? 6

B) Explain the working mechanism of Sonic Soot blowers and how it differs from Steam soot blowers? 10

6. A) How VM is measured Coal? Explain the procedure in detail ? 8

B) A boiler operates with coal of 25% ash and 5400 Kcal/kg GCV fuel and generates total fly ash of 250 Tons per day. If the coal quality changes to 35% ash with 4000 Kcal/kg GCV fuel. How much ash will be generated per day? (fly ash to Bed/Bottom ash ratio is 80:20) 8

7. A) What are the possible reason for MSSV to stuck-up and not getting open after boiler start up? 4

B) During a boiler start up after annual shutdown, after steaming the boiler MSSV glad got failed and Heavy leakage started,
As a Boiler Operating engineer,
What is your action after the leakage?
What are all the possible reasons for gland failure?
How will you ensure to avoid such failures in next shutdown? 12

8. A) What is condensate Polishing ? Explain in detail with a neat sketch ? 8

B) What is meant by COC in cooling tower? What are the parameters impacts (Increase and Decrease) the COC ? 8

9. Explain any **FOUR** in detail: 4x4=16

A) Oxygenated Treatment
B) Post Weld heat Treatment
C) Flash steam
D) Colloidal Silica
E) Name any four Environmental protection equipments used in power plant
F) Boiler purging

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BOILER OPERATION ENGINEERS EXAMINATION – 2017

Reading Boiler Drawing

Time: 2 hrs. Max. Marks: 100

Note :
1. Candidates should answer the paper in ENGLISH only.
2. Answer All Questions

* * * * * *

I. Name the Pipe Fitting symbols shown in Figure - 1 — 2x10 = 20

II. Name the parts of valve shown in Figure - 2 — 1x8 = 8

III. Name the different types of superheaters shown in Figure - 3 — 2x4 = 8

IV. Name the pipe fittings shown in Figure - 4 — 1x2 = 2

V. Draw Schematic diagram of water flow showing how raw water is converted into boiler feed water and name the equipment. — 10

VI. Draw Neat Sketch if Float type steamtrap and name the parts. — 8

VII. Draw Sketches of following superheaters coils. — 8

A) Single pass B) Two pass C) Three pass D) Four pass

VIII. Answer the following questions by reading the diagram of typical boiler and its details. 2x18 = 36

1) What is the thickness steamdrum ? 56
2) At what elevation the muddrum is located with reference to side wall bottom header ?
3) How many water platten assemblies are provided in this boiler ? 05 no!
4) What is the OD of economiser outlet header ? ϕ 114.3
5) What is the distance between steamdrum and waterdrum (center to center) ? 6500
6) What is the OD of furnace side wall tube ? 63.5 OD
7) How many different materials are used for manufacturing of superheater coils ? 3
8) What is the distance between economizer outlet header and inlet header ? 7128
9) What is design temperature considered by the designer for primary superheater outlet header ? 325°c
10) At what elevation common outlet header is located with reference to rear wall bottom header ? 1238
11) What is the temperature and pressure of steam coming out from boiler ? 535°c 29...
12) What is the OD of muddrum ?
13) What is the outside diameter of platten assembly outlet header ? ϕ 168.3
14) At what elevation the steam drum is located with reference to economizer inlet header ?
15) What is the maximum steaming capacity of the boiler ? 32500 kg/hour
16) What is the OD of Saturation link pipe ? ϕ114.3
17) What is the heating surface of boiler ? 2220 Sq.m
18) What is the OD of water platten assy. tube ? ϕ51

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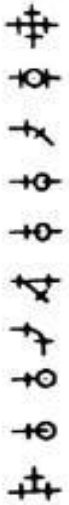
Pipe Fitting Symbols



DESIGN PARAMETERS :

1.	DESIGN PRESSURE	: 53.0 Kg/cm²(g)
2.	DESIGN TEMPERATURE	: 295.5 °C
3.	HYDRAULIC TEST PRESSURE	: 79.5 Kg/cm²(g)
4.	SUPER HEATER OUTLET PRESSURE	: 45 Kg/cm²(g)
5.	SUPER HEATER OUTLET TEMPERATURE	: 420 °C
6.	BOILER CAPACITY	: 32000 KG PER HOUR

HEATING SURFACE AREA BREAK–UP :

a.	FURNACE	: 825 SQ.M
b.	BOILER BANK	: 748 SQ.M
c.	SUPER HEATER	: 240 SQ.M
d.	ECONOMISER	: 456 SQ.M
e.	WATER PLATEN	: 151 SQ.M
TOTAL HEATING SURFACE AREA		: 2220 SQ.M

WORKING METAL TEMPERATURE :

a.	FURNACE	: 298.5 °C
b.	BOILER BANK	: 295.5 °C
c.	SUPER HEATER	
	PRIMARY	
	1. INLET HEADER	: 268 °C
	2. OUTLET HEADER	: 335 °C
	3. COIL	: 364 °C
	SECONDARY	
	1. INLET HEADER	: 325 °C
	2. OUTLET HEADER	: 420 °C
	3. COIL (T1–T2)	: 429 °C
	4. COIL (T2–T3)	: 459 °C
d.	ECONOMISER	
	1. INLET HEADER	: 120 °C
	2. OUTLET HEADER	: 194 °C
	3. COIL	: 205 °C

Details Pertaining to WT Boiler



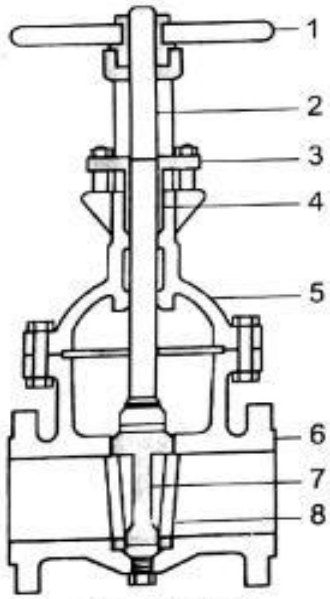


Figure - 2 Valve

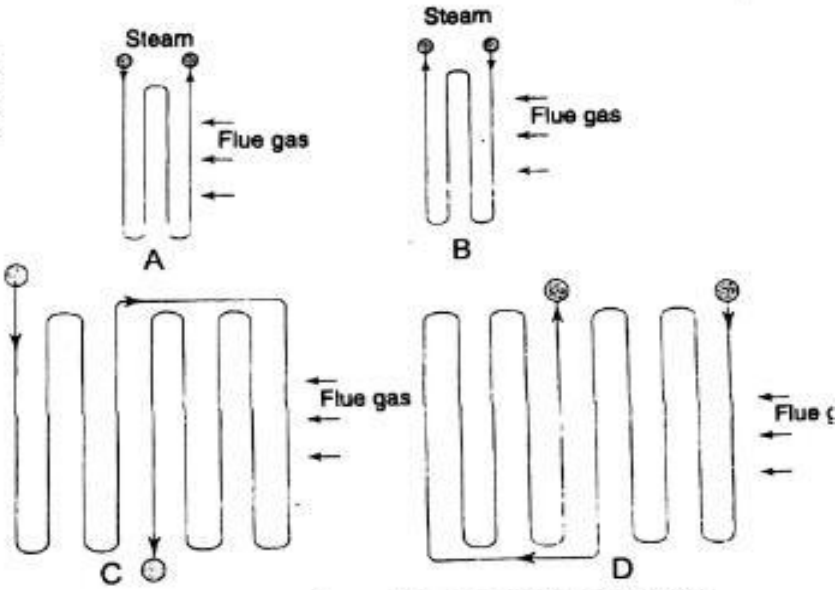


Figure - 3 Different Types of Superheaters

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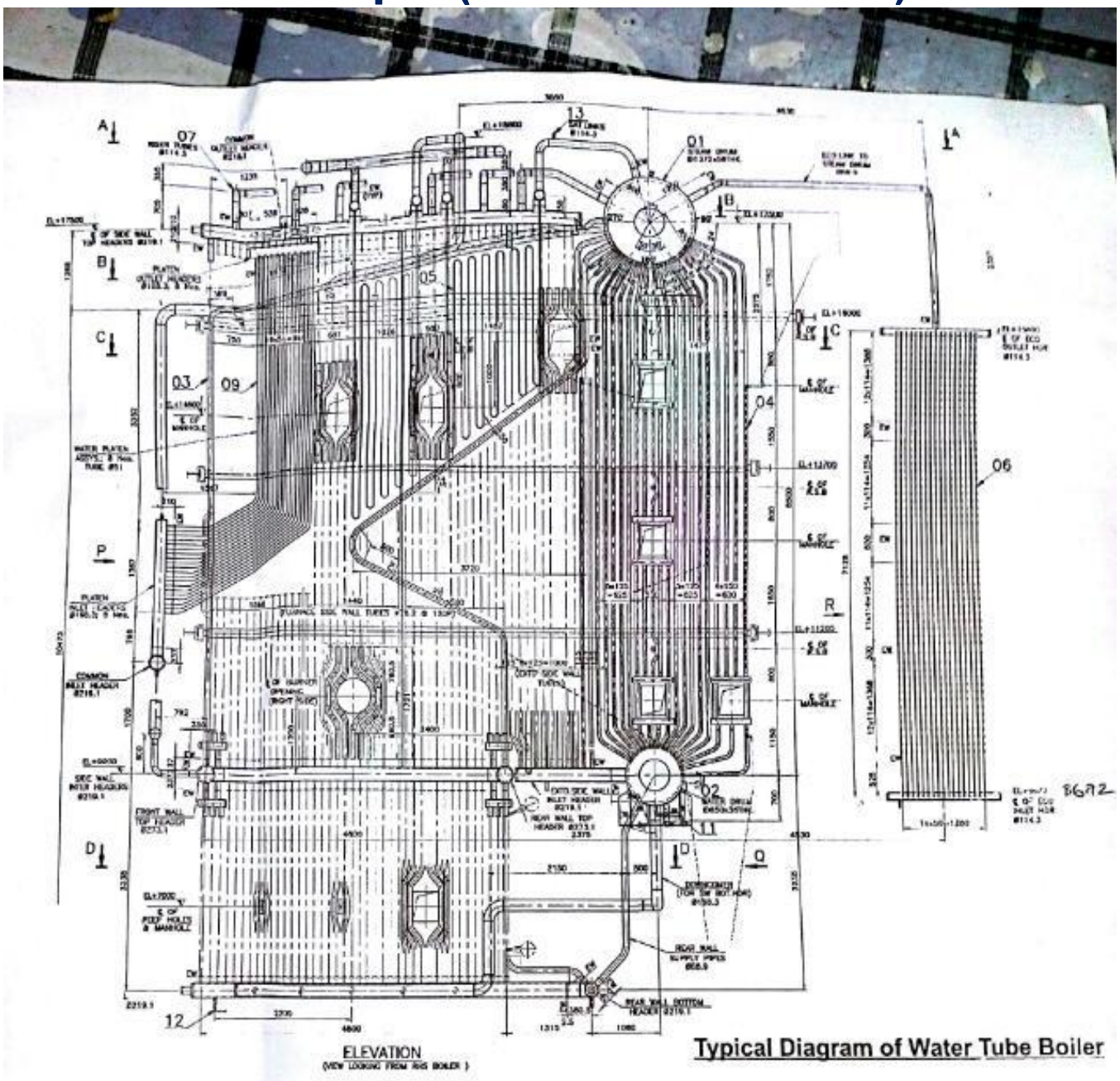

Typical Diagram of Water Tube Boiler

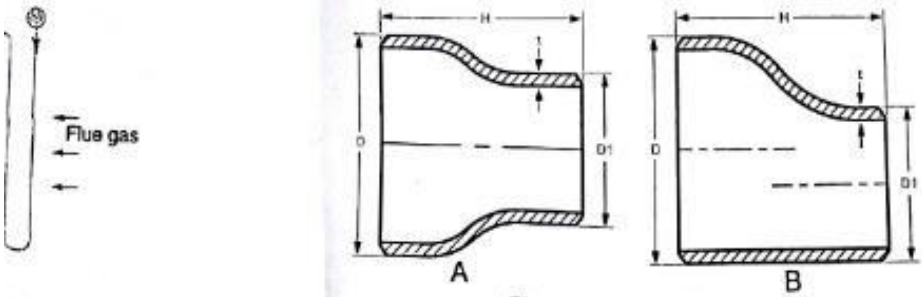

Figure - 4 Pipe Fittings