

BOILER OPERATION ENGINEERS EXAMINATION, DEC-2013

BOILERS-I

AD BOE

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 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 blowoff at a gauge pressure of 0.8 N/mm^2 . 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^2 . 8
- b) A hollow shaft is to transmit 300 KW at 80 RPM. If shear stress is not to exceed 60 N/mm^2 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 it is 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 156° C and Super-heated steam temperature of second stage to be maintained at 490° C to maintain the main steam temperature. The first stage attemperator 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?

4

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/cm², 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 leakages 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 tonnes which is stored in a conical shape in the yard if the diameter at base and height are 100 mts and 75 mts respectively. Assume density of coal is 0.9 kg/M³

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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BOILERS-II

Time: 2 1/2Hrs.

Marks: 100

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- 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
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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 neat sketch 10
2. ✓ a) What is explosion door? And how it safeguards the boiler? 8
- b) What are the reasons for 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 hide out in boiler? Discuss about it and how we can prevent it? 10
4. a) What is Reverse Osmosis? Discuss about RO system with sketch? 10
- b) Why chlorination and De-Chlorination is important in a 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

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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 environment 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

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Time: 2 Hrs.

BOILER DRAWING

Max.marks: 100

Note : Answer all questions in English

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

20 X 2 = 40

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

9

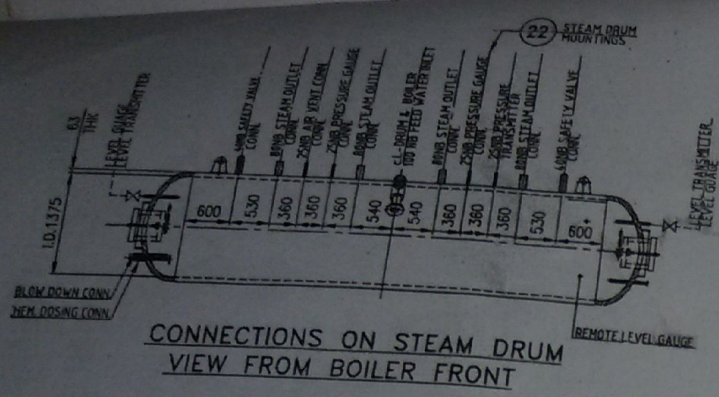
V. Valve symbols are given in Fig. B. Name the valves

17

VI. Identify the weld joints shown in Fig. C

4

12-21

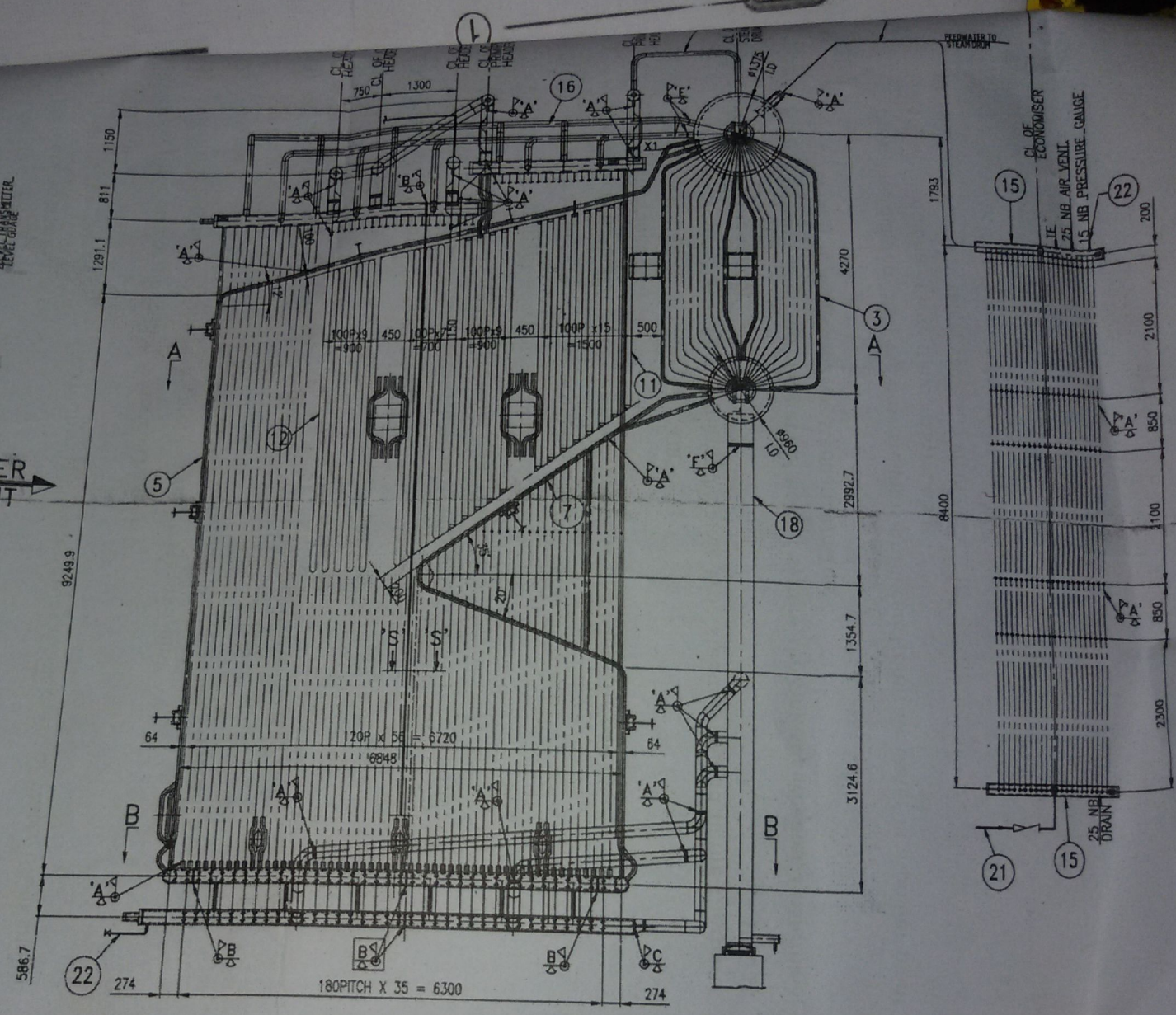


CONNECTIONS ON STEAM DRUM
VIEW FROM BOILER FRONT

BOILER FRONT

WELDING DETAILS AS SPECIFIED
(REF. NOTE 8)

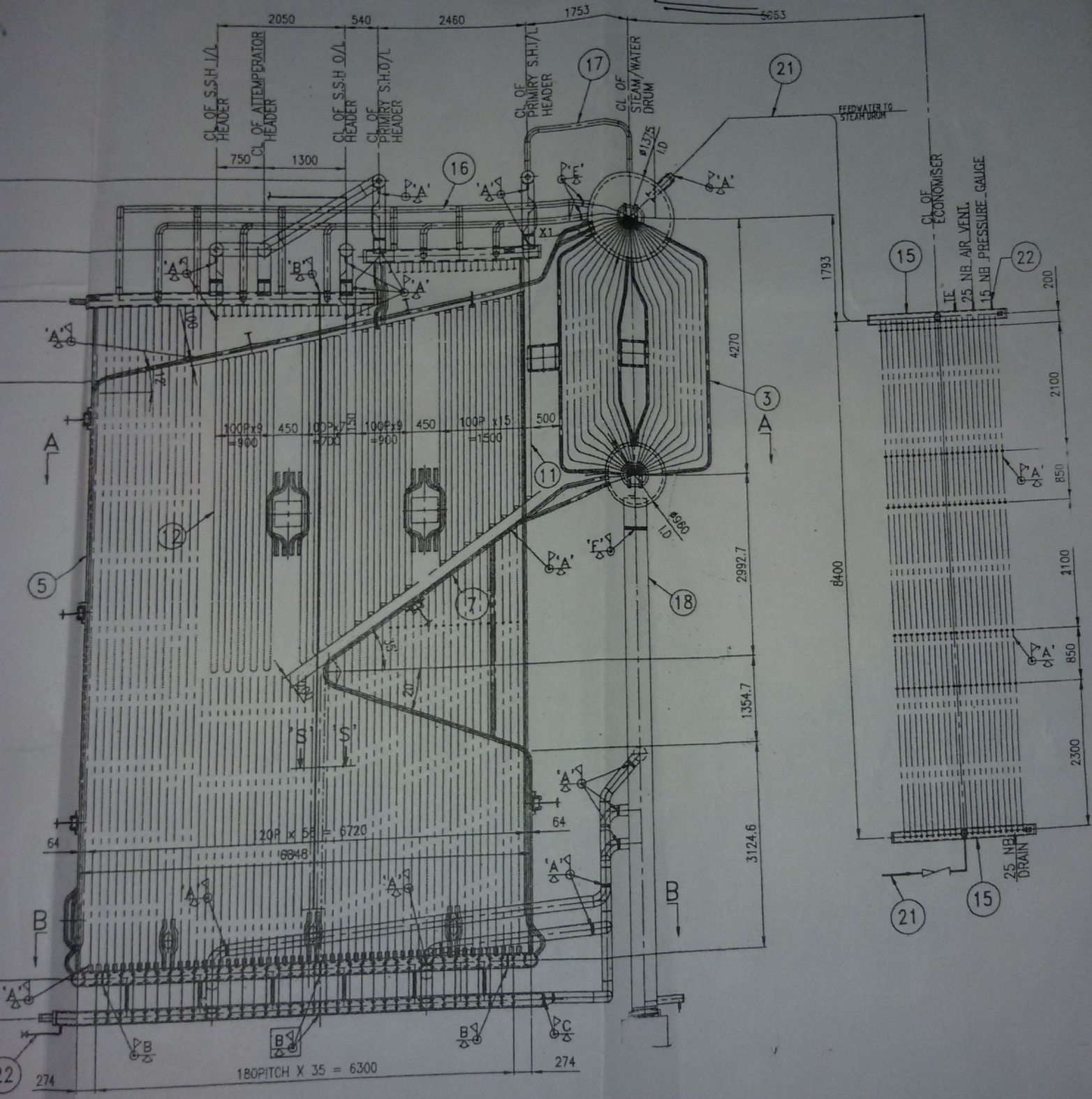
TUBE/PIPE SIZE	NO. OF JOINTS	PURPOSE
O.D.	THK.	
38.1	4.06	185 PRIMARY SUPERHEATER COILS
50.8	4.06	76 SECONDARY SUPERHEATER COILS
38.1	4.06	88 ECONOMISER COIL
63.5	4.06	39 FRONT WATER WALL PANEL
63.5	4.06	39 REAR WATER WALL PANEL
63.5	4.06	57 LEFT SIDE WATER WALL PANEL
63.5	4.06	57 RIGHT SIDE WATER WALL PANEL
219.1	23.01	6 R.H. & L.H. INBED COILS TOP HEADER
219.1	23.01	2 FRONT & REAR WALL BOTTOM HEADER
219.1	23.01	2 R.H. & L.H. SIDE WALL TOP HEADER
50.8	6.35	8 INBED COILS
219.1	23.01	2 R.H. & L.H. INBED COILS BOTTOM HEADER
406.4	40.49	2 MAIN DOWNCOMERS
168.3	10.97	22 DOWNCOMERS
219.1	18.26	2 DOWNCOMERS
101.6	5.6	28 RISERS



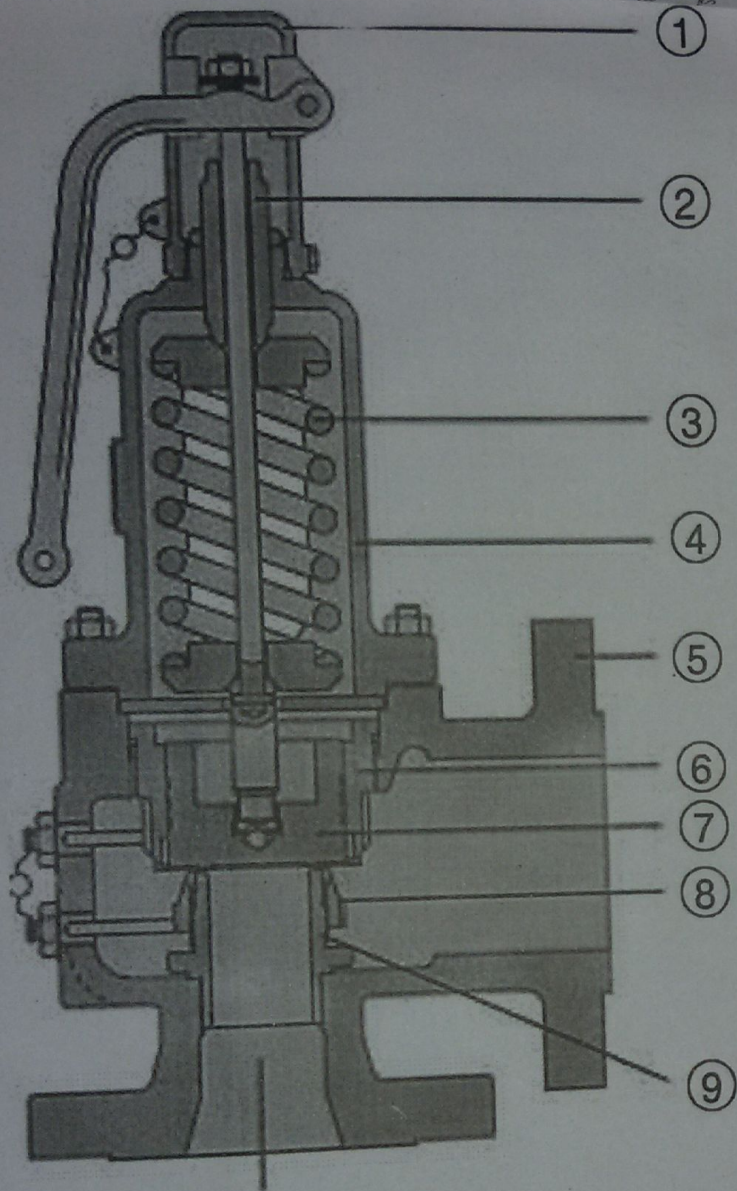
ELEVATION
VIEW FROM BOILER RHS

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ELEVATION
VIEW FROM BOILER RHS



Typical Safety Valve

Fig. A

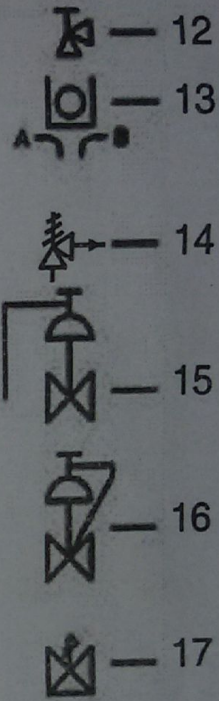
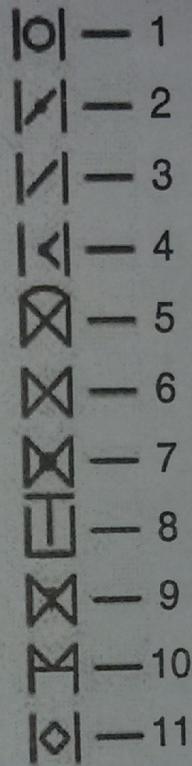


Fig. B

Typical Weld Joints

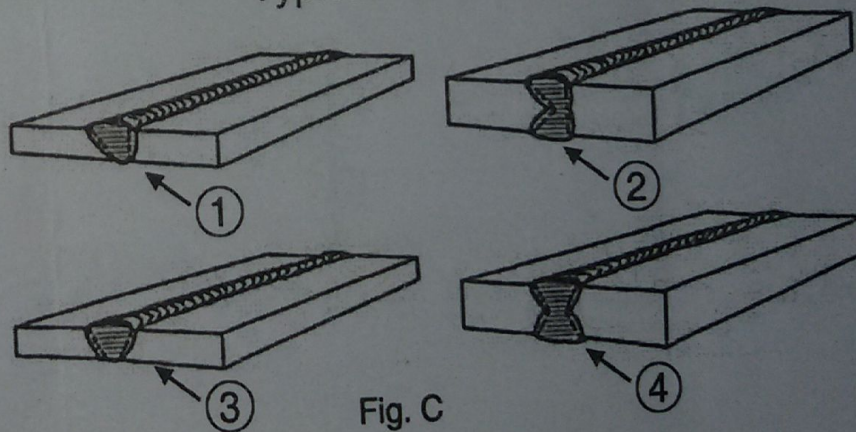


Fig. C

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