Paper 1

Regn No: _____

Name: _____

(To be written by the candidate)

EXAMINATION FOR COMPETENT PERSONS FOR INSPECTION AND CERTIFICATION OF BOILERS – APRIL - 2011

BOILER DESIGN ENGINEERING

Date : 24/4/2011 Time : 09:30 – 11:30 Hrs.

Marks : 100

1. (a)

(i) Can the longitudinal seams of successive rings of shell can fall in line ?

(ii) What is the minimum distance between the adjacent seams?

2 Marks

(b) What is the maximum length of plain furnace, without bowling hoop or corrugation?

2 Marks

(c) What is the minimum and maximum permitted thickness for a plain furnace ?

2 Marks

(d) Give the hydro test pressure in terms of design pressure for various classes of shell type boilers? Class-I, Class-II and Class-III?

2 Marks

(e) Why the tubes need to be expanded? Explain with neat sketches of various tube expansion methods?

2 Marks

2. Given Below the details of superheater Header for the following design conditions.

30 Marks

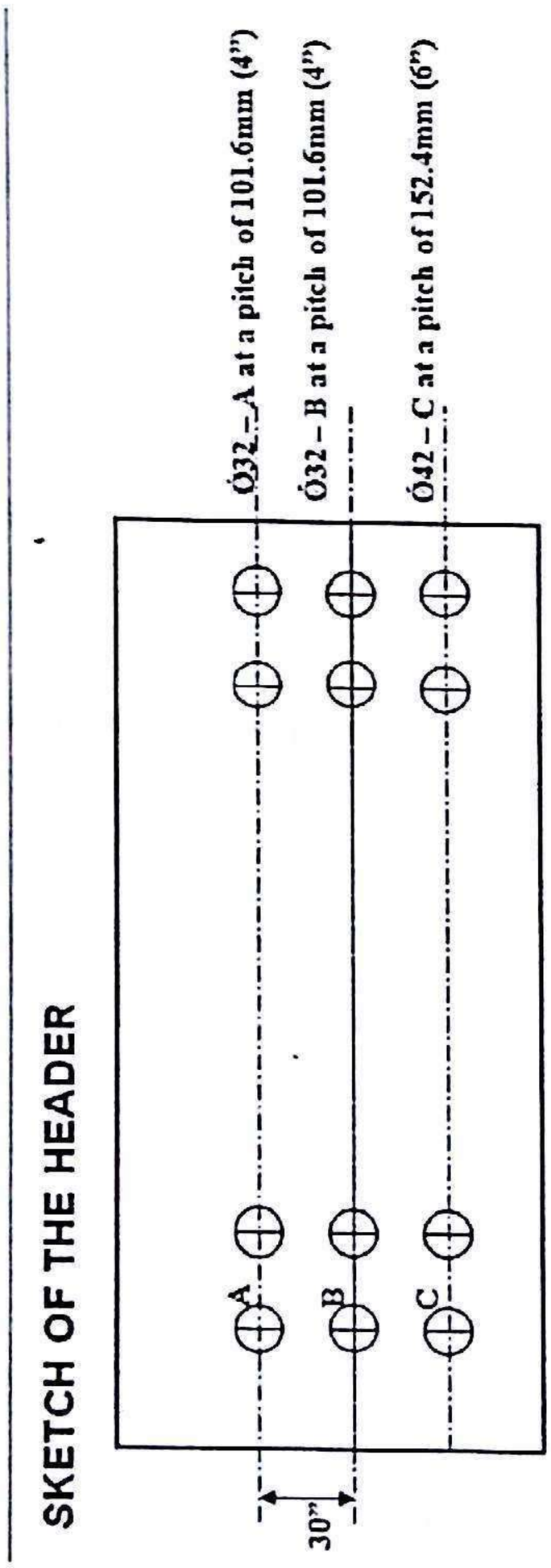
Design Drum Pressure	-	138Kg/cm2
Pressure drop	-	0.8 Kg/cm2
Steam temperature	-	520 degree C
Header inside diameter	-	368 mm
Header thickness	-	56 mm
Header material	-	SA 335 P22

Temp degree C	500	525	550
Stress value Kg/cm	2825.0	652.6	486.4

The header is located in the Penthouse. The hole drilling pattern in the Header is as per the Sketch given below.

(i) Calculate the minimum ligament efficiency.

(ii) Calculate the maximum permissible pressure for the Header for the given design parameters. Whether this can be used for the given pressure of 138.8 Kg/cm2 at 520 degree C.



3. Superheater coil for a boiler has the following design parameters. (20 Marks)

Steam temperature	-	470 degree C
Tube outside diameter	-	44.5mm
Tube nominal thickness	-	5.0 mm
Tube material	-	SA 213 T22
Buttweld co-efficient	-	0.9

No compensation for close radius bends

Allowable stress for SA 213 T22

Temp degree C	450	475	500
Stress Value Kg/cm2	1162.5	1019.7	825.0

The coils are located in the Flue gas path where the heat transfer is through radiation. Check whether this coil can be used for working pressure of 185 Kg/cm2. If the same coil is to be used as Reheater coil for a working pressure of 54 Kg/cm2 and all other parameters remaining same as that of superheater coil, find its suitability.

4. What is the minimum required thickness for a flat tube sheet of shell type of boiler of dry back construction, having the following specification?

(20 marks)

Working pressure	=	150 psi
Shell ID	=	2000 mm
Tube sheet material	=	SA 515 Gr.70
Allowable stress at Metal working temperature	=	20,000 psi

Diameter of the circle taken between staying point of the plate is given under

D	Support points
300	Between furnace stay tube and shell
350	Between gussets and shell
355	Between furnace and stay tubes
310	Between stay tubes

5. Determine the maximum working pressure of a shell having the following specification:

(20 Marks)

Shell ID	=	2000 mm
Material	=	SA 515 Gr. 70
Allowable stress at metal working temperature	=	20,000 psi
Thickness	=	12 mm
Weld efficiency	=	1

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