SECOND EXAMINATION FOR COMPETENT PERSONS FOR INSPECTION & CERTIFICATION OF BOILERS – OCTOBER 2012

Boiler Design Engineering

Date : 07/10/2012   Time : 9:30 – 11:30 Hrs.

Marks : 100

Q1 Each subdivision carries 2 marks.   5 X 2 = 10 Marks

    a .i) As per the Regulation, whether the drum with ID 1372mm & Thickness of 75mm need heat treatment?

    ii) What are the two types of butt joints used to make Longitudinal / circumferential seams?

    b. When the holes are drilled on the weld seams, what are the precautions to be taken?

    c. Give the minimum thickness as per Regulation for the class I,II,III boilers.

    d. i) Whether ERW tubes can be used as stay tubes?

    ii) What is the minimum thickness of the stay tube of diameter 63.5mm as per code?

    e. i) How many Safety Valves are to be provided in the boiler to relieve the Pressure?

    ii) What is the minimum diameter of the Safety Valve?

Q2 Refer the sketch 1 of a sample steam drum .The Steam drum is to be constructed in accordance with the requirements of IBR. It has an inside diameter of 1371 mm and an internal design pressure of 133 Kg/Sqcm(g) at 332 °C. Calculate the thickness of Dished Head as per the appropriate regulations.   (30 Marks)

Note:

1. Material used for dished head is SA 516 Gr.70 and the values of allowable stress value provided in the governing code of plate material are given in the table:

Maximum allowable stress value for SA 516 Gr. 70				
Temp° C	300	325	350	375
Allowable stress value in Mpa	136	132	128	123

2. Consider the forming allowance as 12.5%.

3. Additional reinforcement pad is not recommended for openings

Q3 An integral Economiser is located the convection pass of the boiler with the following design parameters. Check whether the coils can be used for a maximum working pressure of 177 Kg/Sqcm(g). (20 Marks)

Tube size   – D 51 x 3.6 mm

Material   – SA210GrA1

Design Temp – 345°C

Allowable stress for the material can be taken from the following table.

Temp in °C	325	350	375
Stress value in Kg/SqCm	1202.3	1177.0	1071.2

If not found suitable, calculate the tube thickness required to withstand this pressure.

Q4 Find the thickness of the compensating plate to be provided around the opening in a shell type boiler, given the following design details. (20 Marks)

Width of the opening	W	150 mm
Shell Actual thickness	T_s	32mm
Unpierced shell thickness	T_1	28 mm
Branch thickness	T_n	25 mm
Min thickness required for the Branch	T_2	22.5 mm

Allowable stress in Kg/SqCm for the various components can be taken from the following Table:

Shell Plate	S_1	802
Branch	S_2	762
Compensating Pad	S_3	700

Note : 1) There are no external loads acting on the pipe

2) The weld area is negligible.

Q5 Find the minimum required tube thickness for primary convection super heater coils of single loop with the following parameters. (20 marks)

Tube size & Specification   - OD 51 mm & SA 210 Gr.A1

Maximum working pressure   - 68 kg/sqcm (g)

Tube inside fluid temperature   - 333 ° C

Values of allowable stress value for SA 210 Gr A1 provided in governing code of tube material is given in the table:

Temp° C	325	350	375	400
Allowable stress value in MPa	118	117	105	88.9

Note : Commercially available thickness for OD 51 mm & SA 210 Gr.A1 tube are 3.25 mm, 3.66 mm, 4.0 mm ,4.5 mm & 5.00 mm

Ø 410
OPENING

DISHED HEAD

DISHED HEAD
HEMI SPHERICAL
(TYP)

A

GASKET

DOOR PLATE

VIEW — A

SAFETY
VALVE
NOZZLE-2

DOWN COMER-1

RISER1

AIR VENT
NOZZLE

ID 1371

ELEVATION

IBD NOZZLE

CL OF
STEAM DRUM

WATER INLET

STEAM
OUTLET

PRESSURE
GAUGE

DOWN COMER-2

RISER2

SAFETY
VALVE
NOZZLE-2

STEAM DRUM DETAILS

SKETCH 1