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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR

MALAYSIA FRANCE INSTITUTE

FINAL EXAMINATION

JULY 2010 SESSION

SUBJECT CODE	:	FFD 22302
SUBJECT TITLE	:	BASIC PRESSURE VESSEL DESIGN AND STEEL STRUCTURE
LEVEL	:	DIPLOMA
TIME/DURATION	:	12.30pm – 2.30pm (2 HOURS)
DATE	:	08 NOVEMBER 2010

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer TWO (2) question only.
6. Answer all questions in English.

THERE ARE 9 PRINTED PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

1. Rules on the construction of pressure vessels refer to.

   A. ASME I.

   B. ASME II, Part B.

   C. ASME VIII.

   D. ASME V.

(3 marks)

2. What do ASME II, Part A, B, C and D encompass on?

   A. Selection of materials.

   B. Standardization of the materials.

   C. Selection of nozzles and manway.

   D. Selection of the stamps.

(3 marks)

3. Which of the following statement would be the most appropriate about pressure vessel?

   A. It is the gas pressure going out of the pressure vessel.

   B. The gas regulator inside the vessel indicated the gas content.

   C. The content inside the pressure vessel is restless.

   D. The pressure inside the vessel is different than the ambient.

(3 marks)

4. Name the THREE (3) components of lifting attachments?

   A. Shackle, Lifting Lug, and Bolts and Nuts.

   B. Shackle with lug, Eye witness and Lug.

   C. Shackle, Eye-bolt and Lifter.

   D. Shackle and lug, Eye-bolt and Lifting Lug.

(3 marks)

5. What is the best requirement from the following in order to have an economical design of the major and minor vessel?

A. Major vessels 15 – 20 years and minor vessels 8 – 10 years.

B. Major vessels 20 – 30 years and minor vessels 10 – 15 years.

C. Major vessels 10 – 50 years and minor vessels 12 – 15 years.

D. Major vessels 18 – 40 years and minor vessels 5 – 10 years.

(3 marks)

6. The main purpose of a manhole is...

E. to allow the worker to inspect the hole.

F. to provide and to allow for an examination and cleaning.

G. to provide the necessary hole for a man.

H. to provide and to allow for the management to check inside.

(3 marks)

7. A pressure vessel has to retain to pressure. In doing this the pressure applies two types of stresses. They are?

A. Circumferential and length of shell.

B. Circumferential and longitudinal.

C. Circumferential and magnitude.

D. Hoop and circumferential.

(3 marks)

8. All welding shall be done by.

A. SAW and SMEW.

B. SMAW and SAW.

C. SMAW and GTAW.

D. SMAW and SSAW

(3 marks)

9. The preservation of the pressure vessel is usually done by painting the vessel. State the surface preparation that must be taken before the pressure vessel is painted.

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(6 marks)

10. The transportation of vessels by truck requires some considerations. Name THREE (3) of the considerations.

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(6 marks)

11. The pressure vessels openings shall preferably be elliptical, circular or obround. If a circular opening is to be made with Internal Diameter Vessel (IDV) of 180 inches. Calculate the necessary opening base on the given ruling below and justify your answer.

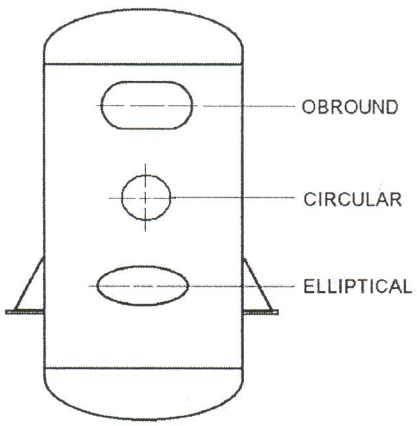


Figure 1 Vessel opening types

The rules, construction details conform to the Code UG-36 through UG-43 and apply to openings:

a) For maximum 60 in IDV one half of the vessel diameter, but maximum 20 in.

b) For opening 60 in IDV 1/3 of the vessel diameter, but maximum 40 in.

(6 marks)

12. Name the FOUR (4) types of dish heads?

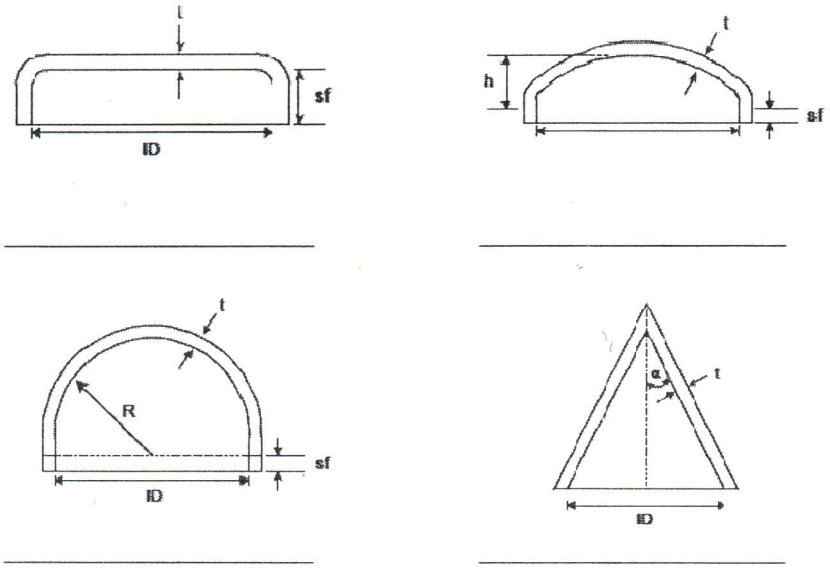
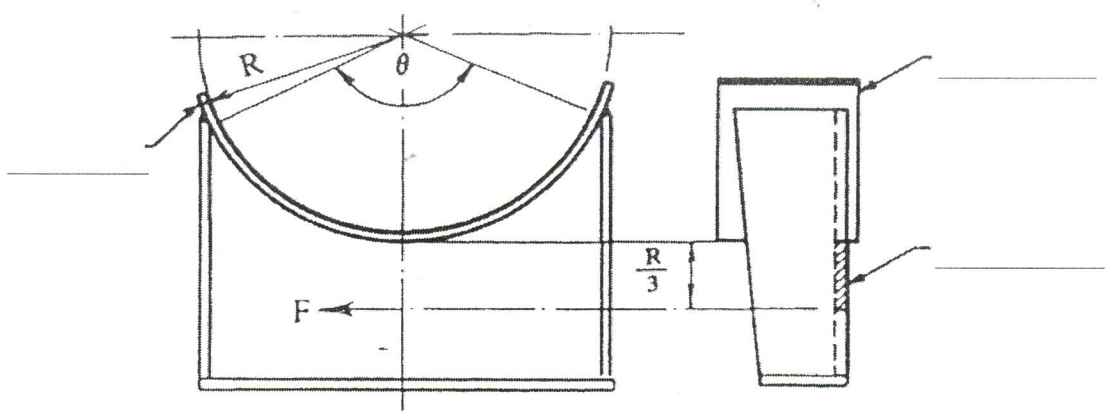


Figure 2 Types of Dish head

(6 marks)

13. With the given diagram of design of saddles label the necessary parts. Joining is made possible by the following three fundamental forces:



(6 marks)

Figure 3 A Saddle Support

14. The deflection ratio for tall towers as per ASME is 6 inches per 100 feet.

Calculate the deflection if a tower is 62 feet tall?

I. 3.82 inches.

J. 3.72 inches.

K. 3.62 inches.

L. 3.22 inches.

(6 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only.

Please use the answer booklet provided.

Question 1

A horizontal pressure vessel 60 inch Internal Diameter is to be fabricated from SA-516 Grade 70 material. The design pressure of 70 psi and stress value of the material 20 000 psi at the design temperature of the vessel is at 600^0F. All joints shall be spot Radiographic Test in accordance with UW-52 with no radiography. The vessel operates full of liquid. The density of the liquid is 62.4 lb/ft^3. Corrosion allowance is 0.75. ***Choose the right formula to answer this question.***

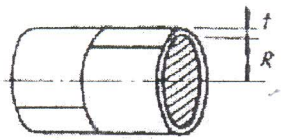
(20 marks)

INTERNAL PRESSURE

FORMULAS IN TERMS OF INSIDE DIMENSIONS

NOTATION

P = Design pressure or max. allowable working pressure psi
S = Stress value of material psi, page 191
E = Joint efficiency, page 172
R = Inside radius, inches
D = Inside diameter, inches
t = Wall thickness, inches
$C.A.$ = Corrosion allowance, inches



CYLINDRICAL SHELL (LONG SEAM)[1]

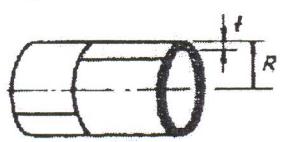
$$t = \frac{PR}{SE - 0.6P} \qquad P = \frac{SEt}{R + 0.6t}$$

INTERNAL PRESSURE

FORMULAS IN TERMS OF OUTSIDE DIMENSIONS

NOTATION

P = Design pressure or max. allowable working pressure psi
S = Stress value of material psi, page 191
E = Joint efficiency, page 172
R = Outside radius, inches
D = Outside diameter, inches
t = Wall thickness, inches
$C.A.$ = Corrosion allowance, inches



CYLINDRICAL SHELL (LONG SEAM)[1]

$$t = \frac{PR}{SE + 0.4P} \qquad P = \frac{SEt}{R - 0.4t}$$

Figure 4 Internal and External Formula

Question 2

a) In terms of horizontal vessels, state when the stiffener rings can be included.

(6 marks)

b) The expansion and contraction of horizontal vessels supported by saddles must be allowed to move based on the information

d.1) State the type of bolts needed to use.

d.2) When should the slide bearing be used?

d.3) How should concrete saddles be considered?

(14 marks)

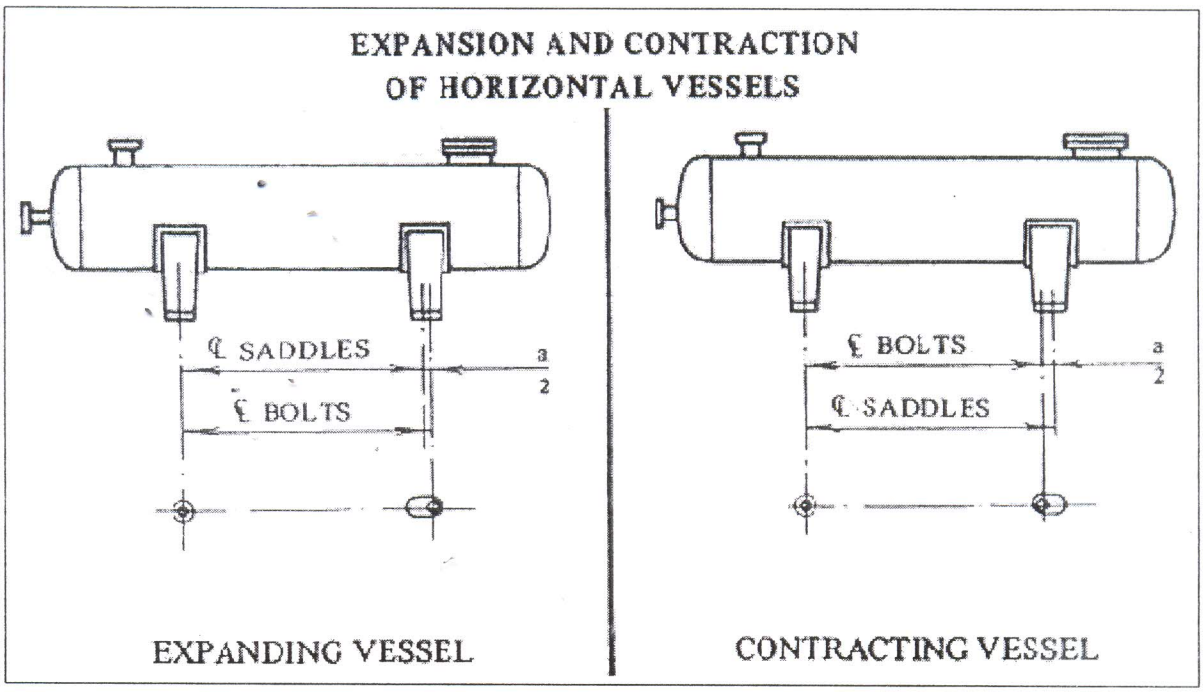


Figure 5 Expansion and Contraction of Horizontal Vessels

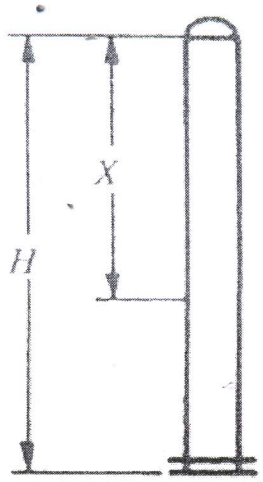
Question 3

For the combination of stresses, you are required to answer 3a and 3b.

tw/tp	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7
m	1.0	0.91	0.84	0.79	0.74	0.71	0.67	0.64	0.62	0.60	0.58	0.56	0.54
tw/tp	1.8	1.9	2.0	2.2	2.4	2.6	2.8	3.0	3.3	3.6	4.0	4.5	5.0
m	0.53	0.51	0.50	0.48	0.46	0.44	0.42	0.41	0.39	0.37	0.35	0.33	0.32

Table 1, Values of factor m

Table 1 is an aid to find the distance down from the top of the tower for which certain thickness is adequate. Since the longitudinal stress due to internal pressure is one half of the circumferential stress, one half of the required wall thickness for internal pressure is available to resist the bending force of the wind.
From Table 1, using factor m can be found the distance X down from the top tangent line within which the thickness calculated for internal pressure satisfactory also to resist the wind pressure



$X = H \times m$

t_p = the required thickness for internal pressure (Hoop Tension) in.

t_w = the required thickness for wind pressure at the bottom head joint to shell, in.

3a) Given:

i) $t_p = 0.233$ in. $t_w = 0.644$ in

ii) $t_w / t_p = 0.644 / 0.233 = 2.7$

iii) H = 100 ft

To find X

3b) Given

i) Height of 0.85H

To find: the required thickness by utilizing Figure 6 to draw the line of height 0.85H.

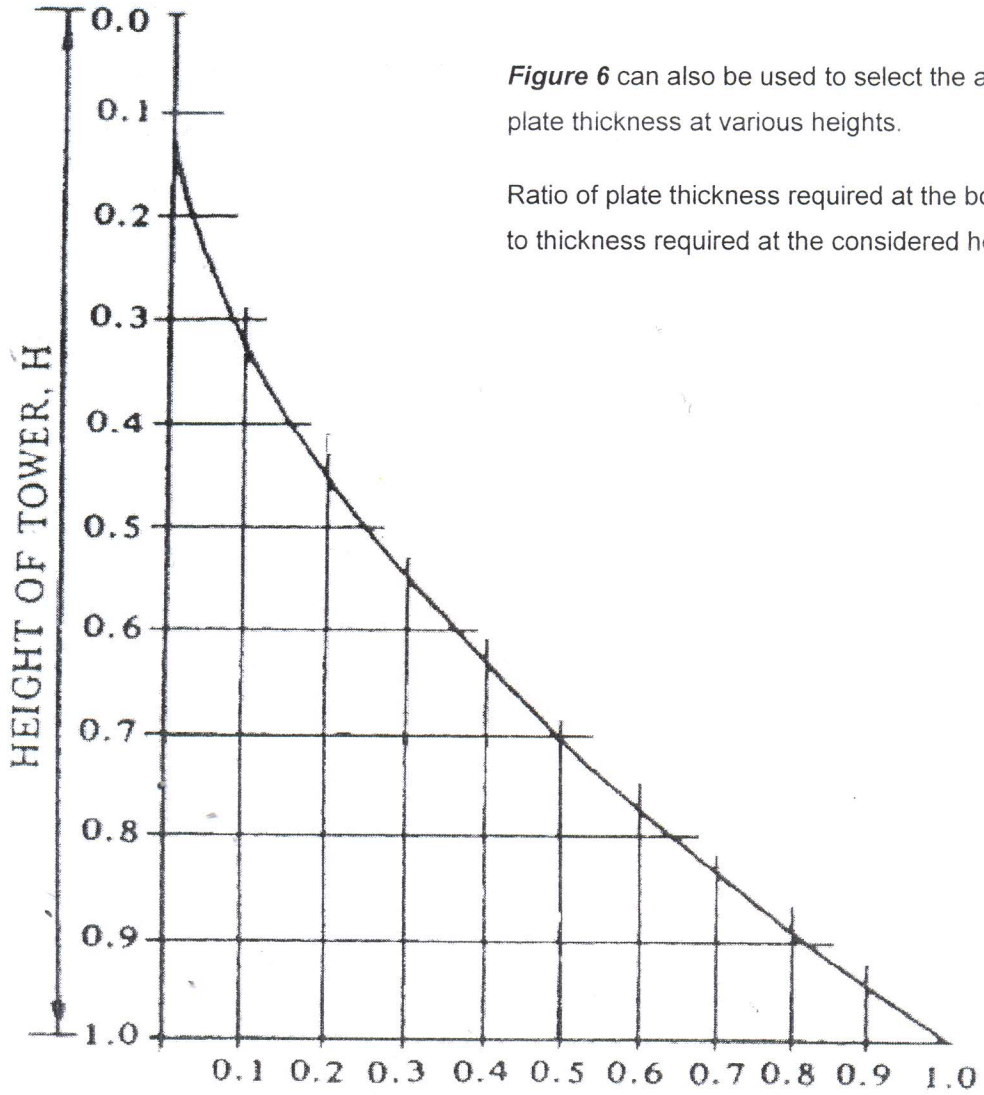


Figure 6 can also be used to select the appropiate plate thickness at various heights.

Ratio of plate thickness required at the bottom ($t_p/2 + t_w$) to thickness required at the considered height.

Figure 6 Moment diagram of a tower under wind pressure

(20 marks)

END OF QUESTION