THE ENGINEERING EQUIPMENT AND MATERIALS USERS ASSOCIATION

Guide for the design, construction and use of mounded horizontal cylindrical vessels for pressurised storage of LPG at ambient temperature

PUBLICATION 190

Edition 1

(Reprinted 2017 incorporating all amendments and errata to date since original publication)

ISBN 978 0 85931 220 2

Imprint reference 08-2017
Imprint reference 05-2015
Imprint reference 11-2005
First published 01-2000

16, Black Friars Lane,
London
EC4V 6EB
www.eemua.org
Tel: +44 (0) 20 74 88 08 01
E-mail: sales@eemua.org
Website: www.eemua.org

ENGINEERING EQUIPMENT AND MATERIALS USERS ASSOCIATION

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THE ENGINEERING EQUIPMENT AND MATERIALS USERS ASSOCIATION

GUIDE FOR THE DESIGN, CONSTRUCTION AND USE OF MOUNDED HORIZONTAL CYLINDRICAL VESSELS FOR PRESSURISED STORAGE OF LPG AT AMBIENT TEMPERATURES

PUBLICATION No 190 : 2000

AMENDMENTS No 2, AUGUST 2017

(incorporating Amendments No 1, November 2004)

The amendments below are issued under the authority of the EEMUA Storage Tanks Technical Committee which has responsibility for the maintenance of this publication. They have been carried through into the digital edition and are provided here for reference for those readers who have a paper copy.

2/1: §4.1.1 Underneath the bullet point "For hemispherical domed ends", *add* the following text and table:

The following dimensions of straight flanges to hemispherical domed ends would normally be provided by manufacturers of such structures.

Table 1 Length of straight flange on domed ends

Outside diameter of vessel (D_o)	**Length of straight flange**
3500 mm < D_o ≤ 4500 mm	30 mm
4500 mm < D_o ≤ 6000 mm	40 mm
6000 mm < D_o ≤ 8000 mm	50 mm

where: D_o = external diameter of vessel

2/2: §4.2 In the first and last bullet points, reference is incorrectly made to 'Table D.1' of PD 5500. The correct references are to 'Table D.2'.

2/3: §4.3.4.2 *Amend* the first paragraph to read:

Unless environmental considerations, e.g. the presence of wet H_2S, require otherwise, the vessel shall be post-weld heat treated in accordance with the requirements of PD 5500 Table 4.4-1, and by PD 5500 Annex D where applicable. Recommended grades of steel are given in Appendix D.

2/4: §7.2 *Insert* as appropriate:

EN 10028-3 Specification for Flat Products Made of Steels for Pressure Purposes—Part 3: Weldable Fine Gain Seels, Normalised

EN 10222-4 Steel Forgings for Pressure Purposes—Part 4: Weldable Fine-grain Steels with High Proof Strength

2/5: §7.2, last line *Delete* the asterisk after 'PD 5500'.

2/6: §7.3 *Insert* after entry for ISO 8503-1:

ISO 9329-3 Seamless Steel Tubes for Pressure Purposes—Technical Delivery Conditions—Part 3: Unalloyed and Alloyed Steels with Specified Low Temperature Properties

2/7: §A.2.2 *Delete* the following sentences:

The table is valid for propane vessels. For butane vessels the figures need to be increased by a further 10%.

2/8: §A.2.2 *Replace* the present table by the following:

Table 2 Stress increase percentages for domed ends

product	diameter D_o	hemispherical heads	torispherical heads	
			with stiffener next to dome	without stiffener next to dome
propane	≤ 3600 mm	11	4	6
	3600 mm < D_o ≤ 4500 mm	11.6	4.3	6.3
	4500 mm < D_o ≤ 6000 mm	12.3	4.9	6.9
	6000 mm < D_o ≤ 7200 mm	15.2	5.7	7.7
	> 7200 mm	16	6	8
butane	≤ 3600 mm	12.1	4.4	6.6
	3600 mm < Do ≤ 4500 mm	12.8	4.7	6.9
	4500 mm < Do ≤ 6000 mm	14.6	5.4	7.6
	6000 mm < Do ≤ 7200 mm	16.7	6.2	8.4
	> 7200 mm	17.6	6.6	8.8

2/9: §A.2.2 *Delete* the existing sentence underneath the present table which reads:

For intermediate values of vessel diameter, interpolation should be used to calculate stress increases.

2/10: §A.4.2.5.2 *Replace* the text 'For a slope of 30°' by:

For a slope of 2 : 3 (see also figure in B.2 Mound):

2/11: §A.4.9 *Add* a new section "A.4.9 Allowable stresses" underneath section "A.4.8 Secondary Bending Stresses" and *add* the following text and table underneath:

Allowable stresses would normally be predicted by the appropriate design code that is used for the verification of the actual stresses which are detailed in Sections A.4.10 and further. The following allowable stresses would normally be applied:

Table 3 Load combinations and allowable stresses

Description	PD 5500	EN 13445
Normal operations f_1	$f_1 = \text{MIN}\left[\left(\frac{Re}{1.5}\right);\left(\frac{Rm}{2.35}\right)\right]$	$f_1 = \text{MIN}\left[\left(\frac{Re}{1.5}\right);\left(\frac{Rm}{2.4}\right)\right]$
Hydrostatic pressure without earth cover f_2	f2 = 0·9*Re	f2 = 0·9*Re
Hydrostatic pressure with earth cover f_3	f3 = 0·9*Re	f3 = 0·9*Re
Earthquake f_4	f4 = 1·2*f1	f4 = 1·2*f1
Explosion (blast load) f_5	f5 = 0·9*Re	f5 = 0·9*Re
Allowable stresses in fillet welds between web of stiffeners and shell plate and between web and flange of stiffeners f_6	f6 = 0·7*f1	f6 = 0·7*f1

2/12: §A.4.9 *Renumber* section "A.4.9 Summary of Stresses" and all its subsections A.4.9.X to "A.4.10 Summary of Stresses" and A.4.10.X.

2/13: §A.4.10 *Renumber* section “A.4.10 Stability of Stiffening Rings, Eurocode 3” and all its subsections A.4.10.X to “A.4.11 Stability of Stiffening Rings, Eurocode 3” and A.4.11.X.

2/14: Appendix D *Replace* in its entirety by the attached page.

EEMUA
August 2017
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APPENDIX D

RECOMMENDED STEEL GRADES

Note.— Materials not specified in this table may be used provided they have guaranteed minimum Charpy impact values at the required test temperature and meet the requirements of PD 5500 Table D.2.

PRODUCT[1]	THICKNESS (mm)	PLATE		PIPE MATERIAL[3]	FORGINGS[3]
		REQ'D IMPACT TEST TEMP (°C)[2]	MATERIAL		
BUTANE	25 to < 35	−40	EN 10028-3 P355NL1	ISO 9329-3 Gr PL23 ASTM A 333 Gr 6	EN 10222-4 P355 QH
	All thicknesses	−20	EN 10028-3 P355N ASTM A 516 Gr 60, S5	ISO 9329-3 Gr PL23 ASTM A 333 Gr 6	EN 10222-4 P355 NH ASTM A 350 LF2
PROPANE	< 18	−40	EN 10028-3 P355NL1	ISO 9329-3 Gr PL23 ASTM A 333 Gr 6[4]	EN 10222-4 P355 QH
	< 30	−20	EN 10028-3 P355N ASTM A 516 Gr 60, S5	ISO 9329-3 Gr PL23 ASTM A 333 Gr 6	EN 10222-4 P355 NH ASTM A 350 LF2
	All thicknesses	−40	EN 10028-3 P355NL1	ISO 9329-3 Gr PL23 ASTM A 333 Gr 6[5]	EN 10222-4 P355 QH

Superscripted Notes

1 For gas mixtures it will be necessary to conduct a full appraisal using PD 5500.

2 Charpy impact test temperatures are derived from EN 10028-3.

3 Required impact test temperature for pipe material and forgings is −50°C.

4 T < 12 mm.

5 T < 40 mm.

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