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Naziemne zbiorniki z tworzyw sztucznych wzmocnionych włóknem szklanym -- Część 3: Projektowanie i kontrola wytwarzania

Na wniosek Komitetu Technicznego nr 130
ds. Aparatury Chemicznej, Zbiorników i Butli do Gazów
Poprawka do Normy Europejskiej EN 13121-3:2008+A1:2010/AC:2011 GRP tanks and vessels for use above ground - Part 3: Design and workmanship
ma status Poprawki do Polskiej Normy

nr ref. PN-EN 13121-3+A1:2010/AC:2011

EUROPEAN STANDARD

NORME EUROPÉENNE

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EN 13121-3:2008+A1:2010/AC

May 2011
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ICS 23.020.10

English version
Version Française
Deutsche Fassung

GRP tanks and vessels for use above ground - Part 3: Design and workmanship

Réservoirs et récipients en PRV pour applications hors sol - Partie 3: Conception et fabrication

Oberirdische GFK-Tanks und -Behälter - Teil 3: Auslegung und Herstellung

This corrigendum becomes effective on 4 May 2011 for incorporation in the three official language versions of the EN.

Ce corrigendum prendra effet le 4 mai 2011 pour incorporation dans les trois versions linguistiques officielles de la EN.

Die Berichtigung tritt am 4.Mai 2011 zur Einarbeitung in die drei offiziellen Sprachfassungen der EN in Kraft.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No.:EN 13121-3:2008+A1:2010/AC:2011 D/E/F

1. Modification to the Contents
10.6, replace "Flat circular ends" with "Bottoms".

2. Modification to Clause 1, Scope
Paragraph 1, line 2, replace "Thermoplastics" *with* "thermoplastics".

3. Modification to 3.12
Replace "design pressure (ρ_D)" *with* "design pressure (p_D)".

4. Modification to Clause 4, Symbols and abbreviations
Table 1, replace symbol "Θ" *with symbol* "θ".

5. Modification to 5.3, Information to be prepared by the manufacturer
Paragraph 5, line 1, replace "Tables 20 and 21" *with* "Tables 18 and 19".

6. Modification to 6.1, General
Paragraph 3, line 2, replace "(see Table 23)" *with* "(see Table 24)".

7. Modification to 6.2.3, Resin based linings
Paragraph 2, line 2, replace "E_{CR} glass" *with* "ECR glass".

8. Modification to 7.1, General
*Paragraph 5, line 3, replace "*7.8.2" *with* "7.8.3".

9. Modification to 7.3, Laminate construction
Definitions below Table 3, U_i , replace "reinforcement" *with* "lamina".

10. Modification to 7.3, Laminate construction
Definitions below Table 3, X_i , replace "unit modulus" *with* "unit tensile modulus".

11. Modification to 7.4, Lamina thickness
Equation (1), replace "$t_i = [1/\rho_g+(100-m_g)/(m_g\times\rho_r)]\times10^{-3}$" *with:*
"$t_i = [1/\rho_g+(100-m_g)/(m_g\times\rho_r)]\times10^{3}$".

12. Modification to 7.5, Laminate properties
Line 2, replace "basic laminae properties" *with* "basic lamina properties".

13. Modification to 7.8.4.5, Derivation of partial design factor A_3
Line 2, replace "Equation (6)" *with* "Equations (6a) and (6b)".

14. Modification to 7.8.4.5, Derivation of partial design factor A_3
Rename the first of the two Equations "(6)" *as* "(6a)" *and the second as* "(6b)".

15. Modification to 8.2.3, Limiting strain for laminate ε_L or lamina ε_i
Paragraph 2, line 1, replace "obtained either from Equation (10)" *with* "obtained from Equations (10a) and (10b)".

16. Modification to 8.4, Laminate design
Equation (10), replace "$all \times u_{lam}$ =" *with* "all. U_{lam} =".

17. Modification to 8.4, Laminate design
Equation (10a), replace "$X_{lam} = X_1 \times m_1 \times n_1 + u_2 \times m_2 \times n_2 \ldots\ldots u_i \times m_i \times n_i$" *with:*
"$X_{lam} = X_1 \times m_1 \times n_1 + X_2 \times m_2 \times n_2 \ldots\ldots X_i \times m_i \times n_i$".

18. Modification to 8.4, Laminate design
Replace Equation "(10)" *with* "(10a)" *and* "(10a)" *with* "(10b)".

19. Modification to 8.4, Laminate design
Definition u_i, *replace* "is the allowable tensile unit load carrying capacity of lamina layer I" *with* "is the tensile unit load carrying capacity of lamina layer I".

20. Modification to 8.4, Laminate design
Definition X_{lam} *replace* "N/mm per kg/m^2" *with* "N/mm".

21. Modification to 9.2.2, Wind
Add "NOTE Reference can be made to EN 1991-1-4.".

22. Modification to 9.2.7, Personnel loading
Add "Snow and access loads shall not be considered to act together." *as last paragraph.*

23. Modification to 9.4.2, Pressure
Paragraph 1, line 1, replace pressure "ρ_D" *with pressure* "p_D".

24. Modification to 9.4.2, Pressure
Last paragraph, line 1, replace "ρ_D" *with* "p_D".

25. Modification to 9.4.2, Pressure
Last paragraph, delete the text "Snow and access loads shall not be considered to act together.".

26. Modification to 10.1, Symbols and units
Delete "d_r mm diameter of neutral axis of stiffener ring".

27. Modification to 10.1, Symbols and units
Delete symbols not used in the standard:
"t_{ck} mm thickness cylinder knuckle area";
"t_{over} mm thickness overlapping laminate";
"t_{Shell} mm thickness shell at branch position".

28. Modification to 10.1, Symbols and units
Add symbol "t mm thickness of shell".

29. Modification to 10.1 Symbols and units
Unit for PS, *replace* "N/mm" *with* "N/mm^2".

30. Modification to 10.2.2, Combined axial loading
Equation (13), replace "$q_{x,m}$ =" with "$q_{x,M}$ =".

31. Modification to 10.2.2, Combined axial loading
Equation (15), replace "$q_{x,c} = q_{x,M} + q_xW + q_{x,p}$" with "$q_{x,c} = q_{x,M} + q_{xW} + q_{x,p}$".

32. Modification to 10.2.2, Combined axial loading
First line on page 34, after Equation (15), replace "where q_x^W is the" *with* "where $q_{x,W}$ is the".

33. Modification to 10.2.2, Combined axial loading
Equation (16), replace "$q_{x,c} = q_{x,M} + q_{x,}^{W} - q_{x,p}$" *with* "$q_{x,c} = q_{x,M} + q_{xW} - q_{x,p}$".

34. Modification to 10.2.2, Combined axial loading
Equation (17), replace "$q_{x,c} = q_{x,p} + q_{x,M} + q_{x,W}$" *with* "$q_{x,c} = q_{x,p} + q_{x,M} + q_{x,W}$".

35. Modification to 10.2.2, Combined axial loading
Last but one paragraph, line 1, replace "Equation (10)" *with* "Equation (10a)".

36. Modification to 10.3.2, Critical axial buckling load
Last paragraph, replace "the equation for k for such sections is given by" *with* "k for such sections is given by Equations (19) and (20)".

37. Modification to 10.3.2, Critical axial buckling load
Add definition "t is the wall at the cut-out".

***38. Modification to* 10.3.2, Critical axial buckling load**
Add reference to 10.6.3.3.5 Cut-outs in a skirt.

39. Modification to 10.3.3, Critical circumferential buckling pressure
Equations (21) and (22), $E_{\varphi b}$ should be $E_{\phi b}$.

40. Modification to 10.3.5, Critical buckling pressure for cylindrical
Equation (24), $E_{\varphi b}$ should be $E_{\phi b}$.

41. Modification to 10.3.5, Critical buckling pressure for cylindrical
Replace Equation "(24)" *with* "(24a)" *and* "(24a)" *with* "(24b)".

42. Modification to 10.3.5, Critical buckling pressure for cylindrical
b), delete the text "for example see Figure 8".

43. Modification to 10.4.1, General requirements
First paragraph, replace "10.4" *with* "Figure 4a) and 4b)".

44. Modification to 10.4.1, General requirements
Paragraph 2, line 1, replace "Thermoplastics" *with* "thermoplastics".

45. Modification to 10.4.1, General requirements
Paragraph 2, line 2 replace "R" *with* "r".

46. Modification to 10.4.1, General requirements
Figure 4a), replace the knuckle radius "R" *with* "r".

47. Modification to 10.4.1, General requirements
Figure 4a), replace the half apex angle "ϕ" *with* "Φ".

48. Modification to 10.4.1, General requirements
Text below Figure 4a), replace "Thermoplastics" *with* "thermoplastics".

49. Modification to 10.4.3.1, Circumferential unit loading in cone
Equation (25), replace "$q\Phi = p_D \times D_k/(2\cos\Phi)$" *with* "$q_\Phi = p_D \times D_k/(2\cos\Phi)$".

50. Modification to 10.4.3.1, Circumferential unit loading in cone
Last paragraph, replace Equation "(10)" *with Equation* "(10a)".

51. Modification to 10.4.3.2, Axial unit load in cone to knuckle junction
Paragraph above Table 7, replace "Equation (10)" *with* "Equation (10a)".

52. Modification to 10.4.3.2, Axial unit load in cone to knuckle junction
Table 7, title, replace the concentration factor "Kc1" *with* "K_{c1}".

53. Modification to 10.4.3.2, Axial unit load in cone to knuckle junction
Paragraph above Table 8, replace Equation "(10)" *with Equation* "(10a)".

54. Modification to 10.4.3.2, Axial unit load in cone to knuckle junction
Table 8, replace "t_c/D" *with* "t_k/D".

55. Modification to 10.4.3.2, Axial unit load in cone to knuckle junction
Last paragraph, replace "Equation (10)" *with* "Equation (10a)".

56. Modification to 10.4.4.1, Strength requirement
Paragraph 1, line 1, replace "Equation (26)" *with* "Equation (25)".

57. Modification to 10.4.4.1, Strength requirement
Paragraph 1, line 2, replace "Equation (10)" *with* "Equation (10a)".

58. Modification to 10.4.4.1, Strength requirement
Paragraph 1, line 2, replace "Equation (26) to (28)" *with* "Equation (25) to (27)".

59. Modification to 10.4.4.2.2, Critical radial buckling pressure p_c
Equation (29), replace "$E_{\varphi b}$" with "$E_{\phi b}$" and "Ex" *with* "E_x".

60. Modification to 10.4.4.2.2, Critical radial buckling pressure p_c
Equation (30), replace "$E_{\varphi b}$" *with* "$E_{\phi b}$".

61. Modification to 10.4.4.2.3, Axial compressive load
Equation (31), replace "$E_{\varphi b}$" *with* "$E_{\phi b}$".

62. Modification to 10.4.4.2.4, Combined axial and radial compressive
Equation (34), replace "$(q_x \times F/u_c)^{1,25}+(p_D \times F/p_c)^{1,25} \le F$" *with* "$(q_x \times F/u_c)^{1,25}+(p_D \times F/p_c)^{1,25} \le 1$".

63. Modification to 10.4.5.1, Covers subjected to internal pressure
Paragraph 1, line 2, replace "For covers outside these parameters the covers" *with* "If $\Phi > 75°$ the covers".

64. Modification to 10.4.5.1, Covers subjected to internal pressure
Equation (35), replace "$q_x = \alpha_b \times p_D \times 1/\sin\phi \times \cos\phi \times (D/t_k)^{1+Bb} \times t_k$" *with* "$q_x = \alpha_b \times p_D \times 1/\sin\phi \times \cos\phi \times (D/t_k)^{1+\beta b} \times t_k$".

65. Modification to 10.4.5.1, Covers subjected to internal pressure
Equation (36a), replace "α_b = 51,6×$(r/D)^2$+7,6×(r/D)+0,13" *with* "α_b = -64×$(r/D)^2$+7,6×(r/D)+ 0,13".

66. Modification to 10.4.5.1, Covers subjected to internal pressure
Equation (36b), replace "β_b = 51,6× (r/D)1,6-8,18×(r/D)+0,52" *with* "β_b = 51,6× $(r/D)^2$-8,18× (r/D)+0,52".

67. Modification to 10.4.5.1, Covers subjected to internal pressure
Last paragraph, replace "Equation (10)" *with* "Equation (10a)".

68. Modification to 10.4.5.2, Covers subjected to external pressure
Paragraph 1, line 1, replace "Equation (37)" *with* "Equation (37a)".

69. Modification to 10.4.5.2 Covers subjected to external pressure
Equation (37), replace "Eb" with "E_b".

70. Modification to 10.4.5.2, Covers subjected to external pressure
Replace Equations "(37)" *and* "(37a)" *with* "(37a)" *and* "(37b)".

71. Modification to 10.5.1, General requirements
Figure 8, replace the depth of end "*l*" *with* "h_i".

72. Modification to 10.5.2, Dished ends subject to internal pressure
Paragraph below Equation (38), replace Equation "(41)" *with* "(38)".

73. Modification to 10.5.2, Dished ends subject to internal pressure
Paragraph above Table 9, replace "Equation (10)" *with* "Equation (10a)".

74. Modification to 10.5.2, Dished ends subject to internal pressure
Table 9, replace h_i/D *= 0,25,* t/D = "0,01" *with* h_i/D *= 0,25,* t/D = "0,005".

75. Modification to 10.6, Flat circular ends
Replace in the title "Flat circular ends" *with* "Bottoms".

76. Modification to 10.6.1.2 Dished ends subject to internal pressure
Paragraph above Equation (49), replace "Equation (10)" *with* "Equation (10a)".

77. Modification to 10.6.1.3
Equation (50), replace "q_{x1} =" *with* "q_{xk1} =".

78. Modification to 10.6.1.3
Equation (51), replace "q_{x1} =" *with* "q_{xk1} =".

79. Modification to 10.6.1.3
Equation (54), replace "q_{kx} =" *with* "q_{xk} =".

80. Modification to 10.6.1.3
Paragraph below Equation (54), replace "Equation (10)" *with* "Equation (10a)".

81. Modification to 10.6.2, Vessels with flat bases subjected to pressure
Note, replace "see 12.5.3" *with* "see 12.5".

82. Modification to 10.6.3.3.1, General
Figure 12a), replace "$t_z = t + t_{o2}$" *with* "$t_z = t + t_o$".

83. Modification to 10.6.3.3.1, General
Figure 12c), replace "$\geq (D * t_{Bk})^{½}$ " *with* "$\geq (D \times t_{bk})^{½}$ ".

84. Modification to 10.6.3.3.2, Unit load for lower part of cylinder region 1
Equation (57), replace "α_φ" *with* "α_ϕ".

85. Modification to 10.6.3.3.2, Unit load for lower part of cylinder region 1
Paragraph above Equation (58), replace "Equation (10)" *with* "Equation (10a)".

86. Modification to 10.6.3.3.2, Unit load for lower part of cylinder region 1
Equation (58), replace "$\pm qx,_{\Delta T}/A_5$" *with* "$\pm q_{x,\Delta T}/A_5$".

87. Modification to 10.6.3.3.3, Unit load for lower part of skirt, region 2
Equation (59), replace "$q_{x,Sku,p} = 6 \times C \times p \times D$" with "$q_{x,Sku,p} = 6 \times C \times p_D \times D$".

88. Modification to 10.6.3.3.3, Unit load for lower part of skirt, region 2
Equation (60), replace "α_φ" *with* "α_ϕ".

89. Modification to 10.6.3.3.3, Unit load for lower part of skirt, region 2
Paragraph above Equation (61), replace "Equation (10)" *with* "Equation (10a)".

90. Modification to 10.6.3.3.3, Unit load for lower part of skirt, region 2
Equation (61), replace "$q_{x,skup} \pm q_{x,sku,\Delta T}/A_5$" with "$q_{x,Sku,p} \pm q_{x,Sku,\Delta T}/A_5$".

91. Modification to 10.6.3.3.3, Unit load for lower part of skirt, region 2
Equation (62), replace "$L_{csku} \geq (D \times t_{sku})^{½}$ " *with* "$L_{c,Sku} \geq (D \times t_{Sku})^{½}$ ".

92. Modification to 10.6.3.3.3, Unit load for lower part of skirt, region 2
Last paragraph, line 1, replace "Equation (10)" *with* "Equation (10a)".

93. Modification to 10.6.3.3.3, Unit load for lower part of skirt, region 2
Last paragraph, line 2, replace "$u_c/q_{x,sk} \geq F$" *with* "$u_c/q_{x,Sk} \geq F$".

94. Modification to 10.6.3.3.3, Unit load for lower part of skirt, region 2
Last paragraph, line 3, replace "Table 6or" *with* "Table 6 or".

95. Modification to 10.6.3.3.4, The unit load in the knuckle region, region 3
Paragraph 1, line 1, replace "knuckle $q_{k,}$" *with* "knuckle $q_{k,p}$".

96. Modification to 10.6.3.3.4, The unit load in the knuckle region, region 3
Paragraph 1, line 2, replace "dome ends" *with* "dished ends".

97. Modification to 10.6.3.3.4, The unit load in the knuckle region, region 3
Equation (66), replace "$q_k = q_{k,p} +$" *with* "$q_k = q_{k,p} +$".

98. Modification to 10.6.3.3.4, The unit load in the knuckle region, region 3
Paragraph below Equation (66), replace "Equation (10)" *with* "Equation (10a)".

99. Modification to 10.6.3.3.4, The unit load in the knuckle region, region 3
Equation (67), replace "$L_c \geq (D \times t_k)^{½}$ " with "$L_c \geq (D \times t_{bk})^{½}$ ".

100. Modification to 10.6.3.3.4, The unit load in the knuckle region, region 3
Equation (68), replace "$q_{over} \geq q_{x,p}$" *with* "$q_{over} \geq q_{x,p}$".

101. Modification to 10.6.3.3.4, The unit load in the knuckle region, region 3
First paragraph on page 57 (below Equation (68), replace "D < 2 mm" *with* "D < 2 m".

102. Modification to 10.6.3.3.4, The unit load in the knuckle region, region 3
Equation (69), replace "+0,2×ρ_D×D" *with* "+0,2×p_D×D".

103. Modification to 10.6.3.3.4, The unit load in the knuckle region, region 3
Paragraph below Equation (69), replace "Equation (10)" *with* "Equation (10a)".

104. Modification to 10.6.3.3.4, The unit load in the knuckle region, region 3
Equation (70), replace "$\tau_{over} = q_{over}/l_{over}$ and $\tau_{over} \leq \tau/K$" *with* "$\tau_{over} = q_{over}/l_{over}$ and $\tau_{over} \leq \tau/K$".

105. Modification to 10.6.3.3.5, Cut-outs in a skirt
Equation (72), replace "$q_x = (W_D/A_c)+[(4\times M_D+W_D)/W_c]$" *with* "$q_x = (W_D/A_c)+(M_D+W_D e_c)/Z_c$".

106. Modification to 10.6.3.3.5, Cut-outs in a skirt
Equation (73), replace "$A_c = D \times t_{sk} \times [\pi-\alpha_c]$" *with* "$A_c = D \times t_{Sk} \times [\pi-\alpha_c]$".

107. Modification to 10.6.3.3.5, Cut-outs in a skirt
Equation (74), replace "$W_c =$" *with* "$Z_c =$".

108. Modification to 10.6.3.3.5, Cut-outs in a skirt
Last paragraph on page 57, replace "t_{sk}" *with* "t_{Sk}".

109. Modification to 10.7.1, General
Paragraph 2, line 2, replace "Thermoplastics" *with* "thermoplastics".

110. Modification to 10.7.1, General
Paragraph 3, line 1, replace "Equation (10)" *with* "Equation (10a)".

111. Modification to 10.7.1, General
Equation (77), replace "$L_S =$" with "$L_j =$".

112. Modification to 10.7.1, General
Figure 14, title, replace "Thermoplastics" *with* "thermoplastics".

113. Modification to 10.8.1, General
Paragraph 3, line 2, replace "in domed heads" *with* "in dished heads".

114. Modification to 10.8.2, Symbols
Replace, t_a *, replace* "(= t+ t_1+ t_2)" with "(= t_c+ t_1+ t_2)".

115. Modification to 10.8.3, Compensation requirements for openings
Equation (79), replace "$v_A = 1{,}5\times[1+d_c/2(D\times t_c)^{1/2}]$" *with* "$v_A = 1{,}5\times[1+d_c/2(D\times t_a)^{1/2}]$".

116. Modification to 10.8.3, Compensation requirements for openings
Equation (80), replace "$q_{max} \le \text{all} \times \cdot U_{Lam} + \text{all} \times U_c$" *with* "$q_{max} \le \text{all}.U_{Lam} + \text{all}.U_c$".

117. Modification to 10.8.3, Compensation requirements for openings
Paragraph below Equation (80), replace "Equation (10)" *with* "Equation (10a)".

118. Modification to 10.8.3, Compensation requirements for openings
Figure 15a), replace wall "t" *with* "t_c".

119. Modification to 10.8.4, Pull out load
Equation (83), replace "$\tau \le$" *with* "$\tau =$".

120. Modification to 10.8.4, Pull out load
Last paragraph, line 2, replace "Equation (84)" *with* "Equation (82)".

121. Modification to 10.8.8, Access and inspection openings
Paragraph 1, row 1, replace "inspection and /or" *with* "inspection and/or".

122. Modification to 10.8.8, Access and inspection openings
Table in Figure 16, replace "V", "W", "X", "Y" *and* "Z" *in the table by* "*v*", "*w*", "*x*", "*y*" *and* "*z*".

123. Modification to 10.8.9, Gusset on branches
Paragraph 1, line 1, replace "of 80 DN or" *with* "of 80 mm or".

124. Modification to 10.9.2, Symbols
u_{csm} *, replace* "Design unit loading for CSM layers" *with* "Ultimate unit load for CSM layers".

125. Modification to 10.9.4, Design methods for all panel shapes
Equation (84), replace "$M_D = M_p + M_{localload} + (M_{snow} + M_{wind})/A_5$" *with* "$M_D = M_p + M_l + (M_{snow} + M_{wind})/A_5$".

126. Modification to 10.9.4, Design methods for all panel shapes
NOTE, a), replace "When M_{local}" *with* "When M_l".

127. Modification to 10.9.5.1, General
5), replace "Figure 17 and 10.9 (2) show" *with* "Figures 17 and 18 show".

128. Modification to 10.9.5.2, Rectangular panel under distributed load
Equation (85), replace "$M_p = \beta_1 \times p \times b^2$ " *with* "$M_p = \beta_1 \times p_D \times b^2$ ".

129. Modification to 10.9.5.2, Rectangular panel under distributed load
Paragraph below Equation (85), replace "and p is the" *with* "and p_D is the".

130. Modification to 10.9.5.2, Rectangular panel under distributed load
Equation (86), replace "$M_p = \beta_1 \times p_1 \times b^2$ " *with* "$M_p = \beta_1 \times p_H \times b^2$ ".

131. Modification to 10.9.5.2, Rectangular panel under distributed load
Paragraph above Table 10b), line 3, replace "pane as" *with* "panel as".

132. Modification to 10.9.5.2, Rectangular panel under distributed load
Paragraph above Table 10b), lines 2 and 3, replace "equation (85)" *with* "Equation (86)" and "equation (86)" *with* "Equation (85)".

133. Modification to 10.9.5.3, Rectangular panel under central local load
Equation (87), replace "$M_1 = Wl(4\times\pi)\times[1,3\times 1n(2\times b/\pi\times r_1)+\beta_2]$" *with* "$M_1 = Wl(4\times\pi)\times[1,3\times \ln(2\times b/\pi\times r_1)+\beta_2]$".

134. Modification to 10.9.5.4, Determination of mass of reinforcement
a), paragraph below Equation (89), replace "Equation (10)" *with* "Equation (10a)".

135. Modification to 10.9.6.1, Circular panels under uniformly distributed
First paragraph, replace "The moment Mp, due" *with* "The moment M_p, due".

136. Modification to 10.9.6.1, Circular panels under uniformly distributed
Equation (95), replace "$M_1 = (Wl4\pi)\times[1,31n(d_p/2r_1)+1]$" *with* "$M_1 = (W/4\pi)\times[1,3\ln(d_p/2r_1)+1]$".

137. Modification to 10.9.6.3, Mass of reinforcement for circular panels
a), paragraph 1, replace "Equation (98)" *with* "Equation (96)".

138. Modification to 10.9.6.3, Mass of reinforcement for circular panels
Equation (97), replace "$\alpha 1$" *and* "$\alpha 2$" *with* "α_1" *and* "α_2".

139. Modification to 10.9.6.3, Mass of reinforcement for circular panels
Equation (97), replace "Wi" *with* "W".

140. Modification to 10.9.6.3, Mass of reinforcement for circular panels
List below Equation (97), α_2, replace "0,013787" *with* "0,137 87".

141. Modification to 10.9.6.3, Mass of reinforcement for circular panels
List below Equation (97), replace the text "P_H is the hydrostatic pressure at the base of a panel (when applicable i.e. rectangular tank design)" *with the text* "p_D is the design pressure (worst combination of pressure, vacuum, snow, wind loading, etc.)".

142. Modification to 10.9.6.4, Plates in the form of a sector of a circle
Paragraph above Equation (100), replace "equation" *with* "Equation (100)".

143. Modification to 10.10.1, General types of rectangular tank configuration
Figure 21, Type (3), replace "Tank with a vertical stiffeners" *with* "Tank with vertical stiffeners".

144. Modification to 10.10.1, General types of rectangular tank configuration
Figure 21, Type (4), replace "Tank with a vertical and horizontal stiffeners" *with* "Tank with vertical and horizontal stiffeners".

145. Modification to 10.11.1, General
Figure 22a), Saddle support angle, "= 120º" *with* "≥ 120º".

146. Modification to 10.11.2.2, Determination of longitudinal flexural moment
Figure 23, saddle support angle, replace "q" with " θ".

147. Modification to 10.11.2.2, Determination of longitudinal flexural moment
Definitions, replace "K_1, K_2 K_{11}" *with* "K_1-K_{11}".

148. Modification to 10.11.2.2, Determination of longitudinal flexural moment
Definitions, replace "Ps is the overpressure" *with* "PS is the overpressure".

149. Modification to 10.11.2.2, Determination of longitudinal flexural moment
Definitions, replace "pu is the under pressure" *with* "p_u is the external pressure".

150. Modification to 10.11.2.2, Determination of longitudinal flexural moment
First paragraph on page 88 (below Figure 24), replace "M1" *with* "M_1".

151. Modification to 10.11.2.2, Determination of longitudinal flexural moment
Delete sentence "M1 is always negative for hemispherical ends.".

152. Modification to 10.11.2.3, Axial unit load at mid-span
Paragraph 3, replace "the maximum tensile axial" *with* "the maximum axial".

153. Modification to 10.11.2.3, Axial unit load at mid-span
Paragraph 4, replace "Equation (10)" *with* "Equation (10a)".

154. Modification to 10.11.2.3, Axial unit load at mid-span
Paragraph 5, replace "the maximum axial tensile" *with* "the maximum axial".

155. Modification to 10.11.2.3, Axial unit load at mid-span
Paragraph below Equation (112), replace "Equation (10)" *with* "Equation (10a)".

156. Modification to 10.11.2.3, Axial unit load at mid-span
Paragraph 2, on page 89 (two paragraphs below Equation 112), replace "compressive load q_{xc}" *with* "compressive load q_x".

157. Modification to 10.11.2.3, Axial unit load at mid-span
Paragraph 2, on page 89 (two paragraphs below Equation 112), line 2, replace "$u_L/q_{xL} \geq F$" *with* "$u_c/q_x \geq F$".

158. Modification to 10.11.2.4, Axial unit load at saddle positions
Paragraph below Equation (113), replace "Equation (10)" *with* "Equation (10a)".

159. Modification to 10.11.2.4, Axial unit load at saddle positions
Paragraph below Equation (114), replace "Equation (10)" *with* "Equation (10a)".

160. Modification to 10.11.2.5, Stability of shell
Paragraph 3, replace "The maximum axial compressive load, q_c," *with* "The critical axial buckling load, u_c,".

161. Modification to 10.11.2.5, Stability of shell
Equation (115), replace "$q_c/q_x \geq F$" *with* "$u_c/q_x \geq F$".

162. Modification to 10.11.2.5, Stability of shell
Paragraph 5, replace "If an under pressure" *with* "If an external pressure".

163. Modification to 10.11.2.6, Shear forces
Table 14, replace "$A > DK_3/4$" and "$A<DK_3/4$" *with* "$A>D/4$" and "$A<D/4$".

164. Modification to 10.11.2.8, Circumferential unit load – unstiffened
Equation (121), replace "$q_{\phi 5} = k_5 \times W_1/(b_1+10t)$" *with* "$q_{\phi 5} = K_5 \times W_1/(b_1+10t)$".

165. Modification to 10.11.2.8, Circumferential unit load – unstiffened
Paragraph below Table 15, replace "Equation (10)" *with* "Equation (10a)".

166. Modification to 10.11.2.9, Loading at the horn of saddle
Paragraph below Equation (127), replace "Equation (10)" *with* "Equation (10a)".

167. Modification to 10.11.3.2, Unit loads in circumferential direction
Equation (128), replace "p" *with* "ρ".

168. Modification to 10.11.3.2, Unit loads in circumferential direction
Equation (129), replace "Ps" *with* "PS" *and* "p" *with* "ρ".

169. Modification to 10.11.3.2, Unit loads in circumferential direction
Equation (130), replace "Ps" *with* "PS".

170. Modification to 10.11.3.2, Unit loads in circumferential direction
Paragraph below Equation (130), replace "Equation (10)" *with* "Equation (10a)".

171. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces
Equation (133), replace "Ps" *with* "PS".

172. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces
Equation (134), replace "Ps" *with* "PS".

173. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces
Equation (135), replace "Ps" *with* "PS".

174. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces
Equation (136), replace "Ps" *with* "PS".

175. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces
Paragraph below Equation (136), replace "Equation (10)" *with* "Equation (10a)".

176. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces
Paragraph above Equation (137), replace "The shear load is at" *with* "The shear load at".

177. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces
Equation (141), replace "Ps" with "PS".

178. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces
Equation (142), replace "Ps" with "PS".

179. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces
Paragraph below Equation (142), replace "Equation (10)" *with* "Equation (10a)".

180. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces
Paragraph above Equation (143), replace "corresponding shear load" *with* "corresponding shear stress".

181. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces
Equation (145), replace "= 50/K *and* $\tau_{allowable}$ ≥" *with* "= 50/K and $\tau_{allowable}$ ≥".

182. Modification to 10.11.3.5, Localised effects at saddle or stiffener
Equation (147), replace "$\Delta_{qx,1}$ 1,10×K_9×W_1/t" *with* "$\Delta_{qx,1}$ = 1,10×K_9×W_1/t".

183. Modification to 10.11.3.5, Localised effects at saddle or stiffener
Definitions below Equation (149), replace "D_s = ùean diameter" *with* "D_s = diameter".

184. Modification to 10.11.3.5, Localised effects at saddle or stiffener
Definitions below Equation (149), replace "^{t} = thickness" with "t = thickness".

185. Modification to 10.11.3.6, Design of the stiffener rings at the saddle
Figure 26, per definition $t_R = t+t_s$ figure to be revised.

186. Modification to 10.11.3.6, Design of the stiffener rings at the saddle
Equation (155), replace "q_{Rx} = 0,53$W1$/($t_r^{1,5}$×$D^{0,5}$)" *with* "q_{Rx} = 0,53W_1/($t_R^{1,5}$×$D^{0,5}$)".

187. Modification to 10.11.4, Longitudinal beam supported vessel
Last paragraph, replace "is given in K.2" *with* "is given in K.3".

188. Modification to 11.1, General
Paragraph 4, lines 2 and 3, replace "the chemical barrier of these chemical barriers for the" *with* "the chemical barrier for the".

189. Modification to 11.1, General
Paragraph 5, lines 1 and 3, replace "two classifications: Classification 150 and Classification 10" *with* "two designations: Class 150 and PN 10".

190. Modification to 11.1, General
Figure 27c), Key 1, replace "PP & PVDF" *with* "PP and PVDF".

191. Modification to 11.2.2, Symbols
b'_o, *replace* "= Go – C" with."= G_o – C".

192. Modification to 11.2.2, Symbols
B_r, *replace* "Is the ionside diameter" *with* "Is the inside diameter".

193. Modification to 11.2.2, Symbols
E, *replace* "Tensile young modulus" *with* "Tensile Young modulus".

194. Modification to 11.2.2, Symbols
Replace "go" *with* "g_o" *and* "Go" *with* "G_o".

195. Modification to 11.2.2, Symbols
σ_a, *replace* "Bolt nominal design load at atmospheric temperature (see Table 20)" *with* "Bolt nominal design stress at design temperature (see Table 20)".

196. Modification to 11.2.2, Symbols
σ_b, *replace* "Bolt nominal design load at design temperature (see Table 20)" *with* "Bolt nominal design stress at atmospheric temperature (see Table 20)".

197. Modification to 11.2.2, Symbols
t_R, *replace* "see Table 21" *with* "see Table 19".

198. Modification to 11.2.2, Symbols
y, *replace* "seating load" *with* "seating stress".

199. Modification to 11.2.3, Bolt loads and required areas
a), paragraph 1, replace "Equation (156)" *with* "Equation (156a)".

200. Modification to 11.2.3, Bolt loads and required areas
a), renumber Equation "(156)" *as Equation* "(156a)".

201. Modification to 11.2.3, Bolt loads and required areas
a), add number "(156b)" *to equation for* H_R.

202. Modification to 11.2.3, Bolt loads and required areas
Paragraph below Equation (157), replace "area, $A_{m,}$" with "area, A_m,".

203. Modification to 11.2.3, Bolt loads and required areas
Equation (158), replace "$A_{m2} = W_{m1}/\sigma_b$" *with* "$A_{m2} = W_{m2}/\sigma_b$".

204. Modification to 11.2.3, Bolt loads and required areas
Paragraph below Equation (158), replace "total bolt area provided, A_b, shall not be less" *with* "total bolt area provided, $n \times A_b$, shall not be less".

205. Modification to 11.2.4, Full faced flange design
Equation (159), replace "$N = [6 \times H_R \times h_T \times k / \sigma_{CSM} \times (\pi \times C - n \times d)]^{0,5}$" *with* "$N = [6 \times H_R \times h_T \times K / \sigma_{CSM} \times (\pi \times C - n \times d)]^{0,5}$".

206. Modification to 11.2.4, Full faced flange design
NOTE C_{SM}/K = 15 N/mm^2 Replace with σ_{CSM}/K = 15 N/mm^2

207. Modification to 11.3.1, General
Figure 30, replace "G'_o" with "G_o".

208. Modification to 11.3.5, Loading moment arms
Equation (169), replace "$h'_t =$" *with* "$h'_T =$".

209. Modification to 11.3.6, Stub flange thickness
Equation (171), "$M = H'_D \times h_D + H'_p \times h_p + H'_T \times h_T$" *with*
"$M = H_D \times h_D + H'_p \times h'_p + H'_T \times h'_T$".

210. Modification to 11.3.6, Stub flange thickness
Equation (172), replace ")" *with* "$)^{0,5}$ ".

211. Modification to 11.3.7.3, Bolting up condition
Equation (175), replace "$W_{m2} = \pi \times G_1 \times b^1 \times y$" *with* "$W_{m2} = \pi \times G_1 \times b' \times y$".

212. Modification to 11.3.7.3, Bolting up condition
Paragraph below Equation (175), replace, "The minimum bolt area A_{m1}" *with* "The minimum bolt area A_m".

213. Modification to 11.3.7.3, Bolting up condition
Equation (176), replace "and $A_{m1} = W_{m2}/\sigma_b$" *with* "and $A_{m2} = W_{m2}/\sigma_b$".

214. Modification to 11.3.7.3, Bolting up condition
Last paragraph/equation, replace "$A_m = n \times A_b$" *with* "$A_m \leq n \times A_b$".

215. Modification to 11.3.8, Stub shear interface design
First paragraph, replace "interface must not" *with* "interface shall not".

216. Modification to 11.3.10, Bearing load
Equation (178), replace "$\sigma_B = [(W_{m1}) \text{ or } (W)]/[1{,}57 \times B_{r2}(G_0 - B_{r2} - 2 \times X)]$" *with*
"$\sigma_B = [(W_{m1}) \text{ or } (W_{m2})]/[1{,}57 \times B_{r2}(G_0 - B_{r2} - 2 \times X)]$

217. Modification to 11.5, Butt and strap jointed flanges
Equation (179), replace "$L_j \geq k \times PS \times d_b/\tau$" with "$L_j \geq K \times PS \times d_b/\tau$".

218. Modification to 12.3.2.3.1, General
Equation (181), replace "$M_2 = C_{m1} \times W \times r_2 + 0{,}16 \times W \times e\rho$" *with*
"$M_2 = C_{m2} \times W \times r_2 + 0{,}16 \times W \times e\rho$".

219. Modification to 12.5.2, Design for uplift
b), replace "wind overturning pressure" *with* "wind overturning load".

220. Modification to 12.5.2, Design for uplift
c), replace "seismic force, the anchorage" *and* "the effect of pressure and wind loadings, shall" *with* "seismic force. The anchorage" *and* "the effect of pressure and wind loadings shall".

221. Modification to 12.5.3, Design of anchor bolts
Definitions below Equation (190), M, replace "N mm" with "Nmm".

222. Modification to 12.5.3, Design of anchor bolts
Definitions below Equation (190), delete sentence "If $N_b < 8$, use above Equation (190) with $W = 0$.".

223. Modification to 12.5.3, Design of anchor bolts
Definitions below Equation (191), H_1, replace "C of G" *with* "centre of gravity".

224. Modification to 13.3, External structures and fittings
Paragraph 5, replace "In the case where integral" *with* "In the case with integral".

225. Modification to 14.4, Calculation of laminate strains
Paragraph 8, line 2, replace "any extra" *with* "any additional".

226. Modification to 14.4, Calculation of laminate strains
Paragraph 9, line 1, replace "If extra reinforcement" *with* "If additional reinforcement".

***227. Modification to* 15.3.4, Quality control documentation requirements**
Table 24 remove all underlining's and change all data in boldface to normal face.

228. Modification to 15.4.2, Fabrication of thermoplastic liners
Paragraph 2, replace "shall be load relieved" *with* "shall be stress relieved".

229. Modification to B.2, Lamina/laminate thickness
Equation (B.1), replace "$t_i = [1/\rho_g + (100 - m_g)/(m_g \times \rho_r)] \times 10^{-3}$" *with*
"$t_i = [1/\rho_g + (100 - m_g)/(m_g \times \rho_r)] \times 10^{3}$".

230. Modification to B.2, Lamina/laminate thickness
Delete "d is the SG of cured resin;" *and* "η number of layers;" *from the definitions below Equation (B.1).*

231. Modification to B.3, Laminate modulus
Definition X_i, replace "N/mm per kg/m^2" *with* "N/mm".

232. Modification to B.5, Determination of laminate strains from load resultants
Equation (B.7), replace "M_x" *with* "M_Φ".

233. Modification to B.5, Determination of laminate strains from load resultants
(2) insert reference to Figure B.2.

234. Modification to B.5, Determination of laminate strains from load resultants
Figure B.2, replace "t_1" *and* "h_1' *with* "t_i" *and* "h_i".

235. Modification to D.10.6, Calculation
Equation (D.7), replace the "d" *in the denominator with* "d_1".

236. Modification to I.1.2, Structural requirements
6), replace "in Table 20 and 19" *with* "in Table 18 and 19".

237. Modification to I.1.2, Structural requirements
Table I.1, 1st row, replace "tF" and "tR" *with* "t_F" and "t_R".

238. Modification to K.3.1, General
Paragraph 2, replace "should be made to N.4 and finite element analysis (FEA)" *with* "should be made using finite element analysis (FEA)".

239. Modification to K.3.2, Symbols

Figure K.8, add angle "Φ*" and moment "*M_Φ*" into the figure.*

240. Modification to K.3.2, Symbols

Key to Figure K.8, M_Φ*, replace* "N/mm" *with* "Nm/m".

241. Modification to K.3.3, Maximum shell strains

Paragraph 5, line 1, replace "T_A and M_A and T_B and M_A in" *with* "T_A and M_A and T_B and M_B in".