

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

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 "E_{CR} 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 " $t_i = [1/\rho_g + (100 - m_g)/(m_g \times \rho_r)] \times 10^{-3}$ " with:
" $t_i = [1/\rho_g + (100 - m_g)/(m_g \times \rho_r)] \times 10^{-3}$ ".

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 a_L or lamina a

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 " $X_{lam} = X_1 \times m_1 \times n_1 + u_2 \times m_2 \times n_2 \dots u_i \times m_i \times n_i$ " with:

" $X_{lam} = X_1 \times m_1 \times n_1 + X_2 \times m_2 \times n_2 \dots X_i \times m_i \times n_i$ ".

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/m²" 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/mm²".

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 " $q_{x,c} = q_{x,M} + q_{x,W} + q_{x,p}$ " 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 " $q_{x,c} = q_{x,M} + q_{x,w} - q_{x,p}$ ".

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), $E_{\phi b}$ should be $E_{\phi b}$.

40. Modification to 10.3.5, Critical buckling pressure for cylindrical

Equation (24), $E_{\phi b}$ 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 " K_{c1} " 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 " $E_{\phi b}$ " with " $E_{\phi b}$ " and " E_x " with " E_x ".
60. **Modification to 10.4.4.2.2, Critical radial buckling pressure p_c**
Equation (30), replace " $E_{\phi b}$ " with " $E_{\phi b}$ ".
61. **Modification to 10.4.4.2.3, Axial compressive load**
Equation (31), replace " $E_{\phi b}$ " with " $E_{\phi b}$ ".
62. **Modification to 10.4.4.2.4, Combined axial and radial compressive**
Equation (34), replace " $(q_x \times F / u_c)^{1,25} + (p_D \times F / p_c)^{1,25} \leq F$ " with " $(q_x \times F / u_c)^{1,25} + (p_D \times F / p_c)^{1,25} \leq 1$ ".
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 $\Phi > 75^\circ$ the covers".

- 64. Modification to 10.4.5.1, Covers subjected to internal pressure**
Equation (35), replace " $q_x = \alpha_b \times p_D \times 1 / \sin \phi \times \cos \phi \times (D/t_k)^{1+\beta_b} \times t_k$ " 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 " $\alpha_b = 51,6 \times (r/D)^2 + 7,6 \times (r/D) + 0,13$ " with " $\alpha_b = -64 \times (r/D)^2 + 7,6 \times (r/D) + 0,13$ ".
- 66. Modification to 10.4.5.1, Covers subjected to internal pressure**
Equation (36b), replace " $\beta_b = 51,6 \times (r/D)^{1,6} - 8,18 \times (r/D) + 0,52$ " with " $\beta_b = 51,6 \times (r/D)^2 - 8,18 \times (r/D) + 0,52$ ".
- 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 " E_b " 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 " $\geq (D * t_{bk})^{1/2}$ " with " $\geq (D \times t_{bk})^{1/2}$ ".

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 " $\pm q_{x,\Delta T}/A_5$ " 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 " $q_{x,Sk,u,p} = 6 \times C \times p \times D$ " with " $q_{x,Sk,u,p} = 6 \times C \times p_D \times D$ ".

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 " $q_{x,Sk,u,p} \pm q_{x,Sk,u,\Delta T}/A_5$ ".

91. Modification to 10.6.3.3.3, Unit load for lower part of skirt, region 2

Equation (62), replace " $L_{csku} \geq (D \times t_{sku})^{1/2}$ " with " $L_{c,Sk,u} \geq (D \times t_{Sk,u})^{1/2}$ ".

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 " $L_c \geq (D \times t_k)^{1/2}$ " with " $L_c \geq (D \times t_{bk})^{1/2}$ ".
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 " $D < 2 \text{ mm}$ " with " $D < 2 \text{ m}$ ".
102. **Modification to 10.6.3.3.4, The unit load in the knuckle region, region 3**
Equation (69), replace " $+0,2 \times \rho_D \times D$ " with " $+0,2 \times p_D \times D$ ".
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 $\tau_{over} \leq dK$ " with " $\tau_{over} = q_{over}/l_{over}$ and $\tau_{over} \leq dK$ ".
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 " $q_x = (W_D/A_c) + (M_D + W_{Dec})/Z_c$ ".
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 " $q_{\max} \leq \text{all } \times \cdot U_{\text{Lam}} + \text{all } \times U_c$ " with " $q_{\max} \leq \text{all } U_{\text{Lam}} + \text{all } U_c$ ".

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 " $\tau \leq$ " 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 " $M_D = M_p + M_{\text{localload}} + (M_{\text{snow}} + M_{\text{wind}})/A_5$ " with " $M_D = M_p + M_i + (M_{\text{snow}} + M_{\text{wind}})/A_5$ ".

126. Modification to 10.9.4, Design methods for all panel shapes

NOTE, a), replace "When M_{local} " with "When M_i ".

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 " $M_1 = W(4 \times \pi) \times [1,3 \times 1n(2 \times b/\pi \times r_1) + \beta_2]$ " with " $M_1 = W(4 \times \pi) \times [1,3 \times \ln(2 \times b/\pi \times r_1) + \beta_2]$ ".
- 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 M_p , due" with "The moment M_p , due".
- 136. Modification to 10.9.6.1, Circular panels under uniformly distributed**
Equation (95), replace " $M_1 = (W/4\pi) \times [1,3 \ln(d_p/2r_1) + 1]$ " 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 " α_1 " and " α_2 " with " α_1 " and " α_2 ".
- 139. Modification to 10.9.6.3, Mass of reinforcement for circular panels**
Equation (97), replace " W_i " 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, " $= 120^\circ$ " with " $\geq 120^\circ$ ".

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 " P_s is the overpressure" with " PS is the overpressure".

149. Modification to 10.11.2.2, Determination of longitudinal flexural moment

Definitions, replace " p_u 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 " P_s " with " PS " and " p " with " ρ ".

169. Modification to 10.11.3.2, Unit loads in circumferential direction

Equation (130), replace " P_s " 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 " P_s " with " PS ".

172. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces

Equation (134), replace " P_s " with " PS ".

173. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces

Equation (135), replace " P_s " with " PS ".

174. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces

Equation (136), replace " P_s " 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 " P_s " with " PS ".

178. Modification to 10.11.3.3, Unit loads in axial direction and lateral forces
Equation (142), replace " P_s " 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 $\tau_{allowable} \geq$ " with " $= 50/K$ and $\tau_{allowable} \geq$ ".

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

183. Modification to 10.11.3.5, Localised effects at saddle or stiffener
Definitions below Equation (149), replace " $D_s = \text{mean diameter}$ " with " $D_s = \text{diameter}$ ".

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

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 " $q_{Rx} = 0,53 W_1 / (t_r^{1,5} \times D^{0,5})$ " with " $q_{Rx} = 0,53 W_1 / (t_R^{1,5} \times D^{0,5})$ ".

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 " $= G_o - C$ " with " $= G_o - C$ ".

192. Modification to 11.2.2, Symbols
 B_i , 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 "*g_o*" 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 $C_{SM}/K = 15 \text{ N/mm}^2$ Replace with $\sigma_{CSM}/K = 15 \text{ N/mm}^2$

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, **s**, **s** shall" with "seismic force. **T**he anchorage" and "the effect of pressure and wind loadings **s** 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_1 , replace "N/mm per kg/m²" 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 " t_F " and " t_R " 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".