

EEMUA 159 Edition 5 Imprint 1 - August 2018**Amendment Sheet 1**

The amendments which follow are issued under the authority of the EEMUA Storage Tanks Committee which has responsibility for the maintenance of this publication. It is being carried through into the digital edition and future printed editions. It is provided here for reference to those readers who currently own a paper copy.

Replacement text**1. The use of '&' and 'and' in the published text:**

The existing '&' is to be replaced with 'and' within the publication text as indicated:

Page	Section	Subsection	Existing Text	Revised Text
23	4.2 Types of corrosion	Bullet point 1	Uniform & Pitting corrosion	Uniform and Pitting corrosion
27	4.2.4 Galvanic corrosion	Paragraph 3, Line 1	Different metals & alloys have different electrochemical...	Different metals and alloys have different electrochemical...
48	5.1.1 Inspection and maintenance (The 7 steps of the out-of-service period)	Step 2, Line 6	...necessary to comply with NDT & Inspection standards.	...necessary to comply with NDT and Inspection standards.
59	5.3.1 General	Paragraph 2, Line 4	...instrument settings, calibration blocks & procedures, probes,...	...instrument settings, calibration blocks and procedures, probes,...
63	5.3.4.1 General	Paragraph 4, Line 5	Next to required inspection & NDT certification; rope access...	Next to required inspection and NDT certification; rope access...
70	5.3.7 Measurement of nozzles and manhole neck plates (<i>Tank roof nozzle inspection</i>)	Step 1, Line 2	...including floating roof rim & bleeder up to the first flange.	...including floating roof rim and bleeder up to the first flange.
248	17.2.7 Execution (Do)	Paragraph 1, Line 4	...identification, planning & scheduling of work is implemented...	...identification, planning and scheduling of work is implemented...
249	17.2.9 Closing the loop (Act/Adjust)	Paragraph 3, Line 4	...taken when reviewing preventive & predictive maintenance tasks to...	...taken when reviewing preventive and predictive maintenance tasks to...
265	17.5.2.1 Indenting level	Bullet Point 2, Line 1	The specified maintenance & repair level for the equipment.	The specified maintenance and repair level for the equipment.
265	17.5.2.2 System & equipment description	Paragraph 1, Line 5	...the concept of availability & reliability will be explained in more detail.	...the concept of availability and reliability will be explained in more detail.

2. Published text mentioning the use of electrical equipment in hazardous areas:

The existing text is to be replaced with the amended text within the publication as indicated:

Page 47, Paragraphs 4 and 5 - Existing text:

Depending on the types of product stored and local directives on hazardous area classification, the use of conventional battery operated (non-Ex/ATEX proof) NDT equipment is often prohibited. Such work can only be executed following proper "task-risk analyses" and/or "hot working" permit schemes which specify safety measures to be used during in-service inspections.

The use of EX-proof, ATEX-proof NDT equipment could allow testing under "cold working" conditions, but is not yet common practice and availability of Ex/ATEX equipment is limited.

Page 47, Paragraphs 4 and 5 - Amended Text:

Depending on the types of product stored and local directives on hazardous area classification, the use of conventional battery operated NDT equipment without the appropriate explosion protection (Ex) certification for use in hazardous areas is often prohibited. Such work can only be executed following proper "task-risk analyses" and/or "hot working" permit schemes which specify safety measures to be used during in-service inspections.

The use of appropriately certified explosion protected (Ex) electrical NDT equipment in hazardous areas could allow testing under "cold working" conditions, but is not yet common practice and availability of certified explosion protected (Ex) electrical equipment is limited.

Page 155, Paragraph 4 - Existing text:

EN ISO 16852⁽²⁷⁾ stipulates the performance requirements, test methods and limits for the use of flame arresters. The required mesh size of an arrester depends on the product vapours and related explosion group. The MESG (Maximum Experimental Safe Gap) varies between <0.5mm and >0.9mm. Flame arresters require an ATEX 2014/34/EU⁽²⁸⁾ approval certificate.

Page 155, Paragraph 4 - Amended text:

EN ISO 16852⁽²⁷⁾ stipulates the performance requirements, test methods and limits for the use of flame arresters. The required mesh size of an arrester depends on the product vapours and related explosion group. The MESG (Maximum Experimental Safe Gap) varies between <0.5mm and >0.9mm. Flame arresters require an appropriate IECEx and/or an ATEX 2014/34/EU⁽²⁸⁾ approval certification.

3. Amendment of title Table 4-1:

Page 30 - Existing text:

Table 4-1 Expected internal corrosion rates (typical (mm/year)) for tanks

Page 30 - Amended text:

Table 4-1 General internal corrosion rates (typical (mm/year)) for uncoated tanks

4. Amendment of text explaining formula parameters;

The existing text is to be replaced with the amended text within the publication as indicated:

Page 120 - Existing text:

Where:

D	Tank diameter (m)
t _{min}	Averaged minimum thickness of thinnest shell course (which may well be a lower shell course than the top shell course (mm)
t	Averaged minimum thickness of the shell course under consideration (mm)
h	Original Height of the shell course under consideration (mm)
H _e	Transposed shell course height using t _{min} (m)
H _E	Transposed total tank shell height (m)
K	Load factor for combined wind and vacuum loads
H _P	Maximum unstiffened height of transposed shell under wind and vacuum loads (m)
V _w	Wind speed as per original design (see also Section 5.1.2) (m/s)
v _a	Design vacuum of tank (mbar)
L	Interspacing between existing or additional wind girders on H _E
n	Number of existing or additional wind girders

Note: For tanks operating at elevated temperatures see Appendix F.

Page 120 - Amended text:

Where:

D	Tank diameter (m)
t _{min}	Minimum average thickness of thinnest shell course (which may well be a lower shell course than the top shell course (mm)
t	Minimum average thickness of the shell course under consideration (mm)
h	Original Height of the shell course under consideration (mm)
H _e	Transposed shell course height using t _{min} (m)
H _E	Transposed total tank shell height (m)
K	Load factor for combined wind and vacuum loads
H _P	Maximum unstiffened height of transposed shell under wind and vacuum loads (m)
V _w	Wind speed as per original design (see also Section 5.1.2) (m/s)
v _a	Design vacuum of tank (mbar)
L	Interspacing between existing or additional wind girders on H _E
n	Number of existing or additional wind girders

Note: For tanks operating at elevated temperatures see Appendix F.

5. Amendment of sub-section title 8.7.3.4:

The existing text is to be replaced with the amended text within the publication as indicated:

Page 135 - Existing text:

8.7.3.4 General corrosion **circular bolted blind off plates**

Page 135 - Amended text:

8.7.3.4 General corrosion of reinforcing plates around nozzles

6. Inclusion of sub-section title 10.3.3.1:

The following text is to be included at the top of page 150:

Page 150 - Text to be included:

10.3.3.1 Operational pressure/vacuum relief vents

7. Amendment of text sub-section 15.2.4.1, Point 4:

The existing text is to be replaced with the amended text within the publication as indicated:

Page 228 - Existing text:

A risk assessment has been performed resulting in a decision where all stakeholders involved agree to deviate from the requirements listed under Section **15.2.3**.

Page 228 - Amended text:

A risk assessment has been performed resulting in a decision where all stakeholders involved agree to deviate from the requirements listed under Section 15.2.1.

8. Amendment of text sub-section 15.2.4.4, Point 2:

The existing text is to be replaced with the amended text within the publication as indicated:

Page 229 - Existing text:

- Repairs shall be executed only by using Tombstone plates in accordance with **Figure 9-4 of API 653** (allowing only radial welds to be laid in this section of the bottom plates).

Page 229 - Amended text:

- Repairs shall be executed only by using Tombstone plates in accordance with Section 9 of API 653 (allowing only radial welds to be laid in this section of the bottom plates).

9. Amendment of text sub-section C.1.8:

The existing text is to be replaced with the amended text within the publication as indicated:

Page 364 - Existing text:

Tolerances on level and verticality should be in accordance with **Section 7.5.1**, and on roundness in accordance with **Section 12.9.3**.

Page 364 - Amended text:

Tolerances on level and verticality should be in accordance with Section 6.5.1, and on roundness in accordance with Section 11.5.3.

10. Amendment of text sub-section C.3.1:

The existing text is to be replaced with the amended text within the publication as indicated:

Page 367, Paragraph 4 - Existing text:

It is important that patch plates are not used **within the critical zone, i.e. in the peripheral area 75mm radially inwards from the tank shell.**

Page 367, Paragraph 4 - Amended text:

It is important that patch plates are not used nor local welding of pits is carried out within the critical zone, i.e. in the peripheral area 150mm radially inwards from the tank shell. In this area as per section 15.2.4.4 repair shall only be executed with tombstones plates or by replacing of the annular section.

11. Amendment of title - Figure C11a:

The existing text is to be replaced with the amended text within the publication as indicated:

Page 370 - Existing text:

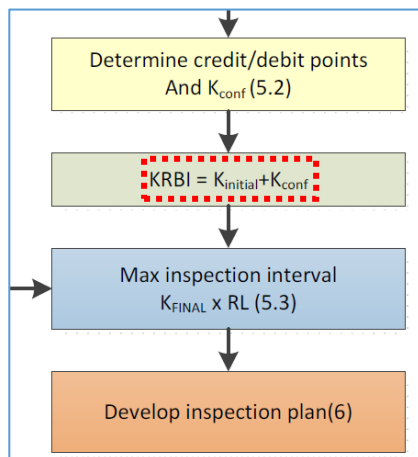
Figure C-11a **Explanation of welding sequence for shell-to-bottom junction**
(continued next page)

Page 370 - Amended text:

Figure C-11a Repair solutions for shell plates (continued next page)

12. Amendment to Figure E-1:

The existing text is to be replaced with the amended text within the publication as indicated:



Page 418 - Existing text:

$$KRBI = K_{initial} + K_{conf}$$

Page 418 - Amended text:

$$K_{final} = K_{initial} + K_{conf}$$

13. Amendment of formula and inclusion of text sub-section E.3.5.4 Step 2:

The existing text is to be replaced with the amended text within the publication as indicated:

Page 428 - Existing text:

$$K_{conf} = \frac{1 \times K_{cr} + 3 \times K_{ie} + 2 \times K_{ma} + 1 \times K_{pr}}{7}$$

(Value between 0 and 1)

$$K_{conf} = 0.4 \times K_{conf} - 0.2$$

(Value may not exceed -0.2 and +0.2)

Page 428 - Amended text:

$$K_{conf\ initial} = \frac{1 \times K_{cr} + 3 \times K_{ie} + 2 \times K_{ma} + 1 \times K_{pr}}{7}$$

(Value between 0 and 1)

$$K_{conf} = 0.4 \times K_{conf\ initial} - 0.2$$

(Value may not exceed -0.2 and +0.2)

The combined value of $K_{final} = K_{conf} + K_{initial}$ may not exceed 1.0

Where:

$K_{initial}$ is established by the location in the Risk Assessment Matrix (RAM) – see model calculations steps, pages 434 to 450.

14. Amendment of formula E.4.2.4.2.2:

The existing formula is to be replaced with the amended formula within the publication as indicated:

Page 432 - Existing formula:

$$RL_A = \frac{\left[\frac{100 - \max((RT_t; RT_u))}{100} \times t_{avg; meas} - 50\% \times t_{limit} \right] + C \times CR_{pit;t}}{(CR_{pit,t} + RL \times CR_{gen})}$$

$$RL_B = \frac{\left[\frac{100 - \max((RT_t; RT_u))}{100} \times t_{avg; meas} - 50\% \times t_{limit} \right] + C \times CR_{gen}}{(CR_{gen} + RL \times CR_{pit,u})}$$

Page 432 - Amended formula:

$$RL_A = \frac{\left[\frac{100 - \max(RT_t; RT_u)}{100} \times t_{avg; meas} - 50\% \times t_{limit} \right] + C \times CR_{pit;t}}{(CR_{pit;t} + CR_{gen})}$$

$$RL_B = \frac{\left[\frac{100 - \max(RT_t; RT_u)}{100} \times t_{avg; meas} - 50\% \times t_{limit} \right] + C \times CR_{gen}}{(CR_{gen} + CR_{pit,u})}$$