SLOVENSKI STANDARD
SIST EN 13445-3:2002/A17:2008
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Neogrevane tlaļ ne posode - 3. del: Konstruiranje

Unfired pressure vessels - Part 3: Design

Unbefeuerte Druckbehälter - Teil 3: Konstruktion

Récipients sous pression non soumis a la flamme - Partie 3 : Conception

Ta slovenski standard je istoveten z: EN 13445-3:2002/A17:2007

ICS:

23.020.30	Tlaļ ne posode, plinske jeklenke	Pressure vessels, gas cylinders

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English Version

Unfired pressure vessels - Part 3: Design

Récipients sous pression non soumis à la flamme - Partie 3 : Conception

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This amendment A17 modifies the European Standard EN 13445-3:2002; it was approved by CEN on 26 May 2007.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for inclusion of this amendment into the relevant national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This amendment exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Contents

Page

Foreword

This document (EN 13445-3:2002/A17:2007) has been prepared by Technical Committee CEN/TC 54 “Unfired pressure vessels”, the secretariat of which is held by BSI.

This Amendment to the European Standard EN 13445-3:2002 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2008, and conflicting national standards shall be withdrawn at the latest by April 2008.

The document includes the text of the amendment itself. The corrected pages of EN 13445-3 will be delivered as issue 29 of the standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Annex J
(normative)

Alternative method for the design of heat exchanger tube sheets

J.3 Specific symbols and abbreviations

Change the following symbols in Annex J.3.3:

J.3.3 Symbols

Add the following symbols:

$A_{R(\min)}$ is the minimum area of the tubed region, [mm^2], see J.5.1.1.3.2;

$d_{1(av)}$ is the average of $d_{1(\min)}$ and $d_{1(\max)}$, [mm], see J.5.1.1.4;

$d_{1(\max)}$ is the maximum value of d_1, [mm], see J.5.1.1.2;

$d_{1(\min)}$ is the minimum value of d_1, [mm], see J.5.1.1.3;

j is an integer to identify any trapezoidal area (tubed or untubed);

k is an integer to identify an untubed (pass partition) zone;

$N_{I(k)}$ is the number of potential extra tubes in a given untubed trapezoidal area, [1], see J.5.1.1.3.2;

$N_{I(r)}$ is the number of potential extra tubes in a given row, [1], see J.5.1.1.3.2;

p_b is the tube pitch in relation to the height of the trapezoidal area, [mm];

p_c is the tube pitch in relation to the width of the trapezoidal area, [mm];

r is an integer to identify a tube row;

$\Delta d_{(act)}$ is the actual difference between $d_{1(\max)}$ and $d_{1(\min)}$, [mm];

$\Delta d_{(all)}$ is the allowable difference between $d_{1(\max)}$ and $d_{1(\min)}$, [mm];

Replace the following symbols:

$N_{I(\min)}$ is the total minimum number of potential extra tubes for the whole tubed area, [1], see J.5.1.1.3.2;

r_o is the radius of the outermost tube hole centre [mm]; see Figure J-7(a) and NOTE in J.5.1.1.2 (also Figure 13.7-1);

Delete the following symbol:

θ is a factor dependant on the tube pitch [1]; see J.5.1.

J.5 Parameters for all types

J.5.1 Diameters and widths

Replace 5.1.1 with the following text:

J.5.1.1 Outside diameter d_1 of tubed region

J.5.1.1.1 General

The procedure for calculating d_1 is given below.

NOTE Upper and lower limits for d_1 can be established by considering the space within the tubed area which is available for additional tubes. d_1 is calculated from the limits.

J.5.1.1.2 Maximum diameter $d_{1(\max)}$

Determine $d_{1(\max)}$ as follows:

$$d_{1(\max)} = 2r_o + d_T \qquad \text{(J.5.1-1)}$$

NOTE If an isolated tube or small group of tubes lies outside the main tubed region (by a distance of more than one pitch) it should be ignored when determining r_o and d_T.

J.5.1.1.3 Minimum diameter $d_{1(\min)}$

J.5.1.1.3.1 Defining trapezoidal areas

Draw the tangent lines to the outside tubes to enclose the tubed region within a polygon. The positions of the tie rods shall be ignored.

NOTE 1 An example is shown in Figures J-7(c) and J-7(d).

NOTE 2 For simplicity, where two tangent lines have nearly equal slopes, they can be replaced by a single tangent line if this line lies outside the centres of any tubes it crosses (i.e. it cuts less than half tube sections). (See area of height b_7 in Figure J-7(b).)

Divide the tubed region into (perforated or un-perforated) trapezoidal areas by drawing straight lines parallel to the tube rows.

Where the intersection of the tangent lines which form the polygon lies closer to the tube centreline, the construction line shall be through the tube centres (see Figure J-7(d)). Where the intersection of the tangent lines which form the polygon lies closer to the tangent line than to the tube centreline, the construction line shall be the tangent to the tube row (see Figure J-7(b)). This also applies when the intersection is mid-way between the tube centre line and the tube tangent line. Extend the construction lines to the enclosing polygon to form trapezoidal areas. Denote the heights of the trapezoidal areas by b_j (j = 1,2, ..,) and widths by c_j (j = 0, 1, 2, .,).

J.5.1.1.3.2 Determination of $A_{R(\min)}$

Determine $A_{R(\min)}$ by one of the following three methods.

(a) Tube counting

Determine the total number of potential extra tubes $N_{I(\min)}$ as follows.

Calculate the tube pitches p_b and p_c as follows:

On triangular pitch:

$$p_b = 0{,}866\, p \qquad \text{(J.5.1-2)}$$

and

$$p_c = p \qquad \text{(J.5.1-3)}$$

On square pitch:

$$p_b = p \qquad \text{(J.5.1-4)}$$

and

$$p_c = p \qquad \text{(J.5.1-5)}$$

For each tube row, count all unfilled positions within the row. For unfilled positions at the ends of the row, multiples of half a tube may be added when the tangent line lies inside the centre of the potential extra tube. This gives $N_{I(r)}$ for each row.

NOTE An example of this is shown in Figure J-7(e).

For a pass partition zone where the distance between the adjacent tube rows equals an integral number of tube pitches, count all the potential extra tube positions to obtain $N_{I(k)}$ for that zone.

NOTE Area of height b_3 in Figure J-7(d) is one where the distance between the adjacent tube rows equals an integral number of tube pitches.

For a pass partition zone or other untubed area, with arbitrary distances to the adjacent tube rows, calculate $N_{I(k)}$ for that zone as follows:

$$N_{I(k)} = \frac{\left[b_{k,p} + p_b\right]\left(c_{k-1,p} + c_{k,p}\right)}{2 p_b \cdot p_c} \qquad \text{(J.5.1-6)}$$

In Equation J.5.1-6, $b_{k,p}$ is the distance between the centrelines of adjacent tube rows and p_b is the corresponding (vertical) pitch; $c_{k-1,p}$ and $c_{k,p}$ are the (upper and lower) widths of the trapezoidal area respectively; and p_c is the corresponding (horizontal) pitch, see Figure J-7(d). The calculated number $N_{I(k)}$ for each partition zone of this type shall be rounded up to the nearest half tube.

NOTE The area of height $b_{5,p}$ in Figure J-7(b) is an untubed area with an arbitrary distance between the adjacent tube rows.

$N_{I(\min)}$ is the sum of all the potential extra tubes from the rows, $N_{I(r)}$, and all the potential extra tubes from the pass partition zones, $N_{I(k)}$. In extreme cases (where the layout is fully packed) $N_{I(\min)}$ may equal zero.

Calculate area $A_{R(\min)}$ as follows:

$$A_{R(\min)} = \left(N_T + N_{I(\min)}\right) \cdot p_b \cdot p_c \qquad \text{(J.5.1-7)}$$

(b) Calculation of all the trapezoidal areas

Calculate the values of b_J and c_J for each of the trapezoidal areas (see FigureJ-7(d)) as follows:

— in the perforated zones, the heights b_J are to be calculated as the nearest multiple of p_b and $\frac{d_T}{2}$. The widths c_J are similarly to be calculated as the nearest multiple of p_c and $\frac{d_T}{2}$. In case of doubt, always assume the smaller value.

— for any pass partition zones, the height of the zone, whether or not it is an exact multiple of p_b, is inserted in Equation J.5.1-8.

Calculate $A_{R(\min)}$ to include all perforated and un-perforated areas as follows:

$$A_{R(\min)} = 0{,}5 \cdot \left\{ (c_0 + c_1) \cdot b_1 + (c_1 + c_2) \cdot b_2 + (c_2 + c_3) \cdot b_3 \ldots\ldots \right\} = \sum_{j=1}^{j=j_{\max}} 0{,}5 \cdot \left(c_{j-1} + c_j\right) \cdot b_j \qquad \text{(J.5.1-8)}$$

(c) Measurement of area

Measure area $A_{R(\min)}$

NOTE This could be done by computer or other device.

J.5.1.1.3.3 Calculation of $d_{1(\min)}$

Calculate $d_{1(\min)}$ from $A_{R(\min)}$ as follows:

$$d_{1(\min)} = \sqrt{\frac{4 A_{R(\min)}}{\pi}} \qquad \text{(J.5.1-9)}$$