Nederlandse
norm

Ontwerp
NEN-EN 12573-3
prEN 12573-3

Gelaste, niet-verplaatsbare, drukloze tanks van thermoplasten. Deel 3: Constructie en berekening van enkelwandige rechthoekige tanks

Publicatie uitsluitend voor commentaar

Welded static non-pressurized thermoplastic tanks.
Part 3: Design and calculation for single skin rectangular tanks

oktober 1996
ICS 23.020.10

Commentaar voor 1 februari 1997

De European Committee for Standardization (CEN), waarin de nationale normalisatie-instituten van 18 Europese landen samenwerken, heeft gepubliceerd het Europese normontwerp:

prEN 12573-3 Welded static non-pressurized thermoplastic tanks. Part 3: Design and calculation for single skin rectangular tanks

Definitief vastgestelde Europese normen zullen als Nederlandse norm gelden. Daarom wordt dit normontwerp in Nederland voor commentaar gepubliceerd. Op het ontwerp ingebracht commentaar zal aan de bevoegde normcommissie worden voorgelegd die hiermee rekening zal houden bij de bepaling van de Nederlandse stem. Indien er geen bezwaar bij het NNI wordt ingebracht, kan dat leiden tot ongewijzigd definitieve vaststelling van het ontwerp als norm.

Van Europese normen bestaan drie officiële versies: Engels, Frans, Duits. Voor Nederland zal de Engelse versie gelden, tenzij voor een geautoriseerde versie in het Nederlands wordt gekozen.

Normcommissie 341 103 "Opslagtanks van kunststof"

Prijsklasse 30

Nederlands Normalisatie-instituut

Kalfjeslaan 2, Postbus 5059, 2600 GB Delft, Telefoon (015) 2 690 390, Fax (015) 2 690 190

EUROPEAN STANDARD

NORME EUROPEENNE

EUROPÄISCHE NORM

DRAFT
prEN 12573-3

September 1996

ICS

Descriptors :

English version

Welded static non-pressurised thermoplastic tanks - Part 3: Design and calculation for single skin rectangular tanks

Cuves statiques soudées en matières thermoplastiques sans pression - Partie 3: Conception et calcul des cuves parallélépipédiques rectangles à simple paroi

Geschweißte ortsfeste drucklose Behälter (Tanks) aus Thermoplasten - Teil 3: Konstruktion und Berechnung von einwandigen Rechteckbehältern (-tanks)

This draft European Standard is submitted to the CEN members for CEN enquiry. It has been drawn up by Technical Committee CEN/TC 266 .

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. prEN 12573-3:1996 E

Contents

Foreword

This European Draft Standard has been prepared by CEN/TC 266 "Thermoplastic static tanks", the secretariat of which is held by BSI.

The Technical Committee CEN/TC 266 decided to submit this European Draft Standard to the CEN-enquiry.

The informative annex A gives some construction details of rectangular tanks as examples.

The informative annex B is a bibliography.

This European Standard consists of 4 parts:

Welded static non-pressurised thermoplastic tanks;

Part 1: General principles
Part 2: Calculation of vertical cylindrical tanks
Part 3: Design and calculation of single skin rectangular tanks
Part 4: Design and calculation of flanged joints

1 Scope

This part of European Standard specifies the design and calculation for single skin rectangular tanks, fabricated from the following thermoplastics:

Polyethylene (PE)
Polypropylene (PP)
Poly (vinyl chloride) (PVC)
Poly (vinylidene fluoride) (PVDF)

The tanks may be strengthened on the outside by means of ribs or frames made of the same or other materials, such as glass-fibre reinforced plastic (GRP) or steel.

Tanks which comply with the requirements of this standard are not intended to withstand internal pressure or vacuum, other than that which may occur during the transfer of fluids (including gases) in their normal operation. The precise figures that apply are given in part 1 of this standard.

Plate theory was used as the basis of the calculation in this document. Reference to membrane theory is found in 11.2.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN XXXX-1 Welded static non-pressurised thermoplastic tanks – Part 1: General principles

EN 1778 Characteristic values for welded thermoplastic constructions – Determination of allowable stresses and moduli for design of thermoplastic equipment

3 Definitions, symbols and abbreviations

For the purposes of this part of this European Standard the following definitions, symbols and abbreviations apply:

3.1 Definitions

Skin: Basic structural element of the tank.

Stiffener: Section attached horizontally or vertically to the skin of the tank.

Wall: Skin of the tank plus stiffeners.

Panel: Area of the skin between stiffeners.

U-frame: Stiffener running beneath the base and vertically up the side of the tank.

3.2 Symbols and abbreviations

E is the elastic modulus of the stiffener material (with plastics, this corresponds to E_c), in N/mm²
$E_{c(al.)D}$ is the allowable creep modulus at the design condition for deformation (temperatur, stress, time, medium), in N/mm^2, see prEN 1778
F is the force, in N
f is the maximum deflection, in mm
J is the moment of inertia of stiffener, in mm^4
k is the correction coefficient
M is the bending moment, in Nmm
p is the excess pressure on the tank base, in N/mm^2
p_m is the mean value of excess pressure for calculation of skin thickness, in N/mm^2
p_1 is the mean value of excess pressure for calculation of the stiffener, in N/mm^2
t is the skin thickness, in mm
W is the moment of resistance of rim stiffeners, in mm^3
x is the length of the tank or distance between the vertical stiffeners, in mm
x' is the effective length of panels assigned to stiffeners, in mm
y is the depth of the tank or distance between the horizontal stiffeners, in mm
y' is the effective depth of panels assigned to stiffeners, in mm
z is the width of the tank or panel, in mm
$\alpha_1 \dots \alpha_5$ is the deformation coefficient
$\beta_1 \dots \beta_5$ is the skin thickness coefficient
$\sigma_{al.}$ is the allowable stress, in N/mm^2, see prEN 1778

4 General considerations in design calculations

Calculation methods are only given for the tank designs illustrated in figures 1 to 5.

Welds shall be situated in regions of low bending moments; the maximum moments are shown in figures 6, 7 and 8.

NOTE: The design should take account of the effects of thermal expansion between the tank wall and any external stiffening.

For construction details of rectangular tank see annex A.

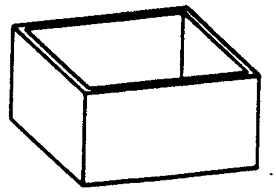

Figure 1: Unstiffened tank

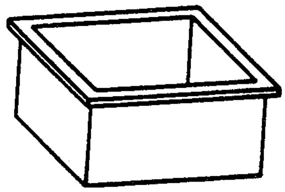

Figure 2: Tank with a horizontal rim stiffener

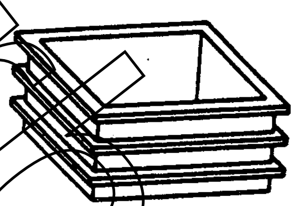

Figure 3: Tank with intermediate horizontal stiffeners

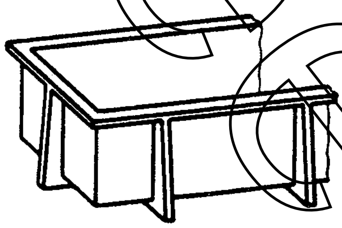

Figure 4: Tank with vertical stiffeners

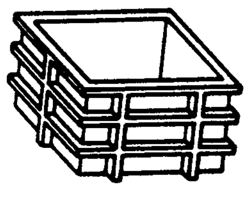

Figure 5: Tank with cross-ribbed horizontal and vertical stiffeners

5 Unstiffened tanks sitting on a continuous flat rigid surface

5.1 General

The calculation of the minimum skin thickness depends on the ratio between the length (x) and depth (y) (see figure 6). The thickness of the base shall be of similar magnitude to the actual thickness of the skin.

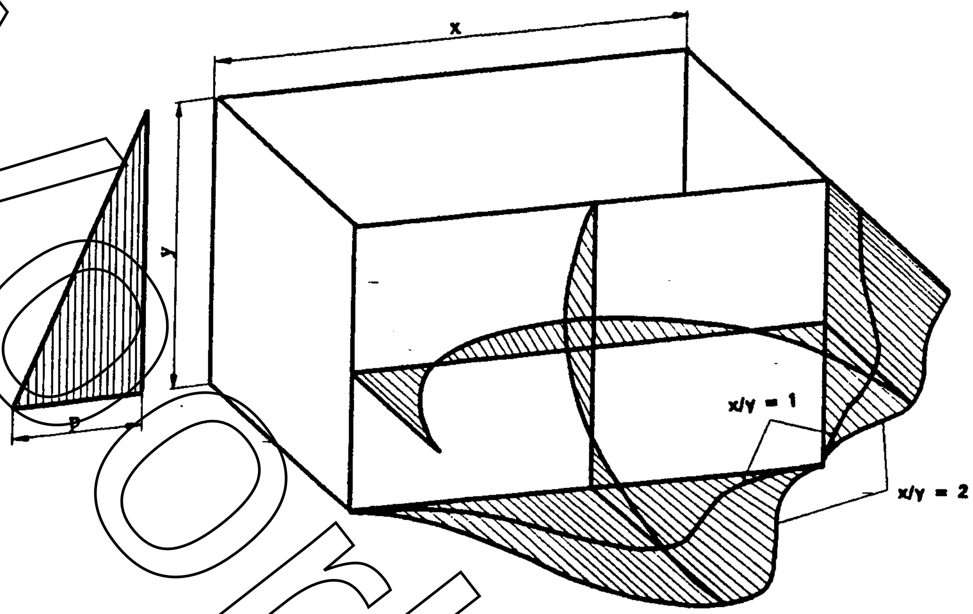

Figure 6: Distribution of bending moments

5.2 Aspect ratio x/y < 0,5

The minimum skin thickness shall be calculated according to equation (1).

$$t = \sqrt{\frac{p \cdot x^2}{2,5\ \sigma_{al.}}} \qquad (1)$$

NOTE 1: In equation (1) for the skin thickness (t), the skin has been assumed as a beam fixed at both ends with the load distributed uniformly between these two points. This leads to a factor of 2 in the denominator. To provide better agreement with measured values, the factor was increased to 2,5.

The maximum deflection of the skin shall be calculated according to equation (2).

$$f = \frac{p\ x^4}{32\ k\ E_{c(al.)_D}\ t^3} \qquad (2)$$

The factor k is either 1 when x < y or 2 when x/y ≈ 0,5.

NOTE 2: In equation (2) for the deflection, there is a factor of 32 in the denominator when a beam is fixed at both ends with the load distributed uniformly between these two points. However, it is possible to use equations based on plate theory which exactly correspond to the particular load case and lead to a factor of 68 if x/y ≈ 0,5. Therefore, an additional factor k was introduced, which, depending on x/y, gives sufficiently accurate results.

Bestelformulier

Stuur naar:

NEN Standards Products & Services
t.a.v. afdeling Klantenservice
Antwoordnummer 10214
2600 WB Delft

NEN Standards Products & Services

Postbus 5059
2600 GB Delft

Vlinderweg 6
2623 AX Delft

T (015) 2 690 390
F (015) 2 690 271

www.nen.nl/normshop

Ja, ik bestel

__ ex. NEN-EN 12573-3:1996 Ontw. en Gelaste, niet-verplaatsbare, drukloze tanks van thermoplasten - Deel 3: Constructie en berekening van enkelwandige rechthoekige tanks € 29.64

Wilt u deze norm in PDF-formaat? Deze bestelt u eenvoudig via www.nen.nl/normshop

Gratis e-mailnieuwsbrieven

Wilt u op de hoogte blijven van de laatste ontwikkelingen op het gebied van normen, normalisatie en regelgeving? Neem dan een gratis abonnement op een van onze e-mailnieuwsbrieven. www.nen.nl/nieuwsbrieven

Gegevens

Bedrijf / Instelling ____________________

T.a.v. ____________________ O M O V

E-mail ____________________

Klantnummer NEN ____________________

Uw ordernummer ____________________ BTW nummer ____________________

Postbus / Adres ____________________

Postcode ____________________ Plaats ____________________

Telefoon ____________________ Fax ____________________

Factuuradres (indien dit afwijkt van bovenstaand adres)

Postbus / Adres ____________________

Postcode ____________________ Plaats ____________________

Datum ____________________ Handtekening ____________________

Retourneren

Fax: 015 2 690 271
E-mail: klantenservice@nen.nl
Post: NEN Standards Products & Services,
t.a.v. afdeling Klantenservice
Antwoordnummer 10214,
2600 WB Delft
(geen postzegel nodig).

Voorwaarden

- De prijzen zijn geldig tot 31 december 2018, tenzij anders aangegeven.
- Alle prijzen zijn excl. btw, verzend- en handelingskosten en onder voorbehoud bij o.m. ISO- en IEC-normen.
- Bestelt u via de normshop een pdf, dan betaalt u geen handeling en verzendkosten.
- Meer informatie: telefoon 015 2 690 391, dagelijks van 8.30 tot 17.00 uur.
- Wijzigingen en typefouten in teksten en prijsinformatie voorbehouden.
- U kunt onze algemene voorwaarden terugvinden op: www.nen.nl/leveringsvoorwaarden.