SLOVENSKI STANDARD
SIST EN 12573-2:2000

01-december-2000

Welded static non-pressurised thermoplastic tanks - Part 2: Calculation of vertical cylindrical tanks

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Geschweißte orstfeste drucklose Behälter (Tanks) aus Thermoplasten - Teil 2: Berechnung von runden stehenden Behältern (Tanks)

Cuves statiques soudées en matières thermoplastiques sans pression - Partie 2: Calcul des cuves cylindriques verticales

Ta slovenski standard je istoveten z: **EN 12573-2:2000**

ICS:

23.020.10	Nepremiļ ne posode in rezervoarji	Stationary containers and tanks

SIST EN 12573-2:2000 **en**

EUROPEAN STANDARD
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English version

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This European Standard was approved by CEN on 14 February 2000.

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This European Standard 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 Central Secretariat has the same status as the official versions.

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

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

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Contents

Foreword

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

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2000, and conflicting national standards shall be withdrawn at the latest by September 2000.

prEN 12573:1999 "Welded static non-pressurised thermoplastic tanks" consists of:

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

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

1 Scope

This standard establishes rules for the design and calculation of welded static, vertical, non-pressurised, cylindrical, flat-bottom thermoplastic tanks. This standard applies to tanks fabricated in the following thermoplastics:

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

This standard does not take into account wind and/or snow loading.If wind or/and snow loading has to be taken into account additional calculations are necessary.

This standard is applicable to tanks in which the cylindrical shell is made of welded plates or a wound cylinder or an extruded pipe.

The calculation takes into account short-term and long-term active pressures as well as the hydrostatic loading. The following values are long-term pressures and represent the limiting values:

Overpressure: 0,0005 N/mm^2 (0,005 bar)
Low pressure: 0,0003 N/mm^2 (0,003 bar)

This standard is only applicable to tanks which 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.

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.

prEN 12573-1:1999 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 Symbols and abbreviations

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

a is the depth of the weld seam, in millimetre

b is the width of the nozzle compensation around the nozzle, in millimetre

C_1 is the load increase factor

C_2 is the material specific design factor

C_3 is the design factor for a two layered tank

C is $C_1 \times C_2$

d is the nominal inside diameter of the tank, in millimetre

d_A is the nozzle outside diameter, in millimetre

d_L is the diameter of hole in lifting lug, in millimetre

$E_{c(al.)St}$ is the allowable creep modulus at the design condition for stability (temperature, stress, time, medium, safety), in newton per square millimetre, see EN 1778

f_l is the long-term welding factor

g is the acceleration due to gravity, in metre per square second (9,81 m/s^2)

g_d is the surface related weights, in newton per square millimetre

h_F is the height at the maximum filling capacity, in millimetre

$h_{F(i)}$ is the height of the liquid above the lower edge of the band (i), in millimetre

h_Z is the total cylindrical height, in millimetre

h_{ZF} is the height of the lower band, in millimetre

l_m is the height of the equivalent middle band from stability calculations, in millimetre

l_o is the height of the equivalent upper band from stability calculations, in millimetre

l_u is the height of the equivalent lower band from stability calculations, in millimetre

p_e is the continuously active external pressure, in newton per square millimetre

p_i is the continuously active internal pressure, in newton per square millimetre

p_{stat} is the overpressure at the tank base due to the contents, in newton per square millimetre

$p_{stat(i)}$ is the overpressure at lower edge of the band (i) due to the contents, in newton per square millimetre

S is the safety factor (see part 1)

T_A is the temperature of the outside air, in degree celsius

T_D is the temperature of the roof, in degree celsius

T_M is the contents' temperature, in degree celsius

t is the calculated thickness of the band omitting the welding factor f_l from the calculation of $\sigma_{al.}$, in millimetre

t_B is the thickness of the base, in millimetre

t_D is the thickness of the roof, in millimetre

t_m is the thickness of the equivalent middle band from stability calculations, in millimetre

t_o is the thickness of the equivalent upper band from stability calculations, in millimetre

t_u is the thickness of the equivalent lower band from stability calculations, in millimetre

t_u^* is the thickness of the equivalent lower band from the stress calculation, in millimetre

$t_{Z(i)}$ is the thickness of the band (i) in the case of varying skin thickness tanks, in millimetre

t_{ZF} is the thickness of the lowest band of single layered tanks, in millimetre

t_{ZN} is the thickness of the nozzle compensation plus the calculated element thickness, in millimetre

$t_{ZF'}$ is the overall thickness of the lowest band of a multilayered tank, in millimetre

$t_{Z0'}$ is the thickness of the outer wall of a multilayered tank, in millimetre

$t_{Z1'}$ is the thickness of the inner wall of a multilayered tank, in millimetre

V is the filling volume, in cubic millimetre

V_A is the weakening coefficient

α is the angle of inclination of the roof, in degree

ε is the permissible edge expansions, in percent

λ is the buckling coefficient

ρ is the density of the thermoplastic material, in gram per cubic centimetre

ρ_F is the density of the contents, in gram per cubic centimetre

$\sigma_{al.}$ is the allowable stress at the design condition, in newton per square millimetre, see EN 1778

The figures 1 to 4 illustrate the main dimensions of tanks.

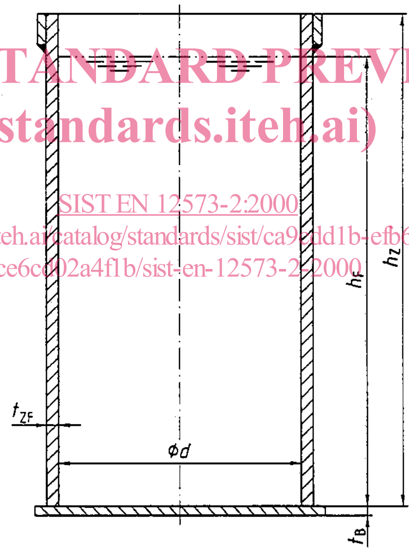

Figure 1: Open flat-base tank with constant wall thickness

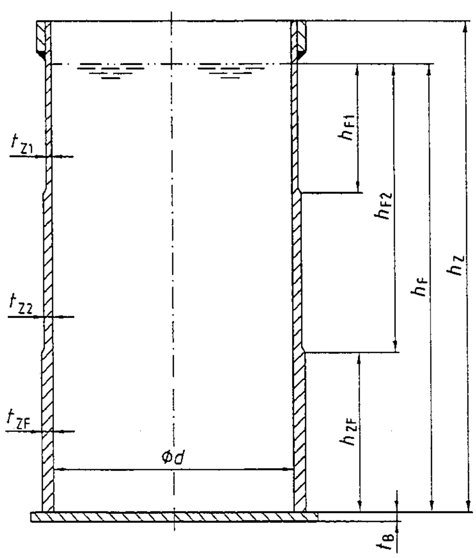

Figure 2: Open flat-base tank with varying wall thickness (three bands)

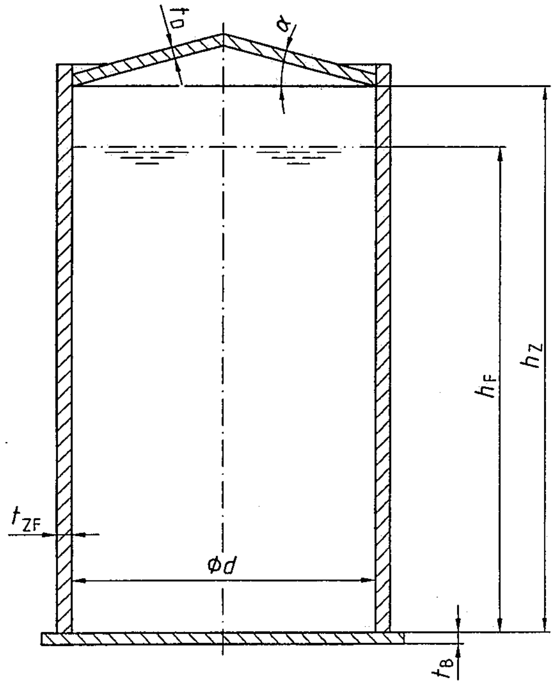

Figure 3: Flat-base tank with conical roof and constant wall thickness

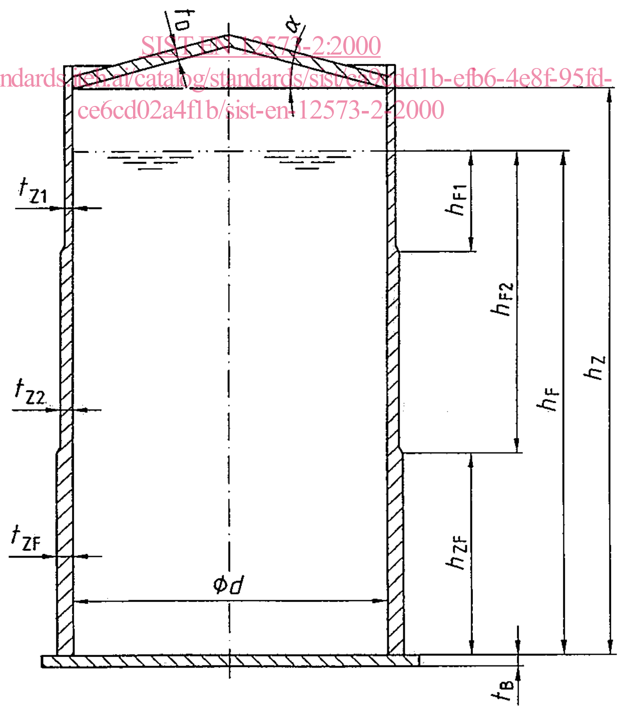

Figure 4: Flat-base tank with conical roof and varying wall thickness (three bands)

4 General principles

General principles shall be according to prEN 12573-1:1999.

5 Temperature

The effective wall temperature is an important factor in determining the dimensions of a tank.

The cylinder and base components shall be designed using the average temperature of the contents T_M.

The roof component shall be designed using the average of the two neighbouring air temperatures. The air temperature in the tank is assumed to be T_M . The surrounding air temperature T_A for indoor installation is assumed to be 20 °C. Figure 5 indicates the temperature zones.

The temperature of the roof shall be calculated according to equation (1).

$$T_D = (T_M + T_A)/2 \quad (1)$$

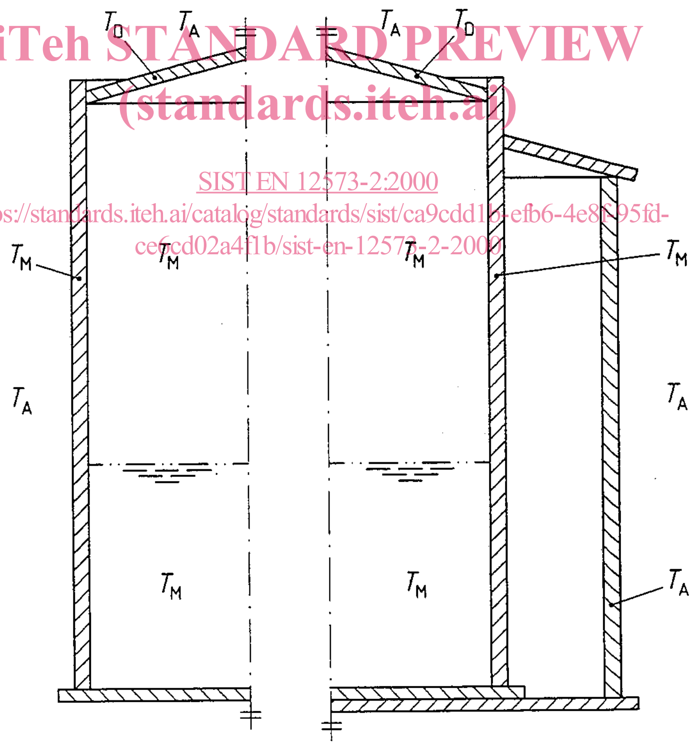

Figure 5: Definition of the effective temperatures