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

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Svetsade stationära icke trycksatta termoplasttankar – Del 1: Generella principer

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EN 12573-1

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English version

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

Cuves statiques soudées en matières thermoplastiques
sans pression - Partie 1: Principes généraux

Geschweißte ortsfeste drucklose Behälter (Tanks) aus
Thermoplasten - Teil 1: Allgemeine Grundsätze

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

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

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 Management Centre has the same status as the official versions.

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



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

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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of an identical text or by endorsement, at the latest by March 2001, and conflicting national standards shall be withdrawn at the latest by March 2001.

The primary design calculations are derived from EN 1778 "Characteristic values for welded thermoplastic constructions – Determination of allowable stresses and moduli for design of thermoplastic equipment". Safety factors have been defined for four categories of tank as detailed in 4.2.

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

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

This standard is intended to be used as part of a certification scheme covered by EN ISO 9001 including items such as the approval testing of welders according to prEN 13067.

Additional to the requirements of this standard, it is necessary to establish requirements concerning the inspection of fabrication, the tightness test, frequency of tests and the type of certificate in accordance with EN ISO 9001.

The informative annex A is a questionnaire for the purchaser on conditions of service for a welded static non-pressurised thermoplastic tank.

The informative annex B gives examples of construction details for the design of welded joints.

The performance of thermoplastic tanks is also dependent on their transport and site installation and recommendations in these areas are given in the informative annex C.

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 specifies general principles for welded static non-pressurised thermoplastic tanks. It applies to work shop and site fabrications.

The standard covers tanks with a capacity of 0,45 m³ (450 litres) and above.

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.

This standard applies to tanks fabricated in the following thermoplastics:

Polyethylene (PE)

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

NOTE: Design data for these materials is given in EN 1778.

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 1778	Characteristic values for welded thermoplastic constructions – Determination of allowable stresses and moduli for design of thermoplastic equipment
prEN 13067	Plastics welding personnel - Approval testing of welders - Thermoplastics welded assemblies
EN ISO 9001	Quality systems - Model for quality assurance in design/development, production, installation and servicing (ISO 9001:1994)

3 Definitions

For the purposes of this standard, the following definitions apply:

3.1 Brimful capacity

The volume of water held by the tank filled through the filling orifice to the point of overflowing.

3.2 Maximum filling capacity

A value of 95 % of the brimful capacity.

4 Design requirements

4.1 General

The manufacturer shall determine from the purchaser all factors relevant to the design of the tank. A recommended enquiry form for this purpose is given in annex A.

4.2 Safety factor

In the design calculation, an overall safety factor (S) for the tank shall be selected and agreed between the contracting partners. There are four categories of tank:

Category 2,0 (corresponding to a safety factor 2,0)
Category 1,7 (corresponding to a safety factor 1,7)
Category 1,5 (corresponding to a safety factor 1,5)
Category 1,3 (corresponding to a safety factor 1,3)

4.3 Material compatibility

Compatibility with contents shall be established using the procedures set down in EN 1778.

4.4 Calculated design life

The minimum calculated design life for a welded static non-pressurised thermoplastic tank shall be at least 10 years and 1 year for bunds subjected to liquid load. When specified by the purchaser, this calculated design life may be extended to a maximum of 25 years.

4.5 Nozzles

An inlet and an outlet nozzle are required. In the case of closed tanks, to reduce the risk of pressurising the tank, a venting nozzle with a nominal diameter of 1,3 times the nominal diameter of the largest inlet or outlet nozzle is required.

4.6 Manhole

In the case of closed tanks with a capacity of 2,0 m³ (2000 litres) and above, at least one manhole shall be provided to allow internal access and retrieval.

4.7 Welded joints

Recommendations for the design of welded joints are given in annex B.

5 Marking

Tanks shall be marked by means of an attached identification plate with, at least, the following information:

- a) Tank manufacturer
- b) Material of construction
- c) Designed contents or density, chemical reduction factor, and design temperature
- d) Maximum filling capacity
- e) Date of fabrication
- f) Manufacturers identification No.
- g) Location for use; internal or external
- h) Category of tank
- i) Calculated desing life
- j) The number of this Standard

An example of an identification plate is shown in figure 1.

6 Packaging, loading, transport and installation

Recommendations for the packaging, loading, transport and installation of welded static non-pressurised thermoplastic tanks are given in annex C.

NOTE: It is recommended, that information giving details of installation, any change of use etc. should be recorded by the user when such events occur. This will result in a continuous record of a tank's service history.

TANK MANUFACTURER	Tankworks plc
MANUFACTURERS IDENTIFICATION NO	ABC 123
DATE OF FABRICATION	15 March 1995
MATERIAL OF CONSTRUCTION	High density polyethylene
MAXIMUM FILLING CAPACITY	30 cubic metres
DESIGN CONTENTS	Hydrochloric acid 36 % Density 1,13 Chemical reduction factor 1,3
DESIGN TEMPERATURE	30 °C
LOCATION	Internal
CATEGORY OF TANK	1,7
CALCULATED DESIGN LIFE	10 years
THIS STORAGE TANK COMPLIES WITH EN 12573	

NOTE: The marking on the left side is normative and the values on the right side are understood as an example.

Figure 1: Example of a tank identification plate

Annex A (informative)

Questionnaire on conditions of service for a welded static non-pressurised thermoplastic tank

This is a proposed questionnaire on conditions of service for a welded static non-pressurised thermoplastic tank which should be completed by either the fabricator, the end user or other competent persons.

* Please tick boxes where appropriate and give specific numbers where requested.

1. Type of construction and dimensions*

- a) Circular
- b) Rectangular
- c) Limiting dimensions
- d) Maximum filling capacity..... (m³)

2. Service/operating conditions*

- a) Agreed category of tank.....
- b) Calculated design life of tank (10 years minimum)
 - 10 years
 - 25 years
 - Intermediate life time (please state)
- c) Range of ambient temperature to be experienced during initial proposed service (please state)
 - (°C)
- d) Intended operating temperature (°C)
- e) Temperature profile expected during working cycle (°C and time)
- f) State if tank will be installed
 - Internal
 - External
- g) Pressure or vacuum conditions

3. Proposed content*

- a) Density (kg/m³)
- b) Detail constituents by completing the table below :

No.	Material/Ingredient	Concentration (%)	Proportion of total (%)
1.			
2.			
3.			
4.			

c) List of solvents expected

.....

d) List of detergents expected

.....

4. Additional equipment

Give details of any additional items which will be used in conjunction with the tank, e.g. agitators, hoppers, air agitators, seal pots, fume scrubbers.

.....

.....

.....

NOTE 1: The required design life of a tank is the period of time which is used in the determination of the tank dimensions (e. g. wall thickness) and allowable stresses. It is **not** the period of **warranty**. Any warranty needs to be agreed between the customer and the tank fabricator.

NOTE 2: If the nature of the intended contents of the tanks changes, then it is recommended that the user seeks advice from the manufacturer or other appropriate authorities.

Date Signature

Name (please print) Position

Name of Company Address

Tel. No. Fax No.

Annex B (informative)

Design of welded joints

B.1 Symbols and abbreviations

For the purposes of this annex the following symbols and abbreviations apply:

- a is the depth of the weld seam, in millimetre
- d is the nominal inside diameter of the tank, in millimetre
- f₁ is the depth of the weld undercut, in millimetre
- f₂ is the height of the external weld built, in millimetre
- h is the height of the stiffener, in millimetre
- l_g is the length of the gap between two weld seams in the case of a both side weld joint, in millimetre
- t is the skin thickness, in millimetre
- t_B is the thickness of the base, in millimetre
- t_D is the thickness of the roof, in millimetre
- t_{Z(i)} is the thickness of the band (i) in the case of varying skin thickness tanks, in millimetre
- t₁ is the thickness of a construction element, in millimetre
- α is the included angle, in degree

B.2 General welding principles

The seams should be dimensioned so that in the case of supporting seams the cross-sections present are fully connected or in the case of filler welds the diameters required for load transmission are present. Butt welds are preferred.

All joints should be counter-welded at the base of the weld or welded from both sides. Seams accessible from one side should have a deep penetration at the base of the weld in order to prevent gaps on the inaccessible side.

With butt welds of different wall thicknesses a constant load transmission should be aimed for, e. g. by bevelling the thicker wall.

Accumulation of weld seams should be avoided. Cross-welds at load-bearing wall sections are not permissible. When fitting stiffeners or similar in the zone of load-bearing seams, free sections of adequate size should be provided.

For all seams the dimensions for the joint forms should be precisely determined as a function of the welding method and the dimensions of the filler material, taking into account base of the weld finish.

Load-bearing seams should be accessible for testing. If such seams are covered by components, then the seam should be tested before the component is welded on or the components should be designed to allow testing.

B.3 Welding design recommendation

All welds should be extrusion welds, otherwise they are specified, see figures B.1 to B.13.

The included angle α should be between 45° and 60°.