Characteristic values for welded thermoplastic constructions - Determination of allowable stresses and moduli for design of thermoplastic equipment

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EESTI STANDARDIKESKUS

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 1778:2000 sisaldab Euroopa standardi EN 1778:1999 ingliskeelset teksti. Käesolev dokument on jõustatud 17.03.2000 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes. Standard on kättesaadav Eesti standardiorganisatsioonist.	This Estonian standard EVS-EN 1778:2000 consists of the English text of the European standard EN 1778:1999. This document is endorsed on 17.03.2000 with the notification being published in the official publication of the Estonian national standardisation organisation. The standard is available from Estonian standardisation organisation.

Käsitlusala: This Standard gives a methodology by which one can design vessels, tanks, ventilation ducting, containers and other apparatus are covered by this standard.	**Scope:** This Standard gives a methodology by which one can design vessels, tanks, ventilation ducting, containers and other apparatus are covered by this standard.

ICS 83.080.20, 83.140.01

Võtmesõnad: plastic, thermoplastic

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English version

Characteristic values for welded thermoplastics constructions

Determination of allowable stresses and moduli for design of thermoplastics equipment

Valeurs caractéristiques des constructions thermoplastiques soudées – Détermination des contraintes admissibles et des modules pour la conception du matériel thermoplastique

Charakteristische Kennwerte für geschweißte Thermoplast-Konstruktionen – Bestimmung der zulässigen Spannungen und Moduli für die Berechnung von Thermoplast-Bauteilen

This European Standard was approved by CEN on 1999-09-02.

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 Central Secretariat or to any CEN member.

The European Standards exist 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, the Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

CEN

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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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 249 "Plastics", the secretariat of which is held by IBN.

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 April 2000, and conflicting national standards shall be withdrawn at the latest by April 2000.

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.

This European Standard has been prepared by Technical Committee CEN/TC 249 "Plastics", the secretariat of which is held by IBN.

Annex A (normative) contains the neccessary creep strength diagrams, the creep modulus diagrams as well as the reduction factors. In Annex B (informative) explanations and calculation examples are included.

Introduction

Because most components are subjected to multiaxial loading, the creep strength diagrams for pipes are taken as a basis for the allowable design stresses. The diagrams have been confirmed by results from many years of measurements and by experience (see [1]).

Extrapolation of creep strength curves to higher temperatures is not permitted. The use of the creep strength curves for dumbbell tensile test pieces is not correct practice because of the reasons mentioned above.

A large number of reduction factors A_2 for the action of the medium taking into account material, stress and temperature have been included. The reduction factors A_2 for the action of the medium and the weld factors f_1 were determined independently of each other.

Investigations established the validity of the multiplicative connection between the weld factor f_1 and reduction factor A_{2K} (reciprocal value of factor for resistance to chemicals $f_{cR\sigma}$ (see [2] and [3]).

1 Scope

This standard specifies a methodology for determination of the characteristic values necessary for the design of welded constructions for example vessels and tanks, ventilation ducting, containers and apparatus.

It is assumed that due regard is paid to the standards and Codes of Practice listed in clause 2 as far as the choice of materials and their processing are concerned. The data is applicable for static loading.

The relevant EN-Standards or ISO-Standards are applicable to the design calculations, dimensions, construction and testing of the various structures.

This standard applies to a wide range of thermoplastic materials, for example: Polyethylene (PE), Polypropylene (PP), Polyvinyl Chloride (PVC) and Polyvinylidene Fluoride (PVDF).

Annex A gives minimum properties for specific grades of these materials. The use of other thermoplastics is permitted, provided that their creep properties exceed the minimum values given in annex A for the known materials.

Properties should be determined in accordance with the relevant ISO and EN standards.

This allows the introduction of thermoplastics with improved properties as appropriate data becomes available.

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 standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

prEN 12202
Plastics piping systems for hot and cold water – Polypropylene (PP)

ISO 899-2
Plastics – Determination of creep behaviour – Part 2: Flexural creep by three-point-loading

ISO 1167

Thermoplastics pipes for the conveyance of fluids – Resistance to internal pressure – Test method

ISO 8584-1
Thermoplastics pipes for industrial applications under pressure – Determination of the chemical resistance factor and of the basic stress – Part 1: Polyolefin pipes

ISO/TR 8584-2
Thermoplastics pipes for industrial applications under pressure – Determination of the chemical resistance factor and of the basic stress – Part 2: Pipes made of halogenated polymers

ISO/TR 9080
Thermoplastics pipes for the transport of fluids – Methods of extrapolation of hydrostatic stress rupture data to determine the long-term hydrostatic strength of thermoplastics pipe materials

3 Definitions, symbols and abbreviations

K	Creep strength at the design temperature and lifetime in newtons per square millimetres
S	Factor of safety
A_1	Reduction factor to take account of the effect of specific strength
A_{2K}	Reduction factor taking into account the effect of surrounding medium (reciprocal value of resistance factor $f_{cR\sigma}$)
$f_{cR\sigma}$	Stress dependent chemical resistance factor
A_{2E}	Reduction factor taking into account the effect of surrounding medium on the modulus of elasticity
E_c	Creep modulus at the design condition (temperature, stress, time) in newtons per square millimetres
$E_{c(al.),St}$	Allowable creep modulus at the design condition for stability (temperature, stress, time, medium, safety factor) in newtons per square millimetres
$E_{c(al.),D}$	Allowable creep modulus at the design condition for deformation (temperature, stress, time, medium) in newtons per square millimetres
T	Design temperature in degrees Centigrade
f_s	Short-term weld factor
f_l	Long-term weld factor
$\sigma_{ef.}$	Effective stress in newtons per square millimetres
$\sigma_{al.}$	Allowable stress at the design condition in newtons per square millimetres
n	Number of fractional loadings
$a_1, a_2 .. a_n$	Proportion of total loading time at each design condition expressed as per cent
$t_1, t_2 .. t_n$	Service life at the individual working conditions (constant pressure and temperature) taking into account reduction, joint and safety factors
t_x	Design life with or without intermittent loading
σ	Principal stress in newtons per square millimetres