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EAST AFRICAN STANDARD

Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 1: General

EAST AFRICAN COMMUNITY

First Edition 2010

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in East Africa. It is envisaged that through harmonized standardization, trade barriers which are encountered when goods and services are exchanged within the Community will be removed.

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

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Introduction

In the preparation of this East African Standard, the following source was consulted extensively:

ISO 15875-1:2003, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 1: General*

Assistance derived from this source and others inadvertently not mentioned is hereby acknowledged.

INTERNATIONAL STANDARD

ISO 15875-1

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Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) —

Part 1: General

Systèmes de canalisations en plastique pour les installations d'eau chaude et froide — Polyéthylène réticulé (PE-X) —

Partie 1: Généralités

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15875-1 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 2, *Plastics pipes and fittings for water supplies*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read "...this European Standard..." to mean "...this International Standard...".

ISO 15875 consists of the following parts, under the general title *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X)*:

— *Part 1: General*

— *Part 2: Pipes*

— *Part 3: Fittings*

— *Part 5: Fitness for purpose of the system*

— *Part 7: Guidance for the assessment of conformity* [Technical Specification]

Contents

Foreword

This document (EN ISO 15875-1:2003) has been prepared by Technical Committee CEN/TC 155 “Plastics piping systems and ducting systems”, the secretariat of which is held by NEN, in collaboration with Technical Committee ISO/TC 138 "Plastics pipes, fittings and valves for the transport of fluids".

NOTE This standard was submitted for CEN enquiry as prEN 12318-1:1996.

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 June 2004, and conflicting national standards shall be withdrawn at the latest by December 2005.

This standard is part of a System Standard for plastics piping systems of a particular material for a specified application. There are a number of such System Standards.

System Standards are based on the results of the work undertaken in ISO/TC 138 "Plastics pipes, fittings and valves for the transport of fluids", which is a Technical Committee of the International Organization for Standardization (ISO).

They are supported by separate standards on test methods to which references are made throughout the System Standard.

The System Standards are consistent with general standards on functional requirements and recommended practices for installation.

EN ISO 15875:2003 consists of the following Parts[1)], under the general title *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X)*

— *Part 1: General* (the present standard)

— *Part 2: Pipes*

— *Part 3: Fittings*

— *Part 5: Fitness for purpose of the system*

— *Part 7: Guidance for the assessment of conformity* (CEN ISO/TS 15875-7).

This Part of EN ISO 15875 includes a Bibliography.

At the date of publication of this standard, System Standards for piping systems of other plastics materials used for the same application are the following:

EN ISO 15874, *Plastics piping systems for hot and cold water installations — Polypropylene (PP) (ISO 15874:2003)*

EN ISO 15876, *Plastics piping systems for hot and cold water installations — Polybutylene (PB) (ISO 15876:2003)*

EN ISO 15877, *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C) (ISO 15877:2003)*

For pipes and fittings which have conformed to the relevant national standard before 1st November 2003, as shown by the manufacturer or by a certification body, the national standard may continue to apply until 30th November 2005

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

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1) This System Standard does not incorporate a Part 4 *Ancillary equipment* or a Part 6 *Guidance for installation.* For ancillary equipment separate standards can apply. Guidance on installation of plastics piping systems made from different materials intended to be used for hot and cold water installations is given by ENV 12108:2001 [1].

Introduction

The System Standard, of which this is Part 1, specifies the requirements for a piping system when made from crosslinked polyethylene (PE-X). The piping system is intended to be used for hot and cold water installations.

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the product covered by EN ISO 15875:

— This standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA;

— It should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

Requirements and test methods for components of the piping system are specified in Part 2 and Part 3 of EN ISO 15875:2003. Characteristics for fitness of purpose (mainly for joints) are covered in Part 5. Part 7 (CEN ISO/TS 15875-7) gives guidance for the assessment of conformity.

This Part of EN ISO 15875 specifies the general aspects of the plastics piping system.

1 Scope

This Part of EN ISO 15875 specifies the general aspects of crosslinked polyethylene (PE-X) piping systems intended to be used for hot and cold water installations within buildings for the conveyance of water, whether or not intended for human consumption (domestic systems), and for heating systems, under design pressures and temperatures according to the class of application (see Table 1).

This standard covers a range of service conditions (application classes) and design pressure and pipe dimension classes. For values of T_D, T_{max} and T_{mal} in excess of those in Table 1, this standard does not apply.

NOTE It is in the responsibility of the purchaser or specifier to make the appropriate selections from these aspects, taking into account their particular requirements and any relevant national regulations and installation practices or codes.

It also specifies the test parameters for the test methods referred to in this standard.

In conjunction with the other Parts of EN ISO 15875 (see Foreword) it is applicable to PE-X pipes, fittings, their joints and to joints with components of other plastics and non-plastics materials intended to be used for hot and cold water installations.

2 Normative references

This 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 (including amendments).

EN ISO 15875-2:2003, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 2: Pipes (ISO 15875-2:2003)*

EN ISO 15875-3:2003, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 3: Fittings (ISO 15875-3:2003)*

ISO 472:1999, *Plastics — Vocabulary*

ISO 1043-1:2001, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

3 Terms and definitions, symbols and abbreviated terms

For the purposes of this standard, the following terms and definitions, symbols and abbreviated terms apply.

3.1 Terms and definitions

In addition to the terms and definitions given below, the terms and definitions given in ISO 472:1999 and ISO 1043-1:2001 apply.

3.1.1 Geometrical terms and definitions

3.1.1.1 Nominal size

3.1.1.1.1
nominal size (DN)
numerical designation of the size of a component, which is a convenient round number, approximately equal to the manufacturing dimensions in millimetres (mm)

3.1.1.1.2
nominal size (DN/OD)
nominal size, related to the outside diameter

3.1.1.2
nominal outside diameter (d_n)
specified outside diameter, in millimetres, assigned to a nominal size DN/OD

3.1.1.3
outside diameter (at any point) (d_e)
measured outside diameter through its cross section at any point of a pipe or spigot end of a fitting, rounded up to the nearest 0,1 mm

3.1.1.4
mean outside diameter (d_{em})
measured length of the outer circumference of a pipe or spigot end of a fitting in any cross section divided by π (≈ 3,142) rounded up to the nearest 0,1 mm

3.1.1.5
minimum mean outside diameter ($d_{em,min}$)
minimum value for the mean outside diameter as specified for a given nominal size

3.1.1.6
maximum mean outside diameter ($d_{em,max}$)
maximum value for the mean outside diameter as specified for a given nominal size

3.1.1.7
mean inside diameter of socket (d_{sm})
arithmetical mean of two measured inside diameters perpendicular to each other at the midpoint of the socket length

3.1.1.8
out-of-roundness (ovality)
difference between the measured maximum outside diameter and the measured minimum outside diameter in the same cross–sectional plane of a pipe or spigot end of a fitting, or the difference between the measured maximum inside diameter and the measured minimum inside diameter in the same cross–sectional plane of a socket

3.1.1.9
nominal wall thickness (e_n)
numerical designation of the wall thickness of a component, approximately equal to the manufacturing dimension in millimetres (mm)

3.1.1.10
wall thickness (at any point) (e)
measured wall thickness at any point around the circumference of a component, rounded up to the nearest 0,1 mm

3.1.1.11
minimum wall thickness (at any point) (e_{min})
minimum wall thickness at any point around the circumference of a component, as specified

3.1.1.12
maximum wall thickness (at any point) (e_{max})
maximum wall thickness at any point around the circumference of a component, as specified

3.1.1.13
tolerance
permitted variation of the specified value of a quantity, expressed as the difference between the permitted maximum and the permitted minimum value

3.1.1.14
pipe series (S)
dimensionless number for pipe designation conforming to ISO 4065 [2]

NOTE According to EN ISO 15875 the pipe series S is used as a means for selecting pipe sizes for practical purposes (see EN ISO 15875-2:2003).

3.1.1.15
calculated pipe value (S_{calc})
value for a specific pipe calculated according to the following equation, rounded up to the nearest 0,1 mm:

$$S_{calc} = \frac{d_n - e_n}{2e_n}$$

where:
d_n is the nominal outside diameter, in millimetres;
e_n is the nominal wall thickness, expressed in millimetres

3.1.2 Terms and definitions related to service conditions

3.1.2.1
design pressure (p_D)
highest pressure related to the circumstances for which the system has been designed

NOTE The design pressure, p_D, is equal to the maximum design pressure, MDP, as specified in EN 806-1 [3].

3.1.2.2
hydrostatic stress (σ)
stress, in megapascals, induced in the wall of a pipe when a pressure is applied using water as a medium. It is calculated using the following approximate equation:

$$\sigma = p \times \frac{(d_{em} - e_{min})}{2e_{min}}$$

where:
p is the applied pressure, in megapascals;
d_{em} is the mean outside diameter of the pipe, in millimetres;
e_{min} is the minimum wall thickness, in millimetres

3.1.2.3
design temperature (T_D)
a temperature or a combination of temperatures of the conveyed water dependent on the service conditions for which the system has been designed

3.1.2.4
maximum design temperature (T_{max})
highest design temperature, T_D, occurring for short periods only

3.1.2.5
malfunction temperature (T_{mal})
highest temperature that can be reached when the control limits are exceeded

3.1.2.6
cold water temperature (T_{cold})
temperature of conveyed cold water of up to approximately 25 °C

NOTE For design purposes 20 °C is used.

3.1.2.7
treated water for heating installations
water, intended for heating installations, which contains additives which have no detrimental effect on the system

3.1.3 Terms and definitions related to material characteristics

3.1.3.1
lower confidence limit (LCL)
quantity, expressed in megapascals (MPa), which can be considered as a material property, representing the 97,5 % lower confidence limit of the average long-term hydrostatic strength at the given temperature, T, and time, t

3.1.3.2
design stress (σ_D)
allowable stress, in megapascals (MPa), in the pipe material, σ_{DP}, or in the plastics fitting material, σ_{DF}, for a given application or service condition, respectively

NOTE See also annex A of EN ISO 15875-2:2003.

3.1.3.3
overall service (design) coefficient (C)
overall coefficient with a value greater than one, which takes into consideration service conditions as well as properties of the components of a piping system other than those represented in the lower confidence limit, LCL

3.1.3.4
own reprocessable material
material prepared from rejected unused pipes and fittings, including trimmings from the production of pipes and fittings, that will be reprocessed in a manufacturer's plant after having been previously processed by the same manufacturer by a process such as moulding or extrusion and for which the complete formulation is known

3.1.4
pipes with barrier layer
plastics pipes provided with a thin barrier layer, e.g. to prevent or greatly diminish the diffusion of gases and the transmission of light through the pipe wall and where the design stress requirements are totally met by the base polymer (PE-X)

3.2 Symbols

C	overall service (design) coefficient
d_e	outside diameter (at any point)
d_{em}	mean outside diameter
$d_{em,min}$	minimum mean outside diameter
$d_{em,max}$	maximum mean outside diameter
d_n	nominal outside diameter
d_{sm}	mean inside diameter of socket
e	wall thickness at any point
e_{max}	maximum wall thickness at any point
e_{min}	minimum wall thickness at any point
e_n	nominal wall thickness
p	internal hydrostatic pressure
p_D	design pressure
S_{calc}	calculated pipe value
$S_{calc,max}$	maximum calculated pipe value
T	temperature
T_{cold}	cold water temperature
T_D	design temperature

T_{mal}	malfunction temperature
T_{max}	maximum design temperature
t	time
σ	hydrostatic stress
σ_{cold}	design stress at 20 °C
σ_D	design stress
σ_{DF}	design stress of plastics fitting material
σ_{DP}	design stress of plastics pipe material
σ_F	hydrostatic stress values of plastics fitting material
σ_P	hydrostatic stress values of plastics pipe material
σ_{LCL}	lower confidence limit of long-term hydrostatic strength

3.3 Abbreviated terms

DN	nominal size
DN/OD	nominal size, outside diameter related
LCL	lower confidence limit
MDP	maximum design pressure
PE-X	crosslinked polyethylene
S	pipe series

4 Classification of service conditions

The performance requirements for piping systems conforming to EN ISO 15875 are specified for four different application classes and shown in Table 1.

NOTE 1 Each class is related to a typical field of application and for a design period of 50 years. The classification is taken from ISO 10508 [4]. The fields of application are given as a guideline and are not obligatory. Class 3 (low temperature underfloor heating) given in ISO 10508 [4] does not apply to EN ISO 15875.

For any application the selection of the applicable class conforming to Table 1 shall be agreed by the parties concerned. Each application class shall be combined with a design pressure, p_D, of 4 bar [2], 6 bar, 8 bar or 10 bar, as applicable.

2) 1 bar = 10^5 N/m^2 = 0,1 MPa

Table 1 — Classification of service conditions

Application class	Design temperature, T_D °C	Time [a] at T_D years	T_{max} °C	Time at T_{max} years	T_{mal} °C	Time at T_{mal} h	Typical field of application
1 [a]	60	49	80	1	95	100	Hot water supply (60 °C)
2 [a]	70	49	80	1	95	100	Hot water supply (70 °C)
4 [b]	20 Followed by 40 Followed by 60 Followed by (see next column)	2,5 20 25	70 Followed by (see next column)	2,5	100	100	Underfloor heating and low temperature radiators
5 [b]	20 Followed by 60 Followed by 80 Followed by (see next column)	14 25 10	90 Followed by (see next column)	1	100	100	High temperature radiators

[a] A country may select either class 1 or class 2 to conform to its national regulations.

[b] Where more than one design temperature appears for any class, the times should be aggregated (e.g. the design temperature profile for 50 years for class 5 is: 20 °C for 14 years followed by 60 °C for 25 years, 80 °C for 10 years, 90 °C for 1 year and 100 °C for 100 h).

NOTE For values of T_D, T_{max} and T_{mal} in excess of those in this table, this standard does not apply.

All systems which satisfy the conditions specified in Table 1 shall also be suitable for the conveyance of cold water for a period of 50 years at a temperature of 20 °C and a design pressure of 10 bar.

All heating installations shall only use water or treated water as the transfer fluid.

NOTE 2 The manufacturer of plastics pipes and fittings should give guidance on the type of water treatment required and on aspects of applications such as oxygen permeation.

5 Material

5.1 General

The material from which the pipes and fittings are made shall conform to EN ISO 15875-2:2003 and EN ISO 15875-3:2003, as applicable.

5.2 Influence on water intended for human consumption

All plastics and non-plastics materials for components of the PE-X piping system, when in permanent or temporary contact with water which is intended for human consumption, shall not adversely affect the quality of the drinking water.

NOTE European standards on test methods for the assessment of migration, odour and flavour and for microbiological assessment are under preparation.

5.3 Reprocessable material

The use of the manufacturer's own reprocessable material obtained during the production and works testing of products conforming to this standard is permitted in addition to the use of virgin material. Reprocessable crosslinked material, material obtained from external sources and recyclable material shall not be used.

Bibliography

[1] ENV 12108:2001, *Plastics piping systems — Guidance for the installation inside buildings of pressure piping systems for hot and cold water intended for human consumption*

[2] ISO 4065, *Thermoplastic pipes — Universal wall thickness table*

[3] EN 806-1, *Specifications for installations inside buildings conveying water for human consumption — Part 1: General*

[4] ISO 10508, *Thermoplastics pipes and fittings for hot and cold water systems*

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