

**Plastics piping systems for drainage and sewerage with or without pressure - Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) - Specifications for pipes, fittings and joints**

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN 14364:2013 sisaldab Euroopa standardi EN 14364:2013 ingliskeelset teksti.	This Estonian standard EVS-EN 14364:2013 consists of the English text of the European standard EN 14364:2013.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 13.02.2013.	Date of Availability of the European standard is 13.02.2013.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile [standardiosakond@evs.ee](mailto:standardiosakond@evs.ee).

ICS 93.030

### Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:  
Aru 10, 10317 Tallinn, Eesti; [www.evs.ee](http://www.evs.ee); telefon 605 5050; e-post [info@evs.ee](mailto:info@evs.ee)

### The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:  
Aru 10, 10317 Tallinn, Estonia; [www.evs.ee](http://www.evs.ee); phone 605 5050; e-mail [info@evs.ee](mailto:info@evs.ee)

English Version

Plastics piping systems for drainage and sewerage with or  
without pressure - Glass-reinforced thermosetting plastics  
(GRP) based on unsaturated polyester resin (UP) -  
Specifications for pipes, fittings and joints

Systèmes de canalisations en plastique pour l'évacuation  
et l'assainissement avec ou sans pression - Plastiques  
thermodurcissables renforcés de verre (PRV) à base de  
résine de polyester non saturé (UP) - Spécifications pour  
tubes, raccords et assemblages

Kunststoff-Rohrleitungssysteme für Abwasserleitungen und -  
kanäle mit oder ohne Druck - Glasfaserverstärkte  
duroplastische Kunststoffe (GFK) auf der Basis von  
ungesättigtem Polyesterharz (UP) - Festlegungen für  
Rohre, Formstücke und Verbindungen

This European Standard was approved by CEN on 14 December 2012.

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 CEN-CENELEC 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 CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



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

Management Centre: Avenue Marnix 17, B-1000 Brussels

# Contents

Page

Foreword.....	5
Introduction .....	6
1 Scope.....	7
2 Normative references.....	8
3 Terms, definitions and symbols .....	9
4 General requirements .....	17
4.1 Classification.....	17
4.1.1 General .....	17
4.1.2 Categories .....	17
4.1.3 Nominal size .....	17
4.1.4 Nominal stiffness .....	17
4.1.5 Nominal pressure .....	17
4.2 Materials .....	18
4.2.1 General .....	18
4.2.2 Reinforcement .....	18
4.2.3 Resin .....	19
4.2.4 Aggregates and fillers .....	19
4.2.5 Elastomers.....	19
4.2.6 Metals.....	19
4.3 Wall construction .....	19
4.3.1 Inner layer.....	19
4.3.2 Structural layer.....	19
4.3.3 Outer layer .....	19
4.4 Appearance .....	20
4.5 Reference conditions for testing .....	20
4.5.1 Temperature .....	20
4.5.2 Properties of water for testing .....	20
4.5.3 Loading conditions .....	20
4.5.4 Preconditioning.....	20
4.5.5 Measurement of dimensions.....	20
4.6 Elapsed time for determination of long-term properties, ( $x$ ) .....	20
4.7 Joints.....	20
4.7.1 General .....	20
4.7.2 Types of joint.....	20
4.7.3 Flexibility of the jointing system.....	21
4.7.4 Sealing ring.....	21
4.7.5 Adhesives .....	21
5 Pipes .....	21
5.1 Geometrical characteristics.....	21
5.1.1 Diameter.....	21
5.1.2 Wall thickness .....	26
5.1.3 Length.....	26
5.2 Mechanical characteristics .....	27
5.2.1 Initial specific ring stiffness.....	27
5.2.2 Long-term specific ring stiffness under wet conditions.....	28
5.2.3 Initial resistance to failure in a deflected condition.....	29
5.2.4 Ultimate long-term resistance to failure in a deflected condition .....	31

5.2.5	Initial specific longitudinal tensile strength .....	32
5.2.6	Initial failure and design pressures for pressure pipes .....	34
5.2.7	Long-term failure pressure .....	36
5.2.8	Resistance to strain corrosion.....	38
5.3	Marking.....	40
6	Fittings.....	41
6.1	General.....	41
6.2	Bends.....	42
6.2.1	Classification of bends.....	42
6.2.2	Dimensions and tolerances of bends .....	42
6.3	Branches.....	46
6.3.1	Classification of branches .....	46
6.3.2	Dimensions and tolerances of branches .....	47
6.4	Reducers.....	49
6.4.1	Classification of reducers .....	49
6.4.2	Dimensions and tolerances of reducers.....	50
6.4.3	Mechanical characteristics of tapered section laminate.....	51
6.5	Non Pressure Saddles.....	52
6.5.1	Classification of saddles.....	52
6.5.2	Dimensions and tolerances of saddles .....	53
6.6	Flanges .....	54
6.6.1	Classification of flanges.....	54
6.6.2	Dimensions and tolerances for flanged adaptors.....	55
6.7	Marking.....	56
7	Joint performance .....	57
7.1	General.....	57
7.1.1	Interchangeability.....	57
7.1.2	Test temperature .....	57
7.1.3	Non-pressure piping.....	57
7.2	Dimensions.....	57
7.3	Non-end-load-bearing flexible joints with elastomeric sealing rings.....	57
7.3.1	General.....	57
7.3.2	Requirements .....	57
7.3.3	Number of test pieces for type test purposes .....	58
7.3.4	Test pieces.....	58
7.4	End-load-bearing flexible joints with elastomeric sealing rings .....	59
7.4.1	General.....	59
7.4.2	Performance requirements for locked-socket-and-spigot joints with elastomeric sealing rings.....	59
7.5	Wrapped or cemented joints.....	61
7.5.1	General.....	61
7.5.2	Performance requirements .....	61
7.5.3	Number of test pieces for type test purposes .....	62
7.5.4	Test pieces.....	62
7.6	Bolted flange joints .....	63
7.6.1	General.....	63
7.6.2	Performance requirements .....	63
7.6.3	Number of test pieces for type test purposes.....	64
7.6.4	Test pieces.....	64
7.6.5	Joint assembly details.....	64
7.6.6	Torque resistance.....	64
Annex A	(normative) Test method for the resistance to bending and pressure of end-thrust loaded joints in pipe systems.....	66
A.1	Principle.....	66
A.2	Apparatus .....	66

<b>A.3</b>	<b>Test pieces .....</b>	<b>66</b>
<b>A.4</b>	<b>Test temperature .....</b>	<b>67</b>
<b>A.5</b>	<b>Calculation of the bending load <math>F</math> .....</b>	<b>67</b>
<b>A.5.1</b>	<b>General .....</b>	<b>67</b>
<b>A.5.2</b>	<b>Calculation of <math>F</math>, if applied in the horizontal plane .....</b>	<b>67</b>
<b>A.5.3</b>	<b>Calculation of <math>F</math>, if applied in the vertical plane.....</b>	<b>68</b>
<b>A.6</b>	<b>Procedure .....</b>	<b>69</b>
<b>A.7</b>	<b>Test report .....</b>	<b>69</b>
	<b>Bibliography.....</b>	<b>71</b>

## Foreword

This document (EN 14364:2013) has been prepared by Technical Committee CEN/TC 155 "Plastics piping systems and ducting systems", the secretariat of which is held by NEN.

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 August 2013, and conflicting national standards shall be withdrawn at the latest by August 2013.

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

This document supersedes EN 14364:2006+A1:2008.

The following list is a list of significant technical changes that have been made since the previous edition:

- changes to many test method references to the more up to date ISO methods;
- extension of the diameter range to 4 000 mm;
- completion of the axial strength tables for all PN classes;
- restructure of the fittings section to be more practical;
- update of the joint testing criteria.

This European Standard is a system standard for plastics piping systems using glass-reinforced thermosetting plastics based on polyester resin (GRP-UP), for drainage and sewerage with or without pressure.

System standards are based on the results of the work being 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.

System standards are consistent with standards on general functional requirements.

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Introduction

This system standard specifies the properties of a piping system and its components when made from glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) intended to be used for drainage and sewerage with or without pressure.

The working group responsible for this European Standard is currently working on a test method and requirements for assessing resistance to impact damage. When this work is completed it may result in additional requirements being incorporated into this European Standard.

This European Standard was prepared recognising the guidelines of EN 476 [1].



# 1 Scope

This European Standard specifies the required properties of the piping system and its components made from glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) intended to be used for drainage or sewerage, including culverts, with or without pressure. In a pipework system, pipes and fittings of different nominal pressure and stiffness ratings may be used together.

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

This European Standard is applicable to GRP-UP, with flexible or rigid joints (see 3.33 and 3.34), primarily intended for use in buried installations.

**NOTE** Piping systems conforming to this European Standard can be used also for non-buried applications provided that the influence of the environment, e.g. from UV-radiation, and the supports are considered in the design of the pipes, fittings and joints.

It is applicable to pipes, fittings and their joints of nominal sizes from DN 100 to DN 4000, which are intended to be used for the conveyance of surface water or sewage at temperatures up to 50 °C, with or without pressure.

This European Standard covers a range of nominal sizes, nominal stiffnesses and nominal pressures.

Clause 6 is applicable to fittings made using any of the following techniques:

- a) fabricated from straight pipe;
- b) moulded by:
  - 1) filament winding;
  - 2) tape winding;
  - 3) contact moulding;
  - 4) hot or cold press moulding.

This European Standard is applicable to the joints to be used in GRP-UP piping systems to be used for the conveyance of water, both buried and non-buried. It is applicable to joints, which are or are not intended to be resistant to axial loading. It covers requirements to prove the design of the joint. It specifies type test performance requirements for the following joints as a function of the declared nominal pressure rating of the pipeline or system:

- c) socket-and-spigot (either integral with pipe or sleeve coupling) or mechanical joint;
- d) locked socket-and-spigot joint;
- e) cemented or wrapped joint;
- f) bolted flange joint.

Recommended practices for the installation of buried pipes made in accordance with this standard is addressed in CEN/TS 14578. Guidelines for the structural analysis of buried GRP-UP pipelines are addressed in CEN/TS 14807.

Guidance for the Assessment of Conformity of products made in accordance with this standard is addressed in CEN/TS 14632.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 681-1, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber*

EN 1119, *Plastics piping systems — Joints for glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test methods for leaktightness and resistance to damage of non-thrust resistant flexible joints with elastomeric sealing elements*

EN 1447, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Determination of long-term resistance to internal pressure*

CEN/TS 14578, *Plastics piping systems for water supply or drainage or sewerage — Glass reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) — Recommended practice for installation*

CEN/TS 14632, *Plastics piping systems for drainage, sewerage and water supply, pressure and non-pressure — Glass reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) — Guidance for the assessment of conformity*

CEN/TS 14807, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) — Guidance for the structural analysis of buried GRP-UP pipelines*

EN ISO 75-2:2004, *Plastics — Determination of temperature of deflection under load — Part 2: Plastics, ebonite and long-fibre-reinforced composites (ISO 75-2:2004)*

EN ISO 527-4, *Plastics — Determination of tensile properties — Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites (ISO 527-4)*

EN ISO 527-5, *Plastics — Determination of tensile properties — Part 5: Test conditions for unidirectional fibre-reinforced plastic composites (ISO 527-5)*

EN ISO 1452-3, *Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized poly(vinyl chloride) (PVC-U) — Part 3: Fittings (ISO 1452-3)*

EN ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions (ISO 3126)*

ISO 2531, *Ductile iron pipes, fittings, accessories and their joints for water applications*

ISO 4200, *Plain end steel tubes, welded and seamless — General tables of dimensions and masses per unit length*

ISO 7432, *Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test methods to prove the design of locked socket-and-spigot joints, including double-socket joints, with elastomeric seals*

ISO 7685, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Determination of initial specific ring stiffness*

ISO 8483, *Plastics piping systems for pressure and non-pressure drainage and sewerage — Glass-reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin — Test methods to prove the design of bolted flange joints*

ISO 8513, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Determination of longitudinal tensile properties*

ISO 8521, *Plastic piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Test methods for the determination of the apparent initial circumferential tensile strength*

ISO 8533, *Plastics piping systems for pressure and non-pressure drainage and sewerage — Glass-reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin — Test methods to prove the design of cemented or wrapped joints*

ISO/TR 10465-3, *Underground installation of flexible glass-reinforced pipes based on unsaturated polyester resin (GRP-UP) — Part 3 Installation parameters and application limits*

ISO 10466, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Test method to prove the resistance to initial ring deflection*

ISO 10468, *Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the long-term specific ring creep stiffness under wet conditions and the calculation of the wet creep factor*

ISO 10471, *Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the long-term ultimate bending strain and long-term ultimate relative ring deflection under wet conditions*

ISO 10928, *Plastics piping systems — Glass reinforced thermosetting plastics (GRP) pipes and fittings — Methods for regression analysis and their use*

ISO 10952, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Determination of the resistance to chemical attack from the inside of a section in a deflected condition*

ISO 11922-1, *Thermoplastics pipes for the conveyance of fluids — Dimensions and tolerances — Part 1: Metric series*

### 3 Terms, definitions and symbols

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

#### 3.1

##### **nominal size**

DN

alphanumeric designation of size of component, which is a convenient integer approximately equal to a manufacturing dimension in mm and which can apply to either the internal diameter (DN-ID) or the external diameter (DN-OD)

Note 1 to entry: The designation for reference or marking purposes consists of the letters DN-ID or DN-OD plus a number.

#### 3.2

##### **nominal stiffness**

SN

alphanumeric designation for stiffness classification purposes, which has the same numerical value as the minimum initial specific ring stiffness value required, when expressed in Newtons per square metre (N/m<sup>2</sup>)

Note 1 to entry: The designation for reference or marking purposes consists of the letters SN plus a number. (See 4.1.4.)

#### 3.3

##### **specific ring stiffness**

$S$

physical characteristic of the pipe, expressed in Newtons per square metre (N/m<sup>2</sup>) which is a measure of the resistance to ring deflection per metre length under external load and is defined by Formula (1):