SLOVENSKI STANDARD
SIST-TS CEN/TS 17152-4:2024

01-september-2024

Cevni sistemi iz polimernih materialov, ki delujejo po težnostnem principu in so položeni v zemljo, za transport in shranjevanje površinske vode - Zaboji za sisteme infiltriranja, reduciranja in hrambe - 4. del: Smernice za konstrukcijsko načrtovanje modularnih sistemov

Plastics piping systems for non-pressure underground conveyance and storage of surface water - Boxes used for infiltration, attenuation and storage systems - Part 4: Guidance for structural design of modular systems

Kunststoff-Rohrleitungssysteme für die drucklose unterirdische Entwässerung für Nicht-Trinkwasser - Versickerungsblöcke zur Verwendung in Infiltrations-, Zwischenspeicher- und Speichersystemen - Teil 4: Leitfaden für die statische Berechnung von Systemen

Ta slovenski standard je istoveten z: **CEN/TS 17152-4:2024**

ICS:

23.040.03	Cevovodi za zunanje sisteme transporta vode in njihovi deli	Pipeline and its parts for external water conveyance systems

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TECHNICAL SPECIFICATION

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English Version

Plastics piping systems for non-pressure underground conveyance and storage of non-potable water - Boxes used for infiltration, attenuation and storage systems - Part 4: Guidance for structural design of modular systems

Kunststoff-Rohrleitungssysteme für die drucklose unterirdische Entwässerung für Nicht-Trinkwasser - Versickerungsblöcke zur Verwendung in Infiltrations-, Zwischenspeicher- und Speichersystemen - Teil 4: Leitfaden für die statische Berechnung von Systemen

This Technical Specification (CEN/TS) was approved by CEN on 12 May 2024 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (CEN/TS 17152-4:2024) has been prepared by Technical Committee CEN/TC 155 “Plastics piping systems and ducting systems”, the secretariat of which is held by NEN.

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

This document is supported by separate standards on test methods to which normative references are made.

EN 17152 consists of the following parts under the general title *Plastics piping systems for non-pressure underground conveyance and storage of non-potable water — Boxes used for infiltration, attenuation and storage systems*:

— *Part 1: Specifications for storm water boxes made of PP and PVC*;

— *Part 3: Assessment of conformity* (CEN/TS);

— *Part 4: Guidance for the structural design of modular systems* (CEN/TS).

Recommended practices for installation are described in CEN/TR 17179 [1].

National standards for pipes and fittings for the transport of surface water are not considered to be conflicting with this document and can thus be allowed to coexist.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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

Introduction

The products covered by this document are part of surface water (previously referred to as stormwater) management systems.

Geocellular systems are an assemblage of boxes, in one or more layers, for which the material and the material characteristics are according to EN 17152-1. The assemblage is considered as a modular system for the purposes of this design guidance.

The general principles of designing structures to withstand long-term loads are well established. However, their application is generally for rigid structures such as concrete bridges, e.g. Eurocode 2 series: Design of concrete structures (EN 1992).

The behaviour of thermoplastics is more complex and the design loads which may be experienced may be different in magnitude and action. This guidance is intended to aid the designer in determining realistic loadings in the design of thermoplastic geocellular modular systems.

NOTE In this guidance, the terms pressure(s) and strength will be used, corresponding to actions and resistances in Eurocodes.

1 Scope

This document gives guidance on the structural design of underground modular systems for infiltration, attenuation and storage of surface water under various conditions of loading. The procedures are explained, with the appropriate variables in the design formulae, and provides graphical information on vehicle surcharge loadings.

These modular systems are constructed from multiple cuboid shaped thermoplastic boxes generally with ancillary components such as inlet/outlet connectors, vents, and access/inspection provision. This guidance is for the design of modular systems conforming to EN 17152-1.

The boxes, including integral components, are injection moulded, extruded or thermoformed thermoplastics, manufactured from polypropylene (PP) or unplasticized poly(vinyl chloride) (PVC-U), and are intended to be used as elements in a modular system where the manufacturer has clearly stated in the documentation how the components are assembled to create a complete infiltration, attenuation or storage system.

Outside the scope of this document are the following conditions:

— seismic loads,

— lateral loads from adjacent structures and embankments,

— influence of trees,

— backfill materials not according to CEN/TR 17179 [1].

Geotextile and/or geomembrane used with modular systems are outside the scope of this document.

NOTE If reference is made in this document to Eurocode standards, the conditions in a national foreword or national annex are normally stated.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 472:2013, *Plastics — Vocabulary (ISO 472:2013)*

EN ISO 1043-1:2011, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics (ISO 1043-1:2011)*

EN 1997-1:—[1], *Eurocode 7 — Geotechnical design — Part 1: General rules*

EN 17152-1:2019, *Plastics piping systems for non-pressure underground conveyance and storage of non-potable water — Boxes used for infiltration, attenuation and storage systems — Part 1: Specifications for storm water boxes made of PP and PVC-U*

[1] Under preparation. Stage at the time of publication: FprEN 1997-1:2024.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 472:2013, EN ISO 1043-1:2011, EN 17152-1:2019 and the following apply.

3.1
limit state
state beyond which the structure no longer satisfies the relevant design criteria

[SOURCE: EN 1990:2023 3.1.2.14]

3.2
ultimate limit state
ULS
state associated with collapse or other similar forms of structural failure

Note 1 to entry: Generally corresponds to the maximum load-carrying resistance of a structure or structural member

[SOURCE: EN 1990:2023 3.1.2.15; modified – note to entry added]

3.3
serviceability limit state
SLS
state that correspond to conditions beyond which specified service requirements for a structure or structural member are no longer met

[SOURCE: EN 1990:2023 3.1.2.16]

3.4
characteristic pressure
principal representative pressure exerted on a structure by an imposed load

3.5
design pressure
characteristic pressure is converted to design pressure by applying load factors relevant to the site and/or application

3.6
load factors
modify characteristic loads to reflect the site classification and/or risk

3.7
characteristic strength
short and long-term strength of boxes declared by the manufacturer according to EN 17152-1

3.8
design strength
characteristic strength is converted to design strength by applying partial factors relevant to the site and/or application

3.9
partial factors
PF
modify characteristic strengths to reflect the application and available data

3.10
variable pressure
pressure resulting from a load that is relevant during a period much shorter than the design life of the modular system and which has a high probability of occurrence

3.11
permanent pressure
pressure that is relevant during a period of the same order as the design life of the modular system

3.12
compliance
deflection per unit of pressure (reciprocal of stiffness)

3.13
modular system
geocellular system made of repeating boxes to function as a tank or reservoir

3.14
submerged unit weight
weight of the solids in air minus the weight of water displaced by the solids per unit of volume of solid mass

4 Symbols and abbreviations

4.1 Symbols

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

A_t	time dependent reduction factor for temporary surcharges	
A_{50a}	reduction factor for a load duration of 50 years	
C_{BL}	lateral compliance of a box	mm/kPa
C_{SL}	lateral compliance of a system	mm/kPa
d	minimum horizontal dimension of the system	m
F_A	single wheel load according to applied load model	kN
F_E	sum of adjacent wheel loads	kN
p_{Gk}	permanent characteristic vertical pressure	kPa
p_{Gd}	permanent design vertical pressure	kPa
p_{Qd}	variable design vertical pressure	kPa
p_{0k}	variable characteristic vertical pressure due to a single load	kPa
p_{Qk}	variable vertical characteristic pressure	kPa
h	equivalent depth of backfill (cover) over modular system	m

K	soil coefficient	–
r_A	radius of the wheel load area	m
r_E	half the distance between adjacent wheel loads	m
R_{0ld}	design lateral short-term strength	kPa
R_{0vd}	design vertical short-term strength	kPa
R_{0lk}	characteristic lateral short-term strength	kPa
R_{0vk}	characteristic vertical short-term strength	kPa
R_{50ald}	design lateral long-term strength	kPa
R_{50alk}	characteristic lateral long-term strength at 50 years	kPa
R_{50avd}	design vertical long-term strength	kPa
R_{50avk}	characteristic vertical long term strength at 50 years	kPa
z	depth to the point where the lateral soil pressure is to be calculated	m
α_F	reduction factor for shallow depth of cover	–
γ_G	partial factor (permanent)	–
γ_Q	partial factor (variable)	–
γ_{dstb}	partial factor, destabilising	–
γ_{LP}	load factor (permanent, lateral)	–
γ_{LT}	load factor (variable, lateral)	–
γ_M	partial safety factor of the material	–
γ_s	unit weight of backfill	kN/m^3
γ_{stb}	partial factor, stabilizing	–
γ_W	unit weight of water	kN/m^3
$\delta_{d.lim}$	design ultimate lateral deflection	m
δ_G	permanent lateral deflection	m
δ_{max}	ultimate deflection from short-term testing	m
δ_Q	variable lateral deflection	m
σ_{Gk}	permanent characteristic lateral pressure	kPa
σ_{Gd}	permanent design lateral pressure	kPa
σ_{Qk}	variable characteristic lateral pressure	kPa
σ_{Qd}	variable design lateral pressure	kPa