



**SLOVENSKI STANDARD**  
**kSIST-TS FprCEN/TS 17152-4:2024**

**01-marec-2024**

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**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

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

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**ICS:**

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

**kSIST-TS FprCEN/TS 17152-4:2024 en,fr,de**



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**FINAL DRAFT**  
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English Version

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

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This draft Technical Specification is submitted to CEN members for Vote. It has been drawn up by the Technical Committee CEN/TC 155.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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## European foreword

This document (FprCEN/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.

This document is currently submitted to the Vote on TS.

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 Plastic 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.

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**FprCEN/TS 17152-4:2024 (E)****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.

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## 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)*

prEN 1997-1:2022, 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*

**FprCEN/TS 17152-4:2024 (E)****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

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$R_{0ld}$	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
$\alpha_F$	reduction factor for shallow depth of cover	-
$\gamma_G$	partial factor (permanent)	-
$\gamma_Q$	partial factor (variable)	-
$\gamma_{dstb}$	partial factor, destabilising	-
$\gamma_{LP}$	load factor (permanent, lateral)	-
$\gamma_{LT}$	load factor (variable, lateral)	-
$\gamma_M$	partial safety factor of the material	-
$\gamma_s$	unit weight of backfill	kN/m <sup>3</sup>
$\gamma_{stb}$	partial factor, stabilizing	-
$\gamma_W$	unit weight of water	kN/m <sup>3</sup>
$\delta_{d.lim}$	design ultimate lateral deflection	m
$\delta_G$	permanent lateral deflection	m
$\delta_{max}$	ultimate deflection from short-term testing	m
$\delta_Q$	variable lateral deflection	m
$\sigma_{Gk}$	permanent characteristic lateral pressure	kPa
$\sigma_{Gd}$	permanent design lateral pressure	kPa
$\sigma_{Qk}$	variable characteristic lateral pressure	kPa
$\sigma_{Qd}$	variable design lateral pressure	kPa

**4.2 Abbreviations**

LM	Load Model
SLS	Serviceability Limit State
ULS	Ultimate Limit State