
**Sistemi za odvod odpadne vode in kanalizacijo zunaj stavb - Načrtovanje - 2. del:
Hidravlično dimenzioniranje**

Drain and sewer systems outside buildings - Design - Part 2: Hydraulic design

Entwässerungssysteme außerhalb von Gebäuden - Planung - Teil 2: Hydraulische
Berechnung

Réseaux d'évacuation et d'assainissement à l'extérieur des bâtiments - Conception -
Partie 2 : Conception hydraulique

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Zunanji sistemi za odpadno
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External sewage systems

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**Drain and sewer systems outside buildings - Design - Part
2: Hydraulic design**

Réseaux d'évacuation et d'assainissement à l'extérieur
des bâtiments - Conception - Partie 2 : Conception
hydraulique

Entwässerungssysteme außerhalb von Gebäuden -
Planung - Teil 2: Hydraulische Planung

This European Standard was approved by CEN on 30 July 2017.

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European foreword

This document (EN 16933-2:2017) has been prepared by Technical Committee CEN/TC 165 “Wastewater engineering”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by March 2018 and conflicting national standards shall be withdrawn at the latest by March 2018.

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 European Standard EN 16933, *Drain and sewer systems outside buildings — Design*, contains the following parts:

- Part 1: Physical design¹⁾
- Part 2: Hydraulic design.

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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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¹⁾ Currently in preparation.

Introduction

Drain and sewer systems are part of the overall wastewater system that provides a service to the community. This can be briefly described as:

- removal of wastewater from premises for public health and hygienic reasons;
- prevention of flooding in urbanised areas;
- protection of the environment.

The overall wastewater system has four successive functions:

- collection;
- transport;
- treatment;
- discharge.

Collection and transport of wastewater is provided by drain and sewer systems.

EN 752:2017 provides a framework for the design, construction, maintenance, operation and rehabilitation of drain and sewer systems outside buildings. This is illustrated in the upper part of the diagram in Figure 1. EN 752:2017 is supported by more detailed standards for the investigation, design, construction, organization and control of drain and sewer systems.

Investigation and assessment standards include:

- EN 13508, *Investigation and assessment of drain and sewer systems outside buildings*.

Design and construction standards include:

- EN 16932²⁾, *Drain and sewer systems outside buildings — Pumping systems*;
- EN 16933³⁾, *Drain and sewer systems outside buildings — Design*;
- EN 1295⁴⁾, *Structural design of buried pipelines under various conditions of loading*;
- EN 1610, *Construction and testing of drains and sewers*;
- EN 12889, *Trenchless construction and testing of drains and sewers*;
- EN 15885, *Classification and characteristics of techniques for renovation, repair and replacement of drains and sewers*.

Management and control standards include:

- EN 14654, *Management and control of operational activities in drain and sewer systems outside buildings*.

²⁾ Currently in preparation.

³⁾ Currently in preparation.

⁴⁾ Currently in preparation.

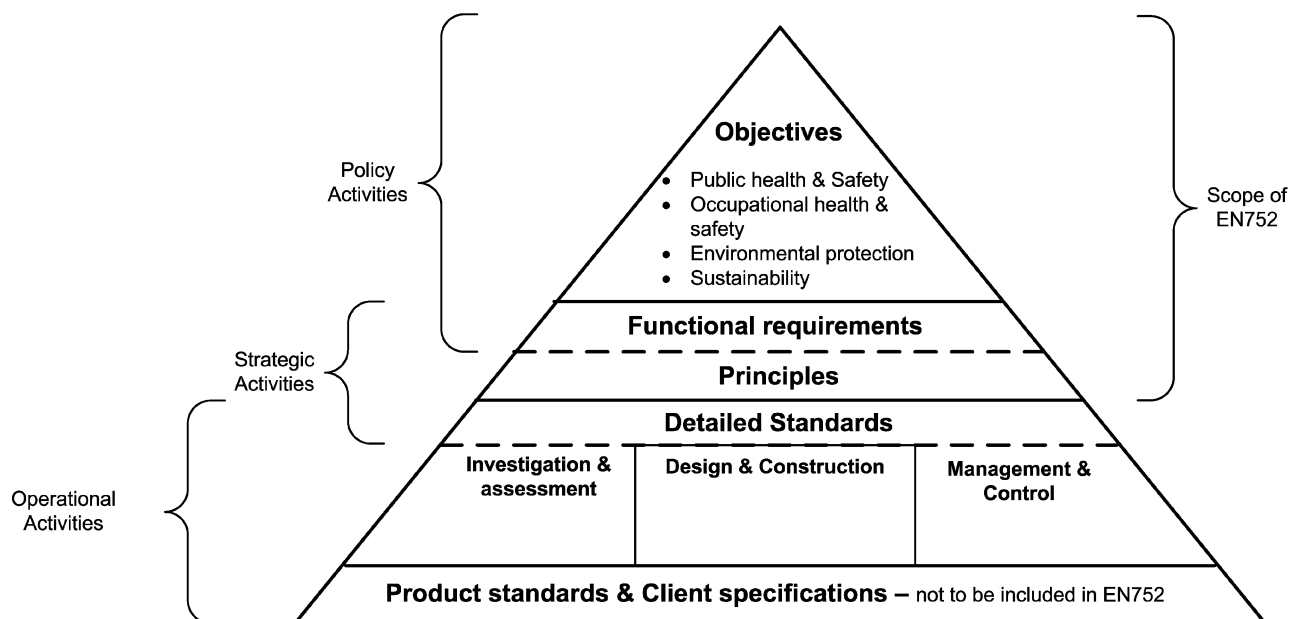


Figure 1 — Relationship to EN 752:2017 and other drain and sewer standards [Source EN 752:2017]

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1 Scope

This European Standard specifies requirements for the design of drain and sewer systems outside buildings.

It is applicable to drain and sewer systems from the point where the wastewater leaves a building, roof drainage system, or paved area, to a point where it is discharged into a wastewater treatment plant or receiving water body.

This document specifies requirements for the hydraulic design of drain and sewer systems and the assessment of the capacity of existing drain and sewer systems.

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 858-1, *Separator systems for light liquids (e.g. oil and petrol) — Part 1: Principles of product design, performance and testing, marking and quality control*

EN 858-2:2003, *Separator systems for light liquids (e.g. oil and petrol) — Part 2: Selection of nominal size, installation, operation and maintenance*

EN 1825-1, *Grease separators — Part 1: Principles of design, performance and testing, marking and quality control*

EN 1825-2:2002, *Grease separators — Part 2: Selection of nominal size, installation, operation and maintenance*

EN 16323:2014, *Glossary of wastewater engineering terms*

EN 752, *Drain and sewer systems outside buildings — Sewer system management*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16323, EN 752 and the following apply.

NOTE 1 Certain key definitions from EN 16323:2014 have been repeated below for clarity. The following additional terms used in this document are defined in EN 16323:

backdrop manhole;	catchment area;	combined sewer overflow;
combined system;	detention tank;	domestic wastewater;
drain;	dry weather flow;	extraneous flow;
foul wastewater;	gradient;	gravity system;
hydro-biological stress;	industrial wastewater;	infiltration (see Figure 2);
inspection chamber;	inverted syphon;	maintenance;
manhole;	outfall;	ramp manhole;
receiving water body;	rehabilitation;	relevant authority;
renovation;	repair;	replacement;
rising main;	runoff coefficient;	self-cleansing;
self-purifying capacity;	separate system;	septic wastewater;

sewer; sewer system;
time of concentration;

surcharge;
time of flow;

tank sewer;
wastewater treatment plant.

NOTE 2 The following additional terms used in this document are defined in EN 752:2017:

expected frequency

flooding

rainfall intensity

3.1

depression storage

precipitation retained in surface hollows that does not contribute to runoff

3.2

rainwater

water arising from atmospheric precipitation, which has not yet collected matter from the surface

Note 1 to entry: See Figure 2.

[SOURCE: EN 16323:2014, 2.1.1.1]

3.3

runoff

water from precipitation that flows off a surface to reach a drain, sewer or receiving water

Note 1 to entry: See Figure 2.

[SOURCE: EN 16323:2014, 2.1.1.2]

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3.4

sub-critical flow

state of flow when the water velocity is less than the velocity of the small surface wave with water levels tending to be stable

3.5

super-critical flow

state of flow when the water velocity is greater than the velocity of the small surface wave with violent fluctuations in water level being possible

3.6

surface receiving water body

receiving water body that is on the surface of the ground (e.g. river, lake or sea)

Note 1 to entry: See Figure 2.

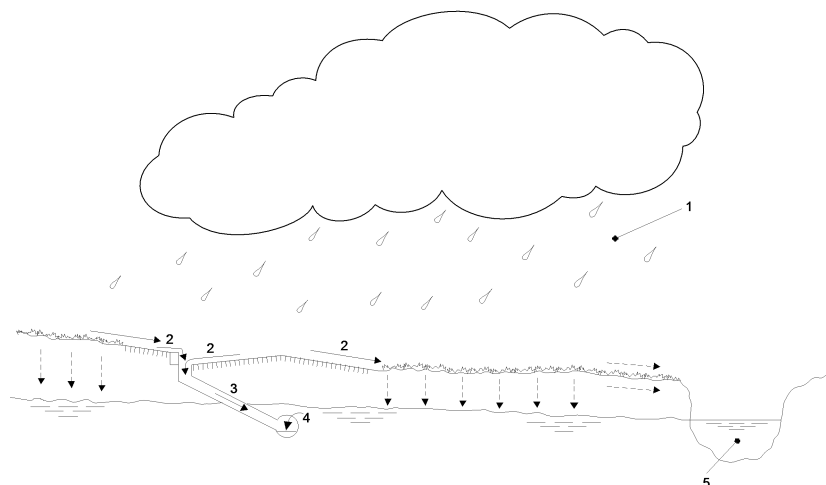
[SOURCE: EN 16323:2014, 2.1.3.7]

3.7

surface water

water from precipitation, which has not seeped into the ground and is discharged to the drain or sewer system directly from the ground or from exterior building surfaces (see Figure 2)

[SOURCE: EN 16323:2014, 2.1.1.3]



Key

- 1 rain water
- 2 runoff
- 3 surface water
- 4 infiltration
- 5 surface receiving water body

Figure 2 — Terminology for flows derived from rain water [Source EN 16323:2014]

3.8

vortex manhole

circular manhole within which a large difference in level is accommodated by the wastewater entering tangentially and descending helically

3.9

wastewater

water composed of any combination of water discharged from domestic, industrial or commercial premises, surface run-off and accidentally any sewer infiltration water

[SOURCE: EN 16323:2014, 2.3.10.65]

4 Symbols and units

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

- A_C is the area receiving rainfall (measured horizontally), in hectares [ha]
- A_f is the flow cross-section perpendicular to the invert of the drain or sewer, in metres squared [m^2]
- C_S is the runoff coefficient (between 0,0 and 1,0), dimensionless [-]
- c is the factor with inclusion of additional losses, dimensionless [-]
- D is the internal diameter of the pipe (bore), in metres [m]
- g is the acceleration due to gravity, in metres per second squared [m/s^2]
- h_f is the local headloss in bends, valves and other fittings, in metres [m]

h_p	the pipeline head loss due to friction, in the pipe in metres [m]
i	is the rainfall intensity, in litres per second and hectare [l/s/ha]
J_E	is the hydraulic gradient (energy loss per unit length), dimensionless [-]
J_F	is the friction gradient, dimensionless [-]
J_S	is the gradient of the invert of the drain or sewer (with open channel possibly not constant), dimensionless [-]
K	is the Manning coefficient, in metres raised to the power one third per second [$m^{1/3}/s$]
k_f	is the headloss coefficient, dimensionless [-]
k_s	is the hydraulic pipeline roughness, in metres [m]
L	Is the length of the pipeline, in metres [m]
Q	is the flow, in metres raised to the power of three per second [m^3/s]
Q_{pk}	is the peak flow rate, in litres per second [l/s]
q	is the lateral inflow per unit of length in the direction of the flow (assumed steady-state), in metres cubed per second and metre [$m^3/(s\ m)$]
R_h	is the hydraulic radius, in metres [m]
t	is the time coordinate, in seconds [s]
v	is the velocity in the direction of flow averaged across the flow cross-section, in metres per second [m/s]
x	is the path coordinate in direction of flow, in metres [m]
y	is filling height in profile or depth of water (perpendicular to invert) or the pressure head in completely filled drains at the invert of the pipe or profile, in metres [m]
λ	is the friction coefficient for the pipe, dimensionless [-]
ν_k	is the kinematic viscosity of fluid, in metres squared per second [m^2/s]

5 General

EN 752 specifies objectives and functional requirements and the principles for design of drain and sewer systems outside buildings.

Hydraulic design can affect the functional requirements, in particular the following:

- protection from sewer flooding;
- protection of surface receiving water bodies;
- prevention of odours and toxic, explosive and corrosive gases;
- maintaining the flow.

Drains and sewers systems shall be designed to provide sufficient capacity for the design flows. In selecting the diameter and/or gradient of the pipe consideration shall also be taken of the need to minimize build-up of sediments and to minimize the risk of blockages (see 7.1).