SIST

# SLOVENSKI STANDARD
# SIST EN 12056-3:2001

**01-december-2001**

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**Težnostni kanalizacijski sistemi v stavbah - 3. del: Odvod vode s streh, načrtovanje in izračun**

Gravity drainage systems inside buildings - Part 3: Roof drainage, layout and calculation

Schwerkraftentwässerungsanlagen innerhalb von Gebäuden - Teil 3: Dachentwässerung, Planung und Bemessung



Réseaux d'évacuation gravitaire a l'intérieur des bâtiments - Partie 3: Systeme d'évacuation des eaux pluviales, conception et calculs



**Ta slovenski standard je istoveten z: EN 12056-3:2000**

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**ICS:**

| | | |
|---|---|---|
| 91.060.20 | Strehe | Roofs |
| 91.140.80 | Drenažni sistemi | Drainage systems |

**SIST EN 12056-3:2001** **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 12056-3

June 2000

ICS 91.060.20; 91.140.80

English version

# Gravity drainage systems inside buildings - Part 3: Roof drainage, layout and calculation

Réseaux d'évacuation gravitaire à l'intérieur des bâtiments - Partie 3: Système d'évacuation des eaux pluviales, conception et calculs

Schwerkraftentwässerungsanlagen innerhalb von Gebäuden - Teil 3: Dachentwässerung, Planung und Bemessung

This European Standard was approved by CEN on 27 October 1999.

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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 Central Secretariat has the same status as the official versions.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels



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## Contents

## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 165 "Waste water 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of an identical text or by endorsement, at the latest by December 2000, and conflicting national standards shall be withdrawn at the latest by June 2001.

This part is the third in a series relating to the functional requirements of gravity drainage systems inside buildings. There will be five parts, as follows: Gravity drainage systems inside buildings

Part 1: General and performance requirements

Part 2: Sanitary pipework - Layout and calculation

Part 3: Roof drainage - Layout and calculation

Part 4: Waste water lifting plants - Layout and calculation

Part 5: Installation and testing, instructions for operation, maintenance and use

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

# 1 Scope

This European Standard applies to wastewater drainage systems, which operate under gravity. It is applicable for drainage systems inside dwellings and commercial, institutional and industrial buildings.

This third part of this European Standard describes a method of calculating the hydraulic adequacy of non-siphonic roof drainage systems and gives performance requirements for siphonic roof drainage systems. It also sets standards for the layout and installation of roof drainage insofar as they affect flow capacity.

This part of this European Standard applies to all roof drainage systems where the outlets are large enough not to limit the flow capacity of the gutter (i.e. free discharge conditions). It applies to all materials used for roof drainage systems.

Detailed information additional to that contained in this Standard may be obtained by referring to the technical documents listed in Annex B.

## 2 Normative references

This European 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 European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 12056-1: Gravity drainage systems inside buildings
Part 1: General and performance requirements

EN 12056-2: Gravity drainage systems inside buildings
Part 2: Sanitary pipework, layout and calculation

EN 12056-5 Gravity drainage systems inside buildings
Part 5: Installation and testing, instructions for operation, maintenance and use

# 3 Definitions and symbols

## 3.1 Definitions

For the purposes of this European Standard, the following definitions apply:

3.1.1 **gutter angle**
deviation in gutter direction

3.1.2 **design water depth**
maximum depth of water under design rainfall conditions

3.1.3 **drainage length**
length of gutter from a stop end to an outlet or half the distance between adjacent outlets, in millimetres

3.1.4 **eaves gutter**
gutter where any spillover will discharge outside the building

3.1.5 **flat sole**
sole of the gutter, which is horizontal in cross-section for at least the width of the outlet

3.1.6 **freeboard**
total depth of gutter minus the designed water depth



3.1.7 **long gutter**
gutter whose drainage length is greater than 50 times its design water depth



3.1.8 **roof drainage of buildings**
all pipework and fittings outside and inside, fixed to or passing through the building structure, including drains below the building, to the point of connection to the buried drain adjacent to the building, used to remove precipitation from a roof (See Scope of EN 12056-1.)

3.1.9 **short gutter**
gutter whose drainage length is not greater than 50 times its design water depth

3.1.10 **siphonic drainage system**
drainage system in which the outlets and pipework enable the system to flow completely full under design conditions and make use of the total head available between the outlets and the discharge point

3.1.11 **spillover level**
level at which water will overflow the gutter

## 3.2 Symbols

For the purposes of this European Standard, the following symbols have been used:

| Symbol | Description | Unit | Text reference |
|---|---|---|---|
| $A$ | effective roof area | $m^2$ | Table 3 |
| $A_E$ | full cross-sectional area of gutter | $mm^2$ | 5.1.2 |
| $A_W$ | cross-sectional area of the gutter below the freeboard | $mm^2$ | 5.2.3 |
| $A_O$ | plan area of a gutter outlet | $mm^2$ | Figure 8 |
| $B_R$ | width of roof from gutter to ridge | m | Figure 1 |
| $C$ | runoff coefficient | dimensionless | 4.1 |
| $d_i$ | internal diameter of pipe | mm | Table 8 |
| $D$ | effective diameter of a gutter outlet | mm | Figure 9 |
| $D_O$ | actual diameter of a gutter outlet | mm | Figure 9 |
| $f$ | filling degree of rainwater pipe which is equal to the proportion of cross-section of rainwater pipe filled with water | dimensionless | Table 8 |
| $F_d$ | depth factor | dimensionless | Figure 5 |
| $F_h$ | outlet head factor | dimensionless | Figure 10 |
| $F_L$ | capacity factor for long and sloping gutters | dimensionless | Table 6 |
| $F_s$ | shape factor | dimensionless | Figure 6 |
| $h$ | head at outlet | mm | Table 7 |
| $H_R$ | height of roof from gutter to ridge | m | Figure 1 |
| $h_d$ | water depth in drain | mm | annex C |
| $i$ | pipe or gutter gradient | dimensionless | annex C |
| $k_b$ | effective pipe roughness | mm | Table 8 |
| $k_O$ | outlet coefficient | dimensionless | Table 7 |
| $L$ | drainage length of gutter, i.e. length of gutter from a stop end to an outlet or half the distance between two adjacent outlets | mm | Table 6 |
| $L_R$ | length of roof to be drained | m | Figure 1 |
| $L_S$ | length of sump | mm | Figure 11 |
| $L_K$ | length of taper of a gutter outlet | mm | Figure 9 |
| $L_W$ | length of weir over which water can flow | mm | 5.3.5 and Figure 12 |
| $Q$ | rate of flow of water | l/s | 4.1 |
| $Q_d$ | drain capacity | l/s | annex C |
| $Q_L$ | design capacity of "short" gutter, laid level | l/s | 5.1.2 |
| $Q_N$ | nominal capacity of gutter | l/s | 5.1.2 |
| $Q_O$ | total flow to an outlet (calculated on area drained multiplied by the rainfall intensity) | l/s | Table 7 |

| Symbol | Description | Unit | Text reference |
|---|---|---|---|
| $Q_{RWP}$ | capacity of a rainwater pipe | l/s | Table 8 |
| $Q_{SE}$ | capacity of an equivalent square eaves gutter | l/s | 5.1.4 and Figure 3 |
| $Q_{SV}$ | capacity of an equivalent square valley or parapet gutter | l/s | 5.2.3 |
| $R$ | is the radius of a gutter outlet | mm | Figure 9 |
| $r$ | rainfall intensity | $l/(s{\cdot}m^2)$ | 4.2 |
| $S$ | width of gutter at sole | mm | Figure 4 |
| $T$ | width of gutter at designated water line | mm | Figure 4 |
| $T_R$ | distance from gutter to ridge measured along the roof | m | Figure 1 |
| $P$ | wetted perimeter | mm | annex A |
| $v$ | flow velocity | m/s | annex C |
| $W$ | design water depth | mm | Figure 4 |
| $Z$ | total depth of gutter to spillover level, including freeboard | mm | Figure 4 |
| $\nu$ | kinematic viscosity of water | $m^2/s$ | annex C |



# 4 Runoff calculations

## 4.1 Quantity of rainwater runoff

The rate of flow of rainwater to be drained away from a roof under steady state conditions shall be calculated from equation 1:

$$Q = r \cdot A \cdot C \qquad (1)$$

where

- $Q$ is the rate of flow of water, in litres per second (l/s);
- $r$ is the rainfall intensity, in litres per second per square metre [$l/(s \cdot m^2)$];
- $A$ is the effective roof area, in square metres ($m^2$);
- $C$ is a runoff coefficient (taken as 1,0 unless national and local regulations and practice state otherwise), dimensionless.

## 4.2 Rainfall intensity, *r*

4.2.1 Where there is adequate statistical rainfall data related to the frequency of recurrence of storms of specific intensity and duration, the rainfall intensity, *r*, used in equation 1 shall be chosen with due regard to the nature and use of the building and appropriate to the degree of risk that can be accepted. Where statistical rainfall data is used, clause 4.2.2 shall not apply.

4.2.2 Where statistical rainfall data does not exist, a minimum rainfall intensity used as a basis for design shall be chosen from the intensities listed in Table 1, appropriate to the climate at the location of the building and in accordance with national and local regulations and practice. The minimum rainfall intensity shall be multiplied by a risk factor given in Table 2 to give the rainfall intensity, *r*, to be used in equation 1, unless national and local regulations and practice state otherwise.

**Table 1 — Rainfall intensity rates**

| Rainfall intensity l/(s · m²) |
|---|
| 0,010 |
| 0,015 |
| 0,020 |
| 0,025 |
| 0,030 |
| 0,040 |
| 0,050 |
| 0,060 |



**Table 2 — Risk factors**



| Situation | Risk factor |
|---|---|
| Eaves gutters | 1,0 |
| Eaves gutters where water overflowing would cause particular inconvenience, e.g. over entrances to public buildings | 1,5 |
| Non-eaves gutters and in all other circumstances where abnormally heavy rain or blockage in the roof drainage system could cause water to spillover into the building | 2,0 |
| For non-eaves gutters in buildings where an exceptional degree of protection is necessary, e.g.<br>- hospital operating theatres<br>- critical communications facilities<br>- storage for substances that give off toxic or flammable fumes when wet<br>- buildings housing outstanding works of art | 3,0 |

### 4.3 Effective roof area, *A*

4.3.1 No allowance shall be made for the effects of wind when calculating the effective roof area, unless national and local regulations and practice state otherwise.

4.3.2 Where no allowance is made for wind, the effective roof area shall be calculated from equation (2):

$$A = L_R \cdot B_R \tag{2}$$

where

$A$ is the effective roof area, in square metres (m²);
$L_R$ is the length of roof to be drained (see Figure 1), in metres (m);
$B_R$ is the width of roof from gutter to ridge (see Figure 1), in metres (m).

4.3.3 Where allowance is made for wind, the effective roof area shall be calculated in accordance with a method selected from Table 3.

4.3.4 In areas where wind is taken into account in rainfall calculations, where rain driven against a wall by the wind can run down onto the roof or into a gutter, 50% of the area of the wall shall be added to the effective area of the roof.

**Table 3 — Effective impermeable roof area**



| Allowance to be made for the effect of wind | Effective impermeable roof area, *A* m² |
|---|---|
| Wind driven rain, 26° to vertical | $A = L_R \cdot \left(B_R + \frac{H_R}{2}\right)$ |
| Rain perpendicular to roof (i.e. surface area of roof used) | $A = L_R \cdot T_R$ |



NOTES:
$L_R$ is the length of roof to be drained, in metres (m);
$B_R$ is the plan width of roof from gutter to ridge, in metres (m);
$H_R$ is the height of roof from gutter to ridge, in metres (m);
$T_R$ is the distance from gutter to ridge measured along the roof, in metres (m);
$A$ is the effective impermeable roof area, in square metres (m²).

Figure 1 illustrates these dimensions.

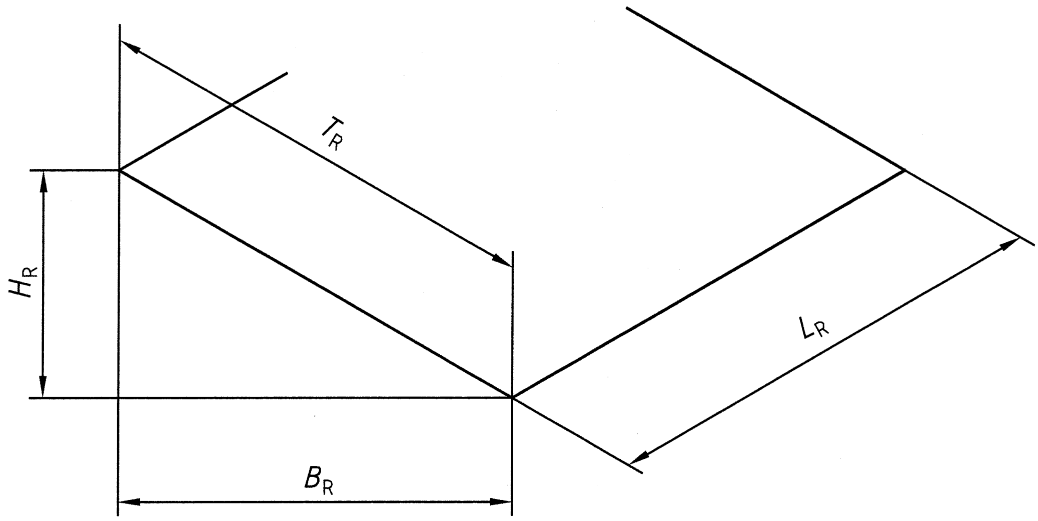


**Figure 1 — Roof dimensions**

# 5 Hydraulic design

## 5.1 Eaves gutters



5.1.1 Gutters may be laid level or to a gradient, unless stated otherwise by local or national regulation. A gutter laid to a nominal gradient of 3 mm/m or less (referred to as "nominally level") shall be designed as a level gutter.



5.1.2 For eaves gutters of semi-circular and similar shape, designed as level and with outlets capable of allowing free discharge, the capacity shall be calculated using its cross-sectional area and shape, from equation (3):

$$Q_L = 0{,}9 \cdot Q_N \quad (3)$$

where

- $Q_L$ is the design capacity of "short" gutter, see 5.1.6, laid level, in litres per second (l/s);
- 0,9 is a factor of safety, dimensionless;
- $Q_N$ is the nominal capacity of the gutter, calculated as $2{,}78 \cdot 10^{-5} \cdot A_E^{1{,}25}$ or determined by test, in litres per second (l/s);
- $A_E$ is the full cross-sectional area of gutter, in square millimetres (mm²).

NOTE 1:
The full cross-sectional area of a gutter is the area of the cross-section below spillover level, as illustrated in Figure 2.

NOTE 2:
For convenience, the variation of $Q_N$ with $A_E$ is shown in Figure 3.