3

TECHNICAL
HANDBOOK

LINE DRAINAGE SYSTEMS

STAVBY JAKO Z KAMENE

CSBETON®

www.csbeton.cz

Line drainage systems

Types of drainage systems

Technical sheets

Properties and characteristics

Application examples

STAVBY JAKO Z KAMENE
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TRANSITION PIECES
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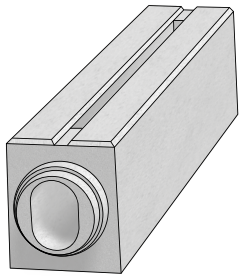
PROFILE VI
PROFILE IV
PROFILE III
PROFILE II
PROFILE I
PROFILE T
PROFILE M

CSB - MICRO-SLOT DRAINS - PROFILE M

Technical data:

Micro-slot drains are suitable for draining rainwater contaminated with small quantities of oil products (drips) from surfaced areas such as traffic infrastructure, parking lots lay-bys, etc. Individual segments are relatively light and can be handled without lifting equipment. Micro-slot drains are designed for D400 class traffic load.



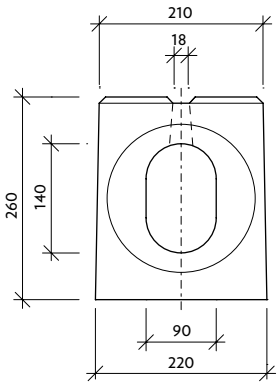
The system consists of the following components:

- 1 m-long slot drain, with or without internal flow gradient
- Complete gully assembly including cast-iron grill, gully trap, cone element and gully shaft
- Cleaning segment incl. cast iron grille
- End cap

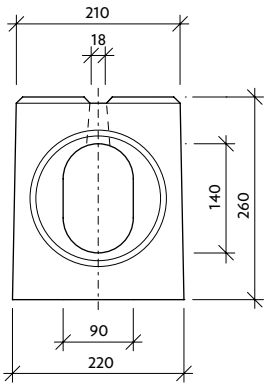
		Nominal dimensions* mm			**Quantity**	**Weight**
name:	Order code	Basic height	Width	Length	pcs/palleta	pcs
Micro-slot drains with interrupted slot	M-T	260	210/220	1000	15	103
Micro-slot drains with interrupted slot, 0.5% flow PROFILE bottom gradient	M-G	260	210/220	1000	10	113
Micro-slot drains with interrupted slot, corner segment	M-corner	260	400	400	-	67
Basic cleaning segment C0	M-C0	260	210/220	1000	10	100
Top cleaning segment CS	M-CS	260	210/220	1000	10	116
Basic gully assembly V0	M-V0	260	210/220	1000	10	93
Gutter gully assembly VU	M-VU	260	210/220	1000	10	89
Spigot end cap	M-ZU	260	210/220	120	-	15
Socket end cap	M-ZZ	260	210/220	120	-	11

Nominal dimensions - basic shapes:

Side-view
socket



Side-view
spigot



All products comply with harmonised European Standards and are patented

* Nominal dimensions include installation dimensions and/or minimum gap.

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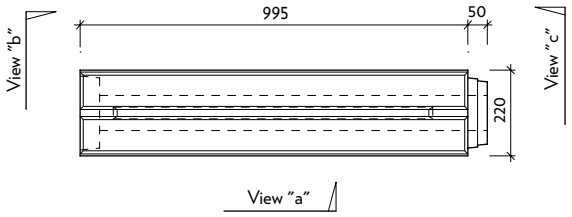
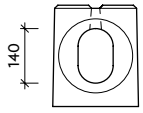
CSB - MICRO-SLOT DRAINS - PROFILE M

Typ M - Micro-slot drain

Plan

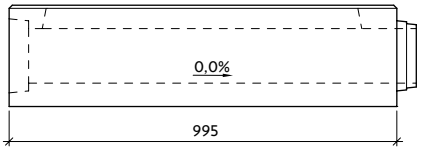


View "b" M - socket

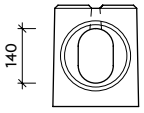


View "a"

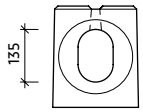
Profile M-T 140/140 without internal flow gradient

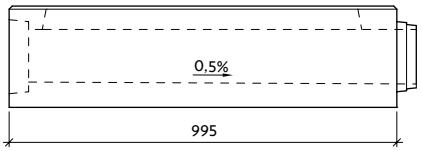


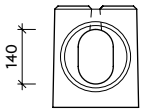
View "c" M - spigot



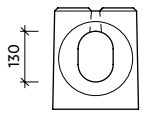
Profile M-G 135/140 0.5% flow profile bottom gradient

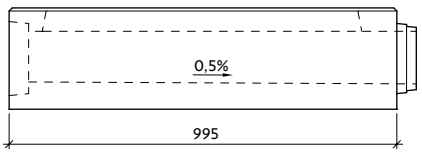


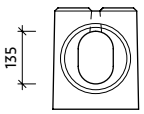




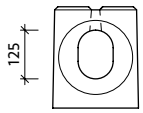
Profile M-G 130/135 0.5% flow profile bottom gradient

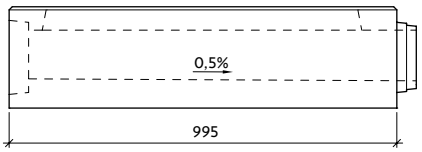


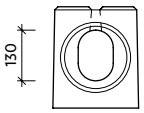




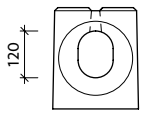
Profile M-G 125/130 0.5% flow profile bottom gradient

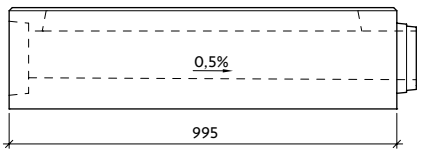


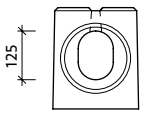




Profile M-G 120/125 0.5% flow profile bottom gradient







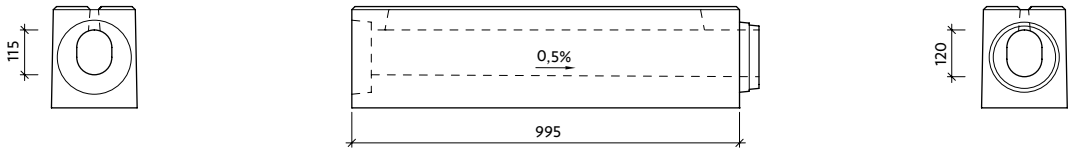
CSB - MICRO-SLOT DRAINS - PROFILE M

View "b" M - socket

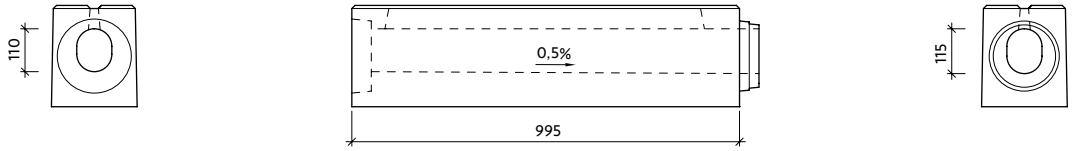
View "a"

View "c" M - spigot

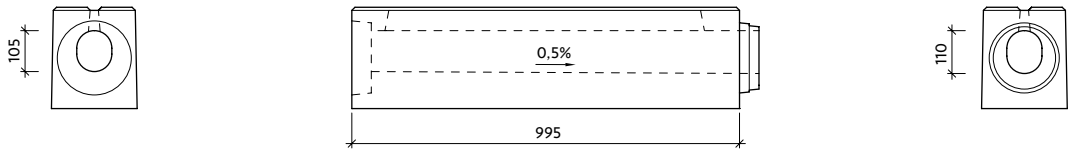
Profile M-G 115/120 0.5% flow profile bottom gradient



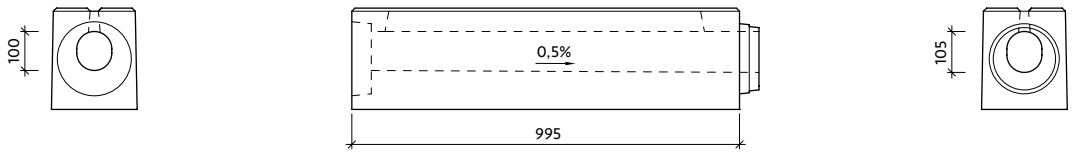
Profile M-G 110/115 0.5% flow profile bottom gradient



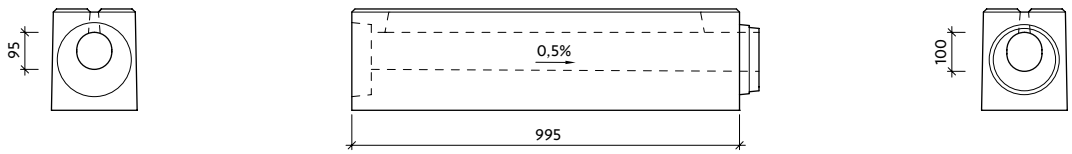
Profile M-G 105/110 0.5% flow profile bottom gradient



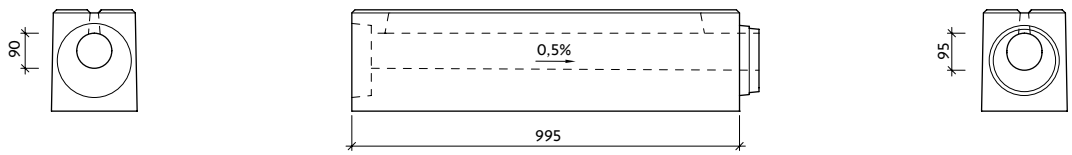
Profile M-G 100/105 0.5% flow profile bottom gradient



Profile M-G 95/100 0.5% flow profile bottom gradient



Profile M-G 90/95 0.5% flow profile bottom gradient

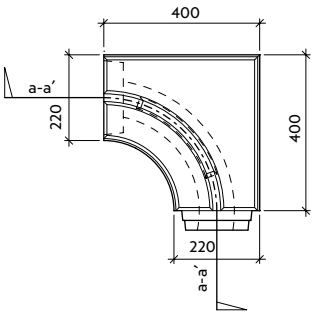


* Nominal dimensions include installation dimensions and/or minimum gap.

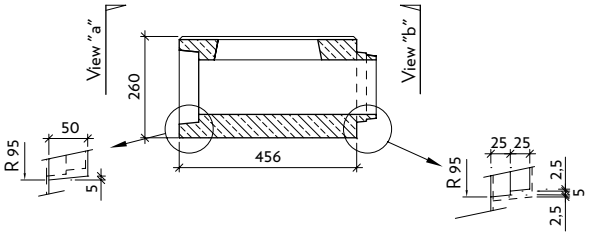
CSB - MICRO-SLOT DRAINS - PROFILE M

M corner 90° - right - slot drain

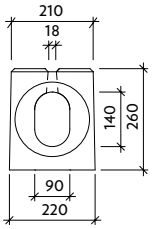
Plan



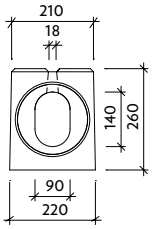
Cross-section: a-a´ M corner 90° - right



View "a" M corner 90° - socket

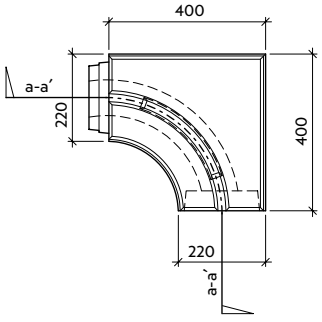


View "b" M corner 90° - spigot

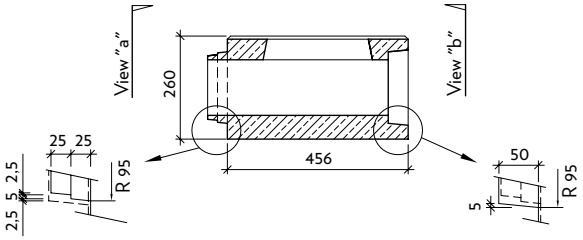


M - corner 90° - left - slot drain

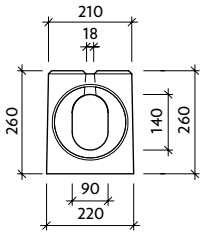
Plan



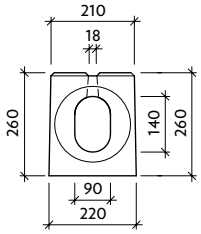
Cross-section: a-a´ M corner 90° - left



View "a" M corner 90° - spigot



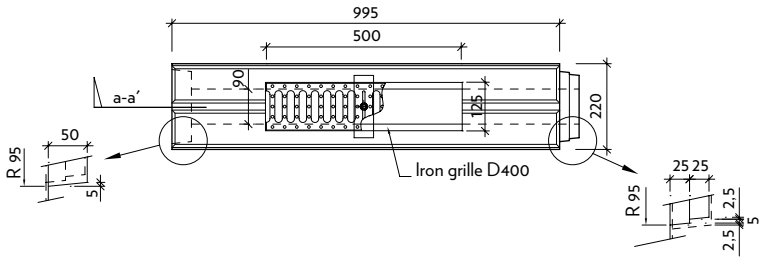
View "b" M corner 90° - socket



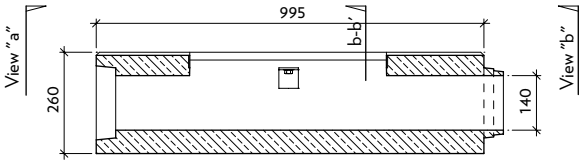
CSB - MICRO-SLOT DRAINS - PROFILE M

M-C0 – Basic cleaning segment with iron grille D400

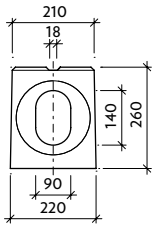
Plan



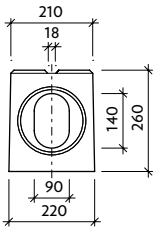
Cross-section: a-a' M-C0



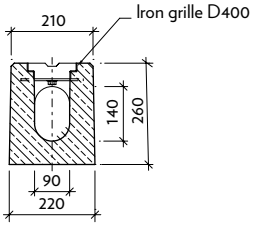
View "a" M-C0 - socket



View "b" M-C0 - spigot

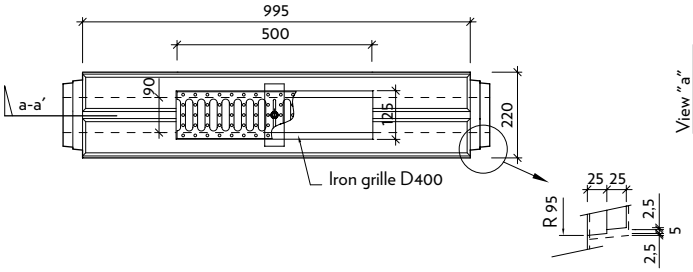


Cross-section: b-b' M-C0

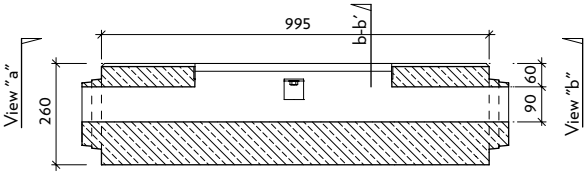


M-CS – Top cleaning segment with iron grille D400

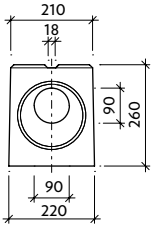
Plan



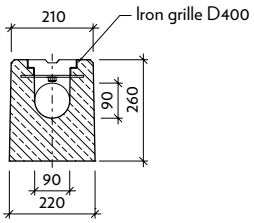
Cross-section: a-a' M-CS



View "a"="b" M-CS - spigot/spigot



Cross-section: b-b' M-CS

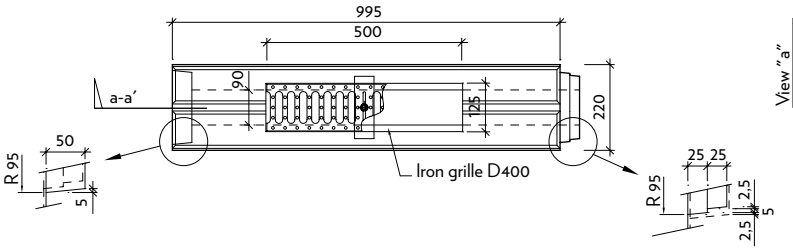


* Nominal dimensions include installation dimensions and/or minimum gap.

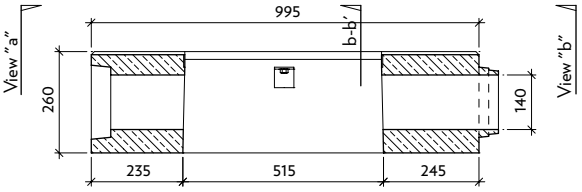
CSB - MICRO-SLOT DRAINS - PROFILE M

M-V0 – Basic gully assembly with iron grille D400

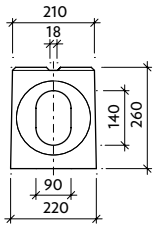
Plan



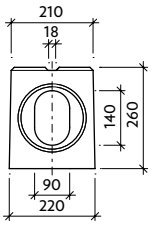
Cross-section: a-a´ M-V0



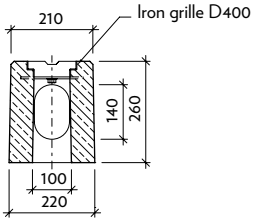
View "a" M-V0 - socket



View "b" M-V0 - spigot

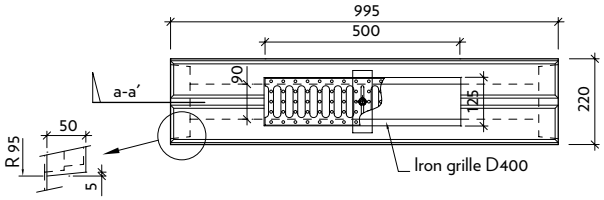


Cross-section: b-b´ M-V0

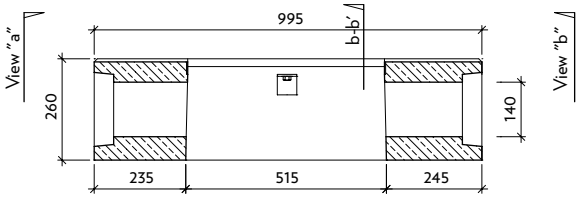


M-VU – Gutter gully assembly with iron grille D400

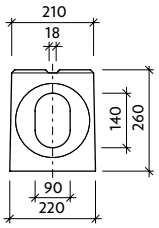
Plan



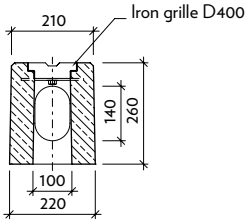
Cross-section: a-a´ M-VU



View "a"="b" M-VU - socket/socket



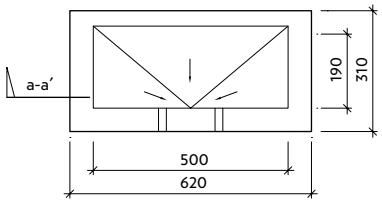
Cross-section: b-b´ M-VU



CSB - MICRO-SLOT DRAINS - PROFILE M

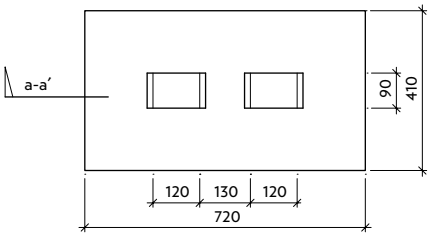
Bucket under gully trap

Plan

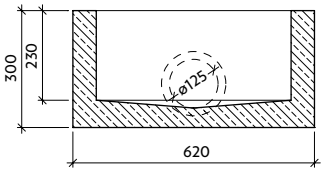


Top cover

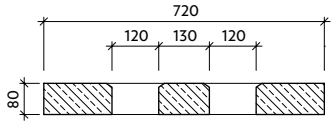
Plan



Cross-section: a-a´ bucket

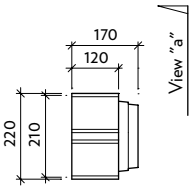


Cross-section: a-a´ Top cover

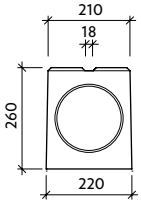


M-ZU - spigot end cap

Plan

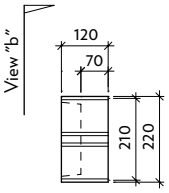


View "a" M-ZU

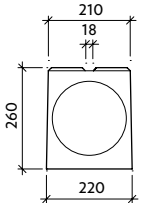


M-ZZ - socket end cap

Plan



View "b" M-ZZ

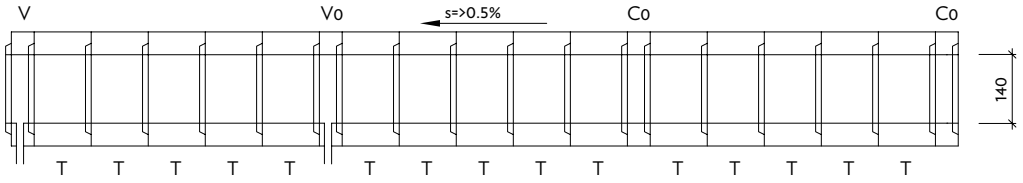


* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - MICRO-SLOT DRAINS - PROFILE M

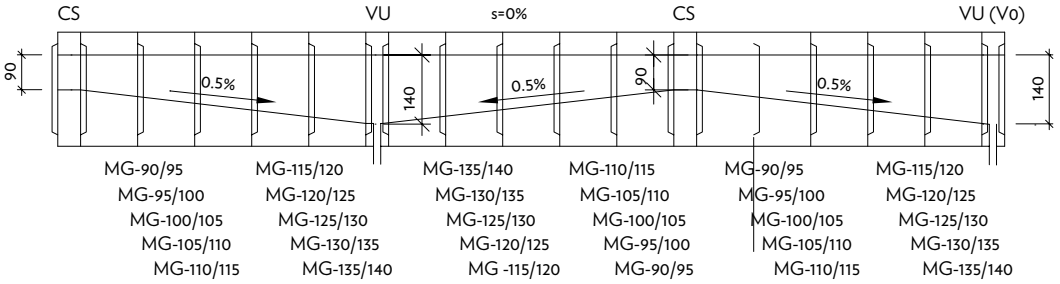
Suggested layout

MT-140/140 Micro-slot drains - layout



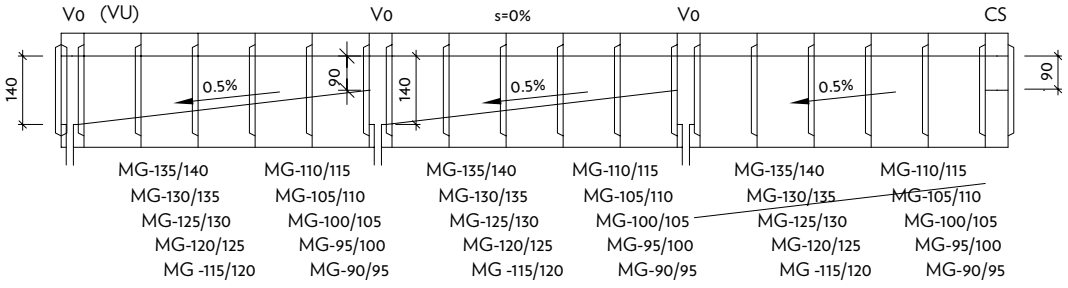
MG Micro-slot drains - layout

(micro-slot drain with roof bottom)



MG Micro-slot drains - layout

(micro-slot drain with saw tooth bottom)



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 140 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 140 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 140 mm flow profile height at both ends

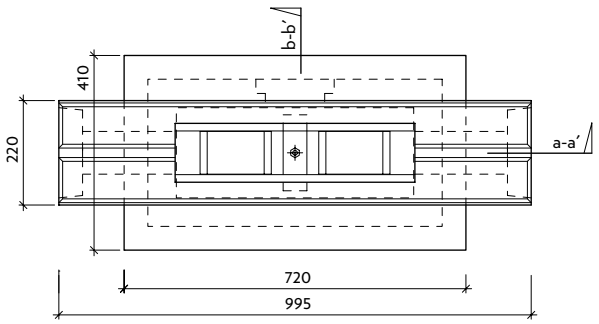
CS – Ridge cleaning element, spigot/spigot, 90 mm flow profile height at both ends

s – Longitudinal flow profile gradient

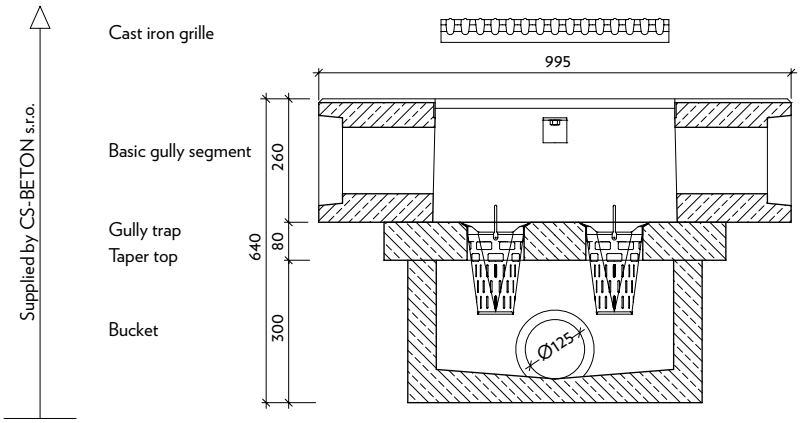
CSB - MICRO-SLOT DRAINS - PROFILE M

Basic gully segment with gully traps

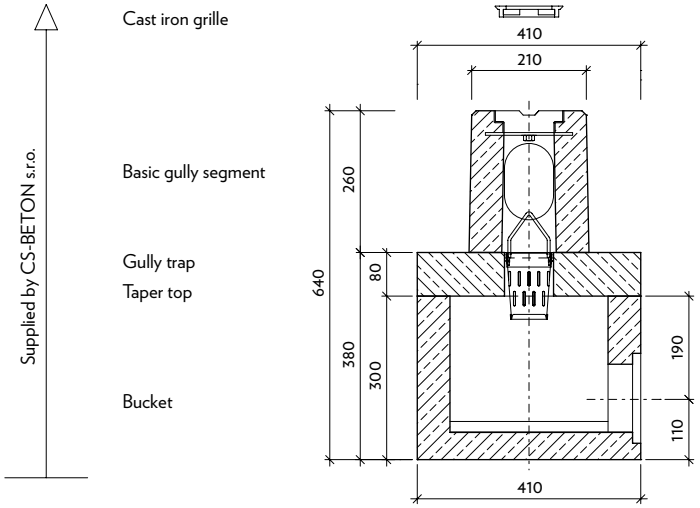
Plan



Cross-section a-a´



Cross-section b-b´



CSB - MICRO-SLOT DRAINS - PROFILE M

Product characteristics:

Micro-slot drains are a modern, fast and efficient way of draining excess water from roads and surfaced areas. The system includes dedicated gully and cleaning segments.

Micro-slot drains ensure efficient draining of excess water from surfaced areas even during extreme rainfall, its transport by means of high-capacity flow profile and removal to a storm sewer. They also collect contaminated water from road surfaces so that it does not come into contact with the surrounding environment. Despite the large flow capacity, the channels are relatively narrow and have excellent self-cleaning ability.

The basic cross-section of the M-series slot drains is slightly trapezoidal, with one base 220 mm wide and the other 210 mm wide and a height of 260 mm. The flow profile is 90 mm wide and 140 mm high. The basic segment length is 1 m and the segments typically weigh around 110 kg. The product line also includes segments with internal gradient, which enables efficient drainage of level or very slightly sloped surfaces.

CS-BETON's micro-slot drains have large load-bearing capacity and can be used in demanding environments. The simple design and high-quality of the structural elements ensure long service life of drainage systems.

M-series micro-slot drains, including gully and cleaning segments, are made of concrete resistant to XF4 aggressive environments (defrosting salts) as per ČSN EN 206-1. In European weather conditions, the systems are not affected by frost.

Micro-slot drains enable organic inclusion into the surface of roads and surfaced areas. They are especially suited for interlock paving. Compared to I Profile slot-drains, they are suitable for smaller roads and surfaced areas with less demand for flow capacity, or wherever access for heavy machinery is limited during installation. Using our special handling kits, the segments can be installed manually by just two people.

Thanks to well-designed joints between individual segments (using rubber seals and special caulk, a finished slot drain is watertight). The rubber used in seals is also resistant to oil substances. The rubber seals also provide an expansion joint between two adjoining segments and prevent them from coming into contact. The expansion joint is approximately 5 mm - wide.

A finished slot drain drainage system installed in a road surface is very durable and practically indestructible. It requires minimum maintenance, only cleaning of the flow profile when it becomes clogged. Cleaning and gully segments are provided for this purpose and should be installed at regular intervals. Regular maintenance of gullies is relatively easy.

The cast iron grilles on gullies and cleaning segments are secured against lift-off from the passing traffic.

Micro-slot drains can be installed in curved layouts. The maximum directional angle between two adjacent segments is 3 degrees. This ensures watertight joints between the adjoining faces. The minimum radius calculated from this angle is 20 m, however, we do not recommend this minimum value as the visible line of the slot segments appears too polygonal and compacting of adjacent road layers may damage the slot drain segments and joints. Minimum recommended radius is 40 m.

CSB - MICRO-SLOT DRAINS - PROFILE M

Introduction:

Micro-slot drains fill a gap in our drainage systems product portfolio. They provide the advantages of standard slot-drains for smaller areas. Installation is easy and handling of the individual segments is similar to handling of kerbstone components.

Thanks to their pricing, micro-slot systems are very attractive for both designers and investors for applications where slot drains with continuous cast-iron grilles have traditionally been used. Typical applications include petrol stations, passenger car parking areas and other smaller areas and smaller local roads, or roads with smaller water runoff.

Micro-slot drain systems are reliable and safe and their operational costs are low. Their inclusion into surfaced areas is easy and seamless. They are especially suited for interlocking pavement.

Important information:
Micro-slot drains are designed to collect water from surfaced areas, not from free terrain.
During installation, gullies must be precisely located in both transversal and longitudinal direction, because the micro-slot segments' length cannot be altered in situ. It is therefore advisable to install the gullies immediately before the slot-drain segments are installed, after a detailed survey. The nominal length of one segment with the rubber seal is 1,000 mm.
The openings at the beginning and end of the line must be closed and sealed using end caps supplied by CS-BETON.

CAUTION!
The „Important information" above includes only a few general rules for installing micro-slot draining systems.

Use the hydraulic calculation provided below to evaluate the flow capacity of M-series slot drain systems.

CS-BETON provides consulting services to designers and architects using micro-slot drain solutions. We will evaluate your preliminary design in the context of the overall technical solution of the roads, surfaced areas and rainwater drainage of your project. We will confirm the proposed drainage solution, or recommend changes and specify recommended elements and their location within the system, including a recapitulation/BoQ for ordering purposes, along with list prices and the total price. All the above services are provided free of charge as a courtesy to our clients.

CS-BETON s.r.o. is not the responsible designer of your project's documentation or its part. According to Section 159 of the Act no. 183/2006 Coll, the designer is responsible for the correct selection of products specified in project documentation based on guaranteed properties of individual products detailed in product property certificates.

When installing the M-line micro-slot drains by CS-BETON, always follow the manufacturer's installation recommendations!

CSB - MICRO-SLOT DRAINS - PROFILE M

Hydraulic calculation:

1. Introduction
The M-series of slot drain systems is suitable for smaller areas such as courtyards, service stations, etc. and wherever manual handling during installation is preferable.

2. Initial assumptions
The hydraulic design of a micro-slot system must always be based on the individual conditions at the given site, i.e. hydrogeology information, size, type and location of the catchment area. The capacity of the drainage system must then be calculated to reflect these conditions.

2.1 Geometrical characteristics
M-series slot drains are produced in two types. The M-G type has a sloped flow profile (5‰) and the M-T type has no internal gradient. Both are used with dedicated cleaning and gully segments. All segments are produced in lengths of 1.0 m.

2.1.1 M-G type segments with internal gradient
This type of system is represented by 10 basic segments with one gully segment (10.0 + 1.0 m) in a „saw teeth" configuration line and/or with one gully and one cleaning segment (10.0 + 2.0 m) when only one such line is used. The basic 10.0 m line with a 5 ‰ flow profile bottom gradient has an upper part of the flow profile cross section formed by an R = 45 mm circle, a bottom part by an R = 45 mm circle, with a 90 x 50 mm rectangle in between. The height of this rectangle changes from 0 to 50 mm and is increased by 5 mm for each subsequent segment.

2.1.2 M-T type segments with constant internal gradient
This type of slot drain does not have a fixed maximum length of one line - individual parameters depend on the site conditions (slopes etc.). However, each line must start with a cleaning and end with a gully segment. The segments have a flow profile cross section formed by a top and bottom circle of a 45 mm radius, with a 90 x 50 mm rectangle in between - it is thus identical to the end profile of the above sloped type.

2.2 Hydrology information
For the hydraulic design of slot drain systems, the most important input parameter is the design rainfall volume, which is used to arrive to the total drained volume and the necessary number of gully segments. The design rainfall volume may be obtained, for instance, from the „Intenzity krátkodobých dešťů v povodích Labe, Odry a Moravy" (Josef Trupl) Table [1], or by ordering the information from the relevant Hydrometeorology Institute branch. Generally speaking, for M Profile slot drain systems, ČSN 75 6101 (Stokové sítě a kanalizační přípojky) [2] specifies 15-minute rainfall with periodicity as per the type of area as the critical parameter. The same parameter is then used for the design of the storm sewer.

2.3 Terrain location
For the most economical system, the slot drains should be located on the catchment area so that their capacity is used to maximum and the number of storm sewer connections is minimal. The ideal scenario is slot drains in the lowest part of the area and a sufficient gradient sloping toward that part. When M-G type segments are used, the line is usually installed on a level surface. When M-T type segments are used, the gradient of the terrain in the longitudinal direction of the line must be at least 5 ‰ and the draining capacity depends on the gradient. Nomographic chart 1 below lists the flow capacity of slot drains and the flow rate for that capacity in relation to the longitudinal gradient. The total capacity of the system must correspond to the catchment area and the design rainfall as per above. The intensity of the design rainfall is reduced as per [2] using a recommended draining coefficient, which depends on type of structures present, type of site and its sloping. TP152 MDS may be used for the design.

2.4 Connection to the storm sewer
The slot drains are connected to the storm sewer via gully segments with a DN 125 opening for a connector to the local storm sewer branch. The gully segments include support surfaces for two gully traps to protect the sewer connector from being blocked by debris.125 The connectors are usually part of the local storm sewer branch and thus sufficient in the given diameter. Should the slot drain be connected directly to a storm sewer mains, the connector must be widened to DN 150.

3. Capacity flow through M Profile slot drains

Calculation of the capacity of this system is based on the „Hydraulické tabulky stok" (Hydraulic tables: Sewage conduits by J. Herle, O. Štefan, J. Turi Nagy) [3]. The same method is also used to design sewage conduits. The roughness coefficient was assumed at n = 0.014 and velocity coefficient c was calculated as per Pavlovský. The calculations do not take into account the effect of aeration in the stream (which is typically present in systems with large gradients). The capacity itself was then calculated using the Chezy formula for gradients of 5 to 100 ‰ and the results were plotted in nomogram 1. The nomogram also shows flow speeds for the given flow rates. The calculation was only performed for M and T profiles, i.e. with constant cross-section, because with such systems, variable distances between gully segments is used depending on the size of the area drained. M/G Profiles, i.e. with internal gradient, have a basic branch length of 10.0 m and the capacity of the last segment at the gully trap is the same as that of a M/T Profile with a gradient of 5 ‰ (gradients other than 5 ‰ are not typically used for M/G profiles). A basic 20 m line of M/G profiles is theoretically capable (see prerequisites in Chapter 5) of draining water from an area of approximately 561 sq m. With a width of 10.0 m, that would represent a length of 56 m, which is normally sufficient for small customers. Gully connectors are DN 125 and their capacity must also be evaluated as per [3]. Generally-speaking, when the connector has at least the same gradient as the slot drain at the gully segment, its capacity should not be exceeded, because the flow area of a DN 125 pipe is approximately 13 % higher than that of a slot drain. The recommended minimum gradient for storm sewer connectors is 20 ‰ (see [4]) to prevent any debris from blocking them.

4. Example hydraulic calculation

This hydraulic calculation is based on theoretical input information. It concerns a typical application of micro-slot drains by small customers - draining of a private property's yard. The property is in an area for which the hydrographical information is taken from data provided by the Roudnice nad Labem meteorological station. The drained area is 10 by 25 m and the slot drains will be installed with a 10‰ gradient. The yard itself has a gradient of 10 to 25 ‰ and is covered with concrete. Design rainfall intensity for T = 15 minutes and periodicity p = 1 is:

I_{NAV} = 112 [l/s.ha]

the run-off coefficient is:

φ = 0,80

the drained area is:

F = 10 x 25 x 0,0001 [ha] = 0,025 [ha]

after reduction by coefficient c = 0,80 the drained area is:

F_{RED} = φ x F [ha] = 0,80 x 0,025 = 0,020 [ha]

the design flow Q_{NAV} is:

$Q_{NAV} = F_{RED} \times I_{NAV}$ [l/s]
Q_{NAV} = 0,020 x 112
Q_{NAV} = 2,24 [l/s]

After comparing this value to the capacity of the slot drain from nomogram 1 for the gradient of 10‰, it is clear that:

Q_{KAP} = 7,75 [l/s] > Q_{NAV} = 2,24 [l/s]

If we assume the slot drains may be installed along the shorter edge of the yard in a gradient of 10 ‰, the capacity will be sufficient. The line will contain (from top to bottom) one cleaning segment, eight basic segments and a gully segment at the end.

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - MICRO-SLOT DRAINS - PROFILE M

Nomograms:

1. Nomograms for preliminary design of drainage systems

For reference design of M-profile draining systems, some calculation assumptions may be simplified. The average rainfall intensity for 15 minute rainfalls and periodicity of p = 1 for the Czech Republic (Labe basin) is:

I_{OR} = 122 [l/s.ha]

Since these slot-drains will not be used to drain water from unsurfaced areas, the average run-off coefficient c as per [2] is:

φ = 0,80

which is correct for concrete/bitumen surfaces with a gradient between 10 and 50 ‰. With these specifications, the following nominal run-off may be assumed:

per 1 sq m of drained area:

Q_{OR} = 1 x 1 x 0,0001 x 0,8 x 122 = 0,00976 [l/s]

per 1 are, i.e. 100 sq. m:

Q_{OR} = 10 x 10 x 0,0001 x 0,8 x 122 = 0,976 [l/s]

per 1 hectare, i.e. 10,000 sq. m:

Q_{OR} = 100 x 100 x 0,0001 x 0,8 x 122 = 97,6 [l/s]

The relationship between design run-off and the drained area is shown in nomogram 2. A comparison of the calculated run-off as per nomogram 2 with the capacity of the slot drain at the given gradient from nomogram 1 gives us enough information to specify the number of gully segments and to optimise the layout of the slot drain system.

2. Gully traps

Each gully contains two gully traps, which protect the storm sewer connections from being blocked by debris. Their outside areas are 85 x 115 mm and they are approximately 300 mm high. For the drainage system to retain its efficiency, the gully traps must be regularly emptied. Each gully trap has 28 slots (80 x 6 mm), which ensures approximately double the flow profile compared to other system components. Gully traps are made of galvanised steel sheeting, or plastic.

3. Conclusion

The simplified calculation of hydraulic characteristics from Chapter 5 is, as already mentioned, intended only as a preliminary evaluation of a proposed drainage system and/or for a final evaluation of systems where occasional overload is not a problem. For customers demanding sufficient drainage system capacity at all times, a professional company shall perform the calculation without simplifying assumptions.

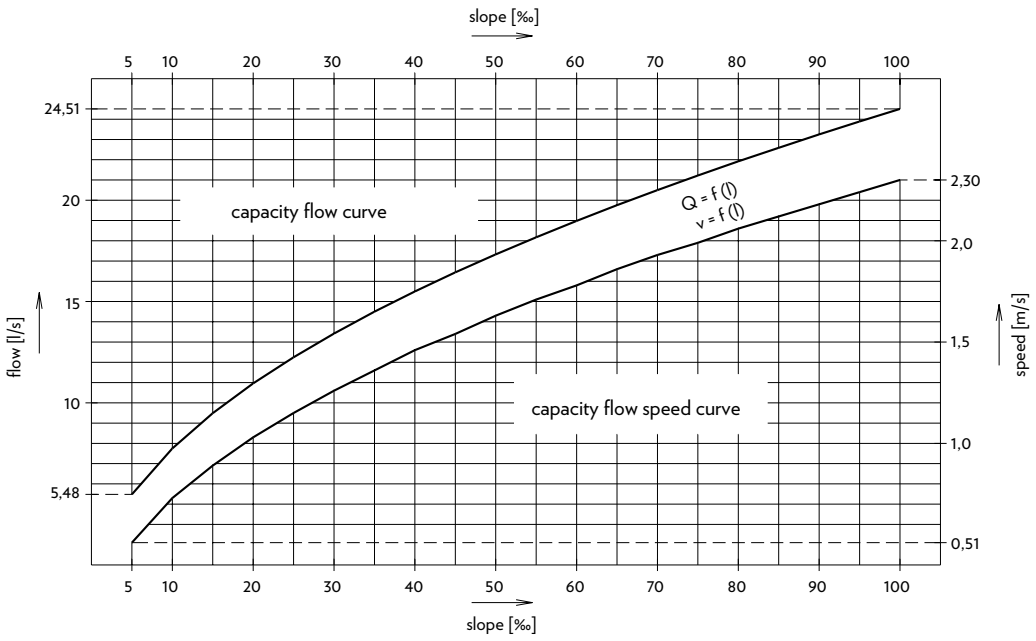
4. Literature

[1] Josef Trupl „Intenzity krátkodobých dešťů v povodích Labe, Odry a Moravy“ (Josef Trupl)
[2] ČSN 75 6101 „Stokové sítě a kanalizační přípojky“
[3] „Hydraulické tabulky stok“ (J. Herle, O. Štefan, J. Turi Nagy)
[4] ČSN 75 6760 „Vnitřní kanalizace“

CSB - MICRO-SLOT DRAINS - PROFILE M

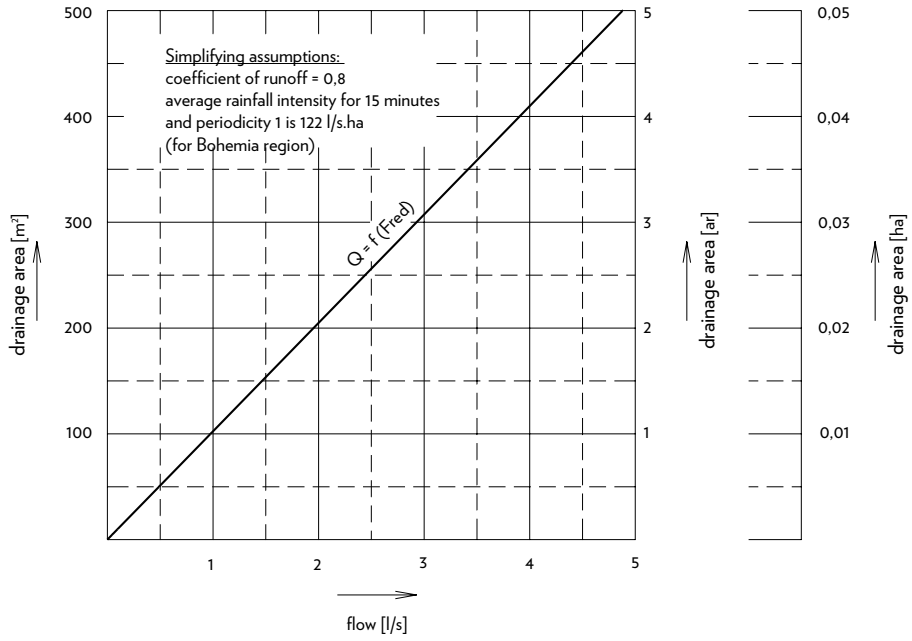
NOMOGRAM No. 1

CAPACITY OF SLOT CHANNELS (roughness coefficient n = 0,014 - by Pavlovsky)
PROFILE "M"



NOMOGRAM No. 2

Determination of surface runoff from 0 to 500 m²



CSB - MICRO-SLOT DRAINS - PROFILE M

Input data:

The following literature has been used in designing the drainage system described in this brochure:

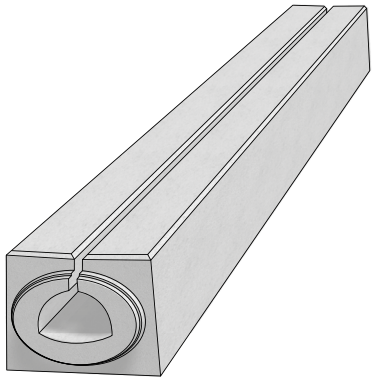
ČSN EN 1433 Odvodňovací žlábky pro dopravní a pěší plochy - konstrukční zásady zkoušení, označování, řízení jakosti
ČSN EN 206 Beton - specifikace, vlastnosti, výroba a shoda
DIN 19 580 Entwässerungsrinnen für Niederschlagswasserzum Einbau in Verkehrsflächen
ČSN 73 6056 Odstavné a parkovací plochy silničních vozidel
ČSN 73 6059 Servisy a opravny motorových vozidel. Čerpací stanice pohonných hmot
ČSN 73 6101 Projektování silnic a dálnic
ČSN 73 6110 Projektování místních komunikací
ČSN 73 6114 Vozovky pozemních komunikací
ČSN 75 6101 Stokové sítě a kanalizační přípojky
ČSN EN 124 Poklopy a vtokové mříže pro dopravní plochy
Vzorové listy staveb pozemních komunikací VL-1 Vozovky a krajnice, Ministry of Transport of the Czech republic, Dopravoprojekt
Vzorové listy staveb pozemních komunikací VL-2.2 Odvodnění, Ministry of Transport of the Czech republic, Dopravoprojekt
TKP 1 - Všeobecně
TKP 18 - betonové konstrukce (vč. 10 příloh)
TKP 31 - opravy betonových konstrukcí
TP 152 - Štěrbinové žlaby na PK, 2001, VPÚ-DECO
TP 170 - Navrhování vozovek PK (všeobecná část, katalog, návrhová metoda), 2004, VTU, Roadconsult
Technical documentation by CS-BETON Velké Žernoseky + VPÚ DECO 96-04
Company standard 7/99 Micro-slot drains as per DIN 19580, CSB
TPV 2/99 - Technologický předpis na montáž mikroštěrbinových trub, CSB
TPV 1/98 - Technologický předpis na opravy betonových prvků odvodňovacích systémů štěrbinových trub, CSB

CSB - SLOT DRAIN PROFILE T-0

Protected by utility patent

Technical data:

Its flow profile places this slot drain between the micro-slot drains and the Profile I slot drains. T Profile slot drains are ideal for tunnels and surfaced areas with a minimum gradient of 0.5%. T profile slot drains are only available with no internal gradient. T profile slot drains are designed for D400 class traffic load. They are self-cleaning under higher flow rates.



The system consists of the following components:
- 4 m-long slot drain, without internal flow gradient
- slot drain with a 12 cm kerbstone
- Exchangeable segment, T-3 profile with 12 cm kerbstone

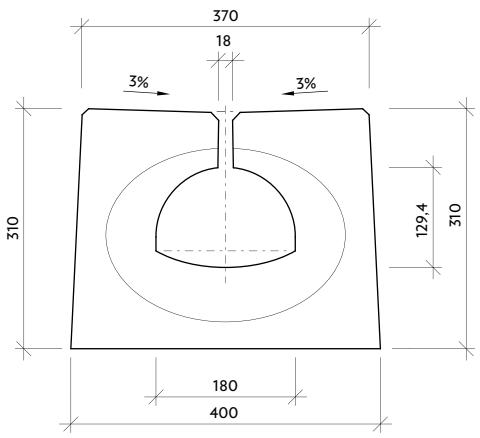
Accessories for all the above slot drains:
- Complete gully assembly, incl. cast iron grille and gully trap
- Complete gully assembly with steel cover for use in tunnels
- Cleaning segment incl. cast iron grille
- End cap

		Nominal dimensions mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**psc/m**	**psc**
Slot drain with continuous slot	T-0	310	4000	370/400	0,25	945
Basic gully assembly V0	T-0-V0	310	1000	370/400	1	233
Gutter gully assembly VU	T-0-VU	310	1000	370/400	1	225
Basic cleaning segment C0	T-0-C0	310	1000	370/400	1	232
Top cleaning segment CS	T-0-CS	310	1000	370/400	1	240
Fire safety barrier	T-0-PP	600	1000	370/410	1	511
Spigot end cap	T-0-ZU	310	120	370/400	-	39
Socket end cap	T-0-ZZ	310	120	370/400	-	27

Nominal dimensions - basic shapes:

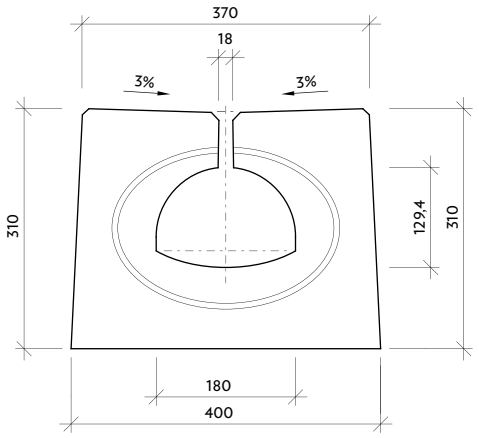
Side-view

Socket



Side-view

Spigot



All products comply with harmonised European Standards and are patented

* Nominal dimensions include installation dimensions and/or minimum gap.

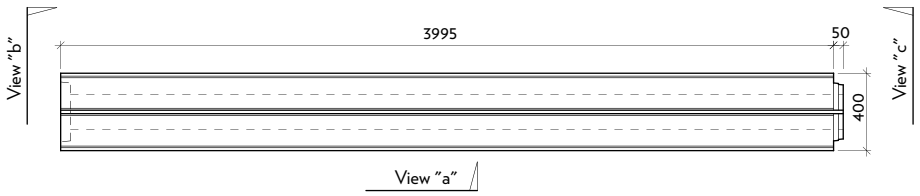
STAVBY JAKO Z KAMENE CSBETON®

CSB - SLOT DRAIN PROFILE T-0

Protected by utility patent

Profile T- 0 - Slot drain with continuous slot

Plan

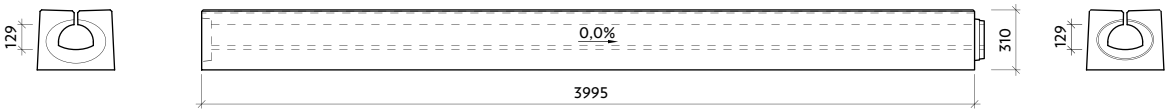


View "b" T-0 - Socket

View "a"

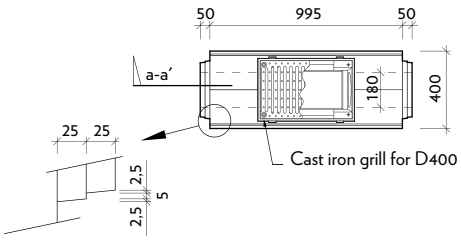
View "c" T-0 - Spigot

Profile T-0-T13/13 without internal flow gradient

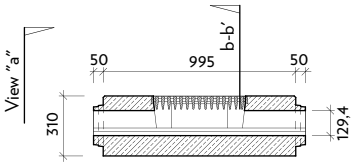


T-0-CS - Top cleaning segment with cast iron grille for D400

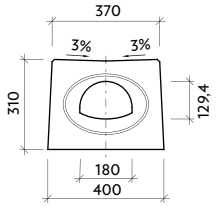
Plan



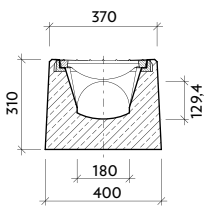
Cross-section: a-a' T-0-CS



View "a" T-0-CS - Spigot/Spigot



Cross-section: b-b' T-0-CS

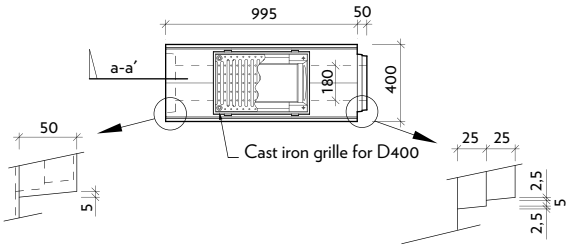


CSB - SLOT DRAIN PROFILE T-0

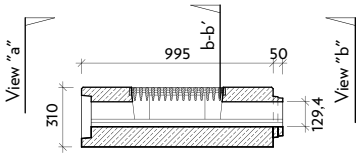
Protected by utility patent

T-0-C0 - Basic cleaning segment with cast iron grille for D400

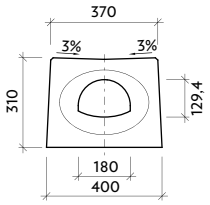
Plan



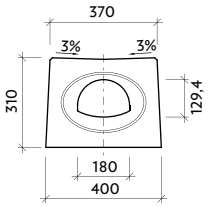
Cross-section: a-a´ T-0-C0



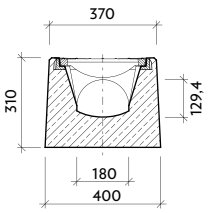
View "a" T-0-C0 - Socket



View "b" T-0-C0 - Spigot

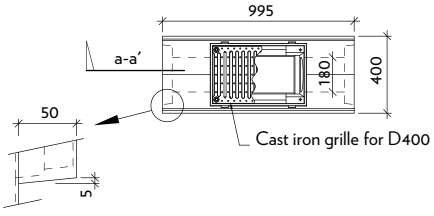


Cross-section: b-b´ T-0-C0

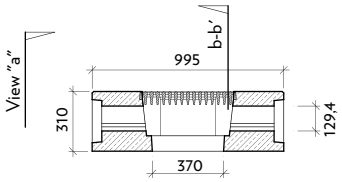


T-0-VU - Gutter gully assembly with cast iron grille for D400

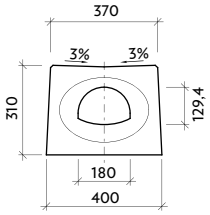
Plan



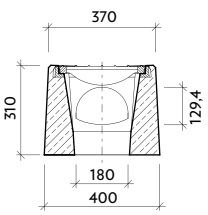
Cross-section: a-a´ T-0-VU



View "a" T-0-VU - Socket/Socket



Cross-section: b-b´ T-0-VU



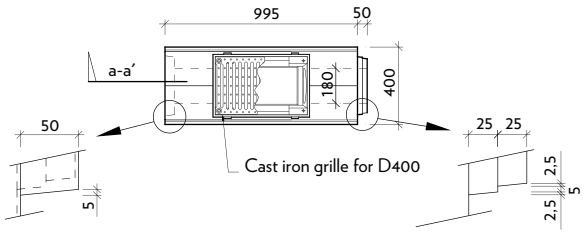
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE T-0

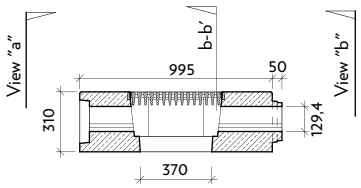
Protected by utility patent

T-0-V0 - Basic gully assembly with cast iron grille for D400

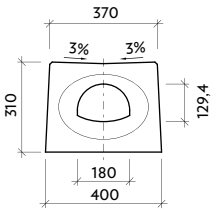
Plan



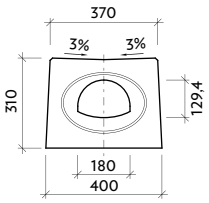
Cross-section: a-a´ T-0-V0



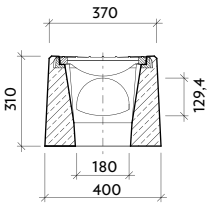
View "a" T-0-V0 - Socket



View "b" T-0-V0 - Spigot

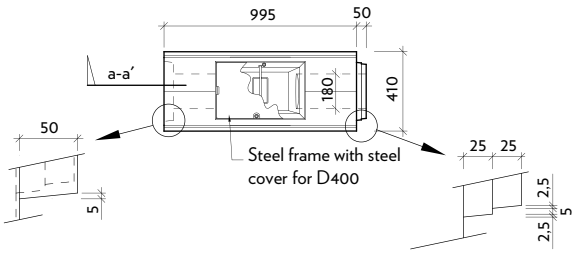


Cross-section: b-b´ T-0-V0

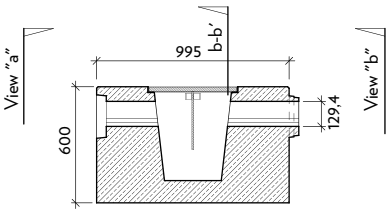


T-0-PP - Fire safety barrier with steel cover for D400

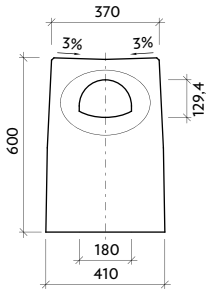
Plan



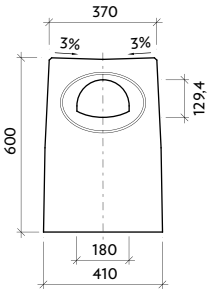
Cross-section: a-a´ T-0-PP



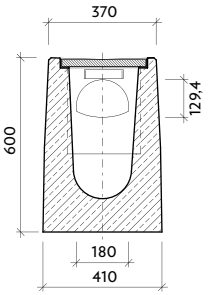
View "a" T-0-PP - Socket



View "b" T-0-PP - Spigot



Cross-section: b-b´ T-0-PP

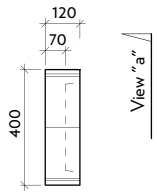


CSB - SLOT DRAIN PROFILE T-0

Protected by utility patent

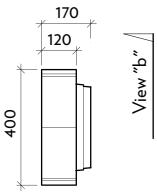
T-ZZ - Socket end cap

Plan

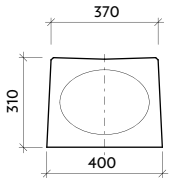


T-ZU - Spigot end cap

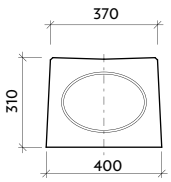
Plan



View "a" T-ZZ - Socket

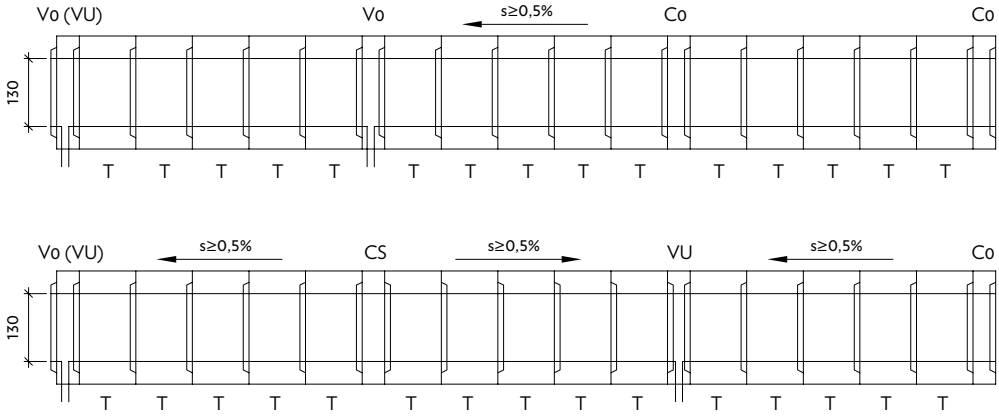


View "b" T-ZU - Spigot



Suggested layout

T-0-T Slot drains - layout



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 130 mm flow profile height at both ends

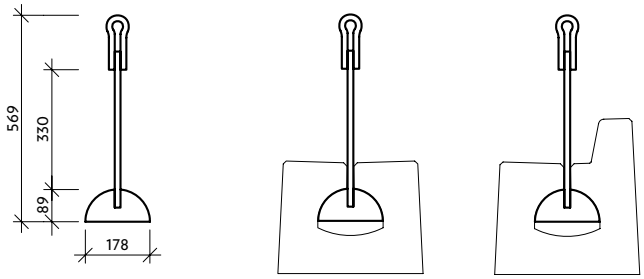
VU –Gutter gully, socket/socket, 130 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 130 mm flow profile height at both ends

CS – Ridge cleaning element, spigot/spigot, 130 mm flow profile height at both ends

s – Longitudinal flow profile gradient

Handling equipment - PROFILE T



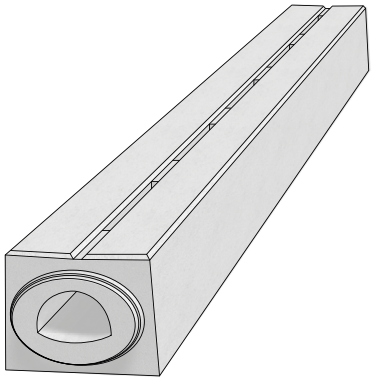
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE T-1

Protected by utility patent

Technical data:

Its flow profile places this slot drain between the micro-slot drains and the Profile I slot drains. T Profile slot drains are ideal for tunnels and surfaced areas with a minimum gradient of 0.5%. T profile slot drains are only available with no internal gradient. T profile slot drains are designed for D400 class traffic load. They are self-cleaning under higher flow rates.



The system consists of the following components:
- 4 m-long slot drain, without internal flow gradient
- Slot drain with a 12 cm kerbstone
- Exchangeable segment, T-3 profile with 12 cm kerbstone

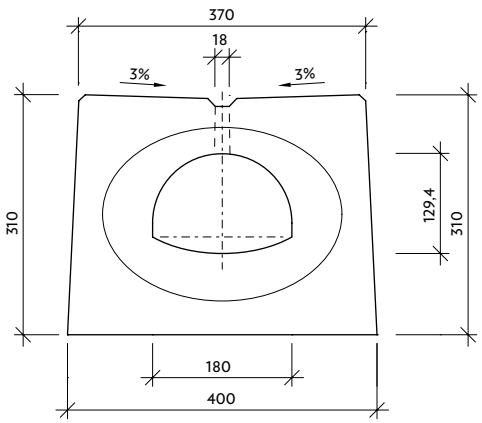
Accessories for all the above slot drains:
- Complete gully assembly, incl. cast iron grille and gully trap
- Complete gully assembly with steel cover for use in tunnels
- Cleaning segment incl. cast iron grille
- End cap

		Nominal dimensions mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**psc/m**	**psc**
Slot drain with interrupted slot	T-1	310	4000	370/400	0,25	995
Basic gully assembly V0	T-1-V0	310	1000	370/400	1	233
Gutter gully assembly VU	T-1-VU	310	1000	370/400	1	225
Basic cleaning segment C0	T-1-C0	310	1000	370/400	1	232
Top cleaning segment CS	T-1-CS	310	1000	370/400	1	240
Fire safety barrier	T-1-PP	600	1000	370/410	1	511
Spigot end cap	T-1-ZU	310	120	370/400	-	39
Socket end cap	T-1-ZZ	310	120	370/400	-	27

Nominal dimensions - basic shapes:

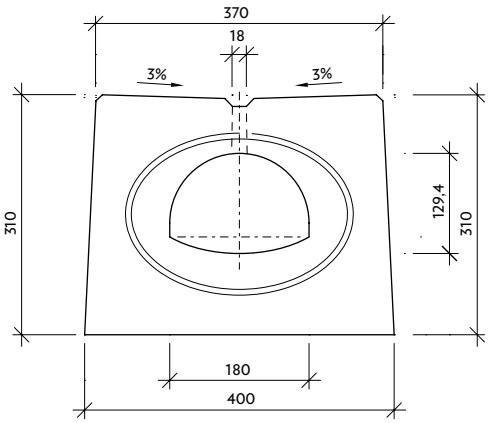
Side-view

Socket



Side-view

Spigot

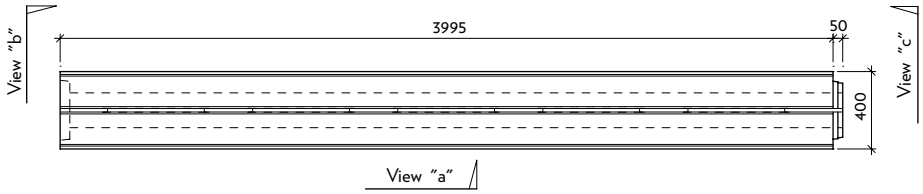


CSB - SLOT DRAIN PROFILE T-1

Protected by utility patent

Profile T-1 - slot drain

Plan

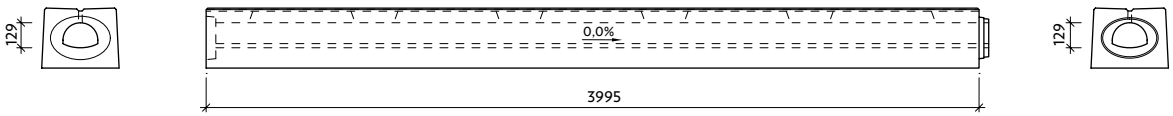


View "b" T-1 - Socket

View "a" T-1

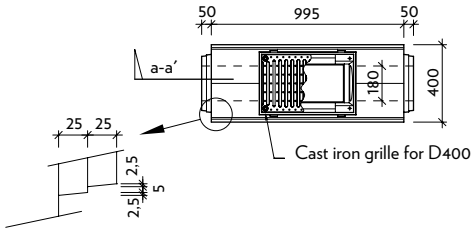
View "c" T-1 - Spigot

Profile T-1-T13/13 without internal flow gradient

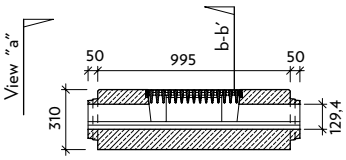


T-1-CS - Top cleaning segment with cast iron grille for D400

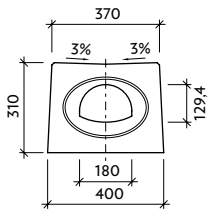
Plan



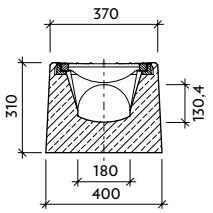
Cross-section: a-a' T-1-CS



View "a" T-1-CS - Spigot



Cross-section: b-b' T-1-CS



All products comply with harmonised European Standards and are patented

* Nominal dimensions include installation dimensions and/or minimum gap.

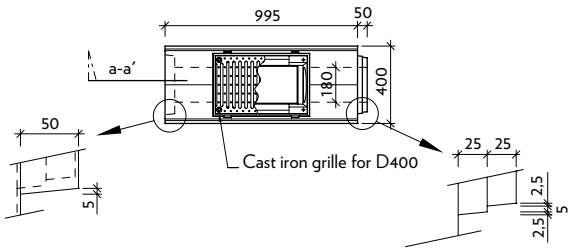
STAVBY JAKO Z KAMENE CSBETON®

CSB - SLOT DRAIN PROFILE T-1

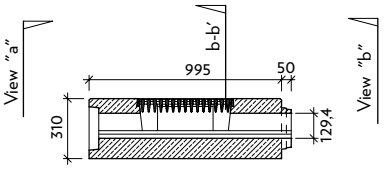
Protected by utility patent

T-1-C0 - Basic cleaning segment with cast iron grille for D400

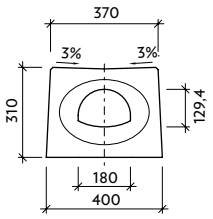
Plan



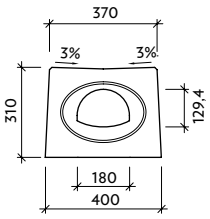
Cross-section: a-a' T-1-C0



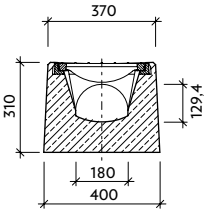
View "a" T-1-C0 -Socket



View "b" T-1-C0 - Spigot

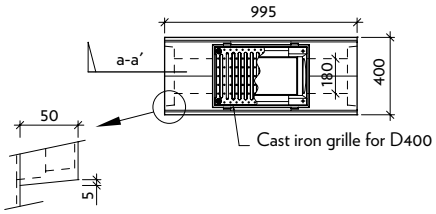


Cross-section: b-b' T-1-C0

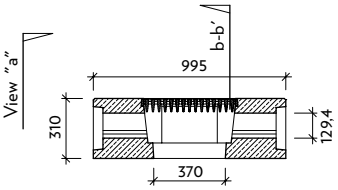


T-1-VU - Gutter gully assembly with cast iron grille for D400

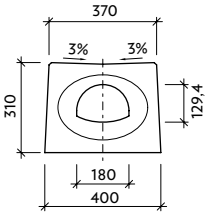
Plan



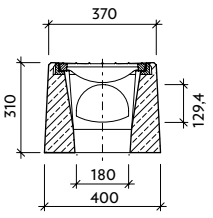
Cross-section: a-a' T-1-VU



View "a" T-1-VU - Socket/Socket



Cross-section: b-b' T-1-VU

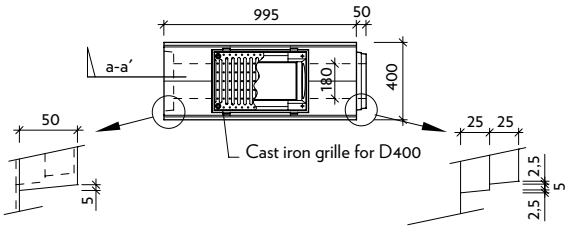


CSB - SLOT DRAIN PROFILE T-1

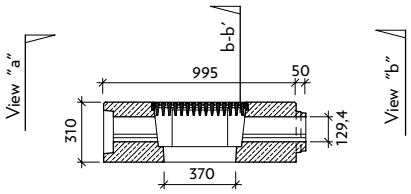
Protected by utility patent

T-1-V0 - Basic gully assembly with cast iron grille for D400

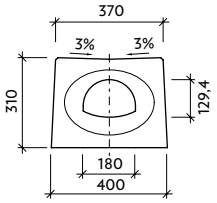
Plan



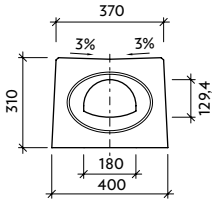
Cross-section: a-a' T-1-V0



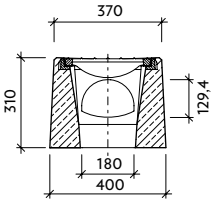
View "a" T-1-V0 -Socket



View "b" T-1-V0 - Spigot

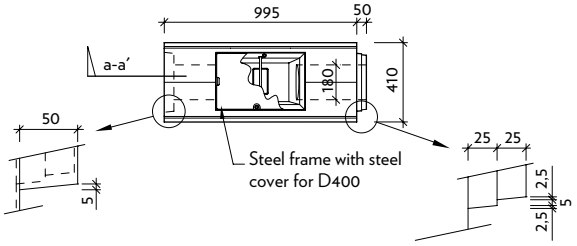


Cross-section: b-b' T-1-V0

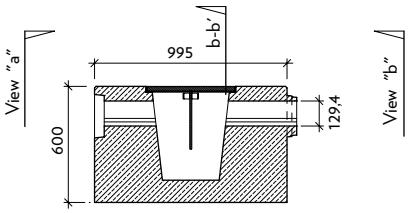


T-1-PP - Fire safety barrier with steel cover for D400

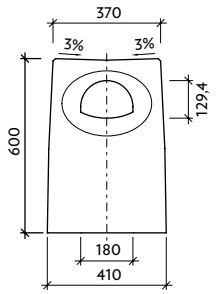
Plan



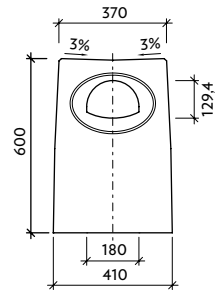
Cross-section: a-a' T-1-PP



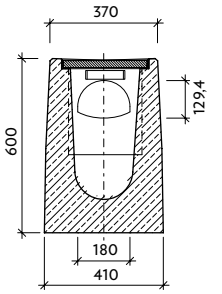
View "a" T-1-PP -Socket



View "b" T-1-PP - Spigot



Cross-section: b-b' T-1-PP



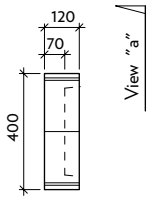
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE T-1

Protected by utility patent

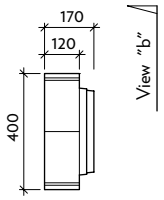
T-ZZ - Socket end cap

Plan

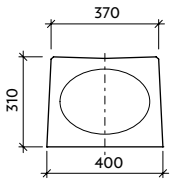


T-ZU - Spigot end cap

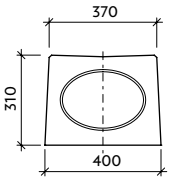
Plan



View "a" T-ZZ - Socket

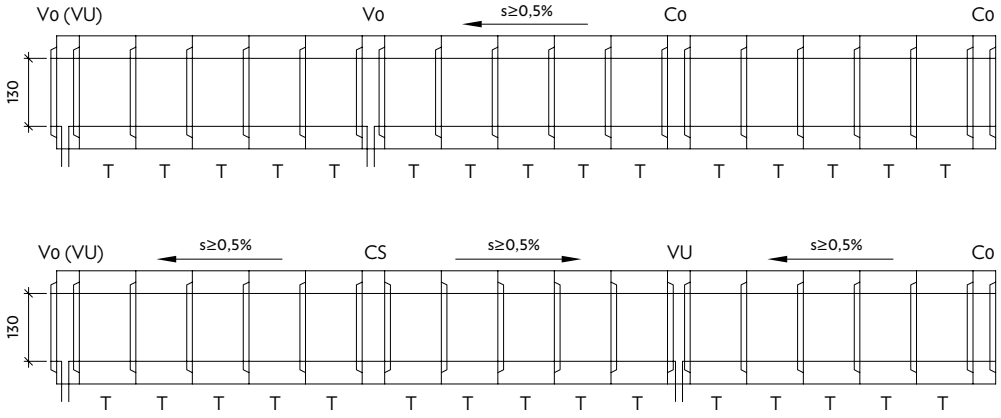


View "b" T-ZU - Spigot



Suggested layout

T-1-T Slot drains - layout



Gully and cleaning element codes

Vo – Basic gully, spigot/socket, 130 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 130 mm flow profile height at both ends

Co – Basic cleaning element, spigot/socket, 130 mm flow profile height at both ends

CS – Ridge cleaning element, spigot/spigot, 130 mm flow profile height at both ends

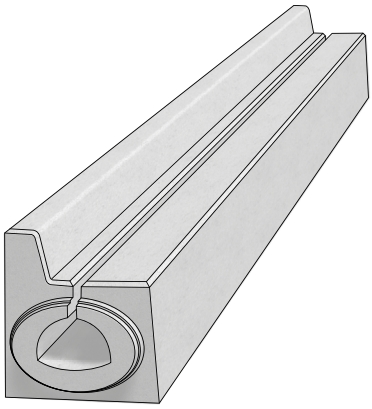
s – Longitudinal flow profile gradient

CSB - SLOT DRAIN PROFILE T-3

Protected by utility patent

Technical data:

Its flow profile places this slot drain between the micro-slot drains and the Profile I slot drains. T Profile slot drains are ideal for tunnels and surfaced areas with a minimum gradient of 0.5%. T profile slot drains are only available with no internal gradient. T profile slot drains are designed for D400 class traffic load. They are self-cleaning under higher flow rates.



The system consists of the following components:
- 4 m-long slot drain, without internal flow gradient
- Slot drain with a 12 cm kerbstone
- Exchangeable segment, T-3 profile with 12 cm kerbstone

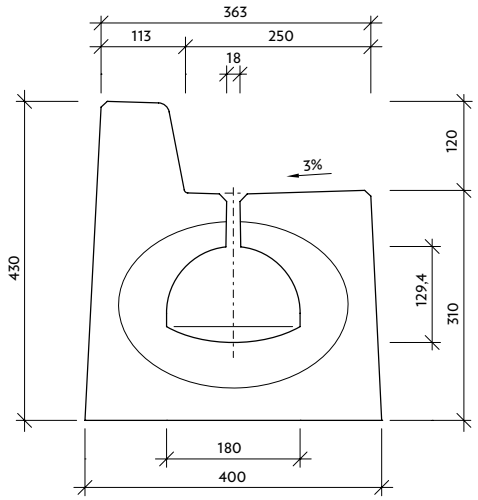
Accessories for all the above slot drains:
- Complete gully assembly, incl. cast iron grille and gully trap
- Complete gully assembly with steel cover for use in tunnels
- Cleaning segment incl. cast iron grille
- End cap

		Nominal dimensions mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**psc/m**	**psc**
Slot drain with continuous slot and 12 cm kerbstone	T-3	310/430	4000	370/400	0,25	1061
Basic gully assembly V0	T-3-V0	310/430	1000	370/400	1	266
Gutter gully assembly VU	T-3-VU	310/430	1000	370/400	1	257
Basic cleaning segment C0	T-3-C0	310/430	1000	370/400	1	264
Top cleaning segment CS	T-3-CS	310/430	1000	370/400	1	272
Fire safety barrier and 12 cm kerbstone	T-3-PP	600/720	1000	370/410	1	543
Slot drain with continuous slot and left 0-12 cm kerbstone	T-0-3-L	310/430	1000	370/400	1	277
Slot drain with continuous slot and left 12-0 cm kerbstone	T-3-0-L	310/430	1000	370/400	1	277
Slot drain with continuous slot and right 0-12 cm kerbstone	T-0-3-P	310/430	1000	370/400	1	277
Slot drain with continuous slot and right 12-0 cm kerbstone	T-3-0-P	310/430	1000	370/400	1	277
Special 12 cm kerbstone	T-3-O	150/270	2000	363/370	0,5	310
Special rising kerbstone, left 12-0 cm	T-3-O-NL	150/270	1000	363/370	1	142
Special rising kerbstone, right 0-12 cm	T-O-3-NP	150/270	1000	363/370	1	142
Spigot end cap, with 12 cm kerbstone	T-3-ZU	310/430	120	370/400	-	42
Socket end cap, with 12 cm kerbstone	T-3-ZZ	310/430	120	370/400	-	30
Slot drain with continuous slot – replaceable segment	T-3-V	310/430	-	363/400	-	-

Nominal dimensions - basic shapes:

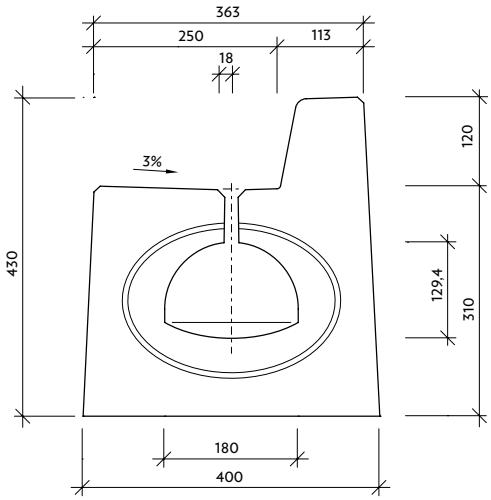
Side-view

Socket



Side-view

Spigot



All products comply with harmonised European Standards and are patented

* Nominal dimensions include installation dimensions and/or minimum gap.

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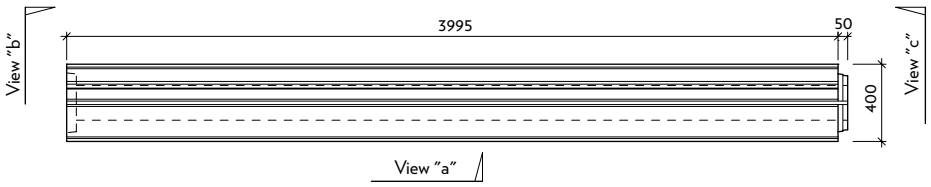
CSB - SLOT DRAIN PROFILE T-3

Protected by utility patent

T-3 - right - slot drain with 12 cm kerbstone

Plan

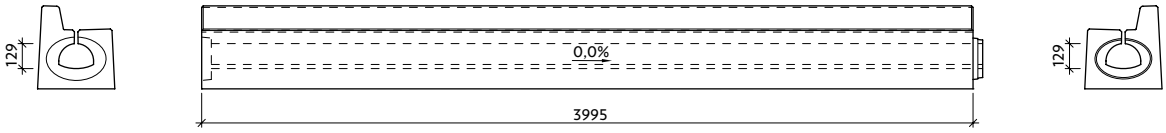


View "b" T-3 - Socket

View "a" T-3

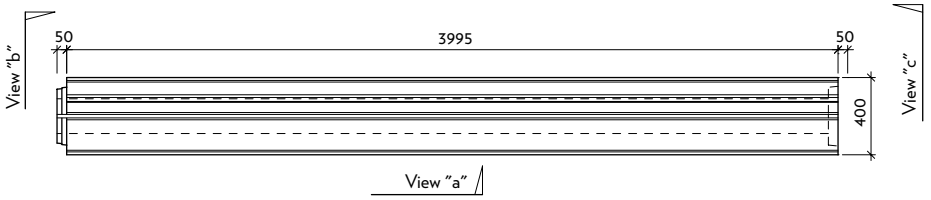
View "c" T-3 - Spigot

Profile T-3-T13/13 - without internal flow gradient



T-3 - left - slot drain with a 12 cm kerbstone

Plan

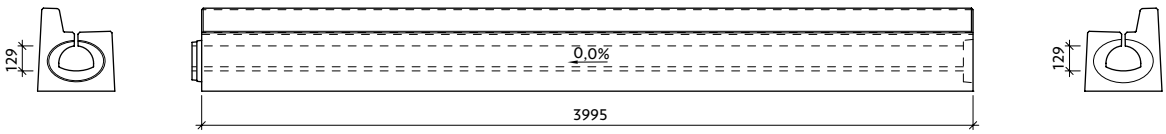


View "b" T-3 - Spigot

View "a"

View "c" T-3 - Socket

Profile T-3-T13/13 - without internal flow gradient

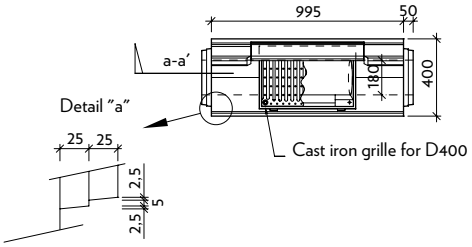


CSB - SLOT DRAIN PROFILE T-3

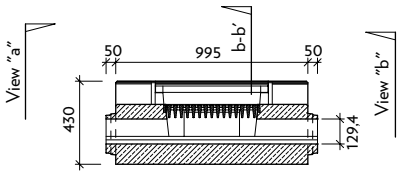
Protected by utility patent

T-3-CS - Top cleaning segment with cast iron grille for D400 and 12 cm kerbstone

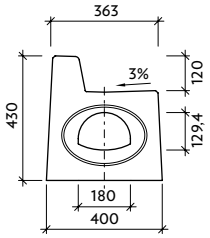
Plan



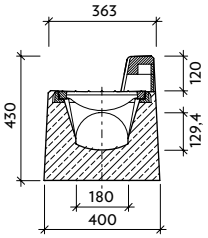
Cross-section: a-a´ T-3-CS



View "a" T-3-CS - Spigot/Spigot

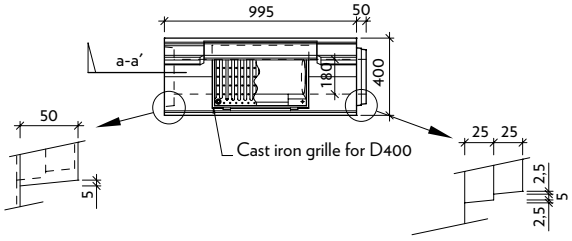


Cross-section: b-b´ T-3-CS

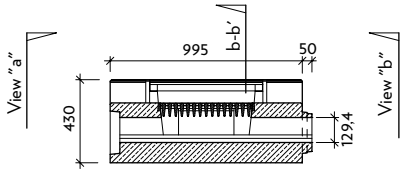


T-3-C0 - right - Basic cleaning segment with cast iron grille for D400 and 12 cm kerbstone

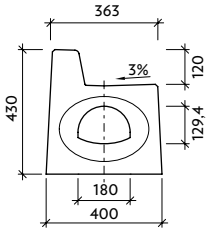
Plan



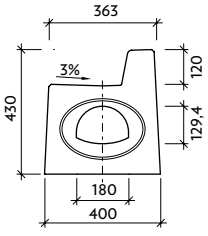
Cross-section: a-a´ T-3-C0



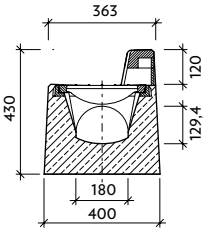
View "a" T-3-C0 - Socket



View "b" T-3-C0 - Spigot



Cross-section: b-b´ T-3-C0



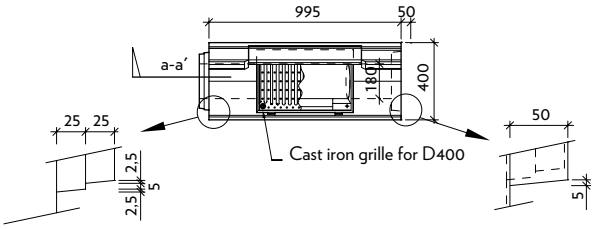
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE T-3

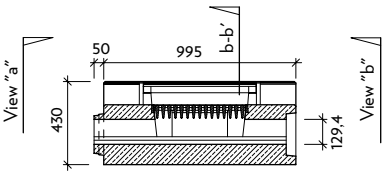
Protected by utility patent

T-3-C0 - left - Basic cleaning segment with cast iron grille for D400 and 12 cm kerbstone

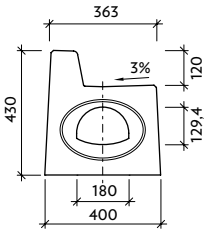
Plan



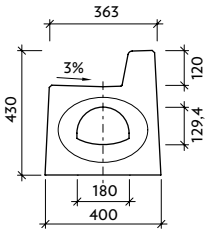
Cross-section: a-a' T-3-C0



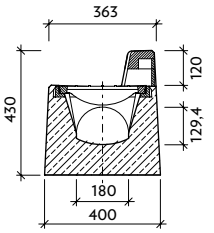
View "a" T-3-C0 - Spigot



View "b" T-3-C0 - Socket

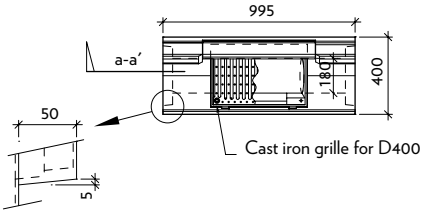


Cross-section: b-b' T-3-C0

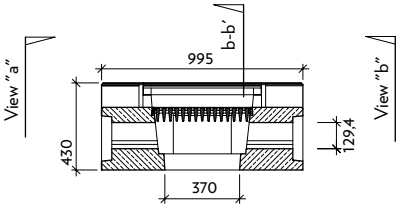


T-3-VU - Gutter gully assembly with cast iron grille for D400 and 12 cm kerbstone

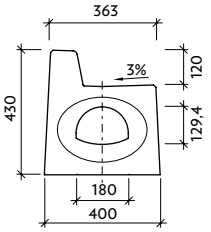
Plan



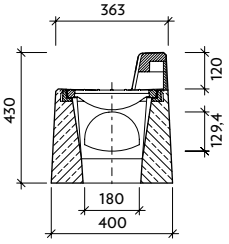
Cross-section: a-a' T-3-VU



View "a" T-3-VU - Socket/Socket



Cross-section: b-b' T-3-VU

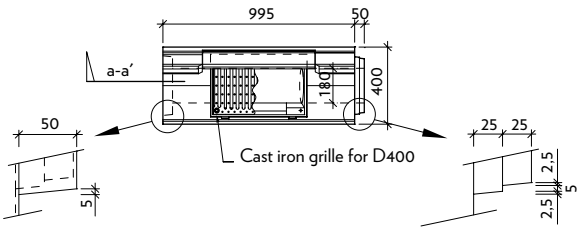


CSB - SLOT DRAIN PROFILE T-3

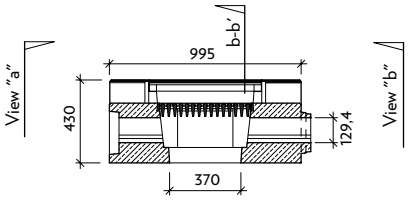
Protected by utility patent

T-3-V0 - right - Basic gully assembly with cast iron grille for D400 and 12 cm kerbstone

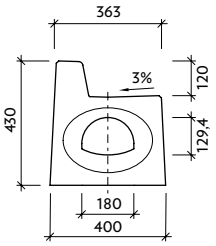
Plan



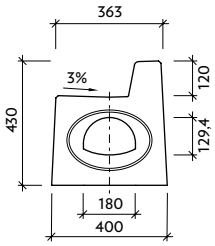
Cross-section: a-a' T-3-V0



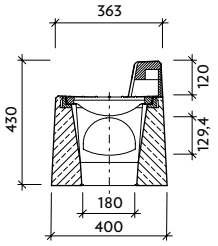
View "a" T-3-V0 - Socket



View "b" T-3-V0 - Spigot

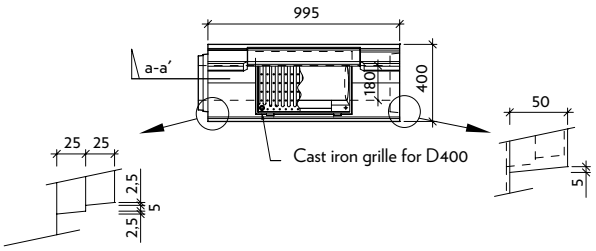


Cross-section: b-b' T-3-V0

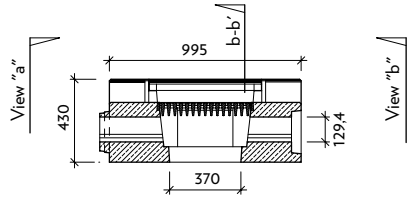


T-3-V0 - left - Basic gully assembly with cast iron grille for D400 and 12 cm kerbstone

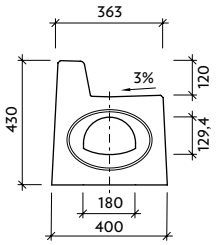
Plan



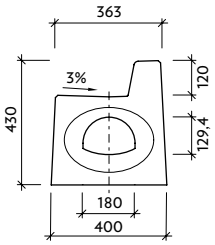
Cross-section: a-a' T-3-V0



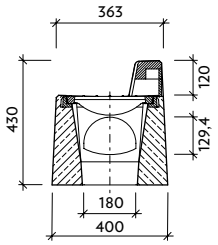
View "a" T-3-V0 - Spigot



View "b" T-3-V0 - Socket



Cross-section: b-b' T-3-V0



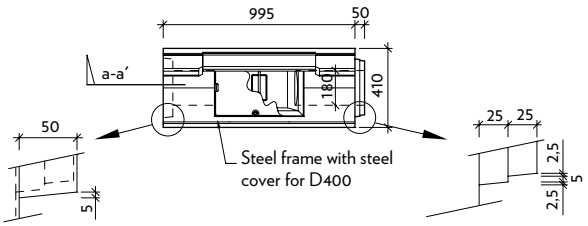
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE T-3

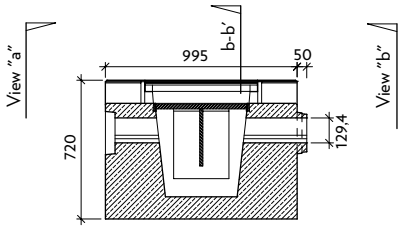
Protected by utility patent

T-3-PP - right - Fire safety barrier with steel cover for D400 and 12 cm kerbstone

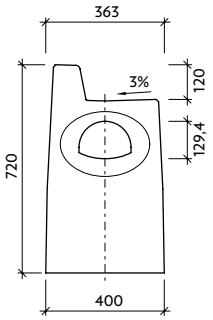
Plan



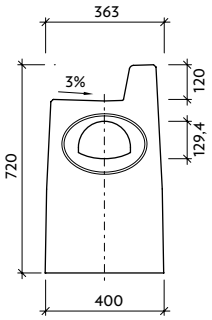
Cross-section: a-a' T-3-PP



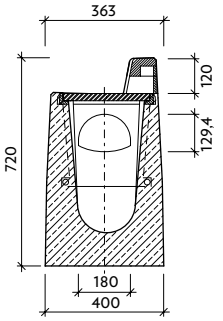
View "a" T-3-PP - Socket



View "b" T-3-PP - Spigot



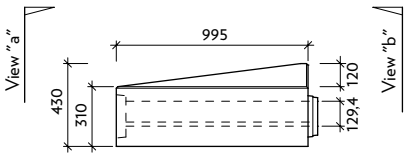
Cross-section: b-b' T-3-PP



T-0-3-P/T-3-0-P - right - Slot drain with 12 cm rising kerbstone

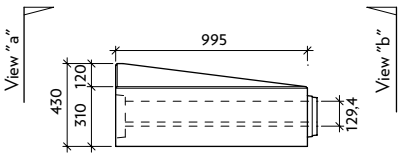
T-0-3-P - right - Slot drain with 0-12 cm rising kerbstone

Front view

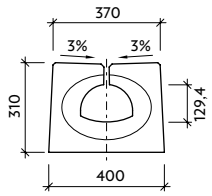


T-3-0-P right - Slot drain with 12-0 cm rising kerbstone

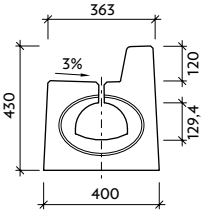
Front view



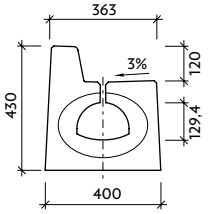
View "a" T-0-3-P - Socket



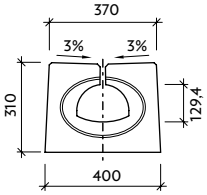
View "b" T-0-3-P - Spigot



View "a" T-3-0-P - Socket



View "b" T-3-0-P - Spigot



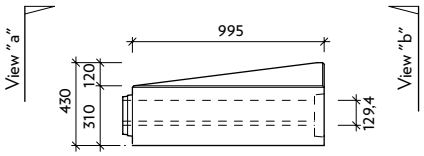
CSB - SLOT DRAIN PROFILE T-3

Protected by utility patent

T-0-3-L/T-3-0-L - left- Slot drain with 12 cm rising kerbstone

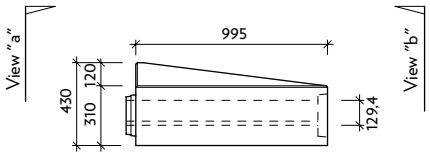
T-0-3-L - left - Slot drain with 0-12 cm rising kerbstone

Front view

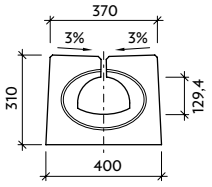


T-3-0-L - left - Slot drain with 12-0 cm rising kerbstone

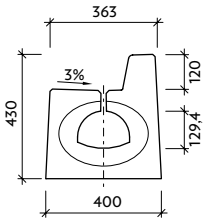
Front view



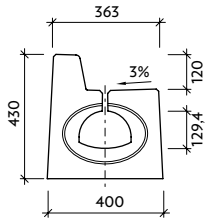
View "a" T-0-3-L - Spigot



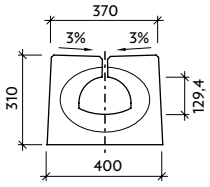
View "b" T-0-3-L - Socket



View "a" T-3-0-L - Spigot

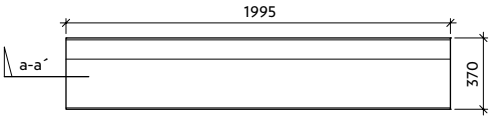


View "b" T-3-0-L - Socket

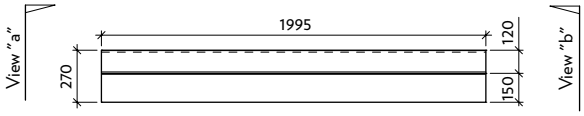


T-3-O - Special 12 cm kerbstone

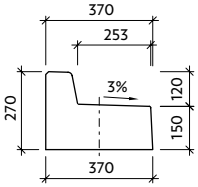
Plan



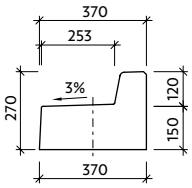
Cross-section: a-a´ T-3-O



View "a" T-3-O

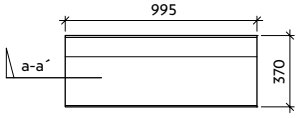


View "b" T-3-O

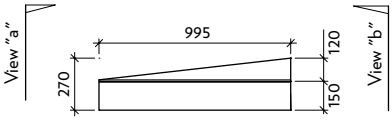


T-O-3-N2 - Special 12-0 cm rising kerbstone

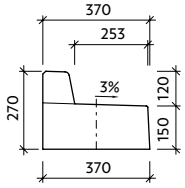
Plan



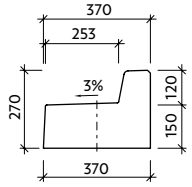
Cross-section: a-a´ T-O-3-N2



View "a" T-O-3-N2



View "b" T-O-3-N2



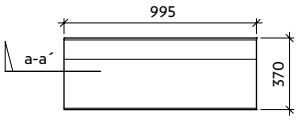
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE T-3

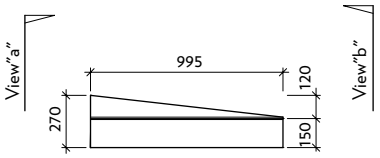
Protected by utility patent

T-3-O-N1 - Special 12-0 cm rising kerbstone

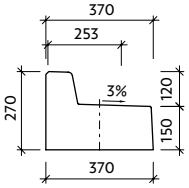
Plan



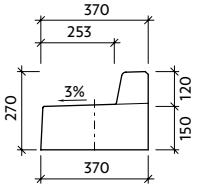
Cross-section: a-a´ T-3-O-N1



View"a" T-3-O-N1

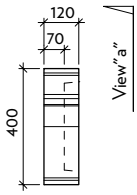


View"b" T-3-O-N1

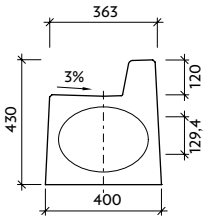


T-3-ZZ - Socket end cap - 12 cm kerbston

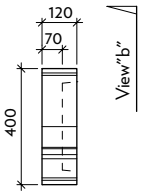
Plan T-3-ZZ left



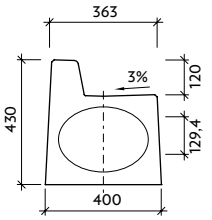
View"a" T-3-ZZ



Plan T-3-ZZ right

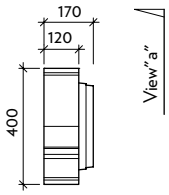


View"b" T-3-ZZ

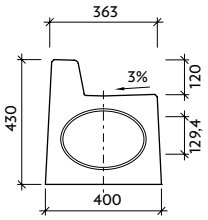


T-3-ZU - Spigot end cap with 12 cm kerbstone

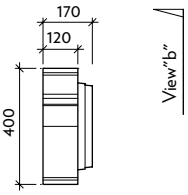
Plan T-3-ZU left



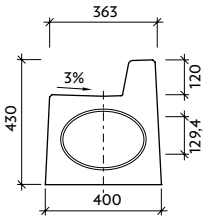
View"a" T-3-ZU



Plan T-3-ZU right



View"b" T-3-ZU

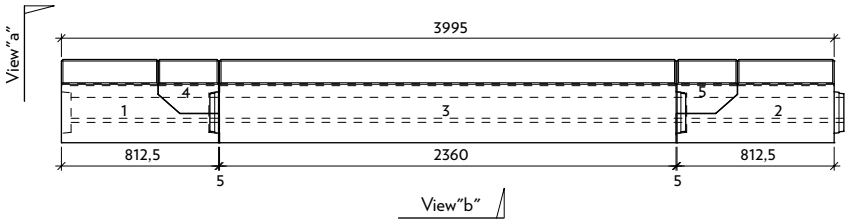


CSB - SLOT DRAIN PROFILE T-3

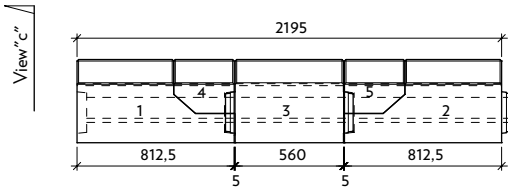
Patented

T-3-V - Slot drain with continuous slot – replaceable segment

Longest possible line



Shortest possible line



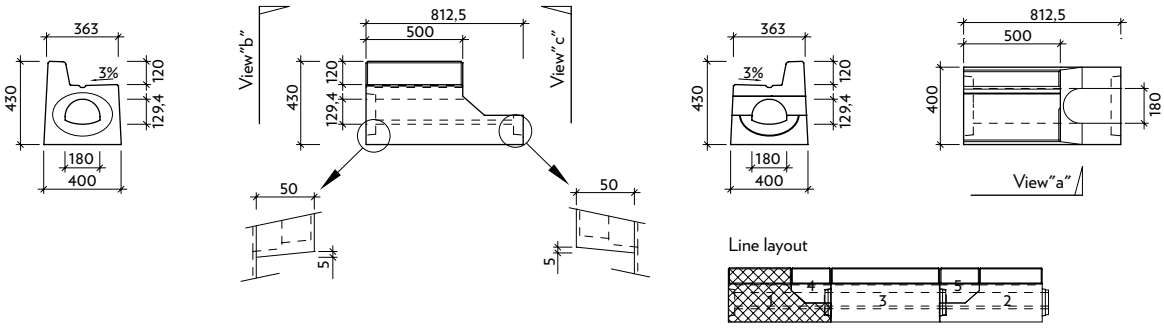
View"a" - Socket

View"b"

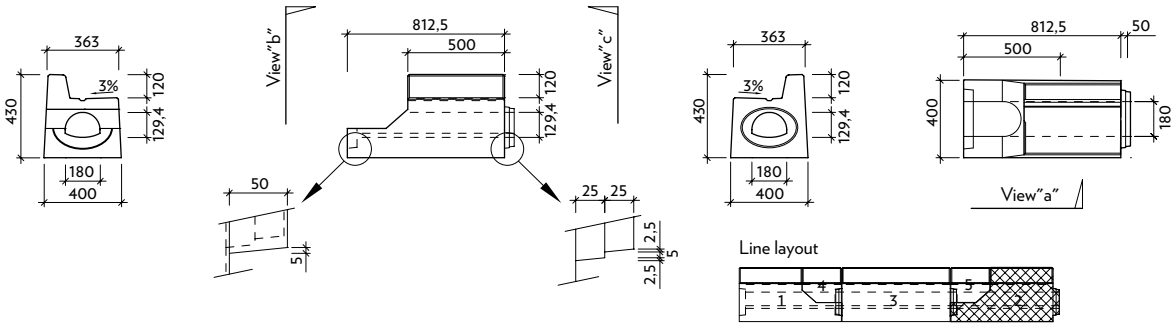
View"c" - Spigot

Plan

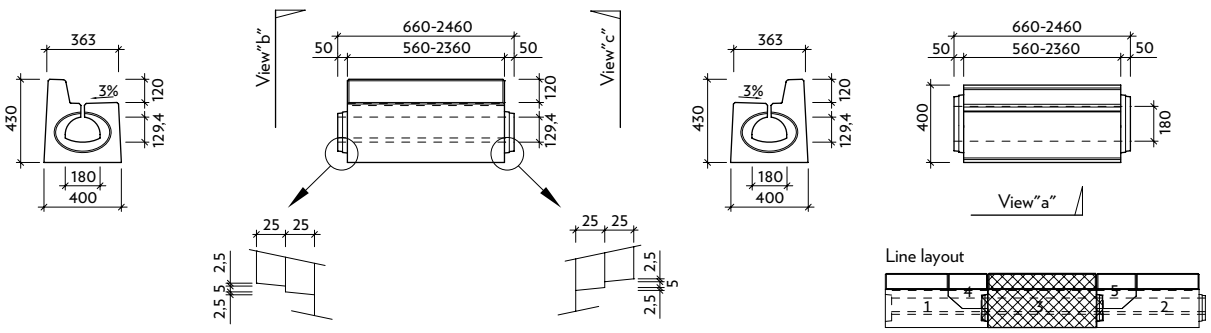
Segment 1.



Segment 2.



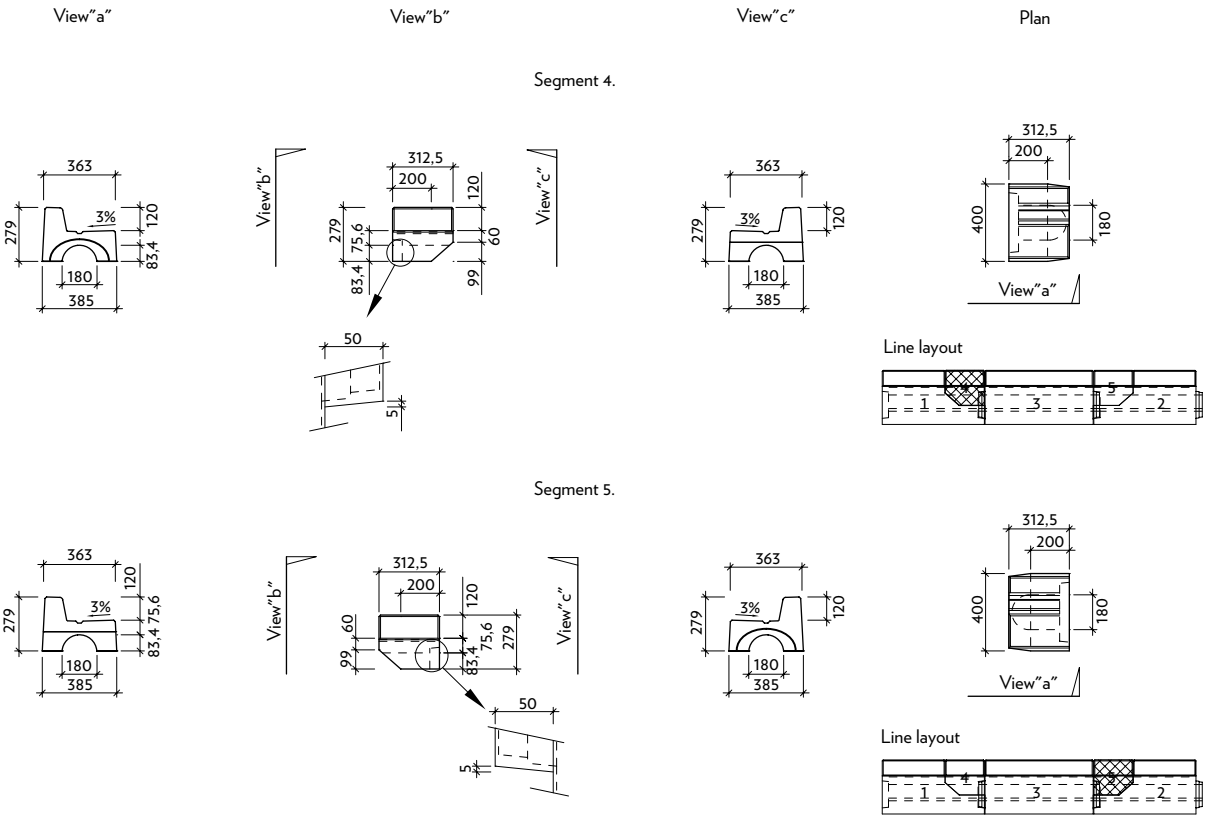
Segment 3.



* Nominal dimensions include installation dimensions and/or minimum gap.

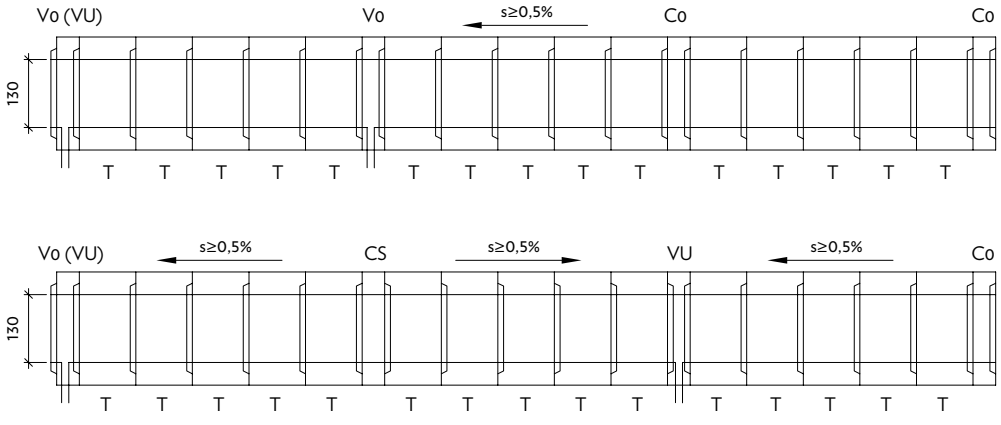
CSB - SLOT DRAIN PROFILE T-3

Patented



Suggested layout

T-3T Slot drains - layout



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 130 mm flow profile height at both ends
VU –Gutter gully, socket/socket, 130 mm flow profile height at both ends
C0 – Basic cleaning element, spigot/socket, 130 mm flow profile height at both ends
CS – Ridge cleaning element, spigot/spigot, 130 mm flow profile height at both ends
s – Longitudinal flow profile gradient

CSB - SLOT DRAIN PROFILE T

Basic gully segment with gully trap

Cross-section a-a´

Cast Iron Grille

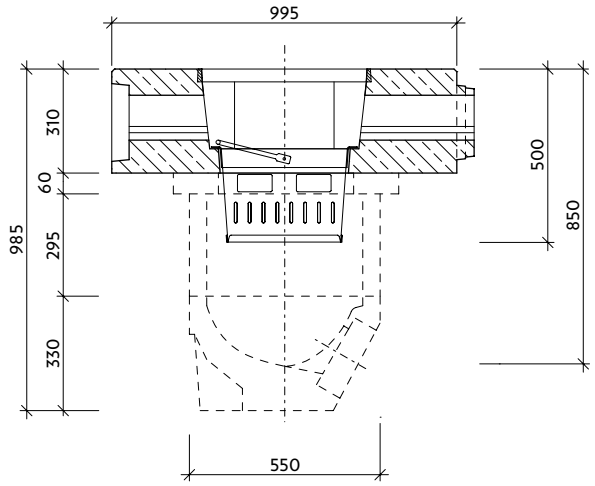
Basic gully assembly

Gully trap, short

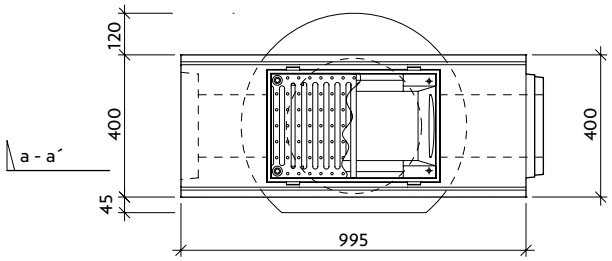
Street gully - 10a make up piece
TBV-Q 450/60/10A

Street gully TBV-Q 450/295/6a

Street gully 1a base slab TBV-Q 450/330/1a (DN150)
Street gully 1d base slabTBV-Q 450/330/1d (DN200)



Plan



* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE T

Product characteristics:

Its flow profile places this slot drain between micro-slot drains and Profile I slot drains. Slot drains are a modern, fast and efficient way of draining excess water from roads and surfaced areas. The system includes dedicated gully and cleaning segments.

Slot drains ensure efficient draining of excess water from surfaced areas even during extreme rainfall, its transport by means of high-capacity flow profile and removal to a storm sewer. This prevents aquaplaning from occurring and collects contaminated water from the road surface so that it does not come into contact with the surrounding environment. Even large capacity slot drains are relatively narrow, so they can be installed within a 0.5 m-wide soft shoulder. Thanks to large flow capacity and narrow flow profile, they are largely self-cleaning.

The slot drain system may be used to reduce the length of storm sewers and the number of its connectors and inlets.

T Profile slot drains are available with continuous and interrupted slots and with integrated 12 cm kerbstones. Slot drains with kerbstones are used on slower speeds roads and areas, where a division between the road and the pavement and/or shoulder is necessary.

T Profile components are designed for loads of up to 400 kN. The simple design and high-quality structural elements ensure long service life of drainage systems.

CS-BETON's slot drains and all the system components are made of high strength C 45/55 XF4 concrete as per ČSN EN 206-1. Efficient plasticiser and aeration admixtures and non-crystalline silicon dioxide (MICROSILICA) admixtures make our concrete extremely resistant to water and chemical defrosting agents. In European weather conditions the systems are not affected by frost.

The design of the slot drain elements allows for a perfect connection to the surrounding road surface. The weight of the slot drain segments (4 m segments weigh approximately 0.9 - 1.1 t) enables compacting of road structure layers in the immediate vicinity without the risk of the segments being moved sideways when suitable techniques such as vibration slabs are used. The slightly slanted side walls also help compacting and connection to the adjoining structures.

CS-BETON's slot drains include a proprietary two-ring AQUAFEST joint technology, which ensures perfect water tightness and resistance to oil residues and other aggressive substances. This prevents surrounding underground and surface waters from being contaminated. The rubber seal also creates an expansion joint between two adjoining drain segments.

The slot drains are manufactured in 4 m-long basic segments. Custom lengths (in 1 cm increments between 0.5 and 4.0 m) may also be supplied. Additional modifications are also possible upon request, such as surface modifications, side outlets, slanted ends, etc. Custom lengths and modified elements are more expensive and take longer to supply.

Installation of slot drains is relatively easy and fast when suitable equipment is used. Upon customer's request, CS-BETON will include a special handling and installation kit with the supply. Always follow manufacturer's installation instructions to ensure functional and long-lasting drainage systems.

A finished slot drain drainage system installed in a road surface is very durable and practically indestructible. It requires minimum maintenance, only cleaning of the flow profile when it becomes clogged. Cleaning and gully segments are provided for this purpose and should be installed at regular intervals. The gullies should be ideally spaced 40 m apart, in any case not more than 50 m. Regular maintenance of gullies is relatively easy. The only maintenance required is removal and emptying/cleaning of the gully traps.

The cast iron grilles on gullies and cleaning segments are secured against lift-off from the passing traffic.

Slot drains can be installed in curved layouts. The maximum directional angle between two adjacent segments is 3 degrees. This ensures watertight joints between the adjoining faces. This limitation suggests that 4 m segments could be used in curves down to a radius of R = 80 m and 2 m segments down to R = 40 m. We do not recommend this minimum value as the visible line of the slot segments appears too polygonal and compacting of adjacent road layers may damage the slot drain segments and joints. This means at least R = 160 m for 4 m segments.

In the overall context and given its reliability, safety and low operational cost, drainage systems using slot drains are more suitable and more economical than other systems in most cases. Slot drain systems are becoming more popular and some applications would be hard to solve without them.

CSB - SLOT DRAIN PROFILE T

Important information:

Slot drains are designed to collect water from surfaced areas, not from free terrain. Water from free terrain may be drained only in exceptional cases and in minimum quantities. However, blocking of the slot or the flow profile by stones and mud must always be prevented (rubble arresting benches, ditches, full lawn cover, more frequent maintenance, etc.). Installation of slot drain into minimum radius curves produces polygonal shapes. During compacting next to such shapes, compacting very closely to the segments must be ensured without any damage or movement to the segments must be ensured. Vibration slabs are recommended.

During installation, gullies must be precisely located in both transversal and longitudinal direction, because the micro-slot segments' length cannot be altered in situ. The nominal length of basic 4 m segments with the rubber seal is 4,000 mm.

The openings at the beginning and end of the line must be closed and sealed using end caps supplied by CS-BETON.

CAUTION!

The „Important information" above includes only a few general rules for installing micro-slot draining systems.

Use the hydraulic calculation provided below to evaluate the flow capacity of M-series slot drain systems.

CS-BETON provides consulting services to designers and architects using micro-slot drain solutions. We will evaluate your preliminary design in the context of the overall technical solution of the roads, surfaced areas and rainwater drainage of your project. We will confirm the proposed drainage solution, or recommend changes and specify recommended elements and their location within the system, including a recapitulation/BoQ for ordering purposes, along with list prices and the total price. All the above services are provided free of charge as a courtesy to our clients.

CS-BETON s.r.o. is not the responsible designer of your project's documentation or its part. According to Section 159 of the Act no. 183/2006 Coll, the designer is responsible for the correct selection of products specified in project documentation based on guaranteed properties of individual products detailed in product property certificates.

When installing the M-line micro-slot drains by CS-BETON, always follow the manufacturer's installation recommendations!

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE T

Hydraulic calculation:

1. Introduction
The T-series of slot drain systems is suitable for smaller areas such as courtyards, service stations, etc. and wherever manual handling during installation is preferable.

2. Initial assumptions
The hydraulic design of a T-slot system must always be based on the individual conditions at the given site, i.e. hydrogeology information, size, type and location of the catchment area. The capacity of the drainage system must then be calculated to reflect these conditions.

2.1 Geometrical characteristics
T Profile slot drains are made without internal gradient only and with a 18 mm-wide slots. The system also includes cleaning and gully segments. This type of slot drain does not have a fixed maximum length of one line - individual parameters depend on the site conditions (slopes etc.). The distance between the beginning/end of the line and the first cleaning and/or gully segment should not exceed 6 m so that simple cleaning and maintenance is possible. Distances between individual cleaning{gully segments depend on the maintenance and cleaning intervals. According to TP 152, the maximum distance is 50 m. The individual segments have a semicircular cross-section with an upper radius of 90 mm, lower radius of 200 mm and a 18 x 180 mm rectangle in between.

2.2 Hydrology information
For the hydraulic design of slot drain systems, the most important input parameter is the design rainfall volume, which is used to arrive to the total drained volume and the necessary number of gully segments. The design rainfall volume may be obtained, for instance, from the „Intenzity krátkodobých dešťů v povodích Labe, Odry a Moravy" (Josef Trupl) Table [1], or by ordering the information from the relevant Hydrometeorology Institute branch. Generally speaking, for M Profile slot drain systems, ČSN 75 6101 (Stokové sítě a kanalizační přípojky) [2] specifies 15-minute rainfall with periodicity as per the type of area as the critical parameter. The same parameter is then used for the design of the storm sewer.

2.3 Terrain location
For the most economical system, the slot drains should be located on the catchment area so that their capacity is used to maximum and the number of storm sewer connections is minimal. The ideal scenario is slot drains in the lowest part of the area and a sufficient gradient sloping toward that part. For T Profile slot drain systems, the slope in the longitudinal direction must be at least 5 ‰. The draining capacity of course depends on the slope of the line.
Nomographic chart 1 below lists the flow capacity of slot drains and the flow rate for that capacity in relation to the longitudinal gradient. The total capacity of the system must correspond to the catchment area and the design rainfall as per above. The intensity of the design rainfall is reduced as per [2] using a recommended draining coefficient, which depends on type of structures present, type of site and its sloping.

2.4 Connection to the storm sewer
Connections to storm sewer are installed in shafts provided under gully segments with a DN 150 or DN 200 connector. The gully segments include support surfaces for gully traps to protect the sewer connector from being blocked by debris.

3. Capacity flow through T Profile slot drains
Calculation of the capacity of this system is based on the „Hydraulické tabulky stok" (Hydraulic tables: Sewage conduits by J. Herle, O. Štefan, J. Turi Nagy) [3]. The same method is also used to design sewage conduits. The roughness coefficient was assumed at n = 0.014 and velocity coefficient c was calculated as per Pavlovský. Our calculations do not assume (given the usual longitudinal sloping of up to 35 ‰) any aeration within the flow. The capacity itself was then calculated using the Chezy formula for gradients of 5 to 100 ‰ and the results were plotted in nomogram 1. The nomogram also shows flow speeds for the given flow rates. The calculation was only performed for M and T profiles, i.e. with constant cross-section, because with such systems, variable distances between gully segments are used depending on the size of the area drained. A 20 m-long line of slot drains is capable (theoretically, see Chapter 5) of draining an area of approximately 1,245 sq. m, i.e. a 10 m-wide road segment 124.5 m long, which is sufficient for most applications. As far as the DN 150 gully connectors are concerned, their capacity must be evaluated at critical points, see Literature [3]. To prevent blocking by debris, all connectors should have a gradient of at least 20 ‰. With smaller gradients of the slot drain lines, the connector capacity may become the limiting factor for the whole system and larger connector diameters and/or gradients are recommended.

4. Hydraulic calculation example

This hydraulic calculation is based on theoretical input information. This specifies an application example involving Profile T slot drains and a motorway with a constant longitudinal gradient of 10 ‰. The road is in an area for which the hydrographical information is taken from data provided by the Roudnice nad Labem meteorological station. The segment which uses slot drains has a width of 12 m and a length of 100 m. The slot drains are installed at the edge of the road. The line includes one gully segment at the bottom end. The limiting parameter for the slot drain line is its cross--section at the bottom end. The road has a transversal gradient toward the slot drains of 25 ‰ and has a bitumen surface. Design rainfall intensity for T = 15 minutes and periodicity p = 1 is:

I_{NAV} = 112 [l/s.ha]

the run-off coefficient is:

φ = 0,80

the drained area is:

F = 12 x 100 x 0,0001 [ha] = 0,12 [ha]

after reduction by coefficient c = 0,80 the drained area is:

F_{RED} = φ x F [ha] = 0,80 x 0,120 = 0,096 [ha]

The design flow Q_{NAV} is:

$Q_{NAV} = F_{RED} \times I_{NAV}$ [l/s]
Q_{NAV} = 0,096 x 112
Q_{NAV} = 10,75 [l/s]

After comparing this value to the capacity of the slot drain from nomogram 1 for the gradient of 10‰, it is clear that:

Q_{KAP} = 16,01 [l/s] > Q_{NAV} = 10,75 [l/s]

Cleaning segments also have to be provided, with maximum spacing of 50 m.

CSB - SLOT DRAIN PROFILE T

Nomograms:

1. Nomograms for preliminary design of drainage systems
For reference design of M-profile draining systems, some calculation assumptions may be simplified. The average rainfall intensity for 15 minute rainfalls and periodicity of p = 1 for the Czech Republic (Labe basin) is:

$$I_{OR} = 122 \text{ [l/s.ha]}$$

Since these slot-drains will not be used to drain water from unsurfaced areas, the average run-off coefficient c as per [2] is:

$$\varphi = 0{,}80$$

which is correct for concrete/bitumen surfaces with a gradient between 10 and 50 ‰. With these specifications, the following nominal run-off may be assumed:

per 1 sq m of drained area:

$$Q_{OR} = 1 \times 1 \times 0{,}0001 \times 0{,}8 \times 122 = 0{,}00976 \text{ [l/s]}$$

per 1 are, i.e. 100 sq. m:

$$Q_{OR} = 10 \times 10 \times 0{,}0001 \times 0{,}8 \times 122 = 0{,}976 \text{ [l/s]}$$

per 1 hectare, i.e. 10,000 sq. m:

$$Q_{OR} = 100 \times 100 \times 0{,}0001 \times 0{,}8 \times 122 = 97{,}6 \text{ [l/s]}$$

The relationship between design run-off and the drained area is shown in nomogram 2. for areas of 500 to 5000 sq m.

A comparison of the calculated run-off as per nomogram 2 with the capacity of the slot drain at the given gradient from nomogram 1 gives us enough information to specify the number of gully segments and to optimise the layout of the slot drain system.

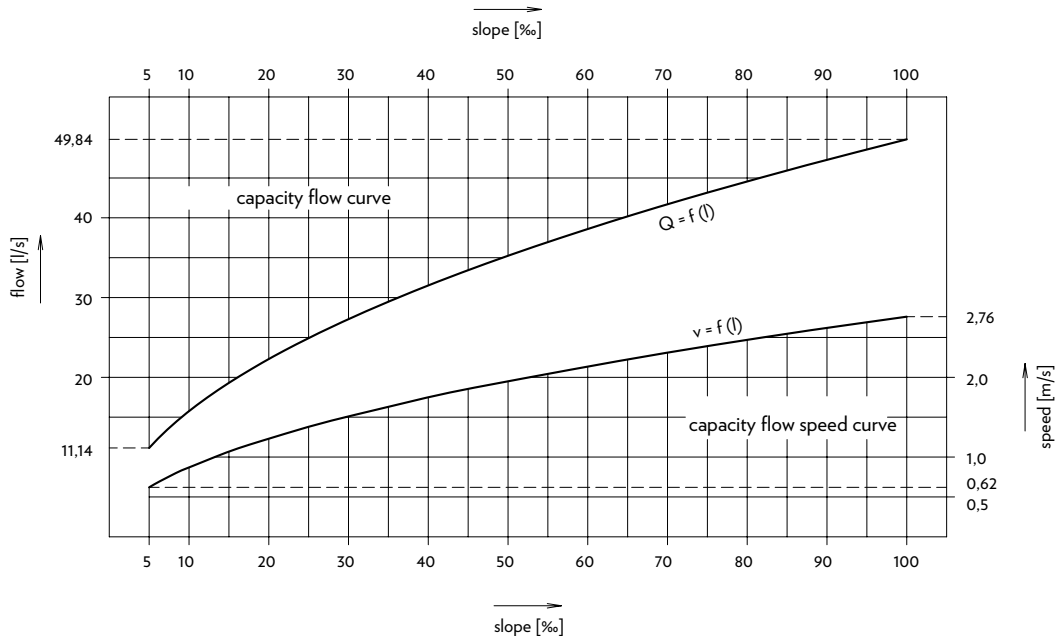
6. Gully trap
Each gully contains two gully traps, which protect the storm sewer connections from being blocked by debris. The TP 152 recommends a distance between gully segments in a line of T Profile slot drains of 30 to 50m, depending on the characteristics of the adjacent surfaced area.

The gully traps have several rows of narrow rectangular openings. The gully trap has a height of 275 mm and a rectangular base of 325 x 145 mm. The shape is conical and fits the support elements within the gully segment. Filling openings are provided at the top of the narrower sides. The upper sides of the trap are 420 mm and 190 mm and a number of draining slots is provided below the filling openings. Every gully trap includes a holding rod for easy handling. Gully traps are made of 1.25 mm thick galvanised steel sheeting. The maximum flow rate through a gully trap is 40.4 l/s.

CSB - SLOT DRAIN PROFILE T

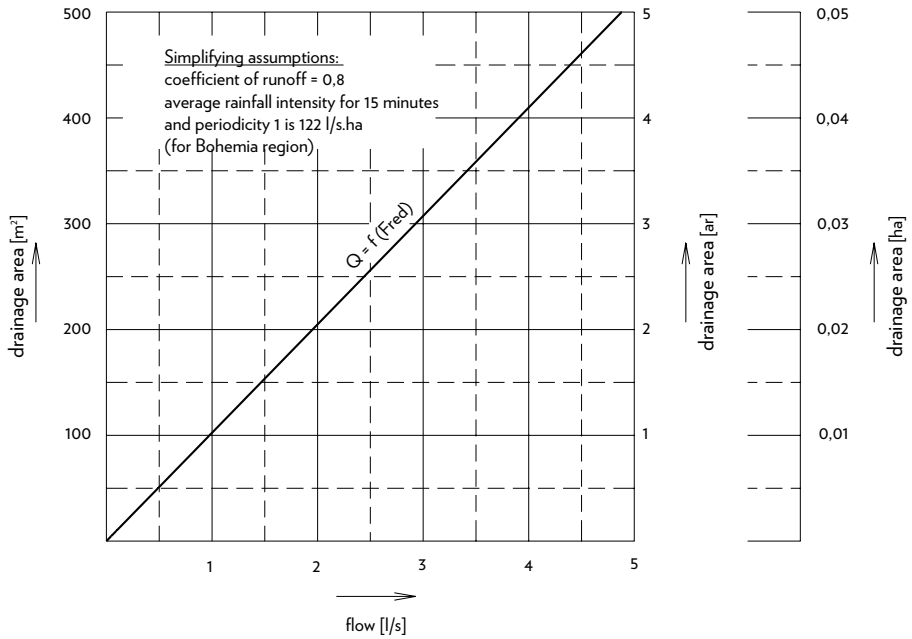
NOMOGRAM No. 1

CAPACITY OF SLOT CHANNELS (roughness coefficient n = 0,014 - by Pavlovsky)
PROFILE "T"



NOMOGRAM No. 2

Determination of surface runoff from 500 to 5000 m²



* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE T

Input data:

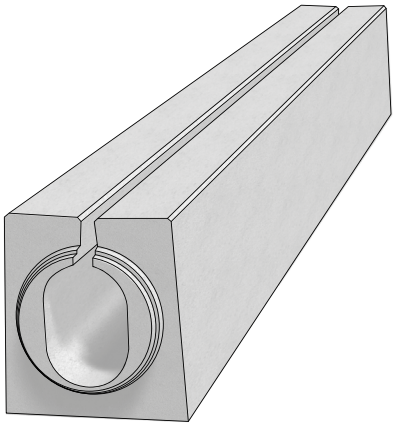
The following literature has been used in designing the drainage system described in this brochure:

ČSN EN 1433 Odvodňovací žlábky pro dopravní a pěší plochy - konstrukční zásady zkoušení, označování, řízení jakosti
ČSN EN 206 Beton - specifikace, vlastnosti, výroba a shoda
DIN 19 580 Entwässerungsrinnen für Niederschlagswasserzum Einbau in Verkehrsflächen
ČSN 73 6056 Odstavné a parkovací plochy silničních vozidel
ČSN 73 6059 Servisy a opravny motorových vozidel. Čerpací stanice pohonných hmot
ČSN 73 6101 Projektování silnic a dálnic
ČSN 73 6110 Projektování místních komunikací
ČSN 73 6114 Vozovky pozemních komunikací
ČSN 75 6101 Stokové sítě a kanalizační přípojky
ČSN EN 124 Poklopy a vtokové mříže pro dopravní plochy
Vzorové listy staveb pozemních komunikací VL-1 Vozovky a krajnice, Ministry of Transport of the Czech republic, Dopravoprojekt
Vzorové listy staveb pozemních komunikací VL-2.2 Odvodnění, Ministry of Transport of the Czech republic, Dopravoprojekt
TKP 1 - Všeobecně
TKP 18 - betonové konstrukce (vč. 10 příloh)
TKP 31 - opravy betonových konstrukcí
TP 152 - Štěrbinové žlaby na PK, 2001, VPÚ-DECO
TP 170 - Navrhování vozovek PK (všeobecná část, katalog, návrhová metoda), 2004, VTU, Roadconsult
Technical documentation by CS-BETON Velké Žernoseky + VPÚ DECO 96-04
Company standard 7/99 Micro-slot drains as per DIN 19580, CSB
TPV 2/99 - Technologický předpis na montáž mikroštěrbinových trub, CSB
TPV 1/98 - Technologický předpis na opravy betonových prvků odvodňovacích systémů štěrbinových trub, CSB

CSB - SLOT DRAIN PROFILE I-0

Protected by utility patent

Technical data:



Profile I slot drains are suitable for draining rainwater contaminated with small quantities of oil products (drips) from surfaced areas such as high-capacity traffic structures (motorways, dual carriageways, main roads, tunnels, runways, lay-bys, large parking lots, etc.). Profile I-1 slot drains are designed for D400, E600 and F900 class traffic loads and transversal vehicle travel. Profile I-0 slot drains and slot drains with kerbstones are designed for D400 class traffic load and no transversal vehicle travel.

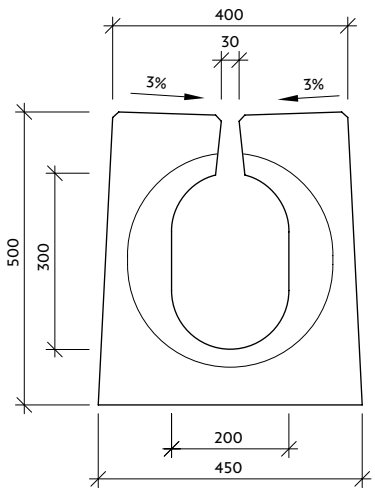
The system consists of the following components:
- 4 m-long slot drain, with or without internal flow gradient
- Slot drains with a 7/12/15/18 cm kerbstone
- Curved slot drain
- Exchangeable segment, I-0, I-I profile

Accessories for all the above slot drains:
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Complete gully assembly with steel cover for use in tunnels
- Cleaning segment incl. plastic cover/cast iron grille
- End cap

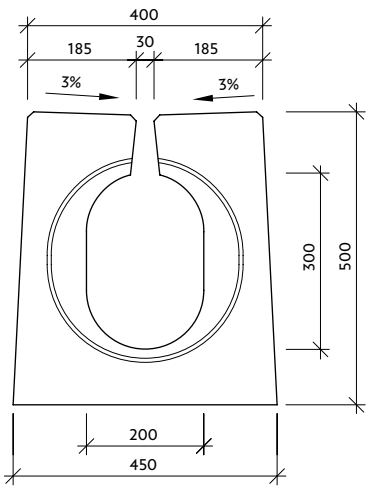
		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**kg/pcs**
Slot drain with continuous slot	I-0	500	4000	400/450	0,25	1496
Slot drain with continuous slot, 0.5% flow profile bottom gradient	I-0-G	500	4000	400/450	0,25	1515 - 1688
Basic gully assembly V0	I-0-V0	500	1000	400/450	1	347
Gutter gully assembly VU	I-0-VU	500	1000	400/450	1	338
Basic cleaning segment C0	I-0-C0	500	1000	400/450	1	394
Top cleaning segment CS	I-0-CS	500	1000	400/450	1	442
Fire safety barrier	I-0-PP	950	2000	400/495	0,5	1540
Slot drain with continuous slot – replaceable segment	I-0-V	500	2100-4000	400/450	-	823-1688
Spigot end cap	I-0-ZU	500	120	400/450	-	76
Socket end cap	I-0-ZZ	500	120	400/450	-	51

Nominal dimensions - basic shapes:

Side-view
Socket



Side-view
Spigot



All products comply with harmonised European Standards and are patented

* Nominal dimensions include installation dimensions and/or minimum gap.

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CSB - SLOT DRAIN PROFILE I-0

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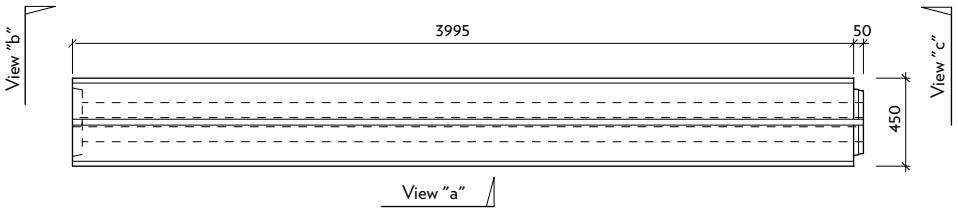
Profile I-0 - Slot drain

Plan

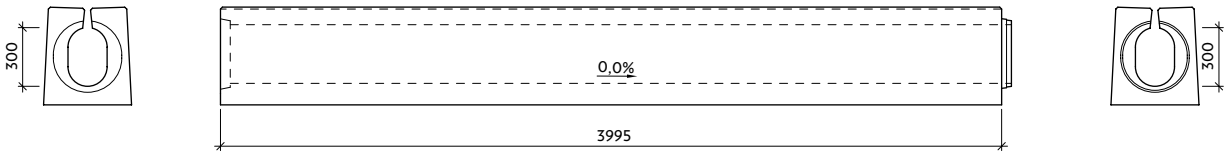


View "b" I-0 - Socket

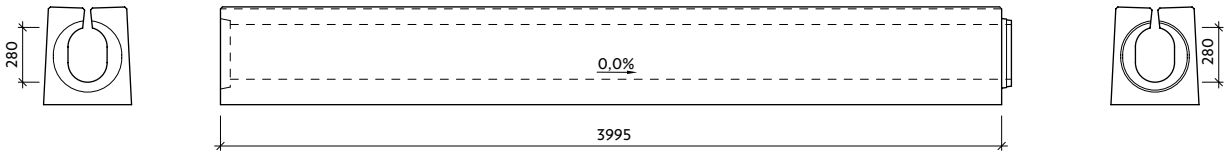
View "a"

View "c" I-0 - Spigot

Profile I-0-T30/30 - without internal flow gradient

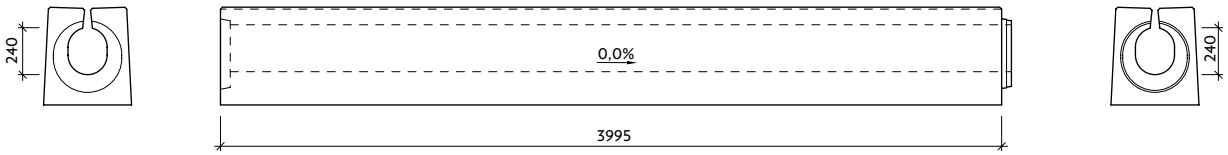


Profile I-0-T28/28 - without internal flow gradient

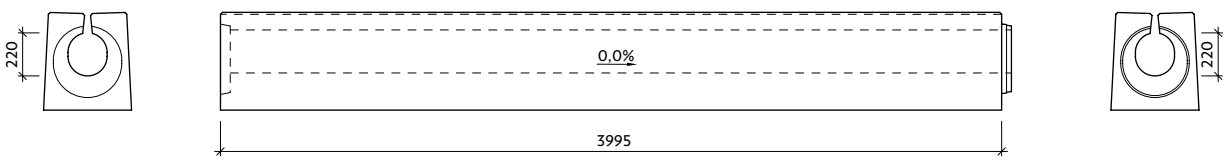


Profile I-0-T26/26 - without internal flow gradient

Profile I-0-T24/24 - without internal flow gradient



Profile I-0-T22/22 - without internal flow gradient

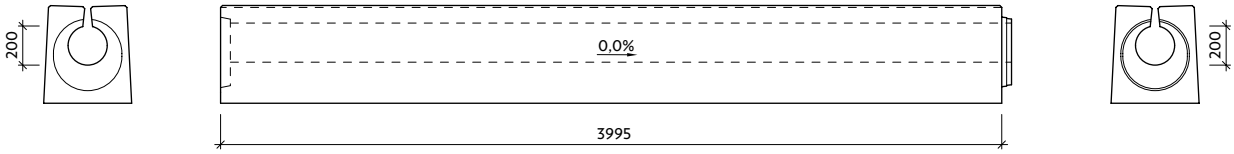


CSB - SLOT DRAIN PROFILE I-0

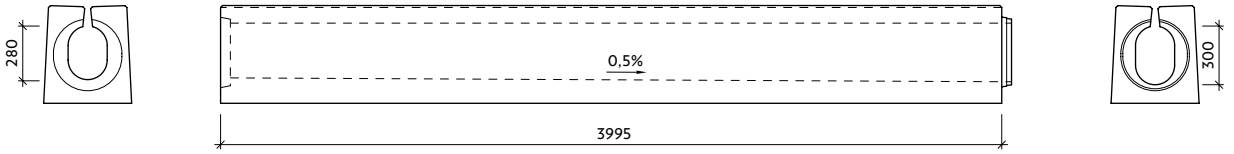
Protected by utility patent

View "b" I-0 - Socket | View "a" | View "c" I-0 - Spigot

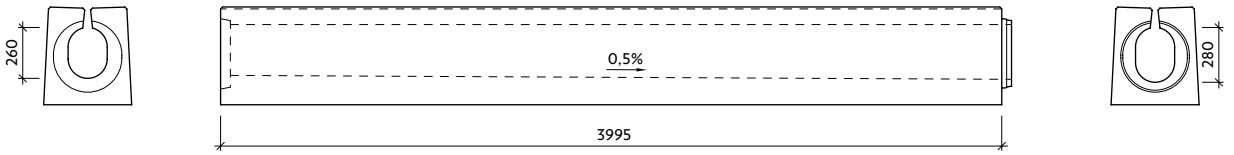
Profile I-0-T20/20 - without internal flow gradient



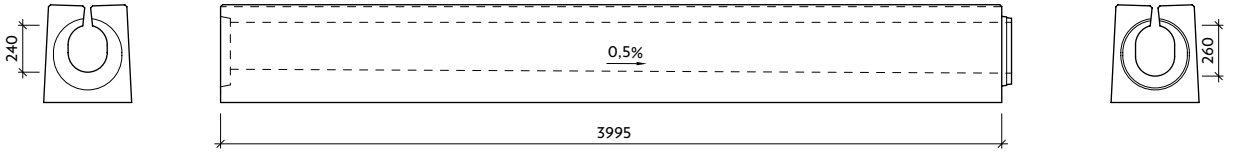
Profile I-0-G28/30 - 0.5% flow profile bottom gradient



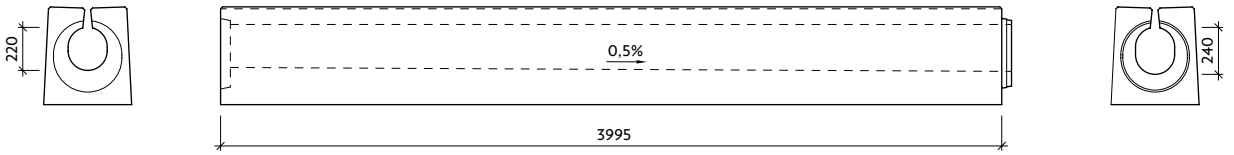
Profile I-0-G26/28 - 0.5% flow profile bottom gradient



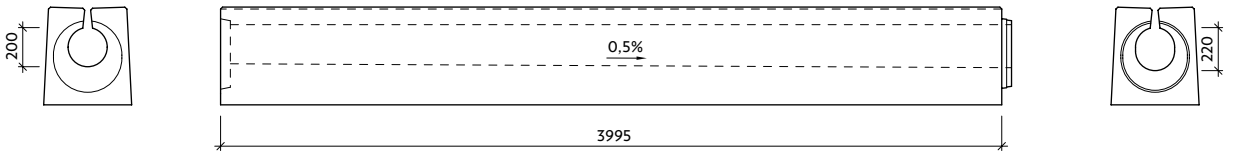
Profile I-0-G24/26 - 0.5% flow profile bottom gradient



Profile I-0-G22/24 - 0.5% flow profile bottom gradient



Profile I-0-G20/22 - 0.5% flow profile bottom gradient



* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-0

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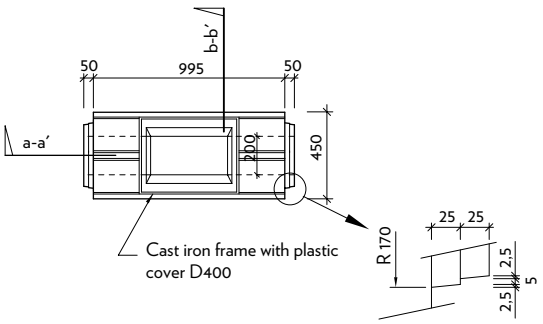
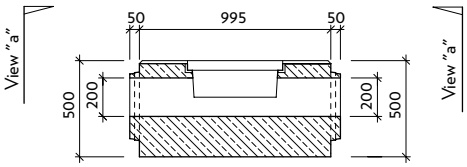
I-0-CS - Top cleaning segment with cast iron frame and plastic cover for D400

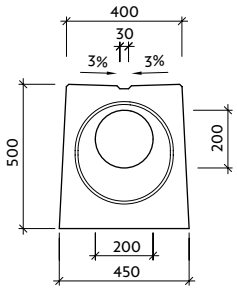
Plan



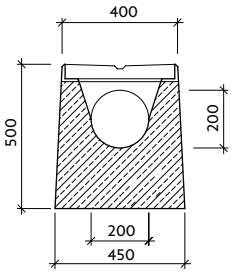
Cross-section: a-a´ I-0-CS



View "a" I-0-CS - Spigot/Spigot

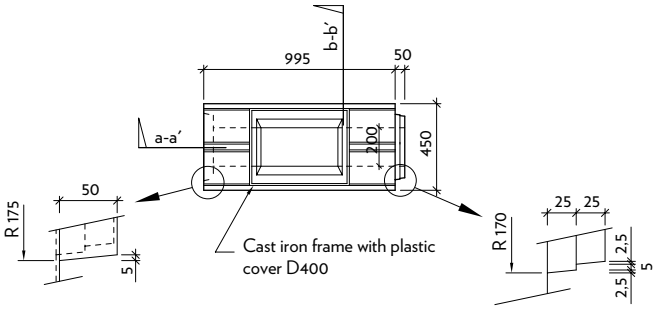


Cross-section: b-b´ I-0-CS

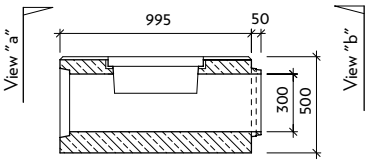


I-0-C0 - Basic cleaning segment with cast iron frame and plastic cover for D400

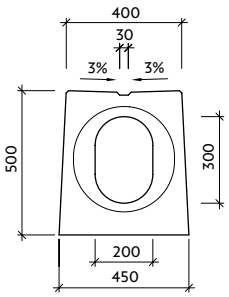
Plan



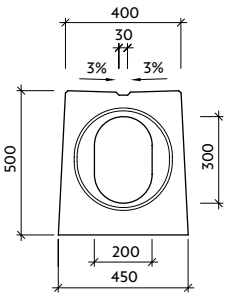
Cross-section: a-a´ I-0-C0



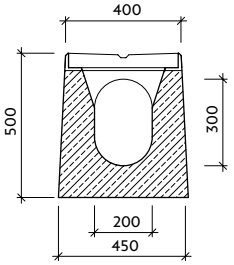
View "a" I-0-C0 - Socket



View "b" I-0-C0 - Spigot



Cross-section: b-b´ I-0-C0

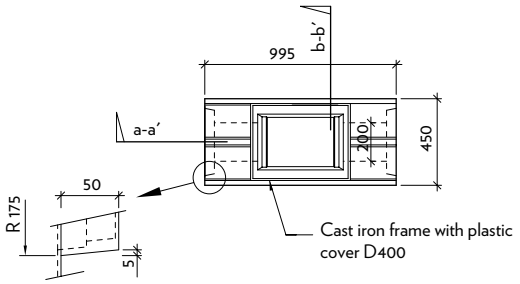


CSB - SLOT DRAIN PROFILE I-0

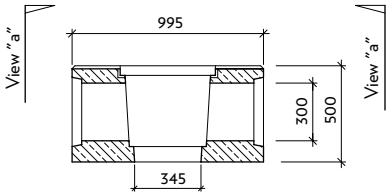
Protected by utility patent

I-0-VU - Gutter gully assembly with cast iron frame and plastic cover for D400

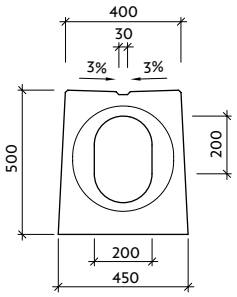
Plan



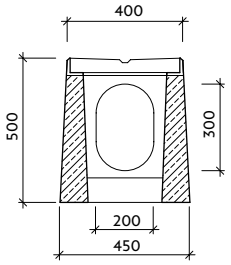
Cross-section: a-a´ I-0-VU



View "a" I-0-VU - Socket/Socket

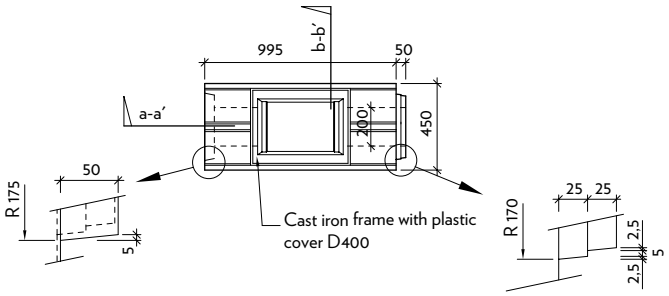


Cross-section: b-b´ I-0-VU

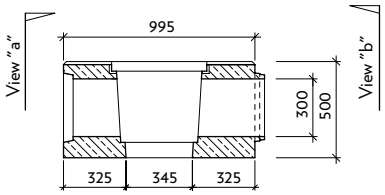


I-0-V0 - Basic gully assembly with cast iron frame and plastic cover for D400

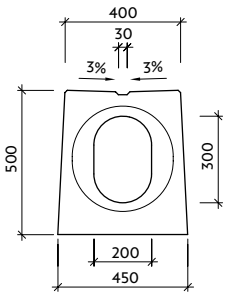
Plan



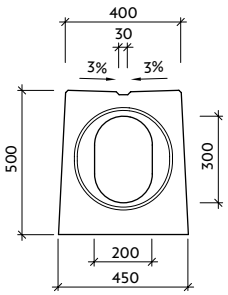
Cross-section: a-a´ I-0-V0



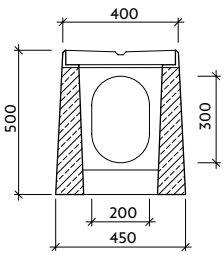
View "a" I-0-V0 - Socket



View "b" I-0-V0 - Spigot



Cross-section: b-b´ I-0-V0



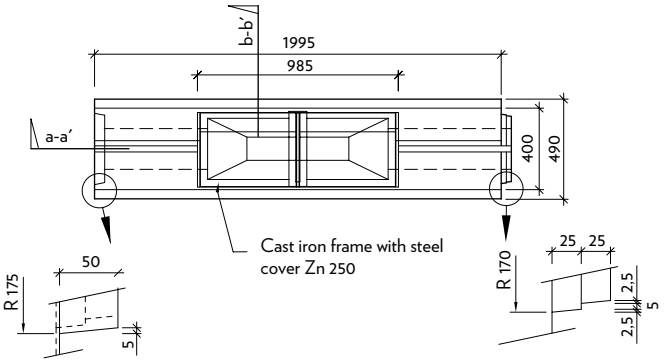
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-0

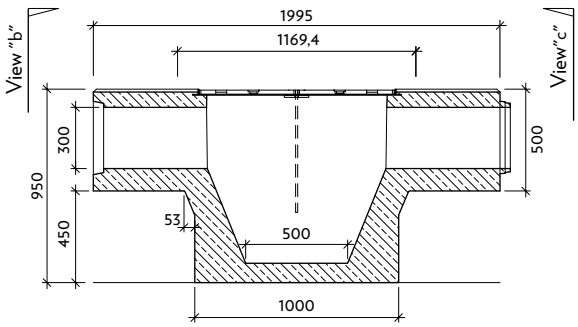
Protected by utility patent

I-0-PP - Fire safety barrier

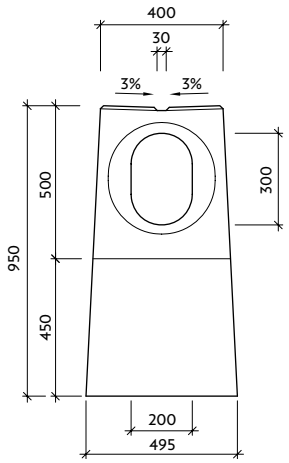
Plan



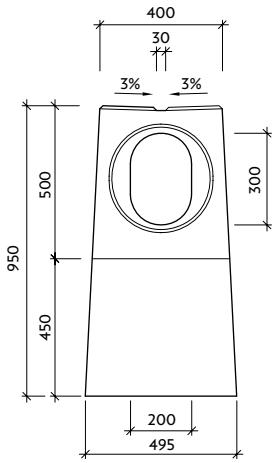
Cross-section: a-a´



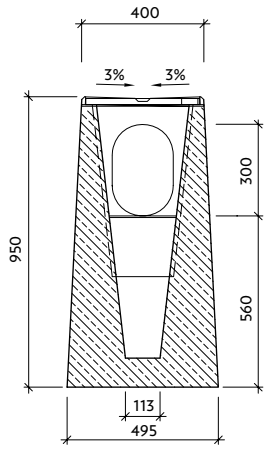
View "b" I-0-PP - Socket



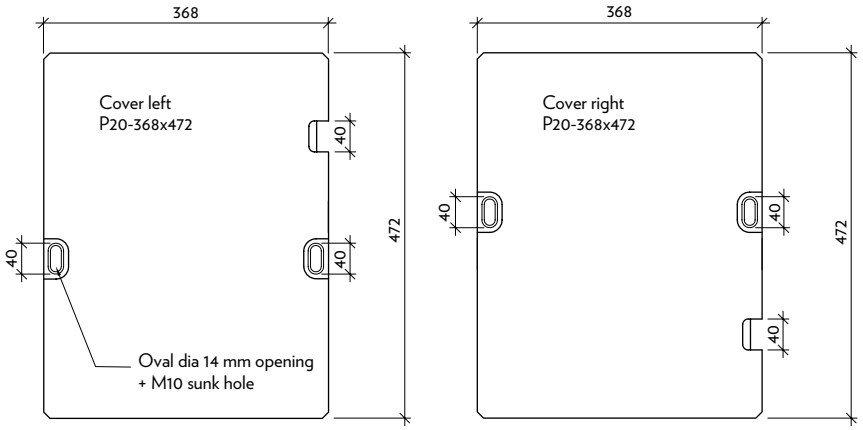
View "c" I-0-PP - Spigot



Cross-section b-b´ I-0-PP



Detail of steel covers in frame (without kerbstone)



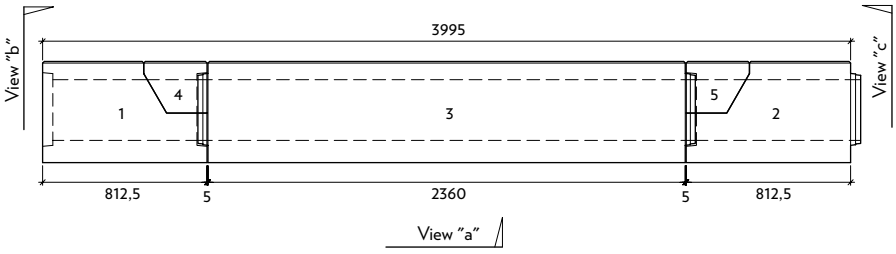
CSB - SLOT DRAIN PROFILE I-0

Patented

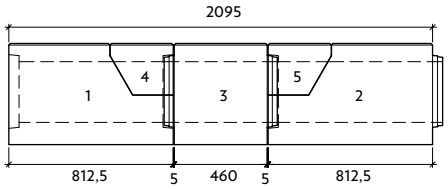
I-0-30/30 - Slot drain – replaceable segment

Plan

Longest possible line

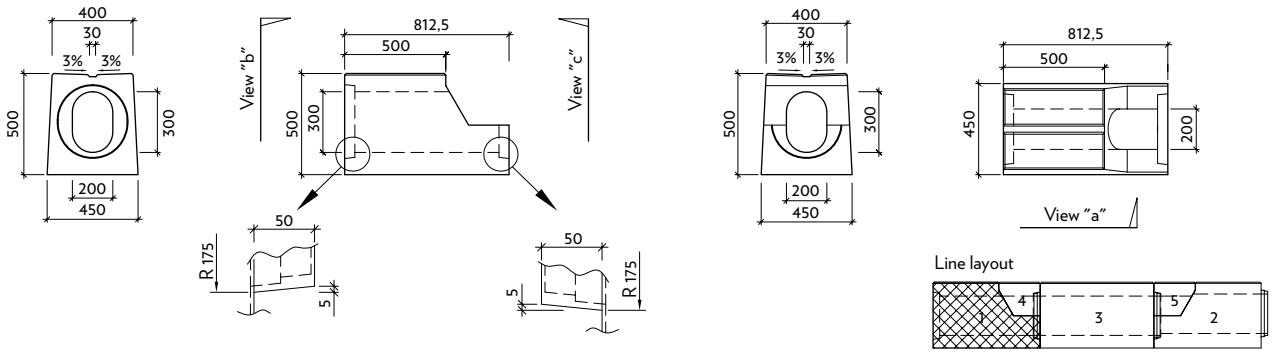


Shortest possible line

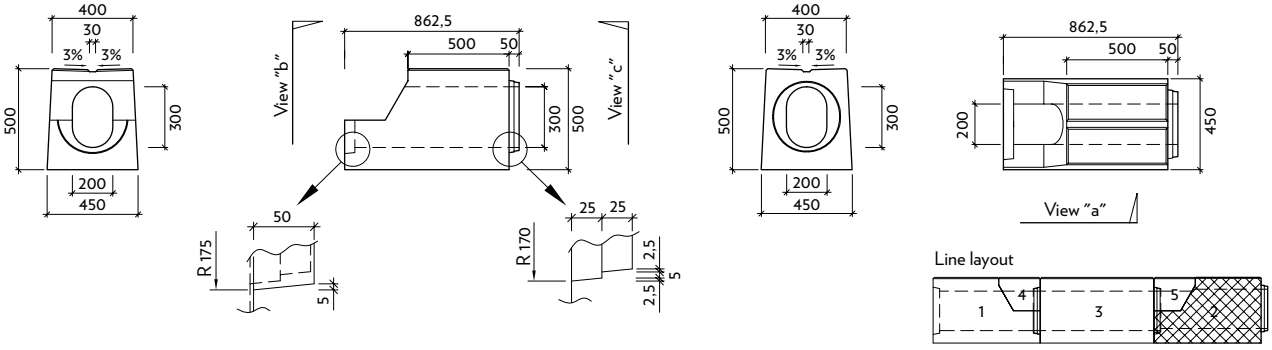


View "b" | View "a" | View "c" | Plan

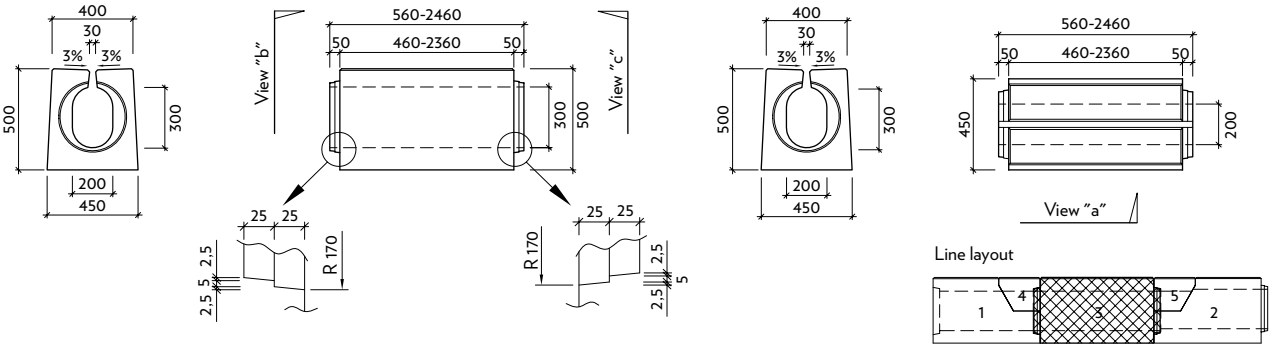
Segment 1.



Segment 2.



Segment 3.



* Nominal dimensions include installation dimensions and/or minimum gap.

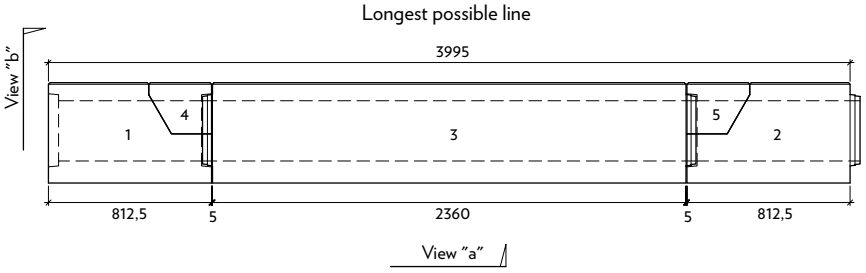
CSB - SLOT DRAIN PROFILE I-0

Patented

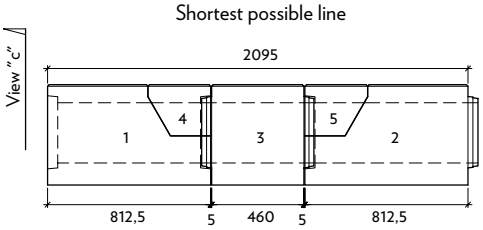
I-0-30/30 - Slot drain – replaceable segment

Plan

Longest possible line

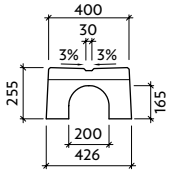


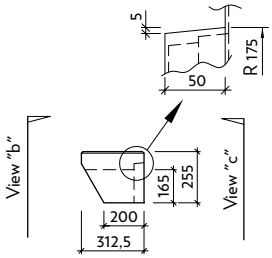
Shortest possible line

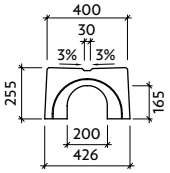


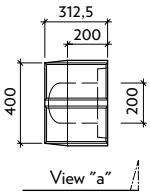
View "b" View "a" View "c" Plan

Segment 4.

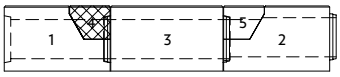




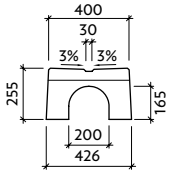


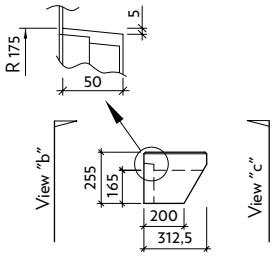


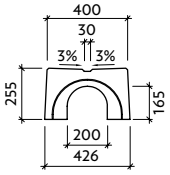
Line layout

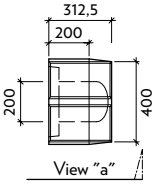


Segment 5.

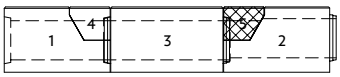








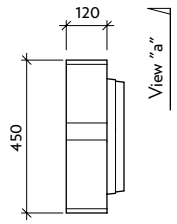
Line layout



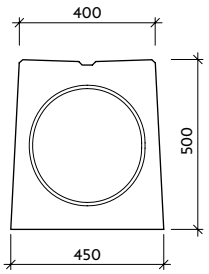
CSB - SLOT DRAIN PROFILE I-0

I-0-ZU - Spigot end cap

Plan

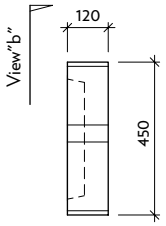


View "a" I-0-ZU - Spigot

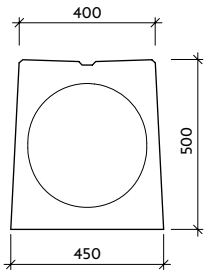


I-0-ZZ - Socket end cap

Plan

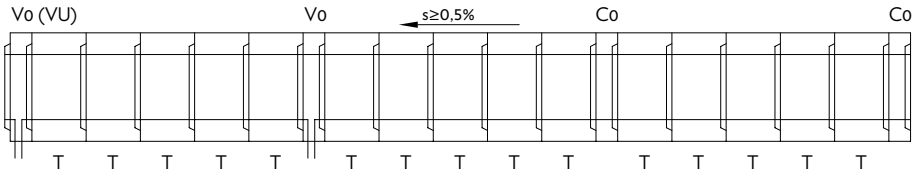


View "b" I-0-ZZ - Socket



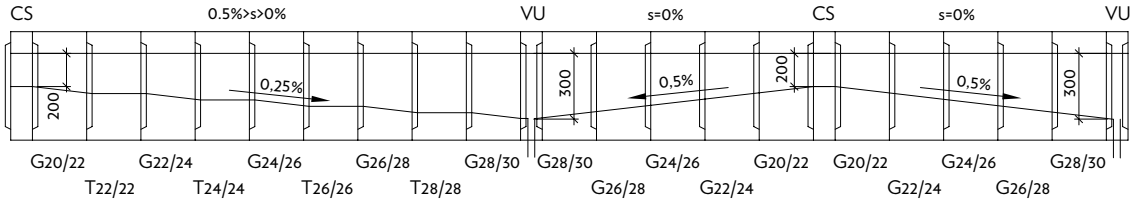
T-0-T Slot drains - layout

Suggested layout



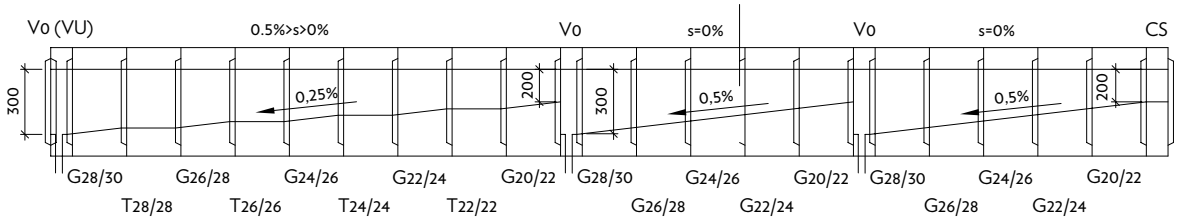
I-0-G Slot drains - layout

(slot drain with roof bottom)



I-0-G Slot drains - layout

(slot drain with saw tooth bottom)



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends

CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends

s – Longitudinal flow profile gradient

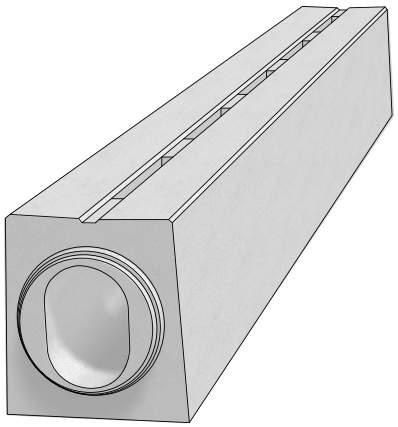
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-1

Protected by utility patent

Technical data:

Profile I slot drains are suitable for draining rainwater contaminated with small quantities of oil products (drips) from surfaced areas such as high-capacity traffic structures (motorways, dual carriageways, main roads, tunnels, runways, lay-bys, large parking lots, etc.). The 0.5 % internal gradient ensures efficient draining and prevents the risk of aquaplaning. Profile I-1 slot drains are designed for D400, E600 and F900 class traffic loads and transversal vehicle travel. Interrupted slot improves stability under transversal vehicle travel.



The system consists of the following components:

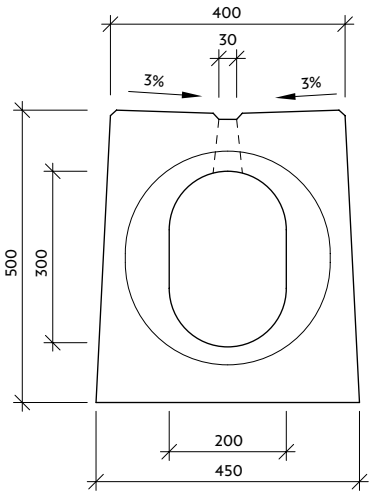
- 4 m-long slot drains with interrupted slots, with or without internal gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- Curved slot drain
- Fire safety barrier (with siphon)
- End cap

		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**pcs**
Slot drain with interrupted slot	I-1	500	4000	400/450	0,25	1510
Slot drain with interrupted slot, 0.5% flow profile bottom gradient	I-1-G	500	4000	400/450	0,25	1529 - 1702
Slot drain with interrupted slot for cycling paths	I-1-CY	500	4000	400/450	1	1520
Slot drain with interrupted slot for cycling paths, 0.5% flow profile bottom gradient	I-1-CY-G	500	4000	400/450	1	1539 - 1712
Slot drain - curved segment	I-1-OB	500	147-943	400/450	-	55 - 365
Basic gully assembly V0	I-1-V0	500	1000	400/450	1	347
Gutter gully assembly VU	I-1-VU	500	1000	400/450	1	338
Basic cleaning segment C0	I-1-C0	500	1000	400/450	1	394
Top cleaning segment CS	I-1-CS	500	1000	400/450	1	442
Fire safety barrier	I-1-PP	950	2000	400/495	0,5	1540
Slot drain with interrupted slot – replaceable segment	I-1-V	500	2100 - 4000	400/450	-	823 - 1688
Spigot end cap	I-1-ZU	500	120	400/450	-	76
Socket end cap	I-1-ZZ	500	120	400/450	-	51

Nominal dimensions - basic shapes:

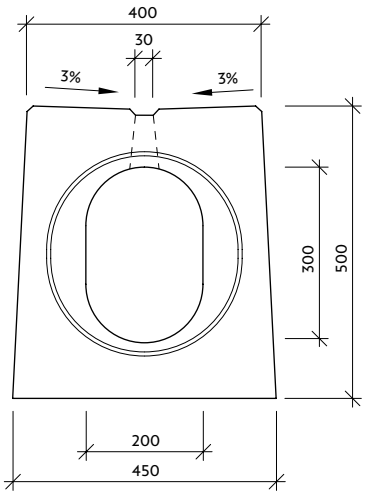
Side-view

Socket



Side-view

Spigot

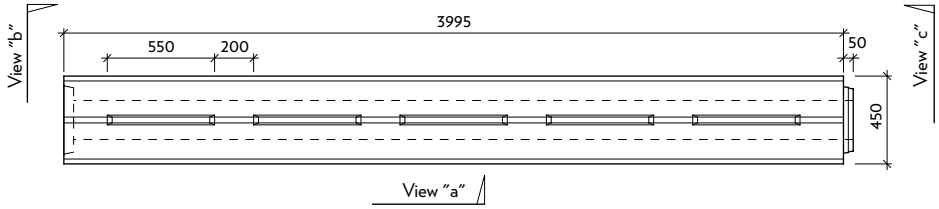


CSB - SLOT DRAIN PROFILE I-1

Protected by utility patent

Profile I-1 - Slot drain with interrupted slot

Plan

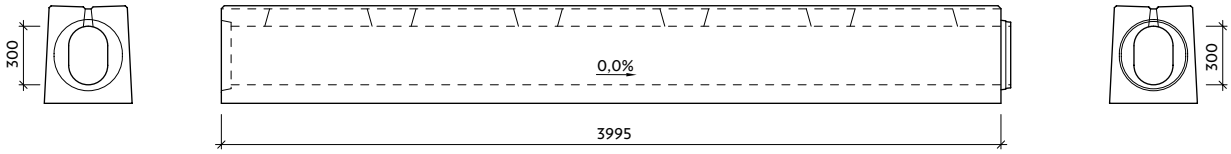


View "b" - Socket

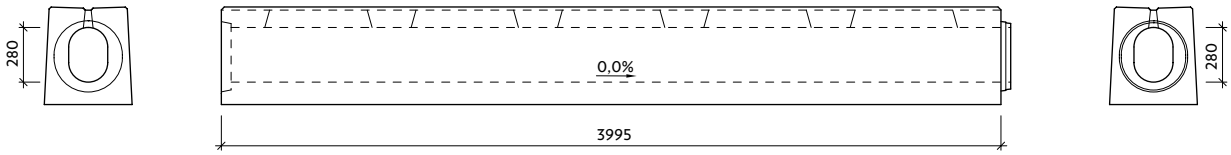
View "a"

View "c" - Spigot

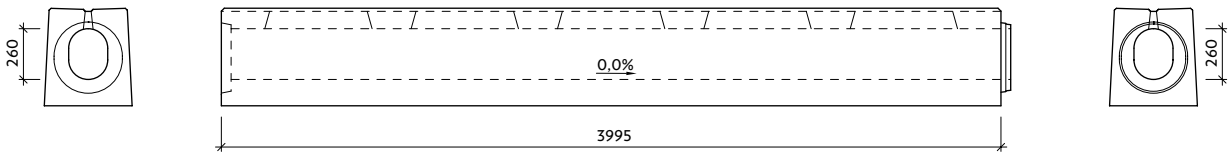
Profile I-1-T30/30 - without internal flow gradient



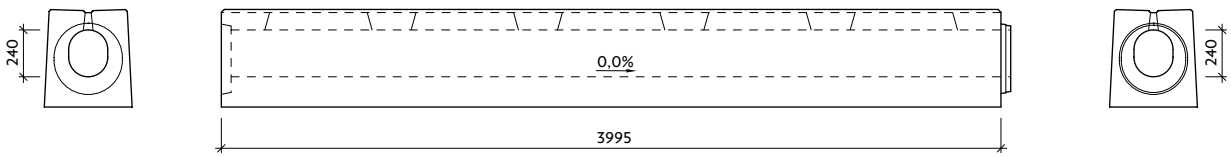
Profile I-1-T28/28 - without internal flow gradient



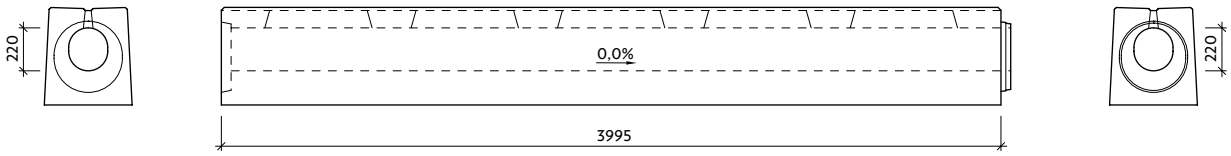
Profile I-1-T26/26 - without internal flow gradient



Profile I-1-T24/24 - without internal flow gradient



Profile I-1-T22/22 - without internal flow gradient



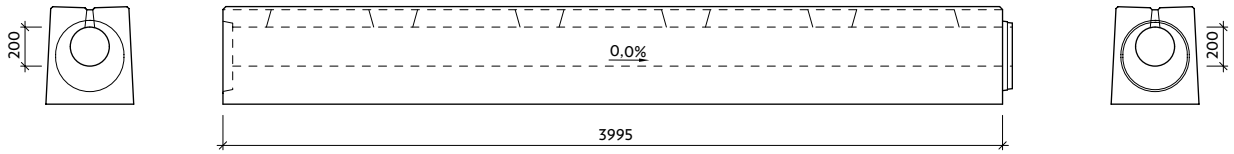
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-1

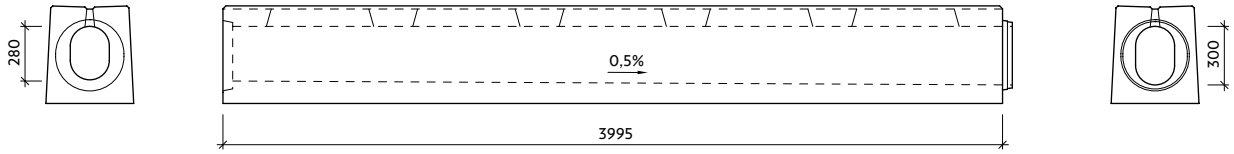
Protected by utility patent

View "b" - Socket | View "a" | View "c" - Spigot

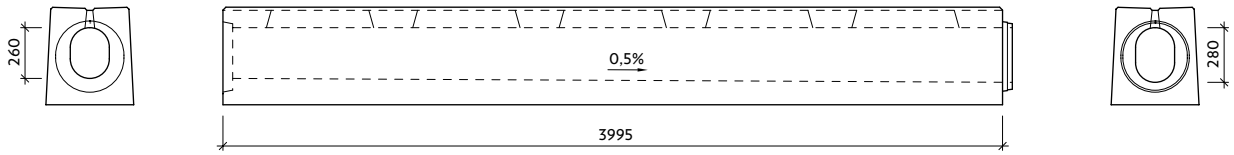
Profile I-1-T20/20 - without internal flow gradient



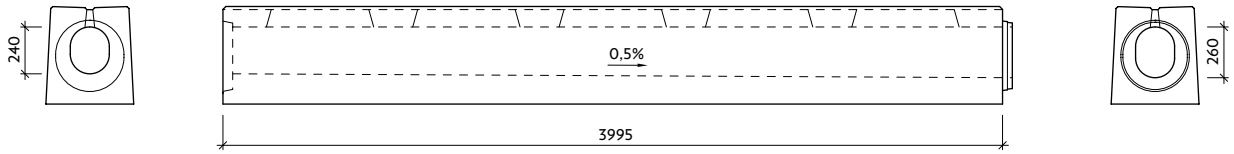
Profile I-1-G28/30 - 0.5% flow profile bottom gradient



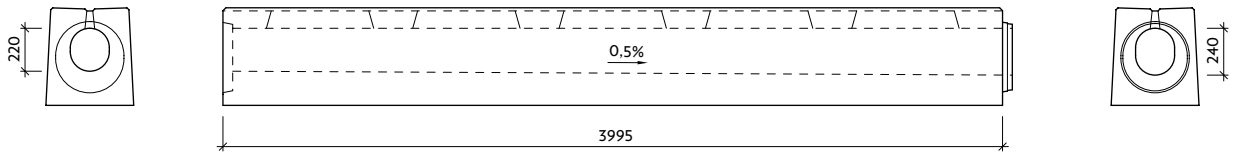
Profile I-1-G26/28 - 0.5% flow profile bottom gradient



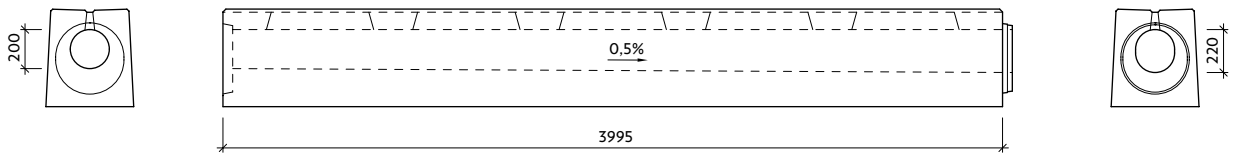
Profile I-1-G24/26 - 0.5% flow profile bottom gradient



Profile I-1-G22/24 - 0.5% flow profile bottom gradient



Profile I-1-G20/22 - 0.5% flow profile bottom gradient



CSB - SLOT DRAIN PROFILE I-1-CY

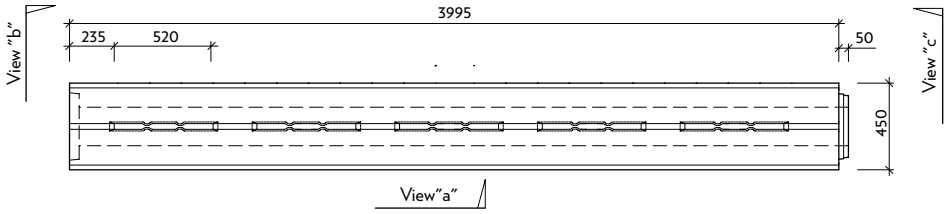
Protected by utility patent

I-1-CY Profile - for cycle paths:

CS-BETON offers special slot drains with interrupted slots to prevent the risk of a bicycle tyre being caught in it. They have special slot connection bridges and the shape of the slot itself is also modified to comply with ČSN EN standards and provide the best comfort for cyclists. The nominal dimensions, however, are the same, so this special cycle path slot drain may be combined with other Profile I components. Custom-length segments and modified segments may be produced upon request.

Profile I-1-CY - Slot drain

Plan

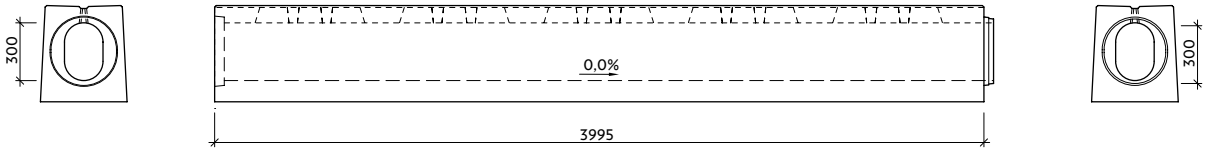


View "b" - Socket

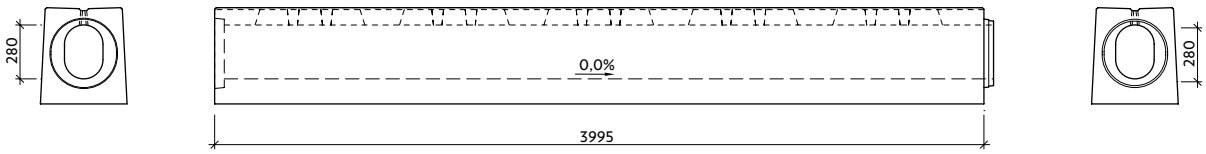
View "a"

View "c" - Spigot

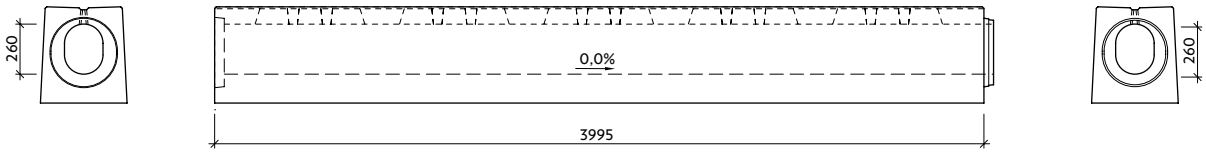
Profile I-1-CY-T30/30 - without internal flow gradient



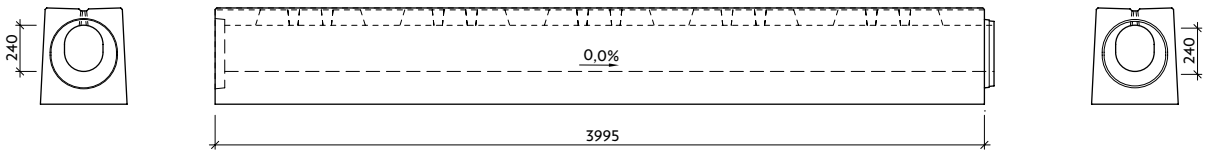
Profile I-1-CY-T28/28 - without internal flow gradient



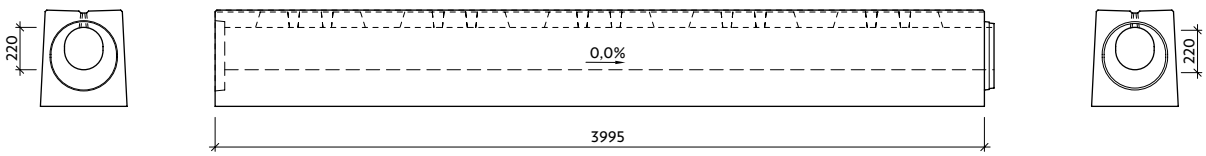
Profile I-1-CY-T26/26 - without internal flow gradient



Profile I-1-CY-T24/24 - without internal flow gradient



Profile I-1-CY-T22/22 - without internal flow gradient



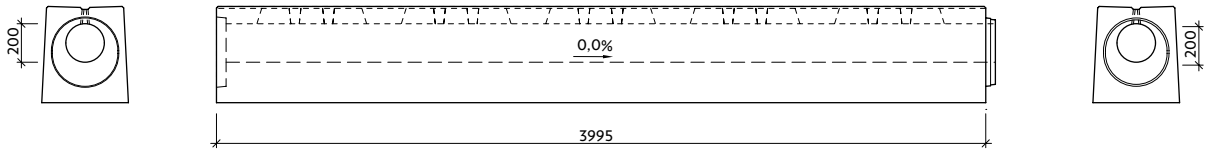
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-1-CY

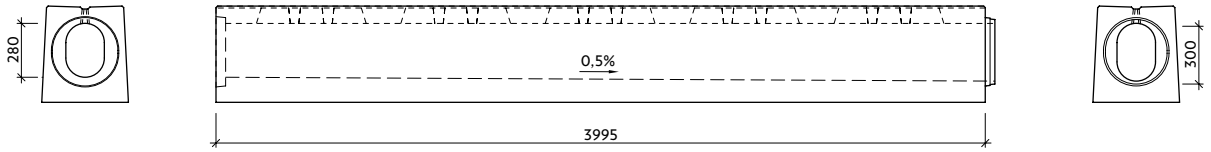
Protected by utility patent

View "b" - Socket | View "a" | View "c" - Spigot

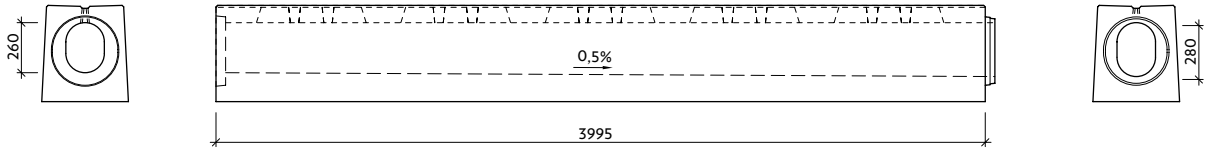
Profile I-1-CY-T20/20 - without internal flow gradient



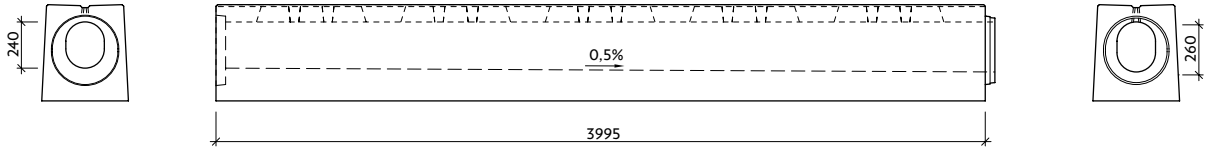
Profile I-1-CY-G28/30 - 0.5% flow Profile bottom gradient



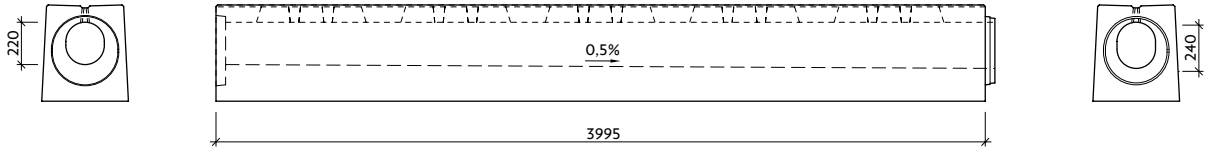
Profile I-1-CY-G26/28 - 0.5% flow Profile bottom gradient



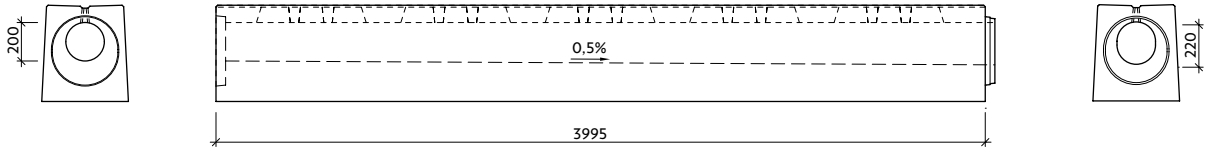
Profile I-1-CY-G24/26 - 0.5% flow Profile bottom gradient



Profile I-1-CY-G22/24 - 0.5% flow Profile bottom gradient



Profile I-1-CY-G20/22 - 0.5% flow Profile bottom gradient

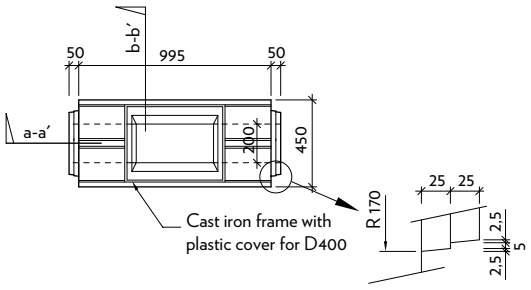


CSB - SLOT DRAIN PROFILE I-1

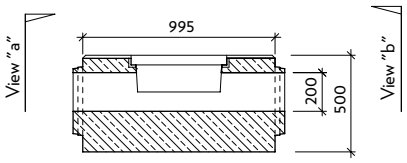
Protected by utility patent

I-1-CS - Top cleaning segment with cast iron frame and plastic cover for D400

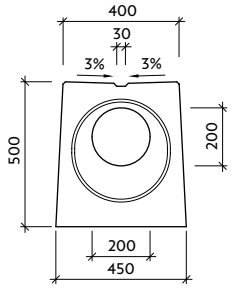
Plan



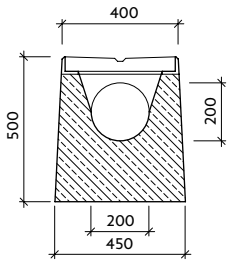
Cross-section: a-a´ I-1-CS



View "a"="b" I-1-CS - Spigot/Spigot

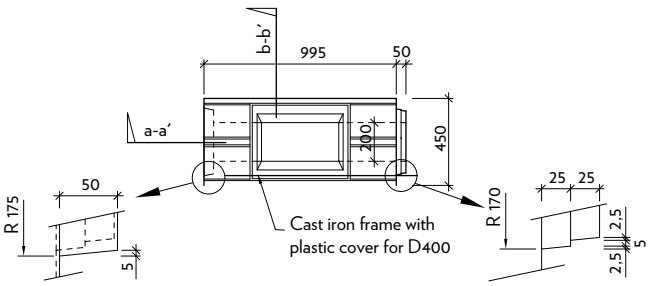


Cross-section: b-b´ I-1-CS

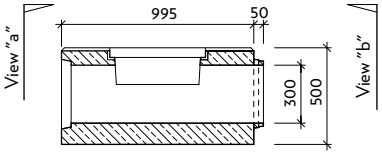


I-1-C0 - Basic cleaning segment with cast iron frame and plastic cover for D400

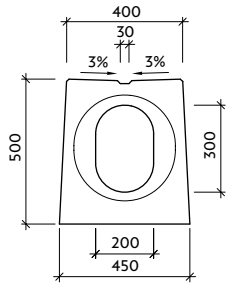
Plan



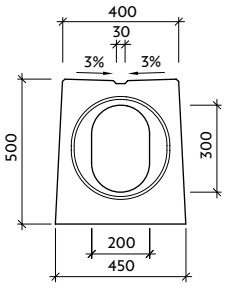
Cross-section: a-a´ I-1-C0



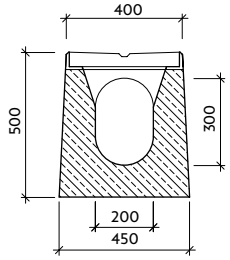
View "a" I-1-C0 - Socket



View "b" I-1-C0 - Spigot



Cross-section: b-b´ I-1-CO



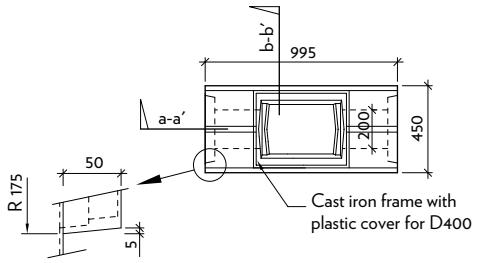
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-1

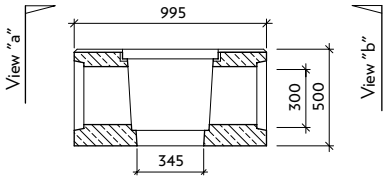
Protected by utility patent

I-1-VU - Gutter gully assembly with cast iron frame and plastic cover for D400

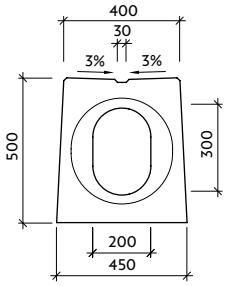
Plan



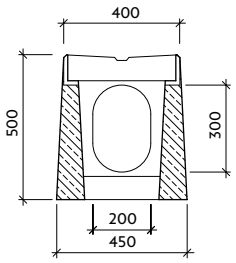
Cross-section: a-a' I-1-VU



View "a"="b" I-1-VU - Socket/Socket

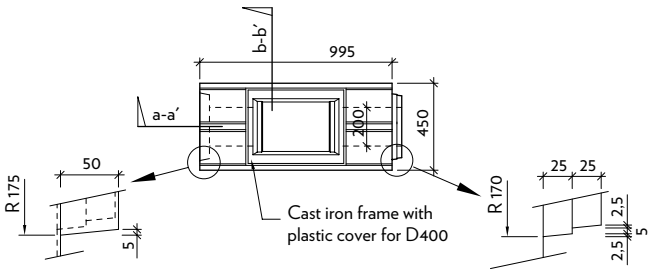


Cross-section: b-b' I-1-VU

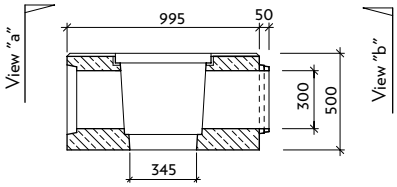


I-1-V0 - Basic gully assembly with cast iron frame and plastic cover for D400

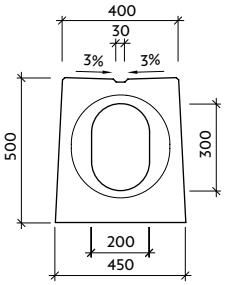
Plan



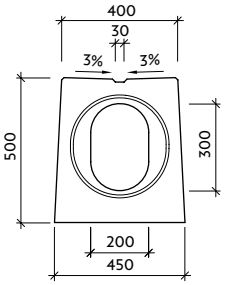
Cross-section: a-a' I-1-V0



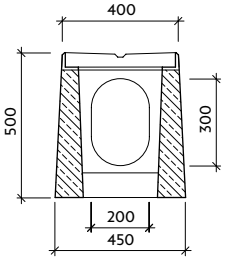
View "a" I-1-V0 - Socket



View "b" I-1-V0 - Spigot



Cross-section: b-b' I-1-V0

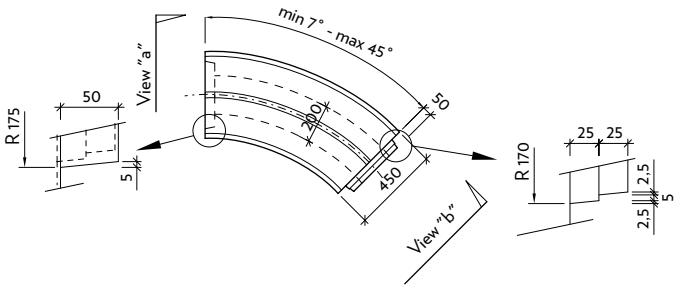


CSB - SLOT DRAIN PROFILE I-1

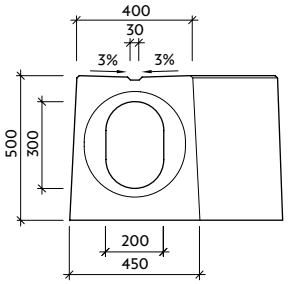
Protected by utility patent

I-1-OB-P - Slot drain - curved segment - right

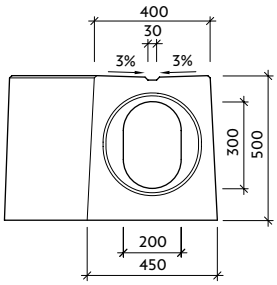
Plan



View"a" - Socket

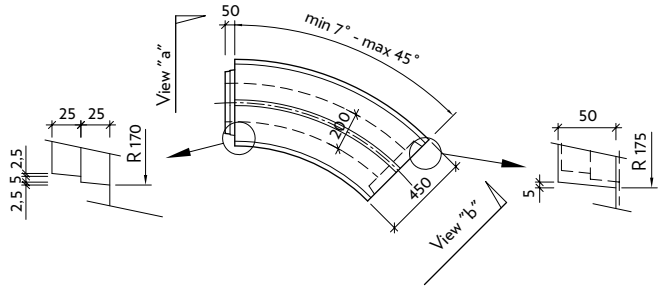


View "b" - Spigot

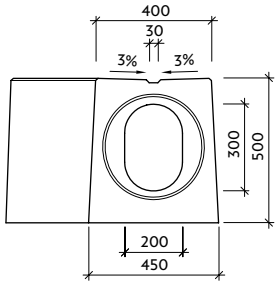


I-1-OB-L - Slot drain - curved segment - left

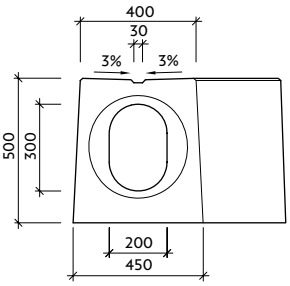
Plan



View "a" - Spigot



View "b" - Socket



* Nominal dimensions include installation dimensions and/or minimum gap.

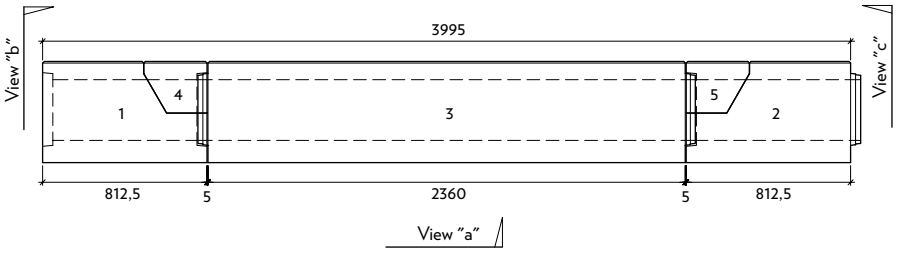
CSB - SLOT DRAIN PROFILE I-1

Patented

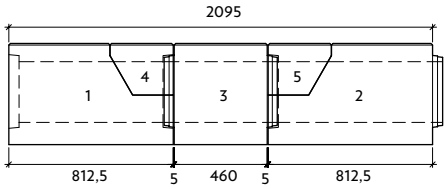
I-0-30/30 - Slot drain – replaceable segment

Plan

Longest possible line

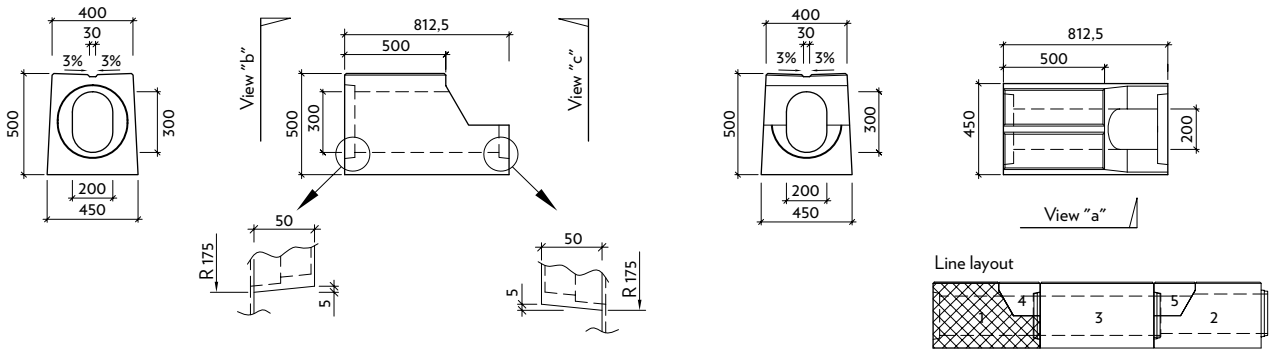


Shortest possible line

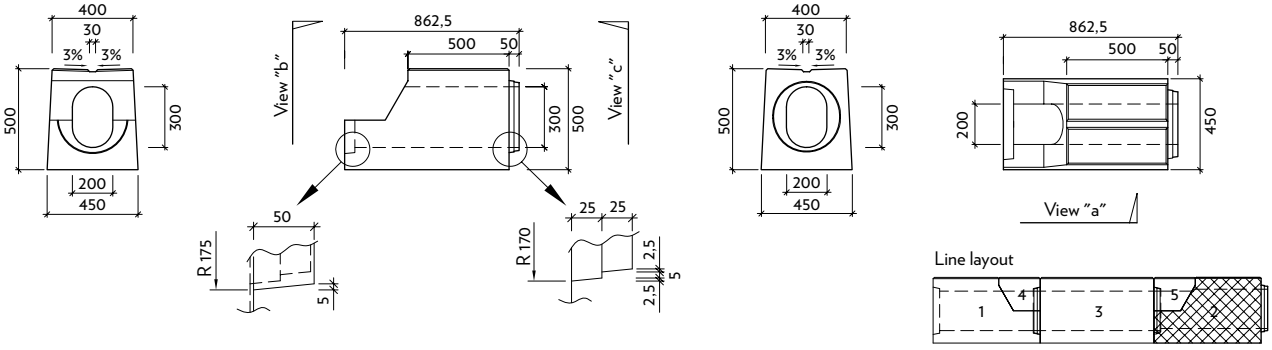


View "b" View "a" View "c" Plan

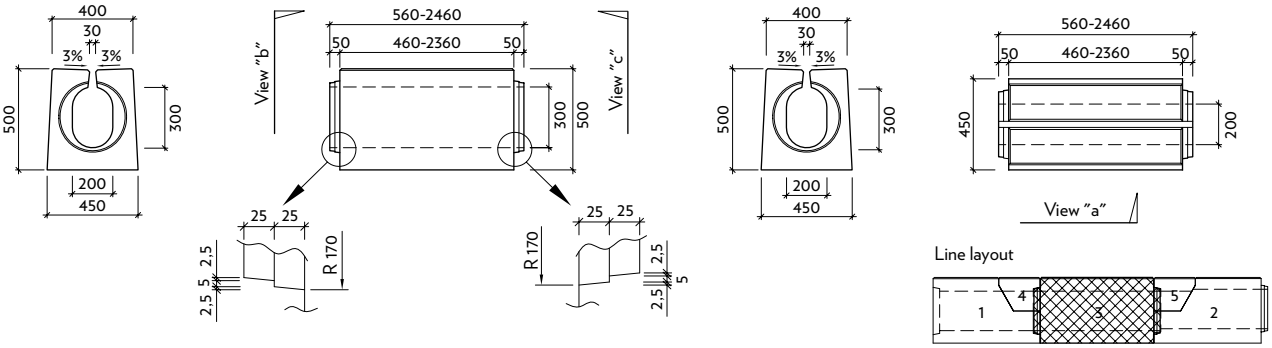
Segment 1.



Segment 2.



Segment 3.



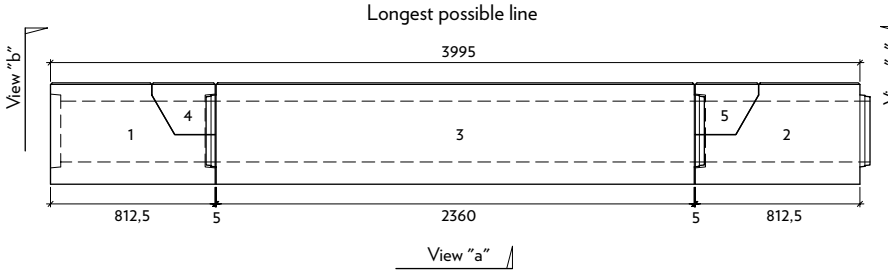
CSB - SLOT DRAIN PROFILE I-1

Patented

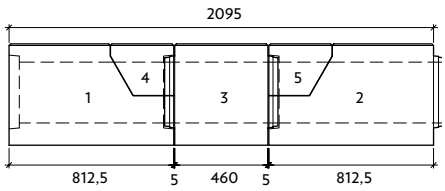
I-0-30/30 - Slot drain – replaceable segment

Plan

Longest possible line

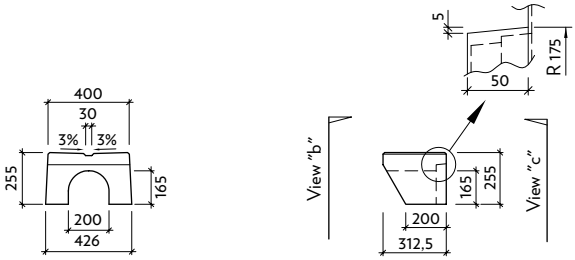


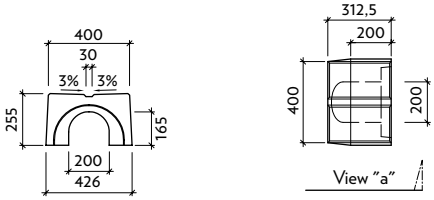
Shortest possible line



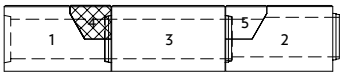
View "b" View "a" View "c" Plan

Segment 4.

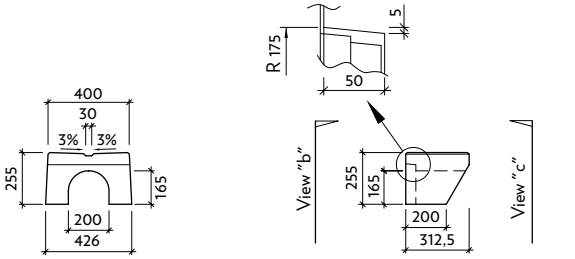


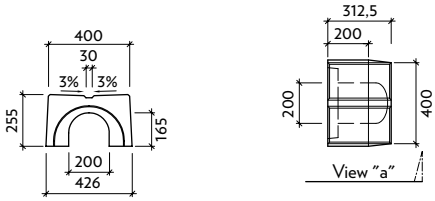


Line layout

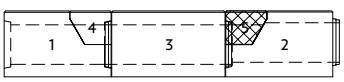


Segment 5.





Line layout



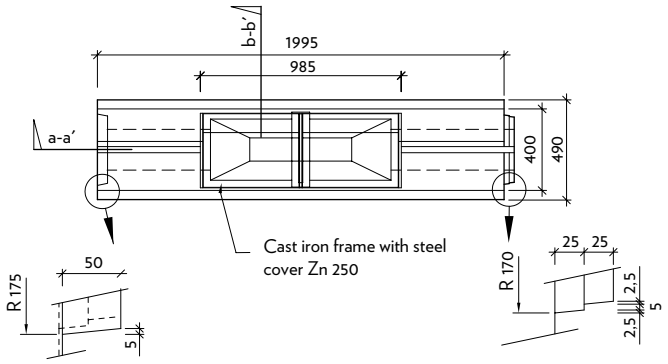
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-1

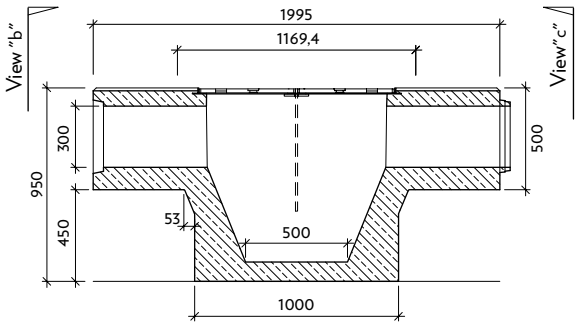
Protected by utility patent

I-0-PP - Fire safety barrier

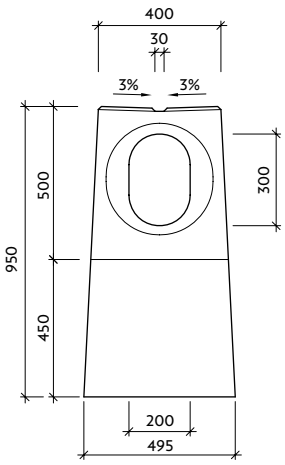
Plan



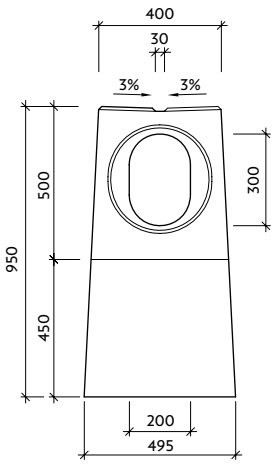
Cross-section: a-a'



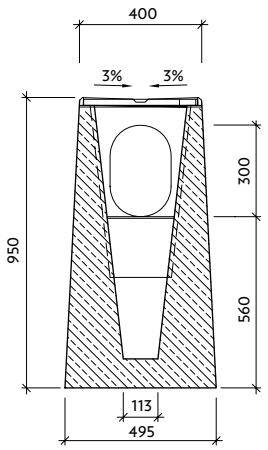
View "b" I-0-PP - Socket



View "c" I-0-PP - Spigot



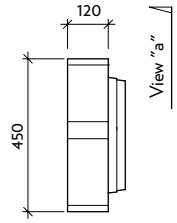
Cross-section b-b' I-0-PP



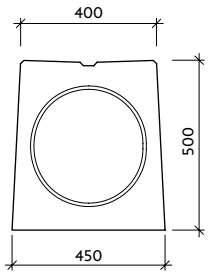
CSB - SLOT DRAIN PROFILE I-1

I-1-ZU - Spigot end cap

Plan

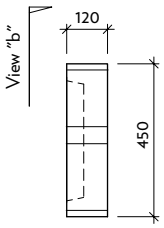


View "a" I-1-ZU - Spigot

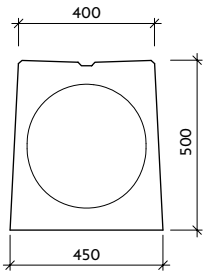


I-1-ZZ - Socket end cap

Plan

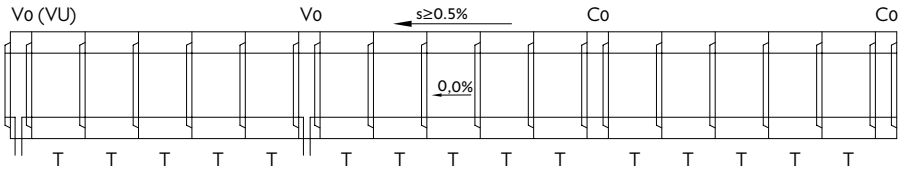


View "b" I-1-ZZ - Socket



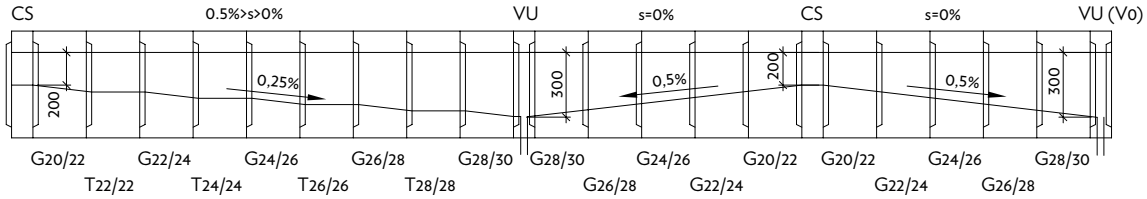
Suggested layout

I-1-T Slot drains - layout



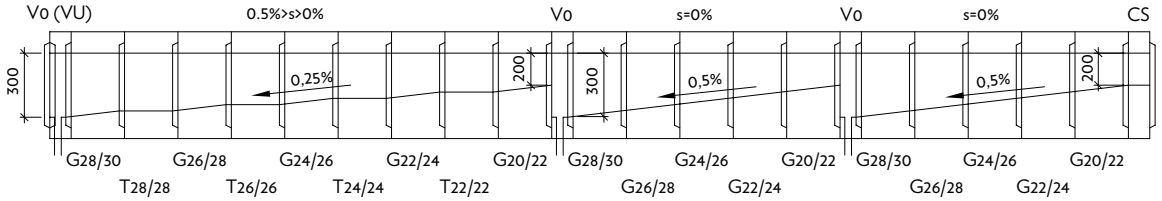
I-1-G Slot drains - layout

(slot drain with roof bottom)



I-1-G Slot drains - layout

(slot drain with saw tooth bottom)



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends

CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends

s – Longitudinal flow profile gradient

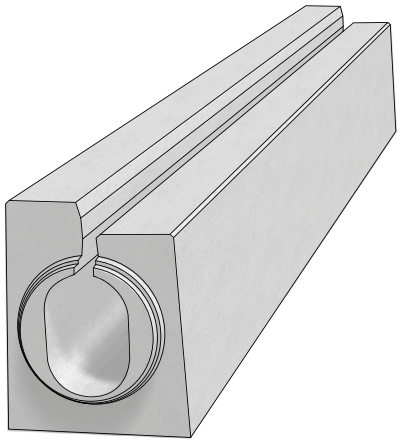
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-2

Protected by utility patent

Technical data:

Slot drain with a 7 cm high kerbstone. This product is suitable for dividing roads from pavements and/or for use in tunnels. They are available without or with internal gradient 0.5%. Gradient-to-gradient components are provided for segments with internal gradient. Profile I-2 slot drains and slot drains with kerbstones are designed for D400 class traffic load and no transversal vehicle travel.

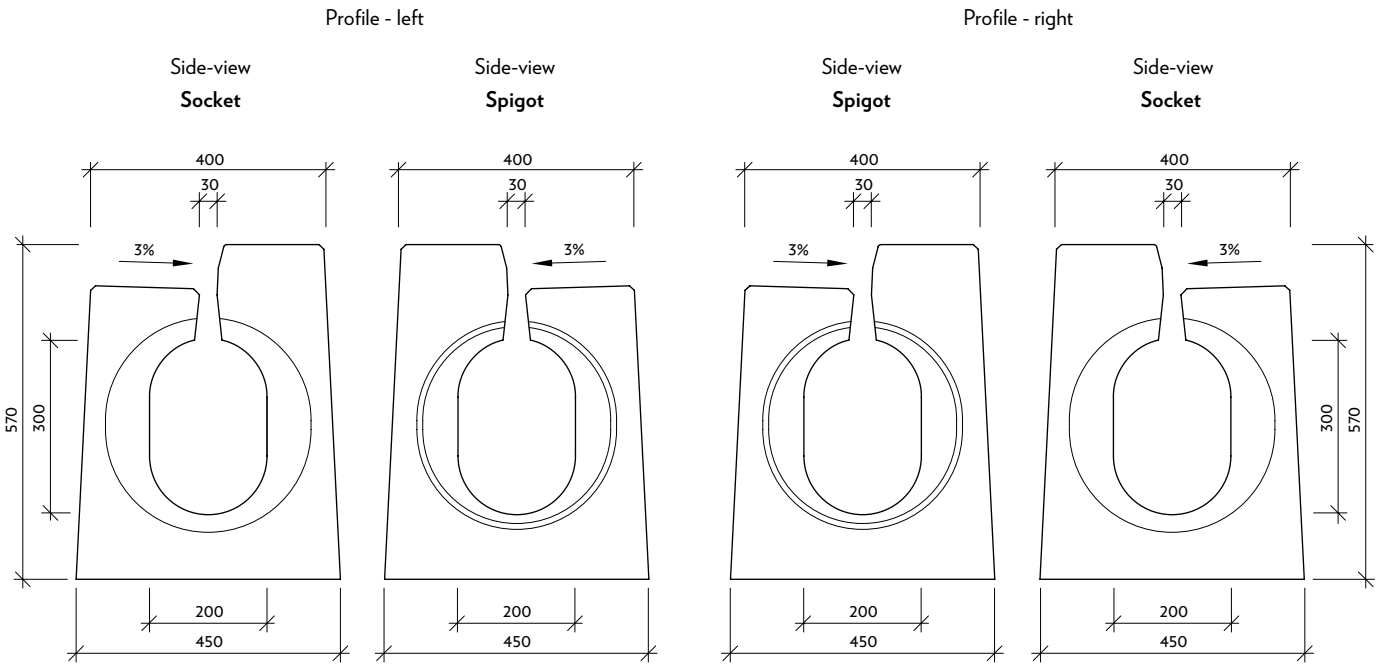


The system consists of the following components:

- 4 m-long slot drains with continuous slots, with or without internal gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- Fire safety barrier (with siphon)
- Slot drain with rising kerbstone
- End cap

		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**pcs**
Slot drain with continuous slot and 7 cm kerbstone	I-2	500/570	4000	400/450	0,25	1584
Slot drain with continuous slot and 7 cm kerbstone, 0.5% flow profile bottom gradient	I-2-G	500/570	4000	400/450	0,25	1603-1771
Basic gully assembly V0	I-2-V0	500/570	1000	400/450	1	295
Gutter gully assembly VU	I-2-VU	500/570	1000	400/450	1	285
Basic cleaning segment C0	I-2-C0	500/570	1000	400/450	1	347
Top cleaning segment CS	I-2-CS	500/570	1000	400/450	1	404
Spigot end cap	I-2-ZU	500	120	400/450	-	76
Socket end cap	I-2-ZZ	500	120	400/450	-	51

Nominal dimensions - basic shapes:

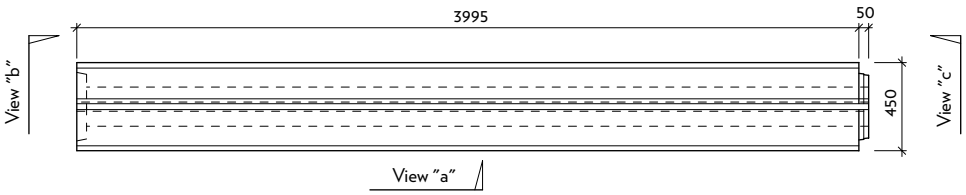


CSB - SLOT DRAIN PROFILE I-2

Protected by utility patent

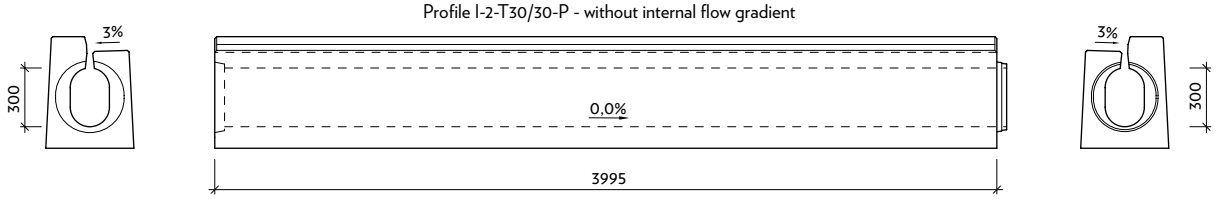
Profile I-2 right - Slot drain

Plan

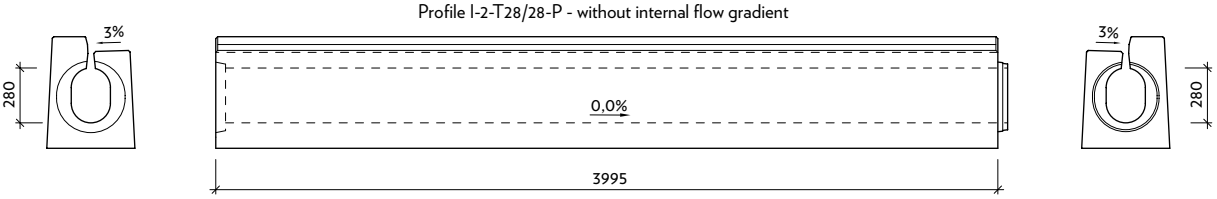


View "b" - Socket | View "a" | View "c" - Spigot

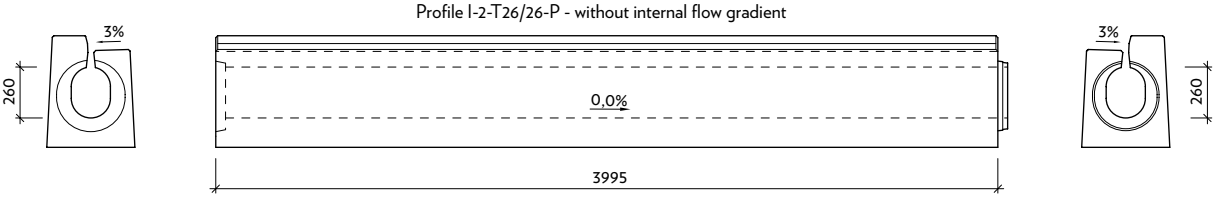
Profile I-2-T30/30-P - without internal flow gradient



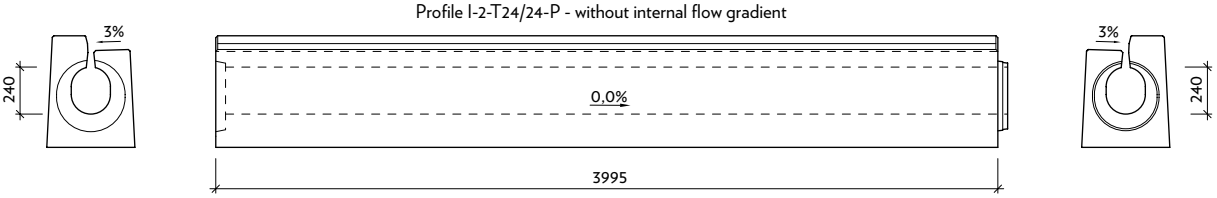
Profile I-2-T28/28-P - without internal flow gradient



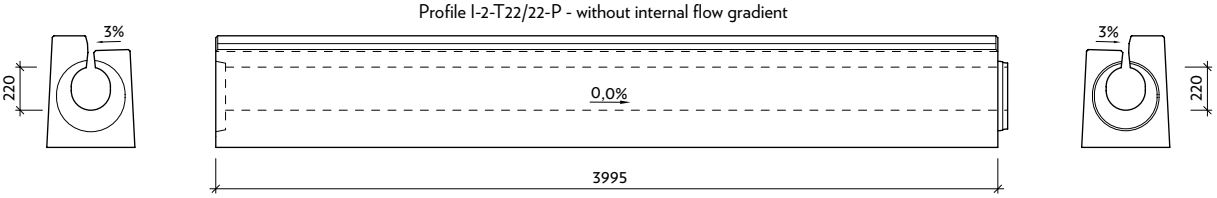
Profile I-2-T26/26-P - without internal flow gradient



Profile I-2-T24/24-P - without internal flow gradient



Profile I-2-T22/22-P - without internal flow gradient



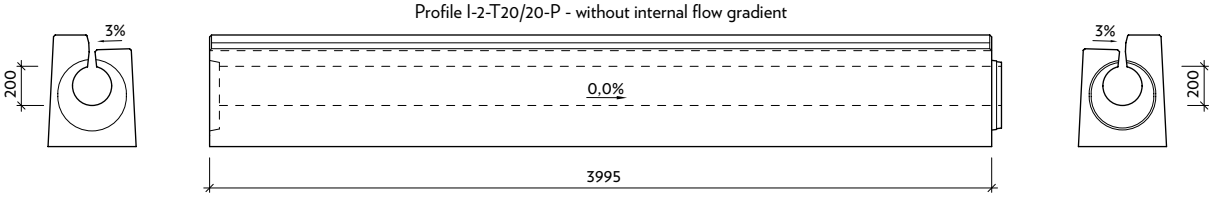
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-2

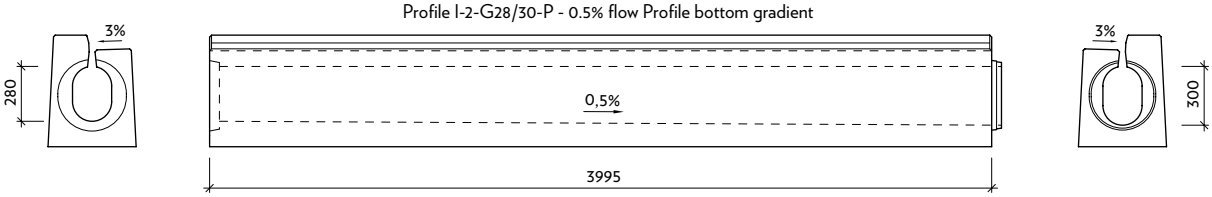
Protected by utility patent

View "b" - Socket | View "a" | View "c" - Spigot

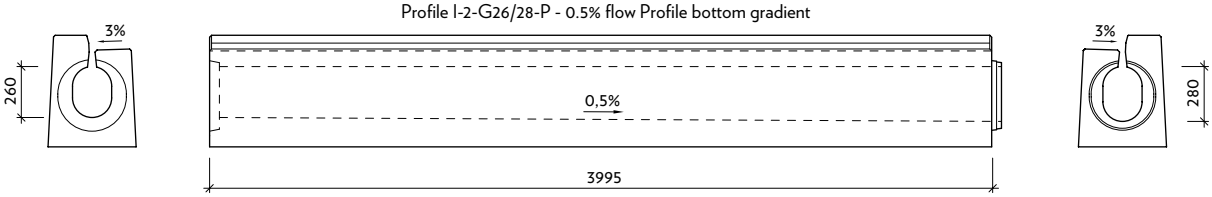
Profile I-2-T20/20-P - without internal flow gradient



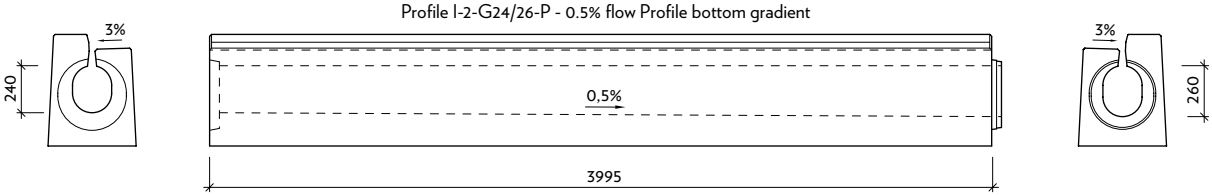
Profile I-2-G28/30-P - 0.5% flow Profile bottom gradient



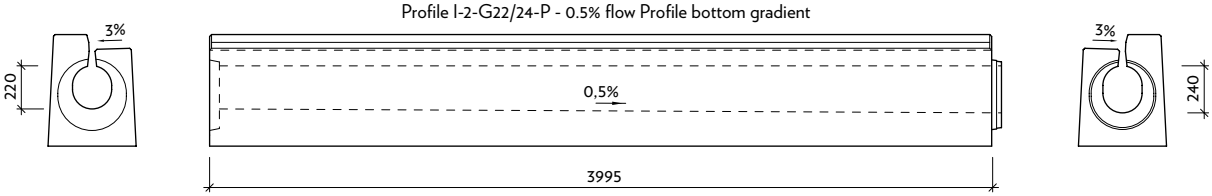
Profile I-2-G26/28-P - 0.5% flow Profile bottom gradient



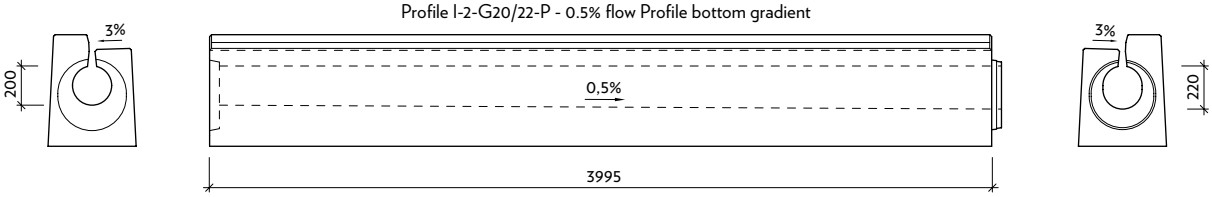
Profile I-2-G24/26-P - 0.5% flow Profile bottom gradient



Profile I-2-G22/24-P - 0.5% flow Profile bottom gradient



Profile I-2-G20/22-P - 0.5% flow Profile bottom gradient

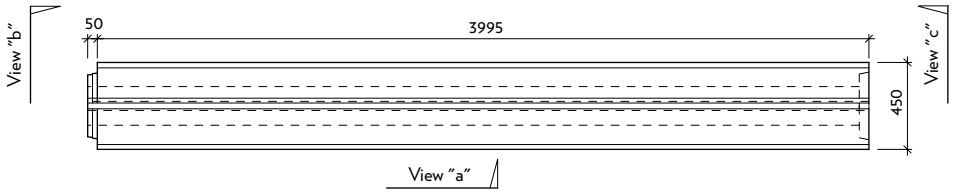


CSB - SLOT DRAIN PROFILE I-2

Protected by utility patent

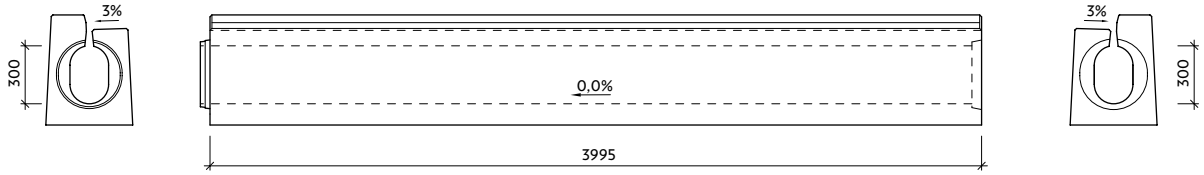
Profile I-2 left - Slot drain

Plan

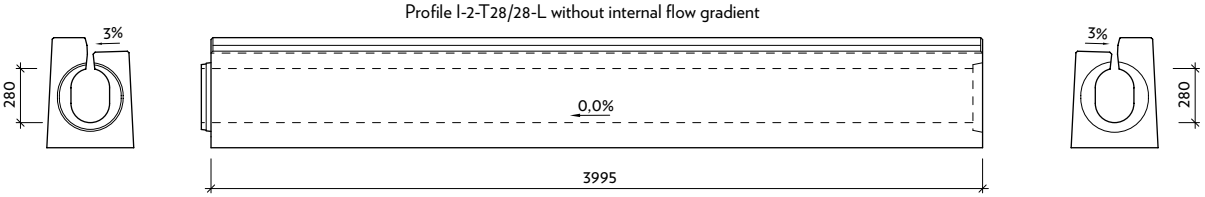


View "b" - Spigot | View "a" | View "c" - Socket

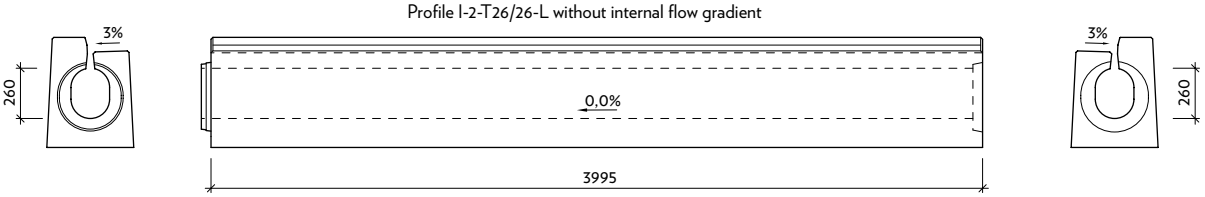
Profile I-2-T30/30-L without internal flow gradient



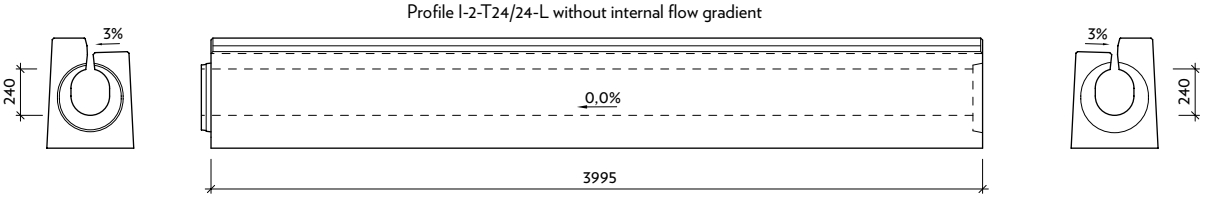
Profile I-2-T28/28-L without internal flow gradient



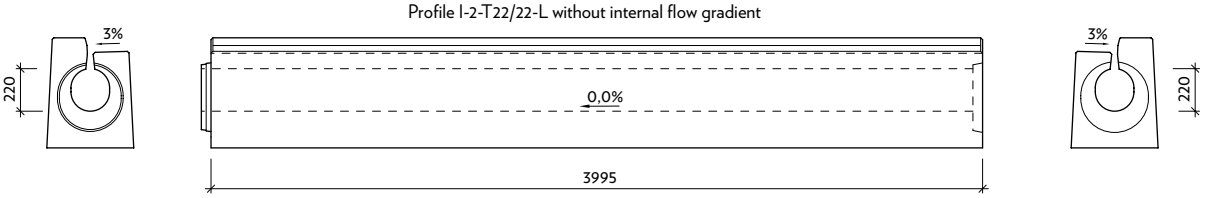
Profile I-2-T26/26-L without internal flow gradient



Profile I-2-T24/24-L without internal flow gradient



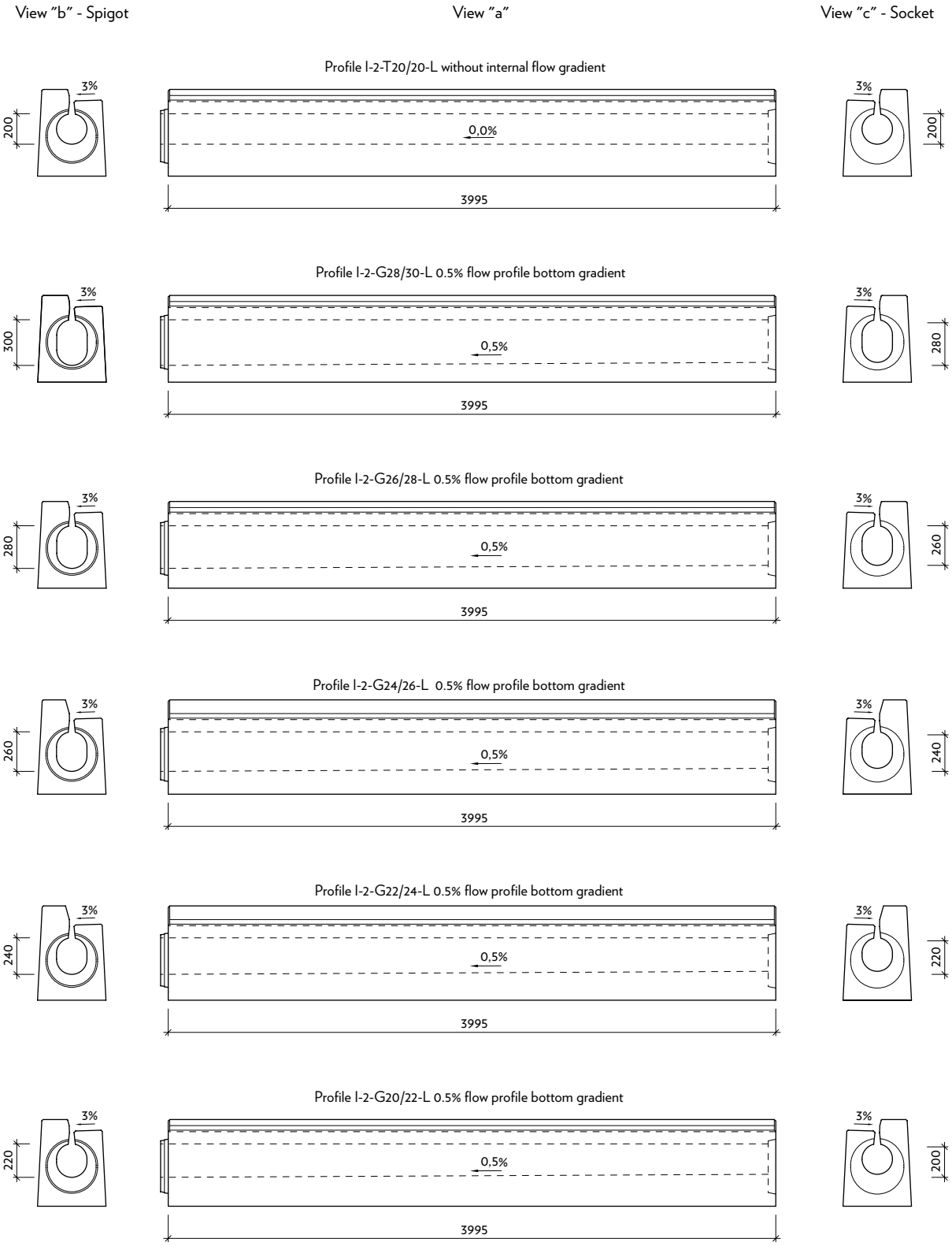
Profile I-2-T22/22-L without internal flow gradient



* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-2

Protected by utility patent

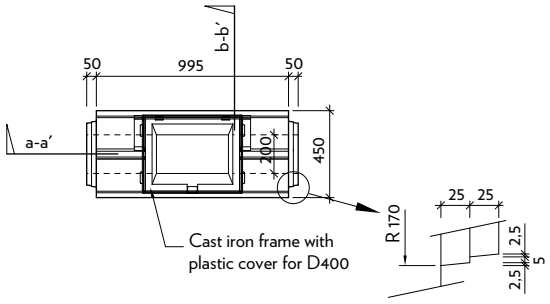


CSB - SLOT DRAIN PROFILE I-2

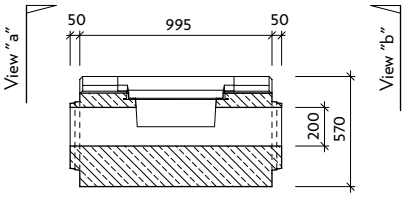
Protected by utility patent

I-2-CS - Top cleaning segment with cast iron frame and plastic cover for D400 - 7 cm kerbstone

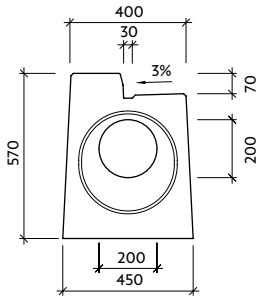
Plan



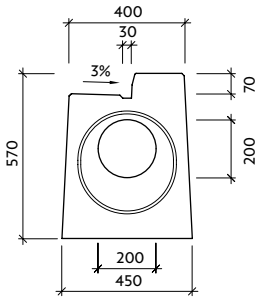
Cross-section: a-a´ I-2-CS



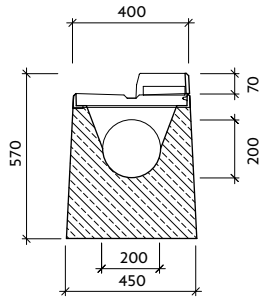
View "a" I-2-CS - Spigot/Spigot



View "b" I-2-CS - Spigot/Spigot

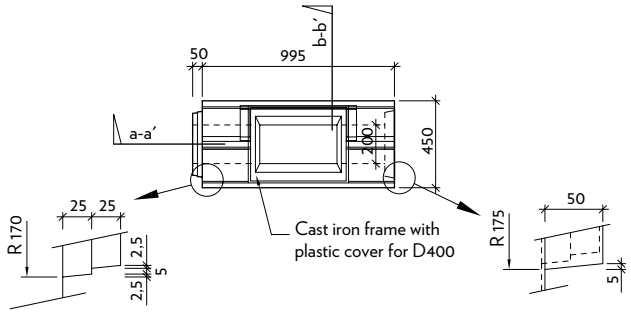


Cross-section: b-b´ I-2-CS

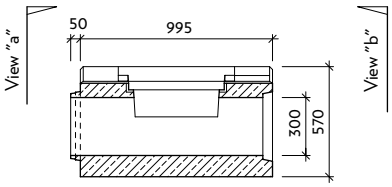


I-2-C0 - left - Basic cleaning segment with cast iron frame and plastic cover for D400 - 7 cm kerbstone

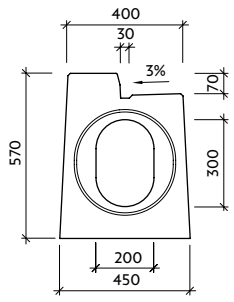
Plan



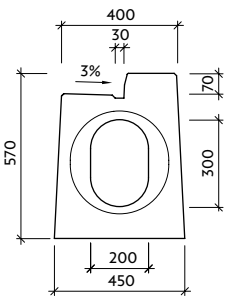
Cross-section: a-a´ I-2-C0



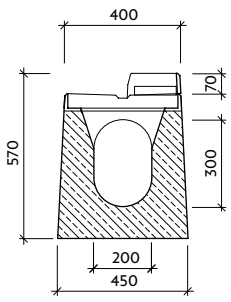
View "a" I-2-C0 - Spigot



View "b" I-2-C0 - Socket



Cross-section: b-b´ I-2-C0



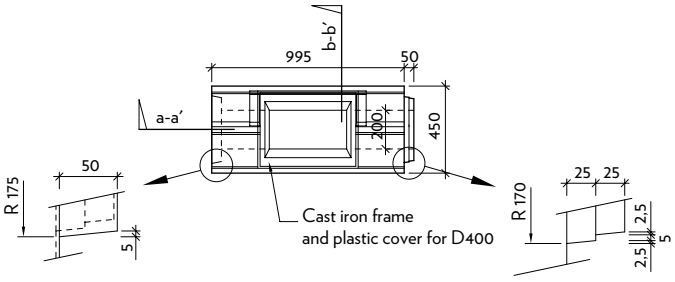
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-2

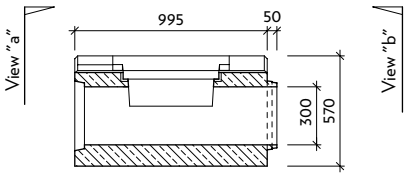
Protected by utility patent

I-2-C0 - right - Basic cleaning segment with cast iron frame and plastic cover for D400 - 7 cm kerbstone

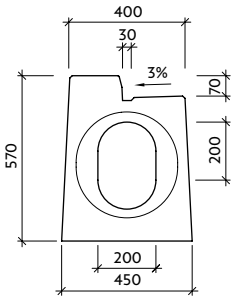
Plan



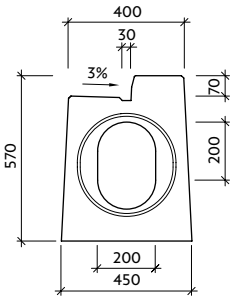
Cross-section: a-a'



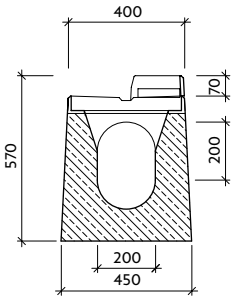
View "a" I-2-C0 - Socket



View "b" I-2-C0 - Spigot

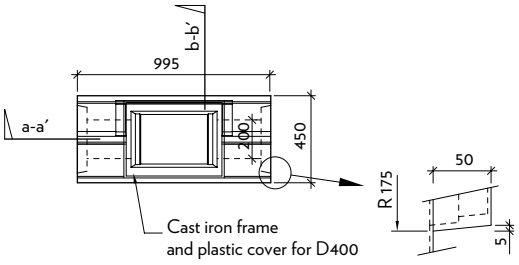


Cross-section: b-b' I-2-C0

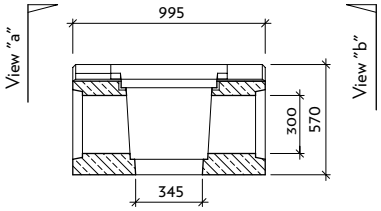


I-2-VU - Gutter gully assembly with 7 cm kerbstone. Cast iron frame and plastic cover for D400

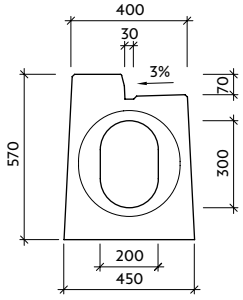
Plan



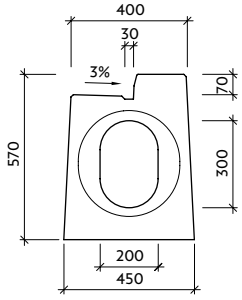
Cross-section: a-a' I-2-VU



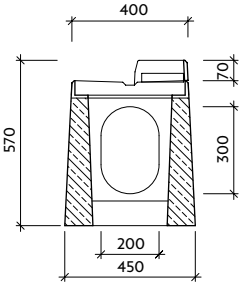
View "a" I-2-VU - Socket/Socket



View "b" I-2-VU - Socket/Socket



Cross-section: b-b' I-2-VU

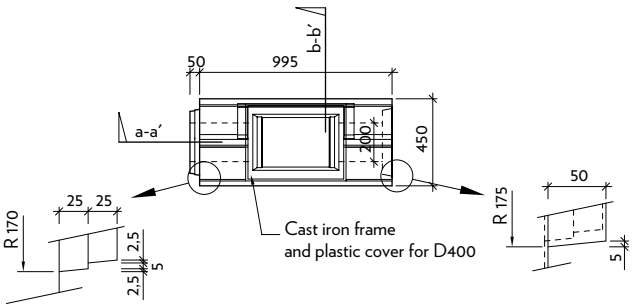


CSB - SLOT DRAIN PROFILE I-2

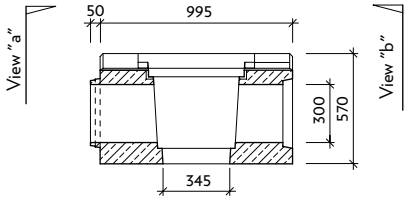
Protected by utility patent

I-2-V0 - left - Basic gully assembly with 7 cm kerbstone. Cast iron frame and plastic cover for D400

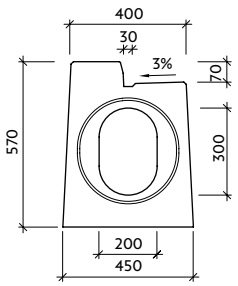
Plan



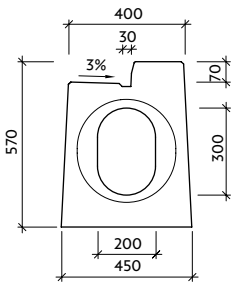
Cross-section: a-a' I-2-V0



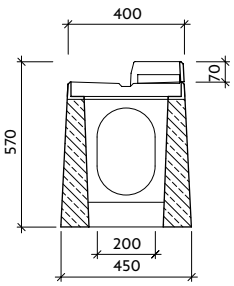
View "a" I-2-V0 - Spigot



View "b" I-2-V0 - Socket

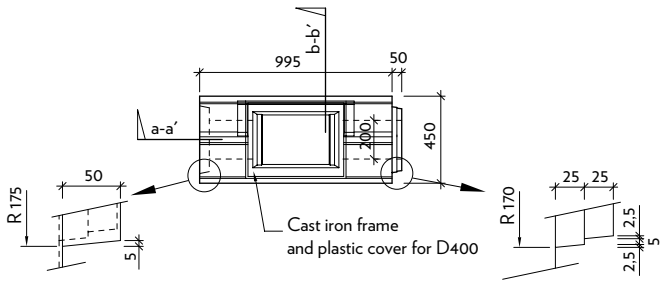


Cross-section: b-b' I-2-V0

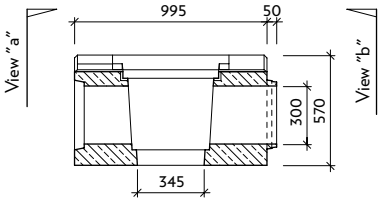


I-2-V0 - right - Basic gully assembly with 7 cm kerbstone. Cast iron frame and plastic cover for D400

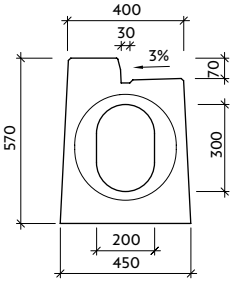
Plan



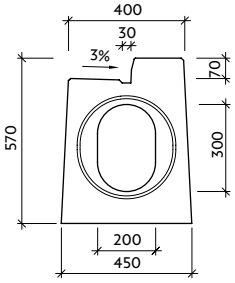
Cross-section: a-a' I-2-V0



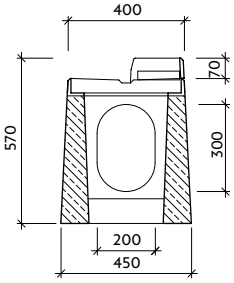
View "a" I-2-V0 - Socket



View "b" I-2-V0 - Spigot



Cross-section: b-b' I-2-V0

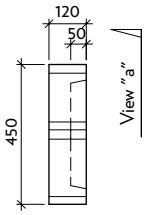


* Nominal dimensions include installation dimensions and/or minimum gap.

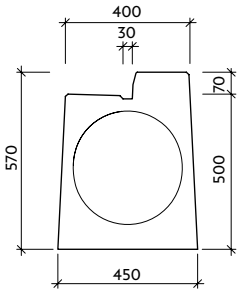
CSB - SLOT DRAIN PROFILE I-2

I-2-ZZ - Socket end cap - 7 cm kerbstone

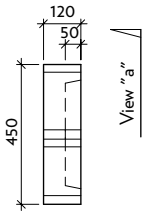
Plan T-ZZ - left



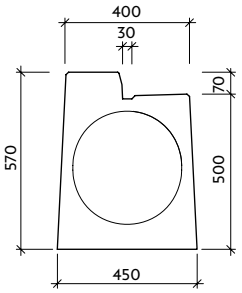
View "a"



Plan T-ZZ - right

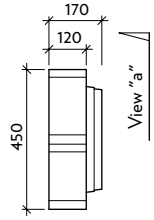


View "a"

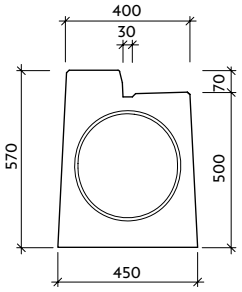


I-2-ZU - Spigot end cap - 7 cm kerbstone

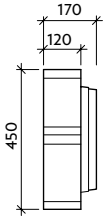
Plan T-ZU - left



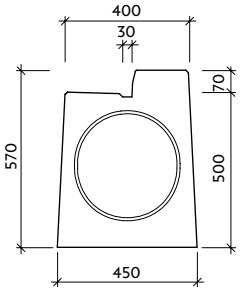
View "a"



Plan T-ZU - right

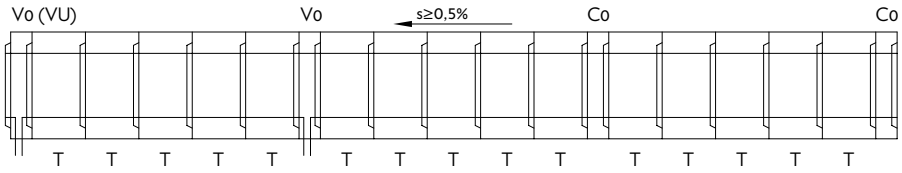


View "a"

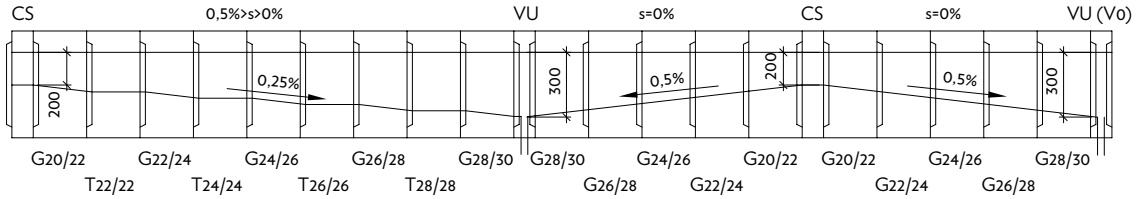


CSB - SLOT DRAIN PROFILE I-2

Suggested layout

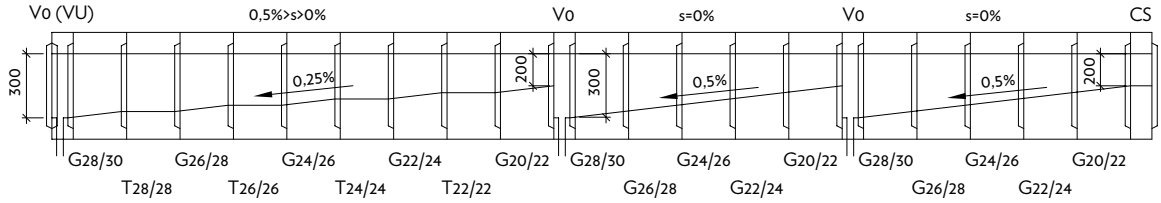


I-2-T Slot drains - layout



I-2-G Slot drains - layout

(slot drain with roof bottom)



I-1-G Slot drains - layout

(slot drain with saw tooth bottom)

Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends

CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends

s – Longitudinal flow profile gradient

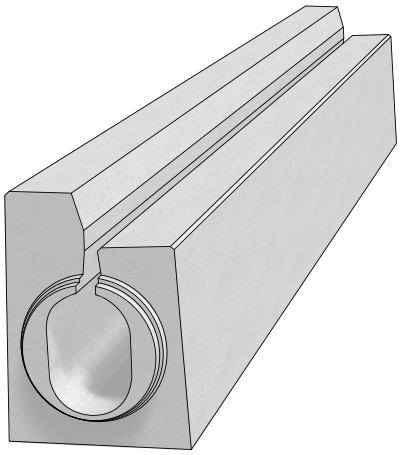
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-3

Protected by utility patent

Technical data:

Slot drain with a 12 cm high kerbstone. This product is suitable for dividing roads from pavements and/or for use in tunnels. They are available with or without internal gradient (0.5%). Gradient-to-gradient components are provided for segments with internal gradient. Profile I-3 slot drains and slot drains with kerbstones are designed for D400 class traffic load and no transversal vehicle travel.

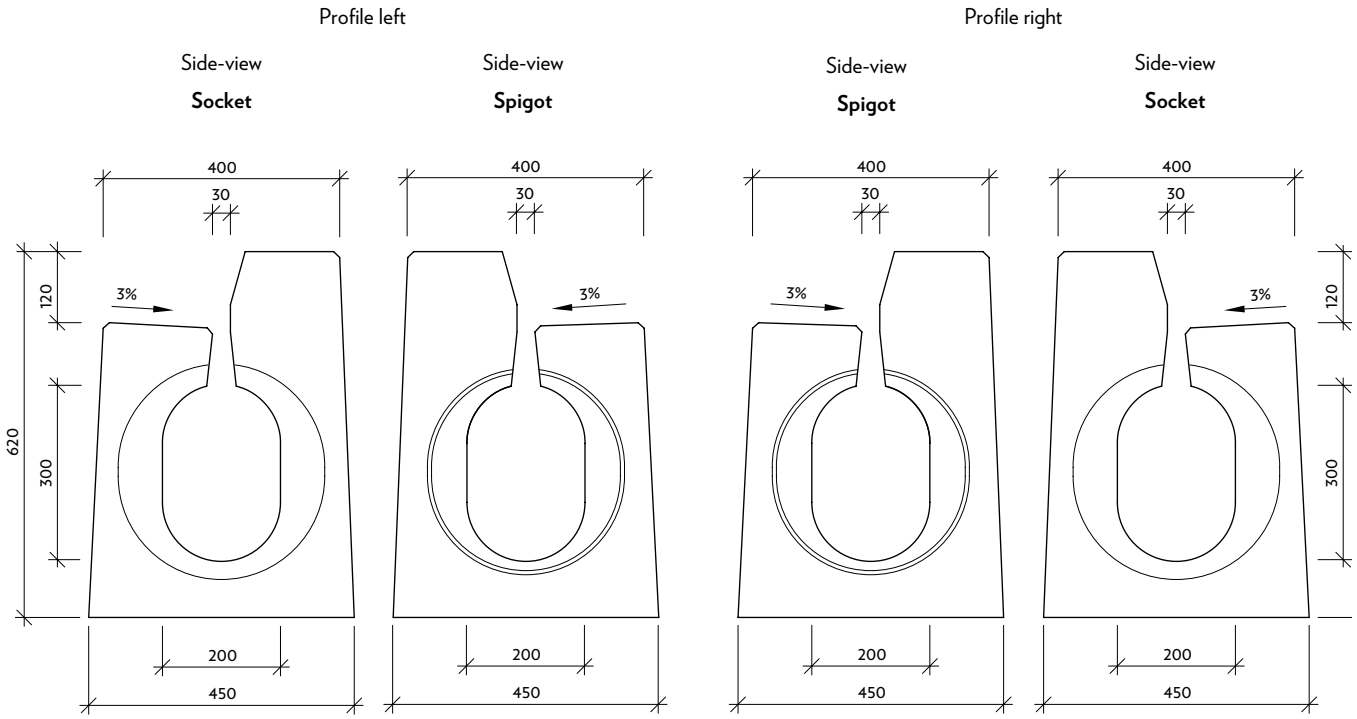


The system consists of the following components:

- 4 m-long slot drains with continuous slots, with or without internal gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- Fire safety barrier (with siphon)
- Slot drain with rising kerbstone
- End cap

		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**pcs**
Slot drain with continuous slot and 12 cm kerbstone	I-3	500/620	4000	400/450	0,25	1704
Slot drain with continuous slot and 12 cm kerbstone, 0.5% flow profile bottom gradient	I-3-G	500/620	4000	400/450	0,25	1723 - 1877
Slot drain without internal gradient, with rising kerbstone (left/right: 0-12/12-0 cm)	I-0-3	500/620	1000	400/450	1	400
Basic gully assembly V0	I-3-V0	500/620	1000	400/450	1	373
Gutter gully assembly VU	I-3-VU	500/620	1000	400/450	1	364
Basic cleaning segment C0	I-3-C0	500/620	1000	400/450	1	420
Top cleaning segment CS	I-3-CS	500/620	1000	400/450	1	468
Fire safety barrier	I-3-PP	950/1070	2000	400/495	0,5	1739
Spigot end cap	I-3-ZU	500	120	400/450	-	76
Socket end cap	I-3-ZZ	500	120	400/450	-	51

Nominal dimensions - basic shapes:

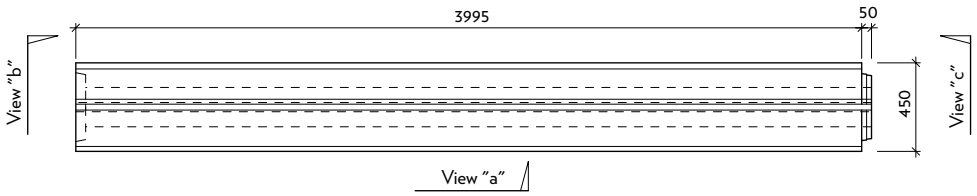


CSB - SLOT DRAIN PROFILE I-3

Protected by utility patent

Profile I-3 - right - Slot drain

Plan

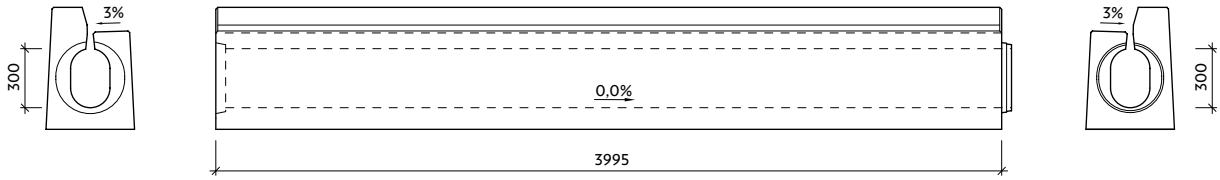


View "b" I-3 - Socket

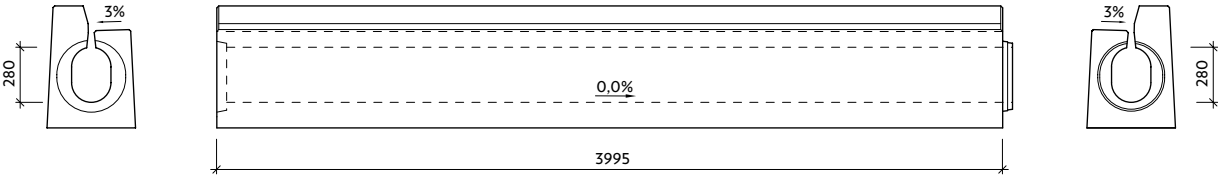
View "a"

View "c" I-3 - Spigot

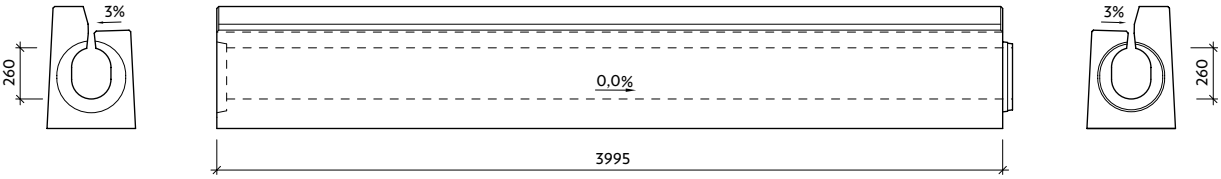
Profile I-3-T30/30-P without internal flow gradient



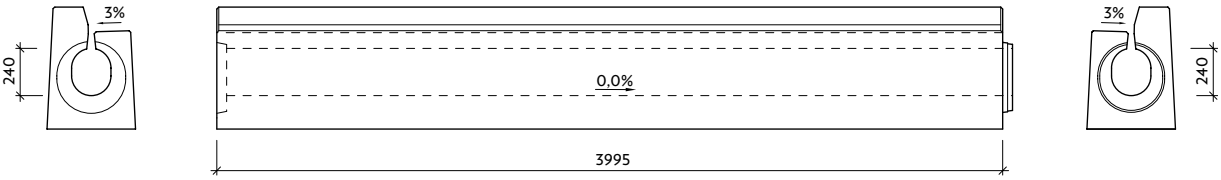
Profile I-3-T28/28-P without internal flow gradient



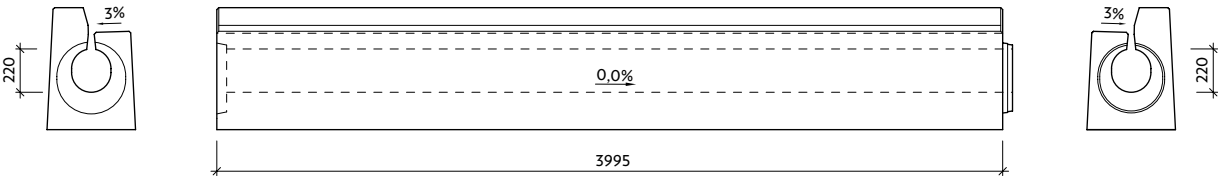
Profile I-3-T26/26-P without internal flow gradient



Profile I-3-T24/24-P without internal flow gradient



Profile I-3-T22/22-P without internal flow gradient



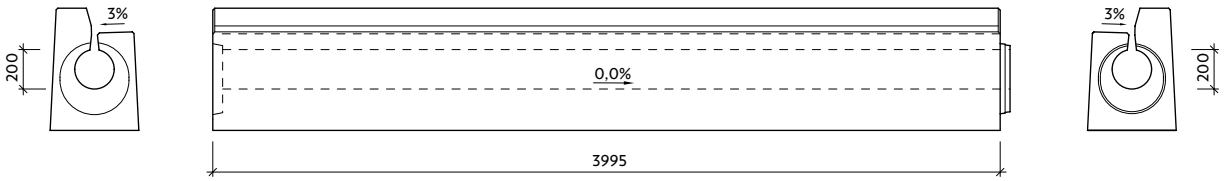
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-3

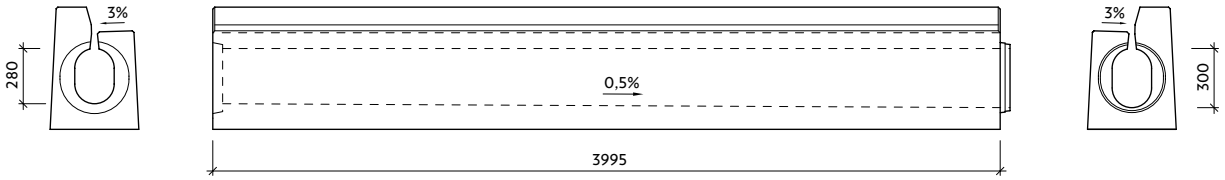
Protected by utility patent

View "b" - Socket | View "a" | View "c" - Spigot

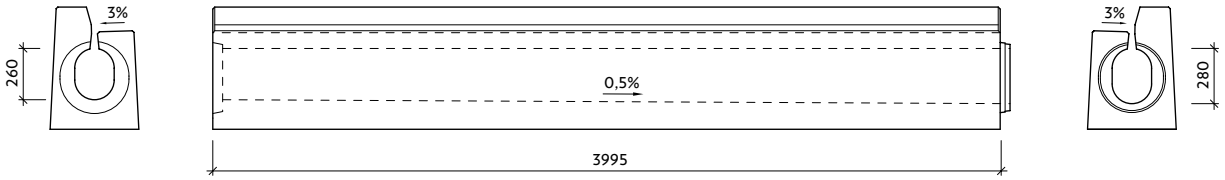
Profile I-3-T20/20-P without internal flow gradient



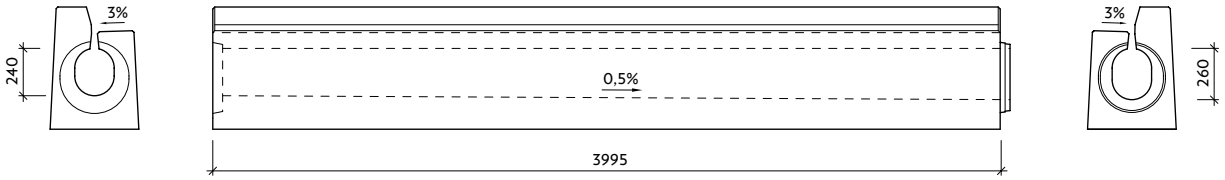
Profile I-3-G28/30-P - 0.5% flow profile bottom gradient



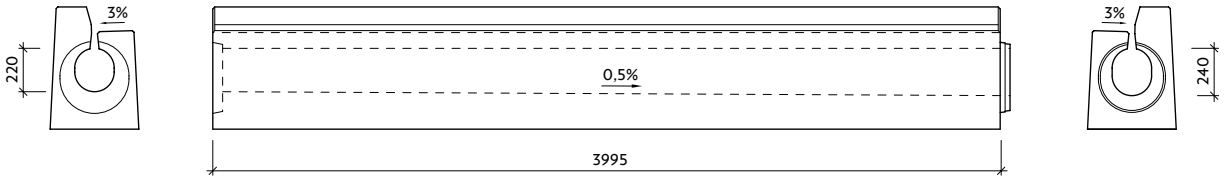
Profile I-3-G26/28-P - 0.5% flow profile bottom gradient



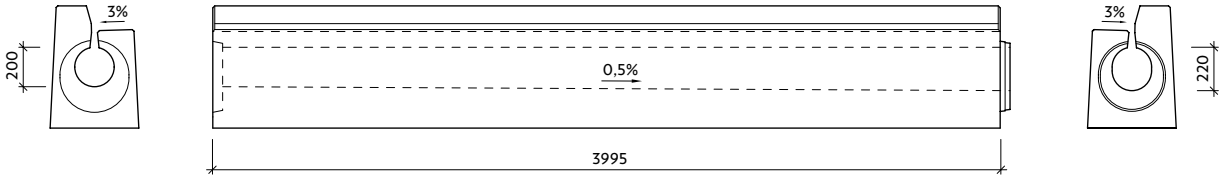
Profile I-3-G24/26-P - 0.5% flow profile bottom gradient



Profile I-3-G22/24-P - 0.5% flow profile bottom gradient



Profile I-3-G20/22-P - 0.5% flow profile bottom gradient

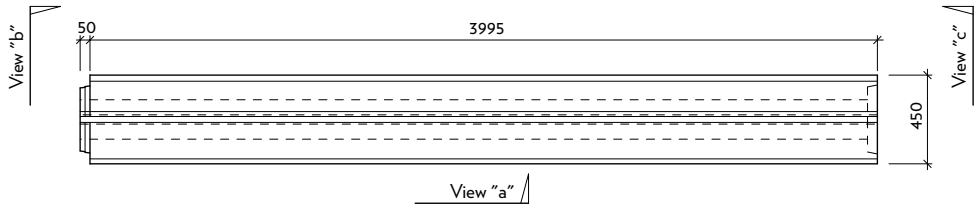


CSB - SLOT DRAIN PROFILE I-3

Protected by utility patent

I I-3 - left - Slot drain

Plan

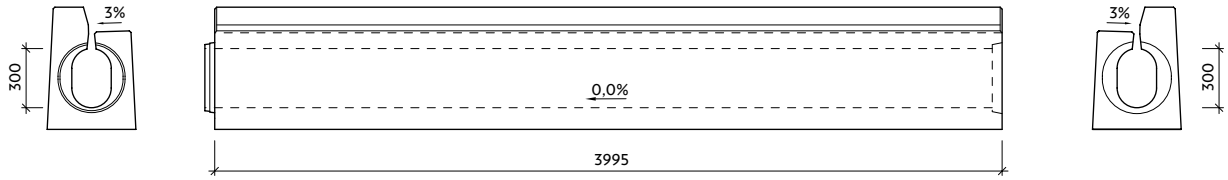


View "b" I-3 - Spigot

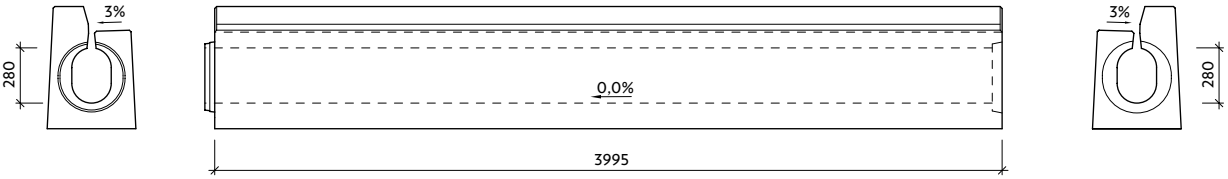
View "a"

View "c" I-3 - Socket

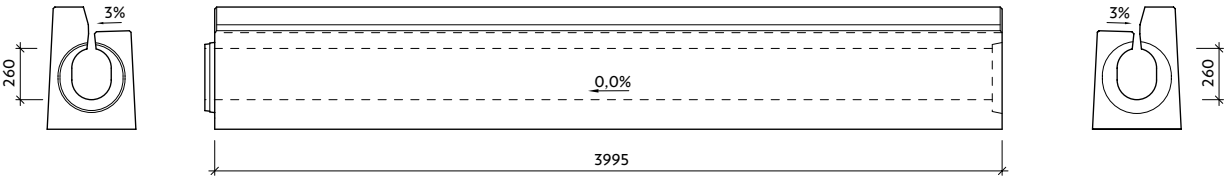
Profile I-3-T30/30-L - without internal flow gradient



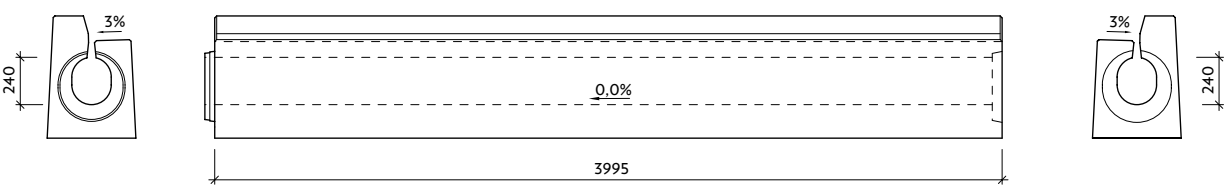
Profile I-3-T28/28-L - without internal flow gradient



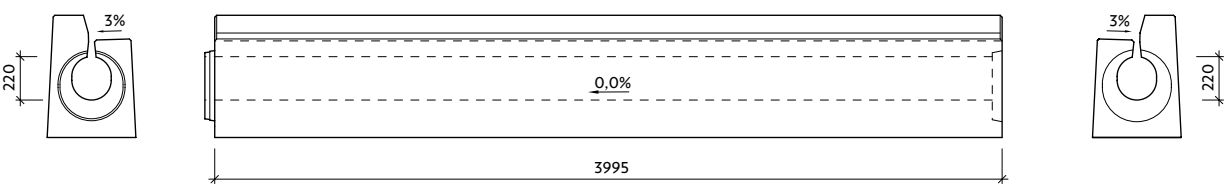
Profile I-3-T26/26-L - without internal flow gradient



Profile I-3-T24/24-L - without internal flow gradient



Profile I-3-T22/22-L - without internal flow gradient



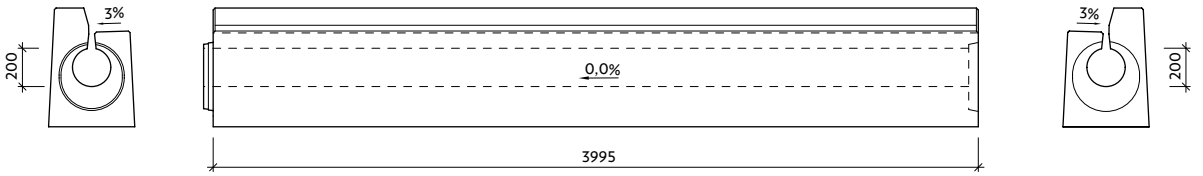
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-3

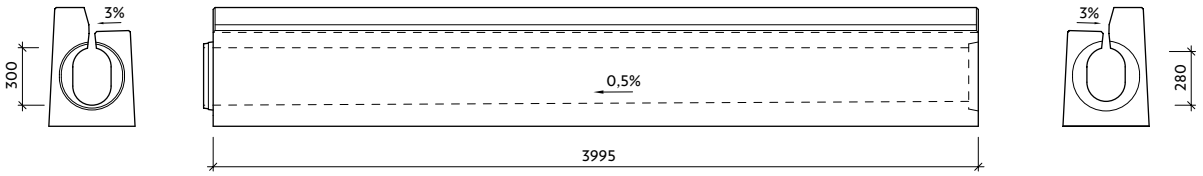
Protected by utility patent

View "b" - Spigot | View "a" | View "c" - Socket

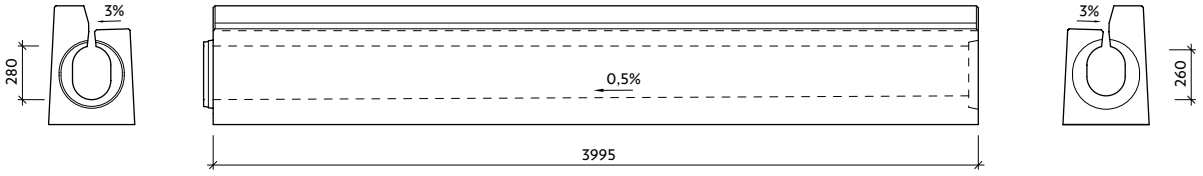
Profile I-3-T20/20-L - without internal flow gradient



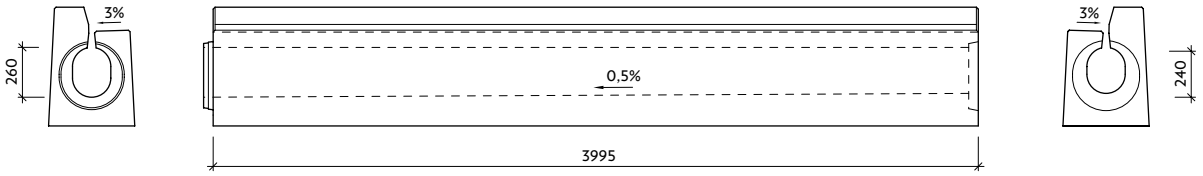
Profile I-3-G28/30-L - 0.5% flow profile bottom gradient



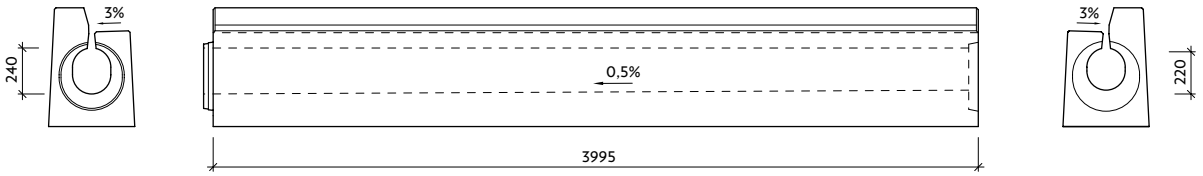
Profile I-3-G26/28-L - 0.5% flow profile bottom gradient



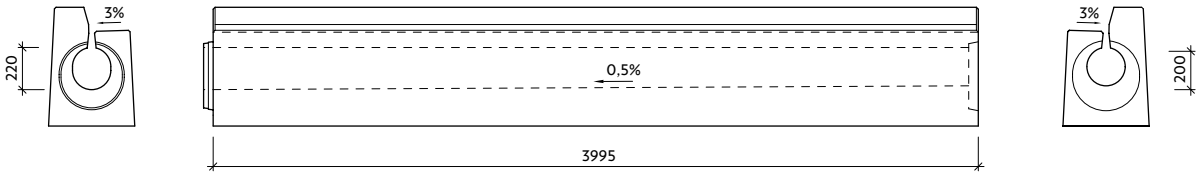
Profile I-3-G24/26-L - 0.5% flow profile bottom gradient



Profile I-3-G22/24-L - 0.5% flow profile bottom gradient



Profile I-3-G20/22-L - 0.5% flow profile bottom gradient

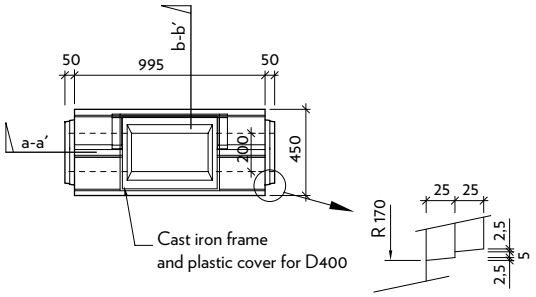


CSB - SLOT DRAIN PROFILE I-3

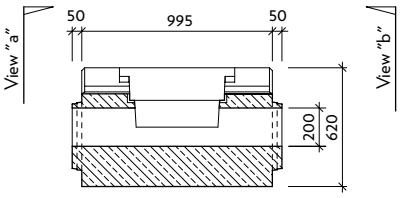
Protected by utility patent

I-3-CS - Top cleaning segment with cast iron grille and plastic cover for D400 - 12 cm kerbstone

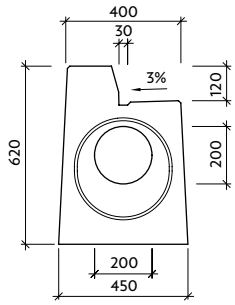
Plan



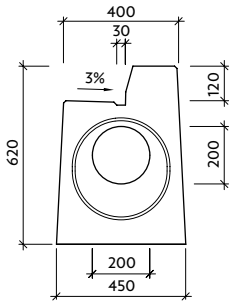
Cross-section: a-a´ I-3-CS



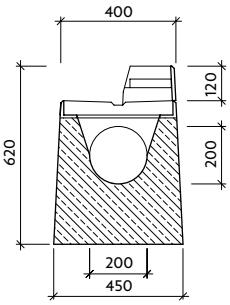
View "a" I-3-CS - Spigot/Spigot



View "b" I-3-CS - Spigot/Spigot

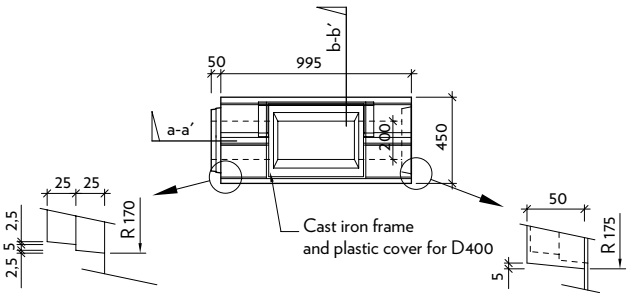


Cross-section: b-b´ I-3-CS

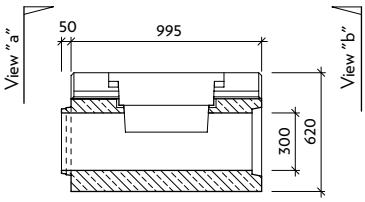


I-3-C0 - left - Basic cleaning segment with cast iron frame and plastic cover for D400 - 12 cm kerbstone

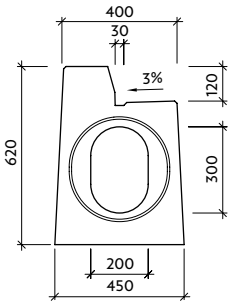
Plan



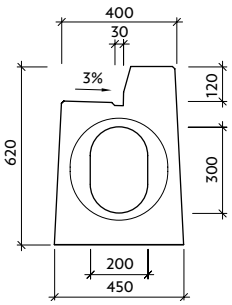
Cross-section: a-a´ I-3-C0



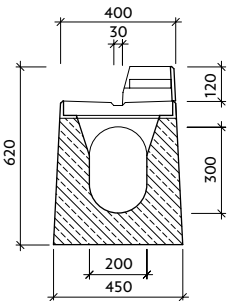
View "a" I-3-C0 - Spigot



View "b" I-3-C0 - Socket



Cross-section: b-b´ I-3-C0



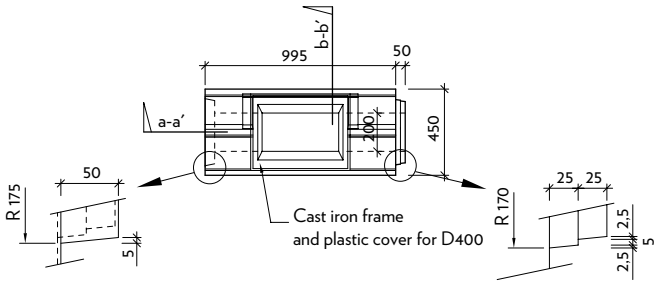
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-3

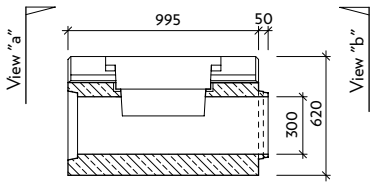
Protected by utility patent

I-3-C0 - right - Basic cleaning segment with cast iron frame and plastic cover for D400 - 12 cm kerbstone

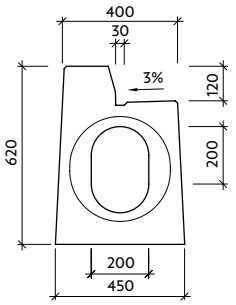
Plan



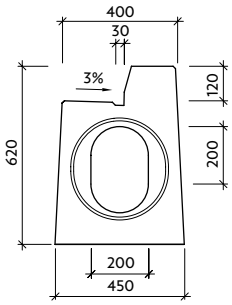
Cross-section: a-a' I-3-C0



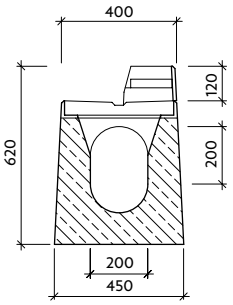
View "a" I-3-C0 - Socket



View "b" I-3-C0 - Spigot

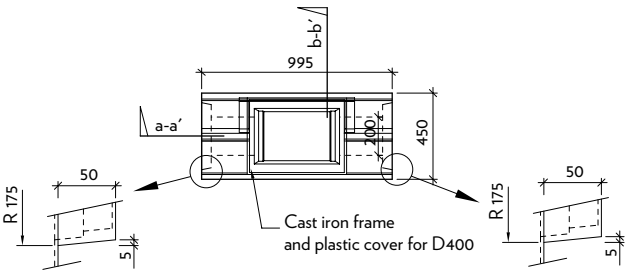


Cross-section: b-b' I-3-C0

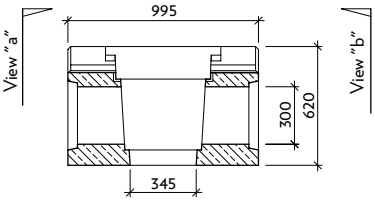


I-3-VU - Gutter gully assembly with cast iron grille and plastic cover for D400 - 12 cm kerbstone

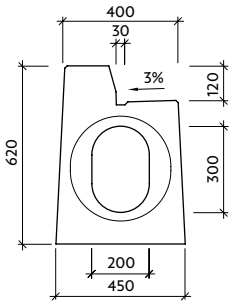
Plan



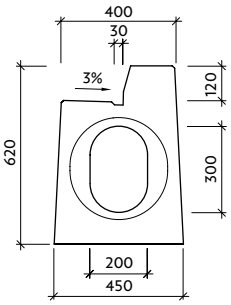
Cross-section: a-a' I-3-VU



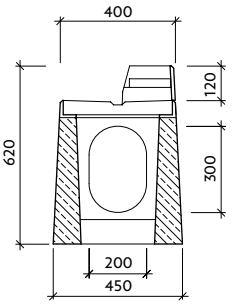
View "a" I-3-VU - Socket/Socket



View "b" I-3-VU - Socket/Socket



Cross-section: b-b' I-3-VU

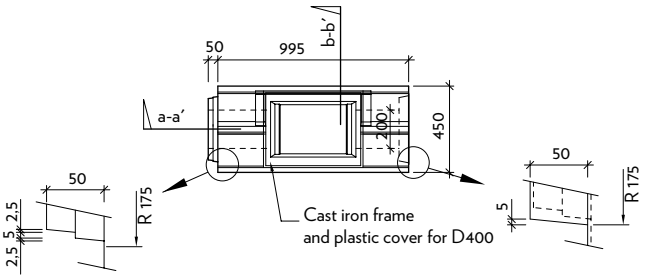


CSB - SLOT DRAIN PROFILE I-3

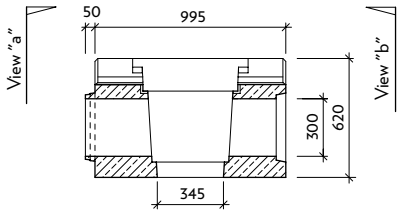
Protected by utility patent

I-3-V0 - left - Basic gully assembly with 12 cm kerbstone. Cast iron frame and plastic cover for D400

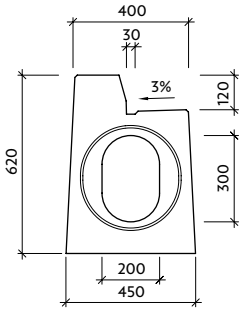
Plan



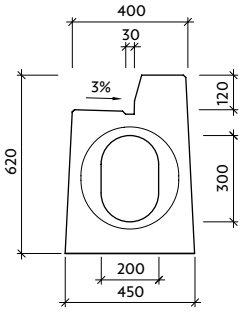
Cross-section: a-a' I-3-V0



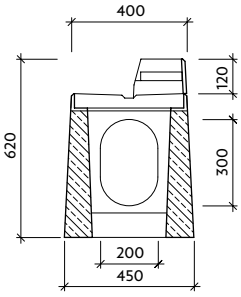
View "a" I-3-V0 - Spigot



View "b" I-3-V0 - Socket

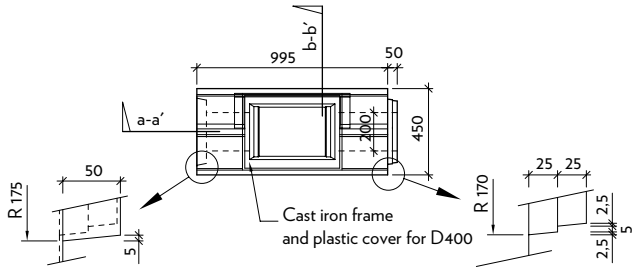


Cross-section: b-b' I-3-V0

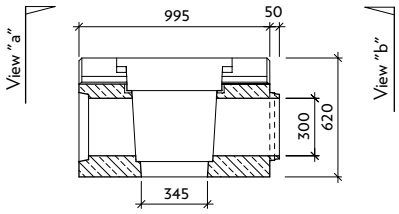


I-3-V0 - right - Basic gully assembly with 12 cm kerbstone. Cast iron frame and plastic cover for D400

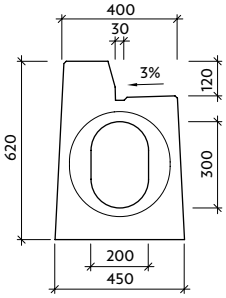
Plan



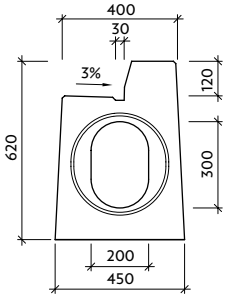
Cross-section: a-a' I-3-V0



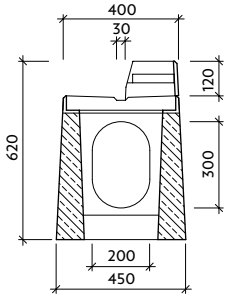
View "a" I-3-V0 - Socket



View "b" I-3-V0 - Spigot



Cross-section: b-b' I-3-V0



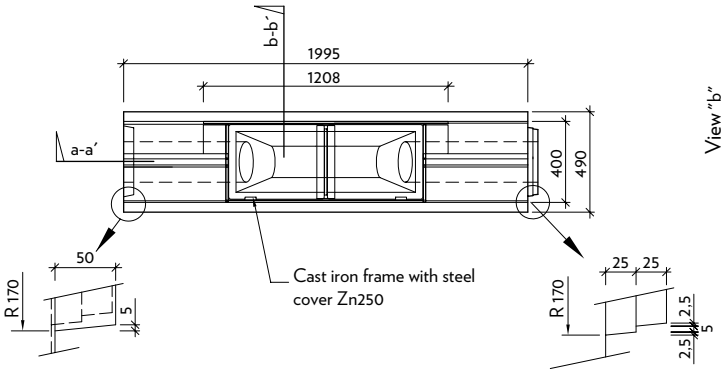
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-3

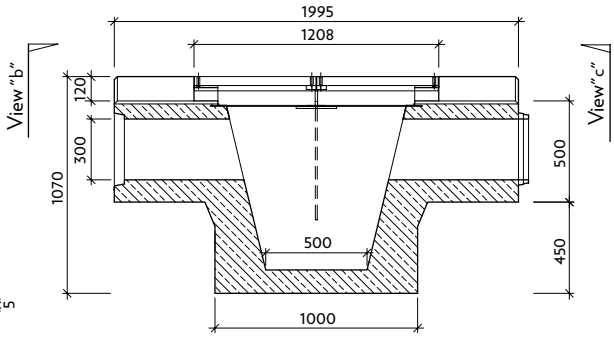
Protected by utility patent

I-3-PP - right - Fire safety barrier with cast iron grille and steel cover for D400 - 12 cm kerbstone

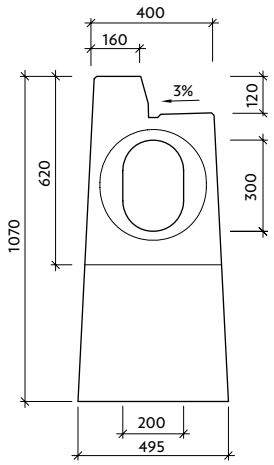
Plan



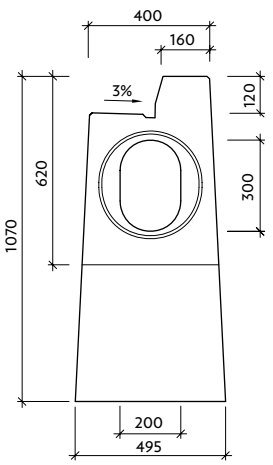
Cross-section: a-a´



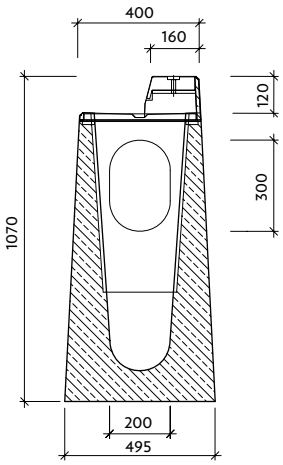
View "b" - Socket



View "c" - Spigot

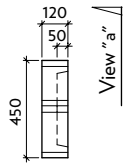


Cross-section: b-b´

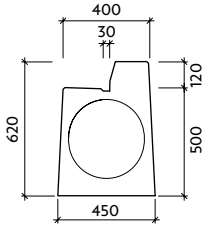


I-3-ZZ - Socket end cap and 12 cm kerbstone

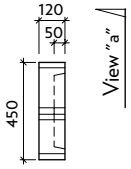
Plan T-ZZ - left



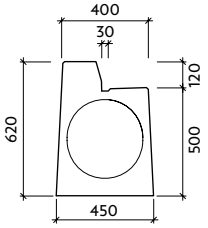
View "a"



Plan T-ZZ - right

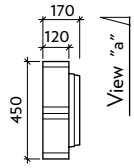


View "a"

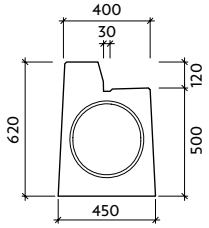


I-3-ZU - Spigot end cap and 12 cm kerbstone

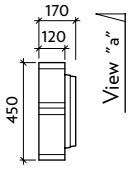
Plan T-ZU - left



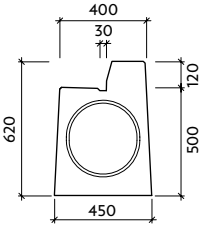
View "a"



Plan T-ZU - right



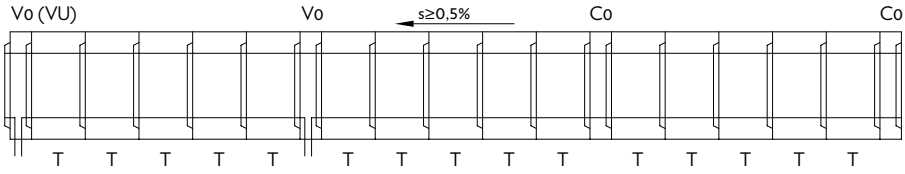
View "a"



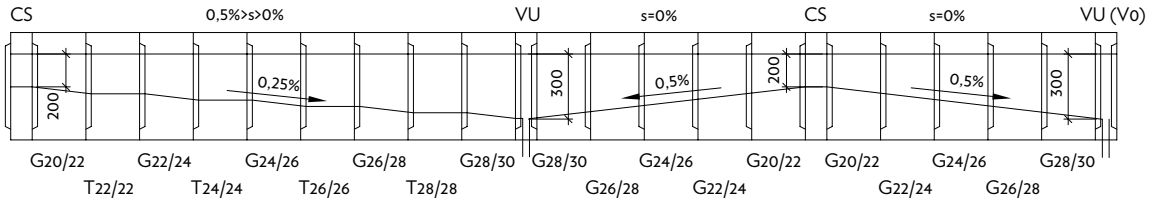
CSB - SLOT DRAIN PROFILE I-3

Suggested layout

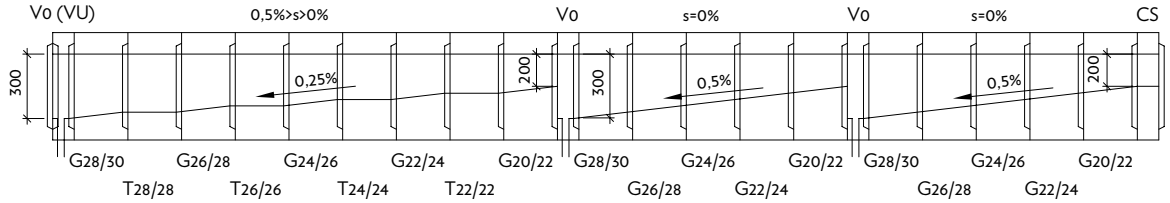
I-3-T Slot drains - layout



I-3-G Slot drains - layout
(slot drain with roof bottom)



I-3-G Slot drains - layout
(slot drain with saw tooth bottom)



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends
VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends
C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends
CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends
s – Longitudinal flow profile gradient

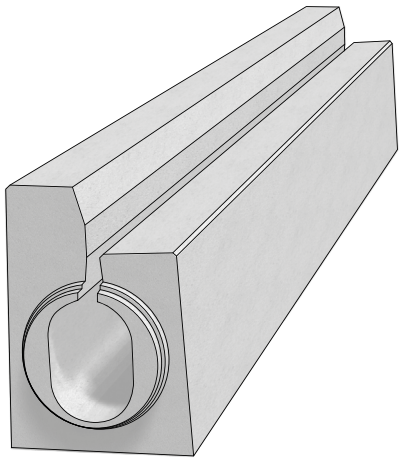
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-4

Protected by utility patent

Technical data:

Slot drain with a 15 cm high kerbstone. This product is suitable for dividing roads from pavements and for use in tunnels. They are available with or without internal gradient (0.5%). Gradient-to-gradient components are provided for segments with internal gradient. Profile I-4 slot drains and slot drains with kerbstones are designed for D400 class traffic load and no transversal vehicle travel.

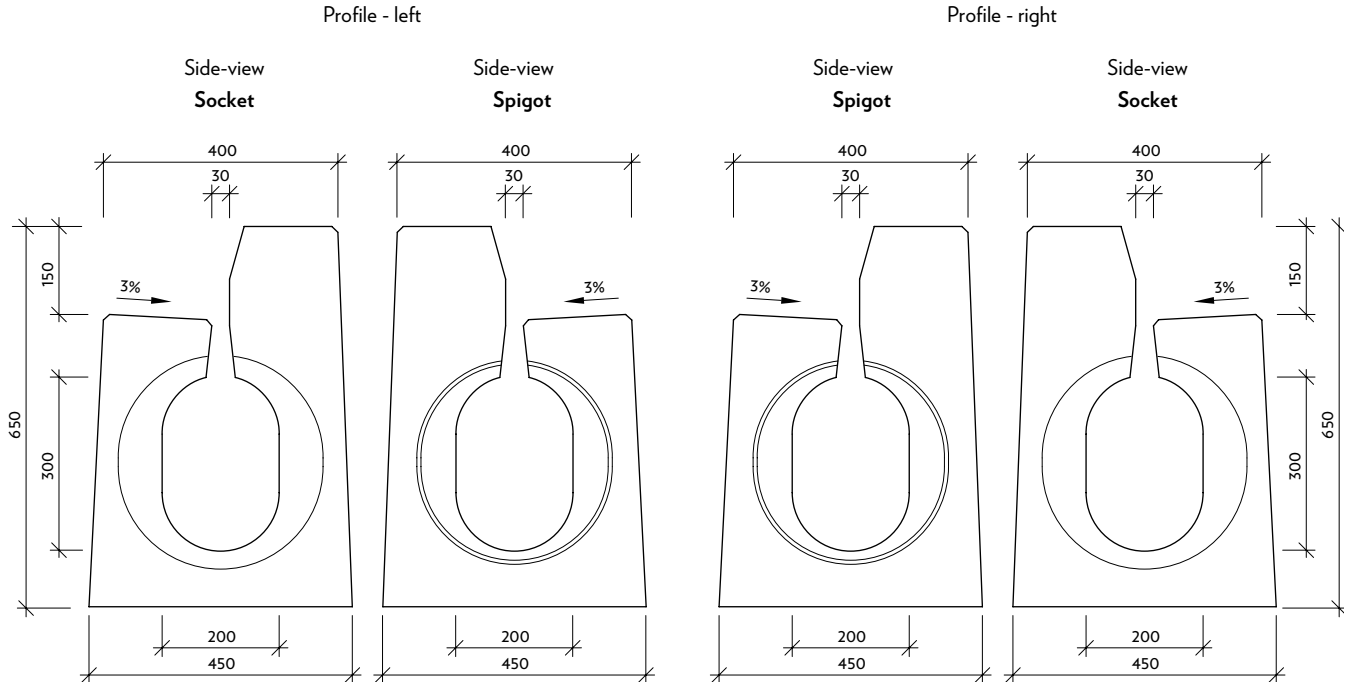


The system consists of the following components:

- 4 m-long slot drains with continuous slots, with or without internal gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- Fire safety barrier (with siphon)
- Slot drain with rising kerbstone
- End cap

		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**pcs**
Slot drain with continuous slot and 15 cm kerbstone	I-4	500/650	4000	400/450	0,25	1710
Slot drain with continuous slot and 15 cm kerbstone, 0.5% flow profile bottom gradient	I-4-G	500/650	4000	400/450	0,25	1730-1898
Slot drain without internal gradient, with rising kerbstone (left/right: 0-15/15-0 cm)	I-0-4	500/650	1000	400/450	1	401
Basic gully assembly V0	I-4-V0	500/650	1000	400/450	1	385
Gutter gully assembly VU	I-4-VU	500/650	1000	400/450	1	377
Basic cleaning segment C0	I-4-C0	500/650	1000	400/450	1	432
Top cleaning segment CS	I-4-CS	500/650	1000	400/450	1	514
Fire safety barrier	I-4-PP	950/1090	2000	400/495	0,5	1728
Spigot end cap	I-4-ZU	500	120	400/450	-	76
Socket end cap	I-4-ZZ	500	120	400/450	-	51

Nominal dimensions - basic shapes:

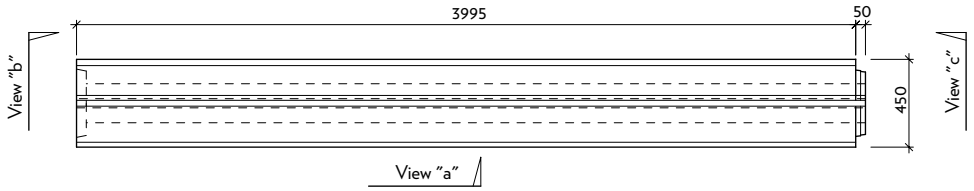


CSB - SLOT DRAIN PROFILE I-4

Protected by utility patent

Profile I-4 right- slot drain

Plan

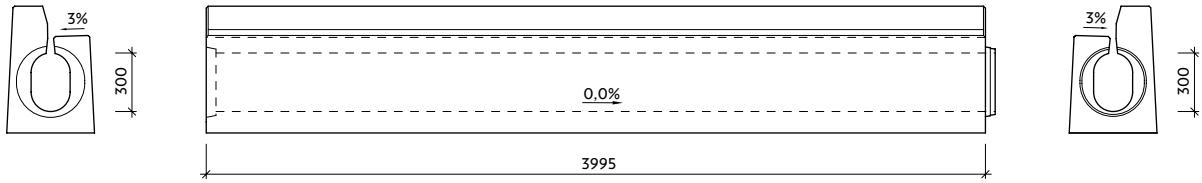


View "b" I-4 - Socket

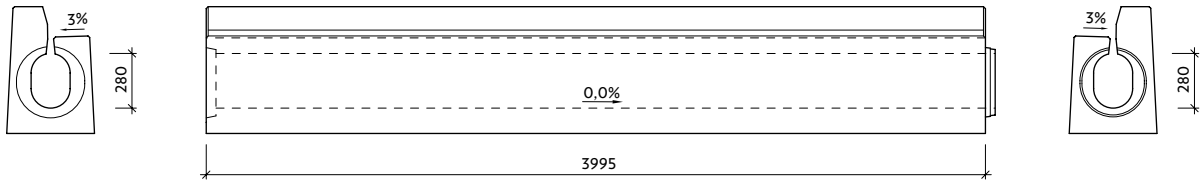
View "a"

View "c" I-4 - Spigot

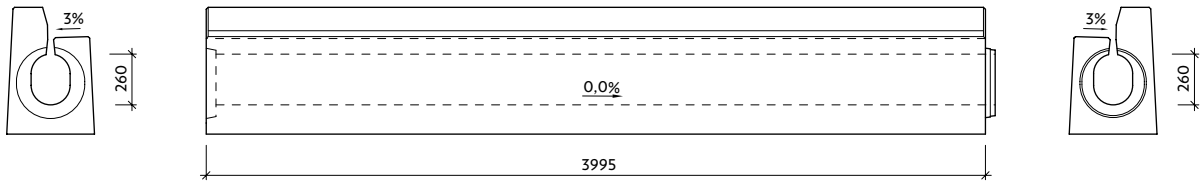
Profile I-4-T30/30-P - without internal flow gradient



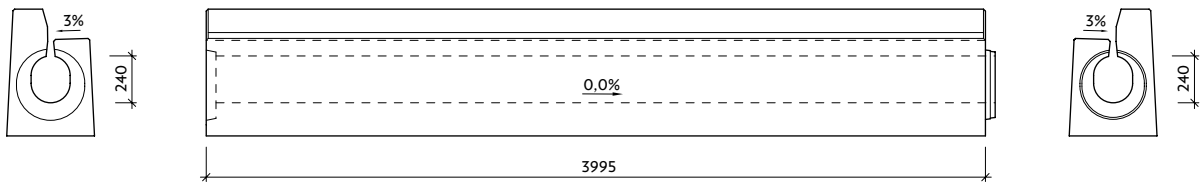
Profile I-4-T28/28-P - without internal flow gradient



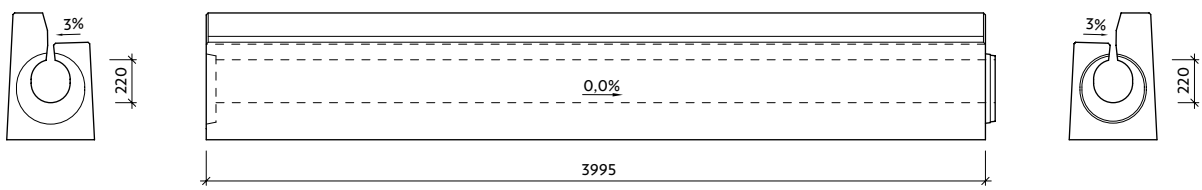
Profile I-4-T26/26-P - without internal flow gradient



Profile I-4-T24/24-P - without internal flow gradient



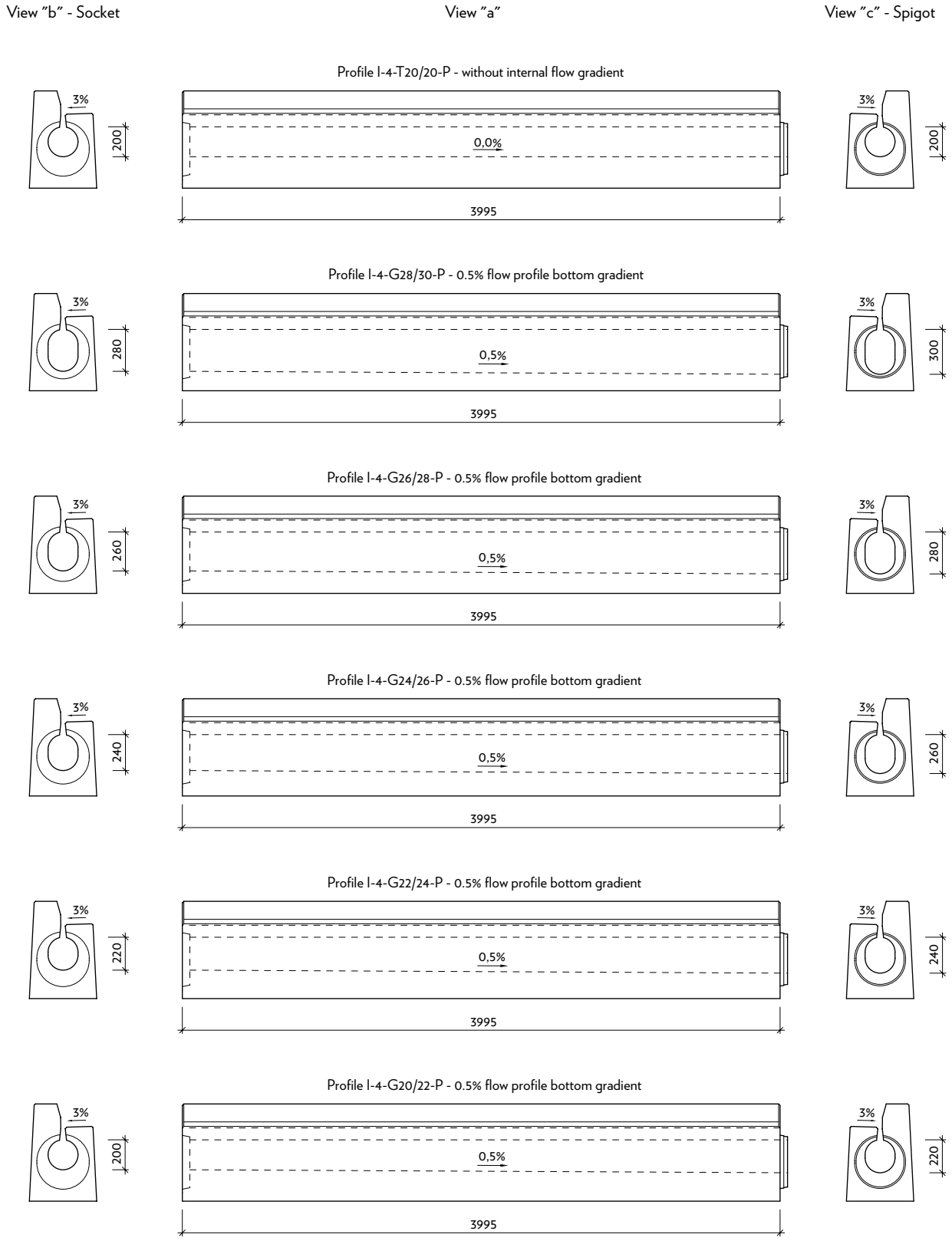
Profile I-4-T22/22-P - without internal flow gradient



* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-4

Protected by utility patent

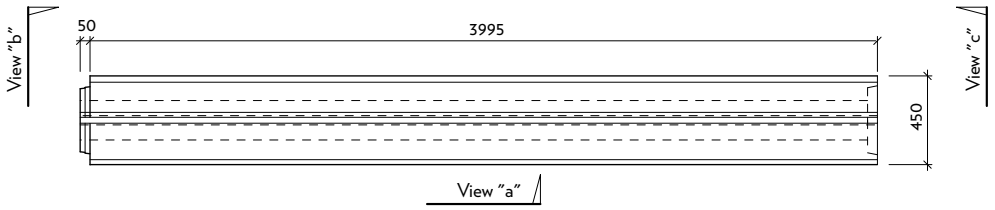


CSB - SLOT DRAIN PROFILE I-4

Protected by utility patent

Profile I-4 - left - slot drain

Plan

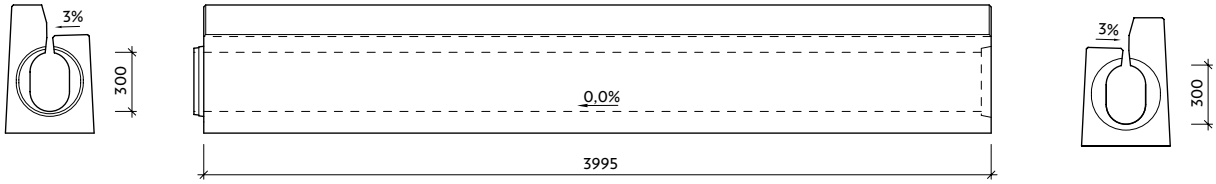


View "b" I-4 - Spigot

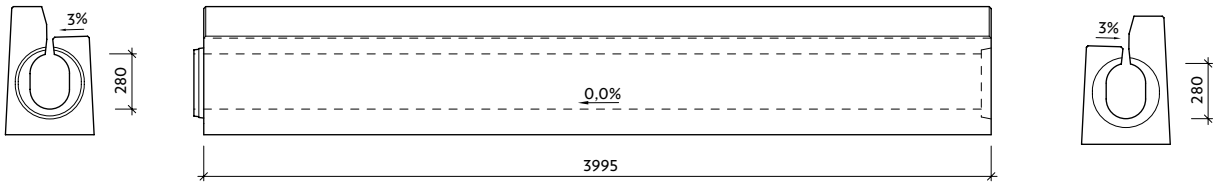
View "a"

View "c" I-4 - Socket

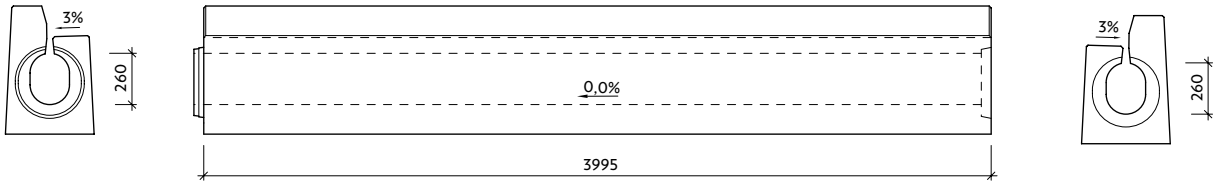
Profile I-4-T30/30-L - without internal flow gradient



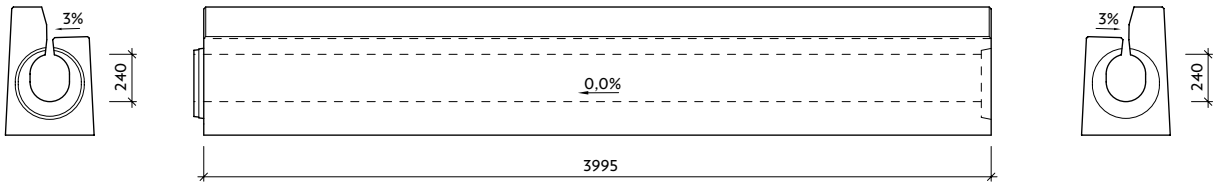
Profile I-4-T28/28-L - without internal flow gradient



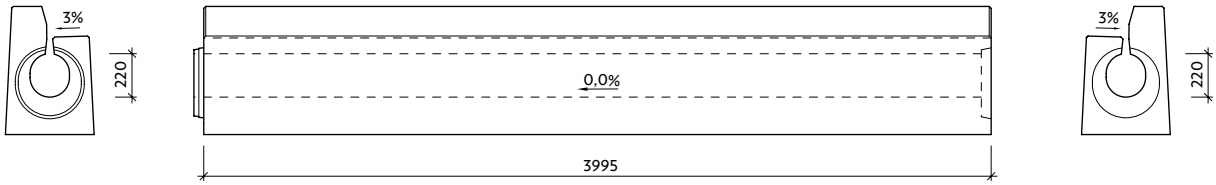
Profile I-4-T26/26-L - without internal flow gradient



Profile I-4-T24/24-L - without internal flow gradient



Profile I-4-T22/22-L - without internal flow gradient



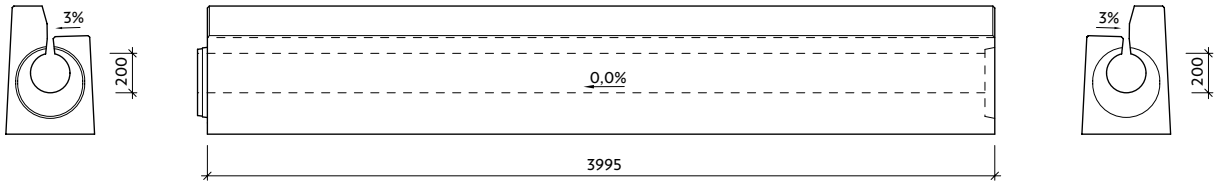
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-4

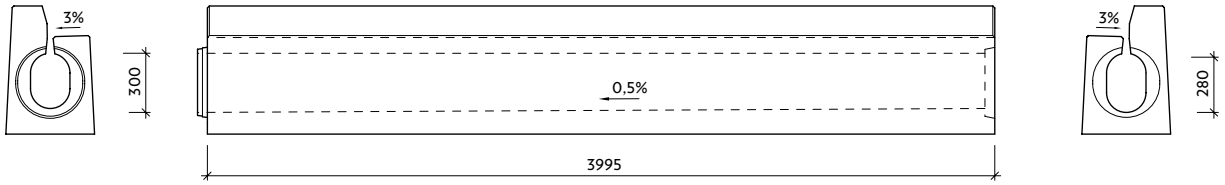
Protected by utility patent

View "b" - Spigot | View "a" | View "c" - Socket

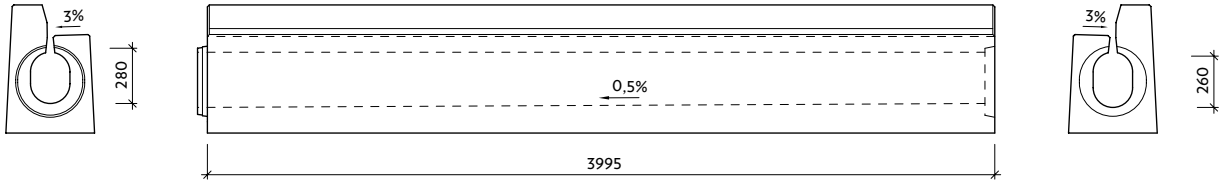
Profile I-4-T20/20-L - without internal flow gradient



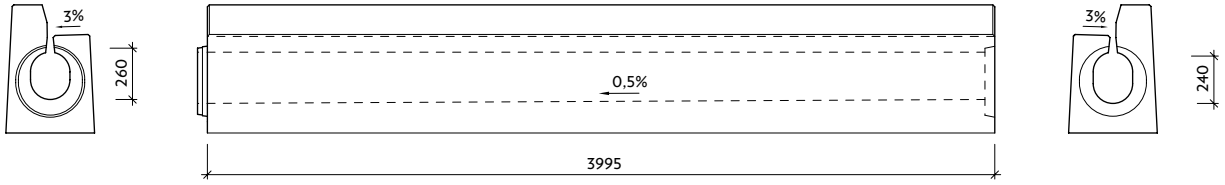
Profile I-4-G28/30-L - 0.5% flow profile bottom gradient



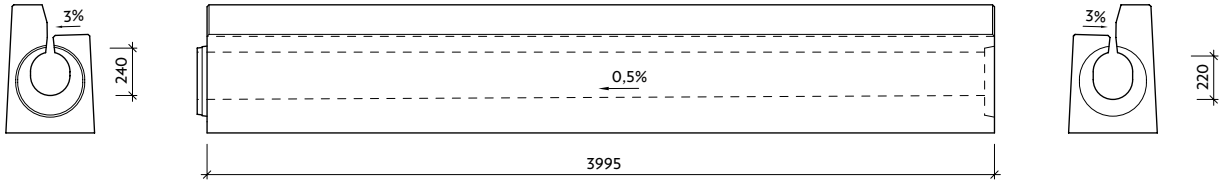
Profile I-4-G26/28-L - 0.5% flow profile bottom gradient



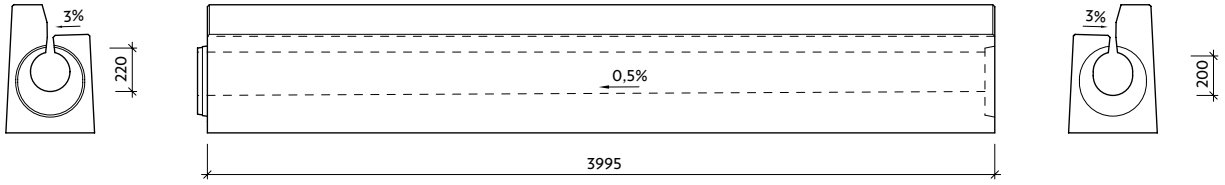
Profile I-4-G24/26-L - 0.5% flow profile bottom gradient



Profile I-4-G22/24-L - 0.5% flow profile bottom gradient



Profile I-4-G20/22-L - 0.5% flow profile bottom gradient

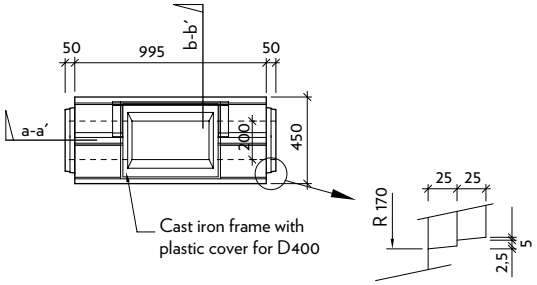


CSB - SLOT DRAIN PROFILE I-4

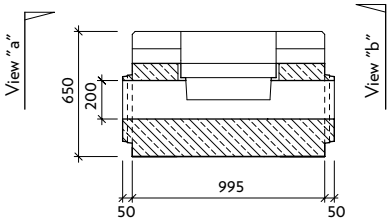
Protected by utility patent

I-4-CS - Top cleaning segment with cast iron grille and plastic cover for D400 - 15 cm kerbstone

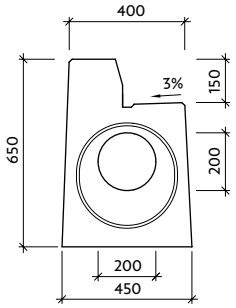
Plan



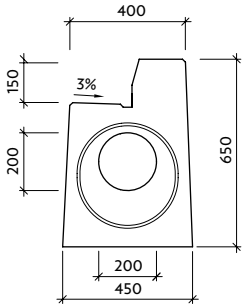
Cross-section: a-a´ I-4-CS



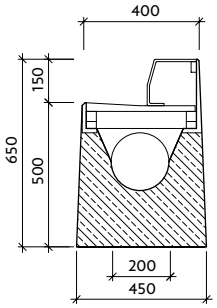
View "a" I-4-CS - Spigot/Spigot



View "b" I-4-CS - Spigot/Spigot

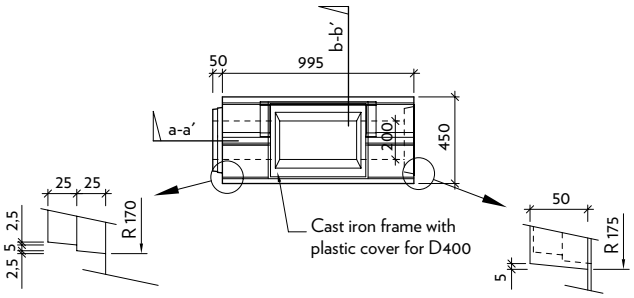


Cross-section: b-b´ I-4-CS

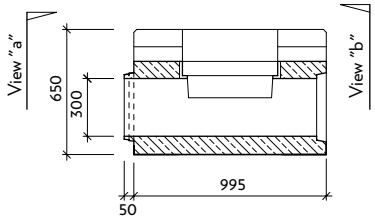


I-4-C0 - left - Basic cleaning segment with cast iron frame and plastic cover for D400 - 15 cm kerbstone

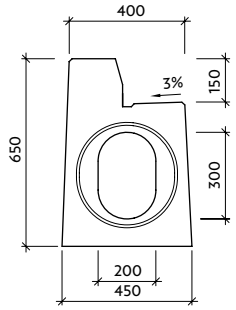
Plan



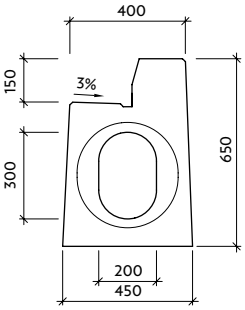
Cross-section: a-a´ I-4-C0



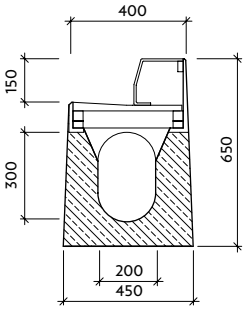
View "a" I-4-C0 - Spigot



View "b" I-4-C0 - Socket



Cross-section: b-b´ I-4-C0



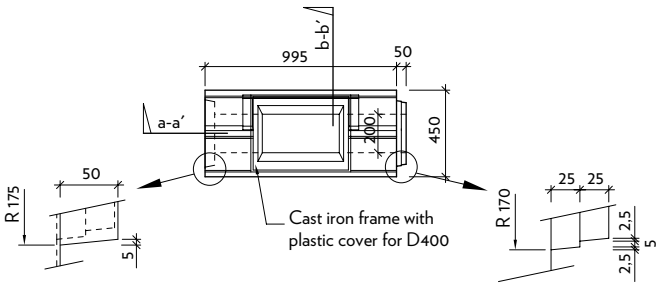
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-4

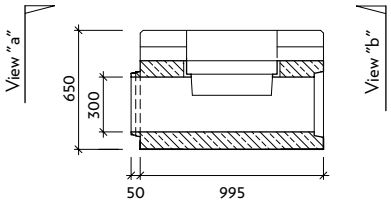
Protected by utility patent

I-4-C0 - right - Basic cleaning segment with cast iron frame and plastic cover for D400 - 15 cm kerbstone

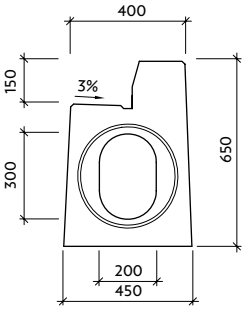
Plan



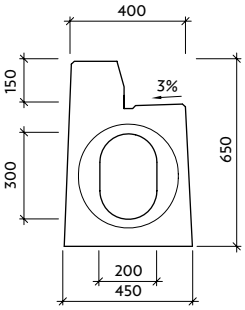
Cross-section: a-a´ I-4-C0



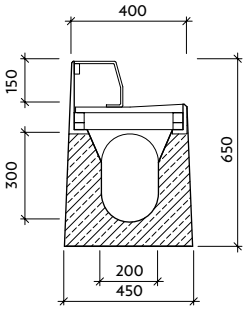
View "a" I-4-C0 - Spigot



View "b" I-4-C0 - Socket

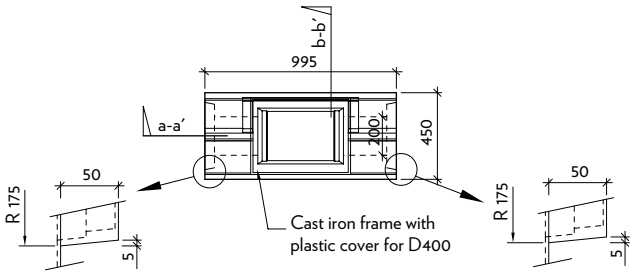


Cross-section: b-b´ I-4-C0

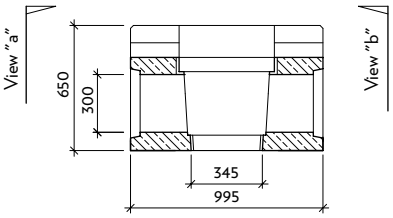


I-4-VU - Gutter gully assembly with 15 cm kerbstone. Cast iron frame and plastic cover for D400

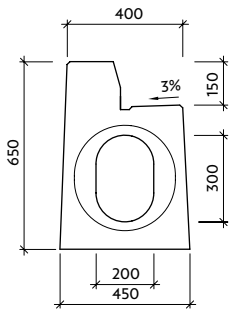
Plan



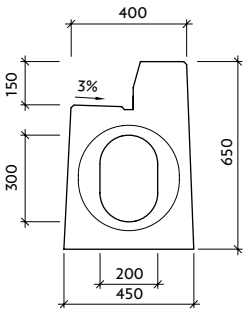
Cross-section: a-a´ I-4-VU



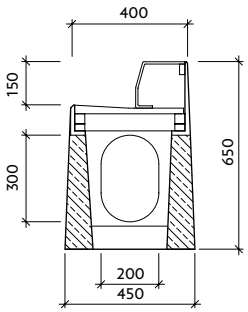
View "a" I-4-VU - Socket



View "b" I-4-VU - Socket



Cross-section: b-b´ I-4-VU

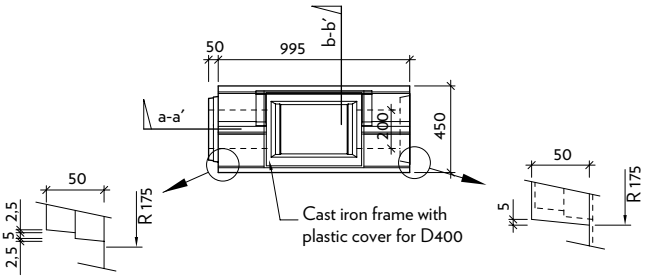


CSB - SLOT DRAIN PROFILE I-4

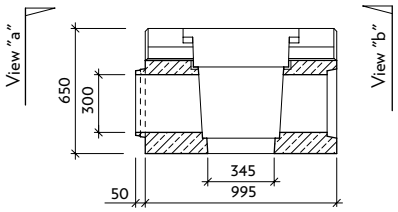
Protected by utility patent

I-4-V0 - left - Basic gully assembly with 15 cm kerbstone. Cast iron frame and plastic cover for D400

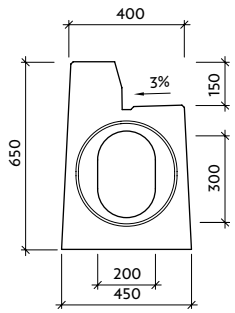
Plan



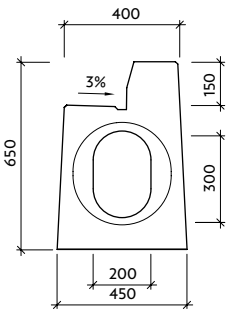
Cross-section: a-a' I-4-V0



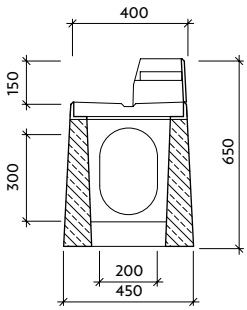
View "a" I-4-V0 - Spigot



View "b" I-4-V0 - Socket

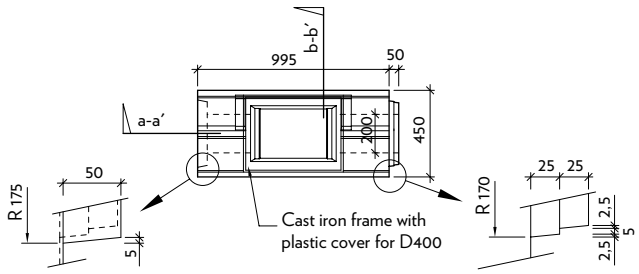


Cross-section: b-b' I-4-V0

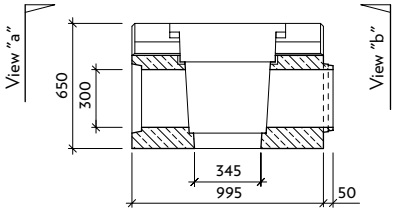


I-4-V0 - right - Basic gully assembly with 15 cm kerbstone. Cast iron frame and plastic cover for D400

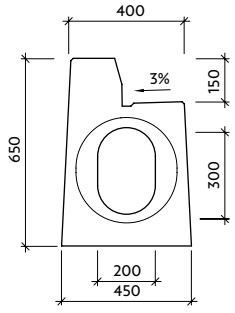
Plan



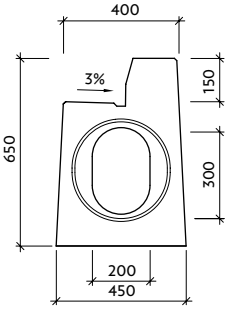
Cross-section: a-a' I-4-V0



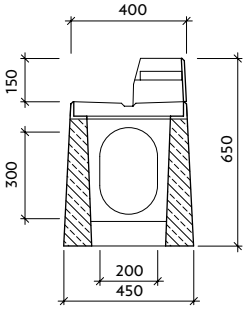
View "a" I-4-V0 - Socket



View "b" I-4-V0 - Spigot



Cross-section: b-b' I-4-V0



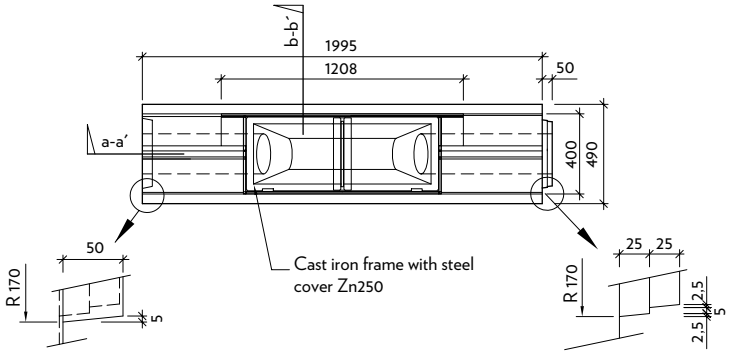
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-4

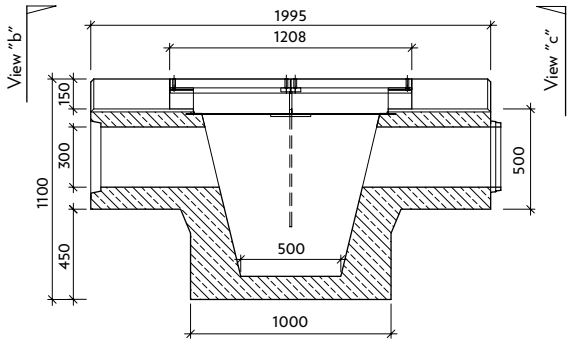
Protected by utility patent

I-4-PP - right - Fire safety barrier with steel cover for D400 and 15 cm kerbstone

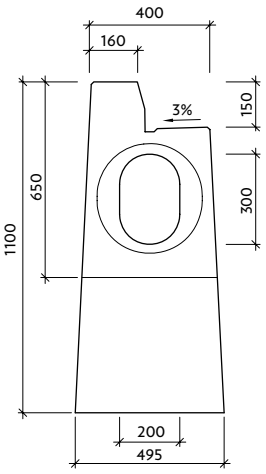
Plan



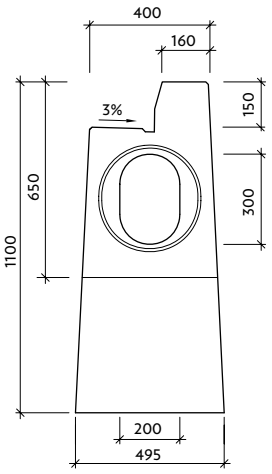
Cross-section: a-a´



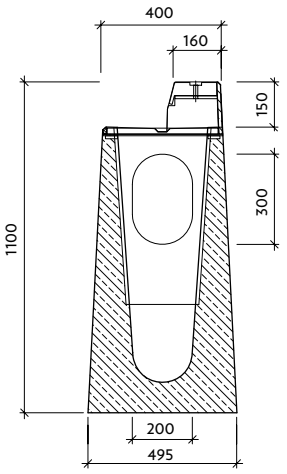
View "b" - Socket



View "c" - Spigot

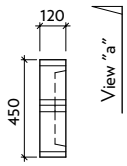


Cross-section: b-b´

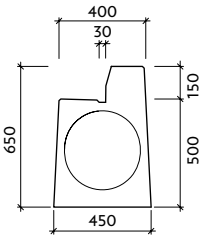


I-4-ZZ - Socket end cap and 15 cm kerbstone

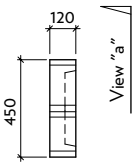
Plan T-ZZ - left



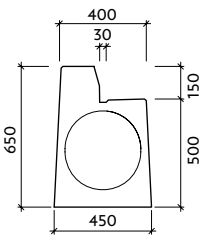
View "a"



Plan T-ZZ - right

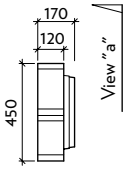


View "a"

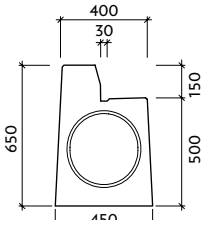


I-4-ZU - Spigot end cap and 15 cm kerbstone

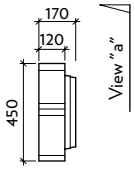
Plan T-ZU - left



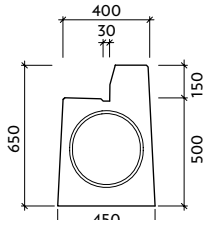
View "a"



Plan T-ZU - right



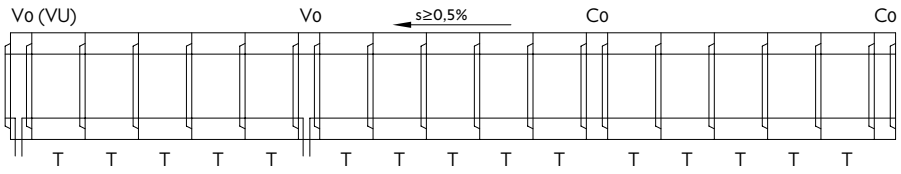
View "a"



CSB - SLOT DRAIN PROFILE I-4

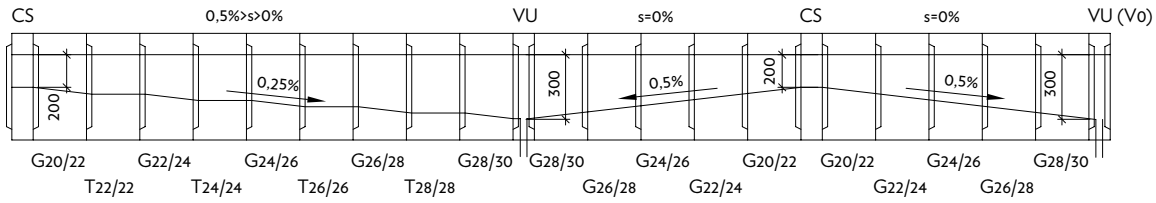
Suggested layout

I-4-T Slot drains - layout



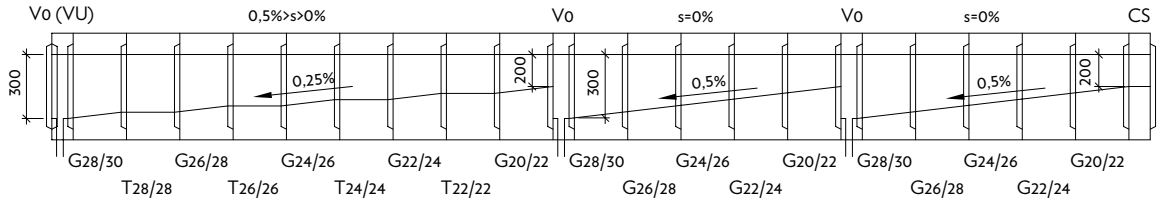
I-4-G Slot drains - layout

(slot drain with roof bottom)



I-4-G Slot drains - layout

(slot drain with saw tooth bottom)



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends

CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends

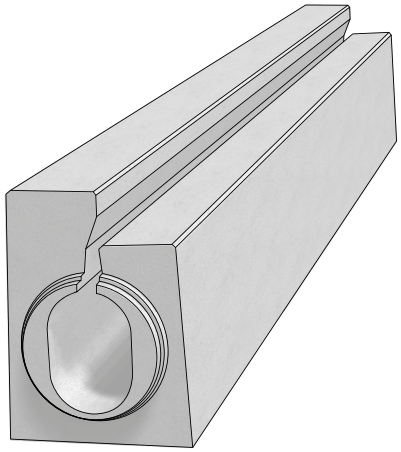
s – Longitudinal flow profile gradient

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-5

Protected by utility patent

Technical data:



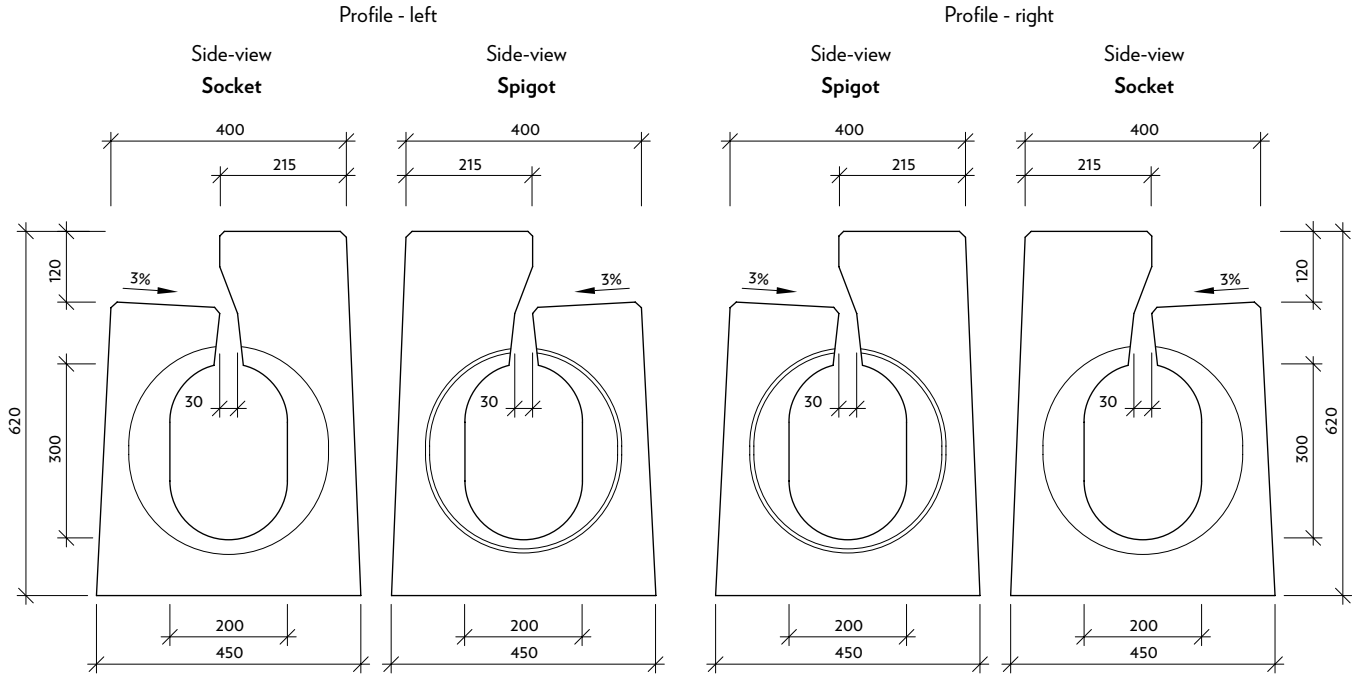
Slot drains with offset covered slot and 12 cm high kerbstone. These products are suitable for dividing roads from pavements and where the slot is to be covered for safety. The kerbstone overlaps the slot and prevents items (bicycle wheels, baby pram wheels, walking sticks, rollerblades etc.) from becoming trapped. They are especially suitable for inner cities and tunnels. They are available with or without internal gradient (0.5%).
Gradient-to-gradient components are provided for segments with internal gradient. Profile I-5 slot drains and slot drains with kerbstones are designed for D400 class traffic load and no transversal vehicle travel.

The system consists of the following components:

- 4 m-long slot drains with continuous slots, with or without internal gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- Fire safety barrier (with siphon)
- Slot drain with rising kerbstone
- End cap

		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**pcs**
Slot drain with continuous slot and 12 cm kerbstone	I-5	500/620	4000	400/450	0,25	1681
Slot drain with continuous slot and 12 cm kerbstone, 0.5% flow profile bottom gradient	I-5-G	500/620	4000	400/450	0,25	1700 - 1849
Slot drain without internal gradient, with rising kerbstone (left/right: 0-12/12-0 cm)	I-0-5	500/620	1000	400/450	1	404
Basic gully assembly V0	I-5-V0	500/620	1000	400/450	1	378
Gutter gully assembly VU	I-5-VU	500/620	1000	400/450	1	369
Basic cleaning segment C0	I-5-C0	500/620	1000	400/450	1	425
Top cleaning segment CS	I-5-CS	500/620	1000	400/450	1	473
Spigot end cap	I-5-ZU	500	120	400/450	-	76
Socket end cap	I-5-ZZ	500	120	400/450	-	51

Nominal dimensions - basic shapes:

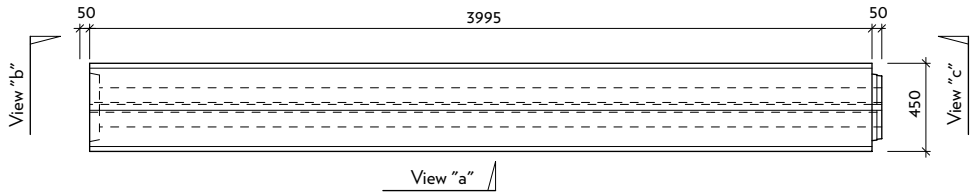


CSB - SLOT DRAIN PROFILE I-5

Protected by utility patent

Profile I-5 - right - Slot drain

Plan

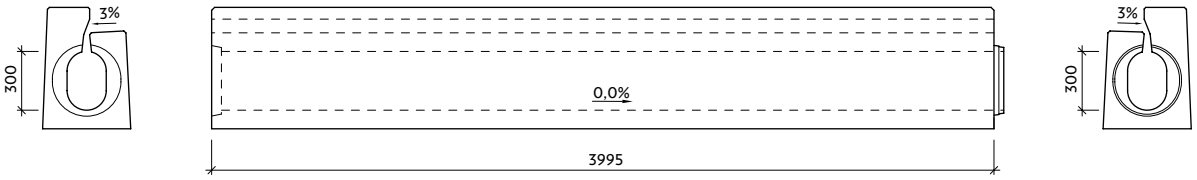


View "b" I-5 - Socket

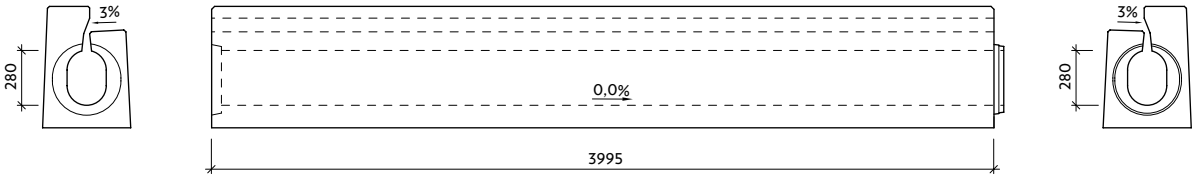
View "a"

View "c" I-5 - Spigot

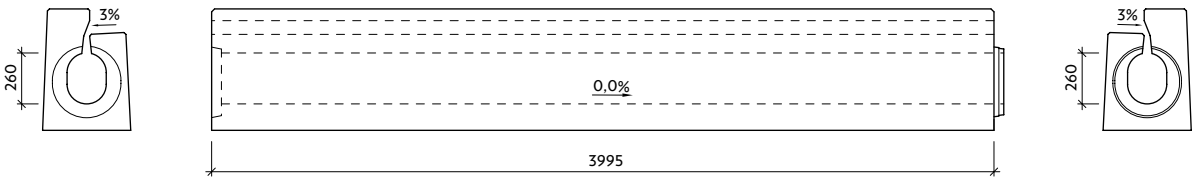
Profile I-5-T30/30-P - without internal flow gradient



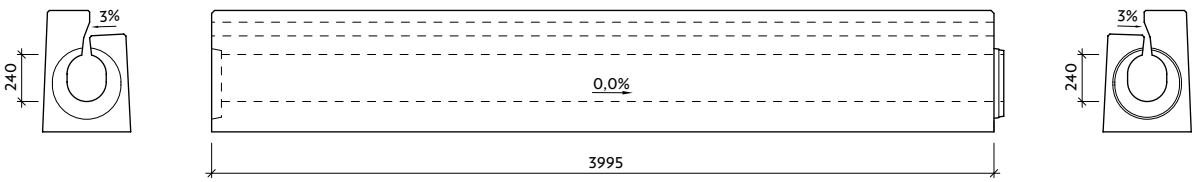
Profile I-5-T28/28-P - without internal flow gradient



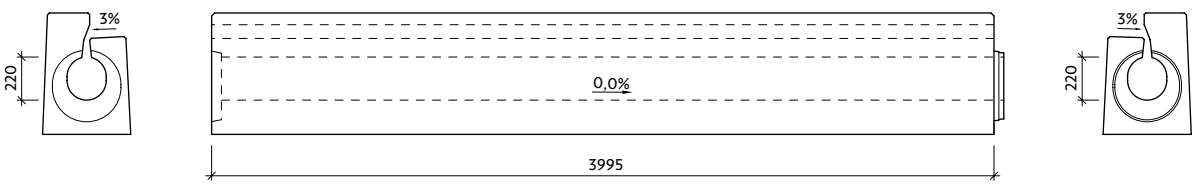
Profile I-5-T26/26-P - without internal flow gradient



Profile I-5-T24/24-P - without internal flow gradient



Profile I-5-T22/22-P - without internal flow gradient



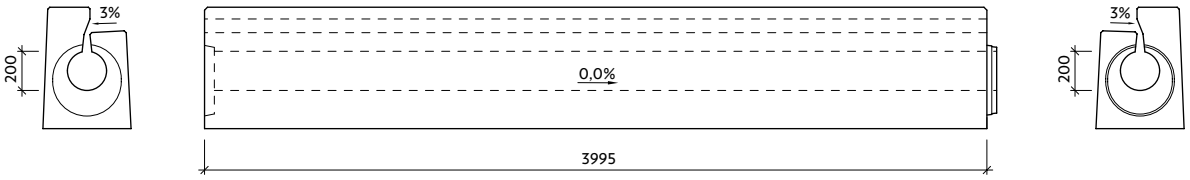
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-5

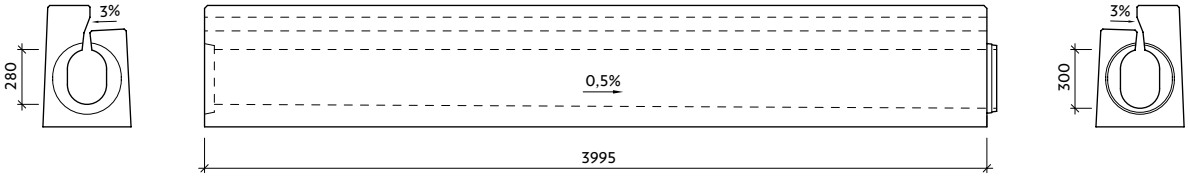
Protected by utility patent

View "b" - Socket | View "a" | View "c" - Spigot

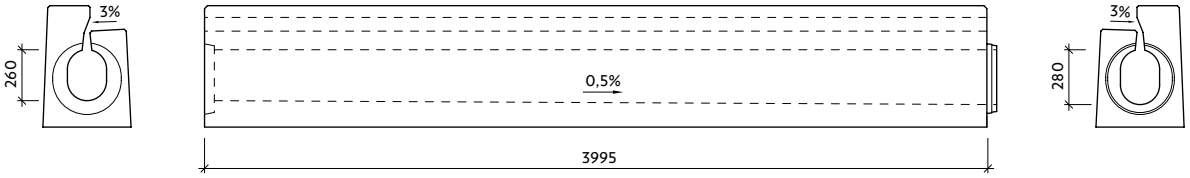
Profile I-5-T20/20-P - without internal flow gradient



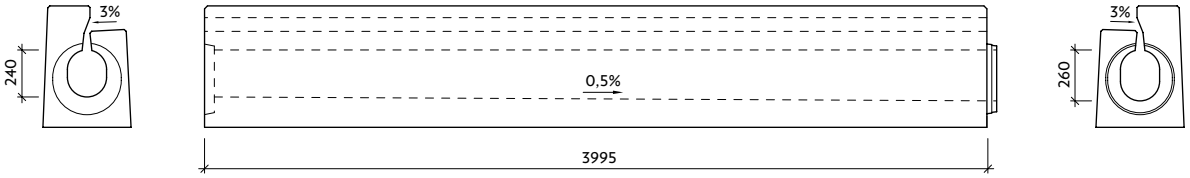
Profile I-5-G28/30-P - 0.5% flow profile bottom gradient



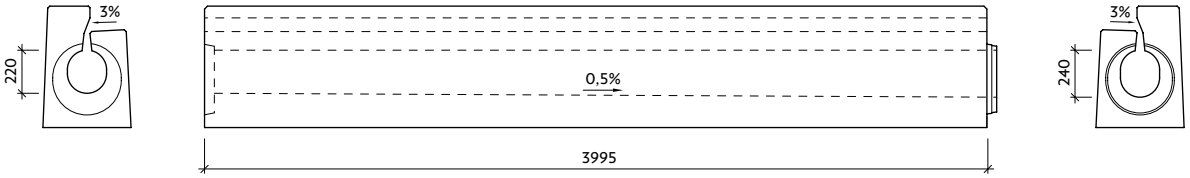
Profile I-5-G26/28-P - 0.5% flow profile bottom gradient



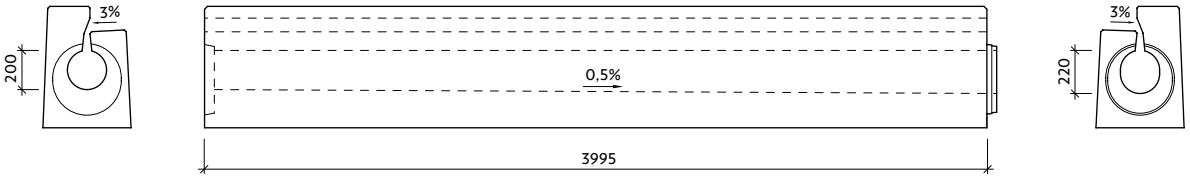
Profile I-5-G24/26-P - 0.5% flow profile bottom gradient



Profile I-5-G22/24-P - 0.5% flow profile bottom gradient



Profile I-5-G20/22-P - 0.5% flow profile bottom gradient

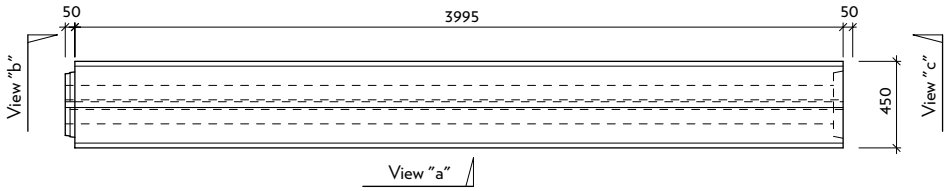


CSB - SLOT DRAIN PROFILE I-5

Protected by utility patent

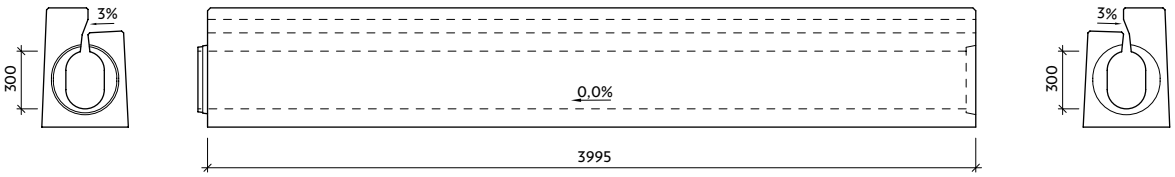
Profile I-5 - left - Slot drain

Plan

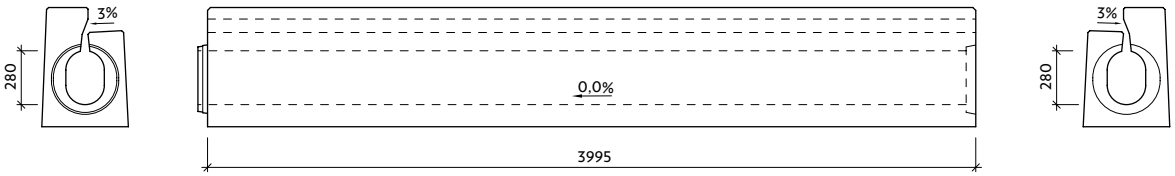


View "b" - Spigot | View "a" | View "c" - Socket

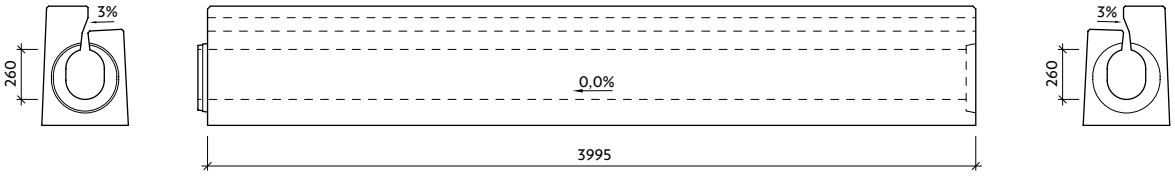
Profile I-5-T30/30-L - without internal flow gradient



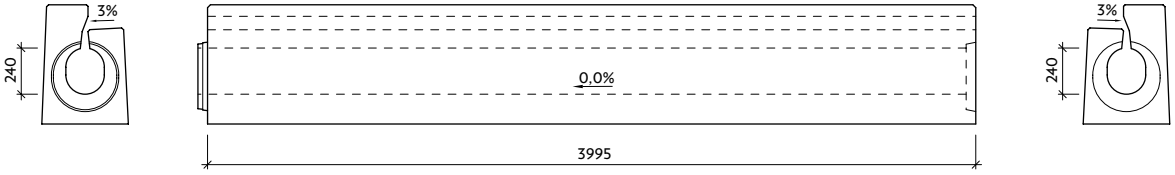
Profile I-5-T28/28-L - without internal flow gradient



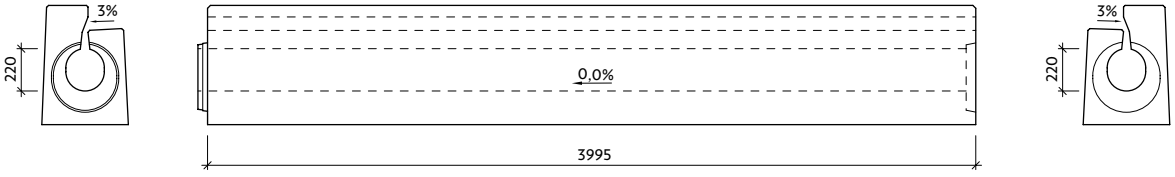
Profile I-5-T26/26-L - without internal flow gradient



Profile I-5-T24/24-L - without internal flow gradient



Profile I-5-T22/22-L - without internal flow gradient



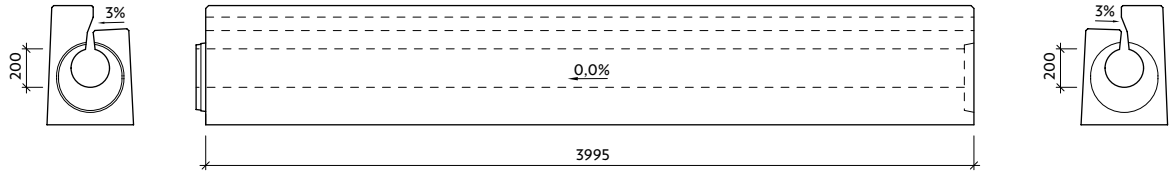
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-5

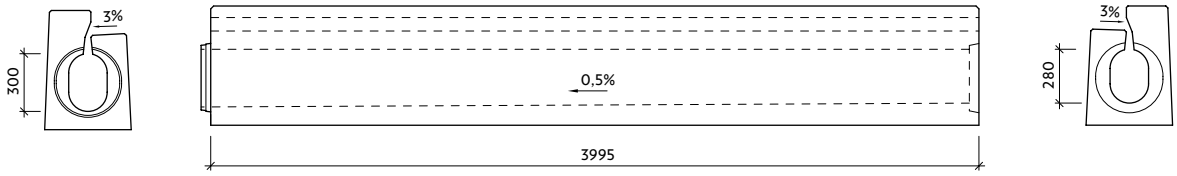
Protected by utility patent

View "b" - Spigot | View "a" | View "c" - Socket

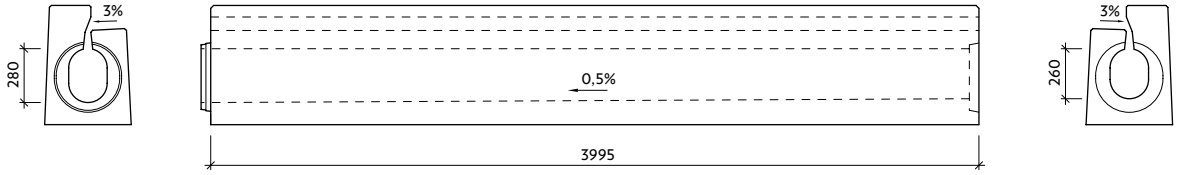
Profile I-5-T20/20-L - without internal flow gradient



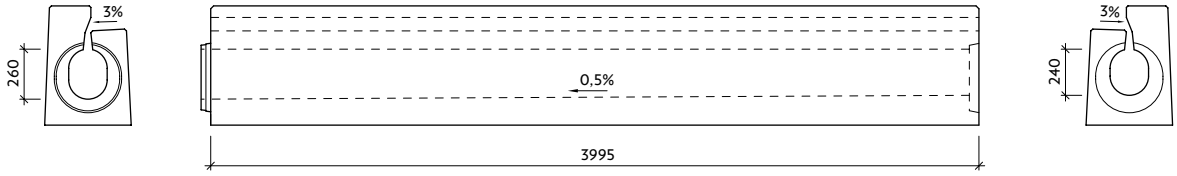
Profile I-5-G28/30-L - 0.5% flow profile bottom gradient



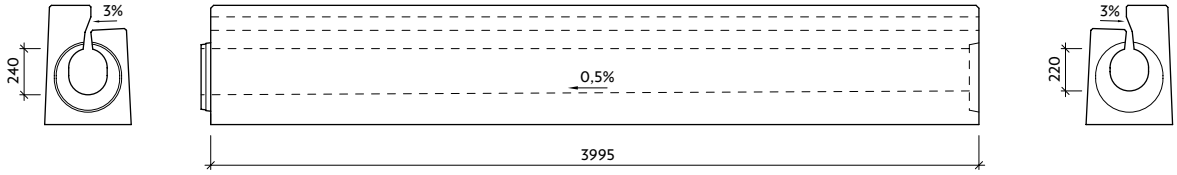
Profile I-5-G26/28-L - 0.5% flow profile bottom gradient



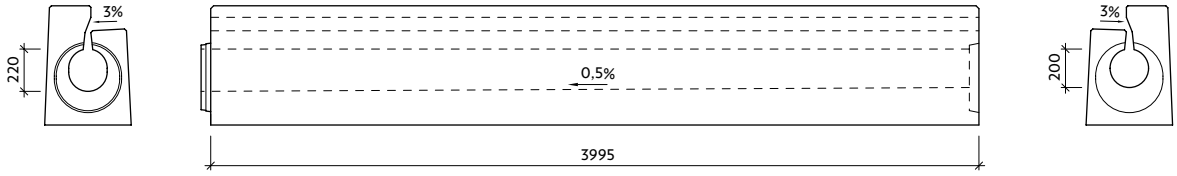
Profile I-5-G24/26-L - 0.5% flow profile bottom gradient



Profile I-5-G22/24-L - 0.5% flow profile bottom gradient



Profile I-5-G20/22-L - 0.5% flow profile bottom gradient

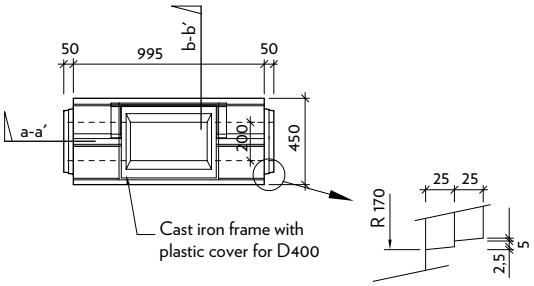


CSB - SLOT DRAIN PROFILE I-5

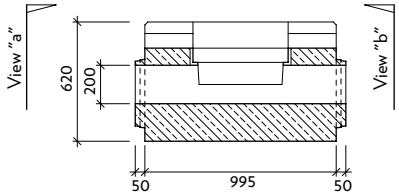
Protected by utility patent

I-5-CS - Top cleaning segment with cast iron grille and plastic cover for D400 - 12 cm kerbstone

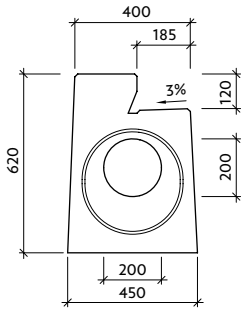
Plan



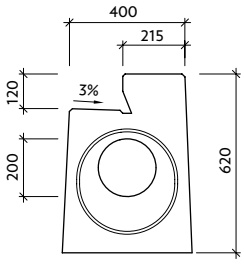
Cross-section: a-a' I-5-CS



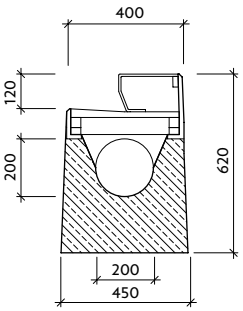
View "a" I-5-CS - Spigot/Spigot



View "b" I-5-CS - Spigot/Spigot

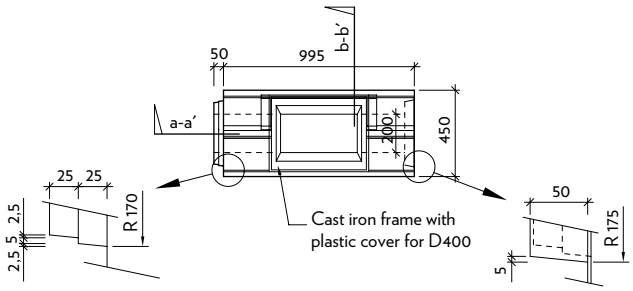


Cross-section: b-b' I-5-CS

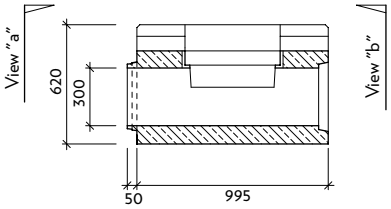


I-5-C0 - left - Basic cleaning segment with cast iron frame and plastic cover for D400 - 12 cm kerbstone

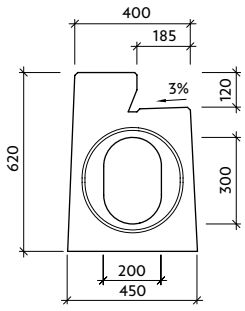
Plan



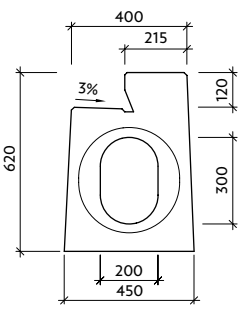
Cross-section: a-a' I-5-C0



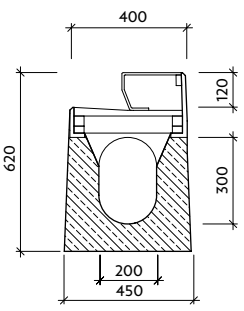
View "a" I-5-C0 - Spigot



View "b" I-5-C0 - Socket



Cross-section: b-b' I-5-C0



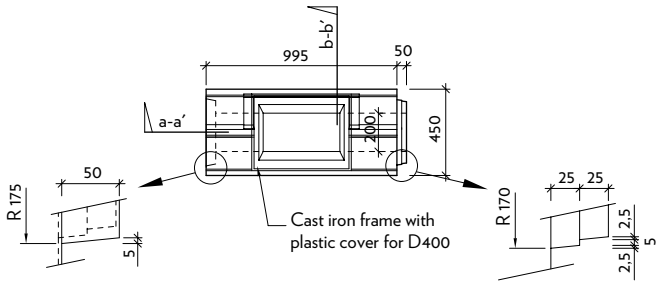
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-5

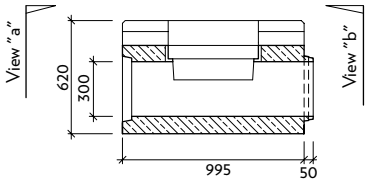
Protected by utility patent

I-5-C0 - right - Basic cleaning segment with cast iron frame and plastic cover for D400 - 12 cm kerbstone

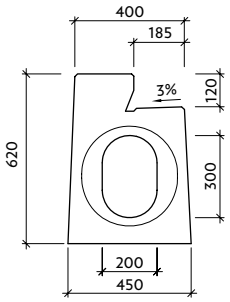
Plan



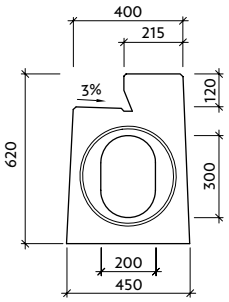
Cross-section: a-a´ I-5-C0



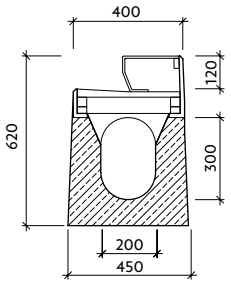
View "a" I-5-C0 - Socket



View "b" I-5-C0 - Spigot

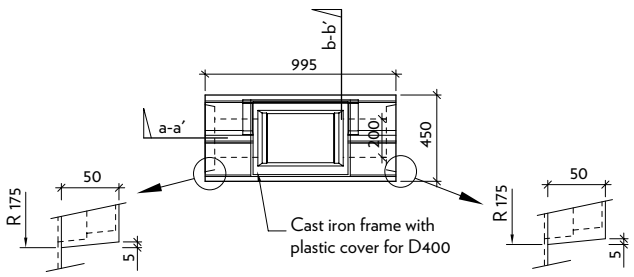


Cross-section: b-b´ I-5-C0

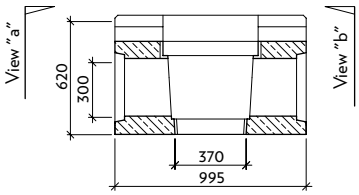


I-5-VU - Gutter gully assembly with 12 cm kerbstone. Cast iron frame and plastic cover for D400

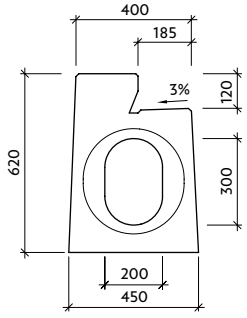
Plan



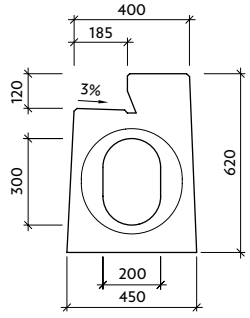
Cross-section: a-a´ I-5-VU



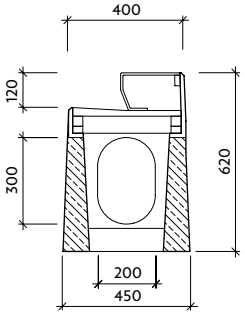
View "a" I-5-VU - Socket/Socket



View "b" I-5-VU - Socket/Socket



Cross-section: b-b´ I-5-VU

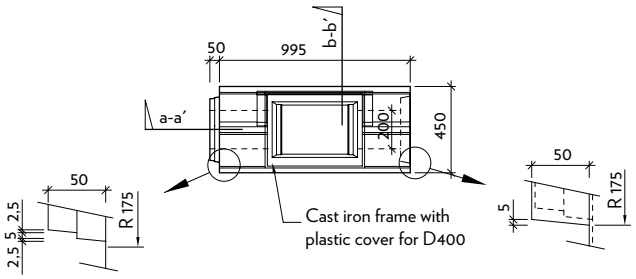


CSB - SLOT DRAIN PROFILE I-5

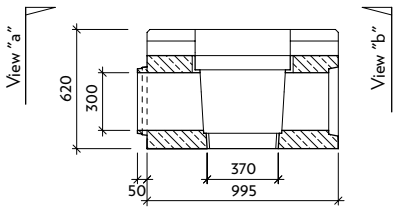
Protected by utility patent

I-5-V0 - left - Basic gully assembly with 12 cm kerbstone. Cast iron frame and plastic cover for D400

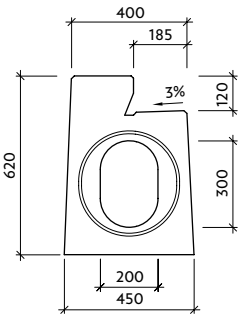
Plan



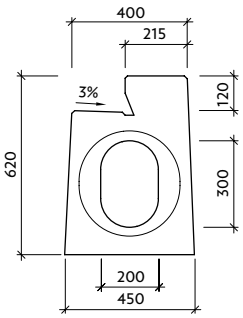
Cross-section: a-a'



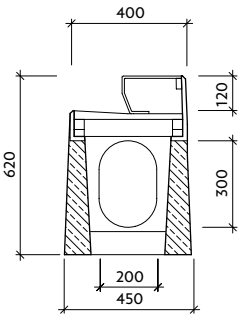
View "a" I-5-V0 - Spigot



View "b" I-5-V0 - Socket

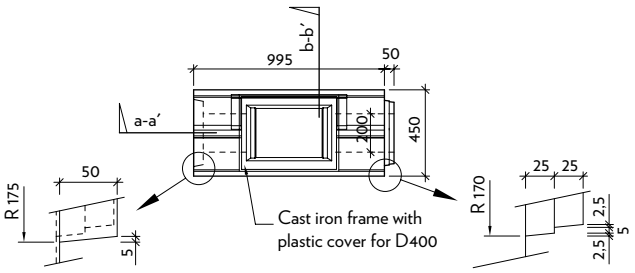


Cross-section: b-b' I-5-V0

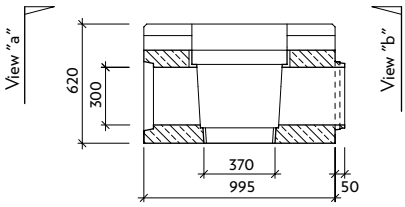


I-5-V0 - right - Basic gully assembly with 12 cm kerbstone. Cast iron frame and plastic cover for D400

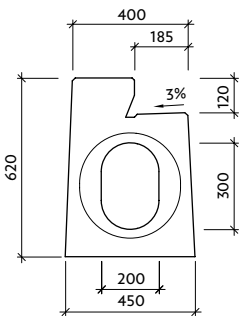
Plan



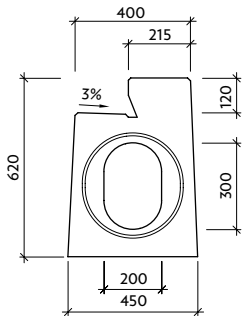
Cross-section: a-a' I-5-V0



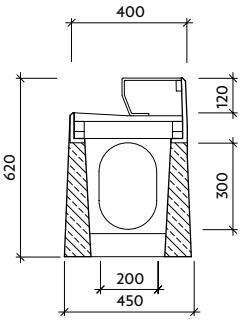
View "a" I-5-V0 - Socket



View "b" I-5-V0 - Spigot



Cross-section: b-b' I-5-V0

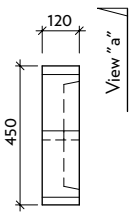


* Nominal dimensions include installation dimensions and/or minimum gap.

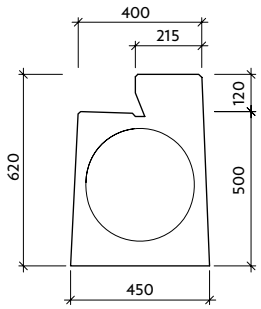
CSB - SLOT DRAIN PROFILE I-5

I-5-ZZ - Socket end cap and 12 cm kerbstone

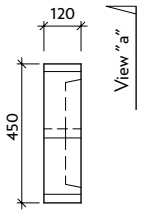
Plan T-ZZ - left



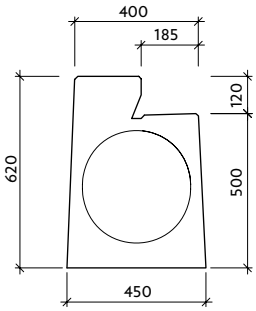
View "a"



Plan T-ZZ - right

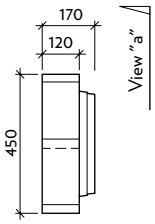


View "a"

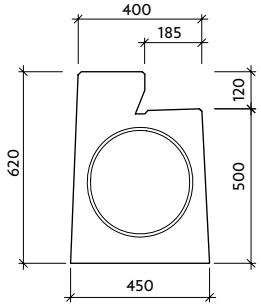


I-5-ZU - Spigot end cap and 12 cm kerbstone

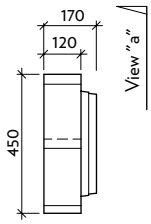
Plan T-ZU - left



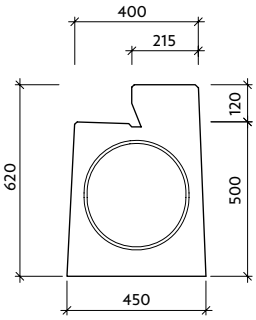
View "a"



Plan T-ZU - right



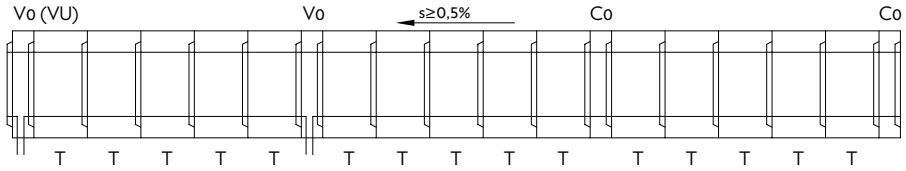
View "a"



CSB - SLOT DRAIN PROFILE I-5

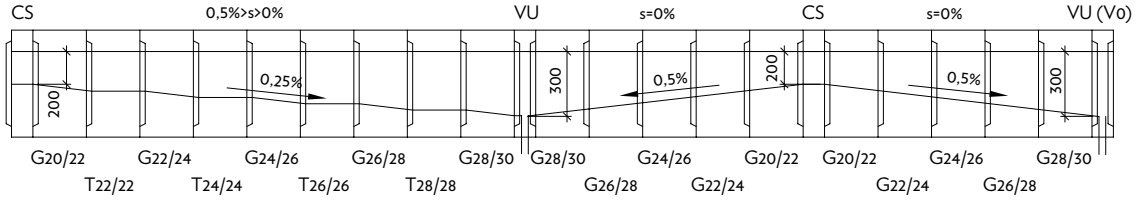
Suggested layout

I-5-G Slot drains - layout



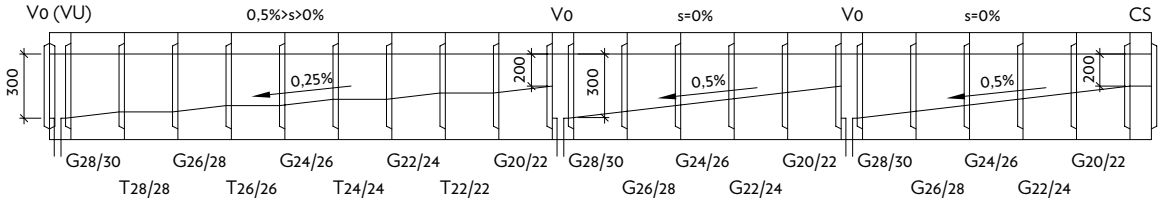
I-5-G Slot drains - layout

(slot drain with roof bottom)



I-5-G Slot drains - layout

(slot drain with saw tooth bottom)



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends

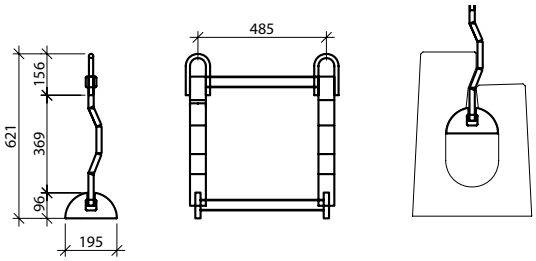
VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends

CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends

s –Longitudinal flow profile gradient

Handling equipment - PROFILE I-5 a PROFILE I-6



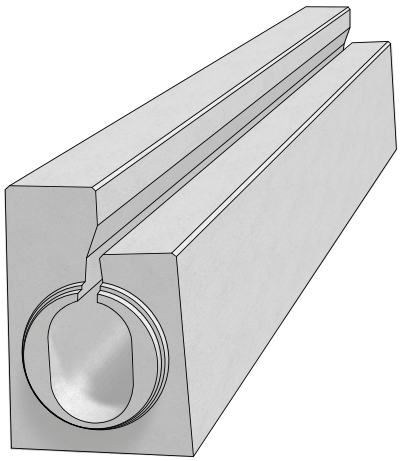
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-6

Protected by utility patent

Technical data:

Slot drains with offset covered slot and 15 cm high kerbstone. These products are suitable for dividing roads from pavements and where the slot is to be covered for safety. The kerbstone overlaps the slot and prevents items (bicycle wheels, baby pram wheels, walking sticks, roller-blades etc.) from becoming trapped. They are especially suitable for inner cities and tunnels. They are available with or without internal gradient (0.5%).
Gradient-to-gradient components are provided for segments with internal gradient. Profile I-6 slot drains and slot drains with kerbstones are designed for D400 class traffic load and no transversal vehicle travel.

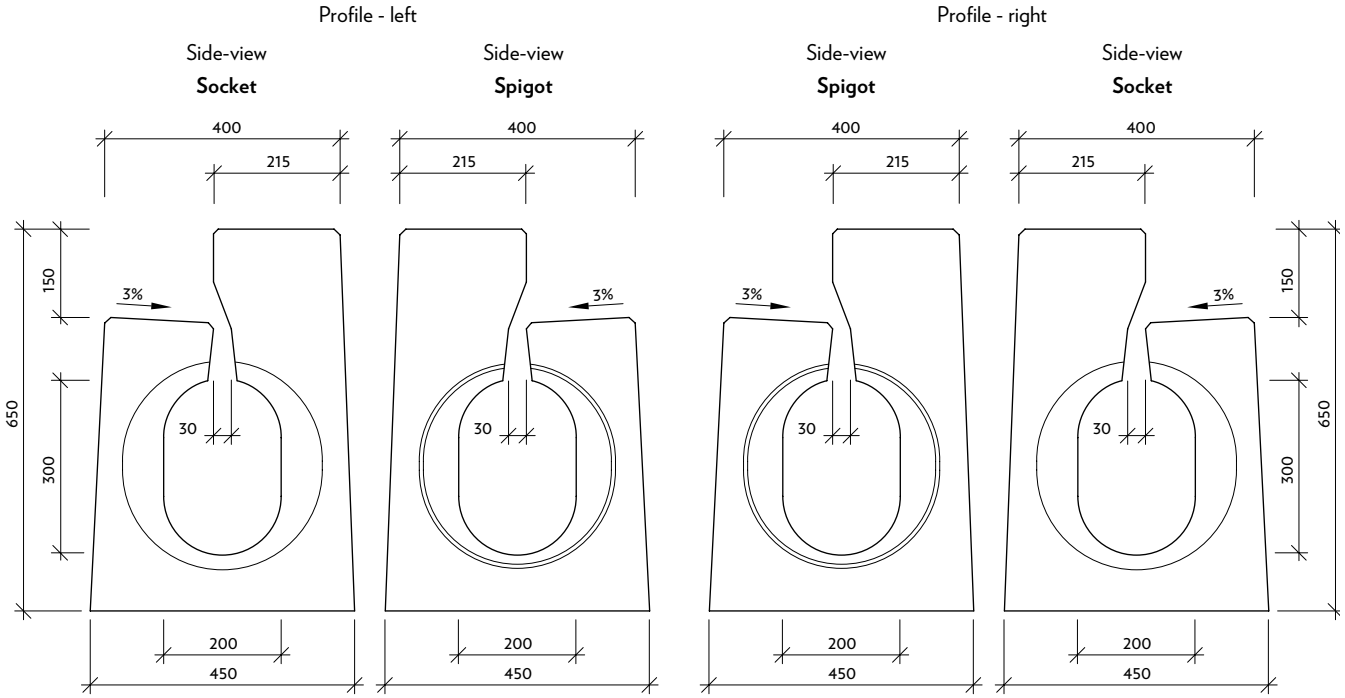


The system consists of the following components:

- 4 m-long slot drains with continuous slots, with or without internal gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- Fire safety barrier (with siphon)
- Slot drain with rising kerbstone
- End cap

		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**pcs**
Slot drain with continuous slot and 15 cm kerbstone	I-6	500/650	4000	400/450	0,25	1737
Slot drain with continuous slot and 12 cm kerbstone, 0.5% flow profile bottom gradient	I-6-G	500/650	4000	400/450	0,25	1757-1907
Basic gully assembly V0	I-6-V0	500/650	1000	400/450	1	383
Gutter gully assembly VU	I-6-VU	500/650	1000	400/450	1	374
Basic cleaning segment C0	I-6-C0	500/650	1000	400/450	1	430
Top cleaning segment CS	I-6-CS	500/650	1000	400/450	1	478
Spigot end cap	I-6-ZU	500	120	400/450	-	76
Socket end cap	I-6-ZZ	500	120	400/450	-	51

Nominal dimensions - basic shapes:



ČSN EN ISO 50001:2012 CERTIFIKOVÁNO ZÚS — Energy consumption management system, certified by TZÚS PRAHA as a certificate body no 3001 under no. 11/2017

ČSN OHSAS 18001:2008 CERTIFIKOVÁNO ZÚS — Health and safety management system, certified by TZÚS PRAHA as a certificate body no 3001 under no. 367/2016

ČSN EN ISO 14001:2005 CERTIFIKOVÁNO ZÚS — Environmental management system, certified by TZÚS PRAHA as a certificate body no 3001 under no. 630/2017.

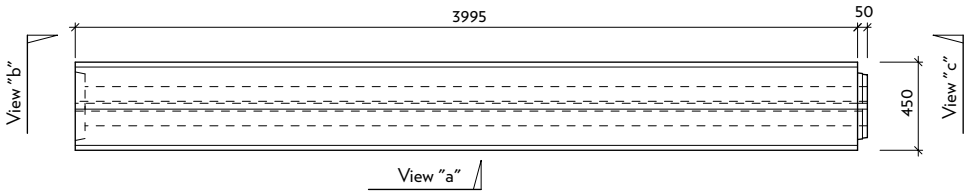
ČSN EN ISO 9001:2009 CERTIFIKOVÁNO ZÚS — Quality management system, certified by TZÚS PRAHA as a certificate body no 3001 under no. 2496/2017.

CSB - SLOT DRAIN PROFILE I-6

Protected by utility patent

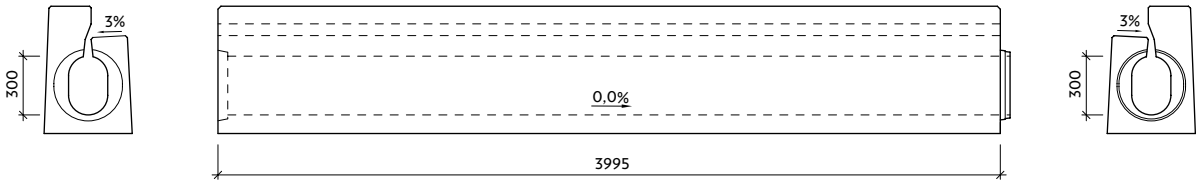
Profile I-6 - right - Slot drain

Plan

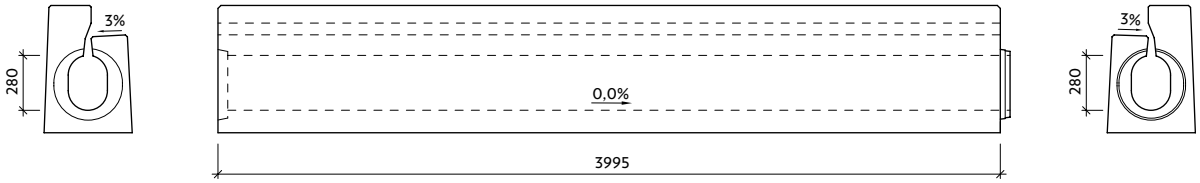


View "b" - Socket | View "a" | View "c" - Spigot

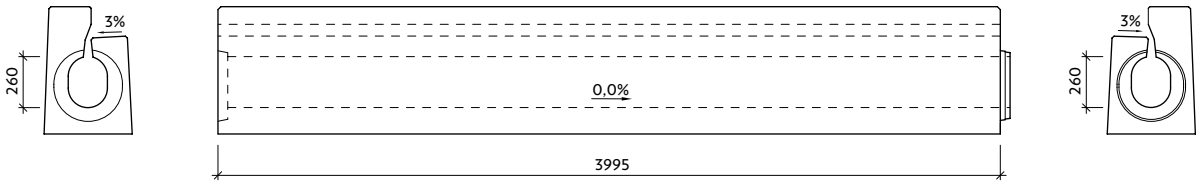
Profile I-6-T30/30-P - without internal flow gradient



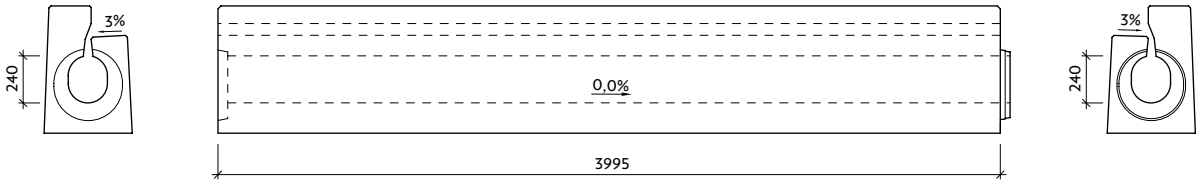
Profile I-6-T28/28-P - without internal flow gradient



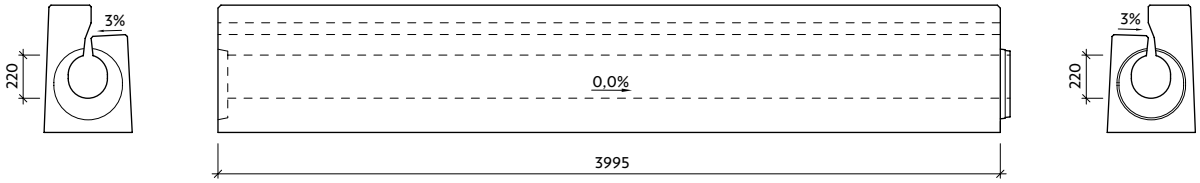
Profile I-6-T26/26-P - without internal flow gradient



Profile I-6-T24/24-P - without internal flow gradient



Profile I-6-T22/22-P - without internal flow gradient



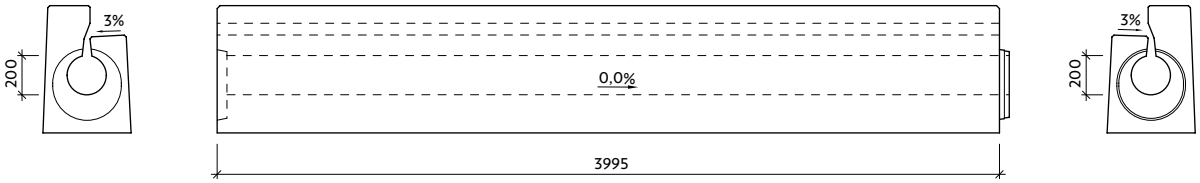
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-6

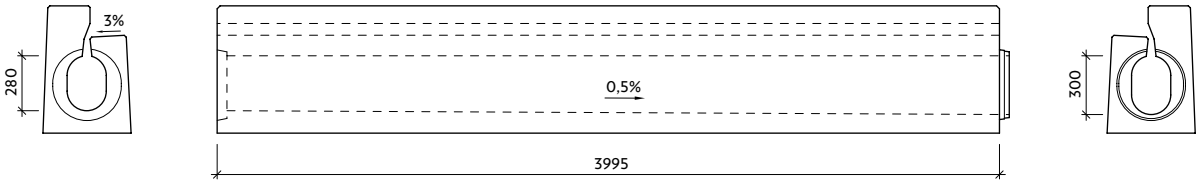
Protected by utility patent

View "b" - Socket | View "a" | View "c" - Spigot

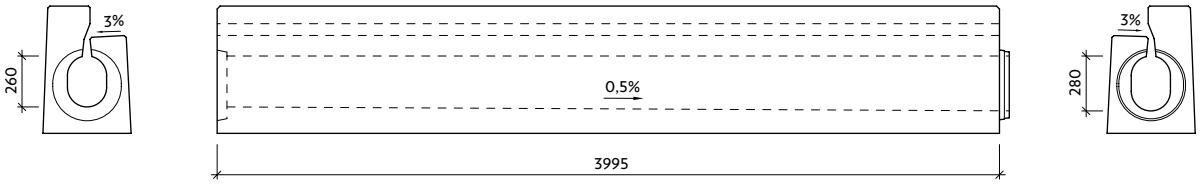
Profile I-6-T20/20-P - without internal flow gradient



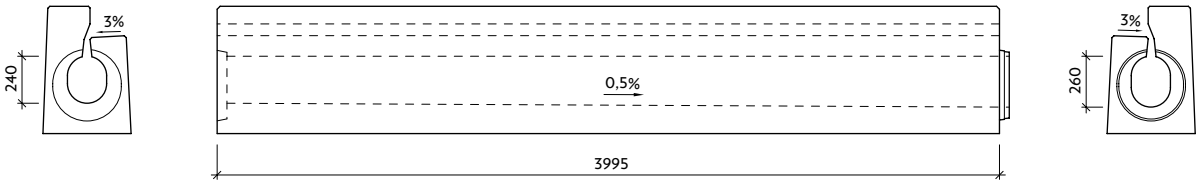
Profile I-6-G28/30-P - 0.5% flow profile bottom gradient



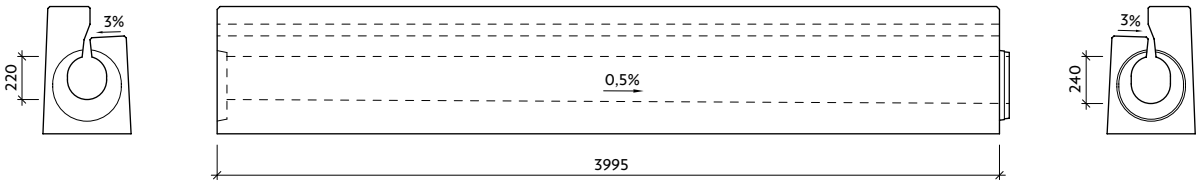
Profile I-6-G26/28-P - 0.5% flow profile bottom gradient



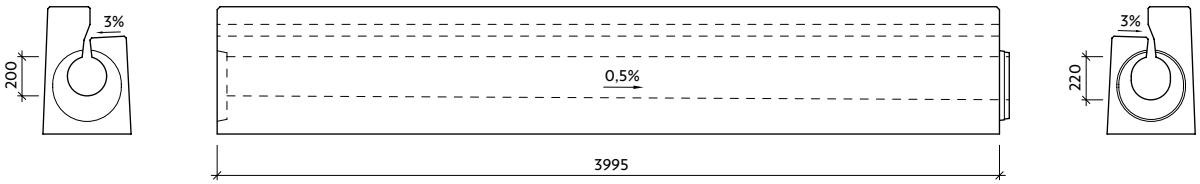
Profile I-6-G24/26-P - 0.5% flow profile bottom gradient



Profile I-6-G22/24-P - 0.5% flow profile bottom gradient



Profile I-6-G20/22-P - 0.5% flow profile bottom gradient

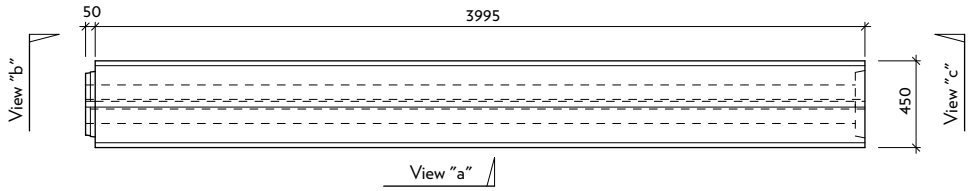


CSB - SLOT DRAIN PROFILE I-6

Protected by utility patent

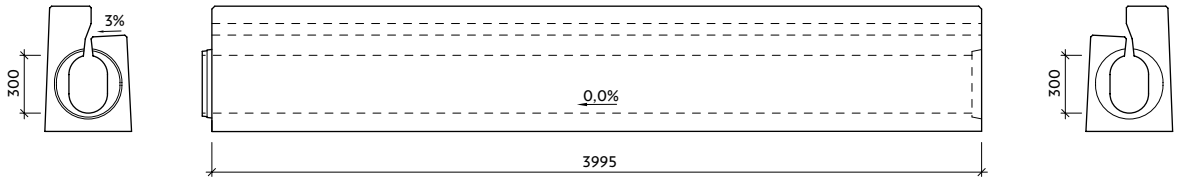
Profile I-6 - left - Slot drain

Plan

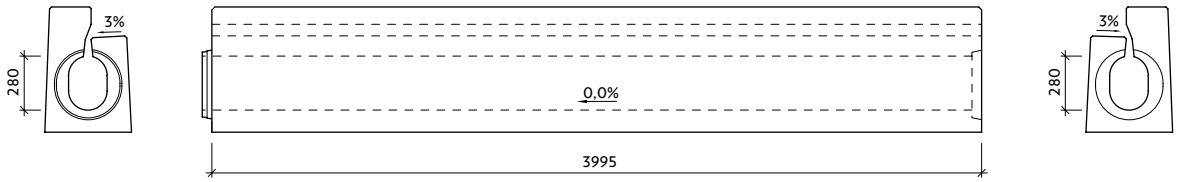


View "b" - Spigot | View "a" | View "c" - Socket

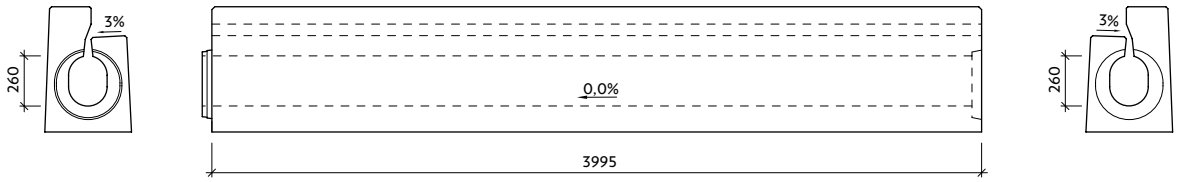
Profile I-6-T30/30-L - without internal flow gradient



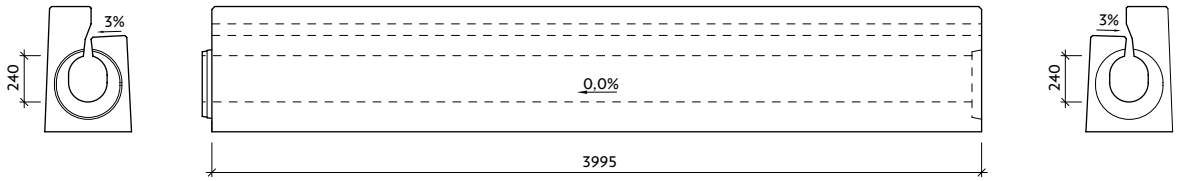
Profile I-6-T28/28-L - without internal flow gradient



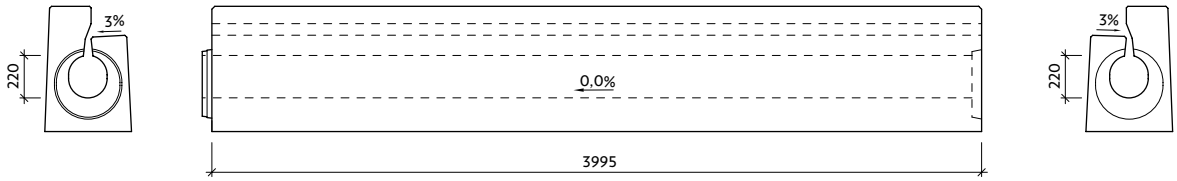
Profile I-6-T26/26-L - without internal flow gradient



Profile I-6-T24/24-L - without internal flow gradient



Profile I-6-T22/22-L - without internal flow gradient



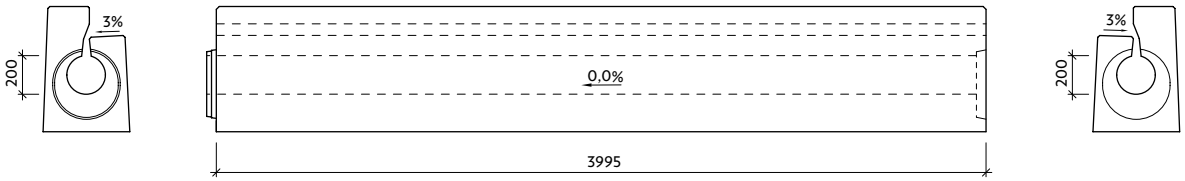
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-6

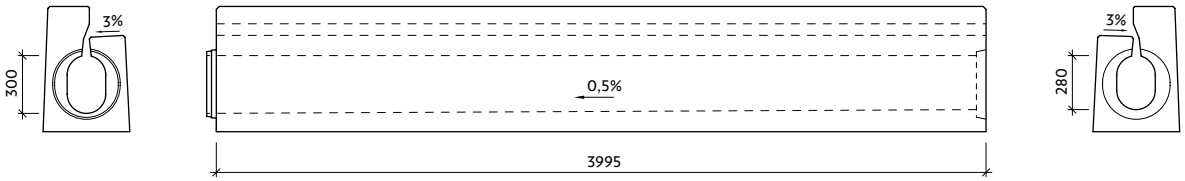
Protected by utility patent

View "b" - Spigot | View "a" | View "c" - Socket

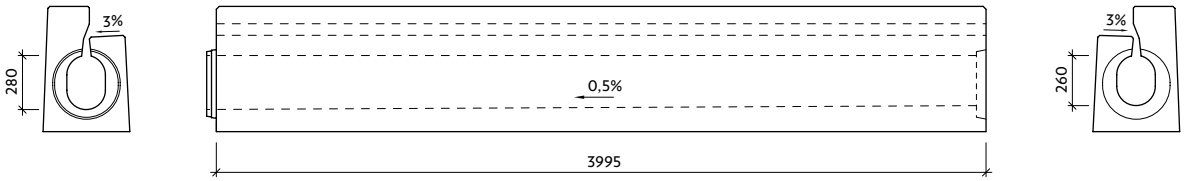
Profile I-6-T20/20-L - without internal flow gradient



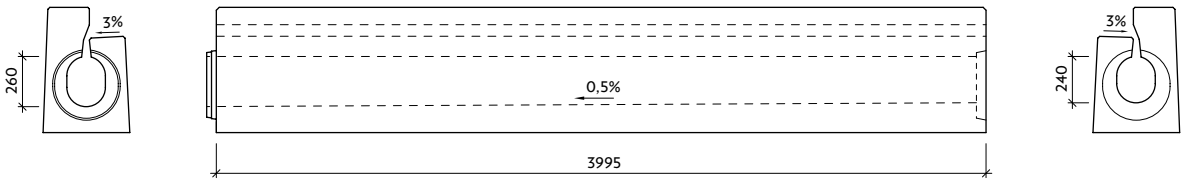
Profile I-6-G28/30-L 0.5% flow profile bottom gradient



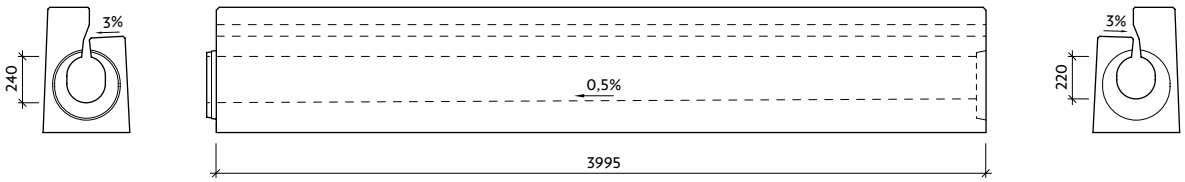
Profile I-6-G26/28-L 0.5% flow profile bottom gradient



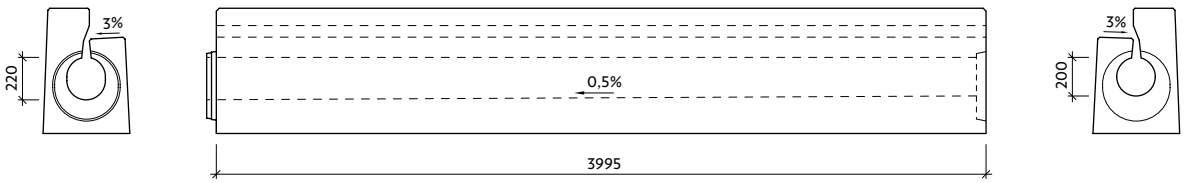
Profile I-6-G24/26-L 0.5% flow profile bottom gradient



Profile I-6-G22/24-L 0.5% flow profile bottom gradient



Profile I-6-G20/22-L 0.5% flow profile bottom gradient

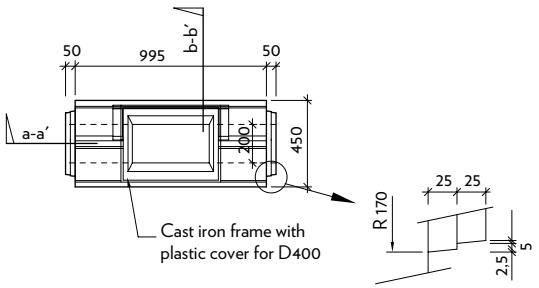


CSB - SLOT DRAIN PROFILE I-6

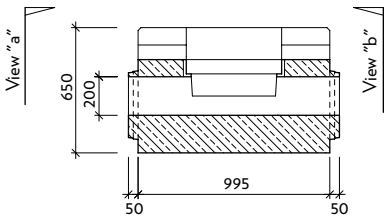
Protected by utility patent

I-6-CS - Top cleaning segment with cast iron grille and plastic cover for D400 - 15 cm kerbstone

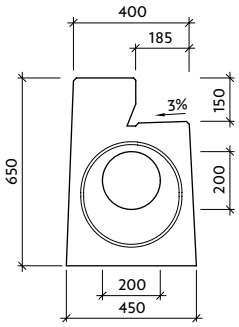
Plan



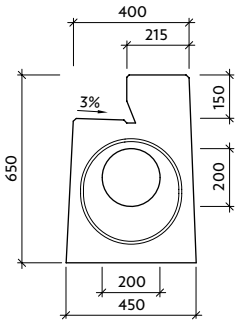
Cross-section: a-a´ I-6-CS



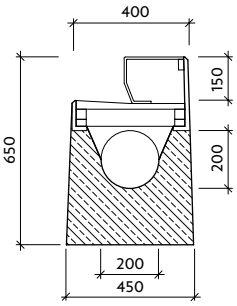
View "a" I-6-CS - Spigot/Spigot



View "b" I-6-CS - Spigot/Spigot

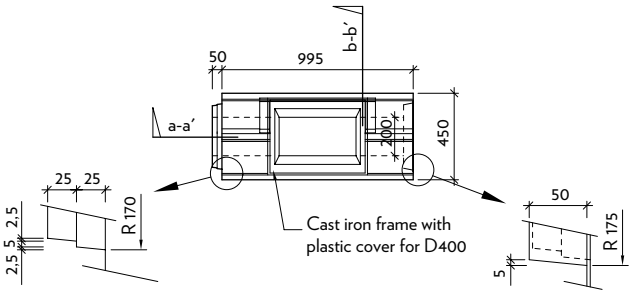


Cross-section: b-b´ I-6-CS

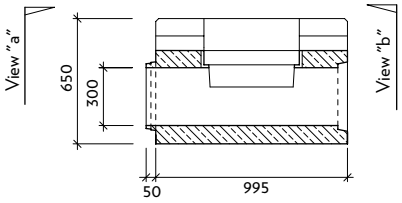


I-6-C0 - left - Basic cleaning segment with cast iron frame and plastic cover for D400 - 15 cm kerbstone

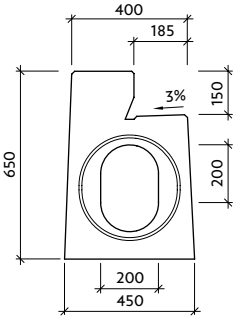
Plan



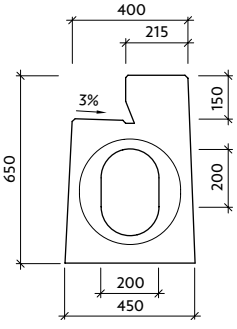
Cross-section: a-a´ I-6-C0



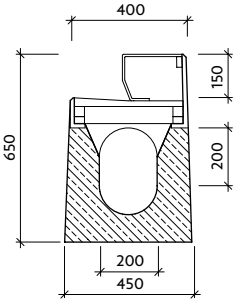
View "a" I-6-C0 - Spigot



View "b" I-6-C0 - Socket



Cross-section: b-b´ I-6-C0



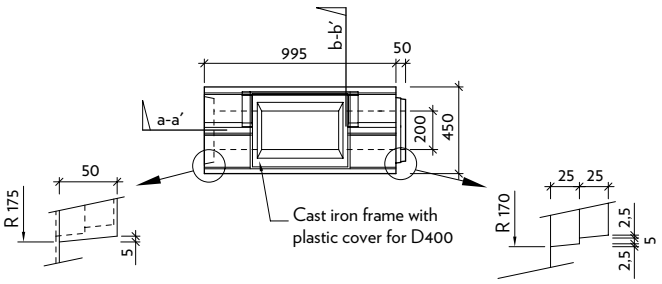
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-6

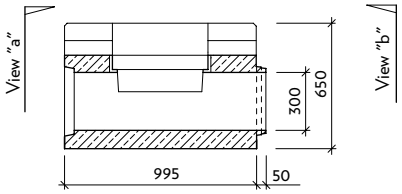
Protected by utility patent

I-6-C0 - right - Basic cleaning segment with cast iron frame and plastic cover for D400 - 15 cm kerbstone

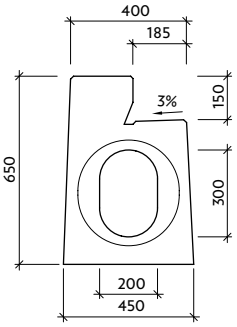
Plan



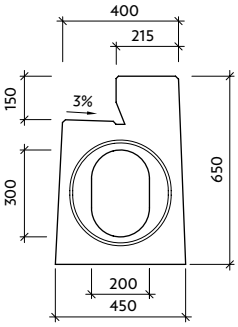
Cross-section.cz: a-a´ I-6-C0



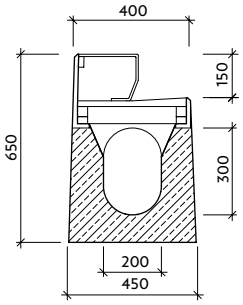
View "a" I-6-C0 - Socket



View "b" I-6-C0 - Spigot

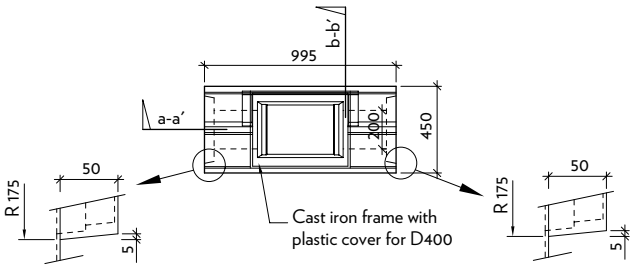


Cross-section.cz: b-b´ I-6-C0

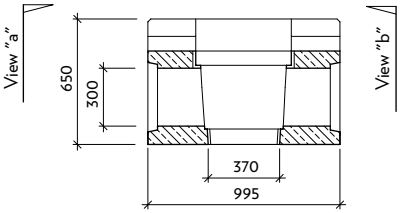


I-6-VU - Gutter gully assembly with 15 cm kerbstone. Cast iron frame and plastic cover for D400

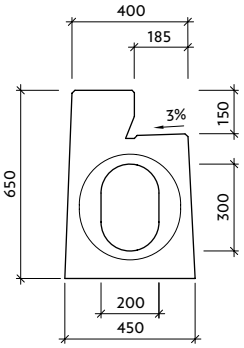
Plan



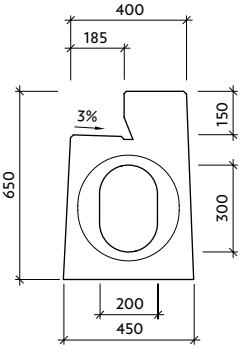
Cross-section.cz: a-a´ I-6-VU



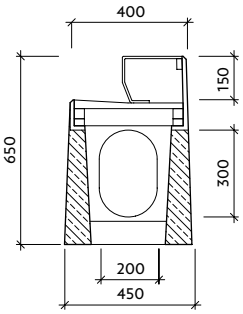
View "a" I-6-VU - Socket/Socket



View "b" I-6-VU - Socket/Socket



Cross-section.cz: b-b´ I-6-VU

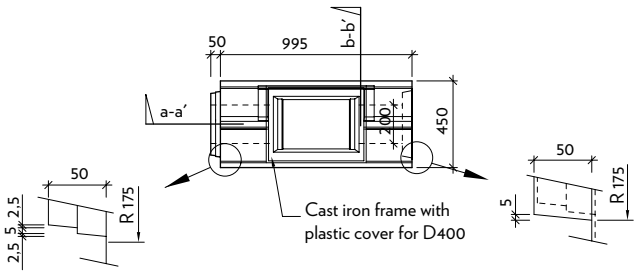


CSB - SLOT DRAIN PROFILE I-6

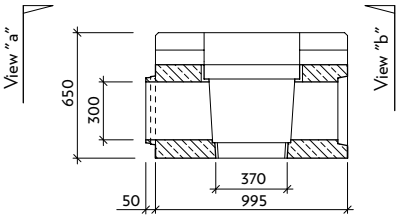
Protected by utility patent

I-6-V0 - left - Basic gully assembly with 15 cm kerbstone. Cast iron frame and plastic cover for D400

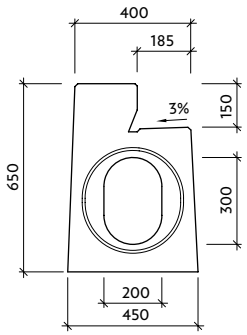
Plan



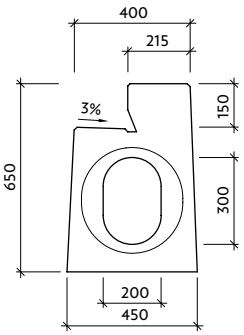
Cross-section.cz: a-a' I-6-V0



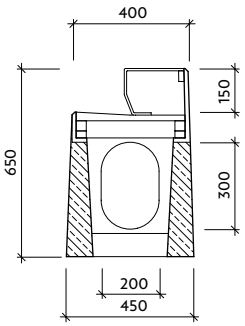
View "a" I-6-V0 - Spigot



View "b" I-6-V0 - Socket

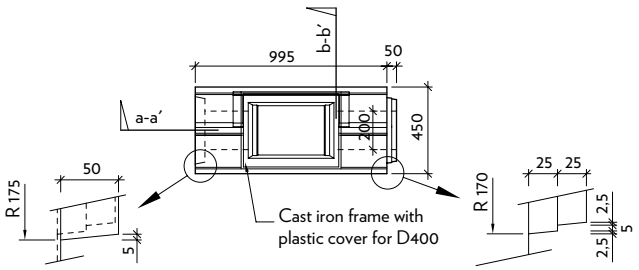


Cross-section.cz: b-b' I-6-V0

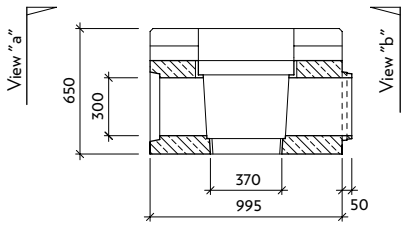


I-6-V0 - right - Basic gully assembly with 15 cm kerbstone. Cast iron frame and plastic cover for D400

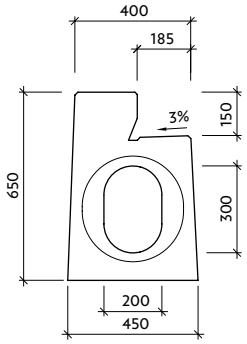
Plan



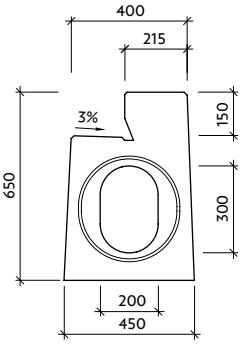
Cross-section.cz: a-a' I-6-V0



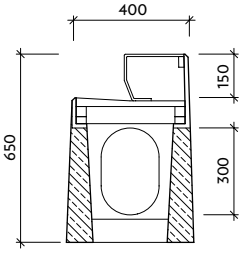
View "a" I-6-V0 - Socket



View "b" I-6-V0 - Spigot



Cross-section.cz: b-b' I-6-V0

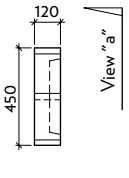


* Nominal dimensions include installation dimensions and/or minimum gap.

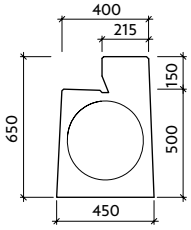
CSB - SLOT DRAIN PROFILE I-6

I-6-ZZ - Socket end cap and 15 cm kerbstone

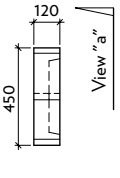
Plan T-ZZ - left



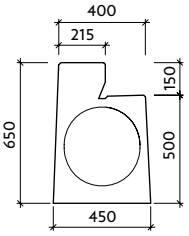
View "a"



Plan T-ZZ - right

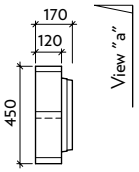


View "a"

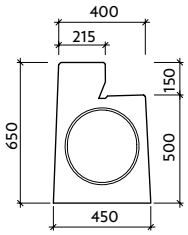


I-6-ZU - Spigot end cap and 15 cm kerbstone

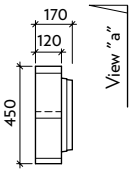
Plan T-ZU - left



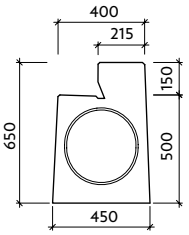
View "a"



Plan T-ZU - right

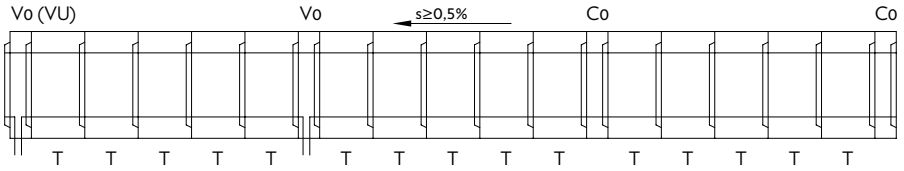


View "a"



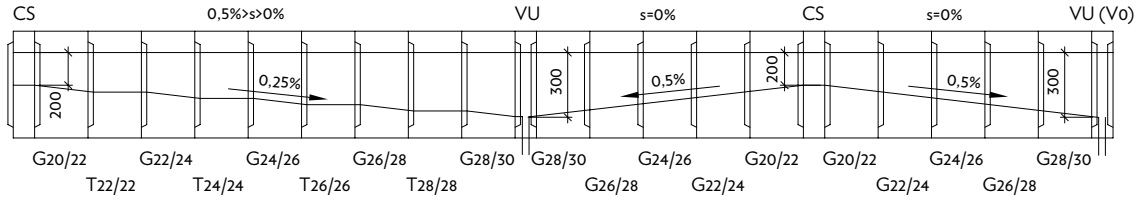
Suggested layout

I-6-T Slot drains - layout



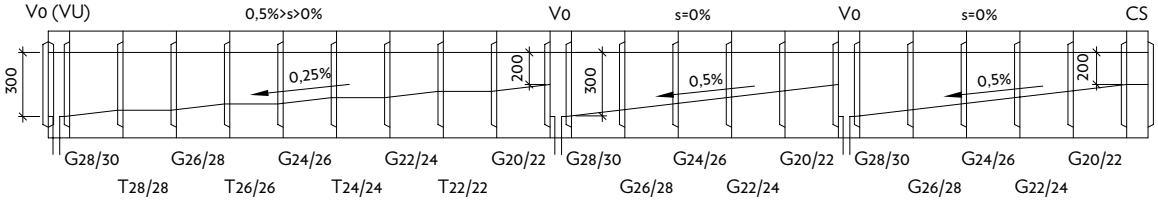
I-6-G Slot drains - layout

(slot drain with roof bottom)



I-6-G Slot drains - layout

(slot drain with saw tooth bottom)



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends

CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends

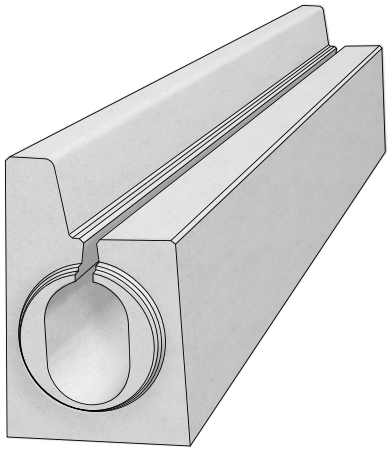
s – Longitudinal flow profile gradient

CSB - SLOT DRAIN PROFILE I-7

Protected by utility patent

Technical data:

Slot drains with non - standard 18 cm high kerbstone, frequently used in Prague. Specifically designed for tunnels and their surroundings. They are available with or without internal gradient (0.5%). Gradient-to-gradient components are provided for segments with internal gradient. Profile I-7 slot drains and slot drains with kerbstones are designed for D400 class traffic load and no transversal vehicle travel.

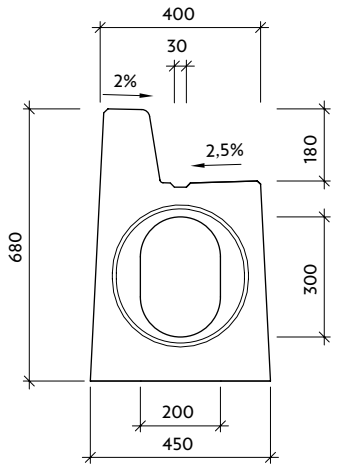


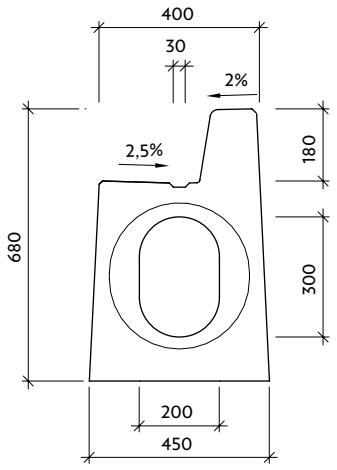
The system consists of the following components:

- 4 m-long slot drains with continuous slots, with or without internal gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- Fire safety barrier (with siphon)
- Slot drain with rising kerbstone
- End cap

		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**pcs**
Slot drain with continuous slot and 18 cm kerbstone	I-7	500/680	4000	400/450	0,25	1680
Slot drain with continuous slot and 18 cm kerbstone, 0.5% flow profile bottom gradient	I-7-G	500/680	4000	400/450	0,25	1699-1872
Basic gully assembly V0	I-7-V0	500/680	1000	400/450	1	397
Gutter gully assembly VU	I-7-VU	500/680	1000	400/450	1	388
Basic cleaning segment C0	I-7-C0	500/680	1000	400/450	1	444
Top cleaning segment CS	I-7-CS	500/680	1000	400/450	1	526
Fire safety barrier	I-7-PP	935/1115	2000	400/490	0,5	1205
Spigot end cap	I-7-ZU	500/680	120	400/450	-	85
Socket end cap	I-7-ZZ	500/680	120	400/450	-	62

Nominal dimensions - basic shapes:





All products comply with harmonised European Standards and are patented

* Nominal dimensions include installation dimensions and/or minimum gap.

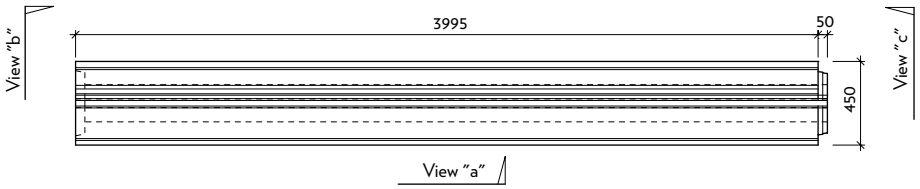
STAVBY JAKO Z KAMENE CSBETON®

CSB - SLOT DRAIN PROFILE I-7

Protected by utility patent

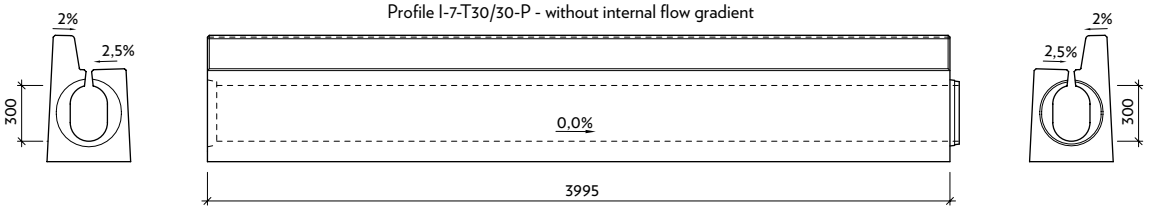
Profile I-7 - right - Slot drain

Plan

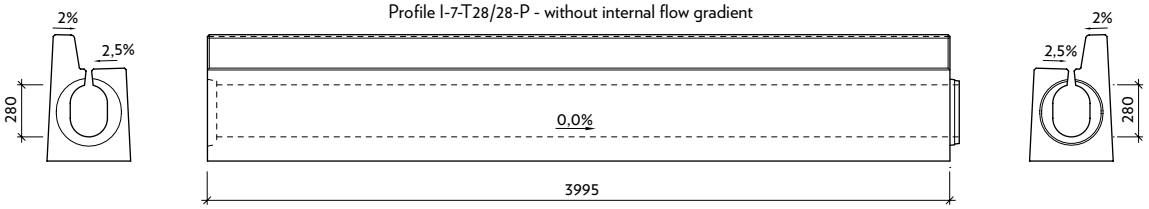


View "b" - Socket | View "a" | View "c" - Spigot

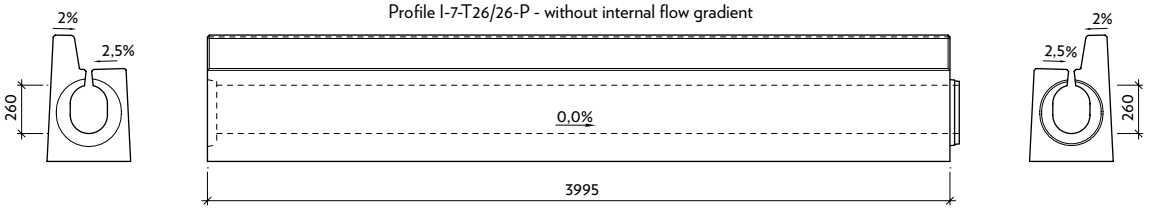
Profile I-7-T30/30-P - without internal flow gradient



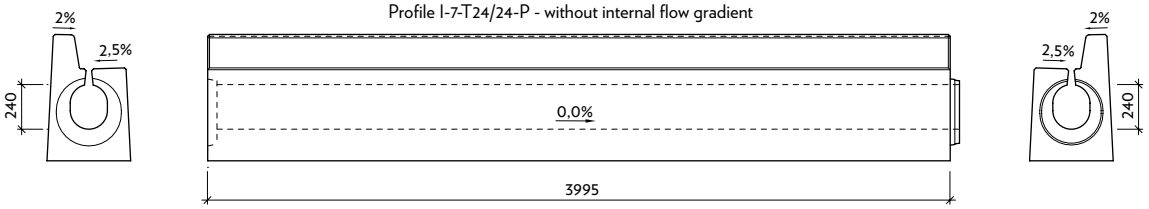
Profile I-7-T28/28-P - without internal flow gradient



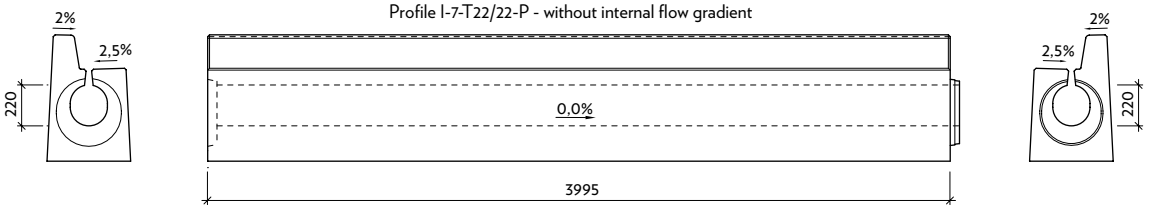
Profile I-7-T26/26-P - without internal flow gradient



Profile I-7-T24/24-P - without internal flow gradient



Profile I-7-T22/22-P - without internal flow gradient

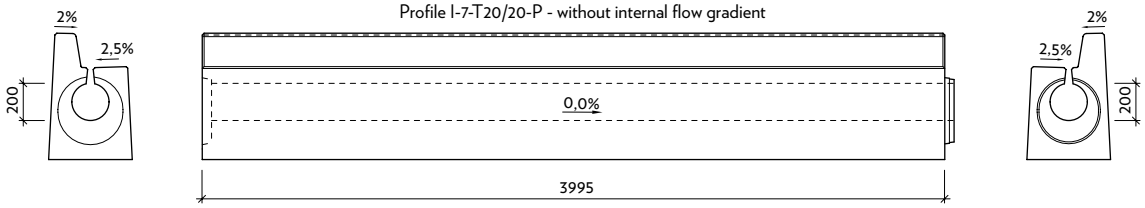


CSB - SLOT DRAIN PROFILE I-7

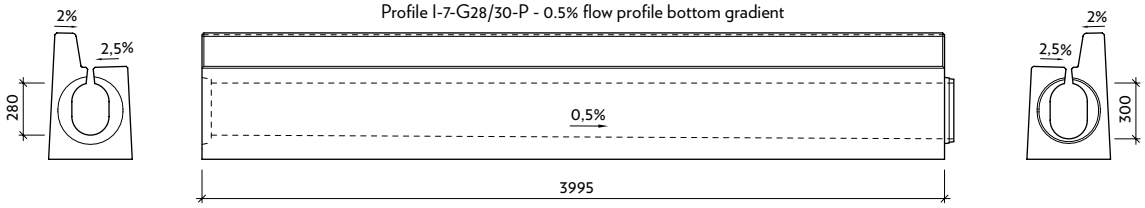
Protected by utility patent

View "b" - Socket | View "a" | View "c" - Spigot

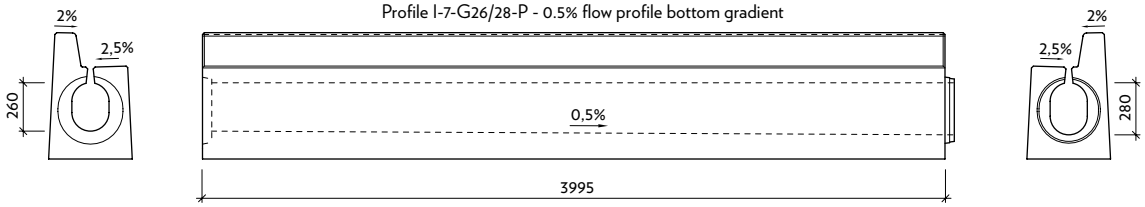
Profile I-7-T20/20-P - without internal flow gradient



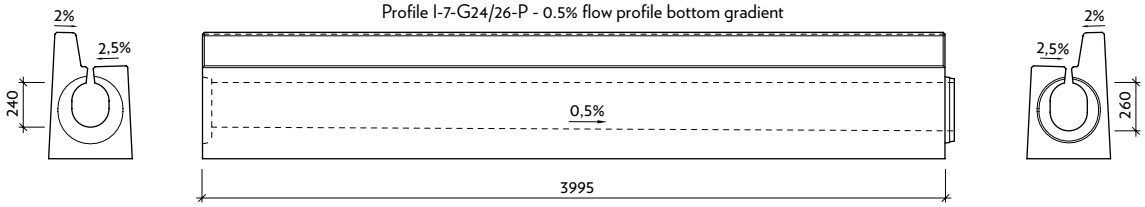
Profile I-7-G28/30-P - 0.5% flow profile bottom gradient



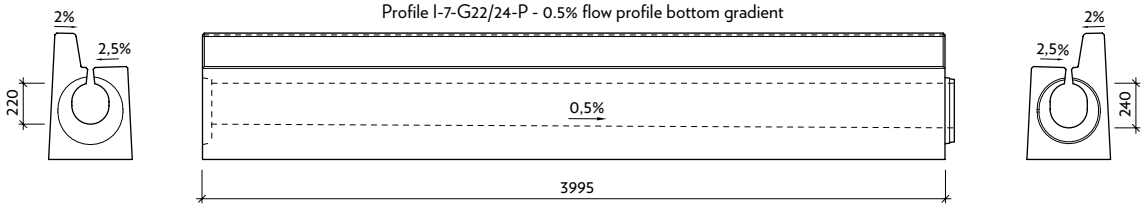
Profile I-7-G26/28-P - 0.5% flow profile bottom gradient



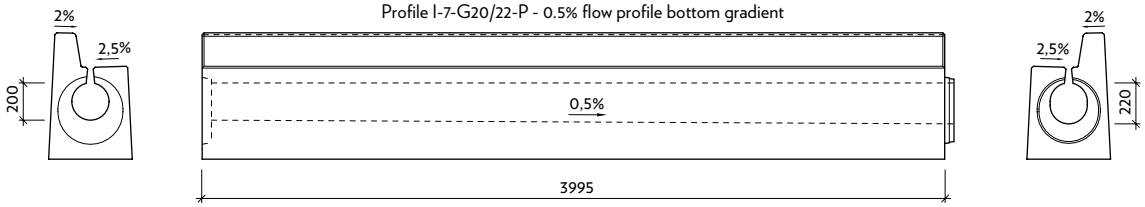
Profile I-7-G24/26-P - 0.5% flow profile bottom gradient



Profile I-7-G22/24-P - 0.5% flow profile bottom gradient



Profile I-7-G20/22-P - 0.5% flow profile bottom gradient



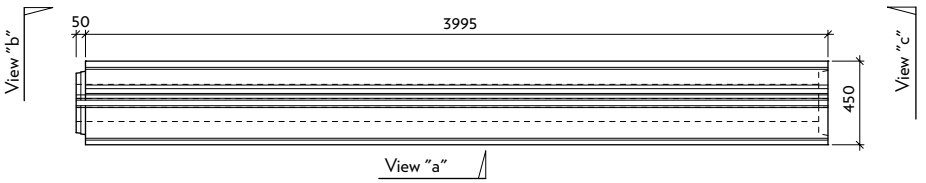
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-7

Protected by utility patent

Profile I-7 - left - Slot drain

Plan

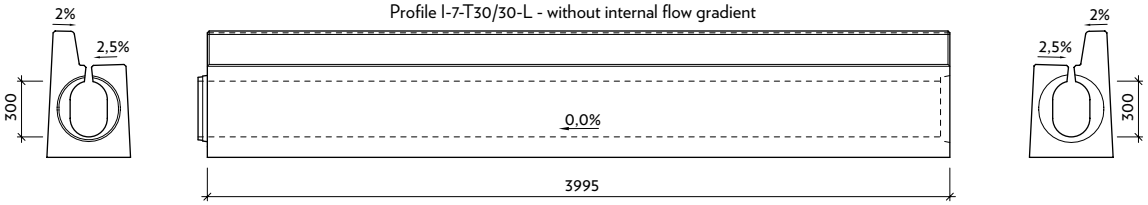


View "b" - Spigot

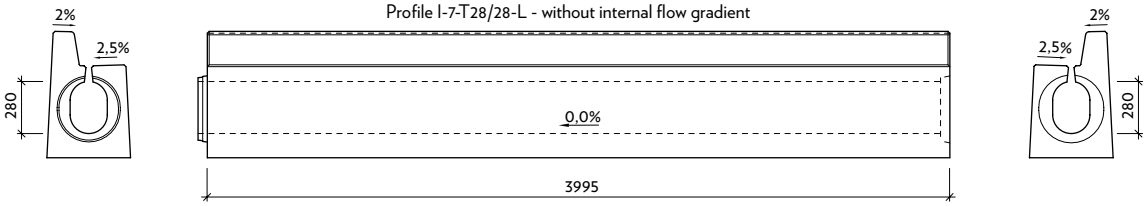
View "a"

View "c" - Socket

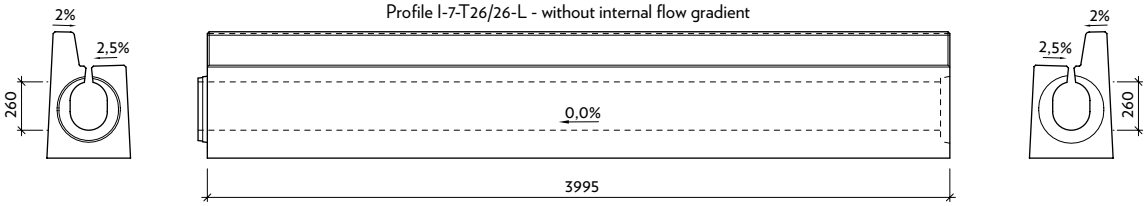
Profile I-7-T30/30-L - without internal flow gradient



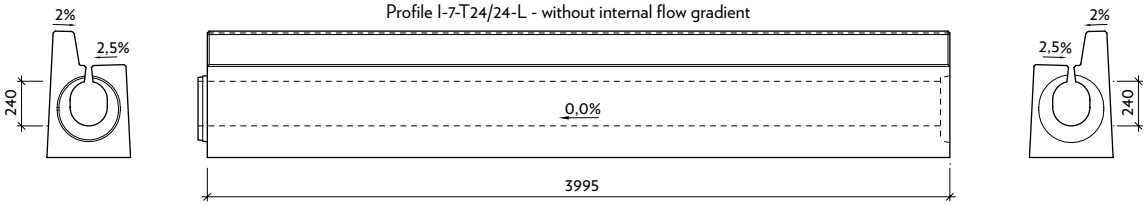
Profile I-7-T28/28-L - without internal flow gradient



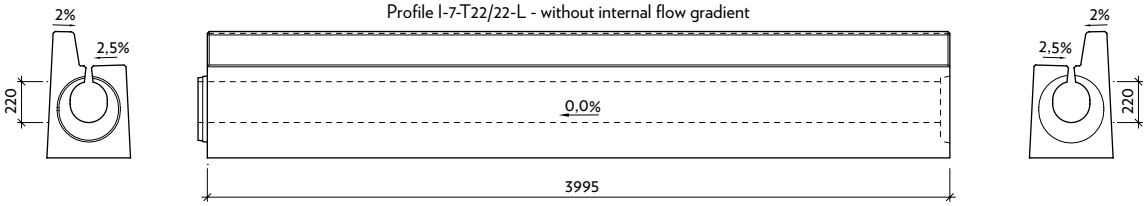
Profile I-7-T26/26-L - without internal flow gradient



Profile I-7-T24/24-L - without internal flow gradient



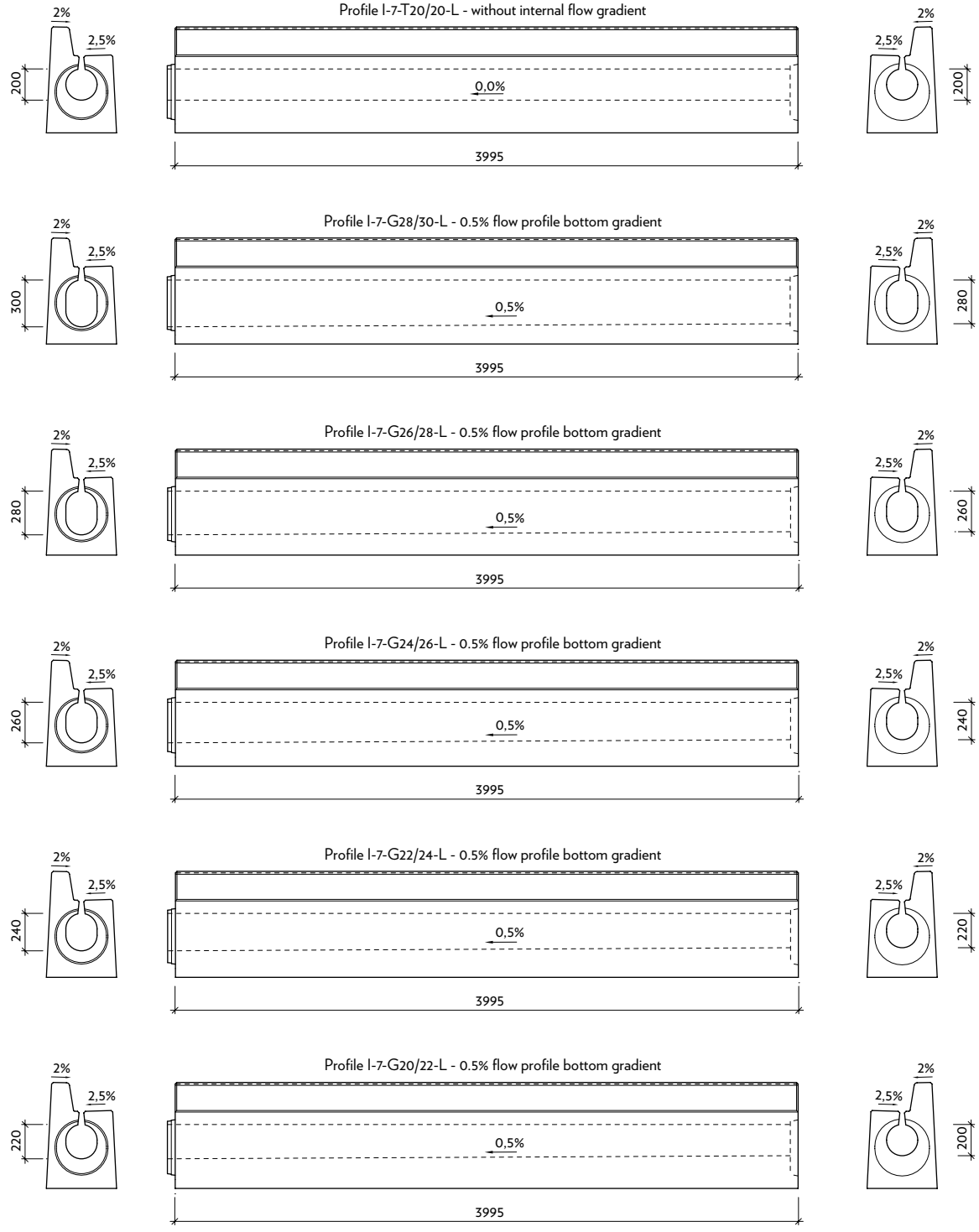
Profile I-7-T22/22-L - without internal flow gradient



CSB - SLOT DRAIN PROFILE I-7

Protected by utility patent

View "b" - Spigot | View "a" | View "c" - Socket



All products comply with harmonised European Standards and are patented

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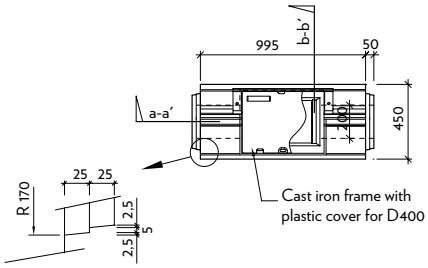
CSB - SLOT DRAIN PROFILE I-7

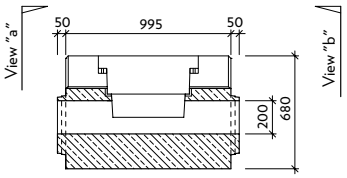
Protected by utility patent

I-7-CS - Top cleaning segment with cast iron grille and plastic cover for D400 - 18 cm kerbstone

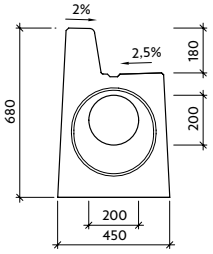
Plan



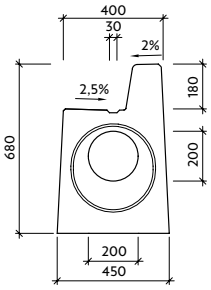
Cross-section: a-a´ I-7-CS



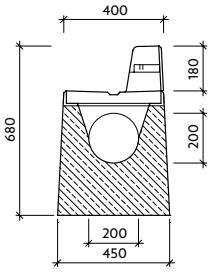
View "a" I-7-CS - Spigot/Spigot



View "b" I-7-CS - Spigot/Spigot

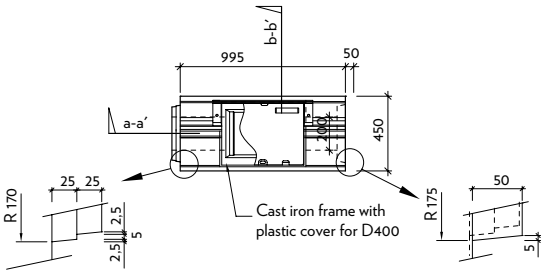


Cross-section: b-b´ I-7-CS

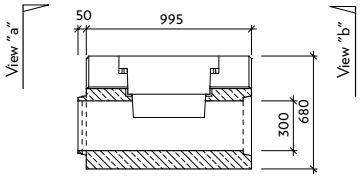


I-7-C0 - left - Basic cleaning segment with cast iron frame and plastic cover for D400 - 18 cm kerbstone

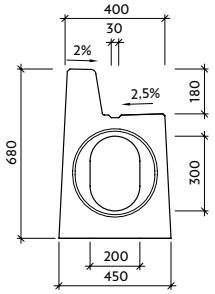
Plan



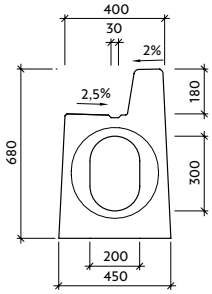
Cross-section: a-a´ I-7-C0



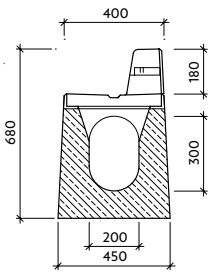
View "a" I-7-C0 - Spigot



View "b" I-7-C0 - Socket



Cross-section: b-b´ I-7-C0

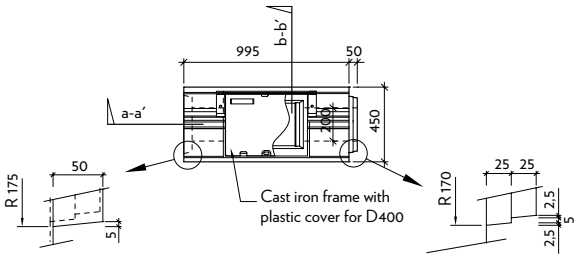


CSB - SLOT DRAIN PROFILE I-7

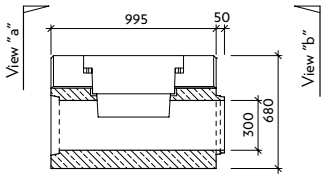
Protected by utility patent

I-7-C0 - right - Basic cleaning segment with cast iron frame and plastic cover for D400 - 18 cm kerbstone

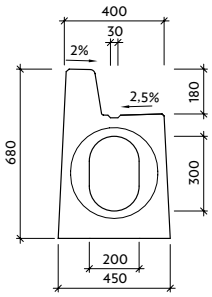
Plan



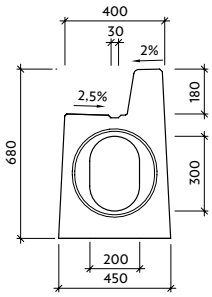
Cross-section: a-a´ I-7-C0



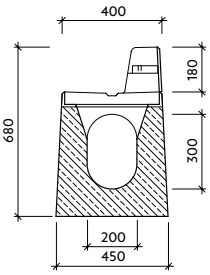
View "a" I-7-C0 - Socket



View "b" I-7-C0 - Spigot

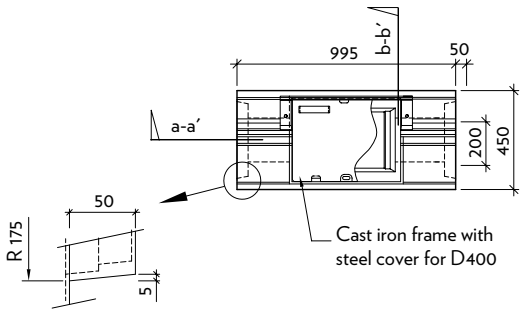


Cross-section: b-b´ I-7-C0

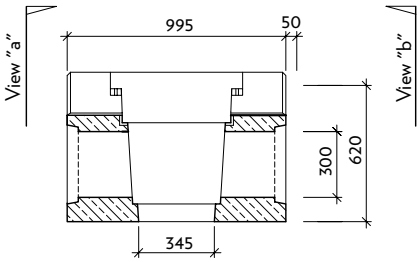


I-7-VU - Gutter gully assembly and 18 cm kerbstone

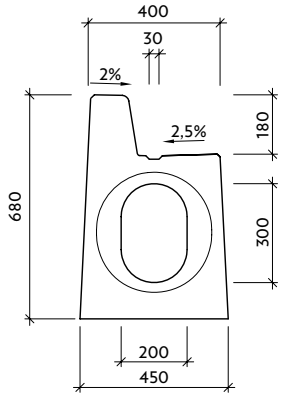
Plan



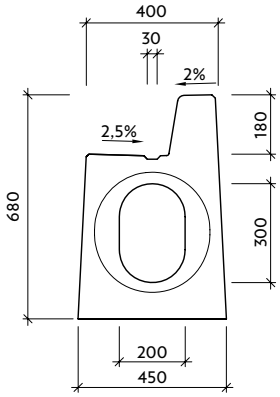
Cross-section: a-a´ I-7-VU



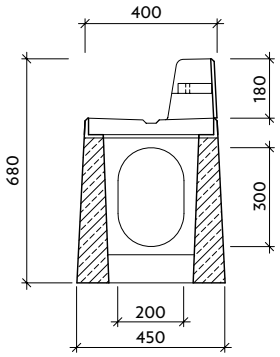
View "a" I-7-VU - Socket/Socket



View "b" I-7-VU - Socket/Socket



Cross-section: b-b´ I-7-VU



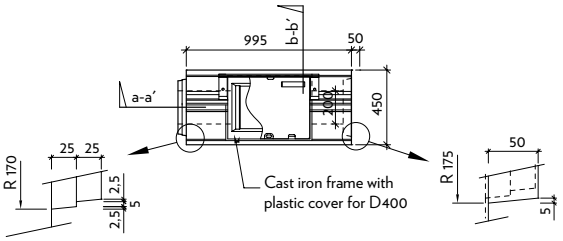
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-7

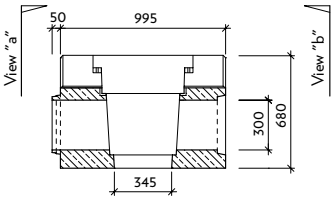
Protected by utility patent

I-7-V0 - left - Basic gully assembly with 18 cm kerbstone. Cast iron frame and plastic cover for D400

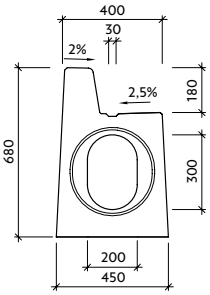
Plan



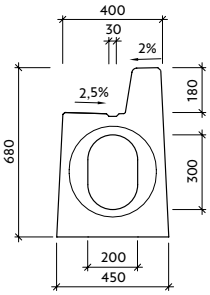
Cross-section: a-a´ I-7-V0



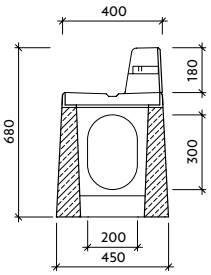
View "a" I-7-V0 - Spigot



View "b" I-7-V0 - Socket

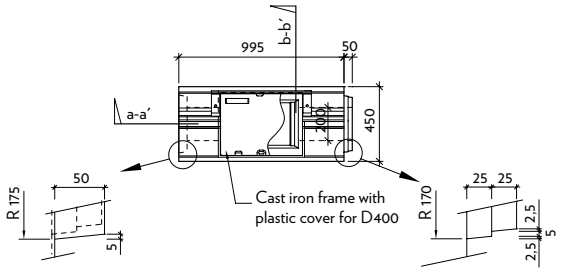


Cross-section: b-b´ I-7-V0

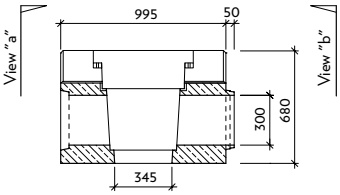


I-7-V0 - right - Basic gully assembly with 18 cm kerbstone. Cast iron frame and plastic cover for D400

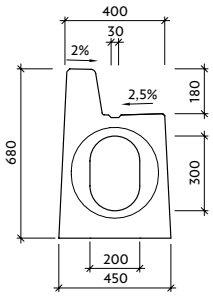
Plan



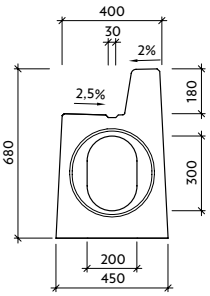
Cross-section: a-a´ I-7-V0



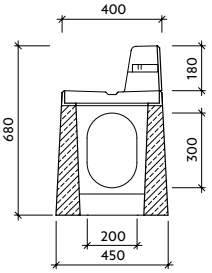
View "a" I-7-V0 - Socket



View "b" I-7-V0 - Spigot



Cross-section: b-b´ I-7-V0

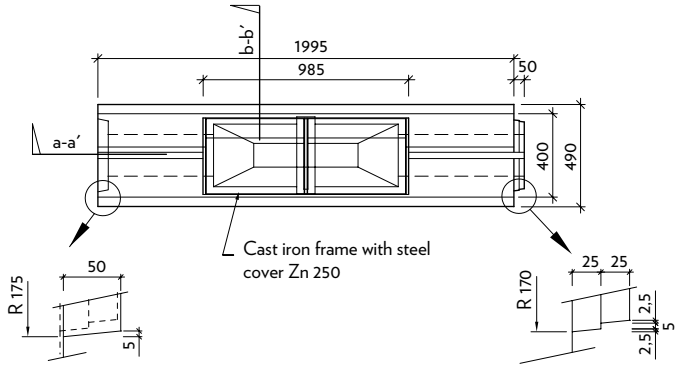


CSB - SLOT DRAIN PROFILE I-7

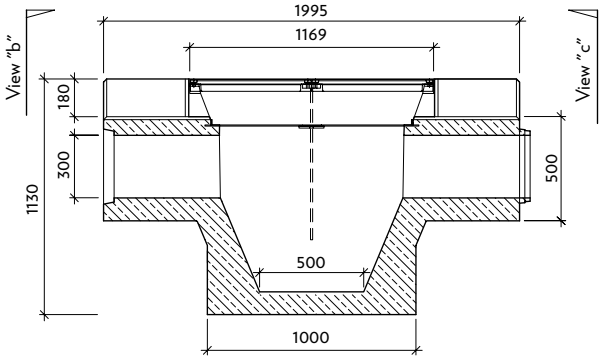
Protected by utility patent

Fire safety barrier with cast iron grille and steel cover for D400 - 18 cm kerbstone

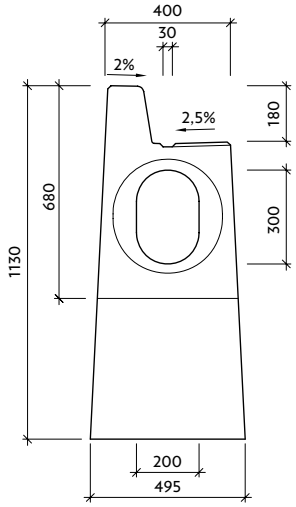
Plan



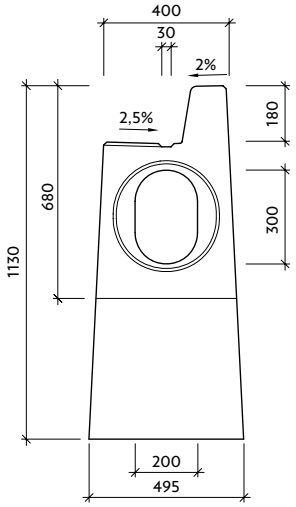
Cross-section: a-a´



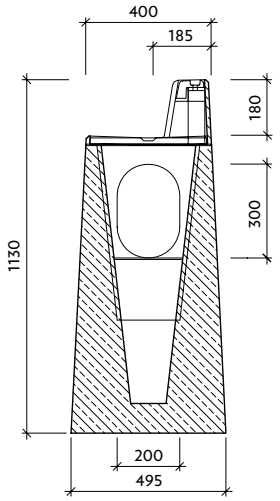
View "b" I-7-PP - Spigot



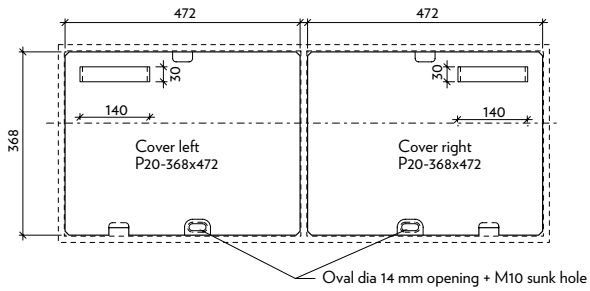
View "c" I-7-PP - Spigot



Cross-section: b-b´ I-7-PP



Detail of steel covers in frame (without kerbstone)



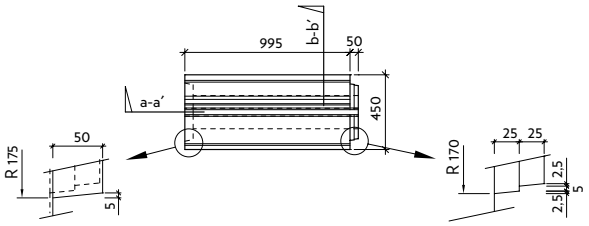
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I-7

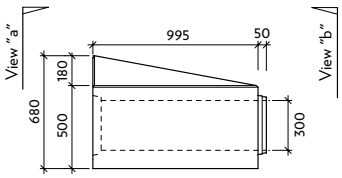
Protected by utility patent

I-7-0 - right - Slot drain with rising 18-0 cm kerbstone

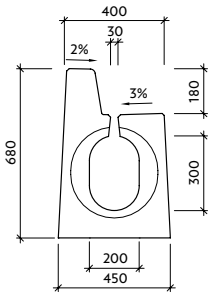
Plan



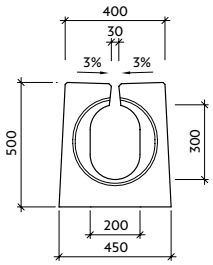
View "a" I-7-0



View "a" I-7-0 - Socket

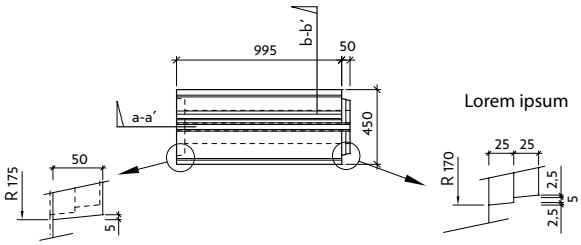


View "b" I-7-0 - Spigot

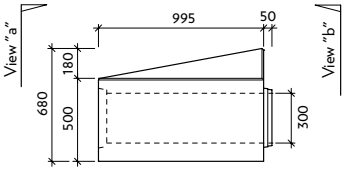


I-0-7 - right - Slot drain with rising 0-18 cm kerbstone

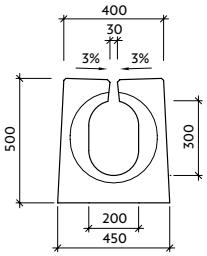
Plan



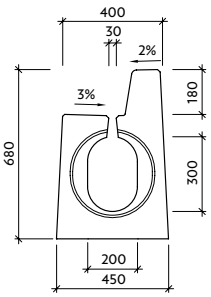
View "a" I-0-7



View "a" I-0-7 - Socket



View "b" I-0-7 - Spigot

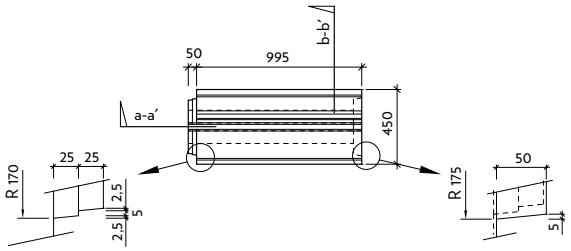


CSB - SLOT DRAIN PROFILE I-7

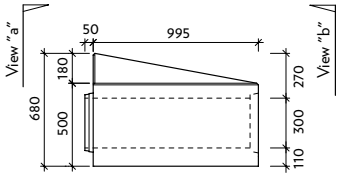
Protected by utility patent

I-7-0 - left - Slot drain with rising 18-0 cm kerbstone

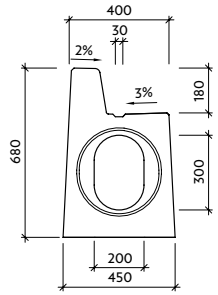
Plan



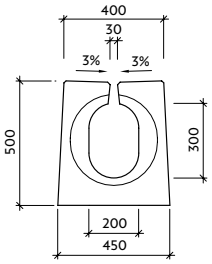
View "a" I-7-0



View "a" I-7-0 - Spigot

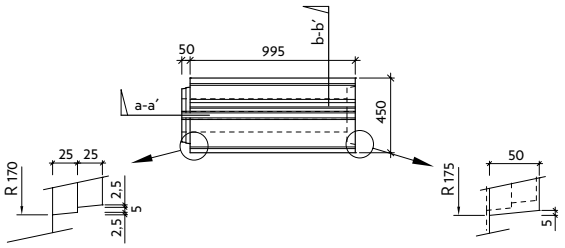


View "b" I-7-0 - Socket

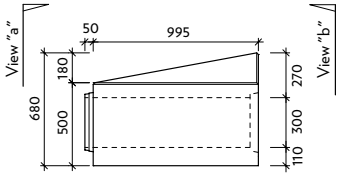


I-0-7 - left - Slot drain with rising 0-18 cm kerbstone

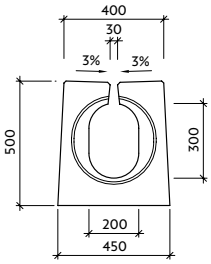
Plan



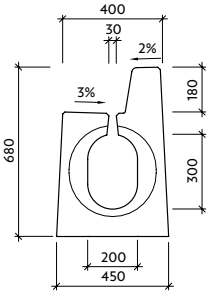
View "a" I-0-7



View "a" I-0-7 - Spigot



View "b" I-0-7 - Socket

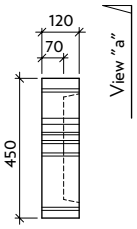


* Nominal dimensions include installation dimensions and/or minimum gap.

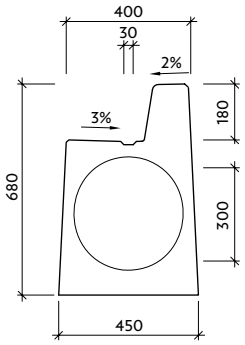
CSB - SLOT DRAIN PROFILE I-7

I-7-ZZ - Socket end cap and 18 cm kerbstone

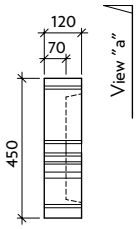
Plan T-ZZ - left



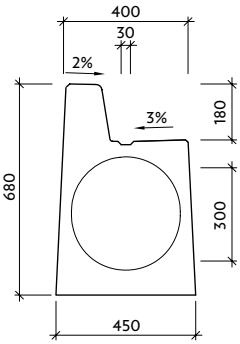
View "a"



Plan T-ZZ - right

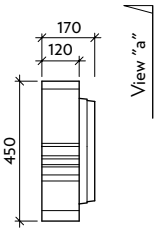


View "a"

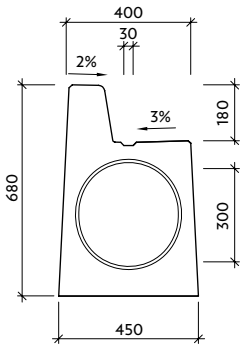


I-7-ZU - Spigot end cap and 18 cm kerbstone

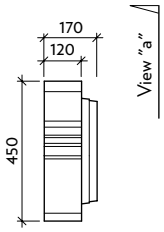
Plan T-ZU - left



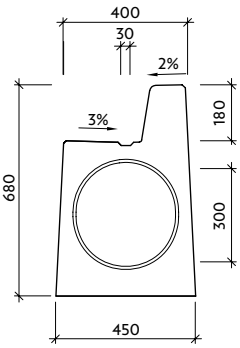
View "a"



Plan T-ZU - right



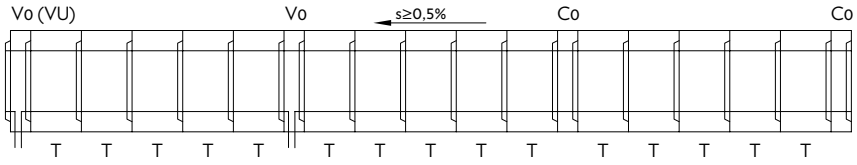
View "a"



CSB - SLOT DRAIN PROFILE I-7

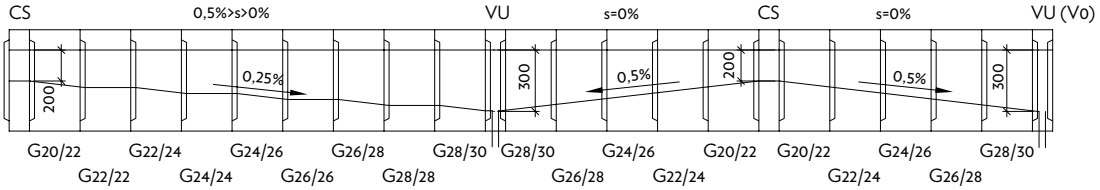
Suggested layout

I-7-T Slot drains - layout



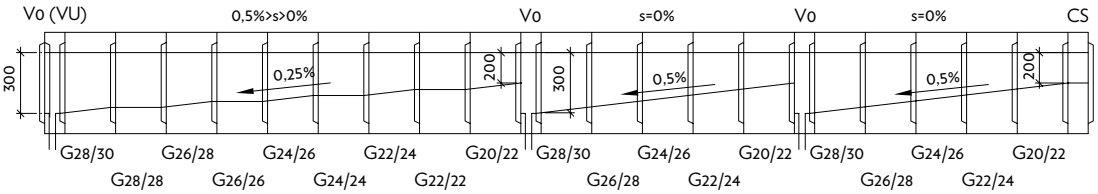
I-7-G Slot drains - layout

(slot drain with roof bottom)



I-7-G Slot drains - layout

(slot drain with saw tooth bottom)



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends
VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends
C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends
CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends
s – Longitudinal flow profile gradient

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I

Cross-section: a-a´

Basic gully segment with gully trap

Plastic cover (Cast iron grill)

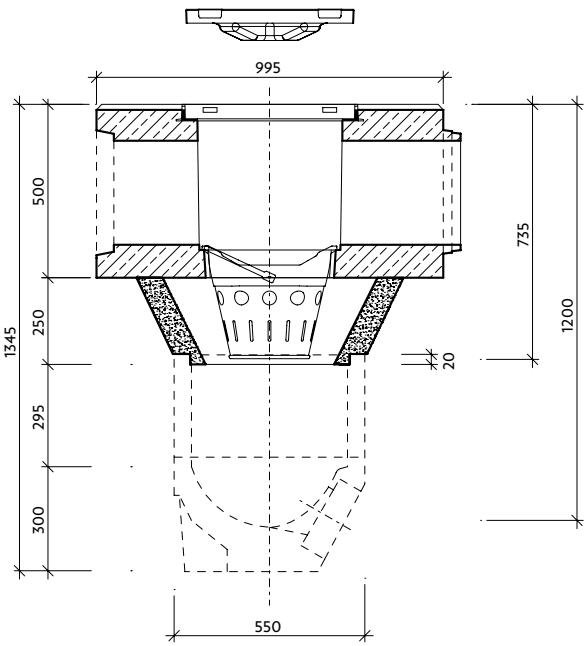
Basic gully segment

Gully trap

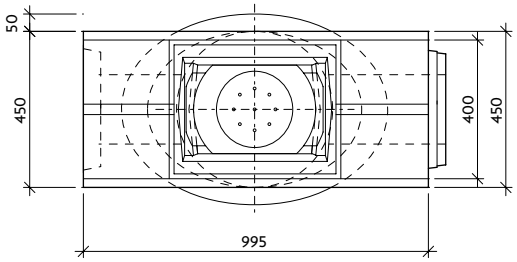
Taper top

Inspection shaft TBV-Q 450/295/6a

Shaft bottom TBV-Q 450/330/1a,
TBV-Q 450/330/1d

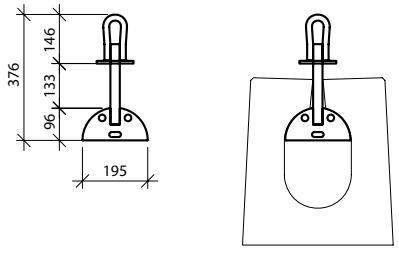


Plan

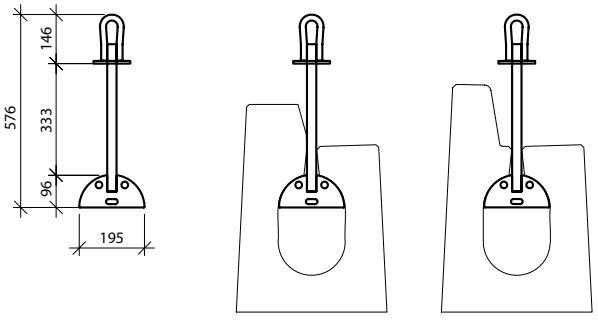


Handling equipment - **PROFILE I**

Small handling kit



Large handling kit



CSB - SLOT DRAIN PROFILE I

Charakteristika výrobku:

Slot drains are a modern, fast and efficient way of draining excess water from roads and surfaced areas. The system includes dedicated gully and cleaning segments.

Slot drains ensure efficient draining of excess water from surfaced areas even during extreme rainfall, its transport by means of high-capacity flow profile and removal to a storm sever. This prevents aquaplaning from occurring and collects contaminated water from the road surface so that it does not come into contact with the surrounding environment. Even large capacity slot drains are relatively narrow, so they can be installed within a 0.5 m-wide soft shoulder. Thanks to large flow capacity and narrow flow profile, they are largely self-cleaning.

The slot drain system may be used to reduce the length of storm sewers and the number of its connectors and inlets.

CS-BETON also offers slot drains with internal flow profile gradient and gradient-to-gradient elements, which enable efficient drainage of level or very slightly sloped surfaces. The upper surface of the segment has a 3% gradient toward the slot. For transversal vehicle travel at high speeds (80 km/hr and higher), a flat upper surface is recommended.

Different segment profiles may be used for different applications, such as:
Slot drains with integrated kerbstones, curved slot drain segments, fire-safety barriers, custom-length segments, sloping segments, custom gully segments and shafts etc..

CS-BETON slot drains have high load-carrying capacity and selection of a suitable type allows them to be used at airports, or the most demanding industrial applications. These segments are made in three versions, for D400, E600 and F900 traffic loads. Segments with interrupted slots are especially suitable for dynamic loading, or to withstand horizontal forces. The simple design and high-quality structural elements ensure long service life of drainage systems.

CS-BETON‘s slot drains and all the system components are made of high strength C 45/55 XF4 concrete as per ČSN EN 206-1. Efficient plasticiser and aeration admixtures and non-crystalline silicon dioxide (MICROSILICA) admixtures make our concrete extremely resistant to water and chemical defrosting agents. In European weather conditions, the systems are not affected by frost.

The design of the slot drain elements allows for a perfect connection to the surrounding road surface. The weight of the slot drain segments (4 m segments weigh approximately 1.5 - 2.1 t) enables compacting of road structure layers in the immediate vicinity without the risk of the segments being moved sideways, when suitable techniques such as vibration slabs are used. The slightly slanted side walls also help compacting and connection to the adjoining structures.

CS-BETON‘s slot drains include a proprietary two-ring AQUAFEST joint technology, which ensures perfect water tightness and resistance to oil residues and other aggressive substances. This prevents surrounding underground and surface waters from being contaminated. The rubber seal also creates an expansion joint between two adjoining drain segments.

Custom lengths (in 1 cm increments between 0.5 and 4.0 m) may also be supplied. Additional modifications are also possible upon request, such as surface modifications, side outlets, slanted ends, etc. Custom lengths and modified elements are more expensive and take longer to supply.

Installation of slot drains is relatively easy and fast when suitable equipment is used. Upon customer‘s request, CS-BETON will include a special handling and installation kit with the supply. Always follow manufacturer‘s installation instructions to ensure functional and long-lasting drainage systems.

Finished slot drain systems require minimum maintenance, only cleaning of the flow profile when it becomes clogged. Cleaning and gully segments are provided for this purpose and should be installed at regular intervals. Regular maintenance of gullies is relatively easy. According to TP 152, the gullies should be ideally spaced 40 m apart, in any case not more than 50 m. The only maintenance required is removal and emptying/cleaning of the gully traps.

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I

The cast iron grilles on gullies and cleaning segments are secured against lift-off from the passing traffic. The 900 kN load versions are made from ductile cast iron. Slot drains can be installed in curved layouts. The maximum directional angle between two adjacent segments is 3 degrees. This ensures watertight joints between the adjoining faces. This limitation suggests that 4 m segments could be used in curves down to a radius of R = 80 m and 2 m segments down to R = 40 m. We do not recommend this minimum value as the visible line of the slot segments appears too polygonal and compacting of adjacent road layers may damage the slot drain segments and joints. This means at least R = 160 m for 4 m segments.
For smaller radius arcs, shorter segments and/or curved segments may be used.

In the overall context and given its reliability, safety and low operational cost, drainage systems using slot drains are more suitable and more economical than other systems in most cases. Slot drain systems are becoming more popular and some applications would be hard to solve without them.

Important information:

Slot drains are designed to collect water from surfaced areas, not from free terrain. Water from free terrain may be drained only in exceptional cases and in minimum quantities. However, blocking of the slot or the flow profile by stones and mud must always be prevented (rubble arresting benches, ditches, full lawn cover, more frequent maintenance, etc.). Installation of slot drain into minimum radius curves produces polygonal shapes. During compacting next to such shapes, compacting next to the segments must be ensured without any damage or movement to the segments must be ensured. Vibration slabs are recommended.

During installation, gullies must be precisely located in both transversal and longitudinal direction, because the micro-slot segments‘ length cannot be altered in situ. The nominal length of basic 4 m segments with the rubber seal is 4,000 mm.

The openings at the beginning and end of the line must be closed and sealed using end caps supplied by CS-BETON.

CAUTION!

The „Important information“ above includes only a few general rules for installing micro-slot draining systems.

Use the hydraulic calculation provided below to evaluate the flow capacity of M-series slot drain systems.

CS-BETON provides consulting services to designers and architects using micro-slot drain solutions. We will evaluate your preliminary design in the context of the overall technical solution of the roads, surfaced areas and rainwater drainage of your project. We will confirm the proposed drainage solution, or recommend changes and specify recommended elements and their location within the system, including a recapitulation/BoQ for ordering purposes, along with list prices and the total price. All the above services are provided free of charge as a courtesy to our clients.

CS-BETON s.r.o. is not the responsible designer of your project‘s documentation or its part. According to Section 159 of the Act no. 183/2006 Coll, the designer is responsible for the correct selection of products specified in project documentation based on guaranteed properties of individual products detailed in product property certificates.

When installing the M-line micro-slot drains by CS-BETON, always follow the manufacturer‘s installation recommendations!

CSB - SLOT DRAIN PROFILE I

Hydraulic calculation:

1. Introduction
The I-series of slot drain systems is suitable for smaller areas such as courtyards, service stations, etc. and wherever manual handling during installation is preferable.

2. Initial assumptions
The hydraulic design of a I-slot system must always be based on the individual conditions at the given site, i.e. hydrogeology information, size, type and location of the catchment area. The capacity of the drainage system must then be calculated to reflect these conditions.

2.1 Geometrical characteristics
I-series slot drains are produced in two types. The I-G profile has an artificial bottom gradient of 5 ‰ and the I-T profile has a constant height of the flow profile. Further options include these: with interrupted slot, with integrated kerbstones, with covered slot, etc.

2.1.1 I-G type segments with internal gradient
This type of system is represented by ma line of 20 basic segments with one gully segment (20.0 + 1.0 = 21,0 m) in a „saw teeth" configuration and/or with one gully and one cleaning segment (20.0 + 2.0 = 22 m) when only one such line is used. Another option are two basic lines with the gully segment in the middle and cleaning segments at the ends - this configuration is 1.0 + 20.0 + 1.0 + 20.0 +1.0 m = 43.0 m. The basic 20.0 m line with a 5 ‰ flow profile bottom gradient has an upper part of the flow profile cross section formed by an R = 45 mm circle, a bottom part by an R = 100 mm circle, with a 200 x 100 mm rectangle in between. The height of this rectangle changes from 0 to 100 mm and is increased by 20 mm for each subsequent segment.

2.1.2 I-T type segments with constant internal gradient
This type of slot drain does not have a fixed maximum length of one line - individual parameters depend on the site conditions (slopes etc.). The distance between the beginning/end of the line and the first cleaning and/or gully segment should not exceed 6 m so that simple cleaning and maintenance is possible. Distances between individual cleaning gully segments depend on the maintenance and cleaning intervals. According to TP 152, the maximum distance is 50 m. The segments have a flow profile cross section formed by a top and bottom circle of a 100 mm radius, with a 200 x 100 mm rectangle in between - it is thus identical to the end profile of the above sloped type.

2.2 Hydrology information
For the hydraulic design of slot drain systems, the most important input parameter is the design rainfall volume, which is used to arrive to the total drained volume and the necessary number of gully segments. The design rainfall volume may be obtained, for instance, from the „Intenzity krátkodobých dešťů v povodích Labe, Odry a Moravy" (Josef Trupl) Table [1], or by ordering the information from the relevant Hydrometeorology Institute branch. Generally speaking, for M Profile slot drain systems, ČSN 75 6101 (Stokové sítě a kanalizační přípojky) [2] specifies 15-minute rainfall with periodicity as per the type of area as the critical parameter. The same parameter is then used for the design of the storm sewer.

2.3 Terrain location
For the most economical system, the slot drains should be located on the catchment area so that their capacity is used to maximum and the number of storm sewer connections is minimal. The ideal scenario is slot drains in the lowest part of the area and a sufficient gradient sloping toward that part. When I-G type segments are used, the line is usually installed on a level surface. When I-T type segments are used, the gradient of the terrain in the longitudinal direction of the line must be at least 5 ‰ and the draining capacity depends on the gradient. Nomographic chart 1 below lists the flow capacity of slot drains and the flow rate for that capacity in relation to the longitudinal gradient. The total capacity of the system must correspond to the catchment area and the design rainfall as per above. The intensity of the design rainfall is reduced as per [2] using a recommended draining coefficient, which depends on type of structures present, type of site and its sloping. TP152 MDS may be used for the design.

2.4 Connection to the storm sewer
Connections to storm sewer are installed in shafts provided under gully segments with a DN 150 or DN 200 connector. The gully segments include support surfaces for gully traps to protect the sewer connector from being blocked by debris.

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I

3. Capacity flow through I Profile slot drains

Calculation of the capacity of this system is based on the „Hydraulické tabulky stok" (Hydraulic tables: Sewage conduits by J. Herle, O. Štefan, J. Turi Nagy) [3]. The same method is also used to design sewage conduits. The roughness coefficient was assumed at n = 0.014 and velocity coefficient c was calculated as per Pavlovský. Our calculations do not assume (given the usual longitudinal sloping of up to 35 ‰) any aeration within the flow. The capacity itself was then calculated using the Chezy formula for gradients of 5 to 100 ‰ and the results were plotted in nomogram 1. The nomogram also shows flow speeds for the given flow rates. The calculation was only performed for M and T profiles, i.e. with constant cross-section, because with such systems, variable distances between gully segments is used depending on the size of the area drained. A basic 20 m line of IG profiles is theoretically capable (see prerequisites in Chapter 5) of draining water from an area of approximately 4,480 sq m. With a width of 20.0 m, that would represent a length of 224 m, which will not be possible in practice. As far as the DN 150 gully connectors are concerned, their capacity must be evaluated at critical points, see Literature [3]. To prevent blocking by debris, all connectors should have a gradient of at least 20 ‰.With smaller gradients of the slot drain lines, the connector capacity may become the limiting factor for the whole system and larger connector diameters and/or gradients are recommended.

4. Example hydraulic calculation

This hydraulic calculation is based on theoretical input information. This specifies an application example involving Profile I slot drains and a motorway with a constant longitudinal gradient of 10 ‰. The road is in an area for which the hydrographical information is taken from data provided by the Roudnice nad Labem meteorological station. The segment which uses slot drains has a width of 12 m and a length of 125 m. The slot drains are installed at the edge of the road. The line includes one gully segment at the bottom end. The limiting parameter for the slot drain line is its cross--section at the bottom end. The road has a transversal gradient toward the slot drains of 25 ‰ and has a bitumen surface. Design rainfall intensity for T = 15 minutes and periodicity p = 1 is:

$$I_{NAV} = 112 \text{ [l/s.ha]}$$

the run-off coefficient is:

$$\varphi = 0{,}80$$

the drained area is:

$$F = 12 \times 125 \times 0{,}0001 \text{ [ha]} = 0{,}15 \text{ [ha]}$$

after reduction by coefficient c = 0,80 the drained area is:

$$F_{RED} = \varphi \times F \text{ [ha]} = 0{,}80 \times 0{,}150 = 0{,}120 \text{ [ha]}$$

The design flow Q_{NAV} is

$$Q_{NAV} = F_{RED} \times I_{NAV} \text{ [l/s]}$$
$$Q_{NAV} = 0{,}120 \times 112$$
$$Q_{NAV} = 13{,}44 \text{ [l/s]}$$

After comparing this value to the capacity of the slot drain from nomogram 1 for the gradient of 10‰, it is clear that:

$$Q_{KAP} = 61{,}92 \text{ [l/s]} > Q_{NAV} = 13{,}44 \text{ [l/s]}$$

Cleaning segments also have to be provided, with maximum spacing of 50 m.

Nomograms:

1. Nomograms for preliminary design of drainage systems
For reference design of I-profile draining systems, some calculation assumptions may be simplified. The average rainfall intensity for 15 minute rainfalls and periodicity of p = 1 for the Czech Republic (Labe basin) is:

I_{OR} = 122 [l/s.ha]

Since these slot-drains will not be used to drain water from unsurfaced areas, the average run-off coefficient c as per [2] is:

φ = 0,80

which is correct for concrete/bitumen surfaces with a gradient between 10 and 50 ‰. With these specifications, the following nominal run-off may be assumed:

per 1 sq m of drained area:

Q_{OR} = 1 x 1 x 0,0001 x 0,8 x 122 = 0,00976 [l/s]

per 1 are, i.e. 100 sq. m:

Q_{OR} = 10 x 10 x 0,0001 x 0,8 x 122 = 0,976 [l/s]

per 1 hectare, i.e. 10,000 sq. m:

Q_{OR} = 100 x 100 x 0,0001 x 0,8 x 122 = 97,6 [l/s]

The relationship between design run-off and the drained area is shown in nomogram 2. for areas of 500 to 5000 sq m.

A comparison of the calculated run-off as per nomogram 2 with the capacity of the slot drain at the given gradient from nomogram 1 gives us enough information to specify the number of gully segments and to optimise the layout of the slot drain system.

6. Gully trap
Each gully contains two gully traps, which protect the storm sewer connections from being blocked by debris. The TP 152 recommends a distance between gully segments in a line of I Profile slot drains of 30 to 50m, depending on the characteristics of the adjacent surfaced area.
The gully segments include small gully traps, which are sufficient for most applications. For applications where large flow rate is required, large gully traps may be used.

The gully traps have several rows of narrow rectangular openings.

The upper sides of the trap are 420 mm and 190 mm and a number of draining slots is provided below the filling openings. Every gully trap includes a holding rod for easy handling. Gully traps are made of 1.25 mm thick galvanised steel sheeting.

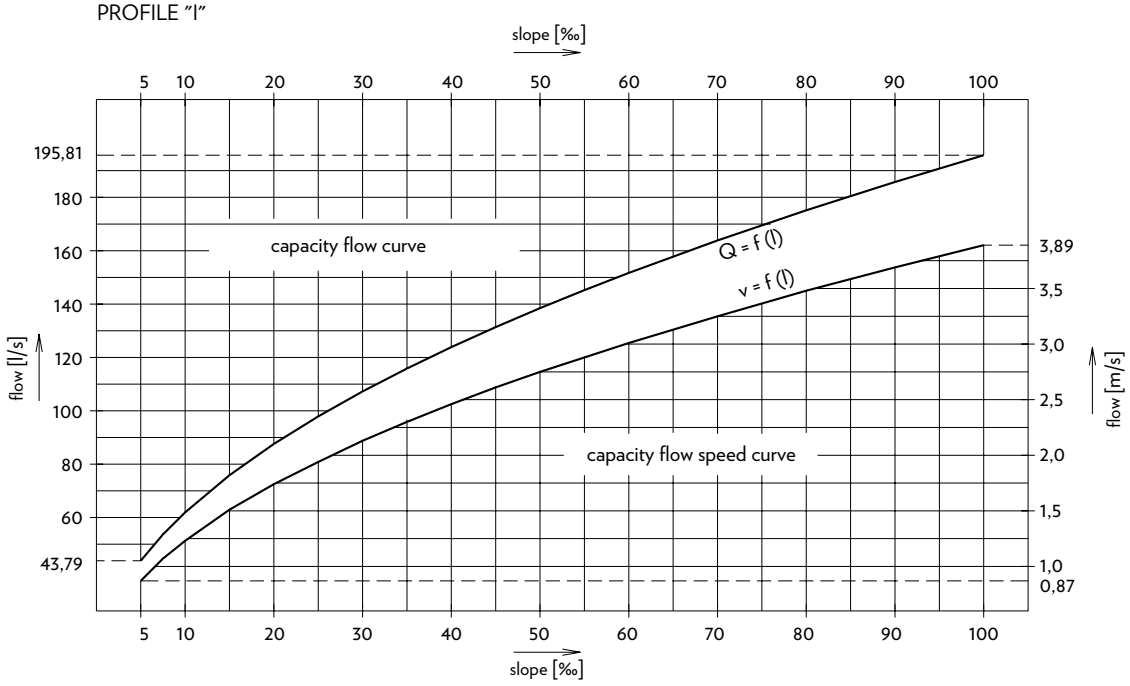
The gully trap has a height of 275 mm and a rectangular base of 325 x 145 mm. The shape is conical and fits the support elements within the gully segment. Filling openings are provided at the top of the narrower sides. The upper sides of the trap are 420 mm and 190 mm and a number of draining slots is provided below the filling openings. Every gully trap includes a holding rod for easy handling. Gully traps are made of 1.25 mm thick galvanised steel sheeting. The maximum flow rate through a gully trap is 40.4 l/s.

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE I

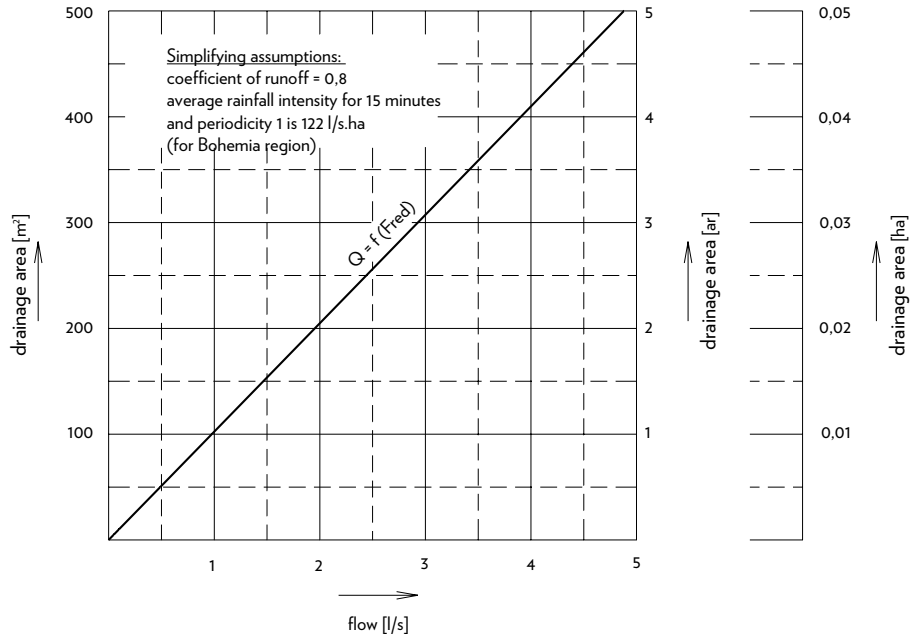
NOMOGRAME No. 1

CAPACITY OF SLOT CHANNELS (ROUGHNESS COEFFICIENT n = 0,014 - BY PAVLOVSKY)
PROFILE "I"



NOMOGRAM No. 2

Determination of surface runoff from 500 to 5000 m²



CSB - SLOT DRAIN PROFILE I

Input data:

The following literature has been used in designing the drainage system described in this brochure:

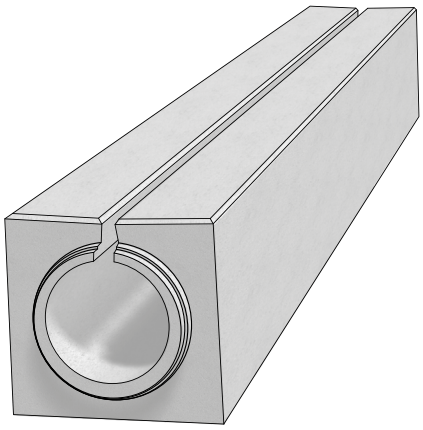
ČSN EN 1433 Odvodňovací žlábky pro dopravní a pěší plochy - konstrukční zásady zkoušení, označování, řízení jakosti
ČSN EN 206 Beton - specifikace, vlastnosti, výroba a shoda
DIN 19 580 Entwässerungsrinnen für Niederschlagswasserzum Einbau in Verkehrsflächen
ČSN 73 6056 Odstavné a parkovací plochy silničních vozidel
ČSN 73 6059 Servisy a opravny motorových vozidel. Čerpací stanice pohonných hmot
ČSN 73 6101 Projektování silnic a dálnic
ČSN 73 6110 Projektování místních komunikací
ČSN 73 6114 Vozovky pozemních komunikací
ČSN 75 6101 Stokové sítě a kanalizační přípojky
ČSN EN 124 Poklopy a vtokové mříže pro dopravní plochy
Vzorové listy staveb pozemních komunikací VL-1 Vozovky a krajnice, Ministry of Transport of the Czech republic, Dopravoprojekt
Vzorové listy staveb pozemních komunikací VL-2.2 Odvodnění, Ministry of Transport of the Czech republic, Dopravoprojekt
TKP 1 - Všeobecně
TKP 18 - betonové konstrukce (vč. 10 příloh)
TKP 31 - opravy betonových konstrukcí
TP 152 - Štěrbinové žlaby na PK, 2001, VPÚ-DECO
TP 170 - Navrhování vozovek PK (všeobecná část, katalog, návrhová metoda), 2004, VTU, Roadconsult
Technical documentation by CS-BETON Velké Žernoseky + VPÚ DECO 96-04
Company standard 7/99 Micro-slot drains as per DIN 19580, CSB
TPV 2/99 - Technologický předpis na montáž mikroštěrbinových trub, CSB
TPV 1/98 - Technologický předpis na opravy betonových prvků odvodňovacích systémů štěrbinových trub, CSB

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE II-0

Technical data:

Profile II slot drains are suitable for draining rainwater contaminated with small quantities of oil products (drips) from surfaced areas such as high-capacity traffic structures (motorways, dual carriageways, main roads, tunnels, runways, lay-bys, large parking lots, etc.). Profile II slot drains are suitable for applications with large amounts of rainfall and where shallow depth is required. They are only available with no internal gradient. Profile II-0 slot drains (continuous slot) are designed for D400 class traffic load and no transversal vehicle travel.



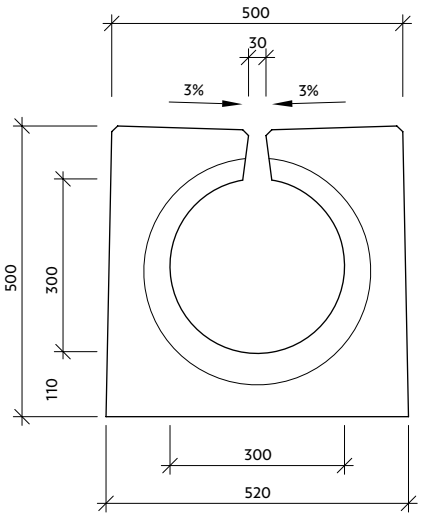
The system consists of the following components:

- 4 m-long continuous slot drain, without internal flow gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- End cap

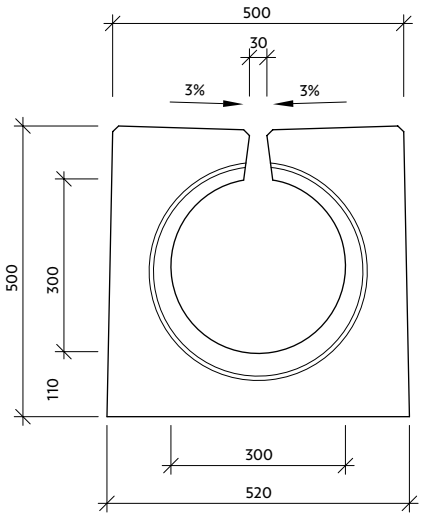
		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**pcs**
Slot drain with continuous slot	II-0	500	4000	500/520	0,25	1673
Basic gully assembly V0	II-V0	500	1000	500/520	1	347
Gutter gully assembly VU	II-VU	500	1000	500/520	1	337
Basic cleaning segment C0	II-C0	500	1000	500/520	1	377
Top cleaning segment CS	II-CS	500	1000	500/520	1	387
Spigot end cap ZU	II-ZU	500	120	500/520	8	84
Socket end cap ZZ	II-ZZ	500	120	500/520	8	57

Nominal dimensions - basic shapes:

Side-view
Socket



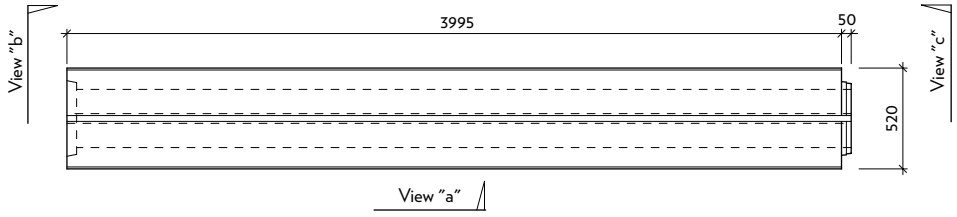
Side-view
Spigot



CSB - SLOT DRAIN PROFILE II-0

Profile II-0 - Slot drain

Plan

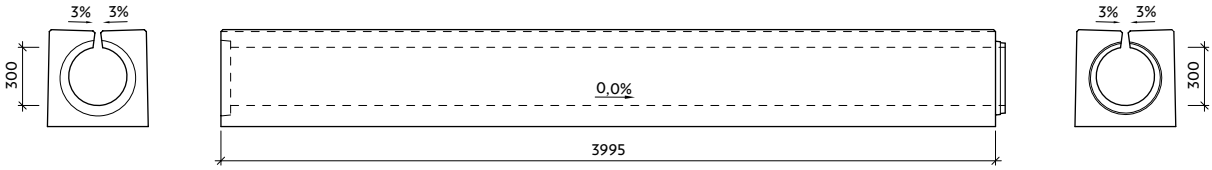


View "b" - Socket

View "a"

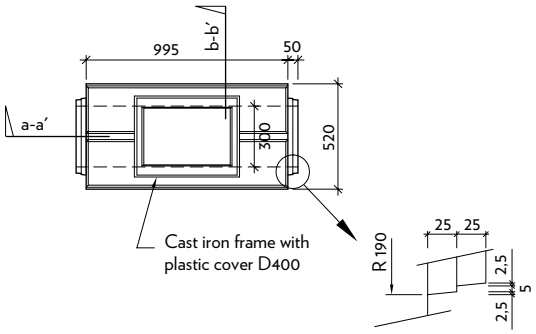
View "c" - Spigot

Profile II-0-T30/30 without internal flow gradient

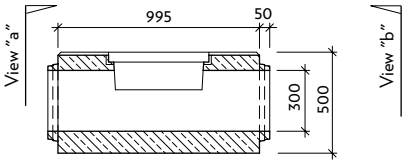


II-0-CS - Top cleaning segment with cast iron frame and plastic cover for D400

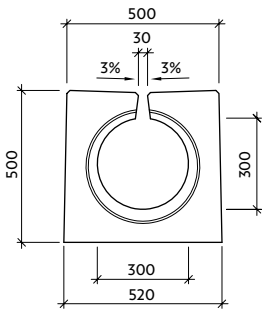
Plan



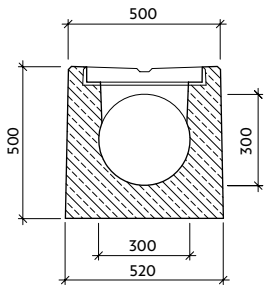
Cross-section: a-a'



View "a"="b" II-0-CS - Spigot/spigot



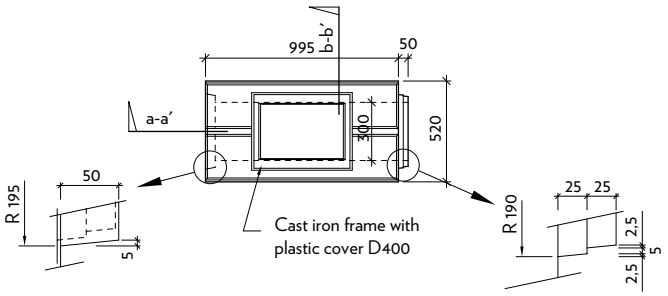
Cross-section: b-b'



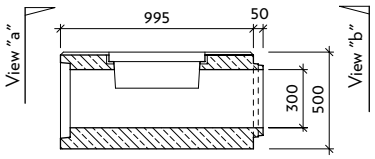
CSB - SLOT DRAIN PROFILE II-0

II-0-C0 - Basic cleaning segment with cast iron frame and plastic cover for D400

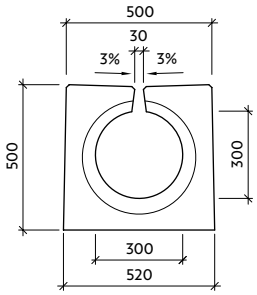
Plan



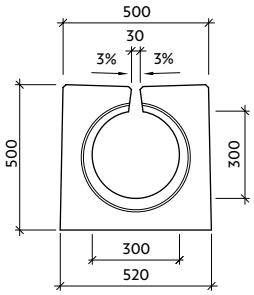
Cross-section: a-a´ II-0-C0



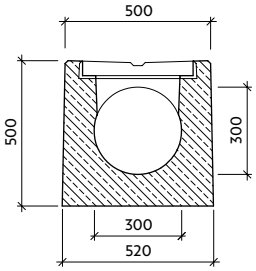
View "a" II-0-C0 - Socket



View "b" II-0-C0 - Spigot

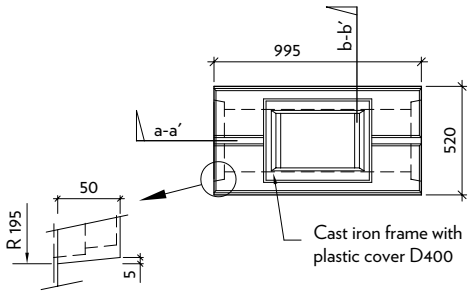


Cross-section: b-b´ II-0-C0

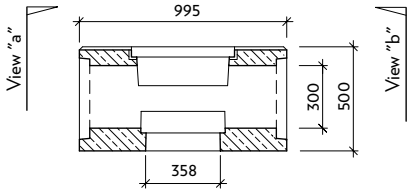


II-0-VU - Gutter gully assembly with cast iron frame and plastic cover for D400

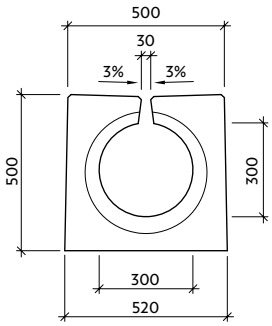
Plan



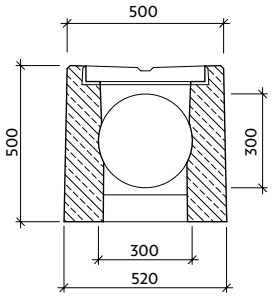
Cross-section: a-a´



View "a"="b" II-0-VU - Socket/socket



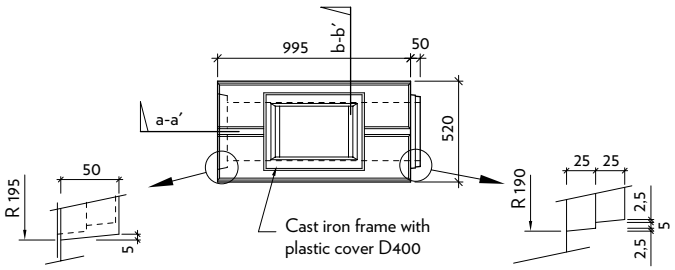
Cross-section: b-b´



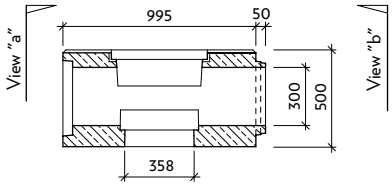
CSB - SLOT DRAIN PROFILE II-0

II-0-V0 - Basic gully assembly with cast iron frame and plastic cover for D400

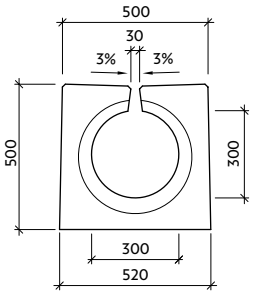
Plan



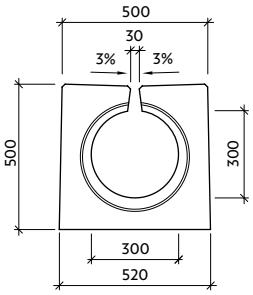
Cross-section: a-a´ II-0-V0



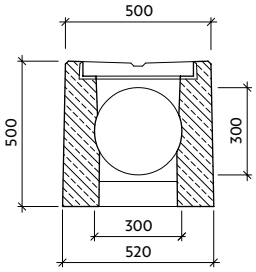
View "a" II-0-V0 - Socket



View "b" II-0-V0 - Spigot

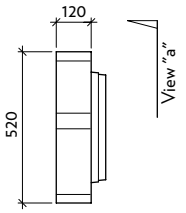


Cross-section: b-b´ II-0-V0



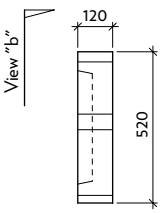
II-ZU - Spigot end cap

Plan

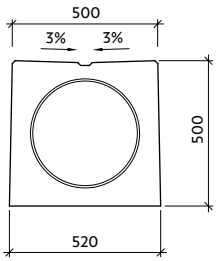


II-ZZ - Socket end cap

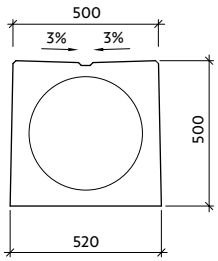
Plan



View "a" II-ZU - Spigot



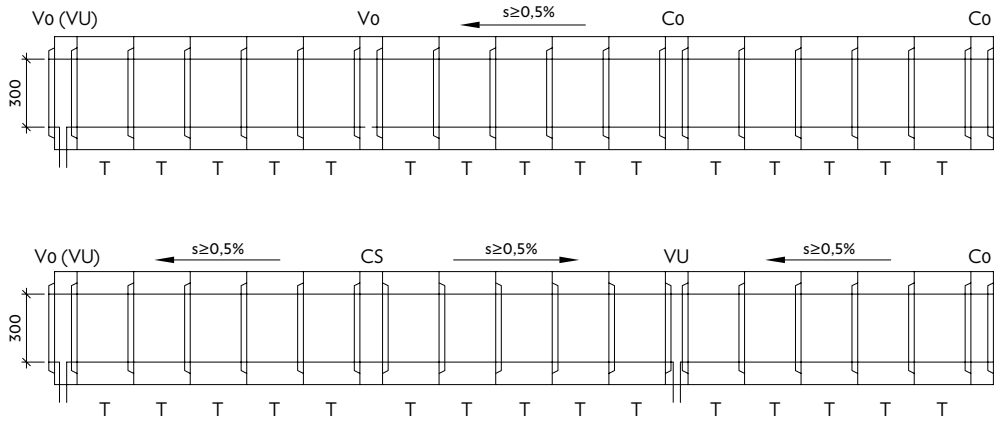
View "b" II-ZU - Socket



CSB - SLOT DRAIN PROFILE II-0

Suggested layout

II-0-T Slot drains - layout



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends

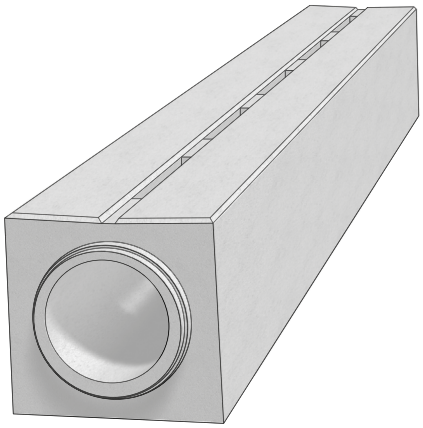
CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends

s – Longitudinal flow profile gradient

CSB - SLOT DRAIN PROFILE II-1

Technical data:

Profile II slot drains are suitable for draining rainwater contaminated with small quantities of oil products (drips) from surfaced areas such as high-capacity traffic structures (motorways, dual carriageways, main roads, tunnels, runways, lay-bys, large parking lots, etc.). Profile II slot drains are suitable for applications with large amounts of rainfall and where shallow depth is required. They are only available with no internal gradient. Profile II-1 slot drains are designed for D400, E600 and F900 class traffic loads and transversal vehicle travel. Profile II-1 (with interrupted slot) are designed for D400, E600 and F900 traffic loads.



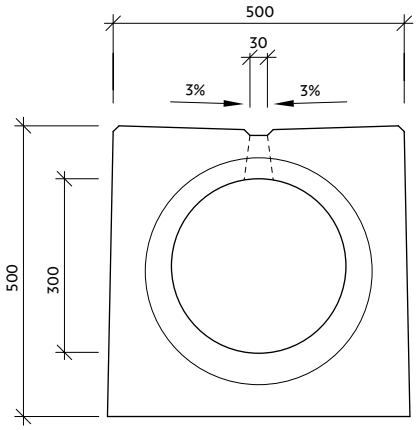
The system consists of the following components:

- 4 m-long slot drains with interrupted slots, without internal gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- End cap

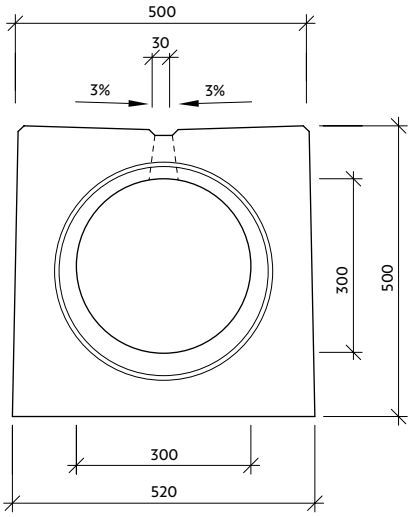
		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**pcs**
Slot drain with interrupted slot	II-1	500	4000	500/520	0,25	1700
Basic gully assembly V0	II-V0	500	1000	500/520	1	347
Gutter gully assembly VU	II-VU	500	1000	500/520	1	337
Basic cleaning segment C0	II-C0	500	1000	500/520	1	377
Top cleaning segment CS	II-CS	500	1000	500/520	1	387
Spigot end cap	II-ZU	500	120	500/520	-	84
Socket end cap	II-ZZ	500	120	500/520	-	57

Nominal dimensions - basic shapes:

Side-view
Socket



Side-view
Spigot



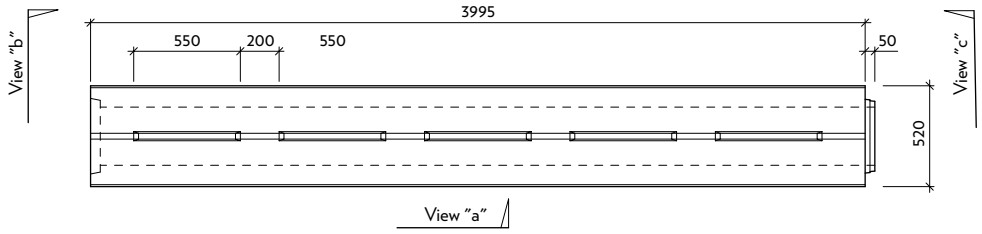
CS-BETON s.r.o.
Produkty splňují požadavky harmonizovaných euronorem ČSN EN

* Nominal dimensions include installation dimensions and/or minimum gap.

STAVBY JAKO Z KAMENE CSBETON®

CSB - SLOT DRAIN PROFILE II-1

Plan

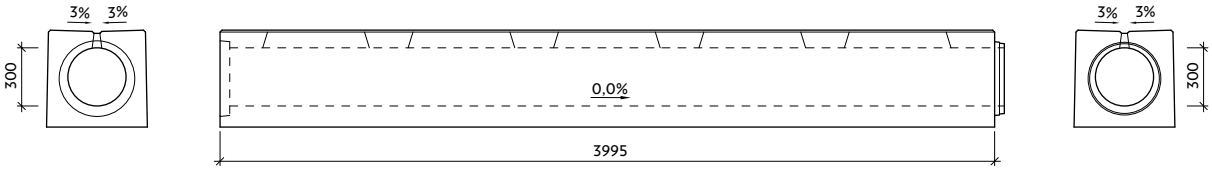


View "b" II-1 - Socket

View "a"

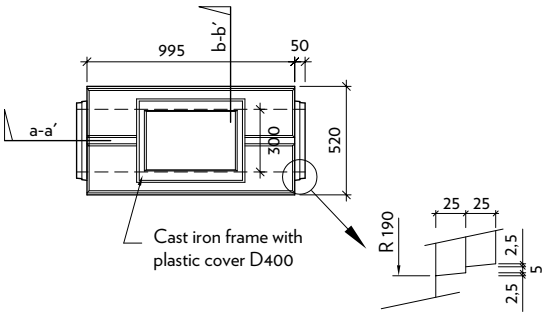
View "c" II-1 - Spigot

Profile II-1-T30/30 bez vnitřního spádu

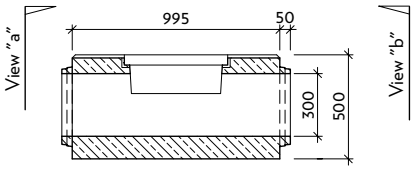


II-1-CS - Top cleaning segment with cast iron frame and plastic cover for D400

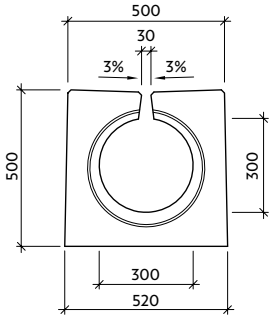
Plan



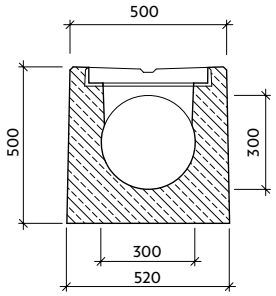
Cross-section: a-a'



View "a"="b" II-1-CS - Spigot/spigot



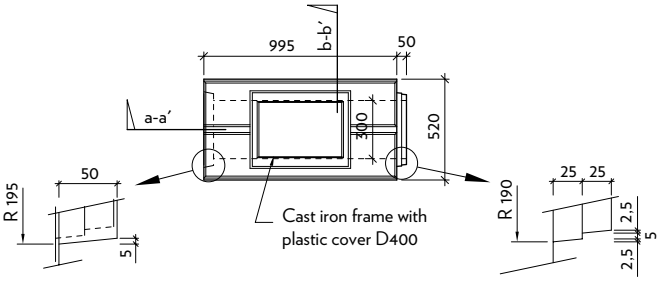
Cross-section: b-b'



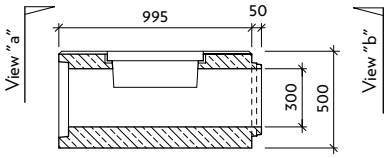
CSB - SLOT DRAIN PROFILE II-1

II-1-C0 - Basic cleaning segment with cast iron frame and plastic cover for D400

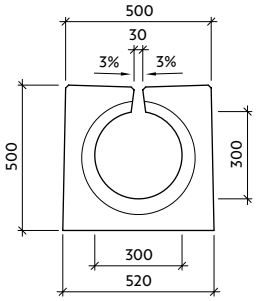
Plan



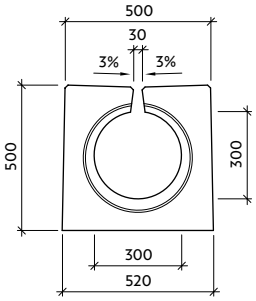
Cross-section: a-a´ II-1-C0



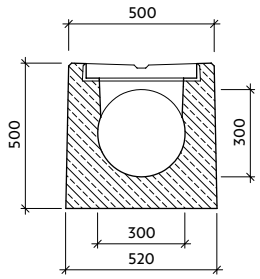
View "a" II-1-C0 - Socket



View "b" II-1-C0 - Spigot

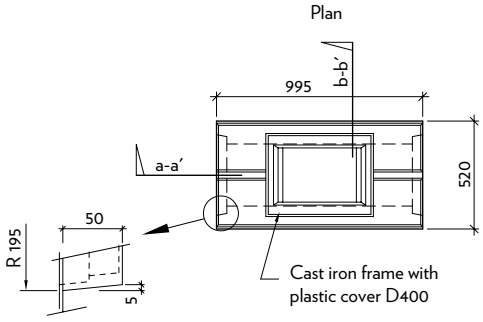


Cross-section: b-b´ II-1-C0

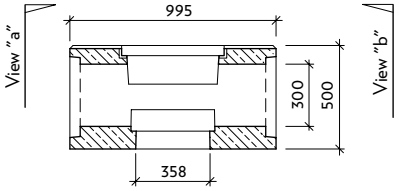


II-1-VU - Gutter gully assembly with cast iron frame and plastic cover for D400

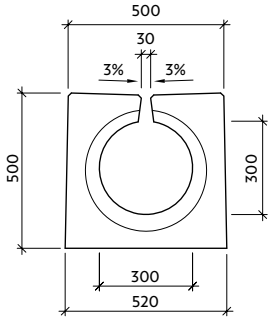
Plan



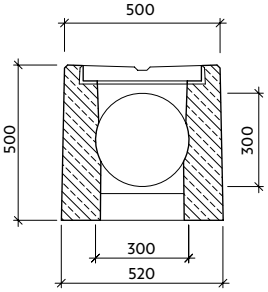
Cross-section: a-a´



View "a"="b" II-1-VU - Socket/socket



Cross-section: b-b´

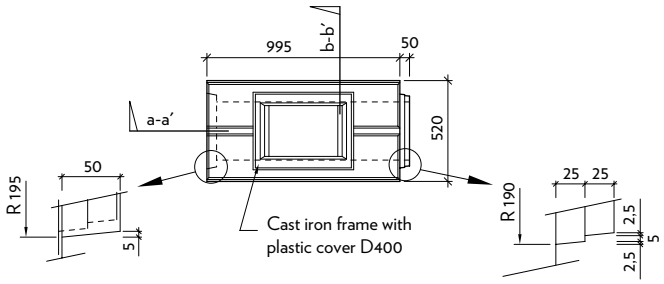


* Nominal dimensions include installation dimensions and/or minimum gap.

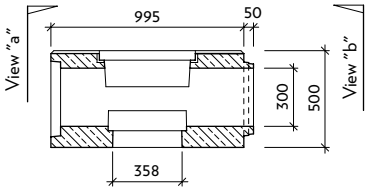
CSB - SLOT DRAIN PROFILE II-1

II-1-V0 - Basic gully assembly with cast iron frame and plastic cover for D400

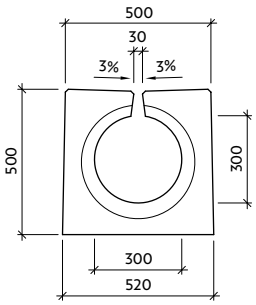
Plan



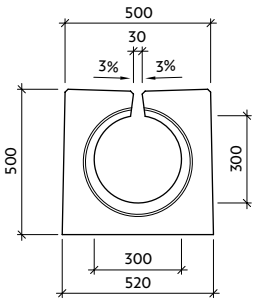
Cross-section: a-a´ II-1-V0



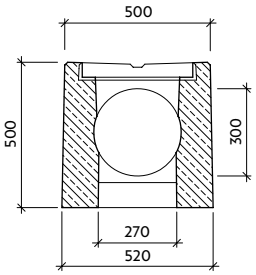
View "a" II-1-V0 - Socket



View "b" II-1-V0 - Spigot

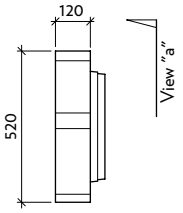


Cross-section: b-b´ II-1-V0



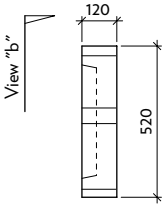
II-ZU - Spigot end cap

Plan

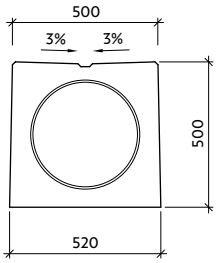


II-ZZ - Socket end cap

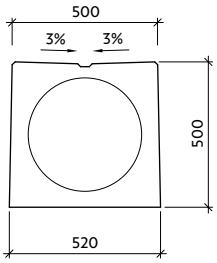
Plan



View "a"



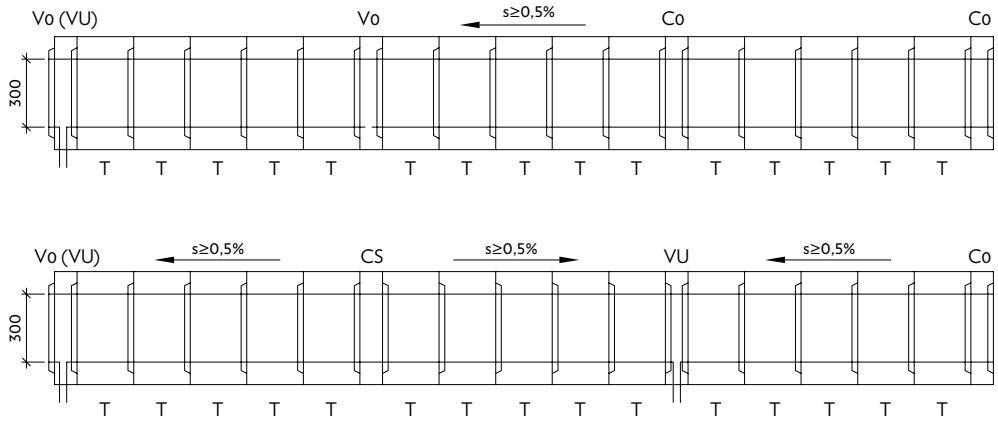
View "b"



CSB - SLOT DRAIN PROFILE II-1

Suggested layout

II-1-T Slot drains - layout



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends

CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends

s – Longitudinal flow profile gradient

CSB - SLOT DRAIN PROFILE II

Basic gully segment with gully trap

Cross-section a-a´

Cast iron frame

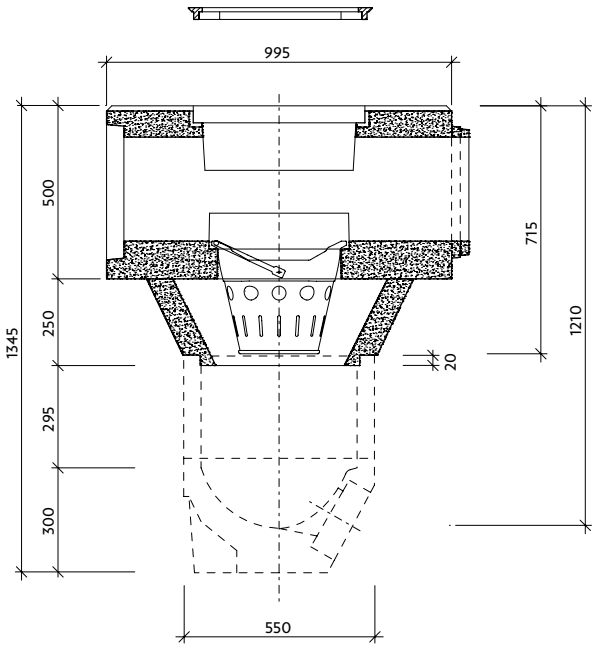
Basic gully segment

Gully trap

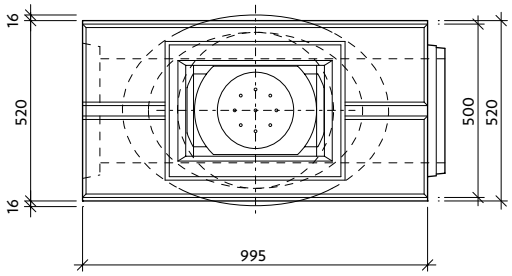
Taper top

Inspection shaft TBV-Q 450/295/6a

Shaft bottom TBV-Q 450/330/1a,TBV-Q 450/330/1d



Plan



CSB - SLOT DRAIN PROFILE II

Product characteristics:

Slot drains are a modern, fast and efficient way of draining excess water from roads and surfaced areas. The system includes dedicated gully and cleaning segments.

Slot drains ensure efficient draining of excess water from surfaced areas even during extreme rainfall, its transport by means of high-capacity flow profile and removal to a storm sever. This prevents aquaplaning from occurring and collects contaminated water from the road surface so that it does not come into contact with the surrounding environment. Even large capacity slot drains are relatively narrow, so they can be installed within a 0.5 m-wide soft shoulder. Thanks to large flow capacity and narrow flow profile, they are largely self-cleaning.

The slot drain system may be used to reduce the length of storm sewers and the number of its connectors and inlets.

Different slot drain profiles are suitable for different applications. For faster drainage, the upper surface of the slot drain segments has a 3% gradient sloping toward the slot. For transversal vehicle travel at high speeds (80 km/hr and higher), a flat upper surface is recommended.

CS-BETON slot drains have high load-carrying capacity and selection of a suitable type allows them to be used at airports, or the most demanding industrial applications. These segments are made in three versions, for D400, E600 and F900 traffic loads. Segments with interrupted slots are especially suitable for dynamic loading, or to withstand horizontal forces. The simple design and high-quality structural elements ensure long service life of drainage systems.

CS-BETON‘s slot drains and all the system components are made of high strength C 45/55 XF4 concrete as per ČSN EN 206-1. Efficient plasticiser and aeration admixtures and non-crystalline silicon dioxide (MICROSILICA) admixtures make our concrete extremely resistant to water and chemical defrosting agents. In European weather conditions, the systems are not affected by frost.

The design of the slot drain elements allows for a perfect connection to the surrounding road surface. The weight of the slot drain segments (The 4 m-long segments weigh approximately 1.7t) enables compacting of road structure layers in the immediate vicinity without the risk of the segments being moved sideways, when suitable techniques such as vibration slabs are used. The slightly slanted side walls also help compacting and connection to the adjoining structures.

CS-BETON‘s slot drains include a proprietary two-ring AQUAFEST joint technology, which ensures perfect water tightness and resistance to oil residues and other aggressive substances. This prevents surrounding underground and surface waters from being contaminated. The rubber seal also creates an expansion joint between two adjoining drain segments.

Custom lengths (in 1 cm increments between 0.5 and 4.0 m) may also be supplied. Additional modifications are also possible upon request, such as surface modifications, side outlets, slanted ends, etc. Custom lengths and modified elements are more expensive and take longer to supply.

Installation of slot drains is relatively easy and fast when suitable equipment is used. Upon customer‘s request, CS-BETON will include a special handling and installation kit with the supply. Always follow manufacturer‘s installation instructions to ensure functional and long-lasting drainage systems.

Finished slot drain systems require minimum maintenance, only cleaning of the flow profile when it becomes clogged. Cleaning and gully segments are provided for this purpose and should be installed at regular intervals. Regular maintenance of gullies is relatively easy. According to TP 152, the gullies should be ideally spaced 40 m apart, in any case not more than 50 m. The only maintenance required is removal and emptying/cleaning of the gully traps.

The cast iron grilles on gullies and cleaning segments are secured against lift-off from the passing traffic. The grilles also come in two versions, the 400 kN ones are made of grey cast iron and for the 900 kN ones from ductile cast iron. Slot drains can be installed in curved layouts. The maximum directional angle between two adjacent segments is 3 degrees. This ensures watertight joints between the adjoining faces. This limitation suggests that 4 m segments could be used in curves down to a radius of R = 80 m and 2 m segments down to R = 40 m. We do not recommend this minimum value as the visible line of the slot segments appears too polygonal and compacting of adjacent road layers may damage the slot drain segments and joints. This means at least R = 160 m for 4 m segments. For smaller radius arcs, shorter segments and/or curved segments may be used.

In the overall context and given its reliability, safety and low operational cost, drainage systems using slot drains are more suitable and more economical than other systems in most cases. Slot drain systems are becoming more popular and some applications would be hard to solve without them.

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE II

Important information:

Slot drains are designed to collect water from surfaced areas, not from free terrain. Water from free terrain may be drained only in exceptional cases and in minimum quantities. However, blocking of the slot or the flow profile by stones and mud must always be prevented (rubble arresting benches, ditches, full lawn cover, more frequent maintenance, etc.). Installation of slot drain into minimum radius curves produces polygonal shapes. During compacting next to such shapes, compacting next to the segments must be ensured without any damage or movement to the segments must be ensured. Vibration slabs are recommended.

During installation, gullies must be precisely located in both transversal and longitudinal direction, because the micro-slot segments' length cannot be altered in situ. The nominal length of basic 4 m segments with the rubber seal is 4,000 mm.

The openings at the beginning and end of the line must be closed and sealed using end caps supplied by CS-BETON.

CAUTION!

The „Important information" above includes only a few general rules for installing slot draining systems.

Use the hydraulic calculation provided below to evaluate the flow capacity of II-series slot drain systems.

CS-BETON provides consulting services to designers and architects using slot drain solutions. We will evaluate your preliminary design in the context of the overall technical solution of the roads, surfaced areas and rainwater drainage of your project. We will confirm the proposed drainage solution, or recommend changes and specify recommended elements and their location within the system, including a recapitulation/BoQ for ordering purposes, along with list prices and the total price. All the above services are provided free of charge as a courtesy to our clients.

CS-BETON s.r.o. is not the responsible designer of your project's documentation or its part. According to Section 159 of the Act no. 183/2006 Coll, the designer is responsible for the correct selection of products specified in project documentation based on guaranteed properties of individual products detailed in product property certificates.

CSB - SLOT DRAIN PROFILE II

Hydraulic calculation:

1. Introduction
Profile II slot drains are designed for drainage of water from surfaced areas such as roads, parking areas, logistic centres, airports, etc. They are intended for applications where quick draining of large areas with significant hydrological potential is expected.

2. Initial assumptions
The hydraulic design of a II-slot system must always be based on the individual conditions at the given site, i.e. hydrogeology information, size, type and location of the catchment area. The capacity of the drainage system must then be calculated to reflect these conditions.

2.1 Geometrical characteristics
Profile II slot drains are available with a constant flow profile and with a continuous or interrupted slot (30 mm wide). The system also includes cleaning and gully segments. This type of slot drain does not have a fixed maximum length of one line - individual parameters depend on the site conditions (slopes etc.). The distance between the beginning/end of the line and the first cleaning and/or gully segment should not exceed 6 m so that simple cleaning and maintenance is possible. Distances between individual cleaning gully segments depend on the maintenance and cleaning intervals. According to TP 152, the maximum distance is 50 m. The flow profile in Profile II slot drains is a simple R = 150 mm circle.

2.2 Hydrology information
For the hydraulic design of slot drain systems, the most important input parameter is the design rainfall volume, which is used to arrive to the total drained volume and the necessary number of gully segments. The design rainfall volume may be obtained, for instance, from the „Intenzity krátkodobých dešťů v povodích Labe, Odry a Moravy" (Josef Trupl) Table [1], or by ordering the information from the relevant Hydrometeorology Institute branch. Generally speaking, for II Profile slot drain systems, ČSN 75 6101 (Stokové sítě a kanalizační přípojky) [2] specifies 15-minute rainfall with periodicity as per the type of area as the critical parameter. The same parameter is then used for the design of the storm sever.

2.3 Terrain location
For the most economical system, the slot drains should be located on the catchment area so that their capacity is used to maximum and the number of storm sewer connections is minimal. The ideal scenario is slot drains in the lowest part of the area and a sufficient gradient sloping toward that part. For II Profile slot drain systems, the slope in the longitudinal direction must be at least 5 ‰. The draining capacity of course depends on the slope of the line.
Nomographic chart 1 below lists the flow capacity of slot drains and the flow rate for that capacity in relation to the longitudinal gradient. The total capacity of the system must correspond to the catchment area and the design rainfall as per above. The intensity of the design rainfall is reduced as per [2] using a recommended draining coefficient, which depends on type of structures present, type of site and its sloping.

2.4 Terrain location
Connections to storm sewer are installed in shafts provided under gully segments with a DN 150 or DN 200 connector. The gully segments include support surfaces for gully traps to protect the sewer connector from being blocked by debris.

3. Capacity flow through II Profile slot drains
Calculation of the capacity of this system is based on the „Hydraulické tabulky stok" (Hydraulic tables: Sewage conduits by J. Herle, O. Štefan, J. Turi Nagy) [3]. The same method is also used to design sewage conduits. The roughness coefficient was assumed at n = 0.014 and velocity coefficient c was calculated as per Pavlovský. Our calculations do not assume (given the usual longitudinal sloping of up to 35 ‰) any aeration within the flow. The capacity itself was then calculated using the Chezy formula for gradients of 5 to 100 ‰ and the results were plotted in nomogram 1. The nomogram also shows flow speeds for the given flow rates. The calculation was only performed for II profiles, i.e. with constant cross-section, because with such systems, variable distances between gully segments is used depending on the size of the area drained. A 20 m-long line of slot drains is capable (theoretically, see Chapter 5) of draining an area of approximately 7,620 sq. m, i.e. a 10 m-wide road segment 762,0 m long, which is sufficient for most applications. As far as the DN 150 (200) gully connectors are concerned, their capacity must be evaluated at critical points, see Literature [3]. To prevent blocking by debris, all connectors should have a gradient of at least 20 ‰. With smaller gradients of the slot drain lines, the connector capacity may become the limiting factor for the whole system and larger connector diameters and/or gradients are recommended.

CSB - SLOT DRAIN PROFILE II

4. Example hydraulic calculation

This hydraulic calculation is based on theoretical input information. This specifies an application example involving Profile II slot drains and a motorway with a constant longitudinal gradient of 10 ‰. The road is in an area for which the hydrographical information is taken from data provided by the Roudnice nad Labem meteorological station. The segment which uses slot drains has a width of 16 m and a length of 500 m. The slot drains are installed at the edge of the road. The line includes one gully segment at the bottom end. The limiting parameter for the slot drain line is its cross--section at the bottom end. The road has a transversal gradient toward the slot drains of 25 ‰ and has a bitumen surface. Design rainfall intensity for T = 15 minutes and periodicity p = 1 is:

I_{NAV} = 112 [l/s.ha]

the run-off coefficient is:

φ = 0,80

the drained area is:

F = 16 x 500 x 0,0001 [ha] = 0,80 [ha]

after reduction by coefficient c = 0,80 the drained area is:

F_{RED} = φ x F [ha] = 0,80 x 0,80 = 0,64 [ha]

The design flow Q_{NAV} is:

$Q_{NAV} = F_{RED} \times I_{NAV}$ [l/s]
Q_{NAV} = 0,64 x 112
Q_{NAV} = 71,68 [l/s]

After comparing this value to the capacity of the slot drain from nomogram 1 for the gradient of 10‰, it is clear that:

Q_{KAP} = 96,47 [l/s] > Q_{NAV} = 71,68 [l/s]

Cleaning segments also have to be provided, with maximum spacing of 50 m.

Nomograms:

5. Nomograms for preliminary design of drainage systems
For reference design of II-profile draining systems, some calculation assumptions may be simplified. The average rainfall intensity for 15 minute rainfalls and periodicity of p = 1 for the Czech Republic (Labe basin) is:

I_{OR} = 122 [l/s.ha]

Since these slot-drains will not be used to drain water from unsurfaced areas, the average run-off coefficient c as per [2] is:

φ = 0,80

which is correct for concrete/bitumen surfaces with a gradient between 10 and 50 ‰.

With these specifications, the following nominal run-off may be assumed:.

per 1 sq m of drained area:

Q_{OR} = 1 x 1 x 0,0001 x 0,8 x 122 = 0,00976 [l/s]

per 1 are, i.e. 100 sq. m:

Q_{OR} = 10 x 10 x 0,0001 x 0,8 x 122 = 0,976 [l/s]

per 1 hectare, i.e. 10,000 sq. m:

Q_{OR} = 100 x 100 x 0,0001 x 0,8 x 122 = 97,6 [l/s]

The relationship between design run-off and the drained area is shown in nomogram 2. for areas of 500 to 5000 sq m.

A comparison of the calculated run-off as per nomogram 2 with the capacity of the slot drain at the given gradient from nomogram 1 gives us enough information to specify the number of gully segments and to optimise the layout of the slot drain system.

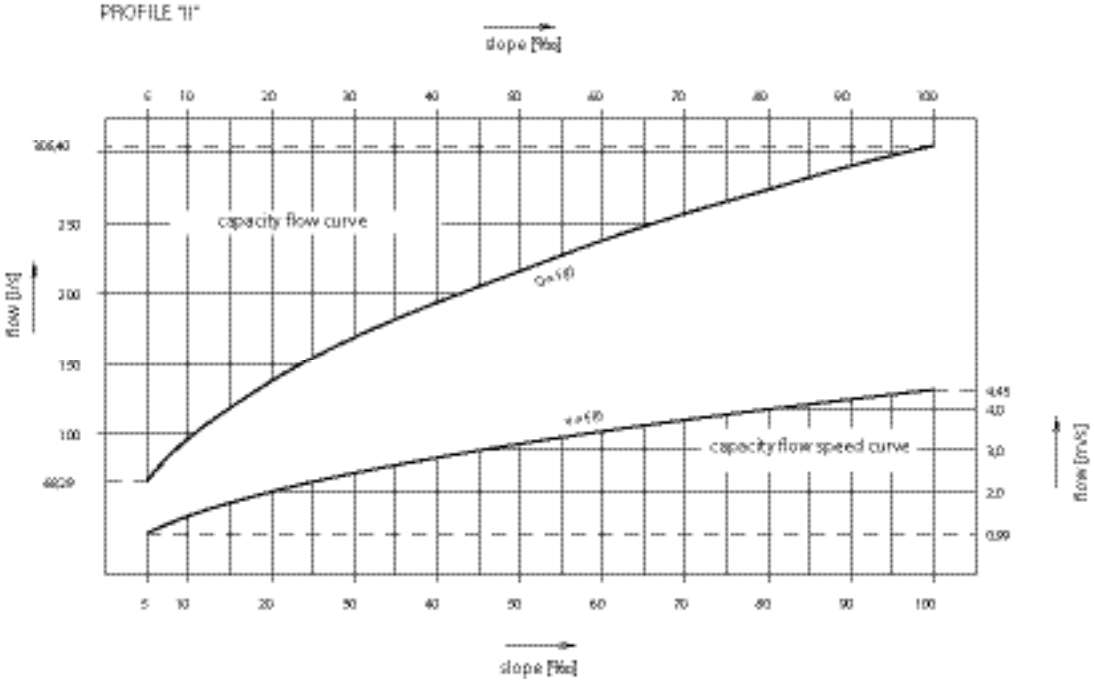
6. Gully trap
Each gully contains two gully traps, which protect the storm sewer connections from being blocked by debris. The TP 152 recommends a distance between gully segments in a line of II Profile slot drains of 30 to 50m, depending on the characteristics of the adjacent surfaced area.

The gully trap has a height of 275 mm and a rectangular base of 325 x 145 mm. The shape is conical and fits the support elements within the gully segment. Filling openings are provided at the top of the narrower sides. The upper sides of the trap are 420 mm and 190 mm and a number of draining slots is provided below the filling openings. Every gully trap includes a holding rod for easy handling. Gully traps are made of 1.25 mm thick galvanised steel sheeting. The maximum flow rate through a gully trap is 21,20 l/s.

CSB - SLOT DRAIN PROFILE II

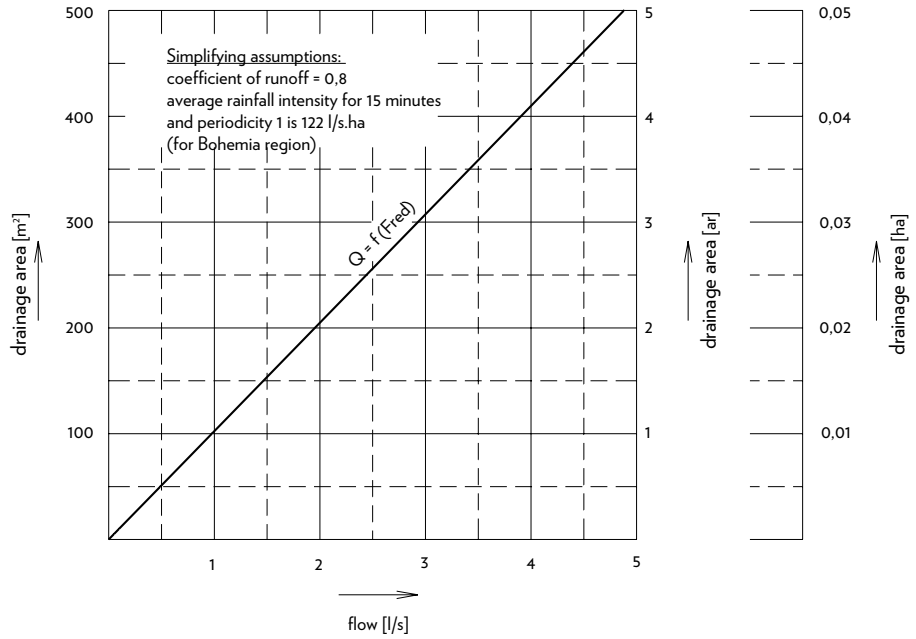
NOMOGRAME No. 1

CAPACITY OF SLOT CHANNELS (ROUGHNESS COEFFICIENT n = 0,014 - BY PAVLOVSKY)
PROFILE "II"



NOMOGRAM No. 2

Determination of surface runoff from 500 to 5000 m²



CSB - SLOT DRAIN PROFILE II

Input data:

The following literature has been used in designing the drainage system described in this brochure:

ČSN EN 1433 Odvodňovací žlábky pro dopravní a pěší plochy - konstrukční zásady zkoušení, označování, řízení jakosti
ČSN EN 206 Beton - specifikace, vlastnosti, výroba a shoda
DIN 19 580 Entwässerungsrinnen für Niederschlagswasserzum Einbau in Verkehrsflächen
ČSN 73 6056 Odstavné a parkovací plochy silničních vozidel
ČSN 73 6059 Servisy a opravny motorových vozidel. Čerpací stanice pohonných hmot
ČSN 73 6101 Projektování silnic a dálnic
ČSN 73 6110 Projektování místních komunikací
ČSN 73 6114 Vozovky pozemních komunikací
ČSN 75 6101 Stokové sítě a kanalizační přípojky
ČSN EN 124 Poklopy a vtokové mříže pro dopravní plochy
Vzorové listy staveb pozemních komunikací VL-1 Vozovky a krajnice, Ministry of Transport of the Czech republic, Dopravoprojekt
Vzorové listy staveb pozemních komunikací VL-2.2 Odvodnění, Ministry of Transport of the Czech republic, Dopravoprojekt
TKP 1 - Všeobecně
TKP 18 - betonové konstrukce (vč. 10 příloh)
TKP 31 - opravy betonových konstrukcí
TP 152 - Štěrbinové žlaby na PK, 2001, VPÚ-DECO
TP 170 - Navrhování vozovek PK (všeobecná část, katalog, návrhová metoda), 2004, VTU, Roadconsult
Technical documentation by CS-BETON Velké Žernoseky + VPÚ DECO 96-04
Company standard 7/99 Micro-slot drains as per DIN 19580, CSB
TPV 2/99 - Technologický předpis na montáž mikroštěrbinových trub, CSB
TPV 1/98 - Technologický předpis na opravy betonových prvků odvodňovacích systémů štěrbinových trub, CSB

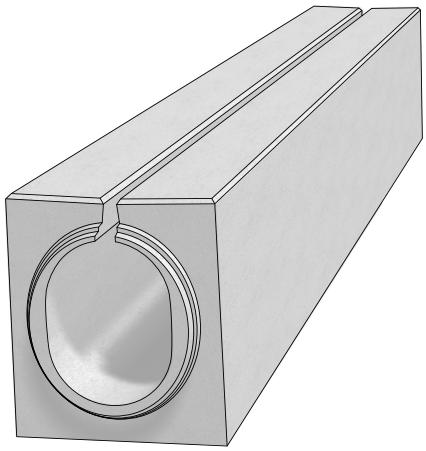
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE III-0

Protected by utility patent

Technical data:

Profile III slot drains are suitable for draining rainwater contaminated with small quantities of oil products (drips) from surfaced areas such as high-capacity traffic structures (motorways, dual carriageways, main roads, tunnels, runways, lay-bys, large parking lots, etc.). Profile III slot drains are designed for locations with extreme rainfal. They are only available with no internal gradient. Profile III-0 slot drains (continuous slot) are designed for D400 class traffic load and no transversal vehicle travel.



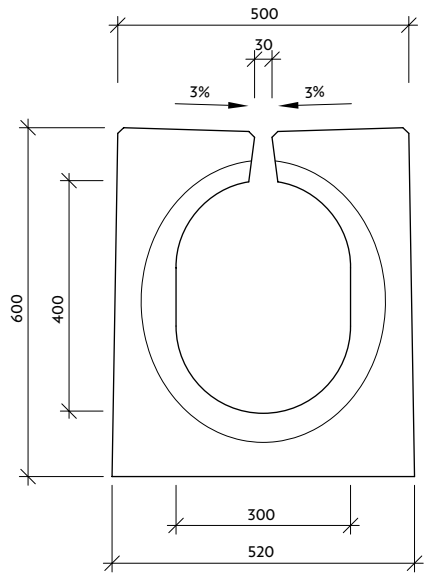
The system consists of the following components:

- 4 m-long continuous slot drain, without internal flow gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- End cap

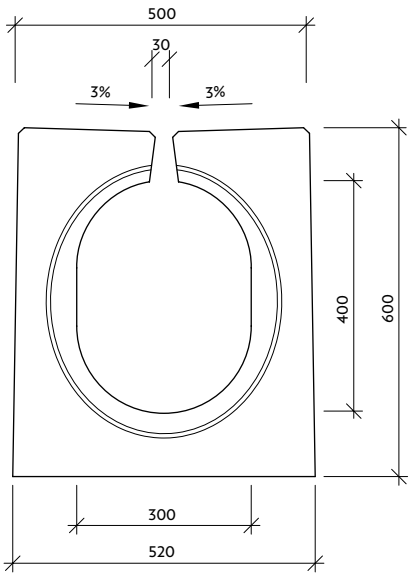
		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**pcs**
Slot drain with continuous slot	III-0	600	4000	500/520	0,25	1869
Basic gully assembly V0	III-V0	600	1000	500/520	1	396
Gutter gully assembly VU	III-VU	600	1000	500/520	1	385
Basic cleaning segment C0	III-C0	600	1000	500/520	1	426
Top cleaning segment CS	III-CS	600	1000	500/520	1	437
Spigot end cap	III-ZU	600	120	500/520	8	102
Socket end cap	III-ZZ	600	120	500/520	8	67

Nominal dimensions - basic shapes:

Side-view
Socket



Side-view
Spigot

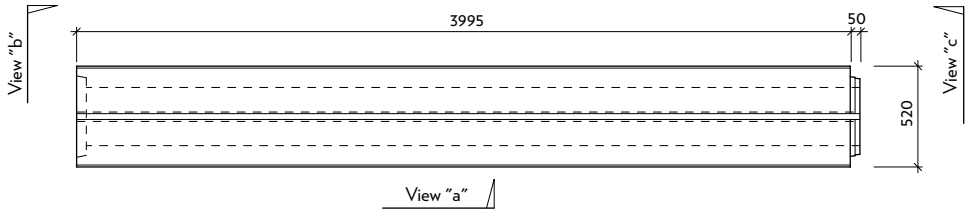


CSB - SLOT DRAIN PROFILE III-0

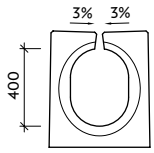
Protected by utility patent

Profile III-0 - Slot drain

Plan

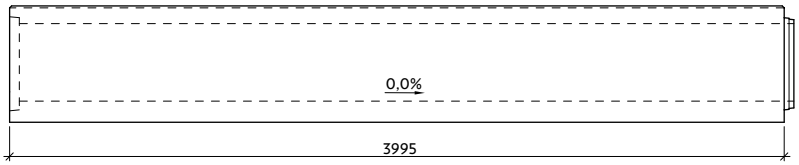


View "b" - Socket

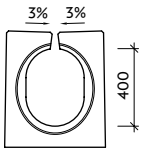


View "a"

Profile III-0-T40/40 without internal flow gradient

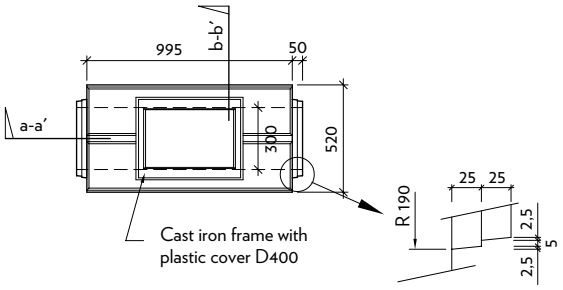


View "c" - Spigot

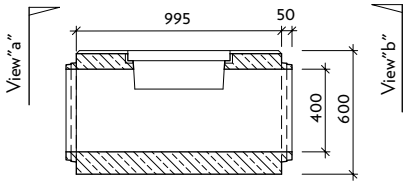


III-0-CS - Top cleaning segment with cast iron grille adn plastic cover for D400

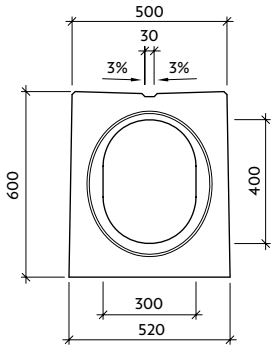
Plan



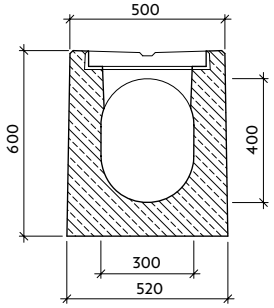
Cross-section: a-a'



View "a"="b" III-0-CS - Spigot/spigot



Cross-section: b-b'

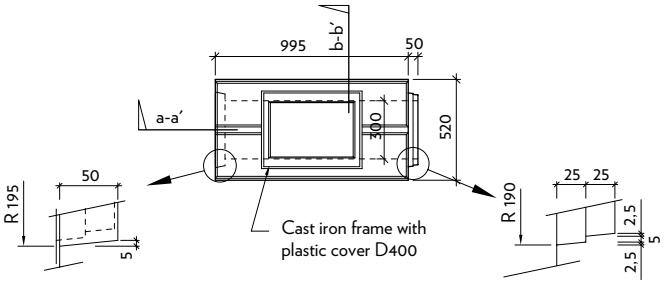


CSB - SLOT DRAIN PROFILE III-0

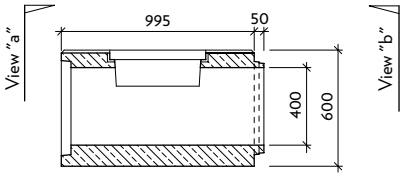
Protected by utility patent

III-0-C0 - Basic cleaning segment with cast iron grille and plastic cover for D400

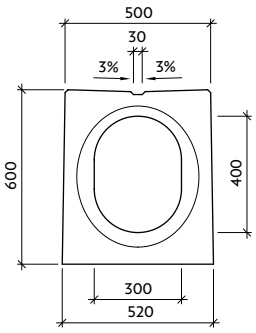
Plan



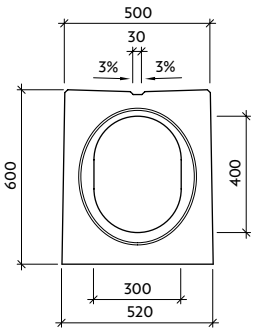
Cross-section: a-a´ III-0-C0



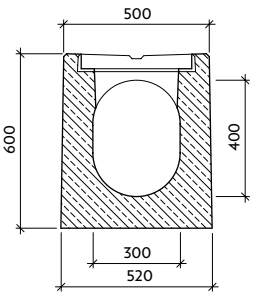
View "a" III-0-C0 - Socket



View "b" III-0-C0 - Spigot

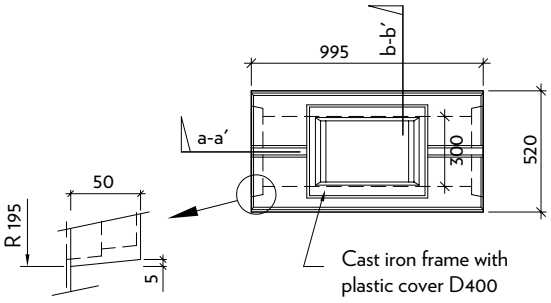


Cross-section: b-b´ III-0-C0

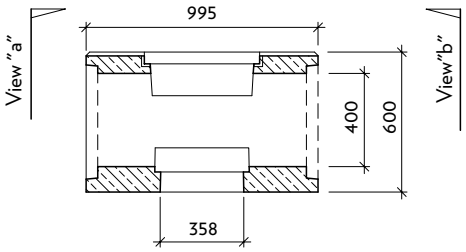


III-0-VU - Gutter gully assembly with cast iron grille and plastic cover for D400

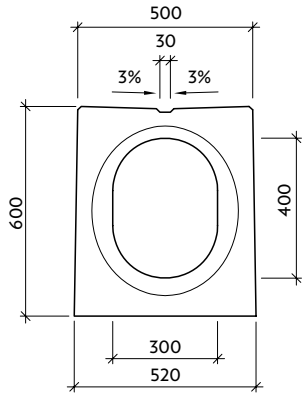
Plan



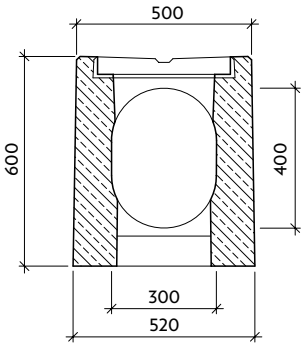
Cross-section: a-a´



View "a"="b" III-0-VU - Socket/socket



Cross-section: b-b´

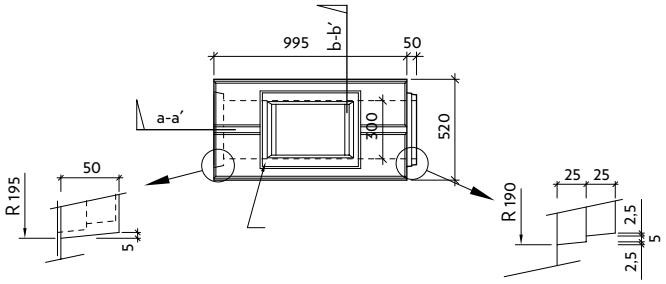


CSB - SLOT DRAIN PROFILE III-0

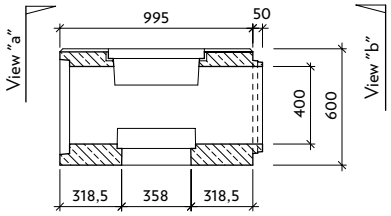
Protected by utility patent

III-0-V0 - Basic gully assembly with cast iron grille and plastic cover for D400

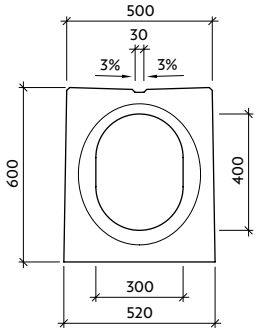
Plan



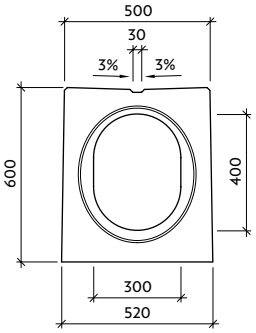
Cross-section: a-a´ III-0-V0



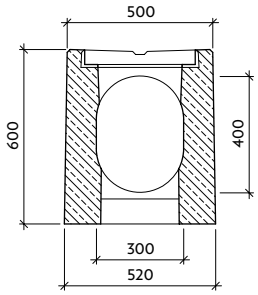
View "a" III-0-V0 - Socket



View "b" III-0-V0 - Spigot

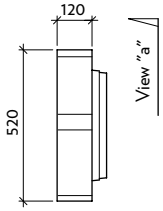


Cross-section: b-b´ III-0-V0



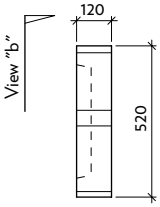
III-ZU - Spigot end cap

Plan

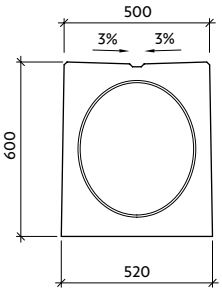


III-ZZ - Socket end cap

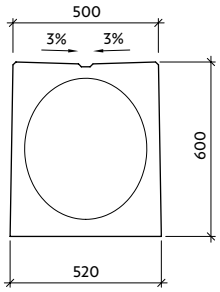
Plan



View "a" III-ZU - Spigot



View "b" III-ZZ - Socket

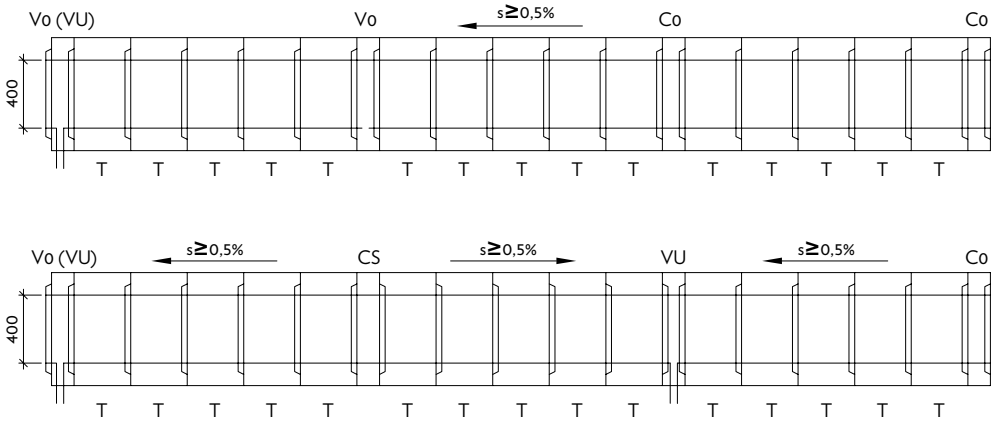


* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE III-0

Suggested layout

III-0-T Slot drains - layout



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends

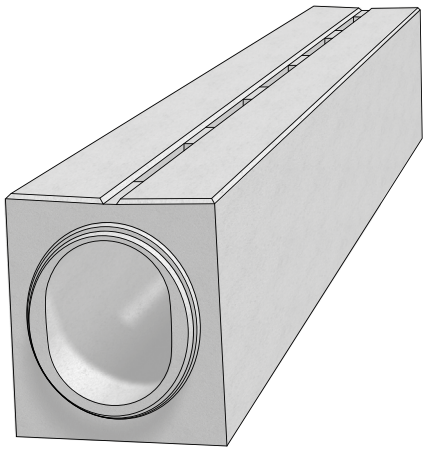
CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends

s – Longitudinal flow profile gradient

CSB - SLOT DRAIN PROFILE III-1

Protected by utility patent

Technical data:



Profile III slot drains are suitable for draining rainwater contaminated with small quantities of oil products (drips) from surfaced areas such as high-capacity traffic structures (motorways, dual carriageways, main roads, tunnels, runways, lay-bys, large parking lots, etc.). Profile III slot drains are designed for locations with extreme rainfal. They are only available with no internal gradient. Profile III-1 slot drains are designed for D400, E600 and F900 class traffic loads and transversal vehicle travel.

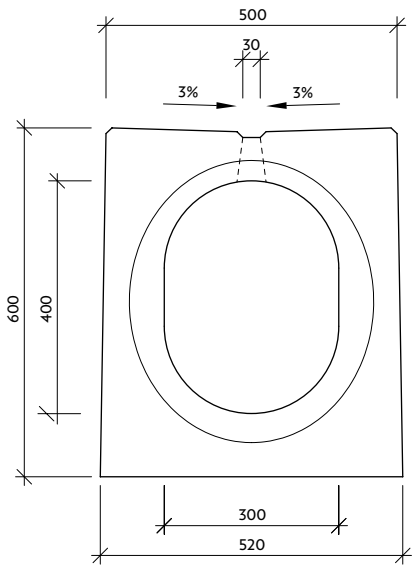
The system consists of the following components:

- 4 m-long slot drains with interrupted slots, without internal gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- End cap

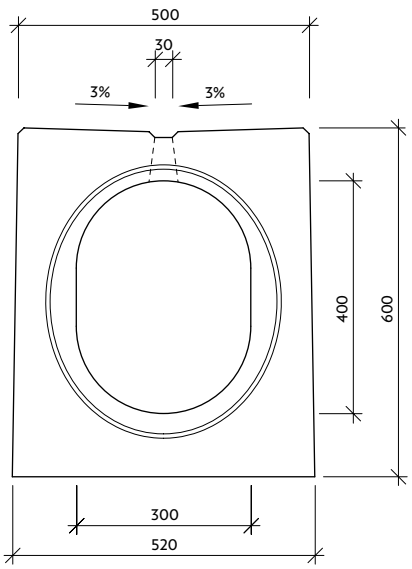
		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**pcs**
Slot drain with interrupted slot	III-1	600	4000	500/520	0,25	1897
Basic gully assembly V0	III-V0	600	1000	500/520	1	396
Gutter gully assembly VU	III-VU	600	1000	500/520	1	385
Basic cleaning segment C0	III-C0	600	1000	500/520	1	426
Top cleaning segment CS	III-CS	600	1000	500/520	1	437
Spigot end cap	III-ZU	600	120	500/520	-	102
Socket end cap	III-ZZ	600	120	500/520	-	67

Nominal dimensions - basic shapes:

Side-view
Socket



Side-view
Spigot



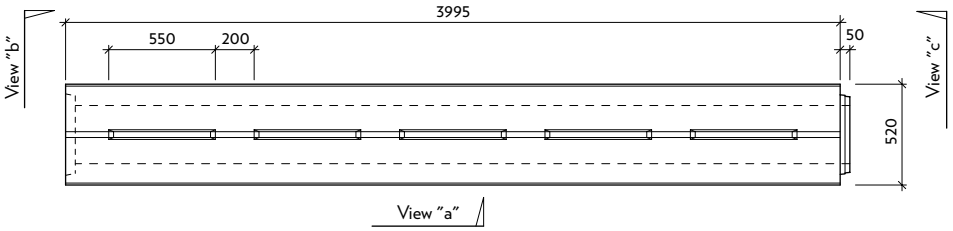
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE III-1

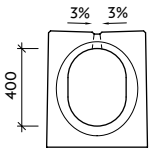
Protected by utility patent

Profile III-1 - Slot drain

Plan

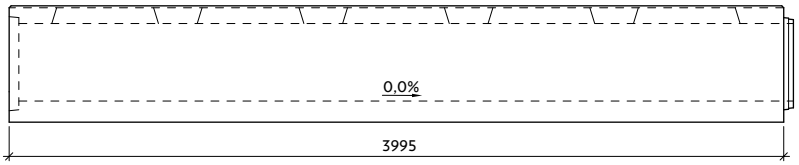


View "b" - Socket

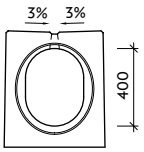


View "a"

Profile III-1-T40/40 without internal flow gradient

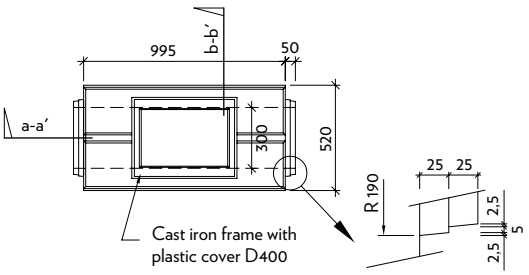


View "c" - Spigot

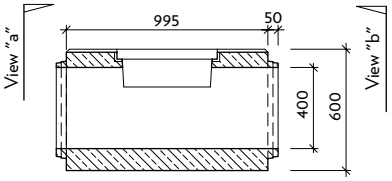


III-1-CS - Top cleaning segment with cast iron grille adn plastic cover for D400

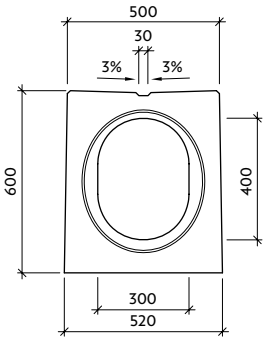
Plan



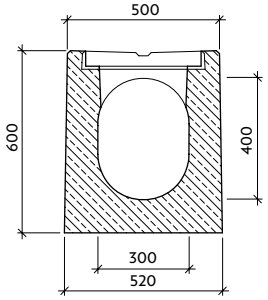
Cross-section: a-a'



View "a"="b" III-1-CS - Spigot/spigot



Cross-section: b-b'

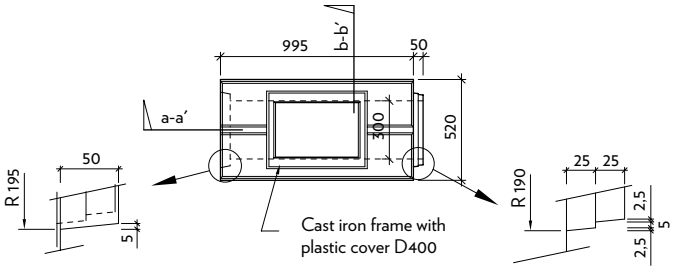


CSB - SLOT DRAIN PROFILE III-1

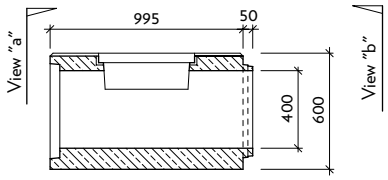
Protected by utility patent

III-1-C0 - Basic cleaning segment with cast iron grille and plastic cover for D400

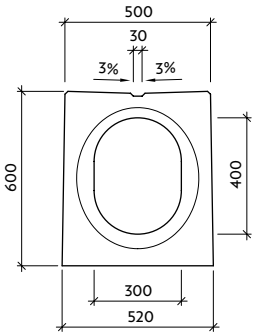
Plan



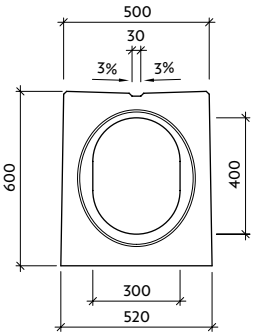
Cross-section: a-a´ III-1-C0



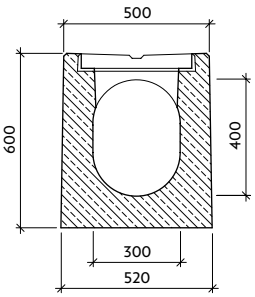
View "a" III-1-C0 - Socket



View "b" III-1-C0 - Spigot

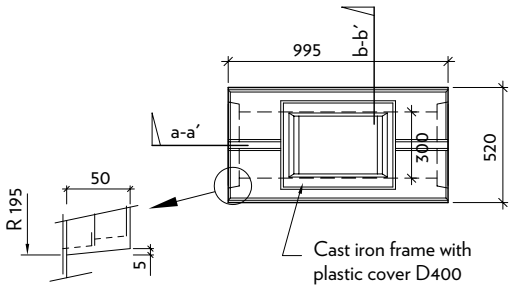


Cross-section: b-b´ III-1-C0

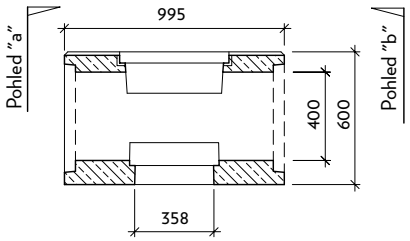


III-1-VU - Gutter gully assembly with cast iron grille and plastic cover for D400

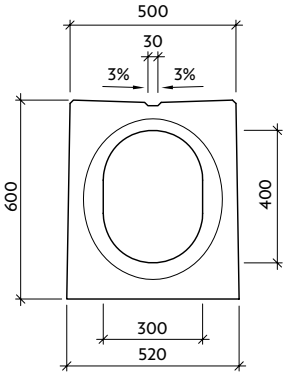
Plan



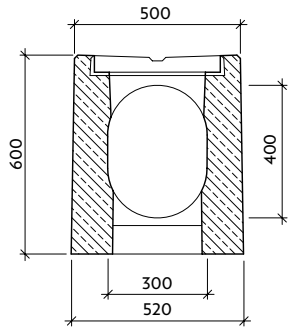
Cross-section: a-a´



View "a"="b" III-1-VU - Socket/socket



Cross-section: b-b´



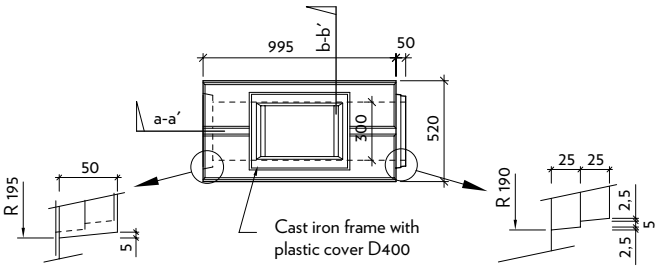
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE III-1

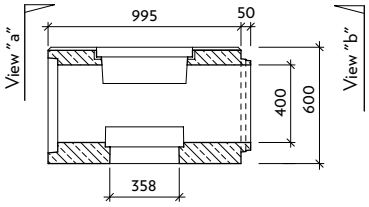
Protected by utility patent

III-1-V0 - Basic gully assembly with cast iron grille and plastic cover for D400

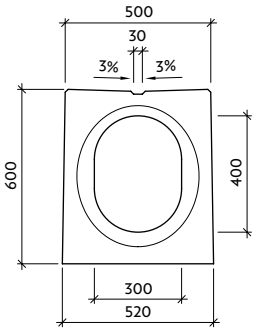
Plan



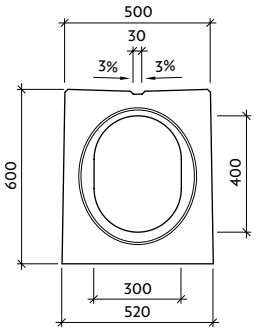
Cross-section: a-a´ III-1-V0



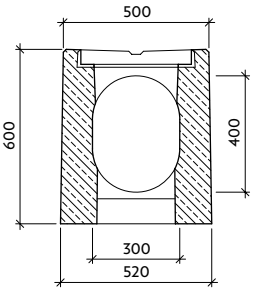
View "a" III-1-V0 - Socket



View "b" III-1-V0 - Spigot

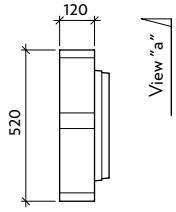


Cross-section: b-b´ III-1-V0



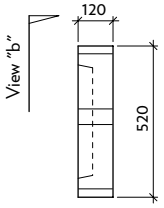
III-ZU - Spigot end cap

Plan

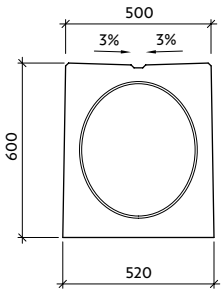


III-ZZ - Socket end cap

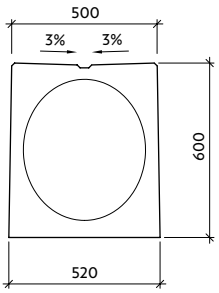
Plan



View "a" III-ZU - Spigot



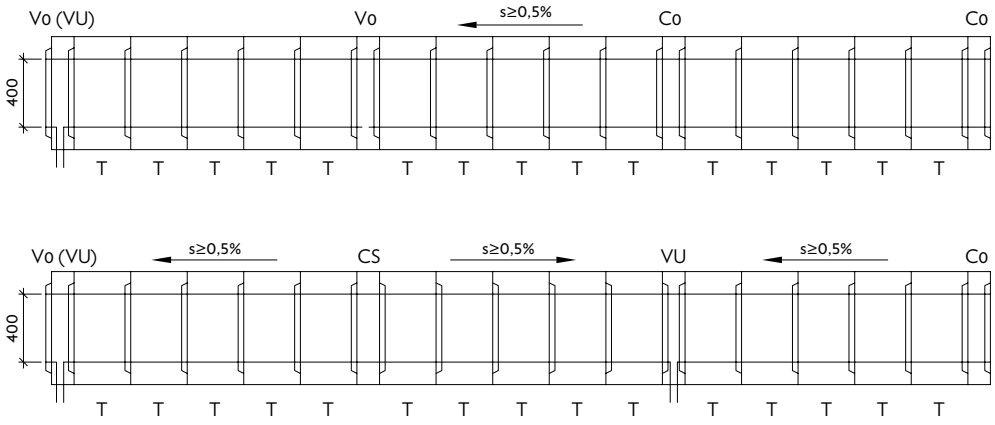
View "b" III-ZZ - Socket



CSB - SLOT DRAIN PROFILE III-1

Suggested layout

III-1-T Slot drains - layout



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends

CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends

s – longitudinal flow profile gradient

CSB - SLOT DRAIN PROFILE III-1

Cross-section: a-a´

Basic gully segment with gully trap

Plastic cover (Cast iron grill)

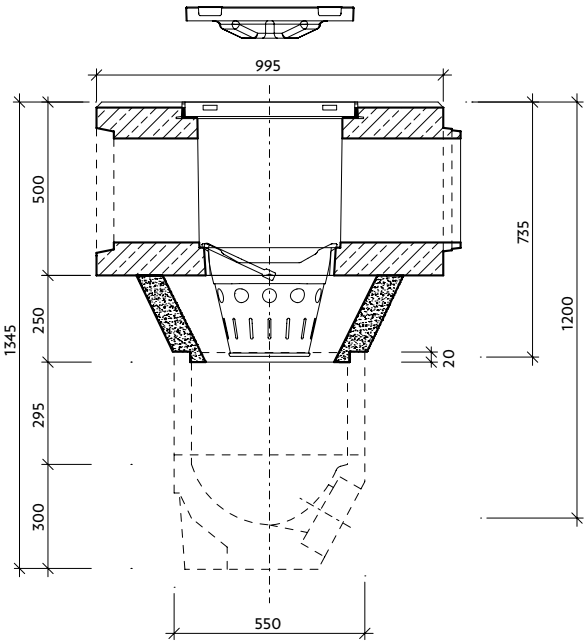
Basic gully segment

Gully trap

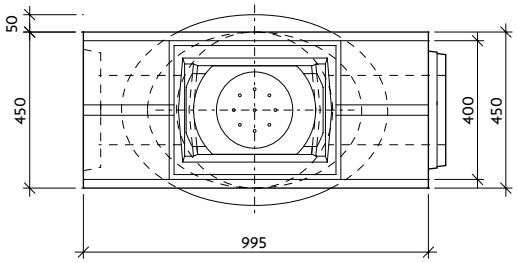
Taper top

Inspection shaft TBV-Q 450/295/6a

Shaft bottom TBV-Q 450/330/1a,
TBV-Q 450/330/1d



Plan



CSB - SLOT DRAIN PROFILE III

Product characteristics:

Slot drains are a modern, fast and efficient way of draining excess water from roads and surfaced areas. The system includes dedicated gully and cleaning segments.

Slot drains ensure efficient draining of excess water from surfaced areas even during extreme rainfall, its transport by means of high-capacity flow profile and removal to a storm sever. This prevents aquaplaning from occurring and collects contaminated water from the road surface so that it does not come into contact with the surrounding environment. Even large capacity slot drains are relatively narrow, so they can be installed within a 0.5 m-wide soft shoulder. Thanks to large flow capacity and narrow flow profile, they are largely self-cleaning.

The slot drain system may be used to reduce the length of storm sewers and the number of its connectors and inlets.

Different slot drain profiles are suitable for different applications. For faster drainage, the upper surface of the slot drain segments has a 3% gradient sloping toward the slot. For transversal vehicle travel at high speeds (80 km/hr and higher), a flat upper surface is recommended.

CS-BETON slot drains have high load-carrying capacity and selection of a suitable type allows them to be used at airports, or the most demanding industrial applications. These segments are made in three versions, for D400, E600 and F900 traffic loads. Segments with interrupted slots are especially suitable for dynamic loading, or to withstand horizontal forces. The simple design and high-quality structural elements ensure long service life of drainage systems.

CS-BETON‘s slot drains and all the system components are made of high strength C 45/55 XF4 concrete as per ČSN EN 206-1. Efficient plasticiser and aeration admixtures and non-crystalline silicon dioxide (MICROSILICA) admixtures make our concrete extremely resistant to water and chemical defrosting agents. In European weather conditions, the systems are not affected by frost.

The design of the slot drain elements allows for a perfect connection to the surrounding road surface. The weight of the slot drain segments (The 4 m-long segments weigh approximately 1.7t) enables compacting of road structure layers in the immediate vicinity without the risk of the segments being moved sideways, when suitable techniques such as vibration slabs are used. The slightly slanted side walls also help compacting and connection to the adjoining structures.

CS-BETON‘s slot drains include a proprietary two-ring AQUAFEST joint technology, which ensures perfect water tightness and resistance to oil residues and other aggressive substances. This prevents surrounding underground and surface waters from being contaminated. The rubber seal also creates an expansion joint between two adjoining drain segments.

Custom lengths (in 1 cm increments between 0.5 and 4.0 m) may also be supplied. Additional modifications are also possible upon request, such as surface modifications, side outlets, slanted ends, etc. Custom lengths and modified elements are more expensive and take longer to supply.

Installation of slot drains is relatively easy and fast when suitable equipment is used. Upon customer‘s request, CS-BETON will include a special handling and installation kit with the supply. Always follow manufacturer‘s installation instructions to ensure functional and long-lasting drainage systems.

Finished slot drain systems require minimum maintenance, only cleaning of the flow profile when it becomes clogged. Cleaning and gully segments are provided for this purpose and should be installed at regular intervals. Regular maintenance of gullies is relatively easy. According to TP 152, the gullies should be ideally spaced 40 m apart, in any case not more than 50 m. The only maintenance required is removal and emptying/cleaning of the gully traps.

The cast iron grilles on gullies and cleaning segments are secured against lift-off from the passing traffic. The grilles also come in two versions, the 400 kN ones are made of grey cast iron and for the 900 kN ones from ductile cast iron. Slot drains can be installed in curved layouts. The maximum directional angle between two adjacent segments is 3 degrees. This ensures watertight joints between the adjoining faces. This limitation suggests that 4 m segments could be used in curves down to a radius of R = 80 m and 2 m segments down to R = 40 m. We do not recommend this minimum value as the visible line of the slot segments appears too polygonal and compacting of adjacent road layers may damage the slot drain segments and joints. This means at least R = 160 m for 4 m segments. For smaller radius arcs, shorter segments and/or curved segments may be used.

In the overall context and given its reliability, safety and low operational cost, drainage systems using slot drains are more suitable and more economical than other systems in most cases. Slot drain systems are becoming more popular and some applications would be hard to solve without them.

CSB - SLOT DRAIN PROFILE III

Important information:

Slot drains are designed to collect water from surfaced areas, not from free terrain. Water from free terrain may be drained only in exceptional cases and in minimum quantities. However, blocking of the slot or the flow profile by stones and mud must always be prevented (rubble arresting benches, ditches, full lawn cover, more frequent maintenance, etc.). Installation of slot drain into minimum radius curves produces polygonal shapes. During compacting next to such shapes, compacting next to the segments must be ensured without any damage or movement to the segments must be ensured. Vibration slabs are recommended.

During installation, gullies must be precisely located in both transversal and longitudinal direction, because the micro-slot segments' length cannot be altered in situ. The nominal length of basic 4 m segments with the rubber seal is 4,000 mm.

The openings at the beginning and end of the line must be closed and sealed using end caps supplied by CS-BETON.

CAUTION!

The „Important information" above includes only a few general rules for installing slot draining systems.

Use the hydraulic calculation provided below to evaluate the flow capacity of III-series slot drain systems.

CS-BETON provides consulting services to designers and architects using micro-slot drain solutions. We will evaluate your preliminary design in the context of the overall technical solution of the roads, surfaced areas and rainwater drainage of your project. We will confirm the proposed drainage solution, or recommend changes and specify recommended elements and their location within the system, including a recapitulation/BoQ for ordering purposes, along with list prices and the total price. All the above services are provided free of charge as a courtesy to our clients.

CS-BETON s.r.o. is not the responsible designer of your project's documentation or its part. According to Section 159 of the Act no. 183/2006 Coll, the designer is responsible for the correct selection of products specified in project documentation based on guaranteed properties of individual products detailed in product property certificates.

CSB - SLOT DRAIN PROFILE III-1

Hydraulic calculation:

1. Introduction
Profile III slot drains are designed for drainage of water from surfaced areas such as roads, parking areas, logistic centres, airports, etc. They are intended for applications where quick draining of large areas with significant hydrological potential is expected.

2. Initial assumptions
The hydraulic design of a III-slot system must always be based on the individual conditions at the given site, i.e. hydrogeology information, size, type and location of the catchment area. The capacity of the drainage system must then be calculated to reflect these conditions.

2.1 Geometrical characteristics
Profile III slot drains are available with a constant flow profile and with a continuous or interrupted slot (30 mm wide). The system also includes cleaning and gully segments. This type of slot drain does not have a fixed maximum length of one line - individual parameters depend on the site conditions (slopes etc.). The distance between the beginning/end of the line and the first cleaning and/or gully segment should not exceed 6 m so that simple cleaning and maintenance is possible. Distances between individual cleaning {gully segments depend on the maintenance and cleaning intervals. According to TP 152, the maximum distance is 50 m. The individual segments have a semicircular cross-section with an upper radius of 50 mm, lower radius of 150 mm and a 300 x 100 mm rectangle in between.

2.2 Hydrology information
For the hydraulic design of slot drain systems, the most important input parameter is the design rainfall volume, which is used to arrive to the total drained volume and the necessary number of gully segments. The design rainfall volume may be obtained, for instance, from the „Intenzity krátkodobých dešťů v povodích Labe, Odry a Moravy" (Josef Trupl) Table [1], or by ordering the information from the relevant Hydrometeorology Institute branch. Generally speaking, for III Profile slot drain systems, ČSN 75 6101 (Stokové sítě a kanalizační přípojky) [2] specifies 15-minute rainfall with periodicity as per the type of area as the critical parameter. The same parameter is then used for the design of the storm sever.

2.3 Terrain location
For the most economical system, the slot drains should be located on the catchment area so that their capacity is used to maximum and the number of storm sewer connections is minimal. The ideal scenario is slot drains in the lowest part of the area and a sufficient gradient sloping toward that part. For III Profile slot drain systems, the slope in the longitudinal direction must be at least 5 ‰. The draining capacity of course depends on the slope of the line.
Nomographic chart 1 below lists the flow capacity of slot drains and the flow rate for that capacity in relation to the longitudinal gradient. The total capacity of the system must correspond to the catchment area and the design rainfall as per above. The intensity of the design rainfall is reduced as per [2] using a recommended draining coefficient, which depends on type of structures present, type of site and its sloping.

2.4 Terrain location
Connections to storm sewer are installed in shafts provided under gully segments with a DN 150 or DN 200 connector. The gully segments include support surfaces for gully traps to protect the sewer connector from being blocked by debris.

3. Capacity flow through III Profile slot drains
Calculation of the capacity of this system is based on the „Hydraulické tabulky stok" (Hydraulic tables: Sewage conduits by J. Herle, O. Štefan, J. Turi Nagy) [3]. The same method is also used to design sewage conduits. The roughness coefficient was assumed at n = 0.014 and velocity coefficient c was calculated as per Pavlovský. Our calculations do not assume (given the usual longitudinal sloping of up to 35 ‰) any aeration within the flow. The capacity itself was then calculated using the Chezy formula for gradients of 5 to 100 ‰ and the results were plotted in nomogram 1. The nomogram also shows flow speeds for the given flow rates. The calculation was only performed for III profiles, i.e. with constant cross-section, because with such systems, variable distances between gully segments is used depending on the size of the area drained. A 20 m-long line of slot drains is capable (theoretically, see Chapter 5) of draining an area of approximately 11,900 sq. m, i.e. a 10 m-wide road segment 1,190 m long, which is sufficient for most applications. As far as the DN 150 (200) gully connectors are concerned, their capacity must be evaluated at critical points, see Literature [3]. To prevent blocking by debris, all connectors should have a gradient of at least 20 ‰. With smaller gradients of the slot drain lines, the connector capacity may become the limiting factor for the whole system and larger connector diameters and/or gradients are recommended.

CSB - SLOT DRAIN PROFILE III

4. Example hydraulic calculation

This hydraulic calculation is based on theoretical input information. This specifies an application example involving Profile III slot drains and an airport runway with a constant longitudinal gradient of 10 ‰.The road is in an area for which the hydrographical information is taken from data provided by he Roudnice nad Labem meteorological station. The segment which uses slot drains has a width of 16 m and a length of 500 m. The slot drains are installed at the edge of the road. The line includes one gully segment at the bottom end. The limiting parameter for the slot drain line is its cross-section at the bottom end. The road has a transversal gradient toward the slot drains of 25 ‰ and has a bitumen surface. Design rainfall intensity for T = 15 minutes and periodicity p = 1 is:

I_{NAV} = 112 [l/s.ha]

the run-off coefficient is:

φ = 0,80

the drained area is:

F = 30 x 500 x 0,0001 [ha] = 1,50 [ha]

after reduction by coefficient c = 0,80 the drained area is:

F_{RED} = φ x F [ha] = 0,80 x 1,5 = 1,2 [ha]

The design flow Q_{NAV} is:

$Q_{NAV} = F_{RED} \times I_{NAV}$ [l/s]
Q_{NAV} = 1,2 x 112
Q_{NAV} = 134,4 [l/s]

After comparing this value to the capacity of the slot drain from nomogram 1 for the gradient of 10‰, it is clear that:

Q_{KAP} = 152,63 [l/s] > Q_{NAV} = 134,40 [l/s]

Cleaning segments also have to be provided, with maximum spacing of 50 m.

CSB - SLOT DRAIN PROFILE III

Nomograms:

5. Nomograms for preliminary design of drainage systems
For reference design of III-profile draining systems, some calculation assumptions may be simplified. The average rainfall intensity for 15 minute rainfalls and periodicity of p = 1 for the Czech Republic (Labe basin) is:

I_{OR} = 122 [l/s.ha]

Since these slot-drains will not be used to drain water from unsurfaced areas, the average run-off coefficient c as per [2] is:

φ = 0,80

which is correct for concrete/bitumen surfaces with a gradient between 10 and 50 ‰.

With these specifications, the following nominal run-off may be assumed:

per 1 sq m of drained area:

Q_{OR} = 1 x 1 x 0,0001 x 0,8 x 122 = 0,00976 [l/s]

per 1 are, i.e. 100 sq. m:

Q_{OR} = 10 x 10 x 0,0001 x 0,8 x 122 = 0,976 [l/s]

per 1 hectare, i.e. 10,000 sq. m:

Q_{OR} = 100 x 100 x 0,0001 x 0,8 x 122 = 97,6 [l/s]

The relationship between design run-off and the drained area is shown in nomogram 2. for areas of 500 to 5000 sq m.

A comparison of the calculated run-off as per nomogram 2 with the capacity of the slot drain at the given gradient from nomogram 1 gives us enough information to specify the number of gully segments and to optimise the layout of the slot drain system.

6. Gully trap
Each gully contains two gully traps, which protect the storm sewer connections from being blocked by debris. The TP 152 recommends a distance between gully segments in a line of I Profile slot drains of 30 to 50m, depending on the characteristics of the adjacent surfaced area.
The gully segments include small gully traps, which are sufficient for most applications. For applications where large flow rate is required, large gully traps may be used.

The gully traps have several rows of narrow rectangular openings.

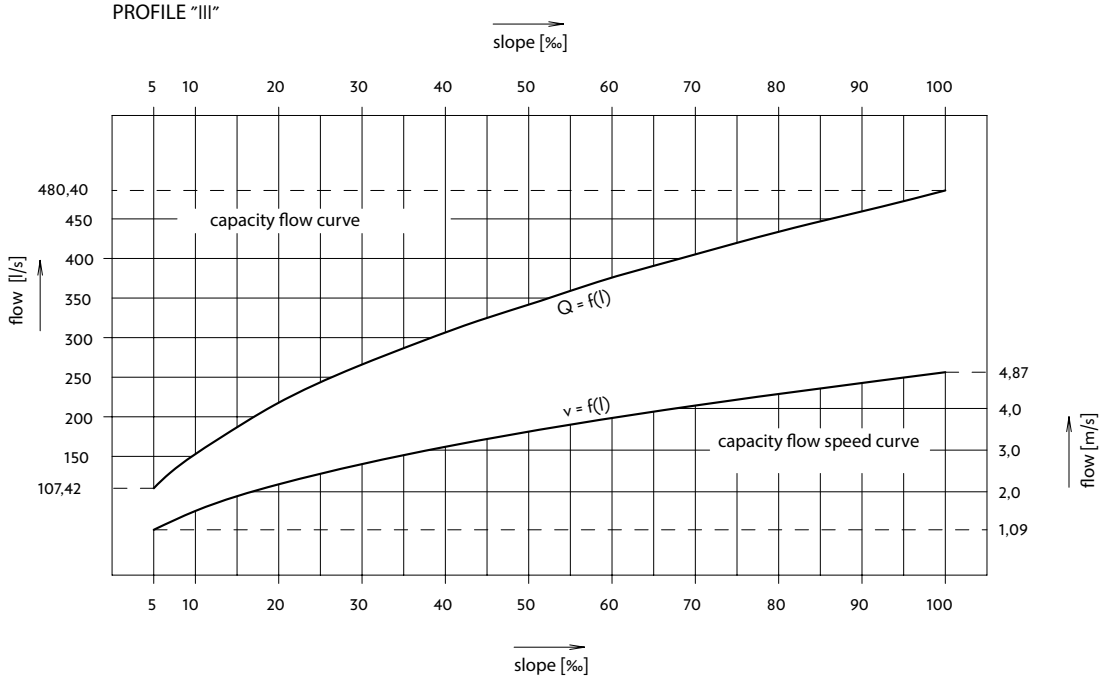
The upper sides of the trap are 420 mm and 190 mm and a number of draining slots is provided below the filling openings. Every gully trap includes a holding rod for easy handling. Gully traps are made of 1.25 mm thick galvanised steel sheeting.

The gully trap has a height of 275 mm and a rectangular base of 325 x 145 mm. The shape is conical and fits the support elements within the gully segment. Filling openings are provided at the top of the narrower sides. The upper sides of the trap are 420 mm and 190 mm and a number of draining slots is provided below the filling openings. Every gully trap includes a holding rod for easy handling. Gully traps are made of 1.25 mm thick galvanised steel sheeting. The maximum flow rate through a gully trap is 21,20 l/s.

CSB - SLOT DRAIN PROFILE III

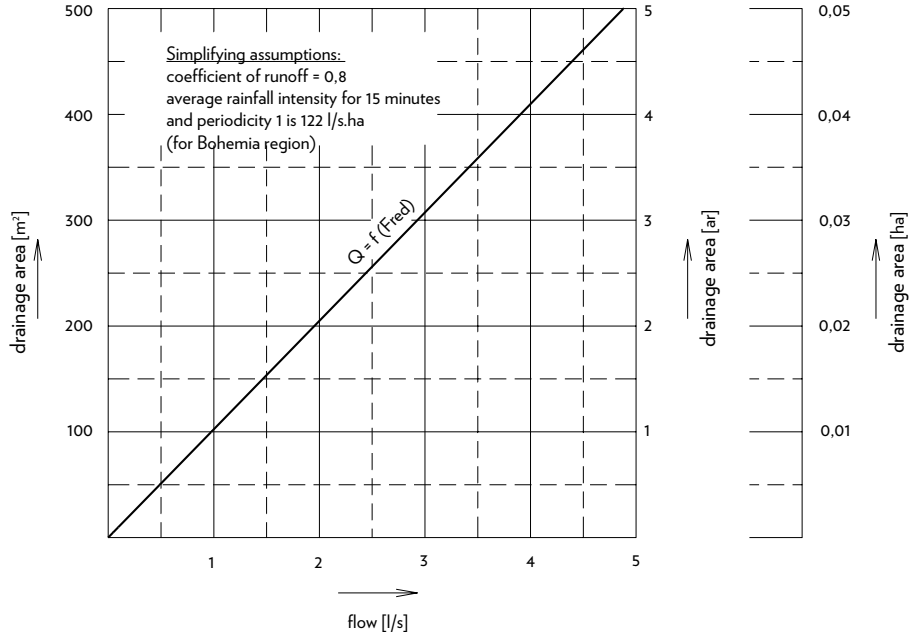
NOMOGRAME No. 1

CAPACITY OF SLOT CHANNELS (roughness coefficient n = 0,014 - by Pavlovsky)
PROFILE "III"



NOMOGRAM No. 2

Determination of surface runoff from 500 to 5000 m²



CSB - SLOT DRAIN PROFILE III

Input data:

The following literature has been used in designing the drainage system described in this brochure:

ČSN EN 1433 Odvodňovací žlábky pro dopravní a pěší plochy - konstrukční zásady zkoušení, označování, řízení jakosti
ČSN EN 206 Beton - specifikace, vlastnosti, výroba a shoda
DIN 19 580 Entwässerungsrinnen für Niederschlagswasserzum Einbau in Verkehrsflächen
ČSN 73 6056 Odstavné a parkovací plochy silničních vozidel
ČSN 73 6059 Servisy a opravny motorových vozidel. Čerpací stanice pohonných hmot
ČSN 73 6101 Projektování silnic a dálnic
ČSN 73 6110 Projektování místních komunikací
ČSN 73 6114 Vozovky pozemních komunikací
ČSN 75 6101 Stokové sítě a kanalizační přípojky
ČSN EN 124 Poklopy a vtokové mříže pro dopravní plochy
Vzorové listy staveb pozemních komunikací VL-1 Vozovky a krajnice, Ministry of Transport of the Czech republic, Dopravoprojekt
Vzorové listy staveb pozemních komunikací VL-2.2 Odvodnění, Ministry of Transport of the Czech republic, Dopravoprojekt
TKP 1 - Všeobecně
TKP 18 - betonové konstrukce (vč. 10 příloh)
TKP 31 - opravy betonových konstrukcí
TP 152 - Štěrbinové žlaby na PK, 2001, VPÚ-DECO
TP 170 - Navrhování vozovek PK (všeobecná část, katalog, návrhová metoda), 2004, VTU, Roadconsult
Technical documentation by CS-BETON Velké Žernoseky + VPÚ DECO 96-04
Company standard 7/99 Micro-slot drains as per DIN 19580, CSB
TPV 2/99 - Technologický předpis na montáž mikroštěrbinových trub, CSB
TPV 1/98 - Technologický předpis na opravy betonových prvků odvodňovacích systémů štěrbinových trub, CSB

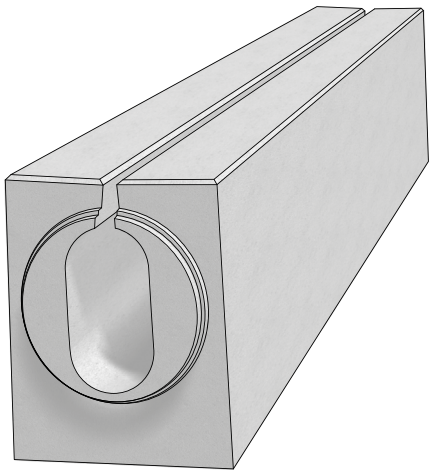
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE IV-0

Protected by utility patent

Technical data:

Profile IV slot drains are suitable for draining rainwater contaminated with small quantities of oil products (drips) from surfaced areas such as high-capacity traffic structures (motorways, dual carriageways, main roads, tunnels, runways, lay-bys, large parking lots, etc.). This product is suitable for applications with extreme rainfalls and a requirement for immediate draining of surfaced areas. Profile IV slot drains are most commonly used on runways and taxiways at airports. They are available with or without internal gradient (0.5%). They are only available with no internal gradient. Profile IV-0 slot drains (continuous slot) are designed for D400 class traffic load and no transversal vehicle travel.



The system consists of the following components:

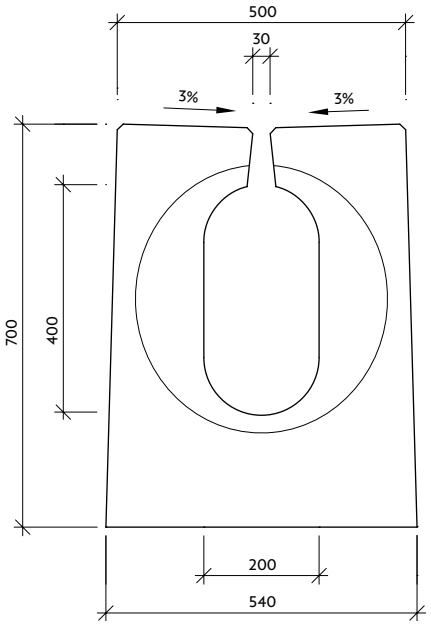
- 4 m-long continuous slot drain, with or without internal flow gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- End cap

		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**pcs**
Slot drain with continuous slot	IV-0	700	4000	500/540	0,25	2632
Slot drain with continuous slot, 0.5% flow profile bottom gradient	IV-0-G	700	4000	500/540	0,25	2651-2993
Basic gully assembly V0	IV-V0	700	1000	500/540	1	688
Gutter gully assembly VU	IV-VU	700	1000	500/540	1	668
Basic cleaning segment C0	IV-C0	700	1000	500/540	1	713
Top cleaning segment CS	IV-CS	700	1000	500/540	1	733
Spigot end cap	IV-ZU	700	100	500/540	-	85
Socket end cap	IV-ZZ	700	150	500/540	-	75

Nominal dimensions - basic shapes:

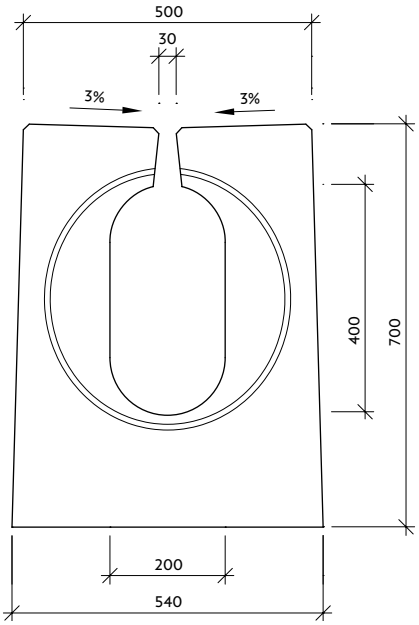
Side-view

Socket



Side-view

Spigot



ČSN EN ISO 50001:2012 CERTIFIKOVÁNO ZÚS — Energy consumption management system, certified by TZÚS PRAHA as a certificate body no 3001 under no. 11/2017

ČSN OHSAS 18001:2008 CERTIFIKOVÁNO ZÚS — Health and safety management system, certified by TZÚS PRAHA as a certificate body no 3001 under no. 367/2016

ČSN EN ISO 14001:2005 CERTIFIKOVÁNO ZÚS — Environmental management system, certified by TZÚS PRAHA as a certificate body no 3001 under no. 630/2017.

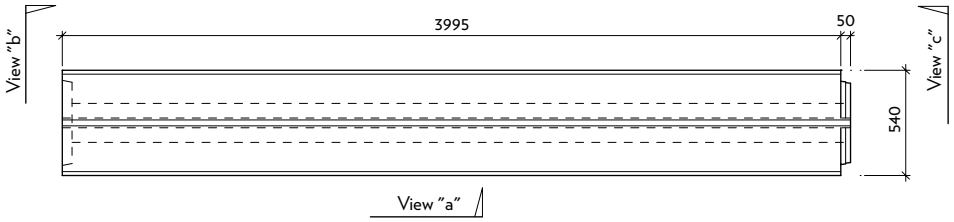
ČSN EN ISO 9001:2009 CERTIFIKOVÁNO ZÚS — Quality management system, certified by TZÚS PRAHA as a certificate body no 3001 under no. 2496/2017.

CSB - SLOT DRAIN PROFILE IV-0

Protected by utility patent

Profile IV-0 - Slot drain

Plan

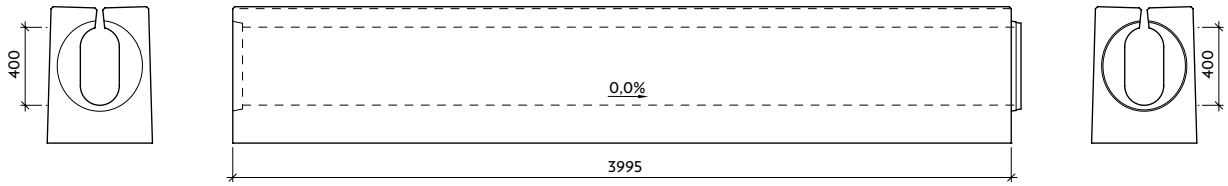


View "b" - Socket

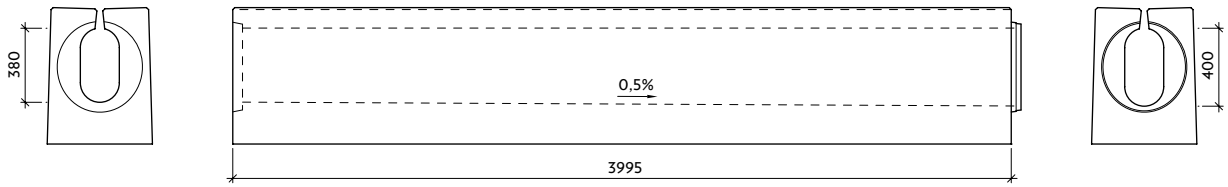
View "a"

View "c" - Spigot

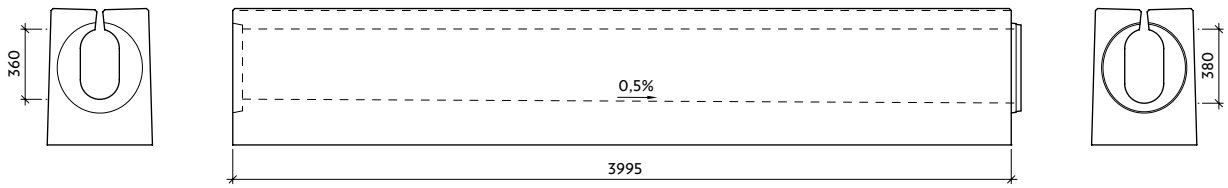
Profile IV-0-T40/40 without internal flow gradient



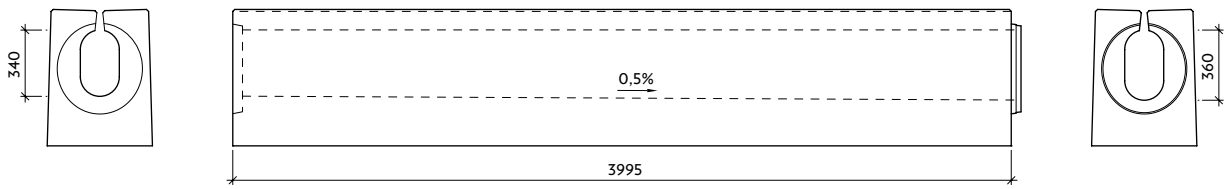
Profile IV-0-G38/40 0.5% flow profile bottom gradient



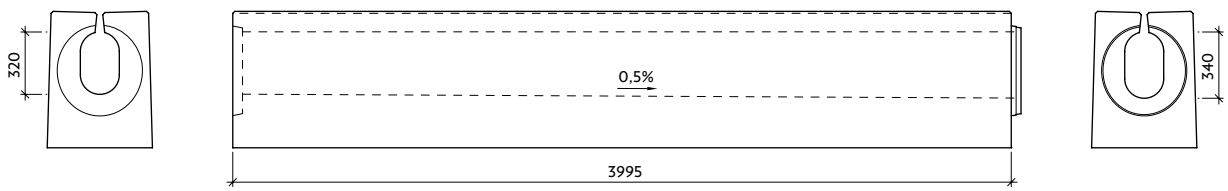
Profile IV-0-G36/38 0.5% flow profile bottom gradient



Profile IV-0-G34/36 0.5% flow profile bottom gradient



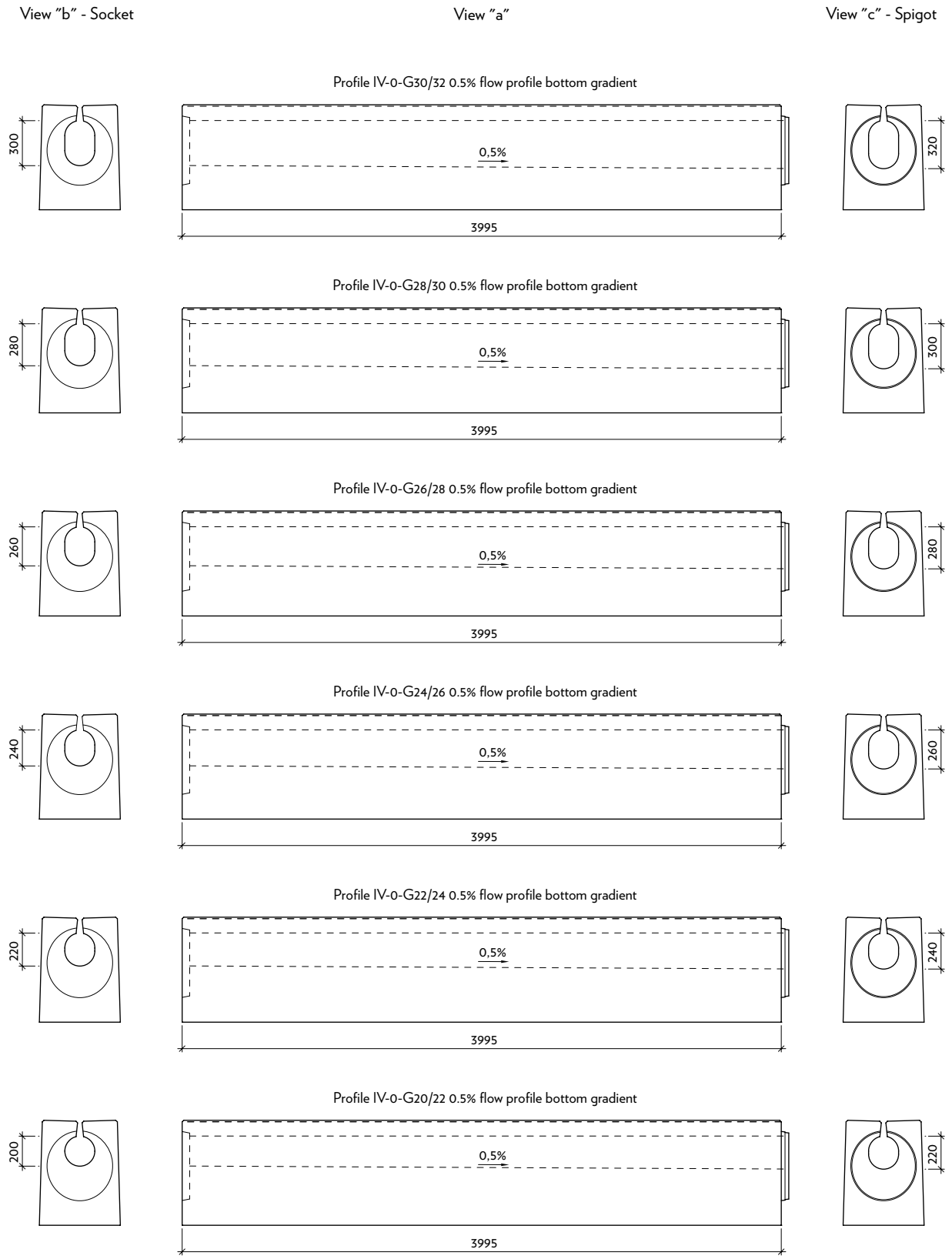
Profile IV-0-G32/34 0.5% flow profile bottom gradient



* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE IV-0

Protected by utility patent

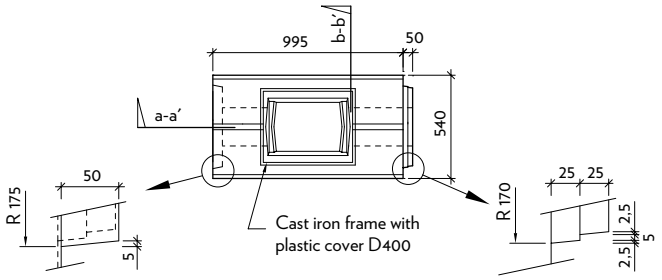


CSB - SLOT DRAIN PROFILE IV-0

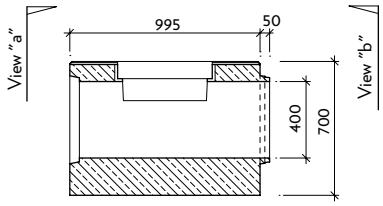
Protected by utility patent

IV-0-C0 - Basic cleaning segment with cast iron frame and plastic cover for D400

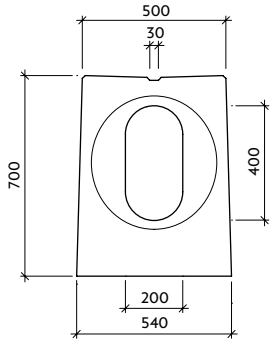
Plan



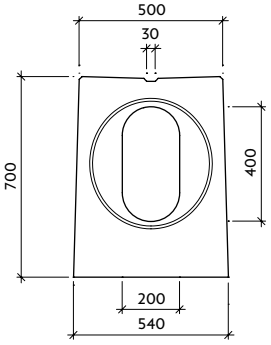
Cross-section: a-a´ IV-0-C0



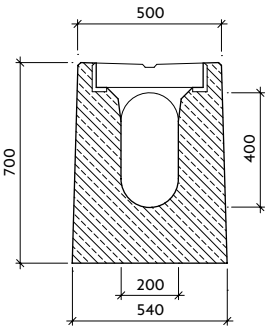
View "a" IV-0-C0 - Socket



View "b" IV-0-C0 - Spigot

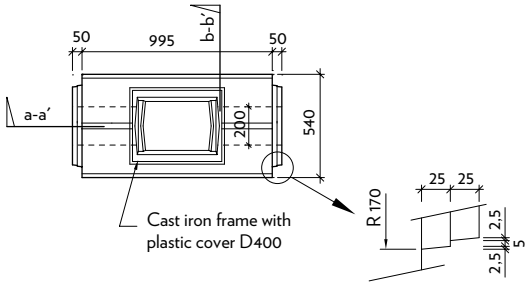


Cross-section: b-b´ IV-0-C0

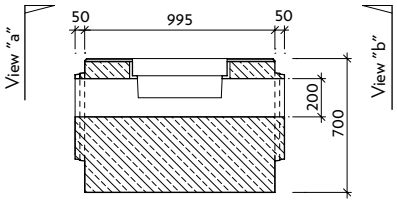


IV-0-CS - Top cleaning segment with cast iron frame and plastic cover for D400

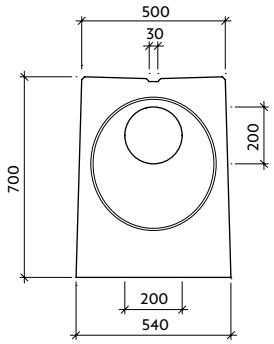
Plan



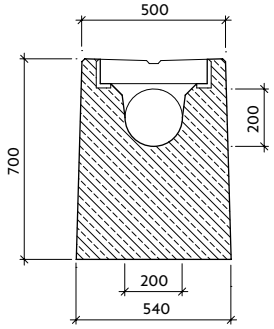
Cross-section: a-a´ IV-0-CS



View "a"="b" IV-0-CS - Spigot/Spigot



Cross-section: b-b´ IV-0-CS



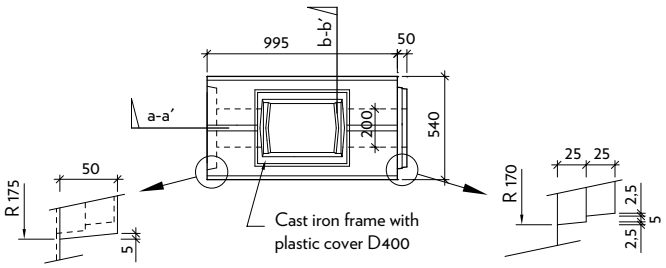
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE IV-0

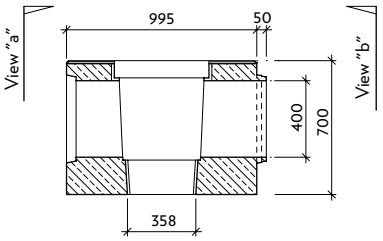
Protected by utility patent

IV-0-V0 - Basic gully assembly with cast iron frame and plastic cover for D400

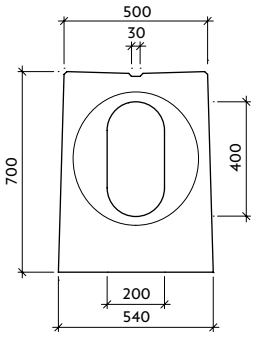
Plan



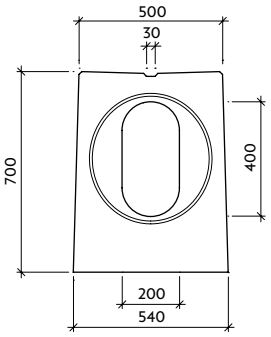
Cross-section: a-a´ IV-0-V0



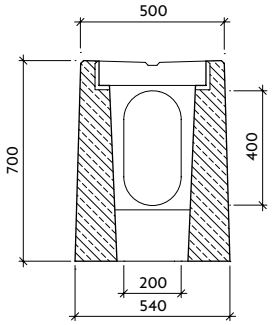
View "a" IV-0-V0 - Socket



View "b" IV-0-V0 - Spigot

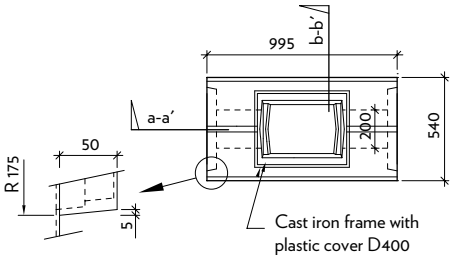


Cross-section: b-b´ IV-0-V0

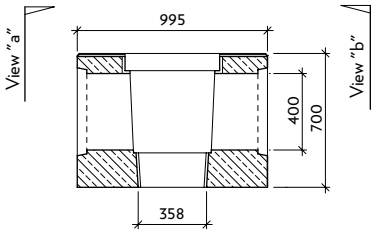


IV-0-VU - Gutter gully assembly with cast iron frame and plastic cover for D400

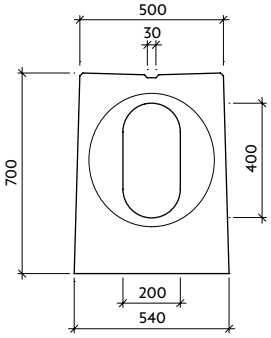
Plan



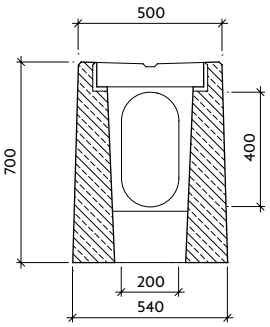
Cross-section: a-a´ IV-0-VU



View "a"="b" IV-0-VU - Socket/Socket



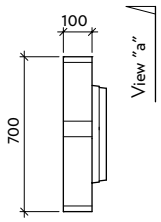
Cross-section: b-b´ IV-0-VU



CSB - SLOT DRAIN PROFILE IV-0

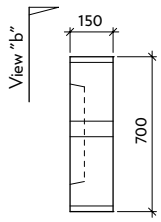
IV-ZU - Spigot end cap

Plan

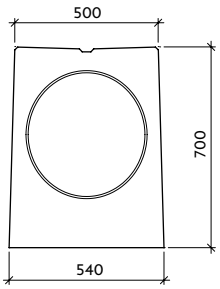


IV-ZZ - Socket end cap

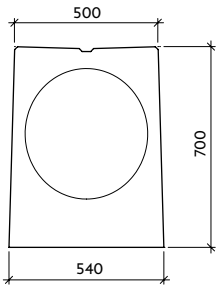
Plan



View "a" IV-ZU - Spigot

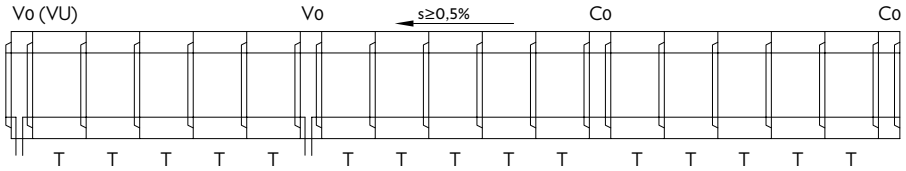


View "b" IV-ZZ - Socket



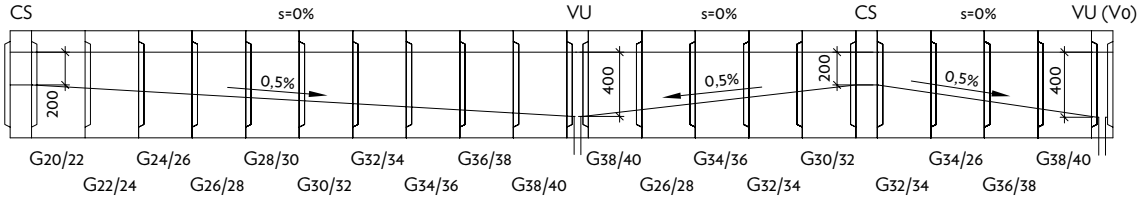
Suggested layout

IV-0-T Slot drains - layout



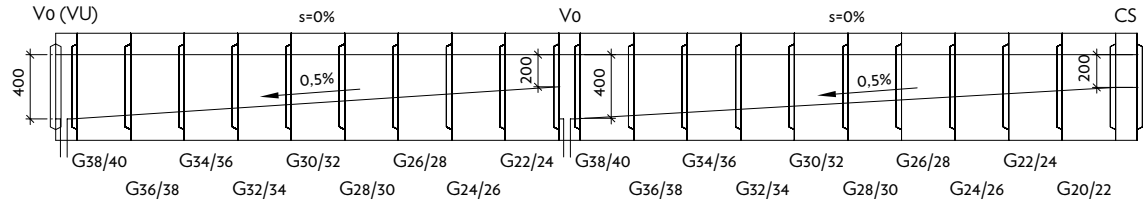
IV-0-G Slot drains - layout

(slot drain with roof bottom)



IV-0-G Slot drains - layout

(slot drain with saw tooth bottom)



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends

CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends

s – Longitudinal flow profile gradient

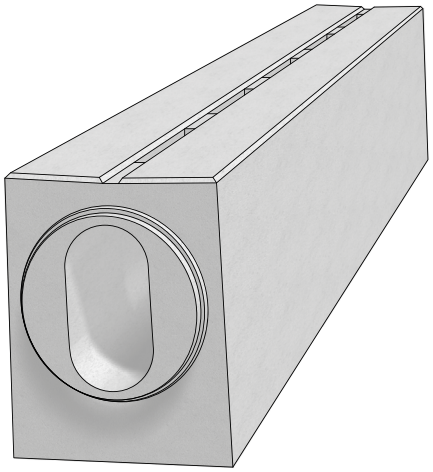
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE IV-1

Protected by utility patent

Technical data:

Profile IV slot drains are suitable for draining rainwater contaminated with small quantities of oil products (drips) from surfaced areas such as high-capacity traffic structures (motorways, dual carriageways, main roads, tunnels, runways, lay-bys, large parking lots, etc.). This product is suitable for applications with extreme rainfalls and a requirement for immediate draining of surfaced areas. Profile IV slot drains are most commonly used on runways and taxiways at airports. They are available with or without internal gradient (0.5%). Profile IV-I slot drains are designed for D400, E600 and F900 class traffic loads and transversal vehicle travel.



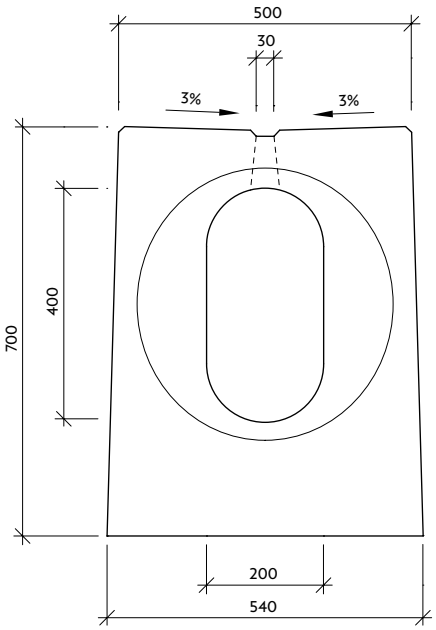
The system consists of the following components:

- 4 m-long slot drains with interrupted slots, with or without internal gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- End cap

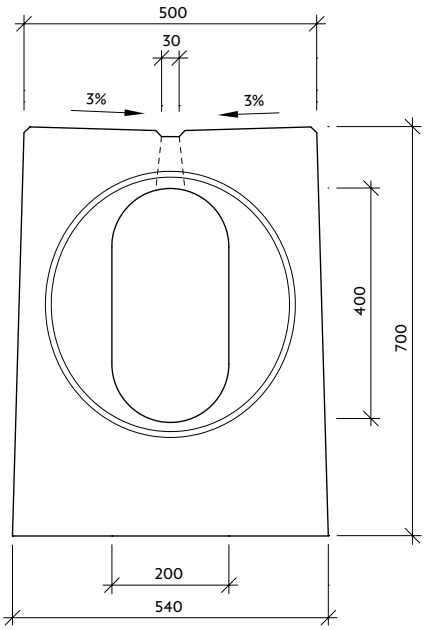
		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**pcs**
Slot drain with interrupted slot	IV-1	700	4000	500/540	0,25	2650
Slot drain with interrupted slot, 0.5% flow profile bottom gradient	IV-1-G	700	4000	500/540	0,25	2669-3011
Basic gully assembly V0	IV-V0	700	1000	500/540	1	688
Gutter gully assembly VU	IV-VU	700	1000	500/540	1	668
Basic cleaning segment C0	IV-C0	700	1000	500/540	1	713
Top cleaning segment CS	IV-CS	700	1000	500/540	1	733
Spigot end cap	IV-ZU	700	100	500/540	-	85
Socket end cap	IV-ZZ	700	150	500/540	-	75

Nominal dimensions - basic shapes:

Side-view
Socket



Side-view
Spigot

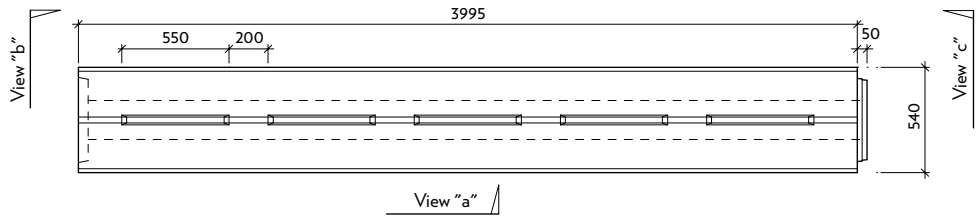


CSB - SLOT DRAIN PROFILE IV-1

Protected by utility patent

Profile IV-1 - Slot drain

Plan

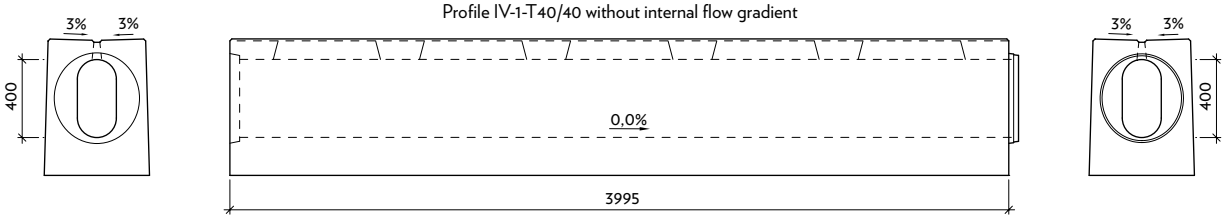


View "b" - drážka

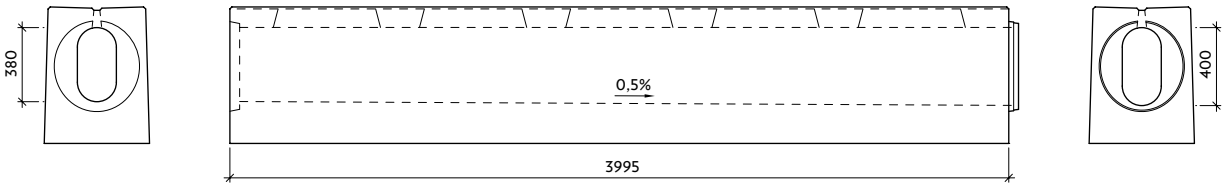
View "a"

View "c" - Spigot

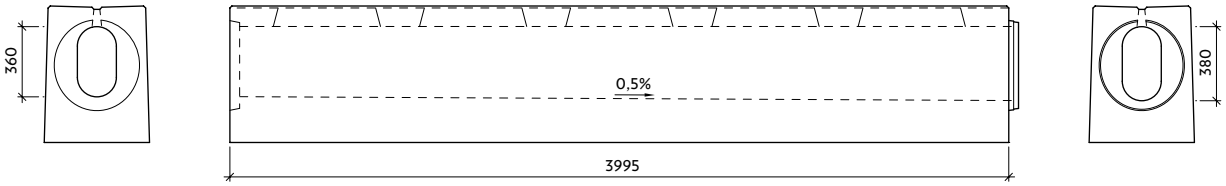
Profile IV-1-T40/40 without internal flow gradient



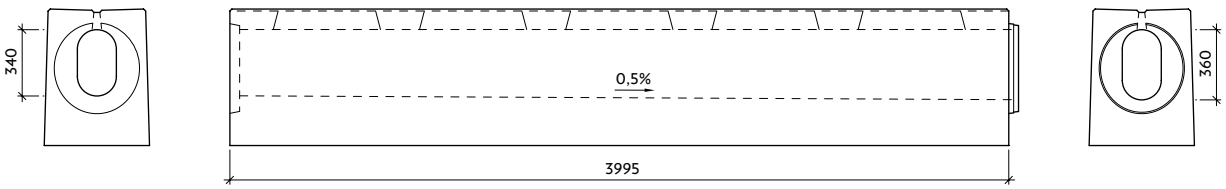
Profile IV-1-G38/40 0.5% flow profile bottom gradient



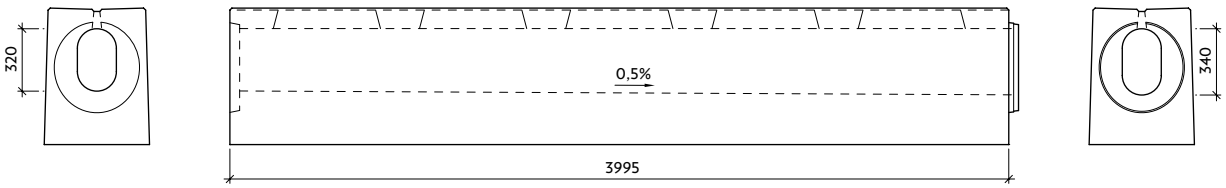
Profile IV-1-G36/38 0.5% flow profile bottom gradient



Profile IV-1-G34/36 0.5% flow profile bottom gradient



Profile IV-1-G32/34 0.5% flow profile bottom gradient



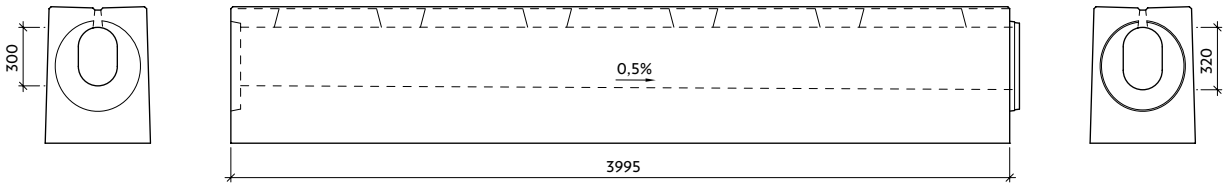
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE IV-1

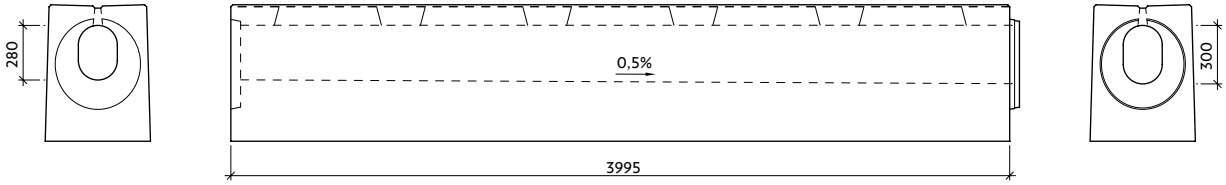
Protected by utility patent

View "b" - Socket | View "a" | View "c" - Spigot

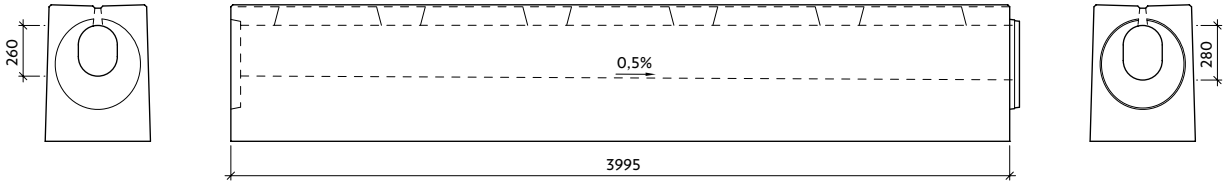
Profile IV-1-G30/32 0.5% flow profile bottom gradient



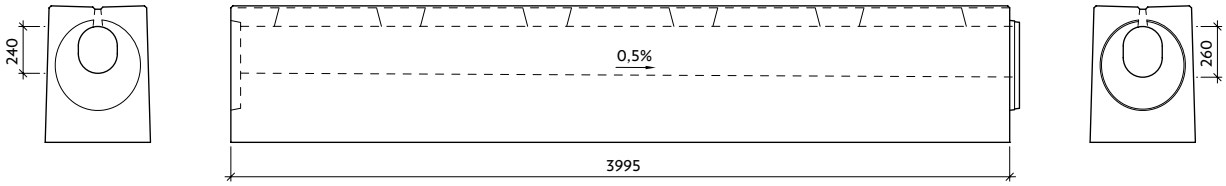
Profile IV-1-G28/30 0.5% flow profile bottom gradient



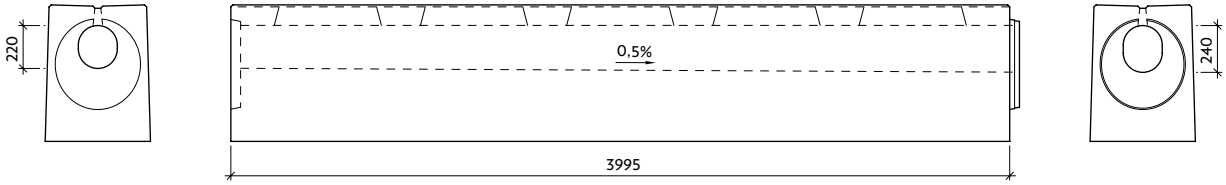
Profile IV-1-G26/28 0.5% flow profile bottom gradient



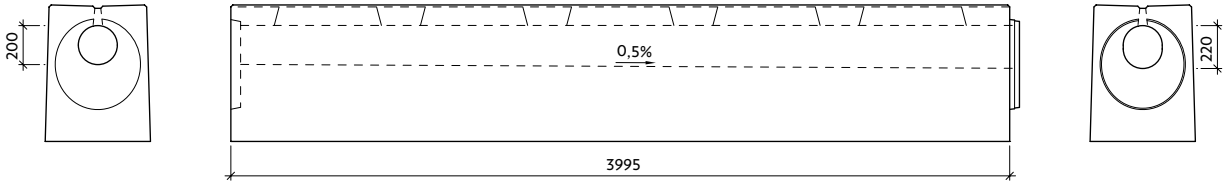
Profile IV-1-G24/26 0.5% flow profile bottom gradient



Profile IV-1-G22/24 0.5% flow profile bottom gradient



Profile IV-1-G20/22 0.5% flow profile bottom gradient

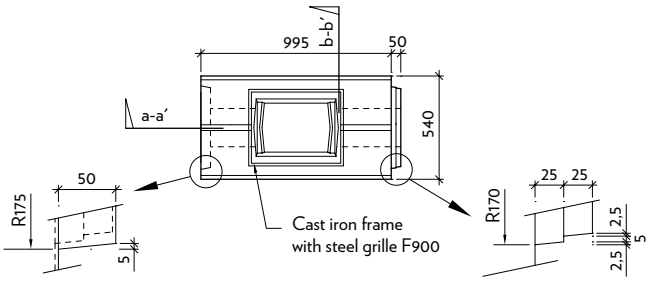


CSB - SLOT DRAIN PROFILE IV-1

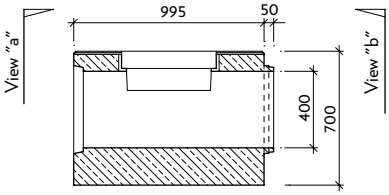
Protected by utility patent

IV-1-C0 - Basic cleaning segment with cast iron frame and steel grille for F900

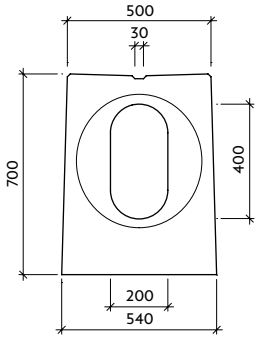
Plan



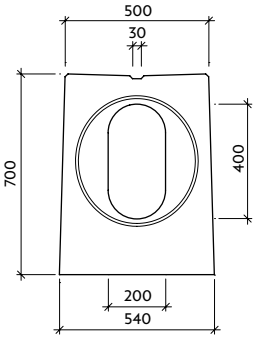
Cross-section



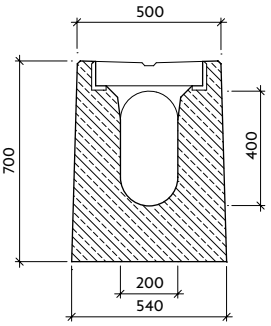
View "a" IV-1-C0 - Socket



View "b" IV-1-C0 - Spigot

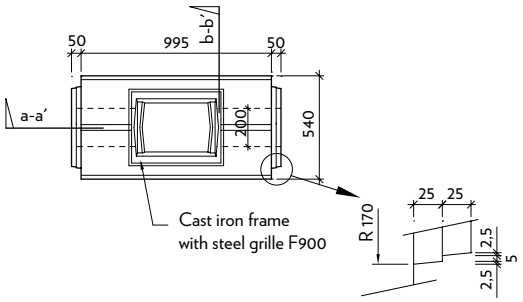


Cross-section: b-b´ IV-1-C0

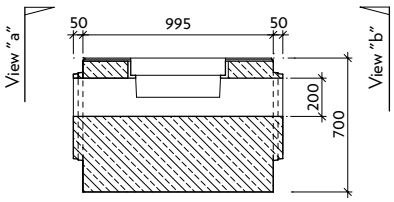


IV-1-CS - Top cleaning segment with cast iron frame and steel grille for F900

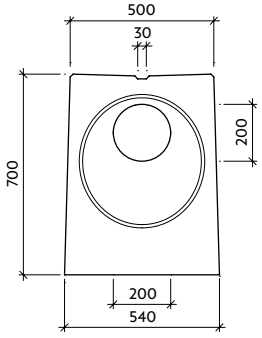
Plan



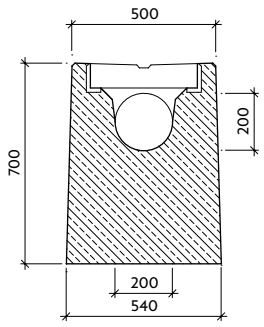
Cross-section: a-a´ IV-1-CS



View "a"="b" IV-1-CS - Spigot/Spigot



Cross-section: b-b´ IV-1-CS



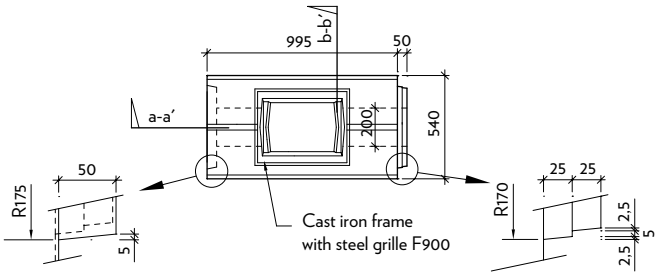
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE IV-1

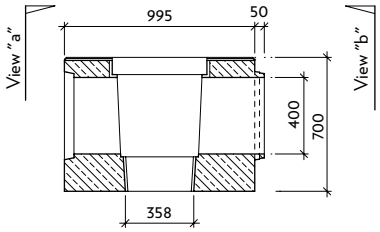
Protected by utility patent

IV-1-V0 - Basic gully assembly with cast iron frame and steel grille for F900

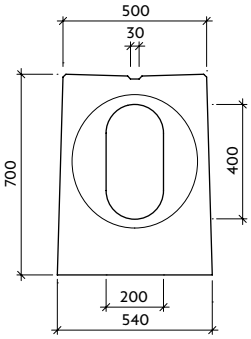
Plan



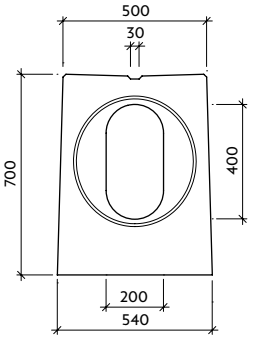
Cross-section: a-a' IV-1-V0



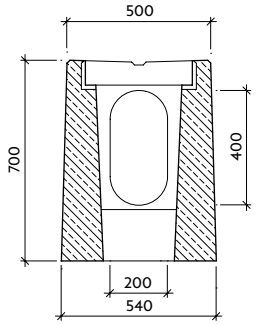
View "a" IV-1-V0 - Socket



View "b" IV-1-V0 - Spigot

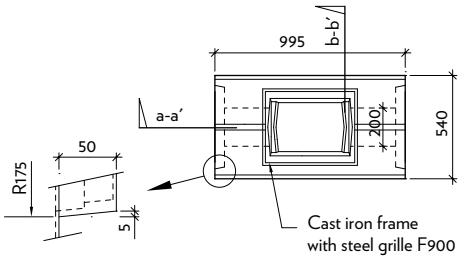


Cross-section: b-b' IV-1-V0

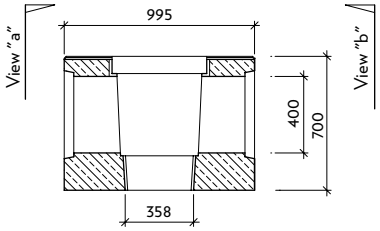


IV-1-VU - Gutter gully assembly with cast iron frame and steel grille for F900

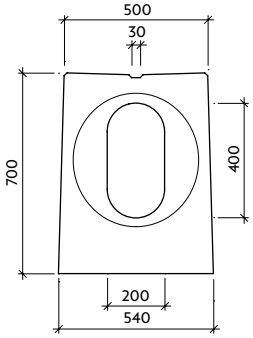
Plan



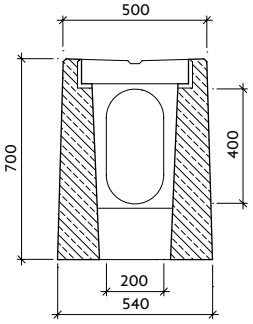
Cross-section: a-a' IV-1-VU



View "a"="b" IV-1-VU - Socket/Socket



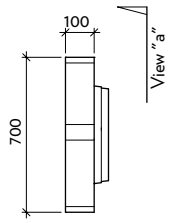
Cross-section: b-b' IV-1-VU



CSB - SLOT DRAIN PROFILE IV-1

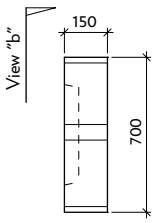
IV-ZU - Spigot end cap

Plan

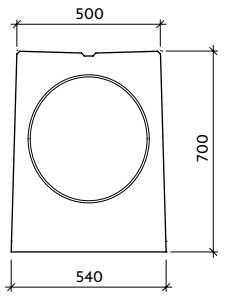


IV-ZZ - Socket end cap

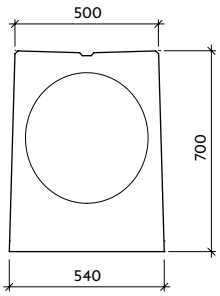
Plan



View "a" IV-ZU - Spigot

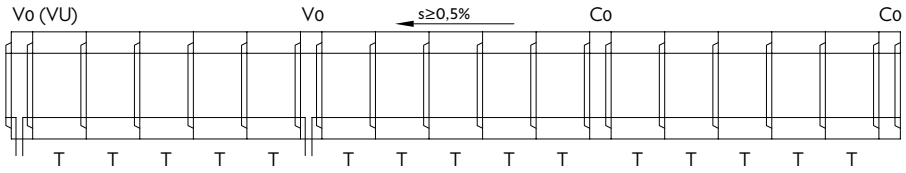


View "b" IV-ZZ - Socket



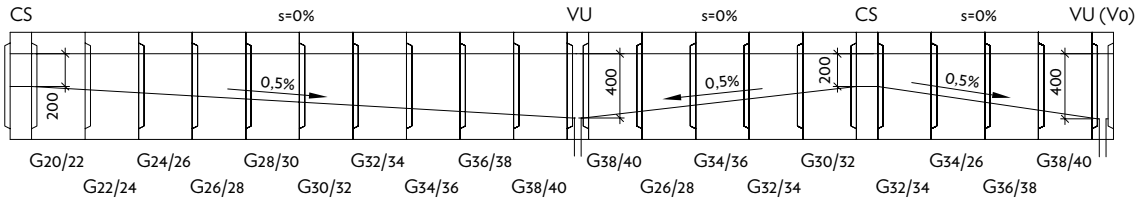
Suggested layout

IV-1-T Slot drains - layout



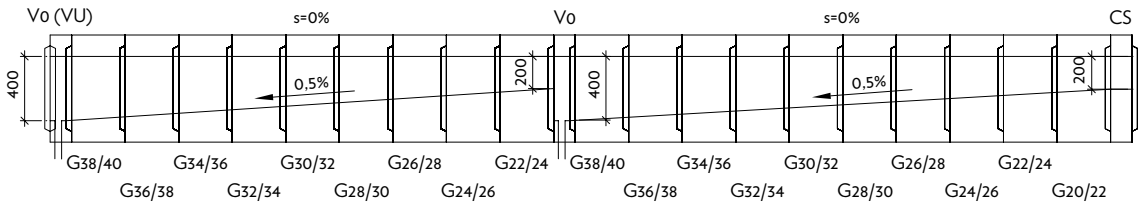
IV-1-G Slot drains - layout

(slot drain with roof bottom)



IV-1-G Slot drains - layout

(slot drain with saw tooth bottom)



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends

CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends

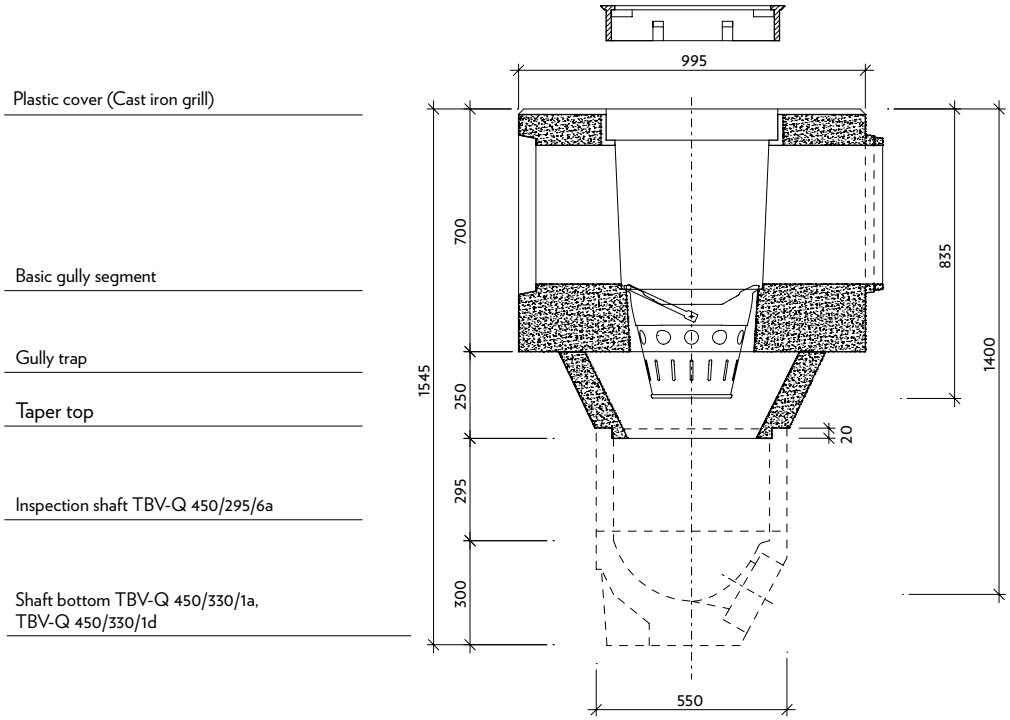
s – Longitudinal flow profile gradient

* Nominal dimensions include installation dimensions and/or minimum gap.

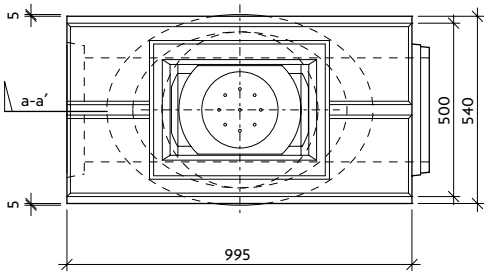
CSB - SLOT DRAIN PROFILE IV

Basic gully segment with gully trap

Cross-section: a-a´



Plan



CSB - SLOT DRAIN PROFILE IV

Product characteristics:

Slot drains are a modern, fast and efficient way of draining excess water from roads and surfaced areas. The system includes dedicated gully and cleaning segments.

Slot drains ensure efficient draining of excess water from surfaced areas even during extreme rainfall, its transport by means of high-capacity flow profile and removal to a storm sever. This prevents aquaplaning from occurring and collects contaminated water from the road surface so that it does not come into contact with the surrounding environment. Even large capacity slot drains are relatively narrow, so they can be installed within a 0.5 m-wide soft shoulder. Thanks to large flow capacity and narrow flow profile, they are largely self-cleaning.

The slot drain system may be used to reduce the length of storm sewers and the number of its connectors and inlets.

CS-BETON also offers slot drains with internal flow profile gradient. These are suitable for minimum or no longitudinal gradients of the drained area. Different slot drain profiles are suitable for different applications. For faster drainage, the upper surface of the slot drain segments has a 3% gradient sloping toward the slot. For transversal vehicle travel at high speeds (80 km/hr and higher), a flat upper surface is recommended.

CS-BETON slot drains have high load-carrying capacity and selection of a suitable type allows them to be used at airports, or the most demanding industrial applications. These segments are made in three versions, for D400, E600 and F900 traffic loads. Segments with interrupted slots are especially suitable for dynamic loading, or to withstand horizontal forces. The simple design and high-quality structural elements ensure long service life of drainage systems.

CS-BETON's slot drains and all the system components are made of high strength C 45/55 XF4 concrete as per ČSN EN 206-1. Efficient plasticiser and aeration admixtures and non-crystalline silicon dioxide (MICROSILICA) admixtures make our concrete extremely resistant to water and chemical defrosting agents. In European weather conditions, the systems are not affected by frost.

The design of the slot drain elements allows for a perfect connection to the surrounding road surface. The weight of the slot drain segments (The 4 m-long segments weigh between 2.6 and 3.0t) enables compacting of road structure layers in the immediate vicinity without the risk of the segments being moved sideways, when suitable techniques such as vibration slabs are used. The slightly slanted side walls also help compacting and connection to the adjoining structures.

CS-BETON's slot drains include a proprietary two-ring AQUAFEST joint technology, which ensures perfect water tightness and resistance to oil residues and other aggressive substances. This prevents surrounding underground and surface waters from being contaminated. The rubber seal also creates an expansion joint between two adjoining drain segments.

Custom lengths (in 1 cm increments between 0.5 and 4.0 m) may also be supplied. Additional modifications are also possible upon request, such as surface modifications, side outlets, slanted ends, etc. Custom lengths and modified elements are more expensive and take longer to supply.

Installation of slot drains is relatively easy and fast when suitable equipment is used. Upon customer's request, CS-BETON will include a special handling and installation kit with the supply. Always follow manufacturer's installation instructions to ensure functional and long-lasting drainage systems.

Finished slot drain systems require minimum maintenance, only cleaning of the flow profile when it becomes clogged. Cleaning and gully segments are provided for this purpose and should be installed at regular intervals. Regular maintenance of gullies is relatively easy. According to TP 152, the gullies should be ideally spaced 40 m apart, in any case not more than 50 m. The only maintenance required is removal and emptying/cleaning of the gully traps.

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE IV

The cast iron grilles on gullies and cleaning segments are secured against lift-off from the passing traffic. The grilles also come in two versions, the 400 kN ones are made of grey cast iron and for the 900 kN ones from ductile cast iron. Slot drains can be installed in curved layouts. The maximum directional angle between two adjacent segments is 3 degrees. This ensures watertight joints between the adjoining faces. This limitation suggests that 4 m segments could be used in curves down to a radius of R = 80 m and 2 m segments down to R = 40 m. We do not recommend this minimum value as the visible line of the slot segments appears too polygonal and compacting of adjacent road layers may damage the slot drain segments and joints. This means at least R = 160 m for 4 m segments.

In the overall context and given its reliability, safety and low operational cost, drainage systems using slot drains are more suitable and more economical than other systems in most cases. Slot drain systems are becoming more popular and some applications would be hard to solve without them.

Important information:

Slot drains are designed to collect water from surfaced areas, not from free terrain. Water from free terrain may be drained only in exceptional cases and in minimum quantities. However, blocking of the slot or the flow profile by stones and mud must always be prevented (rubble arresting benches, ditches, full lawn cover, more frequent maintenance, etc.). Installation of slot drain into minimum radius curves produces polygonal shapes. During compacting next to such shapes, compacting next to the segments must be ensured without any damage or movement to the segments must be ensured. Vibration slabs are recommended.

During installation, gullies must be precisely located in both transversal and longitudinal direction, because the micro-slot segments‘ length cannot be altered in situ. The nominal length of basic 4 m segments with the rubber seal is 4,000 mm.

The openings at the beginning and end of the line must be closed and sealed using end caps supplied by CS-BETON.

CAUTION!

The „Important information“ above includes only a few general rules for installing slot draining systems.

Use the hydraulic calculation provided below to evaluate the flow capacity of III-series slot drain systems.

CS-BETON provides consulting services to designers and architects using micro-slot drain solutions. We will evaluate your preliminary design in the context of the overall technical solution of the roads, surfaced areas and rainwater drainage of your project. We will confirm the proposed drainage solution, or recommend changes and specify recommended elements and their location within the system, including a recapitulation/BoQ for ordering purposes, along with list prices and the total price. All the above services are provided free of charge as a courtesy to our clients.

CS-BETON s.r.o. is not the responsible designer of your project‘s documentation or its part. According to Section 159 of the Act no. 183/2006 Coll, the designer is responsible for the correct selection of products specified in project documentation based on guaranteed properties of individual products detailed in product property certificates.

CSB - SLOT DRAIN PROFILE IV

Hydraulic calculation:

1. Introduction
Profile IV slot drains are designed for drainage of water from surfaced areas such as roads, parking areas, logistic centres, airports, etc. They are intended for applications where quick draining of large areas with significant hydrological potential is expected.

2. Initial assumptions
The hydraulic design of a IV-slot system must always be based on the individual conditions at the given site, i.e. hydrogeology information, size, type and location of the catchment area. The capacity of the drainage system must then be calculated to reflect these conditions.

2.1 Geometrical characteristics
Profile IV-series slot drains are produced in two types. IV-G Profile with an internal gradient of 5 ‰ and IV-T Profile with no internal gradient. All are used with dedicated cleaning and gully segments.

2.2 Hydrology information
For the hydraulic design of slot drain systems, the most important input parameter is the design rainfall volume, which is used to arrive to the total drained volume and the necessary number of gully segments. The design rainfall volume may be obtained, for instance, from the „Intenzity krátkodobých dešťů v povodích Labe, Odry a Moravy" (Josef Trupl) Table [1], or by ordering the information from the relevant Hydrometeorology Institute branch. Generally speaking, for IV Profile slot drain systems, ČSN 75 6101 (Stokové sítě a kanalizační přípojky) [2] specifies 15-minute rainfall with periodicity as per the type of area as the critical parameter. The same parameter is then used for the design of the storm sever.

2.3 Terrain location
For the most economical system, the slot drains should be located on the catchment area so that their capacity is used to maximum and the number of storm sewer connections is minimal. The ideal scenario is slot drains in the lowest part of the area and a sufficient gradient sloping toward that part. When IV-G type segments are used, the line is usually installed on a level surface. When IV-T type segments are used, the gradient of the terrain in the longitudinal direction of the line must be at least 5 ‰ and the draining capacity depends on the gradient. Nomographic chart 1 below lists the flow capacity of slot drains and the flow rate for that capacity in relation to the longitudinal gradient. The total capacity of the system must correspond to the catchment area and the design rainfall as per above. The intensity of the design rainfall is reduced as per [2] using a recommended draining coefficient, which depends on type of structures present, type of site and its sloping. TP152 MDS may be used for the design.

2.4 Terrain location
Connections to storm sewer are installed in shafts provided under gully segments with a DN 150 or DN 200 connector. The gully segments include support surfaces for gully traps to protect the sewer connector from being blocked by debris.

3. Capacity flow through III Profile slot drains
Calculation of the capacity of this system is based on the „Hydraulické tabulky stok" (Hydraulic tables: Sewage conduits by J. Herle, O. Štefan, J. Turi Nagy) [3]. The same method is also used to design sewage conduits. The roughness coefficient was assumed at n = 0.014 and velocity coefficient c was calculated as per Pavlovský. Our calculations do not assume (given the usual longitudinal sloping of up to 35 ‰) any aeration within the flow. The capacity itself was then calculated using the Chezy formula for gradients of 5 to 100 ‰ and the results were plotted in nomogram 1. The nomogram also shows flow speeds for the given flow rates. The calculation was only performed for III profiles, i.e. with constant cross-section, because with such systems, variable distances between gully segments is used depending on the size of the area drained. A 20 m-long line of slot drains is capable (theoretically, see Chapter 5) of draining an area of approximately 7,150 sq. m, i.e. a 10 m-wide road segment 715 m long, which is sufficient for most applications. As far as the DN 150 (200) gully connectors are concerned, their capacity must be evaluated at critical points, see Literature [3]. To prevent blocking by debris, all connectors should have a gradient of at least 20 ‰. With smaller gradients of the slot drain lines, the connector capacity may become the limiting factor for the whole system and larger connector diameters and/or gradients are recommended.

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE IV

4. Example hydraulic calculation

This hydraulic calculation is based on theoretical input information. This specifies an application example involving Profile IV slot drains and a motorway with a constant longitudinal gradient of 10 ‰. The road is in an area for which the hydrographical information is taken from data provided by the Roudnice nad Labem meteorological station. The segment which uses slot drains has a width of 12 m and a length of 125 m. The slot drains are installed at the edge of the road. The line includes one gully segment at the bottom end. The limiting parameter for the slot drain line is its cross--section at the bottom end. The road has a transversal gradient toward the slot drains of 25 ‰ and has a bitumen surface. Design rainfall intensity for T = 15 minutes and periodicity p = 1 is:

I_{NAV} = 112 [l/s.ha]

the run-off coefficient is:

φ = 0,80

the drained area is:

F = 30 x 250 x 0,0001 [ha] = 0,75 [ha]

after reduction by coefficient c = 0,80 the drained area is:

F_{RED} = φ x F [ha] = 0,80 x 0,75 = 0,60 [ha]

the design flow Q_{NAV} is

$Q_{NAV} = F_{RED} \times I_{NAV}$ [l/s]
Q_{NAV} = 0,60 x 112
Q_{NAV} = 67,20 [l/s]

after comparing this value to the capacity of the slot drain from nomogram 1 for the gradient of 10‰, it is clear that:

Q_{KAP} = 91,76 [l/s] > Q_{NAV} = 67,20 [l/s]

cleaning segments also have to be provided, with maximum spacing of 50 m.

CSB - SLOT DRAIN PROFILE IV

Nomograms:

5. Nomograms for preliminary design of drainage systems
For reference design of IV-profile draining systems, some calculation assumptions may be simplified. The average rainfall intensity for 15 minute rainfalls and periodicity of p = 1 for the Czech Republic (Labe basin) is:

I_{OR} = 122 [l/s.ha]

Since these slot-drains will not be used to drain water from unsurfaced areas, the average run-off coefficient c as per [2] is:

φ = 0,80

which is correct for concrete/bitumen surfaces with a gradient between 10 and 50 ‰. With these specifications, the following nominal run-off may be assumed:

per 1 sq m of drained area:

Q_{OR} = 1 x 1 x 0,0001 x 0,8 x 122 = 0,00976 [l/s]

per 1 are, i.e. 100 sq. m:

Q_{OR} = 10 x 10 x 0,0001 x 0,8 x 122 = 0,976 [l/s]

per 1 hectare, i.e. 10,000 sq. m:

Q_{OR} = 100 x 100 x 0,0001 x 0,8 x 122 = 97,6 [l/s]

The relationship between design run-off and the drained area is shown in nomogram 2. for areas of 500 to 5000 sq m.

A comparison of the calculated run-off as per nomogram 2 with the capacity of the slot drain at the given gradient from nomogram 1 gives us enough information to specify the number of gully segments and to optimise the layout of the slot drain system.

6. Gully trap
Each gully contains two gully traps, which protect the storm sewer connections from being blocked by debris. The TP 152 recommends a distance between gully segments in a line of IV Profile slot drains of 40 to 50m, depending on the characteristics of the adjacent surfaced area.
The gully segments include small gully traps, which are sufficient for most applications. For applications where large flow rate is required, large gully traps may be used.

The gully traps have several rows of narrow rectangular openings.

The upper sides of the trap are 420 mm and 190 mm and a number of draining slots is provided below the filling openings. Every gully trap includes a holding rod for easy handling. Gully traps are made of 1.25 mm thick galvanised steel sheeting.

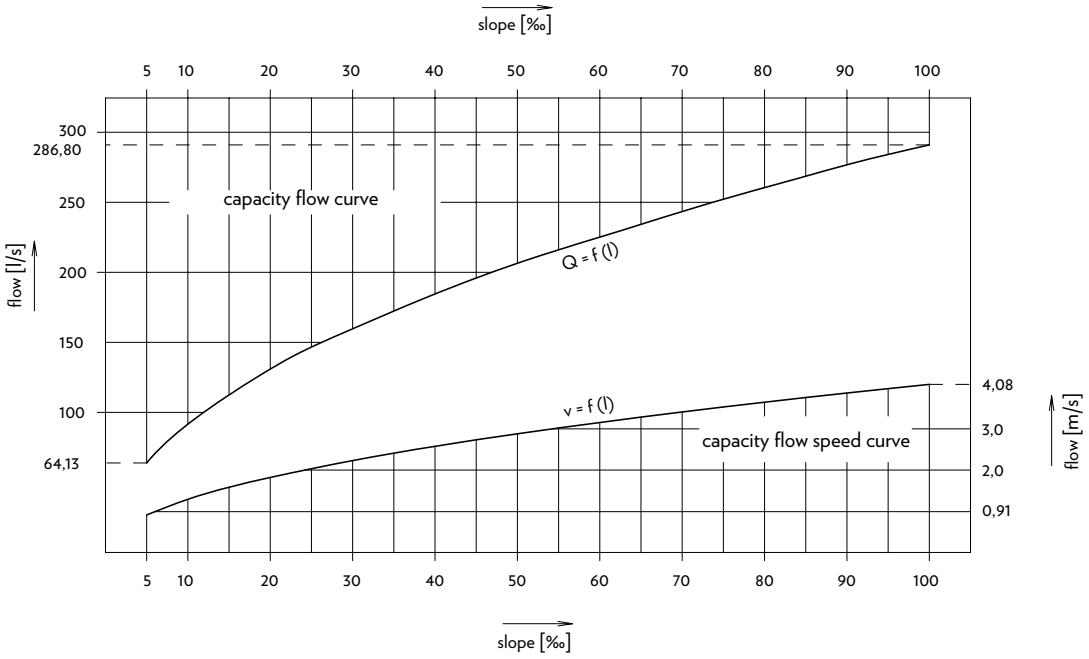
The gully trap has a height of 275 mm and a rectangular base of 325 x 145 mm. The shape is conical and fits the support elements within the gully segment. Filling openings are provided at the top of the narrower sides. The upper sides of the trap are 420 mm and 190 mm and a number of draining slots is provided below the filling openings. Every gully trap includes a holding rod for easy handling. Gully traps are made of 1.25 mm thick galvanised steel sheeting. The maximum flow rate through a gully trap is 21,20 l/s.

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE IV

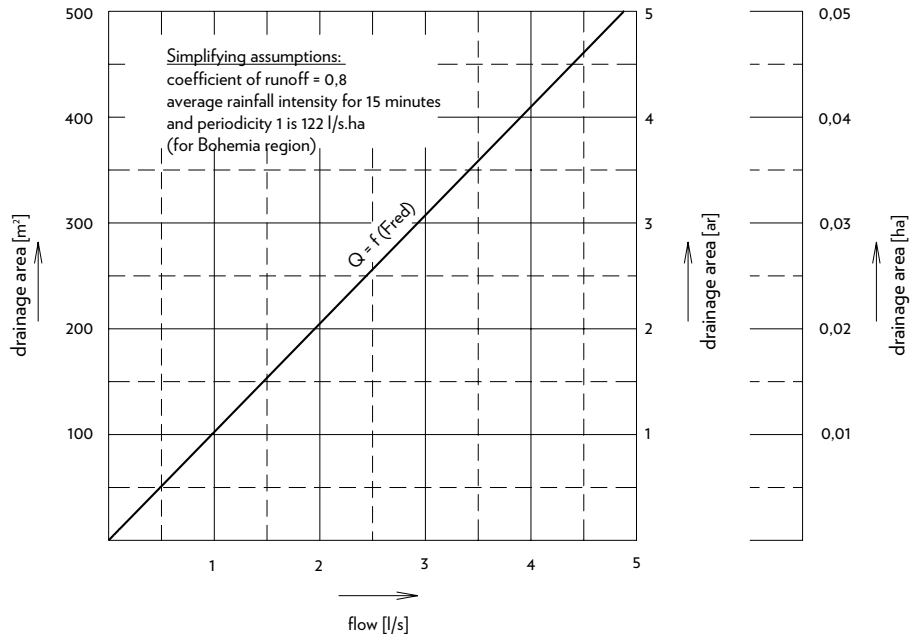
NOMOGRAME No. 1

CAPACITY OF SLOT CHANNELS (ROUGHNESS COEFFICIENT n = 0,014 - BY PAVLOVSKY)
PROFILE "IV"



NOMOGRAM No. 2

Determination of surface runoff from 500 to 5000 m²



CSB - SLOT DRAIN PROFILE IV

Input data:

The following literature has been used in designing the drainage system described in this brochure:

ČSN EN 1433 Odvodňovací žlábky pro dopravní a pěší plochy - konstrukční zásady zkoušení, označování, řízení jakosti
ČSN EN 206 Beton - specifikace, vlastnosti, výroba a shoda
DIN 19 580 Entwässerungsrinnen für Niederschlagswasserzum Einbau in Verkehrsflächen
ČSN 73 6056 Odstavné a parkovací plochy silničních vozidel
ČSN 73 6059 Servisy a opravny motorových vozidel. Čerpací stanice pohonných hmot
ČSN 73 6101 Projektování silnic a dálnic
ČSN 73 6110 Projektování místních komunikací
ČSN 73 6114 Vozovky pozemních komunikací
ČSN 75 6101 Stokové sítě a kanalizační přípojky
ČSN EN 124 Poklopy a vtokové mříže pro dopravní plochy
Vzorové listy staveb pozemních komunikací VL-1 Vozovky a krajnice, Ministry of Transport of the Czech republic, Dopravoprojekt
Vzorové listy staveb pozemních komunikací VL-2.2 Odvodnění, Ministry of Transport of the Czech republic, Dopravoprojekt
TKP 1 - Všeobecně
TKP 18 - betonové konstrukce (vč. 10 příloh)
TKP 31 - opravy betonových konstrukcí
TP 152 - Štěrbinové žlaby na PK, 2001, VPÚ-DECO
TP 170 - Navrhování vozovek PK (všeobecná část, katalog, návrhová metoda), 2004, VTU, Roadconsult
Technical documentation by CS-BETON Velké Žernoseky + VPÚ DECO 96-04
Company standard 7/99 Micro-slot drains as per DIN 19580, CSB
TPV 2/99 - Technologický předpis na montáž mikroštěrbinových trub, CSB
TPV 1/98 - Technologický předpis na opravy betonových prvků odvodňovacích systémů štěrbinových trub, CSB

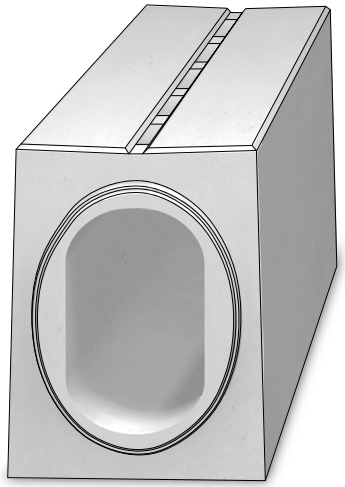
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VI-1

Protected by utility patent

Technical data:

Profile VI slot drains are suitable for draining rainwater contaminated with small quantities of oil products (drips) from surfaced areas such as high-capacity traffic structures (motorways, dual carriageways, main roads, tunnels, runways, lay-bys, large parking lots, etc.). Profile VI has the biggest capacity of all our slot drains. Profile VI-1 slot drains are suitable for locations with extreme rainfall - especially large surfaced areas at airports - and are only available with no internal gradient. Profile VI-1 slot drains are designed for D400 and F900 class traffic loads.



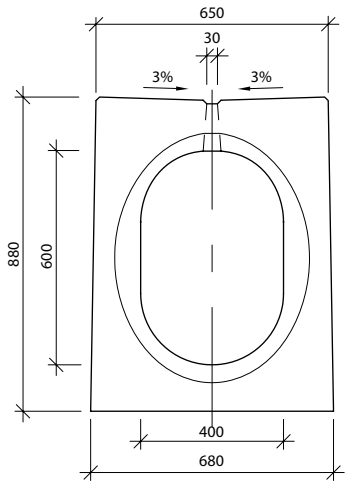
The system consists of the following components:

- 4 m-long slot drains with interrupted slots, without internal gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- End cap

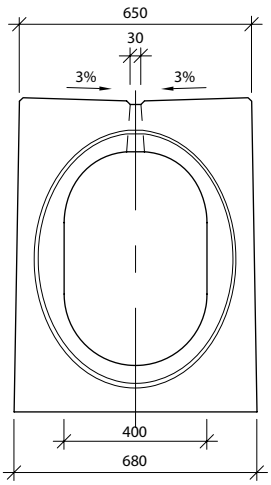
		Nominal dimensions* mm			Quantity	Weight
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**	**pcs**
Slot drain with interrupted slot	VI-1	880	4000	650/680	0,25	3600
Basic gully assembly V0	VI-V0	880	2000	650/680	1	1526
Gutter gully assembly VU	VI-VU	880	2000	650/680	1	1526
Basic cleaning segment C0	VI-C0	880	1000	650/680	1	821
Top cleaning segment CS	VI-CS	880	1000	650/680	1	821
Spigot end cap	VI-ZU	880	120	650/680	-	154
Socket end cap	VI-ZZ	880	120	650/680	-	129

Nominal dimensions - basic shapes:

Side-view
Socket



Side-view
Spigot

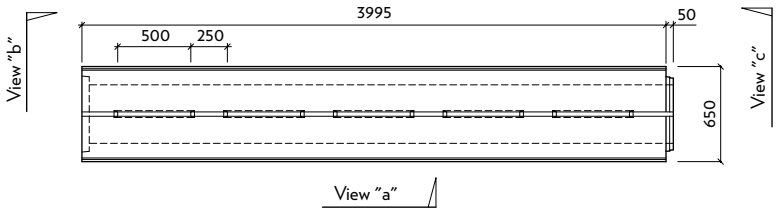


CSB - SLOT DRAIN PROFILE VI-1

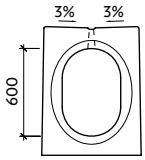
Protected by utility patent

Profile VI-1 - Slot drain

Plan

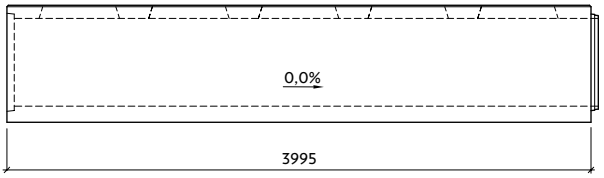


View "b"- Socket

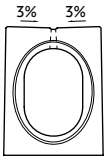


View "a"

VI-1 T60/60 P without internal flow gradient



View "c"- Spigot



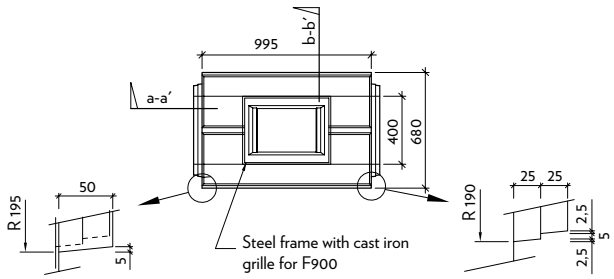
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VI-1

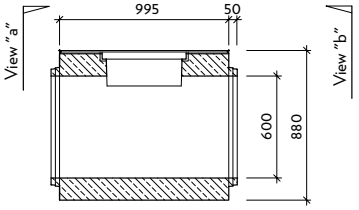
Protected by utility patent

VI-1-CS - Top cleaning segment with steel frame and cast iron grille for F900

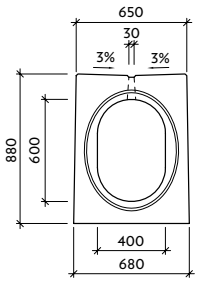
Plan



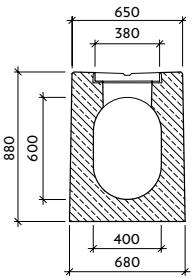
Cross-section: a-a´



View ”a”=”b” VI-1-CS - Spigot/Spigot

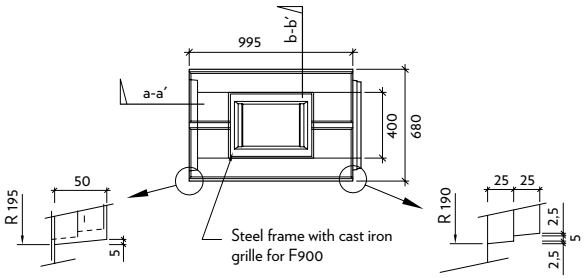


Cross-section: b-b´

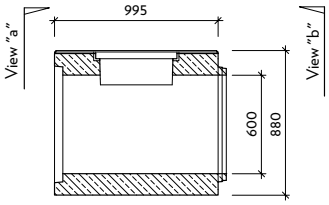


VI-1-C0 - Basic cleaning segment with steel frame and cast iron grille for F900

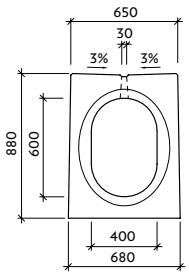
Plan



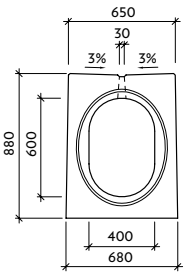
Cross-section: a-a´



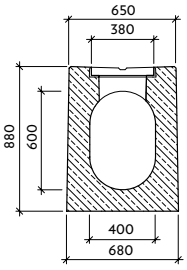
View ”a” VI-1-C0 - Socket



View ”b” VI-1-C0 - Spigot



Cross-section: b-b´

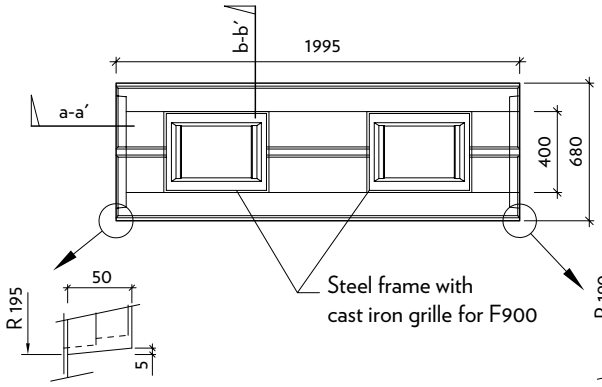


CSB - SLOT DRAIN PROFILE VI-1

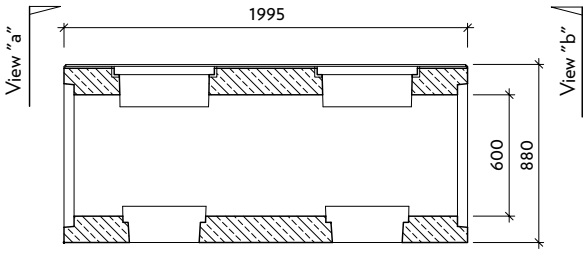
Protected by utility patent

VI-1-VU - Gutter gully assembly with steel frame and cast iron grille for F900

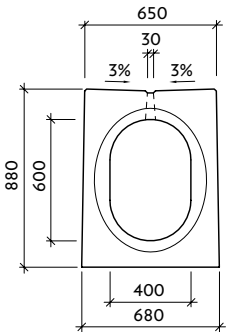
Plan



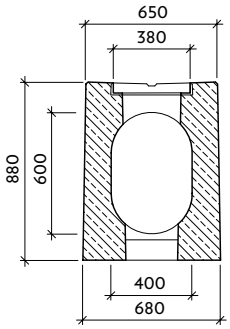
Cross-section: a-a'



View "a"="b" VI-1-VU - Socket/Socket

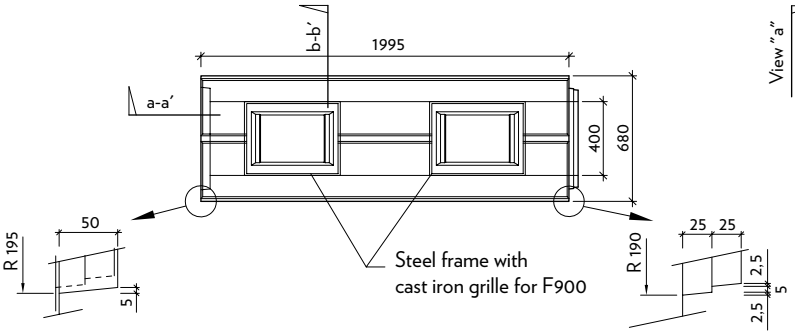


Cross-section: b-b'

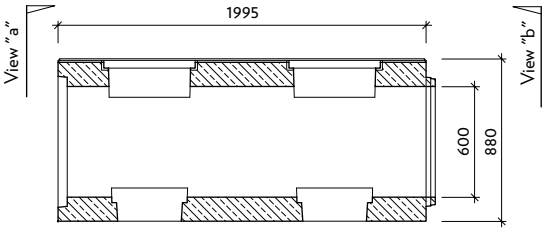


VI-1-V0 - Basic gully assembly with steel frame and cast iron grille for F900

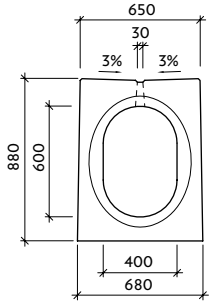
Plan



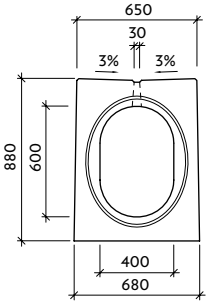
Cross-section: a-a'



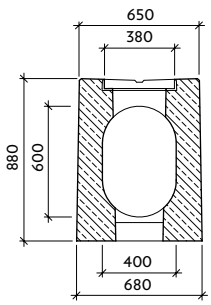
View "a" VI-1-V0 - Socket



View "b" VI-1-V0 - Spigot



Cross-section: b-b'

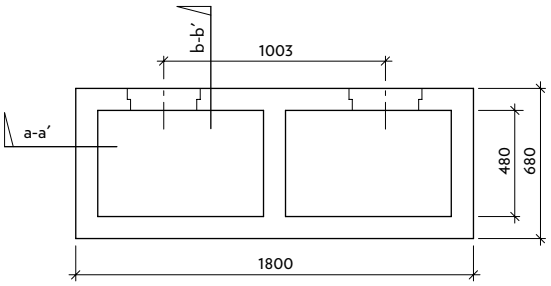


* Nominal dimensions include installation dimensions and/or minimum gap.

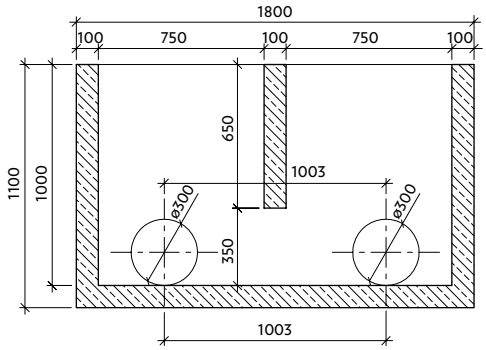
CSB - SLOT DRAIN PROFILE VI-1

Profile VI - vpusťový kus základní V0 - uklidňovací nádrž

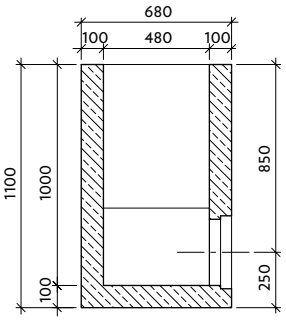
Plan



Cross-section: a-a´

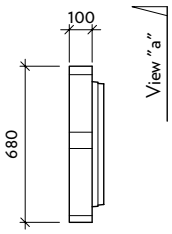


Cross-section: b-b´

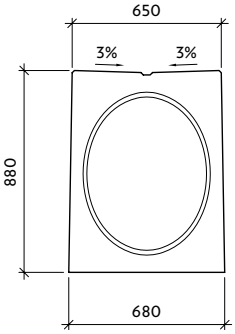


VI-1-ZZ/ZU - end cap

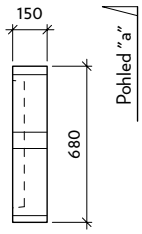
Plan VI-1-ZZ - Socket



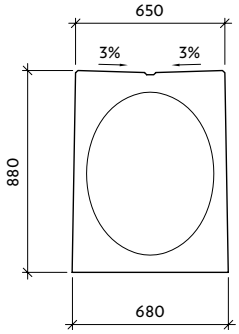
View "a"



Plan VI-1-ZU - Spigot



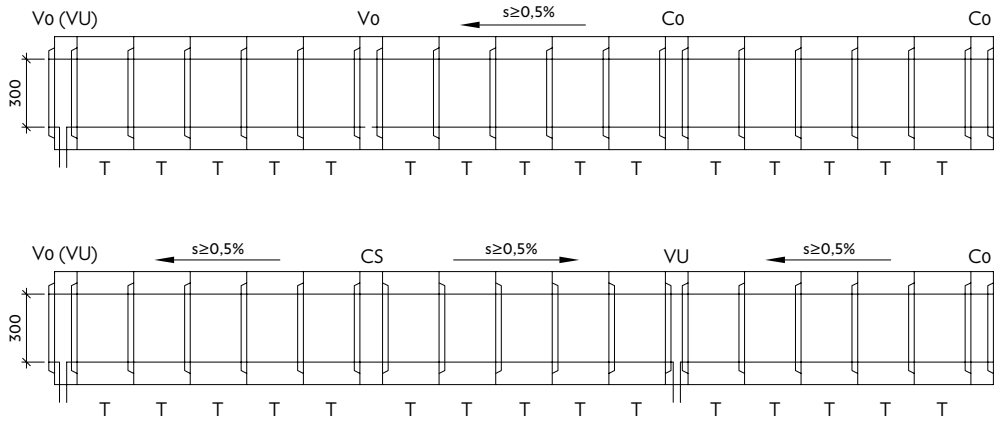
View "b"



CSB - SLOT DRAIN PROFILE VI-1

Suggested layout

VI-1-T Slot drains - layout



Gully and cleaning element codes

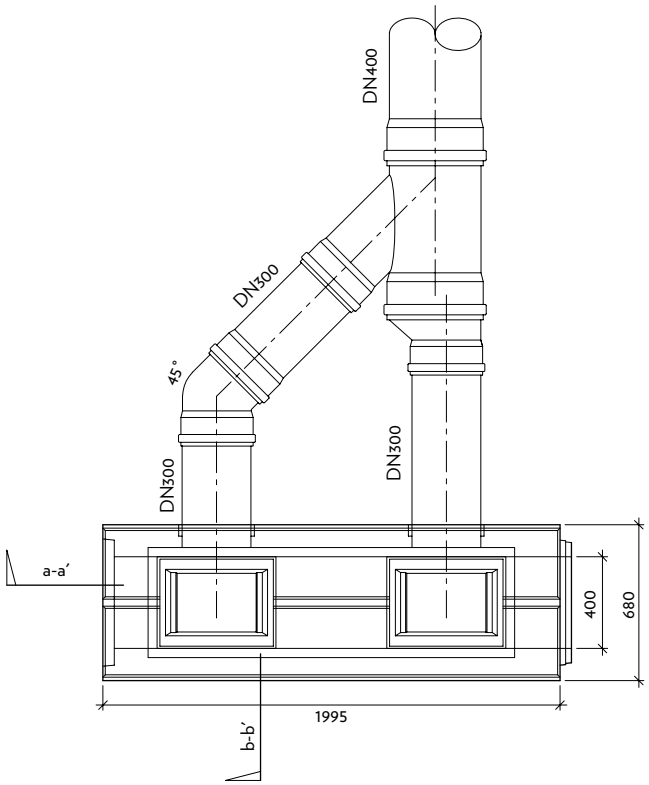
V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends
VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends
C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends
CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends
s – Longitudinal flow profile gradient

* Nominal dimensions include installation dimensions and/or minimum gap.

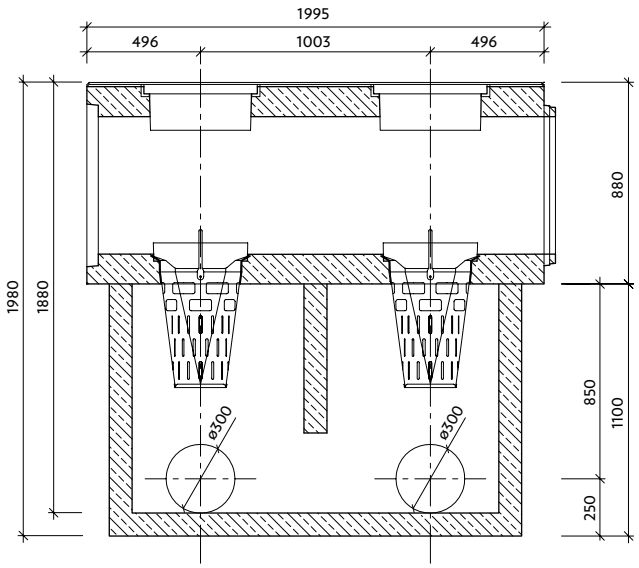
CSB - SLOT DRAIN PROFILE VI

Profile VI - Basic gully segment

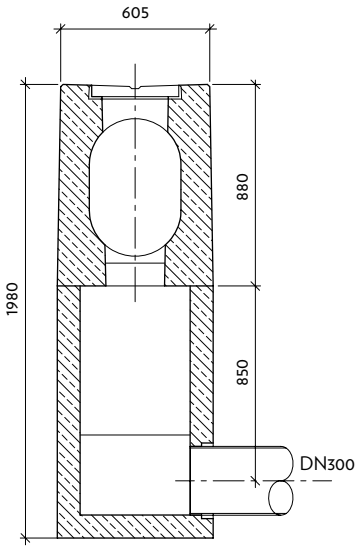
Plan



Cross-section: a-a'



Cross-section: b-b'



CSB - SLOT DRAIN PROFILE VI

Product characteristics:

Slot drains are a modern, fast and efficient way of draining excess water from roads and surfaced areas. The system includes dedicated gully and cleaning segments.

Slot drains ensure efficient draining of excess water from surfaced areas even during extreme rainfall, its transport by means of high-capacity flow profile and removal to a storm sever. They collect contaminated water from the road surface so that it does not come into contact with the surrounding environment. Thanks to large flow capacity and narrow flow profile, they are largely self-cleaning.

The slot drain system may be used to reduce the length of storm sewers and the number of its connectors and inlets.

CS-BETON also offers slot drains with internal flow profile gradient. These are suitable for minimum or no longitudinal gradients of the drained area. Different slot drain profiles are suitable for different applications. For faster drainage, the upper surface of the slot drain segments has a 3% gradient sloping toward the slot. For transversal vehicle travel at high speeds (80 km/hr and higher), a flat upper surface is recommended.

CS-BETON slot drains have high load-carrying capacity and selection of a suitable type allows them to be used at airports, or the most demanding industrial applications. These segments are made in three versions, for D400, E600 and F900 traffic loads. Segments with interrupted slots are especially suitable for dynamic loading, or to withstand horizontal forces. The simple design and high-quality structural elements ensure long service life of drainage systems.

CS-BETON‘s slot drains and all the system components are made of high strength C 45/55 XF4 concrete as per ČSN EN 206-1. Efficient plasticiser and aeration admixtures and non-crystalline silicon dioxide (MICROSILICA) admixtures make our concrete extremely resistant to water and chemical defrosting agents. In European weather conditions, the systems are not affected by frost.

The design of the slot drain elements allows for a perfect connection to the surrounding road surface. The weight of the slot drain segments (The 4 m-long segments weigh between 2.6 and 3.0 t) enables compacting of road structure layers in the immediate vicinity without the risk of the segments being moved sideways, when suitable techniques such as vibration slabs are used. The slightly slanted side walls also help compacting and connection to the adjoining structures.

CS-BETON‘s slot drains include a proprietary two-ring AQUAFEST joint technology, which ensures perfect water tightness and resistance to oil residues and other aggressive substances. This prevents surrounding underground and surface waters from being contaminated. The rubber seal also creates an expansion joint between two adjoining drain segments.

Custom lengths (in 1 cm increments between 0.5 and 4.0 m) may also be supplied. Additional modifications are also possible upon request, such as surface modifications, side outlets, slanted ends, etc. Custom lengths and modified elements are more expensive and take longer to supply.

Installation of slot drains is relatively easy and fast when suitable equipment is used. Upon customer‘s request, CS-BETON will include a special handling and installation kit with the supply. Always follow manufacturer‘s installation instructions to ensure functional and long-lasting drainage systems.

Finished slot drain systems require minimum maintenance, only cleaning of the flow profile when it becomes clogged. Cleaning and gully segments are provided for this purpose and should be installed at regular intervals. Regular maintenance of gullies is relatively easy. According to TP 152, the gullies should be ideally spaced 40 m apart, in any case not more than 50 m. The only maintenance required is removal and emptying/cleaning of the gully traps.

The cast iron grilles on gullies and cleaning segments are secured against lift-off from the passing traffic. The grilles also come in two versions, the 400 kN ones are made of grey cast iron and for the 900 kN ones from ductile cast iron. Slot drains can be installed in curved layouts. The maximum directional angle between two adjacent segments is 3 degrees. This ensures watertight joints between the adjoining faces. This limitation suggests that 4 m segments could be used in curves down to a radius of R = 80 m and 2 m segments down to R = 40 m. We do not recommend this minimum value as the visible line of the slot segments appears too polygonal and compacting of adjacent road layers may damage the slot drain segments and joints. This means at least R = 160 m for 4 m segments. Pro směrové oblouky menších poloměrů lze osazovat do linie žlabu zkrácené prvky popř. v kombinaci s obloukovým žlabem.

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VI

In the overall context and given its reliability, safety and low operational cost, drainage systems using slot drains are more suitable and more economical than other systems in most cases. Slot drain systems are becoming more popular and some applications would be hard to solve without them.

Important information:

Slot drains are designed to collect water from surfaced areas, not from free terrain. Water from free terrain may be drained only in exceptional cases and in minimum quantities. However, blocking of the slot or the flow profile by stones and mud must always be prevented (rubble arresting benches, ditches, full lawn cover, more frequent maintenance, etc.). Installation of slot drain into minimum radius curves produces polygonal shapes. During compacting next to such shapes, compacting next to the segments must be ensured without any damage or movement to the segments must be ensured. Vibration slabs are recommended.

During installation, gullies must be precisely located in both transversal and longitudinal direction, because the micro-slot segments' length cannot be altered in situ. The nominal length of basic 4 m segments with the rubber seal is 4,000 mm.

The openings at the beginning and end of the line must be closed and sealed using end caps supplied by CS-BETON.

CAUTION!

The „Important information" above includes only a few general rules for installing slot draining systems.

Use the hydraulic calculation provided below to evaluate the flow capacity of III-series slot drain systems.

CS-BETON provides consulting services to designers and architects using micro-slot drain solutions. We will evaluate your preliminary design in the context of the overall technical solution of the roads, surfaced areas and rainwater drainage of your project. We will confirm the proposed drainage solution, or recommend changes and specify recommended elements and their location within the system, including a recapitulation/BoQ for ordering purposes, along with list prices and the total price. All the above services are provided free of charge as a courtesy to our clients.

CS-BETON s.r.o. is not the responsible designer of your project's documentation or its part. According to Section 159 of the Act no.

CSB - SLOT DRAIN PROFILE VI

Hydraulic calculation:

1. Introduction
Profile VI slot drains are designed for drainage of water from surfaced areas such as roads, parking areas, logistic centres, airports, etc. They are intended for applications where quick draining of large areas with significant hydrological potential is expected.

2. Initial assumptions
The hydraulic design of a VI-slot system must always be based on the individual conditions at the given site, i.e. hydrogeology information, size, type and location of the catchment area. The capacity of the drainage system must then be calculated to reflect these conditions.

2.1 Geometrical characteristics
Profile VI slot drains are available with a constant flow profile and with a continuous or interrupted slot (30 mm wide). The system also includes cleaning and gully segments. This type of slot drain does not have a fixed maximum length of one line-individual parameters depend on the site conditions (slopes etc.). The distance between the beginning/end of the line and the first cleaning and/or gully segment should not exceed 6 m so that simple cleaning and maintenance is possible. Distances between individual cleaning gully segments depend on the maintenance and cleaning intervals. According to TP 152, the maximum distance is 50 m. The individual segments have a semicircular cross-section with an upper radius of 50 mm, lower radius of 200 mm and a 400 x 200 mm rectangle in between.

2.2 Hydrology information
For the hydraulic design of slot drain systems, the most important input parameter is the design rainfall volume, which is used to arrive to the total drained volume and the necessary number of gully segments. The design rainfall volume may be obtained, for instance, from the „Intenzity krátkodobých dešťů v povodích Labe, Odry a Moravy" (Josef Trupl) Table [1], or by ordering the information from the relevant Hydrometeorology Institute branch. Generally speaking, for VI Profile slot drain systems, ČSN 75 6101 (Stokové sítě a kanalizační přípojky) [2] specifies 15-minute rainfall with periodicity as per the type of area as the critical parameter. The same parameter is then used for the design of the storm sever.

2.3 Terrain location
For the most economical system, the slot drains should be located on the catchment area so that their capacity is used to maximum and the number of storm sewer connections is minimal. The ideal scenario is slot drains in the lowest part of the area and a sufficient gradient sloping toward that part. For VI Profile slot drain systems, the slope in the longitudinal direction must be at least 5 ‰. The draining capacity of course depends on the slope of the line. Nomographic chart 1 below lists the flow capacity of slot drains and the flow rate for that capacity in relation to the longitudinal gradient. The total capacity of the system must correspond to the catchment area and the design rainfall as per above. The intensity of the design rainfall is reduced as per [2] using a recommended draining coefficient, which depends on type of structures present, type of site and its sloping.

2.4 Terrain location
Connection of such slot drain lines to storm sewers uses a special reservoir tank with two DN 300 connection openings. The gully segments include support surfaces for two gully traps to protect the sewer connector from being blocked by debris. The gully segment is 2 m long.

3. Capacity flow through VI Profile slot drains
Calculation of the capacity of this system is based on the „Hydraulické tabulky stok" (Hydraulic tables: Sewage conduits by J. Herle, O. Štefan, J. Turi Nagy) [3]. The same method is also used to design sewage conduits. The roughness coefficient was assumed at n = 0.014 and velocity coefficient c was calculated as per Pavlovský. Our calculations do not assume (given the usual longitudinal sloping of up to 35 ‰) any aeration within the flow. The capacity itself was then calculated using the Chezy formula for gradients of 5 to 100 ‰ and the results were plotted in nomogram 1. The nomogram also shows flow speeds for the given flow rates. The calculation was only performed for VI profiles, i.e. with constant cross-section, because with such systems, variable distances between gully segments are used depending on the size of the area drained. A 20 m-long line of slot drains is capable (theoretically, see Chapter 5) of draining an area of approximately 24.500 sq. m, i.e. a 10 m-wide road segment 2.450 m long, which is sufficient for most applications. As far as the DN 300 gully connectors are concerned, their capacity must be evaluated at critical points, see Literature [3]. To prevent blocking by debris, all connectors should have a gradient of at least 20 ‰. With smaller gradients of the slot drain lines, the connector capacity may become the limiting factor for the whole system and larger connector diameters and/or gradients are recommended.

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VI

4. Example hydraulic calculation

This hydraulic calculation is based on theoretical input information. This specifies an application example involving Profile VI slot drains and an airport runway with a constant longitudinal gradient of 10 ‰.The road is in an area for which the hydrographical information is taken from data provided by he Roudnice nad Labem meteorological station. The segment which uses slot drains has a width of 40 m and a length of 900 m. The slot drains are installed at the edge of the road. The line includes one gully segment at the bottom end. The limiting parameter for the slot drain line is its cross-section at the bottom end. The road has a transversal gradient toward the slot drains of 25 ‰ and has a bitumen surface. Design rainfall intensity for T = 15 minutes and periodicity p = 1 is:

I_{NAV} = 112 [l/s.ha]

The run-off coefficient is:

φ = 0,80

the drained area is:

F = 40 x 900 x 0,0001 [ha] = 3,60 [ha]

after reduction by coefficient c = 0,80 the drained area is:

F_{RED} = φ x F [ha] = 0,80 x 3,60 = 2,88 [ha]

The design flow Q_{NAV} is:

$Q_{NAV} = F_{RED} \times I_{NAV}$ [l/s]
Q_{NAV} = 2,88 x 112
Q_{NAV} = 322,65 [l/s]

After comparing this value to the capacity of the slot drain from nomogram 1 for the gradient of 10‰, it is clear that:

Q_{KAP} = 369,96 [l/s] > Q_{NAV} = 322,56 [l/s]

Cleaning segments also have to be provided, with maximum spacing of 50 m.

CSB - SLOT DRAIN PROFILE VI

Nomograms:

5. Nomograms for preliminary design of drainage systems
For reference design of VI-profile draining systems, some calculation assumptions may be simplified. The average rainfall intensity for 15 minute rainfalls and periodicity of p = 1 for the Czech Republic (Labe basin) is:

I_{OR} = 122 [l/s.ha]

Since these slot-drains will not be used to drain water from unsurfaced areas, the average run-off coefficient c as per [2] is:

φ = 0,80

which is correct for concrete/bitumen surfaces with a gradient between 10 and 50 ‰.

With these specifications, the following nominal run-off may be assumed:

per 1 sq m of drained area:

Q_{OR} = 1 x 1 x 0,0001 x 0,8 x 122 = 0,00976 [l/s]

per 1 are, i.e. 100 sq. m:

Q_{OR} = 10 x 10 x 0,0001 x 0,8 x 122 = 0,976 [l/s]

per 1 hectare, i.e. 10,000 sq. m:

Q_{OR} = 100 x 100 x 0,0001 x 0,8 x 122 = 97,6 [l/s]

he relationship between design run-off and the drained area is shown in nomogram 2. for areas of 500 to 5000 sq m.

A comparison of the calculated run-off as per nomogram 2 with the capacity of the slot drain at the given gradient from nomogram 1 gives us enough information to specify the number of gully segments and to optimise the layout of the slot drain system.

6. Gully trap
Each gully contains two gully traps, which protect the storm sewer connections from being blocked by debris. The TP 152 recommends a distance between gully segments in a line of VI Profile slot drains of 40 to 50m, depending on the characteristics of the adjacent surfaced area.

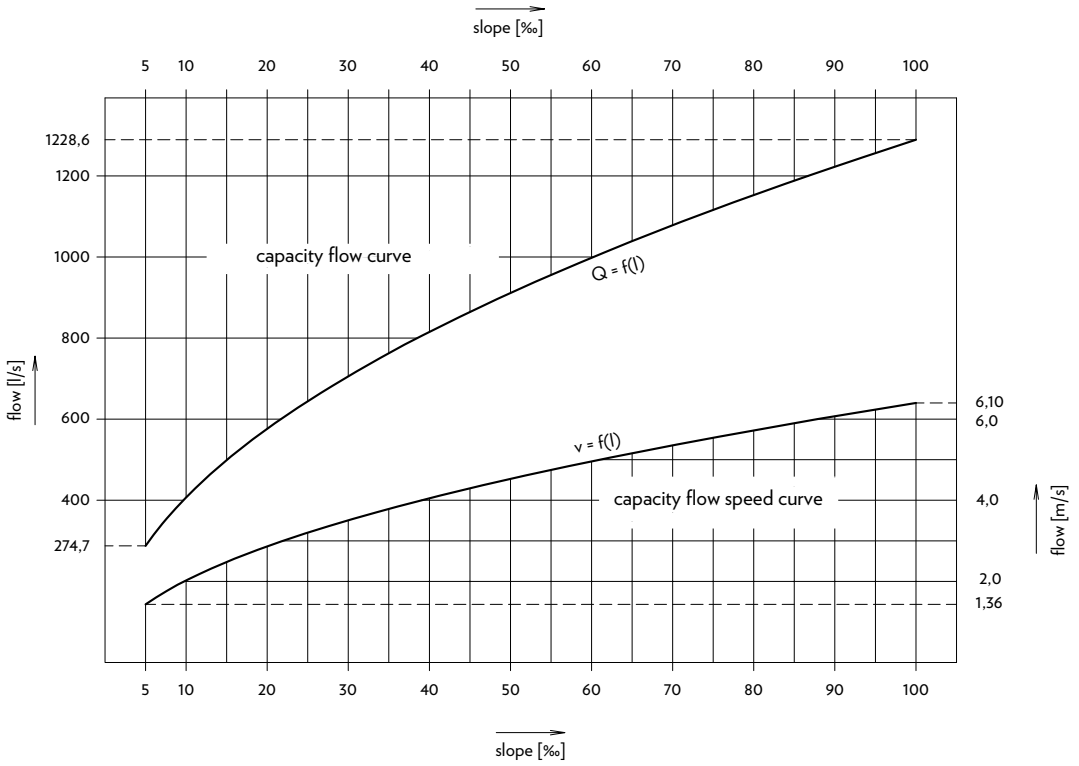
The gully trap has a height of 275 mm and a rectangular base of 325 x 145 mm. The shape is conical and fits the support elements within the gully segment. Filling openings are provided at the top of the narrower sides. The upper sides of the trap are 420 mm and 190 mm and a number of draining slots is provided below the filling openings. Every gully trap includes a holding rod for easy handling. Gully traps are made of 1.25 mm thick galvanised steel sheeting. The maximum flow rate through a gully trap is 21,20 l/s.

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VI

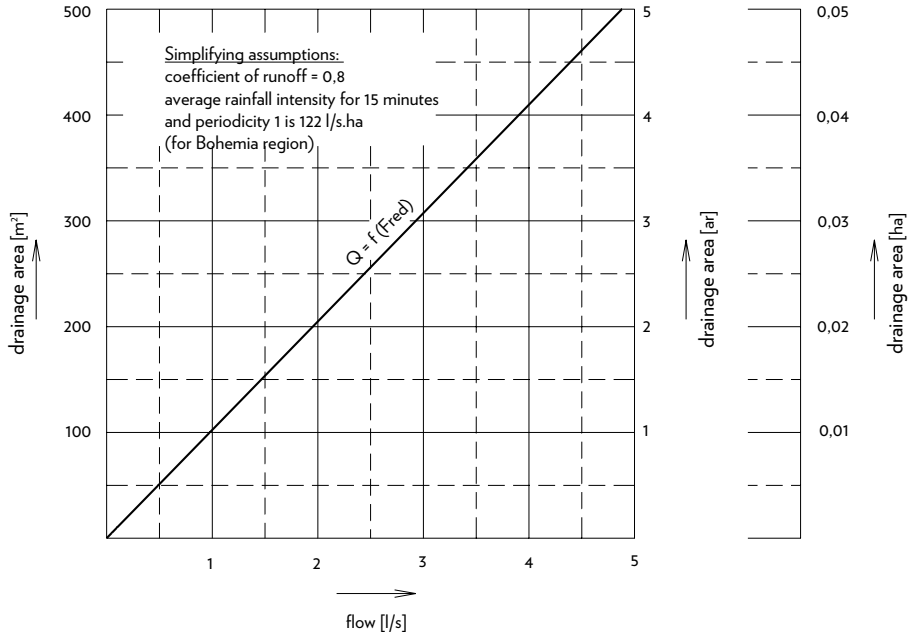
NOMOGRAM No. 1

CAPACITY OF SLOT CHANNELS (ROUGHNESS COEFFICIENT n = 0,014 - BY PAVLOVSKY)
PROFILE "VI"



NOMOGRAM No. 2

Determination of surface runoff from 500 to 5000 m²



CSB - SLOT DRAIN PROFILE VI

Input data:

The following literature has been used in designing the drainage system described in this brochure:

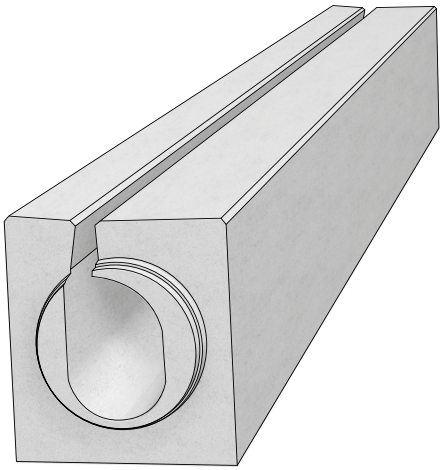
ČSN EN 1433 Odvodňovací žlábky pro dopravní a pěší plochy - konstrukční zásady zkoušení, označování, řízení jakosti
ČSN EN 206 Beton - specifikace, vlastnosti, výroba a shoda
DIN 19 580 Entwässerungsrinnen für Niederschlagswasserzum Einbau in Verkehrsflächen
ČSN 73 6056 Odstavné a parkovací plochy silničních vozidel
ČSN 73 6059 Servisy a opravny motorových vozidel. Čerpací stanice pohonných hmot
ČSN 73 6101 Projektování silnic a dálnic
ČSN 73 6110 Projektování místních komunikací
ČSN 73 6114 Vozovky pozemních komunikací
ČSN 75 6101 Stokové sítě a kanalizační přípojky
ČSN EN 124 Poklopy a vtokové mříže pro dopravní plochy
Vzorové listy staveb pozemních komunikací VL-1 Vozovky a krajnice, Ministry of Transport of the Czech republic, Dopravoprojekt
Vzorové listy staveb pozemních komunikací VL-2.2 Odvodnění, Ministry of Transport of the Czech republic, Dopravoprojekt
TKP 1 - Všeobecně
TKP 18 - betonové konstrukce (vč. 10 příloh)
TKP 31 - opravy betonových konstrukcí
TP 152 - Štěrbinové žlaby na PK, 2001, VPÚ-DECO
TP 170 - Navrhování vozovek PK (všeobecná část, katalog, návrhová metoda), 2004, VTU, Roadconsult
Technical documentation by CS-BETON Velké Žernoseky + VPÚ DECO 96-04
Company standard 7/99 Micro-slot drains as per DIN 19580, CSB
TPV 2/99 - Technologický předpis na montáž mikroštěrbinových trub, CSB
TPV 1/98 - Technologický předpis na opravy betonových prvků odvodňovacích systémů štěrbinových trub, CSB

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VII-0

Technical data:

Line drainage segments are similar to Profile I slot drains. In contrast, they have are offset slot. which ensures sufficient width on one side to apply traffic lane marking strips to the drain segments. These slot drain segments are especially suitable for tunnels and their surroundings. Profile VII-0 slot drains (continuous slot) are designed for D400 class traffic load and no transversal vehicle travel.



The system consists of the following components:

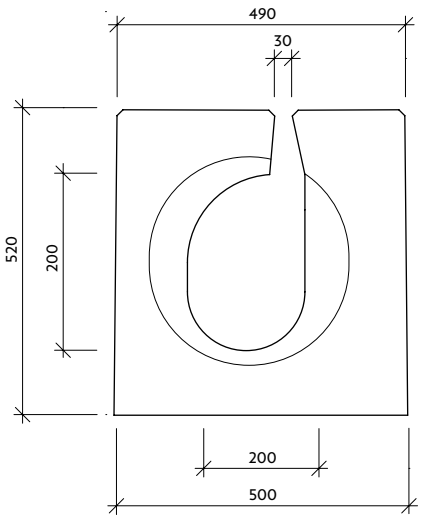
- 4 m-long continuous slot drain, with or without internal flow gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. cast iron grille
- Fire safety barrier (with siphon)
- End cap

		Nominal dimensions* mm			Quantity
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**
Slot drain with continuous slot	VII-0	520	2000	490/500	0,5
Slot drain with continuous slot, 0.5% flow profile bottom gradient	VII-0-G	520	2000	490/500	0,5
Fire safety barrier	VII-0-PP	950	2000	490/500	0,5
Basic gully assembly V0	VII-V0	520	1000	490/500	1
Gutter gully assembly VU	VII-VU	520	1000	490/500	1
Basic cleaning segment C0	VII-C0	520	1000	490/500	1
Top cleaning segment CS	VII-CS	520	1000	490/500	1
Spigot end cap	VII-ZU	520	120	490/500	-
Socket end cap	VII-ZZ	520	120	490/500	-

Nominal dimensions - basic shapes:

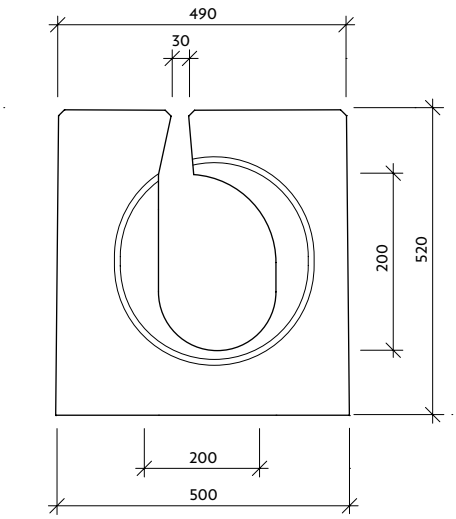
Side-view

Spigot



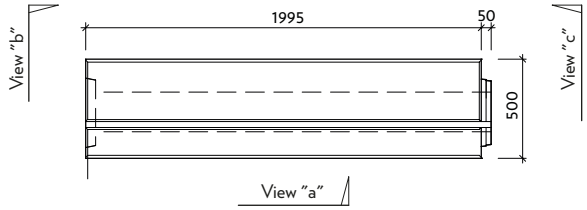
Side-view

Socket



CSB - SLOT DRAIN PROFILE VII-0

VII-0 left - Slot drain with asymmetrical slot drain

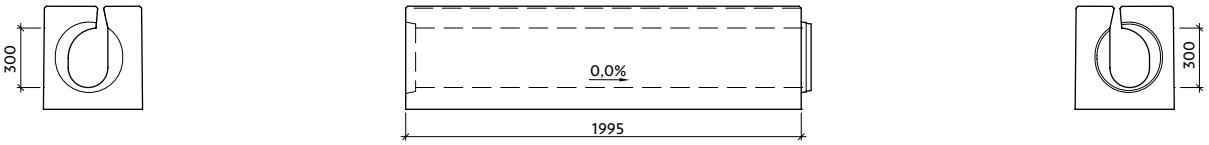


View "b" - Socket

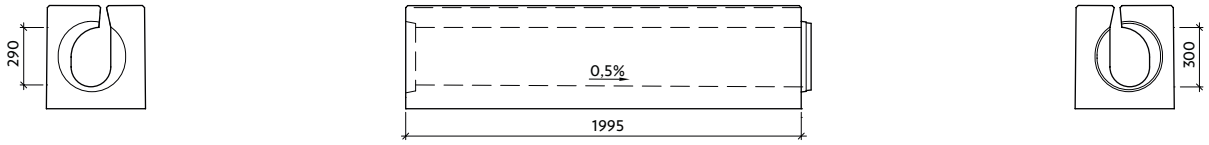
View "a"

View "c" - Spigot

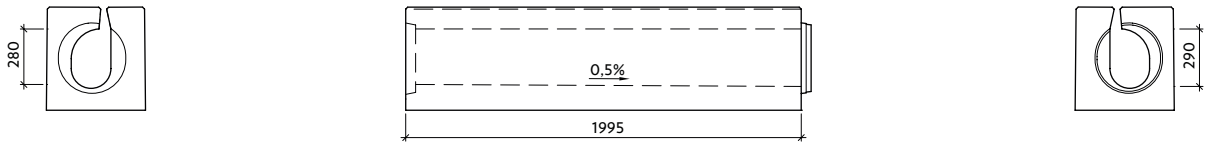
Profile VII-0-T30/30-L without internal flow gradient



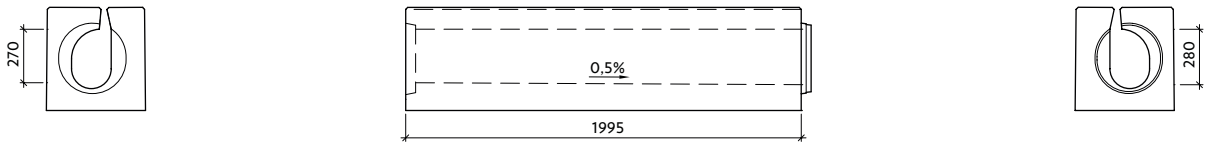
Profile VII-0-G29/30-L 0.5% flow profile bottom gradient



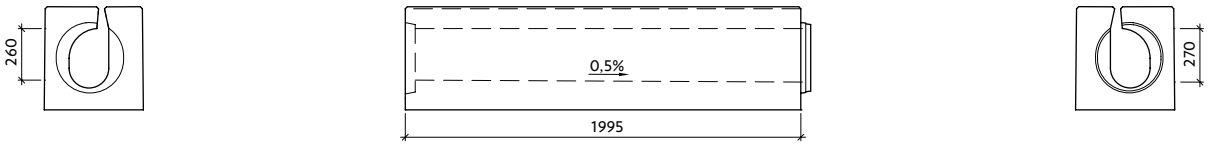
Profile VII-0-G28/29-L 0.5% flow profile bottom gradient



Profile VII-0-G27/28-L 0.5% flow profile bottom gradient



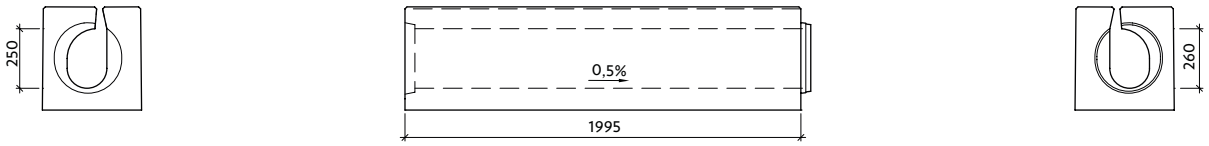
Profile VII-0-G26/27-L 0.5% flow profile bottom gradient



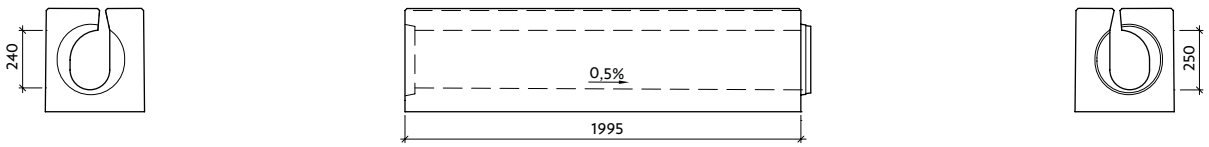
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VII-0

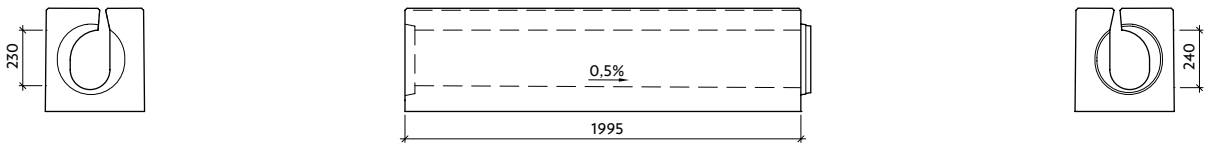
VII-0 left - Slot drain



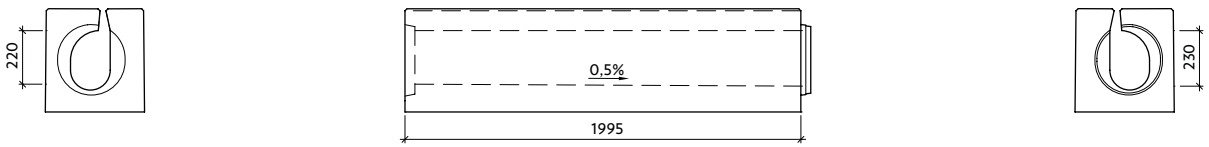
Profile VII-0-G24/25-L 0.5% flow profile bottom gradient



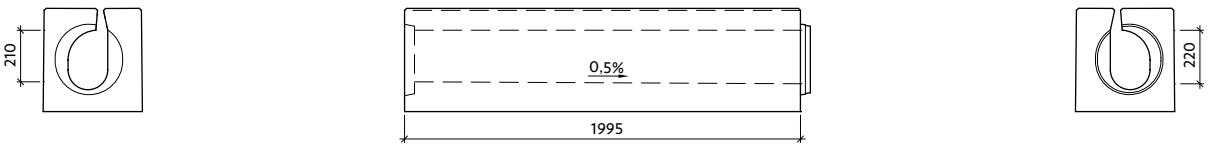
Profile VII-0-G23/24-L 0.5% flow profile bottom gradient



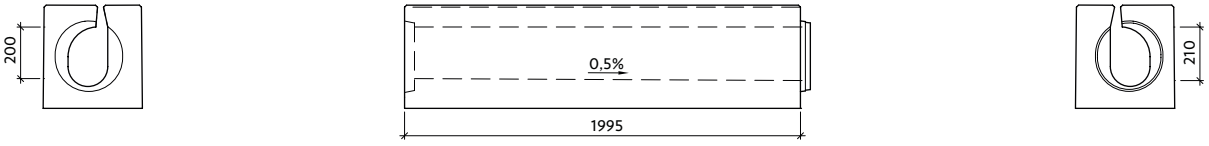
Profile VII-0-G22/23-L 0.5% flow profile bottom gradient



Profile VII-0-G21/22-L 0.5% flow profile bottom gradient

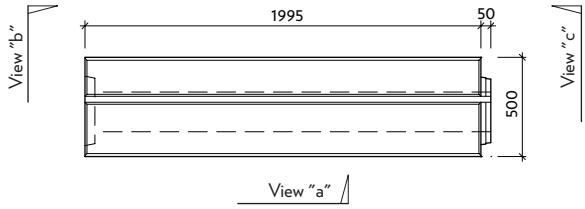


Profile VII-0-G20/21-L 0.5% flow profile bottom gradient



CSB - SLOT DRAIN PROFILE VII-0

VII-0 right - Slot drain with asymmetrical slot drain

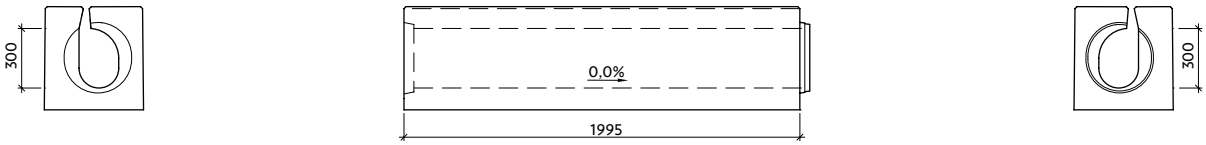


View "b" - Socket

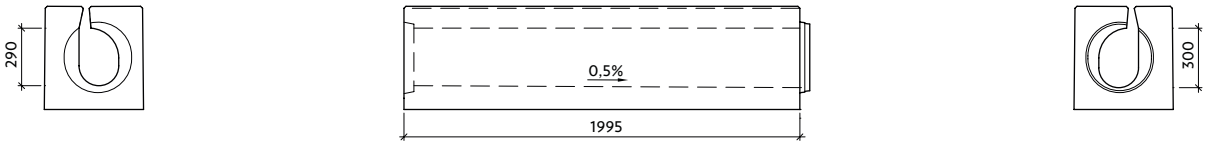
View "a"

View "c" - Spigot

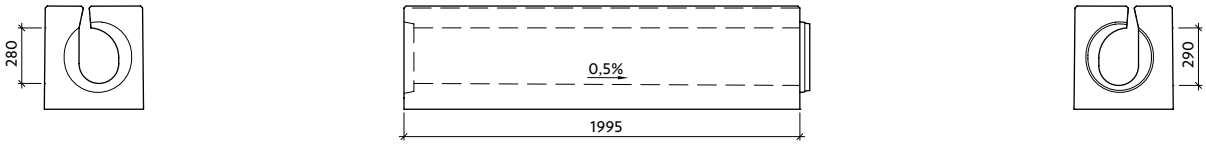
Profile VII-0-T30/30-P without internal flow gradient



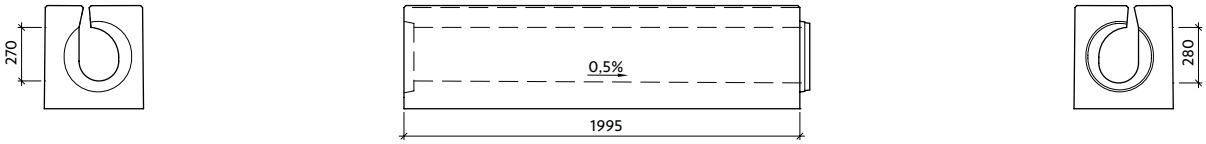
Profile VII-0-G29/30-P 0.5% flow profile bottom gradient



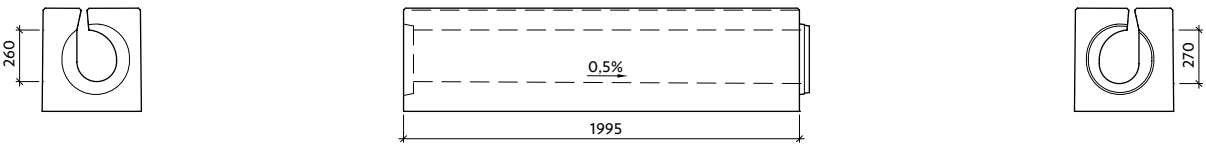
Profile VII-0-G28/29-P 0.5% flow profile bottom gradient



Profile VII-0-G27/28-P 0.5% flow profile bottom gradient



Profile VII-0-G26/27-P 0.5% flow profile bottom gradient

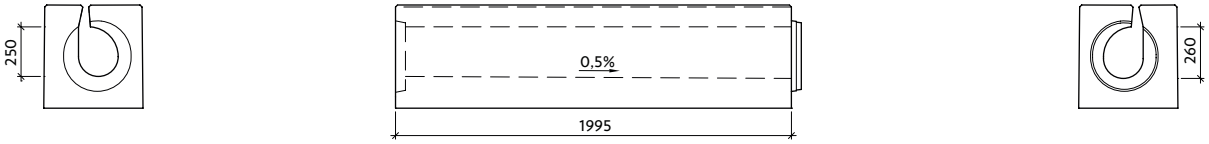


* Nominal dimensions include installation dimensions and/or minimum gap.

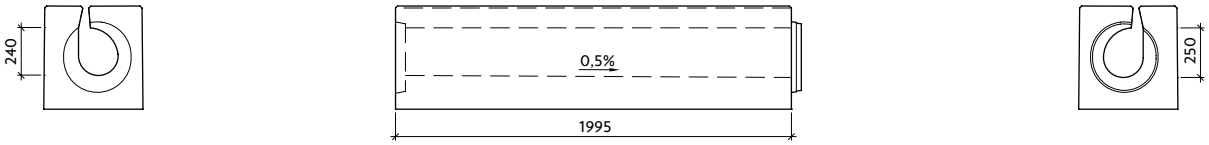
CSB - SLOT DRAIN PROFILE VII-0

VII-0 right - Slot drain

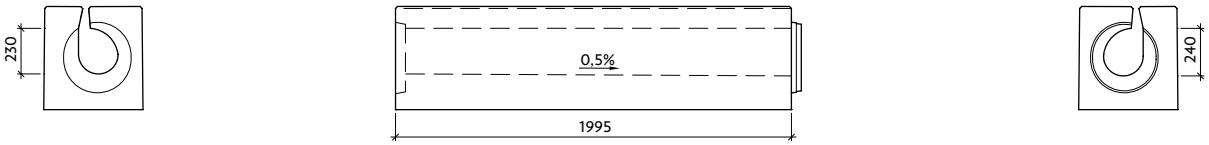
Profile VII-0-G25/26-P 0.5% flow profile bottom gradient



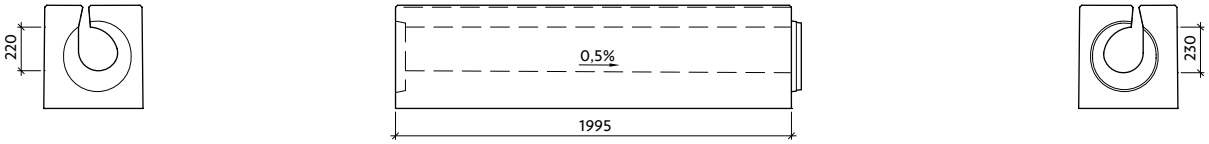
Profile VII-0-G24/25-P 0.5% flow profile bottom gradient



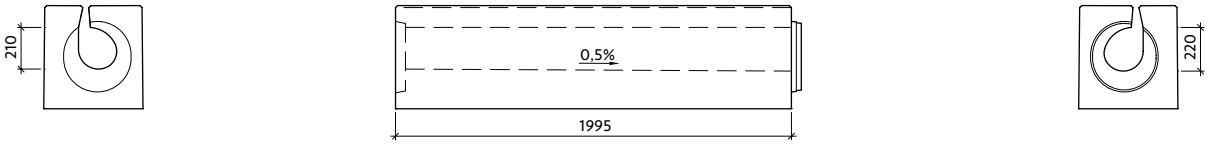
Profile VII-0-G23/24-P 0.5% flow profile bottom gradient



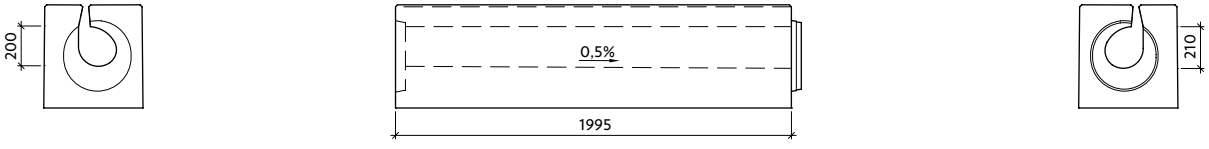
Profile VII-0-G22/23-P 0.5% flow profile bottom gradient



Profile VII-0-G21/22-P 0.5% flow profile bottom gradient



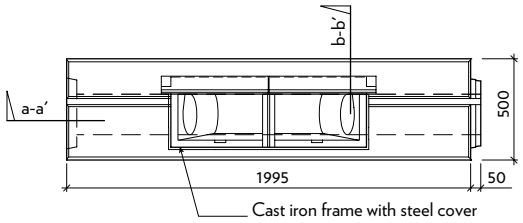
Profile VII-0-G20/21-P 0.5% flow profile bottom gradient



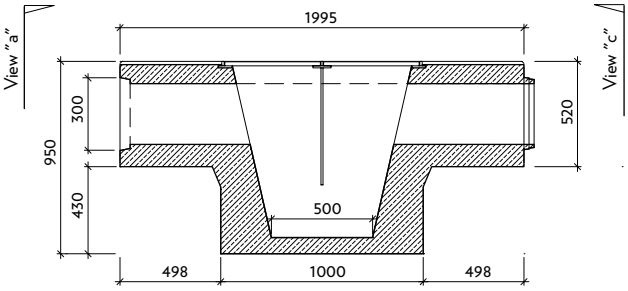
CSB - SLOT DRAIN PROFILE VII-0

VII-0-PP Fire safety barrier with steel cover for D400

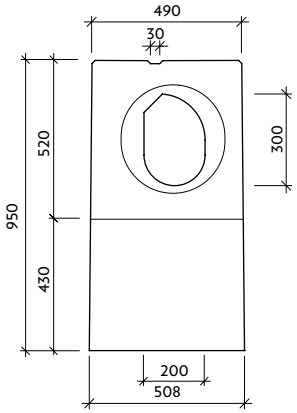
Plan



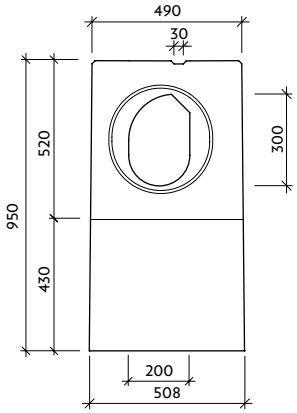
Cross-section: a-a´



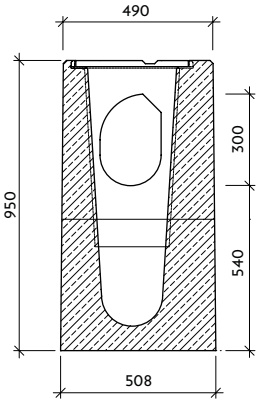
View "a" VII-0-PP-P - Socket



View "b" VII-0-PP-P - Spigot

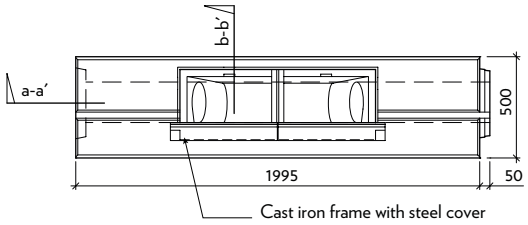


Cross-section: b-b´VII-0-PP-P

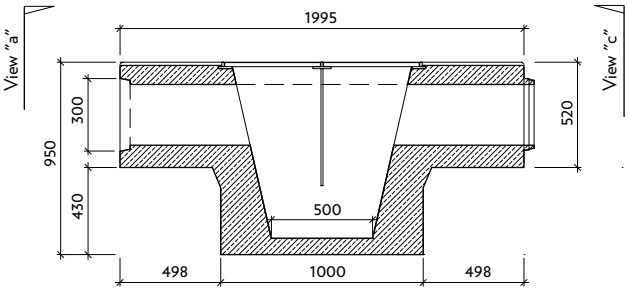


Profile VII-0-L - left - Fire safety barrier with steel cover for D400

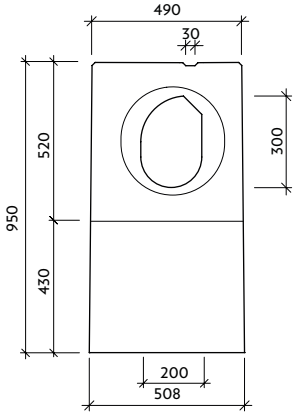
Plan



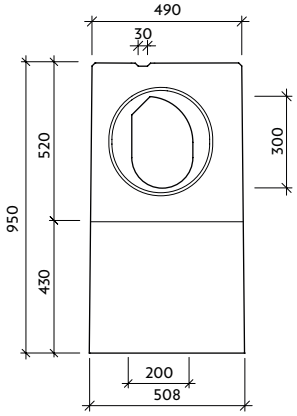
Cross-section: a-a´



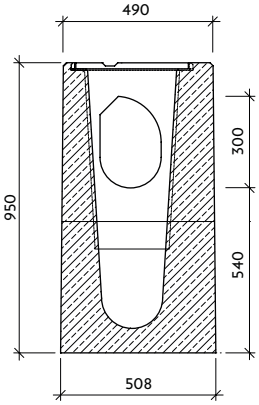
View "a" VII-0-PP-L - Socket



View "b" VII-0-PP-L - Spigot



Cross-section: b-b´VII-0-PP-L

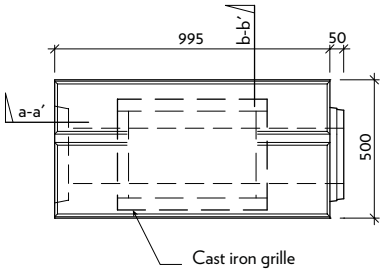


* Nominal dimensions include installation dimensions and/or minimum gap.

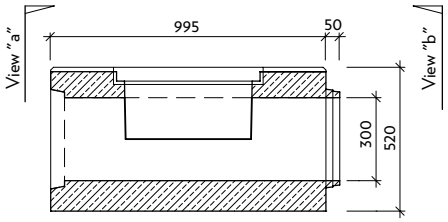
CSB - SLOT DRAIN PROFILE VII-0

VII-0-C0-P - right - Basic cleaning segment

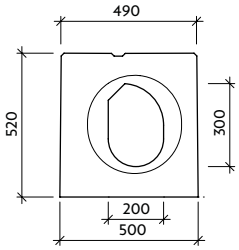
Plan



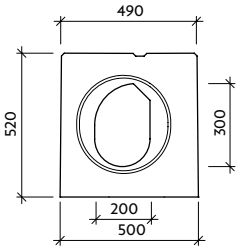
Cross-section: a-a´ VII-0-C0 - P



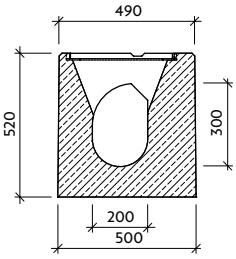
View "a" VII-0-C0-P - Socket



View "b" VII-0-C0-P - Spigot

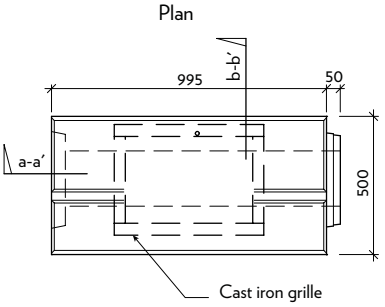


Cross-section: b-b´

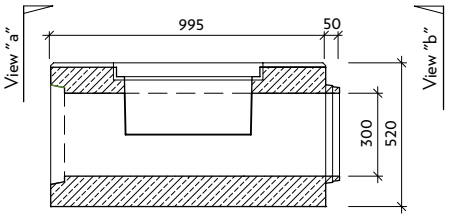


VII-0-C0-L - left - Basic cleaning segment

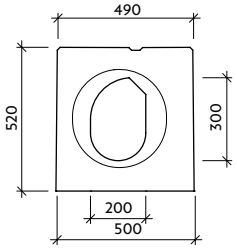
Plan



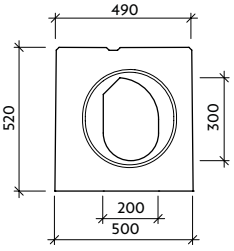
Cross-section: a-a´ VII-0-C0 - L



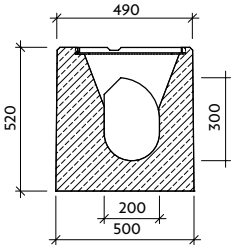
View "a" VII-0-C0-L - Socket



View "b" VII-0-C0-L - Spigot



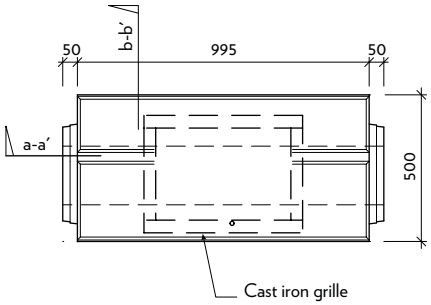
Cross-section: b-b´



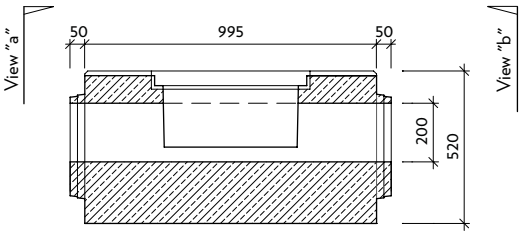
CSB - SLOT DRAIN PROFILE VII-0

VII-0-CS - Top cleaning segment

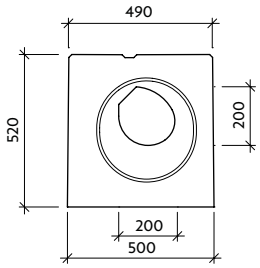
Plan



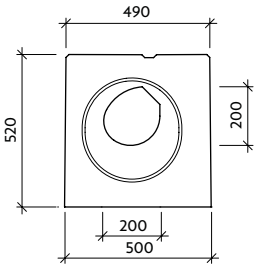
Cross-section: a-a´ VII-0-CS



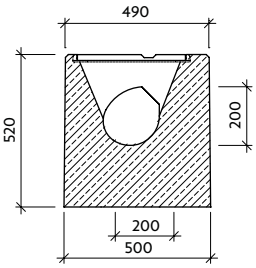
View "a" VII-0-CS - Spigot



View "b" VII-0-CS - Spigot

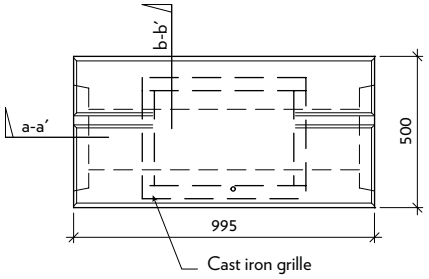


Cross-section: b-b´

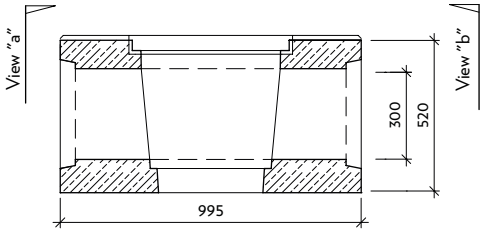


VII-0-VU - Gutter gully assembly

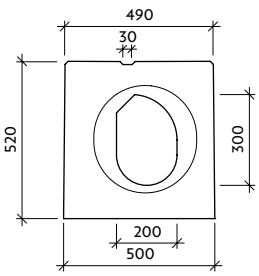
Plan



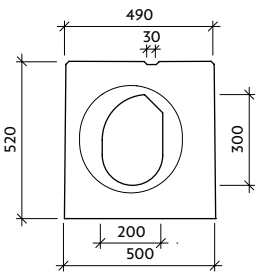
Cross-section: a-a´ VII-0-VU



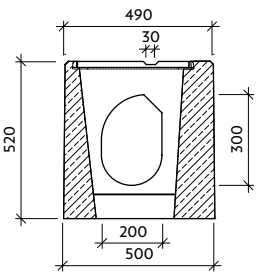
View "a" VII-0-VU - Socket



View "b" VII-0-VU - Socket



Cross-section: b-b´

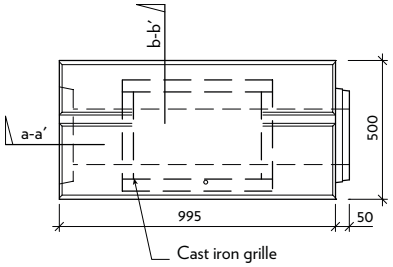


* Nominal dimensions include installation dimensions and/or minimum gap.

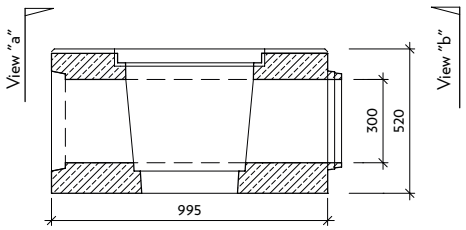
CSB - SLOT DRAIN PROFILE VII-0

VII-0-V0- right - Basic gully assembly

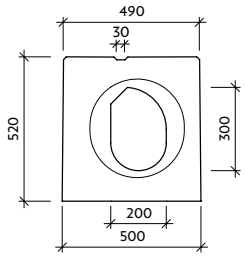
Plan



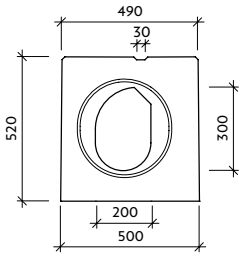
Cross-section: a-a´ VII-0-P



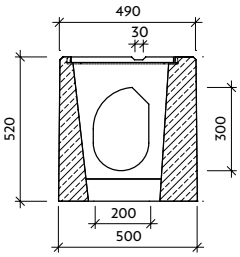
View "a" VII-0-V0-P - Socket



View "b" VII-0-V0-P - Spigot

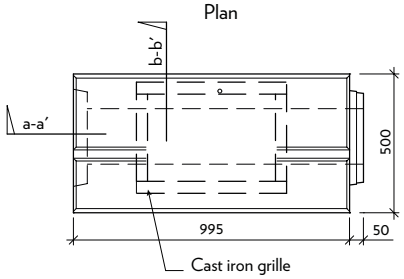


Cross-section: b-b´

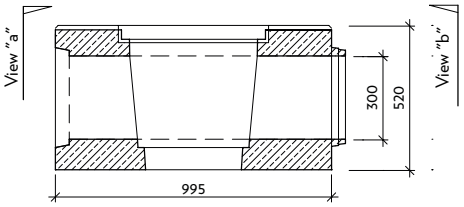


VII-0-L - left - Basic gully assembly

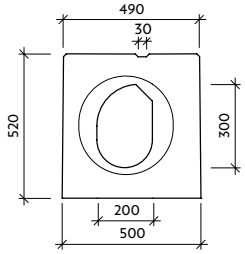
Plan



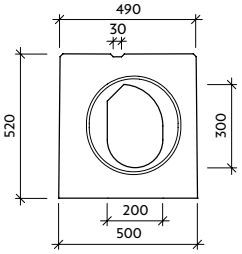
Cross-section: a-a´ VII-0-L



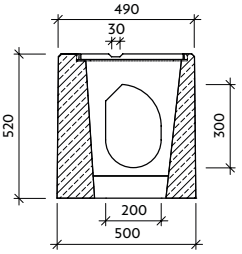
View "a" VII-0-V0-L - Socket



View "b" VII-0-V0-L - Spigot



Cross-section: b-b´

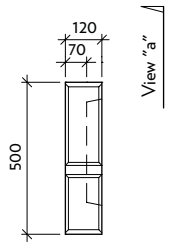


CSB - SLOT DRAIN PROFILE VII-0

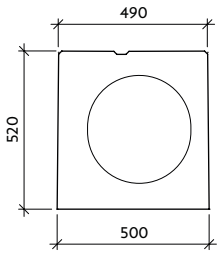
VII-0-ZZ Socket end cap

VII-0-ZZ-P right - Socket end cap

Plan

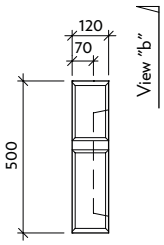


View "a" VII-0-ZZ-P

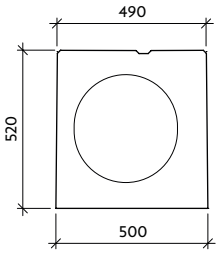


VII-0-ZZ-L left - Socket end cap

Plan



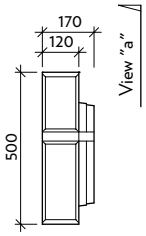
View "b" VII-0-ZZ-L



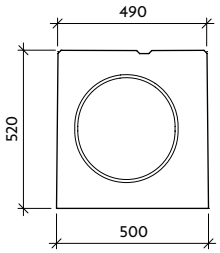
VII-0-ZU Spigot end cap

VII-0-ZU-P right - Socket end cap

Plan

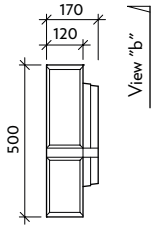


View "a" VII-0-ZU-P

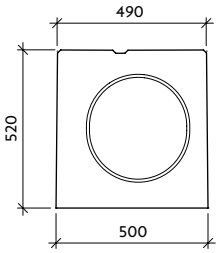


VII-0-ZU-L left - Socket end cap

Plan



View "a" VII-0-ZU-L

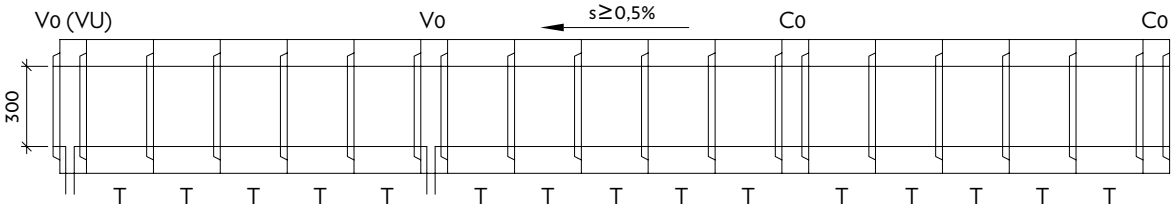


* Nominal dimensions include installation dimensions and/or minimum gap.

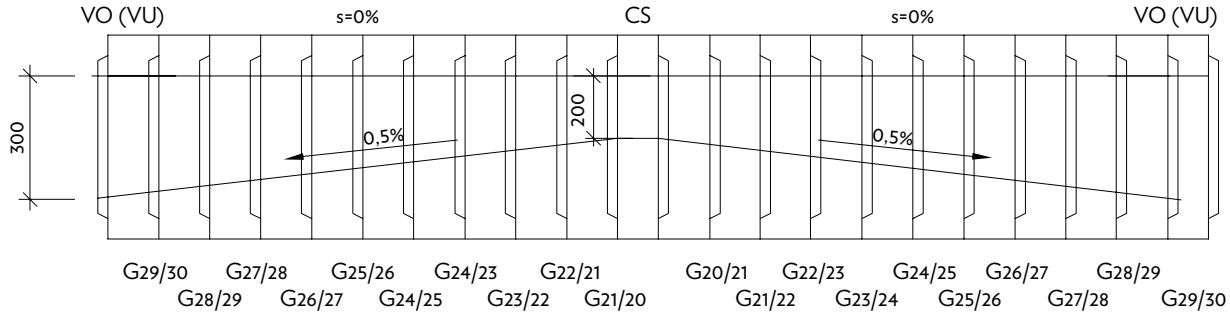
CSB - SLOT DRAIN PROFILE VII-0

Suggested layout

VII-0-T Slot drains - layout



VII-0-G Slot drains - layout



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends

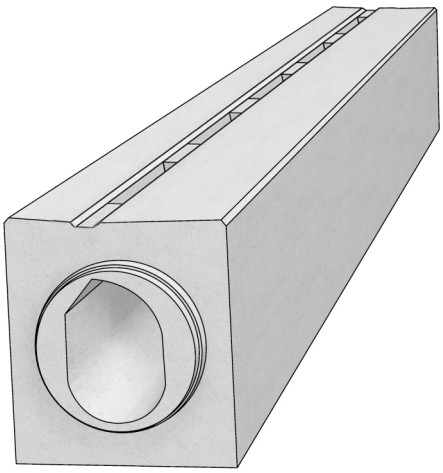
CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends

s – Longitudinal flow profile gradient

CSB - SLOT DRAIN PROFILE VII-1

Technical data:

Line drainage segments similar to Profile I slot drains, but have an offset slot which ensures sufficient width on one side to apply traffic lane marking strips to the drain segments. These slot drain segments are especially suitable for tunnels and their surroundings. Profile VII-1 slot drains are designed for D400 class traffic loads and transversal vehicle travel. Interrupted slot improves stability under transversal loads.



The system consists of the following components:

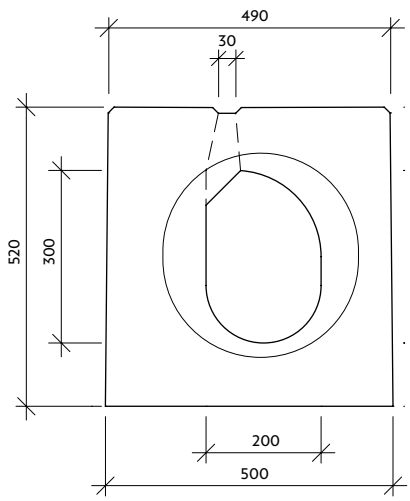
- 4 m-long slot drains with interrupted slots, with or without internal gradient
- Complete gully assembly incl. steel cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. plastic cover/cast iron grille
- Fire safety barrier (with siphon)
- End cap

		Nominal dimensions* mm			Quantity
Name	**Order code**	**Basic height**	**Length**	**Width**	**pcs/m**
Slot drain with asymmetrical interrupted slot	VII-1	520	2000	490/500	0,5
Slot drain with interrupted slot, 0.5% flow profile bottom gradient	VII-1-G	520	2000	490/500	0,5
Special 0 cm kerbstone	VII-1-O	160/174	2000	490/500	0,5
Special 7 cm kerbstone	VII-2-O	230/160	2000	493/490	0,5
Fire safety barrier	VII-0-PP	950	2000	490/500	0,5
Basic gully assembly V0	VII-V0	520	1000	490/500	1
Gutter gully assembly VU	VII-VU	520	1000	490/500	1
Basic cleaning segment C0	VII-C0	520	1000	490/500	1
Top cleaning segment CS	VII-CS	520	1000	490/500	1
Spigot end cap	VII-ZU	520	120	490/500	-
Socket end cap	VII-ZZ	520	120	490/500	-

Nominal dimensions - basic shapes:

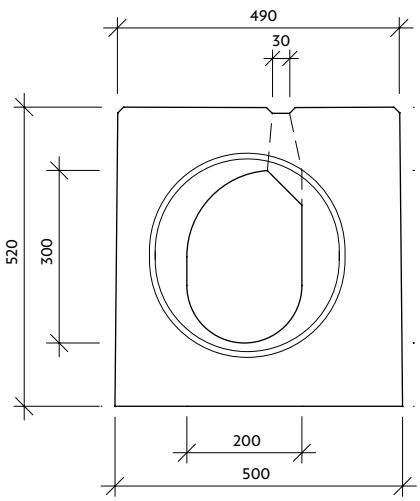
Side-view

Spigot



Side-view

Socket

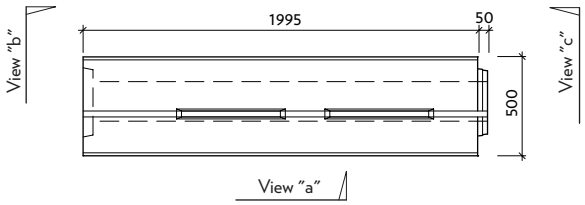


* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VII-1

VII-1 left - Slot drain with asymmetrical slot drain

Plan

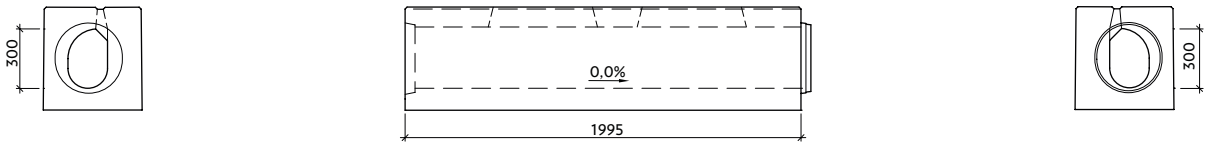


View "b" - Socket

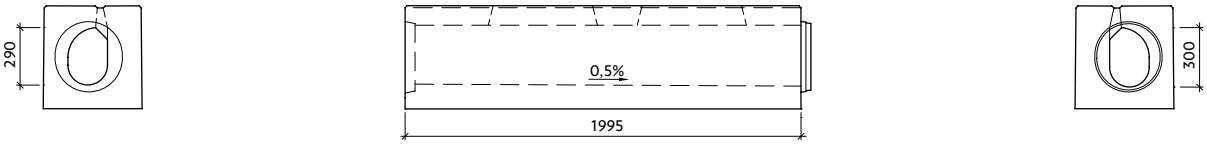
View "a"

View "c" - Spigot

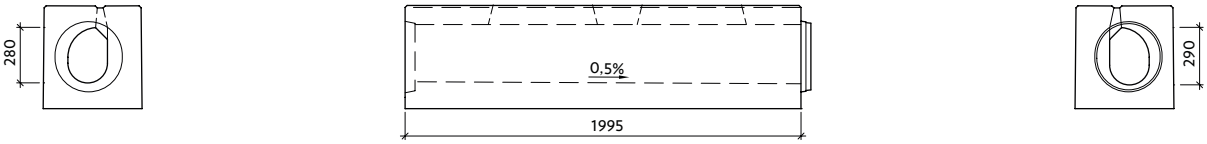
Profile VII-1-T30/30-L without internal flow gradient



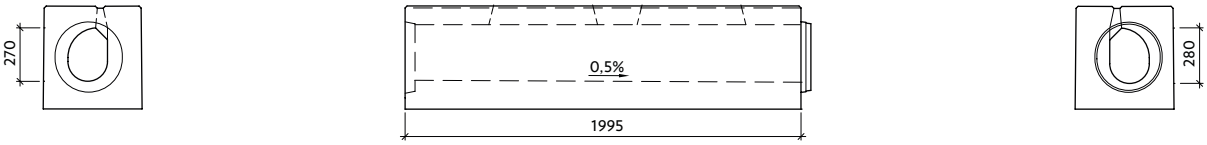
Profile VII-1-G29/30-L 0.5% flow profile bottom gradient



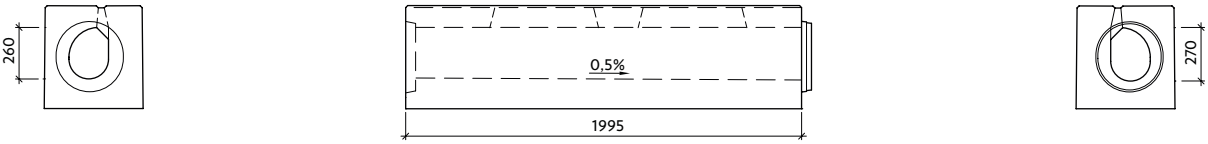
Profile VII-1-G28/29-L 0.5% flow profile bottom gradient



Profile VII-1-G27/28-L 0.5% flow profile bottom gradient



Profile VII-1-G26/27-L 0.5% flow profile bottom gradient



CSB - SLOT DRAIN PROFILE VII-1

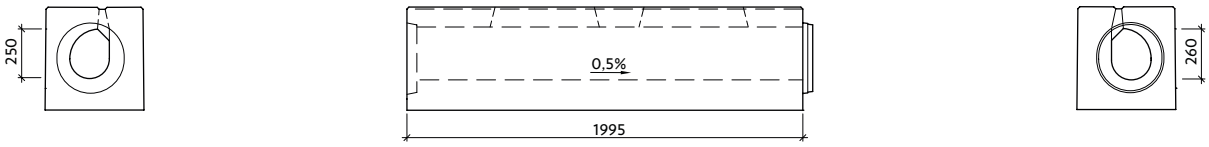
VII-1 left - Slot drain with asymmetrical slot drain

View"b" - Socket

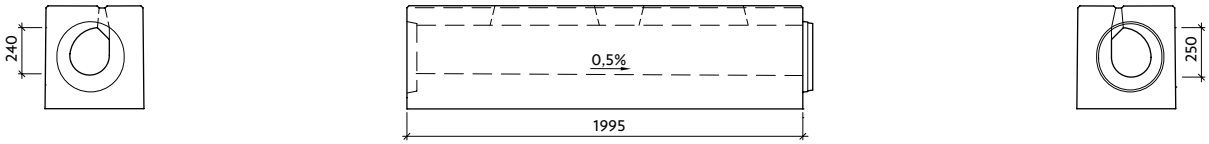
View "a"

View "c" - Spigot

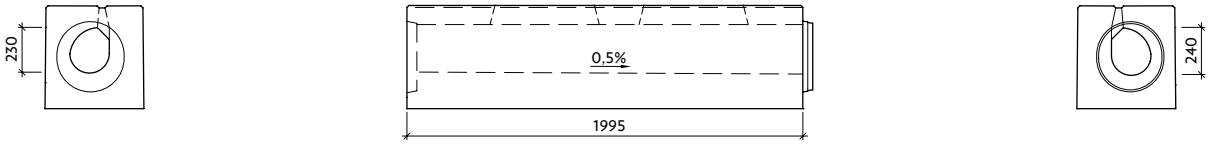
Profile VII-1-G25/26-L 0.5% flow profile bottom gradient



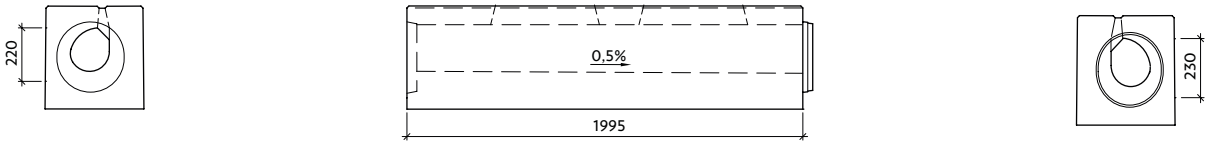
Profile VII-1-G24/25-L 0.5% flow profile bottom gradient



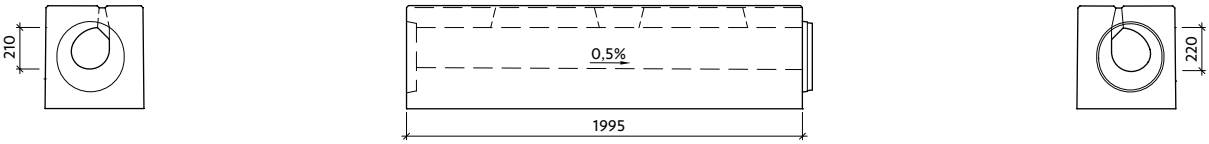
Profile VII-1-G23/24-L 0.5% flow profile bottom gradient



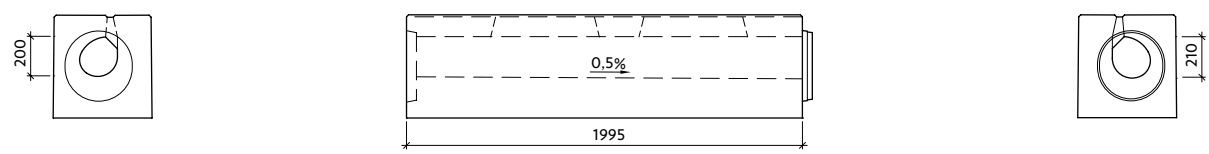
Profile VII-1-G22/23-L 0.5% flow profile bottom gradient



Profile VII-1-G21/22-L 0.5% flow profile bottom gradient



Profile VII-1-G20/21-L 0.5% flow profile bottom gradient

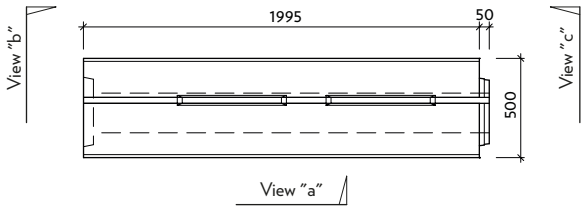


* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VII-1

VII-1 right - Slot drain

Plan

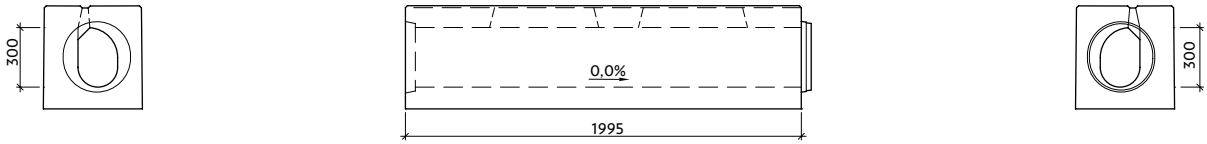


View "b" - Socket

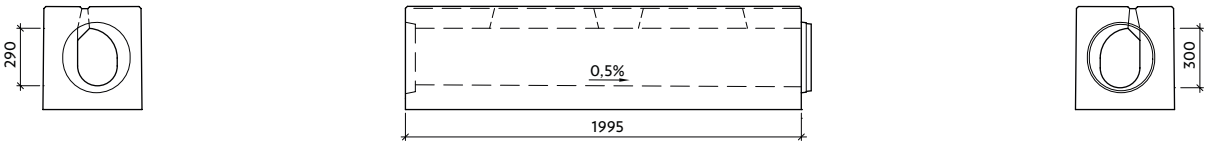
View "a"

View "c" - Spigot

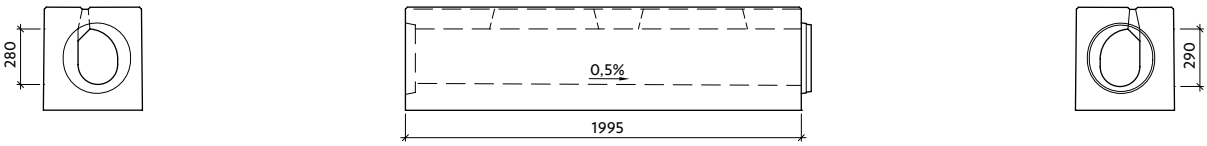
Profile VII-1-T30/30-P without internal flow gradient



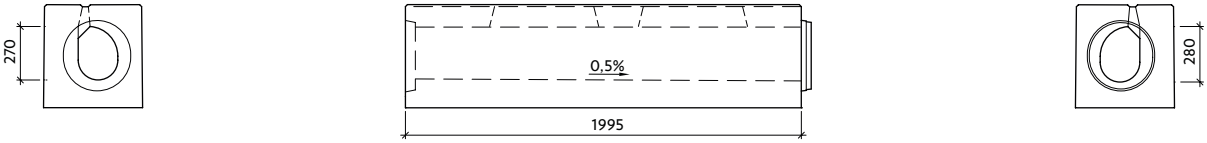
Profile VII-1-G29/30-P 0.5% flow profile bottom gradient



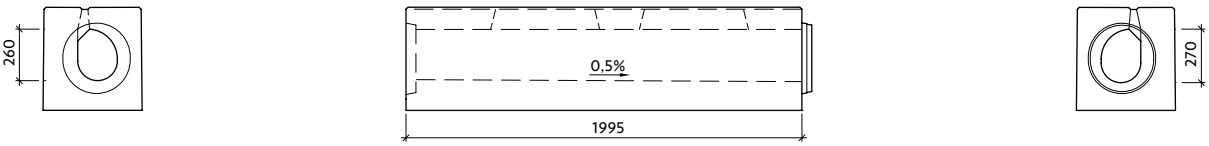
Profile VII-1-G28/29-P 0.5% flow profile bottom gradient



Profile VII-1-G27/28-P 0.5% flow profile bottom gradient



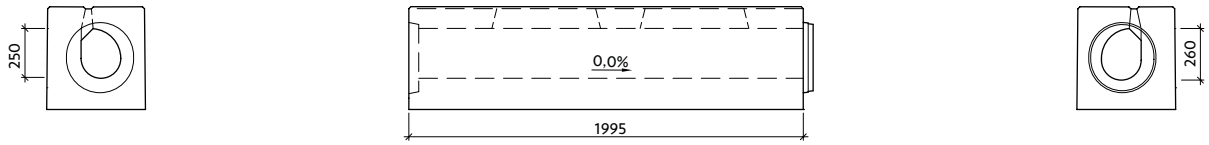
Profile VII-1-G26/27-P 0.5% flow profile bottom gradient



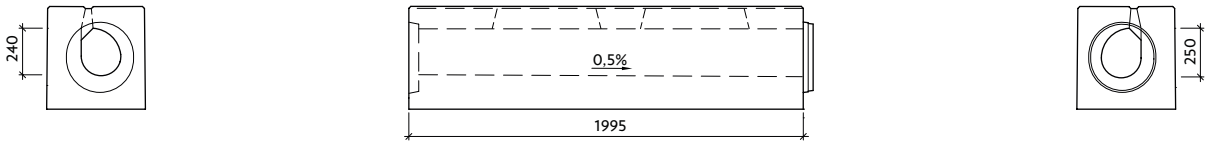
CSB - SLOT DRAIN PROFILE VII-1

VII-1 right - Slot drain

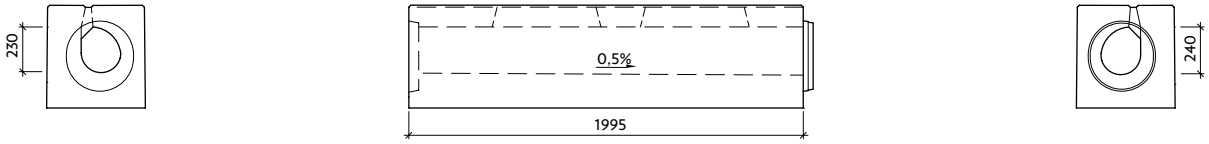
Profile VII-1-G25/26-P without internal flow gradient



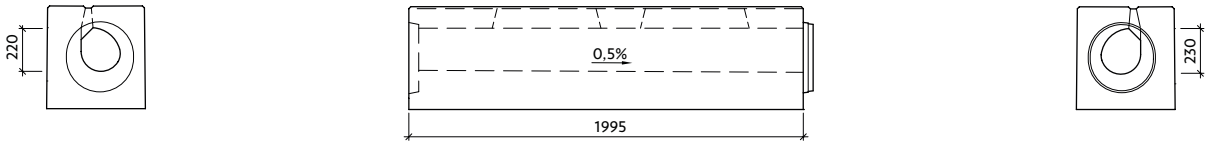
Profile VII-1-G24/25-P 0.5% flow profile bottom gradient



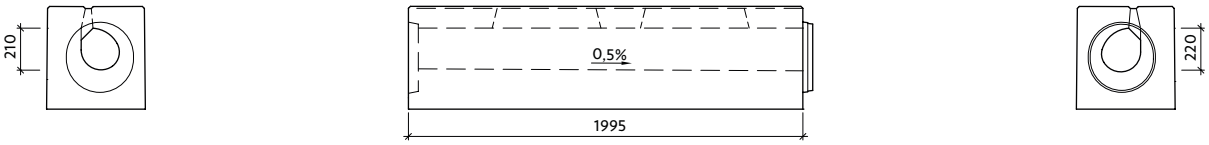
Profile VII-1-G23/24-P 0.5% flow profile bottom gradient



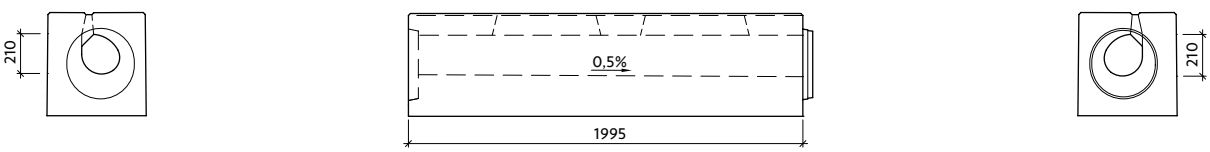
Profile VII-1-G22/23-P 0.5% flow profile bottom gradient



Profile VII-1-G21/22-P 0.5% flow profile bottom gradient



Profile VII-1-G20/21-P 0.5% flow profile bottom gradient

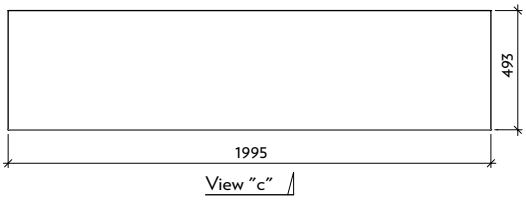


* Nominal dimensions include installation dimensions and/or minimum gap.

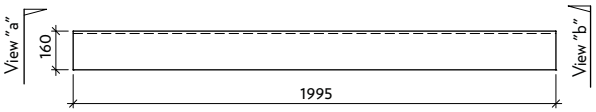
CSB - SLOT DRAIN PROFILE VII-1

Profile VII-1 - Special 0 cm kerbstone

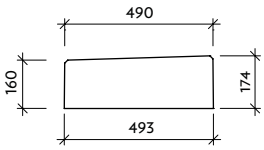
Plan



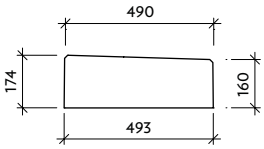
View "c"



View "a" VII-1-O

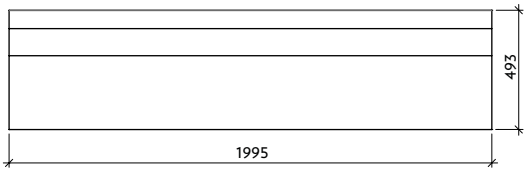


View "b" VII-1-O

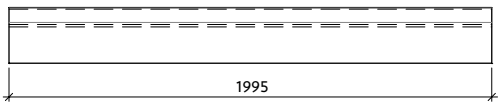


Profile VII-2 - Special 7 cm kerbstone

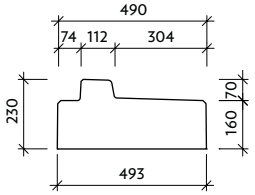
Plan



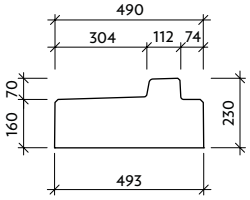
View "c"



View "a" VII-2-O



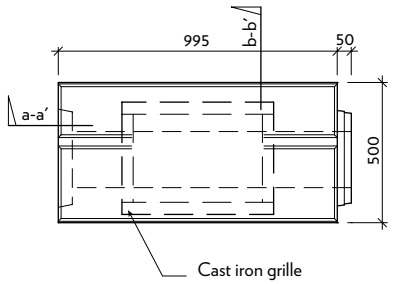
View "b" VII-2-O



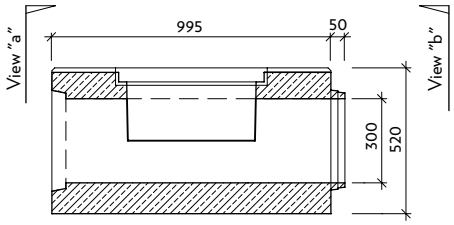
CSB - SLOT DRAIN PROFILE VII-1

VII-I-C0 right - Basic cleaning segment

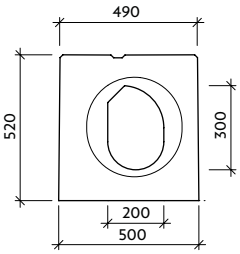
Plan



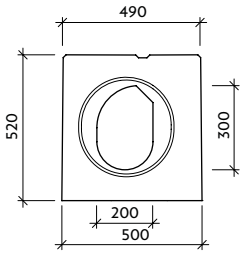
Cross-section: a-a´ VII-1-C0-P



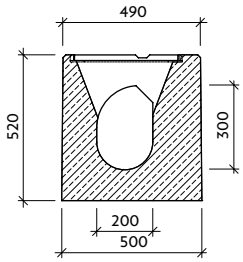
View "a" VII-1-C0-P - Socket



View "b" VII-1-C0-P - Spigot

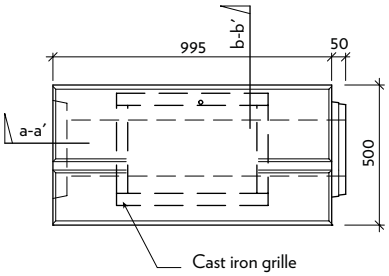


Cross-section: b-b´

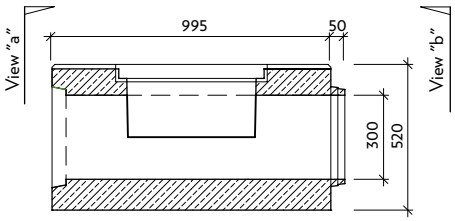


VII-I-C0 left - Basic cleaning segment

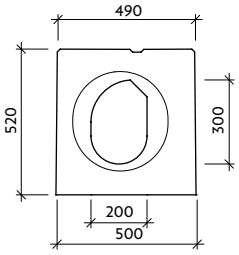
Plan



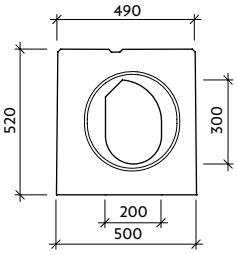
Cross-section: a-a´VII-1-C0-L



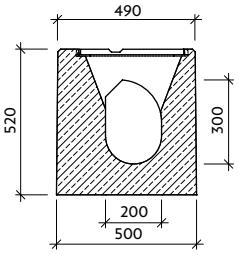
View "a" VII-1-C0-L - Socket



View "b" VII-1-C0-L - Spigot



Cross-section: b-b´

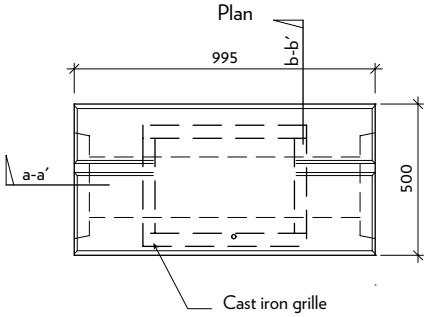


* Nominal dimensions include installation dimensions and/or minimum gap.

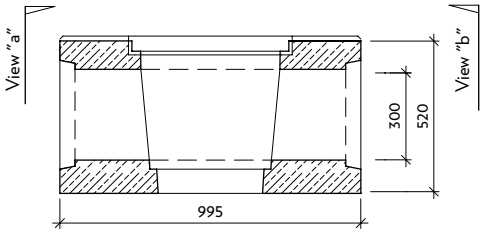
CSB - SLOT DRAIN PROFILE VII-1

VII-I-VU Gutter gully assembly

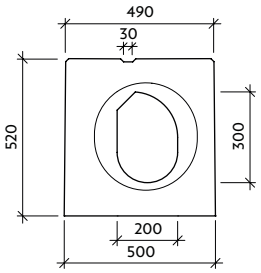
Plan



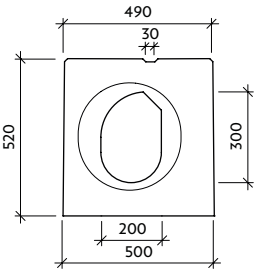
Cross-section: a-a´ VII-1-VU



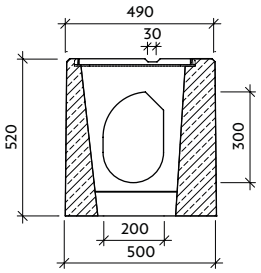
View "a" VII-1-VU - Socket



View "b" VII-1-VU - Socket

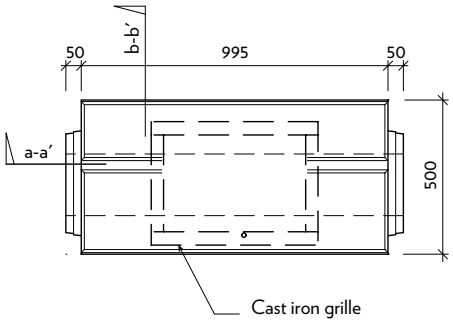


Cross-section: b-b´

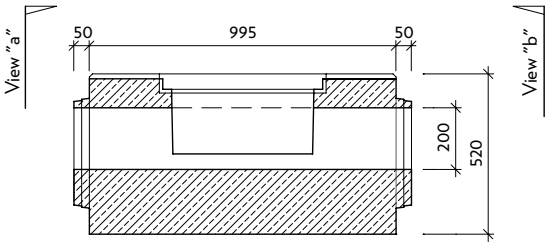


VII-I-CS Top cleaning segment

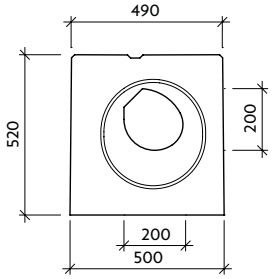
Plan



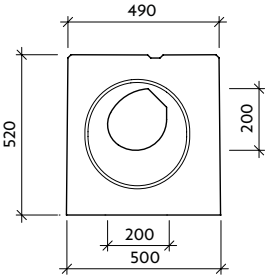
Cross-section: a-a´ VII-1-CS



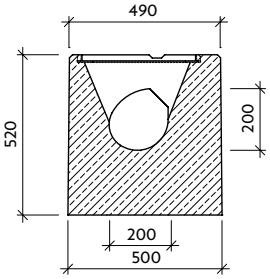
View "a" VII-1-CS - Spigot



View "b" VII-1-CS - Spigot



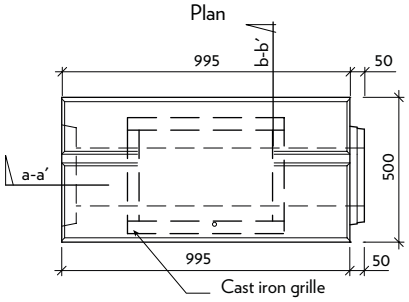
Cross-section: b-b´



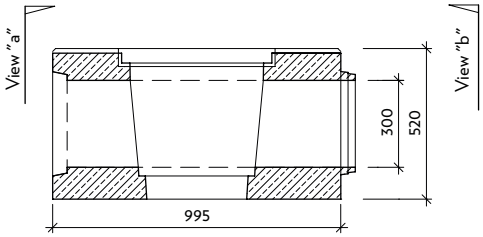
CSB - SLOT DRAIN PROFILE VII-1

VII-I-V0 - left - Basic gully assembly

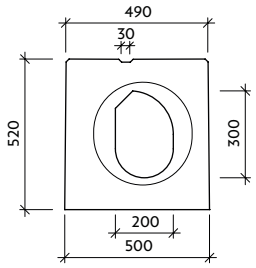
Plan



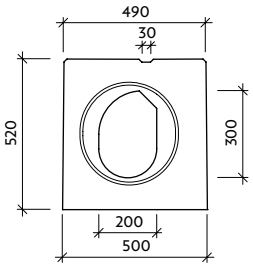
Cross-section: a-a´ VII-1-V0-P



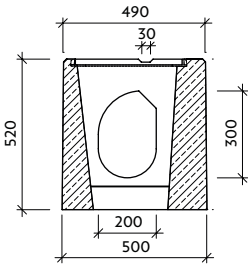
View "a" VII-1-V0-P - Socket



View "b" VII-1-V0-P - Spigot

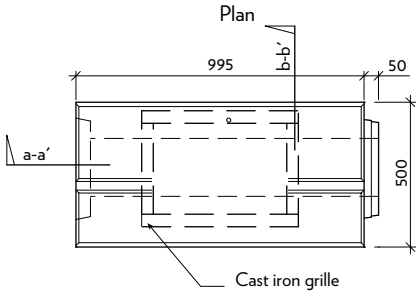


Cross-section: b-b´

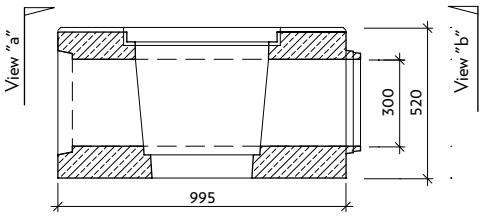


Profile VII-1-V0-L left - Basic gully assembly

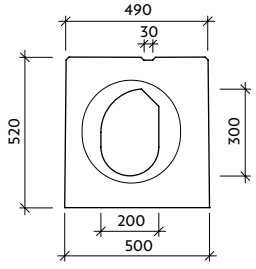
Plan



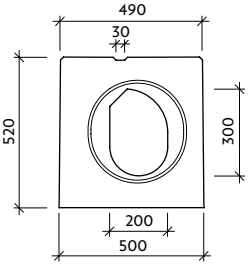
Cross-section: a-a´ VII-1-V0-L



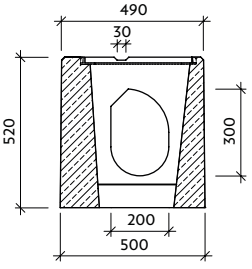
View "a" VII-1-V0-L - Socket



View "b" VII-1-V0-L - Spigot



Cross-section: b-b´

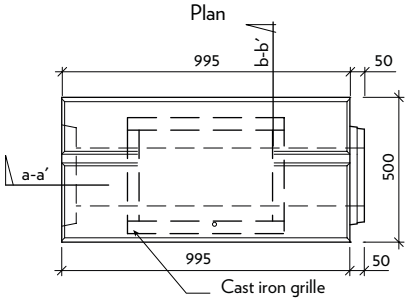


* Nominal dimensions include installation dimensions and/or minimum gap.

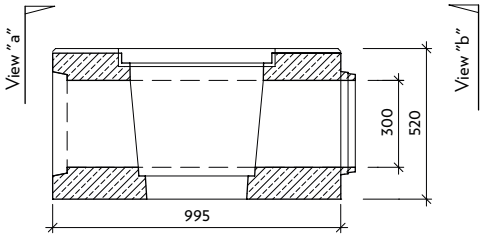
CSB - SLOT DRAIN PROFILE VII-1

VII-I-V0 - left - Basic gully assembly

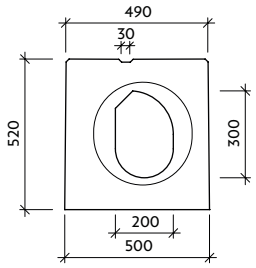
Plan



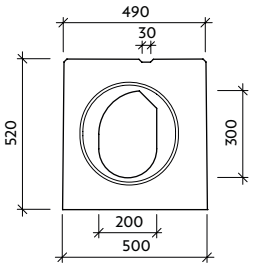
Cross-section: a-a´ VII-1-V0-P



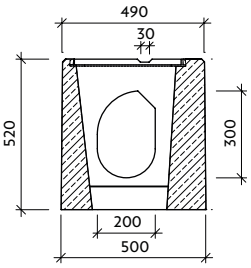
View "a" VII-1-V0-P - Socket



View "b" VII-1-V0-P - Spigot

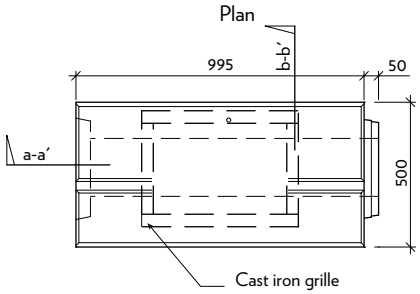


Cross-section: b-b´

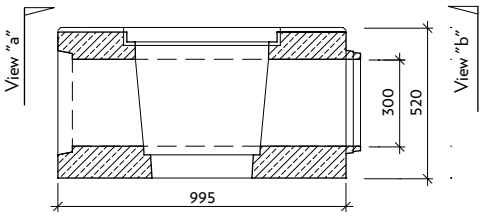


Profile VII-1-V0-L left - Basic gully assembly

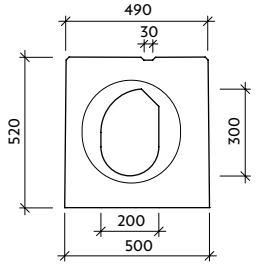
Plan



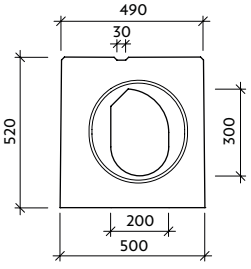
Cross-section: a-a´ VII-1-V0-L



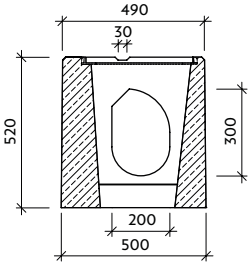
View "a" VII-1-V0-L - Socket



View "b" VII-1-V0-L - Spigot



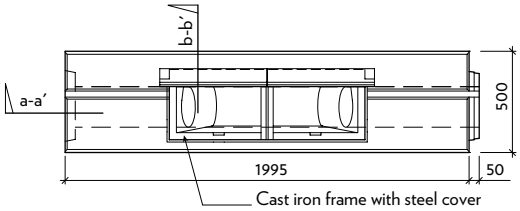
Cross-section: b-b´



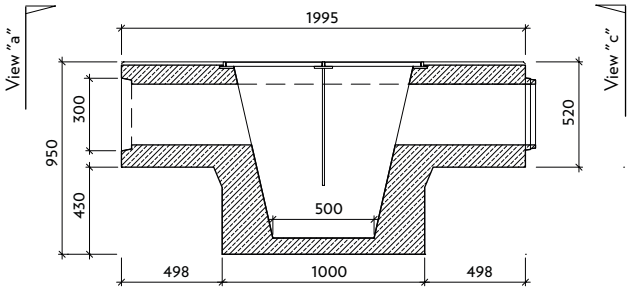
CSB - SLOT DRAIN PROFILE VII-1

VII-I-PP bezpečnostní protipožární uzávěra

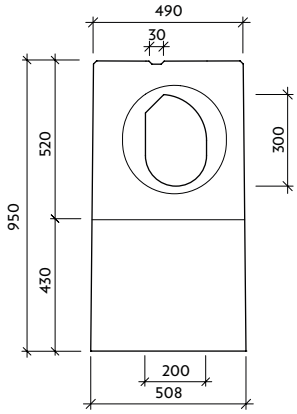
Plan



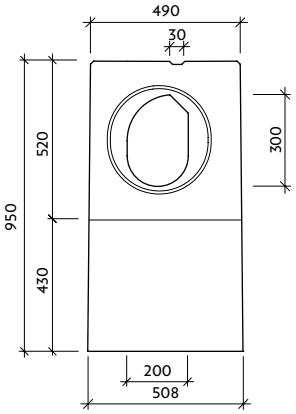
Cross-section: a-a´



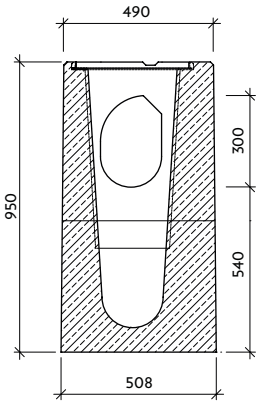
View "a" VII-1-PP-P - Socket



View "b" VII-1-PP-P - Spigot

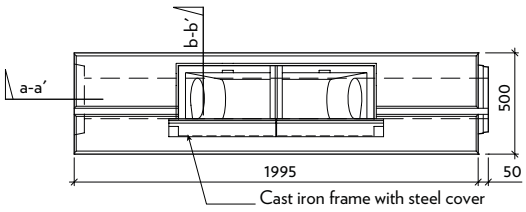


Cross-section: b-b´

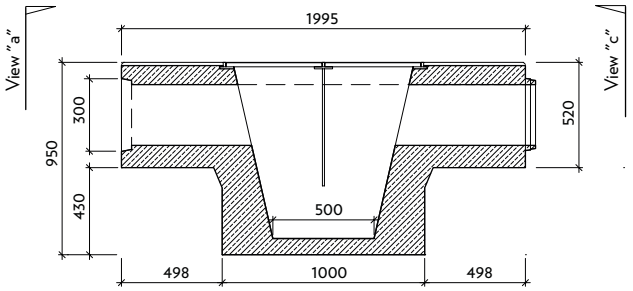


Profile VII-1-L left - Fire safety barrier

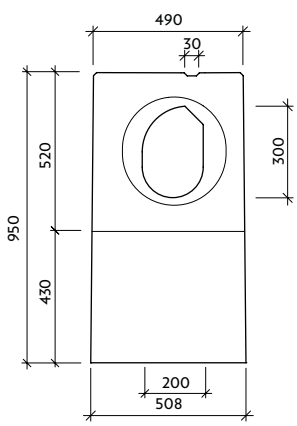
Plan



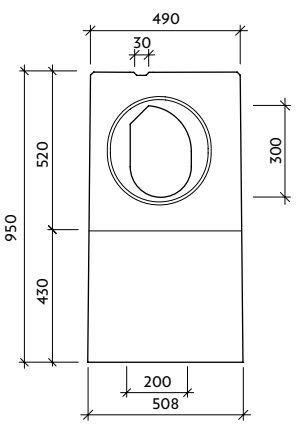
Cross-section: a-a´



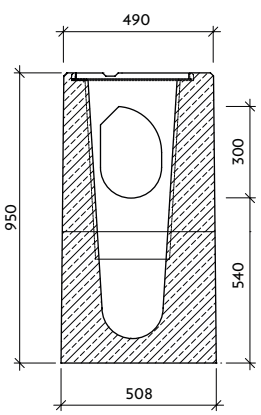
View "a" VII-1-PP-L - Socket



View "b" VII-1-PP-L - Spigot



Cross-section: b-b´

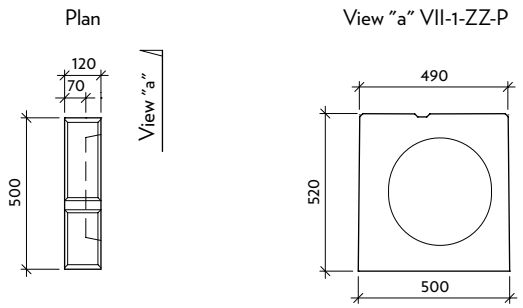


* Nominal dimensions include installation dimensions and/or minimum gap.

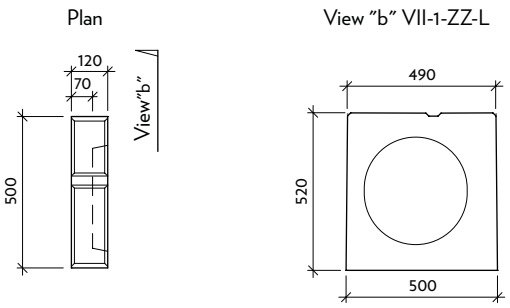
CSB - SLOT DRAIN PROFILE VII-1

VII-I - záslepka

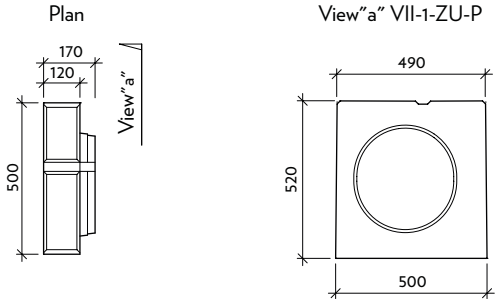
VII-1-ZZ-P right - Socket end cap



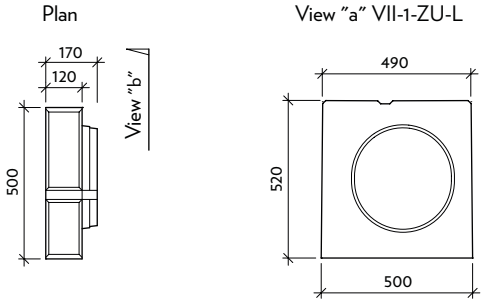
VII-1-ZZ-L left - Socket end cap



VII-1-ZU-P right - Spigot end cap

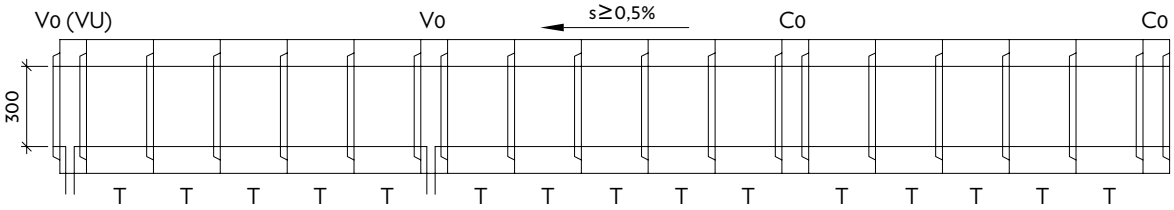


VII-1-ZU-L left - Spigot end cap

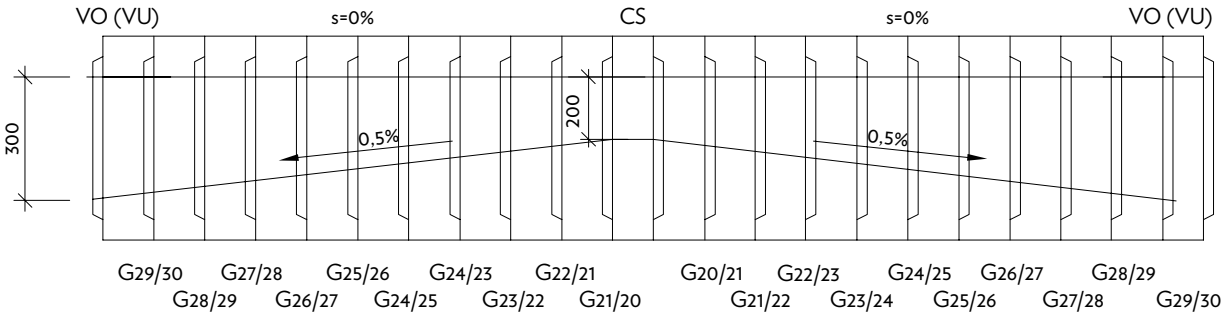


Suggested layout

VII-0-T Slot drains - layout



VII-0-G Slot drains - layout



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends

VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends

C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends

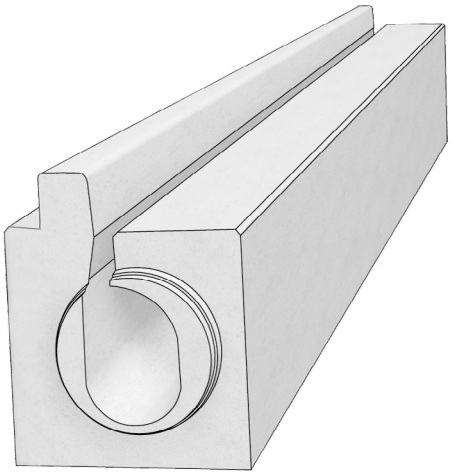
CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends

s –Lngitudinal flow profile gradient

CSB - SLOT DRAIN PROFILE VII-3

Technical data:

Line drainage segments similar to Profile I slot drains, but have an offset slot which ensures sufficient width on one side to apply traffic lane marking strips to the drain segments. These slot drain segments are especially suitable for tunnels and their surroundings. Profile VII-3 drains are made with a continuous slot and a 12 cm kerbstone. Slot drains (continuous slot) are designed for D400 class traffic load and no transversal vehicle travel.



The system consists of the following components:

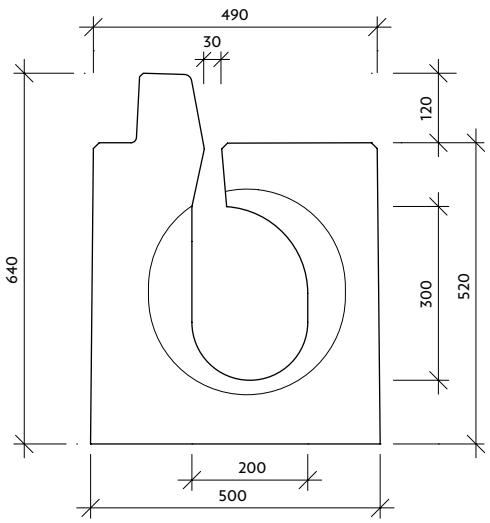
- 4 m-long continuous slot drain, with or without internal flow gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Cleaning segment incl. cast iron grille
- Fire safety barrier (with siphon)
- End cap

		Nominal dimensions mm			Quantity
Name	**Order code**	**Basic height**	**Length**	**Width**	**psc/m**
Slot drain with continuous slot and 12 cm kerbstone	VII-3	640/520	2000	490/500	0,5
Slot drain with 0.5% botto, gradient and continuous asymmetrical slot and 12 cm kerbstone	VII-3-G	640/520	2000	490/500	0,5
Slot drain with continuous slot and 0-12/12-0 cm left rising kerbstone	VII-0-3-L	640/520	1200	490/500	0,83
Slot drain with continuous slot and 0-12/12-0 cm right rising kerbstone	VII-3-0-P	640/520	1200	490/500	0,83
Special 12 cm kerbstone	VII-3-O	160/280	2000	493/490	0,5
Special rising kerbstone, left 0-12 cm	VII-3-O-L	160/280	1200	493/490	0,83
Special rising kerbstone, right 12-0 cm	VII-3-O-P	160/280	1200	493/490	0,83
Fire safety barrier	VII-3-PP	1070/950	2000	490/500	0,5
Basic gully assembly V0	VII-3-V0	640/520	1000	490/500	1
Gutter gully assembly VU	VII-3-VU	640/520	1000	490/500	1
Basic cleaning segment C0	VII-3-C0	640/520	1000	490/500	1
Top cleaning segment CS	VII-3-CS	640/520	1000	490/500	1
Spigot end cap	VII-3-ZU	640/520	120	490/500	-
Socket end cap	VII-3-ZZ	640/520	120	490/500	-

Nominal dimensions - basic shapes:

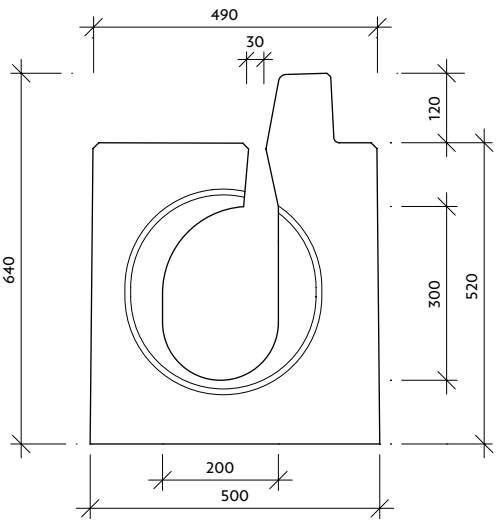
Side-view

Spigot



Side-view

Socket



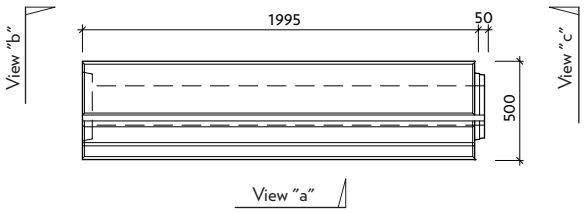
All products comply with harmonised European Standards and are patented

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VII-3

VII-3 left - Slot drain

Plan

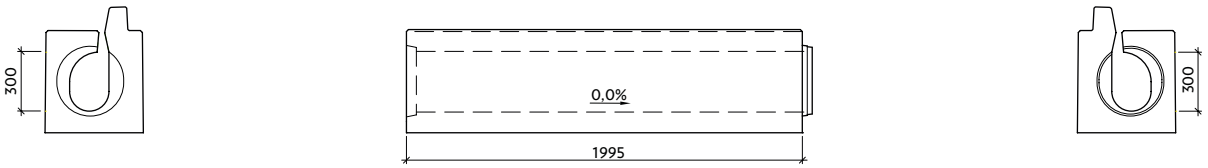


View "b" - Socket

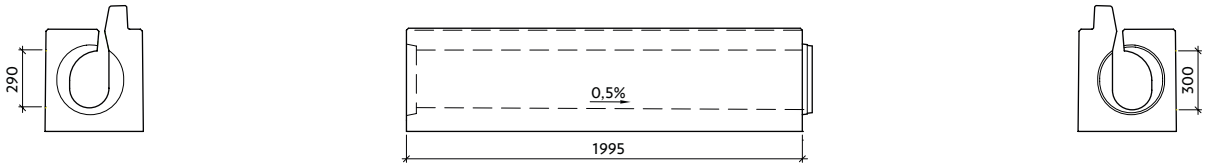
View "a"

View "c" - Spigot

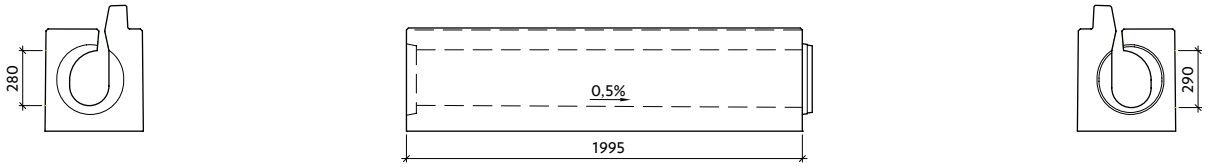
Profile VII-3-T30/30-L without internal flow gradient



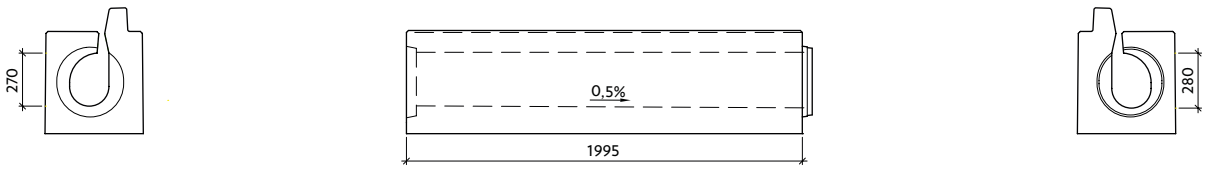
Profile VII-3-G29/30-L 0.5% flow profile bottom gradient



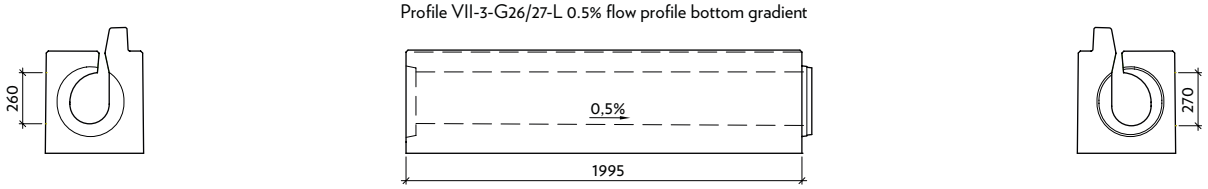
Profile VII-3-G28/29-L 0.5% flow profile bottom gradient



Profile VII-3-G27/28-L 0.5% flow profile bottom gradient



Profile VII-3-G26/27-L 0.5% flow profile bottom gradient



CSB - SLOT DRAIN PROFILE VII-3

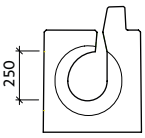
VII-3 left - Slot drain

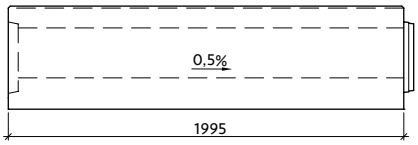
View "b" - Socket

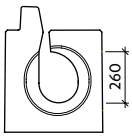
View "a"

View "c" - Spigot

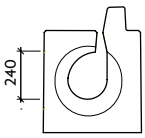
Profile VII-3-G25/26-L 0.5% flow profile bottom gradient

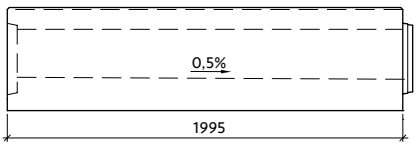


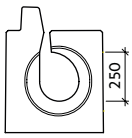




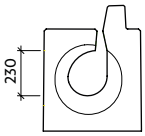
Profile VII-3-G24/25-L 0.5% flow profile bottom gradient

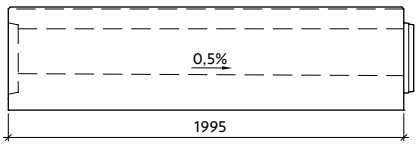


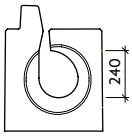




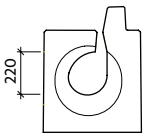
Profile VII-3-G28/29-L 0.5% flow profile bottom gradient

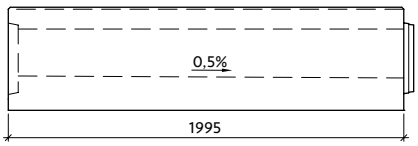


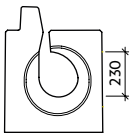




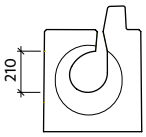
Profile VII-3-G22/23-L 0.5% flow profile bottom gradient

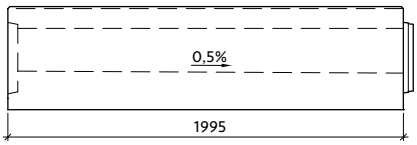


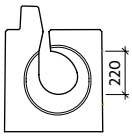




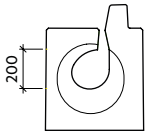
Profile VII-3-G21/22-L 0.5% flow profile bottom gradient

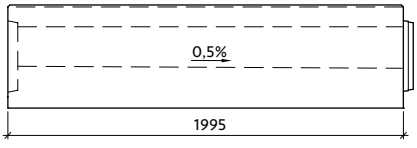


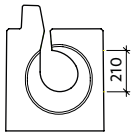




Profile VII-3-G20/21-L 0.5% flow profile bottom gradient





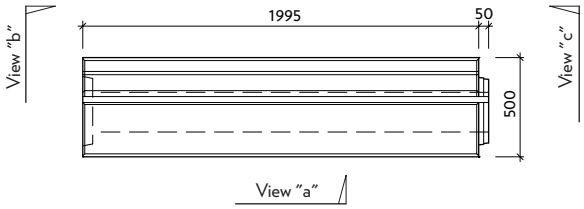


* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VII-3

VII-3 right - Slot drain

Plan

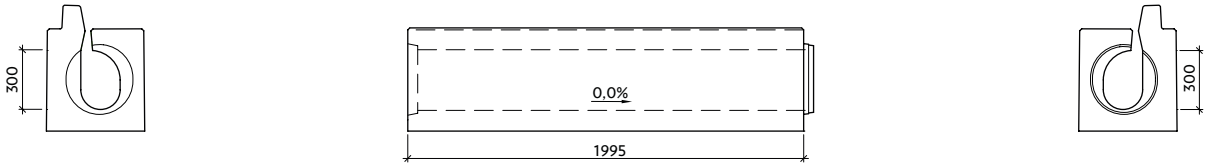


View "b" - Socket

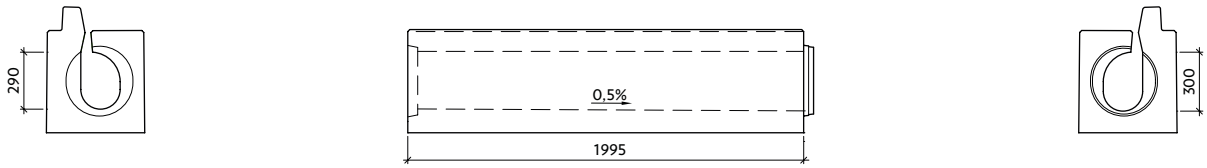
View "a"

View "c" - Spigot

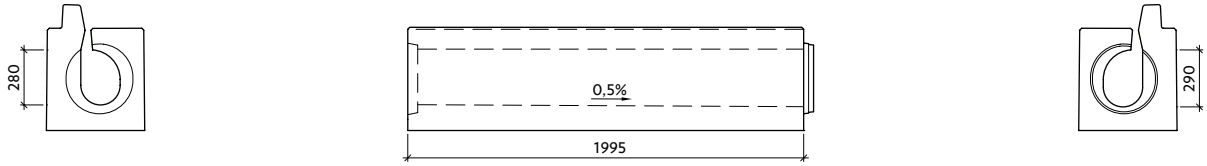
Profile VII-3-T30/30-P without internal flow gradient



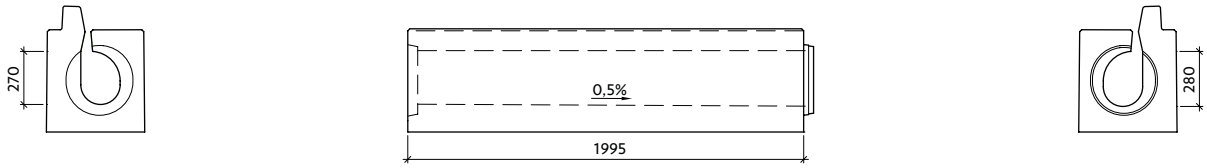
Profile VII-3-G29/30-P 0.5% flow profile bottom gradient



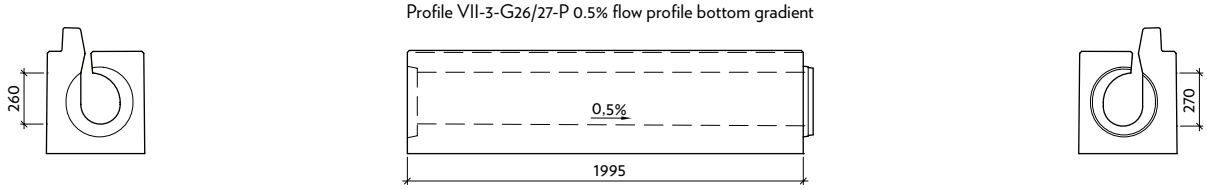
Profile VII-3-G28/29-P 0.5% flow profile bottom gradient



Profile VII-3-G27/28-P 0.5% flow profile bottom gradient



Profile VII-3-G26/27-P 0.5% flow profile bottom gradient



CSB - SLOT DRAIN PROFILE VII-3

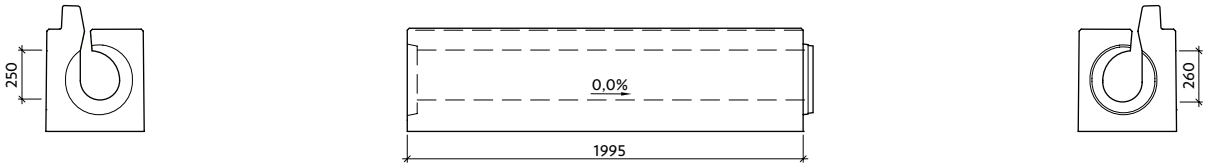
VII-3 right - Slot drain

View "b" - Socket

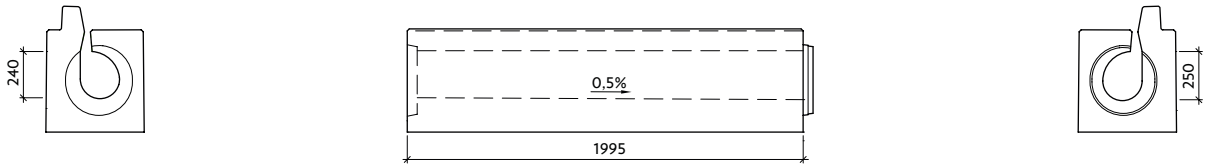
View "a"

View "c" - Spigot

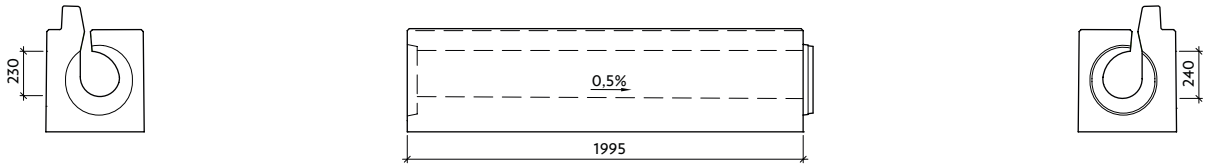
Profile VII-3-G25/26-P without internal flow gradient



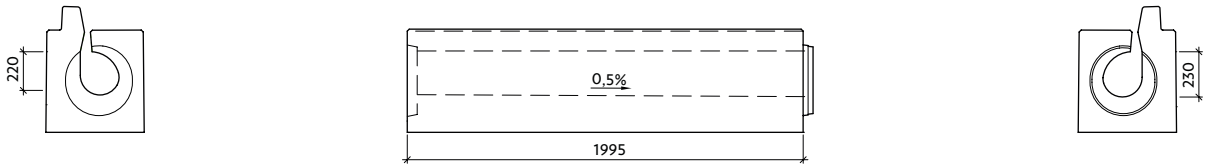
Profile VII-3-G24/25-P 0.5% flow profile bottom gradient



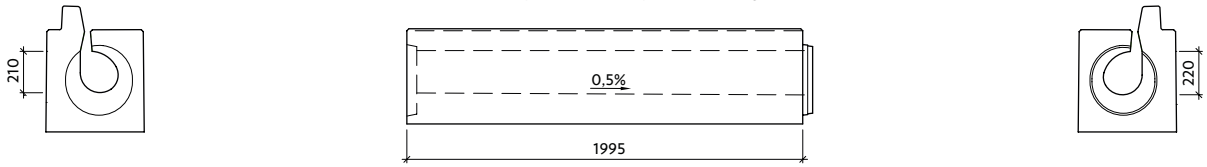
Profile VII-3-G23/24-P 0.5% flow profile bottom gradient



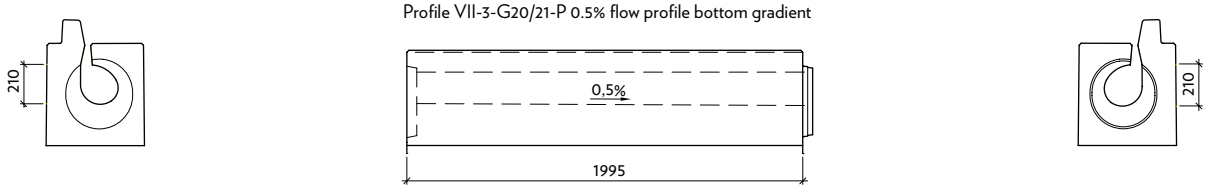
Profile VII-3-G22/23-P 0.5% flow profile bottom gradient



Profile VII-3-G21/22-P 0.5% flow profile bottom gradient



Profile VII-3-G20/21-P 0.5% flow profile bottom gradient

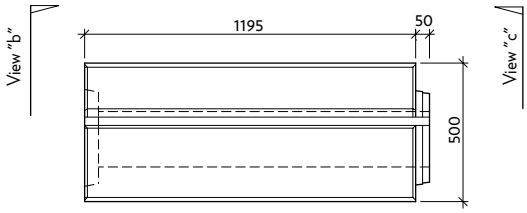


* Nominal dimensions include installation dimensions and/or minimum gap.

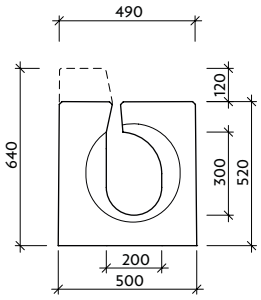
CSB - SLOT DRAIN PROFILE VII-3

VII-0-3-P right - transition piece 0-12 cm kerbstone

Plan

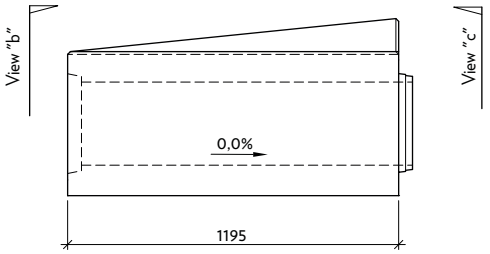


View "b" - Socket

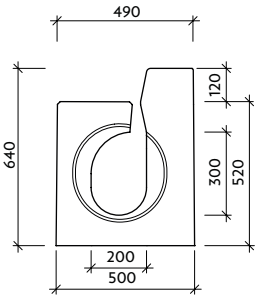


Cross-section

VII-0-3-30/30-P

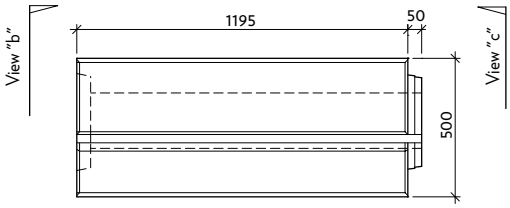


View "c" - Spigot

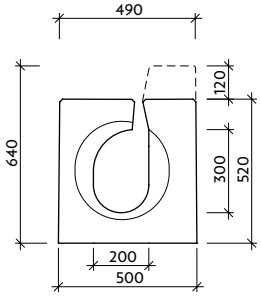


VII-0-3-L left- transition piece 0-12 cm kerbstone

Plan

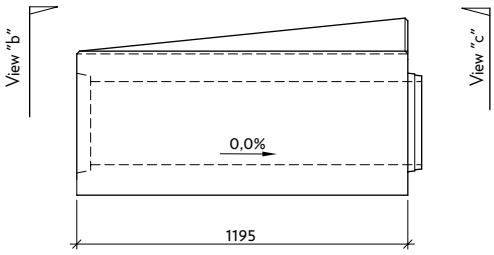


View "b" - Socket

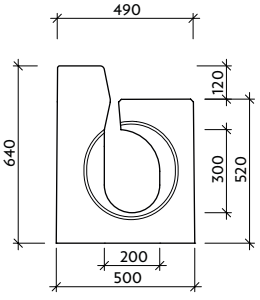


Cross-section

VII-0-3-30/30-L



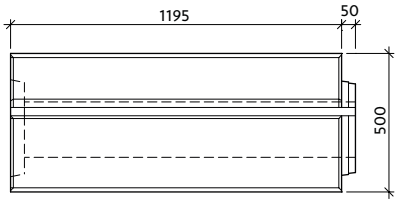
View "c" - Spigot



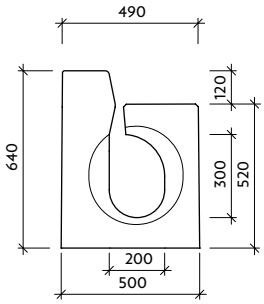
CSB - SLOT DRAIN PROFILE VII-3

VII-3-0-P right transition piece, 12-0 cm kerbstone

Plan

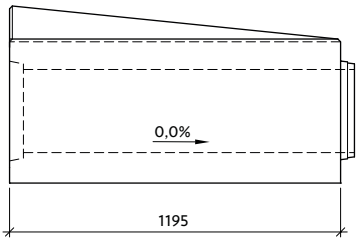


View "b" - View

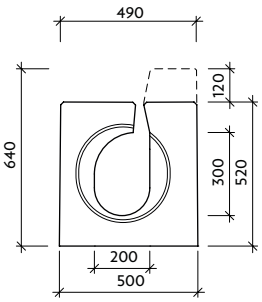


Longitudinal cross-section

VII-3-0-30/30-P

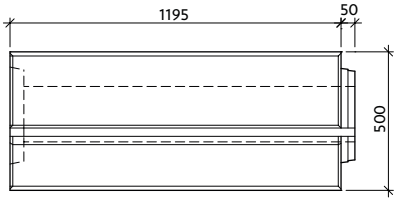


View "c" - Spigot

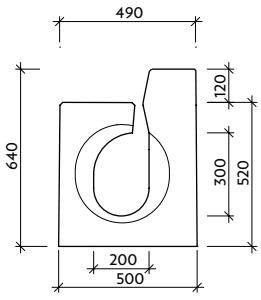


VII-3-0-L left transition piece, 12-0 cm kerbstone

Plan

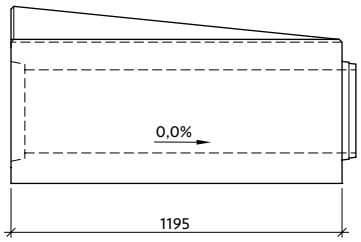


View "b" - View

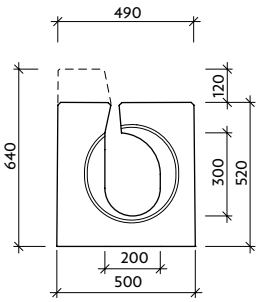


Longitudinal cross-section

VII-3-0-30/30-L



View "c" - Spigot

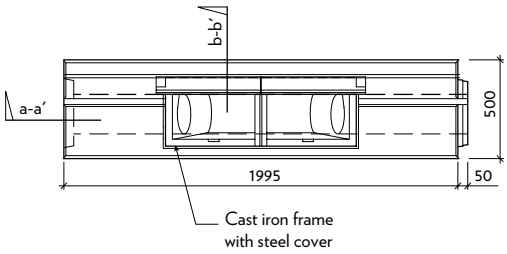


* Nominal dimensions include installation dimensions and/or minimum gap.

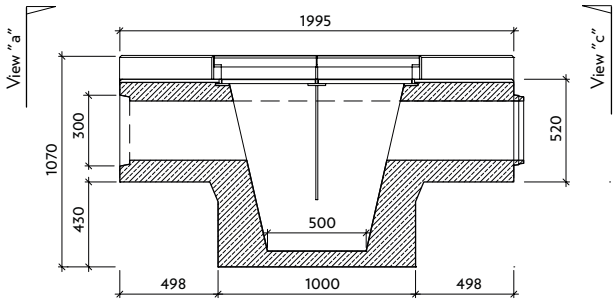
CSB - SLOT DRAIN PROFILE VII-3

Profile VII-3-PP-P right - Fire safety barrier

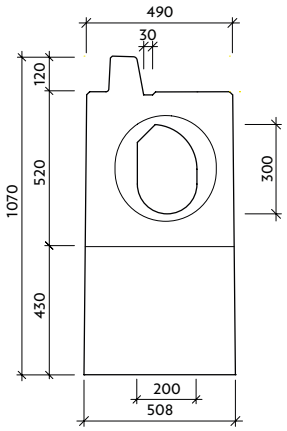
Plan



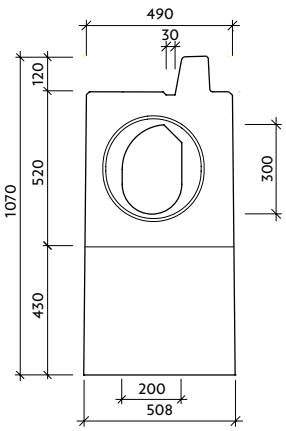
Cross-section: a-a´



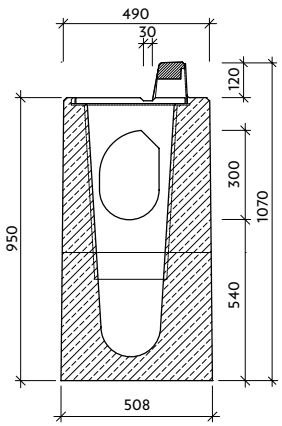
View "a" VII-3-PP-P - Socket



View "b" VII-3-PP-P - Spigot

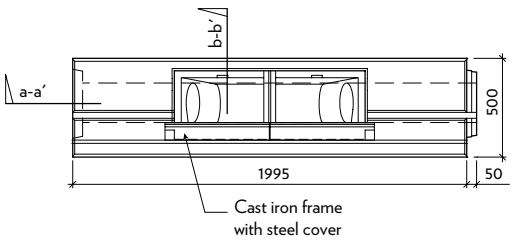


Cross-section: b-b´ VII-3-PP-P

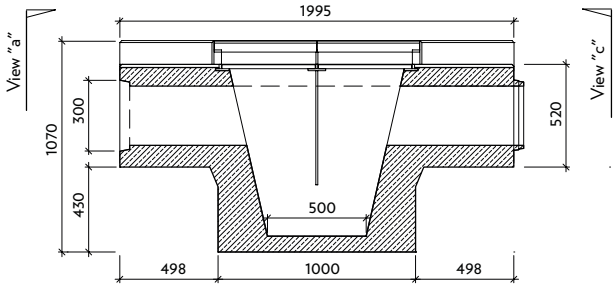


Profile VII-3-L left - Fire safety barrier

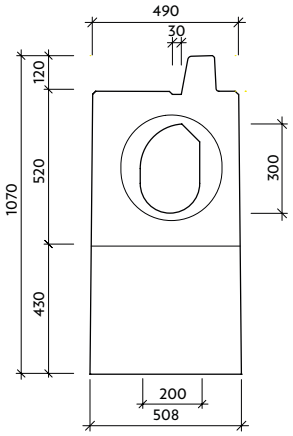
Plan



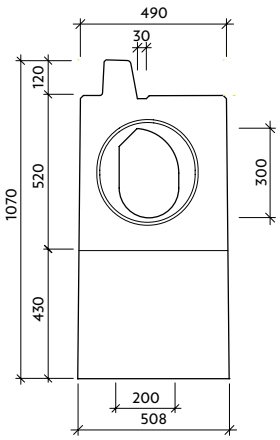
Cross-section: a-a´



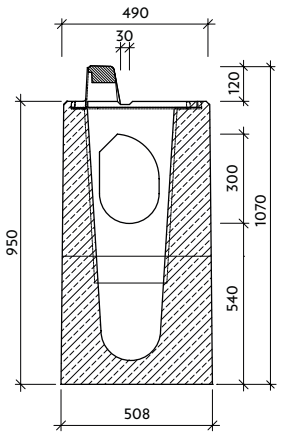
View "a" VII-3-PP-L - Socket



View "b" VII-3-PP-L - Spigot



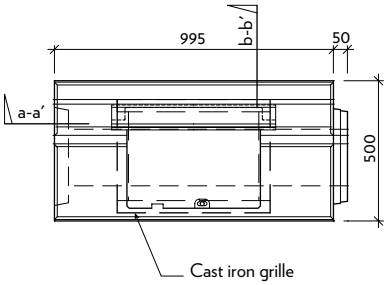
Cross-section: b-b´VII-3-PP-L



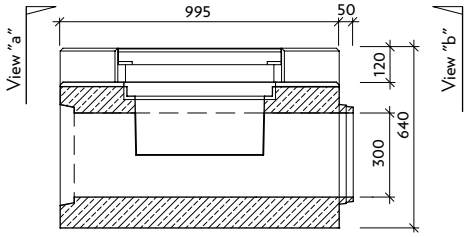
CSB - SLOT DRAIN PROFILE VII-3

Profile VII-3-C0-P right - Basic cleaning segment

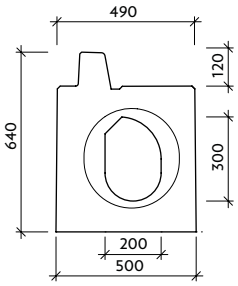
Plan



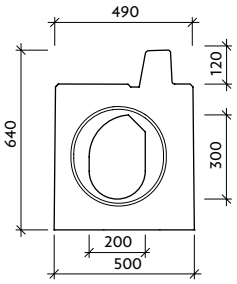
Cross-section: a-a´ VII-3-C0-P



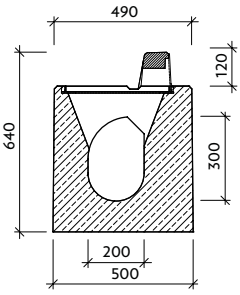
View "a" VII-3-C0-P - Socket



View "b" VII-3-C0-P - Spigot

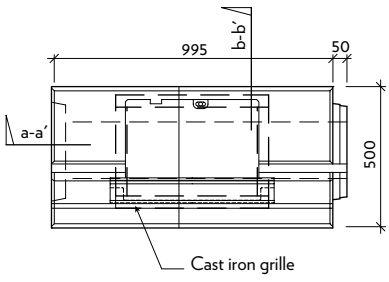


Cross-section: b-b´

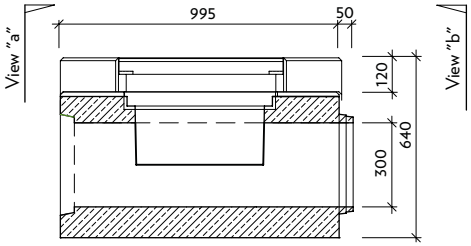


Profile VII-3-L left - Basic cleaning segment

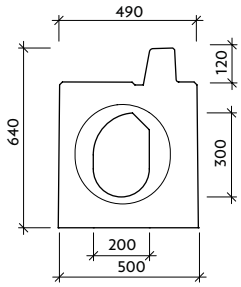
Plan



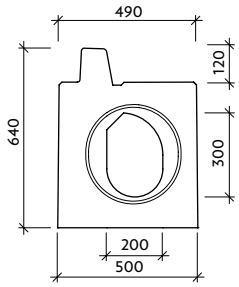
Cross-section: a-a´ VII-3-C0-L



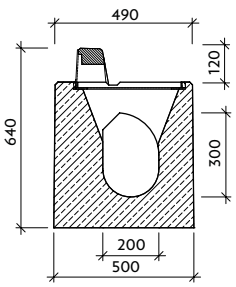
View "a" VII-3-C0-L - Socket



View "b" VII-3-C0-L - Spigot



Cross-section: b-b´

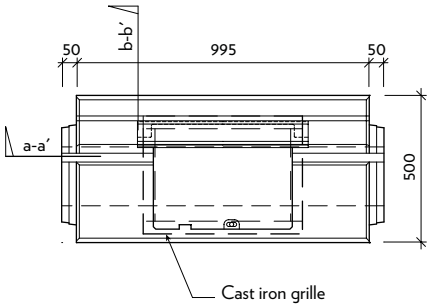


* Nominal dimensions include installation dimensions and/or minimum gap.

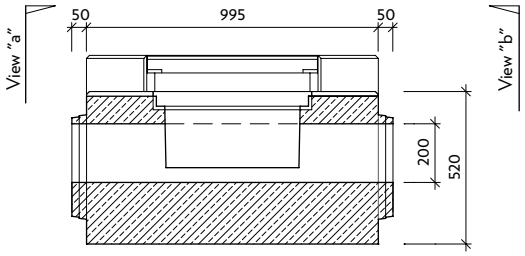
CSB - SLOT DRAIN PROFILE VII-3

VII-3-CS Top cleaning segment

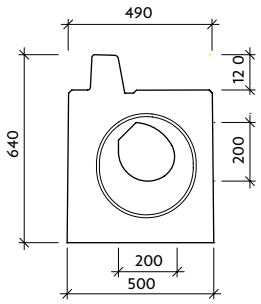
Plan



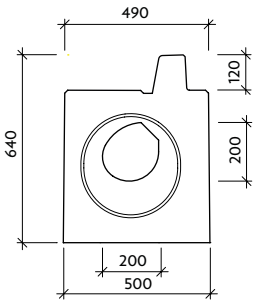
Cross-section: a-a´ VII-3-CS



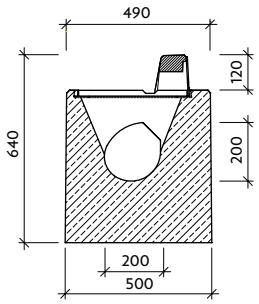
View "a" VII-3-CS - Spigot



View "b" VII-3-CS - Spigot

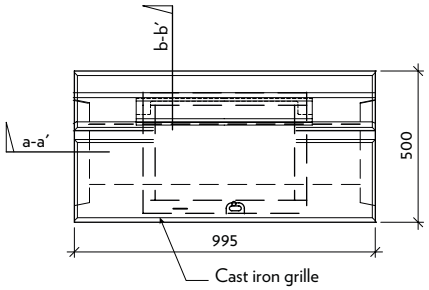


Cross-section: b-b´

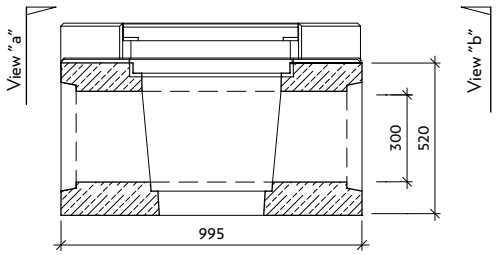


VII-3-VU - Gutter gully assembly

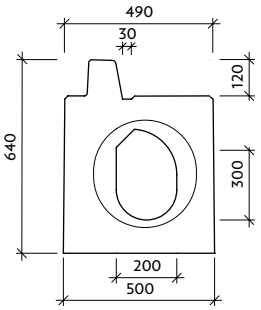
Plan



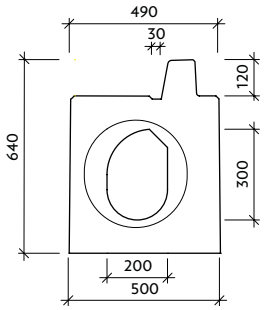
Cross-section: a-a´



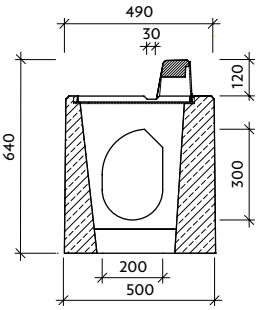
View "a" VII-3-VU - Socket



View "b" VII-3-VU - Socket



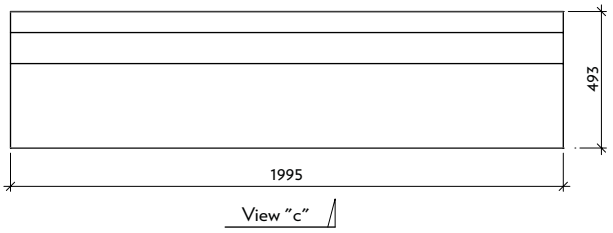
Cross-section: b-b´



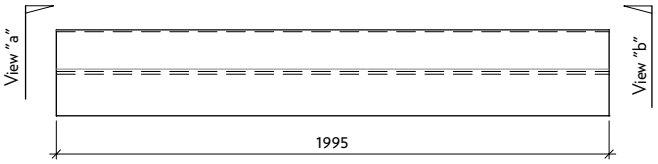
CSB - SLOT DRAIN PROFILE VII-3

Profile VII-3-O tunnel kerbstone

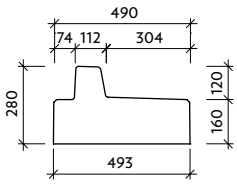
Plan



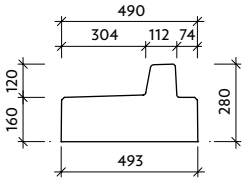
View "c"



View "a" VII-3-O

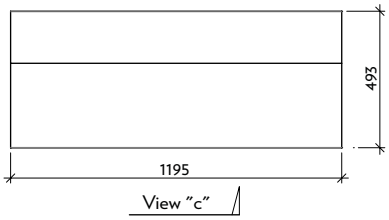


View "b" VII-3-O

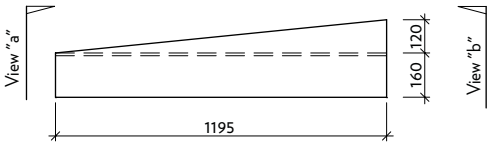


Profile VII-3 - Special rising kerbstone 0-12cm

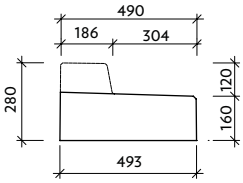
Plan



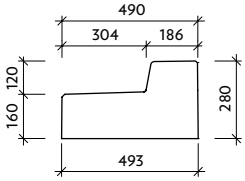
View "c"



View "a" VII-3-O-0-12

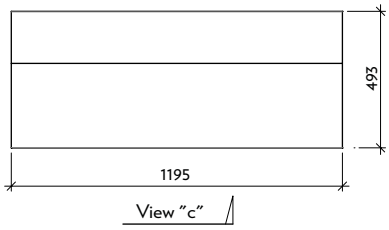


View "b" VII-3-O-0-12

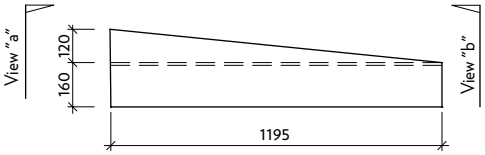


Profile VII-3 - Special rising kerbstone 12-0cm

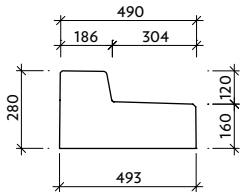
Plan



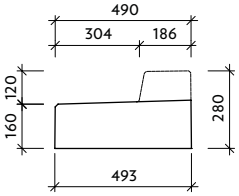
View "c"



View "b" VII-3-O-12-0



View "a" VII-3-O-12-0

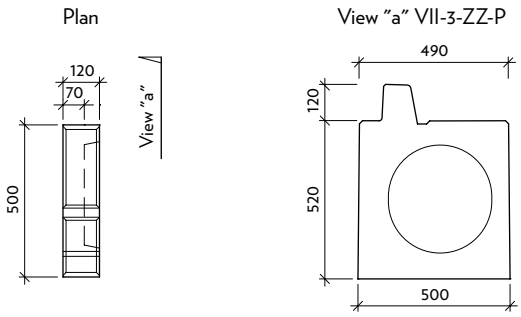


* Nominal dimensions include installation dimensions and/or minimum gap.

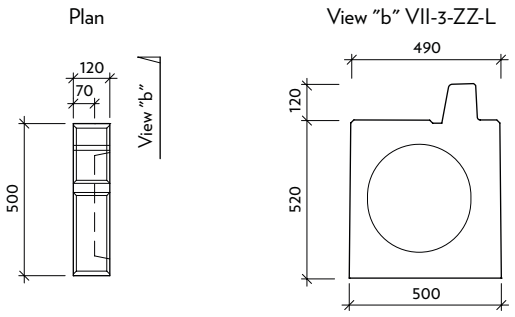
CSB - SLOT DRAIN PROFILE VII-3

VII-3 - Socket/Spigot end cap

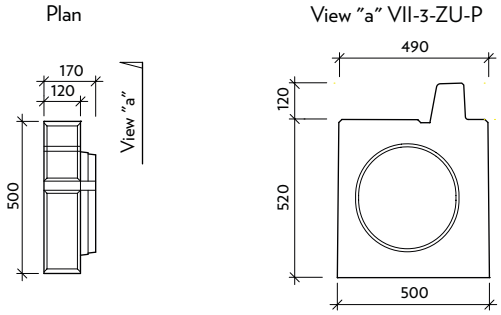
VII-3-ZZ-P right - Socket end cap



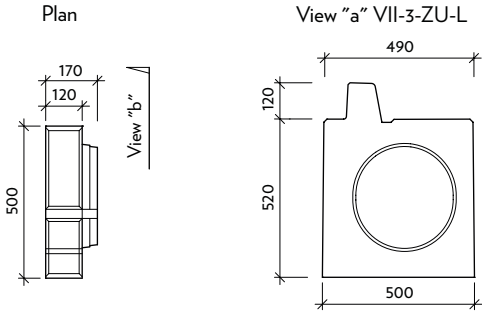
VII-3-ZZ-L left - Socket end cap



VII-3-ZU-P right - Spigot end cap

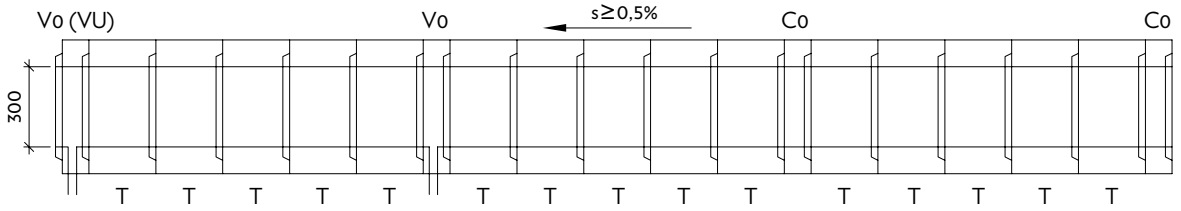


VII-3-ZU-L left - Spigot end cap

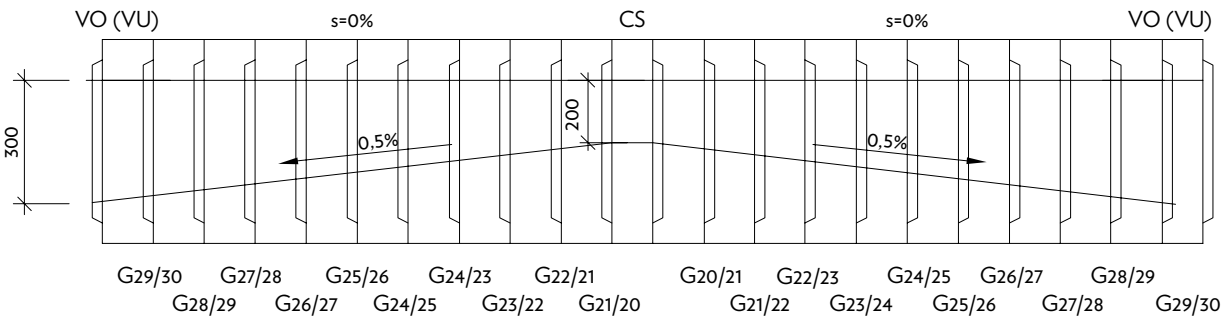


Suggested layout

V-0-T Slot drains - layout



V-0-G Slot drains - layout



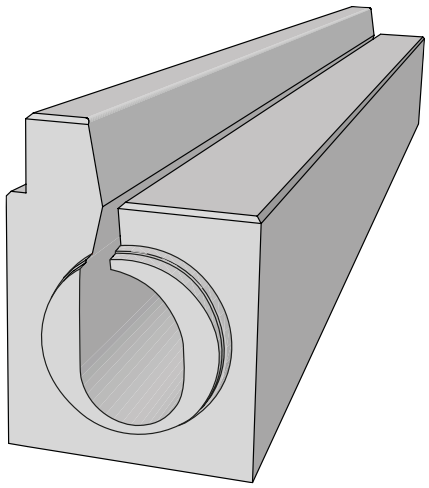
Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends
VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends
C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends
CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends
s – Longitudinal flow profile gradient

CSB - SLOT DRAIN PROFILE VII-4

Technical data:

Line drainage segments similar to Profile V slot drains, with an offset slot, which ensures sufficient width on one side to apply traffic lane marking strips to the drain segments. These slot drain segments are especially suitable for tunnels and their surroundings. Unlike Profile V drains, Profile VII ones include a recess for pavement slabs. Profile VII-4 drains are made with a continuous slot and a 15 cm kerbstone. Slot drains (continuous slot) are designed for D400 class traffic load and no transversal vehicle travel.



The system consists of the following components:

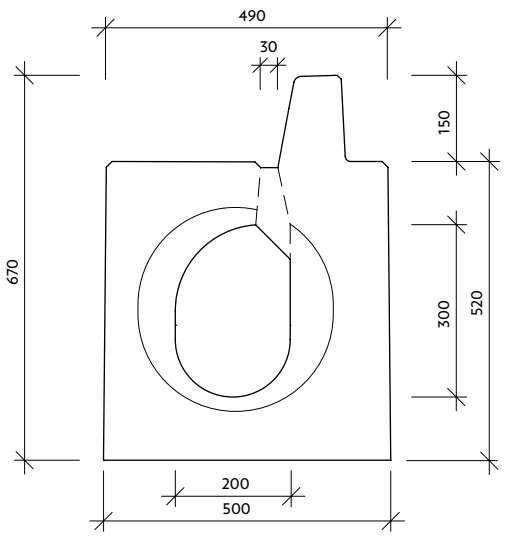
- 4 m-long continuous slot drain, with or without internal flow gradient
- Complete gully assembly incl. plastic cover/cast iron grille, gully trap and rectification cone
- Special rising kerbstone
- Cleaning segment incl. cast iron grille
- Fire safety barrier (with siphon)
- End cap

		Nominal dimensions mm			Quantity
Name	**Order code**	**Basic height**	**Length**	**Width**	**psc/m**
Slot drain with asymmetrical continuous slot and 15 cm kerbstone	VII-4	670/520	2000	490/500	0,5
Slot drain with 0.5% botto, gradient and continuous asymmetrical slot and 15 cm kerbstone	VII-4-G	670/520	2000	490/500	0,5
Slot drain with continuous slot and 0-15/15-0 cm left rising kerbstone	VII-0-4-L	670/520	1500	490/500	0,66
Slot drain with continuous slot and 0-15/15-0 cm right rising kerbstone	VII-0-4-P	670/520	1500	490/500	0,66
Special 15 cm kerbstone	VII-4-O	160	2000	493	0,5
Special rising kerbstone, left 15-0 cm	VII-4-O-N	160	1500	493	0,66
Special rising kerbstone, right 0-15 cm	VII-O-4-N	160	1500	493	0,66
Fire safety barrier	VII-4-PP	1100/950	2000	490/500	0,5
Basic gully assembly V0	VII-4-V0	670/520	1000	490/500	1
Gutter gully assembly VU	VII-4-VU	670/520	1000	490/500	1
Basic cleaning segment C0	VII-4-C0	670/520	1000	490/500	1
Top cleaning segment CS	VII-4-CS	670/520	1000	490/500	1
Spigot end cap	VII-4-ZU	670/520	120	490/500	-
Socket end cap	VII-4-ZZ	670/520	120	490/500	-

Nominal dimensions - basic shapes:

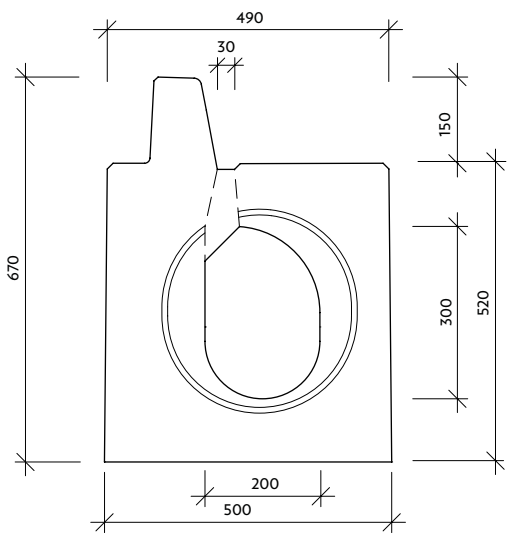
Side-view

Spigot



Side-view

Socket



All products comply with harmonised European Standards and are patented

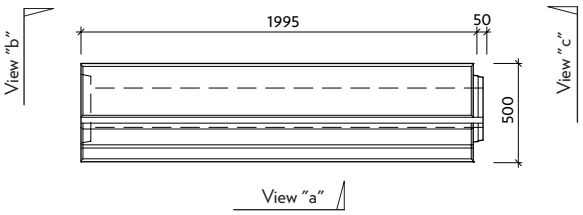
* Nominal dimensions include installation dimensions and/or minimum gap.

STAVBY JAKO Z KAMENE CSBETON®

CSB - SLOT DRAIN PROFILE VII-4

Profile VII-4-L left - Slot drain

Plan

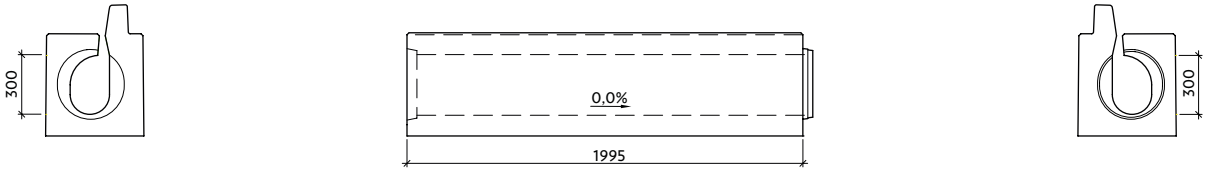


View "b" - Socket

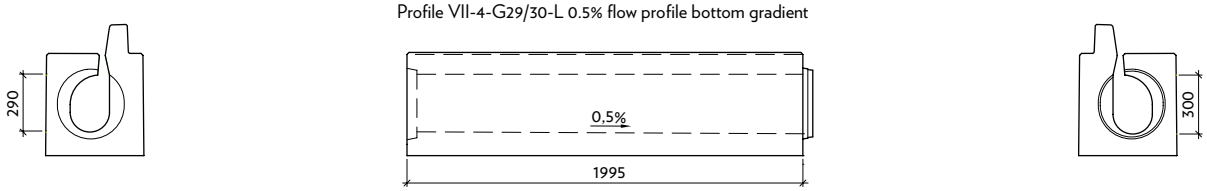
View "a"

View "c" - Spigot

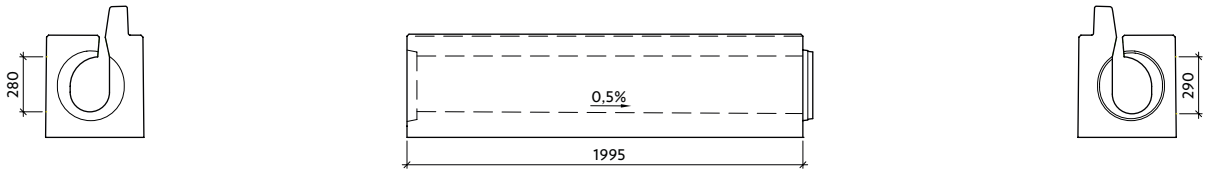
Profile VII-4-T30/30-L without internal flow gradient



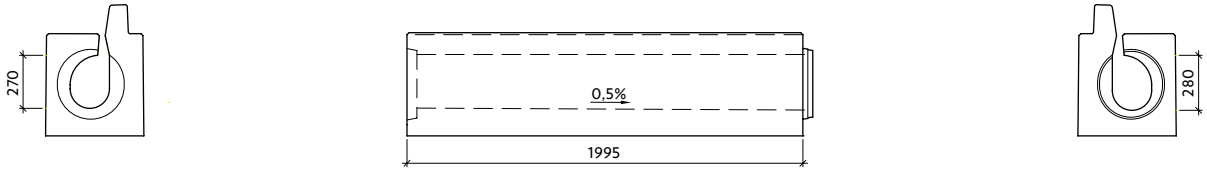
Profile VII-4-G29/30-L 0.5% flow profile bottom gradient



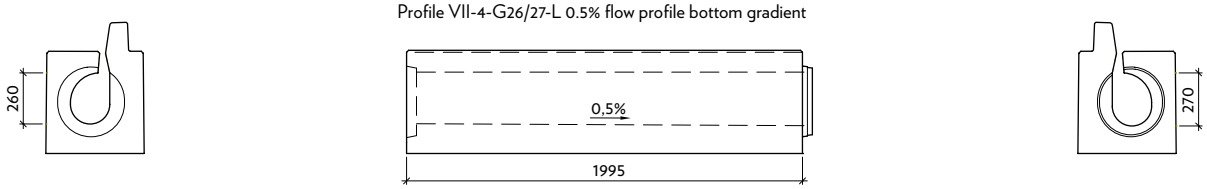
Profile VII-4-G28/29-L 0.5% flow profile bottom gradient



Profile VII-4-G27/28-L 0.5% flow profile bottom gradient



Profile VII-4-G26/27-L 0.5% flow profile bottom gradient



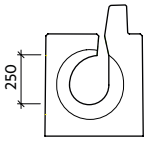
CSB - SLOT DRAIN PROFILE VII-4

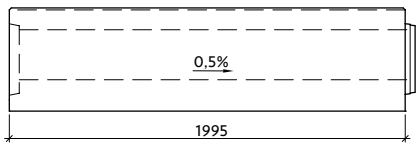
View "b" - Socket

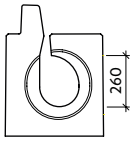
View "a"

View "c" - Spigot

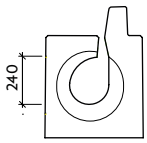
Profile VII-4-G25/26-L 0.5% flow profile bottom gradient

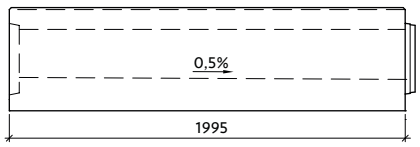


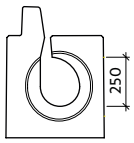




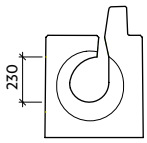
Profile VII-4-G24/25-L 0.5% flow profile bottom gradient

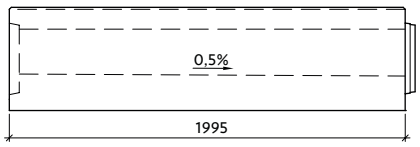


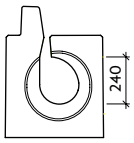




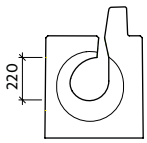
Profile VII-4-G28/29-L 0.5% flow profile bottom gradient

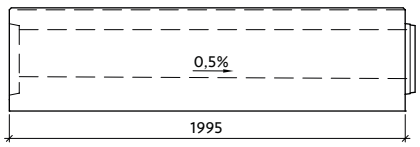


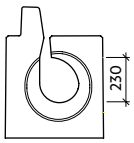




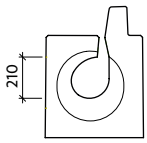
Profile VII-4-G22/23-L 0.5% flow profile bottom gradient

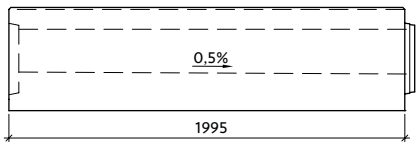


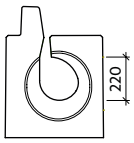




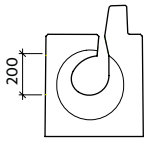
Profile VII-4-G21/22-L 0.5% flow profile bottom gradient

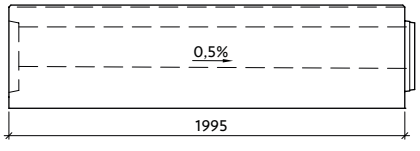


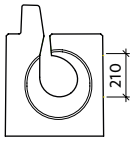




Profile VII-4-G20/21-L 0.5% flow profile bottom gradient





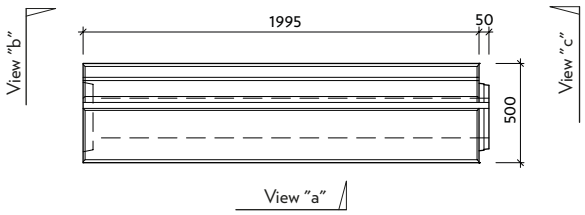


* Nominal dimensions include installation dimensions and/or minimum gap.

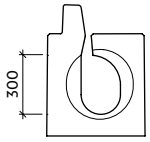
CSB - SLOT DRAIN PROFILE VII-4

Profile VII-4-P right - Slot drain

Plan

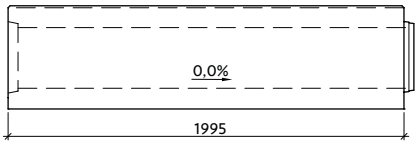


View "b" - Socket

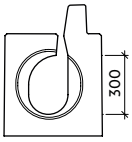


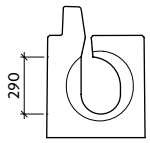
View "a"

Profile VII-4-T30/30-P without internal flow gradient

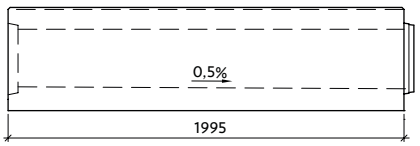


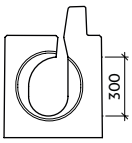
View "c" - Spigot

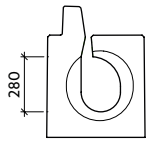




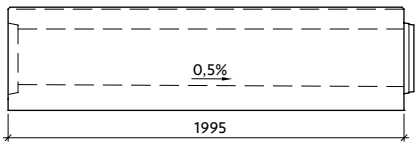
Profile VII-4-G29/30-P 0.5% flow profile bottom gradient

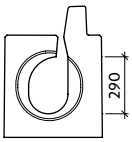


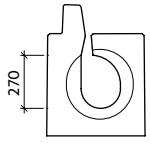




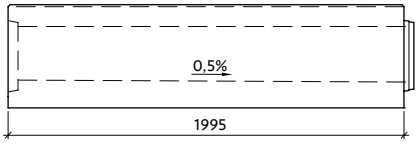
Profile VII-4-G28/29-P 0.5% flow profile bottom gradient

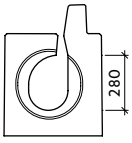


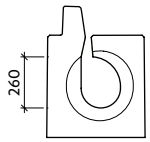




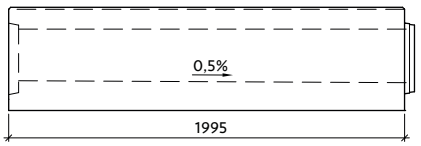
Profile VII-4-G27/28-P 0.5% flow profile bottom gradient

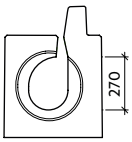






Profile VII-4-G26/27-P 0.5% flow profile bottom gradient





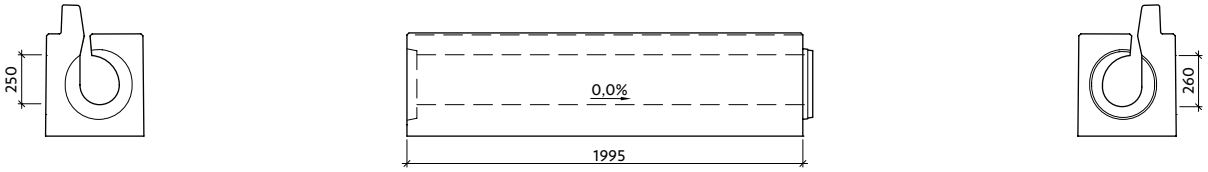
CSB - SLOT DRAIN PROFILE VII-4

View "b" - Socket

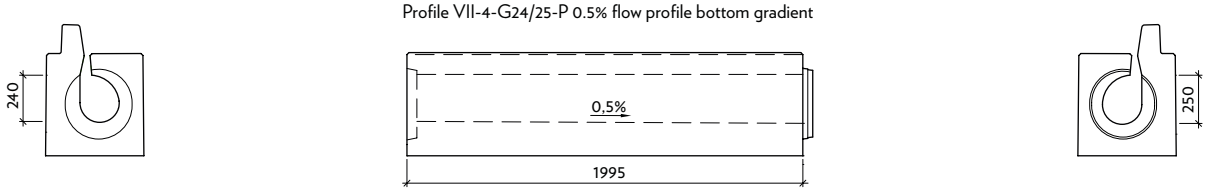
View "a"

View "c" - Spigot

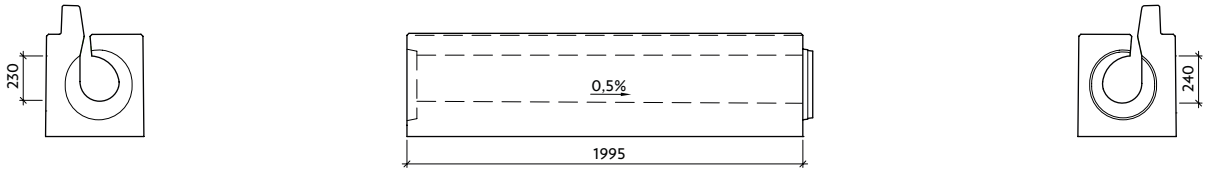
Profile VII-4-G25/26-P without internal flow gradient



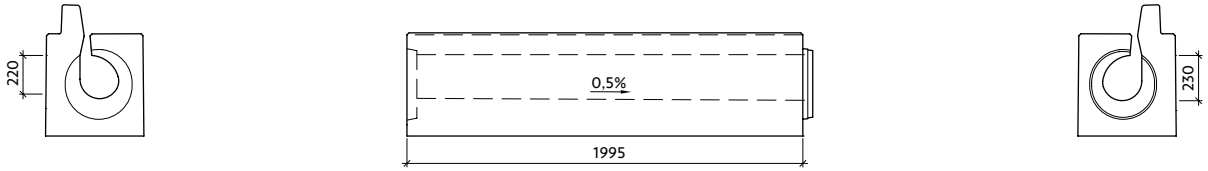
Profile VII-4-G24/25-P 0.5% flow profile bottom gradient



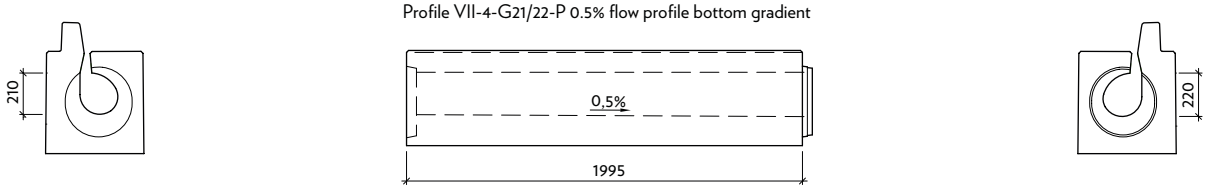
Profile VII-4-G23/24-P 0.5% flow profile bottom gradient



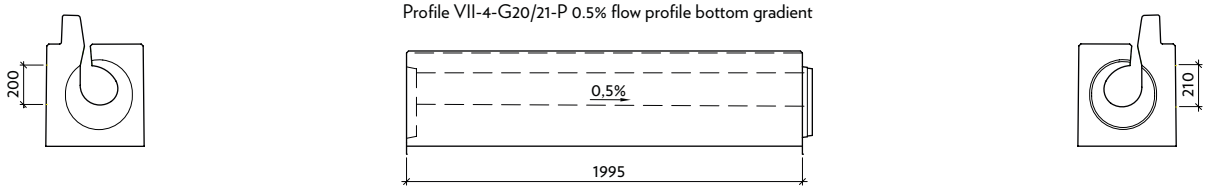
Profile VII-4-G22/23-P 0.5% flow profile bottom gradient



Profile VII-4-G21/22-P 0.5% flow profile bottom gradient



Profile VII-4-G20/21-P 0.5% flow profile bottom gradient



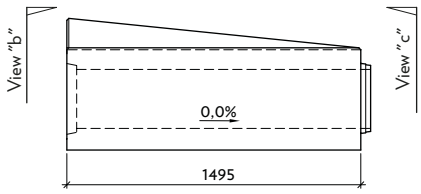
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VII-4

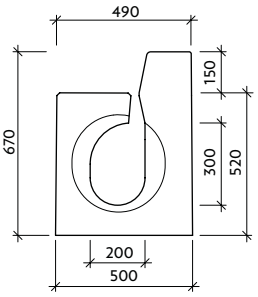
T-4-0-L/T-0-4-L - left - Slot drain with rising 15 cm kerbstone

T-4-0-L left- Slot drain with rising 15-0 cm kerbstone

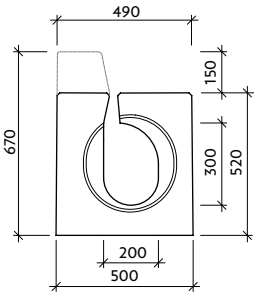
Longitudinal cross-section



View "b" - Socket

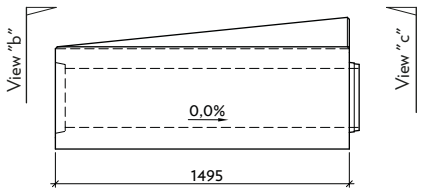


View "c" - Spigot

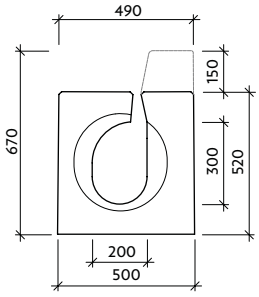


T-0-4-L left- Slot drain with rising 0-15 cm kerbstone

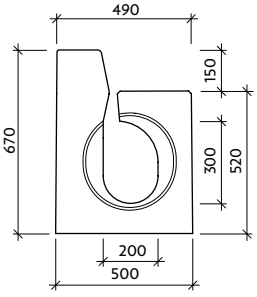
Longitudinal cross-section



View "b" - Socket



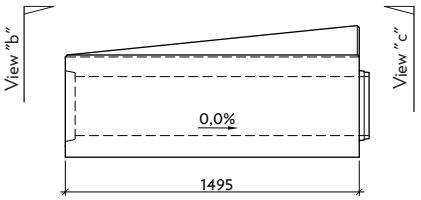
View "c" - Spigot



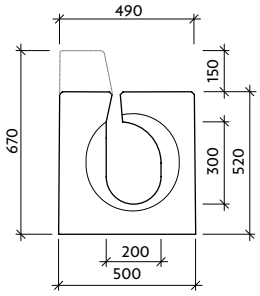
T-4-0-P/T-0-4-P - right - Slot drain with rising 15 cm kerbstone

VII-0-4-P right- Slot drain with rising 0-15 cm kerbstone

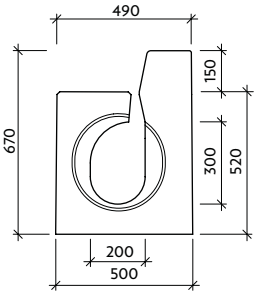
Longitudinal cross-section



View "b" - Socket

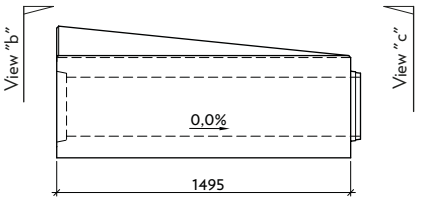


View "c" - Spigot

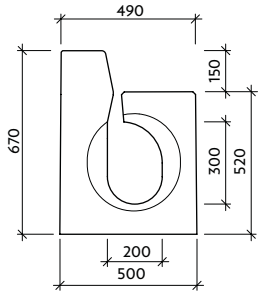


VII-4-0-P right-- Slot drain with rising 15-0 cm kerbstone

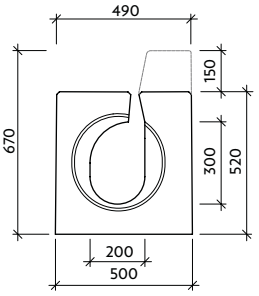
Longitudinal cross-section



View "b" - Socket



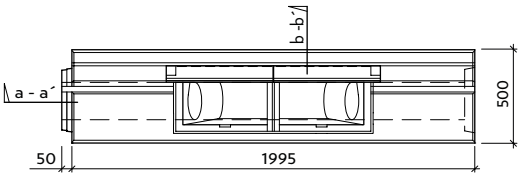
View "c" - Spigot



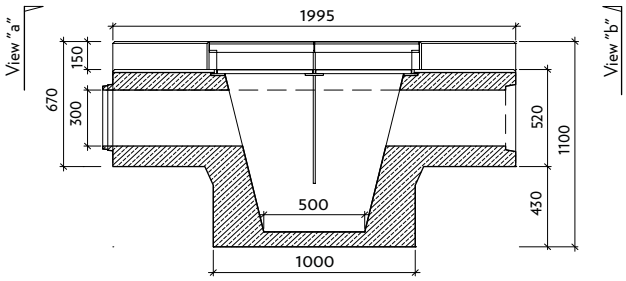
CSB - SLOT DRAIN PROFILE VII-4

Profile VII-4-PP right - Fire safety barrier

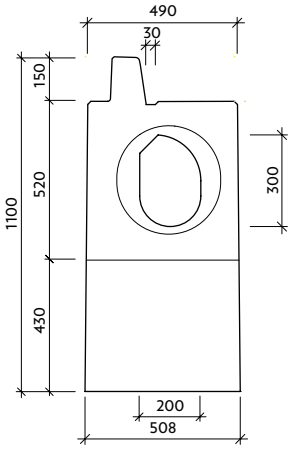
Plan



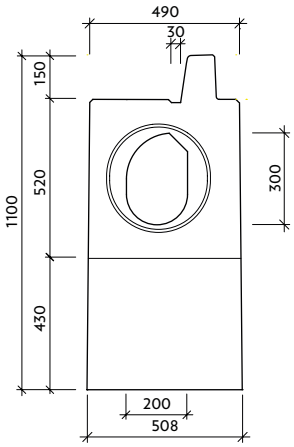
Cross-section: a-a´



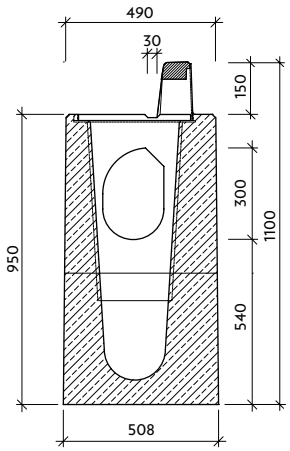
View "a" VII-4-PP-P - Socket



View "b" VII-4-PP-P - Spigot

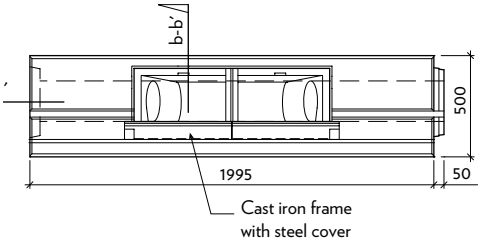


Cross-section: b-b´ VII-4-PP-P

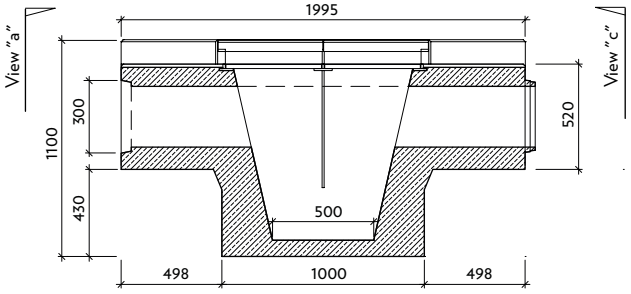


Profile VII-4-PP left - Fire safety barrier

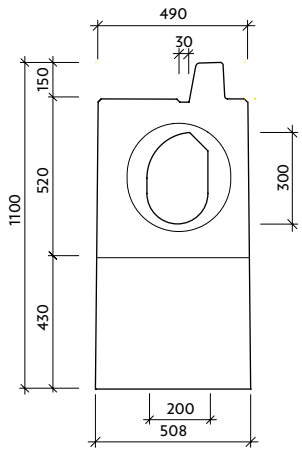
Plan



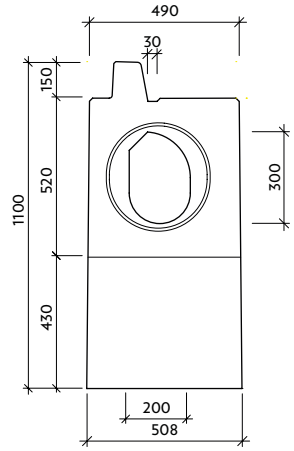
Cross-section: a-a´



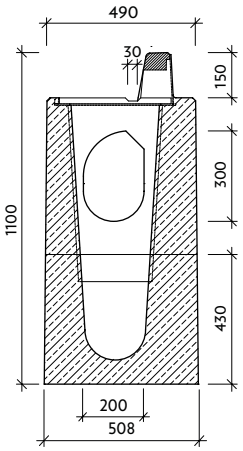
View "a" VII-3-PP-L - Socket



View "b" VII-3-PP-L - Spigot



Cross-section: b-b´VII-3-PP-L

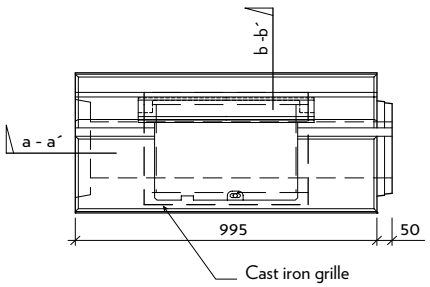


* Nominal dimensions include installation dimensions and/or minimum gap.

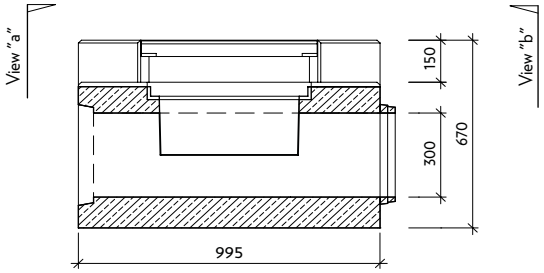
CSB - SLOT DRAIN PROFILE VII-4

Profile VII-4-C0 right - Basic cleaning segmen

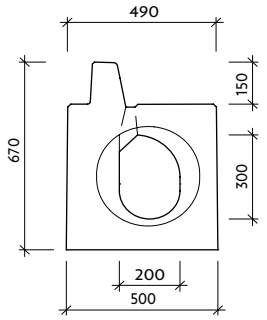
Plan



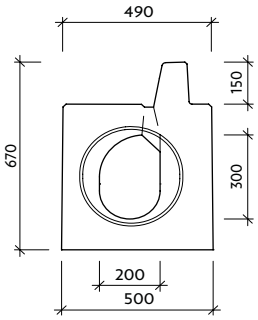
Cross-section: a-a´ VII-4-C0-P



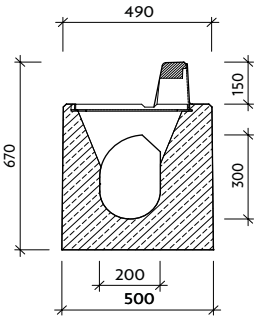
View "a" VII-4-P-C0 - Socket



View "b" VII-4-P-C0 - Spigot

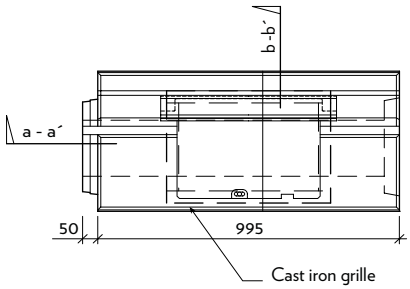


Cross-section: b-b´

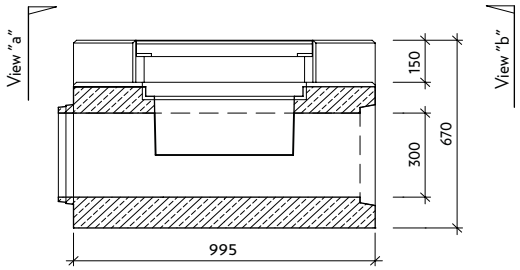


Profile VII-4-C0 left - Basic cleaning segmen

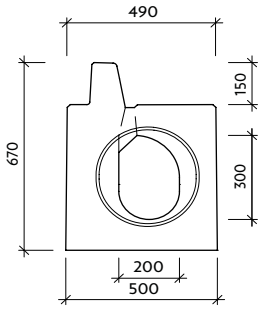
Plan



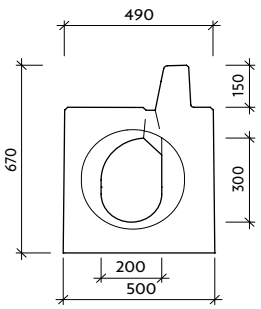
Cross-section: a-a´ VII-4-C0-L



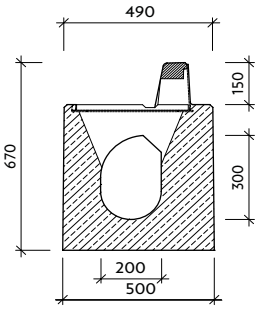
View "a" VII-4-L-C0 - Spigot



View "b" VII-4-L-C0 - Socket



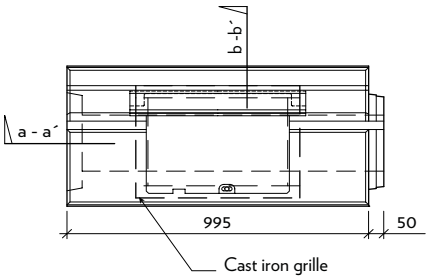
Cross-section: b-b´



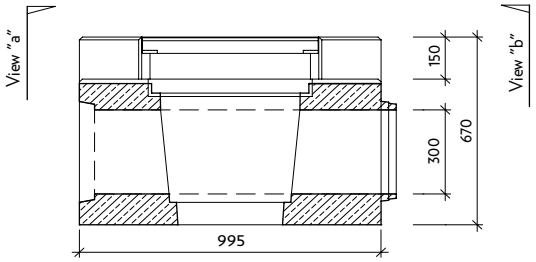
CSB - SLOT DRAIN PROFILE VII-4

Profile VII-4-V0 right - Basic gully assembly

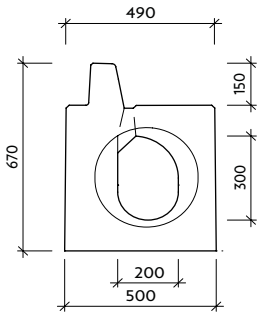
Plan



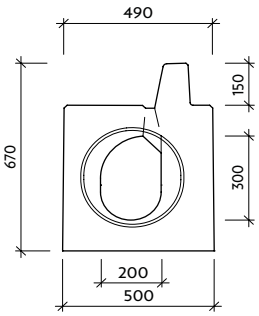
Cross-section: a-a´ VII-4-V0-P



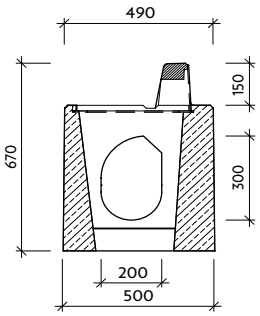
View "a" VII-4-P-V0 - Socket



View "b" VII-4-P-V0 - Spigot

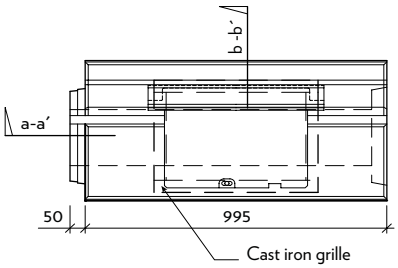


Cross-section: b-b´

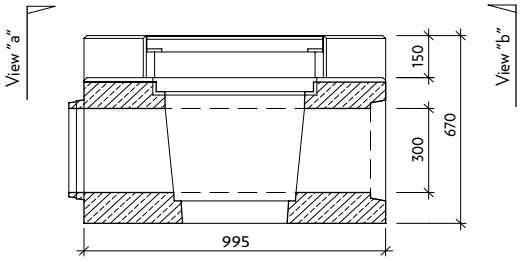


VII-4-V0 left - Basic gully assembly

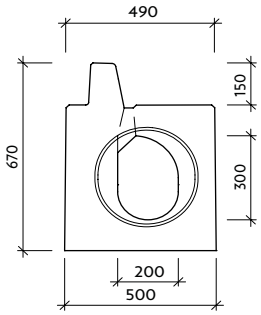
Plan



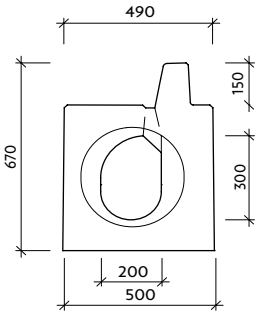
Cross-section: a-a´ VII-4-V0 -L



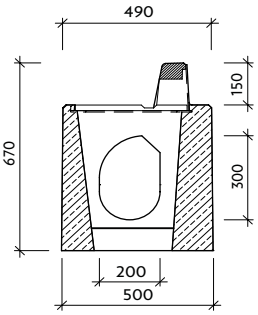
View "a" V-4-L-V0 - Spigot



View "b" V-4-L-V0 - Socket



Cross-section: b-b´

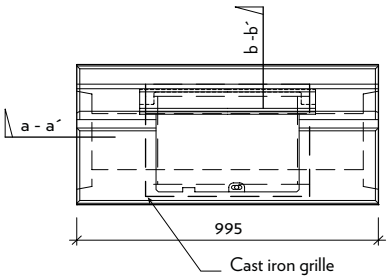


* Nominal dimensions include installation dimensions and/or minimum gap.

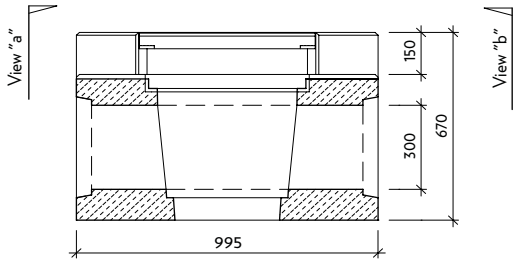
CSB - SLOT DRAIN PROFILE VII-4

Profile VII-4-VU - Gutter gully assembly

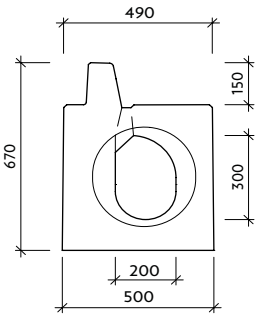
Plan



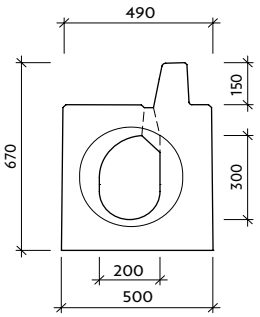
Cross-section: a-a´ VII-4-VU



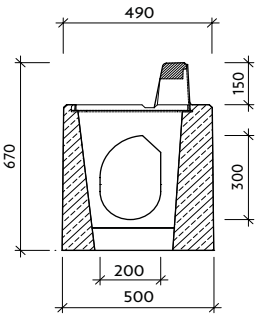
View "a" VII-4-VU - Socket



View "b" VII-4-VU - Socket

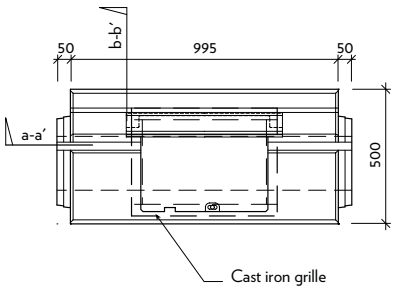


Cross-section: b-b´

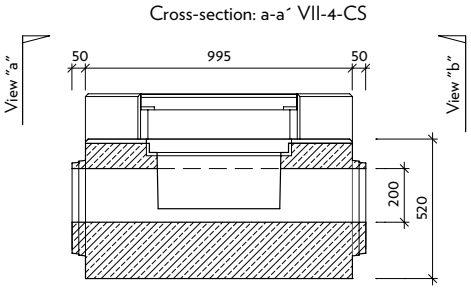


VII-4-CS Top cleaning segment

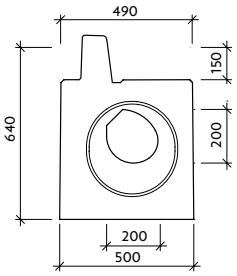
Plan



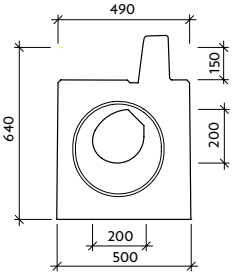
Cross-section: a-a´ VII-4-CS



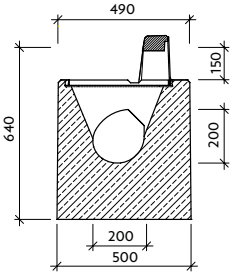
View "a" VII-4-CS - Spigot



View "b" VII-4-CS - Spigot

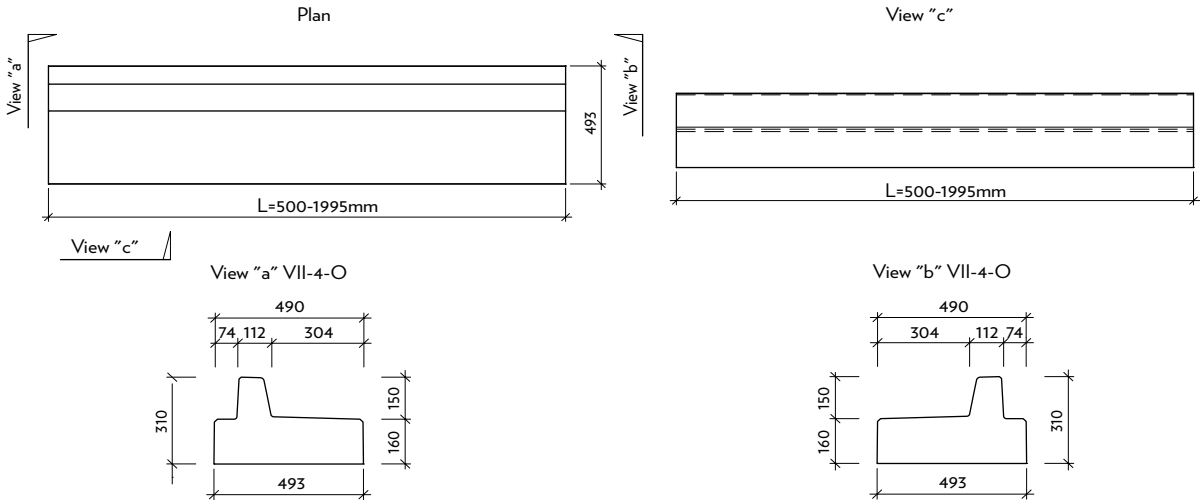


Cross-section: b-b´

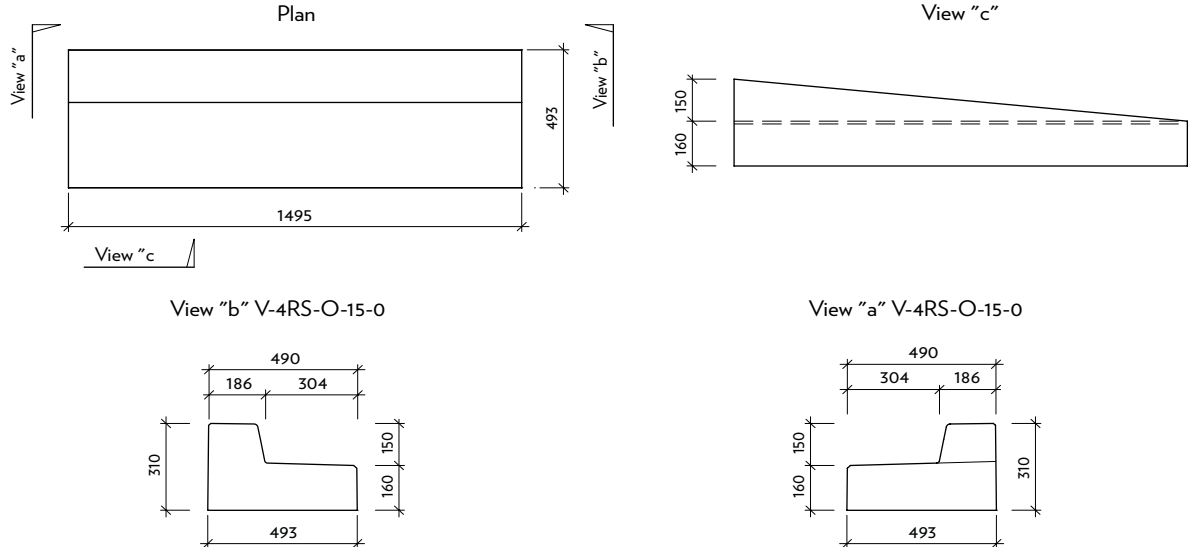


CSB - SLOT DRAIN PROFILE VII-4

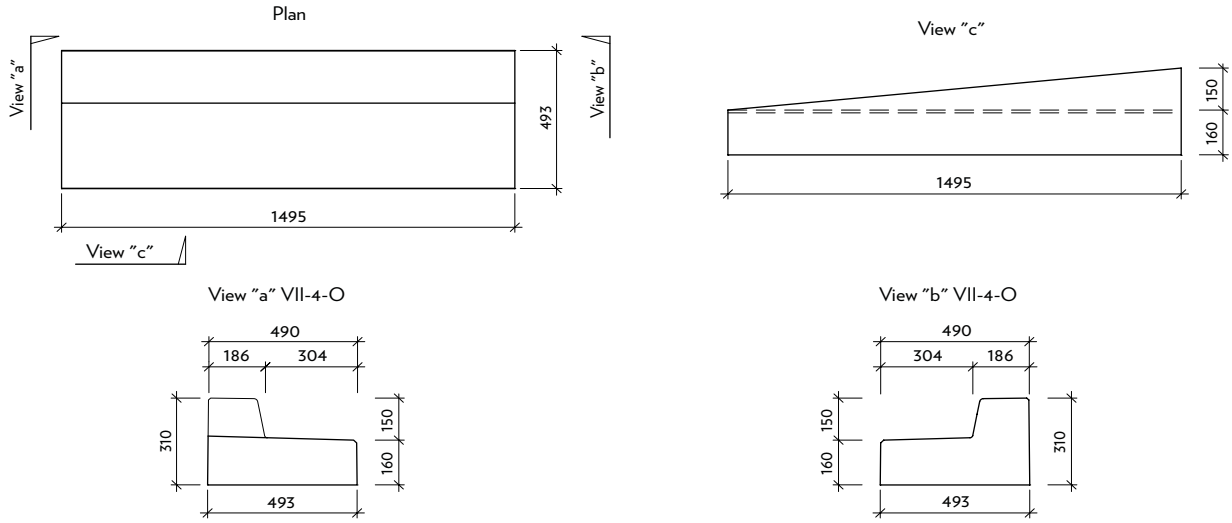
Profile VII-4-0 - Tunnel kerbstone



Profile VII-4-O - Tunnel kerbstone (rising 15-0cm)



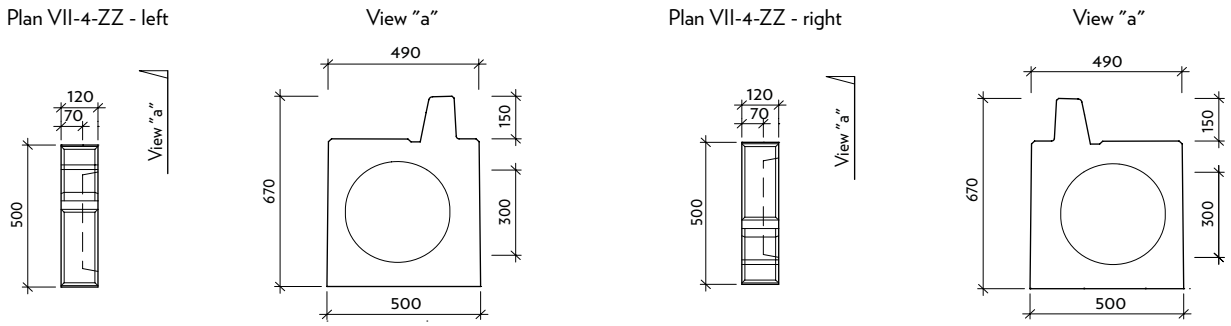
Profile VII-4-O Tunnel kerbstone (rising 0-15cm)



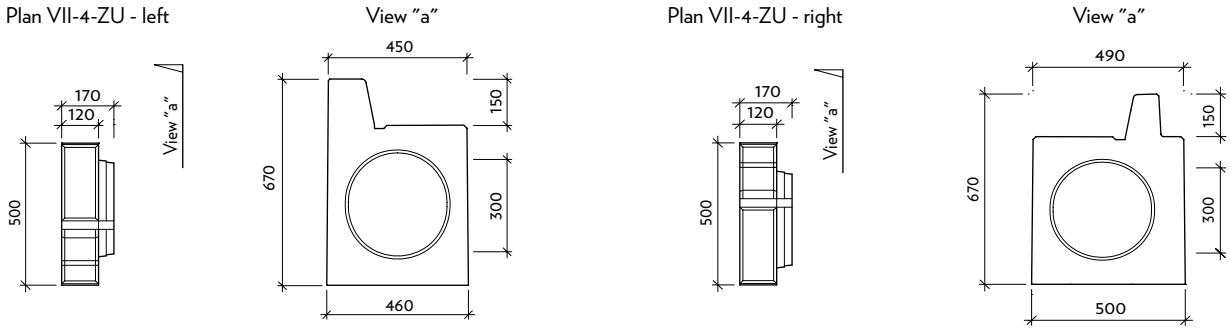
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VII-4

VII-4-ZZ - Socket end cap

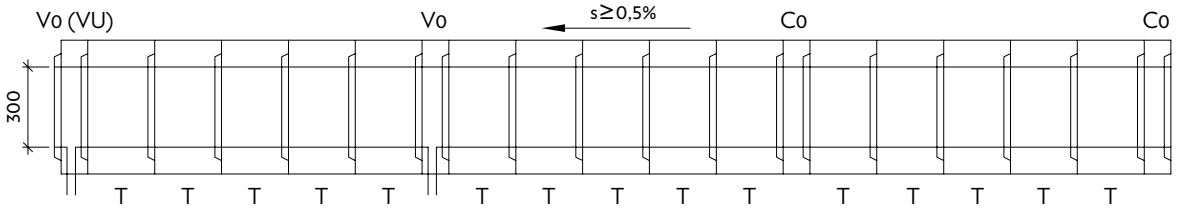


V-4-ZU - Spigot end cap

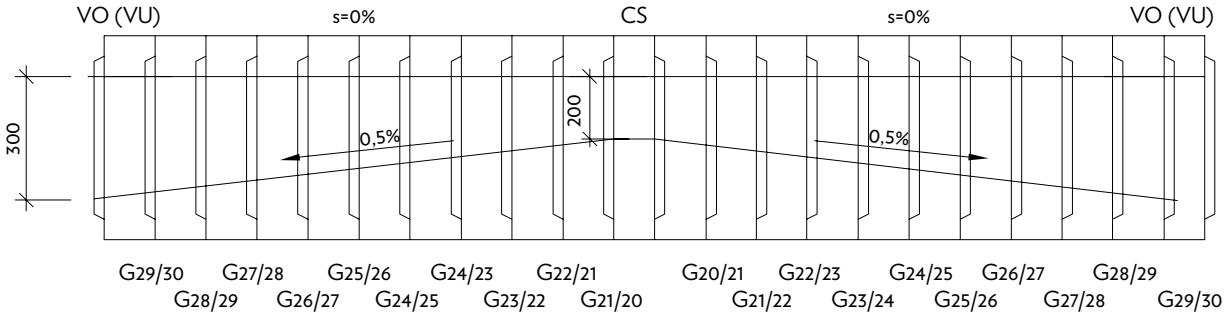


Suggested layout

V-0-T Slot drains - layout



V-0-G Slot drains - layout



Gully and cleaning element codes

V0 – Basic gully, spigot/socket, 300 mm flow profile height at both ends
VU –Gutter gully, socket/socket, 300 mm flow profile height at both ends
C0 – Basic cleaning element, spigot/socket, 300 mm flow profile height at both ends
CS – Ridge cleaning element, spigot/spigot, 200 mm flow profile height at both ends
s – Longitudinal flow profile gradient

CSB - SLOT DRAIN PROFILE VII

Cross-section: a-a´

Basic gully segment with gully trap

Plastic cover (Cast iron grill)

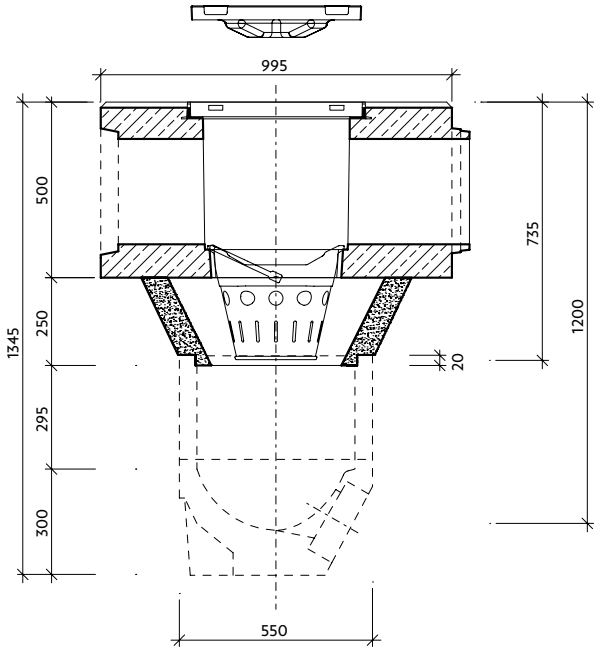
Basic gully segment

Gully trap

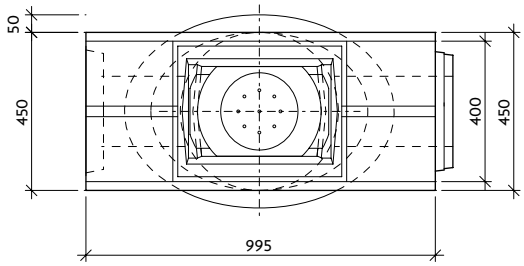
Taper top

Inspection shaft TBV-Q 450/295/6a

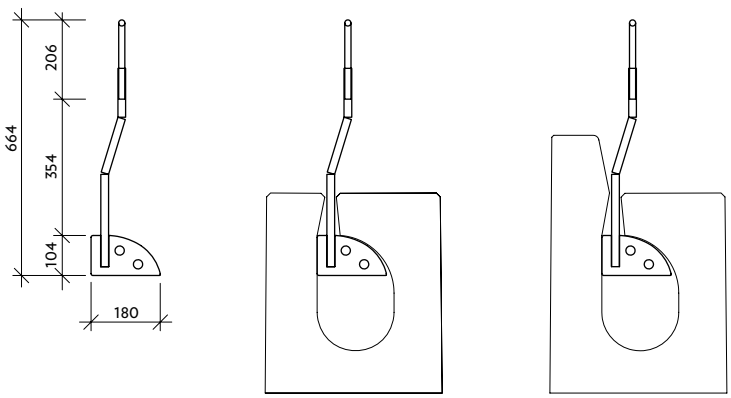
Shaft bottom TBV-Q 450/330/1a,
TBV-Q 450/330/1d



Plan



Handling equipment - PROFILE VII



* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VII

Product characteristics:

Slot drains are a modern, fast and efficient way of draining excess water from roads and surfaced areas. The system includes dedicated gully and cleaning segments.

Slot drains ensure efficient draining of excess water from surfaced areas even during extreme rainfall, its transport by means of high-capacity flow profile and removal to a storm sever. This prevents aquaplaning from occurring and collects contaminated water from the road surface so that it does not come into contact with the surrounding environment. Even large capacity slot drains are narrow, so they can be installed within a 0.5 m-wide soft shoulder. Thanks to large flow capacity and narrow flow profile, they are largely self-cleaning.

The slot drain system may be used to reduce the length of storm sewers and the number of its connectors and inlets.

CS-BETON also offers slot drains with internal flow profile gradient. These are suitable for minimum or no longitudinal gradients of the drained area. Different slot drain profiles are suitable for different applications. For faster drainage, the upper surface of the slot drain segments has a 3% gradient sloping toward the slot. For transversal vehicle travel at high speeds (80 km/hr and higher), a flat upper surface is recommended.

CS-BETON slot drains have high load-carrying capacity and selection of a suitable type allows them to be used at airports, or the most demanding industrial applications. These segments are made in three versions, for D400, E600 and F900 traffic loads. Segments with interrupted slots are especially suitable for dynamic loading, or to withstand horizontal forces. The simple design and high-quality structural elements ensure long service life of drainage systems.

CS-BETON's slot drains and all the system components are made of high strength C 45/55 XF4 concrete as per ČSN EN 206-1. Efficient plasticiser and aeration admixtures and non-crystalline silicon dioxide (MICROSILICA) admixtures make our concrete extremely resistant to water and chemical defrosting agents. In European weather conditions, the systems are not affected by frost.

The design of the slot drain elements allows for a perfect connection to the surrounding road surface. The weight of the slot drain segments (The 4 m-long segments weigh between 2.6 and 3.0t) enables compacting of road structure layers in the immediate vicinity without the risk of the segments being moved sideways, when suitable techniques such as vibration slabs are used. The slightly slanted side walls also help compacting and connection to the adjoining structures.

CS-BETON's slot drains include a proprietary two-ring AQUAFEST joint technology, which ensures perfect water tightness and resistance to oil residues and other aggressive substances. This prevents surrounding underground and surface waters from being contaminated. The rubber seal also creates an expansion joint between two adjoining drain segments.

Custom lengths (in 1 cm increments between 0.5 and 4.0 m) may also be supplied. Additional modifications are also possible upon request, such as surface modifications, side outlets, slanted ends, etc. Custom lengths and modified elements are more expensive and take longer to supply.

Installation of slot drains is relatively easy and fast when suitable equipment is used. Upon customer's request, CS-BETON will include a special handling and installation kit with the supply. Always follow manufacturer's installation instructions to ensure functional and long-lasting drainage systems.

Finished slot drain systems require minimum maintenance, only cleaning of the flow profile when it becomes clogged. Cleaning and gully segments are provided for this purpose and should be installed at regular intervals. Regular maintenance of gullies is relatively easy. According to TP 152, the gullies should be ideally spaced 40 m apart, in any case not more than 50 m. The only maintenance required is removal and emptying/cleaning of the gully traps.

CSB - SLOT DRAIN PROFILE VII

The cast iron grilles on gullies and cleaning segments are secured against lift-off from the passing traffic. The grilles also come in two versions, the 400 kN ones are made of grey cast iron and for the 900 kN ones from ductile cast iron. Slot drains can be installed in curved layouts. The maximum directional angle between two adjacent segments is 3 degrees. This ensures watertight joints between the adjoining faces. This limitation suggests that 4 m segments could be used in curves down to a radius of R = 80 m and 2 m segments down to R = 40 m. We do not recommend this minimum value as the visible line of the slot segments appears too polygonal and compacting of adjacent road layers may damage the slot drain segments and joints. This means at least R = 160 m for 4 m segments. Pro směrové oblouky menších poloměrů lze osazovat do linie žlabu zkrácené prvky popř. v kombinaci s obloukovým žlabem.

In the overall context and given its reliability, safety and low operational cost, drainage systems using slot drains are more suitable and more economical than other systems in most cases. Slot drain systems are becoming more popular and some applications would be hard to solve without them.

For maximum service life, it is recommended to sand/media blast the surface before the VDZ coating is applied.

Important information:

Slot drains are designed to collect water from surfaced areas, not from free terrain. Water from free terrain may be drained only in exceptional cases and in minimum quantities. However, blocking of the slot or the flow profile by stones and mud must always be prevented (rubble arresting benches, ditches, full lawn cover, more frequent maintenance, etc.). Installation of slot drain into minimum radius curves produces polygonal shapes. During compacting next to such shapes, compacting next to the segments must be ensured without any damage or movement to the segments must be ensured. Vibration slabs are recommended.

During installation, gullies must be precisely located in both transversal and longitudinal direction, because the micro-slot segments' length cannot be altered in situ. The nominal length of basic 2 m segments with the rubber seal is 2,000 mm.

The openings at the beginning and end of the line must be closed and sealed using end caps supplied by CS-BETON.

CAUTION!

The „Important information" above includes only a few general rules for installing slot draining systems.

Use the hydraulic calculation provided below to evaluate the flow capacity of III-series slot drain systems.

CS-BETON provides consulting services to designers and architects using micro-slot drain solutions. We will evaluate your preliminary design in the context of the overall technical solution of the roads, surfaced areas and rainwater drainage of your project. We will confirm the proposed drainage solution, or recommend changes and specify recommended elements and their location within the system, including a recapitulation/BoQ for ordering purposes, along with list prices and the total price. All the above services are provided free of charge as a courtesy to our clients.

CS-BETON s.r.o. is not the responsible designer of your project's documentation or its part. According to Section 159 of the Act no. 183/2006 Coll, the designer is responsible for the correct selection of products specified in project documentation based on guaranteed properties of individual products detailed in product property certificates.

CSB - SLOT DRAIN PROFILE VII

Hydraulic calculation:

1. Introduction
Profile VII slot drains are used for large surfaced areas such as roads, parking lots, service stations, etc. They are suitable for applications where large areas have to be drained fast.

2. Initial assumptions
The hydraulic design of a IV-slot system must always be based on the individual conditions at the given site, i.e. hydrogeology information, size, type and location of the catchment area. The capacity of the drainage system must then be calculated to reflect these conditions.

2.1 Geometrical characteristics
Profile VII-series slot drains are produced in two types. The VII-G profile has an artificial bottom gradient of 5 ‰ and the VII-T profile has a constant height of the flow profile. Further options include these: with interrupted slot, with integrated kerbstones, etc.

2.1.1 VII-G type segments with internal gradient
This type of system is represented by a line of 20 basic segments with one gully segment (20.0 + +1.0 = 21.0 m) in a „saw teeth" configuration and/or with one gully and one cleaning segment (20.0 + +2.0 = 22.0 m) when only one such line is used. Another option are two basic lines with the gully segment in the middle and cleaning segments at the ends - this configuration is
1.0+20.0+1.0+20.0+1.0=43.0 m. The basic 20.0 m line with a 5 ‰ flow profile bottom gradient has an upper part of the flow profile cross section formed by an R = 100 mm circle, a bottom part by an R = 100 mm circle, with a 200 x 100 mm rectangle in between. The height of this rectangle changes from 0 to 100 mm and is increased by 20 mm for each subsequent segment.

2.1.2 VII-T type segments with constant internal gradient
This type of slot drain does not have a fixed maximum length of one line - individual parameters depend on the site conditions (slopes etc.). The distance between the beginning/end of the line and the first cleaning and/or gully segment should not exceed 6 m so that simple cleaning and maintenance is possible. Distances between individual cleaning{gully segments depend on the maintenance and cleaning intervals. According to TP 152, the maximum distance is 50 m. The segments have a flow profile cross section formed by a top and bottom circle of a 100 mm radius, with a 200 x 100 mm rectangle in between - it is thus identical to the end profile of the above sloped type.

2.2 Hydrology information
For the hydraulic design of slot drain systems, the most important input parameter is the design rainfall volume, which is used to arrive to the total drained volume and the necessary number of gully segments. The design rainfall volume may be obtained, for instance, from the „Intenzity krátkodobých dešťů v povodích Labe, Odry a Moravy" (Josef Trupl) Table [1], or by ordering the information from the relevant Hydrometeorology Institute branch. Generally speaking, for IV Profile slot drain systems, ČSN 75 6101 (Stokové sítě a kanalizační přípojky) [2] specifies 15-minute rainfall with periodicity as per the type of area as the critical parameter. The same parameter is then used for the design of the storm sever.

2.3 Terrain location
For the most economical system, the slot drains should be located on the catchment area so that their capacity is used to maximum and the number of storm sewer connections is minimal. The ideal scenario is slot drains in the lowest part of the area and a sufficient gradient sloping toward that part. When VII-G type segments are used, the line is usually installed on a level surface. When VII-T type segments are used, the gradient of the terrain in the longitudinal direction of the line must be at least 5 ‰ and the draining capacity depends on the gradient. Nomographic chart 1 below lists the flow capacity of slot drains and the flow rate for that capacity in relation to the longitudinal gradient. The total capacity of the system must correspond to the catchment area and the design rainfall as per above. The intensity of the design rainfall is reduced as per [2] using a recommended draining coefficient, which depends on type of structures present, type of site and its sloping. TP152 MDS may be used for the design.

2.4 Terrain location
Connections to storm sewer are installed in shafts provided under gully segments with a DN 150 or DN 200 connector. The gully segments include support surfaces for gully traps to protect the sewer connector from being blocked by debris.

3.Capacity flow through III Profile slot drains

Calculation of the capacity of this system is based on the „Hydraulické tabulky stok" (Hydraulic tables: Sewage conduits by J. Herle, O. Štefan, J. Turi Nagy) [3]. The same method is also used to design sewage conduits. The roughness coefficient was assumed at n = 0.014 and velocity coefficient c was calculated as per Pavlovský. Our calculations do not assume (given the usual longitudinal sloping of up to 35 ‰) any aeration within the flow. The capacity itself was then calculated using the Chezy formula for gradients of 5 to 100 ‰ and the results were plotted in nomogram 1. The nomogram also shows flow speeds for the given flow rates. The calculation was only performed for VII profiles, i.e. with constant cross-section, because with such systems, variable distances between gully segments is used depending on the size of the area drained. A 20 m-long line of slot drains is capable (theoretically, see Chapter 5) of draining an area of approximately 4480 sq. m, i.e. a 20 m-wide road segment 224 m long, which is sufficient for most applications. As far as the DN 150 gully connectors are concerned, their capacity must be evaluated at critical points, see Literature [3]. To prevent blocking by debris, all connectors should have a gradient of at least 20 ‰. With smaller gradients of the slot drain lines, the connector capacity may become the limiting factor for the whole system and larger connector diameters and/or gradients are recommended.

4. Example hydraulic calculation

This hydraulic calculation is based on theoretical input information. This specifies an application example involving Profile IV slot drains and a motorway with a constant longitudinal gradient of 10 ‰. The road is in an area for which the hydrographical information is taken from data provided by the Roudnice nad Labem meteorological station. The segment which uses slot drains has a width of 12 m and a length of 125 m. The slot drains are installed at the edge of the road. The line includes one gully segment at the bottom end. The limiting parameter for the slot drain line is its cross-section at the bottom end. The road has a transversal gradient toward the slot drains of 25 ‰ and has a bitumen surface. Design rainfall intensity for T = 15 minutes and periodicity p = 1 is:

$$I_{NAV} = 112 \text{ [l/s.ha]}$$

the run-off coefficient is:

$$\varphi = 0{,}80$$

the drained area is:

$$F = 12 \times 125 \times 0{,}0001 \text{ [ha]} = 0{,}15 \text{ [ha]}$$

after reduction by coefficient c = 0,80 the drained area is:

$$F_{RED} = \varphi \times F \text{ [ha]} = 0{,}80 \times 0{,}150 = 0{,}120 \text{ [ha]}$$

the design flow Q_{NAV} is

$$Q_{NAV} = F_{RED} \times I_{NAV} \text{ [l/s]}$$
$$Q_{NAV} = 0{,}120 \times 112$$
$$Q_{NAV} = 13{,}44 \text{ [l/s]}$$

after comparing this value to the capacity of the slot drain from nomogram 1 for the gradient of 10‰, it is clear that:

$$Q_{KAP} = 61{,}92 \text{ [l/s]} > Q_{NAV} = 13{,}44 \text{ [l/s]}$$

cleaning segments also have to be provided, with maximum spacing of 50 m.

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VII

Nomograms:

5. Nomograms for preliminary design of drainage systems
For reference design of VII-profile draining systems, some calculation assumptions may be simplified. The average rainfall intensity for 15 minute rainfalls and periodicity of p = 1 for the Czech Republic (Labe basin) is:

I_{OR} = 122 [l/s.ha]

Since these slot-drains will not be used to drain water from unsurfaced areas, the average run-off coefficient c as per [2] is:

φ = 0,80

which is correct for concrete/bitumen surfaces with a gradient between 10 and 50 ‰.

With these specifications, the following nominal run-off may be assumed:

per 1 sq m of drained area:

Q_{OR} = 1 x 1 x 0,0001 x 0,8 x 122 = 0,00976 [l/s]

per 1 are, i.e. 100 sq. m:

Q_{OR} = 10 x 10 x 0,0001 x 0,8 x 122 = 0,976 [l/s]

per 1 hectare, i.e. 10,000 sq. m:

Q_{OR} = 100 x 100 x 0,0001 x 0,8 x 122 = 97,6 [l/s]

he relationship between design run-off and the drained area is shown in nomogram 2. for areas of 500 to 5000 sq m.

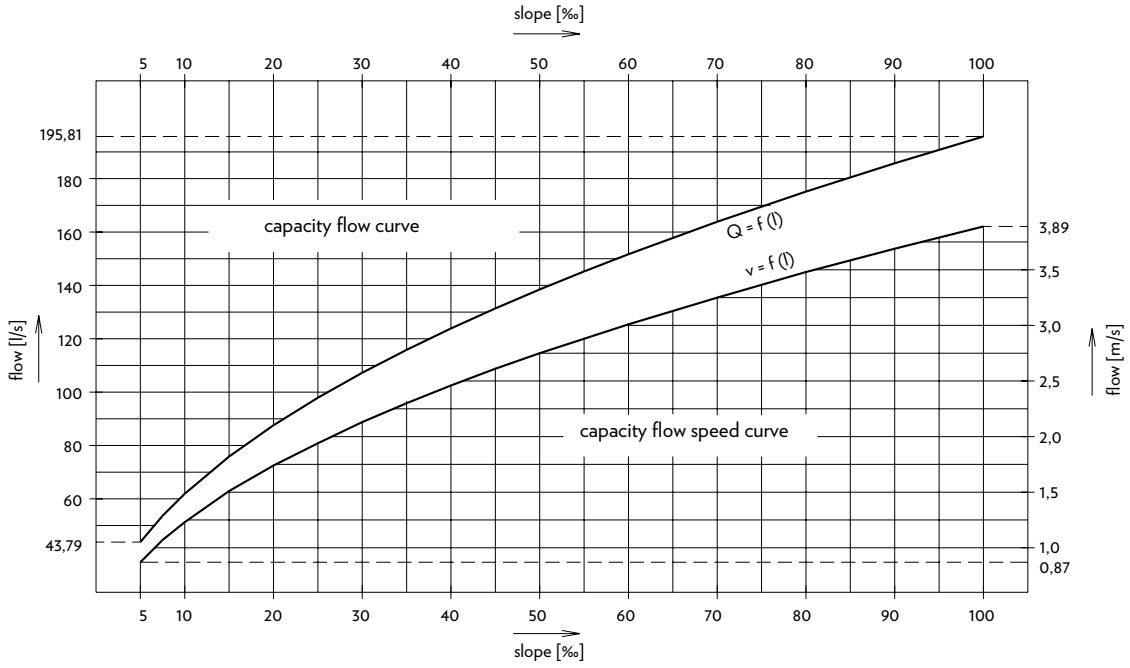
A comparison of the calculated run-off as per nomogram 2 with the capacity of the slot drain at the given gradient from nomogram 1 gives us enough information to specify the number of gully segments and to optimise the layout of the slot drain system.

6. Gully trap
Each gully contains two gully traps, which protect the storm sewer connections from being blocked by debris. The TP 152 recommends a distance between gully segments in a line of VII Profile slot drains of 40 to 50m, depending on the characteristics of the adjacent surfaced area.

The gully segments include small gully traps, which are sufficient for most applications. For applications where large flow rate is required, large gully traps may be used. The gully traps have several rows of narrow rectangular openings. The shape is conical and fits the support elements within the gully segment. Filling openings are provided at the top of the narrower sides. Every gully trap includes a holding rod for easy handling. Gully traps are made of 1.25 mm thick galvanised steel sheeting. The maximum flow rate through a gully trap is 21,20 l/s.

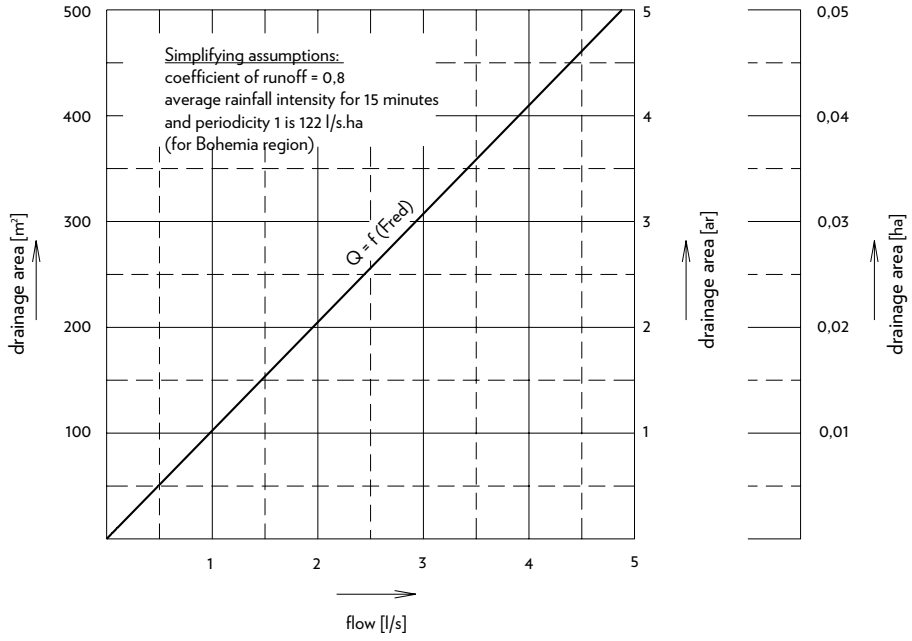
NOMOGRAME No. 1

CAPACITY OF SLOT CHANNELS (ROUGHNESS COEFFICIENT n = 0,014 - BY PAVLOVSKY)
PROFILE "VII"



NOMOGRAM No. 2

Determination of surface runoff from 500 to 5000 m²



* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - SLOT DRAIN PROFILE VII

Input data:

The following literature has been used in designing the drainage system described in this brochure:

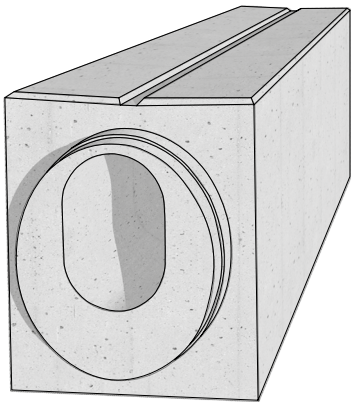
ČSN EN 1433 Odvodňovací žlábky pro dopravní a pěší plochy - konstrukční zásady zkoušení, označování, řízení jakosti
ČSN EN 206 Beton - specifikace, vlastnosti, výroba a shoda
DIN 19 580 Entwässerungsrinnen für Niederschlagswasserzum Einbau in Verkehrsflächen
ČSN 73 6056 Odstavné a parkovací plochy silničních vozidel
ČSN 73 6059 Servisy a opravny motorových vozidel. Čerpací stanice pohonných hmot
ČSN 73 6101 Projektování silnic a dálnic
ČSN 73 6110 Projektování místních komunikací
ČSN 73 6114 Vozovky pozemních komunikací
ČSN 75 6101 Stokové sítě a kanalizační přípojky
ČSN EN 124 Poklopy a vtokové mříže pro dopravní plochy
Vzorové listy staveb pozemních komunikací VL-1 Vozovky a krajnice, Ministry of Transport of the Czech republic, Dopravoprojekt
Vzorové listy staveb pozemních komunikací VL-2.2 Odvodnění, Ministry of Transport of the Czech republic, Dopravoprojekt
TKP 1 - Všeobecně
TKP 18 - betonové konstrukce (vč. 10 příloh)
TKP 31 - opravy betonových konstrukcí
TP 152 - Štěrbinové žlaby na PK, 2001, VPÚ-DECO
TP 170 - Navrhování vozovek PK (všeobecná část, katalog, návrhová metoda), 2004, VTU, Roadconsult
Technical documentation by CS-BETON Velké Žernoseky + VPÚ DECO 96-04
Company standard 7/99 Micro-slot drains as per DIN 19580, CSB
TPV 2/99 - Technologický předpis na montáž mikroštěrbinových trub, CSB
TPV 1/98 - Technologický předpis na opravy betonových prvků odvodňovacích systémů štěrbinových trub, CSB

CSB - TRANSITIONAL PIECES

Protected by utility patent

Technical data:

When storm sewer connections are few and far between, line drainage may be used in place of an underground storm sewer network. This, however, requires higher-capacity flow profiles. To achieve the required flow rates and keep the costs down, innovative transitional pieces enabling different flow profiles to be connected to each other have been designed. The drainage line is divided into sections with different flow rates/flow profiles, smaller at the beginning and larger at the end. For instance, T or I profiles, followed by Profile II, IV and III sections and the largest Profile VI at the end. This system enables large areas to be drained with a single storm sewer connection while keeping the cost down.

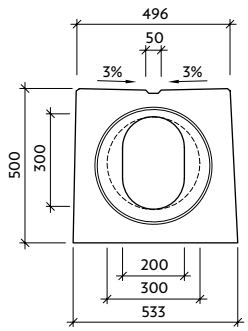


Name	Order code	Nominal dimensions mm			Quantity	Weight
		Basic height	Length	Width	psc/m	pcs
I - II transition slot drain segment, right/left	PP-I-II	500	995	400/450 496/533	1	409
I - III transition slot drain segment, right/left	PP-I-III	600	995	400/450 498/533	1	513
I - IV transition slot drain segment, right/left	PP-I-IV	700	995	400/440 500/540	1	633

Nominal dimensions - basic shapes:

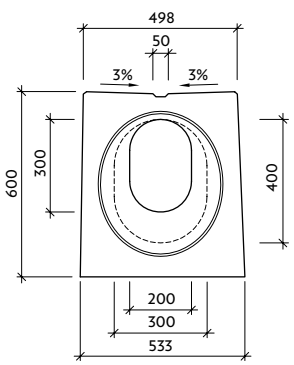
PP-I-II - transition slot drain segment

Side-view
Spigot



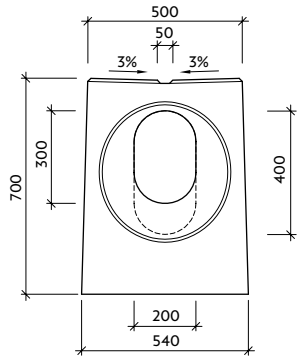
PP-I-III - transition slot drain segment

Side-view
Spigot



PP-I-IV - transition slot drain segment

Side-view
Spigot



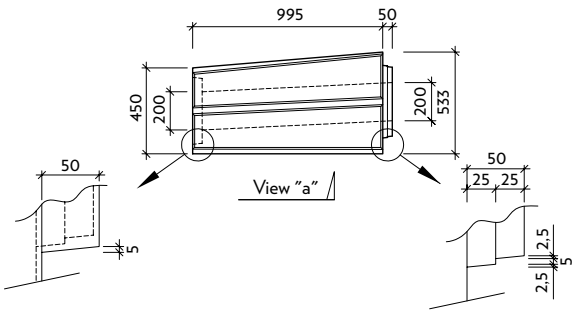
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - TRANSITIONAL PIECES

Protected by utility patent

PP-I-II - transition slot drain segment, left

Plan



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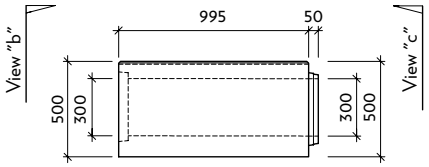
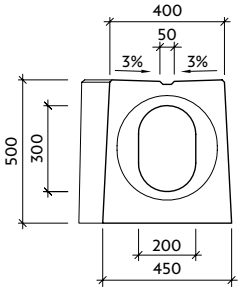
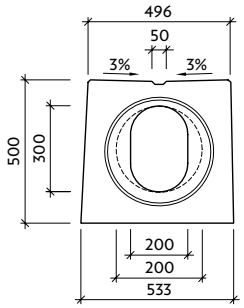


View "b" - Socket

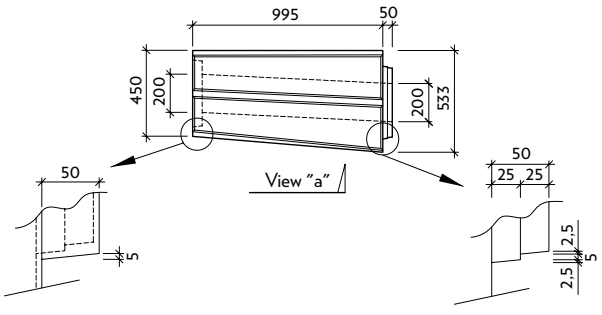


View "c" - Spigot



PP-I-II - transition slot drain segment, right

Plan



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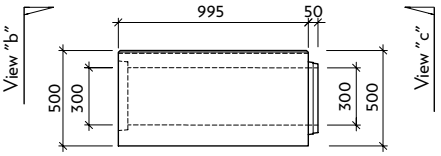

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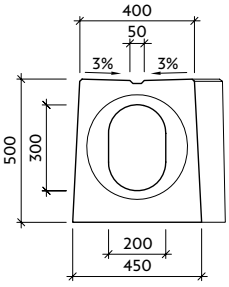
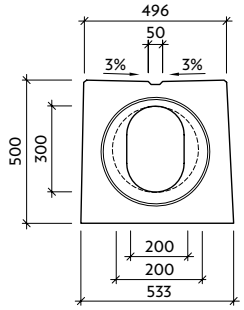


View "c" - Spigot

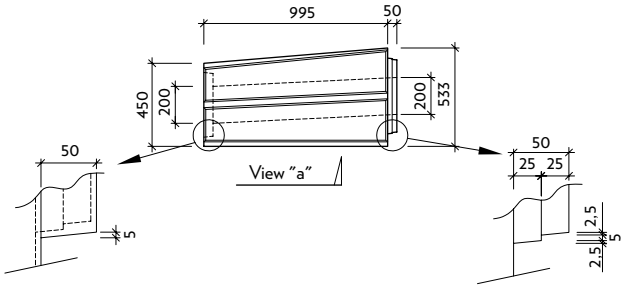


CSB - TRANSITIONAL PIECES

Protected by utility patent

PP-I-III - transition slot drain segment, left

Plan



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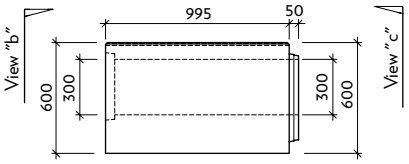

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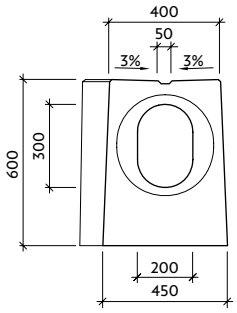

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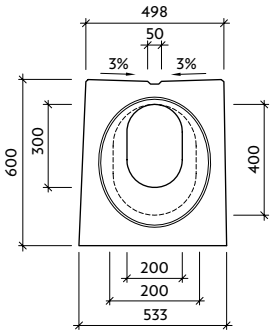
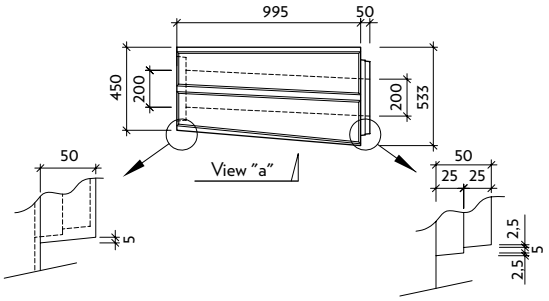


PP-I-III - transition slot drain segment, right

Plan



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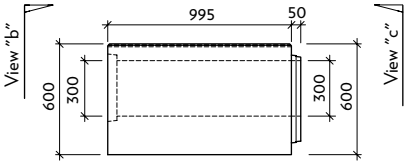

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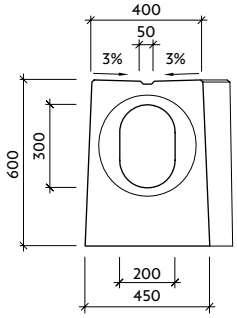

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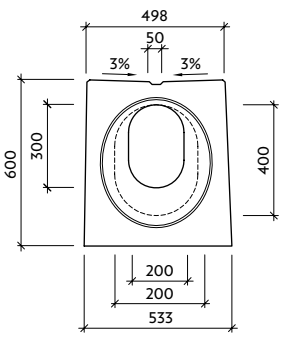


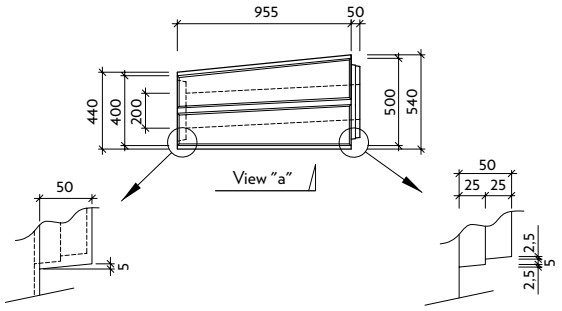
* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - TRANSITIONAL PIECES

Protected by utility patent

PP-I-IV - transition slot drain segment, left

Plan



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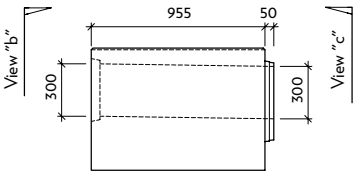
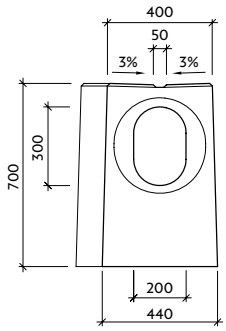
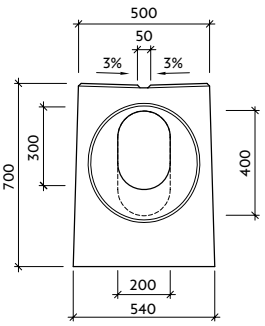


View "b" - Socket

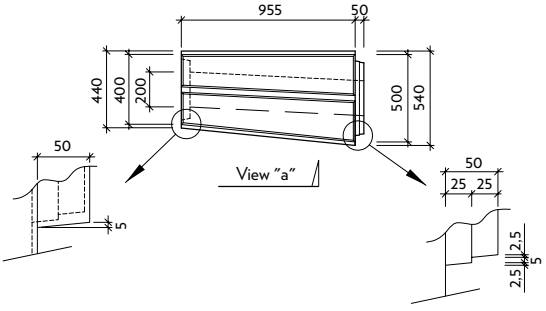


View "c" - Spigot

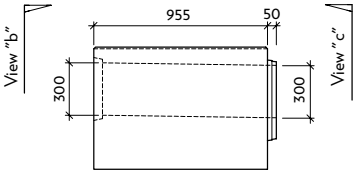


PP-I-IV - transition slot drain segment, right

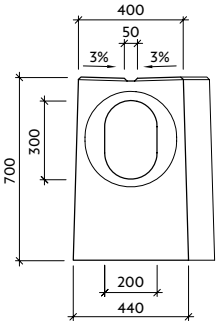
Plan



View "a"



View "b" - Socket



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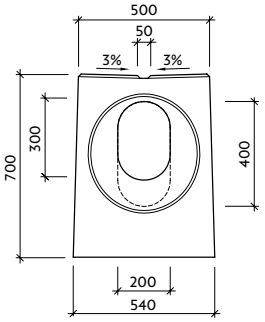


CSB - TRANSITIONAL PIECES

Product characteristics:

Slot drains are a modern, fast and efficient way of draining excess water from roads and surfaced areas. The system includes dedicated gully and cleaning segments.

Slot drains ensure efficient draining of excess water from surfaced areas even during extreme rainfall, its transport by means of high-capacity flow profile and removal to a storm sever. This prevents aquaplaning from occurring and collects contaminated water from the road surface so that it does not come into contact with the surrounding environment. Even large capacity slot drains are narrow, so they can be installed within a 0.5 m-wide soft shoulder. Thanks to large flow capacity and narrow flow profile, they are largely self-cleaning.

The slot drain system may be used to reduce the length of storm sewers and the number of its connectors and inlets.

Different slot drain profiles are suitable for different applications. Segments with flat surface are safe for high driving speeds and provide an aesthetically-pleasing transition between a road and a soft shoulder.

CS-BETON slot drains have high load-carrying capacity and selection of a suitable type allows them to be used at airports, or the most demanding industrial applications. Individual segments are designed and produced for two basic loads, 400 and 900 kN. Segments with interrupted slots are especially suitable for dynamic loading, or to withstand horizontal forces. The simple design and high-quality structural elements ensure long service life of drainage systems.

CS-BETON's slot drain, inlet and cleaning segments are made from C 45/55 XF4 class concrete as per ČSN EN 206. They are resistant to frost and chemical defrosting agents. In European weather conditions, the systems are not affected by frost.

The design of the slot drain elements allows for a perfect connection to the surrounding road surface. The weight of the segments (a 4 m segments weights around 1.7 t) allows for compacting of the road's structural layers next to the installed slot drain (with the necessary degree of caution) without a danger of them being pushed aside. The slightly slanted side walls also help compacting and connection to the adjoining structures.

Thanks to well-designed joints between individual segments (using rubber seals and special caulk, a finished slot drain is watertight. The rubber used in seals is also resistant to oil substances. The rubber seal also provides an expansion joint between two adjacent segments and prevents them from coming into contact. The expansion joint is approximately 5 mm - wide.

The slot drains are manufactured in 4 m-long basic segments. Upon request, other segment lengths may be produced (such as 2m segments). Any segment length up to 4 m may be ordered. Additional modifications are also possible upon request, such as surface modifications, side outlets, slanted ends, etc. Segments shorter than 4 m or in custom lengths, however, are more expensive per unit of length and take longer to supply.

Installation of slot drains is relatively easy and fast when suitable equipment is used. Upon customer's request, CS-BETON will include a special handling and installation kit with the supply. Always follow manufacturer's installation instructions to ensure functional and long-lasting drainage systems.

A finished slot drain drainage system installed in a road surface is very durable and practically indestructible. It requires minimum maintenance, only cleaning of the flow profile when it becomes clogged. Cleaning and gully segments are provided for this purpose and should be installed at regular intervals. Regular maintenance of gullies is relatively easy. According to TP 152, the gullies should be ideally spaced 40 m apart, in any case not more than 50 m. Regular maintenance of drainage outlets is easy thanks to the limited width of the segments. Since the draining system is installed at the edge of the soft shoulder, road barriers or other structures do not come into the way of the gully traps when they are being lifted for cleaning.

The cast iron grilles on gullies and cleaning segments are secured against lift-off from the passing traffic. The grilles also come in two versions, the 400 kN ones are made of grey cast iron and for the 900 kN ones from ductile cast iron. Slot drains can be installed in curved layouts. The maximum directional angle between two adjacent segments is 3 degrees. This ensures watertight joints between the adjoining faces. This limitation suggests that 4 m segments could be used in curves down to a radius of R = 100 m and 2 m segments down to R = 50 m. We do not recommend this minimum value as the visible line of the slot segments appears too polygonal and compacting of adjacent road layers may damage the slot drain segments and joints. This means at least R = 200 m for 4 m segments.

* Nominal dimensions include installation dimensions and/or minimum gap.

CSB - TRANSITIONAL PIECES

In the overall context and given its reliability, safety and low operational cost, drainage systems using slot drains are more suitable and more economical than other systems in most cases. In Germany, they have been used for a long time and are the only solution used for motorways and airports. In recent years, both professionals and the general public in the Czech Republic have had the opportunity to appreciate the benefits of this type of solution on many public infrastructure projects. Slot drain systems are becoming more popular and some applications would be hard to solve without them.

Important information:

Slot drains are designed to collect water from surfaced areas, not from free terrain. Water from free terrain may be drained only in exceptional cases and in minimum quantities. However, blocking of the slot or the flow profile by stones and mud must always be prevented (rubble arresting benches, ditches, full lawn cover, more frequent maintenance, etc.). Installation of slot drain into minimum radius curves produces polygonal shapes. During compacting next to such shapes, compacting next to the segments must be ensured without any damage or movement to the segments must be ensured. Vibration slabs are recommended.

During installation, gullies must be precisely located in both transversal and longitudinal direction, because the micro-slot segments' length cannot be altered in situ. The nominal length of basic 2 m segments with the rubber seal is 2,000 mm.

The openings at the beginning and end of the line must be closed and sealed using end caps supplied by CS-BETON.

CAUTION!

The „Important information" above includes only a few general rules for installing slot draining systems.

Use the hydraulic calculation provided below to evaluate the flow capacity of slot drain systems.

CS-BETON provides consulting services to designers and architects using micro-slot drain solutions. We will evaluate your preliminary design in the context of the overall technical solution of the roads, surfaced areas and rainwater drainage of your project. We will confirm the proposed drainage solution, or recommend changes and specify recommended elements and their location within the system, including a recapitulation/BoQ for ordering purposes, along with list prices and the total price. All the above services are provided free of charge as a courtesy to our clients.

CS-BETON s.r.o. is not the responsible designer of your project's documentation or its part. According to Section 159 of the Act no. 183/2006 Coll, the designer is responsible for the correct selection of products specified in project documentation based on guaranteed properties of individual products detailed in product property certificates.

CSB - TRANSITIONAL PIECES

Input data:

The following literature has been used in designing the drainage system described in this brochure:

ČSN EN 1433 Odvodňovací žlábky pro dopravní a pěší plochy - konstrukční zásady zkoušení, označování, řízení jakosti
ČSN EN 206 Beton - specifikace, vlastnosti, výroba a shoda
DIN 19 580 Entwässerungsrinnen für Niederschlagswasserzum Einbau in Verkehrsflächen
ČSN 73 6056 Odstavné a parkovací plochy silničních vozidel
ČSN 73 6059 Servisy a opravny motorových vozidel. Čerpací stanice pohonných hmot
ČSN 73 6101 Projektování silnic a dálnic
ČSN 73 6110 Projektování místních komunikací
ČSN 73 6114 Vozovky pozemních komunikací
ČSN 75 6101 Stokové sítě a kanalizační přípojky
ČSN EN 124 Poklopy a vtokové mříže pro dopravní plochy
Vzorové listy staveb pozemních komunikací VL-1 Vozovky a krajnice, Ministry of Transport of the Czech republic, Dopravoprojekt
Vzorové listy staveb pozemních komunikací VL-2.2 Odvodnění, Ministry of Transport of the Czech republic, Dopravoprojekt
TKP 1 - Všeobecně
TKP 18 - betonové konstrukce (vč. 10 příloh)
TKP 31 - opravy betonových konstrukcí
TP 152 - Štěrbinové žlaby na PK, 2001, VPÚ-DECO
TP 170 - Navrhování vozovek PK (všeobecná část, katalog, návrhová metoda), 2004, VTU, Roadconsult
Technical documentation by CS-BETON Velké Žernoseky + VPÚ DECO 96-04
Company standard 7/99 Micro-slot drains as per DIN 19580, CSB
TPV 2/99 - Technologický předpis na montáž mikroštěrbinových trub, CSB
TPV 1/98 - Technologický předpis na opravy betonových prvků odvodňovacích systémů štěrbinových trub, CSB

* Nominal dimensions include installation dimensions and/or minimum gap.

STAVBY JAKO Z KAMENE
CSBETON®

INSTALLATION OF SLOT DRAINS

Preparations:

The following requirements must be met before installation itself:

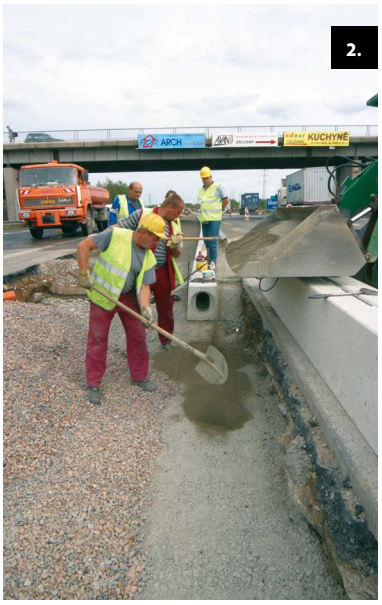
- The base soil uniformly compacted as per project documentation
- Concrete foundations installed as per project documentation (Fig. 1)
- Directional and altitude survey/markings for the slot drain line(s). Use a sufficient number of markings, especially in curved layouts.
- Connector shafts under gully segments installed

Installation:

Cover the concrete foundation with a 30 - 50 mm layer of thick/dry concrete mix. Use maximum aggregate size of 10 mm (Fig. 2).
Insert the lifting device into the slot. Lock it by turning it by 90° (Fig. 3).
Attach the lifting device to the crane rope (Fig. 4).
The CSB micro-slot drain system may be installed without lifting devices.
Move the first segment into the desired position. Adjust its height, direction and gradient.
Apply installation grease onto the contact surface of the socket (Fig. 9).
Fit the rubber seal to the joint ring of the second segment (Fig. 6).
Apply installation to the seal as well (Fig. 7).
Move the next segment to about 60 cm above its intended position. Slowly and gradually lower the segment (Fig. 5).
When the new segment's connection ring reaches the top of the first segment's socket, press the hanging segment down at the end being joined. This tilts the new segment downwards slightly. Continue lowering slowly, until the connection ring and the socket are directly opposite in both vertical and horizontal planes (Fig. 8).

Press the new segment into the socket of the first one while continuing gently lowering it.
Leave approximately 5 mm of gap between the adjacent segments. The same applies to the narrower part of the gap for segments in a curve.


1.


2.


3.


4.


5.


6.


7.

* Nominal dimensions include installation dimensions and/or minimum gap.

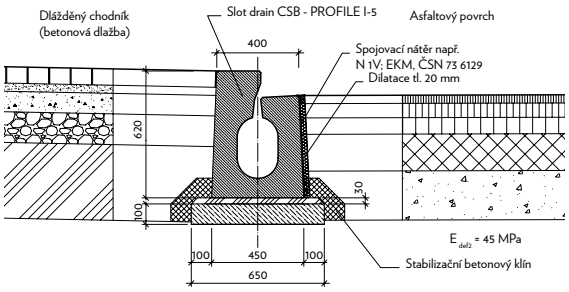
MONTÁŽ ŠTĚRBINOVÝCH ŽLABŮ

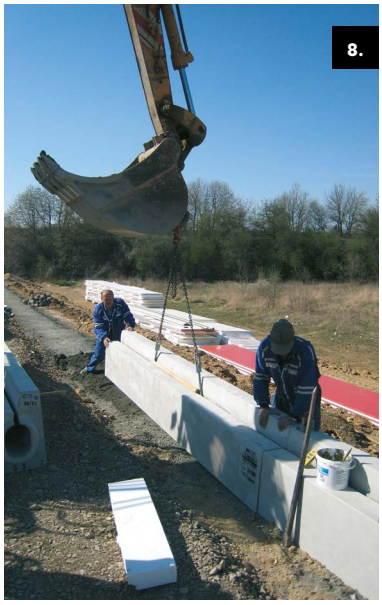
- Adjust the height, direction and gradient of the new segment. Repeat the process for all other segments.
- Make sure that the maximum angle between two adjacent segments is 3%. The Aquafest seal only guarantees water tightness of the joints when this rule is observed.
- Ensure gully segments are correctly connected to the pre-installed storm sewer shafts. (Fig. 10)
- Install gully traps and covers on the gully segments.
- Use the supplied end caps at the end of every line. (Fig. 11)
- Fill horizontal gaps between segments with bitumen or polyurethane caulk.
- Where additional surface layers to be compacted are installed on one side of the line only, cast concrete wedges on the opposite side of the segments to prevent them from moving sideways away from the compacted layers. (Fig. 12)
- The CSB Slot Drain system is very robust. The segments do not have to be surrounded by concrete on all sides to carry the design loads.
- When installing bitumen surface layers next to the slot drains, do not overlap the segments with a vibrating roller. Use a vibrating plate in the immediate vicinity instead. (Fig. 13,14)
- When casting concrete layers around slot drains, always install the recommended expansion joint on the side of the segments.
- Use the system to drain water from surfaced areas only.

System maintenance

- The system does not require any special maintenance apart from cleaning/removal of debris.
- Only ploughs with plastic or rubber skirts must be used in winter.

VZOROVÝ PŘÍČNÝ ŘEZ




8.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10.


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12.


13.


14.

VLASTNOSTI A CHARAKTERISTIKA

The wet-cast technology enables us to produce slot and micro-slot drains with excellent properties, with smooth and resistant surface, superior strength and extreme resistance to water and chemical defrosting agents.

CSB slot drains and micro-slot drains are made of high-strength aerated cement (C45/55 class) and can withstand XF4, XD3 aggressive environments as per ČSN EN 206. They are also compliant with TKP 18 and TP 152 specifications. The concrete mix has a guaranteed minimum air content of 5%. The mixing is done in a fully-automated process using state of the art equipment. Moisture content in the aggregate is monitored by microwave meters, weights are determined by tensiometers and the moisture content in the final mix is also separately controlled

Our high-quality concrete mix ensures:

- high compression strength
- exceptionally high tensile strength
- extreme resistance to water and chemical defrosting agents
- excellent resistance to abrasion
- minimum water absorption
- high-quality surfaces

The slot drain segments are produced in our new, state of the art facility, with automated processes ensuring optimum concrete mix parameters, exact reinforcement position, automated controls and automated curing chamber. During the production, raw materials are inspected and so is the concrete mix (thickness, air content, volume weight and strength after one and seven days). After each product is completed, it undergoes a final inspection in our accredited laboratory (compression strength, resistance to water and chemical agents, characteristics of air pores in hardened concrete, reinforcement shielding check and nominal dimensions check). All tests are performed using procedures prescribed in the relevant technical standards.

Only high-quality materials are used in production of the slot and micro-slot drains:

Natural, washed and crushed gravel as per ČSN EN 12620 is used as aggregate. As per EU legislation, the producer of the aggregate has issued a Declaration of performance and obtained an independent certificate. The aggregate is also tested in all sizes and types.
The cement used in production of the slot drains is regularly tested and has a Declaration of performance as per EU legislation. The properties of the cement used are as per ČSN EN 197-1.

Additives and admixtures are used to improve the quality of the concrete. These are compliant with harmonised EU standards. Their producers also submit Declarations of performance and certificates as per valid EU legislation.

Reinforcement consists of individual reinforcement rods, or reinforcement grids made of specified steel and with specified properties. All reinforcement is covered by at least 454 mm of concrete as per TKP 18. Wherever this required cover cannot be obtained, galvanised steel is used for superior durability. The exact position of the reinforcement in each product is controlled by positioning inserts. All reinforcement steel has a declaration of conformance and a valid certificate.

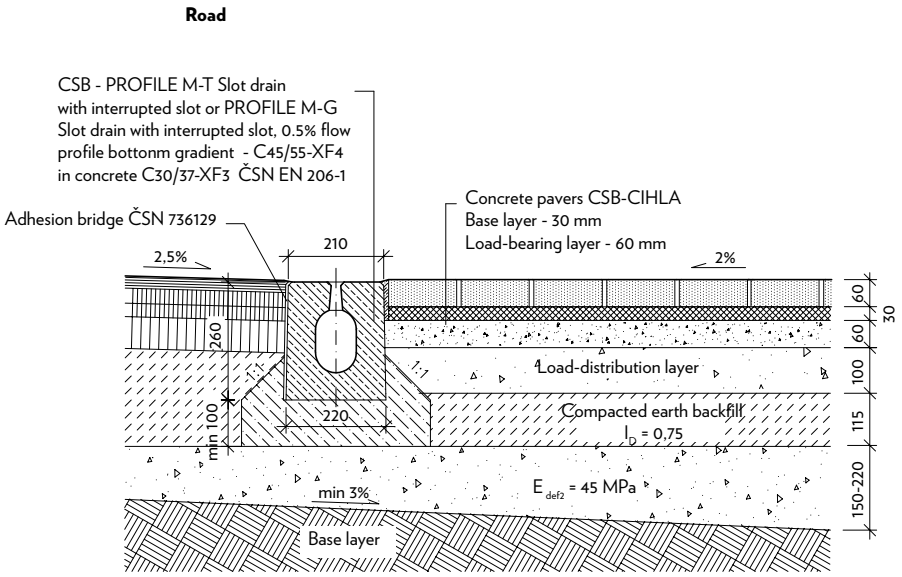
All slot and micro-slot drains are finished in natural concrete grey.

CSB slot and micro-slot drains are produced under a ČSN EN ISO 9001:2001-certified production control system, audited regularly by independent auditors. All products are tested during and after production in accredited testing labs. Our extensive experience, state of the art manufacturing equipment, high-quality raw materials, continuous production monitoring and strong company ethics guarantee the best and constant quality of all our products.

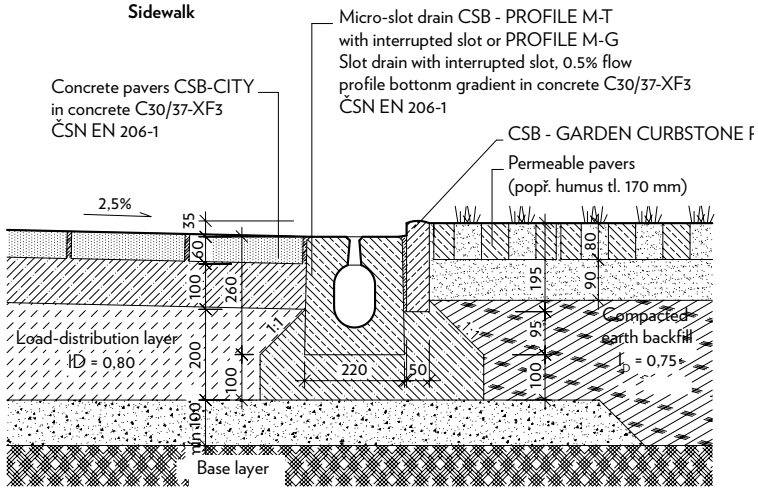
* Nominal dimensions include installation dimensions and/or minimum gap.

APPLICATION EXAMPLES

M PROFILE MICRO-SLOT DRAIN,
ROAD AND PAVEMENT SEGMENT (BUS STOP)

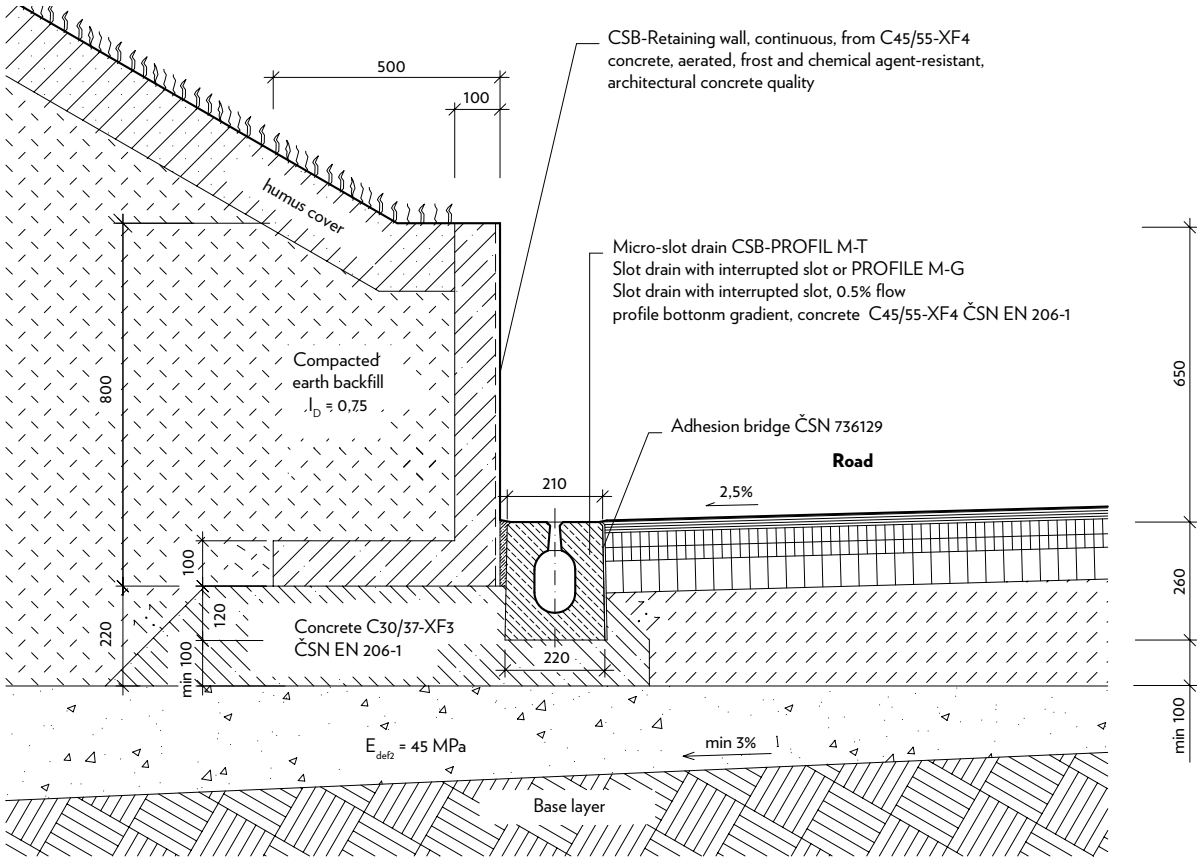


M PROFILE MICRO-SLOT DRAIN,
PAVEMENT COMBINED WITH A VEGETATION ZONE

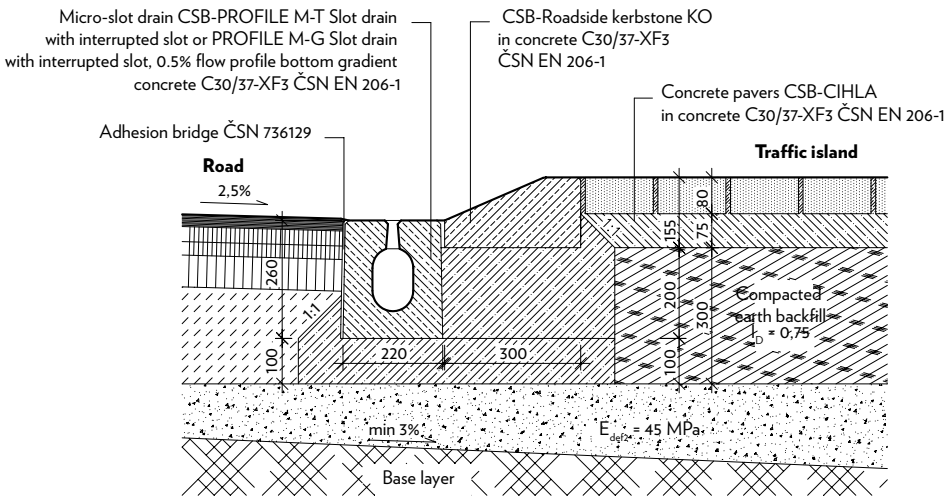


APPLICATION EXAMPLES

M PROFILE MICRO-SLOT DRAIN,
ROAD COMBINED WITH A RETAINING WALL



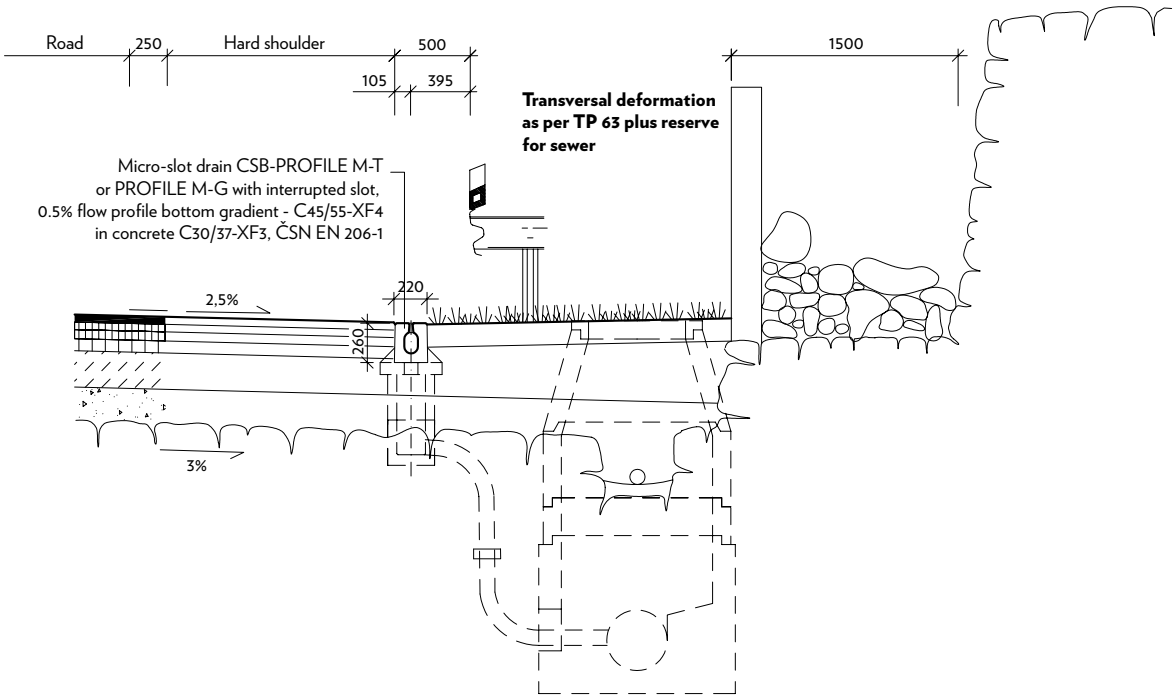
M PROFILE MICRO-SLOT DRAIN
ROAD AND A TRAFFIC ISLAND



TRANSITION PIECES PROFILE VII PROFILE VI PROFILE IV PROFILE III PROFILE II PROFILE I PROFILE T PROFILE M

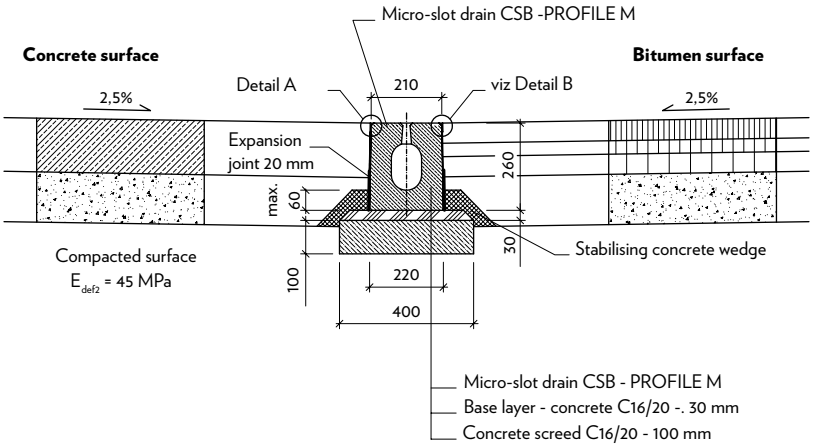
APPLICATION EXAMPLES

M PROFILE MICRO-SLOT DRAIN
SLOT DRAIN IN A ROCK-CUT, WITH STEEL
road barrier, > 60 km/h speed, side drains



APPLICATION EXAMPLES

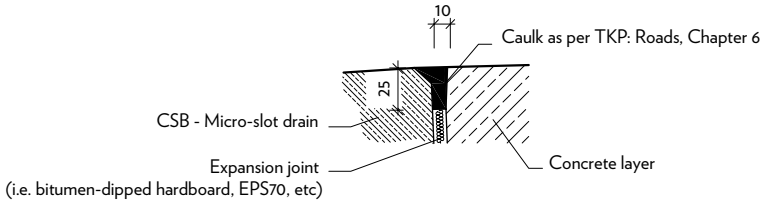
SAMPLE CROSS-SECTION M PROFILE SLOT DRAIN IN A ROAD



Note: USE AN ELASTIC, COMPRESSIBLE AND NON-EXPANDING MATERIAL FOR EXPANSION JOINTS (i.e. bitumen-dipped hardboard, EPS70, etc.), with compacted layers, use 0.7 mm steel sheeting as protection; provide to a level at least 20 mm above the compacted layer.
EXPANSION JOINT MAY ONLY BE OMITTED WHEN THE ADJOINING ROAD SURFACE HAS UNCONSOLIDATED LAYERS!
When the adjoining road surface does not contain any consolidated layers (i.e. base concrete, concrete, cement-bonded aggregate, layers with hydraulic binders, etc.) over the entire height of the slot drain, the expansion joint may be omitted.

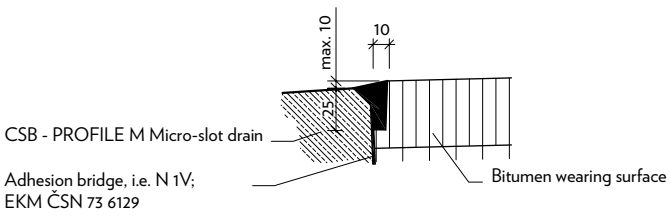
DETAIL OF THE GAP TO BE FILLED WITH CAULK

Detail A



Caulking gap (prepared by cutting, or insertion of a batten).

Detail B

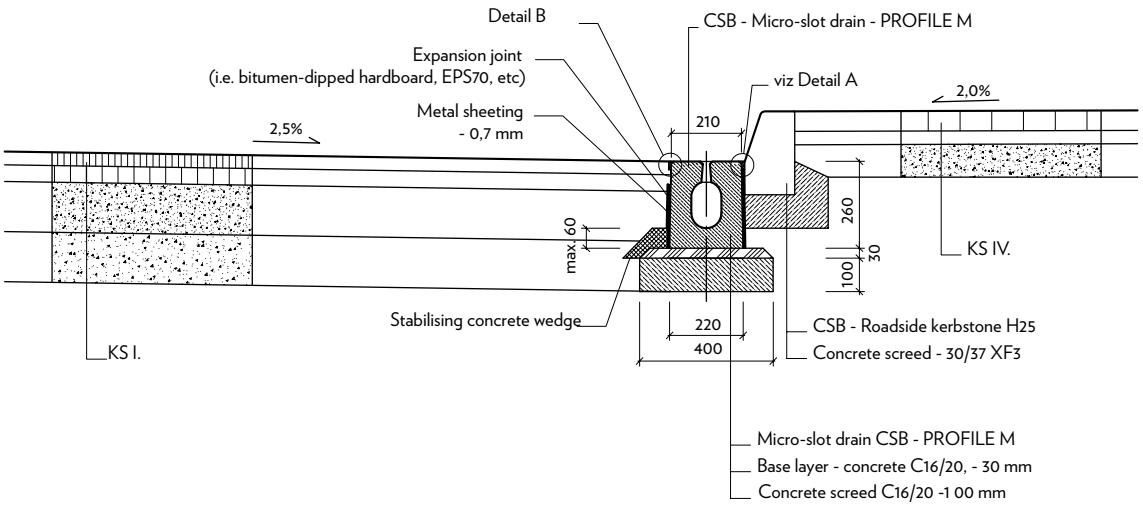


Caulking gap (prepared by cutting, or insertion of a batten).

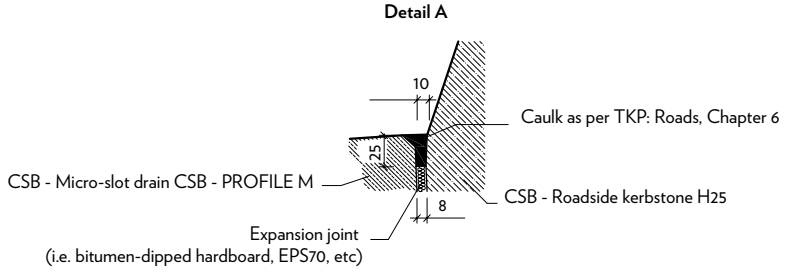
* Nominal dimensions include installation dimensions and/or minimum gap.

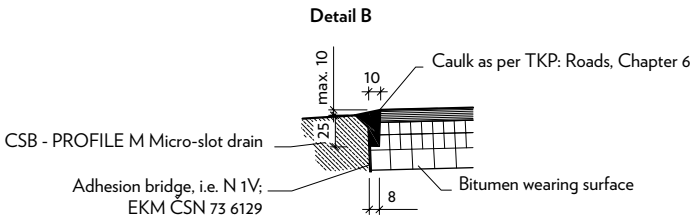
APPLICATION EXAMPLES

SAMPLE CROSS-SECTION M PROFILE SLOT DRAIN IN A ROAD



DETAIL OF THE GAP TO BE FILLED WITH CAULK





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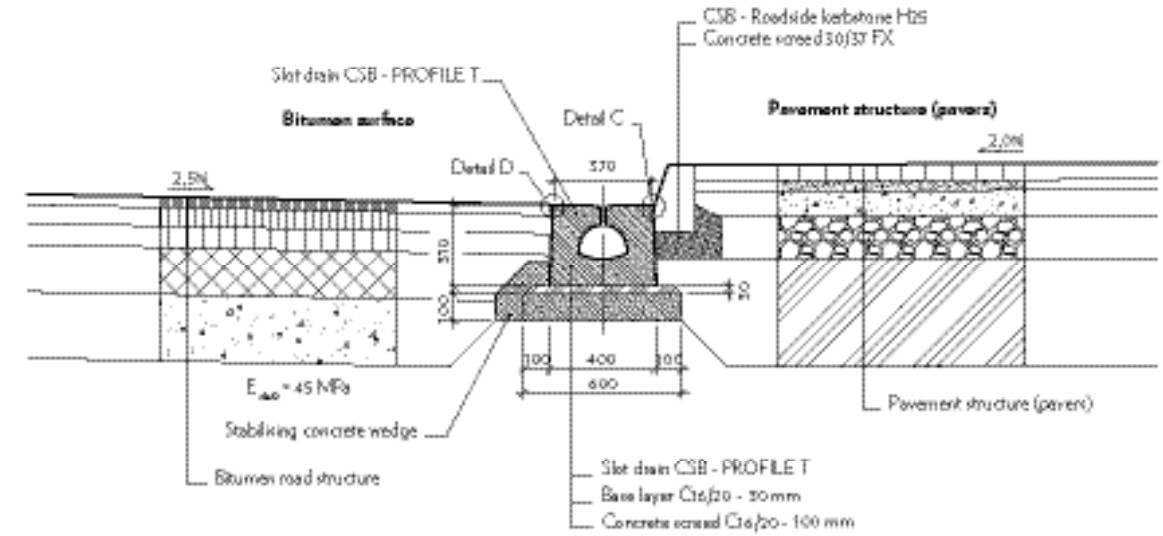
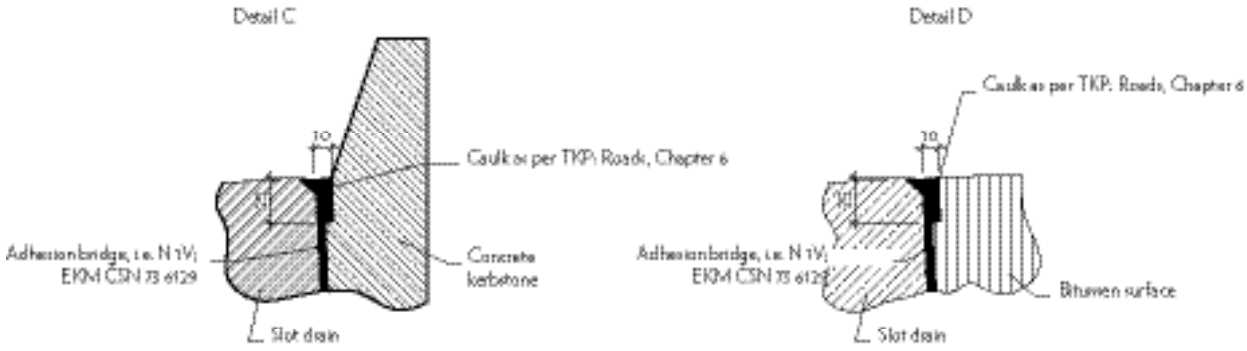
APPLICATION EXAMPLES

SAMPLE CROSS-SECTION T PROFILE SLOT DRAIN IN A ROAD
(Bitumen surface - kerbstone, Sidewalk)



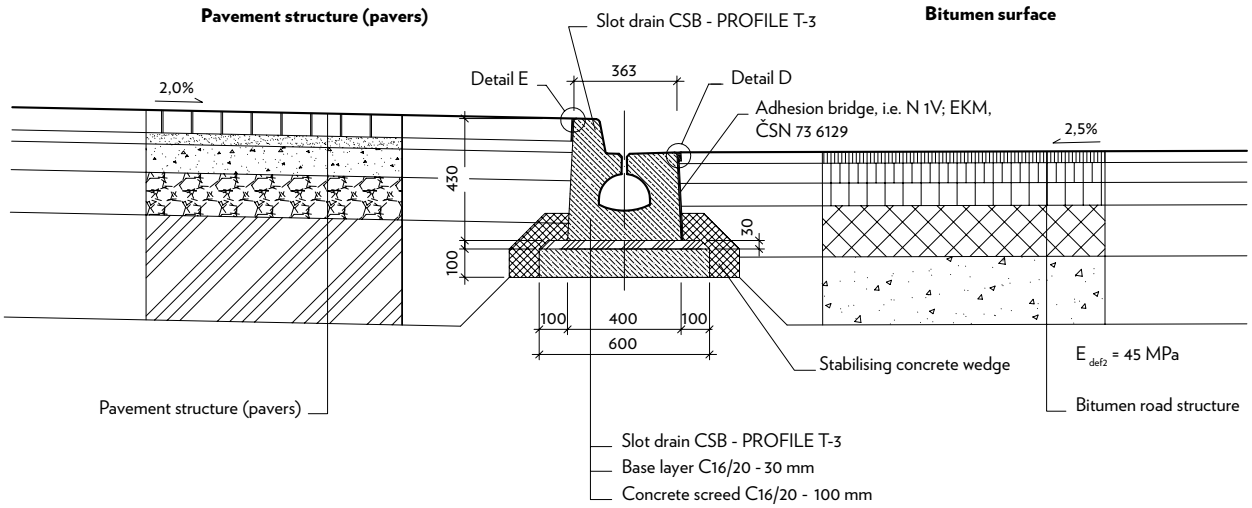


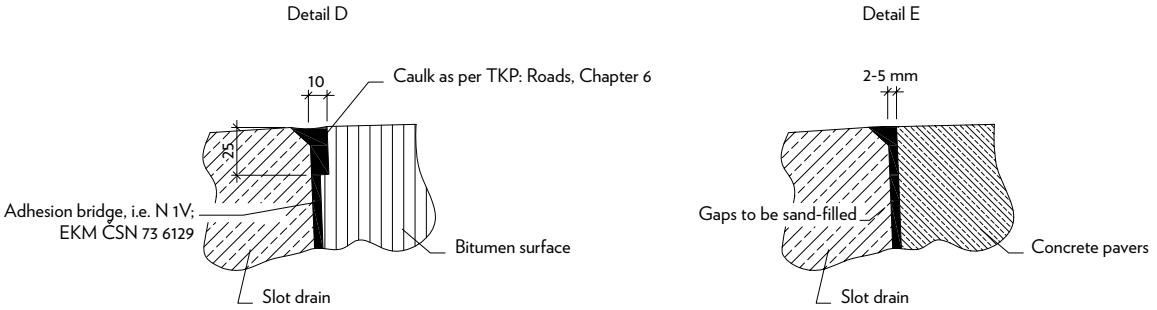
Caulking gap (prepared by cutting, or insertion of a batten).

* Nominal dimensions include installation dimensions and/or minimum gap.

APPLICATION EXAMPLES

SAMPLE CROSS-SECTION T PROFILE SLOT DRAIN IN A ROAD
(Profile T-3, sidewalk - Bitumen surface)





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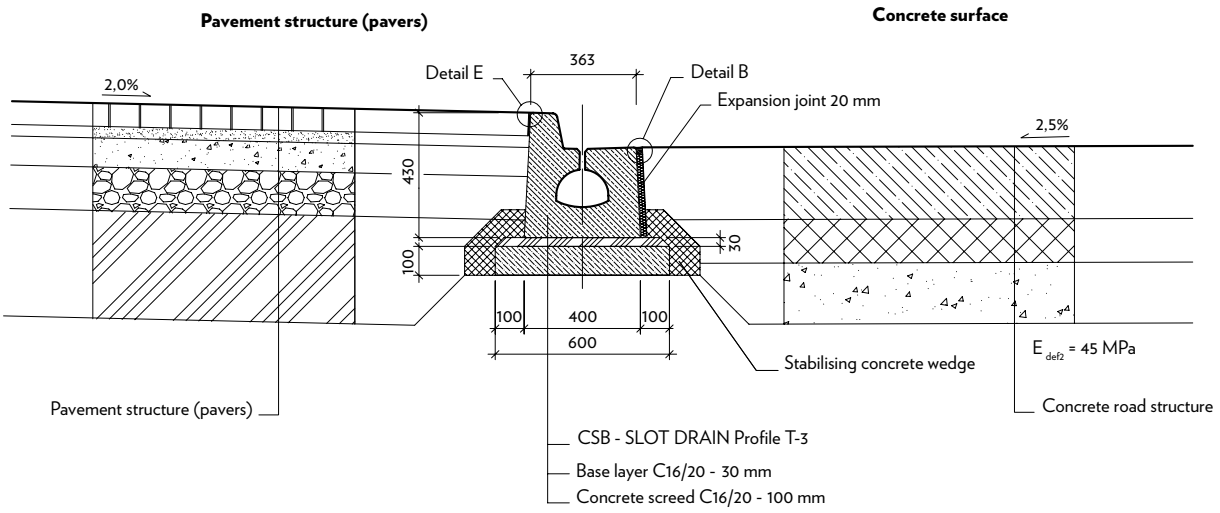
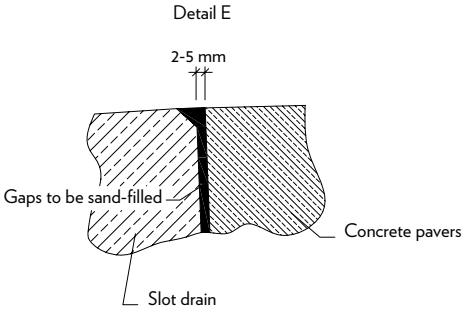
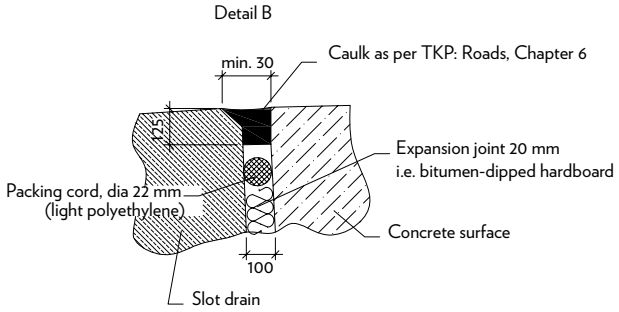
APPLICATION EXAMPLES

SAMPLE CROSS-SECTION T PROFILE SLOT DRAIN IN A ROAD
(Profile T-3, sidewalk - Concrete surface)







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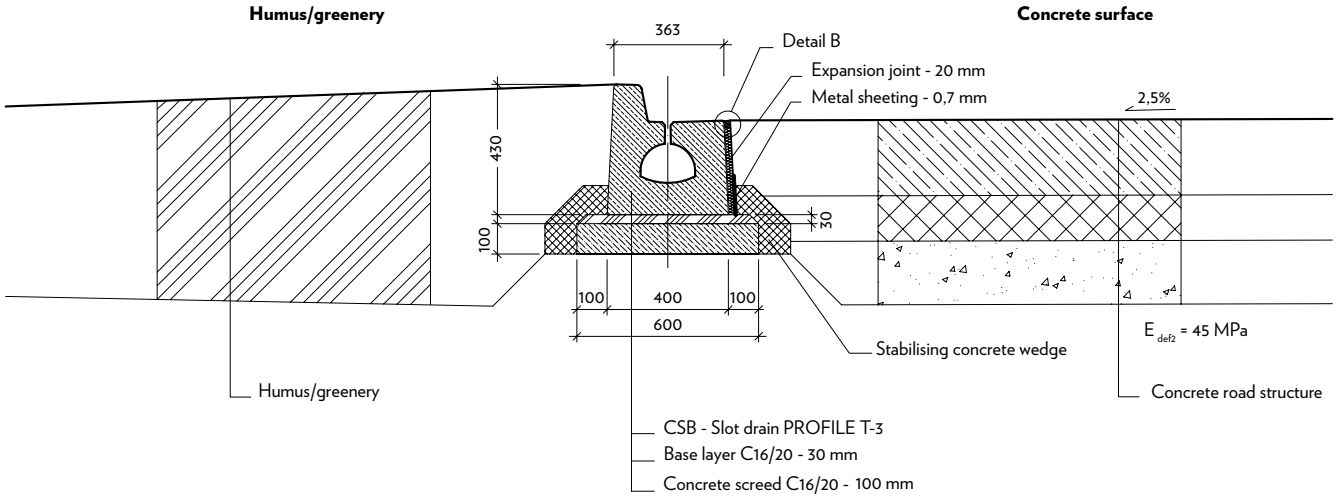
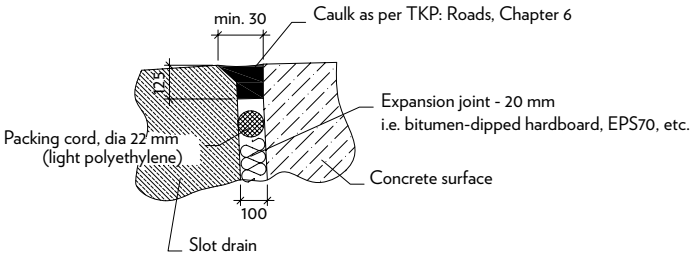
APPLICATION EXAMPLES

SAMPLE SLOT DRAIN CROSS-SECTION IN A ROAD
(Profile T-3, Humus - Concrete surface)



Detail B



Caulking gap (prepared by cutting, or insertion of a batten).

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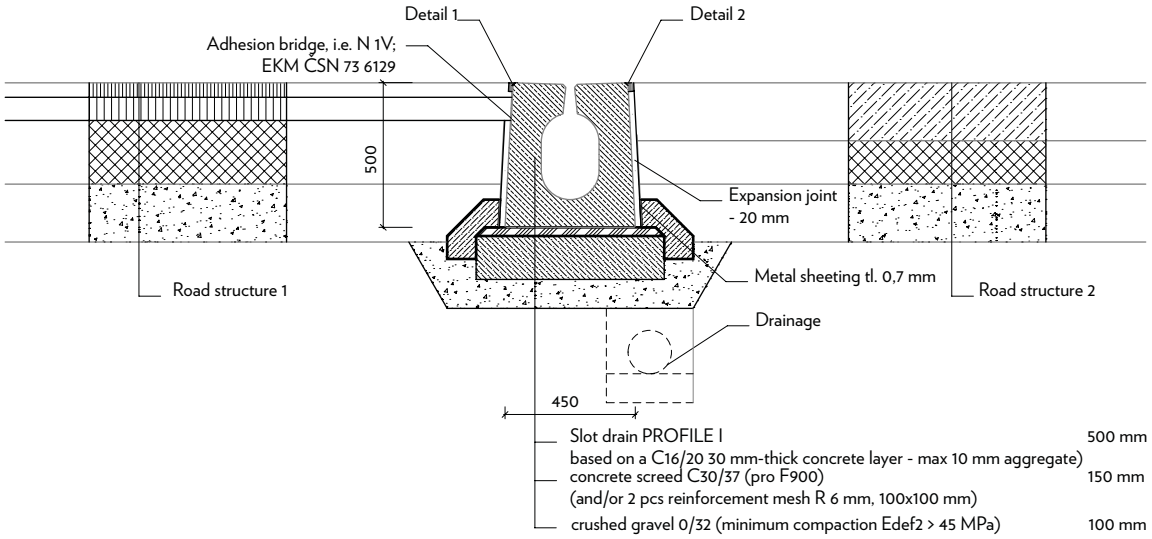
APPLICATION EXAMPLES

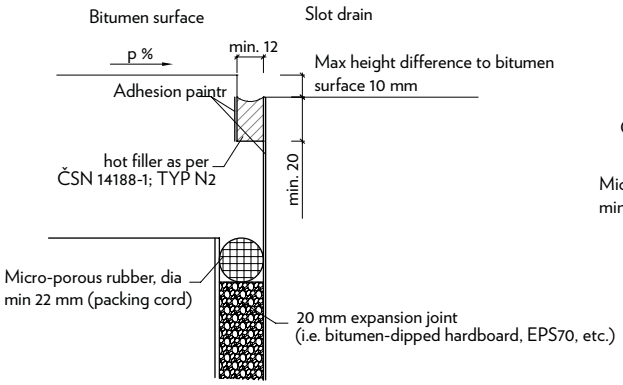
SAMPLE SLOT DRAIN CROSS-SECTION

(Profile I, F900)



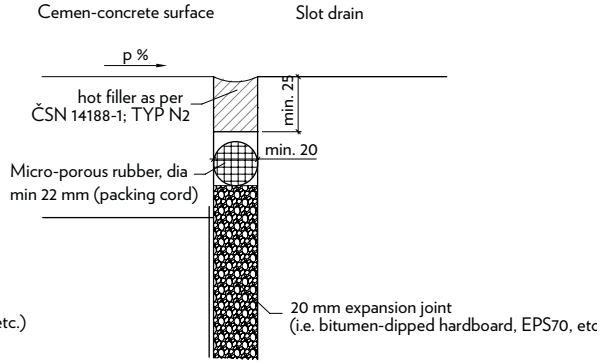
Detail A

Joint between a bitumen road surface and a concrete slot drain



Detail B

Joint between a cement road surface and a concrete slot drain



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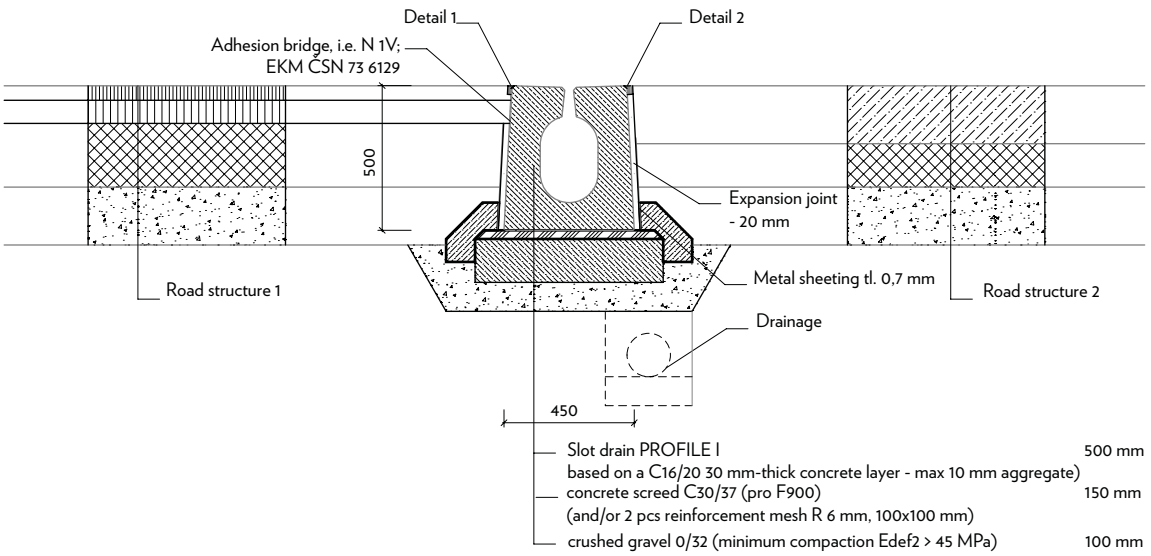
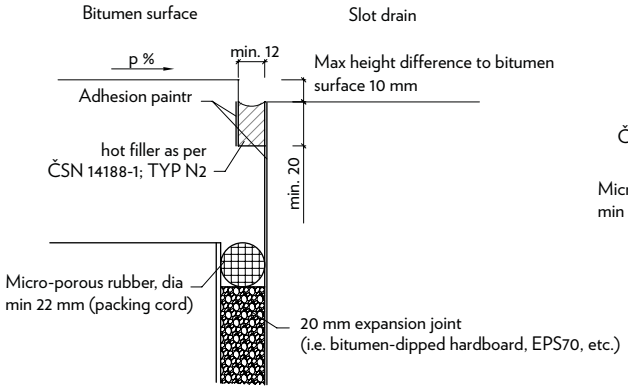
APPLICATION EXAMPLES

SAMPLE SLOT DRAIN CROSS-SECTION
(Profile I, D400/E600)



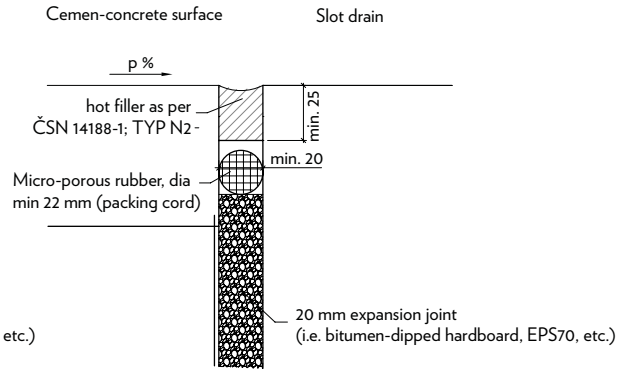
Detail A

Joint between a bitumen road surface and a concrete slot drain



Detail B

Joint between a cement road surface and a concrete slot drain



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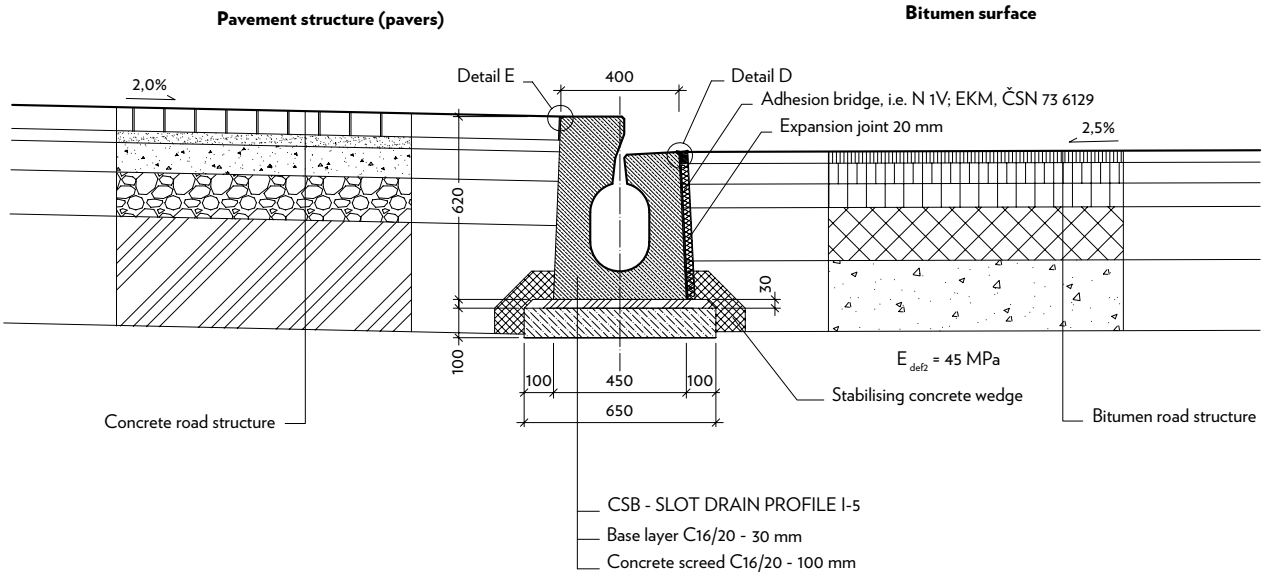
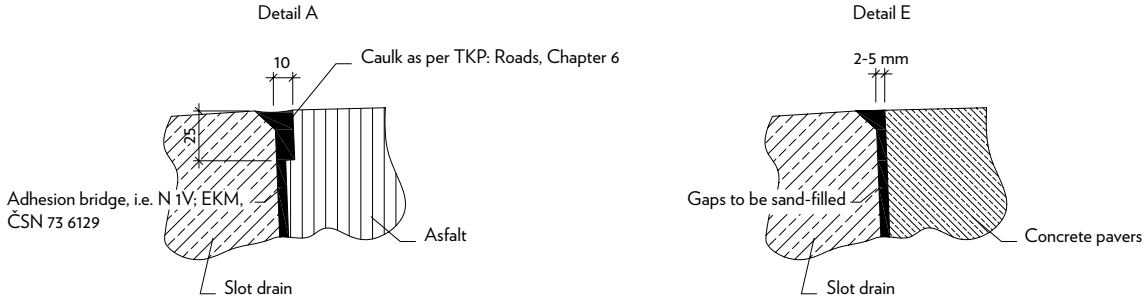
APPLICATION EXAMPLES

SAMPLE SLOT DRAIN CROSS-SECTION IN ROAD
(Profile I-5, Sidewalk - Bitumen surface)





Caulking gap (prepared by cutting, or insertion of a batten).

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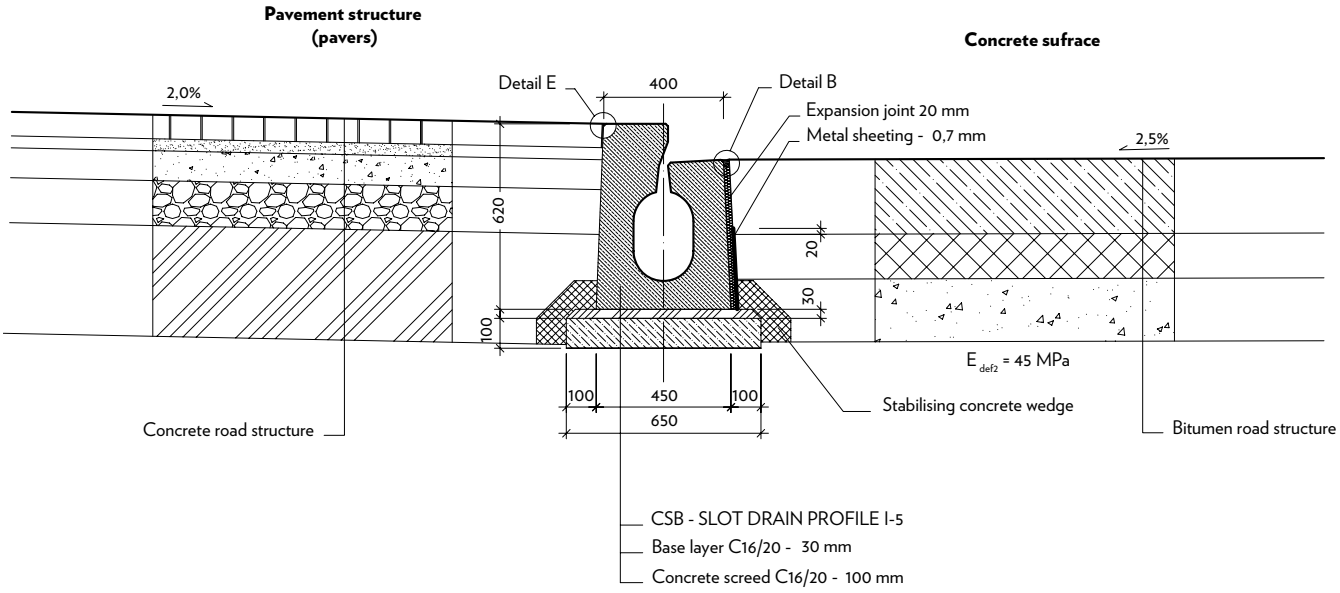
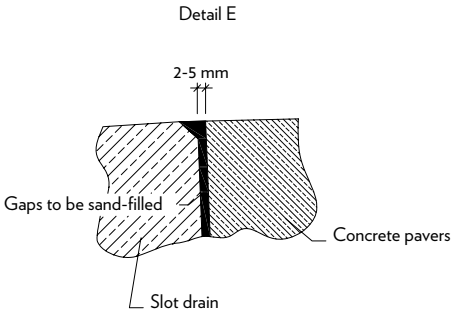
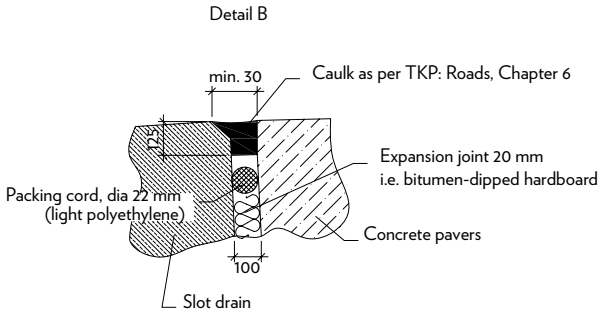
APPLICATION EXAMPLES

SAMPLE SLOT DRAIN CROSS-SECTION IN ROAD
(Profile I-5, Sidewalk - concrete surface)







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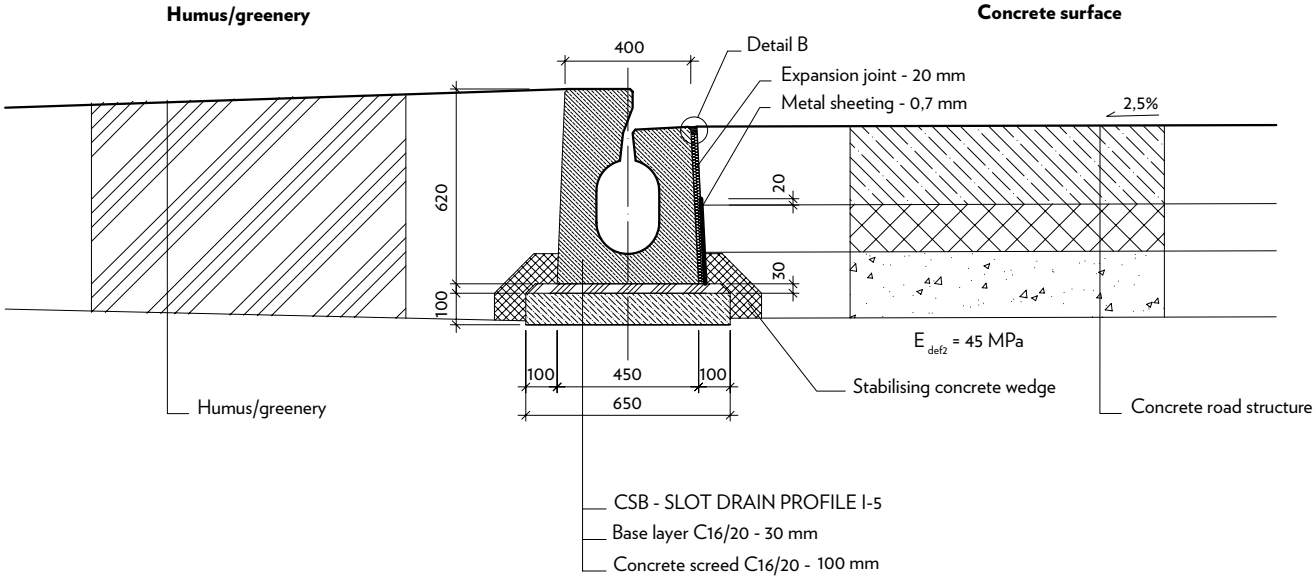
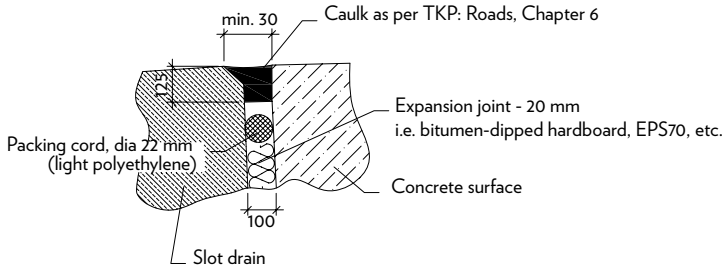
APPLICATION EXAMPLES

SAMPLE SLOT DRAIN CROSS-SECTION IN ROAD
(Profile I-5, greenery - concrete surface)



Detail B



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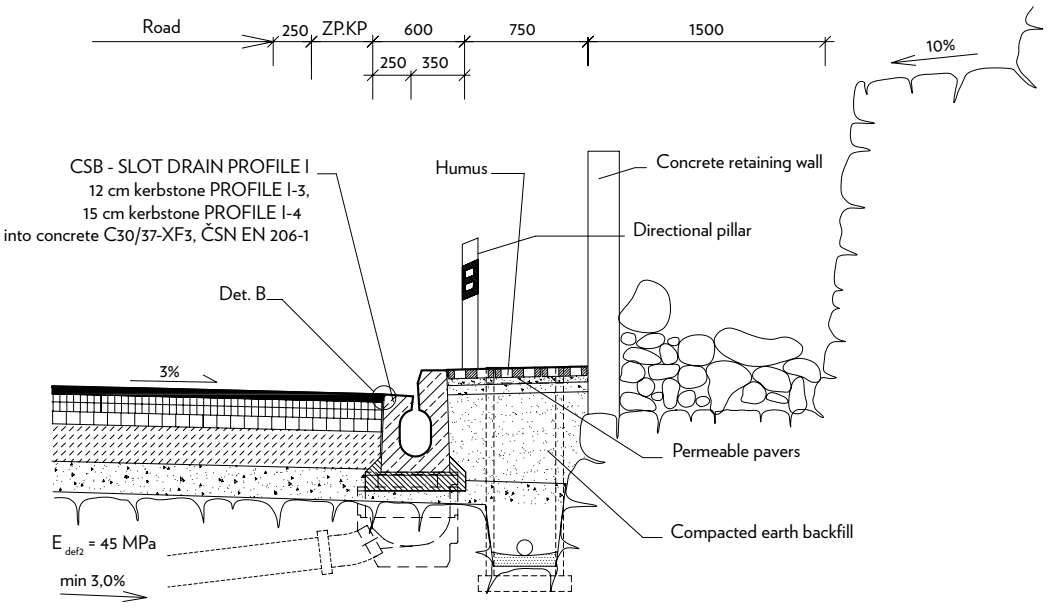
EXPANSION JOINT MAY ONLY BE OMITTED WHEN THE ADJOINING ROAD SURFACE HAS UNCONSOLIDATED LAYERS!
When the adjoining road surface does not contain any consolidated layers (i.e. base concrete, concrete, cement-bonded aggregate, layers with hydraulic binders, etc.) over the entire height of the slot drain, the expansion joint may be omitted.

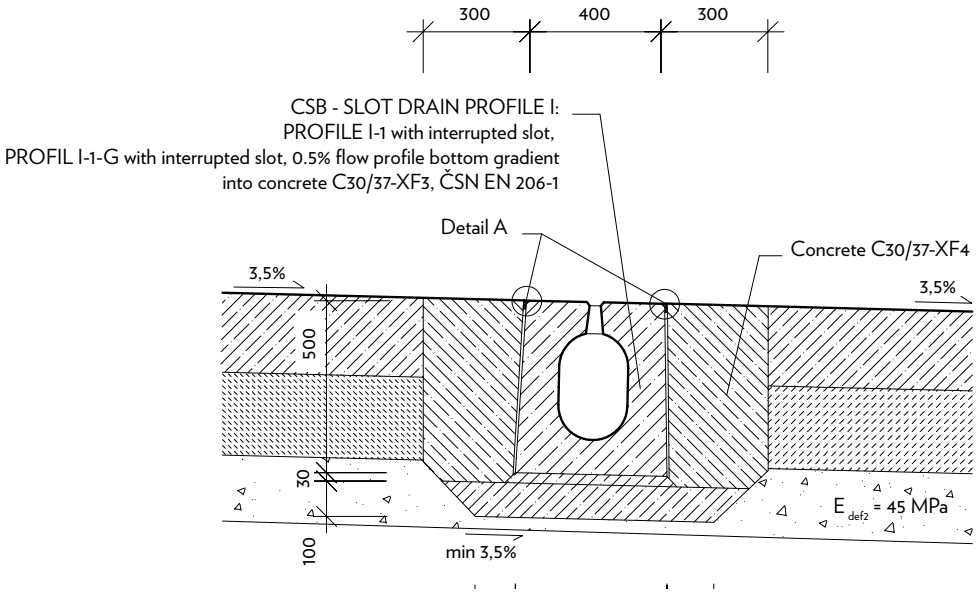
* Nominal dimensions include installation dimensions and/or minimum gap.

APPLICATION EXAMPLES

PROFILE I SLOT DRAIN WITH KERBSTONE
in cut rock, central sewage
city road, < 60 km/h speeds

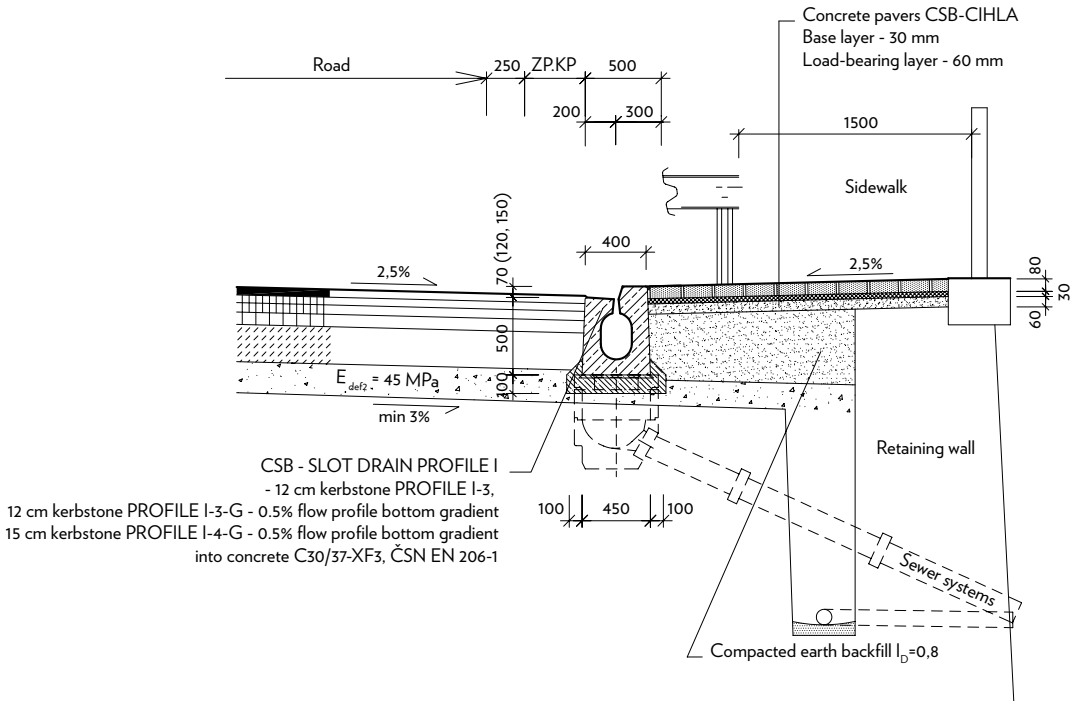


PROFILE I SLOT DRAIN
Refurbishment, as transversal road draining - longitudinal cross-section

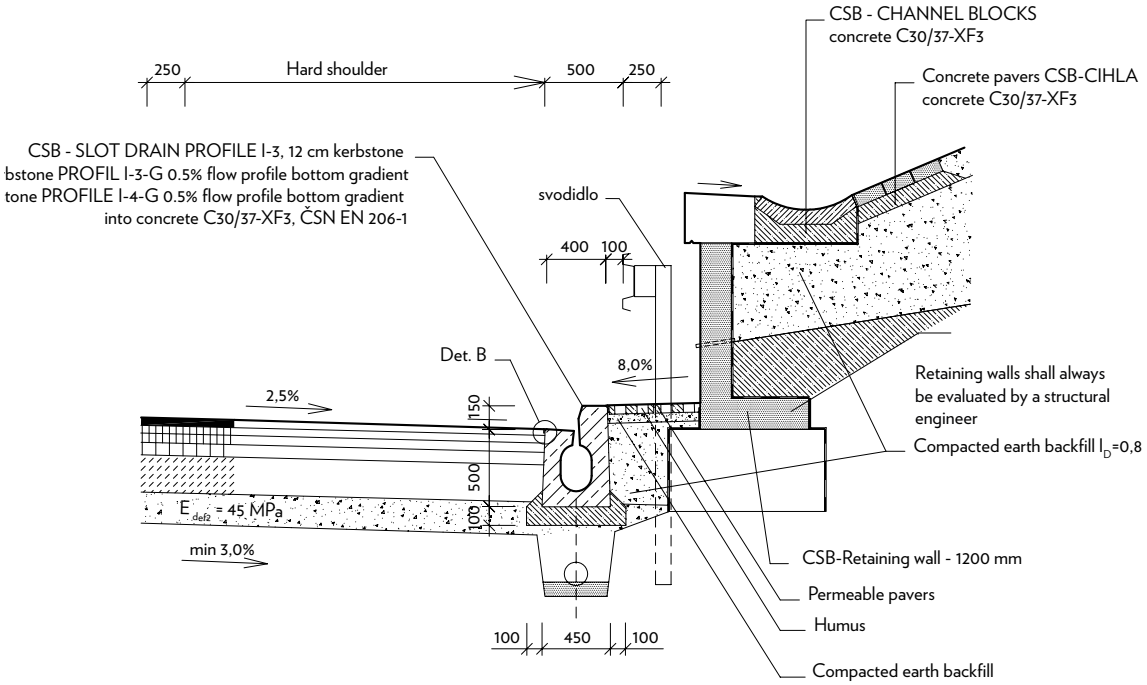


APPLICATION EXAMPLES

PROFILE I SLOT DRAIN WITH KERBSTONE
above retaining wall, > 60 km/h speeds



PROFILE I SLOT DRAIN
in a cutting with a retaining wall, < 60 km/h speeds, central drains



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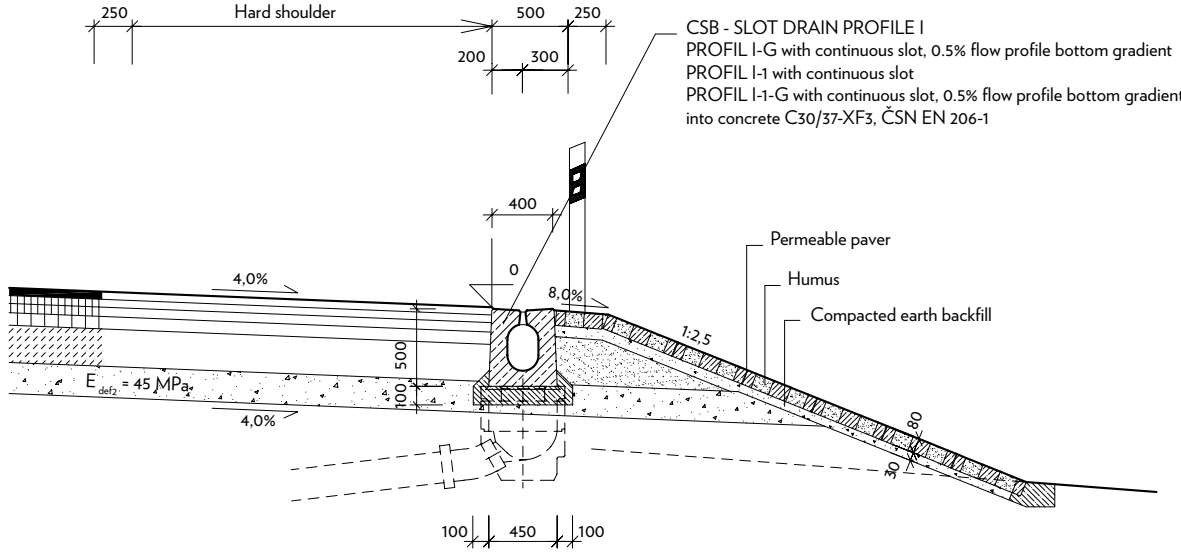
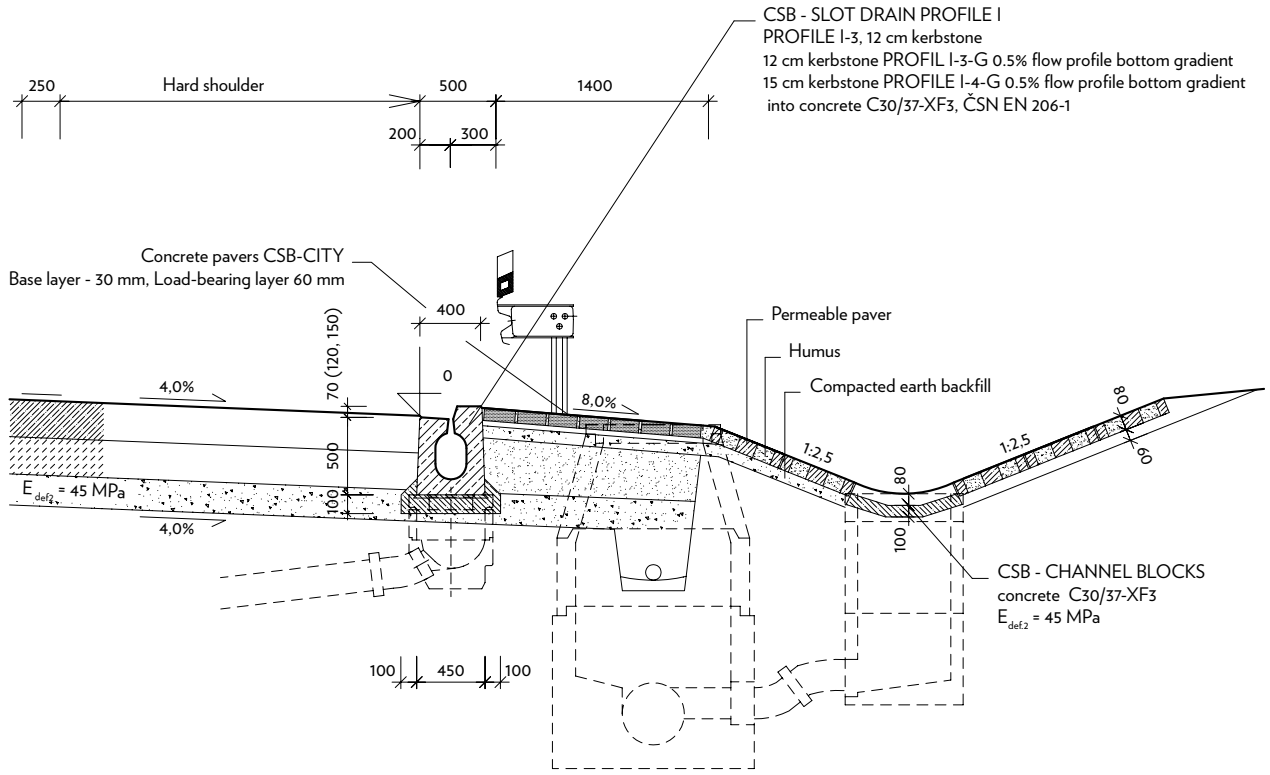
APPLICATION EXAMPLES

PROFILE I SLOT DRAIN
IN A SOFT SHOULDER

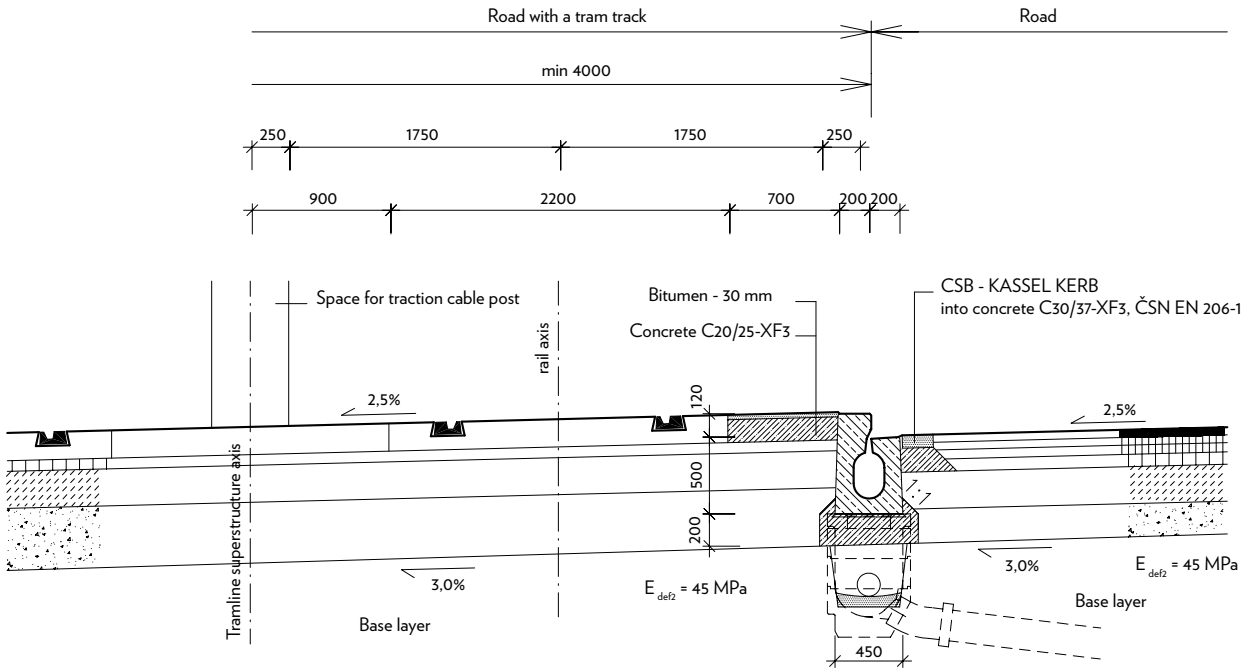


PROFILE I SLOT DRAIN WITH KERBSTONE
within a water source protection zone

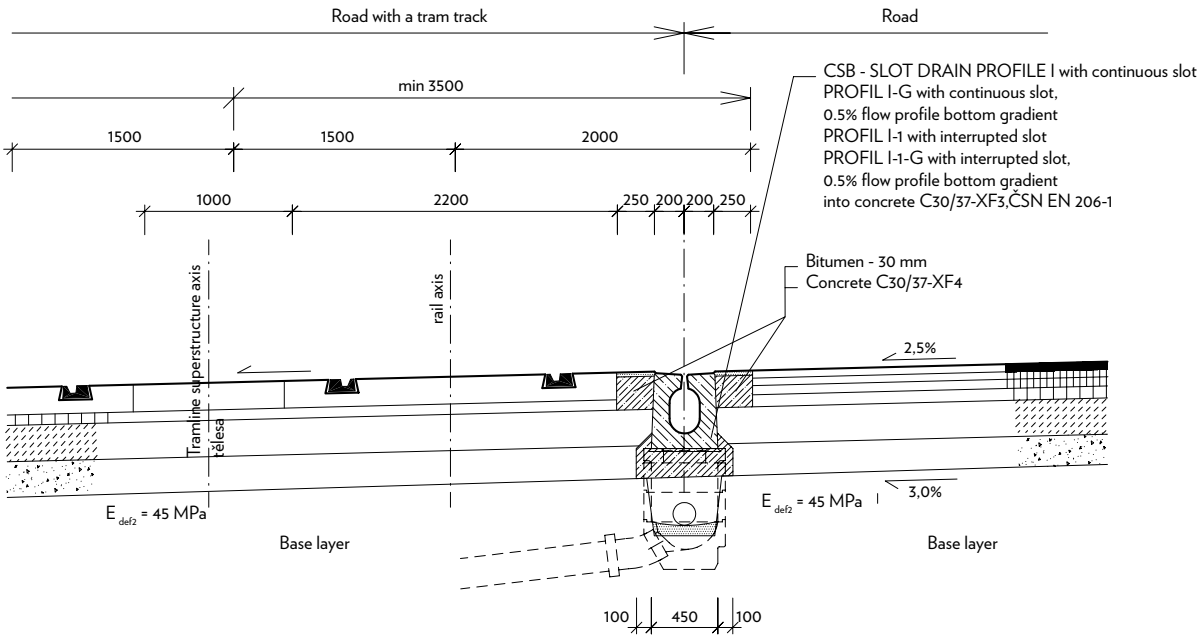


APPLICATION EXAMPLES

I PROFILE SLOT DRAIN WITH KERBSTONE, ROAD NEXT TO A TRAMWAY TRACK
city road, < 60 km/h speeds, central drains



I PROFILE SLOT DRAIN
Road next to a tram track - same level, city road, < 60 km/h speeds



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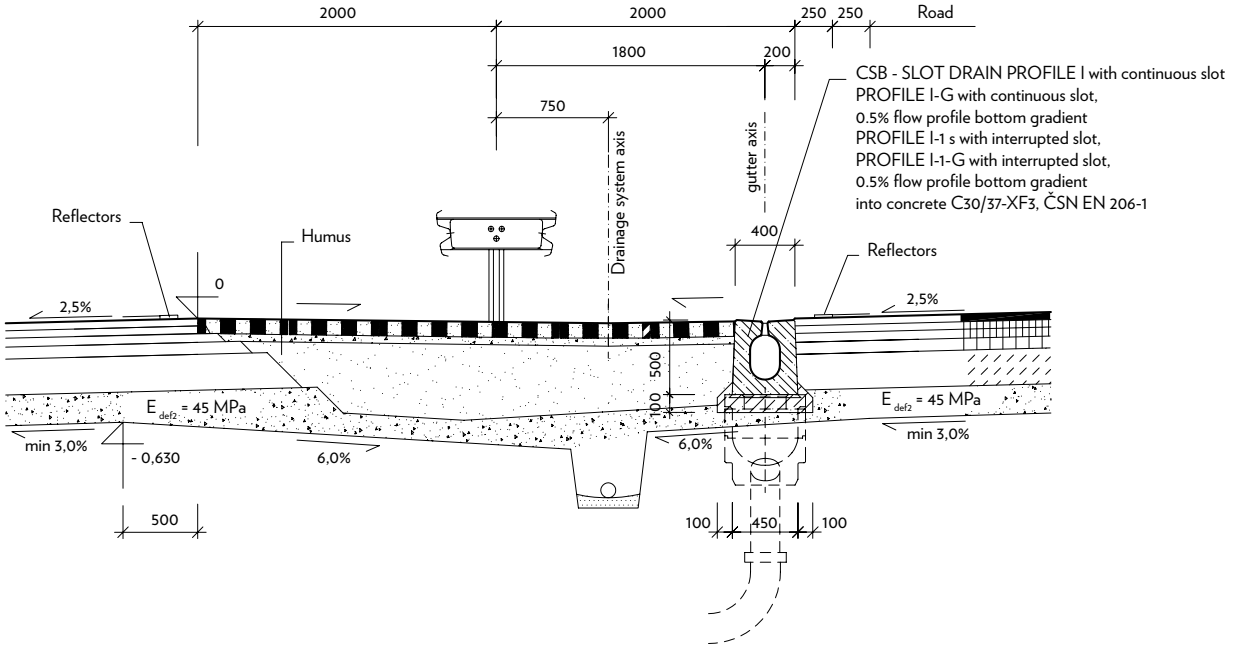
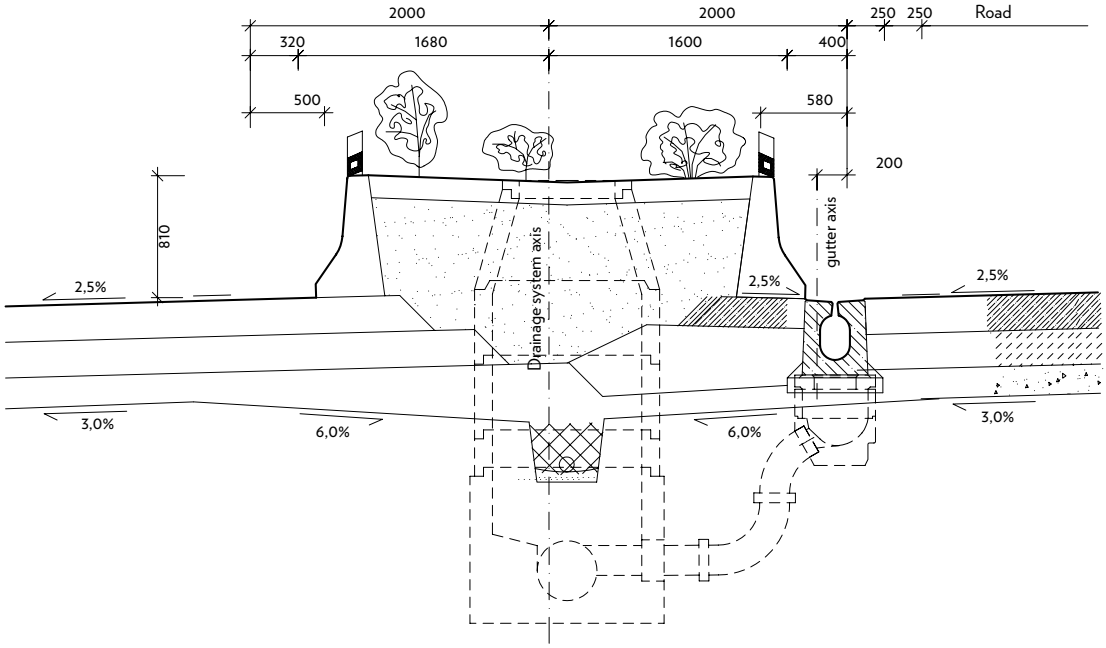
APPLICATION EXAMPLES

I PROFILE SLOT DRAIN
in the central separation lane

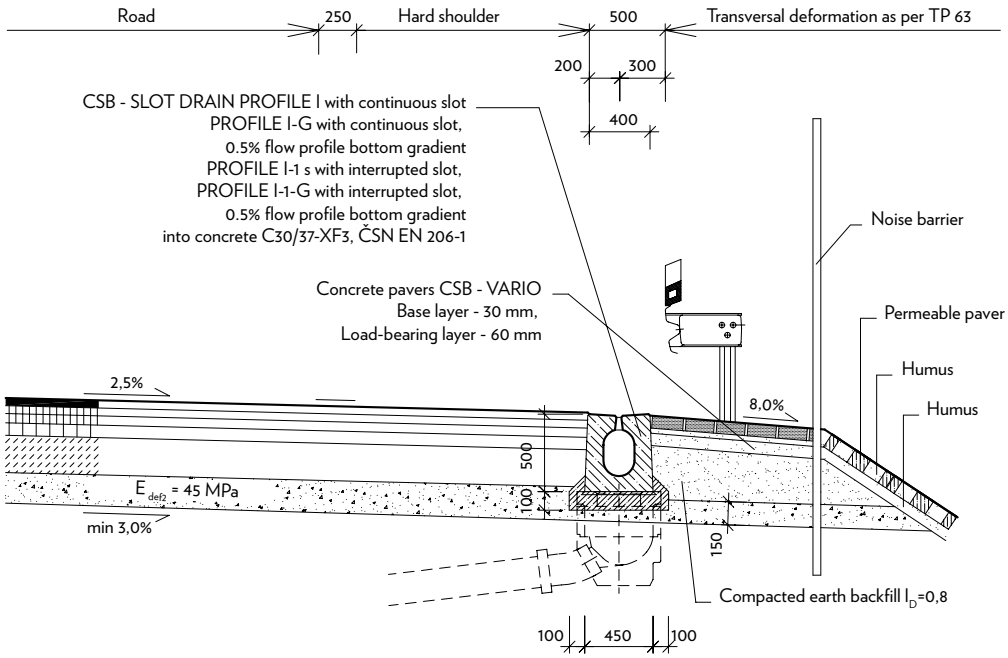


I PROFILE SLOT DRAIN
in the central separation lane with concrete road barriers

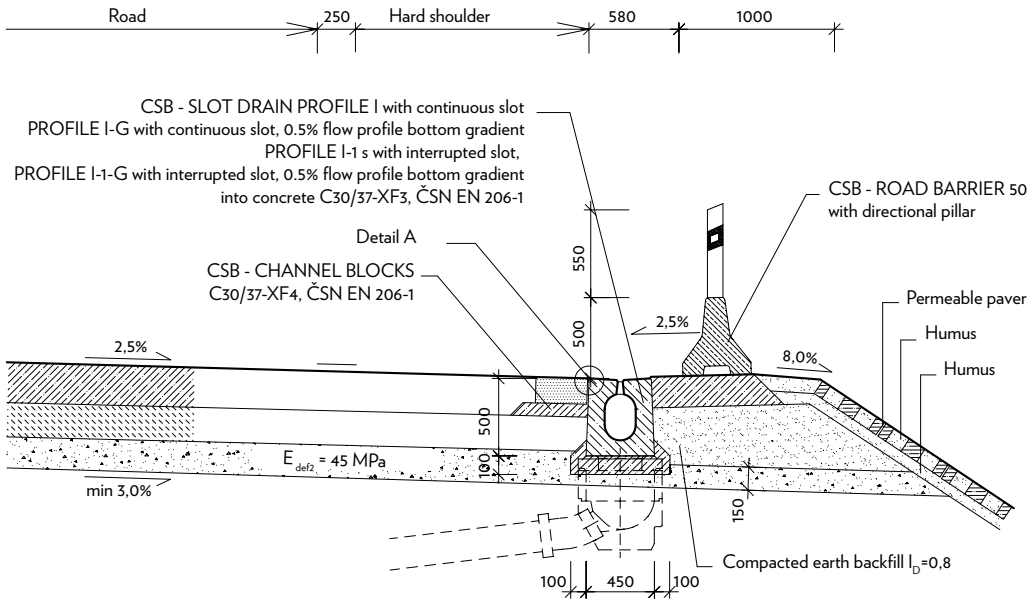


APPLICATION EXAMPLES

I PROFILE SLOT DRAIN
on a mound as an erosion prevention



I PROFILE SLOT DRAIN
on a high embankment, within a water source protection zone



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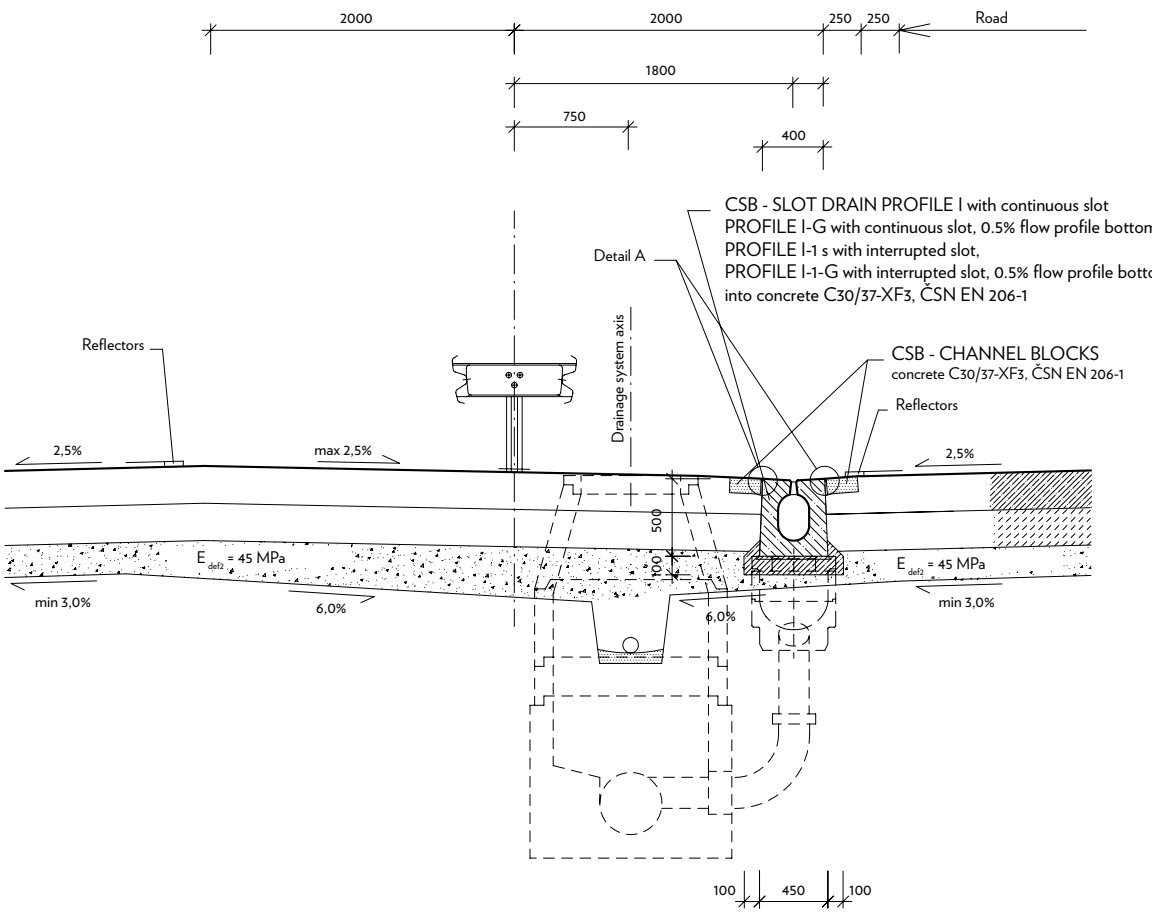
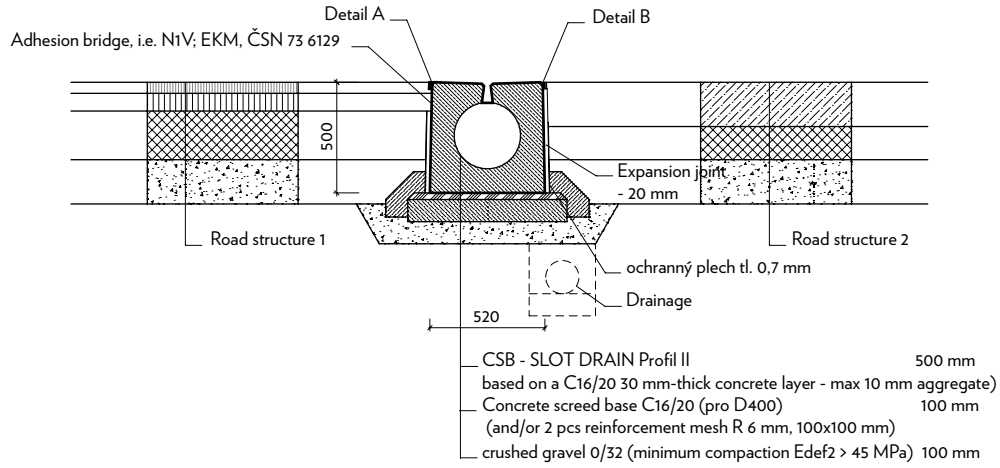
APPLICATION EXAMPLES

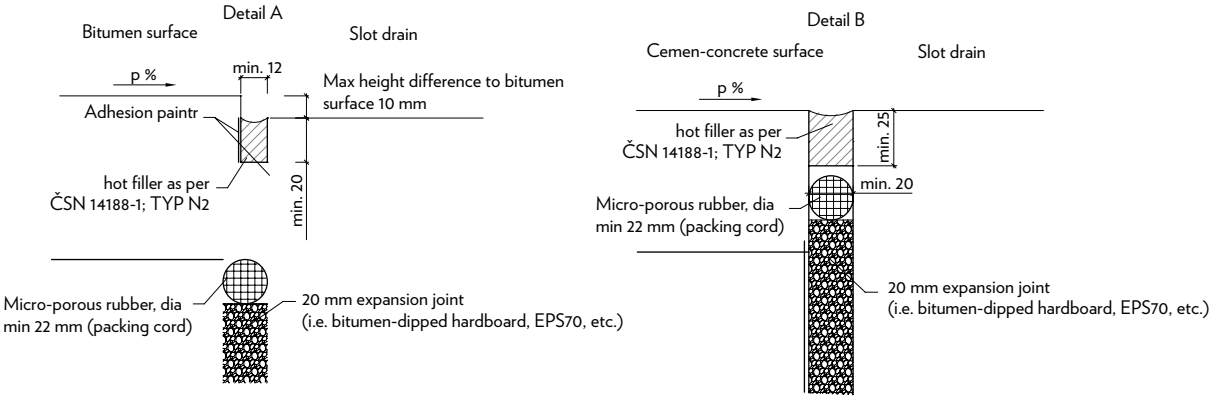
I PROFILE SLOT DRAIN
Central separation lane with different surface levels



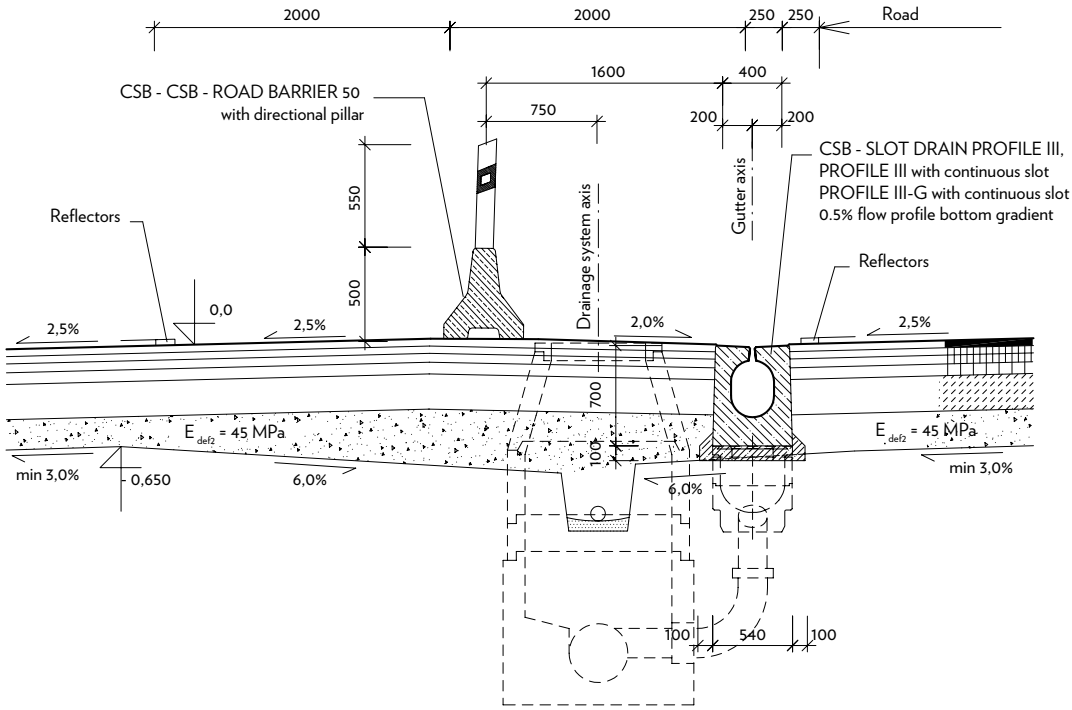
APPLICATION EXAMPLES

II PROFILE SLOT DRAIN SAMPLE CROSS-SECTION IN A ROAD





III PROFILE SLOT DRAIN
Central separation lane with different surface levels



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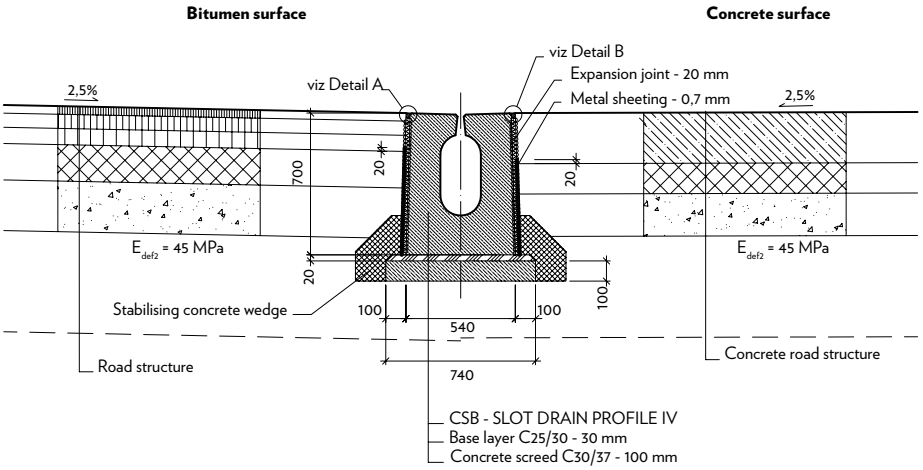
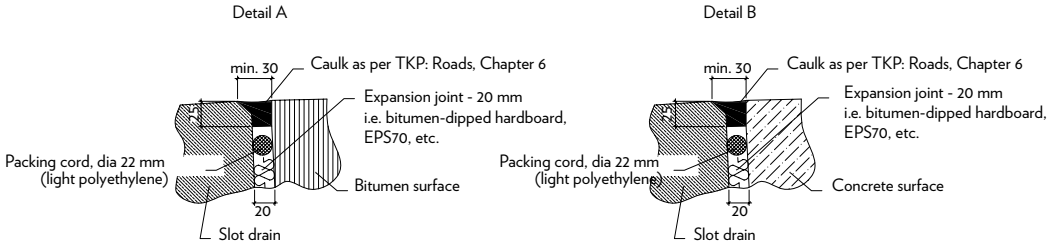
APPLICATION EXAMPLES

IV PROFILE SAMPLE CROSS-SECTION SLOT DRAIN IN A ROAD





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STAVBY JAKO Z KAMENE

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