

FUNNEL

DRAINAGE SYSTEM WITH HIGH HYDRAULIC PERFORMANCE FOR EXTENDED AREAS

Burdens
Australia

Perfect By Definition!

MUFLE[®]
WATER CONVEYING SYSTEMS





MUFLESYSTEM FUNNEL



High Performance for drainage System

The "FUNNEL" is a "high performance" drainage system where a ductile iron "**grating**" collects rainwater from the surface and, through a ductile iron "**cone**", conveys it into the HD-PE "**pipe**" with calculated diameter.

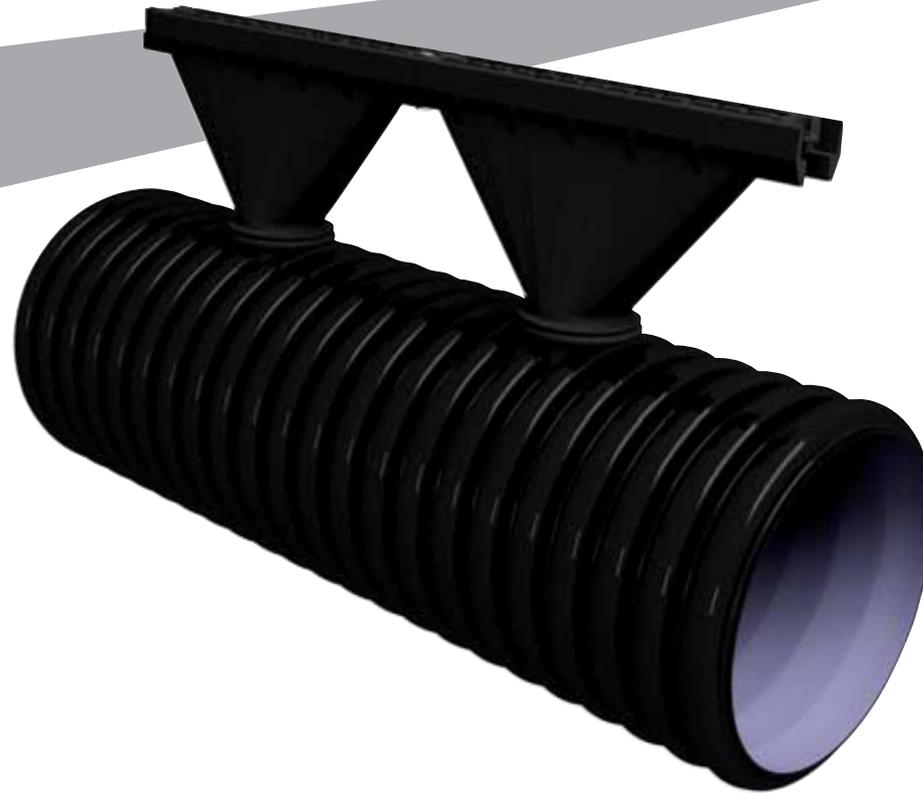
Pipes are available with external diameter from $\varnothing 250$ to $\varnothing 1200$.

Application areas

- Highways
- Toll Highways
- Tunnels
- Logistic Centers
- Docks
- Airport Areas

FEATURES

Fixing System



Flexibility and quick installation: the FUNNEL is supplied with 6 meters long bars. The easy connection among the bars is assured through the coupling and sealing rings.

Security: for the collected water there is one outlet every half meter, in this way, from an hydraulic point of view the system will be not falling into crisis.

Reliability: Reliability: the system has been designed according to the standards of the EN 1433.

Inspections: it is possible to inspect the system every 50 cm, simply pulling out the gratings.

FEATURES

Table A

WATER FLOW RATE WITH FILLING PERCENTAGE EQUAL TO 70% [l/s]

DIAMETRI [mm] DIAMETERS [mm]		PENDENZA DEL COLLETTORE / SEWEGE PIPES SLOPE									
DN / OD	DI / ID	0,05%	0,10%	0,15%	0,20%	0,25%	0,30%	0,35%	0,40%	0,45%	0,50%
250	218	12,1	17,0	20,9	24,1	27,0	29,5	31,9	34,1	36,2	38,1
315	273	22,0	31,1	38,0	43,9	49,1	53,8	58,1	62,1	65,9	69,4
350	300	28,2	39,9	48,9	56,5	63,1	69,2	74,7	79,9	84,7	89,3
400	344	40,7	57,5	70,5	81,4	91,0	99,6	107,6	115,1	122,0	128,6
465	400	60,8	86,0	105,3	121,6	136,0	149,0	160,9	172,0	182,5	192,3
500	427	72,4	102,4	125,4	144,8	161,9	177,3	191,5	204,8	217,2	228,9
630	533	130,8	184,9	226,5	261,5	292,4	320,3	346,0	369,9	392,3	413,5
800	690	260,3	368,1	450,9	520,6	582,1	637,6	688,7	736,3	780,9	823,2
1000	853	458,2	684,1	793,7	916,5	1024,7	1296,1	1212,4	1296,1	1374,7	1449,1
1200	1025	747,9	1057,7	1295,4	1495,7	1672,3	1831,9	1978,7	2115,3	2243,6	2365,0

Table B

EXAMPLE OF CALCULATION OF MAXIMUM NUMBER OF "FUNNELS" (m) TO BE CONNECTED FOR Q = 0,465 l/s

DIAMETRI [mm] DIAMETERS [mm]		PENDENZA DEL COLLETTORE / SEWEGE PIPES SLOPE									
DN / OD	DI / ID	0,05%	0,10%	0,15%	0,20%	0,25%	0,30%	0,35%	0,40%	0,45%	0,50%
250	218	25	36	44	51	57	63	68	73	77	81
315	273	47	66	81	94	105	115	124	133	141	149
350	300	60	85	105	121	135	148	160	171	182	191
400	344	87	123	151	174	195	214	231	247	262	276
465	400	130	184	226	261	292	320	345	369	392	413
500	427	155	219	269	311	347	381	411	439	466	491
630	533	280	397	486	561	628	688	743	794	842	888
800	690	559	791	968	1118	1250	1370	1479	1582	1677	1769
1000	853	984	1392	1705	1969	2201	2411	2605	2784	2953	3113
1200	1025	1606	2272	2783	3213	3593	3936	4251	4545	4820	5081



High hydraulic performance: according to the literature, if the filling percentage of the sewage pipe is fixed to 70%, the water flow rates showed in table "A" are resulting from the slope changes. According to the water flow rate to be drained, it is possible to determine the maximum number of FUNNELS that can be connected to the sewage pipes. The table "B" shows by way of example the values obtained by a water flow rate Q equal to 0.465 l/sec. per meter (calculated for a width of drainage surface equal to 10 meters, with a pluviometric curve $h = 27 \times t^{0.2}$, with run-off time

$t_c = 300$ sec. coefficient of outflow $\alpha = 0,85$). If a sewage pipe with a 250 diameter with 0,25% slope is used, it is possible to connect 56 meters of FUNNEL system, before the water falls into the collector or the pipe diameter is increased.

N.B. It is necessary to verify that the water speed has a figure ranging of 0,4-3,0 (m/s). Our technical department stays at your full disposal for further information about the calculations ref. table "B".



Example of manhole with moulded base



Example of manhole for pipes



The moulded tee can be used as manhole for straight on lining.

The **manholes** are independent components which can be installed on line for ensuring the inspection of the line itself.

The possibility of realizing the custom-made manholes for pipes together with the already existing wide range of manholes with moulded base allows us to change both the pipe diameter and the line direction.

Our technical office stays at your full disposal for any suggestion about the suitable manhole to be used (in particular with ref. to diameter, number and position of insert jointing, height) and about its installation.

INSTALLATION

The following installation instructions and the relative drawings are given only as an example not considering any peculiarities of the installation site or soil characteristics, or morphology and position of any possible slope. Any particular installation must be suggested by the project maker.

1. Dig the trench according to the requested dimensions (according to load classes and pipe diameter), indicating the right slope of the project.
2. Place the stakes blocking the pipes with bended hook head and realized with 8 Ø steel rods with the following height: 20 cm ground depth + 10 cm concrete laying bed + pipe half- diameter. These stakes shall be positioned in pairs at such a distance that the pipe can be easily placed in between and the hook head can be placed in the middle of the pipe. The distance between a pair of stakes shall be not higher than 100 cm.
3. On the bottom trench cast the concrete bed of 10 cm height at least, where the pipe shall be laid down. This bedding layer shall be perfectly flat, otherwise the whole system performance can be compromised (it is recommended the use of topographic instruments in the job site).
4. Position the pipes (6 meters barrels, already perforated every 50 cm distance for connection to the ductile iron cones of Funnel, already welded half coupling with seals) and connect them among

each other through coupling system and EPDM gaskets: the end parts to be connected should be perfectly clean (see the picture on the side). The 110Ø holes existing in the pipes should be turned on the upper part and aligned perfectly.

Fix the pipe by rolling around the iron wire that will be blocked to the stakes heads as described in the step 2. Pay particular attention to avoiding pipe shocks that could damage it.

5. Align and level properly. Build the flanking around the pipe, using a resistance class C25/30 concrete for the same height of the internal diameter. Pay attention to avoid that the concrete shouldn't fall down into the pipe itself (in case of installation areas subjected to heavy traffic, a pipe reinforcement around through electrowelded net 8 Ø with mesh 20x20 is required). This operation should be done with extreme attention filling the trench for the following steps in order to avoid the pipe floating and to keep under control its alignment (if it is necessary use the topographic instruments for guaranteeing the maximum accuracy).

6. After 3 hours at least, start the assembly of ductile iron FUNNEL cones inserting them in relative gaskets (it is advised to lubricate them in order to make the inserting easier). The cones are provided with coupling system in order to be jointed solidly one to each other and to guarantee the perfect alignment.

7. Build the flanking around the cones using a concrete with an appropriate resistance class according to the load class (from D400 to F900). The above mentioned concrete shall be properly reinforced with beaded molding and electro-welded 10 Ø and mesh 15 x 15 on two levels according to specific drawings. Please build the flanking up to a height lower than the volume of ductile iron cone itself. Fill the trench for the following steps in order to straighten the cones and avoid eventual misalignment. All technical information necessary for the concrete coating of the flanking are indicated in the table "C".

8. Complete the installation according to the requirements or with a road paving or with special paving (according to specific drawings). In case that the paving is 20 mm thick minimum and is realized with proper resistance class concrete and reinforcement according to the project, it is allowed to continue with the same paving up to the ductile iron cone extrados. On the contrary (paving lower than 20 mm) it is necessary to build a regular flanking as per our previous step nr 7. In case it is necessary to make watertight the gap between the paving and the ductile iron cone, please use a wooden template to be positioned close to the cone. This template will be removed for being replaced with a bicomponent an elastic concrete mortar for watertightness use.

The users of the FUNNEL products are responsible for the installation instructions control. For any further information we kindly ask you to contact our technical department.

Note

- a. The quotation of the final surface layer should be higher of about 3mm than the upper grating's profile.
- b. In case of special paving with concrete, it is necessary to foresee expansion joints for both directions in order to absorb the horizontal shocks.
- c. In order to protect the ductile iron FUNNEL gratings during the concrete casting and to prevent them to get dirty and the residues of polymer concrete to fall into the pipe through the cone, we advise to cover them with plastic protections until they will be taken away after the end of the works

The best condition for an easy installation of the FUNNEL is that the slope of the pipe and the slope of the finished paving are the same. In case that it doesn't happen, due to the ground morphology or due to choices that cannot be modified according to the project, we recommend the use of "extensions" to compensate the difference of quotations. The measurement and preparation of the single extensions will have to be executed in the job site. The extension is composed by:

- a triple depth socket that has to be inserted directly

into the hole of Ø110 positioned in the corrugated pipe, that guarantees by itself a supplementary height of about 13 cm

- a possible additional pipe as the one used in sewage system in PVC or in similar material to be cut on measure to cover the failing distance (the pipe can be "welded half coupling" type or "smooth" that could be realized "welded half coupling" in the job site after having warmed it). If the triple depth socket is enough, it will be possible

to plan to insert the ductile iron cone directly on it. If the height to be covered is lower than 13 cm of the triple depth socket, it will be necessary to cut it on measure before inserting it. At the end, in case that the height to be covered is higher than 13 cm of the triple depth socket, the fragment of pipe will be inserted on it and therefore the ductile iron cone will be assembled to the pipe. In case that the height of the extension is lower than 25 cm, it will be needed to make the concrete coating of the flanking of "pipe + extension" with C25/30 class concrete up to a height of 5/10 cm below the

head of the extension.

In case that the height of the extension is higher than 25 cm, it will be needed to make the concrete coating of the flanking of "pipe + extension" with a concrete mixture at 6% up to a height of 5/10 cm below the head of the extension.

In order to ensure the alignment of all extensions, it is necessary to lay a wire on the whole line length in order to guarantee the right position.

INSTALLATION

The following instructions and the relative drawings are given only as an example.

Table c

Class of load (AS3996)	E 400	F 600	G 900
Applicable load (AS3996)	400 KN	600 KN	900 KN
Minimum height (H) of concrete flanking	Not lower than the FUNNEL volume		
Minimum thickness (S) of the concrete flanking ³	200 mm	250 mm	300 mm
Class of concrete (resistance to compression EN 206-1) ¹	C 25/30 ¹	C 30/37	C 35/50
Class of concrete ² (resistance to compression EN 206-1)	C 30/37 XF4	C 35/45 XF4	C 40/50 XF4



Therefore the concrete with Constituency Class S4 (EN 206-1) is recommended and the rock aggregate will have to be made of stones with a maximum diameter of 8 mm.

Equip the concrete around the FUNNEL with stretches of electrowelded mesh Ø 10 (with mesh 15 x 15 mm or 20 x 20 mm).

1- If installation is in road crossing subject to heavy traffic (especially trucks), Class C30/37 concrete should be used.

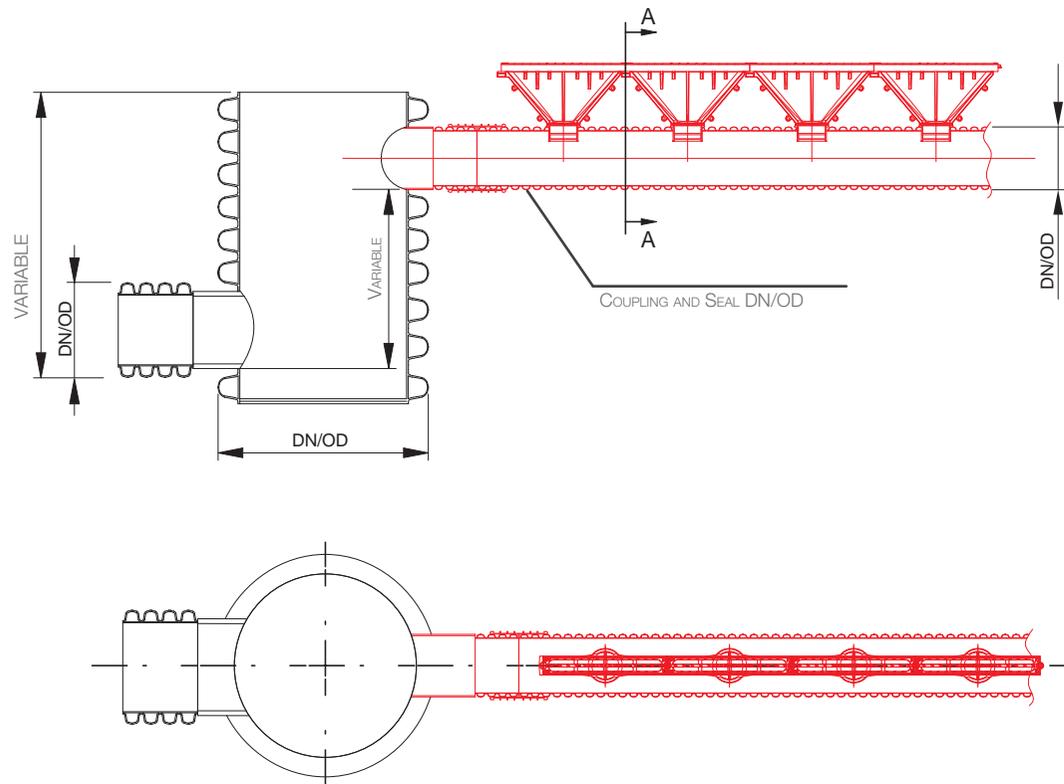
2- If concrete can be affected by frost and thaw cycles.

3- In any case the thickness S will never be lower to $(DN/2 + X \text{ mm})$, with $X=100 \text{ mm}$ for class of load D400 and $X=200 \text{ mm}$ for classes of load E600 and F900.

INSTALLATION

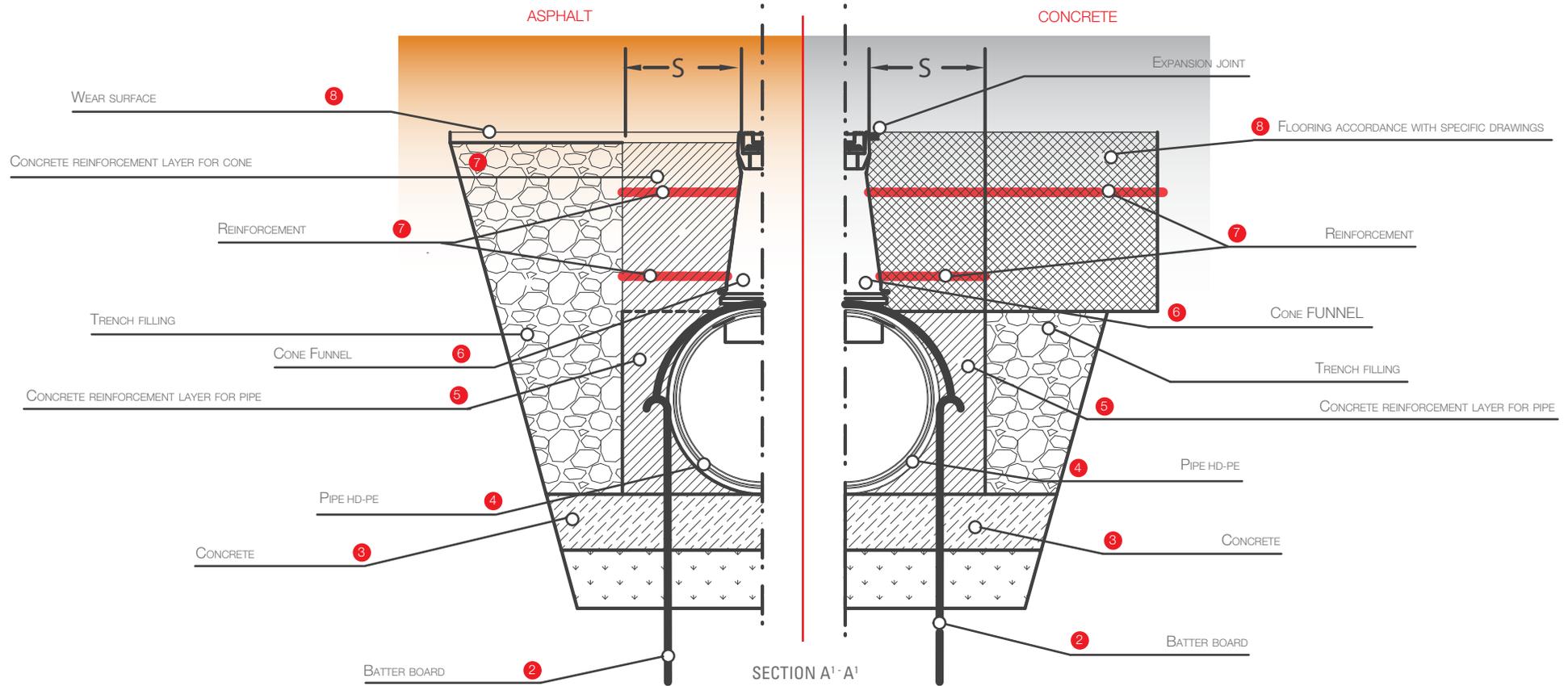
CASE 1: WITHOUT EXTENSIONS

Example of installation with one outlet only at the end of drainage line



CE

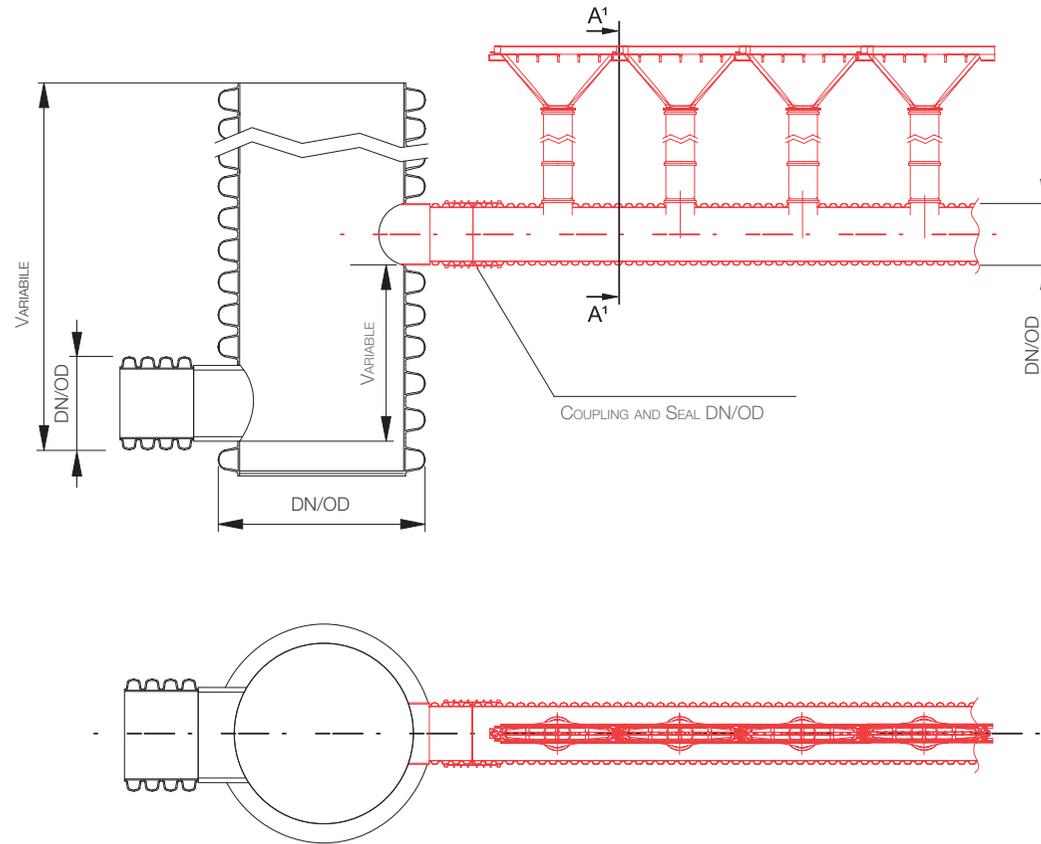
CASE 1: WITHOUT EXTENSIONS Example of installation with one outlet only at the end of drainage line



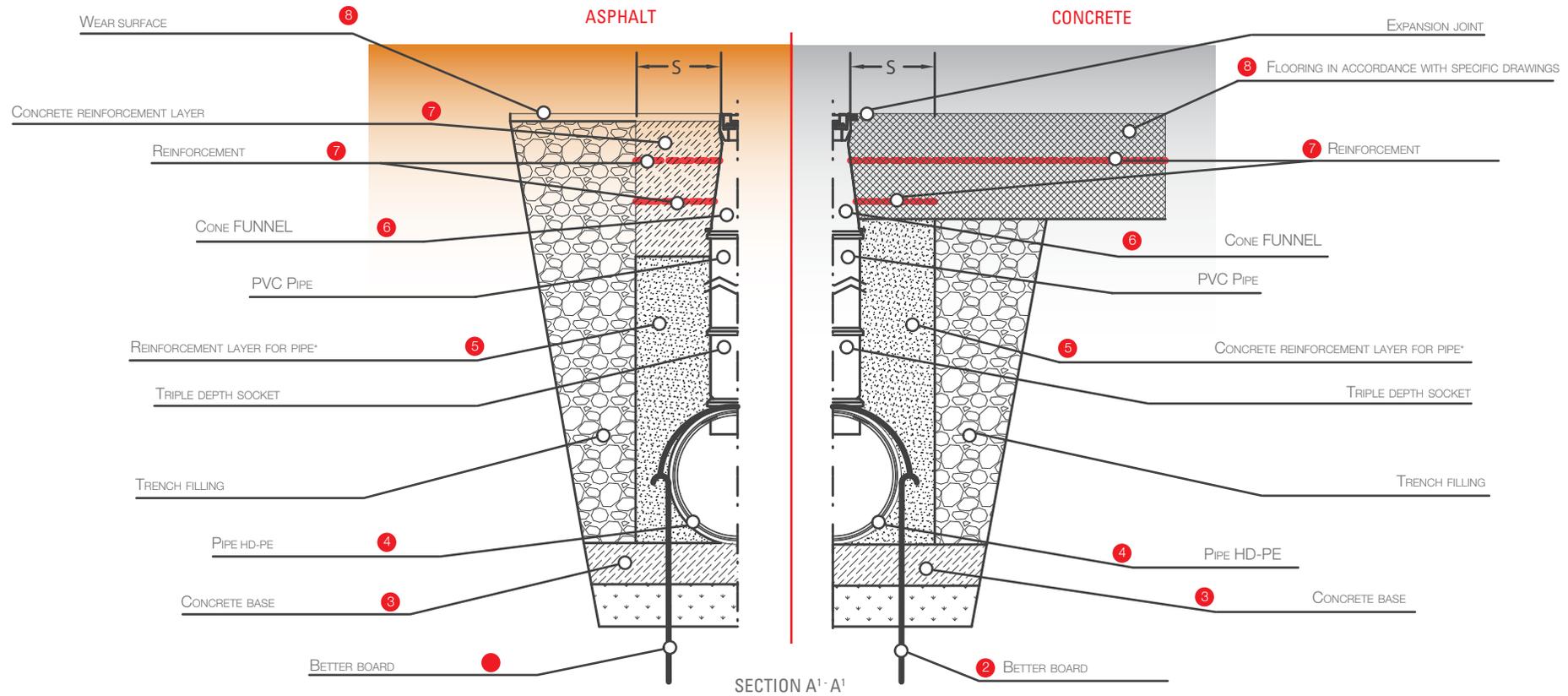
INSTALLATION

CASE 2: WITH EXTENSIONS

Example of installation with one outlet only at the end of drainage line



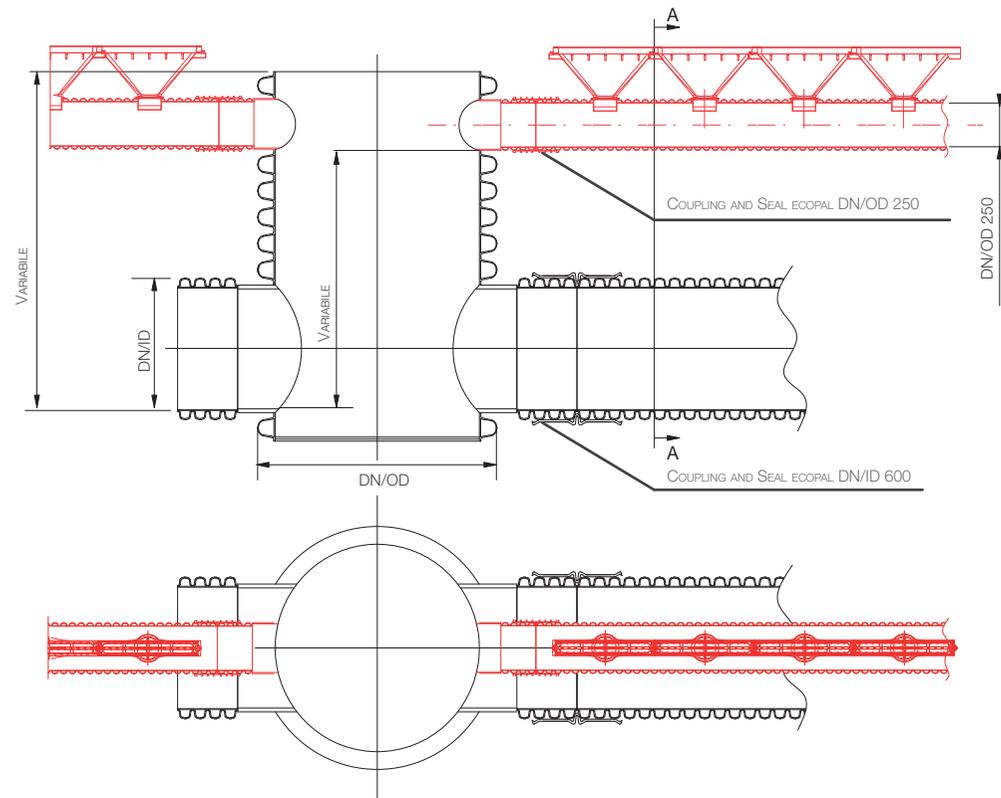
CASE 2 □ WITH EXTENSIONS Example of installation with one outlet only at the end of drainage line



* In case that the height of the extension is lower than 25 cm, it will be needed to make the concrete coating with C25/30 class concrete, in case it is higher than 25 cm it will be needed to use a concrete mixture at 6%.

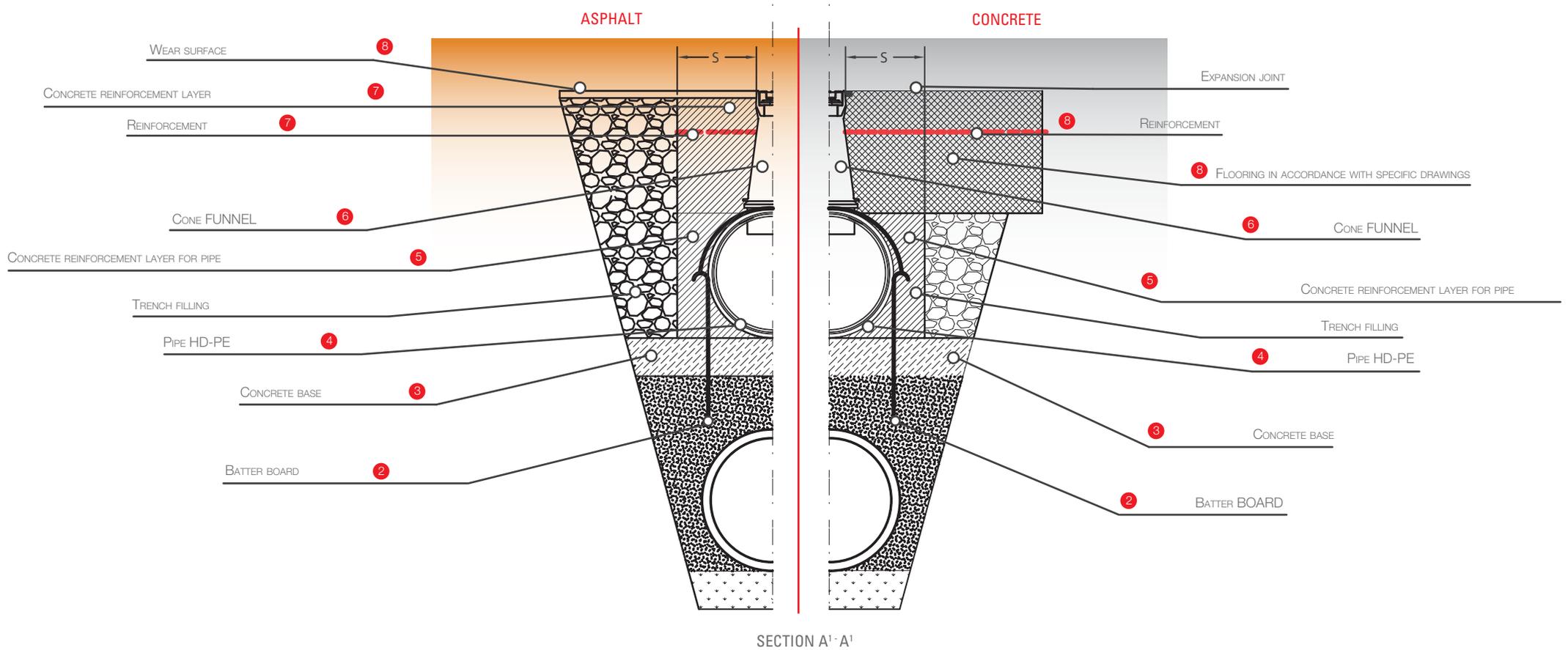
INSTALLATION

Example of installation with "n" outlets connected by pipe



INSTALLATION

Example of installation with "n" outlets connected by pipe



HIGHWAYS TUNNELS INSTALLATIONS



Inside the road and highway tunnels, it is necessary to consider the requirements of new regulations that impose high safety standards.

Moreover, it is mandatory to install the firefighting drainage system inside tunnels being longer than 300 meters.

For guaranteeing water collection and drainage inside the tunnels, it is necessary to provide an appropriate linear drainage system.

The main problems that may occur while choosing the type of the drainage system are listed here below:

1-the size of the grating

2-the necessity to have a security system that prevents the flame spread all along the drainage system line (beside the water flow of firefighting drainage system, it has to be considered that also flammable liquids flows from the tankers or simply from the tanks of cars involved in accidents could fall into the system).

The **FUNNEL** system is ideal for these types of installations. In fact, thanks to the reduced dimensions of the gratings volume, after the installation the visible part is 7 cm only.

HIGHWAYS TUNNELS INSTALLATIONS



Nevertheless, as we have seen, the system guarantees **high hydraulic performance**.

It is possible to realize a special piece “**firebreak manhole**”, keeping the residual water in its loop, works based on the siphon principle and stops the flames and toxic gases spread emitted during the fire.

A “firebreak manhole” should be installed at every 25 meters for a proper system operation. In this way separated drainage lines can be created so that the “**firebreak manhole**” placed at the beginning and at the end of the drainage line can

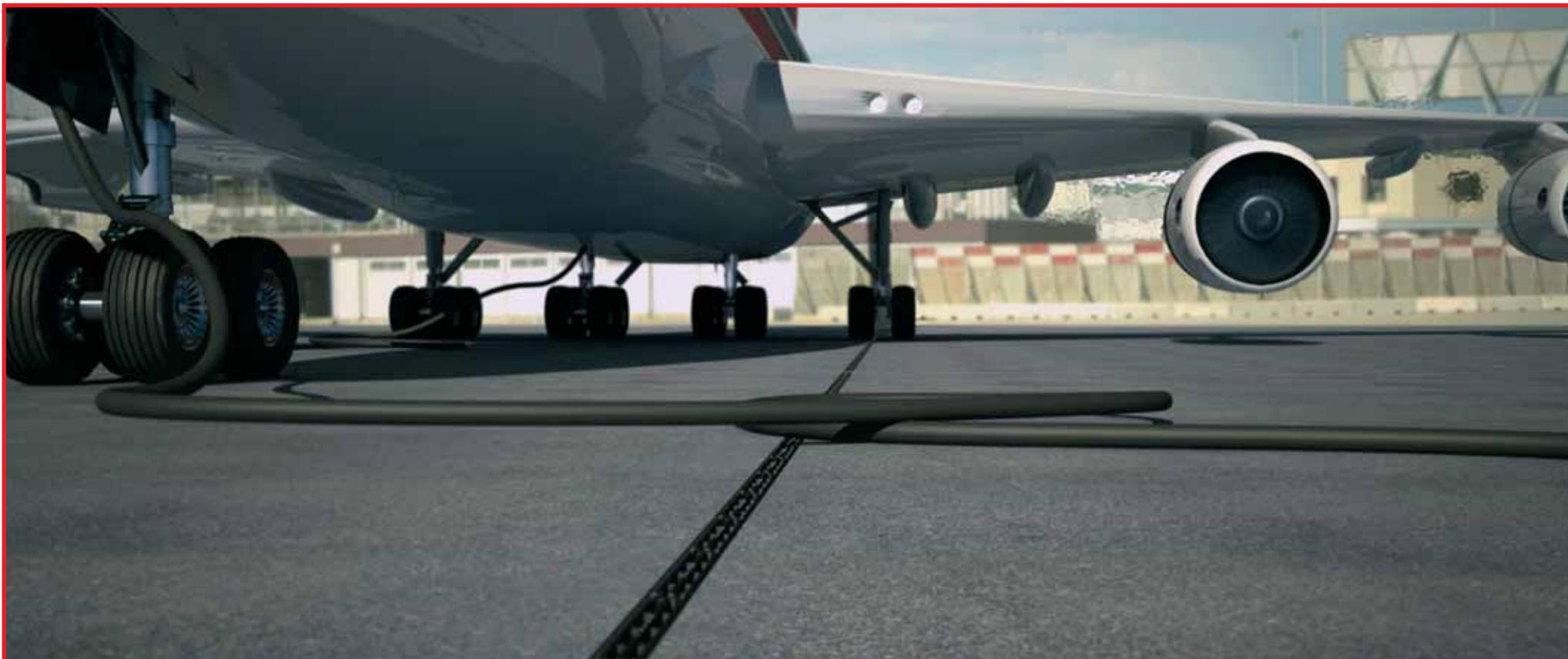
avoid flame, smoke and toxic gases spread.

It is necessary that the siphons are always full of water.

The “**firebreak manhole**” could be easily connected to the rest of the FUNNEL system and it is made of HD--PE as well as the sewage pipe. It guarantees a continuous flow as it can be realized with the same diameter of the other pipes. It is easy to be checked for maintenance and cleaning.

MUFLE

INSTALLATIONS FOR PAVEMENT APPLICATIONS



With regard to pavements, two types of areas can be distinguished at an airport:

- 1. critical area**, i.e. those areas where the aircraft is stationary or it proceeds at low speeds
- 2. not critical area**, i.e. those areas where the shocks on the pavements are lower due to the high speed of the aircraft.

In critical areas the so-called **rigid pavements** are used while in not critical areas the so-called **flexible pavements** are used.

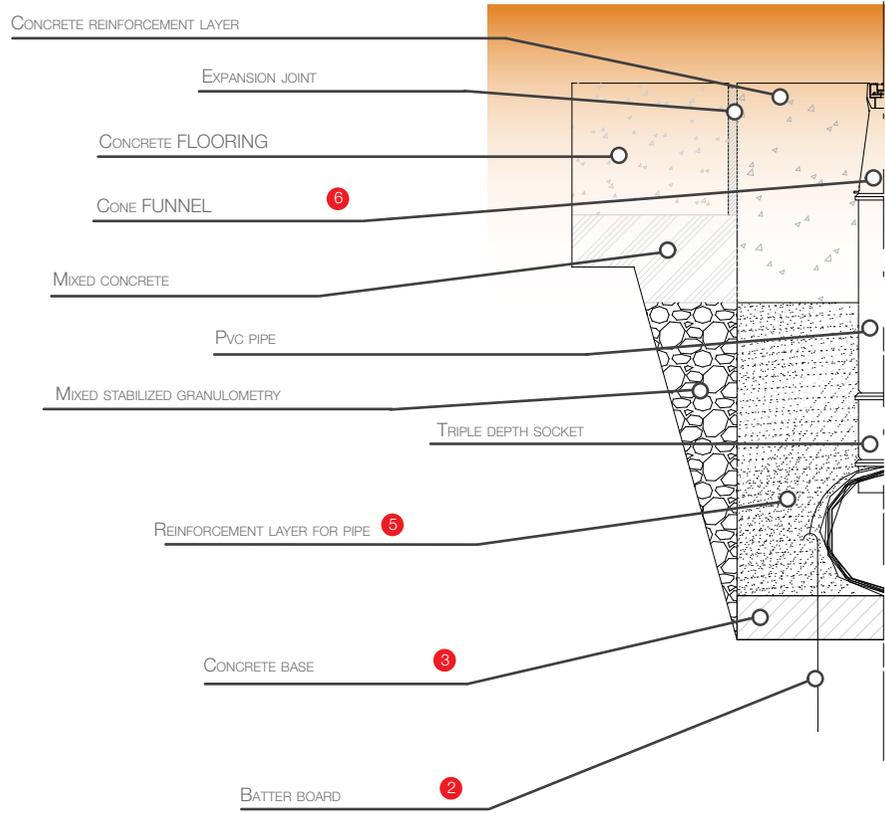
The rigid pavements are composed by:

- a basement layer of mixed granulometry or stabilized with lime or concrete of a thickness from 15 to 45 cm
- a layer of superficial coating represented by adjacent plates in concrete of a thickness between 20 and 70 cm, separated by joints.

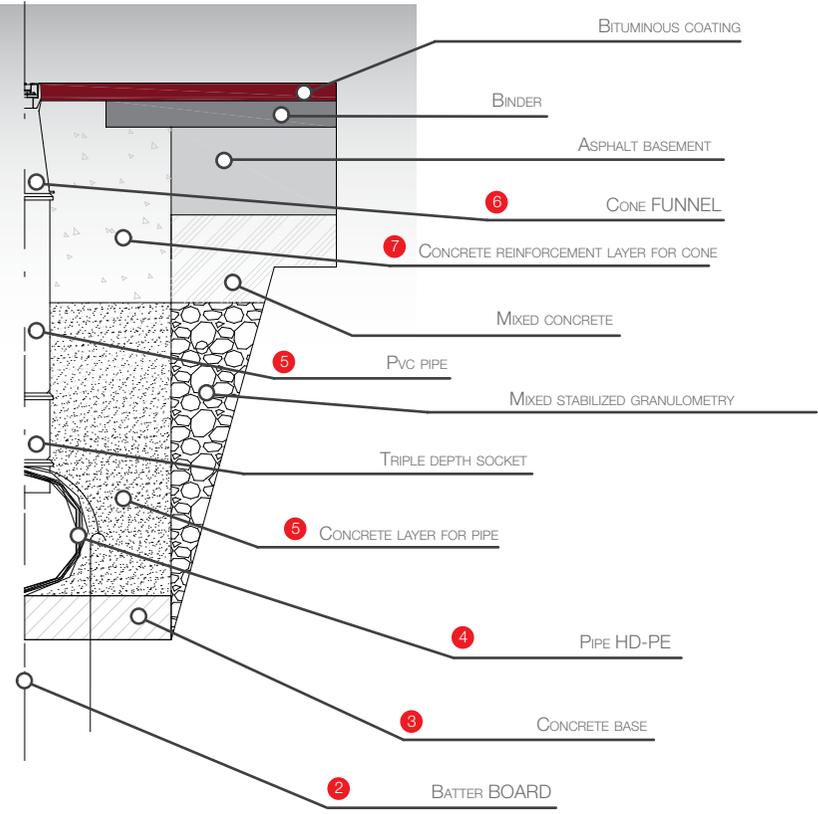
The flexible pavements are typologically similar to those on roads and they are constituted by a several layers with standardized granulometric and static characteristics

INSTALLATIONS FOR PAVEMENT APPLICATIONS

RIGID PAVEMENT



FLEXIBLE PAVEMENT





MUFLESYSTEM
SISTEMI DI DRENAGGIO DELLA PAVIMENTAZIONE

DICHIARAZIONE DI CONFORMITA'

Produttore: Muflesystem srl
Via dell'Industria, 7
62017 PORTO RECANATI
ITALIA

rappresentato dai firmatari in calce, dichiara che tutti i prodotti

MUFLEDRAIN Easy-Flat, Vip-Skip, Smart, Wing, Plus, Slope, Funnel

rispondono alla direttiva europea 89/106/CEE sui prodotti da costruzione.

Descrizione dei prodotti: Sistemi di drenaggio lineari Tipo M per la raccolta e lo smaltimento di acque superficiali installati in aree soggette a traffico pedonale e/o veicolare e relative griglie e coperture

Classificazione: In base all'impiego ed alle istruzioni per la posa in opera, dalla classe di carico A15 alla F900

Materiale dei canali: Polietilene ad alta densità

Dimensioni interne dei canali: Lunghezza=1.000/1.500mm
Larghezza=100/150/200/300
Altezza=55/80/100/140/210/300
Ø=250/320 mm (valido per Funnel)

Materiale delle griglie e coperture: Ghisa sferoidale, acciaio zincato, acciaio inossidabile

Norma di riferimento armonizzata: EN 1433-2008

In conformità a: L'intera norma EN 1433-2008; Allegato ZA; Allegato D

Sistema di dichiarazione di conformità: 3

Laboratorio di prova notificato: IQ0 - Istituto Italiano di garanzia della Qualità
Aut. n° 1608

Porto Recanati (Mc), il 12/01/2011

Ing. Valerio Fedeli
Amministratore Unico

Ing. Aldo Vergari
Responsabile Certificazione Prodotto

Muflesystem srl - Via dell'Industria, 7 - 62017 Porto Recanati (MC) - Italia
 Tel. +39 0733 931111 - Fax +39 0733 931112 - Email: info@muflesystem.it
 P. IVA 02070820428 - C.C.I.A.A. 0421/010010101 - C.F. 02070820428



MUFLESYSTEM
SISTEMI DI DRENAGGIO DELLA PAVIMENTAZIONE

DECLARATION OF CONFORMITY

Manufacturer: Muflesystem srl
Via dell'Industria 7
62017 PORTO RECANATI (MC)
ITALIA

Represented by the undersigned, declares that all the products

MUFLEDRAIN Easy-Flat, Vip-Skip, Smart, Wing, Plus, Slope, Funnel

are in accordance with the European standard 89/106/CEE about building products.

Description of the products: linear drainage channels type M to collect and remove surface water in pedestrian and/or driveway areas with gratings and covers

Classes: on the basis of the use and installation instructions, from loading class A15 to F900

Channels material: Polyethylene High Density

Channels Dimensions: Length=1.000/1.500mm
Width=100/150/200/300
Height=55/80/100/140/210/300
Ø=250/320 mm (valid for Funnel)

Gratings and covers Material: Ductile iron, galvanised steel, stainless steel

Harmonised Standard: EN 1433-2008

In accordance with: the whole standard EN 1433-2008; Annex ZA; Annex D

Declaration of conformity System: 3

Notified test laboratory: IQ0 - Italian institute of quality guarantee
Aut. N° 1608

Porto Recanati (MC), il 12/01/2011

Ing. Valerio Fedeli
CEO

Ing. Aldo Vergari
Responsible for Product Certification

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VOCI DI CAPITOLATO / SPECIFICATIONS

Supply and installation of the drainage system “MufileDrain FUNNEL” equipped with 3 units:

- a. high density polyethylene co- extruded twin wall pipe, smooth internally and externally black corrugated for not under pressure underground sewer ducts with stiffness class SN4 (8) kN/m² and with jointing by HD-PE coupling and EPDM lip seal. This pipe has a diameter calculated according to the water flow rate so that the filling percentage will be not superior to 70% and is equipped with 110 Ø holes with 500mm pitch. Each hole will be provided with a EPDM gasket.
- b. As above mentioned in the point A, the “Funnel” conveys into the pipe the water collected from the surface and is manufactured in ductile iron EN GJS 500/7 according to the EN 1563- 2004; the funnels can be connected through male- female coupling system; the funnel shall be realized with one casting in order to assure one monolithic piece; in the upper part there will be a proper seat for the grating, realized by two 20 mm high frames coming from the same casting. The funnel has been designed with a proper seat for a M10 stainless steel screw in order not to let the screw rotate while fixing the gratings through nuts referred to in point C. The funnel body must be equipped with an inferior round part of a 56mm height and of a 110 Ø for direct connection to corrugated pipes that collect water as a sewage pipe referred to in point A. Pipe

dimensions must be the following ones: standard length 500 mm, total height 300 mm, height after connection to the sewage pipe 244 mm, upper width 75 mm.

- c. Slotted grating in ductile iron GJS 500/7 according to EN 1563-2004 for water drainage, to be positioned in the “funnel” seat referred to in point B; the gratings shall be fixed to the “funnel” through a M10 stainless steel nut to be screwed to the screw shank sticking out from the under part; the gratings are equipped on both short sides with 2 elliptic eyelets. The eyelets will be positioned staggered so that the upper eyelet of one grating is placed on the lower one of the previous grating while applying the gratings to the “funnel”; the screw shank will be pushed through the 2 eyelets and the nut will be screwed on.

The grating shall be in F900 load class with rectangular slot and will be marked with the CEmarking and with all the markings according to the EN 1433-2008.

The sizes of grating shall be the following: standard length 498 mm, standard width 60 mm.



Certified Company
ISO 9001: 2008
CE EN-1433



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MUFLE[®]
WATER CONVEYING SYSTEMS