FLAT ROOF DRAINAGE AND PIPE SYSTEMS

1. Principles

1.1 Fields of application

Flat roof drains collect the rain water from flat roofs, multi-storey car parks, green roofs and terraces. The rain water is drained away from here via internal drainage pipes.

Drains without odour seals are always used in these applications. The drains must also be laid out to ensure that the rain water can be drained off by the shortest possible route.

Flat roof drains are designed for poured gravel roofs, and roofs with no general access, with gravel catching baskets and ball gratings. Special care must be taken with these drainage combinations to ensure that they are only used in areas with no general access because they are only suitable for load class H and people can trip up on the gravel baskets.

Roof surfaces which are used for roof terraces or multi-storey car parks can also be considered as flat roofs. In the case of these roof areas, the flat roof drains must be equipped with specially designed top sections which can be fitted with class K3, L15 or M125[1)] gratings.

1.2 Statutory regulations and standards

Failures in planning and laying out flat roof drainage systems can give rise to faulty drainage. In the case of syphonic drainage systems this can lead to cavitation (the formation of air bubbles) which are a hazard to human life and can damage property. Improper assembly of rain water drainage systems also poses additional risks.

Criminal proceedings may for example be implemented pursuant to Section 323 German Criminal Code when equipment and construction components are installed in a way which jeopardise building safety and can also cause injury or death. Serious fines can also follow in some cases from the violation of state building regulations. The latter can also give rise to civil law claims arising from legal actions against those directly responsible for the damage (Section 823 German Civil Code) and claims for defects (Section 633ff German Civil Code and Section 13 VOB/B = contractual regulations for construction work and contracts) where contractual agreements or DIN regulations have been violated.

Planning and execution is regulated by application-specific standards and regulations. These regulations refer to other stipulations, e.g. to EN 1253 which regulates the design of roof drains, and the flat roof directives.

Roof drainage systems designed for open channel drainage must be configured pursuant to EN 12056.

[1)] See chapter 2.3.

State building regulations and communal ordinances	State and local authority-specific bylaws
EN 12056-1	General application and execution specifications
EN 12056-3	Roof drainage, planning and dimensioning

The German standard DIN 1986-100 is currently being revised and contains some crucial amendments. The tentative publication date is Spring 2007. The following explains the two most important changes with respect to the reference rainfall and the emergency overflows.

Amendments to the reference rainfall $r_{(D,T)}$

D = duration of the rain event

T = annual frequency of the rain event

We recommend that these amendments be taken into consideration during the planning stage.

Current standard	Future amendment
D = 5 minutes	D = 5 minutes
T = every two years[2)]	T = every 5 years[3)]

Emergency overflows

Roofs built using lightweight construction methods and fitted with interior drain pipes must have an emergency drainage system. This means integrating an emergency drain at all of the deepest points. In all other types of roof, analysis is required to take into consideration the statics of the roof and the expected rain events to determine whether emergency drainage is required.

Emergency drainage should always be incorporated in buildings which need special protection. In addition, the emergency systems in this type of building must be capable of draining off the total volume of heavy rain (100-year rainfall).

Emergency drainage can be implemented via appropriately dimensioned attic openings and attic drains, as well a secondary pipe system with free drainage onto a surface which can be flooded without causing any damage.

2) When laying out pursuant to the Kostra Atlas (1997 Edition)

3) When laying out pursuant to the Kostra Atlas (2000 Edition)

2. Planning

2.1 Roof structure/ drain type

Selecting the most suitable flat roof drain to drain the rain water from a building is an important part of the planning stage and depends on the type of roof structure.
The type of roof structure selected depends on the different specifications laid down for the roof and the specified loads, e.g. any traffic loads, the drainage of rain water etc.

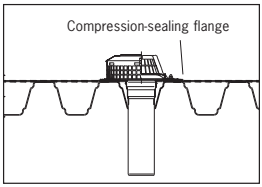
Most roofs can be divided into three groups:

- Roof with air insulation with no sealing
- Roof with air insulation, flat roof/terrace structures without thermal insulation, sealing by **one** sealing membrane
- Non-ventilated flat roof, flat roof/terrace structure with thermal insulation, sealed by **two** sealing membranes

Flat roof drains with the appropriate sealing fixtures have to be selected for installation in the different types of flat roof structures.

2.1.1 Sealing by one sealing membrane

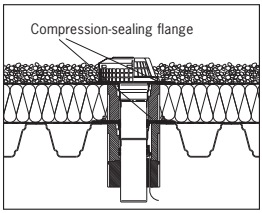
A flat roof/ terrace drain usually incorporates a cast-on compression-sealing flange. The drain body is built into the flat roof or terrace ceiling with the compression-sealing flange lying in a slight depression in the ceiling.
Drains with a compression-sealing flange (also known as one-piece drains) are used in applications such as flat roof or terrace ceilings.



Flat roof drain with a compression-sealing flange assembled in a trapezoidal sheet roof.

2.1.2 Sealing by two sealing membranes

When a second sealing layer is required, the drain body can be extended using an additional extension section (upper part[4]), which has another cast-on compression-sealing flange. The upper part is set at the proper height in the drain body according to the thickness of the insulation, and sealed off against pooled water by a sealing ring or similar.
Depending on the roof structure, drains with two compression-sealing flanges (also known as two-piece drains) are used in applications such as flat roof and terrace ceilings which drain off seepage water.



Flat roof drain with two compression-sealing flanges.

[4] Terms “upper part” and “intermediate section” are usually used synonymously, although a pure “extension” must not necessarily be fitted with a flange. Upper parts/intermediate sections do however usually have either a compression-sealing flange or an adhering flange.

2.2 Inclination of the outlet socket

The layout of the pipes is the crucial aspect for selection of the outlet socket angle of a flat roof drain. Drain bodies with 1.5° inclination (horizontal) for open channel drainage are selected when the pipe is laid in the ceiling. The ceiling construction and the necessary rebates need to be taken into consideration.
Drain bodies with 90° inclination (vertical) are selected if the pipes are laid beneath the ceilings, e.g. in suspended ceilings or when the hole in the ceiling has to be kept as small as possible for structural reasons.

2.3 Cover for flat roof drains

Drains with different types of cover are available depending on the application (e.g. terrace, flat roof or multi-storey car park).
The associated traffic load must be taken into consideration when selecting the type of cover, which is why the installation position has to be classified pursuant to EN 1253.

The different types of covers are classified according to the load classes:

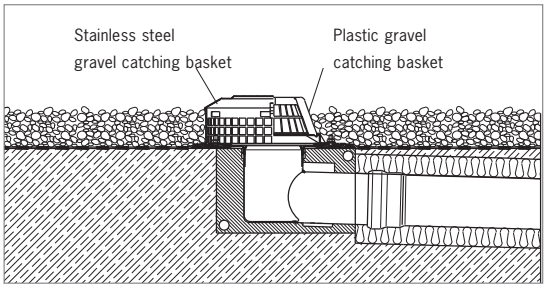
Load class according to DIN EN 1253		Load up to	Fields of application
H 1.5			For non-used roofs
K 3		300 kg	For non-trafficked areas, such as terraces, porches, balconies
L 15		1.5 tons	For light-trafficked areas, without forklift-trucks or green roofs
M 125 / B 125		12.5 tons	For trafficked areas, such as multi-storey car parks or green roofs

In the following, the use and the characteristics of the mentioned cover types are explained:

Load class	H 1.5	K 3	L 15	M 125/B 125
Possible cover types	Ball gratings, gravel baskets	Top sections	Top frames with gratings	Top frames with gratings

2.3.1 Gravel catching baskets

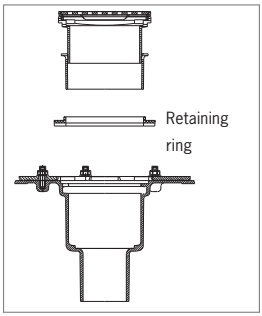
Gravel catching baskets are the third option for covering flat roof drains. They usually have peripheral openings and may also have drainage openings at the top depending on the model.
Gravel catching baskets are the optimal cover for flat roofs with no special structures or for flat roofs covered with gravel. 28/32mm gravel aggregate mixtures are recommended around the grating.
Because of their structural properties, gravel catching baskets can only be used in areas classified as load class H.



SPIN® flat roof drain with a plastic gravel catching basket

2.3.2 Top sections

Top sections with gratings are used in flat roof drains in an analogous way to the standard floor drains used for building drainage. Depending on the model, the top sections are either continuously height-adjustable or adjustable in steps to adapt the height to the level of the floor structure. It is not possible to seal the gap between the drain body and the top section.
The top section can be rotated to adjust the grating pattern to the pattern of the tiles in tiled terraces.
A retaining ring with upward facing seepage openings must be pushed over the cylindrical socket of the top section in flat roof and terrace drains with continuously height-adjustable top sections. All of the gratings in the top sections can be removed. The bolted models are recommended to prevent vandalism.



Flat roof drain combined with a top section[5)]

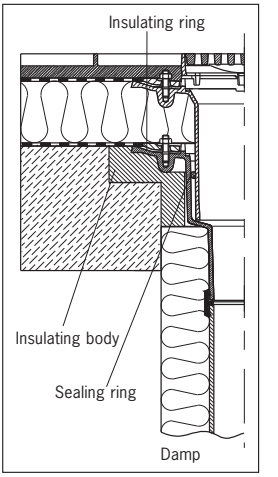
5) The diagram shows the DN 70 ACO flat roof drain. The DN 100 ACO flat roof drain must be used with transition frames.

2.3.3 Top frames and gratings

Depending on the type of cover, top frames with gratings are used in terraces as well as areas open to traffic with higher load classes.
Top frames with gratings are laid directly on top of the drain body. Top rings can be used to provide additional height adjustment (corresponding to the building specifications). The top rings are positioned between the drain body and the top frames or the gratings. Top rings have seepage openings.

2.4 Isolation/thermal insulation

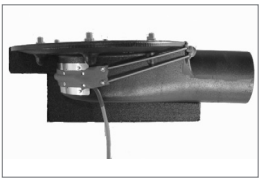
Moulded parts made of polystyrene, mineral wool or vapour-diffusion-tight foam glass (FOAMGLAS) are used to insulate flat roof drains and their upper parts. This is done to block any cold bridges and the formation of condensation water around the drain. This is always required when flat roof drains discharge into pipes lying within buildings.
Insulating bodies are used to insulate drain bodies. If upper parts are also used, they should also be fitted with insulating rings or insulated using the thermal insulation installed in the building.
All of these moulded parts (except mineral wool) can also be used under certain conditions as expendable formwork when pouring the concrete to form the roof.



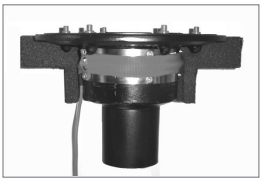
Installation option isolation/thermal insulation

2.5 Heating

A heating for flat roof gullies is required if the flat roof drains are installed in very exposed roofs, e.g. connected to a separate wastewater system, and in buildings which are not heated continuously throughout the winter. A heating for flat roof gullies can be retrofitted in some cases depending on the type of drain body. Free access to the pipe system must be guaranteed in all cases.



Heating for flat roof drains
1.5° inclination



Heating for flat roof drains
90° inclination

2.6 Pipe system applications

The selection of the most appropriate pipe system is a part of the planning phase and depends on the application. EN 12056 must be observed.
Various pipe systems are available depending on the different specifications. This is shown in the following table.

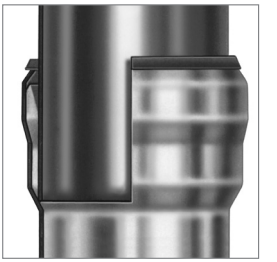
Application	Product solution
External drainage	ACO GM-X pipe ACO GM-X compound piping ACO gutter pipe
Internal drainage	ACO GM-X pipe ACO GM-X compound piping
Grey water	ACO GM-X pipe
Vent pipes	ACO GM-X pipe
	MULTIFLEX flat roof duct
Fitted vacuum cleaning pipes	ACO GM-X pipe, With or without plastic coating
Vacuum pipes	ACO GM-X pipe with special seals
Tank filling and ventilation pipes	ACO GM-X pipe with special accessories
Kitchen wastewater pipes	ACO PIPE, material 1.4301*
Pipes for wastewater contaminated with chemicals	ACO PIPE, material 1.4301*

*WARNING! Restrictions on use depending on the degree of contamination and concentration of chemicals in the wastewater.

2.6.1 ACO GM-X steel drain pipes

ACO GM-X pipes and fittings are subject to EN 123 regulations and are manufactured in compliance with this standard.
New pipes are produced from precision steel pipe pursuant to EN 10305-3 (tensile strength: Rm 310-410N/mm²; failure extension: A_5 min. 28%).
All of the steel pipes and fittings are hot galvanised inside and out. The zinc layer averages 40 mg² or 56 µm and is impact and shock resistant. The zinc layer provides cathodic protection at interfaces and therefore prevents hidden rusting. The pipes and fittings also have a plastic coating built up using alkyd melamine resin. The internal coating reduces the frictional resistance and largely prevents the build-up of crusts.
The plastic coat and the galvanised layer provide optimal corrosion protection.
The moulded GM-X coupling socket has two parts. The sealing element is formed by the first part of the coupling socket. The second part centres the male pipe end. This coupling socket design creates stable and strong connections between pipes and fittings and cannot be bent out of place – to guarantee a very high level of tightness between the pipes and the coupling socket.
The tightness limits specified in local regulations for laid pipelines is complied with. All of the connections with fitted sealing elements withstand internal and external overpressures of 0.5 bar. Additional measures to prevent axial displacement must be applied to pipelines which are subjected to higher pressures. See the table below.

GM-X pipe – available sizes DN 40-DN 300



GM-X coupling socket

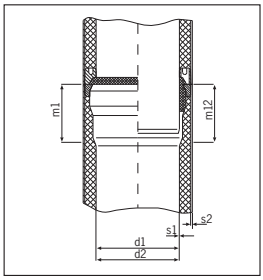
Nominal width	Product description	Tightness values
DN 40	GM-X Safety clamp*	15 bar
DN 50	GM-X Safety clamp*	15 bar
DN 70	GM-X Safety clamp*	5 bar
DN 80	GM-X Safety clamp*	5 bar
DN 100	GM-X Safety clamp*	5 bar
DN 125	GM-X Safety clamp*	4 bar
DN 150	GM-X Circlip	4 bar
DN 200	GM-X Circlip	2 bar
DN 250	GM-X Circlip	1.2 bar
DN 300	GM-X Circlip	1 bar

*In the case of a branch, a safety clamp with notch has to be inserted at spigot of main pipe.

2.6.2 ACO GM-X compound piping

GM-X compound pipes can be used as drainage pipes in areas affected by condensation water. The compound pipes can also be used in areas affected by frost if the piping is fitted with the additional self-regulating auxiliary heating system. The compound pipes can also be used in areas where they are visible to the public because the column style allows the compound pipes to be optimally integrated within modern architecture. Compound pipes can also be produced with an outer stainless steel pipe upon request.

GM-X compound piping – available in sizes ranging from DN 40 – DN 200



DN	d1	d2	m1	m1 2	s1	s2
40	42	89	30	25	1.5	1.8
50	53	89	38	30	1.5	1.8
70	73	102	55	45	1.6	2.0
80	89	134	60	50	1.8	2.0
100	102	134	70	60	2.0	2.0
125	133	164	75	65	2.5	2.0
150	159	204	80	70	2.5	2.0
200	219	273	120	110	3.2	2.0

Compound pipes consist of a GM-X steel drain pipe pursuant to EN 1123 as the pipe transporting the media (inner pipe) and an outer lining consisting of cylindrical steel pipe with a hot-galvanised internal and exterior coating. The two pipes have different diameters and the annulus between is filled with PU hard foam. This PU hard foam prevents the formation of condensation water and forms a strong bond between the two pipes. This stops the two pipes from slipping apart. Technical specifications:

CFC-free polyurethane hard foam

- Raw density: 46 kg/m^3
- Thermal conductivity: 0.020 – 0.024 $W_{(mk)}$
- Foam structure: 85-95% closed cells
- Vapour resistance factor: 50 µ
- Water absorption: 1.7 – 1.8 Vol. %
- Edge ignition compliant with DIN EN 1366: B2

2.6.3 ACO gutter pipes

Gutter pipes connect exterior roof guttering or the attached rain downpipes with the transition to the buried pipes. Gutter pipes usually stick out of the ground by 1 to 2 metres and are designed to be rugged enough to protect the downpipes from damage, and the loss of function such damage could cause.

The figure on the right shows the new design of the ACO gutter pipe which was previously supplied in lengths of 500, 1000, 1500 and 2000 mm in a steel hot-galvanised model in size DN 100 with or without a cleaning opening, as well as with a slotted cleaning opening. This model will gradually replace all of the models for all nominal widths shown in the picture on the left.

2.6.4 MULTIFLEX flat roof ducts

MULTIFLEX flat roof ducts are the simple and safe way of venting grey water soil stacks and interior rooms (e.g. bathrooms and kitchens above a flat roof).
These flat roof ducts are made of stainless steel 1.4301 and consist of twin tube pipe with a continuously thermally insulated annulus filled with inflammable mineral wool. This product complies with building material class A1.
The flexible compression-sealing flange complies with EN 1253 and can be flexibly pushed onto the external pipe.

2.6.5 ACO PIPE stainless steel pipes

In areas where higher specifications are demanded, e.g. industrial kitchens, the food industry or the chemical industry, it is recommended that ACO PIPE pipes are used.
ACO PIPE pipe is available in either stainless steel sheet 1.4301 or 1.4571 (round formed and longitudinally welded). The products are compliant with EN 1124 and backflow protected to pres-sures up to 0.5 bar thanks to the push-fit connection. Backflow protection can be raised to 2.0 bar if the optional push-fit fastening is used.

ACO PIPE stainless steel pipe

2.6.6 ACO GM-X tank-filling and vent pipes

ACO GM-X steel drainage pipes with special accessories can also be used as filling and vent pipes for unpressurised heating oil tanks used to store heating oil pursuant to relevant regulations. For materials and properties see 2.6.1.

Filling pipes are always DN 50. DN 40 or DN 50 pipes can be used for venting heating tanks in compliance with TRbF 20 (edition: March 2001 Number 9.1.2.3).

Filling pipes can be operated at a maximum operating pressure of 6.0 bar with heating oil temperatures at up to 40°C.

Because the tightness specification for ACO GM-X steel drainage pipe is 0.5 bar, the coupling connections for filling pipes and some vent pipes must also be fitted with ACO GM-X safety clamps (see following table). Using the ACO GM-X safety clamps raises the tightness specifications to 15 bar.

Follow local regulations when using filling and vent pipes in earthquake-risk areas.

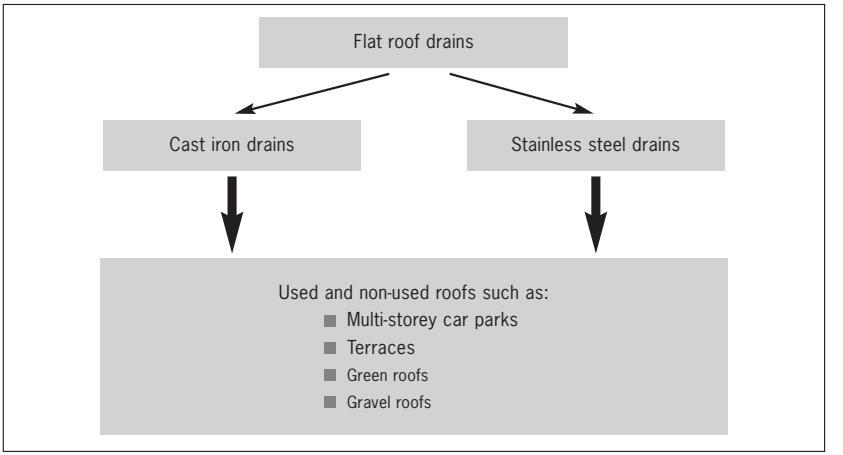
Hazard class of the stored liquids	**Filling pipes**		**Vent pipes**	
	Above ground	Underground	Above ground	Underground
A III (heating oil)	permissible **with** safety clamp	permissible **with** safety clamp[6]	permissible without safety clamp	permissible **with** safety clamp

6) Authorised for liquid-tight safety pipe or safety duct if compliance is observed with TRbF 50 (June 2002).

2.7 Materials

Principally, cast iron drains as well as stainless steel drains can be installed in all roof types. Attention must be paid that the top sections comply with the required load classes.

In the case of pipes, however, there are many differences (see table in chapter 2.6). Metal pipes may only be used above ground. For laying in ground, metal pipes are suitable to a limited extent only and special corrosion protection measures must be applied.
Following diagram contains fields of application for the flat roof drains, dependent upon material.



Applications for flat roof drains are dependent upon material

2.7.1 Cast iron

GJL-200 cast iron is according to EN 1561 an iron-carbon alloy containing carbon flakes embedded in an iron lattice. This “graphite lattice” gives the cast iron its excellent corrosion resistance. No additional surface protection is required.

Cast iron material specifications

- Temperature resistance to 400°C with no change in its mechanical properties
- Insensitive to hot-laid flooring materials such as mastic asphalt or bitumen sheeting
- Strong bond with concrete even when subjected to temperature fluctuations because of the very similar coefficient of expansion between concrete and cast iron
- Sound absorbing because of the large mass
- Sound insulating
- Completely recyclable and long service life

Cast iron flat roof, multi-storey car park and terrace drains are coated with primer for transport protection and for optical reasons.

2.7.2 Stainless steel

Material specifications in Chapter 2.6.5.

2.7.3 Galvanised steel

Material properties given in Chapter 2.6.1 and 2.6.2.

2.8 Determining the drainage type

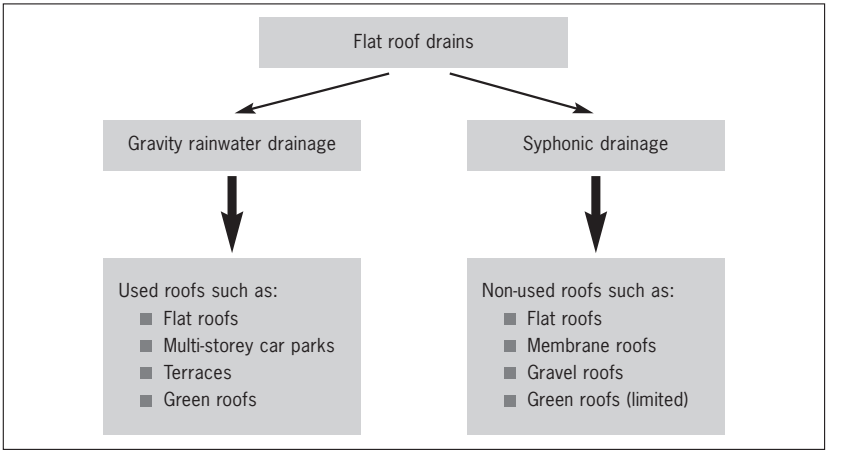
Flat roof drainage systems are divided into either gravity rainwater drainage systems or syphonic drainage systems.

Gravity rainwater drainage systems drain off water merely using the force of gravity. In syphonic drainage systems, the rainwater is drained off in pipes which are always completely full because this is the way the system operates.

Roofs open to the public are best drained using gravity rainwater drainage because of the greater widths of the pipes (less risk of blockage from dirt or litter).

The most important factors influencing dimensioning of both types of flat roof drainage are the local reference rainfall levels, connection to the main drains, the piping layout, the roof structure and the difference in heights.

ACO Haustechnik provides the optimum flat roof drains, accessories and pipe systems for both applications.



Applications for gravity rainwater drainage systems and syphonic drainage systems

2.8.1 Gravity rainwater drainage

The degree of fill (h/d) of gravity rainwater drainage systems designed pursuant to EN 12056-3 (installed within buildings) must not exceed max 0.7 because adequate venting and aeration of the pipes and thus secure drainage of the rain water can only be guaranteed below this level.
Gravity rainwater drainage systems can be used for all roof surfaces in principle, and always have to take into consideration specific aspects during the planning stage. A very important aspect is ensuring the pipes are laid with an adequate gradient, and therefore to ensure that enough space is available to comply with this specification.
Gravity rainwater drainage systems simply drain the water from the roof drains into the downstream piping using the force of gravity. Gravity rainwater drainage requires a large quantity of flat roof drains and pipe connections. The applicable standards should be used to calculate the diameter of the pipes. The number of flat roof drains required and their nominal width is calculated using the rain water flow capacity (Qr) given in l/s. This requires the following details:

- Type of area to be drained (Ψ oder C)
- Surface water area to be drained in m^2 (A)
- Reference rainfall in l/ [s x h] (r)

The flow coefficient Ψ (C) determined by the drained area. This is selected according to the following

table (taken from German regulation DIN 1986-100):

Type of drained area	**Flow coefficient Ψ (C)**
Smooth roofs	
■ Membrane roof	1.0
■ Concrete surfaces	1.0
■ Asphalt	1.0
■ Paved surfaces with grouted joints	1.0
■ Paving stones with grouted joints	1.0
■ Gravel roof	0.5
■ Extensive greening less than 10cm layer	0.5
■ Extensive greening more than 10cm layer	0.3
■ Intensive greening	0.3

For example, the reference rainfall figure used for dimensioning $r_{(D,T)}$ is determined for the specific locality from the following table applicable to Germany and defined in DIN 1986-100. For small towns, the reference rainfall can be taken from the applicable Kostra Atlas.
The rainwater flow capacity (Q) in l/s can then be calculated from the following formula taking into consideration the surface water area (A) to be drained:

Rain water flow capacity	=	reference rainfall	x	flow coefficient	x	effective surface water area	/	10000
Q	**=**	**$r_{(D,T)}$**	**x**	**C**	**x**	**A**	**/**	**10000**

The calculated rainwater flow rate is then used to select the nominal widths and the number of drains with covers needed to drain the area.
The flow capacities of the various drain combinations supplied by ACO Haustechnik are listed in the following table. The water build-up heights on which the tables are based are 35 mm for DN 70 and DN 100 flat roof drains; or 45 mm for DN 125 and DN 150 flat roof drains.
Calculation example for flat roof drains for gravity rainwater drainage system:

Outflow performance of SPIN flat roof drains of cast iron DN 70**

			Ball grating	Flat grating	Top section	Cast iron top section
Art. no.	Nom. width	Inclination	7000.09.00	7000.19.00	5141.81.00 5141.87.00 5141.89.00	5141.83.00
5169.40.00	DN 70	1.5°	6.0	6.4	5.2	4.8
5167.10.00			5.5	4.4	4.2	3.8
5169.20.00	DN 70	90°	7.0	6.7	6.2	5.8
5166.10.00			6.5	5.7	5.2	4.6

** Accumulation height at grating 5 mm

Outflow performance of SPIN flat roof drains of cast iron DN 100 to DN 150***

			Ball grating	Flat grating	Top frame with grating	Top frame with grating	Top frame with grating
Art. no.	Nom. width	Inclination					
7054.11.10	DN 100	1.5°	9.0	8.4	10.7	7.6	12.1
7055.11.10	DN 125		12.0	10.2	12.6		16.4
7056.11.10	DN 150		14.5	12.6	15.0		21.2
7034.10.10	DN 100		8.0	6.2	10.7	7.6	15.2
7035.10.10	DN 125		12.0	10.2	12.6		16.4
7036.10.10	DN 150	90°	13.5	11.0	15.0		18.5

*** Accumulation height at grating 35 mm with DN 100, 45 mm as from DN 125

Outflow performance of SPIN flat roof drains of stainless steel

Art. no.	Nom. width	Inclination	Design	Plastic gravel trap	Stainless steel gravel trap
0174.47.33	DN 70	90°	single-body	2.5	
0174.47.37	DN 70				2.6
0174.47.34	DN 100			4.7	
0174.47.38	DN 100				5.6
0174.47.35	DN 125			8.5	
0174.47.39	DN 125				8.4
0174.47.40	DN 150				8.4
0174.47.67	DN 70		dual-body	2.7	
0174.47.70	DN 70				2.8
0174.47.68	DN 100			5.1	
0174.47.71	DN 100				5.7
0174.47.69	DN 125			8.5	
0174.47.72	DN 125				8.4
0174.76.56	DN 150			8.5	
0174.47.73	DN 150				8.4
0174.48.15	DN 70	1.5°	single-body	2.6	
0174.48.18	DN 70				2.7
0174.48.16	DN 100			5	
0174.48.19	DN 100				5.9
0174.48.17	DN 125			8.3	
0174.48.20	DN 150				9.9
0174.48.21	DN 150			9.9	
0174.48.36	DN 70		dual-body	2.8	
0174.48.39	DN 70				3
0174.48.37	DN 100			4.7	
0174.48.40	DN 100				5.3
0174.48.38	DN 125			8.7	
0174.48.41	DN 150				8.9
0174.48.42	DN 150				

* Outflow performance also applicable to drains DN 150 (with transition element DN 125/150)

The gravity rainwater drainage system for a flat roof is planned for a large warehouse in Rosenheim/Germany. The roof will have an area of 2300 m² and the gravel covered roof will be designed as an air-insulated roof. Two main drain connections are available to drain the roof. The piping systems to drain the roof will be installed below the flat roof ceiling.

Rain water flow capacity	=	reference rainfall	x	flow coefficient	x	effective surface water area	/	10000
51.98	**=**	**452**	**x**	**0.5**	**x**	**2300**	**/**	**10000**

Calculation:
The dimensioning figures corresponding to the rainfall outflow capacity are selected based on the input figures as follows:
Roof surface (A) = 2300 m²
Reference rainfall figures for Rosenheim from table EN 1986-100 (r5,5)[8] = 452l (s x ha)
Outflow coefficient (Ψ) for gravel roof pursuant to table = 0.5

The calculated rainwater outflow capacity (Qr) is therefore 51.98 l/s.

Background information used to select the flat roof drains:
Because the drain pipes are to be laid beneath the flat roof ceiling, vertical drains are required. Gravel catching baskets are required to optimally drain the rain water from the gravel roof. The drain bodies only require one compression-sealing flange because it is an air-insulated roof with only one sealing membrane. This additional information is used to select an ACO SPIN flat roof drain DN 150 with a plastic gravel catching basket. According to the specifications table (see page 69) the flat roof drain corresponds to an outflow capacity of 8.5 l/s.

The number of flat roof drains required is calculated by dividing the rainwater outflow capacity by the outflow capacity of the flat roof drain:

$$\text{The number of flat roof drains required} = \frac{\text{rainwater outflow capacity (Q)}}{\text{Outflow capacity of the selected flat roof drain}}$$

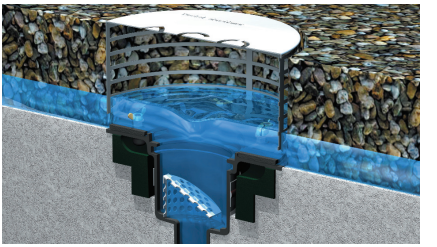
The calculation (51.98/8.5) = 6.11[9]. Therefore, 7 flat roof drains are required to properly drain the surface.
Downpipes with a nominal width of DN 150 are only allowed to have a level of fill of f=0.33. This gives a rainwater outflow capacity of 31.6 l/s, which means that two downpipes are required.

8) Layout pursuant to new standard, data Kostra DWD 2000

9) The absorption capacity of the pipes must be taken into consideration. See table in DIN 1986-100 (2002/03), table A3.

2.8.2 Syphonic drainage

Syphonic drainage systems operate with specially designed flat roof drains which, unlike gravity rainwater drainage systems, are configured to work with completely full pipes (degree of fill h/d 1.0). This can only be achieved by assuring amongst other things that no air is sucked in with the rain water to form bubble vortexes in the pipe systems. Special components are used in the ACO JET flat roof drains to prevent these vortexes from forming.
Once the dimensioning rainfall volumes are reached which get the syphonic system operational, the system works with completely filled pipes which rapidly and safely drain the roof.
Syphonic drainage systems can be used to drain a roof if the following criteria are fulfilled:



ACO JET made of cast iron:
Operation with completely full pipes as planned

- Adequate difference in height of at least 4 metres between the roof and the main drains.
- Drainage of large roof surfaces requiring a minimum outflow capacity of 1.0 l/s.
- If it is possible for each of the drains connected to a downpipe to be hydraulically matched to one another.
- Initiation height of at least 0.3-0.4m between the inflow level to the centre of the inclined pipe.
- Distance between two drains max. 20 metres.

Syphonic drainage pipes only work above the backflow level. All rainwater pipes below the backflow level must be designed as open channel drains.
If traffic or pedestrian surfaces are to be drained (for instance multi-storey car parks or public terraces) it is recommended that open channel drainage systems be used because the small pipe diameters used in syphonic drainage can be blocked more easily by dirt.
Syphonic drainage calculations have to be carried out to ensure that the overall system functions properly. This calculation is based on the volume flow, which is itself derived from the reference rainfall to be drained by the pipe system.
The hydraulic calculation can be carried out using AQUAPERFECT software.
This software generates the following data:

- Isometric diagram of the pipe systems
- Hydraulic calculations
- Material listing
- Specifications

AQUAPERFECT

3. Installation and assembly

3.1 Installing the drain bodyies

3.1.1 Pouring in

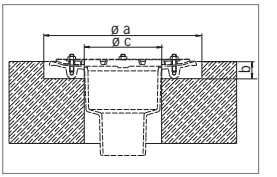
The flat roof drain (or the drain body/isolating body) can be poured in as required when the concrete ceiling is being constructed. Before the concrete is poured, the drain body must be connected to the drain pipes and fixed firmly in place to prevent it moving sideways or upwards when the concrete is poured.
A protective cover must be put on the drain body while the building is being constructed to protect the inside of the drain and the drain pipes. Once the concrete has set, this cover should be removed so that a top section can be installed in the drain body before the rest of the floor structure is constructed.

3.1.2 Rebates

The dimensions of the rebate depend on the design and the type of drain body. We differentiate between rebates which are included in the construction in advance, and those which have to be created in the already completed ceiling.
An elongated slot is the most practicable rebate if it is already built into the ceiling during construction. This gives enough room for manoeuvre to install the drain body. The drain body can also be fixed in place by pouring in concrete through the remaining opening in the rebate after constructing the proper formwork beneath the ceiling.
The dimensions of the rebate need to match the type of drain to be installed. Make allowance for the largest external diameter in the drain body below the compression-sealing flange. If the compression-sealing flange is also to be fitted within the roof construction, allowance must be made in the rebate for the external diameter of the outside of the flange.
The rebates for drains with vertical outlets should include an opening for pouring in the concrete from above.
Drains with lateral outlets are generally joined to the connecting pipe bend before being fitted into the rebate.
The dimensions of the rebate required in this case should be based on the dimensions of the drain plus the pipe bend.
It is usually very difficult to modify rebates after they have been constructed, and is often impossible to modify for structural reasons.
If the rebate is to be constructed by coring after building the ceiling, precise dimensioning of the rebate is always necessary. Attention must be paid in particular to the proper means of fastening the drain, and that there is enough room to pour cement around the drain body to fix it into place.
It is practicable here to use drain bodies with round housings and vertical outlets.

3.1.3 Core boreholes

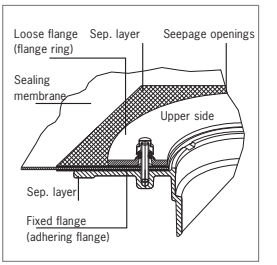
Core boreholes are drilled to cut holes in solid concrete ceilings. They are required to create openings for ventilation or drainage systems through storey ceilings.
The diameter and the layout of the core boreholes or roof drains depends on their dimensions and functions.
In the case of air-insulated roofs (without any overlying insulation) it is important that the sealing flange of the drain is always embedded within the raw concrete. This is important to ensure that the sealing membrane always slopes down unimpeded towards the drain body.
Two core boreholes are required as shown in the adjacent drawing. Borehole (Ø c) is cut to hold the main body of the drain - the width of the borehole depends on the thickness of the ceiling. Borehole (Ø a) corresponds to the bearing surface of the sealing flange – the depth of this borehole is determined by the height of the flange (b).



Core borehole layout for flat roof drains

3.2 Sealing

The compression-sealing flange consists of two parts: the fixed flange and the loose flange.
Sealing using a compression-sealing flange is classified as a thick-bed sealing method. The sealing membrane (e.g. made of PVC or bitumen) is held tight between a loose flange and the fixed flange connected to the drain body. The loose flange is clamped down tight onto the sealing membrane by tightening up nuts which are supplied as standard with the drain body.

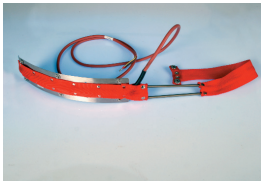


Structure of a seal using the compression-sealing flange method

If thin sealing membranes are used, it will be necessary to lay several layers of sealing membrane around the flange or to include several extra sealing layers. These sealing layers must be completely compatible with the sealing membrane. The material instructions supplied by the manufacturer of the sealing membranes must be fully complied with – the information sheets supplied with the sealing membranes must be kept on site.
In the case of stainless steel drains, a flange seal must always be placed between the fixed flange and the sealing membrane. These flange seals can be ordered from the manufacturer. Flange seals must be put into place below and above the sealing membrane if Sarnafil sealing membranes are used.

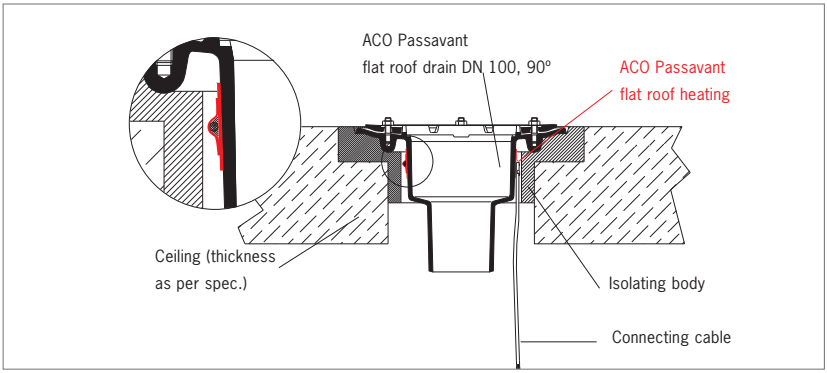
3.3 Heater connection

The adjustable fastening system allows the heating to be installed without using any tools on pipes and drains of any nominal width and outlet angle.
Check that there are no defects in the heating strip before it is installed: do not install any damaged parts. The electrical connection should be carried out by an authorised electrician following the local EVU regulations.



ACO Passavant flat roof drain heating

Installation example



The following is specified by EN 60335-83: around heated roof drains, use only inflammable insulation material.
The lightest possible type of mains connection is specified for connecting up to the mains in roofs: rubberised cable type (HO7RN-F3x1mm²)
Retrofitting is also possible depending on the model and type of installation of cast iron drains. Stainless steel ACO flat roof drains are factory fitted with flat roof heaters.
The cable end of the connecting wire is factory fitted with a welded protection cap. Remove this cap shortly before connecting up to the electrical supply. The end of the cable should then be protected to prevent the penetration of water.
Ensure that the heating strip is not damaged when pouring in hot floor coverings. The device will malfunction if damaged.
The heating is designed not to overheat. The heating elements are not subject to any wear because they have no mechanical temperature switches and temperature protectors. The heating system is protected from water and dust and is therefore also suitable for external use depending on the type of connection. Any thermostats required should be made available in situ.

3.4 Pipe mountings and pipe connections

Before fixing pipes in place, always consult the manufacturer's specifications and the regulations defined in EN 12056.

3.4.1 Gravity rainwater drainage

Because they are only subject to atmospheric pressure, gravity rainwater drainage systems require no special mountings such as safety clamps or fixed points. However, this only applies to downpipes less than 5 metres in height.
Downpipes exceeding 5 metres in height have to be fastened with downpipe mountings. We also recommend that the coupling sockets are also provided with extra protection because problems may arise if there is backflow in the main drain.

3.4.2 Syphonic drainage

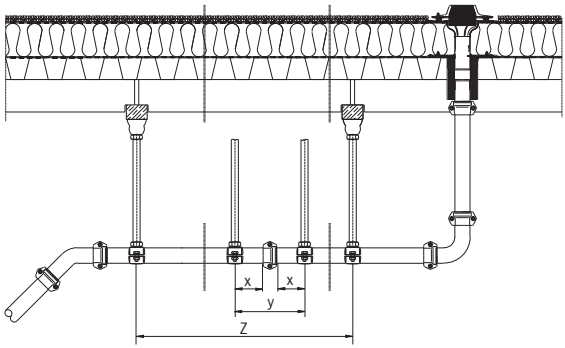
Steel GM-X pipes and fittings can be quickly and simply laid as rainwater drains in syphonic drainage systems.
Some parts of the piping systems in syphonic drainage networks can be subjected to significant under or over pressures. The associated reaction forces must be counteracted by implementing the following measures:

- Proper mounting of the syphonic drainage drains
- Fastening the coupling sockets to prevent axial thrusting
- Suspending the pipes at fixed points
- Fitting pipe clamps

The reaction forces always act on the drain outlets and the pipe sections affected by overpressure. Reaction forces primarily affect the under pressure zones when there are changes in pipe direction. GM-X coupling sockets in these zones should therefore generally be secured with extra safety clamps or safety brackets to stop them being pushed apart.
The mountings selected and shown in the following examples are chosen from the range of mountings supplied by Müpro. It is naturally possible to use mountings and fastenings made by other manufacturers if they are suitable for syphonic drainage systems.

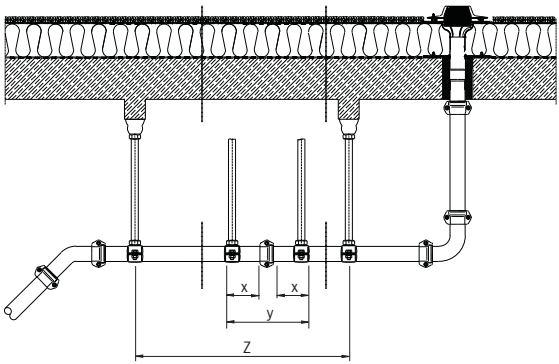
Mounting to trapezoidal sheet sections with fixed point construction

Mounting to trapezoidal sheet sections with fixed point demonstration



Mounting to concrete ceiling with fixed point construction

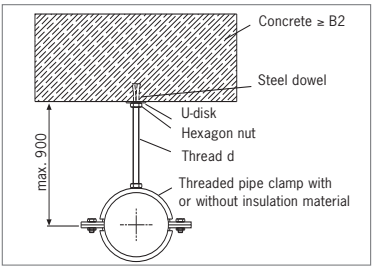
Mounting to concrete ceiling with fixed point demonstration



Mounting distances[10]				
GM-X pipes		For pipe clamps		For fixed points
DN	Length	X before and behind the socket connection max.	Y	Z Total
		m	max. m	max. m
40 – 80	< 4.00	0.50	2.50	12.00
	> 4.00 – 6.00	0.75	2.50	12.00
100 - 150	< 4.00	0.50	3.00	12.00
	> 4.00 – 6.00	0.75	3.00	12.00

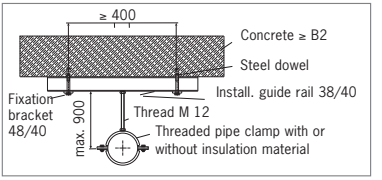
10) The mentioned distances also apply to GM-X compound piping.

Suspended mounting directly to concrete ceiling



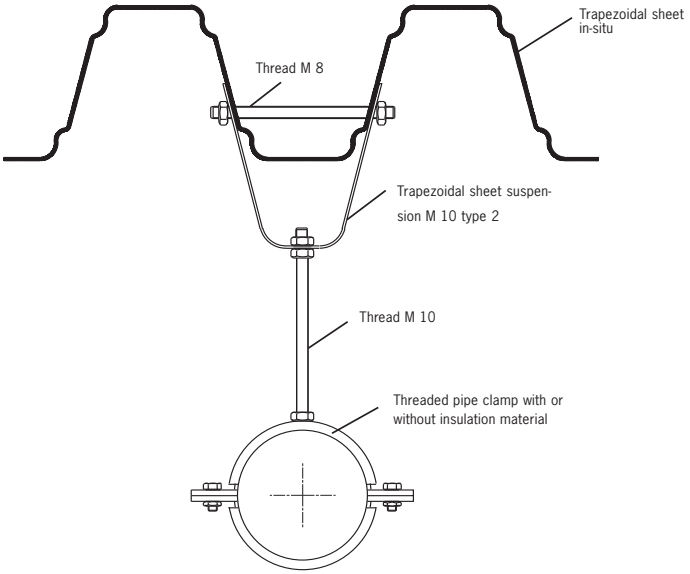
DN	d	Dowels	Pipe clamp	Permiss. in N	Max. mounting distance
40 M	10	Steel dowel M 10	Optimum M 10	800 N	2.5 m
50 M	10	Steel dowel M 10	Optimum M 10	800 N	2.5 m
70 M	10	Steel dowel M 10	Optimum M 10	800 N	2.5 m
80 M	10	Steel dowel M 10	Optimum M 10	800 N	2.5 m
100 M	12	Steel dowel M 12	Threaded pipe clamp M	800 N	3.0 m
125 M	12	FZE – M 12	Threaded pipe clamp M	1500 N	3.0 m
150 M	12	FZE – M 12	Threaded pipe clamp M	1500 N	3.0 m
200 M	12	Adhesive anchor M	Threaded pipe clamp M	2500 N	3.0 m
250 M	12	Adhesive anchor M	Threaded pipe clamp M	3500 N	3.0 m

Suspended mounting with pipe clamps at installation guide rail



DN	d	Dowels	Pipe clamp	Permiss. in N	Max. mounting distance
40 M	10	Steel dowel M 10	Optimum M 10	1350 N	2.5 m
50 M	10	Steel dowel M 10	Optimum M 10	1600 N	2.5 m
70 M	10	Steel dowel M 10	Optimum M 10	1600 N	2.5 m
80 M	10	Steel dowel M 10	Optimum M 10	1600 N	2.5 m
100 M	12	Steel dowel M 12	Threaded pipe clamp M	1600 N	3.0 m
125 M	12	FZE – M 12	Threaded pipe clamp M	3000 N	3.0 m
150 M	12	FZE – M 12	Threaded pipe clamp M	3000 N	3.0 m
200 M	12	FZE – M 12	Threaded pipe clamp M	3000 N	3.0 m
250 M	12	FZE – M 12	Threaded pipe clamp M	3000 N	3.0 m

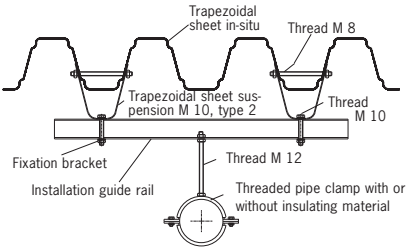
Pipe mountings of single connecting lines to trapezoidal sheet suspensions



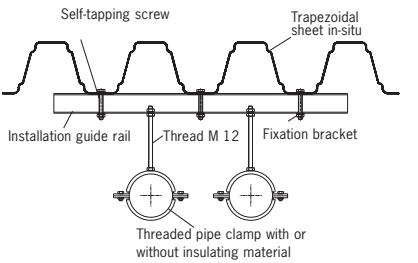
DN	Threaded rod	Suspension	Pipe clamp	Permiss. in N	Max. mounting distance
40	M 10	Trapez. sheet susp. type 2	Optimum M 10	x	2.5 m
50	M 10	Trapez. sheet susp. type 2	Optimum M 10	x	2.5 m
70	M 10	Trapez. sheet susp. type 2	Optimum M 10	x	2.5 m
80	M 10	Trapez. sheet susp. type 2	Optimum M 10	x	2.5 m

Pipe mountings of single connecting lines to trapezoidal sheet suspensions

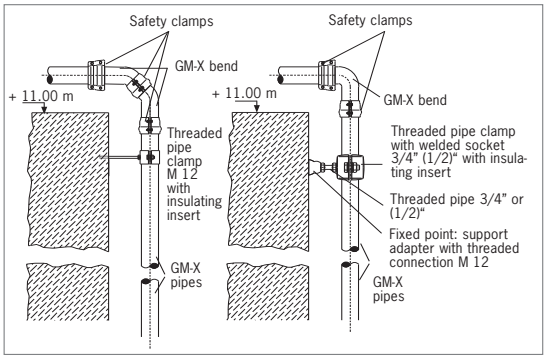
(1) with trapezoidal sheet suspension and installation guide rail

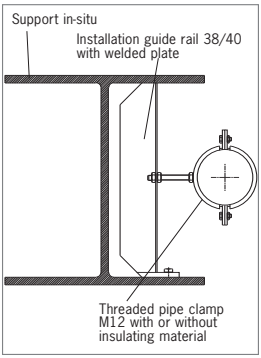


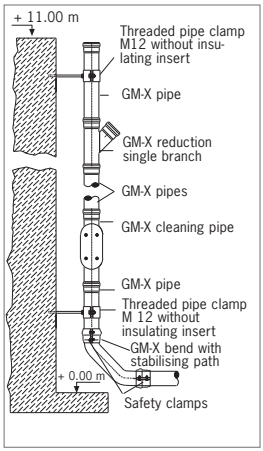
(2) with installation guide rail

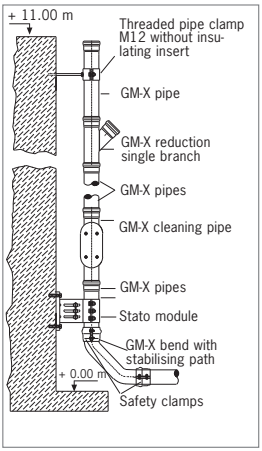


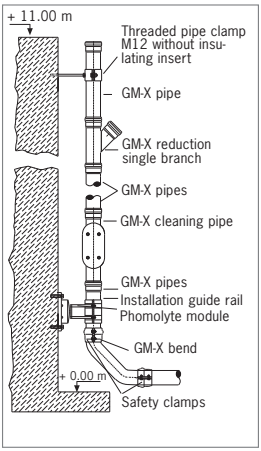
DN	Threaded rod	Suspension	Pipe clamp	Perm. in N	Max. fixation distance
40	M 10	(1) or (2)	Optimum M 10	x	2.5 m
50	M 10	(1) or (2)	Optimum M 10	x	2.5 m
70	M 10	(1) or (2)	Optimum M 10	x	2.5 m
80	M 10	(1) or (2)	Optimum M 10	x	2.5 m
100	M 12	(1) or (2)	Threaded pipe clamp M	x	3.0 m
125	M 12	(1) or (2)	Threaded pipe clamp M	x	3.0 m
150	M 12	(1) or (2)	Threaded pipe clamp M	x	3.0 m


Safety clamps
GM-X bend
+ 11.00 m
Threaded pipe clamp M 12 with insulating insert
GM-X pipes
Safety clamps
+ 11.00 m
GM-X bend
Threaded pipe clamp with welded socket 3/4" (1/2)" with insulating insert
Threaded pipe 3/4" or (1/2)"
Fixed point: support adapter with threaded connection M 12
GM-X pipes


Support in-situ
Installation guide rail 38/40 with welded plate
Threaded pipe clamp M12 with or without insulating material

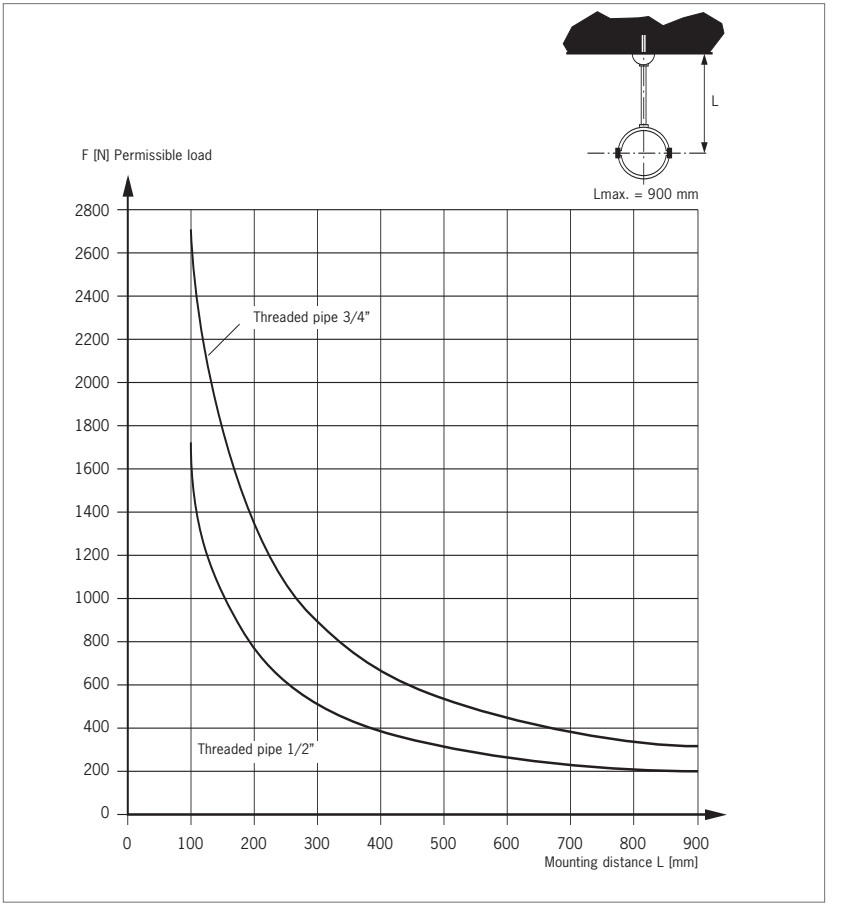

+ 11.00 m
Threaded pipe clamp M12 without insulating insert
GM-X pipe
GM-X reduction single branch
GM-X pipes
GM-X cleaning pipe
GM-X pipe
Threaded pipe clamp M 12 without insulating insert
GM-X bend with stabilising path
+ 0.00 m
Safety clamps


+ 11.00 m
Threaded pipe clamp M12 without insulating insert
GM-X pipe
GM-X reduction single branch
GM-X pipes
GM-X cleaning pipe
GM-X pipes
Stato module
GM-X bend with stabilising path
+ 0.00 m
Safety clamps


+ 11.00 m
Threaded pipe clamp M12 without insulating insert
GM-X pipe
GM-X reduction single branch
GM-X pipes
GM-X cleaning pipe
GM-X pipes
Installation guide rail
Phomolyte module
GM-X bend
+ 0.00 m
Safety clamps

Because of the relatively low strength of trapezoidal steel roof sections, special care must be taken when putting the pipes in place, and particularly for fixed point supports.

- Fixed points should be selected directly on trusses or supports wherever possible.
- Depending on the dimensions of the drain pipe and the distance between the trusses, it may be necessary for GM-X rainwater pipes to be provided with additional lateral support with suitable pipe clamps.
- When fixing pipe supports to trapezoidal steel sections, we recommend that the maximum permissible load be clarified in advance with the structural engineer or the trapezoidal steel manufacturer.



Permissible load in the case of fixed point supports with support adapters when using $^{3}/_{4}$" or $^{1}/_{2}$" threaded pipe according to DIN 2440

4. Maintenance

Roof drains for open channel drainage systems and syphonic drainage systems both have to be maintained. Observe the relevant standards.

4.1 Gravity rainwater drainage

The proper functioning of roof drains must be regularly inspected in accordance with national regulations. They should also be cleaned when required.

4.2 Syphonic drainage

The maintenance of syphonic drainage systems is also defined in national regulations. It is particularly important that the drains are checked every six months to remove any dirt and to inspect their overall condition. It is recommended that a maintenance contract be taken out to service this type of drainage system.

5. Products and Applications

5.1 ACO SPIN flat roof drain of cast iron

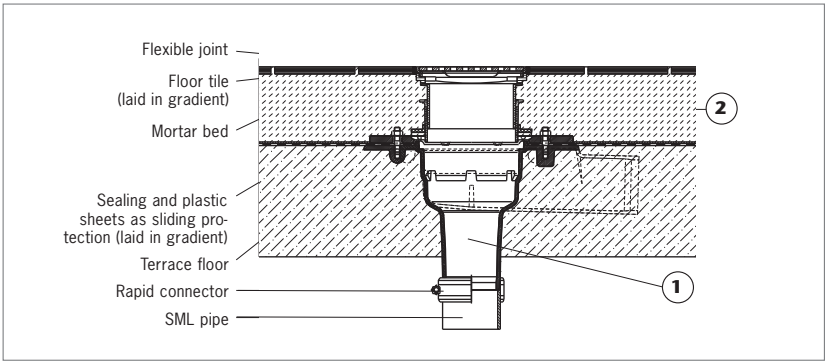
Fields of application:

- Terraces open for public
- Load class K3

Standards/regulations

EN 12056 — Gravity drainage plants inside buildings
EN 1253 — Drains for buildings
EN 1123 — Steel drain pipes and fittings

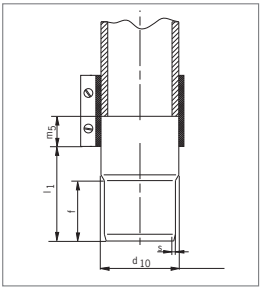
Suggested installation



Products

Item	Article description	Art. no.	Catalogue chapter
1	ACO SPIN flat roof drains of GG 90° inclination, DN 70 with compression-sealing flange	5169.20.00	Flat roof/open channel/cast iron
2	MEKU top section Frame dimensions 148 x 148 mm Class K 3	5141.81.00	Flat roof/open/ channel/cast iron

Installation instructions



Pipe connections

The ACO SPIN flat roof drains are made of cast iron and have an outlet socket as standard for connection to SML pipe, EN 877. A pipe connector is used to connect the drain pipe to the outlet socket.

When connecting to GM-X pipe, connectors can be used to connect cast iron drain pipes to GM-X coupling sockets.

Connection to sealing membranes using compression-sealing flanges

Sealing membranes are laid in the fixed flange of the drain and then held tightly in place with the loose flange.

The sealing membrane must be laid right up to the collar of the drain body. The seepage openings must not be blocked. If a compression-sealing flange is used, first lay the sealing membrane over the fixed flange before tightening up the overlying loose flange. The torque used for tightening up the nuts depends on the type of sealing membrane used.

Gratings and top sections

A large number of top sections are available for the SPIN flat roof drains. Depending on the application, the drain bodies can be combined with top sections for terrace drainage (see installation example on the previous page), top sections for intensive greening/extensive greening, or top sections specially designed for use in multi-storey car parks.

Top section for intensive greening

Top section for multi-storey car park drainage systems

5.2 ACO SPIN flat roof drain of stainless steel for single seal

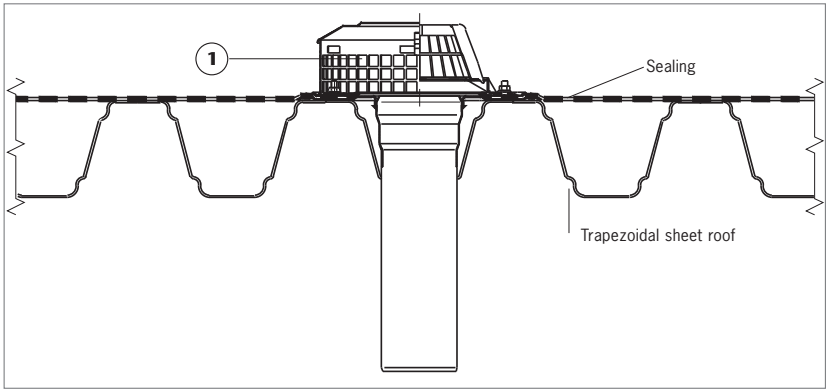
Fields of application:

- Concrete roofs/ trapezoidal sheet roofs with/ without gravel

Standards/regulations

EN 1253 — Drains for buildings

Suggested installation

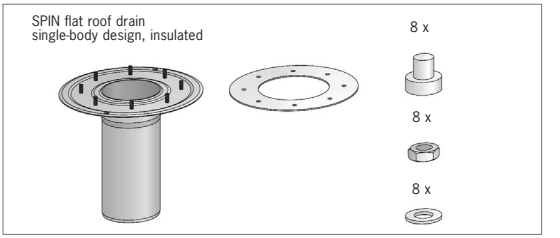


Products

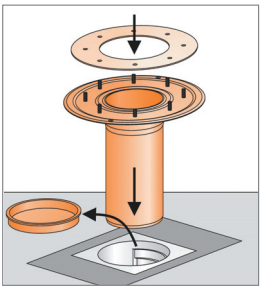
Item	Article description	Art. no.	Catalogue chapter
1	ACO SPIN flat roof drain DN 100, 90° inclination, with stainless steel gravel catching basket	0174.47.38	Flat roof/ Open channel/ Stainless steel

Installation instructions

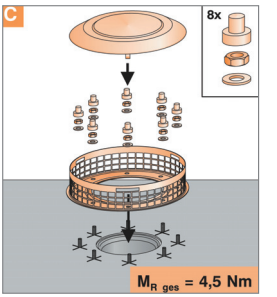
ACO SPIN flat roof drains with compression-sealing flanges are always supplied with a loose flange, nuts, washers and protective caps.



ACO SPIN flat roof drains can be installed in matching rebates in concrete or trapezoidal sheet roofs. Make sure that the compressi-on-sealing flange of the drain is always recessed within the ceiling. The sealing membrane can then be laid around the drain using the compression-sealing flange.



Once the sealing membrane has been laid and connected to the compression-sealing flange, the rest of the roof structure can be laid. This may require the positioning of a basket within the flat roof drain.
SPIN flat roof drains can be supplied with gravel catching baskets made of plastic or stainless steel.

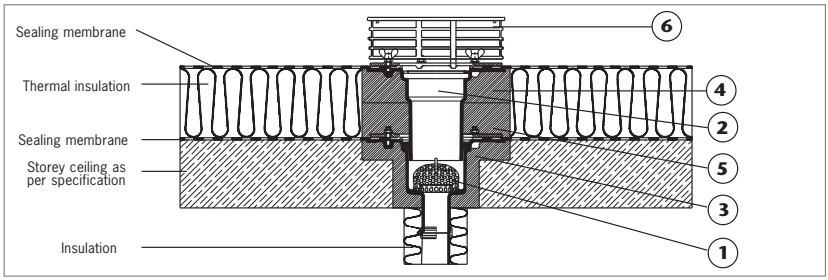


5.3 ACO JET flat roof drain of cast iron for syphonic drainage with double seal

Fields of application:
Syphonic drainage on
- Trapezoidal sheet roofs
- Gravel roofs
- Concrete roofs

Standards/regulations
EN 12056 — Gravity drainage plants inside buildings

Suggested installation



Products

Item	Article description	Art. no.	Catalogue chapter
1	ACO JET flat roof drain, DN 50	7037.10.10	Flat roof/
2	Upper part	7047.10.25	Syphonic drainage
3	Isolating body for flat roof drain	7040.22.00	Cast iron
4	Isolating ring for upper part	7040.12.00	
5	Levelling element for upper part	7040.02.00	
6	Gravel catching basket class H 1.5	7000.02.00	

Installation instructions

Function

ACO flat roof drains for syphonic drainage systems are designed for connection to pipes which, by definition, have to be operated when completely full. Pipes of this kind can only be used when they have the properly certified hydraulic specifications.
The functional elements must always be installed in the drain body. The flat roof drain will not function for syphonic drainage without the functional part.

Assembling a sealing ring with two-piece drains

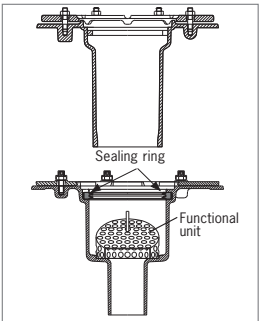


Fig. 1: drain, two-piece design, DN 50

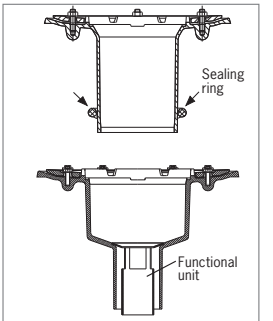


Fig. 2: drain, two-piece design, DN 80

Assembling the pilot tube for ACO JET flat roof drains

DN 50 emergency overflow made of grey cast iron
The lip seal must be placed in the groove of the drain body or the upper part, and coated with lubricant. The accumulating pipe is then pushed on down to the collar. The gravel trap can then be assembled.

Assembling emergency overflow pilot tube for ACO JET flat roof drains DN 80 made of grey cast iron

The roller ring must be pulled over the socket of the pilot tube and rolled uniformly into the drain body or the upper part. The gravel catching basket can then be assembled.

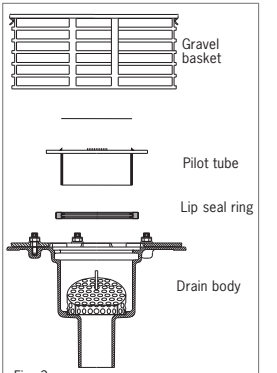


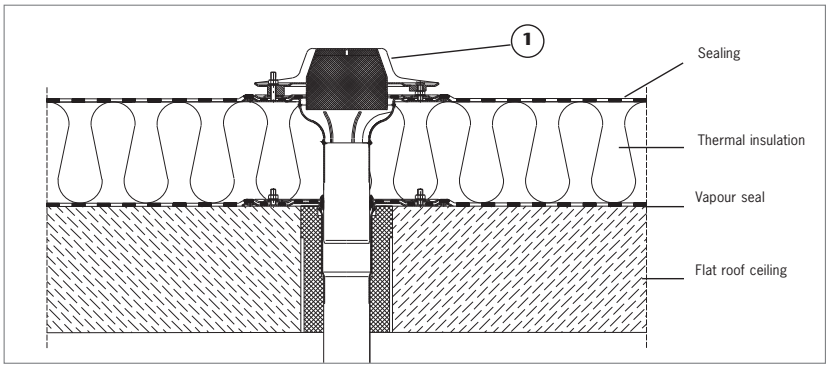
Fig. 3

5.4 ACO JET flat roof drain of stainless steel for syphonic drainage with double seal

Fields of application:
Syphonic drainage on
- Trapezoidal sheet roofs
- Gravel roofs
- Concrete roofs

Standards/regulations
EN 12056 — Gravity drainage plants inside buildings

Suggested installation

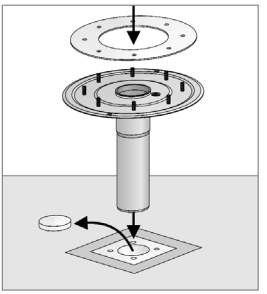


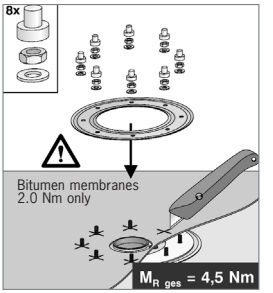
Products

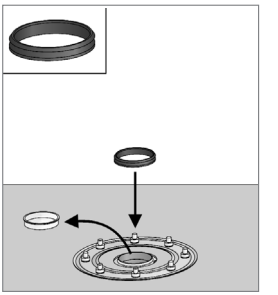
Item	Article description	Art. no.	Catalogue chapter
1	JET flat roof drain DN 70, 90° inclination, two-piece design, of stainless steel	0174.47.00	Flat roof/ Syphonic drainage/ Stainless steel

Installation instructions

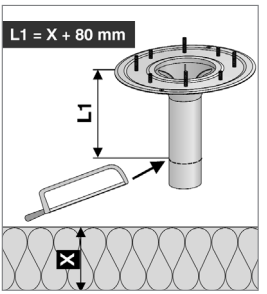
Assembling the body:
After fitting of the body, the sealing membrane is laid on the ceiling and then inserted into the flange of the body. The holes for the screw joint and the inlet are made, then the loose flange can be screwed on.

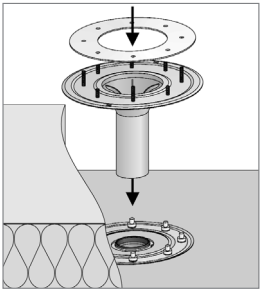


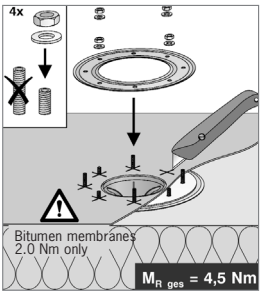




Assembling the extension element with compression-sealing flange
Depending on existing roof structure, the extension element can be cut to length. Then, the second sealing membrane is applied.

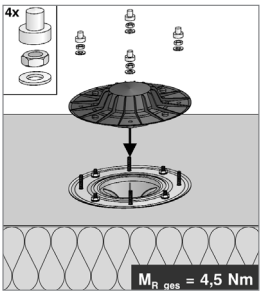


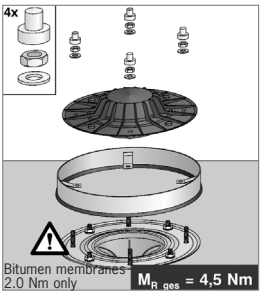




Assembling the gravel trap and collecting ring (optional)

If in addition to assembly of gravel trap (left) a collecting ring is to be integrated, it must at first be put onto the fixed flange. Then, assembly of gravel trap is again carried out (right figure).

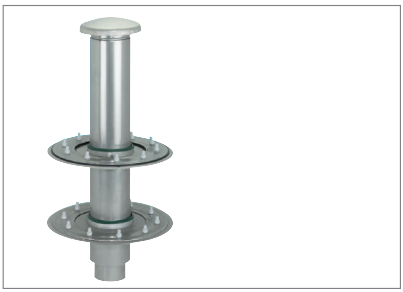




5.5 ACO Multiflex flat roof duct of stainless steel for double seal

Fields of application:

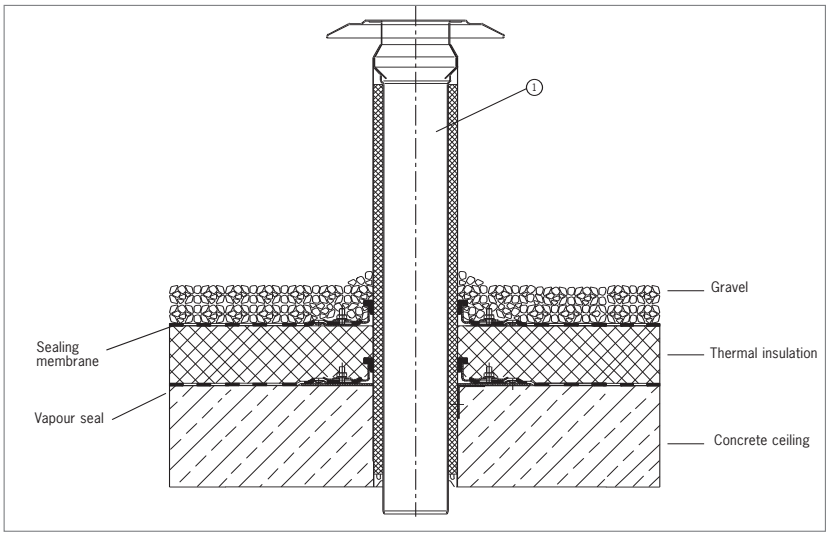
- Ventilation of inside bathrooms, kitchens and grey water downpipes in concrete ceilings or trapezoidal sheet roofs



Standards/regulations

EN 1253 — Drains for buildings

Suggested installation



Products

Item	Article description	Art. no.	Catalogue chapter
1	Multiflex flat roof duct DN 100 with two flanges	0174.43.05	Drainage/ Pipe systems/ Flat roof ducts

Installation instructions

Connection options

The flexibility of the flanges attached to the multiflex flat roof ducts allows quick in situ adjustment to any differences in insulation thickness. The shuttering cones and the support sheets available as optional accessories simplify installation.

Installation in concrete roofs

1. There must be a rebate in the ceiling.
2. The shuttering cone must be placed in a rebate and fixed in place.
3. The flat roof duct must be placed in the cone without a flange.
4. Pour the concrete into the rebate – allow the concrete to set.
5. The first sliding flange is pulled over from the top (adjustable to fit all ceiling thicknesses).
6. The vapour diffusion barrier is laid in the compression-sealing flange.
7. Install the insulation.
8. Pull on the second sliding flange from above (adjustable to all insulation thicknesses).
9. Connect the roof sealing membrane to the compression-sealing flange.
10. Install the rain protection cap if room ventilation is also required.

Installation in trapezoidal sheet roofs

1. Cut out the opening for the flat roof duct.
2. Define the length required for connection on the inside.
3. Fix the support sheet to the ventilation pipe using the fastening brackets and the self-tapping screws.
4. Position the flat roof duct on the trapezoidal sheet roof.
5. Fix the support sheet onto the trapezoidal sheet.
6. The first sliding flange is pulled over from the top (adjustable to fit all ceiling thicknesses).
7. The vapour diffusion barrier is laid in the compression-sealing flange.
8. Install the insulation.
9. Pull on the second sliding flange from above (adjustable to all insulation thicknesses).
10. Connect the roof sealing membrane to the compression-sealing flange.
11. Install the rain protection cap if room ventilation is also required.

5.6 ACO Multi-storey car park drain of cast iron

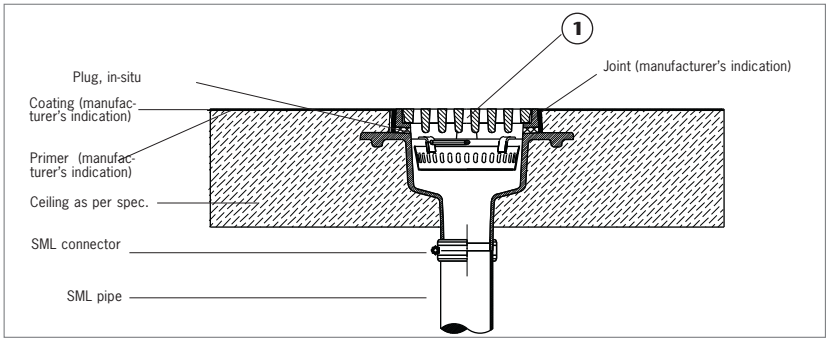
Fields of application:

- Multi-storey car parks with load class B/M 125 without sealing

Standards/regulations

EN 12056-3 - Roof drainage, planning and dimensioning

Suggested installation



Products

Item	Article description	Art. no.	Catalogue chapter
1	Multi-storey car park drain DN 100, 90° inclination with bucket and screwed grating	5935.19.00	Drainage/ Flat roof drains of cast iron for open channel drainage

Installation instructions

Installation

(1) Reinforce the housing. Connect the pipes, pour in concrete (seal the seepage openings in situ).
(2) Construct the covering layer.
(3) Put the bucket into position.
(4) Put the grating into position and bolt it down if necessary.

Retrofitting fire protection fittings

- The fire protection fitting can be installed without any lubricants.
- Installation requires a completely concreted-in drain and ceiling thicknesses of at least 200mm.
- The fire protection fitting can be removed without tools for maintenance. After maintenance, IMMEDIATELY replace the fire protection fittings.

Mounting supports

Mounting supports can be supplied to ensure proper positioning of floor drains, and can be ordered separately as required. They are shown in the cross-sections of the drains.
Three mounting supports are required to position the lower section of the drain. The mounting supports are screwed to the lower sections. The mounting supports are made of metal strip and sit on plastic spacers.