

Roof details and connections



Waterproofing of roof details
and connections

Roof details and connections



Attention : the information herein is a general guideline, but does not take into account restrictions or special instructions related to the bearing element, to certain insulations, to the geographical location, to the structural configuration, etc.

This information does not relieve the professionals from obtaining full knowledge of the reference documents (prevailing Local Technical Standards, Technical Assessments, Installation Specifications, etc.) This entails consulting them in their integral textual form.

Again this document is only a guide; Siplast-Icopal reserves the right to modify the composition and the installation instructions of its products, depending upon the evolution of knowledge and technology.

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Rainwater outlets

Definitions

The rainwater outlet structures include:

- Rainwater drain structures:
 - ▶ Gutters on non-accessible roofs and drain channels on accessible roofs.
 - ▶ valleys.
- The rainwater outlets:
 - ▶ Rainwater outlets.
 - ▶ rainwater downpipes, not covered in this booklet.
 - ▶ overflows.

General layout guidelines

The structures constituting the rainwater outlets shall be laid out so that:

- each rainwater outlet drains the water from a surface:
 - ▶ $\leq 700\text{m}^2$ in the general case.
 - ▶ $\leq 350\text{m}^2$ in the case of a rainwater outlet in the form of a drain channel on a steel-deck roof.
 - ▶ $\leq 200\text{m}^2$ in the case of pedestrian roofs with protection by slabs on adjustable supports.
- all points on a roof are located:

- ▶ Less than 30m from the rainwater drain or outlet structure in the general case.
- ▶ Less than 20m in the case of a roof-deck made of timber and wood derivatives.
- ▶ Less than 20m in the case of pedestrian roofs with protection by slabs on adjustable supports.
- the distance between two rainwater outlets in a gutter, a drain channel or a valley is to be 30m or maximum ($\leq 20\text{m}$ in the case of a roof-deck made of timber and wood derivatives).

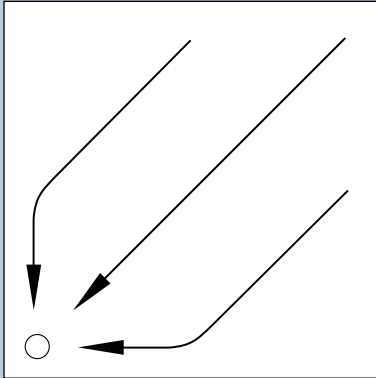
Furthermore, any water accumulated by possible clogging in a downpipe shall be able to be drained, either by a neighbouring downpipe, or by an overflow.

Main reference documents

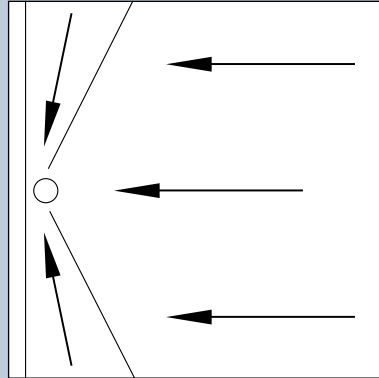
- Calculation and design rules for rainwater outlet installations.
- In the case of roofs with steel-deck, refer to the technical documents in force which shall specify the layout, the number and the section of the rainwater outlets, based upon the installation direction of the ribbed steel deck sheets, the slope of the valleys and the capacity of the framing to support the water accumulations.

The drawing hereunder suggest several ways of setting up rainwater outlets on roofdecks.

One slope roofdecks

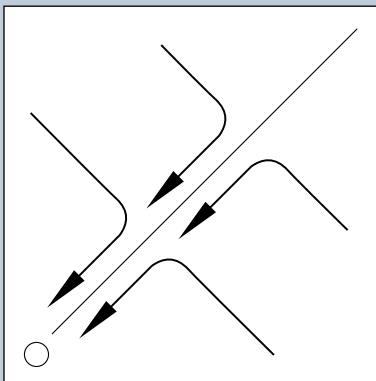


1 - without drain valleys

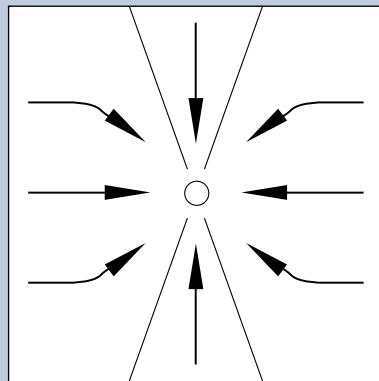


2 - with drain valleys

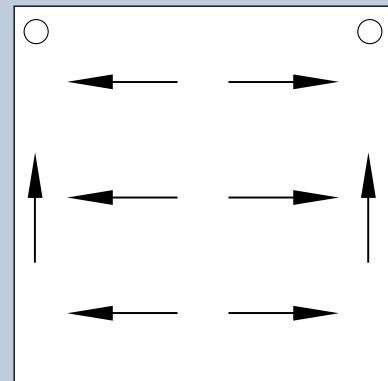
Two slope roofdecks



3 - without drain valleys

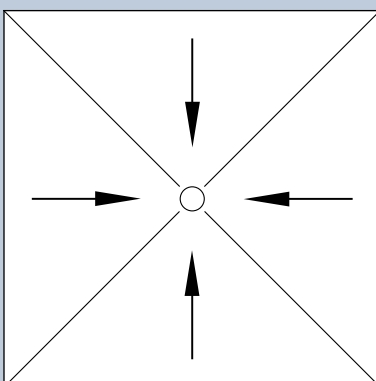


4 - with drain valleys set inside



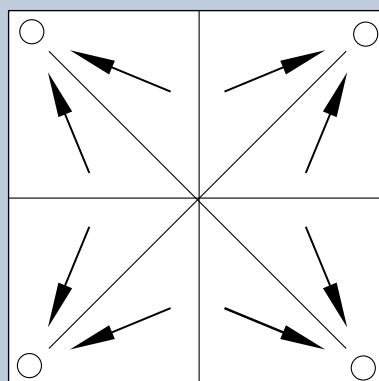
5 - with drain channels on edges

Four slope roofdecks



6 - with one water outlet

Diamond point roofdecks



7 - with four water outlets

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Gutters and drain channels

Definitions

- **Gutters** are structured to drain rainwater, generally of rectangular section, installed on non-accessible roofs. They are not accepted in mountain climate.
- ▶ **Roofs with substrate in masonry or concrete:** they can be boxed between two roof slopes or corbelled out.
- ▶ **Roofs with bearing element in steel or timber and wood derivatives:** boxed gutters are prohibited; only gutters that are corbelled out are accepted.
- ▶ **Pitches:** all pitches are accepted, including zero pitch.
- ▶ **Drain channels** are structures that collect rainwater, generally with rec-

tangular sections, located on accessible roofs and covered with removable protective grilles, to enable maintenance and traffic. Their composition and dimensions are similar to those of the gutters. Slope $\geq 0.5\%$.

Composition

Gutters can be made from:

- reinforced concrete: reinforced concrete gutters shall contain neither flat joints nor raised flat joints;
- metal structures that are self-supporting or are supported by a concrete structure; they do not receive a waterproofing membrane;
- timber or plywood: gutters of timber, plywood or reinforced concrete may

be faced inside with thermal insulation boards, selected and fixed according to the local standards in force.

Minimal section

This depends on the surface of the roof being arranged, the pitch of the gutter and the nature of the constituent materials.

The table set down below, adapted to rectangular section conduits, handling a maximal flow of 3 l/min/m².

It indicates the **sections in cm² to be provided at the bottom of the slope.**

Surfaces of roofs to be drained (in m ² of horizontal surface)	Slope of the gutter or drain channel in millimetres per meter							
	≤ 1	2	3	5	7	10	15	20
≤ 30	94	77	66	55	49	44	38	33
40	116	88	77	66	60	50	44	38
50	132	105	94	77	71	60	55	49
60	154	121	105	88	77	66	60	55
70	171	132	116	99	88	77	66	60
80	187	149	127	110	93	82	71	66
90	204	160	138	115	104	93	77	71
100	220	171	149	126	110	99	88	77
110	236	187	160	132	121	104	93	82
120	253	198	171	143	126	110	99	88
130	264	209	182	148	132	115	104	93
140	280	220	187	159	143	126	110	99
150	291	231	198	165	148	132	115	105
160	308	242	209	176	154	137	121	110
170	319	253	220	181	159	143	126	110
180	335	264	225	187	165	148	132	115
200	385	281	242	203	181	159	137	126
250	423	330	286	236	209	187	159	148
300	484	374	324	269	242	214	181	165
350	544	418	363	302	269	236	203	187
400	594	462	401	335	297	258	225	203
450	643	506	434	363	319	280	247	220
500	698	539	467	390	346	319	264	236
600	792	616	533	445	396	346	302	269
700	884	693	600	500	442	388	339	305

Important:

- The section of the gutters of **timber and wood derivatives** shall be at least **200cm²**.
- The section of the gutters of pitched roofs with bearing element of **masonry** (pitch $\geq 5\%$) is at least **300cm²**.

Dimensions

After installing any waterproofing and insulation, the dimensions comprise:

- **Real Height (RH):** waterproofed height of the shortest vertical wall.

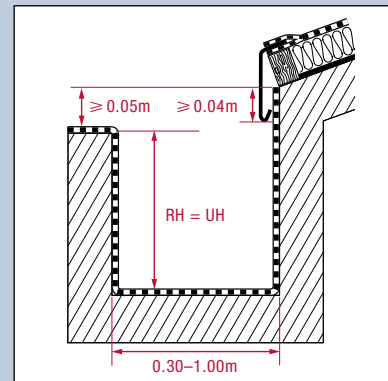
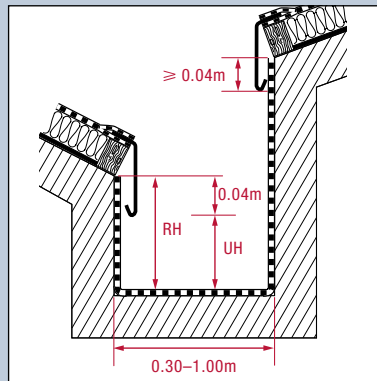
- **Usable Height (UH):** height to be taken into account for the calculation of the section necessary to handle the water drained; it takes into account (if possible) a water trap of 5cm. The

water trap is not necessary in the case of gutters that are corbelled out or boxed gutters with continuous waterproofing membrane.

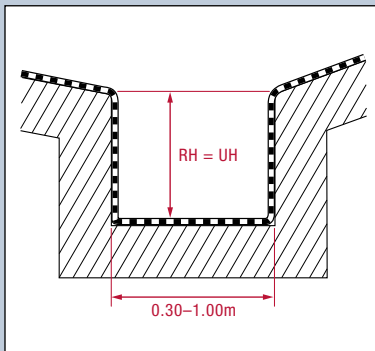
Gutters with discontinuous waterproofing membrane

RH without low limit for adjacent slopes of slope $\leq 5\%$

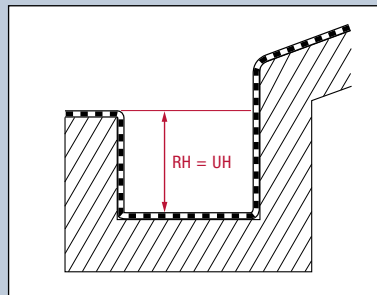
- $RH \geq 0.15\text{m}$ for at least one adjacent slope 5 to 20%
- $RH \geq 0.25\text{m}$ for at least one adjacent slope $\geq 20\%$



Gutters with discontinuous waterproofing membrane

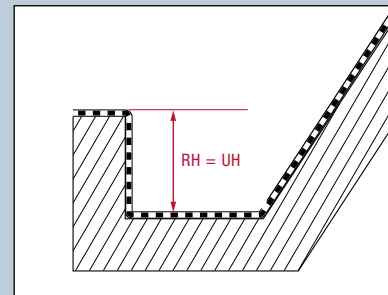


Boxed gutter
 $RH = UH \geq 0.10\text{m}$



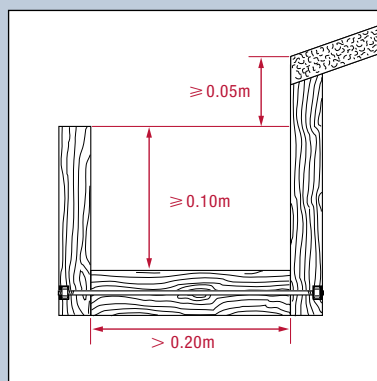
Gutter, corbelled out

$RH = UH$ without minimal limit for an adjacent slope of pitch $\leq 5\%$
 $\geq 0.15\text{m}$ for an adjacent slope 5 to 20%
 $\geq 0.25\text{m}$ for an adjacent slope $> 20\%$



Special case of a timber gutter

The inside width (w) of the gutter shall be from 0.20m to 1.00m and at least equal to the maximal height after installation of any thermal insulation and waterproofing.



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Waterproofing

Thermal insulation boards

It is preferable to select bitumen surfaced thermal insulation boards,

enabling the installation of waterproofing by torching:

- bitumen surfaced mineral wool;
- bitumen surfaced fibrous perlite;
- bitumen surfaced cellular glass.

They are to be fixed in compliance with the manufacturer's specifications.

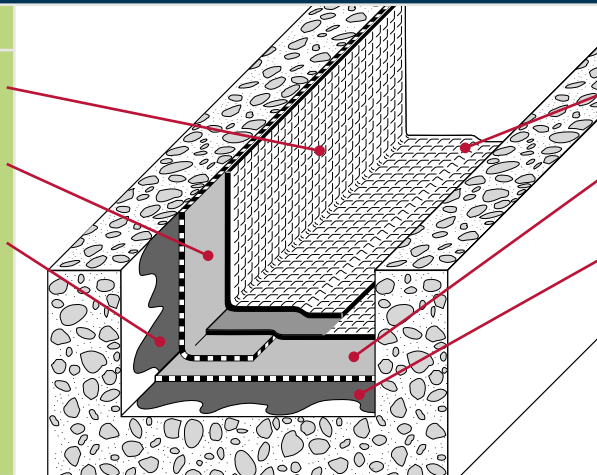
Concrete gutters

Sidewalls, bottom

Top layer, Paradiel S, torched

1st waterproofing layer, Paradiene 35 S R4, torched

Bituminous Siplast Primer (except on insulation)



Bottom

Top layer, Paradiel S, torched

1st waterproofing layer, Paradiene 35 S R4, torched

Bituminous Siplast Primer (except on insulation)

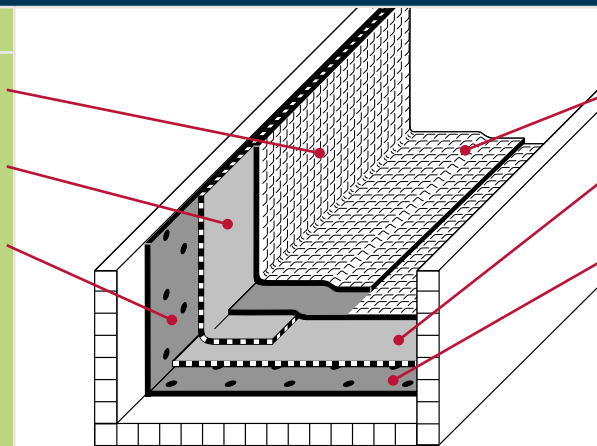
Gutters, of timber or plywood

Sidewalls

Top layer, Paradiel S, torched

1st waterproofing layer, Paradiene 35 S R4, torched

Underlayer (except on insulation) Paradième SVV, nailed



Bottom

Top layer, Paradiel S, torched

1st waterproofing layer, Paradiene 35 S R4, torched

Underlayer (except on insulation) Paradième SVV, nailed

Remarks

The membrane elements are applied on the bottom of the gutters in maximal lengths of 3.50m.

For small section gutters, each of the layers can be made in a single element, against the sidewalls and against the gutter bottom.

Standard description

- The gutter will be made in..., dimensions..., with a slope of ...%.
- The walls will be prepared by...:
 - ▶ (non-insulated gutter) application of one coat of bituminous Siplast Primer,
 - ▶ (insulated gutter) installing panels of ... according to the manufacturer's specifications for that application.

Thickness of ... mm, providing a thermal resistance of... m².°C/W.

- The waterproofing membrane will be composed of...

Valleys

Definitions – Slopes

The valleys drain streaming water.

There are several kinds:

- Central valleys, formed by the intersection of 2 roof slopes;
- Eave valleys formed by the intersection of a roof slope and an upstand.

The accepted slopes are:

- all slopes, including the zero slope for roofs that are not accessible, service roofs, gardens or accessible roofs, with slabs on pedestals.

Important: in the case of bearing elements of steel deck sheet, the local technical standards in force specify the minimal slope of the valleys depending upon the building's configuration and its effect upon the structure's stability.

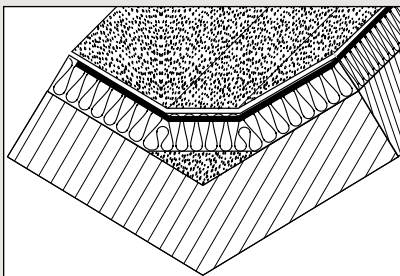
- 0.5% minimum for pedestrian accessible roofs with concrete slab protection and vehicle accessible roofs.

Central valleys

In the case of slopes with steep pitches, they shall include a cant to make it possible to execute the works and for maintenance traffic.

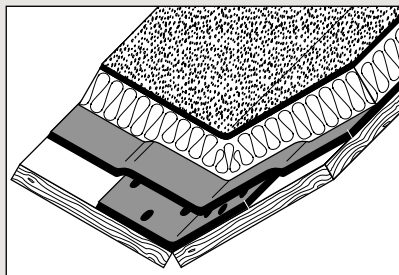
On a bearing element of masonry or steel, the waterproofing membrane of the valleys is generally the same as for the main areas.

In the case of single-ply waterproofing membranes, a reinforcing layer, defined by the Technical Assessment, is installed in advance at the bottom of the valley.



Special case of bearing elements of timber and wood derivatives

The joint is bridged by nailing, every 0.20m, a strip 0.30m developed length, of bitumen faced membrane with aluminium protection, aluminium face against the substrate: strip **Nal** or **Paradiel S**.

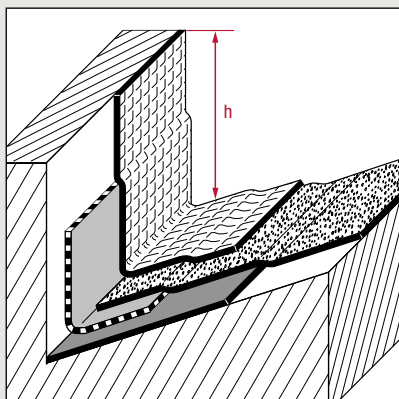


Eave valleys

Definitions

The vertical form shall make it possible for the waterproofing upstand to go up to a minimal height h above any protection of the waterproofing membrane, so that:

- $h \geq 0.10\text{m}$ for a slope $\leq 5\%$;
- $h \geq 0.15\text{m}$ for a slope 5 to 20%;
- $h \geq 0.25\text{m}$ for a slope $> 20\%$.



Note: for a slope $\geq 70\%$ and/or for the drained roof areas $\geq 700\text{m}^2$, a special study is necessary. The waterproofing membrane is dealt with as in the case of an upstand (see booklet corresponding to the type of roof considered).

In the case of single-ply waterproofing membranes, a reinforcing layer, type Paradiene 35SR4, is installed in advance at the bottom of the valley on the roof slope.

Standard description

- According to the case, the valley will include:
 - ▶ a slope of ... % minimum,
 - ▶ a cant of ... cm wide, enabling traffic.
- According to the case, it will receive an underlayer, Paradiene 35SR4
- The waterproofing will be done...

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Rainwater outlets

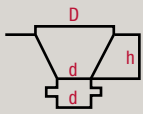
Shape and sizing

The section of the rainwater drain fitting can be constant (cylindrical drain fitting) or variable (tapered drain fitting).

In the case of side drains (fitting axis close to horizontal), existing obearingement of ribbed steel deck sheet, the fitting section shall be rectangular and its sizing shall comply with the relevant technical standards.

The final section of the drain fitting, connecting to the rainwater downpipe is determined depending upon the surface areas of the roofs drained and on the fitting's shape (see table below).

General case

Water outlet with cylindrical drain fitting ⁽¹⁾			Water outlet with tapered drain fitting ⁽²⁾				
Horizontal surface drained (m ²) by a water outlet		Minimal diameter (cm) of the drainpipe or of the fitting	Horizontal surface drained (m ²) by a water outlet, the drain fitting of which is tapered				
at Ø standard	at Ø increased ⁽³⁾	d (cm) ⁽⁴⁾	at Ø standard	at Ø increased ⁽³⁾	D (cm)	d (cm) ⁽⁴⁾	h (cm)
28		6 ⁽⁵⁾	40	37	Approximately D = 2 d	6 ⁽⁵⁾	h = 1,5 d
38		7 ⁽⁵⁾	55	37		7 ⁽⁵⁾	
50	33	8	71	47		8	
64	43	9	91	61		9	
79	53	10	113	75		10	
95	63	11	136	91		11	
113	75	12	161	107		12	
133	88	13	190	127		13	
154	103	14	220	147		14	
177	118	15	253	168		15	
201	134	16	287	191		16	
227	151	17	324	216		17	
254	169	18	363	242		18	
284	189	19	406	270		19	
314	209	20	449	300		20	
346	230	21	494	329		21	
380	253	22	543	362		22	
415	277	23	593	394		23	
452	302	24	646	430		24	
490	327	25	700	466		25	
530	400	26		570	26		
570	472	27		680	27		
615	550	28			28		
660	625	29			29		
700	700	30			30		

(1) One cm² of downpipe section drains one m² of horizontal roof surface.

(2) 0.70cm² of downpipe section drains one m² of horizontal roof surface.

(3) The increased diameters concern certain cases of rainwater drains, connected to roofs containing a waterproofing membrane on bearing elements of ribbed steel deck sheet or of timber and wood derivative panels.

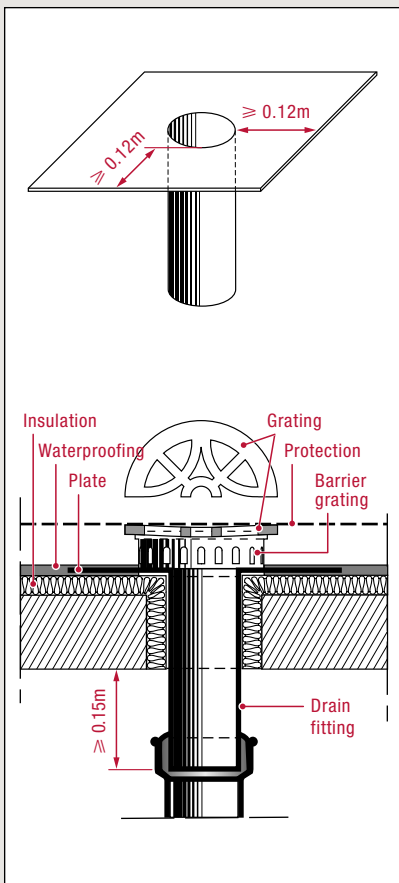
(4) The drain fitting's diameter can be slightly less to take into account the thickness of the constituent material.

(5) The 6cm and 7cm diameters are not accepted except for small surfaces such as balconies and loggias.

Special case

Drained surfaces equal to or less than 287m² per downpipe with cylindrical drain fitting water outlets for the non-accessible roofs on masonry bearing element.

Inside diameter of the pipes (cm)	Horizontal surface area of the roofs drained (m ²)
8	71
9	91
10	113
11	136
12	161
13	190
14	220
15	253
16	287



Composition

The rainwater drains can be, for example:

- of lead, thickness $\geq 2.5\text{mm}$ (diameter limited 0.15m in the case of roofs with metal bearing element), protected inside by dipping in hot bitumen, in the case of concrete slab protection;
- of copper, thickness $\geq 0.6\text{mm}$;
- of zinc, thickness $\geq 0.8\text{mm}$ (diameters limited to $\leq 0.20\text{m}$);
- of galvanised steel sheet, thickness $\geq 1.5\text{mm}$.
- of lead coated stainless steel, thickness $\geq 0.5\text{mm}$;
- of aluminium, thickness $\geq 1\text{mm}$ (diameter limited to 0.20m);
- in material especially suitable for that application (elastomer, etc.).

The rainwater drains shall be protected on all their faces by a coat of bituminous Siplast Primer.

The drain fitting shall overhang the underface of the roof by at least 0.15m and its connection to the downpipe shall be inspection accessible.

All the rainwater drains shall be fitted with a device (grille, balloon grating, barrier grating, ...) designed to exclude debris (papers, sheets, ...) that might clog the downpipes, as well as the materials from any heavy mineral protection.

Waterproofing connection

The drain openings shall be located under the roof's low point so as to avoid water stagnating.

For that purpose, it is recommended (mandatory on steel bearing element) to provide a recess (in the masonry or insulation substrate), 10 to 15mm deep (30mm minimum for rainwater drains in lateral outflow channels on steel bearing element).

The reinforcing plate is coated with bituminous Siplast Primer on its two faces and inserted into the waterproofing system.

In the special case of steel bearing elements, the reinforcing plate is mechanically fixed to the bearing element through the insulation.

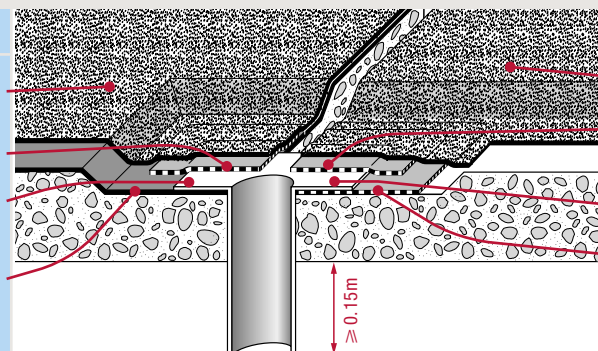
Two-ply waterproofing

2nd waterproofing ply of main area, torched

Reinforcement, Paradiene S VV, torched

Reinforcing plate of the rainwater drains, coated with bituminous Siplast Primer

1st waterproofing ply of the main area



Single-ply waterproofing

Waterproofing of the main area

2nd layer of reinforcement, Paradiene S VV, torched

Reinforcing plate of the rainwater drains, coated with bituminous Siplast Primer

1st reinforcement ply, Paradiene S VV, torched

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Overflows

The professional technical standards provide the guidelines for the layout of any overflows, intended to act as:

- palliating any rainwater drain clogging;
- limiting the water level;
- warning device.

They are not acceptable in mountain climate.

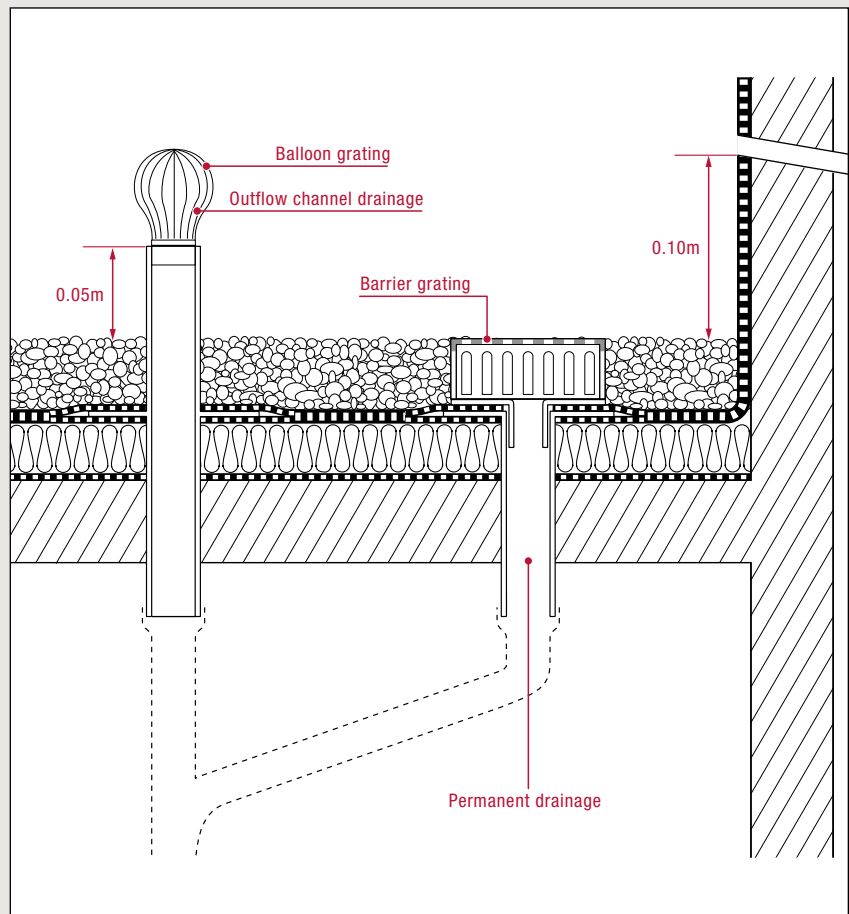
Special cases of roofs designed to temporarily retain rainwater

This concerns only non-accessible flat roofs with gravel protection, zero pitch on bearing element of masonry in plains climate.

The rainwater can be drained at two levels by:

- a permanent drainage in the plane of the waterproofing membrane, the dimensions of which depend on the maximal flow accepted by the developer (case by case study depending on the surface areas of the roof and on any local restrictions concerning discharge into the sewers).
- an “outflow channel” drain located 0.05m above the gravel layer, sized according to the usual rules (see above) so as to provide a normal flow rate for the rainwater and to prevent any accidental overloads and overstepping of the level above the upstands.

Any overflows are positioned at 0.10m above the gravel layer.



Standard description

- The water drains are to be positioned at the roof's low points, by reinforcing plate and drain fitting in ... shape (tapered or straight) and of diameter ... cm, calculated according to the relevant standards in force.
- The reinforcing plate, coated with bituminous Siplast Primer on its two faces will be sandwiched in the welded waterproofing system of the main area, reinforced by one (or two) element(s) of 1 x 1m of Paradiene S VV.
- As the case may be, the water drains will include a device (grille, barrier grating, ...) to prevent clogging.
- As the case may be, the water drains shall be supplemented by drainage by outflow channels (or by overflows) located ... and made ...

Roof penetrations

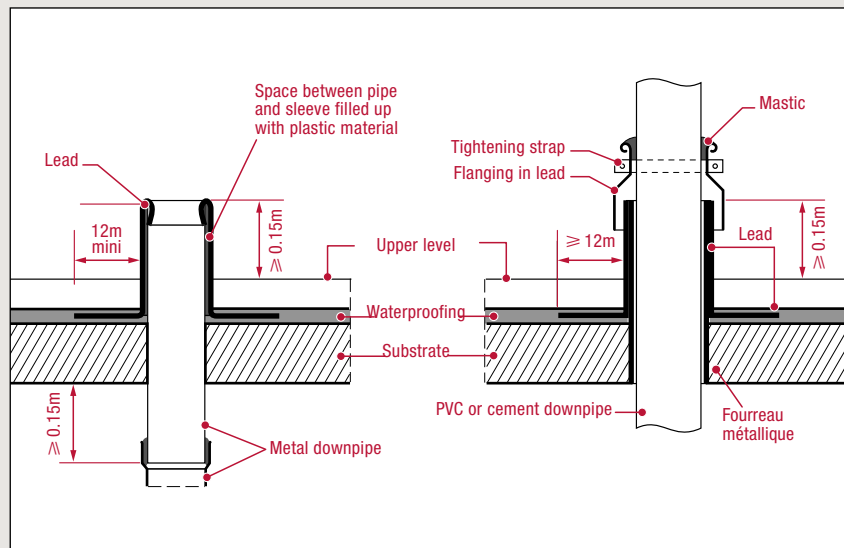
General guidelines

Any structures penetrating the roofs shall be isolated from the waterproofing membrane by a sleeve, connected to the waterproofing membrane by a reinforcing plate welded watertight; this reinforcing plate can be of:

- galvanised steel sheet, thickness $\geq 0.75\text{mm}$;
- zinc, thickness $\geq 0.8\text{mm}$;
- lead, thickness $\geq 2.5\text{mm}$;
- any other material especially suited to this application.

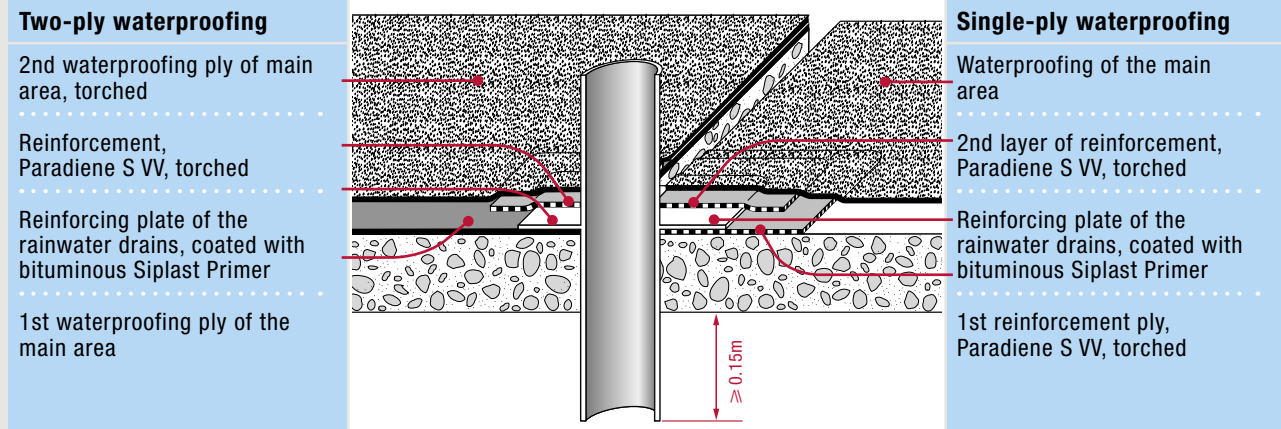
The distance between the sleeve and the edge of the reinforcing plate shall not be less than 0.12m.

A device shall prevent the entry of streaming water between the penetration structure and the sleeve.



Connection to the waterproofing

The reinforcing plate is coated with bituminous Siplast Primer on its two faces and inserted in the waterproofing system.



Standard description

- The roof penetrations will be by reinforcing plate and sleeve, of ..., of suitable section; the sleeve shall protrude at least 15cm above the protection of the waterproofing of the main area.
- The reinforcing plate, coated with cold insulation mastic Siplast Primer on its two faces will be sandwiched in the welded waterproofing system of the main area, reinforced by one (or two) element(s), 1 x 1m of Paradiene S VV.
- The device ... will prevent the entry of streaming water between the penetration device and the sleeve.

Roof details and connections

Expansion joints

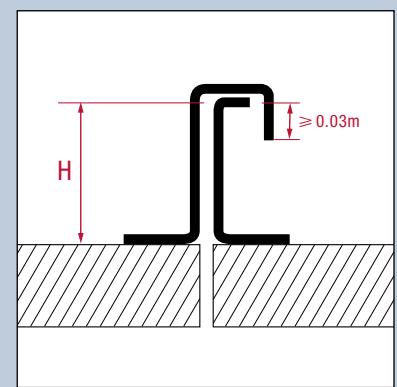
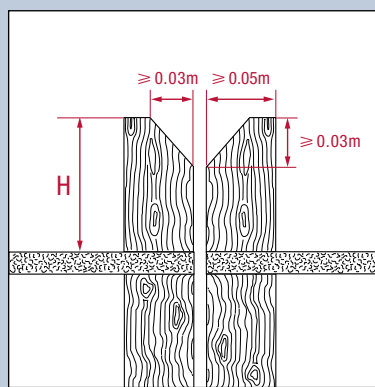
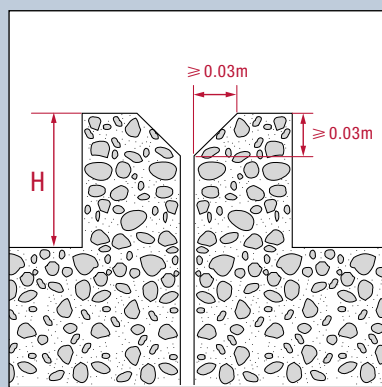
Type of joint based on the intended use of the roof

Type of joint based on the intended use of the roof	Bearing elements	Intended use of the roof			
		Non-accessible or maintenance foot traffic	Accessible for pedestrians and leisure time space with concrete slab protection	Gardens or pedestrian accessible areas with slabs on pedestals	Parking for light vehicles
	Double kerb at joint	Masonry, cellular concrete, timber and wood derivatives, ribbed steel deck sheets	Masonry	Masonry	Masonry
	Raised flat joints	With rabbet, chamfer or steel standing seam joint seal	(2)	With rabbet or chamfer	(2)
	Flat joints	(1)	With rabbet or chamfer	With rabbet or chamfer	(2)
	Flat joints		With rabbet or chamfer		With rabbet or chamfer

(1) Acceptable when the joint is connected to a low parapet (0.05m above the protection).

(2) Possible only outside traffic zones (except for any steel standing seam joint seal).

Eventual upstands



According to the nature of the bearing element, they may be made of concrete, solid timber or galvanised steel sheet.

Their minimal height H is the same as for upstand supports.

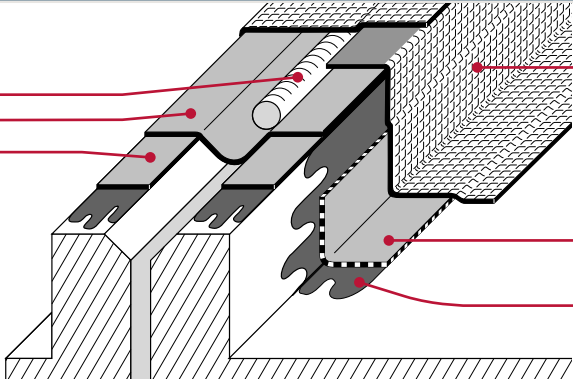
Remark

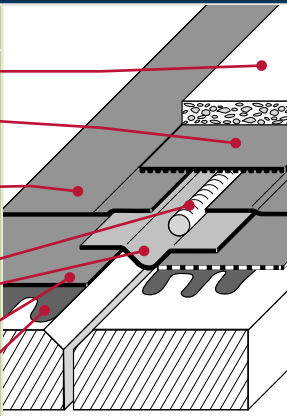
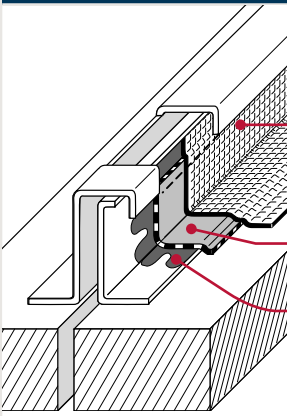
It is forbidden for streaming water to enter through the expansion joint of a roof and then reach another roof located at the same level.

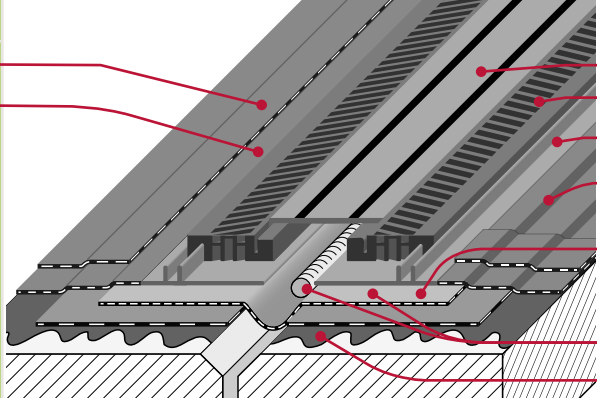
For further information

- French French French Technical Assessment Neodyl N.
- Product manuals: Strip NaI, Neodyl N, Paradiel S, Paradiene, Parafor Solo, Parequerre, Veral and Veretanche.

Waterproofing

Masonry or timber kerbs	
Seal	
Lyre-shaped Joint Neodyl Neodyl cord Torched Neodyl strip Underlayer, nailed or torched on Siplast Primer, Parequerre or Paradiene 35 S R4	
	Upstand
	Top layer: Paradiene S torched or Supradial GS Possible variants: Parafor Solo GS or Vercuire S Reinforcing L-section: Parequerre, torched Siplast Primer

Flat expansion joint on flat roof, pedestrian accessible		Kerb with steel standing seam seal	
Two-ply waterproofing			
Protective slabs Protection of the Bande Nal lyre-shaped seal, aluminium face down 2nd waterproofing layer of the main area Lyre-shaped Neodyl Neodyl cord Torched Neodyl strip 1st layer of waterproofing of the main part Siplast Primer			Upstand
		Top layer: Paradiene S torched or Supradial GS Possible variants: Parafor Solo GS or Vercuire S Reinforcing L-section: Parequerre, torched Siplast Primer	

Flat expansion joint for light vehicle parking area	
Two-ply waterproofing	
Second waterproofing ply First waterproofing ply	
	Single-ply waterproofing
	Paradyl bridge profile Paradyl elastomeric blocks Paradyl support plate Waterproofing of the main part (transversal installation) Underlayer, Paradiene S R4 or Paradiene 35 S R4 Lyre-shaped Neodyl Neodyl cord; Neodyl torched Siplast Primer

Standard description

- The expansion joint will be prepared in compliance with the Neodyl French Technical Assessment with lyre-shaped Neodyl, Neodyl cord and protection by Band Nal (strip), installed aluminium face against the underface.
- It will have a kerb, raised flat, flat, with upstands (in certain cases) in ... dimension ...
- Protection, as the case may be, by
- Paradyl protection in the case of a flat joint for parking areas.

