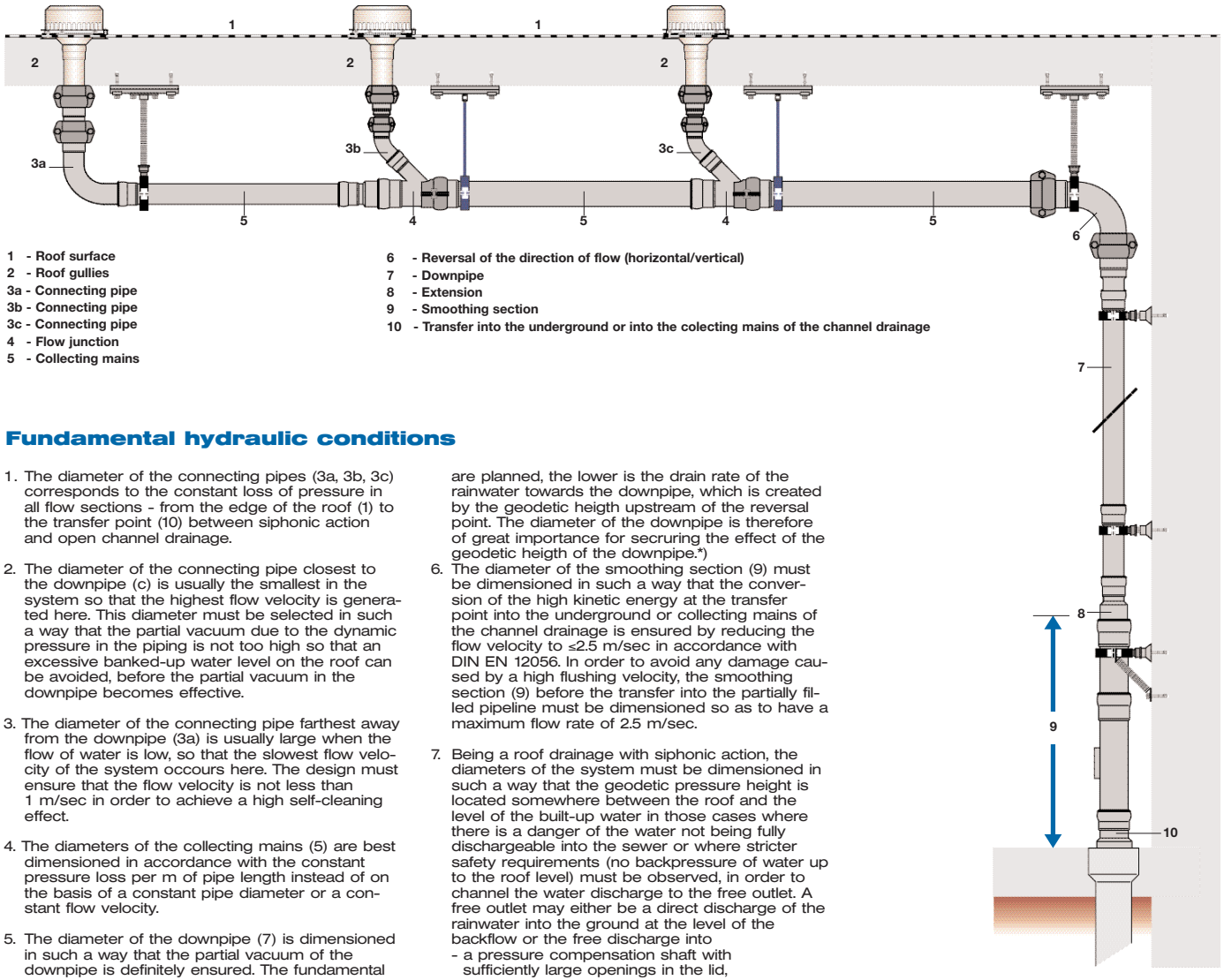

1 - Roof surface
2 - Roof gullies
3a - Connecting pipe
3b - Connecting pipe
3c - Connecting pipe
4 - Flow junction
5 - Collecting mains
6 - Reversal of the direction of flow (horizontal/vertical)
7 - Downpipe
8 - Extension
9 - Smoothing section
10 - Transfer into the underground or into the colecting mains of the channel drainage

Fundamental hydraulic conditions

1. The diameter of the connecting pipes (3a, 3b, 3c) corresponds to the constant loss of pressure in all flow sections - from the edge of the roof (1) to the transfer point (10) between siphonic action and open channel drainage.

2. The diameter of the connecting pipe closest to the downpipe (c) is usually the smallest in the system so that the highest flow velocity is generated here. This diameter must be selected in such a way that the partial vacuum due to the dynamic pressure in the piping is not too high so that an excessive banked-up water level on the roof can be avoided, before the partial vacuum in the downpipe becomes effective.

3. The diameter of the connecting pipe farthest away from the downpipe (3a) is usually large when the flow of water is low, so that the slowest flow velocity of the system occours here. The design must ensure that the flow velocity is not less than 1 m/sec in order to achieve a high self-cleaning effect.

4. The diameters of the collecting mains (5) are best dimensioned in accordance with the constant pressure loss per m of pipe length instead of on the basis of a constant pipe diameter or a constant flow velocity.

5. The diameter of the downpipe (7) is dimensioned in such a way that the partial vacuum of the downpipe is definitely ensured. The fundamental aim of the siphonic drainage system is to channel the rainwater int the horizontal collecting mains above the reversal points of the directional flow (6) and to drain it from there due to the geodetic heigth below the reversal point. This reversal will normally result in partial vacuums. The smaller the diameters of the connecting and collecting pipes are planned, the lower is the drain rate of the rainwater towards the downpipe, which is created by the geodetic heigth upstream of the reversal point. The diameter of the downpipe is therefore of great importance for secruring the effect of the geodetic heigth of the downpipe.*)

6. The diameter of the smoothing section (9) must be dimensioned in such a way that the conversion of the high kinetic energy at the transfer point into the underground or collecting mains of the channel drainage is ensured by reducing the flow velocity to ≤2.5 m/sec in accordance with DIN EN 12056. In order to avoid any damage caused by a high flushing velocity, the smoothing section (9) before the transfer into the partially filled pipeline must be dimensioned so as to have a maximum flow rate of 2.5 m/sec.

7. Being a roof drainage with siphonic action, the diameters of the system must be dimensioned in such a way that the geodetic pressure height is located somewhere between the roof and the level of the built-up water in those cases where there is a danger of the water not being fully dischargeable into the sewer or where stricter safety requirements (no backpressure of water up to the roof level) must be observed, in order to channel the water discharge to the free outlet. A free outlet may either be a direct discharge of the rainwater into the ground at the level of the backflow or the free discharge into
   - a pressure compensation shaft with sufficiently large openings in the lid,
   - a natural river or lake,
   - traffic space,
   - a storage reservoir or canal for rain water,
   - a reservoir of a water recycling plant, or
   - an emergency water reserve.

   The volume must be big enough to provide intermediate storage space for the water difference between the large quantities of water discharged from the roof drainage with siphonic action and the small quantities of rainwater absorbed by the sewer in the case of rising water level.

7.1 The diameters of the siphonic system can be dimensioned in such a way that the entire geodetic height between the roof level and the backflow level is used, in order to apply the smallest possible diameters for the system and to completely use up the relevant geodetic pressure for the discharge of the water within drainage system. When keeping the diameters of the siphonic action system as smalll as possible, the free discharge of the rainwater at the end of a roof drainage with siphonic action must be ensured in form of an outlet into the open ground at the height of the backflow level. In this case, the free outlet of the rainwater discharge should be located immediately next to the downpipe (7).

7.2 If the free discharge of the rainwater at the end of the siphonic system is not possible in the form of an outlet into the open ground at the height of the backflow level, it must be ensured that the rainwater can be channeled into the drainage system downstream of the backflow level and from there to the free outlet. The diameters of the syphonic roof drainage system below the backflow level will have to be dimensioned with regard to the pressure losses, so that the hydrostatic head of water between the roof and the backflow level is sufficient to channel the rainwater to the free outlet if a backflow occurs.

*) cf. Vahlbrauk, W.: From the roof into the eaves in an economical fashion-Fundamental ideas about the safe dimensioning of siphonic action roof drainage systems, in : Sanitär- und Heizungstechnik 57 (1992), No 12, p. 857-862, and Haustechnische Rundschau (1993), No. 7-8, p. 56-60.