

HydroSelf® flushing system

**Basics of wave flusher in
rectangular tanks
round tanks and
tunnel sewers**

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HydroSelf® flushing system in Singapore

Basics of HydroSelf® flushing system in rectangular tanks, round tanks and tunnel sewers

1. Introduction

The HydroSelf flushing system was developed by Steinhardt GmbH and put on the market for the first time in 1985 as a novel flushing system with flushing gates. What was special about the flushing gates was the hook closure, which could be locked and unlocked exclusively via mechanical forces (water power) by means of an encased hydraulic cylinder. The electric control for larger tanks was included at a later point in time.

In Germany, in Europe and worldwide more than 1000 facilities, stormwater tanks, reservoir channels and transport collectors have been equipped with the HydroSelf flushing system.



The success of the HydroSelf flushing system for tanks and channels is based on the abrupt opening of the flushing gate, which causes a flushing wave, similar to a dam break. The flushing water retained in the storage chambers by the flushing gates flows out rapidly and moves with enormous thrust force over the soles of the stormwater tanks and channels to be

flushed. The result is so overwhelming, as dirt and even most stubborn deposits can be removed and flushed away reliably with only one flush.



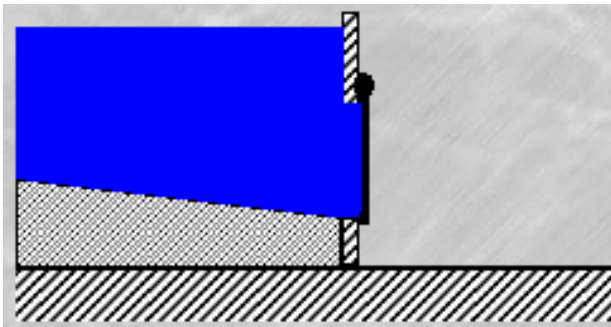
In order to be able to flush circular tanks with the same positive result, the HydroSelf flushing system for round tanks was developed. The radial flushing system operates with a mobile (flushing) container which is connected to a central guide rod. When the tank is filled in rainy weather, the special closure mechanism of the flushing container is locked and retains the stored flush water. After the rainfall, as soon as the tank is empty again, the flushing

process is initiated as the container suddenly moves upward. The flush water flows out of the container bottom and flushes the sole of the round tank via one flushing process.

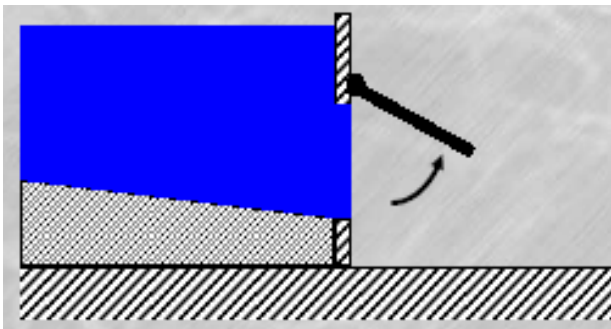
2. The principle of the HydroSelf flushing system

2.1 With flushing gates in tanks and sewer tunnels

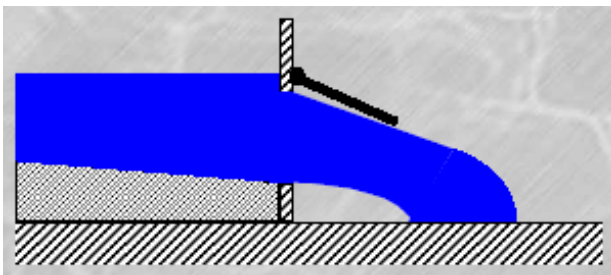
The principle of the HydroSelf flushing system with flushing gates is simple but very successful. The HydroSelf flushing system flushes stormwater tanks and channels highly efficiently from a low level with the energy of the stored water. The storage chambers are located in the area of the structure soles at the high points of the sole in “flushing streets” to be flushed within a tank or at the beginning of flush lanes in channels. The flush water is retained by the flushing gates until the flushing process is either initiated automatically or by hand via unlocking the closure mechanism.



Flush water is impounded in one or several storage chambers and retained by the flushing gates. (The quantity of flushing gates must be selected according to the type and dimensions of the tank or channel.)



The sudden opening of a flushing gate initiates the flushing process. (Several flushing processes are initiated one after the other, as soon as the discharge is free again and the flushing sump empty.)



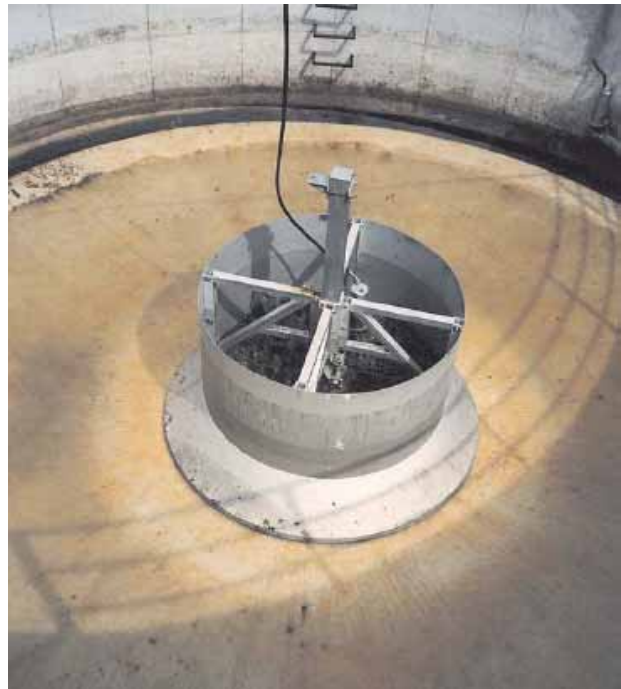
A powerful flushing wave (similar to a dam break) is caused.

The turbulent shock wave generates enormous shear stresses and guarantees the removal of deposits from the tank and channel soles. The large flush water volume ensures that the dirt is reliably transported to the discharge.

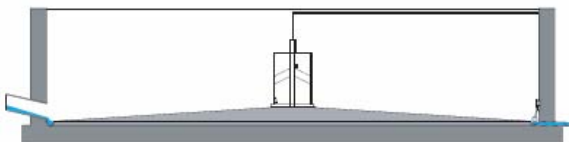


2.2 With a flushing container in a circular tank

The HydroSelf flushing system for circular tanks operates with a central flushing container, which also constitutes the storage chamber for the retention of the flush water. The outside wall of the container corresponds to the storage chamber walls in facilities with flushing gates. The system of container flushing includes the integrated central rod, which is positioned in the centre of the tank together with the container and to which the guide rails plus damper and the closure mechanism are attached. Central rods which might already exist and be necessary from the static point of view, e.g. of concrete in closed stormwater tanks, can be incorporated. The surface of the tank sole in the circulating sealing area of the container edge must, however, be prepared in a special way and it must be absolutely smooth and level.

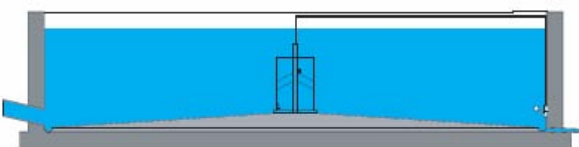


Phase 1 – Dry weather



The dry weather inflow flows into the stormwater tank and then to the discharge via the dry weather flume, which is also used as flushing sump and is located at the outer edge.

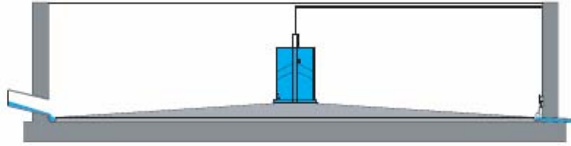
Phase 2 - Rain



During rainfall, the tank is filled due to the throttled discharge. This means that at first the discharge area and then the flushing sump will fill. If the water level

continues to rise, the closure mechanism of the flushing container will be locked. If it keeps on raining, the tank will fill up. The flushing container will also fill, either automatically via backwater gates or by means of an external filling installation.

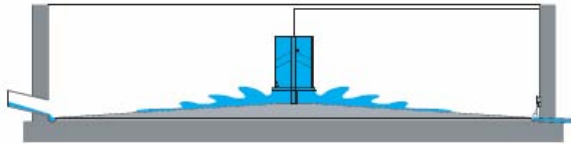
Phase 3 – After the rain



After the rainfall, the tank will empty again. The flush water will, however, be retained in the flushing container. The stored buoyancy force generated by the inclined container walls in the lower part cannot act at the beginning, as the

closure is still locked. Only when the discharge area of the tank and the flushing sump are empty, the mechanism is unlocked and the flushing process initiated.

Phase 4 - Flushing



The control unlocked the closure. The buoyancy force can act now and lift the container wall. The flush water flows out of the container and a radial, even, powerful flushing wave cleans the entire tank sole in the direction of the outside

wall. The flush water with the removed dirt is collected in the dry weather flume and in the flushing sump and passed on to the sewage plant via the discharge area.

3. Advantages of the HydroSelf flushing system

Advantages 1

- Specifically extended flush wave with enormous thrust force
- Also suited for longer flushing lengths with larger water quantities
- Cleaning of flushing lengths exceeding 100 m by far
- Guaranteed removal of most stubborn deposits with one flush

Advantages 2

- Storage chambers are filled automatically
- Cleaning also with partial impoundage
- Environmentally friendly and resource saving

Advantages 3

- Simple and sturdy technology
- Low maintenance due to the application of high-quality materials
- Flushing system tried and tested in more than 1000 facilities worldwide

Advantages 4

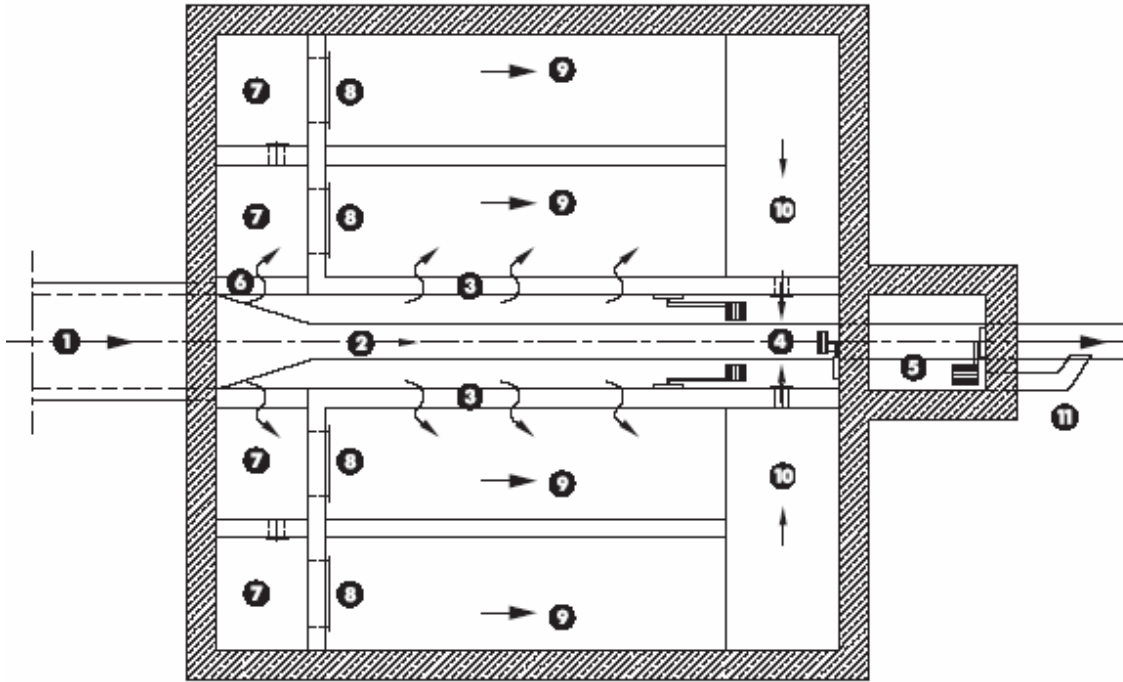
- Safety due to consultation and intensive support in the planning phase
- Quick, competent and experienced service

4. Consulting the flushing system

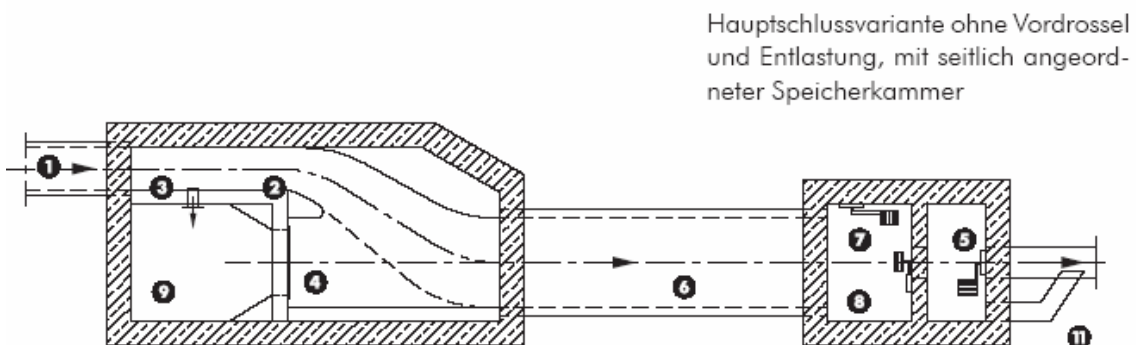
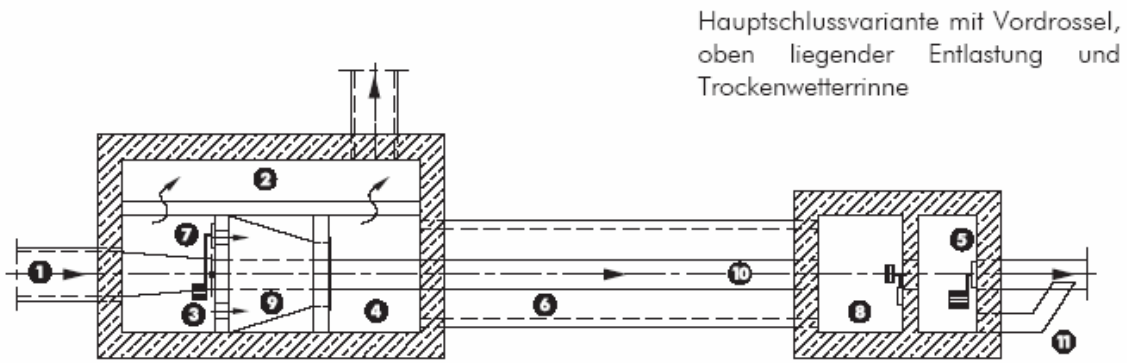
Storm water tanks, reservoir channels and transport collectors are required, planned and manufactured in most differing sizes, dimensions and shapes. The responsibility for the planning usually lies with the consulting engineers. To ensure that such buildings can be approved, the stipulations made by cities, communities or operating companies with respect to the operation must be considered and the respectively applicable guidelines for the structural design must be complied with.

The system drawings in the Steinhardt GmbH technical documents will provide you with an overview on the various possibilities of how to plan a HydroSelf flushing system.

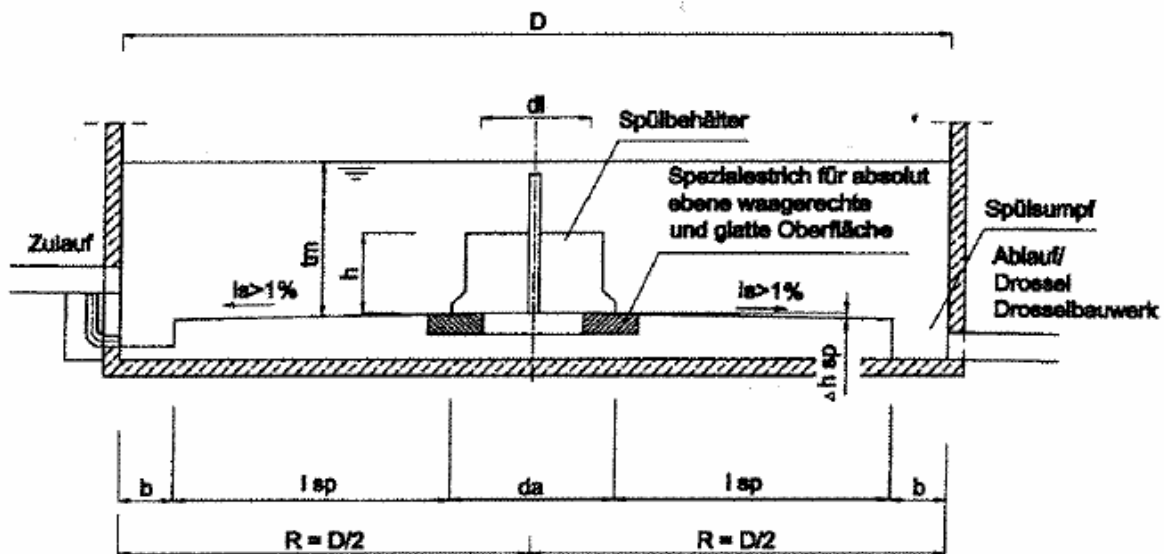
Tank:



Tunnel sewer:



Round tank:



$$\text{Spülstraßenlänge: } l_{sp} = (D - d_a) / 2 - b$$

If you already have your design plans made, in many cases it is also possible to adapt the HydroSelf flushing system to the planned building. Experience has shown, however, that for the optimization of the HydroSelf flushing system, it is necessary to know the hydraulic system of the tank or channel and its water management function in the sewer system. The compilation below displays a selection of important characteristics which should among others be included in the planning.

Tank Large tank or small tank
 Rectangular tank or circular tank
 Stormwater overflow tank or stormwater retention tank
 Function with the main closure or secondary closure variation
 Power supply possible / not possible
 Flush water supply granted

Channel Reservoir channel, transport collector
 Round channel, rectangular channel, special profile
 Function with the main closure or secondary closure variation
 Power supply possible / not possible
 Flush water supply granted

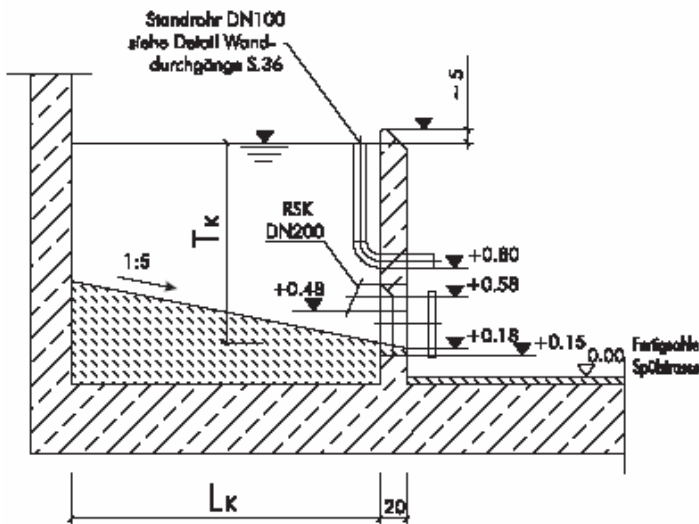
Further details with respect to construction and machine technology as well as general hints can be found in the section "Important information for planners and operators" in the Technical documents relating to the HydroSelf flushing system. Please do not hesitate to contact us for assistance in case of more complex planning projects. Steinhardt GmbH will be happy to contribute its experience.

The most important element for flushing a tank or channel is flush water, which must be collected and stored in the storage chambers.

The geometrical dimensions of the tank or the channels are necessary to establish the flush water. To this end, the required widths of the flushing gates must be determined. For circular tanks the size of the flushing container must be proportional to the tank surface to be flushed.

- Division (of the tank) in flushing lane
- Determination of the quantity of flushing lane
- Determination of the width of the flushing lane
- Determination of the required flush water volume depends
 - Length of the flushing lane
 - Width of the flushing lane
 - Longitudinal inclination of the flushing lane
 - Settlements

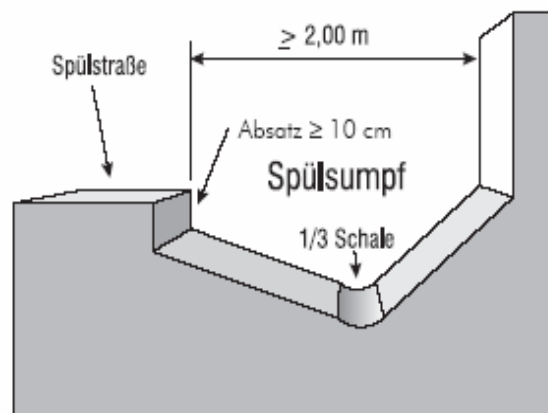
Stand pipe DN 100



Picture of a typical storage chamber

- with storage chamber length L_k
- filling depth T_k (max. ca. 1.50 m)
- Finished sole flushing lane
- storage chamber width e.g. as same as flushing lane width

The flushing sump at the end of a flushing street collects the flush water quantity and the flushed deposits of one flushing street. With larger facilities, the following flushing process may only be initiated if the discharge area and the flushing sump are empty again.



The content of the flushing sump [m³] should always be larger than the content of the largest storage chamber and it should at least feature such a dimension that the volume of the flush water plus the deposits expected (e.g. ca. 30 % of the flush water) fit in together.

Storage chambers



Flushing sump (content > 1.3 x flush water)



5. The control of the HydroSelf flushing system

For the automatic operation of the HydroSelf flushing system, two different control systems are available.

Purely mechanically acting float controls can be used in smaller facilities and if no electricity is available nearby. When planning such a facility, it is, however, absolutely imperative that Steinhardt GmbH is consulted as early as possible, as the structural design of the tanks and reservoir channels must especially be adapted to the control system and coordinated with it.

If the model of a float control is not possible, then the electrically controlled HydroSelf flushing system will be used. The electric control is standard for larger facilities. But it is also applied in smaller stormwater tanks and for flushing channels. The operating ease and the increased flexibility also allow to comply with the customer's special wishes (telecontrol system). Each electric control is suited for automatic operation and manual operation alike.

5.1 Float control (no power required)

The mechanically controlled hydraulic system of the HydroSelf flushing system mainly consists of the flushing gate/flushing container with a special hydraulic cylinder, a main float, a control float and the connecting hydraulic lines.



Each individual flushing gate requires its own main float. A control float can be used for a maximum of two flushing gates. Example: For 4 pcs. flushing gates, 4 pcs. main floats and 2 pcs control floats are required.

The arrangement of the main and control floats is determined depending on the respective project. The main float serves

to lock and unlock the closure mechanism and must be capable of covering a lift distance in a floating manner. Only after the top position has been reached, may water flow into the storage chambers. The control float initiates the flushing process. It must be located at a very low depth in the discharge area. For the initiation of the flushing process, the flushing sump must be empty.

Note: The flushing gate with the float-controlled HydroSelf flushing system is open in the state of rest and it only locks in the event of rain when the rising water level causes the main float to float to the top.

5.2 The electric control

The electrically controlled hydraulic system of the HydroSelf flushing system generally consists of the flushing gate/flushing container with a special hydraulic cylinder, the connecting hydraulic line, the hydraulic unit and the electric control (e.g. in a safety cabinet).



All electric functional parts of the HydroSelf flushing system are located outside the storm water tank. The hydraulic line leads from the hydraulic cylinders at the flushing gates or the container through the structure wall to the hydraulic unit (< 1.0 kW) in the external cabinet or control room. The hydraulic unit and the electric control can be supplied either wired ready-for-operation, mounted on a base plate or with a weatherproof safety cabinet for outdoor installation. Only the power supply and the electrical connection must be carried out by the customer. It is also possible to realize other installation options according to the customer's request, e.g. in central control rooms or the integration in larger cabinet installations.

A hydraulic unit can also be used to control more than one flushing gate in larger tanks by installing a larger number of valves.

For the automatic, water level-dependant control, a float switch is required. The positions of the probes are established for each project individually, mainly, however, above the discharge area. The flushing process is initiated, if the discharge area/flushing sump is empty and the flush water can run off freely.

Note: The flushing gates are always closed (locked) in the state of rest with the electrically controlled HydroSelf flushing system. Therefore water may enter the storage chambers at any optional point in time (automatically or via external filling). The hydraulic system is unpressurised in the state of rest. Electrical energy is only required for a short time for the development of the pressure required to open the flushing gates.

The Steinhardt HydroSelf Flushing system Success with a future

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