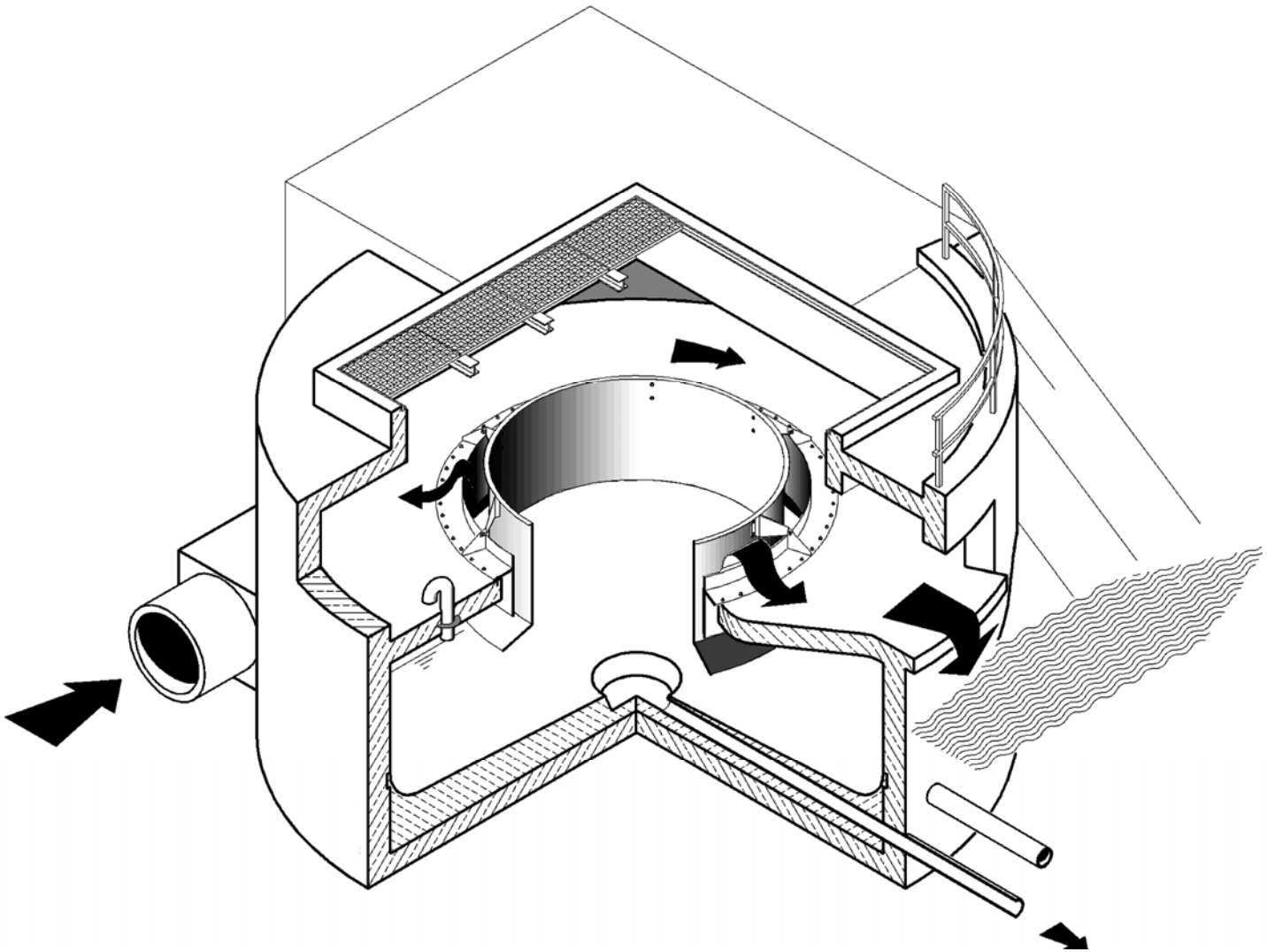


CSO/STORMWATER MANAGEMENT



 **HYDROVEX[®]**

FluidSep Vortex Separator



JOHN MEUNIER

HYDROVEX® FLUIDSEP VORTEX SEPARATOR

INTRODUCTION

The **HYDROVEX® FluidSep** Vortex Separator is a tool in the treatment of CSO and Stormwater. The treatment relies on the properties of the controlled vortex to eliminate settleable suspended solids, as well as floatables carried by the incoming water.

Since 1985, UFT, the German leader in CSO and Stormwater equipment development, has developed the **HYDROVEX® FluidSep**. UFT and its owner, Dr. Hans Brombach, have specialized since the late '70s in induced vortex equipment design. Following the various laboratory and field developments, UFT has created a new concept of vortex separator, the **HYDROVEX® FluidSep** that presents better performances than those already existing.

UFT started the first **HYDROVEX® Fluid Sep** units in the summer of 1987 in the City of Tengen near Schaffhausen in Germany. The units are still operating successfully. A special research program that ended in the summer of 1990 supplied evidence of the superior efficiency of the **HYDROVEX® FluidSep**. The program was based on the qualitative evaluation of sampling campaigns performed at the installation.

HYDROVEX® FluidSep is currently in full operation in Germany, France and the United States of America.

GENERALITIES

Regulators and retention tanks are the most common CSO pollution control structures. If the combined sewer regulator allows important flows to pass without treatment to the outfall, the retention tank acts differently: it offers the advantage of storing the polluted water. In the case of transit type tanks, it can clarify the water before discharging it. The drawback is that these tanks are always very expensive and represent a massive capital investment.

For storm drainage, the stormwater is evacuated by the shortest path directly to the receiving body of water without any treatment. Under these conditions, important pollutant quantities, resulting from the washing of the impervious surfaces (mainly streets, parking lots and roof drainage) are directly sent to the environment.

The **HYDROVEX® FluidSep** Vortex Separator offers, both in Combined Sewers and in Stormwater Drainage, an effective solution to protect the receiving bodies of water. The technology is particularly interesting when applied in combined sewer rehabilitation or extension. The Vortex Separator is also very effective as a stormwater treatment.

OPERATION

The operation of the **HYDROVEX® FluidSep** Vortex Separator described here is based on an In-line installation in a Combined Sewer System. The Dry Weather Flow that gets to the unit passes by freely on the sloped bottom towards the central cone of evacuation and then through a flow regulator.

During a storm event, the incoming flow becomes bigger than the regulated outflow. This will effectively start the filling of the vortex separator. A lot of minor events can be fully intercepted and contained inside the vortex separator volume without actual overflow.

For more intense or more durable storm events, the **HYDROVEX® FluidSep** Vortex Separator start overflowing through its central annular overflow weir. This weir is made of two plunging cylindrical treatment baffles providing a double crown arrangement. The overflow water is evacuated through the ring-shaped opening formed by these two treatment baffles. The overflow is fixed in the circular opening of the top cover of the vortex separator structure. The overflowed water falls from the weir on the upper chamber of the separator and is then evacuated, either towards an additional treatment system or directly to the outfall. Due to its tangential inlet port, the incoming water brings the mass of retained water into a rotational movement inside the tank.

This rotational movement induces the ideal conditions for the creation of a vortex separation in the tank.

The resulting flow pattern is non-turbulent and very favorable to the separation of suspended solids. These particles can readily settle and are furthermore pulled by the centrifugal currents towards the wall of the separator. Once the particles are caught on the limit layer along the walls, they fall to the structure bottom and are finally brought to the unit's evacuation cone. From there, they are carried out with the underflow water through the regulator. The double crown baffle arrangement, plunging into the central section of the chamber, helps to ease secondary currents and increase the limit surface area. The overflow water is clarified.

When the **HYDROVEX® FluidSep** Vortex Separator is filled, an air pocket is formed under the unit's cover, imprisoned by the baffle partition arrangement. The floatables entering the separator will be caught there and will simply circulate around until the unit progressively gets back to dry time flow conditions. The lower surface of the cover always remains free of water, due to the captured air pocket.

If the flow conditions allow it, the vortex separator lower cone can be fitted with an underflow drain. This drain can help separate the coarse elements from the separator. It can also help flush out entrapped material. The opening of the drain allows the draining of the cone to a stocking area located below the device. The sludge drained from the unit must be removed periodically after natural dehydration.

Bench Test for HYDROVEX® FluidSep Vortex Separator

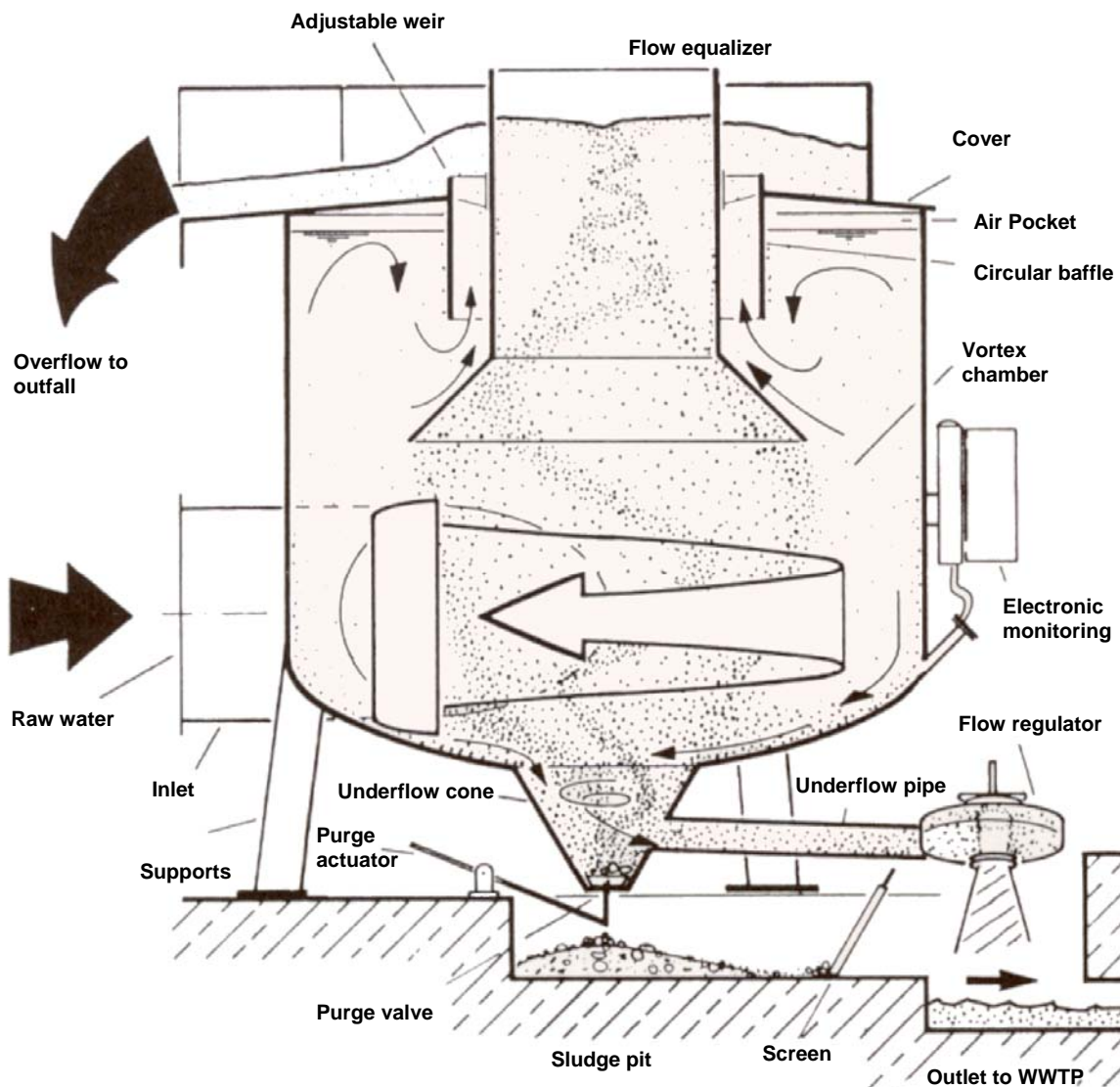
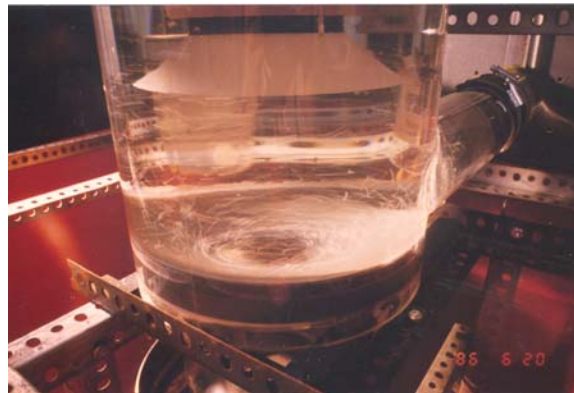
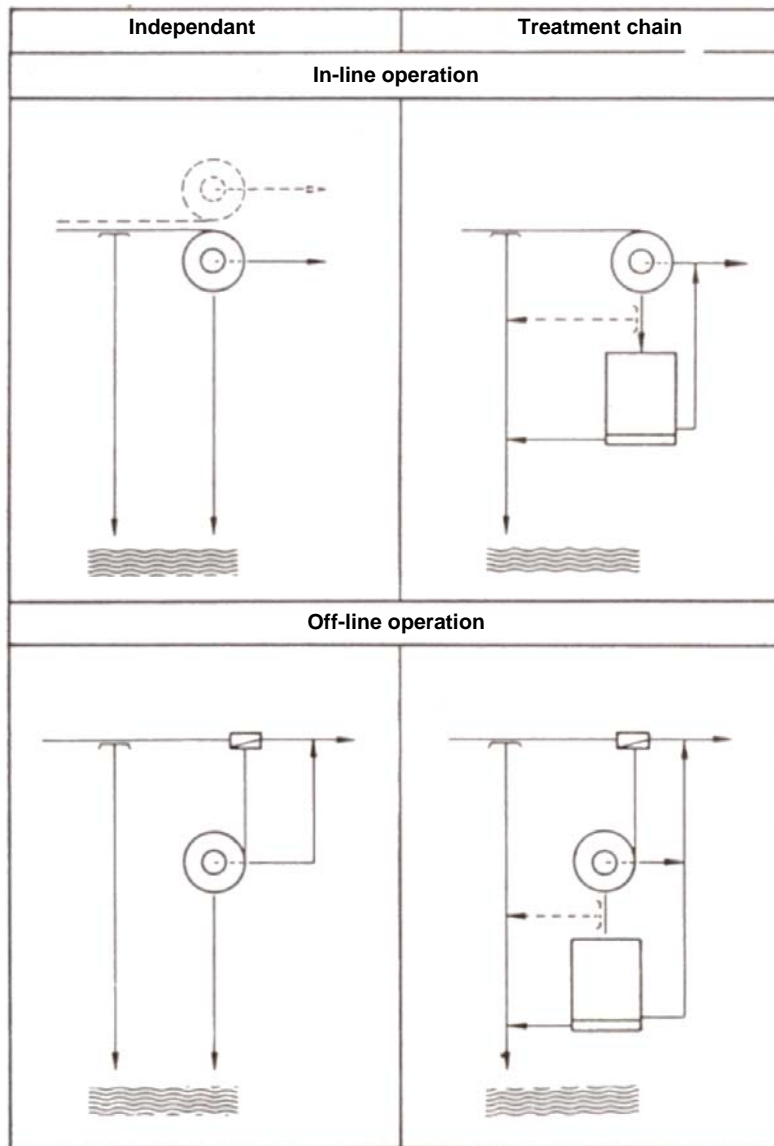


Figure 1: Cross section of a Hydrovex® FluidSep Vortex Separator in full operation

APPLICATIONS

The **HYDROVEX® FluidSep** Vortex Separator has numerous possible applications, either in the storm drainage lines, in the combined sewer system or at the wastewater treatment plant. If required, many **HYDROVEX® FluidSep** units can be operated in parallel. Also, the **HYDROVEX® FluidSep** can be implanted off-line from the main sewer system. In the case of poor flow conditions, the **HYDROVEX® FluidSep** can even be pump fed.



*Figure 2: Various configurations of **HYDROVEX® FluidSep** vortex separators*

COMBINED SEWER APPLICATION

The **HYDROVEX® FluidSep** Vortex Separator can be used as a main CSO treatment, in replacement of a conventional overflow weir arrangement. The overflow frequency will be automatically reduced, simply based on the important retention volume offered by the vortex separator's structure. In overflow conditions, the unit will offer a treatment level equivalent to a headwork. An important fraction of the suspended solids and floatables will be retained and sent to the Wastewater Treatment Plant.

The use of the **HYDROVEX® FluidSep** Vortex Separator, in combination with a transit type clarifier tank, is very effective. The vortex separator will be used as a preliminary treatment whereas the transit type clarifier tank will operate both as a retention tank and a polishing treatment. Low intensity events will be accounted for by the vortex separator alone. For bigger events, the overflow water, already treated in the vortex unit, will receive up to primary clarifier degree treatment in the transit type clarifier tank. Both units are performing far better together than in their stand-alone version. The problems related to resuspending settled materials and cleaning of the retention/treatment structure is greatly reduced.

STORMWATER APPLICATION

The **HYDROVEX® FluidSep** Vortex Separator can treat stormwater from street, roads, parking lots, roof drains, truck loading pads and industrial parks. The bigger part of settleable suspended solids can be trapped inside the unit rather than being freely sent to the environment. However, only an in-line arrangement can be used for this type of application. In storm drains, the solid load essentially includes mineral elements. These can either be sent to the sanitary sewer line or pumped out into a grit classifier for eventual disposal. This last solution is particularly adapted to areas where there are conditions with high grit, sand and salt content.

WASTEWATER TREATMENT PLANT APPLICATION

The **Hydrovex® FluidSep** Vortex Separator can be installed in the Wastewater treatment plant as an additional headwork component. It allows extra polishing of the grit chamber outflow.

DIMENSIONING

The fundamental data required to select and size a **HYDROVEX® FluidSep** Vortex Separator is the local hydraulic conditions and peak flow value Q_{max} . With these limit conditions, we can determine the size and the hydraulic efficiency of the separator.

The **HYDROVEX® FluidSep** should never be too small to maintain the retention volume function of the structure. Conversely, oversizing the unit will increase the construction expenses uselessly. If necessary, it is possible to design several vortex separators in parallel.

To determine the efficiency of the **HYDROVEX® FluidSep** Vortex Separator, it is recommended that a formal characterization campaign be carried out. This will help to identify the real characteristics of the effluent by identifying the composition of polluting materials to separate. When such data is not available, we can use the numerous sedimentation curves available in our group.

The additional equipment necessary to properly operate a **HYDROVEX® FluidSep** Vortex Separator is variable. Normally, it is limited to a flow regulator installed at the underflow exit of the structure. We recommend the installation of flow and level monitoring devices to insure the follow up of the unit and the frequency of activation of the structure.

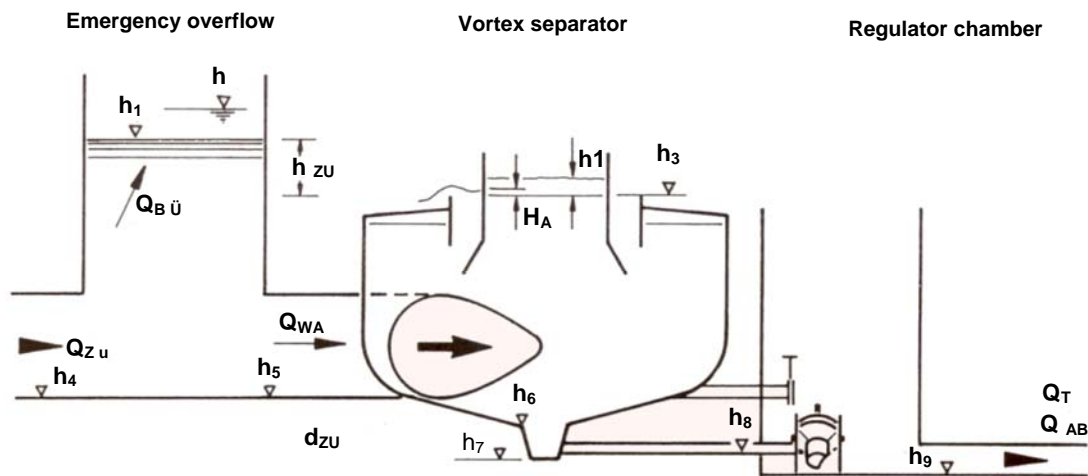


Figure 3: Side section of a simple vortex separator installation. In-line arrangements with free flow conditions.

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