

Test report on the test of particle retention according to the test program of the DIBt approval principles for precipitation water treatment plants part 1

BIRCOprime

Birco GmbH

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1 Introduction

The company

Birco GmbH
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assigned

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with the testing of the particle retention of a stormwater treatment plant based on the approval principles for stormwater treatment plants Part 1: Plants for the decentralized treatment of wastewater from motor vehicle traffic areas for subsequent infiltration into soil and groundwater of the German Institute for Structural Engineering (DIBt) (version November 2017) [1].

In order to represent the inlet conditions of a drainage channel, the system was to be fed on both sides over a distance of 3,500 mm.

The focus of the test was to prove the treatment performance according to DWA-A102 [2]. Decentralized stormwater treatment plants must achieve a specific SS63 (suspended solids < 63 μm) retention in order to be used for the purification of stormwater runoff. For plants with building authority approval from the DIBt, a purification performance of 80% in relation to the parameter SS63 applies. These can be used without further testing for the purification of stormwater runoff from areas in load category III according to DWA-A102. For systems without building authority approval, the cleaning performance is to be determined as part of a test comparable to the DIBt test procedure, which was carried out as part of the commissioned test. The test was carried out in December 2021.

The test results contained in this report relate only to the items tested. The report comprises 8 pages and an annex of 3 pages and shall not be reproduced in part without written approval of PIA GmbH.

2 Description of test object

The "BIRCOprime" system based on the BIRCOmax-i drainage channel is designed as a sedimentation system. Special internals are designed to enhance the retention of settable solids. Due to the arrangement of the internals, the unit is operated in a permanently filled mode. The system to be tested is the system shown in the annex with a total length of 4,500 mm for a connecting area of 2,000 m². A technical drawing of the system can be found in the appendix.

The individual feeding of the system takes place sideways over approx. 3,500 mm. Two ventilated distribution channels are used for continuous feeding.



Figure 2-1: System in test set up (1)



Figure 2-2: System in test set up (2)

3 Test for particle retention

The quartz flour "Millisil W4" from Quarzwerke GmbH was used to test the particle retention. The quartz flour at hand has a residue of 51.4% at the sieve cut 63 µm.

3.1 Test at a connecting surface area of 2,000 m²

The particle retention test was carried out from 08.12.2021 to 10.12.2021 in accordance with the DIBt test principles for a connecting area of 2,000 m². The waiting time between TP 1 and TP 2 was 17.1 hours, the waiting time between TP 2 and 3 was 2.2 hours. There was a total rest period of 19.3 hours between sub-tests 3 and 4 (approval regulation: 16 to 24 hours).

The four sub-tests were performed with the test settings shown in Table 3-1. The test flow rate of TP 4 was set within 12 seconds (specification: minimum flow rate increase of 1 l/s²).

Table 3-1: Test settings

Sub Test	Date	Test duration	Rainfall intensity		Feed volume	Feed of Millisil W4, 50 g/m ²
			Specification	Flow rate*		
		min	l/(s*ha)	l/s	l	kg
1	08.12.2021	480	2.5	0.5	14,400	50.0
2	09.12.2021	200	6.0	1.2	14,400	33.3
3	09.12.2021	48	25.0	5.0	14,400	16.7
4	10.12.2021	15	100.0	20.0	18,000	0

* Actual feed volume: TP 1: 0.51 l/s, 14,688 l; TP 2: 1.19 l/s, 14,335 l; TP 3: 4.97 l/s, 14,314 l

** Actual feed mass: TP 1: 52.4 kg; TP 2: 34.9 kg; TP 3: 17.5 kg

Sampling was evenly distributed over the test period. The samples were analyzed in the laboratory of PIA GmbH for the concentration of TSS and SS63.

The determined cleaning performances of the plant during the particle retention test are summarized in Table 3-2 and Table 3-3. The detailed analysis results of the effluent samples can be found in the Annex.

Table 3-2: Test results particle retention TSS (2,000 m²)

	TP 1	TP 2	TP 3	TP 4
Water volume in l	14,688	14,335	14,314	18,000
Added particle load in kg	52.4	34.9	17.5	-
Inflow concentration in mg/l	3,568	2,435	1,223	-
Average inflow concentration following DIBt-formula in mg/l	1,709			
Outflow concentration in mg/l	471	498	649	119
Particle retention in %	86.8	79.6	47.0	-
Average outflow load following DIBt-formula in kg	24.4			
Average outflow concentration in mg/l	398			
Total particle retention following DIBt-formula in %	76.7			

$$C_{tot,in} = \frac{((14,688 \times 3,568) + (14,335 \times 2,435) + (14,314 \times 1,223) + (0.5 \times 18,000 \times 0))}{14,688 + 14,335 + 14,314 + 18,000} \text{ mg/l}$$

$$= 1,709 \text{ mg/l}$$

$$C_{tot,out} = \frac{((14,688 \times 471) + (14,335 \times 498) + (14,314 \times 649) + (0.5 \times 18,000 \times 119))}{14,688 + 14,335 + 14,314 + 18,000} \text{ mg/l} = 398 \text{ mg/l}$$

$$\text{Passage} = \frac{398 \text{ mg/l}}{1,709 \text{ mg/l}} \times 100\% = 23.3\%$$

$$\text{Retention} = 100\% - 23.3\% = 76.7\%$$

Table 3-3: Test results particle retention SS63 (2,000 m²)

	TP 1	TP 2	TP 3	TP 4
Water volume in l	14,688	14,335	14,314	18,000
Added particle load in kg	52.4	34.9	17.5	-
Part ≤ 63 µm (48,6%) in kg	25.5	17.0	8.8	-
Inflow concentration part ≤ 63 µm in mg/l	1,736	1,186	615	-
Average inflow concentration following DIBt-formula in mg/l	836			
Outflow concentration SS63 in mg/l	471	496	534	52
Retention in %	72.9	58.1	13.2	-
Average outflow load following DIBt-formula in kg	22.1			
Average outflow concentration in mg/l	361			
Total retention following DIBt-formula in %	56.8			

$$C_{tot,in} = \frac{((14,688 \times 1,736) + (14,335 \times 1,186) + (14,314 \times 615) + (0.5 \times 18,000 \times 0))}{14,688 + 14,335 + 14,314 + 18,000} \text{ mg/l}$$

$$= 836 \text{ mg/l}$$

$$C_{tot,out} = \frac{((14,688 \times 471) + (14,335 \times 496) + (14,314 \times 534) + (0.5 \times 18,000 \times 52))}{14,688 + 14,335 + 14,314 + 18,000} \text{ mg/l} = 361 \text{ mg/l}$$

$$\text{Passage} = \frac{361 \text{ mg/l}}{836 \text{ mg/l}} \times 100\% = 43.2\%$$

$$\text{Retention} = 100\% - 43.2\% = 56.8\%$$

4 Summary

Plant description:	<u>BIRCOprime</u>
Manufacturer:	Birco GmbH
Particle retention	
Parameter: Fine-grained, mineral filterable substances	
Test substance	MILLISIL W4 Grain size range 0 µm – 200 µm Part > 63 µm: 51.4%
Connecting surface area: 2.000 m ²	
Result	76.7% Retention of TSS 56.8% Retention of SS63

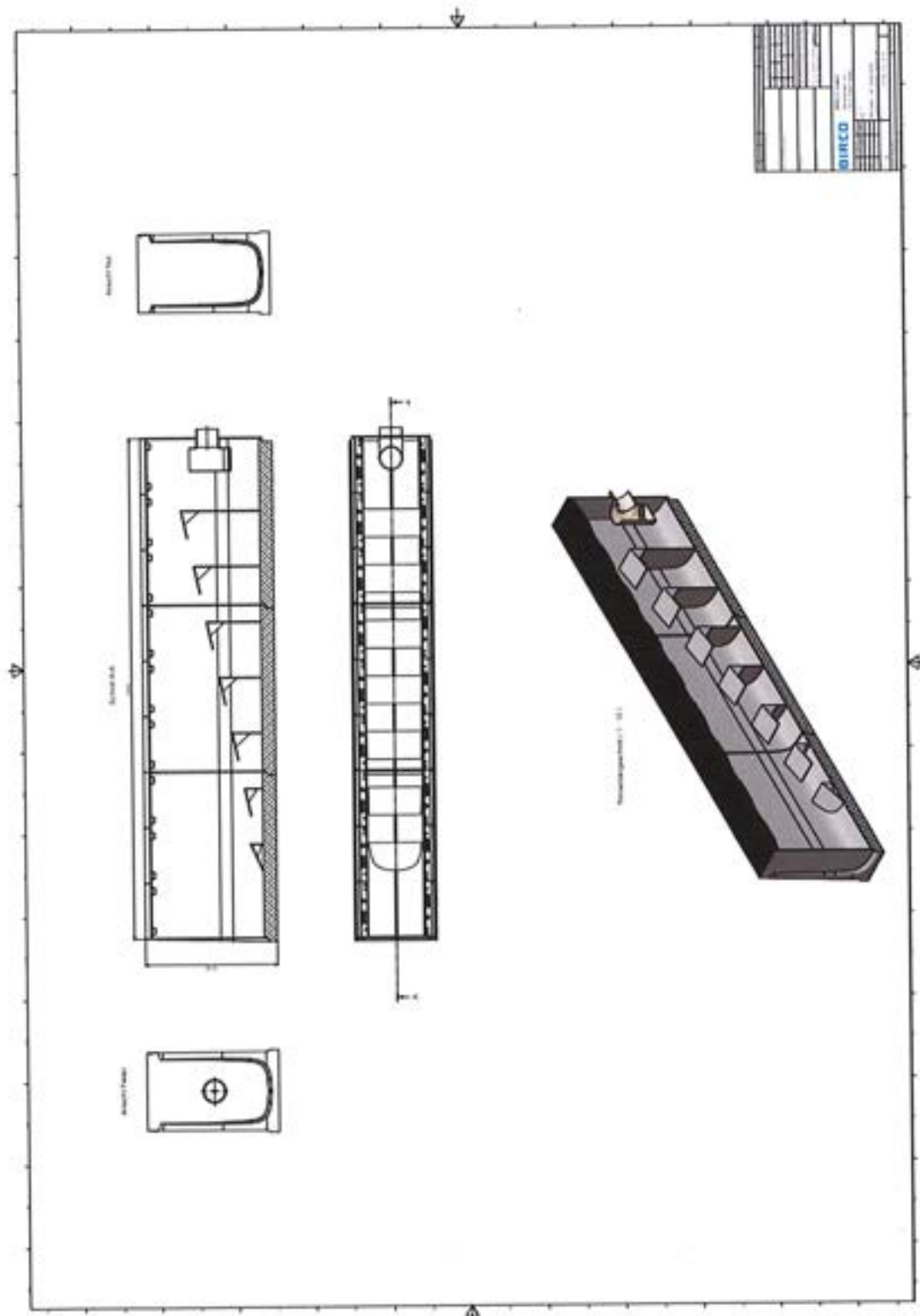
5 Literature

- [1] DIBt (Hrsg.) (2017): Zulassungsgrundsätze für Niederschlagswasserbehandlungsanlagen Teil 1: Anlagen zur dezentralen Behandlung des Abwassers von Kfz-Verkehrsflächen zur anschließenden Versickerung in Boden und Grundwasser des Deutschen Instituts für Bautechnik. Deutsches Institut für Bautechnik (DIBt), November 2017.
- [2] DWA (Hrsg.), BWK (Hrsg.) (2020): Arbeitsblatt DWA-A 102-2/BWK-A 3-2: Grundsätze zur Bewirtschaftung und Behandlung von Regenwetterabflüssen zur Einleitung in Oberflächengewässer – Teil 2: Emissionsbezogene Bewertungen und Regelungen.

End of report.

6 Annex

Figure 6-1: Technical drawing of the system





End of Annex.

