



# 1-STEP® FILTER

Ultimate one step total effluent polishing filter



**At present, removal of suspended solids, nutrients, heavy metals and organic micro pollutants from treated effluent of wastewater treatment plants requires successive conventional processes to be implemented at the WWTP, leading to high investment and operational cost.**

**The 1-STEP® filter, developed by Nijhuis Industries, Witteveen+Bos and Waternet, is an innovative compact fixed bed activated carbon filter operated at a relatively high rate downward flow combining four processes in one single additional treatment unit.**

Besides removal of suspended solids by filtration, it performs excellently on nitrogen removal by simultaneous biological denitrification (using a selective carbon source), chemical phosphate and heavy metals removal (by coagulation and flocculation with a low dose of metal salt) and, if required, removal of organic micro pollutants by adsorption to the activated carbon.

**APPLICATIONS**  
Comprehensive tertiary treatment of treated effluent for final polishing, advanced nitrogen and priority substances removal, and removal of phosphorous to a standard < 0.25 mg P/l. Enabler for successfully addressing water scarcity when implemented in treated effluent recycling schemes.

**CUSTOMER BENEFITS**

1. The 1-STEP® filter produces filtrate of excellent quality.
2. Stable performance and great stability of treated effluent.
3. The compact design results in significant savings on construction cost and plot size.
4. Operational cost are low due to the intelligent monitoring and control philosophy which results in low chemicals and energy consumption.
5. The filter bed can effectively be cleaned by gently backwashing it.
6. The 1-STEP® filter is future proof since it removes a broad spectrum of high priority and emerging substances.

## One Step Total Effluent Polishing filter

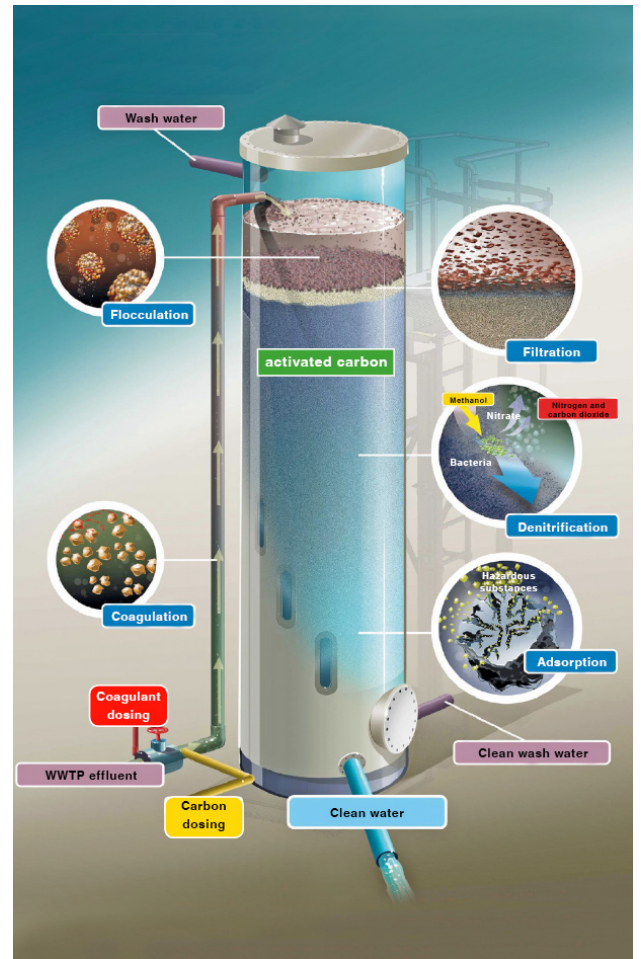
The 1-STEP® filter combines four treatment processes into one additional single treatment unit – see schematic on the right:

1. Removal of suspended solids by filtration.
2. Nitrogen removal by simultaneous biological denitrification using a selective carbon source dosed to the influent of the 1-STEP® filter.
3. Chemical phosphate and heavy metals removal by coagulation and flocculation with a low dose of metal salt (also dosed to the influent of the filter).
4. If required, removal of up to 90% of the incoming organic micro pollutants by adsorption onto the activated carbon.

The 1-STEP® filter is easy to implement and extend since it can be added to existing wastewater treatment plants or function as a pre-treatment unit in treated effluent recycling facilities.

### Delivery to the market

- The 1-STEP® filter solution is a jointly developed product with Waternet as co-innovator and early adopter
- Patented black box solution - Design-Build with Operate option
- Project by Project product and service delivery
- We have delivered 1-STEP® filter solutions worldwide



## Reference - Horstermeer wastewater treatment plant, the Netherlands

### Cost-effective quality improvement

Implementation of the 1-STEP® filter at Horstermeer WWTP resulted in **30 - 50% saving** in investment and operational costs compared to conventional successive processes.

The 1-STEP® filter is cost-effective at small and large scale treatment plants: 0.03 - 0.06 EUR per m<sup>3</sup> (N, P and TSS) depending on flow rate (excluding reactivation).

### Excellent Treated Effluent quality

Demonstrated end-values and removal efficiencies as averages over the four year period 2013-2016:

Parameter	End - Value	Removal Performance
N <sub>total</sub>	< 2.2 mg/l	60-70%
NO <sub>3</sub> -N	< 0.75 mg/l	82-89%
P <sub>total</sub>	< 0.20 mg/l	60-77%
PO <sub>4</sub> -P	< 0.03 mg/l	78-90%
TSS	< 5 mg/l	25-55%

### Innovations resulting in excellent operational performance

- Intelligent dosage and control of chemicals
  - Efficient PAX consumption: Me:P ratio of 3.1
  - Efficient MeOH dosage: 3.9 g COD/g NO<sub>x</sub>-N (N removal up to 4kg N/m<sup>3</sup> filter bed volume)
- Intelligent filtration and backwash control
  - Selected type of activated carbon
  - High filtration rates: up to 15 m<sup>3</sup>/m<sup>2</sup>h
  - Backwashing downtime: ~5%
- Low energy usage (0.04 kWh/m<sup>3</sup> treated)

