



# DENIFOR™

## DOWNFLOW DENITRIFICATION SYSTEM



### DESCRIPTION AND PROCESS

The DENIFOR™ is the most advanced biological downflow denitrification filtration system that allows single step NO<sub>3</sub>-N and TSS removal helping meet limit of technology effluent permits. The system utilizes Degremont's renowned high surface area media Biolite, hence allowing significantly higher treatment capacity within the same footprint. The process involves percolation of Nitrate laden wastewater on and through a bed of Biolite™ media by gravity. The high surface area of the media allows the growth of a large community of denitrifying micro-organisms on and in the media which in the presence of an external Carbon source such as methanol convert the Nitrates into Nitrogen gas, while the suspended solids are captured in the media interstices. The filter is regularly backwashed by a system of air+water washes to clean the media bed and renew the biofilm. Additionally, water only Nitrogen bumps are regularly carried out to release the trapped Nitrogen bubbles in the bed and reduce headloss buildup.

### DESIGN CRITERIA

#### APPLICATION:

- NO<sub>3</sub>-N Removal (Denitrification)
- Filtration

#### SOURCE:

Nitrified wastewater  
Drinking Water

#### EFFLUENT REQUIREMENTS:

NO<sub>3</sub>-N < 1 mg/l  
TSS < 5 mg/l  
Total Nitrogen < 3 mg/l

FEATURES	BENEFITS
<b>HIGH SURFACE AREA MEDIA</b>	Significantly higher treatment capacity in the same footprint as compared to conventional denitrification filters, leading to savings of up to 60% on CapEx
<b>FLEXIBLE BED HEIGHTS</b>	The DENIFOR™ is able to work at different filter bed depths 2.5 ft, 4 ft, 6 ft and 9 ft thus allowing customized solutions based on the needs of the plant
<b>REDUCED OPEX</b>	Lower bed depth options allow for reduced backwash pumping and air scour requirements leading to significantly reduced OpEx while ensuring the same capacity as competing deep bed denitrification filters
<b>RETROFIT CAPABLE</b>	The ability to use lower filter bed depths lends itself to retrofitting existing tertiary filters and adding denitrification capability without needing additional civil construction
<b>COMPACT FOOTPRINT</b>	Higher media depth options allow for much higher treatment capacity (3X-4X traditional denitrification filters) in a compact footprint making the DENIFOR™ an excellent alternative for plants with space constraints
<b>OPERATOR FRIENDLY</b>	The DENIFOR™ is a fully automated system allowing for minimum operator intervention and reducing labor costs.
<b>MODULAR CONSTRUCTION</b>	Allows for easy upgrades, versatile operation and operation of load variations while reducing energy costs
<b>PATENTED PROCESS</b>	The DENIFOR™ is a patented process with innovative backwash and Nitrogen bump cycles allowing for longer run times and reductions in carbon source overfeed

## COMPETITIVE DIFFERENCES

PARAMETER	DENIFOR™	CONVENTIONAL DOWNFLOW DENITRIFICATION FILTERS	BENEFIT
NO <sub>3</sub> -N Loading Rate	50 to 350 lbs/kcf/d	20 to 200 lbs/kcf/d	Higher treatment capacities in the same footprint and lower costs
Hydraulic Loading Rate	2 to 6 gpm/ft <sup>2</sup>	2 to 3.5 gpm/ft <sup>2</sup>	Higher treatment Capacity and lower costs
Nitrate Removal Efficiency	85%-99%	75%-95%	Higher pollutant removal efficiency allowing limit of technology goals
Media Depths	2.5 ft, 4 ft, 6 ft and 9 ft	Only 6 ft	Custom solution and ability to retrofit tertiary filters to add denitrification capability without additional construction
Backwash Water Flow Rate	From 3.9 gpm/ft <sup>2</sup>	6 gpm/ft <sup>2</sup>	Custom flow rates available depending on application for CapEx vs OpEx optimization
Air Scour Flow Rate	From 3.9 scfm/ft <sup>2</sup>	6 scfm/ft <sup>2</sup>	Custom flow rates available depending on application for CapEx vs OpEx optimization
Media Type	Biolite L 2.7 – Expanded Shale/Clay – 2 to 4 mm	Sand – 1.8 to 2.2 mm	Higher Loading Rates and lower costs

## FREQUENTLY ASKED QUESTIONS

### What type of underdrain is employed in the DENIFOR™?

IDI's proven Monoflor underdrain is used for robust construction and low headloss.

### Is tertiary Phosphorus Removal possible with the DENIFOR™?

Yes, by the addition of Ferric/Alum phosphorus removal is possible.

### How is the external carbon feed controlled?

Degremont's proprietary algorithm with feed forward and feed back control loop is employed to ensure optimum carbon source dosage without overfeed.

### What is the typical backwash frequency?

Typically every 24 to 72 hours depending on the influent and temperature conditions

### What is the typical Nitrogen bump frequency?

Depending on the influent flows and loads this can vary from one to three times a day.

### Is a DENIFOR™ Pilot Unit available and what are the flows that can be tested?

Yes, the DENIFOR™ Pilot Unit is available. It is a trailer mounted self-contained mobile system with all the controls and the flexibility to test all 4 bed depths with flows ranging from 2 to 5 gpm.