



# **Biosand Filter - Version 10**

## **Design Changes**

January, 2009

# What changed with design version 10?

## 1. Physical aspects & maximum fill volume

- Height and width of the filter are the same as current design (v. 9.0). Visually, only the height of the spout and the diffuser plate have changed.
- The weight of a version 10 filter box is more than the current design, 95 kg as opposed to 85 kg when empty.
- There is more room under the spout for water storage container (76 cm vs. 66 cm).
- The maximum fill volume is 35% less than the current design; 12 L vs. 18.5 L (3¼ gal. vs. 5 gal.). This means that the improved filter design will need to be filled more often each day to filter the same amount of water, but each fill will be lighter: ~12 kg (26 lbs) rather than ~18 kg (40 lbs).

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## 2. Nominal head and flow rate

- The nominal head (height of reservoir) is reduced by 10 cm (4"); from 27 cm to 17 cm (10.6" to 6.7").
- The reduced head lowers the 'hydraulic loading rate'. This, in turn, will reduce the shear forces that can cause attached particles to become dislodged from the sand media.
- Reduced head has been shown to improve the effectiveness of the biosand filter [Tiwari, 2008].
- The initial flow rate, when the filter is full to the brim, will be about 1/3 less than the current design. It will take a longer period of time to filter the same amount of water.

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## 3. Filter sand and 'clean bed head loss'

- The filter sand (fine sand bed) depth is increased to 55 cm from 45 cm (22" from 18") - 22% greater. This increases the 'clean bed head loss' by the same percentage.
- Viruses are primarily removed by adsorption/ attachment onto the surface of the filter sand. The additional fine sand in the improved design increases the available adsorption area for the removal of viruses.
- More fine sand will need to be washed and screened for the improved filter design.
- The greater 'clean bed head loss' may lead to the flow rate becoming unacceptably slow sooner, or stopping prematurely – requiring more frequent cleaning.

*Note, this issue was found not to be a major concern during the evaluation tests in India and Zambia.*

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## 4. Retention in sand media

- The entire fill volume, 12 litres, will be retained in the fine sand until the filter is used again.
- The retention of the water during the pause period has been shown to make the biosand filter more effective in removing pathogens from the water. The water quality will be improved with design version 10.
- Since all the water is retained in the fine sand during the pause period, there will be much less variability in the quality of the filtered water during each run.