Download this *HydrAid® BioSand filter handbook* and find additional resource materials at www.HydrAid.org/resources

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Training Resources:

Free resource materials are available online at www.HydrAid.org/resources.

HydrAid® BioSand Filter training programs are offered regularly by webinar. Training details, schedule, registration, and fees are available on request at www.hydraid.org/contact – *Administration Contact*

Custom training programs may be arranged for groups of any size at locations of their choice. Custom programs are delivered globally. Fee quotations are available on request at www.hydraid.org/contact - *Administration Contact*.

Consulting services including grant writing, project/program planning, filter media (sand/gravel) preparation, installation training, installation supervision, logistics, and community education, are available globally. Fee quotations are available on request at www.HydrAid.org/contact - *Administration Contact*.

A BRIEF HISTORY

The biosand water filter began its evolution in 1988 when Dr. David Manz, a civil engineer from the University of Calgary (Canada) conceived an idea that resulted from his international work in water systems.

Dr. Manz's idea was to adapt a proven and well-respected technology, slow sand water filtration, for point-of-use application by individual households. The use of slow sand filtration to improve water quality dates back thousands of years. Slow sand filtration is a trusted technology used in commercial water filtration systems for municipalities worldwide.

Dr. Manz's primary adaptation involved the addition of a *protected paused water reservoir* above the filtration sand that provided an optimal environment for the growth of a microbe-destroying biological layer. There are two design features that contribute to the preservation of a biological layer of film – a constant 2-inch layer of water above the sand and a water diffuser that prevents incoming water from disrupting the biological layer. The design enhancement was called *biosand* water filtration. His inexpensive design required no electricity and had no moving or replacement parts.

Today there are over a half-million biosand filters being used by families around the world to produce potable water and to prevent disease, disability, and death. Biosand water filtration is now recognized by the World Health Organization, UNICEF, USAID, governments, and leading NGOs as an efficient and effective point-of-use safe water technology.

After significant laboratory research, development, and testing the first biosand water filters were implemented in 1991 for rural families in Nicaragua. In 1993, households in the Menier Valley of Nicaragua received biosand filters. A year later a cholera epidemic swept Nicaragua and Central America, causing extensive illness and death. Later, Nicaragua's Ministry of Health discovered that no one in the valley had become ill with cholera – the biosand filters had prevented cholera! Concurrently, field studies by Dr. Manz's team showed that the biosand water filters removed an average of 96-97% of fecal coliform bacteria. These findings drew the attention of the health organizations, community health workers, nongovernmental organizations (NGOs), and service groups. Concrete biosand water filters began to proliferate in Central America and beyond.

In 2002 the concrete biosand water filter was introduced into the Dominican Republic through a small Rotary Club project led by entrepreneurs Jim Bodenner and Bob Hildreth. The project was a success and grew. With funding from some 200 Rotary clubs in five countries, nearly 20,000 filters had been installed in the Dominican Republic by 2008 – one of the highest concentrations of biosand filters in the world.

During the implementation of the Dominican Republic program, discussions were initiated with Dr. Manz regarding the development of a plastic version of the original cement filter which he had patented. That interest was driven by inherent advantages of plastic over concrete including quality, weight, cost, production capacity, transportation, and overall scalability. Cascade

Engineering, Inc. was approached to design and develop the first Hydraid® BioSand Water Filter with the same specifications as the cement filter. Cascade has been the sole manufacturer of the Hydraid® BioSand Water Filter from the beginning. Originally, International Aid held an exclusive global license from David Manz to distribute the plastic BioSand filter. However, in August of 2009 when they fell upon hard times, they ceased their program and lost their license.

In December 2009, Dr. Manz granted Cascade Engineering, Inc. a global license to manufacture and distribute the plastic HydrAid® BioSand Water Filter for both humanitarian and commercial purposes. In order to expand this life-saving work, Cascade partnered with Windquest group to form a social business joint venture called Triple Quest and they transferred the license to their joint venture.

In principle, the HydrAid® filters operate and perform similarly to the concrete biosand filters. Their quality, weight, convenience, maintenance, cost, and scalability represent a significant advancement in the technology. (www.HydrAid.org)

Substantial investment, study, research, planning, engineering, and testing went into the development of the HydrAid® filter from 2006 through 2008 during which about 25,000 filters were distributed. That work was supported by Rotary, the Kellogg Foundation, Dow Chemical Company, Cascade Engineering, and other donors. Dr. Mark Sobsey, University of North Carolina, Chapel Hill, also played an important role by conducting critical research on three continents that validated the efficacy and sustainability of the HydrAid® filter.

In May 2008, Dr. Sobsey published a peer-reviewed article in *Environmental Science and Technology* comparing the biosand water filter technology with the four other point-of-use technologies recognized by the World Health Organization. The following is a comparison chart that appeared in that article.

Scoring of Point-Of-Use (POU) Treatment Technologies Based on Sustainability Criteria

Technology	Quantity	Quality	Ease of use	Cost	Supply chain	Overall score
Free chlorine	3	1	3	3	1	11
Coagulation/chlorination	2	3	1	1	1	8
SODIS	1	1	1	3	3	9
Ceramic filters	2	3	2	3	2	12
***BioSand Water Filter**	**3**	**3**	**2**	**2**	**3**	**13**

**Emphasis added. Ratings based on a 1-3 scale (3 = best)*

The HydrAid® filter continues to grow in recognition and reputation. Its design, quality, performance, and scientifically-proven efficacy are unparalleled. Research and development work continues as lessons-learned are incorporated and best practices are disseminated. Efficacy studies conducted in 2008 by Dr. Sobsey in Ghana and Cambodia document that the HydrAid® BioSand filter is the most effective point-of-use technology available in reducing disease.

THE BIOSAND FILTER CONCEPT

The HydrAid® BioSand filter involves unique innovations that enhance traditional processes of *slow sand filtration* which has been used for thousands of years.

The critical innovation unique to HydrAid® BioSand filter is its plastic construction and its integrated patented system (water diffuser, paused water reservoir, biological layer, filter media, and outlet assembly) that has been engineered to destroy and remove harmful pathogens.

How does it work?

Water is poured into the HydrAid® BioSand filter as needed – an equal amount of safe filtered water is immediately dispensed. It can be used immediately or stored in a clean water container. The entire process is powered by gravity. Water is poured into a diffuser plate that dissipates the force of the water which helps avoid disruption of the biological layer. The water enters a paused water reservoir, passes through a disinfecting biological layer, and is then mechanically filtered through layers of engineered filter media before it is discharged through an anti-siphoning standpipe as safe water. An installed filter retains about 15 liters of water within the system.

Three principal mechanisms (chemical and mechanical) are at work in the HydrAid® BioSand filter that eliminate pathogens (bacteria, viruses, and parasites) and make water safe:

1. The consumption of pathogens in the biological layer.
2. The blocking of pathogens and organic material by the filter media.
3. The destruction of pathogens by physical/chemical reaction in the filter's controlled environment – water PH, oxygen levels, atmosphere, temperature, etc.

Water Sources

In developing countries, where point-of-use filtration is most necessary, families use water from multiple sources at different times: taps, reservoirs, rain, rivers, wells, aqueducts, etc. Although it is preferable to use water from the same source for consistency and acceptance, the HydrAid® BioSand Filter is able to produce safe water from multiple water sources even those containing highly turbid water. It is important to remember that tap, bottled, and delivered water is often contaminated between its source and the household. Source water should not contain chlorine, soap or salt water.

Design Features

The HydrAid® BioSand filter is made of medical grade, ultraviolet-resistant plastic. It is powered entirely by gravity. No electricity or solar power is required. There are no moving parts that require replacement or repair. The filter media (sand and gravel) never needs replacement under normal conditions. Safe clean water is produced at the rapid rate of .8 Liters per minute. Paused water sitting overnight has the longest pause time and provides at least 40 Liters per day of safe drinking water. Affordability, sustainability, convenience, and health benefits assure acceptance. A durable design and quality construction promise decades of dependable service.

Flow Rate

The HydrAid® BioSand filter is designed and installed to allow a water flow rate of 0.8 liters/minute or 47 liters/hour. The amount of water that passes though the HydrAid® BioSand filter is controlled by the preparation and mix of filter media. If the flow is too fast, the efficiency of pathogen removal can be reduced. If the flow is too slow, the amount of filtered water may be insufficient to satisfy user needs. Optimal flow rate is assured with accurate filter installation and is maintained with an occasional cleaning/maintenance of the biological layer.

Paused Water Depth

The depth of paused water in the filter is controlled by the volume of filter media (sand) installed in the filter. The desired depth is 5 cm (2 inches). This depth is important because it:

- Protects the biological layer and filter media.
- Promotes the growth and development of the biological layer.
- Creates a favorable environment for beneficial bacteria to feed on pathogens.
- Maintains the necessary atmosphere for gaseous interchange.

Biological Layer

The biological layer is a thin invisible film of living organisms that naturally grows on the top surface of the sand within the paused water reservoir. It is important that the biological layer is treated gently. It is delicate and can be damaged or destroyed if not protected. Damage to the biological layer may reduce the effectiveness of the filter.

Actions that may harm the biological layer:

- Pouring water into the filter without the diffuser plate can disrupt it.
- Allowing the paused water depth to become too shallow can damage it.
- Putting chlorine into the top of the filter can kill it.
- Allowing the paused water to evaporate will kill it.
- Not using the filter for several days can deplete its nutritional supply.

The biological layer requires protecting, nurturing, and maintaining – it is the life of the HydrAid® BioSand filter.

After filter installation or reactivation, it takes 5-14 days for the biological layer to reach full maturity and effectiveness. During this time, the filter will become increasingly effective. Post filtering chlorination provides safe water during the period of time it takes for the biological layer to form. Even without such chlorination, the filter significantly improves water quality.

Pause Periods

The pause periods are those periods of time between filter uses. Daily use is the preferred method of operation. If the filter is not used daily or at least once a week, the biological layer microorganisms could consume all the food (pathogens) that are in their environment and die or the water level could diminish due to evaporation. Either event could significantly compromise the efficiency and effectiveness of the filter.

The pause periods are valuable because during those times beneficial microorganisms in the biological layer consume harmful microorganisms (pathogens) in the water. The best water to drink is the water that has been paused for the longest. For optimal use, it is recommended to use the first water in the morning for drinking, since it has had the opportunity to pause overnight. The filter can be run continuously after that point for bathing,

Water Storage

As water is discharged from the filter it has been filtered and should be stored in a clean safe water storage container. It is important to NOT use the same container used to pour the dirty source water in the top of the filter as you use to collect filtered water from the other end.

Recontamination could occur if the water storage container is contaminated, or if it is left in an open container around sources of contamination. Water coming from the filter is optimal for immediate use. However, most households prefer to store water for convenience. It is important to understand that water can be easily recontaminated naturally during storage.

Recontamination can be minimized in several ways:

- Maintaining a clean covered water storage container used only for that purpose, a container that is distinctively different in appearance from containers used for other purposes.
- Chlorination in the ratio of one drop of chlorine solution (5.25%) per liter of filtered water helps prevent recontamination. Household bleach is suitable for such purposes – concentrations may vary by country from about 3-6%.

Maintenance

HydrAid® BioSand filter requires minimal maintenance. Filter media (sand) never requires replacement under normal conditions. The biological layer can be simply refreshed to periodically enhance flow rate. To learn more about the refresh process please refer to Section 9 of this Handbook referencing ‘Filter Maintenance’.

HYDRAID® BIOSAND FILTER ANATOMY

OPERATION

Water contains microscopic organisms (microbes) including parasites, bacteria, viruses, molds, yeast, etc. Some of these organisms benefit people while others (pathogens) are harmful. They are found free in the atmosphere and reproduce easily. Pathogens can quickly make human beings ill when their concentrations surpass a person's ability to tolerate them. Young children under age 5, whose immune systems are not fully matured or protected by breast feeding, are particularly vulnerable. The HydrAid® BioSand filter removes pathogens from water at the point-of-use in households.

Water can be used from the supply source closest to the home – a tap, reservoir, river, stream, rainwater, well, etc. The supply source, the treatment, and the distribution of the water are controlled by each household. This helps assure optimal household protection.

The filtration process begins when water is poured into the filter. The diffuser plate filters out large debris to prevent such materials from clogging the filter. It also protects the biological layer from disruption and damage due to the force of the water being added.

The paused water reservoir creates a healthy environment where the biological layer can flourish. Oxygen and nutrients are the fundamental elements that are needed for biological

layer growth and development. A two-inch paused water depth is optimal for biological layer oxygenation. The frequent addition of water provides nutrition.

The biological layer destroys pathogens found in contaminated water. The filter media (sand) traps parasites, bacteria and some viruses destroying them by asphyxiation and starvation. The coarse sand prevents excessive sand from washing downward into the bottom gravel layer. The gravel provides water drainage and protects the outlet from becoming clogged.

The standpipe incorporates an anti-siphoning feature that prevents excessive water from being siphoned out of the filter. While the flexible plastic outlet tube provides convenient filling of clean water containers and prevents undue stress to the standpipe.

WATER CHARACTERISTICS

Water that is safe for human use (potable) has the following physical characteristics:

- Colorless – Is free of visible impurities.
- Odorless – Is free of odor other than perhaps a hint of chlorine.
- Insipid – Is tasteless

Water that is not safe for human use (not-potable) may be contaminated with various chemical and/or organic substances. Water that may not be fit for human consumption may contain:

- Fecal material.
- High turbidity or impurities.
- Salt, pesticides, petroleum products, chemicals, heavy metals, or radiation.

FILTRATION MEDIA (SAND) CHARACTERISTICS

The HydrAid® BioSand filter is a simple but sophisticated filter media management system. The filter media consists of carefully engineered/prepared sand and gravel approved by Triple Quest. Not just any sand and gravel will do. Its type of material, size, shape, mix, and source are all relevant to filter performance.

Each of the HydrAid® BioSand filter pallets come with 3 layers of engineered sand and gravel media for each filter. The weight of the media is roughly 110 pounds, with the majority being the smallest media layer. The filtration media is engineered to particular specifications, quantity and quality standards. Together they regulate the water flow rate and the removal of pathogens. Failure to use and maintain the appropriate sand can severely impair the filters capacity to perform properly in the removal of pathogens.

HydrAid® BioSand filters that are purchased with sand/gravel originating in Michigan, USA are shipped with a three-layer system. A three-layer system is possible due to the highly engineered

nature of the sand that is used. If sand/gravel is obtained locally, compliance with HydrAid® BioSand filter standards is essential.

When obtained locally, a four-layer sand/gravel system is commonly used to simplify achieving the specified water flow rates. A variety of potential sand sources exist – crushed stone from quarries, mined upland sand, and mined river sand. Quarry sourced sand is preferred since there is less likelihood for contamination. Other sand sources may require special preparation and implementation. If you are interested in developing a local sand and gravel source please contact us at www.hydraid.org/contact - *Administration Contact*

FEATURES AND BENEFITS

- A sustainable safe water solution
- Excellent water quality that looks and tastes great
- Efficacy and sustainability has been scientifically proven by independent researchers
- High capacity – 47 liters /hour
- No moving parts or replacement parts required
- Easy to maintain
- Durable – life expectancy exceeds 10 years
- Lightweight – casing weighs just 8 pounds. Easy to transport and install
- Gravity operated – no electricity required
- Works on demand
- Easy to use by anyone
- Reduces water storage needs and potential for recontamination
- Sustainable
- Saves money – eliminates need for purchased water, reduces healthcare time and costs
- Benefits health, education, employment, poverty, and security

INSTALLATION

1. *Installation Items*

The following items are used for HydrAid® BioSand filter Installation:

A. Filter installation & maintenance instructions
B. Level – to level filter before filtration media (sand/gravel) installation
C. Wooden shims (variety) – to level filter on uneven surfaces
D. Funnel – to disinfect layer 1 & 2 gravel with bleach post installation
E. Ruler – to measure paused water depth and establish filtration media (sand) depth
F. 1-liter measuring container – to test filter flow rate and remove contaminated water as part of maintenance technique
G. 5-gallon buckets (x3 or 4) (not included) – for water and sand during installation
H. Watch with second hand / timer (not included) – to test filter flow rate
I. Chlorine (5.25% solution) without soap or phosphate additives (not included) – household bleach offers premixed convenience.
J. Flashlight (not included) – to see into filter in low light conditions
K. Spatula (not included) – for leveling filter media in filter (optional)

2. *Filter Kit Parts*

The following items are installed and left for household use:

A. Filter body
B. Diffuser plate
C. Cover
D. Zip strip with serial number (to attach cover to filter body)
E. Standpipe subassemblies (x2)
F. 1 bag of layer 1 gravel (green label bag)
G. 1 bag of layer 2 course sand (yellow label bag)
H. 2 bags of dry layer 3 fine sand (red label bag)
I. Chlorine dropper bottle – for post installation of gravel backwashing and post filtering disinfection of stored water
J. Clean water container with cover (obtained locally) – it is important that the clean water container is easily distinguishable from other containers to prevent recontamination of post filtered water

Note: It is important that sand/gravel complies with HydrAid® BioSand filter quality and quantity standards.. Filter media shipped from Michigan USA is a 3 layer system

3. *Filter Location Selection*

Location criteria:

A. Place in a safe clean indoor location preferably in the kitchen area.
B. Keep away from direct sunlight, wind, rain, freezing temperatures, heat sources, clutter, and animals.
C. Select a protected area in a corner or against a stable wall where the filter is convenient but not likely to be bumped or damaged.
D. Availability of a stable level surface upon which to place the filter.
E. Involve household recipients in selecting the filter location for acceptance, convenience, and permanence. Moving the filter after installation is strongly discouraged as improper use.

4. Filter Placement

Position the filter carefully:

A. The filter must be placed on a level and stable surface.
- On dirt floor – may need claw hammer to break up hard-packed floors.
- On concrete floor – may need to use wooden shims for leveling.
- Consider constructing a concrete or wooden platform.
- Avoid placing on elevated surfaces to prevent tipping and ease filling.

B. Level the filter with a contractor's level – check front to back and side to side.
C. Where possible, position standpipe assembly facing a wall with the flexible Outlet Tube turned in a convenient direction.

5. Filter Assembly

Standpipe Installation:

A. Place Filter Body on its side with outlet fitting pointed upward.

B. Thread the flexible plastic Outlet Tube sub-assembly fitting into Standpipe sub-assembly tee. Tighten by hand until snug.

C. Insert straight end of Standpipe Assembly under the Standpipe Hood that is molded into top rim of Filter Body directly above the outlet fitting.

D. Align elbow end of Standpipe Assembly with PVC fitting at bottom of Filter Body, then connect them firmly together by striking with your hand. Note: PVC fitting glue is generally not required due to extremely low water pressures in the Standpipe.

E. Attach Filter Cover to Filter Body using the plastic Zip Strip. Align square hole in cover with square hole in top rim of Filter Body. Thread Zip Strip through the square holes, and snap the ends together.

F. Set the assembled filter upright and pour in water to test for standpipe leaks. Fix leaks as necessary by gently tapping connections to seat them better. PVC glue can be used to stop stubborn leaks although it is rarely necessary. Leave water in filter for media installation.

Note: See Appendix for additional information about field assembly of Standpipes on earlier HydrAid® BioSand Filter models (Version 1 and 2).

6. Water Filtration Media (Sand & Gravel) Installation

Use only approved sand sources

Notes: See Trouble Shooting (Section 10) for additional information about adjusting flow rate. Always test flow rate with the diffuser plate in place and filled with water to capacity (top of the filter). Flow rate and paused water depth should be checked a day or two after installation, then rechecked 1 – 2 times over a period of 2-3 months for quality assurance and performance. Record findings and adjust as necessary. Also, reinforce operation and maintenance procedures with household.

7. Initial Sanitization (Optional)

A. Replace the diffuser plate and put cover back on the filter.

B. Pour one or more buckets of water through the Diffuser Plate / filter until the water flowing from the Plastic Outlet Tube runs clear.

C. Sanitize the filter by inserting a funnel into the up-turned Plastic Outlet Tube. Mix 1 liter (1000 ml) of clean water with 30ml (2 Tbsp) of chlorine solution (household bleach) and slowly pour all of it into the filter through the funnel. Let stand for 15 minutes while keeping the plastic tubing in its upright position. Return plastic tubing to its downward operating position and flush one or more buckets of water through the filter until the water flows clear and chlorine has been flushed out.

8. Verification

Verify proper installation by recording:

- Installation location, date, and name of installer(s).
- Filter is level.
- There are no leaks.
- Tested water flow rate – should be approximately 0.8 liters (800 ml)/ minute. Note that the water flow rate usually slows a little after a few days of operation and may need readjusting on follow-up. The sand may also compact after a few days requiring that additional sand be added to the filter to maintain the paused water depth at 5 cm (2 inches).

USE & MAINTENANCE

9. Biological Layer Formation

The filter's biological layer accounts for most of the filter's bacteria reduction capabilities. It can take up to 10 days for the biological layer to fully develop. During that

10 day period the filter's ability to remove bacteria in the water will steadily increase proportional to the biological layer development. Chlorination of post filtered water will destroy any remaining bacteria that are not destroyed by the filter during the startup period.

The Filter Media (sand) accounts for essentially all parasite removal. The filter effectively removes parasites immediately upon installation and provides significant water quality improvement.

Within 10 days after installation the filter will achieve optimal efficiency and effectiveness.

Chlorination of post filtered water is ALWAYS recommended during and after the startup period. Chlorination protects stored water from naturally occurring recontamination associated with water storage. A supply of chlorine and a dropper bottle should be provided to the recipient for use during the start-up period and a reasonable effort should be made to encourage continued routine chlorination after the startup period.

Scientific health impact studies have shown that the HydrAid® BioSand filter dramatically improves water quality and reduces the incidence of diarrhea by 60+% without additional interventions such as chlorination, hand washing, or other hygiene and sanitation measures. It is acknowledged that many, perhaps most, recipients will choose not to chlorinate their post filtered water due to chlorine availability, convenience, and taste preferences.

With or without chlorination, HydrAid® BioSand filter will dramatically improve water quality and will have a significant positive health impact.

The biological layer is protected by the paused water. The paused water is protected by the Diffuser Plate. The biological layer should not be allowed to dry out – doing so will destroy it. Once destroyed, it will take up to 10 days for it to redevelop.

If the biological layer does dry out for any reason, a special process needs to be followed. In such situations, water should not be added through the top of the filter. Doing so can cause air-pockets/air-locks to form in the filter thus reducing its performance. Instead, clean water should be added to the filter by pouring it through a funnel inserted into the upturned Plastic Outlet Tube. The water needs to be absorbed into the filter from the bottom up so that air in the sand layer can be forced up and out. The process can be slow so patience is required. Once the water level in the filter has been restored above the top of the sand, the remaining water can be poured into the top of the filter through the Diffuser Plate.

10. Water Quality Management

The HydrAid® BioSand filter is a reliable source of safe water. Its performance is optimized when:

- The filter is level
- The paused water depth is maintained at 5 cm (2 inches)

- The flow rate is 0.8 liters / minute or less
- Nothing other than fresh water is placed into the top of the filter
- Plastic Outlet Tube is allowed to breathe (no plugs, caps, or taps)
- An appropriate clean water container is used
- Post-filtered water storage time is minimized

Water that is retained in the filter overnight will generally be the *best* water. Thus the first 19 liters (5 gallons) could be set aside specifically for drinking purposes. The filter however is designed for continued use and high quality drinking water is continually produced.

Post filtered water will naturally become recontaminated over time if it is stored without adequate chlorination. This is normal for all water. The longer it is stored the greater the potential for recontamination.

If chlorination is not used, the potential for recontamination can be eliminated by drawing water from the filter into clean containers in "as needed quantities". The amount of water that is poured into the filter is equal to the amount that flows from it.

It is preferable to store pre-filtered source water rather than post-filtered water. Doing so offers two benefits:

- As pre-filtered source water is stored overnight sedimentation occurs – the water begins to visibly clear as suspended materials and microbes settle to the bottom of the container. The settling concentrates contaminants at the bottom and improves the quality of water above. The water can then be slowly poured out of the container leaving many contaminants behind. This process can dramatically improve the quality of the water before it is put into the filter. This process can be optimized using a three bucket sequential process over a period of three days and nights in situations of extreme water sedimentation. Sedimentation can be significantly accelerated by adding a small amount of an inexpensive flocculent such as alum to the water (e.g. 3-6 ml or ½ - 1 teaspoons / 5 gallons of water). Using these methods of sedimentation combined with drawing water from the filter in "as needed quantities" can enhance and protect water quality.
- As post filtered water is used in "as needed quantities" the necessity to store water diminishes as does the opportunity for recontamination. Smaller quantities of stored water are easier to protect than larger quantities.

All stored water, pre-filtered and post-filtered, should be covered to keep out bugs, insects, and debris.

Containers used for handling/storing contaminated source water (pre-filtered) and containers use for post-filtered water must be clearly differentiated by shape, size or color to prevent recontamination of filtered water. Containers must not be used interchangeably.

Post-filtered chlorination will ensure the highest quality of water and reduce the potential for storage-related contamination. **WARNING: Keep chlorine away from children!**

A. To chlorinate post-filtered water
   - Fill chlorine dropper bottle with 5.25% chlorine solution (i.e. household bleach) **Note**: Bleach is not available in all countries and solution strengths do vary.
   - Add 1 drop chlorine for each liter of filtered water. e.g. 20 drops of bleach (1ml) /20 liters (5 gal.) of water
   - Mix water well and wait 30 minutes before drinking
   - Keep clean water container covered to avoid contamination

B. Chlorinated water should have a slight chlorine odor. If it does not, repeat the process and wait 15 minutes.

C. Chlorine tablets also work well and should be used according to manufacturer's instructions.

> **NOTE**: Chlorine solutions (household bleach) can lose up to half of their strength when stored for just one year. Chlorine evaporation from treated water always means that treatment is temporary. Effectively chlorinated water will have a slight chlorine smell.

Water must be stored in a clean water container. The following criteria should be considered:

A. Approximately a 20 liters (5 gal.) size is ideal. Larger containers should be avoided due to weight related handling problems and safe storage considerations. **Note**: Water weighs about 1 kg / liter (8 pounds / gallon).
B. Secure cover for small opening to fill with post filtered water.
C. A handle for carrying convenience.
D. A spigot / faucet for sanitation and convenience (preferred if available).
E. Easily cleaned.
F. Used exclusively for filtered water purposes.

Refrigeration, where available, also helps protect post filtered water from recontamination.

11. ***Filter Maintenance*** – *Refresh Process*

Filter maintenance is simple. There are 4 maintenance processes – biological layer, filter outlet tube, diffuser plate and clean water container.

Biological layer – Maintenance illustrations are stamped on the inside of the filter cover. The need for maintenance is indicated by excessive slowing of the water flow rate due to the accumulation of captured material in the biological layer. Flow rate slowing is only an issue of convenience not water quality.

A. Remove filter cover leaving the Diffuser Plate in place.
B. Pour about 4 liters of water through the Diffuser Plate.
C. Remove Diffuser Plate.
D. *Vigorously stir water, just "brushing" the top half centimeter of the sand layer using spoon or spatula. Stirring the sand will cause captured materials to become suspended in the water. Note: Do not dig into the sand - it will cause the biological layer to become buried, potentially resulting in decreased filter performance, water discoloration, and odor.

E. Allow sand particles to settle for a few seconds, then scoop out most of the water and suspended sediment but do not disturb the sand layer.
F. Replace diffuser plate.
G. Repeat adding water, stirring and scooping (steps B – F) as necessary until an acceptable flow rate has been re-established.
H. Upon completion, the biological layer will have been cleaned, the flow rate will have been been re-established, and the filter will be ready to use.
I. Smooth sand layer and replace diffuser plate and filter cover.
J. If the above procedure does not restore normal flow rate, remove the top 5-10 cm (2-4 inches) of sand from filter and place in a bucket with water. (Do not use the clean water container). Agitate and wash the sand. Allow sand to settle for a few seconds, and then scoop or pour out most of the water and suspended sediment. Avoid removing sand. Repeat if necessary. Replace and level sand in filter. Adjust flow rate as necessary.

***Note 1:** This maintenance process should not be confused with "harrowing"which is incorrectly advocated by some organizations. Harrowing involves digging the hands/fingers into the sand layer. Harrowing will introduce captured biological material (biolayer) into the anaerobic sand environment and may cause odor, poor taste, or discoloration.

Note 2: Filter Media (sand) does not require replacement under normal use. Additional sand may need to be added over time due to normal settling and slow loss associated with biological layer maintenance – maintain a 5 cm (2 inch) paused water depth. If sand is added, it is recommended that the top 1-2 cm (1/2 - 1 inch) of sand/biolayer be removed before additional sand is added. Then the removed sand/biolayer should be redistributed on top of the freshly added sand. This will minimize potential for anaerobic decay of the biolayer and speed its recovery.

Outlet tube – The need for maintenance is indicated by growth of mold or algae in the outlet tube. This condition is most prevalent in hot humid climates. Periodic cleaning as needed is recommended.

A. Remove Plastic Outlet Tubing by gently pulling.
B. Soak tube in 1- 2 liters of water containing 15 ml (1TBSP) chlorine solution (bleach). Allow the chlorine solution to flow through the tube by tipping it back and forth.
C. Wipe the adapter outlet fitting clean with chlorine solution.
D. Rinse with filtered water and replace tube.

Diffuser plate – The need for maintenance is indicated by the accumulation of dirt, scum, or debris in the diffuser plate. Periodic cleaning as needed is recommended.

A. Remove filter Cover and Diffuser Plate.
B. Using clean wet cloth, wipe diffuser plate to remove debris. Note: Do not use chlorine. If further cleaning is necessary, use soapy water and rinse thoroughly before reinstalling diffuser plate.
C. Replace filter Cover.

Clean Water Container – The need for periodic maintenance is variable depending upon household conditions and use patterns. Weekly sanitizing is recommended. Post filtered water can be easily re-contaminated during storage. It is recommended that: filtered water is used immediately rather than stored, clean water containers are covered and used exclusively for clean water purposes, stored water is chlorinated, and the container is kept clean.

A. Fill clean water container with a solution of 2 liters post filtered water and 30 ml (2 Tbsp) chlorine solution (bleach). If chlorine solution is not available, hot soapy post filtered water can be used.
B. Using a clean cloth, thoroughly wash the inside and then the outside of clean water container with this solution.
C. Rinse thoroughly with clean post filtered water and air dry.

Note:

- Never use chlorine on the diffuser plate or in the paused water reservoir. It will damage the biological layer.
- Never plug, cap, or tap the outlet tube. It needs to breathe.

13. Moving and Decommissioning

The filter is not portable and is not intended to be moved after installation. However, if it must be moved short distances, keep the filter upright and level. Avoid jarring or dropping. The filter may be lifted by its upper rim. Alternatively, secure lifting straps can be placed under the filter to facilitate lifting and handling. When loaded with filter media and water the filter is heavy (about 61 kg or 135 pounds) and appropriate care should be taken to avoid personal injury and filter damage.

If jarring or vibration is anticipated while moving, the filter media should be removed and reinstall in the new location according to installation instructions. Removed filter media may not be able to be reinstalled do to the mixing of material and loss.

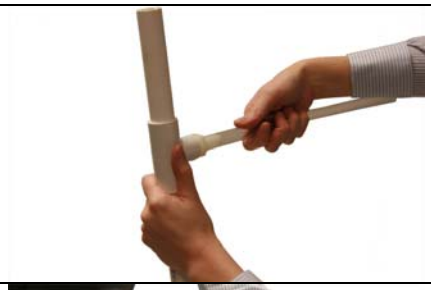
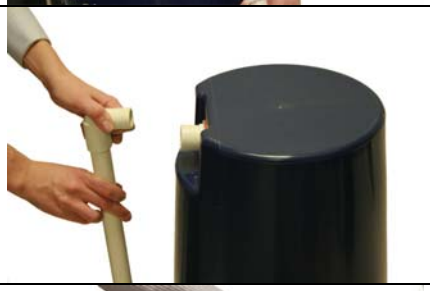
15. Water & Sanitation Training

The HydrAid® BioSand filter is the most critical element of a comprehensive water and sanitation program. Additional benefits will be gained by implementing HydrAid® BioSand filter within the context of a comprehensive hygiene and sanitation program. Additional information and comprehensive culturally sensitive training materials are available for free downloading at www.HydrAid.org/resources. Information about training classes is also available.

REFERENCE TOOLS

16. Assembly & Installation Guide – Quick Reference

	Work Element	Note
	Necessary equipment: Filter Body, Plumbing, Diffuser Plate, Lid, 19 liters(5 gallons) of water, 4 bags of sand: (one bag of level 1, one bag of level 2, two bags of level 3), 1 liter	

	measuring cup, ruler, level	
1	Choose an area indoors to place the filter. The area should be relatively level and be a permanent location. Once installed, the filter should NOT be moved. (Generally, the corner of the kitchen, not near a stove or hot surface is preferred)	Choose a permanent location
2	Remove the clear spout from the flat end of the Plumbing tube.	
3	Rotate the fitting of the clear spout into the side of the Plumbing tube.	
4	Place the flat end of the plumbing tube into the open area below the lip of the filter body.	
5	Turn the filter body upside down. Ensure there are no small particles such as sand in the plumbing tube. Firmly push the plumbing tube down until it is in line with the opening.	
6	Firmly push the curved end of the plumbing tube into the small round opening on the filter body.	
7	Return the filter to an upright position and fill with 1 gallon of water. This is an important step to ensure the sand stays in place during installation.	Fill with 1 gallon of water

8	Pour one bag of level one course gravel media (marked with a green label). Ensure the layer of gravel is level.	
9	Add 1 more gallon of water.	Add 1 more gallon of water
10	Pour one bag of the level two media (marked with a yellow label). Ensure this layer of gravel is level.	
11	Place the diffuser plate on the filter, add 3 gallons of water and then remove the diffuser plate	 Add 3 gallons of water
12	Fill the filter body with the remaining two bags of fine sand media rapidly in a sweeping motion. (It is important to do this fast to prevent sand stratification and filter plugging. Best if two people are available to pour in the sand simultaneously) Ensure the sand media is level	

13	Place the diffuser and the lid on the filter body.	
14	Put the blue zip tie through the openings on the lid and filter body to secure it and identify the filter.	
15	***Optional Flush***: Continue to pour water into the diffuser tray until the system runs clear (usually less than 5 gallons). ***Optional Depth Measure:*** When the filter is at rest (no water coming out of the filter). Remove the diffuser and measure the depth of water. There should be 2 inches of water above the sand. If depth of the water is less than 1 inch or more than 3 inches when the filter is resting, contact Triple Quest LLC at (616) 975-4844. ***Optional Disinfection***: Once water has run clear and it is at rest, Mix 1 liter of water with 2 Tablespoons of chlorine and pour mixture into the standpipe of the filter. Let the mixture stand in the filter piping for 1 minute and then release the standpipe and allow the mixture to flow out. You can put 1 gallon of water in the diffuser tray to help flush the chlorine out of the standpipe. ***Optional Flow Rate***: To ensure the flow rate is .8 L/min, replace the diffuser plate and fill the filter to the top. Put a 1 liter measure at the end of the filter to collect the water. Use a watch with a second hand to count out 60 seconds and capture the water for that entire time. At the end of 60 seconds, you should have captured .8 of a liter. If you capture .8 Liters or less, your filter is working properly. If you have collected more than .9 Liters, contact Triple Quest LLC at (616) 975-4844.	
16	Filter will immediately address reduction of parasites and	

	helminthes, but post-filter chlorination should be observed to address bacteria and viruses in the first two weeks while the BioLayer is developing or else water should not be consumed. ***Develop the BioLayer***: Biolayer is naturally forming and will take roughly 2 weeks to form. Continue to pour at least 5 gallons of water through the system every other day for 2 weeks. For these two weeks it is recommended to not drink the water that comes out or to chlorinate the post-filtered water.	
17	After 2 weeks, the biolayer should address 80-99.9% of bacterias and viruses with proper use. ***Pause Periods:*** We recommend the first water filtered in the morning to be set aside for drinking water since it has been shown that the filtered water is more effective the longer it pauses. ***Chlorination***: To attain WHO guidelines of Bacteria and Virus reduction, we recommend always disinfecting post filtered water with 3 drops of chlorine per gallon prior to consumption to assure the highest quality of water.	

14. Do's & Don'ts

Do's

A. Maintain water flow rate and paused water depth per recommended standards.
B. Keep filter cover on when not in use and keep filter clean.
C. Pour water slowly into the filter through the diffuser plate to keep out debris and avoid disruption of sand.
D. Consistently use two separate colored/shaped buckets: one to pour contaminated water into the top of the filter and another to collect filtered water from the filter.
E. Perform routine maintenance as needed.
F. Avoid moving the filter.
G. Include parents and children in filter use instruction to assure shared understanding and family reinforcement. All filter users should understand both the *how* and the *why* of filter use.

Note: See also FAQs #10

Don'ts

A. Add hoses, plugs, covers, or taps, to the outlet tube – filter ventilation is essential.
B. Add water with excessive amounts of suspended sediment.
C. Touch the plastic outlet tube unless cleaning it – keep animals and children away.
D. Place food in the diffuser plate.

E. Allow salt water, chorine, or soap to be put into the top of the filter since it will damage the filter.
F. Add unfiltered water into the outlet tube.

Note: See also FAQs #12

13. HydrAid® BioSand filter Trouble Shooting

Filter stability – Cause: Filter is not level or is unstable

A. Reposition filter and use wooden shims as necessary.
B. Floor strategies: Use claw hammer to break up and level the compacted surface then use sand or concrete pre-mix to create a level base.
   - Use dry sand to create a level even surface
   - Use dry concrete pre-mix and allow it to harden on its own over time by absorbing moisture from the ground and air.
   - Make a simple 30 cm square (12 inch) square frame of 5 x 5 cm (2”x2”) wood and pour a concrete pad
   - Place a precast concrete pad on a level sand base

Filter leaking – Cause: Loose standpipe fitting.

A. Prevent problems by carefully testing for leaks post filter assembly and before adding sand to filter.
   - Gently tap standpipe elbow into the filter’s PVC outlet fitting. If necessary, PVC glue may be used at this fitting. The standpipe assembly operates under extremely low water pressure, thus stubborn leaks are unlikely.

Water flow rate too slow (less than .5 liters / minute) – Cause: Filter congestion in the biological layer (after using filter) or too much Layer 3 fine sand (at time of installation).

A. If the filter has been in use, perform routine biological layer maintenance as illustrated on inside of filter cover and as described in the Filter Maintenance Section 9 of this handbook.
B. If the filter is being installed, perform the following procedure:
   - Pour water into the diffuser plate
   - Remove the diffuser plate
   - Stir the top 25 cm (10 inches) of sand attempting to suspend fine particles
   - Remove the water with suspended sand particles using a bowl, then retest flow rate.
   - Repeat this process a time of two if necessary.
   - If unsuccessful, remove most of the layer 3 sand from the filter, then wash the sand in a separate bucket(s) to remove a portion of the fine particles. Remove the water and reload the sand into the filter. Adjust superfine sand particles to regulate water flow rate.

Water flow rate too fast (more than .9 liters / minute) – Cause: Insufficient sand, sand not settled, or insufficient Layer 4 superfine sand particles mixed into Layer 3 filter media.

A. Assure a paused water depth of 5 cm (2 in).
B. Gentle c*ompaction* of the sand by rocking the filter slightly may facilitate *settling*.
C. Blend additional Layer 4 superfine sand into the top 10 – 15 cm (4-6 inches) of the sand layer.

Standpipe assembly too long – Cause: PVC fittings are not adequately seated

A. Reseat PVC joints with gently tapping. Do not cut PVC pipes shorter!

FREQUENTLY ASKED QUESTIONS

1. Can the HydrAid® BioSand filter kill all bacteria?

Typically, the filter removes more than 95% of the bacteria if it is installed correctly. The amount of bacteria that remains alive should not be sufficient to cause illness. Nevertheless, disinfection with chlorine is recommended to remove any remaining bacteria.

2. Can the HydrAid® BioSand filter remove parasites?

Yes, typically 100% of parasites are removed if the filter is installed and used correctly. It is important to note that the majority of parasites are highly resistant to disinfection with chlorine; therefore the best way to remove parasites from the water is to filter it.

3. Can the HydrAid® BioSand filter remove viruses?

Yes, many viruses are killed or deactivated through two mechanisms: sand filtering and post-filtering chlorination.

4. Can the HydrAid® BioSand filter remove earth or dirt in water?

Yes, the filter removes more than 95% of the dirt (solids or turbidity of water). It is designed to handle turbidity in the normal course of operation. Nevertheless, if the water is very dirty (more than 70-100 UOT units of turbidity) the filter will need to be cleaned more frequently. If the water is very dirty, it can be left to rest, allowing sediment to settle out and the waterto clear overnight. Also it is possible to prefilter water with a finely woven fabric (doubled several times) to remove the majority of the dirt before pouring the water into the filter.

5. Why should I add chlorine to the post filtered water? Isn't only filtering or only chlorination enough?

The filter removes the majority of the harmful bacteria in the water but not all of it. Without the addition of chlorine, people with deficient immune systems, especially young children under 5 years of age, could still become ill. While parasites have a high resistance to chlorine, filtering effectively removes them. Filtration and chlorination are complimentary. The addition of chlorine to the filtered water will kill remaining bacteria that survive the filter, but more importantly, will prevent the recontamination of stored water that routinely can occur during storage particularly in higher temperatures.

6. How do I add chlorine to the water?

The dirty water always must be filtered before adding chlorine. Put chlorine in the container where the clean water will be stored. It is recommended that sufficient chlorine be added to kill all the bacteria plus a little more to protect the water. It is difficult to calculate how much chlorine to add to the water because it depends on what is in the water and the concentration of the chlorine solution. Typically, it is recommended to add between 1 and 5 drops of chlorine to each liter of water and to leave it rest about 30 minutes before consuming. When a hardly detectable flavor and a scent are present, then sufficient chlorine has been added.

7. How do I find out if the turbidity of the water is less than 70 -100 UOT?

Fill a clear plastic bottle with 2 liters of water. Place the bottle on its side on a paper with written words. Look down from above through the water in the bottle. If you can read the words, the water is less than 70 - 100 UOT and can be poured directly into the filter. If the water is too dirty see Question #4.

8. Can the HydrAid® BioSand filter remove salt from seawater and industrial pesticides, polluting agents or other chemicals?

No, the HydrAid® BioSand filter does not remove the salt from seawater and salt water should never be put into the filter. It does not eliminate contaminates such as industrial pesticides, polluting agents, fluoride or heavy metals dissolved in the water. It is possible to make some modifications to the filter to help remove such contaminates. Such polluting agents and appropriate solutions can only be determined through testing.

9. What does a well-installed and well-maintained HydrAid® BioSand filter look like?

A. Location – Protected from the elements (dust and wind), birds, animals, mosquitoes and insects. It is preferable to install the filter inside.
B. Level – Placed on a flat surface – not inclined and without bumps.
C. Leaks – Free from leaks. Drops of water or wet areas beneath the filter indicate a leak.
D. Cover – Clean on the outside and inside. The cover fits well but is not sealed.
E. Diffuser – Clean.
F. Sand - Surface of the sand is flat and level at depth of 5 cm (2”) below water level.

10. What is the best way to use the filter?

G. Use the filter daily - this will maintain the level of water at 5 cm (2 inches) over the sand (measure when water is paused), and will keep the biological layer alive.
H. Make sure that the water comes from the best source. Always use the same source, if possible. If the water is very dirty, let the water rest / settle for 24 hours, and then filter it by using a finely woven fabric (doubled several times).
I. Slowly pour water from a container through the diffuser plate into the filter, but do not allow the sediment to follow. Reposition the cover immediately after adding water.

J. Make sure that the container in which the water will be stored is clean. Add 1 drop of chlorine solution (5.25%) to each liter of filtered water. For example, if the container holds 20 liters of water add 20 drops of chlorine.
K. When the filtration is finished, cover the filtered water container.
L. Repeat the process at least once each day.
M. Clean the outlet tube periodically.
N. Do not store food in the diffuser plate.
O. Keep animals and children away from the outlet tube and the filtered water.

11. Which water should I use?

The basic HydrAid® BioSand filter is suitable for water that is contaminated with microbes. It is not suitable for use with salt water. Water containing chemicals or heavy metals require supplemental technologies – contact HydrAid® BioSand filter for more information. Always use the cleanest water source possible and try to always use the same source, if possible.

12. Which are the most common errors made by new users of the HydrAid® BioSand filter?

A. Some new users want to add a tap to the Outlet Tube. That keeps the water level too high and prevents oxygen from reaching the biological layer.
B. Some new users perform the biological layer maintenance procedure too frequently – doing so reduces the effectiveness of the water treatment.
C. Some new users add chlorine to the water before filtering it instead of adding it to the container that receives the post filtered water. The addition of chlorine directly to the filter will kill the biological layer and will reduce the effectiveness of the filter.
D. Some new users do not let the dirt in the water settle before pouring the water into the filter.
E. Some new users do not use the best possible water source because it is not the source easiest to reach.
F. Some new users place the filter outside instead of inside. This increases the possibility of re-contamination of the filtered water.
G. Some new users keep food in the filter because it is cooler there.
H. Some new users do not use the filtered water to bathe, to wash their clothes, to cook, and to clean their countertops and utensils. They only use it to drink.
I. Some new users use a large spoon or jar to remove water from the storage container. This will cause re-contamination. The water must be poured directly from the storage container.

13. How can the biological layer be seen?

The biological layer is not visible. At most a little discoloration may be noted in the top surface of sand.

14. Can anything dissolve from the filter and contaminate the water (the plastic, sand, or the biological layer)?

No, the plastic, sand, and biological layer cannot contaminate the water. Sand originating from a river, stream, lake or upland source that is not prepared properly

before being installed, could contain contaminates. Additional information about the use of such sand may be found at www.HydrAid.org/resources.

15. How is the filtered water stored?

The water must be stored in a clean and covered/closed container from which the water can be removed by pouring or spigot – water should not be dipped from the container. The post filtered water should be disinfected with chlorine to prevent re-contamination while it is being stored. Water storage duration should be minimized to prevent re-contamination.

16. What should be done if the water is flowing very slowly?

Refer to *Filter Maintenance Instructions* (Section 9) and *Trouble Shooting* (Section 10) of this Handbook.

17. How often do I need to replace the sand?

The sand does not need to be replaced. It is cleaned using the biological layer maintenance process detailed in Section 9 Filter Maintenance of the Handbook.

18. How much water should remain over the sand?

When the water is paused (no water flowing out of the filter), there should be 5 cm (2 inches) of water above the sand. This allows for oxygen in the air to permeate the biological layer. If there is less than 5 cm, add a little water to compensate for evaporation. After adding the water, measure it again. If there is less than 5 cm, remove a little sand. If there is more than 5 cm a small amount of "approved" sand should be added. Use only "approved" sand – i.e. sand that complies with the *HydrAid® BioSand Filter Media Standards* included in this Handbook.

19. How many times per day may I put water through the filter?

The filter may be used continuously.

20. What do I do if my filter is dry?

This can happen if the filter is not used during a long period or if it has a leak. The water level must be re-established filling the filter though the Outlet Tube using a funnel. Doing so will allow the water to rise from the bottom and will avoid creating air pockets in the sand. This process is similar to disinfecting the outlet tube and gravel layer at the time of installation. Be sure to use filtered water. If filtered water cannot be used, it should first be disinfected with chlorine.

21. What do I do if my filter begins to smell or if the water becomes discolored or poor tasting?

This is usually an indication that there has been improper filter maintenance. Refer to Filter Maintenance (Section 9) in this Handbook to correct the problem. To prevent such problems perform routine filter maintenance.

The most common cause of such conditions is improper technique in cleaning the biological layer. Some organizations, have advocated a *deep cleaning* technique often

referred to as “harrowing”. The harrowing technique involves raking the fingers deeply into the top sand layer. The harrowing technique is not a method approved by HydrAid® BioSand filter or by Dr. David Manz, the inventor of the biosand technology.

Deep cleaning causes three problems. The first is temporary destruction of the biological layer after every cleaning – restoration can take up to 5-10 days during which time filter effectiveness is compromised. The second is water odor, discoloration, and poor taste. The third is eventual clogging of the filter requiring removal/cleaning of filter media or its replacement.

The biological layer consists of sand particles that have developed a biofilm on their surface. The biofilm is organic in nature and requires oxygen to survive. Deep cleaning (harrowing) will cause those sand particles that constitute a portion of the biological layer to be driven (relocated) deep below the sand surface where there is little or no oxygen when the filter is not producing filtered water. When there is water flow through the surface of the sand, water containing oxygen will keep the biofilm coated particles “alive”. When the flow of water is stopped, oxygen may penetrate the upper ½ cm or so of sand but not much deeper. If there is no organic matter below the surface of the sand, anaerobic conditions do not cause problems. However, if the particles with the biofilm are moved below the sand surface, the biofilm dies and anaerobic decomposition of the biofilm occurs. The filtered water may then develop an odor, taste poorly, or even become discolored. This problem will be aggravated if captured organic matter is also swept deep below the sand surface during cleaning – something very difficult to avoid when deep cleaning techniques are used.

APPENDIX

Overview of HydrAid® BioSand Filter Models

Production of the HydrAid® BioSand filter began in mid 2007. The filters are manufactured by a world-class company, Cascade Engineering of Grand Rapids Michigan, using state of the art injection molding techniques and premium materials. The HydrAid® BioSand filter is the product of exacting design, innovative engineering, manufacturing best practices, quality assurance, extensive worldwide field testing and research, and continuous process improvement. The result is a world-class product that provides reliable and sustainable performance even under the most extreme conditions. Safe water is produced, health is protected, and lives are saved.

HydrAid® BioSand filters are enhanced from time to time in response to ongoing research and development, field experience, and user feedback. Enhancements have addressed filter durability, installation simplification, cost reduction, and user convenience. The following illustrations summarize key enhancements across the various versions that have been produced.

Production began in 2007 with Version 1.0 – identifiable by the use of a ½" PVC Standpipe, the use of a union fitting at the bottom of the Standpipe, and a rigid ½" PVC outlet tube. Version 1.5 reinforced the filter's threaded outlet nipple for greater strength – visibly Version 1.0 and 1.5 look essentially identical.

HydrAid® Version 1.0/1.5

HydrAid® BioSand Filter Version 2.0 production began in early 2008. It incorporated the addition of a metal standpipe protective bracket at the base of the filter and a flexible outlet tube. The design better protected the standpipe assembly under extreme conditions and enhanced user convenience.

HydrAid® Version 2.0

HydrAid® BioSand Filter Version 3.0 was introduced in 2009. It entirely eliminated the threaded outlet nipple, the need to wrap threads with Teflon tape, the metal standpipe protective bracket, the union fittings, and the need for PVC glue. The design incorporated a "through-the-wall" factory installed PVC fitting assembly with silicon washer, the use of a robust 3/4" PVC standpipe, and low-pressure no-glue PVC fittings. The standpipe sub-assemblies were factory-assembled making field installation a simple *slip and snap* process that takes only seconds to complete. The flexible outlet tube remains a feature. Version 3.0 also incorporated graphic illustrations inside the Filter Lid that summarize biological layer maintenance and chlorination.

HydrAid® Version 3.0

Note: HydrAid® BioSand Filter Version 3.0 utilizes Spears PVC fittings (SCG 40 D2466) - www.spearsmfg.com. Unlike other PVC fittings, Spears fittings do not require gluing under most conditions due to the extremely low water pressures associated with the HydrAid® BioSand filter.

Hydraid® BioSand Filter Version 4.0 was also introduced in late 2009. It uses the same fitting as Version 3.0, but has a redesigned plastic body to remove the knit line at the base of the filter. The design is the most robust design to date and all filters purchased from Triple Quest or Cascade Engineering, Inc. will be Version 4.0.

HydrAid® BioSand filter Standpipe Field Assembly (required only for HydrAid® BioSand filter Versions 1.0, 1.5, and 2.0)

Stand Pipe Assembly

A. Position the filter body on its side or upside down on a level surface.
B. Tightly wrap Teflon tape clockwise three times around outlet nipple on filter body – start at edge of thread and work toward filter body overlapping tape slightly with each wrap. Press Teflon tape into thread with fingers.
C. Position metal bracket over outflow nipple with shelf portion of the bracket oriented toward the top of the filter.
D. Thread male portion of PVC union onto the outlet nipple on the filter body. Hand tighten so that union and metal bracket is snug – to avoid possible damage to outflow nipple, do not over tighten.
E. Tightly wrap Teflon tape clockwise three times around threads of PVC elbow. Start at edge of thread overlapping tape slightly with each wrap. Press Teflon tape into thread with fingers.
F. Thread PVC elbow into female portion of PVC union. Hand tighten – do not over tighten.
G. Insert the long PVC pipe into the PVC elbow/union assembly. Seat the PVC pipe assembly into the elbow/union assembly by firmly pressing the open end of the pipe assembly against a clean hard surface.
H. Insert the short PVC pipe into the PVC tee. Seat the PVC pipe assembly into the tee by firmly pressing the open end of the pipe assembly against a clean hard surface.
I. Join the long and short PVC pipes at the PVC tee, positioning the tee so its outlet will be oriented toward the front or back of the filter body when the PVC union is assembled. Seat the PVC pipe assembly into the tee by firmly pressing the open end of the pipe assembly against a clean hard surface. NOTE: *PVC glue is not necessary due to very low water pressures. The use of PVC glue may cause errors in adequate seating of fittings and prevent potential realignment of outlet tube.*
J. Thread plastic adapter into the open end of the PVC tee. Hand tighten – do not over tighten.
K. Insert plastic tubing over the barbed end of the plastic adapter.
L. Position the open end of the PVC pipe assembly under the protective cover that is molded into the top of the filter.
M. Snap the PVC elbow end of the pipe assembly into the metal bracket using hand pressure.

N. Align the two ends of the PVC union and assemble. Hand tighten – Do not over tighten.

O. Set the assembled filter upright and fill at least half full with water to test for standpipe leaks. Fix leaks as necessary by re-taping, reseating, or tightening. When water-tight, empty water.

Note: HydrAid® BioSand Filter Version 4.0 is shipped with two Standpipe sub-assemblies that do not require the following field assembly process.

HydrAid® BioSand filter Conversion Procedure – V1.0 - V2.0 to V3.0

V3.0 Conversion Kits can be purchased from HydrAid® BioSand filter.

1. Empty filter of all water and filter media.
2. Place filter body on its side with Outlet Nipple pointed upward.
3. Drill out nipple - drill all the way through the filter wall to create a 1-1/8" hole.

   Use an Irwin No. 9 high-speed self-starting Unibit 7/8" and 1-1/8" (see illustration). The bit requires a ½" drill chuck. The bit, manufactured by Irwin Industrial Tools, is available from lumber, hardware, and home improvement stores – cost is US $40 – $60.

   Purchase online at Amazon.com:
   http://www.amazon.com/exec/obidos/ASIN/B000EB88NG/ref=nosim/14883371-20

4. Install threaded through-wall PVC fittings (2) using silicon washer between internal fitting and filter wall. The ¾" female opening is external to the filter. Tighten till washer compresses slightly and water tight seal is achieved.
5. Assemble and install V3.0 standpipe assembly per HydrAid® BioSand filter Handbook instructions (download at www.HydrAid.org).
6. Test for leaks.
7. Install filter media.

END