Filta-Max

Operator's Guide

IDEXX

Proprietary rights notice

Contents

Introduction

The Filta-Max* Wash Station is used to filter raw and treated waters. When using higher turbidity waters, a pressure of 5 bars (75 psi) is recommended.

The Filta-Max system has been validated and approved in the U.S. for *Cryptosporidium* and *Giardia* sampling using the U.S. Environmental Protection Agency (EPA) 1623 equivalence method. In the UK, the Filta-Max system is included in the Standing Committee of Analysts (SCA) Blue Book: *The Microbiology of Drinking Water* (2010)-Part 14-Methods for the isolation, identification and enumeration of *Cryptosporidium* oocysts and *Giardia* cysts.

Safety

Please read this guide thoroughly before using the Filta-Max system.

We recommend that you perform your own safety assessments of the Filta-Max system and follow your in-house health and safety guidelines.

Make sure that the connections between the housing and the supply lines, or any monitoring equipment, are secure and capable of withstanding operating pressure.

CAUTION: When the wash station is not in use, return the handle to its lowest position. It may drop suddenly if left at its highest position.

Equipment, consumables, and reagents

The following additional equipment, consumables, and reagents are necessary for filter elution.

Equipment and consumables **not** supplied by IDEXX

Sampling pump that is suitable for use with the sampling fittings or a suitable sampling rig for use with a pressurized water supply

- 50 mL centrifuge tubes
- 1–5 mL pipette and disposable tips
- Membrane forceps
- Magnetic stirrer plate
- 10 L carboy/sampling container
- Waste receptacle
- Sampling pump
- Platinum cured tubing
- Magnetic follower
- Sampling rig
- Reagents
  - Phosphate-buffered saline (10 mM PBS)
  - Tween* 20
  - High-vacuum silicon lubricant
  - Reagent-grade water

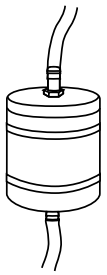
Equipment and consumables supplied by IDEXX

The following equipment and consumables are supplied by IDEXX:

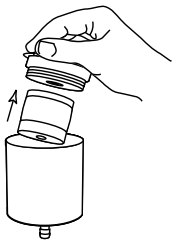
- Manual Wash Station Starter Kit (includes, manual wash station, vacuum set, quick connect tubing set, Filta-Max Housing, housing tools)
- Filta-Max Filter Modules
- Filta-Max Filter Membranes

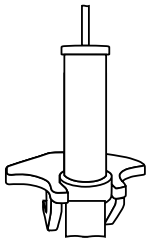
Process overview

1. Sample collection: Place the Filter Module in the Filter Housing and connect the Filter Housing to the required water source for sampling. Connect a suitable waste receptacle to the housing outlet.

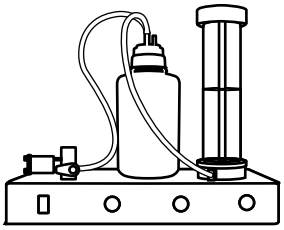


2. Elution: Remove the Filter Module from the housing and attach the Filter Module to the wash station plunger head. Wash the Filter Module with the elution buffer.

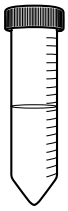




3. Concentration: Concentrate the wash buffer using a 3-μm membrane.



4. Repeat elution and concentration to give a final volume of 25 mL.



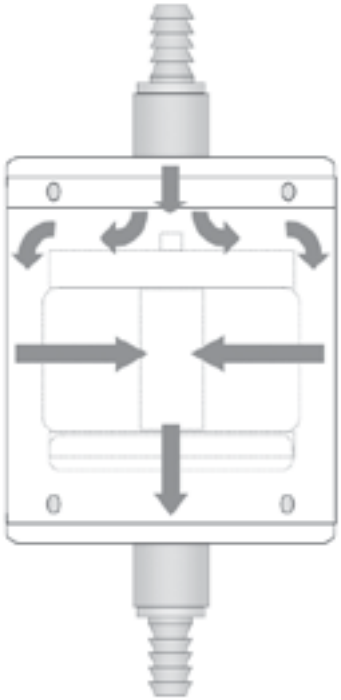
Sampling

Sample collection can be performed at the point of source or in the laboratory. IDEXX provides the equipment necessary to perform sample filtration using the Filta-Max Filter Modules, Filter Housings, and sampling fittings.

Set up the sampling equipment

1. To create a sampling inlet, connect the hose-tail fitting on the housing lid to a hose that is connected to the water supply or a pump.
   Note: A hose clip may be required to ensure that the seal between the hose and the sampling inlet is watertight.
   Note: If a pump (diaphragm, peristaltic, etc.) is used to sample water, it must be installed upstream of the Filter Housing.
2. Connect the hose-tail fitting on the body of the housing to a hose in order to create a sampling outlet.
   Note: A hose clip may be required to ensure that the seal between the hose and the sampling outlet is watertight.

Figure 1. Filter Module and housing orientation



Ensure adequate operating pressure

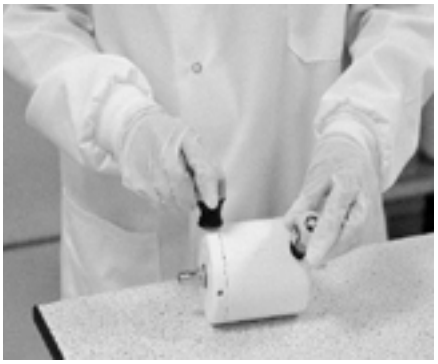
A head pressure of 0.5 bar (7.3 psig) is required to generate flow through the filter. The recommended operating pressure is 5.0 bar (72.5 psig), which should generate a flow of 1–2 liters per minute (LPM). The operating pressure should not exceed 8.0 bar (116 psig). Avoid pressure spikes where possible.

Assemble Filter Housing and collect sample

1. Place the Filter Module bolt-head down into the Filter Housing.

Note: The lid is always the inlet, regardless of the housing type. The Filter Module must be placed correctly within the Filter Housing to work effectively. Ensure that both small O-rings are in position before sampling.

2. Tighten the lid until the two numbered tag holes are aligned and a gap of approximately 0.5 mm is left between the lid and the base. To ensure the O-ring is correctly seated, tighten the lid 1/8 of a turn past this point and back to realign the tag holes.



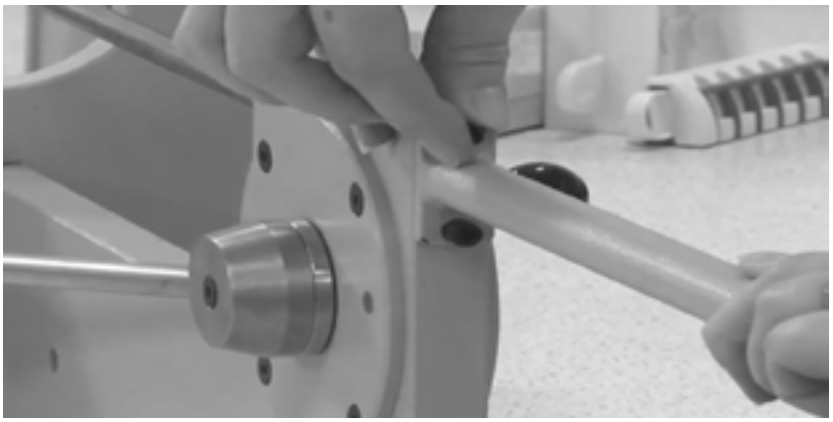
3. Turn on the water supply and restrict the flow to 1–2 LPM using a suitable flow restrictor located downstream of the Filter Housing.
4. When sampling is complete, turn off the water supply.
5. Disconnect the Filter Housing from the sampling setup and seal the hose-tail fittings using the stoppers provided.

Assembly of the wash station

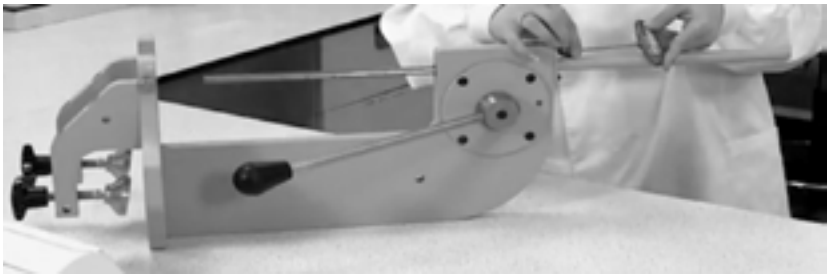
Attach the rack guard

The rack guard is supplied separately from the main body of the wash station.

1. Lay the wash station on its side.
2. Align the holes in the rack guard with those on the wash station, and attach the rack guard using the two hex-head bolts.



3. Tighten with an Allen key.



Secure the wash station

To prevent accidental injury, make sure the rack guard is secured to the wash station prior to operation.

Secure the wash station to the bench with the clamp set provided or by inserting bolts (not provided) in the predrilled holes of the wash station base.

Note: We recommend a work surface of between 2 cm and 3 cm with adequate room underneath the bench.

Quick connect tubing set, vacuum set, and other wash station components

Refer to the illustrations in figure 2 below as you follow the washing instructions in the next section.

Figure 2. Quick connect tubing set, splash guard, and plunger head

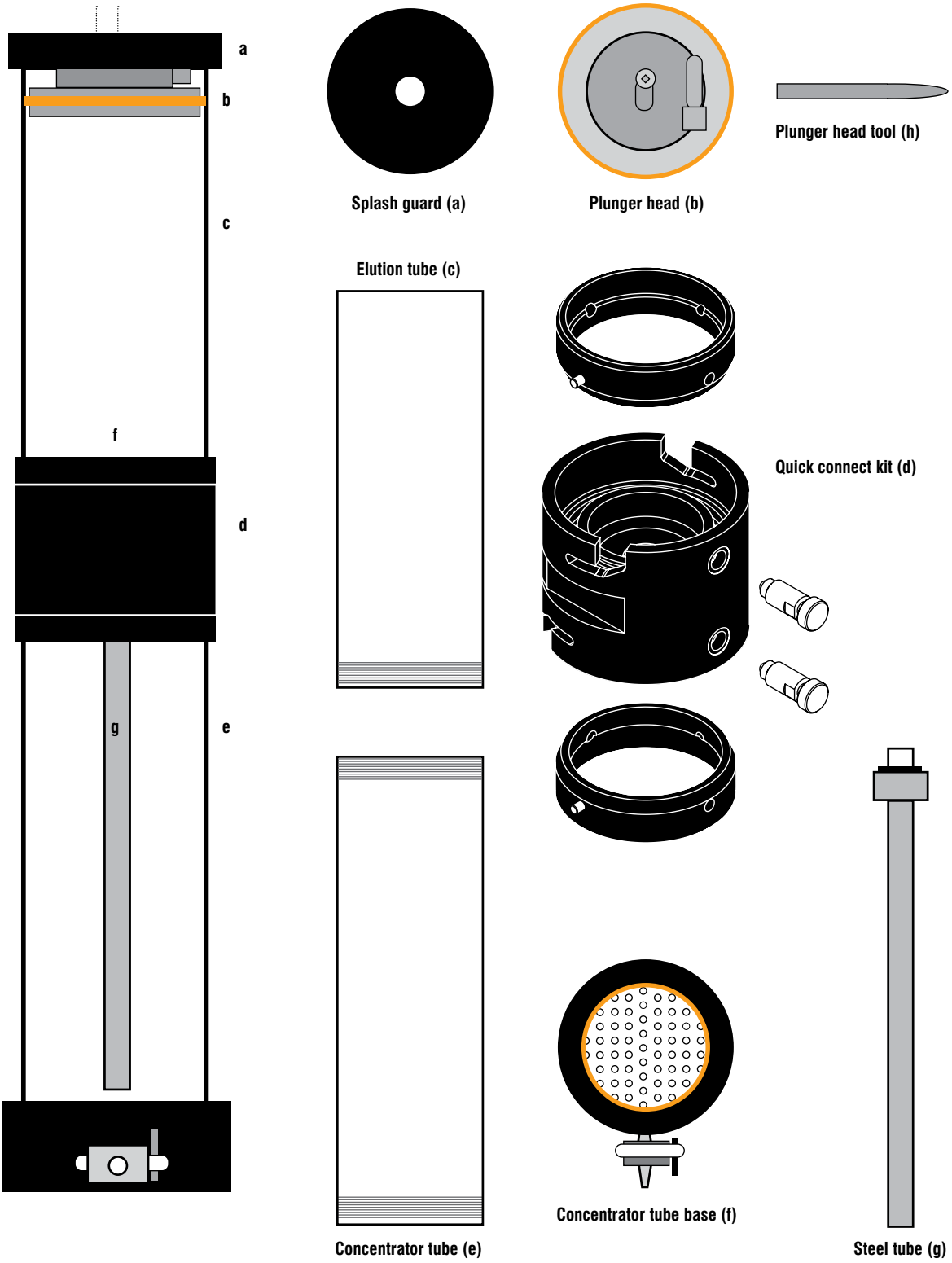
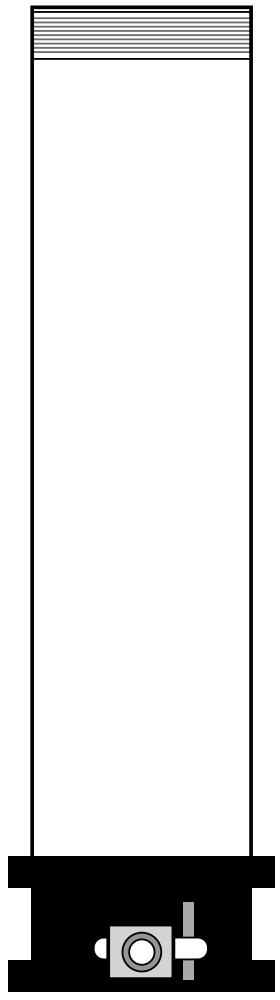
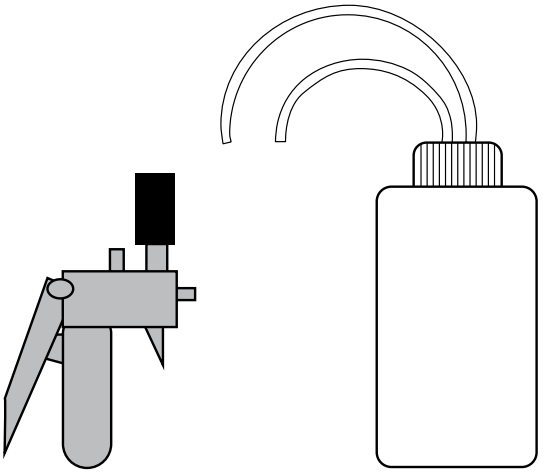


Figure 3. Assembled concentrator tube



Assembled concentrator tube (i)

Figure 4. Vacuum set

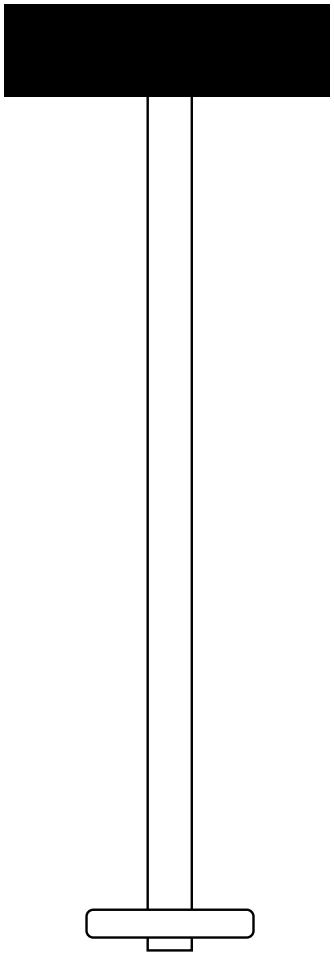


Hand pump (k)

Vacuum waste bottle (l)

Note: Be sure to attach the hand pump to the **shorter** tube.

Magnetic stirrer bar (j)



Elution

First wash

1. Ensure the splash guard is attached.
2. Attach the plunger head (b) and ensure that the plunger pin handle is fully locked down using the tool provided. Lock the plunger head into its highest position.
3. Lubricate the plunger head with a high-vacuum grease and check the O-ring for damage and replace if necessary.
4. Once the manual wash station is set up, ensure the porous support is in place within the concentrator tube base (f) and prewet with distilled water or PBST.
   Note: The phosphate buffered saline used within this method should contain Tween 20 at 0.01%.
5. Using forceps, place one 73 mm membrane flat with the rough side facing up onto the porous support.
6. Screw the concentrator tube (e) to the concentrator base (f). Use either the jaws of the wash station or housing holder to help form a tight seal around the membrane.
7. Open the Filter Housing or transportation container, rinse the lid with PBST and pour the liquid from the housing into the assembled concentrator tube (figure 3 [i]).
8. With the plunger head locked at its highest position, screw the Filter Module onto the plunger head (b).
9. Rinse the Filter Housing or container with distilled water or PBST, and add this rinse volume to the assembled concentrator tube (figure 3 [i]).
10. Add 600 mL of PBST to the assembled concentrator tube.
    Note: If the volume of sample collected from the Filter Housing or container is greater than 50 milliliters, reduce the amount of PBST accordingly.
11. Attach the elution tube (c) to the quick connect (d).
12. Slide the quick connect (d) and elution tube (c) into the jaws of the wash station.
13. Release the locking pin and lower the plunger handle down until the Filter Module sits at the bottom of the elution tube (c).
14. Unscrew the module bolt through the quick connect (d) using the Allen key.
    Note: You may need to apply some pressure on the handle while removing the bolt.
15. Attach the steel tube (g) to the underside of the quick connect (d).
16. Attach the assembled concentrator tube (i) to the underside of the quick connect (d).
17. Release the locking pin on the Wash Station. Wash the filter by moving the plunger fully up and down 20 times. To avoid generating excess foam, move the plunger very smoothly. Once complete, push the plunger handle back to lock into place.
18. Detach the assembled concentrator tube, hold it directly below the steel tube (g), and rinse the outside of the steel tube with PBST.
19. Expel the remaining liquid from the elution tube by compressing the foam five times. Once complete, push the plunger handle back to lock into place and insert a rubber stopper into the end of the steel tube to prevent any loss of sample.

First concentration

1. Stand the assembled concentrator tube (i) containing the concentrate on a magnetic stirring plate, attach the magnetic stirrer bar (j), and begin stirring.
2. Connect the vacuum waste bottle (l) and hand pump (k) to the tap on the concentrator base (f).
3. Open the tap.
4. Increase the vacuum using the hand pump (k) (You can also use a mains-driven pump.).
   Note: The force of the vacuum should not exceed 30 cm Hg.
5. Allow the liquid to drain until it is level with the follower, and then close the tap.
   Note: Do not drain away all liquid.
6. Detach the hand pump (k) from the tap, remove the magnetic stirrer (j), and rinse it over the assembled concentrator tube (i) with PBST to recover all target organisms.
7. Decant the concentrate from the assembled concentrator tube (i) into a 50 mL tube.
8. Rinse the inside of the assembled concentrator tube (i) with PBST and add the rinse to the 50 mL tube.

Repeat elution

Second wash

1. Add 600 mL of PBST to the assembled concentrator tube (i).
2. Remove the stopper from the end of the steel tube (g).
3. Attach the assembled concentrator tube (i) to the quick connect tube.
4. Wash the Filter Module by moving the plunger fully up and down 10 times. To avoid generating excess foam, move the plunger very smoothly.
5. Detach the assembled concentrator tube (i), hold it directly below the steel tube (g), and then rinse the steel tube with PBST.
6. Expel the remaining liquid from the elution tube (c) by compressing the foam discs five times.
7. Place the rubber stopper in the end of the stainless steel tube (g).

Second concentration

Note: For highly turbid waters, you can use more than one membrane. If you use additional membranes for the concentration step, place them into the concentrator base smooth side up.

1. Add the concentrate retained from the first wash to the 600 mL eluate from the second wash.
2. Stand the assembled concentrator tube (i) on a magnetic stirring plate, attach the magnetic stirrer bar (j), and begin stirring.
3. Connect the liquid trap bottle (l) and hand pump (k) to the tap on the concentrator base (f) and begin stirring.
4. Open the tap.
5. Increase the vacuum using the hand pump (k) (You can also use a mains-driven pump.).
   Note: The force of the vacuum should not exceed 30 cm Hg.
6. Allow the liquid to drain until it is level with the follower, and then close the tap.
7. Detach the hand pump (k) from the tap, remove the magnetic stirrer (j) and rinse it, over the assembled concentrator tube (i), with PBST to recover all (oo)cysts.
8. Decant the concentrate from the assembled concentrator tube (i) into a 50 mL tube (the same 50 mL tube used to retain the first concentrate can be used).
9. Rinse the inside of the assembled concentrator tube (i) with PBST and add the rinse to the same 50 mL tube used earlier.
10. Detach the concentrator tube (e) from the concentrator base (f).
    Note: If you have difficulty removing the concentrator tube (e), insert the concentrator base (f) into the jaws of the wash station
11. Add 5 mL of PBST to a membrane bag.
12. Using forceps, remove the membrane from the concentrator base and place into the bag, seal, and rub the surface of the membrane between your finger and thumb for 1 minute.
    Note: Do not rub too vigorously as this may cause a hole in the membrane.
13. Using a pipette, add the liquid from the membrane bag to the 50 mL tube containing the concentrated eluate.
14. Repeat using an additional 5 mL PBST, rubbing the membrane for another minute, and then pipette the liquid into the 50 mL tube containing the concentrated eluate.

Steps continue on next page

15. Cap the tube containing the eluate and centrifuge the tube for 15 minutes using this recommended centrifuge set up:

    Centrifuge requirements (e.g., Hettich Rotanta 460)

    - Swing-out rotor
    - Inserts and support cushions for 50 ml centrifuge tubes
    - Must be in good working order; bucket supports should be lightly greased

    Centrifuge setup

    - Locate centrifuge so as to minimise vibration
    - Balance tubes, buckets, supports, and lids with reagent water to a weight within 0.5 g of each other
    - Set RCF to 1500 × g
    - Set acceleration to maximum and deceleration to minimum
    - Set time to 15 minutes, excluding ramp-up time
16. Aspirate the supernatant to the 3 mL mark on the 50 mL tube.
17. Present samples to IMS as soon as possible.

For further information, refer to the Filta-Max training videos available at: idexx.com/en/water/water-products-services/filta-max; scroll down to *How to use*.

Maintenance and cleaning

Filta-Max components must be cleaned and maintained correctly to avoid contamination and to ensure longevity of the equipment.

Maintenance

- Check all rubber O-rings for wear or deterioration prior to each use—order replacement O-rings as required from IDEXX.
- Lubricate the plunger head O-ring inside and out with vacuum grease before each use.
- Lubricate all other O-rings (concentrator tube set, Filter Housing) regularly to preserve their condition.

Cleaning

You can clean all components of the Filta-Max system using warm water and laboratory detergent. After washing, rinse all components with reagent-grade (oo)cyst-free water and dry them. Relubricate all O-rings. Alternatively, you can use a mild (≤40°C) dishwasher cycle without bleach or rinse aid.

To wash the detachable plunger head:

1. Slide out the locking pin.
2. Using warm water and laboratory detergent, wash the plunger head and the locking pin.
3. Rinse the plunger head and the locking pin with reagent-grade water and dry them.
4. Lightly lubricate the locking pin and reassemble the plunger head.
5. Lubricate the plunger head O-ring inside and out.

Cleaning (US EPA 1623 compliant)

The following protocol complies with the procedure for detection/clarification of *Cryptosporidium* and *Giardia* using Filta-Max, as approved by U.S. EPA.

1. Dismantle the plunger head (see above), the Filter Housing, and the tubing sets.
2. Rinse all components thoroughly in tap water, and then immerse them in 6% w/v sodium hypochlorite solution for 30 minutes.
3. Remove all components from the sodium hypochlorite and rinse them thoroughly with tap water.
4. Using a bottle brush and hot, soapy water, wash all components, and then rinse them with tap water.
5. Rinse all components a final time with sterile reagent water.

WARNING—DO NOT AUTOCLAVE ANY FILTA-MAX COMPONENTS!

Exposure to high temperatures may cause the tubing sets to become opaque and deformed.

Storage and transportation

When storing or shipping Filter Modules, keep these points in mind:

- Filters should be processed within 24 hours of sampling.
- After sampling, filters should be refrigerated.
- The filter must be kept wet during storage.
- If stored or transported in the Filter Housing, the inlet and outlet should be securely plugged with the rubber stoppers provided.
- The Filter Module may be removed from the housing and aseptically placed in an airtight bag along with several milliliters of additional buffer or reagent grade water.

Appendix: Troubleshooting

Technical service contacts

North/South America: +1 207 556 4496 or +1 800 321 0207 • watertechnicalservice@idexx.com

Europe: +00800 4339 9111 • emeatechsupport@idexx.com

UK: +44 (0) 1638 676800 • emeatechsupport@idexx.com

China: +86 21 61279528

Japan: +81 422 71 5921

Australia: +1300 44 33 99

For countries not listed above, visit our website at **idexx.com/water**.

Common problems

Problem: No flow or reduced flow through the housing

Solution:

- Ensure that the pump is placed upstream of the filter. Blockage of the filter or housing is usually due to environmental material.
- Replace the filter.
  Note: Always vent back pressure before opening the housing.

Problem: Difficulty in moving the wash station plunger

Solution:

- Raise the plunger head and lubricate the O-ring and the groove in which it sits.
- Remove the rubber stopper from the steel tube.

Problem: The plunger head becomes detached from the rack

Solution: Ensure that the plunger head is seated correctly on the rack and that the locking handle is fully depressed. Ensure that the screw at the top of the plunger head is tightened securely.
Note: If problems persist or you are unsure of which action to take, contact IDEXX Technical Service.

Problem: How can washed foam discs be contained when the plunger head has been raised?

Solution: Place a disposal bag over the end of the tube as you raise the plunger head. The tubing set can then be inverted to discard the foams.

Problem: How do I prevent the membrane from lifting during the concentration step?

Solution: The membrane must be clamped tightly by the tubing. Placing the concentrator base in the jaws of the wash stand while tightening the tube will help, as will regularly lubricating the O-ring and threads.

Problem: Why do some Filter Module foams only expand very slightly?

Solution: There are two probable causes:

- Time lapse between collection and processing exceeds 24 hours.
- Certain particulates in water can affect foam expansion. This issue may be worse with high-volume samples.

Frequently asked questions

Question: What level of foam expansion is needed for efficient recovery?

Answer: We have found that even if only minimal expansion is observed, full recovery of captured oocysts and cysts can be achieved. Removal of the bolt allows sufficient minimal expansion to occur.

Question: What diameter are the inlet and outlet connections on the Filta-Max housings?

Answer: The inlet and outlet housings each has a diameter of 0.46 inches (11.7 mm).

Further reading

- Bukhari Z. (2000) Method 1623: Validation of Genera technologies Filta-Max foam filters and 50 L sample volumes under the US EPA performance based measurements system. Clancy Environmental Consultants, Inc. P.O. Box 314, St Albans, VT 05478, USA.
- US EPA Office of Water. (1999) US EPA Method 1623: *Cryptosporidium* and *Giardia* in water by filtration/IMS/FA. US EPA Office of Water, Washington, DC 20460. April 1999. EPA-821-R-99-006.(epa.gov/nerlcwww).
- US EPA Office of Water. (1999) US EPA Method 1622: *Cryptosporidium* in water by filtration/IMS/FA. US EPA Office of Water, Washington, DC 20460. January 1999. EPA-821-R-99-001. (epa.gov/nerlcwww).
- Sartory DP, Parton A and Parton AC. (1998) Recovery of *Cryptosporidium* oocysts from small and large volume water samples using a compressed foam filter system. Letters in Applied Microbiology. 27, 318–322.
- Parton A, Mendez F and Sartory D P. (1997) Evaluation of a novel filter for the rapid capture and concentration of *Cryptosporidium* oocysts from drinking waters. Proceedings of the 2nd UK Symposium on Health Related Water Microbiology, International Association on Water Quality, Warwick, UK, 1997. 185–191.