

TECH REPORT

200:

Use of Water Traps and Drying Filter with the FX-5000™ Tension System

Document: Water Trap and Drying Filter Tech Report, Rev. 8.0

05-12-17

Culturing Cells in a Mechanically Active Environment™
Flexcell International Corporation • 2730 Tucker Street, Suite 200 • Burlington, NC 27215
800-728-3714 • (919) 732-1591 • FAX: (919) 732-5196 • www.flexcellint.com

COPYRIGHT © 2009 FLEXCELL® INTERNATIONAL CORPORATION



WATER TRAPS

PURPOSE

The water trap provided with the FX-5000™ Tension System is used to remove moisture from air that cycles through the *FLEX IN* and *FLEX OUT* vacuum lines. On any given cycle, the FX5K™ Tension FlexLink® may draw air from the incubator through small leaks in the BioFlex® baseplate gaskets. As the incubator air is at a very high humidity, this can result in moisture accumulation in the *FLEX IN* and *FLEX OUT* tubing. The water traps collect water and effectively dry the air before it passes into the FlexLink®, and subsequently into the valves and transducers inside the equipment. They also serve to collect any condensed water that may have otherwise entered into the unit.

COMPONENTS

The water traps consist of an inline filter with a collection bulb enclosed in a black protective metal body (Fig. 1). The filter removes moisture from the air and allows dry air to pass through to the FlexLink®. Removed moisture condenses and collects in the bulb below.



Figure 1. Water trap

SPECIFICATIONS

<i>Fitting Size</i>	¼" NPT (fittings supplied)
<i>Max Airflow Rate</i>	53 CFM (1500 L/min)
<i>Max Pressure</i>	150 psi (1 MPa)
<i>Max Temperature</i>	125°F (51°C)
<i>Collection Bulb Volume</i>	2.2 oz (65 mL)
<i>Bulb Material</i>	Polycarbonate with guard
<i>Height</i>	6.58 in (16.7 cm)
<i>Width</i>	1.97 in (5 cm)
<i>Weight</i>	1.25 lb (0.57 kg)

ASSEMBLY NOTES

The water traps come fully assembled with an inline connector fitting on each side. After the system is fully assembled, the water traps will need to be connected inline with the *FLEX IN* and *FLEX OUT* tubing (Fig. 2) about halfway between the BioFlex® baseplate and FlexLink®).



Figure 2. Water trap in line with Flex In tubing.

The water traps should be mounted to a solid surface using screws or cable ties, in a vertical position to assure that water will drain to the bottom of the bulb. The water traps should also be mounted in a position



lower than that of the FlexLink®. This will force all condensed water to drain down into the bulb. When mounting, leave enough room underneath the bulb of each water trap to allow water collection through the valve at the bottom. The airflow direction required for the water traps should also be taken into consideration when mounting. Each water trap will have two stickers on top indicating which side should connect to the tubing that leads to the baseplate (BPLT, see Fig. 3), and which side should connect to the tubing that leads to the FlexLink® (CTRL, see Fig. 3). Use the stickers as indicators when connecting the trap inline. Before connecting the water traps inline with the *FLEX IN* and *FLEX OUT* tubing, set up the entire FX-5000™ Tension system. Locate a convenient position to mount the traps according to the described conditions above. Cut the *FLEX IN* and *FLEX OUT* tubing at this point and connect the tubing to the two side ports of each water trap. The water traps are now ready for use with the FX-5000™ Tension System.



Figure 3. Stickers on top of the water trap indicate which side should connect to the baseplate (BPLT) and FlexLink® controller (CTRL).

MAINTENANCE NOTES

During normal use, some water may collect in the bulb of the water traps. The amount of water that collects in the water traps will vary depending on how well the BioFlex® baseplate and gaskets are sealed in the incubator. An almost perfect seal will produce minimal water in the water traps. To improve the seal, vacuum or silicone grease can be used on the gaskets, and a lead weight and the Plexiglas® window provided with the system can be used on top. Over time, the gaskets will become more flexible, and the seal will improve. The water traps should be monitored hourly during initial use of the system to determine how much water accumulates over a given time period. This will allow the user to predict how often the traps should be emptied in future experiments. Once the water traps are nearly filled with water, the FX-5000™ Tension system should be paused or stopped in order to empty the water traps. *Normal use with a good baseplate seal will not require the stop of experiments in order to empty the water traps.* To empty the water traps, place a cup or other collection container underneath and turn the valve at the bottom of the water traps bulb. This will allow the water to drain out. Once the water is drained, close the valve on the bottom of the water traps.

REPLACEABLE ITEMS

The water traps provided with the FX-5000™ Tension System should function properly throughout the lifetime of the system. Should any moisture be noticed passing through the water traps and condensing in the tubing on the FlexLink® side of the water traps, a replacement filter may be needed. Contact Flexcell® to order a replacement filter.



DRYING FILTER

PURPOSE

The drying filter is provided to remove moisture from the FX5K™ Tension FlexLink® System should any moisture have bypassed the water trap. This filter is necessary when water appears to have reached the internal components of the FlexLink® by way of the *FLEX IN* or *FLEX OUT* tubing. The drying filter should also be used on a regular basis to perform preventative maintenance on the FX5K™ Tension FlexLink®. For regular maintenance, Flexcell® recommends running the drying regimen after each experiment with a 24 hour or longer duration. The drying filter functions by pulling air through desiccant beads and subsequently through the FlexLink® valves and transducer tubing. The desiccant beads absorb the moisture out of the air, drying the tubing and valves.

COMPONENTS

The drying filter consists of a small glass bulb in a plastic housing with desiccant beads (Fig. 4). The drying filter comes fully assembled with two fittings and lengths of tubing to connect to the *FLEX IN* and *FLEX OUT* ports of the FlexLink® unit. The fittings include red locking clips to keep the tubing connected.

SPECIFICATIONS

<i>Fitting Size</i>	1/4" NPT female outlet with male inlet (fittings supplied)
<i>Max Pressure</i>	90 psi (0.62 MPa)
<i>Dimensions</i>	3 3/4 in x 1 11/16 in diameter (9.5 cm x 4.3 cm)
<i>Dimensions with fittings</i>	6 1/4 in x 1 11/16 in diameter (15.9 cm x 4.3 cm)
<i>Weight</i>	0.4 lbs (0.18 kg)



Figure 4. Drying filter with fittings and tubing.

ASSEMBLY NOTES

To connect the drying filter to the FlexLink® (Fig. 5), first remove the *FLEX IN* and *FLEX OUT* tubing from the back of the FlexLink®. Connect the blue polyethylene 1/4" OD tubing from the drying filter to the *FLEX IN* port on the back of the FlexLink®. Connect the blue polyethylene 3/8" OD tubing from the drying filter to the *FLEX OUT* port on the back of the FlexLink®. The drying filter is now ready for use with the FX-5000™ Tension System.



Figure 5. Setup of a drying filter inline with the FX-5000™ Tension System.

RUNNING THE FX-5000™ TENSION SYSTEM WITH THE DRYING FILTER CONNECTED

With the drying filter connected, open the FX-5000™ software. In the **Regimen** menu of the main window display, select **Assign**. Choose the *BioFlex Plate, no Loading Stations* platform assignment, the *Shutdown* username, and the regimen entitled *Drying*. Once the regimen is assigned, press **Start**. Be sure that the vacuum source is turned ON. The sound of air cycling through the drying filter can be heard. Once the regimen is complete, the drying filter should be removed and replaced with the *FLEX IN* and *FLEX OUT* tubing from the BioFlex® baseplate. The drying regimen should have the following parameters:

<i>Shape</i>	½ sine
<i>Min</i>	1.0
<i>Max</i>	10.0
<i>Freq.</i>	2.0
<i>DC%</i>	50.0
<i>Cycles</i>	14400
<i>Duration</i>	0:02:00:00

If it is believed that a significant amount of water may have entered into the FlexLink®, a longer drying regimen may be programmed into the software. To do so, simply modify the time in the default regimen *Drying*. In many cases, if a large amount of water has entered into the FlexLink®, the unit will need to be shipped to Flexcell® for repair.

**MAINTENANCE NOTES:
REGENERATING SILICA DESICCANT BEADS IN THE FX-5000™ DRYING FILTER**

After several drying regimen runs, the silica desiccant beads inside the drying filter will become saturated and turn from blue to pink (Fig. 6). This change in color indicates that the beads require regeneration to remove the moisture. To regenerate the beads, they will need to be removed from the drying filter and heated in an oven.



Figure 6. Drying filter ready for use (left) and saturated drying filter (right).

To remove the desiccant beads:

1. Open the drying filter.
 - a. Use an 11/16” wrench to remove the bottom tubing connector from the drying filter. Use a 9/16” wrench to hold the black fitting on the drying filter in place while removing the silver tubing fitting (Fig. 7).

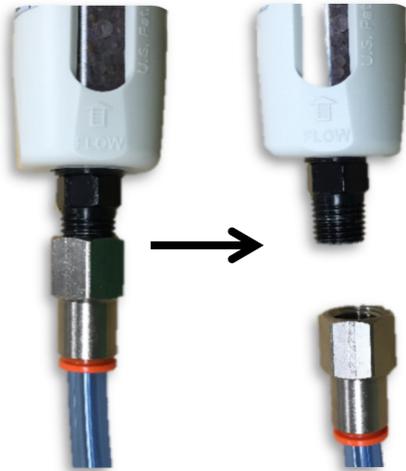


Figure 7. Remove tubing connector.

- b. Pinch the plastic housing on the two marked locations and slide the housing off the glass body (Fig. 8).



Figure 8. Remove plastic housing.

- c. Hold the drying filter upright and unscrew the top black housing from the glass body. Use a $\frac{9}{16}$ " wrench to hold the bottom black fitting in place.
- d. Remove the top black housing, rubber O-ring, and fabric O-ring from the glass body (Fig. 9).

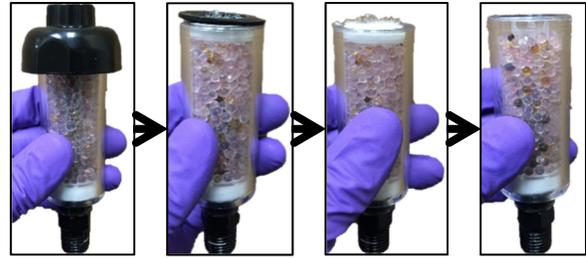


Figure 9. Remove top casing, rubber O-ring, and fabric O-ring.

- 2. Dry the silica desiccant beads.
 - a. Pour out the desiccant beads into a glass container.
 - b. Place the glass container in a drying oven (Fig. 10a).
 - c. *Optional: If a vacuum oven is available, apply a vacuum up to -29 in Hg (-100 kPa; Fig. 10b).*

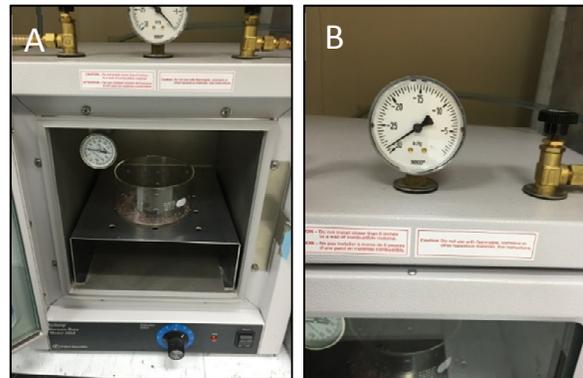


Figure 10. A) Saturated desiccant beads in drying oven. B) Drying oven with vacuum set to -29 in Hg.

- d. Set the temperature to 100-120 °C and turn on the oven.
- e. Leave the container in the oven for 1-2 hours, or until the beads have turned blue (Fig. 11). With vacuum applied, drying should only take 15-30 minutes.
- f. Turn off the oven. If vacuum was applied, vent the oven to atmospheric pressure.
- g. Allow glass container to cool, but do not wait too long or the desiccant



beads will absorb atmospheric moisture.

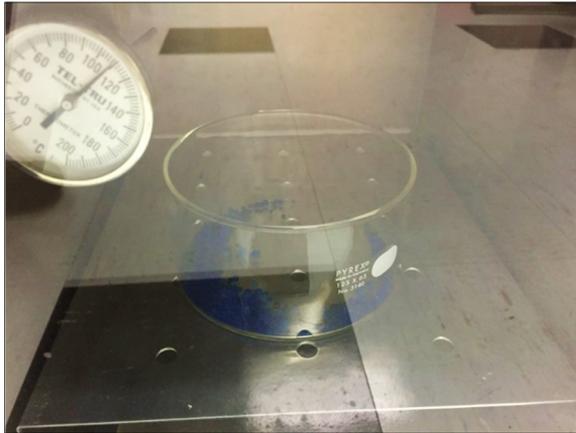


Figure 11. Fully regenerated desiccant beads in oven.

3. Return desiccant beads to the drying filter.
 - a. If necessary, transfer the desiccant beads to a smaller container to facilitate pouring the beads back into the drying filter.
 - b. When pouring the beads into the filter, block the central opening to prevent the beads from entering this section (Fig. 12).

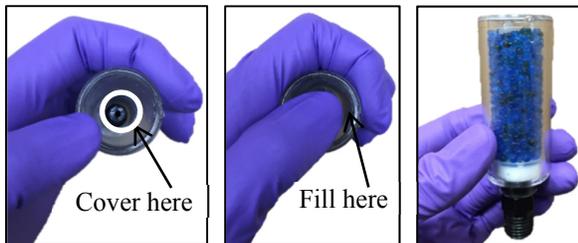


Figure 12. Cover center opening and fill regenerated desiccant beads in outer chamber.

4. Re-assembly drying filter (Fig. 13):
 - a. Place the fabric O-ring around the central opening and rest it on top of the desiccant beads.
 - b. Place the rubber O-ring on the perimeter of the glass body.
 - c. Attach the top black housing and tighten by hand. Use a 9/16" wrench to hold the bottom black fitting in place.
 - d. Slide the plastic housing around the glass body and pinch to fit the tabs under the top black housing.
 - e. Screw the bottom tubing fitting onto the bottom black fitting. Use a 9/16" wrench to hold the bottom black fitting and a 11/16" wrench to tighten the tubing fitting.
5. The drying filter is now ready for use with the FX-5000™.

REPLACEABLE ITEMS

The drying filter can be replaced at a reasonable expense. Regular maintenance of the FX-5000™ Tension System is important to maintain longevity. Contact Flexcell® for information on purchasing a replacement drying filter.

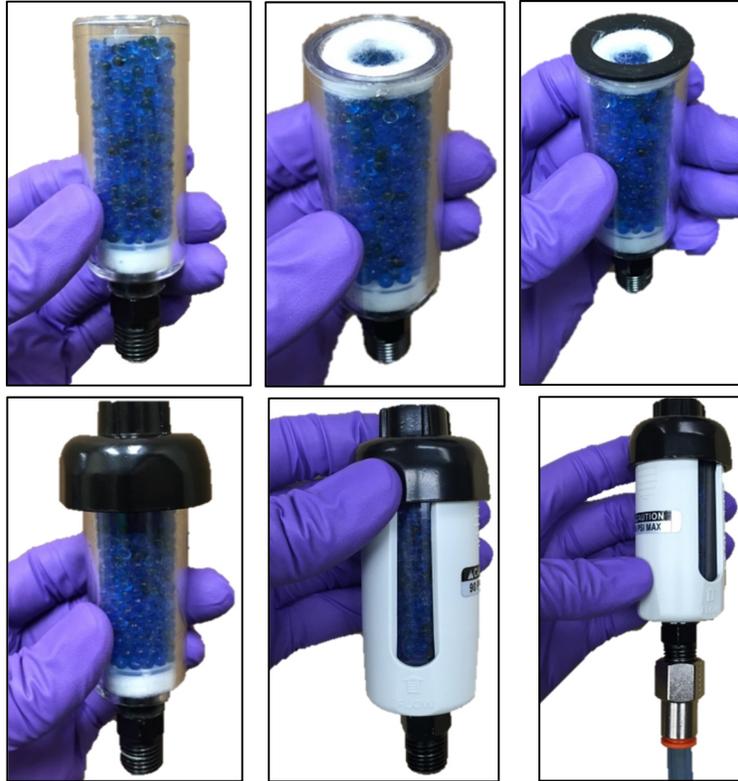


Figure 13. Re-assembly of drying filter.