TECH REPORT

200:

Use of Water Trap and Drying Filter with the Flexcell® Tension Systems

Document: Use of Water Trap and Drying Filter with the Flexcell® Tension Systems Tech Report, Rev. 1.0

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Culturing Cells in a Mechanically Active Environment™
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WATER TRAP

PURPOSE

The water trap provided with the Flexcell® Tension Systems is used to remove accumulated moisture from the *FLEX OUT* tubing line. While at rest or during static regimens, the 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 OUT* tubing. The water trap collects liquid water before it passes into the FlexLink®, and subsequently into the valves and transducers inside the equipment.

COMPONENTS

The water trap consists of an inline filter with a collection bulb enclosed in a black protective metal body (Fig. 1). The filter collects condensed moisture from the baseplate before it can pass through to the FlexLink®. Removed moisture collects in the bulb below and should be drained regularly when there is visible water.

Figure 1. *Water trap*

SPECIFICATIONS

Fitting Size	¼" NPT (fittings supplied)
Max Airflow Rate	55 CFM (1557 L/min)
Max Pressure	250 psi (1.7 MPa)
Max Temperature	125°F (51°C)
Collection Bulb Volume	2.2 oz (65 mL)
Bulb Material	Metal with Sight Gauge
Height	6.58 in (16.7 cm)
Width	1.97 in (5 cm)
Weight	1.25 lbs. (0.57 kg)

ASSEMBLY NOTES

The water trap comes fully assembled with a tubing connection fitting on each side. After the system is fully assembled, the water trap will need to be connected in-line with the *FLEX OUT* tubing (Fig. 2) about halfway between the BioFlex® baseplate and FlexLink®.

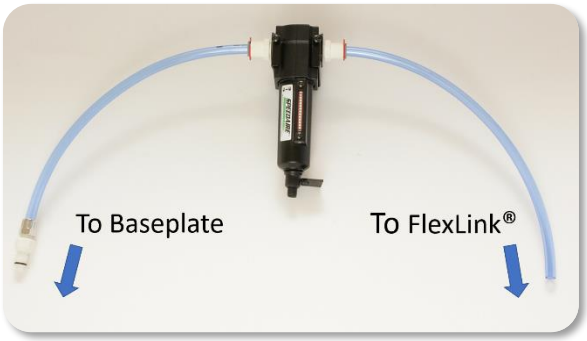

Figure 2. *Water trap with FLEX OUT tubing.*

The water trap 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 trap 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 the water trap to allow water collection through the drain valve at the bottom. The airflow direction required for the water trap should also be taken into consideration when mounting. The water trap will have two stickers on top indicating which side should connect to the tubing that leads to the baseplate (BPLT) and which side should connect to the tubing that leads to the FlexLink® (CTRL), see Figure 3. Use the stickers as indicators when connecting the water trap. Before connecting the water trap in-line with the *FLEX OUT* tubing, set up the entire Tension System. Locate a convenient position to mount the water trap according to the described conditions above. Cut the *FLEX OUT* tubing at this point and connect the tubing to the two side ports of the water trap. The water trap is now ready for use with the 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 trap. The amount of water that collects in the water trap 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 trap. To improve the seal, vacuum or silicone grease can be used on the gaskets, and additional weights on 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 trap should be monitored hourly during initial use of the system to determine how much water accumulates over a given period of time. This will allow the user to predict how often the water trap should be emptied in future experiments. If the water trap is nearly filled with water, the Tension System should be paused or stopped in order to empty the water trap. *Normal use with a good baseplate seal will not require the stop of experiments in order to empty the water trap.* To empty the water trap, place a cup or other collection container underneath the drain valve and turn the valve at the bottom of the water trap bulb. This will allow the water to drain out. Once the water is drained, close the valve on the bottom of the water trap.

REPLACEABLE ITEMS

The water trap provided with the Tension System should function properly throughout the lifetime of the system. Should any moisture be noticed passing through the water trap and condensing in the tubing on the FlexLink® side of the water trap, 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 Tension FlexLink® System. This filter must be used whenever the moisture indicator has visible signs of moisture accumulation (see Fig. 4). 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. Once the desiccant beads have turned pink, they will need to be regenerated for effective drying. Allow the drying regimen to run for the entire 4-hour duration for best results. When scheduling allows, the drying regimen should be run in between every experiment. If an experiment runs for more than 24 hours, the drying regimen should be run more than once. A general recommendation is to run the entire drying regimen one time for every day that an experiment has continuously run. Therefore, if an experiment is run for 72 hours (3 days), at the end of the experiment the drying regimen should be run three times (12 hours). If there is still moisture visible in the moisture indicator tubing, the drying regimen should be repeated until there is no visible moisture.

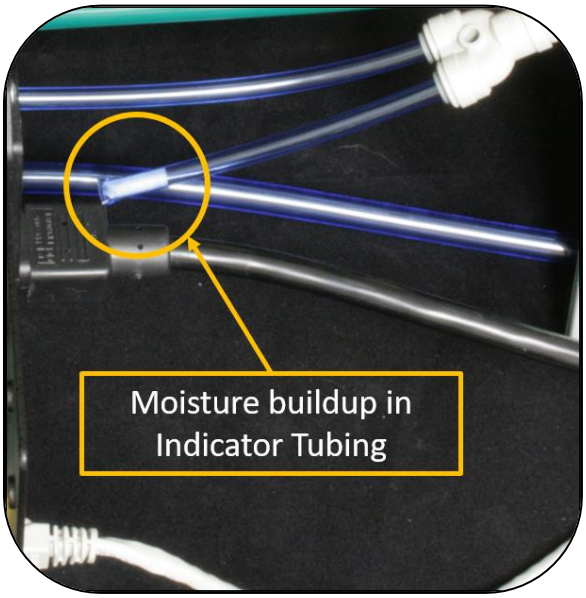

Figure 4 - *FLEX IN moisture indicator tubing with visible moisture accumulation*

COMPONENTS

The drying filter consists of a small glass bulb in a plastic housing with desiccant beads (Fig. 5). 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

Fitting Size	¼" NPT female outlet with male inlet (fittings supplied)
Max Pressure	90 psi (0.62 MPa)
Dimensions	3 ¾ in x 1 $^{11}/_{16}$ in diameter (9.5 cm x 4.3 cm)
Dimensions with fittings	6 ¼ in x 1 $^{11}/_{16}$ in diameter (15.9 cm x 4.3 cm)
Weight	0.4 lbs. (0.18 kg)

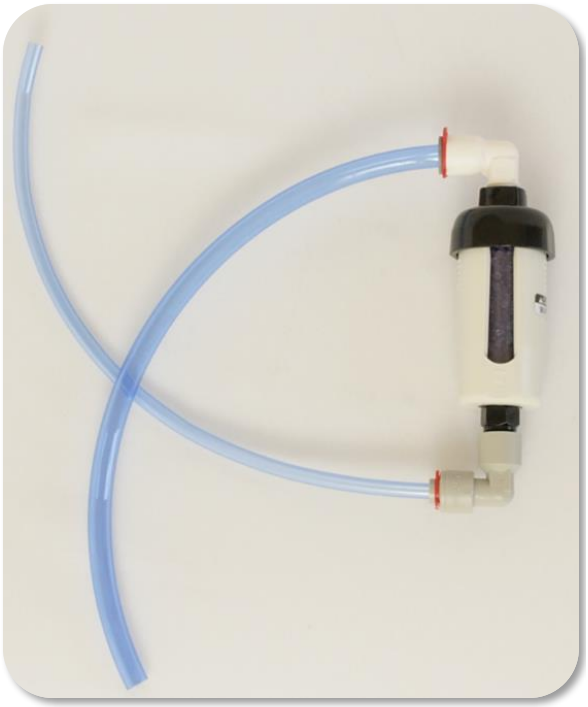

Figure 5. *Drying filter with fittings and tubing.*

ASSEMBLY NOTES

To connect the drying filter to the FlexLink® (Fig. 6), first remove the *FLEX OUT* tubing from the back of the FlexLink®. Remove the *FLEX IN* tubing from the moisture indicating bypass tubing. Connect the blue polyethylene ¼" OD tubing from the drying filter to the open port of the moisture indicating bypass tubing. 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 Tension System.

Figure 6. *Setup of a drying filter in-line with an FX-6000™ Tension System.*

RUNNING THE TENSION SYSTEM WITH THE DRYING FILTER CONNECTED

With the drying filter connected, open the FlexSoft® software. In the ***Regimen*** menu of the main window display, select ***Assign.*** Choose the ***Drying Filter*** platform assignment, the ***Shutdown*** username, and the regimen entitled ***Drying***. If you do not have a ***Drying Filter*** platform in your version of the FlexSoft® program, contact Flexcell®. 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:

Shape	Square
Min	10.0
Max	15.0
Freq.	1.0
DC%	50.0
Cycles	14400
Duration	0:04:00:00

If it appears that a significant amount of water may have entered the FlexLink®, a longer drying regimen may be programmed into the software. To do so, simply modify the time in the default ***Drying*** regimen. If a large amount of water has entered the FlexLink® and affected proper operation, the unit will need to be shipped to Flexcell® for repair.

MAINTENANCE NOTES:
REGENERATING SILICA DESICCANT BEADS IN THE 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. 7). 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.

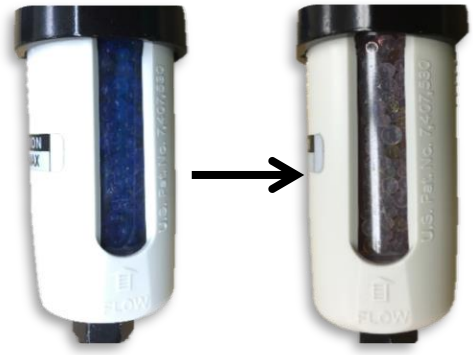

Figure 7. *Drying filter ready for use (left) and saturated drying filter (right).*

To remove the desiccant beads:

1. Open the drying filter.
   a. Use a $^{7}/_{16}$" 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 plastic tubing fitting (Fig. 8).

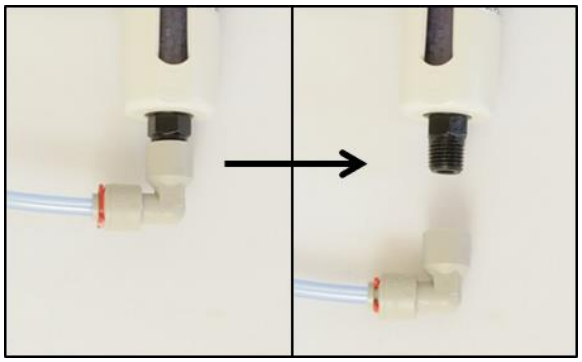

Figure 8*. Remove ¼" tubing connector.*

   b. Pinch the plastic housing on the two marked locations and slide the housing off the glass body (Fig. 9).

Figure 9. *Remove plastic housing.*

   c. Hold the drying filter upright and unscrew the top black housing from the glass body. Use a $^{9}/_{16}$" 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. 10).

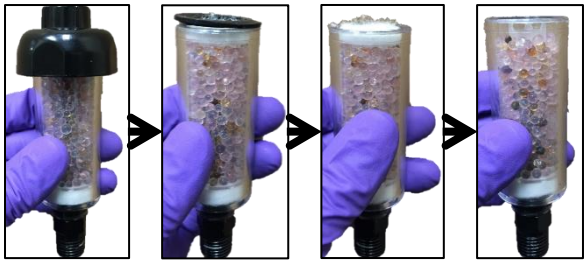

Figure 10. *Remove top casing, rubber O-ring, and fabric O-ring.*

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. 11a).
   c. Optional: If a vacuum oven is available, apply a vacuum up to -29 in Hg (-100 kPa; Fig. 11b).

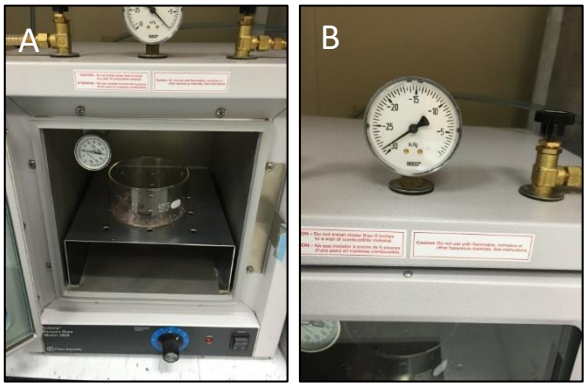

Figure 11. *A) Saturated desiccant beads in drying oven. B) Drying oven with vacuum set to -29 in Hg.*

   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. 12). 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.

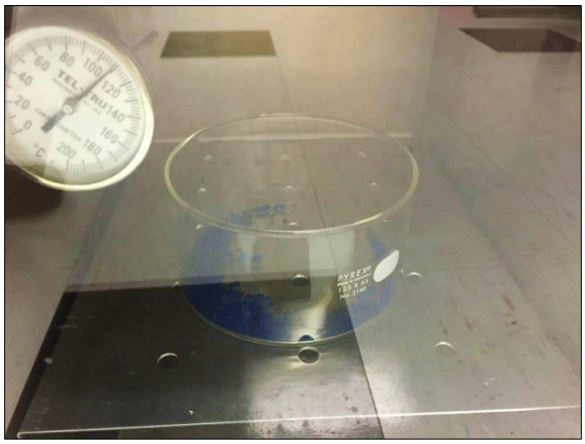

Figure 12. *Fully regenerated desiccant beads in oven.*

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. 13).

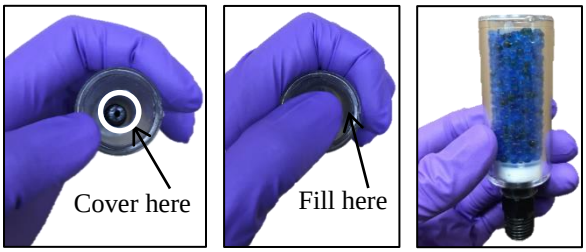

Figure 13. *Cover center opening, and fill regenerated desiccant beads in outer chamber.*

4. Re-assembly drying filter (Fig. 14):
   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 $^{7}/_{16}$" wrench to tighten the tubing fitting.
5. The drying filter is now ready for use with the Tension FlexLink®.

Figure 14. *Re-assembly of drying filter.*

REPLACEABLE ITEMS

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