



BioSurface Technologies Corporation

FC 310 Treatment Imaging Flow Cell Operator's Manual



The Model FC 310 Treatment Imaging Flow Cell was designed specifically for the Center for Biofilm Engineering to provide imaging from the top of the biofilm (biofilm grown using the CDC Biofilm Reactor®) during treatment with biocides, removal agents, and other chemical agents.

Viewing Windows

The viewing windows consist of a no.1 ½ thickness, 25mm diameter, circular cover slip. The glass cover slip viewing window is held in place by a silicone gasket and polycarbonate compression ring that threads quickly into position for a leak-proof seal.

Coupons

The flow channel has been recessed to accept one 0.5in diameter x 0.15in thick disc coupon (same coupon as used in the CDC, RDR, and Bio-inLine Biofilm Reactors, shown above).

1. Flow Cell Assembly and Operation

It is very important that the flow cells be assembled properly to provide a leak-proof seal. The flow cell is designed for a **maximum flow rate of 3.5 mL/minute**. Flow rates in excess of 3.5mL/minute could damage the flow cell or cause leaks.

The polycarbonate plastic is incompatible with organic solvents, acids, and bases. Further chemical compatibility information is available on the internet. The standard influent and effluent connections are nickel-coated brass barbed ports that accommodate size 16 (1/8 inch; 3 mm ID) tubing. The nickel-coated brass is not compatible with acid or base exposure.

Disassembly

1. Unthread the circular lid by turning counterclockwise (looking from above).
2. Carefully remove the glass cover slip from the gasket material. If the cover slip is broken, remove and discard the cover slip.
3. Carefully clean the gasket surface, removing all glass and other debris. **It is very important no residual glass or other material be left on the gasket surface.**
4. Remove the sample disc coupon from the sample well (a pair of needle nose pliers or standard tweezers will suffice if the CBR 2210 Coupon Manipulation Tool is not available). Notches on the side of the well facilitate removal of the disc from the well.
5. Clean the flow channel surfaces using water and laboratory detergent. **Do not scrub or mar the glass/flow channel mating surfaces.**

Assembly

1. Place a test coupon into the coupon well.
2. Place a clean glass coverslip onto the flow cell flow channel. Align the coverslip into the recess on the top of the flow channel to ensure the coverslip is fully in the recess and nowhere above the recess lip around the entire circumference.
3. Place the round silicone gasket into the lid of the flow cell and seat it fully into the recess.
4. Place the lid onto the flow cell and align the threads (turn counterclockwise for ~1/2 turn), and then thread the lid onto the flow cell by turning clockwise until snug (make sure the threads are aligned.) Do not strip or force the lid onto the threads if they are not aligned.
5. Compress the lid gasket onto the glass coverslip to create a water-tight seal. Do not over-tighten, as this may break the glass coverslip.

2. Autoclaving Instructions

The FC 310 Flow Cell is autoclavable up to 121°C, at 20 minutes. Using temperatures or times past what is suggested may cause unnecessary stress to some materials and will not be covered under warranty. Polycarbonate plastic will degrade with a numerous autoclave cycles and may eventually require replacement.

BioSurface Technologies recommends always using the slow (liquid) exhaust option. The fittings, set screw, and lid should be loosened to allow for material expansion when autoclaving the polycarbonate flow cell. Tubing connected to the flow cell should allow free exchange of steam with the surrounding environment. BST recommends using a gas permeable material to cover the tubing ends such as autoclave paper instead of a gas-impermeable material, such as tin foil (for the polycarbonate flow cell, slowly tighten the screws as the flow cell cools or wait until the flow cell is completely cooled before tightening the screws). Align all tubing connected to the flow cell to minimize stress on the flow cell fittings.

3. Spare Parts

Included with the flow cell:

- Spare gasket
- Additional cover slips (no.1 ½ thickness, 25mm diameter)

With proper care, the gaskets should be re-useable for numerous experimental evaluations. Other gasket materials may be used.

4. Troubleshooting

Problem: Glass viewing ports keep breaking

Solution:

- Check to ensure the glass is properly positioned in the recessed slot.
- Ensure the gasket surfaces and flow channel mating surfaces are total free of debris.

Problem: Flow cell leaks

Solution:

- Tighten screws further to compress gasket.
- Make sure flow channel and hose barbs are free and clear of obstructions.
- Make sure glass viewing ports are not cracked or broken.
- Check gasket for rips or tears. Clear of all debris. Replace, as necessary.
- High flow rates may create too much back pressure to contain leakage. Reduce flow rate. **The flow cell is designed for a maximum flow rate of 3.5 ml/minute.**
- Inspect flow channel lip for damage. The seal created by the compression of the gasket to the glass coverslip and flow channel lip must be un-interrupted the entire circumference of the flow cell.

5. Flow Cell Ancillary Equipment List

NOTE: BioSurface Technologies does not sell or supply the ancillary equipment described below. This or comparable equipment is required to complete the reactor system set-up. Please check with your local vendors for availability and current pricing. Equipment listed is not recommended equipment, but an aid to help you identify compatible equipment.

Pump: There are many types of peristaltic pumps available and you may opt for alternative types and pump head configurations (multi-channel versus single channel, higher/lower rpm range, etc.). Depending on what you need to add to the reactor during operation, you may require more than 1 pump or a multi-head pump (media for growth and biofilm treatment chemical for some duration that may require an additional pump).

- **L/S Variable Speed Modular Drive Pump system (1-100 RPM)**
(Cole-Parmer P/N EW-07557-10; 90-230 VAC CE certified)
- **Ismatec Minicartridge Pump Heads for Masterflex L/S Drives**
(Cole-Parmer P/N EW-07623-10)
 - Has 8 channels; will accommodate 8 influent lines. Alternate pump heads are available for 2 or 4 channel systems.
 - Accepts size 13 tubing.

Tubing and Fittings: The tubing you choose depends on the chemical compatibility, gas permeability, wear resistance in peristaltic pumps, and pricing. You must choose the tubing that best fits your needs. C-Flex tubing (listed below) is similar to silicone tubing but has a low gas-permeability compared to silicone. If gas-permeability is not an issue, standard silicone tubing is acceptable.

- **Size 13 tubing 25' C-Flex:**
(Cole Parmer P/N [HV-06424-13](#))
 - For use with the Ismatec pump head cartridges, connected to the size 16 tubing using adapters.
- **Size 13/16 tubing adapters** (connect size 13 to size 16 tubing)
(Cole Parmer P/N EW-30622-22)
- **Masterflex, C-Flex (50 A), L/S 16, 25 ft.** (Cole Parmer P/N EW-06424-16)
 - Accepts the 1/8" barbed connectors (3.2 mm connectors).
 - To connect to the media supply reservoir and to the flow cell connections.
- **Male Luer Lock x 1/8" barb –Polypropylene (included with standard flow cell system)** (Cole Parmer P/N A-30504-10)
- **Masterflex, C-Flex (50 A), 1/4" ID x 7/16" OD, 25 ft**
(Cole Parmer P/N EW-06424-72)
 - A few lengths and adapters to get from the carboy to the smaller diameter tubing, and as a siphon tube inside the carboy.
- **Nylon 1/4" x 1/8" adapter** (Cole Parmer P/N EW-30622-28)
 - Needed to get from the 3/16" or 1/4" ID to the 1/8" tubing.

Carboy: The carboy should be selected based on experiment needs and may be larger or smaller than what is suggested below. Ported lids can be purchased from suppliers, but standard lids are easily converted to ported lids using the following fittings or similar.

- **Cole-Parmer Heavy-Duty PP Carboy with Shoulder Handle, 10 L**
(Cole Parmer P/N EW-62507-10)
- **Filling / Venting ports for carboy lid - 1/4" tubing**

(Cole Parmer P/N EW-06259-10)

- Each reservoir vessel will require this port for the bacterial air vent.
- **Filling / Venting ports for carboy lid - 1/2" tubing**
(Cole Parmer P/N EW-06259-00)
- **Bacterial vent for media and waste reservoirs**
Any 0.22-0.45 um filter will work; can use pre-sterilized filters and mount on the vessels immediately after autoclaving.

Suggested Ancillary Equipment Suppliers:

Cole Parmer: 800-323-4340 (www.coleparmer.com)

Fisher Scientific: 1 800-766-7000 (www.fishersci.com)