

XCell® ATF 6 and 10 Single-use Devices

Set-up Guide

For use with XCell® LS Controllers



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Abbreviations

A-B	Allen-Bradley
AC	Alternating current
Amp	Ampere
ATF	Alternating tangential flow
AUX	Auxiliary
A2B	XCell ATF Device to Bioreactor connection
A2C	XCell ATF Device to Controller connection
CFM	Cubic feet per meter
CSPR	Cell specific perfusion rate
DAC	Disposable Aseptic Connector
dB	Decibels
DC	Direct current
DDVR	Displacement to dead volume ratio
DO	Dissolved oxygen
DPv1	PROFIBUS Decentralized Peripherals version 1
FAS	Field Applications Scientist
FC	Flow control
FIT	Filter integrity testing
FS	Flow sensor
FSE	Field Service Engineer
HFM	Hollow Fiber Module
HMI	Human Machine Interface
HP	Headplate
Hz	Hertz
ID	Inner diameter
I/O	Input/output
kg	Kilograms
L	Liter
lb	Pound
LPM	Liters per minute
LS	Large Scale Controller
mA	Milliamp
mL	Milliliter
mV	Millivolt
NPT	National pipe thread
OD	Outer diameter
PCV	Pressure control valve
PID	Proportional, integral, and derivative
PLC	Programmable logic controller
POI	Product of interest
PRV	Pressure regulating valve
PV	Process value
P2	PCV outlet pressure (Commanded pressure)
P3	Permeate pressure
PPE	Personal protective equipment

psi	Pounds per square inch
psig	Pounds per square inch gauge
QC	Quick Connect
SAPA	Supply Air Protection Assembly
SCADA	Supervisory Control and Data Acquisition
SM	Siemens
SOP	Standard operating procedure
SP	Set point
SUB	Single-use Bioreactor
TC	Tri-clamp
TCD	Total cell density
TCP/IP	Transmission control protocol / Internet protocol
VCD	Viable cell density
VVD	Vessel volume exchange per day

Definitions

ATF rate	Rate at which cell culture is exchanged between the bioreactor and XCell ATF Device. <i>ATF Rate (L/min) = Pump displacement volume (L) ÷ Cycle time (min)</i>
Filtration rate	Rate at which cell culture fluid flows across the hollow fiber membrane. The surface area of the hollow fiber membrane largely determines the value.

1. Introduction

XCell® ATF Technology uses alternating tangential flow (ATF) to intensify upstream processes by retaining cells in suspension cultures, such as mammalian cell culture and viral vectors. An innovative diaphragm pump creates alternating tangential flow, leading to high viable cell densities and increased throughput with lower cost of goods. Typical applications include intensification of the following processes:

- N-1 fed-batch
- Long-term continuous processing
- Vaccine and virus production
- Gene therapy and media exchange

XCell ATF Technology enables production of high density, high viability cell culture applications with linear flux and low shear for scale-up from 1L to 5000 + L. The system includes XCell ATF Devices, XCell® LS Controllers, software, tubing set kits, pressure sensors, and accessories.

Hollow fiber filter (HFF) membranes used in XCell ATF Devices are made of polyethersulfone (PES) with 0.2 µm pore size and 1 mm inner diameter. The shared properties (materials of construction, pore size, ID) ensure linear scalability across all device sizes.

Single-use tubing set kits and accessories are available for the connection of XCell ATF 6 and 10 Devices to both stainless steel and single-use bioreactors, simplifying preparation and connectivity and allowing for the proper exchange of cell culture material between the XCell ATF Device and the bioreactor and for harvesting product during cell-retention operations. XCell LS Controllers operate the diaphragm pump at the base of the device. The devices and tubing set kits are also compatible with legacy C410 Controllers. Additional information on the use of the controllers and XCell ATF Technology can be found XCell LS Controller User Guide.

This document describes the major components, set-up and connectivity of the single-use XCell ATF Large-scale Devices, serving as a reference for making appropriate connections, preparing the device, and initiating the cell culture process with sterility throughout the fluid path. This guide assumes that users possess a basic level of skill and knowledge in the areas of aseptic technique and fluid handling.

For further support in optimizing or troubleshooting, please contact your local Repligen Field Applications Specialist (FAS).

2. About this document

This manual uses several different phrases. Each phrase should draw the following level of attention.

Table 1. Explanation of user attention phrases

Phrase	Description
Note:	Points out useful information.
IMPORTANT	Indicates information necessary for proper instrument operation.
PRECAUTION	Cautions users of potential physical injury or instrument damage if the information is not heeded.
WARNING!	Warns users of potential serious physical injury if warnings are not heeded.

3. Safety precautions

Table 2. Explanation of symbols

Phrase	Symbol	Description
IMPORTANT:		The XCell ATF 6 and 10 Device is designed to be single use. Any attempt to misuse, reuse, or disassemble it will likely result in a loss of sterility and integrity causing leakage, culture contamination, poor performance and/or damage to the XCell ATF 6 and 10 Device.
IMPORTANT:		<p>Sterility: The connection between XCell ATF 6 and 10 Device and bioreactor is made utilizing a GE ReadyMate™ DACs and CPC AseptiQuik® S sterile connectors. It is important to use sterile techniques when connecting and securing the aseptic connector assembly.</p> <p>For wetting and installation, multiple sterile flow path configurations may need to be established. Isolate and clamp tubes along the flow path to maintain sterility.</p>
IMPORTANT:		Ensure the built-in clamps are correctly positioned to establish the requisite flow paths. For best performance, inspect the tubing carefully each time the clamps are removed to ensure the tubing are not crimped. If necessary, gently roll the tubing to re-establish proper flow.
IMPORTANT:		The total length of the A2B tubing from the top of the XCell ATF Single-Use Device to the bioreactor port must not exceed 40" for both XCell ATF 6 and 10 Single-Use Devices.
WARNING:		<p>Power: Use only Repligen the provided power supply.</p> <ul style="list-style-type: none"> • Use only high voltage cord specific for your region provided by Repligen • Do not use a damaged power supply • Do not use a damaged power cord
WARNING:		Tubing: Tubing breakage between the XCell ATF 6 and 10 Device and bioreactor may result in fluid spraying from the pump. Use appropriate measures to protect the operator and equipment.
WARNING:		Wear standard laboratory PPE, including lab coat, protective eye wear and gloves.

Note: Please refer to the XCell LS Controller User Guide for controller-related precautions.

4. Description of XCell ATF Devices

XCell ATF Large-scale Devices include a hollow fiber filter seated above a diaphragm pump, tubing set kits to ensure sterile connectivity, and accessories such as aseptic connectors and permeate pressure sensors. A stainless steel stand is available to ensure the operational stability of the single-use XCell ATF 6 and XCell ATF 10 Devices. XCell ATF Devices are sold separately.

XCell ATF Large-scale Devices are supplied pre-sterilized and require wetting with sterile cell culture media or WFI prior to use.

Note: *The devices are designed to be single-use and are therefore not designed to be cleaned, sanitized, or stored for repeat use. The device should not be exposed to high pH solutions, such as sodium hydroxide for extended time. Do not expose the device to even dilute caustic solutions prior to use.*

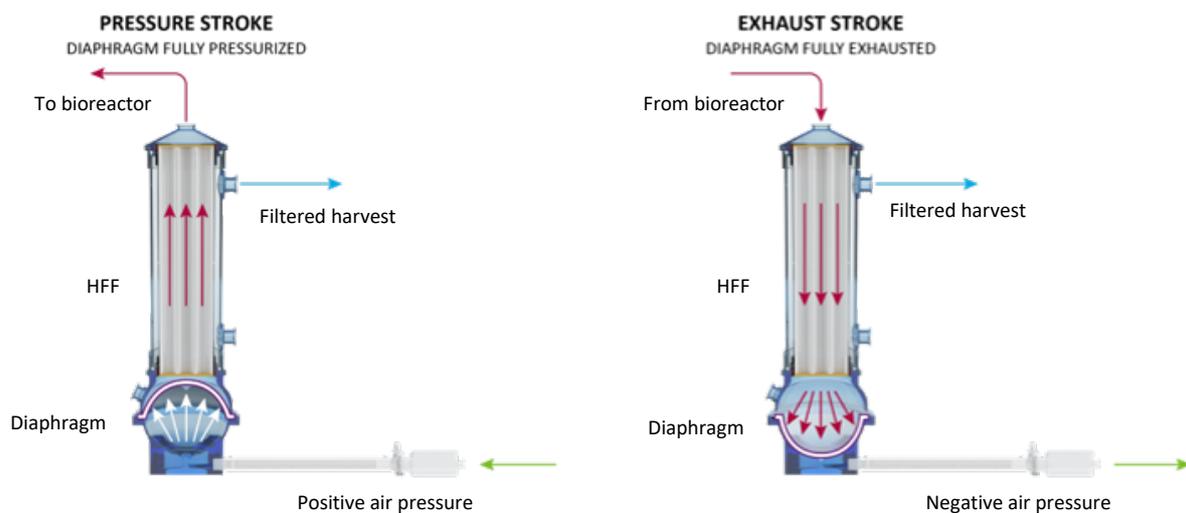
4.1 XCell ATF Devices pump cycle

The diaphragm pump generates alternating tangential flow (ATF) through the hollow fiber filter. ATF is a pulsating, reversible flow of liquid between a process vessel and diaphragm pump.

The process consists of two cycles ([Figure 1](#)), the pressure cycle (P-cycle) and the exhaust cycle (E-cycle). The P-cycle occurs when air is fed into the ATF pump, moving the diaphragm up towards the pump liquid-side (PL) hemisphere and driving the liquid from the diaphragm pump through the hollow fiber filter and into the process vessel.

The E-cycle occurs when vacuum is introduced, thus pulling the diaphragm down towards the pump air-side (PA) hemisphere, and liquid is pulled from the process vessel through the HFF, and back into the diaphragm pump. The diaphragm must travel between the two extremes to complete one cycle. The flow through the hollow fiber filter generates tangential flow in each direction in an alternating fashion.

Figure 1. Pressure and exhaust strokes



Note: *XCell ATF Devices require a vacuum (negative pressure) to move the diaphragm to its lowest position. Positive pressure from the bioreactor is insufficient to completely deflate the diaphragm, necessitating the use of vacuum to ensure proper XCell ATF Device operation.*

5. XCell ATF 6 Single-use Device

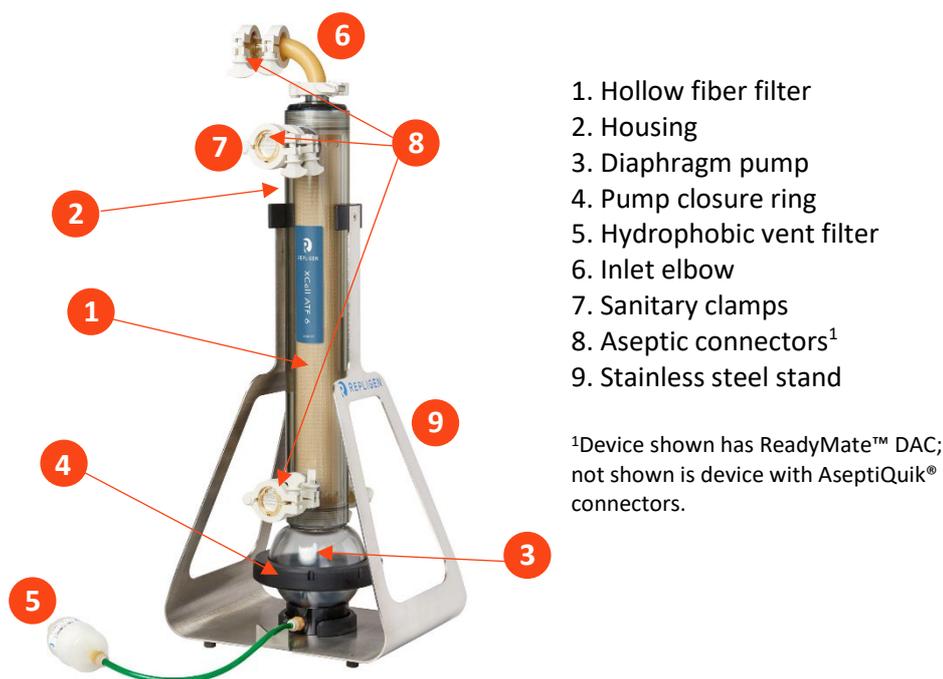
5.1 XCell ATF 6 Single-use Device description

The XCell ATF 6 Single-use Device is recommended for process volumes of 50 – 200 L. The hollow fiber filter is available in both polyethersulfone (PES) and polysulfone (PS) chemistries with 0.2 μm and 0.5 μm and 50 kD MWCO. Components include a diaphragm pump, filter housing, inlet elbow, and a hollow fiber filter cartridge fitted within the filter housing. XCell ATF 6 PES Device is available with both ReadyMate™ and AseptiQuik® aseptic connectors, whereas the PS device is available only with ReadyMate™ aseptic connectors.

Table 3. XCell ATF 6 ordering information

Part #	Description	Notes
SUATF6-G02PS	XCell ATF 6 Single-use Device, 0.2 μm PS	0.2 μm filter, GE ReadyMate™ DAC connections
SUATF6-S02PES	XCell ATF 6 Single-use Device, 0.2 μm PES	0.2 μm filter, GE ReadyMate™ DAC connections
SUATF6-PES-AQL	XCell ATF 6 Single-use Device, 0.2 μm PES	0.2 μm filter, CPC AseptiQuik aseptic connections

Figure 2. XCell ATF 6 Single-use Device components



5.1.1 The diaphragm pump

The diaphragm pump consists of a spherical chamber at the base of the device. A silicone diaphragm separates the air-side hemisphere and the liquid side hemisphere of the pump. The silicone diaphragm moves up and down as either pressurized air or vacuum is applied to the air side of the pump. As the diaphragm pump cycles through exhaust and intake, cell culture suspension moves from the bioreactor to the device and back to the bioreactor. This alternating tangential flow draws cell suspension in a continuous back and forth motion through the lumen of the hollow fiber filters. Alternating flow creates a backflush, enabling filter self-cleaning that minimizes fouling.

5.1.2 The filter module

The filter module contains a hollow fiber filter within a housing. The hollow fiber filter, sitting above the liquid side hemisphere of the diaphragm pump separates media from cells. The filter housing contains five ports: two permeate ports (top and bottom), condition/drain port, and ports to connect the XCell ATF Device to the XCell LS Controller (A2C) and to connect the XCell ATF Device to the bioreactor (A2B).

Note: *The top permeate port directs permeate to the harvest vessel, while the bottom port may be clamped off.*

5.1.3 Stainless steel stand

To ensure stability during set-up and use, it is recommended that the device be placed in the stainless steel stand ([Figure 3](#)). The stand features a ring to hold the bottom of the device securely and a snap ring to hold the filter housing near the top of the device. The stand is provided with a notch to orient and secure the ATF to controller (A2C) line and to provide access to all ports.

Note: *The stainless steel stand needs to be ordered separately from the XCell ATF 6 Single-use Device.*

5.2 Required equipment

The following equipment is required to operate the XCell ATF 6 Single-use Device:

- Control Hardware
 - XCell LS Controller connected to the required air pressure and vacuum pressure sources.
- Permeate (Harvest) fluid management
 - A variable-speed, peristaltic pump that supports flow rates of 50 - 400 mL/min, depending on the bioreactor working volume and perfusion rate.
 - A minimum length of 1/4 inch ID tubing, fitted with a single aseptic connector to mate with the XCell ATF 6 Single-use Device. It is recommended that the permeate line be sterilized via gamma irradiation or autoclaving.
- Pre-use, offline filter wetting equipment
 - Filtered WFI or cell culture media (50 L) dispensed into a single-use biocontainer (bag) fitted with an appropriate length of tubing, a clamp, and a single, terminal, aseptic connector.
 - A sterile 50 L empty single-use biocontainer with an appropriate length of tubing, a clamp, and a single, terminal aseptic connector.
 - A variable speed peristaltic pump that supports flow rates of 1 - 4 LPM and accommodates the tubing ID configured the media/WFI bag.

5.3 Device ports

The device contains five ports/connection points ([Figure 3](#)):

- Top retentate (A2B) port
- Condition/drain port
- Top permeate port
- Bottom permeate port
- XCell ATF Device to XCell ATF LS Controller (A2C) port

All ports, except the A2C port, are supplied dead-ended with GE ReadyMate™ DAC or AseptiQuik® aseptic connectors. The A2C port, dead-ended with a vent filter and located at the lowest point on the pump base is connected to the XCell LS Controller, allowing pressurized air and vacuum to be delivered to actuate the diaphragm according to the user-defined parameters in the XCell LS

Controller software. The remaining four ports carry liquid between the XCell ATF Device and bioreactor or the XCell ATF Device and the permeate vessel. Two ports are connected to the feed, or retentate, side of the cartridge and two ports are connected to the permeate side. The top retentate port is used to make a connection between the XCell ATF 6 Single-use Device and a bioreactor using the A2B tubing sets. The bottom port on the feed side is the condition/drain port. The top permeate port is typically used for harvesting and the lower permeate port remains closed off throughout the process, but it can be aseptically connected to a pressure transducer to monitor the permeate pressure during the process.

Figure 3. XCell ATF 6 Single-use Device ports and stainless steel stand



5.4 XCell ATF 6 Single-use Device tubing set kits

Fluid management for XCell ATF Devices includes tubing set kits and accessories that connect the device to the bioreactor and the XCell LS Controller. The tubing set kits are designed to ensure that the ratio of displacement volume to hold-up volume is greater than or equal to one at the minimum and maximum flow rate. (Displacement to dead volume ratio (DDVR) ≥ 1).

A2B tubing set kits are available in multiple configurations based on the type of bioreactor in use and the desired connectors (Table 3). In addition to the tubing set kits, accessories are required (Table 7).

Tubing set kits include pinch clamps for isolating flow paths and sanitary clamps for securing aseptic connectors. All tubing components are constructed of platinum-cured silicone and are configured with vent filters and aseptic connectors. All tubing set kits are sterilized by gamma irradiation and packed in double plastic bags to maintain sterility.

Notes:

- *Unlinked aseptic connectors are not water resistant. To maintain system sterility, extra care must be taken during set-up to not to introduce liquid onto the connector.*
- *Although superficially similar, the tubing sets for the different devices are not interchangeable. Check the labeling on your tubing set to make sure it is appropriate for your device.*
- *The tubing set kits, permeate pressure sensor kits, and flow sensor are ordered separately.*

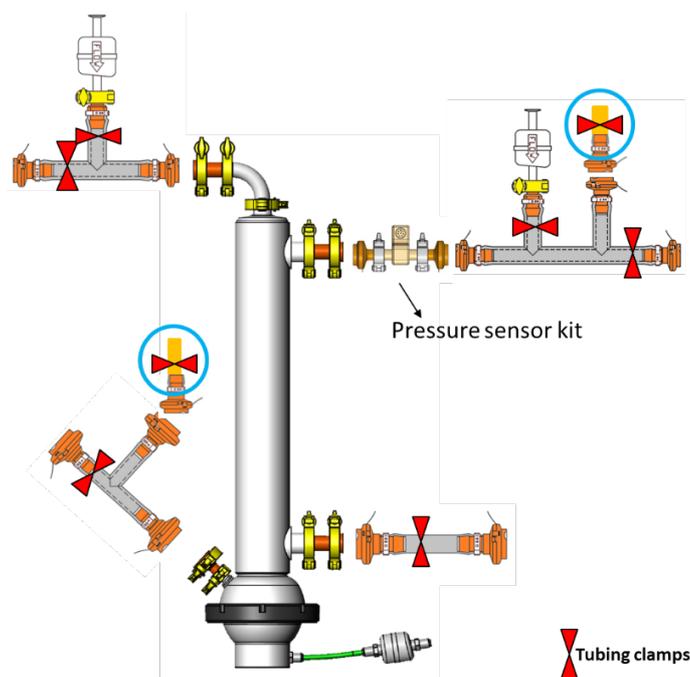
Table 4. XCell ATF 6 Single-use Device tubing specifications

Item	Component	Sterile connector type	Tubing spec (ID, OD, length)		
			ID	OD	Length
Tubing set kit	A2B	ReadyMate™ or AseptiQuik®	3/4"	1.125"	24"
	Top permeate		3/4"	1.125"	12"
	Bottom permeate		3/4"	1.125"	6"
	Vent tee		3/4"	1.125"	10"
	Sample port/Drain port		1/2"	3/4"	6"
	End cap	N/A	-	1.5"	-
Permeate pressure sensor kit	Pressure sensor	ReadyMate™ or AseptiQuik®	3/4"	N/A	4"

Table 5. XCell ATF 6 Connection kit details

Part	Description	Purpose
Sanitary tri-clamps	1.5" clamps	Clamp connectors
ATF to Bioreactor Connection	Tee with vent filter	Connect to bioreactor, pre-use wetting, integrity testing
ATF to Bioreactor Connection	A2B weldable line	Connect to bioreactor
Permeate Connection	Top permeate (optional pressure sensor kit)	Connection to top permeate port, pressure monitoring (if included), wetting, integrity testing
Bottom permeate extension	5" tubing with end cap	Clamp off bottom permeate
Drain connection	Drain tee	Connect to drain port, wetting, draining

Figure 4. XCell ATF 6 Device with tubing set kit



5.5 Connecting XCell ATF 6 Single-use Device to a bioreactor

Two types of connections between the device and bioreactor are available. Hard connections are used where steam-in-place (SIP) is an option, such as with stainless steel bioreactors (SSB). Soft connections are used with single-use bioreactors (SUB) and consist of single-use connectors such as AseptiQuik® and ReadyMate™ DAC.

Fluid management for XCell ATF 6 Devices include retentate (A2B) tubing set kits and accessories that connect the device with the bioreactor, ensuring proper exchange of cell culture material. Intended for use in pilot scale, clinical, and commercial bioprocessing environments, tubing set kits work with XCell LS Controllers and legacy C410 controllers. Permeate tubing (not provided) connects the device to the harvest vessel and should be sterilized by autoclave or attached with a tubing welder or disposable sterile coupling. The permeate tubing should be compatible with the filtrate/harvest pump.

Note: Bioreactor adapters, used to connect tubing set kit to the bioreactor, are not provided.

5.5.1 Single-use XCell ATF 6 tubing set kits and accessories

Several components are required to connect the XCell ATF 6 Device to a bioreactor. XCell ATF 6 autoclavable tubing sets are available in two configurations depending on the preferred connectors. All tubing sets have a pressure rating of 25 psi. Additional accessories are required.

Table 6. Tubing options

Tubing set part number	Bioreactor type	Tubing connection	Included components
SUATF6-TSK-RM	Single-use and Stainless steel	GE ReadyMate™	A2B, vent tee, top and bottom permeate, drain
SUATF6-TSK-AQG		AseptiQuik®	
SUATF6-TSK-AQG-AQL		AseptiQuik®	

Table 7. Required Accessory

Description	Part number	Aseptic connector	Single or Multi-use	Pressure rating	ID (inches)	Material of construction
Permeate Pressure Sensor	SUATF610-PSK-V2	ReadyMate™	SU	25 psi	3/4"	Polycarbonate
	SUATF610-PSK-AQ-V2	AseptiQuik®				

In addition, use of a SSB requires a bivalve assembly and connector.

Table 8. Required stainless steel bioreactor accessories

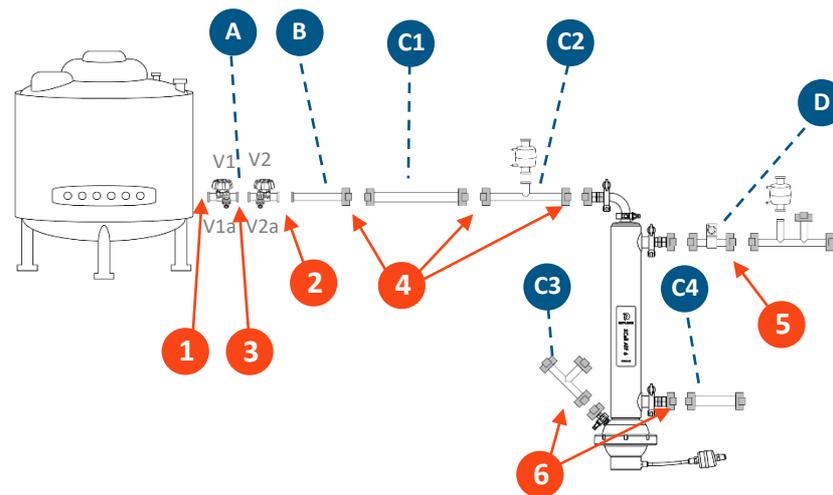
Description	Part number	Tubing connection	Single- or Multi-use	Pressure rating	ID	Material of construction
Bivalve assembly	ATF6-VLV-KIT	N/A	MU	45 psi	3/4"	Stainless steel
Connector	SUATF6-RM-TO-0.75TC	ReadyMate™	SU	25 psi	3/4"	Polycarbonate
	SUATF6-AQG-TO-0.75TC	AseptiQuik®				

5.5.2 Tube set kit assembly: Single-use XCell ATF 6 connected to a stainless steel bioreactor

Tube set kits are available with either ReadyMate™ or AseptiQuik® connectors. Hard connection between the tubing set and the stainless steel bioreactor consists of the following parts, available as a unit:

- Two isolation bivalves: one attached to the bioreactor, and one attached to the housing
- A flexible hose between the main branches of the two valves
- A steam inlet: a side valve on one bivalve
- Condensate drain: a side valve on the other bivalve; lowest of the available valves

Figure 5. Single-use XCell ATF 6 connected to a stainless steel bioreactor



- A. ATF6-VLV-KIT (bivalve)
- B. SUATF6-AQG-TO-0.75TC or SUATF6-RM-TO-0.75TC (tubing set)
- C. SUATF6-TSK-AQG or SUATF6-TSK-RM or SUATF6-TSK-AQG-AQL (tubing set)
 - C1. A2B tubing
 - C2. Vent tee
 - C3. Drain/condition tubing
 - C4. Bottom permeate tubing
- D. SUATF610-PSK-V2 or SUATF610-PSK-AQ-V2 (pressure sensor kit)

Single-use XCell ATF 6 Stainless Steel Bioreactor Tubing Set Kits are available with AseptiQuik® (AQG or AQL) or ReadyMate™ connectors.

Connection instructions:

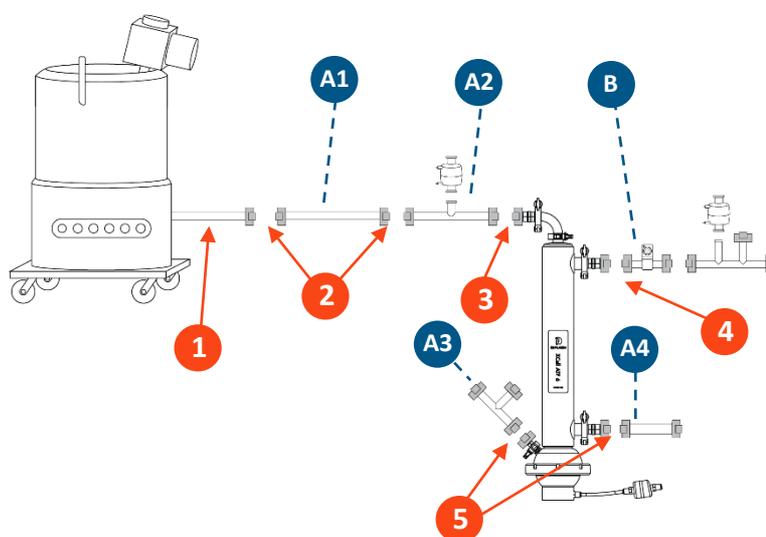
1. Connect the right facing bivalve (A) to the stainless-steel bioreactor. Attach trap to opening at V1a. Open valves V1 and V1a. SIP to sterilize the bioreactor. Close V1.
2. Connect the left facing bivalve (A) to tubing set (B). Open Valves V2 and V2a. Autoclave the entire assembly. Close V2.
3. Clamp the adapter tubing and connect two halves of the bivalve. V1a and V2a should be open; V1 and V2 should be closed. SIP bivalve connection through the open valves. Close V1a and V2a and open V1 and V2.
4. Connect tubing sets (B, C1 and C2). Connect Tubing set (C2) to XCell ATF 6.
5. Attach pressure sensor kit (D) to top permeate port.
6. Attach condition/drain port (C3) and bottom permeate extension (C4).

The following steam-in-place procedure is recommended for hard connections:

1. Attach a steam trap to the condensate valve and connect to a drain.
2. Close steam inlet and condensate drain valves.
3. Securely connect a regulated steam source to the steam inlet valve.
4. Open steam service.
5. Slowly open steam inlet valve.
6. Slowly open steam condensate valve.
7. Sterilize connection for about 20 min. at 121° C and ~16 psi.
8. Cool down.
9. Close the condensate valve.
10. Rapidly close the steam inlet valve and immediately open the main valve into the filtration assembly to minimize a pressure drop in the connection.

5.5.3 Tube set kit assembly: Single-use XCell ATF 6 connected to a single-use bioreactor

Figure 6. Single-use XCell ATF 6 connected to a single-use bioreactor



- A. SUATF6-TSK-AQG or SUATF6-TSK-RM or SUATF6-TSK-AQG-AQL (tubing set)
 - A1. A2B tubing
 - A2. Vent tee
 - A3. Drain/condition tubing
 - A4. Bottom permeate tubing
- B. SUATF610-PSK-V2 or SUATF610-PSK-AQ-V2 (pressure sensor kit)

Single-use XCell ATF 6 single-use bioreactor tubing set kits are available with AseptiQuik® (AQG or AQL) or ReadyMate™ connectors.

Connection instructions:

1. Connect adapter tubing (not provided) to SUB.
2. Connect tubing set (A1) to adapter tubing and vent tee (A2).
3. Connect vent tee (A2) to XCell ATF 6 Device.
4. Attach pressure sensor kit (B) to top permeate port.
5. Attach condition/drain port (A3) and permeate extension (A4).

Note: Adapter tubing is not supplied by Repligen. The parameters for the tubing connected to the SUB: ID ≥ 3/4", length < 10", and a sterile connection to match tubing set A1.

5.6 XCell ATF 6 Single-use Device wetting

5.6.1 Device wetting background

XCell ATF 6 Devices are supplied dry and gamma irradiated. Wetting of the hollow fiber filter is required to ensure robust filter performance. Wetting can be performed either offline or online. Offline wetting does not require the use of the XCell LS Controller and allows for pre-use filter integrity testing while maintaining sterility.

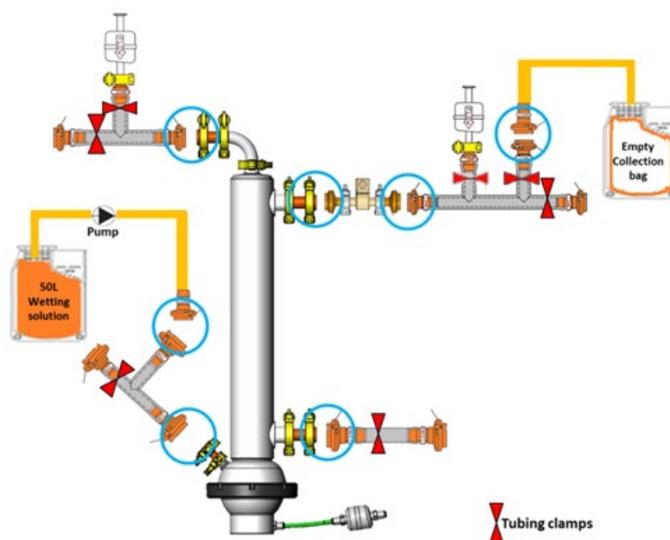
The online wetting procedure is executed with the device connected to a bioreactor that contains sterile cell culture media prior to inoculation. The XCell LS Controller is used to wet the filter. Additional XCell ATF 6 Single-use Devices that will be connected to a running bioreactor must undergo offline wetting.

The offline wetting procedure is recommended for the following reasons:

- Proper wetting – Filling the unit from the condition/drain port wets the membrane inside-out, which drives more uniform wetting of the filter and minimizes the formation of air bubbles inside the filter.
- Filter integrity – This method allows the user to test filter integrity while disconnected from the bioreactor while maintaining sterility. Integrity testing a filter prior to use reduces process risk.
- Sterility check – Upon completion of the wetting process with cell culture media, the media can be incubated overnight to evaluate the sterility of the device before making a connection to the bioreactor.

5.6.2 Offline wetting

Figure 7. XCell ATF 6 Single-use Device offline wetting setup



Instructions:

1. Install the device into the stand and attach the tubing (Figure 7; stand not shown).
2. Clamp aseptic connectors (circled).
3. Ensure tubing clamps are placed in the proper locations for effective filter wetting and to prevent the accidental wetting of the vent filters and unlinked connectors.
4. Connect a 50 L bag containing sterile wetting solution to the condition/drain port and an empty 50 L bag to the top permeate port.
5. Pump wetting solution through the condition/drain port at a flow rate of 1 LPM to fill the device.

6. Stop the pump when the solution begins to fill the top permeate port. Clamp the top permeate port completely such that both vent filter and empty bag segments are closed.
7. Restart the pump briefly. When solution begins to fill the elbow on top retentate, stop the pump and clamp the vent filter segment to close the top retentate completely.

Note: Ensure that the wetting solution does not contact the vent filters or the unlinked aseptic connectors at any point during the wetting process. Add a clamp to the top permeate tubing set to isolate (close) the vent filter line, leaving the line to the collection bag open.

8. Restart the pump at a flow rate of 3 - 4 LPM, allowing for a minimum wetting time of 15 minutes. Continue until the entire volume of wetting solution has passed through the device and into the permeate collection. It is recommended to tilt the device until the air above the top permeate port is removed. Stop pump.
9. Clamp feed and collection tubing to remove bags from device.
 - a. If cell culture media was used for wetting, the media collected in the permeate bag can be used to assess the sterility of the device by incubating it in a shake flask.
 - b. The wetting solution can remain inside the device until the unit is ready to be connected to the bioreactor. Ensure that tubing lines to the vent filters on the top retentate and top permeate tubing sections are clamped.

5.6.3 Filter integrity evaluation

If filter integrity testing is required, the recommendation is that it be performed following the offline wetting step and prior to connection to the bioreactor. The wetting solution must be drained from the device before testing.

1. Remove the clamps at the vent filters on both the top retentate and top permeate ports.
2. Close the line to the collection bag with a clamp and ensure that the condition/drain port clamp is correctly positioned ([Figure 8](#)).
3. Start pump in reverse flow at flow rate of no more than 0.5 LPM to drain the wetting solution into the bag at the condition/drain port.

Note: The draining process will not remove all of the solution from the diaphragm pump. The presence of residual wetting solution in the pump will not affect the filter integrity evaluation or the functionality of the device.

4. After draining the wetting solution, stop the pump and disconnect the bags from the device in a sterile manner by clamping the respective tubing lines.
5. The device integrity can now be evaluated using a forward air diffusion test by connecting a FIT Tester to the vent filter on the top retentate tubing set.
6. Ensure that the vent filter on the top permeate tubing is open for diffused air to escape and all remaining pinch clamps are tightened to avoid leaks ([Figure 9](#)).
7. Pressurize the unit through the top retentate port vent filter to 10 psi and monitor the pressure decay for five minutes. The average pressure decay should not exceed 0.5 psi/min (diffusion rate < 30 SCCM/m²) for the unit to pass the filter integrity test.

Note: To avoid filter drying, it is recommended to clamp the segments leading to vent filters on both permeate and retentate side after FIT evaluation.

Figure 8. Configuration for draining the wetting solution following offline wetting

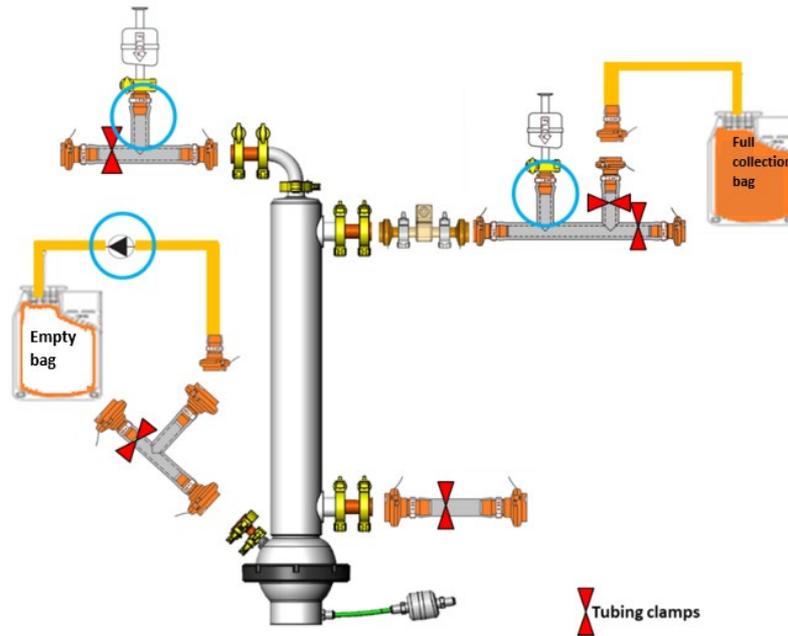
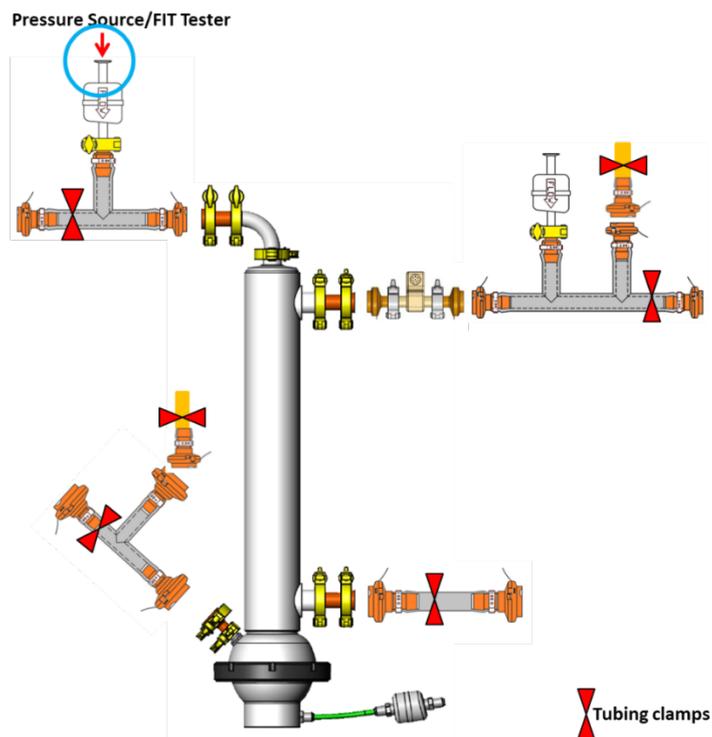


Figure 9. Configuration for post-wetting device integrity testing



5.6.4 Connecting to a bioreactor

After completing the offline wetting procedure and/or the integrity test, use the A2B tubing set to make a connection between bioreactor and the device by using a sterile connector or a tube welder.

Refer to the XCell LS Controller user guide for instructions on operating the XCell ATF 6 Single-use Device.

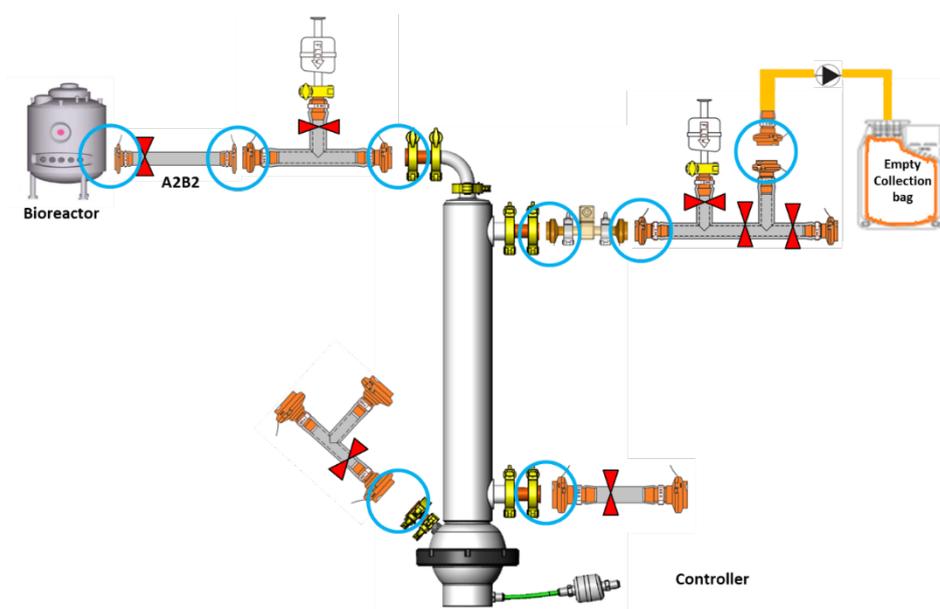
5.6.5 Online wetting

If not wetted offline, after connecting to the bioreactor, devices are wetted using the XCell LS Controller. This method is not amenable to performing a pre-use integrity test.

Instructions:

1. Install the device into the stand and attach the tubing ([Figure 10](#); stand not shown).
2. Connect aseptic connectors (circled). Ensure tubing clamps are placed in the proper locations for effective filter wetting and to prevent the accidental wetting of the vent filters and unlinked aseptic connectors.
3. Connect the device to the bioreactor using the A2B tubing set.
4. Connect the controller to the device via the A2C connection.
5. Connect an empty 50 L bag to the top permeate port.
6. Open clamps on retentate tubing segment ensuring the line between the bioreactor and device is open. Clamp off the vent filter.

Figure 10. Configuration for online wetting of the device (pre-wetting)



Note: Bioreactor head pressure may force media into the device without the XCell LS Controller action.

7. Start the XCell ATF Device pump from the XCell LS Controller at a flow rate of 17.2 LPM (pressure and exhaust) and let it run until the flow set-point is reached.
8. After equilibration, remove the clamp to the empty bag on the permeate port and immediately start permeate pump at a flow rate 3 - 4 LPM.
9. Collect at least 50 L of wetting solution in the collection bag ([Figure 11](#)). The flow rate should be adjusted to allow for a minimum wetting time of 15 minutes.
10. Stop the permeate pump and then the XCell ATF Device pump. Clamp the A2B tubing line and disconnect the collection bag from the top permeate port in a sterile manner by

clamping the tubing (Figure 12). The remaining solution inside the device remain until the bioreactor is ready for the perfusion process.

Note: Close the retentate and permeate vent filters before starting the perfusion process.

Figure 11. Configuration for online wetting of the device (post-wetting)

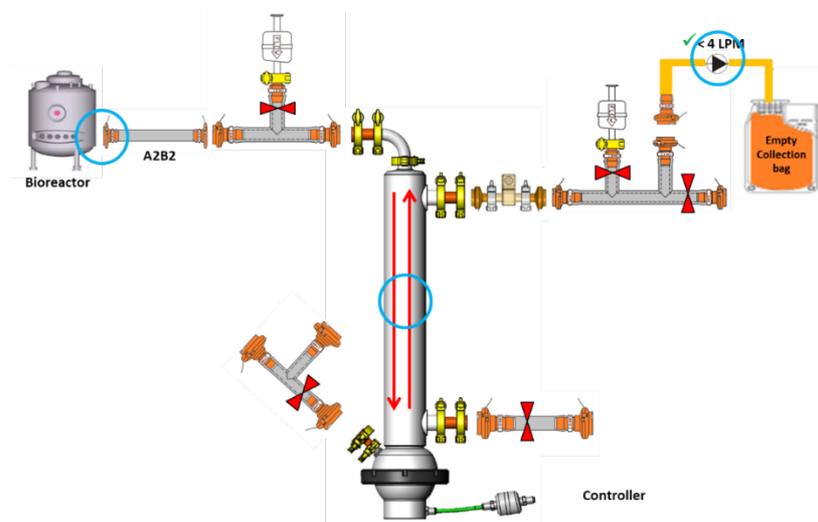
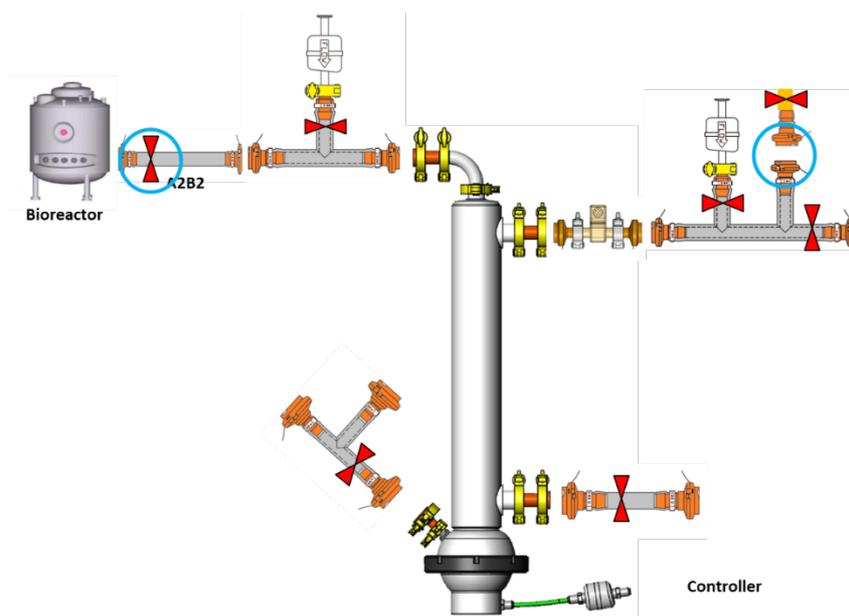


Figure 12. Clamp configuration for disconnecting bags from device



5.7 XCell ATF 6 Single-use Device post-use instructions

After completion of a cell culture process using the XCell ATF 6 Single-use Device, disconnect and discard the device.

Instructions:

1. Stop the permeate pump and disconnect the harvest bag in a sterile manner.
2. Stop the XCell LS Controller and disconnect the XCell ATF 6 Single-use Device A2C line from the controller.
3. Clamp both the A2B and top permeate tubing lines using tubing clamps.
4. Prepare an empty bag or a container (> 5 L) fitted with a ReadyMate™ connector. Connect the empty bag/container to the condition/drain port.
5. Remove the clamps at the vent filters on both the top retentate and top permeate ports. Detach the clamp at condition/drain port to drain the culture into the empty bag.
6. Begin the draining of cell culture solution through the condition/drain port at a flow rate of 1 LPM to the bag/container.

Note: *The device may need to be tilted to drain the cell culture solution from the diaphragm pump.*

7. The pump and disconnect the bag from the device. Now the device is ready to be discarded by following proper waste disposal codes.

6. XCell ATF 10 Single-use Device

The XCell ATF 10 Single-use Device is recommended for process volumes of 200 - 5000+ L. The hollow fiber filter is available in both polyethersulfone (PES) and polysulfone (PS) chemistries with 0.2 and 0.5 μm and 50 kD MWCO. Components include a diaphragm pump, filter housing, inlet elbow, and a hollow fiber filter cartridge fitted within the filter housing. The XCell ATF 10 Device is available with ReadyMate™ DAC on the permeate ports and AseptiQuik® G or L aseptic connectors on the retentate/u-bend ports.

Table 9. XCell ATF 10 ordering information

Part #	Description	Notes
SUATF10-G02PS	XCell ATF 10 Single-use Device, 0.2 μm PS	0.2 μm filter, GE ReadyMate™ DAC and AseptiQuik® connections
SUATF10-S02PES	XCell ATF 10 Single-use Device, 0.2 μm PES	0.2 μm filter, GE ReadyMate™ DAC and AseptiQuik® connections

Figure 13. XCell ATF 10 Single-use Device components



6.1.1 The diaphragm pump

The diaphragm pump consists of a spherical chamber at the base of the device. A silicone diaphragm separates the air-side hemisphere and the liquid side hemisphere of the pump. The silicone diaphragm moves up and down as either pressurized air or vacuum is applied to the air side of the pump. As the diaphragm pump cycles through exhaust and intake, cell culture suspension moves from the bioreactor to the device and back to the bioreactor. This alternating tangential flow draws cell suspension in a continuous back and forth motion through the lumen of the hollow fiber filters. Alternating flow creates a backflush, enabling filter self-cleaning that minimizes fouling.

6.1.2 The filter module

The filter module contains a hollow fiber filter within a housing. The hollow fiber filter, sitting above the liquid side hemisphere of the diaphragm pump, separates media from cells. The filter housing contains five ports: two permeate ports (top and bottom), condition/drain port, and ports to

connect the XCell ATF Device to the XCell LS Controller (A2C) and to connect the XCell ATF Device to the bioreactor (A2B).

Note: The top permeate port is used to pull permeate, while the bottom port may be clamped off.

6.1.3 Stainless steel stand

To ensure stability during set-up and use, it is recommended that the device be placed in the stainless steel stand ([Figure 14](#)). The stand features a ring to hold the bottom of the device securely and a snap ring to hold the filter housing near the top of the device. The stand is provided with a notch to orient and secure the A2C line and to provide access to all ports.

Note: The stainless steel stand needs to be ordered separately from the XCell ATF 10 Single-use Device.

6.2 Required equipment

The following equipment is required to operate the XCell ATF 10 Single-use Device:

- Control Hardware
 - XCell ATF LS Controller connected to the required air pressure and vacuum pressure sources.
- Permeate (Harvest) fluid management
 - A variable-speed, peristaltic pump that supports flow rates of 0.4 - 2.5 L/min, depending on the bioreactor working volume and perfusion rate.
 - A minimum length of 1/4 inch ID tubing, fitted with an aseptic connector to mate with the XCell ATF 10 Single-use Device. It is recommended that the permeate line be sterilized via gamma irradiation or autoclaving.
- Pre-use, offline filter wetting equipment
 - Filtered WFI or cell culture media (220 L) dispensed into a single-use biocontainer fitted with an appropriate length of tubing, a clamp, and a single, terminal, aseptic connector.
 - A sterile 220 L empty single-use biocontainer with an appropriate length of tubing, a clamp, and a single, terminal aseptic connector.
 - A variable speed peristaltic pump that supports flow rates of 2 - 15 LPM and accommodates the tubing ID configured the media/WFI bag.

6.3 Device ports

The device contains five ports/connection points ([Figure 14](#)):

- Top retentate (A2B) port (AseptiQuik® G or L)
- Condition/drain port
- Top permeate port (ReadyMate™)
- Bottom permeate port (ReadyMate™)
- XCell ATF Device to XCell LS Controller (A2C) port

The A2C port, dead-ended with a vent filter and located at the lowest point on the pump base, connects to the XCell LS Controller, allowing pressurized air and vacuum to be delivered to actuate the diaphragm according to the user-defined parameters in the XCell LS Controller software. The remaining four ports carry liquid between the XCell ATF Device and bioreactor or the XCell ATF Device and permeate vessel. Two ports are connected to the feed, or retentate, side of the cartridge and two ports are connected to the permeate side. The top retentate port is used to make a connection between the XCell ATF 10 Single-use Device and a bioreactor using the A2B tubing sets.

The bottom port on the feed side is the condition/drain port. The top permeate port is typically used for harvesting, and the lower permeate port remains closed off throughout the process but can be aseptically connected to a pressure transducer to monitor the permeate pressure.

Figure 14. XCell ATF 10 Single-use Device ports and stainless-steel stand



6.4 XCell ATF 10 Single-use Device tubing set kits

Fluid management for XCell ATF Devices includes tubing set kits and accessories that connect the device to the bioreactor and the XCell LS Controller. The tubing set kits ensure that the ratio of displacement volume to hold-up volume is greater than or equal to one at the minimum and maximum flow rate ($DDVR \geq 1$).

A2B tubing set kits are available in multiple configurations based on the type of bioreactor in use and the desired connectors ([Table 9](#)). In addition to the tubing set kits, accessories may be required ([Table 7](#), [Table 8](#)).

Each tubing set kit includes pinch clamps for isolating flow paths and sanitary clamps for securing aseptic connectors. All tubing components are constructed of platinum-cured silicone and are configured with vent filters and aseptic connectors. All tubing set kits are sterilized by gamma irradiation and packed in double plastic bags to maintain sterility.

Notes:

- *Unlinked aseptic connectors are not water resistant. To maintain system sterility, extra care must be taken during set-up to not to introduce liquid onto the connector.*
- *Although superficially similar, the tubing sets for the different devices are not interchangeable. Check the labeling on your tubing set to make sure it is appropriate for your device.*
- *The tubing set kits, permeate pressure sensor kits, and flow sensor are ordered separately.*

Table 10. XCell ATF 10 Single-use Device tubing materials and specifications

Item	Component	Sterile connector type	Tubing spec (ID, OD, length)		
			ID	OD	Length
Tubing set kit	A2B	AseptiQuik® G or L	1"	1.375"	25"
	Top permeate	GE ReadyMate™	3/4"	1.125"	12"
	Bottom permeate		3/4"	1.125"	6"
	Vent tee		1"	1.375"	28"
	Sample port/ Drain port		1/2"	3/4"	6"
	End cap		N/A	-	1.5"
Permeate pressure sensor kit	Permeate	GE ReadyMate™	3/4"	N/A	4"

Table 11. XCell ATF 10 Connection kit details

Part	Description	Purpose
Sanitary tri-clamps	1.5" clamps	Clamp connectors
ATF to Bioreactor Connection	Tee with vent filter	Connect to bioreactor, pre-use wetting, integrity testing
ATF to Bioreactor Connection	A2B	Connect to bioreactor
Permeate Connection	Top permeate (optional pressure sensor kit)	Connection to top permeate port, pressure monitoring (if included), wetting, integrity testing
Bottom permeate extension	5" tubing with end cap	Clamp off bottom permeate
Drain connection	Drain tee	Connect to drain port, wetting, draining

6.5 Connecting XCell ATF 10 Single-use Device to a bioreactor

Two types of connections between the device and bioreactor are available. Hard connections are used where steam-in-place (SIP) is an option, such as with stainless steel bioreactors (SSB). Soft connections are used with single-use bioreactors (SUB) and consist of AseptiQuik® single-use connectors.

Fluid management for XCell ATF 10 Devices include retentate (A2B) tubing set kits and accessories that connect the device with the bioreactor, ensuring proper exchange of cell culture material. Intended for use in pilot scale, clinical, and commercial bioprocessing environments, tubing set kits work with XCell LS Controllers and legacy C410 controllers. Permeate tubing (not provided) connects the device to the harvest vessel and should be sterilized by autoclave or attached with a tubing welder or disposable sterile coupling. The permeate tubing should be compatible with the filtrate/harvest pump.

Note: Bioreactor adapters, used to connect tubing set kit to the bioreactor, are not provided.

6.5.1 Single-use XCell ATF 10 tubing sets kits and accessories

Several components are required to connect the XCell ATF 10 device to a bioreactor. XCell ATF 10 autoclavable tubing sets are available in two configurations depending on the preferred connectors. All tubing sets have a pressure rating of 25 psi. Additional accessories may be required.

Table 12. Tubing options

Tube set part #	Bioreactor Type	Tubing connection	Included components
SUATF10-TSK-AQL	Single-use and Stainless steel	AseptiQuik® L and Readymate™ (permeate ports)	A2B, vent tee, top and bottom permeate, drain
SUATF10-TSK-AQG		AseptiQuik® G and Readymate™ (permeate ports)	

Table 13. Required accessory

Description	Part number	Single- or multi-use	Pressure rating	ID	Material of construction
Permeate Pressure Sensor	SUATF610-PSK-V2	SU	25 psi	3/4 in	Polycarbonate

In addition, use of a SSB requires a bivalve assembly and connector.

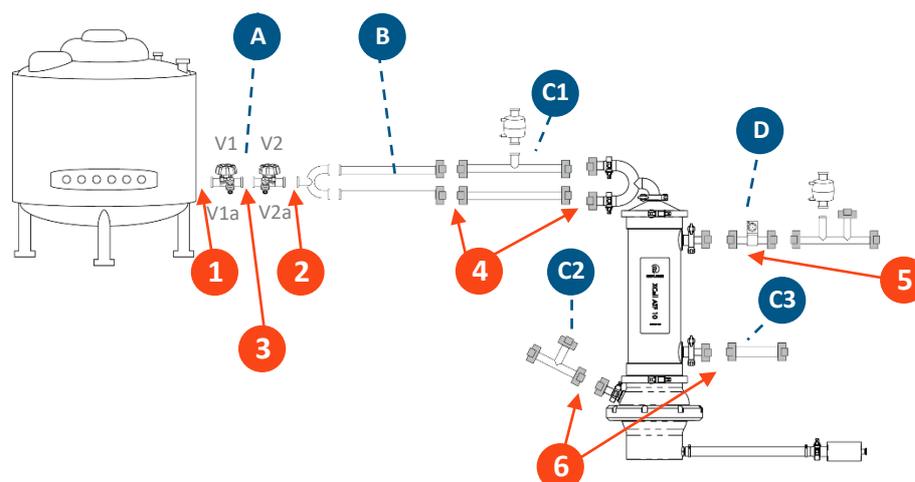
Table 14. Required stainless steel bioreactor accessories

Description	Part number	Tubing connection	Single or multi-use	Pressure rating	ID	Material of construction
Bivalve assembly	ATF10-VLV-KIT	N/A	MU	45 psi	1.5"	Stainless steel
A2B connector	SUATF10-AQL-TO-1.0TC	AseptiQuik® L	SU	25 psi	1"	Polycarbonate
	SUATF10-AQG-TO-1.0TC	AseptiQuik® G				

6.5.2 Tube set kit assembly: Single-use XCell ATF 10 connected to a stainless steel bioreactor

Tube set kits are available with AseptiQuik® connectors. Hard connection between the tubing set kit and the stainless steel bioreactor consists of the following parts, available as a unit:

- Two isolation bivalves: one attached to the bioreactor, and one attached to the housing
- A flexible hose between the main branches of the two valves
- A steam inlet: a side valve on one bivalve
- Condensate drain: a side valve on the other bivalve; lowest of the available valves

Figure 15. Single-use XCell ATF 10 connected to a stainless steel bioreactor

- A. ATF10-VLV-KIT (bivalve/u-bend)
- B. SUATF10-AQL-TO-0.75TC or SUATF10-AQG-TO-0.75TC (tubing set)
- C. SUATF10-TSK-AQL or SUATF10-TSK-AQG (tubing set)
 - C1. Vent tee
 - C2. Drain/condition tubing
 - C3. Bottom permeate tubing
- D. SUATF610-PSK-V2 (pressure sensor kit)

Single-use XCell ATF 10 stainless steel bioreactor tubing set kits are available with AseptiQuik® (AQL or AQG) connectors.

Connection instructions:

1. Connect right facing bivalve (A) to bioreactor. Attach trap to opening at V1a. Open valves V1 and V1a. SIP to sterilize the bioreactor. Close V1.
2. Connect the left facing bivalve and u-bend (A) to tubing set kit (B). Open valves V2 and V2a. Autoclave the entire assembly. Close V2.
3. Connect two halves of the bivalve. V1a and V2a should be open; V1 and V2 should be closed. SIP bivalve connection through the open valves. Close V1a and V2a and open V1 and V2.
4. Connect tubing set (B) to tubing set (C1). Connect tubing set (C1) to XCell ATF 10 Device.
5. Attach pressure sensor kit (D) to top permeate port.
6. Attach condition/drain port (C2) and permeate extension (C3).

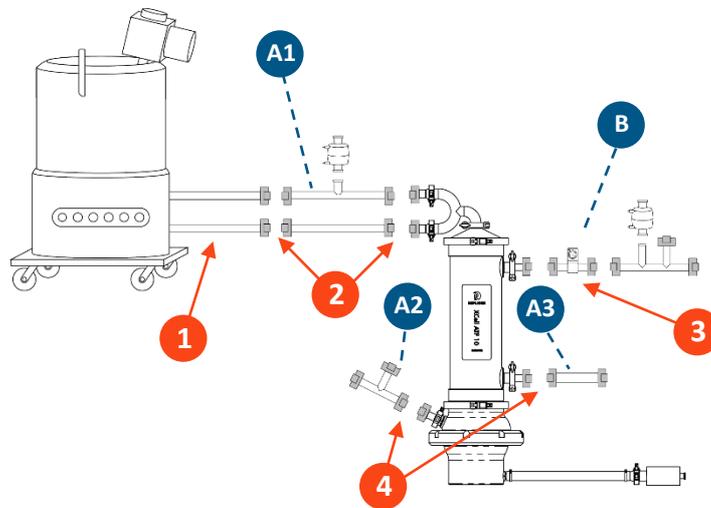
The following steam-in-place procedure is recommended for hard connections:

1. Attach a steam trap to the condensate valve and connect to a drain.
2. Close steam inlet and condensate drain valves.
3. Securely connect a regulated steam source to the steam inlet valve.
4. Open steam service.
5. Slowly open steam inlet valve.
6. Slowly open steam condensate valve.
7. Sterilize connection for about 20 min. at 121° C and ~16 psi.
8. Cool down.
9. Close the condensate valve.
10. Rapidly close the steam inlet valve and immediately open the main valve into the filtration assembly to minimize a pressure drop in the connection.

6.5.3 Tube set kit assembly: Single-use XCell ATF 10 connected to single-use bioreactor

Tube set kits are available with either ReadyMate™ or AseptiQuik® connectors.

Figure 16. Single-use XCell ATF 10 connected to a single-use bioreactor



- A. SUATF10-TSK-AQL or SUATF10-TSK-AQG (tubing set)
 - A1. Vent tee
 - A2. Drain/condition tubing
 - A3. Bottom permeate tubing
- B. SUATF610-PSK-V2 (pressure sensor kit)

Single-use XCell ATF 10 single-use bioreactor tubing set kits are available with AseptiQuik® (AQL or AQG) connectors.

Connection instructions:

1. Connect adapter tubing (not provided) to SUB.
2. Connect adapter tubing to tubing set (A1). Connect tubing set (A1) to XCell ATF 10 Device.
3. Attach pressure sensor kit (B) to top permeate port.
4. Attach condition/drain port (A2) and permeate extension (A3).

Note: Adapter tubing sets are not supplied by Repligen. Parameters for the tubing connected to the SUB: ID ≥ 1 ", length < 10 ", and a sterile connection to match tubing set A1.

6.6 XCell ATF 10 Single-use Device wetting

6.6.1 Device wetting background

XCell ATF 10 Single-use Devices are supplied dry and gamma-irradiated. Wetting of the hollow fiber filter is required to ensure robust filter performance. Wetting can be performed either offline or online. Offline wetting does not require the use of the XCell LS Controller and allows for pre-use filter integrity testing while maintaining sterility.

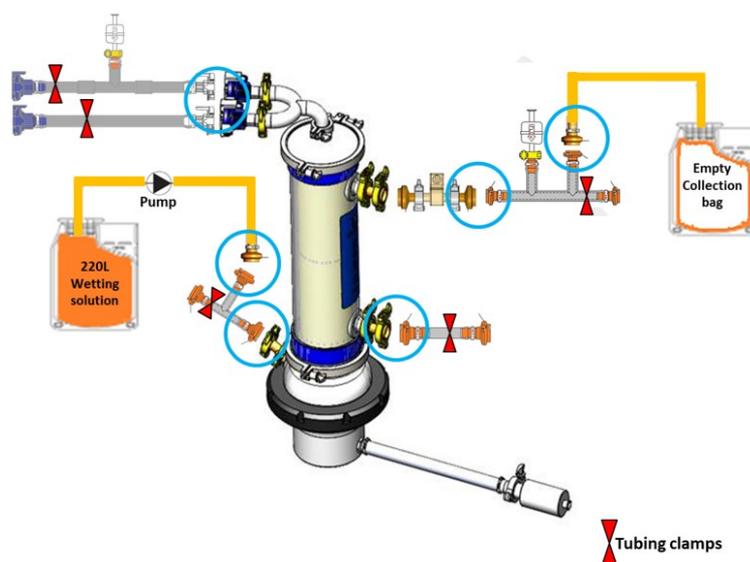
The online wetting procedure is executed with the device connected to a bioreactor that contains sterile cell culture media prior to inoculation. The XCell LS Controller is used to wet the filter. Additional XCell ATF 10 Single-use Devices that will be connected to a running bioreactor must undergo offline wetting.

The offline wetting procedure is recommended for the following reasons:

- Proper wetting – Filling the unit from the condition/drain port wets the membrane inside-out, which drives more uniform wetting of the filter and minimizes the formation of air bubbles inside the filter.
- Filter integrity – This method allows the user to test filter integrity while disconnected from the bioreactor while maintaining sterility. Integrity testing a filter prior to use reduces process risk.
- Sterility check – Upon completion of the wetting process with cell culture media, the media can be incubated overnight to evaluate the sterility of the device before making a connection to the bioreactor.

6.6.2 Offline wetting

Figure 17. XCell ATF 10 Single-use Device offline wetting setup



Instructions:

1. Install the device into the stand and attach the tubing (Figure 17; stand not shown)
2. Connect aseptic connectors (circled).
3. Ensure tubing clamps are placed in the proper locations for effective filter wetting and to prevent the accidental wetting of the vent filters and unlinked connectors.
4. Connect a single-use container with 220 L of sterile wetting solution (WFI or media) to the drain/condition port and an empty 220 L single-use container to the top permeate port.
5. Pump wetting solution through the condition/drain port at 2 LPM to fill the device.
6. Stop the pump when the solution begins to fill the top permeate port. Clamp the top permeate port such that both vent filter and empty bag segments are closed.
7. Restart the pump briefly. When solution begins to fill the U-connector, stop the pump and clamp the vent filter segment to close the top retentate. Ensure the line to the permeate collection bag is open.

Note: Ensure that the wetting solution does not contact the vent filters or the unlinked aseptic connectors at any point during the wetting process. Add a clamp to the top permeate tubing set to isolate the vent filter line, leaving the line to the collection bag open.

8. Restart the pump at a flow rate of 8 - 15 LPM, allowing for a minimum wetting time of 15 minutes. Continue until the entire volume of wetting solution has passed through the device and into the permeate collection bag to ensure complete wetting of the filter. Stop pump.
9. Clamp feed and collection tubing to remove bags from device.

- a. If cell culture media was used for wetting, the media collected in the permeate bag can be used to assess the sterility of the device by incubating it in a shake flask
- b. The wetting solution can remain inside the device until the unit is ready to be connected to the bioreactor, unless performing an integrity test. Ensure that tubing lines to the vent filters on the top retentate and top permeate tubing sections are clamped.

6.6.3 Filter integrity evaluation

If filter integrity testing is required, the recommendation is that it be performed following the offline wetting step and prior to connection to the bioreactor. The wetting solution must be drained from the device before testing.

1. Remove the clamps at the vent filters on both the top retentate and top permeate ports.
2. Close the line to the collection bag with a clamp and ensure that the condition/drain port clamp is correctly positioned ([Figure 18](#)).
3. Start the pump in reverse flow at flow rate of no more than 0.5 LPM to drain the wetting solution in the device to the bag at the condition/drain port.

Note: The draining process will not remove all of the solution from the diaphragm pump. The presence of residual wetting solution in the pump will not affect the filter integrity evaluation or the functionality of the device.

4. After draining the wetting solution, stop the pump and disconnect the bags from the device in a sterile manner by clamping the respective tubing lines.
5. The device integrity can now be evaluated using a forward air diffusion test by connecting an FIT Tester to the vent filter on the top retentate tubing set ([Figure 19](#)).
6. Ensure that the vent filter on the top permeate tubing is open for diffused air to escape and all remaining pinch clamps are tightened to avoid leaks
7. Pressurize the unit through the top retentate port vent filter to 10 psi and monitor the pressure decay for 5 minutes. The average pressure decay should not exceed 0.5 psi/min (diffusion rate < 30 SCCM/m²) for the unit to pass the filter integrity testing.

Note: To avoid filter drying, it is recommended to clamp the segments leading to vent filters on both permeate and retentate side after FIT evaluation.

Figure 18. Configuration for draining the wetting solution

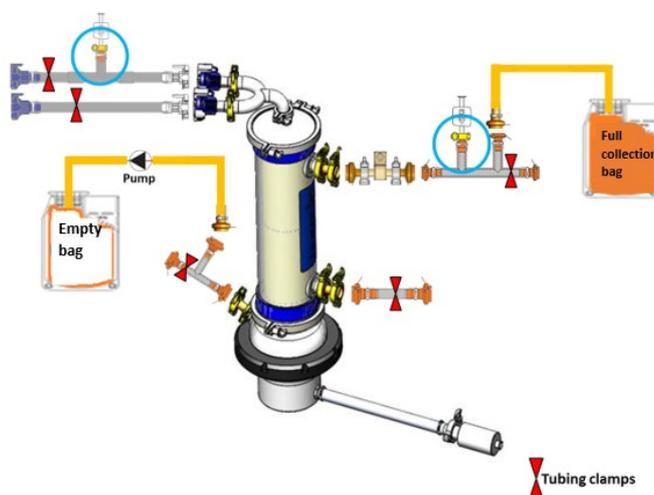
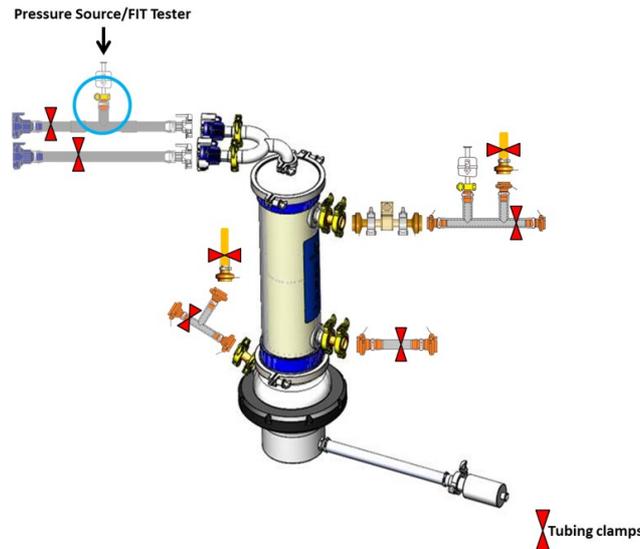


Figure 19. Configuration for post-wetting device integrity testing

6.6.4 Connecting to a bioreactor

After completing the offline wetting procedure and/or the integrity test, use the sterile connectors on the A2B tubing set to connect the device to the bioreactor.

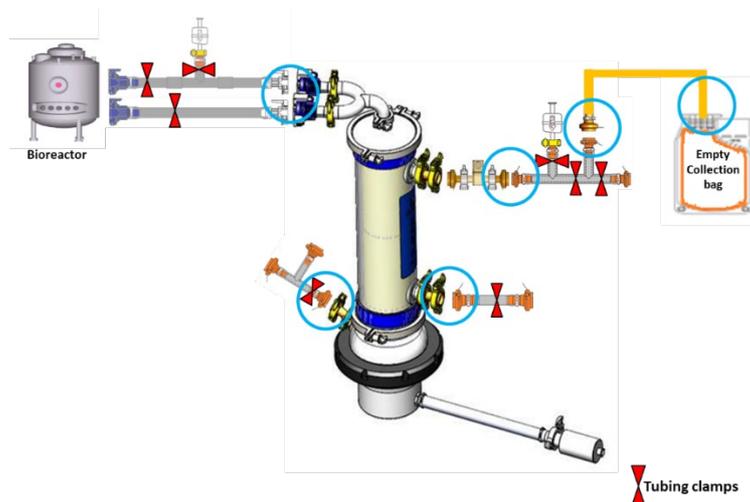
Refer to the XCell LS Controller user guide for instructions on operating the XCell ATF 10 Single-use Device.

6.6.5 Online wetting

If not wetted offline, after connecting to the bioreactor, devices are wetted using the XCell LS Controller. This method is not amenable to performing a pre-use integrity test. Prior to wetting, prepare the bioreactor as required for the cell culture process. The bioreactor must contain sterile cell culture media and be cell free (pre-inoculation) for the wetting procedure.

Instructions:

1. Install the device into the stand and attach the tubing ([Figure 20](#); stand not shown)
2. Connect aseptic connectors (circled). Ensure tubing clamps are placed in the proper locations for effective filter wetting and to prevent the accidental wetting of the vent filters and unlinked connectors.
3. Connect the device to the bioreactor using the A2B tubing set.
4. Connect the XCell LS Controller to the device via the A2C connection.
5. Connect an empty single-use bag (hold-up volume > 220 L) to top permeate port.
6. Remove both clamps on the top retentate tubing segment ensuring that the line between the bioreactor and the device is open. Clamp off the vent filter.

Figure 20. Configuration for online wetting of the device (pre-wetting)

Note: Bioreactor head pressure may force the media into the device without the XCell ATF Device action.

7. Start the XCell ATF 10 Device pump from the XCell LS Controller at a flow rate of 60 LPM (pressure and exhaust) and let it run for five minutes until all air bubbles disappear and flow set-point is reached.
8. After equilibration, remove the clamp to the empty 220 L bag on the top permeate port and immediately start the permeate pump at a flow rate of 8 - 15 LPM.
9. Collect at least 220 L of wetting solution in the permeate collection bag ([Figure 21](#)). The flow rate should be adjusted to allow a minimum wetting time of 15 minutes.
10. Stop the permeate pump and the XCell ATF 10 Device pump. Clamp both A2B tubing lines and disconnect the collection bag from the permeate port in a sterile manner ([Figure 22](#)) by clamping the tubing.

Note: The media from the collection bag can be used to determine the sterility of the wetted XCell ATF 10 Single-use Device.

11. The remaining solution inside the device can remain, until the bioreactor is ready for the perfusion process.

Note: Close the retentate and permeate vent filters before starting the perfusion process.

Figure 21. Configuration for online wetting of the device (post-wetting)

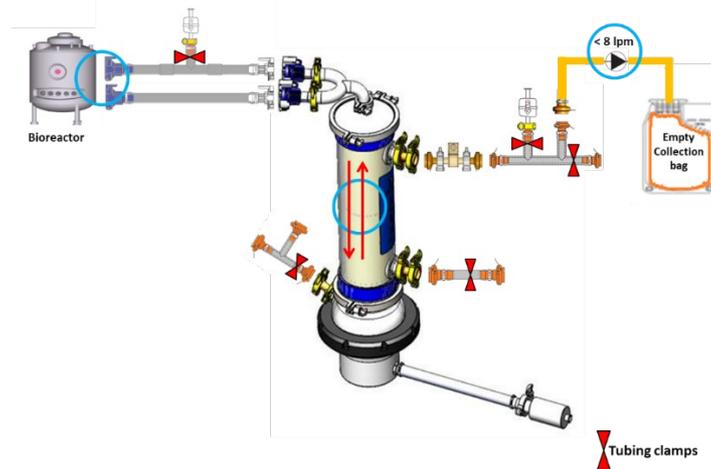
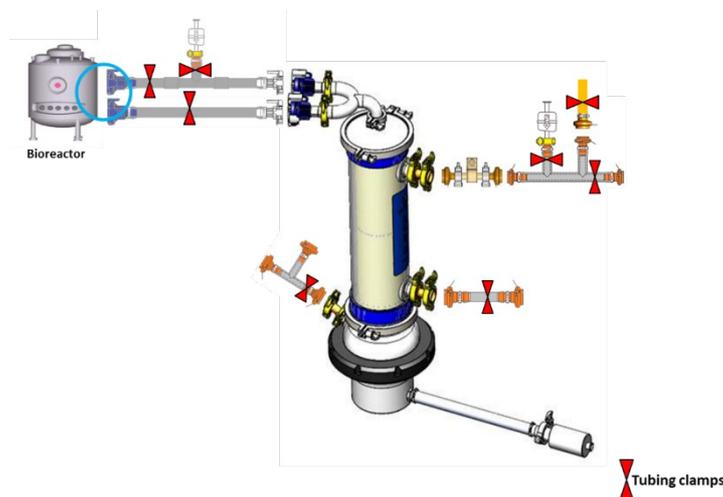


Figure 22. Clamp configuration for disconnecting bags from device



6.7 XCell ATF 10 Single-use Device post-use instructions

After completion of a cell culture process using the XCell ATF 10 Single-use Device, disconnect and discard the device.

Instructions:

1. Stop the permeate pump and disconnect the harvest bag in a sterile manner.
2. Stop the XCell LS Controller and disconnect the XCell ATF 10 Single-use Device A2C line from the controller.
3. Clamp both the A2B and top permeate tubing lines using tubing clamps.
4. Connect an empty bag or a container (> 25 L) to the condition/drain port.
5. Remove the clamps at the vent filters on both the top retentate and top permeate ports. Detach the clamp at condition/drain port to drain the culture into the empty bag.
6. Begin the draining of cell culture solution through the condition/drain port at a flow rate of 1 LPM to the bag/container.

Note: The device may need to be tilted to drain the cell culture solution from the diaphragm pump.

7. Stop the pump and disconnect the bag from the device. Discard device per local waste disposal codes.

7. Frequently asked questions

What do I do if a vent filter accidentally becomes wet during the wetting process?

Vent filters are made of hydrophobic membrane. Wetting solution getting in contact with vent filters for short duration (< 15 minutes) does not impact the integrity and sterility of vent filter and XCell ATF 6 or XCell ATF 10 Single-use Devices. We recommend purging the vent filter to remove the residual solution.

What do I do if a leak is detected during the off-line wetting procedure?

Each individual device is pressure tested at 25 psi to ensure the integrity of the entire assembly. However, if a leak is detected during wetting process, immediately stop the peristaltic pump and identify the location of the leak. Please ensure that the sterile connectors and tubing clamps are appropriately installed at proper locations. Clamping the wrong tubing sets during wetting procedure pressurizes the device and leads to leakage. If no faults were found in setup, please contact a local FAS or customer service for further support.

How do I ensure the sterility of an XCell ATF 6 and XCell ATF 10 Device?

The wetting solution collected from off-line wetting procedure can be incubated in a shake flask at 37° C for 24 hours to assess the sterility of a device.

How long can the XCell ATF 6 and XCell ATF 10 Single-use Devices be stored in a wet condition before connecting to a bioreactor?

After completing the procedure, the tubing segment leading to the vent filters on the A2B and the top permeate tubing segments must be clamped to avoid filter drying. The device can be stored in a wet condition for one week before installing the device for cell culture processing.

What do I do if the device fails pre-use integrity testing?

Please ensure that the tubing clamps on the retentate side are properly installed. Generally, if the filter integrity test fails by small percentage (acceptance criteria: 30 SCCM/m²), it is recommended to wet the filter again using the same procedure. If a gross leak is detected during integrity, please contact a local sales manager or customer service for further support.

Do the XCell ATF 6 and XCell ATF 10 Devices perform similarly to XCell ATF 6 and XCell ATF 10 stainless steel devices?

Yes, the filter used in the XCell ATF 6 and XCell ATF 10 Single-use Devices is same as the one which is being used in the XCell ATF 6 and XCell ATF 10 stainless steel devices. In addition, the single-use device is operated using the same XCell LS Controller as stainless steel without modifying any parameters and the pumps between the stainless steel and single-use equipment is identical.

8. Appendix A Part numbers

Table 15. Single-use XCell ATF 6 Device part numbers

Part #	Description	Notes
SUATF6-G02PS	XCell ATF 6 Single-use Device, 0.2 µm PS	0.2 µm filter, GE ReadyMate™ DAC connections
SUATF6-S02PES	XCell ATF 6 Single-use Device, 0.2 µm PES	0.2 µm filter, GE ReadyMate™ DAC connections
suATF6-PES-AQL	XCell ATF 6 Single-use Device, 0.2 µm PES	0.2 µm filter, CPC AseptiQuik aseptic connections
suATF6-STD	XCell ATF 6 Single-use Device Stand	Stainless steel reusable stand
SUATF6-TSK-RM SUATF6-TSK-AQG SUATF6-TSK-AQG-AQL	XCell ATF 6 Single-use Device Tubing Set Kit	(6) Individual tubing sets (8) Sanitary BioClamps (6) Pinch Clamps
SUATF610-PSK-V2 SUATF610-PSK-AQ-V2	XCell ATF 6 Single-use Device Permeate Pressure Sensor Kit	(1) 3/4" TC SciLog SciPres Pressure Sensor (2) GE ReadyMate™ 3/4" TC Connectors (2) 3/4" TC Bioclamps (2) AseptiQuik 3/4" TC Connectors

Table 16. Single-use XCell ATF 10 Device part numbers

Part #	Description	Notes
SUATF10-G02PS	XCell ATF 10 Single-use Device, 0.2 µm PS	0.2 µm filter, GE ReadyMate™ DAC and AseptiQuik® connections
SUATF10-S02PES	XCell ATF 10 Single-use Device, 0.2 µm PES	0.2 µm filter, GE ReadyMate™ DAC and AseptiQuik® connections
SUATF10-STD	XCell ATF 10 Single-use Device Stand	Stainless steel reusable stand
SUATF10-TSK-AQG SUATF10-TSK-AQL	XCell ATF 10 Single-use Device Tubing Set Kit	(6) Individual tubing sets. Does not include adapter tubing.
SUATF610-PSK-V2 SUATF610-PSK-AQ-V2	Permeate Pressure Sensor Kit	(1) 3/4" TC SciLog SciPres Pressure Sensor (2) GE ReadyMate™ 3/4" TC Connectors (2) 3/4" TC Bioclamps (2) AseptiQuik 3/4" TC Connectors

9. Appendix B Materials of construction

Table 17. XCell ATF 6 materials of construction: product-contact parts

Component	Materials of construction
Filter housing and pump	Polycarbonate
Adhesive	Polymethyl methacrylate (PMMA)
Tubing	Platinum Cured Silicone
Elbow	Polyvinylidene Fluoride (PVDF)
GE ReadyMate™ DAC	Polycarbonate with silicone seal
Hollow fiber cartridge	PES Membrane - Polyethersulfone, Polysulfone, Polyurethane, and Polypropylene PS Membrane - Polysulfone, Polyethylene, Epoxy, and Polypropylene
Gaskets and diaphragm	Silicone

Table 18. XCell ATF 6 materials of construction: non-product-contact parts

Component	Material
Tubing and sanitary clamps	Platinum cured silicone tubing, Glass-Filled Nylon clamps
Pump closure ring	Acrylonitrile Butadiene Styrene (ABS)
Stand	ABS, SS

Table 19. XCell ATF 10 materials of construction: product-contact parts

Component	Materials of construction
Filter housing and pump	Polycarbonate
Adhesive	Acrylated Urethane
Tubing	Platinum Cured Silicone
Elbow	Polyvinylidene Fluoride (PVDF)
ReadyMate™ DAC	Polycarbonate with silicone seal
AseptiQuik® connectors	Polycarbonate with silicone seal
Hollow fiber cartridge	PES Membrane - Polyethersulfone, Epoxy, and Polypropylene PS Membrane - Polysulfone, Epoxy, and Polypropylene
Gaskets and diaphragm	Silicone

Table 20. XCell ATF 10 materials of construction: non-product-contact parts

Component	Materials of construction
Tubing and sanitary clamps	Platinum cured silicone tubing, Glass-Filled Nylon clamps
Pump closure ring	ABS
Stand	ABS, SS

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