

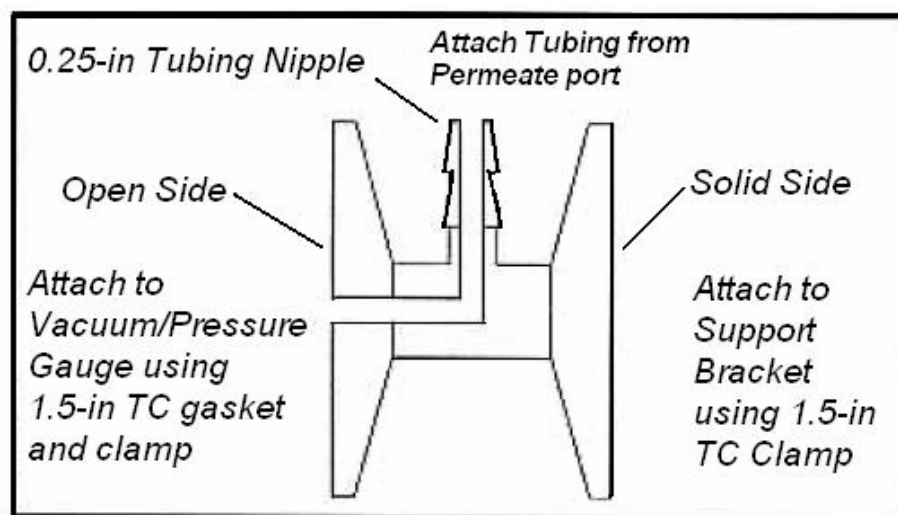
FlexStand™ System Manual Permeate Flow Control Kit Catalog Model Number KPCM-1 (56-4107-73)

Assembly and Operating Instructions

For high flux membranes (all hollow fiber microfiltration and some open pore ultrafiltration hollow fiber such as 750,000 NMWC), permeate flux control is an effective means of decreasing localized high transmembrane pressure (TMP) that leads to pore plugging. This will improve flux stability and increase overall productivity and membrane capacity with particulated feed streams for target protein clarification applications. Details of permeate control operating techniques are provided in the Operating Handbook – hollow fiber cartridges for membrane separations (request Literature 18-1165-30). The technique of permeate flow control is also discussed in detail on pages 14 and 15 of Selection Handbook Hollow Fiber Cartridges and Systems (request literature# 18-1165-29). Hardware set-up is described below.

Manual Permeate Control Kit Assembly

The Manual Permeate Control Kit (Model KPCM-1) consists of a Vacuum/Pressure Gauge, a Support Bracket for the gauge to attach to the FlexStand System support rod, a Backpressure Valve which mounts on the support rod, a 1.5-in sanitary fitting x 1.5-in sanitary fitting x 0.25-in tubing nipple tee and associated clamps, gaskets, adaptors and tubing.



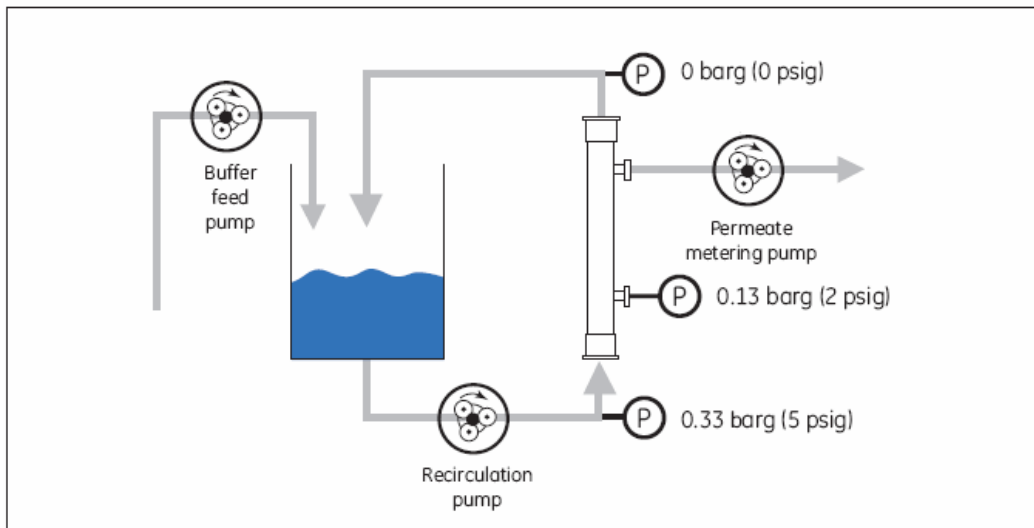
**1.5-in TC Sanitary x 1.5-in Sanitary x 0.25-in Tubing Nipple "Tee"
used in Permeate Flow Control Kit (model # KPCM-1, 56-4107-73)**



1. Position the Support Bracket and the Backpressure Valve on one of the Support Rods.
 2. Using a clamp and gasket, attach the closed (no opening) 1.5-in sanitary fitting side of the tee to the Support Bracket.
 3. Attach the Vacuum/Pressure Gauge to the other side of the tee.
 4. Depending on the cartridge, use either a 0.375 or 0.5-in to -0.25-in reducer to connect the lower* permeate port to the 0.25-in nipple on the tee (see figure below). Use flexible vinyl tubing and snapper clamps provided.
 5. Run a flexible tubing line from the upper permeate port on the cartridge through the Backpressure Valve and then on to the permeate reservoir.
 6. When processing, start with the Backpressure Valve fully closed, then adjust the Backpressure Valve manually to achieve a constant pressure which is only slightly less than the average of the inlet and outlet pressures on the lumen side of the membrane.
- * The permeate may be removed from either the upper or lower port in a vertically mounted hollow fiber cartridge, but is usually taken from the upper port to allow the permeate side to fill up with permeate and make a better hydraulic connection. Permeate control via peristaltic metering pump Permeate control may also be imparted utilizing a variable speed peristaltic pump in place of the Backpressure Valve provided with the Manual Permeate Control Kit. To set up the permeate control loop with the pump:

Permeate control via peristaltic metering pump

Permeate control may also be imparted utilizing a variable speed peristaltic pump in place of the Backpressure Valve provided with the Manual Permeate Control Kit. To set up the permeate control loop with the pump:



1. Follow steps 1 through 4 above for Manual Permeate Control.
2. Run a flexible tubing line from the upper permeate port on the membrane cartridge through the pump head and then on to the permeate reservoir. Note: Heavy-duty tubing must be used within the pump head (see table below for suggested flow rates, pumps and tubing). Adapt lighter weight tubing to the pump tubing using the connectors and clamps provided, if desired.
3. Starting with the pump at minimum rpm, adjust the backpressure on the permeate side by controlling the rate of permeate withdrawal.

If microfiltration membrane pore-plugging occurs, this will be observed initially as a decreasing pressure on the permeate pressure gauge. Progressive negative pressure reading on the vacuum side of the gauge indicates increasing pore plugging due to the pump attempting to draw fluid against an occluded membrane.

Permeate flow control used in clarification applications with hollow fiber microfiltration cartridges - discussion of technique

Permeate flow control for various 30 or 60 cm L hollow fiber microfiltration cartridges are chosen based on the size of the target protein and the density and fouling potential of particulates in the starting material. Some processes with very heavy particulated feeds or high viscosity may not be suited to the use of 60 cm L fibers due to excessive localized TMP. For example, microfiltration clarification of recombinant intracellular protein from bacterial lysate is often most successful in a range of 10-30 l/mh with 0.1 or 0.2 micron pore sizes, depending on the degree of fouling or particulate loading; whereas, clarification of larger expressed proteins (such as monoclonal antibodies) from mammalian cell culture may be successful in a range of 20-50 l/mh using 0.2, 0.45 or 0.65 micron pores sizes, depending on the degree of cell viability in the final batch culture. Flow control rates should be tested for protein recovery and membrane capacity at small scale using the same fiber ID and length as intended for full scale process using clean membranes and starting material representative of the full scale process.

Volumetric flow rates in ml/min for selected flux rates in liters/m²/hour (l/mh)

Catalog Model number*	Flow Path	Area (cm ²)	10 l/mh	30 l/mh	50 l/mh
CFP-x-E-3MA	1.0 mm x 30 cm	110	1.8	5.5	9.2
CFP-x-D-3MA	0.75 mm x 30 cm	120	2.0	6.0	10.0
CFP-x-E-3X2MA	1.0 mm x 60 cm	225	3.8	11.3	18.8
CFP-x-E-4MA	1.0 mm x 30 cm	420	7.0	21.0	35.0
CFP-x-D-4MA	0.75 mm x 30 cm	460	7.7	23.0	38.3
CFP-x-E-4X2MA	1.0 mm x 60 cm	850	14.2	42.5	70.8
CFP-x-D-4X2MA	0.75 mm x 60 cm	950	15.8	47.5	79.2
CFP-x-E-5A	1.0 mm x 30 cm	1200	20.0	60.0	100.0
CFP-x-D-5A	0.75 mm x 30 cm	1600	26.7	80.0	133.3
CFP-x-E-6A	1.0 mm x 60 cm	2800	46.7	140.0	233.3
CFP-x-D-6A	0.75 mm x 60 cm	3700	61.7	185.0	308.3
CFP-x-E-8A	1.0 mm x 30 cm	3600	60.0	180.0	300.0
CFP-x-D-8A	0.75 mm x 30 cm	4100	68.3	205.0	341.7
CFP-x-E-9A	1.0 mm x 60 cm	8400	140.0	420.0	700.0
CFP-x-D-9A	0.75 mm x 60 cm	9300	155.0	465.0	775.0

* Note: "x" =1, 2, 4 or 6 corresponding to 0.1, 0.2, 0.45 or 0.65 micron pore sizes, respectively.

Not all pore sizes are available in all flow path options, for details refer to "Selection Handbook Hollow Fiber Cartridges and Systems", literature# 18-1165-29).

Peristaltic pumps are listed below that may be calibrated for metering the permeate flow rates listed in the previous table:

P1 Peristaltic pump (18-1110-91) flow range:

0.1-8.3 ml/min using 3.1 mm ID tubing

PRP-09WM Peristaltic pump (56-4106-53) flow ranges

5.4-108 ml/min using 1.6 mm ID tubing

20-400 ml/min using 3.1 mm ID tubing

72-1440 ml/min using 6.4 mm ID tubing

Calibrate pump with the appropriate tubing ID that allows selected flow rate to be in the middle of the range of flow rate for that tubing.



imagination at work

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