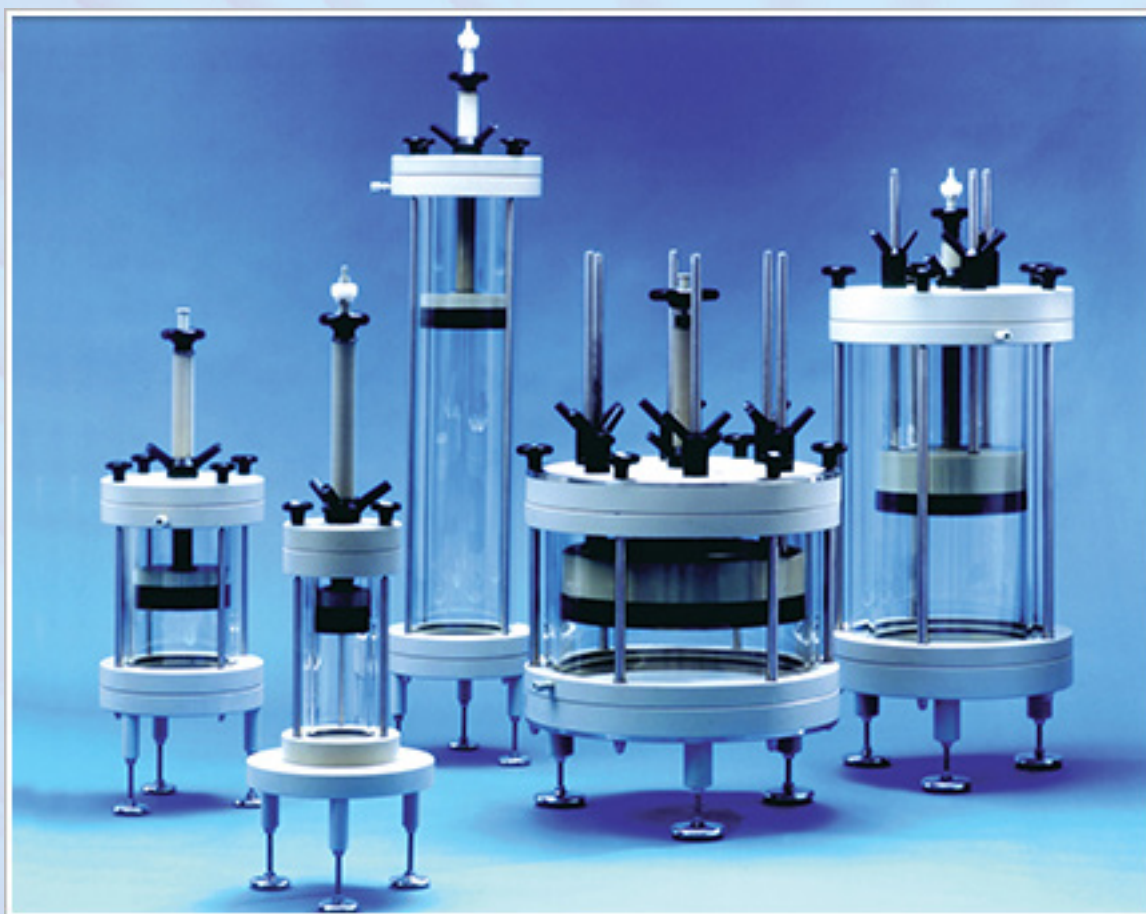


Versatile High-Performance

Upscale[®] Laboratory Glass Columns

From Pilot to Process



essentialLife Solutions
for preparative chromatography

Helping You Succeed!

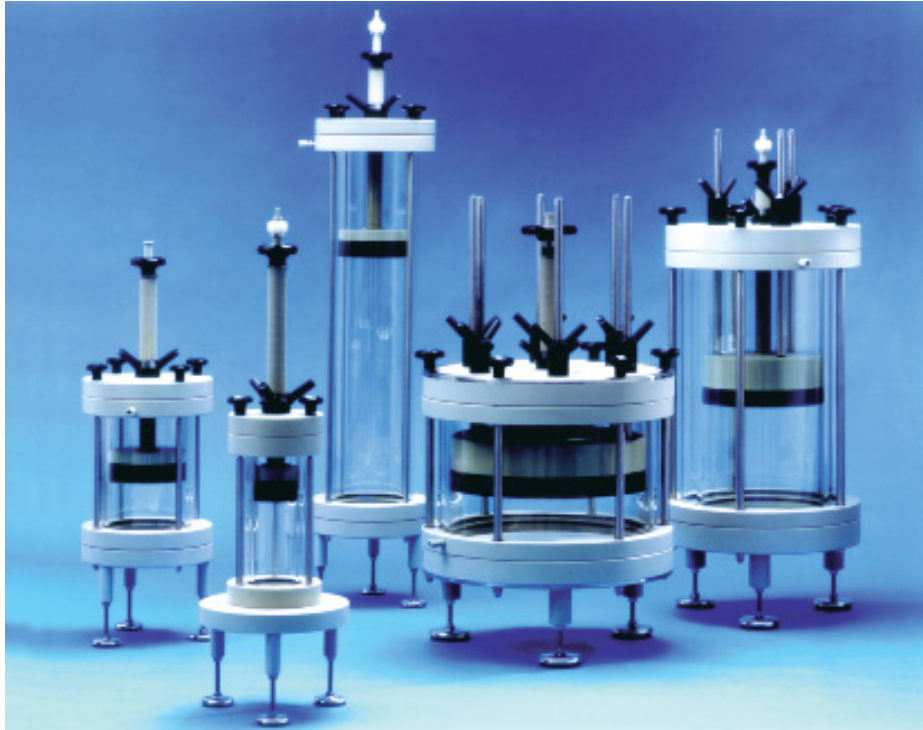
Table of Contents

Introduction	1
Advantages of Upscale® Glass Columns	2
General Description - The Column	3 & 4
General Description - Column Tube Sub-Assembly	5
General Assembly - Base Assembly	6
General Assembly - Piston Sub-Assembly	7
General Assembly - Flow Distributor	8
General Assembly - Connectors and Tubing	9
Maintenance	10
Warranty	10
Temperature / Pressure Chart	11
Materials of Construction	11
Chemical Resistance	12
Packing Content.....	13

General information:

Any/all information contained within subject to change without notice.

Introduction



Essential Life Solutions Upscale® glass columns are designed to meet the requirements for large scale purification of biological molecules using low pressure liquid chromatography techniques.

Upscale® columns consist of a borosilicate glass tube protected by an acrylic jacket, a base plate and an adjustable piston. The piston range allows the user to select a variety of column heights and volumes.

The base plate and the piston are equipped with a flow distributor system, composed of an anti-jetting device and radial distribution channels equipped with a 20 µm (standard) frit.

Upscale® columns feature an efficient flow distribution system which ensures uniform flow of liquid onto the surface of the packing material and out of the column.

The sealing systems at the lower and upper portion of the column have been designed to minimize dead volume which may trap micro-organisms, retain contaminating substances and/or dilute the sample. All connections have a sanitary design.

The column is easily packed with few simple adjustments.

This piston range is set and pressure is applied on the upper seal by simply operating two handles, which reduces the time required for set-up of the column.

Upscale® columns are composed of biocompatible materials and withstand solutions commonly used in low pressure liquid chromatography (acidic and basic solutions, detergents, polar organic solvents).

Advantages of Upscale® Glass Columns

1 UNIQUE FLOW DISTRIBUTION SYSTEM

The base plate and piston are equipped with an efficient flow distribution system composed of an anti-jetting device and radial distribution channels utilizing a 20 μm frit. This system ensures a uniform flow of liquid onto the surface of the packing material and out of the column, resulting in improved separation performance. The fluid delivery (inlet tube) system connections are made at the exterior of the column, providing a more visible and reliable connection.

2 PROVEN MECHANICAL SEAL TECHNOLOGY

The mechanical seal provides simple, accurate and repeatable seal adjustment. The sealing systems at each end of the column have been specifically designed to minimize dead volume, which may trap microorganisms, retain contaminating substances and/or dilute the sample.

3 EASE OF USE

The column is easily packed with a few simple adjustments of the coarse and fine seal adjustment controls. A large hub and handwheel make bed height adjustment virtually effortless.

4 LIGHTWEIGHT DESIGN

The piston assembly is made from polypropylene for a lightweight feel. This facilitates assembly and disassembly for the user without unnecessary exertion or reliance on an external lifting apparatus.

5 PROTECTIVE JACKET FOR TEMPERATURE CONTROL

The acrylic jacket acts as a temperature control unit and as protection for the interior glass from the production environment, this ensuring the ruggedness of the column assembly, as well as maintaining operator safety.

6 HASSLE-FREE SCALE UP

The scale up of process from development through pilot scale through production scale is no problem.

7 FULL RANGE OF SIZES

Upscale® columns are available in standard diameters of 9, 18, 30, and 45 cm and standard lengths of 30, 60 and 90 cm. Custom-made columns of up to 100 cm diameter are also available.

General Description - The Column (figure 1)

The design and the materials of construction are similar for all column diameters and heights.

The geometric features of Upscale® glass columns are summarized in table I.

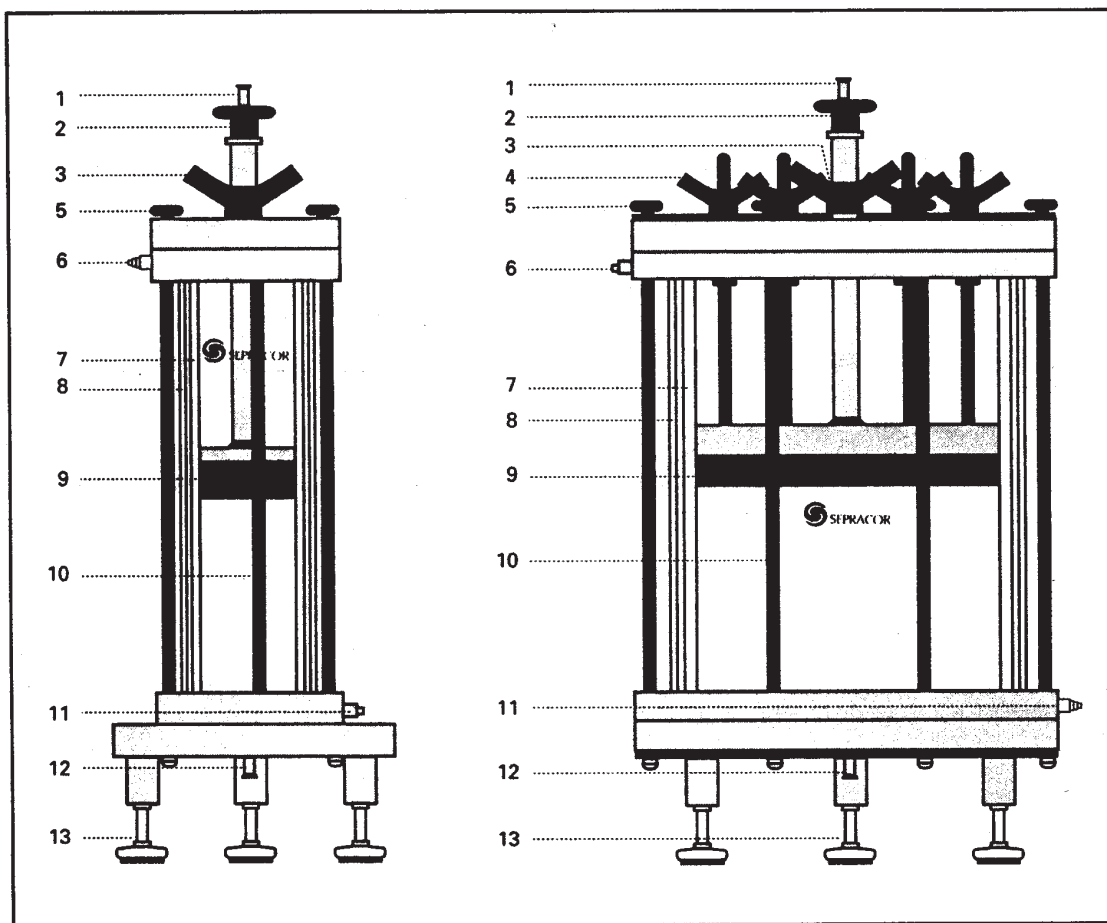


Figure 1: General Description of Upscale® Columns

- | | |
|---|---|
| 1 - Sanitary connection (column inlet) | 7 - Column tube (borosilicate glass) |
| 2 - Seal actuation hand wheel | 8 - Acrylic protective jacket |
| 3 - Bed height adjustment handle | 9 - Adjustable piston-to-tube seal (EPDM) |
| 4 - Pressure rod clamp handle
(only for 300 and 450 mm dia. columns) | 10 - Tie rod column tube unit |
| 5 - Piston / tie rod nuts | 11 - Heat exchange port |
| 6 - Heat exchange port | 12 - Sanitary connection (column outlet) |
| | 13 - Adjustable foot |

General Description - The Column

Table I: Geometric features (1) of Upscale® Columns

Part No.	Column	I.D. (mm)	Max Useful Length (mm)	Piston Stroke (mm)	Volume (L)
265111	90 x 300	90	265	265	0 - 1.68
265117	90 x 600	90	565	400	1.04 - 3.59
265119	90 x 900	90	865	400	2.95 - 5.50
265121	180 x 300	180	265	265	0 - 6.74
265127	180 x 600	180	565	400	4.19 - 14.37
265128	180 x 900	180	865	400	11.83 - 22.01
265131	300 x 300	300	220	220	0 - 15.55
265137	300 x 600	300	520	400	8.48 - 36.75
265138	300 x 900	300	820	400	29.68 - 57.96
265141	450 x 300	450	220	220	0 - 34.98
265147	450 x 600	450	520	400	19.08 - 82.7
265148	450 x 900	450	820	400	66.79 - 130.41

(1) Essential Life Solutions may at times change the features of the columns described in this manual without notice.

(2) 1 inch = 25.4mm

The available diameters and tube heights and the adjustable piston range allows selection of the optimal volume and geometry for the chromatographic process.

The running conditions for Upscale® glass columns are detailed in appendix 1: Operating specifications.

Scaling up is simplified because flow distribution efficiency is maintained for all column sizes. Chemical compatibility and manipulation operations are identical across the range of sizes (see appendix 1: Operating specifications, and appendix 3: Chemical resistance).

Upscale® columns consist of three sub-assemblies (fig. 2):

- the column tube
- the piston with adjustable stroke
- the base assembly

General Description - Column Tube Sub-Assembly

The column tube sub-assembly (glass tube + jacket) consists of two polypropylene flanges connected with stainless steel tie rods which must not be disassembled.

Upscale® columns feature an acrylic jacket which protects the glass tube. The jacket also allows the user to circulate heat exchange fluid between the jacket and glass barrel.

Each flange of the tube sub-assembly is equipped with a threaded hose barb connector for 6 mm internal diameter flexible tube. The thread is $\frac{1}{4}$ " gas Whitworth straight pipe thread. These connectors allow the column to be connected to a cooling/heating circuit. Pressure in the jacket should not exceed 0.5 bar (7.25 psi).

The bottom flange carries two o-rings which with o-rings in place provide the seal with the base plate and frit.

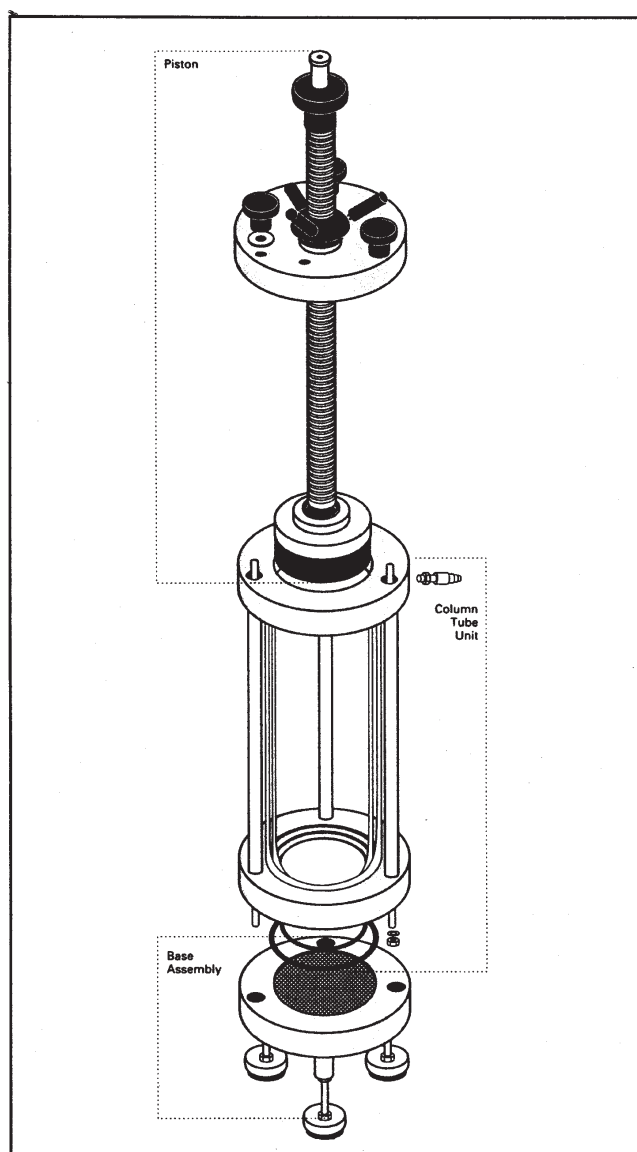


Figure 2: Main sub-assemblies of the Upscale® columns

General Description - Base Assembly

The base plate (fig. 3) of Upscale® glass columns contains a flow distributor topped by a polyethylene frit. The frit diameter is slightly larger than that of the glass tube and both are sealed with o-rings. Therefore there is minimum dead volume in the lower part of the column. The base plate is fixed to the column tube sub-assembly via the extending stainless steel tie rods of the tube sub-assembly.

The adjustable column feet are fixed on the base plate. A bubble level is supplied so that the column can be easily adjusted to the vertical position. The heights of the individual feet can be adjusted by first loosening the 19 mm jam nut adjacent to the polypropylene stand off and then turning the 19 mm head of the leveling bolt adjacent to the foot pad. Retighten the jam nut when adjustments are complete. Adjustable locking column stabilization assemblies can be provided for the 300 and 450 mm diameter as optional accessories.

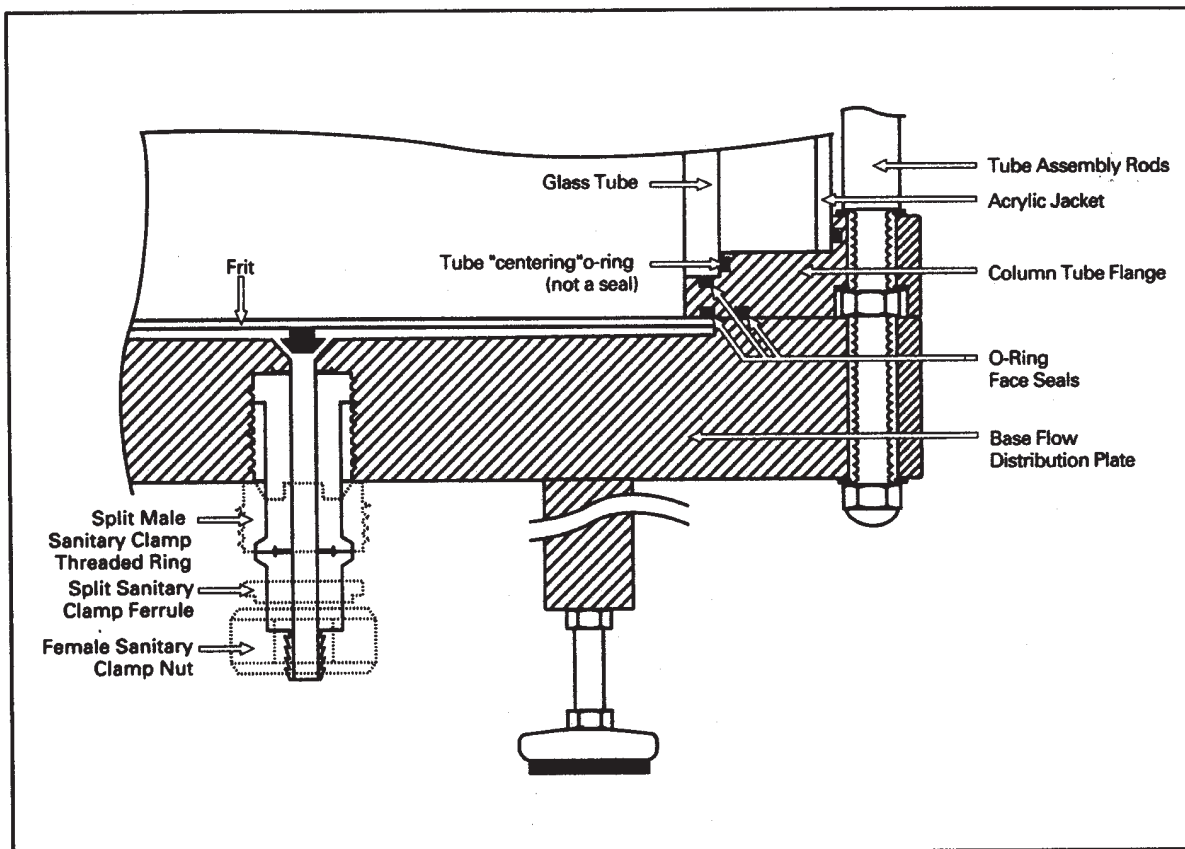


Fig. 3 : Base assembly

General Description - Piston Sub-Assembly

The piston (fig. 4) allows the user to adjust the column bed height and volume (table I).

It is easily introduced into the column tube and is then fixed in place with hand tightened nuts on the stainless steel tie rods. The piston is raised or lowered in the column with the bed height adjuster handle.

The piston to glass barrel seal is obtained by compressing the piston seal actuated by clockwise rotation of the handle located on the end of the central screw. The descending motion during actuation of the seal is designed to eliminate dead volume. This reduces sample dilution, band broadening, accumulation of contaminating products and bacterial proliferation.

On large diameter columns (300 and 450 mm), additional stainless steel pressure rods link the flow distributor of the upper plate of the column. The rods are disengaged from the upper plate during movement of the piston and should be engaged when the final position of the piston has been reached. The pressure rods are engaged and disengaged by hand-tightening the pressure rod handles.

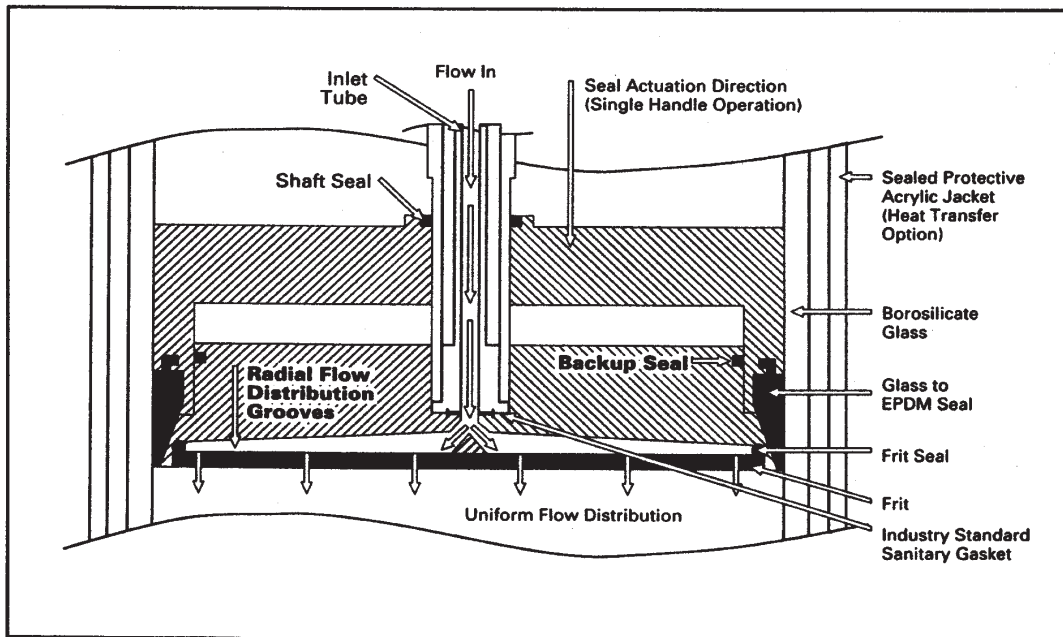


Fig. 4 : Cross section of piston flow adapter assembly

General Description - Flow Distributor (figure 5)

The two (top and bottom) flow distributors are identical except for a slightly larger diameter on the bottom. The column may be used in ascending as well as in descending flow direction.

The flow distribution system consists of :

- an anti-jetting device
- radial distribution channels
- 20 um (standard) polyethylene frit

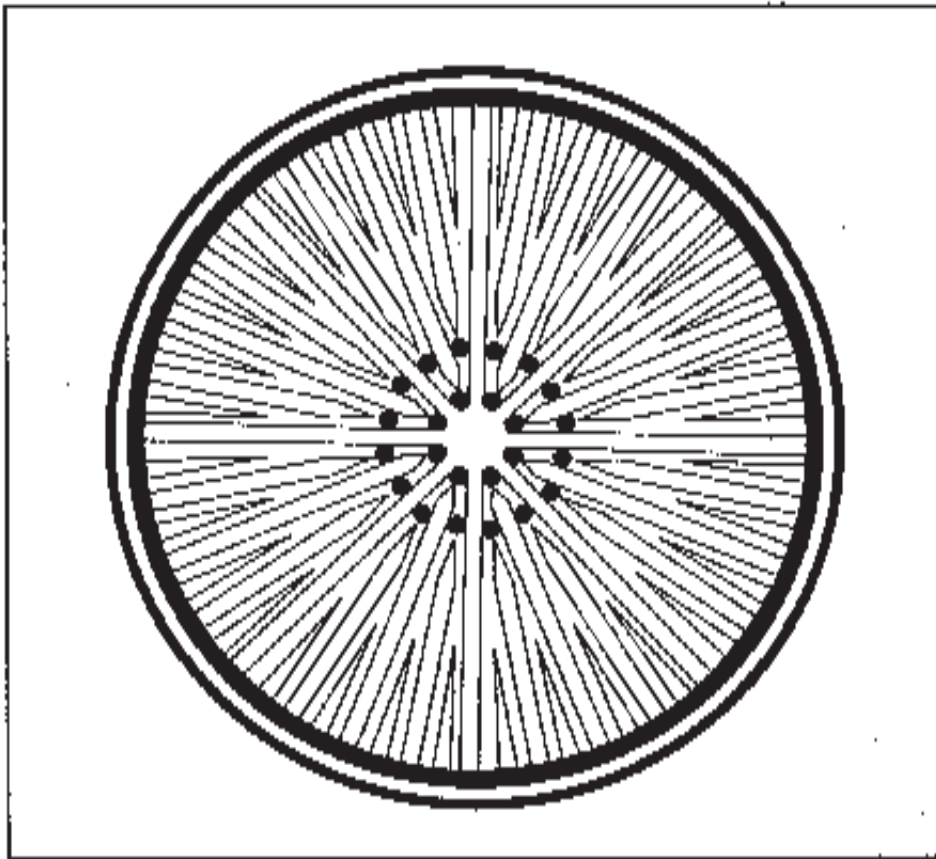


Figure 5: Upscale® flow distribution system

The design of the grooved radial distribution channels minimizes dead volume under the frit and optimizes flow distribution. The polyethylene frit provides the support for the column packing material and increases efficiency of flow distribution by inducing a slight pressure drop between the anti-jetting device and the packing material. An o-ring has been placed around the frit in order to prevent channeling of flow around the frit.

General Description - Connectors and Tubing

The column inlet and outlet are equipped with sanitary connections (fig. 6), which are free of points of retention and are in accordance with international sanitary standards.

The following tubing is recommended to minimize back pressure and reduce contamination:

- ~ for 90, 180 mm dia. columns : 6mm (= 1/4") I.D. tubing with sanitary clamp connection
- ~ for 300, 450 mm dia. columns : 9.5 mm I.D. (3/8" I.D.) tubing with sanitary clamp connection

Each column is supplied with 2 clamps and 4 sanitary gaskets, as well as 2 sanitary flanges with barbed fitting connectors for tubing as above.

The sanitary flanges with barb fitting provides connection of the column to other accessories, which may not have sanitary flanges, via flexible tubing.

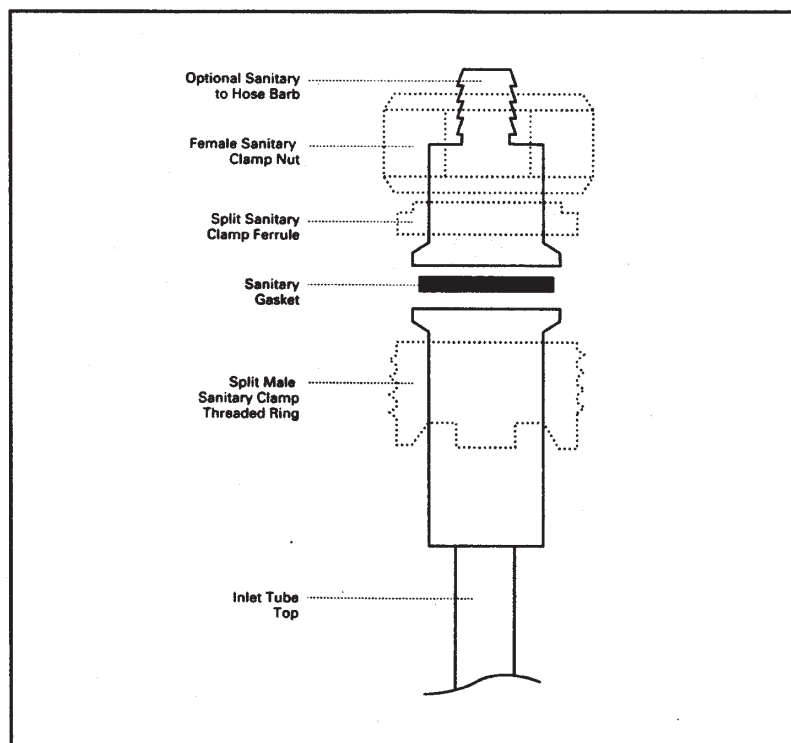


Fig. 6 : Sanitary connection

Maintenance

Columns have a simple design utilizing few parts, for simple cleaning and maintenance.

It is recommended to inspect the frits regularly and to wash them with detergent at each packing operation.

The flow distributors and the internal surface of the glass tube should be washed with detergent, then rinsed with demineralized water. No abrasive should be used on glass.

To maximize frit lifetime, it is recommended to filter all solutions pumped into the column (e.g. 0.2 μm for buffers and 0.45 μm for protein solutions). A clogged frit may give loss of resolution, capacity and efficiency. If this occurs, it is necessary to wash the frit as soon as possible, or to replace it. If the pressure increase caused by the frit clogging is not too high (lower than the mechanical resistance of the column or support), it is possible to continue the run by decreasing the flow rate.

The seals of the column (two o-rings on the bottom flange of the glass tube, one o-ring in the piston flow distributor) should be regularly inspected and should be replaced if damaged.

Warranty

Essential Life Solutions offers a one- year limited guarantee on these columns covering defects in material and workmanship if used under conditions detailed in the instruction manual provided with the column. This guarantee does include frits, o-rings and glass tube.

Temperature / Pressure Chart

* Temperature Range: +4 Deg C to + 40 Deg C (+39 Deg F to + 104 Deg F)

* Pressure Range:

Column Diameter:	mm	9	180	300	450
	inches	3.5	7	11.8	17.7
Working Pressure:	bar	6	4	3	2
	psi	87	58	43	29
Test Pressure:	bar	9	4.5	3.5	2.25
	psi	130	65	51	32

* 1 inch = 25.4 mm

** 1 bar = 14.5 psi

*** Working pressure = max. pressure continuously applied

**** Test pressure = max. pressure applied for quality control

Materials of Construction

Materials in contact with the solutions:

Borosilicate Glass..... Column Tube

Note: Acrylic column tubes available on request.

Poylpropylene..... Tube Flanges, Base Plate, Piston, Sanitary Connections

EPDM..... Piston Seal O-Ring, Sanitary O-Ring

POLYETHYLENE..... Frits

Materials not in contact with the solutions:

POLYMETHACRYLATE..... Jacket

TP316L STAINLESS STEEL..... Tie Rods, Feet, Internal Central Screw

Chemical Resistance

The Materials in contact with the solution are suitable for use with the following substances:

- Acetic acid 50%
- Hydrochloric acid 1N
- Sodium hydroxide 1 N
- Pure ethanol

NOTE:

Due to the wide range of solutions available please contact Essential Life Solutions prior to the purchase of your column.

Packing Content

90 and 180 Diameter Columns:

- 1 Complete Column
- 1 Accessory Kit (P/N 263767 for ID 90 and P/N 263768 for ID 180) including the following:
 - 1 set of 5 top porous frits
 - 1 set of 5 bottom porous frits
 - 1 frit clip
 - 1 set of two o-rings for tube flange
 - 2 top frit o-rings
 - 4 sanitary gaskets ID 6 mm
 - 2 sanitary collars DN 25
 - 1 set of four washers
 - 1 set of four nuts
 - 2 hose barb connections ID 6 mm
 - 2 adapters sanitary flange / hose barb fitting
 - 1 clip dismounting device
 - 1 bubble level
 - 1 column manual
 - 1 wrench of 13 mm

300 and 450 Diameter Columns:

- 1 Complete Column
- 1 Accessory Kit (P/N 263623 for ID 300 and P/N 266043 for ID 450) including the following:
 - 1 top porous frit
 - 1 bottom porous frit
 - 1 frit clip
 - 1 set of two o-rings for tube flange
 - 2 top frit o-rings
 - 4 sanitary gaskets ID 9.525 mm
 - 2 sanitary collars DN 25
 - 1 set of four washers
 - 1 set of four nuts
 - 2 hose barb connections ID 6 mm
 - 2 adapters sanitary flange / hose barb fitting
 - 1 clip dismounting device
 - 1 bubble level
 - 1 column manual
 - 1 wrench of 13 mm

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