

# POROS<sup>®</sup> Prep Self Pack<sup>®</sup> Packing Device for High Performance Perfusion Chromatography<sup>®</sup> Columns



## Column Packing Instructions

### Read Me First!

#### What These Instructions Tell You

These instructions describe how to use the POROS<sup>®</sup> Prep Self Pack<sup>®</sup> packing device and related hardware. They explain:

- How to assemble the packing device
- How to adapt the packing device to different LC instruments
- Specific slurry and packing conditions for your media
- How to pack your own columns
- How to test a column
- How to unpack a column
- How to reuse POROS Self Pack media

#### Other Information Provided

You receive two documents with your media:

- Column Operating Instructions for your media provides information about running the packed column and also provides guidelines for using Perfusion Chromatography.
- Packing and Testing Conditions instructions provide the conditions you need to test the packed column (if appropriate).

**NOTE:** Refer to the Packing and Testing Conditions instructions for packed column testing information only. Ignore slurry and packing conditions information in the Packing and Testing Conditions instructions included with your POROS Self Pack<sup>®</sup> media. This information pertains to the smaller scale device that can also be used with POROS Self Pack media.

## 1 Product Description

The POROS Prep Self Pack Packing Device for Perfusion Chromatography<sup>®</sup> columns lets you pack and repack empty PEEK columns with POROS 20 and POROS 50 Self Pack media. By packing your own Perfusion Chromatography columns, you receive the superb performance of the latest bioseparation technology along with unsurpassed affordability and economy.

The Self Pack packing device:

- Is made of corrosion-resistant 316L stainless steel that can be used with salt buffers.
- Has a total volume of 70 ml (packing device and column).
- Has a maximum operating pressure of 2,000 psi.

You purchase empty columns and POROS Self Pack media separately from the packing device.

### 1.1 Packing Device Hardware

This section describes:

- Packing device parts
- Fitting adaptor kit
- Backpressure regulator

#### Packing Device Parts

The packing device consists of these parts:

- Cap (center cover and lock nut)
- O-ring
- Chamber

A backpressure regulator comes with the packing device. Figure 1 shows the parts of the packing device and the backpressure regulator.

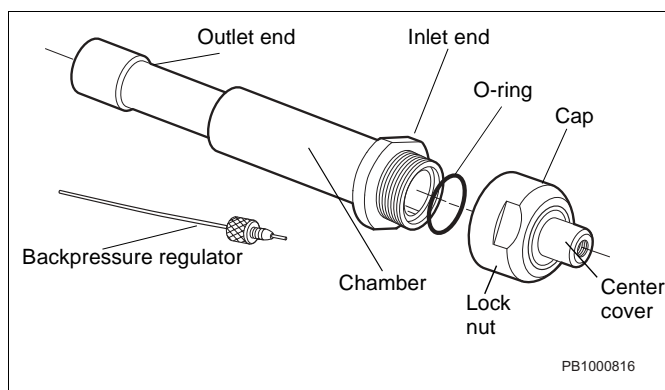


Figure 1 Prep Packing Device Parts

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The inlet end of the chamber connects to your LC instrument. It has:

- A screw-on 2-piece cap with a 10-32 female fitting. You can adapt this fitting to M-6 metric systems (such as the Pharmacia FPLC® system) or 1/4-28 systems by using the fitting adaptor kit provided with the packing device.
- An O-ring seated in a depression around the rim of the inlet opening. The O-ring lets you hand-tighten the cap, even when you use the packing device with high-pressure instruments.

The outlet end is the narrow end of the chamber, where:

- You can connect an empty 10 mm diameter PEEK column tube without making any adaptations.
- A white Teflon® washer recessed in the outlet end of the packing chamber creates a proper seal when a column is screwed in place. (This washer is not visible in Figure 1.)

### Fitting Adaptor Kit

The fitting adaptor kit adapts the Self Pack packing device to M-6 metric or 1/4-28 LC systems. The kit provides these fittings:

- 2 red Fingertight fittings
- 2 beige ferrules (barrel-shaped)
- 2 black metric nuts
- 2 green nuts
- 2 blue ferrules (cone-shaped)
- 2 pieces of orange 0.020-inch I.D. PEEK tubing

To use the fitting adaptor kit:

1. Connect one end of the orange tubing to an M-6 or 1/4-28 system.
  - **For M-6 systems:** Slip a black nut over the tubing followed by a blue ferrule, with the *conical end pointing toward the nut*. Connect to the LC system and finger tighten.
  - **For 1/4-28 systems:** Slip a green nut over the end of the tubing, followed by a blue ferrule, with the *conical end pointing away from the nut*. Connect to the LC system and finger tighten.
2. Put a red Fingertight fitting on the other end of the tubing, followed by a beige ferrule.

The fitting is now ready to be connected to the 10-32 fitting on the cap of the packing device. Because the cap is heavy, do not attach it now. Wait until you are ready to attach the cap to the chamber (see Section 4.3, Filling the Packing Device).

### Backpressure Regulator

The backpressure regulator improves the quality of the packing by increasing the pressure drop over the column during packing. The backpressure regulator shipped with the packing device consists of a length of 0.005-inch I. D. PEEK tubing and a Fingertight fitting. The backpressure regulator screws into the outlet end of an empty column that is installed on the outlet end of the chamber.

## 2 Additional Items Needed to Pack Your Column

In addition to the packing device, to pack a column you need an empty PEEK column, POROS Self Pack media, and protein test standard (all purchased separately). Figure 2 shows these items.

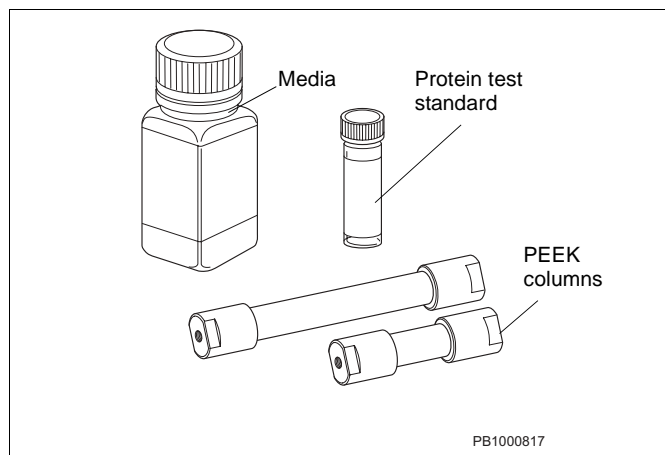


Figure 2 Additional Items Needed

You can order this equipment from Applied Biosystems. For ordering information, see Section 8, Accessories, Spare Parts, and Ordering Information.

### PEEK Column

An empty PEEK column comes with these parts:

- A hollow tube
  - Two end fittings, which screw onto threads at either end of the column tube
  - Two end plugs
- As shipped, the end fittings are assembled on the tube, and the end plugs are installed.
- Four PEEK frits, provided in a separate package
  - Two 10-32 thread fittings and ferrules (used to connect the packed column to a system)
  - A fitting adaptor kit (identical to the one provided with the packing device). This kit adapts the column 10-32 end fitting to M-6 metric or 1/4-28 systems.

Figure 3 shows a PEEK column without end plugs.

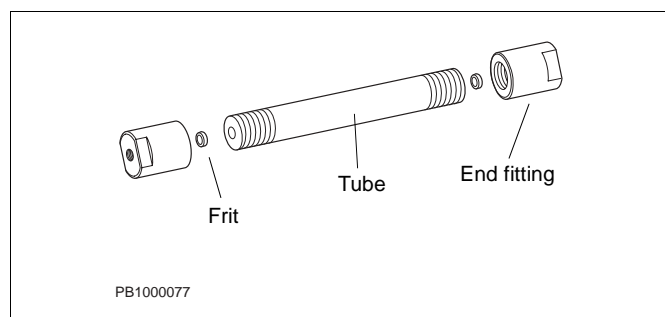


Figure 3 PEEK Column Parts

## 3 Preparing Your Equipment for Packing

To pack a column, you must:

- Clean the column and packing device
- Prepare your LC system
- Assemble the packing device and empty column
- Position the packing device

### Lab Equipment Needed

In addition to the packing device and empty column, you need this equipment to pack a column:

- LC system
- Spatula
- Glass beaker of 200 ml or greater
- Squirt bottle
- Laboratory tissue
- 25 ml graduated cylinder or 20 ml pipette
- Deionized water

### 3.1 Cleaning the Column and Packing Device

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**NOTE:** Observe good laboratory practice. Wear safety glasses during the following procedures.

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The column and packing device are reusable. You clean them differently depending on whether you have used them before.

#### Never Used

If the column and packing device have never been used:

**Column:** Unscrew the end fittings and flush the tube and end fittings with deionized water. Do not reassemble the column. Set all the pieces aside.

**Packing device:** Wash or sonicate the packing chamber and cap with 50% isopropyl, ethanol, or other alcohol to ensure cleanliness. Set all the pieces aside.

#### Previously Used

If the column or packing device has been used before, clean it before each reuse to avoid contamination with packing material left over from a previous use.

**Column:** Sonicate the tube, end fittings, and frits in 50% isopropyl, ethanol, or other alcohol for 10 minutes. Rinse all pieces thoroughly with deionized water. Set all the pieces aside.

**Packing device:** Flush the packing device cap with deionized water and thoroughly wash the threads at the outlet end of the chamber. Residual media gets trapped in the threads during normal use. Wash the O-ring. Flush with organic solvent if you see any media residue on surfaces after the water wash. Rinse again with water to remove the organic solvent. Do not reassemble the packing device. Set all the pieces aside.

### 3.2 Preparing Your LC System

To prepare your LC system, you must:

- Prepare the tubing
- Set the pressure limit
- Prepare the pumps

### Preparing the Tubing

Make sure that the fitting on the end of your LC system pump outlet tubing is compatible with the fitting on the packing device cap. If it is not, use the fitting adaptor kit (see "Fitting Adaptor Kit" on page 2).

Do not connect the free end of the pump outlet tubing to the cap of the packing device yet.

### Set the Pressure Limit

**For Perfusion Chromatography or conventional HPLC systems:**

Set the pressure limit of your system at 2,500 psi.

**For medium-pressure systems:** Set the pressure limit at the maximum allowable on the system.

### Preparing the Pumps

Flush the pumps and the outlet tubing with the packing solvent listed in Section 4.1, Slurry and Packing Solvents.

### 3.3 Assembling the Packing Device and Empty Column

To assemble the packing device and column for packing:

1. Make sure the white Teflon washer is installed in the outlet end of the chamber. The washer is required for a proper seal to pack the column.
2. Lay out the equipment needed for packing (see "Lab Equipment Needed" on page 3).
3. Write the name of your POROS Self Pack media on one of the blank labels provided with the media.  
  
These labels identify the columns and also identify the top of the column (the end connected to the packing chamber). When you use the column, you must use the top as the inlet end.
4. Attach the label to an end fitting on the PEEK column. Reserve this fitting to be the top end fitting.
5. Set the PEEK column end fittings on the countertop so that you can look down into them.
6. Drop a frit into each end fitting. The frit is smaller than the inner diameter of the end fitting and must sit in the center depression that is visible inside the end fitting.
7. Pick up the end fitting without the column label (containing a frit).

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**NOTE:** With PEEK columns, be careful to hold the end fitting level. Otherwise, the frit may slip out of the center depression as you screw in the column, and you will not get a good seal. Media will leak out of the column during packing.

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8. Screw the column tube into the end fitting until finger-tight.
9. Tighten the end fitting a little more by gripping the column tube with one hand and the end fitting in the other hand and tighten securely.
10. Screw the free end of the column tube into the outlet end of the packing chamber. Tighten securely with both hands.
11. Screw the backpressure regulator into the bottom of the column. Finger tighten.
12. Set the second end fitting aside to attach to the inlet end of the column after it is packed.

### 3.4 Positioning the Packing Device

- Clamp the open packing device/column assembly on the front of your LC instrument. If clamps are not available on the instrument, use a ring stand. Make sure that:
  - The packing device is positioned vertically.
  - The pump outlet tubing can reach the top of the packing device.
  - You can fit a 200 ml beaker under the end of the column.
- Position your empty beaker below the end of the column.
- Seat the packing chamber O-ring in the depression around the rim of the chamber opening (shown earlier in Figure 1).

## 4 Packing a Column

This section describes:

- Slurry and packing solvents
- Slurrying the media (POROS 20 only)
- Filling the packing device
- Packing the column
- Removing and capping the packed column
- Cleaning up
- Testing the column

### 4.1 Slurry and Packing Solvents

Table 1 lists the slurry and packing solvents to use for different POROS chemistries.

If you are using POROS 20 media, perform the steps in Section 4.2, Slurrying POROS 20 Media.

If you are using POROS 50 media, skip to Section 4.3, Filling the Packing Device. POROS 50 media is provided in a slurry of 20% ethanol in a ratio of 1.8:1 slurry volume:packed media.

**Table 1 POROS 20 and 50 Slurry and Packing Solvents**

POROS 20 or 50 Media	Slurry Solvent	Packing Solvent
HP2, R1, R2	13% Isopropanol	13% Isopropanol
AL, EP, HE, HQ, HS, MC, OH, PI, S, Protein A, Protein G	0.5 M NaCl	0.15M NaCl
D, Q	25mM sodium acetate pH 4.5, 0.5M NaCl	25mM sodium acetate pH 4.5, 0.15M NaCl

### 4.2 Slurrying POROS 20 Media

**WARNING:** POROS 20 media is provided as a dry powder, which may form a light dust. Use one of the following when handling dry POROS media:

- NIOSH\*/MSHA\*\*-approved respirator with dust cartridge
- Fume hood

\* National Institute for Occupational Safety and Health

\*\* Mine Safety and Health Administration

To slurry the powdered POROS 20 media:

- Weigh out:

Column	Weight of POROS 20 media (g)
10 mmD/50 mmL	2.0
10 mmD/100 mmL	4.0

- If you are using POROS 20 AL, EP, or OH media, react the weighed support (slurry the media in binding solution), then skip to Section 4.3, Filling the Packing Device.

**NOTE:** The prep packing device and column can hold up to 70 ml total volume.

For specific information and guidelines on reacting the support, please refer to the following sections in the POROS AL, EP, and OH Bulk Media Operating Instructions included with the POROS media:

Topic	Section
General Considerations	Section 2
Reacting the Support	Section 3
POROS AL coupling reaction	Section 4
POROS EP coupling reaction	Section 5
POROS OH coupling reaction	Section 7

- For all other media, add the following volume of slurry solvent (see Table 1, "POROS 20 and 50 Slurry and Packing Solvents", on page 4):

Column	Volume of slurry solvent (ml) to add to weighed powder
10 mmD/50 mmL	12
10 mmD/100 mmL	24

- Swirl gently until the material is well suspended.

**NOTE:** Do not use a stir bar or stirring rod. They generate fines and may denature proteins.

When you tilt the mixing vessel, no powder should remain on the bottom. The slurry should have a milky appearance and consistency.

### 4.3 Filling the Packing Device

To fill the packing device:

**CAUTION:** Do not proceed without setting your system pressure as described in Section 3.2, *Preparing Your LC System*.

- Swirl the slurried media to resuspend the slurry.
- Add the following to the open packing device:

Media	Volume of media slurry (ml) to add to packing device
20 $\mu$	Entire volume of slurry prepared in Section 4.2, Slurrying POROS 20 Media.
50 $\mu$	Use a pipette or graduated cylinder to remove the correct volume of slurry: <ul style="list-style-type: none"> <li>For 10 mmD/50 mmL column—10 ml from total slurry volume provided</li> <li>For 10 mmD/100 mmL column—20 ml from total slurry volume provided</li> </ul>

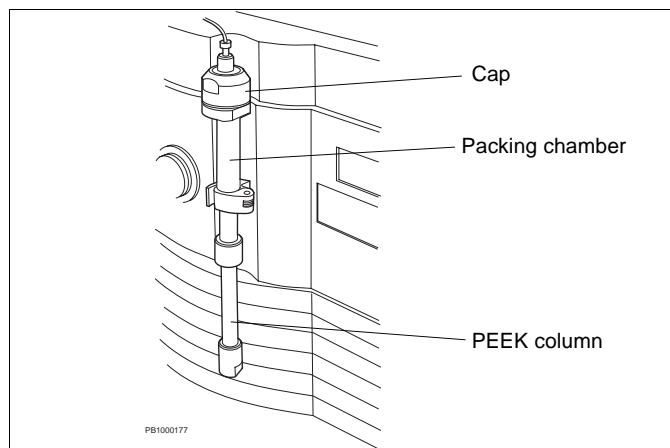
- Rinse the mixing vessel, pipette, or cylinder with a small amount of slurry solvent (see Table 1, "POROS 20 and 50 Slurry and Packing Solvents", on page 4) to ensure that all of the slurry is added to the packing device.
- Add slurry solvent (see Table 1, "POROS 20 and 50 Slurry and Packing Solvents", on page 4) to the packing device until it is completely full.

**NOTE:** Do not stir up the slurry at the bottom of the packing device. Direct the slurry solvent so that it runs down the inner wall of the packing device, instead of pouring directly on the slurry.

- Quickly screw the 2-piece cap onto the packing device: place the center cover on the chamber, thread the lock nut down over the cap and hand tighten until snug. Keep a lab tissue on hand because some liquid may come out through the top as you tighten the cap.

**NOTE:** Do not overtighten the cap. Overtightening can damage the threads of the chamber and the cap.

Figure 4 shows a packing device setup on a BioCAD<sup>®</sup> SPRINT<sup>™</sup> System.



**Figure 4 Typical Packing Device Setup**

- Attach the pump outlet tubing from the LC system to the cap of the packing device. Finger tighten.

### 4.4 Packing the Column

This section discusses these topics:

- Principles of packing
- Packing a column using the VISION<sup>™</sup> BioCAD Workstation, BioCAD Workstation, or BioCAD SPRINT System
- Packing a column using other systems

#### Principles of Packing

As a column packs, the backpressure on the column rises.

The optimal packing flow rate is the highest flow rate possible that:

- Allows packing to proceed within the pressure limit you set earlier, while maintaining a steady pressure reading
- Allows a sufficient volume of packing solvent to pass through the column to ensure an efficient and stable bed

The actual packing flow rate is dependent on the system used, the particle size of the media, and the length of the column.

#### Packing a Column Using the VISION Workstation, BioCAD Workstation, or BioCAD SPRINT System

**NOTE:** Monitor the highest sustained pressure that occurs during packing. Do not exceed this pressure when you run the packed column.

To pack a column:

- Determine the required volume of packing solvent to pass through the column during packing (see Table 2).
- Set the correct flow rate (see Table 2).

**Table 2 Packing Flow Rates and Packing Solvent Volumes**

Column Dimensions	Recommended initial packing flow rate (ml/min)	Minimum volume of Packing solvent to pass through column during packing (ml)
10mmD/50mmL	20	80
10mmD/100mmL	15	150

- Turn on the flow and monitor the volume of packing solvent in the waste beaker below the column.
- Once the required volume of packing solvent has passed through the column and you observe a steady pressure, stop the flow.
- Let the column sit for 3 minutes to allow the pressure to dissipate evenly across the packed bed.

**NOTE:** The packing flow rate has been determined to allow you to comfortably pack your column within the pressure limit of your system. However, variations in frit permeability or system backpressure may require you to adjust the flow rate slightly.

- If your system is well below the pressure limit during packing, increase the flow rate in 0.5 ml/min increments until you approach the pressure limit. Pack columns at the highest flow rate possible without exceeding the system pressure limit.

7. If you reach the pressure limit before you finish packing the column, stop the flow, restart the flow at 0.5 ml/min lower than the original setting, and continue packing. Repeat if necessary until you are able to pack the column within the pressure limit.

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**NOTE:** Occasionally defective frits generate excessive backpressure. If so, replace the frits and start again.

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8. Record the highest sustained pressure that occurred during packing.

Do not exceed 85% of this pressure when you run the packed column.

## Packing a Column Using Other Systems

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**NOTE:** Monitor the highest sustained pressure that occurs as you pack the column. Do not exceed 85% of this pressure when you run the packed column.

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If you are using a system other than the VISION Workstation, BioCAD Workstation, or BioCAD SPRINT System, you need to experiment to find the correct flow rate. Start by setting the flow at the maximum allowable on the system.

When using another system to pack the column:

1. Determine the minimum volume of packing solvent to pass through the column during packing (see Table 2, "Packing Flow Rates and Packing Solvent Volumes", on page 5).
2. Turn on the flow and monitor the volume of packing solvent coming through the column by observing the level in the waste beaker below the column.
3. If you reach the pressure limit before the minimum volume of packing solvent passes through the column, stop the flow, restart the flow rate at 0.5 ml/min lower than the original setting, and continue packing.
4. If the pressure limit is again exceeded, lower the flow rate another 0.5 ml/min.
5. Continue lowering the flow rate in 0.5 ml/min increments until the minimum volume of packing solvent passes through the column and you observe a steady pressure.

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**NOTE:** Occasionally defective frits generate excessive backpressure. If so, replace the frits and start again.

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6. Record the final flow rate. Use this flow rate the next time you pack a column with your system.
7. Record the highest sustained pressure that occurred during packing.

Do not exceed 85% of this pressure when you run the packed column.

## 4.5 Removing and Capping the Packed Column

To remove the column:

1. Unscrew the column from the packing device by grasping the body of the column. (You may need to use pliers. Do not squeeze too tightly with the pliers or you may scratch the tube finish.) Turn the column to the left (counterclockwise) to unscrew it. Do not grasp and turn the outlet end fitting. Doing so unscrews the end fitting from the column. Place a clean beaker below the packing device.

A small bubble of excess packing material covers the top end of the column tube. If the material is wet, lightly touch the bubble with a lab tissue or paper towel to draw off the moisture.

2. Draw the flat side of the spatula across the top of the column to remove the excess material and to level off the top of the packed bed.
3. With a damp tissue, carefully wipe any remaining packing material from around the rim at the top of the column tube. Do *not* touch the top of the packed bed itself.
4. Holding the unused end fitting upright (see Section 3.3, Assembling the Packing Device and Empty Column) to ensure that the frit remains seated, turn the packed column upside down and screw it into the end fitting. Keep track of the column inlet end.
5. Tighten the end fitting with both hands.
6. Insert the end plugs into the column end fittings.
7. Set the column aside while you clean up from the packing procedure.

## 4.6 Cleaning Up

To clean up:

1. Make sure an empty waste beaker is below the column packing device.
2. Pump several milliliters of packing solvent through the packing device to push out excess packing material accumulated at the outlet end of the chamber.
3. Remove the connection at the top of the packing device.  
  
The pressure inside the packing device is released and the entire contents flush into the beaker.
4. Remove the packing device from the clamp, take off the cap, and rinse all pieces thoroughly with water.
5. Rinse the threads at the outlet end to remove residual media.

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**NOTE:** The O-ring may stick to the cap of the packing device by surface tension. Use the spatula to pull it out.

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## 4.7 Testing the Column

After packing, perform the following two tests on the column:

- Permeability test
- Protein separation test using test standards (if appropriate)

For specific conditions for both tests, and expected results for the protein separation test, see Packed Column Performance, in the Packing and Testing Conditions instructions included with your POROS Self Pack media.

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**NOTE:** Refer to the Packing and Testing Conditions instructions for packed column testing information only. Ignore slurry and packing conditions information in the Packing and Testing Conditions instructions included with your POROS Self Pack<sup>®</sup> media. This information pertains to the smaller scale device that can also be used with POROS Self Pack media.

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After you perform the tests:

- Compare the results of the protein separation test to the expected results. If the data does not compare favorably, make sure that your system is functioning properly. If your system is functioning properly, unpack your column and start again (see Section 6, Unpacking a Column.)
- Keep the data generated from both the initial permeability test and the initial protein separation test as a reference standard and use it to monitor the performance of the column over time.

## Periodic Testing

The packing methods for POROS Self Pack media are designed to produce columns that give you hundreds of runs. However, actual column lifetime depends on the samples you run. Contaminants may build up over time, decreasing capacity and increasing backpressure.

To check column backpressure and performance, run a permeability test and the test protein standards after every 100 runs. Compare the results to the reference data you generated after the initial packing.

If the backpressure of the column has increased more than 50% or if the test chromatogram looks different from the original, unpack the column and pack a new one (see Section 6, Unpacking a Column).

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**NOTE:** Always use a freshly packed column for your most important separations, to eliminate any possible contaminating proteins that may remain from a previous run.

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## 5 Running the Packed Column

For information about running the packed column, see the column Operating Instructions included with your POROS Self Pack media.

## 6 Unpacking a Column

To unpack a column:

1. Unscrew the outlet end fitting and remove the frit.
2. Connect the inlet end of the column to the pump outlet tubing of your LC system.
3. Position a beaker under the column.
4. Start the flow rate at 5 ml/min.
5. As soon as the media is pushed out of the column into the beaker, stop the flow.
6. Remove the inlet end fittings and rinse all fittings, frits, and the column tube in water and organic solvent.

### 6.1 Reusing the Media

You can reuse the media to pack a new column.

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**NOTE:** As with any chromatographic media, repacking POROS Self Pack media may result in increased backpressure in the packed column. Backpressure is caused by particulate matter generated when you unpack and repack the column. Do not repack your column more than five times.

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You can reduce backpressure by removing all particulate matter each time you unpack the column.

### Removing Particulate Matter

To remove particulate matter:

1. Suspend the unpacked media in slurry solvent (see Table 1, "POROS 20 and 50 Slurry and Packing Solvents", on page 4).
2. Let the slurry settle for 30 to 60 minutes.
3. Draw off the supernatant, which contains particulate matter.

## Reusing Media

To reuse media:

1. If you are using POROS 20 media, make additional slurry using:
  - 10 mmD/50 mmL columns—0.8 g media in 2 ml slurry solvent
  - 10 mmD/100 mmL columns—1.0 g media in 3 ml slurry solvent
2. Add the following volume of new, unused POROS 20 or POROS 50 slurried media to the used media (from which you have removed particulate matter):
  - 10 mmD/50 mmL columns—2 ml
  - 10 mmD/100 mmL columns—3 ml
3. Add 6 ml of slurry solvent.
4. Slurry the entire mixture thoroughly and use it to repack the column.

If backpressure continues to be a problem, repeat the process to remove particulate matter 2 or 3 times.

## 7 Storing the Packing Device and Column

### 7.1 Packing Device

Store the packing device with the cap on to keep the threads from knocking against other equipment. If the threads are damaged, the device may not seal properly during packing. Also, damaged threads may cause the cap to lock in place irreversibly.

Store the capped device in its original box.

### 7.2 Column

To store a packed column, see the column Operating Instructions included with your POROS Self Pack media.

To store an unpacked column, collect the tube, end fittings, frits, and end plugs, and keep them together.

## 8 Accessories, Spare Parts, and Ordering Information

These accessories are available for your Self Pack equipment:

**Table 3 Self Pack Accessories**

Description	Quantity	Part Number
Prep Packing Device	1	1-9542-00
POROS Self Pack media	See the POROS Self Pack price list.	
Test Standards		
Anion Exchange	Package of 1	1-9002-00
Cation Exchange	Package of 1	1-9003-00
Hydrophobic Interaction	Package of 1	1-9005-00
Protein A/G	Package of 1	1-9006-00
Reversed Phase	Package of 1	1-9001-00
Empty Self Pack Columns		
10 mmD/50 mmL PEEK	1	1-9541-44
10 mmD/100 mmL PEEK	1	1-9541-46
Accessories, column		
10-32 thread fittings and ferrules	Package of 5	GEN602301
Fitting Adaptor Kit	1	1-9532-00
PEEK column frits, 10 mm	1	1-9127-05

## 9 Technical Support

Applied Biosystems is dedicated to helping you use Perfusion Chromatography and POROS media to the fullest extent possible. Our biochromatographers, bioprocess engineers, and applications development laboratories are available for support ranging from telephone consultation to full method development.

Applied Biosystems offers a full line of POROS media for Perfusion Chromatography in the reversed-phase, ion exchange, affinity, and other chromatographic modes. Please contact your Applied Biosystems representative for technical and ordering information.

Applied Biosystems publishes a continuing series of Application and Technical Notes, highlighting specific purification solutions and technical aspects of Perfusion Chromatography. Please contact Applied Biosystems directly for a publication list.

For further details or for answers to questions on POROS Self Pack, Perfusion Chromatography, or other products, please contact Applied Biosystems. Refer to the last page of this document for contact information.





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Subtractive Assay technology, enabled by the use of ImmunoDetection (ID) Sensor Cartridges and the INTEGRAL Micro-Analytical Workstation, is covered by U.S. patent 5,234,586. Other patents pending.

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