Agilent Dynamax Analytical HPLC Column Systems 4.6 mm id

Data Sheet

1. Description

The Agilent Dynamax modular HPLC column system uses a unique technology, Dynamic Axial Compression, to maintain the structure of the packed bed during extended use. Dynamic axial compression compensates for bed reduction without end-fitting removal and tedious topping-off procedures. This produces increased column life in many instances.

Dynamax HPLC columns contain high-quality SS 316 and fluoropolymer components in the fluid path. Columns for biochemical applications are available in biocompatible Dynamax-TI column modules, where all wetted parts consist of titanium or inert polymers. Titanium components eliminate corrosion problems, especially for buffers containing halide salts. They also avoid the possibility that protein activity or recovery may be reduced by interactions with iron, or other metals, that might be released from stainless steel components by harsh aqueous mobile phases.

Each Dynamax HPLC column consists of a replaceable prepacked column module and two reusable end-fittings. The end-fittings form high-pressure seals on the inside surface of the column module. They require no tools for tightening.

End-fitting kits are supplied with an inline solvent filter assembly which attaches to the inlet end of the Dynamax column to prevent particulate matter from reaching and contaminating the packed column bed. The inline filter is available in stainless steel and, for biochemical applications where iron contamination must be avoided, in titanium. Pore sizes on stainless steel filter elements are 0.5 µm, for use on 3 µm packings, and 2 µm for use on 5 µm packings. Titanium filter elements are available in 2 µm and 10 µm pore sizes.

Optional guard assemblies are available. A guard assembly consists of special fittings, inline solvent filter and a replaceable prepacked guard module.

Installed between the inlet end-fitting and the column module, the guard assembly protects the column module from chemical contamination.

Other optional accessories include column coupler assemblies to join multiple Dynamax column modules together in series and a stand-alone guard holder for using guard modules separately.

Dynamax analytical column modules are available in 4.6 mm id and four packed bed lengths: 5 cm, 10 cm, 15 cm, and 25 cm. Guard modules have a 1.5 cm bed length.

The same end-fittings can be used with any column module, regardless of length. Column modules are available prepacked with a variety of microparticulate HPLC packings.

Dynamic Axial Compression and modular hardware allow the Dynamax system to provide high performance with low initial cost, maximum column life, and low column replacement cost.

2. Dynamic axial compression mechanism

Each analytical Dynamax end-fitting consists of four pieces: an inline solvent filter, an axial compression piston, a threaded adapter sleeve, and an axial compression nut. (See Figure 1.) The axial compression piston is an assembly consisting of three pieces: a piston body, a high pressure seal, and a plain seal retainer portion.

Each prepacked Dynamax column module contains a high pressure slurry-packed adsorbent bed with a movable bed retainer at the inlet end. The outlet end contains a fixed bed retainer. The bed retainers are inside the column tube, set in a short distance from each end.

Inlet and outlet ends of the column module can be distinguished in two ways: 1) the flow-direction arrow on the label points toward the outlet; 2) the notch in the outer wall of the column module is closest to the inlet.

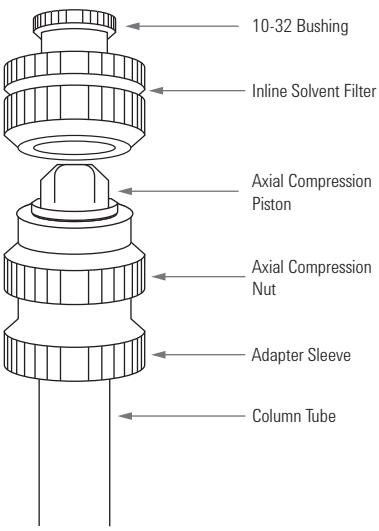

Figure 1. Analytical End-fitting

Inserting an axial compression piston into the column module causes the high pressure seal to contact the interior wall of the tube between the end and the bed retainer. The seal will slide easily whenever the column is not pressurized.

Threading an axial compression nut over the end of the adapter sleeve captures the axial compression piston. Hand tightening the axial compression nut causes the axial compression piston to slide inward toward the bed retainer. With the piston in contact with the bed retainer, hand tightening the nut applies axial force through the piston to the bed retainer. The axial force causes the inlet bed retainer to move slightly, thereby compressing the packing bed to maintain optimal bed structure and compensate for any reduction of bed volume that has occurred during use. (See Figure 2.)

Axial compression pistons and bed retainers contain flow passages for conducting solvent to the inlet end and from the outlet end of the packing bed. These passages are optimized for minimal band spreading. Tubing (1/16" od) from the HPLC system is attached to the axial compression pistons with 10-32 threaded bushings and ferrules.

Dynamax high pressure seals are passive seals, similar to those used in the piston chambers of HPLC pumps. Each seal is a hollow molded ring with one end open and the other end closed. The open end always faces the interior of the column module.

When the column is not pressurized, a small spring inside the seal maintains contact with the column wall with sufficient force to seal at low pressures, but not to prevent the seal from sliding when the axial compression nut is hand tightened. When the column is pressurized, solvent entering the seal from the open side presses the seal against both the column wall and the piston body with increased force. This additional force maintains sealing action at HPLC system pressures.

Effective sealing in Dynamax columns is a function of this passive sealing mechanism only. There is no need to tighten end-fittings with more force than can be applied by hand. Overtightening with tools will not improve the seal and may damage the column module.

Dynamax guard coupling assemblies and column couplers employ special double-ended pistons called axial coupling pistons. Each axial coupling piston contains an optimized flow path to conduct solvent between a guard module and column module, or between two column modules. With respect to axial compression and sealing mechanisms, operation of axial coupling pistons is similar to axial compression pistons.

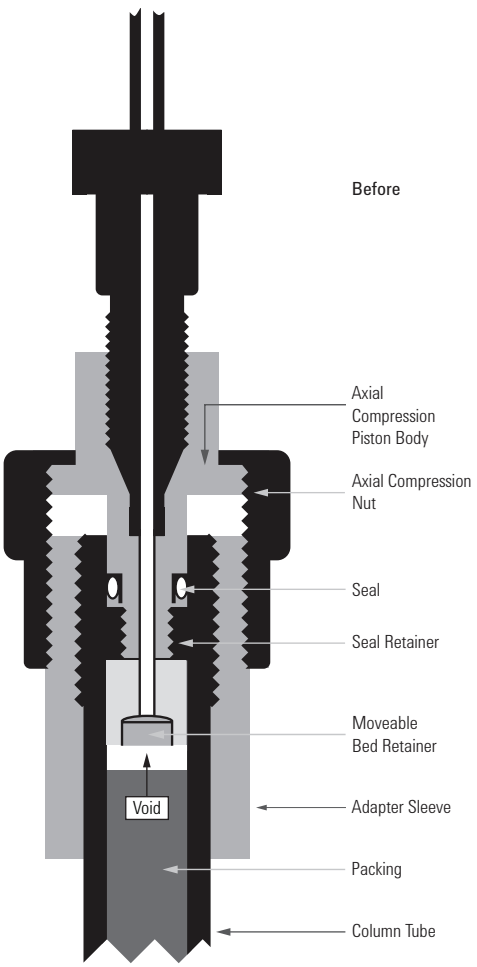

Figure 2. Cross sectional drawing of a Dynamax Analytical Column inlet showing the situation where a void has formed.

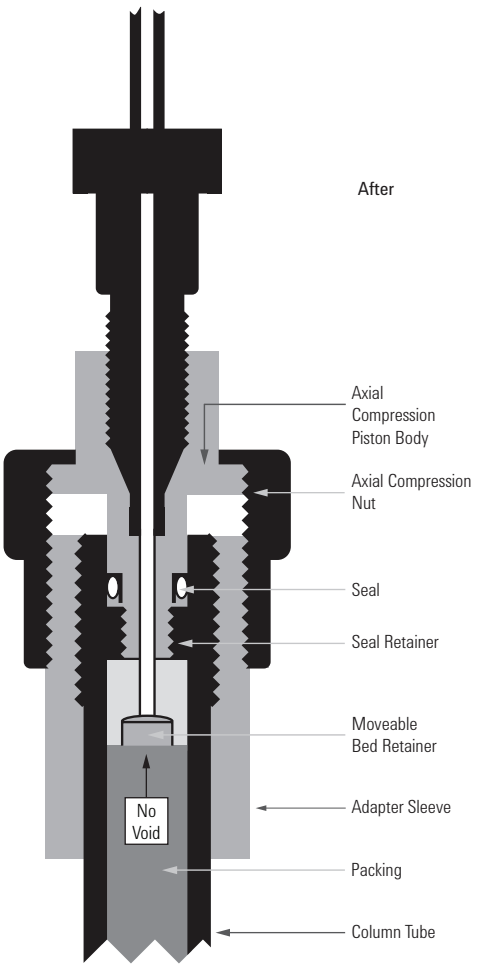

Figure 2B. Cross sectional drawing of a Dynamax Analytical Column inlet showing the effect of Dynamic Axial Compression in eliminating the void.

Assembling Dynamax Columns

3. Single column without guard

The simplest Dynamax column consists of a single prepacked column module and End-Fittings Kit No. 1. Make sure the end-fittings kit and column module you have purchased are for the same diameter column.

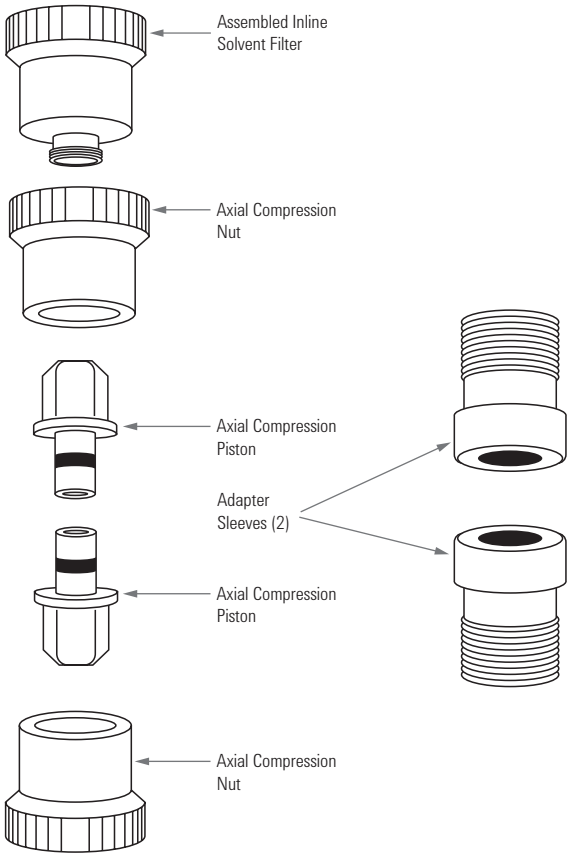

Figure 3. Contents of Analytical End-Fittings Kit No. 1

To assemble the Dynamax column:

3.1. Remove the column module from its box. The column module will have special plastic storage caps threaded on each end. These caps protect the packed bed from drying. Unscrew the caps from each end and save them. You will need them if you remove the column module from your system for storage.

3.2. Remove the end-fittings kit from its shipping container. Check to see that you have received two adapter sleeves, two axial compression nuts, two complete axial compression pistons, and an inline solvent filter assembly. (See Figure 3). You should also have two 10-32 bushings and two ferrules. For future reference, in case replacements should be required, Parker-type ferrules are required but virtually any standard HPLC bushing with 10-32 threads can be used

3.3. Inspect each axial compression piston by turning the plain seal retainer counterclockwise to loosen. Check to see that the seal is present and the open end of the seal (the end from which you can see the spring) faces toward the seal retainer. If not, remove the seal retainer and the seal, then replace with the seal in the proper orientation. (See Figure 4.) Turn the seal retainer clockwise and tighten snugly by hand.

3.4. Attach the adapter sleeves to the ends of the column module. The ends without exterior threads should go onto the column module first. The adapters should be threaded firmly onto the column module by hand. There is no need to tighten them completely; tools should not be used.

3.5. Slide one of the axial compression pistons into the inlet of the column module. The direction of flow is indicated by an arrow on the label and the notch in the outside of the column module is closest to the inlet end. Gently push the axial compression piston into the column as far as you can by hand. The seal should now be inside the column tube.

3.6. Place an axial compression nut over the axial compression piston and thread it gently onto the adapter sleeve. (If the threads will not reach the sleeve, back off the sleeve a few turns until they will.) Tighten without tools until fingertight. The axial compression pistons in analytical Dynamax columns move very easily under light pressure. Even when hand tightening, do not apply excessive force, as this may risk crushing the packing material. NOTE: Wide pore packings are especially sensitive. DO NOT USE TOOLS UNDER ANY CIRCUMSTANCES.

CAUTION: If solvent leakage should occur when operating any Dynamax column, NEVER attempt to solve this problem by tightening the axial compression nut. Axial compression nuts are for applying compression force to the packed bed only. Solvent leakage indicates either a poorly seated ferrule or a worn or improperly seated seal. These problems cannot be corrected by tightening the axial compression nut. Excessive tightening of the axial compression nut can irreversibly damage the column module.

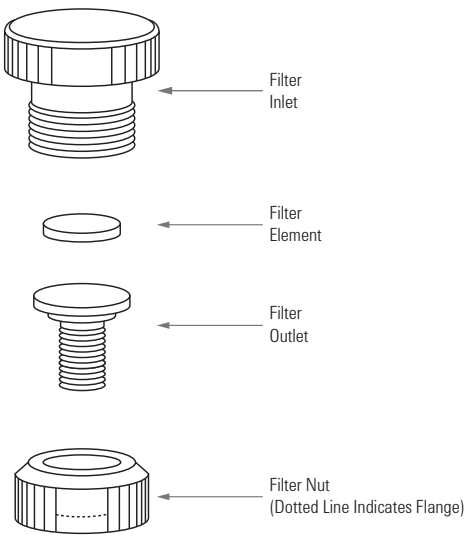

Figure 5. Exploded View of Inline Solvent Filter

3.7. To assemble the inline solvent filter, press the filter element into the recess in the top of the filter outlet (see Figure 5). Place the filter outlet into the filter nut so the filter outlet rests on the flange with its threads extending through the hole in the filter nut. Then thread the filter inlet into the filter nut and fingertighten; this should be enough to prevent leaks. (If the inline filter leaks after installation on the column, tighten the filter inlet into the filter nut no more than 1/8 turn past fingertight using two open-end ½" wrenches. Do not overtighten.)

3.8. To install the inline solvent filter, place a ferrule insert (two are supplied) into the inline filter outlet in the orientation shown in Figure 6. Thread the filter outlet into the axial compression piston until you notice slight resistance. Hold the axial compression piston with a ¼" wrench to prevent it turning, and fingertighten the filter. (The piston must be held with a wrench to avoid scraping the bed support.) Connect the column to the HPLC system and test for leaks. If necessary, hold the piston steady with the wrench and retighten the filter BY HAND only enough to prevent leaks. Tightening more than this is unnecessary.

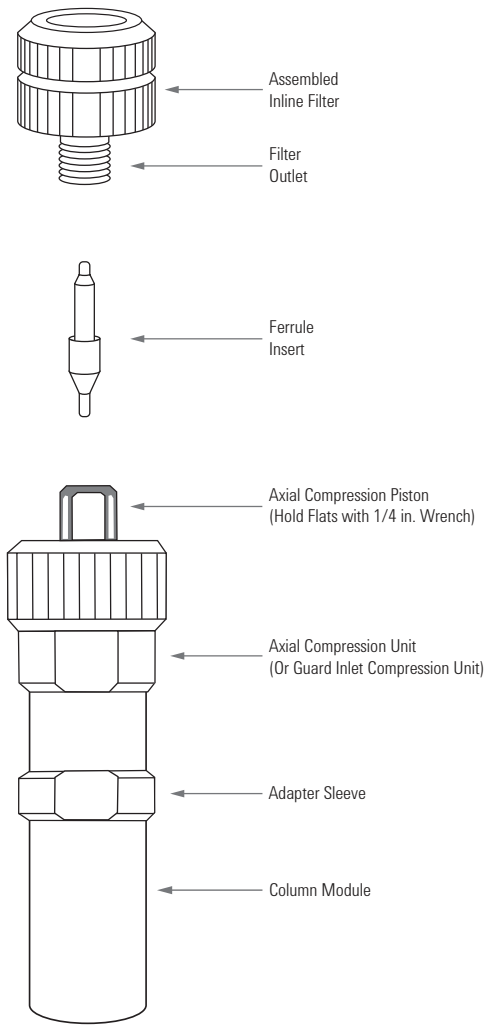

Figure 6. Filter Installation

3.9. Slide the outlet axial compression piston into the outlet of the column module.

3.10. Place the other axial compression nut over the outlet axial compression piston and hand-tighten until snug.

3.11. Connect the column assembly to the HPLC system using the bushings and ferrules supplied. Ensure that flow is in the same direction as the arrow on the column label. Use 1/16" inch od x 0.010 inch id tubing for all connections. Use a second wrench on the flats of the axial compression piston, next to the axial compression nut, to stop the piston turning while seating the ferrule on the tubing. Whenever possible, avoid rotating the axial compression piston inside the column module, as this may lead to premature seal wear.

3.12. Follow the equilibration procedure described in Section 4.0 when first using your Dynamax column. Then depressurize the system and snug the end-fittings again by hand to ensure they are tight.

4. Column Equilibration

Dynamax columns must be equilibrated to starting conditions before use:

4.1. Be sure that the mobile phase is miscible with the shipping solvent for the column. The shipping solvents for stationary phases for Dynamax columns are indicated in your chemistry manual.

4.2. Pump sufficient mobile phase for equilibration through the column under run conditions. Monitor the effluent with your detector. The volume required will depend on the solvent. Bed volumes are approximately 0.17 mL per cm of bed length for 4.6 mm id column modules.

4.3. The column is equilibrated when baseline drift becomes minimal and when peak retention volumes are reproducible in successive runs.

5. Column Module Replacement

You can replace the Dynamax column module without disconnecting the end-fittings from the HPLC System. To do so:

5.1. Depressurize the HPLC system.

5.2. Remove the axial compression nut from each end by turning the nut counterclockwise by hand.

5.3. Pull the axial compression piston from each end of the column module. If the column has been disconnected from the system, inserting bushings in the end-fittings will provide a convenient grip for pulling them from the column module.

5.4. Remove the adapter sleeves from both ends of the column module.

5.5. Remove the storage caps from the new column module and install as described in steps 3.4 to 3.10.

5.6. Check that the end-fittings are snug after equilibrating.

6. Column Module Storage

To remove a Dynamax column module from your HPLC system and store it, follow this procedure:

6.1. While the column module is still in the system, equilibrate with storage solvent. (See Section 4.0 for equilibration instructions, along with your chemistry instruction manual for stationary phase information.)

6.2. Remove the column module from the HPLC system. (See 5.1 through 5.4.)

6.3. Place the storage caps on both ends of the column module.

6.4. Tighten the storage caps snugly by hand and place the column module in its original carton for storage.

7. Column With Guard Module

To assemble a column with guard module you will need one prepacked column module, a prepacked guard module, and End-fittings Kit No. 2. The column module and the guard module must be the same diameter and have the same packing material. To add a guard module to an existing column, see Section 9.0.

7.1. Remove the storage caps from the column and guard modules.

7.2. Remove the end-fittings kit from its shipping container. Check that you have all the parts: two axial compression pistons, one axial coupling piston (double piston with two seals), one axial compression nut, one guard inlet compression nut, two adapter sleeves, and an inline solvent filter assembly (see Figure 7). You should also have two 10-32 bushings and two ferrules.

7.3. Check each piston to ensure the seal is properly orientated. (Section 3.3.)

7.4. Thread the adapter sleeves onto the ends of the column module. (See Section 3.4.)

7.5. Slide the axial coupling piston into the inlet of the column module. (See Section 3.5.)

7.6. Slide the guard module outlet over the axial coupling piston. Flow direction through the guard module is indicated by an arrow on the label. The PTFE bed retainer on the inlet end is snow white and opaque. The Kel-F bed retainer of the outlet is translucent.

7.7. Slide one of the inlet axial compression pistons into the inlet of the guard module.

7.8. Place the guard inlet compression nut over the guard module and fingertighten.

7.9. Assemble the inline solvent filter as described in Section 3.7.

7.10. Place a ferrule insert into the inline filter outlet. (See Figure 6.) Thread the filter outlet into the guard inlet compression nut until you notice slight resistance. Fingertighten the filter.

7.11. Wait a few minutes. This step is essential. It allows the air cushion between the guard and the column modules to flow out. If not removed this air can produce dead volume resulting in reduced column performance.

7.12. Retighten the guard inlet compression nut. Wait a few minutes and check to see that the nut is still tight. Repeat this step, if necessary, until the nut remains snug.

7.13. Slide the other axial compression piston into the column module outlet.

7.14. Place the axial compression nut over the outlet and hand tighten until snug.

7.15. Connect your Dynamax column to the HPLC system as described in Section 3.9.

7.16. When using the column for the first time, equilibrate the column as described in Section 4.0. Then depressurize the system and snug all fittings again by hand.

8. Guard Module Replacement

Replace the guard module periodically to protect the column module from chemical contamination. The required replacement frequency will depend on your samples. Depressurize the HPLC system and replace the guard module as follows:

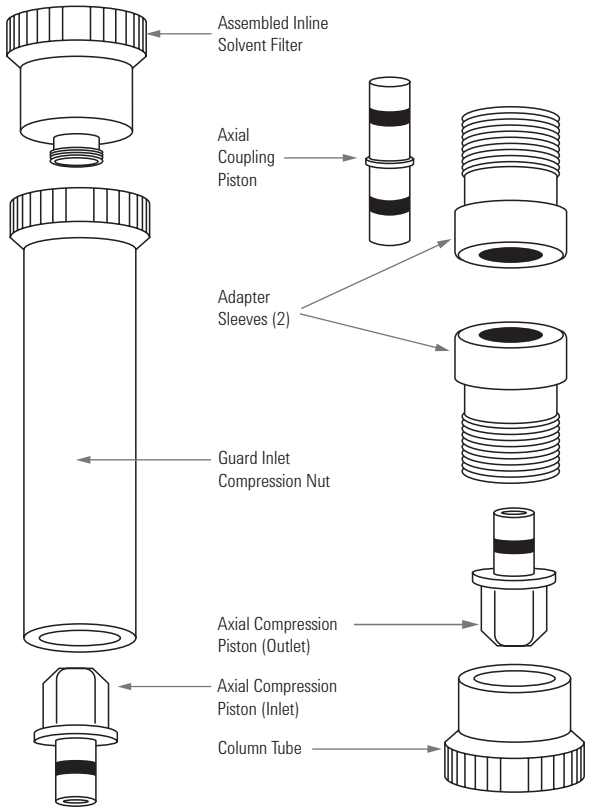

Figure 7. Contents of Analytical End-Fittings Kit No. 2:

8.1. Remove the guard inlet compression nut by turning it counterclockwise by hand.

8.2. Pull the inlet axial compression piston from the guard module. If the column has been disconnected from the HPLC, a bushing inserted in the piston will make a convenient grip.

8.3. Remove the old guard module and replace with a new one. Be sure to heed the flow direction indicated by the arrow on the guard module label.

8.4. Slide the inlet axial compression piston into the new guard module and reattach the guard inlet compression nut. Fingertighten until snug.

8.5. Remove trapped air as described in steps 7.9 and 7.10.

9. Adding A Guard Module To The Column

You can add a guard module to an existing column with a guard-column coupling assembly. The column and guard modules must be the same diameter and have the same packing material.

The 4.6 mm guard-column coupling assembly consists of one axial coupling piston and one guard inlet compression nut. These parts may be identified from Figure 7. Check that all parts have been received. Also, check that seals on the axial coupling piston are properly orientated as described in Section 3.3. Couple the guard module to the column as follows:

9.1. Disconnect the column from the HPLC system.

9.2. Remove the inline solvent filter from the axial compression piston on the column module.

9.3. Remove the axial compression nut from the column inlet by turning it counterclockwise by hand.

9.4. Pull the inlet axial compression piston from the column module.

9.5. Slide the axial coupling piston into the column module in place of the inlet axial compression piston.

9.6. Place the guard module outlet on the axial coupling piston. Flow direction is indicated by an arrow on the guard module label.

9.7. Take the inlet axial compression piston you just removed from the column module and slide it into the guard module inlet.

9.8. Place the guard inlet compression nut on the guard module and hand-tighten.

9.9. Remove entrapped air as described in steps 7.9 and 7.10.

9.10. Reattach the inline solvent filter to the guard inlet compression nut as described in Section 3.8, and reattach the guard inlet to the HPLC system.

10. Connecting Column Modules In Series

You can connect two Dynamax column modules in series using a column coupler assembly. The two column modules must be the same diameter and have the same packing material.

A column coupler assembly consists of one axial coupling piston (Figure 7) and one column-column coupling nut (not shown). Ensure that the seals are properly orientated on the axial coupling piston as described in Section 3.3.

10.1. Remove the storage caps from both column modules.

10.2. Slide the axial coupling piston into the outlet of one of the column modules. Flow direction is indicated by an arrow on the label.

10.3. Place the column-column coupling nut over the coupling piston and fingertighten.

10.4. Thread the inlet of the second column module into the column-column coupling nut and over the coupling piston. Fingertighten until snug.

10.5. Wait several minutes and remove trapped air as described in steps 7.9 and 7.10.

10.6. Complete the column assembly as described in Section 3.0 if no guard module is to be used or Section 7.0 if the column is to be protected by a guard module.

11. Using A Guard Module As A Column

The Stand-Alone Guard Holder permits a guard module to be used separately as a column. The stand-alone guard holder consists of two axial compression pistons, one guard inlet compression nut (similar, but not identical, to the one shown in Figure 7), an inline solvent filter assembly, and one guard outlet compression nut (not shown). Two 10-32 bushings and two ferrules are also included.

Check that you have received all these parts. Check the axial compression pistons for proper seal orientation as described in Section 3.3.

To assemble:

11.1. Remove the storage caps from the guard module.

11.2. Slide the inlet axial compression piston into the inlet end of the guard module. Flow direction is shown by an arrow on the label.

11.3. Slide the outlet axial compression piston into the outlet end of the guard module.

11.4. Place the guard outlet compression nut over the outlet of the guard module and the guard inlet compression nut over the inlet. Thread the two nuts together and fingertighten until snug.

11.5. Reattach the inline solvent filter to the guard inlet compression nut as described in Section 3.8.

11.6. Attach to the HPLC system using 10-28 bushings and ferrules.

11.7. Equilibrate as described in Section 4.0. The bed volume is approximately 0.25 mL for a 4.6 mm id guard module.

Care and Use Guidelines

12. Testing Your Column

Always evaluate column performance when a new column module is installed or after prolonged storage, using the standard test procedure. Consult your chemistry manual for specific test conditions.

Please refer to the appropriate chemistry manual provided with your column for care and use guidelines.

13. Important Recommendations

To assure long column life, depressurize the HPLC system periodically and hand-tighten all axial compression fittings on Dynamax columns. This will maintain optimum packed bed structure and minimize formation of voids which decrease column performance.

NEVER attempt to tighten Dynamax axial compression fittings while the column is part of a pressurized HPLC system. Seals will not slide easily under these conditions. Always depressurize the system completely before tightening.

NEVER use tools to tighten Dynamax axial compression fittings. The Dynamax column system has been designed so that hand tightening is always sufficient. Overtightening with tools may crush the packed bed and damage important internal components.

Leakings around a Dynamax seal cannot be corrected by tightening the axial compression nut. In case of leakage, replace the seal.

When attaching a Dynamax column to an HPLC system, keep tubing lengths to a minimum and avoid introducing dead volumes at fittings and connectors.

DO NOT overtighten bushings and ferrules when making system connections. Overtightening can damage bushings and Dynamax axial compression pistons.

When connecting a guard module to a column module, or when connecting two column modules in series, always follow the instructions for removing trapped air from the axial coupling fitting. Failure to follow these instructions can result in dead volume in the fitting and reduced column performance.

Use only HPLC-grade solvents. Solvents should be degassed with helium or by vacuum filtration.

Filtration of all mobile phases through microporous membrane filters for particulate removal is recommended. It is essential when

using solvent systems which contain dissolved salts or which may support bacterial growth. Nylon-66 or PVDF membrane filters are recommended because of their resistance to all common HPLC solvents.

Fully equilibrate the column to the starting conditions before each chromatographic run.

14. Caring For Your Column

For best performance and maximum column life, the following rules should be followed:

Do not exceed column pressure limits. The pressure limit on 4.6 mm id prepacked Dynamax columns is approximately 4500 psi. The pressure limit on Dynamax column hardware is 6000 psi.

Do not subject a column to mechanical shock.

Do not make a change between two immiscible solvents. Columns are supplied equilibrated with the appropriate test mobile phase listed in Section 12.0. Even when changing between two miscible solvents, it is best to condition the column first with a 50/50 mixture of the two solvents.

Do not use solvent systems with a pH less than 2 or greater than 8. Silica-based columns are degraded at either extreme of pH.

Do not store the column in aqueous systems for long periods.

Do not subject the column to rapid variations in pressure.

Avoid particulate matter in system by filtering samples and solvents.

ALWAYS use a pressure filter to reduce pulsation, a major cause of decreased column life.

Columns that have lost performance due to chemical contamination can often be regenerated by washing with stronger solvents than are used during normal chromatographic procedures. The elutropic series recommended in the appropriate chemistry manual should be strictly followed.

15. Eliminating Voids

Void formation can lead to reduced HPLC column performance. This is usually observed as loss of efficiency appearing as peak broadening, resulting loss of resolution, and even peak splitting in severe cases. Columns that have lost performance due to void formation at the inlet end of the packed bed can often be restored by tightening the inlet axial compression nut. This applies axial compression force through the inlet axial compression piston and moves the bed retainer to fill the void.

CAUTION: Reduced column performance can also be the result of chemical contamination. Always apply axial compression carefully and sparingly when attempting to restore lost performance. If the first attempt does not improve performance significantly and there is any chance that the column may have been contaminated chemically, please follow the instructions for column regeneration in Section 14.0. Applying excessive axial compression force in an attempt to eliminate non-existent voids can irreversibly damage the column bed.

15.1. Evaluate performance of the column by running a chromatogram with the test mixture (described in your chemistry manual) calculating column efficiency as indicated.

15.2. Slowly stop the flow in the HPLC system to relieve pressure on the column.

15.3. Grasp the adapter sleeve at the column inlet with one hand while turning the inlet axial compression nut with the fingertips of the other hand. Fingertighten in this manner until you feel a moderate resistance to further movement.

CAUTION: Do not overtighten

15.4. Restart the HPLC system and gradually bring the column up to the operating mobile phase flow rate and pressure.

15.5. Repeat the analysis of the test mixture and efficiency calculation.

15.6. If performance has improved significantly, but has not reached the original performance of the column, repeat steps 15.3 through 15.5 until no further improvement is observed.

15.7. If axial compression does not improve performance or the original performance level cannot be attained, try the chemical regeneration procedure.

15.8. If neither axial compression nor chemical regeneration succeed in restoring the column module to a useful performance level, then the column module is spent. Replace it with a new one. Dynamic axial compression provides a means for significantly extending column life in cases where loss of performance results from physical voiding at the column inlet. Dynamic axial compression cannot, however, protect against all forms of column damage.

Column Maintenance

16. Replacing the Inline Filter

In normal use the filter traps particulate matter and may eventually become blocked (you can reduce particulate matter to some extent by filtering samples and mobile phases). A blocked filter causes excessive backpressure and should be replaced. You may be able to clean the filter (described below) but cleaning may not be effective.

16.1. Remove the inline filter from the column. Remove and save the ferrule insert.

16.2. Disassemble the inline filter by reversing the procedure described in Section 3.7.

16.3. Remove the filter element from the recess in the filter nut (you may need to pry the filter element out with a small screwdriver).

16.4. Clean the filter element by ultrasonication in 20% nitric acid for about 30 minutes. Use care when working with nitric acid.

16.5. All traces of nitric acid must be removed before reinstalling the filter: a) Assemble the filter and connect it to the pumping system. Do not connect the column yet. b) Flush the filter thoroughly by pumping HPLC-grade water at 0.5 mL/min for 5 minutes. c) Switch to the equilibration mobile phase to flush the water. d) Connect the column and equilibrate.

16.6. Reassemble the inlet end-fitting and handtighten until snug. (If there is no improvement in backpressure after cleaning the filter element, replace it.)

17. Changing a Seal

17.1. Depressurize the column completely.

17.2. Remove the axial compression nut at the leaking fitting by turning it counterclockwise by hand.

17.3. Remove the axial compression piston from the column.

17.4. Unscrew the seal retainer from the axial compression piston.

17.5. Remove the old seal and replace it with a new one. The open side of the seal with the spring visible should be towards the seal retainer.

17.6. Replace the seal retainer and reassemble the fitting.

18. Agilent Dynamax Parts List

Part Number	Description
Dynamax Fittings Kit	
R000083800	End-Fittings Kit No. 1, for 4.6 mm id Dynamax Column only
R000083800	Analytical End-Fitting Kit, Titanium/Fluoropolymer, 10 µm, for 4.6 mm id Hydropore Column
R000083800	Analytical End-Fitting Kit, Titanium/Fluoropolymer, 2 µm, for 4.6 mm id Hydropore-5 Column
R000083802	End Fittings Kit No. 2, for 4.6 mm id Column and Guard
R000083802	Column-Guard End-Fitting Kit, 2 µm, Titanium/ Fluoropolymer, for 4.6 mm id Hydropore-5 Column and Mini-Cartridge Guard
Guard/Column Coupling Assembly	
R000083801	Guard-Column Coupling Assembly, for 4.6 mm id Column
R000083801	Guard-Column Coupling Assembly, Titanium/ Fluoropolymer, 10 µm, for 4.6 mm id Hydropore Column
R000083801	Guard-Column Coupling Assembly, Titanium/ Fluoropolymer, 2 µm, for 4.6 mm id Hydropore-5 Column
Column Coupling Assembly	
R000083803	Column-Column Coupling Assembly, Titanium/ Fluoropolymer, for 4.6 mm id Column Modules
R000083803	Column-Column Coupling Assembly, Titanium/ Fluoropolymer, for 4.6 mm id Hydropore and Hydropore-5 Columns
Stand Alone Guard Holder	
R000083804	Stand-Alone Holder for 4.6 mm id Guard Module only
R000083804	Mini-Cartridge Holder, Titanium/Fluoropolymer, 10 µm, for 4.6 mm id Hydropore Mini-Cartridge
R000083804	Mini-Cartridge Holder, 2 µm, Titanium/Fluoropolymer, for 4.6 mm id Hydropore-5 Mini-Cartridge
Replacement Filters and Seals	
R000083904	Inline Solvent Filter Assembly, 0.5 µm, for 4.6 mm id Dynamax Column System
R000083904	Inline Solvent Filter Assembly, 10 µm, Titanium, for 4.6 mm id Hydropore Columns and Mini-Cartridges
R0000839042	Inline Solvent Filter Assembly, 2 µm, Titanium, for 4.6 mm id Hydropore-5 Columns and Mini-Cartridges

Part Number	Description
Replacement Filters and Seals	
R000083908100	Replacement Filter Kit, Titanium, 10 µm, includes 5 filter elements and 2 ferrule inserts for 83-904-TI Solvent Filter Assembly
R000083908020	Replacement Filter Kit, Titanium, 2 µm, includes 5 filter elements and 2 ferrule inserts for 83-904-2TI Solvent Filter Assembly
R000083907	Replacement Column Seals for 4.6 mm id Dynamax Column System, pkg of 2
R00007003005	Replacement Plain Seal Retainer, for 4.6 mm id Dynamax Column System
R00007003503	Replacement Plain Seal Retainer, Titanium, for 4.6 mm id Hydropore and Hydropore-5 Columns and Mini-Cartridges
Other Replacement Parts	
R000083906	Axial Compression Nut for 4.6 mm Dynamax
R00007003008	Adapter Sleeve for 4.6 mm Dynamax
R00007003009	Inlet Compression Nut for 4.6 mm Coupled Guard
R00007003014	Inlet Compression Nut for 4.6 mm Stand-Alone Guard
R00007003015	Outlet Compression Nut for 4.6 mm Stand-Alone Guard
R00007003059M	Complete Axial Compression Piston for 4.6 mm Dynamax
R00007003060M	Complete Axial Coupling Piston for 4.6 mm Dynamax (includes seals)
Accessories	
R000083FPKIT	FPLC Adapter Kit, includes PTFE tubing and all necessary fittings to connect a Hydropore Column Module or Mini-Cartridge to an FPLC system.

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