



Agilent Dynamax Modular Preparative HPLC Column System 41.4 mm id

Data Sheet

1. Description

The Agilent Dynamax Macro-HPLC System is a modular column system for preparative HPLC. It employs 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 41.4 mm id columns top the Dynamax line, offering the greatest sample capacity and the lowest cost per capacity unit. They are available with the same packings as other Dynamax high performance preparative columns, and provide a means of scaling up separations for requirements exceeding the capacity of Dynamax 21.4 mm id columns.

Dynamax 41.4 mm id columns are offered in 25 cm bed lengths in all chemistries. For protein LC scale-up, Hydropore chemistries are also available in 10 cm long 41.4 mm id stainless steel column modules equipped with titanium bed supports. Titanium solvent filters are also available for use with these column modules.

Dynamax 41.4 mm id columns may be used alone, or with directly coupled Dynamax 41.4 mm id, 5 cm bed length guard columns for protection from chemical contamination.

End-fittings are purchased only once, and may be used with any of the available 41.4 mm id column modules. When column or guard replacement is necessary, only the column or guard module need be replaced.

Dynamax end-fittings form high pressure seals on the inside surface of the column module. They require no tools for tightening.

Dynamax 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

The Dynamic Axial Compression feature of 41.4 mm id Dynamax columns eliminates voids to extend column life as with other Dynamax sizes. In the 41.4 mm id system, the Axial Compression Nut at the column inlet is actually an Axial Compression Module containing a planetary gear mechanism to provide mechanical advantage for compressing the column. Hand tightening the Drive Wheel pushes an internal piston into the column tube and eliminates inlet voids. No tools are required. (See Figure 1.)

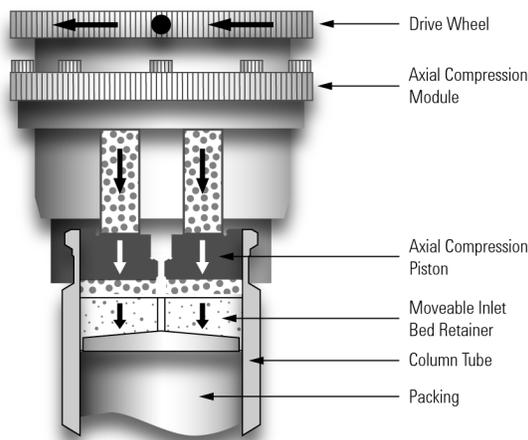


Figure 1. Diagram of the inlet end of a 41.4 mm id Dynamax column. Arrows show direction of movement and applied force.

Each prepacked Dynamax Column Module contains a high pressure slurry-packed adsorbent bed with a moveable Bed Retainer at the inlet end. The outlet end contains a fixed Bed Retainer. The Bed Retainers are inside the Column Module, a short distance from each end.

Inlet and outlet ends of the Column Module can be distinguished in two ways: The flow-direction arrow on the label points toward the outlet. The wrench flats or groove in the outer wall of the Column Module is the closest to the inlet.

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.

Hand tightening the Drive Wheel on the Axial Compression Module pushes the inlet Axial Compression Piston toward the inlet Bed Retainer. Hand tightening the Drive Wheel exerts axial force through the Piston to the Bed Retainer. This axial force causes the inlet Bed Retainer to move slightly compressing the packed bed to maintain optimal bed structure and compensate for any reduction of bed volume that has occurred during use.



Axial Compression Pistons and Bed Retainers contain flow passages for conducting solvent to the inlet end and from the outlet end of the packed bed. These passages are optimized for minimal band spreading. Tubing (1/16" od) from the HPLC system attaches to the Axial Compression Pistons via ¼-28 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 is closed. The open end always faces the interior of the Column Module.

When the column is not pressurized, a spring inside the Seal maintains contact with the column wall with sufficient force to seal at low pressures, but does not prevent the Seal from sliding when the Drive Wheel of the Axial Compression Module is hand tightened. When the column is pressurized, solvent entering the seal from the open side presses the seal against the column wall and the piston body with increased force. This additional force maintains sealing action at HPLC system pressures.

CAUTION: Effective sealing in Dynamax columns is a function of this passive sealing mechanism only. There is no need to tighten the End-Fittings with more force than can be applied by hand. Over-tightening with tools will not improve the seal and may damage the Column Module or the Packing. This is especially important for the 41.4 mm id Dynamax system: The planetary gear mechanism provides more than adequate mechanical advantage for compressing the packed bed when required. Tools must never be used. Hand tightening of the Drive Wheel is all that is ever necessary.

Dynamax Guard Coupling Assemblies 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. With respect to axial compression and sealing mechanisms, operation of Axial Coupling Pistons is similar to Axial Compression Pistons.

Assembling Dynamax Columns

3. Single column without guard

The simplest Dynamax column assembly consists of a single prepacked Column Module and End-Fittings Kit No.1. Make sure the End-Fittings Kit you have purchased is for the 41.4 mm id column Catalog No. 83-840 or 83-840-T1.

To assemble the Dynamax column:

Remove the Column Module from its box. The Column Module will have plastic shipping end-caps on either end. These Endcaps protect the column threads. Remove the Endcaps and save them; you will need them if you remove the Column Module for storage.

Remove the End-Fittings Kit from its shipping container. Check to see that you have received:

- One Axial Compression Module
- One Outlet Axial Compression Nut/Column Stand (with four legs)
- One Inlet Axial Compression Piston (with four socket head screws opposite the ¼-28 inlet port)
- One Outlet Axial Compression Piston (with two socket head screws adjacent to the ¼-28 outlet port)
- One Replacement Inlet Axial Compression Piston Body

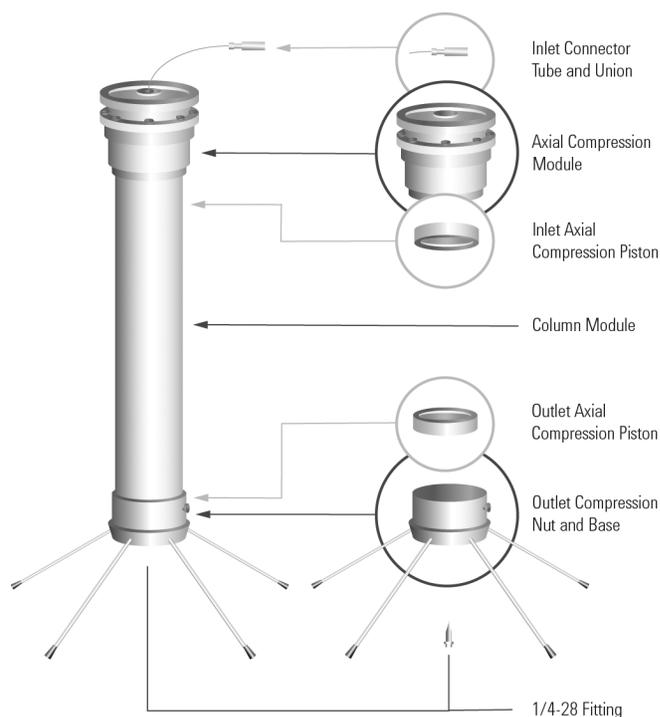


Figure 2. Components of Dynamax 41.4 mm End-Fittings Kit No. 1. (Column module not included in Kit.)

To assemble the Dynamax column:

Each kit also contains connections required to attach the Column Module to your HPLC system. These connections consist of Female-Female Union for 1/16" od tubing and a plastic reusable connector for SSI-type fittings. A 20 cm-length x 1/16" od x 0.030" id stainless steel tube is provided with ¼-28 male nuts and ferrules swaged onto either end. One end of the tubing is inserted into the Union; the remaining end is for connection to the column inlet. The plastic reusable fitting connects the Column Module to your HPLC system via the Union. (See Figure 2.) You should also have two extra ¼-28 male nuts and two ferrules.

- 3.1. Inspect each Axial Compression Piston to ensure 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.
- 3.2. Before assembling the Column Module please refer to Figure 2.
- 3.3. Slide the Outlet Axial Compression Piston into the outlet of the Column Module. Direction of flow is indicated by an arrow on the column label and the wrench flats or groove in the outside of the Column Module is closest to the inlet end. Push the Axial Compression Piston into the column as far as you can by hand. The Seal should now be located inside the Column Module.
- 3.4. Assemble the Outlet Compression Nut/Column Stand by threading the four legs provided into the appropriate holes in the nut. This forms a quadripod base which enables the column to stand independently. Tighten the Outlet Axial Compression Nut onto the Column Module outlet by hand until snug. Secure the base by hand tightening the thumb screw. Stand the Column Module on a level surface.

3.5. Inspect the inlet wall of the Column Module to be sure that it is free of particulate material. This is important to avoid scratching the seal. Then slide the Inlet Axial Compression Piston into the inlet of the Column Module as far as you can by hand. The Seal should now be located inside the Column Tube.

3.6. Connect the Inlet Axial Compression Piston to the Female-Female Union using the tubing provided.

3.7. First, back off the Axial Compression Module Drive Wheel by turning counter-clockwise. Thread the union and connecting tubing through the center hole of the Axial Compression Module. Gently tighten the Axial Compression Module onto the Column Module inlet by hand until snug. "Snug" means as tight as can be comfortably achieved by hand. DO NOT USE TOOLS! Tightening by hand ensures proper axial force and prevents over-tightening which can damage column components. Gently turn the Drive Wheel clockwise by hand until you feel the internal piston contact the Inlet Axial Compression Piston.

3.8. When contact occurs, there is a slight but discrete and noticeable increase in resistance to rotation of the Drive Wheel. Turn the Drive Wheel one more complete turn.

3.9. Connect the column assembly to your HPLC system using the male nuts and ferrules provided. Be sure that the flow is in the direction of the arrow on the column label. Catalog No. 38-3060, 38-3061, 1533, U-175 or U-176) for all connections. A plastic reusable connector Catalog No. FTF-110 is recommended for connecting the column outlet to your system.

3.10. When first using your Dynamax Column follow the equilibration procedure.

4. Column Equilibration

4.1. Dynamax columns must be equilibrated to starting conditions before use.

4.2. 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 their enclosed chemistry manuals.

4.3. 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 volume for a 41.4 mm id x 25 cm bed length Column Module is approximately 250 mL.

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

5. Column Module Replacement

5.1. De-pressurize the HPLC system.

5.2. Remove the Axial Compression Nut and Axial Compression Module from each end of the Column Module by turning counterclockwise by hand. Before removing the Axial Compression Module, turn the Drive Wheel counterclockwise until the internal piston is no longer in contact with the inlet Axial Compression Piston. Then unscrew the Axial Compression Module.

5.3. Pull the Axial Compression Piston from each end of the Column Module. If the Column has been disconnected from the system, inserting ¼-28 bushings in the Axial Compression Pistons will provide a convenient grip for pulling them from the Column Module.

5.4. Remove the Shipping Endcaps from the new Column Module and install as described in Section 3.

6. Column Module Storage

If you wish 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 the chemistry instruction manual for your stationary phase.)

6.2. Remove the Column Module from the system (See Section 5.)

6.3. Place the Shipping Endcaps over both ends of the Column Module.

7. Column With Guard Module

To assemble a Column with Guard Module you will need one pre-packed Column Module, a pre-packed Guard Module, and End-Fittings Kit No.2 (Rainin Catalog No. 83-842). The Column Module and the Guard Module should contain the same packing material. To add a Guard Module to an existing Column, see Section 9.0.

7.1. Remove the Shipping Endcaps from the Column Module and from the Guard Module. Remove the End-Fittings Kit from its shipping container. Check to see that you have all the component parts:

- One Axial Compression Module
- One Outlet Axial Compression Nut/Column Stand (with four legs)
- One Inlet Axial Compression Piston (with four socket head screws opposite the ¼-28 inlet port)
- One Outlet Axial Compression Piston (with two socket head screws adjacent to the ¼-28 outlet port)
- One Axial Coupling Piston (a double Piston with two seals)
- One Guard Column Adapter Sleeve
- One Replacement Inlet Axial Compression Piston Body

Each Kit also contains all connections required to attach the Column with Guard Module to your HPLC system (as described in Section 3 for End-Fittings Kit No. 1). See Figure 3.

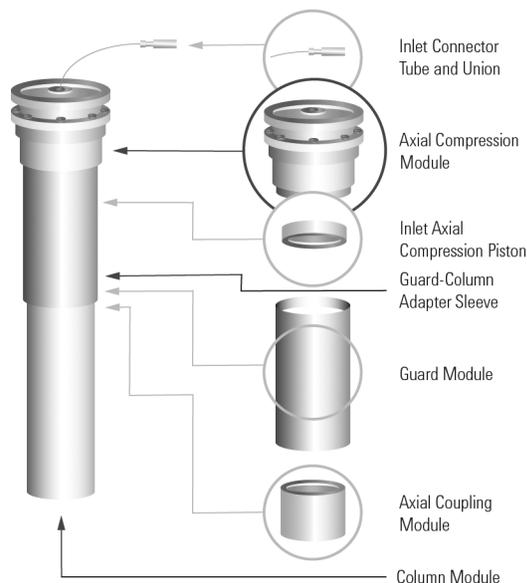


Figure 3. Detail of Guard Module attachment to 41.4 mm id Dynamax column.

7.2. Check each Piston to ensure that the Seal is properly orientated. (See Section 3.) Also check the walls of the Column and Guard Modules to be sure that any particulate material that might be present has been removed.

7.3. Slide the Outlet Axial Compression Piston into the Column Module outlet. (See Section 3.)

7.4. Assemble and attach the Outlet Axial Compression Nut/Column Stand. (See Section 3.)

7.5. Slide the Axial Coupling Piston into the inlet of the Column Module (as Section 3 describes for the Inlet Axial Compression Piston).

7.6. Slide the Guard Module outlet over the Axial Coupling Piston. The direction of flow is indicated by an arrow on the Guard Module label.

7.7. Slide the Inlet Axial Compression Piston into the inlet of the Guard Module.

7.8. Place the Guard Column Adapter Sleeve over the attached Guard Module and carefully hand tighten onto the Column Module inlet until snug. Be sure the Adapter Sleeve threads on easily. If resistance is encountered, unscrew and try again after cleaning the threads. **DO NOT FORCE! DO NOT USE TOOLS!**

CAUTION: The Adapter Sleeve is heavy. Be careful not to drop it. Connect the Inlet Axial Compression Piston to the Union using the tubing provided.

7.9. Thread the Union and connecting tubing through the center hole of the Axial Compression Module. Attach the Axial Compression Module to the Guard Column Adapter Sleeve by hand until snug. Gently turn the Drive Wheel clockwise by hand until you feel the internal piston contact the Inlet Axial Compression Piston. (See Section 3.)

7.10. Turn the Drive Wheel one more complete turn. The completely assembled Column Module with Guard is shown in Figure 3.

7.11. Wait a few minutes. This wait is absolutely necessary. It allows air forming a cushion between the Guard Module and the Column Module to flow out. If not removed this air can produce dead volume and result in reduced column performance.

7.12. Turn the Drive Wheel one more complete turn.

7.13. Connect your Dynamax Column Module with Guard to your HPLC system as described in Section 3.

7.14. When using the Column for the first time, equilibrate according to the procedure outlined in Section 4.0.

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. To replace the Guard Module:

8.1. De-pressurize the HPLC system.

8.2. Remove the Axial Compression Module as in Section 5. Pull the Inlet Axial Compression Piston from the Guard Module. If the Column has been disconnected from the HPLC system, a ¼-28 bushing inserted in the Piston will provide 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 as described in Section 7.

8.5. Remove entrapped air as described in Section 7.

9. Adding a Guard Module To an Existing Column

You can add a Guard Module to an existing Column using a Guard/Column Coupling Assembly (Rainin Catalog No. 83-841). The Column and Guard Module must be the same diameter and should contain the same packing material.

The Guard/Column Coupling Assembly consists of: one Guard Column Adapter Sleeve and one Axial Coupling Piston. These parts may be identified from Figure 3. Check to see that all the parts have been received and that the Seals on the Axial Coupling Piston are properly orientated as described in Section 3.

To couple the Guard Module to the Column:

9.1. Disconnect the Column Inlet from your HPLC system.

9.2. Turn the Drive Wheel counterclockwise by hand until the internal piston within the Axial Compression Module is no longer in contact with the Inlet Axial Compression Piston. Then remove the Axial Compression Module by turning counterclockwise by hand.

9.3. Pull the Inlet Axial Compression Piston out of the Column Module.

9.4. Slide the Axial Coupling Piston into the Column Module inlet in place of the Axial Compression Piston.

9.5. Slide the Guard Module outlet over the Axial Coupling Piston. The direction of flow is indicated by an arrow on the Guard Module label.

9.6. Take the inlet Axial Compression Piston you just removed from the Column Module and slide it into the inlet of the Guard Module.

9.7. Place the Guard Column Adapter Sleeve over the Guard Module and thread onto the Column Module by hand until snug.

9.8. Connect the Inlet Axial Compression Piston to the Union using the tubing provided.

9.9. Attach the Axial Compression Module as described in Section 7.

9.10. Remove entrapped air as described in Section 7.

9.11. Reattach the Column Inlet to your HPLC system.

10. Connecting Column Modules In Series

Column Modules may be connected in series by using a minimal length of stainless steel tubing (0.030" id). Connect the outlet of one column to the inlet of a second column using the tubing indicated with appropriate ¼-28 bushings and ferrules (or plastic reusable connectors).

11. Using A Guard Module As A Column

The Stand-Alone Guard Holder, Catalog No. 83-844, permits a Guard Module to be used separately as a column. The Stand-Alone Guard Holder consists of one Inlet Axial Compression Piston, one Outlet Axial Compression Piston, one Axial Compression Module, one Guard Column Adapter Sleeve, and one Guard Outlet Compression Nut.

Check to be sure you have received all these parts. Check the Axial Compression Pistons for proper Seal orientation as described in Section 3.

To assemble:

11.1. Remove the Shipping Endcaps from the Guard Module. Inspect the Guard Module walls and remove any particulate material present.

11.2. Slide the Inlet Axial Compression Piston into the inlet end of the Guard Module. Direction of flow is indicated by an arrow on the label.

11.3. Slide the Outlet Axial Compression Piston into the outlet end of the Guard Module.

11.4. Thread the Guard Outlet Compression Nut into the Guard Column Adapter Sleeve. Insert the Guard Column Module with Axial Compression Pistons in place into the Guard Column Adapter Sleeve so that the Outlet Axial Compression Piston contacts the Guard Outlet Compression Nut.

11.5. Thread the Axial Compression Module onto the inlet side of the Guard Column Adapter Sleeve until snug. Turn the Drive Wheel clockwise by hand until the internal piston contacts the Inlet Axial Compression Piston. (See Section 3.) Turn the Drive Wheel one additional complete turn.

11.6. Equilibrate as described in Section 4.

Care and Use Guidelines

12. Testing Your Column

Whenever a new Column Module is installed, or after prolonged storage, always evaluate performance using the standard test procedures. Consult your chemistry manual for specific test conditions.

For Dynamax column care and usage, please refer to the appropriate chemistry manual provided with your column.

13. Important Recommendations

To ensure 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. Over-tightening with tools will damage important internal parts.

IMPORTANT: Leakage around a Dynamax Seal cannot be corrected by increasing the torque on the Axial Compression Nut (that is, further turning of the Drive Wheel of the Axial Compression Module). In case of leakage, the Seal should be replaced.

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

Do not over-tighten Bushings and Ferrules when making system connections. Over-tightening can damage Axial Compression Pistons.

When connecting a Guard Module to a Column Module always follow the instructions for removing trapped air from the Axial Compression Coupling Piston. Failure to follow these instructions carefully 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. This is essential when using solvent systems which contain dissolved salts or which may support bacterial growth. Nylon-66 membrane filters are recommended because of their resistance to all common HPLC solvents.

Fully equilibrate the column to the starting conditions before beginning each chromatographic run. Do not exceed the pressure limits of the column. The pressure limit on pre-packed 41.4 mm id Dynamax columns is approximately 2,000 psi. The pressure limit of 41.4 mm id Dynamax column hardware is 4,000 psi. (In case of overpressure, the inlet Seal will normally be the first failed component.)

Use a pulse damper to reduce pulsation. Pulsation is a major cause of decreased column life. This is especially important at the high solvent flow rates typically used in preparative-scale chromatography.

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. Refer to chemistry manual for further information.

Column Maintenance

14. Changing The Inlet Solvent Filter

14.1. Depressurize the Column completely.

14.2. Remove the Axial Compression Module as described in Section 9.

14.3. Remove the Inlet Axial Compression Piston.

14.4. Remove the four socket head screws, the Seal Retainer, and the Seal from the Inlet Axial Compression body with the used filter.

14.5. Replace the Inlet Axial Compression Piston body (containing the pressed-in solvent filter) with a new body. Attach the Seal and Seal Retainer to the new body in the proper orientation (See Section 3.). Replace and tighten the socket head screws snugly. Replace the Inlet Axial Compression Piston in the inlet end of the Column Module and reattach the Axial Compression Module.

15. Changing An Axial Compression Piston Seal

15.1. Depressurize the column completely. If the inlet Fitting is leaking, the Axial Compression Module must be removed as described in Section 5.

15.2. If the outlet Fitting is leaking the Axial Compression Nut/Column Stand must be removed. Disconnect the Column outlet from your HPLC system. Loosen the thumb screw by turning counterclockwise. Support the Column and remove the Axial Compression Nut by turning counterclockwise by hand. There is no need to remove the legs attached to the Nut which form the quadripod base.

15.3. Remove the Axial Compression Piston from the Column.

15.4. Loosen and remove the socket head screws (two for the Outlet Piston, four for the Inlet Piston) which hold the Seal Retainer to the Piston body. Separate the Seal Retainer from the Piston body.

15.5. Remove the old Seal and replace it with a new one. The open side of the Seal with the spring visible should be toward the Seal Retainer.

15.6. Replace the Seal Retainer and reassemble the Fitting. Replacement of Seals on an Axial Coupling Piston may be accomplished in a similar fashion.

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, Stainless Steel

Part Number	Description
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Dynamax Fittings Kit

R000083840	End-Fittings Kit No. 1 for 41.4 mm id Dynamax Columns
R000083842	End-Fittings Kit No. 2 for 41.4 mm id Dynamax Columns

Guard/Column Coupling Assembly

R000083841	Guard Column Coupling Assembly for 41.4 mm id Columns
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Stand Alone Guard Holder

R000083844	Stand Alone Guard Holder for 41.4 mm id Guard Modules
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Replacement Seals

R000083947	Replacement Seals for 41.4 mm System, package of 2
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Replacement Fittings and Tubing

R0000010140	SSI Male Bushing, ¼-28 Threads, for 1/16" od Tubing, pkg of 10
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R0000010142	SSI Ferrules, 1/16", pkg of 10
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Replacement Piston Assemblies *(Complete With Seals and Retainers)*

R00007002211	Inlet Axial Compression Piston Assembly for 41.4 mm id System
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R00007002059M	Outlet Axial Compression Piston Assembly for 41.4 mm id System
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R00007002060M	Axial Coupling Piston Assembly for 41.4 mm id System
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Replacement Hardware

R00007002013	Guard Column Adapter Sleeve for 41.4 mm id System
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R00007002047	Outlet Axial Compression Nut/Column Stand for 41.4 mm id System (includes Thumbscrew Knob)
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R00007002048	Legs for 7002-047 Column Stand, set of 4
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19. Agilent Dynamax Parts List, Titanium

Part Number	Description
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R000083840TI	End-Fitting Kit, SS316/Titanium/Fluoropolymer for 41.4 mm id Hydropore Dynamax Column Module
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R000083947	Replacement Column Seals, SS316/Fluoropolymer for 41.4 mm id Hydropore Dynamax Column Module, package of 2
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Replacement Tubing

R00000175	Titanium Tubing, 1/16" od x 0.030" id x 20 cm
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R00000176	Titanium Tubing, 1/16" od x 0.030" id x 30 cm
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R00001533	Peek-High-Pressure chemically inert Plastic Tubing, 1/16" od x 0.030" id x 5 feet, Green
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R0000220193	Titanium Ferrules for 1/16" od tubing, (for use with Parker-type fittings) pkg of 2
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Refer to your chemistry manual for ordering information on column and guard modules.

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