Agilent Zorbax Rapid Resolution and Rapid Resolution HT Cartridge-Columns

Datasheet

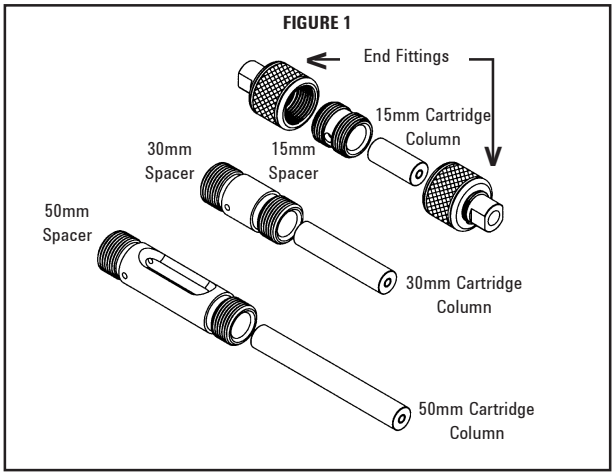
General Description

The Zorbax Rapid Resolution (3.5µm) and Rapid Resolution HT (1.8µm) Cartridge-Column Series provide convenient, cost-effective, high-speed, liquid chromatographic analyses. The cartridge components assemble quickly and easily to provide a high-efficiency, low dead-volume column that seals with hand tightening, using perfluoro-elastomer gaskets, at pressures up to 400 bar (6000 psi) and temperatures up to 80°C. The reusable cartridge end fittings adapt the cartridge column for connection to standard 1/16" LC fittings. Rapid Resolution and Rapid Resolution HT cartridges are filled with high performance Zorbax StableBond and Eclipse bonded phase packings to provide the highest quality separations possible in such short length columns. Rapid Resolution and Rapid Resolution HT cartridges are recommended for high-speed analyses that require only a moderate number of theoretical plates (e.g. high-throughput LC/MS applications). These units provide shorter analysis time and savings in column and solvent costs. Four types of Rapid Resolution cartridge columns filled with 3.5µm packings are available: 2.1x15mm, 2.1x30mm, 4.6x15mm, and 4.6x30mm. Six types of cartridge columns are available for Rapid Resolution HT columns filled with 1.8µm packings: 2.1 x 15mm, 2.1 x 30mm, 2.1 x 50mm, 4.6 x 15mm, 4.6 x 30mm, and 4.6 x 50mm. The 4.6 and 2.1mm x 50mm lengths are also available as columns with fixed end fittings.

Zorbax Packings

The 3.5µm and 1.8µm packings used in the Rapid Resolution and Rapid Resolution HT cartridge-series columns are physically and chemically the same as other Zorbax StableBond and Eclipse packings of different particle sizes in all other Zorbax columns. The characteristics of Zorbax particles include exceptional structural rigidity and an extremely narrow particle-size distribution, contributing to the formation of efficient, stable bed structures. These packings consist of exhaustively derivatized, high-purity porous-silica microspheres having reproducible bonded monolayers.

FIGURE 1



Column Characteristics

The cartridges are made of 316 stainless steel. The packing is retained in the cartridges by stainless steel frits which are pressed into the cartridge. The Rapid Resolution cartridges containing 3.5µm particles have 2µm inlet frits and 0.5µm outlet frits. The Rapid Resolution HT cartridges containing 1.8µm particles have inlet and outlet frits of 0.5µm porosity and should be protected to minimize pluggage of the inlet by debris in the mobile phase or samples.

The combination of particle size, column diameter and length was chosen to provide a wide range of resolving power and compatability with high-throughput applications, including LC/MS and LC/MS/MS. The following table summarizes typical efficiency of test solutes (in plate numbers) for the Rapid Resolution and Rapid Resolution HT cartridge columns.

Typical Plate Number (N) per Column

	N	
ID x Length	**RRHT**	**RR**
4.6 x 50 mm	12000*	6500**
4.6 x 30 mm	6000	2500
4.6 x 15 mm	2400	1200
2.1 x 50 mm	9000*	4500**
2.1 x 30 mm	4500	2300
2.1 x 15 mm	2000	1000

* Available in cartridge or fixed end-fitting formats
** Available in fixed end fitting format only. Cartridges available as special order columns. Call for quotation.

Safety Considerations

Safety precautions must be observed while operating any HPLC column. Considerations for safe operation are primarily concerned with chemical exposure. Prior to using any chemical, hazards should be assessed. Precautions should be taken to prevent exposure to potential hazards in case of spills, leaks, and other accidents.

The small particles in the column packing are respirable; therefore, cartridges should not be opened.

Operation Guidelines

- The direction of flow is marked on the column.
- While generally not harmful to the column, reversing flow should be avoided except to attempt removal of inlet pluggage.
- A new cartridge is shipped dry; therefore, flush new cartridge columns with 20 column volumes of methanol, then 20 column volumes of mobile phase before use. This will avoid any equilibration problem and will ensure reproducible selectivity with new columns.
- Maximum operating pressure is 400 bar (6000 psi).
- Optimum pH range for maximum life of StableBond columns is 1.8 to 6 and for Eclipse columns 3 to 8. Maximum pH ranges are 1.8 to 8 for StableBond and 2 to 9 for Eclipse, with risk of reduced column lifetime.
- Maximum operating temperature is 40°C when using a mobile phase with pH ≥ 6. At low pH, StableBond columns may be used up to 80°C, and Eclipse columns up to 60°C.

Cartridge Column Assembly

The standard configuration, (exploded view in Figure 1), requires a column spacer, an analytical cartridge column, and two end fittings. The end fittings contain a perfluoro-elastomer gasket to seal with hand-tightening. To assemble, first screw the appropriate length spacer into one end-fitting until only two or three threads remain showing. Put the analytical column into the spacer noting the direction of the flow arrow. (Flow through the column should always be in the direction of the arrow.) Next, the other end-fitting is screwed on the spacer. Both end fittings are then hand-tightened. For your convenience, a wrench has been provided to aid in the removal of a spacer from an end-fitting. To remove a spacer from an end-fitting, engage the tooth end of the wrench in the hole through the side of the spacer, then rotate the wrench and the spacer in a counter clockwise direction.

Storage Recomendations

Long term storage of silica-based cartridge colums should be in a pure organic solvent, preferably an aprotic liquid such as 100% acetonitrile. If the column has been previously used with a buffered mobile phase, the buffer should first be removed by purging the column with 20-30 columns volumes of a 50/50 mixture of methanol or acetonitrile and water, followed by 20-30 column volumes of the pure solvent. Store the columns tightly capped inside the plastic tubes used for shipping the columns to prevent contamination or damage to the column ends.

Rapid Resolution and Rapid Resolution HT Cartridge Columns should be stored at room temperature.

Ordering Information

For more information or to order our products, visit our Agilent Technologies home page on the World Wide Web at http://www.agilent.com/chem/supplies
For Technical Support in the US and Canada, call 1-800-227-9770 or call your local Agilent sales office.

Rapid Resolution HT Columns & Cartridges Datasheet Addendum

In order to obtain the maximum performance (column efficiency and peak resolution) from Rapid Resolution HT columns and cartridges, it is important to use a fast detector response time and to make several hardware changes to your HPLC to minimize extra-column system volume. These hardware changes include narrower internal diameter connecting capillary tubing as well as a lower volume detector flow cell for both isocratic and gradient applications. Gradient applications also benefit from changes to the solvent mixer and associated pump tubing to minimize the dwell volume.

The following table contains a complete list of recommended changes to an Agilent 1100 HPLC to maximize the performance of the Rapid Resolution HT columns. If you will only be doing isocratic analyses, then you only need to consider doing items 1-6. However, if you will be performing gradient analyses you should also consider doing items 7-8.

Parts Needed To Optimize An Agilent 1100 HPLC
For Rapid Resolution HT Columns/Cartridges

		Standard 1100		Optimized 1100 for Rapid Resolution HT	
Item	Description	Size	Part Number	Size	Part Number
1	Detector Peak Width (Response Time)	1.0 - 2.0 Sec		0.1 Sec	
2	Needle Seat Capillary	0.17 mm (Green)	G1313-87101	0.12mm (Red)	G1313-87103
3	Injector to Column Compartment Capillary	28 cm x 0.17 mm (Green)	01090-87304	28 cm x 0.12 mm (Red)	01090-87610
4	Column Compartment to Column Capillary	7 cm x 0.17 mm (Green)	G1316-87300	7 cm x 0.12 mm (Red)	G1316-87303
5	Column to DAD Capillary	38 cm x 0.17 mm (Green)	G1315-87311	38 cm x 0.12 mm (Red)	G1315-87312
6	Standard Flow Cell	13 µL	G1315-60012		
	Semi-Micro Flow Cell (1st choice for most RRHT)			8 µL	G1315-60011
	Micro High Pressure Flow Cell			1.7 µL	G1315-60015
	500 nL Flow Cell *			500 nL	G1315-68714
7	Solvent Mixer **	420 µL	G1312-87330 G1312-67308 G1312-67307	80 µL	5022-2165 5022-2166 79841-87609 (2)
8	Pump to Autosampler Capillary **		G1312-67305	55 cm x 0.125 mm	G1375-87318
	* Only needed for 2.1x15mm cartridges				
	** Only needed to minimize dwell volume for GRADIENT analyses				

Zorbax Low-Volume Columns Operational Guidelines

General Considerations

lnterest has developed for columns with smaller internal volumes (shorter length, smaller internal diameters) designed for high performance/high speed separations. Anticipated uses for such columns include: (1) applications requiring enhanced sensitivity for small samples; (2) reduced mobile phase solvent consumption per analysis to decrease costs and environmental impact; (3) specialized techniques such as LC/MS; (4) high speed analyses with no loss in separation performance to improve analytical productivity. The purpose of this document is to provide the user of these columns with information targeted at optimizing the chromatographic utility of high performance, low internal-volume Zorbax columns. The dimensional configuration of columns designed for the applications noted above, results in decreased internal volumes as compared to commonly-used 4.6mm ID x 150mm columns. Peaks generated from these columns at reasonable k' values have considerably smaller volumes than those of standard 4.6 x 150mm columns. This volume effect is shown in Table 1.

TABLE 1

Volume Characteristics

Column	Internal Column Volume	Calculated Peak Volume (4s)
2.1 x 150 mm	0.35 mL	52 µL
3.0 x 150 mm	0.70 mL	112 µL
4.6 x 75 mm	0.80 mL	120 µL
4.6 x 150 mm	1.60 mL	260 µL

The peak volumes listed in Table 1 are typical of columns having about 10,000 theoretical plates and peak elution with k' = 3. The very low-volume 2.1 x 150mm columns require HPLC equipment specifically designed with low-volume components (injectors, detector cells, etc.) to achieve maximum performance. The larger volumes of the 3.0 x 150mm and 4.6 x 75mm columns allow them to be used in well-designed standard HPLC equipment. However, all low-volume columns perform best when used with proper attention to the factors discussed in the following sections.

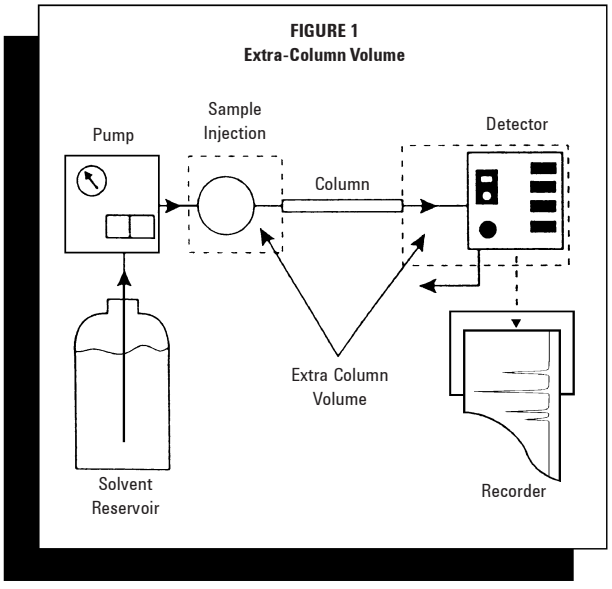


FIGURE 1
Extra-Column Volume

Extra-Column Volume Effects

Extra-column volume is defined as the HPLC system volume measured from the injector through the detector, exclusive of the column (Figure 1). The efficiency of separations achieved with low-volume columns is highly dependent on operating an HPLC unit with minimal extra-column volume. This effect is due to the small peak volumes exhibited by these columns. Large extra-column volumes can significantly degrade the inherent performance of a low-volume column. Some HPLC systems that perform well with standard bore, 4.6mm ID columns, can be poorly matched to the needs of narrow-bore columns or 4.6mm ID columns shorter than 150 mm. For example, an HPLC system with 50 µL of extra-column volume (typical for some older standard systems) reduced the column efficiency of a 2.1mm ID narrow-bore column by 45%, in contrast to an "optimized" HPLC system with only 8 µL of extra-column volume (Figure 2). Loss of column efficiency, and therefore, resolution, will be even more severe for earlier eluting peaks.

Clearly, it is very important to use appropriate equipment and to take special care in using any low-volume column to realize the full potential for high resolution afforded by these products.

Special Considerations

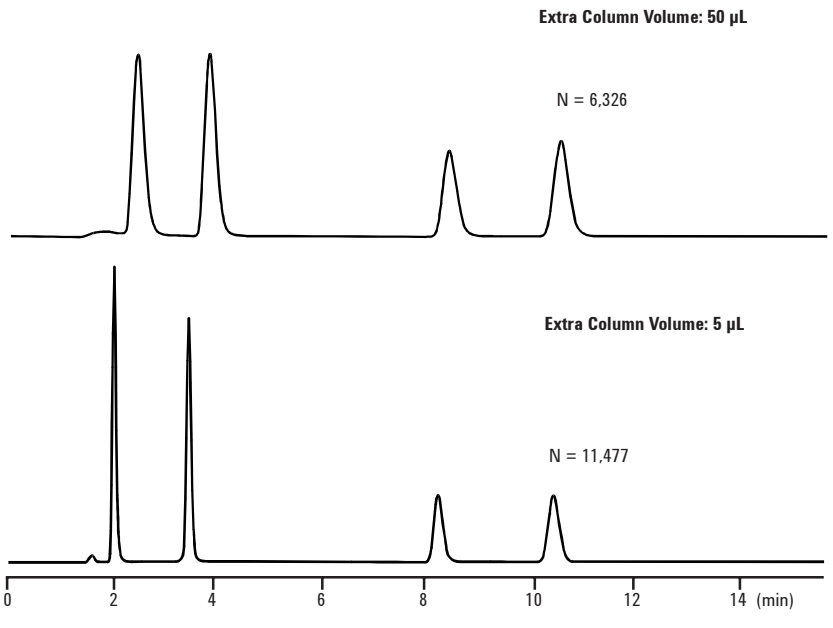
- Peak Retention – The volume of a peak increases as its retention is increased. Thus, extra-column volume is less of a factor if peak retention is increased for the first peak of interest.
- Detector – For best results, the detector must be designed for low-volume operation. The flow-cell volume should be minimized (preferably 2µL or less).
- Injection System – The sample injector should be of a micro-design to minimize internal volumes.
- Connecting Tubing – Tubing of internal diameter of at most 0.010 inch (0.25 mm) is required, and the shortest possible lengths should be used for connection from the injector to the column and the column to the detector. Only zero dead-volume connectors should be used for any required connections. All tube ends must be flat and bottom out in the fittings.
- Sample Solvent

  Isocratic – The sample should be dissolved in the mobile phase or in a solvent that is weaker than the mobile phase.

  Gradient – Sample should be dissolved in the initial A solvent or in a solvent substantially weaker than the B solvent.
- Injection Volume Isocratic – The volume of sample injected must be kept as small as possible. A good guideline is to inject a volume less than 15% of the volume of the initial peak. Typical sample volumes are 5 µL or less, and usually < 2 µL.

  Gradient – Sample-volume requirements are less critical if the initial peak k' (isocratic) is high (e.g. 20). In these cases, it is possible to inject several column volumes of sample, concentrating it on the head of the column. The sample peaks then are eluted at appropriate gradient compositions with low peak volumes.
- Flow Rates – The flow rate for optimal column efficiency for narrow-bore columns is proportionately smaller than that of a standard bore column due to the smaller internal volume. Flow rates recommended for Zorbax narrow-bore columns(2.1mm ID) are 0.15 to 0.35 mL/min and 0.4 to 0.5 mL/min for 3.0mm ID columns.

FIGURE 2
The Effects of Extra-Column Volume on Narrow-Bore (2.1x150 mm) Column Performance



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