Performance characteristics of the Agilent 1290 Infinity Thermostatted Column Compartment

New QuickChange valves, two heated zones up to 100 °C, improved usability

Technical Note

Introduction

The Agilent 1290 Infinity Thermostatted Column Compartment (TCC) offers a number of performance and usability improvements:

- valve heads can be easily changed by the user,
- operation up to 100 °C
- two heated zones enable the operation of up to four 100-mm long columns at two different temperatures.

This Technical Note describes the design of the Agilent 1290 Infinity Thermostatted Column Compartment.

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The new design

The Agilent 1290 Thermostatted Column Compartment offers a number of significant improvements that increase usability, flexibility and performance (Figure 1).

Usability was improved by implementing a new capillary guide to hold capillaries in position. The leak funnel was redesigned from earlier models and allows easier capillary installation on optional valves (Figure 2).

For improved data quality in routine operations, a new door-open sensor was introduced. This sensor prevents analysis when the front door is not closed properly, which would result in non-comparable temperatures inside the columns and variations in chromatographic results.

More flexibility is provided by longer heat exchange carries, due to the installation of 100-mm long columns in one heated zone. New QuickChange valves allow much faster and easier maintenance operations. For example, the change from a 1200 bar column selection valve to a 2 position/10 port valve can be accomplished in only a few minutes, since valve heads are exchanged from the front of the instrument without the need to take the instrument stack apart, and disassemble the module. For easy installation of capillaries attached to the valves, the capillaries are mounted on pull-out rail (Figure 2).

In addition, radio frequency identification (RFID) tags positioned at the rear of the valves provide storage of valve type, serial number, pressure range and number of valve switches.

Different valve types can be installed:

- 2 position/10 port valve (1200 bar) for automated column regeneration to provide highest sample throughput
- 2 position/6 port valve (1200 bar) for sample enrichment and sample stripping or dual column selection
- 8 position/9 port valves (400 or 1200 bar) for 8-fold column selection used in method development, multimethod applications and walk-up LC systems

The implementation of 8 position/9 port valves in two clustered Agilent 1290 Infinity TCCs enables the most versatile setup for method development and multimethod applications. For more details on this topic please refer to Agilent publication number 5990-4095EN.

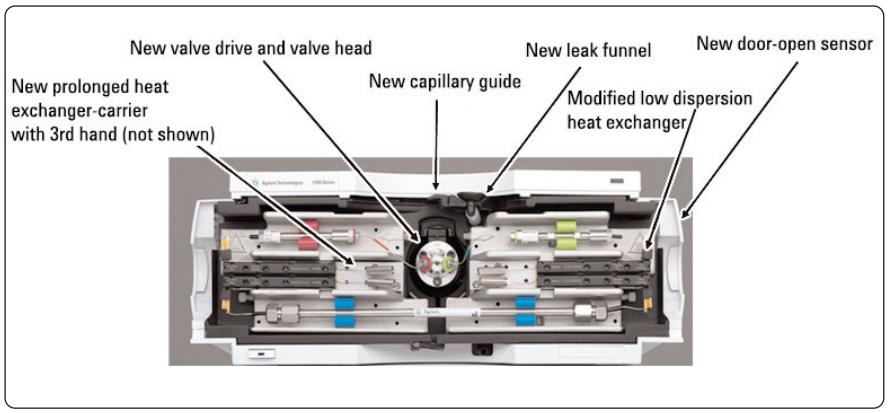

Figure 1
Optimized parts of the new Agilent 1290 Infinity TCC.

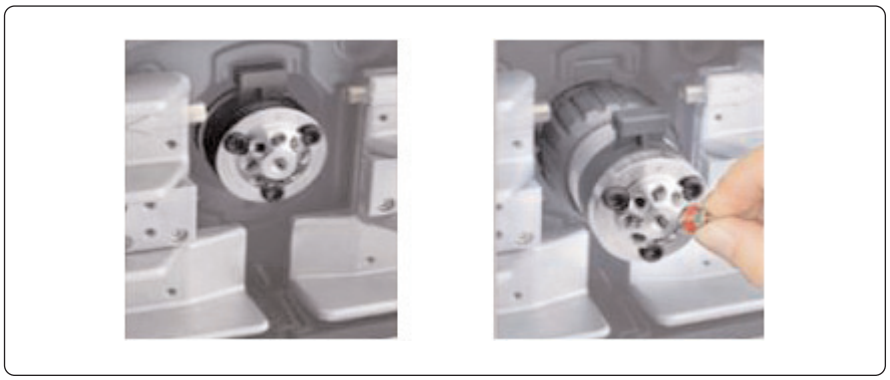

Figure 2
Ease of installation of capillaries and maintenance with new slide-out valve.

Equipment

The instrument used was an Agilent 1290 Infinity LC system, with the following modules:

- Agilent 1290 Infinity Binary Pump with vacuum degasser
- Agilent 1290 Infinity Autosampler
- Agilent 1290 Infinity TCC
- Agilent 1290 Infinity DAD for 160-Hz operation

Performance of the column compartment

The temperature range of the Agilent 1290 Infinity TCC is 10 °C below ambient up to 100 °C. The temperature stability is ± 0.05 °C. The temperature accuracy is ± 0.8 °C with calibration ± 0.5 °C and the heat-up/cool-down time is 5 min from ambient to 40 °C, and 10 min from 40 °C to 20 °C.

The equivalency of temperatures compared to legacy systems is important for method transferability. Figure 3 shows the comparison of the temperature of pure water (highest thermal capacity) directly at the column inlet of a new Agilent 1290 Infinity TCC (G1316C) compared to an Agilent 1200 Series Thermostatted Column Compartment SL (G1316B). Setpoints are the lowest and highest possible temperature settings across the entire specified flow rate. The difference of these two modules even under these extreme conditions is typically around or even below 0.5 °C.

In Figure 4, an example for the precision of retention times overnight is given. 80 runs were done starting on the 24th of March at 1:56 pm and ending with the start of the last run on the 25th of March at 2:38 am. It should be noted that the air condition was switched off at 8:00 pm. In Table 1 the results for the relative standard deviation are combined. The cycle time, including run time, was 9 min and 36 sec.

	RSD RT over 80 runs
Peak 1	0.049%
Peak 2	0.029%
Peak 3	0.014%
Peak 4	0.011%
Peak 5	0.013%
Peak 6	0.015%

Table 1
Long term precision of retention times.

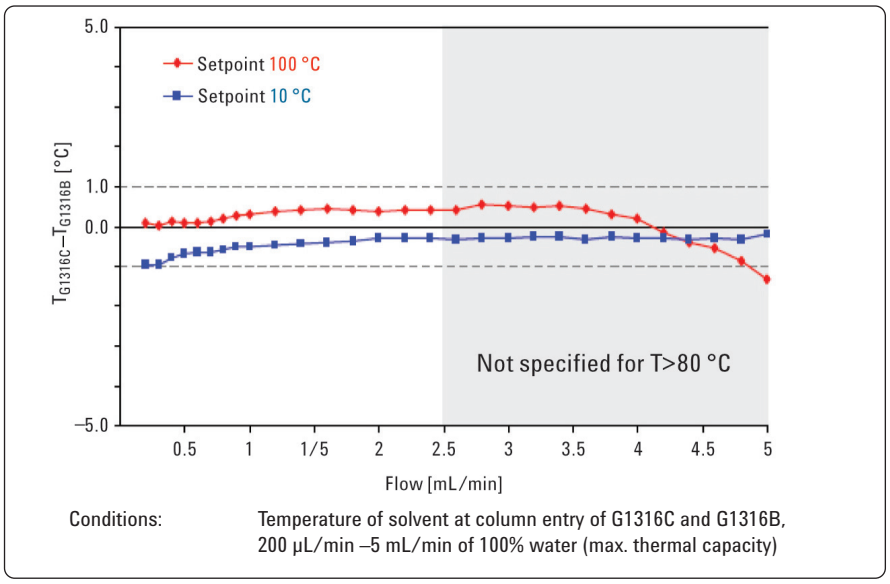

Figure 3
Temperature compared between G1316C and G1312B, measured with water at different flow rates and at 10 and 100 °C (100 °C is only specified up to 2.5 mL/min).

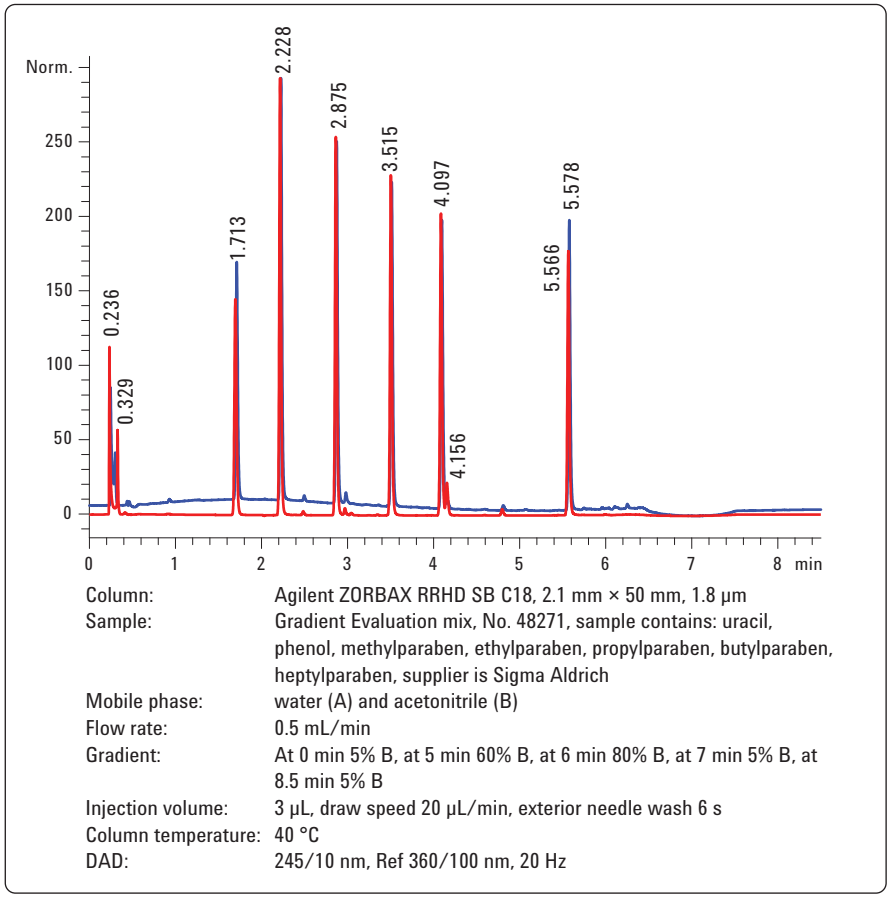

Figure 4
First and 80th run from 1:56 pm to 2:38 am of the next day at 40 °C column temperature, blue is the first injection, red is the 80th injection.

Conclusion

The Agilent 1290 Infinity Thermostatted Column Compartment integrated into a 1290 Infinity LC System offers high performance combined with high flexibility. Different valves can be integrated by removing and installing different valve heads. Columns up to 300 mm in length can be installed. Two heated zones are available and can be set at different temperatures. The excellent temperature stability of the Agilent 1290 Infinity TCCs enable highly precise retention times during long sequences running day and night, combined with an excellent comparability of thermal behavior to legacy systems.

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