# rSPECtive rtormance

# Waters<sup>®</sup> 515 HPLC Pump Gradient Chromatography: Excellent Performance for both Analytical and Narrow-Bore Applications

# Gradient Chromatography for Demanding Applications:

The need to separate chemically different compounds contained in complex sample mixtures is a challenge faced by many chromatographers. While isocratic methods are favored for less demanding separations, gradient chromatography provides the means to resolve complex mixtures through precisely programmed variations in solvent strength (e.g., organic for reversed-phase or ionic for ion-exchange). The ability of advanced solvent management systems (e.g, Waters Alliance<sup>™</sup> HPLC System) or traditional pumping technologies (e.g., Waters 515 Pump) to exceed our customers requirements and expectations are important aspects of the Waters Corporation "It's All Important" theme.

## Outstanding Gradient Performance with Multi-pump Technology:

The technology contained in Waters 515 pumps make them well suited for gradient chromatography at a variety of operating conditions. Each solvent required for the formation of the gradient is delivered to the column via a separate pump with Millennium<sup>® 32</sup> Chromatography Manager Software controlling the rate of solvent delivered to the system. Solvent blending occurs after the eluent leaves each pump. "High Pressure Gradient Formation" is the term frequently used to describe this method of non-isocratic solvent delivery (WPP11). The ability of Waters 515 pumping technology to yield highly reproducible gradient separations of a complex test mixture (See WPP34: A Gradient Test Mix for Characterizing Instrument Performance) is seen in Figures 1A and 1B and Table 1.



### Figures 1A , 1B and Table 1: 515 Pump Gradient Performance at 1.0 mL/min

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### **Reduce Solvent Consumption Without Sacrificing Gradient Performance:**

The cost of solvent disposal and the need for higher sensitivity have driven the development of columns with reduced internal diameter (e.g., 2.1 mm Vs. 3.9 or 4.6 mm internal diameter columns). Effective use of narrow-bore columns for gradient chromatography requires systems capable of reproducibly delivering eluents at comparatively low flow rates. In addition, HPLC system volumes should be minimal in order to maximize sample throughput. The Waters 515-based system is ideally suited for narrow-bore analysis when coupled with the Waters 717+ Autosampler configured with the low volume option kit (Waters Part Number 055886). The ability of this "high-pressure" HPLC gradient configuration to yield highly reproducible narrow-bore chromatography of a complex test mixture is demonstrated in Figures 2A and 2B and Table 2 below.



Figures 2A , 2B and Table 2: 515 System Gradient Performance at 0.29 mL/min

Summary:

• The precision of solvent delivery provided by the HPLC pump(s) can be the single-most important factor affecting run-to-run retention time reproducibility for both isocratic and gradient separations.

• The excellent gradient performance characteristics of the Waters 515 Pump make this technology well suited for chemists who prefer to use multi-pump systems for conventional analytical or solvent-saving narrow-bore chromatography.

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