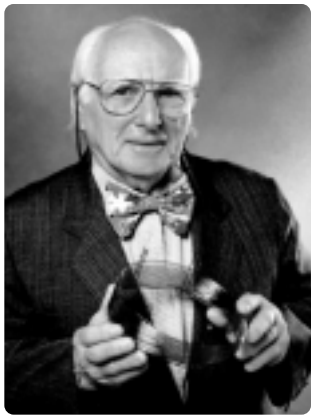
J&W Capillary Columns for GC/MS and Trace Analysis from Agilent Technologies

Technical Note

A letter from Walt Jennings

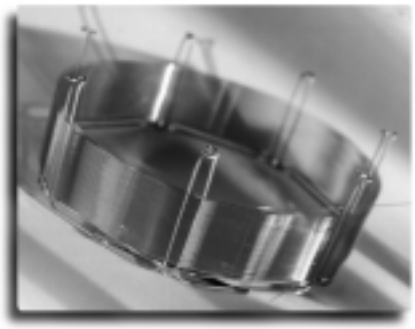
Dear Chromatographer,



Today's analysts are expected to detect and quantitate increasingly smaller quantities of more and more active solutes. Detectors like benchtop mass spectrometers and ion traps have become much more common. Our analytical potentials are now increasingly challenged by extraneous signals, resulting in an increased demand for lower bleed columns. Answering that demand gave rise to a new generation of thermally resistant columns capable of operation at higher temperatures and a much lower level of bleed signal. Once again, J&W was the industry leader, and our merger with Agilent Technologies will only strengthen that position.

Walt Jennings,
Cofounder,
J&W Scientific

Capillary Columns for Demanding Applications



There is a rapidly increasing population of benchtop GC/MS instruments in analytical laboratories that analyze a broadening range of trace level, higher temperature samples. These samples require increasingly inert, lower bleed, higher temperature columns. It seems logical and proper to apply the "ms" name to columns deliberately designed to chromatograph a broader range of low level samples and generating lower bleed at even higher temperatures.

What makes a J&W low bleed column from Agilent unique? Unique polymer chemistry and proprietary surface deactivation technology, both of which have contributed to columns that adhere to the tightest quality control specifications in the industry for bleed, inertness, selectivity and efficiency. Some column companies simply select the better performing capillary columns from batches of their standard columns. J&W "ms" columns utilize special surface deactivation and siloxane chemistries which enhance the chromatographic performance of siloxane polymers.

Four of the eight low bleed capillary columns from Agilent (DB™-5ms, DB-35ms, DB-17ms, DB-225ms) were designed to provide selectivities that are virtually identical to their conventional counterparts. As a result, in most cases all of the benefits of low bleed columns can be realized without any noticeable shift in analyte retention.

Not all low bleed phases are designed to mimic existing column selectivity. Because the polysiloxane backbone of the stationary phase was optimized to yield the lowest bleed column possible, DB-XLB has no conventional counterpart. Many users also gain sensitivity by replacing their general purpose, apolar columns such as 100% dimethylpolysiloxane and 5% diphenyl/95% dimethylpolysiloxane with DB-XLB.

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The Benefits of “ms” Grade Columns

Column bleed is the normal degradation of the stationary phase polymer. This degradation is accelerated at higher temperatures, hence the elevated baseline as temperature rises to the column’s upper limit (Figure 1).

Analytical sensitivity and detection limits are ultimately a function of the ratio of signal to noise (S/N). Decrease the noise, and sensitivity is increased. Using low bleed stationary phases reduces the column contribution to background noise and the reduced column bleed results in improved mass spectral purity and more accurate library identification. In addition, the exteded upper temperature range of these more thermally stable phases results in shorter analysis times and extended column lifetime.

Low bleed columns are not just for the “ms” user. Anyone performing trace analysis where sensitivity and instrument performance are issues should be concerned about bleed. Many GC detectors (MS, FID, PID, ECD, NPD, SCD) are sensitive to contamination from bleed and will require less maintenance when using low bleed columns. Ion trap “ms” users, because of the unique relationship between ion storage capacity of the trap and sensitivity, will especially benefit from low bleed columns. Many users are already taking advantage of all the benefits that low bleed stationary phases provide. With improved sensitivity, shorter analysis times, excellent inertness and virtually identical selectivity these phases are clearly the superior choice for your GC and GC/MS applications.

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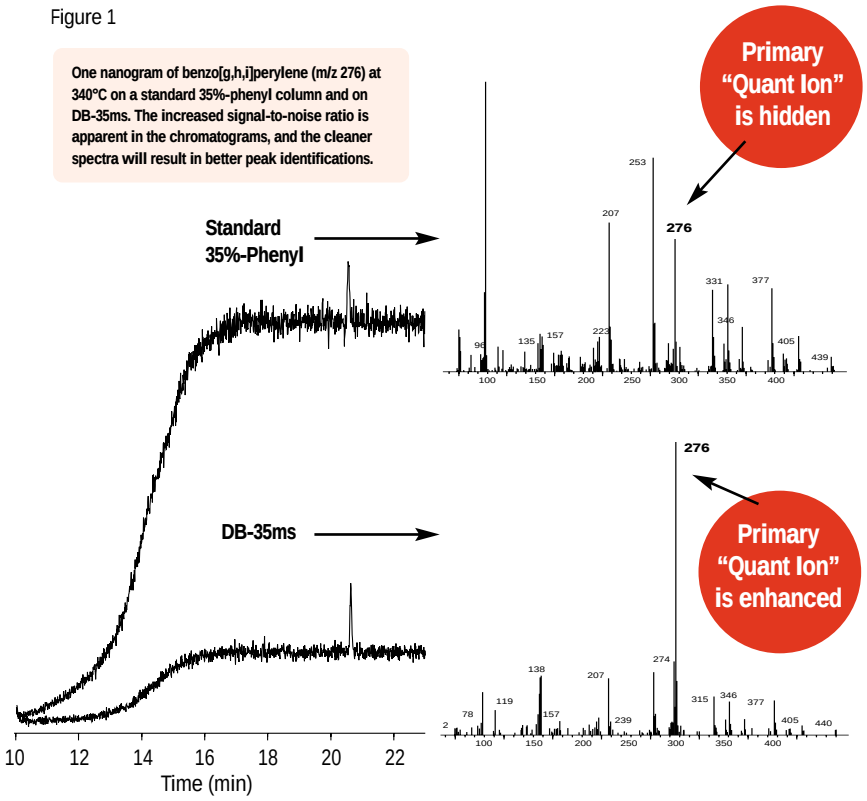
Table 1
Retention Indices at 90°C

Compound	Column DB-5ms	DB-5	DB-XLB	DB-35ms	DB-35	DB-17ms	DB-17
3,5-dimethylpyridine	980.5	978.9	1016.8	1124.5	1104.3	1159.3	1160.3
1-nitrohexane	1088.9	1083.3	1053.6	1150.0	1164.9	1209.5	1208.3
1,4-diisopropylbenzene	1168.9	1168.7	1186.2	1255.1	1257.1	1291.0	1289.3
1-nonanol	1171.9	1173.0	1186.2	1247.7	1243.8	1274.4	1273.7
2-decanone	1190.0	1190.9	1215.4	1283.0	1276.6	1310.2	1309.2

Figure 1

One nanogram of benzo[g,h,i]perylene (m/z 276) at 340°C on a standard 35%-phenyl column and on DB-35ms. The increased signal-to-noise ratio is apparent in the chromatograms, and the cleaner spectra will result in better peak identifications.



Selectivity Options in GC/MS Columns

The special siloxane chemistry used by Agilent allows for the manufacture of low bleed columns over a range of polarity. The columns are highlighted on the following pages.

The data in Table 1 makes several important points. The first is the close agreement of the retention values for the arylene “ms” columns relative to the standard siloxane polymers. These differences will be transparent to the majority of all users. The second observation is that DB-XLB is a unique stationary phase with a relatively low polarity in the range of a (12% phenyl)-methylsiloxane. This selectivity, coupled with the attributes of extremely low bleed and a deactivation technology that yields a highly inert surface, makes DB-XLB an excellent choice for trace analytical work.

Two Phase Chemistries Provide Many Column Options

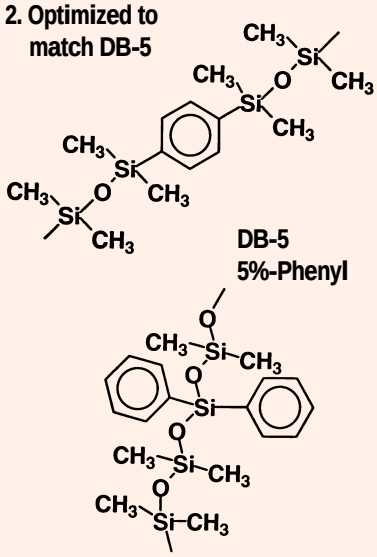
"ms" grade columns using two approaches to siloxane chemistry are available from Agilent. Both have advantages and yield columns of low bleed, high thermal stability and excellent inertness.

Need help? Dennis Gere as well as our entire technical support staff staff is always here to help — **800-227-9770.**

Low Bleed Arylene Phases

Arylene "ms" columns utilize special surface deactivation and siloxane chemistries, which enhance the chromatographic performance of siloxane polymers. Figure 2 is a representation of the arylene chemistry used to make DB-5ms. DB-XLB, DB-35ms, DB-17ms and DB-225ms use a proprietary second generation arylene technology to provide even better performance at high temperatures, expanding the range of commercially available low bleed columns. These polymers were designed to be virtually identical to their "parent" polymers, so selectivity differences are often very subtle (see Table 1). What one quickly notices with these columns is the low bleed signature of the column at elevated temperatures, as well as the improved thermal stability of the more polar "ms" columns such as DB-35ms, DB-17ms and DB-225ms. Higher temperature limits also mean extended column lifetime and shorter analysis times for many applications.

Figure 2



These columns are available in a wide range of configurations

DB-5ms (equivalent to HP-5TA):

Designed with the selectivity of a standard 5%-phenyl siloxane phase, DB-5ms incorporates arylene technology to provide a phase that not only bleeds less but also offers excellent inertness to both acidic and basic sample components. Available in a large selection of standard part numbers, DB-5ms has upper temperature limits of 325°C isothermal and 350°C on a program. DB-5ms is equivalent to HP-5TA.

DB-XLB:

XLB means eXceptionally Low Bleed. This is the lowest bleed column available anywhere. DB-XLB uses second generation arylene technology to provide a phase with excellent inertness, higher temperature limits (340/360°C) and a unique selectivity. Good for all general applications as well as those that push the limits of your existing GC/MS column, DB-XLB has a selectivity that makes it the first choice for the GC/MS analysis of specific PCB congeners.

DB-35ms (equivalent to HP-35ms):

Second generation arylene technology has also yielded phases with increasing polarity. DB-35ms has a selectivity that is virtually identical to a standard 35%-phenyl siloxane with increased upper temperature limits (340/360°C) and greatly reduced bleed. DB-35ms gives the GC/MS user a selectivity option for the resolution of high boiling, late eluting components. DB35ms is equivalent to HP-35ms.

DB-17ms:

DB-17ms uses second generation arylene polymer technology to give a selectivity that is virtually identical to standard 50%-phenyl siloxane columns. These columns have significantly higher upper temperature limits (320/340°C) with greatly reduced column bleed.

DB-225ms:

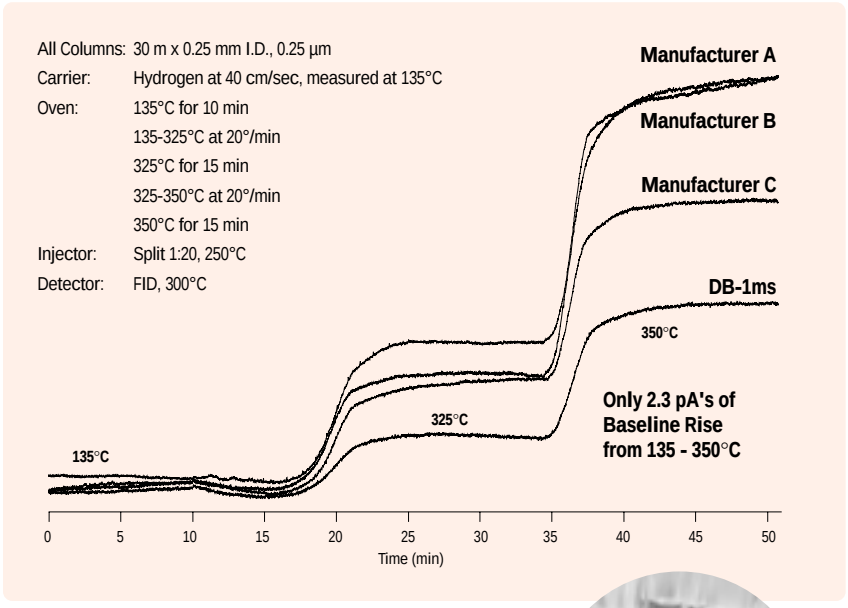
DB-225ms has been designed to provide lower bleed and a higher upper temperature limit (240/260°C) while maintaining selectivity which is virtually identical to that of the standard DB-225 (50% cyano-propylphenyl-methylpolysiloxane). The lower bleed allows for more sensitive analyses of trace components in bleed sensitive detectors and less detector fouling. DB-225ms is an excellent choice for the analysis of fatty acid methyl esters (FAMEs) and tetrachlorodibenzo-p-furans (TCDFs).

Allen Vickers along with our entire technical support staff is always here to help. **Call us at 800-227-9770.**

Optimized Siloxanes

Stationary phases such as DB-1 or HP-1, which are essentially 100% dimethylpolysiloxane, are not accurately mimicked with arylene inclusion to strengthen the polymer backbone. That's because the addition of other functional groups causes a significant change in the selectivity of the phase. While some manufacturers have taken this path, the resulting columns have a significantly different selectivity from the standard 100% dimethylpolysiloxane. J&W Scientific has utilized its years of experience as the worlds largest manufacturer of capillary GC columns to design phases that meet the requirements of trace analysis and retain the selectivity of the original phases. This translates to improved deactivation, new polymer synthesis and processing techniques and stringent quality control. One of these phases, DB-1ms, has a greatly reduced background level even at elevated temperatures (Figure 3).

Figure 3
Low Bleed Comparison of "1ms" Columns



These columns are available in a wide range of configurations

DB-1ms

Provides the same selectivity as the standard DB-1 column. Improved thermal stability is achieved through unique, proprietary techniques allowing for increased temperature limits (340/360°C). DB-1ms exhibits exceptional inertness for the analysis of acidic and basic compounds. Lower bleed, increased temperature limits and excellent inertness are the perfect combination for trace level analysis. Availability in a large selection of standard part numbers makes the DB-1ms a good choice for general applications that push the limits of your standard DB-1 column.

HP-1ms

Provides the same selectivity and inertness as the standard HP-1. An optimized manufacturing process ensures that each column meets ultra-low bleed specifications. Increased signal-to-noise ratios at maximum temperatures (325-350°C) and incredible inertness for acidic and basic compounds make HP-1ms a good choice for applications requiring low detection limits.

HP-5ms

HP-5ms uses the same stationary phase as the standard HP-5, providing low bleed without the use of arylene technology. HP-5ms exhibits the same selectivity as the standard HP-5 with reduced bleed at the maximum temperatures (325-350°C). A good choice for general GC/MS applications and trace level analysis.

Phase	Dimensions	Part Number	Price
DB-1ms	30 m x 0.25 mm x 0.25 µm	122-0132	$ 473
HP-1ms	30 m x 0.25 mm x 0.25 µm	19091S-933	475
DB-5ms	30 m x 0.25 mm x 0.25 µm	122-5532	473
HP-5ms	30 m x 0.25 mm x 0.25 µm	19091S-433	475
DB-XLB	30 m x 0.25 mm x 0.25 µm	122-1232	473
DB-35ms	30 m x 0.25 mm x 0.25 µm	122-3832	473
DB-17ms	30 m x 0.25 mm x 0.25 µm	122-4732	473
DB-225ms	30 m x 0.25 mm x 0.25 µm	122-2932	473

Each stationary phase is available in a variety of dimensions.
A full listing of the low bleed columns are on the chemical analysis online store at ***www.agilent.com***

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