A Beginner’s Guide to your GC Columns: Installation, Care, and Maintenance

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Application Engineer
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Agenda

• Unboxing / “getting to know your column”
• Install the column
• Preventive measures
• Corrective measures
• Latest instrument developments
Column Construction

Polyimide coating
Flexible polymeric coating; adds mechanical strength and temperature stability to fused silica

Fused silica
Amorphous glass-like tubing comprised of silicon dioxide; high temperature resistance, low reactivity. May contain rough edges creating active sites.

Deactivation
Chemical treatment layer; smooths fused silica surface to enhance inertness

Stationary phase
Polymeric coating atop deactivation layer; commonly comprised of polysiloxane- or polyethyleneglycol-based compounds
The “Unboxing” of the GC Column

Important for identification and re-ordering

Column stationary phase

Programmed temperature limit (<10 min)

Isothermal temperature limits

Unique to each column (identification)
# Agilent J&W Column Portfolio - DB, HP, CP, VF

<table>
<thead>
<tr>
<th>Low Polarity</th>
<th>Mid Polarity</th>
<th>High Polarity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CP-Sil 2</strong></td>
<td>DB &amp; HP-1ms UI</td>
<td><strong>DB-XLB</strong></td>
</tr>
<tr>
<td><strong>DB-MTBE</strong></td>
<td>DB &amp; HP-1ms</td>
<td><strong>DB &amp; HP-5ms UI</strong></td>
</tr>
<tr>
<td><strong>CP-Select CB MTBE</strong></td>
<td><strong>VF-1ms</strong></td>
<td><strong>VF-5ms</strong></td>
</tr>
<tr>
<td><strong>DB &amp; HP-1</strong></td>
<td>DB &amp; HP-5</td>
<td><strong>DB &amp; VF-35ms</strong></td>
</tr>
<tr>
<td><strong>CP-Sil 5 CB</strong></td>
<td><strong>CP-Sil 8 CB</strong></td>
<td><strong>DB &amp; HP-5</strong></td>
</tr>
<tr>
<td><strong>Ultra 1</strong></td>
<td><strong>Ultra 2</strong></td>
<td><strong>DB &amp; VF-17ms</strong></td>
</tr>
<tr>
<td><strong>DB-1ht</strong></td>
<td><strong>VF-DA</strong></td>
<td><strong>DB-17</strong></td>
</tr>
<tr>
<td><strong>DB-2887</strong></td>
<td><strong>DB-5.625</strong></td>
<td><strong>HP-50+</strong></td>
</tr>
<tr>
<td><strong>DB-Petro/PONA</strong></td>
<td><strong>DB &amp; VF-5ht</strong></td>
<td><strong>DB-17ht</strong></td>
</tr>
<tr>
<td><strong>CP-Sil PONA CB</strong></td>
<td><strong>CP-Sil PAH CB</strong></td>
<td><strong>DB-608</strong></td>
</tr>
<tr>
<td><strong>DB-HT SimDist</strong></td>
<td><strong>Select Biodiesel</strong></td>
<td><strong>DB-TPH</strong></td>
</tr>
<tr>
<td><strong>CP-SimDis</strong></td>
<td><strong>SE-54</strong></td>
<td><strong>DB-502.2</strong></td>
</tr>
<tr>
<td><strong>CP-Volamine</strong></td>
<td><strong>HP-VOC</strong></td>
<td><strong>DB-VRX</strong></td>
</tr>
<tr>
<td><strong>Select Mineral Oil</strong></td>
<td><strong>DB-VRX</strong></td>
<td><strong>DB-624</strong></td>
</tr>
<tr>
<td><strong>HP-101</strong></td>
<td><strong>VF-624ms</strong></td>
<td><strong>VF-624ms</strong></td>
</tr>
<tr>
<td><strong>SE-30</strong></td>
<td><strong>VF-1301ms</strong></td>
<td><strong>CP-Select 624 CB</strong></td>
</tr>
<tr>
<td><strong>CP-Sil 13 CB</strong></td>
<td><strong>DB-1301</strong></td>
<td><strong>VF-1301ms</strong></td>
</tr>
</tbody>
</table>

Agilent J&W columns have over 50 different stationary phase offerings
What's Inside?

Column tag contains useful information

Column plug holds column ends together and protects against contamination. To put the column in storage, use this plug again or a piece of septa over the ends of the column.
## Column Performance Summary

**Catalog:** 19091S-433UI  
**Serial:** [Barcode Image]

**Stationary Phase:** HP-5MS UI  
**Description:** 30m x 0.250mm x 0.25µm  
**Temperature Limits:** -60°C to 325°C (350°C Pgm)

### Performance Results

<table>
<thead>
<tr>
<th>Theoretical Plates/Meter: n-DECANE</th>
<th>3208</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retention Index:</td>
<td></td>
</tr>
<tr>
<td>n-PROPYLENETHYLENE</td>
<td>553.110</td>
</tr>
<tr>
<td>1-HEPTANOL</td>
<td>967.660</td>
</tr>
<tr>
<td>Resolution:</td>
<td></td>
</tr>
<tr>
<td>1-OCTENE, n-OCTANE</td>
<td>2.97</td>
</tr>
</tbody>
</table>

### Compound Identification

<table>
<thead>
<tr>
<th>Compound Identification</th>
<th>Retent. Time</th>
<th>Part. Ratio</th>
<th>1/2-Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PROPIONIC ACID</td>
<td>1.543</td>
<td>0.30</td>
<td>0.027</td>
</tr>
<tr>
<td>2. 1-OCTENE</td>
<td>2.203</td>
<td>0.88</td>
<td>0.015</td>
</tr>
<tr>
<td>3. n-OCTANE</td>
<td>2.282</td>
<td>0.92</td>
<td>0.016</td>
</tr>
<tr>
<td>4. 1,3-PROPANEDIOL</td>
<td>2.552</td>
<td>1.15</td>
<td>0.020</td>
</tr>
<tr>
<td>5. 4-METHYLPYRIDINE</td>
<td>3.051</td>
<td>1.57</td>
<td>0.021</td>
</tr>
<tr>
<td>6. n-NONANE</td>
<td>3.738</td>
<td>2.15</td>
<td>0.027</td>
</tr>
<tr>
<td>7. TRIMETHYLPHOSPHATE</td>
<td>4.482</td>
<td>2.78</td>
<td>0.033</td>
</tr>
<tr>
<td>8. n-PROPYL BENZENE</td>
<td>5.193</td>
<td>3.38</td>
<td>0.038</td>
</tr>
<tr>
<td>9. 1-HEPTANOL</td>
<td>5.682</td>
<td>3.79</td>
<td>0.041</td>
</tr>
<tr>
<td>10. 3-OCTANONE</td>
<td>6.368</td>
<td>4.37</td>
<td>0.047</td>
</tr>
<tr>
<td>11. n-DECANE</td>
<td>6.940</td>
<td>4.85</td>
<td>0.053</td>
</tr>
</tbody>
</table>

### Test Conditions

- **Inlet:** Split (250°C)  
- **Detector:** FID (325°C)
- **Carrier Gas:** Hydrogen  
- **Flow:** 42.1 cm/sec (1.2 ml/min)
- **Holdup Compound:** Pentane (1.187-min)
- **Temperature Program:** Isothermal at 65°C
Chromatographic Performance

- 320 °C
  Spec: 4.0 pA
  Meas: 2.1 pA

- 65 °C

The graph shows the chromatographic performance with peaks labeled 1 to 11. The specified and measured values at different temperatures are indicated.
## Test Mixture Components

<table>
<thead>
<tr>
<th>Compounds</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrocarbons</td>
<td>Efficiency</td>
</tr>
<tr>
<td></td>
<td>Retention</td>
</tr>
<tr>
<td>FAMEs, PAHs</td>
<td>Retention</td>
</tr>
<tr>
<td>Alcohols</td>
<td>Activity</td>
</tr>
<tr>
<td>Acids</td>
<td>Acidic character</td>
</tr>
<tr>
<td>Bases</td>
<td>Basic character</td>
</tr>
</tbody>
</table>
Column Installation Procedure

• Install the column
• Leak and installation check
• Column conditioning
• Setting linear velocity or flow rate
• Bleed profile
• Test mix
Contamination from Hand Lotion

Column: DB-5ms, 30 m x 0.25 mm, 0.25um
Carrier: H2, 60 cm/sec, constant flow
Injector: split 1:20, 250C
Detector: FID, 320C, N2 make up gas
Oven: 40C for 0.75 min, 40-325C at 20C/min, 325C for 30 min

Procedure:
(1) One small drop of liquid placed on one fingertip.
(2) Fingertip was wiped with paper towel to remove as much of the offending material as possible.
(3) Lightly touched the part of the column sticking up above the ferrule.
(4) Installed column into injector.
(5) Set oven temperature to 40C.
(6) Started oven temperature program as soon as oven reached 40 °C.
“Touchless” Packaging
## Column Installation

### What type of ferrule should I use?

<table>
<thead>
<tr>
<th>Composition</th>
<th>Re-use</th>
<th>Max Temperature (°C)</th>
<th>Use</th>
<th>Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyimide (Vespel)</td>
<td>Yes</td>
<td>280</td>
<td>Easy seal</td>
<td>Shrink after heating causing leaks after thermal cycle; isothermal only</td>
</tr>
<tr>
<td>Graphite</td>
<td>Yes</td>
<td>450</td>
<td>FID, NPD, inlets</td>
<td>Contamination, permeable to air – not for oxygen sensitive detectors</td>
</tr>
<tr>
<td>Polyimide/graphite (85% / 15%)</td>
<td>Limited</td>
<td>350</td>
<td>MS, ECD, inlets</td>
<td>Still shrink after thermal cycles creating leaks; need to retighten regularly</td>
</tr>
<tr>
<td>Flexible Metal</td>
<td>No</td>
<td>450</td>
<td>Capillary flow technology (backflush, splitters, and so on)</td>
<td>May not seal well with damaged fittings or rough surfaces</td>
</tr>
</tbody>
</table>

“Short” ferrules for inlet and detector configurations on Agilent GCs

“Long” ferrules for MS transfer lines and MS interface nut
Graphite/Polyimide Blend Capillary Ferrules

- Unfortunately, a leak occurred following normal temperature program runs
- Studies show that the leaking continues with use of the ferrules
  - Not just after the first one or two runs

**Standard column nuts and ferrules**

- just installed

and after 25 injections

Frequent retightening of the fitting is needed to maintain a leak-free seal, as well as system performance and productivity.
Column Installation: Self Tightening Column Nut

- Spring driven piston continuously presses against ferrule
- Automatically retightens when ferrule shrinks
- No leaks, no downtime, no frustration
- Wing design for finger tightening
- No tools needed
- No polymer materials for durability
- Compatible with only short graphite
- Vespel ferrules

For inlet or detector

For mass spectrometry transfer line
Increasing Ease of Use Through Continued Innovation: Self Tightening Nuts

For GC inlet or detector

- Easier and faster to install
- Collar holds column in place
- Single-hand installation into inlet
- No tools needed

For mass spectrometry transfer line
Self Tightening Nuts: No Leaks, No Downtime, No Frustration

- Spring-driven piston continuously presses against ferrule
- Automatically retightens when ferrule shrinks
- Wing design for finger tightening
- No tools needed

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G3440-81013</td>
<td>Column Nut, Collared Self-Tightening MSD</td>
</tr>
<tr>
<td>G3440-81011</td>
<td>Column nut, Collared Self Tightening Inlet/Detect</td>
</tr>
<tr>
<td>G3440-81012</td>
<td>Collar for Self Tighthening Nut</td>
</tr>
</tbody>
</table>

Column Installation
Measuring the right distance

White out

Self Tightening column nut collar or septa

Septa
Cutting the Column

Gently scribe through the polyimide coating
• Do not attempt to cut the glass

Recommended tools
• Diamond or carbide-tipped pencil, or sapphire cleaving tool
• Ceramic wafer
• Ocular

Do not use
• Scissors, file, and so on
Examples of Column Cuts
Column Installation

How tight is tight?

Overtightened ferrule
New Agilent Universal Fit GC Detector Jets

- Easier column installation and jet replacement reducing the risk of column damage
- Lubricant free threads reducing the risk of contamination
- Made of strong material reducing the risk of deforming
- Universally fits in both capillary column and packed column (adaptable) FID detectors

<table>
<thead>
<tr>
<th>Previous Jets</th>
<th>New Universal Fit Jets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous Jet PN</td>
<td>Jet Orifice ID (inch/mm)</td>
</tr>
<tr>
<td>19244-80560</td>
<td>0.011 / 0.29</td>
</tr>
<tr>
<td>G1531-80560</td>
<td>0.011 / 0.29</td>
</tr>
<tr>
<td>18710-20119</td>
<td>0.018 / 0.47</td>
</tr>
<tr>
<td>19244-80620</td>
<td>0.018 / 0.47</td>
</tr>
<tr>
<td>G1531-80620</td>
<td>0.018 / 0.47</td>
</tr>
<tr>
<td>18789-80070</td>
<td>0.030 / 0.76</td>
</tr>
<tr>
<td>G1534-80580</td>
<td>0.011 / 0.29</td>
</tr>
<tr>
<td>G1534-80590</td>
<td>0.011 / 0.29</td>
</tr>
</tbody>
</table>
Column Installation
Leak check

Do not use snoop

- Electronic leak detector
- IPA/water
- Inject a nonretained peak

Gas leak detector
p/n G3388B
If My System is Leak-free, What Should My Air Ion Abundances be?

• These are just estimates!
  • $H_2O$: $\sim$2,000 counts (less is ok)
  • $N_2$: $\sim$10,000 counts (less is ok)*
  • $O_2$: $\sim$3,000 counts (less is ok)
  *Make sure to purge your Gas Clean filter

High vacuum gauge pressure (for SQ):
$\sim$1 x$10^{-5}$ Torr†
† dependent on flow rate
Example Tune Report with Leak

### Target m/z | Actual m/z | Abund | Rel Abund | Iso m/z | Iso Abund | Iso Ratio
---|---|---|---|---|---|---
69.00 | 69.00 | 498,432 | 100.0% | 70.00 | 6,216 | 1.2% 
219.00 | 219.00 | 391,232 | 78.5% | 220.00 | 18,216 | 4.7% 
502.00 | 502.00 | 23,680 | 4.8% | 503.00 | 2,467 | 10.4% 

Air/Water Check: H2O ~1.8%  N2 ~42.1%  O2 ~11.4%  CO2 ~1.3%  N2/H2O ~2325.0%

Column(1) Flow: 1.00  Column(2): 1.20 ml/min  Interface Temp: 250
Use Leak Detector and/or Electronics Duster to Find Your Leaks

Why use a leak detector?

• High sensitivity
• Recommended for leak detection in gas plumbing and fittings

![Agilent G3388B leak detector](link)

Typical Electronic Duster Components and Ions

<table>
<thead>
<tr>
<th>Component</th>
<th>m/z</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,1-difluoroethane</td>
<td>51.65</td>
</tr>
<tr>
<td>1,1,1-trifluoroethane</td>
<td>69</td>
</tr>
<tr>
<td>1,1,1,2-tetrafluoroethane</td>
<td>69.83</td>
</tr>
</tbody>
</table>

Use electronics duster

• Hold can upright (don’t spray liquid!)
• Spray short bursts around possible leak points
• “Live” tune profiling for ions to pinpoint leak
# Leak and Installation Check

Inject a nonretained compound

<table>
<thead>
<tr>
<th>Detector</th>
<th>Compound</th>
</tr>
</thead>
<tbody>
<tr>
<td>FID</td>
<td>Methane or butane</td>
</tr>
<tr>
<td>ECD</td>
<td>MeCl₂ (headspace or diluted)</td>
</tr>
<tr>
<td>NPD</td>
<td>CH₃CN-acetonitrile (headspace or diluted)</td>
</tr>
<tr>
<td>TCD</td>
<td>Air</td>
</tr>
<tr>
<td>MS</td>
<td>Air or butane</td>
</tr>
</tbody>
</table>

The peak should be sharp and symmetrical
Nonretained Peak Shapes

Check for:

- Too low of a split ratio
- Injector or septum leak
- Liner problem (broken, leaking, misplaced)
- Column position in injector and detector
Calculating Linear Velocity

Inject a nonretained compound and obtain the retention time:

\[ \bar{\mu} = \frac{L}{t_o} \]

- \( \bar{\mu} \) = Average linear velocity (cm/s)
- \( L \) = Column length (cm)
- \( t_o \) = Retention time (s)

\[ \mu = He \ 20–40 \ cm/s \]
\[ \mu = H_2 \ 35–55 \ cm/s \]

\( \mu \) is dependent on column temperature, but is independent of column dimensions.
Calculating Flow Rate

Inject a nonretained compound and obtain the retention time:

\[ \bar{F} = \frac{\pi r^2 L}{t_o} \]

\( \bar{F} \) is dependent on column temperature
Measuring flow with a flow meter is often inaccurate

\( \bar{F} \) = Flow rate (mL/min)
\( r \) = Column radius (cm)
\( L \) = Column length (cm)
\( t_o \) = Retention time (min)
Column Conditioning

System **must be leak free** before conditioning column

Heat the column to the **lower** of:

- Isothermal maximum temperature **or** 20 to 30 °C above highest operation temperature.

- Temperature programming is not necessary.

Stop conditioning when the stable baseline is obtained: 1 to 2 hours, usually
Generating a Bleed Profile

Temperature program the column without an injection*

*Agilent J&W DB-1 30 m x 0.32 mm id, 0.25 µm
Temperature program // 40 °C, hold 1 min // 20 °C/min to 320 °C, hold 10 min
Own Test Mixture

• More specific to your application
• Selective detectors
• Concentrations specific to your application
• Use same instrument conditions
• Easiest to simply inject a calibration standard
• Store for future measure of column performance
Agilent ULTRA Chemical Standards have:

- Best in class online search, compare, and ordering capabilities
- Rapid shipping: 99.9% of orders dispatched within 24 to 48 hours (continental US only as of now)
- Custom standard solutions including our new online custom quoting tool, enabling customers to upload recipe formulations to and to modify the recipe before submitting it
  - Tool will allow customers to see the quote pricing instantly and allow them to check quote pricing based on quantity range
  - Check it out at https://www.agilent.com/en/product/chemical-standards

- Rigorously tested and manufactured under ISO 9001, ISO 17025, and ISO 17034 certifications
- Sample preparation materials, columns, supplies, instrumentation, and reference materials from a single source
Proper Care of Your Column
Common Causes of Column Performance Degradation

- Physical damage to the polyimide coating
- Thermal damage
- Oxidation (O₂ damage)
- Chemical damage by samples
- Contamination
Physical Damage to the Polyimide Coating

- The smaller the tubing diameter, the more flexible it is
- Avoid scratches and abrasions
- Immediate breakage does not always occur upon physical damage
Thermal Damage

Degradation of the stationary phase is increased at higher temperatures

• Rapid degradation of the stationary phase (breakage along the polymer backbone) caused by excessively high temperatures

  Isothermal limit = indefinite time
  Programmed limit = 5–10 minutes

• Temporary "column failure" below lower temperature limit

• If this happens:
  - Disconnect column from detector
  - “Bake out” overnight at isothermal limit
  - Remove 10–15 cm from column end
Oxidation (O₂ Damage)

Oxygen in the carrier gas rapidly degrades the stationary phase. The damage is accelerated at higher temperatures. Damage along the polymer backbone is irreversible. (Premature filament failure/excessive source maintenance.)

Dimethylpolysiloxane

<chemical formula>CH₃SiO(CH₃)₂SiO(CH₃)₂SiO(CH₃)₂O₂</chemical formula>

Decreased retention
Reduced response
Higher bleed

<graph>

~ 5% O₂

</graph>
How to Prevent Column Damage by Oxygen

• High-quality carrier gas (four 9s or greater)

• Leak free injector and carrier lines
  – Change septa
  – Maintain gas regulator fittings

• Appropriate impurity traps

Efficient, fast, easy
Bonded and crosslinked columns have excellent chemical resistance except for inorganic acids and bases.

\[
\text{HCl, NH}_3, \text{KOH, NaOH, H}_2\text{SO}_4, \text{H}_3\text{PO}_4, \text{HF}
\]

Chemical damage will be evident by excessive bleed, lack of inertness or loss of resolution/retention.
Chemical Damage
What to do if it happens

• Remove 0.5 to 1 m from the front of the columns
• Severe cases may require removal of up to 5 m
What is Normal Column Bleed?

Normal background signal generated by the elution of normal degradation products of the column stationary phase. Column bleed is influenced by:

- Phase type
- Temperature
- Column dimensions

![Graph showing Agilent J&W DB-624 30 m x 0.53 mm id, 3.0 µm with 24 pA/260 °C and Agilent J&W DB-1 30 m x 0.32 mm id, 0.25 µm with 12 pA/320 °C over time]
Mass Spectrum of Phenylmethylpolysiloxane Column Bleed
Normal background (HP-5ms UI)
What is a Bleed Problem?

An abnormal elevated baseline at high temperature

It is **not**

- A high baseline at low temperature
- Wandering or drifting baseline at any temperature
- Discrete peaks
Column Contamination and Symptoms

- Fouling of GC and column by contaminants
- Mimics nearly every chromatographic problem

- Poor peak shape
- Loss of separation (resolution)
- Changes in retention
- Reduced peak size
- Baseline disturbances (semivolatiles only)
Typical Samples That Contain a Large Amount of Residues

- Biological (blood, urine, tissue, plants)
- Soils
- Foods
- Wastewater
- Sludges

*All samples contain residues (even standards)*
Other Sources of Contamination

- Septum and ferrule particles
- Gas and trap impurities
- Unknown sources (vials, syringes, and so on)

Sample vial septum bleed profile:
Types of Residues

Nonvolatile residues

- Any portion of the sample that does not elute from the column or remains in the injector.

Semivolatile residues

- Any portion of the sample that elutes from the column after the current chromatographic run.
Methods to Minimize Nonvolatile Residue Problems

- Sample cleanup
- Packed injection port liners
- Guard columns
Offline Options for Sample Matrix Removal

- Bond Elut solid phase extraction cartridges and plates
- Captiva EMR-Lipid filtration cartridges and plates
- QuEChERS
- Chem Elut S
- Filter vials
- Captiva syringe filters
- SPME

May 21, 2020
Filtration – Captiva Filter Vials

Part Number Description
5191-5933 PTFE filter vial, 0.45 µm, 100/pk
5191-5934 PTFE filter vial, 0.20 µm, 100/pk
5191-5935 Nylon filter vial, 0.45 µm, 100/pk
5191-5936 Nylon filter vial, 0.20 µm, 100/pk
5191-5939 RC filter vial, 0.45 µm, 100/pk
5191-5940 RC filter vial, 0.20 µm, 100/pk
5191-5941 PES filter vial, 0.45 µm, 100/pk
5191-5942 PES filter vial, 0.20 µm, 100/pk
5191-5943 Vial closure tool

See appendix for solvent compatibility poster request

Agilent.com/chem/filtervials
Filter vials user guide: 5994-0814EN
Captiva EMR–Lipid Cleanup Improves Analytes S/N Ratio and Integration Accuracy on GC/MS(/MS) of Pesticides in Olive Oil

<table>
<thead>
<tr>
<th>Pesticide</th>
<th>Captan</th>
<th>Permethrin</th>
<th>Deltamethrin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EMR-Lipid cleanup</strong></td>
<td><img src="image1" alt="Graph" /></td>
<td><img src="image2" alt="Graph" /></td>
<td><img src="image3" alt="Graph" /></td>
</tr>
<tr>
<td><strong>Zirconia sorbent cleanup</strong></td>
<td><img src="image4" alt="Graph" /></td>
<td><img src="image5" alt="Graph" /></td>
<td><img src="image6" alt="Graph" /></td>
</tr>
<tr>
<td><strong>C18/PSA cleanup</strong></td>
<td><img src="image7" alt="Graph" /></td>
<td><img src="image8" alt="Graph" /></td>
<td><img src="image9" alt="Graph" /></td>
</tr>
</tbody>
</table>
The main compound responsible for cork taint is 2,4,6-trichloroanisole. It is one of the most odor intense compounds known and has a distinct musty, moldy aroma.
The guard column is 3–5 m of deactivated fused silica tubing with the same diameter as the analytical column. It is connected with a zero dead volume union.
Nonvolatile Contamination
What to do if it happens

• Do not “bake out” the column
• Front end maintenance
  – Clean or change the injector liner
  – Clean the injector
  – Cut off 0.5–1 m of the front of the column
• Turn the column around
• Cut the column in half
Semivolatile Contamination
What to do if it happens

• “Bake out” the column
  – Limit to 1-2 hours
  – Longer times may polymerize some contamination and reduce column life

• Solvent rinse the column
Instrumentation: Leveraging Intelligence Innovations
Introducing the Agilent 8890 GC System
Flexible and expandable to meet your needs today and tomorrow

Future-proof: Ready for anything
- Powerful next generation electronic architecture
- Expanded smart-connected functionality
- Full suite of inlets, detectors, and accessories, CFT, Deans switch, backflush, GC x GC, dual simultaneous injection
- Six valves, eight heated zones, plus LVO
- Generation 6 precision EPC
- Smart keys
- 7-inch color touch display
Agilent 8890 GC System
Smart-connected GC

Modern intuitive interface

• 7-inch color touch screen
  - Configuration
  - Status
  - Methods
  - Sequence info
  - Troubleshooting, diagnostics, and help

• Real-time chromatographic evaluation
  - Blank evaluation
  - Detector evaluation
Some Examples of Guided Troubleshooting/Step-by-Step Guides on the Agilent 8890 GC System
GC Columns with Smart Key (for the Agilent 8890 GC only)

For immediate identification and use monitoring of your GC column

- Available with the Agilent 8890 GC model only
- Can track use of a GC column
- Smart key contains GC column information, including:
  - Part and serial numbers
  - Number of injections/runs
  - Time at/above temperature limits
  - Date installed
  - Temperature limits – GC columns
    - If more than one column is installed, temperature is determined by lowest column smart key installed (DB-WAX vs DB-5)
    - Column length/trimming done edited in “column maintenance mode” in software and rewritten to smart key
    - S/N of last instrument installed in if it was in an Agilent 8890 GC
## Other Resources

<table>
<thead>
<tr>
<th>Resources</th>
<th>Weblinks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2  Smart key product page (not for ordering smart keys)</td>
<td>URL: <a href="www.agilent.com/chem/smartkey8890">www.agilent.com/chem/smartkey8890</a></td>
</tr>
</tbody>
</table>
Common Frustrations with GC

• Measuring column length correctly
• Cutting your column correctly
• How tight is too tight?
• Clipping columns to deal with active sites, then updating retention times
Common Care and Maintenance Scheme for GC Columns

1. Cut off 6 inches to 1 foot of the inlet end of the column

2. Bake out the column for no more than 2 hours

3. Cut off more column (repeat as necessary)

Intuvo…

Change the Guard Chip
Innovating the GC Flow Path

Conventional flow path

- Inlet
- Gold seal
- Nuts and ferrules
- Classic capillary column
- To detector

Intuvo flow path

- Inlet
- Guard Chip
- Flow Chip
- Click-and-run direct connections
- To detector
- Intuvo planar column
Easier and Faster Maintenance with Intuvo

- No more ferrules
- Direct face seal connections
- Audible and tactile click lets you know connection is made
- Less unplanned downtime
- Fewer batch reruns, fewer samples lost
No More…

Measuring

Over-tightening

Trimming
A New Portfolio of GC Consumables

- UI inlet liners
- Guard Chip
- Intuvo Flow Chips
- No-trim column
- Smart keys
- Tools and accessories

May 21, 2020 A Beginner's Guide to your GC Columns: Installation, Care, and Maintenance
Tips to Assure a Good Column Installation

Finger tighten until only one thread on each of the two nuts is showing.

If more than one thread is showing, wiggle or reposition the column into place to further finger tighten the nuts to one thread.
Tips to Assure a Good Column Installation

Check that the small integrated column nuts on the column are in form fitted place on the heater, in the instrument.

Click and run.
Smart key Technology

- Smart chip tells your Intuvo what you have
- Sets temperature limits for you
- Keep track of performance with read/writeable smart key
Agilent Intuvo 9000 Videos

The Agilent Intuvo 9000 GC System – Environmental Science Corporation (ESC)
Discover higher GC productivity with the Agilent Intuvo 9000 GC system
Playing time: 4:00

The Agilent Intuvo 9000 GC System Story
Learn more about the Agilent Intuvo 9000 GC System
Playing time: 2:21

The Agilent Intuvo 9000 GC System: Return on Investment. Return on Innovation
A testimonial about the return on investment on the Agilent Intuvo 9000 GC System
Playing time: 4:17
Always Remember

• Start with a good installation
• Maintain an oxygen-free system
• Avoid physical, thermal, and chemical damage
• Take steps to prevent contamination
Contact Agilent Chemistries and Supplies Technical Support

1-800-227-9770 Option 3, Option 3:

Option 1 for GC and GC/MS columns and supplies
Option 2 for LC and LC/MS columns and supplies
Option 3 for sample preparation, filtration, and QuEChERS
Option 4 for spectroscopy supplies
Option 5 for chemical standards

Available in the USA and Canada 8–5, all time zones

gc-column-support@agilent.com
lc-column-support@agilent.com
spp-support@agilent.com
spectro-supplies-support@agilent.com
chem-standards-support@agilent.com