Zebron™
GC Columns

GC COLUMN
INSTALLATION GUIDE

phenomenex®
. . . breaking with tradition℠

www.phenomenex.com/GC

TROUBLESHOOTING TOOLS

- Flow meter
- New syringe
- Methane or other non-retained compound
- New septa, ferrules and injector liners
- Leak detector
- Column performance test sample
- Reference column
- Instrument manuals

PRE-INSTALLATION CHECKLIST

- Replace oxygen, moisture and hydrocarbon traps as necessary.
- Check gas cylinder pressures to ensure that an adequate supply of carrier, make-up and fuel gases are available. Carrier gases should be of the highest purity. **Note**: It is critical that oxygen and water be removed from the carrier gas by the appropriate use of filters and adsorbents.
- Ensure that the injection port is clean and free of sample residues, septum, or capillary debris.
- Check and replace as necessary critical injector components such as seals, liners, and septa.
- Check and replace detector seals as necessary.
- Carefully inspect your column for damage or breakage.

CRITICAL COLUMN INSTALLATION STEPS

INJECTOR INSTALLATION

Note: GC columns do not have a specific directional flow when received from the manufacturer. Upon initial use of your new Zebron™ column, Phenomenex recommends the practice of dedicating one specific end of the column for injector installation only. This is particularly important when dealing with active/caustic or contaminating compounds. If these compounds are routinely injected onto the column, degradation of the phase will occur—leading to higher bleed. A typical first step to remedying (removing) this bleed would be to trim 10 cm from the front (injector) end of the column and keep trimming this inlet end of the column as necessary. Trying to remedy any bleed issues by trimming the column may not work if both ends have been interchangeably installed into the inlet.

1. Place a capillary nut and ferrule on the injector end of the GC column, allowing a section of column to protrude. Trim one to two centimeters from the protruding end to remove ferrule contamination that may have entered the column. Inspect the cut with a magnifier to ensure that a smooth, clean, square-cut edge has been made - recut if necessary. *See figure on p. 3.*
2. Carefully hang the column in the GC oven, being cautious not to scratch or damage the polyimide coating on the capillary tubing. Rotate the column to avoid sharp bends of the capillary column and any contact of the column with oven surfaces.
3. Insert the column into the injector exactly the correct distance specified in the instrument manual. Tighten the ferrule nut finger-tight then ½ turn with a wrench. If the column can still be moved, tighten another ¼ turn until the column is secure.
4. Adjust the carrier gas to obtain the flow rate listed on the test chromatogram.

CRITICAL COLUMN INSTALLATION STEPS (cont'd)

DETECTOR INSTALLATION

Note: For users with sensitive detectors such as MS and ECD, column conditioning steps should be performed before installing the column to prevent contamination and frequent maintenance of the detector.

1. Place the column nut and ferrule past the end of the column and cut a centimeter or two off the end of the column. Be sure that the ferrule is the right size and pointing in the correct direction. Inspect the cut with a magnifier and ensure that the cut is square and smooth. *See figure below.* Recut if needed.

2. Insert the outlet end of the column into the detector exactly the distance prescribed in the instrument manual. Distances will vary between detectors. Tighten the ferrule nut finger-tight then ½ turn with a wrench. If the column can still be moved, tighten another ¼ turn until the column is secure.

3. Inspect the column connections for leaks using an electronic leak detector. Leaks at the inlet end may introduce oxygen to the column that will result in increased column bleed and damage to the column phase.

Proper & Improperly Cut Capillary

Correct Incorrect

COLUMN CONDITIONING

1. Allow sufficient time for the carrier gas to flow through the column to purge any oxygen that may be in the system.

2. Raise the temperature of the column to the maximum isothermal operating temperature that is listed on the individual *Zebron™ GC Column Test Report*. Maintain this temperature until a constant baseline is achieved. Conditioning times will depend on the phase identity and thickness, with thicker films taking longer to stabilize. In order to minimize the downtime of the instrument, columns can be conditioned overnight at the maximum isothermal temperature.

INSTALLATION TESTING

1. Inject a detectable unretained sample, such as methane for an FID, to determine dead volume time and linear gas velocity at the desired column temperature. Adjust gas pressure for optimal flow depending on carrier gas selection.
2. The non-retained peak must have ideal peak shape or installation is faulty and needs to be redone.

CHECKING FOR LEAKS

Use a thermoconductivity detector to check for leaks. It is highly sensitive to H_2, He, and N_2 and will not contaminate the instrument or column. Liquid leak indicators are not recommended for capillary columns. There is the risk of drawing the liquid into the column or fittings and contaminating the system.

Note: If Vespel® ferrules are being used, leakage can occur after the initial heating phase due to ferrule deformation. Be sure that the fitting is re-tightened after this initial heating phase, then carefully check all corrections for leaks.

UNRETAINED VOLUME PEAK SHAPE TESTING

If the peak is broad and/or tailing, check the following:

- Improper column positioning/insertion into inlet or detector
- Gross contamination of the splitter sleeve
- Chipped or cracked splitter sleeve
- Improper sweeping of sample at column end by makeup gas
- Damaged or crushed column end

Tailing peak indicates improper installation	Symmetrical peak indicates proper installation
	

NON-RETAINED PEAK TIMES AND MARKERS

Methane with FID/TCD:
Calculate linear velocity by injecting 25-100 µL of 1% methane in N_2 gas blend. Measure the retention time of the methane peak and calculate the following:
Linear Velocity (u) = L/t_o

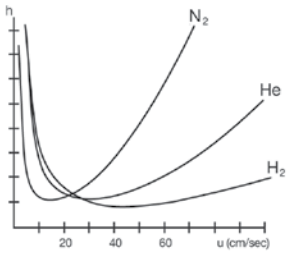
Detector Type	Marker Compound
ECD	Methylene chloride[2, 3], Dichlorodifluoromethane
FID	Methane, Butane[1]
NPD	Acetonitrile[2, 4]
PID ELCD	Vinyl chloride
TCD, MS	Methane, Butane[1], air

1. From a disposable lighter
2. Place 1-2 drops in an autosampler vial and tightly cap. Shake and inject 1-2 µL from the headspace of the vial. Do not inject any liquid.
3. Use a column temperature above 55 °C.
4. Use a column temperature above 95 °C.

RECOMMENDED NON-RETAINED RETENTION TIMES

Length (m)	H_2 (sec)	He (sec)	N_2 (sec)
15	38	75	150
30	75	150	300
60	150	300	600

h (u) Curves for Different Gases



COLUMN DIMENSION SELECTION GUIDE

	Length (L)	ID (r)	Phase Thickness (d_f)
RESOLUTION (R)	$R \sim \sqrt{L}$ To double resolution, quadruple the length	$R \sim \frac{1}{r}$ Resolution decreases with increased diameter	$R \sim \frac{1}{\sqrt{d_f}}$ Resolution decreases with increased thickness
SAMPLE CAPACITY (SC)	$SC \sim \sqrt{L}$ Longer columns have slightly better capacity	$SC \sim r^2$ Capacity is exponential as diameter increases	$SC \sim d_f$ Sample capacity increases with thicker films
RETENTION TIME (t_r)	$t_r \sim L$ Longer columns require longer analysis times	$t_r \sim r$ Smaller diameter columns allow faster analysis times	$t_r \sim d_f$ Thicker films require longer analysis times

COLUMN PHASE SELECTION GUIDE

	Polarity Scale	Zebron™ Phase	Highlight
Non-Polar	5	**ZB-1**	Non-polar phase suited for true boiling point separations
	5	**ZB-1ms**	Extremely low bleed column for non-polar compounds
	5	**ZB-1HT Inferno™**	High temperature stability (430 °C) for non-polar compounds
	5	**ZB-1XT SimDist**	Metal column with increased accuracy for simulated distillation analysis, high temperature stability (450 °C)
	8	**ZB-SemiVolatiles**	Specifically designed and tested for supreme inertness to active acids and amines; our column of choice for SVOCs, PBDEs, and environmental PAHs
	8	**ZB-5**	Versatile low polarity column for general lab use
	8	**ZB-5ms**	Arylene phase for enhanced resolution of PAHs and multi-ring aromatic compounds
	8	**ZB-5MSi**	Very inert for good peak shape of active compounds, such as acids and bases
	8	**ZB-5MS*PLUS*™**	The next generation of inertness for food testing, specialty chemical, and toxicology analyses
	8	**ZB-5HT Inferno**	High temperature stability (430 °C) to separate high molecular weight compounds and eliminate carry overs
	9	**ZB-XLB**	Low polarity si-arylene column with bleed and sensitivity levels designed for MS detectors
	9	**ZB-XLB-HT Inferno**	High temperature analysis of mid-polar compounds
	13	**ZB-624**	Optimized for separating volatile organic compounds (VOCs)
	18	**ZB-35**	Intermediate polarity column for high molecular weight analysis
	18	**ZB-35HT Inferno**	High temperature analysis of mid-polar compounds
	19	**ZB-1701**	Optimized phase providing an alternate selectivity to phenyl phases with similar polarity
	19	**ZB-1701P**	Specially tested to ensure good response for DDT and endrin
	24	**ZB-50**	High polarity column capable of high - temperature bake-out to remove contaminants
Polar	52	**ZB-WAX*PLUS*™**	100 % aqueous stable with high retention of alcohols and other chlorinated solvents
	57	**ZB-WAX**	Bonded, solvent rinsable phase excellent for separating polar complex mixtures
	58	**ZB-FFAP**	Provides better peak shape for underivatized acids
Exclusive		**ZB-CLPesticides-1 & -2**	Run multiple chlorinated pesticide classes by GC/ECD on one column set
		ZB-MultiResidue™ -1 & -2	Novel phase designed for pesticides, herbicides, and insecticides for all detection methods
		ZB-Bioethanol	Fast analysis of bioethanol fuel
		ZB-Drug-1	Rapid and improved separations for drugs of abuse
		ZB-BAC-1 & -2	More accurate blood alcohol analysis, especially for post-mortem samples

* See individual phases for detailed specifications and limitations.

Composition	Polarity	Temperature Range* (Isothermal/TPGC)	MS Certified
100 % Dimethylpolysiloxane	Nonpolar	-60 to 360/370 °C	✓
100 % Dimethylpolysiloxane	Nonpolar	-60 to 360/370 °C	✓
100 % Dimethylpolysiloxane	Nonpolar	-60 to 400/430 °C	✓
100 % Dimethylpolysiloxane	Nonpolar	-60 to 450 °C	✓
5 % Phenyl-Arylene 95 % Dimethylpolysiloxane	Nonpolar	-60 to 325/350 °C	✓
5 % Phenyl 95 % Dimethylpolysiloxane	Nonpolar	-60 to 360/370 °C	✓
5 % Phenyl-Arylene 95 % Dimethylpolysiloxane	Nonpolar	-60 to 325/350 °C	✓
5 % Phenyl 95 % Dimethylpolysiloxane	Nonpolar	-60 to 360/370 °C	✓
5 % Phenyl-Arylene 95 % Dimethylpolysiloxane	Nonpolar	-60 to 325/350w °C	✓
5 % Phenyl-Arylene 95 % Dimethylpolysiloxane	Nonpolar	-60 to 325/350 °C	
Proprietary	Intermediate	30 to 340/360 °C	✓
Proprietary	Intermediate	30 to 400 °C	✓
6 % Cyanopropylphenyl 94 % Dimethylpolysiloxane	Intermediate	-20 to 260 °C	
35 % Phenyl 65 % Dimethylpolysiloxane	Intermediate	40 to 340/360 °C	✓
35 % Phenyl 65 % Dimethylpolysiloxane	Intermediate	40 to 400 °C	✓
14 % Cyanopropylphenyl 86 % Dimethylpolysiloxane	Polar	-20 to 280/300 °C	
14 % Cyanopropylphenyl 86 % Dimethylpolysiloxane	Polar	-20 to 280/300 °C	
50 % Phenyl 50 % Dimethylpolysiloxane	Polar	40 to 320/340 °C	✓
Polyethylene Glycol	Polar	20 to 250/260 °C	
Polyethylene Glycol	Polar	40 to 250/260 °C	✓
Nitroterephthalic Acid Modified Polyethylene Glycol	Polar	40 to 250/260 °C	
Proprietary	Intermediate	40 to 320/340 °C	
Proprietary	Intermediate	-60 to 320/340 °C	✓
Proprietary		-60 to 340/360 °C	✓
Proprietary		40 to 320/340 °C	✓
Proprietary		-20 to 260/280 °C	✓

* See individual phases for detailed specifications and limitations.

Australia
t: +61 (0)2-9428-6444
f: +61 (0)2-9428-6445
auinfo@phenomenex.com

Austria
t: +43 (0)1-319-1301
f: +43 (0)1-319-1300
anfrage@phenomenex.com

Belgium
t: +32 (0)2 503 4015 (French)
f: +32 (0)2 511 8666 (Dutch)
f: +31 (0)30-2383749
beinfo@phenomenex.com

Canada
t: +1 (800) 543-3681
f: +1 (310) 328-7768
info@phenomenex.com

China
t: +86 (0)20 2282-6668
f: +86 (0)20 2809-8130
chinainfo@phenomenex.com

Denmark
t: +45 4824 8048
f: +45 4810 6265
nordicinfo@phenomenex.com

Finland
t: +358 (0)9 4789 0063
f: +45 4810 6265
nordicinfo@phenomenex.com

France
t: +33 (0)1 30 09 21 10
f: +33 (0)1 30 09 21 11
franceinfo@phenomenex.com

Germany
t: +49 (0)6021-58830-0
f: +49 (0)6021-58830-11
anfrage@phenomenex.com

India
t: +91 (0)40-3012 2400
f: +91 (0)40-3012 2411
indiainfo@phenomenex.com

Ireland
t: +353 (0)1 247 5405
f: +44 1625-501796
eireinfo@phenomenex.com

Italy
t: +39 051 6327511
f: +39 051 6327555
italiainfo@phenomenex.com

Luxembourg
t: +31 (0)30-2418700
f: +31 (0)30-2383749
nlinfo@phenomenex.com

Mexico
t: 01-800-844-5226
f: 001-310-328-7768
tecnicomx@phenomenex.com

The Netherlands
t: +31 (0)30-2418700
f: +31 (0)30-2383749
nlinfo@phenomenex.com

New Zealand
t: +64 (0)9-4780951
f: +64 (0)9-4780952
nzinfo@phenomenex.com

Norway
t: +47 810 02 005
f: +45 4810 6265
nordicinfo@phenomenex.com

Puerto Rico
t: +1 (800) 541-HPLC
f: +1 (310) 328-7768
info@phenomenex.com

Spain
t: +34 91-413-8613
f: +34 91-413-2290
espinfo@phenomenex.com

Sweden
t: +46 (0)8 611 6950
f: +45 4810 6265
nordicinfo@phenomenex.com

United Kingdom
t: +44 (0)1625-501367
f: +44 (0)1625-501796
ukinfo@phenomenex.com

USA
t: +1 (310) 212-0555
f: +1 (310) 328-7768
info@phenomenex.com

All other countries
Corporate Office USA
t: +1 (310) 212-0555
f: +1 (310) 328-7768
info@phenomenex.com

phenomenex®
. . . breaking with tradition℠

www.phenomenex.com

Phenomenex products are available worldwide. For the distributor in your country, contact Phenomenex USA, International Department at international@phenomenex.com

GU1923041 6_W