Selecting the Right Inlet Liner for Efficient Sample Transfer

GC inlets convert an injected liquid phase sample into gas for transfer onto the GC column. Selecting the wrong liner can lead to incomplete transfer, poor separation, and peak tailing—often incorrectly attributed to the GC system. As a result, you could waste valuable hours on troubleshooting.

Agilent CrossLab
From Insight to Outcome

Sample Matrix

High concentration analytes

Typical split injection

- Low pressure: Split taper, wool, low pressure (LP), Ultra Inert (UI), 870 µL, 4 mm — **5190-2295**
- Glass-fritted liner: Single taper, universal UI frit, 870 µL, 4 mm — **5190-5105**

Auto inject (liquid sample)

General use	Viscous sample	Dirty matrix
Glass-fritted liner: Single taper, universal UI frit, 870 µL, 4 mm — **5190-5105**	Low pressure: Split taper, wool, LP, UI, 870 µL, 4 mm — **5190-2295**	Single taper low pressure: Split taper, wool, LP, UI, 870 µL, 4 mm — **5190-2295**
Low pressure: Split taper, wool, LP, UI, 870 µL, 4 mm — **5190-2295**	Split taper, wool, LP, deactivated, 870 µL, 4 mm — **5183-4647**	Split taper, wool, LP, deactivated 870 µL, 4 mm — **5183-4647**
Straight, wool: Split, UI, 990 µL, 4 mm — **5190-2294**		Split, single taper wool, deactivated 870 µL, 4 mm — **5183-4711**

Specialized applications

Manual slow inject

Dirty matrix	Clean matrix
Low pressure: Split taper, wool, LP, UI, 870 µL, 4 mm — **5190-2295**	Straight cup: Split, 800 µL, 4 mm — **18740-80190**

HS/P&T

- Straight, UI: 250 µL, 2 mm — **5190-6168**
- Straight, deactivated: quartz, 250 µL, 2 mm — **5181-8818**

Trace analytes

Typical splitless injection

- Single taper: Ultra Inert (UI) with wool, 900 µl, 4 mm — **5190-2293**
- Glass-fritted liner: Single taper, splitless UI frit, 4 mm — **5190-5112**

PTV

Deactivated: Single baffle, glass wool, 180 µL, 2 mm — **5183-2038**	Double taper, UI, 800 µL, 4 mm — **5190-3983**	Single taper, UI, 900 µL, 4 mm — **5190-2292**
Single baffle, 180 µL, 2 mm — **5183-2036**	Double taper, deactivated 800 µL, 4 mm — **5181-3315**	Single taper, deactivated 900 µL, 4 mm — **5181-3316**
Multibaffle, 150 µL, 1.8 mm — **5183-2037**		
Sintered glass, 112 µL, 1.5 mm — **5190-1426**		

Hot splitless clean matrices

Backflash issues

No backflash issues

Splitless injection: high recovery

Dirty matrix	Clean matrix
Direct connect, single taper, wool, bottom hole, UI, 675 µL, 4 mm ID — **5190-7020**	Direct connect, dual taper, UI with hole, 575 µL, 4 mm ID — **5190-7011**

Cold splitless, multimode inlet

Active analyte

- Dimpled: UI, 200 µL, 2 mm — **5190-2297**
- Single taper, deactivated, 200 µL, 2 mm — **5190-2296**

HS/P&T

- Straight: UI, 250 µL, 2 mm — **5190-6168**
- Deactivated quartz, 250 µL, 2 mm — **5181-8818**

SPME

Fast transfer

- Splitless, straight 35 µL, 0.75 mm — **5190-4048**

What to consider when choosing a GC inlet liner

Sample concentration

- Use a split injection when compounds of interest are present in high concentration or when you don't need low limits of detection. In a split injection, only the desired amount of sample is transferred onto the GC column—avoiding column overload and prolonging column life.
- Choose a splitless injection when compounds of interest are present at low concentration levels. This technique involves closing the split vent at the start of the injection, directing all the flow passing through the inlet to the column. At the end of a set period (the purge time), the split vent is opened to flush out any remaining vaporized solvent.
- Direct injection is best when compounds of interest are at trace levels, and contact between the sample and inlet seal (or wool) could cause degradation or adsorption. With direct injection, the sample is injected into a hot inlet, vaporizing the entire sample into the GC column.
- Use a multimode injection (MMI) for small volumes of active analytes with lower boiling points. Samples are injected into a cold inlet that is programmed to increase in temperature. This temperature increase first vaporizes the solvent to vent, then vaporizes the compounds of interest, introducing them onto the column. Not suitable for samples with high boiling points that vaporize partially.

GC solvent vapor volume

The volume of sample introduced into a heated liner increases greatly during vaporization. How much it expands is determined by the solvent, the inlet temperature, and the pressure inside the liner. See table.

Your liner volume needs to be large enough to accommodate the gaseous sample. If the diameter is too small, the sample will expand beyond the liner's capacity—causing sample loss through the septum purge flow and split line. When the sample doesn't transfer to the column, it can lead to peak tailing, poor peak area reproducibility, and carryover.

Analyte activity

Peak tailing or splitting is caused by secondary interactions between the analyte and the wall, frit, or glass wool found in some liners. For active analytes, an inert liner surface can help you avoid such interactions.

To optimize your GC method parameters, use our vapor volume calculator and solvent vent calculator. Find them both at **www.agilent.com/chem/gc-calculators**

Ready to purchase inlet liners? Visit **www.agilent.com/chem/inlet-liners**

Vapor volumes for a 1 µL injection of common GC solvents at different inlet pressures and temperatures

Solvent	Inlet Pressure (KPa)	Inlet Temperature (°C)				
		100	150	200	250	300
Water (bp = 100 °C)	66	-	1.17	1.30	1.44	1.58
	83	-	1.06	1.18	1.31	1.43
	105	-	0.95	1.06	1.17	1.28
Methanol (bp = 65 °C)	66	-	0.52	0.58	0.64	0.70
	83	-	0.47	0.53	0.58	0.64
	105	-	0.42	0.47	0.52	0.57
Acetonitrile (bp = 82 °C)	66	-	0.40	0.45	0.50	0.55
	83	-	0.37	0.41	0.45	0.50
	105	-	0.33	0.37	0.40	0.44
DCM (bp = 40 °C)	66	0.29	0.33	0.37	0.41	0.44
	83	0.26	0.30	0.33	0.37	0.40
	105	0.23	0.27	0.30	0.33	0.36
Ethyl Acetate (bp = 77 °C)	66	-	0.21	0.24	0.27	0.29
	83	-	0.20	0.22	0.24	0.26
	105	-	0.17	0.19	0.22	0.24
Toluene (bp = 111 °C)	66	-	0.20	0.22	0.24	0.27
	83	-	0.18	0.20	0.22	0.24
	105	-	0.16	0.18	0.20	0.22
Pentane (bp = 36 °C)	66	0.16	0.18	0.20	0.23	0.25
	83	0.15	0.17	0.19	0.21	0.22
	105	0.13	0.15	0.17	0.18	0.20
Hexane (bp = 69 °C)	66	-	0.16	0.18	0.20	0.22
	83	-	0.15	0.16	0.18	0.20
	105	-	0.13	0.15	0.16	0.18

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