

Troubleshooting Gas Chromatograph Baseline Problems

A16089

This document is concerned with diagnosis: the process of going from unexpected behavior of the GC to the probable location of the difficulty (causes).

Baseline problems arise from many causes. Some of these are:

- Electronic or mechanical failure
- Contamination in critical areas, such as detectors
- Incorrect or inappropriate setpoints
- Leaks, column or septum bleed, or other chromatographic difficulties

These problems may interact to a certain degree and or arise from any of the above areas.

Baseline Symptoms:

Position

1. Baseline not at left (lower) part of chart:

- Check the zero of your recording device: An attenuation or range change during the run may be responsible.
- Check the TCD polarity.

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2. Baseline position changes suddenly during the run:
 - This usually results from a range or attenuation change.
 - It can also result from valve operations: If valves are being switched during the run.
 - Septum leak

Wander and Drift

Baseline wander and drift may occur when a flow or temperature setting is changed. If the system is not stabilized at the new conditions before starting a run, some baseline changes are to be expected.

(The following assumes that sufficient time has elapsed for stabilization.)

1. Baseline moves steadily upscale or downscale (drift) during the run.
 - This is most frequently seen during temperature programming: Operation with a single column (no column compensation) at moderate to low attenuation causes this. If dual columns are used, check that the signal mode is correct for column compensation.
 - It is also possible that the compensation is insufficient or too great. Thorough column conditioning minimizes (this cause of drift).
2. Baseline erratic, moves up and down (wander):
 - Suspect a leak in the system: Check septum condition and replace if necessary. Check column connections.
 - If there is a leak at the detector end of the system then retention times should be stable and only sensitivity is reduced. A leak at the inlet end of the column will result in decreased sensitivity and delayed retention times.

Noise

Noise is rapid vertical baseline fluctuations, broadening the baseline and giving it a hairy appearance. Noise is different from spiking; spikes are isolated events, rather than almost continuous.

Some noise is inevitable with any detector. At high attenuation it is invisible but appears as attenuation is decreased.

1. Noise appears suddenly on a previously clean baseline:

- Consider all changes made recently to the system: Reduced attenuation for example.

- New septa may contribute noise from bleed of low molecular weight material. If noise decrease when inlet temperature is lowered, this is the likely cause.

- Contaminated carrier gas: Check to see if a new tank was replaced recently, replace with a different lot number. If the new gas was badly contaminated it may have contaminated the traps and changing the tank may not show any improvement until the traps are regenerated.

- Contaminated detector gases (hydrogen or air)

- Air currents from a fan or air conditioner blowing across the top of the instrument may interfere with gas exiting from the detector.

- A contaminated detector results in noise.

2. Noise increases gradually to an unacceptable level:

- This indicates a gradual build up of the noise source, rather than an abrupt change as discussed above. Flame ionization detectors are susceptible to build up of deposits in the collector. In extreme cases spiking occurs along with increased noise level.

- Silicon dioxide deposits are formed when bleed from a silicone column is burned in the flame. This material is removed mechanically. Preventative measures include use of low column loadings, stationary phases with high temperature limit, thorough column conditioning before use, and the lowest possible oven temperatures for the analysis.

- Carbon deposits may form from solvents that burn poorly (chlorinated and aromatics). If possible, avoid such solvents. If they are necessary, periodic cleaning of the collector is required.

-Gradual noise increase may occur from saturated carrier gas drier or chemical traps. When these approach their capacities, contaminants begin to pass through and create noise. Trap and drier regeneration or replacement eliminates this source of noise.

Spiking

Spikes are isolated baseline disturbances, usually as sudden and large upscale movements. If accompanied by noise, the noise problem should be solved first, since spiking may disappear at the same time.

1. Spikes appear whenever the chart is running:
 - The cause is almost always electronic in origin: Loose connections are likely. Check signal cable connections at the detector and controller ends.
 - Loose or dirty contacts between printed circuit boards and their connectors may be responsible.
2. Spikes appear on chromatograms but not when the recorder is isolated, (no input signal)
 - This could be indicative of a detector problem: For example, an extremely dirty FID collector.
 - If a metal or glass packed column is being used column material could have been blown into the detector: FID and NPD are more susceptible due to the narrow bore of the jet.

Systematically troubleshooting the GC is key to understanding and diagnosing the cause of baseline problems. Isolating the problem can usually be accomplished by simply identifying “what was changed last.” If problems still occur after stepping through the suggestions in this document please call for Agilent Technical Assistance.