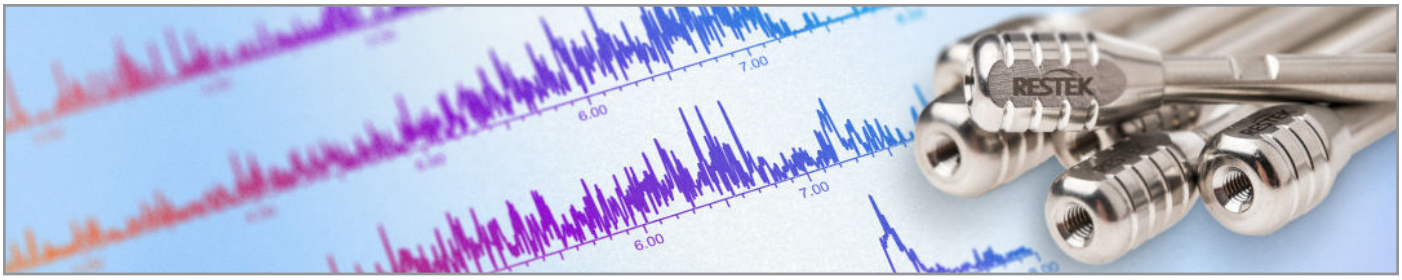


Effective LC Troubleshooting: Symptom-Based Strategies and Solutions

- Tips for reestablishing a smooth baseline.
- Guidance on diagnosing and solving common peak problems.
- Best practices for managing system back pressure.

Every instrument and every method will at some point experience a deterioration in performance that requires troubleshooting. When this occurs, the first—and most essential—part of LC troubleshooting is knowing what "normal" looks like. By carefully documenting instrument qualification tests, maintenance events, and system suitability results, you create an invaluable source of comparison that establishes normal ranges and can reveal where problems may lie. For example, rerunning a flow rate accuracy test and comparing it to previous values can help establish whether a flow rate issue is the root cause behind retention time shifts. In this article, we explore common problems with baseline variation, chromatographic peaks, and system pressure and offer practical tactics for resolving them. Use these general guidelines in combination with equipment manuals and your laboratory's standard operating procedures to get your instrument back into service quickly and effectively.

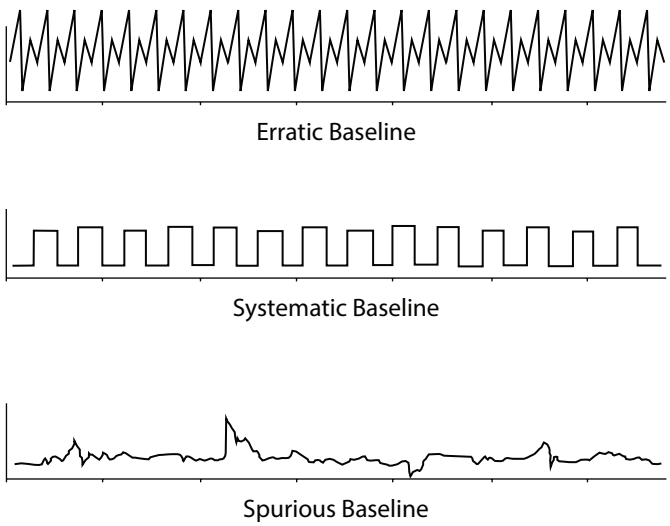
Related Products

- *Syringe Filters with Luer Lock Inlet*
- *Thomson SINGLE StEP Standard Filter Vials*
- *Backpressure Regulators*
- *Bluestem Glass Solvent Filter*
- *DEGASi PLUS Mobile Phase Degasser*
- *LC Stainless Steel Capillary Tubing*
- *PEEK Tubing*

Reestablishing a Smooth Baseline

Encountering an inconsistent baseline is not unusual in LC laboratories. Variation can be caused by a number of factors, and determining if there is a pattern can help you establish the cause (Figure 1). If you are seeing an erratic baseline, it is likely caused by a leak or an air bubble, so checking all fittings, confirming the degasser is working, and purging your system with fresh mobile phase should stabilize the baseline. If you are using a UV detector, a noisy baseline can also indicate that it is time to change the detector lamp or flow cell. However, if there is regularity to the changes in the baseline, it may be a pump or piston issue, and routine maintenance of those parts should resolve the problem. Finally, if the baseline is looking bad overall, a thorough system cleaning is recommended. Note that ambient temperature changes can also cause baseline fluctuations, so using a column oven or insulating the column and tubing may also restore performance.

Figure 1: Abnormal baselines that are commonly encountered in LC troubleshooting.



Troubleshooting Peak Issues

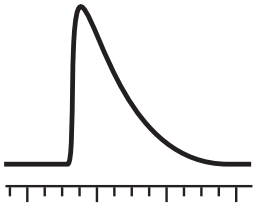
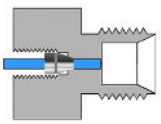
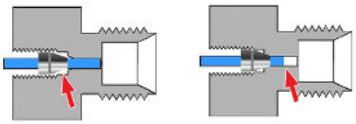
Troubleshooting peak problems is necessary during both routine analysis and method development, but the changes that are allowable under those two scenarios are different. Issues with poor peak shape, sensitivity, and retention that develop over time in an established method that is otherwise performing well indicate a change has occurred (e.g., system leak, mobile phase deterioration, guard contamination, etc.) and resolving it through maintenance should restore performance. However, some of the tips discussed below, such as adding buffer to mobile phases or changing the column temperature, should not be made during routine analysis because they may require additional validation before implementation.

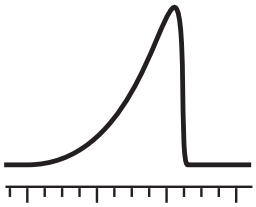
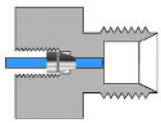
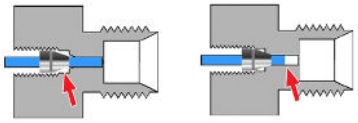
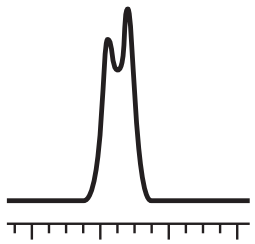
In contrast, peak issues seen during method development indicate further changes to method parameters may be needed, and more opportunities for improvement are available than when they are encountered with an established method. During method development, in addition to using the LC troubleshooting guidelines below, the sample preparation method, column stationary phase, and analytical conditions can be optimized for the matrices and compounds to be analyzed. When making changes to improve chromatographic peaks, it is important to first understand what factors can or cannot be changed based on your laboratory's standard operating procedures.

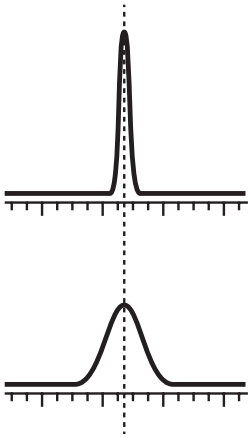
Improving Poor Peak Shape

Sharp, symmetrical peaks improve accuracy and sensitivity, but many factors can cause peaks to tail, front, split, or broaden. These types of peak distortions often lead to other problems, such as shifting retention times or coelution. If you observe distorted peak shapes either during routine analysis or method development, the LC troubleshooting tips in Table I will help you diagnose the problem based on the symptoms you observe in the chromatogram.

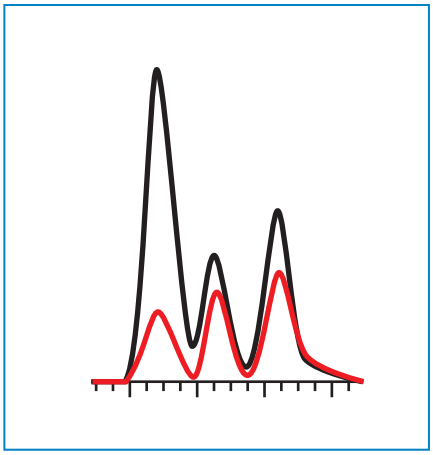
Table I: LC troubleshooting tips for improving peak shape.

<table>
<tr><th>Symptom</th><th>Cause</th><th>Solution</th></tr>
<tr><td>Peak tailing
  </td><td>Column overloading</td><td>Inject less mass (dilute the sample or decrease the injection volume). Note that injection volume is limited by column size; general guidelines for acceptable ranges are as follows:
<table>
<tr><th>Column ID</th><th>Volume (µL)</th></tr>
<tr><td>2.1 mm (30 -100 mm length)</td><td>1-3</td></tr>
<tr><td>3.0-3.2 mm (50-150 mm length)</td><td>2-12</td></tr>
<tr><td>4.6 mm (50-250 mm length)</td><td>8-40</td></tr>
</table></td></tr>
<tr><td></td><td>Worn or degraded column</td><td>While proper care can maximize LC column lifetime, columns are consumables that eventually will have to be replaced. Poor chromatographic performance can indicate it is time to replace the column. But, before replacing it, try regenerating it using the procedure outlined in Table II.</td></tr>
<tr><td></td><td>Contamination</td><td>• Prepare fresh solutions to rule out incorrectly prepared or degraded solutions.
• Flush your analytical column following the manufacturer's recommended cleaning procedure.
• Change guard columns regularly, making sure to match the phase of your analytical column.
• If using MS analyzers, make sure you use LC-MS grade solvents and additives.</td></tr>
<tr><td></td><td>Interactions with silanol on silica surface</td><td>Add buffer to your mobile phase (aqueous and organic portions should be buffered equally) to block active sites on the silica surface.
A buffer can be prepared by mixing a weak acid with the salt of its conjugate base. When using formic acid, use ammonium formate to buffer the solution and when using acetic acid, use ammonium acetate.</td></tr>
<tr><td></td><td>Interfering/coeluting matrix components</td><td>• Analyze a standard prepared in solvent for comparison.
• Filter sample extracts.
• Consider adding or modifying the sample preparation procedure to produce cleaner extracts.</td></tr>
<tr><td></td><td>Excessive system volume</td><td>Reduce system volume by using shorter tubing segments or smaller internal diameter tubing to minimize peak dispersion. When replacing the tubing, it is important to make proper connections by ensuring that the tubing and ferrule are both fully seated in the column port.</td></tr>
<tr><td></td><td>Poor connections</td><td>Ensure that the tubing and ferrule are both fully seated in the column port.
Correct
 
Tubing and ferrule seated correctly
Incorrect
 
Ferrule not seated, causing leak
Tubing not seated, causing dead volume</td></tr>
</table>

<table>
<tr><th>Symptom</th><th>Cause</th><th>Solution</th></tr>
<tr><td rowspan="5">Peak fronting
  </td><td>Solvent incompatibility (particularly likely if early eluting peaks are fronting)</td><td>Dilute the sample in the same solvent composition (or weaker) as the initial mobile phase composition. Try to match both the aqueous:organic ratio and the buffer strength.</td></tr>
<tr><td>Worn or degraded column</td><td>While proper care can maximize LC column lifetime, columns are consumables that eventually will have to be replaced. Poor chromatographic performance can indicate it is time to replace the column. But, before replacing it, try regenerating it using the procedure outlined in Table II.</td></tr>
<tr><td>Contamination</td><td>• Prepare fresh solutions to rule out incorrectly prepared or degraded solutions.
• Flush your analytical column following the manufacturer's recommended cleaning procedure.
• Change guard columns regularly, making sure to match the phase of your analytical column.
• If using MS analyzers, make sure you use LC-MS grade solvents and additives.</td></tr>
<tr><td>Column overloading</td><td>Inject less mass (dilute the sample or decrease the injection volume). Note that injection volume is limited by column size; general guidelines for acceptable ranges are as follows:<table><tr><th>Column ID</th><th>Volume (µL)</th></tr><tr><td>2.1 mm (30 -100 mm length)</td><td>1-3</td></tr><tr><td>3.0-3.2 mm (50-150 mm length)</td><td>2-12</td></tr><tr><td>4.6 mm (50-250 mm length)</td><td>8-40</td></tr></table></td></tr>
<tr><td>Interfering/coeluting matrix components</td><td>• Analyze a standard prepared in solvent for comparison.
• Filter sample extracts.
• Consider adding or modifying the sample preparation procedure to produce cleaner extracts.</td></tr>
<tr><td>Poor connections</td><td>Ensure that the tubing and ferrule are both fully seated in the column port.
Correct
 
Tubing and ferrule seated correctly
Incorrect
 
Ferrule not seated, causing leak
Tubing not seated, causing dead volume</td></tr>
<tr><td rowspan="3">Peak splitting
  </td><td>Solvent incompatibility</td><td>Dilute the sample in the same solvent composition (or weaker) as the initial mobile phase composition.</td></tr>
<tr><td>Solubility issue</td><td>Ensure that the sample is fully soluble in both the sample solvent and the mobile phase to prevent precipitation.</td></tr>
<tr><td>Contamination</td><td>• Prepare fresh solutions to rule out incorrectly prepared or degraded solutions.
• Flush your analytical column following the manufacturer's recommended cleaning procedure.
• Change guard columns regularly, making sure to match the phase of your analytical column.
• If using MS analyzers, make sure you use LC-MS grade solvents and additives.</td></tr>
</table>

<table>
<tr><th>Symptom</th><th>Cause</th><th>Solution</th></tr>
<tr><td>Broad Peaks
  </td><td>Column overloading</td><td>Inject less mass (dilute the sample or decrease the injection volume). Note that injection volume is limited by column size; general guidelines for acceptable ranges are as follows:<table><tr><th>Column ID</th><th>Volume (µL)</th></tr><tr><td>2.1 mm (30 -100 mm length)</td><td>1-3</td></tr><tr><td>3.0-3.2 mm (50-150 mm length)</td><td>2-12</td></tr><tr><td>4.6 mm (50-250 mm length)</td><td>8-40</td></tr></table></td></tr>
<tr><td></td><td>Change in mobile phase concentration</td><td>Make fresh mobile phase and keep capped to prevent evaporation or contamination.</td></tr>
<tr><td></td><td>Flow rate too low</td><td>Increase mobile phase flow rate.</td></tr>
<tr><td></td><td>Peak dispersion in the injector</td><td>Use a smaller sample loop.</td></tr>
<tr><td></td><td>Too much retention</td><td>• Use less retentive stationary phase.
• Try gradient elution.
• If running an isocratic method, increase mobile phase strength.
• Adjust buffer composition.</td></tr>
<tr><td></td><td>Detector cell volume too large or response time too long</td><td>Use smaller cell and/or decrease response time.</td></tr>
<tr><td></td><td>Extra column volume is too large</td><td>• Use shorter tubing with a smaller internal diameter.
• Use zero-dead-volume end fittings.</td></tr>
<tr><td></td><td>Low column temperature</td><td>Raise temperature.</td></tr>
<tr><td></td><td>End of guard or analytical column lifetime</td><td>Replace guard and/or column.</td></tr>
<tr><td></td><td>Insufficient column efficiency</td><td>Try a smaller particle column.</td></tr>
<tr><td></td><td>Coelution</td><td>• Loss of resolution can be cause by degraded mobile phase or contaminated guard columns. Prepare fresh mobile phase and replace the guard column. If this does not separate the coeluting peak, restore or replace the analytical column.
• Lack of initial resolution during method development indicates column selectivity or chromatographic parameters are not suitable. Adjust mobile phase, column temperature, or try column with a different stationary phase selectivity.</td></tr>
<tr><td></td><td>Leak</td><td>• Check for loose fittings and tighten or replace.
• If leaks or precipitates are found on pump, may need to replace pump seals.</td></tr>
</table>

Dealing With a Decrease in Sensitivity



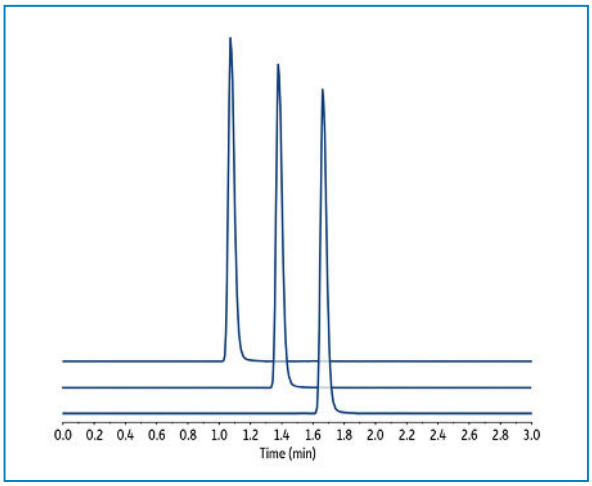
A loss in sensitivity can indicate problems with either the sample preparation or the analytical system. First, confirm that the sample preparation procedure was followed correctly, including storage temperature and time, and verify that system parameters are set correctly and functioning properly. Always check for obvious problems (e.g., calculation/dilution error, autosampler needle not reaching sample, incorrect injection volume, wrong detector settings, no mobile phase flow, detector or lamp turned off, integrity of the reference standard, etc.) before looking for more complex issues. Having a coworker double check your work can be invaluable because it is often easier for an independent person to spot problems than it is for someone who is already familiar with the work.

Once simple problems have been ruled out, analyzing a known standard is a helpful diagnostic tool for LC troubleshooting. If results are within the expected range, the system is performing well, and the problem is in the sample preparation or handling; however, if low response is also seen for the standard, the problem is likely with the instrument. It is also possible that analytes are simply outside of the instrument's sensitivity range. In this case, sample concentration may bring them within range, but care must be taken to prevent the loss of more volatile analytes.

If poor response is seen only in the first few injections, it is possible that the sample is adsorbing to active sites in the sample loop or column. Using a passivation solution or making a few preliminary sample injections to condition the system and reduce adsorption prior to actual sample analysis may help restore analyte response. If response has decreased across all peaks, this is likely caused by calculation errors, incorrect dilutions, or a decrease in injection volume that may result from leaks, system malfunctions, programming errors, or use of the wrong size sample loop. If a catastrophic loss of retention is observed, it is possible that phase dewetting has occurred and the column must be regenerated or replaced, but this is a relatively rare event compared to other causes.

For LC-MS analysis, there could be additional causes responsible for a decrease in sensitivity. Issues with the MS analyzer can be a common source, so verifying that the MS performance is at its best is essential. Directly infusing the tuning solution into the MS (bypassing the LC system) is an easy step that provides useful information for troubleshooting. Since there are several possible causes of loss in MS sensitivity (e.g. cleanliness of the optics, buffer precipitate in the MS entrance, need to change an electron multiplier, ionization source performance, compounds tuning, etc.) we recommend checking with your manufacturer for specific troubleshooting information. Ion suppression due to matrix interferences can also cause poor response in LC-MS systems, but this typically must be addressed with major method changes that may require revalidation, such as better sample preparation procedures, use of internal or matrix-matched standards, and changes to the mobile phase composition.

Stabilizing Shifting Retention Times



For accurate identification and quantification, it is critical that analytes always elute at the same retention time. However, it is not uncommon to observe retention time shifts during routine analysis, and there are a number of possible causes. As a first step in LC troubleshooting, verify that all method settings are correct and that the mobile phase was properly prepared (particularly if you see a big change instead of a slight drift). Preparing fresh mobile phase is an easy way to eliminate problems caused by composition changes due to evaporation, reactions, contamination, or incomplete mixing. Also, if you are transferring an existing method to a new instrument, be sure to account for any difference in dwell volume between the instruments because that can significantly affect retention time. Other possible causes include the following:

1. Incorrect or variable flow rate—manually confirm that the flow rate is correct and verify that there are no leaks in the system.
2. Temperature fluctuations—always use a thermostatically controlled column compartment.
3. Solvent mismatch—make sure that the sample solvent is compatible with the starting mobile phase (try to match both the aqueous:organic ratio and the buffer strength).
4. Sample overloading—don't inject more sample than the column can hold.

5. Column contamination/clogging—flush the column to remove any particulates, particularly if back pressure is also elevated. If this does not work, it may be time to replace the column. Using a guard column is recommended to minimize contamination and maximize column lifetime.
6. Matrix interferences—analyze a solvent standard and compare it to your sample to see if the shifting peaks are actually matrix components.
7. Insufficient column equilibration—allow more time between runs, sufficient time for passing 10 column volumes is recommended. Note: Column equilibration may take longer for HILIC analyses.
8. Air bubbles—purge air from pump and ensure the mobile phase is degassed. Inspect pump seals and change if leaks are evident.

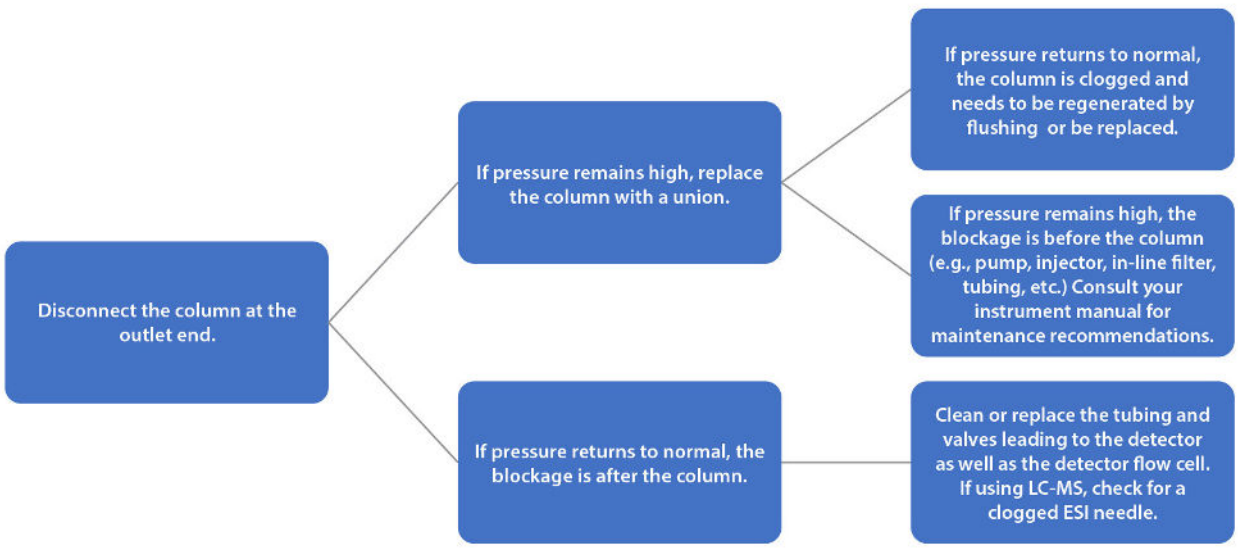
Occasionally, ghost peaks will appear at unexpected times during analysis. This can be tested by making a solvent injection after a sample injection. If a peak appears, it is likely a late-eluting peak carried over from the previous sample injection. In this situation, increasing the flow rate, extending the run time, or adding a gradient step may help eliminate the carryover problem. The risk of carryover can also be reduced by minimizing extra system volume by plumbing the LC with shorter, smaller diameter tubing and zero-dead-volume connections because this will reduce the places that sample can build up. In addition, needle wash solvents and needle wash parameters are important to consider in order to reduce carryover. Ghost peaks can also be caused by contamination in the mobile phase, guard column, or analytical column. This can be resolved by preparing fresh, degassed mobile phase; replacing the guard column; and replacing your analytical column (but first try flushing it according to the manufacturer's recommended cleaning procedures).

Restoring Normal System Pressure

Diagnosing the Cause of Increased Back Pressure

Increased back pressure is one of the most common of all LC troubleshooting issues, but it is important to remember that not all pressure changes indicate a problem. For example, pressure will change during gradient analysis as mobile phase viscosity increases (maximum viscosities are at ~50:50 for methanol:water and ~20:80 for acetonitrile:water). So, it is important to know what is normal for your setup in order to diagnose a problem. It is also important to work within the pressure limits of your LC (e.g., do not use <2.7 µm columns in instruments with a 400 bar limit). When abnormally high back pressure is observed, it indicates a blockage exists somewhere in the system, and the first step in resolving it is to identify the location by isolating one potential source at a time following the steps in Figure 2.

Figure 2: LC troubleshooting steps for locating system blockages that cause increased back pressure.



Removing Column Clogs and Contaminants

Increased back pressure and decreased chromatographic performance can indicate column contamination or blockage. Flushing the column and preventing future blockage using the following guidelines can solve the problem and extend the life of your analytical column.

Treatment

Flushing HPLC and UHPLC columns in the direction shown on the column with a series of solvents can be an effective way to remove both chemical contaminants and particulates that have formed clogs. Use a minimum of 20 column volumes of each solvent and flush in the order shown in Table II below. Following regeneration, always store your column in the solvent recommended by the column manufacturer.

Table II: Solvent Sequence for Column Flushing

Reversed-Phase Columns	Normal Phase Columns
1. Water:methanol (95:5 v/v)	1. Isopropyl alcohol
2. Methanol	2. *n*-Hexane
3. Isopropyl alcohol	3. Ethanol
4. *n*-Hexane	4. Original mobile phase
5. Isopropyl alcohol	
6. Methanol	
7. Water:methanol (95:5 v/v)	
8. Original mobile phase	

Prevention

- Always use fresh, filtered mobile phases to remove particulates and prevent bacterial growth. Keep your mobile phase bottles capped to avoid contamination. If using MS analyzers, make sure you use LC-MS grade solvents and additives.
- Filter samples to remove matrix particulates; syringe filters and filter vials simplify this task.
- Confirm the sample solvent and mobile phases are compatible. Solvent mismatch can cause sample components or buffer salts to precipitate and form clogs.
- Use a guard column or precolumn filter to protect your analytical column. Always select a guard system and phase that matches the analytical column.
- Regularly inspect and replace pump seals, auto-injector rotors, inline filters, and needle seats before normal wear and tear causes them to break down and shed particles into the flow stream.

Although less common, it is also possible to encounter pressures that are too low. In this scenario, leaks are a usually the culprit, so check your fittings and pump carefully for signs of moisture or precipitates. If tightening or replacing the fittings does not solve the problem, it may be time to replace the pump seals. Trapped air bubbles or a stuck check valve can also cause pressure drops, but both issues can generally be fixed by flushing the system with degassed mobile phase or an appropriate solvent, such as isopropyl alcohol. If this does not resolve this problem, it may be time to replace the check valves. Some leaks could be due to scratches in the rotor seal in six-port valves. The leak may not be visible, but it will cause a drop in the pressure and flow. When looking for leaks or measuring flow rate accuracy, be sure to utilize an old column or a flow restrictor. In addition to pressure drops, leaks can cause other chromatographic problems, such as increased retention, decreased signal, or even automatic instrument shut down. To prevent this, make it a daily practice to inspect fittings for residue, and wipe tubing with a lab tissue to detect moisture. Gently retightening fittings and regularly replacing tubing, fittings, and seals as part of your routine maintenance plan is a good way to prevent catastrophic leaks and unexpected downtime. Restek's Routine LC Maintenance guide is a helpful starting place when developing or refining a maintenance plan.

Summary

LC troubleshooting is an essential part of generating accurate and reliable data. While there are many potential causes of poor performance, careful observation of the chromatographic symptoms, testing of one possible cause at a time, and comparison to an established "normal" state will help you quickly and effectively identify the root cause. Finally, working any lessons learned into a routine maintenance plan will help prevent future problems and keep your instrument running more efficiently.

Syringe Filters with Luer Lock Inlet

- Luer lock inlet offers leak-tight syringe connection.
- Variety of filter types, porosities, and diameters.
- Color coded for easy identification.
- Rugged polypropylene housing.
- Autoclavable to 121 °C for 15 minutes.
- Quantity break pricing for greater savings.

Note: Syringe filters are for laboratory use only.

Description	Color	Diameter	Porosity	qty.	cat.#
Cellulose Acetate					
Syringe Filter	Green	4 mm	0.22 µm	100-pk.	23972
	Blue	4 mm	0.45 µm	100-pk.	23973
	Red	30 mm	0.22 µm	100-pk.	23982
	Red	30 mm	0.45 µm	100-pk.	23983
	Red	13 mm	0.45 µm	100-pk.	26155
	Red	13 mm	0.22 µm	100-pk.	26156
	Red	25 mm	0.45 µm	100-pk.	26157
	Red	25 mm	0.22 µm	100-pk.	26158
Nylon					
Syringe Filter	Yellow	4 mm	0.22 µm	100-pk.	23970
	Pink	4 mm	0.45 µm	100-pk.	23971
	Pink	30 mm	0.22 µm	100-pk.	23980
	Pink	30 mm	0.45 µm	100-pk.	23981
	Pink	13 mm	0.22 µm	100-pk.	26146
	Pink	13 mm	0.45 µm	100-pk.	26147
	Pink	25 mm	0.22 µm	100-pk.	26148
	Pink	25 mm	0.45 µm	100-pk.	26149
PES (polyethersulfone)					
Syringe Filter	Green	13 mm	0.22 µm	100-pk.	23966
	Green	13 mm	0.45 µm	100-pk.	23967
	Green	25 mm	0.22 µm	100-pk.	23968
	Green	25 mm	0.45 µm	100-pk.	23969
	White	4 mm	0.22 µm	100-pk.	23978
	Blue	4 mm	0.45 µm	100-pk.	23979
	Green	30 mm	0.22 µm	100-pk.	23988
	Green	30 mm	0.45 µm	100-pk.	23989
PP (polypropylene)					
Syringe Filter	Blue	25 mm	0.22 µm	100-pk.	28935 NEW!
	Black	25 mm	0.45 µm	100-pk.	28936 NEW!
PTFE (polytetrafluoroethylene)					
Syringe Filter	Purple	4 mm	0.22 µm	100-pk.	23974
	Orange	4 mm	0.45 µm	100-pk.	23975
	White	30 mm	0.22 µm	100-pk.	23984
	White	30 mm	0.45 µm	100-pk.	23985
	White	13 mm	0.22 µm	100-pk.	26142
	White	13 mm	0.45 µm	100-pk.	26143
	White	25 mm	0.22 µm	100-pk.	26144
	White	25 mm	0.45 µm	100-pk.	26145
PVDF (polyvinyldifluoride)					
Syringe Filter	Brown	4 mm	0.22 µm	100-pk.	23976
	Red	4 mm	0.45 µm	100-pk.	23977
	Blue	30 mm	0.22 µm	100-pk.	23986
	Blue	30 mm	0.45 µm	100-pk.	23987
	Blue	13 mm	0.22 µm	100-pk.	26150
	Blue	13 mm	0.45 µm	100-pk.	26151
	Blue	25 mm	0.22 µm	100-pk.	26152
	Blue	25 mm	0.45 µm	100-pk.	26153

Cellulose Acetate, Nylon, PES, PVDF—hydrophilic applications
PP (polypropylene), PTFE—hydrophobic applications
Syringe filters are for laboratory use only.

Cut costs, not quality!

ordering notes

Price per 100-pack. Price breaks are available at 5 and 10 packs.
Your correct price will be reflected on your invoice.

FREE sample packs available. Use these handy packs for method development or to compare with your current brand. Request yours today by adding -248 to the part number. Sample pack orders cannot be placed online—please call. Limit one sample pack per customer.

Thomson SINGLE StEP Standard Filter Vials

Simply squeeze particulates and contaminants out of your sample!

- Recommended for samples containing less than 10% solid particulates.
- Easy-to-use vials offer fast sample filtration and require only a squeeze of your fingers.
- Minimize sample loss by eliminating multiple transfers.
- Color-coded caps allow easy identification of 0.2 µm or 0.45 µm membranes in PVDF, PTFE, PES, or nylon.
- Preslit PTFE/silicone caps help eliminate broken autosampler needles and cored septa.
- Rugged polypropylene vial houses insert with 450 µL loading capacity and low dead volume (120 µL).
- Fit most standard 12 x 32 mm autosamplers, including UHPLC instruments.

Description	Color	Porosity	qty.	cat.#
Nylon				
Thomson SINGLE StEP Standard Filter Vial	black preslit cap	0.2 µm	100-pk.	25891
	pink preslit cap	0.45 µm	100-pk.	25892
PES (polyethersulfone)				
Thomson SINGLE StEP Standard Filter Vial	grey preslit cap	0.2 µm	100-pk.	25897
PTFE (polytetrafluoroethylene)				
Thomson SINGLE StEP Standard Filter Vial	green preslit cap	0.2 µm	100-pk.	25893
	blue preslit cap	0.45 µm	100-pk.	25894
PVDF (polyvinyldifluoride)				
Thomson SINGLE StEP Standard Filter Vial	red preslit cap	0.2 µm	100-pk.	25895
	yellow preslit cap	0.45 µm	100-pk.	25896

Patent No. 7,790,117

Backpressure Regulators

Backpressure regulators can improve detector performance by preventing bubble formation in the detector flow cell. They also are useful in post-column reaction lines and between detectors and fraction collectors in preparatory work. Regulators are superior to more specific alternative solutions, like small-bore tubing, in which pressure varies with flow rate.

Description	qty.	cat.#
Backpressure Regulator: end-of-line, $^1/_{16}$" OD tubing, flanged	ea.	25017
Backpressure Regulator: end-of-line, high-pressure seat	ea.	25018
Backpressure Regulator: flow-through, 5 µL internal volume	ea.	25020

Bluestem Glass Solvent Filter

26431

- Restek Bluestem glass solvent filter provides clean mobile phase to extend the life of columns and pump seals.
- 15 µm borosilicate glass frit sits lower than conventional glass filters to draw more mobile phase from each bottle.
- Blue filter stem allows instant visual confirmation of upright filter orientation.
- Connects to standard ⅛" OD (3.2 mm) PTFE tubing using your existing frit adaptor. For best performance, we recommend using Restek's frit adapter (sold separately as cat.# 26392).

Description	qty.	Similar to Part #	cat.#
Frit Adaptor, PTFE	4-pk.	Agilent 5062-8517	26392
Glass Solvent Filter, 15 µm frit	ea.	Agilent 5041-2168	26431

DEGASi PLUS Mobile Phase Degasser

NEW!

Ultra-high degassing efficiency in a small, durable unit.

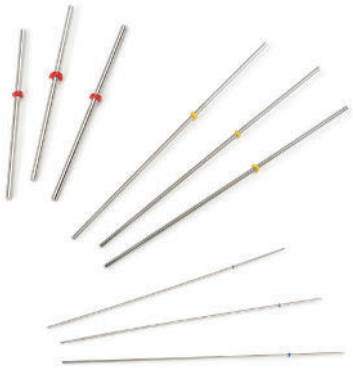
- ZHCR patented control (variable RPM) maintains constant vacuum to eliminate baseline fluctuations.
- Systec AF membrane is highly gas permeable, allowing a small 480 µL chamber volume for fast start-up and equilibration.
- Flow path is biocompatible and offers broad chemical compatibility.
- Continuous vacuum system monitoring to ensure optimum operational conditions are maintained.
- Advanced error and leak-checking functions (refer to instruction manual).
- Use with any HPLC system.
- CE & RoHS compliant.

25839

Description	Voltage	qty.	cat.#
DEGASi PLUS Mobile Phase Degasser	110 – 240 V	ea.	25839

LC Stainless Steel Capillary Tubing

- 316-grade stainless steel.
- Precise precut lengths.
- Clean and smooth surface finish.
- Color coded for easy identification.
- Tight tolerance: OD and ID +/-0.001".



Whether you need to replace system tubing as part of your troubleshooting or want to reduce the dwell volume of your system as you move to narrower columns, Restek has the quality tubing in the lengths and IDs you need. Each ID is color coded, so it is easy to identify and replace correctly. Tubing is precision cut, resulting in clean, square-cut ends without ovality.

Color	ID	OD	Length	Material	Max Pressure	qty.	cat.#
Red	0.005" (0.127 mm)	1/16"	5 cm	316-grade stainless steel	27,850 psi	3-pk.	25813
Red	0.005" (0.127 mm)	1/16"	10 cm	316-grade stainless steel	27,850 psi	3-pk.	25814
Red	0.005" (0.127 mm)	1/16"	20 cm	316-grade stainless steel	27,850 psi	3-pk.	25815
Red	0.005" (0.127 mm)	1/16"	30 cm	316-grade stainless steel	27,850 psi	3-pk.	25816
Yellow	0.007" (0.178 mm)	1/16"	5 cm	316-grade stainless steel	26,610 psi	3-pk.	25817
Yellow	0.007" (0.178 mm)	1/16"	10 cm	316-grade stainless steel	26,610 psi	3-pk.	25818
Yellow	0.007" (0.178 mm)	1/16"	20 cm	316-grade stainless steel	26,610 psi	3-pk.	25819
Yellow	0.007" (0.178 mm)	1/16"	30 cm	316-grade stainless steel	26,610 psi	3-pk.	25820
Blue	0.010" (0.254 mm)	1/16"	5 cm	316-grade stainless steel	25,160 psi	3-pk.	25821
Blue	0.010" (0.254 mm)	1/16"	10 cm	316-grade stainless steel	25,160 psi	3-pk.	25822
Blue	0.010" (0.254 mm)	1/16"	20 cm	316-grade stainless steel	25,160 psi	3-pk.	25823
Blue	0.010" (0.254 mm)	1/16"	30 cm	316-grade stainless steel	25,160 psi	3-pk.	25824
Orange	0.020" (0.508 mm)	1/16"	5 cm	316-grade stainless steel	20,230 psi	3-pk.	25825
Orange	0.020" (0.508 mm)	1/16"	10 cm	316-grade stainless steel	20,230 psi	3-pk.	25826
Orange	0.020" (0.508 mm)	1/16"	20 cm	316-grade stainless steel	20,230 psi	3-pk.	25827
Orange	0.020" (0.508 mm)	1/16"	30 cm	316-grade stainless steel	20,230 psi	3-pk.	25828

27746

PEEK Tubing

- Ideal for plumbing to and inside HPLC systems.
- 1⁄16" OD in 3- and 10-meter lengths.
- Less oxygen permeable and more temperature resistant than PTFE or Tefzel tubing.
- Easily cut to length using Clean-Cut Tubing Cutter (cat.# 25069).
- Use with PEEK finger-tight or flangeless fittings.
- Use tubing ≤ 0.007" to 7000 psi; tubing ≥ 0.010" ID to 5000 psi.

Color	ID	OD	Length	Max Pressure	qty.	Similar to Part #	cat.#
Natural	0.0025"	1/16"	1 m	7000 psi	3-pk.	VICI JR-T-5764-M1	27746
Red Stripe	0.005"	1/16"	3 m	7000 psi	ea.	Agilent 5042-6461; Grace 5131751, AL35720; VICI JR-T-5999-M3	27747
Red Stripe	0.005"	1/16"	10 m	7000 psi	ea.	VICI JT-T-5999-M10	27748
Yellow Stripe	0.007"	1/16"	3 m	7000 psi	ea.	Agilent 0890-1763; Grace 5131753, AL35722; VICI JR-T-6000-M3	27749
Yellow Stripe	0.007"	1/16"	10 m	7000 psi	ea.	VICI JR-T-6000-M10	27750
Blue Stripe	0.010"	1/16"	3 m	5000 psi	ea.	Grace 5131759, AL35728; VICI JR-T-6001-M3	27751
Blue Stripe	0.010"	1/16"	10 m	5000 psi	ea.	VICI JR-T-6001-M10	27752
Orange Stripe	0.020"	1/16"	3 m	5000 psi	ea.	Grace 5131757, AL35726; VICI JR-T-6002-M3	27753
Orange Stripe	0.020"	1/16"	10 m	5000 psi	ea.	VICI JR-T-6002-M10	27754
Green Stripe	0.030"	1/16"	3 m	5000 psi	ea.	VICI JR-T-6003-M3	27755
Green Stripe	0.030"	1/16"	10 m	5000 psi	ea.	VICI JR-T-6003-M10	27756

RESTEK
Pure Chromatography

Questions? Contact us or your local Restek representative (www.restek.com/contact-us).

www.restek.com

Lit. Cat.# GNAR3485-UNV