



HPLC System Purchasing Guide: GMI Certified Knowledge

High-Performance Liquid Chromatography or *High-Pressure Liquid Chromatography* (HPLC) is a popular analytical technique used by many laboratories to separate, identify, purify, and quantify a variety of samples. Critical to research and lab facilities, an HPLC system consists of a mobile phase, pump, injector, column, detector, and a computer data section all working together to separate compounds or mixtures into individual components, avoiding unexpected contaminants and ensuring correct compositions of a plethora of products. Whether for applications including food and water safety, discovery of pharmaceutical drugs, public health improvement, product cleanliness, and environmental analysis, it is essential to work with powerful, speedy, and highly sensitive HPLC systems.

With so many models and types of HPLC system in the market, finding the most suitable one for your application can be an intimidating and overwhelming task. GMI has prepared this simple guide to give an HPLC refresher and walk you through components to consider when selecting the right system for your lab.

Assess Application Demands and Needs for your HPLC System

An important step in selecting the most apt HPLC system for your laboratory is reviewing your application requirements. You can start by answering these questions.

- Are you looking for a simple and stand alone benchtop system or a fully automated and computer software controlled system?
- Does your application require low pressure or high pressure gradient mixing? For low pressure mixing, you can get an HPLC system typically with quaternary pumps that allow mixing of the mobile phase just right after the proportioning valves and is characterized with higher dwell volumes. For high pressure mixing, you can look for HPLC systems featuring binary pumps that allow mixing on the chamber past the pumps and are characterized with lower dwell volumes. A number of options for your high pressure mixing needs are available at GMI including the Knauer [AZURA Lab Prep LC 50](#) as well as HPLC system proposals with [multiwavelength UV](#) and [UV/DAD detection systems](#).
- Will you be purchasing an HPLC system for a professional research lab or a university research lab? Different type of systems may be deemed appropriate for each, like getting a basic chromatography data system for university use while a higher-end one will be better for use in professional research labs.
- Have you had any experience with any HPLC systems in the past or would you need assistance in installation and training?



Depending on your specific application, you can also look out for HPLC accessories such as:

- Fraction collector - used to collect and store in different containers all chromatographically separated materials
- Thermostatted column compartment - temperature-controlled column compartment for heating and cooling, for applications reliant on retention time reproducibility
- [Autosampler](#) - aids in quick sample loading on a chromatograph, when getting an autosampler be sure to consider its sample volume range, cycle and load times, precision and accuracy as well as container types
- Degasser - to eliminate dissolved gas in HPLC eluents
- Manual injection valve - for transferring pre-loaded samples onto columns

To obtain maximum control and optimum sample processing, don't forget to match your HPLC hardware system with the computer and software that you will be using.

Consider Lab Space Requirements where the HPLC will be Situated

Before you start looking for an HPLC System, you also have to bear in mind your available lab area as this can influence the convenience of location and accessibility of the equipment. If you have a spacious lab, you can look into modular preparative HPLC systems that can further be expanded for access to more detection methods and higher throughputs. Made of separate modules that you can stack, switch, and connect to work as one unit, these modular systems provide superior flexibility, allowing you to continuously support the latest technology without purchasing a whole new system every now and then. For workrooms with a smaller space, you can get compact benchtop models instead like the Agilent [1200 Binary VWD HPLC](#), [1200 Quaternary MWD System](#) and [1200 Quaternary DAD HPLC](#) and Knauer [AYLXBACA-A AZURA Educational System](#).

In need of modular HPLC systems? GMI has a large inventory of used HPLC systems from major MFGs including the [HP Agilent 1100 Series](#), [HP Agilent 1050 Series](#), [HP Agilent 1200](#) and the [Thermofisher Ultimate 3000](#). We also showcase new preparative LC systems such as [Knauer's AZURA Lab Prep LC 50 HPG](#). You can view our brand new systems for HPLC from Knauer [here](#).

Review and Decide On Budget Allocations for your HPLC Purchase

Since most laboratories place a large slice of their funding on lab instruments, it is vital to allocate your budget wisely. For those with ample resources at hand, you can always get new HPLC systems for your life science and pharmaceutical applications. Keep in mind an instrument's lifetime costs as this can also help in deciding whether to acquire new units for your lab. Buyers with limited resources should not fret as there are a variety of alternatives available like getting modular systems that allow you to add modules or upgrade parts at a later time, just



when the need arises.

You can also consider one of the popular options nowadays, purchasing a used or [fully recertified to factory specifications HPLC system](#). While most Original Equipment Manufacturers (OEMs) may take some time in supplying new lab instruments, a used equipment distributor like GMI offers easily available and more economical HPLC systems for any urgent unit replacement needs or to meet market demands. Choosing quality, certified pre-owned lab equipment from trusted and industry-leading distributors such as GMI can help you save up to 70% of your budget.

HPLC Pump Type Preference

Responsible for propelling the mobile phase to the column at a specific flow rate and under constant pressure, pumps ensure constant flow of the liquid catalyst, avoiding changes in elution time of sample components as well as errors in results.

The two main types of pumps used in HPLC include:

- Constant Pressure Pumps - offer consistent & continuous flow rate across the column through pressure from a gas cylinder
- Constant Flow Pumps - can either be a reciprocating piston pump that transport solvents by the reciprocating motion of a piston in a hydraulic chamber or a syringe type pump that are ideal for small bore columns, delivering constant flow rate to the column through a motorized screw arrangement

Usually made of stainless steel, titanium, and resistant materials, these pumps provide two types of operation, delivering constant (isocratic pump) and variable (gradient pump) mobile phase composition. Depending on your flexibility requirements, consider the following pump types and identify the best one for your application:

- Binary/Binary with Solvent Selection Pumps - can pool and mix two eluents together at the same time, consist of two independent pumps that can provide flow for each solvent, high-pressure proportioning
- Quaternary Pumps - can pool and mix four different eluents at the same time, consist of one pump, low-pressure proportioning

Ensure you select HPLC pumps that are compatible with solvents, buffer salts and solutes, and are corrosion resistant. These should offer constant flow delivery independent of back pressure as well as low dead volume for minimized issues on solvent changeover.

HPLC Column Chemistries and Types



Knowing your compounds of interest, including the physicochemical characteristics of the molecules to be separated as well as the interactions between these molecules through chromatography media or resins, can help you pick out the most fitting column component of your HPLC system. With the column considered as the heart of a chromatograph and with different types of columns based on their composition and methods of separation available, make sure you buy the right one for your specific application. Consider column length and particle size/porosity as these factors can affect your sample analysis. The most HPLC column types are described below for your reference.

- Normal Phase Columns - separate sample components based on polarity of sample components, widely used in pharmaceutical analysis
- Reversed Phase Columns - separate sample components also based on polarity but happens opposite the normal phase columns, based on hydrophobicity
- Ion Exchange Columns - separate sample components based on the attractive ionic force between molecules and charged stationary phase, surface charges
- Size Exclusion/Gel Filtration Columns - separate sample components based on size

The dimension of an HPLC column influences the efficiency, sensitivity, and speed of an analysis. Based on primary column dimensions such as particle size, internal diameter, and length, these columns can be classified as:

- High-Performance Analytical Columns - used for qualitative and quantitative analysis, with internal diameter ranging from 1.0-4.6mm and lengths ranging from 15-220mm
- Preparative Columns - used for preparative work, with internal diameter greater than 4.6mm and lengths ranging from 50-250mm
- Capillary Columns - with internal diameter ranging from 0.1-1.0mm, available in various lengths
- Nano Columns - with internal diameter less than 0.1mm

Looking for columns and column parts compatible with your HPLC system? You can check out GMI's convenient online store offering a large inventory of liquid chromatography [parts and accessories](#) from popular scientific brands [here](#).

HPLC Flow Rate

Aside from the column dimension, stationary phase particle size, and temperature, also affecting an HPLC system pressure is the flow rate. Picking the most appropriate flow rate is necessary as using a higher than usual one can impact your system's chromatographic quality, offering insufficient time for your analyte to interact with the stationary phase.



Look again into your column particle size, length and internal diameter because these help identify the right flow rate needed. Large diameter columns require higher flow rates. Shorter columns and elevated flow rates lead to faster analyses. You can refer to the table below for the typical flow rates used based on the internal diameter, injection volume, and loading capacity of your column.

Typical Flow Rates	Loading Capacity (mg)	Typical Injection Volume (μL)	Internal Diameter (mm)
0.5-2	1	15	4.6
4-15	4.7	100	10
10-50	19.5	400	21.2
40-100	42.5	1000	30
100-300	118	2000	50
400-1000	473	10000	100

HPLC Detector Types and Access to Wavelengths

Chromatography detectors are units used to identify sample components eluted off chromatography columns. Selecting the right detector will depend on the analytes you want to detect, the level of required sensitivity, properties of eluents or liquid solvents used in the separation, as well as the type of information required by your experiment.

The most common non-destructive HPLC detector types are:

- UV/Vis Detector - specifically responds to particular compounds based on the presence of light absorbing functional groups
- Photo-diode Detector - an absorbance detector like UV/Vis, compared to UV/Vis detectors that visualize obtained results in light intensity and time, PDA detectors add a third



dimension of wavelengths

- Fluorescence Detector - provides higher sensitivity compared to a UV-Vis detector
- Refractive Index Detector - based on changes in refractive index of eluting compounds in the mobile phase, less sensitive compared to a UV-Vis detector
- Multiple Wavelength Detector - can detect several wavelengths in parallel channels
- Variable Wavelength Detector - can change wavelength detected within a run, only has one wavelength output
- Mass Spectrometry Detector - showcases very high sensitivity as well as selectivity, detects analytes based on molecule fragmentation through electric fields, separates samples based on mass to charge ratios of fragmented molecules

At the most ideal, choose detectors that offer low noise, low detection limits, high sensitivity towards solute over mobile phase, and large linear dynamic range.

All HPLC components mentioned are typically offered by manufacturers as part of a complete system. However, at GMI, you are given more flexibility to combine a range of options available for each component, depending on your chosen brand. Additionally, GMI also showcases a wide range of [new](#), [used](#), and always in-stock HPLC systems for accurate quantitative and qualitative analyses of drugs and pharmaceuticals, nucleic acids, bodily fluids, pesticides, polymers, lipids, amino acids, and more.

For over 20 years, GMI has been serving the scientific market and cost conscious laboratories with cutting-edge products and unparalleled services. With an ISO 9001:2008 certification under our wings, we assure any instrument purchased from us has undergone meticulous refurbishing, recalibration, recertification, and testing processes. We also offer a number of service agreement, warranty, rental, installation and training options for our HPLC products.

For any assistance needed on potential new or used HPLC system purchase, feel free to reach us at **1-888-702-1775** or email us at sales@gmi-inc.com.