

SELECTING LABORATORY PACKAGING

Important decisions that aid results



**PACKAGING
DOWN TO A
SCIENCE**

TABLE OF CONTENTS

Consider the Contents 3

Choose the Container. 4 - 7

Choose the Closure 8 - 9

Determine Best Value-Added Services 10

Select the Right Laboratory Packaging Supplier 11

When considering the large market for laboratory supplies, laboratory packaging can sometimes lose focus to equipment, chemicals, and other consumables. But this is a mistake. Choosing the appropriate laboratory packaging is critical in avoiding costly errors and operational inefficiency.

Years of research can be invalidated if quality control and reference samples intended for long-term storage are ruined due to container compatibility issues. Experimentation can be faulted if clear glass is used instead of amber when UV protection is required. Expensive chemicals can be ruined if damaged in a standard glass container instead of cushioned, safety-coated bottle. Incorrect plastic resin choices may not provide effective barriers to gases, chemicals and other compounds. Incompatible liners in closures can result in caps backing off the bottle from loss of torque, leading to contents evaporating.

All this can be avoided by choosing the appropriate bottle and cap combination for your product and application. This paper lays out key considerations for choosing the right container and closure, adding the proper container treatments and services, and selecting the right supply partner.



CONSIDER THE CONTENTS

There are some factors that can quickly narrow the type of packaging you need.

PROPERTIES OF THE ITEM BEING CONTAINED

You want to ensure compatibility between the packaging and the contents. The bottle and closure/liner system must be able to safely contain your product. Check the MSDS (Material Safety Data Sheet) as to whether there are limits on using certain plastic resins, liners, or coatings. Valuable compounds should be protected against accidental damage and long-term deterioration from environmental exposure.

STORAGE AND USAGE

Compounds that will be stored for long periods of time may benefit from a container that blocks light or that provides strong barrier properties to reduce evaporation (like with glass and some coated plastics). Also think about how portable the bottle needs to be and how you want users to interact with it. If there are hazardous chemicals involved, safety-coated glass bottles may help, as they offer the compatibility attributes of glass with the safety of plastic by the application of a plastic coating to the outside of a glass bottle.

VOLUME OF THE CONTENTS

When a bottle is filled to its nominal capacity, the contents generally fill the container to its shoulder area. This is the volume listed for a container in most marketing materials. The “overflow capacity”, however, is the maximum volume of a bottle if the contents were filled to the very top (or the brim). Selecting the right volume is important as the headspace – the volume above the contents of the container and below the neck opening – may be critical for some volatile compounds and when the contents need to withstand any changes in pressure.

FILLING AND DISPENSING

Depending on your application, the opening of the bottle may be critical to how the contents are filled and dispensed. Do you need a wide opening or a narrow opening? The opening style can be essential to ensuring that the contents are filled and delivered in a safe fashion. Most of the common laboratory containers are classified as narrow-mouth or wide-mouth.



CHOOSE THE CONTAINER

CONTAINER MATERIAL

Selecting the correct material for your package is important to ensure product compatibility. Evaluate these factors when determining the material and style of container.

GLASS

- Acceptable for most chemicals; inert
- Impervious to gases
- Rigid and recyclable
- Autoclavable

PLASTIC

- Rigid and recyclable
- Durable and impact-resistant
- Lighter weight than glass

METAL

- Extremely durable
- Easier to recycle than plastic
- Can withstand high heat

Once you have determined the broad category of the container material suited to your application, evaluate the attributes of the specific types of each material.

GLASS OPTIONS

TYPE I BOROSILICATE GLASS

- Excellent protection against chemical attack
- Higher softening point for greater heat resistance
- More resistant to thermal shock and breakage
- More resistant to weathering, in which salt from the atmosphere accumulates on glass containers

TYPE III SODA LIME GLASS

- Smooth and non-porous surface, making it ideal for cleaning processes
- Economically priced

SAFETY-COATED TYPE III SODA LIME GLASS

- Impact-resistant coating
- Bottles are slip-resistant for improved handling stability
- Safely contains even the most aggressive chemicals for a short period, allowing for clean-up



PLASTIC OPTIONS

PET - POLYETHYLENE TEREPHTHALATE

- Glass-like clarity
- Durable, rigid and impact-resistant
- Exceptional gas and moisture barrier properties
- Good alcohol and solvent barrier

HDPE - HIGH DENSITY POLYETHYLENE

- Excellent moisture barrier
- Impact-resistant and translucent

PVC - VINYL/POLYVINYL CHLORIDE

- Transparent and rigid
- Excellent resistance to oxygen permeation and oils
- Good water barrier characteristics

LDPE - LOW DENSITY POLYETHYLENE

- Squeezable and soft, particularly suited for squeeze, spray or dropper applications
- Virtually unbreakable and more resistant to stress cracking than HDPE
- Retains impact strength at very low temperatures

PP - POLYPROPYLENE

- Autoclavable
- Excellent contact clarity
- Excellent impact strength, stress crack resistance, and barrier characteristic

PS - POLYSTYRENE

- Rigid, glass-like clarity
- Lightweight
- Able to withstand high fill temperatures (up to 180 °F)
- Generally used for dry products, which are not extremely hydroscopic in nature



For plastic containers, you should check resin compatibility with the chemicals being stored. Reference Qorpak's compatibility chart for more detailed information – Qorpak.com/pages/ContainersandClosuresChemPlastics.

FLUORINATION

Some plastic resins can be fluorinated to prevent bottle “paneling.” Paneling is the term used to describe when the sides of a plastic bottle partially collapse due to pressure changes or chemical reactions between the bottle and its contents.

Fluorination is a process that adds a barrier to the plastic. This helps guard against product weight loss and paneling. It also helps to control odor and prevent discoloration of the container. Many types of plastic can be fluorinated.



HDPE



Barrier Plastic

METAL OPTIONS

Metal containers may not be your first thought when considering laboratory packaging, but its advantages may make it the right material for your application.

TINPLATE

- Corrosion-resistant
- Stable
- Cost-effective

STEEL

- Strong
- Interior coatings available
- Excellent barrier against water, oxygen, and light



CONTAINER COLOR

Do your contents need protection from UV light? Do you need to visually inspect the contents? Selecting the right color container will help ensure the integrity of the contents.

CLEAR/FLINT

Clear glass is best suited for alcohol, water, sauces, and foods that aren't affected by light. Clear containers allow for visual inspection of the contents. Plastic resins that can also be clear include PET, PVC, and polystyrene.

Glassmakers in 18th century England made what was known as "flint" glass from virtually pure quartz rock (calcined flint). Although the term "flint" does not describe how glass is produced today, this term is still commonly used when referring to clear glass.

AMBER/BROWN

Amber glass provides protection for light-sensitive material and absorbs nearly all radiation consisting of wavelengths shorter than 450 nm, offering excellent protection from ultraviolet radiation. Amber is the most common colored glass.

COBALT BLUE

This a deep-blue colored glass prepared by including a cobalt compound, typically cobalt oxide or cobalt carbonate, in a glass melt. It also offers some UV protection.

NATURAL

Natural plastic refers to translucent/opaque appearance of white or off-white plastic. These resins are produced without added colorants. Polypropylene, HDPE, and LDPE bottles can be natural in color.



NECK FINISH

Everyone from consumers to scientists know that the cap on your bottle must fit correctly to prevent leakage, evaporation, and potentially dangerous spills. To ensure a proper fit, the cap must be coordinated with the bottle's neck finish – which includes the size and threading of the neck.

Cap sizes are not interchangeable – a 28-400 cap will not fit properly on a bottle with a 28-410 neck finish.

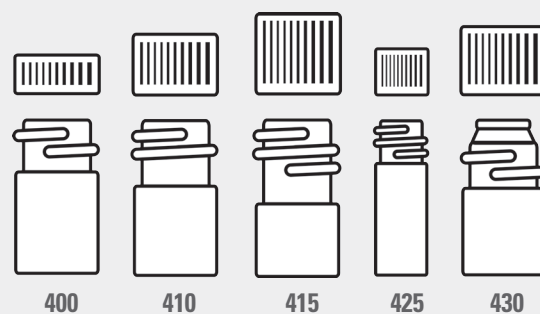
Neck finishes are expressed in two numbers. The first number refers to the diameter of the closure or bottle opening (in mm) and refers to the nominal diameter measured across the inside of the cap at the opening or the outer diameter of the bottle.

The second number represents the GPI thread finish and refers to the height of the cap and the style of threads on the cap and the container. GPI refers to the Glass Packaging Institute, which standardized neck finishes many years ago for both glass and plastic containers.

SELECTED HEIGHTS OF STANDARD CLOSURES

Closure Size (mm)	400 Finish	410 Finish	415 Finish	425 Finish
8	—	—	—	.262 - .280 in
10	—	—	—	.273 - .291 in
13	—	—	.428 - .458 in	.298 - .316 in
15	—	—	.533 - .563 in	.298 - .316 in
18	.359 - .377 in	.499 - .529 in	.593 - .623 in	—
20	.359 - .377 in	.530 - .560 in	.718 - .748 in	—
22	.359 - .377 in	—	.813 - .843 in	—
24	.388 - .406 in	.622 - .652 in	.933 - .963 in	—
28	.388 - .406 in	.684 - .714 in	1.058 - 1.088 in	—
33	.388 - .406 in	—	.245 - 1.275 in	—
38	.388 - .406 in	—	—	—
43	.388 - .406 in	—	—	—
45	.388 - .406 in	—	—	—
48	.388 - .406 in	—	—	—
53	.388 - .406 in	—	—	—
58	.388 - .406 in	—	—	—
63	.388 - .406 in	—	—	—
70	.388 - .406 in	—	—	—
77	.467 - .485 in	—	—	—
83	.467 - .485 in	—	—	—
89	.515 - .533 in	—	—	—
100	.577 - .595 in	—	—	—
110	.577 - .595 in	—	—	—
120	.665 - .683 in	—	—	—

COMMON CAP FINISHES



Learn more about proper closing torque on our website: [Qorpak.com/pages/ClosureTorque](https://www.Qorpak.com/pages/ClosureTorque)



CHOOSE THE CLOSURE

When selecting a cap for your container, the type of material used in the cap and the nature of the lining material are both important.

CAP MATERIAL

The three most commonly used closure materials in the laboratory market include thermoplastic, thermoset and metal.

THERMOPLASTIC

- Common resins include polypropylene and polystyrene
- Good impact strength and pliability
- Cost-effective
- Can be re-melted after they are formed

THERMOSET/PHENOLIC

- Common resins include urea, phenolic, and melamine
- Wide range of chemical capability
- Most temperature-tolerant of plastic closures
- Also known as Bakelite

METAL

- Widest range of temperature tolerances
- Resistant to fracture from impact

LINER MATERIAL

The liner comes into contact with the item being stored. This contact area is called the facing. The facing must be physically and chemically compatible with the contents. The opposite side of the liner is called the backing. The backing comes in contact with the closure. The backing can provide desired compression, resiliency, and thickness.

There are many types of liners available. For example, PTFE liners resist attack from virtually all chemicals and provide resilience for a tight seal and low moisture transmission.



The table below outlines many possible liners. As always, be sure to test your product with the liner you choose to be sure they are compatible.

SUGGESTED CAP LINER APPLICATIONS

Suggested Uses	F217 & PTFE	Pulp/Vinyl	PolyCone	Rubber	Rubber Backed/ PTFE Faced	Solid PE	Aluminum Foil	SturdeeSeal (F217) PE Foam	F422 Foam	Unlined	Plastisol	Pulp/PE
Acids - mild						x		x			x	
Acids	x							x	x			
Alcohols							x	x				
Alkalis						x		x				
Analytical lab samples	x											
Aqueous-based products	x							x				
Autoclavable				x	x							
Beverage		x	x									
Brake fluids							x					
Canning											x	
Chemicals	x	x	x			x						
Chemical applications packed at less than 120 °F, including mild acids, alkalis, solvents, alcohols, oils and aqueous products		x										
Chrome cleaners							x					
Cold fill applications		x										
Corrosive chemicals	x											
Cosmetics	x							x				
Diagnostic reagents	x											
Dry products										x		
Environmental samples	x											
Essential oils			x									
Food applications	x	x					x				x	
High purity chemicals	x											
Honey												x
Hot fill applications							x				x	
Household oils	x							x				
Hydrocarbons												
Injectables				x								
Ketones							x					
Liquids susceptible to evaporation			x					x				
Macrobiology			x									
Medical		x										
Mineral oils							x					
Nail polish remover						x						
Non-acid food products							x					x
Non-alkaline							x					
Non-oil products at room temp.						x						
Oils							x					
Organic solvents							x					
Personal care products		x										
Pharmaceuticals	x			x								
Powders		x					x					x
Soaps			x									
Solids							x					
Solvents	x											



DETERMINE BEST VALUE-ADD SERVICES

For convenience and cost savings, laboratory packaging can be delivered to you with additional features and services.

PRE-CLEANING

If you are doing any sampling, testing, or validation, you need to make sure the results were not skewed by a contaminant that may have come from the container. Newly manufactured bottles and vials may contain release agents and contaminants from the manufacturing factory that coat all surfaces of these bottles or vials on both the inside and outside. Conditions of storage or transportation also have the possibility of adding contaminants. To obtain clean containers or clean vials, rigorous mechanical, chemical, or other cleaning procedures must be employed.

PRE-CLEANING OPTIONS CAN INCLUDE:

- Contaminants – KaptClean[®] Environmental Containers are available “Cleaned” or “Cleaned & Certified” for contaminants including semi-volatiles, volatiles, or metals.
- Particulates – Super Cleaned or oil analysis containers meet or exceed less than 10 particles in the greater than 10 micron size per milliliter. Ultra Cleaned containers feature a proprietary cleaning process that removes up to 99.5% of particles that are 5 microns and larger.
- Visually clean – bottles cleaned by Vacuum & Ionization have no visible particles.

KITTING & PACKAGING

The right case-pack configuration can help with inventory issues and ensure that you have the packaging on hand when you need it. Do you need your bottles with caps already attached when you receive them in, or do you need separate components? The advantages to each depends on how you use them.

CONVENIENCE PACKS

- Minimizes breakage – full height partitions and top pads
- Easy product identification – pressure-sensitive labels included
- Effortless reordering – cartons are bar-coded with catalog number and description
- Packed in small quantities – the way you use them
- Easy to handle and store – cartons are smaller and lighter than bulk packs

BULK PACKS

- Save money – bulk pricing provided
- Lower freight costs – ship less often
- Less reordering – spend more time at the workbench

CAPS ATTACHED

- Saves you time – no more searching for the proper size cap
- Prevents mistakes – the right liner in the right cap on the right bottle
- Reduces carton dust – dust cannot get inside the bottle or behind the liner
- Simplifies ordering – consolidate two inventory items into one

CAPS SEPARATE

- Multiple case-pack choices – available by each, bagged for cleanliness, or bulk packed
- Faster filling – no need to remove cap before filling
- Trouble-free loading – quickly add many caps to your production line/equipment





SELECT THE RIGHT LABORATORY PACKAGING SUPPLIER

The right packaging supplier can make all of this easy. You want a partner who is expert in the laboratory space, understand your needs, and can deliver with the quality, service, and pricing you need.

QUESTIONS YOUR PACKAGING SUPPLIER SHOULD BE ASKING YOU

- What type of lab do you have, how many quality samples are you required to pull for testing, and what kind of tests are you running?
- What laboratory packaging issues do you have now and how does this affect your business?
- What safety or compliance concerns do you have?
- What inventory challenges do you face including availability, on-time delivery, and storage issues?
- Are you having trouble sourcing a particular product?
- Would a custom design be advantageous?
- How can we help grow your net income and what cost-savings initiatives do you have?
- How would knowledge, technical support, white papers, and innovative products help your business?

THINGS TO CONSIDER WHEN CHOOSING A PACKAGING SUPPLIER

- Breadth of selection of in-stock products
- Product quality is consistent and meets the specifications
- Warehousing services and inventory management
- On-time delivery
- ISO and Quality certifications
- Ability to meet regulatory or compliance needs
- Technical expertise of the sales team
- Sales team is responsive and dedicated to your growth
- Reports, shipping documents, and invoices are understandable and accurate
- Ability to scale with your business
- Competitive prices

ABOUT QORPAK, A DIVISION OF BERLIN PACKAGING

Qorpak, a division of Berlin Packaging, is a leading worldwide supplier of laboratory containers and supplies. For more than 35 years, Qorpak has served laboratory, research, and testing professionals through its own expert sales and service team as well as through an international network of distributors. In addition to thousands of types of containers and closures in plastic, glass and metal, Qorpak sells commonly used chemicals, supplies, and benchtop equipment.

Qorpak is a one-stop shop, with a majority of these products in-stock and ready to ship. In addition, the company provides kitting, packaging design, financing, consulting, warehousing, and logistics services. Qorpak is ISO 9001 Certified and compliant with cGMP. The company can be reached at 1.800.922.7558 and Qorpak.com

