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Lab Manager®

# LAB OVENS RESOURCE GUIDE

# Questions to Ask When Buying a Lab Oven

Depending on the intended use, there are a variety of oven types to choose from

**by Lab Manager**

## How does sample or material type influence the ideal type of lab oven?

Depending on your intended use there are a variety of ovens to choose from. For general drying or baking purposes, a gravity convection oven can be used. These are typically cheaper and offer a degree of temperature uniformity, but they can develop cold or stagnant spots. Alternatively, a mechanical convection oven can be used which has a blower unit to allow for increased temperature uniformity, as well as fast recovery when the oven has been opened. If the oven is required for drying, desiccating, moisture determination, or outgassing a vacuum oven may be best.

## Will the size or volume of samples you need to heat affect which style of lab oven should be used?

Laboratory ovens come in a wide range of sizes—from very small personal use to large-scale industrial units with walk-in capabilities. For larger ovens, a separate power source may be required. These units can draw a lot of electricity and increase the overhead and maintenance requirements of the laboratory. Alternatively, if the sample volume is large, but the size of the samples is small, it may be wiser to invest in multiple smaller ovens as opposed to one large unit.

## How will the type of analysis or laboratory affect the type of lab oven required?

For some laboratories which have stringent compliance guidelines on samples, such as work involving semiconductors and electronic applications, a specialized variety known as a clean room oven may be needed. These ovens utilize a HEPA filter system along with very precise temperature control and uniform heating. For samples that are volatile or potentially explosive, the Class A division of ovens should be used, which includes safeguards against explosive or volatile samples.

# Safety and Circumspection in Laboratory Oven Use

The safety features of laboratory convection ovens must coordinate with user responsibility to avoid unnecessary dangers

**by Brandoch Cook, PhD**

## User safety in oven operation

When using a laboratory oven, it is best to avoid burning yourself. It's obvious but needs to be said. Think about your busy morning; when you pull up to the fast-food drive-thru flustered and eager at 7 am for coffee and a breakfast sandwich, what do you do? Chances are, you drive away one-handed, gripping change in your fist while the coffee cup goes between your legs. You don't even think about it; you've got too many other distractions and somewhere else to be. Science is like that too. You've got four experiments running simultaneously, and the oven timer says your glassware is done drying. While coffee might be 70 or 80°C, a laboratory oven can be as hot as 300°C. As such, it is imperative to wear appropriate personal protective equipment when using the oven (including thermoprotective gloves and a lab coat) and to stand to the side when you open the door.

It is equally important to avoid exposure to toxic vapors and fumes. If you forget about residual organic solvents coating your glassware or use the oven mistakenly to dry volatile or toxic samples, all the fumes will remain in the heated chamber. After all, it's not a fume hood, and unless it's customized to connect to a ventilation source, guess where it will vent? In your face, all at once, when you open the door. Alternatively, it may ignite and burst into flames. Therefore, it is important to always understand the chemical properties of the samples you put in an oven, to rinse glassware several times with distilled water, and to double-check that what you thought was clean before you bake it is clean.

## Convection ovens—safety standards and options

Laboratory ovens occupy two categories: convection ovens and vacuum ovens, and the former can be further subdivided into 1) gravity or natural, and 2) mechanical or forced convection ovens. Vacuum ovens usually serve specialized functions, such as outgassing solvents during procedures that require a high degree of environmental control. For the comparatively mundane functions of drying and heating samples, or preparing glassware for sterile use, convection ovens are standard. A gravity oven allows heated air to naturally expand, rise, and equilibrate an internal space to a desired temperature. It is a cheaper, albeit less versatile option than most mechanical ovens, which employ a blower fan to distribute heated air around the chamber.

Both types of convection ovens should adhere to approved engineering and safety standards. These include the 2007 updated DIN 12880 international standards for temperature stability and homogeneity, and the UL 61010-1 certi-

fication mark for safety in electrical equipment pertaining to control, measurement, and laboratory use. Additionally, ovens should have automatic shutoff, door locks, and alarm systems for over- and under-temperature situations. Just like with any laboratory equipment purchase, there are a variety of options ranging in features and price.

Keep in mind, however, that even the best mechanical convection oven is optimized to protect the sample before it protects you, a potentially vexing hierarchy. The best thing you can do to protect yourself is read the user's manual, which contains numerous key safety warnings, and acts as the best guide to train all laboratory members and inform them of potential risks.

# Remote Features for Laboratory Ovens

Control from a distance can be used to monitor and operate lab ovens

**by Mike May, PhD**

Lab ovens are used in many processes, often lasting for hours, which can add appeal to remote operation. Remote features are included with some ovens and some features can be added. Across this market, many options exist, but there's room to grow in terms of use.

On some lab ovens, a scientist can use a remote control to manage all options: from controlling the temperature and starting and stopping programs to logging data and setting up text alerts. Although labs of any size could benefit from an oven with remote control, labs with a larger footprint typically require this type of oven so tests can be remotely monitored without the researcher needing to walk across a large lab or even come into the building

## Adding options

Many lab ovens come with various options that can provide remote capabilities.

Just offering remote operations, though, doesn't ensure that scientists will want them. While scientists can purchase industrial test chambers—basically superpowered lab ovens—that come with a range of remote options, companies have found that few customers request them.

## Controlling the future

For some scientists, remote control of a heating device might lie ahead—especially for researchers who run their lab ovens around the clock.

One option is upgrading an existing oven with a controller. With this, many ovens can be controlled through a smartphone.

When shopping for a lab oven with remote control, the buyer should see if there is free and easy phone support for the life of the product along with independent satisfaction ratings of the products and service.

Although some scientists might expect more maintenance on an oven with remote control, that's not typically the case. Remotely controlling and monitoring a lab oven or other heating device can make life easier in labs and companies.

# How Lab Ovens Meet the Demands of Advanced Research and Diverse Applications

Nearly every lab or production facility of any sort needs an oven, but it is how they get used that is important

**by Mike May, PhD**

## Expanding the specs of temperature range and accuracy

Historically, ovens and incubators have been distinct cousins in the lab. Ovens have a wide temperature range with less accuracy and incubators have less temperature range but more accuracy. But they are closely related. In fact, advances in research demand even closer capabilities from these devices. Applications are asking for a wider temperature range and close, tight specifications for accuracy. That has to do with the development of new materials like plastics and nanomaterials being used for batteries and all sorts of things. The platform that provides those temperature and accuracy features is really a hybrid between an oven and an incubator.

Beyond the materials placed in an oven, different applications need various devices put in an oven. Some scientists need room for analytical columns. Some companies offer ovens that can support this by featuring room for analytical columns that is supported by a column switching valve inside the column heated department. This will prevent time loss to changing columns and reduce the leaking that comes from reusing and reconnecting columns. Some users will also look for other ways to speed up oven operations. This can be done by sourcing an oven with fast heating and cooling capabilities, so users do not need to wait a long time for an oven to reach a set point.

## A real workhorse

Although lab ovens can be extremely robust—working great for years—any device needs some maintenance. For example, if the door seal is not flexible enough anymore, then an oven's specification is out the window.

Even with all the parts in working order, an oven needs calibration now and then. The big rule of thumb—if you use the oven, and it's not standing in a corner for occasional use—is that you should get it calibrated once a year.

# Expanded Applications for Today's Lab Ovens

One of the most common pieces of equipment in any lab is the laboratory oven.

**by Ryan Ackerman**

## Intricate applications from humble beginnings

These workhorse instruments are used for a variety of applications, ranging from simple glassware drying to much more intricate operations such as the removal of chemicals from heat-sensitive materials via vacuum pressure.

The typical types of laboratory ovens seen in most laboratories are convection or forced air ovens. Manufacturers have made substantial upgrades to these basic types, including improved energy efficiency and more accurate temperature control. As a result, these units are great for drying glassware and equipment, and for annealing or baking samples. However, as every lab is different, sometimes a more specialized solution may be required.

## Keeping clean

To minimize the risk of crossover contamination in many processes, such as pharmaceutical or healthcare manufacturing, many laboratories utilize clean rooms. These clean rooms are held under strict accreditation guidelines—such as those laid out in ISO 14644-1—that dictate the maximum size and number of particles allowable in the clean room.

As the heating and drying of materials can produce aerosols and various particulates, manufacturers offer many solutions that adhere to these guidelines and prevent contamination from occurring. Their clean room ovens may come with inert atmosphere purging, fully welded stainless steel interiors, and Class E11 HEPA filters to ensure that contamination is prevented both inside and out.

## Keeping dry

While vacuum technology has been around for a considerable amount of time, vacuum ovens are a specialized approach for many laboratory applications. By utilizing a vacuum, the temperature at which a liquid will evaporate is reduced, which allows for the drying of heat-sensitive samples.

Many industries use this technology for testing, such as the food and beverage industry for moisture testing food, medical technology manufacturers to remove moisture without causing heat damage to the equipment, and the medical cannabis industry to assist in the extraction of THC. To ensure the proper configurations and protocols are met for each laboratory, companies may offer a wide range of vacuum oven types, along with vacuum pumps, including enhanced safety options for volatile samples and reagents.

## Keeping safe

In some laboratory processes—especially those where solvents or highly volatile compounds are used—the addition of heat can pose a significant safety hazard. In response to this, manufacturers may offer highly specialized units that can mitigate the risk of fire or explosions. This is achieved through a variety of measures: ovens are made of highly rein-

forced steel, have pressure relief systems, and allow for close monitoring of exhaust rates and temperatures. In some cases, a heating element can be eliminated by using high-velocity air as a heating method, further reducing the risk of explosion or fire.

As the laboratory and testing landscape continues to change, manufacturers must keep up to offer customers what they need. The lab oven—with its ever-increasing selection—shows a clear example of the growing need for robust equipment.

# Product Spotlight

## BEING—The 'Smart Choice' for Laboratory Drying and Vacuum Ovens

The BEING BOF mechanical (forced air) convection, BON natural (gravity) convection, and BOV vacuum ovens are ideal for many laboratory applications.

There are 14 models to choose from. The BOF series is available in 30-, 51-, 121-, 211-, and 400-liter chambers. The BON series is available in 30-, 50-, 115- and 211-liter chambers. Both series have an ambient + 10°C to 300°C temperature range and two models with space-saving stackability.

The BOV series has an ambient + 10°C to 200°C temperature range in 24-, 53-, 91, 125- and 216-liter chambers in 4-sided jacketed or direct-shelf heating.

All are budget-friendly, energy efficient, and have many features that provide safe and easy operation.

The ovens' intelligent programmable controller has a bright, easy-to-understand LCD (BOV) or 4.3-inch capacitive touchscreen (BOF & BON) that shows all operating parameters on a single screen and provides excellent temperature regulation.

All BEING ovens come with a 2-year warranty.

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# Featured Manufacturer

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We are committed to providing customers with innovative and reliable products to meet the ever-changing laboratory needs on instruments like mechanical and natural convection, cooling, and $CO_2$ incubators, mechanical and natural convection drying and vacuum ovens, orbital and incubated shakers, square magnetic heated stirrers, rotary evaporators, chillers, circulating and water baths, vacuum pumps, and much more!

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