

INSPIRED INNOVATION

Despatch
INDUSTRIES

BATCH OVEN SELECTION GUIDE

A GUIDE TO SELECTING THE RIGHT OVEN FOR YOUR PROCESSING APPLICATION



A Guide to Selecting the Right Oven for your Processing Application

1. What is your Application?

The possibilities are virtually limitless, from the common to the out-of-the-ordinary. Some applications include:

- ◆ Annealing
- ◆ Bonding
- ◆ Sterilization/depyrogenation
- ◆ Laboratory testing
- ◆ Clean process production
- ◆ Shrink fitting
- ◆ Curing
- ◆ Finish baking
- ◆ Burn-in
- ◆ Heat treating
- ◆ Drying
- ◆ Aging

Despatch manufactures high tolerance, high performance ovens for these and many other complex, high-volume applications – ovens that deliver consistent, reliable results. We also specialize in developing custom ovens and process solutions that speed production and improve product quality.

2. Batch or Continuous?

Batch Ovens

For applications where the load size or production volumes vary substantially, batch processing is a good approach. Batch ovens are also ideal for situations that require a high degree of flexibility in terms of process variables such as temperature or dwell (soak) time.

Continuous Ovens

Where a large quantity of similar product pieces are processed, continuous operation may be the optimal approach. Continuous ovens help ensure consistent thermal processing times for each part in high-volume applications, such as manufacturing electronic components or automotive parts. Continuous ovens may also allow several discrete processes to be combined, reducing material handling and increasing throughput.

If your application lends itself to a continuous oven, please contact Despatch Industries for technical assistance in selecting the appropriate continuous oven.

3. Chamber Sizing?

Chamber size depends on the size of the product or parts, the number of products in each batch, and the number of batches required per day to meet production requirements. If the interior space is too small, insufficient space between parts results in poor performance. If it is too large, space, time and energy are wasted.

When using gravity or forced circulating airflow, allow 2-3 inches (5.1 - 7.6cm) around each part and away from the oven walls.

When using forced recirculating airflow, parts still benefit from spacing, but can be loaded more densely vertically because airflow is distributed along the entire side wall. Parts should still be kept 2-3 inches (5.1 - 7.6cm) from the oven walls.

Lab or Bench-top Production Ovens

Because of their small, convenient size, these ovens are used for laboratory test and development applications, as well as production applications that require small batch loads. Despatch offers these ovens in chamber sizes from 1 cubic foot to 27 cubic feet (28 to 764 liters)

Cabinet Ovens

This size is referred to as a reach-in oven because they are ergonomically designed for easy loading and unloading. Cabinet ovens are floor-mounted, very efficient in terms of footprint and range in size from 4 to 96 cubic feet (113 to 2,718 liters).

Walk-In and Truck-In Ovens

Large batch ovens, can accommodate a wide variety of specific product/process needs. They are suitable for loading by fork truck or manually. Despatch offers a complete line of standard walk-in and truck-in ovens, as well as large custom batch systems.

4. Temperature Requirements?

When considering your application's temperature requirements, first note the minimum and maximum operating temperatures required. Other temperature considerations include:

- ◆ The required dwell time at temperature, and the overall cycle time needed.
- ◆ The type and amount of product load. The oven design will need to have sufficient heating capacity to bring the product to the desired temperature within the specified time.
- ◆ Whether the heat-up rate needs to be controlled or if the product can be allowed to reach temperature as quickly as possible.
- ◆ Any specific cool-down requirements.

5. Temperature Uniformity Requirements?

Uniformity is critical to consistent heat processing results. It is typically expressed as the maximum difference between the highest and lowest temperatures in a chamber at a specified setting. For example, $\pm 2\text{C}^\circ$ at 200C° .

Factors that influence temperature uniformity include:

- ◆ Cold air stratification (cold air entering chamber)
- ◆ Accuracy and response speed of controller
- ◆ Heat loss through oven walls
- ◆ Placement of workload
- ◆ Ability to direct the air through the chamber

6. Airflow Type?

Gravity Convected Heat

The simplest, most economical approach. Heated air rises, then returns to the heat source as it cools.

- ◆ Perfect for powders and other products that may be disturbed by forced air.
- ◆ Use when chamber temperature uniformity and time-to-temperature specifications are not critical.

Forced Circulating

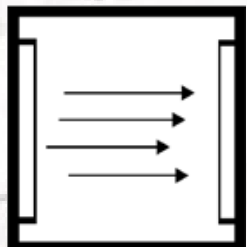
Incorporates a fan to create a vertical or horizontal airflow pattern. Best for products that air may pass vertically through or around.

- ◆ Significantly speeds time-to-temperature and heat transfer to parts.
- ◆ Requires proper spacing of parts to ensure optimal vertical or horizontal airflow.
- ◆ Despatch ovens feature a unique fan design that improves temperature uniformity and performance by directing air to all areas of the chamber.

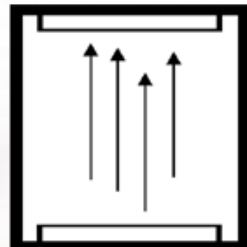
Forced Recirculating

Ideal for applications involving tray-loaded or shelf-loaded products that require precise temperature uniformity.

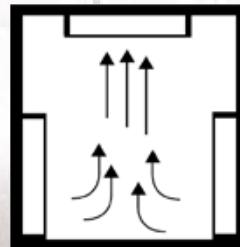
- ◆ The fan is strategically positioned so air moves across the heater and into the duct in the one side, and returns through the duct in the opposite wall.
- ◆ Creates a true horizontal/vertical airflow that ensures fast, consistent heat transfer.
- ◆ Provides precise and consistent process results, even when product is densely loaded.



Horizontal

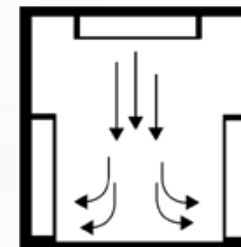


Vertical Up



Uniflow

A combination of vertical up and horizontal airflow typically used in walk-in and truck-loading ovens. Ideal for large products with an uneven shape.



Reverse Uniflow

Supply at top, return at sides. Used for large loads that require vertical airflow.

7. Design and Construction Quality?

Proper Oven Construction:

- ◆ Improves temperature uniformity and performance
- ◆ Reduces heat loss and energy expenses
- ◆ Simplifies cleaning and service

Oven Interior

Stainless steel provides excellent corrosion resistance and cleans easily. All Despatch interior oven surfaces are available in stainless steel.

Aluminized and mild steel are less expensive, but offer less protection against corrosion, rust and contamination.

Shelves should feature a sturdy, non-tip design, and allow for proper airflow and easy product loading/unloading.

Look for Applicable Standards

U.L. & C-UL listed oven, U.L. & C-UL listed control panel (available as an option), SEMI S2 and CE conformance are listings that are a sign of quality. They indicate that the oven or open industrial control panel has undergone extensive tests to verify reliability.

8. Special Processing Needs?

Flammable Materials - Class A Ovens

The National Fire Protection Association (NFPA) requires specially designed "Class A" ovens for processing products involving flammable solvents, volatiles or combustible materials.

Class A Ovens Feature:

- ◆ Forced exhaust, to keep flammable vapor concentrations well below the Lower Flammable Limit (LFL)
- ◆ A purge timer that operates in conjunction with forced exhaust to purge volatiles before heaters are energized.
- ◆ An airflow switch, required to prove exhaust airflow.
- ◆ Explosion relief panel, designed to relieve and vent pressure through an explosion relief area or plug.

Inert Atmosphere

Inert atmosphere ovens provide nitrogen or argon gas, which some processes require to prevent product oxidation at elevated temperatures.

- ◆ Inert gas is injected into the chamber, pressurizing the oven and replacing the oxygen.
- ◆ The chamber features high integrity welds and special motor seals to maintain the inert atmosphere and ensure process consistency.

Clean Process

Clean process ovens prevent particulate contamination of sensitive products through special construction and components, such as High Efficiency Particulate Air (HEPA) filters or other special air filtration systems, rounded corners for cleaning and continuous back welding to prevent migration of particles into the oven.

9. Temperature Controller?

Controllers play a key role in overall oven performance. Despatch uses microprocessor-based, digital proportioning controllers. Precise temperature control is achieved with a thermocouple sensor and solid state heater controls.

- ◆ Single setpoint controllers are simplest to use and are appropriate when the process requires one setpoint temperature.
- ◆ Programmable ramp/soak controllers are appropriate when multiple setpoint temperatures are required, or when the rate of heating must be controlled.

The Despatch Protocol Plus controller can function either as a programmable ramp/soak controller or as a single setpoint controller. An optional serial communications port (RS232/422/485) allows data communication between the oven controller and a PC.

With Protocol Manager software, the user may interface with up to 32 ovens from a single PC. This powerful tool provides data logging of critical operating information, recipe management and remote monitoring capability.

10. Match your Needs to the Chart on the Back Page.

Refer to the handy chart on the back of this guide to find the Despatch oven models that meet your needs. Remember, Despatch can customize any oven to your exact requirements.

Despatch Standard Oven Types

900 Series Benchtop Temperature Chamber



The 900E Series chambers are designed for high and low temperature simulation where high performance and close temperature tolerance are required. The units are ideal for small lot qualification testing, burn-in, life test, temperature cycling or research and development. Maximum temperature is 274°C (525°F). Models available: 0.4 to 1.78 cubic feet (11.3 to 50.4 liters).

LBB Forced Convection Ovens

A combination of horizontal and vertical airflow offers excellent temperature uniformity. Fast heat-up rates reduce cycle time and improve productivity. Digital controls regulate temperatures within tight tolerances. The fan and heater are top-mounted to prevent damage from spills. Maximum temperature is 204°C (400°F). Models available: 2.3 to 27 cubic feet (66 to 765 liters).



LAC High-Performance Oven



Horizontal-recirculating airflow provides exceptional temperature uniformity. Protocol Plus™ Microprocessor based controller is easy to use, and provides flexibility and two levels of password security. Cleaning is easy due to the baked enamel exterior, stainless steel interior and smooth door surface. Maximum temperature is 260°C (500°F). Models available: 1 to 18 cubic feet (28 to 510 liters).

LCC/LCD Clean Process



Forced horizontal-recirculating airflow that is 100% HEPA filtered and ISO Class 5 (Class 100) operation throughout the process cycle provide the ultimate in thermal processing. Smaller capacity units can be stacked for added capacity while maintaining a small footprint. The LCC/LCD is UL/C-UL listed, CE and SEMI S2 compliant for universal acceptance. Silicone-free construction is a standard option. Maximum temperature is 350°C (662°F). Models available: 1.6 to 14 cubic feet (45 to 396 liters).

PCO2-14 Polyimide Cure

The PCO2-14™ Polyimide Cure solution is a clean process oven designed for polyimide baking and curing applications. This high-performance, clean process oven (ISO Class 5/Class 100 recirculated airflow) offers many unique components, including a pressure relief system, an oxygen control system and a process monitoring system which allows the oven to achieve the strict oxygen level and atmospheric requirements involved in polyimide curing. Maximum temperature is 350°C (662°F). Model available: 14 cubic feet (396 liters).



SD Sterilization and Depyrogenation



The SD Sterilization and Depyrogenation oven is specifically designed to meet the stringent requirements of the pharmaceutical and medical device industry. It is available in different configurations to meet specific temperature and cycle time requirements. The SD is equipped with a HEPA filter to guarantee ISO Class 5 (Class 100) conditions throughout the entire cycle, a small footprint with large capacity, comprehensive validation support, touchscreen controls, and a flush exterior. Standard maximum temperature is 285°C (545°F) with option up to 320°C (608°F). Models available: 30 to 180 cubic feet (850 to 5,097 liters).

RA/RF Reach-In Batch Ovens



Forced horizontal recirculating airflow offers exceptional temperature uniformity in a reach-in oven. RFD Class A ovens meet NFPA 86 requirements for flammables and solvents. A microprocessor-based controller provides flexibility and accuracy. Delivers fast, consistent thermal processing results. Maximum temperature is 343°C (650°F). With custom options available for higher temperatures 538°C (1000°F). Models available: 4.2 to 35 cubic feet (119 to 991 liters).

Qmax Series

The Qmax Series High Performance Reach-in forced-convection oven is specifically designed to meet the frequent air changes and tight temperature uniformity required of the ASTM 5423 Type I & Type II oven specification. The Qmax exceeds the ASTM 5423 Type II performance requirement with a temperature variation of less than 6°C at 300°C while maintaining 100-200 air changes per hour. Ideal for testing, curing, aging and other thermal applications where tight temperature uniformity is required. Maximum temperature is 343°C (650°F). Model available: 4.2 cubic feet (119 liters).



TAD/TFD Truck-In/Walk-In Ovens

A truck-in/walk-in oven designed for industrial process versatility and dependability. Horizontal recirculating airflow ensures uniform temperatures throughout the oven. TFD Class A ovens meet NFPA 86 requirements for flammables and solvents. Fully assembled and factory tested. Maximum temperature is 343°C (650°F). With custom options available for higher temperatures 538°C (1000°F). Models available: 52.6 to 216 cubic feet (1490 to 6116 liters).



Process Oven Applications

| Common Applications | Interior Oven Size | Maximum Temperature | Air Flow Type/ Direction | Special Condition | Model |
|---|---|---------------------|--------------------------|---|--------------------------|
| Bench Top Ovens | | | | | |
| Testing, Burn-In, Temp. Cycling, R&D | 0.4 to 1.78 cu.ft. (11.3 to 50.4 liters) | 274°C/525°F | Horiz./Vert. Recirc. | | 900 Series |
| Testing, Curing, Drying, Annealing | 2 to 18 cu.ft. (66 to 510 liters) | 204°C/400°F | Nat. Convect | | LEB Natural Convection |
| Testing, Curing, Drying, Annealing | 2 to 27 cu.ft. (66 to 765 liters) | 204°C/400°F | Forced Convect | Pass Through (optional) | LBB Forced Convection |
| Testing, Curing, Drying, Annealing | 1 to 18 cu.ft. (28 to 510 liters) | 260°C/500°F | Horiz. Recirc. | | LAC High Performance |
| Curing and Testing Without Oxidation | 1.6 to 14 cu.ft. (45 to 396 liters) | 350°C/662°F | Horiz. Recirc. | Inert Atmosphere | LLC/LLD Inert Atmosphere |
| Testing, Curing, Drying, Bonding | 1.6 to 14 cu.ft. (45 to 396 liters) | 350°C/662°F | Horiz. Recirc. | ISO Class 5 (Class 100) (Class A, Inert optional) | LCC/LCD Clean Process |
| Curing, Drying, Sterilizing, Aging | 4.2 cu. ft. (119 liters) | 343°C/650°F | Horiz. Recirc. | Class A | RFD Batch |
| Reach-In Ovens | | | | | |
| Curing and Testing Without Oxidation | 9 to 29 cu.ft. (254 to 821 liters) | 538°C/1,000°F | Horiz. Recirc. | Inert Atmosphere | PN Inert Atmosphere |
| Sterilization, Depyrogenation | 30 to 180 cu.ft. (850 to 5,097 liters) | 285°C/545°F | Horiz. Recirc. | ISO Class 5 (Class 100) Pass Through | SD Clean Process |
| Preheating and Testing Pipes | 2.7 to 4 cu.ft. (76.5 to 113.3 liters) | 260°C/500°F | Horiz. Recirc. | Top Loading | PTC Top-Loading |
| Curing, Drying, Sterilizing, Aging | 4.2 to 35 cu.ft. (119 to 991 liters) | 343°C/ 650°F* | Horiz. Recirc. | Class A | RFD Class A Batch |
| Curing, Drying, Sterilizing, Aging | 4.2 to 35 cu.ft. (119 to 991 liters) | 343°C/ 650°F* | Horiz. Recirc. | | RAD Batch |
| Testing, Curing, Aging | 4.2 cu.ft. (119 liters) | 343°C/ 650°F | Horiz. Recirc. | Meets ASTM 5423 Type I and II Specifications | Qmax Reach-In |
| Walk-In Ovens | | | | | |
| Aging, Bonding, Curing, Drying, Finish Baking, Heat Treating, Burn-In | 52 to 216 cu.ft. (1,490 to 6,116 liters) | 343°C/ 650°F* | Horiz. Recirc. | | TAD Walk-In |
| Aging, Bonding, Curing, Drying, Finish Baking, Heat Treating, Burn-In | 52 to 216 cu.ft. (1,490 to 6,116 liters) | 343°C/ 650°F* | Horiz. Recirc. | Class A | TFD Class A Walk-In |
| Aging, Annealing, Curing | 360 to 2,207 cu.ft. (10,190 to 62,500 liters) | 343°C/ 650°F | Uniflow | Class A (optional) | S-Series Walk-In |

* Higher temperatures available upon request.

Note: Rating of "Class A" ovens is determined by flammable/volatile loading at a given operating temperature. Flammable/volatile ratings should never be exceeded. Property damage, bodily injury or death could occur if ratings are not followed. Please consult the factory if your process involves volatiles, combustible materials or solvents.

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