

06.06

White paper

Inside the box: Heated holding improves productivity

Executive Summary

With a few exceptions, heated holding cabinets have remained low-tech stalwarts of institutional feeding—heated boxes that safely store large quantities of cooked food long enough to be served hot. Behind this mundane view is a function within the food production system of practically any type of foodservice operation that can be mined for extraordinary gains in productivity and cost reduction.

One way to think about holding is that it “buys” time. The longer you can keep cooked foods looking and tasting as good as when they were freshly prepared, the more flexibility you have in the timing of other kitchen operations. This “extra” operations time allows you to cook well before the mealtime rush, cook in higher volume, produce your menu more efficiently, and reduce food handling and waste.

Most simple heated cabinets can keep food hot and appetizing for short periods. However, different foods react differently to periods of extended holding. The principle determinant of holding time is humidity control. Newer holding technology has been developed that automatically measures and maintains precise relative humidity in the holding environment. These self-styled “smart” holding cabinets are able to maintain the quality of many different types of foods for hours rather than minutes, giving operators tremendous flexibility in food production strategies, equipment arrays and labor utilization. Well-insulated holding cabinets are extremely energy-efficient and are among the least costly categories of equipment to operate and maintain. A full-size ENERGY STAR[®] qualified holding cabinet is estimated to *save nearly \$300 per year* in energy costs based on national averages.

With the wide range of technology currently on the market and several avenues for significant return on investment, foodservice operators should consider their holding cabinet purchases with as much care as other major equipment.

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Introduction

Among other things, a study of the history of manufacturing around the world for the past 30 years would show a continual move towards fewer, highly productive workers operating increasingly automated machinery from less space. That is a pretty fair description of the overall trend in foodservice kitchen operations, particularly among quick-serve restaurants. Underlying such thinking are principles of production that measure throughput and quality, and use this data as feedback for continuous improvement.

That's a fancy way of suggesting that most foodservice operators can look around and find ways that their kitchens can become better systems for manufacturing ready-to-eat food. One place that is often *overlooked* is holding.

With a few exceptions, heated holding cabinets have remained low-tech stalwarts of institutional feeding—heated boxes that safely store large quantities of cooked food long enough to be served hot. Behind this mundane view is a function in the food production system that can be mined for extraordinary gains in productivity and cost reduction. What a properly utilized holding function really does is suspend time. Ideally, food that is served after being held for any length of time will be just as good as when it was first cooked. The more time foodservice operators obtain through holding, the more potential they have to maximize the efficiency of practically every other function in the food manufacturing and delivery system.

Sound a bit more exciting? This white paper takes a closer look at the basic issues in foodservice production that holding addresses and how some of the newer science in holding can help restaurants, supermarket delis and banqueting operations increase throughput at lower operating costs by leveraging the value of existing equipment and labor to greater levels.

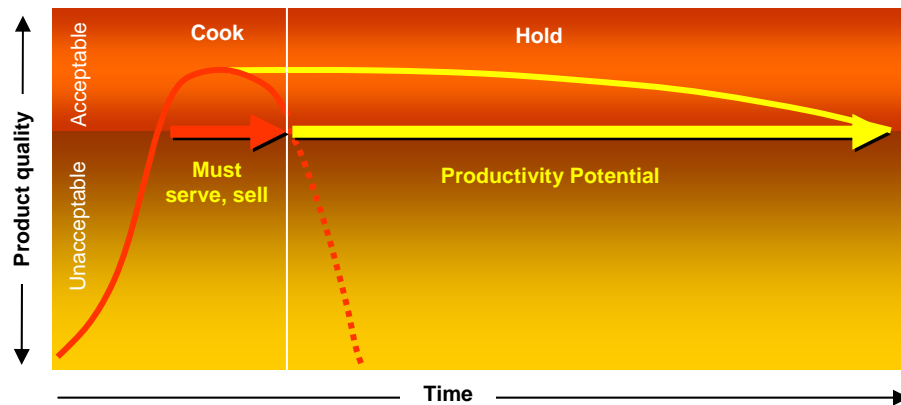
Buying time

Restaurants, delis and other retail foodservice operations put a great deal of resources into equipment and procedures that produce food with the consistent flavor, texture and appearance their customers have come to expect. Yet without some means to preserve this accomplishment for a reasonable amount of time, the effort—along with a significant portion of food—is wasted. That is where holding cabinets come in.

Heated holding cabinets are typically used to keep extra quantities of food hot and tasty until it is time to fill orders or re-supply a display or warmed assembly station. But when we think a little harder about this function, it's easy to see that what holding cabinets really do is produce extra time in the operation of your kitchen. This extra time—a function of how long foods can be held at acceptable quality—can be used in many ways to increase the utilization of equipment and improve the efficiency of processes and workers. Depending on the type of food and the quality of your holding equipment, the productivity potential can be significant (Fig. 1).

Fig. 1—Holding productivity potential

This graph illustrates the potential productivity available to foodservice operators when they include holding in their production strategies.



“Buying” extra operations time with heated holding cabinets allows you to:

- **Cook well before the meal time rush.** “Cooking to hold” results in more efficient production that often eliminates the need for additional cooking equipment and accessories. You can also save on energy costs by cooking during off-peak usage hours. Employees are free to focus on service, so more orders can be taken and served during peak meal times.
- **Cook in higher volume.** Cooking ahead of time allows operators to better utilize existing cooking equipment by cooking a series of full loads, rather than partial loads to order. Using higher capacity equipment that produces more product per load from the same floor space will save even more money.

- **Reduce product handling.** Full size holding cabinets can become a key part of a “reduced-touch” production process. Pans or grids of food can be removed from ovens or fryer baskets and placed directly into holding cabinets without re-racking for pick and pack staging, or as part of a cook/chill production process.
- **Reduce product waste.** Properly integrated holding capabilities preserve cooked food safely for significantly longer periods than heated display cases or warming lights. This enables you to sell more and throw away less over the course of the day.
- **Efficient menu production.** Using holding cabinets to hold a wide variety of foods for different lengths of time can help you plan your cooking sequence for the best utilization of equipment, labor and time.

These are just a few examples of how the general principle of heated holding can extend beyond simply keeping something warm until you need it. In every case, the benefits grow with the length of time that food can be acceptably held.

So how long *can* food be held? To answer that question, we need to take a closer look at the principles behind heated holding and how they are applied in the design of holding cabinets.

* * *

A subtle science

Holding is harder than it looks

One of the first things every aspiring chef learns is that cooking is a function of time, temperature and moisture. This is also true of holding with a few important differences.

When food is cooked it undergoes rapid and continuous change as it is subjected to extreme conditions. The finished or “done” state is simply a point to be reached along the path of change. To maintain this state for any length of time requires conditions that are much more subtle in relation to those of the food itself. Ideal holding conditions are those that cause very little in the way of further dynamic changes in the food and prevent changes from taking place naturally.

Most simple heated cabinets can do this for short periods. However, different foods react differently to periods of extended holding. Most fried and baked products, for instance, tend to dry out. Other foods become soggy as excess humidity builds up from covered dishes or “wetter” foods and forces the re-absorption of oils, juices or sauces that were released during cooking. The structure and flavor of casseroles, hot sandwiches or other multi-textured foods will begin to breakdown as drying and absorption affect ingredients differently.

Other factors

Size and cut makes a big difference in how long meats, poultry and fish can be held. Large whole or half joints, which are typically cooked in a slower process, usually hold well. The combination of crust and high ratio of volume to surface area make it easier to

preserve flavor and texture in a heated holding environment. For this reason, also, thick fish steaks can be held longer than thin fillets, which do not hold well at all.

With proper humidity control, longer holding times actually *improve* the flavor and consistency of certain meats, such as ribs. What is essentially a low-temperature slow-cooking environment continues to breakdown proteins in a gentle way, making the meat more tender. The absorption of seasonings and sauces into the product in this case, enhances the desired flavor and texture.

Altogether, the number of variables in play make it quite difficult to create the perfect holding environment indefinitely. The goal of holding—to suspend the results of cooking at their peak indefinitely—is elusive. But the benefits for production of a holding technology that can successfully hold a wide range of foods for hours rather than minutes would be significant.

Fig. 2—What can be held together?

This chart shows popular menu items grouped by common holding temperature ranges. Items in the same temperature range can generally be held together. Holding times will vary depending on the durability of the item and humidity in the cabinet. The Humidity column shows ideal relative humidity. With a controlled-humidity holding cabinet, much longer holding times can be achieved. These figures are based on Henny Penny HHC-900 and SmartHold® holding cabinets. Results will vary for other manufacturers.

Menu Item	Temp °F	Temp °C	Humidity
Fried chicken	175 - 185	79 - 85	10%
Corn dogs	165 - 175	74-80	10 - 20%
Fried fish	165 - 175	74-79	20 - 30%
Hamburger patties	165	74	45 - 50%
Hot dogs	165	74	40 - 65%
Bacon, ham, sausage	155 - 165	68-74	20 - 30%
Prime rib, roast beef, steaks (rare-medium)	155 - 165	68-74	30%
Pizza	150 - 160	66-70	15 - 20%
Scrambled eggs	140 - 160	60-70	40 - 70%
BBQ ribs	140 - 160	60-70	75 - 80%
Baked potatoes	140 - 150	60-66	60 - 70%
Rice	140 - 150	60-66	65 - 80%
Pancakes, biscuits, rolls	140 - 150	60-66	30%

* * *

A critical function

Heat = Food Safety

Keeping cooked foods at safe internal temperatures prior to serving is a straightforward task for any insulated, thermostat-controlled heated holding cabinet: A certain cabinet temperature yields a certain internal food temperature.

Maintaining even heat throughout the cabinet is managed in several ways. Size and configuration of the units themselves is often the first determinant. For example, single or

multi-drawer holding cabinets conserve heat within a relatively small space. Full-size holding cabinets with racking for multiple pans usually require some means of dispersing heat throughout the space. A convection system with fans circulating heated air is the most common. Some designs build heating elements into the cabinet walls to heat the space evenly.

It should be noted that heated display and merchandising cases are able to safely “hold” hot cooked food for short periods of time. Where most basic models fall short of holding cabinets is in their ability to circulate hot air effectively and maintain even heat in all locations of the case. However, some merchandisers address these issues effectively through specific even heating technology and higher wattage heating elements that can maintain temperature with rear doors open or off for serving.*

Heat + Humidity = Food Value

In a “warming” environment of heat only, most cooked foods quickly dry out, shrink, and actually lose heat that is otherwise stored in its moisture. Under such conditions, it doesn’t really matter how long you can keep cooked foods at safe internal food temperatures since the result is too unappetizing to be sold. That’s why an equally important priority of heated holding is maintaining food quality, sometimes referred to as its “value.”

In a holding environment, the main determinant of a food’s cooked value—its taste, texture, appearance and moisture content—is humidity. Humidity in a basic thermostat-controlled holding cabinet comes from the food itself. For short periods of time, both conditions of food safety and food value can be met. However, maintaining food value over longer periods requires some semblance of control over the amount of humidity in the cabinet at any given time.

Humidity control—the critical factor

Relative humidity inside a holding cabinet can vary a great deal, depending on the type and quantity of food being held, how it was cooked, how long it has been held and how often new products are added into the cabinet and how often the doors are opened and closed. Most “dry” heated holding cabinets have a manual slide vent that allows moist air to escape when humidity builds to an undesired level. “Humidified” models also have water pans—particularly those that use fans to circulate heat—offering a passive means of adding humidity through evaporation. This combination of evaporation, moving air and external venting is intended to maintain some degree of humidity control in the holding environment.

For limited menu applications or operations that simply don’t require holding times much beyond an hour, this level of technology is all that’s necessary. Obtaining the benefits of longer holding times requires the ability to measure and maintain the relative humidity inside the holding environment in a much more precise way.

* [Henny Penny HMR heated merchandisers](#) feature Therma-Vec Even Heat Process and independently-controlled radiant heat over each well.

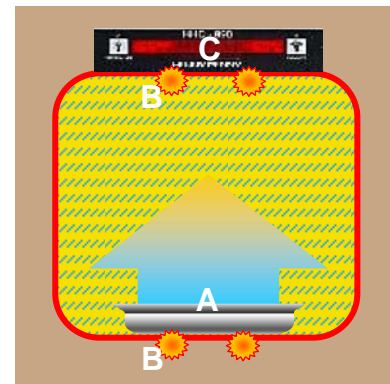
Recent advances in holding technology incorporate humidity control sensors to monitor conditions in the cabinet. “Smart” cabinets, like the [SmartHold®](#) series from Henny Penny, take control a step further by using the measurement of relative humidity to control the introduction or venting of moisture in order to *maintain* a desired level. In the Henny Penny units, for example, a patented system actually permits the user to select any level of relative humidity between 10 and 90%, and to maintain that level indefinitely or adjust it in 1% increments. This level of control is achieved by the capability to also *remove* humidity through a sensor controlled venting system, a feature quite rare among holding cabinets.

Sensor feedback control also does a much better job than conventional thermostats of maintaining precise temperatures throughout the cabinet. One major advantage that emerges is the ability to hold at temperatures under 150°F (65°C). In effect, this is a “proofing” mode that allows holding cabinets to proof bread and other bakery items.

Fig. 3—How SmartHold works:

SmartHold technology links heated water pan (A), fans, and ventilation in a “closed loop” control system illustrated at right. Sensors (B) constantly monitor conditions within the cabinet and signal automatic adjustments necessary to maintain selected humidity level (C). This enables the operator to:

- Hold at any humidity level between 10 and 90% relative humidity, and at any temperature in either proofing mode [80-140°F (27-60°C)] or normal holding [160-210°F (71-99°C)].
- Select or adjust humidity level in one-percent increments.
- Generate and maintain the precise desired level throughout the holding cycle automatically.



* * *

The payoff

The perfect holding environment for any food

The overwhelming advantage to precise humidity control in a holding cabinet is that foods no longer have to dry out, shrink, or turn soggy over a period of time in exchange for staying hot. Operators can create the perfect holding environment for any type of food simply by selecting the right temperature and humidity level.

Such technology isn’t particularly cheap. It’s important to gauge the holding needs of your operation honestly to see if such control is worth more than it costs. On the other hand, it’s hard to overestimate the benefits this quantum leap in control has to offer over conventional hot boxes.



Longer holding times, increased utilization

First, such smart systems have the potential to hold many popular items almost indefinitely. Certainly, holding times measured in hours, rather than minutes. And this

extra time *does* come cheap in terms of labor—the programmable process is completely automated. Countdown timers also help employees keep track of holding times for individual trays of food.

Secondly, the precise control of temperature and humidity means you can hold just about any item for a long time. This is a major benefit, because conventional wisdom has it that many items simply *can't* be held for long, if at all. The gains in productivity can accrue across your entire menu.

Third, a smart holding cabinet can provide holding and proofing capabilities with one piece of equipment. You'll save on the expense and floor space of a separate proofing cabinet. Increased utilization, alone, can pay for the unit.

Smooth out production, labor

A cook/hold component in foodservice production has the effect of smoothing out the production process. Having plenty of high-value food ready to serve eliminates spikes in production during busy meal times, after school, or when the team bus shows up after a game.

Cooking in large batches well ahead of time also reduces the need for scarce skilled labor, such as chefs, to be present throughout the day as is the case with cook-to-order production.

Increased demand can be met utilizing normal food prep and service conditions with no additional labor and little disruption to existing employee functions. On average, this results in fewer staff hours and lower labor costs. Over time, these savings represent a considerable return on investment.

Low operating costs

If a piece of equipment is designed to earn you more money the longer it remains on, it had better be energy efficient. In fact, holding cabinets are excellent candidates for the most energy efficiency of any category of major kitchen equipment. Good quality units—with or without humidity sensor control—are insulated across every dimension, including the doors and even below the control modules. A full perimeter door gasket and self-closing doors help keep the environment sealed, as well.

These and other features allow the [HHC-900 Series](#) from Henny Penny to achieve an idle energy rate of 40 or less watts per cubic foot of interior cabinet volume. This is good enough to earn the ENERGY STAR[®] mark, widely recognized as identifying the most energy efficient appliances.

In terms of dollars and cents, the savings add up. According to a recent North American Association of Food Equipment Manufacturers (NAFEM) publication, ENERGY STAR-qualified foodservice equipment can save operators “hundreds, even thousands, of dollars a year in energy costs.” A single qualifying heated holding cabinet, for example, might save its owner \$281 per year based on average energy costs across the country.[†]

[†] http://www.nafem.org/client_files/publications/inprint/2004_spring.pdf

If you're looking to save money by purchasing a low-cost, non-insulated holding cabinet, you should look at the lifecycle costs that include energy consumption (Fig 4). Test results published in a presentation by *Foodservice Equipment Reports* at the 2005 Hospitality Supply Management Spring Conference show a significant cost difference over five years of operation:

Fig. 4—Go with energy efficiency
 Be sure to compare energy efficiency when specifying holding equipment. Insulated holding cabinets cost far less to own over time.

Lifecycle Costing		
Bench test example: Hot Holding Cabinets		
	Non-insulated	Insulated
Initial Cost	\$1100	\$2100
5 yr. operating cost.*	\$3550	\$1360
Total lifecycle cost	\$4650	\$3460

*measured energy plus nominal maintenance for estimating purposes

Source: <http://www.ism.ws/ConfPastAndOnlineDaily/Files/May05/YE-Ward.pdf>

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Conclusion

High-quality insulated heated holding cabinets—particularly those with appropriate humidity control—offer foodservice operators significant opportunities to improve food value, throughput and productivity. The ability to hold a wide variety of foods for long periods of time is like putting production time in the bank. The reduction in waste, alone, becomes a major justification. The key to achieving these advantages lies in equipment that offers more precise control of the holding environment. The flavors, textures and moisture content of various cooked foods react differently to heat and humidity. The ability to set and maintain ideal holding conditions for popular menu items can mean the difference between twenty minutes and two hours. This translates into smoother production schedules, better equipment utilization throughout the kitchen, and lower labor and operating costs.

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For information on more productive holding, please contact: Tim Kasler, Henny Penny, (937) 456-8440, tkasler@hennypenny.com

Visit Henny Penny at www.hennypenny.com

Sources and background

Citation: Sample average energy cost savings

http://www.nafem.org/client_files/publications/inprint/2004_spring.pdf

Citation: Bench tests, cost differences insulated vs non-insulated

<http://www.ism.ws/ConfPastAndOnlineDaily/Files/May05/YE-Ward.pdf>

Background: How to buy an energy-efficient holding cabinet

http://www.eere.energy.gov/femp/procurement/eep_hot_food.cfm

Background: Equipment life cycle costs

http://www.fermag.com/sr/v7i5_sr_lifecycle.htm

Background: Holding cabinets earning the ENERGY STAR® mark

http://www.energystar.gov/index.cfm?c=hfhc.pr_hfhc

Background: Strategic holding benefits

<http://www.foodservice411.com/fesmag/archives/2004/10/> (Requires free registration to view article)

Additional information

Henny Penny SmartHold® Proofing and Holding Guide

The ability to effectively and accurately hold hot foods has never been possible until now. SmartHold Heated Holding Cabinets have the unique ability to produce longer holding times with significantly improved food quality over any other heated holding cabinet. After two or more hours, food will still look fresh and moist. The extended holding times and improved food quality can reduce food costs and minimize waste.

Food is actually better left *uncovered* inside a SmartHold cabinet because of the cabinet's ability to create and continuously monitor and maintain the perfect holding environment. Leaving food uncovered is also less labor-intensive, produces less waste, and minimizes clean-up effort and time.

The chart on the next page shows recommended SmartHold cabinet settings for optimizing holding times and food quality for some common menu items. Many of the suggestions can be applied to a number of other similar dishes that are not included here. For additional recommendations, please contact one of our corporate chefs.

When holding a variety of menu items at the same time, keep in mind that some foods are more durable than others and can be held at a wider range of settings. Conversely, there are items that require a narrower range of temperature and humidity settings. When holding a variety of items, the temperature and humidity settings should be closer to those suggested for the more sensitive foods or midway between foods with similar durability.

When selecting the proper temperature and humidity settings, keep in mind that food temperatures must remain above the minimum required safe holding temperature [USA minimum: 140°F (60°C)]. If the cabinet door(s) is opened frequently, then the temperature will have to be set slightly above the minimum required safe holding

temperature. The higher temperatures suggested in the chart are intended for situations where the door(s) will be opened frequently.

Proofing times will vary slightly depending upon the type and size of dough to be proofed. Typically the dough should double in size. **NOTE: Perishable foods cannot be safely held while proofing!**

Menu Item	Cabinet Temperature	Cabinet Humidity	Comments
BBQ ribs	140 – 160°F (60 – 70°C)	75 – 80%	Longer hold times (8 – 16 hours) will help to tenderize the meat and infuse the sauce flavor.
Cabbage rolls in sauce	140 – 160°F (60 – 70°C)	50 – 60%	This is a durable item if covered $\frac{3}{4}$ or more by sauce. If less sauce is used, increase the humidity to 70% – 75%.
Casseroles	140 – 160°F (60 – 70°C)	50 – 70%	The humidity setting will vary depending upon the desired crispness of the crust, if any.
Baked chicken (bone-in)	140 – 160°F (60 – 70°C)	60 – 65%	This is a fairly durable item that can be subjected to settings outside the recommended parameters.
Dough (Proofing)	95°F (35°C)	90%	Follow the guidelines of a specific recipe, if available.
Scrambled eggs	140 – 160°F (60 – 70°C)	40-70%	This is a delicate item. It is important to conform to these settings.
Baked fish	140 – 160°F (60 – 70°C)	80 – 85%	Thinner portions should be held at higher temperature and humidity settings.
Hamburgers	165°F (74°C)	45 – 50%	This is a delicate item. It is important to conform to these settings.
Pizza	150 - 160°F (66 – 70°C)	15 – 20%	Thin crust requires less humidity, and overall this is a fairly delicate item.
Pot pies	140F – 160°F (60 – 70°C)	30 – 40%	This is a fairly durable item that holds heat well, and the humidity setting may be increased, depending upon the desired texture of the crust.
Baked potatoes	140 – 150°F (60 – 66°C)	60 – 70%	This is a very durable item. A much lower humidity can be used if held for less than 2 hours.
Scalloped potatoes	140 – 160°F (60 – 70°C)	60 – 70%	This is a fairly durable item that holds heat well, and the humidity setting may be adjusted, depending upon the desired texture.
Rice	140 – 150°F (60 – 66°C)	65 – 80%	If held for an extended period of time, it is important to conform to these settings.
Steamed vegetables	140 – 160°F (60 – 70°C)	80 – 85%	This is a delicate item, but lower humidity settings can be used for shorter periods of time.

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