Hospitality Review

Volume 19
Issue 2 *Hospitality Review Volume 19/Issue 2*

Article 8

1-1-2001

Extending Holding Time for Hot Foods

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Abstract
Humidifying the air inside a hot holding cabinet can greatly extend the holding time for hot foods by retarding the quality degradation of the food due to moisture loss. Not all cabinets are equally effective in maintaining temperature and humidity. A rudimentary understanding of how heat and moisture are transferred to the food will help operators select the cabinet that best meets operation's needs. The authors address what works and why.

Keywords
Douglas Nelson, Food and Beverage

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Extending the holding times for hot foods can help reduce both labor and food costs. However, before those savings can be realized, there are two main concerns that must be addressed. First, the food must maintain a temperature of at least 140°F (60°C) in accordance with the Food and Drug Administration's 1999 Food Code.[1] The second concern is the prevention of product degradation to the point where it is no longer of acceptable quality.

Based on the nature of the two problems, it would appear that by correcting one, the other would be made worse. If the holding temperature is raised to maintain the required product temperature, then the elevated temperature will increase the rate of product degradation. Conversely, if the holding temperature is lowered to maintain product quality, then the food temperature may drop to unsafe levels. While the two problems seem to be in conflict, there is one simple solution to both: humidify the air surrounding the food.

The use of humidity to keep food from drying out is not a new concept. The practice most likely began with chefs putting pans of water in the bottom of their hot holding cabinets and ovens. Today almost every manufacturer of hot holding cabinets has a humidified model. One of the earliest manufacturers of humidified holding cabinets has successfully demonstrated the benefits of adding humidity with various products from peas to eggs to hot muffins.[2]

Research conducted in the

Arthur Avery Research Laboratory at Purdue University clearly demonstrated the importance of humidity in extending the holding time for hamburger patties. That study found that moisture loss was the only significant change in the quality of the patties during holding. By increasing the humidity in a hot holding cabinet to approximately 95 percent, it was possible to serve hamburgers that had been held for two hours with sensory qualities that were not statically different from those of freshly cooked patties.[3] That study also found that it was possible to hold the patties at an internal temperature greater that 140°F (60°C) with an air temperature of 160°F (71°C). The air temperature in holding cabinets that are not humidified is usually set at approximately 180°F (82°C) to maintain the proper product temperature. Hamburger patties held at 180°F (82°C) in a cabinet that is not humidified can typically only be held for 10 minutes or less before a significant loss of quality will occur.

Benefits accrue

Extending the holding times for hot products by using humidified holding cabinets can greatly benefit an operator in several ways. Longer holding times can reduce the number of employees required to operate the facility. By extending the holding times it is possible for the same person to cook the food before the start of a meal period and then serve the food during the meal. This reduces the need to hire a second person to serve while the first person cooks. This type of multi-tasking is extremely important in today's tight labor market.

In addition to the impact on labor, extending holding times can reduce waste. With short holding times, managers must accurately project demand or run the risk of under producing and experiencing product outs or over producing and having to discard items that have exceeded their allowable holding times. If the product can be held longer, then the need for accurate projections becomes less of a concern. Instead of having to throw away food after 10 minutes, it can be held until it is served. The only time surplus products would be thrown away is at the end of the serving period, instead of several times during the period. To maximize the benefits associated with extending hot holding times, operators must be able to identify equipment features that are vital to producing a stable holding environment. To be able to accurately identify important features and gauge their impact on the holding process, it is important to have a basic understanding of how adding humidity extends holding times.

Humid air slows loss

Many foods that people find desirable contain a significant amount of moisture. The moisture contained in products like meat plays an important role in the perceived juiciness of the product. Moisture in the food can either be "bound" molecularly to the food or be what is called "free water." It is the free water that mixes with the fat in meat that liquefies during the cooking process to give the meat its "juicy" characteristic.[4] The more free water in a product, the moister it is perceived to be. For a product to remain moist, the free water must stay in the product. If a moist product is placed in a dry environment, then the free water will evaporate and the product will dry out. By humidifying the air around the product, the rate at which it dries can be greatly reduced. Air can only hold so much moisture. As the air becomes more humid, the rate at which it pulls moisture from food slows down. An analogy could be made to crowding many people into a small room; the first few people can enter the room fairly easy, but as the room fills up, it gets harder and harder for new people to enter. The more moisture you have in the air, the harder it is for the water molecules to leave the food and enter the air.

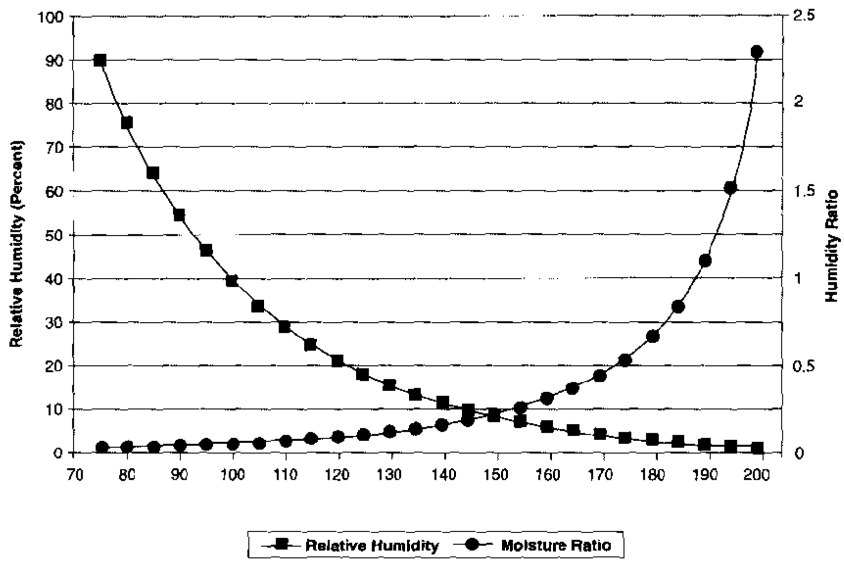
Hot air holds moisture

Air at a given temperature and pressure only holds so much water. The amount of moisture in the air compared to the amount of moisture that the air can hold is an effective working definition for the relative humidity of the air. The actual definition of relative humidity is based on the partial pressure of the water vapor in the air divided by the partial pressure of the water vapor when the air is saturated at that temperature and pressure. The air is saturated when it is holding all the water vapor that it can. However, dividing the mass of water in the air by the total mass of water the air can hold is a reasonably accurate definition, and is much easier to understand and use.

The amount of moisture that the air can hold, and consequently the relative humidity, is temperature dependent. In other words, as the temperature increases, the amount of moisture that the air can hold also increases. Using information from the tables found in the *ASHRAE Handbook*[5] it is easy to see the impact of rising temperature on the amount of moisture that air can hold, and consequently the relative humidity of the air. For example, air at 75°F (24°C) can hold 0.01882 pounds of moisture per pound of dry air. In a warm kitchen it is not unusual to see temperatures around 75°F (24°C) and 90 percent relative humidity. At 90 percent relative humidity the air is holding approximately 0.01694 (0.01882x 90 percent) pounds of water per pound of dry air. If the air temperature were raised to 180°F (82°C), the typical holding temperature for non-humidified holding cabinets, then its relative humidity would drop to 2.6 percent. At 180°F (82°C), air can hold 0.6578 pounds of water per pound of dry air.[6]

When the air is heated in something like an oven or a dry holding cabinet, the only moisture in the air is what was there before heating and what evaporates from the food. Hence, while the air still contains approximately the same weight of water, its relative

Figure 1
Moisture held by air



Graph reflects the total amount of moisture air can hold at a given temperature (humidity ratio) and the effect of heating air initially at 75°F and 90 percent relative humidity.

humidity drops dramatically because it is capable of holding more water. Returning to the crowded room analogy, raising the temperature of the air would be equivalent to increasing the size of the room. If the room is filled to capacity and then a wall is removed, increasing the capacity, then the room is no longer at 100 percent capacity and more people may enter.

Figure 1 shows how the moisture-holding capability of the air changes as it is warmed. If room air is heated without adding moisture, then the resulting relative humidity of room air would go down. What is humid to the point of being uncomfortable at 75°F (24°C) is extremely dry at normal holding temperatures.

Dry air shortens times

The air and the food will exchange moisture until a point of equilibrium is reached. At that point the water activity is approximately equal to the relative humidity of the air. If the air is drier than the food, the food will lose moisture to the air. How fast the moisture is lost depends on the difference between the relative humidity of the air and the water activity of the food. If the difference is great, then the rate of water loss by the food is great, and the food will quickly suffer quality degradation. If the air is only slightly drier than the food, then the rate of moisture loss by the food will be very small and the product can be maintained for extended periods of time without a significant loss of quality.

If a moist food, such as meat, is placed in a non-humidified cabinet, then the difference between the water activity of the food and the relative humidity of the air will be very great, as will the rate of moisture loss by the food. In a very short period of time the quality of the meat would deteriorate to the point that it would no longer be suitable to serve. If moist products are to be held for long periods of time, then the air surrounding the food must be humidified to ensure product quality is maintained.

For example, pieces of meat with a water activity of 0.95 could be held for approximately 18 times as long in a humidified cabinet set at 90 percent relative humidity, as compared to the non-humidified cabinet. This is because the driving force behind the moisture leaving the meat is the difference between the water activity of the food and the relative humidity of the air. When the cabinet has a relative humidity of 90 percent, the difference is 5 percent. In a non-humidified cabinet at 180°F (82°C) with a relative humidity of 2.6 percent, the difference is 92.4 percent, resulting in a driving force that is approximately 18 times as large as that for the humidified cabinet. Since the driving force behind the moisture loss in the humidified cabinet is 1/18 of that of the non-humidified cabinet, the rate of moisture loss for the meat in the humidified cabinet is also 1/18 that of the non-humidified cabinet. Therefore, it will take the meat approximately 18 times as long in the humidified cabinet to lose enough moisture to degrade the product's quality to the point where it is no longer servable. If the meat could have been held for 10 minutes in the non-humidified cabinet, then it could be held for three hours in the humidified cabinet.

100 percent is bad

A water activity of 1.00 is pure water. Since people usually don't drink their entrees, it is safe to assume that the water activity of food is something less than one. Meat and poultry have water activities of .95 or higher, while for dry items such as crackers, it is usually down around 0.50.[7] Just as air takes moisture from food in its attempt to reach 100 percent relative humidity, food will take moisture from the air in its attempt to attain a water activity of one. Even a moist food such as meat will absorb water from the air if exposed to 100 percent relative humidity.

Just as losing too much moisture causes loss of quality in food, so does gaining too much moisture. If hamburger is exposed to air at 100 percent relative humidity, then it will absorb water and develop a gray color and steamed flavor, neither of which is very desirable. Therefore, if the holding times are to be extended without damaging the product, the relative humidity of the air needs to be approximately equal to or slightly less than the water activity of the product. Too little moisture and the product dries out; too much moisture and the product can become water logged and lose color, texture, and flavor.

Moisture loss cools product

Another important problem associated with moisture loss is its effect on product temperature. It takes a large amount of energy to vaporize water, approximately 400 times what it takes to raise the temperature of an equivalent weight of beef 1°F (or approximately 700 times what it takes to raise the temperature of an equivalent weight of beef 1°C).[8] As moisture leaves the food, it takes with it the energy required to vaporize the moisture. While some of the energy needed to vaporize the water comes from the air, the majority of it comes from the food. As the food loses moisture and the corresponding energy, its temperature drops. How fast the temperature drops depends on how fast the food loses moisture; how far it drops depends on the relative humidity and the temperature of the air.

It is possible to predict the temperature of the food based on the air temperature and the relative humidity. The temperature of moist food will be approximately the saturation temperature of the air. The saturation temperature of the air is the temperature at which the amount of moisture the air is holding is all that it can hold.

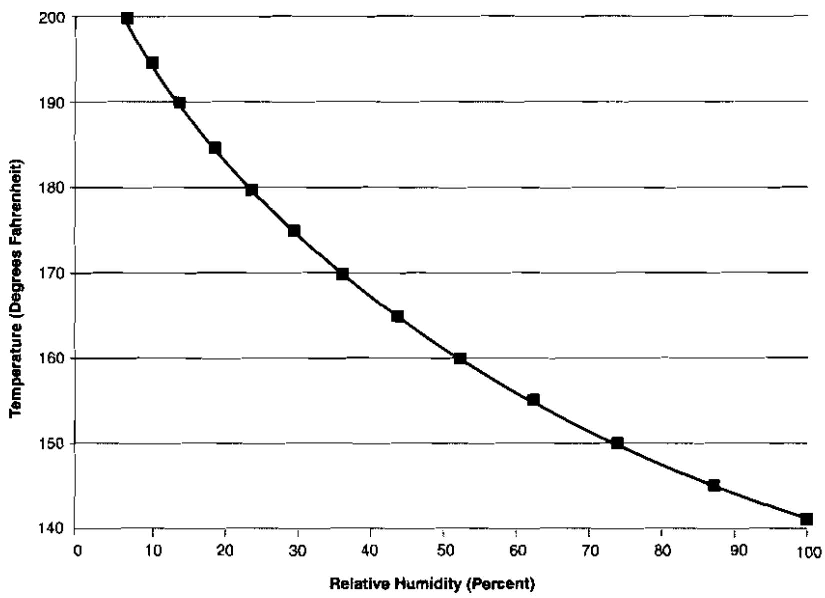
Returning to the earlier example with relative humidity, if the air is 75°F (24°C) with a 90 percent relative humidity, then it contains 0.01694 pounds of water per pound of dry air. Air would be saturated with that amount of moisture at 72°F (22°C).[9] The temperature of a moist product held under those conditions would drop to approximately 72°F (22°C). If the air is heated without adding moisture, then the temperature at which the air would be saturated with 0.01694 pounds of moisture per pound of dry air, and consequently the product temperature, would still be 72°F (22°C).

In a non-humidified holding cabinet, the product temperature would not actually drop all the way to 72°F (22°C). In a closed cabinet, the moisture lost by the product is absorbed by the air, raising the relative humidity inside the cabinet. The product's temperature drop is also reduced by changes in the water activity of the food. As it dries, its water activity decreases, resulting in a reduced rate of moisture and heat loss. While the product temperature would not likely fall all the way to 72°F (22°C), it would drop below 140°F (60°C) unless the air temperature was high enough (approximately 180°F or 82°C) to replace some of the heat lost by the food due to evaporation.

Cabinet reduces heat loss

By humidifying the cabinet, it is possible to maintain safe food temperatures with lower air temperatures. Figure 2 is a graph of

Figure 2
Temperature and humidity combinations to maintain temperature of 140°F (60°C)



the air temperatures versus humidity required to maintain a product temperature of 140°F (60°C). The figure clearly shows that as the level of humidity increases, the required air temperature decreases. Instead of operators having to set the cabinet temperature to 180°F (82°C) in order to maintain a safe food temperature, by increasing the relative humidity to 95 percent, the air temperature can be dropped to approximately 150°F (66°C) and still maintain a safe food temperature.

Lower temperatures mean less energy loss through the walls of the cabinet. The less energy lost through the walls, the lower the energy cost to run the cabinet. The driving force that causes heat to move through a wall is the temperature difference between the two sides of the wall. The amount of heat moving through the wall is directly proportional to the driving force.[10] If the air temperature in the cabinet is lowered from 180°F (82°C) to 150°F (66°C), then the driving force, the temperature difference between the inside and outside wall temperatures, for a cabinet in a 75°F (24°C) kitchen would decrease by approximately 24 percent. This would result in a 24 percent drop in energy required to maintain the cabinet's temperature.

There are two basic ways to humidify a holding cabinet, steam injection and a heated water tank. Today's holding cabinets are generally humidified with a heated water tank in the bottom of the cabinet. This method is favored over steam injection because of the lack of reliable humidity sensors required for steam injection. For steam injection, a hygrometer must be used to control relative humidity. At the high temperature found in holding cabinets, most currently available hygrometers are too expensive, not accurate enough, or easily fouled. Therefore, steam injection is not widely used. The advantage of the water tank method is the ability to control the relative humidity by controlling the water and air temperatures, something that is much easier to measure. Additionally, the water tank method allows for the portability of the holding cabinet. Steam injection requires the unit to be attached to a water supply or boiler.

Problems do exist

While the water tank method is currently the most common method, it is not without problems. A serious drawback to using the water tank method is its slow recovery time. It can take as long as 20 minutes for the cabinet to recover both temperature and humidity after the door has been opened.[11]

Another problem identified was stratification within the cabinet. While the temperature within a humidified cabinet is consistent throughout the cabinet, the relative humidity is not. A study conducted at Purdue University revealed that the relative humidity in a cabinet could vary by as much as 10 percentage points between the top and the bottom of the cabinet.[12] For example, if the top of the cabinet has a relative humidity of 90 percent, then the bottom half will have a relative humidity of 80 percent. This humidity stratification can either be a problem or a benefit, depending on the application. If an operator needs to store all items at 90 percent relative humidity, then the stratification will limit either the capacity of the cabinet, or reduce the holding times for items stored in the bottom. On the other hand, if the operator is holding items that require different relative humidity levels in the same cabinet, then the stratification can be used to store each item in its ideal humidity range.

Size is factor

In order to ensure as rapid a recovery time as possible, as well as minimize energy costs, a number of features should be considered when selecting a cabinet. One of the most important features is the size of the water tank and the amount of surface area exposed to the air. The size affects both the maximum obtainable humidity level in the cabinet and the recovery time after the door is opened. Just as larger doors would allow more people to enter a room faster, the larger surface area of the water tank allows water vapor to leave the water and enter the air faster. Cabinets with larger water tanks are capable of obtaining greater relative humidity levels and will have faster recovery times.

Cabinets with tanks that are too small may not even be able to generate the high relative humidity levels required to hold moist foods.

Three full-size commercial holding cabinets were tested in the Arthur C. Avery Research Laboratory at Purdue University to determine the maximum obtainable relative humidity levels and recovery times.[13] The cabinets were provided for testing by Cres Cor®, a food service equipment manufacturer located in Mentor, Ohio. The depth of the water tank was the same for all three cabinets, approximately 3.4 inches. The surface area was different for all three cabinets: 75, 277, and 306 square inches. As predicted, the cabinet with the smaller water tank was not able to generate enough water vapor to achieve relative humidity levels above 40 percent. The other two cabinets were both able to generate relative humidity levels in excess of 95 percent. Because the cabinet with the smaller water tank was not able to generate high enough relative humidity levels, it was not included in the recovery time study. The results of the recovery time study on the remaining two cabinets were very useful in illustrating some of the more important features to look for when selecting a humidified cabinet. To protect the anonymity of the company that supplied the cabinets for this test, the two cabinets will simply be referred to as Cabinet A and Cabinet B.

Cabinet A had the fastest recovery time and the least amount of humidity stratification of the two cabinets. Both cabinets were set as close as possible to maintain 95 percent relative humidity. To check recovery time the cabinets were allowed to stabilize temperature and humidity; then the top door was opened for 15 seconds and closed.

Differences reported

The temperature and humidity levels were measured using two hygrometers, one placed in the middle of the top half of the cabinet and one placed in the middle of the bottom half of the cabinet. The average humidity level in the top half of both stabilized cabinets was approximately 94 percent. Once the door was closed, Cabinet A took an average of seven minutes for the relative humidity level to reach 90 percent and 10 minutes and 38 second to reach 93 percent. Cabinet B took more than twice as long to reach 90 percent (17 minutes and 56 seconds), and more than three times as long to reach 93 percent (36 minutes and 51 seconds). In addition, Cabinet A exhibited less humidity stratification; the difference between the relative humidity at the top sensor and the bottom sensor was 4.5 percentage points for Cabinet A compared to11.1 for Cabinet B.

Clearly there are design differences between the two cabinets that led to the rather significant performance differences reported. A closer examination of the design differences between the two cabinets revealed that no one feature accounted for all the performance differences, but that they were due to the size of the water tank, power requirements, air movement, and air/moisture leakage.

In addition to a large water tank being required to achieve high humidity levels, water holds significantly more energy per unit of volume than does air. Therefore, the larger the water tank, the more energy available for recovery, hence the shorter the recovery time. The surface area of the water tank is also important to recovery. The greater the surface area, the faster the moisture and heat can leave the water and the shorter the recovery time. Cabinet A's water tank was approximately 10.5 percent larger than Cabinet B's water tank. This meant that Cabinet A had 10.5 percent more energy stored in the water that could be used to evaporate the water, resulting in a shorter recovery time. In addition, the larger surface area of the water tank in Cabinet A meant that more water could evaporate at one time, again speeding recovery. Another problem with a smaller water tank is that it would need to be filled more often than a larger tank.

Power affects recovery

The energy stored in the water will be used up in the first few minutes of the recovery period; after that, all the energy required for recovery comes from the air and water heaters. The overall power rating for Cabinet A was 2112 watts, compared to 2000 watts for Cabinet B. The difference between the power ratings was only 5.6 percent, not large enough by itself to account for much of the large difference in recovery times for the two units.

Another important factor is the distribution of the power. Cabinet B had a 1000-watt heater in the water and a 1000-watt heater in the air. While the power distribution for Cabinet A was unavailable, its performance suggests that it has a greater percentage of the power directed to the water heater. It took Cabinet B approximately five minutes to recover the air temperature compared to 10 minutes for Cabinet A. The slower air temperature recovery time indicates that more energy was being supplied to the water than to the air. Once the air temperature recovers, the air heater turns off. This means that after five minutes the power draw for Cabinet B was only 1000 watts. When the air heater shut off, the cabinet was still over 12 minutes away from recovering to 90 percent relative humidity, while for Cabinet A, when the air heater turned off, the relative humidity was already close to 93 percent. While on the surface it would seem more important in maintaining food temperature to recover air temperature than recover relative humidity, this is not true. Because there is so much energy in water vapor, it is more important in maintaining food temperature that the relative humidity be recovered so the water stops evaporating from the food. Therefore, while more power is important, the distribution is equally important. Cabinets will recover faster if more of the power is directed toward the water tank.

Airflow is important

Recovery time is also impacted by airflow within the cabinet, in particular, how the air moves past the water tank. The faster the air moves across the surface of the water, the faster heat and moisture will be transferred into the air. The faster they are transferred to the air, the faster the recovery time.

It is also important to have good airflow to prevent the stratification of temperature and humidity within the cabinet. Both cabinets pulled air from the cabinet into a fan at the top, heated the air, then returned it to the cabinet via channel(s) that ran vertically inside the cabinet: Cabinet A had two channels, one on each side, while Cabinet B employed a single channel on the back wall. Air left the channel(s) and was returned to the cabinet through a series of holes in the channel(s). Air will take the path of least resistance as it returns to the cabinet, meaning as much air as possible will move through the first set of holes in the channel(s).

Holes control flow

Cabinet B had uniformly placed holes, all the same diameter, running the length of the cabinet. Cabinet A varied the number and size of the holes in the air channel, locating more holes of greater diameter near the bottom of the cabinet. By increasing the number and size of the holes near the bottom, Cabinet A was able to maintain uniform airflow throughout the entire height of the cabinet. As a result, recovery time was decreased, as was stratification. In Cabinet B, the airflow was not uniform throughout the entire height of the cabinet; this resulted in a slower recovery time and increased stratification.

It is important that the cabinet be tightly sealed. Escaping air will take with it heat and humidity that must be replaced. Leaking cabinets require more energy to maintain desired temperature and humidity levels. In addition, they will have a longer recovery time since the heat and humidity lost when the door was opened must be replaced, as does the heat and humidity that is leaking from the cabinet with the air during the recovery process. A tight seal around the door is a must; however, it is not the only place that place that air can leak from a cabinet. While both cabinets had a small amount of leakage around the door seal, Cabinet B also had leaks around the metal joints in the cabinet. Leaks can be detected by moisture condensing on the exterior of the cabinet. Small leaks will appear as a fog on the metal similar to what is seen on a bathroom mirror after a hot shower. Larger leaks can create droplets of water that can run down the sides of the cabinet. Cabinet B had several larger leaks around the top joint, which contributed to the longer recovery time.

Another important feature is adequate insulation in the walls, top, bottom, and doors. Because of the high relative humidity, the dew point for the air will be relatively close to its temperature. If the walls of the cabinet are not well insulated, then the temperature of the walls can be below the dew point. When this happens, moisture will condense on the walls. Condensation makes it harder to maintain the desired temperature and humidity levels in the cabinet.

In addition to the condensation problem, poorly insulated cabinets are less energy efficient. Both cabinets tested were well insulated and little or no condensation was observed on the interior walls. Both cabinets used an inch and a half of fiberglass insulation, giving them an R-value of approximately 6.5 foot squared hour-degree Fahrenheit per BTU (British Thermal Unit). The greater the R-value, the better the cabinet is insulated and the less heat will be lost through the walls.

Research is necessary

It is best to begin the selection process by researching operational needs based on a current menu and anticipated future changes. Cabinets that are capable of maintaining high humidity levels tend to be more expensive than other models. If an operation does not intend to hold moist food items for extended periods of time, then it might be financially better to purchase one of the less expensive non-humidified cabinets. If one of the humidified cabinets is required, then observing the operation of several different cabinets is an important part of the selection process. The most important features to look for to ensure that the cabinet will be able to maintain the proper temperature and humidity are as follows:

- large water tank with at least 275 square inches of surface area
- at least 2000 watts of power with more power directed to the water heater than the air heater
- larger and/or more numerous holes in the return air channels nearer the bottom of the cabinet
- R-value in the wall of at least 6, the higher the better
- tight seal around the door and no leaks through the sides, top, or bottom of the cabinet

The first feature to look at is the water tank. It should hold as much water as possible and have a surface area of at least 275 square inches. Some of the better models can hold more than 10 gallons of water. Airflow inside the cabinet is another important consideration. The air intake is typically near the top of the cabinet and the air is channeled back into the cabinet either at the back or sides. To ensure uniform airflow, the openings where the air is returned to the cabinet should be larger and/or more numerous the farther they are from the fan. While the size and position of the air holes is a good indication of airflow, it is still a good idea to check for uniformity by holding a piece of paper in front of the air returns. The paper should be deflected the same amount at all levels. It is also important that the airflow across the top of the water not be restricted in any way. If the water tank has a cover, the cabinet should be operated with the cover removed.

Heater size and power distribution along with the R-value are also important features to check. The best way is to talk to a company representative. They can also be checked by observing the operation of the cabinet by turning it on to 160°F (71°C) and 95 percent relative humidity. Once it comes to the temperature, the door should be opened. Excessive condensation on the interior of the cabinet indicates that it is not adequately insulated.

Power distribution can be checked by closing the door for 30 seconds and timing how long it takes the water temperature to recover. Better cabinets will take 10 minutes or less to recover. If the cabinet has a temperature display for the water, or a light indicating when the water heater is on, these can be used to indicate when the water temperature has recovered. If the unit does not have either, the temperature of the water can be taken when the door is opened and then again after 10 minutes. To be considered recovered the temperature after 10 minutes should be within one degree Fahrenheit of the initial temperature.

The final critical check while the cabinet is operating is to look for leaks. If the cabinet is leaking, steam will be observed leaving the cabinet, or condensation will form on the cabinet. The better unit will have little or no steam leaking around the door seals, and no other discernable leaks.

Another important consideration is how easy it is to drain and clean the cabinet. While all cabinets must be approved for use in commercial operations, they do not all require the same amount of work to keep clean. All of the seals, doors, racks and interior surfaces should be easy to clean. Models that have racks and rack supports that are easy to remove are generally easier to clean. When checking the ease of draining the water tank, it is important to note what happens to the water as it leaves the cabinet. Can it be direct to a drain using a hose, or must it be positioned over the drain to prevent water from spilling onto the floor? Either option may be acceptable depending on the facility in which the cabinet will be used.

Finally, operators may need to consider portability. If the cabinet must be moved, the unit should have heavy-duty wheels that roll easily over kitchen floors and thresholds and electrical requirements that allow for movement from one location to another.

Overall the new generation of humidified hot holding cabinets can be a great asset to almost any food service operation, whether fast food, fine dining, or banquet service. However, not all cabinets are equally effective in maintaining temperature and humidity. By using the principals of heat and humidity transfer presented in this article, it is possible to select a cabinet capable of maintaining specific holding environments and thus extending holding times for a wide variety of food.

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