Section Two

Making Specific Equipment Choices
CHAPTER NINE

Food Preparation Equipment
Mixers
- Mixers include three general types:
  - Planetary or standard (most commonly used)
  - Spiral (used for high volume dough preparation)
  - Vertical-cutter mixer (for rapid chopping and cutting)
- Mixers range in size from 5 quart to 140 quart models
- Stainless steel bowls are preferred
- Selection of the mixer should be based on its intended use (because of its impact on future repair needs)
- Fewer repairs are generally required for:
  - Fixed speed models (as compared to variable control)
  - Gear transmission models (as compared to belt driven)
- Most common mixer attachments are flat beaters (paddles), wire whips, dough arms or hooks, and pastry knives
- If purchasing a used mixer, make certain that it has a bowl guard (older models may not) or that a retrofit bowl guard kit is available
- If purchasing a larger mixer, consider getting:
  - A bowl dolly or truck for moving heavy bowls on floor models
  - Adaptors for smaller bowls
  - Power lift and tilter
  - Timer
  - Bowl scraper
  - Grinder, dicer, or chopper attachments
  - Greater horsepower

Slicers
- Consider the size of blade as they cannot be retrofit with a larger size
- Smaller manually operated models with 10” knives are ideal where occasional slicing is done, automatic models are time and labor saving, but do require monitoring
- Larger models with 12” knives are best when large volume slicing is done
- Select horsepower needs based on the product to be sliced
- Gear driven motors are better for “tougher” foods
- Determine needs for thickness of slice
- Stainless steel parts are preferred

Food Processors
- Food processors can be used to dice, slice, grate, shred, and julienne food
- Commercial model should always be used, never a home-style unit
- Most durable models will be made from stainless steel
School nutrition directors act as Trusted Advisors in decisions about food processors to modify texture to accommodate special needs of the students

Toasters
- Toasters can be either slot or conveyor style
- Slot sizes are smaller for standard size breads and larger for buns, bagels, and Texas-style toast
- Evaluate the crumb trays, as these need to be cleaned frequently
- Consider a shut-off option for when toast might become caught
- Determine the size of toaster to purchase based on peak production needs
- Consider slot toasters for low volume needs, conveyor toasters for large volume
Food Preparation Equipment

Introduction
Food preparation equipment needs will vary with the school menu and with the type of foods that are purchased. If school nutrition programs use more convenience foods, it is obvious that fewer pieces of food preparation equipment, such as mixers or food processors, will be required. If a slicer is needed, a small slicer may be adequate. On the other hand, the use of convenience foods will increase the need for other pieces of equipment, such as refrigeration. School nutrition directors need to consider these choices carefully for their operation. If these Trusted Advisors decide to prepare foods from scratch, mixers, vertical cutter mixers, slicers, and food processors are likely be needed.

Mixers
This piece of equipment is defined as a vertical mixer with an overhead motor. There are three general types of mixers. They are planetary, spiral, and vertical-cutter mixers. Planetary mixers are the most commonly used of the three and are used for most of the mixing needs in a school nutrition program.

Standard or planetary mixers are a valuable and versatile piece of equipment because of the variety of attachments. There are numerous manufacturers and models of mixers on the market. Mixers range from table top 5 quart models used for smaller mixing needs to 140 quart floor models geared to high volume institutional use.

<table>
<thead>
<tr>
<th>Mixer Capacity</th>
<th>Application</th>
<th>Space Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 quart</td>
<td>Specialty Mixer</td>
<td>Counter</td>
</tr>
<tr>
<td>12 quart</td>
<td>Small-General Purpose Mixer</td>
<td>Counter</td>
</tr>
<tr>
<td>20 quart</td>
<td>General Purpose Mixer</td>
<td>Counter or Floor</td>
</tr>
<tr>
<td>30 quart</td>
<td>Light/Heavy Duty Mixer</td>
<td>Floor</td>
</tr>
<tr>
<td>40 quart</td>
<td>General Purpose Mixer</td>
<td>Floor</td>
</tr>
<tr>
<td>60 quart</td>
<td>Pizza Dough Mixer</td>
<td>Floor</td>
</tr>
<tr>
<td>80 quart</td>
<td>General Purpose Mixer</td>
<td>Floor</td>
</tr>
<tr>
<td>140 quart</td>
<td>Heavy Duty Mixer</td>
<td>Floor</td>
</tr>
</tbody>
</table>

Spiral mixers are different in that the bowl rotates as well as the beater attachment unlike planetary mixers where only the beater rotates. Spiral mixers are generally used just for high volume dough preparation. Spiral mixers are thought to result in better development of doughs (more gentle kneading), and less heating of the product during mixing which prevents too early a fermentation of the yeast.

Vertical-cutter mixers are unique in that they have extremely rapid blade action and are most commonly used for chopping and cutting (similar to a blender) rather than whipping or beating.
ingredients. Their greatest advantage is speed as they cut or chop food in one-fourth to one-tenth of the time needed in other machines. Disadvantages of the vertical-cutter mixer include that they are noisier, more difficult to operate as timing is critical, and do not whip very well. Staff members need to be well trained because mixing times are generally so short. If one is not careful, it is possible to make juice out of salad greens.

Vertical-cutter mixes come in both countertop (10, 15, and 20 quart) models and floor mounted (25, 40, 60, 80, and 130 quart) models. Safety features include an interlock device so that the machine cannot be operated unless the bowl and lid are locked into place, and a viewing portal so that the product can be viewed without opening the lid. Pulse control or “jog” buttons help to control the cutting of products that require very little time to prepare.

**Purchase Recommendations for Standard/Planetary Mixers**

- Mixing bowl size will vary with the type of mixer purchased
  - Recommend purchasing the size required for the largest recipe that will be prepared with the mixer
  - Remember to include possible expansion of the ingredients during mixing (e.g., a 20 quart bowl is needed for mixing 4 quarts of cream)
  - Manufacturers’ Web sites often have guides to help with this decision
  - Most commonly used sizes are 20, 30, and 60 quart models

- Purchase stainless steel bowls if you can afford them
  - Tinned bowls eventually have to be retinned and may cause color of some foods, such as mashed potatoes, to darken
  - Stainless steel bowls last longer and school nutrition directors generally find that they are worth the extra expense
  - The expression “pay me now or pay me later” is how some school nutrition directors view the decision of purchasing stainless steel bowls rather than tinned bowls

- Horsepower (HP) varies from 1/6 to 6 HP
  - Purchase more HP (1/2 greater than usual for that size mixer) if preparing heavy doughs, such as breads and bagel mixes
  - Compare manufacturers and models to purchase for your operational needs

- Consider how many speeds you will need for your recipes
  - Three speeds are the most commonly purchased
  - Models are available with 3-9 speeds

- If a larger mixer is purchased and you want to fit smaller bowls, consider getting adapter rings
  - Consider also purchasing smaller mixer attachments
  - It is more common to purchase two different mixers if mixing needs are widely divergent

- Consider the intended use of the mixer in relation to future repair needs. Fewer repairs are generally required for:
  - Fixed speed models (as compared to variable control which operate in the same way that a rheostat used in some light fixtures operates with a continuous number of settings rather than a simple on and off switch)
  - Gear transmission models (as compared to belt driven transmission models)
  - Decide carefully on which attachments are necessary for your recipes; the most common mixer attachments are shown in the table below
## Types of Mixer Attachments

<table>
<thead>
<tr>
<th>Name</th>
<th>Flat Beater (or paddles)</th>
<th>Wire Whip</th>
<th>Dough Hook (or Arms)</th>
<th>Pastry Knife</th>
</tr>
</thead>
</table>

**Attachment**

**Consistency of Batter**
- Medium
- Light
- Heavy
- Heavy

**Mixer Speed**
- Medium
- High
- Low
- Low

**Examples of Products**
- Cakes, icings, vegetables
- Eggs whites, frostings
- Bread, bagel, pizza doughs
- Pastry

- Bowl guards should be standard on any mixer purchased
- Bowl guards and safety training are important for employee safety when using mixers
- If using an older model, a retrofit bowl guard kit is available
- If purchasing a floor model mixer, consider purchasing the following:
  - A bowl dolly or truck for moving heavy bowls on floor models
  - Adaptors for smaller bowls
  - Power lift (to raise the bowl to the agitator) and tilter
  - Timer (some have auto shut-offs, some are programmable)
  - Bowl scraper (which minimizes the need for bowl scraping during mixing)
  - Grinder, dicer, or chopper attachments (that are placed on the power take-off hub located on the front of the overhead motor)
  - Greater HP
- Additional attachments include:
  - Bowl splash covers to control the splashing of wet and dry ingredients
  - Bowl extension attachments that increase the height of bowl to minimize whipped ingredients from being thrown from the bowl

### Slicers

There are also numerous manufacturers of slicers on the market. Most are designed to slice high volume amounts of meat and cheese quickly and efficiently. Slicers vary in size, depending on the need of the school nutrition program. Smaller manually operated models with 10” knives are ideal for occasional slicing tasks. Larger models with 12” knives are best for large volume slicing tasks. The slicer may be used for:

- Slicing hot or cold meat in uniform thickness
- Slicing cheese in uniform thickness
- Slicing vegetables, using an optional accessory
Most models are operated either manually or automatically. Automatic slicers allow for staff
to set the slicing thickness, but perform other tasks at the work station while monitoring the
slicing task.

It is important to evaluate how the blade sharpeners operate. Generally, blade sharpeners are built-
in. Some are easier to use than others depending on the brand and model. Most slicers should be
designed to dismantle for easy cleaning and sanitation.

Advantages of slicers include that they:
- Are labor saving (as compared to slicing by hand)
- Are faster than slicing by hand
- Provide maximum yield with less waste
- Produce more uniform products of consistent thickness

**Purchase Recommendations**
- Consider purchasing a rolling cart with locking brakes so that the cart does not move
  while it is being used and can be moved to a variety of locations
- Purchase a slicer that has a lever which allows the slicer to be more easily tilted up for
  cleaning underneath, preventing the employee from having to lift a heavy dangerous
  piece of equipment
- Purchase a separate machine for slicing breads if bread slicing is a need, because slicers
  work best for meats and cheese
- Consider blade size needs carefully, purchasing the largest size needed
- Slicer blades cannot be retrofitted after purchase
- Popular sizes for slicer blades are 10” and 11 ¾”
- Consider horsepower need based on the products to be sliced
- Popular horsepower would be one-third and one-fourth
- Purchase more horsepower when cheese slicing is a frequent task
- Gear driver motor blades are better for “tougher” foods (such as meats and cheeses)
  which might cause belt slippage with belt-driven motors
- If considering a great deal of uniform slicing, select:
  - Automatic carriage to eliminate the need to be moved by hand
  - Carriage fences to prevent product from slipping
  - Automatic portion control scales (attached to receiving bed)
  - Chute attachments which hold slicing products (such as long vegetables) in place
- Determine needs for thickness of slices
- Most slicers will cut from paper thickness diameter up to ¾”
- Some slicers will cut thickness up to 1 ½ inch
- Evaluate slicing speed when purchasing an automatic slicer
- Slicer speeds may range from 1 slice per minute up to more than 55 per minute
- Evaluate the plug and cord configurations to determine if these are appropriate for the location.
- Buy stainless steel parts if at all possible
- Consider stainless steel as the preferred material for knife blade durability and cleaning
- Decide between separate or attached blade sharpeners
- Consider an infrared lamp for keeping meats hot that are sliced throughout the serving period
**Food Processors**

There are numerous manufacturers of food processors. Most food processors are compact in design to use less counter space. Food processors are used to modify texture of ingredients, decrease product waste, and to speed up the production or preparation time of some recipe ingredients. In addition, today’s food processors can be used to dice, slice, grate, shred, and julienne food. Continuous feed units process food quickly in uniform pieces and assist in labor saving.

**Purchase Recommendations**

- Use a commercial model, never a home-style unit
- Consider the types of cutting tools or plates needed
- For example, slicing, pulping, grating, or dicing plates
- Consider purchasing a processor made from stainless steel
- Consider portability needs of the food processor
- Evaluate the quality of the products made from the food processor
- Consider textural modification needs of the special needs students

School nutrition directors are **Trusted Advisors** in knowing the best methods to modify the food texture. For example, food processors can be used to help produce meals for special needs children:

- Chopped foods that are in bite-sized pieces (although this may also be accomplished with a knife)
- Ground foods that are soft and small enough to swallow with little or no chewing
- Pureed foods that are smooth in texture and the consistency of mashed potatoes

**Toasters**

Toasters are often used in school nutrition programs that serve school breakfast. Toasters are occasionally used in school nutrition programs that serve toasted buns, bagels, or Texas-style toast during the lunch meal. Toasters come in two general types, which are slot and conveyor toasters. The slot sizes may be either standard size to accommodate regular slices of bread or large size to accommodate large bread items.

**Purchase Recommendations**

- Evaluate ease of cleaning the crumb trays in the toasters
- Evaluate a shut-off option as a safety feature
- Consider an adjustable heat control feature to adjust for different size bread products
- Consider a feature which allows either one or two sided toasting for more flexibility
- Evaluate peak production needs and purchase accordingly
- Consider slot toasters for low volume needs
- Consider conveyor toasters for larger volume needs
- Assess the energy needs of conveyor toasters
The three general types of mixers are planetary, spiral, and vertical-cut mixers with planetary mixers being the most commonly used. Spiral mixers are used for high volume dough preparation and vertical-cut mixers are used for extremely rapid chopping and cutting of ingredients.

Generally, mixers are available in sizes from 5 quart to 140 quart and may be ordered with a variety of attachments, horsepower capabilities, and number of speeds. As a rule, stainless steel bowls are preferred, due to durability. The intended use of the mixer in relation to its future repair needs should also be considered. Fixed speed models (as compared to variable control) and gear transmission models (as compared to belt driven transmissions) are generally considered more reliable. The most common mixer attachments are flat beaters or paddles, wire whips, dough arms or hooks, and pastry knives. Additional attachments might include a grinder, dicer, or chopper.

There are numerous manufacturers of automatic and manual slicers. Most are designed to slice large quantities of meat and cheese, but slicers will vary in size, speed, horsepower, thickness of slices, and added attachments. Slicers should be purchased with the largest blade size needed as slicers cannot be retrofit with larger blades. Most commonly purchased slicer blades are either 10 or 12 inches. Built-in blade sharpeners are one of the more common attachments. Again, gear driven motor blades and stainless steel parts are considered more reliable, particularly if tough foods will be sliced.

Food processors are another common piece of equipment in some schools. Most are compact in design to use less counter space. They may be used to dice, slice, grate, shred, and julienne food and may be particularly useful for textural modification needs of students in the school nutrition program.

Toasters can be either slot (for small volume needs) or conveyor type (for large volume needs). Slot sizes may vary for standard size breads or may be larger for buns and bagels or Texas-style toast. The ability to easily clean crumb trays is an important consideration in purchasing a toaster. The appropriate size of toaster to purchase is generally determined from peak production needs.
Cooking Equipment: Ovens and Ranges
General Guidelines for All Ovens
- General purchasing guidelines include checking door handles, length of preheating time, oven interior size, cleanability, insulation, hinges, number of racks, types of mountings possible
- Basic use includes loading/unloading quickly, following manufacturer’s recommendations for venting, avoiding the use of foil, using good quality pans, filling ovens to capacity, preheating for the shortest time possible, cooking at the lowest recommended temperature for roasts and the highest for baked products, and not opening the door during cooking
- School nutrition director’s experience elevates them to the valued position of Trusted Advisor in knowing which pieces of cooking equipment best meet their operational needs

Convection Ovens (forced air ovens)
- Very common in schools
- Can be gas or electric, but gas will still need electricity for the fan
- Advantages include faster cooking, good browning, efficient use of oven space, compact size, possible cost savings if it replaces the need for two ovens
- Disadvantages include increased cooking losses, thick surface crust or uneven cooking in some foods, blowing of fragile batters, higher purchase price, and greater utility costs
- Purchasing recommendations including checking the size of the oven interior, the slides, preheating time, oven exterior material, insulation, automatic shut-off control for fan
- Best practices include setting the thermostat higher before loading, avoiding over/under loading, not using tall pans, loading/unloading quickly, precooking fragile batter, adding a pan of water when preparing meat, fish, and poultry, shutting off the fan during loading

Conventional Ovens
- Traditional style of oven, often replaced today with a convection oven

Deck Ovens
- Best flexibility is obtained from separate controls for top and bottom
- Recommended oven height will vary with the products being prepared

Reel Ovens
- Only used in very large volume school nutrition programs

Conveyor Ovens
- Used for large volume preparation of pizza or hot sandwiches
- Advantages include consistent product quality, less labor, speed of production
Disadvantages include that it can only be used for thinner foods, and that more maintenance is generally required.
Purchasing considerations number of belt speeds, availability of side doors, different settings for zone cooking, availability of viewing doors.

**Microwave Ovens**
- Combination microwave and infrared, convection, or steam are available.
- Both power level and size of microwave should be considered.
- Only commercial ovens should be used in school nutrition programs.
- Advantages to microwave ovens include faster heating, no need to preheat, energy efficiency, low cost, minimal maintenance, and compact size.
- Disadvantages include uneven cooking, hot/cold spots, need for skilled repair, limited use for tenderizing and cooking meat products, lack of browning during cooking, and problems with overcooking of foods.

**Turbochef® Ovens**
- Removes the cold air layer around food to speed up the cooking process.
- Available as small countertop units which are stackable.

**Cook by Light Ovens**
- Uses a combination of intense light and infrared energy.
- Available as small countertop units which are stackable.

**Range Tops**
- Gas versions are more durable burners, no preheating needed, infinite heat settings, more energy efficient than electric.
- Electric versions are slower to heat/cool, less prone to fires from grease spills, require less maintenance and ventilation than gas.
- Open cooktops are more energy efficient, less affected by dented and bowed pan bottoms, used more for speedy, intermittent cookery.
- Closed cooktops are used to hold several warm stock pots, are more flexible for the size of stock pot used on them, take longer to preheat.

**Induction Cooktops**
- Use a different type of heating method which requires a magnetic metal pan.
- Not all magnetic pans heat equally well on an induction cooktop.
- They are also energy efficient, easier to clean off, and cooler in the kitchen.

**Basic Use of Range Tops**
- Pots should be larger than the burner.
- Gas flames should be adjusted to the bottom of the pan and the color blue.
- Pans should make full contact with the range and be kept covered.
Cooking Equipment: Ovens and Ranges

Introduction

Cooking equipment represents a huge long-term investment. Types of cooking equipment will vary from one school to another, depending on operational needs. In fact, although traditional cooking methods using ranges and cooktops may still be used in some schools, newer technologies now offer faster and more efficient (although often more expensive) alternatives. The use of convection ovens, for example, is now extremely common in schools. Combi-ovens are now a very common equipment choice because they use steam for cooking and are discussed in the chapter on steam cooking equipment. Healthy methods of food preparation are an important consideration in cooking equipment. Faster cooking technologies and those that prepare food with less fat have become more popular for healthy school environments.

Selection of cooking equipment is one of the most critical decisions because food simply cannot be prepared without proper cooking equipment. Purchase considerations include specific factors for each type of equipment as discussed in this chapter. In addition, overall considerations include the number of years of warranty coverage, what exactly is covered by the warranty, and how easy it might be to get repair service. Examples have occurred where a school has had to pay labor for a two hour drive to the school and a two hour drive back in order to have a service person fix or calibrate an oven. In areas where the local equipment repair company is not a factory authorized service agent or trained on specific name brands, paying this travel time can be a huge cost and an important part of the decision of what equipment to buy.

General Guidelines for All Ovens

Many oven choices are available, including:
- Conventional
- Deck
- Reel or revolving
- Convection
- Conveyor
- Microwave
- Turbochef®
- Cook by light (by Flashbake®)

Purchase Recommendations

- Handles on doors should be checked for heat as well-insulated handles can be touched without a potholder
- Consider glass doors which allow food to be viewed without opening the door
- Check preheat times for the shortest among manufacturers
- Check the oven interior size to make certain that it can accommodate the size of pans that will be used
- Be sure that the oven can be easily cleaned
- Confirm the level of insulation
- Evaluate the insulation by brand (at least four inches is preferred)
Door hinges should be heavy duty, counterbalanced (to stay flat), should open level, and hold up to 220 lb. (90 kg)

Consider production needs when verifying standard number of oven racks, and order additional oven racks to meet projected needs

Consider in advance what type of installation will be done, mountings can be:
- Platform (concrete base)
- 6” (15 cm) legs for floor
- 4"(10 cm) legs for countertop equipment
- Equipment stands

Plan the delivery as ovens are one of the heavier pieces of equipment

Ovens require fire suppression equipment, most (but not all) require ventilation

**Basic Use**

Appropriate use of the ovens would suggest the following practices:
- Load the oven as fast as reasonably possible to minimize heat loss
- Do not add uncooked pans of food to an oven where food is already cooking or uneven cooking will result
- Keep vents closed unless the product should not be exposed to moisture (follow manufacturers’ instructions)
- If possible, avoid the use of aluminum foil covers on pans because it may:
  - Limit browning
  - Affect heating efficiency and cooking times
  - Affect moisture loss in the product (unless it is supposed to be used to minimize moisture loss)
  - Get caught in the fan of convection ovens and require a service person to repair
- Keep tables, carts, or racks nearby for easy loading/unloading
- Use good quality pans because:
  - Warped pans may cause uneven cooking
  - Very shiny pans may also cause uneven cooking
  - Aluminum pans will conduct heat better
  - Dull finish pans will also conduct heat better
- Fill ovens to capacity to avoid energy waste
- Cook foods immediately after preheating the oven to minimize energy use
- Cook at the lowest recommended temperature for meat products and cook at the highest recommended temperature for baked products to save energy
- Do not open the door during cooking to maintain product quality and save energy

Newer types of ovens have expanded the choices for school nutrition programs. Some experts have suggested that more changes have occurred in oven designs in the last 20 years than any other kind of kitchen equipment. The school nutrition director’s experience elevates them to the valued position of *Trusted Advisor* in knowing which pieces of cooking equipment are best to meet their operational needs.
Convection Ovens

Convection ovens are very commonly used in school nutrition programs for a variety of products including breads, cookies, cakes, pies, meats, seafood, pizza, potatoes, and other products. These ovens offer a cooking chamber with a fan to circulate hot air. Convection ovens are not energy efficient but offer faster more even cooking of products on multiple shelves in the oven, because of the movement of air. These ovens are available as either gas or electric, but gas convection ovens will still require electricity for operating the fan. Gas ovens need to be vented under a hood or through a flue stack. Flue diverters and adaptors are available from the manufacturer.

Convection ovens are available in single, double stacked, and roll-in models. Each cooking chamber of a standard convection oven has 11 rack guides and is often supplied with five racks, although additional racks may be purchased. Roll-in models are designed for larger volume cooking. Roll-in ovens allow a cooking rack of pans to be easily wheeled into the cavity, thereby eliminating the need to manually load the oven, shelf by shelf.

Convection ovens are available in two depths. The standard depth model accommodates 18” x 26” sheet pans in a right to left loading position. The extra deep depth model accommodates 18” x 26” sheet pans in a right to left and/or front to back loading position. Oven capacity will range from 10 to 22 sheet pans, depending on whether the oven is single or double deck (10-11 for single deck and 20-22 for double deck) and the model. The doors may open and close either independently or simultaneously. Doors are offered with glass window panels or solid stainless steel. The decision of what size convection oven to buy will depend on several factors including:

- Quantity of product that needs to be prepared at any given time (shorter meal periods will require food to be prepared faster or in advance)
- Production needs for different products (if it is possible to prepare one product in advance and place it in a warming cabinet before another product is prepared, fewer ovens will be required)
- Number of temperature settings needed for different products (because one cannot bake a cake at 325° F (163° C) at the same time that one is cooking pizza at 400° F (204° C)
- Size of sheet pans to be used in the oven (if sheet pans are specifically sized for the oven, this will provide for the most efficient use of space in the oven)

School nutrition directors functioning as a Trusted Advisor should therefore evaluate convection oven needs carefully. Mistakes in purchasing the wrong size can be avoided if school nutrition directors plan a production schedule for key pieces of cooking equipment, particularly for convection ovens because they are used so heavily. The production schedule will show a time chart of what is to be prepared in the oven in 15 minute or half hour intervals, how many pans will be in the oven, and at what temperature. School nutrition directors are best able to determine the size of oven (or ovens) needed after this production schedule has been developed. They are Trusted Advisors in this very critical decision making process.

Manufacturers also offer various control packages. The control packages range from electronic ignition, mechanical thermostats and dial-type timers to solid state controls that are digitally displayed to computer based controls that are programmable. Coding features are also offered in the control packages such as fan delay, force cool-down fan mode, and moisture injection.
Advantages to convection cooking include:
- Faster cooking
- Good browning
- Efficient use of oven space
- Compact oven size for the quantity that can be produced
- Lower cost if one convection oven can replace multiple conventional ovens

Disadvantages to convection ovens may include:
- Increased cooking losses (decreased yield)
- A thick surface crust may develop on food
- Uneven surface effects on fragile products (due to “wind currents”)
- Blowing of fragile batters, meringues (a fire can happen if the batter or meringue is blown into fan)
- More expensive than conventional ovens

Recipes need to be adjusted from conventional oven recipes for use in a convection oven. Oven temperature, length of cooking time, or both may require adjusting. Generally, 25-35% less time is needed for cooking in convection ovens as compared to conventional ovens. Examples of decrease temperature adjustments by food products:
- Cookies 25° F (14° C)
- Casseroles 25° F (14° C)
- Cakes 50° F (28° C)
- Yeast bread 50° F (28° C)
- Meats 50° F (28° C)
- Other yeast products 75° F (42° C)

Purchase Recommendations
- Confirm interior of the oven is large enough to accommodate standard full size pans
- Evaluate the slides that support the pans (8-11 slides are common in an oven) to verify that pans can be pulled out one-half/two-thirds of the way without having the pan tilt or slide out
- Select the oven with a shorter preheating time (15 minutes is common)
- Evaluate the exterior material, as stainless steel is preferred when the oven will be placed near grease producing equipment
- Select finishes with 16-20 gauge, no. 4 finish
- Select insulation that is four inches (10 cm) on the sides and two inches (5 cm) in the door
- Make sure that there is an automatic shut-off for the fan when the door is opened
- For greatest flexibility, make sure that the oven has:
  - The ability to also cook without the fan
  - Cook and hold feature for foods that may be prepared in advance and held for a short period of time before service
  - Quick disconnects and casters so that the oven can be moved out of the way for more thorough cleaning
  - The desired door opening (top or bottom, side/side, etc.)
Best use of the convection oven suggests the following practices:

- Set the thermostat 50-75° F (28-42° C) higher before loading to compensate for temperature loss
- Avoid over/under loading
- Place partial loads on center shelves, keeping pans away from walls as much as possible
- Do not use pans where the food level is much below the top of the pan (this results in a poor cooked color). Cakes or cookies, for example, would never be baked in a four inch depth pan.
- Load/unload quickly
- Load bottom racks first
- Cook meringues and light batters for 7-10 minutes before turning the fan on (consider also that these products may be best done in other ovens)
- For meat, fish, poultry, set a pan of water in the bottom of the oven to prevent excessive moisture loss (or use a combination oven steamer)
- Shut off the fan during loading (unless it has an automatic shut-off)
- Open the door that is not connected to the interlock if the temperature needs to be lowered

**Conventional Ovens**

Conventional ovens can be used for a wide variety of cooking needs, such as cakes, cookies, meats, or other products. Conventional ovens may be electric or gas (although gas ovens will still need electricity for a timer, lights, or a fan, if these are provided on the oven). Although still used for smaller quantity preparation in some school nutrition programs, the use of convection ovens has replaced conventional ovens in many schools.

**Deck Ovens**

Deck ovens are an energy efficient choice for large quantity preparation of roasts or bakery products, such as cakes and cookies. Deck ovens are often stacked to increase cooking or baking capacity. Deck ovens can be placed on a stand with pan racks underneath for added flexibility. If ovens are stacked, consideration should be given to the height of the ovens. Ovens that are stacked must be easily reached to make them easy to use and to minimize the possibility of being burned when reaching into the oven.

Both gas and electric deck ovens are possible. Greatest flexibility is provided if the oven has separately controlled elements in the top and bottom of the oven. Gas deck ovens are one of the few pieces of equipment that require no electricity. Appropriate oven height will vary with the product. Typically, ovens are sized using the following guidelines for what is being prepared:

- Roasts use a 12-15” oven height (30.5-78 cm)
- Bakery products use a 4-8” oven height (11.6-23.2 cm)

**Reel Ovens**

Reel or revolving ovens are not commonly used in school nutrition programs unless the school is very large or in central kitchens. These ovens are used in high volume operations (bakeries for example) and have revolving shelves that operate much like a Ferris wheel to provide even cooking for large batches. Some of these ovens are so large that they are assembled on-site. Strong shelving and shelf stabilizers are important because tipping of the shelves (and the pans on
them) could be a problem resulting in huge product losses and the need to clean the oven (which requires entering the oven) once the oven has cooled.

**Conveyor Ovens**

Conveyor ovens are a type of oven that uses a moving conveyor belt made of either stainless steel or wire mesh. Although most school nutrition operations will not have a conveyor oven, they might be considered if they serve a large volume of pizza or hot sandwiches. Advantages to conveyor ovens include that they provide a very consistent product quality with very little staff training (the conveyor means that the process is highly automated) and that they need less labor to use (no supervision of the cooking process is required). In addition, conveyor ovens may be faster depending on the type of heating used in the oven (infrared cooking or impinger cooking, for example). Disadvantages are that they are more expensive than some of the other ovens (deck ovens, for example), products generally have to be thinner (2 inches or 5 cm or less) to be able to be cooked in a conveyor oven and that more maintenance is required (because of the moving belt on the conveyor). The four types of conveyor ovens are:

- Impingers
  - A very carefully and accurately directed blast of hot air “impinges” or forcefully hits the food to speed the cooking process
  - Impingers are specifically designed for foods to be prepared in them
  - Impinger ovens, for example, are commonly used for pizzas
- Natural convection (turbulence or free flow)
- Forced convection (directed, controlled flow)
- Infrared (available in electric only, these are very fast, but an expensive type of conveyor oven)

**Purchase Recommendations**

- Better conveyor ovens allow the operator to adjust the belt for different speeds
- Side doors are useful for shorter cooking times for products such as sandwiches
- For more product cooking options, purchase ovens that have different settings for zone cooking

Twin belts are also available on some ovens so that the belts can be set at two different speeds for different products. Gas conveyor ovens will still require electricity for the moving belt and all conveyor ovens will require ventilation under a hood. Space for the conveyor is also needed as these ovens require a longer space than conventional ovens. Floor models typically need seven feet, although only three feet may be within the oven itself. Countertop models will need four feet. A viewing door so that the product can be seen while it moves through the conveyor may also be helpful.

**Microwave Ovens**

Microwave ovens have become widely used since they were first introduced in the U.S. in the 1960s. Combination ovens (microwave combined with either infrared, convection, or steam cooking ability) are becoming more common now.
Power level of the microwave is an important consideration and may not be correlated with size of the microwave. In other words, larger microwaves are not necessarily more powerful machines. Examples of microwave power levels and what they may be used for are shown below. If different types of tasks are done, school nutrition directors should either purchase the highest wattage that is required for any of the tasks or consider purchasing different types of microwaves for the different tasks.

- 700 watt for small volume cooking, warming
- 1000 watt for heating precooked foods
- 1400-2700 watt for defrosting and reheating larger quantities of food

Smaller units are somewhat more flexible in that they may use standard plugs (at 120 volts), whereas larger heavy duty microwaves may be 208 or 240 volts. Microwave oven placement is also somewhat more flexible in that they do not need to be placed underneath a cooking hood.

Although many types of microwave ovens are available, microwave ovens produced for home use should never be used in school nutrition programs. Microwave ovens intended for commercial use are more powerful and durable. If home use microwave ovens are used in a school, the ovens will likely burn out in a much shorter time. Even worse, their use might void the equipment warranty and not be allowed by the school's fire insurance policy.

Advantages to microwave oven use include:
- Heating of food is faster
- Cooking does not add heat to the kitchen
- Oven does not need preheating
- Process is energy efficient
- Oven is relatively low cost
- Maintenance costs are lower as compared to other ovens
- Oven is compact
- Same dish can be used for both cooking and serving

Disadvantages to microwave use may include:
- Cooks somewhat unevenly
- Has hot/cold spots
- Requires skilled repair
- Does not allow for tenderization or flavor development in meat products because of the short cooking times
- Does not brown (heat susceptors and combination cooking units improve browning)
- Easily overcooks food

The most common uses of microwave ovens in foodservice operations include:
- Fast thawing
- Warming/heating (not cooking)
- Reheating small portions of food

As quantities get larger, times greatly increase and energy efficiency decreases so this has limited the use of the microwave for other purposes. Some newer options in microwaves that has made their use easier are touch pads, built-in sensors, and heavier duty models. For busy areas,
microwave ovens can be stacked, but location should be considered carefully as they will require space on all sides for venting.

**Turbochef® Ovens**

Turbochef® ovens are a newer type of cooking option (introduced between 1991 and 1994). They are now being used in some restaurants, including chain restaurants. Turbochef® ovens are different because they suck air out of the bottom of the oven (instead of pushing air to the food) to improve heat transfer between the food and the surrounding air. This removes the cold air layer around the food and greatly speeds up the cooking process. Sandwiches cooked in a Turbochef® oven actually brown and are crisp instead of soggy.

Generally, Turbochef® ovens are small countertop units. They are stackable and programmable. In addition, they are extremely energy efficient because they are only turned “on” at the time foods are being cooked. Although they are more expensive than other ovens, their speed of cooking is a great advantage for preparation of sandwiches and many other foods.

**Cook by Light Ovens**

Cook by light ovens are also a new introduction to cooking technology. Some of the first ovens (named Flashbake® ovens) were introduced in 1993. Cook by light ovens use a combination of intense light and infrared energy. They use light waves and not microwaves to quickly penetrate food. Cook by light ovens can actually brown food because a computer in the oven is used to balance the two heat sources to cook both the interior and the exterior simultaneously. Cook by light ovens are:

- Programmable
- Generally small stackable countertop units
- Not in need of ventilation hoods
- Energy efficient
- Extremely fast

**Range Tops**

Range tops used to be a common part of almost all school nutrition programs and may still be important in some schools. They can be used for:

- Sautéing
- Pan frying
- Grilling
- Heating stock pots or sauce pans

Today however, other pieces of cooking equipment such as steamers, convection ovens, or combi-ovens are more commonly used for the cooking needs in many schools. In addition, range tops are used less often because of the growth of convenience or pre-processed foods.

There are numerous manufacturers of gas and electric range tops. Range tops require exhaust ventilation and a fire suppression system so they must be placed underneath hoods and are relatively energy inefficient. Advantages to electric or gas range tops include the following:
Electric

- Burners are somewhat slower to heat or cool (is disadvantage or an advantage depending on how they are used, some staff will turn off the heat and leave the pan warming on the burner for a short time)
- For less skilled staff, burners can be set to different temperatures through the control knobs with no guessing as to the correct temperature
- Some types of electric range tops are available which allow an infinite number of settings

Gas

- Burners are considered more durable than the electric burners
- They require no preheating
- They allow for an infinite range of heat settings

The decision to purchase a gas versus an electric model cooktop is an important decision. In all new construction, an all-electric kitchen might be less costly if the infrastructure needed for gas lines is expensive. On the other hand, in areas where severe storms and loss of power is common during school months, gas equipment might still be able to be used when the power goes out if the gas equipment controls are not electric and if electrically controlled ventilation systems are not required for the equipment to be used safely.

The decision between gas or electric models is also influenced by energy use and expected utility costs. Utility costs will vary across the U.S. so that purchase decisions will need to be based on the geographic area. The electric rates in California, for example, are likely to be higher than in many other geographic areas, and the gas rates in Texas are likely to be lower.

Cooktops can be open (with an exposed burner) or closed (solid sheet of metal). Listed below is a comparison between the two types of cooktops.

Open Cooktops

- Are more energy efficient than closed tops
- Their ability to heat is less affected by bowing, bulging, or dented pan bottoms because the pans will more evenly fit into the ring or grate as compared to the flat surface of a closed cooktop
- Are most likely to be useful for speedy, intermittent cookery

Closed Cooktops

- Hold more pots than open burners
- Are more flexible in that they hold multiple sizes of pans
- Are used for continuous heavy cookery because they will hold several warm stock pots
- Take longer to preheat (for example, ten minutes for gas cooktops and 20-30 minutes for electric models)

Closed cooktops are generally made of cast iron or steel plates which are between ½ to 1 inch thick and put together (depending on the school's needs) in multiples of 12 inch widths and 24 inch depths. Most commonly, they are installed in a group of three with a separate heat control for each of the three portions of the cooktop.
Griddle-type range tops which include a stainless steel fence around the two sides and back (which helps to prevent spattering or dripping of batters off the edge of the cooking surface) are also useful for some schools. These griddle-type tops are made of thicker steel and offer grease troughs and grease containers that can be emptied after each use. They are used for continuous heavy cookery of griddle items and may come with Teflon or other non-stick coatings. Countertop models are also available for griddles or other range top types.

Other types of specialty range tops are also available, but are generally not used in school nutrition operations, including Chinese or wok ranges, stockpot ranges, and taco ranges.

**Induction Cooktops**

Induction cooktops use a newer type of cooking technology and are being installed in some schools. Induction cooktops are sold by fewer manufacturers, but variations in options are still available. Induction involves a different method of heating in which an electromagnetic field is created between the stovetop and pan which provides a current that converts to heat with the resistance of the metal in the pan. In this heating system, the choice of pan type is critical.

Magnetic metal pans (made of magnetic stainless steel, cast iron, or nickel) must be used in order to create the electromagnetic field for heating. School nutrition directors should check with manufacturers to make sure that pans will work on induction units. Some stainless steel pans, for example, are magnetic (because of their higher iron and nickel content) and some stainless steel pans are not magnetic (so they are not suitable for induction cooktops). Pans made with non-magnetic metals (such as copper or aluminum) will not work on induction cooktops, unless the non-magnetic metal is used only in the interior of the base of the pan (so that it is sandwiched between two pieces of magnetic metal) to improve the evenness of the heating of the pan.

Research at Purdue University in the Hospitality and Tourism Management Department has suggested that not all magnetic pans heat equally well on an induction cooktop. Best choices are the most highly magnetic and have a flat bottom that provides the best contact with the induction surface. Whatever the pan type, empty pans should not be heated as this could result in damage to the cooktop.

Advantages to the use of induction cooktops includes:

- Safety benefits when used around children
- Faster cooking
- Easy cleaning
- Does not heat up the kitchen
- Energy efficiency
- Operate from a 12 volt, standard three prong plug-in so that they may be used with most standard outlets in non-traditional locations where higher voltage wiring is not available

Disadvantages may include:

- More expensive
- Limited in capacity (unless multiple units are purchased)
- Require the purchase of new pans
Induction cooktops have a smooth, solid ceramic top and come in both one and two burner models. They may be free-standing, making them easy to carry from one location to another or installed into countertops. They generally operate from 12 volt, standard three prong plug-ins and are therefore, only available as electric models. Temperature controls on these units vary with the manufacturer. Some units have specific temperature settings for the control knob; others have an infinite number of settings possible and operate similar to a rheostat.

**Basic Use of Range Tops**

General rules for efficient use of range tops would include the following:

- Pots should be one inch (2.5 cm) larger than the burner
- Gas flames should be adjusted to barely touch the bottom of the pan
- Gas flames should be adjusted until they are blue for the most efficient type of flame
- Pan bottoms should be flat bottomed allowing for full contact with the range
- Pots should be kept covered

Other considerations include that the range tops will need:

- A nearby and convenient work table
- A nearby refrigerator
- A sink to drain pots and an overhead mixing faucet
- Daily cleaning with a manufacturer recommended cleaner
- A fire suppression system
Cooking equipment is a huge investment for schools. Many choices exist including newer technologies that offer faster and more efficient cooking (although it may also be more expensive). Although many prefer the advantages of gas cooking equipment, the decision between gas or electric models depends on several factors including purchase price, utility costs and warranty.

Many oven choices are available. Some experts have suggested that more changes have occurred in oven designs in the last 20 years than in any other kind of kitchen equipment. Although conventional ovens are not as commonly used anymore, convection ovens are now very common and are available in a variety of models (gas or electric), sizes, and depths. Although they are more expensive than conventional ovens, they offer faster cooking and good browning in a compact space. Deck ovens may be used for many cooking and baking needs. Reel ovens and conveyor ovens are not commonly used in schools, but may occasionally be used in some high volume operations. Microwave ovens have become widely used since they were first introduced. Combination microwave ovens (with infrared, convection, or steam cooking ability) are now available. Turbochef® and cook by light ovens are two of the newest cooking technologies. They offer extremely fast cooking (including browning) in a very compact space, but are a more expensive alternative.

School nutrition directors should think carefully about their oven choices. Products can generally be cooked/baked in more than one type of oven (convection versus conventional versus combi-ovens, etc.). Because of this, school nutrition directors should look at the best oven choices for their particular needs. Careful decision making is important because each oven type will vary by purchase price, repair and maintenance cost, energy consumption, ventilation requirements, cooking speed, product quality, space requirements, and flexibility for different kinds of cooking.

In addition, even though a versatile oven may be purchased, it may not be able to be used for all cooking needs because of overlapping production requirements with several products needing to be prepared at the same time. Salespeople may promote one oven for all cooking needs, but school nutrition directors should always look at their production schedule before making final cooking equipment selections in order to make sure that all products can be prepared that need to be prepared. School nutrition directors’ familiarity with their menus and recipes, as well as the coordination and scheduling of equipment in preparing food, elevates them to the valued position of Trusted Advisors in selecting which pieces of cooking equipment are best for their operations.
CHAPTER ELEVEN

Cooking Equipment:
Tilt Skillets, Broilers, and Fryers
Introduction
- School nutrition directors are the *Trusted Advisor* in deciding which pieces of equipment are required to meet the production needs

Tilt Skillets
- Versatile piece of equipment with four sides and rectangular grill top, a pour spout, cover, and a trunnion
- Purchase recommendations include:
  - Upgrading the metal in the tilt skillet to stainless steel
  - Considering features such as spring assisted lids, power tilts, gallon markings, hot/cold faucets, and draw-offs for larger tilt skillets

Broilers
- Available in infrared or radiant heat
- Require operator skill and can be a fire hazard
- Small broilers are used for finishing entrees, larger broilers are used for fast cooking of thinner cuts of meat
- Purchase recommendations include:
  - Buying heavy gauge steel, well insulated units with reflective interiors
  - Considering infrared units when speed is more important than cost
  - Placing broilers side by side rather than stacking
  - Selecting stainless steel sides on the broiler if installation is near fryers
  - Considering warming ovens
  - Evaluating grids and shelves in the broiler

Fryers
- Newer fryers offer improved efficiency, improved quality of finished products, and more automation to make them “mistake proof”
- Purchase recommendations include:
  - Purchasing more than one fryer to avoid flavor transfer if different products are commonly prepared
  - Comparing capacity of floor and countertop models
  - Assessing space and fire suppression needs of the fryer
  - Considering what types of products will be prepared in the fryer
  - Evaluating the amount of desired automation
  - Deciding on the type and thickness of the metal for the fryer
  - Deciding on inclusion of a filtering system
  - Checking to see if the fryer has a cool zone
Cooking Equipment: Fryers, Broilers, and Tilt Skillets

Introduction
Cooking options in school nutrition programs may include tilt skillets, broilers, and fryers. Broilers and fryers are not very versatile pieces of cooking equipment, so some schools may not use these at all because they do not support the menu needs. On the other hand, tilt skillets are considered very versatile, but they may not be found in all school kitchens because they are either unfamiliar, or the school nutrition programs use alternative pieces of equipment. School nutrition directors are the Trusted Advisors when determining equipment needs because of their knowledge related to the menus and production needs related to the meals served.

Tilt Skillets
The tilt skillet is also known as the tilting braising pan and tilting fry pan. Tilt skillets have a rectangular grill top with four sides, a centered pour spout, a hinged cover, and a trunnion which allows the grill top to be tilted to drain at a 90 degree angle. In fact, some school nutrition programs have replaced large kettles with tilt skillets, due to their versatility. They are particularly good when all the ingredients are ultimately cooked in the same piece of equipment. Most common uses of a tilt skillet include:
- Grilling
- Browning or braising
- Pan frying
- Sautéing
- Stir frying
- Steaming with the assistance of optional steamer pan insert rack
- Boiling stews and sauces
- Holding

Most tilt skillets are free standing units but models are available that can be wall or counter mounted. Counter top models may range in size from 10-16 gallons, whereas most floor models hold either 30 or 40 gallons. Tilt skillets may be gas or electric, but gas units will still require electricity for the controls. Additional options that may be purchased include:
- Receiving pan support
- Pour lip strainer
- Vented lid
- Fill faucet or spray hose
- Casters
- Special stands

Purchase Recommendations
- Best for large batch cooking
- Good for pan grilling or pan frying
- When one needs to grill several products at different settings, maybe the tilt skillet is not the better equipment choice
Consider upgrading the metal to a stainless steel for improved versatility
Consider spring assisted lids to make lifting the lid easier/lighter, and a power tilt to automatically raise or lower the skillet
Consider optional accessories such as gallon markings stamped on side of skillet, hot and cold faucets for adding water as needed in food production or to aid in cleaning, and a draw-off when pouring contents from the tilt skillet
Installation needs should be addressed to effectively use the tilt skillet, such as including a floor sink or grate in line with the tilt skillet’s pour path
Size requirements should be evaluated based on production needs, because production capabilities may be overstated by manufacturers

Broilers

Broilers provide very intense dry heat to cook or finish the surface of meats or other entrees. Heat may be either infrared or standard radiant heat. The infrared heat provides faster heating, but is more expensive than standard radiant heat. Products prepared in broilers have excellent flavor. In addition, products are often lower in fat and better in retention of vitamins with this fast cooking process. The speed of the cooking process is also a disadvantage in that it is not very versatile in the types of food products that can be prepared in broilers. Different types of broilers include:
- Smaller broilers are used for finishing entrees, for example browning, melting, reheating
- Larger broilers are used for broiling thinner cuts of meat that have a low to moderate fat content

Broilers also require some skill on the part of the operator as there are no timers, ejectors, flashing lights, or buzzers to tell when the product is done. In addition, they can be a fire hazard, due to the high temperatures used in the broiler itself as well as the food cooked in the broiler. In addition, to prevent a fire hazard, broilers must be installed correctly. Fires have occurred when broilers are bolted into wooden studs in the wall to stabilize them and prevent tipping. Unfortunately, because of the high heat, the metal bolts caused the wooden studs in the wall to catch fire. Broilers need to be located under a ventilation hood, as well as fire suppression equipment.

Purchase Recommendations
- Buy 16 gauge stainless steel (or heavier), well insulated units with reflective interiors
- If speed is more important than cost, get infrared, but consider that they:
  - Cost more
  - Cook in half the time
  - Preheat in about 30 seconds verses approximately ten minutes for standard radiant broilers
  - Use 30% less energy than standard radiant broilers
- Buy multiple broilers when peak time periods require multiple products to be broiled
- Place multiple broilers side by side rather than stacking them, to improve accessibility
- Stainless steel sides on the broiler are recommended if broiler placement is near a fryer
- Consider a built-in warmer oven with the broiler when there is a delay from preparation to service
- Adjustable grids (1 ½ to 8 inches or 3.75 to 20 cm) and shelves that pull out provide easy use, but should have a safety lock to prevent them from coming out all the way, and shelves should be warp resistant
Be cautious of broiling productivity stated by manufacturers because they generally do not include the time associated with product loading.

**Fryers**

Fryers are used less often in school nutrition programs because of the concern for healthy methods of food preparation. Also, many of the food items that required frying techniques are now available in formats that do not require frying. Fryers are categorized in size by the capacity of the frying oil and the pounds of frozen food which may be cooked in one hour. Fryers are available as stand alone units or banked as several units together.

Modern technology in fryers has improved the quality of fried products, improved their efficiency, and made the fryers easier to use. Models can be countertop or floor standing. Newer models have become more automated and may include devices to lower baskets, time the frying cycle, and then raise the basket. Additional options include:

- A stainless steel fry tank cover
- Extra baskets and screens
- Skimmer
- Crumb scoop
- Tank scoop
- Automatic basket lift
- An upgrade to stainless steel fry tank, if not standard
- Casters
- An upgrade on choice of controls
- Flex hose and quick disconnect with restraining device
- Stainless steel exterior
- Landing station
- Warming lamp for the landing station
- Filter station

Controls are the key to maintaining temperature. The best fryers have less variation in the cooking temperature which produces a better quality product. There are three basic types of controls:

- Millivolt control system has a ten second delay response to temperature and a possible temperature swing of 20°F (11°C)
- Solid state control system has modulating thermostats and may react to +/- 2°F
- Computer control system reacts to +/-1°F with various programmable functions

Appropriate care of fryer oil is a must. Choose oil that will withstand frying at high temperatures for longer periods of time. The following practices will save the life of the oil and support improved food quality:

- Change or replenish the oil periodically
- Filter frequently
  - Frequent filtering may result in a net savings of 25-50% of the oil as well as an improvement in product quality
Oil breakdown is accelerated by
- Food crumbs, particularly from breaded, battered products
- Water from improper drying after cleaning or from “wet” foods that are fried in the oil
- Soap residue left from cleaning
- High heat for long time periods
- Salt from food or from “salting” food items while in fryer baskets

Determine which method of filtering is needed in advance of purchasing the fryer. It is important for the nutrition assistant/technician to maintain safety at all times and to follow manufacturers’ directions carefully with any of the methods listed below.

- The skimming method only skims bread/food crumbs from the top of the oil with a strainer or skimmer
  - Least expensive method but does not provide complete oil care as the vat will still need to be cleaned periodically
- A manual method is more often used for smaller fryers
  - A stockpot, metal filter holder and filter for the holder are used to filter the oil, the vat is cleaned, and the oil is poured back into the fryer
  - Provides somewhat better filtering of the oil than skimming and is inexpensive, but has some safety concerns
- A portable filter method is used more often for larger fryers
  - A wheeled cart is rolled under the fryer, oil is poured directly onto a filter or screen, then through a pump, and a hose back into the vat
  - Does an excellent job filtering, but is more expensive and requires a storage area
- Built-in filters are generally used for multiple fryers
  - The filter unit, stored in a cabinet below the fryer, automatically transfers oil from the vat to a tank where filtering occurs
  - The vat may be cleaned while the oil is being filtered
  - Does an excellent job filtering the oil and is the most expensive, but does not require extra space for the filter

**Purchase Recommendations**
- If frying more than one product in the same frying oil and the products have strong flavors (fish, for example), purchase more than one fryer to avoid transfer of flavors
- Check fryer capacity
  - If frying less than 65 lbs. (30 kg) of fries/hour, a countertop model can be used
  - If greater than 65 lbs. (30 kg), a free standing fryer is needed
  - If frying greater than 100 lbs. (45 kg) of fries/hour, more than one fryer may be needed (check manufacturers’ guidelines)
- Make sure adequate space is available
  - Need 12-24” (30-60 cm) width for each unit, 22-36” (55-90 cm) depth
- Fire protection is critical
  - Should be placed under a hood with fryer fire protection
  - Should be positioned at least 16” (40 cm) away from surface flame cooking equipment such as gas ranges
  - When using a solid or semi-liquid shortening there must have a melt cycle for safety reasons
If frozen foods are the primary frying items, the fryer should have a quick recovery time.
Consider the volume of food needed at any given time.
Consider automatic basket lifts, timers, and computer controls for maximum food quality and to save labor time.
Stainless steel that is a minimum of 18 gauge is recommended to maintain life expectancy.
Determine the appropriate filtering system (built-in, portable, manual).
Select a fryer with a “cool zone”
• A deep well indentation that allows crumbs to settle to the bottom of the well in an area where temperatures are lower and removes food particles from temperatures that would char or burn it and give bad flavors to the other products that are to be fried in the oil.
Consider an extended flue to move the exhaust high away from the tank.
On gas models, evaluate whether a pressure reducing valve is needed.
SUMMARY

Purchasing recommendations for tilt skillets would include upgrading the metal used in the tilt skillet to stainless steel to provide production versatility and consider including spring assisted lids, power tilts, gallon markings, hot/cold faucets, and draw-offs for larger tilt skillets. Installation needs should address the most effective use and include a floor sink or grate in line with the tilt skillet’s pour path.

Although school nutrition programs have reduced or limited the use of fryers, they may be used in some situations. Fryers and broilers are not versatile pieces of cooking equipment, but some schools may find them useful for meeting particular production needs. Tilt skillets, on the other hand, are quite versatile and could be used for a great deal of cooking in school nutrition programs. The primary advantage of the tilt skillet is the versatility it provides in addressing menu needs.

Fryers and broilers are intense cooking methods and need both hood ventilation and fire suppression equipment. Newer fryers offer improved quality of finished products, improved efficiency, and more automation. Should a fryer be a part of the equipment purchase, school nutrition directors should decide in advance what type of filtering method should be used for their fryer as they cannot retrofit the fryer with a built-in filter, if this is desired.

Broilers require operator skill to use to prevent fire hazards. Smaller broilers are used for finishing of entrees, whereas larger broilers are used for fast cooking of thinner cuts of meats. Purchasing recommendations might include evaluating the choice of standard radiant broiler versus infrared broiler and determining whether there is a need for an attached warming oven.
CHAPTER TWELVE

COOKING EQUIPMENT:
STEAM EQUIPMENT
Steam Jacketed Kettles
- Can be used to make soups, stockpot products, double boiler products, and braised or boiled meats
- Full-jacketed models are preferred for large quantities of boiled products where products float at the surface, such as potatoes, boiled meats, pastas
- Two-thirds jacketed models are preferred for products that are not boiled, such as soups, stews, sauces, bisques, puddings, pie fillings
- For larger models, consider getting bottom drawoffs, counterbalanced or spring-assisted covers, and kettle mounted faucets with hot and cold water
- Consider splash guards, drainage pits, stainless steel, ventilation hoods, condensate ring, installation, capacity, power stirrer, shallow style kettle, cold water jacket, and the need for flexibility

Steamers
- Water treatment of hard water is critical for steamers
- Advantages include faster cooking, uses less water and energy, results in better nutrient retention, less product shrinkage, and reduced labor
- Disadvantages include ease of overcooking, carry-over flavor, difficulty in cooking frozen food, and lack of browning
- Best practices include cooking vegetables al dente, cooking uniform size food, defrosting before cooking, not using plastic wrap or aluminum foil during the cooking process, using a perforated pan for most cooking, water filtration, and regular deliming of equipment

Pressureless or Convection Steamers
- Use more water and energy than pressurized steamer, but have less flavor transfer, doors can be opened during the cooking process, and they are less expensive
- Purchase recommendations include considering an automatic deliming or filtration system, evaluating gaskets, selecting good doors, selecting a suitable location, evaluating available steam capacity, looking at overall production needs

Low-pressure Steamers
- Typical pressure of five pounds per square inch (psi) in a low-pressure steamer produces a temperature of 227° F (108° C)
- Used for large volume preparation and will hold up to eight standard-sized sheet pans per compartment

High-pressure Steamers
- Cook at the highest steamer temperatures, a pressure of 15 psi produces a cooking temperature of 250° F (121° C)
CHAPTER HIGHLIGHTS (continued)

- Capacity is generally less than low pressure models as they only may hold three standard-sized pans

**Combination Convection Oven Steamers (Combi-ovens)**

- Able to cook in hot air mode, steam mode, and a combination of both modes
- Flexible, fast, and able to reduce shrinkage and enhances the quality of some cooked foods
- First introduced into the U.S. in the 1980's
- Highly programmable
- Gas or electric models are available, but gas models require electricity
- Needs a nearby floor drain
- Energy efficient
- Can be half size or full size

**Boiler Free, Boilerless, or Connectionless Steamers**

- Do not require a boiler, water filtration system, steam connection, or even a plumbing connection
- Water is added manually into a tank with a heating element which then creates steam in the cabinet
Cooking Equipment: Steam Equipment

Introduction
Steam cooking can be done in a diverse group of equipment. Some of the equipment, such as steam jacketed kettles, have undergone relatively few changes for many years (steam jacketed kettles have been manufactured for at least 100 years). Others such as combination convection oven steamers, convection steamers, and boilerless/connectionless steamers are newer and have become very popular in some school nutrition programs.

Proper sizing of equipment is essential. Production capacity is highly dependent on the piece of equipment, the type of food being prepared, the temperature of food put into the compartment, and the size and number of pans that can be used or the overall size of the steam jacketed kettle. These should be evaluated carefully based on the school's menu and the school nutrition director's knowledge as the Trusted Advisor in making equipment decisions. Additional detailed information on steam equipment's capacity can be obtained from manufacturers or through the website for the North American Foodservice Equipment Manufacturer's Association website at http://www.nafem.org. One example of a resource at this website is a pdf document titled Handbook of Steam Equipment. Manufacturers' information, if used, should be evaluated carefully. Capacity estimates will generally not take into account actual use factors, such as the time needed to load or unload the equipment, or the time needed for pressure build-up prior to cooking.

Steam Jacketed Kettles
Steam jacketed kettles have been one of the mainstays of the cooking equipment choices. Steam jacketed kettles can be used to make soups, stockpot products, double boiler products, and braised or boiled meats. The advantage of using steam jacketed kettles is that it reduces preparation time for products that would otherwise be prepared on a range top. Some estimates are that it reduces the time needed for boiled products by one-third.

Purchase Recommendations
- Selection of full or two-thirds jacketed models, referring to the amount of surface area of the inner jacket that transfers steam heat, should be based on the products that will be prepared in the kettle
- Full jacketed models are preferred for large quantities of boiled products where products float at the surface such as potatoes, boiled meats, pastas
- Two-thirds jacketed models are preferred for products that are not boiled such as soups, stews, sauces, puddings, pie fillings
- For pastas, baskets are helpful accessories to eliminate the draining process
- For larger wall- and floor-mounted kettles, evaluate the tilting mechanism for how easy it is to use and consider whether a bottom draw-off is needed
- For larger models, consider these optional accessories:
  - Bottom draw-off pipe style drains used for pouring the food into pots or pans (available in 1, 2, 3 inch diameter or 2.5, 5, 7.5 cm sizes, based on product usage)
  - Counterbalanced or spring-assisted covers
Kettle mounted faucet with hot and cold water
- Kettle mounted mixing motor, particularly for models which are 80 gallons and above
- Because products are hot, purchase splash guards for both tilting and drawoff models
- Drainage pits are recessed areas in the floor with a drain and are highly recommended for wall and floor mounted models in new construction
- Upgrade to stainless steel for more longevity when preparing diverse food products
- Steam jacketed kettles must be placed under ventilation hoods if braising meats or entrées
- Check local regulations for specific ventilation requirements
- A condensate ring option on a steam jacketed kettle protects the employee from hot dripping condensate when the lid is raised
- Consider when writing the specification what type of mounting/installation (pedestal, legs, wall) is needed
- Table models are available up to 20 quarts
- Floor or wall models are available up to 200 gallons
- Kettles greater than 40 gallons require a power stirrer attached to the side of the kettle which mechanically mixes the food in the kettle
- Shallow kettles are preferred for foods that are easily crushed
- Some kettles have a connection to cold water within the jacket which can be used for faster cooling of mixtures, such as pastas to prevent overcooking
- Purchase the size required based on maximum volume required for any recipe
- Two kettles may provide more flexibility for multiple recipe preparation
- All kettles require head space (80% of listed capacity) for safe operation
  - Nominal kettle capacity is the calculated maximum volume when filled to the rim
  - A minimum of 2-3” of clearance below the rim is needed for stirring and to avoid boiling over

**Steamers**

Steamers use a closed cavity with moist steam heat at pressures from 0-15 lb. (0-6.8 kg) to cook the food. Steamers can be pressureless, low-pressure, or high-pressure, or combination steamers. Steamers are often the cooking method of choice with delicate items, such as fish and some vegetables that need to be kept whole during the cooking process and fast cooking of vegetables, pasta, rice, potato, or meat products, either in small batches or volume. Steamers are often stacked and a separate timer is recommended for each compartment. Steamers should hold standard sized steamtable pans and the slides should allow the pan to be pulled out 2/3 of the way without tipping.

All steamers, both pressureless and pressurized, provide a very efficient and fast heat transfer cooking method. In fact, the rate of heat transfer in cooking speed is very rapid in a steamer as compared to a standard conventional oven. To illustrate this, if you stick your hand into a preheated oven, you are not immediately burned although it will feel quite hot. By contrast, if you place your hand over a pan of boiling water or a tea kettle, you will be scalded in a matter of a few seconds.
In addition, steam cooking uses less energy than convection ovens and allows for preparation of food closer to the time of service. This is an advantage for delicate foods, such as vegetables that might dry out if held for a long time in a warming cabinet.

It is critical to treat hard water for use in steamers. When steamers are being selected, school nutrition directors should carefully consider their water quality and their possible need for filtration systems and automatic deliming options. Warranties and service agreements may not cover repairs for breakdowns caused by water hardness. Since water quality varies from one geographic area to another, it is best to have a water analysis conducted prior to building a new kitchen or purchasing a steamer. In doing so, serious problems can be deferred. For example, dirt may clog equipment, excess chlorine can cause corrosion, and lime or scale build up can lead to equipment breakdown. Recommendations for water quality consist of:

- Total dissolved solids are no greater than 60-80 parts per million (ppm)
- pH is neutral or near neutral (7.0-8.0)
- Water hardness is no greater than 2.0 grains
- Chlorine is no greater than 25-30 ppm

Finally, schools should check with the local health department and fire code to make sure of venting and other requirements for steamers. Regulations may vary from one area to another.

Advantages of steam cooking include:

- Faster cooking
- Uses less water than boiling
- Uses less energy than boiling
- Results in better nutrient retention
- Results in less product shrinkage
- Reduced labor demands associated with pan washing

Disadvantages of steam cooking include:

- It is easy to overcook foods, although newer steamers may have more accurate thermostats, including a load compensating thermostat to automatically adjust cooking time by the volume of food cooked
- Carry-over flavor from one product to another can occur if the equipment is not properly cleaned, although some of the newer steamers have an open free-vented drain which allows food waste and condensate to automatically be collected and removed out the drain to minimize carry-over flavors
- Frozen blocks of products, such as frozen vegetables, do not cook well
- Steam cooking does not brown foods
Steam sources for cooking equipment may include:

- Central steam plant
- Self-contained steam made by a boiler installed in the equipment itself and powered by gas or electricity
- Direct steam made by a boiler near the kitchen
  - Contains descaling agents and is not allowed to have direct contact with food
  - Regenerated/steam coil generated steam made from direct steam that is provided to a coil immersed in water that then produces “clean steam”
    - This may be the type of steam used for steamers that have steam touch or contact the food during heating

**Best Practices**

- Be careful of overcooking, as this is the most common mistake in steam cooking
- Cook vegetables al dente
- Make certain foods are uniform in size to create more even cooking
- Defrost frozen vegetables before pressure cooking
- Frozen products should first be defrosted and then separated and/or stirred for actual cooking
- Do not use plastic wrap or aluminum foil as covers in pressure steamers
- Consider the effect of the pan depth in cooking, as food in shallow pans will cook faster than in deep pans
- Perforated pans should be used for most foods for faster cooking, with the exception of scrambled eggs and dried fruits that are being dehydrated
- For pasta, nest a perforated pan in a solid pan filled with cold water
- Consider water filtration for the steamer
- Descal or delime steam equipment on a regular schedule

**Pressureless or Convection Steamers**

Pressureless steamers, also called convection steamers, cook food in an enclosed cabinet at temperatures of 212° F (100° C). Steam is injected into the cabinet and creates a kind of current of convection steam. Some units also have a fan to help distribute steam.

Convection steamers can be either gas or electric. Steam sources can be from self-contained generators or direct steam from a central supply or external boiler. Installation of the steamer in an area with a drain reduces the hazard of wet or slippery floors.

Pressureless steamers are used for rapid cooking of vegetables and other foods. They are ideal for cooking vegetables because they minimize vitamin, color, and texture changes, and minimize shrinkage.

There are several differences between pressureless and pressurized steamers. For example, pressurized steamers use less water and energy than pressureless steamers. On the other hand, in pressureless steamers, steam is vented and the condensate is drained off to reduce less flavor transfer. In addition, one of the biggest advantages to the use of pressureless steamers is that the door can be opened during the cooking process, whereas the door cannot be opened during cooking with a pressurized steamer, without it being a serious safety hazard. Finally, pressureless
Steamers are generally smaller and less expensive than pressurized steamers. Because of their easy use, more than half of the steamers sold in the U.S. are pressureless steamers.

The use of pressureless steamers has grown, particularly those with self-contained generators. In addition, manufacturers have recently improved pressureless steamers so cooking speed and volume capacities are greater, therefore, increasing their usefulness. Finally, some of the newest types of steamers may have the option of either pressureless or pressure steaming.

**Purchase Recommendations**

- Consider an automatic deliming option
- Consider adding a filtration system if the water is hard
- Evaluate the gaskets carefully because good gaskets need to be very heat resistant and provide a good seal to prevent steam leaks
- Select doors that can withstand much abuse
- Consider placement location carefully, as all steamers require:
  - A floor drain
  - A place for pan storage
  - Utilities, such as the steam, gas, or electricity
  - A level floor
  - A ventilation hood
- Consider steam capacity if the unit is not self-contained, because it will impact other pieces of steam equipment that are connected into the same steam line
- General guidelines to consider for steam equipment that is not self-contained:
  - It takes 75 boiler horse power (BHP) for one steamer compartment and 1 BHP per 20 gallons of steam jacketed kettle capacity
  - If the steam line can not accommodate additional steam equipment, a self-contained steam unit can be used
  - Consider steam pressure levels for each piece of steam equipment
  - When steam pressure levels differ for multiple pieces of equipment, a valve is needed to accommodate the different pressure levels
- Consider overall production needs
- Two smaller steamers may be better than one larger steamer, unless similar sized pieces of food are being cooked together such as multiple pans of vegetables
- The size and type of steam equipment varies tremendously among schools, although general foodservice guidelines might suggest the following for the size of steamer based on the number of meals served per hour:

<table>
<thead>
<tr>
<th>Size of operation</th>
<th>Size of steamer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-200 meals/hour</td>
<td>1 single compartment</td>
</tr>
<tr>
<td>200-400</td>
<td>1 double</td>
</tr>
<tr>
<td>400-600</td>
<td>1 triple</td>
</tr>
<tr>
<td>600-800+</td>
<td>1 quadruple or 2 double</td>
</tr>
</tbody>
</table>
High-pressure Steamers
High-pressure steamers cook at the highest steamer temperatures. Pressure levels may go up to 15 psi depending on the manufacturer and the model purchased. A pressure of 15 psi produces a cooking temperature of 250°F (121°C). Their capacity, however, is generally less than low-pressure models as they only may hold three standard-sized steamtable table pans. Because of this, they are generally used for small batches cooking techniques. High-pressure steamers come in both countertop and cabinet models, and may be either gas or electric. Steam is usually regenerated/steam coil generated. Steamers will require hook up to drains.

Low-pressure Steamers
Low-pressure steamers have better productivity and lower operating costs than pressureless steamers when volume cooking is being done. Power requirements for low-pressure steamers are the same as high-pressure steamers, except that they may use self-contained boilers, direct steam from a central source, or steam produced from another part of the building, which is then used to make steam for the steamer through a steam coil heat exchanger. Hook up to drains is also required. The cooking temperature in low-pressure steamers is higher than pressureless steamers, but lower than high-pressure steamers. The typical pressure of five psi in a low-pressure steamer, for example, will produce a temperature of 227°F (108°C) in contrast to pressureless steamers that only produce a cooking temperature of 212°F (100°C). Low-pressure steamers are used for large volume preparation and will hold up to eight standard-sized steamtable pans per compartment.

Combination Convection Oven Steamers
The combination oven steamer commonly referred to as combi-oven, offer a single chamber with the ability to cook in three modes. These are the hot air mode (convection oven), a steam mode (convection pressureless steamer), and a combination of both modes (circulating hot air with superheated steam). The combi-oven may cook in all three modes independently or in sequence moving from one mode to another depending on the menu item. For example, one can start the cooking cycle of a meatloaf in the steam mode to sear the outside and accelerate the cooking process, move to the combination mode to reduce shrinkage and the cooking time, and finish in a high temperature convection hot air mode to enhance the outside color. Advantages to combi-ovens include:

- Flexibility
- Reduced cooking time
- Less shrinkage of meat products
- Enhancement of food quality
- Large cooking capacity

Combi-ovens were introduced in Europe in the 1970s and the United States in the mid-1980s. Their use has become quite common in the U.S. because they provide very fast and flexible cooking. Combi-ovens are also highly programmable to efficiently combine the different cooking technologies of pressureless steam and convection heating to produce high quality food products. There is also a holding mode for finished products for short time periods of an hour or less. Combi-ovens can be used on a countertop or a cart, and are available in stacking or roll-in models.
Combi-oven modes provide production flexibility. The most commonly used modes by products include:

- Dry cooking mode
  - Bakery products
  - Pizza
- Steam cooking mode
  - Vegetables
  - Seafood
  - Rethermalization
- Combination mode
  - Pastries
  - Breads
  - Meats

In combi-ovens, steam is produced by a self-contained steam generator. Softened water is recommended for combi ovens. A cold water connection is required, as well as an indirect waste pipe with an air gap for the floor drain. Gas or electric models are available, but gas models will still require electricity. Combi-ovens should be installed with an open air gap drain underneath the oven, as recommended by the manufacturer. Combi-ovens are more expensive than standard ovens, but may be used to replace two pieces of cooking equipment and may also be space-saving. Combi-ovens are thought to be 60% more energy efficient as compared to standard ovens.

Combi-ovens are available in two generic sizes which are half size and full size. Half size models accommodate 12” x 20” x 2” pans or 13” by 18” pans. Full size models accommodate 12” x 20” x 2” pans and 18” x 26” pans. Both sizes are available in several capacity sized models. Some manufacturers describe sizes in levels or pan racking positions, such as 10 levels. Models up to 10-11 pan capacity can be mounted on tables, stands, or even double stacked. Both half and full size models in the 20 pan capacity can be placed on carts which provide space for pan storage below the oven. Additional options and accessories available for extra cost include:

- Stainless steel support stands
- Landing or loading tables
- Roll-in carts
- Pan slides for stands
- Additional pan racks/wire shelves
- Casters
- Water treatment system
- Special electrical requirements

**Boiler Free, Boilerless, or Connectionless Steamers**

- Different manufacturers have different names for this type of steamer
- This type creates steam in the cabinet from water which is manually introduced into a tank with a heating element
- These are useful for low to medium volume operations because they hold three to six pans
They are easily movable, although they still require electricity and use considerably less water than other types of steamers.

They may not require a water filtration system.

Some may not require any type of plumbing connection, while others may have plumbing connections to automate the drain control, draining the generator when the main power is off or the water level control through the use of low-water and high-water probes so there is no need to refill or monitor the water level during cooking.

One consideration is that they may have slower cooking times than standard steamers.

This type of steamer will require careful use, as employees may still be burned by steam when the door is opened.

This type of steamer requires time to heat up.
Steam cooking equipment includes a diverse group of equipment, some of which have been used for 100 years or more and other types which are quite new. Steam cooking generally offers speed, energy savings, labor savings, and good nutrient retention as compared to other types of cooking.

Steam jacketed kettles are found in many school nutrition operations and can be used to make soups, stockpot products, double boiler products, and braised or boiled meats. They come in full or two-thirds jacketed models. More options are available on larger capacity kettles.

The choice of steamer type depends on the volume and speed needs of the school nutrition program. For all types, water treatment of hard water is critical. Overcooking is the most common mistake with steamers. Pressureless steamers are one of the most popular types in foodservices. They use more water and energy than pressurized steamers, but offer the advantages of less flavor transfer and the flexibility of being able to open the door during the steaming process. Low-pressure steamers are used for large volume preparation. Interestingly, high-pressure steamers cook at higher temperatures, but do not handle as great a volume because they are only able to hold three standard-sized pans.

Combi-ovens have also become very common in school foodservice operations. The combi-mode is highly flexible as it can cook in hot air mode (convection oven), a steam mode (convection pressureless steamer), and a combination of both modes (circulating hot air with superheated steam). Connectionless steamers offer desirable flexibility and are becoming more popular in schools.
CHAPTER THIRTEEN

Refrigerated and Low-Temperature Storage Equipment
Chapter Highlights

Refrigerators and Freezers

- Mechanical parts
  - Evaporator
  - Compressor
  - Condenser (air or water cooled)
- Water cooled condensers are more expensive, but last longer, require fewer repairs, and operate better in hot climates or conditions.
- Walk-in refrigerators and freezers are appropriate for large quantity storage.
- Reach-in refrigerators are the main use refrigerators.
- Under-the-counter refrigeration provides convenience.
- Roll-in and pass-through refrigerators are useful for racks and rolling carts.
- Milk or ice cream chest-style units are often used in service areas where doors are opened frequently.
- Outside walk-in units may add needed storage space when no more interior space is available.

Amount and types of refrigerated storage will vary with the menu, delivery frequency, volume and type of preparation, use of commodity foods, and reliance on refrigerated versus frozen food products.

School nutrition directors act as Trusted Advisors in determining the amount of refrigerator and freezer space needed. The amount will depend on:
  - Number of meals offered
  - Types of meal/snack programs offered
  - Type of menu
  - Delivery frequency
  - Volume of preparation done.

General purchasing recommendations for all refrigerators and freezers include:
  - Purchase only commercial equipment.
  - Evaluate the refrigerant and purchase new rather than used equipment.

Purchasing recommendations for reach-in refrigerators include:
  - Determine the number of compartments needed.
  - Evaluate the insulation, construction materials, doors, and gaskets.
  - Check the thermometers.
  - Determine freight rate and warranties.

Purchasing recommendations for walk-in refrigerators include:
  - Evaluate the insulation, construction materials, doors, and gaskets.
  - Check the thermometers.
  - Determine freight rate and warranties.
  - Determine whether alarms would be useful.
Purchasing recommendations for reach-in freezers include:
- Determine the number of compartments needed
- Evaluate the insulation, construction materials, doors, and gaskets
- Check the thermometers
- Determine freight rate and warranties

Purchasing recommendations for walk-in freezers include:
- Evaluate the insulation, construction materials, doors, and gaskets
- Check the thermometers
- Determine freight rate and warranties
- Determine whether alarms would be useful

**Energy Efficiency for Refrigerators and Freezers**
- Minimize the number of times doors are opened

**Blast Chillers and Freezers**
- Blast chillers and freezers very rapidly cool foods through the use of a forced air current
- Purchasing recommendations include:
  - Select heavy duty components
  - Choose larger compressors
  - Compare fans

**Ice Machines**
- Four types are those that only make ice, those that make and store ice, those that dispense ice, and those that make and dispense ice
- Choice of ice machine is affected by the volume produced
- Generally between one to three pounds of ice are needed per customer
- Purchasing recommendations include:
  - Purchase countertop or under-counter models for smaller/moderate quantities, floor models for larger quantities
  - Consider buying two units if need will vary throughout the day
  - Evaluate manufacturers’ sizing charts carefully
  - Select ice cube shape and size based on the intended use of the ice
  - Consider water softening and/or filtration
Refrigerated and Low-Temperature Storage Equipment

**Introduction**

Refrigerated and low-temperature storage equipment is designed to keep potentially hazardous food cold so that it is out of the temperature danger zone where microorganisms might grow. In addition, although it is not as obvious, cold temperature equipment serves at least three other purposes. They are to preserve the quality of the food put into them, lengthen the shelf life of fragile foods, and enhance the sensory perception of foods that might be stored in them.

For these reasons, good cold holding equipment is extremely important. The selection of efficient cold holding equipment is also important because the equipment operates continuously and it must be energy efficient. Small differences in insulation or the way the equipment is used can impact energy use and costs to run the equipment.

Insulation and the way the equipment is used also affects the temperatures of the food held in refrigerated and low-temperature storage equipment. This is critical also because cold holding equipment faces a huge task in achieving and maintaining food to the proper temperatures. Some equipment can not handle this task very well when they are not used them wisely. Without proper cold holding, a foodservice operation would be shut down by a health inspector. Good holding equipment is absolutely key to the safety, quality, shelf life, and sensory perception of the food served in school nutrition operations.

Location of the refrigerated and low-temperature equipment is important for efficiency of the equipment. Refrigeration should be placed conveniently for food deliveries and storage, but also located in areas where employees will be using them.

**Refrigerators and Freezers**

All refrigerators and freezers are composed of three mechanical parts. They are the evaporator, compressor, and condenser. The evaporator is located inside the cabinet and helps to convert the refrigerant into a gas to help in cooling. The compressor is often located above the cabinet or outside the kitchen and performs the pumping of the refrigerant. The condenser may be located either inside or outside the kitchen and converts the refrigerant gas back into a liquid so that the process may be repeated. As the three parts work appropriately, maximum efficiency is achieved.

Condensers may be air or water cooled. Prices will be higher for water cooled condensers, but they are generally considered more effective. Advantages and disadvantages to both systems as shown below.

**Air Cooled Condensers**

- Do not operate well in extremely hot climates or conditions
- Require more frequent repairs
- Have a shorter lifespan
- Are less expensive
**Water Cooled Condensers**

- Operate well in the kitchen
- Require less frequent repairs
- Last longer
- Are more expensive

Most new refrigerators do not need a separate plumbing connection because they are now equipped with an automatic defrost and condensate disposal system. The need for a separate plumbing connection should still be checked, however. In addition, local sanitation codes should be consulted. For example, floor drains are generally prohibited inside refrigerators. The type and amount of refrigeration that is needed should be considered carefully. Because of their size and utility needs, changes after construction are extremely difficult. Types of refrigeration and their “ideal” use are given below:

- Walk-in refrigerators and freezers are considered most affordable for storage of large quantity
- Reach-in refrigerators and freezers are often viewed as the major form of refrigeration in most foodservice operations, as they are preferred if constant access is required
- Pass-through refrigerators act as a wall dividing two work areas where food needs to be accessible from both sides
- Under-the-counter refrigerators/freezers or refrigerator/freezer drawers are useful if constant access is required, particularly for smaller quantities
- Roll-in refrigerators are used in quantity preparation where racks and rolling carts are heavily depended upon to transport food to the refrigerator
- Mobile refrigerators are used to transport food to other locations as temporary holding refrigeration
- Combination refrigerator/freezers provide a great deal of flexibility due to the ability to switch the unit from a refrigerator to a freezer and back as the need arises, but are more expensive and are generally used in similar situations to reach-in refrigerators
- Milk or ice-cream chest-style refrigerators and freezers are often used in service areas because they are energy efficient when doors are opened frequently
- Outdoor walk-in refrigerators or freezers may be used to add additional cold space, but special consideration is needed to accommodate outdoor placement

The amount of refrigerator and freezer space that is needed for school nutrition programs is different for each school. School nutrition directors functioning as Trusted Advisors should understand the program profile associated with each school to truly determine appropriate refrigerator and freezer space requirement. The amount of space will depend on:

- Number of meal programs offered
- Type of menu and variety
- Type of production
- Type of recipes and forms of ingredients
- Frequency of food deliveries
- Volume of preparation based on number of customers served
- General advice
  - Schools receiving deliveries multiple times per week will need less space
  - Schools receiving less frequent deliveries will need more space
  - Two times as much refrigerated space is suggested as compared to the volume of
freezer space, but newer schools are now being planned with a greater volume of
freezer space as compared to refrigerated space
- 159 cubic feet of refrigerated space may be needed for every 250 lunch meals served,
  with additional space for breakfast meals and afterschool snacks
- 28 pounds of food will fit into a cubic foot of refrigerated storage space

These guidelines are highly dependent on the individual school. For example, some schools will use the
opposite amount of freezer versus refrigerated space. In these schools, they may allow for twice as much
freezer space as for refrigerator space. Their reasons include a greater reliance on convenience and
processed foods due to a shortage of labor and high labor/benefit costs, the food safety benefit of using
frozen food, use of frozen commodity foods, and other frozen foods such as bread products.

If space and the budget are not limited, the ideal kitchen would provide a variety of refrigerators
and freezers for both bulk storage and convenient storage near work areas. In addition, it would
include refrigerators and freezers in the service areas for both holding of pre-prepared products for
the serving line and for self-service areas. More specifically, it would likely include:
- Walk-in refrigerators/coolers
- Walk-in freezer
- Roll-ins/Reach-ins by
  - Hot food production
  - Salad
  - Dessert/bakery
- Reach-in/pass-through and chest refrigerators and freezers in the service area as needed,
  including a milk coolers

**Purchasing Recommendations for Refrigerators and Freezers**

For all refrigerators and freezers, it is important to remember that only commercial pieces of
equipment may be used in the school nutrition program. Home models of equipment should never
be used in a commercial operation.

In addition, for all refrigerators and freezers, it is important to evaluate the type of refrigerant.
This is an issue when buying a used refrigerator because of changes in regulations regarding the
use of environmentally friendly refrigerants. For example, the production of chlorofluorocarbon
(CFC) containing refrigerants was banned in 1995, although their use in existing systems is still
allowed. Retrofitting can be done, although expensive and it may be a stress on other components
of the refrigeration system which may cause the system to fail. The purchase of used refrigeration
equipment is generally not recommended for several reasons. The primary reasons include:
- The CFC issue/retrofitting is expensive
- Lack of warranty on compressor or coil
  - Most warranties on new equipment are 12 months for refrigeration unit and 5 years
    on compressor motors
- Cost of disassembling, moving, reassembling walk-in units
- Life expectancy is between 5-20 years according to most manufacturers, although many
  older models are still in use
Purchase Recommendations for Reach-in Refrigerators

- Determine desired number of compartments
  - Multiples of 1, 2, or 3, are common and 4 are possible, but will require wide doorways for delivery of these units
  - Each compartment generally has 20-25 cu. ft.
    - Single compartment  20-25 cu. ft.
    - Double compartment  46-52 cu. ft.
    - Triple compartment  70-80 cu. ft.
    - Quadruple compartment 100 cu. ft.
  - Interior compartment space may vary with brand name
  - Bottom mounted refrigeration will reduce interior storage space and require a door that is ½ the height of a regular door
  - Top mounted refrigeration has more interior storage space

- Evaluate the insulation
  - Good insulation allows flexibility if the cold holding temperature requirements are lowered (for example to 35° F or 2° C)
  - Industry standard equals 2 to 3” rigid or foamed in place polyurethane

- Select the exterior materials carefully, as it can change cost by 30-35%
  - Satin or polished stainless steel is considered the best
  - Anodized aluminum is less expensive than stainless steel and may be acceptable if the sides are hidden
  - Laminated surfaces are one of the least expensive and more commonly used in home refrigerators
  - Plastic or vinyl finishes over steel is a less expensive alternative
  - Fluorescent lighting and white ceilings also create more brightness to the interior of the refrigerator or freezer

- Determine whether shelves or slides are preferred
  - Slides are a flexible choice, but will require the use of pans
    - Near the serving line, slides may be preferred when these refrigerators are used as pass-through units
    - Determine the type and number of slides based on the pans that will be used for that serving area

- Determine preferred hinges (right or left); three hinge doors provide more stability
  - Choose the opening so that it is opposite of the work area, allowing more access to the food products
  - Should lock at 90° angle, although some allow 120° or 180° door swings and adjustable stops to provide access in tight spaces

- Select door opening type and size
  - Solid doors have better insulation
  - Glass doors allow staff to view the inventory of prepared items, minimizing opening of doors to locate food
  - Sliding doors are an option
  - Split or half doors decrease the amount of cold air lost when door is opened, but yields less interior storage and smaller size door opening for large items

- Choose door closers
  - Latch style
  - Magnetic seals, providing a tighter close to the door
- Evaluate the gaskets
  - Type of gasket to promote cleanability, durability, and ease of replacement
  - Purchase gasket heaters as an option to prevent condensation in high humid climates
- Check thermometers
  - External thermometers make it easy to frequently check the temperature
  - Should be accurate to within 3° F (about 2° C)
  - Inside thermometers are appropriate and provide added verification of unit temperatures
  - Consider linking the thermometers to the school alarm system for added protection of food when power or equipment failures occur
- Determine freight rate
- Compare warranties

**Purchase Recommendations for Walk-in Refrigerators**
- Determine whether pre-fabricated or pre-engineered units are desired
  - Consider purchase price, freight cost, and construction/installation costs
  - Walk-ins built on-site may be constructed with Styrofoam insulated walls and have glazed tiles
  - Pre-fabricated or pre-engineered units may be built with 4-6” thick insulated modular panels
  - Many manufacturers use fiberglass reinforced plastic (FRP) for the framing
- Evaluate the insulation
  - Appropriate thickness will vary
  - Verify insulation rating because some types may need to be 4-6” thick
  - Urethane provides better insulation and does not need to be as thick as fiberglass, polystyrene, or styrofoam insulation
  - Floor may be insulated to prevent sweating from condensation
- Determine whether approved to use food storage pallets on the floor for additional storage
- Select door opening type and size
  - Doors should be durable to resist the impact of carts so that they will not dent, rust, warp, or scratch
  - Solid doors have better insulation
  - Glass doors or viewing windows allow staff to have a better view of the type of products inside (which may minimize door opening to find certain foods)
  - Small access doors on walk-in coolers are also very useful
  - Compare the size of the door opening with the width needed for roll-in carts
- Choose door closers
  - Latch style
  - Magnetic seals provide a tighter closer
  - Door snubbers help to pull a door closed when it starts to shut
- Consider getting a kickplate (i.e. diamond tread) to improve durability and prevent damage to the door
- Evaluate gaskets
  - Type of gasket to promote cleanability, durability, and ease of replacement
  - Gasket heaters are an option to prevent condensation in humid climates
- Confirm best location for condensation drainage pipes to prevent interference with kitchen work
Check thermometers
- External thermometers make it easy to frequently check the temperature
- Should be accurate to within 3° F (about 2° C)
- Inside thermometers are appropriate and provide added verification of unit temperatures
- Consider linking the thermometers to the school alarm system for added protection of the food when power or equipment failures happen

Determine freight rate

Compare warranties

Determine whether alarms would be useful to send alerts when the temperature rises above an established level

### Purchase Recommendations for Reach-in Freezers

- Determine desired number of compartments
  - Multiples of 1, 2, or 3, are common (4 are also possible, but will require wide doorways for delivery of these units)
  - Each compartment generally has 20-25 cu. ft.
    - Single compartment 20-25 cu. ft.
    - Double compartment 46-52 cu. ft.
    - Triple compartment 70-80 cu. ft.
    - Quadruple compartment 100 cu. ft.
- Interior compartment space may vary with brand name
- Bottom mounted refrigeration will reduce interior storage space and require a door that is ½ the height of a regular door
- Top mounted refrigeration has more interior storage space

- Evaluate the insulation
  - Good insulation allows flexibility if the cold holding temperature requirements are lowered, for example to 35° F or 2° C
  - Industry standard equals 2-3” rigid or foamed in place polyurethane

- Select the exterior materials carefully, as the selection can influence the overall cost by 30-35%
  - Satin or polished stainless steel is considered the best
  - Anodized aluminum is less expensive than stainless steel and may be acceptable if the sides will be hidden
  - Laminated surfaces are one of the least expensive and are commonly used in home refrigerators
  - Plastic or vinyl finishes over steel are a less expensive alternative and are easy to clean
  - Fluorescent lighting and white ceilings also create more brightness to the interior of the refrigerator or freezer

- Determine whether shelves or slides are preferred, slides are a more flexible choice, but will require pans

- Determine preferred hinges (right or left); three hinge doors are also better for stability
  - Choose the opening so that it is opposite of the work area, allowing the employee be access
  - Should lock at 90° angle, some allow 120° or 180° door swings and adjustable stops to provide access in tight spaces
Select door opening type and size
- Solid doors have better insulation
- Glass doors allow staff to view the inventory of food items, minimizing the need to open door
- Sliding doors are also available
- Split or half doors decrease the amount of cold air lost when the doors are opened, but yield less interior storage and smaller size door openings for large items
  - Split or half doors that individually lock may be very useful, depending on type of use

Choose door closers
- Latch style
- Magnetic seals provide a tighter close to the door to minimize cold air loss

Evaluate the gaskets
- Type of gasket to promote cleanability, durability, and ease of replacement
- Purchase gasket heaters as an option to prevent condensation in high humid climates

Check thermometers
- External thermometers make it easy to frequently check the temperature
- Should be accurate to within 3° F (about 2° C)
- Inside thermometers are appropriate and provide added verification of unit temperatures
- Consider linking the thermometers to the school alarm system for added protection of food, due to power or equipment failures

Determine freight rate

Compare warranties

**Purchase Recommendations for Walk-in Freezers**

Determine whether pre-fabricated or pre-engineered units are desired
- Consider purchase price, freight cost, and construction/installation costs
- Walk-ins built on-site may be constructed with styrofoam insulated walls and have glazed tiles
- Pre-fabricated or pre-engineered units may be built with 4-6” thick insulated modular panels
- Many manufacturers use fiberglass reinforced plastic (FRP) for the framing

Evaluate the insulation
- Appropriate thickness will vary
- Verify the insulation rating because some types may need to be 4-6” thick
- Urethane provides better insulation and does not require the thickness of fiberglass, polystyrene, or styrofoam
- Floor needs to be insulated to prevent sweating from condensation
- Doors should not freeze shut

Determine whether approved floor pallets are needed for additional storage

Select door opening type and size
- Doors should be durable to resist the impact of carts so that they will not dent, rust, warp, or scratch
- Solid doors have better insulation
- Glass doors or viewing windows allow staff to view the type of products inside, minimizing opening of door
- Compare the size of the door opening with the width needed for roll-in carts
Choose door closers
- Latch style
- Magnetic seals provide a tighter closer
- Door snubbers help to pull a door closed

Consider getting a kickplate to improve durability and prevent damage to the door

Evaluate the gaskets
- Type of gasket to promote cleanability, durability, and ease of replacement
- Gasket heaters are an option to prevent condensation in high humid climates

Confirm best location for condensation drainage pipes to prevent interference with kitchen work

Check thermometers
- External thermometers make it easy to frequently check the temperature
- Should be accurate to within 3° F (about 2° C)
- Inside thermometers are appropriate and provide added verification of unit temperatures
- Consider linking the thermometers to the school alarm system for added protection of food when power or equipment failures happen

Determine freight rate

Compare warranties for all parts of the unit

Determine whether alarms would be useful to send alerts when temperature rises above an established level

**Energy Efficiency of Refrigerators and Freezers**

To best use refrigerators and freezers, the single best practice is to minimize the number of times that the door is opened and closed. Other ways to increase the energy efficiency of refrigeration systems includes:

- Locating the walk-in freezer inside the walk-in refrigerator
  - When the freezer door is opened, the cold air goes into the refrigerator instead of the kitchen

- Maintain cool kitchen temperatures
- Perform routine maintenance on gaskets and coils
- Store deliveries into storage promptly
- Leave air space around foods for proper air circulation

**Blast Chillers and Freezers**

Blast chillers and freezers very rapidly cool foods through the use of a forced air current. They are much more efficient than regular refrigerators and freezers at cooling foods particularly if a great deal of food is prepared in advance. Their efficiency can best be explained as an analogy to wind chill temperatures in winter where the actual temperature seems colder when wind is present as compared to temperatures when there is no wind.
In addition to their food safety advantages, this rapid cooling is also likely to result in a better quality product. Blast units are common in cook-chill preparation. They are also usually adaptable to Hazard Analysis Critical Control Point (HACCP) systems because they have temperature probes, and have printing systems which allow temperature monitoring of products used in them. Because of the added fan and HACCP components, they are also more expensive than standard refrigeration. Units can be either reach-in or roll-in styles.

Blast chiller capacities vary. Smaller sizes will hold 18-30 pounds of food, medium chillers will hold 45-100 pounds, and larger sizes may hold up to 400 pounds of food. Food may be placed on shelves in reach-in style or on roll-in carts in larger units. Some blast chillers even include a conveyor belt system. Some units have casters and can be rolled from one production area to another.

**Purchase Recommendations**
- Select heavy duty components
- Choose larger compressors
- Choose fans with higher speeds
- Select easy to clean units
- Access to evaporator components is important as they will need to be cleaned periodically
- Removable racks or shelves are also easier to clean
- Choose units with automatic defrost and evaporation systems

**Ice Machines**
The four types of ice machines include:
- Those that only make ice in production facilities
- Those that make ice and store it
- Those that dispense ice
- Those that make and dispense ice

One of the biggest concerns related to ice machines is the volume that is produced. The need for ice will vary considerably in each school nutrition operation based on the use in the production and service areas. Should iced beverages be a part of the meal service, commonly used estimates range from slightly less than one pound per customer up to three pounds. The best choice of ice machine will depend on how much ice is needed and where it is needed.

**Purchase Recommendations**
- If smaller/moderate quantities are required in several locations, consider countertop or undercounter ice makers which will generally produce 25-200 pounds or 11.4-90 kg per day
- Floor models are required for larger quantities and can make up to 3,300 pounds or 1500 kg per day
- If the school has heavy peak requirements, but lighter off-peak requirements, buy two smaller stacked-type units with on “on-hold” during off-peak time periods
- Multiple units are also good if one unit goes down
- If a great deal of ice is needed in the production area and a moderate need for dispensing in the dining room or cafeteria, consider purchasing a larger ice making/storage unit for the kitchen and manually fed dispensers in a self-service location
Evaluate carefully manufacturers’ sizing charts for volume production, their assumptions are often that
- The bin can hold the peak volume of ice produced every hour or that the ice is removed for storage elsewhere
- Ice is not wasted
- Ice machines are operating at peak efficiency which means the kitchen is not hot, but cool room temperature

- A 10° F (6° C) air temperature difference will decrease production by 5%
  - Ice in the bin will melt faster
  - Warm tap water to make the ice will lengthen the time needed for ice production

Select the preferred type of condenser
- Air cooled condensers work best if the unit is outside the kitchen, particularly if the ambient temperature exceeds 80° F (27° C), they can be located up to 100 feet away, for example on a roof
- Water cooled condensers are less affected by warm temperatures

Select ice cube shape and size based on the intended use of the ice
- Smaller shaped ice melts faster, but packs easier into a glass
- Larger shaped ice melts more slowly, but may be awkward, based on use
- Most commonly preferred ice for beverages are straight cubes or pillow cubes
- Salad bars use crushed or flaked ice

Consider noise level of unit
- Consider water softening and/or filtration to improve performance of the machine
- Consider warranty and preventative maintenance
Refrigeration equipment should be chosen wisely. Refrigeration is critical for the quality, shelf life, sensory characteristics, and safety of the food that is stored in them. In addition, refrigerators and freezers are among the most expensive pieces of equipment purchased in a school nutrition kitchen. They are also considered a “main use” piece of equipment. Staff open and close the doors to the refrigerators numerous times over the course of one day, therefore, they need to be accessible and convenient to provide a smooth work flow. Without them, perishable food could not be held safely. In addition, if a unit is undependable and breaks down and the food in them becomes unsafe to use, there is a great risk for losing huge amounts of food. Refrigeration equipment operates continuously, therefore, energy efficiency is a serious consideration when making this type of purchase.

Refrigeration equipment typically are one of the longest use pieces of equipment and the choices that are made affect the operation for many years. School nutrition directors functioning as Trusted Advisors will therefore need to consider their choices carefully. They need to purchase the types of refrigerators and freezers that best meet their operational needs. The selection options include walk-ins, reach-ins, under-the-counter, roll-in, pass-through, and chest units. Blast chillers and freezers are a more efficient style of refrigeration unit that rapidly cools food through the use of a forced air current, but are more expensive.

The choice of ice machine is also critical. Several types are available. Volume needed and the preferred shapes of ice are important considerations in ice machine purchases.

For both refrigeration equipment and ice machines there are, of course, are many manufacturers. Some of these manufacturers have been around sixty years or more. Compare brands carefully. The quality of refrigerators, freezers, and ice machines purchased is a decision that will influence the school nutrition operation for a long time.
CHAPTER FOURTEEN

Serving Equipment
Serving Equipment

- School nutrition directors as Trusted Advisors understand that flexibility is key in selection of serving equipment.
- Important trends:
  - Mobile serving equipment
  - Modular serving equipment

Cold Food Tables and Salad Bars

- Two types are mechanically refrigerated and non-mechanical, ice-cooled models.
- Tables are based on modules of 12 x 20" and come with 2-6 units put together.
- Upscale trends are to use more wood and stone-like materials.
- Good insulation on the sides and bottom is essential.
- Local health code requirements should be checked for drain and temperature sensing device requirements.
- Considerations in self-service areas:
  - Height
  - Sneeze or breath guards
  - Tray slides
  - Attractiveness
- Self-service options:
  - Adapter bars
  - False well bottoms
  - Templates
  - Air screens
  - Casters

Hot Food Tables

- Two types are steam tables and dry tables.
- Dry tables are convertible to steam tables with spillage pans.
- Come in modules of 12 x 20", usually 2-6 modules are put together for a unit.
- Can be preassembled or assembled on-site.
- Local health code regulations should be checked for sneeze or breath guards and temperature sensing device requirements.
- Not very heat efficient, best practices include:
  - Keeping the amount of food in serving pans to a minimum.
  - Using covers on pans.
  - Using infrared heat lamps.
  - Stirring liquid foods.
  - Using hot water according to manufacturer’s directions.
  - Prewarming plates or dishes.
Warming Cabinets
- Although batch preparation is preferred, short term hot holding of food is sometimes necessary
- Holding cabinets with humidity control are better at holding foods than dry cabinets
- Available as drawers or cabinets, and as reach-in, pass-through, roll-in, and roll-through models
- Warming cabinet options:
  - Bumpers
  - Heavy duty casters
  - Right or left opening hinges
  - Timers
  - Fans
  - HACCP compatible monitoring and documentation systems
  - Dual doors with dual temperature controls

Upright Display Cases
- Unrefrigerated cases are available for bakery products
- Refrigerated units are used for salads, sandwiches, juices, and dairy products
- Generally not recommended for overnight storage
- Units are generally not very energy efficient
- Upright display case options:
  - Doors or air curtains
  - Sliding or swinging doors
  - Right or left openings on doors
  - Locks

Milk Coolers
- Capacity of units will vary from 4-16 cases of milk
- Units should be evaluated for ability to maintain temperatures when the door is open
- Thermometers should be accurate and easily visible from the front
**Serving Equipment**

**Introduction**

Types of serving equipment for a school nutrition operation will be determined based from the menu. Because menus will vary, however, flexibility is key in the selection of serving equipment. School nutrition directors in their role as *Trusted Advisors* clearly understand the menu and this need for flexibility. Service trends in schools are to incorporate multiple points of service both inside and outside the dining room. Mobile equipment is particularly valuable today as it offers the most flexibility and allows conversion of the serving line from a straight line to a scatter to a food court as needed. In addition, most manufacturers now offer a variety of modular serving line choices which offer a mix and match combination of well units (generally 12 x 20 inches or 30 x 51 cm). Multiples of three and four well units are common, but more are possible. Units can also be attached to each other to increase the service choices.

Freshly prepared food is the ideal in terms of quality and food safety. However, if food needs to be prepared in advance and held prior to service, proper temperature control is critical for food safety. In addition, the Health Code requires that all potentially hazardous foods be held at proper temperatures during the service period. This is important because holding and serving equipment is generally not designed to raise or lower the temperature of food. Instead, holding and serving equipment is designed to hold already hot or cold food at the appropriate temperatures. Selection of good quality equipment and the appropriate use of that equipment are essential to keep food safe during service.

Safety for employees and student customers is also important in serving equipment to prevent injuries. Important safety features would include lockable casters, smooth corners and edges on equipment, wrap around or corner bumpers, and doors which will not drop down or close unexpectedly and catch hands, arms, or fingers. Appropriate height of serving equipment is also important for safe use so that difficult reaching into equipment is not needed. In addition, employee safety can be improved with steam tables or cold tables with drains that direct water into floor drains.

**Cold Food Tables and Salad Bars**

There are two types of cold food tables that might be used for salad bars or service of other cold food items. Cold food tables may either be mechanically refrigerated or non-mechanical, ice cooled models. Some of the mechanically refrigerated food tables are also convertible to hot food tables with the flip of a switch. Cold food tables can also be purchased with wells for pans or as open bin units that can serve as display areas for 18” x 26” (46 x 66 cm) trays of pre-portioned fruits and vegetables, pre-wrapped sandwiches, or pre-made chef salads.

Size of the cold food table is an important purchase consideration. Tables are based on modules of 12 x 20” (30 x 51 cm) and come in units with two to six of these modules put together, although other configurations are possible with custom purchasing and allow for just about any length or shape. Custom units are generally more expensive than buying direct stock, but their ability to fill a particular need may make their purchase desirable. For all units, adapters can be purchased to divide the 12” openings for use by different sizes of pans.
Depending on the need for electricity, cold food tables may be attached to the floor as a freestanding unit or may be portable so that they may be used in more than one location. All cold food tables, however, should have insulation on the sides and bottom. In addition, a drain with a one-half inch (2.5 cm) hose diameter is also important. Finally, health code requirements require a built-in thermometer to make certain that potentially hazardous foods are kept out of the danger zone temperature. Options for cold tables include:

- Adapter bars are useful to divide the 12” openings for use with different sizes of pans
- False well bottoms are useful in non-mechanical units to allow water to drain from melted ice and slow the melting of the remaining ice
- Templates are available for either mechanical or non-mechanical units which create holders for bowls or containers in the salad bar; they also create a more finished appearance and keep ice at colder temperatures to minimize melting when ice is used
- Air screens create a directed air flow across the top of food and back into the casework to help in temperature maintenance of foods kept in the cold table
- Casters offer greater flexibility for use; important features include durability, size, and locking ability
- Overhead display shelves provide opportunity to maximize space while displaying menu items, a la carte items, or promotional decorations/displays

Cold food tables that are used in self-service areas have additional considerations that school nutrition directors as Trusted Advisors understand. Height of the cold food table, sanitation regulations related to sneeze or breath guards, tray slides, and the attractive appearance of the cold food table are important in self-service areas.

For example, cold food tables are available with heights that are more suitable for elementary school aged children (28” or 71 cm) in addition to the standard height units. Consideration of the age and height of the student customers is important if food is to be served safely from self-service cold food tables in the school nutrition program. School nutrition directors acting as Trusted Advisors use their knowledge of food safety to determine how best to serve food.

Local health codes should be checked for sneeze or breath guard requirements for all self-service tables. Generally, sneeze or breath guards are required above all cold (or hot) tables and should be placed so that they protect the food at a height between 18-45” (45.7-114 cm) above the table top surface. Adjustable portable sneeze guards may be useful in situations where flexibility is needed.

Self-serve tables will also require tray slides. These can be tubular or full shelf designs. Tray slides should be free from sharp edges and should have rounded corners so that they will not catch clothes or hands, and will allow for smooth movement of trays. Full shelf designs are preferred by some school nutrition directors to minimize spills as the customers move through the lines.

Finally, appearance of the cold food tables is also a consideration in self-service areas. Cold food tables are commonly constructed with metal, plastic, or coated wood countertop surfaces. Upscale trends are to use more wood coated to meet sanitation code regulations and stone-like materials.
Hot Food Tables

Two types of hot food tables are available. Most units are called steam tables and hold pans over a well containing heated water which helps to maintain a constant temperature, 180-190° F (82-88° C). Hot food tables have a sealed well with a drain and may be ordered with a water tap for filling the well. The second type is dry tables which are used without water in the wells and do not contain a drain, but can be converted to a wet steam table with the use of spillage pans. Spillage pans are typically 8” deep (20 cm) to accommodate all depths of serving pans. They act like a double boiler in that the smaller serving pan is placed inside a larger pan (the spillage pan) which contains water. The use of steam (either with a wet steam table or a spillage pan in the dry table) improves the heat transfer to serving pans so that they heat more evenly with minimal scorching of the food. The advantage to the dry tables is that they do not require a plumbing connection; however, tables with drains (that are plumbed into floor drains) are generally preferred because employees will not need to empty hot water from the wells. Hot food tables may either be gas or electric.

Hot tables are also based on modules of 12 x 20” (30 x 51 cm) and come in units with two to six connected modules. Adapters can be purchased to divide the 12” openings for use with different sizes of pans. For example, they can be used to make the openings appropriate for ½, ¼, 1/6, 1/3, or 1/9 size pans. Typical depths of serving pans can be 4” (10 cm), or 2 ½ (6.25 cm).

Hot food tables can be purchased either preassembled or may be assembled on-site. Preassembled tables have higher shipping costs, but greater stability.

Similar to the regulations for cold tables, local health codes should be checked for sneeze or breath guard requirements. Generally, sneeze or breath guards are required above all hot (or cold) tables and should be placed so that they protect the food at a height between 18-45” (45.7-114 cm) above the table top surface.

Health code requirements also call for a built-in temperature sensing device for the water in the well because of the need to keep potentially hazardous foods out of the temperature danger zone. In addition, food temperatures will need to be checked with a food thermometer prior to putting the food into the hot food table and periodically after placing the food into the table (for example, once every hour) because steam tables are not very heat efficient.

Steam tables should never be used to cook potentially hazardous foods as this is a violation of the health code regulations. Although they can achieve fairly high food temperatures, they are extremely slow at bringing foods to those temperatures. Steam tables should only be used to hold hot food at hot temperatures. To best maintain food temperatures in hot food tables, the following guidelines include:

- The amount of food in serving pans should not exceed what can be served in a fairly short period of time
- Covers should be used when food is being held to keep food hot, but uncovered when customers are being served
- The disadvantage is that covers on food do not allow the food to be seen by customers. If this is a concern, the following practices could be done:
  - Using clear plastic covers
  - Using a half size cover to keep a portion of the food covered while the other half
Infrared heat lamps can be used above the hot food line to enhance the hot holding capacity of the hot food table, but not in an area where students may be burned.

- Liquid foods such as soups and stews should be stirred periodically to even out the heating of the food.
- Hot water should be used according to manufacturer's directions in the steam table.
- Lunch plates should not be chilled.

Hot food table placement should also be considered. Tables should be placed in an area where they can be easily filled, but should not be next to laminated table top surfaces because they will cause the separation or peeling of the laminate.

**Warming Cabinets**

Ideal preparation of school lunches is generally thought to be batch preparation so that food is held a minimal amount of time, if at all. If holding of hot food is required however, warming cabinets may be used as an interface between production and service. Warming drawers are also possible as an under the counter model. Warming cabinets and drawers provide a safe temperature controlled storage area for short periods of time (for example, less than one hour) for cooked and ready-to-eat food items to meet service demands.

If food must be held for an hour or longer, a better food holding device is a humidified holding cabinet in order to best maintain the quality of the food product. Non-humidified holding cabinets dry and toughen food products that are held in them for extended time periods.

Holding cabinets come in a variety of mobile and stationary styles for short term holding of foods. Reach-in, pass-through, roll-in, and roll-through models are possible. They are made with glass or aluminum doors. Applications for heated cabinets include:

- Meat
- Poultry
- Fish
- Pizza
- Vegetables
- Breads, muffins, biscuits, rolls
- Proofing bakery dough

Holding cabinets should have sufficient power to be able to reheat rapidly when the door is opened in order to keep food out of the temperature danger zone. The best types of holding cabinets provide heat both from the bottom and the top. Because the quality of food will decrease during holding, the following practices are recommended:

- Holding food for minimal lengths of time by incorporating batch preparation techniques
- Covering food with pan lids or foil

Single cabinets are generally about 20” x 27” x 27” (51 cm x 69 cm x 69 cm) and hold 6-8 full size sheet pans. Smaller countertop models are also available. Exteriors are generally aluminum (less expensive) or 22 gauge stainless steel (more durable). Controls may be either manual or electronic. Electronic controls may provide the option of setting different temperatures for compartments.
within a multiple cabinet. Cabinets with stainless steel interiors and removable tray slides are generally the easiest to clean. Options and accessories include:

- Corner or perimeter bumpers
- Heavy duty casters (casters may also be different sizes, such as three or five inch with brakes)
- Right or left opening hinges
- Timers
- Fans
- HACCP compatible monitoring and documentation systems which have temperature probes and printing systems to allow temperature monitoring of products used in them
- Dual doors with dual temperature controls
- Half doors (instead of full doors) which minimize the heat loss when doors are opened
- Glass doors on the kitchen side allow for an easier view when restocking

All warmers should come with a temperature gauge on the outside of the unit to help in monitoring the temperature of food products.

**Display Cases**

Display cases are being used more and more to market prepackaged foods. Unrefrigerated units for bakery products and refrigerated units for salads, sandwiches, juices, and dairy products have become popular.

For baked goods, a dry cabinet is important. Wire racks provide the best air circulation. Merchandising (appearance) is better with a mirrored interior, glass doors, and interior lighting.

Refrigerated units are also common in service areas. Thermometers are required and should be visible from the front or outside of the unit. Generally, most units are not intended for overnight storage of food, so it is important to check the manufacturer’s guidelines. Single units generally offer about 25 cubic feet (.7 cubic meters). Refrigerated display cases made with stainless steel exteriors are considered the best for cleaning, although the use of Acrylonitrile Butadiene Styrene (ABS) plastic for the interiors and door liners is also less expensive and durable for low temperature products and piping.

These units are generally not very energy efficient. Doors can be either sliding or a swing type. The choice of right or left openings should be based on the service flow and the location of other nearby equipment. Locks are a valuable option for areas that require greater security between service periods.

**Milk Coolers**

Milk cooler refrigerated units are available with top access or open front access with a single door or from both sides with dual doors. Stainless steel or white exteriors are commonly available. Milk coolers are sized by the number of cases of milk that they hold and generally will hold between 4 to 16 cases of milk.
School nutrition directors, as Trusted Advisors, are also considering how milk products will be merchandised when deciding the types of milk coolers to purchase. Non-traditional milk coolers, such as reach-in refrigerators with glass doors, barrel coolers, and glass door display cases are being used to present and serve milk products to students.

Units should be carefully evaluated for their ability to maintain temperatures when the doors are open. The better cabinets will hold cartons between 35-38°F (2-3°C) for at least two hours with the doors open. Digital thermometers are preferred and readily visible from the front to check that milk cartons are maintained at safe temperatures during the entire service period. In addition, the units should be evaluated for the ease of cleaning and have bottom drains for easy cleaning. Options and accessories include:

- Stainless steel interior, as well as exterior
- Legs or casters provide flexibility for use in multiple locations and serve to safely secure the unit
- Wrap-around or corner bumpers
Serving equipment needs to be flexible to meet the changing needs of school nutrition today. Mobile and modular equipment are particularly valuable today because of their flexibility. Trends include the use of more attractive finishes and materials on serving equipment.

Most importantly, food safety is a key responsibility of all cold and hot holding, warming, or serving equipment. Local health code regulations should be checked for sneeze or breath guards, drain requirements, and the need for thermometers. In addition, both hot and cold holding/serving equipment may be limited in its ability to heat or chill food. Hot and cold holding/serving equipment should therefore only be used to maintain food that is already at the appropriate temperature. Best practices in the use of serving equipment are also important to maintain the safety of food while it is being served. Finally, employee and student customer safety should be a consideration in the selection of all serving equipment.
CHAPTER FIFTEEN

Cleaning Equipment
Introduction

- School nutrition directors, as Trusted Advisors, understand the importance of safely cleaning dishes

Dishmachines

- Selection variables include:
  - Space available
  - Foodservice needs
  - Preference for hot water or chemical sanitizing machines
  - Power and plumbing sources
  - Local building and health codes
  - Proposed budget
- Dishmachines require:
  - Proper ventilation
  - Adequate lighting
  - Proper utilities
  - Drains of appropriate size and location
  - Adequate walls, floor, and ceiling

Hot Water Sanitizing Dish Machines

- Generally purchased, rather than leased
- Require a booster heater

Chemical Sanitizing Dish Machines

- Often leased
- Generally have lower energy costs, although higher chemical costs

Under the Counter Dishmachines

- Designed for very small volume foodservices
- Come with dual or single wash arms

Single Tank, Door-style

- Designed for small volume needs
- Require ventilation, booster heaters are generally built-in

Conveyor Dishmachines

- Designed for higher volume needs
- Instead of doors, may have plastic curtains and may automatically shut down
- Will have a thermometer in each tank

Flight-type Dishmachines

- Most expensive
Uses a conveyor with rows of plastic tipped pegs so no racks are used
More automated

Guidelines for Selecting the Appropriate Dishmachine
A critical step is to project the dishmachine capacity that is needed
Needed volume depends on the following:
- Number of students and meal periods
- Need for speedy return
- Length of dishwashing cycle
- Number of dishes, pots, pans, and cooking utensils needed
- Use of disposables
- Whether the dishmachine is filled to capacity during dishwashing
Guidelines are based on general estimates only and should be used only as a starting point in determining the size of machine needed

Pot, Pan, and Utensil Washers
Differ from standard dishmachines
Do not have a specific timed wash cycle
Have a larger motor to pump water
Require non-foaming type soap
Need more horsepower to create “turbulence” in the wash water

Food Waste Disposers and Pulpers
Municipal codes should be checked for regulations associated with use
Pulpers produce less volume of waste that would enter a sewer system

Trash Compactors and Recycling Equipment
Trash compactors can potentially reduce the volume of waste such that trash hauling expenses may be reduced by 50% or more
Corrugated board balers may also decrease trash hauling
Cleaning Equipment

Introduction
Without effective dish cleaning, a school nutrition program cannot safely operate, although dish cleaning may be done differently in different schools. For example, school nutrition directors, as Trusted Advisors, use information regarding the use of disposables verses permanent ware in making a decision about whether to purchase a dishmachine or use a three compartment sink. Although the use of disposables minimizes the need to wash dishes, some school nutrition programs still use dishmachines. These directors believe that dishmachines minimize the labor needed for cleaning and provide a more precisely controlled method for cleaning dishes. In addition, the school nutrition director, as the Trusted Advisor, understands the long-term implications of dishmachine choice. For example, the space and budget needed to purchase a particular dishmachine may not be possible at a later date. This would mean that the use of disposables may become a permanent choice that the school will need to live with for a very long time.

For school nutrition programs that have decided to use permanent ware, dishmachines are critical to the safety of the school nutrition operation. They are also one of the most expensive pieces of equipment in the operation, so careful decision making is important because of the consequences of the decision will be around for a very long time.

Dishmachines
Numerous variables need to be considered when selecting a dishmachine. They include:
- Space available
- Foodservice needs, particularly in regards to the use of disposable dishes or permanent ware
- Preference for a hot water or chemical sanitizing machine
- Power and plumbing sources
- Energy and water saving features on the machine
- Local building and health codes
- Proposed budget
- Availability of good employees as labor costs for washing dishes can be a penny or more per dish

Dishmachines require a number of features. They include the following:
- Proper ventilation prevents excessive humidity and possibly poor/unsafe working conditions
- Adequate lighting allows staff to see broken dishes and excess water accumulation
- Proper utilities since inadequate power can damage the machine or result in poor performance
- Floor drains as the location and appropriate size can prevent excess water accumulation
- Moisture resistant surroundings as walls, floors, and ceiling need to resist moisture, absorb sound, and be easy to clean
The choice of dishmachine can affect utility costs. An insulated dishmachine may save hundreds of dollars per year in utility costs, as compared to an uninsulated machine. An infrared dishmachine is thought to save thousands of dollars per year as compared to a 10-20 year old conventional dishwasher.

Dishmachines are categorized by the type of sanitizing system used, the number of tanks, and the way dishes go through the machine. The sanitizing system can either be hot water sanitizing or chemical sanitizing. Hot water sanitizing machines will require a booster heater, which is either purchased as part of the dishmachine or purchased separately and added when the machine is installed. The differences between these two types of dishmachines are shown below.

**Hot Water Sanitizing Dishmachines**
- Generally purchased, rather than rented
- Dishes dry faster because of the hotter rinse temperatures, although plastic dishes will dry more slowly than china dishes
- Thought to be better for the environment because they rely less on chemicals
- Require the purchase of a booster heater to raise the temperature for sanitizing
  - For example, booster heaters are designed to heat the rinse water from 140° to a sanitizing temperature of 180° F or 61° to 82° C
  - Booster heaters can be electric, gas, steam, or infrared

**Chemical Sanitizing Dishmachines**
- Often rented, state agencies should be contacted for guidance on contracts
  - For example, state agencies may give specific guidance on not being able to pay interest or rental agreements that require the purchase of chemicals
- Dishes dry slower because of the lower temperatures used during the sanitizing cycle
- Generally have lower energy costs because they do not need a booster heater
- Higher chemical costs

Dishes move through dishmachines either by means of a stationary rack in the machine or on a conveyor. Some conveyors require the use of racks while other conveyors have pegs between which the dishes are placed. A summary of general guidelines to consider for purchasing different type of dishmachines as well as available options are listed below.

**Under the Counter Dishmachines**
- Designed for very small volume foodservice operations, but not as commonly used in schools
- Removable racks are recommended so employees can rack the dishes in advance
- Come with dual (top and bottom) wash arms or single
- Automatic deliming option is useful

**Single Tank, Door-style (Stationary Rack Dishmachine)**
- Designed for small volume needs
- Newer machines contain microcomputers to help accurately time cycles
- Require ventilation
- Booster heater is generally built-in
- Many are “field convertible” – can be converted from hot water to a chemical machine or vice versa
**Conveyor Dishmachines (Two or Three Tank)**
- Designed for higher volume needs
- Have more options than stationary machines
  - Recirculating prewash or power prewash cycles
  - Automated activators run the machine only when racks are inside
- Instead of doors have plastic curtains
- Machines will automatically shut down if inspection doors are opened during a cycle
- Will have a thermometer in each tank

**Flight-type Dishmachines**
- Extremely expensive
- Uses a conveyor with rows of plastic tipped pegs, preventing the need for racking dishes/trays
- Belt widths can be different and will affect capacity
- Microcomputer controls are available for greater precision in new machines
- Can be highly automated to minimize labor needs

**Dishmachine Options**
- Blower-dryer
  - Electric or steam heated blower to dry dishware and silverware
  - Adds to the length needed for the dishmachine
  - Exhaust requirements essential
- Ventilation system
  - Helps to increase the machines efficiency
  - Creates a more comfortable environment
  - Speeds air drying of the dishes
- Larger size entrance/exit
  - Allow pots and pans to be washed on typical 20 x 20 racks
  - Some are available to accommodate a 60 quart mixing bowl
- Water softener
  - Recommended unless the water is already classified as “reasonably soft”
  - Prevents dishes from having water spots after wash
  - Aids in decreasing detergents requirements
  - Aids in preventing pipes and spray arms from clogging
  - Minimizes the frequency of descaling and deliming repairs
  - Influences the lifespan of the dishmachine

**Guidelines for Selecting the Appropriate Dishmachine**
Requirements for dishmachines in schools vary tremendously. The first consideration in making a purchasing decision is the capacity of the machine. Careful sizing of the dishmachine is also important because these are large pieces of equipment and their location is also important.
Things to consider in the location of the dishmachine include:
- Efficient access from both the kitchen and the dining room/cafeteria
- Materials (floor, wall, and ceiling) that aid in muffling the sound
- Strong floor to support the weight of the dishmachine
- Non-skid flooring and/or rubber mats to minimize the risk of employees slipping
- Adequate water pressure
  - Confirm pressure requirements with manufacturer
  - Confirm pressure with local plumber

Selecting the correct type and capacity of dishmachine is important because of the expense associated with the machine and labor to run the machine. When pricing the costs associated with running a dishmachine, school nutrition directors, as Trusted Advisors, should focus on the volume of dishes to be washed, as criteria for selecting the dishmachine that will meet their needs. The volume will depend on the following considerations:
- Number of students
- Number of meal periods
- Number of dishes, silverware, and tray typically needed per student
- Number and type of meal
- Length of dishwashing cycle
- Number of pots, pans, and cooking utensils to be run through the dishmachine

Reliance on the use of disposables for some or all of the school’s dish needs causes the biggest impact on the need for dishwashing. Each school will need to determine their dishmachine need. Manufacturers’ websites can assist in the decision making process, as they generally have capacity information on their dishmachines. It is wise to confirm the information with an equipment distributor and other school nutrition directors that may have that type dishmachine in their operation. Keep in mind that the information may vary when it comes to application of the dishmachine. Manufacturers’ information is typically based on fully loaded machines that are operating continuously and unloaded immediately. Keep in mind that training is needed for the school nutrition staff to perform the task in a productive manner. When dishmachines are not efficiently or completely filled prior to starting the dish cycle, fewer dishes will obviously be washed, therefore, reducing the level of productivity as compared to running a machine that is fully loaded.

To get a better picture of what size capacity machine to purchase, some schools use the assumption that in actual use, most dishmachines are only operated at 70% capacity. A simple example of how to calculate the needed dishmachine capacity for a school using the 70% capacity rule is shown below.
## Calculation Example

Assume that a dishmachine is needed for a 500 student elementary school that serves approximately 250 children every 30 minutes during the lunch periods. Six items (dishes, silverware, trays) are used for every child.

250 students x 6 items per student = 1500 dishes needed for a 30 minute lunch period
1500 dishes x 2 lunch periods per hour (every 30 minutes) = 3000 dishes needed per hour

70% Efficiency adjustment:

3000 dishes divided by .70 (this is the 70% adjustment factor that you use to divide the number of dishes needed per hour) = 4286 dishes per hour

The calculated dish machine capacity for this school would be approximately 4286 dishes per hour. The type of dishmachine that is likely to be needed for this school is a two-tank conveyor machine, using the following guidelines.

<table>
<thead>
<tr>
<th>Dishmachine Type</th>
<th>Dish Capacity Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Tank, Door</td>
<td>1,550 dishes per hour (or 53-62 racks)</td>
</tr>
<tr>
<td>Two-Tank Conveyor</td>
<td>5,850 (or 205-234 racks)</td>
</tr>
<tr>
<td>Three-Tank Conveyor</td>
<td>6,650 (or 234-272 racks)</td>
</tr>
<tr>
<td>Flight type</td>
<td>12,000 (racks are not used)</td>
</tr>
</tbody>
</table>

Although, the example provided above uses a 70% efficiency adjustment, school nutrition directors, as Trusted Advisors, are advised to train staff on ways to increase efficiency. Keep in mind that costs associated with labor, chemicals, and water to run a dishmachine are the same for a 70% capacity as they are for a 100% capacity. Training staff on ways to increase efficiency when operating a dishmachine is critical.

Careful calculation of the dishmachine capacity is also important because it affects the size of the space needed for the machine in the kitchen or dishroom. Determination of the amount of space needed is slightly complicated because additional space is needed for the:

- Soiled dish area which is generally 50% larger than the cleaned dish area
- Cleaned dish area because of the space need to adequately dry the dishes
- Booster heater or other mechanical needs, such as added ventilation equipment

General guidelines regarding dishmachines are provided by manufacturers. This information is valuable and will assist in comparing types of dishmachines. Trusted Advisors use this information to compare one manufacture with another. It is wise to consider this information as a starting point when determining operational needs. The next step is to explore and compare the productivity of different models of dishmachines based on the information provided by the manufacturers and other foodservice operators. Be sure to compare the models of dishmachines and space dimensions needed based on the meals served per hour. By initiating a comparison process, a Trusted Advisor will make an informed purchasing decision based on the specific needs of the school nutrition operation.
Pot, Pan, and Utensil Washers

Pot, pan, and utensil washing can be done three different ways. For smaller schools, this washing may be done in a three compartment sink. If three-compartment sinks are used extensively, one useful option is to use an agitated powersink, which includes a powerful agitator that provides continuous turbulent movement to the wash water to more easily remove stubborn food soil without the need for scrubbing by hand. Larger schools may find it more efficient to use a dishmachine. In some schools, the same dishmachine that is used to clean dishes from the cafeteria may also be used to clean pots, pans, and utensils if a larger dishmachine opening and exit (a “tall” dishmachine) is purchased. Other very large operations may decide however, to purchase a dishmachine designed specifically for cleaning these items. Pot and pan washers can either be under-the-counter models or free-standing. They are similar to the dishmachines already discussed. Should pot and pan washer be the route taken, other issues to consider include:

- Allows for longer wash cycle because they do not have a specific timed wash cycle
- Uses a non-foaming type of soap to better penetrate baked-on food and grease
- Provides more horsepower to create water turbulence assisting in the removal of encrusted food

Food Waste Disposers and Pulpers

Food waste disposers (also called disposals) are usually integrated into the sink area set up at the dirty end of the dishmachine, although they may be used in other areas such as the salad or vegetable preparation areas. Municipal codes should be checked to see if food waste disposers are allowed, as disposers produce a great deal of waste water. Municipal codes should also be checked to see how disposers are to be connected to water or sewer systems, for instance the use of grease traps is likely to be one of the regulations.

Pulpers are usually set up in the area in front of the dishmachine for use in cleaning off plates and trays in preparation for washing. They operate very differently compared to food waste disposers and are likely to be allowed in most municipal codes. Pulpers can also take paper waste, as well as food. The greatest advantage of pulpers is that they reduce waste into 15% of its original volume and only use 1/3 of the water of food waste disposers. They operate by grinding food and paper waste into a pulp, which is then piped to an extractor where the solids are separated from the water. The waste is then sent to a garbage can and the water is reused in the grinding process. Advantages to the use of the pulper include:

- A reduction in the volume of waste by up to 85%
- A reduction in the needed number of trash pick-ups
- A reduction in labor hours taking garbage bags to the dumpster area
- Elimination of the need to sort paper from food waste
- A reduction in rodent and insect problems

Disadvantages to the use of the pulper include:

- A high initial capital cost for the pulper equipment
- Increased energy costs
- Possible odor and mess related to their use

Trash Compactors and Recycling Equipment

Schools produce tremendous amounts of garbage. The solid waste stream is composed of many types, including paper and cardboard, food, plastics, metal, glass and other materials. Schools
often pay large amounts of money to have this trash hauled away. To reduce trash hauling expenses, some schools have turned to the use of trash compactors. Trash compactors may reduce trash hauling expenses by 50% or more. The principle is simple in that the fewer the number of trash pick-ups, the less expense associated with waste hauling. In addition, trash compactors are often used as part of a comprehensive recycling program which may also include recycling of corrugated cardboard and office-type paper in order to further reduce waste hauling expenses. Several types of compactors are available, but school nutrition programs are most likely to use the type of compactor that can be used with wet food wastes. Other advantages to the use of a trash compactor include:

- Minimize odors and leakage from the dumpster
- Minimize insect or rodent problems

Corrugated board (cardboard) balers are another piece of equipment that is often used in waste management and recycling. Cardboard balers have a double benefit in that they eliminate cardboard from the waste stream and they bring in some income if the bales can be sold to recycling companies. The amount of cardboard waste can be significant as it may be more than 25% of the trash produced from a school nutrition program.

In some areas, recycling equipment may be rented so that schools would not need to use upfront money to start a recycling program. On the other hand, when the purchase of recycling equipment is the only option and on-site improvements (such as concrete platforms or pads and electrical outlets) are required for the recycling equipment site, the savings in garbage hauling bills each month is thought to compensate for the cost of the recycling equipment and site within a couple of years.

As Trusted Advisers school nutrition directors should carefully evaluate the advantages and disadvantages of recycling equipment. Waste hauling prices will vary across the country. One rule of thumb that has been cited for schools is that if the school (not just the foodservice) spends more than $1,500 per month on waste hauling, they should evaluate the costs and benefits of starting a trash compacting and recycling program. Even if they may not be able to purchase a complete system, schools might consider sharing a baler, if there is a convenient central location and custodians or other employees might be able to periodically drop off cardboard. Critical features to consider include:

- Size of the compactor
- Sufficient parking lot space
- Frequency of waste hauling pick-ups
- Enclosed hoppers with safety interlocks
- Key operation
- Access for the garbage hauler
- Matches local garbage truck configurations
- Odor-control units
- Trash container fullness monitors
- Safety features
- Ease of use
Dishwashing is one of the most critical functions in a school nutrition program. Schools cannot function safely without clean dishes. In addition, dishmachines are a major expenditure and require a great deal of labor, energy, and water to run.

One of the first decisions in dishmachine selection is the choice of hot water verses chemical sanitizing machines. School nutrition directors will also need to consider a number of other factors including the budget and whether to purchase or lease a machine. Also, consideration should be given to available space, power and plumbing sources, energy and water-saving features on the machines, local building and health codes, and the availability of employees.

The numbers of meals served is one of the biggest considerations in equipment choice. The type and size of dishmachine required will depend on the number of students, the number of meal periods, the need for speedy return of dishes, the length of dishwashing cycle, the number of pots, pans, and cooking utensils, and the number of dishes typically used by each student. Other decisions in this area include the choice of pot and pan washers, disposers, pulpers, trash compactors, or recycling equipment. The use of disposables verses permanent ware is a critical decision that all schools should evaluate in regards to their needs for dishwashing.
CHAPTER SIXTEEN

Utensils, Trays, and Tableware
CHAPTER HIGHLIGHTS

Introduction
- Use of the right tool can help make a better quality product, create less worker fatigue, and help to get the job done efficiently

Hand Tools
- Consider:
  - Textured surface handles
  - Tools which keep the wrist straight
  - Avoiding sharp edges on gripping surfaces
  - Avoiding deeply contoured handles
  - Matching handle diameter to handling force
  - How the tool will be used
- Triple-edge spoons with straight bottom edges scoop food more completely out of a steam table pan
- Two types of whips are French whips and piano whips
- Strainers use fine mesh for straining or rinsing of foods
- Colanders have larger size holes or perforations

Cutlery
- Types of knife manufacture are forging, stamping, and computer-guided laser beams
- The metal used to make the knife is important to the quality and care
- Common knives include:
  - Chef’s knife
  - Salad knife
  - Paring knife
  - Boning knife
  - Slicer
  - Cleaver

Pots and Pans
- Common metals are aluminum, stainless steel, cast iron, or some combination of these metals
- Metal type and thickness govern the ability to cook evenly

Sheet Pans
- Durability is a key selection factor

Measuring Equipment
- Weight measuring equipment should be selected based upon:
  - Weight measuring capacity
  - Area of weighing surface
  - Level of precision needed
Ease of use and calibration
Expenses for purchase and operation
Label printing
Durability of measuring tools is very important

Serving and Holding Containers
Steam table pans made of stainless steel are the most common

Flatware
Most accurate assessments of durability can be made from evaluation of actual product samples
Stainless steel is most durable and vary in quality and price

Plates and Glasses
Reusable plastic plates and glasses are commonly used
Strength of ceramic plates will depend on the clay used, air bubbles, thickness, type of edge, and size and shape of the rim
Strength of the glassware will depend on annealing, shape and thickness of the glass, tempering, and addition of chemical compounds

Trays
Selection of trays will consider the following factors:
- Durability
- Cleanability
- Drying time
- Functionality
- Attractiveness
- Cost
- Portability

Disposable Dishes, Trays, and Flatware
Price is critical for disposables as they are an ongoing expense
Advantages to the use of disposables include:
- Possibility of lower costs
- Eliminates some dishwashing needs
- Eliminates need to clean and transport to a commissary or satellite school
- Lighter weight
- Possibility of speeding up the meal service
Disadvantages include:
- Generally not the green choice
- Possibility of higher costs
- May be less safe to carry
- Requires more storage space
Utensils, Trays, and Tableware

Introduction

Use of the right tool can make a huge difference in efficiency. It will often result in a better quality product, less worker fatigue, and a job that is accomplished faster and more safely. Why then would we not want to pick our tools carefully?

Utensils used to measure, weigh, mix, cook, and finally store food are commonly referred to as smallware. Even though these pieces of equipment do not cost as much as the large pieces of cooking, preparation, and washing equipment discussed earlier, decisions about smallwares are every bit as important to the production in your school kitchen. Individual staff members will tell you that well chosen tools can make their job easier and poorly chosen tools will make their job harder. Finally, the right tool is also very important for employee safety as well as efficiency.

Similarly, the choice of permanent ware (dishes, trays, glasses, or flatware) for student customers is also important. Permanent ware is handled extensively and may be subject to much “abuse”. It also needs to be carefully cleaned and sanitized thousands of times over the course of its lifetime. Selection of disposable ware for student customers is an alternative that some schools have considered attractive. The decision of permanent ware versus disposables should be evaluated carefully in each school. The appropriate decision in each school may be different. Permanent ware may be considered the best choice in some schools because it is environmentally friendly or the “green choice”. In other schools, disposables may be the optimum choice for cost reasons, particularly if recycling or composting choices are available. In schools where recycling or composting is available, some schools have, in fact, considered disposables the “environmentally friendly choice”.

Hand Tools

Hand held tools should be designed to be safe, efficient, and easy to handle. The following points are useful in evaluating many types of hand held tools:

- Avoid sharp edges on surfaces for gripping
- Textured surfaces on handles help to minimize accidents
- Avoid deep contours on handles
- Select tools where the wrist will be held straight to avoid wrist strain
- Select a handle diameter to match the force used when handling the tool
- Tools that are supported by arms and held away from the body should not weigh more than 5.1 lb. (2.3 kg)
- Tools requiring precision should not weigh more than 1 lb. (5 kg)
- Tools used for long periods should be lighter
- Minimum handle length for gripping most tools is 4 inches (10 cm)
- Minimum handle diameter for a power grip is 1.2-2 inches (3-5 cm)
- Minimum handle diameter for a precision grip is .3-.6 inch (.8-1.5 cm)
New technology is making its way into the design of many tools, including some of the simplest and most basic of tools. For example, there are a variety of spoons on the market. Newer types include spoodles which can be used for stirring, scooping, and portioning and combine the stirring capabilities of a spoon with the portion control capabilities of a ladle. In addition, the plastic handle has a notch on top and a stopper on the bottom to prevent the spoodle from sliding down into the pot when it is not being used. Spoodles range in size from 2-8 oz. (59-237 mL) and are available with different colored handles to separate the possible uses of the utensil. Because spoodles typically come with plastic handles, the heat resistance of these should be carefully checked to make certain of their intended use, serving versus cooking or both. Another newer type of spoon is called a triple-edged spoon. The bottom edge of the spoon is shaped to match the interior of the serving pan so that they will scoop out food more completely. Triple-edged spoons come with plastic handles and may be either perforated or solid metal.

Whips are created for light rapid stirring and introduce air into the ingredients. All whips should be made from durable steel and welded smooth so that they are easily cleanable. Commonly used types of whip include:

- French whips
  - Have stiff wires
  - Available in a variety of lengths from 10 to 24 inches (25-61 cm)
  - Used for small batches and heavier batters
- Piano whips or balloon whips
  - Have finer wires
  - Available in lengths between 10 to 18 inches (25-46 cm)
  - Used for lighter sauces, whipping cream, or thin soups

Spatulas are also commonly used tools in a school nutrition kitchen. The most common length is 14 inches (36 cm), but they also come as short as ten inches or as long as 20 inches (50 cm). They are available in a variety of blade shapes and may be slotted, perforated, or solid. Spatulas that act as bowl scrapers have a flexible, plastic blade and polypropylene handle. Even though they might look like they can be used on hot surfaces, most will melt when exposed to heat. Be sure to check the manufacturer's guidelines.

Tongs are commonly used for serving food, but may also be used to handle some foods during preparation and cooking. They should be commercial-grade and made of stainless steel. They are available in sizes from 10 to 16 inches (25-41 cm) and have different types of edges from flattened to scalloped.

Strainers and colanders are useful in the kitchen for straining or rinsing foods. Strainers use a single or double layer of mesh whereas colanders use perforations which provide much larger holes to drain through. They are cup, bowl, or cone shaped and range from very small to very large sizes. Specialty types include:

- China cap is a metal mesh cone welded to a stainless steel ring and handle
  - Used to strain stocks, sauces, and soups
  - Ranges in size from eight inches in diameter and depth to about 12 inches (30 cm) in diameter and depth
- Sieve is similar in appearance to a cup with a mesh screen at the bottom
  - The handle on the side is used to hold it while sifting flour or other dry ingredient
Food mill is a strainer with a hand crank that turns a blade inside the mill
- Used to puree or grind foods
- Available with interchangeable blades with a different sized holes

Colanders usually have feet on the bottom to allow them to sit in a sink for draining. They also usually have handles so that they are easily carried. They are generally made of 10 to 18 gauge stainless steel.

**Cutlery**

Good knives are essential in food preparation. The correct knives to purchase will depend on the menu. For example, menus that require chopping of lots of ingredients will generally need chef’s knives, whereas fine slicing for preparation of individual portions will require paring knives. Important considerations in knife selection also include quality and durability. The two most common types of knife manufacture are forging and stamping. Newer technology might also include the use of computer-guided laser beams to more precisely cut the blades. Differences between forged and stamped knives include:
- Forged knives are made when steel is heated and shaped or compressed with pressure and later more finely sharpened with honing and grinding
- Forged knives are generally considered stronger and are more expensive
- Stamped knives are made from a sheet of flat steel and stamped with molds to cut the various shapes and sizes of blades
- Stamped blades are then sharpened individually

The quality of knives depends on the metal used in producing the blade. The shape of the blade and the handle, and the construction of the handle are described below:
- Blades can be made from
  - Stainless steel
    - Does not rust or discolor
    - Holds a sharp edge longer
    - Blade edge is harder to sharpen
  - Carbon steel
    - Easier to sharpen
    - Loses the sharp edge quickly
    - Frequently needs re-sharpening
    - Darkens when in contact with acid foods
    - Pits and rusts more easily than other types
  - High-carbon stainless steel
    - Tries to take advantage of the best qualities of both metals
    - Keeps the sharp edges longer
    - Does not rust or discolor
- Length and shape of metal that goes into the handle
  - A tang is the portion of the blade that extends into the handle
  - A full tang extends to the end of the handle
    - Provides strength and durability
  - A partial tang does not run the full length of the handle
A rat-tail tang has a thinner tang that runs the length of the handle
- Found in bargain-priced knives
- May not be as durable

- Construction of the handle
  - Made from wood or plastic
  - Sanitation codes should be checked for allowed materials
  - Wood handles are sometimes preferred for the highest quality knives
  - Unfinished wood handles, if allowed, should be handled carefully as they may soak up water and become stained
  - Rivets in the handle should also be checked to make certain that they will hold the tang in place and are completely smooth with the surface of the blade

- Other considerations
  - Size of the handle
  - Shape of the handle
  - Ergonomic design

Knife selection should coincide with the tasks to perform. Types of knives include:

- Chef’s knife or French knife
  - 8-12 inch blade knife (20-30 cm)
  - Used for most chopping and slicing jobs

- Salad knife
  - A smaller version (6-9 inches or 15-23 cm) of the chef’s knife
  - Used mostly for salad or fruit preparation

- Paring knife
  - A very small blade (3-4 inches or 8-10 cm) with a sharp tip
  - Used for paring and trimming fruits and vegetables

- Boning knife
  - The thinner blade on this knife (5-6 inches long or 13-15 cm) is used to separate raw meat from bone
  - The blade may be stiff or flexible

- Slicer
  - A long slender knife (12-14 inches or 30-36 cm) with a flexible blade used to slice cooked meats

- Cleaver
  - A knife with a rectangular shape about 4 inches wide (10 cm)
  - Used for heavy duty chopping, including chopping through bones

The choice of cutting board is almost as important as the knife because a good cutting surface will make the job easier and safer, and will not dull the knife. Most schools will use some type of plastic cutting board. One of their greatest advantages is that they are easy to clean because they can be run through a dishmachine. The use of color coded plastic cutting boards has also made them safer because these minimize the risk of cross contamination due to the separation of tasks by color. For example, green would be used for vegetables, red for beef, and yellow for poultry. Some of the plastic-type cutting boards are non-slip and will not move during the chopping process. Regulations regarding cutting boards should be checked with the local health code. Many local health codes, for example, do not allow the use of wood cutting boards because they cannot be run through the dishmachine and are therefore more difficult to clean and sanitize.
Pots and Pans

Pots and pans are among the highest priced types of smallware that a school kitchen will purchase. Tremendous variety exists. Pots and pans most commonly are aluminum, stainless steel, or some combination of these two metals. Iron pots and pans have a limited use in most school nutrition programs, although they may be used with induction cookware. Nonstick coatings are also available for most pots and pans. The metal should distribute heat evenly and uniformly, be lightweight enough to allow for easy handling, and be durable for long-term use.

The two basic factors that govern a metal’s ability to cook evenly are the type of metal and its thickness. The thicker the bottom of the pan, the better it holds the heat. Material will also affect durability, weight, beauty, and cost. Advantages and disadvantages to each type of metal are listed below:

- **Aluminum**
  - Lightweight and easier to lift
  - Good heat conductor
  - Not very durable because of metal softness
  - Not as good for use with acid foods

- **Stainless steel**
  - Not a good heat conductor
  - Very durable
  - Better for use with acid foods

- **Iron**
  - Inexpensive
  - Good heat conductor
  - Cracks and rusts easily
  - Very heavy and harder to lift
  - Need to check local health code regulations regarding the use of iron

Sheet Pans

Sheet pans are used extensively in school nutrition programs. Selection of good quality sheet pans is similar in many ways to the selection of pots and pans. Durability, weight, beauty, heat conduction, and cost are key to the selection of sheet pans. In addition, their size in relation to the ovens that they will be used in is important for efficient use of the space in the oven. For example, full-size pans are generally about 17 ¾” x 25 ¾” x 1” (or 45 cm x 65 cm x 2.5 cm), whereas half-size sheet pans are generally about half the length of the full size or roughly 17 ¾” x 12 7/8” x 1” (or 45 cm x 33 cm x 2.5 cm). Quarter size and other size pans are also available. Other considerations for sheet pans include:

- Choice of light and dark-colored finishes
  - Dark colored pans are often preferred because they heat up faster and result in more browning
  - Light colored pans are preferred for cookies and products in which extensive browning on the bottom is not desirable
Gauge of the pan
- Heavier gauge pans (18 gauge, for example) may be preferred in that they are generally less flimsy
- Durable rolled edges which provide easy handling
- Non-stick coating
  - Non-stick coatings are thought to perform better because foods do not stick and the pans are easier to clean
  - Should evaluate additional implications of using non-stick pans such as, washing method recommendations and types of hand tools that can be used
- Insulated pans
  - Generally not recommended by cooking experts

Measuring Equipment
Recipe preparation and the portioning of food require several different types of measurement tools including weight measuring scales and volume measuring cups, scoops, spoons, and ladles.

When selecting weight measuring equipment, consider the following issues:
- Select the weight measuring capacity based on the heaviest food item to be weighed during preparation or service
- Scales used in the receiving and loading dock area are a different type of scale used for bulk weighing during deliveries
- Scales with a larger weighing surface are generally easier to use
- The level of precision needed
- How easy they are to use and calibrate
  - Digital scales are usually easiest to read
  - Scales which allow the employee to “zero out” a container that might be used to hold food for weighing also simplify the weighing process
- How easy are they to clean
- How expensive are they to purchase and operate
- Need for a scale that prints out a label for the food

Volume measures include a variety of cups, spoons, ladles, and scoops. Commercial measuring cups and spoons are generally made from seamless heavy-duty aluminum. Durability of the measuring cups and spoons is important, because utensils which are easily dented may distort the capacity and not measure accurately. In addition, metal cups are generally considered more desirable than glass because of the unavoidable breakage which can occur with glass. Ladles are generally made from 18 gauge steel and their capacity is stamped on their handle. Ladles will range in size from one ounce up to 72 ounces (30 mL to 2.13 L) and handle lengths will vary from nine to 18 inches (23-46 cm). Plastic covered handles can help to keep them cool when they are used for hot liquids. Two types of scoops are used in school kitchens. The first is used as a portion measurement tool and is sometimes called a disher. Common sizes are 12, 16, or 20 with the number representing the number of scoops one can get per quart of product when this size of scoop is used. Scoops will be stamped with the size and are easier to distinguish when the handle is also color coded by size. The second type of scoop is used to handle or transfer dry ingredients or ice. These scoops are generally made from stainless steel or heavy cast aluminum and range in size from four to 84 ounces (118 mL to 2.48 L).
Serving and Holding Containers

One of the most commonly used serving and holding containers in the school kitchen are the steam table pans. Other names for these include hotel pans, counter pans, or service pans. Both solid and perforated pan types are available. They come in a variety of sizes based on the standard size of 12x20 inches (30x51 cm). In addition to the standard size, pans come in half sizes (12x10 inches or 30x25 cm), third-pan sizes (12x6 ½ inches or 30x17 cm), and fourth-pans (6 ½ x10 inches or 17x25 cm). The use of long half pans (6x20 inches or 15x 50 cm) offer a flexible side-by-side arrangement so that one does not have to reach over one pan to get to another. Depths for these pans range from 1 ¼ to 6 inches (3-15 cm). Pans range from 20 to 24 gauge steel with the 20 gauge being thicker than the 24 gauge. The gauge of thickness influences durability. A variety of lid sizes can be used on these pans to cover all or part of the food. Handles on the lids are typically indented so that they can be stacked neatly. Look for pans that are manufactured with corners that prevent them from sticking together when they are nested together. Adaptor plates are also commonly used to fit the different size pans into steam table wells other than the standard sizes. Stainless steel is the most commonly purchased material for steam table pans; however plastic pans are now available as well. The advantages and disadvantages of each are shown below:

- Stainless steel steam table pans
  - More durable
  - More expensive
- Plastic steam stable pans
  - Not as durable as stainless
  - May not be as heat or cold tolerant
  - Do not develop bent corners
  - Scratches do not show
  - Lighter in weight
  - Less noisy
  - Less expensive

Permanent Ware

Selection of flatware and dishes should always be based on an actual examination of samples of the flatware and dishes. Pictures in a catalog do not given an accurate picture of the thickness, weight, or feel of the product. Durability of the product can also be much better assessed in person.

Carefully consider replacement costs of permanent ware as replacement needs may create an ongoing expense. Availability of permanent ware to purchase in the future will also help to keep a more pleasing and uniform appearance during the service of food. Durability of permanent ware is one of the most important features because of its effect on replacement cost. Selection of permanent ware that is less likely to break is also important from the standpoint of handling. Clearly it is a safety issue for children. In addition, it is important for employees. Most breakage of china dishes is thought to occur in the dishroom, so employees should be taught how to handle and place china dishes in the dishmachines to minimize the breakage that might occur during the cleaning process.
Permanent Ware - Flatware

Durability of the metal forks and spoons is key when making this purchasing decision. Although weight may be one possible indication of its durability, a more accurate assessment occurs when the flatware is inspected. For example, the spoon and fork should be placed on a table surface and examined to see if they will bend when pressure is placed on the bowl of the spoon or the tines of the fork.

The most durable flatware is generally considered to be stainless steel. It is also often preferred because it does not rust or tarnish, and is less likely to scratch, dent, or stain. The type of stainless steel, however, should be considered carefully as there are different quality levels, hardness, and prices associated the type of stainless steel that is used. A commonly used type is “18/8” which is an abbreviation for a type which contains 18% chrome, 8% nickel, and 74% steel. The chrome is added to flatware to give luster or shine to the flatware and the nickel and steel provide strength. Together these metals help to minimize staining of the metal when exposed to acid foods and cleaning chemicals and provide strength to the utensil.

An additional concern of school nutrition directors as Trusted Advisors will be the safety of the student customers when flatware is being selected. Safety considerations include the quality and type of flatware selected. For example, knives may not be desirable for students. Finally, school nutrition directors as the Trusted Advisors will also consider how easy it is for special needs children to use the flatware or whether other types of flatware are required.

Permanent Ware - Plates and Glasses

Utility and durability are essential in the choice of plates and glasses. They are washed after each use and need to be able to stand up to this vigorous use.

Reusable plastic plates and glasses are popular choices for school nutrition directors. Plates are available as either flat plates or compartmentalized. Plastic glasses are available in a variety of sizes, depending on whether they are to be used for juices, water, or milk. The greatest advantages of reusable plastic ware are its safety for children and its low cost as compared to other types of permanent ware. Important factors in its selection include:

- Durability
- Attractiveness
- Length of time that it can be used before it needs to be replaced
- Appearance after extended use
- Replacement cost
- Ease of use
- Cleanability
- Drying time
- Functionality

Alternatively, plates may also be ceramic. When plates are properly made these should be able to easily withstand the knocks, temperature changes, and rigor of normal use.

Plates should also be considered an ongoing expense due to the occasional need for replacement. Future cost and availability of the plates, therefore, is one consideration in making the choice of
plate. In addition, durability is a very important consideration, not just from the standpoint of replacement costs; it is also a safety issue for the handling of the plates by employees and student customers.

Glasses made from glass are not commonly used in schools. If used, they should also be viewed as an ongoing expense. The future cost, availability, durability, and safety of the glassware are important factors when purchasing this item. It is beneficial to keep extra supplies of glassware on hand. If the number of glasses is in short supply, employees are more likely to grab glasses directly out of the dishmachine when they are hot and put them immediately into service. When this happens, the glasses are more likely to crack when they are “shocked” with a cold liquid when they are still hot from the dishwasher.

Most commercial glassware is pressware. Pressware is made by pressing the glass into a mold to create its shape and then cooling it slowly by a process called annealing to strengthen and stabilize the glass. Strength of the glassware will also depend on the shape and thickness of the glass, the presence of extra thick glass material at stress points, tempering, or through the addition of chemical compounds to the liquid glass material.

**Permanent Ware - Trays**

Two types of trays are used by student customers in school meal programs. They are flat trays which may be used to carry plates or containers of food and compartmentalized trays which function as both a plate and as a tray. Selection of trays will be based on a variety of factors, including their:

- Durability
- Cleanability
- Drying time
- Functionality
- Attractiveness
- Cost
- Portability

“Plastic” types of trays may be described as polycarbonate, melamine, fiberglass, ABS plastic, or other plastic polymers. They are known to be difficult to dry when they are run through the dishmachine. This should be carefully considered when they are being cleaned. Dishmachines that have a drying device will help to dry the trays faster. In addition, drying time may also be a factor in selecting the type of tray to purchase. Trays that have sloping compartment walls or handles, for example, generally allow water to drain faster and also help to promote faster drying.

**Disposable Dishes, Trays, and Flatware**

Another alternative for some schools has been the use of disposables rather than permanent ware. Disposables may include flatware, plates, trays, or some combination of these. Many choices of materials are available depending on the disposable being considered. Flatware may be made from polystyrene or polypropylene for example, and plates, food containers, or trays may be polystyrene, a type of paperboard, aluminum, or fiber molded cardboard, among other choices.
If disposables are used, their purchase is clearly an ongoing expense. Price is therefore, very important. Because prices may fluctuate, this is a careful consideration in their selection and method of purchasing. Advantages and disadvantages to the use of disposables are shown below.

- Advantages of disposables include:
  - May be less expensive than permanent ware
  - Will reduce dishwashing needs
  - Provide a very sanitary option
  - Available in a wide variety of choices
  - Are lighter in weight
  - May provide faster meal service
  - May be able to recycle or compost

- Disadvantages of disposables include:
  - They are not generally considered the “environmentally friendly choice”
  - They will need to be continuously purchased
  - May be harder or less safe, in some cases, for children to carry
  - Require more storage area

Purchasing decisions for disposable ware should also be made after examining samples of the products. Decisions should never be made on the pictures and prices shown in a catalog. If possible, it would be helpful to try these products with one’s menu and cafeteria to see what other changes in service or preparation would be needed. Polystyrene flatware for example will be more rigid and may have sharp edges when broken, whereas polypropylene flatware will be almost “rubbery” by contrast and less likely to break. The purchase of combination flatware such as a spork (a cross between a spoon and a fork) would reduce the number of pieces of flatware that need to be purchased and minimize the needed storage space.
Use of the right tool can help make a better quality product, result in less worker fatigue, and get the job done more quickly and safely. Because of their importance to the everyday tasks, good tools are essential in a good school nutrition program. Employees will clearly tell you that a “good” tool will make their job easier and a “bad” tool will make their job harder. In general, all tools should be easy to use, durable, readily cleanable, accurate, and reasonable in cost. Sanitation codes should also be checked to see if there are limitations to the use of particular kinds of tools, such as, wooden handles on knives or wooden cutting boards.

In addition, many of these tools may need to be replaced periodically so price is a serious consideration as they represent an ongoing expense. Keep in mind that many of these tools, including the flatware, plates, and glasses are best evaluated for quality and durability by testing samples rather than looking at their pictures in catalogs.

The use of disposable dishes, trays, and flatware has been a choice of some school nutrition programs. The most important message for the use of disposables is that this choice is a personal choice for a school based on the advantages and disadvantages to their use. The major advantages associated with their use are that there may be lower “dish” costs associated with their purchase and elimination of some of the dishwashing needs. The major disadvantage is that they generally are not considered the “environmentally friendly choice”, although in some schools recycling and composting may improve their use as an environmentally friendly option.