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ABSTRACT

This guide is designed to assist Federal and State agencies, local school authorities, and other personnel concerned with planning or equipping school food service facilities. The document indicates the minimum quantity of equipment needed to efficiently operate a school food service by specifying the type, size, and quantity of equipment required for various size operations ranging from 100 to 1,500 Type A lunches per day. In addition, it identifies the facilities required at work stations. lists desirable equipment features, and includes representative layouts of individual equipment. Planners are advised that because of the many variables associated with food service, judgment should be exercised in selecting equipment. In addition, when one is maintaining or expanding food service operations, he should keep in mind that equipment should be compatible with the existing food service equipment and should meet the State and local health, fire, and safety codes. (Author/MLF)

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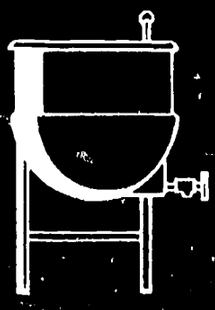

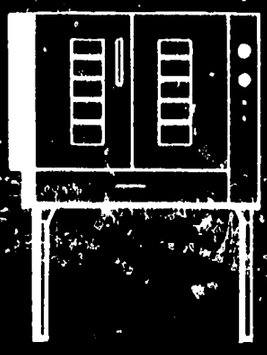

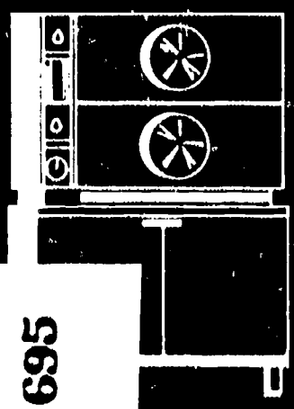

Equipment Guide for On-Site School Kitchens

PROGRAM AID NO. 1091
U.S. DEPARTMENT OF AGRICULTURE
FOOD AND NUTRITION SERVICE • CHILD NUTRITION DIVISION

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SECTION F—AUXILIARY EQUIPMENT

SECTION G—KITCHEN SPACE REQUIREMENTS

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PREFACE

The Equipment Guide for On-Site Kitchens is designated to assist USDA, FNS Regional Offices, State Agencies, local school authorities, and other personnel concerned with the planning of new or with equipping existing school food service facilities. It provides the minimum quantity of equipment to efficiently operate a school food service.

The publication specifies the type, size, and quantity of equipment required for various size school food service operations ranging from 100 to 1,500 Type A lunches per day. In addition, it identifies the facilities required at the work station, lists the desirable equipment features, and where necessary, includes representative type layouts of individual equipment. Because of the many variables associated with food service, judgment should be exercised in selecting equipment. When maintaining or expanding food service operations, equipment should be compatible with the existing food service equipment. Equipment selected should also meet the State and local health, fire, and safety codes.

The following factors were given prime consideration in determining the type, size, and number of items of food preparation equipment required:

- Typical Type A lunch cycle menus following USDA recipes.
- Raw-to-done food preparation plus some use of convenience foods.
- Type A lunch with limited choice within the pattern unless otherwise stipulated.
- Maximum utilization of available donated commodities.
- Progressive cooking where feasible.
- Lunch period from 1 to 1½ hours.
- Food service employees averaging 6 hours per day.
- Proper placement, installation, and utilization of equipment.
- Two consecutive convection oven loads for recipes as required.
- Mobile hot food holding cabinet(s) behind the serving line with an approximate 30- to 40-minute holding time.
- Walk-in refrigerators and freezers adjacent to food preparation area, floor(s) level with surrounding area for effective utilization of mobile equipment.
- Refrigerated and dry storage space based on weekly and bi-monthly local deliveries and monthly USDA commodity deliveries.
- One central steam source for the entire kitchen.

- Modular pan concept, i.e., 12" x 20" hot food service pans and 20" x 24" sheet pans compatible with pan holding and transporting equipment.
- Compartment tray for elementary schools.
- Maximum utilization of mobile equipment.
- Labor saving concepts, i.e., self-cleaning ventilating systems, semi-automatic tray washing, etc.

The materials included in this guide were drawn from many sources. While the large number makes it impossible to list them individually, the Department wishes to acknowledge the extent and importance of their contributions.

Issued July 1974

Supersedes PA No. 292
"A Guide for Planning and Equipping School Lunchrooms"

INTRODUCTION

The importance of planning and equipping school food service facilities is a matter of concern to many. Therefore, the combined efforts of architects, consulting engineers, equipment specialists, sanitarians, and State and local supervisory staff are necessary to assure a properly planned and equipped food service facility.

Important basic points to consider in planning and equipping a food service facility are:

1. **EQUIPMENT REQUIREMENTS:** When initiating or expanding a lunch program, food service equipment requirements should be based on actual or estimated participation. Estimated participation should include those factors that could result in a future increase or decrease in participation. The avoidance of over equipping a food service facility is essential to good management practices. Over equipping not only costs more initially but also increases maintenance costs.

2. **CLASSIFICATION OF SCHOOL:** Consider the age groups that will be attending school: elementary, junior high, senior high or a combination of these.

3. **CORRELATION OF THE SCHOOL PLANT:** The design of the entire school building determines the location and best arrangement of the food service facility.

4. **SCHOOL'S ADMINISTRATIVE POLICY:** The capacity of the dining room depends upon the length of the serving period. If school policy limits the lunch period to a short time, more dining space and serving equipment are required than if the lunch is served to groups coming in at different times, thus permitting the reuse of seating space and longer use of serving equipment.

5. **AVAILABILITY OF UTILITIES AND SERVICES:** Determine whether public utilities—gas, electricity, water, and sewers—are available, or whether private utilities are necessary. Consider location—rural or urban—and whether the school gets quick, frequent deliveries of supplies and services, or is located away from such facilities.

6. **SELECTION OF SCHOOL LUNCH EQUIPMENT:** When initiating a new program in schools where kitchen equipment is already available, judgment should be exercised to determine whether the existing equipment is adequate to meet the recommendations herein, or will need to be supplemented. Select equipment on its own merit for school food service, not because of its use in commercial restaurants or other public institutions.

7. **DURABILITY OF MATERIALS:** The food service facility should be planned to be useful without major remodeling for many years. It should be functional and durable, and should not require major repairs or replacement expenses.

8. **SANITATION:** Lunchroom construction and equipment should be sanitary and easy to keep clean. Equipment should include sanitizing devices for washing and sterilizing all dinnerware and utensils. Sanitary storage facilities for dry and perishable products are also essential.

9. **ENVIRONMENT:** Consider cleanliness, good lighting, cheerful colors, good ventilation, and noise control. Consider also the possibility of connecting the intercommunication systems of the school with the lunchroom and of providing space for bulletin boards and educational exhibits. These all lend attractiveness, and develop pride of the employees, students and community in their school lunch program.

10. **INDIVIDUALITY OF SCHOOL:** In those areas of food preparation equipment where there are no commonly accepted standards, the equipment recommended is not flexible enough to fit all schools. Each school feeding program is an individual problem and the information contained herein should be adjusted accordingly.

SECTION A

LARGE FOOD SERVICE EQUIPMENT

SUMMATION TABLE OF EQUIPMENT REQUIRED

Large Food-Preparation Equipment		Number Type A Lunches Served Per Day										
		100–250	251–300	301–350	351–400	401–450–	451–500	501–600	601–750	751–1000	1001–1250	1251–1500
1. CONVECTION OVENS (See Section #AA1)												
Single stack		1	1	1	1	1	1	2[1]	2[1]	2[1]	3[1] or 1	3[1] or 1
Roll-In type, single compartment												
2. STEAMERS (See Section #AA2)												
High Pressure 15 lbs	One compartment	1 or 1	1 or 1									
Low Pressure 5 lbs	One compartment											
	Two compartments			1	1	1	1	1				
	Three compartments								1	1	1	1

[1] In kitchens where space is at a premium, double-stack convection ovens could be used in lieu of two separate single-stack convection ovens.

SUMMATION TABLE OF EQUIPMENT REQUIRED (Cont'd.)

Large Food-Preparation Equipment	Number Type A Lunches Served Per Day										
	100–250	251–300	301–350	351–400	401–450	451–500	501–600	601–750	751–1000	1001–1250	1251–1500
3. Steam-Jacketed Kettles and Tilting Braising Pans [1] (See Section #AA3)											
20-gallon kettle	1									1	
30-gallon kettle		1	1				2	2			
40-gallon kettle				1	1		1		2	2	3
-OR-											
60-gallon kettle [2]							1	1		1	2
40-gallon kettle										1	
-OR-											
20-25-gallon tilting braising pan	1						1	1			
30-35-gallon tilting braising pan		1	1								2
40-gallon or large tilting braising pan			1	1	1				1	1	
40-gallon kettle							1	1	1		
60-gallon kettle [2]										1	1

[1] Optional: A table-mounted trunnion or stationary kettle of 5-10-gallon capacity is recommended for high schools offering choice within Type A pattern and/or a la carte items.
[2] Sixty gallon kettles are recommended only when equipment is low profile.

SUMMATION TABLE OF EQUIPMENT REQUIRED (Cont d.)

Large Food-Preparation Equipment	Number Type A Lunches Served Per Day										
	100–250	251–300	301–350	351–400	401–450–	451–500	501–600	601–750	751–1000	1001–1250	1251–1500
4. Utility Ranges (See Section #AA4)											
12″ to 18″ (top cooking only)	1	1	1	1	1						
36″ (top and oven cooking)						1	1	1	1	1	1
5. Deep Fat Fryers (See Section #AA5)											
Approximately 60 lbs. French Fries per hour	1	1									
Approximately 95 lbs. French Fries per hour			1	1	2	2	2	2	3	3	4

SUMMATION TABLE OF EQUIPMENT REQUIRED (Cont d.)

Large Food-Preparation Equipment	Number Type A Lunches Served Per Day										
	100–250	251–300	301–350	351–400	401–450	451–500	501–600	601–750	751–1000	1001–1250	1251–1500
6. Food Mixers and Vertical Cutter Mixers (See Section #AA6)											
Food Mixers											
20-quart	1								1	1	1
30-quart		1	1	1	1	1					
60-quart							1	1	1	1	1
-OR-											
Vertical Cutter Mixers											
40-quart [1]							1	1	1	1 or 1	1 or 1
60-quart [1]											

[1] Optional. A 20-quart food mi[illegible]commended for high schools.

SUMMATION TABLE OF EQUIPMENT REQUIRED (Cont'd)

Large Food-Preparation Equipment	Number Type A Lunches Served Per Day										
	100–250	251–300	301–350	351–400	401–450–	451–500	501–600	601–750	751–1000	1001–1250	1251–1500
7. Food Cutters (See Section [1]—#AA7)											
Table model, electric	[1] [2]	[1] [2]	[1] [2]	[1] [2]	[1] [2]	[1] [2]	1[1]	1[1]	1[1]	1[1]	1[1]
8. Food Slicers (See Section #AA8)											
Electric (manually-operated)	1	1	1	1	1	1	1[3]	1[3]			
Electric (automatic)									1	1	1

[1] A food cutter is not required if school has a vertical cutter mixer.
[2] A food cutter is not required if school has a food mixer with necessary attachments.
[3] High schools only and when preparing large quantities of sliced foods should consider purchasing an automatic food slicer for this size operation.

CONVECTION OVENS

1. Number and Type Convection Ovens Recommended: [1]

Number of Type A Lunches Served Daily	Number and Type Equipment
100–500	1 single-stack convection oven [2]
501–1000	2 single-stack convection ovens [2] – OR – 1 double-stack convection oven [2 3]
1001–1500	3 single-stack convection ovens [2] – OR – 1 single-stack convection oven [2] 1 double-stack convection oven [2 3] – OR – 1 roll-in convection oven [4]

[1] The convection oven is an extremely versatile piece of equipment which occupies considerably less floor space than deck ovens of comparable capacity. Because of its versatility, this guide only recommends the convection oven.

For schools still desiring deck ovens, the suggested oven capacities are:
250 meals— 6 pans
500 meals—10 pans
750meals—16 pans
750 meals—16 pans (This will require scheduling of successive loads).

[2] Capacity per stack convection oven depends upon the overall dimensions of the oven cavity, the number of racks, space between racks, and the heat input. The above equipment recommendations are based on an oven cavity that can accommodate and properly cook off interchangeably either ten 12" x 20" x 2½" hot food service pans of food using five racks with two 12" x 20" x 2½" hot food service pans per rack or nine sheet pans (measuring 18" x 26" x 1" or 20" x 24" x 1") of food using nine racks of 1 sheet pan per rack. These recommendations also take into consideration the proper scheduling of kitchen equipment. In the case of certain main dish USDA recipes, the oven(s) will have to be scheduled for two consecutive cooking loads. In those instances where the school bakes all its bread products or is a secondary school and choices within pattern are offered, an additional convection oven may be required.

[3] The double convection oven is suggested when kitchen space is limited although it is more difficult to load and unload the top racks of the top oven cavity

[4] The above recommendations for the roll-in oven are based on an oven that can accommodate and properly cook off one mobile rack load that has a minimum of 18 pan supports for holding either 12" x 20" x 2½" hot food service pans or sheet pans measuring 18" x 26" x 1" or 20" x 24" x 1".

If a roll-in convection oven is installed, the dimension of mobile rack should be considered when contemplating the purchase of roll-in refrigerators, holding cabinets and proof boxes for ultimate versatility and compatibility.

2. **Recommended Facilities at Work Station:**
   a. Ventilating equipment (See Section #FF1).
   b. Adequate lighting.
   c. Sufficient aisle room for easy loading and unloading of oven cavity. (minimum 42")
   d. Optional roll-in loading system for convection ovens where advantageous. Roll-in systems usually reduce the capacity of oven cavity.

3. **Desirable Equipment Features:**

Convection Ovens

   a. Adequate oven capacity (see footnote #2 under paragraph 1, number and type convection ovens recommended).
   b. Heat inputs:
      (1) Electric (minimum 10 KW)
      (2) Gas (minimum 85,000 BTU)
   c. Easy-to-remove deflector plates for cleaning and replacement in gas ovens.
   d. Fan blade accessible and easy to remove and replace from the front for periodic cleaning.
   e. Porcelain enamel interior lining. Stainless steel or aluminized steel are satisfactory interior liners but are difficult to clean.
   f. French-type doors that open to the sides at least 140° with adjustable-type friction latch and operated by one door handle. If doors can be opened independently, each door should be equipped with electric interlock switch for blower motor. Each door should have a thermal window of tempered glass.
   g. Two-speed blower motor for increased flexibility.
   h. Ready accessibility to components, front and rear, for inspection, adjustment, repair, or replacement.
   i. National Sanitation Foundation Seal of Approval (NSF).
   j. Underwriters' Laboratories, Inc. Seal of Approval (UL).
   k. American Gas Association Seal of Approval (AGA).

Roll-In Convection Ovens

   a. Adequate oven cavity (see footnote # 4 under paragraph 1, number and type convection ovens recommended).
   b. Air-tight seal where a mobile rack forms the bottom of the roll-in oven. In addition the casters should not get sufficiently hot to damage vinyl-covered floors. (Note: This mobile piece of equipment should be compatible with other roll-in types of equipment in kitchen.)
   c. Good temperature distribution throughout entire oven when loaded or partially loaded.
   d. Positive-type door lock.
   e. National Sanitation Foundation Seal of Approval (NSF).
   f. Underwriters' Laboratory Seal of Approval (UL).
   g. American Gas Association Seal of Approval (AGA).

STEAMERS

1. **Type, Number and Size of Steamer Recommended:** [1]

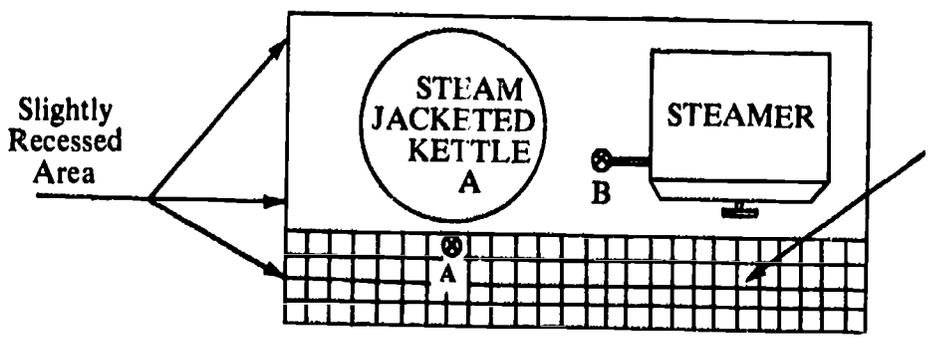
Number of Type A Lunches Served Daily	Type Steamer	Number and Size of Steamer Unit	Minimum Capacity Per Compartment
100–300	High pressure (15 lbs.) —OR— Low pressure (5 lbs.)	1 High Pressure Cooker —OR— 1 2-compartment steamer	3 12" x 20" x 2½" hot food service pans. —OR— 6 12" x 20" x 2½" hot food service pans.[2]
301–600	Low pressure (5 lbs.)	1 2-compartment steamer	—OR— 3 18" x 26" x 1" or 20" x 24" x 1" sheet pans.
601–1500	Low pressure (5 lbs.)	1 3-compartment steamer [3]	

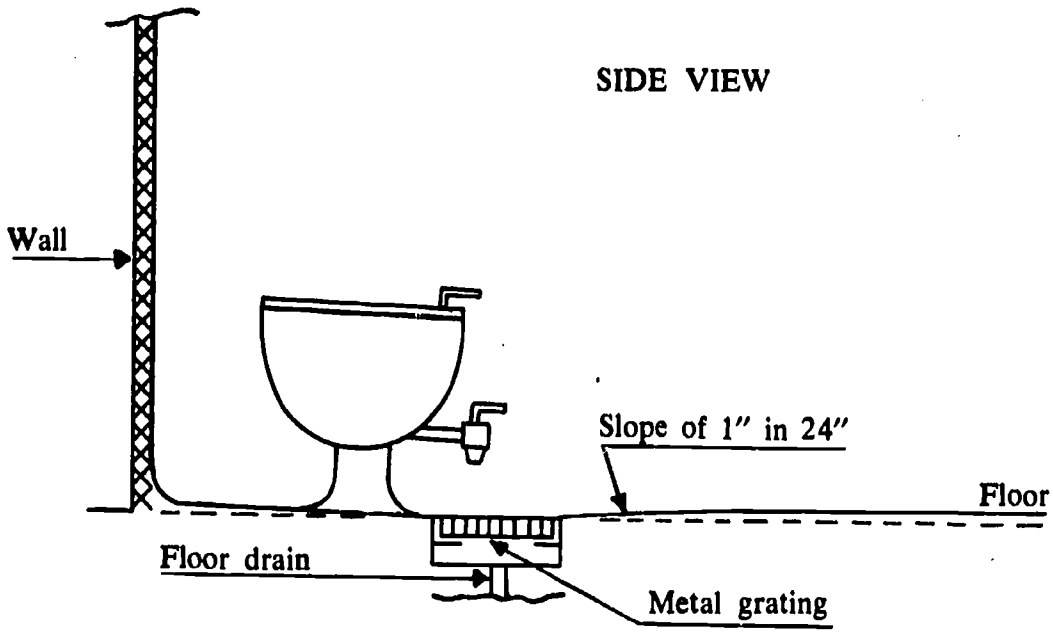
[1] Steamers can be purchased as individual pieces of equipment or in combination units with steam-jacketed kettle(s).
[2] The compartment steamer recommendations are based on a low-pressure steamer with multi-shelf pan supports capable of holding a minimum of six 12" x 20" x 2½" hot food service pans and/or a minimum of three sheet pans measuring either 18" x 26" x 1" or 20" x 24" x 1".
[3] The height of the third compartment of a self-contained steamer is frequently too high to allow for an efficient operation; whereas, a direct steam unit is of a workable height.

2. **Recommended Facilities at Work Station:**
   a. For individual steamer(s) and kettle(s), recessed floor area with adequate floor drainage system to accommodate both the condensate from the steamer and water used for clean-up purposes. If the school food service operation includes steam-jacketed kettle(s), then the recessed area and drainage system should be sufficient to accommodate both the steamer and kettle(s).

Floor Drain A: Locate directly below kettle draw-off valve.
Floor Drain B: Locate on side or behind steamer. Do not locate under steamer.

TOP VIEW





The proposed drainage system described in paragraph 2a does not apply to combination steamer and kettle units. In combination unit installations, only a level floor with a single floor drain is generally required.

b Hot and cold running water at steamer work station for both cooking and cleaning purposes.
c. Adequate ventilation.
d. Adequate lighting.
e. Timer unit (mechanical, preferably machine mounted).
f. Stainless steel work table or mobile cart for holding 12" x 20" hot food service pans and/or sheet pans measuring 18" x 26", or 20" x 24". If using 20" x 24" pans, make sure pans are compatible with mobile carts.

3. Desirable Equipment Features:

a. Steamer (direct steam, see Section #FF2 for source of steam) with stainless steel interior with baked enamel or other durable finish for exterior finishes. When procuring self-contained units in lieu of direct-steam equipment, try to purchase those combination units or individual pieces of equipment having 1.5 boiler horsepower per steamer compartment. In combination units (steamer and kettle[s]) remember to add a minimum of 0.5 horsepower per each 10 gallons of steam-jacketed kettle capacity. The above boiler horsepower ratings are needed for efficient simultaneous operation of steam equipment.
b. Each compartment capable of holding a minimum of six 12" x 20" x 2½" hot food service pans or a minimum of three sheet pans measuring either 18" x 26" x 1" or 20" x 24" x 1".
c. Automatic steam controls for (a) stopping steam from entering unit at end of cooking cycle and (b) exhausting steam and condensate.

d. Door equipped with a self-engaging latch. When latch is released door automatically opens a minimum of 15 degrees.
e. Enclosed hot pipes, controls on compartment, etc. (for safety).
f. Visible steamer-mounted pressure gauge.
g. Exposed air traps and safety valves.
h. Double-door construction preferable.
i. One-piece door gasket easily replaced by kitchen personnel without special tools.
j. Steamer-mounted timer for each compartment.
k. National Sanitation Foundation seal of Approval (NFS).
l. American Society of Mechanical Engineers seal of Approval (ASME).
m. Underwriters' Laboratory seal of Approval (UL).
n. American Gas Association seal of Approval (AGA).

4. Proper Use of Steamer for Cooking:
a. Fresh and frozen vegetables.
b. Pasta products and rice.
c. Some meats and fowl (partial cooking).

STEAM-JACKETED KETTLES AND TILTING BRAISING PANS

1. Number and Size of Steam-Jacketed Kettles and Tilting Braising Pans Recommended:

Number of Type A Lunches Served Daily	Number, Type and Size Equipment [1] [2]		
	Steam-Jacketed Kettles		Steam-Jacketed Kettles and Tilting Braising Pans
100–250	1 20-gallon kettle	– OR –	1 20-25-gallon tilting braising pan
251–350	1 30-gallon kettle	– OR –	1 30-35-gallon tilting braising pan
351–500	1 40-gallon kettle	– OR –	1 40-gallon tilting braising pan
501–750	2 30-gallon kettles – or – 1 60-gallon kettle [3]	– OR –	1 20-25-gallon tilting braising pan 1 40-gallon kettle
751–1000	2 40-gallon kettles	– OR –	1 20-25-gallon tilting braising pan 1 60-gallon kettle [3] OR any other workable combination
1001–1250	2 40-gallon kettles 1 20-gallon kettle – or – 1 60-gallon kettle [3] 1 40-gallon kettle	– OR –	1 40-gallon or larger tilting braising pan 1 60-gallon kettle [3] OR any other workable combination
1251–1500	3 40-gallon kettles – or – 2 60-gallon kettles	– OR –	2 30-35-gallon tilting braising pans 1 60-gallon kettle [3] OR any other workable combination

[1] A table model trunnion or stationary kettle of 5-10 gallon capacity is suggested for high schools when choice within Type A pattern and/or a la carte items are offered.

[2] Steam-jacketed kettles can be purchased as individual pieces of equipment or in a combination unit with steamer(s).

[3] Sixty-gallon kettles can be used in place of two 30-gallon kettles, or one 20- and one 40-gallon kettle, or in combinations of one 60-gallon kettle with other size kettles, e.g. 20- and 60-gallon kettles to replace two 40-gallon kettles, etc., providing the 60-gallon kettle is low profile. Otherwise, the 60-gallon kettle is apt to be too high for efficient use.

2. Total Usable Capacities of Steam-Jacketed Kettles [1]

Kettle Size	Total Usable Capacity				
	Gallons	Number of Individual Servings			
		Full Cups	¾ Cups	½ Cups	¼ Cups
20 gallons	16	256	341	512	1024
30-gallons	24	384	512	768	1536
40-gallons	32	512	683	1024	2048
60-gallons	48	768	1024	1536	3072

[1] The above table is based on 80 percent usable capacity. Manufacturers generally express kettle size as total kettle capacity (level full) and the usable capacity is approximately 20 percent less than stated.

3. Recommended Facilities at Work Station:

a. Recessed floor area with adequate floor drainage system with removable metal grating. See Section #AA-2, paragraph 2a. For 1-2 kettles (a 4" drain pipe) and for 3-4 kettles (a 6" drain pipe or two 4" drains.) If there is only 1 kettle and the projected program will only require 1 kettle, it is a good idea to locate the 4" drain pipe directly below the kettle draw-off valve.

b. Double-arm swing faucet, positioned for easy filling of kettle(s) or a wall-mounted pre-rinse spray unit with back siphon breaker, flexible armoured high with "pistol-grip" water valve located for easy filling and washing both inside and outside of kettle(s).

c. A 30-37" perforated aluminum stirring paddle or composition paddle for 20- and 30-gallon kettles and a 45" perforated aluminum paddle for kettles in excess of 30 gallons. A French whip should also be considered.

d. Stainless steel measuring device, similar to a yardstick but in gallon graduations. A water metering device is a recommended option for large food service operations.

e. Adequate ventilation (located under mechanical exhaust hood).

f. Kettle cover (hinged 1-2 piece cover with handle so located and designed as to prevent exposure to steam or possible burns on opening cover).

g. Stainless steel baskets for kettle (optional).

h. Removable or permanent mounted kettle rack for holding 12" x 20" hot food service pans during pan filling operations. Acceptable substitute is rack cart for holding 12" x 20" pans.

4. Desirable Equipment Features:

a. Two-thirds jacketed kettle, direct steam (see Section #FF2 for source of steam), fabricated from Series 300 stainless steel. When procuring self-contained units in lieu of direct-steam equipment, try to purchase those combination units of individual pieces of equipment having 0.5 boiler horsepower per each 10 gallons of kettle capacity. In combination

units (steamer and kettle(s)) remember to add a minimum of 1.5 boiler horsepower per steamer compartment. The above horsepower ratings should guarantee efficient operations.

b. Larger diameter kettles of the same capacity have a greater heat transfer surface area. Therefore, before procuring, compare square feet of heat transfer area.
c. Kettles are available as stationary and tilting. When considering stationary kettles, the draw-off should be 2½"-3" in diameter. When considering tilting type, a pan support is desirable.
d. Sanitary draw-off with compression disc-type drain valve. Generally, it is easier to clean and repair.
e. National Sanitation Foundation Seal of Approval (NSF).
f. American Society of Mechanical Engineers Seal of Approval (ASME).
g. Underwriters' Laboratory Seal of Approval (UL). (Does not apply for direct-steam equipment.)
h. American Gas Association Seal of Approval (AGA). (Does not apply for direct-steam equipment.)

5. Proper Use of Kettle and Braising Pan:

a. Moist-heat cookery of meat and poultry braising or simmering/boiling.
b. Combination dishes such as soups, stews, chili con carne, chili-mac, spaghetti, goulash, etc.
c. Vegetable cookery (frozen and fresh), hard cooked eggs, cooked cereal, puddings, pie fillings, sauces, jello, etc.
d. Shallow fat frying of fish, chicken, etc., and griddle work for such items as pancakes, French toast, hamburgers, etc. Braising pan only. NOTE: Mobile units can be wheeled from kitchen to serving line and served directly from braising pan.

UTILITY RANGES [1]

1. Number and Size Utility Range Recommended:

Number Participants	Suggested Equipment			
	Number	Description		
		Type	Top Cooking Section	Oven
100–450	1	Utility range 12" to 18" wide, commercial type, heavy duty, gas or electric, top cooking only.	2-burners or 1 rectangular hot plate	NONE
451–1,500	1	Range 36" commercial type heavy duty, gas or electric, top and oven cooking.	2-burners plus 1 rectangular hot plate	Overall oven shelf dimensions should be sufficient to accommodate interchangeably one 18" x 26" sheet pan or two 12" x 20" hot food service pans.[2]

[1] Utility ranges are required for preparing small batches of ingredients.
[2] Additional oven space is intended for supplementing convection oven (See Section #AA1).

2. Recommended Facilities at Work Station

a. Adequate ventilation (see Section #FF1).
b. Adequate lighting.
c. Sufficient aisle room for easy loading and unloading.

3. Recommended Equipment Features

a. Easy accessibility for repairing.
b. Suggested minimum electric (KW) and gas (BTU) characteristics:

	Electric	Gas
Burners (or French Hotplate)	4 KW	60,000 BTU
Rectangular Hotplate	5 KW	40,000 BTU

c. Thermostatically controlled hotplate with even heat distribution.
d. National Sanitation Foundation Seal of Approval (NSF).
e. Underwriters' Laboratories Seal of Approval (UL) where applicable.
f. American Gas Association Seal of Approval (AGA) where applicable.

DEEP FAT FRYERS

1. **Optional piece of equipment.** An alternative to deep fat frying is oven preparation of items such as oven-fried chicken and reheated frozen French fries.

2. **Number and size (capacity) of deep fat fryers recommended:**

Number of Type A Lunches Served Daily	Number and Capacity of Fryer [1,2]	
	Number	Capacity
100–300	1	60 lbs. of potatoes from raw to done, or 90 lbs. of chicken pieces per hour.
301–400	1	95 lbs. of potatoes from raw to done, or 100 lbs. of chicken pieces per hour.
401–750	2	
751–1250	3	
1251–1500	4	

[1] The equipment recommendations are based on electrical deep fat fryers having a ratio of 1 KW input to five pounds of potatoes cooked from raw to done per hour. If gas, an equivalent ratio.

[2] The number and capacity of the recommended deep fat fryers are based on a continuous frying prior and during the serving time with holding time held to minimum. It does not allow for the preparation and serving of two deep fat fried items on the same menu. If blanched, semi-thawed potatoes are used, the capacity is significantly increased. For fried chicken, the holding time will be approximately 60 minutes where equipment is marginal for size of operation, i.e., 1 fryer for 400, 2 fryers for 750, etc.

3. **Recommended Facilities at work station:**
   a. 18" spreader plate which attaches to the side of the deep fat fryer, or work table adjacent to fryer.
   b. Infrared heating lamps for maintaining temperature of fried items, especially potatoes.
   c. Cover for fat vessel.
   d. Adequate ventilation (see ventilating equipment, section #FF1) (check with local authority on local fire codes and requirements of National Fire Protection Association Standard No. 96, entitled, "Ventilation of Cooking Equipment").
   e. Adequate lighting.
   f. Sufficient aisle space for easy loading and unloading of fryer.

4. **Recommended Equipment Features:**
   a. For safety purposes, the on/off switch should be located on the front panel in front of the fryer fat vessel.
   b. Fryer should be serviceable from the front.
   c. Working height should be 36".
   d. If electric, a kilowatt input of 1 KW per each 5 lbs. of potatoes fried from raw to done per hour. If gas, an equivalent ratio.
   e. If electric, lift up heating elements for "burn off" and easy cleaning of fat vessel.
   f. Twin standard mesh baskets fabricated from corrosion resistant steel.
   g. If electric, the heating elements should be enclosed, resistance type with stainless steel sheath.
   h. The fat vessel should have a cold zone where food particles will accumulate without being scorched.
   i. A means for draining the fat vessel, preferably a bottom drain over siphon type.
   j. National Sanitation Foundation Seal of Approval (NSF).
   k. Underwriters' Laboratory Seal of Approval (UL).
   l. American Gas Association Seal of Approval (AGA).

FOOD MIXERS AND VERTICAL CUTTER MIXERS

1. Number, Type and Size of Equipment Recommended:

Number of Type A Lunches Served Daily	Number, Type and Size of Equipment		
100–250	1 20-quart mixer [1]		
251–500	1 30-quart mixer [1]		
501–750	1 60-quart mixer [1 2]	- OR -	1 40-quart vertical cutter mixer
751–1000	1 60-quart mixer [1 2] - PLUS - 1 20-quart mixer	- OR -	1 40-quart vertical cutter mixer [3]
1001–1500	1 60-quart mixer [1 2] - PLUS - 1 20-quart mixer	- OR -	1 40-quart vertical cutter mixer [3]

[1] Available Mixer attachments:
a. Meat and food chopper
b. Vegetable slicer attachments with vegetable slicing, grating and 5/16" shredding plates.
c. High speed drive.
[2] Bowl truck, 30-quart adapter bowls, and beaters.
[3] A 20-quart mixer is also suggested for high schools, where the school does all its baking and serves a la carte items.

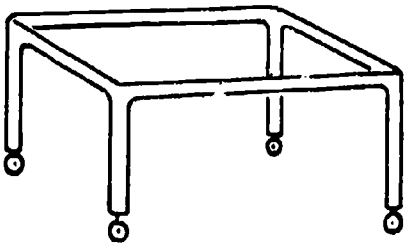
2. Recommended Facilities at Work Station:

Vertical Cutter Mixer:

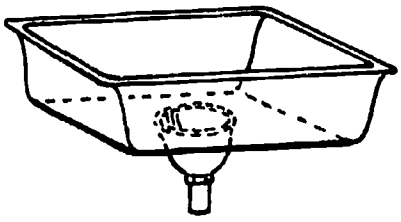
a. Hot and cold water lines connected to a mixing faucet with approximately 4 feet of flexible armoured hose with self-closing spray valve. The bracket for holding the spray unit should be machine mounted. NOTE: The spray unit must be equipped with a siphon breaker to conform with public health requirements.

b. Adequate floor drainage system to accommodate water used for clean-up purposes. For example, when the VCM is tilted forward for emptying bowl, the lip of the bowl is a considerable distance from the floor. Consequently, there is a tendency for liquids to splatter. This problem is easily resolved by fabricating a mobile floor drainage system consisting of (1) a metal frame with casters; (2) a 22-quart oblong stainless steel sink measuring 21" x 12 $15/16$" x 6" with 4" hole punched in center to accommodate a standard cup strainer drain fitting, and (3) a perforated stainless steel 12" x 20" x 2" hot food service pan.

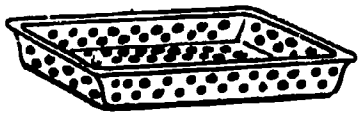
(1)



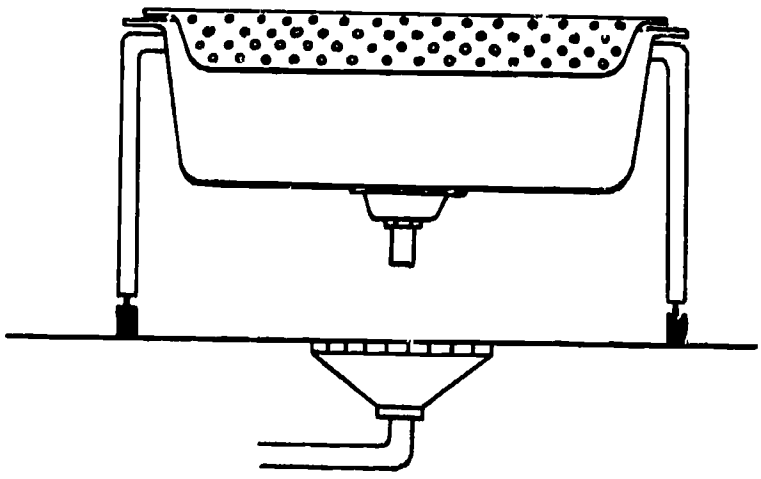
(2)



(3)



Front View of Assembled Mobile Floor Drainage System



Floor drain

c. Clock with large sweep second hand located in the preparation area so that the operator can readily see and read it while operating the vertical cutter mixer.

Food Mixer:
Locate in area of compartment sink.

3. Desirable Equipment Features:

Food Mixers (only):
a. Three or more speeds.
b. Gear drive.
c. Bowl lift with automatic top and bottom lock.
d. Built-in mechanical timer, especially in 30- and 60-quart sizes.
e. Attachment hub and availability of such attachments as vegetable slicer, meat chopper, etc.
f. Totally enclosed electric motor.
g. Stainless steel bowl.
h. National Sanitation Foundation Seal of Approval (NSF).
i. Underwriters' Laboratory Seal of Approval (UL).

FOOD CUTTERS
Table Models

1. Number and Type Food Cutter Recommended:

Number of Type A Luncheons Served Daily	Recommended Number of Food Cutters
100–500	[1] [2]
501–1500	1 food cutter [1] [3]

[1] A food cutter is not required if you have a vertical cutter mixer.
[2] A food cutter is not required if you have a food mixer with the following attachments:
- a. Vegetable slicer attachment with vegetable slicing, grating and 5/16" shredding plates
- b. Food Chopper (optional)
- c. Hub and Shaft
- d. High speed drive

[3] Based on engineering principles, food cutters can generally be designated as either revolving knives and bowl OR rotating plate with permanent bias and horizontal feed entries or any combination of such entries.

2. Desirable Equipment Features:
- a. Yield of uniformly sliced, grated, and shredded products.
- b. Easy adjustment for varying thicknesses of sliced products.
- c. High production rate.
- d. Easy to disassemble and assemble for cleaning. (No tools should be required.)
- e. Maximum protection of user against possible contact with revolving cutting knives or rotating plate.
- f. Food contact surface fabricated from 18-8 stainless steel, aluminum, or any other corrosion-resistant metal accepted by NSF.
- g. Fully enclosed electric motor.
- h. National Sanitation Foundation Seal of Approval (NSF).
- i. Underwriters' Laboratory Seal of Approval (UL).

FOOD SLICERS

1. Number and Type Food Slicer Recommended:

Number of Type A Lunches Served Daily	Number and Type Gravity-Feed Food Slicer
100–750	1 electric (manually-operated) [1]
751–1500	1 electric (automatic)

[1] Optional for high schools serving in excess of 500 Type A lunches and where the schools are preparing large quantities of sliced products (such as sliced cheese, luncheon meats, roast beef, turkey, etc.) to purchase either a manually operated or automatic food slicer.

2. Desirable Equipment Features:

a. Easy adjustment to cut uniformly any thickness of slice from 0 to ¾" or more.
b. Capacity to hold and cut rectangular-shaped products measuring up to 9" or more in width or round shaped products up to 7" or more in diameter.
c. Solid stainless steel or plated carbon steel knife with minimum diameter of 11".
l. Easy to disassemble and assemble for cleaning. (No tools should be required.)
e. Maximum protection against contact with knife.
f. Food contact surfaces fabricated of 18-8 stainless steel, aluminum (preferably polished) or any other corrosion-resistant metal accepted by NSF.
g. Gravity feed on the electric, manually operated slicer.
h. Sealed (enclosed) electric motor.
i. A neon pilot light near "off-on" switch to indicate whether slicer is off or on.
j. Knife blade should be able to be sharpened without removing guard.
k. A "lifting foot" or lever to raise slicer for cleaning under it.
l. National Sanitation Foundation Seal of Approval (NSF).
m. Underwriters' Laboratory Seal of Approval (UL).

SECTION B

REFRIGERATOR, FREEZER, AND DRY STORAGE

SUMMATION TABLE OF EQUIPMENT REQUIRED

Refrigerators, Freezers, and Dry Storage	Number Type A Lunches Served Per Day						
	100	250	500	750	1000	1250	1500
1. Walk-in and Reach-In Refrigerated Units (See Section #BB1)							
Reach-In Refrigerators (Number of Sections)	1	3	1[1]	1[1]	1[1]	1[1]	1[1]
Reach-In Freezers (Number of Sections)	1	3[4] or	—	—	—	—	—
Walk-In Refrigerator (Calculated exterior sq. ft.)	—	64[2]	64[2]	79	106	132	158
Walk-In Freezer (Calculated exterior sq. ft.)	—	48[2]	48[2]	55	74	92	110
2. Dry Storage (See Section #BB2)	—	—	—	—	—	—	—
Walk-in dry storage (Interior Sq. Ft.)	50	125	250	375	500	625	750

[1] Considered supplemental point of use refrigeration (See Section #BB1)
[2] Minimum size walk-in recommended.

WALK-IN AND REACH-IN REFRIGERATED UNITS

1. **Recommended Walk-In and Reach-In Refrigerators and Freezer:**

Number of Type A Lunches Served Daily	Walk-In Units [1]				Reach-In Units [2]	
	Refrigerator		Freezer		No. of Sections	
	Interior	Exterior	Interior	Exterior		
	Cu. Ft.	Sq. Ft. (Approx)	Cu. Ft.	Sq. Ft. (Approx)	Refrig-erator	Freezer
100	—	—	—	—	1	1
250	159	26 [3]	111	19 [3] or	3	4
500	318	53 [3]	221	38 [3]	1 [4]	—
750	477	79	332	55	1 [4]	—
1000	636	106	442	74	1 [4]	—
1250	795	132	553	92	1 [4]	—
1500	954	158	663	110	1 [4]	—

[1] Space requirements for walk-in refrigerators and freezers vary considerably depending upon such variables as frequency of deliveries and buying practices. The above table is based on 10 days, a combination of weekly and bi-weekly deliveries for locally purchased foods plus monthly deliveries for donated commodities.

[2] Due to increasing use of mobile carts and food cabinets with walk-in units, it is suggested that walk-in refrigerators smaller than approximately 64 square feet (based on exterior dimensions) not be considered. Smaller freezers than approximately 48 square feet (based on exterior dimensions) should not be considered.

[3] Where space is at a premium or operation is 250 Type A lunches daily or smaller, reach-in and roll-in units should be considered in lieu of walk-in units. The number of sections required was based on a nominal size of 22 cubic feet per section. Refrigeration calculations were based on 5-days for 36° to 40° F. storage and 10-days for minus 10° to 0° F. storage.

[4] Reach-in refrigerators should be considered as supplemental refrigeration. The number of sections depend upon the size of the particular operation, layout and distances from the work areas to the walk-in for an efficient operation.

WALK-IN AND REACH-IN REFRIGERATED UNITS

1. **The following formulas were used to determine the space requirements for Walk-In and Reach-In Refrigerated Units.** Determine total pounds of food to be stored at 36° to 40° F. and —10° to 0° F.

Total pounds of food to be stored at 36° to 40° F. = [Number of meals to be served] × [2.1 lbs. (lbs. of "As Purchased" foods required per meal)] × [.4543 (Percent of food requiring 36° to 40° F. storage)] × [Days (Combination of weekly and biweekly for local procurements and monthly deliveries for commodities.)]

Total pounds of food to be stored at —10° to 0° F. = [Number of meals to be served] × [2.1 lbs. (lbs. of "As Purchased" foods required per meal)] × [.3157 (Percent of food requiring —10° to 0° F. storage).] × [Days (Combination of weekly and biweekly for local procurements and monthly deliveries for commodities.)]

2. **Determine interior cubic feet of space required.**

Interior cubic feet of space required = [Total pounds of food to be stored] ÷ [15 pounds of food per cubic feet of storage [1]]

1 Based on 30 lbs. of food per cubic foot which has been adjusted to allow for aisles, unused space between shelves, for **walk-in units.** For **reach-in units,** use 22 lbs.

3. **For walk-in units, determine interior square feet of space required.**

Interiod square feet of space = [Cubic feet of space (Determined in #2)] ÷ [7.5 feet (Suggested height)]

4. **For walk-in units, convert interior square foot into approximate exterior square foot of space.** (Factor provides approximate exterior square foot figures and should be used only for size operations stated in Table #BB1.)

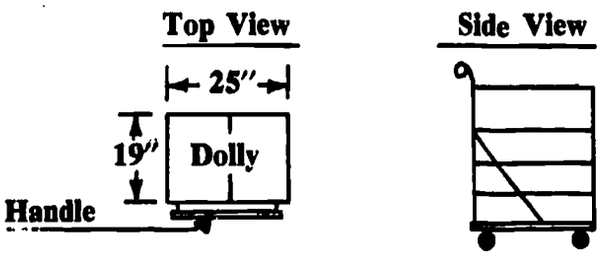
Approximate exterior square feet of space = [Intericr square feet] ÷ [.86 (factor)]

2. Recommended Facilities at Work Station:

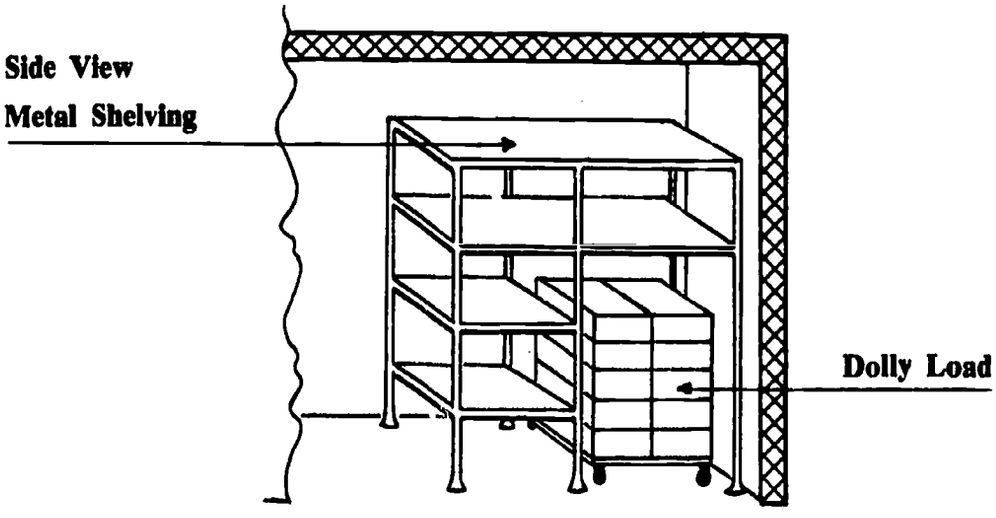
a. Mobile carts and cold food cabinets (see Section #FF3 Mobile Equipment).

NOTE: In addition to the use of mobile cabinets in the walk-in refrigerator, the food service concept suggests the use of dollies for canned goods. Here, the incoming cases of #10 canned fruits, vegetables, etc. are placed on dollies and then rolled into the dry storage area and parked beneath the shelving. In the case of canned fruits, etc. which sometimes require prechilling prior to serving, a dolly load of canned fruit, e.g. fruit cocktail, is rolled from the dry storage area into the walk-in refrigerator and parked beneath the shelving. This should be done several days prior to actual time of serving.

b. Dollies measuring 19" x 25" with 4"-5" casters (2 fixed, 2 swivel, preferably with roller bearings) designed to hold 2 stacks and intended in use to hold 4 cases high per stack of # 10 cans for a total of 8 cases per dolly load.



c. Adjustable metal shelving, 18" wide, preferably solid-type shelving for the refrigerator and wire-type shelving for the freezer. Shelving where dolly loads of canned foods are parked should be 21" wide. Remember to provide 30 lineal inches of 21" shelving for each dolly. The bottom of the lowest shelf should be a minimum of 36" from the floor in order to accommodate the dolly. For operations in excess of 500 Type A lunches leave space for a minimum of two dollies.



3. **Desirable Equipment Features:**

Walk-In Refrigeration System

a. Separate refrigeration system for both walk-in refrigerator and freezer compartments.

b. Refrigerator compartment 36° to 40° F. with a 10° F. temperature differential between refrigerant (coil temperature) and walk-in compartment temperature of 36 to 40° F. while operating at ambient temperature of 90° F. Compressor to operate for no more than 70 percent of the time under no-load conditions i.e. empty walk-in.

c. Freezer compartment (maximum storage temperature 0° F.) with a 12 to 15° F. temperature differential between refrigerant (coil temperature), and walk-in compartment temperature of 0° F. while operating at ambient temperature of 90° F. Compressor to operate for no more than 80 percent of the time under no-load conditions i.e. (empty walk-in).

d. Dual pressure controls (high and low pressure cut-off) for 36 to 40° F. compartment. An automatic, low ambient control unit is also required for those installations having a remote refrigeration system, where compressor is subject to ambient temperatures below freezing.

e. Dual pressure controls (high and low pressure cut-offs) for —10° to 0° F. compartment. A time clock for electric defrost of evaporator. An automatic, low ambient control unit is also required for those installations having a remote refrigeration system where compressor is subjected to ambient temperatures below freezing.

f. Thermostatic expansion valve.

g. Liquid line strainer and dryer and moisture-indicating sight glass.

h. Automatic audio visual safety alarm system.

i. Underwriters' Laboratory Seal of Approval (UL).

Walk-In Compartments

a. For an efficient operation, the floor of the walk-in refrigerator **should be level with the adjacent flooring.**

b. The following installations on concrete slabs are recommended. Other types of installations may be prone to point loading and moisture in floor panels.

c. System for locking panels should guarantee an air-tight durable seal which manufacturer will guarantee for a minimum of 5 years under normal usage. If gasket material is required as seal, it should be of approved type.

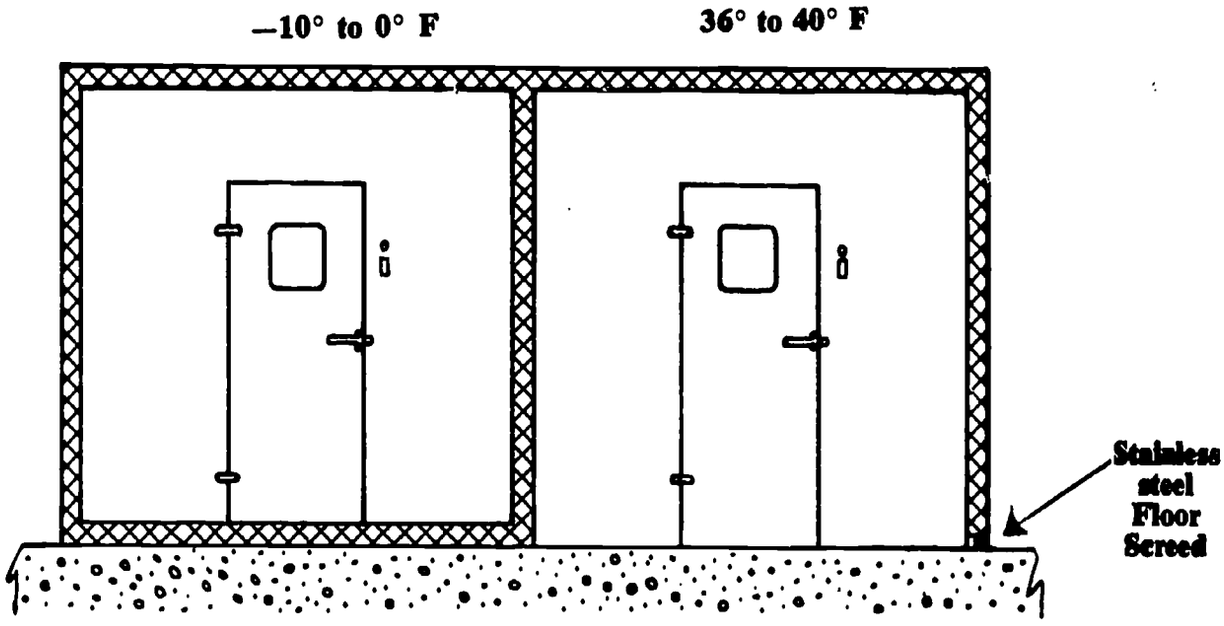
d. First preference of insulation is foamed in-place or froth-type urethane.

e. Insulated floor screeds should be used where prefabricated walk-in units are installed on concrete slab floors.

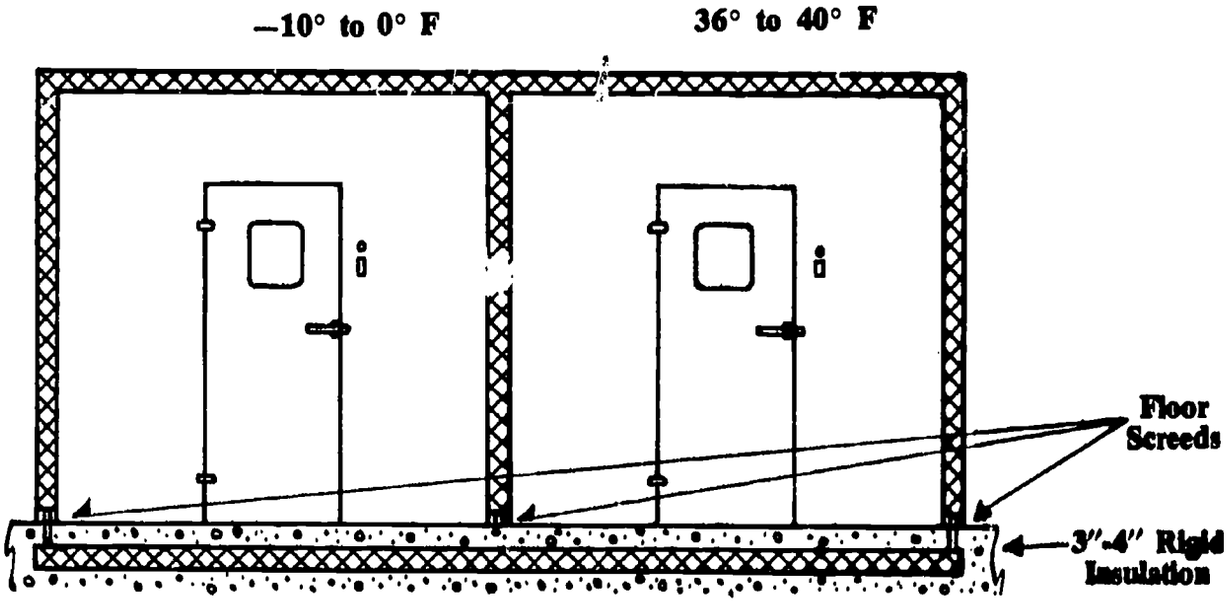
f. Where factory-fabricated floors are used, there should be a minimum floor loading of 300

pounds per square foot without floor distortion. Diamond plate steel or aluminum should be considered where there is continuous traffic of loaded dollies or food cabinets.

Uninsulated Floor



Insulated Floor



g. There should be replaceable anti-sweat heaters around each walk-in unit door and frame.

h. The main door to each compartment should be 34-36" wide with optional insulated glass view port. There should be a positive safety latch with lock and can-lift hinges.

i. There should be a flush, exterior-mounted thermometer of 2½" diameter for each compartment.

j. There should be an interior-mounted, vapor-proof incandescent light per each 100 square feet of space.

k. National Sanitation Foundation Seal of Approval (NSF).

l. Underwriters' Laboratory Seal of Approval (UL).

Reach-In and Roll-In Refrigerated Units

a. Properly-sized compressor, condensor and evaporator.

b. 2½" of foamed in-place or froth-type urethane insulation throughout, including door(s).

c. Uniform air distribution throughout the refrigerated section(s) whether partially or fully loaded.

d. Seamless construction of interior.

e. Durable door hinges, handle(s), and mounting hardware which are designed to stay in place and last the life of the unit.

f. Self-closing door(s) with safety stop(s).

g. Door gasket, molded, one piece, providing a positive seal.

h. Heavy duty adjustable shelving.

i. All interior accessories easily removable without special tools.

j. Condensor should be accessable for cleaning.

k. Durable system for locking door(s) to prevent pilferage.

l. Exterior-mounted thermometer for indicating product zone temperature.

m. Adjustable legs for leveling refrigerator.

n. High temperature warning light (for temperatures in excess of 50° F.).

o. Power indicator lights.

p. Automatic defroster-timer for freezer.

q. Underwriters' Laboratory Seal of Approval (UL).

r. National Sanitation Foundation Seal of Approval (NSF).

DRY STORAGE

The dry food storage area provides orderly storage for food not requiring refrigeration. It should also provide protection of foods and other supplies from spoilage, theft, fire, insects, rodents, etc.

1. **Space**
   Space required depends upon menu, number of meals, quantities purchased and frequency of deliveries. Allow at least one-half square foot floor space per meal served daily. If the school is part of a large system with a central warehouse used for the storage of foods, space requirements will depend on the frequency of deliveries from the central source. Additional space may be needed if large quantities of food are bought locally at one time; if large quantities of USDA-donated foods are requested; or, if delivery of donated foods is infrequent.

2. **Location of Storeroom**
   The dry storage area should ideally be (a) adjacent to the food preparation area, (b) convenient to receiving and (c) on the same floor level to minimize handling and maintain security.

3. **General Construction Features**
   a. Floors should be level with surrounding food preparation and receiving area to allow for mobile equipment in the movement of supplies.

   b. Exterior and interior walls and subfloors need to be tightly constructed, vapor-sealed below ground, rodent and insect-proof, and where necessary, insulated to insure protection of foods from the elements.

      Walls and ceiling of light colors, smooth, impervious to moisture, easy to wash and repair, are preferable.

   c. A heavy-duty door with a minimum width of 42 inches is recommended. The door should lock from the outside, but always open from the inside without a key. The door should have a "kick plate" to protect it from skids, dollies and carts.

   d. Windows are **not recommended** unless required by State and local regulations. Where windows are required, they should be equipped with security-type sash, security screen, or security bars and located to avoid interference with shelving. To protect foods from direct sunlight, windows should be frosted.

   e. Lighting and wiring should meet the National Electrical Code requirements (American Standard) together with local requirements. In order to provide adequate lighting for the storage area, illumination levels of approximately 15-foot candles are desirable. This is normally achieved by about 2 watts per square foot of floor area. For best distribution of light, have the fixtures centered over each aisle.

   f. Wherever foods are stored, a **reliable** easy-to-read thermometer is essential to make sure that proper temperatures are maintained in order to prevent spoilage and deterioration. Wall thermometers are suitable for the dry food storage area. Mount the thermometer in the vicinity of the door, where there is less danger of breakage from bumping, and at about eye level for easy reading. It **should not be mounted** on the door, near a light bulb, or in a recessed pocket.

Some of the characteristics of a good wall thermometer are:

Overall length of approximately 12 inches, mounting holes at top and bottom, a temperature range of minus 20° F. to plus 120° F. in 2°-scale divisions, a red, liquid-filled or mercury-filled magnifying glass tube for easy reading, a rust-resistant scale, thermometer bulb and tube fully protected by side flanges on the frame to avoid breakage.

g. Good ventilation in the dry food storage area is essential to the proper storage of any type of food. Ventilation helps retard growth of various types of bacteria and molds, prevents mustiness and rusting of metal containers, and minimizes caking of ground or powdered foods, by assisting in controlling the temperature and humidity.

Temperatures of 50° to 70° F. are recommended for the dry food storage area. However, during some months it may be possible to maintain temperatures between 40° to 45° F. and this is desirable for many foods normally kept in the dry food storage area.

In cooler climates, the recommended temperatures can usually be held by proper insulation and by natural and/or mechanical ventilation. Natural ventilation is obtained by proper construction of the storeroom to permit entrance of fresh cool air through louvers at the floor level and the escape of warm air through louvers at the ceiling or roof level.

In hot, humid climates, where the recommended temperatures of 50° to 70° F. cannot be maintained by natural or mechanical ventilation, and/or humidities are consistently high (over 80 percent), it may be necessary to install air conditioning.

Mechanical, or forced-air ventilation, with intake and/or exhaust fans, keeps fresh air circulating.

Generally, four air changes per hour will be adequate. During the winter months, it may be necessary to use heating equipment to keep certain foods from freezing.

h. The storeroom should be free of uninsulated steam and water pipes, water heaters, transformers, refrigeration condensing units, steam generators or other heat-producing equipment.

i. For access to shelving only, aisles at least 30 inches wide are needed. Aisles, a minimum of 42 inches wide, are recommended for mobile movement of supplies.

Storeroom equipment:

For dry storage operation, consideration should include shelf, semi-live skid or dolly and pallet storage.

a. Shelving in the storeroom can be of wood, preferably metal. It should be supported by uprights not more than 48 inches apart. Practical height for the highest shelf is approximately 7 feet. Lower shelves should be adjustable in height, and the lowest shelf should be 36 inches from the floor to permit storage of bulk items on platforms below. Shelves should be securely braced against tipping and provide a minimum of 1-inch clearance from the wall for cleaning and air circulation.

Shelving is available in depths from 12 to 27 inches. The 18 to 21 inch depths appear to offer maximum usable space and permit easy control for most items if access is from one side only. (The 12 and 18 to 21 inch depths are better for small and large items, respectively.) Where access is from two sides, two 18 to 21 inch shelves placed back to back can be used to an advantage. Clearance between the shelves should be at least 15 inches to accommodate stacking Nos. 2, 2½, 3, and 10 cans.

Table 1—Can and Carton measurements for estimating shelf capacity and vertical clearance

Size can	Approximate diameter of can	Clear height per tier	Cans per carton	Size of carton
	Inches	Inches	Number	Inches
No. 2	3½	5	24	14 x 10½ x 9¼.
No. 2½	4	5	24	17 x 12¾ x 10¼.
No. 3 (cylinder) .	4¼	7½	12	17½ x 13½ x 7¾.
No. 10	6¼	7½	6	19 x 12¾ x 7¼.

b. Mobile equipment is needed for efficient handling and storing foods. The kinds and volume of foods to be handled determine the types of equipment. In addition to handtrucks required in the receiving area, semi-live skids and dollies may be used for removing supplies from the receiving area to the storage and from storage to the kitchen and for the effective storage of quantity lots of bagged food and cased/boxed foods. See Figures 1 and 2.

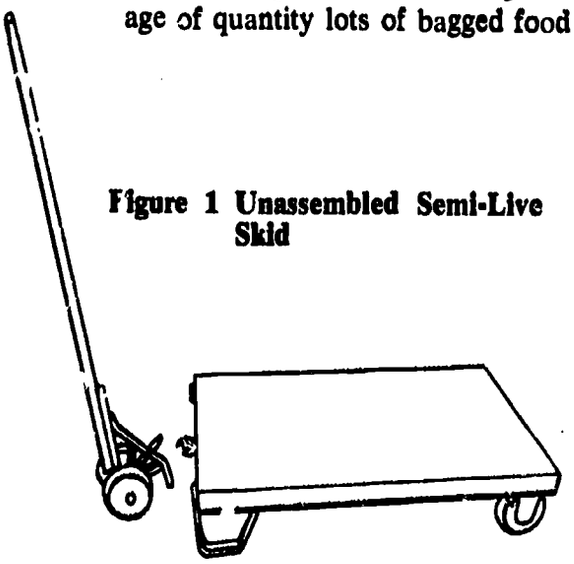


Figure 1 Unassembled Semi-Live Skid

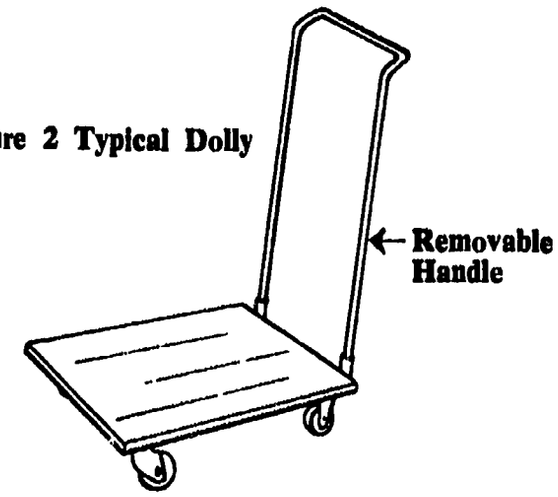
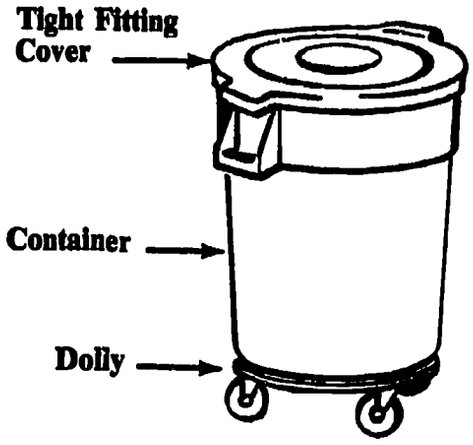


Figure 2 Typical Dolly

Containers with tight-fitting covers and dollies (see Section #FF3) should be used for storing broken lots of such items as flour, cornmeal, sugar, dried beans, rice and similar foods. The number needed will depend on the number and types of foods to be stored, delivery practices, etc. Scoops are needed for each food storage container in use. See Figure 3.

Figure 3 Container on Dolly



Shelf-type trucks are helpful in assembling food supplies from the storage area and delivering them to the preparation area. See Figure 4.

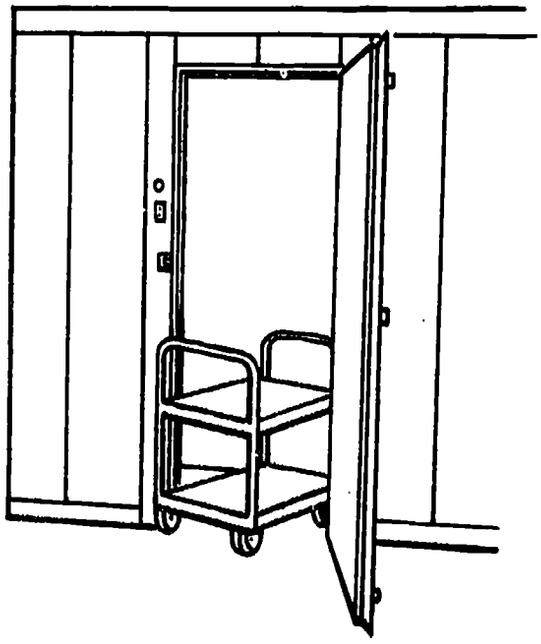


Figure 4 Shelf-type trucks

NOTE

Power or hand-operated fire extinguishers should be available in the storage room or nearby in the kitchen. They need to be inspected regularly.

Handwashing facilities located near the storeroom are essential.

SECTION C

DISHWASHERS, SINKS AND RELATED EQUIPMENT

SUMMATION TABLE OF EQUIPMENT REQUIRED

Dishwashers, Sinks and Related Equipment	Type Table Service	Number Type A Lunches Served Per Day									
		100–200	201–300	301–350	351–450	451–500	501–600	601–750	751–1000	1001–1250	1251–1500
1. Dishwashers (See Section #CC1)											
Surge Tank	[1]	1									
	[2]	1									
	[3]	1									
– OR –											
Single-tank door	[1]	1	1	1							
	[2]	1	1								
	[3]	1	1								
– OR –											
Single-tank conveyor	[1]				1	1	1				
	[2]			1	1	1					
	[3]		1	1	1						

[1] Compartment tray with stainless steel flatware.
[2] Serving tray, compartment dinner plate and stainless steel flatware.
[3] Serving tray, dinner plate, fruit dishes and stainless steel flatware.

SUMMATION TABLE OF EQUIPMENT REQUIRED

Dishwashers, Sinks and Related Equipment	Type Table Service	Number Type A Lunches Served Per Day									
		100–200	201–300	301–350	351–450	451–500	501–600	601–750	751–1000	1001–1250	1251–1500
Single-tank conveyor with integral prewash	[1]							1	1	1	1
	[2]						1	1			
	[3]					1	1				
– OR –											
Double-tank conveyor with integral prewash	[1]										
	[2]								1	1	1
	[3]							1	1	1	1
– OR –											
Flight dishwasher (single tank with integral prewash) with or without automatic tray stacker	[1]									1	1
	[2]									1	1
	[3]									1	1

[1] Compartment tray with stainless steel flatware.
[2] Serving tray, compartment dinner plate and stainless steel flatware.
[3] Serving tray, dinner plate, fruit dishes and stainless steel flatware.

SUMMATION TABLE OF EQUIPMENT REQUIRED

Dishwashers, Sinks and Related Equipment		Number Type A Lunches Served Per Day									
		100–200	201–300	301–350	351–450	451–500	501–600	601–750	751–1000	1001–1250	1251–1500
2. Waste Handling Equipment (See Section #CC2)											
Disposers ¾-1¼ HP units having no floor supports	Vegetable preparation or pot and pan sink						1	1	1	1	1
	Dishwashing area [1]	1	1	1	1	1	1	1	1-2	1-2[2]	1-2[2]
Pulper-Extractors Only recommended where local laws prohibit use of disposers.	Dishwashing area						1	1	1	1[2]	1[2]

[1] Number of disposers depends upon soiled dish table layout. (See Section #CC2).

[2] For tray washing system, utilizing flight dishwasher, use either disposer system with recirculated water or pulper-extractor. (See Section #CC1, paragraph 4, Tray-Washing System/Flight Dishwasher.)

SUMMATION TABLE OF EQUIPMENT REQUIRED

Dishwashers, Sinks and Related Equipment	Number Type A Lunches Served Per Day									
	100–150	151–300	301–350	351–450	451–500	501–600	601–750	751–1000	1001–1250	1251–1500
3. Sinks (See Section #CC3)[1]										
2-compartment with integral drainboards		1	1	1	1	1	1	2[2]	2[2]	2-3[2]
3-compartment with integral drainboards[3]	1	1	1	1	1	1	1	1	1	1
Hand	1	1	1	1	1	1	1	1	1	1

[1] The exact number of hand sinks and compartment sinks will depend upon local health codes and whether there are partitioned areas specifically designated for baking, vegetable preparation, pre-preparation, cooking, etc., plus the overall dimensions of the various food preparation areas.

[2] If the school does not bake bread and/or rolls, one less sink is recommended.

[3] Only 3-compartment sinks were recommended for pot and pan washing operations because of overall versatility and in anticipation of revised public health codes.

DISHWASHERS

1. Model Dishwashers Recommended:

Number of Type A Meals Served Daily Per Type Table Service			Model Dishwashers
Compartment Trays	Serving Tray and Compartment Dinner Plate	Serving Tray and Conventional Dishes	
100–200	100–200	100–200	Surge-type dishwasher
100–350	100–300	100–200	Single-tank door dishwasher
351–600 [1]	301–500 [1]	201–450 [1]	Single-tank conveyor dishwasher
601–1500	501–750	451–600	Single-tank conveyor dishwasher with integral prewash
—	751–1500	601–1500	Double-tank conveyor dishwasher with integral prewash
1001–1500 [2]	1001–1500	1001–1500	Flight dishwasher (single tank) with integral prewash

[1] When labor is in short supply or is not reliable, it is suggested that dishwasher be equipped with integral prewash unit using recirculated wash water.

[2] When contemplating the use of compartment tray-type table service, it is desirable to purchase the automatic tray stacker plus a compartment tray which is specifically designed for holding the Type A lunch and will "stack either way." If the above described system has students bussing soiled trays onto the lead end of the dishwasher, then only one person is generally required for the dishwashing operation. (See paragraph 4, Tray-Washing System/Flight-Dishwasher.)

2. Recommended Facilities at Work Station:

Door, Conveyor and Flight Dishwashers

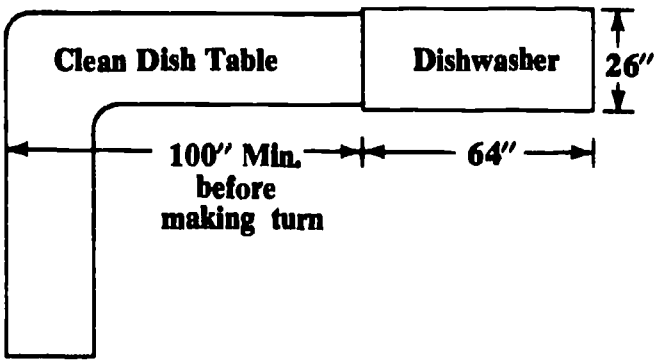
a. Adequate supply of 140° F water.
b. Water pressure reducing valve (gauge pressure of 20 pounds per square inch, p.s.i.). This valve is necessary since dishwashers are basically designed to operate at this pressure.
c. Adequate drainage system. (A minimum of 2 floor drains of 2-4" diameter.) One drain should be located under the soiled dish table and the other drain under the discharge end of the dishwasher.
d. Hot and cold water with hose for cleaning area.
e. Adequate ventilation. (See subparagraph d. under paragraph 3. Desirable Equipment Feature.)
f. Adequate lighting.
g. Detergent dispenser for the dishwasher.
   1st choice: Electronic dispenser
   2nd choice: Hydraulic dispenser
   Note: If the board of education does not install a detergent dispenser, then "Brickett-Type Detergent" should be utilized.
h. Optional: Final rinse injector for drying agent.

i. Hot water booster to provide 180° F. rinse water as specified in National Sanitation Foundation (NSF) Bulletin #3. Note: Sizing of this unit is the responsibility of the manufacturer of hot water boosters. When procuring steam operated dishwashers, a hot water booster is not required. Instead, a heat exchanger for 180° F. water is necessary.

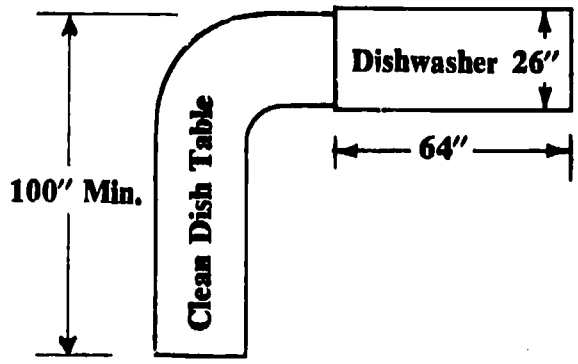
j. Soiled dish table. (Minimum length of 100 inches includes area for receiving soiled table service, *disposal*, *racking*, etc.)

k. Clean dish table. **Minimum length of 60 inches for door type dishwashers and 100 inches for conveyor-type dishwashers.** For conveyor-type dishwashers a minimum of 100" of clean dish table in a straight line is recommended before making a conventional 90° turn. However, if the turn is fabricated in accordance with the manufacturers' specifications for "curved rack guide," this design can make it possible for the turn to begin immediately following the discharge end of the dishwasher. See drawings below.

Conventional 90° turn



90° turn using "curved rack guide"



l. Waste Handling Equipment. (See Section #CC2)

m. Mobile carts for storing, transporting and dispensing clean tableware.

3. Desirable Equipment Features:

Conveyor Model Dishwasher

a. Stainless steel or nonferrous nickel alloy for the interior of the dishwasher, manifold and headers, pump impeller, etc. (With today's detergents, the use of brass should be minimized.)

b. Regulated steam ejector for maintaining hot water in wash tank and steam heated final rinse water. (See Section #FF2 for steam.)

c. Prewired, factory installed machine-mounted control panel.

d. Ventilation: Factory fabricated and installed vent connection with locking damper on hood and door-type dishwashers. Factory installed "end-cowl" vent with integral splash shield and locking damper.

Dishwasher which can be factory or field adopted to make use of a steam condensing unit in the event it is not possible or desirable to vent dishwasher heat into the building vent system.

e. National Sanitation Foundation Seal of Approval (NSF).

f. Underwriters' Laboratory Seal of Approval (UL).

g. American Gas Association Seal of Approval (AGA). (Only if wash tank is gas heated.)

4. Tray-Washing System:

Conveyor Dishwasher

The tray-washing system layout (shown in Figure 1, was designed to minimize labor costs in schools with 500 or more in daily participation. The students placed soiled flatware through opening (A) which leads to a mobile soak sink (J). The napkins and empty milk cartons are dropped through opening (B) which leads to a 20 to 30-gallon mobile garbage can (K). Soiled compartment trays are dropped off at opening (C). Employee (X) picks up the soiled tray in right hand. In an arc movement from right to left, the employee (X) turns over soiled tray, taps soiled tray on "tap-off bar" (D) over cone of disposer (E) and finally places tray in dishwasher rack (F). When rack (F) is full of soiled trays, employee (X) pushes rack into single-tank conveyor dishwasher (G) with integral prewash. The trays are mechanically prewashed, washed, rinsed and final rinsed. Employee (Y) stationed at clean dish table (H) removes clean trays from rack and stacks them on a mobile cart. When the layout calls for a clean dish

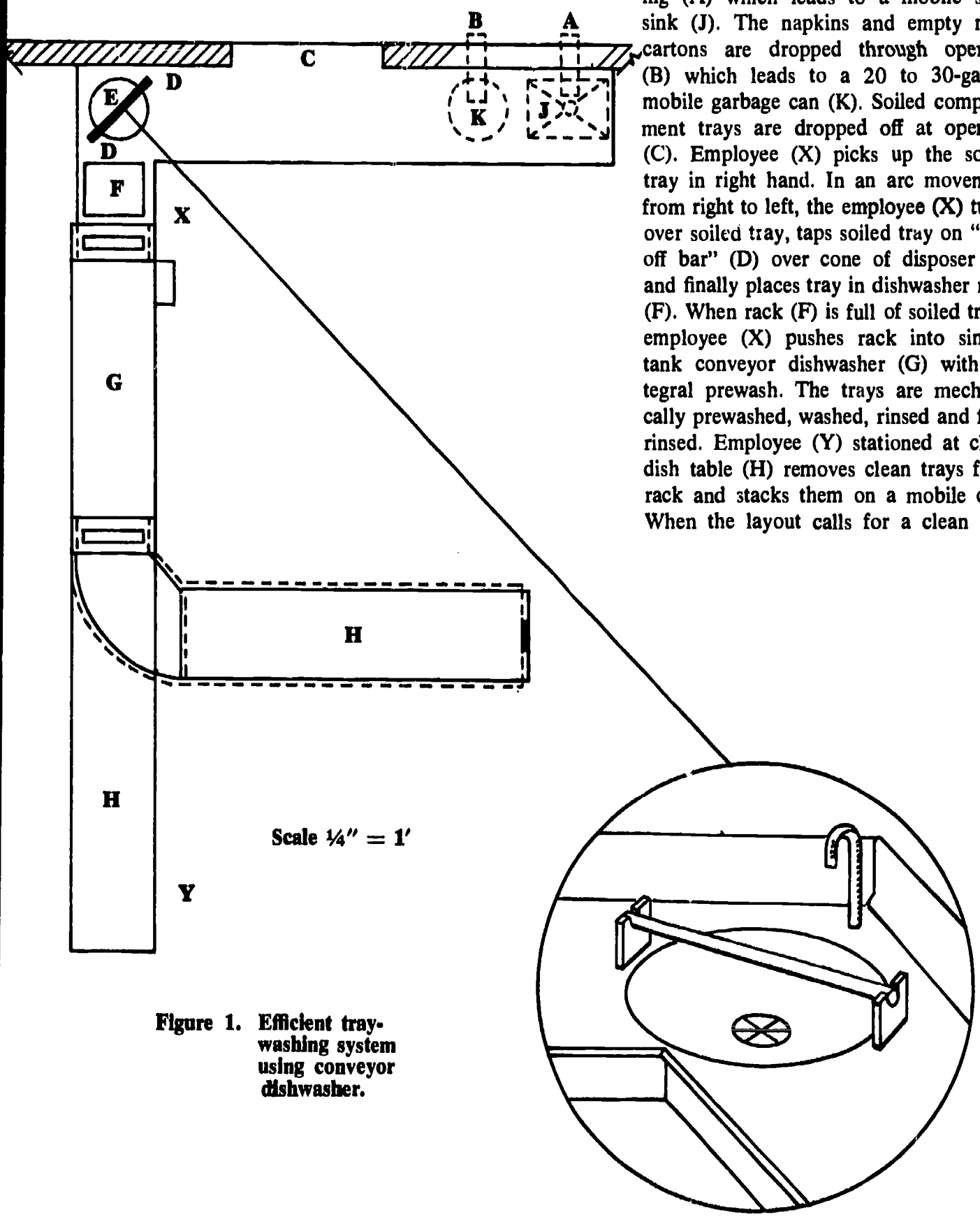


Figure 1. Efficient tray-washing system using conveyor dishwasher.

table with a 90° turn, a curved rack guide (I) should be installed. The curved rack guide eliminates the need of an employee to push or pull rack loads around the 90° turn. Dimensions of a curved rack guide are critical and for this reason a working drawing was included. (See Figure 2(a) for right-hand turn and 2(b) for left-hand turn.)

Figure (2a) Curved Rack Guide (Right-hand turn)

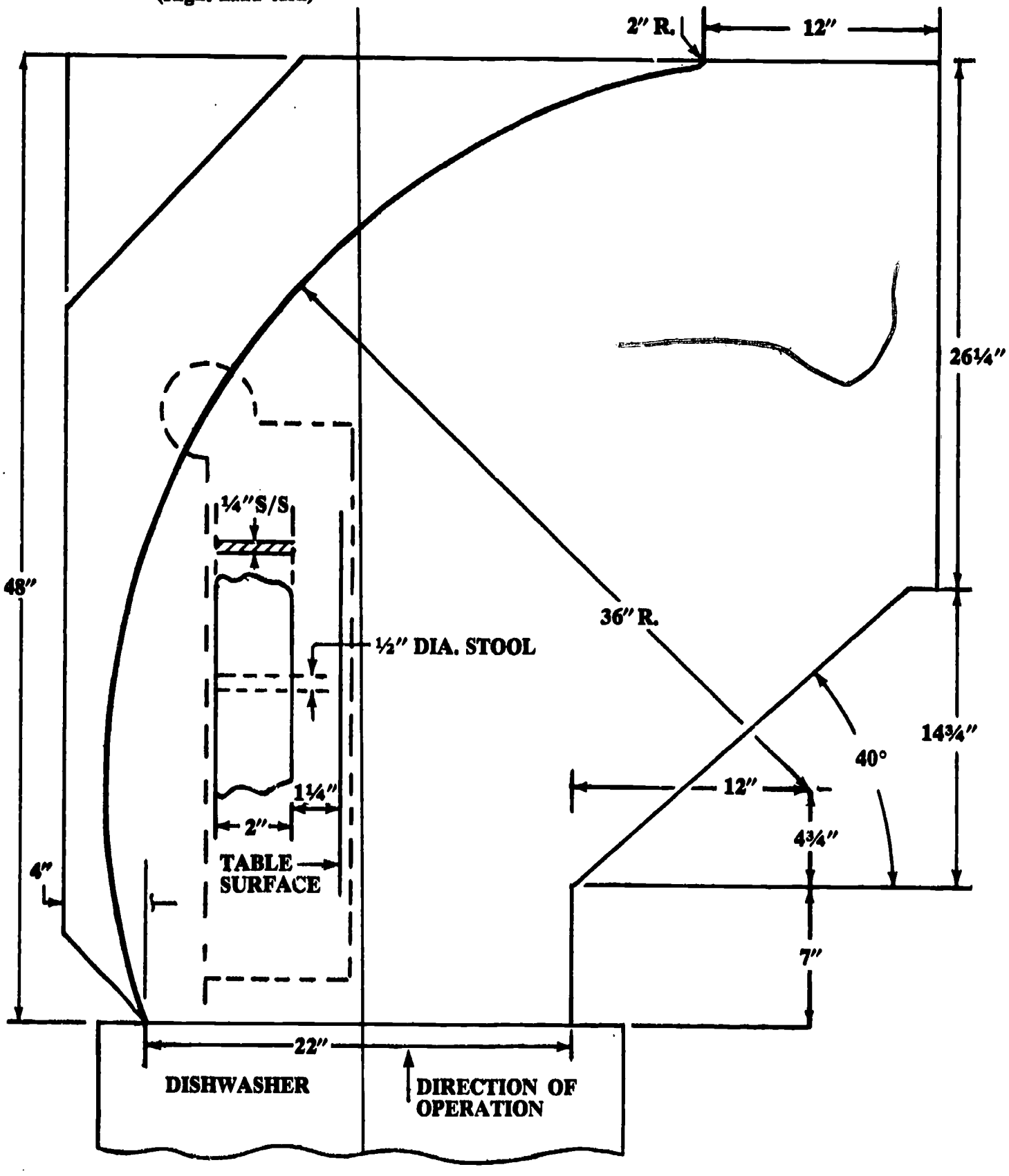
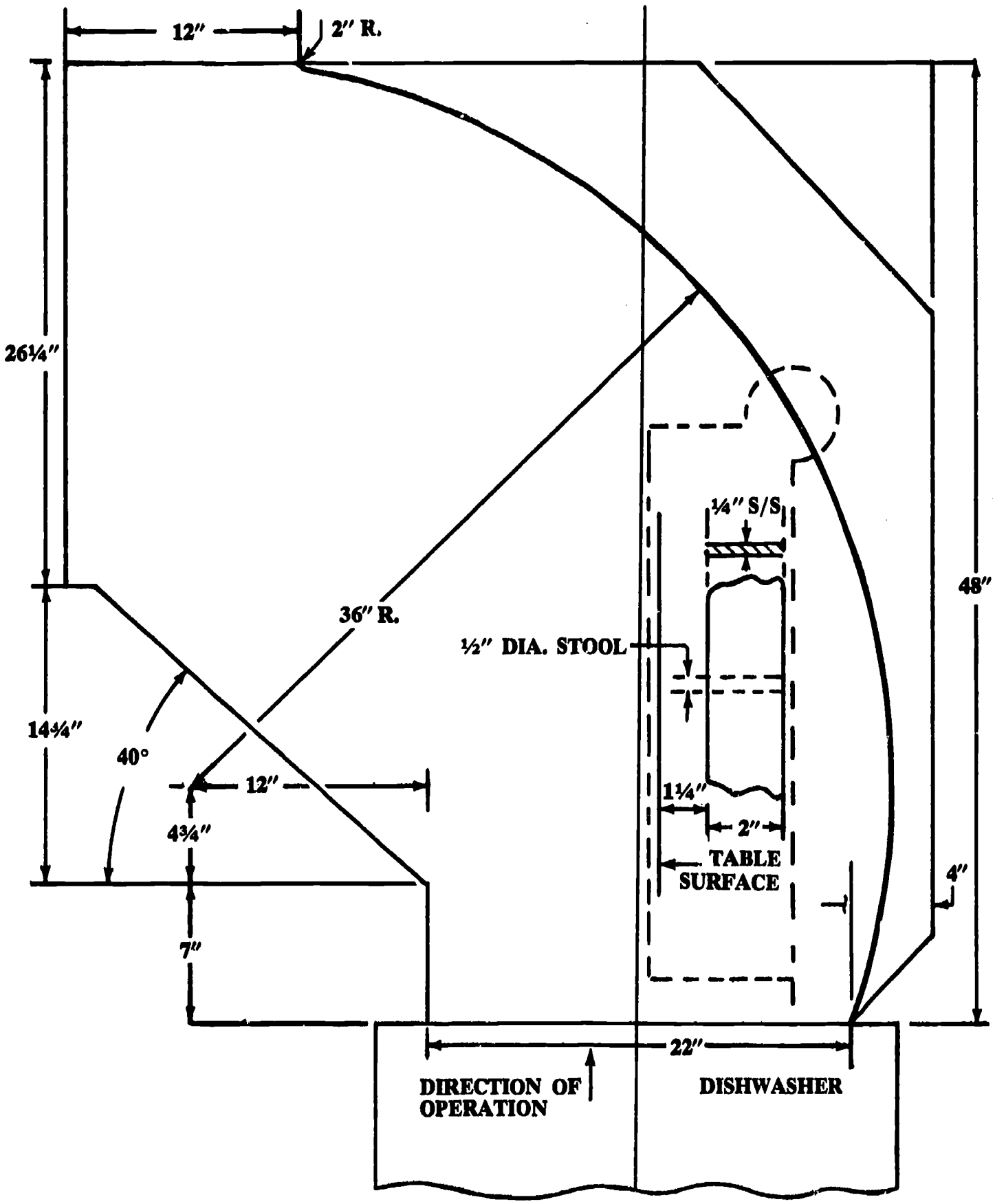


Figure (2b) Curved Rack Guide
(Left-hand turn)



Flight Dishwasher

This tray-washing system was designed to minimize labor costs in schools with 750-1500 average daily participation. In this system, (see Figure 1) the students drop soiled flatware through opening (A) which leads to soak sink (H). Napkins and milk cartons are dropped through opening (B) which leads to disposer system with recirculating water or pulper-extractor (G). Soiled compartment trays are placed on the dishwasher conveyor through opening (C). The soiled trays pass through a special tri-tank flight dishwasher (D) where trays are prewashed (gross soil removed), washed, rinsed, final rinsed and air dried at the discharge end of the dishwasher (E). The air-dried, clean trays are then deposited on an automatic tray stacker (F). When full, the dishwasher is automatically stopped.

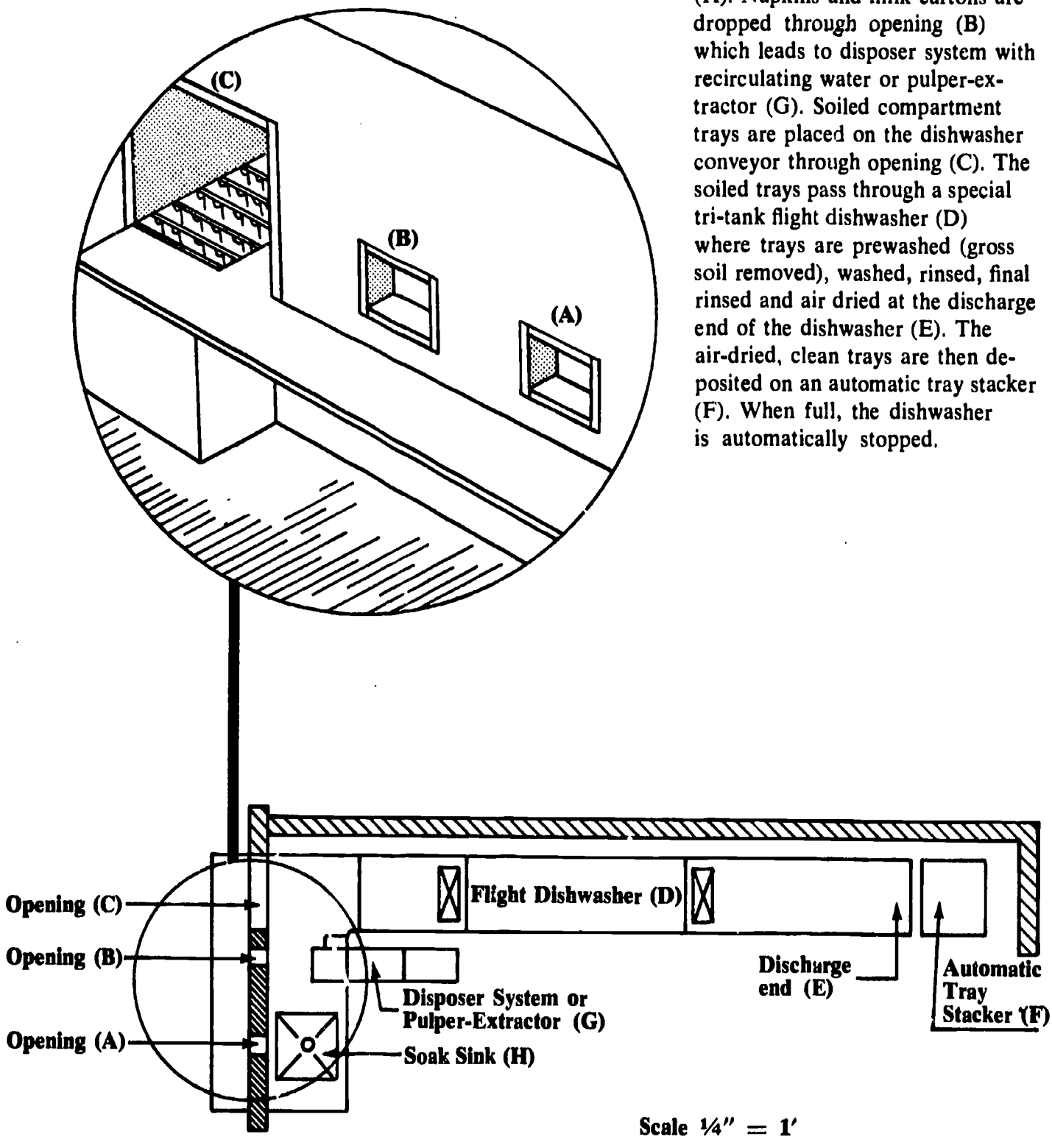


Figure 1 Semi-Automatic Tray-Washing System

The disposer system with recirculating water or pulper-extractor (G) has three basic functions and they are (1) pump for prewash operation of dish washer, (2) gross soil extractor for prewash section of dishwasher and (3) disposer for extracted soil from prewash section of dishwasher plus napkins and milk cartons dropped off by students. The pulper-extractor differs from the disposer system in that solid matter is not put into the sewage system. (See Figure 2.)

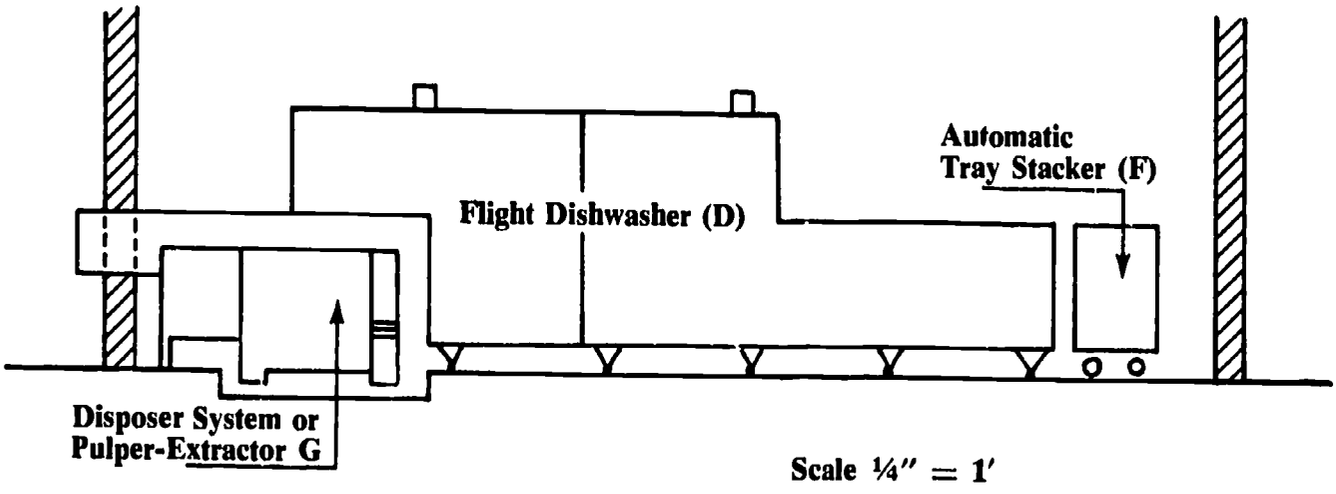


Figure 2 Side view of proposed system

WASTE HANDLING EQUIPMENT

1. **Pulper-extractors should be considered in lieu of disposers in communities that prohibit the use of disposers or in the Tray Washing System using flight dishwashers. (See Section #CC1, paragraph 4, Tray Washing System/Flight Dishwasher.)**

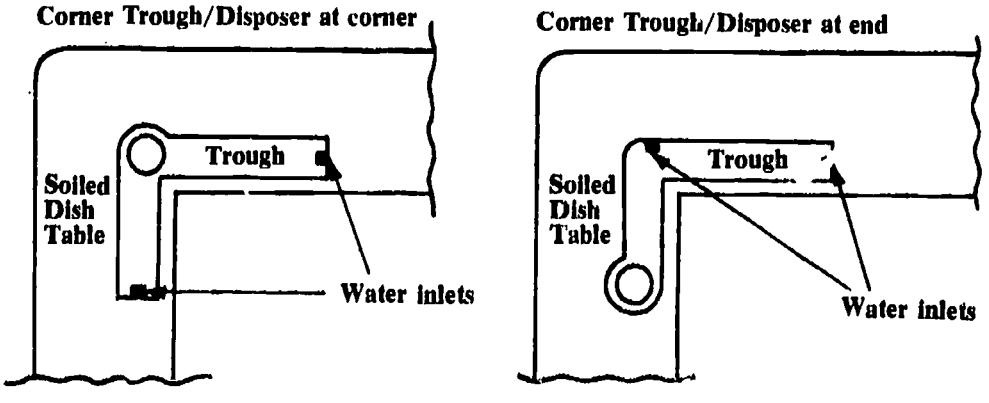
2. **Number and Horsepower of Disposers Recommended:**

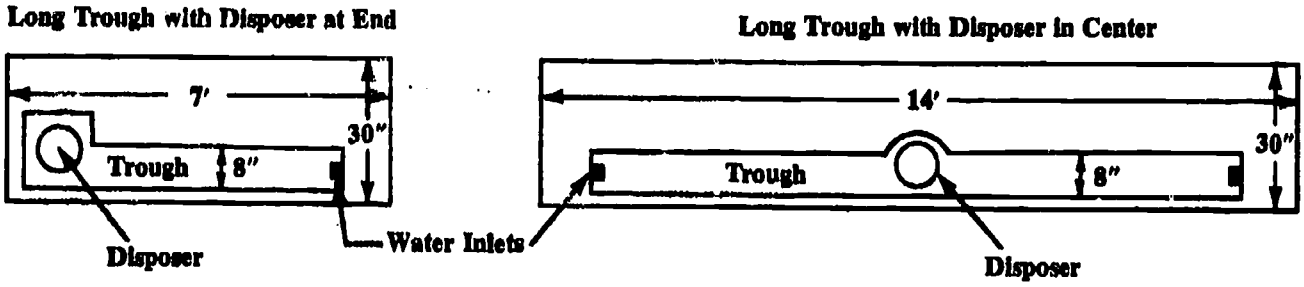
Number of Type A Lunches Served Daily	Recommended Areas Requiring A ¾–1¼ H.P. Disposer [1]	
	Dishwashing	Vegetable Preparation or Pot and Pan Sink
100–500	1	—
501–750	1	1 [2]
751–1000	1–2 [3]	1
1001–1500	1–2 [3]	1

[1] Only ¾-1¼ horsepower (H.P.) disposer (sink or table-mounted, requiring no floor supports) are recommended for school food service operations. If the menu consists of entree items with bones (excluding fowl and fish), then a higher horsepower unit (1½-3) is recommended.
[2] Only recommended for schools (particularly high schools) frequently serving salads and offering choice of entree within Type A pattern.
[3] The exact number of disposers for a dishwashing operation depends upon such variables as type table service, equipment and equipment layout plus size and shape of designated room. For example, two disposers might be required if other than a trough arrangement with disposer is used in a "T" shaped dishwashing layout.

3. **Recommended Facilities at Work Station:**
   a. Adequate drainage (**Note:** Before procuring a disposer check with manufacturer on plumbing requirements, plumbing in existing or proposed new structure and with local sanitarian or at sewage treatment plant—some cities require permit.)
   b. Adequate water supply.
   c. Adequate power supply.

4. **Suggested Installations:**
   a. Disposer unit installed in trough arangement. For school lunch programs using conventional serving trays, china and stainless steel flatware. The following are acceptable disposer installations.





• **The long trough arrangement with disposer located in center is ideal for "H" and "T" shaped dishwashing layouts.**

REMEMBER

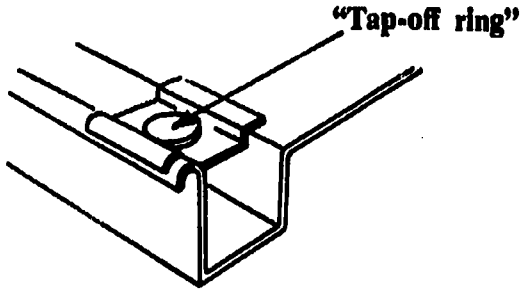
1. The width of trough should be approximately 6–8".
2. The length of trough should not exceed 7 lineal feet, if disposer is end mounted.
3. The length of trough should not exceed 14 lineal feet, if disposer is center mounted.
4. The pitch should be approximately 1" drop per lineal foot of trough.
5. The lower end of the trough should be high enough off the floor to permit the proper installation of the disposal unit.

b. Disposer installed with cone: For school lunch programs using compartmented trays and desiring a tray dishwashing system, see Section #CC1 Dishwashing, paragraph 4—Tray-Washing System/Conveyor Dishwasher, for acceptable layout.

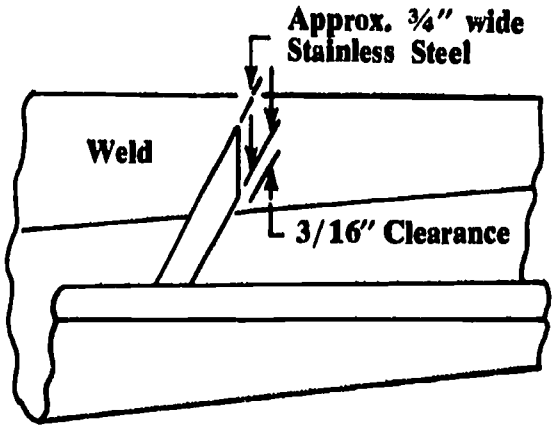
5. Desirable Equipment Features:

Disposers

a. ¾-1¼ horsepower (H.P.) table-mounted (with no floor supports) disposer.
b. Reversible electric motor for easy unjamming of unit (electric control group should consist of a switch mounting bracket, a **manually operated reversing switch** and solenoid valve).
c. Continuous duty, electric motor with built-in overload protection.
d. Motor shaft supported by either tapered or ball bearings with separate alignment bearing support.
e. Heavy cast housing.
f. Cutter block that can easily be replaced.
g. Self-cleaning flushing action.
h. Underwriters' Laboratory Seal of Approval (UL).
i. Accessory group for disposers (Note: Accessories will vary with type installation, whether trough or conventional table-type installation.)
   (1) Pre-rinse spray with wall bracket:
   Required in all dishwasher installations in which the dishwasher lacks an integral pre-wash unit (such as door-type dishwasher or plain conveyor-type dishwasher). **Recommended option** for all other type dishwashers and dishwashing systems.
   (2) Vacuum breaker (refer to local plumbing code).
   (3) For trough arrangement:
   (a) Trough "tap-off ring" (should be located at 4-foot intervals). This unit generally consists of a specially fabricated bracket which fits tightly in the trough. A circular hole should be cut in the 12 gauge stainless steel bracket for accommodating a rubber "tap-off ring."



(b) A ¾" wide piece of 12 gauge stainless steel can be welded to the sides . . . across the trough approximately 3/16" above the floor of the trough. Water will flow under, waste will float over and silverware will be stopped.



(c) A flow-control valve on the incoming water line to trough to maintain water flow rates of 7-9 gallons per minute.

(4) **For Table Arrangement:**
(a) 18" cone with scraping ring.
(b) Vinyl scraping dome.
(c) Vinyl scraping ring.
(d) Stainless steel silver saver.

Pulper-Extractor

a. Direct drive motor with encapsulated windings and sealed bearings mounted by means of a radial flange.
b. Pulper shall be of heavy 11 gauge Type 304 stainless steel.
c. Machined stainless steel impeller with mechanical seal section and equipped with pumping vanes.
d. Rotating shearing blades, with tungsten carbide cutting edges, bolted into machined pockets in the impeller and shall be replaceable.
e. The pulper shall be equipped with a pump designed for slurry applications, incorporating a mechanical shaft seal for positive protection against leakage.
f. The control panel shall include all necessary electrical components, prewired to a terminal strip.
g. An automatic water level control shall be included.
h. The shearing mechanism shall consist of two horizontal rotating shearing blades on the impeller which pass by at least three stationary shearing blades on the sizing ring.
i. Extractor mechanism shall consist of a mechanical stainless steel screw with helicoid flight, reinforced at final extraction point; stainless steel encased nylon brush on the trailing edge of the flight; stainless steel plug cutter; machined shaft and keyway for the drive sprocket; and a matching Type 302 reinforced stainless steel screen.

HAND AND COMPARTMENT SINKS

1. Number and Type Sinks Recommended:

Number of Type A Lunches Served Daily	Minimum Number and Type Sinks Recommended [1]		
	Compartment Sinks		Hand Sinks
	2-Compartment [2]	3-Compartment [2]	
100–150	—	1 [3]	1
151–500	1	1 [3]	1
501–750	1	1	1
751–1000	2 [4]	1	1
1001–1250	2 [4]	1	1
1251–1500	2–3 [4]	1	1

[1] The exact number of hand sinks and compartment sinks will depend upon local and state public health codes and whether there are partitioned areas specifically designated for baking, vegetable preparation, pre-preparation, cooking, etc., plus the overall dimensions of the various food preparation areas.

[2] Only 3-compartment sinks were recommended for pot and pan washing operations because of overall versatility and in anticipation of revised public health codes or to comply with existing codes.

[3] For smaller operations of 100–200 lunches where a school installs a surge-type dishwasher, a separate 3-compartment sink is still recommended.

[4] If the school does not bake bread and/or rolls, one less sink is recommended.

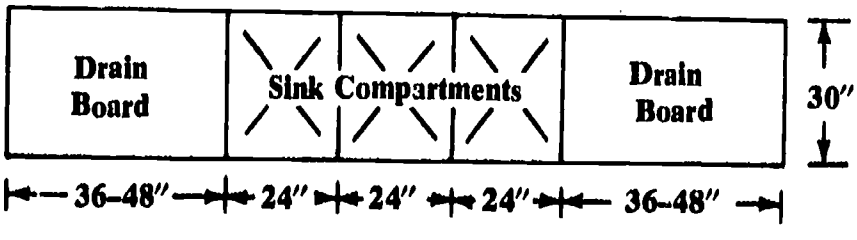
2. Recommended Facilities at Work Station:

a. Floor drain in the immediate vicinity of *compartment* sink.
b. A paper towel and soap dispenser and trash receptacle in immediate vicinity of each hand sink.

3. Recommended Equipment Features:

Compartment Sink

a. Compartment sink with drainboards.



b. Each compartment capable of accommodating 18" x 26" sheet pans with a depth of 11-14".
c. 14 gauge, type 18-8 stainless steel fabricated sink integral drainboards and 10" high back splash mounted on a minimum of 1⅝" O.D. (outer dimensions) x 14 gauge tubular legs with adjustable bullet feet.
d. Approximate height of sink, 34-36" to top of raised rolled rim.
e. Swing faucet or individual hot and cold faucets for each compartment. All faucets should have replaceable valve seats.
f. A separate drain system for each sink compartment.
g. Exterior activated lever waste control for each compartment.
h. Rear overflow for each compartment.
i. Recessed stainless steel basket-strainer for each level waste control.
j. Under shelf or rack where clearance permits.
k. National Sanitation Foundation Seal of Approval (NSF).

Hand Sink

a. Dimensions of hand sink should be such as to prevent possible usage for cleaning small food service equipment.
b. Foot or knee-operated control.

4. Options for Compartment Sink:

a. Removable scrap tray with drain between right side drainboard and sink compartment.
b. Garbage disposer. (See Section #CC2.)

SECTION D

SERVICE AREA EQUIPMENT

SERVING LINES REQUIRED

1. **Factors Affecting Serving Lines:**
The planning of a serving line requires consideration of many factors. Each item must be carefully analyzed and its relationship to related factors understood before a decision is made. The following factors should be considered:
   a. Length of Serving Time: When the serving time is decreased for a fixed number of students, additional serving lines or serving line equipment is generally required.
   b. Menu: Where choice within the Type A pattern or a la carte service is offered, an additional or longer serving line may be required.
   c. Degree of Self-Service: Self-service can advantageously or adversely affect the serving line rate, depending upon age of students, food items to be picked up, location of serving line, etc.
   d. Table Service: The type of table service (compartment trays versus serving trays with plates) effects the support equipment for the serving line.

2. **Definitions:**
   a. Student Lunch Period: The length of time established for a student to proceed to the dining area, be served, consume the meal, and exit.
   b. Seating Time: The average time a student occupies a seat while in the dining area.
   c. Serving Time: The total length of time required to serve all students during an established school lunch period.
   d. School Lunch Period: The total time the dining area is required to be in service to accommodate all the student lunch periods.
   e. Total Serving Line Rate: The total number of students served per minute from all serving lines.
   f. Single, Multiple, and Continuous Lunch Period: (See Section #DD3, paragraph 2).

3. **How to Compute Number of Serving Lines for Continuous Lunch Period:**
   Step 1 Determine the **serving time** by subtracting the seating time from the school lunch period.

School Lunch Period	90 Min.
Seating time	— 20 Min.
Serving time	70 Min.

   Step 2 Determine the **total serving line rate** by dividing the school enrollment by the serving time.

$$\text{Total Serving Line Rate (10)} = \frac{700 \text{ Enrollment}}{70 \text{ Serving Time}}$$

   Step 3 Determine the **number of serving lines** by dividing the total serving line rate by the following acceptable individual serving line rates for the various types of food service.

Type A without choice	10	Meals per minute
Type A with choice	7–8	Meals per minute
Type A plus a la carte	5–6	Meals per minute

   When the computation results in a **fraction** of a serving line, an **additional serving line** should be considered. Such factors as the length of the school lunch period, and/or reduction in a la carte items (when applicable) should be weighed before deciding on an extra line.

SERVING LINE EQUIPMENT

1. **Serving Lines:**
   Serving lines can be conventional or conveyorized. They are available in various sizes and configurations (straight, "L" and "T" shaped, circular, scatter, etc.) depending upon the size of the food service operation, menu, space available, and configuration of space.

   The following two figures, 1 and 2, are of a conventional serving line which is approximately 20–25 feet long, 28–30 inches high for elementary and 34 inches high for secondary schools. The line consists of a hot food section, cold food section, milk cooler, cashier or checker, tray and tableware dispensing equipment, and back-up equipment for serving line such as hot and cold food holding cabinets, etc.

   Figure 1 is of a serving line for schools serving a Type A lunch only. Since the price of the lunch is fixed, the cashier can be located at the beginning of the line.

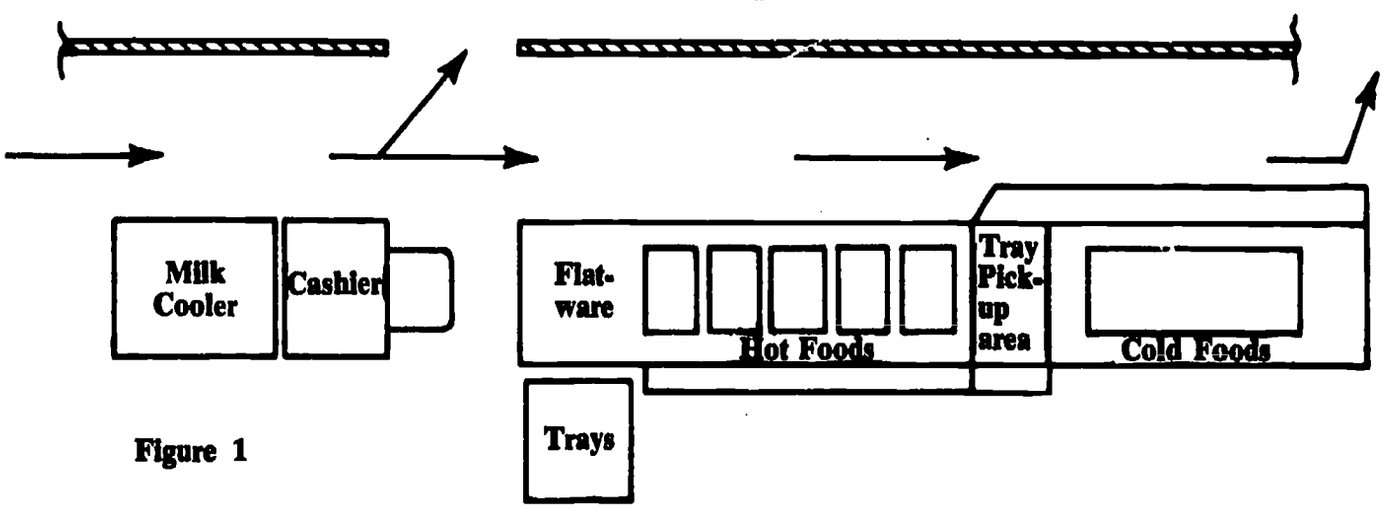


Figure 1

Figure 2 is of a serving line for a school serving Type A lunches with a la carte items on the same line. The cashier in this arrangement is located at the end of the serving line.

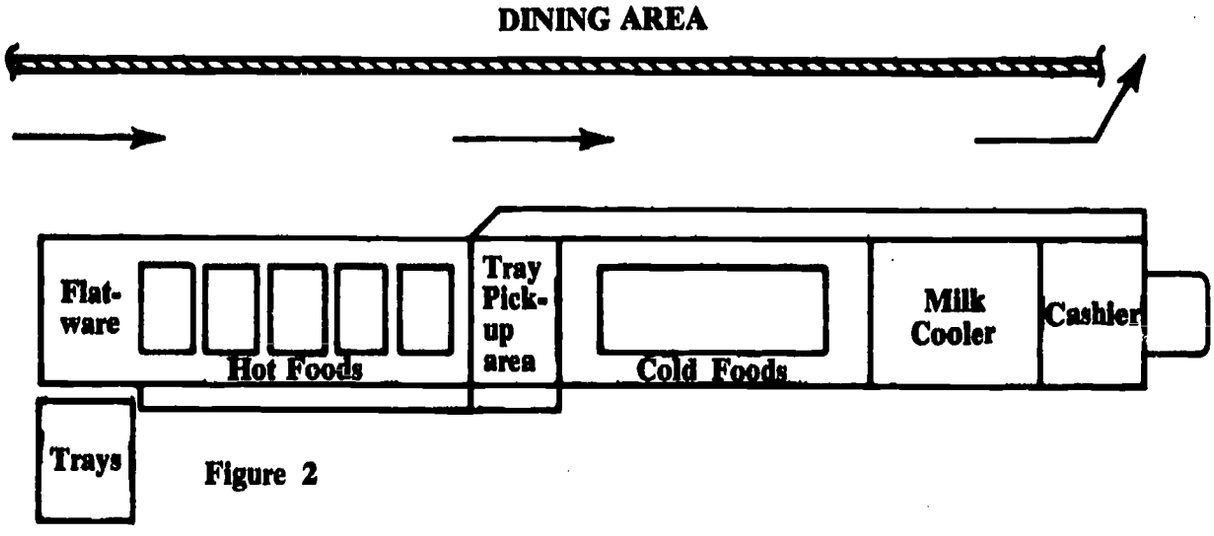
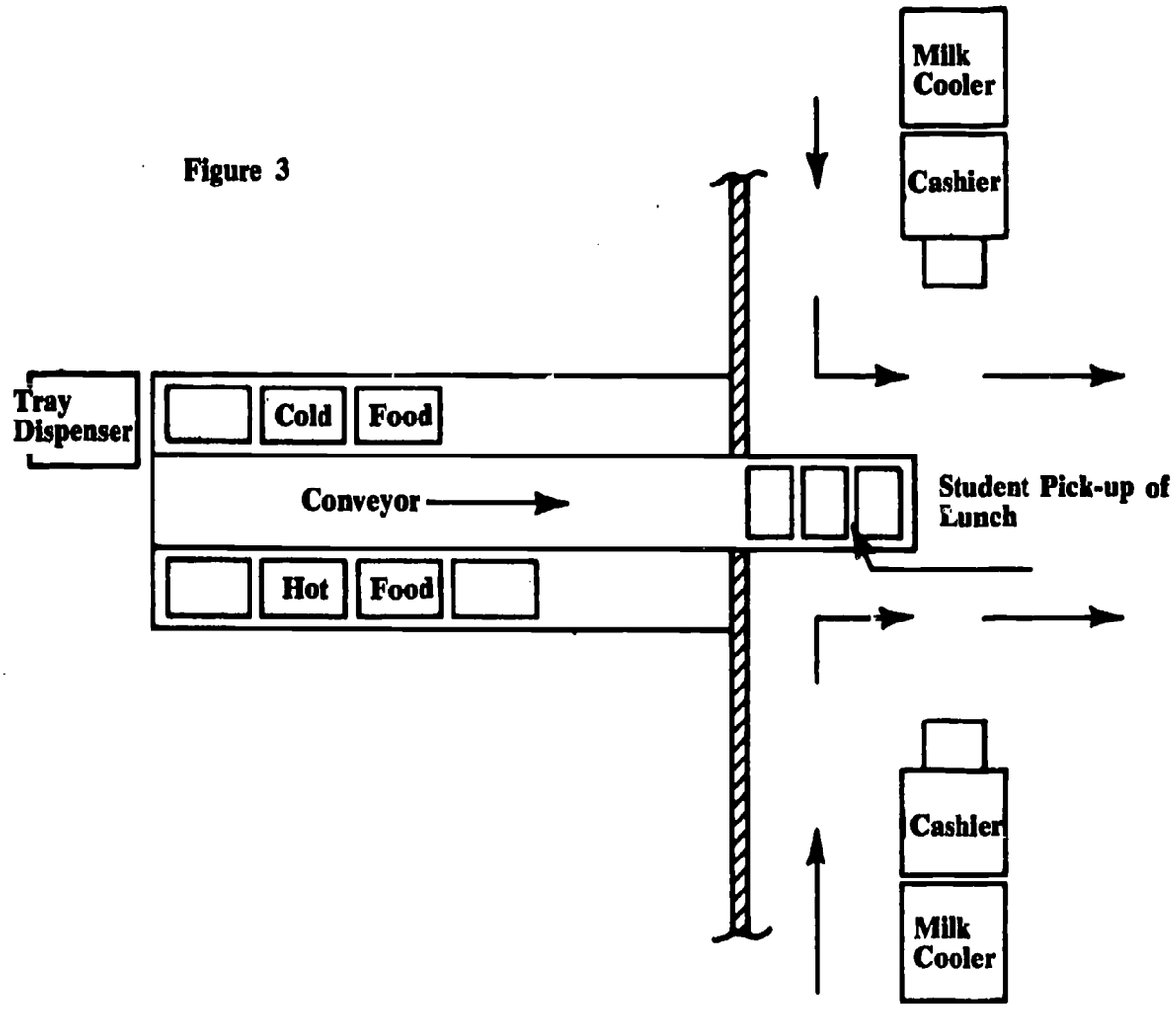


Figure 2

Figure 3 is of a conveyorized line for a large school food service operation serving Type A lunches only. Consider a conveyorized serving line when labor market is critical and fast serving line rates are essential. (Note the location of the two cashiers.)

Figure 3



2. **Serving Line Equipment:**
   The purchase of locally fabricated single unit serving line consisting of hot food section, cold food section, and area for cashier is generally less costly than purchasing factory-produced components. However, in many instances, the component approach is more feasible because of versatility, flexibility, and mobility. Where space is critical or configuration of available space is unusual, mobile serving equipment is a necessity. The mobile equipment can be rolled into the dining area and/or any other available space as required for serving.

   Serving line equipment should be fabricated from 18–8 stainless steel.

   a. **Hot food section** should be 5–6 feet long and contain from 4-5 wells for accommodating 12″ x 20″ hot food service pans to depth of 6″. Wells should be dry heat type.
   b. **Cold food section** should be approximately 6 feet long for salads, bread, etc. If the students pick up cold foods, they should have easy access to them. Check with local public health officials to determine whether the cold food section of the serving line requires mechanical refrigeration.

IMPORTANT

The hot and cold food sections should have a sneeze guard. If compartmentized trays are used and students pick up trays at end of hot food section, a tray pickup area should be provided between the hot and cold food sections (see Figures 1 and 2). If student pick-up of filled tray is at end of cold section, a similar area should be provided.
When applicable, the student tray slide should be stainless steel, solid with ridges or tubular and approximately 12" wide to accommodate serving trays and/or compartment trays. In elementary schools, the tray slide should be approximately 28" from the floor, 30" for junior high schools or combination elementary and junior high and 32" to 34" for senior high schools.

c. **Milk cooler(s)** should be of sufficient capacity to meet program needs. The cooler should accommodate the cases that the milk is delivered in to avoid extra handling. Consideration should be given to the purchase of front loading milk coolers. In addition, elementary students can readily reach the cartons of milk in the front row of cases of milk. The cooler should be mechanically refrigerated.

d. **Checker or cashier's section** should be approximately 24" long with end of counter recessed for knee space. Bottom shelf may act as foot-rest or may be omitted. Locked cash drawer (optional).

e. **Tableware, plate, and self-leveling tray cart(s)** should be considered for an efficient operation. When compartmentized trays are used, serving line employees normally handle the tray. Under these circumstances, a flatware and tray transport and dispensing cart(s) should be considered for the serving line.

When service trays and plates are used, the students normally pick up the service trays. Under these circumstances, a service tray and tableware transport and dispensing cart plus a plate cart should be considered.

The flatware should be washed and dispensed from polyethylene or stainless steel perforated flatware cylinders.

f. **Self-service dispensing units for prepackaged items** (optional) may be used in place of the hot and/or cold food section of the serving line providing the food is preportioned-and prewrapped. If properly used, these units can increase the serving line rate.

g. **Conveyorized line** (optional as shown in Figure 3) should be approximately 12–15 feet long to allow ample space for the hot and cold tray make up area and ample student pick up area at the end of the serving line. An automatic shut-off is necessary at the student pick up area. Generally, the conveyor speed is adjusted by a variable speed control. The number of work stations along the line also affects the speed of the line.

DINING AREA AND SEATING REQUIREMENTS

1. **Background Information:**
The purpose of the school dining area is to provide an attractive area for students to eat in a relaxed atmosphere. The number of students to be fed at one time is one of the first decisions that must be made in determining the seating capacity of the dining area. This decision should involve the school lunch manager, business manager, and officials who schedule classes in order for lunch schedules to be harmonious. Before the seating capacity of any dining area can be determined, certain factors must be identified and decisions made. Factors to consider are: the type of lunch period, total lunchroom operation, total enrollment, entry rate(s), student seating time, style of service, multiple use of area, etc.

2. **Types of Lunch Periods:**
   a. Single Lunch Period: This type lunch period requires a dining area of sufficient size, equipped with sufficient tables and chairs to accommodate the entire student enrollment at one time. This type lunch period is normally used in small schools. The seating capacity for single lunch period is equal to the total student enrollment plus the faculty (provided the faculty and students dine together).
   b. Multiple Lunch Period: This type lunch period employs more than one serving and seating. The student body is divided into groups of approximately equal number. Each group is served, seated, and leaves the dining area before another group arrives. Seating capacity of multiple lunch periods is equal to the total number of students in the group, plus faculty (provided faculty and students dine together).
   c. Continuous Lunch Period: This type lunch period requires even time intervals for the release of students so that the students arrive at the dining area in an even flow. Students then pass through the serving line to be served at a constant rate. Procedures for determining seating capacity for continuous lunch periods are found in paragraph 5, Determining the Number of Seats Required.

3. **Types of Seating Available:**
   a. Mobile Folding Tables with or without attached Benches: The tables fold in the middle and can be easily moved.
   b. Mobile Folding Tables with Attached Stools: Table folds in the middle and can be easily moved. Individual stools are attached to table.
   c. Mobile Folding Tables with Stacking Chairs: Table folds in middle and can be easily moved. Chairs are not attached, and are self-stacking.
   d. Standard Tables with Chairs: Tables and chairs do not fold and are generally not moved after each meal. Tables do not move easily.

4. **Definitions:**
   a. Student Lunch Period: The length of time that a student is allowed to proceed to dining area, be served, consume the meal, and exit.
   b. Seating Time: The average time a student occupies a seat while in the dining area.
   c. Entry Rate: The number of students entering the dining area per minute regardless of whether or not they are program participants.
   d. Serving Time: The total length of time required to serve all students during an established school lunch period.
   e. School Lunch Period: The total time the dining area is required to be in service to accommodate all the student lunch periods.

5. Determining the Number of Seats Required:

a. Single Lunch Period: Seating must be sufficient to accommodate the entire school enrollment at one time (including faculty).

b. Multiple Lunch Period: The number of seats required is determined by dividing the total school enrollment (including faculty) by the number of lunch periods scheduled.

c. Continuous Lunch Period: The seating capacity of a continuous lunch period is determined as follows:

(1) First determine the serving time by subtracting the average seating time from the school lunch period.

School Lunch Period	90 Min.
Seating Time	— 20 Min.
Serving Time	70 min.

(2) Determine the entry rate by dividing the total enrollment by the serving time.

$$\text{Entry Rate (10)} = \frac{\text{Enrollment } 700}{\text{Serving Time (70)}}$$

(3) To determine the number of seats required, multiply the entry rate times the seating time. Entry rate 10 (per minute) × 20 (minutes) seating time = 200 seats required.

6. Approximate Space and Seating Capacity Per Type Table:

	Rectangular Folding Tables with Attached Benches		Rectangular Folding Tables with Attached Stools		Rectangular Tables with Stacking Chairs		Square or Round 48" Tables with Stacking Chairs[1]	
	Approx. Sq. Ft. Per Student	Number of Students Per Table	Approx. Sq. Ft. Per Student	Number of Students Per Table	Approx Sq. Ft. Per Student	Number of Students Per Table	Approx. Sq. Ft. Per Student	Number of Students Per Table
Elem K–6	8–10	16	8–10	16	10–12	12	11–14	4–6
Jr. High 7–8	9–11	14	9–11	14	11–14	12	11–14	4–6
Sr. High 9–12	11	12	11	12	11–14	12	11–14	4–6

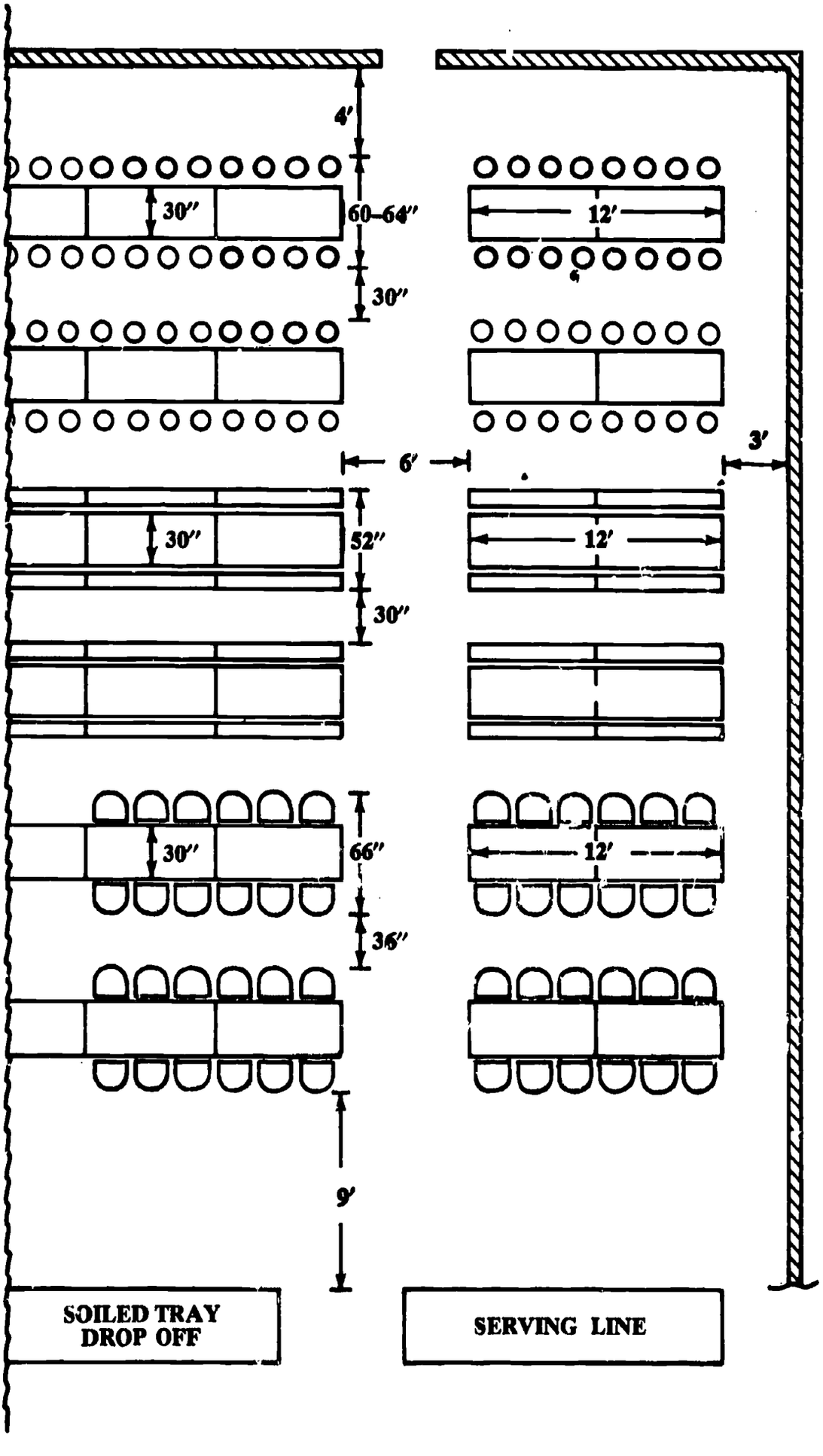
[1] Trapezoidal-shaped trays should be used with round tables and square tables.

CONSIDERATION WHEN DETERMINING SPACE REQUIREMENTS

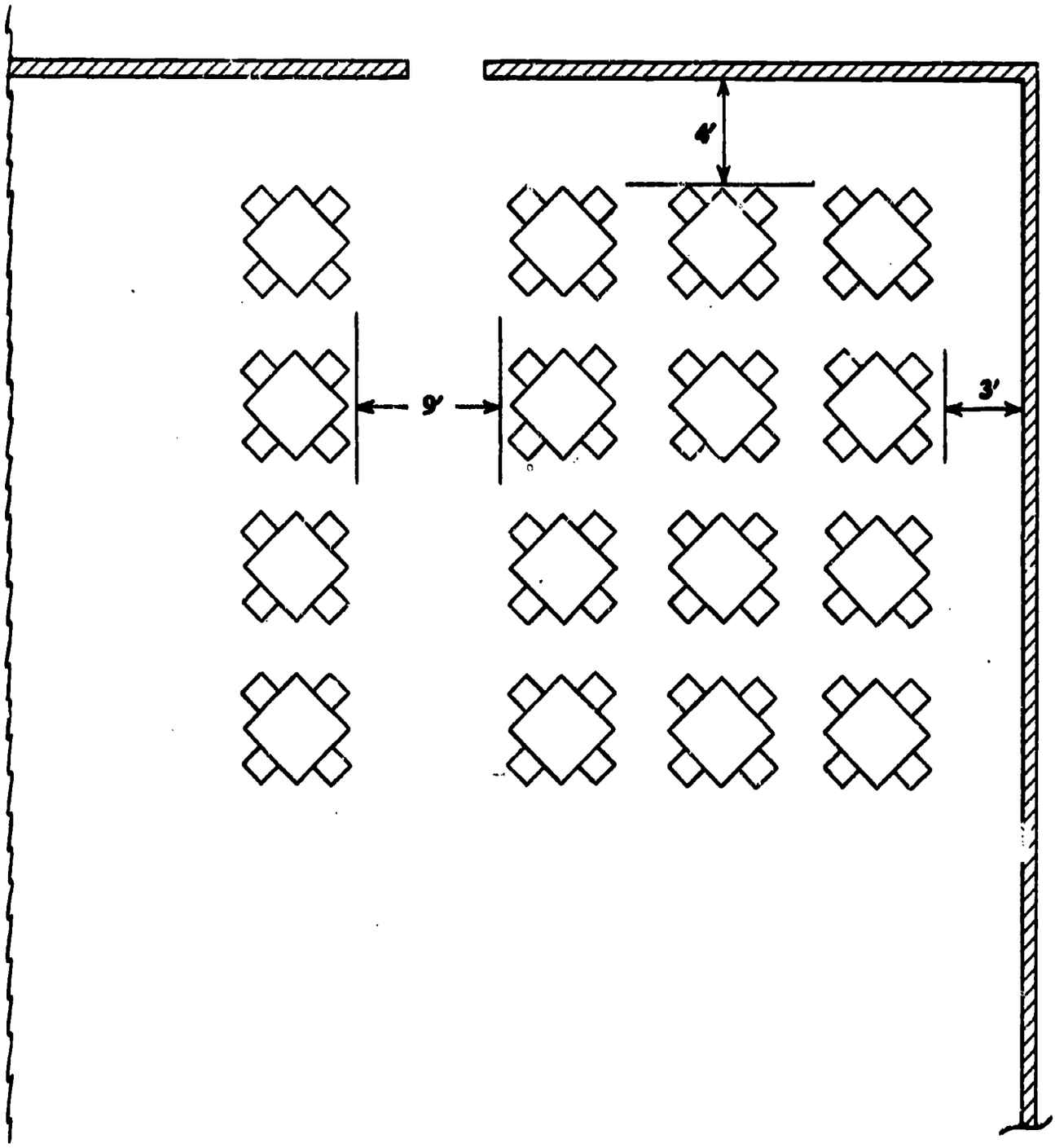
Using number square feet per student as a basis for determining room size should be used cautiously. It should be used only for budget or planning. If room is intended for multi-purpose use, the other uses may dictate the size and shape of area.

The square footage for dining area depends upon such variables as (a) configuration of dining space, (b) obstructions within such as support columns, piping, etc., (c) aisle (space) between tables and walls, (d) age and size of students.

Minimum Aisle and Space Requirements For Rectangular Tables



Minimum Aisle and Space Requirements For Square Tables



DINING ROOM EQUIPMENT

1. **Considerations in Selecting Dining Room Equipment:**
Prior to the selection, certain considerations must be made to ensure that the type of equipment purchased adequately meets the needs of the school.

   a. Intended Use of Room: If the dining room is going to be used for other purposes, the equipment that is chosen must be compatible with those purposes.
   b. Age of Students: The age of students determines the height of the furniture and the space required per student.

	Height of Tables	Height of Chairs	Linear Space Per Person
Elementary	25" to 27"	13½" to 17"	18" to 24"
Junior High	27" to 30"	15" to 17"	20" to 24"
High School	29" to 30"	17" to 18"	20" to 24"

   c. State and Local Codes: The size of [illegible] room and equipment must comply with State and local codes.
   d. Available Space: Certain types of equipment occupy less space and allow more seating per square foot.
   e. Types of Trays: Trapezoidal trays should be used with round, curved, small square tables, and odd shaped tables.
   f. Cost of Labor: The cost of labor must be considered for cleaning the dining room. Mobile furniture should be considered if labor costs are high.
   g. Aesthetic Appearance: The appearance of a dining room can be enhanced if tables and seating are in a variety of shapes, sizes, patterns, and colors. Within budget limitations, this should be considered to avoid the institutional atmosphere created by the use of similar tables.

2. Suggested Uses of Tables and Seating in Multi-purpose Rooms:

	INTENDED ROOM FUNCTION							
	Dining	Auditorium	Gymnasium	Study Hall	Classroom(s)	Testing	Library	Room Dividers
Mobile Folding Tables with Benches	X	X[1]	X					X
Mobile Folding Tables with Stools	X	X[1]	X	X[2]	X[2]	X[2]	X[2]	
Mobile Folding Tables with Stacking Chairs	X	X	X[3]	X	X[3]	X	X	X
Standard Tables with Stacking Chairs	X			X	X	X	X	

[1] Mobile folding tables with benches or stools can be used providing school purchases stacking chairs; however, this is an additional cost.
[2] Mobile folding tables with stools with backs are acceptable; however, they are generally more costly than other comparable quality seating.
[3] Requires more manhours to convert to various operations which can be costly.

3. General Advantages and Disadvantages of Different Types of Tables and Seating:

Mobile Folding Tables with Attached Benches

a. Advantages
   (1) Allows for fast and easy cleaning of dining area resulting in manhour savings.
   (2) Dining area always looks neat and orderly, even after heavy usage.
   (3) Generally requires less square feet of dining area per student.
   (4) Allows for fast conversions of multi-purpose room operations.
   (5) Converts into effective room dividers.
   (6) Offers cost savings over other types of seating that normally would be used in multi-purpose rooms.

b. Disadvantages
   (1) Does not provide individual seating for auditorium functions. Sometimes schools purchase stacking chairs which is an additional cost.
   (2) Necessitates children's climbing over the bench to sit down.

Mobile Folding Tables with Attached Stools
a. Advantages
   (1) Allows for fast and easy cleaning of dining area resulting in manhour savings.
   (2) Makes possible neat and orderly appearance of dining area, even after heavy usage.
   (3) Generally requires less square feet of dining area per student.
   (4) Allows for fast conversions of multi-purpose room operations.
b. Disadvantages
   (1) Does not provide ideal individual seating for auditorium functions.
   (2) Generally, comparable mobile folding tables with attached stools (with or without backs) are somewhat more costly than mobile folding tables with separate chairs, or mobile folding tables with benches.

Standard or Mobile Folding Tables with Separate Stacking Chairs
a. Advantages
   (1) Allows for individual seating with backs for auditorium functions, study halls, etc. Normally desirable for high schools when room is used for study halls.
   (2) Generally comparable mobile folding tables with stacking chairs are less expensive than mobile folding tables with attached stools.
   (3) Standard tables with stacking chairs are generally less costly than any other type table seating combination.
   (4) Dining areas furnished with small, fixed-legged tables (round or square) do not have institutional appearance. In addition, can advantageously be arranged into rooms with odd configurations.
b. Disadvantages
   (1) More difficult to clean, resulting in higher manhour requirements.
   (2) Requires more square feet of dining area per student.
   (3) Difficult to maintain in an orderly appearance.

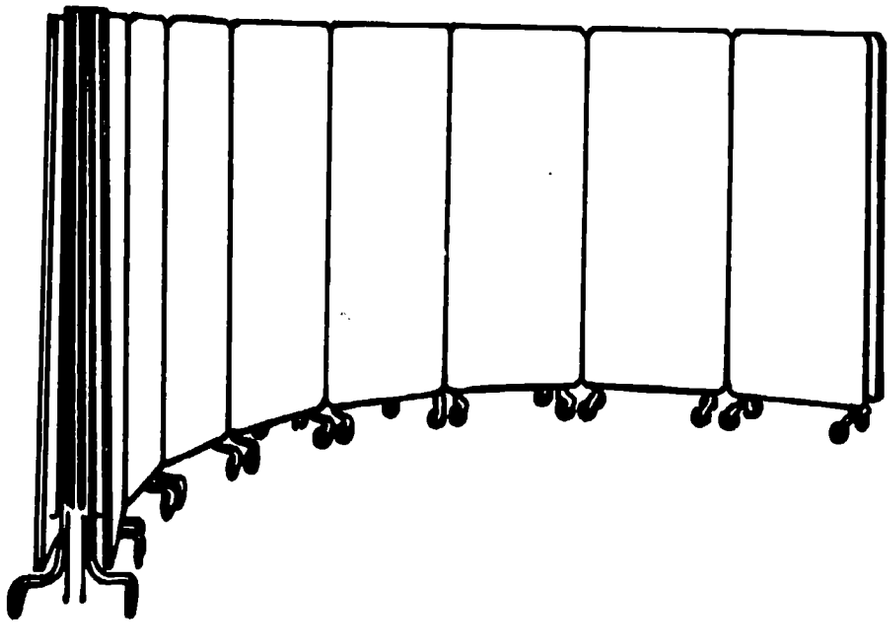
REMEMBER

A combination of types of tables and seating may provide aesthetic appearance while maintaining efficiency in space, conversion for other purposes, and cleaning of dining area.

4. Recommended Equipment Feautres:

a. Mobile Folding Tables
   (1) The table top should be fabricated from ¾" to ⅞" high density press board or plywood. Glue used in press board or plywood should be water resistant. A minimum of 1/16" high pressure plastic laminate meeting NEMA specifications should be glued to the top of the press board or plywood with the best quality adhesive currently recommended by the manufacturer of the plastic laminates. The bottom surface of the press board or plywood would be covered with a minimum 20/1000" plastic impregnated backing sheet. All remaining exposed edges should be treated (painted) with a special combination filler lacquer, and enamel. (This is recommended in lieu of bullnose or flat-edge binding with plastic, aluminum, or stainless steel.)

(2) The press board or plywood top with plastic laminate and backing sheet should not be considered part of the structural framing. (The mobile folding table should have a utilized frame that can be folded and rolled when top folded and locked in closed position.)
(3) Structural framing of the table and benches or stools should be designed to minimize obstructions during ingress and egress, and make straddling unnecessary.
(4) All critical joints in the framing should be either welded or rivited. The pivot points for folding tables should be bolts with locking nuts or rivets.
(5) The top of the table should be held to the framing by either special deep-threaded wood screws or expanded rivets.
(6) The mobile folding table should be designed to fold so that the top surface is exposed. Folded tables may be used as room dividers.



(7) Tables should be center folding. Before purchasing tables, make sure that table, when folded, will pass through immediate door openings.
(8) Folding tables should open and close, in one simple operation, whether the table is equipped with benches or stools.
(9) Either springs or torsion bar(s) should be provided at the hinge area to counterbalance the heavy weight of the table. Compression springs or locks should be capable of holding table with benches or stools in semi-open position for easy cleaning of floor.
(10) When folding tables come equipped with attached individual stools, the diameter of the stools should be approximately 13".

b. Standard Tables
(1) The table should have a unitized frame.
(2) For table top, see paragraph a. above, folding tables. Hollow core tables are not recommended. Light weight top with hardwood framing and "honeycomb construction" is an alternative where weight is a factor.

c. Chairs
(1) Frame should be heavy gauge tabular steel with chrome plated legs.
(2) The seat and the bench should be of acceptable plastic.
(3) The chairs should be at the proper height and should be comfortable.
(4) The seat and back should be attached to the frame with rivets.
(5) Chairs should be equipped with either steel or rubber glides.

SECTION E

SMALL PREPARATION EQUIPMENT

SMALL EQUIPMENT DEFINITION

The term "small equipment" generally refers to those items used in food preparation which can be held in the hand. It also includes large mixing bowls and pans. The following list describes the types of small equipment generally needed for an efficient on-site school food service operation. Quantities of items listed are not specified, as the needs for each school food service operation vary.

PREPARATION AND SERVING EQUIPMENT

Board

Cutting, 18" x 24" x ¾", composition rubber or plastic.
Pastry, 18" x 24" x ¾", composition rubber or plastic.

Bowls

Hand mixing 3-80 quarts, aluminum or stainless steel (large bowls 30-80 quarts should have mobile stand).

Brushes

Pastry, nylon bristles
Vegetable, nylon bristles
Kettle drain, nylon bristles

Chopper or Grinder, food, approximately 3-lb. capacity, manually operated, corrosion-resistant metal.

Cleaver, 6" blade, light weight ¾ to 1 lb., hardwood handle.

Colander, 11–16 qt. aluminum or stainless steel.

Covers, for 12" x 20", or 12" x 18" food service pans, dome-type, stainless steel.

Containers, 20–30 gallon, tight fitting lid, galvanized metal or heavy duty plastic.
For storage, equipped with dolly (can be mobile ingredient bins with covers).
For garbage and waste, line with plastic liner.

Cutlery, Knives, blades of high carbon content or stainless steel, full tong construction desirable, minimum, 2 rivets, two-piece hardwood handles or equivalent construction.
Boning knife, approximately 6", flexible narrow blade.
Boning knife, approximately 6", stiff wide blade.
French cook's knife, approximately 10" blade.
Paring knife, spear or clip point, approximately 2½"-3" blade.
Slicing knife, approximately 12" blade.
Spatula, approximately 8-10" long, narrow or wide.
Spreader, butter, flexible, approximately 3-4" blade.
Steel, approximately 12" long magnetized.
Turner, "hamburger," approximately 3-4½" flat area.
Turner, or offset spatula; approximately 10"-1½" stainless steel blade.

Cutlery Rack, type suitable to operation.

Cutters

Biscuit, 2" diameter
Butter, 48 cuts per pound, corrosion-resistant steel wires
Dough, (optional, needed if bread and rolls are baked)

Dredges, (shakers), salt, pepper, and spices.

Fork, cook's 12"-14" long, 2-tine, forged, hardwood handle or equal construction.

Funnel, 1-pint to 1-qt. capacity, plastic or metal.

Grater, hand, heavy-duty, fine, or course, corrosion-resistant metal.

Juice Extractor, press or rotary-type, manually operated, aluminum or stainless steel.

Ladles

Portioning, 2-8 ounces, stainless steel.
Transferring (from kettle to pans) 1-4 quarts, stainless steel.

Mats, (floor) interlocking synthetic, rubber or vinyl-slip resistant, grease and alkali-resistant.

Measures, with pouring lip, aluminum.

Cup, graduated
Quart, graduated
Gallon, graduated

Molder, Hamburger, 3 ounce size.

Openers, can, institutional, table mounted, manual, or electric heavy duty.

Paddle, kettle, stirring, 30-37" for 20-and 30-gallon kettles, 45" for kettles larger than 30-gallon, perforated, aluminum or stainless steel.

Peeler, fruit and vegetable, swivel; hand operated.

Portion Filler, hand operated for preparation of flowable foods (i.e. ketsup, cole slaw, etc.) into single service containers

Pot Holders, or Oven Mitts, asbestos.

Pots and Pans

Bun or sheet pans, either 18" x 26" x 1" or 20" x 24" x 1" aluminum.
Double boiler, 12-quart insert, 12-quart pot, flat bottom insert, fitted cover, insert and outer pot may be used separately, aluminum or stainless steel.
Dry ingredients, 1 quart aluminum or stainless steel.
Food service pans, either 12" x 20" or 12" x 18" with a depth of 2½", 4" and 6" as needed, stainless steel.
Muffin pans, 12 cups per frame, approximate cup size 2¾" diameter by 1½" depth.
Pie pans, 8"-10" diameter, aluminum or tinned ware.
Roast pans, of length and width compatible with oven, aluminum or stainless steel, seamless, 2 drop handles.
Sauce pans, approximately 4 quart, long handle, heavy duty, aluminum or stainless steel.
Sauce pots, approximately 20 quarts, approximately 14" diameter, 2 loop handles, heavy duty, aluminum or stainless steel.
Saute-pan, with long handle and cover, heavy duty aluminum.
Utility or dish pans, 14-27 quarts, aluminum or stainless steel, heavy duty with or without handles.

Rack, heavy duty for holding disposable garbage bags.

Rolling Pin, 4" diameter x 14" revolving handles, heavy duty.

Saw, butcher's hardwood or metal handle 20"-24" blade.

Scales

Portion scale, 32 ounce, ¼ ounce graduations.
Bakers, 5-18 lb. capacity balance type.
Counter, 25-30 lb. capacity ¼ to ½ ounce graduation.
Platform, portable beam type; 250 lb. capacity.

Scoops, portioning, stainless steel, plastic handle, size:

No. 6 (⅔ cup)
No. 8 (½ cup)
No. 10 (⅖ cup)
No. 12 (⅓ cup)
No. 16 (¼ cup)
No. 20 (3⅕ tablespoons)
No. 24 (2⅔ tablespoons)
No. 30 (2⅕ tablespoons)
No. 40 (1⅗ tablespoons)

Scraper, bowl, 4"-6" wide flexible nonmetallic blade.

Shears, kitchen, 7"-8" steel.

Sieve, flour, 16"-20" diameter, aluminum.

Skimmers, 4"-6" diameter with approximately 12" handle, aluminum or stainless steel.

Slicer, egg, wire, corrosion-resistant metal.

Spoons

Measuring set, graduated from ¼ teaspoon to 1 tablespoon, aluminum or stainless steel.
Stirring, 11"-14" long, solid, stainless steel.
Serving, 12"-14" long, solid, slotted, and perforated.

Stools, metal.

Strainer, china cap, 10"-12" diameter.

Thermometers

Oven, minimum temperature range, 200° to 600° F. in 10°-scale divisions.
Roast meat, stainless steel stem, hermetically sealed dial, minimum temperature range, 140° to 200° F. in 5°-scale divisions, movable metal index, or tube-type with armored stem and non-toxic liquid filling.
Refrigerator and freezer, temperature range —40° to +70° F, 1° scale divisions.
Dry storeroom, temperature range —20° F to 120° F, 2° scale divisions.

Timer, range of 60 minutes, marked in one-minute scale divisions.

Tongs, salad, 9"-12" aluminum, or stainless steel.

Trays, approximately 12" x 16" or 14" x 18" aluminum or stainless steel.

Whip, corrosion-resistant wire 14"-20".

DINING ROOM EQUIPMENT

Dispensers

Napkin, corrosion-resistant material.
Straw, corrosion-resistant material.
Shakers, salt and pepper, serving counter or dining table use, aluminum or stainless steel.

DISHWASHING EQUIPMENT

Flatware Cylinders, plastic or stainless steel (washing and dispensing flatware).

Racks, light weight plastic, various types to properly accommodate table service used in operation, i.e., compartmentized tray, service tray, plates and flatware.

Soak Tank, mobile, soaking flatware in dishwashing operation, plastic or stainless steel.

CLEANING AND MISCELLANEOUS EQUIPMENT

Brushes

Pot, approximately 5" x 6" short or long handle, nylon bristles.
Wire, approximately 2" x 8" fine steel bristles.

Brooms

Push, approximately 14", 16", 18" width, long handles.
Upright, long handle, natural fiber, heavy-duty.

Brushes

Scrub, floor, long handle, heavy-duty.

Buckets

Scrub, metal or plastic galvanized, bale handle.

Carborundum Stone, double face, minimum length 8" (use special mineral oil when sharpening knives).

Cutter, wire.

Dispenser, paper towel.

Hammer, claw.

Mop, mobile 16-44 quarts, double tank, squeeze-type detachable wringer desirable, galvanized metal.

Dust Pans, 12-16" pan, heavy duty.

Mops

Dust-treated 16-24" heavy duty.
Wet, heavy-duty, string or sponge, detachable handle.

Rack, broom, and mop, stationary type.

Gloves, rubber, elbow length.

SECTION F

AUXILIARY EQUIPMENT

SUMMATION TABLE OF EQUIPMENT REQUIRED

Auxiliary Equipment	Number Type A Lunches Served Per Day					
	250–300	301–400	401–450	451–800	801–1200	1201–1500
1. Ventilating Equipment (See Section #FF1)	1	1	1	1	1	1
2. Steam Generators (Boilers) (See Section #FF2)	1	1	1	1	1	1
3. Mobile Carts, Cabinets, etc. (See Section #FF3)						
4. Food Preparation Tables (See Section #FF4)						

VENTILATING EQUIPMENT

1. **A ventilating system** is required wherever the preparation of food produces heat, odor, smoke, steam, or grease laden vapor. Equipment normally vented includes ovens, ranges, steam-jacketed kettles, steamers, tilting braising pans, deep-fat fryers, griddles, and other smoke or vapor-producing equipment.

   A ventilating system basically consists of a ventilator (sometimes referred to as a hood), ducts, air movement equipment, and other special accessories as required (such as fan duct and ventilator fire protection equipment).

   Ventilator:
   The ventilator is of the capacity and configuration so as to prevent cooking vapors from the cooking equipment from entering the surrounding kitchen area.
   Ducts:
   Ducts are the means by which air from the ventilator is carried outside of the food preparation facility.
   Air Movement Equipment:
   Air movement equipment (consisting of fans, electric motor, etc.) is used to exhaust air from the cooking area through the ventilator and ducts to the outside.
   Fire Protection Equipment:
   Fire protection equipment consists of ways and means to turn off the ventilaor, close off the duct opening of the ventilator and extinguish the fire.

2. **Types of Ventilators:**
   For ease of identification, the types of ventilators are identified as non-filtering and filtering. Non-filtering hoods are not included in the guide because of their limited use. In a filtering ventilator the grease and other suspended particles are either removed by passing air through a metal mesh filter(s) or employing the principle of centrifugal force.

   Metal Mesh Filter:
   The most common method of filtering employs a removable metal mesh filter. During operation, the hot vapors condense on the cooler metal mesh filter(s.) The actual size and the number of removable filters within a given ventilator depend upon the size and style of ventilator. A cross section of such a unit is shown in Figure 1.

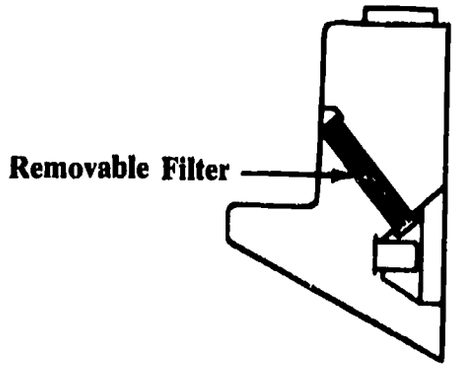


Figure 1 Metal Mesh Filter

Centrifugal Extractor:

In this method grease and other suspended particles are removed by centrifugal force. The centrifugal force is accomplished by forcing high velocity air to make rapid turns within the unit. Depending upon the design, water or cool air may be employed to increase the efficiency of the unit. Centrifugal grease extractors are generally self-cleaning. A cross section of such a unit is shown in Figure 2.

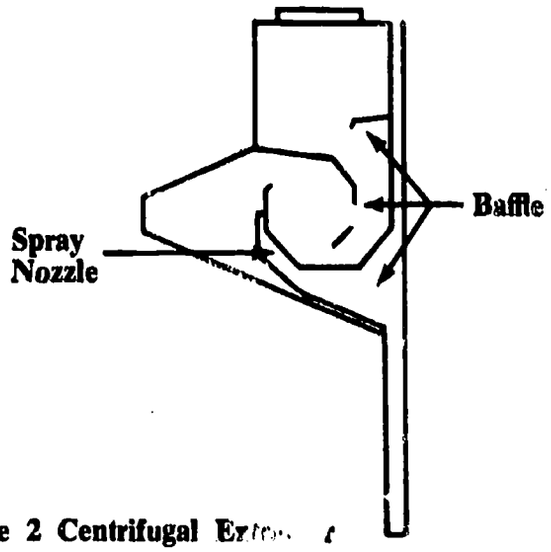


Figure 2 Centrifugal Extr...

3. Ventilator Styles:

Ventilators come in two basic styles, canopy and non-canopy. They may be either the metal mesh or centrifugal extractor type.

Canopy:

This style ventilator normally overhangs a minimum of 6" beyond the edge of the battery of cooking equipment on all exposed sides. It should be noted that in many localities local codes require a 12" over-hang. For centrifugal extractor canopy-style ventilator, there is generally no over-hang. The distance from the floor to the lower edge of the ventilator should not exceed 7' or be less than 6'3".

Non-Canopy:

This style ventilator does not overhang the cooking equipment. Instead, the front edge of the ventilator is set back from the front of the cooking equipment. This style ventilator is frequently referred to as a "backshelf" style.

4. Factors to be considered in selecting a ventilating system:

In selecting the type and style of ventilating system, consideration should be given to the following:

a. Initial equipment and installation costs. (Remember to include the ventilator, ducts, make-up air unit and fire protection equipment.)
b. Operation and maintenance costs.
c. Labor costs for keeping ventilator clean.
d. Cost of heating or cooling make-up air. (Remember, ventilators that have high velocity air movement with small volume of air generally exhaust less air and consequently less make-up is required.)
e. Fire insurance premiums.

5. Recommended Equipment Features:

All ventilators should have the following basic approvals:

a. Sanitation—All ventilators should have affixed to them the National Sanitation Foundation (NSF) seal of approval, as well as meeting all of the local health codes.

b. Fire Protection—All ventilators should meet the requirements of the National Fire Protection Association Standard No. 96 entitled "Ventilation of Cooking *Equipment*" 1970, plus local fire codes. This pamphlet covers aspects of a ventilation system including design, air movement, materials used in fabricating, etc. Locally designed and fabricated ventilators should also comply with NFPA No. 96 standards.

c. Building Code—All ventilators should meet the local building code requirements.

d. Insurance Rating Bureau—All ventilators should meet the standards of the Insurance Rating Bureau having jurisdiction for the area where installed.

e. Underwriters' Laboratory Seal of Approval (U L).

STEAM GENERATORS (BOILERS)

This section contains information on steam generators (boilers) operating at 15 PSI or less pressure.

Design of system and sizing of steam generator should be done by an engineer.

Installation of "direct-steam" operated equipment in institutions, military installations, hospitals, colleges, restaurants, etc. is an accepted and common practice.

In most states, steam generators operated at less than 15 PSI do not require licensed steam engineers for operating the unit.

1. **Types of Steam-Operated Equipment:**
   a. "Self-contained": This type has a steam generator as an integral part of the equipment. The steam generator is generally designed and fabricated for operation of the involved equipment only.
   b. "Direct-steam": This type has a separate source of steam for operating the equipment. The system basically consists of one low-pressure steam generator supplying steam to all "direct-steam" operated equipment, such as steamers, kettles, etc.

2. **When to Consider a Steam Generator:**
   a. When the proposed (new or renovated) facility includes dishwashing equipment, or several pieces of steam-operated equipment, consideration should be given to the purchase of "direct-steam" operated equipment and a steam generator.

   Advantages of steam-generator:
   (1) Greater ease of operation.
   (2) Simultaneous operation of all steam-operated equipment at full capacity, if properly sized.
   (3) Instantaneous heat-up with shorter cooking time.
   (4) Greater efficiency resulting in lower operating costs.
   (5) Lower maintenance costs.
   (6) Greater life expectancy.
   (7) Lower initial equipment/installation cost. (Larger size operations.)
   (8) Steam available for cleaning, heating water, and other uses.

   b. When the proposed (new or renovated) facility does not include dishwashing equipment or several pieces of steam-operated equipment, consideration should be given to the purchase of "self-contained" equipment. In general, "self-contained" equipment should be limited to those instances where equipment needs are small and limited.

3. **Other Sources of Steam:**
   a. School Steam Generators: The school steam generator should be considered when (1) steam supply is available throughout the entire school year, (2) there is an adequate steam supply, and (3) non-toxic boiler descaling compounds are used for cleaning the boiler. If toxic cleaning compounds are used the available steam is commonly referred to as "contaminated steam." In some instances, a contaminated steam supply can be converted to a "clean

steam" supply by changing to a non-toxic boiler cleaning compound. In those instances, where the school plans on continuing the use of toxic cleaning compounds, the contaminated steam may be used providing the steam is used in those pieces of equipment where the steam does not come in contact with food or table service, or a steam coil boiler is installed for converting contaminated steam into "clean steam."

b. A separate steam generator for operation of kitchen equipment is highly recommended as shown in Figure 1.

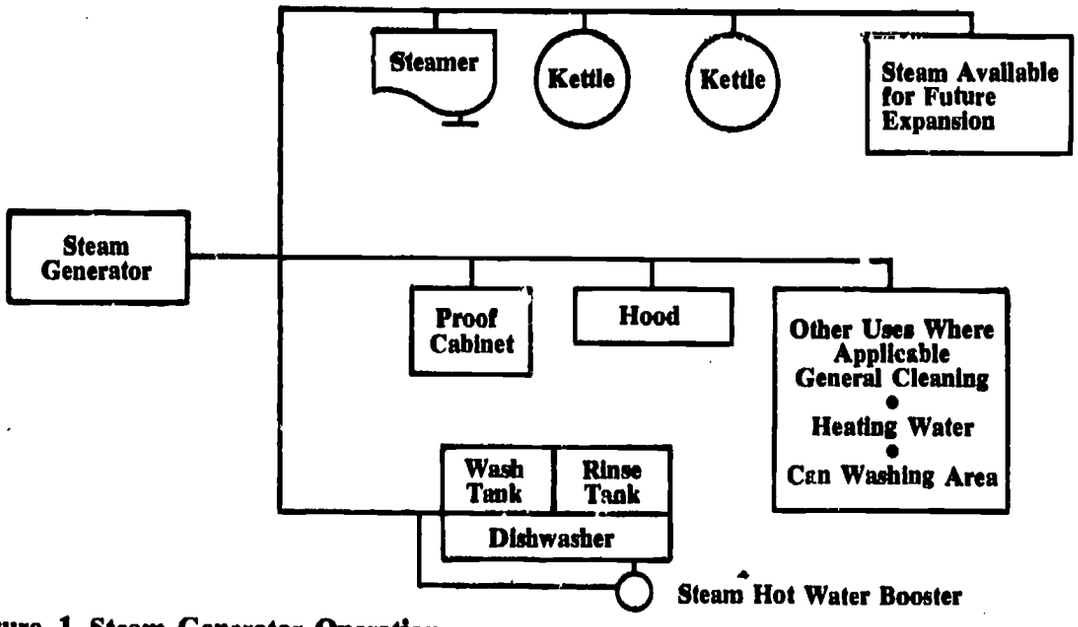


Figure 1 Steam Generator Operation

4. Boiler Horsepower Demands of Equipment:

Boiler horsepower (BHP) demands vary with the manufacturers of food service equipment. Therefore, care should be exercised to insure that the steam generator capacity will be sufficient for the food service equipment specified plus allowance for future growth. Commonly, accepted boiler horsepower demands at equipment are as follows: (These demands are at the equipment and therefore do not reflect delivery loss to equipment due to the piping and other resistance.)

Equipment	Boiler Horsepower Demands at Equipment
Steamer	1.5 BHP per steamer compartment
Kettle	.5 BHP per each 10-gallon capacity [1]
Single-Tank Door Dishwasher	4.0 BHP per dishwasher [2]
Single-Tank Conveyor Dishwasher	9.0 BHP per dishwasher [2]
Double-Tank Conveyor Dishwasher	12.0 BHP per dishwasher [2]
Single-Tank Flight Dishwasher	13.0 BHP per dishwasher [2]

[1] The .5 boiler horsepower demand per 10 gallons of steam-jacketed kettle is sufficient to bring 70° F water to boil (212° F.) in one hour. Generally, dishwashing operation and steam cooking do not occur simultaneously; therefore, the heating time can be expected to be less than one hour.

[2] The boiler horsepower demand for the dishwasher takes into consideration both wash and final rinse.

MOBILE EQUIPMENT

Mobile equipment can increase the efficiency of the kitchen, conserve manpower, and save the energy of the worker for more productive jobs. Mobile equipment can be used for both transporting and storing food and equipment.

The following list of mobile equipment is offered as a suggestion of the types of mobile equipment that might be used in an efficient school food service operation. All items are not required in every operation.

The exact quantity, type, and size of mobile equipment needed for an efficient operation must be selected for the particular operation remembering needs, costs, and layout.

Bowl Stand, for hand mixing bowls, stainless steel or aluminum, with or without pan rack below.

Cooling Racks, aluminum or stainless steel. Accommodate both food service and sheet pans.

Dish Rack Dolly, aluminum or stainless steel to hold standard dish racks.

Dolly with removable handle (case cart), may be used in large operations for transporting and storing quantity lots of cased foods, 16 gauge, stainless steel, 19″ x 25″ platform to accommodate two cases of #10 cans per tier.

Flatware Carts, for plastic or stainless steel flatware holding cylinders, stainless steel frame with fiberglass or stainless steel shelves, when sizing assume 35-pieces of flatware per cylinder. Recommended when using compartment trays.

Flatware and Tray Cart, stainless steel or aluminum frame, shelf at top to accommodate plastic cylinders for flatware, shelves may be stainless steel or fiberglass. Recommended when using service trays and plates.

Food Holding Cabinet(s) (hot, cold, and proofing) aluminum framing and walls, insulated or uninsulated, unheated, capable of interchangeably holding food service pans and sheet pans. Use as cold food cabinet by inserting cooling plates (filled with harmless sealed-in solid chemical refrigerant). Use as proofing cabinet by inserting removable heater-humidity unit.

Garbage Bins, should fit under drop-off chute in dishroom.

Garbage Can Dollies (needed if cans are used), steel frame.

Hand Trucks

2-wheel, 500-pound capacity, tubular or channel steel frame.

4-wheel, 800-pound capacity, steel frame, wood or steel body, counter sink bolts, 24″ 42″.

Mixer Bowl Dolly, use when 30-quart mixers or larger are used.

Mixer Stand, for 20-quart or smaller mixers, stainless steel, with locking wheels, with rack for attachments.

Plate Cart, may be self-leveling for dinner plates, stainless steel, or aluminum frame with stainless steel, aluminum or fiberglass body, self-leveling devices should be adjustable. Recommended when using service trays and plates.

Pot Rack, aluminum or stainless steel, tubular frame 5'-6' high with 18"-27" wide, 3-5 slotted shelves with locking wheels.

Refrigerator Storage Racks, stainless steel or aluminum, slotted shelves for air movement, locking wheels, 18" wide, lengths to fit needs.

Roll-In Convection Oven Cart, aluminum or stainless steel, must be compatible with the oven.

Semi-Live Skids, may be used in large operations for transporting and storing quantity lots of bagged and cased foods, 800-pound capacity, 24" x 36" platform size, should have small turning radius. Platforms should stack when not in use to save floor space.

Slicer Cart, with stainless steel side trays, with or without pan rack below, locking wheels, aluminum or stainless steel frame.

Soak Tanks for Flatware, stainless steel or plastic design to hold 1 combination dish rack, should have closing drain and locking wheels.

Storage Bins, stainless steel or plastic, should fit under baker's or work table. Acceptable substitutes are 20 to 30-gallon containers fabricated from galvanized metal or plastic, fitted with cover and dolly.

Tray Carts, to hold 2 stacks of compartment trays, 150 in each stack, self-leveling unit, should be adjustable, should have stainless steel frame, may be open or enclosed, recommended when using compartment trays.

Utility Carts, 2 or 3 shelves, stainless steel or fiberglass shelves, stainless steel or aluminum tube frame.

Other Types of Mobile Equipment:
The following pieces of equipment can be placed on wheels to improve their versatility:
Serving Line Equipment
Tilting Braising Pans
Preparation Tables

Recommended Features:

1. All mobile equipment, where applicable, should be fabricated in accordance with National Sanitation Foundation specifications.
2. Caster wheels should be approximately 5" in diameter with ball bearings and fabricated from moisture, chemical, and grease-resistant material.
3. All mobile equipment should be equipped with bumpers where required.
4. Underwriters' Laboratory Seal of Approval (UL) approved where applicable.

NOTE:

Aisles and work areas should be sufficiently large to allow mobile equipment entry and use in the work center. The space in which mobile equipment is used should be from 48" to 54". Where mobile equipment is used and where workers pass regularly, 60" of space is needed.

FOOD PREPARATION TABLES

Food preparation tables of the correct type, size, and in the quantity needed are necessary for the efficient operation of a food service facility. Factors that determine the need for food preparation on tables include number of work stations and employees, type and number of meals prepared daily, degree of raw-to-finish preparation, degree to which mobile racks and cabinets are employed, layout and available space.

1. Number and Type Table Generally Required.[1]

Number of Type A Lunches Served Daily	Type Table, Number and Length		
	Cook's	Baker's	Work [2]
100–250	1 6′	—	1 6′
250–350	1 6′	1 6′ [3]	1 6-8′
351–500	1 8′	1 6-8′	1 6-8′
501–750	1 8′	1 6-8′	The number and size of work tables depends upon the number of employees requiring table space for food preparation. To determine the approximate lineal footage of work tables, multiply the number of employees requiring table space by 4 linear feet per employee. Then subtract the length of cooks' and bakers' table as specified in this chart. Acceptable lengths of work tables are from 4′ to 8′.
751–1000	1 8′	1 8′	
1001–1250	1 8′	1 8′	
1251–1500	1 8′	1 8′	

[1] The chart is based on school lunch programs using donated commodities and preparing foods from raw to finish.
[2] Frequently referred to as preparation table.
[3] Optional for 250-350 meals daily.

2. Table Variations:

Tables can be purchased with an open front for accommodating mobile storage bins, racks, etc., undershelf for storage, enclosed base cabinet, or with built-in bins. In addition, they may include overhead or back shelves, overhead utensil rack, drawers, curbing, sinks, and may be stationary or mobile. Whether the table is equipped with an open undershelf, curbing, etc., depends upon intended use.

Tables are available in lengths ranging from 3-12′ or more, widths of 24-48″ or more and varying heights depending upon intended use. Care should be exercised in selecting tables with proper overall dimension for efficient operations.

3. Recommended Equipment Features:

a. Unless there is a special need, the cook's table should be from 6-8′ in length, 30″ in width and 34″ in height and may be stationary or mobile. Cook's *tables generally* have an undershelf, drawers and utensil rack. If table is located along wall, both backshelves and wall-mounted utensil rack should be considered. (Check local ordinances to determine whether open undershelf storage of clean equipment is permitted.)

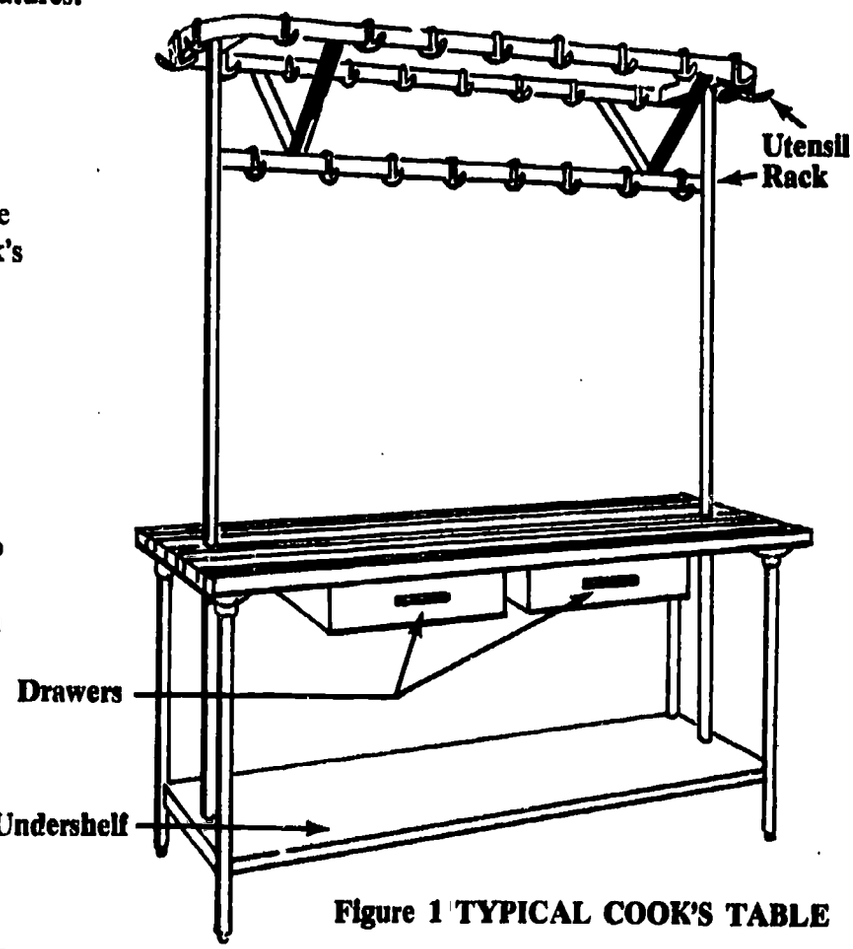


Figure 1 TYPICAL COOK'S TABLE

b. The baker's table should be approximately 6-8′ in length, 30-36″ in width and 34″ in height with 6″ raised curbing on 3 sides (back and ends), drawer(s) and facilities for ingredient storage. Mobile ingredient bins are recommended, where flour and sugar are procured in large containers, i.e., 100-pound bags, etc. Inexpensive substitutes for specifically designed ingredient bins are 20-30 gallon galvanized metal or plastic containers with tight fitting lids and dollies. If table is located away from wall, the curbing may be omitted thereby permitting accessibility from all sides of the table.

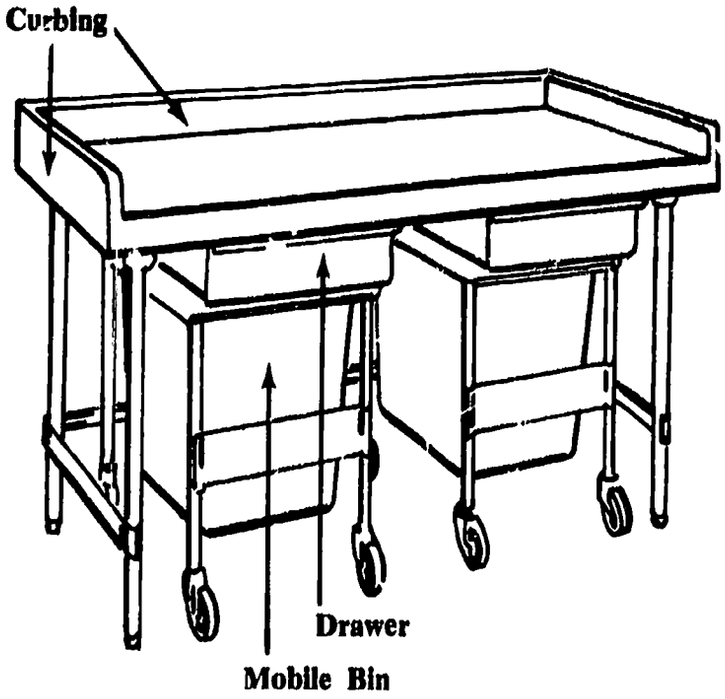


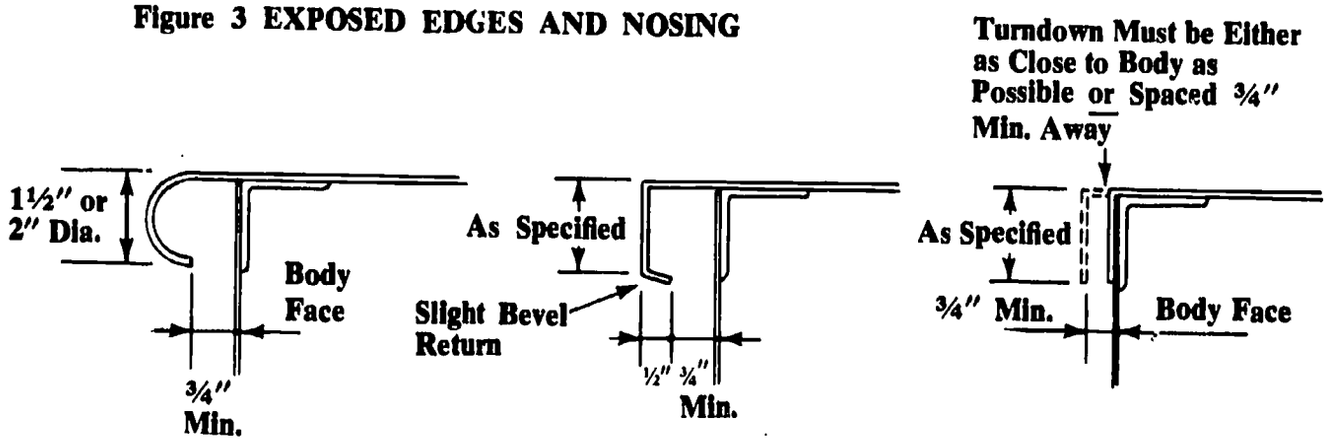
Figure 2 BAKER'S TABLE WITH MOBILE BIN

c. Work tables (which are used in food preparation) should be from 4-8′ in length, 30″ in width and 34″ in height and may be stationary or mobile. When both sides of the work-table are to be used, widths of 42-48″ should be considered. If mobile, the wheel casters should be 5″ in diameter and swivel. In many instances it is advantageous to have an open front worktable capable of accommodating mobile bins, carts, etc. If table use requires cutlery, a drawer should be provided.

d. All table tops should ideally be fabricated from 14-gauge, 18-8 stainless steel.

e. Tables should be fabricated in accordance with National Sanitation Foundation (NSF) standards. If fabricated locally, particular attention should be given to the exposed edges, the table legs, and feet. See Figures 3 and 4.

Figure 3 EXPOSED EDGES AND NOSING



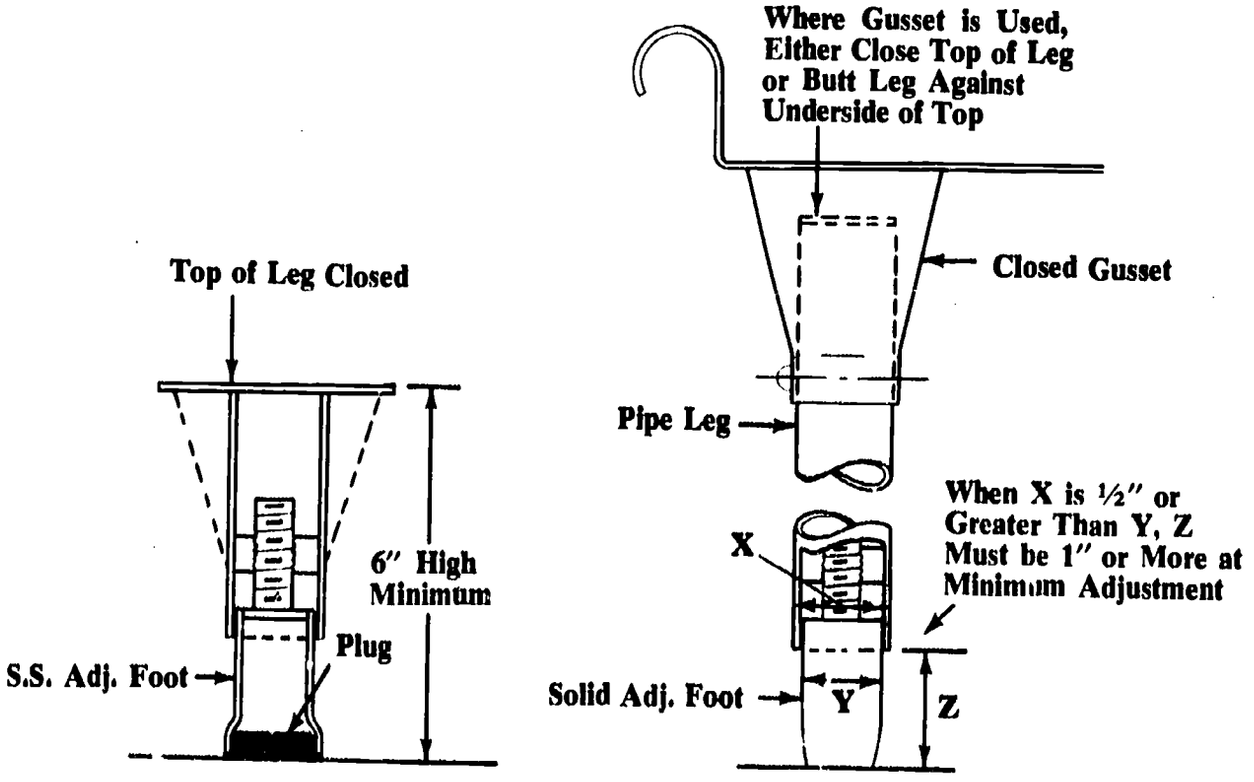


Figure 4 TABLE LEGS AND FEET

SECTION G

KITCHEN SPACE REQUIREMENTS

INTRODUCTION

Developing space requirements for food service facilities, particularly large ones, is a difficult task. Some of the factors which influence space requirements are: type of preparation and service, number of meals prepared, menu variety, frequency of deliveries, extent of mobile equipment utilization, configuration of the area, and structural features of the building. Careful analysis of the needs of the particular operation is required.

The following table is presented as guidance for budgeting purposes only and represents the space needed in the work areas when the pieces of equipment in these areas are efficiently arranged.

NOTES

KITCHEN SPACE REQUIREMENTS

1. The suggested space requirements below are merely guidelines and will vary with each food service facility.

Space Requirements Per Type A Lunches Served (Sq. Ft.)			Col 1 Food Preparation[1]	Col 2 Serving Line	Col 3 Walk-In and Reach-In Refrigerator	Col 4 Walk-In and Reach-In Freezer	Col 5 Dry Storage	Col 6 Dishwashing	Col 7 Office	Col 8 Employees' Room & Toilet[3]	Total (Cols. 1 thru 8)	Receiving Dock and Waste Holding Area	Lunchroom
	100	Per 100	360	200	8	8	50	110	75	45	856	70	See Section #DD3, Dining Area and Seating Requirements
		Per Meal	3.6	2.0	.08	.08	.50	1.10	.75	.45	8.56	—	
	250	Per 250	564	200	64	48	125	140	75	45	1261	70	
		Per Meal	2.25	.80	.26	.19	.50	.56	.30	.18	5.04	—	
	500	Per 500	606	200	64	48	250	200	75	75	1518	70	
		Per Meal	1.21	.40	.13	.10	.50	.40	.15	.15	3.04	—	
	750	Per 750	669	400[2]	79	55	375	200	75	85	1938	70	
		Per Meal	.89	.53	.11	.07	.50	.27	.10	.11	2.58	—	
	1000	Per 1000	753	400[2]	106	74	500	200	75	100	2208	80	
		Per Meal	.75	.40	.11	.07	.50	.20	.08	.10	2.21	—	
	1250	Per 1250	927	400[2]	132	92	625	200	75	115	2566	150	
		Per Meal	.74	.32	.11	.07	.50	.16	.06	.09	2.05	—	
	1500	Per 1500	1057	400[2]	158	110	750	200	75	130	2880	200	
		Per Meal	.70	.27	.11	.07	.50	.13	.05	.09	1.92	—	

[1]Food preparation area allows for entrance ways, access areas and doors.
[2] Based on two serving lines.
[3] If persons of opposite sex are employed, separate locker rooms should be provided.

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