FOOD ESTABLISHMENT GUIDE FOR DESIGN, INSTALLATION, AND CONSTRUCTION RECOMMENDATIONS

PART 1 - MENU

The menu is an integral part of the Plan Review Process. The menu or a listing of all of the food and beverage items to be offered at the food service establishment must be submitted by the applicant to the regulatory authority with the submission of all other Plan Review application documents.

As with the inspection process, the plan review process should focus on the food and what will happen to the food. The source and quantity of food to be served should be reviewed along with the preparation and post-preparation operations and the proposed storage practices.

Food preparation processes should be evaluated to determine the types and volumes of foods to be prepared. Special attention should be given to the review of complex food processes which will involve:

- multiple ingredients being assembled or mixed
- potentially hazardous foods
- foods which will be prepared or held for several hours prior to service
- foods requiring cooling and reheating
- multiple step processing (passing through the critical temperature zone, 135•F to 41•F more than once).

The style of food service should also be reviewed. The style of food service may be cook-to-order (cook-serve), self-service (buffet or salad bar), service of pre-packaged foods, service of large volumes of food, food preparation requiring multiple steps and handling, etc.

A suggested system of menu evaluation involves the review of categories of foods and their required preparation, i.e.:

- all food needs to come from an inspected and approved source
- thin meats such as poultry, fish, eggs (hamburgers, sliced meats, & fillets)
- thick meats and whole poultry (roast beef, whole turkey, whole chickens, & hams)
- cold processed foods (salad, sandwiches, vegetables)
- hot processed foods (soups, stews, casseroles)
- bakery goods

This system is useful since the critical control points for each process remain the same regardless of the individual menu ingredients.

The menu for a food service establishment dictates the space and equipment requirements for the safe preparation and service of various food items. The menu will determine if the proposed receiving and delivery areas, storage area, preparation and handling areas, and thawing, cooking, and reheating areas are available and adequate to

handle the types and volumes of foods being served.

When looking at the menu, evaluate the flow patterns for the preparation of the foods to be served to be sure that the lay-out of the facility provides an adequate separation of raw ingredients from ready-to-eat foods, that the traffic patterns are not crossing paths with waste items and other sources of contamination.

With proper understanding of the menu, the plans for food service establishments can be reviewed to assure that the food items proposed can be protected during the service operation.

Other references are available for additional formulas and information. One such reference includes: Kazarian, E. A., Ph.D., Food Service Facilities Planning. Copyright Van Nostrand Reinhold, NY., 1989.

PART 2- FACILITIES TO MAINTAIN PRODUCT TEMPERATURE

Sufficient hot-holding and cold-holding facilities shall comply with the standards of NSF or equivalent, and shall be designed, constructed and installed in conformance with the requirements of these standards.

REFRIGERATION FACILITIES SIZING AND DESIGN

The plan review for storage needs to provide adequate refrigeration facilities for the proper storage, transportation, display, and service of potentially hazardous foods. Specific refrigeration needs will be based upon the menu, number of meals, frequency of delivery, and preparation in advance of service. All refrigerators must be capable of maintaining potentially hazardous foods (PHF) at 41• F or below.

If potentially hazardous foods are prepared a day or more in advance of service, a rapid cooling procedure capable of cooling potentially hazardous foods from 135• F to 41• F within 6 hours (135• F to 70• F in 2 hrs. & 70• F to 41• F in 4 hrs.) should be provided. The capacity of the rapid cooling facilities must be sufficient to accommodate the volume of food required to be cooled to 41• F within 6 hours.

Provide point-of-use refrigerators and freezers at work stations for operations requiring preparation and handling of potentially hazardous foods. Refrigeration units, unless designed for such use, should not be located directly adjacent to cooking equipment or other high heat producing equipment which may tax the cooling system's operation.

SIZING CONSIDERATION FOR CALCULATING TOTAL REFRIGERATED STORAGE NEEDS, INCLUDING WALK-INS

To plan reserve storage, the following need to be considered: menu, type of service, number of meals per day, number of deliveries per week and adequate air ventilation in the area where refrigeration system will be located.

The following is a suggested formula to establish required reserve storage (note: only 40% of any walk-in unit actually provides usable space):

Total Interior Storage Volume Needed:

$$\frac{\text{Vol. per meal (Cu. ft.) x number of meals}}{.40}$$

Below are estimated typical meal volumes for each of three types of refrigerated storage:

Meat, Poultry and Seafood	=	.010-.030 Cu. ft. per meal
Dairy	=	.007-.015 Cu. ft. per meal
Vegetables and fruit	=	.020-.040 Cu. ft. per meal

Thus for a restaurant serving 1000 meals between deliveries (assume a minimum of 4 day storage) the following storage capacities are needed:

Meat refrigerated storage = $\frac{.030 \text{ Cu. ft./meal} \times 1000 \text{ meals}}{.40}$

= 75 Cu. ft.

Vegetable refrigerated storage = $\frac{.040 \text{ Cu. ft./meal} \times 1000 \text{ meals}}{.40}$

= 100 Cu. ft.

Dairy refrigerated storage = $\frac{.015 \text{ Cu. ft./meal} \times 1000 \text{ meals}}{.40}$

= 37.5 Cu. ft.

To calculate the interior storage space (in square feet) required for the above example, divide the volume (Cu. ft), in each case, by the height of the unit.

Example:
For meat refrigerated storage = $\frac{75 \text{ Cu. ft.}}{6 \text{ ft. (height)}}$

= 12.5 sq. ft.

The interior floor area would have to be 12.5 sq. ft. to accommodate refrigeration storage of meat for 1000 meals.

To estimate total interior volume or space, add together the requirements for each type of food.

To convert interior measurements to exterior floor area, multiply by 1.25. Thus, for meat storage, in the above example an exterior floor area = 1.25 x 12.5 sq. ft., or 15.6 sq. ft. would be needed.

ADDITIONAL RECOMMENDATIONS FOR REFRIGERATED STORAGE FACILITIES

A. Shelving for walk-in and reach-in refrigeration units should be equipment that is certified or classified for sanitation by an ANSI accredited certification program.

B. Interior finishes of walk-in and reach-in refrigeration units should be certified or classified for sanitation by an ANSI accredited certification program. Galvanized metal is not recommended because of its tendency to rust.

C. All refrigeration units must have numerically scaled indicating thermometers accurate to ± 3•F. The temperature sensing device must be located in the unit to measure air temperature in the warmest part. All such thermometers should have an externally mounted indicator to facilitate easy reading of the temperature of the unit. Refrigerators and freezers shall be capable of maintaining appropriate temperatures when evaluated under test conditions of an ANSI accredited certification program.

D. Air circulation within refrigeration and freezer units should not be obstructed and should allow for an even and consistent flow of cold air throughout the units.

Refrigeration Unit maximum operating temperature (cabinet air) should be:

Type	Max Temp	Max Compressor Operating time
Refrigerated buffet units	Cabinet air temp 41•F Food temp 33-41•F	70%
Storage & display refrigerators	Cabinet air temp 41•F Food temp 33-41•F	70%
Storage & display freezer	Cabinet air temp 0•F Food Frozen	80%

Rapid pull down refrigeration units must be capable of cooling cooked PHF s from 135•F to 70•F within 2 hours, and from 70•F to 41•F within 4 hours or less.

E. Approved coved juncture base around the interior.

F. Approved coved junction base around the exterior.

G. Approved enclosure between the top of the unit and the ceiling if this space is twenty-four inches or less. Fixed equipment shall be spaced to allow for cleaning along the sides and behind, or sealed to adjoining equipment or walls.

H. Refrigeration units should not be installed exterior to the building if non-packaged foods will be transported from the unit to the food establishment.

I. If the walk-in floors are water-flushed for cleaning or receive the discharge of liquid waste or excessive melt water, the floors should be non-absorbent (i.e. quarry tile or equal) with silicone or epoxy impregnated grout and, sloped to drain. Local jurisdictions may require drains to be located outside of the cooling box within 5 feet of the cooler box.

J. Walk-in freezer doors should be equipped with pressure relief ports.

K. All walk-in units should be constructed and installed in accordance with nationally recognized standards and/or code requirements and bear the certification mark of an ANSI accredited organization (e.g. NSF, UL, ETL).

L. Each walk-in unit shall be equipped with lighting that provides 10 foot candles of light throughout the unit when it is full of product.

HOT HOLDING AND REHEATING FACILITIES

The hot holding facilities must be capable of maintaining potentially hazardous foods at an internal temperature of 135•F or above during display, service and holding periods.

Reheating equipment must be capable of raising the internal temperature of potentially hazardous foods rapidly (within a maximum of 2 hours) to at least 165•F. Appropriate product thermometers will be required to monitor the food temperature.

SAMPLE COLD STORAGE CALCULATIONS

Cited on the next few pages are examples of cold storage calculations prepared by the North Carolina Department of Health, Food Lodging and Institutional Sanitation Branch, Plan Review Subcommittee.

The following three charts are based on the volume of the meals, number of meals served and frequency of delivery.
To calculate the interior storage space required for walk-in refrigeration units for the following charts to square feet, simply divide the cu. ft. (volume), in each case by the height of the unit.

MEAT AND POULTRY COLD STORAGE CHART FOR WALK-IN UNITS

number of meals meals served between deliveries	storage per cu. ft. per 0.01 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.015 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.020 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.025 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.03 Cu. Ft. per meal per number meals served
200	5	7.50	10.00	12.50	15.00
250	6.25	9.38	12.50	15.63	18.75
300	7.50	11.25	15.00	18.75	22.50
350	8.75	13.13	17.50	21.88	26.25
400	10.00	15.00	20.00	25.00	30.00
450	11.25	16.88	22.50	28.13	33.75
500	12.50	18.75	25.00	31.25	37.50
550	13.75	20.63	27.50	34.38	41.25
600	15.00	22.50	30.00	37.50	45.00
650	16.25	24.38	32.50	40.63	48.75
700	17.50	26.25	35.00	43.75	52.50
750	18.75	28.13	37.50	46.88	56.25
800	20.00	30.00	40.00	50.00	60.00
850	21.25	31.88	42.50	53.13	63.75
900	22.50	33.75	45.00	56.25	67.50
950	23.75	35.63	47.50	59.38	71.25
1000	25.00	37.50	50.00	62.50	75.00
1050	26.25	39.38	52.50	65.63	78.75
1100	27.50	41.25	55.00	68.75	82.50
1150	28.75	43.13	57.50	71.88	86.25
1200	30.00	45.00	60.00	75.00	90.00
1250	31.25	46.88	62.50	78.13	93.75
1300	32.50	48.75	65.00	81.25	97.50
1350	33.75	50.63	67.50	84.38	101.25
1400	35.00	52.50	70.00	87.50	105.00
1450	36.25	54.38	72.50	90.63	108.75
1500	37.50	56.25	75.00	93.75	112.50
1550	38.75	58.13	77.50	96.88	116.25
1600	40.00	60.00	80.00	100.00	120.00
1650	41.25	61.88	82.50	103.13	123.75
1700	42.50	63.75	85.00	106.25	127.50
1750	43.75	65.63	87.50	109.38	131.25
1800	45.00	67.50	90.00	112.50	135.00
1850	46.25	69.38	92.50	115.63	138.75
1900	47.50	71.25	95.00	118.75	142.50
1950	48.75	73.13	97.50	121.88	146.25
2000	50.00	75.00	100.00	125.00	150.00

VEGETABLE AND FRUIT COLD STORAGE CHART FOR WALK-IN UNITS

number of meals meals served between deliveries	storage per cu. ft. per 0.020 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.025 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.030 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.035 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.040 Cu. Ft. per meal per number meals served
200	10.00	12.50	15.00	17.50	20.00
250	12.50	15.63	18.75	21.88	25.00
300	15.00	18.75	22.50	26.25	30.00
350	17.50	21.88	26.25	30.63	35.00
400	20.00	25.00	30.00	35.00	40.00
450	22.50	28.13	33.75	39.38	45.00
500	25.00	31.25	37.50	43.75	50.00
550	27.50	34.38	41.25	48.13	55.00
600	30.00	37.50	45.00	52.50	60.00
650	32.50	40.63	48.75	56.88	65.00
700	35.00	43.75	52.50	61.25	70.00
750	37.50	46.88	56.25	65.63	75.00
800	40.00	50.00	60.00	70.00	80.00
850	42.50	53.13	63.75	74.38	85.00
900	45.00	56.25	67.50	78.75	90.00
950	47.50	59.38	71.25	83.13	95.00
1000	50.00	62.50	75.00	87.50	100.00
1050	52.50	65.63	78.75	91.88	105.00
1100	55.00	68.75	82.50	96.25	110.00
1150	57.50	71.88	86.25	100.63	115.00
1200	60.00	75.00	90.00	105.00	120.00
1250	62.50	78.13	93.75	109.38	125.00
1300	65.00	81.25	97.50	113.75	130.00
1350	67.50	84.38	101.25	118.13	135.00
1400	70.00	87.50	105.00	122.50	140.00
1450	72.50	90.63	108.75	126.88	145.00
1500	75.00	93.75	112.50	131.25	150.00
1550	77.50	96.88	116.25	135.63	155.00
1600	80.00	100.00	120.00	140.00	160.00
1650	82.50	103.13	123.75	144.38	165.00
1700	85.00	106.25	127.50	148.75	170.00
1750	87.50	109.38	131.25	153.13	175.00
1800	90.00	112.50	135.00	157.50	180.00
1850	92.50	115.63	138.75	161.88	185.00
1900	95.00	118.75	142.50	166.25	190.00
1950	97.50	121.88	146.25	170.63	195.00
2000	100.00	125.00	150.00	175.00	200.00

DAIRY COLD STORAGE CHART FOR WALK-IN UNITS

number of meals meals served between deliveries	storage per cu. ft. per 0.007 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.009 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.011 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.013 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.015 Cu. Ft. per meal per number meals served
200	3.50	4.50	5.50	6.50	7.50
250	4.38	5.63	6.88	8.13	9.38
300	5.25	6.75	8.25	9.75	11.25
350	6.13	7.88	9.63	11.38	13.13
400	7.00	9.00	11.00	13.00	15.00
450	7.88	10.13	12.38	14.63	16.88
500	8.75	11.25	13.75	16.25	18.75
550	9.63	12.38	15.13	17.88	20.63
600	10.50	13.50	16.50	19.50	22.50
650	11.38	14.63	17.88	21.13	24.38
700	12.25	15.75	19.25	22.75	26.25
750	13.13	16.88	20.63	24.38	28.13
800	14.00	18.00	22.00	26.00	30.00
850	14.88	19.13	23.38	27.63	31.88
900	15.75	20.25	24.75	29.25	33.75
950	16.63	21.38	26.13	30.88	35.63
1000	17.50	22.50	27.50	32.50	37.50
1050	18.38	23.63	28.88	34.13	39.38
1100	19.25	24.75	30.25	35.75	41.25
1150	20.13	25.88	31.63	37.38	43.13
1200	21.00	27.00	33.00	39.00	45.00
1250	21.88	28.13	34.38	40.63	46.88
1300	22.75	29.25	35.75	42.25	48.75
1350	23.63	30.38	37.13	43.88	50.63
1400	24.50	31.50	38.50	45.50	52.50
1450	25.38	32.63	39.88	47.13	54.38
1500	26.25	33.75	41.25	48.75	56.25
1550	27.13	34.88	42.63	50.38	58.13
1600	28.00	36.00	44.00	52.00	60.00
1650	28.88	37.13	45.38	53.63	61.88
1700	29.75	38.25	46.75	55.25	63.75
1750	30.63	39.38	48.13	56.88	65.63
1800	31.50	40.50	49.50	58.50	67.50
1850	32.38	41.63	50.88	60.13	69.38
1900	33.25	42.75	52.25	61.75	71.25
1950	34.13	43.88	53.63	63.38	73.13
2000	35.00	45.00	55.00	65.00	75.00

MEAT AND POULTRY COLD STORAGE CHART FOR REACH-IN UNITS

number of meals meals served between deliveries	storage per cu. ft. per 0.01 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.015 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.020 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.025 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.03 Cu. Ft. per meal per number meals served
200	2.67	4.00	5.33	6.67	8.00
250	3.33	5.00	6.67	8.33	10.00
300	4.00	6.00	8.00	10.00	12.00
350	4.67	7.00	9.33	11.67	14.00
400	5.33	8.00	10.67	13.33	16.00
450	6.00	9.00	12.00	15.00	18.00
500	6.67	10.00	13.33	16.67	20.00
550	7.33	11.00	14.67	18.33	22.00
600	8.00	12.00	16.00	20.00	24.00
650	8.67	13.00	17.33	21.67	26.00
700	9.33	14.00	18.67	23.33	28.00
750	10.00	15.00	20.00	25.00	30.00
800	10.67	16.00	21.33	26.67	32.00
850	11.33	17.00	22.67	28.33	34.00
900	12.00	18.00	24.00	30.00	36.00
950	12.67	19.00	25.33	31.67	38.00
1000	13.33	20.00	26.67	33.33	40.00
1050	14.00	21.00	28.00	35.00	42.00
1100	14.67	22.00	29.33	36.67	44.00
1150	15.33	23.00	30.67	38.33	46.00
1200	16.00	24.00	32.00	40.00	48.00
1250	16.67	25.00	33.33	41.67	50.00
1300	17.33	26.00	34.67	43.33	52.00
1350	18.00	27.00	36.00	45.00	54.00
1400	18.67	28.00	37.33	46.67	56.00
1450	19.33	29.00	38.67	48.33	58.00
1500	20.00	30.00	40.00	50.00	60.00
1550	20.67	31.00	41.33	51.67	62.00
1600	21.33	32.00	42.67	53.33	64.00
1650	22.00	33.00	44.00	55.00	66.00
1700	22.67	34.00	45.33	56.67	68.00
1750	23.33	35.00	46.67	58.33	70.00
1800	24.00	36.00	48.00	60.00	72.00
1850	24.67	37.00	49.33	61.67	74.00
1900	25.33	38.00	50.67	63.33	76.00
1950	26.00	39.00	52.00	65.00	78.00
2000	26.67	40.00	53.33	66.67	80.00

VEGETABLE AND FRUIT COLD STORAGE CHART FOR REACH-IN UNITS

number of meals meals served between deliveries	storage per cu. ft. per 0.020 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.025 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.030 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.035 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.040 Cu. Ft. per meal per number meals served
200	5.33	6.67	8.00	9.33	10.67
250	6.67	8.33	10.00	11.67	13.33
300	8.00	10.00	12.00	14.00	16.00
350	9.33	11.67	14.00	16.33	18.67
400	10.67	13.33	16.00	18.67	21.33
450	12.00	15.00	18.00	21.00	24.00
500	13.33	16.67	20.00	23.33	26.67
550	14.67	18.33	22.00	25.67	29.33
600	16.00	20.00	24.00	28.00	32.00
650	17.33	21.67	26.00	30.33	34.67
700	18.67	23.33	28.00	32.67	37.33
750	20.00	25.00	30.00	35.00	40.00
800	21.33	26.67	32.00	37.33	42.67
850	22.67	28.33	34.00	39.67	45.33
900	24.00	30.00	36.00	42.00	48.00
950	25.33	31.67	38.00	44.33	50.67
1000	26.67	33.33	40.00	46.67	53.33
1050	28.00	35.00	42.00	49.00	56.00
1100	29.33	36.67	44.00	51.33	58.67
1150	30.67	38.33	46.00	53.67	61.33
1200	32.00	40.00	48.00	56.00	64.00
1250	33.33	41.67	50.00	58.33	66.67
1300	34.67	43.33	52.00	60.67	69.33
1350	36.00	45.00	54.00	63.00	72.00
1400	37.33	46.67	56.00	65.33	74.67
1450	38.67	48.33	58.00	67.67	77.33
1500	40.00	50.00	60.00	70.00	80.00
1550	41.33	51.67	62.00	72.33	82.67
1600	42.67	53.33	64.00	74.67	85.33
1650	44.00	55.00	66.00	77.00	88.00
1700	45.33	56.67	68.00	79.33	90.67
1750	46.67	58.33	70.00	81.67	93.33
1800	48.00	60.00	72.00	84.00	96.00
1850	49.33	61.67	74.00	86.33	98.67
1900	50.67	63.33	76.00	88.67	101.33
1950	52.00	65.00	78.00	91.00	104.00
2000	53.33	66.67	80.00	93.33	106.67

DAIRY COLD STORAGE CHART FOR REACN- IN UNITS

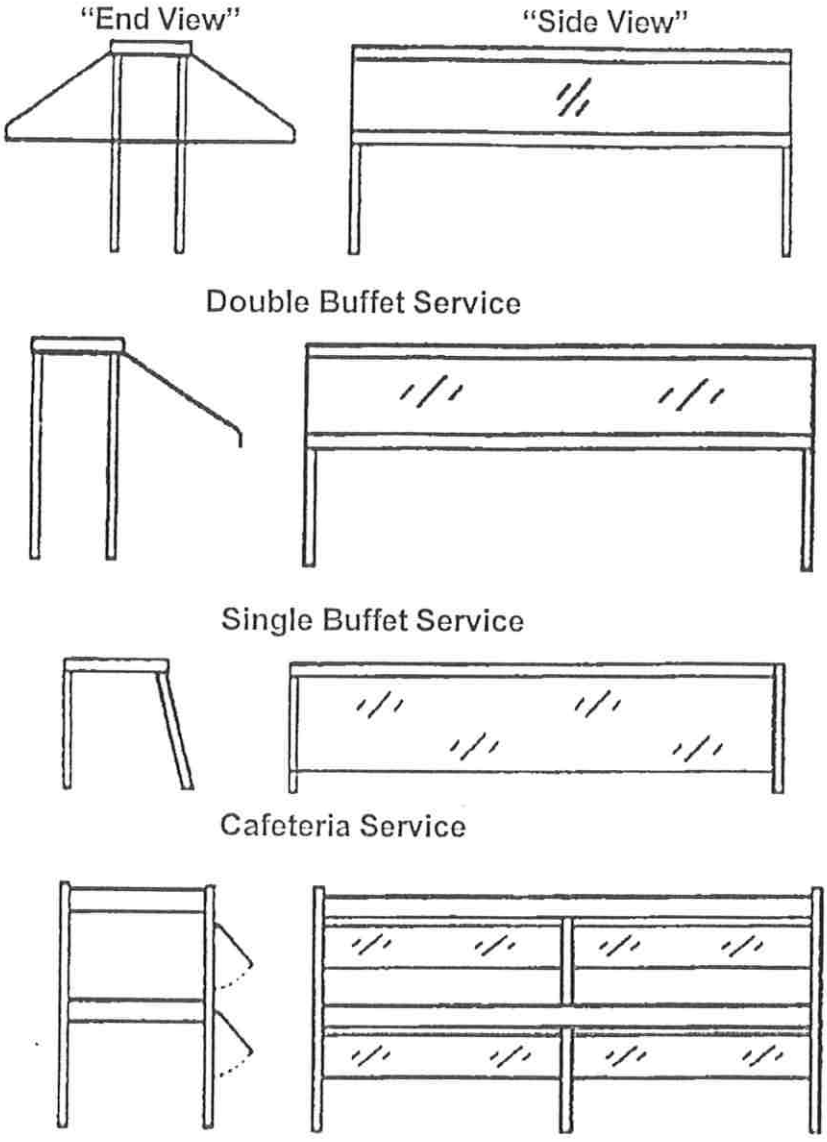
number of meals meals served between deliveries	storage per cu. ft. per 0.007 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.009 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.011 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.013 Cu. Ft. per meal per number meals served	storage per cu. ft. per 0.015 Cu. Ft. per meal per number meals served
200	1.87	2.40	2.93	3.47	4.00
250	2.33	3.00	3.67	4.33	5.00
300	2.80	3.60	4.40	5.20	6.00
350	3.27	4.20	5.13	6.07	7.00
400	3.73	4.80	5.87	6.93	8.00
450	4.20	5.40	6.60	7.80	9.00
500	4.67	6.00	7.33	8.67	10.00
550	5.13	6.60	8.07	9.53	11.00
600	5.60	7.20	8.80	10.40	12.00
650	6.07	7.80	9.53	11.27	13.00
700	6.53	8.40	10.27	12.13	14.00
750	7.00	9.00	11.00	13.00	15.00
800	7.47	9.60	11.73	13.87	16.00
850	7.93	10.20	12.47	14.73	17.00
900	8.40	10.80	13.20	15.60	18.00
950	8.87	11.40	13.93	16.47	19.00
1000	9.33	12.00	14.67	17.33	20.00
1050	9.80	12.60	15.40	18.20	21.00
1100	10.27	13.20	16.13	19.07	22.00
1150	10.73	13.80	16.87	19.93	23.00
1200	11.20	14.40	17.60	20.80	24.00
1250	11.67	15.00	18.33	21.67	25.00
1300	12.13	15.60	19.07	22.53	26.00
1350	12.60	16.20	19.80	23.40	27.00
1400	13.07	16.80	20.53	24.27	28.00
1450	13.53	17.40	21.27	25.13	29.00
1500	14.00	18.00	22.00	26.00	30.00
1550	14.47	18.60	22.73	26.87	31.00
1600	14.93	19.20	23.47	27.73	32.00
1650	15.40	19.80	24.20	28.60	33.00
1700	15.87	20.40	24.93	29.47	34.00
1750	16.33	21.00	25.67	30.33	35.00
1800	16.80	21.60	26.40	31.20	36.00
1850	17.27	22.20	27.13	32.07	37.00
1900	17.73	22.80	27.87	32.93	38.00
1950	18.20	23.40	28.60	33.80	39.00
2000	18.67	24.00	29.33	34.67	40.00

For additional formulas and information, other references to refer to include:

North American Association of Food Equipment Manufacturers. An Introduction to the Food Service Industry. First Edition, 1995

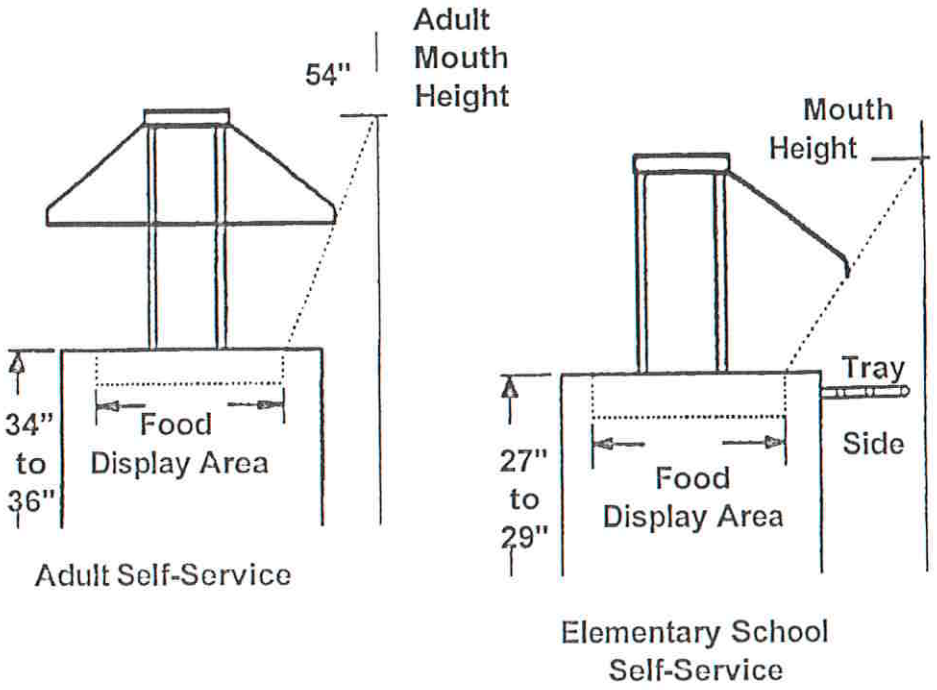
Salvato Textbook. Environmental Engineering & Sanitation 4th Edition. John Wiley & Sons, Inc. United States, 1992.

Kramer Engineering Data, Catalog No. R-114, Kramer-Trenton Co., Trenton, N.J.



Buffet or Smorgasbord Shielding

Figure 3-2



Buffet or Smorgasbord Shielding

Figure 3-3

PART 3 - FACILITIES TO PROTECT FOOD

Adequate facilities must be provided to promote good hygienic practices, sanitary food handling and to minimize the potential of cross contamination between ready-to-eat and raw products.

GENERAL FOOD PROTECTION

Provide a separate food preparation area for handling, washing and preparing raw meat, fish, and poultry, if served. Where portable cutting boards are planned, they should be color coded or labeled for specific use.

All food being displayed, served, or held must be adequately protected from contamination by the use of: packaging; serving line, storage or salad bar protector devices; display cases; or by other effective means, including dispensers.

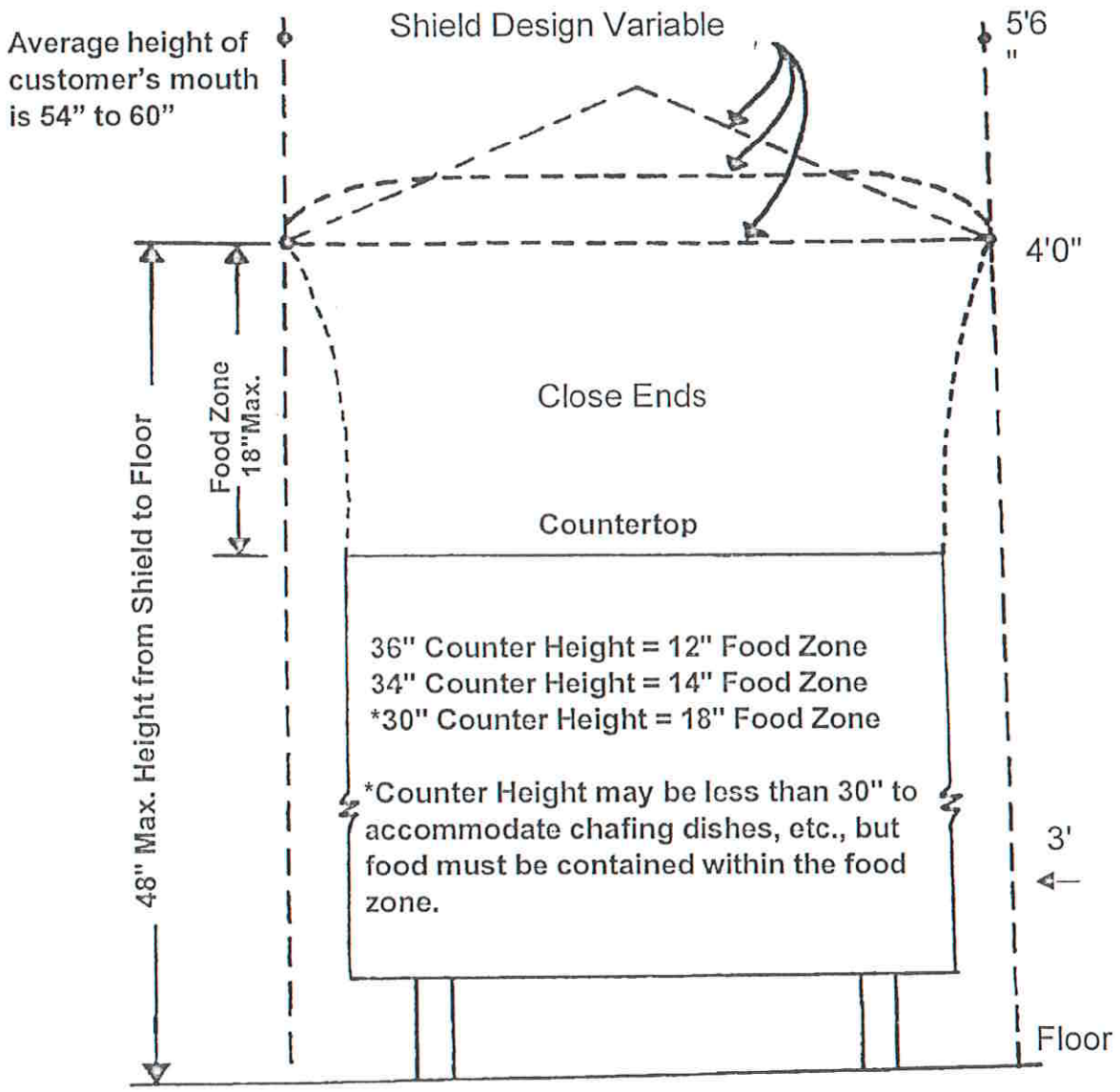
Salad bars and sneeze guards shall comply with the standards of an ANSI accredited certification program. The food shield should intercept the direct line between the customer's mouth and the food on display. On the average, the vertical distance from the customer's mouth to the floor is 4'6" to 5'. This average must be adjusted for children in educational institutions, and for other special installations such as to accommodate the wheel chair bound. See figure #3-1 through 3-3.

Running water dipping wells should be provided for the in-use storage of dispensing utensils where frozen desserts are being portioned and dispensed.

Cleaned equipment and utensils shall be stored in a clean, dry location where they are not exposed to splash, dust, or other contamination. This should be of particular concern at salad bars and waitress stations.

FOOD PREPARATION SINK

Provide separate areas to segregate food handling operations involving raw and ready-to-eat products. For washing raw fruits and vegetables, it is advisable to provide a separate food preparation sink with a minimum 18" drainboard.



"End View"

Buffet or Smorgasbord Shielding

Figure 3-1

PART 4 - HANDWASHING

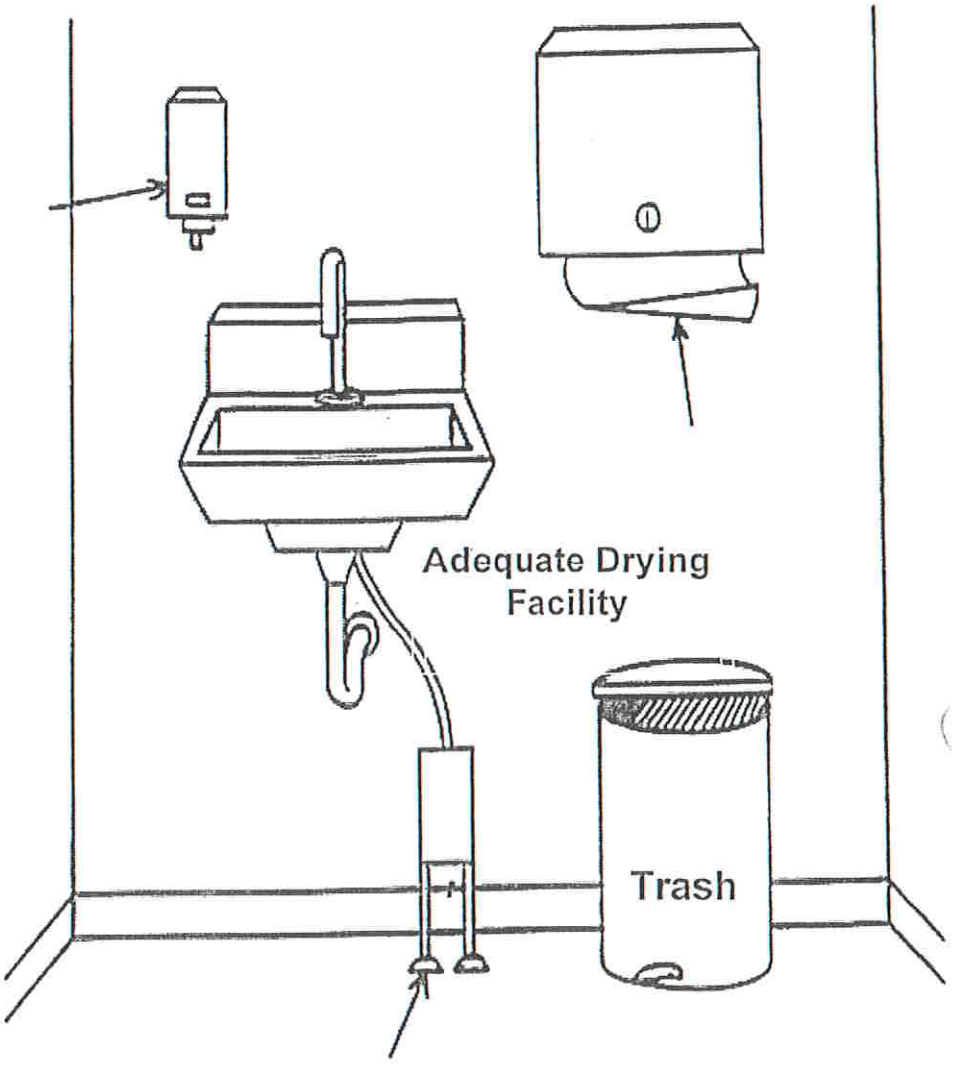
HANDWASHING FACILITY

Provide a separate handwashing sink; hand drying device, or disposable towels; supply of hand cleaning agent; and waste receptacle for each food preparation area, utensil washing area, and toilet room (required number based on law). Sinks used for food preparation or for washing equipment or utensils shall not be used for handwashing.

Each handwashing sink shall be provided with hot and cold water tempered by means of a mixing valve or a combination faucet to provide water at a temperature of at least 100•F. Any self-closing, slow-closing or metering faucet shall be designed to provide a flow of water for at least 15 seconds without the need to reactivate the faucet. See figure #4-1.

Handwashing sinks shall be of sufficient number and conveniently located for use by all employees in food preparation and utensil washing areas. Handwashing sinks shall be easily accessible and may not be used for purposes other than handwashing. It is suggested that a handwash sink be located within 25 feet of a work station. Splashguard protection is suggested if adequate spacing to adjoining food, food preparation, food contact surfaces, and utensil washing area surfaces (drainboards) is insufficient. Splash from a handwash sink may not contaminate food, equipment or utensils. A baffle or barrier may be needed if the handsink abuts a food preparation or service surface.

Soap
Dispenser
(used only for
hand-washing)



Handwash Sink
Example

Figure 4-1

PART 5 - WATER SUPPLY AND SEWAGE DISPOSAL

Where non-municipal water supply and sewage disposal are utilized, the location of these facilities shall be noted on the plans and certification of compliance with state and local regulations shall be provided.

WATER SUPPLY

Enough potable water for the needs of the food service establishment shall be provided from a source constructed and operated according to law.

Potable water from a municipal water supply is appropriate for the needs of a food service establishment.

The pumping and storage capacities, as well as the frequency of testing of a non-municipal water supply must be specified.

WATER USE DATA GUIDE (Suggested Formula)

-Pot sink = 49.399 gals. for a total fill 49.399 x 4 fills per day =	197.596 gals. per day
-Floor wash = 12 gals. 12 x 3 fills per day =	36 gals. per day
-General sanitation =	30 gals. per day
-Prep sink =15 gals 15 x 2 fills per day =	30 gals. per day
-3 Full time employees 3 x 30 gals. =	90 gals per day
-Dishmachine 46.2 gals x 2 meal periods=	92.4 gals. per day
Total Daily Usage =	476 gals. per day

SEWAGE DISPOSAL

All sewage including liquid waste shall be disposed of by a public sewage system or by a sewage disposal system constructed and operated according to law. If used, a grease trap shall be located to be easily accessible for cleaning.

PART 6 - EQUIPMENT AND INSTALLATION

All equipment in food establishments should be certified or classified for sanitation by an ANSI accredited certification program.

Equipment including ice makers and ice storage equipment shall not be located under exposed or unprotected sewer lines, open stairwells or other sources of contamination.

The following equipment installation requirements will help to ensure proper spacing and sealing which will allow for adequate and easy cleaning:

FLOOR MOUNTED EQUIPMENT

Whenever possible equipment should be mounted on approved castors or wheels to facilitate easy moving, cleaning, and flexibility of operation. Wheeled equipment requiring utility services should be provided with easily accessible quick-disconnects or the utility service lines should be flexible and of sufficient length to permit moving the equipment for cleaning. Check with local fire safety and building codes to ensure that such installations are acceptable. See figure #6-1 thru 6-3.

Floor-mounted equipment not mounted on wheels or castors with the above utility connections should be:

1. Sealed to the floor around the entire perimeter of the equipment (the sealing compound should be pliable but not gummy or sticky, non-shrinking, retain elasticity and provide a water and vermin-tight joint); or

2. Installed on a solid, smooth, non-absorbent masonry base. Masonry bases and curbs should have a minimum height of 2" and be coved at the junction of the platform and the floor with at least a 1/4" radius. The equipment should overhang the base by at least 1" but not more than 4". Spaces between the masonry base and the equipment must be sealed; or

3. Elevated on legs to provide at least a 6" clearance between the floor and equipment. The legs shall contain no hollow open ends. See figure #6-4.

4. Display shelving units, display refrigeration units and display freezers may be exempt from the above.

For equipment not readily moveable by one person, spacing between and behind equipment must be sufficient to permit cleaning. Provide at least 6" of clear unobstructed space under each piece of equipment. See figure #6-5.

If all the equipment butts against a wall it must be joined to it and/or sealed in a manner to prevent liquid waste, dust and debris from collecting between the wall and the equipment.

When equipment is butted together or spreader plates are used the resultant joint must prevent the accumulation of spillage and debris therein and must facilitate cleaning.

Provide unobstructed and functional aisle and working spaces between units of equipment. A minimum 36" width is recommended. See figure #6-6.

All utility and service lines and openings through the floor must be sealed adequately. Exposed vertical and horizontal pipes and lines must be kept to a minimum. The installation of exposed horizontal utility lines and pipes on the floor is prohibited. Any insulation materials used on utility pipes or lines in the food preparation or dishwashing areas must be smooth, non-absorbent and easy to clean. It is desirable that switch boxes, electrical control panels, wall mounted cabinets, etc. be installed out of the cooking and dishwashing areas. Electrical units which are installed in areas subject to splash from necessary cleaning operations or food preparation should be water-tight and washable.

TABLE MOUNTED EQUIPMENT

All table mounted equipment shall be:

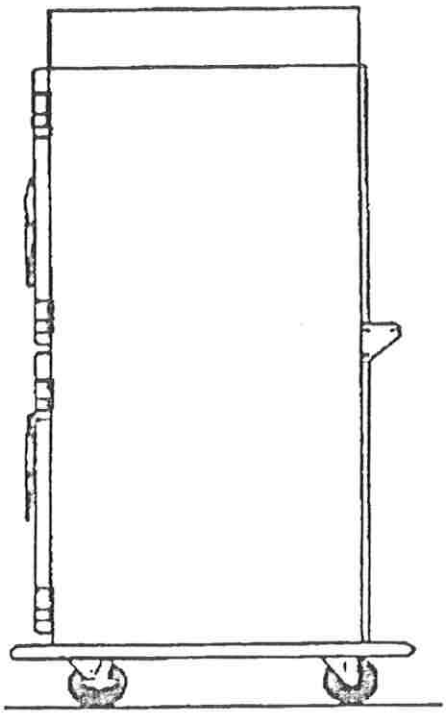
A. Sealed to the table or counter; or

B. Elevated on approved legs to provide at least a 4" clearance between the table or counter and equipment and installed to facilitate cleaning; or

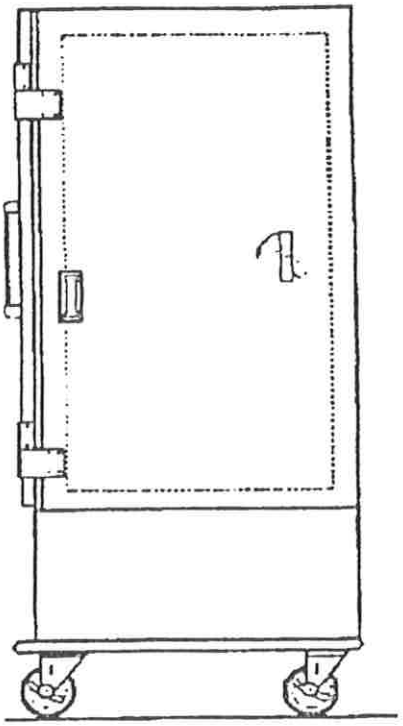
C. Portable: 30 pounds or less, no dimensions exceeding 36", no fixed utility connections.

Equipment open underneath, such as drain boards, dish tables, and other tables should be installed 4" away from the wall or sealed to the wall. Metal legs of all tables and sinks in food preparation areas should be made of stainless steel. The under-shelves of food preparation tables should also be made of stainless steel.

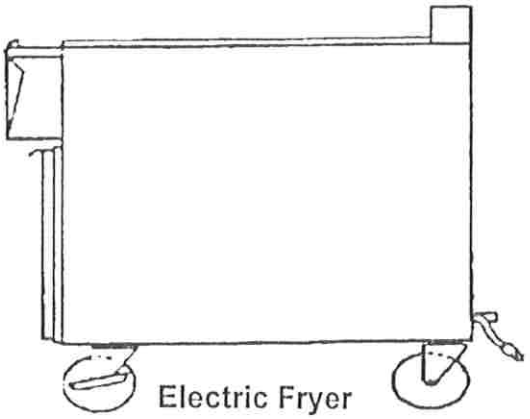
Other references are available for additional formulas and information. One such reference includes: North American Association of Food Equipment Manufacturers. An Introduction to the Food Service Industry. First Edition, 1995.



Holding Cabinet



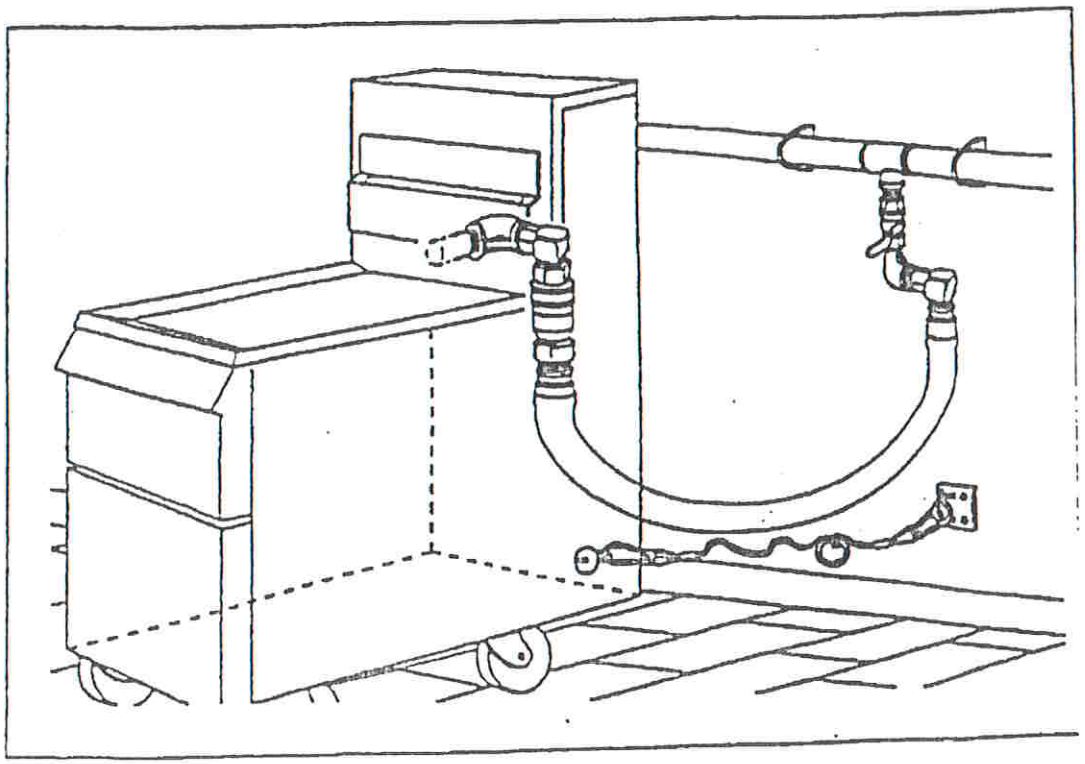
Reach-in Refrigerator



Electric Fryer

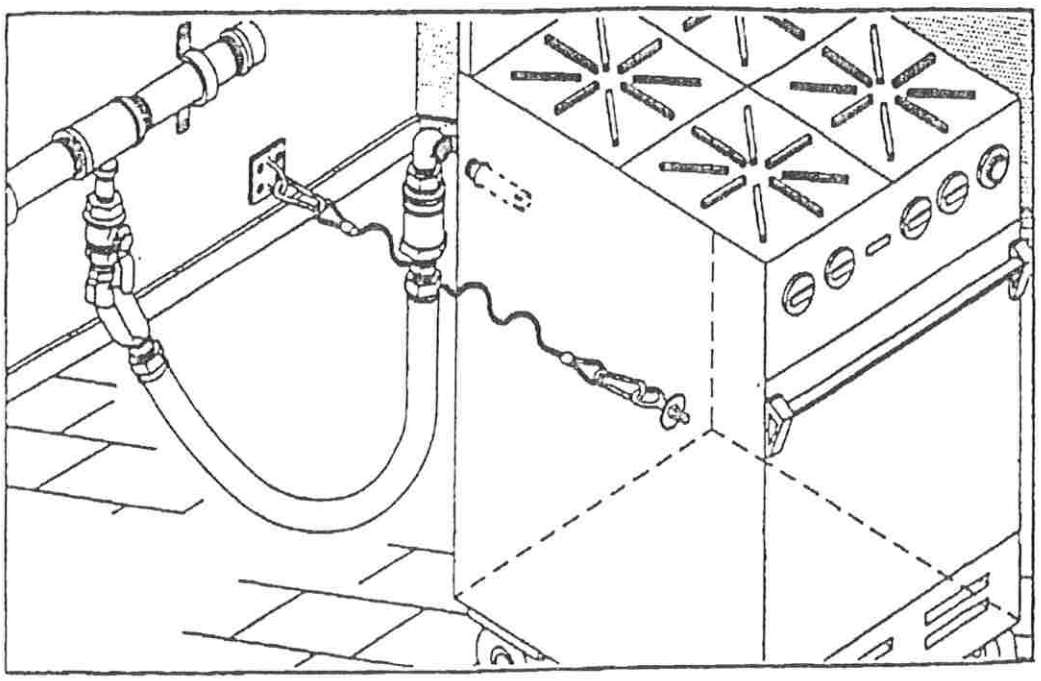
Kitchen Equipment Mounted On Castors

Figure 6-1



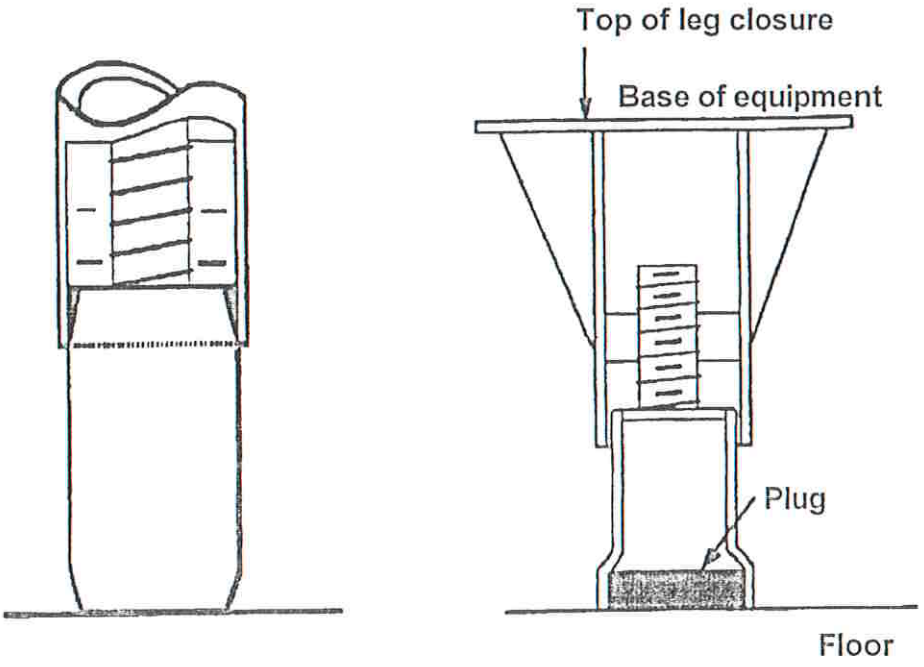
Flexible Gas Connector With Keeper Chain

Figure 6-2



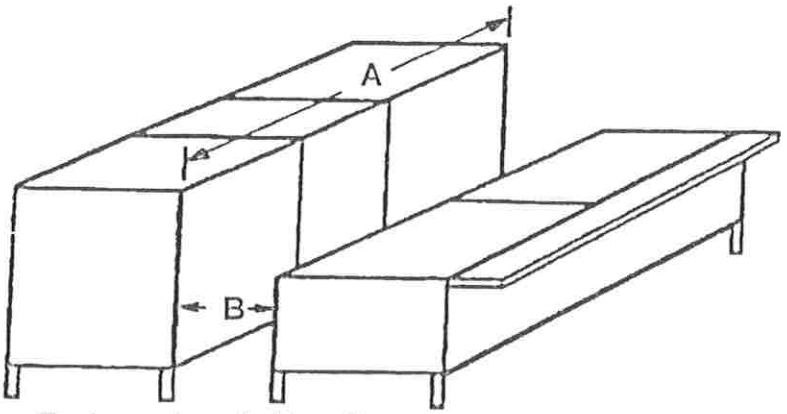
Flexible Gas Connector With Keeper Chain

Figure 6-3

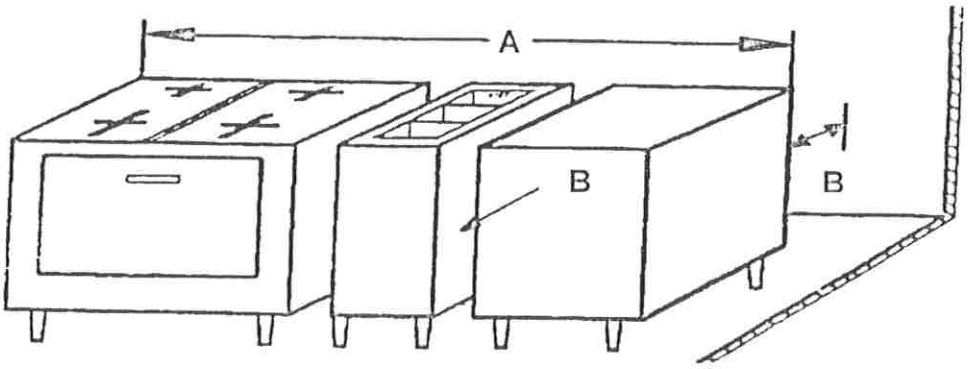


Floor Mounted

Figure 6-4



Equipment sealed together



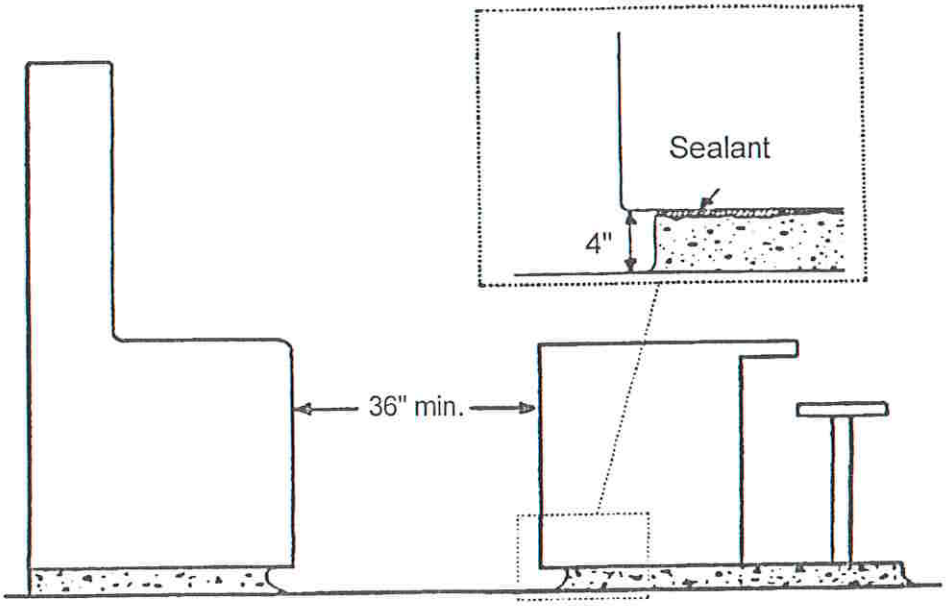
Equipment spaced apart

Recommended Equipment Spacing From Walls Provided Access is Available From Both Ends:

Equipment Length (A)	Space From Walls and Equipment (B)
4' or less	6"
4' - 8'	12"
8' or more	18"

Equipment Spacing

Figure 6-5



Floor Mounted Equipment

Figure 6-6

PART 7 - DRY STORAGE CONSIDERATION

The dry storage space required depends upon the menu, number of meals, quantities purchased, and frequency of delivery. The location of the storeroom should be adjacent to the food preparation area and convenient to receiving. Adequate ventilation should be provided. Ideally, the storeroom should be free of uninsulated steam and water pipes, water heaters, transformers, refrigeration condensing units, steam generators or other heat producing equipment. Temperatures of 50°F to 70°F are recommended.

A suggested formula used in estimating required storage space is as follows:

$$\text{Required Storage Area (square feet)} = \frac{\text{Volume per meal} \times \text{Number of meals between deliveries}}{\text{Average height} \times \text{Fraction of usable storeroom floor area}}$$

(1) Volume per meal = .025 to .050 cu. ft. per meal served
(2) Useful storeroom height = 4 to 7 feet
(3) Storage time between deliveries = 3 to 14 days
(4) Fraction of useable storeroom floor area = .3 to .6

For example assume 100 meals per day and a 10 day storage between deliveries = 1000 meals for which to provide storage:

$$\text{Required Storage Area} = \frac{.05 \text{ cubic feet} \times 1000 \text{ meals}}{5 \text{ feet} \times .3}$$

Required Storage Area = 33 square feet

Shelving can be constructed of suitably finished hard wood, durable plastic or preferably of corrosion resistant metal. The highest shelf for practical use is 7' and the lowest one should be 6" from the floor. Clearance between the shelves should be at least 15". Sufficient moveable dunnage racks and dollies (with smooth surfaces, cleanable in case of food spillage or package breakage) should be provided to store all food containers at least 6" above the floor.

Dunnage racks, pallets, etc. should be spaced sufficiently from walls to allow for vermin monitoring and inspection. A space of 18" is recommended. Wooden shelving and pallets require a higher level of maintenance and are more conducive to vermin infestation. Food containers shall not be stored under exposed or unprotected sewer lines or leaking water lines. Approved food containers with tight-fitting covers and dollies should be used for storing bulk foods such as flour, cornmeal, sugar, dried beans, rice and similar foods. Scoops are needed for each food storage container in use.

DRY STORAGE CALCULATION EXAMPLES:

Two suggested formulas used in estimating required storage space are as follows:

Formula # 1 - Linear feet of shelving for storage (ft) =

$$\frac{\text{Volume per meal x number of meals between deliveries}}{D \times H \times C}$$

D = Depth of the shelves in feet
H = Clearance between shelves in feet
C = 80% effective capacity of shelf height

For example, assume 400 meals per day and a 10 day storage between deliveries = 4000 meals for which to provide storage, Volume of .035 per meal, shelf depth of 18 inches, clearance of 18 inches between shelves and 80% effective capacity of shelf height:

Linear feet of shelving for storage (ft.) = $\frac{.035 \text{ cu. ft} \times 4000 \text{ meals}}{1.5 \text{ ft.} \times 1.5 \text{ ft.} \times 80\%} = 77.77$ Linear feet

Formula # 2 – Required Storage Area (sq. ft.) =

$$\frac{\text{Volume per meal x number of meals between deliveries}}{\text{Average height x fraction of usable storeroom floor area}}$$

(1) Volume per meal = .025 to .050 cu. ft. per meal served (2) Useful storage height = 4 to 7 feet.
(2) Storage time between deliveries = 3 to 14 days
(3) Fraction of useable storeroom floor area = .3 to .6

For example, assume 100 meals per day and a 10 day storage between deliveries = 4000 meals for which to provide storage:

Required Storage Area = .05 cu. ft. x 1000 meals 5 ft. x.3

Required Storage Area = 33 square feet

Cited on the next few pages are examples of dry storage calculations prepared by the North Carolina Department of Health, Food, Lodging and Institutional Sanitation Branch.

Other references are available for additional formulas and information. One such reference includes: Stipanuk, D.M., & Roffmann, H., Hospitality Facilities Management & Design, 1992.

Formula #1
Dry Storage Chart # 1

calculated storage area per .025 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	1 ft. deep by 1ft high shelves	1 ft. deep by 18 inches high shelves	1 ft. deep by 2ft high shelves
200	6.25	4.17	3.13
250	7.81	5.21	3.91
300	9.38	6.25	4.69
350	10.94	7.29	5.47
400	12.50	8.33	6.25
450	14.06	9.38	7.03
500	15.63	10.42	7.81
550	17.19	11.46	8.59
600	18.75	12.50	9.38
650	20.31	13.54	10.16
700	21.88	14.58	10.94
750	23.44	15.63	11.72
800	25.00	16.67	12.50
850	26.56	17.71	13.28
900	28.13	18.75	14.06
950	29.69	19.79	14.84
1000	31.25	20.83	15.63

Formula #1
Dry Storage Chart # 2

Calculated storage area per .025 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	1.5 ft. deep by 1ft high shelves	1.5 ft. deep by 18 inches high shelves	1.5 ft. deep by 2ft high shelves
200	4.17	2.78	2.08
250	5.21	3.47	2.60
300	6.25	4.17	3.13
350	7.29	4.86	3.65
400	8.33	5.56	4.17
450	9.38	6.25	4.69
500	10.42	6.94	5.21
550	11.46	7.64	5.73
600	12.50	8.33	6.25
650	13.54	9.03	6.77
700	14.58	9.72	7.29
750	15.63	10.42	7.81
800	16.67	11.11	8.33
850	17.71	11.81	8.85
900	18.75	12.50	9.38
950	19.79	13.19	9.90
1000	20.83	13.89	10.42

Formula #1
Dry Storage Chart # 3

calculated storage area per .025 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	2 ft. deep by 1ft high shelves	2 ft. deep by 18inches high shelves	2 ft. deep by 2ft high shelves
200	3.13	2.08	1.56
250	3.91	2.60	1.95
300	4.69	3.13	2.34
350	5.47	3.65	2.73
400	6.25	4.17	3.13
450	7.03	4.69	3.52
500	7.81	5.21	3.91
550	8.59	5.73	4.30
600	9.38	6.25	4.69
650	10.16	6.77	5.08
700	10.94	7.29	5.47
750	11.72	7.81	5.86
800	12.50	8.33	6.25
850	13.28	8.85	6.64
900	14.06	9.38	7.03
950	14.84	9.90	7.42
1000	15.63	10.42	7.81

Formula #1
Dry Storage Chart # 4

calculated storage area per .03 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	1 ft. deep by 1ft high shelves	1 ft. deep by 18 inches high shelves	1 ft. deep by 2ft high shelves
200	7.50	5.00	3.75
250	9.38	6.25	4.69
300	11.25	7.50	5.63
350	13.13	8.75	6.56
400	15.00	10.00	7.50
450	16.88	11.25	8.44
500	18.75	12.50	9.38
550	20.63	13.75	10.31
600	22.50	15.00	11.25
650	24.38	16.25	12.19
700	26.25	17.50	13.13
750	28.13	18.75	14.06
800	30.00	20.00	15.00
850	31.88	21.25	15.94
900	33.75	22.50	16.88
950	35.63	23.75	17.81
1000	37.50	25.00	18.75

Formula #1
Dry Storage Chart # 5

calculated storage area per .03 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	1.5 ft. deep by 1ft high shelves	1.5 ft. deep by 18 inches high shelves	1.5 ft. deep by 2ft high shelves
200	5.00	3.33	2.50
250	6.25	4.17	3.13
300	7.50	5.00	3.75
350	8.75	5.83	4.38
400	10.00	6.67	5.00
450	11.25	7.50	5.63
500	12.50	8.33	6.25
550	13.75	9.17	6.88
600	15.00	10.00	7.50
650	16.25	10.83	8.13
700	17.50	11.67	8.75
750	18.75	12.50	9.38
800	20.00	13.33	10.00
850	21.25	14.17	10.63
900	22.50	15.00	11.25
950	23.75	15.83	11.88
1000	25.00	16.67	12.50

Formula #1
Dry Storage Chart #6

calculated storage area per .03 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	2 ft. deep by 1ft high shelves	2 ft. deep by 18inches high shelves	2 ft. deep by 2ft high shelves
200	3.75	2.50	1.88
250	4.69	3.13	2.34
300	5.63	3.75	2.81
350	6.56	4.38	3.28
400	7.50	5.00	3.75
450	8.44	5.63	4.22
500	9.38	6.25	4.69
550	10.31	6.88	5.16
600	11.25	7.50	5.63
650	12.19	8.13	6.09
700	13.13	8.75	6.56
750	14.06	9.38	7.03
800	15.00	10.00	7.50
850	15.94	10.63	7.97
900	16.88	11.25	8.44
950	17.81	11.88	8.91
1000	18.75	12.50	9.38

Formula #1
Dry Storage Chart # 7

calculated storage area per .035 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	1 ft. deep by 1ft high shelves	1 ft. deep by 18 inches high shelves	1 ft. deep by 2ft high shelves
200	8.75	5.83	4.38
250	10.94	7.29	5.47
300	13.13	8.75	6.56
350	15.31	10.21	7.66
400	17.50	11.67	8.75
450	19.69	13.13	9.84
500	21.88	14.58	10.94
550	24.06	16.04	12.03
600	26.25	17.50	13.13
650	28.44	18.96	14.22
700	30.63	20.42	15.31
750	32.81	21.88	16.41
800	35.00	23.33	17.50
850	37.19	24.79	18.59
900	39.38	26.25	19.69
950	41.56	27.71	20.78
1000	43.75	29.17	21.88

Formula #1
Dry Storage Chart # 8

calculated storage area per .035 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	1.5 ft. deep by 1ft high shelves	1.5 ft. deep by 18 inches high shelves	1.5 ft. deep by 2ft high shelves
200	5.83	3.89	2.92
250	7.29	4.86	3.65
300	8.75	5.83	4.38
350	10.21	6.81	5.10
400	11.67	7.78	5.83
450	13.13	8.75	6.56
500	14.58	9.72	7.29
550	16.04	10.69	8.02
600	17.50	11.67	8.75
650	18.96	12.64	9.48
700	20.42	13.61	10.21
750	21.88	14.58	10.94
800	23.33	15.56	11.67
850	24.79	16.53	12.40
900	26.25	17.50	13.13
950	27.71	18.47	13.85
1000	29.17	19.44	14.58

Formula #1
Dry Storage Chart # 9

calculated storage area per .035 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	2 ft. deep by 1ft high shelves	2 ft. deep by 18inches high shelves	2 ft. deep by 2ft high shelves
200	4.38	2.92	2.19
250	5.47	3.65	2.73
300	6.56	4.38	3.28
350	7.66	5.10	3.83
400	8.75	5.83	4.38
450	9.84	6.56	4.92
500	10.94	7.29	5.47
550	12.03	8.02	6.02
600	13.13	8.75	6.56
650	14.22	9.48	7.11
700	15.31	10.21	7.66
750	16.41	10.94	8.20
800	17.50	11.67	8.75
850	18.59	12.40	9.30
900	19.69	13.13	9.84
950	20.78	13.85	10.39
1000	21.88	14.58	10.94

Formula #1
Dry Storage Chart # 10

calculated storage area per .04 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	1 ft. deep by 1ft high shelves	1 ft. deep by 18 inches high shelves	1 ft. deep by 2ft high shelves
200	10.00	6.67	5.00
250	12.50	8.33	6.25
300	15.00	10.00	7.50
350	17.50	11.67	8.75
400	20.00	13.33	10.00
450	22.50	15.00	11.25
500	25.00	16.67	12.50
550	27.50	18.33	13.75
600	30.00	20.00	15.00
650	32.50	21.67	16.25
700	35.00	23.33	17.50
750	37.50	25.00	18.75
800	40.00	26.67	20.00
850	42.50	28.33	21.25
900	45.00	30.00	22.50
950	47.50	31.67	23.75
1000	50.00	33.33	25.00

Formula #1
Dry Storage Chart # 11

calculated storage area per .04 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	1.5 ft. deep by 1ft high shelves	1.5 ft. deep by 18 inches high shelves	1.5 ft. deep by 2ft high shelves
200	6.67	4.44	3.33
250	8.33	5.56	4.17
300	10.00	6.67	5.00
350	11.67	7.78	5.83
400	13.33	8.89	6.67
450	15.00	10.00	7.50
500	16.67	11.11	8.33
550	18.33	12.22	9.17
600	20.00	13.33	10.00
650	21.67	14.44	10.83
700	23.33	15.56	11.67
750	25.00	16.67	12.50
800	26.67	17.78	13.33
850	28.33	18.89	14.17
900	30.00	20.00	15.00
950	31.67	21.11	15.83
1000	33.33	22.22	16.67

Formula #1
Dry Storage Chart # 12

calculated storage area per .04 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	2 ft. deep by 1ft high shelves	2 ft. deep by 18inches high shelves	2 ft. deep by 2ft high shelves
200	5.00	3.33	2.50
250	6.25	4.17	3.13
300	7.50	5.00	3.75
350	8.75	5.83	4.38
400	10.00	6.67	5.00
450	11.25	7.50	5.63
500	12.50	8.33	6.25
550	13.75	9.17	6.88
600	15.00	10.00	7.50
650	16.25	10.83	8.13
700	17.50	11.67	8.75
750	18.75	12.50	9.38
800	20.00	13.33	10.00
850	21.25	14.17	10.63
900	22.50	15.00	11.25
950	23.75	15.83	11.88
1000	25.00	16.67	12.50

Formula #1
Dry Storage Chart # 13

calculated storage area per .045 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	1 ft. deep by 1ft high shelves	1 ft. deep by 18 inches high shelves	1 ft. deep by 2ft high shelves
200	11.25	7.50	5.63
250	14.06	9.38	7.03
300	16.88	11.25	8.44
350	19.69	13.13	9.84
400	22.50	15.00	11.25
450	25.31	16.88	12.66
500	28.13	18.75	14.06
550	30.94	20.63	15.47
600	33.75	22.50	16.88
650	36.56	24.38	18.28
700	39.38	26.25	19.69
750	42.19	28.13	21.09
800	45.00	30.00	22.50
850	47.81	31.88	23.91
900	50.63	33.75	25.31
950	53.44	35.63	26.72
1000	56.25	37.50	28.13

Formula #1
Dry Storage Chart # 14

calculated storage area per .045 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	1.5 ft. deep by 1ft high shelves	1.5 ft. deep by 18 inches high shelves	1.5 ft. deep by 2ft high shelves
200	7.50	5.00	3.75
250	9.38	6.25	4.69
300	11.25	7.50	5.63
350	13.13	8.75	6.56
400	15.00	10.00	7.50
450	16.88	11.25	8.44
500	18.75	12.50	9.38
550	20.63	13.75	10.31
600	22.50	15.00	11.25
650	24.38	16.25	12.19
700	26.25	17.50	13.13
750	28.13	18.75	14.06
800	30.00	20.00	15.00
850	31.88	21.25	15.94
900	33.75	22.50	16.88
950	35.63	23.75	17.81
1000	37.50	25.00	18.75

Formula #1
Dry Storage Chart # 15

calculated storage area per .045 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	2 ft. deep by 1ft high shelves	2 ft. deep by 18 inches high shelves	2 ft. deep by 2ft high shelves
200	5.63	3.75	2.81
250	7.03	4.69	3.52
300	8.44	5.63	4.22
350	9.84	6.56	4.92
400	11.25	7.50	5.63
450	12.66	8.44	6.33
500	14.06	9.38	7.03
550	15.47	10.31	7.73
600	16.88	11.25	8.44
650	18.28	12.19	9.14
700	19.69	13.13	9.84
750	21.09	14.06	10.55
800	22.50	15.00	11.25
850	23.91	15.94	11.95
900	25.31	16.88	12.66
950	26.72	17.81	13.36
1000	28.13	18.75	14.06

Formula #1
Dry Storage Chart # 16

Calculated storage area per .05 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	1 ft. deep by 1ft high shelves	1 ft. deep by 18 inches high shelves	1 ft. deep by 2ft high shelves
200	12.50	8.33	6.25
250	15.63	10.42	7.81
300	18.75	12.50	9.38
350	21.88	14.58	10.94
400	25.00	16.67	12.50
450	28.13	18.75	14.06
500	31.25	20.83	15.63
550	34.38	22.92	17.19
600	37.50	25.00	18.75
650	40.63	27.08	20.31
700	43.75	29.17	21.88
750	46.88	31.25	23.44
800	50.00	33.33	25.00
850	53.13	35.42	26.56
900	56.25	37.50	28.13
950	59.38	39.58	29.69
1000	62.50	41.67	31.25

Formula #1
Dry Storage Chart # 17

calculated storage area per .05 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	1.5 ft. deep by 1ft high shelves	1.5 ft. deep by 18 inches high shelves	1.5 ft. deep by 2ft high shelves
200	8.33	5.56	4.17
250	10.42	6.94	5.21
300	12.50	8.33	6.25
350	14.58	9.72	7.29
400	16.67	11.11	8.33
450	18.75	12.50	9.38
500	20.83	13.89	10.42
550	22.92	15.28	11.46
600	25.00	16.67	12.50
650	27.08	18.06	13.54
700	29.17	19.44	14.58
750	31.25	20.83	15.63
800	33.33	22.22	16.67
850	35.42	23.61	17.71
900	37.50	25.00	18.75
950	39.58	26.39	19.79
1000	41.67	27.78	20.83

Formula #1
Dry Storage Chart # 18

Calculated storage area per .05 cu. ft. per meal served
Linear feet of storage shelf area need

Meals Served	2 ft. deep by 1ft high shelves	2 ft. deep by 18inches high shelves	2 ft. deep by 2ft high shelves
200	6.25	4.17	3.13
250	7.81	5.21	3.91
300	9.38	6.25	4.69
350	10.94	7.29	5.47
400	12.50	8.33	6.25
450	14.06	9.38	7.03
500	15.63	10.42	7.81
550	17.19	11.46	8.59
600	18.75	12.50	9.38
650	20.31	13.54	10.16
700	21.88	14.58	10.94
750	23.44	15.63	11.72
800	25.00	16.67	12.50
850	26.56	17.71	13.28
900	28.13	18.75	14.06
950	29.69	19.79	14.84
1000	31.25	20.83	15.63

Dry Storage Chart # 1 - Formula #2

calculated storage area per .025 cu. ft. per meal served						calculated storage area per .03 cu. ft. per meal served					
meals served	useful storeroom height	0.3 usable storeroom floor area	0.4 usable storeroom floor area	0.5 usable storeroom floor area	0.6 usable storeroom floor area	meals served	useful storeroom height	0.3 usable storeroom floor area	0.4 usable storeroom floor area	0.5 usable storeroom floor area	0.6 usable storeroom floor area
200	4	4.17	3.13	2.50	2.08	200	4	5.00	3.75	3.00	2.50
250	4	5.21	3.91	3.13	2.60	250	4	6.25	4.69	3.75	3.13
300	4	6.25	4.69	3.75	3.13	300	4	7.50	5.63	4.50	3.75
350	4	7.29	5.47	4.38	3.65	350	4	8.75	6.56	5.25	4.38
400	4	8.33	6.25	5.00	4.17	400	4	10.00	7.50	6.00	5.00
450	4	9.38	7.03	5.63	4.69	450	4	11.25	8.44	6.75	5.63
500	4	10.42	7.81	6.25	5.21	500	4	12.50	9.38	7.50	6.25
550	4	11.46	8.59	6.88	5.73	550	4	13.75	10.31	8.25	6.88
600	4	12.50	9.38	7.50	6.25	600	4	15.00	11.25	9.00	7.50
650	4	13.54	10.16	8.13	6.77	650	4	16.25	12.19	9.75	8.13
700	4	14.58	10.94	8.75	7.29	700	4	17.50	13.13	10.50	8.75
750	4	15.63	11.72	9.38	7.81	750	4	18.75	12.00	11.25	9.38
800	4	16.67	12.50	10.00	8.33	800	4	20.00	15.00	12.00	10.00
850	4	17.71	13.28	10.63	8.85	850	4	21.25	15.94	12.75	10.63
900	4	18.75	14.06	11.25	9.38	900	4	22.50	16.88	13.50	11.25
950	4	19.79	14.84	11.88	9.90	950	4	23.75	17.81	14.25	11.88
1000	4	20.83	15.63	12.50	10.42	1000	4	25.00	18.75	15.00	12.50

Dry Storage Chart # 2 - Formula #2

calculated storage area per .04 cu. ft. per meal served					
meals served	useful storeroom height	0.3 usable storeroom floor area	0.4 usable storeroom floor area	0.5 usable storeroom floor area	0.6 usable storeroom floor area
200	4	5.83	4.38	3.50	2.92
250	4	7.29	5.47	4.38	3.65
300	4	8.75	6.56	5.25	4.38
350	4	10.21	7.66	6.13	5.10
400	4	11.67	8.75	7.00	5.83
450	4	13.13	9.84	7.88	6.56
500	4	14.58	10.94	8.75	7.29
550	4	16.04	12.03	9.63	8.02
600	4	17.50	13.13	10.50	8.75
650	4	18.96	14.22	11.38	9.48
700	4	20.42	15.31	12.25	10.21
750	4	21.88	16.41	13.13	10.94
800	4	23.33	17.50	14.00	11.67
850	4	24.79	18.59	14.88	12.40
900	4	26.25	19.69	15.75	13.13
950	4	27.71	20.78	16.63	13.85
1000	4	29.17	21.88	17.50	14.58

calculated storage area per .04 cu. ft. per meal served					
meals served	useful storeroom height	0.3 usable storeroom floor area	0.4 usable storeroom floor area	0.5 usable storeroom floor area	0.6 usable storeroom floor area
200	4	6.67	5.00	4.00	3.33
250	4	8.33	6.25	5.00	4.17
300	4	10.00	7.50	6.00	5.00
350	4	11.67	8.75	7.00	5.83
400	4	13.33	10.00	8.00	6.67
450	4	15.00	11.25	9.00	7.50
500	4	16.67	12.50	10.00	8.33
550	4	18.33	13.75	11.00	9.17
600	4	20.00	15.00	12.00	10.00
650	4	21.67	16.25	13.00	10.83
700	4	23.33	17.50	14.00	11.67
750	4	25.00	18.75	15.00	12.50
800	4	26.67	20.00	16.00	13.33
850	4	28.33	21.25	17.00	14.17
900	4	30.00	22.50	18.00	15.00
950	4	31.67	23.75	19.00	15.83
1000	4	33.33	25.00	20.00	16.67

Dry Storage Chart # 3 - Formula #2

calculated storage area per .045 cu. ft. per meal served					
meals served	useful storeroom height	0.3 usable storeroom floor area	0.4 usable storeroom floor area	0.5 usable storeroom floor area	0.6 usable storeroom floor area
200	4	7.50	5.63	4.50	3.75
250	4	9.38	7.03	5.63	4.69
300	4	11.25	8.44	6.75	5.63
350	4	13.13	9.84	7.88	6.56
400	4	15.00	11.25	9.00	7.50
450	4	16.88	12.66	10.13	8.44
500	4	18.75	14.06	11.25	9.38
550	4	20.63	15.47	12.38	10.31
600	4	22.50	16.88	13.50	11.25
650	4	24.38	18.28	14.63	12.19
700	4	26.25	19.69	15.75	13.13
750	4	28.13	21.09	16.88	14.06
800	4	30.00	22.50	18.00	15.00
850	4	31.88	23.91	19.13	15.94
900	4	33.75	25.31	20.25	16.88
950	4	35.63	26.72	21.38	17.81
1000	4	37.50	28.13	22.50	18.75

calculated storage area per .05 cu. ft. per meal served					
meals served	useful storeroom height	0.3 usable storeroom floor area	0.4 usable storeroom floor area	0.5 usable storeroom floor area	0.6 usable storeroom floor area
200	4	8.33	6.25	5.00	4.17
250	4	10.42	7.81	6.25	5.21
300	4	12.50	9.38	7.50	6.25
350	4	14.58	10.94	8.75	7.29
400	4	16.67	12.50	10.00	8.33
450	4	18.75	14.06	11.25	9.38
500	4	20.83	15.63	12.50	10.42
550	4	22.92	17.19	13.75	11.46
600	4	25.00	18.75	15.00	12.50
650	4	27.08	20.31	16.25	13.54
700	4	29.17	21.88	17.50	14.58
750	4	31.25	23.44	18.75	15.63
800	4	33.33	25.00	20.00	16.67
850	4	35.42	26.56	21.25	17.71
900	4	37.50	28.13	22.50	18.75
950	4	39.58	29.69	23.75	19.79
1000	4	41.67	31.25	25.00	20.83

Dry Storage Chart # 4 - Formula #2

calculated storage area per .025 cu. ft. per meal served						calculated storage area per .03 cu. ft. per meal served					
meals served	useful storeroom height	0.3 usable storeroom floor area	0.4 usable storeroom floor area	0.5 usable storeroom floor area	0.6 usable storeroom floor area	meals served	useful storeroom height	0.3 usable storeroom floor area	0.4 usable storeroom floor area	0.5 usable storeroom floor area	0.6 usable storeroom floor area
200	5	3.33	2.50	2.00	1.67	200	5	4.00	3.00	2.40	2.00
250	5	4.17	3.13	2.50	2.08	250	5	5.00	3.75	3.00	2.50
300	5	5.00	3.75	3.00	2.50	300	5	6.00	4.50	3.60	3.00
350	5	5.83	4.38	3.50	2.92	350	5	7.00	5.25	4.20	3.50
400	5	6.67	5.00	4.00	3.33	400	5	8.00	6.00	4.80	4.00
450	5	7.50	5.63	4.50	3.75	450	5	9.00	6.75	5.40	4.50
500	5	8.33	6.25	5.00	4.17	500	5	10.00	7.50	6.00	5.00
550	5	9.17	6.88	5.50	4.58	550	5	11.00	8.25	6.60	5.50
600	5	10.00	7.50	6.00	5.00	600	5	12.00	9.00	7.20	6.00
650	5	10.83	8.13	6.50	5.42	650	5	13.00	9.75	7.80	6.50
700	5	11.67	8.75	7.00	5.83	700	5	14.00	10.50	8.40	7.00
750	5	12.50	9.38	7.50	6.25	750	5	15.00	11.25	9.00	7.50
800	5	13.33	10.00	8.00	6.67	800	5	16.00	12.00	9.60	8.00
850	5	14.17	10.63	8.50	7.08	850	5	17.00	12.75	10.20	8.50
900	5	15.00	11.25	9.00	7.50	900	5	18.00	13.50	10.80	9.00
950	5	15.83	11.88	9.50	7.92	950	5	19.00	14.25	11.40	9.50
1000	5	16.67	12.50	10.00	8.33	1000	5	20.00	15.00	12.00	10.00

Dry Storage Chart # 5 - Formula #2

calculated storage area per .035 cu. ft. per meal served						calculated storage area per .04 cu. ft. per meal served					
meals served	useful storeroom height	0.3 usable storeroom floor area	0.4 usable storeroom floor area	0.5 usable storeroom floor area	0.6 usable storeroom floor area	meals served	useful storeroom height	0.3 usable storeroom floor area	0.4 usable storeroom floor area	0.5 usable storeroom floor area	0.6 usable storeroom floor area
200	5	4.67	3.50	2.80	2.33	200	5	5.33	4.00	3.20	2.67
250	5	5.83	4.38	3.50	2.92	250	5	6.67	5.00	4.00	3.33
300	5	7.00	5.25	4.20	3.50	300	5	8.00	6.00	4.80	4.00
350	5	8.17	6.13	4.90	4.08	350	5	9.33	7.00	5.60	4.67
400	5	9.33	7.00	5.60	4.67	400	5	10.67	8.00	6.40	5.33
450	5	10.50	7.88	6.30	5.25	450	5	12.00	9.00	7.20	6.00
500	5	11.67	8.75	7.00	5.83	500	5	13.33	10.00	8.00	6.67
550	5	12.83	9.63	7.70	6.42	550	5	14.67	11.00	8.80	7.33
600	5	14.00	10.50	8.40	7.00	600	5	16.00	12.00	9.60	8.00
650	5	15.17	11.38	9.10	7.58	650	5	17.33	13.00	10.40	8.67
700	5	16.33	12.25	9.80	8.17	700	5	18.67	14.00	11.20	9.33
750	5	17.50	13.13	10.50	8.75	750	5	20.00	15.00	12.00	10.00
800	5	18.67	14.00	11.20	9.33	800	5	21.33	16.00	12.80	10.67
850	5	19.83	14.88	11.90	9.92	850	5	22.67	17.00	13.60	11.33
900	5	21.00	15.75	12.60	10.50	900	5	24.00	18.00	14.40	12.00
950	5	22.17	16.63	13.30	11.08	950	5	25.33	19.00	15.20	12.67
1000	5	23.33	17.50	14.00	11.67	1000	5	26.67	20.00	16.00	13.33