

SECTION III

Allegheny County Health Department *and* Conference for Food Protection

FOOD FACILITY PLAN REVIEW REFRIGERATION GUIDE

FOOD FACILITY GUIDE FOR DESIGN, INSTALLATION, AND CONSTRUCTION RECOMMENDATIONS

PART 2 - FACILITIES TO MAINTAIN PRODUCT TEMPERATURE

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 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 within 6 hours (140°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 .

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:

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

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 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 + 2°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:

<u>Type</u>	<u>Max Temp</u>	<u>Max Compressor Operating time</u>
Refrigerated buffet units	Cabinet air temp 41°F Food Temp 33-41°	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 140°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 coed 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 side 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 discharges 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.

**The following three charts are based on the volume of the meals, number of meals served and frequency of delivery.
To calculate 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 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
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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 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 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 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 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 REACH-IN UNITS

number of 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:
[FDA Plan Review Guide](#)

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.

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