Ice Machine Sizing Guide

QUICK REFERENCE SIZING GUIDE BY CUSTOMER USAGE

Application Sizing Guide (daily ice use)		CUSTOMERS (Figures include 20% safety factor) 100	250	500	1,000	1,500
Restaurant	1.5 lbs. ice per meal sold	180	450	900	1,800	2,700
Cocktail Bar	3.0 lbs. ice per seat	360	900	1,800	3,600	5,400
sWater Glass	6 oz. ice per 12 oz. glass	45	113	225	450	675
Salad Bar	35 lbs. of ice per cubic foot	---	---	---	---	---
Beverage Only	5 oz. ice per 7-10 oz. cup	38	94	188	375	563
Beverage Only	8 oz. ice per 12-16 oz. cup	60	150	300	600	900
Beverage Only	12 oz. ice per 18-24 oz. cup	90	225	450	900	1.350
Guest Ice	5 lbs. per hotel room	600	1,500	3,000	6,000	9,000
Hotel Catering	1 lb. per person	120	300	600	1,200	1,800
Patient Ice	10 lbs. per patient	1,200	3,000	6,000	12,000	18,000
Cafeteria	1 lb. per person served	120	300	600	1,200	1,800

QUICK SIZING GUIDELINES

To determine the ice usage in a bar or restaurant, count the number of chairs for customers, multiply that number by 3 lbs. of ice per bar stool and 1.5 lbs. per table seat. This should fulfill the customer's needs, unless they are offering self-serve beverages or there is an exceptionally large carry-out business. If the carry-out customer is at least one-third of the in-store business, add 1 lb. of ice for each carry-out customer.

Nursing home and hospital ice needs are calculated in much the same way. It is only necessary to count the number of beds and refer to the following amounts: Hospitals need 10 lbs. of ice per bed; nursing homes require 6 lbs. of ice per bed. Be sure to take into consideration other uses such as cafeterias and staff dining rooms, provided these areas do not have their own icemakers.

For churches or other places that use ice only once or twice a week, a small production machine on a large bin may be adequate and economical to fulfill an occasional need for ice. However, if this is done and two meetings are scheduled one after the other, the machine may not have time to adequately refill the bin before the start of the second engagement.

When calculating total daily ice usage make certain to include all anticipated ice usage. The final step is to consult the ice machine specification sheets for the model selected to determine its production capabilities under the operating conditions at the customer's place of business.

CALCULATION METHOD FOR SIZING ICE MACHINES AND STORAGE BINS

The quick reference sizing guide works well in many cases; however, customers use ice for numerous applications such as product cooling, self-serve beverages, product packaging, display and, in some cases, retail package sales. To meet customer needs, a more detailed calculation of ice usage and storage requirements is required.

SIZING ICE MACHINES

SELF-SERVE BEVERAGES OR CARRY-OUT

You need to know the size and quantity of drinks sold. Refer to the following table. This table assumes the cups are completely filled with ice.

Cup Size (fl. oz.)	Average Beverage (fl. oz.)	Average Ice (oz.)
6	3	3
12	6	6
16	8	8
20	10	10
32	16	16
48	24	24

After establishing the number of different sized cups sold in a busy day and multiplying that number by the quantities indicated, a fairly accurate estimate can be determined. If the establishment uses an ice-cooled beverage dispenser, iced salad bar or some other type of display that requires ice, the amounts needed are examined separately under product Display/Packing and Cold plate Cooling Sections.

COLD PLATE COOLING

To calculate the amount of ice consumed cooling the cold plate, choose the appropriate operating condition and multiply by the "average amount of beverage" in the "average cup size."

Soda/Syrup Inlet Temperature						
Drinks per min.	50	60	70	80	90	100
2	0.6	1.1	1.7	2.3	2.8	3.4
4	1.1	2.3	3.4	4.5	5.6	6.8
6	1.7	3.4	5.1	6.8	8.5	10.2
8	2.3	4.5	6.8	9.0	11.3	13.5
10	2.6	5.6	8.5	11.3	14.1	16.9
12	3.4	6.8	10.2	13.5	16.9	20.3
14	3.9	7.9	11.8	15.8	19.7	23.7

EXAMPLE:

Find the amount of ice "burned" on a cold plate for a system that has the following operating conditions:

1. 80ºF inlet soda/syrup temperature
2. 6 vends/minute
3. 18 fl. oz. average amount of beverage drink

Therefore:
From the table choose row "6" and column "80."
This gives a constant of **6.8**.
6.8 x 18 = 122.4 lbs./hour

PRODUCT DISPLAY/PACKING

To size an icemaker to handle product display or packing, it is necessary to determine the cubic feet of ice needed in 24 hours (length x width x depth). Since the calculations are done using the foot as a standard unit of measure, the depth must be converted into feet. If the depth is less than 12 inches, divide depth required by 12 to make the conversion to feet. A cubic foot of ice weighs approximately 35 lbs., so multiply the cubic feet of space to be used for product display or packing by 35 to determine the ice needs for a 24-hour period.

EXAMPLE:

A supermarket has a fish display case that is 25 feet long and 3 feet deep. They wish to set the fish in ice to a depth of 6 inches (6 inches = .50 foot).

- Ice requirement for 24 hours: 25 ft. x 3 ft. x .5 ft. = 37.5 cu. ft.
- 37.5 cu. ft. x 35 lbs. = 1312 lbs.

SAMPLE:

A restaurant has 200 table seats with 4 turns per night, 20 stools at the bar and a salad bar that measures 6 ft. x 3 ft. with a required ice depth of 4 inches.

General ice usage:	20 (bar stools) x 3 lbs. = 60 lbs.
	200 (seats) x 4 (turns) x 1.5 lbs. - 1,200 lbs.
Product display:	6 ft. x 3 ft. x .33ft. = 5.4 cu. ft.
	5.4 cu. ft. x 35 lbs. = 189 lbs.

Finally, add all ice usage to determine the requirement for a 24-hour period:
1,200 lbs. + 60 lbs. + 189 lbs. = 1,449 lbs. ice per day

The above sizing methods assume that the icemaker will run continuously 24 hours a day. This total utilization of the icemaker gives the customer the most cost effective way of producing the required ice. It also requires the bin to be properly sized or the customer will run out of ice.

The example below shows how two operations can have very different usage patterns, yet still require the same size icemaker.

	Convenience Store	Restaurant
Monday	400 lbs.	Closed
Tuesday	400 lbs.	200 lbs.
Wednesday	400 lbs.	200 lbs.
Thursday	400 lbs.	200 lbs.
Friday	400 lbs.	700 lbs.
Saturday	400 lbs.	800 lbs.
Sunday	400 lbs.	700 lbs.
Weekly Total	2,800 lbs.	2,800 lbs.

Using our formula - 2, 800 lbs. wkly. usage ÷ 7 days x 1.2 ("safety factor") = 480 lbs. ice/day.

SIZING STORAGE BINS

When ice is used in equal amounts 7 days per week, as in our convenience store example, the storage bin can be sized to match the production capacity of the icemaker. Each day approximately 500 lbs. will be produced and 500 lbs. will be used.

Some people think that to size the bin they need only to match the bin to the highest day's usage. This will not always work and often results in a customer running out of ice. If we had used this method for the restaurant example above, we would have specified an 800 lb. bin. On Friday, the restaurant would have used 700 lbs. of ice, leaving 100 lbs. of ice in the bin. With Saturday's production of 500 lbs. we would have only 600 lbs. in the bin - and we would need 800 lbs. - leaving us 200 lbs. short on Saturday and again on Sunday. The result would be an unhappy customer.

This is the case in our restaurant example. There are three days - Friday, Saturday and Sunday - when the required amount of ice exceeds the production capacity of the icemaker (these are called "peaks"). In this case, the bin and not the icemaker should be sized to take care of these "peak" days. The best way to determine the size bin required is to work backwards from the last "peak" day - in this case Sunday. Take the amount by which each day's usage exceeds the 500 lb. daily production of the icemaker.

Sunday usage - 700 lbs. = 200 lbs. over production
Saturday usage -800 lbs. = 300 lbs. over production
Friday usage -700 lbs. = 200 lbs. over production
Total = 700 lbs. over production

Add the total (700 lbs.) to the daily production figure (500 lbs.) to get the bin capacity required to meet the restaurant's weekend demand for ice. This method tells us we need at least a 1,200 lb. bin.

Once you think you know the size of the bin required, you can check your estimate as follows: Assuming the bin is empty Sunday evening, 500 lbs. will be produced on Monday with no usage and another 500 lbs. on Tuesday for a total of 1,000 lbs. in the bin. Tuesday's usage of 200 lbs. will lower the bin contents to 800 lbs. but with 500 lbs. of production, the bin will be full at 1,200 lbs. on Wednesday. The same will be true for Thursday. As we enter the weekend peak period on Friday we have 1,200 lbs. in the bin from which we will use 700 lbs. This leaves 500 lbs. in the bin, plus 500 lbs. produced in 24 hours for a total of 1,000 lbs. Saturday's usage of 800 lbs. reduces the ice available to 200 lbs., plus 500 lbs. of production for a total of 700 lbs. - exactly the amount needed for Sunday's usage.

It's always a good idea to add the same 20% "safety factor" to the bin as we did to the icemaker. This adjusts for the ice voids and pyramiding that can occur in the bin. In the case of our restaurant, the addition of the "safety factor" means we would look for a bin with a storage capacity of approximately 1,400 lbs. (1,200 x 1.2 = 1,440). We can see that an icemaker rated at 500 lbs. of daily product would easily meet the needs of both of the previous examples, provided that the icemaker runs continuously.

A GENERAL REVIEW OF THE RULES FOR SIZING ICEMAKERS AND BINS

1. Ice needs are seldom uniform; more ice is generally needed in summer than in winter. Understanding the ice usage of the customer is a must to assure sufficient ice is available to meet peak demands. Remember, water temperature, as well as the surrounding air temperature, affect the output capacity of icemakers. Determine what these factors will be during the peak demand periods. Then verify the icemaker and storage bin selection by the preceding method and refer to the machine's production chart to determine the expected capacity under these conditions.

2. Determine the size of the icemaker required by dividing the "worst case" week's total ice usage by seven. Then add in a 20% "safety factor".

3. If equal amounts of ice are used each day (including weekends), size the bin to match the ice production.

4. If there are peaks (where a day's usage exceeds a day's production), size the bin to store adequate ice to meet the peak demand(s).

5. Remember that the per pound cost of making ice is about four times the per pound cost of storing ice. It's always much less expensive for the customer to meet their "peak" demands by using the storage bin when possible.

6. When sizing the bin, double-check the bin's true capacity, using the current ARI directory.

7. A final element to take into account is the shape of the bin, the location of the icemaker(s) on the bin, and the size and location of the icemaker(s') ice discharge. An ice discharge opening centered on an extremely wide bin will result in much more pyramiding and, therefore, less storage.

LOCATION

Always locate the ice machine where ambient temperatures will not fall below 50ºF nor rise above 100ºF.

CLEARANCE

Always make certain the ice machine and storage bin will fit through all doors and hallways leading to the final installation site. When installed, there must be a 6-inch air clearance on rear, top and right side of modular ice makers. Air intake and discharge areas require 6-inch clearance on all machines. Keep in mind when selecting the ice maker location that modular machines may be stacked to increase production capacity as requirements grow.

UTILITY CONNECTIONS

Electrical, water and drain connections must be within 6 feet of machine location. All connections must meet national, state and local codes.

ELECTRICAL REQUIREMENTS

Separate circuits, fuses and/or breakers are required for each icemaker or dispenser. Wire, fuse and circuit breaker sizes must be calculated by a qualified electrician, based on the model's specifications and must meet all national, state and local codes.

PLUMBING REQUIREMENTS

Ice machines must always be connected to the building's **cold** water supply. For proper operation, water temperatures must not exceed 45ºF-90ºF and pressure must be within 20-120 psi. Icemaker drain tubing must be a minimum of ½" I.D. Bin drain tubing must be a minimum of ¾" I.D. Icemaker and bin drains must be vented. Separate drain lines must be used for icemaker and bin. Water-cooled condenser drains must not be vented nor connected to icemaker or bin drain lines. All plumbing must meet national, state and local codes.