INSTRUCTIONS FOR USING THE
NORTH STAR CAPACITY GUIDANCE CURVE - METRIC

Reference: IMC-2-CS and IMC-2-SS -Metric (Revision D-March 4, 2010)

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The enclosed capacity curves are based on reasonably oil-free ammonia and 15.6ºC make-up water. In accordance with note #2 of our curve for Freon refrigerant the capacities are reduced by 5%. The other correction factor is the make-up water temperature and is derived in accordance to note #4. Add these two correction factors together to get the total correction percentage.

The capacity range of each of our ice makers consists of a shaded area and is identified by the model of the ice maker shown in the middle. The bottom of each shaded area represents 2mm thick ice and the top represents 1.5mm thick ice. In most applications 1.5mm thick ice is satisfactory. One application where we recommend using 2mm thick ice is if the ice is going to be stored aboard a boat for a long period of time or is to be conveyed by a pneumatic blower system.

In the lower right-hand corner of the curves is a graph that indicates the number of kw per thousand kgs of ice. This graph stops at 32°C make-up water but can be used for warmer water on a straight line basis. However, we don't recommend using high temperature water because the ice maker freezing surface is not efficient and too expensive to use as a water chiller. It would be more economical to provide a separate water chiller to cool the water to 5°C, particularly for the larger sized ice makers.

For the following example let's assume that a carbon steel freezing surface is acceptable, the refrigerant is ammonia and the make-up water temperature is 15.6°C. Therefore, there is no correction required to the curves. Assume the requirement is 25 metric tons per day of 2mm thick ice. This can be produced by a M-90 CS ice maker at -20°C evaporator temperature or by a M-60 CS at -26.5°C evaporator temperature. Refer to the water temperature graph in the lower right-hand corner. With 15.6°C water it requires 5.02 kW per 1,000 kg of ice. In both cases the refrigeration requirement would be 25 tons of ice x 5.02 kw of refrigeration per ton of ice or 125.5 kw of refrigeration. In this example it would be best to match condensing units to both ice makers to determine whether the larger ice maker with a smaller condensing unit is more economical than a smaller ice maker with a larger condensing unit. In addition to first cost, also compare the electrical cost per ton and consider the possible future need to increase capacity.

For another example, assume the requirement is 30 tons of ice per 24 hours with a stainless steel freezing surface, 1.5mm ice thickness, Freon refrigerant and a 20°C water supply. Refer to the water temperature graph for the stainless steel curves. With 20°C water it requires 4.34 kw per 1,000 kgs of ice. Enter the water temperature in the "CORRECTIONS" section in the lower left-hand corner of the sheet which would read 15.6 minus 20 divided by 5.6, times 6% which equals a -4.7% correction. The Freon refrigerant correction per note #2 is -5.0% for a total correction of -9.7%. The 1.5mm ice thickness is the top of the shaded area. The only ice maker that could produce 30 tons per day under these conditions would be the model 90 SS, so reduce the 1.5mm curve by -9.7% and where the corrected curve intersects with the 30 ton per day line would determine the evaporator temperature. Another way to determine the evaporator temperature is to divide 30 by 0.89 which equals 32.9 equivalent tons on the 1.5mm curve, or an evaporator temperature of approximately -27.5°C. The refrigeration load would be 30 times 4.34 kw per 1,000 kg of ice or 130.2 kw.

Lastly, select a compressor that closely or slightly exceeds the requirements determined in the above examples. For instance, in the first example of the model 60 CS machine, the requirement was 125.5 kw of refrigeration at a -26.5°C evaporator temperature. With the condensing temperature determined, enter the compressor ratings and read from the chart the capacity of the compressor in kw at a higher evaporator temperature than -26.5°C, for example, -20°C, and a second rating slightly lower than the requirement, for example a -30°C. Divide both of these kw ratings by 5.02 kw of refrigeration per ton of ice and plot the resultant numbers on the -20°C and -30°C temperature lines respectively. Draw a straight line between these two plotted points and where it crosses the corrected ice maker curve will determine the balancing point of the ice maker and compressor under the operating conditions noted.

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