What's a "Ton" in the HVAC World?

Tonnage ... the unit of measure used in air conditioning to describe the cooling capacity of a system. One ton of cooling is based on the amount of heat needed to melt one ton (2000 lbs.) of ice in a 24 hour period. One ton of cooling is equal to 12,000 Btu/hr.

Ton of refrigeration ... means its cooling capacity or heat removal capacity. One ton means the cooling effect equivalent to convert 1 ton (US short ton of 2,000 lb or 910 kg) of water into ice at the same temp. Since latent heat of ice (heat required to convert water into ice at the same temp.) is 80 Kcal/kg, one ton equals to 3000 Kcal/hr (Kilo calories per hour) or 12,000 BTU/hr (British Thermal Unit per hour).

Nameplate or Raw Capacity Tons(1 Ton = 12000 BTU/hr = cooling capacity of 1 ton of ice) This is what is stamped on the air conditioner. It is a considerable overestimate of how much cooling the air conditioner will actually provide.

Air Conditioning Term "Ton" 1 ton of capacity equals 12,000 Btu/hr ... for 24 hours

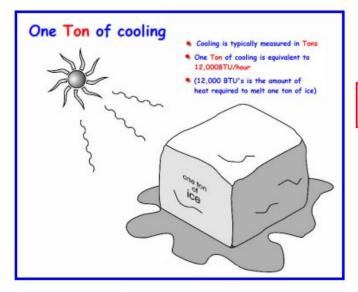
Background on the derivation for tons of refrigeration... and information on the similar SI standard

- The latent heat of fusion for ice is 144 BTU/lb. For one ton, that is 2000 lb x 144 BTU/lb, or 288,000 BTU. Refrigeration's roots are in the ice making industry, and the ice guys wanted to convert this into ice production. If 288,000 BTU are required to make one ton of ice, divide this by 24 hours to get 12,000 BTU/Hr required to make one ton of ice in one day.
- This is simply the requirement for the phase change from liquid to solid -- to convert +32 deg F water into +32 deg F ice. As a practical matter, additional refrigeration is required to take city water and turn it into ice.
- One BTU is the heat removal required to lower the temperature of one pound of water by one degree F. In SI units, kilocaries are used. One kilocalorie is the heat removal required to lower the temperature of one kilogram of water by one degree C. One ton of refrigeration is equal to 3024 kilocaries per hour. It is basically the 12,000 BTU/Hr divided by pounds per kilogram divided by 1.8 (to get from degrees F to degrees C).

"Tonnage trivia

- As a rule of thumb, 400 square feet can be cooled per 12,000 BTU/hr (12,000 BTU/hr equals one ton of air conditioning). However, other factors which will also affect the total heat load.
- Simply put, a one-ton air conditioner can remove 12,000 BTU from a space per hour.
- Since there are 12,000 BTUs/hr (for 24 hrs) in a ton, a 3-ton air conditioning unit will produce 36,000 BTUs and so forth. The size of the area to be cooled determines the correct size of the system in tons.
- To determine what size air conditioner a house needs, a contractor will conduct a heat gain/heat loss calculation, which enables the contractor to match the size of the unit to the BTU requirements of the specific house. A general rule of thumb for an average home is about 500 sq. ft. per ton.

How do We Translate BTUs to Tons of Air Conditioning or Cooling Capacity?



One ton of air conditioning capacity produces the same cooling ability as melting one ton of ice in 24 hours.

288,000 BTUs / 24 hours = 1 Ton of cooling

12,000 BTUs / hour = a 1-ton air conditioning system

Or if we know the total number of BTUs at which an air conditioning system is rated, since this number is usually given in BTUH or BTUs / hour, we just divide that number by 12,000 to get the number of tons of cooling capacity.

A 36,000 BTUh air conditioner is providing 36,000 / 12,000 or 3 Tons of cooling capability per hour.

If we know the number of tons of cooling capacity that an air conditioning system is rated for, we just multiply the number of air

conditioning capacity in Tons by 12,000 to get the number of BTUs of cooling capacity of the system.

A 3-ton air conditioner is providing 3 x 12,0000 or 36,000 BTUs of cooling capability per hour.

A ton is equal to 12,000 BIUs. Thus, a 2-ton air conditioner is equivalent to a 24,000 BTU air conditioner.

Definition of BTUs and BTUH: a BTU is one "British Thermal Unit" which is defined as the quantity of heat that would be required to increase the temperature of one pound of water by one degree Fahrenheit.

A BTUH is defined as the number of BTU's lost (if we're talking about heat loss or air conditioning), or provided (if we're talking about providing heat for a building) in one hour. You'll often see BTUH as a number on data plates on air conditioners and on heating systems.

One BTU is also equal to 252 calories. So what's a calorie?

Definition of Calorie or Calories: a calorie is defined as the quantity of heat needed to raise the temperature of one gram of water by one degree Centigrade

The "R" value of a material is its resistance to heat flow through the material. When buying various insulation materials you will almost always see an "R" value quoted for the material. In general, higher "R" means more resistance to heat loss and therefore lower heating or cooling bills for the building

Mathematically, "R" is simply the reciprocal of the two measures of resistance to heat flow "K" (R = 1/K) or "U" ($R_{(whole\ building)}$ = 1/U) defined below. "K" measures the heat flow through an individual substance and "U" measures the *overall* building heat loss by adding all of the various areas and substances together.

1 kW is 0.7457 horsepower 1 kWhr is 3,413 BTU/hr 1 ton is 12,000 BTU/hr

Sizing Chart Cooling

Base BTUsRecommended Air Conditioner BTUs			
Number of Rooms Cooled	Room Area MINimum Square Feet	Room Area MAXimum Square Feet	BTUs Needed
One		100	4,000 - 6,000
One	100	180	6,000 - 7,500
One	180	270	7,500 - 9,000
One	270	400	9,000 - 10,500
Several		400	10,500 - 12,000
Several	400	500	12,000 - 13,500
Several	500	700	13,500 - 15,000
Several	700	800	15,000 - 16,500
Large Areas		900	16,500 - 18,000
Large Areas	900	1000	18,000 - 19,500
Large Areas	1,000	1,100	19,500 - 21,000
Large Areas	1,000	1,100	19,500 - 21,000
Large Areas	1,100	1,200	12,000 - 22,500
Large Areas	1,200	1,500	22,500 - 24,000
Large Areas	1,500	1,700	24,000 - 25,500
Large Areas	1,700	1,900	25,500 - 27,000
Large Areas	1,900	2,200	27,000 - 28,500

Air Conditioning ... What is a SEER rating

- SEER ... seasonal energy efficiency ratio ... a measurement of efficiency for appliances.
- Central air conditioner efficiency ... determined by its SEER rating.
- SEER rating ... defined as the total cooling output (in British thermal units or Btu) provided by the unit during its normal annual usage period divided by its total energy input (in watt-hours) during the same period.
- Since 1992, the minimum efficiency standard for central air conditioners and heat pumps was set at 10 SEER.
- As of January 2006, the minimum efficiency level for all new central air conditioners manufactured must be at least 13 SEER.
- An air conditioner rated at 13 SEER uses 30 percent less electricity than a 10 SEER system.