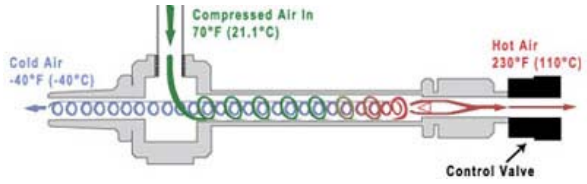
How Does a Vortex Tube Work?

What is a Vortex Tube?

It's your answer for instant cold air, where and when you need it, using nothing but compressed air as a power source. There's no maintenance, no mess, no explosion hazard, no electricty, no moving parts - just clean, cold air for industrial or laboratory spot cooling.



Vortex Tube Performance Data

Inlet Pressure psiG	Cold Fraction %						
	20	**30**	**40**	**50**	**60**	**70**	**80**
20	61.5	59.5	55.5	50.5	43.5	36.0	27.5
	14.5	24.5	36.0	49.5	64.0	82.5	107.0
40	88.0	85.0	80.0	73.0	62.5	51.5	38.0
	20.5	35.0	51.5	71.0	91.5	117.0	147.0
60	104.0	100.0	93.0	84.0	73.0	59.5	44.5
	23.5	40.0	58.5	80.0	104.0	132.0	168.0
80	115.0	110.0	102.0	92.0	80.0	65.5	49.0
	25.0	43.0	63.0	86.0	113.0	143.0	181.0
100	123.0	118.0	110.0	99.0	86.0	70.0	53.0
	26.0	45.0	66.5	91.0	119.0	151.0	192.0
120	129.0	124.0	116.0	104.0	90.5	74.0	55.0
	26.0	46.0	69.0	94/0	123.0	156.0	195.0
140	135.0	129.0	121.0	109.0	94.0	76.0	56.5
	25.5	46.0	70.5	96.0	124.0	156.0	193.0

Figures in pink area give temperature drop of cold air, °F
Figures in grey area give temperature rise of hot air, °F

How Does a Vortex Tube Work?

How *can* you get cold air and hot air from one compressed-air stream? Lots of people have tried to explain it, including the French physicist who invented the Vortex Tube in the 1930's, Georges Rangue. Many different theories have been put forward.

Vortex Tubes behave in a very predictable and controllable way. When compressed air is released into the tube through the vortex generator, you get hot air out of one end of the tube and cold air out the other. A small valve in the hot end, adjustable with the handy control knob, lets you adjust the volume and temperature of air released from the cold end.

The vortex generator—an interchangeable, stationary part—regulates the volume of compressed air, allowing you to alter the air flows and temperature ranges you can produce with the tube.

"Cold Fraction": an important term for understanding Vortex Tube performance

"Cold Fraction" is the percentage of input compressed air that's released through the cold end of the tube. As a rule of thumb, the less cold air you release, the colder the air will be. You adjust the cold fraction with the control knob.

Cold fraction is also a function of the type of vortex generator that's in the tube, i.e., a "high cold fraction" or "low cold fraction" generator.

Most industrial process applications use a high cold fraction (above 50%). A high cold fraction tube can easily give you cold outputs 50-90°F (28-50° C) *below* your compressed air temperature.

High cold fractions give you a greater air flow, but they don't give the lowest possible temperatures. The high cold fraction combination of airflow and cold temperature produces the maximum refrigeration capacity, or greatest Btu/H (Kcal/H).

A low cold fraction (below 50%) means a smaller volume of air coming out that's very cold (down to -40°F/-40°C). In short, the less air you release, the colder the air.

Just remember, your maximum Btu/H (Kcal/H) capacity (also called maximum cooling or refrigeration) occurs with a high cold fraction tube.

The chart to the left shows you the temperature drop (pink bar) and rise (grey bar) you can get at various inlet pressures and cold fraction settings.