

Vortex Tubes



Sub-Zero Spot Cooling using Compressed Air

Vortex tubes...our founding technology. More than 40 years ago, we pioneered the application of the vortex tube principle to solve industrial cooling problems.

Maintenance free,
no moving parts

Cycle repeatability
within – 1%
within – 1%
within – 1%

Drops inlet temperature by
up to 100°F

Cools without electricity
or refrigerants

Exceptionally reliable,
compact and lightweight

Over the years, thousands of companies of all sizes have used ITW Vortec vortex tubes on their equipment to spot cool a part or process, thermal test components, speed set solders or hot melt adhesives, and so much more. A vortex tube from ITW Vortec can produce up to 6000 BTUH of refrigeration or deliver temperatures down to -40°F.

Vortex Tubes are an effective, low cost solution to a wide variety of industrial spot and process cooling needs. With no moving parts, a vortex tube spins compressed air to separate the air into cold and hot air streams. While French physicist Georges Ranque is credited with inventing the vortex tube in 1930, ITW Vortec was the first company to develop and apply this phenomenon into practical and effective cooling solutions for industrial use. Vortex Tubes have a very wide range of application for spot cooling on machines, assembly lines and processes.

Vortex Tubes have many applications:

- ◆ Cool machine operations
- ◆ Temperature cycle parts
- ◆ Set solders and adhesives
- ◆ Cool cutter blades
- ◆ Cool heat seal operations
- ◆ Dry ink on labels and bottles
- ◆ Keep electronics cool
- ◆ Dehumidify gas samples
- ◆ Thermal test sensors



MODEL	AIR CONSUMPTION		CAPACITY (100 PSIG)	
	(SCFM)	(SLPM)	BTUH	kCAL/hr
106-2-H	2	57	100	25
106-4-H	4	113	255	64
106-8-H	8	226	400	101
208-11-H	11	311	640	161
208-15-H	15	425	900	227
208-25-H	25	708	1500	378
308-35-H	35	991	2650	668
328-50-H	50	1415	3000	756
328-75-H	75	2123	4500	1134
328-100-H	100	2830	6000	1512

Specifications are at 100 PSIG (6.9 Bar).

Vortex Tubes

The table below shows approximate temperature drop and rise achieved by vortex tubes when adjusted to various Cold Fractions. A Cold Fraction is the percentage of cold air produced versus total filtered compressed air consumed by any Vortex Tube.

COLD FRACTION	10		20		30		40		50		60		70		80		90		
	PSIG/BAR	F°	C°	F°	C°	F°	C°	F°	C°	F°	C°	F°	C°	F°	C°	F°	C°	F°	C°
20/1.4		63	35	62	34	60	33	56	31	51	28	44	24	36	20	28	15	17	9
		7	4	15	8	25	14	36	20	50	28	64	36	83	46	107	59	148	82
40/2.8		91	51	88	49	85	47	80	44	73	41	63	35	52	28	38	21	26	14
		9	5	21	11	35	19	52	29	71	39	92	51	117	65	147	82	220	122
60/4.1		107	59	104	58	100	56	93	52	84	47	73	41	60	33	45	25	29	16
		10	6	24	13	40	22	59	33	80	44	104	58	132	73	168	93	236	131
80/5.5		119	66	115	64	110	61	102	57	92	51	80	44	66	36	49	27	31	17
		11	7	25	14	43	24	63	35	86	48	113	63	143	79	181	101	249	138
100/6.9		127	71	123	68	118	66	110	61	99	55	86	48	71	39	53	29	33	18
		12	8	26	14	45	25	67	37	91	51	119	66	151	84	192	107	252	140
120/8.3		133	74	129	72	124	69	116	64	104	58	91	50	74	41	55	31	34	19
		13	8	27	14	46	26	69	38	94	52	123	68	156	87	195	108	257	142
140/9.7		139	78	135	75	129	72	121	67	109	61	94	52	76	42	57	32	35	20
		14	8	28	16	47	27	71	39	96	53	124	69	157	88	196	109	259	144

Table Baseline: Compressed air temperature: 70°F/21°C
 Pressure Dew Point: -69°F/-56°C (dry air)
 Backpressure: not to exceed 5 PSIG/0.4 Bar
 Numbers on the Blue Bar: Temperature Drop
 Numbers on the White Bar: Temperature Rise

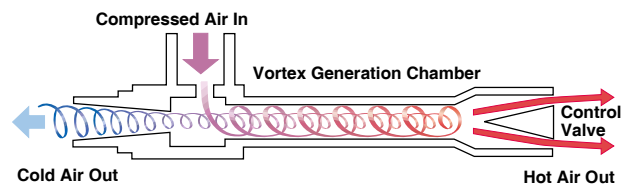
Air Flow - The total SCFM air consumption of any Vortex Tube is proportional to any particular absolute inlet pressure as follows:

$$\frac{(\text{PSIG} + 15) \times \text{Generator Rating}}{115} = \text{approximate total air consumption}$$

All Vortex Tubes are Easily Adjusted to Regulate Airflow Volume and Temperature

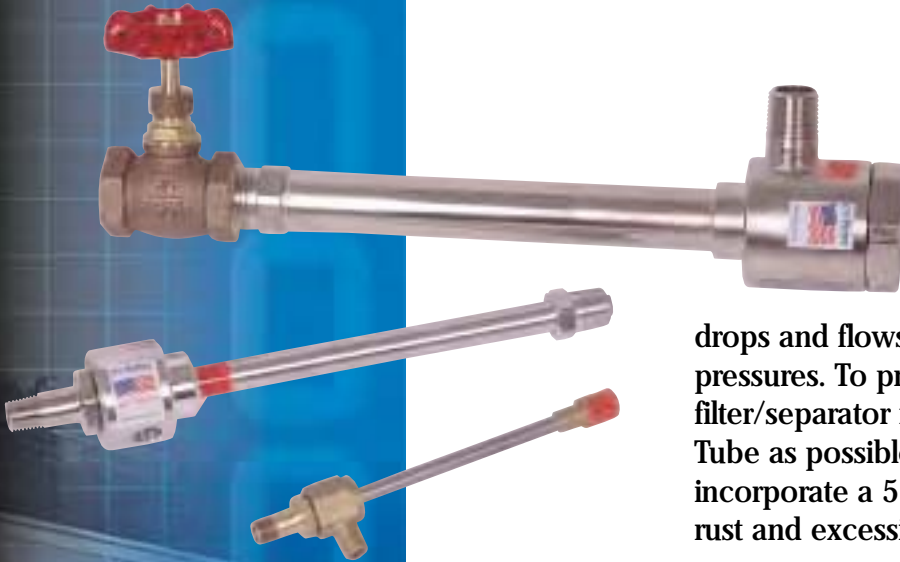
Vortex Tube performance can be further modified by changing an internal bushing or generator. These modifications can change the total flow capacity (CFM) and cold fraction to achieve maximum refrigeration or lowest possible cold temperature. Generator kits, hot end / cold end mufflers, as well as stainless steel Vortex Tube models are available. For help with your spot cooling application, please contact one of our Application Engineers. They will be happy to assist you with proper Vortex Tube selection.

TECH notes



Fluid (air) that rotates around an axis (like a tornado) is called a vortex. A Vortex Tube creates cold air and hot air by forcing compressed air through a generation chamber, which spins the air at a high rate of speed (1,000,000 RPM) into a vortex. The high-speed air heats up as it spins along the inner walls of the Tube toward the control valve. A percentage of the hot, high speed air is permitted to exit at the valve. The remainder of the (now slower) air stream is forced to counterflow up through the center of the high-speed air stream in a second vortex. The slower moving air gives up energy in the form of heat and becomes cooled as it spins up the tube. The chilled air passes through the center of the generation chamber finally exiting through the opposite end as extremely cold air. Vortex tubes generate temperatures down to 100°F below inlet air temperature. The control valve located in the hot exhaust end can be used to adjust the temperature drop and rise for all Vortex Tubes.

Vortex Tubes



With our models ranging from approximately 6" to 13" long, Vortex Tubes are a very compact source of refrigeration and spot cooling capability. They are designed to utilize a filtered compressed air supply of 80 - 110 PSIG. Pressures lower than 80 PSIG will still provide some cooling, but temperature drops and flows are reduced due to the lower inlet pressures. To prepare the air source, an appropriate filter/separator must be used, placed as near to the Vortex Tube as possible. ITW Vortec's Auto-Drain filters-separators incorporate a 5 micron filter that effectively removes dirt, rust and excessive moisture from the compressed air supply.

Reliable, Maintenance-Free Cooling

Using an adequately filtered and dried compressed air source, Vortex Tubes are essentially a no-maintenance cooling solution. With no moving parts to break or wear out, they will provide years of trouble-free operation. Prolonged use with dirty or oily air can cause wear or dirt collection within the tube. Under these conditions, occasional disassembly, inspection and cleaning are the only maintenance activities required.

Since the tube's performance is affected by the absolute pressure ratio applied, care should be taken not to restrict the cold outlet. A small amount of back pressure on the cold outlet to allow air to move through piping or ducting is acceptable. Back pressure, measured at the tube, should be limited to less than 5 PSIG.



Due to the sound of escaping air, the noise from a Vortex Tube, in some externally mounted applications, should be muffled. Ordinarily the ducting of the cold air output through tubing or into an enclosure will adequately reduce noise levels. If required, specially designed cold end or hot end mufflers are available for your installation. It should also be noted that some applications have used the hot air output as a source of spot heating. Temperatures up to 200°F (93°C) can be generated using no electricity, with its related interference and hazards.

As the originator of vortex tube technology for industrial applications, ITW Vortec's expertise and problem-solving experience with vortex tubes is widely recognized. Our technical staff is ready to assist you with your cooling needs.

APPLICATION

notes

The manufacturer of form, fill and seal packaging equipment uses #106-8-H Vortex Tubes to keep sealing bar clamp shield temperatures below 150°F. Excessive clamp shield heat would inadvertently melt film adjacent to the seal and cause marred wrap or a defective package.

A laboratory uses a #208-15-H Vortex Tube connected to a simple heat exchanger to lower and maintain the water temperature in a cold water bath testing device.

One of the largest producers of air conditioning compressors cools the exterior shell of its units after a baked on painting process with #308-35-H Vortex Tubes mounted on a cooling enclosure.

Plastic injection and blow molders increase their production rates by using Vortex Tubes to speed the cooling of molded areas, especially those to be machined.

A worldwide manufacturer of finishing equipment for the printing industry incorporates ITW Vortec Vortex Tubes as a cooling device for slitter blades.