

# Dokumentation

## ***Vortex-Rohre - druckluftbetriebene Kältegeneratoren - Typ VORTEX 14 ... -***



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## 2. Artikelnummern und Daten

### VORTEX-Rohre - druckluftbetriebene Kältegeneratoren

**Funktion:** Einströmende Druckluft wird durch das VORTEX-Rohr in einen Warmluft- und einen Kaltluftstrom aufgeteilt. Die warme Luft tritt auf der einen, die kalte Luft auf der anderen Seite des Rohres aus. Durch ein Regulierventil lässt sich die Temperaturdifferenz zwischen eintretender Druckluft und austretender Kaltluft einstellen. Bei sinkender Austrittstemperatur verringert sich gleichzeitig die austretende Kaltluftmenge. Es lassen sich Temperaturen von -40°C auf der Kaltluft- und bis zu +110°C auf der Heißluftseite erzeugen. Bei konstanter Lufteintrittstemperatur und Druck kann die Austrittstemperatur mit einer Toleranz von +/- 0,6 K eingestellt werden.

**Werkstoffe:** Gehäuse: Edelstahl AISI 303, VORTEX-Generator: Kunststoff

**Temperaturbereich:** -20°C bis max. +120°C

**Betriebsdruck:** 1 - 8 bar, optimal: 5 bar (gefilterte, ungeölte Druckluft)

- Anwendungsbeispiele:**
- genaue Temperaturregelung
  - genaue Anpassung des VORTEX-Rohres an jede Anforderung durch mitgelieferte leicht wechselbare VORTEX-Generatoren
  - Kühlung von Lötstellen, Heißkleber oder Klebstoffen
  - Kühlung beim Punktschweißen, vermeidet Verfärbungen und Verformungen
  - Kühlung von z. B. flüssiger Schokolade in der Lebensmittelverarbeitung
  - Kühlung von Kaltform- und Ultraschallwerkzeugen
  - Kühlung bei spanabhebender Bearbeitung ohne Kühlmittel (z. B. für Kunststoffe)
  - Kühlung von Nadeln in Nähmaschinen
  - Kühlung von Schneidwerkzeugen
  - Thermo-Prüfung elektronischer Komponenten
  - Schrumpfassungen

- Vorteile:**
- geringe Anschaffungs- und Betriebskosten
  - wartungsfrei
  - keine beweglichen Bauteile - kein Verschleiß

- für den Betrieb wird nur Druckluft benötigt, keine Elektrizität
- keine Rückstände auf dem gekühltem Gut durch Kühlmittel oder Kältespray

Typ	Luft-eintritt	Kaltluft-austritt	Bau-länge	Rohr-Ø	Lieferumfang
VORTEX 14 B	Rp 1/4" IG	G 1/4" AG	210	45	VORTEX-Rohr mit rotem Generator
VORTEX 14	Rp 1/4" IG	G 1/2" IG	285	45	VORTEX-Rohr mit Schalldämpfer (für Kaltluftseite), 8 Stk. VORTEX-Generatoren (gelb, grün, rot, weiß, blau, grau, beige), Gelenkschlauch für Kaltluft
VORTEX 14 KP	Rp 1/4" IG	G 1/2" IG	285	45	VORTEX-Rohr mit Schalldämpfer (für Kalt- und Warmluftseite), 4 Stk. VORTEX-Generatoren (gelb, rot, blau, braun), Gelenkschlauch für Kaltluft, Magnetfuß
VORTEX 14 CC **	Rp 1/4" IG	Gehäuse-befestigung in 3/4"-Loch, Luftverteilung durch Schlauch	200	45	VORTEX-Rohr zur Schaltschrankkühlung (max. 1800x1800x600), Thermostatsteuerung, 4 Stk. VORTEX-Generatoren (gelb, rot, blau, braun), Abluftventil in VORTEX-Rohr integriert, Schlauch zur Luftverteilung, ausgeführt nach IP 56

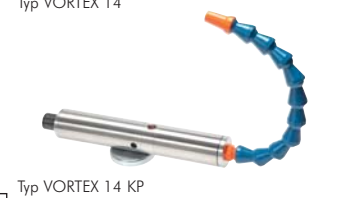
\*\* bitte gewünschte Spannung angeben

#### VORTEX-Generatoren

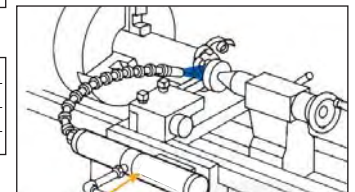
Farbe	gelb	grün	rot***	weiß	blau	grau	beige	braun
Temperatur*	-31C°	-33C°	-30C°	-34C°	-26C°	-30C°	-24C°	-29C°
Kälteleistung* (kcal/h)	130	130	230	230	380	380	630	630
Luftverbrauch* (l/min)	280	280	420	420	700	700	990	990

\* Lufteintritt bei 5,5 bar und 20°C, Regelungsschraube 2,5 Umdrehungen geöffnet (70% des Luftstrahls entweicht als Kaltluft)

\*\*\* als Standard in allen VORTEX-Rohren eingebaut



Typ VORTEX 14 CC



## 3. Sicherheitshinweis



**Achtung:** Das VORTEX-Rohr erzeugt sowohl kalte als auch heiße Luft. Teile des Rohres werden im Betrieb heiß/kalt und sollten nicht berührt werden.

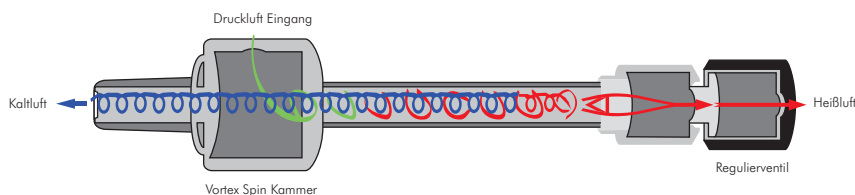
## 4. Funktionweise und Einstellung

Die am Drucklufteingang eintretende Luft wird innerhalb des Rohres mittels eines sogenannten Generators in eine schnelle Rotation versetzt und strömt entlang der Außenwand in Richtung Heißluftaustritt. Ein Teil der Luft tritt hier aus, der andere Teil strömt durch das Zentrum zurück und kühlt sich dabei ab. Die kalte Luft tritt am Kaltluftausgang aus.

Das Verhältnis des Volumenstroms und der Temperatur in einem VORTEX-Rohr sind voneinander abhängig. Öffnet man das Regulierventil am Heißluftaustritt, verringert sich der Kaltluft-Volumenstrom und die Temperatur sinkt. Durch Schließen des Ventils verstärkt sich der Kaltluftstrom und dessen Temperatur steigt an. Der Prozentsatz an Luft, der aus dem kalten Ende des VORTEX-Rohres strömt, wird Kaltluftanteil genannt.

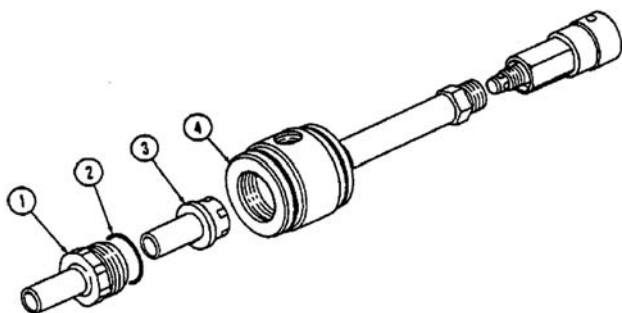
Die gewünschte Temperatur stellt man mithilfe eines Thermometers ein, den man in den kalten Luftstrom hält und mit dem Regulierventil am Heißluftaustritt die gewünschte Temperatur stufenlos reguliert.

Durch einfaches Wechseln des Generators lassen sich verschiedene Leistungsstufen mit einem Vortex-Rohr erzielen.



## 5. Austausch des VORTEX-Generators

Zum Austauschen des Generators löst man zunächst die Verschlusskappe (1) am Kaltluftaustritt und entfernt vorsichtig den O-Ring (2). Jetzt lässt sich der Generator (3) aus der Wirbelkammer (4) entnehmen und durch einen anderen Generator (3) ersetzen. Anschließend sind der O-Ring (2) und die Verschlusskappe (1) wieder zu montieren.



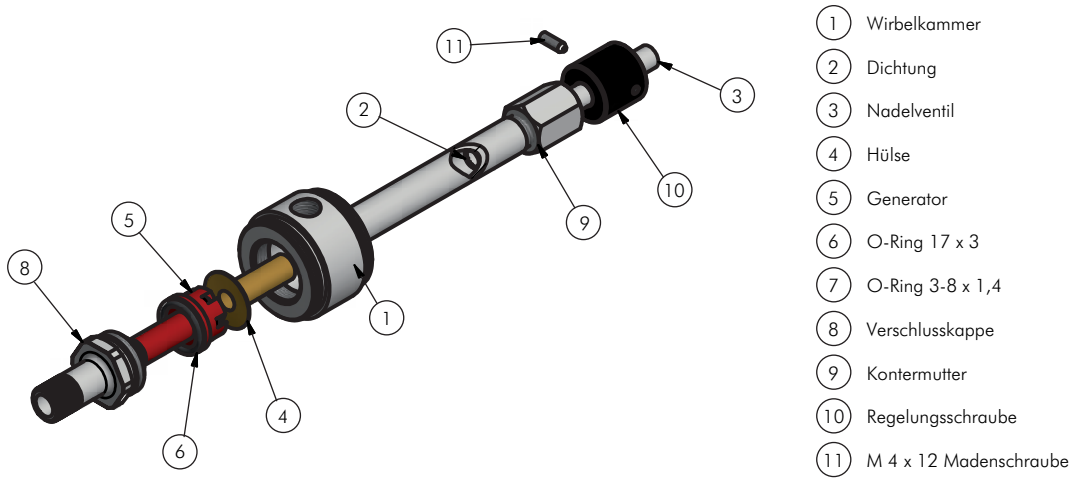
## 6. Leistungsdaten

Druck in Bar	Kälteleistung in %						
	20	30	40	50	60	70	80
1	25	24	24	20	18	15	11
	6	10	15	20	26	33	43
2	35	34	32	29	25	21	15
	8	14	21	29	37	47	59
3	53	51	48	44	38	31	23
	12	21	31	43	55	71	87
4	56	54	50	45	39	32	24
	13	22	31	43	56	71	90
5	58	55	51	46	40	33	25
	13	22	32	43	58	72	91
6	59	57	53	48	41	34	26
	13	22	32	44	58	73	93
7	69	66	62	56	48	40	30
	14	24	35	49	64	80	105
8	70	67	63	57	49	41	32
	14	25	37	51	66	84	105

Die Zahlen in den blauen Kästen zeigen die Temperatur-Senkung der Einbluft in °C

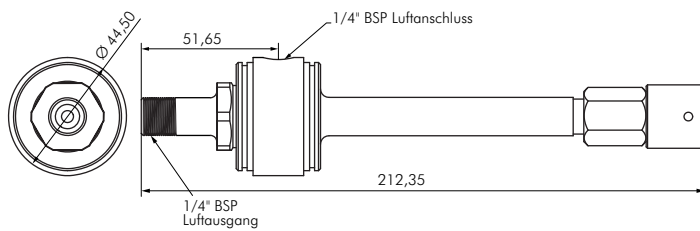
Die Zahlen in den roten Kästen zeigen den Temperatur-Anstieg der Einbluft in °C

## 7. Teilleiste

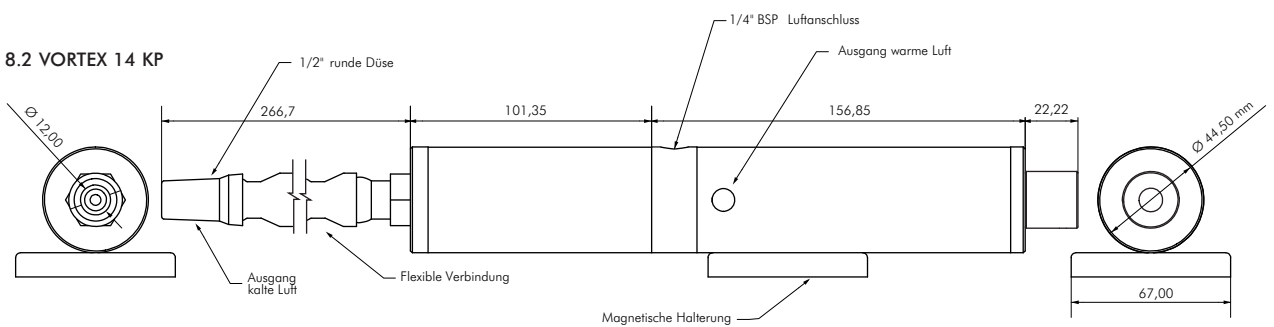


## 8. Abmessungen

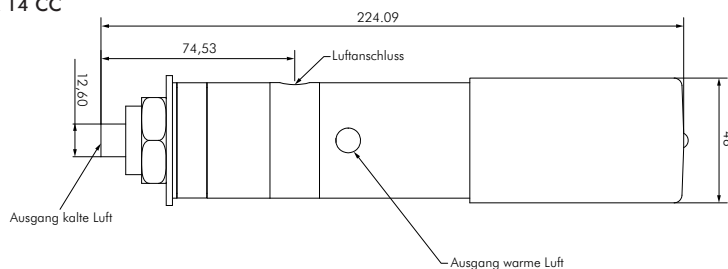
### 8.1 VORTEX 14 B



### 8.2 VORTEX 14 KP



### 8.3 VORTEX 14 CC



## 9. Bedienungsanleitung VORTEX 14 KP / Operating Manual VORTEX 14 KP

The VORTEX 14 KP provides a cold airflow commonly used for spot cooling.

At the heart of the VORTEX 14 KP is the Vortex Tube which is encased in a hot and cold end silencer. Cold air produced by the Vortex is directed to specific area through knuckle trucking. Hot air is then vented through two holes located in the silencer.

The cold air temperature can be as low as 50°C below the inlet air temperature and be maintained to +/- 0.6°C.

VORTEX 14 KP have no moving parts and so are intrinsically safe. They require virtually no maintenance which makes them ideal for harsh environments.

### 9.1 Safety and Inspection

All products are packed carefully at our factory. Nevertheless, we recommend careful examination of the carton and contents for any damage.

To protect yourself and others when using compressed air, you should be aware of the following general safety guide lines:

- Warning – When compressed air is misused, it can cause serious injury or even death.
- Never point an air hose at anyone in fun or to remove dirt from clothing or the body.
- Never use compressed air without adequate eye and ear protection. Use safety glasses with side shields or goggles and ear protectors.
- Before attempting to disconnect a hose from an airline, the air should be cut off, and the remaining air bled from the line.
- Keep air hoses off the floor where they become tripping hazards and are subject to damage by vehicles, doors, and dropped tools. If possible, suspend air hoses from overhead. Please be aware of the following safety guidelines:
  - Please be aware of the following Safety guidelines specific to the Coldstream Gun:
    - Do not operate the Coldstream Gun at compressed air pressures above 11 Bar (160 psi)
    - All Coldstream Guns create both hot and cold air so parts of the unit will become hot.
    - Compressed Air Temperature must not exceed 55°C.
    - Ambient operating temperature can not drop lower than -10°C.
    - Ambient operating temperatures must not exceed 66°C.
    - Compressed air temperature must not exceed 55°C.

### 9.2 Maintenance

The VORTEX 14 KP has no moving parts, making them virtually maintenance free. Clean and dry compressed air moving through the VORTEX 14 KP will not cause wear on any of the components. Occasionally dirt, water or oil may enter the VORTEX 14 KP from the compressed air supply, which could hinder performance. If this happens simply take the unit apart, clean the parts with soapy water, allow drying time and then reassemble. When reassembling ensure you tighten all the components. If the parts are not tightened performance may be affected.

### 9.3 Compressed Air Supply

It is recommended to use a 5-micron (or smaller) filter to remove water and dirt from the compressed air supply.

A 5 micron filter will remove 99% of foreign material from the air supply; the use of an oil filter with an effective filtration of 0.01 ppm will remove the oil droplets for an even cleaner compressed air supply. Failure to use a filter may cause clogging and/or freezing of the compressed air line and the components within the VORTEX 14 KP. When the temperature of the compressed air within the VORTEX 14 KP reaches 0°C the water vapour in the air will start to freeze. This could potentially cause a problem with ice clogging the orifices of the VORTEX 14 KP. In this instance an air dryer must be used to lower the dew point and keep water vapour out of the air line. A dryer rated at 19°C will produce a dew point low enough to eliminate the water vapour freezing.

### 9.4 Compressed Air Lines Sizes

Figuring the correct pipe size for your compressed air system is an important task. Pipe that is sized too small can create big pressure losses and reduce operating efficiency.

Many people who plan the piping never consider the fittings or the future.

**FITTINGS:** Every pipe fitting creates a certain amount of increased frictional air loss that is equal to a specified length of pipe. Any turns in the pipe at fittings, ells, tees, and valves increase pressure drops even more.

**FUTURE:** Are you planning to add more equipment in the next year or two? Then plan for larger piping now. Since the material costs in piping are low compared to installation or replacement cost, it's wise to select pipe of an adequate size. If there is any doubt that a pipe size may create a pressure drop, use the next largest size. Remember that an oversize pipe compensates for possible scale build-up and provides for future expansion of the overall air system.

## Steps to calculating overall piping size for your compressed air system:

1. Determine your air compressor's maximum CFM.
2. Draw a piping schematic and show all pipe fittings, valves, etc.
3. Measure and write the corresponding lengths of pipe on your schematic, then total the length of all straight pipes needed and note that on your schematic.
4. Using TABLE 1 (over page), find your compressor's CFM number on the far left column, and then go to the right until you see the column header with nearest length in feet to your total pipe length. Find where the CFM & PIPE LENGTH intersect on the chart and it will show the recommended pipe size for that length.
5. Take that pipe size to TABLE 2 and use the table to find all the EQUIVALENT LENGTHS OF PIPE needed for each PIPE FITTING. Write these lengths on your piping schematic at each fitting.
6. TOTAL all the EQUIVALENT LENGTHS OF PIPE needed for each PIPE FITTING and add to your total of straight length of pipe. This will give you a new and more accurate total pipe length needed.
7. Take your new total of EQUIVALENT LENGTH OF PIPE IN FEET back to TABLE 1 and use this number to determine the PIPE SIZE you need.

## Specific VORTEX 14 KP Pipe Size

To obtain maximum performance from the VORTEX 14 KP, accurate measures of air pressure and air volume must be obtained. Line pressure of 70-90 psi (5-6 Bar) can be present without a sufficient volume (cfm) of air.

To ensure that both pressure and volume are present to efficiently operate the VORTEX 14 KP a line size of 3/8" pipe or 1/2" hose should be used for applications 10ft from the main header. Use 1/2" pipe or 3/4" hose up to 20ft. For pipe size over 20ft from the header please refer to the table over the page.

## How to determine what size of PIPE you need for compressed air lines:

TABLE 1: EQUIVALENT LENGTH OF PIPE LINES IN FEET  
Don't forget to include \*PIPE FITTINGS in your final calculations

Your Air Compressor's CFM	25 feet	50 feet	75 feet	100 feet	150 feet	200 feet	250 feet	300 feet
1	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
5	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
10	1/2	1/2	1/2	3/4	3/4	3/4	3/4	3/4
15	1/2	3/4	3/4	3/4	3/4	3/4	3/4	3/4
20	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
25	3/4	3/4	3/4	3/4	3/4	1	1	1
30	3/4	3/4	3/4	3/4	1	1	1	1
35	3/4	3/4	1	1	1	1	1	1
40	3/4	1	1	1	1	1	1	1
50	1	1	1	1	1	1	1	1
60	1	1	1	1	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/4
70	1	1	1	1	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/4
80	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/2	1 - 1/2	1 - 1/2	1 - 1/2
100	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/2	1 - 1/2	1 - 1/2	1 - 1/2
125	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/2	1 - 1/2	1 - 1/2	1 - 1/2
150	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/2	1 - 1/2	1 - 1/2	1 - 1/2
175	1 - 1/2	1 - 1/2	1 - 1/2	1 - 1/2	2	2	2	2
200	1 - 1/2	1 - 1/2	1 - 1/2	1 - 1/2	2	2	2	2
225	1 - 1/2	1 - 1/2	1 - 1/2	1 - 1/2	2	2	2	2
250	2	2	2	2	2	2	2	2
275	2	2	2	2	2	2	2 - 1/2	2 - 1/2
300	2	2	2	2	2	2	2 - 1/2	2 - 1/2
350	2	2	2	2	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2
400	2	2	2	2	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2
450	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	3	3
500	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	3	3
550	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	3	3	3	3
600	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	3	3	3	3
750	2 - 1/2	2 - 1/2	2 - 1/2	3	3	3	3	4
1000	3	3	3	3	3	3	4	4

TABLE 2: \* EQUIVALENT LENGTH OF PIPE (FT.) for PIPE FITTINGS  
Add these numbers for each pipe fitting to total length of straight pipe

Pipe Size	Long Rad, Ell or run of tee	STD. Ell or Run of reduced tee	Tee Thru side outlet	Globe Valve	Gate Valve
1/2	0.62	1.55	3.1	17.3	0.36
3/4	0.82	2.06	4.12	22.9	0.48
1	1.05	2.62	5.24	29.1	0.61
1 - 1/4	1.38	3.45	6.9	38.3	0.81
1 - 1/2	1.61	4.02	8.04	44.7	0.94
2	2.07	5.17	10.3	57.4	1.21
2 - 1/2	2.47	6.16	12.3	68.5	1.44
3	3.07	6.16	15.3	85.2	1.79
4	4.03	7.67	20.2	112	2.35

## 9.5 Installation

All VORTEX 14 KP are fitted with a strong magnet allowing it to be fitted to any surface that will hold the magnet. The magnet can be removed by unscrewing the hot end silencer and removing the nut holding the magnet in place.

### Air Fitting

The large VORTEX 14 KP has a 1/4" BSP female air fitting. Standard Pneumatic push-fit compressed air fittings can be used on the VORTEX 14 KP.

## 9.6 Operation

### VORTEX 14 KP

All VORTEX 14 KP are set to deliver the most efficient cooling possible. VORTEX 14 KP are factory set to 70% cold fraction at 80psi (5.4 Bar). As standard they are fitted with a Red 15 cfm Generator, so approximately 10cfm of cold air will exit through the cold end of the VORTEX 14 KP.

### Cold Fraction

The Cold fraction is the percentage of input compressed air that is released through the cold end of the VORTEX 14 KP. The Cold Fraction is adjusted in two ways, by adjusting the control relief valve to exhaust more or less air (Adjustable version only) or by changing the generator inside the VORTEX 14 KP.

There are two levels of Generator, either a "high" or "low" cold fraction model. A "high" cold fraction Generator is where more than 50% of the air flow exits through the cold end of the VORTEX 14 KP. This setting will suit most industrial applications as it provides the most efficient cooling, although not the coldest possible temperature.

A "low" cold fraction Generator is where less than 50% of the air flow exits through the cold end of the VORTEX 14 KP. This setting will provide the lowest air temperatures but will not be as efficient.

### Generators

The VORTEX 14 KP is supplied with a set of 4 high fraction Generators as standard.

Yellow 10cfm (283 l/min)

Red 15cfm (425 l/min)

Blue 25cfm (708 l/min)

Brown 35cfm (991 l/min)

The Generators within the VORTEX 14 KP control the air consumption and air flow, they also influence the achievable temperatures.

To change the Generator, simply unscrew the cold end silencer (the end the knuckle trunking is fitted to).



You will then need to remove the cold cap from the Vortex Tube. You can simply unscrew this from the VORTEX 14 KP. Inside you will find an O'ring and Generator.



## Adjustable VORTEX 14 KP

The Adjustable version of the VORTEX 14 KP features a control knob that allows fine-tuning of the volume of hot air exiting the VORTEX 14 KP. This in turn affects the volume of cold air and the temperature of that air.

Like the non-adjustable version the adjustable VORTEX 14 KP is factory set at 80psi (5.4 Bar) to 70% cold fraction. To reset to the factory setting turn the control knob clockwise until closed. Once it is completely closed you can set to 70 Cold Fraction by turning the knob 2.5 turns anti-clockwise



## Flexible Knuckle Trunking

All VORTEX 14 KP feature a single outlet hoses.

The single outlet hose is made of 12 x 1/2" flexible knuckles. The overall length of the hose is approximately 310mm.

## 9.7 Troubleshooting

### Air Flow

Problems with compressed air flow can be caused by:

1. Air pressure too low – increase air pressure at the relevant regulator.
2. Undersized compressed air lines – replace pipes with correct sizes, see section 9.4.
3. Blocked compressed air line – remove blockage.
4. Insufficient compressor size – Check compressor size for fitting.

### VORTEX 14 KP

Problems with the air temperature can be caused by:

1. Incorrect generator fitted – Check and replace generator (see section 9.6)
2. Ambient Compressed air temperature to high – Check compressed air temperature and use cooler if necessary.
3. Loose/missing parts – Check all Cabinet Cooler parts are screwed in tightly and there are no missing parts.
4. Water vapour in the compressed air supply – Check compressed air supply.
5. Air pressure too low – increase air pressure at the relevant regulator



## 10. Bedienungsanleitung VORTEX 14 CC / Operating Manual VORTEX 14 CC

The VORTEX 14 CC uses compressed air to provide a cold air source which stops industrial cabinet/panels or enclosures overheating and prevents ingress of contamination such as dust or moisture.

The VORTEX 14 CC Unit (excluding Solenoid Valve and Thermostat) is intrinsically safe, and requires virtually no maintenance. They have no moving parts making them ideal for harsh environments.

VORTEX 14 CC can be used with or without electrical thermostats and solenoid valves (VORTEX 14 CC System). These are used to regulate the cooling within an enclosure.

### 10.1 Safety and Inspection

VORTEX 14 CC are packed carefully at our factory. Nevertheless, we recommend careful examination of the carton and contents for any damage.

To protect yourself and others when using compressed air, you should be aware of the following general safety guidelines:

- Warning – When compressed air is misused, it can cause serious injury or even death.
- Never point an air hose at anyone in fun or to remove dirt from clothing or the body.
- Never use compressed air without adequate eye and ear protection. Use safety glasses with side shields or goggles and ear protectors.
- Before attempting to disconnect a hose from an air line, the air should be cut off, and the remaining air bled from the line.
- Keep air hoses off the floor where they become tripping hazards and are subject to damage by vehicles, doors, and dropped tools. If possible, suspend air hoses from overhead.

Please be aware of the following safety guidelines specific to the VORTEX 14 CC:

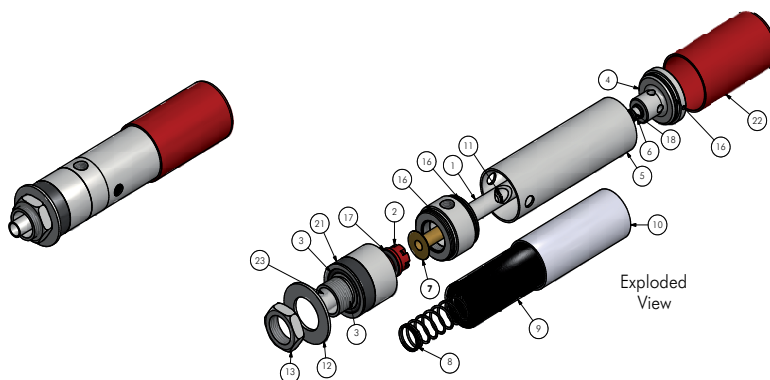
- VORTEX 14 CC create both hot and cold air so parts of the unit will become hot.
- Do not operate the VORTEX 14 CC at compressed air pressures above 11 Bar (160 psi)
- Compressed air temperature must not exceed 55°C
- Ambient operating temperature must not exceed 66°C
- Ambient operating temperature can not drop lower than -10°C

### 10.2 Maintenance

The VORTEX 14 CC has no moving parts. Clean compressed air moving through the will not cause wear on any of the components.

Occasionally, dirt, water or oil may enter the cooler from the compressed air supply. This could hinder the performance. If this happens simply take the unit apart, clean the parts with soapy water, allow drying time and then reassemble.

When reassembling ensure you tighten all the components. If the parts are not tightened correctly, the coolers performance may be affected. Also, please ensure the generator is fitted. At the same time the element in the air filter should be changed.



PARTS LIST			
ITEM	QTY	PART NUMBER	REV
1	1	Spin Chamber	B
2	1	Generators (See Drawing)	A
3	1	Bulkhead Fitting	A
4	1	Hot End Cap	A
5	1	Hot End Sleeve	B
6	1	Needle Valve	B
7	1	Brass Sleeve	A
8	1	Silencer Spring	A
9	1	Silencer Foam	A
10	1	Plastic Insert	A
11	1	Star Washer	
12	1	Bulk Head Washer	A
13	1	Bulkhead Nut 33mm	B
17	1	O Ring 17x3mm	A
18	1	O Ring 3/8x1/4	A
19	1	O Ring 30x3mm	A
20	1	Blind Rivet 3.2 x 4.8 mm	
21	1	Relief Valve	A
22	1	Red End Cap	A
23	1	Bulk Head Insert	A
16	3	O Ring	A

## 10.3 Compressed Air Supply

It is recommended to use a 5-micron (or smaller) filter to remove water and dirt from the compressed air supply. A 5-micron filter will remove 99% of foreign material from the air supply; the use of an oil filter with an effective filtration of 0.01 ppm will remove the oil droplets for an even cleaner compressed air supply. Failure to use a filter may cause clogging and freezing of the compressed air line and the components within the VORTEX 14 CC.

When the temperature of the compressed air within the VORTEX 14 CC reaches 0°C the water vapour in the air will start to freeze. This could potentially cause a problem with ice clogging the orifices of the VORTEX 14 CC.

In this instance an air dryer must be used to lower the dew point and keep water vapour out of the air line. A dryer rated at -19°C will produce a dew point low enough to eliminate the water vapour freezing.

## 10.4 Compressed Air Lines Sizes

Figuring the correct pipe size for your compressed air system is an important task. Pipe that is sized too small can create big pressure losses and reduce operating efficiency. Many people who plan the piping never consider the fittings or the future.

**FITTINGS:** Every pipe fitting creates a certain amount of increased frictional air loss that is equal to a specified length of pipe. Any turns in the pipe at fittings, ells, tees, and valves increase pressure drops even more.

**FUTURE:** Are you planning to add more equipment in the next year or two? Then plan for larger piping now. Since the material costs in piping are low compared to installation or replacement cost, it's wise to select pipe of an adequate size. If there is any doubt that a pipe size may create a pressure drop, use the next largest size. Remember that an oversize pipe compensates for possible scale build-up and provides for future expansion of the overall air system.

### Steps to calculating overall piping size for your compressed air system:

1. Determine your air compressor's maximum CFM.
2. Draw a piping schematic and show all pipe fittings, valves, etc.
3. Measure and write the corresponding lengths of pipe on your schematic, then total the length of all straight pipes needed and note that on your schematic.
4. Using TABLE 1 (over page), find your compressor's CFM number on the far left column, and then go to the right until you see the column header with nearest length in feet to your total pipe length. Find where the CFM & PIPE LENGTH intersect on the chart and it will show the recommended pipe size for that length.
5. Take that pipe size to TABLE 2 and use the table to find all the EQUIVALENT

### LENGTHS OF PIPE needed for each PIPE FITTING. Write these lengths on your piping schematic at each fitting.

6. TOTAL all the EQUIVALENT LENGTHS OF PIPE needed for each PIPE FITTING and add to your total of straight length of pipe. This will give you a new and more accurate total pipe length needed.
7. Take your new total of EQUIVALENT LENGTH OF PIPE IN FEET back to TABLE 1 and use this number to determine the PIPE SIZE you need.

### Specific VORTEX 14 CC Pipe Size

To obtain maximum performance from the VORTEX 14 CC, accurate measures of air pressure and air volume must be obtained. Line pressure of 70-90 psi (5-6 Bar) can be present without a sufficient volume (cfm) of air.

To ensure that both pressure and volume are present to efficiently operate the VORTEX 14 CC a line size of  $\frac{3}{8}$ " pipe or  $\frac{1}{2}$ " hose should be used for applications 10ft from the main header. Use  $\frac{1}{2}$ " pipe or  $\frac{3}{4}$ " hose up to 20ft. For pipe size over 20ft from the header please refer to section 10.4.

How to determine what size of PIPE you need for compressed air lines:

TABLE 1: EQUIVALENT LENGTH OF PIPE LINES IN FEET  
Don't forget to include \*PIPE FITTINGS in your final calculations

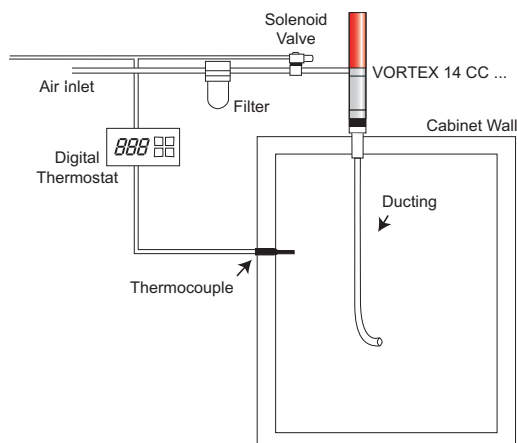
Your Air Compressor's CFM	25 feet	50 feet	75 feet	100 feet	150 feet	200 feet	250 feet	300 feet
1	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
5	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
10	1/2	1/2	1/2	3/4	3/4	3/4	3/4	3/4
15	1/2	3/4	3/4	3/4	3/4	3/4	3/4	3/4
20	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
25	3/4	3/4	3/4	3/4	3/4	1	1	1
30	3/4	3/4	3/4	3/4	1	1	1	1
35	3/4	3/4	1	1	1	1	1	1
40	3/4	1	1	1	1	1	1	1
50	1	1	1	1	1	1	1	1
60	1	1	1	1	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/4
70	1	1	1	1	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/4
80	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/2	1 - 1/2	1 - 1/2	1 - 1/2
100	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/2	1 - 1/2	1 - 1/2	1 - 1/2
125	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/2	1 - 1/2	1 - 1/2	1 - 1/2
150	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/4	1 - 1/2	1 - 1/2	1 - 1/2	1 - 1/2
175	1 - 1/2	1 - 1/2	1 - 1/2	1 - 1/2	2	2	2	2
200	1 - 1/2	1 - 1/2	1 - 1/2	1 - 1/2	2	2	2	2
225	1 - 1/2	1 - 1/2	1 - 1/2	1 - 1/2	2	2	2	2
250	2	2	2	2	2	2	2	2
275	2	2	2	2	2	2	2 - 1/2	2 - 1/2
300	2	2	2	2	2	2	2 - 1/2	2 - 1/2
350	2	2	2	2	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2
400	2	2	2	2	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2
450	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	3	3
500	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	3	3
550	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	3	3	3	3
600	2 - 1/2	2 - 1/2	2 - 1/2	2 - 1/2	3	3	3	3
750	2 - 1/2	2 - 1/2	2 - 1/2	3	3	3	3	4
1000	3	3	3	3	3	3	4	4

TABLE 2: \* EQUIVALENT LENGTH OF PIPE (FT.) for PIPE FITTINGS  
Add these numbers for each pipe fitting to total length of straight pipe

Pipe Size	Long Rad, Ell or run of tee	STD. Ell or Run of reduced tee	Tee Thru side outlet	Globe Valve	Gate Valve
1/2	0.62	1.55	3.1	17.3	0.36
3/4	0.82	2.06	4.12	22.9	0.48
1	1.05	2.62	5.24	29.1	0.61
1 - 1/4	1.38	3.45	6.9	38.3	0.81
1 - 1/2	1.61	4.02	8.04	44.7	0.94
2	2.07	5.17	10.3	57.4	1.21
2 - 1/2	2.47	6.16	12.3	68.5	1.44
3	3.07	6.16	15.3	85.2	1.79
4	4.03	7.67	20.2	112	2.35

## 10.5 Installation

The drawing below shows the recommended way to fit a VORTEX 14 CC and VORTEX 14 CC System (including digital thermostat and solenoid valve).



To fit the VORTEX 14 CC follow the steps below:

## A. Drill Hole

Drill 1.02" (26 mm) hole in the position you would like to fit the VORTEX 14 CC.

Please be aware that 200mm of the VORTEX 14 CC will extend from the outside of the enclosure so allow clearance.

It's recommended that the VORTEX 14 CC is installed in the top of the enclosure. However, if space is an issue the VORTEX 14 CC can be installed in any position, even upside down, with no loss of performance.

## B. Remove bulk head nut & washer from the bottom of the VORTEX 14 CC:



## C. Fit desired generator

As standard the VORTEX 14 CC is supplied with a red (Refrig) 15cfm, 293W (1000 Btu/hr) generator. To change the generator simply unscrew the bulk head fitting and replace the generator with another colour. Please remember to re-fit the o-ring and screw bulk head fitting until tight.

Four generators are provided with the VORTEX 14 CC. Information on all generators and sizing can be found in section 10.6.



## D. Fit VORTEX 14 CC in place

From outside the enclosure, place the cold end of the VORTEX 14 CC into the drilled hole.

## E. Re-fit bulk head nut and washer

Once this is done tighten bulk head nut & washer until the VORTEX 14 CC is secure.

## F. Connect cold air ducting to the end.

It's recommended that the cold air ducting is directed from the VORTEX 14 CC to the bottom of the enclosure. This will allow for increased cooling throughout the cabinet/panel. This will also avoid any excess water vapour in the compressed air being blown over components.

If the air is clean and dry the cold air ducting can be directed to particularly hot areas of the enclosure. Alternatively you can drill holes in the cold air ducting and allow air to be distributed to several areas. If you choose this method you will need to plug the end of the cold air ducting and ensure the holes drilled into the tube are equal to the hole at the end.

Where necessary please fit appropriate filters.

## G. Connect air supply

The VORTEX 14 CC has a 1/4" bsp female air inlet. Standard pneumatic push-fit compressed air fittings can be used on the VORTEX 14 CC.

Please refer to section 10.4 when deciding on pipe sizes.

## H. Connect the digital thermostat & solenoid valve to the air

supply (only with VORTEX 14 CC System) See section 10.7 of this operating manual. Your VORTEX 14 CC is now ready for use.

## 10.6 Operation

### 1. VORTEX 14 CC

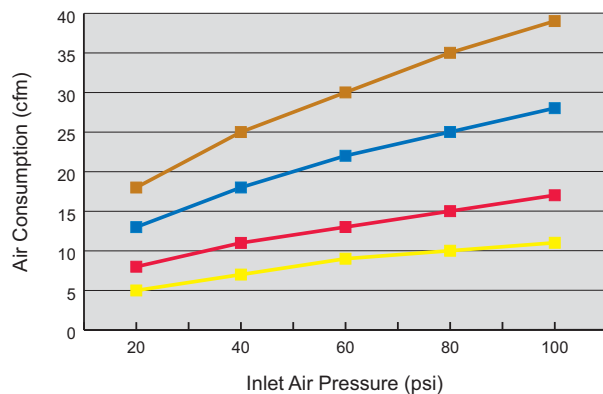
The VORTEX 14 CC is factory set to deliver the most efficient cooling needed to maintain a desired temperature inside an enclosure. At 80psi (5.5 Bar), 10cfm (70% of 15 cfm, red generator) of cold air will exit from the VORTEX 14 CC providing 293 Watts (1,000 Btu) of Cooling. The bladder valve acts as a pressure relief valve. This will automatically release air from the enclosure maintaining approximately 8" water column (0.0199 Bar) positive pressure inside the cabinet/panel.

### 2. Generators

The generators within the VORTEX 14 CC control the air consumption and air flow. They also influence the achievable temperatures. The chart below shows achievable temperatures with different generators fitted. Please note these are approximate temperatures and should only be used as a guide. The VORTEX 14 CC will perform differently when used in other environments.

		Inlet air pressure					
Generator Colour	Consumption in CFM (l/min)	60 PSI (4.1 Bar)		80 PSI (5.5 Bar)		100 PSI (6.8 Bar)	
		CFM at test	2.5 turns of needle valve	CFM at test	2.5 turns of needle valve	CFM at test	2.5 turns of needle valve
		cfm (l/min)	°C	cfm (l/min)	°C	cfm (l/min)	°C
Yellow	10H (283)	13 (368)	-27.2	18 (510)	-35.0	21 (595)	-31.3
Red	15H (425)	16 (453)	-28.3	21 (595)	-32.9	25 (708)	-32.6
Blue	25H (708)	23 (651)	-19.0	30 (849)	-23.4	31 (878)	-24.9
Brown	35H (991)	30 (849)	-15.8	36 (1019)	-18.6	43 (1218)	-18.0

The graph below shows air consumption at varying inlet air pressures.



### 4 x High fraction generators are supplied as standard:

Yellow 10cfm (283 l/min) - Cooling capacity of 190W (650 Btu/hr) Red 15cfm (425 l/min) - Cooling capacity of 293W (1000 Btu/hr) Blue 25cfm (708 l/min) - Cooling capacity of 499W (1,700 Btu/hr) Brown 35cfm (991 l/min) - Cooling capacity of 703W (2,400 Btu/hr)

A single VORTEX 14 CC is capable of cooling up to 703 Watts (2,400 Btu/hr). Optimising the cooling capacity is still a vitally important factor, choosing the correct generator will not only reduce running costs but also extend the life of the compressor.

To choose the most efficient generator you must calculate the total heat load in Watts Btu/hr to which the enclosure is exposed. The total heat load is a combination of the heat transfer from outside due to ambient air temperature and the heat which is created internally.

### 3. Humidity

If a VORTEX 14 CC is run constantly relative humidity inside the cabinet stabilises at approximately 45%.

To prevent condensation forming on the cold air pipe close off any vents or fan outlets on the outside wall of the enclosure. This reduces the ambient air from circulating within the cabinet/panel and reduces the chance of condensation.

Fans can be installed into the enclosure which will help to circulate air.

## 10.7 Magnetventil & Thermostat (nur VORTEX 14 CC ... System) / Solenoid Valve & Thermostat (VORTEX 14 CC ... System Only)

A VORTEX 14 CC System is supplied with either a 24V or 230V digital thermostat and solenoid valve.

The combination of solenoid valve and digital thermostat allows application specific set up and reduces running costs. It means cold air will only be supplied to the enclosure when it's needed.

The digital thermostat is factory set to activate the VORTEX 14 CC when the internal cabinet/panel temperature reaches 30°C. It will then cool the enclosure until the temperature drops to 22°C. At this point the VORTEX 14 CC is deactivated ready for the process to start again.

### Adjustment of Factory settings

The thermostat is password protected to stop adjustment of the parameters. The following 3 steps explain how to unlock the thermostat for parameter adjustment.

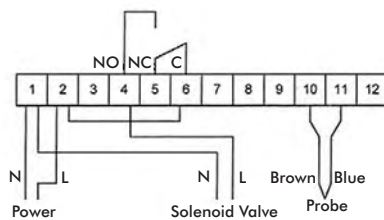
1. Power up thermostat – the temperature will be displayed.
2. Press and hold the 'P' until a '0' is displayed (when 0 is displayed release the 'P' button)
3. Press and hold the  $\Delta$  button until the display shows 9000. Press 'P' once, you will now have access to change the parameters.

### Adjusting the main parameters

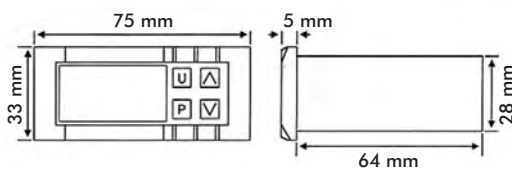
There are 2 main parameters that you may wish to adjust; the Set Point and Differential. The following 5 steps will guide you through this process.

1. Use the 2 arrow buttons to toggle through the parameters.
2. When you reach 'SP' on the display stop and press the 'P' button once. This allows you to adjust the set point of the thermostat between 10 and 50. The Set Point is the temperature that once activated the system will cool the cabinet/panel to (factory set to 22°C).
3. Once you have entered your Set Point press the 'P' button once. This will activate the new setting and return you to the main toggle menu.
4. Using the 2 arrow buttons toggle through the parameters until you reach 'HSEt'.
5. When you have reached 'HSEt' press the 'P' button once. This allows you to adjust the differential of cooling. The differential is the number of degrees above the set point that the unit will cool from (factory set to 8°C above a set point of 22°C, meaning the unit will start cooling when the internal cabinet temperature reaches 30°C).

### Thermostat Wiring Diagram:



### Thermostat Dimensions:



## 10.8 Approvals

The VORTEX 14 CC is IP56 (Nema 4/12)

## 10.9 Troubleshooting

### Air flow

Problems with compressed air flow can be caused by:

1. Air pressure too low – increase air pressure at the relevant regulator
2. Undersized compressed air lines – replace pipes with correct sizes, see section 10.4
3. Blocked compressed air line – remove blockage
4. Insufficient compressor size – Check compressor size for fitting VORTEX 14 CC

### Air Temperature

Problems with air temperature can be caused by:

1. Incorrect generator fitted – Check and replace generator, see section 10.6
2. Ambient compressed air temperature too high – Check compressed air temperature and use cooler if necessary
3. Loose/missing parts – Check all VORTEX 14 CC parts are screwed in tightly and there are no missing parts.
4. Water vapour in the compressed air supply – Check compressed air supply
5. Air pressure too low – increase air pressure at the relevant regulator