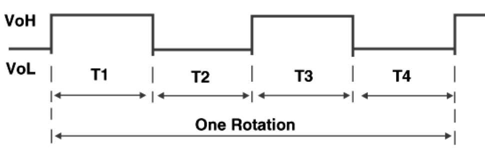
DC Fan

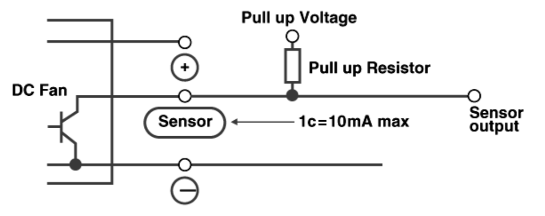
Pulse Sensor
(2 Pulse per revolution signal) /Tachometer output

Pulse sensors are used for detecting the rotational speed of the fan motor. If fan locked on VH, signal stays locked. If fan locked on VL, signal stays at VL for a few hundred MS, then moves to VH.
Vcc: rated voltage

Output Waveform



Output Circuit Open Collector



Lock Sensor
(Locked rotor alarm signal)

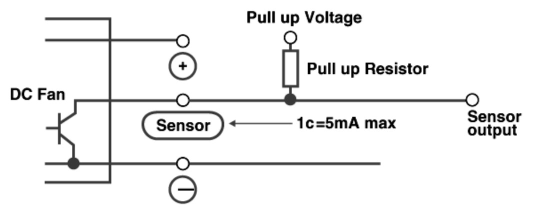
Lock sensors are used to detect if the fan motor is in operation or stopped.

Output Waveform

Alarm high: The signul staye at VL, when fan is running and goes to VH when fan stop.

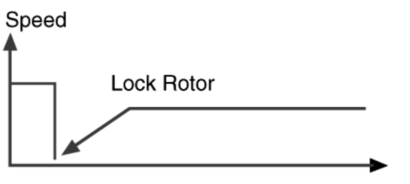
Alarm low: The signul staye at VH, when fan is running and goes to VL when fan stop.

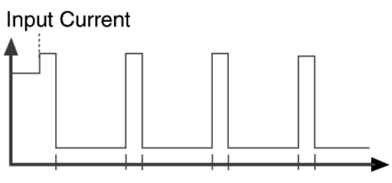
Output Circuit Open Collector



Current limit protection/ Auto restart protection

When the fan motor is locked, the device will cut off the drive current within two to sixseconds and restart automatically after a few seconds. If the lock situation is continued the device will work as cut off→restart→ cut off→ restart→.... repeatly till the lock is released.

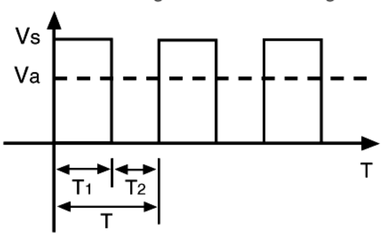




Speed control by PWM Signal

A speed control lead can be provided that will accept a PWM signal from the customer circuit to vary the speed of the fan. The change in speed is linear by changing the Duty-Cycle of the PWM. PWM signal types are standardized as following;
Open collector type and pull-up voltage is changed by maximum operating voltage and sink current by consuming current.

■ PWM signal function design is decided by customer.

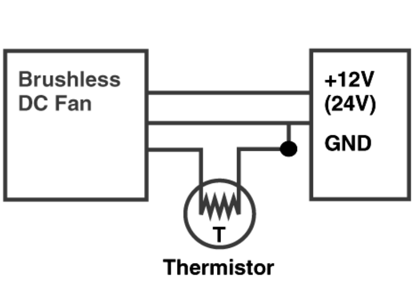


$T = T_1 + T_2$
α: Duty-Cycle
$Va = \alpha \times Vs$

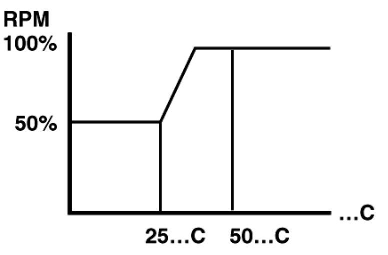
Speed control temperature sensor

UTEC thermally controlled fans use a thermistor to sense temperature. The thermistor can be mounted in the hub area or on the end of special length leads.The fan will operate at maximum speed if the thermistor senses high temperature and minimum speed if the temperature is low.Between these upper and lower limits, fan speed will vary almost linearly with temperature.

Electrical Drawing



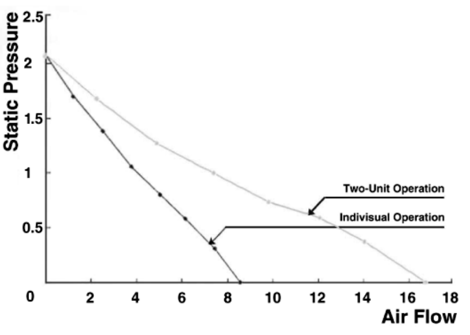
Temperature …C v.s. Speed(RPM)

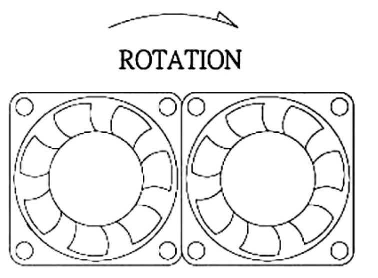


Multiple Fan Use

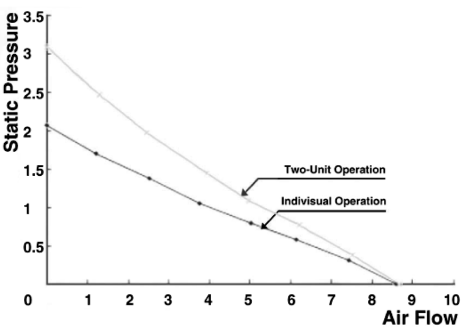
The following figures show the performance characteristics for parallel and series operationov two identical fans.

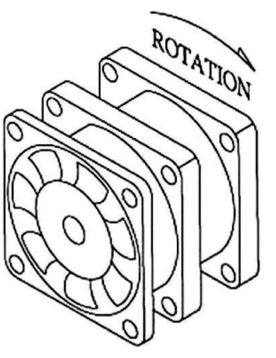
Parallel Operation
An additional fan in parallel to the first increases airflow in a low static pressure situation





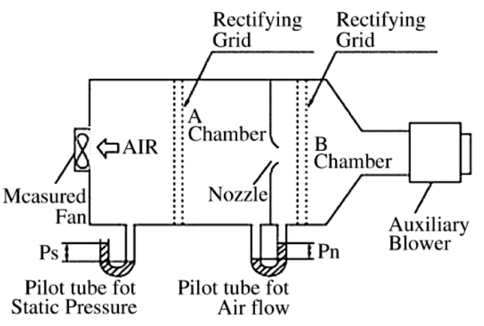
Serial Operation
An additional fan in series increases the airflow in high stastic pressure enclosure





Airflow & Pressure Measurement

An AMCA Standard 210 double chamber is used to accurately measure air volume and static pressure.



Maximum Static Pressure: When the nozzle is closed, the pressure in chember A will reach maximum.

Maximum air flow: When opening the nozzle and absorbing the air using the auxiliary blower to make the static pressure zero(Ps = 0), the differential pressure(Pn) between A Chamber and B Chamber will reach the maximum. The air flow obtained by applying the differential pressure(Pn) to the above equation can be called the maximum air flow.

Note: Fan performance is calculated using the data obtained from this equipment according to the following formula:
The Equation: Alrflow

$$Q=60\cdot C\cdot \frac{\pi}{4}\cdot D^2\sqrt{2g/r\cdot 0.10197Pn}\ (m^3/min)$$

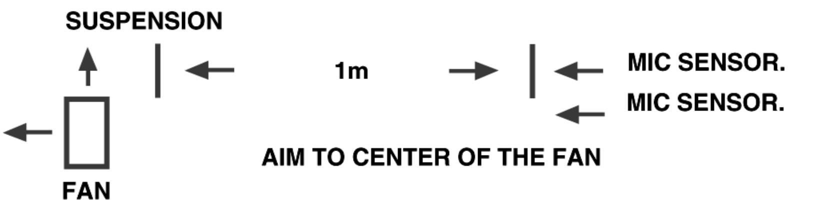
C : Coefficient of nozzle air flow
D : Diameter of nozzle (m)
r : Air density

$$\left(1.293 \times \frac{273}{273+t} \times \frac{P}{1013.25}\right)\ (kg/m^3)$$

t : Temperature (oC)
P : Air pressure (hPa)
Pn : Differencial pressure of air flow (Pa)
g : 9.8m/s2

Acoustic Noise Measurement

Noise measurments are performed in an Anechoic Chamber with less than 19 dBA background noise in compliance with ISO7779 standards. 1m from inlet side.



Units Of Measure And Conversions

Fan airflow, static pressure, temperature, and dimensions are often referred to in a variety of unit measures. Next are the measures and methods of conversion.

Airflow

CFM	m3/min	m3/hr
1	0.028	1.7
35.3	1	60
0.59	0.017	1
0.16	0.06	3.6

Static Pressure

in H20	mm H20	Pa
1	25.4	249
0.039	1	9.81
0.004	0.1	1

Fan Life Testing

Life expectancy of a cooling fan is a critical element in thermal design. UTEC uses parametric failure modes during life testing to caluculate forlife expectancy. Speed (RPM) and Current (mA) failures include both "hard failures" (where the fan is nonfunctional) and "parametric failure".These parametric failures are defined as 15% decrease in RPM and 15%increase in current than initial.

Including parametric failure modes leads to a more conservative L-10 and MTTF reporting standard than those methods that measure life performance using only hard fialures.

UTEC evaluates fan life and reliability during the design phase using accelerated life testing in conjunction with ORT (On-going Reliability Testing).Accelarated life testing is used to compress the amount of time required to conduct life testing. Development testing occurs early in the product design, prior to product release. It is vital to characterize the reliability of the product in the initial stages of deign to allow for improvements and to meet the reliability specifications prior to release to manufacturing.

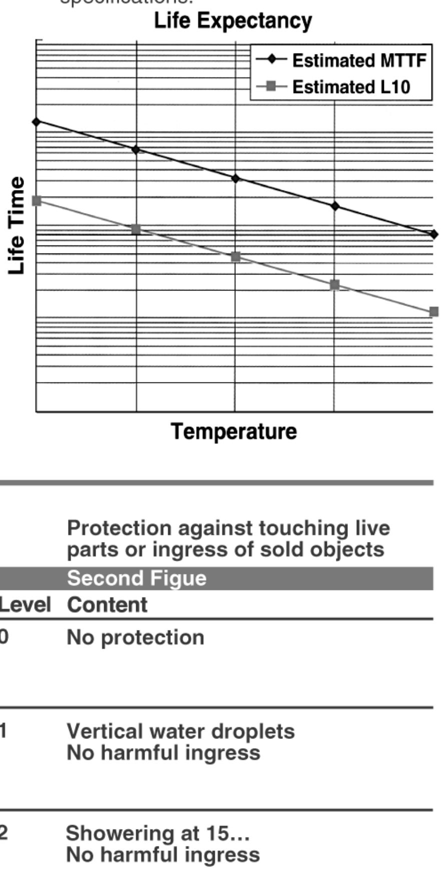
Once the design has been through design verification testing and is turned over to manufacturing. ORT is conducted. The value of ORT is a continued refinement of the accuracy of the accerarated life testing and constant review ofthe design of the fan. This continued process improvement allows for ongoing evaluation and increase in fan life and reliability.

Under accelerated life testing, UTEC fans are tested at extreme environmental conditions, with temperature stress factors above standard operating levels. In order to gather meaningful data within a reasonable time frame. The stress factors must be accelerated to simulate different operating environments. High temperature stress is the most common stress factor used for these purposes

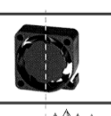
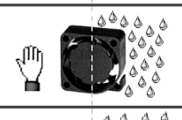
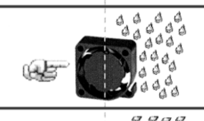
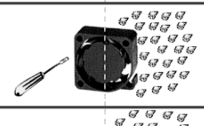
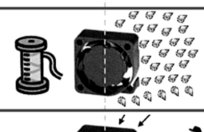
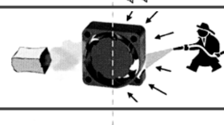
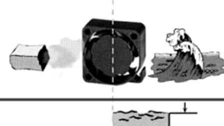
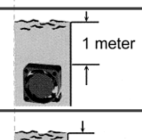
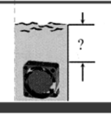
Proper understanding of accelerating stresses and design limits are necessary to implement a meaningful accelerated reliability test. UTEC usesthe Arrhenius model for determining acceleration factors (AF) during life testing. This is the most commonly used model in accelerated life testing where thermal stress is the primary factor affecting life.

Life test data gathered from different type of fan lends to highly accurate statistical analysis. This data can produce very detailed information about the behavior of the product for reliability and prediction of fan performance in the field. The Weibull Distribution is a typical method employed by UTEC for which 10% of population will have failed and 90% of population will continue to operate within specifications.

Life Expectancy



IP Protection

Protection against touching live parts or ingress of sold objects				Protection against touching live parts or ingress of sold objects
IP First Figue				**Second Figue**
Content	**Level**		**Level**	**Content**
No protection	0		0	No protection
Touching by hand or 12mm dia.object	1		1	Vertical water droplets No harmful ingress
Touching by finger or 12mm dia.object	2		2	Showering at 15… No harmful ingress
Touching by tools or wire 2.5mm dia. or 2.5mm dia.object	3		3	Showering at 60… No harmful ingress
Touching by tools or wire 1mm dia. or 1mm dia.object	4		4	Splashing from any direction No harmful ingress
Total touch protection or no harmful ingressof dust	5		5	Water jets from any direction No harmful ingress
Total touch protection or noingress of dust	6		6	Large volumes of water No ingress
		 1 meter	7	Immerson up to 1 meter deep No ingress
			8	Submersion at specified depths exceeding 1 meter No ingress

This figure can be seen in the specification.