

# Centrifugal Fans Model USF

- Commercial & Industrial Applications
- Single Width



BUILDING VALUE IN AIR.

 **GREENHECK**  
Building Value in Air.

July  
2019

Greenheck's single-width centrifugal fans are designed to provide efficient and reliable operation for commercial and industrial applications. Our products are manufactured with state-of-the-art laser, forming, spinning and welding equipment, and undergo quality control testing to ensure a trouble-free start-up.

## Benefits of Greenheck Centrifugal Products

- AMCA licensed performance and UL Listed
- Ease of selection using Greenheck's eCAPS® or CAPS® software selection tools
- Tiered product portfolio offering the best value fan for any given application
- AutoCAD® and Revit® models available for download
- Quick Build and Fast Pass expedited shipping programs
- Factory tested prior to shipment



## Certifications

Air Performance	AMCA	Sizes	Wheel
A1	Sound and Air	18 - 73	AF
B1	Sound and Air	7 - 73	BI
B2	Air	4 - 24	BI
B3	Air	4 - 18	BI
B4	Air	27 - 49	BI
B5	Air	6 - 10	BI
F1	Air	9 - 24	FC
F2	Air	6 - 10	FC



Certified data may be found in Greenheck's Computer Aided Product Selection program (CAPS)



UL/cUL 705 Listed Power Ventilator  
UL/cUL File E40001

UL/cUL 762 Power Ventilators for Restaurant Exhaust Appliances  
UL/cUL File MH11745

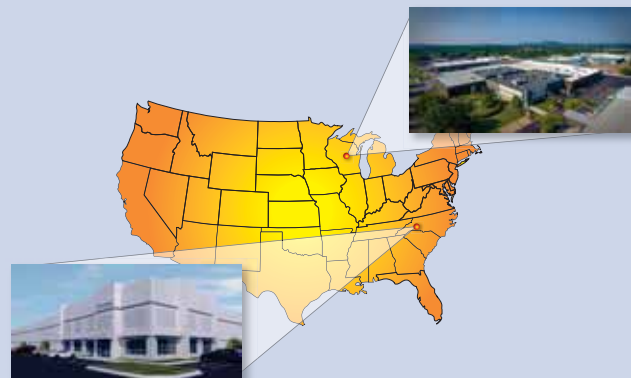
UL/cUL Power Ventilator for Smoke Control Systems  
UL/cUL File MH17511

## Manufactured in the USA

Model USF fans are built in one of two manufacturing locations, Schofield, WI and Shelby, NC. Multiple manufacturing locations enables us to build fans and get them to you, our customer, faster.

### Quick Build Availability

Select model USF fan configurations are available in as little as 3 days on our Quick Build program.



*Greenheck's centrifugal products are designed to handle a variety of commercial and industrial applications:*

- General supply, return or exhaust systems
- Emergency smoke exhaust (buildings, car parks, etc.)
- Restaurant grease exhaust
- Stairwell pressurization
- Process heat exhaust
- Filter houses and dust collectors
- Built-up or custom air handlers
- Spark-resistant fume exhaust
- Corrosive fume exhaust
- Grain drying

### Emergency Smoke (UL/cUL Listed):

*Atriums, libraries, multi-story buildings*

Select Greenheck centrifugal fans are UL/cUL Listed for Power Ventilators for Smoke Control Systems. Fans can be installed for dual application use or as a dedicated emergency system, with the primary function of the fan being general air movement, but built to withstand operation seen in emergency smoke situations. The UL Listing indicates the model is designed and tested to exhaust heat and smoke in an emergency situation.

The emergency high temperature option is suitable for the following temperatures:

Operating Temperature	Time Duration
500°F (260°C)	4 hours
572°F (300°C)	2 hours
752°F (400°C)	2 hours
1000°F (538°C)	15 minutes



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### High Temperature Process Exhaust:

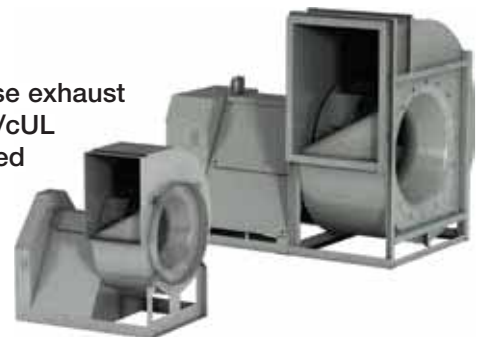
*Kilns, Dryers, Furnaces*

Designed for applications involving elevated temperatures above 250°F (121°C) continuously for extended periods of time. Material and arrangement choices are limited to components suitable for this application and located to minimize effects. Fans manufactured with a high temperature process package include high temperature shaft seal, heat slinger, high temperature fan bearing grease, and high temperature coating on steel fans. Heat slinger dissipates heat being transferred down the fan shaft preventing bearing grease evaporation. Applications up to 1000°F can be handled with the use of stainless steel materials.

### Restaurant Grease Exhaust (UL/cUL 762 Listed):

*Restaurants*

The centrifugal scroll fans are designed for high pressure restaurant grease exhaust applications. Either Permalock™ or welded housing are available with UL/cUL Listing of Power Ventilators for Restaurant Exhaust Appliances. The welded housing is suitable for indoor or outdoor mounting locations, whereas the Permalock™ housing is suitable for outdoor kitchen ventilation installations. Listing tests exceed duct temperatures of 400°F (204°C) continuous operation. UL/cUL 762 selections require a drain connection and access door for cleaning.



## Efficiency – Controllability – Simplicity

The USF direct drive model (100 series only) is an arrangement 4 utility set fan with a backward-inclined or forward-curved centrifugal wheel. The housing is constructed from galvanized steel with a bolted frame. High performance powder coating is optional. Fans are provided with an integral speed control for easy system balancing. Simplified wiring and preprogrammed variable frequency drive (3-phase) make installation quick and easy.

### Standard Construction and Configuration

- Volume up to 6,500 cfm
- Static pressure up to 3 in. wg
- Galvanized or coated steel
- Greenheck's Permalock™ lock seam scroll
- Aluminum wheel
- NEMA-3R, toggle switch, mounted and wired
- Bolted access door
- Weatherhood
- Drain

### Accessories

- Inlet guard
- Outlet flange
- Outlet guard
- Backdraft gravity damper
- Neoprene isolators
- Equipment supports
- Extended warranty

### Simplified Wiring

Easy to install – featuring a terminal strip, disconnect and speed control mounted and wired by the factory.

### Direct Drive Motor

Low maintenance – no belts, bearings or pulleys to service.

### Integrated Speed Control

Speed control is mounted, wired and programmed at the factory. Adjust fan speed with the push of a button.

Single-phase applications use Greenheck's electronically commutated (EC) Vari-Green® motor with a control dial for adjustment.

Three-phase applications use a NEMA Premium Efficient motor with variable frequency drive (VFD).

1- and 3-phase options can be controlled via 0-10 vDC signals.

### Vari-Green Motor Benefits

Greenheck's electronically commutated (EC) Vari-Green motor combines motor technology, controllability and energy-efficiency into a single low-maintenance unit and is the industry's first fully-controllable motor.

- Motor can attain up to 85% efficiency, reducing energy consumption.
- 80% usable RPM turndown vs. 30% on AC single-phase direct drive, allowing for a broader speed adjustment covering more fan performance ranges.



### 3-Phase Motor with Micro Drive (VFD)

Electronically commutated (EC) motors are great for single-phase applications. However, once a fan performance approaches 1 hp, motors move to 3-phase applications.

Using a 3-phase induction motor with a micro drive (VFD) is a good way to get the same functionality as an EC motor.

- 3-phase induction motors are just as or more efficient than single-phase EC motors.
- Micro Drive (VFD) allows motor to speed up or slow down to achieve desired RPM.

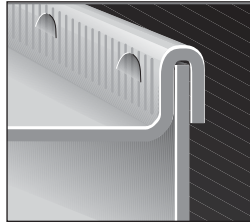
## Wheels

Greenheck centrifugal fans have multiple wheel options. All wheels are statically and dynamically balanced to grade G6.3 per ANSI S2.19.

	Backward-Inclined (BI)	Airfoil (AF)	Forward-Curved (FC)
Wheel Type			
Application	General purpose, clean air or severe environments	Clean air or fume exhaust	Clean air
Temperature	Up to 1000°F (538°C)	Up to 500°F (260°C)	Up to 180°F (82°C)
Construction	Steel Aluminum 316 Stainless Steel	Steel Aluminum	Steel Aluminum

## Permalock™ Housings

Permalock™ housings use a mechanically fastened seam instead of welding. This airtight and watertight housing construction uses the same structural support as all welded housings. Permalock™ construction is an excellent value engineering option for applications up to 8.5 in. wg (2.1 kPa).



## Welded Housings

Optional on Class 0, I, II and standard on larger fan sizes, centrifugal fans are manufactured with heavy gauge, welded housing construction. All welded construction is common for industrial applications and is suitable for pressures up to 22 in. wg (5.5 kPa).



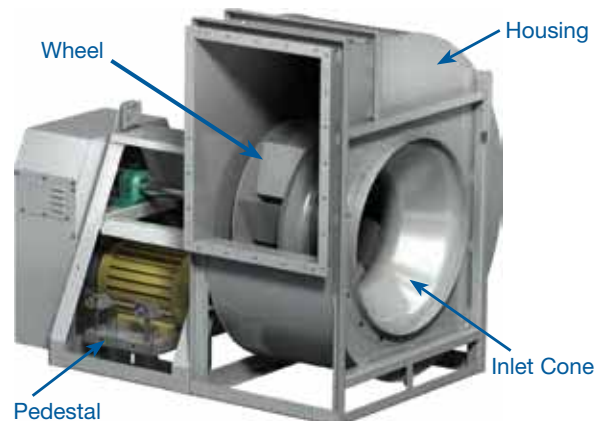
## Alternative Materials

Greenheck offers centrifugal fans in aluminum or stainless steel construction as an alternative to coated steel. Aluminum construction provides advantages for applications with high moisture and various chemicals. Aluminum also reduces the weight of the fan if there are structural concerns. Stainless steel (316L) construction is used for environments subject to continuous high heat up to 1000°F (538°C) or severe corrosives. Both aluminum or stainless steel construction can be applied to the entire fan (housing, wheel, inlet cone and drive frame) or the airstream components (housing, wheel and inlet cone) only.

## Spark-Resistant Construction

Greenheck centrifugal fans are available with spark-resistant designs suitable for applications that involve flammable particles, fumes or vapors. Spark-resistant construction options adhere to guidelines defined within AMCA Standard 99-0401-86.

<b>Spark A</b>	All parts in contact with the airstream are constructed of non-ferrous material (usually aluminum).
<b>Spark B</b>	The fan wheel is constructed of a non-ferrous material (usually aluminum). A non-ferrous (aluminum) rub ring surrounds the fan shaft where it passes through the fan housing.
<b>Spark C</b>	The inlet cone is constructed of non-ferrous material (usually aluminum). A non-ferrous (aluminum) rub ring surrounds the fan shaft where it passes through the fan housing.



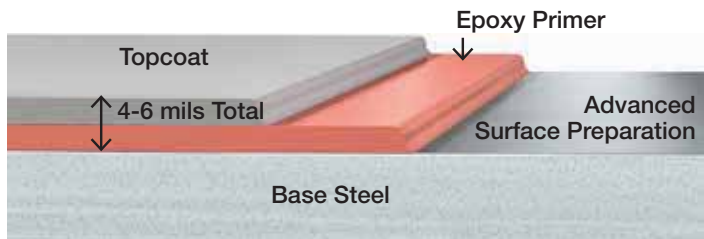
## Protective Coatings

Greenheck offers a wide variety of protective coatings suitable for corrosive applications. All coatings are electrostatically-applied baked powders that offer a durable, long lasting finish. For more information on our complete offering of coatings, visit [www.greenheck.com](http://www.greenheck.com) and navigate to Resources/Library/Application-Articles. Search for [Performance Coatings for Ventilation Products](#).

Chemical Resistance Ratings						
Chemical	Bleach	Sulfuric Acid (10%)	HCl (10%)	MEK	Chlorine (0.1%)	NaOH (20%)
Permatector	0	1	2	2	0	—
Hi-Pro Polyester	0	0	0	1	0	—
Hi-Pro-Z	0	0	0	1	0	1
<b>RATING DESCRIPTIONS</b>	0 - No effect 1 - Slight change in gloss or color 2 - Surface etching, severe staining, but film integrity remains 3 - Significant pitting, cratering, swelling, or erosion with obvious surface deterioration					

## Two-Coat Advantage

For corrosive environments, use Greenheck’s Hi-Pro-Z two-coat coating technology. Test data demonstrates our two-coat paint system offers four times the corrosion resistance of other coatings commonly available within the fan industry.



## Performance Tested

When selecting a powder coating finish for heavy-gauge welded steel fans, critical information such as environment, moisture, exposure, abrasives, and chemicals should be considered.

Powder coatings are the best choice for most extreme applications. Major advantages over most vendor-applied liquid coatings include:

- Superior finish with uniform coverage and thickness
- A better coating provides better protection
- The process is environmentally friendly
- Unequaled value

	Coatings	Color	Coating Specifications	Environments						
				CLEAN AIR	COASTAL	CHEMICAL *	EXTREME WEATHER	ABRASIVE PARTICLES	SUN-UV	
One Coat Process	<b>Permatector™</b> Standard coating for steel products in both indoor and outdoor applications	Concrete Grey RAL 7023	Thickness: 2.0 - 3.0 mils Polyester urethane powder coating	X						
	<b>Hi-Pro Polyester</b> Formulated for exterior durability, color and gloss retention. Excellent for chemical applications.		Thickness: 2.0 - 3.0 mils High performance polyester urethane powder coating	X		X			X	
Two Coat Process	<b>Hi-Pro-Z</b> Two-coat powder paint coating is resistant to saltwater, chemical fumes and moisture in corrosive environments		Thickness: 4.0 - 6.0 mils Hi-Pro Polyester topcoat with epoxy basecoat	X	X	X	X	X	X	

Note: Hi-Pro-Z is not available on aluminum.

\*Chemical Resistant Rating Above

## Vibration Analysis

All centrifugal wheels undergo a computerized balance analysis to a grade of G6.3. In addition, USF 500 series centrifugal products endure a complete mechanical vibration test after assembly. Our custom data acquisition system uses tri-axial accelerometers to measure the vibration in three planes at the design operating speed. A permanent record for each fan's performance is kept on file and is available upon request.

The standard "filter-in" vibration levels attained meet the requirements of Fan Application BV-3 as defined in AMCA Standard 204-05 "Balance Quality and Vibration Levels for Fans". Consult factory if more stringent vibration levels are necessary.



Copies of these signatures are kept on file and are available upon request.



Drive Type	Filter-In Vibration Limit (Rigidly Mounted)
Belt	0.15 in/sec-pk
Direct Arrg. 4	0.08 in/sec-pk
Direct Arrg. 8	0.15 in/sec-pk

500 series only

## Split Housings

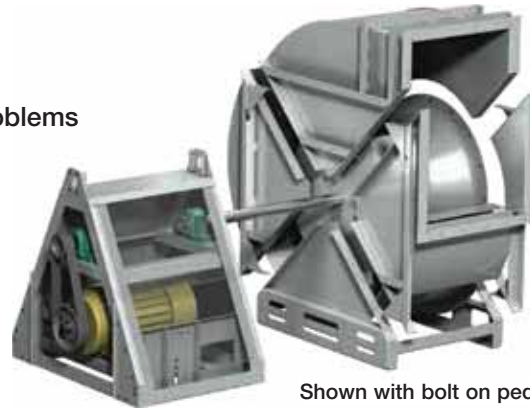
Quad split housings can solve many space limitation problems in both retrofit and new construction situations.

Not available on 45° discharges TAD, BAD.

### Size Limitations:

7 - 73	Bolt-on Pedestal Standard
33 - 73	Quad Split Optional

500 series only



Shown with bolt on pedestal and quad split housing (option)

## Premium Bearings

Belt drive centrifugal products are manufactured with "Air Handling Quality" self-aligning ball or roller pillow block bearings. All bearings include zerk fittings for relubrication and are selected for a basic rating fatigue life of L<sub>10</sub> in excess of 80,000 hours (L<sub>50</sub> at 400,000 hrs.) at the maximum RPM for the selected pressure class. 400 and 500 series models utilize concentric locking collars for smoother operation and providing superior grip force between the bearing collar and fan shaft.

For more critical applications, 500 series models offer bearings with a minimum L<sub>10</sub> life in excess of 200,000 hours (L<sub>50</sub> at 1,000,000 hrs.)

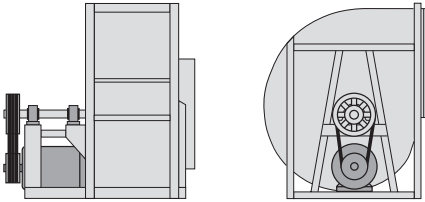
	L <sub>10</sub> Life	Equal to L <sub>50</sub> or Average Life
Industry Standard	40,000 hrs.	200,000 hrs.
USF Standard	80,000 hrs.	400,000 hrs.
500 Series Upgrade	200,000 hrs.	1,000,000 hrs.

L<sub>10</sub> life implies 90% reliability or 10% failure rate after the stated hours.  
 L<sub>50</sub> life implies 50% reliability or 50% failure rate after the stated hours.



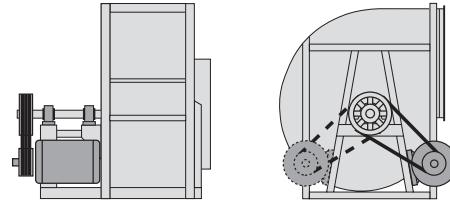
## Arrangement 10 – Belt Drive

- Recommended as first choice configuration for belt drive applications
- Most compact belt drive arrangement
- Bearings are mounted out of the airstream
- Motor is mounted beneath the drive frame
- Available with a weatherhood to cover motor, drives and bearings
- Moderate dirt and heat tolerance



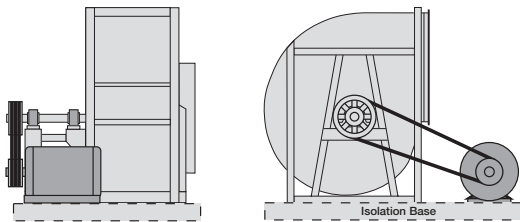
## Arrangement 9 – Belt Drive

- Bearings are mounted out of the airstream
- Easy access to large motors mounted on drive frame
- Standard motor position is on the right side of the drive frame
- Optional motor position is on the left side of the drive frame
- Available with motor cover, belt guard and shaft guard



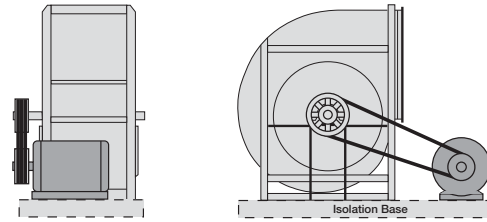
## Arrangement 1 – Belt Drive

- Bearings are mounted out of the airstream
- Unlimited motor size
- Requires an isolation base (by factory) or structural pad to mount the fan and motor
- Choice of motor positions W, X/Y or Z (see page 9)
- Available with motor cover
- Suitable for high temperatures or contaminated air



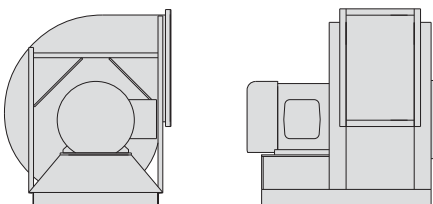
## Arrangement 3 – Belt Drive

- Bearings are mounted in the airstream
- Unlimited motor size
- Requires an isolation base (by factory) or structural pad to mount the fan and motor
- Choice of motor positions W, X/Y or Z (see page 9)
- Available with motor cover, belt guard
- Recommended for clean air at ambient temperatures



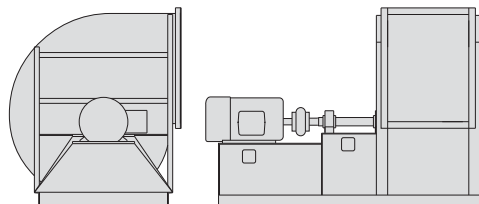
## Arrangement 4 – Direct Drive

- Available with partial width wheel and housing modifications for specific performance
- Recommended for higher horsepower applications in lieu of belt drive
- Limited to standard motor speeds, but are available with variable frequency drive compatible motors
- Provides compact design with low maintenance
- Available with motor cover



## Arrangement 8 – Direct Drive

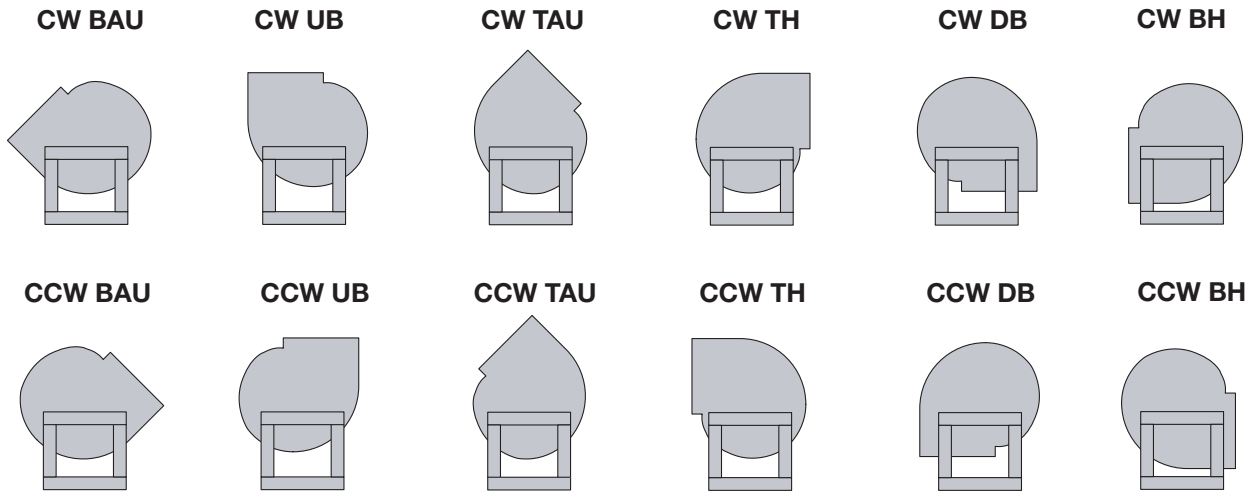
- Available with partial width wheel and housing modifications for specific performance
- Recommended for higher horsepower applications in lieu of belt drive
- Limited to standard motor speeds, but are available with variable frequency drive compatible motors
- Bearings located out of the airstream
- Suitable for high temperatures or contaminated air
- Available with motor cover, belt guard



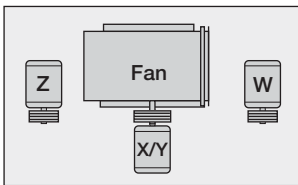


## Discharge Positions and Rotatable Housings

Rotation and discharge is always determined from the drive side of the fan.



## Motor Positions – Arrangements 1 and 3 Fans



Motor position and fan rotation are determined from drive side

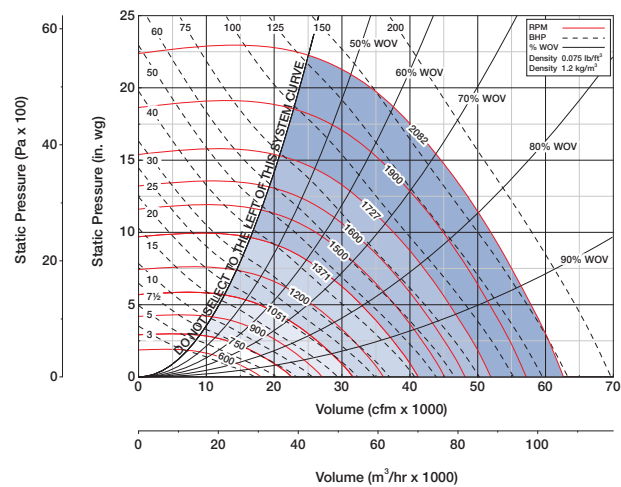
Fan arrangements 1 and 3 require a structural steel base or structural platform to support the fan and motor. The motor can be located in any of three positions around the fan shaft to ensure proper alignment. Motor positions W and Z tend to make a longer footprint from end to end. Positions X/Y tend to make a shorter but wider footprint.

## Class of Construction

AMCA defines fan class based on minimum outlet velocities and pressures a fan must be capable to produce. Fan classes are designated as 0, I, II, III or IV. As the fan class increases, the outlet velocity and pressure requirements increase as defined in AMCA Standard 99. As the outlet velocity and pressures increase, the fan construction (material gauge, shaft diameter, motor size, etc.) must also change to physically accommodate the faster RPMs required.

Centrifugal products are available in Class 0, I, II, III, or IV, with Class 0 having the lowest maximum fan RPM and Class IV having the highest maximum fan RPM.

A typical fan curve is shown with shaded class limits. For specific certified fan data, please consult Greenheck's Computer Aided Product Selection program, CAPS.



Class 0	Class I	Class II	Class III	Class IV
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## Vibration Isolators and Isolation Bases

Greenheck offers a complete package of vibration isolators, isolation bases and inertia bases to simplify field assembly and reduce transmitted vibrations.

Refer to the catalog on [www.greenheck.com/Resources/Library/Literature](http://www.greenheck.com/Resources/Library/Literature). Search for [Mounting Bases and Vibration Isolation](#).

### Mounting Types



#### Direct Mount

No base required, isolators are attached directly to equipment. Direct isolation can be used if equipment is unitary and rigid without the use of additional support. Direct isolation is not recommended for equipment having large overhung loads (e.g. motors on arrangement 9 fans). If there is any doubt that equipment can be supported directly on isolators, use bases or consult the factory.



Isolation base with height saving brackets

#### Isolation Base

Isolation bases consist of formed steel members welded into a rigid one-piece base. A motor slide base is included where applicable. Bases are required for all arrangement 1 and 3 fans with independently mounted motors. Isolation bases are available without isolators, with rubber mounts or with spring mounts. All formed steel bases with spring mounts incorporate height saving brackets.



Inertia base

#### Inertia Base

Inertia bases may be desirable where isolation bases do not provide sufficient mass or where discharge velocities cause greater reaction forces. The additional weight of the concrete reduces the vibration amplitude and reduces reaction forces from fan thrust and start and stop motion. Concrete is by others.

Note: Motor slide base is included on arrangement 1 & 3 fans.

### Isolator Types



Neoprene

#### Rubber Mount

Neoprene mountings consist of a steel top plate and base plate completely embedded in colored (oil-resistant) neoprene for easy identification of capacity. Neoprene mountings are furnished with a tapped hole in the center. This enables the equipment to be bolted securely to the rubber mount.



Restrained

#### Restrained Spring Mount

Restrained spring isolators consist of laterally stable, free-standing springs assembled into a steel housing. These assemblies are designed for vertical and horizontal motion restraint. Springs provide 50% overload capacity and are color coded or identified to indicate load capacity. Restrained spring mounts are recommended for equipment subject to wind-loading or large torquing forces. They are also used for equipment subject to large weight changes such as swing-out fans.



Free Standing

#### Free-Standing Open Spring Mount

Free-standing spring isolators are unhusd laterally stable steel springs. They provide a minimum horizontal stiffness of 0.8 times the rated vertical stiffness and provide an additional 50% overload capacity. These isolators are equipped with a top mounted adjusting bolt and an acoustical non-skid base. Springs are color coded or identified to indicate load capacity.

## Access Door

Bolted or hinged access doors provide access for cleaning or inspection.

## Backdraft Damper

Backdraft dampers are available in galvanized, painted steel or aluminum construction and include counterweights for tight closure when the fan is de-energized.

## Belt Guard

Belt guards are designed to allow easy access to the belts and pulleys for service. All belt guards include tachometer openings to monitor the fan speed as well as an access panel for testing belt tension. Belt guards meet OSHA guidelines.

## Disconnect Switch

Greenheck offers a wide selection of NEMA rated fusible or non-fusible disconnect switches. Switches can be factory mounted or shipped loose for field installation.

## Drain with Plug

A one-inch (25 mm) threaded drain connection is located at the bottom of the fan housing to drain water that may accumulate.

## Extended Life Bearings

Extended life bearings are selected for a basic rating fatigue life  $L_{10}$  per ABMA Standards in excess of 200,000 hours at the maximum RPM.  $L_{10}$  is the life associated with 90% reliability of a bearing.

## Extended Lubrication Lines

Single-width fans are available with flexible nylon or copper tubing extending from the bearings to conveniently located grease fittings mounted on the fan pedestal (or on the exterior of weatherhood if a weatherhood is supplied).

## Grease Containment

Grease trap is designed to collect grease residue to avoid drainage onto roof surface. Grease traps ship loose for field installation.

## Heat Slinger

The heat slinger is an aluminum cooling disc mounted on the fan shaft between the inboard bearing and the blower housing to dissipate heat conducted along the fan shaft.

## Inlet Companion Flange

Punched companion inlet flanges are available on single-width fans.

## Inlet and Outlet Flanges

Optional inlet flanges on single-width fans are pre-punched and welded to the inlet collar. Punched outlet flanges are standard on fan sizes 33-73.

## Inlet and Outlet Guards

Removable inlet and outlet guards provide protection for personnel and equipment in non-ducted installations. Inlet and outlet guards meet OSHA guidelines.

## Motor Cover (Arrg. 1 W or Z, 3, 4, 8, 9)

A weatherproof motor cover shields the motor components from dust, dirt and moisture for outdoor installations.

## Shaft Guard (Arrg. 1, 8 or 9)

Shaft guards are designed to cover shafts and bearings. Extended lube lines are optional for bearing lubrication without removal of the guard. Shaft guards meet OSHA guidelines.

## Shaft Seal

A felt, neoprene, or ceramic shaft seal with a rub ring is available for operation at high temperatures or for exhausting contaminated air.

## Stainless Steel Shaft

Stainless steel fan shafts are available for applications where standard carbon steel shafts may exhibit excessive corrosion or heat stress.

## Sure-Aire™

Non-invasive flow monitoring system capable of capturing accuracy within 3% and available with or without electronics. Clean air applications only.

## Weatherhood (Arrg. 1 X/Y, 10)

Vented steel weatherhoods protect the motor and drive components from rain, moisture, dust, and dirt. Weatherhoods meet OSHA guidelines and are easily removed for service access.

## Volume Control:

### Volume Control Damper

Control dampers are available in painted steel, aluminum or stainless steel. Actuator options include manual quadrant or electric.

### VFD Rated Motor

Variable frequency drives (VFD's) change the frequency of the input power to the motor, which results in changing the motor's speed. Changing the speed of the fan provides the greatest potential for energy savings at partial loads.



# Centrifugal Fans

## Greenheck's Centrifugal Product Offering

Greenheck's tiered model approach gives you flexibility in size, performance and construction matching the appropriate model to your application. Our centrifugal product line offers a variety of options in construction features, materials and performance by model.

- Backward-inclined, forward-curved or airfoil wheel options
- Class 0-4 pressure ratings
- Permalock™ or fully welded scroll designs
- Belt or direct drive configurations
- Galvanized, coated steel, aluminum or stainless construction materials
- Spark-resistant or high temperature packages



## Enjoy Greenheck's extraordinary service, before, during and after the sale.

Greenheck offers added value to our wide selection of top performing, energy-efficient products by providing several unique Greenheck service programs.



- Our Quick Delivery Program ensures shipment of our in-stock products within 24 hours of placing your order. Our Quick Build made-to-order products can be produced in 1-3-5-10-15-20 or 25-day production cycles, depending upon their complexity.
- Greenheck's free Computer Aided Product Selection program (CAPS), rated by many as the best in the industry, helps you conveniently and efficiently select the right products for the challenge at hand.
- Greenheck has been Green for a long time! Our energy-saving products and ongoing corporate commitment to sustainability can help you qualify for LEED credits.
- Our 3D service allows you to download, at no charge, easy-to-use AutoDesk® Revit® 3D drawings for many of our ventilation products.

Find out more about these special Greenheck services at [greenheck.com](http://greenheck.com)

## Our Commitment

*As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.*

Product warranties can be found online at [Greenheck.com](http://Greenheck.com), either on the specific product page or in the literature section of the website at [Greenheck.com/Resources/Library/Literature](http://Greenheck.com/Resources/Library/Literature).



Prepared to Support  
Green Building Efforts

