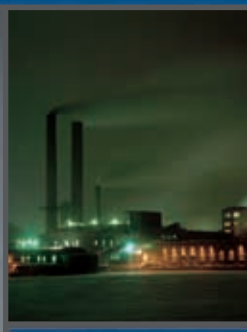
Centrifugal Fans
Models SWD, USF and CSW

- Backward-Inclined and Airfoil Wheels
- Single-Width



Commercial & Industrial Applications

BUILDING VALUE IN AIR.

GREENHECK
Building Value in Air.

February 2017

Centrifugal Fans

GREENHECK
Building Value in Air.

Greenheck's airfoil and backward-inclined 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 endure our quality control testing to ensure trouble-free start-up. Greenheck centrifugal models include industry-leading design features to ensure your ventilation equipment has the latest technologies available.

Available with Greenheck Centrifugal Products:

- AMCA licensed performance
- Permalock™ or all welded scroll design
- Set screw or concentric mount bearings with the industry's highest cataloged bearing life
- Corrosion-resistant, electrostatically applied and baked powder coatings
- Both belt and direct drive configurations
- Galvanized, coated steel, aluminum or stainless construction materials
- UL/cUL approvals for electrical, kitchen grease and high temperature operation

Made in U.S.A.

Models SWD, USF and CSW fans are designed and 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.

MODEL	AMCA	SIZES
SWD	AMCA Air	All sizes (07-18)
USF-BI 200	AMCA Air	6 - 10
USF-BI 200	AMCA Sound and Air	12 - 22
USF-BI 300	AMCA Air	6 - 10
USF-BI 300	AMCA Sound and Air	12 - 24
USF-BI 300	AMCA Air	27 - 49
USF-AF 400	AMCA Sound and Air	18-49
USF-BI 400	AMCA Sound and Air	All sizes (7-49)
CSW-AF	AMCA Sound and Air	All sizes (18-73)
CSW-BI	AMCA Sound and Air	All sizes (7-73)

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

c UL us LISTED

UL/cUL 705 Listed Power Ventilator
UL/cUL File E40001 (SWD, USF-200, -300, -400, CSW)
UL/cUL 762 Power Ventilators for Restaurant Exhaust Appliances
UL/cUL File MH11745 (USF-300, -400, CSW)
UL/cUL Power Ventilator for Smoke Control Systems
UL/cUL File MH17511 (USF-300, -400, CSW)

Quick Build Availability

Models SWD, USF and CSW fans are available in as little as 5 days on our Quick Build program. Quick Build offers you a number of lead times to meet your needs.

Quick Build Program			
Model	5 Day	10 Day	Standard
SWD		✓	✓
USF-200	✓	✓	✓
USF-300 (6-24)	✓	✓	✓
USF-300 (27-49)	✓	✓	✓
USF-400	✓	✓	✓
CSW	✓	✓	✓

Centrifugal Fans

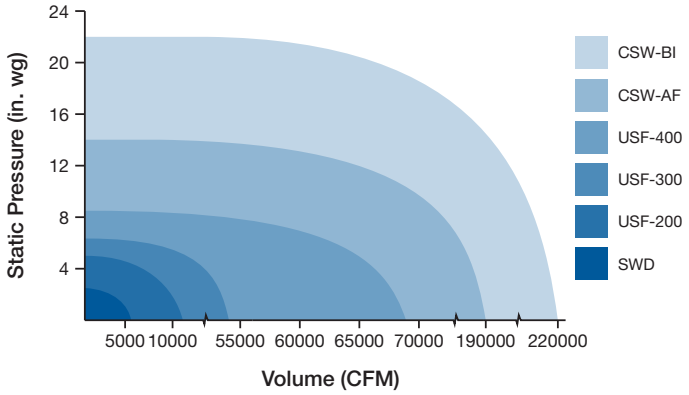
GREENHECK
Building Value in Air.

Greenheck's centrifugal products are specified to handle a variety of commercial and industrial projects.

- 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

Benefits of Greenheck's centrifugal fans

- Designed, engineered and tested prior to shipment to provide years of smooth, vibration-free operation with minimal maintenance.
- Centrifugal fans are more efficient at higher static pressures and quieter than propeller fans
- Housing changes airflow direction efficiently without adding static pressure from duct turns
- Flexible installation locations, inside or outside
- Inlet cone reduces system effects when fitting into tight spaces
- Serviceable components at the same level as the technician



Greenheck's tiered 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.

- Quick and easy selection options along with AutoCAD® and Revit™ models available for download and integration into plan drawings, custom equipment schedules and specifications.
- Multiple motor and control options for energy efficiency savings and exact control.
- eCAPS®, an easy to use cloud based cross-model selection program quickly ranks the tiered centrifugal models based on performance, and providing detailed estimated first cost, operating costs, weights, and dimensions. Enhanced construction requirements show only models matching project requirements.
- CAPS™ selection software leads the industry in providing selection details, options accessories and full submittal packages. The centrifugal product filter quickly guides the user to available models meeting criteria and offering full range of available options and accessories.


SWD


USF-200


USF-300


USF-400


CSW

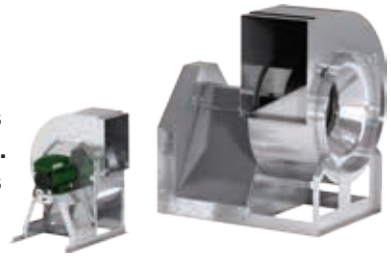
MODEL/SIZE	CAPACITIES CFM (*m³/hr*)	STATIC PRESSURE in. wg (kPa)	Drive		Frame		Scroll Materials			
			Belt	Direct	Bolted	Welded	Galvanized	Coated Steel	Aluminum	Stainless
SWD	5,500 (*9340*)	2.5 (*.62*)		✓	✓		✓	✓	✓	
USF-200	10,000 (*16990*)	5.5 (*1.4*)	✓		✓		✓			
USF-300	53,000 (*90050*)	5.5 (*1.4*)	✓		✓			✓		
USF-400	66,000 (*112130*)	9 (*2.2*)	✓			✓		✓		
CSW-BI (7-73)	231,000 (*392470*)	21 (*5.2*)	✓	✓		✓		✓	✓	✓
CSW-AF (18-73)	195,000 (*331300*)	14 (*3.5*)	✓	✓		✓		✓	✓	

Centrifugal Fan Applications

GREENHECK
Building Value in Air.

Light Duty Commercial and Institutional:

General ventilation, office space, retail space, cafeterias, break rooms, conference rooms



Building or room with relatively clean air found in a normal work place environment. Air volumes are typically below 8,000 cfm with static pressures less than 3 in. wg (747 Ps). Application needs a basic fan model providing good value. Galvanized housing and bolted construction are appropriate for the requirements of this application.

Models: SWD, USF-200

Commercial and Institutional:

Warehouse, hotels, atriums, theaters, gyms, library

Larger volumes of air up to 20,000 cfm with low to moderate static pressures to 5 in. wg (1245 Pa). Air quality is relatively clean; used for supply or exhaust. Fan coating available for cosmetic appearance or improved weather protection. Instances may require fan certified for use in emergency conditions.

Models: SWD, USF-200, USF-300

Light Industrial and Specialty Commercial:

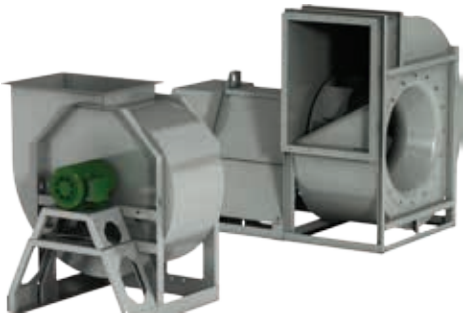
Waste water treatment, garage exhaust, restaurants, mechanical rooms, manufacturing space, dedicated exhaust hoods, emergency smoke, natatoriums, cleanrooms

Category involves a wide range of airflow volume from very low to 60,000 cfm with moderate pressures below 8 in. wg (1990 Pa). Fans applied to dedicated exhaust systems or combined between process and clean air. Applications requiring higher efficiency can use airfoil wheel. Fans may be subjected to increased level of chemicals or particulates in the air. Additional contaminates such as grease exhaust or light dusts are possible. Specialized coatings are available when needed. Fans may also have need for dual use in emergency conditions or spark resistance.

Models: SWD, USF-300, USF-400, CSW

Industrial:

Process exhaust, fume exhaust, chemical processing, high temperatures, high humidity, vibration sensitive areas



Systems having a broad airflow performance range from low to high volumes and pressures for supply or exhaust from different processes. Application often requiring additional strength and rigidity to the unit through welded scroll housings and frames. Application of specialized coatings or construction materials for spark resistance, extra protection to resist corrosion or high temperatures. High degree of durability in the fan is critical for process operation or for safety concern. Components required are of the highest quality, durability and longest life.

Models: USF-400, CSW

Centrifugal Fan Applications

GREENHECK
Building Value in Air.

Emergency Smoke (UL/cUL Listed):

Atriums, libraries, multi-story buildings

Fan installed for emergency use on a dedicated emergency system or dual application use with the primary function of the fan being general air movement but built to withstand operation seen in emergency smoke situations. Greenheck models USF-300, USF-400, and CSW are available with the UL/cUL Power Ventilators for Smoke Control Systems. Listing indicates the model is designed and tested to exhaust heat and smoke in an emergency situation.

Models: USF-300, USF-400, CSW

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

Operating Temperature	Time Duration
500ºF (260ºC)	4 hours
572ºF (300ºC)	2 hours
752ºF (400ºC)	2 hours
1000ºF (538ºC)	15 minutes

c UL US LISTED

UL/cUL 705 Listed Power Ventilator
UL/cUL File E40001(SWD, USF-200, -300, -400, CSW)
UL/cUL 762 Power Ventilators for Restaurant Exhaust Appliances
UL/cUL File MH11745 (USF-300, -400, CSW)
UL/cUL Power Ventilator for Smoke Control Systems
UL/cUL File MH17511 (USF-300, -400, CSW)

High Temperature Process Exhaust:

Kilns, Dryers, Furnaces

Application involving elevated temperatures above 250°F (121°C) continuously or extended periods of time. Material and arrangement choices are limited to components suitable for this application and located to minimize effects. Fans are manufactured with high temperature process package that includes 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 fan shaft preventing bearing grease evaporation.

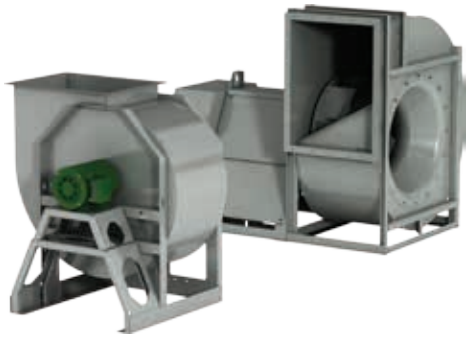
Model: CSW

Temperature Option	Wheel Type	Arrangement	Material
251–500ºF (121–260ºC)	BI, AF	1, 8, 9, 10	Steel, 316 Stainless Steel*
501–750ºF (261–400ºC)	BI	1, 8	316 Stainless Steel
751–1000ºF (401–538ºC)	BI	1	316 Stainless Steel

Note: Aluminum construction is suitable up to 250ºF (121ºC)
* AF wheels are steel construction only.

Chemical and Hazardous Exhaust:

Petrochemical, Mills, Fertilizer, Poultry Barns



Specialized type of HVAC industrial application with air containing high concentration levels of hazardous chemicals from process exhaust or other sources. Application dictates utilizing a higher performance coating or use of corrosion-resistant materials (stainless steel or aluminum). Systems may also combine with high temperatures.

Model: CSW

Restaurant Grease Exhaust (UL/cUL 762 Listed):

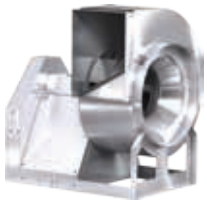
Restaurants

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/cUL762 selections require a drain connection and access door for cleaning.

Models: USF-300, USF-400, CSW

Model Comparison

GREENHECK
Building Value in Air.



MODEL COMPARISON		SWD	USF-200	
Performance	Volume (CFM max *(m^3/hr)*)	5,500 *(9340)*	10,000 *(16990)*	
	Static Pressure (Ps max)	2.5 in. wg *(623 Pa)*	5.5 in. wg *(1370 Pa)*	
	Sizes	7-18	6-22	
	Class	–	–	
Standard Construction	Wheel Type	BI	BI	
	Drive Type	Direct	Belt	
	Scroll Material	Galvanized	Galvanized	
	Scroll Construction	Permalock™	Permalock™	
	Discharges	TH, UB, BH, TAU, BAU, DB, TAD, BAD	TH, UB	
	Arrangements	4	10	
	Wheel Construction	Riveted	Riveted	
	Wheel Material	Aluminum	Size 6-10 Aluminum Size 12-22 Coated Steel	
	Frame Construction	Bolted	Bolted	
	Frame Material	Galvanized, Coated Steel	Galvanized	
	Inlet Cone Material	Aluminum	Coated Steel	
	Inlet / Outlet Connection	Slip Fit / Slip Fit	Slip Fit / Slip Fit	
	Bearings	–	Set Screw	
	Bearing Life	–	L_{10} 80,000 Hours	
	Factory Vibration Test	–	–	
Options	Welded Scroll	Yes	–	
	High Temperature Limit (Continuous)	250°F (121°C)	250°F (121°C)	
	Stainless Airstream	–	–	
	Aluminum Construction	Airstream	–	
	Spark Resistant	AMCA Spark B & C	–	
	UL/cUL 705 (Electrical) Listed	Yes	Yes	
	UL/cUL 762 (Grease Exhaust) Listed	–	–	
	HT-UL/cUL (Emergency Smoke) Listed	–	–	
	Extended Life Bearings	–	–	
	Quad Split Housing	–	–	
	Stainless Shaft	–	–	
Accessories	Isolation	Direct Mount / Rails	Direct Mount	
	Access Door - Hinged / Bolted	Bolted	Bolted	
	Inlet/Outlet Guards	Yes	Yes	
	Motor Cover (Arr, 1, 3, 4, 8, 9) / Weatherhood (Arr 1 X/Y, 10)	Yes	Yes	
	Sure-Aire Airflow Measurement	–	–	
	Backdraft / Volume Control Damper	WD, HB, HCD	WD	
	Inlet / Outlet Flange	Yes	Yes	
	Heat Slinger / Shaft Seal	–	–	
	Coating Options	Yes	–	
	Disconnect Switch	NEMA 1, 3R, 4, 4X, 12	NEMA 3R	

				
	USF-300	**USF-400**	**CSW**	**MODEL COMPARISON**
	53,000 ***(90050)***	66,000 ***(112130)***	231,000 ***(392470)***	Volume (CFM max ***(m^3/hr)***)
	5.5 in. wg *(1370 Pa)*	9 in. wg *(2240 Pa)*	21 in. wg *(5230 Pa)*	Static Pressure (Ps max)
	6-49	7-49	7-73	Sizes
	–	0, I	0, I, II, III (BI IV)	Class
	BI	BI & AF	BI & AF	Wheel Type
	Belt	Belt	Belt / Direct	Drive Type
	Coated Steel	Coated Steel	Coated Steel	Scroll Material
	Permalock™	Permalock™	Permalock™ on Class 0, I, II & <54 Welded on Class III, IV & >=54	Scroll Construction
	TH, UB, BH, TAU, BAU	TH, UB, BH, TAU, BAU	TH, UB, BH, TAU, BAU, DB	Discharges
	10	10	1, 3, 4, 8, 9 & 10	Arrangements
	Size 6-24 Riveted Size 27-49 Welded	Welded	Welded	Wheel Construction
	Size 6-10 Aluminum Size 12-49 Coated Steel	Coated Steel	Coated Steel	Wheel Material
	Bolted	Welded	Welded	Frame Construction
	Coated Steel	Coated Steel	Coated Steel	Frame Material
	Coated Steel	Coated Steel	Coated Steel	Inlet Cone Material
	Slip Fit / Flange	Slip Fit / Flange	Slip Fit / Flange	Inlet / Outlet Connection
	Set Screw	Concentric Locking	Concentric Locking	Bearings
	L_{10} 80,000 Hours	L_{10} 80,000 Hours	L_{10} 80,000 Hours,	Bearing Life
	–	–	Yes	Factory Vibration Test
	–	Yes	Yes	Welded Scroll
	400°F (204°C)	400°F (204°C)	1000°F (538°C)	High Temperature Limit (Continuous)
	–	–	Yes	Stainless Airstream
	–	–	Airstream or Entire Unit	Aluminum Construction
	AMCA Spark B & C	AMCA Spark B & C	AMCA Spark A, B & C	Spark Resistant
	Yes	Yes	Yes	UL/cUL 705 (Electrical) Listed
	Yes	Yes	Yes	UL/cUL 762 (Grease Exhaust) Listed
	Yes (excludes size 6-10")	Yes	Yes	HT-UL/cUL (Emergency Smoke) Listed
	–	–	L_{10} 200,000 Hours	Extended Life Bearings
	–	–	Yes	Quad Split Housing
	–	–	Yes	Stainless Shaft
	Direct Mount / Rails	Direct Mount	Direct Mount / Bases / Inertia	Isolation
	Hinged / Bolted	Hinged / Bolted	Hinged / Bolted	Access Door - Hinged / Bolted
	Yes	Yes	Yes	Inlet / Outlet Guards
	Yes	Yes	Yes	Motor Cover (Arr, 1, 3, 4, 8, 9) / Weatherhood (Arr 1 X/Y, 10)
	–	Yes	Yes	Sure-Aire Airflow Measurement
	WD, HCD	HB, HCD	HB, HCD	Backdraft / Volume Control Damper
	Yes	Yes	Yes	Inlet / Outlet Flange
	Yes	Yes / Yes	Yes / Yes	Heat Slinger / Shaft Seal
	Yes	Yes	Yes	Coating Options
	NEMA 3R	NEMA 3R	NEMA 3R, 4, 4X, 7/9, 12	Disconnect Switch

SWD - Vari-Green Options

GREENHECK
Building Value in Air.

Model SWD

Greenheck's backward-inclined utility fans have many advantages; higher operating efficiencies, non-overloading horsepower curves and higher pressure capabilities. You will also receive the following benefits with these fans:

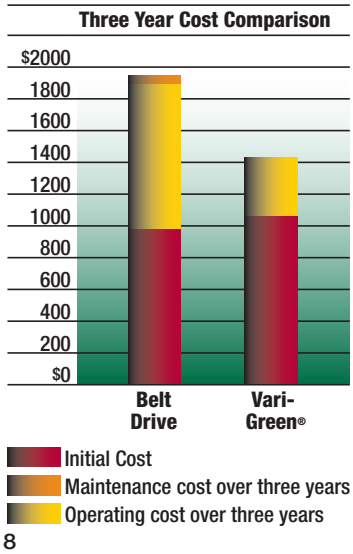
- Available in seven sizes (7 through 18) capacities from 100 to 5,500 cfm (170 to 9,352 m³/hr) and static pressures to 2.5 in. wg (623 Pa). Model SWD is offered exclusively with Vari-Green electronically commutated motors for energy efficiency and ease of control.

Vari-Green® Motors

Greenheck's electronically commutated (EC) Vari-Green® (VG) motor combines motor technology, controllability and energy-efficiency into one single low maintenance unit and is the industry's first fully controllable motor. When combined with Greenheck's SWD fans, most of the CFM and static pressure ranges of a belt drive can be attained with the benefits of a direct drive.

Motor Information						
HP	**RPM**	**Volts**	**HZ**	**Phase**	**FLA**	**Enclosure**
1/6	1725	115	50/60	Single	3.4	TENV
1/4	1725	115	50/60	Single	3.7	ODP
		115/230			3.3/1.8	
1/2	1725	115	50/60	Single	6.7	ODP
		115/230			6.8/3.5	
3/4	1725	115	50/60	Single	10.1	ODP
		115/230			9.0/4.9	
1	1725	115	50/60	Single	12.4	ODP
		115/230			11.4/6.3	
1	1725	115/208-230	50/60	Single	12.0/6.0	TEFC
2	1725	208-230	50/60	Single	12.0	TEFC
Extended RPM Motors						
1/2	2500	115	50/60	Single	6.5	ODP
3/4	2200	115	50/60	Single	11.3	ODP

Constant Volume Life Cycle Analysis



Analysis is based on operating costs for a period of three years where the fans operate continuously at 1725 rpm, 24/7, with an energy rate of $0.10/kWh. Maintenance on the SQ-120 is estimated at $65/yr.

Note: Example is based on a relative cost. Use and installation variables may produce different results.

Vari-Green Advantages

- Initial cost is similar to a belt drive
- Lower operating cost
- No maintenance, no belts, pulleys or bearings
- Easy RPM adjustment

Features

1. Dial on Motor Control - A potentiometer (dial on motor control) is mounted on the motor for easy speed adjustment for system balance. Simply turn the dial; there are no belts and pulleys to adjust.
2. Control Wire Inputs - the motor accepts a 0-10 VDC signal from Building Automation Systems, Vari-Green Controls or other controls to adjust motor speed.
3. Consolidated Motor with Dial and 0-10 VDC Signal - Refer to greenheck.com, Vari-Green Motor and Controls IOM for specific information.

Vari-Green Motor Benefits

Operates on AC power that's converted to DC—providing a more efficient motor operation as compared to an AC operation.

- The motor can attain up to 85% efficiency and reduce energy consumption.
- Watt savings of 20-70% depending on RPM. Note: As motor speed is turned down, efficiency stays high as compared to an AC motor that decreases dramatically.
- Operates cooler than a standard AC motor at lower RPMs. A cooler motor has longer motor life and reduces energy consumption.
- 80% usable RPM turndown vs. 30% on AC single phase direct drive.
- SWD fans with Vari-Green motors can provide most of the CFM and static pressure ranges of a comparable belt drive.
- Maintenance costs are reduced as there are no belts or bearings to replace and no pulleys to adjust.
- Direct drive fans are often preferred where maintenance access is difficult.
- Provides a solution for demand controlled ventilation applications.

Vari-Green® Controls

Transformer - Provides 24V power from the existing line voltage at the fan to the Vari-Green motor and controls. Dual voltage primary (120/240V) transformer provided with the fan.

Remote Dial - Allows for remote, manual airflow adjustments. Wall plate with dial may be mounted in a standard 2x4 inch electrical junction box.

Two-Speed Control with Integral Transformer - Control allows motor RPM to be set at two independent speeds (high or low). Meets minimum airflow requirements with the ability to bump up to high speed in an emergency or meet maximum airflow requirements, or reset to low for energy conservation. Speeds are selectable via either a dry contact input which utilizes an external switching device to toggle between speeds, or an AC digital input which allows an AC voltage signal to be used to change speeds.

Constant Pressure Control - Indoor - Control Vari-Green motor via static (variable volume) or velocity (constant CFM) pressure on the inlet or outlet side of the fan. Optional, one or two, duct or room probes for use in:

- Multi-family structures - Apartments, condos, hotels; dryers, residential kitchens and bathrooms.
- Institutional facilities - Schools, prisons, multi-story office buildings; bathrooms.

Constant Pressure Control - Outdoor - Control Vari-Green motor via static pressure on the inlet side of the fan. Includes one duct probe and transducer for use in:

- Multi-family structures - Apartments, condos, hotels; residential kitchen, dryer facilities and bathrooms.
- Institutional facilities - Schools, prisons, multi-story.

Air Quality – VOC - Control a Vari-Green motor via changes in volatile organic compounds (VOC's). VOC's are gasses that are emitted from humans, building materials, perfumes, foods, and furniture off-gassing. Range is 0-2000 CO_2 ppm equivalent.

- Institutional facilities – Schools, court house, hospitals; bathrooms, waiting rooms, cafeteria.
- Commercial buildings – Office space, conference rooms, bathrooms, break room.

Air Quality – Temperature and Humidity - Control Vari-Green motor via changes in temperature, humidity, or both. Range is 15 to 130°F *(-10° to 55°C)* and 0 to 100% relative humidity.

- Multi-family structures – Apartments, condos, hotels; bathrooms, utility rooms.
- Commercial buildings – Office buildings; office space, conference rooms, utility rooms, bathrooms.

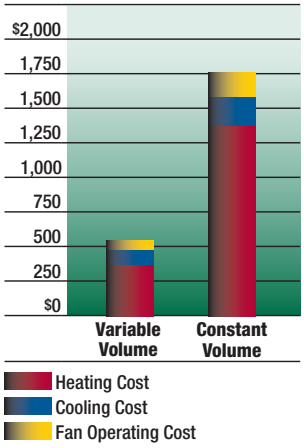
Demand Controlled Ventilation for Multi-story Buildings

Applications requiring constant pressure or variable volume can utilize SWD fans with Vari-Green motors and Vari-Green controls. Demand controlled ventilation systems reduce the amount of energy used by decreasing the speed of the fan when demand is low. This in turn lessens the amount of conditioned air exhausted and further reduces total operating costs associated with air conditioning and heating in multi-storied buildings such as: hotels, multi-family complexes, institutional facilities, and high rise commercial buildings.

The Vari-Green constant pressure control is pre-programmed and easy-to-install for applications that include: venting dryers, bathrooms, residential type kitchen space or industrial process exhaust.

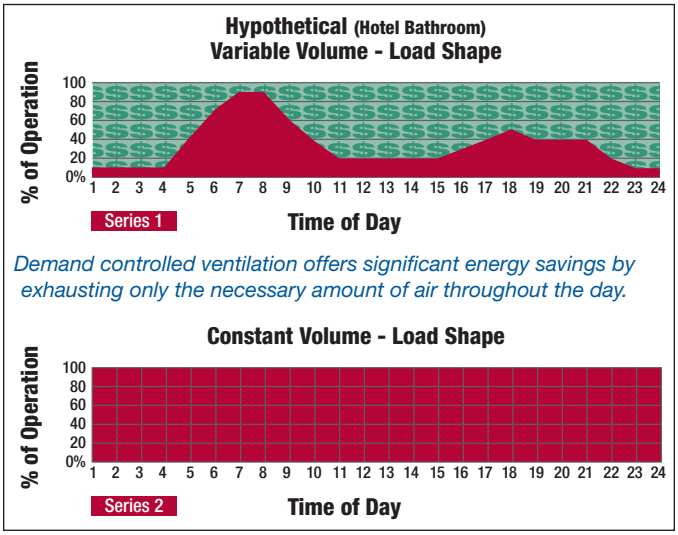
Contact fans@greenheck.com for more information.

Variable Volume Operating Cost Analysis



Example of potential savings based on a northeast city in the USA using Vari-Green components for variable volume.

Daily Operating Comparison: Variable Volume and Constant Volume



Demand controlled ventilation offers significant energy savings by exhausting only the necessary amount of air throughout the day.

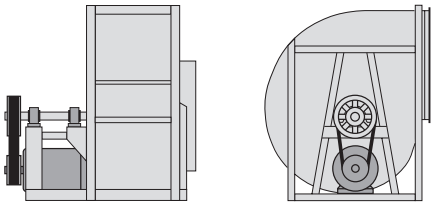
Note: A standard VFD compatible motor can also function within a variable volume system.

Arrangement 10 — Belt Drive

Single-Width, Backward Inclined or Airfoil Wheel

USF-200 / 300 / 400, CSW All Sizes

- Recommended as first choice configuration for belt drive applications.
- 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.
- Compact design.
- Available with heat fan packages up to 500°F (260°C).



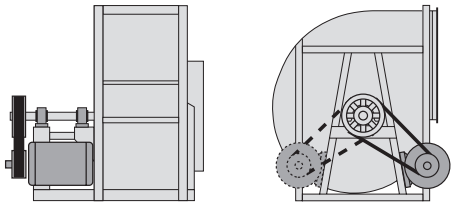
Class 0, I, II

Arrangement 9 — Belt Drive

Single-Width, Backward Inclined or Airfoil Wheel

(CSW Size 33 - 73)

- 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.
- Available heat fan packages to 500°F (260°C).



Class 0, I, II, III

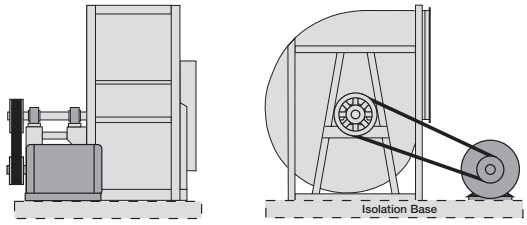
Arrangement 1 — Belt Drive

*Single-Width, Backward Inclined or *Airfoil Wheel*

(CSW Size 7 - 73)

- 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 11).
- Available with motor cover.
- Suitable for high temperatures or contaminated air.
- Available heat fan packages to 1000°F (538°C).

[*Airfoil wheel available to 500°F (260°C)].



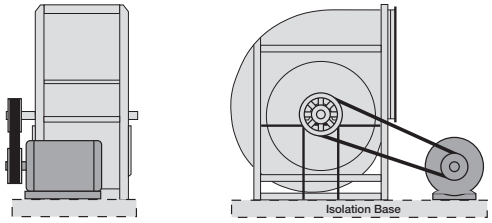
Class 0, I, II, III, IV

Arrangement 3 — Belt Drive

Single-Width, Backward Inclined or Airfoil Wheel

(CSW Size 33 - 73)

- 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 11).
- Available with motor cover, belt guard.
- Recommended for clean air at ambient temperatures.



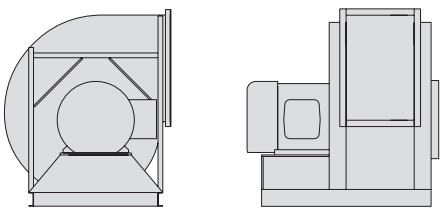
Class 0, I, II, III

Arrangement 4 — Direct Drive

Single-Width, Backward Inclined or Airfoil Wheel

(CSW Size 10 - 44)

- 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.



Class 0, I, II, III, IV

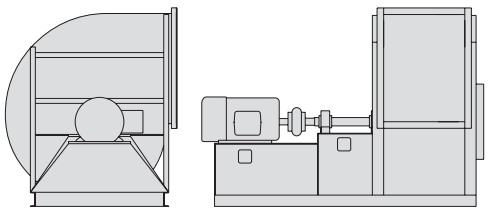
Arrangement 8 — Direct Drive

*Single-Width, Backward Inclined or *Airfoil Wheel*

(CSW Size 33 - 49)

- 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.
- Available heat fan packages to 750°F (400°C).

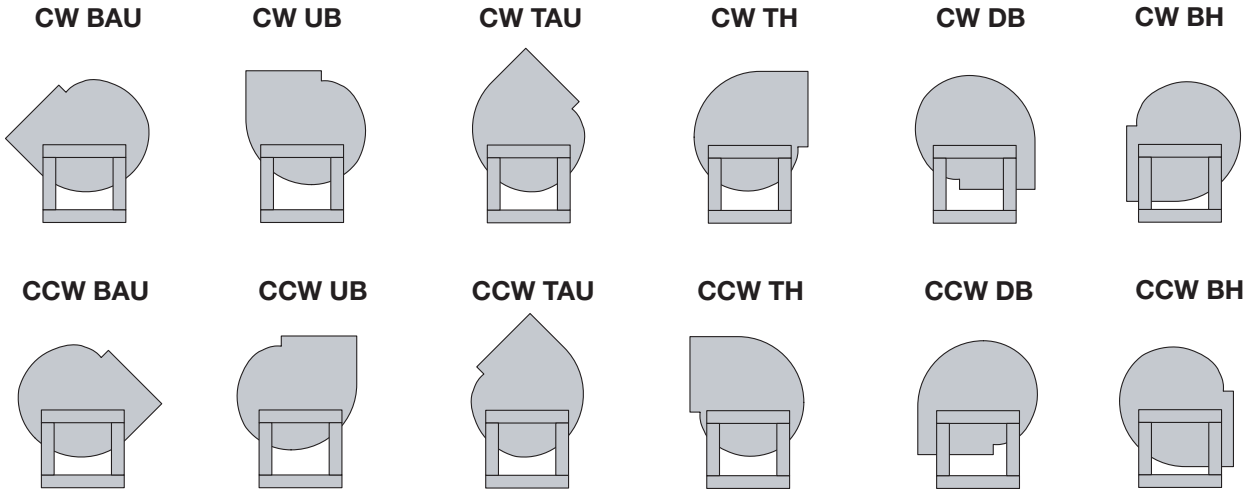
[*Airfoil wheel available to 500°F (260°C)].



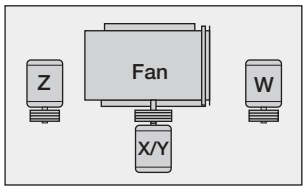
Class I, II, III, IV

Discharge Positions and Rotatable Housings

All centrifugal fans are available with clockwise (CW) or counterclockwise (CCW) rotation. See pages 6-7 for available discharge positions. **Rotation and discharge is always determined from the drive side of the fan.** Rotatable housings are standard on fan sizes 30 and less; arrangements 1, 4 and 10; and Class 0, I and II.



Motor Positions — Arrangements 1 and 3 Fans (CSW)



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.

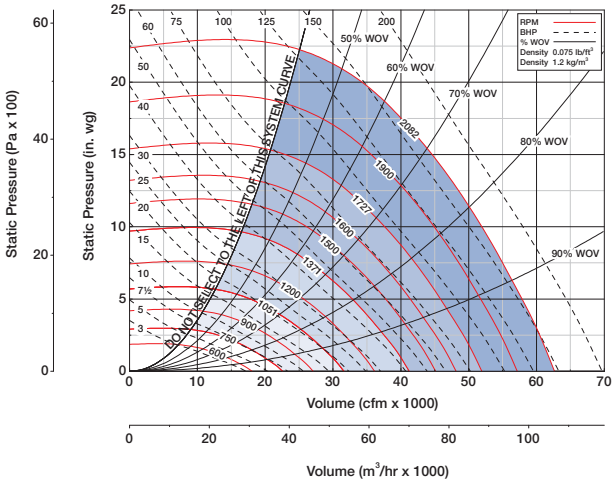
Class of Construction

Fan class refers to a construction level designed to handle a given fan outlet velocity and pressure. As the fan performance requirements increase, the fan construction (material gauge, shaft diameter, motor size) must also increase to physically handle the new work load.

Centrifugal products are available in Class 0, I, II, III, or IV, with Class 0 being the lightest construction and Class IV having the heaviest construction and performance capacity.

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.

USF-400, CSW



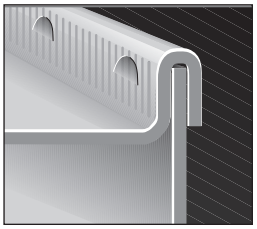
Class 0	Class I	Class II	Class III	Class IV

Wheels

Greenheck centrifugal fans have non-overloading backward-inclined blades. Both our flat blade backward-inclined (BI) and airfoil (AF) designs operate efficiently and quietly. All wheels are statically and dynamically balanced to grade G6.3 per ANSI S2.19.

	Backward Inclined (BI)	Airfoil (AF)
Wheel Type		
Application	General purpose, clean air or severe environments	Clean air or fume exhaust
Temperature	Up to 1000ºF (538ºC)	Up to 500ºF (260ºC)
Construction	Steel Aluminum 316 Stainless Steel	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 inches wg (2.1 kPa).

Models SWD, USF-200, USF-300, USF-400, CSW

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 housing materials such as aluminum or stainless steel are only available with CSW models.

Models USF-400, CSW

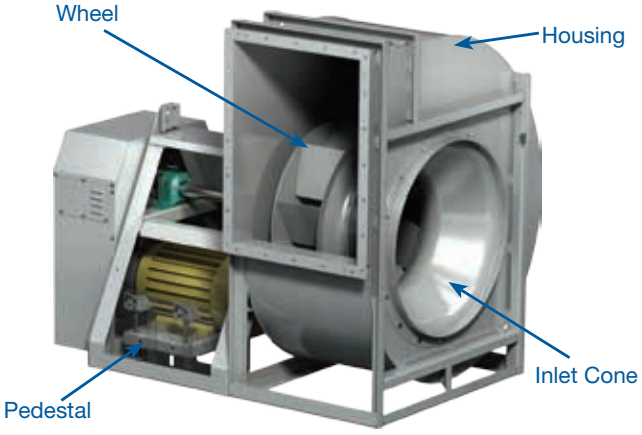
Alternative Materials

Greenheck offers centrifugal models SWD and CSW in aluminum or CSW in stainless airstream 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 1000ºF (538ºC) 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.

Spark A	All parts in contact with the airstream are constructed of nonferrous material (usually aluminum). *(CSW)*
Spark B	The fan wheel is constructed of a nonferrous material (usually aluminum). A nonferrous (aluminum) rub ring surrounds the fan shaft where it passes through the fan housing. *(SWD, USF-300, USF-400, CSW)*
Spark C	The inlet cone is constructed of nonferrous material (usually aluminum). A nonferrous (aluminum) rub ring surrounds the fan shaft where it passes through the fan housing. *(SWD, USF-300, USF-400, CSW)*



CSW Material Availability by Model and Configuration

Construction	Wheel Type*	Construction	Size	Class	Arrangement
Coated Steel	BI/AF	Permalock™/Welded	7 – 73	0, I, II, III, IV	Any—1, 3, 4, 8, 9 & 10
Aluminum, entire	BI/AF	Welded	7 – 30	0, I, II	1, 4, 10
316 Stainless, airstream	BI	Welded	7 – 30	0, I, II, III	1, 10
316 Stainless, airstream	BI	Welded	33 – 49	0, I, II, III	1, 8, 9, 10
Spark A	BI/AF	Welded	7 – 49	0, I, II, III	1, 10 (All) / 8 & 9 (33-49)
Spark B	BI/AF	Permalock™/Welded	7 – 49	0, I, II, III	1, 8, 9, 10
Spark C	BI/AF	Permalock™/Welded	7 – 73	0, I, II, III	1, 8, 9, 10

Consult factory for sizes and options beyond what is cataloged. * BI=Backward Inclined AF=Airfoil Blade
Not all wheel types, sizes or classes are available in all arrangements

Protective Coating Options (Models SWD, USF-300, USF-400, CSW)

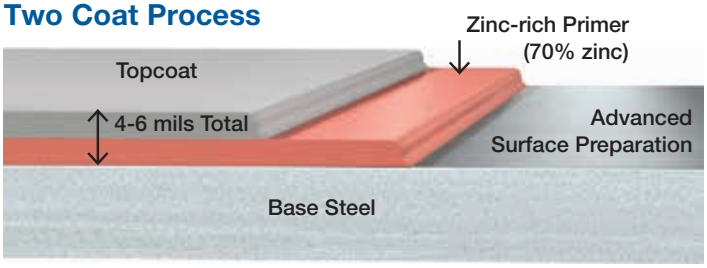
Greenheck offers a wide variety of protective coatings suitable for corrosive applications. All coatings are electrostatically-applied baked powders that offer a durable, long lasting finish. For more information on our complete offering of coatings, visit www.greenheck.com and navigate to Library/Application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

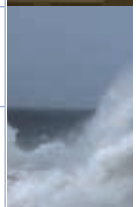
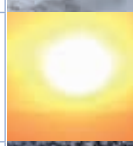
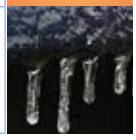
Zinc Advantage

For corrosive environments, discover Greenheck's zinc-rich basecoat technology. The protection offered by the zinc-rich basecoats in Perma-Z and Hi-Pro Z result in extraordinary corrosion resistance. Test data demonstrates our two-coat paint system offers three (Perma-Z) and four (Hi-Pro Z) times the corrosion resistance of other coatings commonly available within the fan industry.

Chemical Resistance Ratings						
Chemical	Bleach	Sulfuric Acid (10%)	HCl (10%)	MEK	Chlorine (0.1%)	NaOH (20%)
Permatector	0	1	2	2	0	—
Hi-Pro Poly	0	0	0	1	0	—
Perma-Z	0	1	2	2	0	2
Hi-Pro-Z	0	0	0	1	0	1
RATING DESCRIPTIONS	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 Process



	Coatings	Color	Coating Specifications	Environments: CLEAN AIR	COASTAL	CHEMICAL*	EXTREME WEATHER	ABRASIVE PARTICLES	SUN-UV	
One Coat Process	**Permatector™** 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					X	
One Coat Process	**Hi-Pro Polyester** Formulated for exterior durability, color and gloss retention. Excellent for chemical applications.	Concrete Grey RAL 7023	Thickness: 2.0 - 3.0 mils High performance polyester urethane powder coating	X		X			X	
Two Coat Process	**Perma-Z** Two-coat powder paint coating provides outstanding corrosion protection in many extreme applications	Concrete Grey RAL 7023	Thickness: 4.0 - 6.0 mils Permatector topcoat with zinc-rich, epoxy basecoat	X	X		X	X	X	
Two Coat Process	**Hi-Pro-Z** Two-coat powder paint coating is resistant to saltwater, chemical fumes and moisture in corrosive environments	Concrete Grey RAL 7023	Thickness: 4.0 - 6.0 mils Hi-Pro Polyester topcoat with zinc-rich, epoxy basecoat	X	X	X	X	X	X	

Note: Perma-Z and Hi-Pro-Z are not available on aluminum.

**Chemical Resistant Rating Above*

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_{10} in excess of 80,000 hours (L_{50} at 400,000 hrs.) at the maximum RPM for the selected pressure class. USF-400 and CSW models utilize concentric locking collars for smoother operation and providing superior grip force between the bearing collar and fan shaft.

For more critical applications CSW models offer bearings with a minimum L_{10} life in excess of 200,000 hours (L_{50} at 1,000,000 hrs.)

	L_{10} Life	Equal to L_{50} or Average Life
Industry Standard	40,000 hrs.	200,000 hrs.
USF, CSW Standard	80,000 hrs.	400,000 hrs.
CSW Upgrade	200,000 hrs.	1,000,000 hrs.

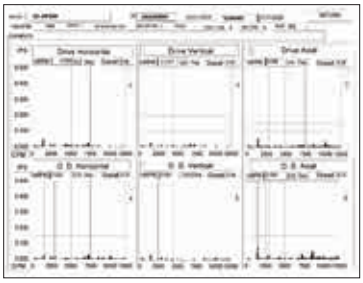
L_{10} life implies 90% reliability or 10% failure rate after the stated hours.
L_{50} life implies 50% reliability or 50% failure rate after the stated hours.
(USF-200, USF-300, USF-400, CSW)

Vibration Analysis

All centrifugal wheels undergo a computerized balance analysis to a Grade of G 6.3. In addition, CSW 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. *(CSW)*

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



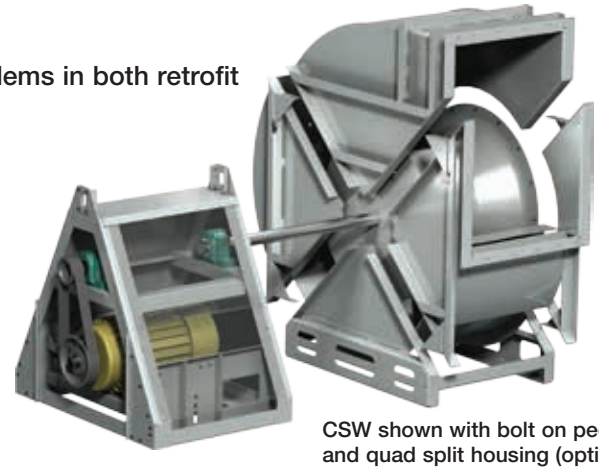
Copies of these signatures are kept on file and are available upon request

CSW Split Housings

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

Not available on 45° discharges TAD, BAU.

Size Limitations:	
7-73	Bolt-on Pedestal Standard
33-73	Quad Split Optional



CSW shown with bolt on pedestal and quad split housing (option)

Fan Monitoring System

Greenheck's Fan Monitoring System (FMS) is designed to allow facilities and maintenance managers the ability to stay connected with their critical ventilation products. The FMS package includes a pre-programmed monitor along with a wide selection of commonly applied sensors to monitor the overall equipment health, plan maintenance, and monitor energy usage. *(USF-200, USF-300, USF-400, CSW)*

Fan Monitoring System Benefits

- Pre-programmed electronics with commonly applied sensors
- Applicable to any fan type in easy-to-access or remote locations
- Connects with Building Management System (BMS)
- Customizable to unique installations and applications
- Schedule maintenance based on operation, not calendar dates

System Integration

Sure-Aire™

The Sure-Aire airflow monitoring station measures fan flow within an accuracy of 3%. Unlike traditional flow probes mounted in the fan venturi that create a system effect hindering a fan's performance, Sure-Aire does not interfere with airflow and will not impact the fan's air or sound performance. This option is available on USF-400 and CSW centrifugal products and ships completely assembled from our factory.

An electronics package with pressure transmitter and digital read out is available with the Sure-Aire system. The electronic kits are available for 50 or 60 Hz power supplies and provide a 4-20 mA or 0-10 volt output that can be tied into the building's management system.

Motor Starters

The fundamental function of a motor starter is to protect the motor from damage that can occur from over amping. With a Greenheck motor starter you will be provided with the best motor protection available.

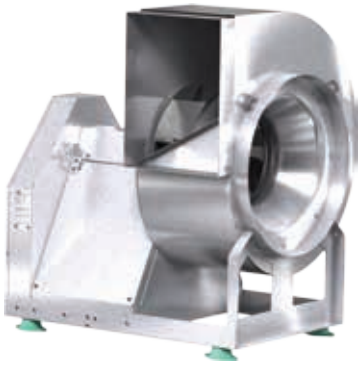
Specific model components may include; physical interface, overload protection, disconnect, magnetic contactor, NEMA-1 or NEMA-3R steel enclosures and pre-engineered easy system integration. For complete information on specific Greenheck Motor Starter models, refer to greenheck.com, Motor Starter web page.

Vibration Isolators and Isolation Bases

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

Refer to Mounting Bases and Vibration Isolation catalog on www.greenheck.com.

Neoprene | Restrained | Free Standing



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 Arr. 9 fans). If there is any doubt that equipment can be supported directly on isolators, use rails, bases or consult the factory.

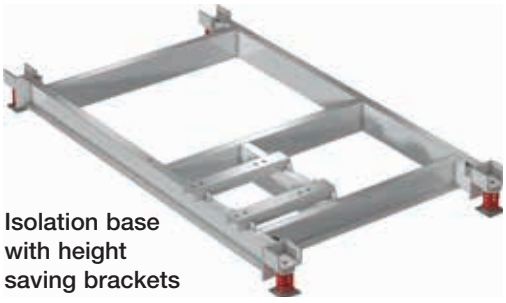
(SWD, USF-200, USF-300, USF-400, CSW)

Mounting Rails

Mounting rails consist of aluminum top and bottom rail construction with equipment mounting bolts which slide within slots for easier installation. Aluminum rails are available with three types of mounting:

1. With neoprene mounting for up to 3/8 inch deflection.
2. With free-standing spring mounts for up to 1 inch static deflection.
3. With zinc plated hardware and springs incorporating vertical limit stops providing up to 1 inch static deflection. This type is recommended for outdoor applications requiring rails with springs.

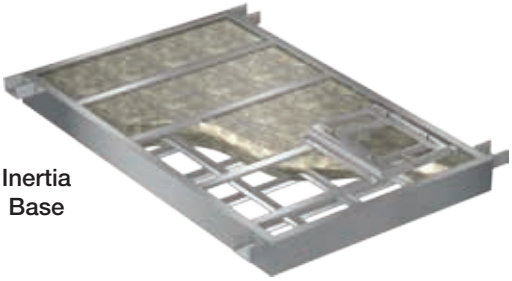
(Rails are shipped loose, not mounted) *(SWD, USF-300)*



Isolation base with height saving brackets

Isolation Bases

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 Arr. 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. *(CSW)*



Inertia Base

Inertia Bases

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 Arr. 1 & 3 fans) *(CSW)*

Weatherhoods (Arr. 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. (*USF-200, USF-300, USF-400, CSW)*

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. *(CSW)*

Shaft Guard

Shaft guards are designed to cover shafts and bearings on arrangements 1, 8, or 9 configurations. Extended lube lines are optional for bearing lubrication without removal of the guard. Shaft guards meet OSHA guidelines. *(CSW)*

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

A weatherproof motor cover shields the motor components from dust, dirt and moisture for outdoor installations. *(SWD, CSW)*

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. Steel only. *(SWD, USF-200, USF-300, USF-400, CSW)*

Inlet and Outlet Flanges

Optional inlet flanges on all single-width fans are pre-punched and welded to the inlet collar. Punched outlet flanges are standard on fan sizes 33-73. *(SWD, USF-200, USF-300, USF-400, CSW)*

Access Doors

Bolted or hinged access doors provide access for cleaning or inspection. Access doors are standard on downblast discharge fans. *(SWD, USF-200, USF-300, USF-400, CSW)*

Inlet Companion Flanges

Punched companion inlet flanges are available for all single-width fan sizes. *(SWD, USF-200, USF-300, USF-400, CSW)*

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. *(SWD, USF-200, USF-300, USF-400, CSW)*

Heat Slingers

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. Heat slingers are not available for Arrangement 3 or 4 fans. *(CSW)*

Stainless Steel Shafts

Stainless steel fan shafts are available for applications where standard carbon steel shafts may exhibit excessive corrosion or heat stress. *(USF-400, CSW)*

Shaft Seals

A felt, neoprene, or ceramic shaft seal with a rub ring is available for operation at high temperatures or for exhausting contaminated air. Stuffing boxes are available upon request. *(USF-300, USF-400, CSW)*

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. *(CSW)*

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). *(USF-300, USF-400, CSW)*

Disconnect Switches

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. *(SWD, USF-200, USF-300, USF-400, CSW)*

Grease Containment

Grease trap designed to collect grease residue to avoid drainage onto roof surface. Grease traps ship loose for field installation. *(USF-300, USF-400, CSW)*

Backdraft Dampers

Backdraft dampers are available in galvanized, painted steel or aluminum construction and include counterweights for tight closure when the fan is de-energized. *(SWD, USF-200, USF-300, USF-400, CSW)*

Volume Control:

Volume Control Dampers

Control dampers are available in painted steel, aluminum or stainless steel. Actuator options include manual quadrant or electric. *(SWD, USF-400, CSW)*

VFD Rated Motors

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. *(SWD, USF-200, USF-300, USF-400, CSW)*

Selection data for the model CSW can be found in our CSW Performance Supplement and online at www.greenheck.com.

Selection

The first consideration in any fan selection is the amount of air to be moved and the resistance to this air movement. Air volume requirements are established through specific codes or accepted industry standards. Once the air volume is known, system resistance can be determined by summing up the losses through the system components. Duct layout, duct size, coil, filters, dampers and fan accessories all affect system resistance. “ASHRAE Guide and Data Books” and manufacturer’s data on individual system components are common sources of information available to the system designer.

In most applications, several fans may meet the required airflow and system resistance conditions. An optimum fan selection requires evaluation of alternative fan types and fan sizes, as they relate to initial cost, operating cost, available space and allowable sound levels. The relative importance of these facts varies with each system.

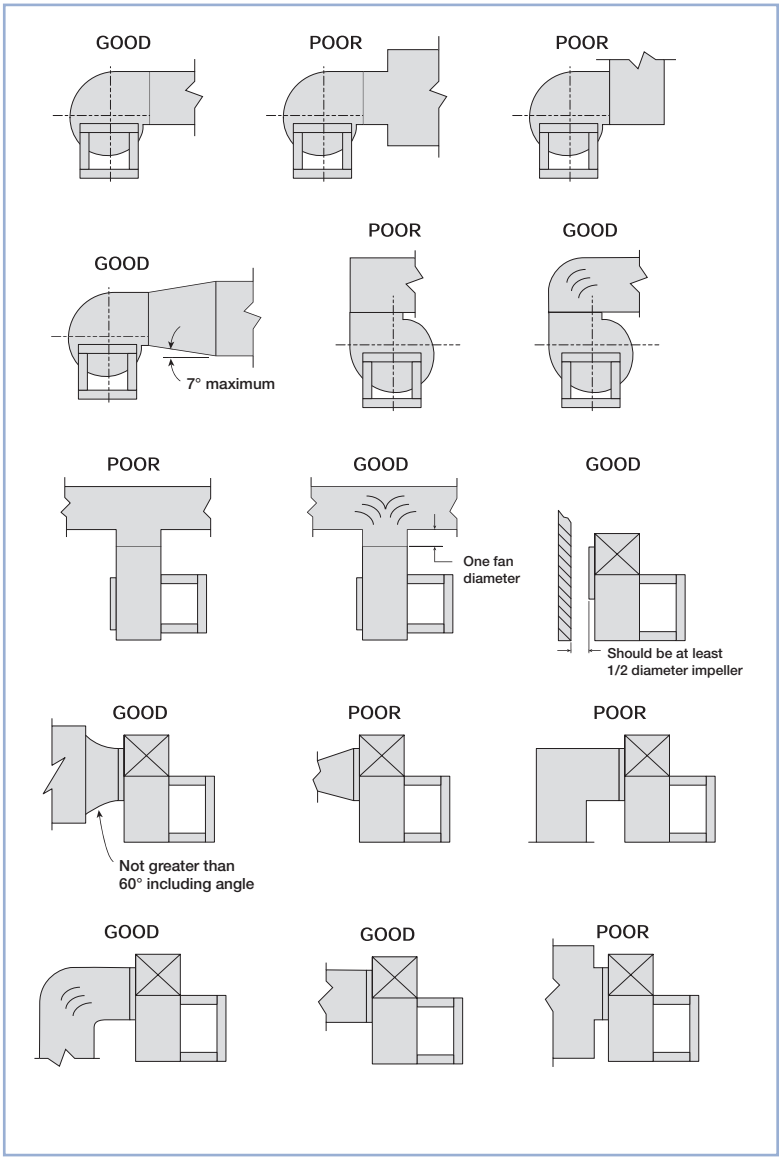
When deciding on a specific fan size, consider selections that allow for adjustments after installation. Avoid selecting fans that are within 10% of the maximum fan RPM or max motor horsepower capacity. If a selection is within 10% of capacity, upgrade to the next class of construction if possible. Avoid selections near the fan “stall” if there is potential variability in pressure. Operation in stall conditions will result in low fan performance and potential vibration issues. Watch for fan selections with excessive fan RPM’s (above 2700 fan RPM) as these can generate higher sound levels. Select a slower running fan (typically a larger diameter wheel) if possible. Please contact your local Greenheck Representative if you need any assistance in reviewing fan selections.

Effects of Installation on Performance

Fan ratings presented in the performance tables and curves are in accordance with AMCA Standard 210 “Laboratory Methods of Testing Fans for Aerodynamic Performance Rating”. The AMCA test procedure utilizes an open inlet and a straight outlet duct to assure maximum static regain.

Any installation with inlet or discharge configurations that deviate from this standard may result in reduced fan performance. Restricted or unstable flow at the fan inlet can cause pre-rotation of incoming air or uneven loading of the fan wheel yielding large system losses and increased sound levels. Free discharge or turbulent flow in the discharge ductwork will also result in system effect losses.

The examples below show system layouts and inlet and discharge configurations which can affect fan performance.



Centrifugal Fan Model Number Codes:

The model number code is designed to completely identify the fan. The correct code letters must be specified to designate the correct construction. The remainder of the model number is determined by the size and performance.

SWD - 10 - VG - CW - TH - X

Model
Single Width
Direct Drive

Fan Size
07 through 18

Motor HP
4 = 1/4
5 = 1/2
7 = 3/4
10 = 1
20 = 2

Wheel Rotation
CW - Clockwise
CCW - Counterclockwise

Discharge Position
UB - Upblast
TAU - Top Angular Upblast
TH - Top Horizontal
TAD - Top Angular Downblast
DB - Downblast
BAD - Backward Angular Downblast
BH - Backward Horizontal
BAU - Backward Angular Upblast

Certification
None
X - UL/cUL 705 Listed (Electrical)

USF - 2 06 - BI

Model
200, 300, 400

Fan Size
06 through 49

Blade
BI-Backward Inclined
AF-Airfoil

CSW - 18 - BI - 21 - 10 - CW - TH - II - A 400 - X

Model

Fan Size
07 through 73

Blade
BI-Backward Inclined
AF-Airfoil

Housing
21 - Permalock™
41 - Welded

Arrangement
1, 3, 4, 8, 9 & 10

Rotation
CW - Clockwise
CCW - Counterclockwise

Discharge Position
TH, UB, DB, BH, TAU, BAU, BAD, TAD

Fan Class
0, I, II, III, IV

Motor Nominal Speed
A = 1800
B = 1120
C = 870
J = 1425
K = 950
M = 3600
R = 2900

Motor HP

4 = 1/4	15 = 1½	100 = 10
3 = 1/3	20 = 2	150 = 15
5 = 1/2	30 = 3	200 = 20
7 = 3/4	50 = 5	300 = 30
10 = 1	75 = 7½	400 = 40

Certification
None
X - UL/cUL 705 Listed (Electrical)
G - UL/cUL 762 Listed (Grease Exhaust)
HTUL - UL/cUL HT Listed (Emergency Smoke)

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