

GreenPark™

Configurable Car Park Solutions



BUILDING VALUE IN AIR.



May 2018

GreenPark™ Overview

As cars are parked within an underground parking structure, carbon monoxide (CO) and other noxious fumes are emitted into the atmosphere. There is a need for an efficient ventilation system that can remove these toxins, circulate fresh air into the car park, and assist firefighters in the case of a fire emergency. There are two options for this task, ducted or ductless ventilation.

While ducted ventilation has been the standard for many years, innovation in the field of ventilation has shifted the conventional ventilation system towards ductless designs. Ductless designs use jet fans to dilute and remove contaminants and control the smoke. These systems provide greater control at a fraction of the cost of traditional ducted systems. The solution is **Greenheck's GreenPark™!**

GreenPark is a system which consists of both services and components. These combine to provide ventilation during normal operation of the car park, as well as removing the smoke during emergency situations. GreenPark services include sensor placement, Computational Fluid Dynamics (CFD) analysis, and control sequencing. GreenPark components include supply and exhaust fans, GreenJet® (GJ) fans, Life Safety and Volume Control dampers, and sensors.

What is GreenPark™?

GreenPark is a ductless car park offering that combines products and services to provide reliable, energy efficient ventilation along with emergency smoke exhaust.

GreenPark Advantages

- **Simplified Design:** Eliminates the need to perform costly duct design.
- **Lower Construction Cost:** GreenJet fans have less height than ducted systems, resulting in less excavation and lower overall construction cost.
- **Lower Installation Cost:** A typical GreenPark system results in less installation time overall.
- **Improved Operational Costs:** Eliminating the ducts reduces the static pressure required and allows the GreenJet fans to run with less power. Additionally, the sensors allow running the system only when the demand requires.
- **Reduced Maintenance:** In addition to eliminating duct cleaning, GreenJet fans are more accessible for maintenance than traditional systems.
- **Enhanced Safety:** GreenJet fans are more efficient at removing noxious fumes and cleaning smoke, resulting in a safer environment with the added benefit of minimizing potential damage caused to the building.

Design Partner

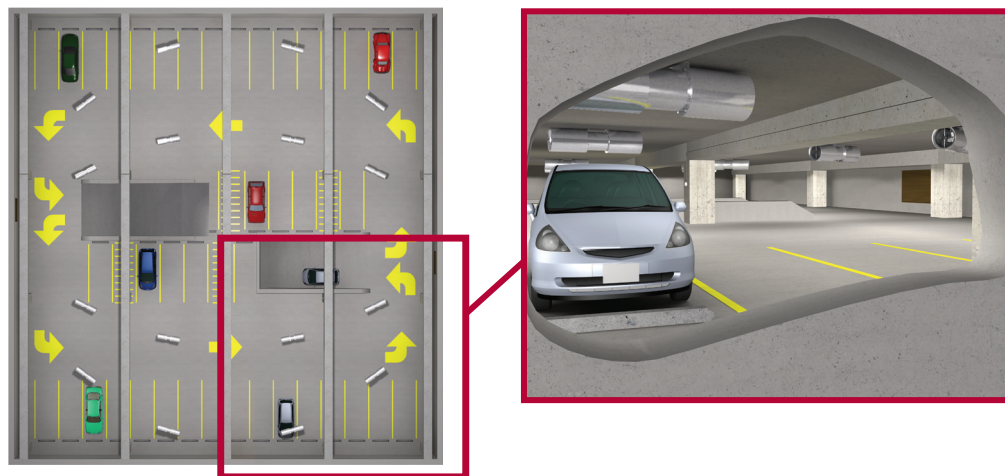
Greenheck knows that every enclosed parking structure has different requirements. This is due to varying geometries, different building types, or conflicting regulatory agencies. That is why GreenPark is a fully configurable solution providing you the highest quality, most cost-effective solution for your region. Greenheck's dedicated engineers will work with you from the beginning stages of building design and assist with decisions such as supply and exhaust shaft locations, fire zoning, and fan placement. As the design continues, the GreenPark solution can include control sequencing, switching diagrams, and even provide commissioning. The GreenPark team is ready to assist in order to provide the system you need! Contact your local sales representative for details.

Car parks need to be designed for two reasons: normal mode and fire mode. Normal mode requires ventilation due to the constant movement of contaminants and fire mode is required to control smoke to ensure occupant safety. The initial system cost can be minimized by designing the car park for both modes of operation.

Normal Mode Operation

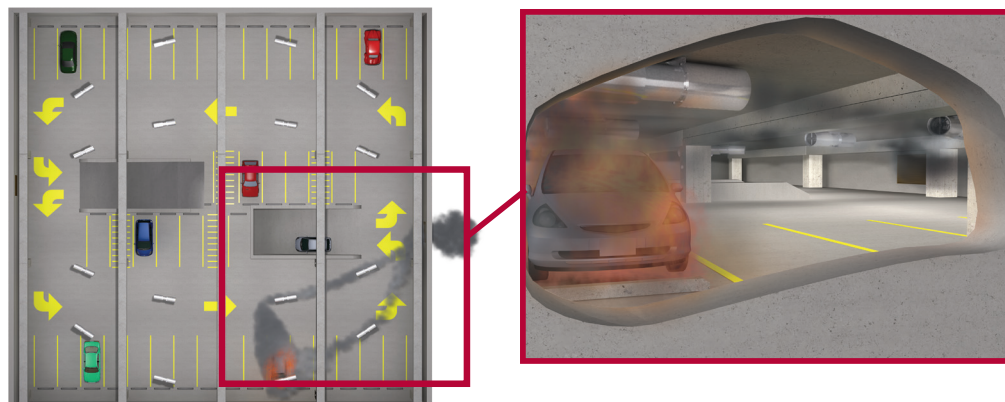
During normal mode operation, the system needs to reduce and remove toxic gases such as carbon monoxide and mono-nitrogen oxides. GreenPark technology combines sensors and GreenJet fans to minimize and control toxicity levels. These fans are arranged in such a way to direct air to a main exhaust fan that removes it from the car park. Make-up air is then provided through the entrance and exit ramps or through a dedicated supply fan. This process allows the fans to remove the contaminated air from the car park without the use of costly and unsightly ductwork.

GreenJet fans can be used with sensors to increase the speed of the fan automatically as CO levels rise within the space. This demand-based fan control can save as much as 85 percent of operating costs compared to traditional ducted systems.



Fire Mode Operation

During a fire, the GreenPark system helps to control and remove the smoke. Once a fire is detected in the structure, GreenJet fans in that smoke control zone are switched to high speed along with the main exhaust fans. GreenJet fans quickly isolate the smoke and direct it towards the exhaust for removal. In addition to smoke removal, the system also controls the smoke with greater precision compared to ducted systems. This greater smoke control allows the creation of a smoke-free area for firefighters, and ensures the pedestrian exits are clear for egress. The overall GreenPark system provides full smoke control for the car park while maintaining entry and exit areas for pedestrian and safety personnel.



The process for specifying and selecting the GreenPark services is customized for your needs. It is important to work closely with your Greenheck representative to ensure the proper selection and placement of equipment. A Computational Fluid Dynamics (CFD) analysis is required to validate the final quantity, location, and size of GreenJet fans required. Greenheck’s engineers are available to leverage their experience in conjunction with the CFD analysis to assist with:

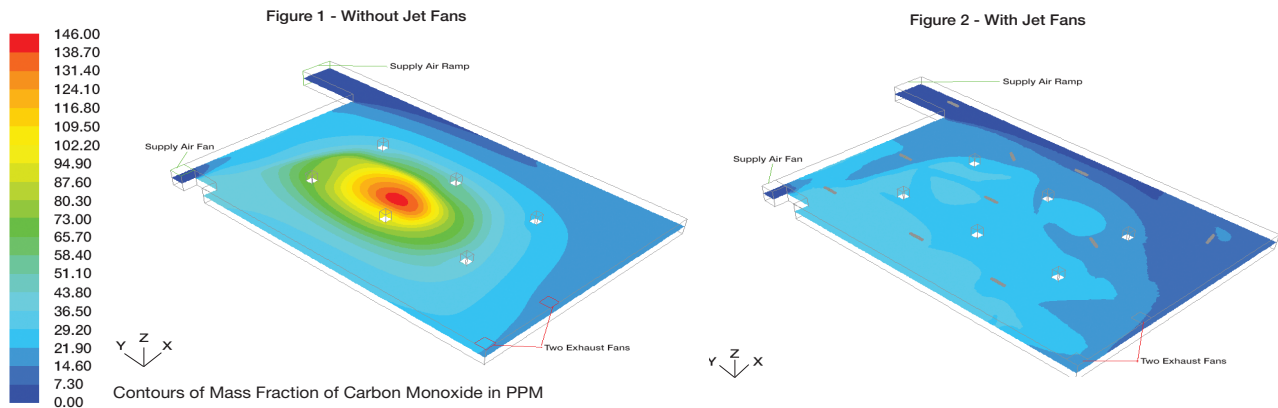
Design Considerations

- Standards: Apply relevant codes such as NFPA, IBC, ASHRAE, and European Standards
- Required air changes: Optimize air flow for normal and fire modes
- Sound: Reduce sound levels to acceptable limits for tenants
- Control strategy and sequencing: Define sensor to fan correlation and system response
- Accessibility and aesthetics: Advise on placement of ramps, wall openings, and pedestrian exits
- GreenPark components: Reduce cost and optimize safety with selection and placement

Computational Fluid Dynamics (CFD)

A CFD analysis is a simulation of the space in normal mode and fire mode. This analysis is required to ensure that the building is designed in the safest, most cost-effective way possible. It is important to note that there is a broad degree of quality related to CFD due to the relative ease of manipulating the results. Therefore, a trusted manufacture must be used and proper simulation must be conducted which utilizes a three dimensional model along with careful design and boundary conditions.

Figure 1 and 2 depict a CFD analysis conducted showing CO concentration levels with and without jet fans running respectively. These figures illustrate how the simple installation of GreenJet fans maintain the CO levels below harmful concentration. Once the CO levels are deemed acceptable, additional simulations are performed to ensure other criteria are acceptable.



A CFD analysis from Greenheck provides the following:

- 3D static and dynamic simulations of the space in both operating modes
- CO levels at various heights in basement
- Smoke levels at various heights
- Temperature profile of space during fire
- Visibility
- Videos of various parameters during fire mode
- Jet fan and sensor placement with locations populated in CAD
- Jet fan/sensor correlation and appropriate control sequencing
- General control sequencing during normal and fire mode

As a design partner, Greenheck helps provide a safe, efficient, and comfortable car park for the user.

GreenPark is a single source offering that provides all the services and components you need to design and install the proper system. GreenPark components include:

- GreenJet (GJ) fans
- Sensors
- Life Safety and Volume Control Dampers
- Supply and Exhaust fans

The basic principle of the GreenPark system is to provide the *right amount of ventilation* in the *right location* at the *right time* and the *right price*. GreenJet fans are used in conjunction with main exhaust fans and usually supply air fans (when ramps, entrances, etc. are not sufficient to supply the fresh air). GreenJet fans are used to mix the air and guide it towards the intake of the main exhaust fans which then move this air out of the space.

Right Amount of Ventilation

GreenJet fans are typically used in conjunction with a sensor monitoring system (typically CO). The contaminant levels are measured and fan capacity varies based on the sensor reading. Several fans can be grouped together on a single sensor or each fan can be controlled pending the space needs. The fans are constantly changing speed throughout the day based on the demand required, minimizing sound and cost.

Right Location

Computational Fluid Dynamics (CFD) is used to place the fans in the parking structure in order to provide the ventilation at the right location. This ensures optimal placement of the fans to maximize their effectiveness which minimizes the total number of fans required and ultimately initial cost.

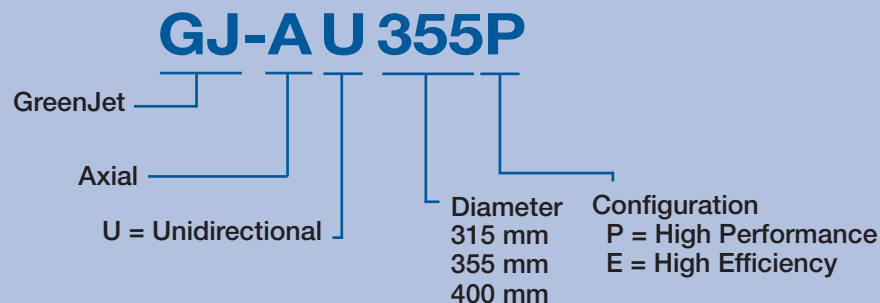
Right Time

With the use of the sensors and a good control system, the fans only need to operate when required. They can be operated from a remote control station during a fire to utilize the correct fans facilitating the exhaust of smoke from the structure in the most efficient manner.

Right Price

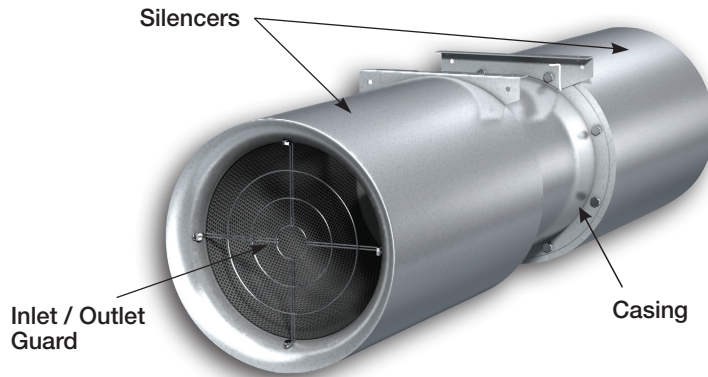
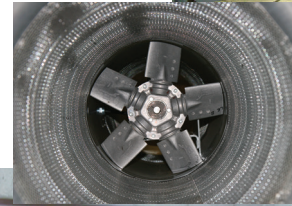
The GreenPark system reduces initial cost by reducing excavation costs and eliminating ductwork and associated design and installation costs. The operating costs are also further reduced due to the smaller fan motor requirements and demand-based system.

Model Number Code



GreenJet Series

The GreenJet series includes a range of fans to accommodate your need for car park ventilation. The unidirectional series (GJ-AU) comes standard with inlet and outlet silencers, inlet guards, mounting feet and aluminum die cast propellers and blades. The GJ-AU series features a true airfoil propeller which is designed to move high volumes of air at a high efficiency in a smaller diameter fan.



GreenJet Standard Construction Features & Accessories

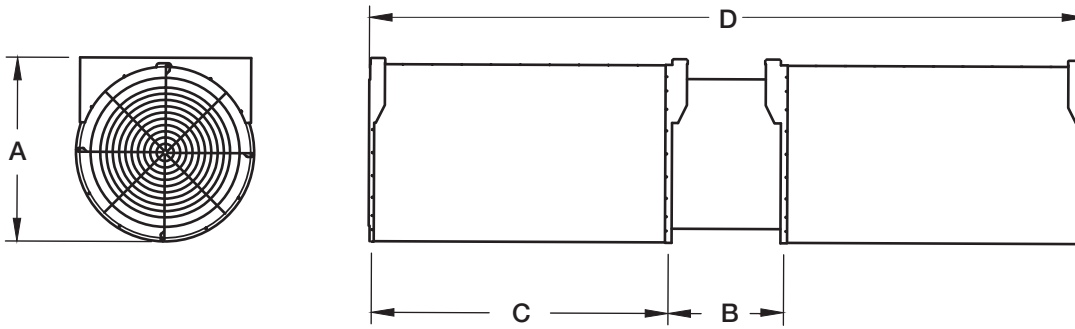
- **Aluminum airfoil propeller:** Move high volumes of air with maximum thrust and maximum efficiency.
- **Galvanized casing:** Continuously welded to prevent air leakage.
- **Motor plate:** Securely welded to fan inner tube to improve rigidity and prevent vibration.
- **Silencers:** Available in two options - short (one diameter length) and long (two diameter length).
- **Direction vanes:** Available on select models to direct airflow.
- **Smoke extraction:** 300°C for 2 hours (F300 Certificate 370-CPR-1745) and 400°C for 2 hours (F400 Certificate 370-CPR-1848) available on select models. Tested and certified in accordance with EN12101-3:2015.
- **IEC rated motors:** 50 Hz or 60 Hz motors available, in single or two speed, VFD rated, various efficiency changes.



Greenheck India Private Limited certifies that the GJ models shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.

Performance certified is for installation type B: Free inlet, Ducted outlet. Performance ratings do not include the effects of appurtenances (accessories). Power rating (BHP/kW) does not include transmission losses.

GreenJet Dimensional Data



Size	A mm (in.)	B mm (in.)	C ¹ mm (in.)	C ² mm (in.)	D ¹ mm (in.)	D ² mm (in.)
GJ-AU315P/E	420 (16½)	400 (15¾)	315 (12¾)	630 (24¾)	1030 (40½)	1660 (65¾)
GJ-AU355P/E	458 (18)	400 (15¾)	355 (14)	710 (28)	1110 (43¾)	1820 (71⅝)
GJ-AU400P/E	502 (19¾)	400 (15¾)	400 (15¾)	800 (31½)	1200 (47¼)	2000 (78¾)

GreenJet Performance

Unit	3500/1770 RPM (60 Hz)					
	Airflow CMH (CFM)	Thrust N	Operating Power kW (hp)	Motor kW (hp)	Sound ¹ LWA	Sound ² dBA
GJ-AU315P	4596/2297 (2705/1352)	25/6	0.73/0.09 (0.98/0.12)	0.75/0.37 (1/0.50)	90/75	63/48
GJ-AU315E	4202/2102 (2473/1237)	20/5	0.59/0.07 (0.79/0.09)	0.75/0.37 (1/0.50)	89/73	62/46
GJ-AU355P	8011/4006 (4715/2358)	60/15	1.45/0.18 (1.95/0.24)	1.5/0.37 (2/0.50)	96/82	69/55
GJ-AU355E	7264/3632 (4275/2138)	48/12	1.1/0.14 (1.48/0.19)	1.1/0.37 (1.5/0.50)	93/78	66/51
GJ-AU400P	10141/5070 (5969/2984)	75/15	1.46/0.18 (1.96/0.25)	1.5/0.37 (2/0.50)	92/78	64/50
GJ-AU400E	9087/4544 (5348/2674)	60/15	1.08/0.14 (1.45/0.19)	1.1/0.37 (1.5/0.50)	92/77	64/49
Unit	2900/1450 RPM (50 Hz)					
GJ-AU315P	4582/2291 (2697/1348)	24/6	0.74/0.09 (0.99/0.12)	0.75/0.37 (1/0.50)	91/75	64/48
GJ-AU315E	4200/2100 (2472/1236)	20/5	0.57/0.07 (0.76/0.09)	0.75/0.37 (1/0.50)	87/71	60/44
GJ-AU355P	7715/3858 (4541/2271)	54/14	1.28/0.16 (1.72/0.21)	1.5/0.37 (2/0.50)	92/77	65/50
GJ-AU355E	7229/3614 (4255/2127)	49/12	1.08/0.14 (1.46/0.18)	1.1/0.37 (1.5/0.50)	93/78	66/51
GJ-AU400P	10103/5052 (5946/2973)	73/18	1.45/0.18 (1.94/0.24)	1.5/0.37 (2/0.50)	92/77	64/49
GJ-AU400E	9161/4580 (5392/2696)	60/15	1.08/0.14 (1.45/0.19)	1.1/0.37 (1.5/0.50)	89/73	61/57

Air and Sound testing was done in accordance with AMCA Publication 210 and AMCA Publication 300 and values shown are at free air.
¹LWA inlet Sound Power levels are calculated per AMCA Standard 301 for installation type B: free inlet, ducted outlet (without silencers). The AMCA Certified Ratings Seal applies to LWA values only.
²dBA sound pressure values represent the configuration at free air with 2 diameter length silencers on the fan inlet and outlet. The values are the total sound at 3 meters away in a spherical free field and are not licensed by AMCA International.

Sensors

The GreenPark system recommends using sensors to increase the speed of the fan automatically as CO levels rise within the space. This demand-based control can save over 85 percent of energy costs compared to continuously running systems. The analog transmitter is used for monitoring gases in the ambient air with high resolutions that ensure the safety and comfort for the occupants for spaces with over 20 percent of vehicles being Diesel, Nitrous Dioxide must also be monitored. Consult your Greenheck representative for sensor availability.

Sensor Features

- **High Resolution:** With a 3ppm resolution, you can be assured that the system will work as it was intended and any noxious fumes will be vented from the space in a timely basis so the occupants are safe and feel comfortable.
- **Factory Calibration:** All sensors are factory calibrated, reducing your total installation and commissioning time.
- **Reverse Polarity Protection:** Eliminates potential damage due to installation errors.
- **Overload Protection:** Overload protection will prevent damage from lightning strikes and other electrical surges which may cause power surges which could drive high voltage to the cables.
- **Casing Options:** Multiple casing options are available to suit your environment.
 - IP32 - G housing
 - IP44 - F housing
 - IP54 - D housing
 - IP65 - A housing
- **Analog Output:** Analog output is available as standard in either current mode (4-20mA) or voltage mode (2-10mA).



IP-54

Dampers

Life Safety Dampers

Life safety dampers are intended to protect openings in walls, ceilings, floors and/or partitions to prevent the spread of fire and/or smoke. These are necessary in multi-level car parks with common shafts to limit spread of smoke from one floor to another.

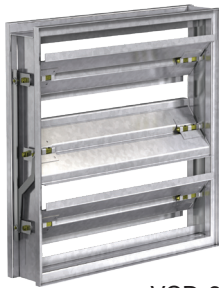


DFD-210

FSD-211

Volume Control Dampers

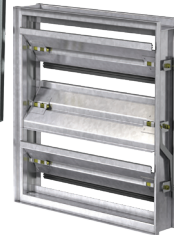
Volume control dampers regulate the flow of air and can be used in supply fan system applications.



VCD-20



VCD-33



VCD-23

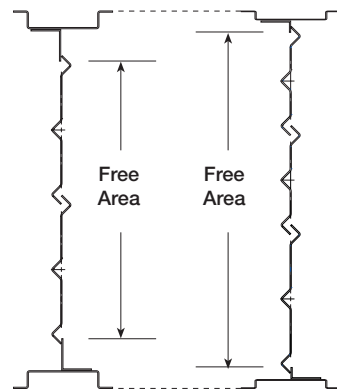


Damper Features

Variable Symmetric Blade Design (VSB)

Part of Greenheck's unique approach to damper construction, Variable Symmetric Blade design (VSB), uses two principles to increase damper performance. First, all damper blades are symmetric about their axis. Second, combinations of varying blade widths are used in a single damper. These two features are part of Greenheck's standard construction and provide the following advantages:

- Increases mounting flexibility
- Increases free area which reduces pressure drop creating lower operating costs (Figures 1 and 2)
- Reduces actuator torque minimizing the actuator size (Figure 3)

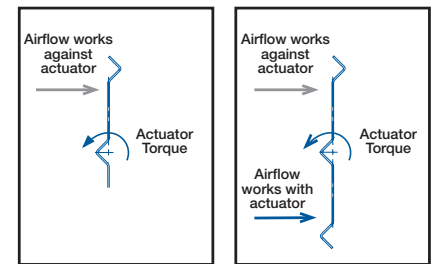


Competitor

Greenheck with low profile frame

Figure 1

Figure 2



Unbalanced Blade Requires Higher Torque

Balanced Blade Requires Less Torque

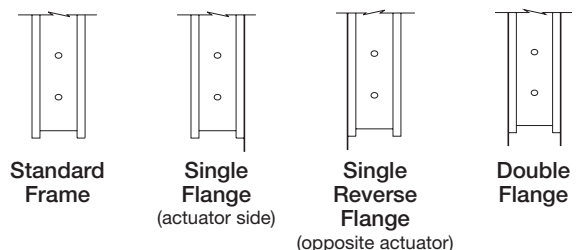
Figure 3

Design and Construction Features

- **Guaranteed Performance:** Select dampers are available with AMCA performance and leakage certifications, along with UL safety ratings for life safety damper models, giving you the confidence you need to know the products will perform as specified when you need it the most.
- **Blades:** 3V and airfoil blades are fabricated from galvanized material, incorporating three longitudinal V-Type grooves running the full length of the blade to increase strength. This blade is designed for low to medium velocity and pressure applications.
- **Frame:** Each frame is built with four separate pieces of material and joined by our Tog-L-Loc® process resulting in the following advantages:

- Rigid frame
- Increased corrosion resistance
- Optimal free area
- Square frame

Frame Options



Supply and Exhaust Fans

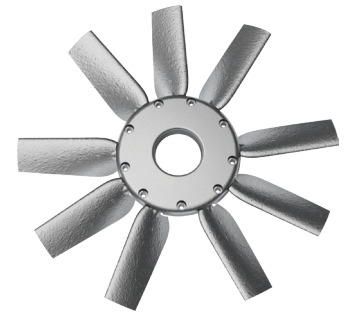
Greenheck's high performance, direct-driven supply and exhaust axial fans are ideal for inline air ventilation in commercial, industrial or institutional buildings. The casing design and construction are well suited for indoor or outdoor applications and can be easily installed in ducted or non-ducted systems. Additionally, these fans are designed to reduce operating costs with improved efficiency. Finally, the supply and exhaust fans are available in high-temperature construction to ensure that the fan will perform in case of a fire when it is needed most.



Value Added Features

High Performance Propeller

The unique blade shape and hub are designed to move high volumes of air with less power, saving on energy costs and total cost of ownership. Propellers are high efficiency, airfoil aluminum. Tight tolerances between the blades and casing improve overall efficiency.



Blades

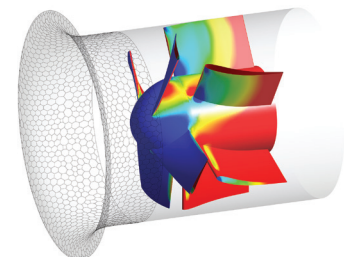
Tighter tolerance between the blades and casing improve overall efficiency and in turn overall sound levels. For quieter operation, blades are engineered for wide blade shapes and unique blade count. The asymmetrical rotor and stator combination reduces the blade pass frequency tones while generating a smoother sound spectrum.

Hubs

A wide selection of hub diameters further optimizes the fan performance in a cost-effective manner by choosing the right hub for the required volume and pressure.

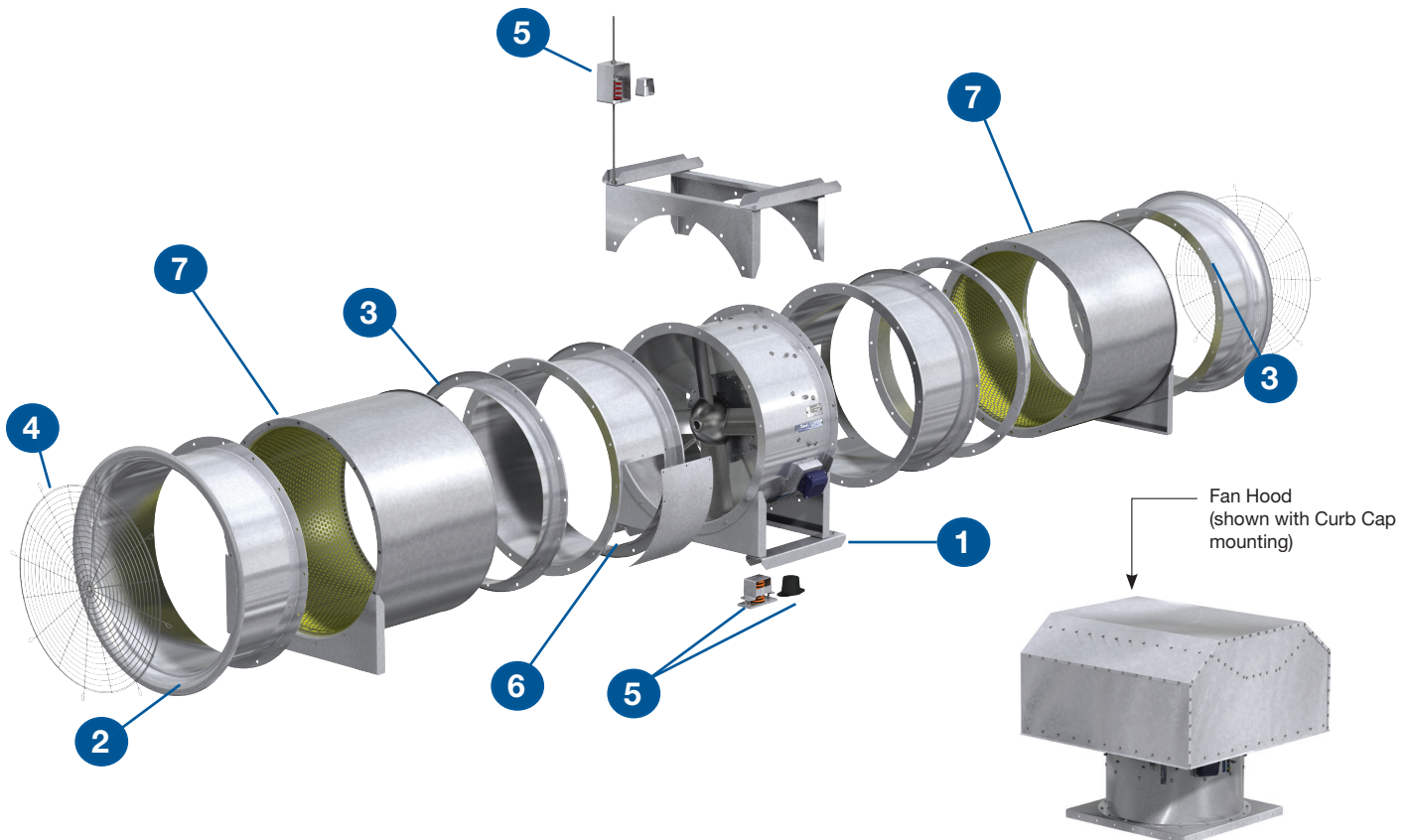
Extensive Research & Development (R&D) and Performance Testing

Greenheck engineers used Computational Fluid Dynamics (CFD) and Finite Element Analysis (FEA) to design the RA fan. The RA aerodynamic design and structural endurance were further tested in our state-of-the-art R&D facilities and performance testing labs.



Options and Accessories

- 1. Mounting Brackets:** Allows for horizontal ceiling or base mount, or vertical mount on select sizes. The brackets also provide an attachment point for any vibration isolation devices.
- 2. Inlet and Outlet Bells:** Minimizes energy losses into the fan from free non-ducted inlet condition to ensure rated performance.
- 3. Companion Flanges:** Aides the connection of the fan casing flange to ductwork. Flanges are prepunched to match the bolt hole dimensions.
- 4. Inlet and Outlet Guards:** Protects personnel and equipment in ducted or non-ducted installations. Guards are removable for routine fan maintenance.
- 5. Isolators:** Available in either neoprene or spring mounts. The isolators are furnished in sets of four and are sized to match the total weight of each fan, motor and accessory combination.
- 6. Inspection Sections:** Allows access to the fan for cleaning or visual inspection of the propeller or motor. Inspection sections are available for the inlet, outlet, or both. When required, adding an inspection section will completely encase your motor.
- 7. Silencers:** Length equivalent to either one fan diameter (1D) or two diameters (2D) are available. The silencers are designed to reduce noise from the fan inlet and/or outlet in sound sensitive applications.
- 8. Fan Hood:** Constructed of galvanized steel and are available for upblast and downblast, roof mount configurations.
- 9. Disconnect Switch:** High temperature disconnect switches are available for positive electrical shut-off at the fan (not shown below).
- 10. Emergency Temperature Options:** High temperature performance certified in accordance with EN12101-3:2015 for design time and temperatures used in emergency heat and smoke extract applications.
 - 300°C / 2 Hours (572°F/2 Hrs) (F300 Certificate 370-CPR-1745)
 - 400°C / 2 Hours (752°F/2 Hrs) (F400 Certificate 370-CPR-1848)



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 unique Greenheck service programs.



- 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.

Find out more about these Greenheck services at www.greenheck.com or www.greenheck.co.in



Building Value in Air

Greenheck delivers value to mechanical engineers by helping them solve virtually any air quality challenges their clients face with a comprehensive selection of

top quality, innovative air-related equipment. We offer extra value to contractors by providing easy-to-install, competitively priced, reliable products that arrive on time.

And building owners and occupants value the energy efficiency, low maintenance and quiet dependable operation they experience long after the construction project ends.

Our Commitment

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



Prepared to Support
Green Building Efforts

