

# Laboratory Exhaust Systems

Vektor<sup>®</sup>-CH and Vektor<sup>®</sup>-CD

Centrifugal High Plume and High Plume Dilution Exhaust System



**VEKTOR<sup>®</sup>**



 **GREENHECK**  
Building Value in Air.

June  
2020

# Vektor-CH High Plume and Vektor-CD High Plume Dilution Exhaust System

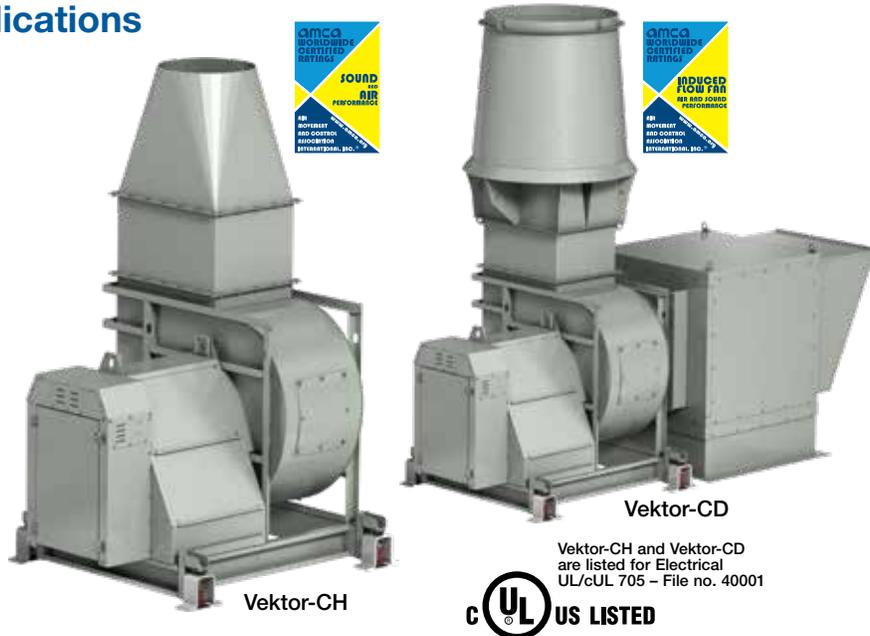
Greenheck's pre-engineered system, Vektor-CH and Vektor-CD centrifugal based exhaust fans offer high efficiency and high capacity operation with flexible laboratory exhaust designs for chemical, fume, or odors. The Vektor-CH and Vektor-CD feature advanced technology designed to safely and effectively remove, project and disperse laboratory exhaust safely away from the building. These models provide flexibility in your system for bypass air, dilution air, demand based staged operation and system redundancy. CH and CD models have high pressure capabilities to handle increased system pressure from additional components such as high efficiency filtration, UV light treatment, scrubbers or odor removal treatment.

## Vektor CH and CD Applications

- Laboratories:
  - Biological
  - Chemical
  - Animal (vivarium)
  - Physical
- Pharmaceutical companies
- Research facilities
- Industrial processes

Vektor-CD Patents  
Manufactured by Greenheck Fan Corp.  
under the following patent numbers:  
U.S. Patents:  
No. 7547249  
Singapore Patents:  
No. 124105

Other U.S. and Foreign  
Patents Pending



## Vektor-CH and CD Value Benefits and Advantages

- High velocity exhaust effluent for high plume heights
- System designed specifically for reliability required in life safety applications
- Distributed weight loading and lower system profile
- 125 mph (201 km/h) high wind loading without guy wires
- AMCA Spark C resistant construction standard (AMCA Spark B optional)
- Air handling quality bearings with L<sub>10</sub> 80k hour rated bearing life
- Single source responsibility - removing performance, fit-up and component misapplication issues
- Motors, drives and bearings are at roof deck level for safety and easy servicing
- Seismic control restrained spring isolators selected for use in critical areas and sized for a complete system
- High efficiency centrifugal wheel and scroll housings engineered for reduced turbulence and aerodynamic efficiency
- Engineered and tested for structural integrity with certified air and sound performance
- Chemical resistant flex connections for quick installation
- Low maintenance direct drive option, one year motor lubrication interval

Vektor-CH and CD fan systems are designed for compliance to ANSI Z9.5, NFPA 45, and UL 705 Standards and codes for laboratory exhaust fans. In addition, Vektor systems follow the latest ASHRAE HVAC Applications Handbook (Chapter 45) and ASHRAE Laboratory Design Guidelines. Vektor-CH and CD fan systems are designed to withstand 125 mph (201 km/h) windloading without the use of guy wires.

## Vektor-CH

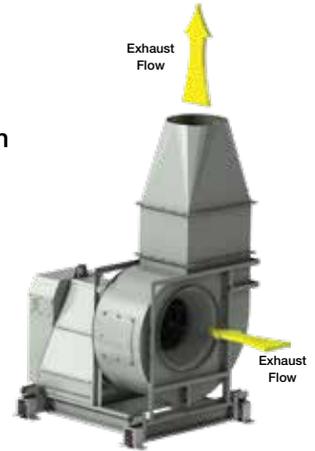
### High Plume

Vektor-CH provides the combined high efficiency performance of the scroll style fan with an engineered conical discharge nozzle. Exhaust disperses safely above the maintenance space on the building's roof deck along with areas in close proximity to the fan location. The safe dispersal of exhaust also has no impact on air intakes on the building or adjacent buildings.

Each fan size has multiple conical discharge nozzles available to provide options in plume height, sound level and energy requirement to best fit the project requirements.

*Performance Range: up to 56,000 cfm (95,100 m<sup>3</sup>/hr) and 12 in. wg (3.0 kPa)*

*Sizes: 12-44*



## Vektor-CD

### High Plume Dilution

Vektor-CD provides the dual benefits of a high plume discharge and increased exhaust dilution away from your fan and building. The nozzle has a patented design to entrain additional ambient air, diluting the exhaust effluent from the laboratory. Exhaust contaminant concentration levels are diluted up to 190%.

Each fan size has multiple discharge nozzles available to provide options in dilution plume height, sound level and energy requirement to best fit the project requirements.

*Performance Range: up to 122,000 cfm (207,300 m<sup>3</sup>/hr) and 13.5 in. wg (3.4 kPa)*

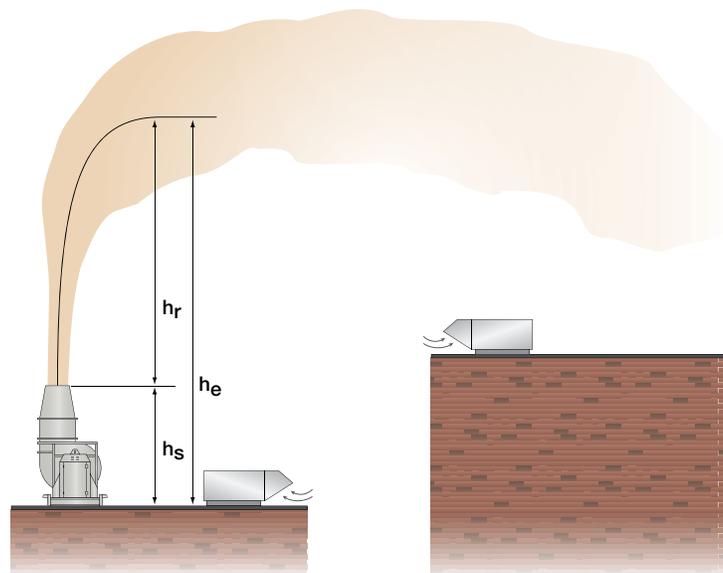
*Sizes: 12-66*



## Chemical Emission and Odor Dispersion – Plume Height Calculations

The effective plume height is an important factor in designing exhaust systems servicing laboratories. The effective plume height needs to be high enough to avoid exhaust re-entrainment into the same or adjacent buildings. Fan discharge type, concentration levels and airflow volumes all affect the needed effective plume height. The effective plume height ( $h_e$ ) is the physical height of the fan system ( $h_s$ ) plus the plume rise ( $h_r$ ).

ASHRAE 2015 Applications Handbook, (Chapter 45) on laboratory design uses a geometric formula taking into account downwind distance, height of the building, prevailing wind speed and the terrain factor surrounding the building.



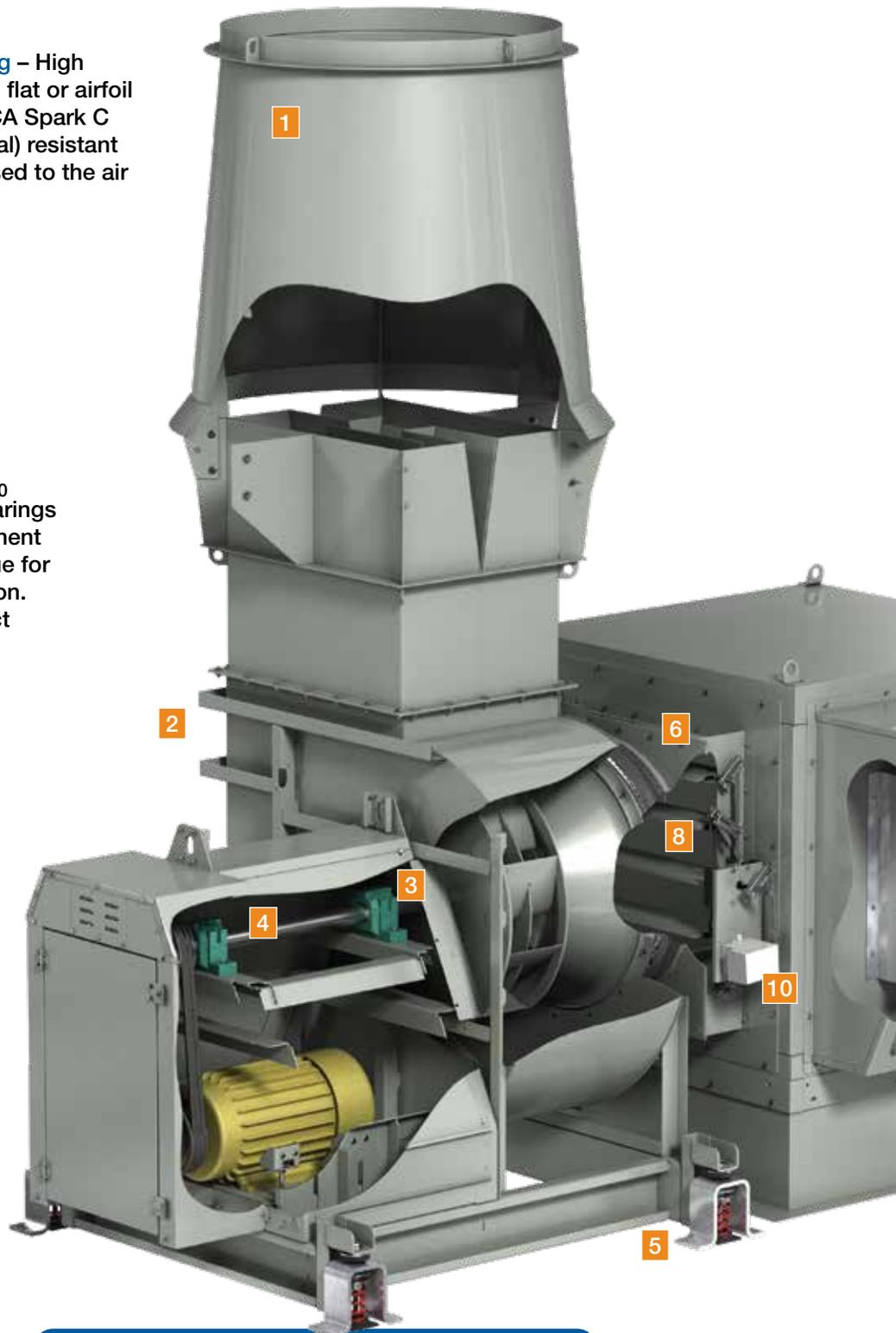
# Vektor-CH and Vektor-CD Features

- 1 Pre-engineered Nozzle/Windband** – Designed and tested with certified performance.
- 2 Centrifugal Wheel and Scroll Housing** – High performance centrifugal wheels with flat or airfoil blades for increased efficiency, AMCA Spark C (standard) or AMCA Spark B (optional) resistant construction and all fasteners exposed to the air stream are stainless steel.
- 3 Shaft Seal** – Shaft penetration into the fan housing is sealed to prevent contaminated exhaust from leaking into the surrounding area.
- 4 Shaft Bearing** – Air handling quality with L<sub>10</sub> 80,000 hrs. (minimum) or L<sub>10</sub> 200,000 hrs. (optional) rated life. Bearings 100% inspected with tighter component tolerances and reduced swivel torque for improved alignment and fan operation. (Belt drive arrangement 10 and direct drive arrangement 8).

- 5 Formed Base and Seismic Isolators** – Formed and coated steel base increases system structural rigidity. Restrained spring isolators, seismically rated to minimum 1.0 g, are sized for all components including stack, nozzle and windband.



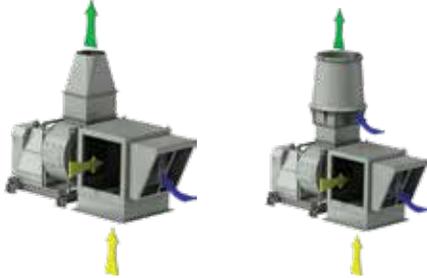
- 6 Transition and Flex Connection** – Compact square-to-round transition from damper to fan inlet provides quick and easy fit-up. Transition is removable for damper inspection. Chemical and UV resistant flex material with stainless clamps connect the fan to the transition and plenum. Flex connection combined with vibration isolators effectively isolates the fan.



## Belt Drive Arrangement 10:

- Speed adjustment by sheave change
- Motor change out without accessing wheel
- Longer bearing life

**7 Bypass Air Plenum (BAP)** – Common plenum to connect multiple fans to exhaust system. Plenum designed to minimize system effects based on the fan airflow capacities. Duct connection locations on bottom or side.



**8 Isolation Damper** – Parallel airfoil blade dampers isolate individual fans from the plenum when not in operation as well as to prevent backward wheel rotation. Dampers are mounted to the exterior of the plenum allowing for service and inspection without entering into the contaminated bypass plenum.

**9 Bypass Damper** – Opposed airfoil blade dampers provide full airflow control throughout the damper’s operating range. Dilutes bypass air exhaust concentration levels prior to entering into the fan or balance building flow variations to maintain constant fan volume and set plume height. Dampers are sized specifically for volumes and pressures required on the application.

**10 Actuators** – Isolation and bypass air dampers are available with factory mounted electric actuators to expedite system installation and to contribute to a safe, operational lab system. Actuators selected and sized on project specific operating torque requirements and control needs.



**Direct Drive Arrangement 4:**

- Motor shaft connected to fan wheel
- One year motor lubrication interval
- Fewer components

**Value Added Features**

**Complete Fan System AMCA Licensed** – Certified for Sound and Air Performance as a complete assembly including discharge nozzle and windband. All component losses are included during selection.

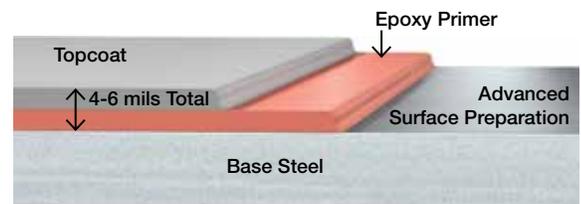
**Windloading** – Fan assemblies are able to withstand 125 mph (201 km/h) wind loading without the need for guy wires.

**Vibration Testing** – Vektor fans are vibration tested as a complete assembly and must pass AMCA 204 vibration standard BV-4, 0.10 in./s (2.5 mm/s) filter-in at the specified fan RPM.

Vibration testing is performed with triaxial accelerometers that take measurements in three planes; vertical, axial and horizontal. Test results for each fan are stored as permanent record and are available upon request.

**LabCoat™ Corrosion Resistant Coating** – All steel components are electrostatically powder coated with corrosion-resistant Hi-Pro Polyester topcoat and epoxy primer, which protects against a wide spectrum of acids, alkalis and solvents.

**LabCoat™ Cross Section**



**Direct Drive Arrangement 8:**

- Coupled motor and fan shaft
- Motor change out without accessing wheel
- Longer bearing life

## Sure-Aire™

The Sure-Aire airflow monitoring station measures fan flow within an accuracy of 3%. Unlike traditional flow probes which are often mounted in the fan venturi and 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 Vektor-CH and Vektor-CD models 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 come in 50 or 60 Hz power supplies and provides a 4-20 mA or 0-10 volt output to tie into the building's management system.



## Fan Monitoring System

Greenheck's Fan Monitoring System is designed to allow facilities and maintenance managers the ability to stay connected with their critical ventilation products. The fan monitoring system package includes a pre-programmed electronic monitor along with a wide selection of commonly applied sensors to monitor the overall equipment health, plan maintenance, and energy usage.



### Fan Monitoring System Benefits

- Applicable to any fan type in easy-to-access or remote locations
- Connects with building management system (BMS)
- Customized to unique installations and applications
- Schedule maintenance based on operation, not calendar dates

### Sensor Packages:

- Vibration (fan/motor)
- Bearing temperature
- System pressures
- System temperatures (airstream)
- Amp draw
- Fan RPM

### System Integration



## Actuators

Vektor systems are available with factory mounted and wired electric actuators. Each is sized and selected to handle the specific requirements of the laboratory application.

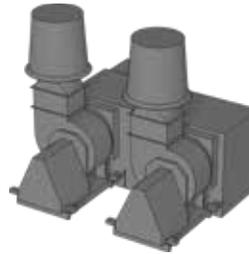


Isolation Damper and Actuator

Isolation Damper Actuator Options	Bypass Damper Actuator Options
2-position spring return actuator with end switches	Modulating operation for bypass airflow control
Electronic actuators Power: 24 VAC/VDC, 115 VAC or 230 VAC (transformers optional) Control signal: 2-10 VDC or 4-20 mA	Electronic actuators Power: 24 VAC/VDC, 115 VAC or 230 VAC (transformers optional) Control signal: 2-10 VDC or 4-20mADC
Single point wiring of the transformer and actuator	NEMA-1 enclosure (NEMA-4 enclosure optional)
NEMA-1 enclosure (NEMA-4 enclosure optional)	

## Computer Aided Program Selection (CAPS®)

- CAPS provides needed information for an informed decision and streamlines the design process
- Size options presented for side-by-side comparison
- Sort sizes by criteria such as fan rpm, energy consumption, sound levels and effective plume height
- Full submittal information, drawings, weight, fan curves and component details, print, or PDF
- Revit®, and scaled AutoCAD® drawings are downloadable as configured.



Revit Drawing



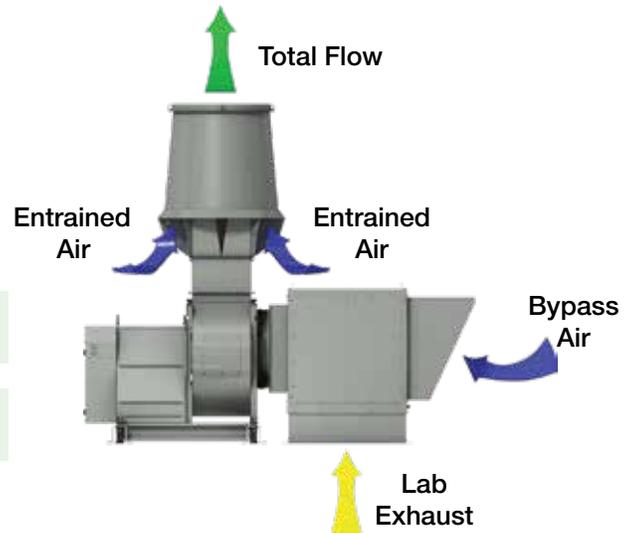
CAPS Configuration

## Vektor CD Dilution Calculations

Dilution percentage is calculated by dividing the total outlet volume by the building (lab) exhaust volume. Additional bypass air through optional bypass damper is not directly included in calculating dilution percentage since this air is in the total outlet volume.

$$\text{Lab Exhaust} + \text{Bypass Air} + \text{Entrained Air} = \text{Total Flow}$$

$$\text{Total Flow} \div \text{Lab Exhaust} = \text{Dilution Percentage}$$



## Multiple Fan Plenum Configurations for Energy Savings and Redundancy

Multiple fans connected to a common plenum provide a design that can be utilized for energy saving with fan staging capabilities or redundancy for safety and reliability. Greenheck's modular plenum and heavy duty isolation dampers provides flexibility and reliability for different control and operation strategies.



Single Fan System



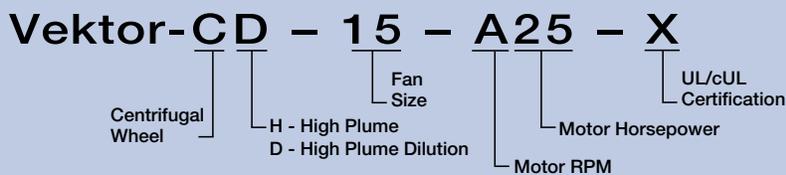
2x1 Opposed System



Multiple Fan System



## Model Number Nomenclature





# Family of Lab Exhaust Systems

**High Plume** - Effective means of creating a discharge plume height to prevent re-entrainment of chemical exhaust fumes into make-up air systems.



## Vektor-H

- High Plume Discharge Nozzle
- Centrifugal wheel
- Compact design / sealed airstream components
- Up to 26,000 cfm and 4 in. wg



## Vektor-MH

- High Plume Nozzle
- Mixed flow wheel / bifurcated housing
- Compact design
- Up to 47,000 cfm and 11 in. wg



## Vektor-CH

- High Plume Nozzle
- Centrifugal wheel
- Up to 56,000 cfm and 12 in. wg

**High Plume Dilution** - Fan design that entrains and mixes outside ambient air into the exhaust airstream prior to exiting out the windband discharge. Potentially hazardous exhaust or exhaust fumes are diluted and dispersed quickly.



## Vektor-MD

- High Plume Discharge Nozzle with Entrainment and Dilution
- Mixed flow wheel / bifurcated housing
- Compact design
- Up to 83,000 cfm and 11.5 in. wg



## Vektor-CD

- High Plume Discharge Nozzle with Entrainment and Dilution
- Centrifugal wheel
- Highest efficiency / easy service design
- Up to 122,000 cfm and 13.5 in. wg

**High Plume Variable Geometry Nozzle (VGN)** - The discharge area automatically adjusts to maintain a constant discharge velocity and remain compliant to design codes. VGN maximizes effective plume heights during periods of reduced flow and lower discharge velocity fixed nozzles.



## Vektor-HS

- VGN discharge nozzle technology
- Variable volume flow – constant velocity discharge
- Centrifugal wheel
- Up to 26,000 cfm and 3.5 in. wg



## Vektor-MS

- VGN discharge nozzle technology
- Variable volume flow – constant velocity discharge
- Mixed flow wheel / bifurcated housing
- Up to 32,000 cfm and 10 in. wg



## Vektor-CS

- VGN discharge nozzle technology
- Variable volume flow – constant velocity discharge
- Centrifugal wheel
- Up to 32,000 cfm and 10 in. wg

## 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).*

