

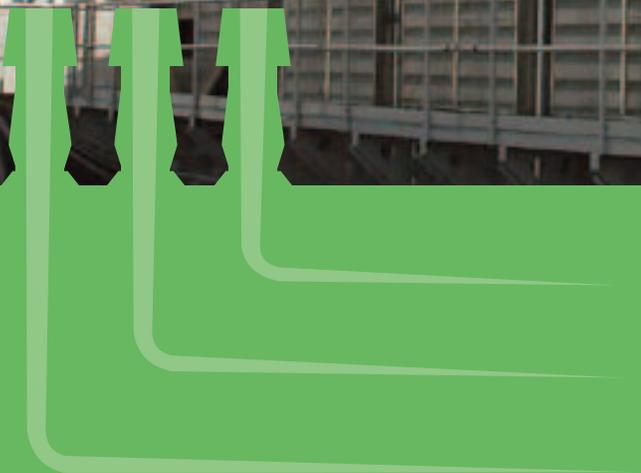
# **Strobic Air<sup>®</sup> Exhaust Systems**

**Reliable, Low Profile Solutions for Roof Exhaust**

Your trusted leader for **ALL** of your hazardous exhaust needs serving:

- **Laboratory Workstations**
- **Industrial Processing**
- **Specialized Applications**

Insuring the safety of your most valuable resource, **your people...**



*The Power of Innovation<sup>™</sup>*

**STROBIC AIR**  
TECHNOLOGIES

A CECO Environmental Company



**CECO**  
ENVIRONMENTAL

## The Tri-Stack® system is your solution for exhaust fume and odor control

### Time tested superior design: The proven product for your building exhaust

Strobic Air's Tri-Stack® exhaust systems are practical, cost-effective, and energy efficient solutions for all of your exhaust needs. Whether your concern is pollution abatement, re-entrainment, or odor control, Tri-Stack® systems offer an effective solution for you. Operating at thousands of facilities as direct replacements for tall, unsightly conventional centrifugal exhaust fans, Tri-Stack® systems offer several benefits you won't find anywhere else. Modular construction allows for easy installation and low system pressures to provide a fast payback when compared to traditional centrifugal stack exhaust designs. The low profile design, low noise levels, variable air volume control, and vibration free operation all result from the superior design and construction of the Tri-Stack® system. Tri-Stack® systems are also virtually maintenance-free, offering significant cost savings for labor while eliminating the need for rooftop penthouses and expensive vibration control measures. Direct drive motors exhibit up to L-10 150,000 hours eliminating the need to replace belts, pulleys, or other limited life components.

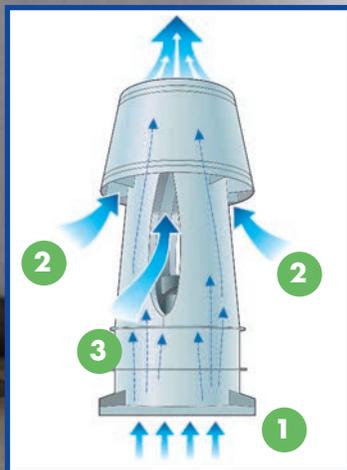
Tri-Stack® systems are ideal for use in hospitals, biomedical facilities, and research laboratories at universities as well as private pharmaceutical, chemical, and petrochemical organizations. Specialty applications from diesel generator exhaust to emergency ammonia fume extraction are also common and can be custom designed for your needs. Tri-Stack® systems are the industry leader wherever issues of exhaust pollution, odor control, re-entrainment, aesthetics, or energy savings are a priority.

### Tri-Stack® Systems roof exhaust fans: configurations for any project size or application

Tri-Stack® systems can be designed for retrofit and new construction. They can be configured to meet your design requirements, as well as optimize efficiency to ensure you have the best possible design. Strobic Air's experienced staff will be pleased to work with you to determine the best possible Tri-Stack® configuration for your application.

### Strobic Air's Tri-Stack®: Three stacks in one fan

There exists a common misconception that "TRI" in Tri-Stack® equates to three fans. However, in truth, "TRI" refers to the unique ability of each individual fan in the Tri-Stack® series to incorporate three stacks (or streams) of air into a single plume, which is composed of the following:



- 1 The first stack comes from the building source itself.
- 2 The second stack is induced through the windband. This stack allows the nozzle plume to develop fully before exiting the top of the windband and helps shield it from cross-winds.
- 3 The third stack is entrained through the teardrop shaped motor cut-outs of the unique nozzle design. The nozzle design allows the motor to remain outside of the hazardous exhaust stream, therefore allowing for easier maintenance and long life cycle. This stack adds air volume to the center of the stack as well as allows ambient air for cooling of the motor.

**Strobic Air's Tri-Stack® fan is the industry's most efficient, best cost of ownership, and reliable fan.**

## **Consider these outstanding advantages of Tri-Stack® fans and systems**

### **Prevent re-entrainment**

Tri-Stack® systems send a vertical plume of diluted exhaust gas up to 150' high, providing atmospheric disbursement and preventing exhaust from re-entering the facility through fresh air supply ventilation systems, doors, and windows.

### **Eliminate odor**

Entrainment of outside air and vertical trajectory of exhaust air by Tri-Stack® fans effectively dilutes and disperses odors, preventing them from entering or lingering near the facility and neighboring buildings.

### **Reduce noise at the property line**

Tri-Stack® systems are inherently quiet. Direct drive motors eliminate the noise generated by fans with belts and pulleys; high efficiency operation permits use of smaller horsepower motors; more efficient blade design contributes to quieter operation. Our mixed flow, direct drive impellers allow us to balance to the industry best of 0.5 mils peak to peak which contribute to lowest sound levels for any fan compared to all other fan manufactures. When noise is especially critical, Strobic Air offers a selection of noise attenuation accessories and options described in more detail on the following pages.

### **Compliance with architectural and aesthetic ordinances**

Low profile Tri-Stack® systems are often not visible from the property line. Problems associated with tall, unsightly stacks such as the perception of exhausting polluted air into the neighborhood are eliminated with Tri-Stack® systems. Since many communities have strict ordinances governing height of building exhaust stacks, Tri-Stack® systems are ideal for code compliance in virtually all cases. Our engineers are also able to work with you to create custom designs to comply with any requirements that are not already met.

### **Lower cost of ownership**

The direct drive configuration of the Tri-Stack® system combined with mixed flow impeller design allows for superior energy efficiency compared to a belt driven system. Based on current energy costs, a typical Tri-Stack® system can provide a full return on investment (ROI) in as little as two years. Strobic Air offers accessory energy recovery and Smart System™ controls that can further reduce energy costs. In addition, our 7-year warranty makes Strobic Air Tri-Stack® systems the industry leader in overall cost of ownership.



## Mixed flow impeller technology: the key to superior performance

**Tri-Stack® systems provide significant performance, reliability, and cost advantages over conventional centrifugal exhaust fans**

Strobic Air has refined mixed flow technology fans for almost three decades, and has pioneered many aerodynamic concepts with the technology. Mixed flow fans provide optimum performance in virtually all configurations of low pressure/high flow and high pressure/low flow. They offer substantial advantages over centrifugal-type fans such as higher efficiency performance for lower horsepower requirements for comparable pressures and flows. The constant acceleration ratio of mixed flow fan blades permits both the leading and trailing edges to perform equal work, maximizing efficiency and providing a stable performance curve without stall or un-stall sections.

Because Tri-Stack® systems require so little maintenance, building maintenance workers are freed up to spend their time on productive work. In addition, the need for rooftop penthouses to protect maintenance workers is also eliminated, reducing costs and weight on the roof structure.

On a direct operating cost basis, use of Tri-Stack® mixed flow fan technology reduces energy consumption. With the combination of both energy recovery and Smart System™, the Tri-Stack® solution dramatically lowers overall energy cost.

Wind band entrains outside air above motor to enhance discharge volume and effective stack height

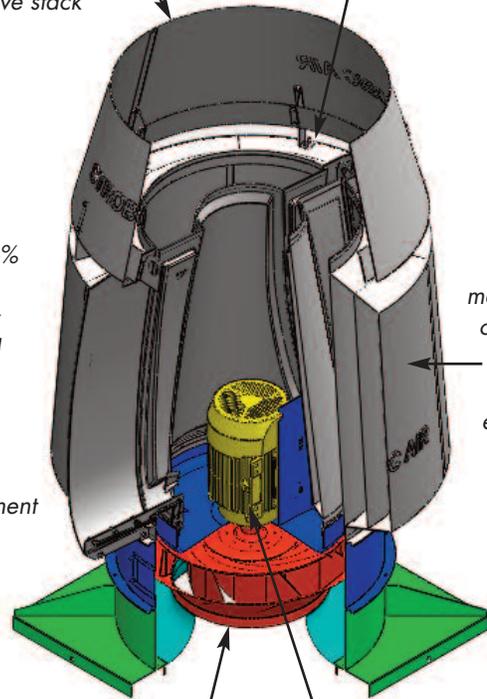
Modular construction speeds and simplifies installation, reduces cost and downtime

Up to 170% of free outside air introduced into the airstream prevents odor and re-entrainment

Special materials and coatings are available for severe environment duty

Specially designed, mixed flow impellers provide high pressure and volume at low RPM and mount directly to motor shaft without belts or pulleys

Direct drive motors are virtually maintenance free, with typical lifetimes of 150,000 hours



## **The top 10 ways Tri-Stack® systems reduce costs**

Cost is obviously a key consideration when evaluating capital equipment for complex HVAC systems. To that end, consider these 10 reasons why Tri-Stack® systems help reduce costs for pollution abatement, odor control, and re-entrainment.

### **Modular construction**

Tri-Stack® systems are composed of three individual modules, specially designed to speed and simplify installation while lowering installation cost. Modular design permits quick installation directly on the roof, eliminating the need for expensive construction equipment and helicopters that require building evacuation. Tri-Stack® systems are easily retrofitted onto existing roofs.

### **Fast installation**

A typical Tri-Stack® four fan system can be mounted on the roof in less than two hours with minimal rigging equipment. When retrofitting existing systems Tri-Stack® systems eliminate the need for “temporary” exhaust systems. In addition to substantially reduced installation costs, engineering costs and disruption of work schedules are also reduced.

### **Reduced horsepower motors**

Our exhaust nozzle design maximizes system performance to provide increased airflow and efficiency while lowering horsepower requirements, thus further reducing energy consumption.

### **No protective penthouses**

Without maintenance problems, there is no need for expensive penthouses to protect maintenance personnel on the roof under adverse conditions. As a result, you can expect savings of several hundreds of thousands of dollars in a typical installation.

### **Maintenance-free operation**

Tri-Stack® direct drive motors are virtually maintenance-free with typical lifetimes of 15 to 20 years. There are no belts, pulleys, flex connectors, or spring vibration isolators to maintain, and the motors are designed to operate continuously with only periodic maintenance for years under normal conditions.

### **Unique exhaust nozzle design**

Tri-Stack® systems use exhaust nozzles designed to lower resistance, increase flow and pressure, and increase outlet velocities to minimize bypass requirements.

### **Special fan wheel design**

The Tri-Stack® mixed flow impeller is the most efficient fan design resulting in lower horsepower requirements with subsequent energy reduction. Its non-stall characteristics permit use of frequency drives, further enabling the reduction of energy consumption.

### **No expensive silencers needed**

Increased air flow vs. resistance efficiencies enable Tri-Stack® systems to provide high performance and substantially lower noise levels. This often eliminates the need for expensive inlet and outlet silencers.

### **Simple installation without the need for roof curbs**

The physical stack height of Tri-Stack® systems is typically 60% of conventional stacks. Low profile design eliminates the need for spring isolation, inertia bases, flexible connections, guy wires (with associated pitch pocket roof leaks), or other expensive, time consuming, and maintenance intensive installation hardware and procedures.

### **150,000 hour motor lifetimes**

The direct drive motors in Tri-Stack® systems are designed to operate continuously for years under normal conditions. Typical lifetimes are 150,000 hours.

## Tri-Stack® systems meet AMCA 210/260/300 and all applicable ventilation standards

Tri-Stack® systems conform to all applicable ventilation standards such as:

- AMCA (Air Movement Control Association) 210/260/300 for the majority of our fans
- ANSI/AIHA (American National Standards Institutes/ American Institute of Hygienic Association) Z9.5 for laboratory workstations and their exhaust systems
- ASHRAE (American Society of Heating, Refrigerating, and Air-conditioning Engineers, Inc.) 45
- NFPA (National Fire Prevention Association) 45.

These organizations provide guidelines with regard to building air intake and exhaust design, indoor air quality and re-entrainment issues of contaminated exhaust entering doors, windows and outside air intakes.

## Value added accessories for enhanced system performance

### Maximize HVAC system performance and minimize noise at the property line

Strobic Air offers a number of useful accessories for Tri-Stack® systems to reduce energy consumption, provide even quieter operation through higher sound attenuation, as well as special construction materials and/or coatings to accommodate unusual applications such as operation in acidic, caustic and high temperature environments. Many of these accessories are described below.

### Energy recovery systems

Unique glycol/water heat exchanger coil modules for Tri-Stack® systems extract exhaust heat for heating or cooling conditioned makeup air. A 1°F rise in makeup air temperature permits a corresponding 3% reduction in heating costs, drastically lowering energy costs for savings of thousands, or hundreds of thousands, of dollars per year.



### Smart System™

Automatically maintains safe ventilation levels while minimizing facility energy cost and carbon footprint. (For more details see next page.)



### Acoustical Silencer Nozzles™



Acoustical silencer nozzles for Tri-Stack® systems attenuate up to 12 dBA for quieter operation in particularly noise sensitive areas. Low profile design is unobtrusive, enhancing roofline aesthetics without affecting fan performance. Acoustical silencer nozzles

may be retrofitted onto existing Tri-Stack® fans quickly and conveniently.

### Fans for harsh environments

Tri-Stack® fans may be constructed with highly specialized materials and/or coatings for use in caustic, corrosive and other severe environments (such as chemical processing, plating and wastewater treatment facilities) where they may be exposed to nitric acid, fluorides, sulfuric acids and other high concentrations of caustic exhaust components.



### HEPA filtration system



Tri-Stack® HEPA filtration systems are available for special medical/pharmaceutical applications such as isolation room and quarantine room exhaust, Level 4 safety laboratories, or similar applications, bag in/bag out.

## Fans for high temperature environments

Tri-Stack® fans are also available in rigid steel construction for high temperature applications such as emergency diesel generator, furnace or boiler room exhaust. High temperature systems can withstand up to 1000° F continuously and incorporate a chemically resistant high temperature coating.



## Retrofit applications

Replacing outmoded centrifugal fans with Tri-Stack® fans is sensible, convenient, and cost-effective.

One manifolded Tri-Stack® fan can typically replace up to 20 individually dedicated stacks enhancing building aesthetics and eliminating negative implications associated with roof stacks. In addition

to performance and operating cost advantages, retrofitting Tri-Stack® systems reduces engineering costs and eliminates extensive coordination of production/processing schedules to prevent unnecessary and expensive downtime.



## Mono-Stack™

For less mission critical applications Strobic Air offers a series of centrifugal fans. These Mono-stack™ fans can be fitted with many of our standard Tri-Stack® options, such as, Smart System™, energy recovery systems, and more. The Mono-Stack™ comes standard with:

- Powder coating
- Variety of wheel diameters
- AMCA B or C construction
- BV3 or BV4 vibration ratings
- Ability be used in conjunction with Variable Frequency Drives (VFDs)
- Modular plenum construction allowing for future expansion



## Smart System™

The Smart System™ maintains safe ventilation levels while minimizing facility energy costs and carbon footprint. Controlling to a static pressure set point in your ductwork, the Smart System™ dynamically measures fan performance, allowing it to safely control fan speed while never dropping below a minimum outlet velocity and stack height. Once fan speed is reduced to reach a minimum outlet velocity, bypass dampers are adjusted to meet lower building demand.

## Features and Benefits

- Can contribute to Leadership in Energy & Environmental Design (LEED) certification
- Controls fan speed to meet building demand while maintaining a minimum outlet velocity and effective stack height
- Reduces sound levels at off-peak loading
- Logs performance data for more than 5 years
- Stages fan operation and rotates redundant fan
- Can be retro-fit onto existing systems
- Easy to use touch screen controls
- Communicates with most building systems
- Detects failures and activates backup fan
- Controls isolation and bypass damper positions
- Optional wind speed optimizer adjusts minimum outlet velocity based on wind speed and direction to maximize system efficiency

## System Response

The Smart System™ is designed to quickly respond to fan failures and other adverse system conditions. In the event of a fan failure, a backup fan will immediately engage and ramp up to speed, restoring system pressure quickly. In addition, an alarm will be sent via email or text message to one or several people simultaneously to notify them of the failure.

## Fan Functions

The Smart System™ will control all of the following:

- Maintains duct static pressure set point
- Adjusts fan operating frequency
- Cycles fans on/off every 30 days
- Controls isolation damper position
- Adjusts bypass damper position
- Automatically rotates backup fan
- Detects failures and activates redundant fan
- Measures and records system performance
- Communicates with building system

## Smart System™ (cont.)

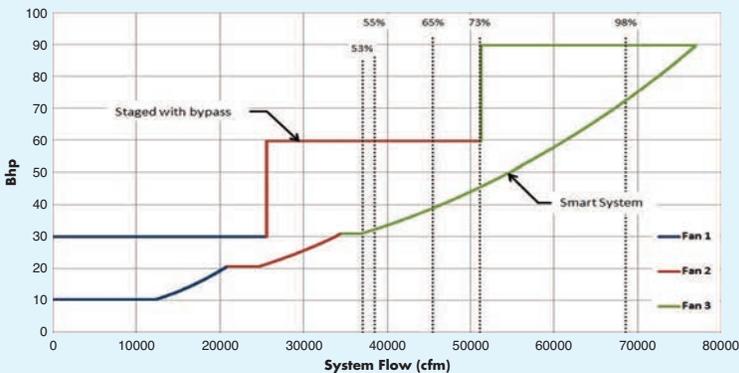
### LEED Credits

Installation of the Smart System™ can help your building obtain LEED points for overall building energy efficiency. The Smart System™ helps obtain points for "Optimizing Energy Performance" by reducing the energy consumption of your exhaust air, and for "Measurement and Verification" by providing the ability to store performance data of your exhaust system.

Technical Specifications				
Input Power	Operating Temp.	Static Pressure Accuracy	Communication Compatibility	Fan Functions Controlled
115 VAC/ 15A	32-122°F (0-50°C)	± 0.8%	<ul style="list-style-type: none"> <li>■ BACnet</li> <li>■ LonWorks®</li> <li>■ MetaSYS N2</li> <li>■ Apogee® P1</li> <li>■ MODBUS®</li> </ul>	<ul style="list-style-type: none"> <li>■ Fan operating frequency</li> <li>■ Cycle fan on/off</li> <li>■ Isolation damper position</li> <li>■ Bypass damper position</li> </ul>

### Energy Usage

Model TS3S300D12 30hp (3 Fans Operating)



Design Flow: 70,000 cfm

Count	Demand %	Demand Flow (cfm)
70	53%	37,100
35	55%	38,500
13	65%	45,500
10	73%	51,100
40	98%	68,600

Staged with Bypass

Bhp	Per Week (hp)
59.7	4,179
59.7	2,090
59.7	776
59.7	597
89.6	3,584

Total/Year: 583,732 hp

With Smart System™

Bhp	Per Week (hp)
31.6	2,212
32.4	1,134
38.9	506
45.6	456
72.5	2,900

Total/Year: 374,801 hp

Kilowatt savings over (1) year:  
155,800 kw

\* Based on Laboratory Modeling Guideline using ASHRAE 90.1-2007 Appendix G

## Technical/Field Support

Strobic Air technical and sales engineers can also provide valuable support services for you and your clients. Performance and cost comparisons of Tri-Stack® systems vs. alternative methods of pollution abatement, as well as informative presentations on system design, construction, operation, and advantages. These support services have proved useful for building owners and/or managers who are considering new or retrofit systems. We can also provide computer-generated sound calculations to the property line or into the facility. A comprehensive resource library of technical/tutorial/applications articles as well as case studies can be found at [www.choosetrystack.com](http://www.choosetrystack.com).

### How to get more information...

Tell us about your application. We will work with you and others associated with your project to recommend the best solution for your pollution abatement or odor control problem.

**Our OneCECO Air Pollution Control team can handle almost any air emission project. In addition to Strobic Air, the team includes:**

#### Adwest Technologies

- Regenerative thermal oxidizers
- Dual & multiple chamber technology
- Biogas thermal & catalytic oxidizers
- Rotary concentrators

#### Busch International

- Fume exhaust for steel & aluminum mills
- Product cooling – JET\*STAR
- Industrial ventilation
- Fugitive emissions – lead dust

#### Entrol-Buell Technologies

- Reactor & regeneration cyclones
- Third stage separators
- Fourth stage cyclones
- Hopper cyclones

#### Fisher-Klosterman Entrol

- High-efficiency/severe-service cyclones
- Wet scrubbers
- Venturi & packed-bed scrubbers
- Dust collection/filtration technology

#### Flex-Kleen

- Pulse jet filtration technology
- ASME code vessels for product recovery
- Cartridge collectors
- NFPA compliance filtration systems

#### HEE-Duall

- Chemical fume & acid gas treatment
- Chemical & biological odor control
- Degasifiers & carbon adsorbers
- Thermoplastic & FRP tanks, duct & fans
- Bio-Reaction biofilters

#### K&B Duct & Component Parts

- Standard duct & components
- Clamp together duct
- Dust collection systems

#### Kirk & Blum Services

- Engineered air systems
- Custom sheet metal/plate fabrication
- Turnkey solutions provider
- Testing, permits, design & installation

#### SAT Technology

- Organic waste gas treatment systems
- Wet scrubber systems
- VOC concentrators
- Heat recovery systems

#### Zhongli Industrial Technology

- Flue gas dampers
- Ball mill systems

Visit [www.cecoenviro.com](http://www.cecoenviro.com) for more information.

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