

Put fume hood exhaust—
and other process exhaust—in its place:

*Away from your building
and your neighbors*

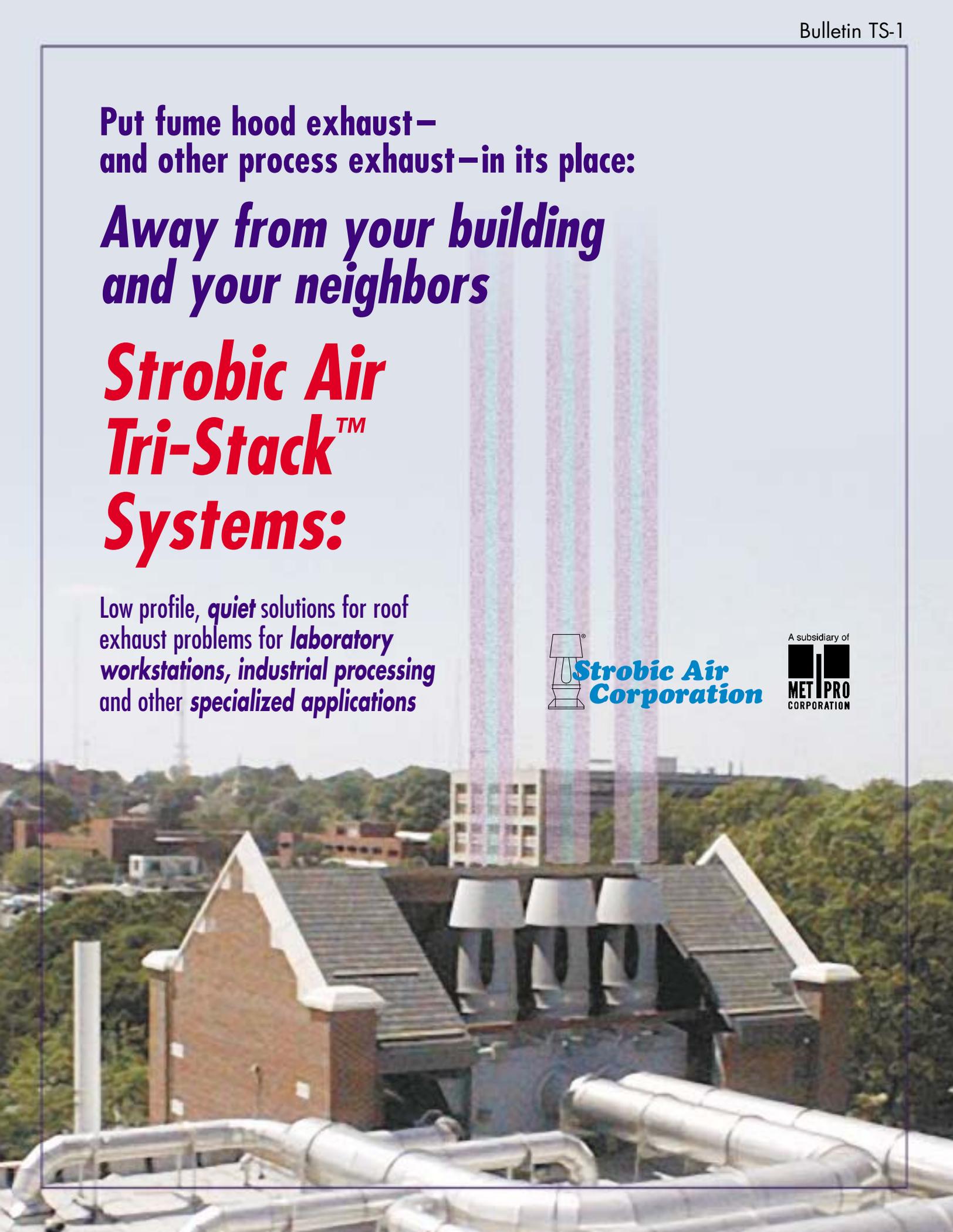
Strobic Air Tri-Stack™ Systems:

Low profile, *quiet* solutions for roof
exhaust problems for *laboratory
workstations, industrial processing*
and other *specialized applications*



**Strobic Air
Corporation**

A subsidiary of
**MET PRO
CORPORATION**



The Tri-Stack *system solution* to pollution abatement and odor control

Job proven and time tested:

The right place for your building exhaust



Strobic Air Tri-Stack exhaust systems are practical, cost-effective and energy efficient solutions for pollution abatement, re-entrainment and odor control problems. Tri-Stack fans and systems are used at hundreds of facilities, serving

as direct replacements for conventional centrifugal exhaust fans which are usually associated with tall, unsightly stacks. Lightweight, modular construction with lower system pressures (typically 2" w.g.) than conventional exhaust

stack designs help provide a two year payback when used for centrifugal fan replacement. Other advantages of Tri-Stack systems include low profile design, low noise levels, variable air volume control and vibration free operation at lower operating costs. Tri-Stacks are also virtually maintenance-free, offering significant cost savings with regard to maintenance labor, while eliminating the need for rooftop penthouses and expensive vibration prevention hardware. Direct drive motors exhibit up to 200,000 hour lifetimes, eliminating the need to replace belts, pulleys, or other limited life components.

Tri-Stack systems are designed for use at hospitals, biomedical facilities and

research laboratories at universities, pharmaceutical, chemical and petrochemical organizations. They're also ideal for exhausting hospital/infirmiry isolation rooms (or research laboratories and pharmaceutical production facilities) where 100% conditioned makeup air is usually required, and for emergency diesel generator exhaust to prevent re-entrainment and eliminate odor in the neighborhood. In fact, Tri-Stack systems should be considered wherever issues of exhaust pollution, odor control, re-entrainment, aesthetics and energy savings are important.

Tri-Stack TS Series roof exhaust fans

Sizes, capacities and configurations for virtually any pollution abatement and odor control application

Tri-Stack systems are designed for retrofit and new construction. They are available with many different motor sizes to meet precise airflow and pressure requirements. Strobic's technical/engineering staff will be pleased to work with you to determine the best possible Tri-Stack configuration for your application.

The Tri-Stack TS-2 roof exhaust fan provides up to 18,500 CFM with static pressures of 5.25" w.g. maximum and motor horsepower ranging from 5 to 15.



Consider these outstanding advantages offered by Tri-Stack fans and systems:

- Prevent re-entrainment-** Tri-Stack systems send a vertical “jet plume” of diluted exhaust gas up to 350’ high, providing atmospheric disbursement and preventing exhaust from re-entering the facility through fresh air supply ventilation systems, doors, and windows.
- Eliminate odor-** The dilution capabilities of Tri-Stack fans (up to 170% of free outside air is introduced into the airstream above the roof), effectively eliminate odors, preventing them from entering the facility and neighboring buildings.
- Reduce noise at the property line-** Tri-Stack systems are inherently quiet. Direct drive motors are quieter than centrifugal fans with belts and pulleys; high efficiency operation permits use of smaller horsepower motors; more efficient blade design contributes to quieter operation. In the event that noise is a problem, Strobic Air offers a number of noise attenuation accessories described elsewhere in this brochure.
- Comply with architectural/aesthetic ordinances-** Low profile Tri-Stack systems are often not even visible from the property line. As a result, problems associated with tall, unsightly stacks – including the perception of exhausting polluted air in 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.
- Lower energy costs-** Direct drive motors in Tri-Stack systems use substantially less energy per horsepower than comparable belt driven motors. Combined with mixed flow impeller design energy consumption is minimized. Based on current energy costs, a typical Tri-Stack system can provide a return on investment (ROI) in less than two years. In addition, for applications that require conditioned makeup air, Strobic offers accessory heat exchanger systems that can significantly reduce energy costs.

Fan Family	CFM Range	Maximum Static Pressure	Horsepower Range
BS-002	3200	5.00	1 to 3
BS-005	4700	5.00	1 to 3
TS-1	11500	8.50	5 to 15
TS-2	18500	5.25	5 to 15
TS-3	32000	6.75	10 to 30
TS-4	45000	10.50	20 to 60
TS-5	81000	9.50	60 to 100

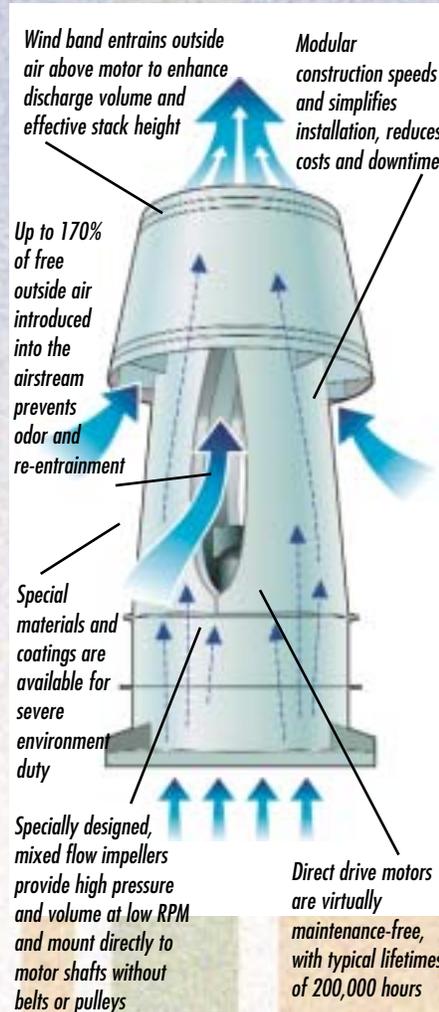


This Tri-Stack TS-3 roof exhaust fan incorporates an integral acoustical silencer nozzle for highest attenuation in particularly noise sensitive areas.

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 been refining mixed flow technology fans for more than two decades, and has pioneered many aerodynamic concepts associated with this technology. Mixed flow fans – originally developed for low pressure, high flow applications – provide optimum performance in virtually all configurations of low pressure and high flow, and high pressure and low flow. They offer substantial advantages over centrifugal-type fans such as higher efficiency performance for lower horsepower requirements for comparable pressures and flows, as well as energy efficient operation. 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 unstall sections.



Because Tri-Stack systems require little or no maintenance, health and safety considerations of maintenance people (on the roof) are eliminated, while freeing them for more 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 as indicated in the chart opposite. When combined with accessory heat recovery systems, Tri-Stack systems dramatically lower overall energy costs for building climate control.

Tri-Stack systems reduce costs 10 ways

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 (with self-contained mixing boxes or plenums) may be easily retrofitted onto existing roofs with minimal effort.

Fast installation—A typical Tri-Stack four fan system can be mounted on the roof – in less than two hours – with minimal rigging equipment. And when retrofitting existing systems (typically installed while penthouses are being constructed), Tri-Stack eliminates the need for “temporary” exhaust systems. In addition to substantially lower installation costs, engineering costs are also reduced, as well as disruption of work schedules which can cause wasteful and expensive downtime.

Reduced horsepower motors— A new 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's no need for expensive penthouses to protect maintenance personnel on the roof under adverse conditions. Instead, you can expect savings of several hundreds of thousands of dollars in a typical installation.

Maintenance-free operation— Tri-Stack's direct drive motors are virtually maintenance-free with typical lifetimes of 200,000 hours. There are no belts, pulleys, flex connectors, or spring vibration isolators to maintain, and the motors are designed to operate continuously—without periodic maintenance—for years under normal conditions.

Unique exhaust nozzle design— Tri-Stack systems incorporate computer designed, state-of-the-art exhaust nozzle designs that help lower resistance, increase flow and pressure, and increase stack outlet velocities to minimize bypass requirements. These characteristics work together to further reduce operating costs.

Special fan wheel design— Tri-Stack's unique fan wheels are developed with Computer Aided Design (CAD) techniques. Efficient fan blade design helps lower horsepower requirements with subsequent energy reduction. In addition, non-stall characteristics permit use of variable frequency drives, further enhancing efficiency and reducing energy consumption.

No expensive silencers needed— Increased air flow vs. resistance efficiencies enable Tri-Stack systems to provide high performance at substantially lower noise levels—particularly in the lower octave bands—often eliminating the need for expensive inlet and/or outlet silencers.

Simple installation without roof curbs— Stack height of Tri-Stack systems is only about 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.

200,000 hour motor lifetimes— The direct drive motors in Tri-Stack systems are designed to operate continuously for years under normal conditions; typical lifetimes are 200,000 hours.

Tri-Stack systems meet ANSI Z9.5, ASHRAE 110, NAPA 45 and all applicable ventilation standards

Tri-Stack systems conform to all applicable ventilation standards – without exception – such as ANSI/AIHA Z9.5 (American National Standards Institutes/American Institute of Hygienic Association) for laboratory workstations and their exhaust systems), ASHRAE (American Society of Heating, Refrigerating, and Air-conditioning Engineers, Inc.) 110, and 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.

System Cost/Performance Comparison

Fan Type	Tri-Stack	Centrifugal
	TS4L400A12	40" SWI-BC
Flow Rate (CFM)	33253	33253
Inlet SP (in)	3.00	3.00
Outlet Velocity (FPM)	6239	6239
Inlet Duct Size	54" SQ	40" DIA
Velocity (ft./min.)	1642	3811
90 Inlet Elbow	N/A	0.25"
Inlet System Effect	N/A	0.60"
Inlet Flex	N/A	0.10"
Outlet Flex	N/A	0.10"
45 Outlet	N/A	0.21"
System Effect	N/A	0.17"
Straight Stack Loss	N/A	0.02"
Dish. Nozzle Loss To 3472 FPM	N/A	0.75"
Fan SP Req'd (in)	3.00"	5.20"
Fan HP	33.89	49.12
Belt % Loss	N/A	5%
Belt Loss	N/A	2.456
Motor HP	33.89	51.576
Motor KW	25.27	38.46
Fan Height/Stack Height (ft)	11.60	16.80
Plume Height (ft) @ 15 MPH Wind	52.40	47.20
Effective Stack Height (ft)	64.00	64.00
Dilution Ratio	1.87	1.00
Total Entrained Flow (CFM)	62,183	33,253
Energy KW @ 10 KW	\$64.52	\$98.20
Annual Energy Cost	\$23,549	\$35,841
Maintenance. Hours/Month	0	4
Maintenance Cost @ \$35/MH	0	\$1,680
Annual Operating Cost/Fan	\$23,549	\$37,521
Annual Operating Cost/ 4 Fan System	\$94,196	\$150,084

Value added accessories for enhanced system performance

Maximize HVAC system performance, minimize noise at the property line

Strobic Air offers a number of useful accessories for Tri-Stack fans including systems to reduce energy consumption, provide even quieter operation through higher sound attenuation, and many 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 here.



Heat 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.)



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 are also available with special materials of construction 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

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



Fans for high temperature environments

Tri-Stack fans are also available in rigid steel construction for many high temperature applications such as emergency diesel generator, furnace or boiler room exhaust. Fans can withstand up to 750° F temperatures without the need for outside air dilution, and incorporate chemical resistant high temperature coatings. A brass rub ring on the inlet bell conforms to AMCA "C" spark resistance specifications.



Retrofit applications

Replacing outmoded centrifugal fans with Tri-Stack fans is practical, 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.



Strobic Air provides valuable support services for architects, engineers and contractors



Strobic's technical/engineering staff has considerable experience working with consulting engineers and architects. We offer many support services for planning new and/or retrofit roof exhaust systems. In addition to comprehensive—and realistic—performance/engineering data, we can provide guidance, if desired, for appropriate wind and/or noise studies to pinpoint possible areas of re-entrainment or noise, and eliminate problems prior to system design and construction. Technical literature specifically related to architectural issues is also available.

Technical/field support for your clients



Strobic technical and sales engineers can also provide valuable support services—for you and your clients—such as 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, an extensive Computer Aided Design (CAD) drawing file, and a comprehensive resource library of technical/tutorial/applications articles as well as case studies on Tri-Stack installations.

Tri-Stack Engineering Guide

Strobic Air offers a unique Engineering Guide which helps reduce system engineering time substantially. The Engineering Guide shows how to eliminate the need for tall stacks in fan installation at the start of a project, offers alternative design plans, and provides useful technical data to save you time and effort.



Safety design response team

Our Safety Design Response Team is also available to help analyze your existing pollution abatement and/or odor control system, without obligation. Chances are we can offer a number of alternative design plans to enhance performance, add efficiency, lower costs, reduce stack heights, add redundancy, and provide for future growth.



How to get more information...

Tell us about your application. We'd be pleased to work with you—and others associated with your project—to recommend the best Tri-Stack system solution for your pollution abatement or odor control problem.

For design/applications tips, visit our web site:
www.strobicair.com or
www.met-pro.com/strobic.html
E-mail: tristack@strobicair.com

Tri-Stack Generation III roof exhaust systems...

First we invented the technology. Then we perfected it.



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