

FIRE SAFETY

SMOKE VENTILATION

PARKING GARAGE FANS

LIFE SAFETY AND SMOKE VENTILATION





Solid coverage of the entire garage



Less horsepower per square foot of operation



Constant flow of air for safety as required

WE DELIVER THE **AIR MOVEMENT FUNCTIONS, CAPACITY, PERFORMANCE AND LIFE SAFETY CRITERIA** THAT ANY PARKING GARAGE REQUIRES

Air movement in occupied buildings has many roles to play. Not just to bring the ventilation and comfort that are vital to human existence. It also has the potential to protect.

In an ideal world, this would all be achievable via natural, non-mechanical processes. But reality is different. In most cases, and to varying extents, powered air movement is essential.

From functional operational routines, to one-off emergency situations, fans have a front-line role to play in many built environments, matching precise needs, Woods Air Movement Ltd. certainly has the right solution.

Our knowledge and reputation has been built up through engineering innovation and development. This reflects an impressive track record that equips all our customers with a special confidence. An assurance that, whatever the need or application, Woods Air Movement Ltd. can deliver the product, the performance and the service that is required. Precisely.

Our expertise is not confined to original manufacture and supply. It is available to you from the selection process onwards, and continues well beyond installation, throughout each system's operating life.

When you first select and install one or more of our systems, our partnership with you is only just beginning. Because you'll always be able to call on Woods Air Movement Ltd. experience. We're at your service.

One expert source

Woods Air Movement Ltd. has the widest range of parking garage fans available in today's market: from the largest induction thrust fan; through to compact, lightweight Jet thrust fan models to meet any installed requirement.

That means we can deliver all the air movement functions, capacity, performance and life safety criteria that any parking garage requires – whatever its size and purpose.

In short, our expertise has precisely the answer you need.

Total air movement solutions

The ideal air movement equipment will satisfy the correct combination of several factors, applying to a specific project:

FUNCTION: Including air supply or extraction; heat transfer and recovery; and, in the event of fire, emergency management of smoke and toxic fumes

FLOW: Required air volume capacity and speed

ENERGY EFFICIENCY: Less energy consumed to achieve the desired result

CONTROLLABILITY: Allowing performance to match demand – no more, no less

SOUND: Quiet operation to avoid noise distraction

SPACE AVAILABILITY: Fitting the space or location available

At Woods Air Movement Ltd., we have the technology and experience to give you the correct combination to fit your application.



A DIFFERENT APPROACH: The complete solution to parking garage ventilation

Ducted systems are the traditional approach to enclosed parking garage ventilation, with fresh air levels based on a given number of air changes per hour.

Constant running of a ventilation system, even in extended periods of low, or even no traffic or ventilation requirement, results in high day to day running costs.

The solution is to incorporate a Woods Air Movement Ltd. Thrust Fan System. Ventilation can be designed using a CO or NOx sensor monitoring system, so that selected fans run only when necessary. Additional savings are made due to lower pressure main extract fans being used as they do not have to cope with system resistances found in ducted systems.

All our designs will be prepared to the customer's requirements, taking into account any regulations that apply. If required, the Thrust Fan System can be designed

to a traditional volumetric air change rate or design fire loads.

Woods Air Movement Ltd. realizes the importance and possible life saving function of our Thrust Fan System and offers full Computational Fluid Dynamics (CFD) modeling to every customer, on every project. You will learn more about CFD on page 8.

With over a 99% uptake by our customers, they too realize the importance of getting it right. CFD ensures system optimization and, more importantly, that the occupants safety is not compromised.

Woods Air Movement Ltd. avoids the poor design or 'guesstimates' used by some, and employs best practice CFD modeling methods. This avoids making a project unnecessarily expensive by using too many fans, or an under performing system by specifying too few.



Thrust Fan Systems are one of the most cost effective ways to ventilate, both in terms of installation cost and long term running costs

The Woods Air Movement Ltd. Thrust Fan System is one of the most efficient and cost effective parking garage ventilation systems available on the market today.

Both day-to-day pollution and emergency smoke are safely and effectively ventilated. Designed to the highest standards and meeting the most stringent criteria to ensure all design requirements are met.

- High System Performance
- Low Installation Costs
- Low Running Costs
- Optimizes Parking garage space
- CFD System Design

Although the Woods Air Movement Ltd. Thrust Fan System works on surprisingly simple principles, highly trained engineers, backed up with the latest high quality Computational Fluid Dynamic (CFD) software, gain high system performance through skilled design.

This system design, paired with Woods Air Movement Ltd. high-tech product design, ensures an optimized high performance system.

Thrust Fan Systems are designed to meet customer's project requirements, whether a simple pollution control system, smoke clearance, or a full smoke control system

Pollution Control

Woods Air Movement Ltd. Thrust Fan System, is an efficient and reliable ventilation system, providing fresh air and removing harmful emissions to ensure the safety of parking garage occupants.

Pollution ventilation can be designed on a traditional volumetric air change rate, or by using CO, LPG and NOx sensor monitoring systems.

Emergency ventilation can be designed using volumetric or design fire calculations.

A Thrust Fan System is a duct-free system, relying on a series of strategically placed jet fans, to control and distribute air around the parking garage.

Main extract fans, take the contaminated air out of the parking garage, with fresh make up air supplied from entrance/exit ramps, or through supply fans if required.

Choice in fan sizes and profiles, operating systems and detection systems allows versatility in the Thrust Fan System design, allowing the most efficient design to meet the parking garage's requirements.

Extract rates can be varied by constant pollution monitoring. Sensors placed at optimum points around the parking garage, allowing the control system to regulate which fans operate to dilute and/or extract the contaminated air.

The system's high flexibility allows the most favorable operation both in terms of safety, economy and efficiency.

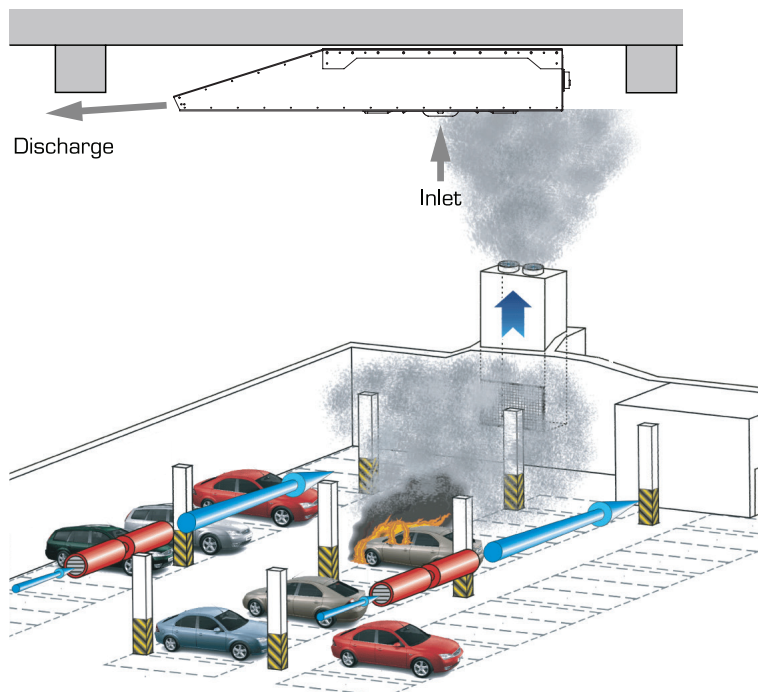
JET AND INDUCTION THRUST SYSTEMS

On detecting a fire emergency signal, the Thrust Fan System is automatically switched from day-to-day mode/vent into fire mode. Jet Thrust Fan units and main extract fans are run to full design speed - reaching full speed and maximum thrust in just a matter of seconds.

Woods Air Movement Ltd.'s comprehensive range of fans allows individual project requirements to be met. An appropriate number of Induction fans are selected and carefully positioned to ensure even air distribution and movement. Controls will depend on the individual project and can range from a simple timed system, to a full pollution sensing multi-stage system, with the ability to optimize efficiency and provide effective, compliant solutions. The type and specification of system is determined by the customer's project requirements and the application of local ventilation standards. Woods Air Movement Ltd. can combine all forms of ventilation solutions available in the various forms of ducted, Jet Thrust or Induction thrust systems.

In case of a fire emergency, the system's primary task is to limit smoke propagation inside the parking garage and direct flow to the closest extract points, where the contaminated air is then removed from the building.

Figure 1



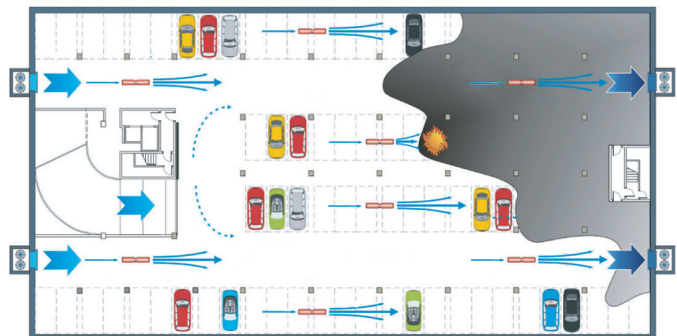
Smoke is extracted by the main extract fans, and smoke control is maintained by the Jet Thrust Fans (see Figure 1).

Where required, the Thrust Fan System can be designed as a fully reversible system, using Jet Thrust fans with Truly Symmetrical technology (see page 7), allowing the smoke to be evacuated to the nearest extract point. (see Figure 2)

Full smoke control is designed to keep escape routes clear and allow fire fighting crews easier access to the seat of the fire.

Note: Not all parking garages will allow or require a full smoke control system, but Thrust Fan System can still provide a highly effective smoke clearance or fume extract only system if required.

Figure 2



Thrust Fan Systems provide effective and regular day-to-day ventilation, and high performance emergency smoke ventilation in a fire situation

TRULY SYMMETRICAL TECHNOLOGY

PARKING GARAGE FANS

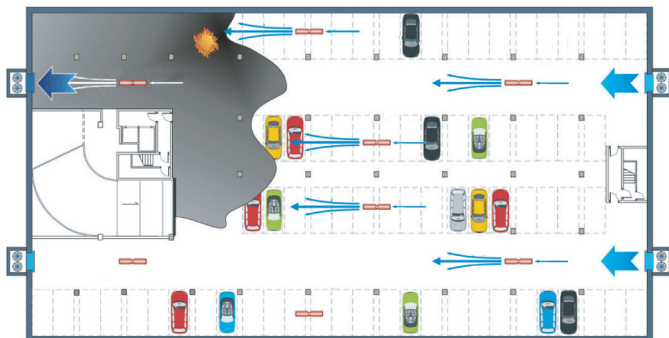
Woods Air Movement Ltd. is the recognized world leader in axial fan design. Thrust Fans are no exception. Designed using state-of-the-art Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD) computer modeling, and tested in our laboratories to optimize performance.

Both the Jet Thrust Fans and Main extract fans boast Truly Symmetrical technology. This allows the system to operate in a fully reversible mode, offering 100% thrust in both directions, allowing the Jet Thrust Fan to direct smoke and fumes to the nearest and safest extract point. This reduces the time it takes to extract air out of the parking garage, minimizes the amount of smoke and maximizes escape routes and fire fighting access.

Many competitors rely on uni-directional thrust, or where bi-direction is an option, reverse thrust is severely restricted by their conventional blade design – this can be over 40% reduction! Woods Air Movement Ltd. is the only company to offer Truly Symmetrical technology on their impellers.

Features and Benefits

HIGHER SYSTEM PERFORMANCE: By controlling the air supply with Thrust fans a full smoke control design can be made – something just not possible with a conventional ducted extract system.



In an emergency, full fan extract rate can be reached in as little as 20 seconds allowing immediate response to the situation. Full smoke control can be designed into the system, which can encompass fully reversible Jet and extract fans if required.

LOWER INSTALLATION: Installation costs are normally lower with a Thrust Fan System, compared to a ducted system. Installation is simpler saving on labor costs, depending on the size and layout of the parking garage.

There are other hidden savings too. With no ductwork, other services, such as cables, gas and water supplies, and soil pipes, can be routed straight across the ceiling line, without having to avoid ductwork or hangers.

Access for routine maintenance is easy, and of course, there are no distribution ducts and dampers to be cleaned and inspected.

LOWER RUNNING COSTS: Long term running costs are significantly lower, even on a constant run system, and even more impressive if the project uses pollution detection sensing, to selectively run the fans.

Far lower system resistance, compared to a ducted system means that smaller, less powerful extract fans are used to maintain the same volume flow rate and air change rate - meaning lower power operating costs and less noise pollution.

OPTIMIZES CAR PARKING SPACE: A Thrust system ensures optimum use of parking garage space with no requirement for low-level extract points, freeing up car parking space.

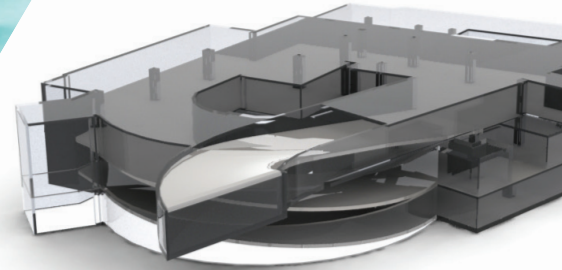
The low profile design fans can be used to optimize headroom for vehicles and pedestrians and gives a more pleasing aesthetic appearance.

SYSTEM DESIGN: Unlike most other systems available on the market today, Woods Air Movement Ltd. designs and models parking garage systems using highly sophisticated and state-of-the-art CFD analysis programs.

This enables the parking garage to be optimally ventilated, ensuring maximum efficiency in pollution and emergency ventilation modes.



ABOUT COMPUTATIONAL FLUID DYNAMICS (CFD)



Airflow behavior is difficult and complicated to predict. Accurate calculation is paramount in order to create an effective parking garage ventilation system. Woods Air Movement Ltd. modeling is backed up with both lab test research and smoke test commissioning in real parking garages to ensure accuracy.

How it Works

Manual calculation methods, used by many, are extremely limited in their ability. Manual calculation is usually inaccurate, which is why Woods Air Movement Ltd. offers full CFD analysis to customers on all projects.

The CFD program is comprised of a solver, which integrates the relevant differential conservation equations (Mass, Linear Momentum Energy and Concentration). The software program solves these algebraic equations for a finite number of iterations until an acceptable level of accuracy has been obtained, allowing accurate parking garage design.

Woods Air Movement Ltd. CFD Engineers are highly trained and experienced, using their knowledge and expertise to design the system with the correct number and positioning of Thrust Fans.

Design is verified by using industry recognized, highly accurate, CFD modeling software. The system is then adjusted and recalculated if required.

CFD software allows the creation of visualization planes, which intersect points of interest in the model, where contours and vectors of any stored variable, such as air speed, pressure, velocity, etc., can be displayed.

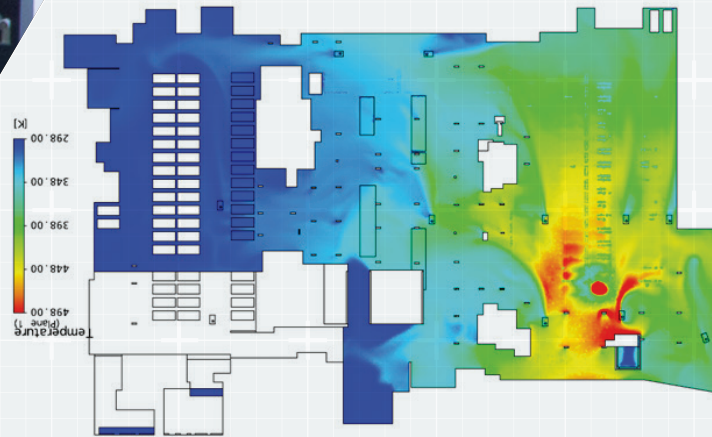
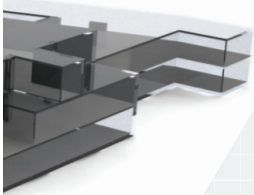
Particle sources can be attached to inlets and outlets within the model or positioned within free space if desired. Particles are then released allowing a visualization of general airflow movement through the parking garage.

A range of parameters are considered in the analysis, including air speed, velocity, quality and overall distribution of the airflow within the space.

Process Stages:

A computer model of the layout of the parking garage is created. 3-D plots are sent to the customer for approval.

- 1 Once approved, the design layout of the parking garage and model geometry will be frozen, and detailed analysis undertaken.
- 2 The model is initially run with only the main fans operating. This identifies the main bulk airflow paths from the supply to the extract points and any areas of re-circulation within the parking garage.
- 3 Thrust Fans are added to the model and positioned to distribute the airflow to all of the areas of the parking garage, ensuring removal of any stagnant areas of air.
- 4 A detailed report of the results is produced for each project with appropriate air speed plots, velocity profiles and particle animations.



Prevailing environmental conditions, particularly within inner city environments can also impact the conditions within a Parking garage. Woods Air Movement Ltd. can take into account these external conditions within their CFD modeling.

Woods Air Movement Ltd. can design full smoke control solutions and provide comprehensive fire modeling to prove the systems. There are two types of Smoke Control System as described within BS7346 Part 7. The first is to achieve tenable conditions for the fire brigade to enter the Parking garage, locate and tackle the fire and the second is to assist means of escape for Parking garage occupants. Woods Air Movement Ltd. can design for both.

Image showing a transient combustion model of a car stacker system.

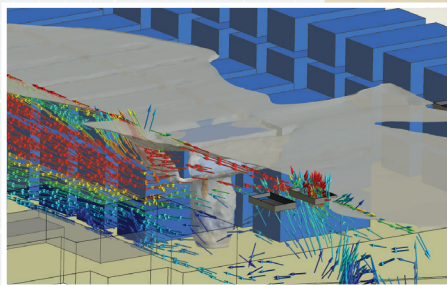
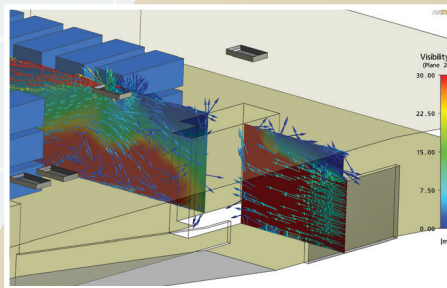


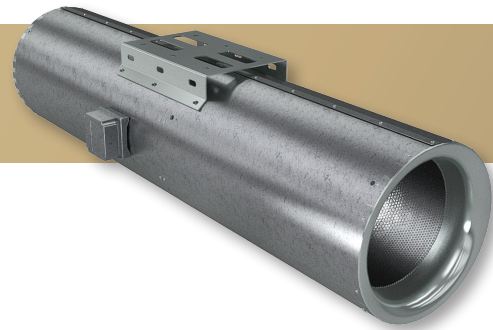
Image showing how an engineering approach improves a design - by removing the supply in the ceiling, smoke is no longer dragged to low level giving better visibility with the parking garage.



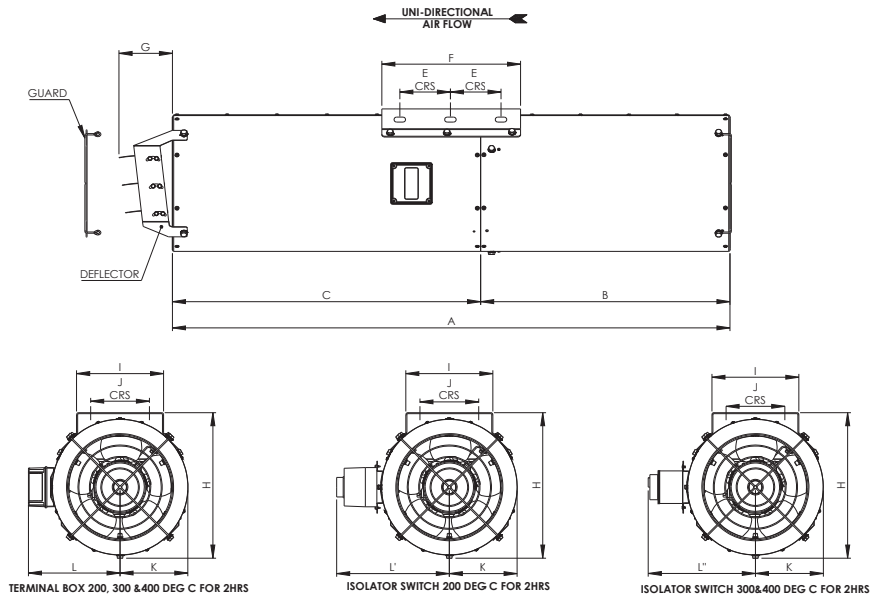
Main Features:

- Complex geometry modeling of any environment
- Advanced meshing techniques
- Steady state and transient analysis
- Pollution and Emergency ventilation simulation and analysis
- Advanced state of the art design fire modeling and simulation including both inert and combustion modeling techniques.
- Isosurfaces of smoke and temperature
- Local Mean Age of air (LMA) – used to assess ventilation performance and quickly compare design solutions
- Graphical outputs for analysis include:
 - Air speed profiles
 - Streamline animations
 - Contaminant and / or toxicity profiles
 - Temperature profiles
 - Visibility profiles
 - Smoke visualization

Jet Thrust Systems



Dimensions and Drawings - JTv Slim Line



Dia	Configuration	Inlet	Outlet	A	B	C	E	F	G	H	I	J	K	L	L'	L''	Approx Mass (lbs)
12.40	UNI-DIRECTIONAL	G	G/D	67.24	30.08	37.17	6.10	16.73	6.46	17.56	10.47	7.09	8.19	11.06	13.58	12.91	122
13.98	UNI-DIRECTIONAL	G	G/D	67.40	30.16	37.24	6.22	16.73	6.30	19.13	11.26	7.87	8.98	11.89	14.45	13.78	117
15.75	UNI-DIRECTIONAL	G	G/D	71.42	32.56	38.88	7.28	17.72	6.34	20.91	12.05	8.66	9.84	12.76	15.28	14.61	155

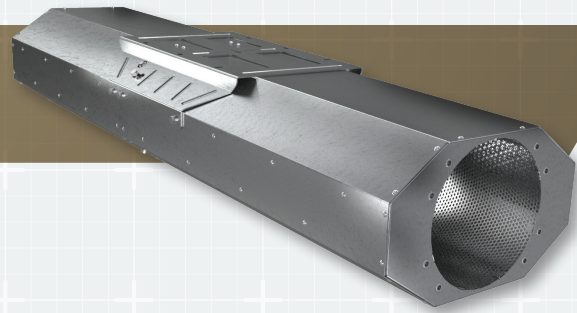
All dimensions in inches

50Hz Performance and Acoustic data for F200 rated fans, with no accessories fitted (i.e. free inlet/outlet)

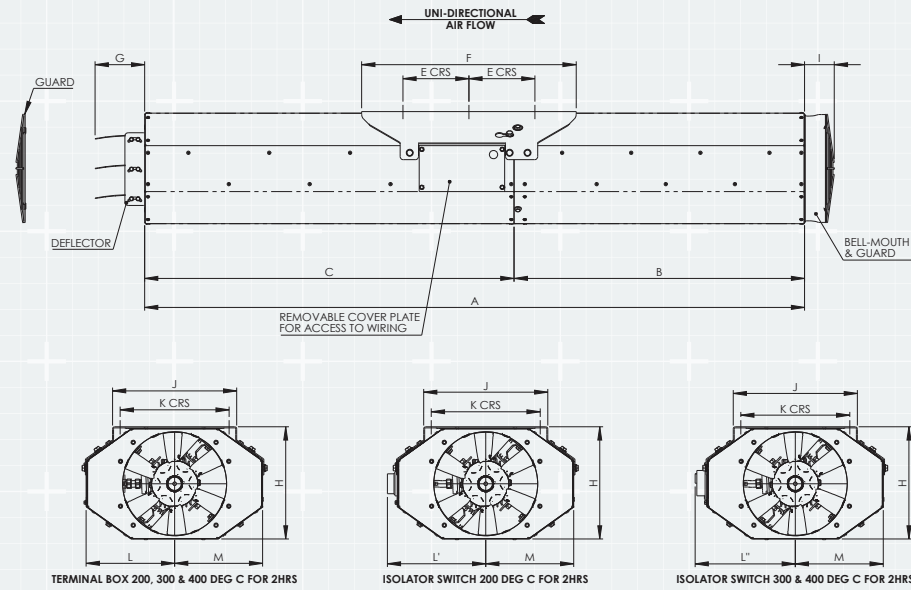
Dia	Product Type	Thrust (lbf)	Volume (cfm)	Sound Power LwA	Sound Pressure LpA @ 9.84 ft	Pole Speed	Nominal Power kW	Full Load Current (A)	Starting Current (A)
12.40	Standard	7.42/1.80	3072/1526	75/59	54/38	2/4	0.95/0.21	2.23/0.71	15.0/3.47
13.98	Standard	11.47/2.70	4365/2162	75/59	54/38	2/4	1.27/0.29	2.86/0.87	15.0/3.47
15.75	Standard	17.31/4.50	6039/3051	79/65	58/44	2/4	1.73/0.43	3.91/1.33	22.5/5.43

Sound Power Level, LW = dB re 10⁻¹²W
 Sound pressure level, LpA = dB re 2 x 10⁻⁵PA, provided for comparative purposes at a distance of 9.84 ft, based on hemispherical propagation in free field conditions.
 Please note data for 392°F without accessories

Jet Thrust Systems



Dimensions and Drawings - JTv Low Profile



Dia	Configuration	Inlet	Outlet	A	B	C	E	F	G	H	I	J	K	L	L'	L''	M	Approx Mass (lbs)
12.40	UNI-DIRECTIONAL	BM&G	D/G	78.74	34.65	44.06	7.87	25.59	5.91	13.39	3.54	14.80	12.99	10.55	11.73	11.97	10.55	199
13.98	UNI-DIRECTIONAL	BM&G	D/G	78.74	34.65	44.06	7.87	25.59	5.91	14.96	4.13	16.18	14.17	11.34	12.44	12.76	11.34	210
15.75	UNI-DIRECTIONAL	BM&G	D/G	78.74	34.65	44.06	7.87	25.59	5.91	17.32	4.45	17.32	14.17	12.32	13.35	13.74	12.32	234

All dimensions in inches

50Hz Performance and Acoustic data for F200 rated fans, with no accessories fitted (i.e. free inlet/outlet)

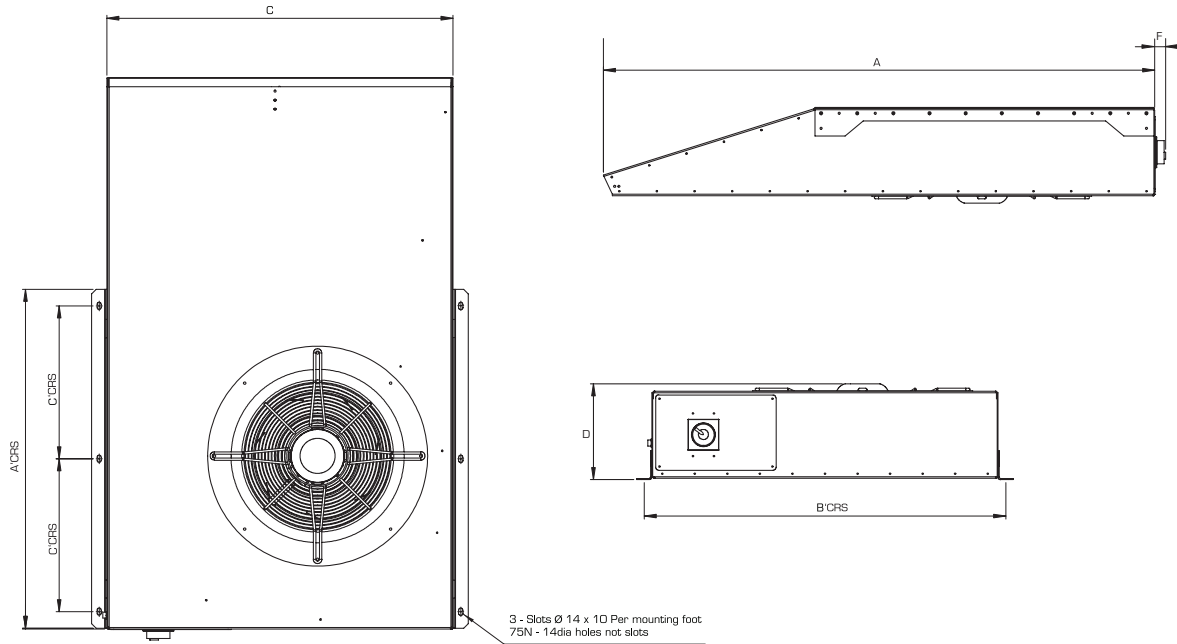
Dia	Product Type	Thrust (lbf)	Volume (cfm)	Sound Power L_{wA}	Sound Pressure L_{pA} @ 9.84 ft	Pole Speed	Nominal Power kW	Full Load Current (A)	Starting Current (A)
12.40	Standard	6.52/1.57	2882/1420	74/59	53/36	2/4	0.95/0.21	2.23/0.71	15.0/3.47
13.98	Standard	9.89/2.47	4047/1992	77/61	56/40	2/4	1.27/0.29	2.86/0.87	15.0/3.47
15.75	Standard	15.29/3.82	5657/2860	79/62	58/41	2/4	1.73/0.43	3.91/1.33	22.5/5.43

Sound Power Level, $L_W = \text{dB re } 10^{-12}\text{W}$
 Sound pressure level, $L_{pA} = \text{dB re } 2 \times 10^{-5}\text{PA}$, provided for comparative purposes at a distance of 9.84 ft, based on hemispherical propagation in free field conditions.
 Please note data for 392°F without accessories

Induction Thrust Systems



Dimensions and Drawings - 'INDUCTION' Parking Garage Fan



Fan	A	A'CRS	B'CRS	C'CRS	D	F	Temp Rating	Weight (lbs)
50 N	9.92	27.56	33.11	11.61	10.45	1.46	572°F/ 2HRS	265

All dimensions in inches

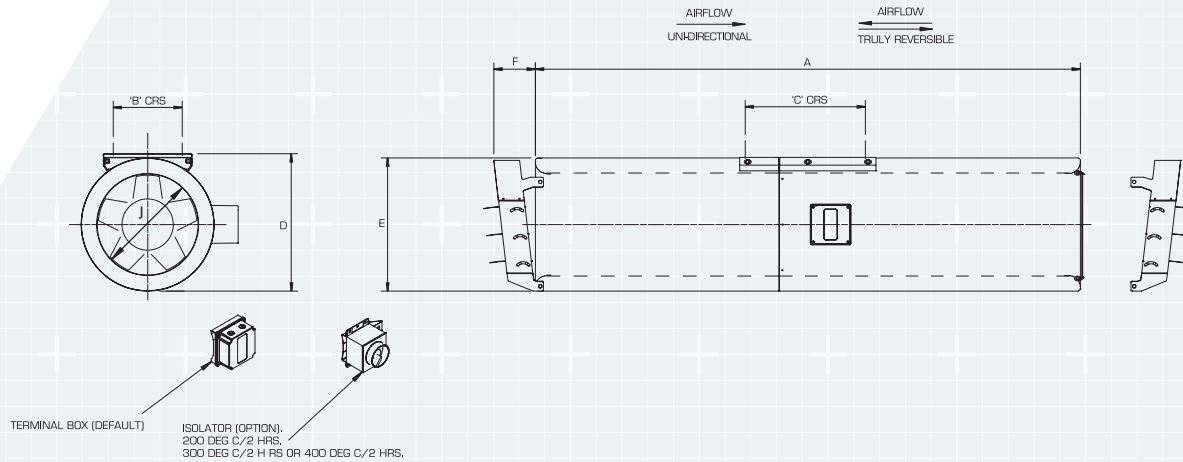
Dia	Product Type	Thrust (lbf)	Volume (cfm)	Sound Power L_{wA}	Sound Pressure L_{pA} @ 9.84 ft	Rpm	Nominal Power kW	Full Load Current (A)	Starting Current (A)
50N	Induction	10.34/2.70	3094/1610	92/75	74/57	1430/695	1.38/0.35	3.2/1.36	16.0/4.08

Sound Power Level, $LW = dB \text{ re } 10^{-12}W$
 Sound pressure level, $LpA = dB \text{ re } 2 \times 10^{-5}PA$, provided for comparative purposes at a distance of 9.84 ft., based on hemispherical propagation in free field conditions.
 Please note data for 572°F.
 Thrust calculated for 15° from horizontal position.

Jet Thrust Systems



Dimensions and Drawings - SLIM-LINE Parking Garage Fan



Fan Dia (")	Configuration	A	B	C	D	E	F	Temp Rating (°F)	Inlet	Outlet	Weight (lbs)
12.40	UNI-DIRECTIONAL	67.24	7.09	12.20	17.56	16.38	5.12	392°F/2HRS 572°F/2HRS OR 752°F/2HRS	BM & GUARD	DEFLECTOR	190
	TRULY REVERSIBLE								DEFLECTOR	DEFLECTOR	192
	TRULY REVERSIBLE								BM & GUARD	BM & GUARD	185
13.98	UNI-DIRECTIONAL	67.40	7.87	12.44	19.13	17.95	5.12		BM & GUARD	DEFLECTOR	199
	TRULY REVERSIBLE								DEFLECTOR	DEFLECTOR	201
	TRULY REVERSIBLE								BM & GUARD	BM & GUARD	194
15.75	UNI-DIRECTIONAL	71.42	8.66	14.57	20.91	19.69	5.12	BM & GUARD	DEFLECTOR	245	
	TRULY REVERSIBLE							DEFLECTOR	DEFLECTOR	247	
	TRULY REVERSIBLE							BM & GUARD	BM & GUARD	240	

All dimensions in inches

Dia (in.)	Product Type	Thrust (lbf)	Volume (cfm)	Sound Power L_{wA}	Sound Pressure L_{pA} @ 9.84 ft	Rpm	Nominal Power kW	Full Load Current (A)	Starting Current (A)
12.40	Slim-Line	4.99/1.26	2543/1250	86/71	68/53	2775/1370	0.7/0.12	1.88/0.56	14.6/2.84
13.98	Slim-Line	8.09/1.98	3644/1801	85/70	67/52	2775/1370	0.9/0.11	2.74/0.82	14.5/2.86
15.75	Slim-Line	13.26/3.33	5276/2585	87/75	69/57	2875/1415	1.35/0.16	3.35/0.99	23.5/4.97

Sound Power Level, $L_w = \text{dB re } 10^{-12} \text{ W}$
 Sound pressure level, $L_{pA} = \text{dB re } 2 \times 10^{-5} \text{ PA}$, provided for comparative purposes at a distance of 9.84 ft, based on hemispherical propagation in free field conditions.
 Please note data for 392°F without accessories

FläktGroup

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EXCELLENCE IN SOLUTIONS

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Woods Air Movement Ltd. delivers smart and energy efficient Air Distribution and Air Quality solutions to support every application area. We offer our customers innovative technologies, high quality and outstanding performance supported by more than fifty years of accumulated industry experience. The widest product range in the market, and strong market presence with 30 years of experience in the USA, guarantee that we are always by your side, ready to deliver Excellence in Solutions.

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Our **AIRPARK** program is now available to help make a fast airflow analysis.

