Industry and Infrastructure

High Temperature - Large Tunnel Fans

FläktWoods

High Temperature Fans

Fläkt Woods is the industry leader in air movement technology, providing innovative solutions worldwide. Our extensive knowledge of design and applications is based on over 100 years of experience in tunnels, buildings, industry and original equipment manufacturers. Fläkt Woods' global coverage reaches over 100 countries and is supported by an extensive distribution network.

Our expertise in tunnel ventilation applications covers road and rail tunnels, metros, tunnel construction and wind tunnels. Fläkt Woods' products have been successfully used in underground projects throughout the world and our Large JM product range is unrivalled in its technology, innovation and efficiency.

Ventilation

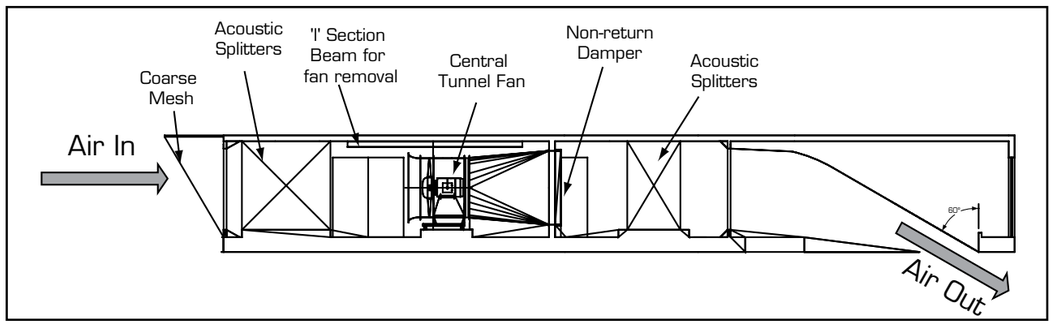
Ventilation is required for safety and to maintain acceptable temperatures and comfort.

Pollution emitted by trains and road vehicles must be removed to provide an acceptable and safe environment. The heat from a train may need to be removed by forced ventilation in order to ensure that the temperature is acceptable to both people and equipment. In the case of a fire, smoke must be removed in order to enable safe escape and to assist access to fight the fire. The normal ventilation principles are to dilute pollution and to increase visibility by removal of particles.

In an emergency the smoke is controlled by creating sufficient air velocity to drive it away from the fire. Depending on the control strategy, the smoke can then be extracted. In rail and metro systems it is common to create a safe haven by pressurisation of the non-incident tunnel.

Saccardo Nozzle

The Saccardo nozzle system operates on the principle that a high-velocity air jet is injected longitudinally into the tunnel to induce a high volume airflow in the tunnel. For this to be successful, the fans have to be carefully matched to optimise performance. The system uses blocks of JM Aerofoil axial fans, 5 in parallel for each tunnel, and fitted with special nozzles to accelerate the air.



Noise Levels

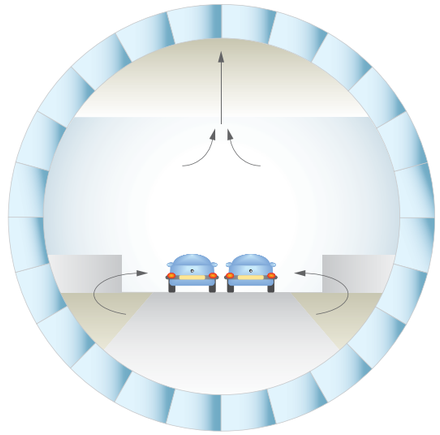
Fläkt Woods offer acoustic analysis and attenuators to ensure the fans are in accordance with environmental requirements and local regulations.

Tunnel Ventilation Methods

There are a number of different types of ventilation methods for tunnels and these can either be used independently or in combination. Fläkt Woods can advise you in all aspects of tunnel ventilation.

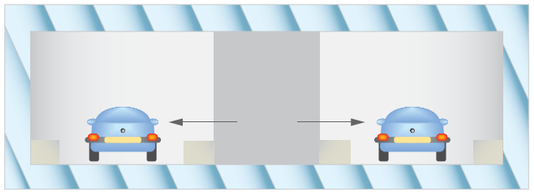
Fully Transverse System

A fully transverse system supplies fresh air from a low level, normally from a duct underneath the roadway. The hot, polluted air rises and is extracted at a high level normally through a ducted system above the roadway. This is the most exact system generally requiring large, fixed pitch, JM Aerofoil fans in parallel.



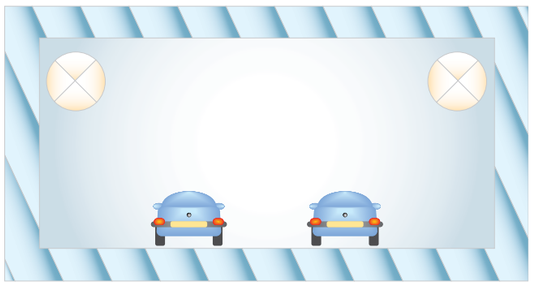
Semi-Transverse System

This system is similar to the fully transverse system in the supply and extraction of air and is used for long, congested two-way tunnels. Semi-transverse systems rely on longitudinal air movement along the tunnel and require a higher ventilation rate.



Longitudinal Ventilation Systems

The simplest solution for tunnels as air movement is created along the length of the tunnel by large fans, jet fans or a combination of the two. The air can enter at one portal and leave at another, or be supplied or extracted at points within the tunnel.



EN 12101-3 and ISO 21927-3 Certification

Emergency, High Temperature, Smoke Extract Fans fall within the scope of the EU Construction Products Directive.

The implementation of the Construction Products Directive and the publication of the product specific standard, EN 12101-3 have made it a mandatory requirement for smoke control fans sold into the European Union to carry a CE Mark from April 1st, 2005. The CE mark may only be affixed after successful completion of testing, auditing of factory production control and the issue of a certificate by accredited independent authorities.

This procedure is intended to prevent fan failures during an emergency smoke situation, where a fan failure can ultimately lead to the loss of life.

Fläkt Woods fans are certified to EN 12101-3 and ISO 21927-3 by a third party; however, because ISO 21927-3 applies globally, it provides specifications against which powered smoke and heat exhaust ventilators can be evaluated and certified outside EU member states.

Fläkt Woods fully endorse the concept that, in such a safety critical application, only fully verified and certified products should be specified. This made the decision to test and certify this core product range all the more easier. The decision was made to embark on a major testing programme, the JM HT range was successfully tested in compliance with this demanding new legislation with minimum complications.

The certification of large fans has been made challenging as there were no independent laboratories capable of testing the largest fans. Since 2006, Fläkt Woods have been working with the certifying authorities to built and certify a high temperature facility capable of testing fans up to 3.5 meters diameter at up to 400°C. This investment resulted in Fläkt Woods being able to offer a British Standards Institution Certified, CE marked JM HT product including 300°C/2 hours 400°C/2 hours ranges, in diameter starting at 1400mm up to a maximum of 2800mm at relevant time/temperature categories. Fläkt Woods offers a comprehensive range of approved accessories.

Fläkt Woods have enhanced their position as the foremost provider of specialist products for emergency high temperature smoke control by becoming the first fan manufacturer in the world to be able to apply CE marking to these safety critical products, ensuring that Fläkt Woods has one of the most comprehensive range of products available in the World.

It is also believed that Fläkt Woods is now the only manufacturer to have successfully tested a 2.24 metre diameter fan, running at 1500 rpm, with a 1MW motor.


EC Certificate

EC-CERTIFICATE OF CONFORMITY

0086 - CPD - 474878

JM HT Aerofoil
as detailed on the Supplementary Information Sheet

produced and placed on the market by

Fläkt Woods Limited
Axial Way, Colchester, Essex, C04 5ZD

EN 12101-3: 2002

Alastair Trivett, Managing Director,
BSI Product Services - Global

Date: 14 September 2007

This certificate first issued Date 7 September 2004

The British Standards Institution is incorporated by Royal Charter.

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Large JM High Temperature Overview

Fläkt Woods offer the most comprehensive range of fans and accessories for the Tunnel and Metro applications:

- Size range 1.4m to 2.8m with optional non-certified ranges available (please enquire)
- Guaranteed performance to ISO 5801
- Unidirectional or truly reversible blade sections
- Higher pressure twin impeller and 2 stage fans are available
- High Temperature certification for 200°C and 300°C categories up to 710kW, and 400°C up to 1000kW
- Static pressures up to 4000 Pa and volume flow up to 180 m^3/s
- Fans are tested up to 2.24 metre diameter, running at 1500 rpm, with a 1MW motor
- All cast rotating impeller components are examined by X-ray to ensure reliability in service
- IEC motors certified to EN 12101-3 and ISO 21927-3
- NEMA motors available, currently being tested to certification ISO 21927-3
- Steel parts hot dip galvanised (except hub)
- Manufacturer registered and assessed in accordance with BS EN ISO 9001
- Paint finish optional
- Accessories:
  - Guards
  - Condition Monitoring
  - Anti Vibration Mounts
  - Flexible Connectors
  - Bellmouth/Coned Entries
  - Diffusers, Transition Pieces
  - Silencers
  - Dampers
  - Starters and controls

Unrivalled R&D Facilities

Our dedicated laboratory in Colchester, unique in the UK, is equipped to demonstrate and prove product performance and control strategies. We have further R&D facilities in Sweden, Finland, France and the USA.

The fan performance is maintained and improved in line with a planned Research and Development programme to ensure optimised aerodynamic and acoustic performance.

Axial flow Aerofoil fans Aerodynamic performance in accordance with ISO5801 Type C code D; Acoustic Performance BS 848 in a semi reverberant area ISO5136; Over speed 125% for 15 Minutes ; X-Ray examination ASTME 155; Balance ISO 1940; Vibration BS848 pt7 ISO 14694.

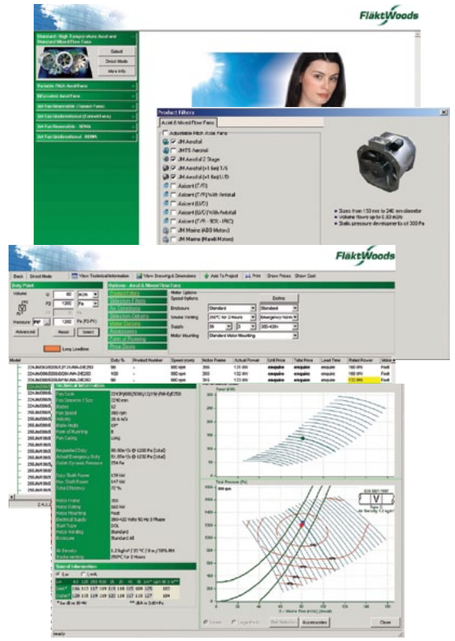
Fan Selector

Fan Selector is the selection software for all the Fläkt Woods Group Fan products: Axial Flow Fans (among which are Large HT fans and Jet Fans for Tunnels), Centrifugal fans, Boxed Fans, Roof Extract units and Plate mounted fans.

The Fan Selector allows you to choose fans which fit your required application.

How to Register, easy as 1, 2, 3!
All you need to do is register your details on-line and follow the simple instructions shown below.

1. Type in the site link to start the process: http://fanselector.flaktwoods.com/signup/
2. Fill in the fields that have red text labels, but if you wish to complete more of the form, this would be helpful.
3. Once you have entered your details, just click the "Register" button at the bottom of the registration page to submit your request.



User Account Set-up

Once a user account has been created, our automatic registration system will send you an e-mail confirming your user name and password. Note: your username will be your e-mail address, so if you have a personal address this would be better than a general one (as this will allow you to personalise our software). The account set-up process is normally completed between 24-48 hours after your initial password confirmation.

Desktop CD

Should you prefer to use the Desktop version of the software (which is locally installed onto your computer's hard drive), then this is available on request. All you need to do is to advise your full postal address and we would be happy to mail a CD to you.

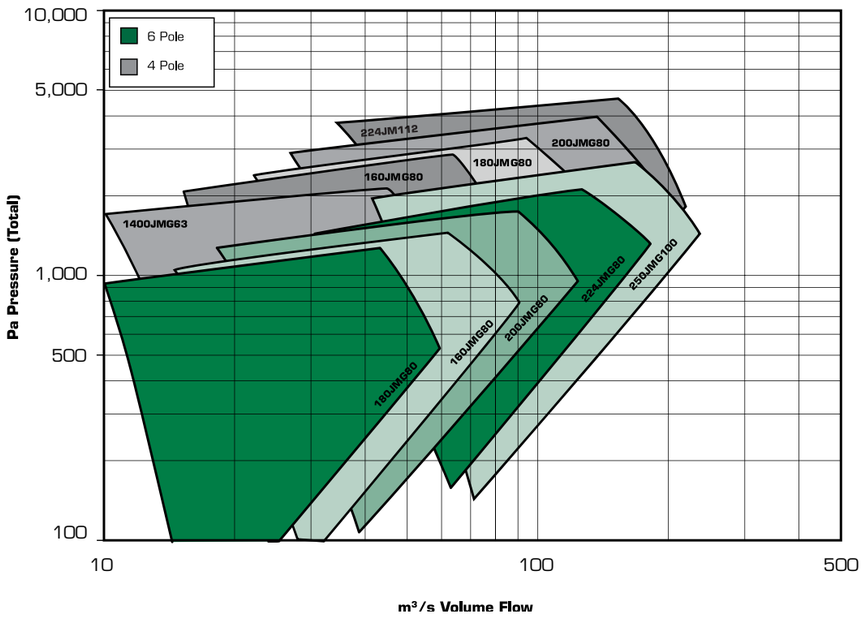
Link to the On-Line Fan Selector: http://fanselector.flaktwoods.com

1. After logging in, the first screen displayed allows the selection of axial fans, identify and click 'select' to continue.
2. The next screen displays the various types of axial fans, therefore it is necessary to filter the selection by clicking 'product filter' and 'edit'
3. The desired flow and pressure can be input to identify suitable fans.
4. Other filters can be adjusted so that the desired fan is identified.

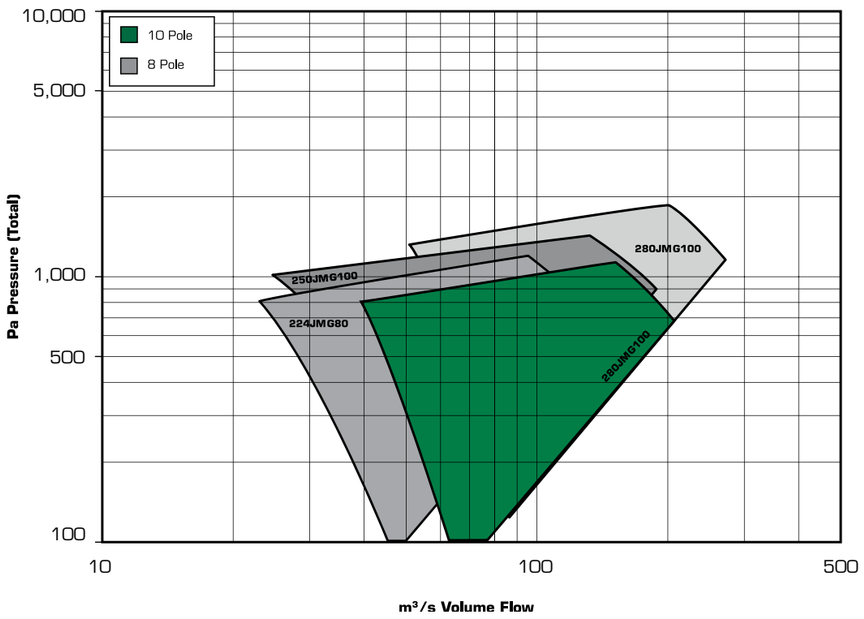
Each fan can be highlighted and technical information made available

Selection Curves F300

Unidirectional 50Hz 4 & 6 Pole

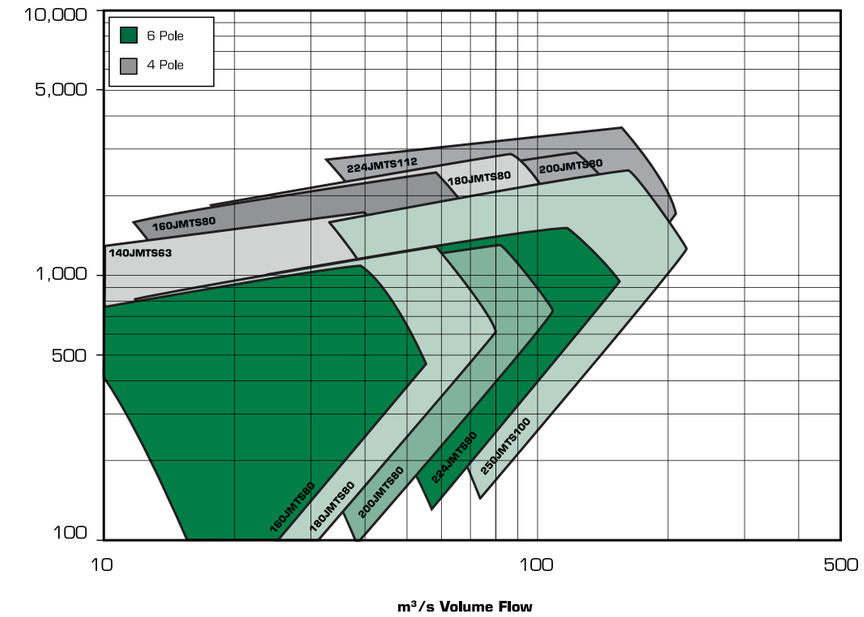


Unidirectional 50Hz 8 & 10 Pole

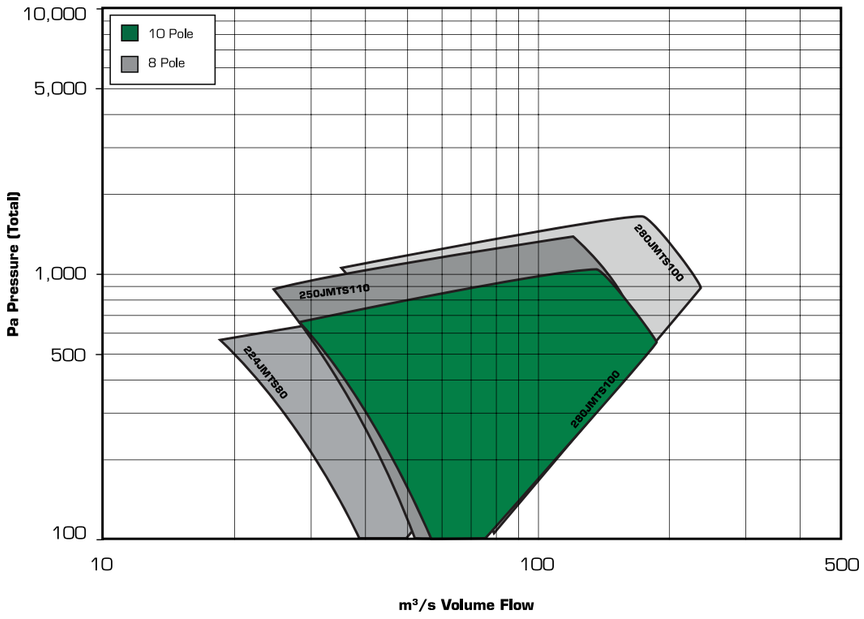


Selection Curves F300

Truly Reversible 50Hz 4 & 6 Pole

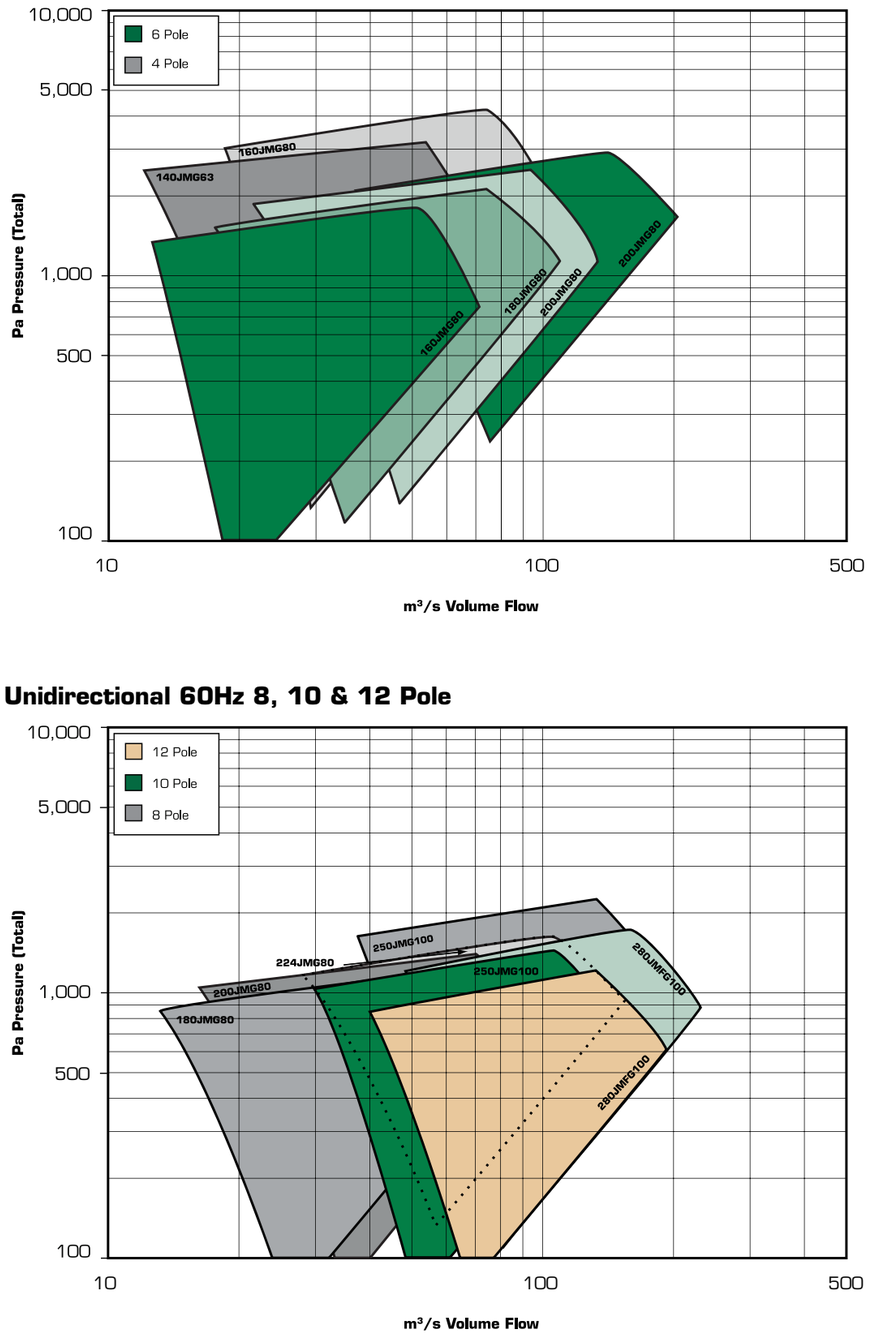


Truly Reversible 50Hz 8 & 10 Pole



Selection Curves F300

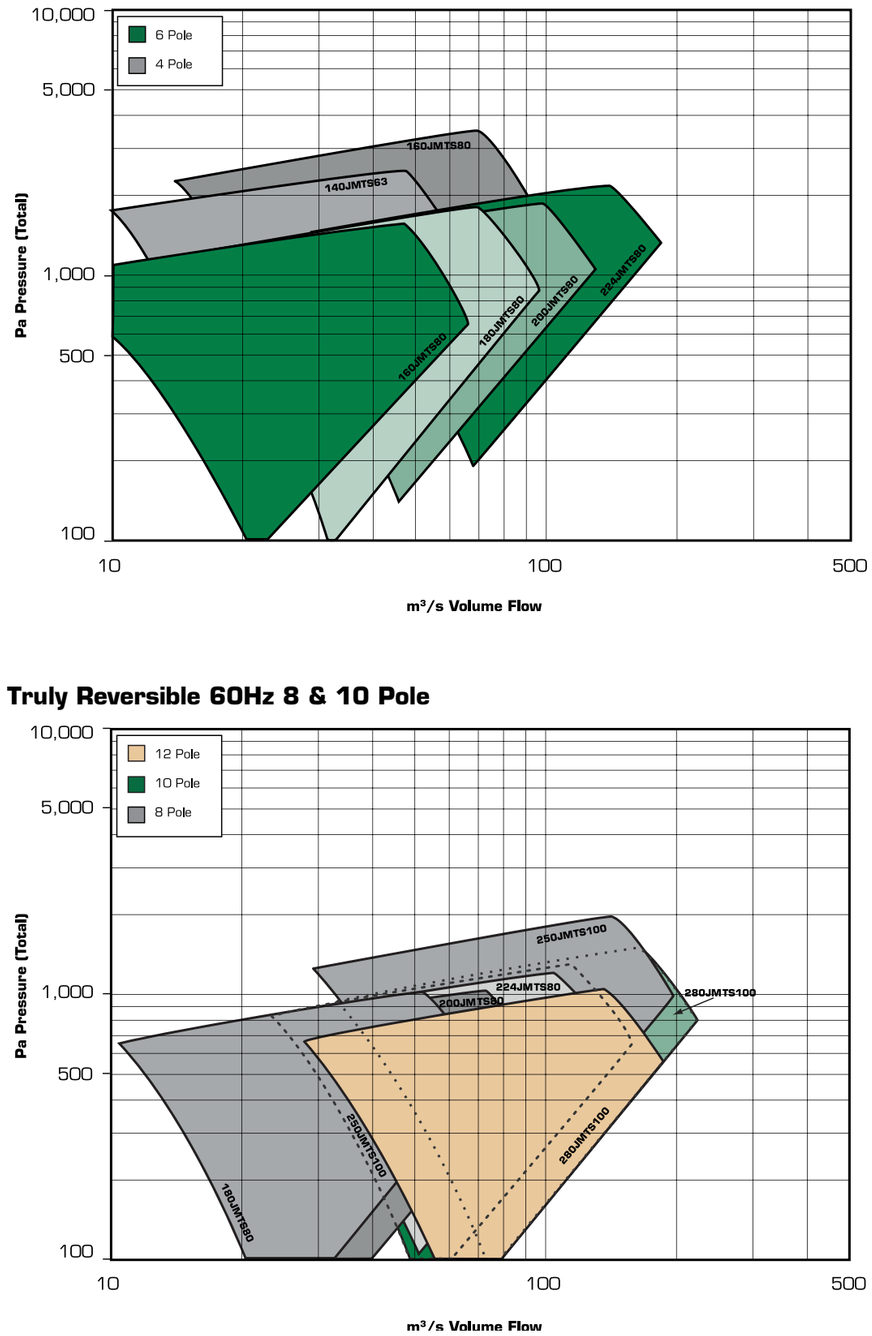
Unidirectional 60Hz 4 & 6 Pole



Unidirectional 60Hz 8, 10 & 12 Pole

Selection Curves F300

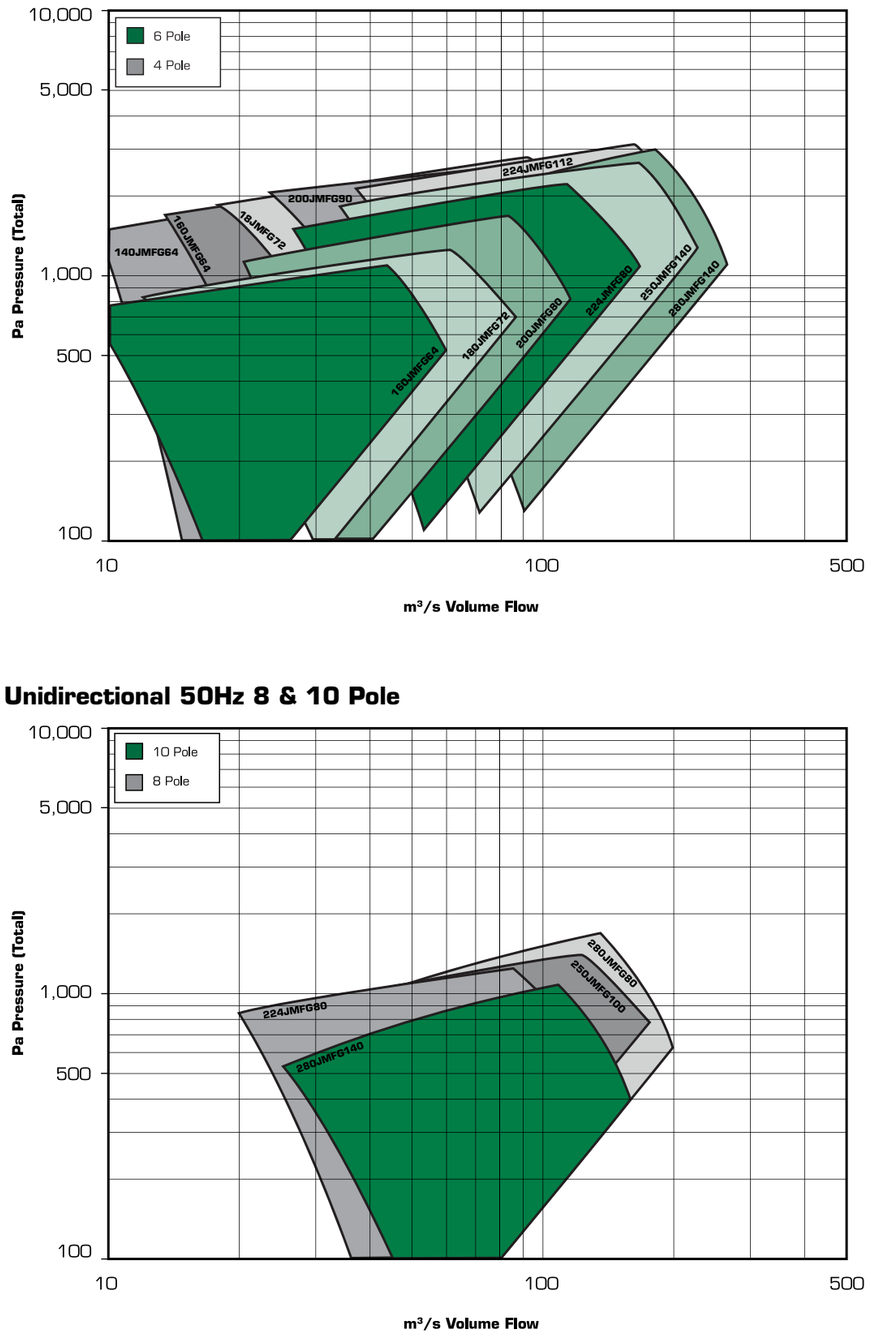
Truly Reversible 60Hz 4 & 6 Pole



Truly Reversible 60Hz 8 & 10 Pole

Selection Curves F400

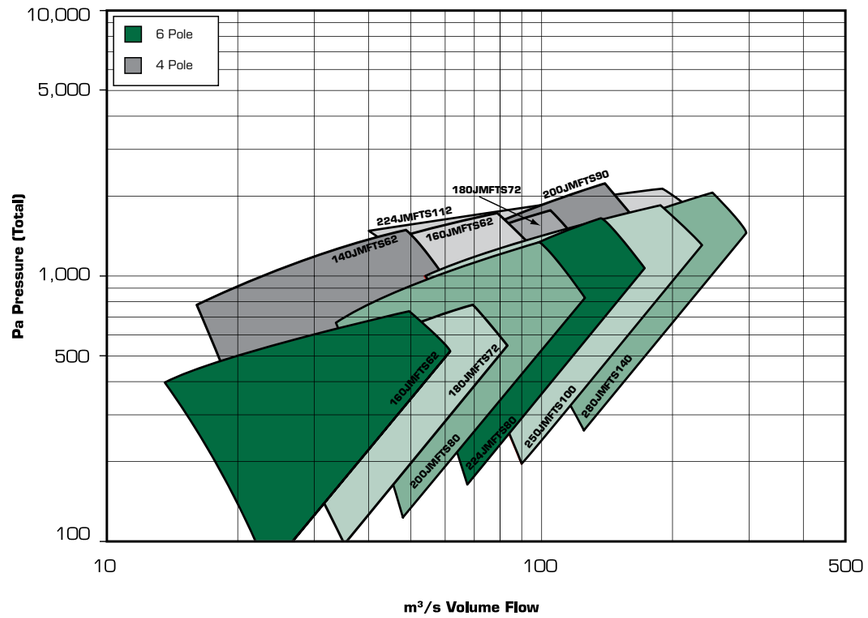
Unidirectional 50Hz 4 & 6 Pole



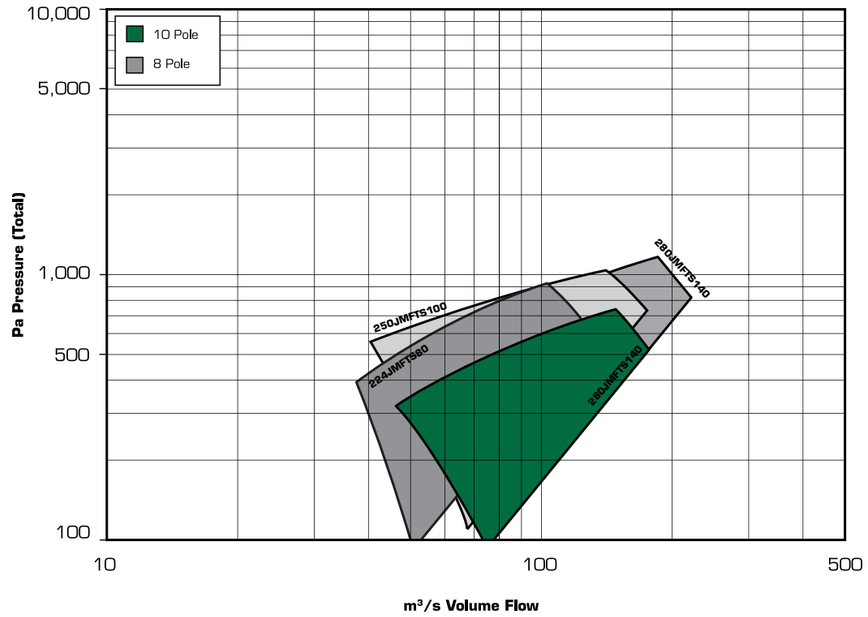
Unidirectional 50Hz 8 & 10 Pole

Selection Curves F400

Truly Reversible 50Hz 4 & 6 Pole

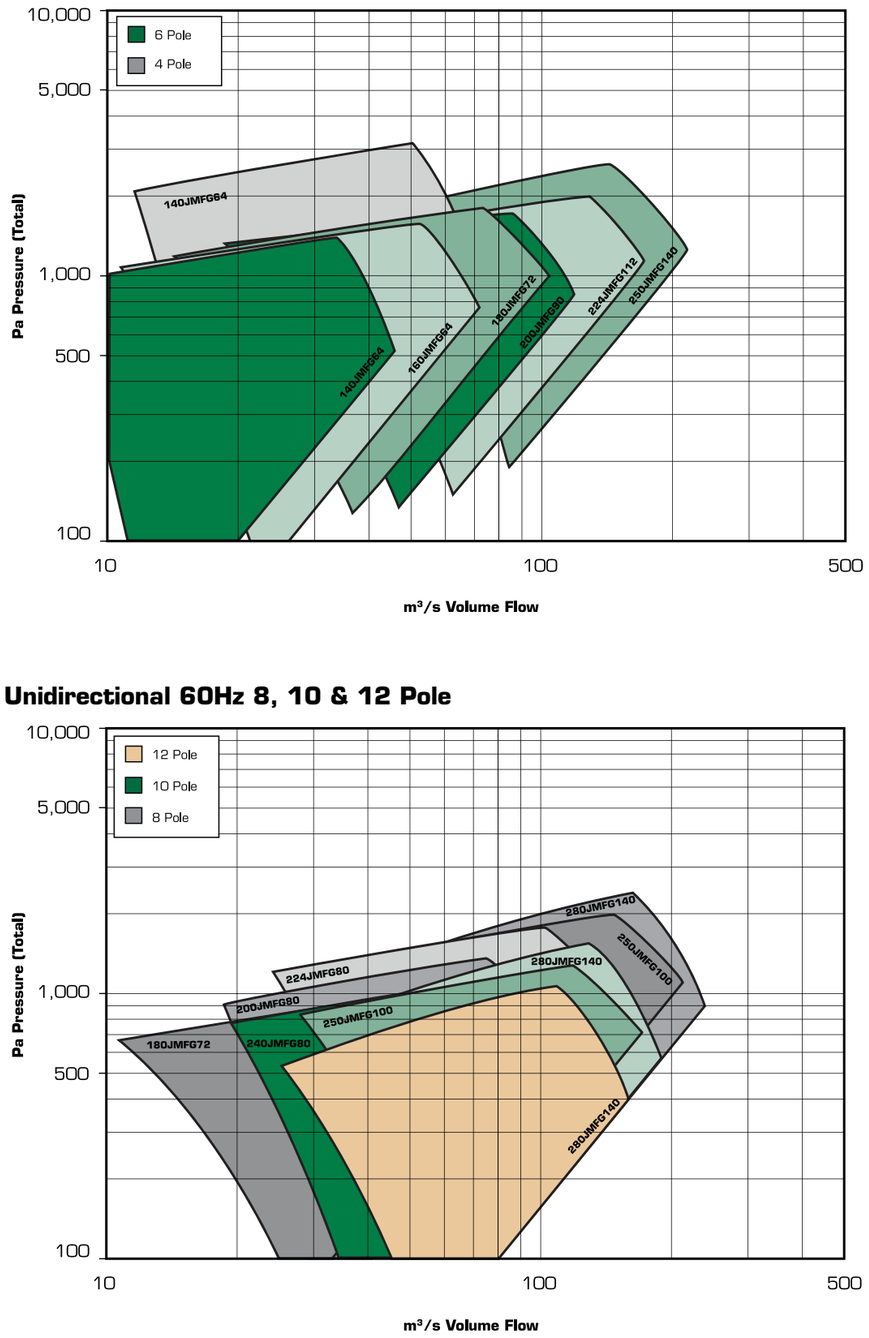


Truly Reversible 50Hz 8 & 10 Pole



Selection Curves F400

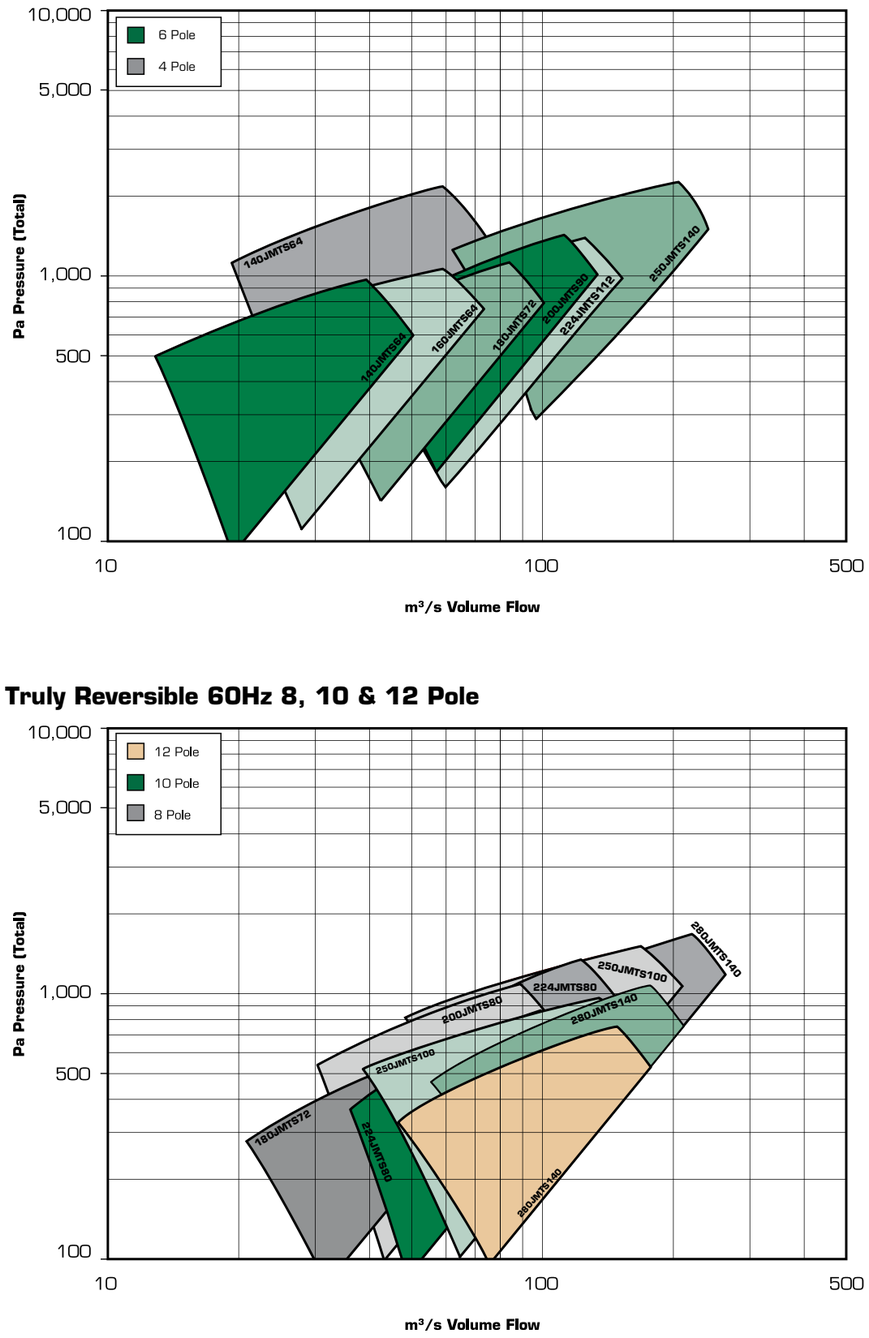
Unidirectional 60Hz 4 & 6 Pole



Unidirectional 60Hz 8, 10 & 12 Pole

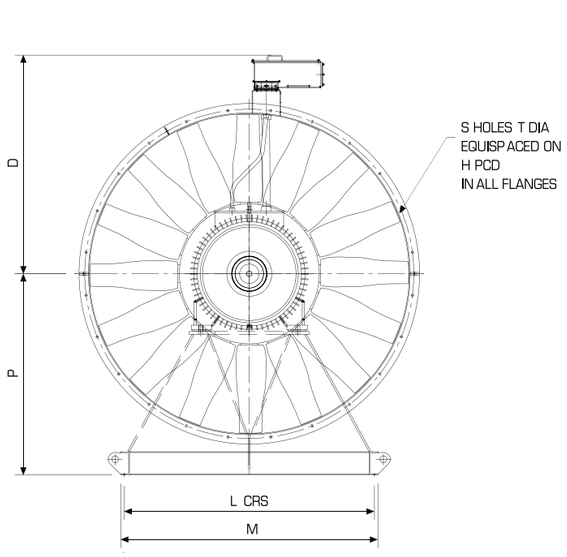
Selection Curves F400

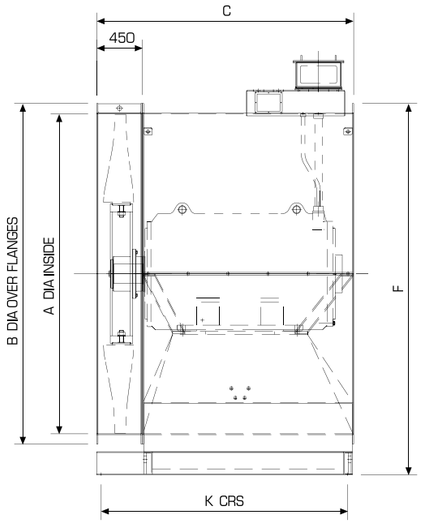
Truly Reversible 60Hz 4 & 6 Pole



Truly Reversible 60Hz 8, 10 & 12 Pole

Dimensions and Weights - Horizontal Mounting





Fan Dia	A	B	C MAX	D MAX	F	K CRS	L CRS	M	P	H PCD	S	T	Max Fan Weight Less Motor (kg)
1400	1400	1538	2050	1050	1670	1700	1300	1400	900	1470	20	15	1400
1600	1600	1760	2050	1150	1962	1700	1454	1600	1082	1680	24	18	1765
1800	1800	1960	2050	1250	2162	1700	1500	1800	1182	1880	24	18	1785
2000	2000	2160	2050	1350	2418	1700	1630	2000	1330	2080	24	18	1850
2240	2240	2415	2050	1470	2658	1700	1830	2200	1450	2320	24	18	2000
2500	2500	2716	2650	1700	2968	2500	1940	2000	1610	2580	24	18	3700
2800	2800	3055	2650	1850	3288	2500	2190	2250	1760	2880	24	18	4170

The motor is sized for the highest absorbed power of the curve. An indication of the motor rating may be established by the calculation shown below:

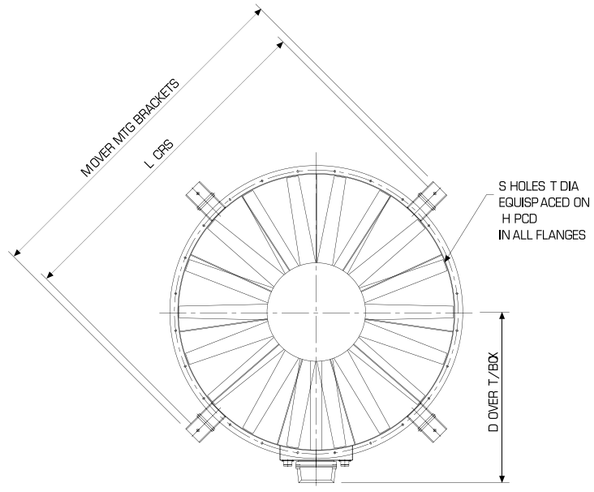
Unidirectional fans: Motor power (kW) = Flow (m^3/s)*total pressure (Pa)*0.0015
Truly reversible fans: Motor power (kW) = Flow (m^3/s)*total pressure (Pa)*0.0017

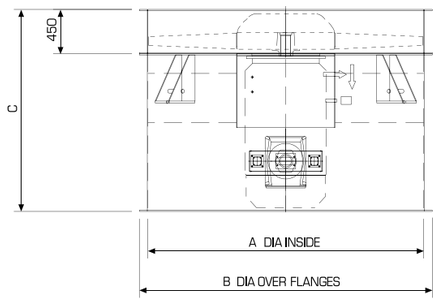
F300 & F400 Motors Weight (kg)

Motor Power (kW)	50 Hz	55	75	90	110	132	160	200	250	315	355	400	450	500	560
	60 Hz	63	86	103	126	152	184	230	287	362	408	460	517	575	644
4 poles		446	720	756	900	1007	1000	1525	1651	1835	1865	2140	2140	2500	3200
6 poles		645	830	930	1000	1150	1520	1754	1916	2180	2500	2900	3150	3300	3400
8 poles		830	930	1021	1390	1520	1680	1820	2180	2600	3200	3400			

Note: For motors exceeding the kW catalogue refer to Fläkt Woods - Colchester.

Dimensions and Weights - Vertical Mounting





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1400	1400	1560	2050	1050	1750	2000	1470	20	15	2000
1600	1600	1760	2050	1150	1950	2200	1680	24	18	2365
1800	1800	1960	2050	1250	2250	2400	1880	24	18	2425
2000	2000	2160	2050	1350	2500	2650	2080	24	18	2500
2240	2240	2415	2050	1470	2840	3000	2320	24	18	2720
2500	2500	2716	2650	1700	3100	3250	2580	24	18	4620
2800	2800	3055	2650	1850	3400	3650	2880	24	18	5220

The motor is sized for the highest absorbed power of the curve. An indication of the motor rating may be established by the calculation shown below:

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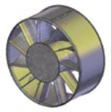
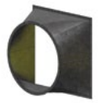
6 poles		645	830	930	1000	1150	1520	1754	1916	2180	2500	2900	3150	3300	3400
8 poles		830	930	1021	1390	1520	1680	1820	2180	2600	3200	3400			

Note: For motors exceeding the kW catalogue refer to Fläkt Woods - Colchester.

Accessories and Additional Features

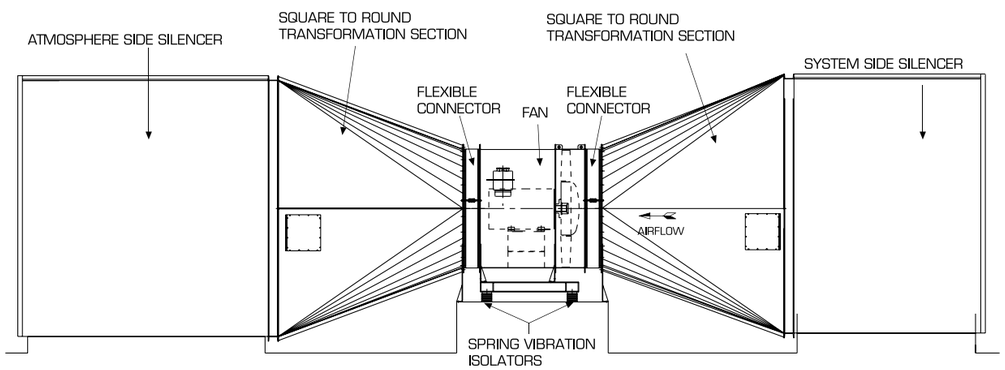
Inlet Cone		**Inlet Wire Guard**	
Flexible Sleeves and Matching Flanges		**Anti Vibration Mountings**	
Diffusers		**Transitions Pieces**	

Attenuators

Fläkt Woods has over 50 years experience in sound control engineering and can assess and design attenuators to meet sound attenuation on both system and atmospheric sides. Attenuators can be provided as complete units, modules and splitter only to suit concrete shafts and housings. Airways velocity above 10m/s should be avoided to limit system pressure and noise generation.

Product Accessories

Such as inlet cones, guards, flexible connectors and anti-vibration mountings are available. For further information, please enquire.



Typical Installation - Horizontal Airflow

Accessories and Additional Features

Dampers

Key to the control and operation of many ventilation systems are control dampers. These should normally be sized on an airway velocity of 8m/s or below in order to avoid excessive system pressure and excess sound generation. Physical support must be designed in to accept both static and dynamic loading.

Vibration/Condition Monitoring

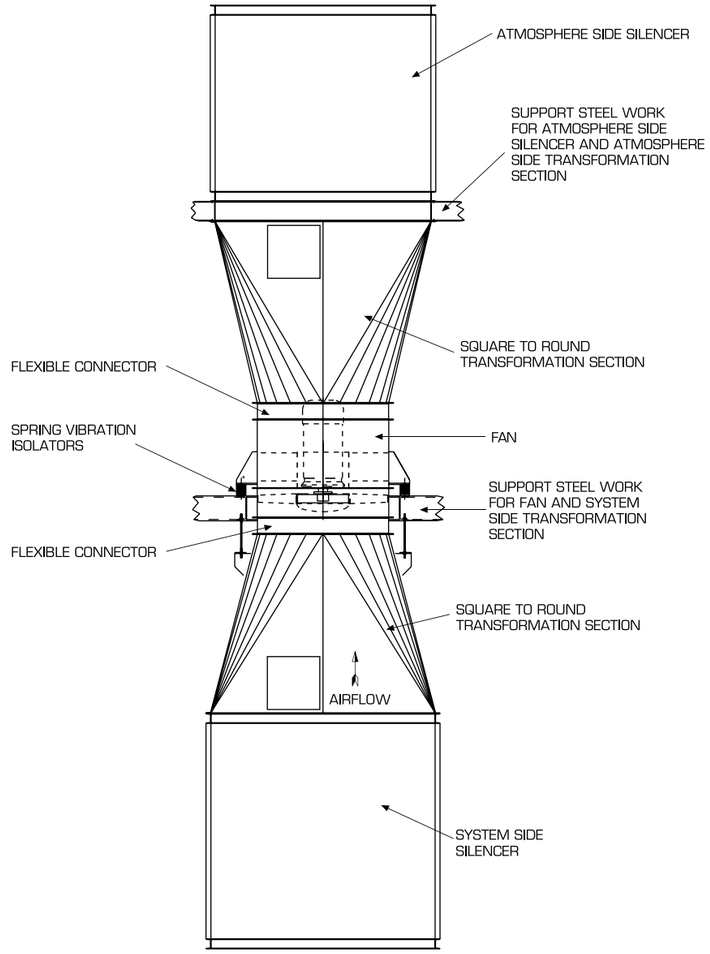
Principle operating monitoring systems are available on the fans to minimise risks of breakdown and enable programmed maintenance to be effectively planned. Options include bearing vibration and temperature systems, bearing condition monitoring and motor winding condition. We will be pleased to discuss the best choice for your application.

Motor Starters/ Inverter Drives

Drive systems can be supplied and specified through Fläkt Woods to match the operating characteristics of the fan drives and ensure compatibility of the complete package. Interfacing with key control and management systems are principle specification requirements.

After Sales Service

Fläkt Woods Service and Repair Division offer a full range of site support activity that includes routine monitoring site surveys and service contracts. Please contact Colchester for further details.



Typical Installation - Vertical Airflow

Reference List

Holmesdale Tunnel
United Kingdom

Vienna Metro
Austria

Athens Metro
Greece

Hong Kong Metro
China

Fläkt Woods' Extensive Project Tunnel & Metro Reference List

Road Country	Project
Algeria	Algerian Road Tunnel
Australia	Mitcham Frankston Freeway
Australia	M5 East Tunnel
Australia	Lane Cove
Australia	Brisbane eastern busway
Austria	Wske Tunnel
Belgium	Gare De Namur
Belgium	Leopold II
Brazil	Lamsa tunnel
Canada	Toronto Airport
China	Hu Rong Su Tunnel
China	Chong Qin Fang Dou Shan
China	Sky Pier (Tunnel 1)
China	Hu Nan Jia Hou Yan
China	Hu Nan Xue Feng Shan Tunnel
Croatia	Tunnel Trsat
Croatia	Tunnel Skurinje
Croatia	Sveti Rok 2
Croatia	Mala Kapela
Croatia	Veliki Glozac
Croatia	Tunnel Bisko
Croatia	Tunnel Mravince
Croatia	Tunnel Strazina
Croatia	Cardak
Croatia	Brezovica
Croatia	Sveta Tri Krajla
Croatia	Mala Kapela
Croatia	Tunnel pecine
Dubai	Dubai International Airport
Finland	Kehu Project
Finland	Hakamaentie/Kivihaka Tunnel
Finland	Vuoli Tunnel
Finland	Keha 1
Finland	Kehu 2
France	Tunnel du Vieux Port
France	A14
France	A86
France	A51
Greece	Egnatia Odos-Panagia-Grevena
Greece	Eftaxias
Hong Kong	Route 8
Hong Kong	Sky Plaza
Hong Kong	Lantau Airport & Railway
Hong kong	Contract 708
India	DAMEL
India	C Doctor
Italy	Seiano Tunnel
Italy	Montenegrone Project
Italy	Martignano
Italy	Gran Sasso
Italy	Mongrando Tunnel
Italy	Gra Salva Candida
Italy	Cesena Tunnel
Italy	Valsassina Tunnel
Italy	Spezia
Italy	Lonato Tunnel
Italy	Ronco Tunnel
Italy	Val Badia Tunnel
Italy	Marinasco Tunnel
Italy	Autostrada del Fiori
Luxembourg	Tunnel Howald
Malaysia	SMART
Monaco	T33 Tunnel
Monaco	TFT Tunnel
New Zealand	JHT New Zealand
Norway	E18 - Bjorvika Tunneln
Norway	Norway Road Tunnel
Norway	Mesta As
Norway	Krakeroytunnelen
Norway	Sporsmal om mal
Norway	Tussentunneln
Poland	Rondo Tunnel
Portugal	Tunnel Do Rossio
Portugal	Moscavide aeroporto

Road Country	Project
Puerto Rico	Tven Urbana
Qatar	New Doha International Airport
Qatar	NDIA Free Trade Zone
Saudi Arabia	Jamarat Bridge Phase II
Saudi Arabia	Jamarat Bridge Basement
Saudi Arabia	King Khalid Road Tunnel
Saudi Arabia	King Abdullah Tunnel
Serbia	Vrmac Tunnel
Singapore	Singapore Metro Link
Sweden	Arlandabanan, Stockholm
Switzerland	Biasca Tunnel
Syria	Kafar Sousah Road Tunnel
Taiwan	Pinglin
UK	A3 Hindhead Tunnel
UK	Bell Common Tunnel
UK	Holmesdale Tunnel
UK	Limehouse Link
UK	Terminal 5 - Coach Station
UK	T5 - Taxi Bridge
UK	Blackwall Tunnel
UK	New Tyne Crossing
USA	Bunyard Tunnel
USA	Detroit Airport
USA	Minneapolis Airport
USA	Tulip City Airport
USA	Whittier Tunnel
Yemen	Sayhut-Nishtun Road Project

Rail/Metro Country	Project
Australia	Parramatta Rail Link
Austria	U3 Station Erdberg
Austria	U2/1 Schottenring
Austria	River City
Austria	U1 Unterwerk
Austria	U2 Messe
Austria	U4 Schottenring
Austria	Vienna Metro - Gross
Austria	Vienna Metro - Leoup
Austria	Obb wien mitte
Austria	U4 schotatenring
Brazil	Sao Paulo Metro Line 4
Canada	TTC Shepherd
Canada	TTC Petrofit
Canada	TTC York Mills
Canada	Montreal STCUM
China	Guangzhou Metro
Denmark	Copenhagen Metro
Dubai	Dubai Light Railway
Greece	Attiko Metro - Elliniko Ext.
Greece	Egnatio Odos Driscos Tunnel
Greece	Attiko Metro, Athens
Hong Kong	TKO South Hong Kong
Hong Kong	Beacon Hill Tunnel
Hong Kong	Lok Ma Chau
Hong Kong	Penny's Bay Line
Hong kong	Mtr/tsy station
Hungary	Budapest Metro Line 2
Hungary	Budapest Metro Line 4
India	Delhi Metro Phase II
India	Delhi Metro
India	DMRC Phase 1 (Mc1b)
India	Damel
India	Dwarka sector 21 east
Iran	Mashhad Metro
Italy	Passante Ferroviario Di Torino
Italy	Torino Di Bologna
Italy	Nodo Di Bologna
Italy	Passante Ferroviario
Italy	Turin Metro
Italy	Turin Metro Lot 6c Project
Italy	Rome Rail Station
Italy	Avigliana
Italy	Alifana Metro

Rail/Metro Country	Project
Italy	Milan Metro
Italy	Metro Station Napoli
Italy	Milan Metro Line 3 extension
Italy	Monterrobbio Milan metro 2
Italy	Nci Roma
Italy	Turin metro
New Zealand	Britomart Project
New Zealand	Otira Rail Tunnel
Portugal	Lisbon Metro
Portugal	Porto Metro
Puerto Rico	Tren Urbano
Romania	Bucharest Metro
Singapore	CCL2
Singapore	CCL3
Singapore	CCL4
Singapore	CCL5
Singapore	KPE Expressway
Singapore	North East Line
Taiwan	Nankang Extension Project
Taiwan	KMRT
Turkey	Adana Light Rail
Turkey	Antalya Light Rail
UK	Bank Station DLR
UK	Channel Tunnel Rail Link
UK	Cooling the Tube
UK	Docklands Light Railway
UK	Jubilee Line Extension
UK	Liverpool Street Station
UK	Heathrow T5 Track Transit
UK	Woolwich Arsenal Extension
USA	Las Vegas Airport
USA	MBTA Greenline (Boston)
USA	NYCTA E-31261
USA	NYCTA E-31080
USA	NYCTA E-31255
USA	NYCTA E_31269
USA	NYCTA E-31264
USA	Amtrak Penn Station
USA	NYCTA C-20201
USA	NYCTA C-20203
USA	NYCTA E-31265
USA	NYCTA E-31243
USA	Trimet (Portland, OR)
USA	MARTA (Atlanta)
USA	NJNY PATH
USA	BART (San Francisco)
USA	MBTA R-10 (Boston)
USA	MSP Light Rail
USA	NYCTA C-52003
USA	NYCTA E-31271
USA	SDSU LRT
USA	Amtrak Weehauken
USA	NYCTA E-31277
USA	SEA-TAC
USA	NYCTA 03A8607
USA	Cincinnati Airport
USA	Denver Airport
USA	NYCTA E-31287
USA	NJT NERL
USA	Amtrak 1st Ave
USA	Beacon Hill (Seattle)
USA	NYCTA E-31274
USA	NYCTA E-31278
USA	Maverick (Boston)
USA	NYCTA A-36006
USA	NYCTA E-31290R
USA	Pittsburgh North Connector
USA	Transportation Hub
USA	NJT Bergen
USA	SDSU LRT
USA	Beacon Hill (Seattle)
USA	Pittsburgh North Connector
USA	LA Mid-Connector
Venezuela	Valencia Metro

we bring better air to life

Fläkt Woods is a global leader in air management. We specialise in the design and manufacture of a wide range of air climate and air movement solutions. And our collective experience is unrivalled.

Our constant aim is to provide systems that precisely deliver required function and performance, as well as maximise energy efficiency.

Solutions for all your air climate and air movement needs

Fläkt Woods is providing solutions for ventilation and air climate for buildings as well as fan solutions for Industry and Infrastructure.

Air Handling Units (AHUs)

Modular, compact and small AHU units. Designed to ensure optimisation of indoor air quality, operational performance and service life.

Air Terminal Devices and Ducts

Supply and exhaust diffusers and valves for installation on walls, ceiling or floor are all included in our large range and fit all types of applications.

Chilled Beams

Active induction beams for ventilation, cooling and heating, and passive convection beams for cooling. For suspended or flush-mounted ceiling installation – and multi-service configuration. With unique Comfort Control and Flow Pattern Control features.

Residential ventilation

A complete range of products for residential ventilation. Consists of ventilation units, exhaust air fans and cooker hoods designed to optimise indoor comfort and save energy.

Energy recovery

Dessicant-based product and systems that recover energy, increase ventilation and control humidity.

Fans

Advanced axial, centrifugal and boxed fans for general and specialist applications. Comprehensive range including high temperature and ATEX compliant options. Engineered for energy efficiency and minimised life cycle cost.

Chillers

Air-cooled and water-cooled chillers with cooling capacity up to 1800kW. Designed to minimise annual energy consumption in all types of buildings.

Controls and drives

Variable speed drives and control systems, all tested to ensure total compatibility with our products. Specialist team can advise on energy saving and overall system integration.

Acoustical Products

A complete line of sound attenuating products, including rectangular and round silencers, Media Free silencers, custom silencers and acoustic enclosure panels.

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