Jet Fan Systems

Ventilation and smoke control for car parks.

wolter

Jet Fan Systems.

The combination of CO ventilation and smoke control in underground car parks.

Given the continuously rising volume of inner-city traffic it is virtually mandatory to provide for adequately sized car parks as a part of every major real-estate development project, whether it be private or public, such as office buildings or shopping malls, museums or theatres. As these locations are frequented by a large number of individuals, high standards apply with respect to building services engineering and public safety. More often than not, conventional car park ventilation systems fail to meet these requirements.

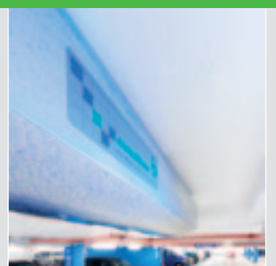
Functional principle

In recent years, jet fan technology has established itself as the new standard in car park ventilation in many countries all over the world. In Europe today, more than 2.500 jet fan systems are in operation in car parks of various sizes. As opposed to conventional ventilation concepts based on transverse ventilation and ducted systems, the concept of jet ventilation (frequently also referred to as impulse ventilation) is derived from the longitudinal ventilation systems found in most road tunnels, whereby a high-velocity stream of air is injected by a series of free-blowing silenced axial fans. Thus, jet fans effectively distribute and transport the air on each car park level from the supply to the exhaust points. The decisive design parameters being the air speed profile and the thrust generated by the fan.

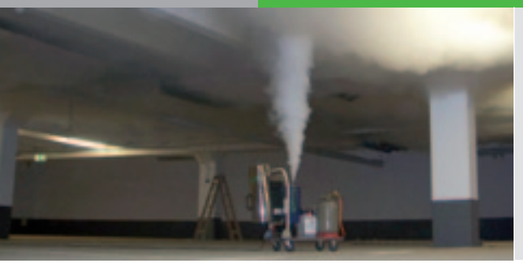
Advantages of the jet ventilation system

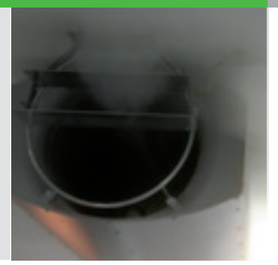
Smoke control in the event of a fire

Careful project planning allows to use the jet fan system not only as a means of CO ventilation and mechanical smoke exhaust, but also to effectively control the spreading of smoke. By utilising fully reversible impellers, the thrust direction of each individual fan can be changed in order to contain the smoke within the affected area and to transport it to the nearest exhaust point. This keeps emergency exits free of smoke and prevents smoke from contaminating non-affected areas of the car park. Depending on the detected location of the fire within the car park, the standard direction of airflow can automatically be reversed so that the air supply inlets can serve as fume exhaust points should they be nearer to the location of the fire. If required, the control logics for this emergency ventilation mode can be designed and programmed by Wolter. This direction-controlled containment of fire gases allows for effective fire-fighting, as the



The Wolter jet fan system in a real fire test.





location of the fire remains visible and can be safely approached by fire-fighters from the upstream side of the airflow.

As early as 1998 the TNO institute (Delft) examined the effectiveness of the impulse ventilation system in a series of 18 real fire tests in an underground car park in Amsterdam. The results of this test series have been published in a research paper, which, among other aspects, addresses smoke production, smoke propagation and occuring temperatures as well as the possibility of effective smoke control in case of a car fire in an enclosed space. It has been verified that the jet ventilation system, as opposed to a conventional ducted system which was subject to the same fire test, could effectively cool and contain the occurring fire gases. Air ducts, however, failed to provide sufficient exhaust capacity and even had the tendency to further the diffusion of smoke fumes in the worst case.

System controllability allows for efficient operation

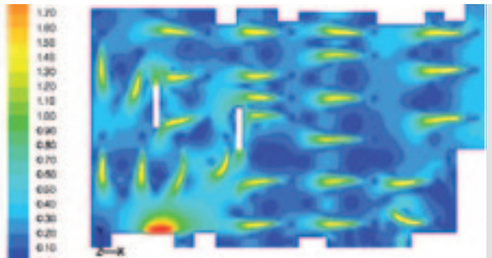
The jet ventilation system can be automatically controlled in a way that adjusts the required ventilation volume contingent on the current occupancy level of the car park. CO concentration is continually monitored by an adequate number of CO detection heads spread throughout the car park. As long as pollution limits are not exceeded, individual fans in designated areas of the car park may be switched off, thus saving energy and lowering the noise level within the building.

Lower energy consumption reduces operating costs

Given the almost continuous operation of the ventilation system throughout the year, the jet ventilation system taps a considerable potential for lowering operational costs. Ducted ventilation systems, usually designed as a compromise between required air volume, installation space and installation cost, cause high air velocities and subsequently high pressure losses in the ducted system. The ventilation fans must operate against this pressure drop and will consequently absorb more power. In a ductless jet ventilation system, the architecture of the car park itself serves as the air duct. Air velocities are much lower and there is no resistance caused by a duct system. The total amount of energy consumed by a jet ventilation system is therefore significantly lower.

Lower construction costs and more efficient use of floor space

Jet fans will require additional wiring and electronic controls, but this is more than compensated for by significant savings in installation costs, as air ducts become obsolete when using an impulse ventilation system. Furthermore, fan sizes and installed motor powers can be reduced. With increasing floor space, the cost advantage of the jet fan system becomes even more significant. The low profile of the jet fan allows to keep the ceiling height of the car park to a minimum.

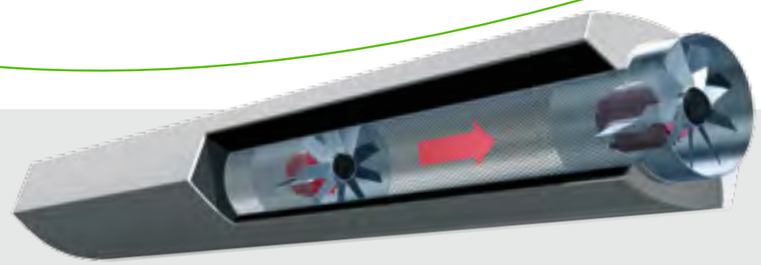


Jet fans will allow the creation of virtual fire compartments within the car park, as their airstreams prevent smoke from spreading to adjacent areas not affected by the fire. The physical division of the floor space by fire walls is no longer necessary and even the use of a sprinkler system might become obsolete. Thus, the use of a jet fan system allows for a more open-plan design of the car park and enhances manoeuvrability. The overall number of parking spaces is increased, effectively enhancing operating results.

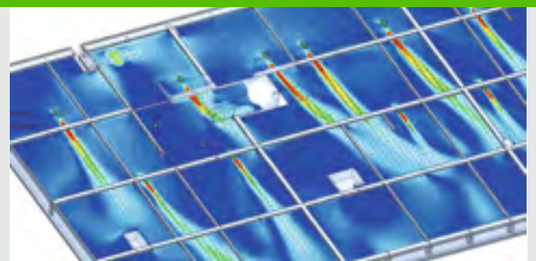
Improved air quality throughout the entire car park

In enclosed car parks, the induction effect of Wolter jet fans creates a constant movement of air from the supply to the exhaust points, keeping CO levels to a minimum. A well-designed distribution of jet fans throughout the car park will prevent the accumulation of exhaust fumes in dead spots. The high-velocity air stream along the ceiling level will induce a low-velocity airstream at floor level, ensuring the required mixing of low-level and high-level atmosphere which is generally insufficient in a ducted system, while keeping the air speed at walking height still comfortably low.

The use of jet fans achieves ventilation results superior to conventional ducted systems and offers substantial advantages. The additional capital cost of the jet fans is more than compensated by savings in construction and operating costs, as well as an improved utilisation of the existing floorspace.



The integral fan-motor-assembly can easily be extracted from the fan casing for inspection or servicing purposes without dismounting the entire jet fan from the ceiling.



Air-speed profile of a cross-section

Frankfurt am Main. **OpernTurm.**

Office Building OpernTurm

- Completion: spring 2010.
- Car park floor space: app. 18.000m².
- Parking spaces: 650.
- With sprinkler system.

Scope of Supply Wolter / Burkhardt Projekt GmbH:

- 42 Jet fans.
- 4 Axial exhaust fans.
- Dampers and grilles.
- Control cabinet.
- CO detection system.
- Installation and commissioning.

Project management
from design stage to commissioning.

Wolter and its co-operation partner Burkhardt Projekt GmbH will assist you through all stages of your car-park project, from the initial layout to the final acceptance test. We will provide all documentation necessary to obtain a homologation from local authorities.

Planning Phase

Design and layout by means of computational fluid dynamics analysis (CFD)

The initial step in the design of a jet ventilation system should always be a careful analysis of air distribution and movement based on computational fluid dynamics (CFD). Customised software allows us to create a 3-dimensional image of the car park. After determining all relevant parameters such as required air-change rates, exhaust volume and airflow direction, different ventilation scenarios for standard and emergency operation can be studied. Taking into account all relevant local regulations, the number, size and positioning of jet fans can be optimised.

CFD software visualizes direction vectors of airflows and air distributions in all areas of the underground car park. CFD design can also be used to simulate smoke propagation for different fire scenarios and to study the smoke-control effects of alternative jet fan distributions.

Installation Phase

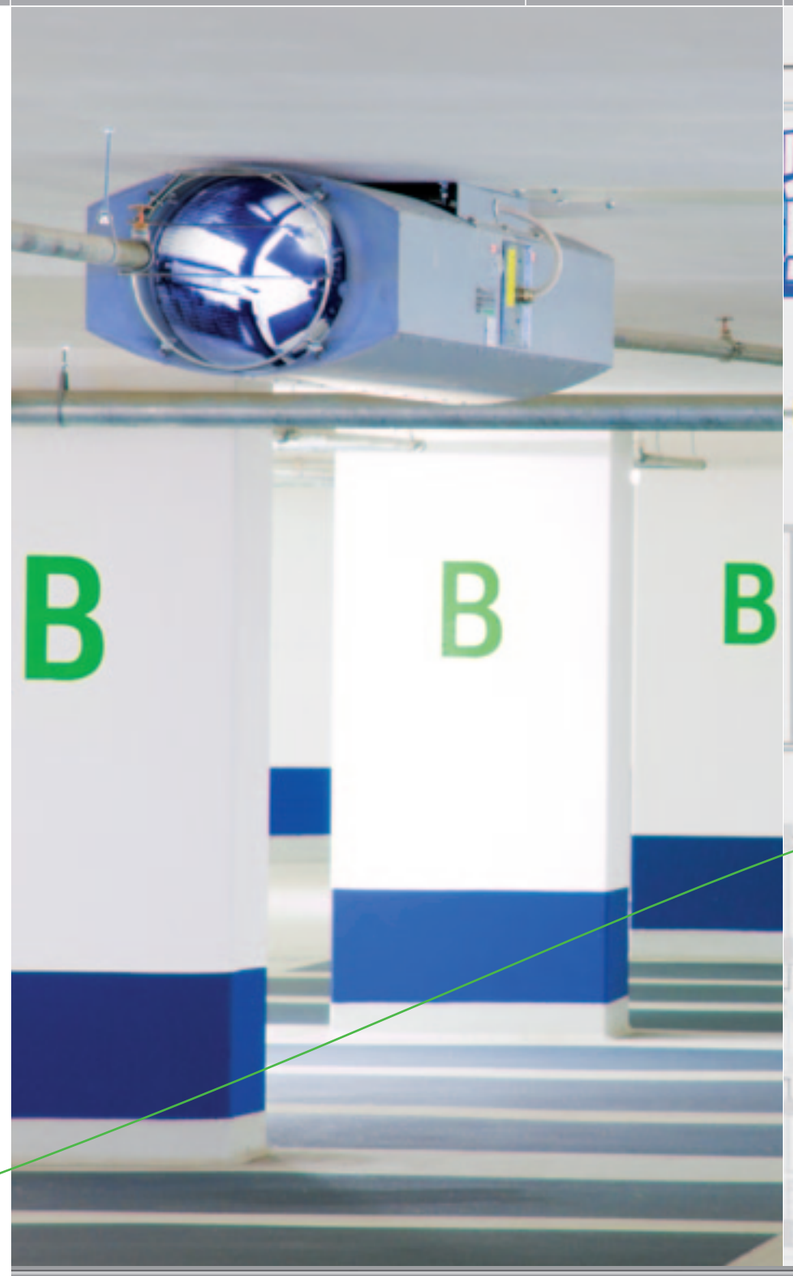
- Installation-ready supply of fans and ancillary equipment such as volume control dampers, guards and sound attenuators.
- Delivery of CO-sensors, smoke detectors and control cabinet and integration with the central building control systems.
- Implementation of the control cabinet PLC programming.
- Testing of the CO monitoring system.

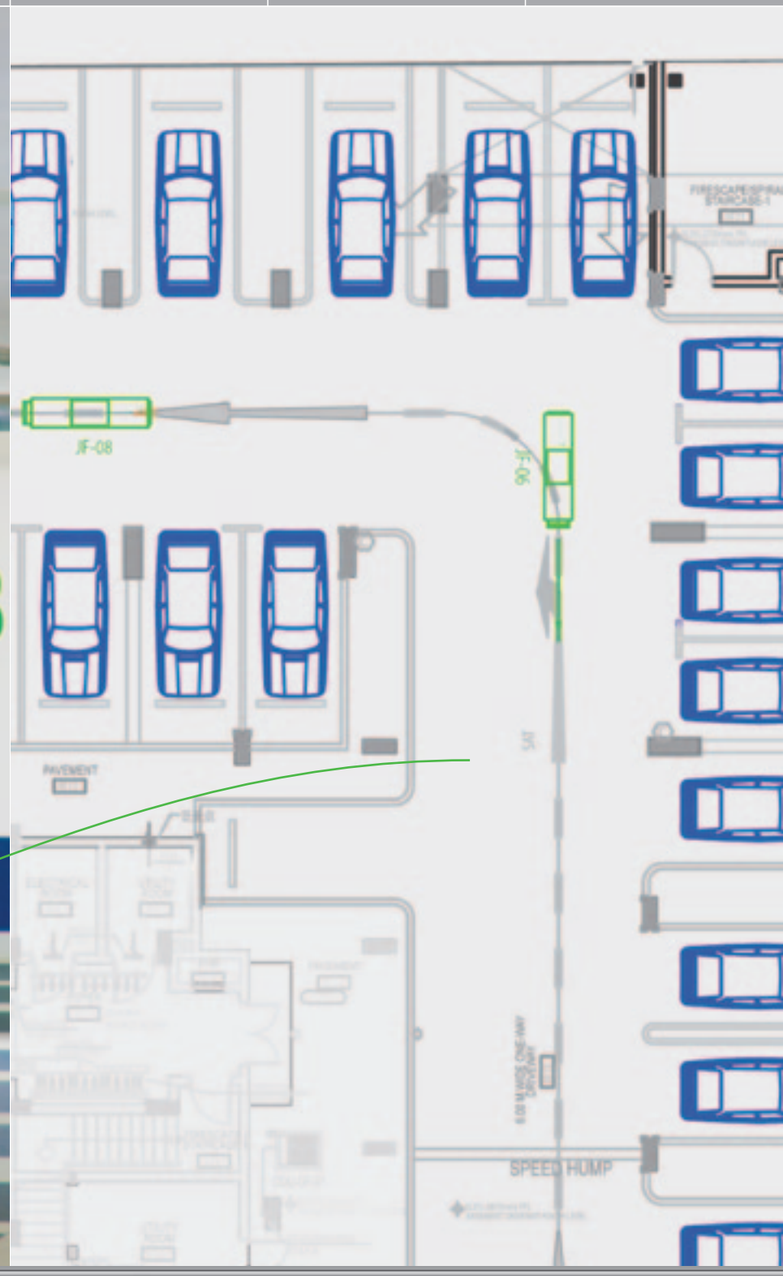
Commissioning and acceptance tests

- Functional demonstration of the installation by means of hot or cold smoke tests, if required.
- Complete system documentation for submittal to car park operators and civil protection authorities.

Service

- Periodical inspections and maintencance.
- Adjustment of running patterns according to changes in traffic volume.





Frankfurt am Main. **MyZeil (PalaisQuartier).**

Shopping Center MyZeil
Office/Hotel Building PalaisQuartier

- Completion: spring 2009.
- Car park floor space: app. 45.000m².
- Parking spaces: 1.400.
- With sprinkler system.

Scope of Supply Wolter / Burkhardt Projekt GmbH:

- 105 Jet fans.
- 12 axial supply and exhaus fans.
- Dampers and grilles.
- Control cabinet.
- CO detection system.
- Installation and commissioning.

Components of the Jet Fan System.

As a turn-key supplier, we offer all services and components required to implement a jet ventilation system.

Jet Fans of axial and centrifugal type

In accordance with the European Construction Products Regulation 305/2011/EU, both Wolter JF series jet fans as well as AXV supply and exhaust axial fans are tested and certified in accordance with DIN EN 12101-3. They ensure operation at elevated temperatures of 300°C for at least 2 hours, or 400°C for at least 2 hours, respectively. The production of these fans is subject to CE supervision by notified body MPA Braunschweig.

Wolter axial type Jet Fans are manufactured in standard sizes ranging from 280–400 and cover all thrust requirements usually found in relevant specifications. The integral fan-motor-unit of JFUO/JFRO type jet fans is inserted into an oval-shaped, integral sound-attenuated casing made from sheet steel. As the fan-motor-assembly can easily be extracted from the casing, it is not necessary to dismount the entire fan from the ceiling for revision or maintenance purposes. In addition to the standard casing of 2.250mm length (version L), a short-cased fan (version S) of 1.200mm length is available for limited installation space.

Each JFUO/JFRO jet fan is equipped with a detachable mounting bracket as standard. These brackets allow for an easy installation of the fan unit as they can be fixed to the ceiling separately. The fan itself is subsequently screwed to the mounting bracket.

JFUC/JFRC Fan types feature a circular sound attenuator of 800mm length. Guide vanes mounted on the pressure side direct the airstream underneath downstand beams if necessary.

Wolter JFC centrifugal type Jet Fans allow for high thrust performance while maintaining a very low unit height. Due to the low design profile, the ceiling height of the car park can be kept to a minimum. The integrated outlet nozzle increases the outlet airflow velocity, directs the airflow at a downward angle, and enables the fan to operate in its optimum efficiency range. The outlet deflector fitted to the nozzle is adjustable in order to provide for an adjustment of the horizontal airflow pattern on site. An inlet wire guard and ceiling mounting brackets are fitted as standard. The JFC centrifugal Jet Fans are available with nominal thrust ratings of 30, 50, 60, 80 and 100N.

Wolter isolator switches can be fitted on all fan types as an option. Wolter high-temperature isolator switches have been tested and certified in accordance with DIN EN 12101-3 in conjunction with the jet fan.

Casings

For the JFUO/JFRO type jet fans, the casing is designed as an integral, single-piece silencer. The casings feature an oval-shaped design to provide for maximum clearance below the fan. The casings of the JFUC/JFRC type jet fans are designed as a single-piece round silencer casing as standard, a split casing for easier service access is optionally available.

A patented design feature of the Wolter axial jet fans is the integral motor-impeller unit, which is inserted into the casing. This unit can be easily extracted for maintenance and repair, eliminating the need to uninstall the complete fan including the casing.

The casing of all axial and centrifugal Jet Fan types are made of sendzimir-galvanized steel. Other finishes, including customised powder coating, are optionally available.

Custom-designed executions are possible, e.g. fans can be fitted with two motors and two impellers in order to comply with the run/stand-by requirements of some countries.

Impellers

The aerodynamically shaped impellers of JFUO/JFRO/JFUC/JFRC axial Jet Fans are Manufactured from injection-moulded aluminium alloy, the pitch angle can be adjusted during standstill. Motorised painted steel impellers can be offer as well. Impellers are balanced to grade G6.3 according to VDI 2060 / ISO 1940-1:2003. The backward curved high-efficiency centrifugal impellers of JFC Jet Fans are made of welded aluminium sheets and are balanced to grade G2.5 acc. to VDI 2060 / ISO 1940-1:2003.

Motors / Control Equipment

Each unit is equipped with a 2-speed motor of protection class IP55. Low speed operation is usually sufficient for CO-ventilation under normal conditions. In the event of fire, a considerable power reserve is disposable by switching the fans to full speed. Mains supply is connected either through a terminal box or an optional disconnect switch in standard or high temperature execution. On JFUO/JFRO fans, both are located in a recessed opening in the fan casing accessible from the outside by a removable cover.

Smoke Extract version

In the smoke extract version, the jet fans are able to withstand a temperature of 300°C or 400°C for a duration of at least 2 hours, and can be used both for normal day-to-day CO-ventilation, and for smoke extraction and smoke control in case of a fire.

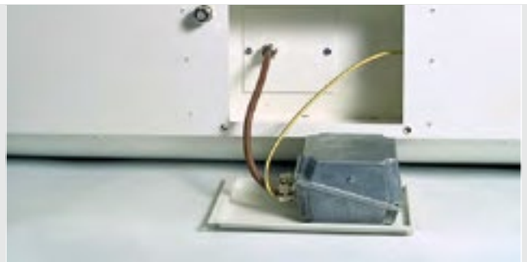
Fan code.

JF U O 250 / 250 A AE S -2

- Number of poles
- Silencer Length
  S = Short-cased;
  L = Long-cased
- Motor type
  AE = Single phase AC
  AD = Three phase AC
  EE = Single phase EC
- Impeller blade type
  A = Propeller blade;
  blank = Aero blade
- Outlet Size
- Inlet Size
- Silencer version
  O = Oval-Shaped
  C = Round shaped
  B = Bend
- Airflow Version
  U = Uni-Direction
  R = Reversible
- Jet Fan

Jet Fan centrifugal


Control Cabinet


Recessed terminal box / disconnect switch

AXV Main Exhaust and Supply Fans

AXV axial fans are available up to nominal size 1800, also for F300 (300°C/2h) and F400 (400°C/2h) temperature ratings, tested and CE certified according to DIN EN 12101-3 in compliance with the European Construction Products Regulation 305/2011/EU.

The jet fan system has to be designed in a way that sufficient air circulation in all areas is guaranteed and waste air is transported to the exhaust points without creating an aerodynamic “short circuit” whereby the supply air is extracted too early without achieving a thorough mixture of the atmosphere. Adequately sized main exhaust fans are therefore an important part of the overall system. Where natural air supply, e.g. through ramps, is insufficient, supply fans have to be installed. If required by the ventilation design, exhaust and supply fans can also be manufactured as reversible units.

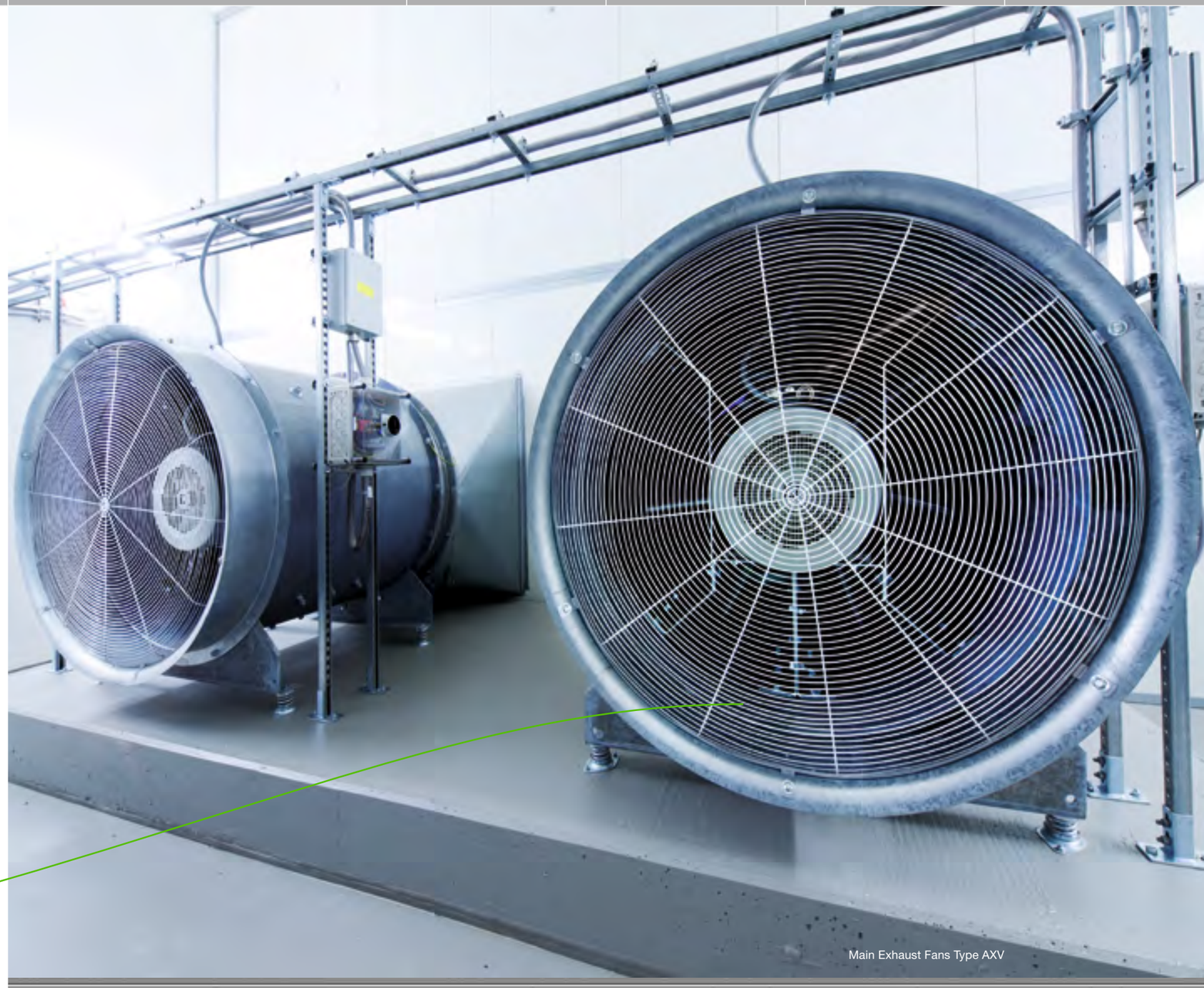
Sensors and Controls

The running pattern of the jet fans depends on current ventilation needs as determined by the network of CO sensors and fire detectors throughout the car park. It can be adjusted according to pre-defined programs in the course of the day or dependent upon continually monitored CO levels in different locations.

The jet fans are operated by a programmable logic control cabinet that enables the individual control of each single fan. The PLC programming has to ensure defined start-up times of the fans and provide overriding capabilities in the case of fire or malfunction. The required quantity of CO-sensors and smoke detectors and their distribution in the car park has to be individually determined during the design stage. Also, the smoke-control running pattern has to be carefully designed in order to determine exactly which fans have to be put in reverse mode should a fire occur in a specific area. In fire mode, individual start-up times of fans in different zones have to be observed, which is vital for the functioning of the entire sytems. Wolter is a turn-key system supplier, i.e. all necessary sensors, smoke detectors and the programmed control cabinet can be obtained from a single source, ensuring optimal integration of all components as well as trouble-free connection to the central building control system.

Ancillary Components

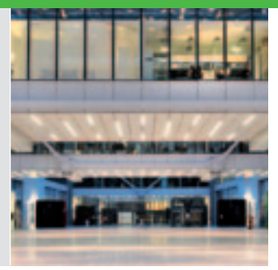
All necessary ancillary components such as volume-control dampers, guards or silencers are available from Wolter. Where, due to architectural conditions, standard components can not be used, their design can be adapted to suit the requirements of a specific installation.



Main Exhaust Fans Type AXV

Reference Project **The Squaire.**

The Squaire (Airrail Center).



Frankfurt am Main. **The Squaire (Airrail Center).**

Office/Hotel Building
The Squaire (Airrail Center)

- Completion: spring 2011.
- Car park floor space: app. 15.000m².
- Parking spaces: 1.400.
- With sprinkler system.

Scope of Supply Wolter / Burkhardt Projekt GmbH:

- 117 Jet fans.
- Dampers and grilles.
- Control cabinet.
- CO detection system.
- Installation and commissioning.

Reference Project **EZB.**

Frankfurt am Main. **European Central Bank**

ECB New Construction
Office Building

- Completion (car park): 2011.
- Car park floor space: app. 17.000m².
- Parking spaces: 650.
- With sprinkler system.

Scope of Supply Wolter / Burkhardt Projekt GmbH:

- Jet fans.
- Axial exhaust fans.
- Dampers and grilles.
- Control equipment.
- CO detection system.
- Installation and commissioning.

ECB.

Jet Fans in Vertical Arrangement.

Applying jet fan technology to open car parks.

Wolter supplied 149 vertical impulse fans of sizes 1.000 and 1.400 for the car park ventilation system of Munich's new soccer stadium Allianz-Arena. The Espalande car park can house approximately 9.800 cars and is among the largest ones in Europe.

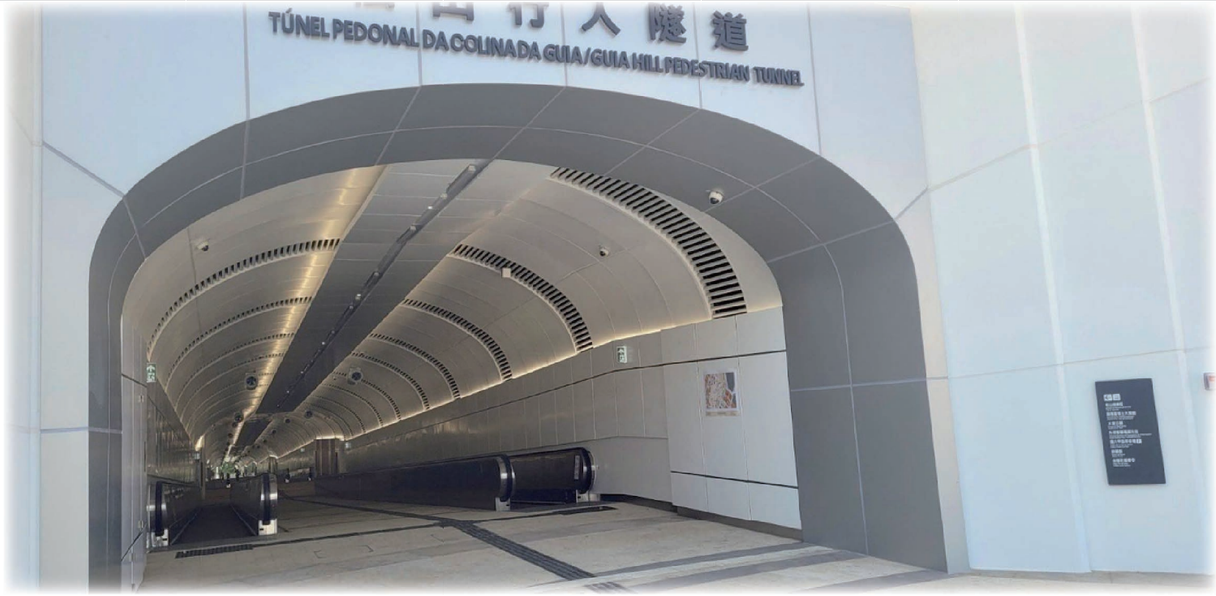
The fans are mounted on the bottom of large atriums and point vertically upwards, thus inducing a secondary airstream that ventilates the open parking decks above.

Technical Data.

Fan Type	Motor Power 300°C/2h [kW]	Nom. Current 300°C/2h [A]	Motor Power 40°C [kW]	Nom. Current 40°C [A]	Fan Speed [1/min]	Volume Flow [m3/s]	Thrust [N]	Sound Pressure [dB(A) 3m/45°]	Weight [kg]
AC motors, Single Phase, 230VAC, 50Hz, IP54, Uni-directional, Oval									
JFU 250/250A AE - M	NA	NA	0,19/0,17	0,9/0,8	2.730/2.500	0,59/0,51	9/6	52/50	30
JFU 250/200A AE - M	NA	NA	0,19/0,17	0,9/0,8	2.730/2.500	0,47/0,41	9/6	53/51	30
JFU 250/180A AE - M	NA	NA	0,19/0,17	0,9/0,8	2.730/2.500	0,42/0,37	9/6	53/51	30
JFU 250/250A AE - L	NA	NA	0,18/0,16	0,9/0,8	2.600/2.160	0,55/0,44	7/5	51/48	30
JFU 250/200A AE - L	NA	NA	0,18/0,16	0,9/0,8	2.600/2.160	0,44/0,36	7/5	52/49	30
JFU 250/180A AE - L	NA	NA	0,18/0,16	0,9/0,8	2.600/2.160	0,40/0,32	7/5	52/49	30
AC motors, Single Phase, 230VAC, 50Hz, IP54, Uni-directional, Circular									
JFUC 250/250A AE - M	NA	NA	0,19/0,17	0,9/0,8	2.730/2.500	0,59/0,51	9/6	52/50	30
JFUC 250/200A AE - M	NA	NA	0,19/0,17	0,9/0,8	2.730/2.500	0,47/0,41	9/6	53/51	30
JFUC 250/180A AE - M	NA	NA	0,19/0,17	0,9/0,8	2.730/2.500	0,42/0,37	9/6	53/51	30
JFUC 250/250A AE - L	NA	NA	0,18/0,16	0,9/0,8	2.600/2.160	0,55/0,44	7/5	51/48	30
JFUC 250/200A AE - L	NA	NA	0,18/0,16	0,9/0,8	2.600/2.160	0,44/0,36	7/5	52/49	30
JFUC 250/180A AE - L	NA	NA	0,18/0,16	0,9/0,8	2.600/2.160	0,40/0,32	7/5	52/49	30
JFUC 315/315A AE - 2	NA	NA	0,25/0,20	1,1/0,9	2.580/2.160	1,01/0,86	15/11	57/54	56
JFUC 400/400A AE - 4	NA	NA	0,19/0,17	0,88/0,77	1.350/1.100	1,05/0,81	10/6	52/50	77
*AC motors, Three-Phase, 380VAC, 50Hz, IP54, Uni-directional, Oval, **L**ong and **S**hort*									
JFUO 250/250 AD L	0,55/0,11	1,3/0,85	0,37/0,06	0,97/0,53	2.880/1.440	0,72/0,36	12/3	47/34	66
JFUO 300/300 AD L	1,3/0,3	2,8/1,3	1,1/0,25	2,4/1,1	2.880/1.440	1,27/0,63	26/6	62/44	108
JFUO 370/315 AD L	2,0/0,5	4,2/1,56	2,0/0,5	4,2/1,56	2.880/1.440	1,77/0,89	47/12	63/45	140
JFUO 370/355 AD L	2,0/0,5	4,2/1,56	2,0/0,5	4,2/1,56	2.880/1.440	2,20/1,10	57/14	65/47	142
JFUO 370/370 AD L	2,4/0,6	5/1,9	2,0/0,5	4,2/1,56	2.880/1.440	2,46/1,23	62/16	67/49	153
JFUO 250/250 AD S	0,55/0,11	1,3/0,85	0,37/0,06	0,97/0,53	2.880/1.440	0,72/0,36	12/3	50/36	37
JFUO 300/300 AD S	1,3/0,3	2,8/1,3	1,1/0,25	2,4/1,1	2.880/1.440	1,27/0,63	26/6	65/46	73
JFUO 370/315 AD S	2,0/0,5	4,2/1,56	2,0/0,5	4,2/1,56	2.880/1.440	1,77/0,89	47/12	66/47	99
JFUO 370/355 AD S	2,0/0,5	4,2/1,56	2,0/0,5	4,2/1,56	2.880/1.440	2,20/1,10	57/14	68/49	96
JFUO 370/370 AD S	2,4/0,6	5/1,9	2,0/0,5	4,2/1,56	2.880/1.440	2,46/1,23	62/16	70/51	102
*AC motors, Three-Phase, 380VAC, 50Hz, IP54, Reversible, Oval, **L**ong and **S**hort*									
JFRO 250/250 AD L	0,55/0,11	1,3/0,85	0,37/0,06	0,97/0,53	2.880/1.440	0,67/0,33	11/3	46/34	66
JFRO 300/300 AD L	1,3/0,3	2,8/1,3	1,1/0,25	2,4/1,1	2.880/1.440	1.18/0.59	22/6	61/43	108
JFRO 370/370 AD L	2,4/0,6	5/1,9	2,0/0,5	4,2/1,56	2.880/1.440	2,31/1,16	55/14	66/48	153
JFRO 250/250 AD S	0,55/0,11	1,3/0,85	0,37/0,06	0,97/0,53	2.880/1.440	0,67/0,33	11/3	48/35	37
JFRO 300/300 AD S	1,3/0,3	2,8/1,3	1,1/0,25	2,4/1,1	2.880/1.440	1,18/0,59	22/6	64/45	73
JFRO 370/370 AD S	2,4/0,6	5/1,9	2,0/0,5	4,2/1,56	2.880/1.440	2,31/1,16	55/14	69/51	102

Technical Data. (Continue...)

Fan Type	Motor Power 300°C/2h [kW]	Nom. Current 300°C/2h [A]	Motor Power 40°C [kW]	Nom. Current 40°C [A]	Fan Speed [1/min]	Volume Flow [m3/s]	Thrust [N]	Sound Pressure [dB(A) 3m/45°]	Weight [kg]
AC motors, Three-Phase, 380VAC, 50Hz, IP54, Uni-directional, Circular									
JFUC 250A AD	NA	NA	0,19/0,136	0,37/0,23	2.750/2.300	0,58/0,48	9/6	52/49	-
JFUC 250 AD	on request	on request	0,37/0,06	0,97/0,53	2.880/1.440	0,72/0,36	12/3	51/37	60
JFUC 315 AD	on request	on request	0,55/0,11	1,3/0,85	2.880/1.440	1,47/0,73	32/8	63/45	65
JFUC 355 AD	on request	on request	1,1/0,25	3,1/0,6	2.880/1.440	2.09/1.04	52/13	67/49	69
JFUC 400 AD	on request	on request	1,5/0,37	3,3/1,27	2.880/1.440	2,78/1,39	73/18	71/53	77
JFUC 450 AD	on request	on request	3/0,75	6,2/2,4	2.880/1.440	3,93/1,96	116/29	75/56	-
AC motors, Three-Phase, 380VAC, 50Hz, IP54, Reversible, Circular									
JFRC 250 AD	on request	on request	0,37/0,06	0,97/0,53	2.880/1.440	0,67/0,33	11/3	56/39	61
JFRC 315 AD	on request	on request	0,55/0,11	1,3/0,85	2.880/1.440	1,37/0,68	28/7	62/45	66
JFRC 355 AD	on request	on request	1,1/0,25	3,1/0,6	2.880/1.440	1,95/0,98	45/11	66/48	70
JFRC 400 AD	on request	on request	1,5/0,37	3,3/1,27	2.880/1.440	2,60/1,30	64/16	69/52	78
JFRC 450 AD	on request	on request	3/0,75	3/0,75	2.880/1.440	3,67/1,83	102/25	73/54	-
AC motors, Three-Phase, 380VAC, 50Hz, IP54, Centrifugal									
JFC 30	0,75/0,18	-	0,75/0,18	-	1.440/720	1,49/0,74	31/7,7	71/55	67
JFC 50	1,10/0,25	-	1,10/0,25	-	1.440/720	1,86/0,93	48/12	73/57	78
JFC 60	1,50/0,37	-	1,50/0,37	-	1.440/720	2,04/1,02	58/14,5	76/58	87
JFC 80	2,20/0,55	-	2,20/0,55	-	1.440/720	2,50/1,25	80/20	75/57	110
JFC 100	3,00/0,75	-	3,00/0,75	-	1.440/720	2,96/1,48	104/26	76/61	129
*AC motors, Three-Phase, 380VAC, **60Hz**, IP54, Centrifugal*									
JFC 30	1,5/0,37	-	1,5/0,37	-	1.750/870	1,80/0,90	45/11,0	74/58	78
JFC 50	2,2/0,55	-	2,2/0,55	-	1.750/870	2,23/1,12	69/17,3	77/61	90
JFC 60	3,0/0,75	-	3,0/0,75	-	1.750/870	2,45/1,22	83/20,9	80/62	95
JFC 80	4,0/1,10	-	4,0/1,10	-	1.750/870	3,00/1,50	115/37,4	79/61	120



Throw Length Calculation

Calculating the throw length of a jet fan is a multifaceted process that requires consideration of multiple factors (characteristics of fan and airflow, environment...etc) and variables. To obtain accurate results, it may be necessary to combine various methods such as theoretical calculations, experimental measurements, manufacturer data and professional software.

Two calculation methods are shown as below:
1) Industrial methods

$$X = \frac{K * D_o * V_o}{V_x}$$

Where: X = Max. throw length in meter;
K = Constant (5,5) as per industrial standard;
D_o = Outlet diameter of jet fan in meter;
V_o = Velocity at jet fan outlet in m/s;
V_x = Velocity at a chosen point in m/s.

An Example:
Fan model JFU 250/180A AE-M at high speed, outlet diameter D_o is approx. 180 mm, outlet velocity is approx. 16,7 m/s, so the max. throw length at 0,5 m/s can be caculated as follows:

$$X = \frac{5,5 * (180 / 1.000) * 16,7}{0,5} = 33,07 \text{ m}$$

2) ATL test methods

$$X = \frac{K * \sqrt{Q_o * V_o}}{60 * V_x}$$

Where: X = Max. throw length in meter;
K = Constant (6,2) as per ATL test data;
Q_o = Outlet airflow in m^3/h;
V_o = Velocity at jet fan outlet in m/s;
V_x = Velocity at a chosen point in m/s.

An Example:
Fan model JFU 250/180A AE-M at high speed, max. outlet airflow Q_o is approx. 1.530 m^3/h, outlet velocity is approx. 16,7 m/s, so the max. throw length at 0,5 m/s can be caculated as follows:

$$X = \frac{6,2 * \sqrt{1.530 * 16,7}}{60 * 0,5} = 33,03 \text{ m}$$

Induced Airflow

The induced airflow of a Jet Fan refers to the suction and driving effect of the airflow generated by the fan on the surrounding air, which can effectively improve air circulation efficiency, optimize indoor environment and improve comfort.
The calculation formulae of the approx. induced airlfow $\mathbf{Q_x}$ as below can be used:

$$Q_x = \frac{0,2 * X * Q_o}{D_o}$$

An Example:
By using the data in the example from ATL test method for throw length above, the induced airflow of JFU 250/180A AE-M can be calculated as follows:

$$Q_x = \frac{0,2 * 33,03 * 1.530}{180 / 1.000} = 56.561 \text{ CMH}$$

EC Technology

Motorized Impeller

The axial fans have aerodynamically moulded blades made from galvanised and painted sheet steel. The blades are mounted directly onto the external rotor motor. The motorised impeller is balanced in two planes according to quality level G 2.5 (DIN ISO 1940).

The EC (Electronically Commutation) Motors with die cast aluminium enclosure have maintenance free ball bearings & are capable of continuous operation (S1). The EC fan motor is capable of variable speed control. The motor speed can be pre-set by the user to operate at a certain maximum fan speed and the fan speed can also be adjusted automatically according to the cooling demand of the room to provide energy savings during period of partial load. A minimum fan speed can be preset by the user to avoid lower fan speeds than the requirement which is required in order to maintain sufficient airflow in the room. The fan motor is variable speed and totally enclosed fan cooled type with Class F insulation, IP54 standard. Motor assembly conforms to standards: EN60034-1, EN60335-1& EN62233.

IEC Standard Motor

EC motor technology has been proven in various applications during the last five years. Wolter now introduces EC Fans to develop further energy-saving solutions, particularly important in today's environmentally-conscious world.

Electronically commutated motors offer some major benefits when used in Jet fans

- Higher efficiency of up to 90% with lower input power
- Minimal rise in air temperature on the air stream
- Efficient speed control
- Longer motor life due to lower running temperatures
- Longer bearing life because of the soft-start feature

Features of Permanent Magnet, Electronically Commutated Motor:

- Single phase, 220 to 277VAC, 50/60Hz input
- IEC80, aluminum frame, IP54 solution
- Total efficiency (motor + drive) - IE5
- Vibration Grade A
- Continuous speed adjustment by:
  - Tact buttons (local)
  - DC voltage (remote): 2 to 10VDC
  - DC current (remote): 4 to 20mA DC
  - Frequency (remote): 10 to 95%

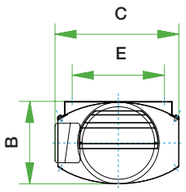
Technical Data.

EC motors, 220~277V, 50/60Hz, IP54

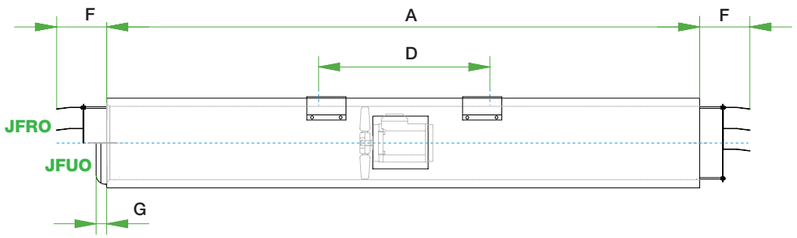
Fan Type Model Size	Motor Power 40°C [kW]	Nom. Current 40°C [A]	Fan Speed [1/min]	Volume Flow [m3/s]	Thrust [N]	Sound Pressure [dB(A) 3m/45°]	Weight [kg]
JFUO 300/300 EE L - 2	0.55	5.20	2880	1.21	24	62	108
JFUO 300/300 EE L - 4	0.12	1.10	1440	0.60	6	44	108
JFUO 370/315 EE L - 2	1.10	9.20	2880	1.55	36	63	140
JFUO 370/315 EE L - 4	0.25	1.90	1440	0.82	10	45	140
JFUO 370/355 EE L - 2	1.10	9.20	2880	1.92	44	65	142
JFUO 370/355 EE L - 4	0.25	1.90	1440	1.02	12	47	142
JFUO 370/370 EE L - 2	1.10	9.20	2880	2.15	48	67	153
JFUO 370/370 EE L - 4	0.25	1.90	1440	1.14	13	49	153
JFRO 300/300 EE L - 2	0.55	5.2	2880	1.16	22	61	108
JFRO 300/300 EE L - 4	0.12	1.1	1440	0.58	5	43	108
JFRO 370/370 EE L - 2	1.1	9.2	2880	2.06	44	66	153
JFRO 370/370 EE L - 4	0.25	1.9	1440	1.10	12	48	153
JFUO 300/300 EE S - 2	0.55	5.20	2880	1.21	24	65	73
JFUO 300/300 EE S - 4	0.12	1.10	1440	0.60	6	46	73
JFUO 370/315 EE S - 2	1.10	9.20	2880	1.55	36	66	99
JFUO 370/315 EE S - 4	0.25	1.90	1440	0.82	10	47	99
JFUO 370/355 EE S - 2	1.10	9.20	2880	1.92	44	68	96
JFUO 370/355 EE S - 4	0.25	1.90	1440	1.02	12	49	96
JFUO 370/370 EE S - 2	1.10	9.20	2880	2.15	48	70	102
JFUO 370/370 EE S - 4	0.25	1.90	1440	1.14	13	51	102
JFRO 300/300 EE S - 2	0.55	5.2	2880	1.16	22	64	73
JFRO 300/300 EE S - 4	0.12	1.1	1440	0.58	5	45	73
JFRO 370/370 EE S - 2	1.1	9.2	2880	2.06	44	70	102
JFRO 370/370 EE S - 4	0.25	1.9	1440	1.10	12	52	102
JFUC 315 EE - 2	0.55	5.20	2880	1.40	29	63	65
JFUC 315 EE - 4	0.12	1.10	1440	0.70	7	45	65
JFUC 355 EE - 2	1.10	9.20	2880	1.85	41	67	69
JFUC 355 EE - 4	0.25	1.90	1440	0.99	12	49	69
JFUC 400 EE - 2	1.10	9.20	2880	2.39	54	71	77
JFUC 400 EE - 4	0.25	1.90	1440	1.35	17	53	77
JFRC 315 EE - 2	0.55	5.20	2880	1.15	20	62	66
JFRC 315 EE - 4	0.12	1.10	1440	0.58	5	45	66
JFRC 355 EE - 2	1.10	9.20	2880	1.73	35	66	70
JFRC 355 EE - 4	0.25	1.90	1440	0.86	9	48	70
JFRC 400 EE - 2	1.10	9.20	2880	2.29	50	69	78
JFRC 400 EE - 4	0.25	1.90	1440	1.20	14	52	78
JFUB 250/200 A EE	0.12	1.00	2700	0.43	7	54	26
JFUB 250/250 A EE	0.12	1.00	2700	0.50	6	53	26
JFUB 315/280 A EE	0.20	1.65	2700	0.91	16	61	32
JFUB 315/315 A EE	0.20	1.65	2700	0.98	14	60	32

Dimensions.

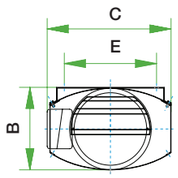
JFUO L - Jet Fan, Uni-directional, Oval, Long



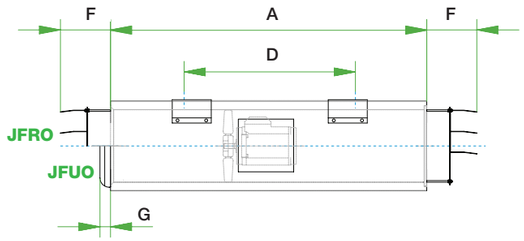
JFRO L - Jet Fan, Fully Reversible, Oval, Long



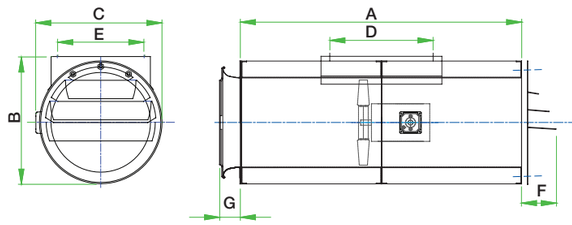
JFUO S - Jet Fan, Uni-directional, Oval, Short



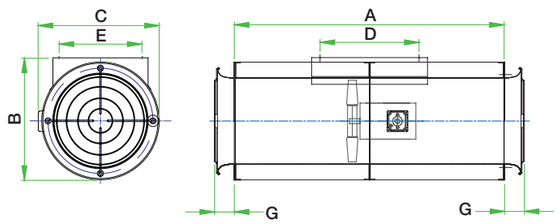
JFRO S - Jet Fan, Fully Reversible, Oval, Short



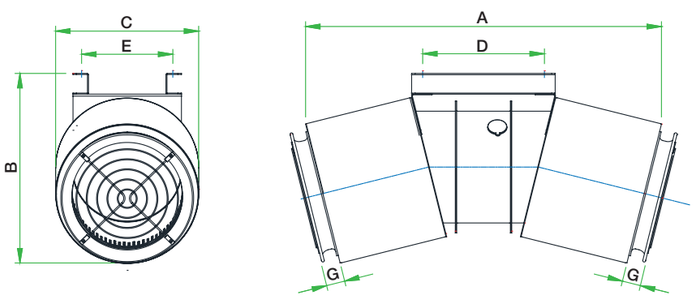
JFUC - Jet Fan, Uni-directional, Circular



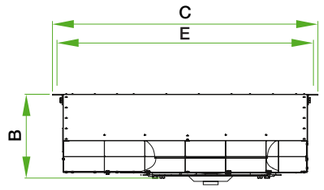
JFRC - Jet Fan, Fully Reversible, Circular

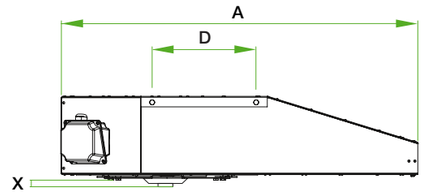


JFUB - Jet Fan, Uni-directional, Bend



JFC - Jet Fan, Centrifugal





All dimensions in mm

Type	A	B	C	D	E	F*	G*	X
JFUO 250	1.200	270	395	690	255	170	46	-
JFRO 250	1.200	270	395	690	255	170	-	-
JFUO 300 L	2.250	343	530	690	380	190	46	-
JFUO 300 S	1.200	343	530	690	380	190	46	-
JFRO 300 L	2.250	343	530	690	380	190	-	-
JFRO 300 S	1.200	343	530	690	380	190	-	-
JFUO 370/315 L	2.250	415	600	690	450	190	46	-
JFUO 370/315 S	1.200	415	600	690	450	190	46	-
JFUO 370/355 L	2.250	415	600	690	450	190	46	-
JFUO 370/355 S	1.200	415	600	690	450	190	46	-
JFUO 370/370 L	2.250	415	600	690	450	190	46	-
JFUO 370/370 S	1.200	415	600	690	450	190	46	-
JFRO 370 L	2.250	415	600	690	450	190	-	-
JFRO 370 S	1.200	415	600	690	450	190	-	-
JFUC 250/250.200.180	750	364	365	295	190	-	59	-
JFUC 315	800	447	435	295	190	190	59	-
JFRC 315	800	447	435	295	190	190	59	-
JFRC 355	900	486	475	295	190	-	59	-
JFRC 400	1.000	527	515	395	290	-	59	-
JFRC 450	1.000	582	565	395	290	-	59	-
JFC 30	1.008	221	893	395	861	-	-	24
JFC 50	1.135	260	893	395	861	-	-	-
JFC 60	1.200	280	893	395	861	-	-	-
JFC 80	1.336	291	993	450	961	-	-	23
JFC 100	1.551	325	1.093	510	1.061	-	-	-
JFUB 250/200	854	486	350	306	210	-	48	-
JFUB 250/250	854	486	350	306	210	-	48	-
JFUB 315/280	1034	550	416	354	265	-	51	-
JFUB 315/315	1034	550	416	354	265	-	54	-

* Uni-directional jet fans JFUO / JFUC: inlet guard and cone (dimension G) on inlet, discharge guide vanes (dimension F) on outlet;
Fully reversible jet fans JFRO: discharge guide vanes (dimension F) on both sides.
Fully reversible jet fans JFRC: inlet guard and cone (dimension G) on both sides.

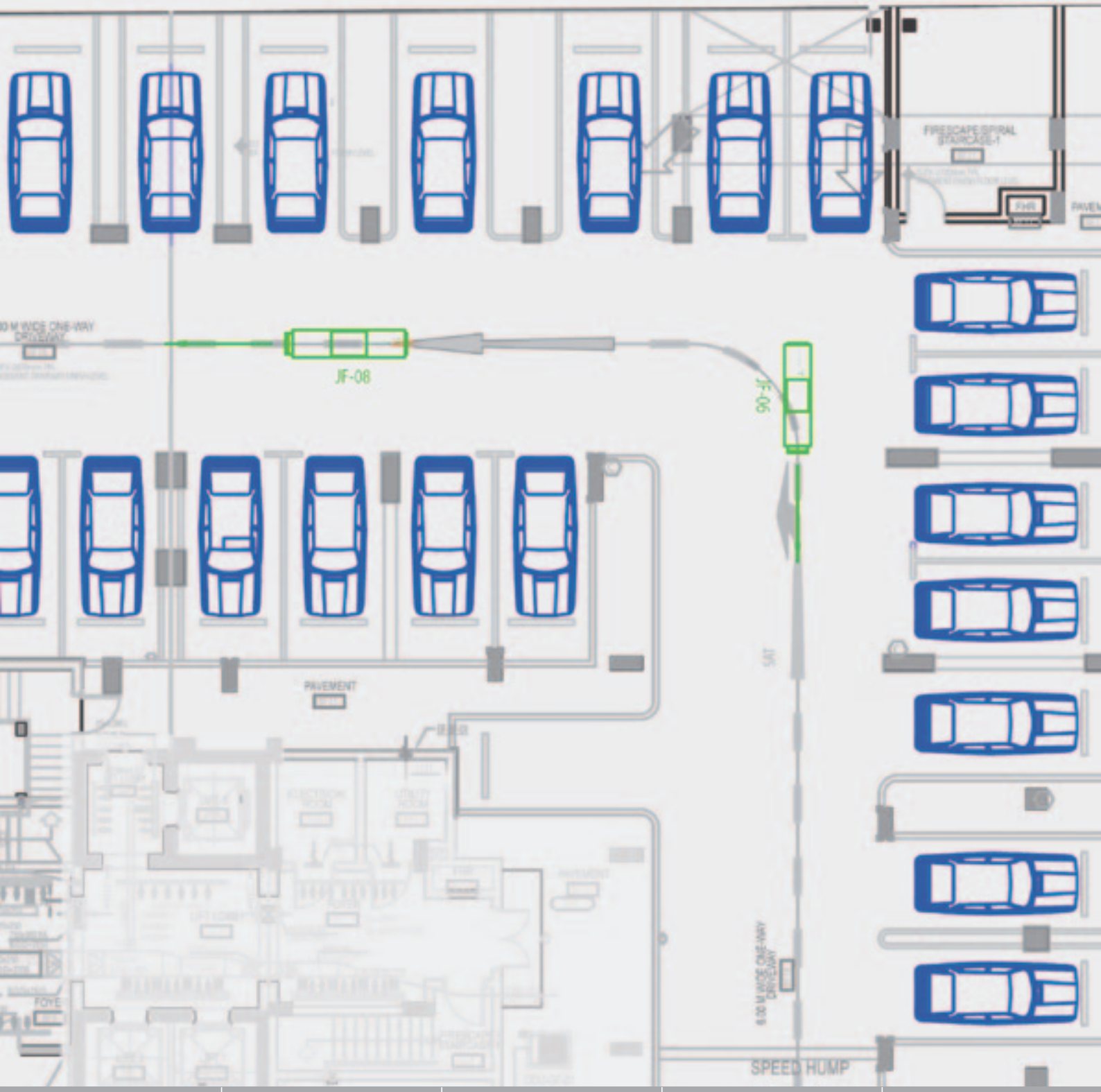
All technical details are subject to change without prior notice.

Expertise in design and installation. **Globally.**

Experience is paramount when it comes to the planning and installation of a jet ventilation system. Our reference list stands out. Wolter specialist engineers will be happy to assist you in every way possible – send us your plans or contact us to arrange for a meeting.

Selected Reference Projects as of February 2015.

Project	Location	Parking Spaces (app.)	Year
BMW MITZ Phase 2	Munich, Germany	2.000	2008
Porto Arabia - The Pearl	Doha, Qatar	2.000	2008
Airport Sabiha Gokcen	Istanbul, Turkey	4.000	2008
PalaisQuartier (MyZeil)	Frankfurt am Main, Germany	1.400	2008
Pendik Krea Shopping Center	Istanbul, Turkey	1.100	2008
Shopping Forum	Istanbul, Turkey	2.300	2008
Cambridge Mall	Medan, Indonesia	1.440	2008
212 Shopping Center	Istanbul, Turkey	4.000	2008
Yas Island	Abu Dhabi, UAE	1.450	2009
Cultural Village	Doha, Qatar	2.800	2009
The Squaire (Airrail Center)	Frankfurt Airport, Germany	630	2009
IKEA Shopping Center	Lodz, Poland	2.000	2009
313@somerset Shopping Center	Singapore	230	2009
BluLotus	Istanbul, Turkey	450	2009
Decathlon	Istanbul, Turkey	865	2009
St. Urbanus-Kirchplatz	Gelsenkirchen, Germany	160	2009
Parkcity	Istanbul, Turkey	490	2010
Spiegel Verlag	Hamburg, Germany	240	2010
Ericuscontor	Hamburg, Germany	220	2010
Sign Hafenoffice	Düsseldorf, Germany	250	2010
Universitätsplatz	Fulda, Germany	220	2010
Retro	Bratislava, Slovakia	620	2010
Marmara Forum	Istanbul, Turkey	4.500	2010
Marka Spot	Istanbul, Turkey	270	2010
Merter Metro	Istanbul, Turkey	210	2010
Europäische Zentralbank	Frankfurt am Main, Germany	650	2010
IKEA	Berlin, Germany	380	2010
Alexanderplatz	Berlin, Germany	600	2010
ECE Shopping Center	Oldenburg, Germany		2010
Pairc an Clochar	Oranmore, Ireland	500	2010
AKBATI Shopping Center	Istanbul, Turkey	3.500	2010
Quartier Unterlinden	Freiburg, Germany	250	2010
PGGM Investments	Zeist, The Netherlands	1.000	2010
HDI-Gerling Versicherung	Hannover, Germany	620	2010
Metro Markt	Izmir, Turkey	230	2010
Royal Breeze Buildings	Ras Al Khaimah, UAE	800	2010
Millenium Hall Shopping Center	Rzeszow, Poland	1.000	2010
Muratpas	Istanbul, Turkey	230	2010
Marienplatz-Galerie	Schwerin, Germany	150	2010
Baumax Shopping Center	Izmir, Turkey	235	2010
Neue Mitte	Ingelheim, Germany	450	2010
Administration Building	Khartoum, Sudan	100	2010
Sparkasse	Nürnberg	110	2011
Zaailand Shopping Center	Leeuwarden, The Netherlands	200	2011
Kai Tak Airport	Hong Kong, China	250	2011
Mega Bangna Shopping Center	Bangkok, Thailand	4.200	2011
Festival City	Cairo, Egypt	5.600	2011
Medimall Shopping Center	Rotterdam, The Netherlands	700	2011
HDI-Gerling Versicherung	Hannover, Germany	300	2011
Le Flair Condominium	Düsseldorf, Germany	230	2011
Toyota Center	Beirut, Lebanon	350	2011
Buyaka Residence	Istanbul, Turkey	1200	2011
TAVG Iskenderpasa	Istanbul, Turkey	250	2011
TG Am Forum	Günzburg, Germany	260	2011
TG Europaviertel Baufeld 2	Frankfurt am Main, Germany	200	2011
Arena Park Shopping Mall	Istanbul, Turkey	850	2011
Marriott	Baku, Azerbaijan	300	2011
Tarsus Corio Shopping Mall	Tarsus, Turkey	800	2011
Hill Top Residence	Beirut, Lebanon	400	2011
TG Bahnhof Nord	Aschaffenburg, Germany	200	2011
Galleria Mall	Amman, Jordan	800	2011
Maleiha Camp	Sharjah, UAE	1200	2011
Buyaka Shopping Mall	Istanbul, Turkey	1200	2011
Metro Market	Samsun, Turkey	250	2011
Fenerbahce Ulker Sports Hall Arena	Istanbul, Turkey	750	2011
Metro Market	Istanbul, Turkey	300	2011
Metro Market	Dudullu, Turkey	100	2011
Varyap Residences	Istanbul, Turkey	2500	2011
World Trade Center	Hong Kong, China	60	2011
Shek Pai Wan Public Housing	Macau, China	400	2011
Double Cove Lok Wo Sha	Hong Kong, China	550	2012
Renaissance Hotel	Bangkok, Thailand	240	2012
OC Futurum	Hradec Králové, Czech Republic	300	2012
E.ON Avacon	Salzgitter, Germany	100	2012
TG Stadthalle	Reutlingen, Germany	230	2012
Forty West	Cairo, Egypt	200	2012
Golden Park Batman	Batman, Turkey	300	2012
Beirut City Center	Beirut, Lebanon	1400	2012
Tower 115	Bratislava, Slovakia	500	2012
Akasya Shopping Mall	Istanbul, Turkey	3500	2012
Tommy Shopping Center	Korcula, Croatia	500	2012
Zlocien	Krakau, Poland	100	2012
City Centrum	Rzeszow, Poland	250	2012
Batorego	Poznan, Poland	150	2012
Mysliwska	Krakau, Poland	200	2012
Petrzalka City	Bratislava, Slovakia	100	2012
Akkoza C Block Residence	Istanbul, Turkey	350	2012
Autopia Car Center	Istanbul, Turkey	1200	2012
Bauhaus Kagithane	Istanbul, Turkey	500	2012
Bomonti Congress Center	Istanbul, Turkey	800	2012
Brewery Square	Dorchester, UK	150	2012
Buyukhanli Plaza	Istanbul, Turkey	500	2012
Crowne Plaza Oryatas	Istanbul, Turkey	500	2012
Dogus Oto Bursa	Istanbul, Turkey	550	2012
Dolphine Shopping Mall	Kocaeli, Turkey	400	2012
Heathrow Airport Terminal 2A	London, UK		2012
I.T.U. Teknokent	Istanbul, Turkey	670	2012
Kingston Riverside	London, UK	200	2012
Quartermile Q10 + Q20	Edinburgh, UK	200	2012
Vialand Theme Park	Istanbul, Turkey	4900	2012
Yasampark Residences	Izmir, Turkey	200	2012
Central Plaza Ram-Indra	Bangkok, Thailand	250	2012
Hilton Phuket Arcadia	Phuket, Thailand	220	2012
Amari Hua Hin	Hua Hin, Thailand	230	2012
AWHO	Noida, India	184	2012
Mall Of India	Gurgaon, India	2340	2012
Adobe	Noida, India	844	2012
Anant Raj	Gurgaon, India	133	2012
One Oasis Cotai South	Macau, China	100	2012
Macau CN4 Public Housing	Macau, China	150	2012
IKEA	Wroclawu, Poland	800	2013
Gaziantep Forum	Gaziantep, Turkey	1200	2013
Laurus Residences	Istanbul, Turkey	350	2013
Oxygen Tower	Noida, India	480	2013
Enovation Tower	Gurgaon, India	210	2013
City View	Bangalore, India	750	2013
Rymarska	Wroclaw, Poland	280	2013
Kminkowa	Wroclaw, Poland	270	2013
Ferrero	Belsk Duzy, Poland	210	2013
Akasya Shopping Mall	Istanbul, Turkey	180	2013
Soyak Soho	Istanbul, Turkey	380	2013
The Istanbul Residence	Istanbul, Turkey	2650	2013
The Istanbul Tunnel	Istanbul, Turkey		2013
BRE SienKievicza	Wroclaw, Poland	140	2013
Harmony Towers	Bursa, Turkey	1000	2013
Varyap Meridian I Blok	Istanbul, Turkey	920	2013
Mall of Istanbul	Istanbul, Turkey	9600	2013
PG Raadhuisplein	Drachten, Netherlands	800	2013
PG Q park Laakhaven Hol	Den Haag, Netherlands	1400	2013
Chmielna	Krakow, Poland	90	2013
Achrafieh 2030	Beirut, Lebanon	650	2013
Dlugosza	Wroclaw, Poland	450	2013
Izmir Adnan Menderes Airport	Izmir, Turkey	180	2013
Gemini Park rozbudowa	Bielsko-Biala, Poland	944	2013
Metrogarden Shopping Mall	Istanbul, Turkey	900	2013
Bajan	Wroclaw, Poland	450	2013
Maslak Orjin Office	Istanbul, Turkey	1600	2013
Respublika Shopping Mall	Kiev, Ukraine	4500	2013
Centrum Kongresowe	Krakow, Poland	355	2013
Varyap Plaza Commercial	Istanbul, Turkey	300	2013
Socar Tower	Baku, Azerbaijan	950	2014
Istanbloom	Istanbul, Turkey	900	2014
Cairo Airport TB2	Cairo, Egypt	2500	2014
Polat Holding Kagithane Office	Istanbul, Turkey	360	2014
PG Centrumsplan Dorpsv	Zuidhoorn, Netherlands	80	2014
Diyabakir Forum Shopping Mall	Diyabakir, Turkey	1500	2014
Efesan Port Logistic Center	Dilovasi, Turkey	1200	2014
Osiedle Batory	Poznan, Poland	108	2014
Beirut Terraces	Beirut, Lebanon	400	2014
Pullman Hotel	Dubai, UAE	90	2014
Presidental Palace of Turkish Republic	Ankara, Turkey		2014
King Abdulaziz Center for World Culture	Dhahran, Saudi Arabia	180	2014
Central Plaza West Gate	Bang Yai, Thailand	1550	2014
Namaa 75 Office Building	Cairo, Egypt	290	2014
Kapital Dolapdere Office	Istanbul, Turkey	250	2014
Kapital Maslak Office	Istanbul, Turkey	250	2014
Mehmetcik Vakfi	Istanbul, Turkey	230	2014
Spot C Mall	Choueifat, Lebanon	1400	2014
Lok Wo Sha	Hong Kong, China	200	2014
New HK Red Cross Headquarters	Hong Kong, China	30	2014
Yau Ma Tei Police Station	Hong Kong, China	30	2014
East Point City Commercial	Hong Kong, China	35	2014
68 Boundary Street	Hong Kong, China	20	2014
Sama Beirut	Beirut, Lebanon	650	2015
Nowy Rynek	Jelenia Gora, Poland	399	2015
IKEA Bydgoszcz	Bydgoszcz, Poland	730	2015
Sukcesja Lodz	Lodz, Poland	1400	2015
Dubois Wroclaw	Wroclaw, Poland	77	2015
Quasar	Istanbul, Turkey	900	2015



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