www.howden.com

Providing ventilation to underground traffic

Ability to perform in the toughest conditions

Revolving Around You™

With six generations of experience, Howden probably knows more about moving large volumes of air, effectively, safely and efficiently, than any other company in the world.

Howden has been at the leading edge of industrial fan and air moving equipment design for more than 160 years. Operating from bases in 26 countries spread across every continent, we offer a truly global service. Our ventilation equipment is installed in some of the world's longest tunnels.

Revolving Around You™

In tunnel ventilation throughout the world, Howden is the partner of choice.

Maintaining a safe supply of air in tunnels demands absolute reliability. When the supply of fresh air is compromised, the effect on driver alertness and safety can be rapid and hazardous.

There are two fundamental systems of tunnel ventilation, longitudinal and transverse.

In longitudinal ventilation, all of the air enters and leaves through the ends of the tunnel, and it is moved along the space by jet fans.

In transverse systems, air is injected into the tunnel by large axial fans at set points along its length.

Howden manufactures both types of fan systems, and can advise on optimum arrangements for tunnels of all sizes and situations. Our fully costed proposals include predicted operating costs as well as capital expenditure and full technical specifications. Above all, we understand the absolute, overriding importance of reliability as the foundation of safe operation.

Applications knowledge

We know that before we design any fan, we have to fully understand what its duties will be. Through meticulous investigation, we eliminate the unexpected and make sure that the performance it delivers will meet or exceed customer expectations. In addition to road transport tunnels, we are widely experienced in the design and installation of metro and train tunnel ventilation, test rigs, temporary ventilation for tunnel construction phases, and industrial fans of all kinds.

Service

Our commitment to service is absolute. We will be ready to help with support, spares and upgrade advice throughout the life of the equipment. And, with our global presence, we can have expert engineers and technicians on-site quickly, no matter how remote the installation.

Global experience, local service

Howden fans are known for outstanding efficiency and reliability under the most demanding conditions. With a range extending from less than half a metre to more than six metres, they meet the requirements of every tunnel ventilation system. Our ventilation equipment is in constant operation on every continent, providing safe conditions in some of the world's most challenging underground roadways.

Advice

Our immense expertise, gathered from designing and installing tunnel and other ventilation systems over many decades, is at the disposal of every prospective customer. The right advice at the start of a project can bring significant savings in time and cost.

Research and Development

Our continuous investment in Research and Development is driven by the needs of our customers. We constantly explore ways of improving reliability and energy efficiency, for example by using model tests.

Design

Because no two tunnels are ever the same, every ventilation project is a bespoke project. From the specifications provided by customers, we custom design each fan to deliver the volume and pressure of air required, and to provide the thrust required at set locations throughout the tunnel.

Manufacture

Industrial axial fans are finely balanced, precision engineered products. Howden manufacturing combines traditional craftsmanship with state-of-the-art technology, and every component is quality tested before leaving our premises.

Installation

We never consider a job finished until all fans have been tested at full speed and the whole system has been commissioned. During this process, we can be as hands-on as the customer chooses, from supervising the activities of other contractors to providing a full turnkey service.

Turnkey capabilities

We can carry out a tunnel fan project as a full turnkey operation, from design to commissioning and including all civil works, subcontracting and supervision. We can take responsibility for scheduling, logistics and cost management, giving customers the advantage of dealing with a single supplier.

Control and management software

In addition to the fans themselves we can supply, install and test monitoring and control systems to keep the fan in safe operation, and we can adjust fan status and speed to maintain a safe, healthy environment.

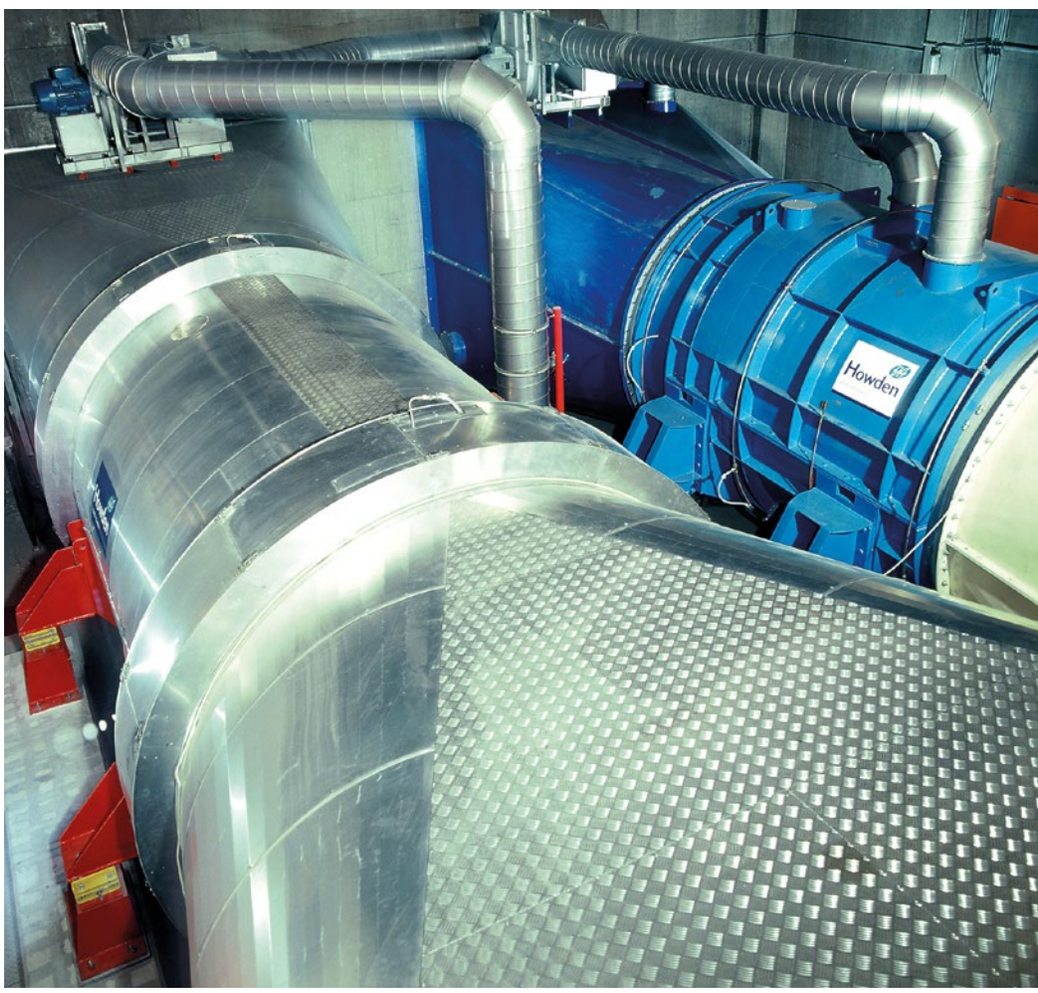
Axial fans

Axial fans are the preferred technology where large volumes of air are required, and are ideal for tunnel ventilation using transverse or semi-transverse techniques. They are also ideal for smoke extraction duties.

Axial fans are available in a wide range of sizes and types. They can be supplied with either fixed blades, in which the angle of the impeller blades is set when the rotor assembly is manufactured, or with variable pitch blades which can be adjusted to optimise the volume flow to the prevailing conditions.

In some variable pitch fans, any adjustment has to be carried out while the fan is at standstill. Like fixed blade fans, these units can then be controlled by variable speed drives to deliver the air volume required.

Maximum control and operating efficiency, however, can be achieved by using fans in which the blade angle can be adjusted while the fan is in normal operation. Using a hydraulic or electromechanical control system, the fan performance can be precisely and instantly governed without any disruption to service, and while the motor is running at its optimum design speed, offering the most energy efficient, and cost-efficient way of matching air volume to real-time needs.

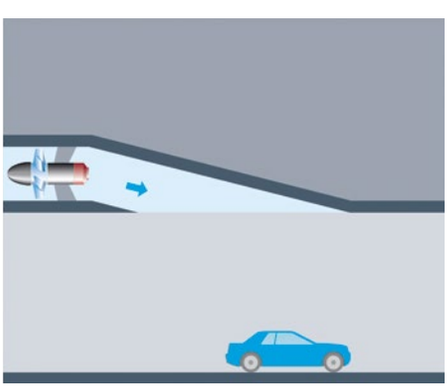


Configuration options

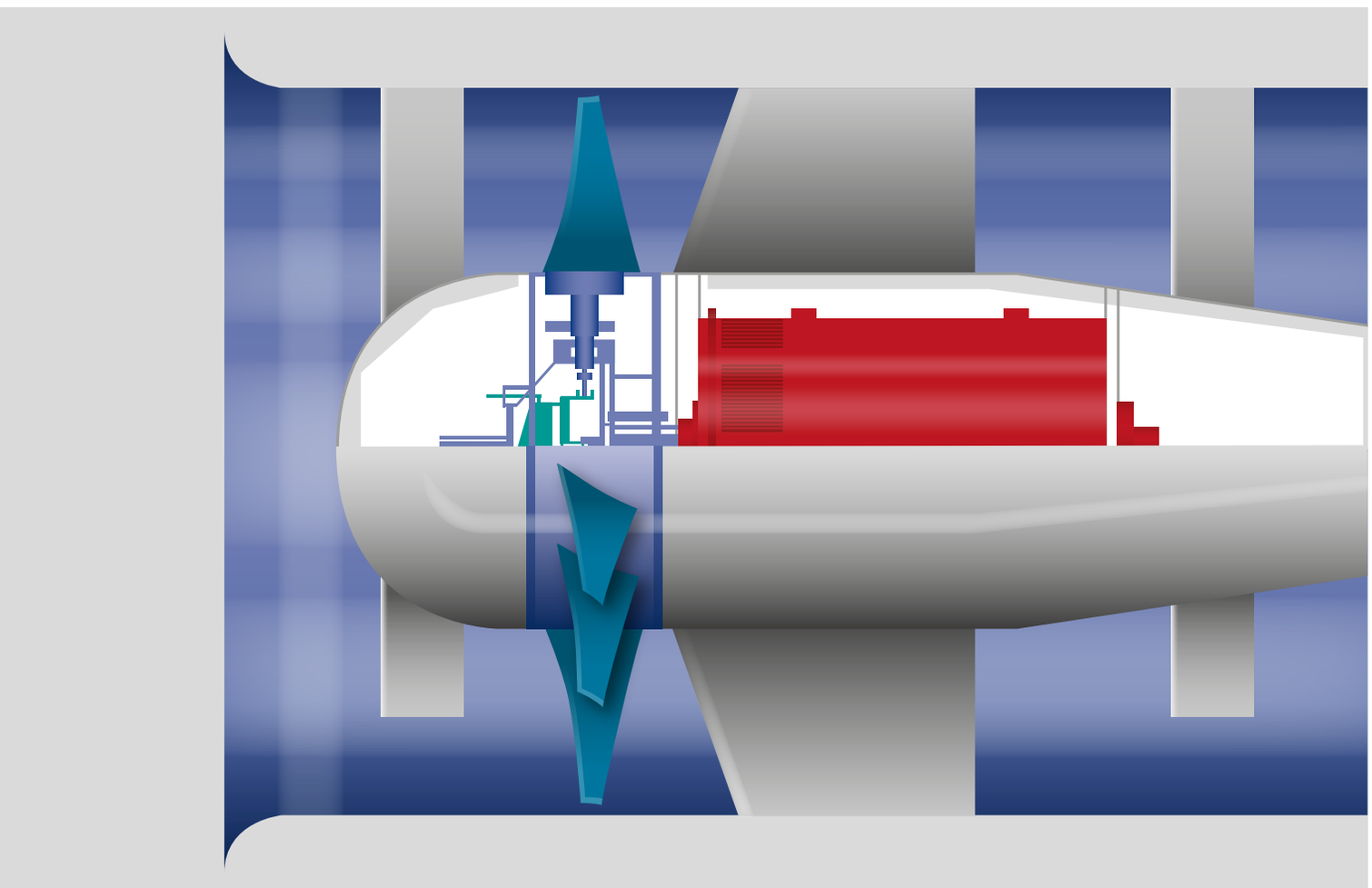
Howden axial fans can be supplied with a choice of motors, including soft start, star delta and variable speed options. We can also provide units capable of reversible operation when required.

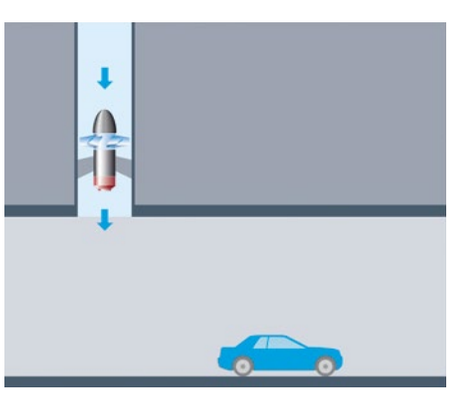
Axial fans offer

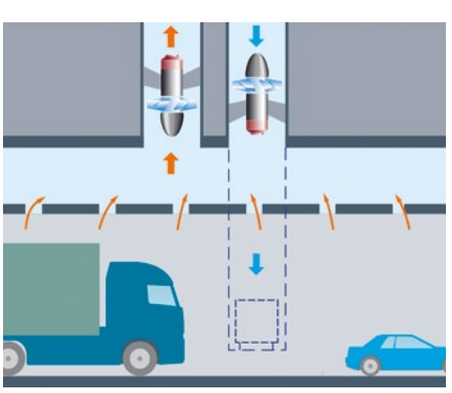
- High efficiency
- Low noise
- Robust, durable construction
- High reliability
- Low maintenance
- Flexibility in responding to changing requirements
- A wide choice of sizes
- Excellent corrosion protection

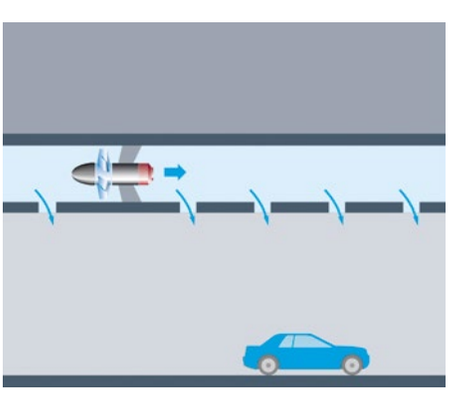


Axial fans are capable of running at 250°C (requirement in Switzerland) and at 400°C (rest of Europe) in case of fires/emergencies for two hours as per EN 1201 part 3.







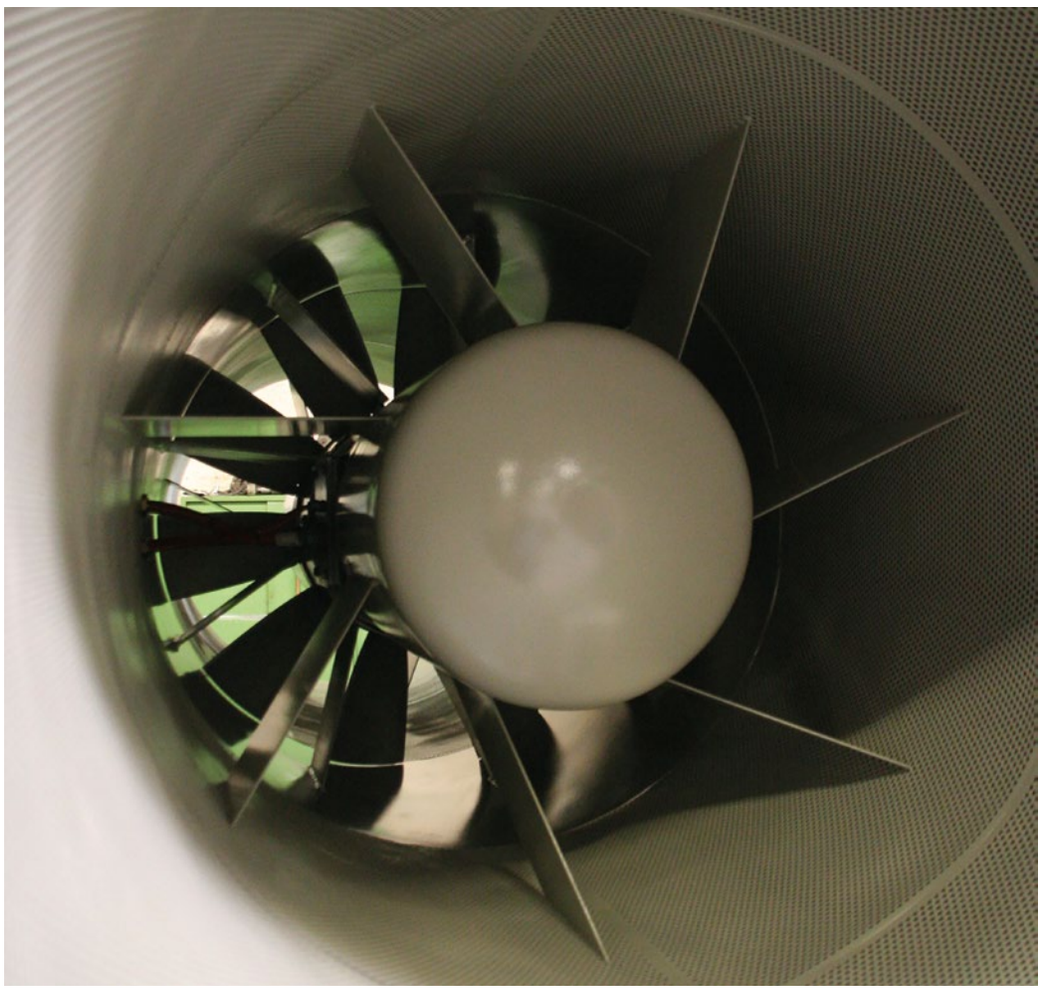


Jet fans

Jet fans are designed to produce the greatest possible ratio of thrust to power consumption. Consisting of axial fans in a special configuration, they are primarily used in longitudinal ventilation applications and for smoke extraction.

We can supply two types of jet fans, each suited to particular tunnel conditions. Each type is available in a range of standard sizes, all incorporating rotors that are dynamically balanced to eliminate vibration and noise. They are fitted with effective silencers, to offer outstandingly quiet operation, and protected against corrosion by either the use of stainless steel or duplex coating.

Jet fans are normally suspended from the tunnel wall, and can be attached by either rigid mounts or flexible mounts with dampers designed to suit local condition. Both types of fan are fitted with lifetime lubricated bearings and suitable for variable speed drives and soft start and star delta options.



APR fans

APR fans feature symmetrically profiled blades, which are equally effective operating in either direction, and incorporate an internal cone at the opposite end of the casing from the motor to ensure that the thrust generated will be almost the same whichever its direction. Because they add enormous flexibility to the system, APR jet fans are useful in tunnels with traffic flowing in both directions, or where wind conditions can have a significant impact on airflow in the tunnel.

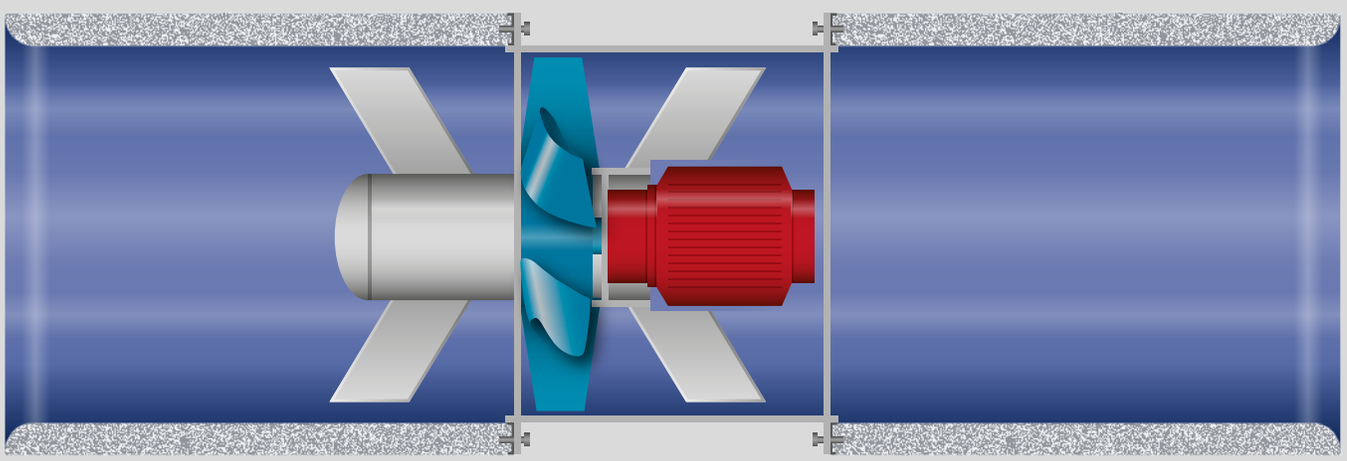
APA fans

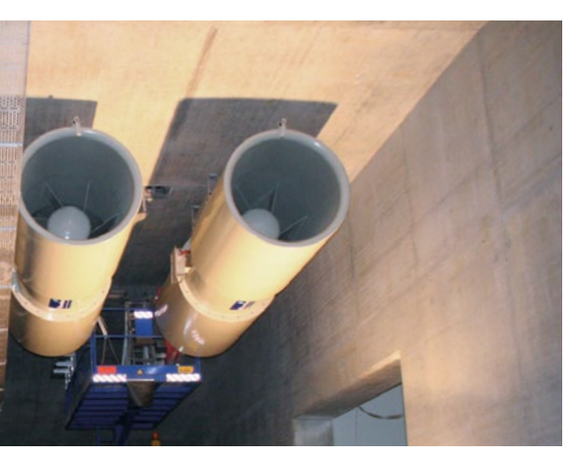
APA fans incorporate impellers with asymmetric blade profiles designed to maximise thrust in one direction, and offer a very high airflow for the energy consumed and the size of the fan unit. They are eminently suitable for tunnels where traffic flows in one direction only. While they can be used to provide a reversed operation, the thrust provided is much reduced.

Jet fans offer

- High thrust with low power consumption
- Low noise operation
- Low maintenance
- Easy installation with no separate buildings or ductwork
- Excellent corrosion resistance
- An exceptionally small physical profile
- Choice of mountings to suit local conditions

> Jet fans are capable of running at 250°C (requirement in Switzerland) and at 400°C (rest of Europe) in case of fires/emergencies for two hours as per EN 1201 part 3.





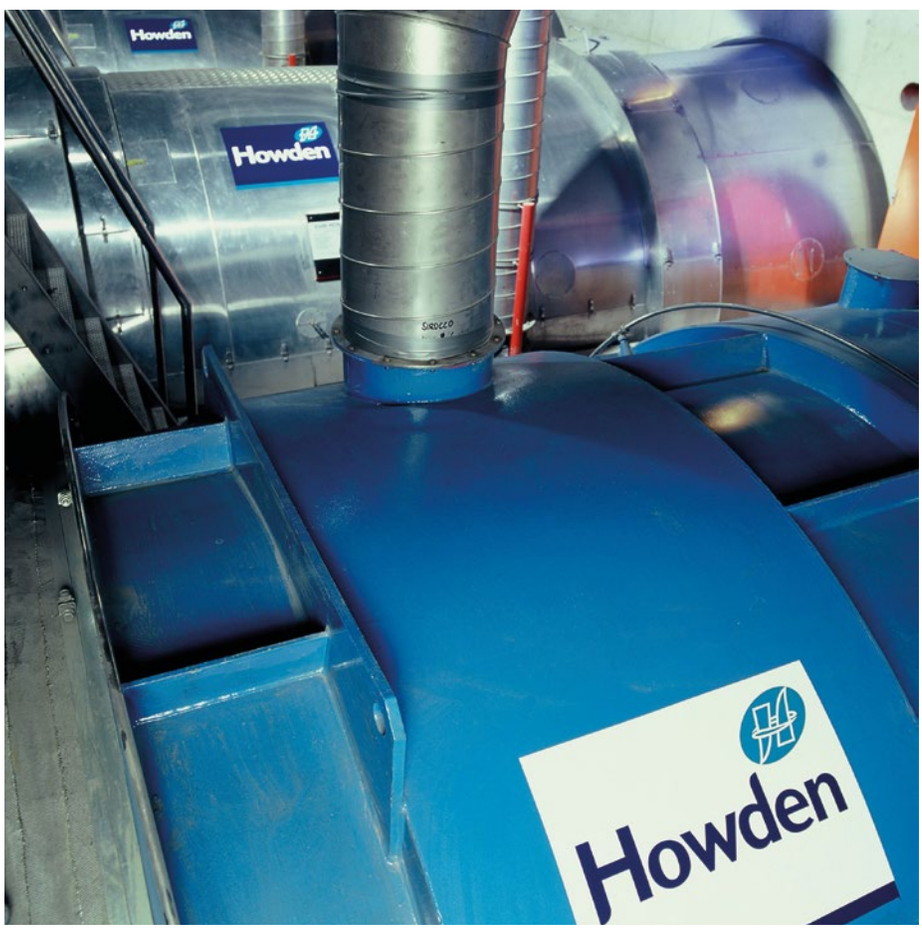
Aerodynamic testing

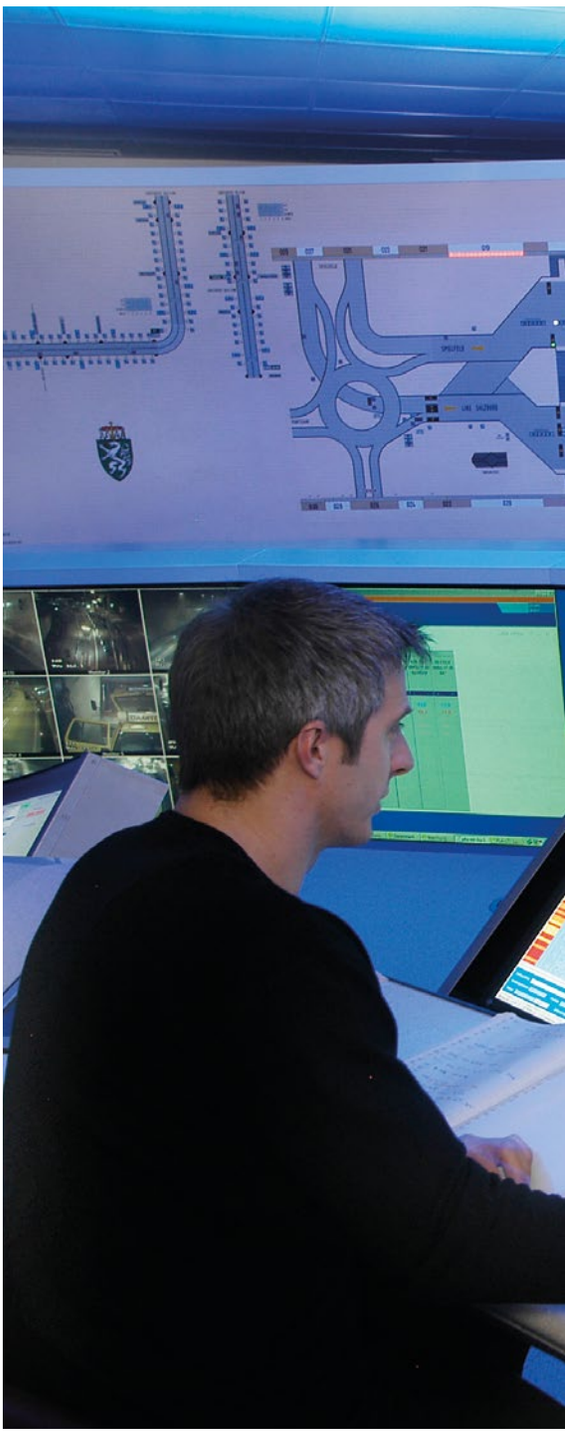
In jet fans, the criterion for excellence is the ratio of thrust generated to power consumed. We have built a dedicated test rig to ensure that the actual, measured, thrust will comfortably meet the ventilation requirements set out by the customer.

Testing also allows noise measurements and power consumption measurements and tests are performed in accordance with standard DIN ISO 13350.

Longitudinal ventilation

In longitudinal ventilation systems, all the ventilation air enters the end of the tunnel, and is driven through by impulse transmission. Jet fans, placed close to the wall, take in a proportion of the total air flowing through the tunnel, and expel it at high pressure. The air leaving the fan contains considerable kinetic energy, and as this is disseminated into the rest of the air stream, the whole volume of air is drawn along.





Longitudinal ventilation is suitable for tunnels up to 2km long with traffic in both directions, although this may be extended to 5km with light unidirectional traffic that helps to drive the airflow. It is generally the most economic system, because there is no need for external ventilation buildings or infrastructure, and running costs are relatively low.

Monitoring and control

The volume of ventilation air required depends principally on conditions within the tunnel. Petrol driven vehicles lead to a build-up of carbon monoxide, while diesel engine exhausts contain particulate matter that impairs visibility.

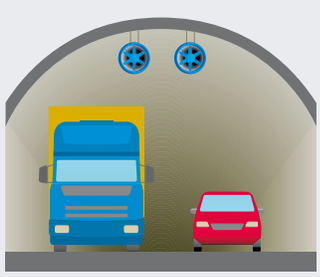
Optimising the fan position

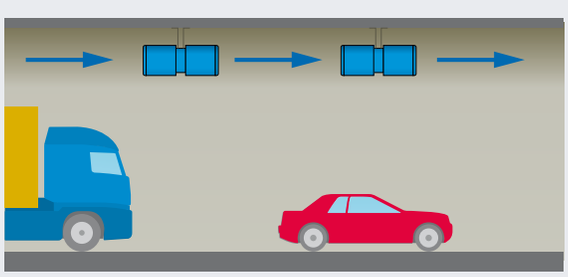
Because jet fans are aligned with the airflow through the tunnel, they must be installed reasonably close to a wall or, more usually, the tunnel roof. Their small physical size makes it easy to place them outside the traffic space, although in restricted conditions they can be successfully installed in niches set into the wall or roof.

They can be arranged singly or in groups of two or more, with gaps of at least 50m between groups to allow the air leaving the fans to draw the greatest possible mass of air into the flow.

When air leaves the fan at high speed, there are losses in thrust due to friction with the surface nearest the fan, and the losses are worsened when the fan is placed in a niche.

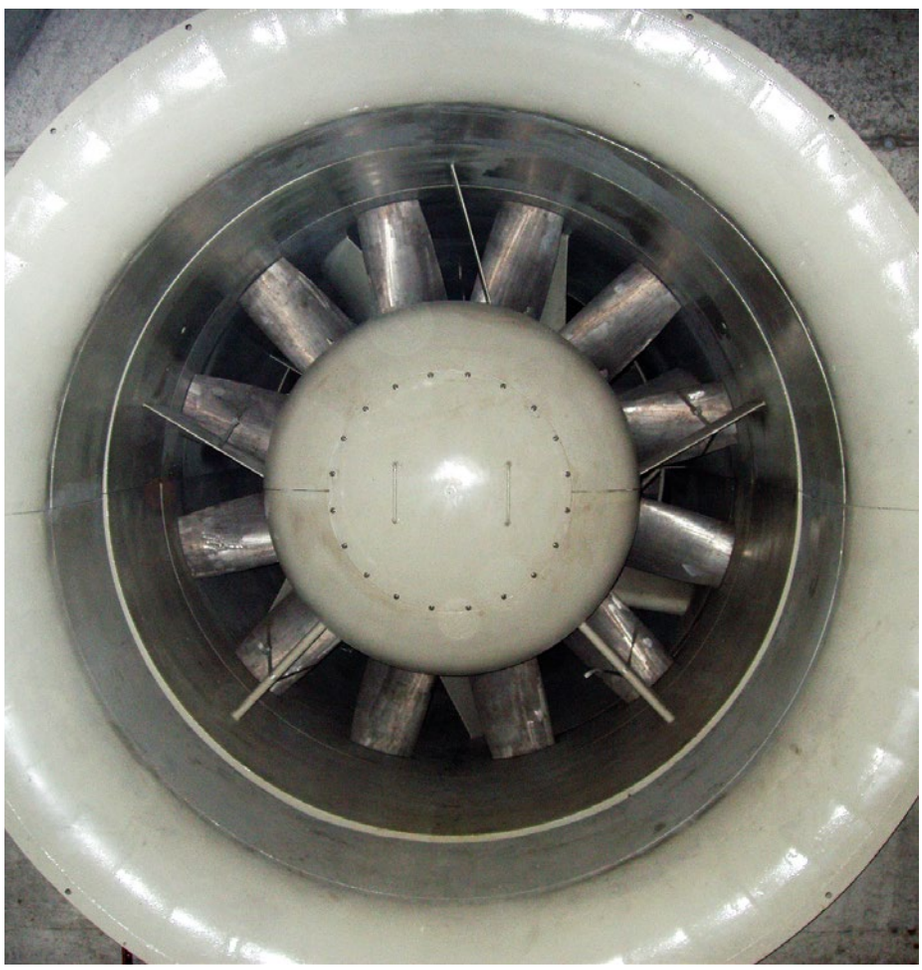
We have carried out an intensive research programme to investigate ways of minimising the effects of friction, and while each case must be assessed individually because of the large number of variables involved, we can often significantly reduce friction by using jet deflectors.





Transverse ventilation

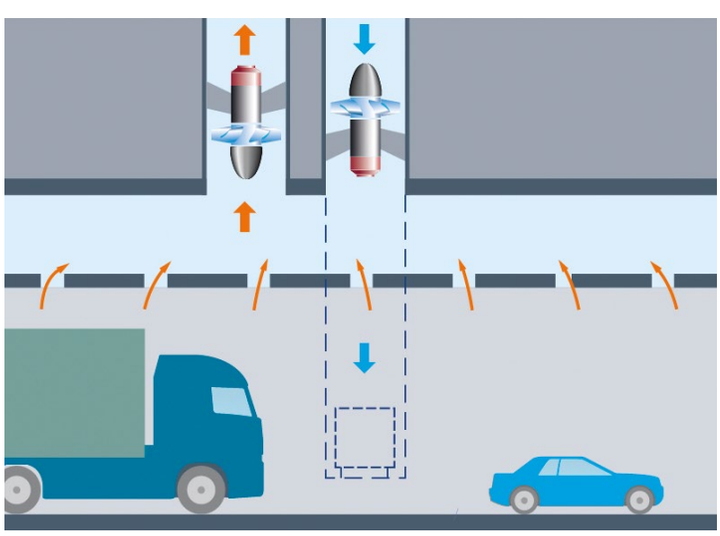
In transverse ventilation, air is delivered into the tunnel at intervals throughout its length by large axial fans. The air is normally introduced through vents low in the tunnel wall, just above the road surface, and removed through exhaust ducts higher in the wall or on the roof, to allow the best possible air circulation.

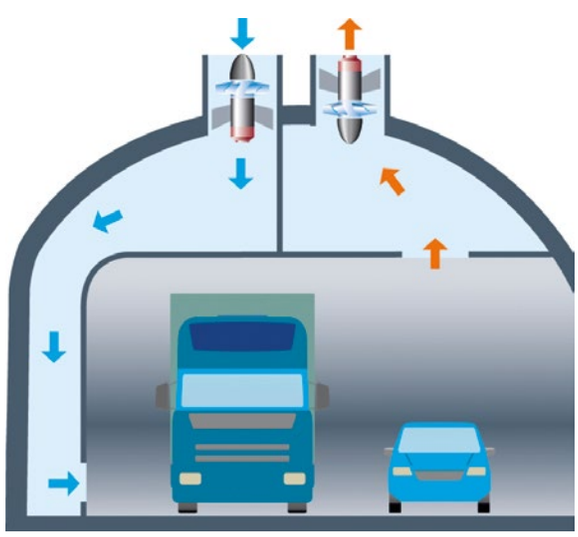


Transverse ventilation is suited to tunnels more than 2km long, and by adding more ventilation stations at intervals along the tunnel length it can be designed to cope with the longest tunnels or heaviest traffic. Because it requires more infrastructure, including one or more ventilation stations above ground and ducting to distribute the air, transverse systems are more expensive to construct and maintain.

They are, however, largely resistant to winds or other meteorological conditions, and unaffected by vehicle movement. This makes them the optimum choice for all road tunnels except short unidirectional tunnels.

Transverse ventilation systems can be monitored and controlled in the same way as longitudinal installations.



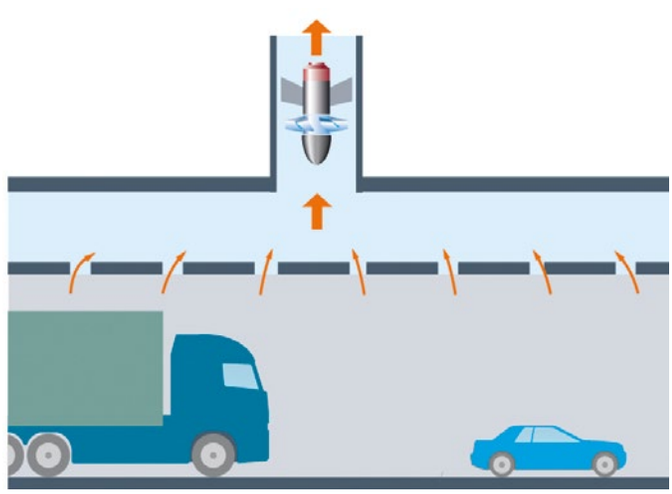


Semi-transverse ventilation

Semi-transverse ventilation combines aspects of both longitudinal and transverse systems by using the entrances of the tunnel as well as fan-induced airflow through ducts in the tunnel.

It is most effective when configured to use fans for exhaust extraction, with all fresh ventilation air entering through the tunnel entrances. However, instead of passing through the whole tunnel, the contaminated air is extracted at exhaust portals spread at uniform intervals along the tunnel length. Semi-transverse systems are suitable for tunnels of intermediate length, carrying medium to heavy traffic.

The construction and operating costs are lower than those for a fully transverse system, and the ventilation levels can be governed in similar ways to the two principal techniques. Where necessary, jet fans can be introduced to move air between the exhaust ducts.



Lifetime support

Every Howden product is backed by an absolute commitment to service, spares and support throughout its lifetime. We regard every contract as the beginning of a lasting partnership

In addition to regular maintenance and the supply of OEM spares designed, we are always on hand if an emergency response is required. Our global structure means we can have fully trained engineers on-site, anywhere in the world, within a very short time. When required, they will have access to the workshops and manufacturing facilities they need quickly and efficiently.

We are also happy to provide advice and information when circumstances change. Increased traffic loadings may mean that a ventilation system is becoming overburdened. New technologies often bring opportunities for more energy efficient systems. Whatever the development, we can offer expert advice on the best course of action.

We are also committed to the highest standards of quality, environmental protection, health and safety in all our products and services. All our products and spare parts meet or exceed every applicable international standard.

Our list of accreditations includes

- Quality Management System ISO 9001:2008
- Environmental Management System ISO 14001:2004
- Health and Safety Management System OHSAS 18001:2007
- Safety Certificate for Contractors 2011
- Smoke and Heat Control Systems Part 3: Specification for powered smoke and heat control ventilators (fans) EN 1201 part 3

In the end, however, complete customer satisfaction is one of the most important benchmarks we know.

Revolving Around You™

Howden

www.howden.com

At the heart of your operations

Howden people live to improve our products and services and for over 160 years our world has revolved around our customers. This dedication means our air and gas handling equipment adds maximum value to your operations. We have innovation in our hearts and every day we focus on providing you with the best solutions for your vital operations.

Howden Axial Fans ApS

Industrivej 23
DK-4700 Næstved
Denmark
Tel: +45 5577 6262
Fax: +45 5572 3343
Email: howdenaxialfans @howden.com

Howden Axial Fans GmbH

Habsburgerstr. 7
DE-73432 Aalen-Ebnat
Germany
Tel: +49 7321 55049 00
Fax: +49 7321 55049 49
Email: howdenaxialfans @howden.com

Revolving Around You™