

ExVel[®] Turbo Fans

Versatile custom designed units for process-critical applications



Revolving Around You™

The peripheral speed of a large ExVel[®] impeller can often exceed 1000 km per hour, faster than the speed of a jet airliner.



Every ExVel[®] unit that leaves our factory is a custom-built unit, individually designed to the customer's unique specification. Some have been in operation since the 1970s, and if it were a wheel an ExVel[®] impeller installed 40 years ago would by now have travelled around 350 million kilometres, well over the distance to the sun and back. Outstanding engineering.

Revolving Around You[™]



An ExVel® impeller probably has the highest tip speed of any welded impeller ever manufactured.

The energy contained in the impeller assembly is colossal. That's one of the reasons they are engineered to the highest standards of rigidity and strength.

The other reason for their outstanding robustness is that ExVel® turbo fans play an essential, process-critical role in a wide range of industrial applications. Originally developed to meet the extreme challenges of the mechanical vapour compression process, they are manufactured to the highest standards of reliability and performance because our customers need to know they can depend on them without question.

By operating at previously unattainable speeds, ExVel® extends fan capabilities into new areas of pressure and flow volume. The technology has been developed to meet the need for ultra reliable operation that extends the upper limits of fan and blower performance. Delivering up to 160 cubic metres per second of flow, or a pressure

rise of up to and beyond one bar in standard atmospheric conditions, it offers excellent controllability and turn-down capabilities. With the option of combining single units in series, it is capable of meeting duties and specifications that are normally handled by compressors, and doing so with outstanding economy.

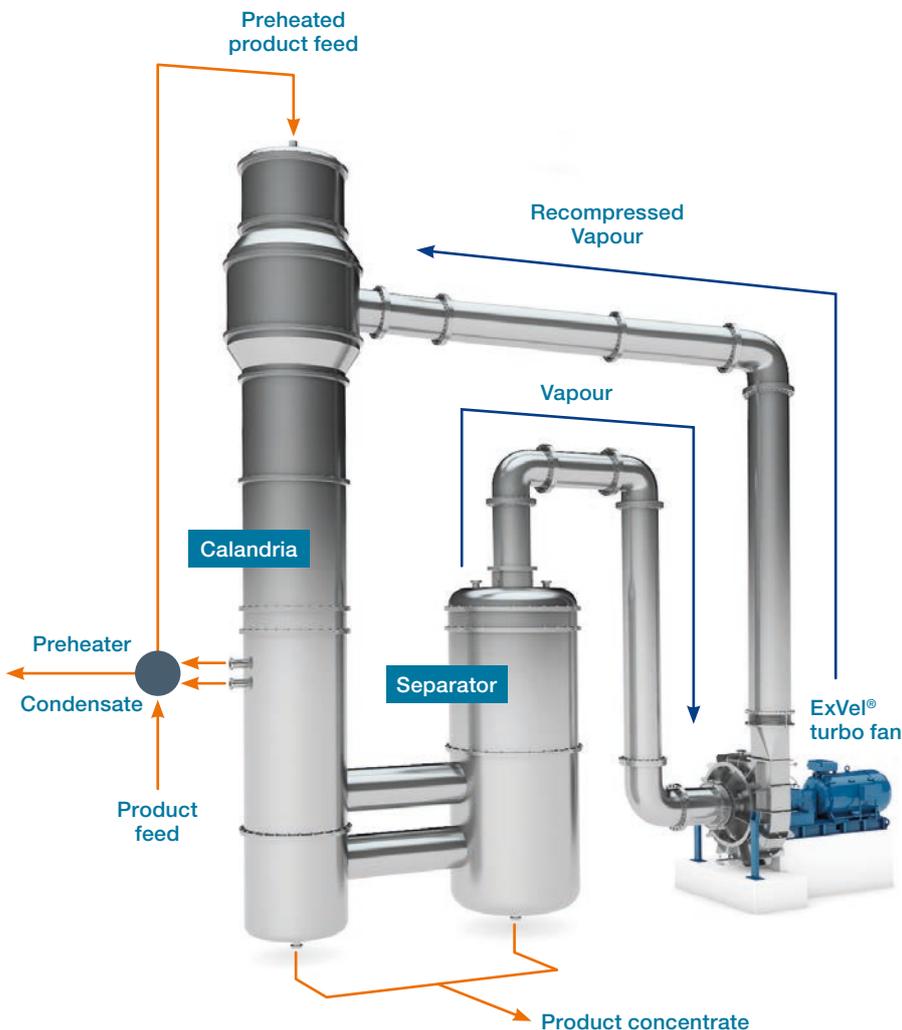
Because every unit is designed to meet the customer's precise specification, ExVel® technology is superbly versatile with a wide range of industrial process applications. Offering complete process gas isolation, immensely strong construction and a choice of impeller materials capable of coping with corrosive gases, ExVel® is continually finding new applications across an enormous range of industrial applications, from chemicals and food processing to oil extraction.

Modular design with multiple applications

The versatility of the ExVel® design makes it the clear choice in virtually any industry where there is a need for high-volume gas handling with high pressure differentials.

ExVel® turbo fans combine competitive cost with an outstanding track record of long plant life and reliability. They offer complete isolation of the process gas and a robust ability to handle corrosive gases. These factors are identifying ExVel® as the first choice across the oil and petrochemical industries, chemicals manufacturing, food processing and many other activities where long-term, round-the-clock operation is essential and unscheduled stoppages have expensive consequences.

More than 2000 ExVel® turbo fans are today installed around the world, performing vital roles in a wide range of applications. A reference list is available on request.



The MVC or MVR process

Mechanical Vapour Compression or Recompression works by re-using the heat energy contained in vapour. This energy would otherwise be wasted.

In a typical falling film evaporation plant, feed liquid is distributed across a large number of vertical tubes, and as it flows down them it forms a thin, descending layer. The tubes pass through a jacket of high temperature vapour that condenses on the outside of the tubes, releasing latent heat and raising the temperature of the feed liquid.

By the time the liquid reaches the bottom of the tubes much of the water has been evaporated off, leaving a concentrated, viscous liquid. The water that leaves the tubes as vapour now contains most of the energy that was initially fed in.

This vapour is fed through an ExVel® turbo fan which raises its pressure and temperature so that it can be fed back into the system to evaporate more feed liquid. The system is a highly efficient and cost-effective way of re-using heat energy that would otherwise be lost.



Developed for the demands of Mechanical Vapour Compression or Recompression

The ExVel® turbo fan was initially developed to meet the rigorous demands of the Mechanical Vapour Compression process. This is a technique, developed in 1980, that recycles the vapour created during the evaporation process and re-uses the energy it contains. The dairy industry in Finland was an early adopter of the technology, and found that the process brought energy savings of the order of 90%. MVC soon found a role in a broad range of processes where a product goes through an evaporation stage. The technique is equally valuable where the end product is the concentrated fluid, such as condensed milk, or where it is the water itself, for example as part of a water recovery and re-use process.

ExVel® turbo fans are already widely used in

- Dairy industry
- Food processing
- Starch and sweeteners production
- Oil and gas
- Pulp and paper industry
- Water recovery / Zero liquid discharge (ZLD)
- Utility water treatment
- Desalination and distillation
- Renewable fuel production
- Pharmaceuticals industry
- Chemical industry

The optimum choice for other applications too

Robust reliability and dependable performance make ExVel® turbo fans the natural choice for many applications and processes, and they are widely used in a range of air or gas circulation, pressurisation or exhaust roles where uninterrupted service is essential. In formaldehyde production, for example, they are specified to undertake recirculation and pressurisation duties in the FORMOX™ process by Johnson Matthey Formox, the world-leading company who developed the technology.

Proven reliability in challenging environments

For more than a decade ExVel® turbo fans, many of them exceptionally large units with motors exceeding 4 MW, have been used in the Steam-Assisted Gravity Drainage process in oil sands projects. Steam injected into the oil sands reservoir reduces viscosity, allowing the bitumen to be pumped to the surface. By using MVC evaporators to provide distillate for the boilers that generate the steam, high levels of water recycling and energy efficiency can be achieved. Working in extreme conditions, ExVel® has become the clear market leader based on an excellent safety, reliability and performance records. Around 40 ExVel® units have now been sold to SAGD applications.



ExVel® – packaged to perform and go on performing

Every ExVel® turbo fan is a highly evolved, bespoke unit. It is normally supplied as a skid-mounted package tailored to meet the customer's specification in the most effective, efficient way possible.

The materials we use in the manufacturing of ExVel® turbo fans are selected for their suitability for the final duties of the unit. While the list below is typical, we can offer several other options to meet individual project demands.

Impeller

Duplex and super duplex stainless steels EN 1.4462 (Grade 2205) and EN 1.4410 (Grade 2507)

High yield strength structural steels S690QL

Casing, inlet and diffuser

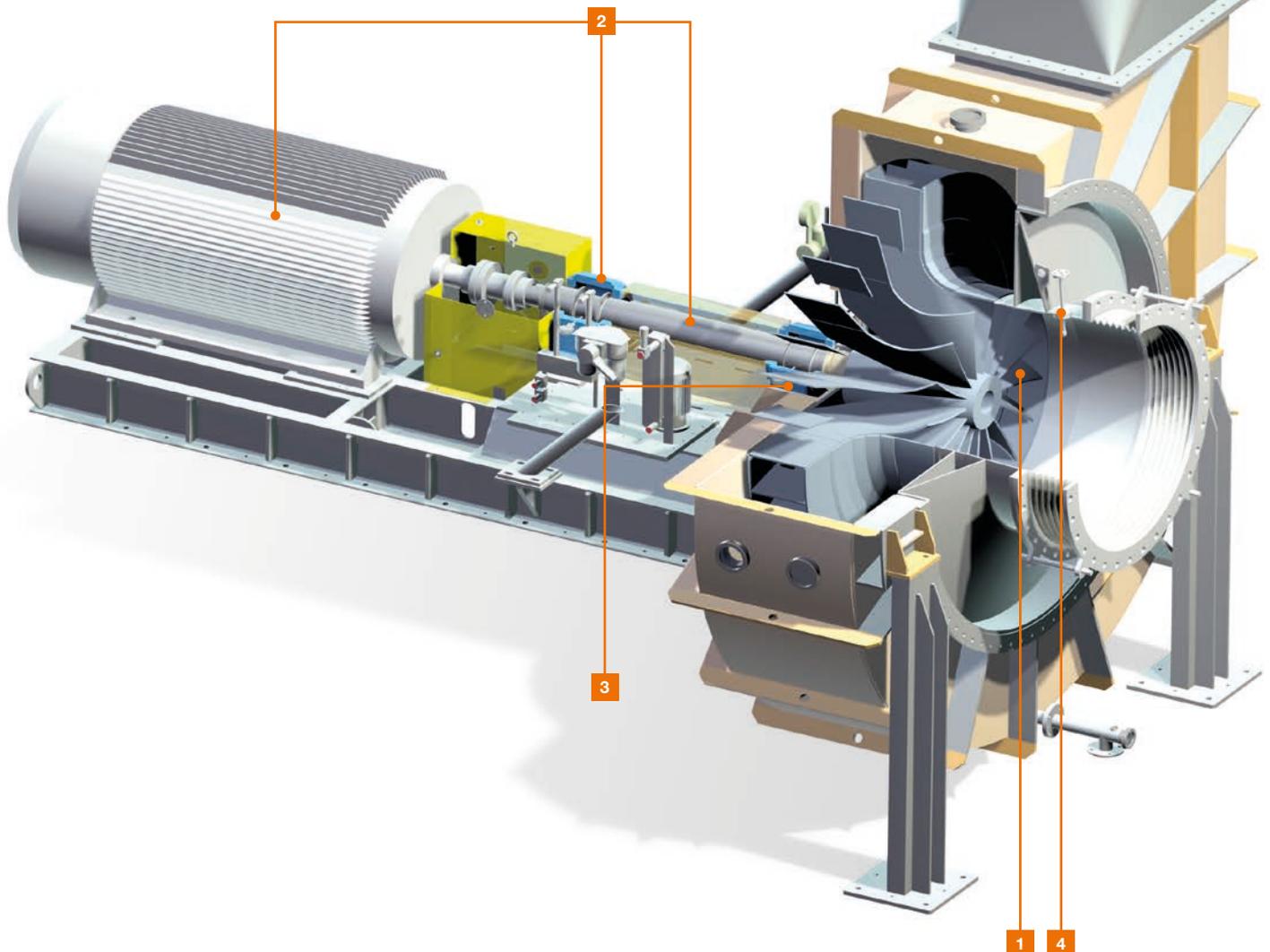
Duplex and super duplex stainless steels EN 1.4462 (Grade 2205) and EN 1.4410 (Grade 2507)

Austenitic stainless steels (EN 1.4307 (Grade 304L) and EN 1.4404 (Grade 316L))

Non-alloy structural steels (S235 and S355)

Pedestal

Non-alloy structural steels (S235 and S355)



ExVel® turbo fan features and options



ExVel® turbo fan impeller

1 Advanced impeller design

The ExVel® impeller is the product of extensive research that allows us to fine-tune each one to its individual demands and duties. High efficiency, full-length blades, either radial or backward curved to suit application and customer demands, maximise the energy imparted to the process gas, while intermediate radial blades add structural rigidity. The impeller uses an overhung closed-face design, with a flange manufactured from heavy plate steel, and the gas inlet geometry is designed to further reinforce the strength of the unit. ExVel® impellers are perfectly suited to abrasive and corrosive gases, and provide the optimum balance of performance and long operational life.

Labyrinth seals employ a system of carbon rings riding on a ceramic sleeve, providing a smooth contact that permits virtually friction-free high-speed operation and so eliminates problematic heating effects.

Buffer seals using a medium suitable for the process, such as demineralised water or clean process steam. A steam conditioning system to provide buffer steam can be added to the skid-mounted package at the customer's request.

Vacuum barrier configurations are suitable for applications where the process gas is clean and hazard free.

4 Water injection

The ExVel® turbo fan can be fitted with injection systems that introduce water, either continuously or intermittently, into the suction flow. Where the process gas has a tendency to deposit particulate matter on the impeller, this can effectively prevent a troublesome build-up. Cleaning chemicals may be added to assist with the washing process. Where the process gas is vapour, the injected water can be used for de-superheating purposes.

2 Drives and bearings

While other options are available to suit particular applications and customer preferences, ExVel® turbo fans are normally directly coupled to an optimised low noise, low vibration motor. We can provide standard or variable speed electric drives, fluid drives or steam turbine drive. In most situations no gearing is required, reducing the weight and noise levels as well as the cost, but geared options are available if preferred.

Designed as a single integrated unit

The ExVel® package is designed and assembled to meet customer specifications, and can include variable speed drive (VSD), inlet guide vane controls, flexible joints and full instrumentation and monitoring systems. Optional additions include acoustic enclosures for noise attenuation, and all ExVel® turbo fans meet the relevant national and international standards, including PED, ATEX and API 673 where appropriate.

Outline specification

Using advanced fluid dynamic modelling, finite element analysis, novel welding techniques and the latest bearing designs, ExVel® turbo fans offer impressive performance.

Motor powers up to 6 MW

ΔT increase up to 10°C in a single stage or 23°C in multiple stages, depending on the inlet water vapour conditions

Pressure increase exceeding 1 bar in air applications

Volume flow of over 160 m³/s depending on gas conditions

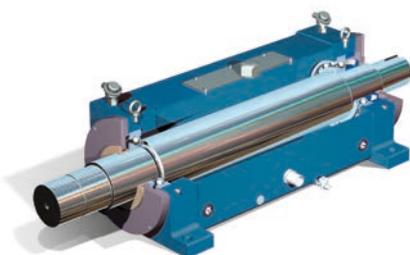
The choice of bearings is critical to factors like impeller balance, running speed and length of interval between servicing and maintenance. We have standardised on two bearing types, each bringing advantages in particular applications.

Anti-friction bearings are installed in a custom-designed monobloc housing with an integral oil sump, forced oil lubrication and labyrinth seals. The system means that oil is circulated constantly, even when no power is supplied, so the ExVel® can be coasted down safely in the event of outages.

Sleeve bearings allow the shaft to ride on a film of oil, with no mechanical contact between the shaft and its seating. The housing is horizontally split to allow easy access maintenance, and with proper care the sleeve bearing assembly is capable of lasting indefinitely.

3 Gas-tight operation

The ExVel® fan shaft is completely isolated from the process gas flow. We select the type of shaft seal to suit the process gas and customer preferences.



Oil lubricated bearing monoblock



Drive rod and seals



Sleeve bearing

Exceptional strength, exceptional safety

The ExVel® unit is engineered to perform at high temperatures and pressures, in either vacuum or over-pressure roles, with total containment of the process gas. Casing stiffeners have been added at key structural points to bring additional robustness, and the impeller material is selected to match the process gas and the conditions within the application.

Our engineers are familiar with the performance of the behaviour of corrosive gases at high temperatures and pressures, and can advise on the ExVel® configuration that will bring the greatest reliability and cost-effectiveness over the longest period.

Research, development and testing

The highly successful ExVel® modular design has been developed and refined using the most up-to-date fluid modelling software and finite element analysis, with theory always proven by practical trials. Our Espoo factory contains comprehensive, custom designed test-bed facilities that are used for research and development purposes. We use this unique installation to continually investigate and improve the aerodynamics of our impeller and casing designs, to ensure that ExVel® products continue to represent the leading edge of the technology. In addition to ensuring that we always offer the greatest energy efficiency and lowest emission levels, our research and development engineers also investigate operational improvements such as more advanced instrumentation, including remote monitoring options.

Turbo fan testing

All ExVel® turbo fans, even the largest units, pass strict mechanical Factory Acceptance Tests (FAT) under vacuum conditions before they leave our premises. These are often witnessed by the buyers and end users of the unit. Before we prepare a unit for transit, customers also have the option of commissioning more specific measurements of volume flow, pressure increase and efficiency using our unique test-bed installation.

Built to your specification and your schedule

We take great pride in both our leading edge products and our ability to meet customers' demands. Our manufacturing capabilities are designed to meet our customers' schedules and deadlines, not our own, allowing us to offer fast, reliable delivery of fully packaged and comprehensively tested units.





The right choice for unconditional process purity

More than 2000 ExVel® units are already installed throughout the world, in a very broad range of applications each with its own demands. For pharmaceuticals processing, for example, we can provide turbo fans with highly polished steel surfaces that meet the stringent criteria required for absolutely safe operation within clinically sensitive, contamination-free situations.



With ExVel[®], you buy more than a product

Every ExVel[®] turbo fan leaves our factory fully tested and with an unequivocal commitment to lifetime support based on Howden's global network of local service centres.





Our engineers have unique knowledge of ExVel® technology, and wide experience of their applications. We firmly believe that the best way of avoiding unscheduled downtime, extending the life of the equipment and ensuring continued, efficient and reliable operation is through a properly planned maintenance partnership designed to prevent problems rather than fixing them when they happen.

We can arrange a service and maintenance package tailored to your own needs and preferences. We can also arrange any work to suit your production schedules, carrying out inspections and maintenance work during your normal production breaks.

We can design a service agreement that includes any or all of the following

Training in the safe installation, operation and maintenance of ExVel® equipment.

Expert supervision of on-site personnel.

Diagnostic and troubleshooting activities on ExVel® turbo fans and their applications.

Creating an on-site spares list and ensuring it is kept properly stocked and up to date.

Retrofits and upgrades

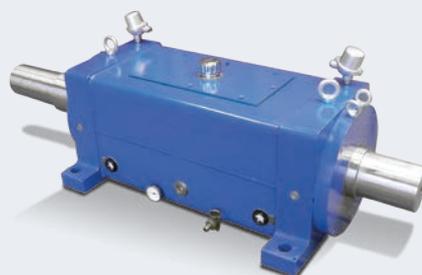
There can be many reasons for retrofitting an existing turbo fan. Improvements in technology mean that a new impeller in an existing casing may offer dramatically improved results. The duties and conditions in the plant may have altered, meaning that a different specification is required. Changing legislation around emissions, or the impact of energy costs, can make it imperative to enhance efficiency.

Whatever the reason for a retrofit, we can provide a comprehensive assessment of the options available, with a breakdown of both the capital costs of the project and an analysis of the energy savings and performance improvements that will be brought over the lifetime of the plant.

Upgrades and enhancements undoubtedly offer the most economical, fastest and least disruptive route to optimised performance.

ExVel® spare parts

From seals and bearings to complete impellers, carry a full one-year warranty, and are created using the original production drawing for your ExVel® package to ensure accuracy and compatibility.





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.



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