www.howden.com

The wastewater industry relies purely on performance

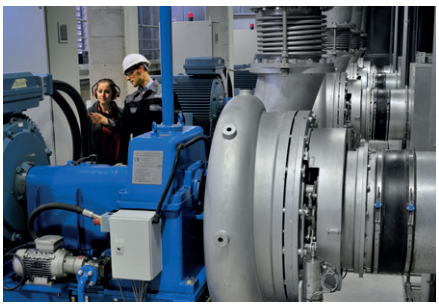
Aeration technology and control systems for wastewater plants

Revolving Around You™

In an industry where performance and reliability are essential, Howden's expertise and high efficiency compressors, blowers, and control systems are the clear choice.

Howden, founded in 1854, is a world leading supplier of compressors, fans and rotary regenerative heat exchangers for a large range of environmental and industrial applications. Whether pre-engineered or custom built for a specific application, our products are known throughout the world for their high levels of performance, reliability and innovation.

Revolving Around You™



Howden products are designed to deliver cost effective aeration solutions, optimising plant operations and lowering the life cycle costs.

Expertise built on experience

The modern wastewater treatment industry requires the movement of large volumes of air at low pressure and Howden products provide a reliable source of air for its key process. The compressors can account for over 50% of the power used in a treatment plant. Howden has been involved in wastewater treatment for many decades and is continuously developing blower technology in line with the industry's growing demands and the very specific needs of water treatment plants.

Howden has been supplying blowers to wastewater treatment plants for over fifty years. By combining our high efficiency blowers and compressors with our innovative digital solutions, we can offer the most advanced and efficient aeration systems available.

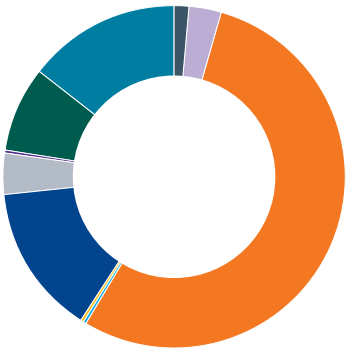
Our highly efficient compressor design, fitted with variable inlet guide vanes and variable vane diffuser system offers a unique high performance across the entire duty range.

We have an unrivalled range of blowers and compressors covering more than 15 frame sizes, with volumes up to 350,000 m^3/hr (206,000 CFM) with the option to install a unified control system that can optimise part-load operation.

Howden blowers and compressors provide air for key wastewater management processes.

Stand alone and bundled aeration systems.

Providing performance optimisation through Data Driven Advantage (DDA) enabled equipment.



Electricity requirements for activated sludge wastewater derived from the water environment federation energy conservation task force.

- **54.1%** Aeration control systems
- **3.2%** Clarification
- **1.4%** Grit
- **14.3%** Wastewater pumping
- **8.1%** Lighting and buildings
- **0.3%** Chlorination
- **3.9%** Belt press
- **14.2%** Anaerobic digestion
- **0.1%** Gravity thickening
- **0.5%** Return sludge pumping

Chart Source: "Water and Wastewater Energy Best Practice Guidebook", December 2006, provided by Focus on Energy, prepared by Science Applications Interface Corporation

The aeration power behind the treatment process

Howden is an invaluable source of application expertise as well as a supplier of complete, integrated air supply systems.

Minimising energy consumption

The need to minimise energy consumption, whether for cost or environmental reasons has become a factor of enormous significance.

The aeration system is responsible for by far the largest proportion of the energy consumption in any aerobic wastewater treatment plant. Howden equipment can provide the smallest footprint and highest flow rate.

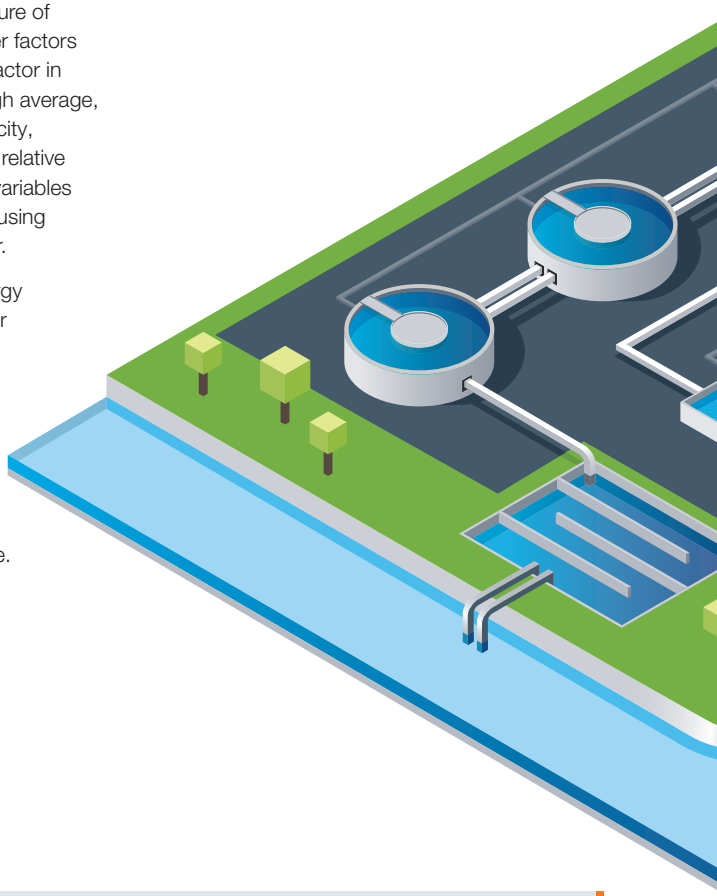
The exceptional performance is based on the Dual Point Control technology. Dual Point Control™ uses inlet guide vanes and variable diffuser vanes, located on the discharge of the impeller, acting as an extension of the impeller blade. The variable pitch diffuser vanes modify the flow of air in the blower internals and independently manage the two variables of power consumption via several continuously monitored process and environmental variables. The control methodology maintains the base isentropic efficiency at or near its maximum relative value across a wider range of flow and inlet temperature conditions, and significantly increases blower stability, allowing for wider turndown without surge. The direction of rotation and shape of the vanes are such that the capacity of the machine can be varied from 100% to 45% with virtually no decrease of efficiency.

The whole system is governed by a modern control system incorporating an easy-to-use human-machine interface. Over the lifetime cost of the equipment, Howden offers the highest cost savings through a combination of energy efficiency and the reliability offered by our 'built to last' philosophy.

Predicting real performance

Alongside the volume and pressure of air required, there are many other factors which affect operation. We will factor in the time the plant runs at full, high average, low average and minimum capacity, and add ambient conditions like relative humidity and temperature, and variables like energy availability and cost, using figures supplied by the customer.

Allowance can be made for energy price rises and maintenance over a 20-year operating period. Our modelling software precisely monitors real-time operational conditions, comparing them to figures supplied by the customer and providing an invaluable insight into savings over the equipment's planned life.



Proven efficiency

Howden high efficiency blower and compressor systems have been thoroughly researched and tested to provide flexibility and control even when plant conditions require greatly reduced capacity.

Our figures relate directly to the working efficiency of our aeration systems, once installed and running, they will be reflected with genuine energy savings.

All solutions, whether using single-stage geared compressors, single-stage turbo blowers, or rotary lobe (positive displacement) blowers, are designed to work at peak efficiency when they are running at full capacity.

When the capacity drops to normal operating levels, however, the efficiency may fall away dramatically. Of the three technologies, single-stage integrally geared compressors are the most efficient

Howden compressors, with their inlet guide vanes (or speed control), variable diffuser vanes and enhanced impeller design, have a clearly measurable advantage in maintaining excellent performance in the full operating range of 45% to 100% capacity. Howden technologies excel where plant conditions dictate operating away from the design point, providing significant operational benefits.

Rotary Blowers

Roots™ positive displacement blowers

EasyAir™ Turbo Blowers

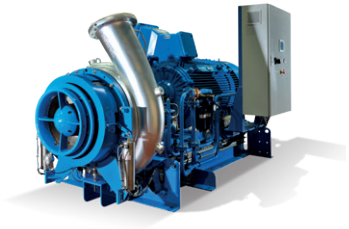
Howden high speed direct drive turbo blowers

KA Compressors

HV-Turbo™ integrally geared single-stage compressors

SF(G) Compressors

Kühnle, Kopp & Kausch™ (KK&K) integrally and separately geared single-stage compressors



SG Compressors

Howden integrally geared single-stage compressors

OIB Compressors

Roots™ overhung impeller with bearing housing compressors

Product portfolio

- Rotary blowers
- EasyAir™ Turbo blowers
- KA compressors
- SF(G) compressors
- SG compressors
- OIB compressors

Control systems

- Blower protection panels with available surge protection and prevention
- Blower pressure control systems
- Blower flow control systems
- Masterless control
- Master blower sequencing panel
- Dissolved Oxygen (DO) control systems
- Ammonia and nitrate control loops
- Most Open Valve (MOV) control systems
- Proportional basin flow control systems to maximise blower operating ranges

Exceptional technology with superior performance and control

Over the life of the plant, Howden blowers and compressors are by far the most cost effective technology available. Their capital cost will quickly be offset by lower energy expenditure, typically as early as the first 12 to 36 months of operation, leaving decades for the savings to grow.

Responsive integrated technology

Howden blowers and compressors typically run for decades without any intervention except minimal planned maintenance. Their robust success is a testimony to the quality of their engineering, and their track record is proven.

Howden offers a wide choice of frame sizes with a capacity flow of up to 350,000 m^3/hr (206,000 CFM), covering the most extensive duty range on the market. With the widest volume and pressure range available, Howden can supply a product to meet any demand our clients have – and with highest efficiency levels, Howden is the clear choice for water treatment plants.

Our blowers and compressors are designed to provide plant operators with efficiency across the actual operating range.

Exceptional turndown capability is built in as standard to ensure that when plants are operating at low load, the efficiency of the aeration system is unaffected. Howden products will maintain effectiveness through the full flow range, including the key 60-80% window and dropping to as low as 45% capacity when required.

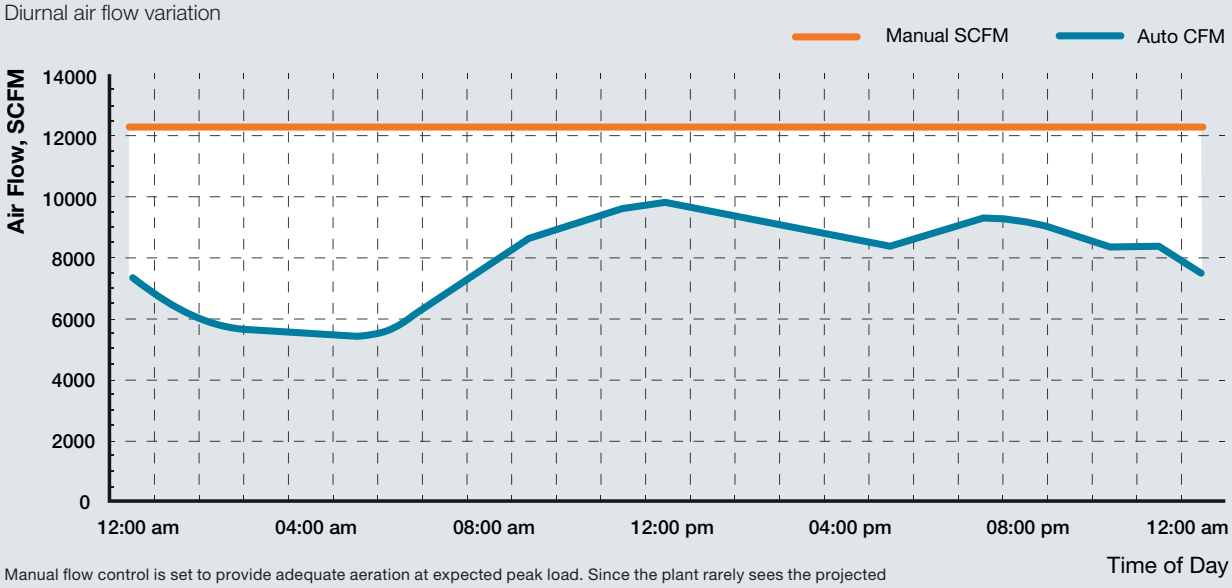
Effective control systems

Howden aeration controls are an energy efficient way to optimise the performance of your aeration process through automated direct flow control, Most-Open-Valve (MOV) technology and our proprietary control algorithms as compared to pressure control systems. Direct flow control with MOV logic will minimise the required system pressure thus, lowering the pressure and power demanded of the aeration compressor as compared to a constant pressure system.

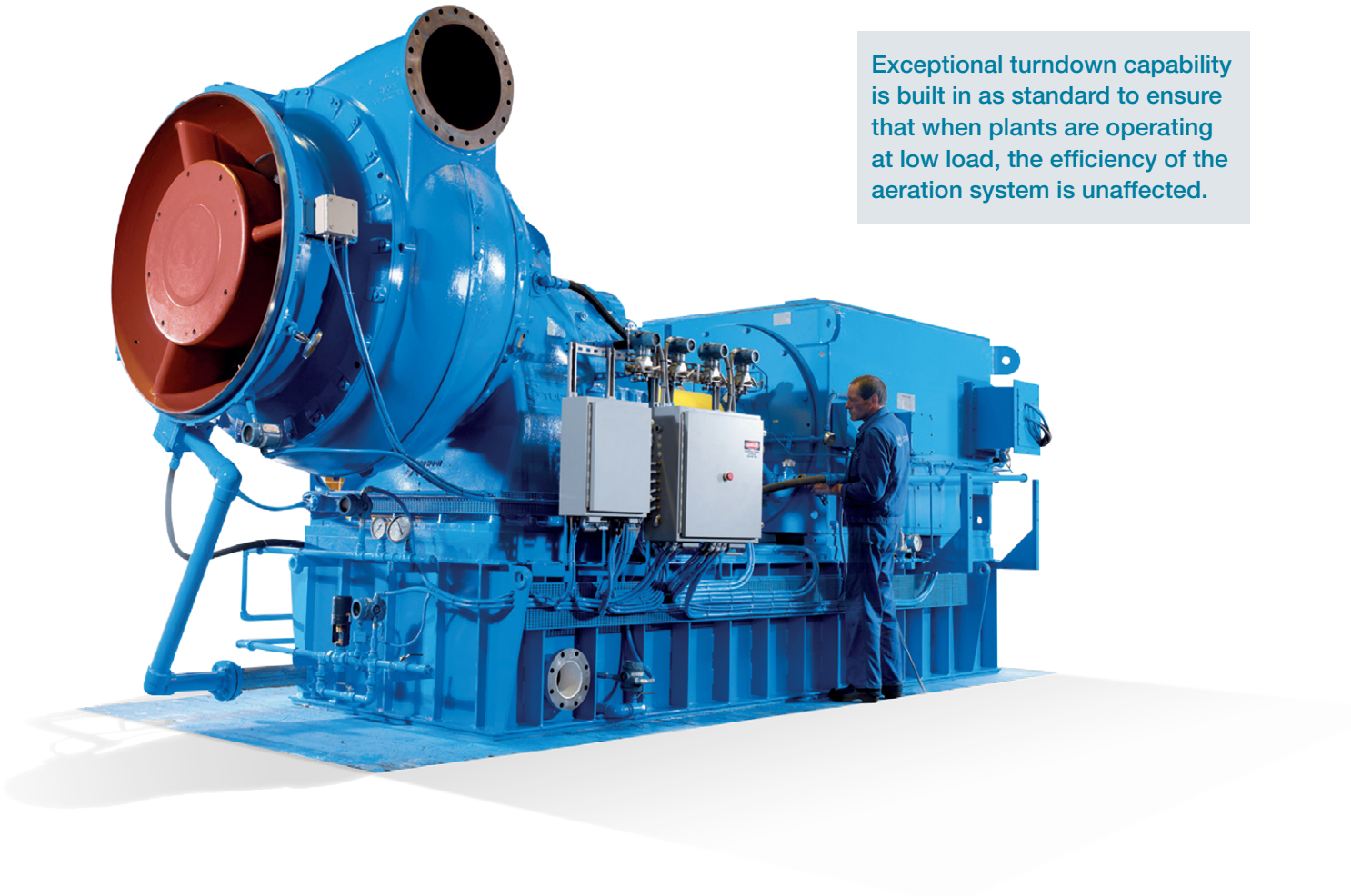
Howden aeration controls provide an effective means for determining precise aeration requirements demanded by your wastewater treatment system, reducing air and power demands of the aeration blowers.

Manual vs. automatic flow control

Diurnal air flow variation



Manual flow control is set to provide adequate aeration at expected peak load. Since the plant rarely sees the projected peak load, significant power can be saved by automating the aeration control system as depicted by the graph.

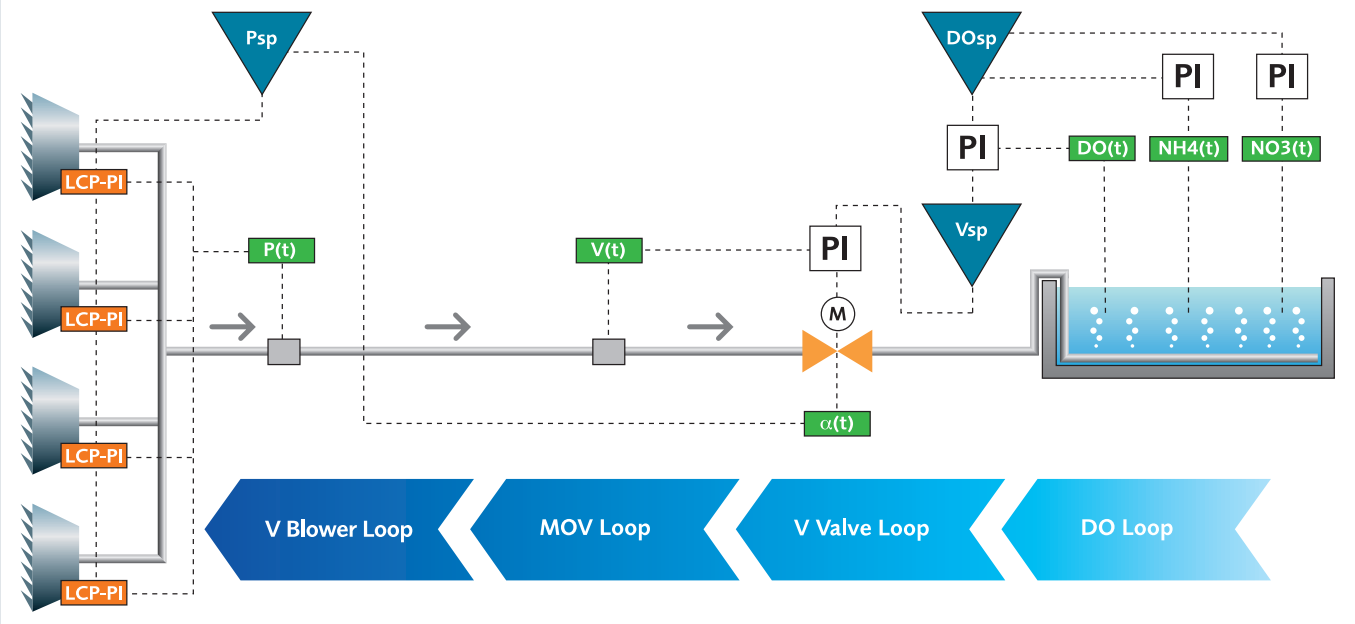


Exceptional turndown capability is built in as standard to ensure that when plants are operating at low load, the efficiency of the aeration system is unaffected.

BioActive Response System (BARS)

Howden's BioActive Response System combines the energy efficient Airflow Integrated Management (AIM) system with a downstream air distribution system in which four control loops interact in real time to produce the minimum air flow required to efficiently treat the water in the aeration tanks. By constantly maintaining the lowest possible main header air pressure (MOV control), BARS prevents unnecessary energy consumption and reduces running costs.

The first control loop sets the dissolved oxygen level set-point based on readings of the ammonium and nitrate levels in the water. The second loop uses the dissolved oxygen level (DOL) deviation from the DOL set-point as basis for setting the air flow set-point of the air control valves. The third loop sets the main header pressure (or airflow set-point) based on readings of the most open control valve position and finally the fourth loop controls the air flow produced by the on-line blowers.



Our products

Roots™ Rotary Blowers

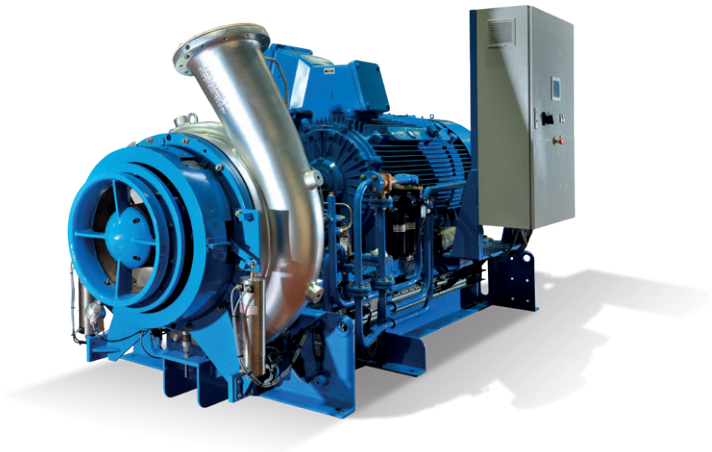
Howden is the longest continuously-run manufacturer of rotary positive displacement blowers. Our Roots blowers were invented in 1854 by the Roots Brothers, the first PD blowers available in the world. Howden offers rotary bi-lobe or tri-lobe blower designs with capacity up to 10,030 m^3/hr (5,900 CFM). Our blowers are reliable and sturdy, with noise and pulsation reduction (WHISPAIR) and integral discharge jet plenum for dry operation in high vacuum levels.

EasyAir™ Turbo Blowers

Howden's EasyAir™ Turbo combines leading aerodynamic technology, magnetic bearings and permanent magnetic motor technology to deliver a reliable, compact, highly efficient, single-stage blower with capacity up to 6,200 m^3/hr (3,650 CFM). The high efficiency and wide volumetric turndown capability is achieved through a combination of variable diffuser vane and speed drive technology.

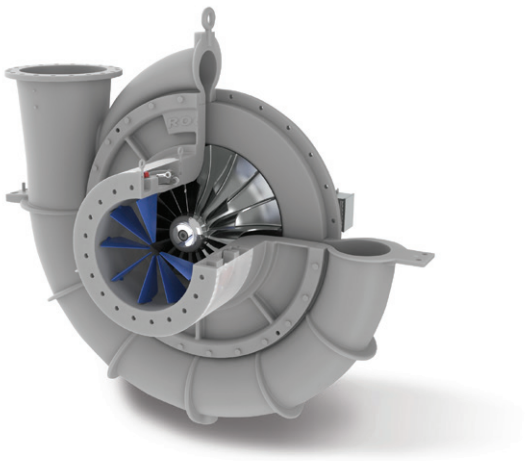
SG Compressors

Howden's SG compressors are available in a choice of 15 frame sizes with a capacity flow of up to 130,000 m^3/hr (80,000 CFM), covering the most extensive duty range on the market. With the widest volume and pressure range available, SG blowers maintain effectiveness through the full flow range, including the key 60-80% window and dropping to as low as 45% capacity when required.



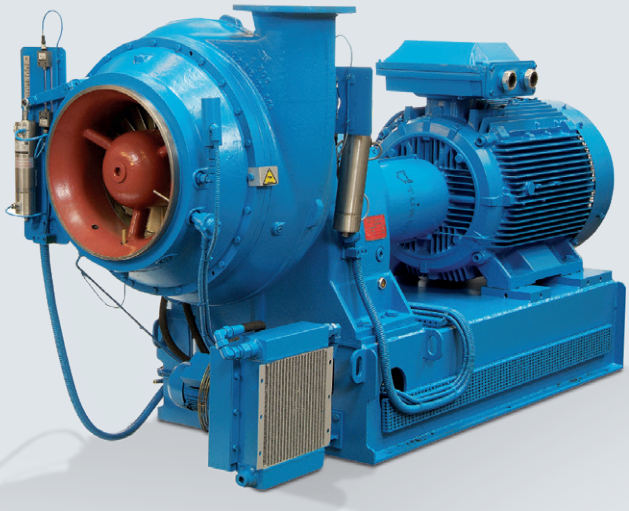
Roots™ OIB Compressors

Howden's OIB single-stage compressors feature an overhung impeller design, suitable for a wide range of applications with capacity ranging from 77,000 to 350,000 m^3/hr (45,320 to 206,000 CFM). In addition, OIB compressors are suitable for a variety of constant speed or variable speed drivers including electric motors and steam turbines.



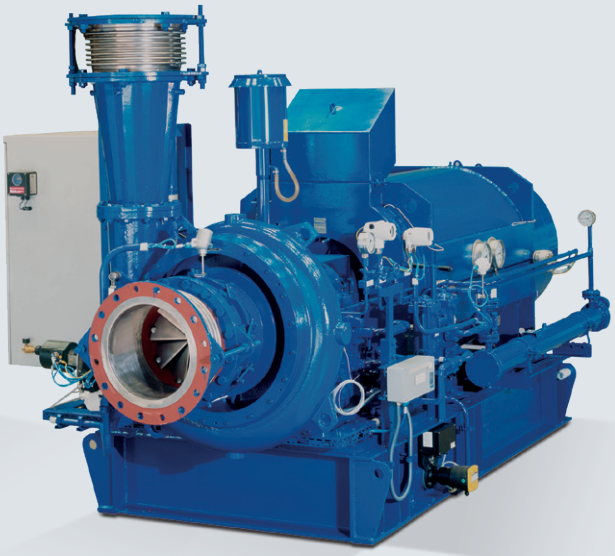
HV-Turbo™ KA Compressors

The KA series is driven by an electric motor through a speed increasing gearbox. It is furnished as a complete unit with internal variable control vanes, integral speed increasing gearbox, driver, lubrication system and intuitive controls. Packages are available in standard configuration with pre-designed options or custom configurations, with capacity ranging from 1,000 to 125,000 m³/hr (590 to 73,500 CFM).



Kühnle, Kopp & Kausch™ (KK&K) SF(G) Compressors

The SF(G) series is a range of integrally and separately geared single-stage compressors with semi-open impellers. The impeller is overhung mounted directly onto the high speed shaft of the gearbox. Air flows up to 300,000 m³/hr (176,500 CFM) can be handled with separately geared compressors. It provides state-of-the-art safety and reliability at lowest lifecycle costs.



One of the leading turbo machinery manufacturers with over 100 years of experience and continuous development, with a fleet of more than 12,000 installed compressors and blowers; we are a prime partner for your business.

Howden digital solutions

Leading the way in smart aeration with DDA enabled wastewater solutions

As world leader in rotating equipment, with unrivalled application expertise and the largest installed base globally, Howden's current wastewater solutions are now enhanced with the introduction and combination of Data Driven Advantage (DDA), offering a unique and innovative digital solution for the performance optimisation of your equipment.

Howden has been supplying robust, highly reliable products for the wastewater industry for more than 50 years. Combining the exceptional product knowledge and OEM expertise with our unique digital twin models and Augmented Reality (AR) driven service, we now offer our customers an invaluable insight into the operational efficiency of their products that can save significant time and costs and transform the experience of owning Howden equipment.

Reduced energy consumption

The aeration process within a wastewater treatment plant is a large proportion of the energy consumption. Howden blowers and compressors, already characterised by low footprint and high flows, now have the added benefit of being DDA enabled, allowing Howden to recommend the most appropriate operational changes to optimise performance and the efficiency of our customers' wastewater plants, demonstrating overall energy savings.

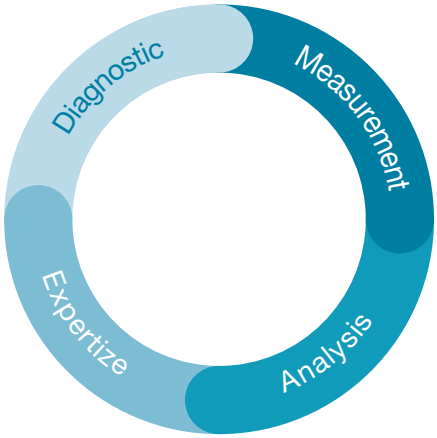
The digital twin

The Howden digital twin is used to analyse and simulate real world conditions, including how the equipment responds to changes, and how you can improve your operations. The digital twin provides our customers with a safe environment to make changes and quickly analyse the short and long term impact that they would have on the plant operations.

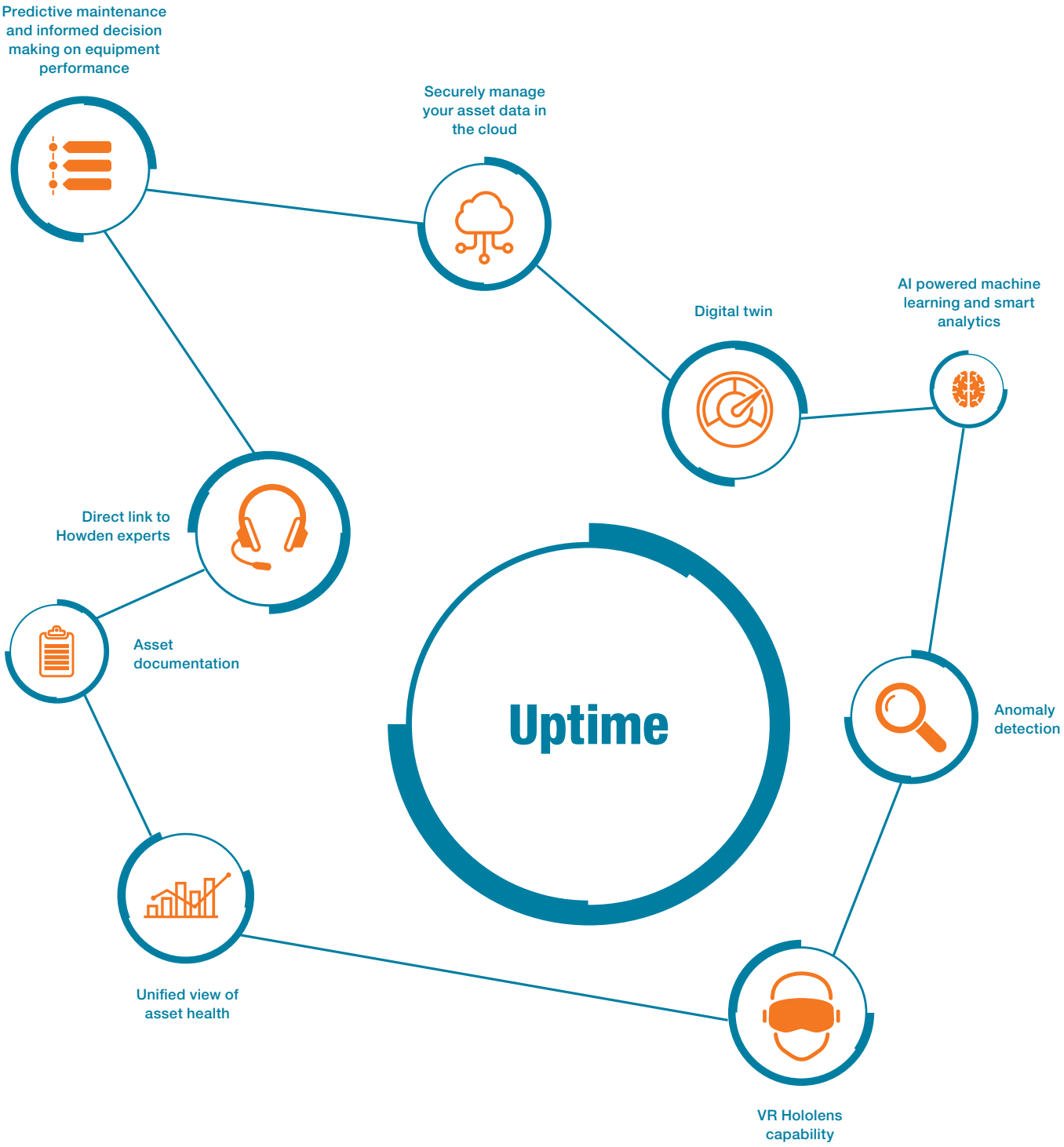
Our unique digital twin model is a combination of a theoretical performance map created using Howden's 160 years of OEM expertise from databooks and design manuals to selection tools, and an operational data set which is fed through the model directly from the sensors that are deployed around the equipment. When the theoretical performance map is superimposed on the real-life operational data, this enables the mapping of the current operation in respect to the equipment's best efficiency point, delivering performance optimisation and increasing the overall efficiency of your wastewater treatment plant.

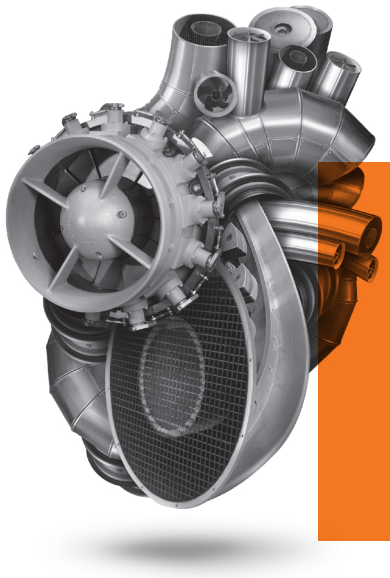
AR enablement

Howden's state-of–the-art AR service provides real-time sensor values which can be displayed on mobile and Microsoft HoloLens devices. This allows the customer to witness a live performance of data as the machine runs. AR service will display pressures, temperatures and vibration changes as they happen, and it will even pick up and alert the user of any anomalies.



Expert guidance close at hand





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 Turbo

Allegade 4
3000 Helsingoer
Denmark

Tel: + 45 49 21 14 00
Email: HTO-DK.Sales@howden.com
Web: www.howden.com/turbo

Revolving Around You™