

Turblex[®] Centrifugal Turbo Compressor

High performance aeration technology for water treatment



Howden designs and manufactures high performance aeration technology for municipal wastewater treatment and industrial applications

Highlights

Highest efficiency is automatically and continuously maintained over the entire turndown range, including off-design ambient temperatures and pressures where units most often operate.

Turndown to 45% (or less) at constant speed.

Variable flow by means of variable vane diffusers, pre-rotational inlet guide vanes or a combination of both systems, using DUAL POINT CONTROL™.

High-quality bearing construction results in exceptionally long life with minimal maintenance.

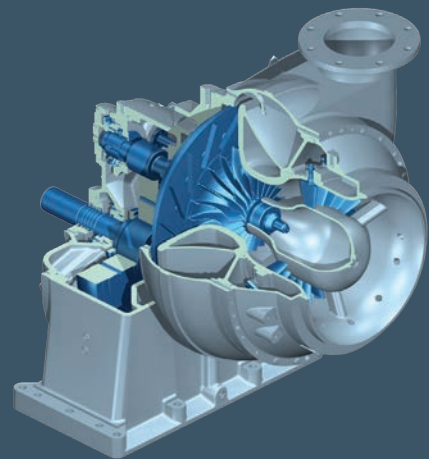
Guaranteed oil-free air delivery.

Compact design saves floor space and facilitates the replacement of older, less efficient compressors.

Standard or tailor made instrumentation and control for compressor operation.

Low noise level with no pressure pulsation.

Low operating and maintenance costs.





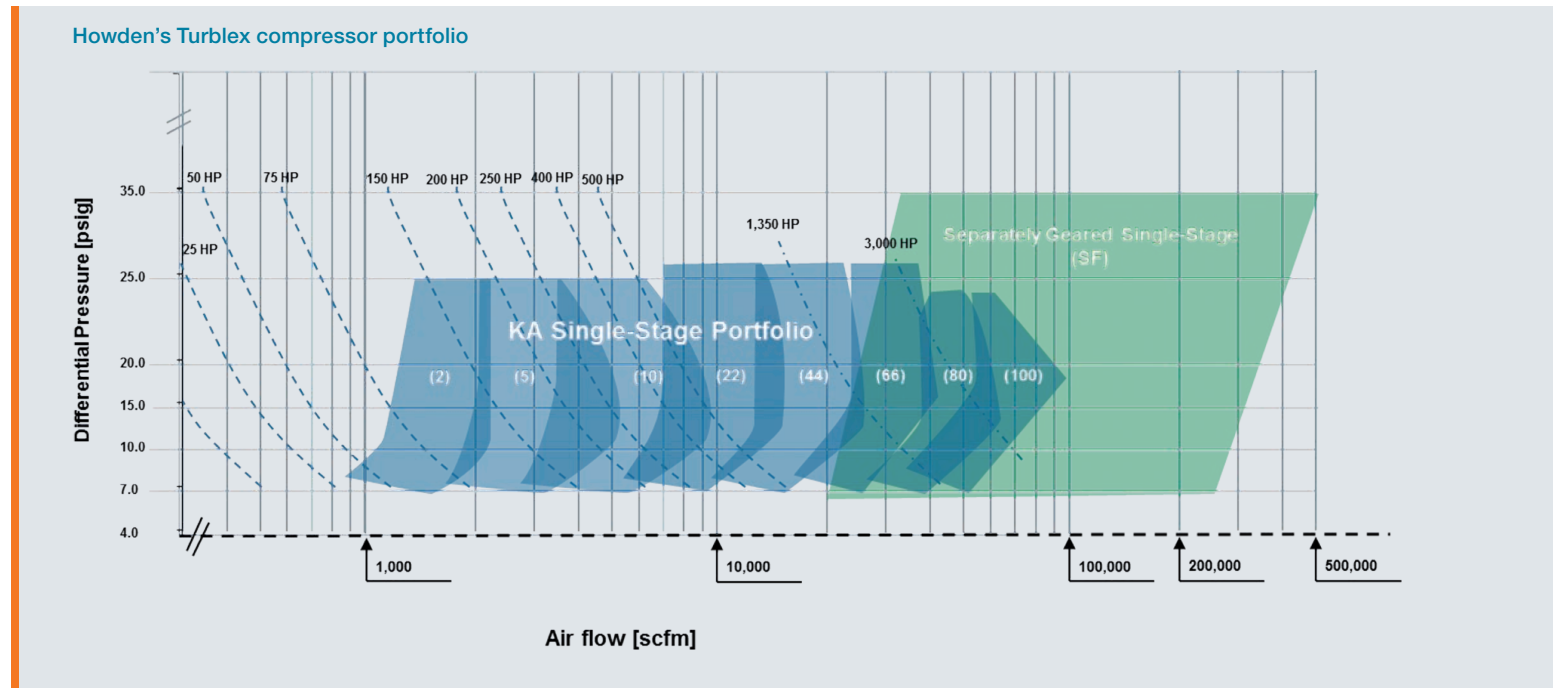
Highest efficiency

Howden's range of Turblex compressors are made uniquely according to plant specifications, thereby consuming significantly less energy compared to other compressor designs. The high quality compressor components and conformity with technical standards for a broad range of applications, ensure long-term reliability and minimum maintenance.

With more than 9000 units operating worldwide, Howden has become the market leader within its specific application areas.

Our turbo compressor competence center is located in Beasley, TX. Here, our highly skilled experts and dedicated engineers are constantly improving compressor technologies, while keeping their main focus on optimized efficiency and continued reduction of energy consumption.

Fields of application



Wastewater treatment

Biological treatment of effluent in:
Municipal sewage

Industrial sewage

Flue gas desulphurization

Oxidation air blowers associated with the cleaning of flue gases produced within power and heavy industry.

Fermentation and enzyme production

Biochemical treatment within pharmaceutical and yeast production industry and similar biological processes.

Furnaces and smelters

Air blowers providing combustion or reaction air primarily for the petrochemical and metals industries.

Sulphur recovery

Air blowers providing reaction air for the catalytic recovery of sulphur within the petrochemical industry.

Air lubrication

The technology is based on blower air that is under the hull of the vessel, creating a carpet of bubbles. The air bubbles' distribution across the hull surface reduces the resistance

generated between the ship's hull and the water, thus generating an estimated propulsion energy savings of 7-10%.

Compressor flow and pressure range

Flow and pressure range from 1,300 to 300,000 scfm. Differential pressure up to 35 psig (up to 57 psi possible with two stage design).

The Turblex compressor series for municipal and industrial applications is comprised of different sizes. Howden offers a complete package consisting of an integrated gearbox, coupling, electric motor and lube oil system, all mounted on a common base frame.

Efficiency by design

The Turblex compressor has an advanced mechanical and aerodynamic design, with cutting edge control system. The air-end and integral gearbox have been developed and evolved during more than 30 years of manufacturing experience, creating the most high-efficient air compressor available in the market today.

A well designed compressor is customized to site conditions while requiring minimal power consumption. Compressors may be controlled by variable inlet guide vanes, variable diffusers, or both. The choice between the different control systems is based on variable flow rate demand, the discharge pressure and ambient conditions.



KA22 compressor

Inlet flow from:
5,500-16,000 scfm and differential pressure from 6.7-12 psig.

Compressor components



Component key

1	Discharge check valve
2	Discharge butterfly valve
3	Operator interface
4	Local control panel
5	Vibration isolators
6	Base/oil reservoir
7	Discharge cone/silencer
8	Blow-off butterfly valve
9	Blow-off valve silencer
10	Air compressor and gearbox
11	Inlet silencer
12	Inlet filter
13	Inlet transition shroud
14	Coupling and OSHA guard
15	Lube oil cooling components
16	Main drive motor

Compressor

Meets the demands for high efficiency and maximum regulating range. Electric linear actuators precisely move the inlet guide vanes and variable diffuser vanes to automatically and continuously optimize efficiency and vary flow.

Gearbox

Speed increasing gearbox is integral with the compressor.

Driver

Compressors can be driven by electric motors, internal combustion engines or steam turbines.

Coupling and OSHA guard

Torsional analysis dictates the type of coupling to provide the longest life with lowest maintenance.

Base/oil reservoir

The compressor/gearbox, driver and oil lube system are mounted on a common, rigid base. Lube oil reservoir is integral within the base.

Lube oil system

Electric and mechanical oil pumps, oil/water cooler, oil filters and piping are skid mounted.

Inlet filter/silencer

Two-stage filter provides maximum filtration to protect downstream underwater air diffusers.

Valves

A variety of isolation valves can be provided with any Turblex system.

Local control panel

Designed for monitoring and controlling Turblex compressors. The panel can be skid or remote mounted.

Instrumentation

Tailored to customer requirements and comes factory pre-wired to the control panel.

Isolation mounts

Isolates the compressor from the floor.

Aerodynamics & mechanical design

All components in the air stream are aerodynamically designed to minimize turbulence, thus streamlining flow through the compressor.



Variable diffuser vane system

The Variable Diffuser Vane system (VDV) controls the flow by adjusting the angle of 17 to 20 diffuser vanes. The vanes are flow optimized, allowing adjustment of the nozzle area, while still maintaining an excellent efficiency throughout the entire operational range of the compressor. The vanes are arranged radially around the impeller.

Inlet guide vane system

The Inlet Guide Vane system (IGV) controls the incidence angle of the inlet flow to the impeller, and thus influences the relative speed of the air. This allows the adjustment of the delivered head from the compressor and optimization of power consumption according to changes in operational parameters such as inlet temperature, outlet pressure and flow.

Inlet air is continuously and automatically pre-rotated by 13-24 vanes and arranged radially around the concentric inlet, thus maximizing efficiency throughout the operational range. The vanes are supported at both ends, providing an unusually strong and long-lasting configuration.

The impeller

The core of the compressor is the impeller with backward leaning blades angled according to regulation and milled from a solid forged piece of high grade aluminum alloy (originating from the aircraft industry), with an optimal weight/strength ratio. Howden easily customizes the design of the semi-open impeller by means of three-dimensional simulation software (Computer Fluid Dynamic simulation (CFD)) to meet individual plant requirements. The impeller design is based on an extensive database comprising of full factory tests of more than 9,000 compressors, as well as full scale tests and finite element analysis.

The KA turbo compressor series consist of single-stage compressors with integrated gearboxes. Compressor and gearbox are standard, fully integrated, vertically split with the pinion shaft above the drive shaft. The design is compact and easy to maintain. All gearwheels are customized according to compressor configuration.

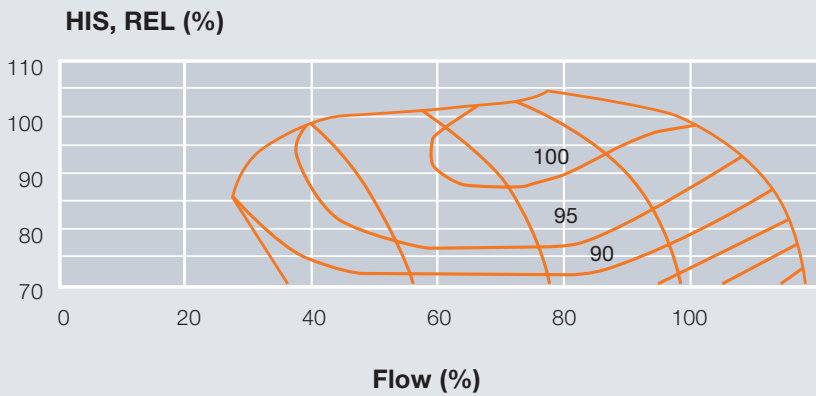
Various gear types for different requirements

Howden offers several different combinations of air-ends and gearboxes. Selection depends on the capacity, required power and type of driver. All gearboxes share similar heavy duty design features for a long, low maintenance operation.

Various compressor control configurations:

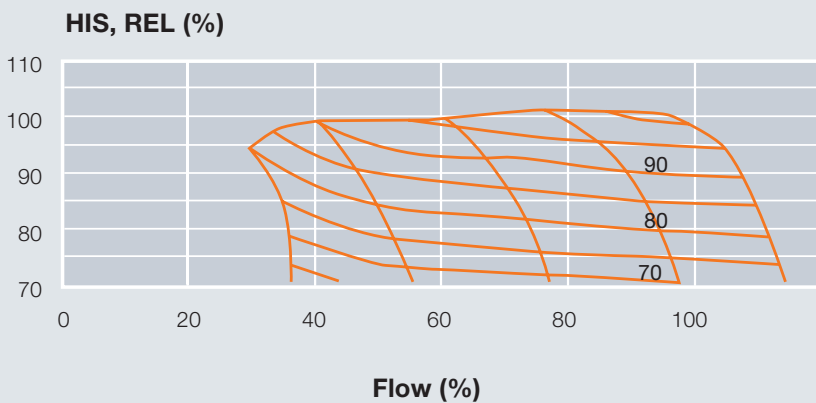
Variable diffuser and inlet guide vane system

This design features the unique Turblex DUAL POINT CONTROL™ system with both inlet guide vanes and variable diffusers, which ensure high efficiency operation, even at off-design conditions. This makes the KA turbo compressors especially suitable when operating requirements are characterized by substantial fluctuation in inlet temperature, discharge pressure and flow.



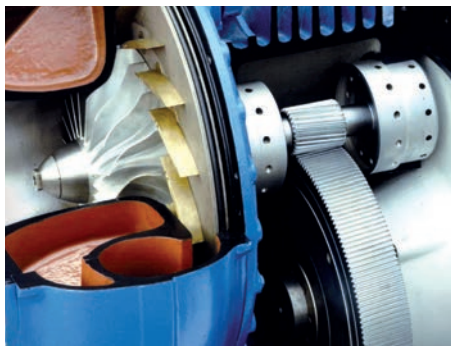
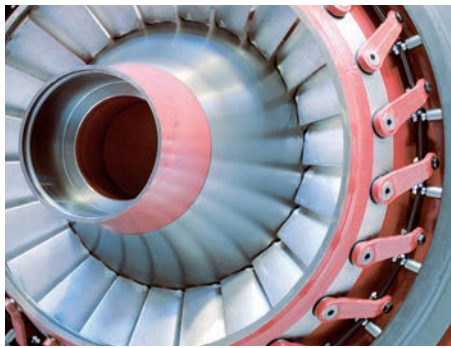
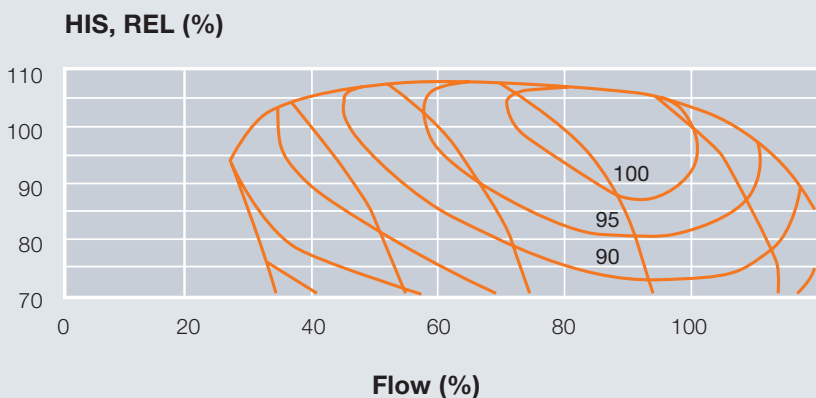
Variable diffuser vane system

Equipped with a variable diffuser vane system, the KA turbo compressor has relatively steep performance curves and is thus particularly well suited for high efficiency operation at relatively constant discharge pressure and inlet temperature.



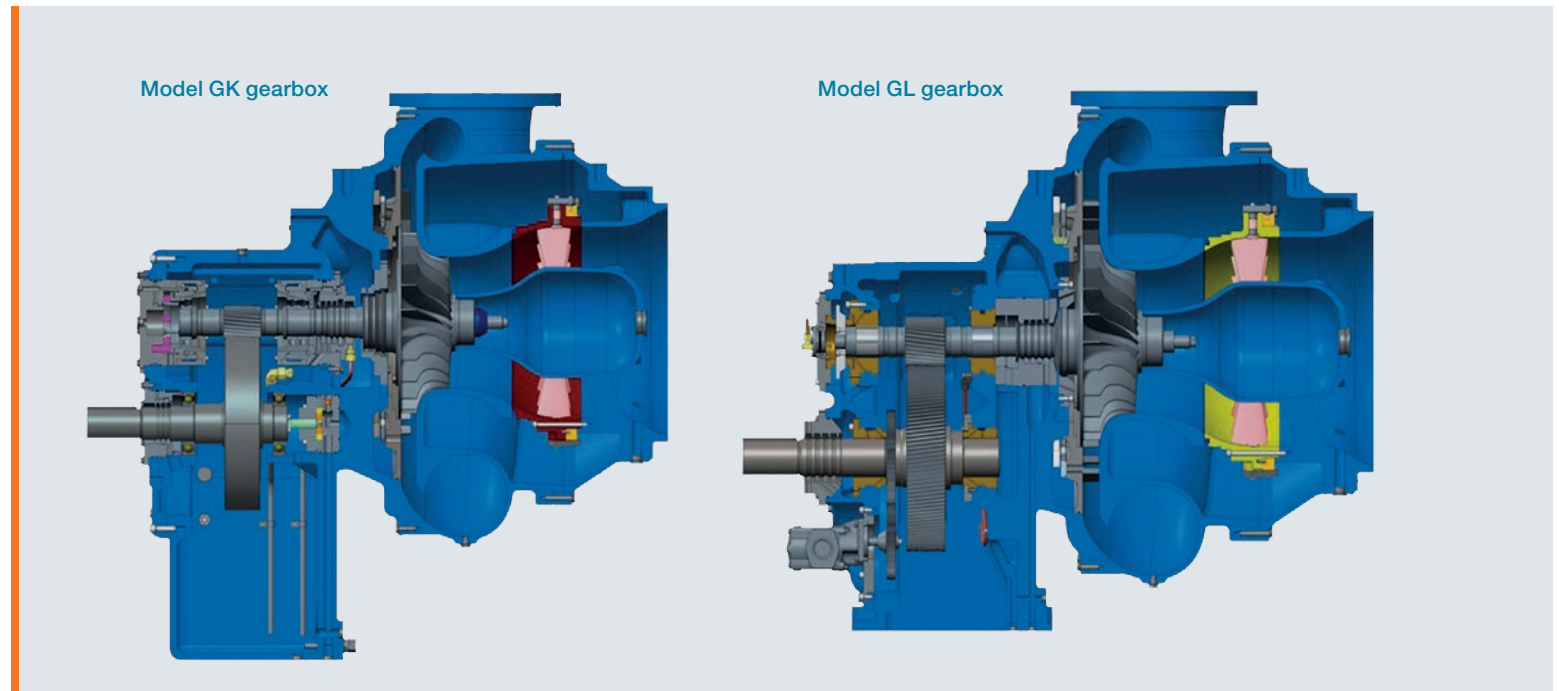
Inlet guide vane system

Equipped with an inlet guide vane system, the KA turbo compressor is the most efficient solution for applications demanding high flow rates. This design also complies with API standards and is highly suitable for industrial applications.



Ball bearing unit with helical gear and diffuser vanes for optimal efficiency.

Mechanical design & control



GL and GB gear type series

The gears are helical cut from high grade steel alloy, case hardened and grinded to close tolerances. The bearings are hydrodynamic, multi-pad bearings with forced oil lubrication. The designed bearing lifetime is 100,000 operational hours.

The design ensures easy access to vibration and temperature probes, which can be equipped optionally. The air and oil seals are non-contact labyrinth type. Gears and bearings are pressure lubricated by electrically and mechanically driven oil pumps.

The GL gearboxes allow for higher flow and higher pressure within the range of Turbex compressors and extend the maintenance intervals.

GK gear type series

Aeration installations in smaller decentralized wastewater treatment plants often require special needs for compressor design and performance. The GK series is ideal for small-scale plants because they offer a particularly compact design with an integrated gearbox. This gearbox is equipped with ball bearings lubricated by an integrated oil pump.

Special gear type series

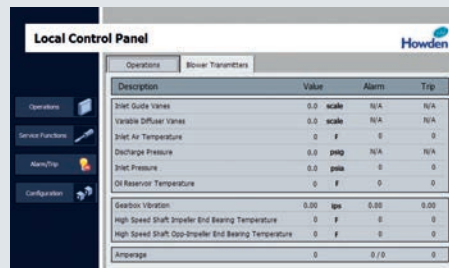
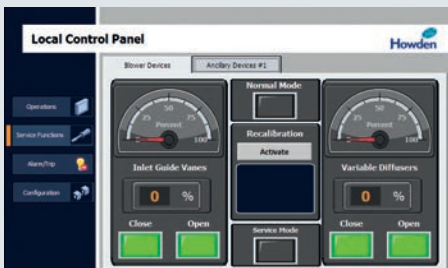
The special GC gear type is a planetary, two stage, co-axial gearbox for combustion engine drivers and well suited for applications such as methane recovery processes. This type of gearbox is designed for increased torsional forces originating from the driver.



Efficiency by control

The efficiency of the aeration equipment ultimately depends on the control system.

The Turblex compressors are provided with safeguards and monitors for long-term, trouble free operation. Other instruments are available to monitor compressor operation and include vibration and bearing temperature monitors that are generally used on larger units. Maintenance status monitors are available for inlet air filters, oil filters, oil reservoir level, and reverse rotation.



Local control

The Howden Local Control Panel (LCP) is specially designed for monitoring and controlling the Turblex compressor with diffuser and inlet guide vanes.

Standard features

- Control panel mounted on or off-skid.
- Control is provided by an internal PLC and job customized software.
- Equipped with touch panel operator interface with color screen.
- Emergency stop push button.
- Factory tested.
- Protection class NEMA 12.
- Power supply according to specific requirements.
- Industrial ethernet.
- Multi-language interface.

The Local Control Panel is also provided with contactors for auxiliary equipment, such as:

- Actuator for the blow-off valve.
- Electric motor for the lube oil pump.
- Electric motor for the air/oil cooler fan.

Special features

Systems may be designed to accommodate specific client needs, for instance:

- Different PLC platforms.
- Other network communication available to DCS/SCADA: PROFIBUS DP, Ethernet, MODBUS TCP.
- Modification for tropical environment.
- Remote connect online support via mobile network/local area network.
- Trending of operational data.

Vibration and monitoring devices

- Turblex compressors for municipal and industrial applications can be equipped with vibration detection and monitoring devices.
- Accelerometer offers vibration detection and monitoring. The analog signal is connected directly to the PLC in the LCP.
- Proximity probes for radial and axial shaft vibration monitoring.

Master control

The Master Control Panel (MCP) is designed for automatically controlling the air supply of a compressor group arrangement from 2 up to 15 Turblex compressor units. With the MCP control using the highly efficient cascade control philosophy, the process is constantly provided with the right amount of oxygen.

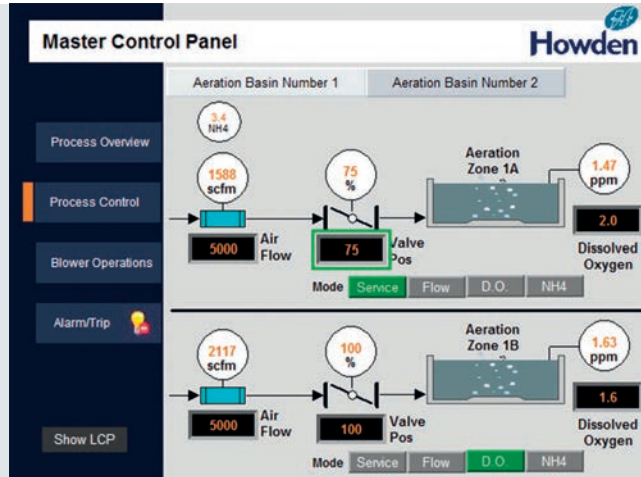
This kind of regulation ensures:

- Maximum efficiency and lower energy consumption.
- Accurate control, even under fluctuating conditions.
- More precise flow and simplified instrumentation.

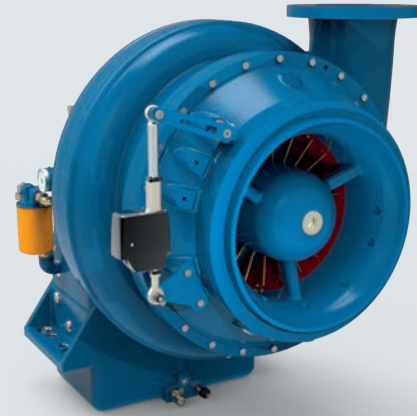
MCP single overview

- Easy overview of each compressor's operational status.
- Single overview for the operator on the complete compressor system showing all events and system messages.
- Direct indication of main discharge pipe pressure and set-point.
- All critical functions and settings are access protected.

Control & testing



MCP single overview



The four integrated control loops

Howden provides complete air-supply systems for wastewater treatment plants, thus ensuring effective integration of the aeration process with the other downstream processes in the plant. The aeration process consists of four central control loops that, when fully integrated and fine tuned, ensure smooth, efficient operation of the aeration system.

Dissolved oxygen/ammonium/flow control

Most aeration systems are controlled on the basis of measurements of the dissolved oxygen in the aeration tanks. The settings of the air-flow control valves are based on these measurements.

The four integrated control loops

To minimize power consumption, the header pressure is kept as low as possible by monitoring the control-valve positions. During peak loads, the header pressure is increased in order to provide maximum air flow. Under part-load conditions, it is reduced to keep power consumption to a minimum. This enables continuous adjustment of the total delivered air flow to precisely match requirements.

An unlimited range of different processes can also be linked to the main air header, thus facilitating control of many additional sub-processes, i.e., channel aeration, side stream treatment, aerobic digestion, etc.

Main header pressure control

The aeration tanks are supplied with air flow through a main-air header. This is kept at a constant pressure by regulating the compressors between 40 to 100% capacity.

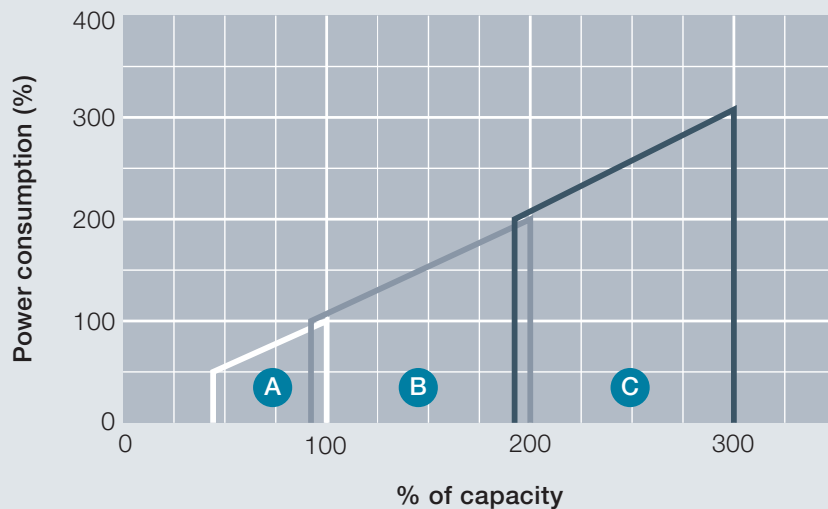
Cascade control

Easy fine-tuning according to process requirements, as only one compressor at a time is regulated. Maximum number of compressors can be operated optimally.

The prime advantages of the system solution include:

- Single-source responsibility
- System integration
- Greater overall efficiency
- Better control and smoother operation
- Avoid interface issues
- Start-up and fine tuning
- Greater system reliability
- On-line support

Cascade control



Testing

Standard Shop Test

Each compressor core unit is tested in our advanced test stand in accordance with our Standard Shop Test specification. The test stand is certified every year according to ISO 9001 and the calibration procedures are conducted at regular intervals according to ASME, ISO and API international standards.

During the Standard Shop Test, each compressor is operated at maximum design load for 3 to 10 operating hours, depending on the compressor type.

The test procedures have been developed during decades of testing thousands of turbo compressors and fulfill the following purposes:

Provide data over the entire specified operational range for quality approval.

Provide data for the automated power saving program with variable diffuser and inlet guide vane system.

Provide specific and statistical data as feedback for the compressor design program.

Provide to the customer documentation of the performance data and the performance range in the form of a graphic presentation.

The following are performed during the Standard Shop Test:

Mechanical/operational test

The lubricating oil system is put into operation and the safety controls are checked and adjusted.

Initially, the compressor is running at low load and special attention is paid to vibration, the temperature rise of the bearing covers and the labyrinth seal flanges. The housings, flanges, and pipes, including the lube oil system, are checked for tightness.

Vibration measurements

According to ISO 10816, each compressor is run at maximum load and the vibration velocity is recorded within the range 10–1,000 Hz.

Noise measurements

According to ISO 3746, the sound pressure measurements are recorded and an engineer evaluates the test data in relation to the specified data. A noise certificate can be issued on customer request.

Performance test

Heat balance test:

Establishes a total energy balance for the compressor by measuring all the losses and adding them to the energy input to the compressed gas.

Torque meter test:

Measures the torque using a precision torque meter and the rpm of the driver.

Electric motor test:

Performs an energy balance on the driver in accordance with the appropriate test codes for the particular type of machine.

Additional testing

In addition to the mandatory tests, Howden offers an optional testing portfolio.

Witness test:

The test will be conducted by an experienced test engineer in cooperation with the test stand technicians, according to international standards. The complete test procedure is witnessed either by the customer, or a third party, i.e., an inspector from an independent and neutral inspection company.

Certified test:

When the client is not in the position to attend the witness test, a certified test can be offered. An experienced test engineer will conduct this test. Test log sheets will be signed by the test engineer certifying specified test points selected by the customer.

National and international test standards

Howden compressor testing procedures, as well as the testing equipment, instrumentation, and calibration are in conformity with the national and international norms of testing turbo compressors:

ISO 5389-2, Dec. 2005:

Turbo compressors – Performance Test Code

PTC 10 and 13 – 1997:

Performance Test Code on Compressors and Exhausters

API Standard 672 Fourth Edition, March 2004:

Packaged, Integrally Geared Centrifugal Air Compressors for Petroleum, Chemical, and Gas Industry Services

EN ISO 5167-1, 2003/EN ISO 5167-2, Jan. 2004:

Measurement of Fluid Flow by Means of Pressure Differential Devices

ISO 10816-1, 1995:

Mechanical Vibration

ISO 3746, 1995:

Acoustics – Determination of Sound Power Levels of Noise Sources Using Sound Pressure

EN ISO 9001, 2000:

Quality Management Systems – Fundamentals and Vocabulary.

ChartWater™

ChartWater is a global manufacturer and service provider for municipal water treatment and industrial process applications, offering a comprehensive portfolio of proven and innovative water treatment solutions from Chart Industries, BlueInGreen, AdEdge Water Technologies, and Howden.



Chart Industries

Chart Industries is a leading, independent global manufacturer of highly engineered equipment servicing multiple applications in the Energy, Water, and Industrial Gas markets. For water applications, Chart provides cryogenic storage tanks and vaporizers for liquid oxygen, liquid carbon dioxide, liquid nitrogen, and liquid hydrogen, resulting in the lowest lifecycle cost solution in the market.



BlueInGreen

BlueInGreen is a gas dissolution expert that provides the most efficient method of dissolving gases in water. This efficiency provides the most effective solution for a variety of oxygen, carbon dioxide, and ozone applications using carbon dioxide for pH control, remineralization, and strong acid replacement in industrial wastewater pretreatment and discharge pH permit compliance – and dissolving the highest concentration of ozone for advanced oxidation applications.



AdEdge Water Technologies

AdEdge Water Technologies is a water treatment technology and solution provider specializing in the design, development, fabrication, and supply of water treatment solutions. Using specialty medias, legacy, and innovative technologies, AdEdge can help remove a wide range of contaminants such as PFAS, Arsenic, Iron and Manganese from water.



Howden, a Chart Industries Company

Howden is a global manufacturer of high efficiency blowers and compressors and innovative digital solutions for advanced, efficient smart ambient aeration systems.

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