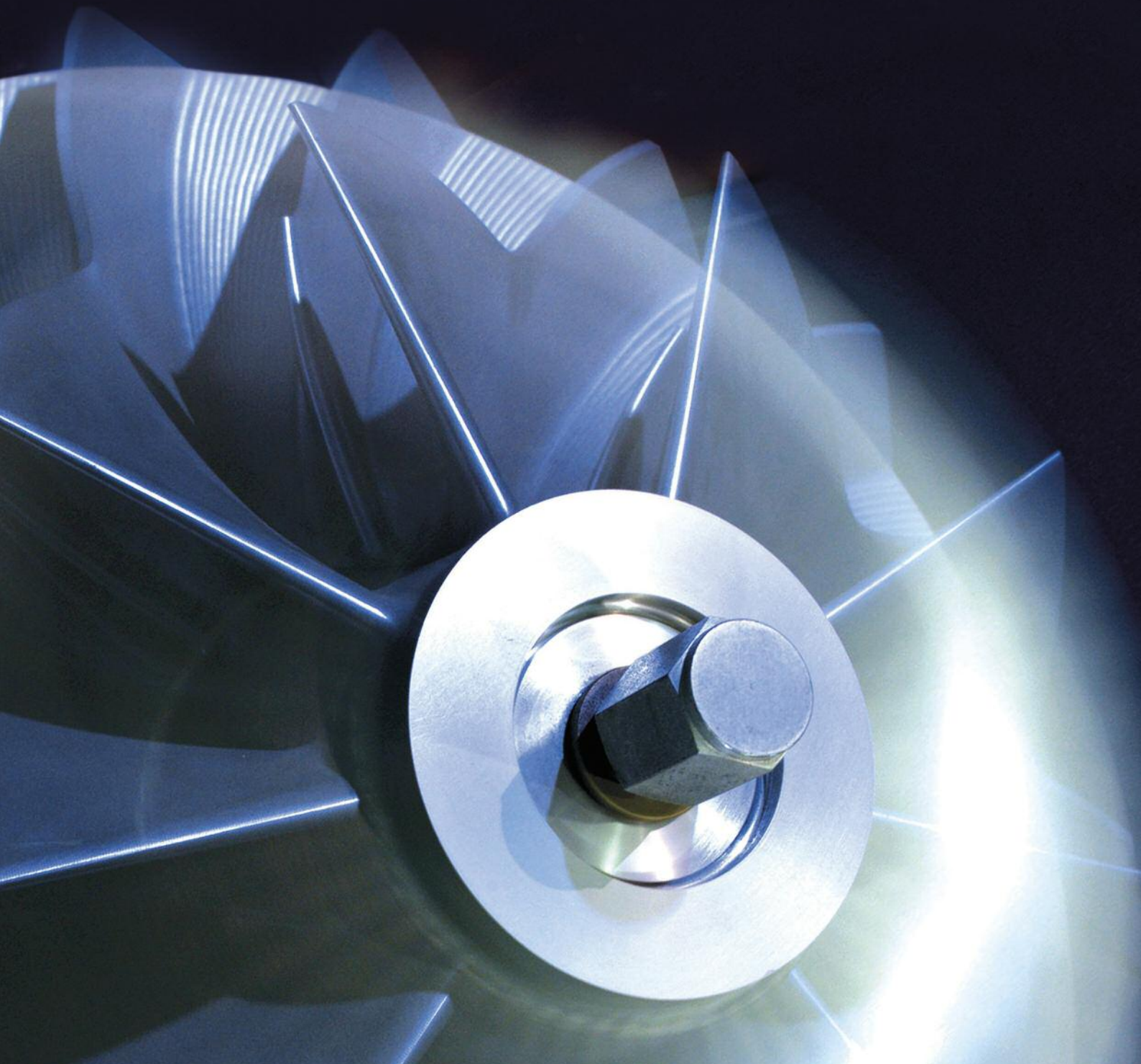


TURBO BLOWERS & COMPRESSORS

HIGH EFFICIENCY CENTRIFUGAL TURBO BLOWER & COMPRESSOR
SYSTEMS FOR REFINING, POWER & INDUSTRIAL APPLICATIONS





OTHER HOWDEN COMPRESSOR DIVISION PRODUCTS:



Rotary Twin Screw Compressors



Process Screw Compressors



High Pressure
Diaphragm Compressors



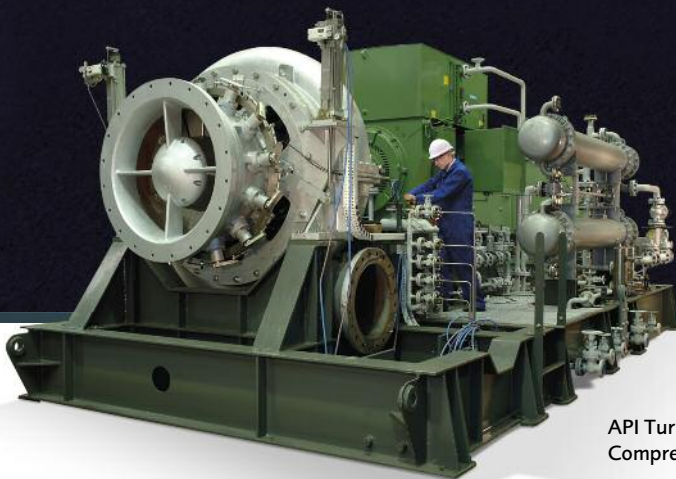
Piston Compressors

TURBO BLOWERS & COMPRESSORS FROM THE **GLOBAL LEADER IN AIR AND GAS HANDLING**

HOWDEN IS ONE OF THE WORLD'S LEADING ENGINEERING COMPANIES IN THE FIELD OF AIR AND GAS HANDLING. FOUNDED IN 1857 IN GLASGOW BY JAMES HOWDEN AND INITIALLY SPECIALISING IN MARINE STEAM ENGINES AND BOILERS, THE COMPANY BUILT A REPUTATION FOR INNOVATION AND QUALITY THAT LED TO ITS STEADY GROWTH INTO A GLOBAL ORGANISATION WITH A WORKFORCE OF OVER 4,000 PEOPLE IN 17 COUNTRIES.

HOWDEN PROCESS COMPRESSORS

Part of Howden's compressor division, Howden Process Compressors (HPC) designs, manufactures, supplies and supports the Howden 'SG' range of high efficiency turbo blowers & compressors. The 'SG' range encompasses industrial type blowers used in the power, mining and water industries, whilst our turbo compressor version is best suited for API specification type applications in the downstream oil & gas industry.



API Turbo
Compressors



Industrial
Turbo Blowers

Howden's range of compressors and complete compressor packaged systems are used in the petroleum, petrochemical, refrigeration, fuel gas and other markets where performance and reliability are crucial. We have over one hundred years of experience behind us and supply our compressors to API or equivalent industry standards.

We designed and supplied the first diaphragm compressor and were the first company to commercialise screw compressor technology. We have built on this experience and now offer screw, piston (reciprocating) and diaphragm process gas compressors, and highly efficient turbo blowers & compressors capable of meeting the most demanding conditions.

THE HOWDEN 'SG' RANGE OF HIGH EFFICIENCY TURBO BLOWERS & COMPRESSORS



All Howden's turbo blower & compressor models are designed and supplied as single stage, integrally geared units and complete packages, and provide high efficiency over a wide operating range.

Systems are designed and built to API and other industry standards for applications in the petrochemical/refining, power, mining, industrial and water industries.

HISTORY OF HOWDEN TURBO BLOWERS & COMPRESSORS

Acquired by Howden in 1997 to complement their range of compressor technologies and solutions, Bryan Donkin, based in Chesterfield, UK, was one of the longest established designers of rotary blowers and compressors with a history extending back to 1856. For almost 100 years, as Bryan Donkin and now Howden, we have supplied turbo blowers & compressors for a wide range of applications in international markets.

Today, Howden turbo blower & compressor systems are designed, manufactured and tested on-site at our centre of excellence facility in Renfrew, UK, and global aftermarket support activities are managed from our regional service centre in Chesterfield, UK.

KEY PRODUCT FEATURES

ADAPTABILITY

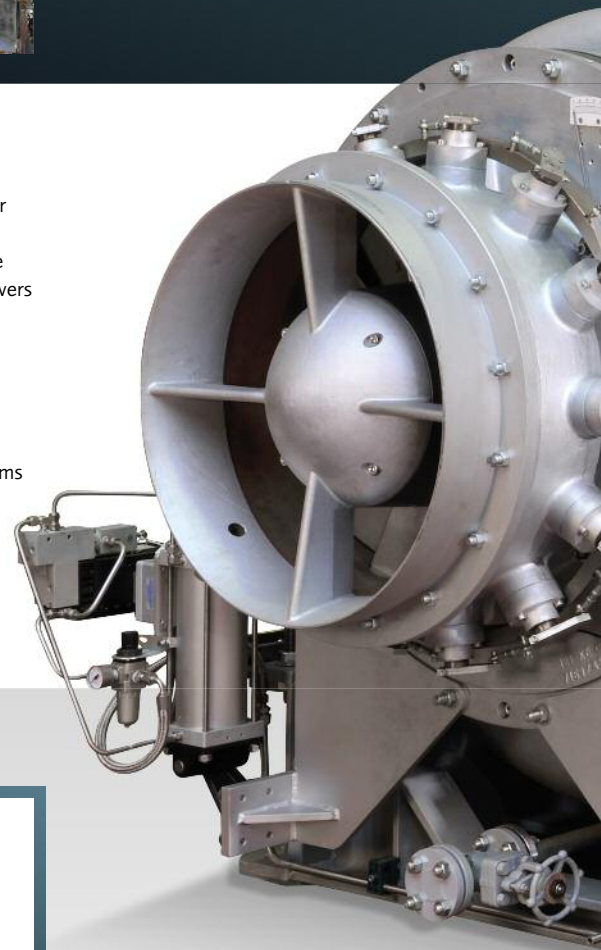
- Industrial or bespoke
- API Standards 617, 672 & 614
- Compact skid design or separate lube oil console
- Turn down to 45% volume flow

EFFICIENCY

- High efficiency designed impeller
- Maintains optimum efficiency in all duty points

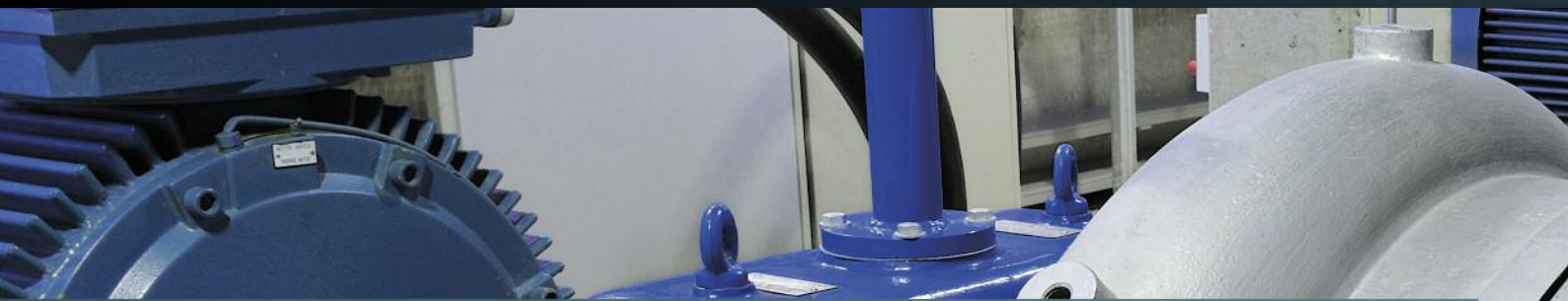
RELIABILITY

- Ease of maintenance
- Minimum downtime
- Designed to suit all environments





GLOBAL MARKETS & APPLICATIONS



HOWDEN'S APPLICATION EXPERTISE COVERS THE DESIGN AND SUPPLY OF OVER 1,200 TURBO BLOWERS/COMPRESSORS ACROSS A WIDE RANGE OF MARKETS INCLUDING THE FOLLOWING.

PETROCHEMICAL/REFINING

Sulphur Recovery Units (SRU)

Turbo compressors providing reaction air for the catalytic recovery of sulphur within refineries and gas processing facilities.

Sulphuric Acid Plants

Turbo compressors providing combustion for sulphur burning and acid regeneration.

Fertiliser Production (UREA)

Turbo compressors providing atomising air for the fluidised bed.

POWER

Flue Gas Desulphurisation (FGD)

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

Circulating Fluidised Bed (CFB)

Blowers providing fluidising air within the loop seal system on a circulating fluidised bed (CFB) boiler.

Mechanical Vapour Recompression

Air blowers used to recompress low pressure waste steam from one process to be used in another process rather than being discharged to atmosphere or condensed.

MINING

Metal Smelting

Oxidation air blowers for smelting processes.

Metal Refining

Aeration, oxidation and combustion air blowers for biological and conversion processes.

Iron Production

Blast furnace air blowers for reaction (hot blast) and combustion air applications.

Sulphuric Acid Plants

SO₂ blowers for metallurgical process off-gas acid plants.

INDUSTRIAL

Effluent Treatment

Aeration blowers associated with the biological treatment of effluent within industrial plants.

Carbon Black

Blowers providing combustion air for the associated furnaces.

Fermentation

Air blowers associated with biochemical fermentation within pharmaceutical and yeast production markets.

Fuel Gas Blowers

Blowers handling natural and 'dirty' coke-oven, manufactured, landfill and other bio gases. (landfill extraction – Howden V Series).

Mechanical Vapour Recompression

Air blowers used to recompress vapour generated during an evaporation process so that it can be used as the heating medium for the same evaporation process.

WATER

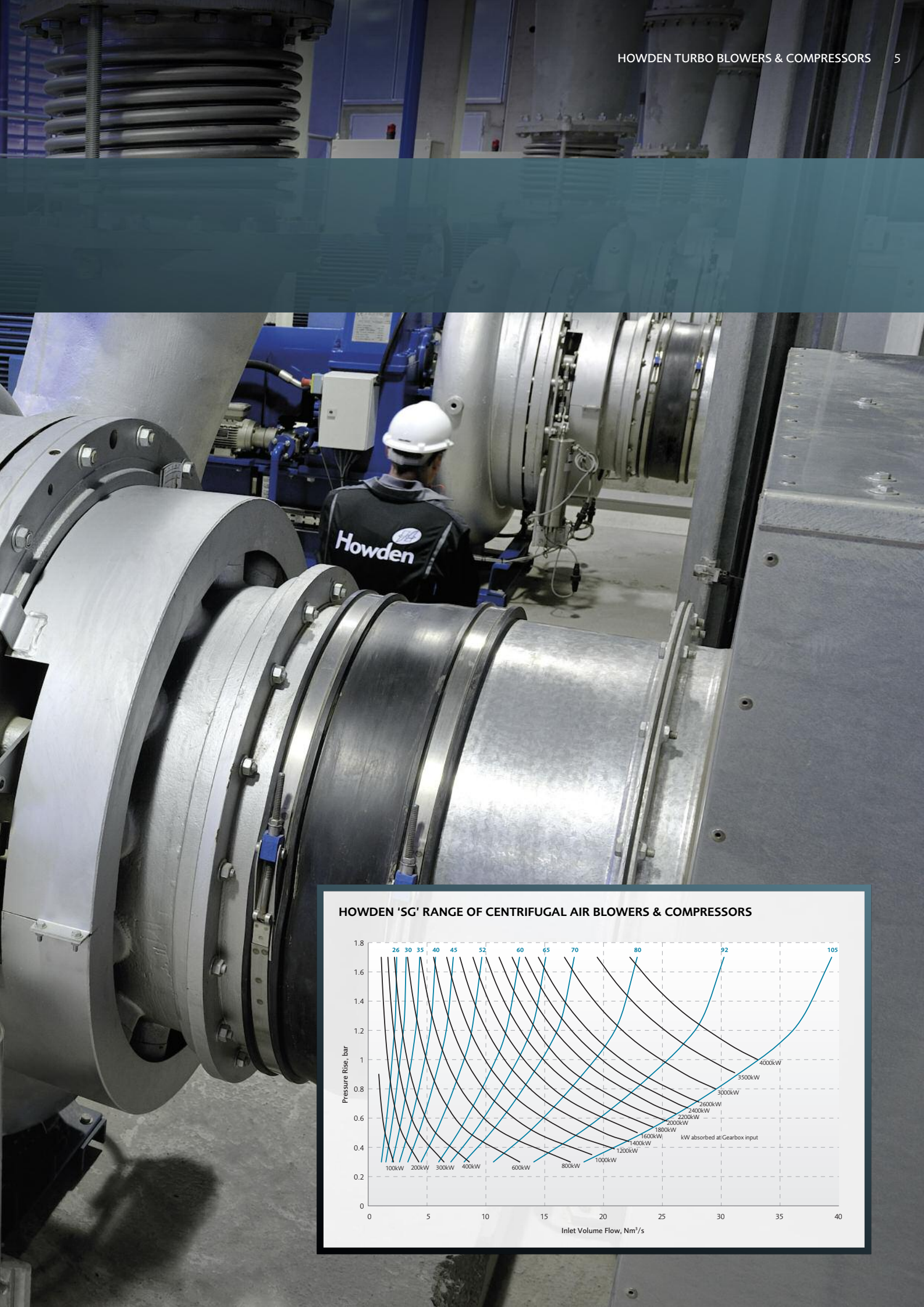
Waste Water Treatment*

Aeration blowers associated with the biological treatment of effluent within municipal sewage treatment plants.*

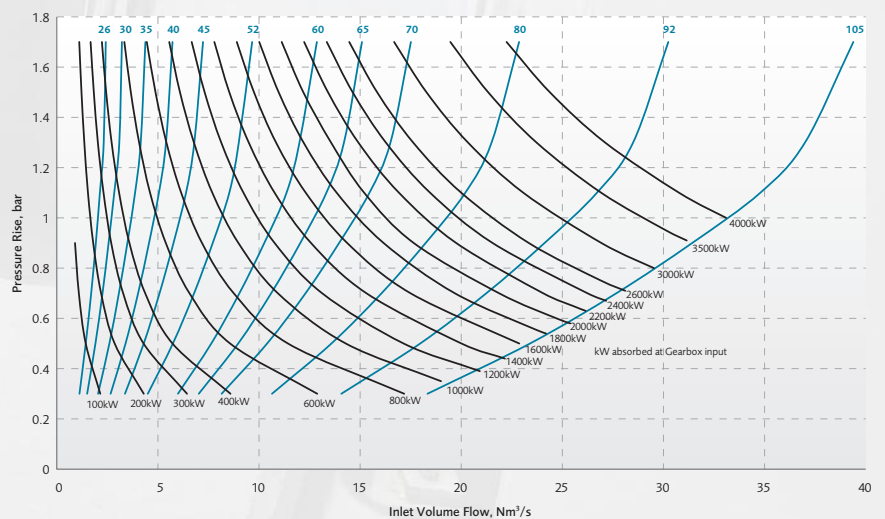
Downstream Control

Our BioActive Response System (BARS) is a fully-automated, highly efficient control system that optimises the operation of aeration turbo blowers.

*For more information on this application please see our specialised 'Howden Water Technology' brochure.



HOWDEN 'SG' RANGE OF CENTRIFUGAL AIR BLOWERS & COMPRESSORS



BLOWER/COMPRESSOR SPECIFICATIONS

PROVEN EFFICIENCY & RELIABILITY

THE HOWDEN RANGE OF SINGLE STAGE TURBO BLOWERS & COMPRESSORS PROVIDE PROVEN RELIABILITY DEVELOPED OVER THE LAST 100 YEARS. THE INTEGRATION OF OVERHUNG HIGH EFFICIENCY IMPELLER, PRECISION GEARS AND HIGH STABILITY BEARINGS RESULTS IN SMOOTH, MINIMUM POWER LOSS TRANSMISSION. PRESSURISED OIL LUBRICATION WITH HIGH INTEGRITY PROTECTION SYSTEMS ENSURES MAXIMUM RELIABILITY AND HENCE AVAILABILITY OF EQUIPMENT.



IMPELLER: Induced backward curved vane impeller.



SPLIT GEARBOX: Horizontally split gearbox provides easy access to gears and bearings.



INSTRUMENTATION: Optional API Lubrication System.

IMPELLER

- Fully machined from solid forging by multi axis computerised machining centre.
- Impeller material options are aluminium alloy (2618A) or nickel-chrome corrosion resisting steel.
- Induced backward curve or radial profile.
- Dynamically balanced to ISO 1940 Specification.
- Overspeed tested to a minimum 115% of operating speed.

GEARBOX

- Gear case in cast iron grade 250 to BS 1452 (ASTM A48-83-35B).
- Horizontally split for ease of maintenance.
- Single helical speed increasing type.
- Shafts and gearwheel are fully machined from carbon steel forgings.
- Gearing is to AGMA Quality 11 to 13 as required.
- All gears have ground tooth profile.
- AGMA service factor of 1.4 minimum.

CASINGS

- In cast iron with options for carbon and stainless steel.

SHAFT SEALS

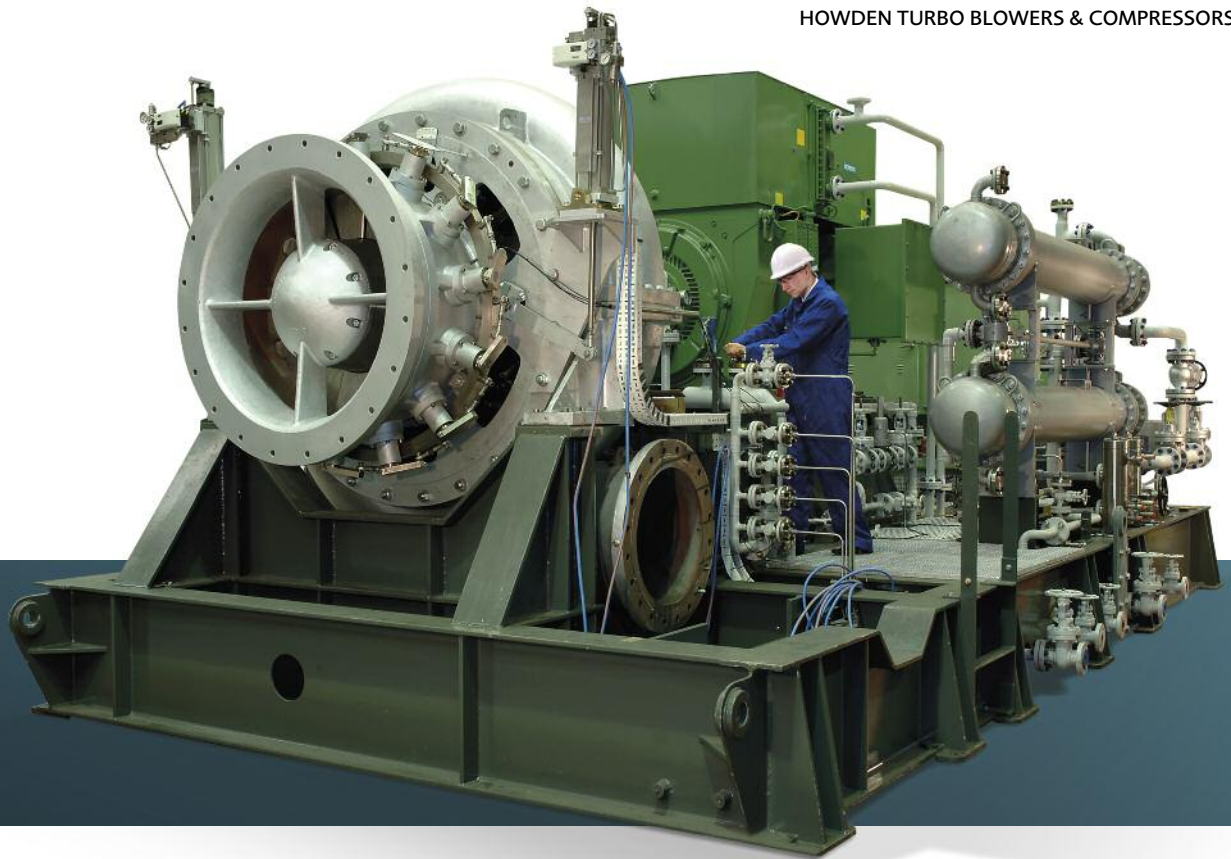
- Carbon ring standard.
- Options for labyrinth type seals to suit client specifications.

BEARINGS

- Low speed bearings are of the anti-friction type, or Taperland Journal type if specified or required due to loading.
- High speed bearings are of the tilting pad journal type, providing durability and prolonged reliable operation.
- Axial loading is absorbed by thrust rings at periphery of lower speed gear wheel transferred from high speed shaft via thrust collars to minimise power loss.
- All bearings are oil lubricated from the pressure oil lubrication system.
- All bearings are easily accessible by removal of the top half gearbox casing.

INSTRUMENTATION AND PROTECTION

- Oil pressure at bearing supply manifold.
- Lube oil temperature after cooler monitoring.
- High speed shaft journal bearing temperature monitoring.
- Process air temperature monitoring.
- Lube oil pressure low (acts as both alarm and also re-starts auxiliary oil pump in the event of falling oil pressure).
- Lube oil pressure low trip.
- Oil reservoir temperature low switch (inhibits blower operation with oil temperature below 20°C).
- Additional instrumentation can be provided as required.
- All alarm/trip/indication functions are displayed at the local control panel (pages 8 & 9).
- Condition monitoring of machine and driver available.
- Designs to suit API 617 & 672 & 670.
- Designs for safe & hazardous areas.



PRESSURE LUBRICATION SYSTEM

- Integrated or separate lubrication system to provide a safe and reliable oil supply.
- Baseplate can act as oil reservoir.
- Main oil pump is mechanically driven from low speed shaft, sized to provide satisfactory oil supply throughout run down period or in the event of power outage.
- Electrically driven auxiliary oil pump used to prime the system before start-up and act as a standby unit in emergency and during shutdown.
- Oil cooler – shell & tube or air blast type.
- Duplex oil filters to allow online changing.
- Differential pressure indicator across filter.
- Immersion heater and thermostat.
- Oil temperature control valve.
- API 614 and special purpose.

DRIVERS

- Suitable for explosive or non explosive atmospheres.
- Electric motors to IEC, NEMA or API standards.
- Steam turbines.

MACHINE CAPABILITIES

- Volume flow up to 130,000 m³/hr (80,000 CFM).
- Differential pressure up to 2 barg (29 psig).
- Power rating up to 5,000 kW (6,700 hp).
- Impeller tip speed up to 450 m/sec (1,476 ft/sec).
- 87% polytropic efficiencies.

CONTROL PANELS

- Suitable for explosive or non explosive atmospheres.
- Locally mounted, factory pre-wired to the package instrumentation, or remotely mounted with package edge junction boxes factory pre-wired to the package instrumentation.
- Door mounted graphical operator interface to display monitored parameters, equipment status and alarm messages.
- Optional switchgear for ancillary drives.
- Communication of monitored parameters to plant control system by a variety of industry standard network protocols.

CONTROL SYSTEMS

As well as controlling the operation of the blower and ancillaries the control system offers the following features:

- Control routines for surge detection.
- Control routines to optimize efficiency by inlet and outlet guide vane control.
- Optional routine for surge avoidance.
- Multi-blower control routines for power optimization and load sharing.
- Multi-blower control routines by a master panel or Howden Masterless System.
- Optional control system documentation for implementation by third party.



IN CONTROL: Turbo Blower Control Systems.

INLET/OUTLET CONTROL SYSTEMS MAXIMISING OPERATING EFFICIENCY

HOWDEN CONTROL SYSTEMS MAXIMISE OPERATING EFFICIENCY AND PROVIDE INFINITELY VARIABLE CAPACITIES OVER A WIDE DUTY RANGE. FULLY AUTOMATIC CAPACITY CONTROL IS ACHIEVED FROM A SINGLE INPUT SIGNAL, PROCESSED AND RELAYED TO THE ELECTRIC, PNEUMATIC OR HYDRAULIC GUIDE VANE ACTUATORS. CONSTANT SPEED DRIVE MOTORS ARE RETAINED TO ENSURE MAXIMUM RELIABILITY.

TYPES OF CONTROL SYSTEM AVAILABLE

INLET GUIDE VANE CONTROL (IGV)

- Inlet guide vane control assembly is fitted to the blower/compressor to enhance efficient capacity control whilst retaining the simple constant speed motor.
- Guide vanes are manufactured from AISI 316 stainless steel and equally spaced radially about the bore of the inlet branch, to pre-rotate the air before entering the impeller.
- Guide vanes are supported in self lubricated bearing sleeves, provided with an "O" ring seal at the vane shoulder to isolate linkage from the flow medium.
- Actuation is by a single spindle, via non-lubricated linkage system.
- Electric servo motor actuator fitted for modulating control. (Pneumatic actuators can be provided).

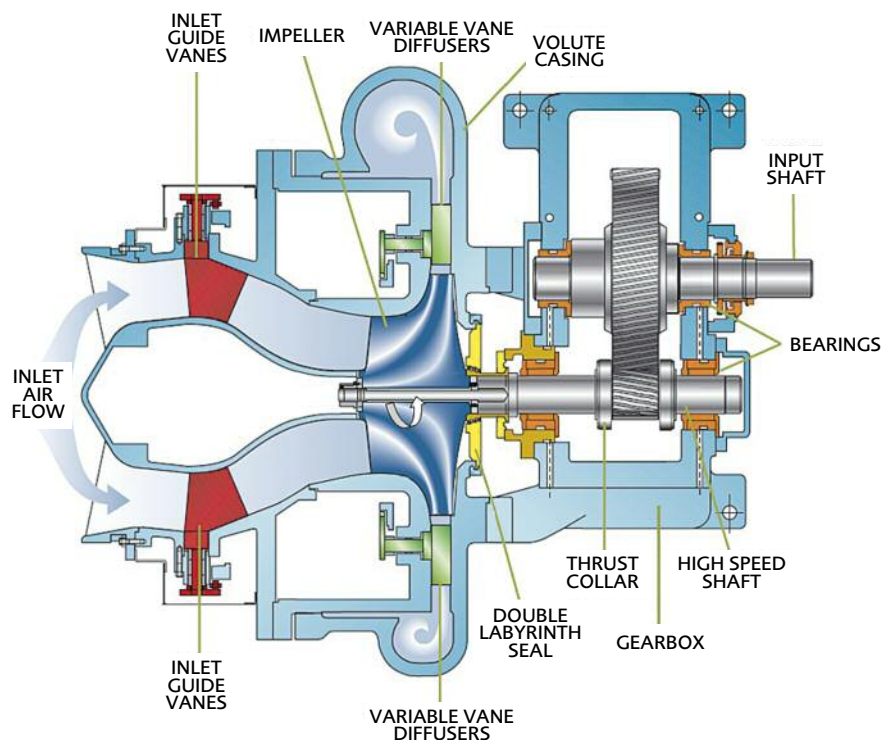
VARIABLE DIFFUSERS FOR FLOW CONTROL (VVD)

- Diffuser vane control assemblies are incorporated within the blower/compressor to achieve efficient capacity control whilst retaining the simple constant speed motor.
- Aerofoil vanes are manufactured from AISI 316 stainless steel.
- Actuation is by a single spindle, via a non-lubricated linkage system.
- Electric servo motor actuator fitted for modulating control. (Pneumatic actuators can be provided).

COMBINED CONTROL (CVC)

The Howden combined vane control (CVC) features:

- Enhances the advantages of both the variable vane diffuser and inlet guide vanes.
- Maintains high design efficiency over a wider range air flow and ambient temperature range than either of the individual control systems.





VARIABLE DIFFUSERS FOR FLOW CONTROL (VVD)



A. VVD closed

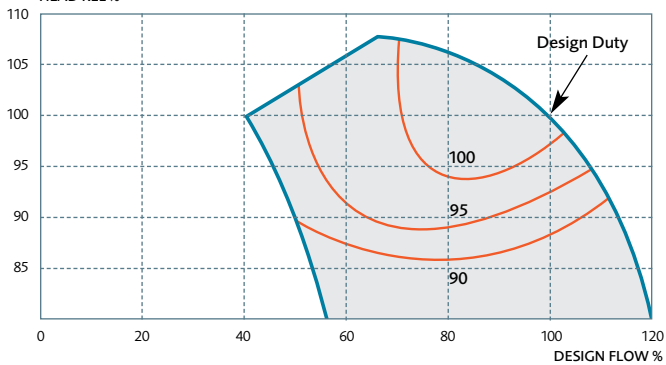
B. VVD partially open

C. VVD fully open

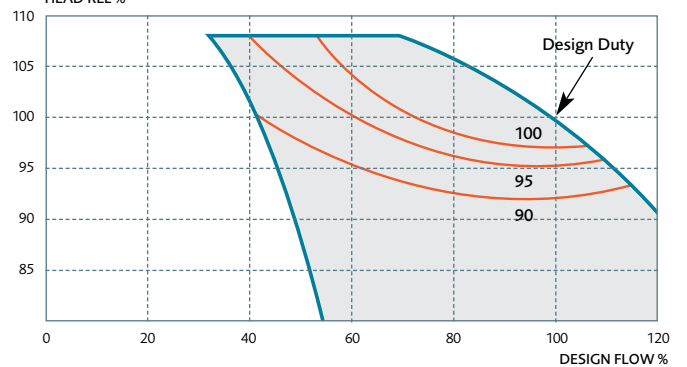
PERFORMANCE CURVES

THE PERFORMANCE CURVES BELOW SHOW LINES OF CONSTANT ACTUAL MACHINE EFFICIENCY RELATIVE TO DESIGN EFFICIENCY THROUGHOUT FLOW RANGE AND ISENTROPIC HEAD RANGE.

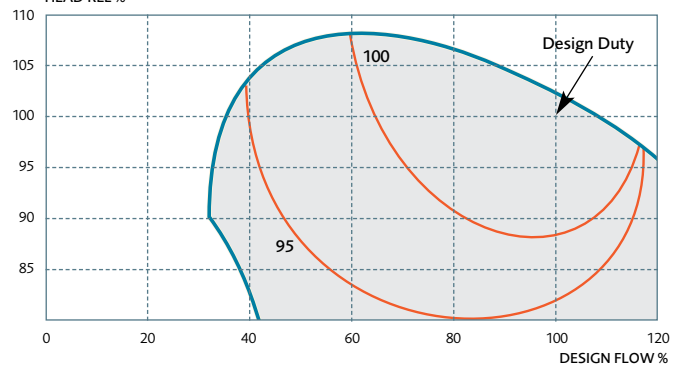
IGV: INLET GUIDE VANE CONTROL
HEAD REL %



VVD: VARIABLE VANE DIFFUSER CONTROL
HEAD REL %



CVC: COMBINED VANE CONTROL
HEAD REL %



EXPERT ENGINEERING DESIGN

ENSURING OPTIMUM PERFORMANCE

WITH OVER 1,200 INDIVIDUAL TURBO BLOWERS/COMPRESSORS SUPPLIED AND INSTALLED WORLDWIDE, HOWDEN HAS A LONG PEDIGREE IN THE ENGINEERING DESIGN OF PROCESS AIR SYSTEMS THAT DELIVER THE OPTIMUM NEEDS OF INDIVIDUAL PROJECTS.

Upon receipt of a project enquiry specification, a thorough review of process requirements by expert Howden project and applications personnel ensures that the most cost effective and energy efficient design proposal is submitted to the customer, whether for a turbo blower/compressor or a full process compression package installation.

HOWDEN CAN OFFER A STANDARD DESIGN OF TURBO COMPRESSOR TO API 672 4TH EDITION OR AP1 617 7TH EDITION, WITH MINIMUM DEVIATIONS.

PRODUCT INTEGRITY, LONG OPERATIONAL LIFE AND MAXIMUM EFFICIENCY OF COMPRESSION ARE THE MAIN FOCUS OF OUR ENGINEERING DESIGN.

RESEARCH AND DEVELOPMENT

Howden's continual commitment to engineering excellence begins with research and development. Many factors influence our customers' requirements. We respond to their changing needs through a continuing programme of product development, using new techniques, materials and manufacturing processes that lead to continuous improvements for resistance to corrosion, abrasion and high temperature, combined with the high speeds encountered on turbo blowers & compressors.

SYSTEM DESIGN

Using the latest CAD technology, customised packaged sets are designed to comply with the requirements of international standards such as API, ASME (VIII DIV1), BS, DIN, GOST, AD. Drawings and manuals can be provided in electronic format to facilitate incorporation with total project documentation.



CONTRACT MANAGEMENT

Professional contract management has earned us the reputation for on-time delivery. A senior contract engineer is assigned to each project and is responsible for co-ordinating and submitting all required documentation, liaising with the client and closely monitoring progress through to site installation and commissioning. This ensures maximum attention to detail with the greatest flexibility to meet with changing specifications and satisfy individual customer needs.

MANUFACTURING EXCELLENCE

PRODUCING THE HIGHEST QUALITY BLOWERS & COMPRESSORS IN THE INDUSTRY

HOWDEN IS COMMITTED TO MANUFACTURING THE HIGHEST QUALITY BLOWERS & COMPRESSORS IN THE INDUSTRY. WE EMPLOY STATE OF THE ART MACHINE TOOLS TO ATTAIN THE HIGHEST POSSIBLE ACCURACY AND TOLERANCES THAT ALLOW US TO PRODUCE OUR RANGE WITH OPTIMUM EFFICIENCY AND OUTSTANDING RELIABILITY.

All Howden turbo blowers & compressors bear the European Standard's C.E. mark (when supplied within the European Union) and comply with International standards and codes including API.

Our quality systems are continually assessed by Lloyds Register and certified to ISO9001:2008, ensuring consistent quality throughout all aspects of the design and manufacture process.

Howden Process Compressors holds TRIPLE CERTIFICATION to the following international standards:

- Quality Management: ISO 9001:2008
- Health & Safety Management: OHSAS 18001:2007
- Environmental Management: ISO 14001:2004

PRODUCT TESTING

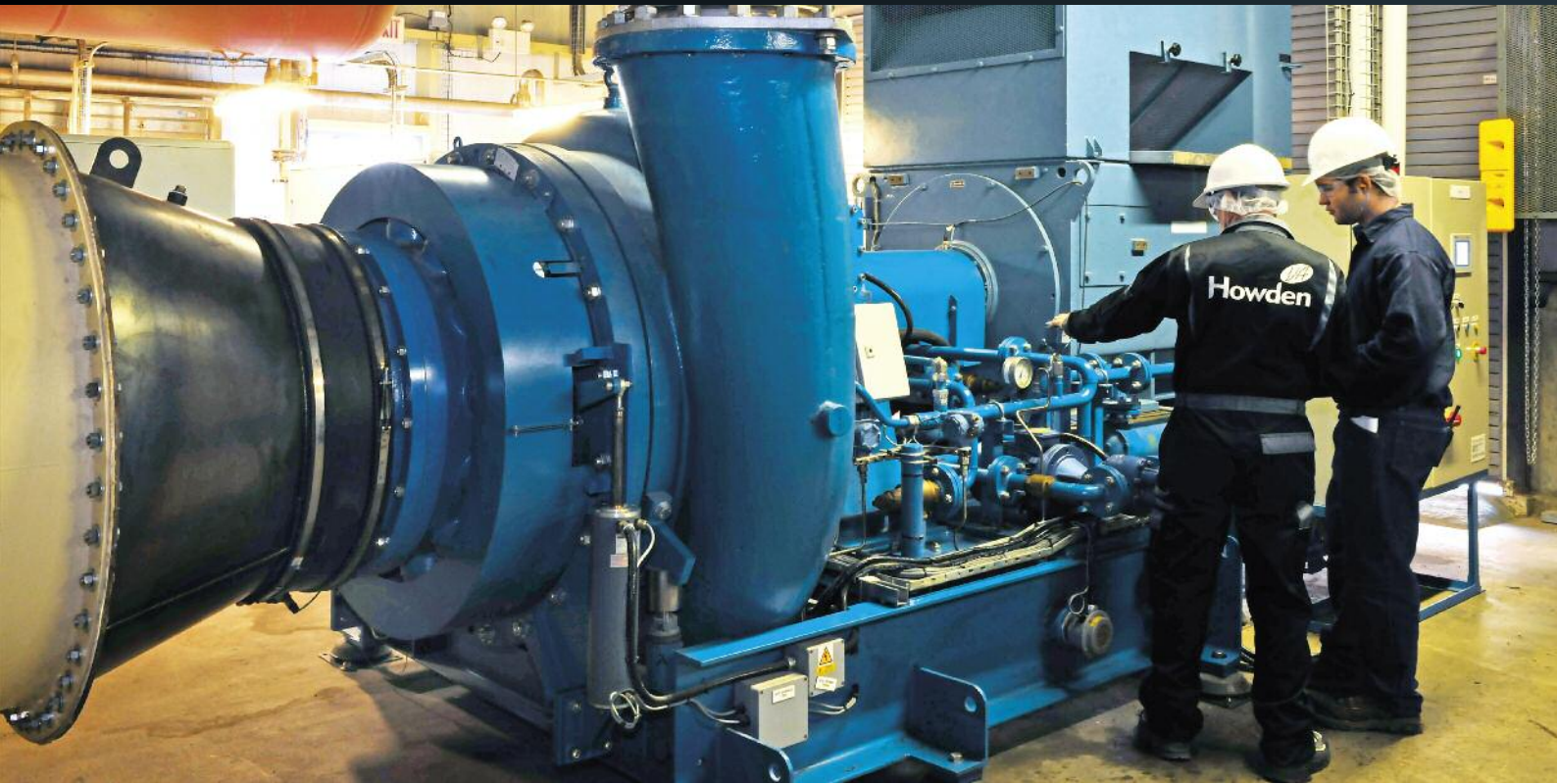
Comprehensive in-house testing, to API standard, gives confidence that each turbo blower & compressor unit will perform reliably throughout its life.

Testing procedures available include:

- Mechanical no-load test.
- Standard as part of the Howden Process Compressors programme.
- String test.
- Optional. To prove all instrumentation and system.
- Performance test.
- Optional. To BS 2009 or ASME PTC 10 code.



LIFETIME CUSTOMER CARE



HOWDEN PROVIDES A LIFELONG AFTERCARE SERVICE, FROM SUPPLYING OUR ORIGINAL SPARE PARTS TO MAINTENANCE SERVICES AND ENGINEERING TROUBLESHOOTING.

OEM SPARE PARTS

Our highly experienced engineers are available to install, assist in installation, commission the electrical, mechanical and control aspects and also to provide on-site training in maintenance techniques to our customers' own engineers. Our company policy in the area of after sales activities, is one of continuous support through the supply of spare parts for all machinery and its associated ancillary equipment. Full and comprehensive plant records are kept on an almost indefinite basis and, as an example, spare parts are regularly supplied for machinery in excess of 50 years old.

OVERVIEW OF LIFETIME SUPPORT

- Supply of original replacement parts.
- Blower/Compressor up-grades and retrofits.
- Component and valve repairs.
- Field site service.
- Engineering troubleshooting.
- Maintenance contracts.
- Re-commissioning.
- Customer operator training.
- Remote monitoring.
- Global sourcing.

TYPICAL SPARE PARTS INCLUDE:

- Bearings
- Labyrinth seals
- Bearing oil seals
- Oil filter elements
- Air filter elements.

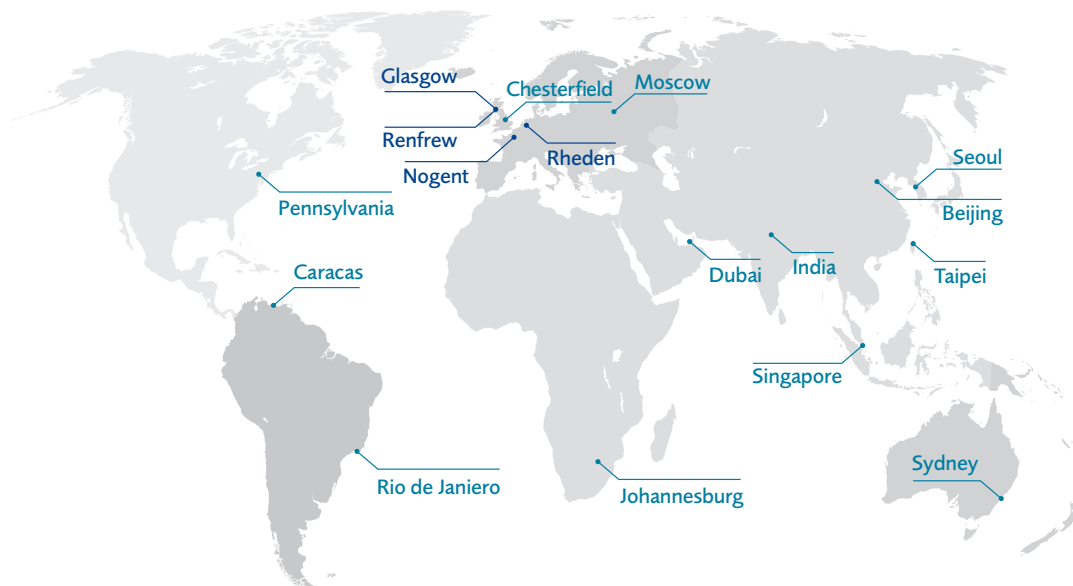


HOWDEN IS ALSO ABLE TO SUPPORT LEGACY PRODUCTS PREVIOUSLY SUPPLIED BY BRYAN DONKIN CO.

GLOBAL COVERAGE



THE HOWDEN COMPRESSOR DIVISION HAS MANUFACTURING, SALES AND REGIONAL SERVICE CENTRES LOCATED THROUGHOUT THE WORLD, ENSURING OUR CUSTOMERS HAVE A LOCAL HOWDEN SPECIALIST TO RESPOND PROMPTLY TO THEIR SPECIFIC COMPRESSOR NEEDS.



PASSION FOR COMPRESSION

Howden, founded in 1854, is a world leading supplier of compressors, fans and rotary regenerative heat exchangers for a large range of 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.

The combination of our product knowledge with our extensive applications experience, gained by our engineers on sites throughout the world, allows us to provide our customers with full support, from the initial project inception right through to the end of the plant life.

Howden Compressor Division companies occupy a unique position in compressor design and manufacturing. We pioneered many of the technologies that the global oil and gas, petrochemical, industrial refrigeration, power and chemical industries now rely on.

Related publications:

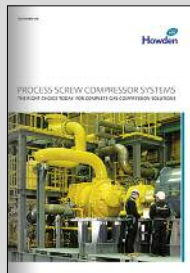
The following publications are available upon request or by download from our website www.howden.com/compressors



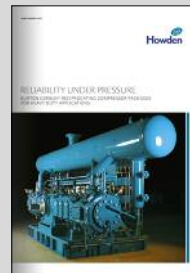
Howden Compressor Division



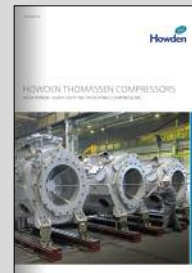
Howden Water Technology



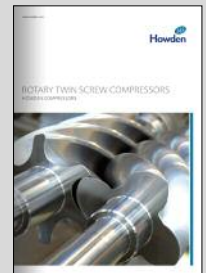
Process Gas Compressor Systems



Howden Burton Corblin



Howden Thomassen
Compressors



Howden Compressors



HOWDEN PROCESS COMPRESSORS

Head Office

Old Govan Road, Renfrew PA4 8XJ
United Kingdom

Sales & Service Centre

Park Road, Holmewood Industrial Park
Chesterfield S42 5UY
United Kingdom

Turbo Blower Sales

Tel: +44 1246 859 053
Email: blowers.sales@howden.com

Spare Parts & Service

Tel: +44 1246 859 053
Email: blowers.aftersales@howden.com

