

ENGINEERING EXCELLENCE WORLDWIDE

FANS, HEAT EXCHANGERS AND COMPRESSORS



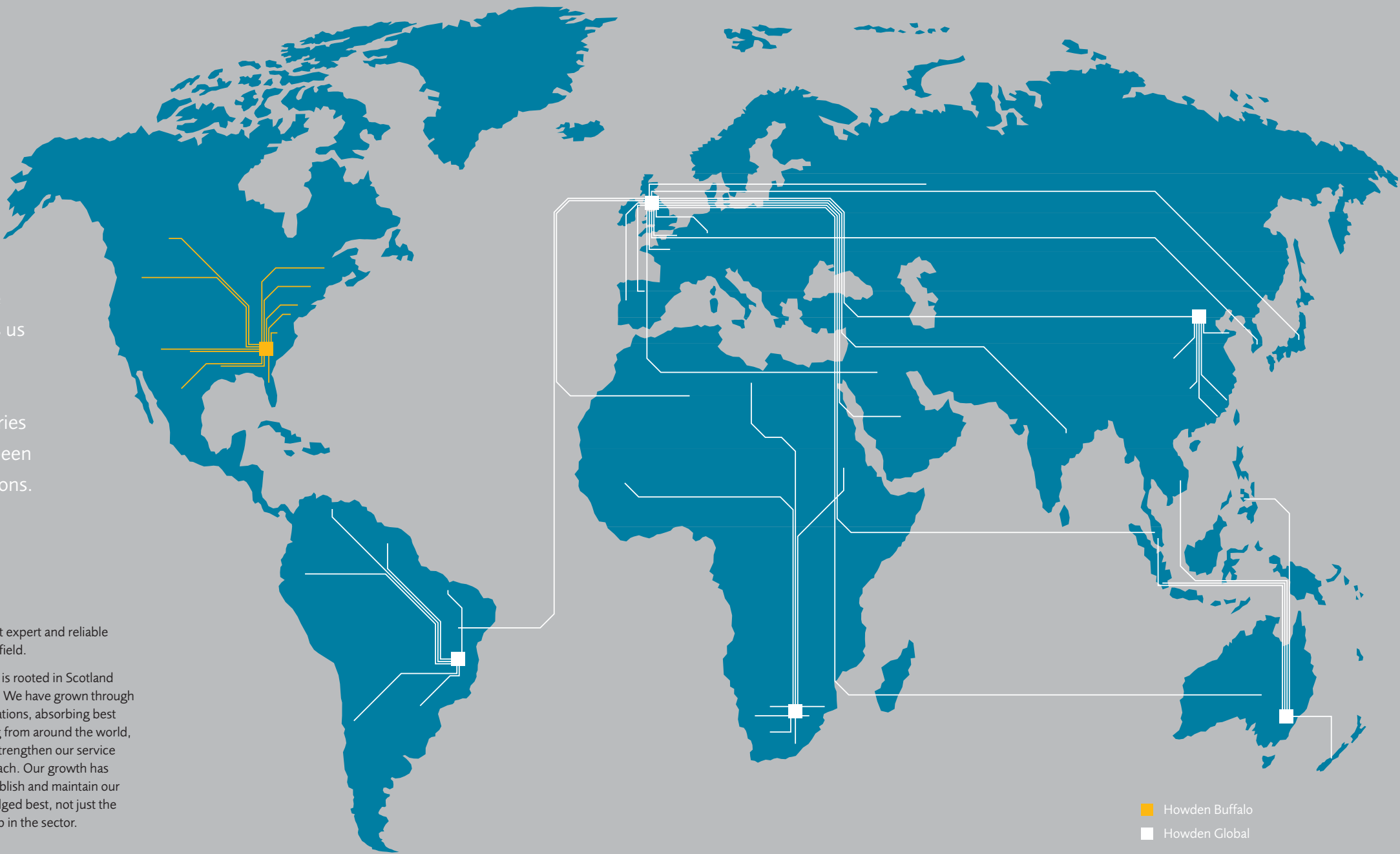
HOWDEN... THE GLOBAL FORCE IN AIR AND GAS HANDLING

Howden, including its North American affiliate, is the global force in air and gas handling. And that makes us an integral part of everyday life on every continent. Howden reliability and expertise underpin the global power, petrochemical, metals and many other industries in a host of ways. Over the past 150 years, we have been the driving force behind many revolutionary innovations. And we have become the biggest and most trusted engineering group in the sector through our commitment as well as our expertise.

We are committed to our customers. When Howden is involved in a project, whatever its size or value, we do not consider the job done until our equipment is running efficiently to specification, whenever it is needed. And even then we like to stay involved. Our commitment lasts throughout the life of the equipment.

We are committed to the future. Our continuous research programme, investigating the performance of rotating machinery under extreme conditions, keeps us at the forefront of air and gas engineering. We are committed to maintaining

our reputation as the most expert and reliable engineering group in our field. Our engineering tradition is rooted in Scotland and international in scope. We have grown through collaborations and associations, absorbing best practice and new thinking from around the world, and building bonds that strengthen our service and our innovative approach. Our growth has been orchestrated to establish and maintain our position as the acknowledged best, not just the largest, engineering group in the sector.



Howden is organised to meet the demands of the global market. Over 2500 employees in all corners of the world can operate with the independence that suits their customers' needs, while always being able to call on the experience and resources of all parts of Howden when they have to.

A CLEAR COMMITMENT TO QUALITY AND PROVEN RELIABILITY

The Howden fan portfolio, ranging in size from 15 metre diameter cooling fans down to pre-engineered units is designed to cover virtually all industrial situations where performance and reliability are essential. Between these extremes lie many fan series, each designed for a specific purpose. These include the Variax® variable pitch axial flow fan with a complex mechanism to adjust the blade angle and thus maintain maximum efficiency at all loadings, and our heavy duty centrifugal fans which can be tailored to suit a wide range of operating conditions, from clean air to high temperature dust-laden gas.

And as well as fans, Howden produces compressors, and heat exchangers, each a carefully considered and meticulously designed response to an exacting challenge.

Our range of compressors is unique. It includes diaphragm compressors, providing compression up to 1,000 bar with zero contamination and reciprocating compressors, designed for heavy-duty applications in the petrochemical industry. We supply high efficiency screw compressor packages, complete with all required controls, instrumentation and auxiliary equipment; fully tested and ready for installation at site.

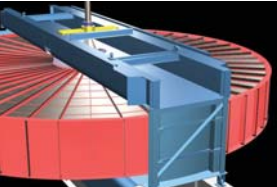
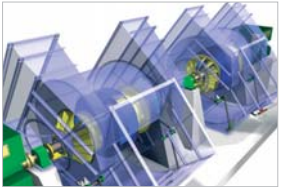
Our high-efficiency turbo-compressors are used in a wide range of process applications, at pressures up to 5 bar.

Our state-of-the-art heat exchangers are the product of a distinguished history. Working with the inventor Fredrik Ljungström in the early twentieth century, Howden introduced a rotating air heater that revolutionised steam boiler performance. Today, Howden continues to drive performance forward and, through engineering expertise, leads the world in this technology.

Throughout the entire product range, the quality of manufacture is backed by innovative engineering and design. The precise geometry of fan blades, the materials and coatings used, the bespoke control systems, even the specially designed bearings, are all products of decades of research and experience.

Howden products can be found in a vast number of situations where quality and reliability are vital. Almost all are individually engineered to suit the application and environment. The starting point is always a thorough analysis of customer needs and how they can most efficiently be satisfied.

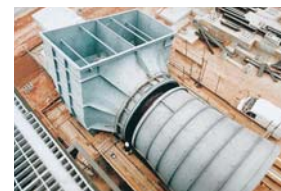
On-site maintenance by Howden personnel at Avedøre power station, Copenhagen, Denmark.



Our products are integral to many leading edge developments. From fans and heat exchangers for the latest high-efficiency, low-emissions power stations to compressors for emerging processes in the energy sector; from nuclear power to the water industry, our engineering is relied upon.

IN A CHALLENGING ENVIRONMENT, HOWDEN IS THE OPTIMUM CHOICE

If there is a common factor in the diverse applications in which Howden products are found, it is the importance of absolute, continuous reliability. Where performance is critical, in areas such as power generation, petrochemicals, tunnels and mining, Howden engineering is the benchmark. Wherever there is a challenging environment, such as extreme temperatures, corrosive gases or erosive particles, Howden is the optimum choice.



In the power industry, Howden engineering raises efficiency, lowers fuel consumption, and reduces pollution. Our fans and heat exchangers improve boiler performance and disperse flue gases. We have unique experience in areas such as flue gas desulphurisation and selective catalytic reduction, which contribute to cleaner power.

Howden is at the heart of much of the world's petrochemical processing. Screw compressor

systems are found in oil and gas fields from the North Sea to the Middle East. In flare gas reduction, gas cleaning, liquefaction and other gas handling applications, our unrivalled experience grows with each new task and keeps us at the cutting edge.

In the cement and steel industries, Howden fans and compressors have vital roles, ranging from heat recovery to air cleaning. In mining

and tunnelling, our fans ensure a supply of breathable air throughout underground workings. In mineral processing, sewage treatment and a host of other areas, from the everyday to the obscure, Howden quality provides the bedrock for success.

www.howden.com
www.howdenbuffalo.com


Howden

A PROVEN RECORD IN WORLD-CLASS ENGINEERING



EUROPE:
DRAX POWER STATION

Drax, situated in northeast England is the largest coal fired power station in Western Europe. In the mid-1990s each of the 6 x 660MW boilers was fitted with a flue gas desulphurisation plant, becoming the world's largest such installation.

Howden has designed, supplied and installed all the air preheaters, boiler draught fans, gas reheaters and FGD booster fans. To meet the requirements of the EU's Large Combustion Plant Directive the station is reducing NOx emissions using a Boosted Overfire Air (BOFA) system and Howden has supplied fans for this. Many of the air preheaters which were installed between 20 and 30 years ago, have now been upgraded to the latest Howden advanced sealing system.



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CHINA:
TUOKETUO POWER STATION

Tuoketuo is one of China's flagship power stations, with eight 660MW generating units using the latest supercritical boiler technology.

State-of-the-art stations such as this play a vital role in developing the Chinese economy, and the highest levels of availability must be achieved to sustain the country's growing demand for power. Each unit is fitted with air preheaters and boiler draught fans supplied by **Howden Hua**.

From its base in Beijing, Howden Hua has become the leading supplier of fans and rotary regenerative heat exchangers in China.



USA (HOWDEN BUFFALO):
BOSTON CENTRAL ARTERY TUNNEL

The Boston Central Artery Tunnel is the largest, most technically complex and challenging highway project in American history. The tunnel has replaced a six-lane highway through central Boston, reducing congestion and bringing environmental benefits to the people of the city.

With 14 miles of ductwork extracting the exhaust fumes of almost a quarter of a million vehicles a day, the ventilation system for the project is one of the largest such systems in the world.

It is driven by 95 double-inlet centrifugal fans each over 3m in diameter, 35 jet fans and eight axial fans, all supplied by **Howden Buffalo Inc.**, (a subsidiary of Anderson Group Inc., and a licensee of Howden).



SOUTH AFRICA:
SASOL SYNTHETIC
FUELS PLANT

Since the early 1970s, the Sasol plant has converted coal into synthetic oil. There are 17 boilers on site, and maintaining the highest levels of performance and availability is a constant challenge.

Howden Africa works in partnership with the plant operators, assuming responsibility for the programmed maintenance and enhancement of all the boiler fans. This includes the placement of a full-time project manager and maintenance supervisor on site.

One typical initiative, which increased plant output and simultaneously reduced maintenance requirements, was the replacement of the original induced draught fans with Howden's latest design.



HOWDEN... OVER 150 YEARS OF EXPERIENCE

Howden's experience is unique. We have led the way in understanding the behaviour of materials and machines at extremes of temperature and speed. Perhaps even more importantly, we have unprecedented experience in providing engineering solutions that combine the highest levels of availability and reliability with elegance, economy and efficiency.

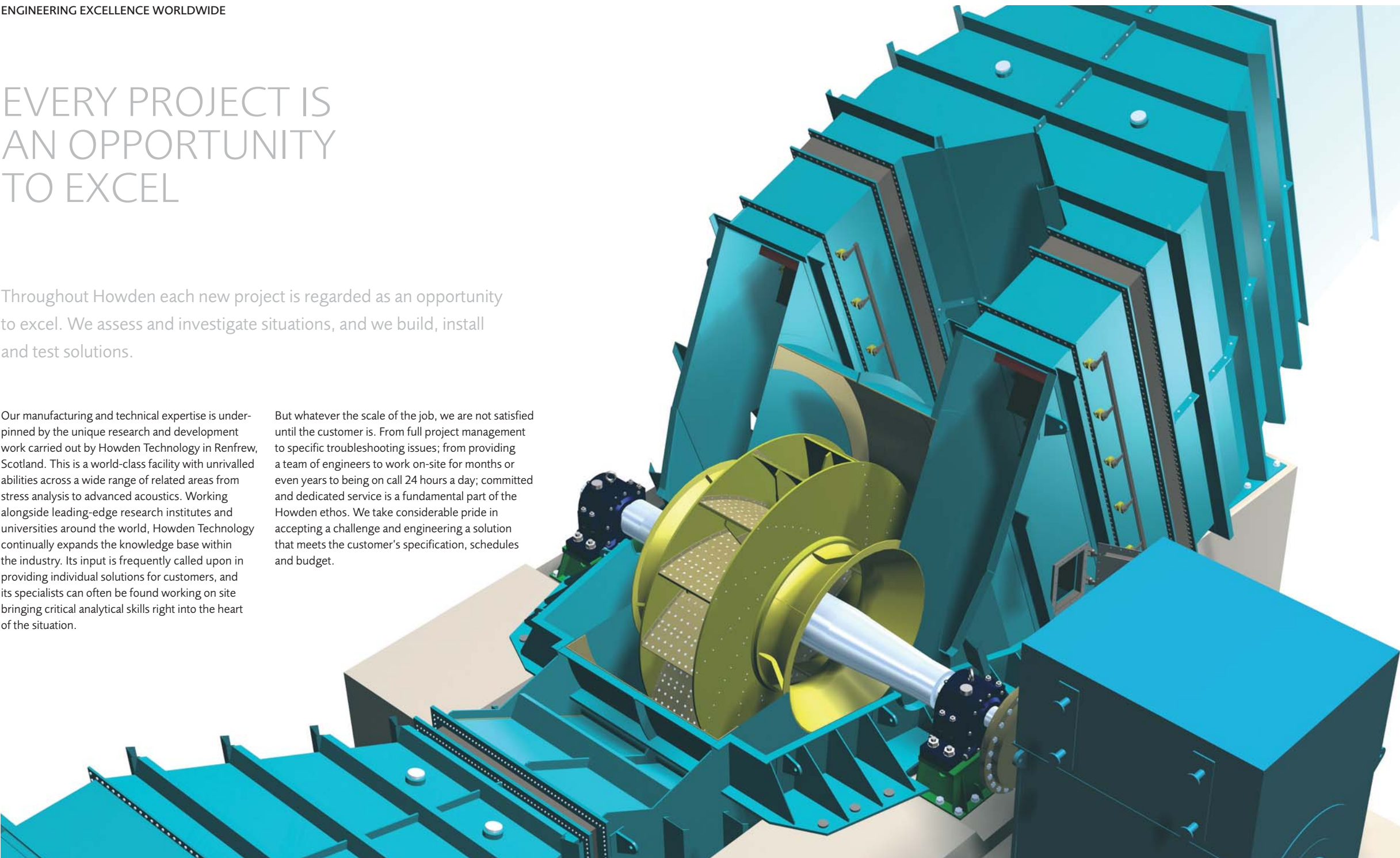


EVERY PROJECT IS AN OPPORTUNITY TO EXCEL

Throughout Howden each new project is regarded as an opportunity to excel. We assess and investigate situations, and we build, install and test solutions.

Our manufacturing and technical expertise is underpinned by the unique research and development work carried out by Howden Technology in Renfrew, Scotland. This is a world-class facility with unrivalled abilities across a wide range of related areas from stress analysis to advanced acoustics. Working alongside leading-edge research institutes and universities around the world, Howden Technology continually expands the knowledge base within the industry. Its input is frequently called upon in providing individual solutions for customers, and its specialists can often be found working on site bringing critical analytical skills right into the heart of the situation.

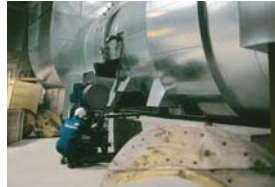
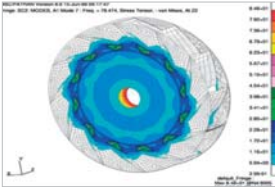
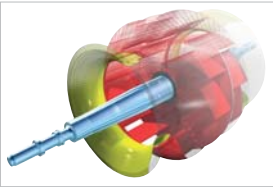
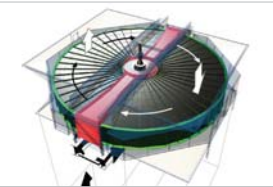
But whatever the scale of the job, we are not satisfied until the customer is. From full project management to specific troubleshooting issues; from providing a team of engineers to work on-site for months or even years to being on call 24 hours a day; committed and dedicated service is a fundamental part of the Howden ethos. We take considerable pride in accepting a challenge and engineering a solution that meets the customer's specification, schedules and budget.



ENGINEERING EXCELLENCE WORLDWIDE

Howden engineers are hugely respected throughout the world.

And our involvement runs well beyond design, manufacture and installation. We offer a full aftermarket service to monitor, maintain and refurbish plant and equipment, whether or not it was originally supplied by us, in many cases raising performance well above the original design parameters. Our engineers are hugely respected throughout the world, offering expert supervision of maintenance and upgrading of industrial installations.



QUALITY ASSURANCE

Howden companies have been awarded a range of quality assurance accreditations. Most have quality management systems that meet the requirements of ISO 9001:2000, and many have already gained accreditation to ISO 14001 for environmental management.

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www.howdenbuffalo.com



Focussing on its global expertise in fans, heat exchangers and compressors, Howden delivers first class technology, project management and customer support. Wherever our customers are located, a Howden office is close at hand. With engineering, manufacturing and sales offices throughout the world, we understand and satisfy local market needs.

For further information, contact your local representative, our website or any of the companies listed below.



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Howden

COMMITMENT TO THE FUTURE

THROUGHOUT THE WORLD, HOWDEN AFTERMARKET SERVICES
ARE ENHANCING THE PERFORMANCE AND EXTENDING THE LIFE
OF AIR AND GAS HANDLING EQUIPMENT



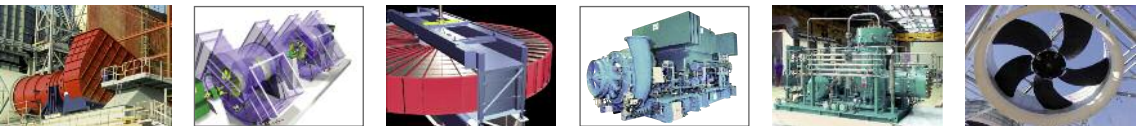
ENGINEERING EXCELLENCE WORLDWIDE

HOWDEN PRODUCTS AND EXPERTISE UNDERPIN INDUSTRIAL PROCESSES AND POWER GENERATION IN VIRTUALLY EVERY PART OF THE WORLD. IN THE MOST EXTREME, DEMANDING AND HOSTILE ENVIRONMENTS, OUR AIR AND GAS HANDLING EQUIPMENT GOES ON PROVIDING THE ROBUST, RELIABLE PERFORMANCE THAT PEOPLE DEPEND ON WHEN THE APPLICATION IS CRITICAL. WE ARE COMMITTED TO KEEPING IT THAT WAY. THE DRIVING FORCE BEHIND HOWDEN'S SUCCESS IS HOWDEN TECHNOLOGY. FOR 150 YEARS, WE HAVE BEEN AT THE LEADING EDGE OF ENGINEERING RESEARCH. NO OTHER COMPANY APPROACHES OUR CAPABILITIES IN APPLICATIONS LIKE AERODYNAMICS, ACOUSTICS, ROTOR DYNAMICS AND STRESS AND VIBRATION ANALYSIS. THIS EXPERTISE IS CONTINUALLY BEING APPLIED TO NEW PRODUCTS. BUT IT IS ALSO BEING USED TO EXTEND THE ACTIVE LIFE OF INSTALLED EQUIPMENT IN ALL KINDS OF SITUATIONS, IN COUNTRIES THROUGHOUT THE GLOBE. HOWDEN ENGINEERING CAN GIVE EXISTING PLANT NEW LIFE AND NEW RELIABILITY.

HOWDEN

KNOW-HOW

Howden global service covers a comprehensive range of rotating equipment, heat exchangers and related products.



The world relies on Howden technology in a surprising breadth of applications, including Power generation // Petrochemicals // Tunnel ventilation // Chemical engineering // Iron and steel manufacturing // Mining // Cement manufacturing // Metals and minerals // Wind tunnels // Transport // Sugar processing // Pulp and paper manufacturing // Environmental industries // Industrial gases // Nuclear technology

OUR AFTERMARKET SERVICES INCLUDE:

- Spare parts supply
- Spare part repairs
- Retrofits – new equipment in existing installations
- Refurbishment – restoration to 'as new' performance
- Revamping – improving the output and/or efficiency of the plant
- Preventive maintenance programs and contracts
- Site surveys, inspection and plant evaluation
- Troubleshooting – a wide range of different types of testing and analysis.

TOTAL GLOBAL SUPPORT

When we design and build air and gas handling equipment, whether it is part of our pre-engineered range or produced specifically for a customer application, we back the product with a service that starts with the order and continues throughout the life of the installation. Through expert maintenance and the use of certified parts and carefully planned upgrading, that life can be surprisingly long.

WE ARE UNIQUELY EXPERIENCED. For one and a half centuries, since the early days of air and gas engineering, we have been building an unrivalled resource of skills and knowledge. We understand the unique conditions and circumstances that prevail in the wide diversity of industries in which we operate. We profoundly understand air and gas handling equipment,

no matter who made it or who installed it, and we will apply the same care and insight to protecting and prolonging its productive life.

WE ARE UNIQUELY GLOBAL. Howden companies operate on every continent. In each of our specialist areas, our local engineers have behind them a powerful bank of facilities, research, experience and capabilities, on which they can draw at any time.

Howden aftermarket support is a response to your needs. We will always offer you the most cost effective, long-term and technically excellent solution to the problems of ageing plant or changing conditions.

Main image: Howden Hua inspection team at Weihai Power Station, China.

LOCAL/GLOBAL



CLOCKWISE FROM TOP LEFT:

Howden Hua design office in Beijing, China

Reconditioning work being carried out at Howden Hua's factory in Weihai, China

Element line at Howden Spain's factory in La Union

Howden South America design office in Sao Paulo, Brazil

Inspection of silencers for axial fans in Howden's factory in Johannesburg, South Africa

Howden Turbowerke office in Coswig, Germany

AERODYNE FANS • AEREX FANS • AIRSCREW • AIRTECH FANS •
AMERICAN BLOWER • BERRY FANS • BUFFALO FORGE • BURTON
CORBLIN COMPRESSORS • CANADIAN BLOWER • CARTER FANS •
CLEMCORP FANS • DAVIDSON FANS • DONKIN BLOWERS • ENGART
FANS • FANTECNIC FANS • GODFREY BLOWERS • HISON FANS •
HOWDEN BUFFALO • HOWDEN • SIR OCCO FANS AND HEATERS •
JAMES HOWDEN • JOY GREEN FANS • MAJAX FANS • NORDISK FANS •
NOVENCO VARIAX • PITSTOCK FANS • PHOENIX FANS • POWERMAX
FANS • REAVELL CENTRIFUGAL • SAFANCO FANS • SHELDON FANS •
SIROCCO SOFRAIR BLOWERS • STORK FANS • STURTEVANT FANS •
TALLERES SANCHEZ LUENGO (TSL) • TURBOWERKE MEISSEN
VENTILATEURS NEU • VENTILATOREN SIROCCO • VOITH FANS •
WALLER WESTINGHOUSE FANS • WOLF FANS • WHEELER FANS

PRODUCT

PRODUCT KNOWLEDGE

Howden has grown steadily over the years to become the global force in air and gas handling. We have, during that time, acquired, incorporated or formed partnerships with many other companies. Each one was chosen because it added a particular specialisation, technology or advantage to the service we could offer. The list covers celebrated names and formidable reputations.

POSITIVE PLANNING

Plant failure can be very expensive, especially when you are unprepared for it. Unexpected and unscheduled outages can have enormous consequences.

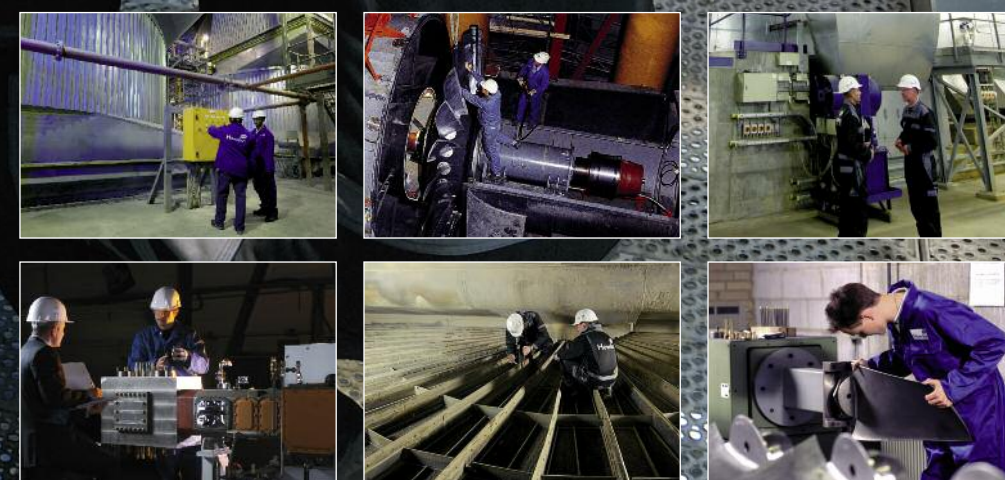
HOWDEN CAN RESPOND IMMEDIATELY TO YOUR EMERGENCIES. A vast number of spare and replacement parts can be supplied, delivered and when necessary fitted by Howden engineers as a matter of urgency. When you have a crisis, we're on call.

BETTER, THOUGH, TO AVOID THE UNEXPECTED. We can advise you about, or carry out, inspections and servicing designed to keep your equipment trouble free. From your maintenance record, we can recommend critical interventions or suggest upgrades that will improve performance or economy.

We regard the supply of parts as a core activity, and we treat it with the same care that we bring to new installations. Enquiries and orders are handled by specialist staff, to ensure that they accord with your service records and our understanding of your needs. Whether they are for Howden installations or third party equipment, they are meticulously checked to make sure they are appropriate. And, where possible, we will advise you on new technologies or developments that might raise the performance, longevity or economy of your equipment.

Main image: Inspection of variable pitch axial flow fan at Ensted Power Station, Denmark.

MAINTENANCE



CLOCKWISE FROM TOP LEFT:

Maintenance inspection at Matla Power Station, South Africa

Replacement of axial fan cast iron blades at Asnaes Power Station, Denmark

Axial fan inspection at Avedøre Power Station, Denmark

Axial blade balancing at Howden UK's factory in Belfast, Ireland

Inspection of air preheater elements at Ensted Power Station, Denmark

QA inspection of piston compressor at Howden BC Compressor's factory in Nogent, France

ADVANCED

TECHNOLOGY THAT NEVER STANDS STILL

Product development is a continuous process of improvement. It follows that all equipment will eventually become outdated.

Most Howden installations involve our products working seamlessly with other equipment. The finished, integrated plant is a major custom-built project that represents an enormous investment of time and money. We do not believe it should be left to run into obsolescence.

THAT'S WHY WE ARE DEDICATED TO GIVING ALL EXISTING INSTALLATIONS, WHEREVER POSSIBLE, THE BENEFITS OF THE MOST UP-TO-DATE HOWDEN TECHNOLOGY. Through careful upgrades and retrofits, we can vastly improve the performance of old products or equipment that is not meeting the demands

made on it. Whether or not the plant was made or installed by Howden, we can advise you on the most cost-effective route to improved performance.

We regularly inject new economy and efficiency through interventions such as designing new impellers to fit existing casings, reducing noise, re-coating surfaces to protect against erosion or corrosion, enhancing air or gas heaters, or introducing improved seals to reduce heat loss. Each action is carefully planned to meet all the parameters of the existing situation.

Main image: Manufacturing of axial fan casing at Howden Hua's factory in Weihai, China.



CLOCKWISE FROM TOP LEFT:

Manufacturing of centrifugal fan impeller at Howden Hua's factory in Weihai, China

Performance testing of a Howden screw compressor at Howden's compressor plant in Glasgow, UK

Balancing of axial fan impeller at Howden Hua's test facilities in Weihai, China

Manufacturing of elements for air preheaters Howden Spain's factory in La Union

Laboratory testing of enamelled elements

Polishing of cooling fan blades at Howden Hua's cooling fan factory in Weihai, China

ON-SITE

THE RIGHT PLACE AT THE RIGHT TIME

Howden have become the acknowledged global experts by maintaining a local presence. Our aim is to do everything in our power to keep your plant operational and free from unscheduled stoppages. We can work alongside your own personnel, training your staff and building a partnership that lasts throughout the life of the equipment. During that time, we can carry out regular monitoring, inspection, servicing and repairs. We can advise on upgrades, and carry them out at the most convenient time. We can maintain a meticulous installation and service record, an invaluable tool in planning and ensuring the future safety and reliability of the equipment.

EVERY HOWDEN SUPERVISOR OR ENGINEER WORKING ON-SITE HAS THE WHOLE OF HOWDEN'S GLOBAL EXPERTISE TO DRAW ON.



CLOCKWISE FROM TOP LEFT:

Howden inspectors at Weihai Power Station, China

Screw compressor package assembly

Inside Ensted Power Station in Denmark

On-site at Matla Power Station, South Africa

Inspection at Avedøre Power Station, Denmark

Test assembly of cooling fan

UNDERSTANDING THE BIG PICTURE

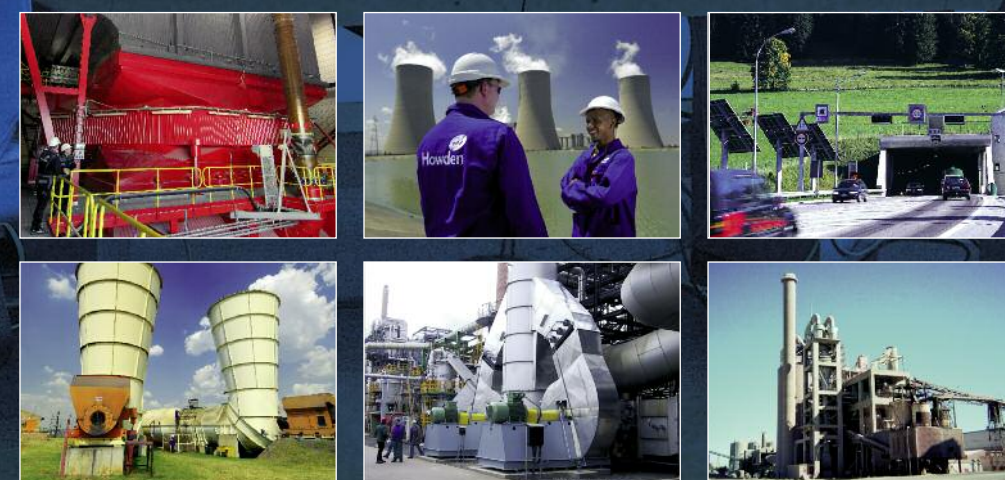
Howden's reputation as the pre-eminent experts in air and gas handling is widely acknowledged. In building that reputation, we have had to acquire a comprehensive understanding of other people's businesses.

Our equipment is, almost invariably, an integral part of a complex installation. To design for optimum performance, we have to understand the interplay of the various elements, and the ways in which noise, vibration, flow, power supplies, insulation and a whole host of other variables act throughout the plant. We have made it our business to master the big picture as it applies to each of the industries in which we operate.

In this process, the contribution made by our Howden Technology division has been invaluable. Howden Technology operates at the cutting edge, carrying out research into a broad spectrum of inter-related technologies.

The whole investigative and intellectual resource that Howden represents is frequently called upon to explore the complex problems that can crop up in complex installations. When the problem has to be found before it can be addressed, or where interacting factors stand in the way of optimum efficiency, we can bring a holistic approach and an unrivalled depth of understanding.

PERFORMANCE



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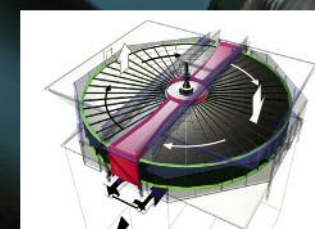
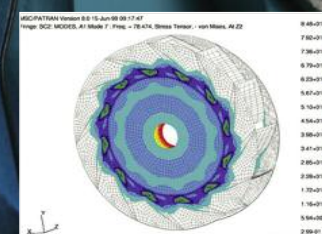
- FGD gas-gas heater at Ensted Power Station, Denmark
- On-site at Lethabo Power Station, South Africa
- Howden supplies a variety of fans for tunnel ventilation, ranging from jet fans to large axial exhaust fans
- Cement plant in Algeria
- Centrifugal fans installed at German Petrochemical plant
- Axial surface fans at Khutala mine in South Africa

TROUBLE SHOOTING

Every Howden company can, when addressing advanced troubleshooting issues, draw on the unparalleled expertise of Howden Technology. A unique resource offering world-class research and problem-solving, it provides unmatched insight in highly specialist, operationally critical areas such as:

- STRESS ANALYSIS USING FINITE ELEMENTS
- ADVANCED ACOUSTIC ANALYSIS IN BOTH LABORATORY AND ON-SITE CONDITIONS
- DIGITAL ACOUSTIC INVESTIGATION USING SYSNOISE SYSTEMS
- ANALYSIS OF COMPLEX STRUCTURAL DYNAMICS IN STATIC AND ROTATING COMPONENTS
- ADVANCED ANALYSIS OF METAL FATIGUE AND FRACTURE MECHANICS
- HIGH-TEMPERATURE METAL CREEP EVALUATION
- INVESTIGATION OF ROTOR DYNAMICS IN MULTIPLE SHAFT SYSTEMS
- SITE STRAIN GAUGING AND TESTING UP TO TEMPERATURES OF 300°C
- DESIGN AND MANUFACTURE OF SPECIALIST ELECTRONICS
- DYNAMIC SURVEYS OF SITE VIBRATION PROBLEMS
- ON-SITE FAN PERFORMANCE TESTING IN ACCORDANCE WITH INTERNATIONAL STANDARDS.

TECHNOLOGY



CLOCKWISE FROM TOP LEFT:

Finite element analysis of centrifugal fan impeller

Howden supervisors meet regularly to discuss troubleshooting issues and share knowledge

Performance analysis at Lethabo Power Station, South Africa

Howden South America design office

Air preheater design software

Screw compressor vibration analysis at Howden's Glasgow factory

Committed to quality assurance

We are committed to integrating quality into all aspects of our business. Our companies have been awarded a range of quality assurance accreditations. Most have quality management systems that meet the requirements of ISO 9001:2000, and many have already gained accreditation to ISO 14001 for environmental management.

Committed to health and safety

We are committed to maintaining the awareness of all employees through training and setting of management objectives. We seek continual improvement in health and safety and there is an ongoing challenge for all our managers to achieve this. Many of our companies are already in compliance with or accredited to OHSAS 18001.

For further information, contact your local representative, visit our website or contact any of the companies listed below.



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WORLD CLASS ENGINEERING, WORLDWIDE EXPERIENCE

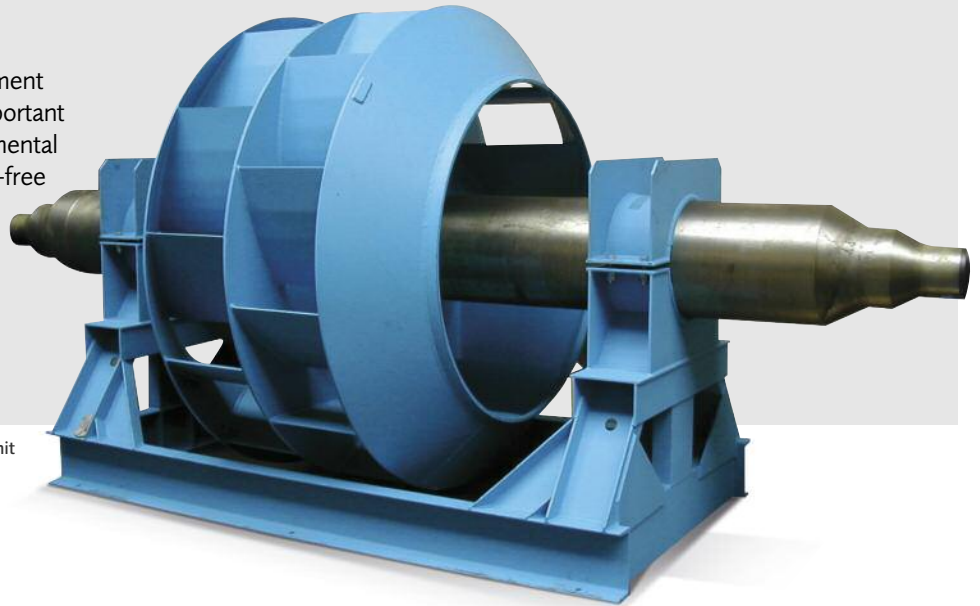
HOWDEN PROCESS FANS FOR THE CEMENT INDUSTRY



DEPENDABLE, CONTINUOUS PRODUCTION: HOWDEN RELIABILITY

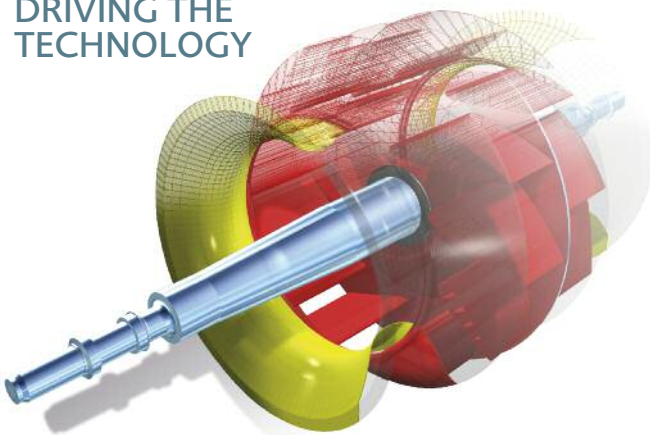
Cement manufacturing is one of the most important activities underpinning economic growth and development throughout the world. It is an expanding and increasingly critical industry, and one where reliability and efficiency are of paramount importance. And just as whole economies rely on cement production, cement manufacturing relies on the fans that move enormously high volumes of air and particulate matter around the plant.

Process fans account for the greatest part of the power consumption of a cement plant, and their efficiency is acutely important in reducing running costs and environmental impact. In addition, continuous trouble-free operation for months and even years is demanded. If a fan has downtime, the plant has downtime.



Filter ID fan impeller unit

DRIVING THE TECHNOLOGY



Howden has been designing and making fans specifically for the cement industry for more than 40 years, and have been fully involved as semi-dry and dry processing grew in importance and as other innovations, such as the introduction of precalcining in the 1970s, brought higher efficiency and greater outputs.

Above: Centrifugal fan design software

Our experience and understanding gives us a complete overview of cement manufacturing, and enables us to offer a comprehensive and flexible service that responds to market needs. Often, a customer will know exactly what is required, and supply a full specification for the equipment they want. Sometimes, they will want to discuss the parameters of the plant and draw on our advice and recommendations. Whatever the scope of the enquiry, we can give a positive response.

We often, for example, organise complimentary seminars for prospective clients and their staff to introduce our technology and the ways in which we can meet their requirements, and each seminar is custom designed so that areas such as installation, maintenance and revamping can be covered in as much or as little detail as desired. We regularly work with all of the major engineering specialists engaged in designing and building cement plants worldwide, and we are equally happy to talk to end users and plant operators. Our long experience and continuous research and development means that the advice and expertise we offer reflects the most up-to-date and informed thinking.



PROCESS FANS ACCOUNT FOR THE GREATEST PART OF THE POWER CONSUMPTION OF A CEMENT PLANT, AND THEIR EFFICIENCY IS ACUTELY IMPORTANT IN REDUCING RUNNING COSTS AND ENVIRONMENTAL IMPACT.

WORLDWIDE EXPERIENCE: WORLD CLASS PERFORMANCE

Howden is a global organisation with a presence on every continent. Our structure allows any Howden business unit to draw on the expertise, manufacturing capability and R&D facilities of the entire group of companies worldwide. We have a long-established centre of excellence for the design and production of process fans for the cement industry based at Lille in France, and in 2008 we introduced a second facility in Sao Paulo, Brazil, to help serve South American markets.

FOUR DECADES OF EXCELLENCE

Our Lille base has grown out of the accumulated experience of the Berry, Davidson and Neu companies, which merged before being integrated into the Howden Group in 1989. Berry supplied the kiln ID fans to a Belgium cement plant wet process cement line in Obourg which was at that time the largest in the world. After building a reputation supplying fans to France and Algeria, Berry was acquired by Davidson and began to replace radial with curved blades, and to draw on their knowledge of aerofoil as well as flat blade sections to give the greater dust resistance and higher efficiency sought by the cement industry.

Working in the steel market, the Davidson company had also developed expertise in the use of wear plates to protect the vulnerable areas of fans subject to high levels of abrasion and corrosion. The introduction of wear plates into clinker cooler ID fans and raw mill ID fans helped to increase its penetration into the cement market. Berry Davidson was well placed to take advantage of the move from oil to coal that took place in many plants in the early 1980s, and resulted in many fans being changed over to suit the new fuel.

A GLOBAL ORGANISATION WITH A PRESENCE ON EVERY CONTINENT



Top: Performance analysis on site – image shows a rotary kiln

Above: Impeller refit – Howden engineers co-ordinating with client team on site

Right: Impeller for revamping a cement plant pre-heater ID fan



EXPERT FOCUS, EXCEPTIONAL FLEXIBILITY

As our associations with a growing range of cement plant specialists widened, in 1983 Berry Davidson began to use exclusively Weldox 700F steel, with its valuable properties in the creep range, for all fans operating in an environment of 400°C or higher. The latter part of the decade saw the company join forces with Neu, and then with Howden who brought expertise covering an enormous spectrum of air and gas handling technology to bear on cement fans.

Today, Howden can not only supply all of the critical process fans and other heavy duty units such as the coal mill fan, we can provide all of the supplementary air and gas handling equipment a cement plant may require. We can also draw on either specialist or local manufacturing to provide each customer with the most cost effective solution without any compromise in quality.

THE KEY TO MAXIMISING EFFICIENCY: HOWDEN EXPERTISE

There are many fans, undertaking various duties, throughout a cement plant. The most important, however, are the process fans that are an integral part of the manufacturing line. These are the fans where robust reliability, the capacity to run at maximum efficiency continuously over months and years, is fundamental to the efficiency and productivity of the whole plant. These are the fans in which Howden excels.



Site inspection
of Howden fan

PREHEATER EXHAUST FAN

The preheater exhaust fan is an induced draught fan which is used to minimise residual oxygen in the high-temperature exhaust gases produced in the rotary kiln and preheaters (or cyclones) where the raw mix is turned into clinker. This is a situation where dust can create an extremely abrasive atmosphere, and Howden offers a range of protective options, with a choice of impeller coverage and materials. Dust build-up is also an important challenge and blade shape/blade angle are designed to minimize the dust build-up effect. The preheater exhaust fan is a variable speed fan with a thermally shielded casing and a high critical speed ratio, purpose-designed for continual effectiveness in an exceptionally challenging environment.

RAW MILL ID FAN

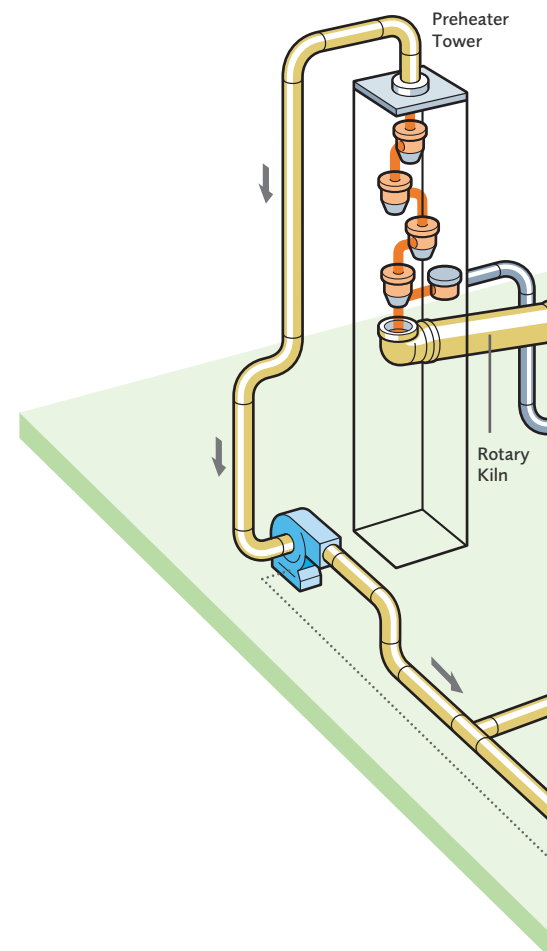
The raw mill fan is also situated in a highly abrasive environment. In the raw mill, the constituent materials of the cement are mixed to achieve the desired chemical content, and the mixture is ground down to the required particle size for both efficient production and strength in the cement being produced. Howden offers a choice of raw mill fans with abrasion protection, case linings and running parameters designed to meet the precise needs of the plant.

FINAL ID FAN

The final induced draught fan maintains the negative pressure at the preheater fan outlet, and in some plants it will, in addition, undertake the same task for the raw mill fan. The final ID fan can be supplied as either a variable speed device or as fixed speed with a box vane control to govern the fan output. The location of the fan, after the dust removal equipment, makes it possible to use aerofoil blades to achieve the high efficiency required.

CLINKER COOLER ID FAN

The clinker leaving the kiln at very high temperature is carried on a moving grating through which cold air is blown by a series of forced draught cooler fans. The moving bed of clinker may be up to half a metre deep, and peak temperature can be between 300°C and 450°C. Rapid cooling by high-efficiency fans produces a volume of hot air that is used for kiln air combustion on one side and handled by a single clinker cooler ID fan on the other side. This fan may be either variable speed or fixed speed with BVC output control, and may be fitted with protective wear plates and nosepieces appropriate to its duty. The hot air handled by the fan can be used elsewhere in the grinding process. Maximum design flow takes into account possible material avalanche through the kiln.



CEMENT MILL ID FAN

During the last stage of Portland cement production, the clinker is ground into a fine powder and mixed with additives in a rotating cylinder where is pummelled by steel balls. The cylinder is divided into a first chamber in which coarse grinding takes place, and a second chamber for finer grinding. The two chambers are separated by a diaphragm, and the cement fan passes a current of air through the chamber to help move the particles through the chambers as well as remove moisture and cool the cylinder.



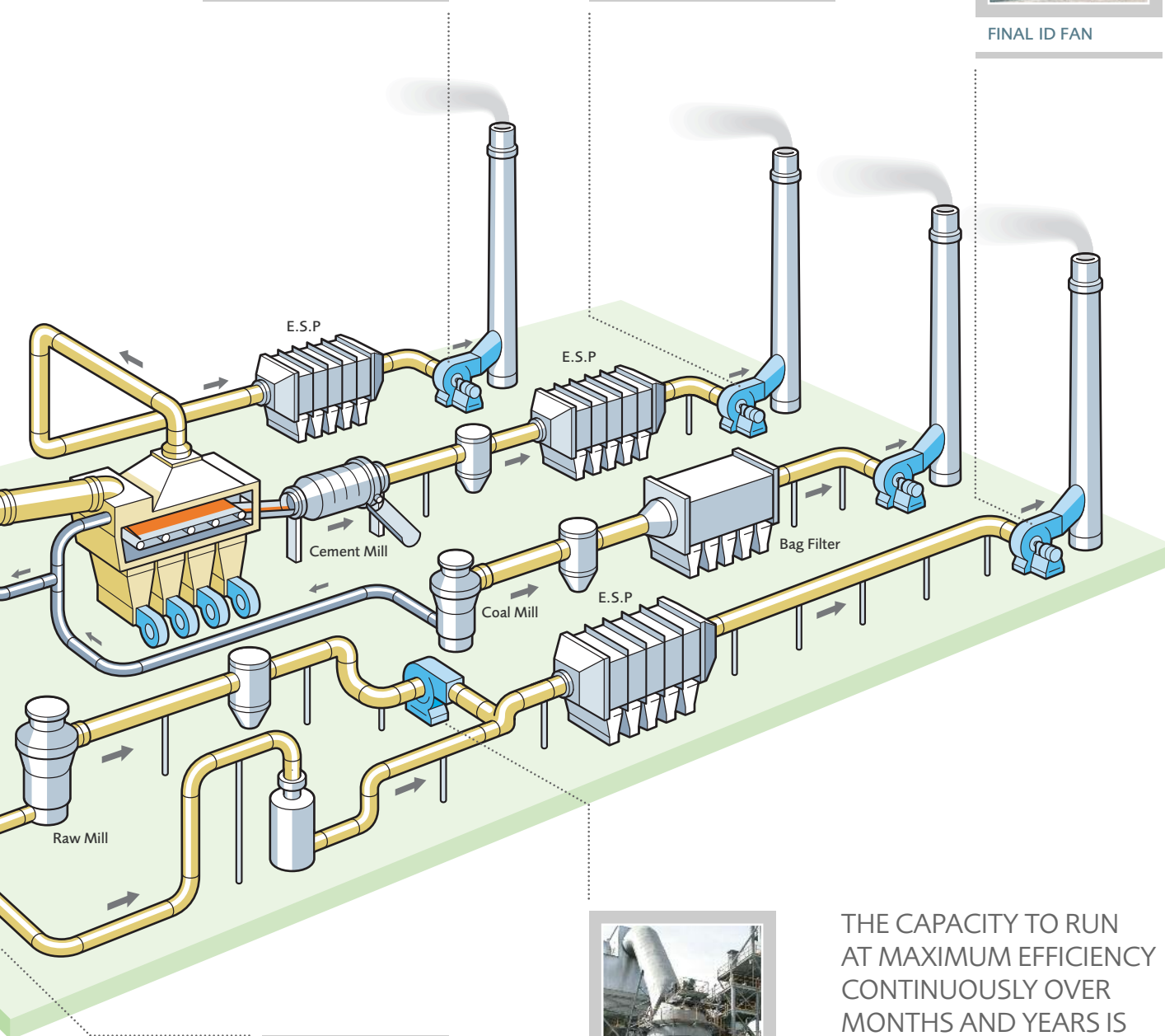
CLINKER COOLER ID FAN



CEMENT MILL ID FAN



FINAL ID FAN

PREHEATER
EXHAUST FAN

RAW MILL ID FAN

THE CAPACITY TO RUN AT MAXIMUM EFFICIENCY CONTINUOUSLY OVER MONTHS AND YEARS IS FUNDAMENTAL TO THE EFFICIENCY AND PRODUCTIVITY OF THE WHOLE PLANT.

UNSURPASSED QUALITY: HOWDEN ENGINEERING

Howden's considerable understanding of cement plants ensures that the equipment we supply is perfectly matched to its environment and its duties, and that it meets – and usually exceeds – its contract specifications. Our knowledge of air flow, and the causes and effects of temperature, vibration, corrosion, abrasion and other hazards enables us to take an overview of the fan as a part of a larger system, and we can advise on the impact that elements such as ducting and filters will have on air flow and plant performance. All of these factors can be taken into account when we are invited to discuss or advise on cement process fans.



Application of protective paint to a fan unit

HOWDEN TECHNOLOGY: A UNIQUE RESOURCE

Howden's knowledge of fluid dynamics, acoustics and vibration analysis is underpinned by our leading-edge research and development division, Howden Technology, which offers unique opportunities to investigate all kinds of air and gas handling situations. Information is freely shared across all Howden companies, and every Howden engineer has access to a global network of advice, experience and troubleshooting.

This enables us to provide the most flexible service, and to supply exactly what the customer wants. At one extreme, this may be only the shaft and rotating elements of the fan, ready to be installed into static parts supplied by the customer. It may be a whole fan built to a specification supplied by the specialists responsible for the plant design. At the other extreme, we may be invited to comment on the plant design, identify potential problems and recommend solutions relating to ducting, filtering and layout, in addition to supplying some or all of the fans. We can, if required, offer a package that includes motors, inverters and transformers. We respond to the customer's requirements.

PUSHING THE BOUNDARIES OF ENGINEERING QUALITY

The most significant advantage Howden present to customers is the quality of our engineering. In the extreme environment of a cement plant, where fans will run continuously for periods well in excess of six months, and carry on for many years without maintenance, manufacturing must be of the highest quality, and damaging vibration must be eliminated. The reliability of our equipment exceeds 97%.

Nevertheless, we are continually investigating ways of minimising downtime. In conditions where dust accumulation may occur, for example, we can fit a system which will continually monitor conditions and analyse the balance of the moving parts, and automatically compensate to maintain accurate balancing while the fan is running.



Top: Manufacturing of centrifugal fan impellers
Above: Detail showing wear plate fittings



ADVANCED PROTECTION FOR EXTENDED FAN LIFE

Howden's research into turbulence informs our choice of materials for wear plates and the areas to which wear plates or protective nosings will be applied. Tungsten carbide or chromium carbide may be used in extremely abrasive areas, and plates may be either welded, or fixed in place with encapsulated or countersunk bolts for ease of replacement without any adverse effect on flow and efficiency.

Large process fans may also make a major, and unwelcome, contribution to the noise of a cement plant. We can use a combination of low-noise impeller design, attenuators and soundproofed casings to reduce noise and meet the relevant environmental and H&S criteria.

UNIQUE PRODUCTS FROM PROVEN DESIGNS

Every process fan we make is custom built, adapted from a tried and tested basic design to combine low cost with exceptional performance. And every detail, from the selection of the steel to the choice of bearings, from the quality of welding to the application of finishes, is chosen and scrupulously inspected to extend the working life of our fans at peak efficiency.

Each customer or territory may have a range of applicable standards, and we will always meet and normally exceed these parameters. On security and safety matters we follow the best practice of the European 'Machine Directory' guidelines throughout all our contracts worldwide. In the normal running conditions for which they were designed, our fans typically exceed efficiency levels of 80%, the minimum environmentally acceptable figure.

For each fan we can also provide figures for environmental impact, detailing the carbon consumption involved in the manufacture, lifetime operation and eventual disposal of the machinery. Once we have built and tested the units we can either deliver them with full documentation for the client to install, provide a full supervision and commissioning procedure or, if required, undertake the installation ourselves.

LIFETIME SUPPORT: THE HOWDEN COMMITMENT

When Howden supply a fan, we back it with a promise to have spares and servicing available, as required, throughout the life of the equipment, and all of the spare parts we supply are based on original production drawings of the specific installation. While repairs are seldom necessary in cement process fans which are designed for extended trouble free running, where the necessity does arise, our commitment is absolute. The area of our aftermarket commitment which may be of more interest is our retrofit and fan revamping services.



Above: Maintenance inspection at cement plant



Right: Kiln ID fan impeller unit



Before and after images showing the revamping of a Kiln ID fan installation

INVESTMENT THAT PAYS DIVIDENDS

No matter what the age of a fan, Howden can offer a full refurbishment service which will restore the unit to the performance levels it achieved when it originally left our factory. Where a new fan unit is required for an existing plant, no matter who the manufacturer of the original fan was we can create a unit which will integrate fully with the plant, and fit into all the existing ducting. Such a replacement programme will normally significantly increase plant efficiency, and may rapidly pay for its initial investment. Where we are working with an existing plant, we can carry out a full vibration analysis, investigate the fluid dynamics around the fans and provide a comprehensive troubleshooting service.

We also provide a revamping and optimising service which can significantly improve the production output, the plant efficiency, or both. Conditions in a cement plant usually change over time. Filters may deteriorate, dust build-up can affect air flow at various points, and planned changes such as additional environmental protection to meet new legislation may affect

performance. External factors such as increased production demand or rising fuel prices may also provide an impetus to increase fan efficiency.

Revamp options include replacement rotors with new impeller profiles, introducing vane controls at inlet boxes, and changing to variable speed drives. They present an opportunity for existing cement plants to benefit from the research and technological changes that make new plants significantly more efficient.

The process starts with an investigation into each individual case, and we are happy to make proposals for any process fans, from any manufacturer.

In cement lines more than five years old, it is invariably worth discussing a revamp programme with our engineers. Changes we recommend and implement will usually pay for themselves in under eighteen months and go on to present considerable savings over the long term.



Howden has been involved in the design and engineering of air and gas handling equipment for over 150 years. We have unsurpassed understanding of the dynamics involved in moving high volumes of air, and we have evolved a range of innovative strategies for dealing with extreme temperatures and abrasive, particulate-laden gases. Our engineering is world-class, and our understanding of vibration analysis, materials science and dynamic systems is state-of-the-art.



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