HIGH PERFORMANCE
DONKIN CENTRIFUGAL TURBO
COMPRESSOR SYSTEMS
HOWDEN PROCESS COMPRESSORS
Howden, the world’s largest and longest established fan and compressor manufacturer provides solutions for the air and gas handling needs of clients. James Howden, a pioneering Scots engineer, founded the company in Glasgow in 1854. Today the Group has subsidiaries in five continents and more than 15 countries worldwide.

Howden Process Compressors is the organisation within Howden that designs and manufactures various types of blowers and screw compressor packages. Bryan Donkin, one of the longest established designers of rotary blowers and compressors with a history extending back to 1856, was integrated into Howden Process Compressors in 1997. A centre of excellence encompassing all these compression technologies was developed at our manufacturing site in Scotland. Design, application engineering, manufacturing, testing and after sales support are available for the full range of compression products offered by the company.

THE HOWDEN PEDIGREE
Howden, Bryan Donkin, Sirocco, Reavell, Davidson, Nau, Sofara and Barry – all renowned worldwide for their technical expertise in the design and manufacture of fans and blowers – combined to provide an enviable resource of experience for customer confidence.

Combining more than 150 years experience in the utility, process gas, petrochemical and many other industries, we are uniquely placed to offer customers an individually engineered compression solution to suit their particular application and individual requirement.

WORLDWIDE COVERAGE GUARANTEED
Worldwide Cover is achieved via Howden’s comprehensive network of regional facilities, and a network of technically qualified regional managers.

A thorough review of process requirements by qualified project and applications personnel ensures that the most cost effective and energy efficient design proposal is submitted to the customer, whether for a centrifugal blower or a full process compression package installation.

The Howden Donkin range of integrally geared, high efficiency turbo compressors has been developed, over 40 years, for use in a broad range of process applications worldwide. Product integrity, long operational life and maximum efficiency of compression are the main focus of design.

MARKETS AND APPLICATIONS

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

SULPHURIC ACID PLANT
Combustion air blowers and process gas mixture cleaning, sometimes combined.

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

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

FURNACE/SMELTER/REACTOR AIR SUPPLY
Air blowers providing combustion or reaction air primarily for the petrochemical and metals industries.

PROCESS GAS BLOWERS
Blowers handling a wide range of process gases for the petrochemical and heavy industry.

FUEL GAS BLOWERS
Blowers handling natural and ‘dirty’ coke-oven, manufactured, landfill and other bio gases. (sandbl extraction)

CARBON BLACK PLANT
Air blowers providing combustion air for the associated furnaces.

WASTE WATER TREATMENT
Aeration blowers associated with the biological treatment of effluent in municipal sewage treatment plants.

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

FEATURES
• Continuous operation/critical service
• Maximum reliability
• Ease of maintenance
• Skid mounted with integral lubrication
• Variable flow by means of variable vane diffusers, pre-rotational inlet guide vanes or a combination of both systems
• Wide flow range, available to below 45% of design flow
• Highest efficiency levels over entire operating range
• Steep pressure/volume curve to give inherent stability and protection against surge
• Horizontally split gearbox for ease of maintenance and inspection
• Well proven long working life
• (Machines 30 years old still operational)
• Two stage labyrinth or carbon ring sealing to give guaranteed oil free process gas delivery
• Compact packaged unit, factory assembled or underbed to increase installation time
• Capacity up to 250,000 m³/hr
• Pressure up to 5 Bar A.
HOWDEN PROCESS COMPRESSORS

COMPRESSOR SPECIFICATIONS – SINGLE STAGE TURBO COMPRESSORS, PROVEN RELIABILITY

The Howden Donkin range of single stage turbo compressors provide proven reliability developed over 40 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
- Fully machined from solid aluminium forging (ASTM B247) by multi axis computerised machining centre.
- Also available in nickel-krome corrosion resistant steel.
- Induced backward curve or radial profile.
- Retained on high speed shaft by a central bolt.
- Subjected to ultrasonic test before final machining.
- Dymamically balanced to ISO 1940 Specification.
- Overspeed tested to a minimum 115% of operating speed.

GEARBOX
- Gearcase 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.
- Gearcase is to AGMA Quality 11 to 13 as required.
- All gears have ground tooth profile.
- AGMA service factor of 1.4 minimum.
- API optional.

CASINGS
- In cast iron grade 250 to BS 1452 (ASTM A48-83-35B).

SHAFT SEALS
- Double labyrinth type with air vent to atmosphere to guarantee oil free air discharge from the blower.

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, to give almost vibration free operation at high speed.
- 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 integral pressure oil lubrication system.
- All bearings are easily accessible by removal of the top half gearbox casing.

INSTRUMENTATION & PROTECTION DEVICES
- Pressure indicator at bearing supply manifold.
- Lubrication after cooler bearing temperature monitoring.
- High speed shaft journal bearing temperature monitoring.
- Process air temperature monitoring.
- Lubrication after cooler temperature low switch (indtacts both alarm and also re-starts auxiliary oil pump in the event of falling oil pressure).
- Lubrication after cooler temperature low trip.
- Oil reservoir temperature low switch (indtacts blower operation with oil temperature below 20°C).
- Additional instrumentation can be provided as required.
- All alarm/indication functions are displayed at the local control panel (pages 8 & 9).
- API optional.

Pressure Lubrication Schematic

NOTE: To suit the individual applications, various materials of construction are available to ensure maximum resistance to corrosion, abrasion and high temperature.
CONTROL SYSTEMS – MAXIMISING OPERATING EFFICIENCY

TYPES OF CONTROL SYSTEM AVAILABLE

Variable Outlet Vane Diffuser (VVD)

Pre-rotational Inlet Guide Vane Control (IGV)

Combined Inlet & Outlet Control (CVC)

Howden Donkin 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.

COMBINED CONTROL (CVC)

The Howden Donkin 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 of air flow and ambient temperature range than either of the individual control systems.

INLET GUIDE VANE CONTROL (IGV)

- Inlet guide vane control assembly is fitted to the blower to enhance efficiency at a constant speed motor.
- Guide vanes are manufactured from AISI 316 stainless steel.
- Actuation is by a single spindle, via non-lubricated linkage system.
- Electric servomotor actuator fitted for modulating control. (Pneumatic actuators can be provided).

INLET GUIDE VANE CONTROL (IGV)

VARIABLE VANE DIFFUSER ASSEMBLY

A. VVD closed
B. VVD partially open
C. VVD fully open

VARIABLE DIFFUSERS FOR FLOW CONTROL (VVD)

- Diffuser vane control assemblies are incorporated within the blower 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 non-lubricated linkage system.
- Electric servomotor actuator fitted for modulating control. (Pneumatic actuators can be provided).

PERFORMANCE CURVES

The performance curves below show lines of constant blower actual efficiency relative to design efficiency throughout flow range and isentropic head range.
LOCAL CONTROL PANEL WITH FULLY AUTOMATIC SEQUENCING

Howden Donkin local control panels are designed by our experienced team of electrical engineers specifically to provide fully automatic sequencing of start up/shut down cycles, together with the monitoring of all blower safety systems.

STANDARD FEATURES
- Base plate mounted with all on base plate items fully wired/piped up.
- RESERVED off base plate - with all items wired to the terminal box at the blower base plate. Wiring from the terminal box to the panel would be done by a third party on-site.
- Control carried out by PLC, interfaced with the operator interface on the front of the panel.
- The operator interface is a combined data entry and display station, comprising a LCD screen and a membrane keypad.
- Local control panel houses contactors, fuses, overload and interface terminals necessary for the effective safe control of the compressor and auxiliary drives only.

Each local control panel is individually factory tested prior to delivery. Systems may be designed to accommodate individual customer needs if required.

All control panels comply with European Union (EU) machinery directive. Control panel illustrations and descriptions are typical only.

TYPICAL DISPLAYS ON THE GRAPHIC SCREEN

AUTOMATIC START SEQUENCE
Before the compressor can start up, the local control panel (LCP) ensures that:
- IOV/VVD are fully CLOSED to ensure and minimise load start-up condition;
- Blow-off valve (BOV) is OPEN;
- Outlet check valve is CLOSED;
- Cooling water is FLOWING or air blast oil cooler fan is RUNNING;
- Acoustic enclosure ventilation fan is RUNNING (if enclosure is to be supplied);
- Inlet isolating valve is OPEN (if fitted);
- Outlet isolating valve is CLOSED (if fitted);
- Bearing temperature is ok;
- Outlet air temperature is ok;
- Oil temperature in reservoir is 20°C minimum.

When all these interlocks are satisfied, the compressor start signal starts the electrically driven auxiliary oil pump. This pump pressurises the lubrication system and, when this pressure has been maintained for a pre-determined length of time, the LCP signals the main compressor drive motor to start. At this point, the mechanically driven oil pump begins to deliver oil and, after a pre-determined time just in excess of the main motor run-up time, the electrically driven pump is shut down and reverts to standby duty. The compressor then comes under the influence of the process control signal, and is delivering air to process.

VIBRATION MONITORING
All Howden Donkin compressors are dynamically balanced within ISO 1940 levels. Vibration monitoring takes several forms:
- A simple switch to detect total machine vibration which STOPs the blower.
- One or two non-contacting probes at each high speed bearing with the option of axial displacement monitoring also.

The graphic display in the LCP gives ALARM, TRIP and INDICATION functions. This system detects a trend of increasing vibration levels and can also be used as a preventative maintenance system.

OTHER SAFETY SYSTEMS
Surge
Howden Donkin compressors are designed with a steep pressure/volume characteristic between DESIGN point and SURGE point. This gives an in-built protection against a surge condition, whilst still keeping the compressor running and supplying air to process.

A serious SURGE condition can be dealt with in several ways:
- On detecting a SURGE condition - STOP the blower.
- On detecting a SURGE condition - OPEN FULLY the blow-off valve.
- PREVENT A SURGE condition use a flow/pressure sensing system to a modulating blow-off valve.

AUTOMATIC STOP SEQUENCE
The compressor stop sequence can be initiated either:
- a) under normal conditions where the air demand is falling;
- b) falling oil pressure;
- c) under other emergency conditions, where a serious fault arises.

Under normal conditions, the auxiliary oil pump re-starts if oil pressure falls to a pre-set value. On compressor reaching STOP, the LCP powers all positional devices listed left to the correct position in readiness for the next start-up.

On falling oil pressure, the auxiliary oil pump re-starts and initiates ALARM in the graphic display in the LCP. If oil pressure continues to fall, the machine SHUTS DOWN.

Under other EMERGENCY conditions causing shut down, the above oil pump sequencing is repeated. Whenever fault initiated the STOP condition, the graphic display in the LCP gives the ‘first up’ indication of the fault to identify exactly and clearly the cause of the STOP condition.

Fully automatic sequencing control panel
The Howden Donkin master control systems provide fully automatic control of a multi-blower installation from a single process variable. Overall plant efficiency is maximised with the Howden Donkin 'load sharing system' control philosophy.

The Howden Donkin master control systems are designed to control automatically, multiple blower installations from a SINGLE process control signal and to:

a) Allow the minimum number of operating blowers to satisfy demand for air.
b) Share the total load equally between the number of operational blowers to:
   - achieve maximum overall efficiency;
   - ensure all blowers have equal operating times and loads.

Alternatively the local control panel can be configured to provide a masterless control system.

MASTER CONTROLS
Two basic master control systems are in use –

Outlet pressure control (Fig. 1)
The pressure is kept constant in the discharge manifold. Air is supplied through CONTROL VALVES (V), which are controlled by the process control system.
Pressure transmitter (PT) measures the supply pressure to valves (V) and sends a 4-20 mA signal to the PROCESS CONTROLLER (PC) within the MASTER CONTROL SYSTEM. This CONTROLLER output signal then adjusts the compressor control systems and also decides when individual compressors should be started or stopped.

Process/flow control (Fig. 2)
A direct FLOW CONTROL system is used in sewage treatment aeration systems. As the quantity and quality of effluent into the secondary aeration zones varies, there is a need to vary the air flow to achieve the desired final water discharge quality. The signals from dissolved oxygen probes are taken to transmitter (DT) which gives a 4-20 mA signal proportional to the dissolved oxygen content in the water – this signal is fed to a process control algorithm incorporated into the master control PLC.
This signal is compared with the set point of the PC (manual or remotely adjustable) and any resultant deviation signal is fed to the master control system algorithm. In turn this signal adjusts the position of the control system of individual blowers and ultimately stops/starts blowers as dictated by the DT output signal.

TYPICAL MULTI BLOWER FLOW: Pressure system (Fig. 3)

NOTE: The pressure loss (P in Fig. 3) through the pipework between blowers and varies with air flow rate. The HOWDEN DONKIN MCP adjusts, AUTOMATICALLY, the outlet pressure set point to MINIMISE OUTLET PRESSURE and, therefore, MINIMISE POWER ABSORBED.

COMPRESSOR RANGES
TOTAL QUALITY COMMITMENT—
DESIGN, MANUFACTURING,
TESTING AND SERVICING

Howden Process Compressors’
total commitment to quality covers
all aspects of design, manufacturing,
testing and servicing. We regularly
work to the requirements of all
the major worldwide specifying
authorities. All machines bear
the European Standard CE mark
(when supplied within the
European Union). Howden Process
Compressors quality systems are
audited by Lloyds Register to ISO
9001, ensuring consistent high
quality of design and manufacture.

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, liaison 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 Compliance
All equipment is manufactured with a view to
minimising noise level and surface temperatures,
in-line with the EU requirements. Due to the nature
and individuality of the equipment to meet process
requirements, it is not possible to specify noise
levels and surface temperatures in a broadly based
brochure such as this. In certain circumstances EU
guidelines may be exceeded and additional
protection required.

Test Facility
Howden Process Compressors’ test facility
ensures that each compressor is tested
rigorously before despatch.

Testing procedures available include:
- Mechanical no-load test
- String test
- Performance test

Customer Support
A team of highly experienced engineers
is available to install, assist in installation,
commission electrical, mechanical and control
aspects and also to provide on-site training in
maintenance techniques to our customers’
own engineers.

Research and Development
Howden Process Compressors’ 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 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.

Spares
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 45 years old.

Typical spares:
- Bearings
- Labyrinth seals
- Bearing oil seals

Dynamic balancing of impeller
Coupling alignment: Laser alignment of gearbox
and motor shafts

Spares

Variable vane diffusers: A blower fitted with
variable vane diffusers for capacity control
ENVIRONMENTAL AND INDUSTRIAL APPLICATIONS

Howden’s broad experience covers the supply, not only of turbo compressors but also of centrifugal fans, rotary screw and ‘Roots’ positive displacement machines for almost all industrial zones. Equipment is operational in over 40 countries on 6 continents for environmental, chemical, petrochemical, steel metal refining and general industrial applications.
Howden, founded in 1854, is the world’s leading supplier of fans, blowers, compressors and rotary regenerative heat exchangers for a large range of industrial applications. No matter whether our fans are pre-engineered or custom built for each application, they are known throughout the world for their high levels of performance, reliability and innovation.

Combining our knowledge with our extensive applications experience, gained by our engineers on sites throughout the world, allows us to support our customers from initial project inception to end of plant life.
PROCESS SCREW COMPRESSOR SYSTEMS
THE RIGHT CHOICE TODAY: FOR COMPLETE GAS COMPRESSION SOLUTIONS
HOWDEN’S EXPERIENCE IN THE FIELD OF SCREW COMPRESSORS IS UNIQUE. WE WERE THERE WHEN THEY WERE INVENTED.

In the 1930s, Howden worked in co-operation with Professor Lysholm of Svenska Rotor Maskiner Sweden to pioneer the first experimental screw compressors. In the 1940s, it was Howden that brought the technology to a viable reality and took out the first commercial licence.

Howden screw compressors are manufactured at our dedicated compressor plant. This allows us to maintain the highest standards of precision engineering and quality control. In the 1960s, building on our work with oil free screw compressors, we began the parallel development of oil injected screw compressors.

The two technologies have been advancing steadily ever since, each bringing unique advantages to a spectrum of applications. Our process screw compressors find wide application in sectors such as oil and gas exploration and extraction – including offshore platforms and FPSO vessels – petrochemicals and power generation.

In 2006, we installed the world’s largest process screw compressor system in an FPSO in Bohai Bay, China, using four compressors to drive the offshore fuel gas boosters. Our process screw compressors are installed in butadiene plants such as Maoming and Tianjin in China, heavy hydrocarbon handling at Russian installations, gas vapour recovery in Kuwait and flare gas recovery in the UAE. In Brazil, oil companies use Howden process screw compressors for on and offshore applications ranging from town gas handling and butadiene plant, to flash gas processing and fuel gas boosting.

THE HIGHEST STANDARDS OF PRECISION ENGINEERING AND QUALITY CONTROL
GAS COMPRESSION SYSTEMS
WITH WORLDWIDE APPLICATION EXPERTISE

Rotary process screw compressors operate by drawing gas into the spaces between the lobes of the twin screws. As the rotors turn, the gas is forced by the profile of the screws into a continuously decreasing space until it reaches the outlet port at high pressure.

The system is capable of handling extremely problematic gases, in the most challenging environments. Because it operates by positive displacement, it can cope with the changing molecular weights encountered in applications like flare gas recovery, and even handle liquid slugs in the gas stream. And, because it does not generate out-of-balance forces, it needs significantly less foundation strength than a reciprocating compressor.

The screw compressor principle delivers gases smoothly and continuously at constant pressure, free of surges, twenty-four hours a day, seven days a week, for years on end. It is the technology of choice in situations where high availability and reliability is required over long-term continual running. It is the workhorse of a host of vital processes across the oil and gas, petrochemical and energy industries. Its ability to cope with the most hazardous and corrosive gases, and accept fluctuations in input composition while delivering a constant pressure output, makes it the invaluable core of a host of industrial operations.

The development of the oil injected rotary screw compressor, in which a synthetic oil is introduced to act as a sealant, a lubricant and often an integral part of the chemical process, brought performance to a new level. It is not suitable for every environment, but where it is appropriate it brings advantages of versatility, lower power consumption, lighter weight and reduced noise with the same exceptional reliability.

ALMOST ALL HOWDEN PROCESS SCREW COMPRESSORS ARE CUSTOM DESIGNED AND BUILT FOR THEIR SPECIFIC USE. HOWEVER, WE ALSO OFFER A RANGE OF STANDARD MODULAR PACKAGES PROVIDING FUEL GAS COMPRESSION FOR INDUSTRIAL GAS TURBINES.

OUR PRODUCTS MEET OR EXCEED ALL RELEVANT INTERNATIONAL STANDARDS AND QUALITY ASSURANCE PARAMETERS, INCLUDING

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Howden process screw compressors has full ISO 9001 quality assurance accreditation, and every contract is assigned an individual quality plan as well as full certification to meet technical and legislative requirements.
DELIVERED READY TO GO

Howden’s detailed and systematic contract management ensures that even the most complex compressor packages are delivered on time and ready for hook-up. This reduces installation time to a minimum. Our international sales managers work alongside the end-user and our own contract managers to review the best approach and ensure that the most cost-effective and efficient design proposal is produced, tailored precisely to the customer’s requirements.

Once an order is placed, a senior contract engineer is assigned to the project and takes over the responsibility for liaising with the customer, handling all documentation and monitoring the production process from design through assembly, testing, delivery, installation and commissioning. This gives the customer a single authoritative point of contact who is familiar with every detail of the job. It also provides the flexibility to deal with changing specifications or customer needs.

Before a package is assembled, compressors are tested on dedicated test-beds using Howden Standard or PTC9 procedures. Customers can arrange to witness this testing, and may also specify a string test at Howden’s Renfrew factory.
There is no major industrial gas application in the world that Howden does not have experience of, either as the supplier of key equipment or advising on the best response to a unique set of circumstances. We understand the pressures on the industries we work with, and the compressors we create are meticulously engineered to ensure a substantial margin of security and robustness.

**HOWDEN KNOW-HOW**

OIL AND GAS EXPLORATION AND EXTRACTION; SHALLOW & DEEP WATER
The special issues associated with oil exploration and extraction often relate to geography and extreme climatic conditions, ranging from hot, dry desert situations to ship-based units operating a long way offshore in heavy seas. They also include unpredictable, hazardous and changeable gas composition. Howden’s custom approach, based on a thorough analysis of all the factors involved, provides a tested route to the right compressor package for each unique set of circumstances.

In offshore situations – including FPSOs – weight and size of plant is obviously critical and the close proximity of personnel to the equipment makes noise an important health and safety consideration. The advantage of low power consumption in hard-to-reach situations is also of major relevance, making Howden oil injected compressor packages the correct choice.

FLOATING PRODUCTION, STORAGE AND OFFLOADING (FPSO) APPLICATIONS
Howden screw compressor packages have been developed and installed onto many of the FPSO facilities around the world. FPSO vessels can be found in remote and extreme climatic conditions in deep water locations where they eliminate the need for long, expensive pipelines from outwells to onshore terminals. Howden’s oil free and oil injected systems, the product of long experience working with problem gases, make them eminently suitable for FPSO applications.

The high specification and compact design of Howden systems allow them to be integrated into an enormous range of ancillary equipment ready for installation in remote and difficult locations. This makes them a uniquely efficient choice for process gas compression on FPSOs.
PETROCHEMICALS AND INDUSTRIAL APPLICATIONS

The enormous range of challenges within the petrochemical industries encompasses extremes of temperature, toxic and hazardous process gases, and other application-specific demands. In applications as diverse as butadiene plants and process refrigeration, there are critical health and safety considerations as well as a need for total dependability. In such extremes, the benefits of Howden’s bespoke approach become clear.

Whether supplied as a stand-alone unit or a compete package, each Howden compressor is designed to match the rigours of its environment as well as its specific task, and engineered to offer continuous uninterrupted operation over many decades.

MID AND DOWNSTREAM OIL AND GAS

Screw compressors have a host of applications throughout the processing of oil and gas. From the first stages of compressing the gas to separate out the moisture content and delivering a smoothed flow into the higher pressure centrifugal compressors when it comes ashore, right through to the refining stages.

The ability of oil free screw compressors to handle hazardous and corrosive gases is a particular advantage where the process gas is inconsistent. They cope efficiently with the sour gases typical of the late stages of oil and gas fields. The technology is the ideal method for gases with high sulphur dioxide content, or mixtures with high levels of dirt and particulates, oil or tars.
OIL FREE COMPRESSOR PACKAGES

OPERATE AT SPEEDS OF BETWEEN 2,000 AND 15,000RPM, DELIVERING UP TO 26,000 CUBIC METRES OF GAS PER HOUR AT PRESSURES UP TO 15 BAR

There are many situations where oil free technology presents the best approach. Oil free screw compressors are available in different configurations and materials providing the most compact arrangement, to allow the handling of gases with high levels of liquid, dirt and particulates. These configurations are eminently suitable for use with hazardous or corrosive gases, or where contamination is an issue.

With no lubrication present in the compression chamber, the rotors must never touch. Their constant spacing is maintained by a gear system outside the chamber. Rotor lengths, diameters and profiles are designed to meet individual conditions and demands. Howden’s specialised systems of shaft seals, configured to suit the particular process gas, ensure complete leak-free isolation of the gas within the system.

Oil free compressors operate at speeds of between 2,000 and 15,000rpm, delivering up to 26,000 cubic metres of gas per hour at pressures up to 15 bar, and will cope with high temperature environments up to 225°C.

OPERATING DATA:
- Pressures up to 15 bar
- Inlet volume up to 26,000m³/h
- Built to meet or exceed API 619 or industry standards

They are widely used in processes such as mechanical vapour recompression, gas gathering, sour gas handling, gas liquefaction, and flare gas recovery in industries such as petrochemical plants, refineries, synthetic rubber plants, and the manufacture of synthetic fertilisers, caprolactam, vinyl chloride monomers and soda ash.
OIL FREE COMPRESSORS ARE USED IN PROCESSES SUCH AS VAPOUR RECOMPRESSION, GAS GATHERING, SOUR GAS HANDLING, GAS RELIQUEFACTION, AND FLARE GAS RECOVERY
Oil injected compressors offer a number of advantages across a range of applications that demand high efficiency and high discharge pressures. The synthetic oil is an integral part of the machine. It is specifically engineered to suit the process – it can, for example, be designed to keep the gas within the machine at neutral acidity, whatever its original pH value. Issues such as dew point control and compatibility with the process gas are always considered when selecting the oil.

Oil injected compressors operate at speeds of between 1,000 and 4,500rpm, delivering up to 16,000 cubic metres per hour of gas at pressures up to 60 bar, and can be supplied as tandem units offering two-stage compression within a single unit.

Applications for oil injected compressors include sour gas handling, flare gas recovery, gas boosting, flash gas, gas reliquefaction, gas gathering and gas recycling. They are found in situations such as on and offshore oilfields, refrigeration plants, gas turbines and petrochemical applications.
APPLICATIONS FOR OIL INJECTED COMPRESSORS INCLUDE SOUR GAS HANDLING, FLARE GAS RECOVERY, GAS BOOSTING, FLASH GAS, GAS RELIQUEFACTION, GAS GATHERING AND GAS RECYCLING.
SUPPLIED AS A COMPLETE PACKAGE

We design, engineer, assemble and test complete compressor packages in addition to building the compressors themselves. Each one is custom designed for its environment and its duties, incorporating as much additional plant as appropriate. We make certain that the complete installation meets all operational safety standards and matches the size and weight criteria and environmental guidelines of its site. By creating and testing an integrated system, we are able to apply our standards of reliability and efficiency to the whole package.

CUSTOM DESIGNED

Full electronic control, instrumentation and monitoring systems for pressure, temperature, oil level, flow and vibration are provided, using the latest technology. Local and remote control panels can be supplied. We also use leading condition monitoring systems to provide a continuous check on the drive train. Easy access for maintenance is built in.

Ancillary equipment – such as gearboxes, filters, oil management, condensate removal, noise suppression, acoustic shielding, scrubbers, coolers, heaters and other elements – is added and the entire system is tested and proved before shipping. The finished package is custom designed, in shape, size and performance, to slot straight in and hook up to existing plant. All piping and electrical connections are in place. Installation and commissioning time, and the potential for mismatches, consequential problems and delays is minimised or eliminated.

Where environmental conditions demand exceptionally low noise levels, acoustic enclosures – with optional fire and gas detection and fire suppression systems – can be added.

Howden compressor packages are ambitious pieces of engineering, constructed to meet every demand of their final working environment in round the clock operation often extending into decades. Throughout the world, they underpin production in the oil and gas, petrochemical, energy and other sectors where absolute reliability is paramount.
OPTIMISING THE DESIGN

Howden engineers specify and configure each element of the compressor and its ancillary equipment for optimum efficiency, value and reliability.

CASINGS
Casings may be manufactured from cast or nodular iron, carbon steel, LT carbon steel or 12% chrome steel to suit the process gas.

SEAL ARRANGEMENTS
Oil free compressors may incorporate a combination of simple restrictor rings, labyrinth seals, water seals and mechanical seals, depending on the gas being handled. Each arrangement can be supplied with inert or process gas buffering as appropriate.

Oil injected compressors have a single balanced wetted type seal fitted as standard. For some applications, it is appropriate to add secondary dry-running outboard containment seals.

A tandem balanced mechanical seal arrangement, with API seal plan and pressurised seal system, can also be supplied to meet specific conditions.

BEARINGS
Oil free compressors are fitted with sleeve journal bearings and tilting-pad thrust bearings. In oil injected compressors, the sleeve journal bearings are complemented by either tilting pad or angular contact anti-friction thrust bearings. Where a process gas such as ammonia makes it necessary, copper-free bearings can be supplied.

ROTORS
Rotor lengths, diameters and profiles for each compressor unit are selected to maximise efficiency.
Every Howden process screw compressor installation, from a stand-alone machine to the most complex package with full instrumentation, gas processing equipment and hook-up pipework, comes with a lifetime commitment. The track record of such installations makes it clear that they can be expected to give years of problem-free round-the-clock operation. If, however, upgrade or refurbishment is required, even many decades after initial installation, Howden will be able to offer expert advice based on the original production drawings and our own leading-edge research. The back up extends to complete plant removal and re-installation on a different site if required.

Howden is a global organisation, with a permanent presence on every continent and a network of engineers capable of offering a local response wherever required. Our highly experienced personnel can draw on the services of Howden Technology – our highly experienced research division.

SPARES AND UPGRADES
We provide a full spare and replacement parts service, backed by comprehensive records to ensure that replacements are accurate and upgrades are appropriate. Parts are certified OEM spares, the only way to maintain original levels of efficiency, performance and reliability, and are delivered on site worldwide to be fitted by your own personnel or, where appropriate installed by Howden engineers.

We supply spares kits for many screw compressors, covering seals, bearings, valve assemblies, annual inspection kits and overhaul kits designed to prevent unexpected outages. Where compressors have been in operation for many years and a full refurbishment is thought advisable, we can arrange a full rebuild of compressors followed by a full testing procedure and underpinned by a renewed warranty.
Focusing on its global expertise in compressors, fans and heat exchangers, 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.