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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.

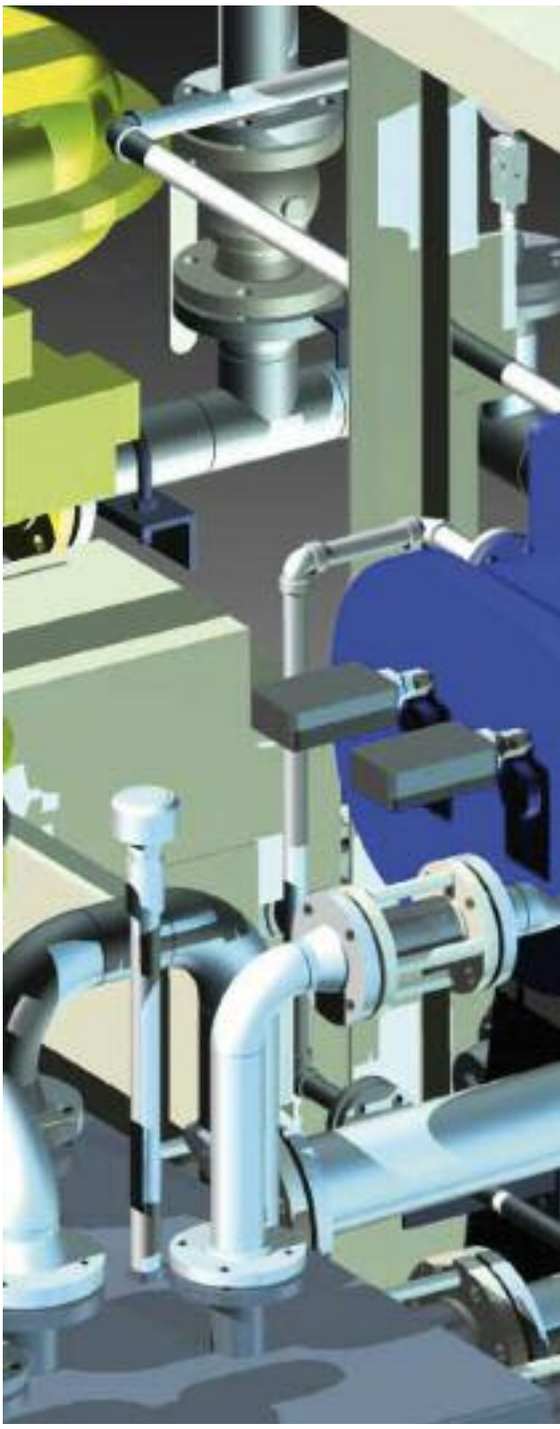
In 2006, we installed the world's largest process screw compressor system in an FPSO in Bohai Bay, China, using four compressors to drive the offshore fuel gas boosters. Our process screw compressors are installed in butadiene plants such as Maoming and Tianjin in China, heavy hydrocarbon handling at 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 towngas handling and butadiene plant, to flash gas processing and fuel gas boosting.

THE HIGHEST STANDARDS OF PRECISION ENGINEERING AND QUALITY CONTROL

OIL INJECTED PROCESS SCREW COMPRESSOR SYSTEMS

OIL FREE PROCESS SCREW COMPRESSOR SYSTEMS

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.

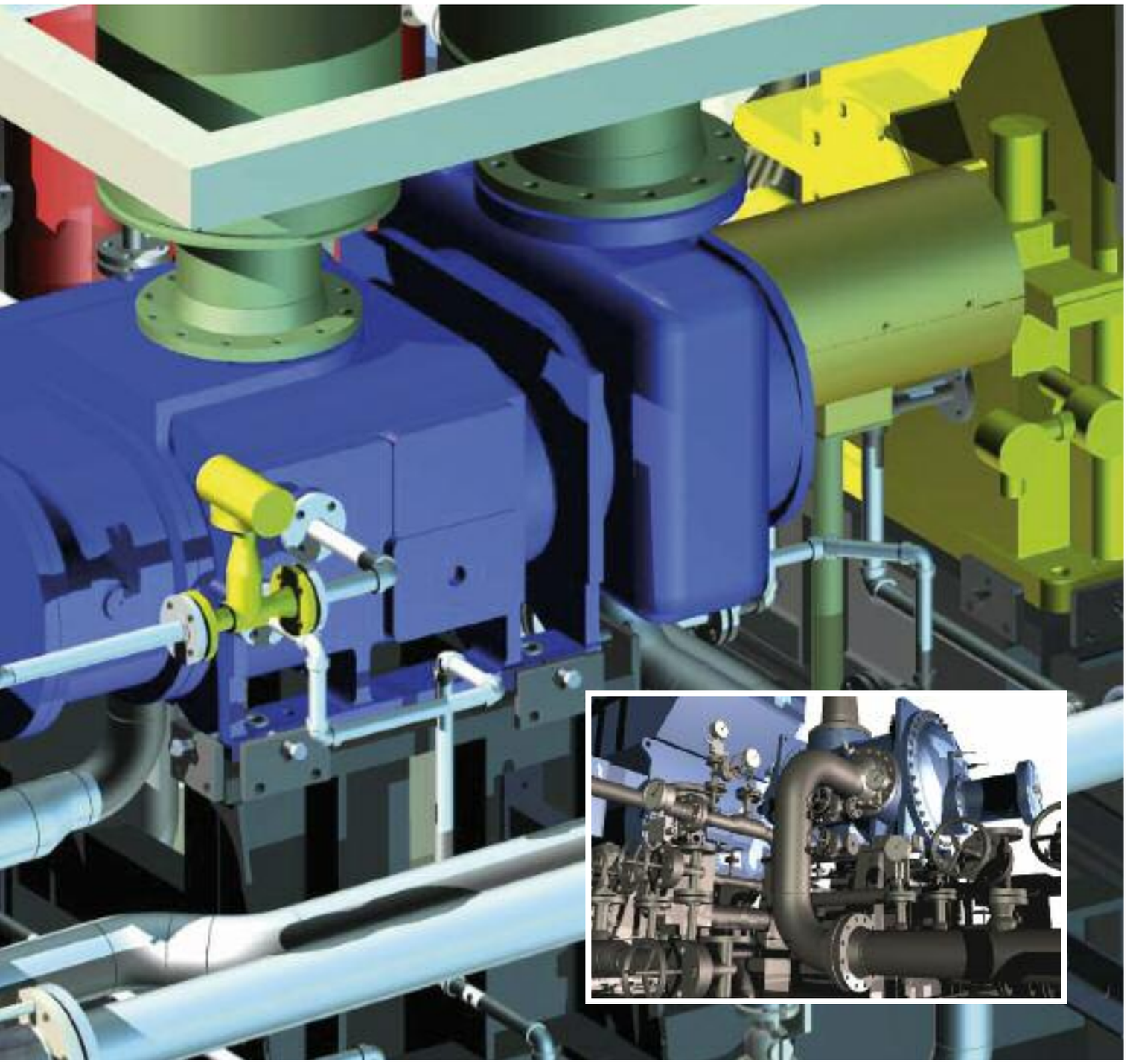
The development of the oil injected rotary screw compressor, in which a synthetic oil is introduced to act as a sealant, a lubricant and often an integral part of the chemical process, brought performance to a new level. It is not suitable for every environment, but where it is appropriate it brings 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

American Bureau of Shipping	Germanischer Lloyd
API	GOST/GGTN
ASME VIII Div 1	HS&E
Bureau Veritas	Lloyd's Register
CE	NACE
Chinese Licence	PED
Det Norske Veritas	TEMA

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.

HOWDEN KNOW-HOW

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.

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.

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.

PETROCHEMICALS AND INDUSTRIAL APPLICATIONS

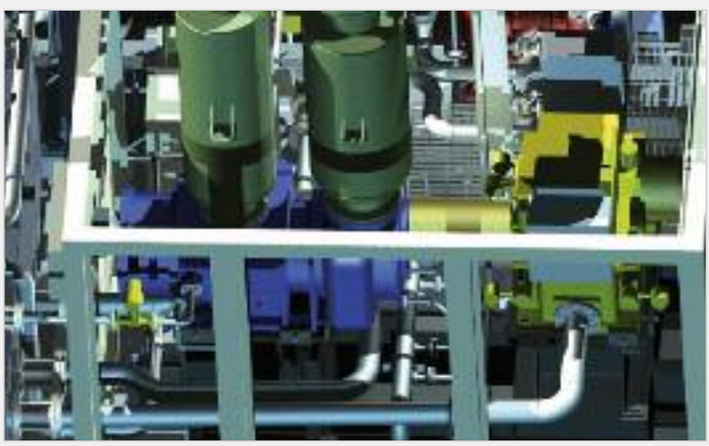
The enormous range of challenges within the petrochemical industries encompasses extremes of temperature, toxic and hazardous process gases, and other application-specific demands. In applications as diverse as butadiene plants and process refrigeration, there are critical health and safety considerations 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.

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.



OPERATING DATA:

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

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.

They are widely used in processes such as mechanical vapour recompression, gas gathering, sour gas handling, gas reliquefaction, 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 COMPRESSOR PACKAGES

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

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.

OPERATING DATA:

- Pressures up to 60 bar
- Inlet volume up to 16,000m³/h
- Built to meet or exceed API 619 or industry standards

By lubricating the screw shafts and thus enabling the male rotor to drive the female, the oil eliminates the need for the gearing system used in the oil free compressor. The rotor shaft is normally direct-coupled to an electric motor running at two or four-pole speed, bringing reductions in cost, maintenance and power consumption.

Howden's single or dual shaft seal systems maintain a high level of isolation, and the oil film not only provides a seal between the tip of the screw and the chamber casing, it offers protection from corrosion, reduces noise and cools the operation. A separate oil management system, normally designed to meet API 614 standard, recovers, filters, cools and pumps the oil through the compressor at the optimum pressure.

One of the most significant advantages of Howden oil injected compressors is the integral slide valve which keeps the compressor running at maximum efficiency by adjusting the capacity of the chamber to follow changes in the specific gravity of the gas. This lowers power consumption and so reduces costs – a major advantage when power supply is at a premium, and one that brings a consequential reduction in carbon emissions and helps operators to meet their environmental commitments.

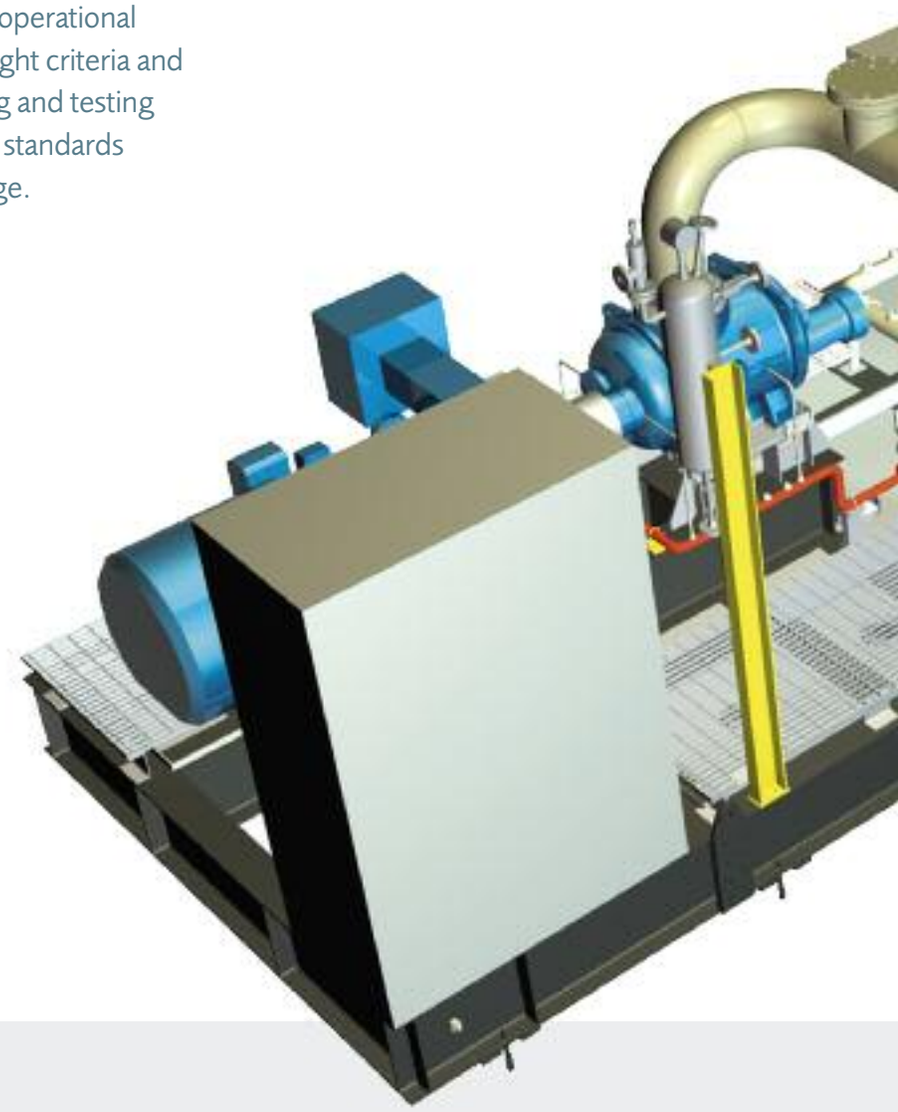
Oil injected compressors operate at speeds of between 1,000 and 4,500rpm, delivering up to 16,000 cubic metres per hour of gas at pressures up to 60 bar, and can be supplied as tandem units offering two-stage compression within a single unit. The lower running speed offers quieter operation, and the smaller size and weight is a major advantage in many offshore or confined situations.

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.



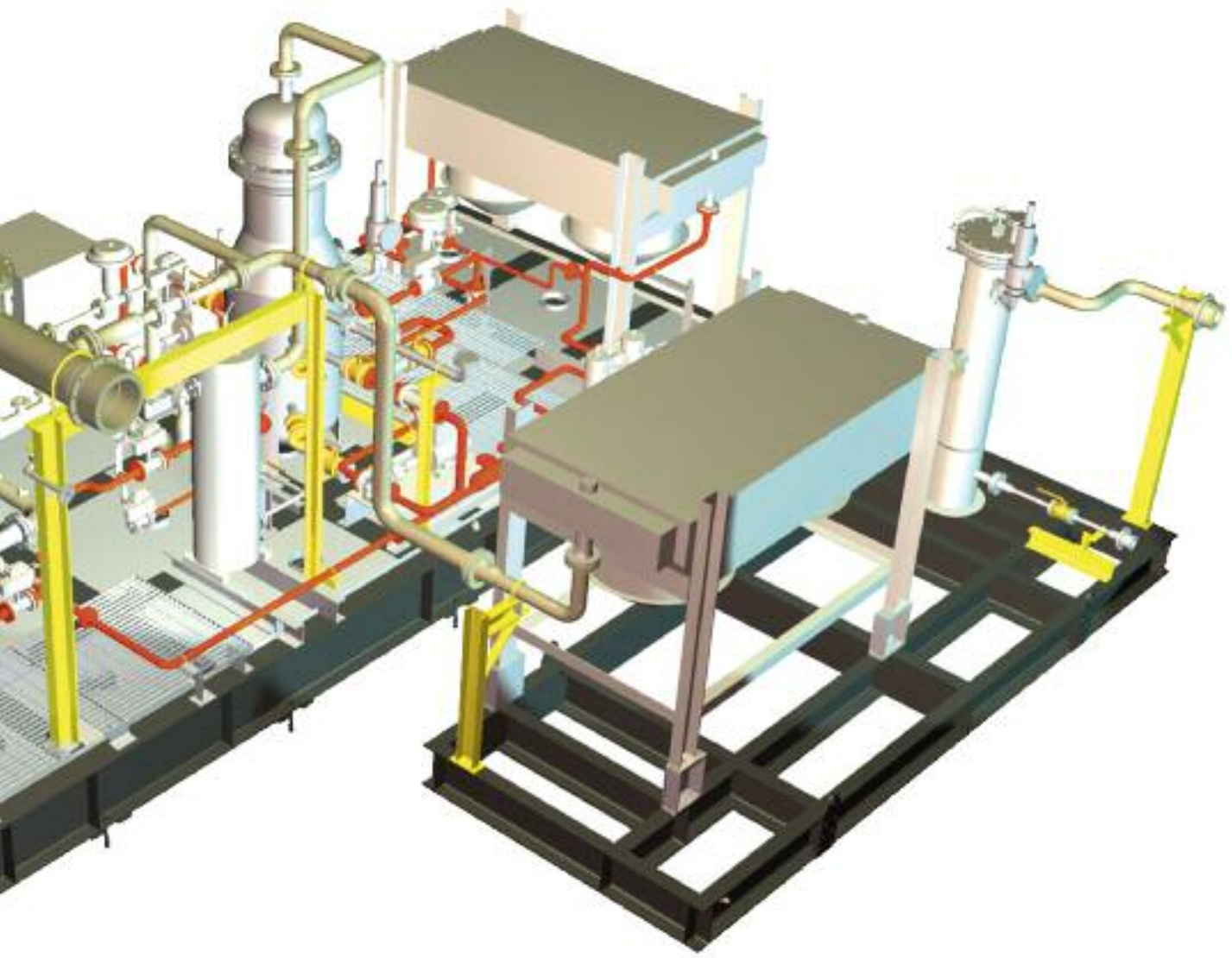
CUSTOM DESIGNED

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.

WORLDWIDE LIFETIME SUPPORT

EVERY HOWDEN PROCESS SCREW COMPRESSOR IS THE PRODUCT OF OVER SEVEN DECADES OF EXPERIENCE.

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.

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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.

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