EagleBurgmann®
Rely on excellence

Sealing competence for refining technology

As diverse as the requirements for refining technology: Sealing solutions from EagleBurgmann.

Europe
More than 3,300 EagleBurgmann API seals are installed in numerous European refineries, petrochemical and oil & gas plants.

Saudi Arabia
EagleBurgmann provides 400 sealing systems to API 682 e.g., APItex and H75 pusher seals.

India
EagleBurgmann has installed more than 7,000 API seals in a large number of refining and petrochemical plants.

Middle East and North Africa
In the MENA region, over 6,000 API 682 seals from EagleBurgmann are in operation.

Germany
Four major refineries in Germany benefit from our Service Contracts. EagleBurgmann takes care of the entire installed seal base.

Americas

More than 1,000 API 682 seals are installed in Brazil, Venezuela, Mexico, USA and Canada.

China

EagleBurgmann has installed over 1,200 API seals in different refineries and petrochemical plants for major companies like Sinopec and Petrochina.

Asia-Pacific

In the Asia-Pacific region, EagleBurgmann has installed over 2,300 API seals in a number of refineries and petrochemical plants for all major companies.

Sealing partner for refining technology

EagleBurgmann is one of the world's leading system suppliers of sealing technology and has been a partner to the refining industry for many years. From the beginning, we've used our innovative approach to shape the sealing technology in this demanding industry.
Our products and solutions are successfully deployed throughout the world in all primary and secondary refining processes.

Comprehensive industry-specific knowledge

We understand the needs of the refining industry and have a profound understanding of the various processes involved.
With our application expertise and technical consultancy skills we can provide reliable and cost-effective solutions for every need: products and services as well as application and standardization concepts.

Full-service partner with a global presence

Research and development, consulting, engineering, design, production and a broad range of modular services are competencies that our customers use to their benefit.
Our comprehensive network of production sites and sales and service centers means that we are always close to you, wherever you are in the world.

EagleBurgmann

Sealing technology: A key component in the operation of refineries.

Reliably safe and very economical

No industrial production plant can be operated without seals. The number of sealing locations and media to be controlled is correspondingly large, as is the number of plant components that need to be sealed: rotating equipment such as pumps, agitators and compressors, valves and flanges, not to mention pipes and ducts carrying gases and liquids.

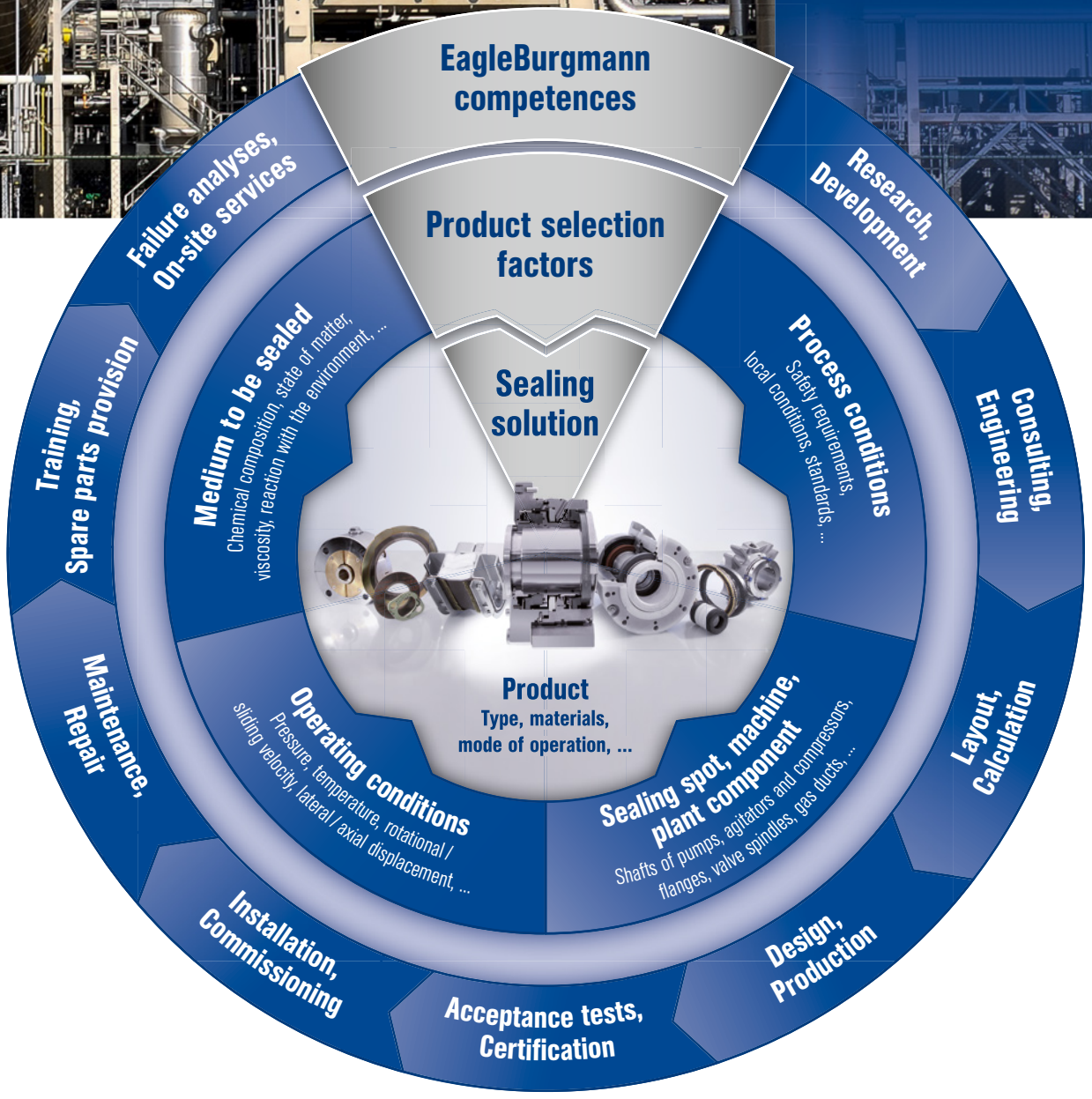
The reliability of the entire plant depends on many individual parts. The seals, as key components, play an important role. They protect systems and components from external influences and contamination as well as help prevent emissions. They thus increase process safety, availability and the economic viability of the plant.

Sealing technology also offers considerable potential for reducing costs – through process-orientated design and standardization, for example. The right product portfolio and knowledge of the processes and standards used allows EagleBurgmann to implement solutions that are not only technically safe and reliable but economically first-rate as well.

Sealing solutions to meet any requirement

When choosing the product, its product type, the materials used and the method by which it will be operated, several factors play a major role: the process conditions, the sealing location, the operating conditions and the medium to be sealed.

No matter what requirements our customers have, we know how these factors affect functionality and economic viability and we translate this expertise into outstanding long-term, reliable sealing solutions. EagleBurgmann has all the expertise it needs to manage and support the entire development, life and service cycle of its sealing solutions.



Experience, demand and commitment: The building blocks for optimized sealing solutions.

Reliable market partner with worldwide presence

With over 60 subsidiaries and 250 locations worldwide, we use our global focus to the benefit of our customers. Thus our production network, which has plants in Europe, Asia, North and South America, ensures that we are always in line with market requirements and that we can produce on attractive terms and are able to supply regional markets.

We also have a comprehensive network of sales and service centers which covers every important economic region. Being close to our customers also means we are precisely acquainted with their processes and individual requirements.

EagleBurgmann is part of the German Freudenberg Group and the Japanese EKK Group. We have access to all the resources we need to offer optimum support to major customers at the international level and also become their long-term, reliable partner.

Consulting and engineering with meaning

Technical expertise grows from knowledge and not just knowledge of sealing technology but also the machines, components and media to be sealed, along with the manufactured products and industrial processes and process conditions.

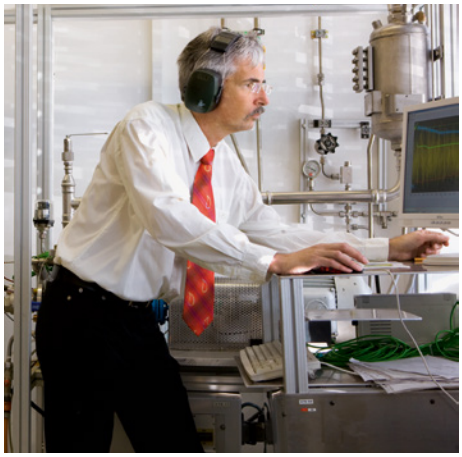
Knowledge management helps us keep our comprehensive knowledge up to date and make it available to the entire company. We use databases, courses and training to develop our employees and bundle our industry expertise from all around the world.

Our dedicated and committed employees use this wide and varied know-how to give our customers well-founded advice on how to choose the best product from technical and economic viewpoints and how to calculate and design according to need.

High-level research and development

We invest a great deal in research and development in order to consistently improve the performance of our products. EagleBurgmann carries out publicly sponsored research projects and works together with institutes and universities. Joint projects with customers and suppliers are a regular source of new solutions.

Two large research and development centers in Germany and Japan, combined with a worldwide network of testing facilities, allow us to respond flexibly to the requirements of our customers.
We run acceptance test rigs for pump, agitator and compressor seals, development and testing laboratories for expansion joints and special test benches for acceptance tests and certification of seals to API 682.



Wide-ranging standard portfolio and tailored solutions

Largely standardized and modular product series are an essential part of our portfolio. But we also offer individual solutions and provide the necessary development, engineering and production capacity for this purpose. Using the latest calculation and design methods, such as 3D-CAD, we adapt our products to customer-specific requirements or design new solutions. Worldwide design standards ensure that the most stringent technical requirements are met.

EagleBurgmann produces according to the most demanding internal and external standards at various locations around the world. At all of these locations, we use ultramodern equipment, optimized and standardized production processes and a great vertical production range – all building upon the reliable base of our excellent employees. Our quality management systems are ISO 9001 certified, for example.

Protection of humans, the environment and industrial plants

Safety is an elementary requirement for industrial sealing technology. It is ultimately all about protecting humans, the environment, products and resources. A lot of what EagleBurgmann does goes far beyond the legal requirements. This sense of responsibility is part of the company culture and is firmly anchored in the guiding principles of the group.

Our environmental management system is ISO 14001 certified to and our work safety management system fulfills OHSAS 18001. Regular audits and numerous training courses raise awareness in employees and management alike. This develops a culture in which everyone feels responsible for work safety, the environment and health protection within the company and on our customers' own premises.

Modular service concept ensures maximum flexibility

Products and services are both sides of the same coin. Professional installation and commissioning, practical knowledge transfer, intelligent inventory management and regular servicing and maintenance extend service life and protect investments.

The need for services varies according to the operator and the system and is as diverse as the industry itself. Failure mode analysis, tailored onsite services and engineering services related to sealing technology play an increasingly important role.

Be it for individual sealing systems, critical process elements, specific plant units, or a comprehensive service agreement for entire plants – our TotalSealCare modular service concept has the solution for every requirement. The individual service modules can be combined as needed to ensure maximum flexibility.

Comprehensive product portfolio: Sealing solutions to meet any requirement.

An overview of the EagleBurgmann product lines

Our comprehensive product portfolio covers all needs of the refining industry. From mechanical seals for pumps and compressors, magnetic couplings, carbon floating ring seals, seal supply systems, compression packings and gaskets through single and multiple layered fabric, steel or rubber expansion joints and high-end metal expansions joints for FCCU.

Over the course of our long partnership with the refining industry, we have developed a range of standard, high-grade solutions which meet many of the industry's diverse needs. We also design and manufacture special and one-off customer-specific solutions to suit individual applications.

More than 21,000 EagleBurgmann API seals are in operation world-wide. We offer the widest product portfolio of mechanical seals and seal supply systems to API 682 4th edition.

This may mean a volume-produced seal or an engineered one-off solution. EagleBurgmann products are rugged, reliable and easy to assemble and they offer a very attractive cost-benefit ratio.

On the following pages we set out our product portfolio. This is followed by a number of sample applications from real life, divided into the categories of distillation, cracking, gas processes, liquid and heavy hydrocarbons.

Mechanical seals for pumps

The entire range of liquid or gas lubricated seals. Available as standard seals or special versions, as single or multiple seals and for all categories and arrangements in accordance with API 682.

Successfully utilized in refining technology:

- e.g. EM300, H75, LL9UC, MBS682, MFL, SH, LNF, LY9TC, LY9SA, MFLWT

Mechanical seals for agitators

For sealing shafts in mixers, kneaders, reactors, filters, dryers and special machines in normal and sterile processes. Rugged, economical, designed for practical application. For steel and glass-lined tanks.

Successfully utilized in refining technology:

- e.g. M481

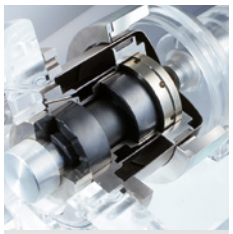
Mechanical seals for compressors

The entire range of seals for process gas compressors. Rugged, non-wearing, contact-free operation. Available as single and dual seals, tandem seals, and tandem seals with intermediate labyrinth.

Successfully utilized in refining technology:

- Compressor seals: e.g. DGS, PDGS, MDGS, NF953
- Separation seals: e.g. CobaSeal, CSE, CSR

Magnetic couplings



For very demanding applications. Hermetically sealed, leak-free and maintenance-free pumping and mixing. Our magnetic couplings reliably contain media within closed-loop systems.

Successfully utilized in refining technology:

- e.g. MAK66, MAK885, NMB High Effiency

DiamondFace technology: a landmark in mechanical seal coating technology

EagleBurgmann made a quantum leap in mechanical seal technology when it introduced DiamondFace in 2007.

Innovative technology
A microcrystalline layer with all the attributes of natural diamond is applied to the sliding faces by chemical vapor deposition (CVD) at 2,000 °C (3,632 °F) in a vacuum furnace. Thick layers coupled with extremely flat and uniform sealing surfaces characterize this procedure, which was developed together with the Fraunhofer Institute for Surface Engineering and Thin Films in Braunschweig, Germany.

Outstanding properties
Seal faces with DiamondFace are extremely hard and resistant to wear, have excellent thermal conductivity and exhibit excellent chemical resistance. The layer adhesion exceeds all known practical requirements.

Convincing benefits
For mechanical seals this means a considerably longer service life, with maintenance intervals extended accordingly and greatly reduced life cycle costs.

Carbon floating ring seals

Long-life, maintenance-free compact labyrinth cartridge seals with low leakage.

Successfully utilized in refining technology:

- e.g. WKA250ND, WKA400HD, WKA700, WKA802HD, WKA1100HP

Seal supply systems

Depending on the design, application and mode of operation, mechanical seals and magnetic couplings need supply units for flushing, cooling, pressurization and leakage compensation. EagleBurgmann supplies the entire range from a single source.

Successfully utilized in refining technology:

- Coolers: e.g. WEL, WE, WED
- Cyclone separators: e.g. ZYA6
- Quench systems: e.g. QFT6000
- Buffer / barrier fluid systems: e.g. TS2000 / 4000 / 5000 / 6000, TSA6, TSB6, SPO (53B), SPO (53C)
- Leakage detection and collection systems: e.g. LS050, LSA6, LSB6,
- Gas supply systems: e.g. GSS60001, GSS6002, SMS, RoTechBooster

Compression packings

The economical and reliable method of sealing pump shafts and valve spindles. A broad product range, innovative materials and material combinations, and special impregnating agents and lubricants enable us to provide solutions for even the most demanding requirements.

Successfully utilized in refining technology:

- Compression packings for pumps: e.g. Buraflex, Buratex, Buraflon, Thermoflon
- Compression packings for valves: e.g. Rotatherm, BuraTAL low emission

Gaskets

Ready-to-install seals or sheet materials. State-of-the-art materials, material combinations and production methods allow us to supply a multitude of versions, variations and shapes.

Successfully utilized in refining technology:

- Graphite seals: e.g. Statotherm, Rotatherm
- Metal gaskets: e.g. Buralloy, Spiraltherm, Corratherm (several hundred thousand seals in accordance with ASME16.20 in use worldwide)

Expansion joints

For ducts and pipe systems carrying gas – to reliably compensate for pressure and temperature fluctuations, vibrations and misaligned joints.

Successfully utilized in refining technology:

- High-end metal expansion joints: e.g. FCCUC and FCCUH for Fluidized Catalytic Cracker Units, styrene expansion joints, penetration seals.
- Metal expansion joints: e.g. Types HA, LA, TB, UN
- Fabric expansion joints: e.g. Fluastal, FlexGen

Special products

Special applications require innovative and specific solutions. As well as special seals and sealing elements for marine technology and the aerospace industry, we also provide high-quality metal bellows and diaphragm couplings.

Successfully utilized in refining technology:

- Diaphragm couplings

Upstream, midstream, downstream: Sealing solutions for the entire process chain.

Pumping, transporting, and processing: The value-added chain in the hydrocarbon processing industry breaks down into three main segments: upstream (exploration and production), midstream (transport and storage), and downstream (processing and refining). We have significant experience in all segments and can offer advanced sealing systems and services to meet all technical, environmental, and economic requirements.

Upstream and midstream processes

Oil and gas production offshore and onshore requires different technologies and equipment according to the operating environment. Special pumps are used to transport multiphase flows of oil, gas, water and sand, after which they are isolated in separation facilities. The separated crude oil and gas is then sent for further processing to refineries.

Whether the work takes place on or off-shore, maximum safety combined with the longest possible service life and long maintenance intervals are the primary requirements placed on sealing technology in the oil and gas industry. Individually customized and optimized sealing systems and expert know-how are the determining factors in this respect.

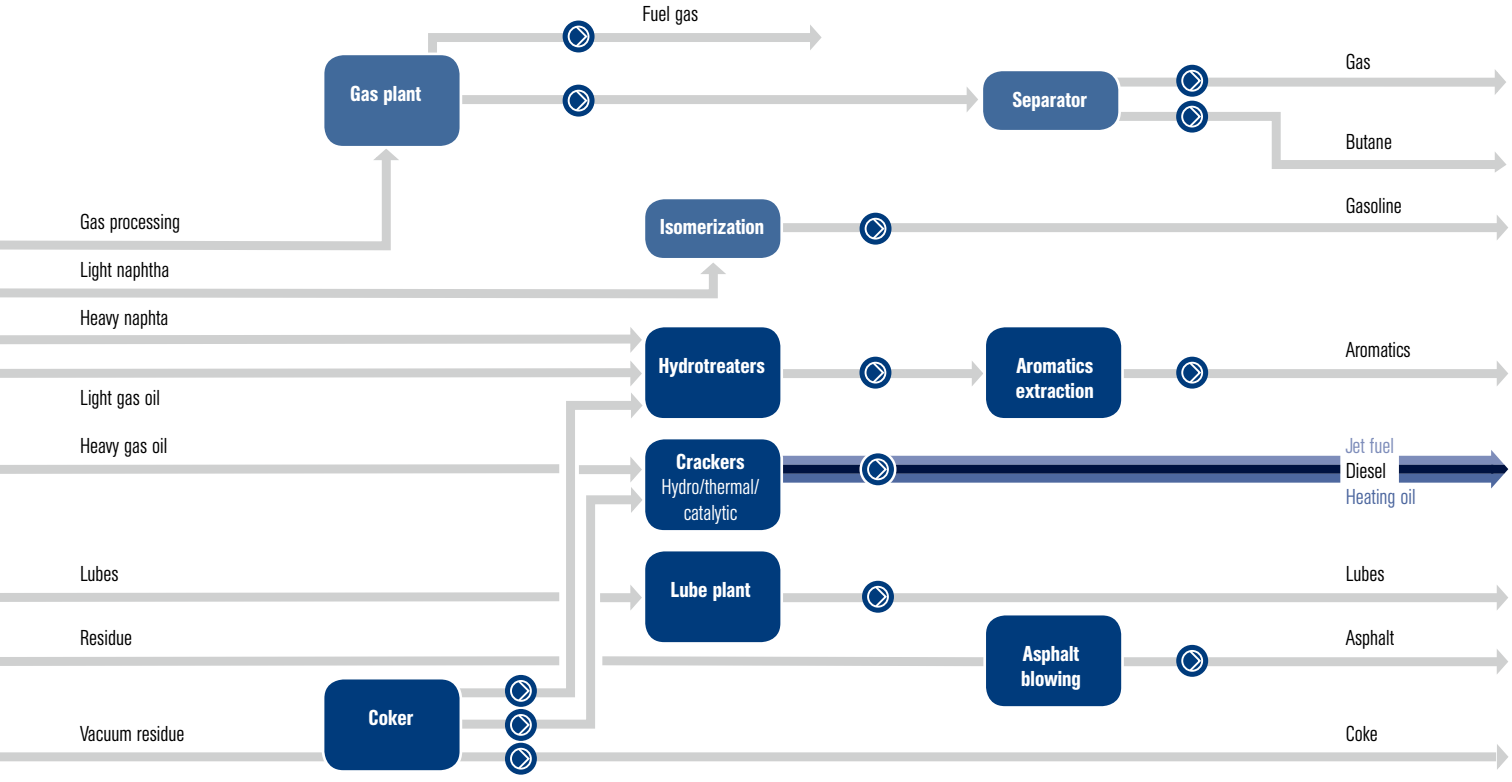
For more detailed information about upstream and midstream applications, please request a copy of our "Sealing competence for the oil and gas industry" brochure and visit our website.

Downstream

Processing and refining crude oil in refineries creates different feedstocks for the petrochemical industry and numerous end products. These include, for example, liquefied gases (propane, butane), fuels (petrol, diesel, heating oil, jet fuel), lubricants, bitumen and sulfur.

From distillation, cracking, desalination through to coking, the sealing of toxic and flammable media with standardized and proven sealing technology is a central requirement in the refinery industry.

The application of sealing systems conforming to the latest API 682 standard is an essential condition. EagleBurgmann supplies the full range of mechanical seals and supply systems for all categories and configurations as defined in API 682 4th edition. The comprehensive EagleBurgmann portfolio of sealing technology and services covers all the needs of refinery engineering.



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Sealing technology in distillation processes: Demanding conditions - reliable solutions.

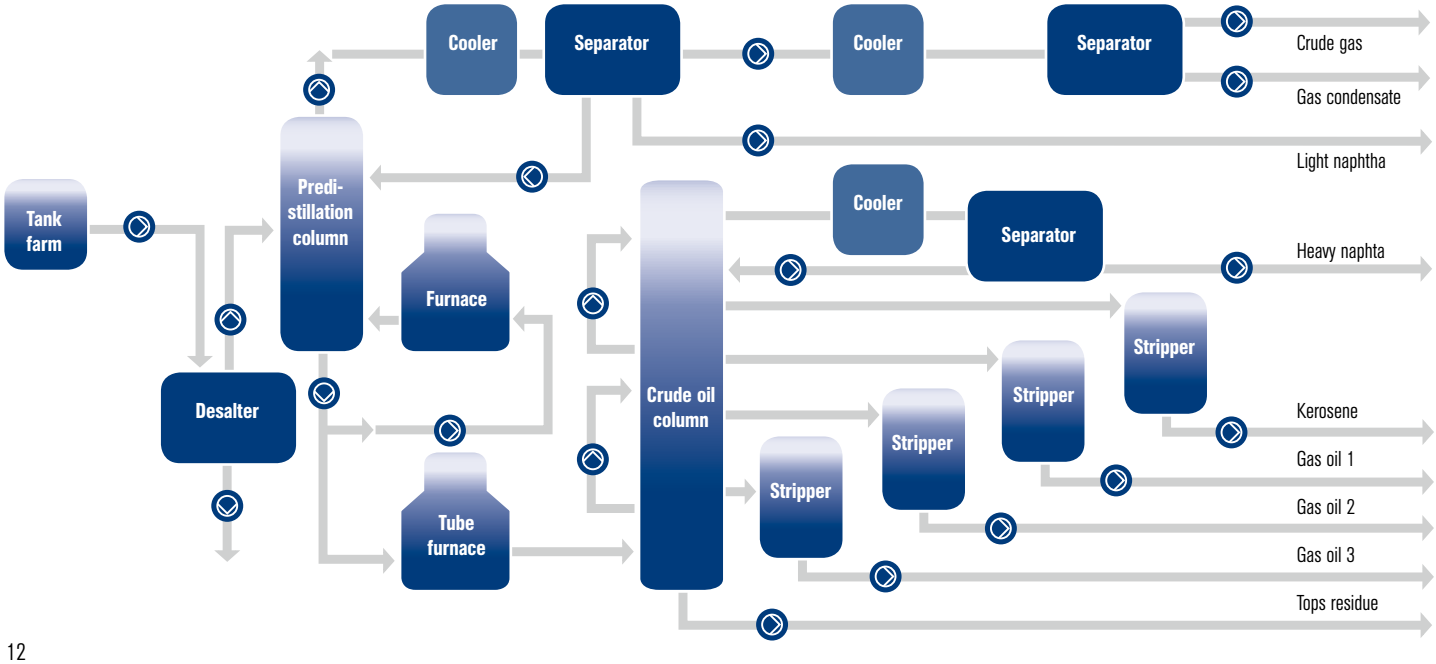
For distillation, the crude oil is first heated to around 350 °C (662 °F) and then broken down into individual products. Substances with a boiling point above this temperature become gaseous and rise in the distillation column.

High temperatures and different compositions of crude oils - which can also be corrosive (hydrogen sulfide + sulfur) and abrasive - are some of the greatest challenges faced by the sealing technology used in refinery distillation facilities.

EagleBurgmann sealing systems have proven their added value over many years for sealing applications in both atmospheric and vacuum distillation processes. The portfolio of robust single and dual mechanical seals with the necessary buffer, cooling and quench systems is optimized for distillation applications.

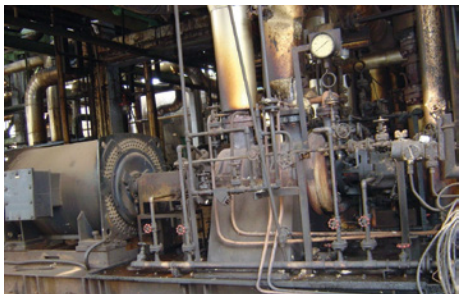
We guarantee reliable sealing of the complete process chain in distillation facilities with our proven H75 and LL9 pusher seal types, while the MFLWT and MBS metal bellows seals are preferred for particularly high temperatures. High quality sliding materials such as Buka 22 (a silicon carbide material) and structural materials from Inconel® are used for metal bellows.

EagleBurgmann offers perfectly customized supply systems (to API 682 4th edition) to guarantee optimum operating conditions for the seals. Numerous operators around the world are applying our sealing technology successfully in their process pumps and are profiting from the associated increased plant availability.

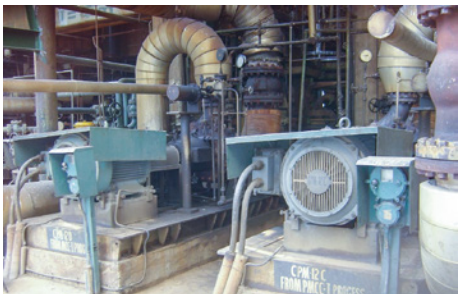


Since 2002, a refinery in Minatitlan, Veracruz, Mexico, has been using the EagleBurgmann **H75K/90** together with a **TS6050** seal supply system and **WDK5120** cooler to API 682 Plan 21 + 52 in a Sulzer centrifugal pump for distillation. Operating conditions: p = ... 17.89 bar (259 PSI); t = 247 °C (477 °F); n = 1,780 min^{-1}; d1 = 75 mm (2.95"). Media: hydrocarbons with traces of H_2S).

EagleBurgmann **high-end standpipe expansion joint** installed in a refinery in Texas, USA. Operating conditions: p = ... 6.89 bar (100 PSI); t = 510 °C (950 °F); d = 1,170 mm (46"). Medium: flue gas.

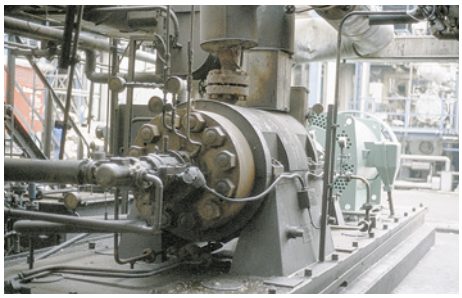


Kochi Refineries Ltd., India applying in their visbreaker unit EagleBurgmann metal bellows seals **Y14D52C** with a supply system to API 682 Plan 32 + 62 in an Ebara centrifugal pump. Operating conditions: p = ... 8.9 bar (129 PSI); t = 247 °C (477 °F); n = 1,780 min^{-1}; p1 = 75 mm (2.95"). Medium: vacuum residue.

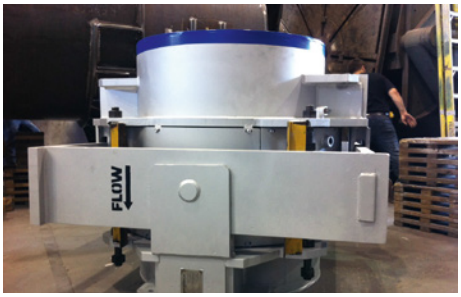


EagleBurgmann seal type **Y14D64TC** with supply system to API 682 Plan 11 and 62 running successfully in a KEPL centrifugal pump in the distillation unit of Kochi Refineries Ltd., India, since 2002. Operating conditions:
p = ... 9.6 bar (139 PSI); t = 42.3 °C (108 °F);
n = 3,550 min^{-1}; d1 = 100 mm (3.94").
Media: hydrocarbons + hydrogen fluoride

MFLWT80F2/85 mechanical seals with a **WEL** air fin cooler to API 682 Plan 21, installed in a bottom pump-around pump from Sulzer in the distillation unit of the Sohar refinery in Oman. Operating conditions:
p = ... 4.19 barg (60 PSIG); t = 278 °C (532 °F);
n = 1,475 min^{-1}; d1 = 68 mm (2.68”).
Medium: gas oil.



EagleBurgmann **MFLWT80S3/90** sealing Byron Jackson pumps supplied to API 682 Plan 02 + 54 by an EagleBurgmann **SPA 3020/A22** supply system. Operating conditions: t = 332 °C (630 °F);
p = 8.5 bar (123 PSI). Medium: residual oil.



An Australian refinery has been fitted with a **cold wall gimbal expansion joint** (d = 1,067 mm (42")) and a **tied universal single expansion joint** (d = 889 mm (35")). Operating conditions:
p = ... 4.14 bar (60 PSI); t = 750 °C (1,382 °F).
Medium: flue gas.

In the distillation unit of a Mexican refinery in Salina Cruz, Oaxaca, EagleBurgmann metal bellows seals type **MFLWT80/75** seal the shafts of Sulzer horizontal pumps. Operating conditions:
p = ... 9.42 bar (137 PSI); t = 175 °C (347 °F);
n = 3,560 min^{-1}. Media: hydrocarbons

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Cracking: Overcoming extreme temperatures with “cool” sealing technology.

The fraction of crude oil which cannot be distilled further is then cracked. In this process, long chain molecules are split into smaller molecules under pressure and temperature in order to generate additional short-chain hydrocarbons such as gasoline, diesel or kerosene.

Different cracking methods with specific sealing requirements are used, depending on the operator’s requirements.

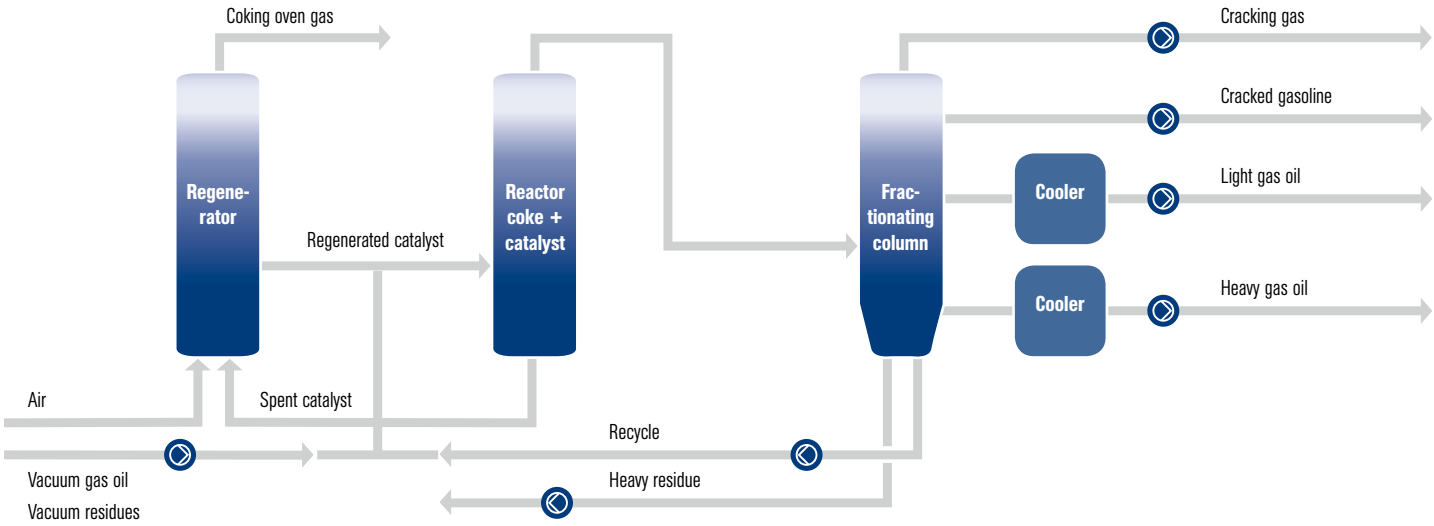
Thermal cracking methods: steam cracking, visbreaking and coking are used to produce different products. While the starting mixture is heated to temperatures between 370 °C (698 °F) and 460 °C (860 °F), the pressures remain below 15 bar (218 PSI).

Catalytic cracking methods: the fuel yield can be increased to around 60 % with the aid of a zeolite catalyst. Petroleum components, middle distillates and gases are generated. Process temperatures can reach up to 500 °C (932 °F).

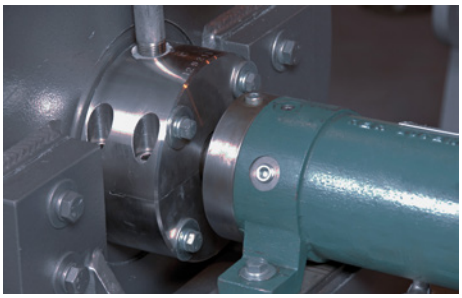
Hydrocracking methods: The most flexible method in relation to the crude oil used and the products generated is also the most cost-intensive due to the high hydrogen consumption. The operating conditions range between pressures of 70 ... 200 bar (1,015 ... 2,900 PSI) and temperatures of 350 °C ... 500 °C (662 °F ... 932 °F).

The plant components and thus the sealing technology used must remain in operation, without interruption, over long periods at extremely high temperatures and pressures. Reliability and availability are thus the decisive criteria.

EagleBurgmann supplies perfectly designed dual mechanical seals for sealing different hydrogen sulfide (H_2S) concentrations in pumped media and high-end metal expansion joints for cracking facilities. “Cool” sealing technology for these “hot” areas!



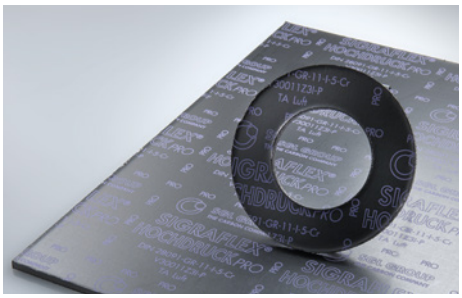
EagleBurgmann has designed a new high performance magnetic coupling type **NMB 22P-10R-65-ND2**. This is installed in a multistage vertical can pump of an ethylene cracker unit in a German refinery. p = ... 65 bar (943 PSI); t = -32 ... +40 °C (-26 °F ... +104 °F); n = 2,980 min^{-1}; drive power: 315 kW direct start; design torque: >1,700 Nm. Media: hydrocarbons C2+C4.



In a cracking unit in the United States a compressor is sealed by EagleBurgmann Espey carbon floating ring seals type **WD200** and **WDKS**. Operating conditions: p = ... 5 bar (73 PSI); t = 75 °C (167 °F); n = 3,000 min^{-1}; d1 = 55 mm (2.17"). Medium: cracked process gas (containing dust).

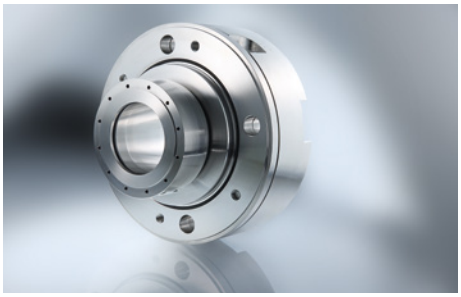
Since 2001, PDVSA (Petroleos de Venezuela) has been using EagleBurgmann seals type **H75K/110** with supply system **TS6050** to API 682 Plan 52 in a Sulzer between bearings pump. Operating conditions: p = ... 4 bar (58 PSI); t = 52 °C (126 °F); n = 3,560 min^{-1}; d1 = 80 mm (3.15"). Media: aromatic hydrocarbons.

A high pressure dry gas seal EagleBurgmann type **PDGS2.1/130** seals a Bhel compressor in the hydrocracker unit of the Panipat refinery in India. Operating conditions: p = ... 179 bar (2596 PSI); t = 160 °C (320 °F); d1 = 112 mm (4.41"). Media: H2 + CH4, N2.



During T&I 2013 all heat exchangers in a German refinery have been equipped with low emission graphite gaskets **Statotherm 9593/HDR Pro** from EagleBurgmann. The gaskets have been manufactured in the EagleBurgmann service center located on-site and have significantly contributed to meet on-time repair schedules.

The shafts of KEPL pumps of Chennai Petroleum Corporation Ltd. in India are reliably sealed by EagleBurgmann metal bellows seals type **MFLWT80/90** and **MFL65F/85**. Operating conditions: p = 16.08 ... 19.93 bar (233 ... 289 PSI); t = 238 °C ... 263 °C (460 °F ... 505 °F); n = 2,955 min^{-1}; d1 = 80 mm (3.15"). Media: hydrocarbons.



The catalytic cracking unit of Tüpras Izmir Refinery, Turkey was commissioned in 2001. EagleBurgmann type **H75** dual seals with supply systems to API 682 Plan 11 + 52 + 61 are successfully sealing the shafts of 63 pumps in this unit. 18 of these pumps have never had to be shut down for maintenance of the mechanical seals. Operating conditions: p = ... 2.71 bar (39 PSI); t = 101 °C (214 °F); n = 2,955 min^{-1}; d1 = 50 mm (1.97"). Media: hydrocarbons.

EagleBurgmann provided a large sized **universal spent catalyst standpipe expansion joint** for a refinery in Texas, USA. Operating conditions: p = ... 3.79 barg (55 PSIG); t = 732 °C (1,350 °F); d = 1,500 mm (59"). Media: flue gas and catalyst fines.

EagleBurgmann **LL9DTUU** dual mechanical seals are applied to seal a Sulzer pump of a catalytic cracking unit operated by Chennai Petroleum Corporation Ltd. in India. Operating conditions: p = ... 13.73 bar (199 PSI); t = 40 °C (104 °F); n = 2,965 min^{-1}; d1 = 70 mm (2.7"). Media: hydrocarbons.

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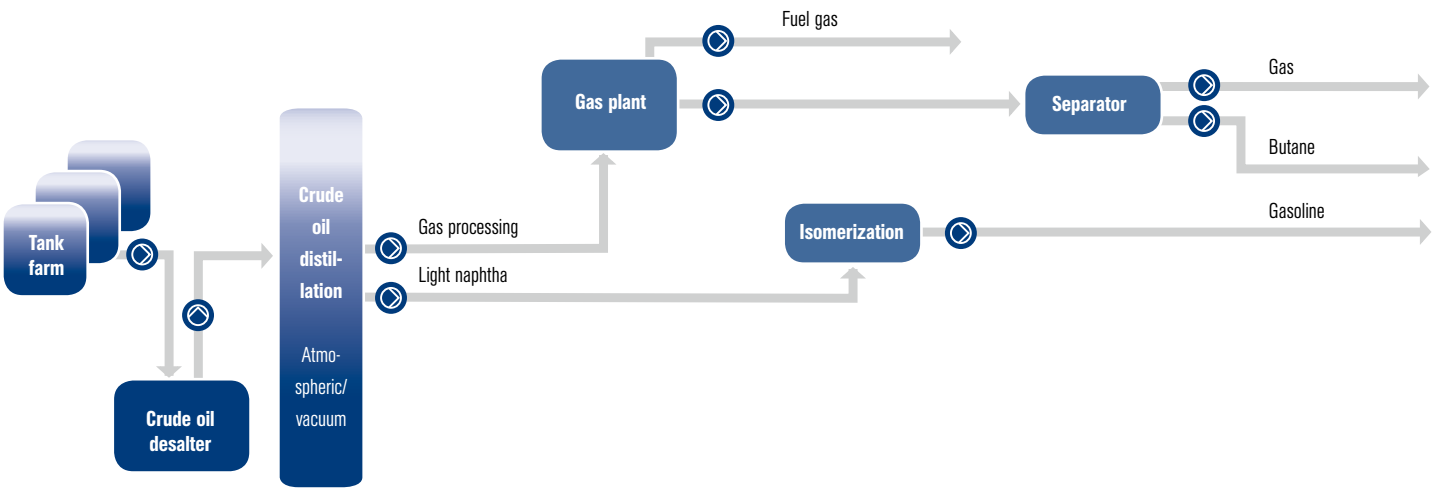
Gas processing: Sealing critical gases without compromise.

Refinery gas occurs during distillation and post-processing of the crude oil. The gas mixture largely consists of methane, propane, butane and hydrogen. As it is contaminated with various substances, the gas is cleaned in scrubbers and is often used for heating. Gas fractions that can be cost-effectively exploited, such as ethylene and propylene, are separated and supplied to the petrochemical industry.

The significant rotating equipment in these applications are compressors, in addition to the process pumps.

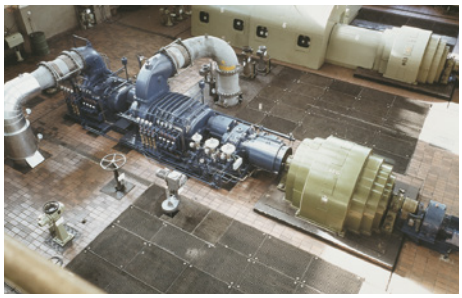
Demands placed on the sealing technology are high. Extreme temperatures below -100 °C (-148 °F), high speeds and pressures, media in the gaseous or liquid state, combined with flammability and the risks that the gases pose to the environment demand uncompromising technology and sealing.

Our robust DGS and PDGS compressor seals have established their position as the default solution in the field of gas-lubricated mechanical seals for critical gases such as oxygen, hydrogen or carbon dioxide. We largely apply pusher type H75 and LL9UC mechanical seals to seal process pumps, while our MFL and MBS682 series metal bellows seals have proven their value in cryogenic processes.



For a MAN Turbo compressor at Shell Godorf, Germany, EagleBurgmann has supplied a **DGS20/113** dry gas seal together with a **SMS** seal management system. The compressor is operated in the gas processing section of the plant. Operating conditions: p = ... 30 bar (435 PSI); t = -20 °C ... 180 °C (-4 °F ... 356 °F); n = 9,811 min^{-1}; d1 = 100 mm (3.94"). Medium: gas.

A GE-Thermodyn compressor - operated in the isomerization unit of the Tüpras Kirikkale refinery in Turkey - is safely sealed with EagleBurgmann dry gas seals type **DGS9/123**. Operating conditions: p = 12.6 bar (182 PSI); t = 38 °C ... 150 °C (181 °F ... 302 °F); n = 12,915 min^{-1}; d1 = 103 mm (5.06"). Medium: mixture of hydrocarbons.



The two-stage screw compressor (Aerzen VR0825) used to compress coking oven gas in a coking plant is one of the biggest ever built. It is sealed with an EagleBurgmann type **HSH2/215**.

Coking oven gas compressor (Mannesmann Demag) at Wintershall AG, Lingen. Originally equipped with labyrinth seals, the turbine-driven single-shaft radial compressor has been converted to EagleBurgmann dual **DGS** seals and a buffer gas supply system. Operating conditions: p = 5.6 barg (81 PSIG); n = 12,800 min^{-1}; d1 = 134.8 mm (5.3"). Medium: gas with H_2S content.

De-ethanizer pump in a LPG fractionation unit of the ENOC refinery, U.A.E., equipped with an unpressurized dual EagleBurgmann **sealing system to API 682**. Configuration: 2CW-CS, piping plans 14 and 76. Operating conditions: p = 36 ... 39 bar (522 ... 566 PSI); t = 1 °C ... 43 °C (34 °F ... 109 °F); n = 2,933 min^{-1}. Medium: LPG. The MTBF has improved drastically since installation.

The ENI refinery in Sannazzaro De' Burgondi, Italy, operates a Finder centrifugal pump in its gasification unit. The pump is sealed by EagleBurgmann **HRKS4-DF/58** mechanical seals. Operating conditions: p = 16.08 ... 19.93 bar (233 ... 289 PSI); t = 238 °C ... 263 °C (460 °F ... 505 °F); n = 2,955 min^{-1}; d1 = 80 mm (3.15"). Medium: carbon slurry.

Liquid hydrocarbons: Safe sealing technology for explosive mixtures.

The hydrocarbons occurring within the refinery are further treated in various processes according to requirements for special end products and composition.

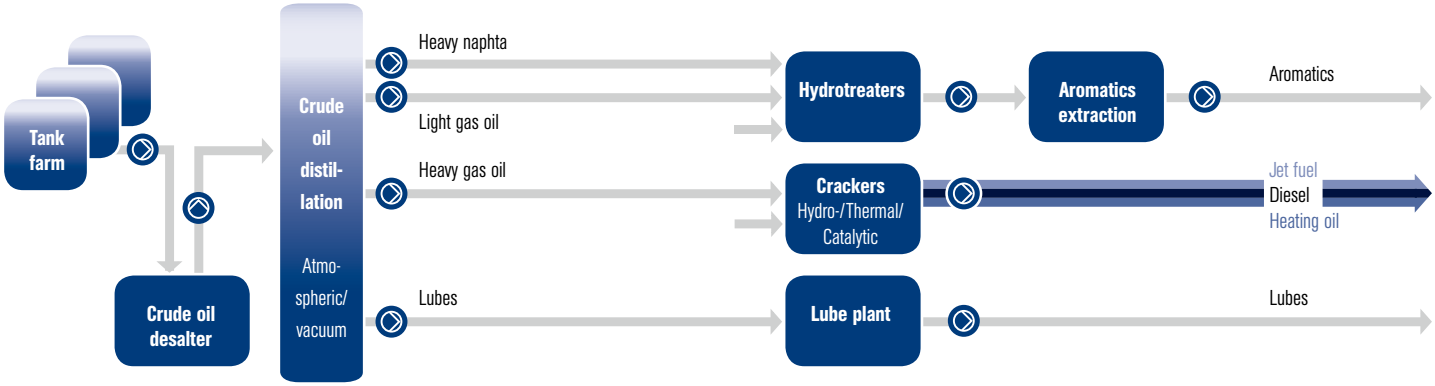
For example, the reforming process serves to increase the octane rating of the gasoline which - untreated - has a very low knock resistance (40 ... 60) and is thus unsuitable for modern engines that need 91 ... 98 octane fuels. To this end, naphthene is converted by dehydration and isomerization into aromatics with high octane ratings. The reactions take place at between 450 °C ... 550 °C (842 °F ... 1,022 °F) and under pressures ranging from 15 ... 60 bar (218 ... 870 PSI).

The base oil also cannot be used straight away to manufacture engine oil because of its properties. The aromatics need to be removed first, then the paraffin wax is extracted. The final step is to remove impurities.

The sealing of flammable and explosive media mixtures (in compliance with the German Technical Instructions on Clean Air Control (TA-Luft) and the ATEX guidelines is one of the biggest challenges facing sealing technology in these processes.

Mature, standardized mechanical seal solutions (types H75, LL9UC, MFL and LY) have proven their added value all around the world for all kinds of process pumps.

We offer durable EagleBurgmann expansion joints for pipeline systems and ducts carrying liquids and gases. For reliably sealing flanges, Spiraltherm spiral wound and Corratherm corrugated gaskets are successfully applied seal solutions in numerous areas of the refinery.



EagleBurgmann mechanical seals are installed in demethaniser reboiler pumps from Thompson Byron Jackson at the Santos-owned Moomba gas plant in South Australia. EagleBurgmann solved the challenges with its seal type **H75KF-D** and a supply system to API 682 Plan 53C. Operating conditions: p = 36 bar (522 PSI); t = -20 °C ... +38 °C (-4 °F ... +100 °F); n = 1,480 min^{-1}. Media: light hydrocarbons.

Boiler feed water pumps in the hydrogen unit of the Turkish Tüpras Kirikkale refinery are equipped with EagleBurgmann **SHPV2/64** seals and supply systems to API 682 Plan 02 + 23. Operating conditions: p = 43 bar (624 PSI); t = ... 282 °C (540 °F); n = 1,470 min^{-1}; d1 = 58 mm (2.28"). Medium: boiler feed water

H75KF-D1/130 back-to-back dual seals with supply system **SP09030/M012-D1** to API 682 Plan 53 have been successfully sealing the shafts of Pacific between bearing pumps since 2004. The system is located in the CRP refinery of Petroleos De Venezuela S.A. Operating conditions: p = 4 barg (58 PSIG); t = 200 °C (392 °F); n = 3,600 min^{-1}; d1 = 104.1 mm (4"). Media: naphtha, gasoil + 3 % H_2S.

In the alkylation plant of the refinery of Salina Cruz, Oaxaca, Mexico, our **H74-D/85** functions as a dual seal for between bearings pumps from Byron Jackson. Operating conditions: p = 9.61 bar (139 PSI); t = 42.3 °C (108 °F); n = 3,550 min^{-1}; d1 = 79.38 mm (3.12"). Media: hydrocarbons + hydrogen fluoride.

The hydro desulfurization unit of the refinery in Ciudad Madero, Tamaulipas, Mexico is equipped with a Mitsubishi compressor. It is reliably sealed by EagleBurgmann **SH6-D** dual mechanical seals. Operating conditions: p = 3.4 ... 5.6 bar (49 ... 81 PSI); t = 20 °C ... 150 °C (68 °F ... 302 °F); n = 5,460 ... 8,190 min^{-1}; d1 = 150 mm (5.91"). Medium: gas.

H75KF-D1/130 back-to-back dual seals with supply system **SP09030/M012-D1** to API 682 Plan 53 have been successfully sealing the shafts of Pacific between bearing pumps since 2004. The system is located in the CRP refinery of Petroleos De Venezuela S.A. Operating conditions: p = 4 barg (58 PSIG); t = 200 °C (392 °F); n = 3,600 min^{-1}; d1 = 104.1 mm (4"). Media: naphtha, gasoil + 3 % H_2S.

Stripper reflux pumps within the naptha hydro treater unit of the ENOC refinery in Dubai are fitted with EagleBurgmann **H75VKS20/105** mechanical seals and supplied to API 682 Plan 11. Operating conditions: p = 11.77 bar (25 PSI); t = 43 °C (109 °F); n = 1,485 min^{-1}; d1 = 80 mm (3.15"). Media: hydrocarbons.

In the ENOC refinery in Dubai, U.A.E., LPG pumps are sealed by EagleBurgmann **H75VKS20/85** dual tandem face-to-face mechanical seals. Applied API piping plans: 11 + 53B. Operating conditions: p = 17.75 bar (257 PSI); t = 43 °C (109 °F); n = 2,950 min^{-1}; d1 = 60 mm (2.36"). Media: hydrocarbons.

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Heavy hydrocarbons: Simple solutions - with the right seal.

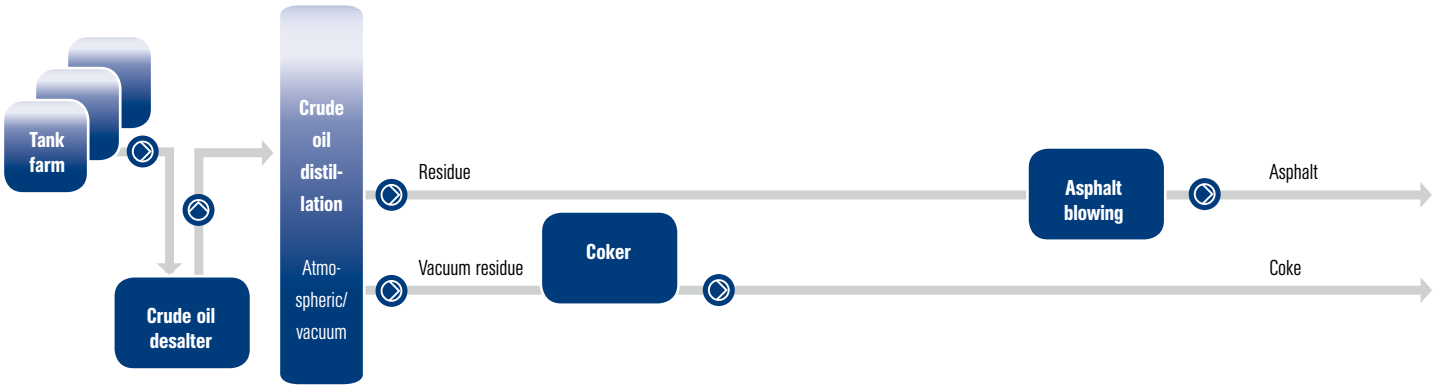
Heavy hydrocarbons such as bitumen from the vacuum distillation process and thermal cracking methods are converted into gases, fuels, middle distillates and pet coke in the coker unit. The starting product is first heated to around 500 °C (932 °F), cracking the long-chain hydrocarbons into short chains. Considerable quantities of saleable coke are produced as a by-product of this process.

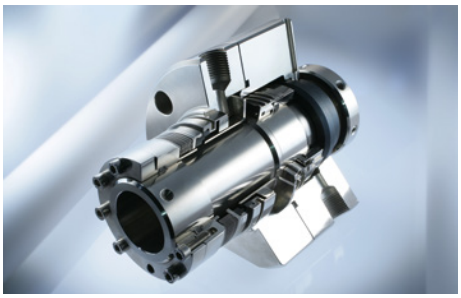
High process temperatures required by the process, due to the high solidifying points, combined with the extremely contaminated media, are the main challenges for the mechanical seal technology.

Technically mature MFLWT and Y9 high-temperature metal bellows seals and suitably designed EagleBurgmann supply systems have been most successful in this challenging environment.

On the other hand, EagleBurgmann packings and packing cartridge units type 9984 significantly contribute to increased throughput in refineries world-wide. As a critical process component in hydraulic decoking systems the packing cartridges help to increase life time and productivity of the unit.

EagleBurgmann BuraTAL-Flex 6070 low-emission valve packings have been approved as the standard packing in refineries. They meet even strictest environmental regulations (e.g. API 622 and API 589).

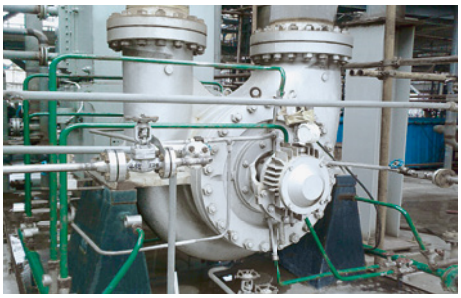




An EagleBurgmann **MFLWTS1/83** seals the shaft of a Leistritz screw pump in the de-asphalting unit of the ENI refinery in Sannazzaro de' Burgondi, Italy. Pump and metal bellows seals were started up in 2006. Operating conditions: p = 1.87 bar (27 PSI); t = 274 °C (525 °F); n = 1,700 min^{-1}; d1 = 75 mm (2.95"). Medium: asphaltene.

Bhel compressor in the delayed coker unit of the Panipat refinery run by the Indian Oil Corporation Ltd. The machine is equipped with EagleBurgmann **DGS20.1/200** tandem gas seals and a **diaphragm coupling**. Operating conditions: p = 6 barg (87 PSIG); t = 150 °C (302 °F); n = 8,909 min^{-1}; d1 = 180 mm (7.09"). Medium: flue gas.

For a KSB pump installed in the delayed coker unit, the Indian Panipat refinery applied EagleBurgmann pusher seals **LL9DTUU** in tandem arrangement. Operating conditions: p = 23.5 bar (340 PSI); t = 40 °C (104 °F); n = 2,900 min^{-1}; d1 = 58 mm (2.28"). Media: hydrocarbons.



Fujian Refining & Petrochemical Co., Ltd. in China applies a BB2 pump for propane de-asphalting. The shaft seal is an EagleBurgmann **SHV1/102-PTA1/2**. Configuration 2CW-CW, piping plans 21+52. Operating conditions: p = 73 barg (1,059 PSIG); t = 165 °C (329 °F); n = 2,970 min^{-1}.

Pumps in upgraders at Suncore Energy in Fort McMurray, Alberta, Canada are equipped with EagleBurgmann **HRZS1/80** mechanical seals. Operating conditions: p = 11.38 bar (165 PSI); t = 92.2 °C ... 182.2 °C (198 °F ... 360 °F).

Service made to measure: TotalSealCare.

Our seven service modules

Optimized services are major contributors to making sure that plants function smoothly – and that doesn't just begin with maintenance. With TotalSealCare, our modular service concept, we are able to cover all individual service requirements very flexibly. The individual modules can be combined as required.

1 Consulting & Engineering

After establishing and analyzing all of the installed seals in a system, we develop standardization concepts based on the "as-is" status. The results we strive for are to reduce the number of seal types, sizes and materials used and to improve the plant performance of the system. We advise you on codes of practice and statutory regulations and indicate what actions need to be taken.

2 Maintenance

In the plant or in the service center, qualified fitters and technicians look after all the aspects of seal maintenance – installation, start-up, servicing, conversion, overhaul and repair. We record and document functionally relevant data (failure reasons and related costs). This means it is possible to evaluate seal operating times and maintenance costs on a continuous basis, thereby defining measures for extending service intervals.

3 On-site Service

Our on-site service includes the components of an overhaul service, conversions and service container. We deploy a service unit directly to your premises: equipped with the basic range of seals or a stock of seals discussed with you in advance and staffed by qualified personnel. On-site, we assure production of the necessary gaskets, ensure that the documentation is complete and advise our customers on the selection and installation of seals. Our range of services also includes complete conversions (e.g. acc. to TA-Luft).

4 Inventory Management

Based on your individual requirements and the applicable quality regulations, we develop a concept for inventory management of complete seals and spare parts. Furthermore, we optimize stocking on-site or in the EagleBurgmann service center. In this way, you reduce your administration overhead and concentrate on your key operations.

5 Seminars & Training

We offer an extensive range of continuing education programs in sealing technology, developed for service and maintenance personnel, and skilled staff and engineers from various branches of industry including refining, chemical, power generation, foodstuffs, paper and pharmaceutical. Our program includes group seminars, individual training and seminars specifically tailored to your requirements held at our premises or at a location of your choice.

6 Technical Analysis & Support

A team of seal specialists is responsible for rectifying process malfunctions or "bad actors". The latest methods, such as thermography or data logging, are used for diagnosing critical items for the operation of the plant and for defining measures to resolve them. In our research and development centers, we perform realistic tests on test rigs or in original pumps. The objective is to extend the MTBF and to increase system reliability by individual and constructive solutions.

7 Service Agreements

We offer our customers specific agreements that are combined from the six service modules. Whether for individual seal systems, critical process elements, specific plant units or an extensive seal service for complete plants, the modular structure of our service makes it possible to satisfy individual requirements. With our well established monitoring instrument, SEPRO, we can also record all seal-related data for documentation and evaluation purposes.

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EagleBurgmann is one of the internationally leading companies for industrial sealing technology. Our products are used everywhere where safety and reliability are important: in the oil and gas industry, refining technology, the petrochemical, chemical and pharmaceutical industries, food processing, power, water, mining, pulp & paper, aerospace and many other spheres. Every day, more than 6,000 employees contribute their ideas, solutions and commitment towards ensuring that customers all over the world can rely on our seals. Our modular TotalSealCare service underlines our strong customer orientation and offers tailor-made services for every application.

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