



# CHETRA Mechanical Seals

for Refineries and the Petrochemical Industry

## In refineries and the petrochemical industry crude oil is processed into finished products.

Sealing is needed for a great diversity of media in various states of matter: Typical processing tasks deal with media close to boiling point, substances with a lot of solid particles and others that are highly volatile, at temperatures ranging from very low to very high (-150°C to +400°C).

These media, some of which are explosive and polluting, are subject to regulations imposed by TA-Luft (clean air act), ATEX, API, TÜV (German technical monitoring association) and others.

These aspects as well as the need for cost effectiveness – long MTBF/MTBR – are taken into account by CHETRA as of the basic conception of the mechanical seal and in the selection of suitable accessories and support with sound advice on applications.



## The results are innovative and often customised solutions based on decades of experience.

The CHETRA delivery range contains both tailor-made products and high-quality standard seals, characterised by:

- » Robust design with extensive safety margins.
- » Protection of sensitive components.
- » Solid rotary seal rings and stationary seats in self-aligning arrangements.
- » Stationary design, if applicable.
- » Special seal face geometry.
- » Controlled circulation guidance for optimal heat removal.
- » Material optimisation; use of suitable materials, some with patented surface treatment – use of API 682-approved materials.



## “Made in Germany” quality and international experience.

CHETRA is an international specialist for advanced and efficient mechanical seals. We offer “Made in Germany” quality with mechanical seals in complex and demanding applications for well-known customers in the refinery and petrochemical sector both in Germany and abroad.

The mechanical seals are designed in compliance with API 682, ISO 21047, TÜV rules and the respective factory standards and local regulations.

Our claim to high quality is reliably underpinned: since 1996 we have been working in conformance to DIN EN ISO 9001:2008 and are certified by DQS/IQ NET.





## Example Seals



### CHETRA type 875 A

Typical areas where this double metal bellows seal is used are in FCC plants, combi-crackers, high temperature bottom pumps, slurry oils and similar applications.

This mechanical seal is designed for the higher temperature range up to max 400° C. It can be arranged either "back-to-back" (API plan 53/54) or in "tandem" (API Plan 52). The average service life is more than 4 years (MTBF) but applications with a service life of 12 years have been recorded.

The CHETRA type 875 A is fitted on both sides with high-temperature bellows and graphite secondary seals as well as an additional safety throttle bushing and feed screw. The stationary seats are self-aligning. A regulated circulation guidance optimises the cooling in the seal face area.



### CHETRA type 881 D

This is a mechanical seal designed for especially difficult applications and optimised for solid matter, frequently changing operating conditions and pressure surges. It is typically used in conditions where levels of pressure, speed and temperature hover around the upper limits ( $p_{max}$ : to 150 bar,  $t_{max}$ : 260° C,  $v_{max}$ : 35 m/s)

This high-tech mechanical seal is used wherever the safety aspect is of prime importance, such as e.g. in main quench oil pumps, hydrogenation, ethylene oxide and lean amine charge pumps.

As one of the highest-quality mechanical seals on the market, the CHETRA type 881 or CHETRA type 881 D (double balanced) is produced in a stationary version and offers very advanced design features: In addition to the special protection of the sensitive components, it has an internal differential piston, "Multi-Point-Injection" and particularly sturdy over-dimensioned components.



### CHETRA type 207 A

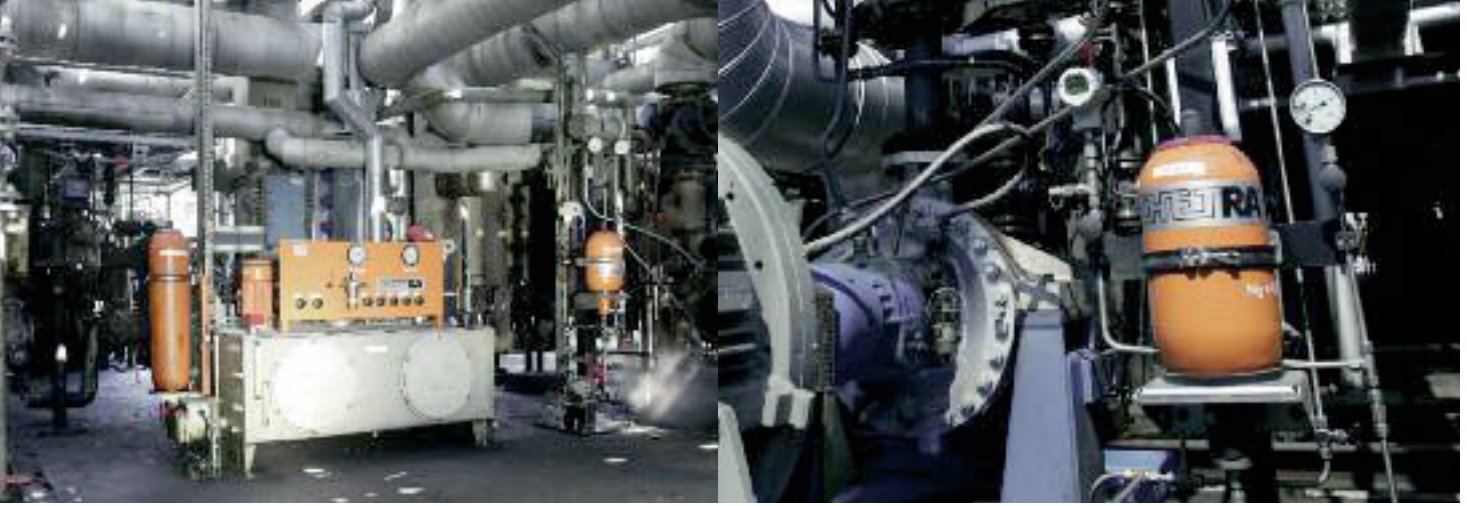
The stationary single mechanical seal in a cartridge version is suitable for a great number of applications in refineries and in the petrochemical industry up to  $t_{max}$ : 200° C.

With its high-quality material, this mechanical seal not only has the API elements that are vital for operation (e.g. safety throttle bushing, circulation and quench connections), it is also universally usable.

It is therefore particularly suitable for standardization measures, which shortens repair times and increases plant availability and accordingly improves the MTBF/MTBR factor.







# Experience

## Innovative supply systems and accessories.

- » **CHETRA individual supply systems and central systems:** A complete range for the supply of mechanical seals consisting of **barrier fluid pressure** and **quench containers** in accordance with the EC directives and the pressure vessel directive including API vessels (in accordance with ASME).
- » **CHETRA vessel accessories:** p/t measurement devices, level switch, manual refill pump, cooling coil, pressure measuring switch.
- » **CHETRA heat exchanger:** water or air cooled.
- » **CHETRA cyclone separator.**
- » **CHETRA pressure transmitter.**
- » **CHETRA loop systems and central barrier fluid systems:** For the optimum supply of the mechanical seals, with the monitoring and signalling to a control room. Up to 50 loop systems with an accumulator bladder can be supplied from a CHETRA **central barrier fluid system** with an output of 100 bar.  
These facilities offer the highest levels of operational dependability and are also increasingly used in TA-Luft (clean air act) applications.

## CHETRA International Services.

- » **CHETRA mechanical seal service centres** in Europe, the Middle East and Asia as well as service supervisors of the company headquarters who can be called out at short notice ensure the rapid use of CHETRA mechanical seals, regardless of whether they are new or used.
- » **CHETRA repair and maintenance service:** Damage analysis, suggestions of potential areas of improvements, expert corrective maintenance and optimisation of in-house and third party seals, worldwide logistics.
- » **CHETRA maintenance agreements:** Tailor-made fixed costs contracts and maintenance agreements.
- » **CHETRA spare parts service:** A high level of warehouse availability and sophisticated logistics for the worldwide supply of mechanical seal spare parts. Spare part kits for all the cartridge mechanical seals (all the parts that are subject to a dynamic load) as well as the individual spare parts can be obtained in accordance with the parts unit.
- » **CHETRA CAS® Computer Aided Seal Selection:** An application review developed by us for 1000 media relating to the mechanical seal type and materials whilst taking account of the pressure, temperature and speed, including a recommendation in terms of the appropriate method of operation and the determination of the frictional power.



# Solutions

## Technology

### **Environmental Compatibility and Central Monitoring.**

To comply with the considerably stricter emission limits set by TA-Luft (clean air act) 2002 (5.2.6.1) a quarter of all operating pumps in Bavaria's largest refinery was equipped with modern double seals and the corresponding accessories.

This measure was implemented by the refinery in order to meet its own specifications, API 682 and ATEX 95 as well as the managing operator's wish to have as much standardisation as possible.

In a close cooperation between the refinery, the industrial service provider who carried out the conversions and the CHETRA technicians, a pre-assembled CHETRA double seal offering the appropriate gland plate and sleeve adaptations to the pumps was selected and as a result it was not necessary to modify the pumps.

For an optimum supply, each mechanical seal was connected to a loop system fed from a central barrier fluid system with a capacity of 600 l. An integrated pressure transmitter monitors this constantly and sends signals to the measuring control station.

### **State-of-the-art combi-cracker – reliable mechanical seal.**

During the construction of the state-of-the-art combi-cracker in a German large-scale refinery the focus was on a high level of cost-effectiveness through rapid production with the market-dictated possibilities of conversions to diesel or petrol (gasoline). These requirements apply to the same degree to the mechanical seal and accessory devices for the pumps.

90 % of all mechanical seal applications were equipped with CHETRA double seals with due consideration to API 682 as well as the refinery's own standards. The requirements also called for conformity to ATEX 95 and TA-Luft (clean air act) 2002 and extensive standardisation.

The applications cover the entire range: amine charge and slop pumps, lean amine (with solids), vacuum residue, slurry residue, HEL Light Heating Oil; cracked gas oil; solid fuel; bitumen diesel (DK, MHC), the most varied hydrocarbons (LCO, LCCB, LVGO, SGO, VGO, CSO and a lot more). Application data: up to  $t = 380^{\circ}\text{C}$  and  $p = 60\text{ bar}$ . Three seal types meet these requirements: 875 A, 807 AS/HD and 857.

### **No failures at the heart of an ethylene plant.**

One of the most important units in an ethylene plant is the main quench oil pump. The main requirements set for the mechanical seal are reliability and service life (MTBF factor).

In a study conducted by the managing operator which compared all European ethylene plants the highest MTBF factor was attained by the CHETRA mechanical seal. At no point in time during the periods of use under scrutiny was it necessary to turn off or repair the pump(s) because of a failure in a CHETRA mechanical seal (MTBF > 4.5 years).

Application data:  $p: 18\text{ bar}$ ,  $t: 175^{\circ}\text{C}$ ,  $n: 1500\text{ min}^{-1}$ , Size: 110 mm.

## Refineries and the Petrochemical Industry

The mechanical seals listed here are without exception "cartridge" seals, available in compliance with **API 682** and **customer-specific standards** and **adapted** to the respective unit.

More mechanical seals are available.

Mechanical seal type / Series:	Typical applications:	Technical data (physical parameters):
<b>Single mechanical seals</b>		
201 201 A 201 S	Pipeline-pumps; booster-pumps; crude oil, finished products, cavern pumps; loading area – diesel, petrol (gasoline), heating oil light/heavy; quenching water, alkaline solutions, condensate	p <sub>max</sub> : 70 / 130 bar t <sub>max</sub> : +200° C v <sub>max</sub> : 35 m/s
207 207 A 207 AS 207 S	Universal mechanical seals for volatile and non-volatile hydrocarbons, alkaline solutions, acids, oils Refinery standardisation (single mechanical seals up to 200° C)	p <sub>max</sub> : 50 bar t <sub>max</sub> : +200° C v <sub>max</sub> : 25 m/s
700 700 A 700 H	Hydrocarbons high t° range, hydrocarbon condensate, heavy heating oil, heavy gas oil, heat transfer oil	p <sub>max</sub> : 28 bar t <sub>max</sub> : +250 / 400° C v <sub>max</sub> : 25 m/s
<b>Double mechanical seals</b>		
351F	Compressor applications (liquid barrier fluid); LPG projects; cooling. Media: propane, butane, natural gas, HCL, mixed and process gases, ammonia, helium	p <sub>max</sub> : 25 / 50 bar t <sub>max</sub> : +100 / 200° C v <sub>max</sub> : 25 m/s
541	Mixer applications; top / bottom drives; polymeric solutions, butadiene	p <sub>max</sub> : 35 bar t <sub>max</sub> : +220° C v <sub>max</sub> : 10 m/s
581	Mixer applications; solids fuels, rocket fuel	p <sub>max</sub> : 35 bar t <sub>max</sub> : +220° C v <sub>max</sub> : 10 m/s
807 807 AS / HD 807 S	Transfer pumps, MOL pumps; universal double mechanical seal in the refinery area; TA-Luft (clean air act) environmental applications	p <sub>max</sub> : 35 bar t <sub>max</sub> : -100°C up to +200 / 250° C v <sub>max</sub> : 25 m/s
851 A 851 B 851 B / T	Highly and self-flammable medium, LPG, propylene, ethylene, propane, methane, C4, LNG, solvents (in connection with flare); toxic, highly-explosive media; aromatic hydrocarbons – benzene, toluene, xylene and such like	p <sub>max</sub> : 50 bar t <sub>max</sub> : -120° C up to +260° C v <sub>max</sub> : 25 m/s
875 875 A	High-temperature applications: slurry oil, hot oil, hot oil circulation, hot cracked products with catalyst, FCC plants, combi crackers, high-temperature bottom pumps; TA-Luft (clean air act) environmental applications etc.	p <sub>max</sub> : 28 bar t <sub>max</sub> : -40° C up to +400° C v <sub>max</sub> : 25 m/s
881 881 A 881 D (861)	Double mechanical seals (double balanced) for pumps in applications with particularly difficult conditions: solids, frequently changing operating conditions – main quench oil pumps; ethylene oxide, butadiene; LNG, TA-Luft (clean air act) applications	p <sub>max</sub> : 50/150 bar t <sub>max</sub> : -163° C up to +260° C v <sub>max</sub> : 35 m/s
887 887 A 887 S	Bitumen, waste oil processing, heavy gas oil, Vacuum tower bottom, residue applications combining elevated t° with slurries	p <sub>max</sub> : 50 bar t <sub>max</sub> : +320° C v <sub>max</sub> : 35 m/s

All mechanical seals can be supplied in versions **conforming to ATEX**. Dimensions shaft diameter: from 20 mm to 300 mm, also available in inch.

### Safety instructions relating to the field of application and the technical specifications:

The information in this pamphlet corresponds with the latest technological findings as well as comprehensive tests and experiences gained. However, please note that the technical specifications have a mutual influence upon each other and that our products can therefore not be used in the maximum range in terms of all the technical specifications at the same time. Amongst other things the temperature ranges stated are dependent upon the type of secondary seal, accessory equipment and the other technical parameters. In view of the variety of application options available and the technical facts and information they merely provide an indication of how to beneficially apply them and cannot be completely applied in every single case. We can therefore not be held liable for this information. We always recommend that you carry out tests prior to general use.

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