PUMPS FOR
CHLOR-ALKALI
ELECTROLYSIS

THE RIGHT SOLUTION. FOR ANY FLUID.
Flexibility, reliability, long lifetimes, simple maintenance and low operating costs are the requirements placed on modern chlorine production plants. Friatec continuously develops the Rheinhütte family of pumps for the chlorine sector and today offers plant constructors and operators one of the most extensive range of pumps to meet these exacting standards.
SPECIAL PUMPS FOR THE CHLORINE INDUSTRY

Chlorine is one of the most important basic chemicals and an essential component for a wealth of products that we use in our daily lives. Three-quarters of the 55 million tonnes of chlorine which are produced in the 650 chlorine plants around the world each year alone are used for the production of PVC (for example for window frames), isocyanates (for example for insulation materials) and inorganic chemicals (for example for disinfectants).

In production processes of this scale, efficiency and safety play a vital role and they serve as the driving force behind technological advances. For instance, the development of the membrane technology made it possible to achieve energy savings of around 20% compared with what was previously the oldest industrial process, amalgam electrolysis. The feeding of oxygen to the cathode side allows the most recently developed process, oxygen depolarized cathode technology (ODC), to produce further energy savings of up to 30%. This also enables hydrochloric acid to be used as a feedstock for the production of chlorine.

For many decades now, Rheinhütte pumps have been used successfully in all known processes for the production of chlorine. Efficiency, economy and safety are – in view of the aggressive nature and toxicity of the pumped media – always of particular significance. For example, more than 15 years ago, the Rheinhütte developers designed a leakage-free circulation pump for mercury for use in amalgam electrolyses – and thus helped to meet the ambitious emissions targets.

The aggressive chemical nature of the pumped media which contain chlorine and hydrogen chloride has always presented a challenge for the materials which are used. The same is also true – and to a particular extent – for pumps in which high flow speeds have an additional impact on material removal.

As the world’s only supplier of pumps in all material classes, Friatec has a wealth of experience in the chlorine industry. Whereas previously use was made almost exclusively of pure metal pumps made from titanium, titanium-palladium and nickel in the catholyte and anolyte circuit, pumps made from plastic (e.g. PTFE, PVDF and PE 1000) are now also increasingly becoming an established fixture in the industry.
EVERYWHERE
RHEINHÜTTE PUMPEN
IN CHLORINE PRODUCTION

The Chlor-alkali-Electrolysis Process

<table>
<thead>
<tr>
<th>Position</th>
<th>Medium</th>
<th>Pump type</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a + 1b</td>
<td>310 g/l NaCl - Brine - Chlorine free - Raw brine / Purified brine / Diluted brine</td>
<td>RN, RMKN,</td>
<td>Super duplex, Super austenite, Titanium, TiPd</td>
</tr>
<tr>
<td>1c</td>
<td></td>
<td>RCNKu, FNPM</td>
<td>PTFE, PFA, PVDF, PE 1000</td>
</tr>
<tr>
<td>1d</td>
<td>Chlorine containing brine 200g/l NaCl</td>
<td>RN, RMKN,</td>
<td>Titanium, TiPd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RCNKu, FNPM</td>
<td>PTFE, PFA, PVDF</td>
</tr>
<tr>
<td>2a</td>
<td>Catholyte – 31% NaOH Caustic soda</td>
<td>RN, RMKN,</td>
<td>Nickel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RCNKu, FNPM</td>
<td>PTFE, PFA, ETFE</td>
</tr>
<tr>
<td>2b</td>
<td>Hot Catholyte – 31% NaOH Caustic soda</td>
<td>RN, RMKN</td>
<td>Nickel, Super austenite (R3020)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RCNKu, FNPM</td>
<td>PTFE, PFA, ETFE</td>
</tr>
<tr>
<td>2c</td>
<td>Cold caustic soda NaOH</td>
<td>RN, RMKN</td>
<td>Super austenite (R3020)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RCNKu, FNPM</td>
<td>PTFE, PFA, ETFE, PE 1000, PP</td>
</tr>
<tr>
<td>3a</td>
<td>Moist chlorine gas</td>
<td>FGP</td>
<td>FRIKORUND® KERAMIK</td>
</tr>
<tr>
<td>3b</td>
<td>Chlorine containing sulphuric acid</td>
<td>RNSi, FNPM, RCNKu</td>
<td>PTFE, PFA</td>
</tr>
<tr>
<td></td>
<td>Liquefied chlorine gas</td>
<td>GVS0</td>
<td>Austenite (1.4408)</td>
</tr>
</tbody>
</table>
RHEINHÜTTE PUMPS – AN OVERALL CONCEPT

The Rheinhütte family of pumps offers specific solutions for all industrial processes of chlorine production. In amalgam and diaphragm technology and in membrane electrolysis plants for salt brines or hydrochloric acids, our pumps have been successfully represented worldwide in all stages of the process for many decades now. When it comes to pumping catholyte solutions (NaOH, 80°C) – to protect the electrolysis membranes from Fe-ions – only pure, iron-free pump materials can be considered for use. Rheinhütte Pumpen successfully makes use here of centrifugal pumps made from nickel, ETFE, PFA or PTFE.

On the anolyte side (see diagram: 1a, 1b, 1c, 1d), identical Rheinhütte pumps made from titanium, titanium-palladium or PTFE complement our range.

The pumping of moist chlorine gas (3a) presents supreme demands for the corrosion resistance of all of the components which are used. Solid ceramic liquid ring vacuum pumps have proved their worth for many decades here and they offer an unique alternative to special pumps made from titanium. Sulphuric acid is used to dry the moist chlorine gas. At this point, due to the dry chlorine gas in the sulphuric acid, even titanium is not suitable as a material for pumps. Only the special material SIGUSS which has been developed by Rheinhütte guarantees – along with PTFE and PFA – long lifetimes for centrifugal pumps.

With due consideration of the special requirements for the pumped media and the express wishes of individual customers, the »appropriate« Rheinhütte pump is designed, the right material is chosen and the optimum type of seal is selected.

This approach has ensured that for more than 50 years we have been a successful partner in the chlorine industry – worldwide.
OUR MATERIAL EXPERTISE

RHEINHÜTTE PUMPEN - YOUR EXPERT IN INDUSTRIAL PUMP CONSTRUCTION

METAL

Out of our range of materials comprising more than 20 metals, the following metals in particular have proved to be very suitable for use in Chlor-alkali Electrolysis:

- Titanium – for brines containing chlorine gas
- TiPd – titanium-palladium alloy for brines containing chlorine gas and acidic brines
- Nickel – the material for strong hot alkaline solutions which does not introduce any corrosion products
- Super-Duplex – ideal for pure brines and cheap at the same time
- Super austenite – a selection of high-quality austenites with lots of chromium, nickel, molybdenum and nitrogen for brines and alkaline solutions – even in tough conditions
- Siguss – the special material for all sulphuric acid media – excellent resistant even to boiling temperature
- On request, we can also offer you special alloys which have proven to be ideal in your applications.

Rheinhütte pumps made from high-quality stainless steels and numerous pure metals.

PLASTIC

Plastics provide a good supplement to many areas of application. Our pumps are available in six different materials, each tailored to your specific application:

- PTFE – the all-round talent among the plastics
- PFA – an optimised material for pump design, similar to PTFE
- ETFE – the high quality lining material as a low cost alternative to PFA
- PVDF – the reasonable all-rounder
- PE 1000 (UHMW PE) – the wear-resistant plastic
- PP – the tried-and-tested plastic for ancillary processes

All manufactured in-house. Plastics from Rheinhütte Pumpen – more than just plastic.

CERAMIC

Ceramic materials offer universal corrosion and abrasion protection. Rheinhütte Pumpen offers FRIKORUND® – a dedicated Friatec ceramic development, which has been tried and tested and optimised for use in pump construction.

- Ceramics from FRIATEC AG.:
  FRIKORUND® – FRIALIT® – DEGUSSIT®

The specialist for ceramic materials and construction.
PUMPS
MADE FROM METAL

Comply with DIN EN 22858 and 94/9/EG (ATEX)

RN – The Standard for the Chlorine Industry
The variety of available materials, sizes and types of shaft seals provides great flexibility and reliability for users and planners. Titanium and nickel versions are specially adapted to cater for the needs of the chlorine industry. A revised bearing support concept ensures smooth running and a long life span for the pump. All of the important modules are easily accessible and simple to fit, which saves time and money when it comes to maintenance.

Sizes
47 different pump sizes

Materials
More than 20 different metal alloys and pure metals

Seals
Single and double mechanical seals in a standard or cartridge design

Options
Heating jacket for all parts
Close-coupled design
Open or closed impellers
Various flushing options on the mechanical seal

RMKN – The Sealless Magnetic Drive Pump
The reliable magnetic drive concept, which has proven its worth over many decades, ensures maximum reliability in demanding industrial applications. Energy-saving spacer cans and a large selection of pump sizes make it possible to produce cost-effective and reliable facilities. Titanium and nickel versions are also available for this range. Thanks to the modular principle, the RMKN and RN ranges are compatible with one another.

Sizes
30 different pump sizes

Materials
More than 20 different metal alloys and pure metals

Options
Heating jacket for all parts which come into contact with media
Close-coupled design
Ceramic spacer can
Leakage sensor
Temperature transmitter
External flushing

Technical Data

<table>
<thead>
<tr>
<th>DN</th>
<th>25 to 400</th>
</tr>
</thead>
<tbody>
<tr>
<td>PN</td>
<td>16 bar</td>
</tr>
<tr>
<td>Q</td>
<td>max. 2,500 m³/h</td>
</tr>
<tr>
<td>H</td>
<td>max. 140 m</td>
</tr>
<tr>
<td>T</td>
<td>-40 to 300° C</td>
</tr>
<tr>
<td>P (shaft)</td>
<td>max. 90 kW</td>
</tr>
</tbody>
</table>

Technical Data

<table>
<thead>
<tr>
<th>DN</th>
<th>25 to 150</th>
</tr>
</thead>
<tbody>
<tr>
<td>PN</td>
<td>16 bar</td>
</tr>
<tr>
<td>Q</td>
<td>max. 400 m³/h</td>
</tr>
<tr>
<td>H</td>
<td>max. 140 m</td>
</tr>
<tr>
<td>T</td>
<td>-40 to 250° C</td>
</tr>
<tr>
<td>P (shaft)</td>
<td>max. 45 kW</td>
</tr>
</tbody>
</table>
PUMPS
MADE FROM PLASTIC

Comply with DIN EN 22858 and 94/9/EG (ATEX)

RCNKu – The Solid and Robust Pump

All of the parts which come into contact with media are made from solid plastic (no lining). A completely closed metal armour ensures a long life span because it protects the plastic from UV radiation and from external forces and moments. High-quality, pure fluoroplastic satisfies supreme demands for use in the chlorine industry.

Sizes
20 different pump sizes

Materials
PTFE · PFA · PVDF · PE 1000 · PP

Seals
Single and double mechanical seals

Options
Customised hydraulics
(for example for low NPSH)
Free-flow hydraulics (vortex)
Different mechanical seal flushes for tough conditions of use

FNPM – The High-end Magnetic Drive Pump

The entire range has been optimised in recent years: the primary focus here was on achieving flexibility in pump selection, simple maintenance, high operational reliability and a design that meets the needs of the market. The modular structure and the unique magnet unit allow effortless handling and save costs when it comes to keeping spare parts in stock.

Sizes
15 different pump sizes

Materials
PTFE · PFA · PVDF · PE 1000 · PP

Options
Friction-optimised slide bearings for critical fluids
Ceramic spacer cap
Temperature measurement
Leakage sensor
External flushing
Close-coupled design

Technical Data

<table>
<thead>
<tr>
<th>DN</th>
<th>80 to 400</th>
</tr>
</thead>
<tbody>
<tr>
<td>PN</td>
<td>16 bar</td>
</tr>
<tr>
<td>Q</td>
<td>max. 3,000 m³/h</td>
</tr>
<tr>
<td>H</td>
<td>max. 100 m</td>
</tr>
<tr>
<td>T</td>
<td>-50 to 180° C</td>
</tr>
<tr>
<td>P (shaft)</td>
<td>max. 600 kW</td>
</tr>
</tbody>
</table>

Technical Data

<table>
<thead>
<tr>
<th>DN</th>
<th>25 to 125</th>
</tr>
</thead>
<tbody>
<tr>
<td>PN</td>
<td>16 bar</td>
</tr>
<tr>
<td>Q</td>
<td>max. 350 m³/h</td>
</tr>
<tr>
<td>H</td>
<td>max. 100 m</td>
</tr>
<tr>
<td>T</td>
<td>-30 to 190° C</td>
</tr>
<tr>
<td>P (shaft)</td>
<td>max. 66 kW</td>
</tr>
</tbody>
</table>
PUMPS
MADE FROM CERAMIC

CERAMIC VACUUM PUMPS

Moist chlorine gas is one of the most aggressive fluids found within chlorine production. Many dechlorination processes take place under a vacuum of from 200 to 400 mbar(A). Liquid ring vacuum pumps have proven their worth here over many decades. However, titanium – the only resistant metallic material – is marketed by many manufacturers as a rare commodity, which then sometimes results in considerable increases in cost and availability shortages. This is why Rheinhütte recommend using ceramic as a material – and has been doing so for over 60 years.

FGP - The Chlorine Gas Pump

The FGP liquid ring vacuum pump occupies a dominant position in our range of pumps for the chlorine industry. Made from the solid silicate ceramic material Frikorund®, it is not only resistant to all fluids containing chlorine and hydrogen chloride, but it is also almost completely independent to the trend which has seen a rapid rise in the costs of pure metals.

Sizes
6 different pump sizes as a vacuum pump and compressor.

Materials
Casing: Frikorund® ceramic, Impeller: PTFE, titanium

Seals
Double mechanical seals of different makes
Stuffing box

Options
Package units incl. separator, gas ejector, pipelines, fittings and measurement technology

Technical Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>V&lt;sub&gt;max&lt;/sub&gt;</td>
<td>700 m³/h</td>
</tr>
<tr>
<td>P&lt;sub&gt;min&lt;/sub&gt;</td>
<td>25 mbara</td>
</tr>
<tr>
<td>P&lt;sub&gt;max&lt;/sub&gt;</td>
<td>2.5 barg</td>
</tr>
</tbody>
</table>

Vacuum Compact Package Unit

Friatec considers the entire process when it comes to the design of the pumps and components. For the operation of a liquid ring vacuum pump, additional components are required (for example a separator, heat exchanger etc.). On request, our customers can receive individually equipped compact installations – right through to full units which are ready for use.

Together with our customers, we identify which components will meet the specific needs on site. They can rely here on our many years of expertise in working with special materials, our design flexibility and our experienced project management.

Compact Package Units: All necessary components in one robust support frame.
OUR SERVICES
AT A GLANCE

PUMP DESIGN
The success of an installation starts with selecting the right pump. The type, size and seal must satisfy the requirements presented by the pumped medium. Thanks to modern, computer-optimised hydraulics, Rheinhütte pumps are ideally suited to meet any applications.

MATERIAL ADVICE
Which materials are best suited to your particular application? Whether you require pump materials, seal materials or changes in process affecting the pumps – our material specialists will offer you an individual recommendation, with full commitment.

OPERATING CONCEPT
Whether you want to monitor centrifugal pumps or operate complex vacuum installations, we will work with you to devise the right operating concept which meets your needs – from manual to fully automatic.

INDIVIDUAL APPROVAL
All Rheinhütte centrifugal and vacuum pumps as well as Rheinhütte vacuum compact installations are tested at our factory before they are delivered: Together with our customers, specific details, processes and basic principles are tested and discussed.

DOCUMENTATION
You need specific documentation? Whether standard or project - according to your requirements we create your individual project documentation.

ON-SITE SUPPORT
Whether it is for initial start-up or for training your personnel – our engineers are also available to assist you on site.
SUCCESS
IS BORN OF EXPERIENCE

150 YEARS OF RHEINHÜTTE PUMPEN

As pump manufacturers to the world, Rheinhütte Pumpen is your expert for demanding pump applications – and has been for over 150 years. Our experience for designing pumps for conveying abrasive, corrosive and toxic media, our product innovations and the supreme product quality have made Rheinhütte Pumpen a proven component of many major plants – all over the world.

THE INDIVIDUAL DEMANDS OF OUR CUSTOMERS ARE OUR BENCHMARK

Our customers benefit from our customized advisory services on materials, sealing systems and maintenance concepts. Experienced project teams will draw up individualized documentation in line with your requirements. Our customers specifications are what counts for us and are integrated in our Quality Management systems, testing processes and the official approval procedure for pumps and installations.

YOUR RELIABLE PARTNER FOR PUMPS IN CHLOR-ALKALI ELECTROLYSIS

For over 50 years now, we have been developing and fabricating special pumps for conveying a wide range of different media in chlor-alkali electrolysis installations. Plant constructors and operators all over the world appreciate our comprehensive service concept which is attuned to their requirements. Individual support and straightforward cooperation are what characterise our business relationships. We work together successfully with prestigious plant constructors and operators of chlor-alkali electrolysis plants – examples include Uhde, Akzo Nobel, Arkema, Bayer Technology Services, Dealim Chemical Co., Jacobs Engineering, Vestolit, Solvay Chemicals, Borsodchem and Arabian Chlor Vinyl Company.

With our customised solutions for conveying media in Chlor-Alkali Electrolysis plants, in particular the extensive documentation requirements and testing of the pumps, we along with our customers are constantly setting new benchmarks.
RHEINHÜTTE PUMPEN
GLOBAL EXPERTISE

RHEINHÜTTE Pumpen GmbH
Rheingaustraße 96-98 – 65203 Wiesbaden – Germany
Tel +49 (0)611 604-0 – Fax +49 (0)611 604-328
info@rheinhuette.de
www.rheinhuette.de