MECHANICAL SEPARATION AND DRYING

Only the best technology will lead you to optimum results
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Process steps
Filters and Filter/Dryers

1. Filling
2. Filtering
3. Displacement washing
4. Reslurry washing
5. Smoothing
6. Drying/cooling
7. Discharging
Rosenmund offers a comprehensive range of innovative products that meet the highest standards of quality for the pharmaceutical and chemical industry: from separators for solid and liquid materials to high-performance filter systems and dryers to engineered systems.

In addition, Rosenmund offers a complete range of control systems for all products: manual, semi-automatic or fully automatic systems via PLC/DCS. This wide range of products is perfectly supplemented by a comprehensive range of services, for which highly motivated and qualified specialists are available around the globe.

**Range of services:**
- Testing
- Process assistance
- Installation
- Commissioning
- Qualification
- Training
- After-sales services

**Range of products:**
- Engineered systems
- Separation & drying of liquid and solid material: Filters · Filter/Dryers · Dryers
- The following materials are available for manufacturing: Stainless steel · Hastelloy · Alloy · Glass-Lined
- Heating/Cooling systems
- Vacuum systems
- Gas recirculation systems
- Control systems
- Product discharge and containment systems
- Pilot Plant Facility

**Spare parts and rental program:**
- A wide range of rental machines
- Recycling & range of used products
- On-site service & maintenance program
- Spare parts service
- World-wide service centres local to customers

A closely linked system of innovative products and effective services is the guarantee for complete success. For customers as well as for Rosenmund!
Progress by tradition

Advanced technologies have a long tradition at Rosenmund.

For almost 200 years, Rosenmund has been known for innovative products that are accompanied by first-rate performance in service and customer support. The company was founded in Liestal/Switzerland in 1810, and today it is an extremely successful technology leader in the global market.

Rosenmund has acquired an excellent reputation with pioneering developments such as the very first Filter/Dryer, and it has consistently increased its technological lead since then. Today, Rosenmund is one of the world’s best known manufacturers of mechanical separators, filters, dryers, and engineered systems for the pharmaceutical and chemical industry. And this committed company puts all its effort into extending this lead even further in the future!

Milestones

- 1810: Foundation of the company
- 1965: First vacuum filter with mechanical discharge
- 1969: First automatic pressure filter with mechanical discharge
- 1970: First pilot plant
- 1976: First Filter/Dryer
- 1981: First Nutrex reactor/Filter/Dryer
- 1981: First sterile Filter/Dryer
- 1984: First paddle filter, Filter/Dryer with contact drying
- 1985: Basel innovation prize for Nutrex system
- 1994: ISO 9001 certification
- 1994: 1,000th machine produced
- 1995: Acquisition of the Guexa company (France)
- 1995: First Spherical Dryer
- 1999: Rosenmund becomes a subsidiary of De Dietrich (France)
- 2001: Acquisition of Glatt Inox dryer technology

Rosenmund is active worldwide

member of De Dietrich PROCESS SYSTEMS

a solution ahead
The elementary advantages of the innovative Rosenmund filter and Filter/Dryer technology:
- **Optimum efficiency**
- **Professional high performance**
- **Total flexibility**
- **Easy cleaning (CIP/WIP and SIP).**

Whether in the chemical, pharmaceutical or food industry – Rosenmund filters and Filter/Dryers prove themselves through a very high efficiency in washing and isolating solids, even in the most difficult production processes. The high-performance Rosenmund filters can also be converted to Filter/Dryers simply and quickly, by the addition of upgraded features.

**Side discharge.**

The ideal application spectrum for side discharge:
- Multi-purpose production with frequent product changes.
- Processes with stringent requirements for low-particle and sterile production.
- Limited building heights.

Special design features:
- Side discharge valve with metal-to-metal seal.
- Side discharge valve for pressure-tight closure after each product discharge – without prior cleaning of the sealing areas! Ideal for automatic process control and contamination-free production.
- Rosenmund Easiclean side discharge valve for manual cleaning in the case of difficult products.
- Two- or three-blade agitator for an efficient agitation and discharge process.
- Quick-lock bayonet or C-clamp main flange closure.

**Total discharge with the Gas Knife system.**

The Rosenmund Gas Knife is a unique and innovative solution that enables a total product discharge without manual intervention.

**Glass-Lined Filter/Dryer.**

The great demand for non-corrosive Filter/Dryers led to this joint development between De Dietrich and Rosenmund. The innovative Glass-Lined/Hastelloy construction guarantees maximum resistance to chemical solutions and aggressive solvents.
Cleaning and Decontamination (CIP/WIP and SIP).

CIP/WIP and SIP systems are an integral part of Rosenmund’s process equipment range, including steam sterilisation and aseptic use. The application of specialised spray systems and sterilisation methods validation of the vessel preparation process.

Special applications: microwave drying.

The use of microwaves for chemical processes provides clear advantages:
- Improved heat transfer to the product.
- Volumetric and selective heating.
- No harmful substances.
- Gentle and fast drying of difficult products.
- Low energy consumption.
- Reduced drying times, especially in the case of temperature-sensitive products and when conventional heat transfer methods are difficult to apply.

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F = Filter  F/D = Filter/Dryer
Universal Dryer

The innovation: agitator and chopper in one system.

The better the mixing, the more efficient the drying. To achieve a maximum drying performance, Rosenmund has integrated a high-speed rotating chopper in one of the two agitator arms of the horizontal dryer. This chopper moves through the product with the agitator, efficiently breaking up lumps of agglomerates (wet or dry) but also providing additional mixing capability.

Fast drying through full-area heating.

Maximum heat transfer input to the product is achieved by heating the total vessel area and the agitator. A further advantage is the formation of an especially fine product powder in the dryer, which accelerates the heat transfer and thus the drying. The particle size of the product can be decreased further by the addition of a fixed stator to the agitator system.

Wet or dry chopping.

Wet or dry chopping with the chopper/stator combination can make further milling or sieving steps unnecessary. The wet milling reduces the thermal strain on the product. In addition, a good milling effect is often achieved with an appropriate grain size distribution. For products that are sensitive to high-shear agitation, the chopper can be removed quickly and easily.

Huge flexible degree of filling due to a high torque and a very good mixing effect of the agitator/chopper system.

Hydraulic drives for the agitator and chopper ensure a consistently high torque, even with low rotational speeds. Therefore the dryer can be filled between 20-90% of total capacity whilst retaining optimal agitation, mixing and drying performance. This huge degree of flexibility makes it possible to dry batch sizes that have greatly varying volumes and products that have greatly varying physical characteristics. Regardless of whether you have suspensions, solutions or filter-moist products – lumpy transition phases in which the agitator and chopper require more power can be easily overcome.
Agitator to wall clearance prevents crust formation and product overheating.

The special construction of the agitator (results in a typical wall clearance of 2-5 mm) therefore the entire interior surface of the dryer is evenly coated. Crust formation is therefore absolutely minimised and heat is applied evenly to the product during the entire drying process. Since the agitator is supported at both ends of the shaft, it results smaller wall clearances than those in spherical and pan dryers can be achieved whilst maintaining the very high agitator torque!

Special version.

Standard Dryer with three-arm agitator instead of chopper.

Easy inspection through the front door.

The hinged front door, which can be quickly and easily opened for inspection, provides access to the entire diameter of the cylinder. The agitator is held in place by the main bearing.

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Important advantages summarised:

- Chopper integrated in the agitator arm.
- Reliable lump breaking.
- Small particle / grain size.
- Wet and dry milling.
- Drying independent of the initial product consistency.
- Small agitator to wall clearance.
- Hinged door for easy inspection.
- Full-surface heating of the agitator and vessel.
- High torque means maximum filling volume.
- Complete encasing of the drive system.
- Single-nozzle device on the agitator for applying nitrogen (N₂) or liquids for granulation.
- Pilot scale trials can be conducted in the Rosenmund technical centre.
Spherical Dryers

Cleaned in a flash. Emptied completely.

The easy cleaning and simple emptying are the most convincing features of the Rosenmund spherical dryer. Its simple structure, the spherical vessel and the slide ring seal above the product area make CIP/WIP cleaning and SIP sterilisation possible with a few spray balls or ARD nozzles. Cleaning fluids and dissolved product residues run out through the drain fittings at the lowest point of the vessel. Along with the slope in the direction of the outlet valve, this enables a complete and fast product discharge. The product outlet is a special ball valve that seals the vessel with minimum volume.

Maximum mixing with the three-arm agitator.

The spherical dryer achieves a high degree of mixing via a three-arm agitator with a high rational speed. By heating the agitator, the heat-exchange area can be increased further, thus improving heat transfer and preventing wet goods from being baked onto the hub and blades. These are the ideal prerequisites for short drying times and a reproducible drying results.

High speed chopper reduces agglomerate formation.

To prevent the formation of agglomerates that avoid moisture from being removed from the product, an additional chopper will improve results in many cases. The vertically arranged chopper brings two decisive advantages. First of all, it helps to achieve consistent results that are practically independent of the filling volume. Secondly, no wet product is sprayed on parts of the walls that the agitator does not reach.

Everything in view during inspection!

To allow quick inspection at any time, the top driven spherical dryer can be opened easily by swivelling up the lower half of the sphere. This simple operation is achieved by a hydraulic part-turn actuator driving open a bayonet quicklock main flange, all at the touch of button! The dryer can be fixed to the ceiling, ideal for cleaning-room installations for product offloading.
Explosion pressure surges? No problem at all!

Since dryers are usually designed for vacuum operation, the risk of thermal decomposition or dust explosion requires them to be designed for higher pressures in many cases. The spherical shape with maximum volume and minimum surface is the ideal geometry for an explosion containing vessel. The ball valve will remain in the sealed position even if a power failure occurs, and it is a reliable component in this fail-safe principle. A construction that is resistant to explosion pressure surges is therefore easily accomplished!

Important advantages at a glance:
- Drying, mixing and granulating.
- Fast and easy cleaning (CIP/WIP and SIP).
- Total product discharge.
- Short drying times.
- Reproducible drying result.
- Heatable agitator.
- Vertical chopper/lumpbreaker.
- Easy to inspect.
- Assembly in ceiling.
- Containment of explosion pressure surges.

### Nominal and Used Volume, Drive Power, Empty Weight, and Container Dimensions

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- t. d. = top drive
- b. d. = bottom drive
Pan Dryers

Field-proven and reliable: the Filter/Dryer design.

Heated agitator with adjustable speed.

The simple change in the design of the heated flat bottom enlarges the heating area considerably. The agitator of the pan dryer is also normally heated and is equipped with speed control. Many elements such as the metallically sealed side discharge valve have been taken from the proven Filter/Dryer range.

Fast agitator replaces the chopper.

The top driven pan dryer (alternatively with bottom drive as well) relies on rotational velocity. A particularly fast agitator with a circumferential speed of up to 3 m/s (spherical dryer only around 1.5 m/s) ensures optimum mixing. The lifting and lowering agitator also provides mixing on the vertical axis. At the same time, the minimal agitator to wall clearance keeps the wall free from product crust. The rotational high speed of the agitator combined with its vertical translation does not require the use of a chopper.

Slide ring seal without product contact.

As with the spherical dryer, the mechanical seal of the pan dryer is also advantageously located outside of the product area. Depending on the application, it can either be lubricated with gas or liquid. The axial motion of the agitator is sealed by metal bellows, as with the Filter/Dryer.
Easy internal inspection.
Inspection is easily possible when the pan bottom is lowered, as with the spherical dryer. In the case of frequent cleaning and opening cycles, the pan dryer is also ideally equipped with a time-saving main flange bayonet quick-lock fitting instead of C-clamps.

Important advantages at a glance:
- Proven Filter/Dryer technology.
- Agitator speed-controlled and heated.
- Fast cleaning (CIP/WIP and SIP).
- Simple emptying.
- Short drying times.
- Easy to inspect.

Rosenmund Pan Dryer agitator

Rosenmund Pan Dryer, Final assembly

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De Dietrich Double conical dryer SR

The glass lined double conical dryer type SR is a device that was designed for drying easily flowing products. The rotation of the double cone allows the product to be mixed - without an internal agitator.

Field-proven and reliable: the Dryer principle.

A proven concept.

The design of the double conical dryer combines the drying and mixing function in one simple and stable device. The operation and maintenance costs are very low. The drying times are reduced to an acceptable level. As a result, this concept provides a simple solution for many drying requirements.

The advantages of a glass lined coating.

The characteristics of the glass lined coating provide special solutions for numerous processes:

- Anti-corrosion, when the dry solution is not chemically neutral.
- Fire polishing and anti-sticking, the dry mass does not stick.
- Anti-contamination for products that require a 100% metal-free contact.
- Easy cleaning for API.

Double Conical Dryer SR 1600 clean room design: reverse mechanical sealing and vacuum tube on the same side in order to reduce dead zones and improve the cleanability.
Various options:

- Adjustable lump breakers (choppers) for materials that tend to become lumpy.
- Insulation and special coating.
- Heated cover to prevent condensation.
- "Clean room" version with minimised dead zones and remote control for filling, emptying and cleaning functions.
- Stainless steel design available.

A De Dietrich product.

The double conical dryer is part of the De Dietrich product range. Like Rosenmund, this company is a member of the French group De Dietrich Process Systems with its long tradition, innovation and expertise.

<table>
<thead>
<tr>
<th>Type SR</th>
<th>Container volume l</th>
<th>Heating area m²</th>
<th>Drive power kW</th>
<th>Empty weight appr. kg</th>
<th>a x b mm</th>
<th>h1 mm</th>
<th>h2 mm</th>
<th>h3 mm</th>
<th>A mm</th>
<th>B mm</th>
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</table>
The decisive step from theory to practice. In the recently built technical centre pilot plant, customers can perform practical experiments and test process optimisation steps with experienced experts from Rosenmund.

Pilot Plant Facility

Experiments and process optimisation in the new pilot plant in Liestal/Switzerland.

Made-to-measure solutions for all customers.

No two customers are alike. No two problems are the same. From years of experience, we know that every equipment is unique. Every customer has his own products, which are manufactured on different premises by individual employees – based on different ideas. For this reason, we offer comprehensive services to individually optimise our product range of delivery - at our new technical centre.

A completely new technical centre.

The fully equipped Rosenmund technical centre opened in November 2002. This international test centre provides Rosenmund customers from the pharmaceutical and chemical industry with a complete range of services. The technical centre is designed for carrying out industrial experiments with products from the chemical and pharmaceutical industry. The recognised core competence lies in the area of the concentration and drying of API (Active Pharmaceutical Ingredients) that contain solvents.

Plant and know-how from one supplier.

The Liestal technical centre provides Rosenmund customers with comprehensive competence that significantly simplify the decision-making involved in selecting plants and machines. Do you want to change or optimise your process? For this purpose, you will want to compare systems - for example, between a horizontal, vertical or spherical dryer. No problem at the new technical centre; our experimental units are at your disposal. Since we provide all the systems, we can guarantee you objective advice.
Direct advantages for Rosenmund customers:

- Shorter equipment commissioning times through determination of product suitability, correct system selection, and process sequence specification.
- Optimisation of processing times through precise scale-up and/or estimation of vessel residence times throughout the process route.
- Determination of effective cleaning processes (CIP/WIP and SIP).
- Determination of the selection criteria according to customer evaluation, e.g., drying time, quality (crystal shape, activity etc.), emptying, CIP-capability, price.

Summary of Rosenmund Tech Centre Pilot Plant Capability:

- Data acquisition and analysis.
- Scale-up experiments as a basis for projection to production sizes in respect to filtration and drying time, fill volume, recrystallisation and particle size distribution.
- Optimisation of the process sequence.
- Machine optimisation.
- Product trials for equipment selection and to establish suitability.

Due to their special design, which fulfils all GMP standards, Rosenmund equipment allows complete GMP and FDA validation.
Rosenmund technical centre, Spherical Dryer with top drive 100 l

Spherical Dryer 100 l

Test product

Technical centre equipment

Universal Dryer 100 l
Spherical Dryer 100 l
Evapor evaporator CEP-1
Pan Dryer

Test report

Estimation
Production size
Scale-up
High-Tech Solution

Engineering.
We not only perform the planning and integration of our product in your buildings, we also partner with our customers to provide fully engineered solutions from concept stage to performance qualification.

Product handling.
We provide almost everything to do with the filter and vacuum dryer: screens/sieves, lifting columns, containers, container mixers, insulation valves, weighing systems and many other pieces of equipment.

Training and courses.
Should your personnel already be trained on the new control system when the plant is delivered? Or does your process first have to be optimised on the new plant?

We will be happy to support you with help and advice.

Profit from the superior competence of high-tech solutions!
Rosenmund is a subsidiary of the French De Dietrich technology group. Rosenmund customers therefore have quick access to the technology, the know-how and the global service of an international company at all times. You benefit from this!

Service without limitation or borders. Whether you need advice or troubleshooting, information or services – we provide you with a quick and direct connection worldwide through our global sales and service network. This guarantees short reaction times and excellent service. The addresses of our factories and sales representatives are found here.

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