



System Solutions for the Food Industry

Food Industry – Guarantee for Healthy and Safe Nutrition



Product-specific process design ensures innovations, efficiency and quality in a rapidly growing industry

Combined processes

In addition to the classical process step of mixing, it is also technologically possible to combine all additional processing steps usually required by the food industry in a single Lödige Mixer.

This means, for example, that work intensive premixing is unnecessary.

- Alkalinization
- Fat intermixing
- Moistening / Coating
- Conching
- Emulsifying
- Heating
- Homogenization
- Iodizing
- Crystallization
- Cooling
- Lecithinizing
- Mixing / granulating
- Pasteurizing
- Fusion granulating
- Sterilization
- Drying
- Coating
- Compacting
- Fluidizing
- ... and many more

Foodstuffs are the „resources for sustaining life“

As the old adage goes: „you are what you eat“. People, meaning customers, are taking this saying more and more to heart. Naturally, the quality criteria for the production, processing and distribution of foodstuffs is set at a respectively high level.

Production of foodstuffs means the targeted alteration or transformation of raw materials from plant or animal origins into safe, healthy and delicious foodstuffs, with substantial commercial volumes.

The food industry is one of the most important and dynamic production sectors in all of Europe. With a share of more than 14 percent in employment and sales, it is the second largest industry in the manufacturing sector.

In order to remain competitive despite rising standards and changing markets as well as customer habits, the efficiency of the processing methods used will become even more important in the industry in the future. The more so since consumers expectations on product safety and quality are continually increasing. The potential for innovation lies predominantly in automation or the implementation of new types of technologies for substance conversion. The preparation and mixing of various substances plays a major role here.

Lödige provides the solution

Lödige systems provide the necessary mixing and processing precision for an optimum process design in the broad spectrum of production for the food industry. The systems operate efficiently, economically and with optimum solution concepts. Lödige possesses decades of experience in the construction of mixers and processing systems for this versatile and challenging industry. Lödige systems are successfully operated by leading brand names around the world.



Lödige is of course member of the EHEDG.

Lödige Mixing Systems for the production of international, high quality products



Processing of powders

- Ice cream powder
- Flavourings / Seasonings
- Oven-ready flour mixes with addition of fat and lecithin
- Flour
- Enzymes
- Vanilla sugar



Processing of granulated products

- Table salt
- Coffee and tea extracts
- Flavored instant drinks
- Powdered whey / powdered milk



Processing of fragile materials

- Muesli / cereals
- Instant soups
- Bouillon cubes
- Spice mixes with concentrates
- Tea mixtures
- Dried vegetables
- Frozen fruit and vegetables
- Tobacco



Processing of viscous products

- Baby food
- Glazings
- Cheese spread ingredients
- Other emulsions and pastes



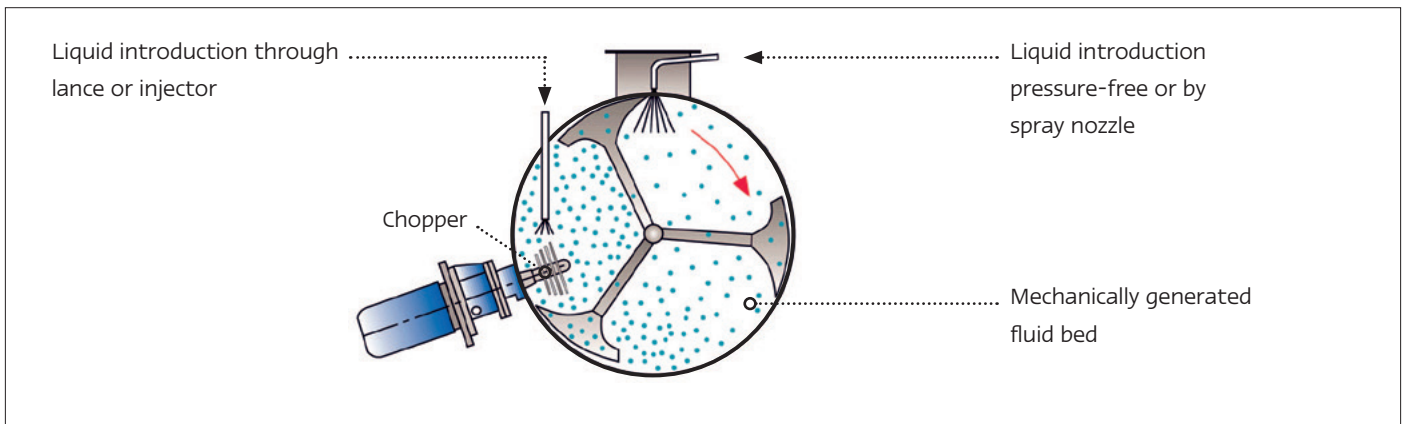
- Creams / dressing / mustard
- Basic fruit pulps
- Chocolate ingredients
- Wafer fillings etc.



Processing of nutraceuticals

- Vitamin preparation
- Dietary food
- Nutritional supplements
- Conditioning products
- Enzymes / starter culture

Batch Mixing and Granulating in a Horizontal System



Various types of liquid dosing in a horizontal Lödige Ploughshare® Mixer

The invention of the Ploughshare® Mixer has set a high standard for mixing and processing technology. Large numbers of patented innovations are based on this system. Lödige Mixers guarantee homogeneous, precision mixing within minimum mixing times.

Ploughshare® Shovels rotate as mixing elements in special arrangement on a horizontal shaft in a horizontal, cylindrical mixing drum. The size, number and positioning, geometric shape and peripheral speed of the mixing elements are coordinated to cause three dimensional movement of the components. Turbulence in the product, with total involvement of all material, prevents the formation of dead or low-movement zones in the mixing drum and promotes high speed, precise mixing.

The specially shaped shovels lift the product radially from the wall of the drum to prevent particles from remaining between the mixing elements and the drum wall. The mechanically generated fluid bed is therefore ideal for gentle

mixing if fragile and heat sensitive components are included in the mix. Modified Ploughshare® Shovels can be used for special applications or particular component characteristics to further intensify this effect. In special cases, in particular in combined processes, the effect of the mixing elements may require additional support and this is provided by separately driven, high speed choppers. A short mixing time with optimum adaptation of the drive power ensures minimized power consumption. The low-maintenance concept of Lödige Mixers guarantees maximum operational availability of production units.

The excellent accessibility to all inside parts of the mixer reduces considerably the time and expenditure for cleaning and inspection. The mixers can be adapted as an option to automatical cleaning systems (WIP/CIP) processes and therefore provide the highest standard of hygiene for even the most difficult, microbiological components.



Major contract: 18 machines are ready for the factory acceptance test

Individual production yield due to precise configuration of the system

Lödige systems produce maximum homogeneity of even the most difficult products. Quote: "Ploughshare® Mixers, running at the appropriate speed, are the most suitable. The best possible mixing quality is obtained under production conditions after only 16 seconds. In ribbon blenders products are mixed more slowly and the quality of the final mix is poorer than that obtained in Ploughshare® Mixers."

Solutions for Process Technology

With a multitude of process-technical possibilities Lödige systems can be designed and applied for various kinds of products and production steps. Besides the conventional mixing process, a combination of the additional process steps, mostly necessary in the food industry, is possible in the Lödige system. Labour-intensive premixes, for example,

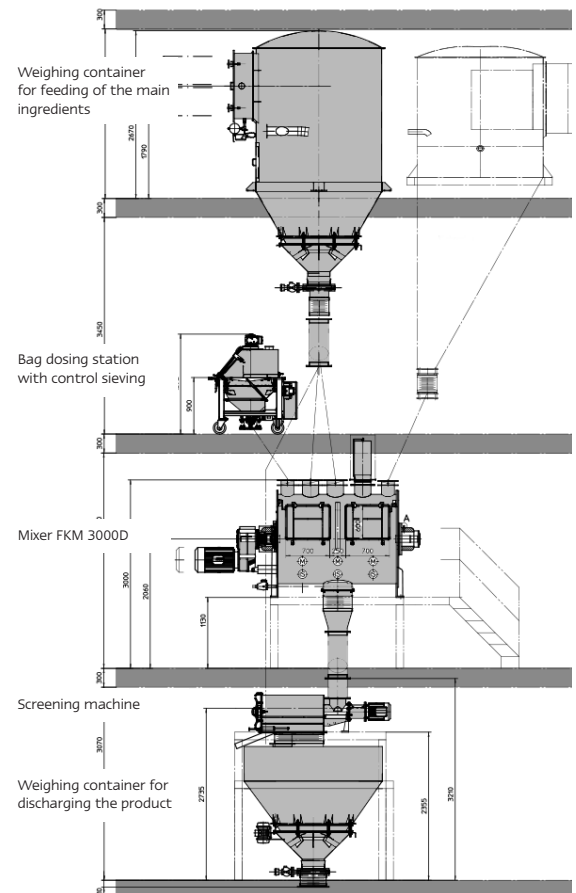
can thus be omitted. All systems listed below are available both in production sizes as well as in laboratory scale.



Horizontal Lödige Ploughshare® Mixer type FKM 1200 DR



Fully welded mixing elements without any gaps or dirt traps (Hygienic Design)



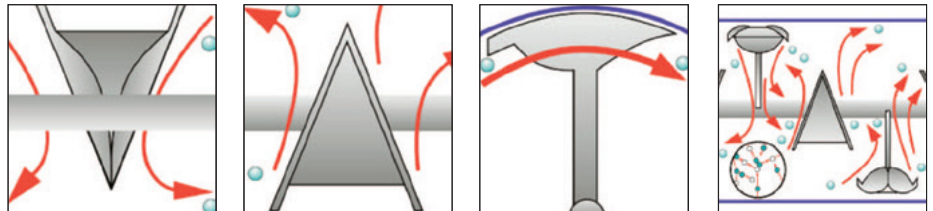
Mixing plant with weighing container

Continuous Mixing and Granulating in a Horizontal System

The continuous Ploughshare® Mixer operates according to the mechanically generated fluid bed introduced to mixing technology by Lödige. The mixing elements are specifically adapted to individual applications.

This mixing system achieves high throughputs which can be varied dependent upon residence time, filling degree and product properties.

The resultant individualisation of the particles in the mix (fluid bed) allows addition of liquids and coating of particles in a continuous process too. The continuous process is operable at filling degrees between 20 and 50 % without influencing the mix quality. The mixing elements are designed to achieve constant backmixing during the residence time prior to discharge the mixed product via the outlet. The adjustment of the size of the discharge opening by means of a slide or a weir has a direct influence on the residence time. Dosing fluctuations can be compensated by the mixer.



Mixing principle generated in the Ploughshare® Mixer



Continuous Lödige Ploughshare® Mixer type KM 150 D



Continuous Mixer type KM with adjustable slide in the discharge chute

Washing in Place (WIP) as standard cleaning process for horizontal mixing systems

Lödige demonstrates a broad know-how not only in the field of mixing solids where hygienic designs are relevant.

Requirements made upon the Ploughshare® Mixer and design improvements:

In case of hygienic production, an optimal ease of cleaning has to be taken into account for the machine design without influencing its functionality. Some components have to be particularly considered for hygienic reasons. The mixing elements and the choppers have to be easy to clean, accessible and

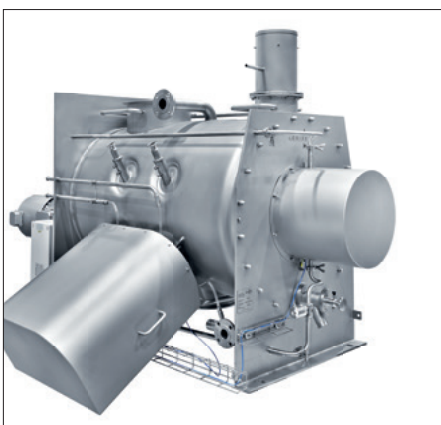
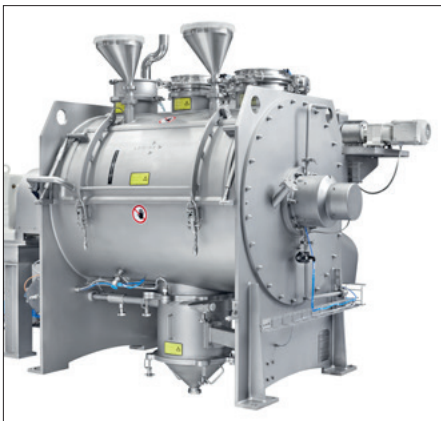
dismountable. A large inspection door thus enables the inspection of the complete drum inside. A specific feature of the machine design is the pull-out function of the main shaft which can be completely extracted from the mixing drum (advantageous for drying and pharmaceutical applications).

Rinseable air purged seals or mechanical face seals are usually the best technical solution for the main shaft and the chopper sealings. The product contact surfaces have a surface roughness of $Ra < 0.8 \mu m$. Generally, surface roughness has to be smaller than the particle size of the material adhering to the surfaces in order to achieve direct wetting of residue with the cleaning substances. Smoothed and polished surfaces are ideal. The

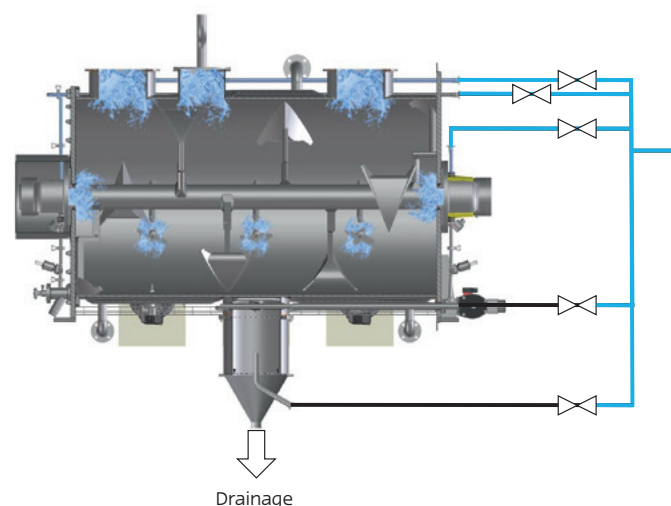
surface can also be electro-polished to further reduce its roughness. In this case, the mixing elements are completely welded onto the mixing shaft and have the same surface roughness as the inside surface of the drum.

The so-called Washing in Place (WIP) is an automatic cleaning feature requiring some manual preparatory steps to perform the cleaning process. In case of the Ploughshare® Mixer, some manual preparations are required before wet cleaning (installation of washing device for example).

The shaft seals are purged with compressed air during the production process and prior to the product feeding



Ploughshare® Mixer with stainless steel piping for efficient wet cleaning

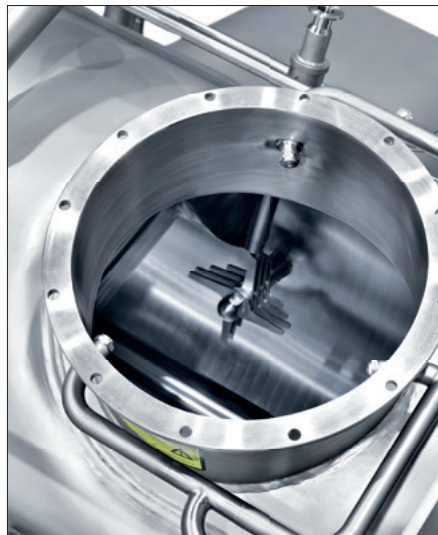


step. This prevents the product from penetrating into the gap between static and rotating part of the sealing. The compressed air flow is controlled by a flow meter and can be monitored. The operator can check the air quantity and pressure at the Operator Panel.

All shaft seals are purged with water, therefore they are equipped with drain valves. The feeding and discharge are cleaned by means of rotary nozzles which are installed on a removable washing adapter. During cleaning, the main shaft runs forwards and backwards at intervals. The ventilation filter has to be cleaned

separately and the opening is closed with a washing adapter. A drain funnel can be docked onto the machine outlet in order to drain off the wash water. As an option there is the possibility to swivel the complete outlet to the side to clean the discharge door separately.

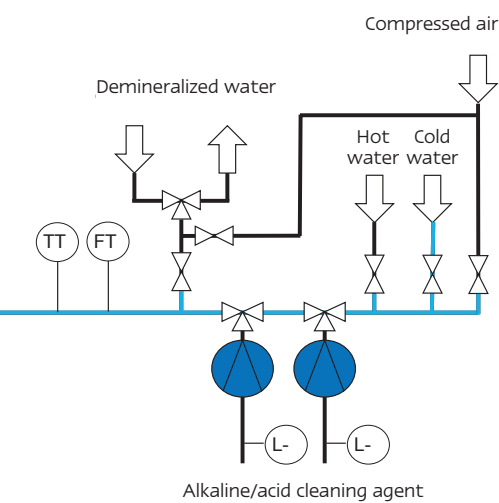
After the wet cleaning, all mixer parts, seals, pipes and valves which have been supplied with water will be dried by conditioned compressed air.



Cleaning nozzles for WIP cleaning process



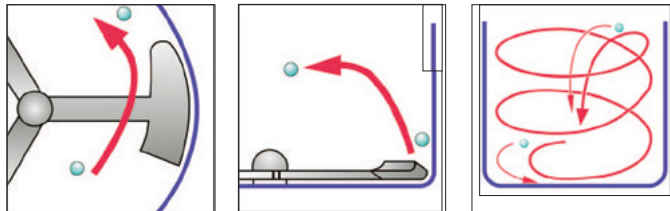
Fully dismountable discharge door



Flow diagram of the WIP cleaning for Ploughshare® Mixers

Batch Mixing and Granulating in a Vertical System

Mixing Granulators are standardized systems compliant with all GMP / WIP design requirements. They are extremely easy to clean and require a minimum of maintenance.



Mixing principle generated in the Mixing Granulator MGT

A three-arm mixing impeller rotates close to the base of a vertical, cylindrical mixing drum. The special design of this element and its peripheral speed are coordinated in such a way that the mixing product is circulated as vortex and thereby accelerated horizontally and vertically. This type of product movement produces a high-speed, intensive mix, even in cases where the granular structure and shape, bulk density and surface condition of components differ considerably.

High quality mixing is ensured in minimum time. If necessary, a highspeed, separately driven chopper disperses any lumps and promotes uniform liquid distribution and wet granulation. The granulation endpoint can be precisely determined.

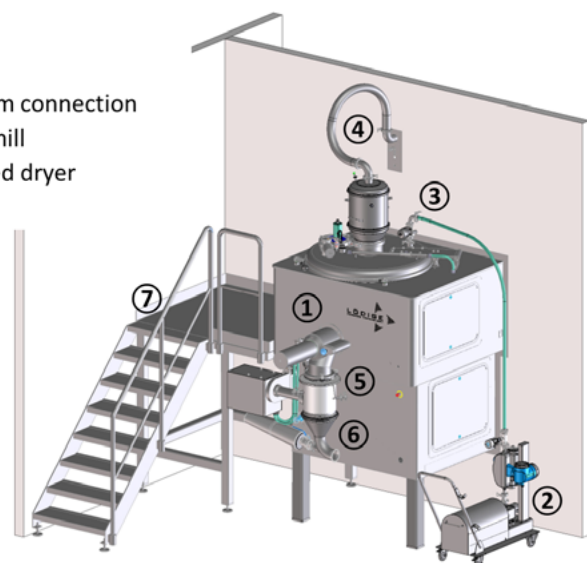


Mixing Granulator type MGT



Mixing tool which can be raised up

- ① MGT housing
- ② pump station
- ③ liquid addition
- ④ aspiration / vacuum connection
- ⑤ discharge / sieve mill
- ⑥ transfer to fluid bed dryer
- ⑦ operator platform



Example of a MGT installation with various options

Batch Mixing of viscous/paste-like products in a vertical system

Wet Mixer NOHK for food applications

The Wet Mixer NOHK is suitable for processing viscous to pasty and poor-flow products. It can be used for a wide range of applications in the food industry and also for applications in the pharmaceutical industry. The conical shape of the vessel allows for a maximum possible discharge with the least amount of residue.

Mode of operation

The Wet Mixer is a vertical mixing system designed for batch processes. The geometry of the conical mixing vessel, the arrangement and shape of the mixing tools and their peripheral speed are coordinated in all machine sizes to ensure effective mixing of the components. According to the application required, a combination of mixing tools is arranged on the shaft to generate product transport, dispersion and deagglomeration. The vertical position of the tools inside the vessel can be adjusted over a wide range to suit the application. An adjustable deflector is used to divert the product movement in a defined manner.

Range of application

Mixing and processing of products with medium or high viscosity like soup paste, baby food and special sauces. Equipped with helical tools, the NOHK is also suitable for simple mixing process.



Suitable tool combination to ensure an effective process

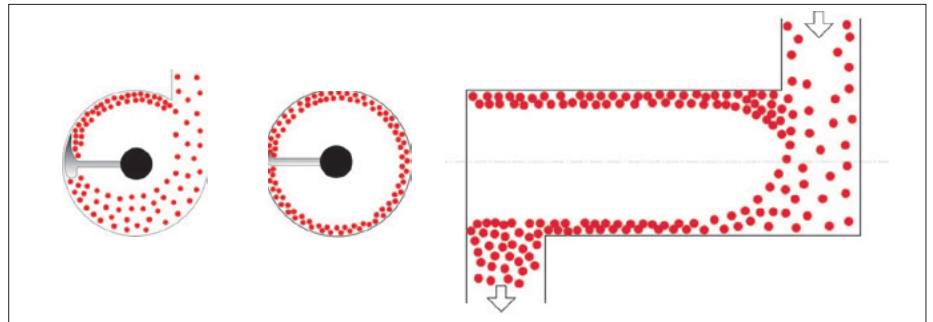


Wet Mixer type NOHK mainly used for the production of baby food

Mixing and Processing in a continuous Ringlayer System

The Lödige High Speed Continuous Mixer CoriMix® CM excels with wide range of applications for mixing, humidifying, granulating and densifying processes. The system produces constant product quality and provides controlled granulation.

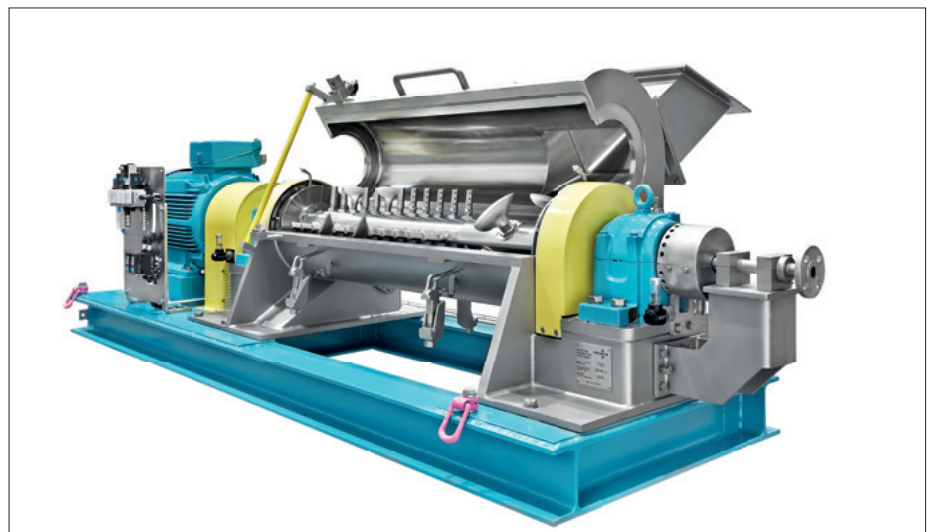
The system is based on the high peripheral speed of the mixing shaft of up to 40 m/s, the resultant centrifugal force forming an annular layer of product. The profile of the annular layer features a high shearing intensity, which is caused by the high differential speed between the rotating, specially shaped mixing tools and the mixer wall. The product is moved through the mixing chamber in a pluglike flow, with the residence time being influenced by the degree of filling, the rotation speed, the geometry and adjustment of the mixing tools as well as the mixing drum length and the volume flow rate. The system offers the possibility to divide the mixing chamber into zones of different shear intensity, thus permitting system optimisation for varying product properties. The liquid components are directly introduced into the annular layer. This ensures a homogeneous distribution within the product and avoids wetting of the mixer wall and mixing shaft. CoriMix® systems provide optimal cleaning as the mixing drum is divided axially over the entire drum. High feed rates of 20 - 200 kg/h (for example CM 20) are achieved with machines of compact design.



Principle of the continuous Ringlayer Mixing



CoriMix® type CM 5 with removable shaft as hygienic solution

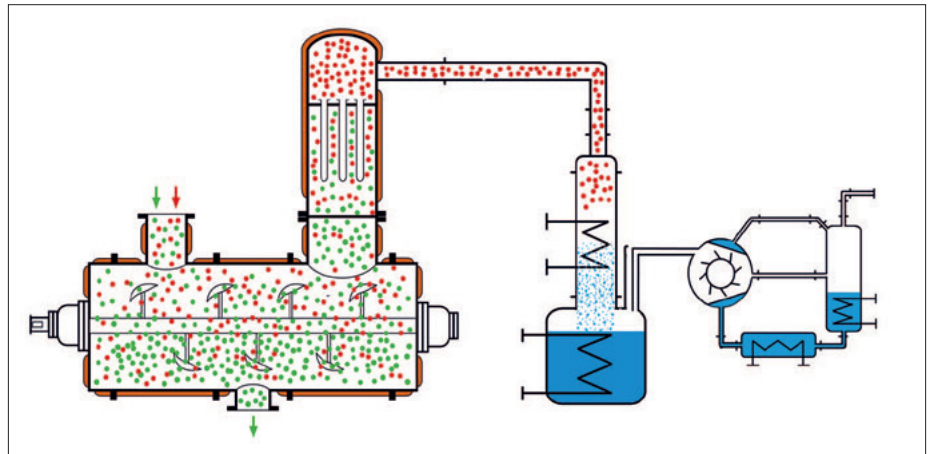


CoriMix® type CM 80

Drying in a DRUVATHERM® Vacuum Shovel Dryer

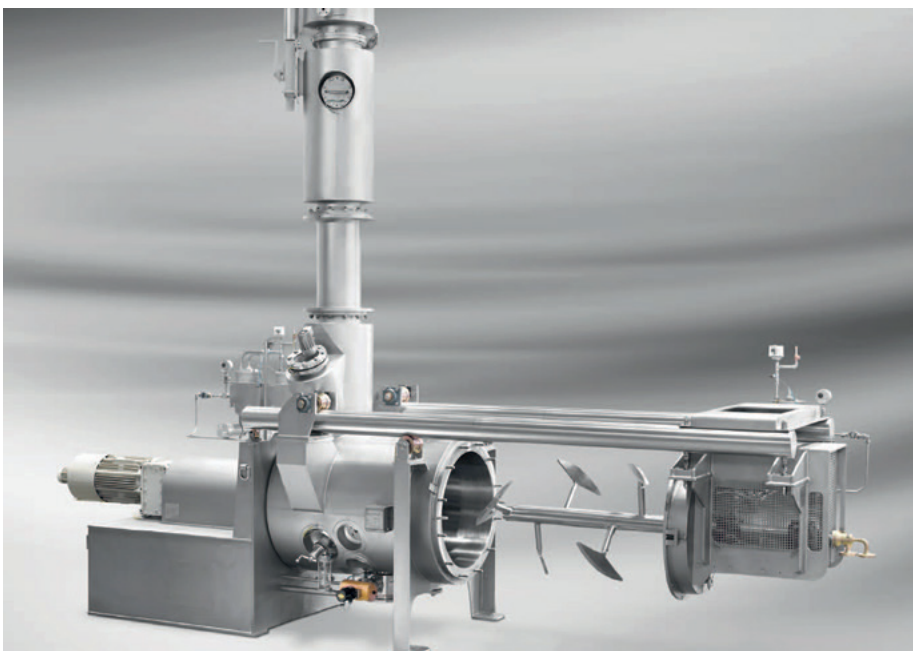
Horizontal Lödige drying systems ensure precisely reproducible, constant and reliable processes. All shovel dryer variations can be manufactured in containment design.

The large product surfaces produced in a mechanically generated fluid bed increase heat exchange whilst greatly reducing processing times. Intensive and homogeneous mixing prevents the development of temperature and moisture gradients in the product and increases at the same time the contact frequency and thereby the heat exchange between product particles and heating jacket. When drying is carried out under vacuum, the process can be run at low, product-protecting temperatures. A high temperature gradient is obtained between the product and the heating jacket resulting in the effective



Principle of the DRUVATHERM® Vacuum Shovel Dryer

introduction of heat. Mixing and drying processes can be run with high precision ensuring the reproducibility of a product formulation. Shovel dryers up to 1200 l total volume can be designed with only one bearing. Even larger dryers are available with pull out mixing shafts.



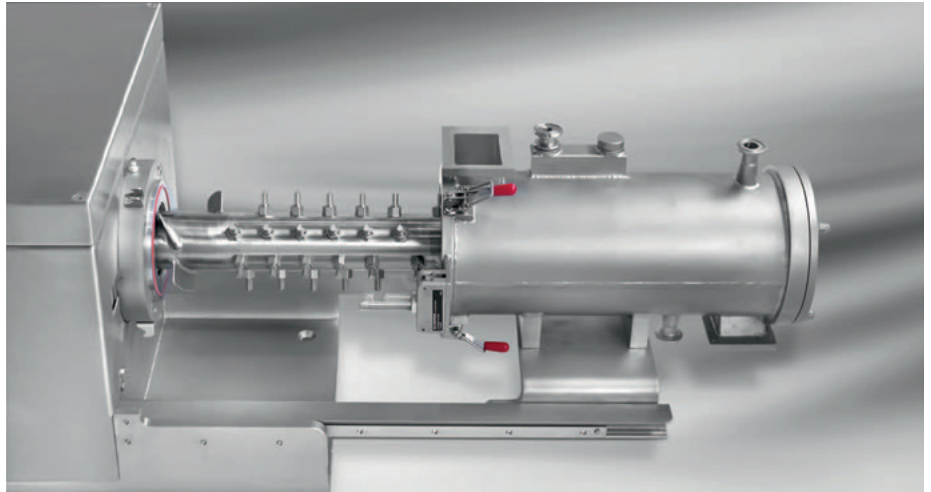
DRUVATHERM® Vacuum Shovel Dryer type VT with pull out shaft



DRUVATHERM® Vacuum Shovel Dryer type DVT 50 for research and development

Machines for research, product development and production of samples

Lödige laboratory systems work in accordance with the same principle as production machines and ensure reliable scale-up to production-machine sizes. Know-how concerning quality of the mix, product behaviour and process parameters can be scaled up without restriction. Small scale production can be therefore carried out in accordance with the same quality criteria.



Laboratory Ringlayer Mixer type CoriMix® CM



Ploughshare® Laboratory Mixer with interchangeable drums



Laboratory Mixing Granulator with interchangeable vessels



Laboratory Vacuum Dryer

Lödige Research and Test Centre

The Lödige Research and Test Centre is equipped with the most modern machines for:

- Mixing
- Kneading
- Dispersing
- Emulsifying
- Wet granulating
- Drying
- Heating / Cooling
- Coating

to ensure testing under production conditions and in compliance with hygienic conditions.

The Lödige Test Centre with floor space of more than 400 m² provides trial capacity for more than 30 machines including a laboratory for physical analysis. A separate area is dedicated to cosmetic trials. All machines are suitable for WIP/CIP and suitable for small scale production.



Ploughshare® Mixer FM 130

- Mixing
- Granulating
- Moistening
- Adding fat
- ... and more

Total volume 130 l

Working volume 90 l

Universal applications

High mixing quality

Heating / cooling jacket



Laboratory Ringlayer Mixer CoriMix® CM 5

- Mixing
- Granulating
- Densifying

Throughput up to 240 l/h



Mixing Granulator MGT 125

- Mixing
- Granulating
- Wet granulating
- Drying

Total volume 125 l

Working volume 90 l

Control of the point of granulation

Dust-free feeding

Rasp / sieve downstream

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Lödige supplies high-grade components, subsystems and systems for technical processing applications in a wide range of industries. We are specialized in the field of mixing, granulating, coating, drying and reaction. Our profound knowledge of processes, development and production enables us to contribute to the success of our partners throughout the world.

Lödige, which was founded in 1938, is a family-run business in its third generation now.

With the invention of the Ploughshare® Mixer, Lödige created a mixing unit that can cover a wide range of different processing tasks. This unit forms the basis for numerous innovations in the area of mixing and processing technology.

Industrial mixing and processing technology has been significantly influenced by Lödige and will continue to be so in the future.

Over 500 patents and more than 30,000 machines and systems demonstrate our experience with customer-oriented system solutions. Lödige operates with more than 300 employees worldwide and supports its customers with a network of subsidiaries, technical offices and agencies.