Centrifuge Technology Solutions
Pusher centrifuges
Powerful solutions based on competence and experience

Unfailing innovative spirit

For decades, Ferrum has been designing state-of-the-art pusher centrifuges for solid-liquid separation. Our vast experience is complemented by a marked desire for innovations. In this way, we create high-performance products – and ensure the success of our customers.

Customer-oriented service

Our design, sales and service teams remain at our customers’ disposal around the clock. This means that our customers have complete access to our know-how of more than 9000 applications on over 6000 machines in use worldwide.

Lasting advantages

Ferrum guarantees comprehensive service, from the first construction plan to preventive maintenance. In addition, we optimise costs in conjunction with our customers over the entire usage cycle (Total Cost of Ownership: TCO). This task goes beyond purely technical approaches, because Ferrum evaluates the customer-specific needs during long-term use and in so doing considers the requirements of the overall system. Specific solutions are thus developed with the lowest residual moisture, high solid yields, high washing efficiency, low crystal breakage, low maintenance costs and reduced hidden costs – in short, cost-effective facilities throughout the entire usage cycle.

Top performance for decades:
The pusher centrifuge system
Escher Wyss

This high-performance machine from Ferrum is a continuously operating filter centrifuge. The solid-liquid mixture to be separated is delivered continuously through the inlet pipe into the rotating distributor and is evenly distributed throughout the entire sieve area in the first stage. The majority of the liquid is already centrifuged off here and a solid cake is formed. The first stage also incorporates an oscillating movement in addition to the rotation. This is performed hydraulically by means of a pusher piston with a reversing mechanism. In this way, the solid cake is pushed in ring sections according to the pusher length from the first to the second stage, and finally leaves the machine through the collecting channel and the solids casing. The solid is cleaned in the pusher centrifuge via the continuous addition of washing liquid on to the solid cake. The wash pipes or other washing devices can be arranged easily and cost-effectively in the freely accessible basket interior. The spun-off mother liquor and washing liquid are collected in the housing and drained off separately if necessary.

Cover
On the machines (P-32 – P-120), the cover comprises two sections of polyester fibre glass, and on the PM-230 it consists of coated sheet steel. The cover protects the components attached to the stator from dirt and spraying water, while also protecting the operating personnel from contact with rotating parts.

Stator
The stator bears the bearing casing with the rotor and the flange-mounted housing and solids housing, as well as the drive and pump assemblies. The welded construction additionally serves as an oil tank, and its large footprint ensures a high degree of stability.

Bearing assembly
The bearing assembly consists of the bearing housing, made of grey cast iron, main shaft and pusher shaft, and also the antifriction bearings and slide bearings. The main shaft runs in two sturdy antifriction bearings which are lubricated by oil from the hydraulic system. The bearings are protected by labyrinth rings on the product and drive side. The pusher shaft is guided by slide bearings. Lubrication is by oil from the hydraulic system.
Decisive advantages

High solid output
• by means of the optimal cake height enabled by our efficient suspension distributor.
• by increasing the pusher frequency by means of flow control with central hydrostatic pressure medium feeding.

Low residual moisture
• by means of the additional separation of inter-capillary and capillary liquid via the breaking up of the cake and the reforming of the cake during the transition to the larger basket stage.
• by selecting the optimal cake height and thus improving retention times.

High solid yield
• due to the use of Escher Wyss sieve segments with precisely dimensioned slots running parallel to the machine axis and radial widening towards the outside.

High washing efficiency
• as a result of the product-dependent positioning of the washing devices in the basket interior, which is freely accessible thanks to our suspension distributor.
• due to the addition of washing liquid in several washing zones (counter-current washing is possible).

Low crystal breakage
• due to the gentle acceleration of breakage-prone particles in the task zone by the efficient suspension distributor.
• due to collision-free solid discharge enabled by the specially lined solids housing.

Low power consumption
• due to the minimal pusher force required as a result of the short baskets.
• due to optimised acceleration performance resulting from the separation of approx. 80% of the mother liquor in the first stage with its small diameter.

Low space requirements
• due to the compact design enabled by a construction oriented towards time-saving maintenance and inspection work.

Low maintenance costs
• due to parts and sieves which are optimally adapted to the operating conditions as a result of intensive research and many years of experience.
We’ll help you make the right choice

**Laboratory tests**
In scaling to the production process, our experience enables us to help you. In selecting the appropriate machine parameters for a special process, often only laboratory tests or on-site tests can help. We are fully prepared to conduct such tests.

**Specific characteristics**
Ferrum supports its customers in the selection of products which can be optimally integrated into existing facilities and permit long-term use. In this respect, different characteristics are important – e.g. the typical production quantities of salt (NaCl).

**Typical throughputs of Ferrum centrifuges for salt (NaCl)**

<table>
<thead>
<tr>
<th>NaCl t/h</th>
<th>PM-230</th>
<th>P-32</th>
<th>P-40</th>
<th>P-50</th>
<th>P-60</th>
<th>P-80</th>
<th>P-100</th>
<th>P-120</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>70</td>
<td>60</td>
<td>50</td>
<td>40</td>
<td>30</td>
<td>20</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

**High-tech design**
The latest-generation pusher centrifuges represent a finely-tuned balance between high-quality materials, polished engineering design, requirement-matched electronics, sturdy drive engineering and micro-sensor technology. For this balance, state-of-the-art software is an important factor. Our software embodies many years of experience and optimisation effort. This begins with the layout of the construction on CAD workstations and influences on the automation software forming the basis of the total centrifuge technology solution.
### Technical specifications

**P-120 hydraulic pusher drive**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basket diameter</td>
<td>1200 mm</td>
</tr>
<tr>
<td>Operation mode</td>
<td>continuous</td>
</tr>
<tr>
<td>Optional integrated pre-thickener</td>
<td>Yes</td>
</tr>
<tr>
<td>Suspension feed</td>
<td>filling pipe or screw conveyor</td>
</tr>
<tr>
<td>Solid discharge</td>
<td>open or bundled through pipe</td>
</tr>
<tr>
<td>Typical number of stages</td>
<td>1, 2, 3, 4 cylindrical</td>
</tr>
<tr>
<td>Max. rotor speed</td>
<td>900 min⁻¹</td>
</tr>
<tr>
<td>Max. pusher frequency</td>
<td>76 min⁻¹ variable</td>
</tr>
<tr>
<td>Max. g-number</td>
<td>543 xg</td>
</tr>
<tr>
<td>Electrical power (e.g. NaCl), rotor/pusher consumption</td>
<td>150/60 kW</td>
</tr>
<tr>
<td>Dimensions (LxWxH)</td>
<td>4.0 x 2.3 x 1.9 m</td>
</tr>
<tr>
<td>Weight</td>
<td>13 000 kg</td>
</tr>
<tr>
<td>CCTS options</td>
<td>Yes</td>
</tr>
<tr>
<td>Example: typical NaCl throughput</td>
<td>85 t/h</td>
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</tbody>
</table>

**P-100 hydraulic pusher drive**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basket diameter</td>
<td>1000 mm</td>
</tr>
<tr>
<td>Operation mode</td>
<td>continuous</td>
</tr>
<tr>
<td>Optional integrated pre-thickener</td>
<td>Yes</td>
</tr>
<tr>
<td>Suspension feed</td>
<td>filling pipe or screw conveyor</td>
</tr>
<tr>
<td>Solid discharge</td>
<td>open or bundled through pipe</td>
</tr>
<tr>
<td>Typical number of stages</td>
<td>1, 2, 3, 4 cylindrical</td>
</tr>
<tr>
<td>Max. rotor speed</td>
<td>1200 min⁻¹</td>
</tr>
<tr>
<td>Max. pusher frequency</td>
<td>76 min⁻¹ variable</td>
</tr>
<tr>
<td>Max. g-number</td>
<td>852 xg</td>
</tr>
<tr>
<td>Electrical power (e.g. NaCl), rotor/pusher consumption</td>
<td>113/53 kW</td>
</tr>
<tr>
<td>Dimensions (LxWxH)</td>
<td>4.0 x 2.3 x 1.8 m</td>
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<tr>
<td>Weight</td>
<td>12 000 kg</td>
</tr>
<tr>
<td>CCTS options</td>
<td>Yes</td>
</tr>
<tr>
<td>Example: typical NaCl throughput</td>
<td>70 t/h</td>
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</table>

**P-80 hydraulic pusher drive**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Basket diameter</td>
<td>800 mm</td>
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<tr>
<td>Operation mode</td>
<td>continuous</td>
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<tr>
<td>Optional integrated pre-thickener</td>
<td>Yes</td>
</tr>
<tr>
<td>Suspension feed</td>
<td>filling pipe or screw conveyor</td>
</tr>
<tr>
<td>Solid discharge</td>
<td>open or bundled through pipe</td>
</tr>
<tr>
<td>Typical number of stages</td>
<td>1, 2, 3, 4 cylindrical</td>
</tr>
<tr>
<td>Max. rotor speed</td>
<td>1500 min⁻¹</td>
</tr>
<tr>
<td>Max. pusher frequency</td>
<td>80 min⁻¹ variable</td>
</tr>
<tr>
<td>Max. g-number</td>
<td>1006 xg</td>
</tr>
<tr>
<td>Electrical power (e.g. NaCl), rotor/pusher consumption</td>
<td>72/32 kW</td>
</tr>
<tr>
<td>Dimensions (LxWxH)</td>
<td>3.6 x 2.06 x 1.53 m</td>
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<tr>
<td>Weight</td>
<td>8000 kg</td>
</tr>
<tr>
<td>CCTS options</td>
<td>Yes</td>
</tr>
<tr>
<td>Example: typical NaCl throughput</td>
<td>50 t/h</td>
</tr>
</tbody>
</table>

**P-60 hydraulic pusher drive**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Basket diameter</td>
<td>630 mm</td>
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<tr>
<td>Operation mode</td>
<td>continuous</td>
</tr>
<tr>
<td>Optional integrated pre-thickener</td>
<td>Yes</td>
</tr>
<tr>
<td>Suspension feed</td>
<td>filling pipe or screw conveyor</td>
</tr>
<tr>
<td>Solid discharge</td>
<td>open or bundled through pipe</td>
</tr>
<tr>
<td>Typical number of stages</td>
<td>1, 2, 3, 4 cylindrical</td>
</tr>
<tr>
<td>Max. rotor speed</td>
<td>1600 min⁻¹</td>
</tr>
<tr>
<td>Max. pusher frequency</td>
<td>80 min⁻¹ variable</td>
</tr>
<tr>
<td>Max. g-number</td>
<td>1300 xg</td>
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<tr>
<td>Electrical power (e.g. NaCl), rotor/pusher consumption</td>
<td>40/20 kW</td>
</tr>
<tr>
<td>Dimensions (LxWxH)</td>
<td>3.0 x 1.76 x 1.27 m</td>
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<tr>
<td>Weight</td>
<td>4860 kg</td>
</tr>
<tr>
<td>CCTS options</td>
<td>Yes</td>
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<tr>
<td>Example: typical NaCl throughput</td>
<td>30 t/h</td>
</tr>
<tr>
<td>Model</td>
<td>Type</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------</td>
</tr>
<tr>
<td>P-50</td>
<td>hydraulic pusher</td>
</tr>
<tr>
<td>P-40</td>
<td>hydraulic pusher</td>
</tr>
<tr>
<td>P-32</td>
<td>hydraulic pusher</td>
</tr>
<tr>
<td>PM-230</td>
<td>mechanical pusher</td>
</tr>
</tbody>
</table>
Pre-thickening of the mixture – an important step

Continuous running pusher centrifuges demand continuous feeding conditions. A continuous feed is the sine qua non of continuously running pusher centrifuges. The correct thickening of the inflowing suspension ensures optimal functioning of the pusher centrifuge. Ferrum’s range of different thickening and dosing devices make this vital process step perfect.

**Curved sieve**
The mixture to be thickened is applied under pressure to the curved surface of the sieve. The resulting centrifugal force pushes a portion of the liquid through the sieve slots. The thickened mixture is collected at the end of the sieve track and fed into the centrifuge.

**Static pre-thickener**
The static pre-thickener is the simplest thickening device if the solid discharge behaviour and spatial proportions permit its use. The inflowing quantity to the centrifuge is regulated by the Ferrum DAU dosing device. This device enables uniform, dosed delivery of the thickened mixture to multiple machines.
The integrated pre-thickener is another Ferrum innovation. The conical design allows the pusher centrifuge to be fed directly with the mixture from the crystallisation processes. Corresponding adjustment of the process quantities thus eliminates the need for external pre-thickening installations.

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**Hydrocyclone**

The hydrocyclone separates the solid and liquid by centrifugal acceleration. The thickened mixture is fed into the centrifuge, and the mother liquor exits the hydrocyclone through the overflow.

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Customised applications

**Application-specific solutions (CCTS) improve the process in the entire system**

The solid-liquid separation is an important process step in the manufacturing of different products. In this separation, the centrifuge is generally the central factor in a facility. However, the lowest total cost of ownership (TCO) can only be achieved by optimising the entire system. In this endeavour, Ferrum is constantly in search of innovative approaches to ensure the lowest process costs. This involves integrating applications and process interfaces into the planning, because the processes occurring before and after the centrifugation – e.g. the pre-thickening – are exceptionally important. The product range runs from application-specific feeding options with a screw conveyor or feeding pipe, through the assembly of the correct dryer, up to direct discharge in a conveyor or packaging unit. We place our entire system planning experience at our customers’ disposal and offer you innovative system planning solutions.

**Efficient conveyor systems**

An optimised feed conveyor system reduces idle time, improving the uniformity of feeding into the continuously running pusher centrifuge, and thus enhances product quality. All of this reduces the running process costs. Ferrum delivers the right solutions for each application.

**Cut costs with specific applications**

Ferrum develops different mechanical options which are directly integrated into the centrifuge and specifically oriented towards different processes. In this way, for example, Ferrum pusher centrifuges can be directly equipped with an integrated pre-thickener, leading to significant savings in total costs as costs for external pre-thickening are reduced.

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*Optimised systems yield the lowest process costs*

*Improved feeding options guarantee continuous output with the highest quality standards*
The integrated pre-thickener – a pioneering innovation

Pusher centrifuges are sturdy, reliable centrifuges which achieve excellent process-engineering operating results in the dehumidification and washing of granular solids. Here, the operational safety of the pusher centrifuge is ensured if the mixture to be separated possesses a minimum product-specific concentration. To achieve this, Ferrum has developed an integrated pre-thickener. This offers various advantages:

- Fluctuating feed concentrations no longer result in congestion suspension carry-over.
- Partially eliminating the need for external pre-thickening outside of the pusher centrifuge.
- The integrated pre-thickener improves cake formation, i.e. a cylindrical cake is produced and washing is improved.
- The integrated thickener optimises the product acceleration in such a way that the product is accelerated more gently than possible with today's conventional feeding geometries, lowering crystal breakage.

Dosing device DAU 120
- 2 outputs
- Mechanical adjustment of flow rate
- DN 120 connection flange
- Drive motor power 0.55 kW

Dosing device DAU 400
- Choice of 1–4 outputs
- Pneumatic rotary drive for adjustment of flow rate
- DN 400 connection flange
- Drive motor power 0.75 kW

Thickener-Agitator RW 400
- Choice of 1–4 outputs
- DN 400 connection flange
- Drive motor power 0.75 kW

In this case, the flow rate adjustment is controlled by means of valves.
Modern automation concepts

Ferrum produces different monitoring and diagnostic options for pusher centrifuges. In this way, the processes can be automated and made even more efficient.

SI rotor speed monitoring, TC oil temperature monitoring, SI pusher frequency monitoring, FL Bearing lubrication monitoring, PL Oil pressure display, XL Vibration monitoring, LI Oil fill level display, TI Process temperature monitoring, TI Oil temperature display, PI Process pressure monitoring, PI Filter contamination display, GO Door monitoring

Controls and visualisation options for pusher centrifuges

CAS-P.2
With this control panel, the centrifuge and the feeding can be controlled on-site. In addition, the imbalance is monitored and an emergency stop button is available. The interlock between the rotor and the pump motor is equipped with a relay control so that the process times can be adjusted to the required conditions without any problems.

CAS-P.3/4/5
With this control panel, the entire centrifuging process can be controlled (except for control of the mixture quantity in the centrifuge). The control of the process times can therefore be adapted to the required conditions— even without the use of programming devices (e.g. adjustment of the after-running time of the oil pump to the deceleration time). The control software can be adapted to the specific requirements with a minimum of effort.

CAS-P.4/5
This concept represents a complete solution (Customized Centrifuge Technology Solution) in two versions:
- Rotor motor with delta-star startup or direct startup
- Oil pump with direct startup
- Rotor motor speed continuously variable by means of FC (frequency converter), oil pump directly driven.

CAS-P.3/4/5-SPS
The stored program control (SPC) is optionally integrated with a vibro control frequency analyser in a separate wall cupboard (dimensions in mm: H1000, B800, D300). The signals from the control panel and the feedback signals are at floating potential.
Broad spectrum of service options

To review the different processes and to continuously adapt these to requirements, we offer our customers different service packages and professional consulting.

Model  
“Gold Service”
Frequency  
every 6 months
Type  
preventive maintenance
Response time  
24–48 hours
Key components determined by contract (warehouse or guaranteed procurement lead time)
Wearing parts  
are charged

Model  
“Silver Service”
Frequency  
every 12 months
Type  
inspection and safety checks, maintenance and upkeep on request
Response time  
10 working days
Wearing parts  
are charged

Model  
“Steel Service”
Frequency  
every 36 months
Type  
complete review and safety checks
Response time  
10 working days
Wearing parts  
are charged

Model  
“UVV Inspection”
Frequency  
every 3 years
Type  
inspection and safety checks according to accident prevention regulations, maintenance and upkeep on request
Wearing parts  
are charged

Model  
“Process analysis for optimisation”
Frequency  
on request
Type  
process analysis up to optimisation offering
Response time  
10 working days
Service  
approx. 2 days analysis on-site
Travel costs  
are charged according to expenditure

Model  
“Docu Service”
Frequency  
during upgrade
Type  
the machine operating manuals are updated in keeping with the upgrade
Response time  
4 weeks

Model  
“Qualification Service”
Frequency  
on request
Type  
the machine qualification is performed and documented
Response time  
on request
Travel costs  
are charged according to expenditure
Outstanding references and international markets

Thanks to our innovative power, our markets are growing

In the raw materials processing industry, agrochemistry and petrochemistry markets, where high purity in combination with the highest availability is required, our pusher and scraper centrifuges are continuously equipped with the latest technical innovations.

Centrifugation of sodium carbonate decahydrate
- Throughput approx. 30 t/h
- Oil cooling with air cooler
- Air recirculation

With the integrated thickener, this pusher centrifuge P80/2 functions with absolute reliability in spite of the concentration fluctuations of the suspension.

Three pusher centrifuges of the P-100 model each with a throughput of 75 tonnes of salt per hour. Thanks to the low solid loss, low residual moisture and high reliability, this centrifuge achieves very low process costs throughout the duration of its operation.

Examples of products which are centrifuged

- Nitrocellulose fibres
- Salt (NaCl)
- Plastic granulate
- Ammonium sulphate

Adipic acid, ammonium chloride, ammonium sulphate, boric acid, borax, carboxymethylcellulose, dextrose, iron sulphate, urea, potassium chloride, potassium chloride, potassium sulphate, carbon, plastics, linters, sea salt, sodium hydrogen carbonate, sodium carbonate, sodium chloride, sodium chloride, sodium cyanide, sodium sulphate, nickel sulphate, nitrocellulose, oxalic acid, phosphate, zinc sulphate and many more.
The Ferrum competence

Experience from global applications

- Team of specialists in process technology, machine construction, automation technology, production technology, assembly crew, project manager team, team for global logistics
- 6000 machines in the markets pharmaceuticals, chemistry, agrochemistry, fine chemical industry, raw material processing industry, mining, petrochemistry, foodstuffs industry, environmental technology
PUSHER CENTRIFUGE QUESTIONNAIRE

PROSPECTIVE CUSTOMER:

Telephone Internal/Direct dial
Fax E-Mail

SEPARATION TASK: The goal of centrifugation is the separation of a mixture into solid and liquid components
The valuable component is ☐ the solid ☐ the liquid
Is the facility ☐ existing ☐ new
For better evaluation of the separation problem, enclose the flowchart of the facility on a separate sheet
(or as a .dwg-file)!

SOLID:

Name
Chemical formula

Density at °C kg/m³
Bulk density in the centrifuge kg/m³

Grain size distribution (please indicate determination methods, such as sifting, laser diffraction, etc.)

<table>
<thead>
<tr>
<th>-mesh/DIN</th>
<th>Weight %</th>
<th>Weight %</th>
<th>Weight %</th>
<th>Weight %</th>
<th>Weight %</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

Mean grain size mm
Particle form ☐ cube ☐ fibres
☐ Spherical ☐ needles
☐ Wafers ☐ Flakes

LIQUID:

Name
Composition

Density at °C kg/m³
Dynamic viscosity °C cP corresp. to $10^4$ Ns/m²
pH value

Available on the Ferrum web site as an Excel file.
### MIXTURE:

<table>
<thead>
<tr>
<th>Solid content</th>
<th>Weight % or g/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>°C</td>
</tr>
<tr>
<td>Density at</td>
<td>°C</td>
</tr>
</tbody>
</table>

Mean settling rate of the solid (static)

Special characteristics:  
- flammable  
- corrosive  
- explosive  
- abrasive  
- toxic  
- pathogenic  

Can the mixture be thickened?  
- Yes  
- No

If yes, how?

### WASHING LIQUID:

<table>
<thead>
<tr>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composition</td>
</tr>
</tbody>
</table>

| Density at | °C | kg/m³ |
| Dynamic viscosity at | °C | cP corresp. to $10^{-3}$ Ns/m² |
| Temperature | °C |

### OPERATING CONDITIONS:

| throughput | kg/h | mixture |
| Output | kg/h | solid damp |
| Permitted residual moisture in the treated solid | Weight % or percentage of solid | Weight % |
| Permitted solid content in the separated liquid | Weight % or ppm |
| Required purity after washing | Weight % or ppm |

What is the impurity?

| Required washing liquid quantity | m³/h solid dry |
| Mixture dosage with |  
- dosing apparatus  
- valve  
- pump  
| Solid transport after centrifuge |  
- screw conveyor  
- conveyor belt  
| Electrical current for drive: |  
- current type  
- ex protection  
- Voltage | V |
| Frequency | Hz |

Suitable construction materials for parts in contact with products are:

| Installation |  
- outdoors  
- indoors  
| Temperature at installation site | min. °C max. °C |

### EXPERIENCE:

General observations (e.g. available experience, special centrifuge models, N₂ fumigation, etc.)

Are centrifuges already in use  
- Yes  
- Non

If yes:  
- centrifuge model mm  
- drum rotational speed mm⁻¹
- Drum diameter mm  
- pusher frequency mm⁻¹
- Solid quantity damp kg/h  
- Residual moisture Weight %

### ANALYTICAL CHEMISTRY:

For experiments in our laboratory:

Maximum permitted temperature for drying the solid | °C |

Method for determining the residual moisture

Method for determining the purity