

# Preparation Technology for Friction Lining Compounds

Dry mixing · Wet mixing · EVACMIX® Process



# EIRICH: Your partner for the friction lining industry

## **Investing in the right equipment keeps you one step ahead of your competition**

The required profile for friction linings is becoming increasingly demanding, with OEMs in particular expecting top quality product. It is well known that homogeneity is critical in the process for the quality of a friction lining mixture, and producers need the suitable process equipment to get good results. This is where EIRICH shows its strengths.

Production of homogeneous friction lining mixtures is often physically difficult due to the breadth of the bulk density spectrum. This is particularly apparent on mixing systems where there is no separation between material transport and mixing power input. The EIRICH mixing principle provides a unique way of achieving this separation. It gives the user much greater freedom and as well as distinct advantages. For that reason, EIRICH mixing systems have been used for years by many

satisfied producers in the friction lining industry. EIRICH mixing systems have obvious advantages and deliver excellent results for all types of linings used in the production of cycles, passenger cars, commercial vehicles, rail vehicles and in industrial applications.

EIRICH also supplies material processing solutions, e.g. foundry sand preparation systems, for other components related to friction linings such as castings for brake callipers, brake back plates, brake disks and brake drums.

## **What you can expect from EIRICH**

EIRICH systems provide the complete solution of ready-to-press mixed batch compound. EIRICH offers and delivers the complete package, from initial mixing trials in our fully equipped test center to the delivery of a complete turnkey solution and system, including high level control systems complete with data logging and batch traceability.

## **Outstanding results – whichever processing pathway you choose**

There are essentially two common processing pathways in the friction lining industry:

- mixed constituents with phenolic resin powder
- mixed constituents with liquid phenolic resin

In the future, it is highly likely that a greater proportion of the mix recipes will contain liquid phenolic resin due to the increased need for homogeneity.

## **Conclusion:**

**Invest in EIRICH process equipment for your production facility in preparation for future demands on quality friction lining products**



*EIRICH Intensive mixer RV12W\**

## Typical friction lining products



# The advantages of the unique EIRICH mixing system

## **EIRICH intensive mixers have the following distinctive characteristics:**

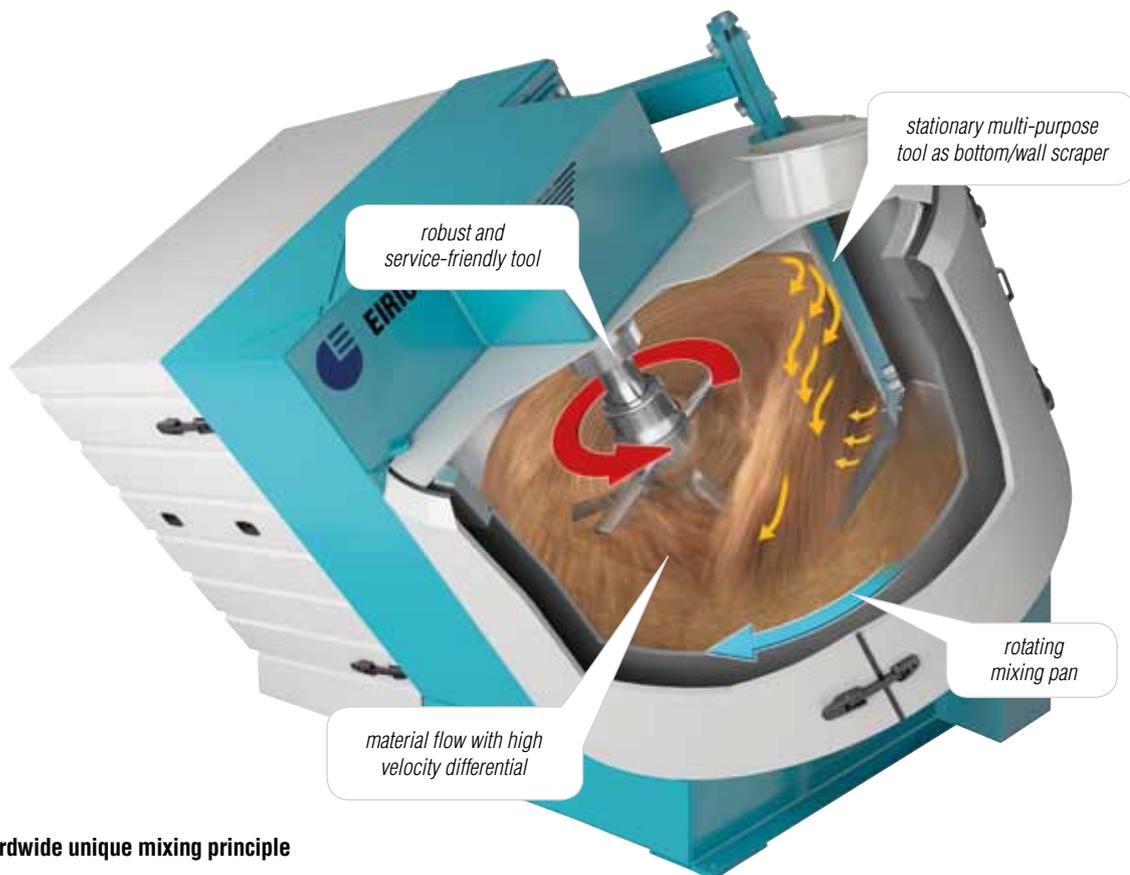
- rotating mixing pan
- stationary bottom/wall scraper
- high-speed mixing tool which is mounted eccentrically off-center in the mixing pan

## **The unique working principle of the EIRICH intensive mixer**

What distinguishes the EIRICH mixer from other mixing systems available in the market is the rotating mixing pan and the eccentrically-positioned mixing tool. The rotating pan transports material to the mixing tool, eliminating any dead

space. A stationary bottom/wall scraper returns any material deposits, which form on the mixing pan wall, to the material flow. In contrast to other mixing systems, the mixing tool has no material transport function. Tool speeds between 1 m/s and 30 m/s support an unprecedented number of process variations.

Variable power input gives the EIRICH mixer the capability to handle powder mixtures which are difficult to mix as well as high-plasticity compounds and suspensions in the same machine using a single mixing tool. Explosion protected versions of the mixer can be supplied for processing solvents and dry materials which pose explosion risks.



**Worldwide unique mixing principle**

## Summary listing the unique features of EIRICH mixing systems

### 1. Two processing pathways in one and the same mixer.

Phenolic resin in powder or liquid form can be processed with one and the same mixer, achieving perfect repeatable results batch after batch. Users can start processing dry batch mixes NOW and produce wet batch mixes without re-design of the mixer IN THE FUTURE, and therefore no further investment is necessary.

### 2. Defined opening of fibers

High, variable tool speeds open fibers such as Aramid, Glass fiber and Kevlar to the required degree without additional and costly tools. The fibers are opened up to the point where they are optimal for the friction lining compound. This is achieved solely with standard tools configuration. Additional chopper blades or similar high-wear components are not necessary significantly reducing operational costs and machine downtimes.

### 3. Low tool wear

Due to the machine design the tools are not close to the wall and bottom, which dramatically minimizes the friction and wear. The rotor / mixing tool can run at up to 30 m/s, whereas speeds on other types of mixers can only achieve tip speeds in the lower one-digit range. The result is unparalleled homogeneity and substantially lower tool wear.

### 4. Excellent mixing quality

The mixing pan geometry in combination with high tool speeds and separation of the mixing function (rotor) and material transport (mixing pan) delivers outstanding, unparalleled mixing results.

### 5. Short mixing times

Mixing times can be very short due to separation of the mixing function and material transport, requiring relatively small mixers, reducing capital expenditure and on-going operating costs.

### The main advantages of the EIRICH modular system at a glance:

- Unparalleled mixing quality without risk to de-mix (regardless of the bulk density spectrum)
- Preparation of mixed batch containing phenolic resin in powder or liquid form in the SAME mixer
- Precise and defined opening of fibers without additional chopper tools
- Short processing times
- Machine design reduces tool wear to a minimum
- ATEX execution to Zone 20 (internal) / 22 (external)

# EIRICH Intensive mixer programm

**EIRICH intensive mixers are service-friendly, wear-resistant and deliver high operational reliability. The list of outstanding features includes:**

- high flexibility
- no dead zones or temperature gradients in the mixer
- easy access, good cleanability (can be automated on request)
- excellent scale-up capabilities

**Model range for friction lining compounds**

Lab models with capacities of 5, 10, 40 and 150 liters are available. These models have removable (5 and 10 liters), or hydraulically swiveling (40 and 150 liter) mixing pans, and are intended for all-manual operations (e.g. in labs or for small series production). All of these mixers are valuable tools for up-scaling investigations. They can be used for R&D and also for process

development without disrupting ongoing production. The production mixers are designed for use in machine clusters in fully automated production. Capacities range from 75 liters to 1,500 liters (which is normally the upper limit). For higher throughput rates, large mixers with capacities up to 12,000 liters are also available. The W version with hinged covers offers the additional advantage of easy access to the machine interior for cleaning and maintenance purposes.

The choice of mixer size depends on the intended throughput rate as the batch times are normally significantly shorter compared to other mixing systems. As a result, relatively small and less expensive machines can be used without any reservations due to the consistent reproducibility. Depending on the requirements, ATEX versions of our mixers are also available: Zones 20 and 21 (interior) and Zone 22 (exterior). Versions for gas explosion protection zones can also be provided.

Laboratory			Production							
Type	EL5/10 Profi (Plus)	R05T	R08W	R09W	R12W	RV12W	R16W	RV16W	R19	RV19
Volume l	5/10	40	75	150	250	400	600	900	1125	1500
Throughput t/h	-	-	0,9**	1,8**	3**	4,8**	7,2**	10,8**	13,5**	18**
Load capacity (kg) at 1.3 kg/l bulk density	up to 7/12	52	98	195	325	520	780	1110	1470	1950
Rotor drive power kW	5,2	7,5	11	18,5	22	30	37	55	75	90
ATEX	Dust Zone interior 21 / Zone exterior 22, on request also Zone interior 20 / Zone exterior 22 can be provided as well as gas explosion protection zones									

**Options:** Higher drive power, hardmetal wear protection for mixing tools, batch and discharge systems, filters, controllers and much more

*\*\*Throughputs are average values based on typical batch times*



EL10 Profi lab mixer,  
volume 10 liters\*



R02VAC lab mixer with peripherals,  
volume 5 liters\*



R09W lab mixer,  
volume 150 liters\*



Production mixer R12W,  
volume 250 liters\*

### EVACMIX®

R02VAC	R08VAC	RV11VAC	RV15VAC	RV19VAC
5	75	375	750	1500
-	0,6**	2,9**	5,9**	11,7**
up to 7	98	490	975	1950
5,2	30	45	55	110



Production mixer RV19VAC,  
volume 1500 liters\*

# Dry mixes



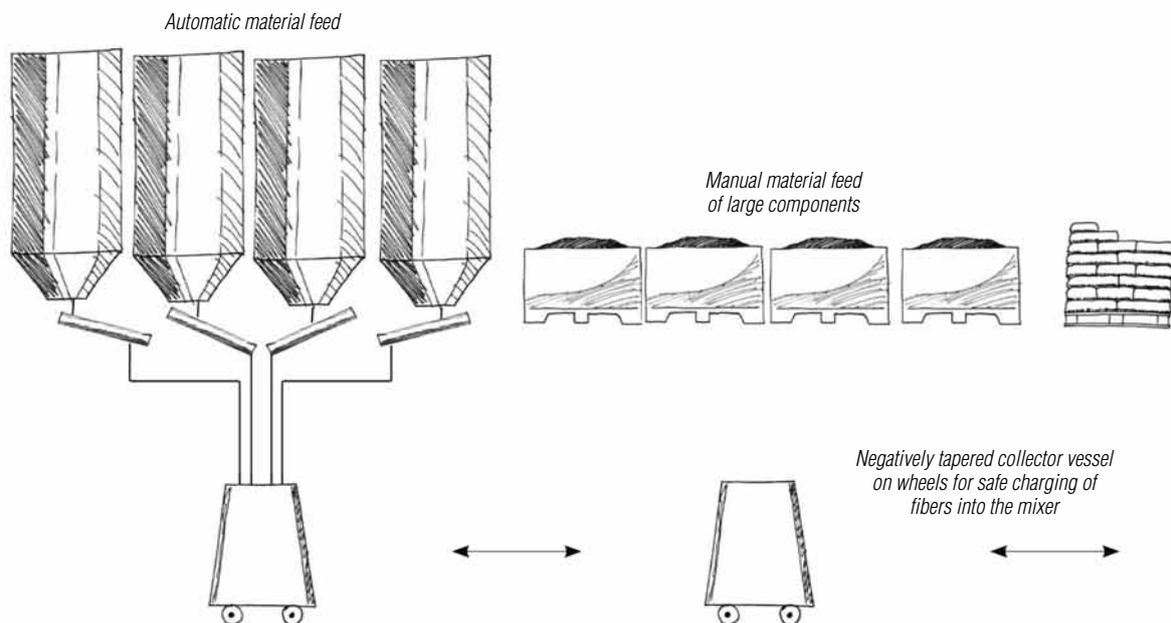
Typical dry mix

During the production of friction linings from dry mixes, usually many products are mixed together. All of these recipes have one thing in common: the bulk density spectrum of the components is very broad. The constituents range from fiber materials at roughly 50-100 g/liter to very heavy metallic materials with well above 4 kg/liter bulk density. Precisely these differences in bulk density are a difficult challenge and essentially an insurmountable problem for most types of mixers. At the low tool speeds which are needed to reduce wear on these mixer types with tools that run close to the bottom and wall, de-mixing is a recurring problem during the mixing process. EIRICH realized this back in the 1920's, and in the year 1924 the planetary mixers were replaced with the first EIRICH intensive rotating pan mixers. The lower / poor homogeneity is reflected with other mixing systems on the market which have tools that run close to the mixing vessel walls and bottom, particularly when critical mixing times are exceeded (de-mixing can occur). Centrifugal forces cause heavy product to accumulate in the outer

zone of static pans during mixing. On the EIRICH mixer, the product is continually transported to the mixing tool.

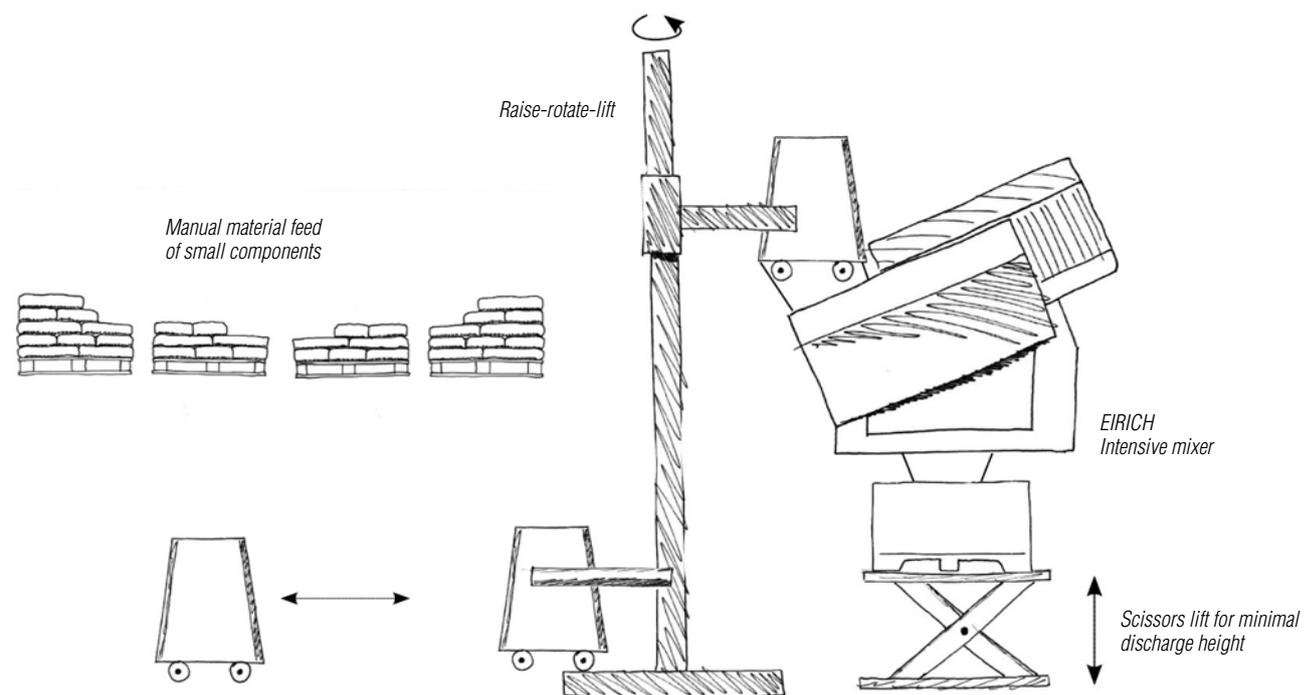
Dry mixes normally contain phenolic resin in power form along with various organic substances. As a result, ATEX compliance (or compliance with other explosion protection regulations outside the EU) is usually mandatory for a machine or system implementation. In normal circumstances, the machine interior is classified as ATEX Zone 20 (or equivalent in other explosion protection regimes), because a potentially explosive atmosphere may be present during the entire mixing cycle. Well-known friction lining producers currently use mixers in this explosion protection category, to their satisfaction.

**Unique Advantages:** The EIRICH mixer can also produce wet mixes without any design changes. The EIRICH mixer gives users maximum freedom, even when entirely new formulations are introduced. In many cases, complex and expensive process sequences with multiple processing machines can be consolidated in a single process unit.





*Intensive mixer R12W\**



*\*Photo similar, subject to changes*

# Wet mixes



Typical wet mix

Wet mixing is becoming increasingly common to avoid the well-known phenomenon of de-mixing during discharging and the de-mixing tendency inherent in the mixer design of conventional mixer types or just to achieve the binding of the dust in the product. The highly efficient EIRICH mixing system can process the mix with unparalleled speed and efficiency in around 5 - 15 minutes.

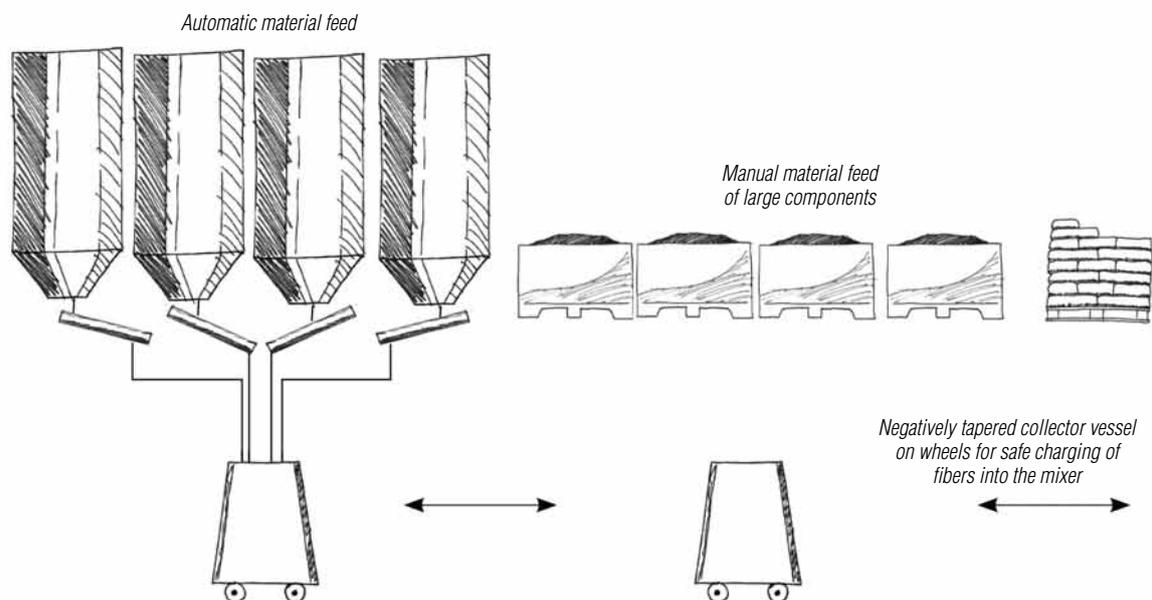
**Mixing:** Liquid phenolic resin can also be used to make mixtures dustfree or at least low-dust. In this connection the smallest particles get embedded into the multi-dimensional opened up fiber structures.

**Granulation:** Phenolic resin is used as the binder. It „freezes“ the homogeneity which varies depending on the type of mixer used. De-mixing during discharging cannot occur.

**Coating:** If desired, product prepared before can also be coated. This process is also handled by the EIRICH mixer in highest perfection.

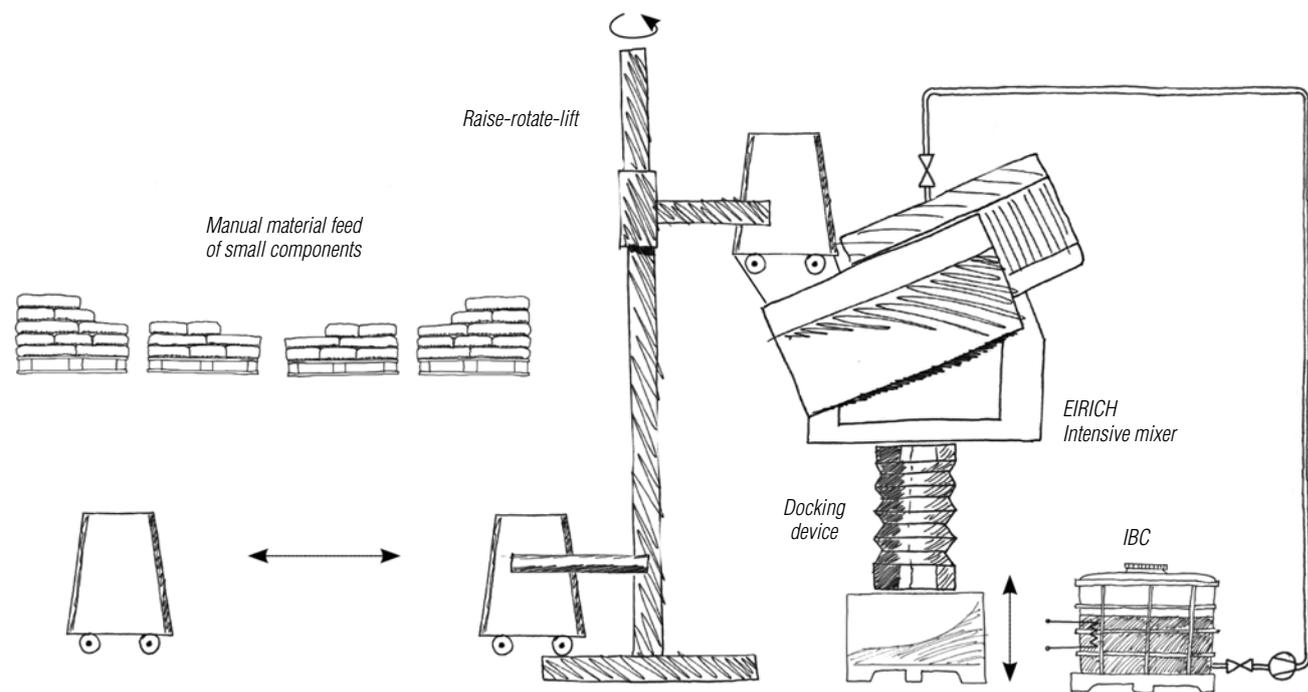
Liquid phenolic resin normally has very high viscosity (25,000 - 50,000 mPas). Ideally, dosing of the high-viscosity phenolic resin should be positively controlled from the preheated resin vessel using a pump and flow meter. This enables the optimum feeding with regard to time and position at shortest batch times. During charging of phenolic resin the crucial challenge to eliminate lumpy accumulation often arises. This challenge is only resolved with specially designed tools running at high speed, which is solely achieved by the EIRICH mixer. This produces huge advantages for the user, because the design of the mixers completely and safely excludes the possibility of lump formation on the mixing tools. Because following the addition of liquid phenolic resin the product no longer tends to generate dust, the machine interior can mostly be rated as ATEX Zone 21 (or equivalent under other applicable explosion protection regulations).

The EIRICH mixer is the only machine on the market which can handle both dry and wet mixing with ease and without the need for any technical modifications. So users of EIRICH equipment can react at any time in the most effective way to changing market needs without further significant investments and modifications.





*Intensive mixer R16W\**



*\*Photo similar, subject to changes*

# Mixes containing solvents

To guarantee that the distribution of the very high viscosity liquid phenolic resin is as homogeneous as possible, solvents can be added to thin the mixture and improve the flow properties. Also, solvents can be used to dissolve and liquefy phenolic resin powder.

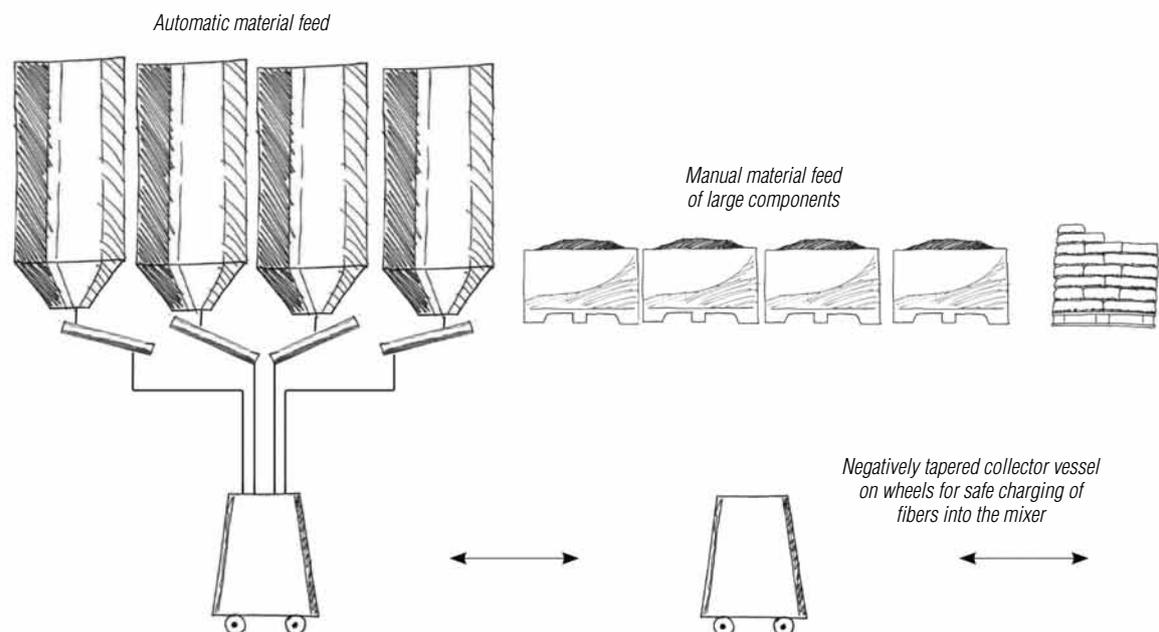
## EVACMIX® vacuum technology

The EVACMIX® process developed by EIRICH has proven to be very effective for solvent recovery. By reducing the vapor pressure which in turn lowers the boiling point, the solvent escapes from the mix as a gas. Pre-heated nitrogen is used as the carrier gas which is saturated with solvent vapor, dried in the circulation loop and then returned. What is left is a nearly solvent-free mix which can be used directly in the downstream process. As required, the product can be cooled back down at the end of batch processing, e.g. by adding liquid nitrogen or dry ice (CO<sub>2</sub>).

For the EVACMIX® vacuum preparation, the rotating pan is enclosed by a tightly fitting vessel in which the pressure drop required by the process can be carried out. Disregarding the aggregation stage of the phenolic resin it can also be mixed, granulated or coated as described under “wet mixes“, depending on the process related requirements.

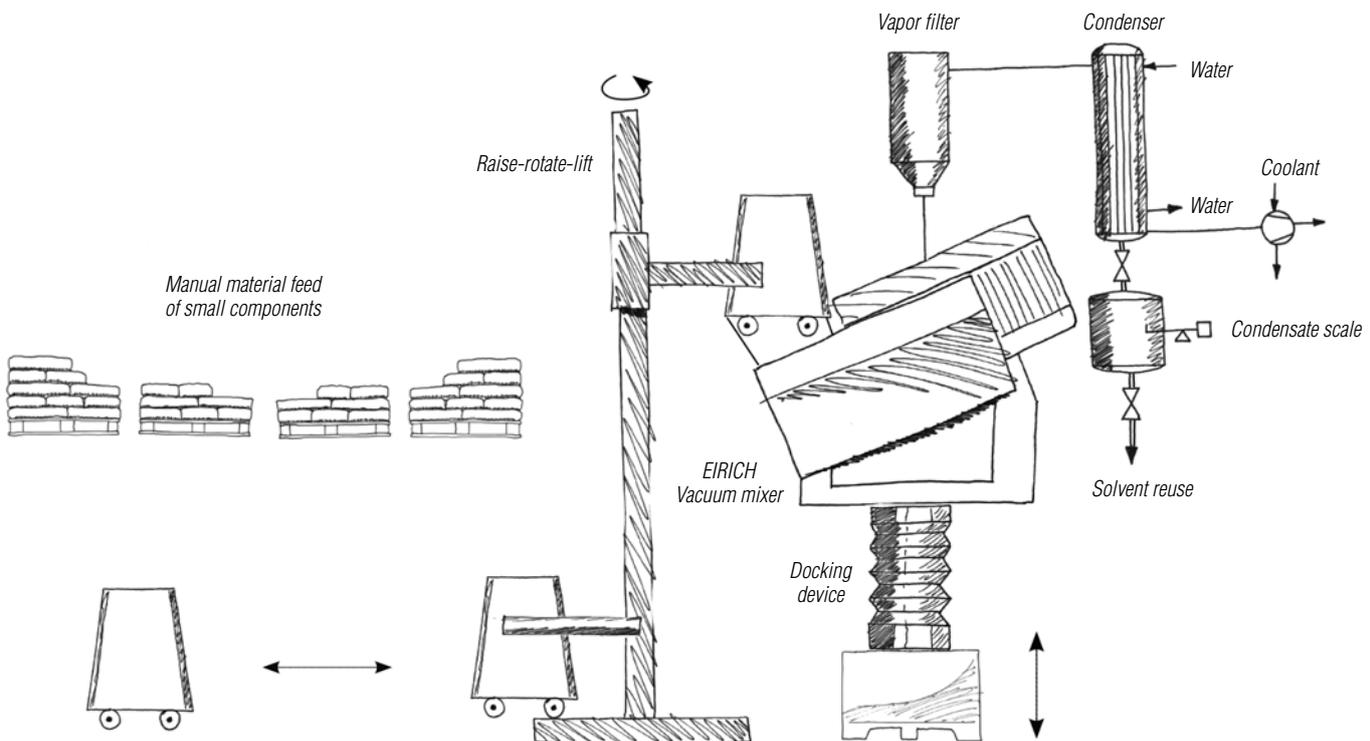
As a further advantage the EVACMIX® vacuum process also mitigates the additional explosion risk caused by the solvent vapor, which comes with the dust explosion difficulties. Evacuation of the vacuum mixer ensures that the critical oxygen content in the mixing pan remains significantly (and safely) below 5-6%. For inerting, the mixing pan is then flooded with pre-heated nitrogen gas. After that, pure solvent or a phenolic resin/solvent mixture can be fed in.

The end result is a highly homogeneous ready-to-press granulate with a moisture content  $\leq 1\%$  which is suitable for pressing in the downstream process.





EVACMIX® vacuum mixer RV19VAC\*



\*Photo similar, subject to changes

# EIRICH services – maximum confidence across the board

EIRICH offers a comprehensive range of services for the friction lining industry worldwide: from the initial consultation to the planning and implementation of a preparation solution, reliable after-sales service and the dependable delivery of original spare parts.

## **Test centers**

EIRICH maintains test centers on various continents. There, experienced engineers and process technicians join forces with the user in optimizing specific process steps and devising a basis for the optimum performance of new applications with untried mix compositions.

## **Engineering**

Data collected at the EIRICH test center is used as the basis for selecting the right machines and equipment.

## **Systems engineering**

Only machines and equipment developed and built by EIRICH itself and products from efficient and experienced partners are considered in the engineering and order handling stage.

## **Process control and instrumentation**

EIRICH develops and builds its own machine and process control systems and instrumentation for complete preparation solutions. The range covers new installations as well as the modernization or expansion of existing machines and preparation systems. All components are exactly configured for the user's needs. The results are tailor-made solutions covering everything from conventional keyboard control systems and special batch controllers with formula management to the ServiceExpert software package with online documentation and the forward-looking planning of maintenance.

## **Installation and commissioning**

An experienced service team is available for installation and commissioning. Local partners assist us, and the customer's personnel are instructed in the course of the work.

## **Training**

Training for your operating and maintenance team is provided by expert instructors to ensure that you get the most out of your investment over the long term. It includes instructions concerning the system's operation, safety regulations, process optimization, maintenance intervals and repair work.

## **Customer service**

EIRICH after-sales service is your guarantee of expertise, high availability and comprehensive support. The portfolio includes the worldwide supply of genuine EIRICH spare parts, rapid response to production stoppages and fast machine / system repairs.

Particularly beneficial options are:

### ■ **Teleservice**

Remote diagnosis via data link. This is guaranteeing fast, low-cost support when problems occur.

### ■ **Condition Monitoring**

Sensors mounted on key functional elements send data in real time to a central analysis system in order to detect component degradation before a major fault occurs. This can enhance machine availability and reduce maintenance costs.

### ■ **Maintenance software packages**

The software ServiceExpert ECD provides simple access to engineering drawings, images and photos to quickly identify even very small parts, including a shopping basket function. With the ServiceExpert ECS a tailored, comprehensive, state-of-the-art maintenance management software solution is available which helps to maximize machine availability.



## Industrial Mixing and Fine Grinding Technology

### Tradition and innovation since 1863

EIRICH stands worldwide for a comprehensive range of products and services in the field of preparation technology. Its particular focus is on mixing and fine grinding technology, with know-how developed over 150 years of close cooperation with industrial users, universities and research institutions.

Pursuing a corporate philosophy of operating internationally and thereby ensuring close proximity to every customer, the EIRICH Group has secured its place in all the key economic regions of the world.

The focus is on innovative technology for machinery and systems engineering designed to offer solutions for high-standard preparation tasks from a single source.

Applications and process technology with own test centers, a high vertical range of production and comprehensive after-sales service provide the ideal basis for the development of modern and economical processes for a multitude of industries.

**Building materials – Ceramics – Glass – Carbon paste – Battery paste  
Friction linings – Metallurgy – Foundries – Environmental protection**

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