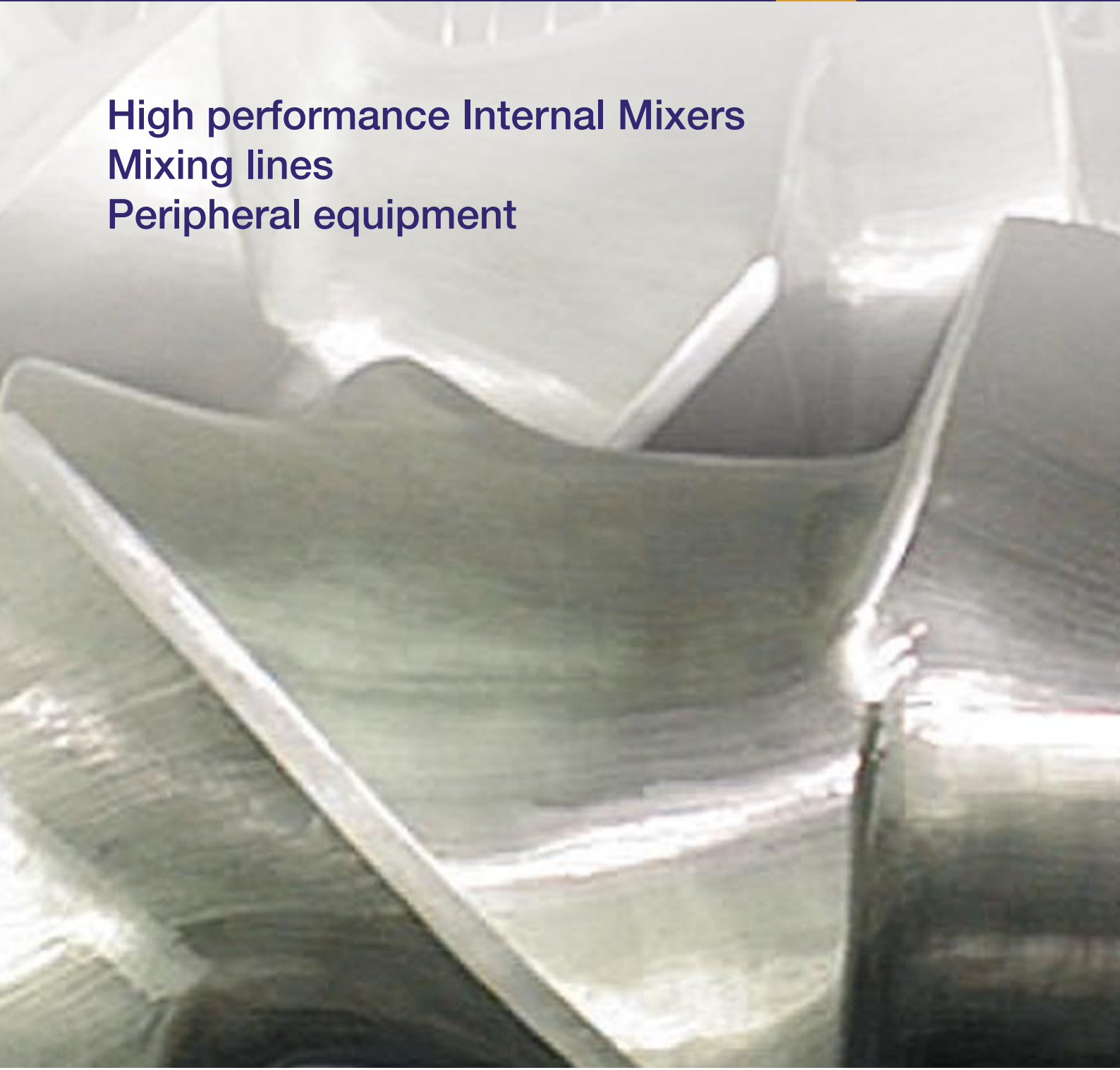


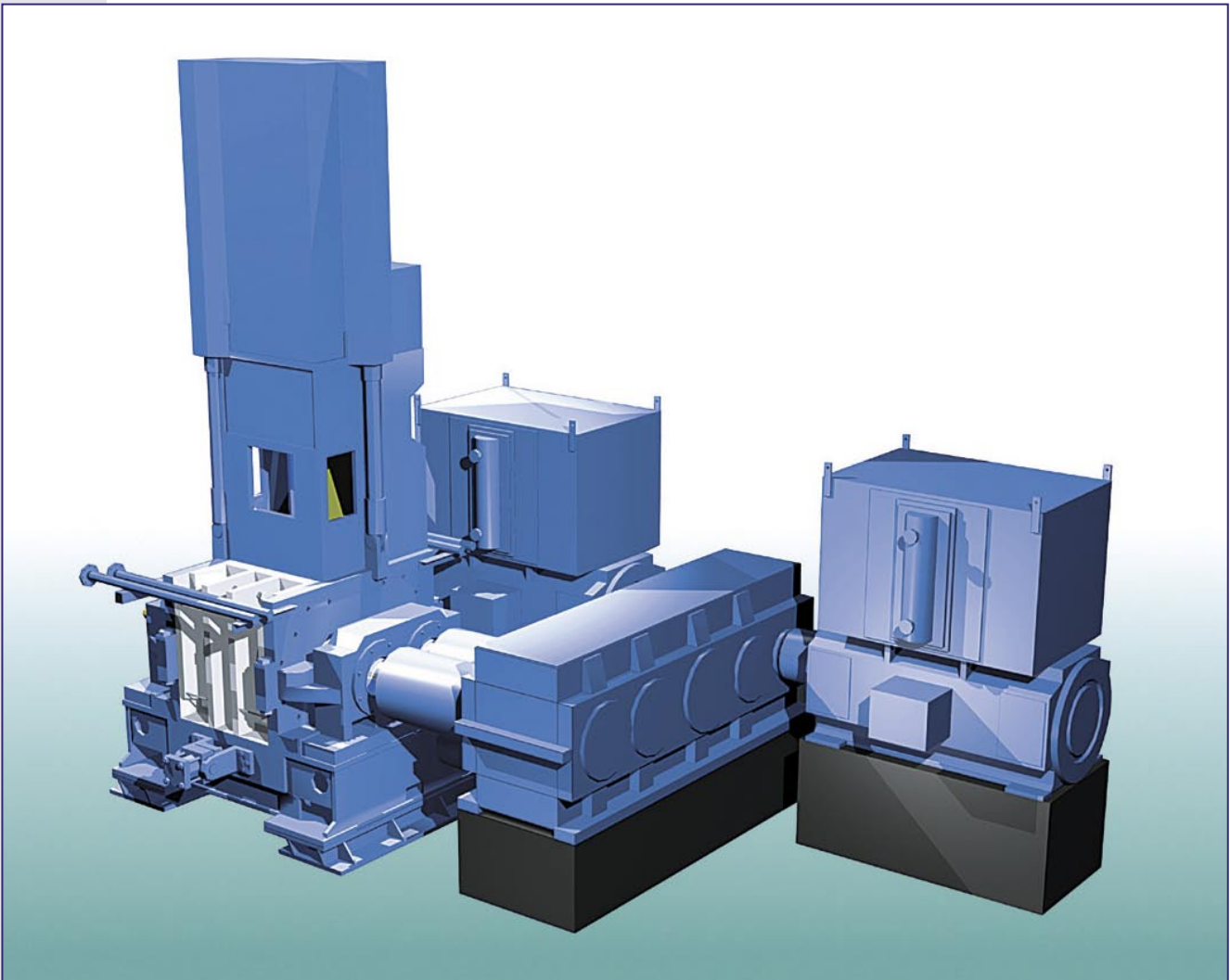
High performance Internal Mixers
Mixing lines
Peripheral equipment



A Superior Concept. Makes the most of your mixing room.

With high performance internal mixers to the original Werner & Pfleiderer design, we can supply the most economic, reliable, maintenance-friendly customized machine for any type of compound production and capacity requirement.

We develop, manufacture and sell complete mixing room systems, from silo storage, weighing and feeding equipment, mixers, roll mills, dump extruders and their peripheral equipment.

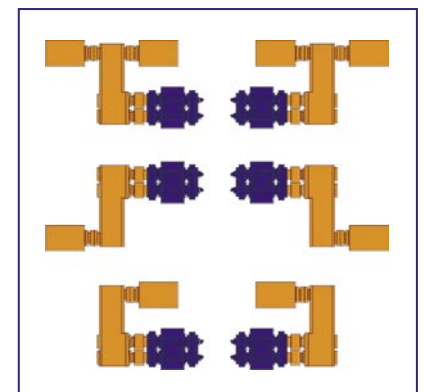




High performance Internal Mixers

Harburg-Freudenberger offers two types of internal mixer: GK-N with tangential rotors and GK-E with intermeshing rotors. A full range of sizes in both types and a modular mixer design allows us to meet any customer demands. The three basic mixer modules, hopper, mixer block and base plate, can each be turned through 180° and the position of the mixer drive can be varied, so that the mixer configuration can be adapted to fit into the space available in the most effective manner.

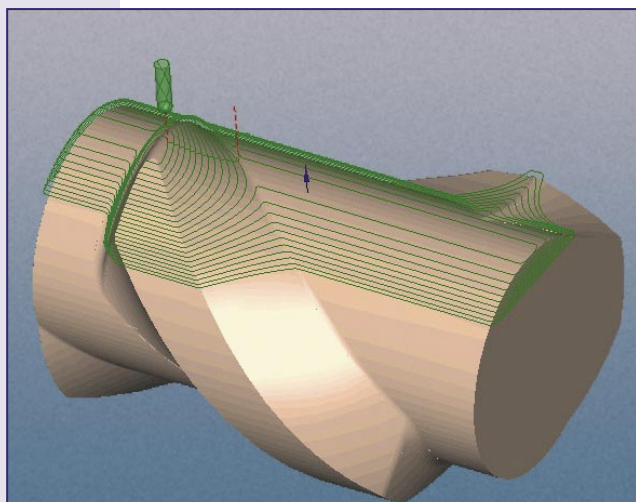
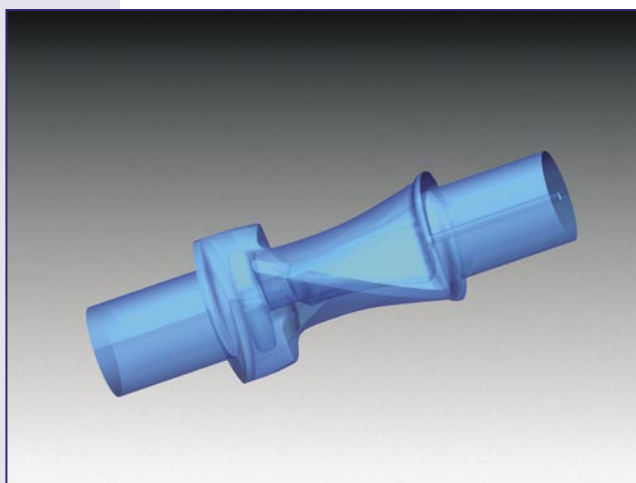
The modular mixer design also simplifies access to the rotors, while two-piece bearing housings and removable chamber sides ensure that installation and maintenance can be carried out in the shortest possible time.

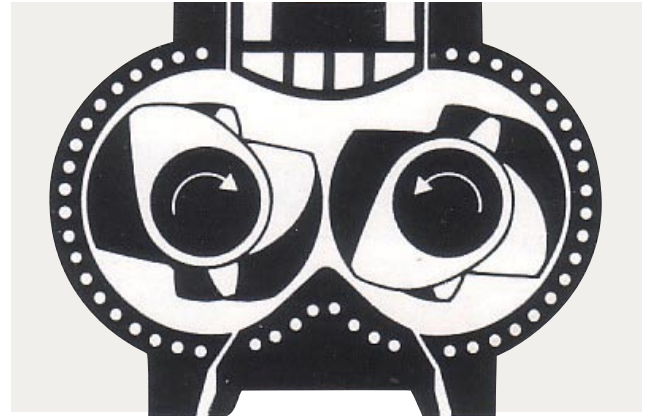




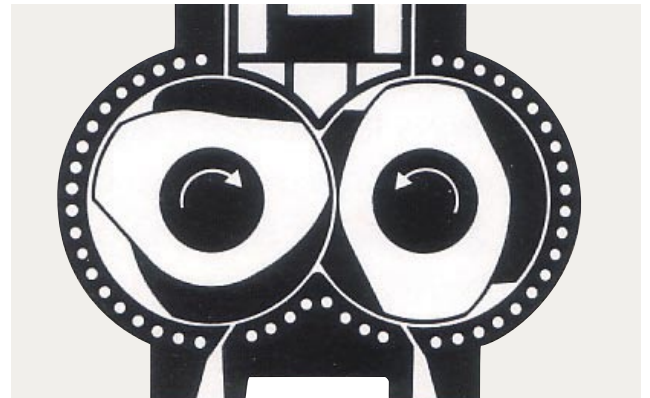
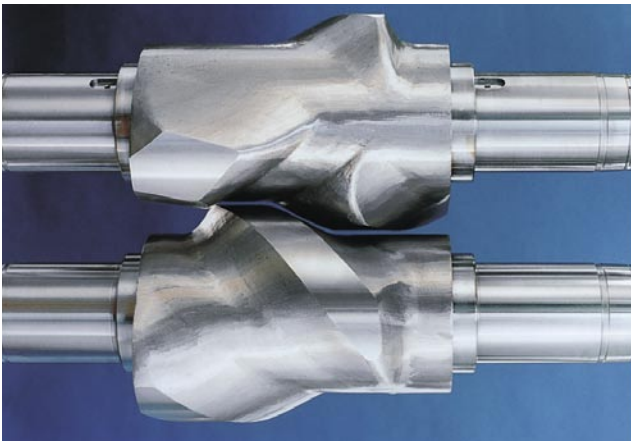
Rotors manufactured with top precision

Our rotor geometries have been developed with the most modern CAD-systems available; they have been tested and optimized to a minute degree using simulation programs and practical trials. The actual rotors are produced to the highest level of reproducible precision on NC-machines that are programmed on the basis of the CAD-data.





GK-N series



GK-E series

GK-N series Internal Mixers with tangential rotors:

Unsurpassed for high output

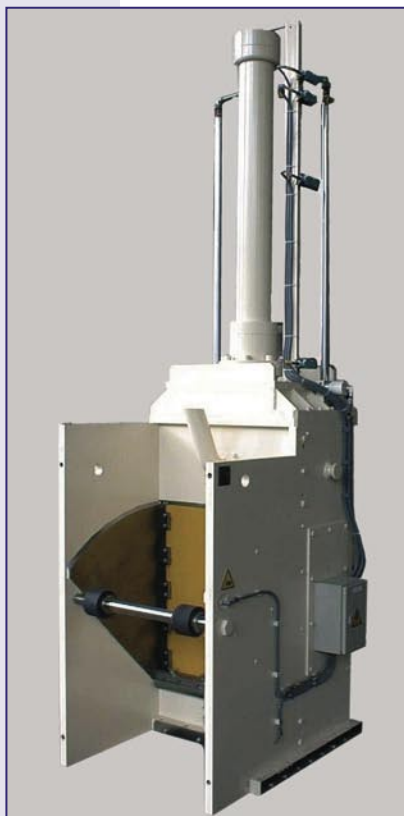
Characteristic features of our GK-N high performance Internal Mixers are their high fill factors and short feed and discharge times. These mixers achieve high output rates when processing less temperature-sensitive compounds. The rotors can be provided with various geometries. The standard configuration ZZ2 pushes the compound alternatively from the centre of the mixing chamber to either side, with a small helix angle that provides an intensive mixing action. Flow dividers distribute the material effectively, while the rotor wings, ending short of the rotor end plates, improve material flow through these areas.

In the Tyre industry GK-N mixers are often used with proven four-wing rotors. This geometry delivers higher heat transfer into the compound at the start of the mixing cycle and results in a faster temperature build-up.

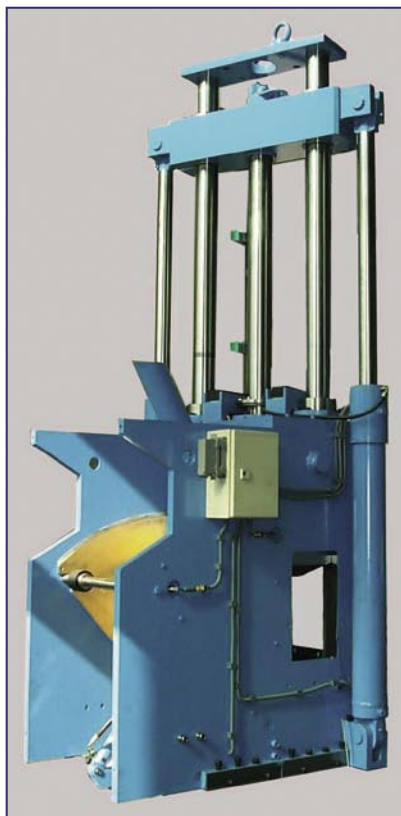
GK-E series Internal Mixers with intermeshing rotors: Ideal for high quality

GK-E high performance Internal Mixers offer the advantage of rapid energy input into the compound, thus permitting considerable improvements in quality. The extremely favorable mixing chamber volume to surface/cooling area ratio allows the problem free processing of more temperature sensitive compounds. The PES-5 rotors, developed on the proven PES geometry,

reduce cycle times considerably by quickly mixing in fillers and plasticizers. In addition the improved cooling characteristics often make it possible to reduce multi stage mixing and increase cost efficiency. The standard PES geometry has wide wing tips and involute intermeshing zones that produce a re-layering of the compound similar to that obtained in open mill mixing.



*Hydraulic feeding device
(1-cylinder)*



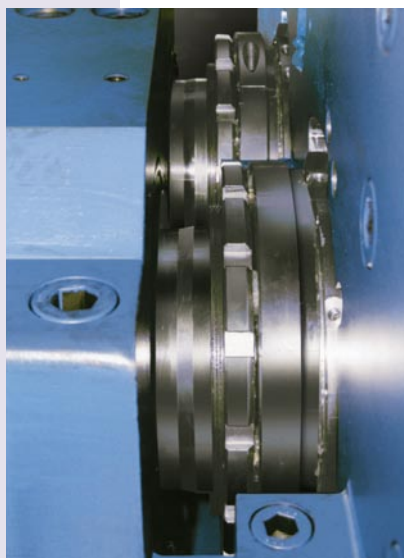
Hydraulic feeding device (2-cylinder)

Hydraulic ram for improved compound quality

To improve the feeding of the internal mixer we developed the hydraulic ram. In contrast to a pneumatic ram, where ram pressure often varies, the hydraulic ram produces a constant and reproducible ram pressure that in turn ensures constant high compound quality. In addition hydraulic rams can be controlled more precisely; they consume less energy and produce much less noise in operation.

Controlled, reproducible ram pressure

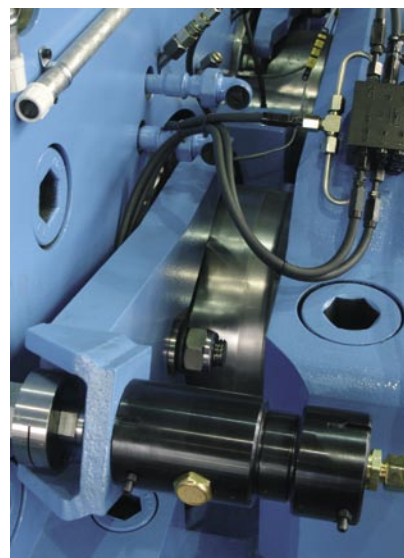
The feeding hopper consists of a fabricated body, ram and ramrod, with a pneumatic or hydraulic cylinder attached to provide the ram pressure. A sensitive digital control system ensures exact compliance with the pre-selected ram pressure, with our hydraulic ram providing particularly high levels of consistency and reproducibility.



Dust stop sealing GA

Reliable, easily accessible dust rings

To make the dust rings readily accessible and easy to replace, they are positioned outside the opening for the rotor, in the mixer end frame. The dust ring assembly has one zone for pasting the compound ingredients and another where the dust rings seal the mixer chamber. Lubrication points are fed from a high-pressure oil pump and the quantity of oil can be adjusted individually for each lubrication point. Safety valves protect against excess pressure.

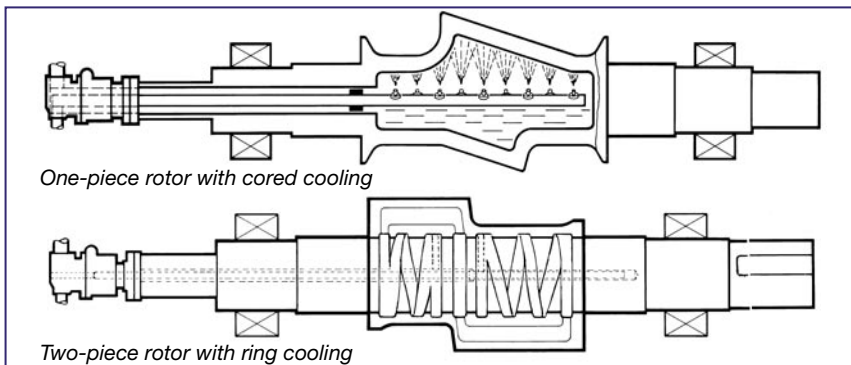
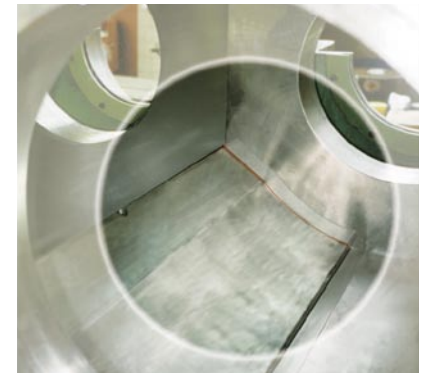


Dust stop sealing WYH



Durable, crack-free hard coating

For wear protection we use a special hard coating alloy we developed in-house. Our hard coating has a particularly homogeneous microstructure, uniform thickness, high tensile strength and very high corrosion resistance. Surface hardness is over 50 HRC.



Highly effective cooling – into the rotor wing tips

The adjustable constant cooling systems used on our high performance internal mixers ensure low compound batch temperatures and therefore provide ideal conditions for effective mastication, carbon black dispersion and problem-free final mixing. The rotor cooling channels extend up into the rotor wing tips. The unique 2-piece rotor design enables the construction of a rotor with high transverse strength and optimal wall

thickness for effective cooling. Thus the thermal control of the rotor is excellent (Supercooled®). The crack-free hard coating of the mixing chamber halves makes it possible to position the cooling channels near to the inside surface of the chamber, while the design of the cooling channels guarantees high water throughput and fast heat dissipation. The ram and drop door are also fitted with generously sized cooling systems.

Leak-free Drop door

The drop doors on our mixers are designed to seal the bottom of the mixing chamber with a positive fit. Internal mixers to the original Werner & Pfleiderer design provide a positive fit between the door top and the rotor end plates as well as the chamber sides. It is therefore impossible for compound ingredients or plasticizers to escape. The drop door top is hard coated where it comes into contact with the compound, has drilled cooling channels and can be easily replaced.

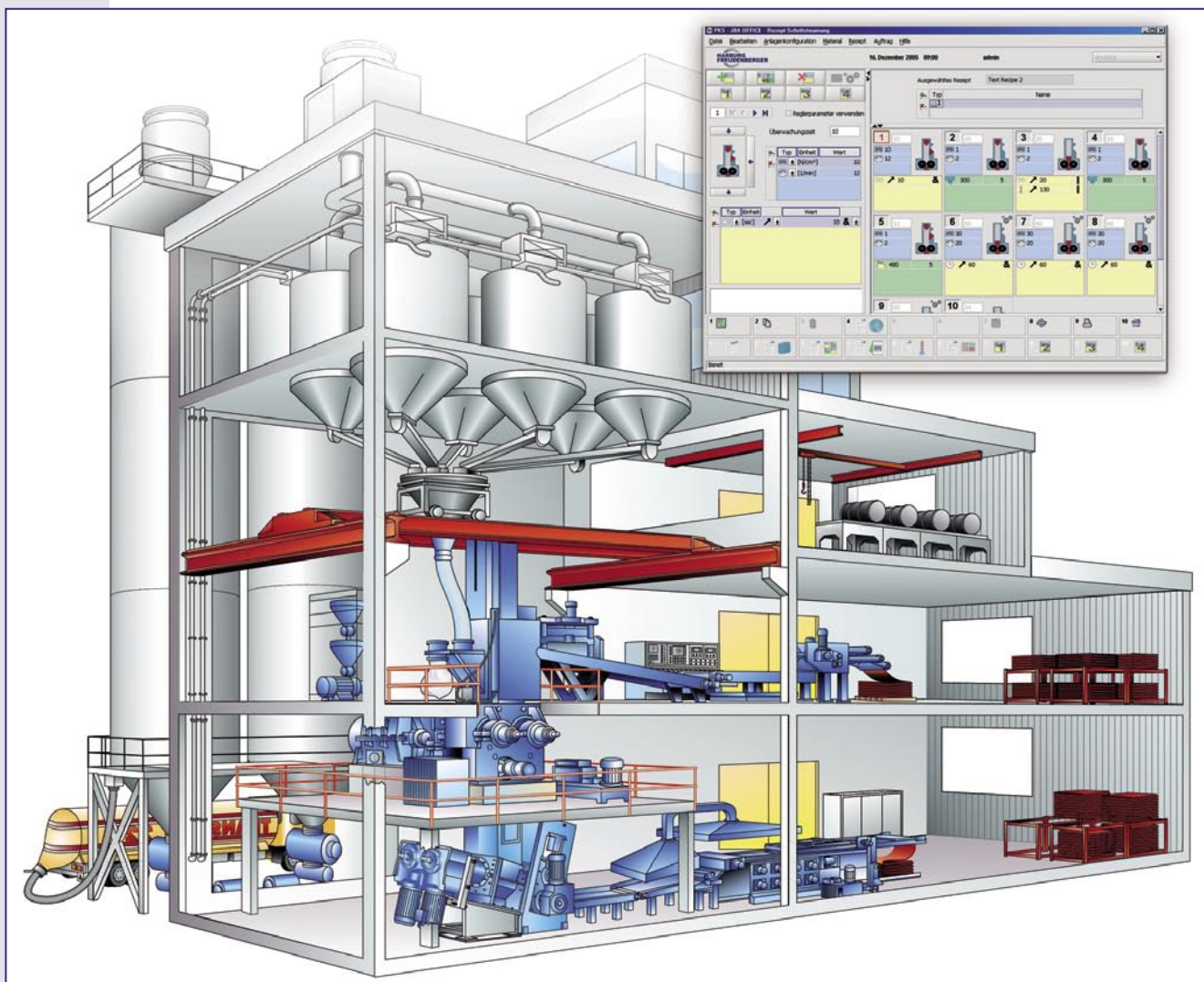
Mixing lines

Complete mixing room systems – from a single source with complete security

Within our complete mixing room systems we guarantee that all the individual elements and subsystems are perfectly matched, from the raw material intake to the discharge of the finished sheet, pellet or granulate.

In this way all interfaces between the instrumentation and control equipment are guaranteed to be problem-free.

What is more, we are here to help at every stage of your project. In the preparatory phase we can draw up a complete investment plan that includes flow diagrams depicting the overall system, as well as profitability analyses and feasibility studies. By carrying out much of the basic engineering and detailed engineering at the same time as we draw up your project study, we can provide a clear view of the scope of our services.



Our computer-based project management system keeps deadlines and costs under tight control throughout the term of the project. Our experienced process engineers are on hand during the commissioning of your new facilities and also when you move into production.

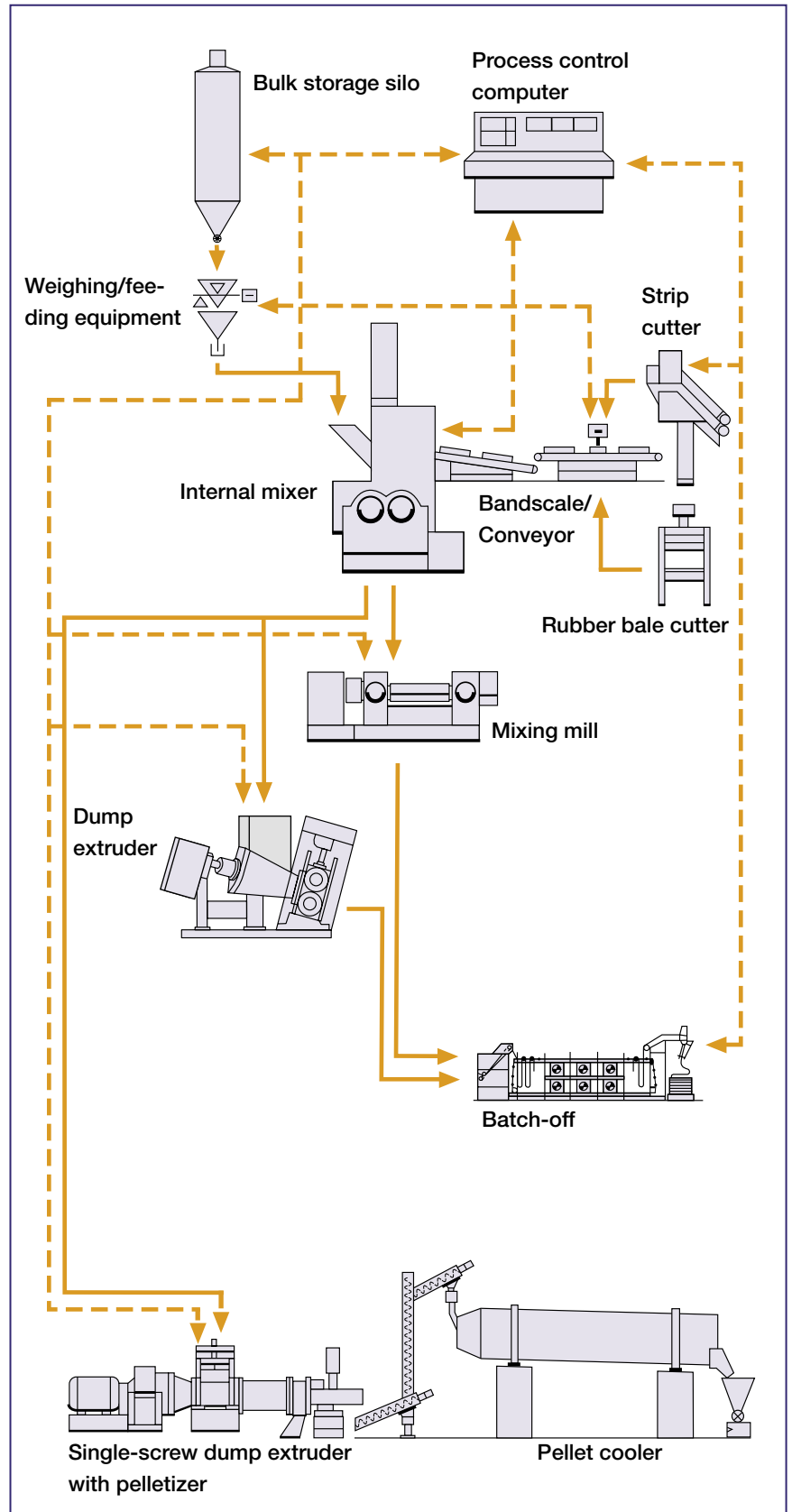
The strength of the rubber mixing division in Freudenberg, lies in the design and construction of complete mixing room systems, from raw material intake to the finished sheet, pellet or granulate.

With optimally matched individual elements, the most modern microprocessor process controls and integrated quality control, we guarantee constant reproducible quality, combined with flexibility and high productivity.

For decades the rubber mixing division in Freudenberg has enjoyed the confidence of rubber mixing experts from around the world because of the quality of this service.

This is not least because we can supply complete mixing lines “from one source”. These are based on our experience as a single supplier, with the crucial know how in all aspects of planning and equipping complete mixing rooms to the most modern standards.

You can make use of this unique “from one source” concept to ensure the success of your project and the efficiency of your production. Please contact us to obtain further information.



Tandem technology

Central to the tandem concept is the direct transfer of the compound from an upper, conventional, internal mixer into a lower mixer with no ram, the tandem mixer.

The advantage of this method of mixing is that the mixing process in the upper machine can be optimized specifically for the production of a master batch or base compound. This involves mixing with a high specific energy input to obtain the best filler dispersion. Here the ram can be used effectively to press the compound into the area between the rotors to increase the shear forces to which it is subjected.

The high specific energy input quickly raises the temperature of the compound, which in turn heats up the walls of the mixer to a high temperature. In a conventional mixer the cross-linking chemicals cannot be added directly into the mixer at this point. Processors can solve this problem by using a multi-stage mixing process, or by reducing the rotor speed, which reduces the temperature increase but extends the mixing time, or in some cases by introducing cooling phases during the mixing cycle, i.e. cooling the compound in the mixer at reduced rotor

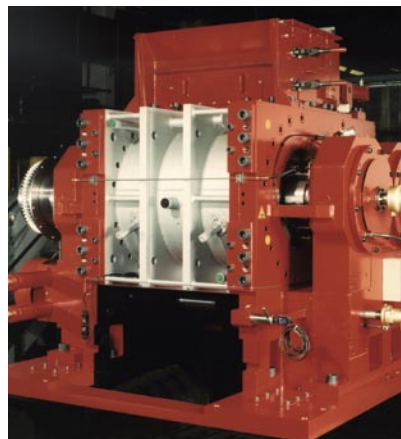
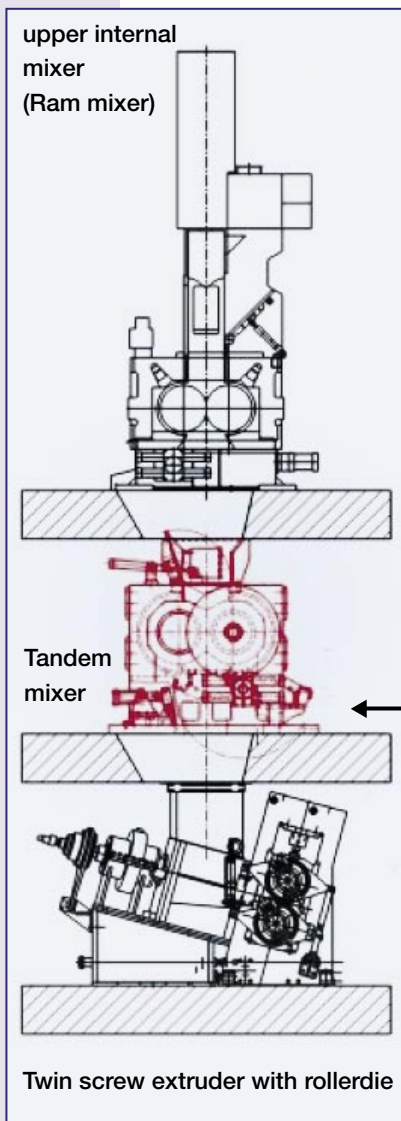
speed. Each of these solutions costs time and thus lowers productivity.

In the tandem mixing process, the compound is discharged from the upper mixer directly into a significantly larger machine. The higher volume of this tandem mixer and its large surface area relative to the batch volume of the compound allows the latter to cool down very quickly.

The cross-linking chemicals, added either in the final phase of base compound mixing or fed directly into the tandem mixer, can then be mixed in effectively in the lower machine. As mixing is performed in parallel in the upper and lower mixers, the same time is available for mixing the finished compound as for mixing the base compound. The ability to optimize the design of each unit for its specific purpose provides the potential to reduce mixing times compared to other conventional mixing techniques.

The tandem mixing technique eliminates the need for multi stage mixing and therefore master batch stocks and storage. In many cases the capital released in these areas is enough to finance the tandem mixer.

The throughput of the mixing line can be increased by up to 100%.



Peripheral equipment



Laboratory Internal Mixers

Decades of experience in the design and construction of laboratory mixers ensure a high degree of operational reliability and durability. These mixers have proved themselves with excellent performance in daily application in laboratory use.



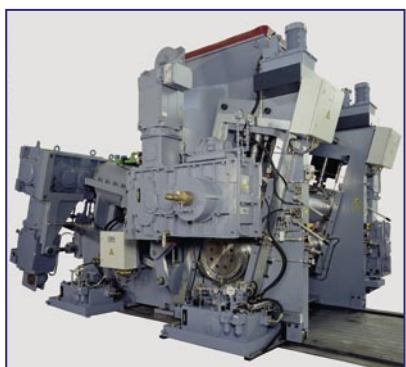
High performance Mixing Mills

Our range of high performance mixing mills offers a suitable downstream option for any internal mixer, or for more special open mill mixing applications.



Rubber bale cutter

The hydraulic rubber bale cutter cuts the bales of synthetic or natural rubber into smaller pieces, enabling easy and exact polymer weighing in line with compound recipe requirements.



Dump extruder

Our dump extruders are precisely matched to our internal mixers, offering high-quality, low-cost downstream processing with a variety of shaping possibilities.



Strip cutting machine

Producing various sizes of strip, slabs and continuous sheet, to feed cold-feed extruders, mixer loading conveyors or pre-heating mills.



Electrical control

Equipped with the most modern electrical components and modules, our electrical control systems are tailor made for the mixing room and feature precise functioning, high operational reliability and clear logic.

Harburg-Freudenberger

We develop, build and distribute machines, lines and systems across our three company divisions based on 150 years of company tradition.

Rubber mixing technology

We provide the most comprehensive range of machines for the rubber and caoutchouc industry including all major preparation and processing stages.

- Complete mixing room systems
- Internal mixer
- Mixing mills
- Dump extruder

Caoutchouc technology

Production machines and lines for the manufacture of tires and technical rubbergoods from raw material feeding to vulcanisation:

- Extruder
- Extrusion lines
- Tire building machines
- Curing presses

Edible Oil Technology

Machines for processing oilseed, crude oils of vegetable origin and animal raw materials as well as screw presses for the dewatering of synthetic caoutchouc and similar products:

- Screw presses
- Extraction lines
- Refining lines
- Process engineering

We are always at your service

With our foreign offices and our service points we have a global presence.

If you would like to learn more about Harburg-Freudenberger or if you require information on specific services, please do not hesitate to contact us.



Harburg-Freudenberger Maschinenbau GmbH
Gummimischtechnik
Asdorfer Straße 60 • 57258 Freudenberg • Germany
Postfach 11 80 • 57251 Freudenberg • Germany
Tel.: +49 2734 491 - 0 • Fax: +49 2734 491 - 150

Harburg-Freudenberger Maschinenbau GmbH
Kautschuktechnik • Speiseöltechnik
Seevestraße 1 • 21079 Hamburg • Germany
Postfach 90 05 52 • 21045 Hamburg • Germany
Tel.: +49 40 771 79 - 0 • Fax: +49 40 771 79 - 325

Hamburg-Harburg Freudenberg Belišće Topeka Akron Paris Teheran Moskau

www.harburg-freudenberger.com