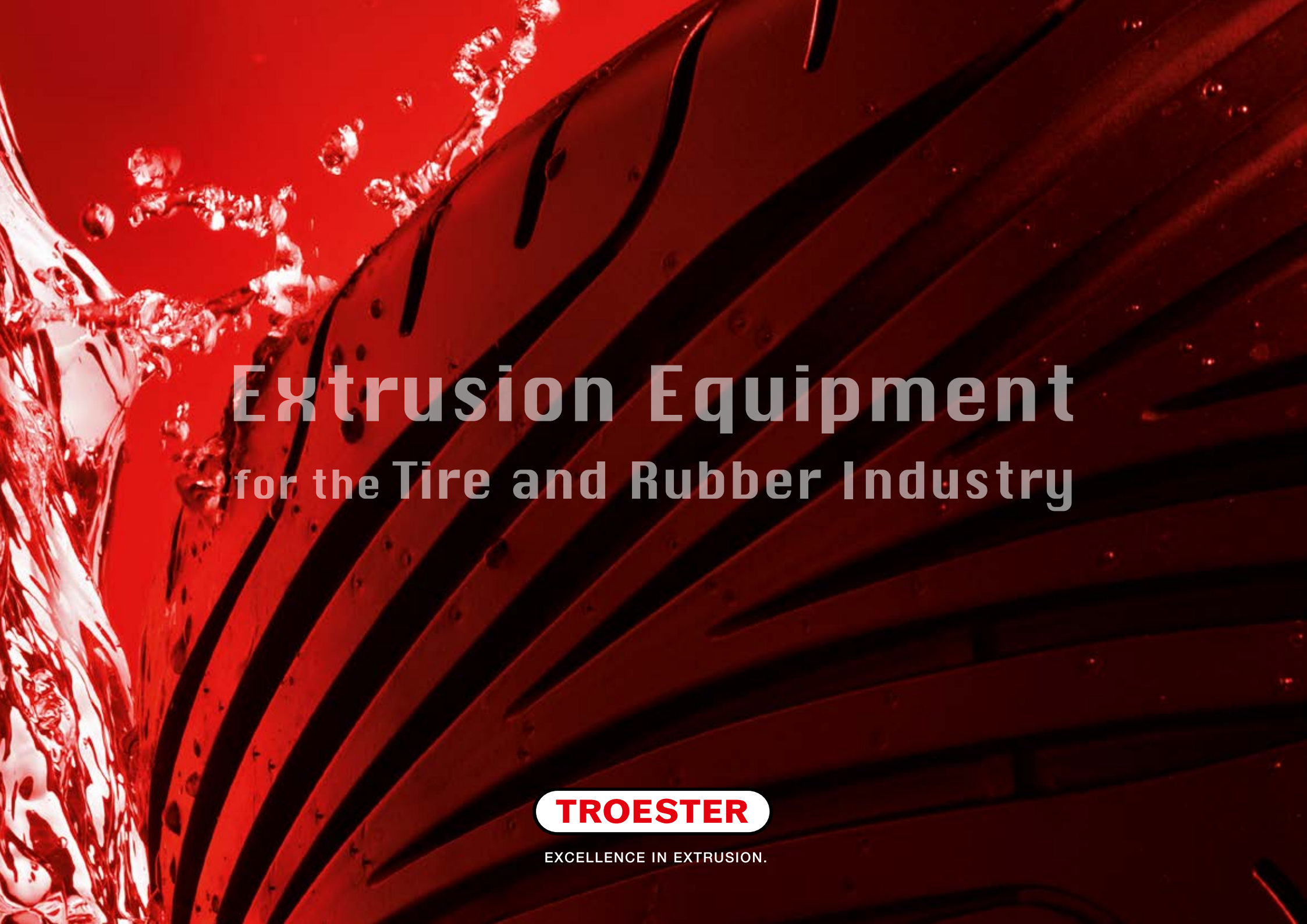




Extrusion Equipment

for the Tire and Rubber Industry

TROESTER

EXCELLENCE IN EXTRUSION.

Extrusion Equipment for the Tire and Rubber Industry

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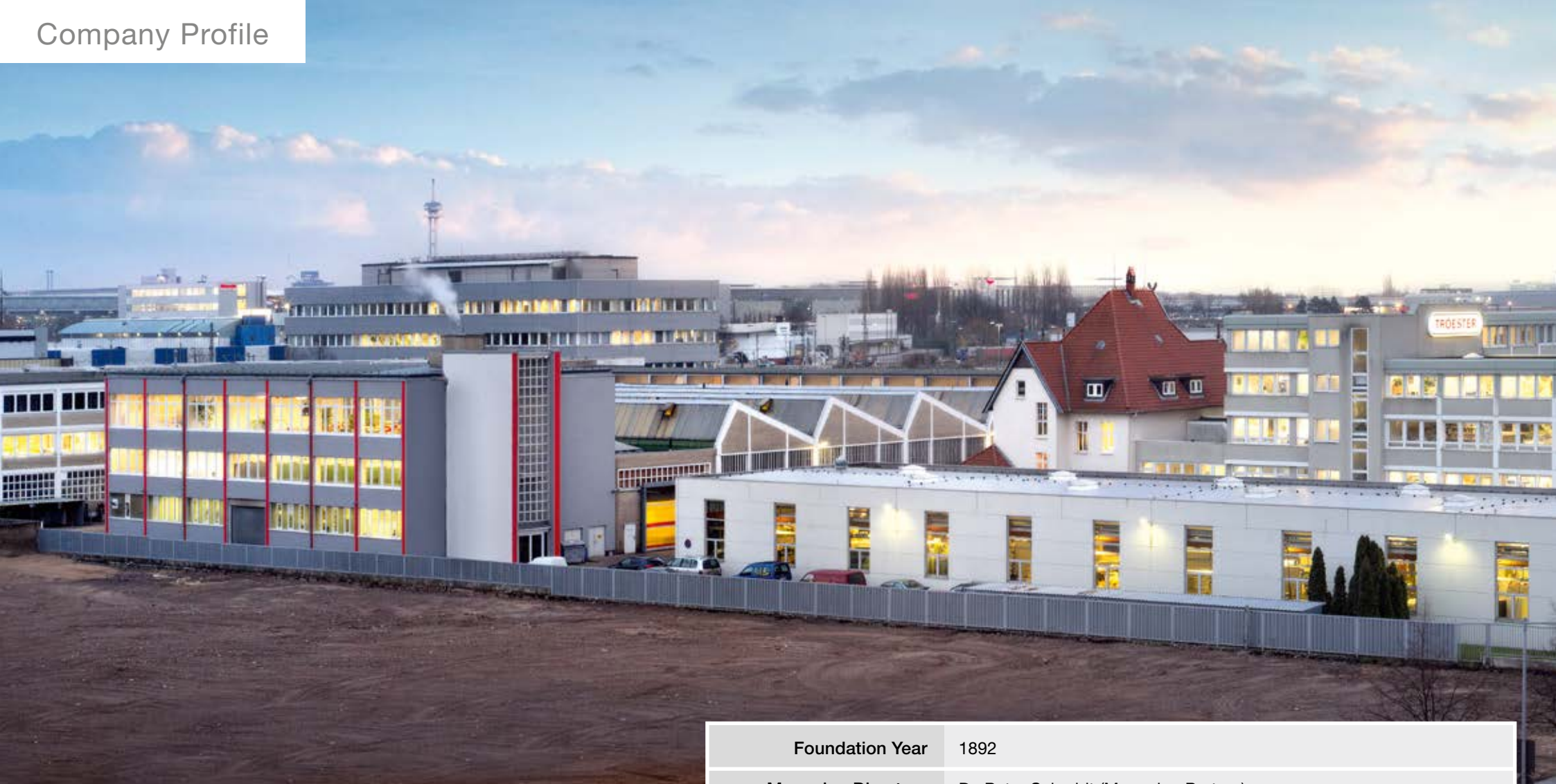


»We are what we repeatedly do.
Excellence, then, is not an act but a habit.«

Aristotle (*Greek Philosopher, 384 - 322 BC*)



EXCELLENCE IN EXTRUSION.



Foundation Year	1892
Managing Directors	Dr. Peter Schmidt (Managing Partner) Dipl.-Ing. Bernd Pielsticker
Staff	approx. 500 employees in R&D and manufacturing, mechanical and electrical design and administration
Subsidiary Companies	TROESTER Machinery, Ltd./USA TROESTER Machinery (Shanghai) Co., Ltd./PR China X-Compound GmbH, Switzerland
Representative Offices	in Russia and France
Representations	in over 40 countries



Excellence in Extrusion

In 1892, the engineer Paul Troester struck upon the innovative idea of building machines which could process unvulcanised rubber and guttapercha. He thus laid the foundation for a name which is world-renowned and synonymous for technological advancement, quality and outstanding performance in the fields of rubber and plastics processing.

The essential feature of all machines and lines built by TROESTER is their superior process technology. Highly qualified development engineers design efficient extrusion lines with a long service life. The latest production processes for the manufacture of tires, profiles, tubes, automotive rubber goods and cables require customized system technology. TROESTER develops efficient machine and equipment control systems which flexibly employ the hardware components of leading manufacturers.

TROESTER developments will continue to set the milestones for rubber and plastics processing in the future. In doing so, we are committed to the growing demands for quality, efficiency and environmental compatibility.





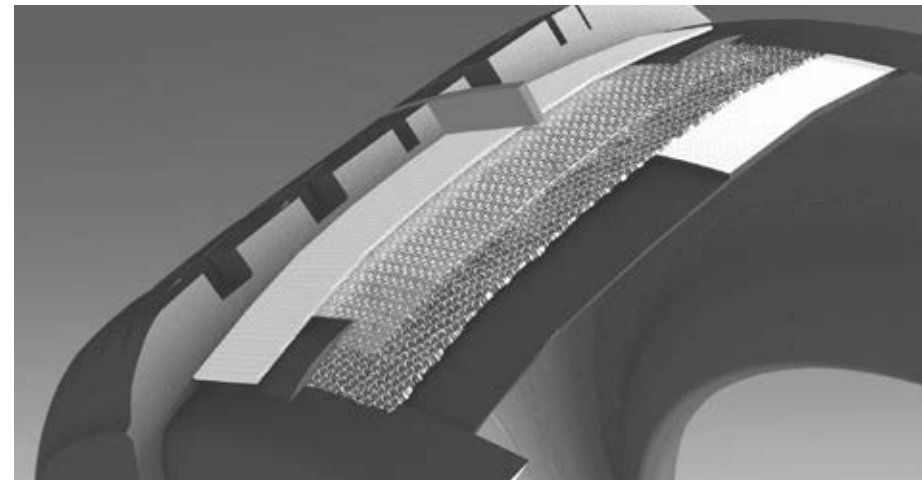
Lines for Manufacturing Tire Components

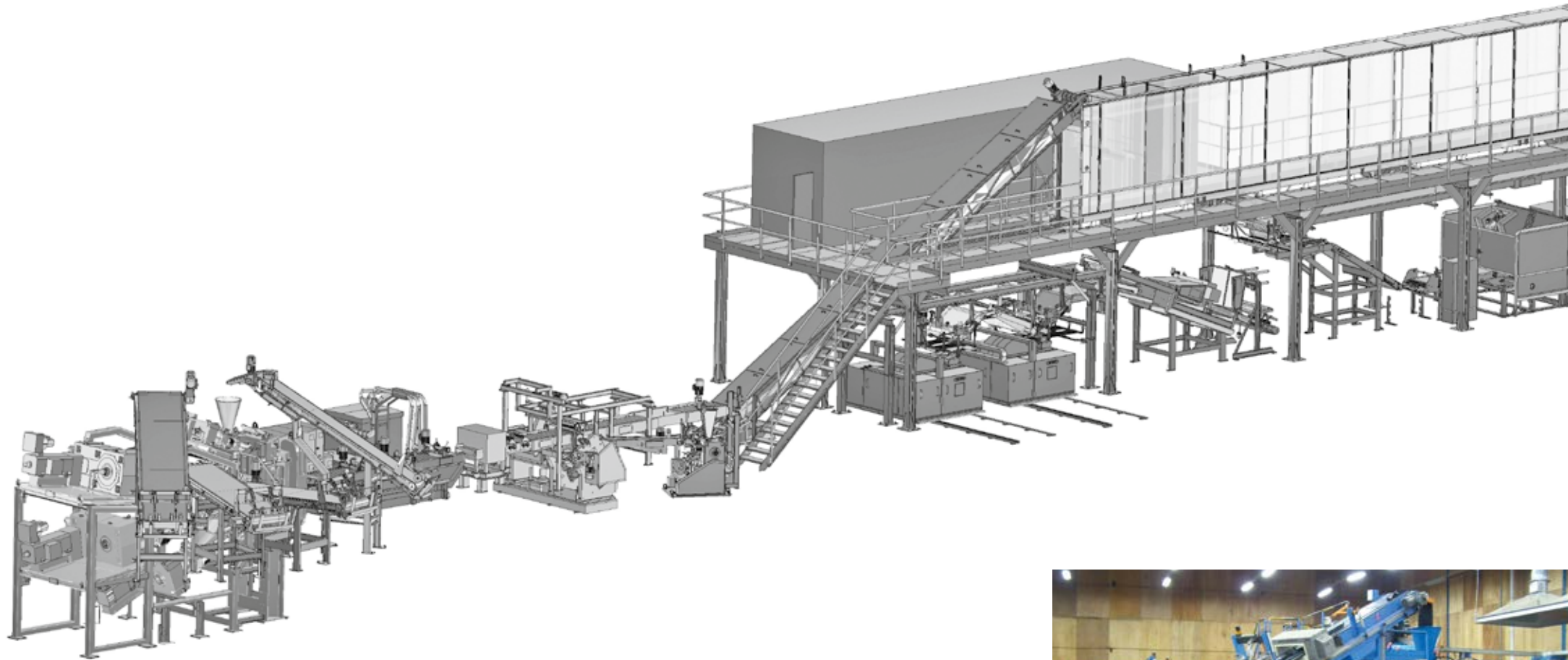
Tire manufacturers all over the world rely on TROESTER's Expertise and Experience. Wide ranging innovative and continual technical development have enabled TROESTER to become one of the world-wide leading manufacturers of complete extrusion lines for the production of car and truck tire components.

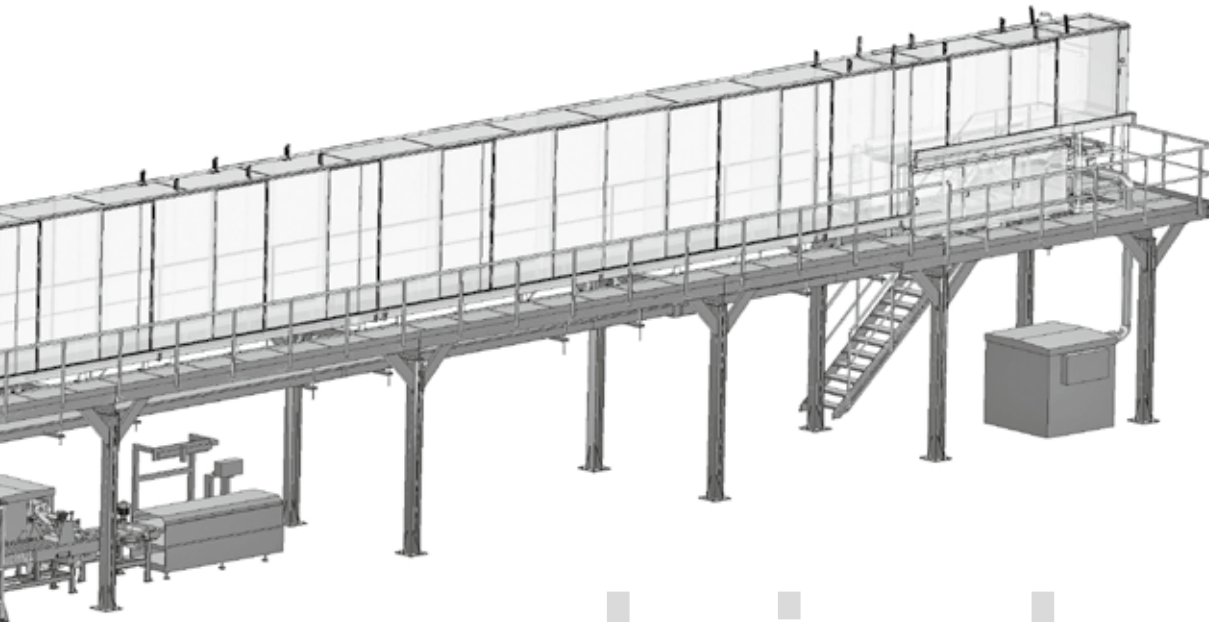
Compared to the lines made from individual machines, complete tire-component lines from one supplier offer remarkable advantages. The control system is developed, designed and programmed in-house by using the latest available electrical components. All specifications are considered according to the individual needs of the tire manufacturer. During the whole project the customer only has one contact partner, who also coordinates transport, installation and commissioning: TROESTER.

This solution also offers advantages for the finished quality of tires. Car and truck tire components which are produced on TROESTER lines are characterized by high dimensional accuracy as well as extremely small positional tolerances between the individual components.

Even when it comes to the development of new products, TROESTER offers our customers comprehensive know-how and the solid reassurance associated with "Made in Germany".

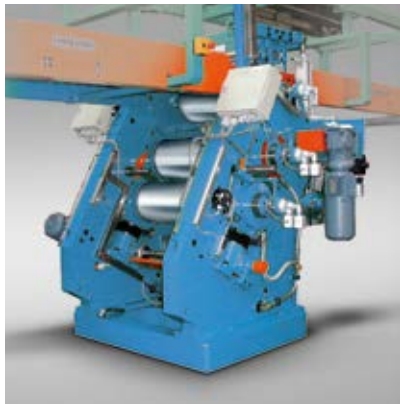


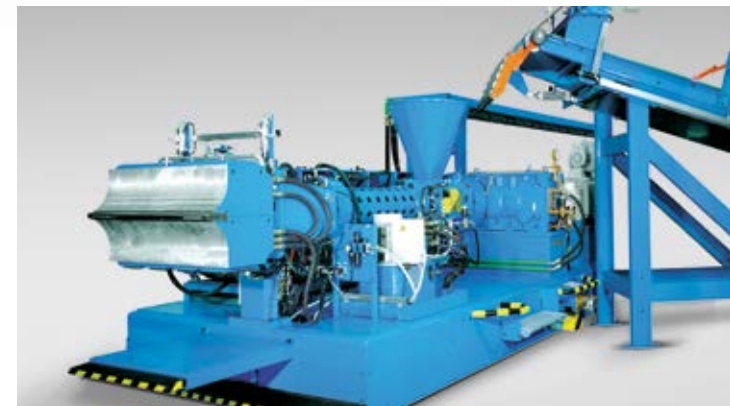
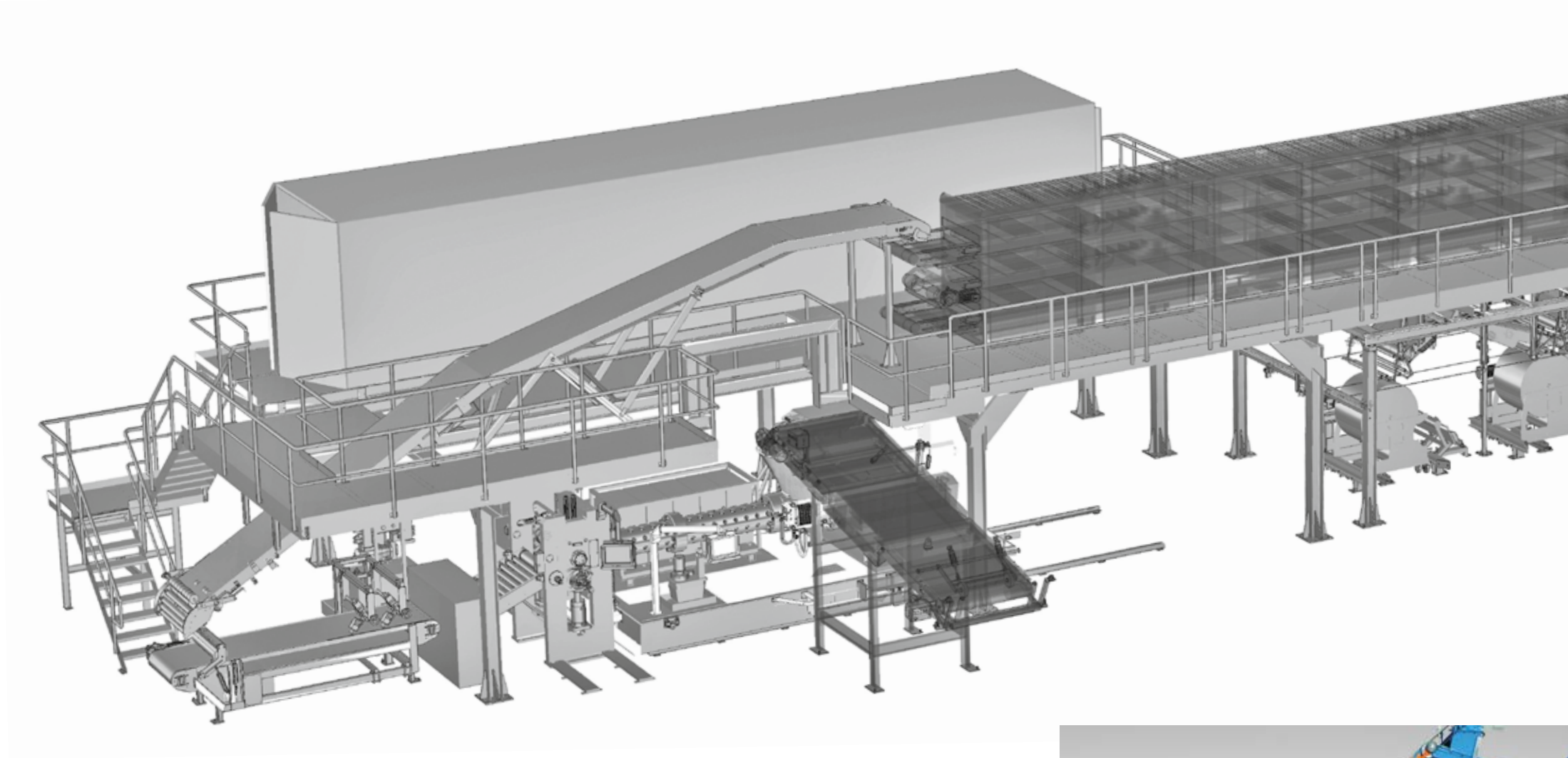


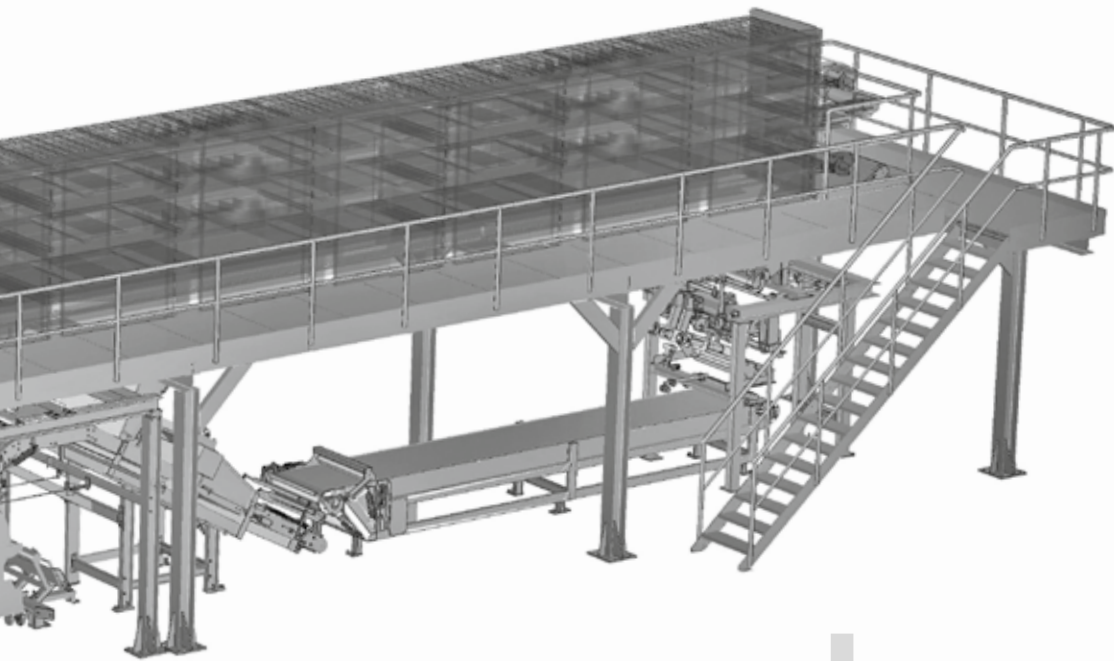


- > High speed line (e.g. 45 m/min for tread, 60 m/min for sidewall)
- > Take away conveyor with shock cooling for sidewall components
- > E-house container on mezzanine
- > Special water treatment
- > Optimized material flow with winders close to the extruder area

high speed



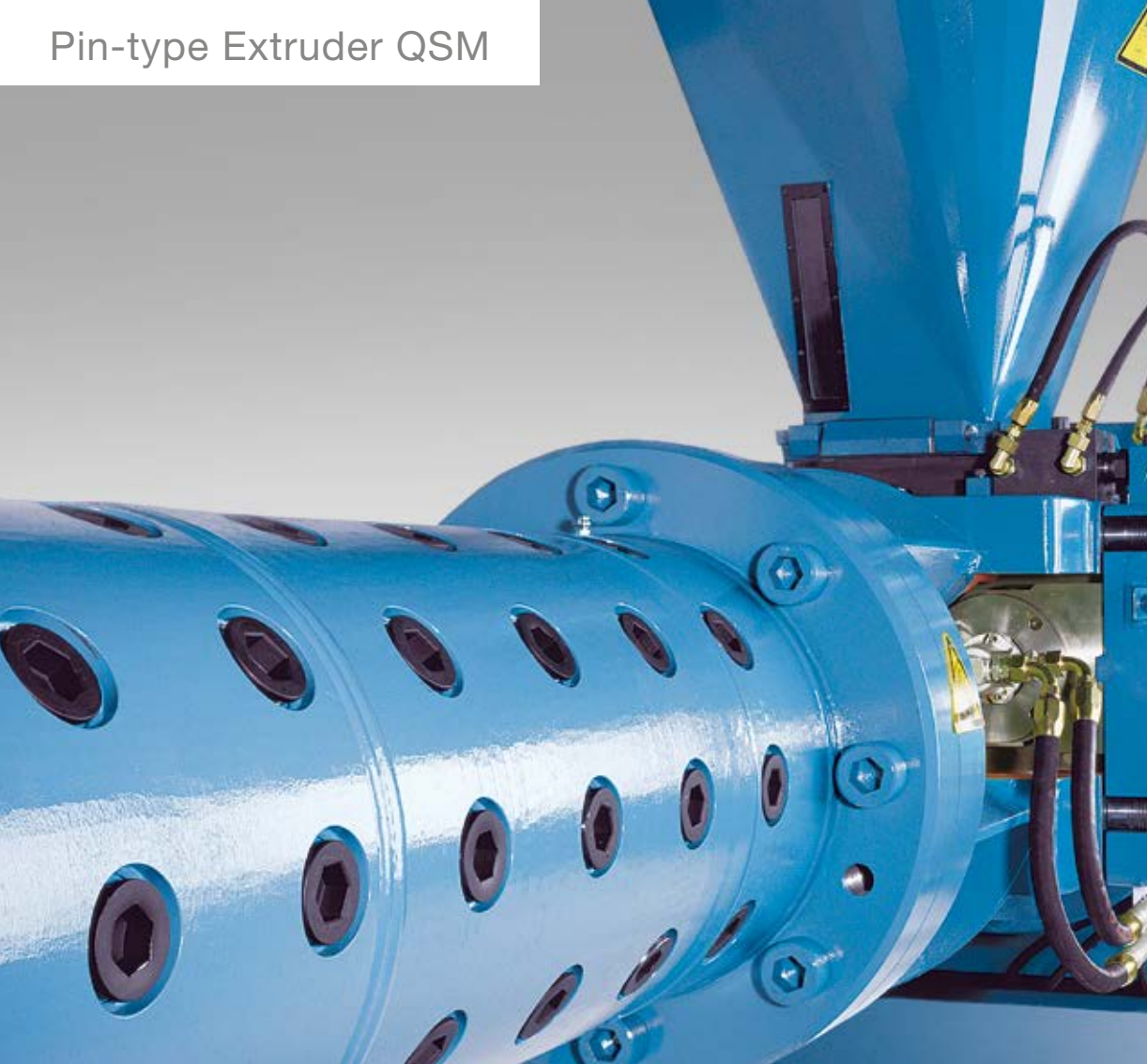




- > Up to 70 m/min. line speed
- > Minimized floor space
- > Automatic calender sleeve change
- > Closed loop forced air cooling
- > High energy efficiency
- > Cold edge cutting
- > E-house container on mezzanine

air cooling





The QSM Extruder

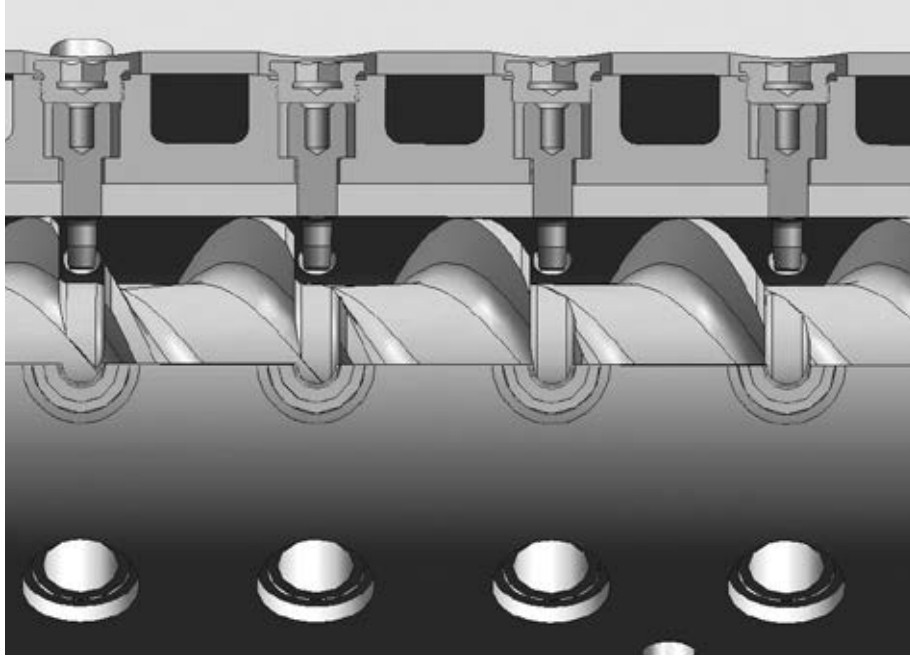
The QSM technology was substantially co-developed, in the mid 1970s, by TROESTER. The continuous development of this technology allowed tire manufacturers to extrude a wide range of rubber compounds, with optimum plasticization, without the need to change the extruder screw.

The QSM pins, which are inserted externally through the barrel wall, continuously divide the stream of rubber compound. This intensive continuous mixing achieves a thermally homogenised and gentle plasticization of the compound at a low temperature.

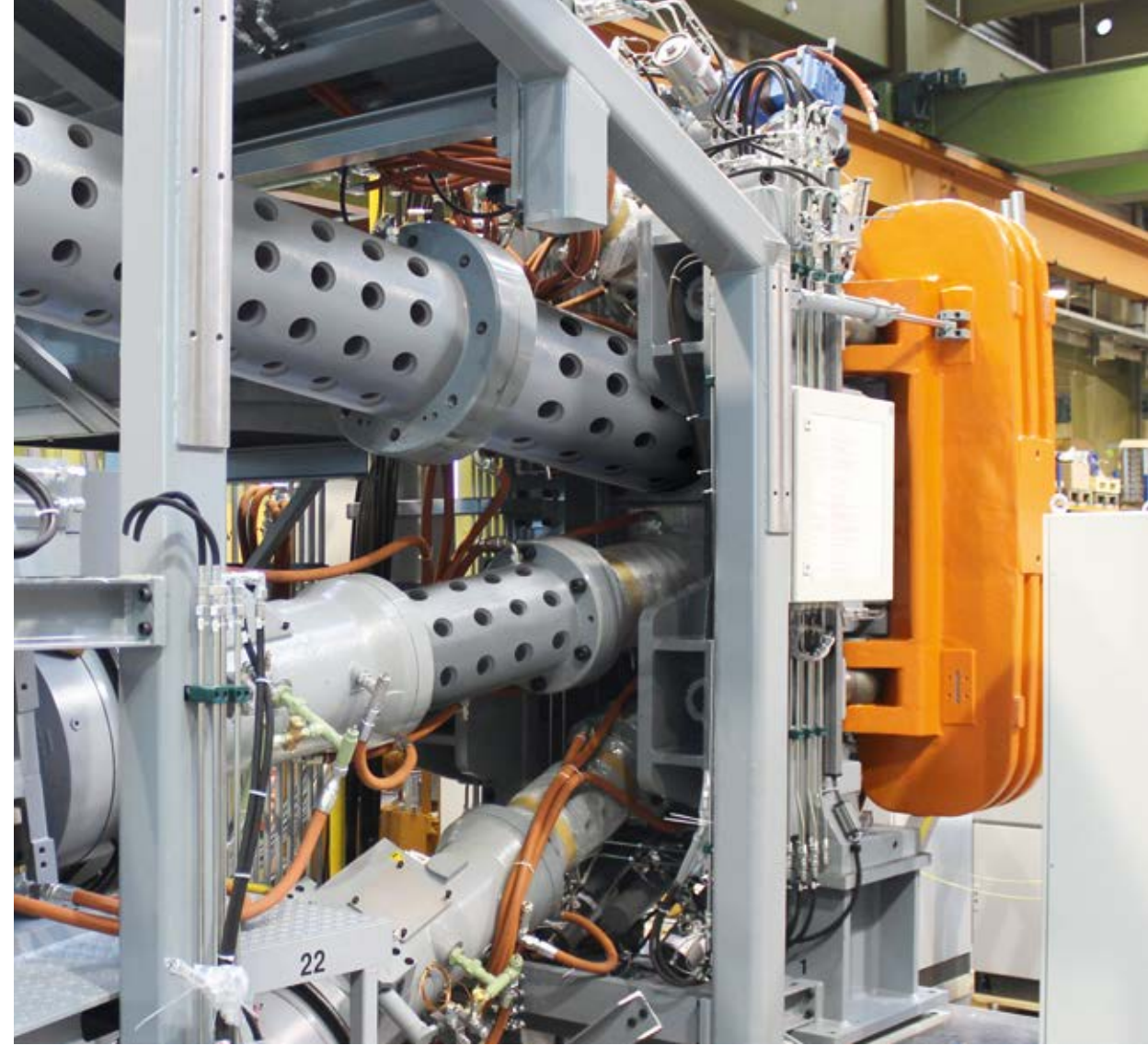
The screw of a QSM extruder is usually made from nitrided steel. In some cases, where required, special steels are also used. When processing particularly abrasive compounds, that cause excessive wear on the outside flight tips, a special hard coating can be applied. TROESTER also has special screw coatings in its delivery programme.

The QSM Extruder at a Glance

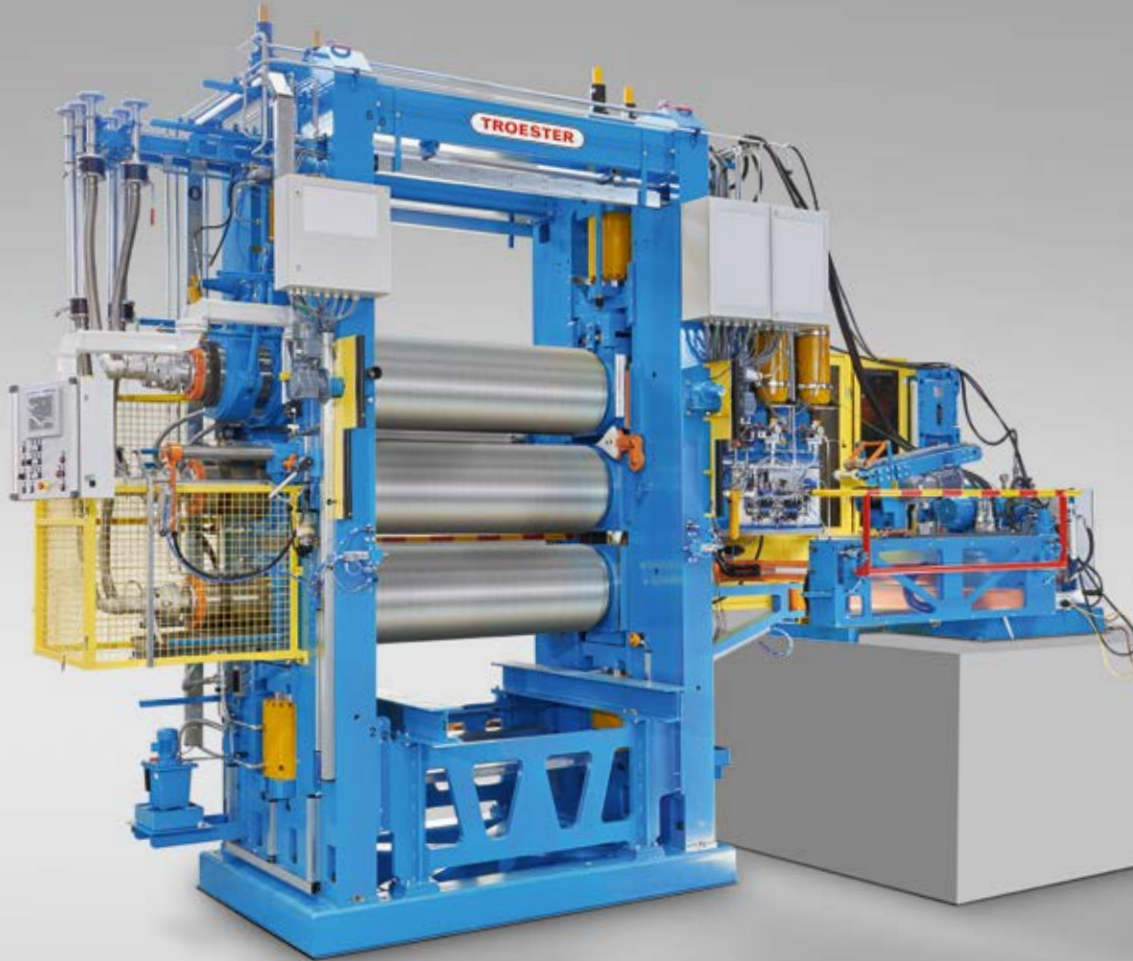
- > Universal for all rubber compounds
- > High throughput, whilst maintaining optimum production quality and extrusion temperature
- > 60 – 300 mm screw diameters
- > Self-cleaning
- > Also available as vacuum-version
- > Individual adjustment of the extruder performance by modification of the pin configuration



Schematic view of the cross flow mixing barrel



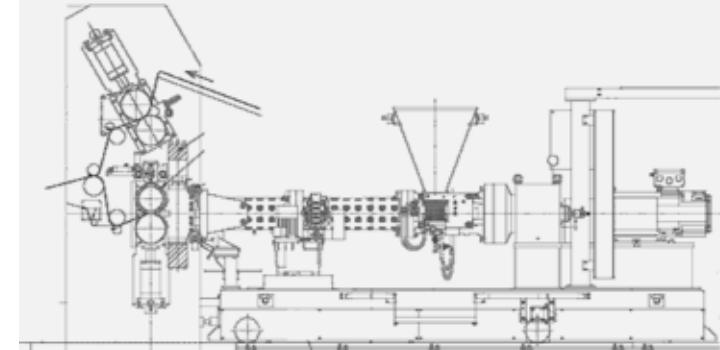
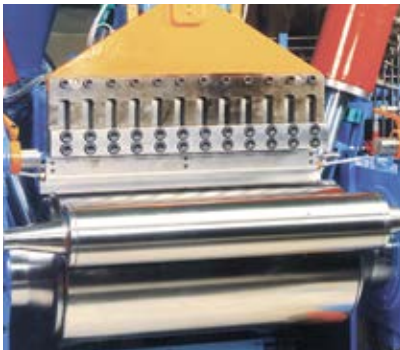
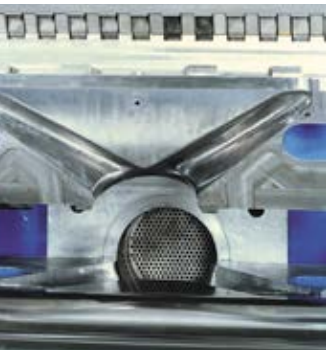
QSM compound cross section: flow division obtained by the pins of the pin-type mixing barrel

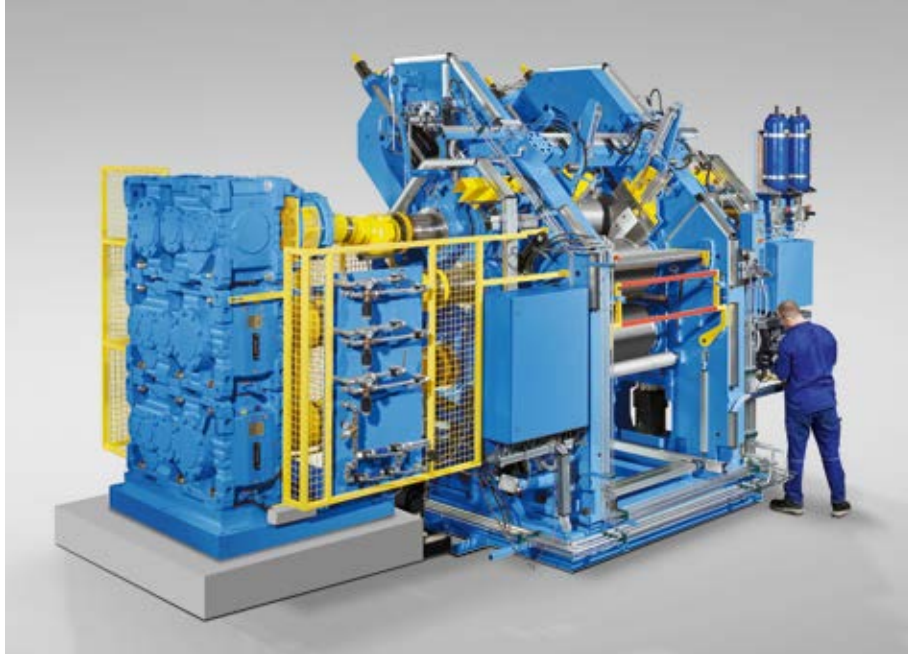


Roller-Head, Single-Roll Roller Die and Calender Systems

Roller-Head Systems

Roller Head Systems are typically used in tire industry to produce innerliner materials. As opposed to multi-roll calenders the rubber compound is fed through the roll gap directly from a wide base extrusion head to achieve porosity free rubber sheets/profiles.



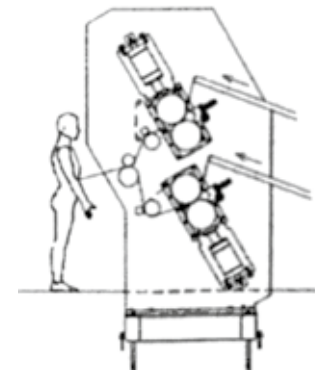
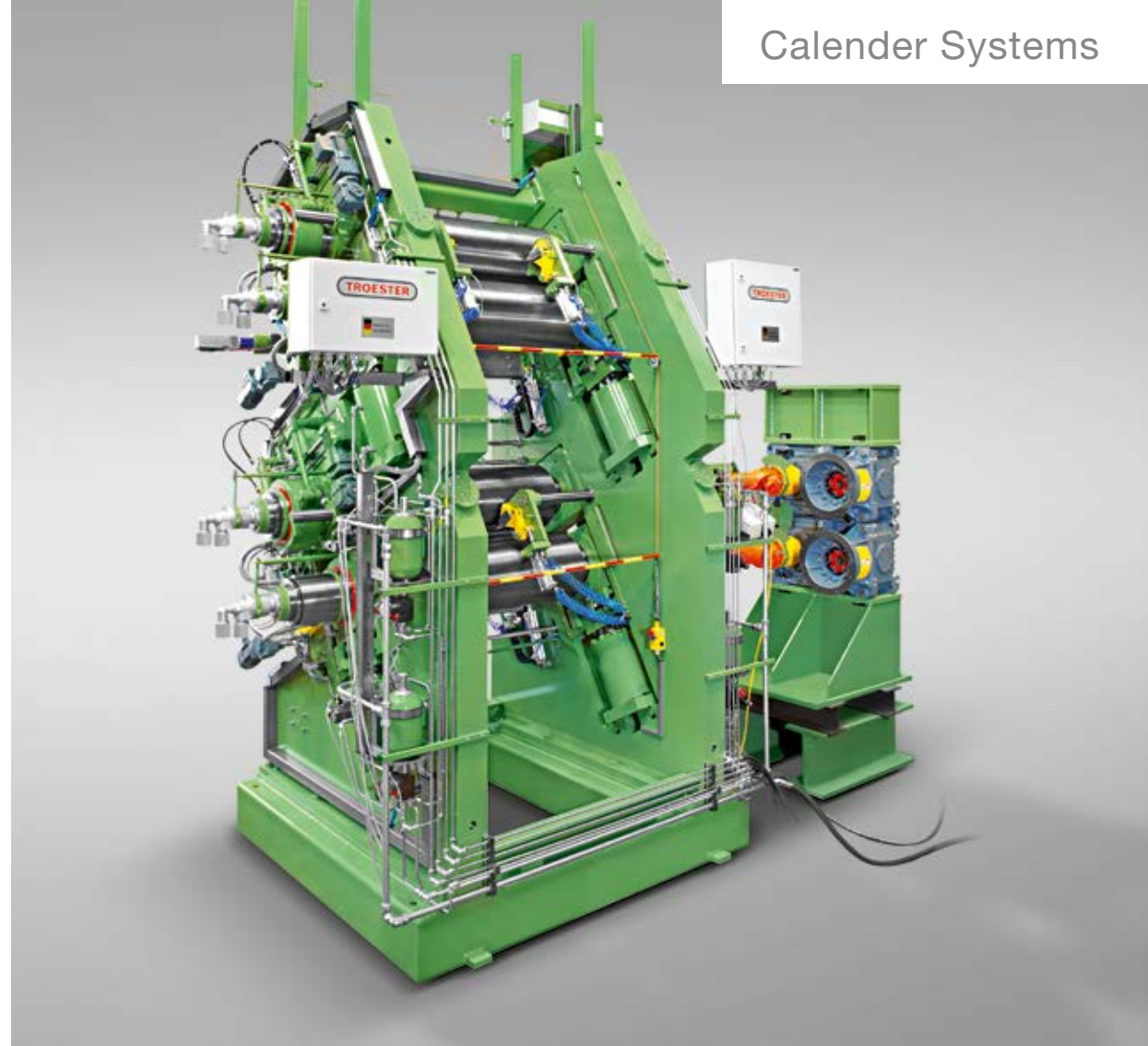


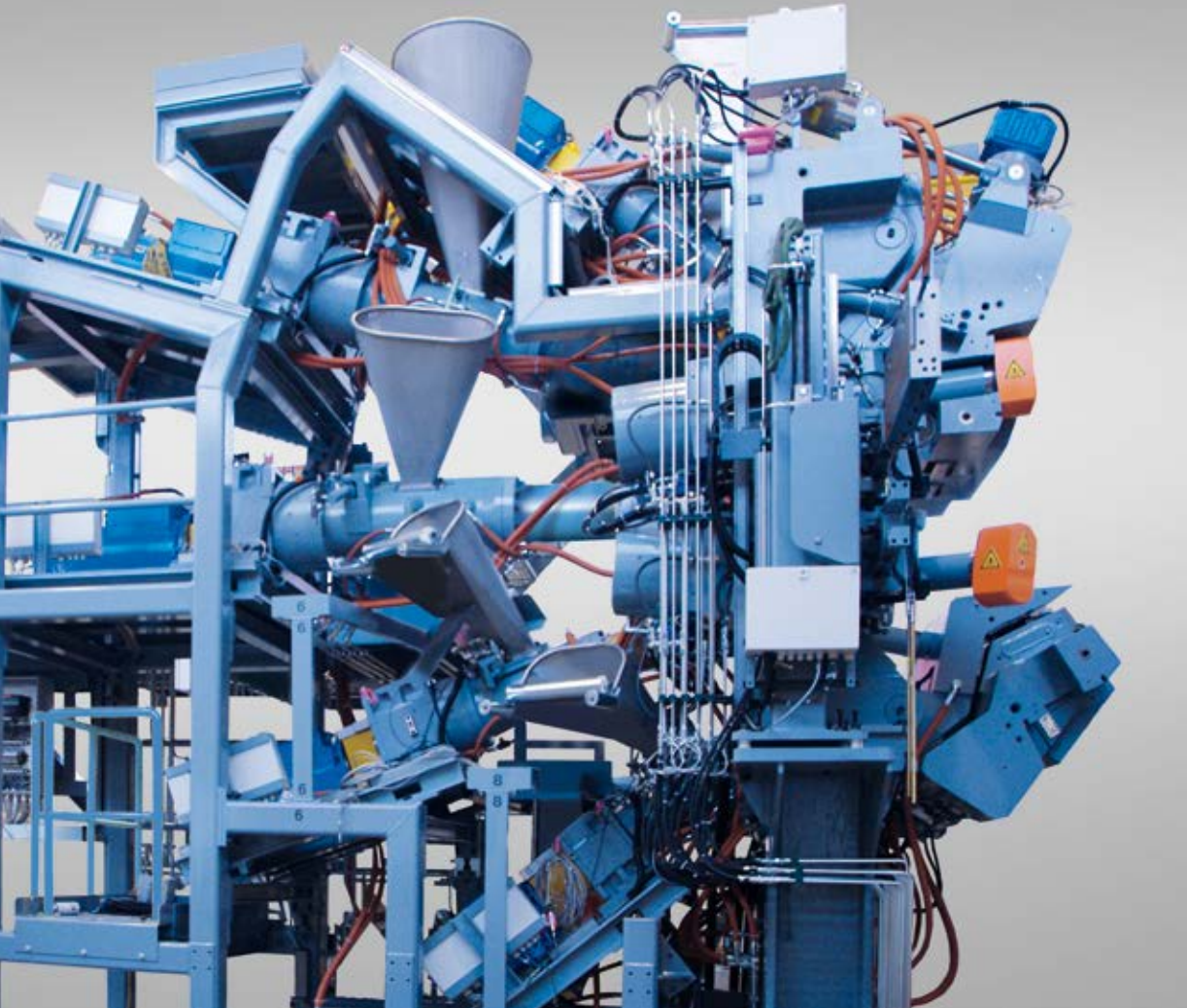
Single-Roll Roller Die Systems

The Single-Roll Roller Die System is a multipurpose system for various applications producing high-quality profiled rubber sheets, for example sidewalls, treads apex strips and innerliners.

Calender Systems

When producing high-quality articles made from rubber compounds, calenders play an important roll. Due to the variation of roll dimensions, the number of rolls and their arrangement, there are so many possibilities that it would exceed the scope of this brochure to thoroughly describe them all.





CoExtrusion

TROESTER offers a broad variety of CoExtrusion aggregates starting from extrusion heads with 2 extruders TROESTER CoEx® 2 up to multiple extrusion systems enabling the extrusion of up to 6 different rubber compounds with TROESTER CoEx® 5plus1.

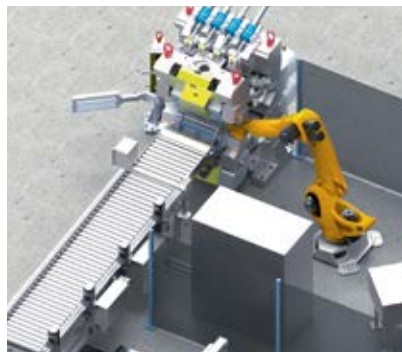
The portfolio includes the C-Clamp Head as well as the patented Hammer-Head and Y-Head all available in multiple opening sizes for optimum adaption to the customers' needs. The chosen clamping system depends on the requirements and on the individual production routine of the tire manufacturer.

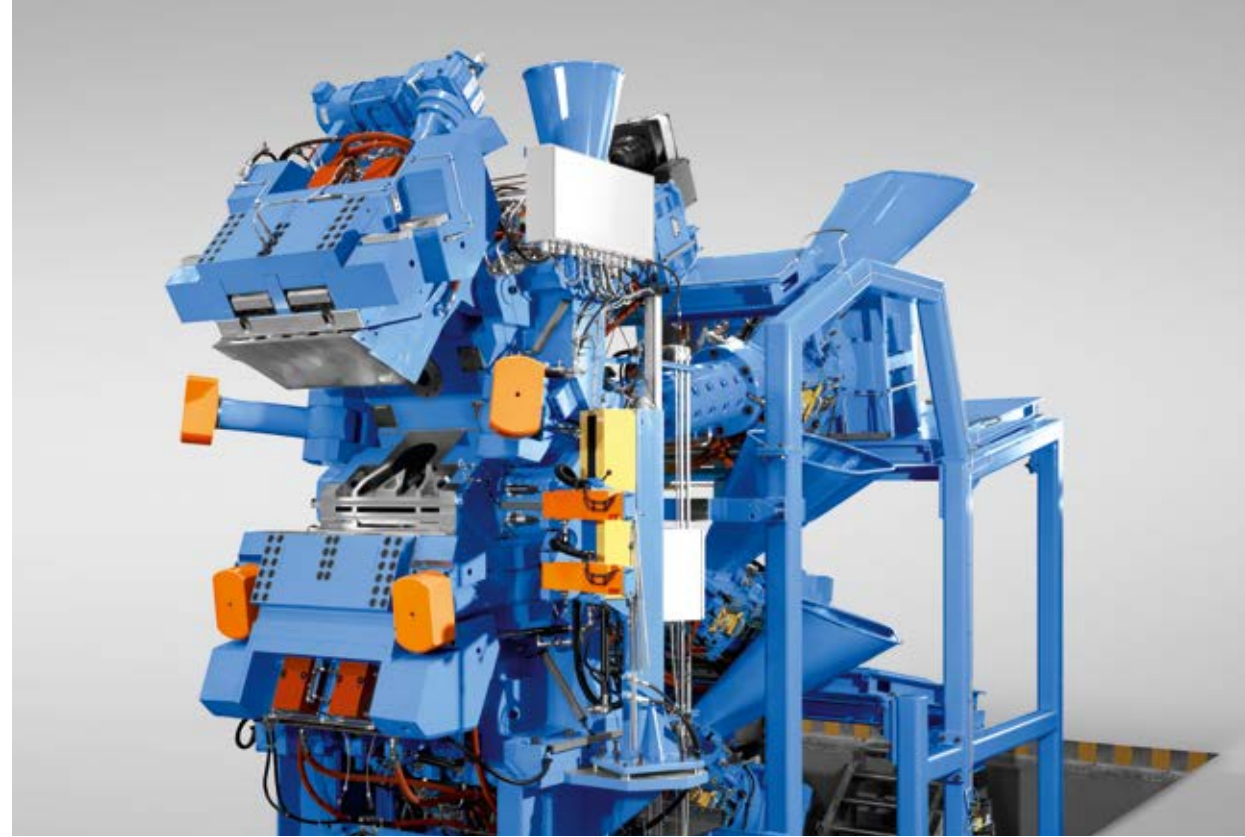
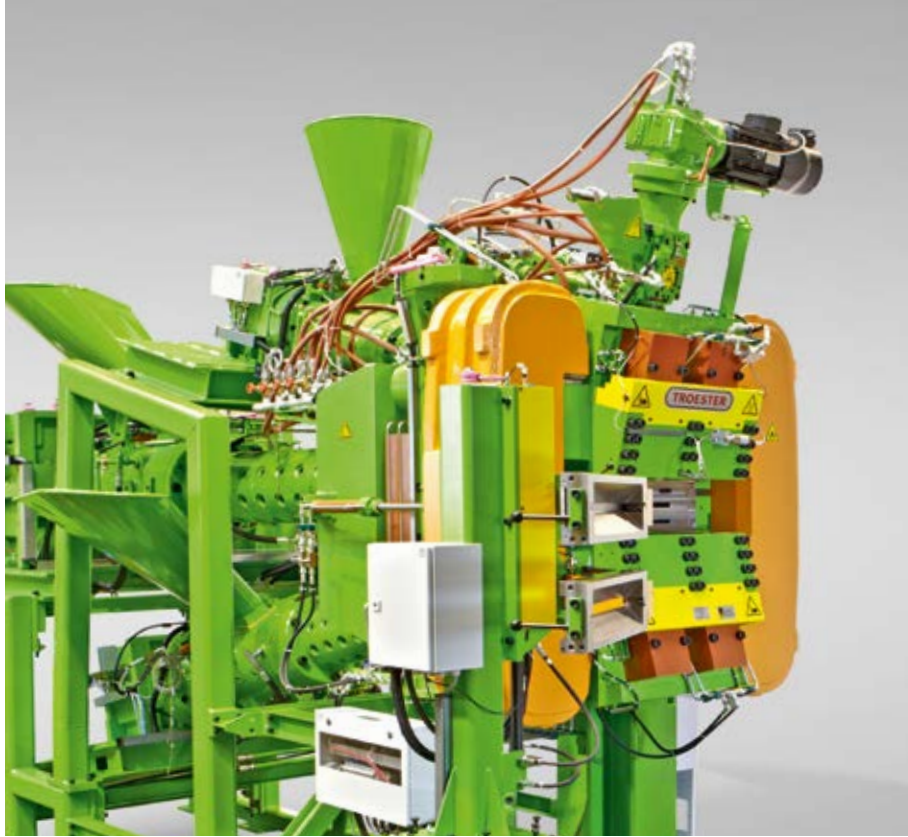
The flow channels are matched to the customers' individual requirements and their products with the use of Finite Element Flow Simulation. The flow history for the rubber in the head is analysed and adopted in order to achieve a constant swelling behaviour at the head outlet and a uniform flow.

The general goal is a material-independent flow channel design in order to allow an easier design of the subsequent flow-segments.

Besides an appropriate forming of the extrudate, the flow channels are designed with the lowest possible pressure consumption. This helps to reduce the compound temperature at the outlet and to increase the extrusion speed.

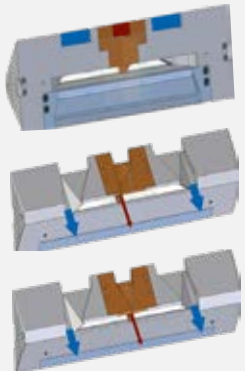
The features as a whole meet the demand of the tire industry for flexible manufacturing equipment to achieve a high productivity of the line at an increased variety of products with the best price/performance ratio.



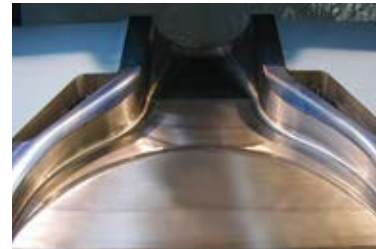


Design advantages

Chimney extrusion –
pre die (example)



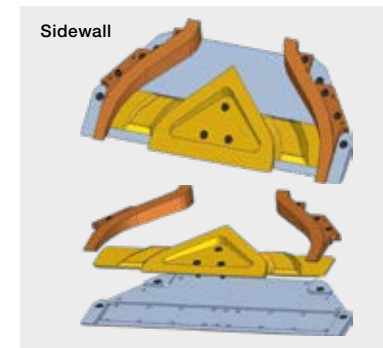
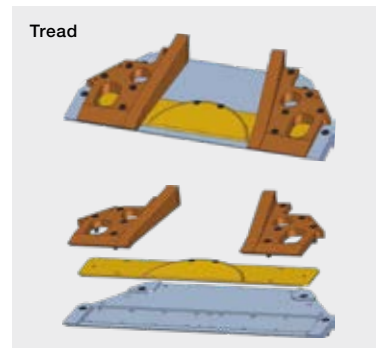
- > Proven technology adapted to the new design
- > No narrow channels or undercuts
- > One overlapping piece can be used for chimney and non-chimney profiles (only exchange of middle part required)
- > Exchangeable middle part for overlapping piece allows easy lateral positioning of chimney
- > Considerable production cost optimization by
 - minimizing the required number of extrusion tools
 - reducing the changeover times



Flow Channels

Single piece tools

Modular tools



Downstream Equipment



Downstream Engineered in Germany

The downstream of an extrusion line is an integral part of a successful extrusion line. The seamless interaction between extrusion unit and subsequent line components assure a high line performance including remarkable product tolerances at high line speed.

TROESTER has a broad and unique experience with tailor made extrusion lines. The more challenging the more thankful tire manufacturers are for the special skills of our engineering team. Together with our customers, we established several milestones in rubber extrusion in regard to line speed, accuracy, cooling and winding technology, etc.



Downstream Equipment Portfolio

- > Take away and shrinkage conveyors
- > Bottom and/or edge cementing
- > Cooling technology
- > Auto-threading
- > Product assembly
- > Cross skiver
- > Tread cutter
- > Winding technology with cassette handling devices
- > Booking technology
- > Measuring systems
- > Line control





Equipment for Manufacturing Profiles, Hoses and Industrial Rubber Goods

Permanent technical further development in collaboration with TROESTER customers from all over the world provides a security for economically working machines and lines that stand out for their excellent product quality.

Equipment for the manufacture of profiles, hoses and other technical rubber goods offer these advantages. From the design work to the manufacture and transport to the installation and commissioning there is a competent partner for this kind of equipment: TROESTER.

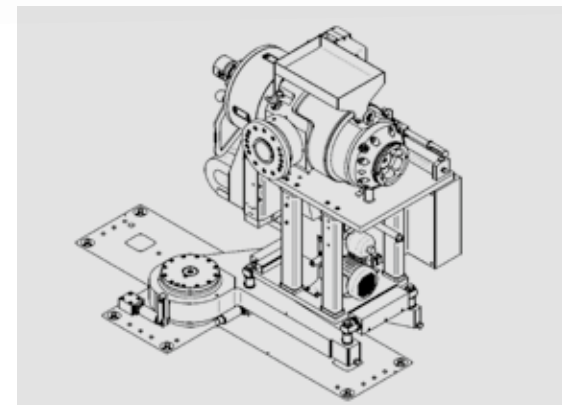
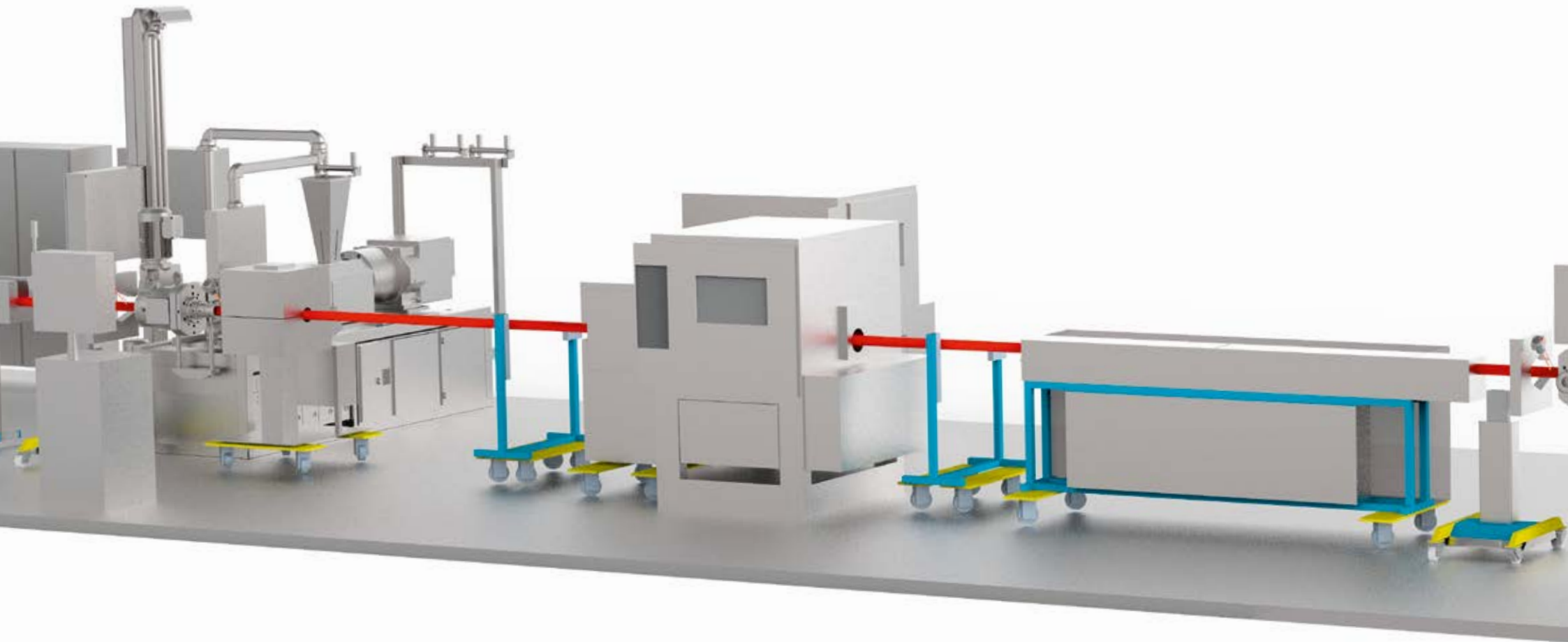
The large number of worldwide installed equipment for tubes and profiles as well as the great customer satisfaction with TROESTER as supplier has of course many more reasons. For example the superior process technology resulting from the development of efficient machines and lines with a long service life. Further the perfected system technology for machine and line control play a decisive roll. Another criterion is the qualified TROESTER service and support which provides customers with the exact support required, enabling them efficiently to produce high-quality rubber goods after the starting phase.

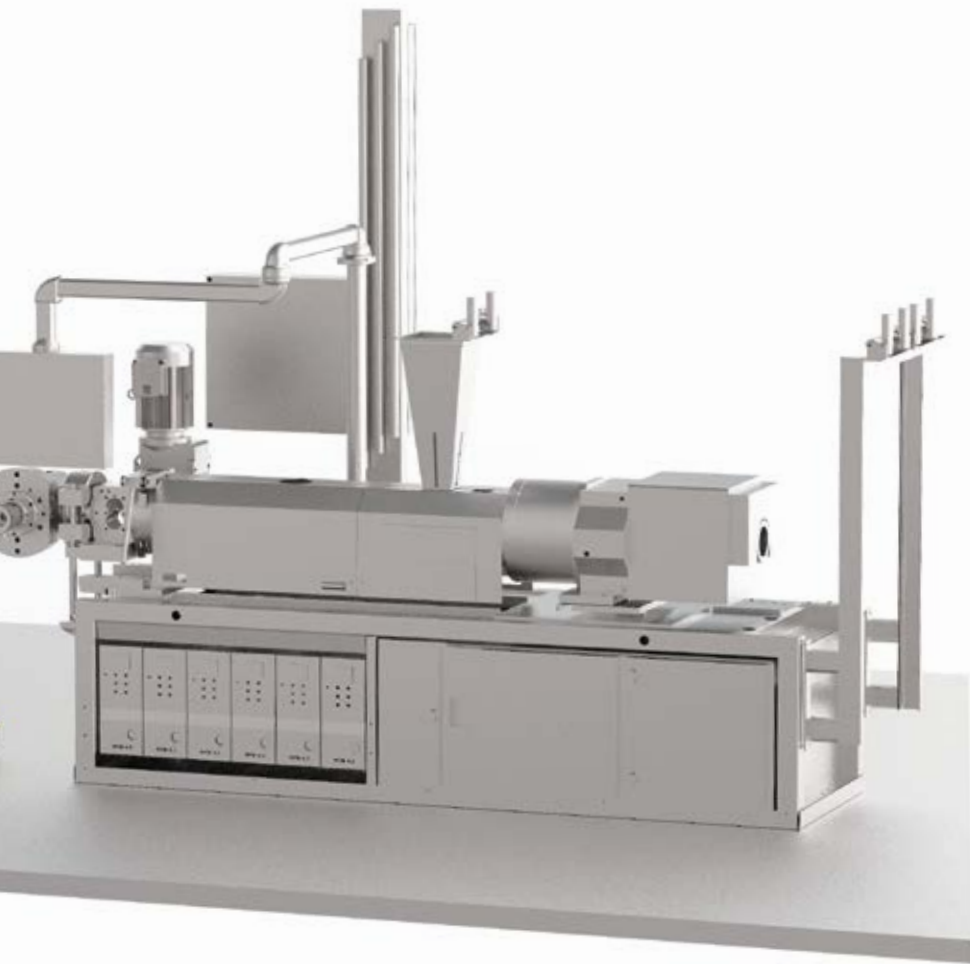


EXCELLENCE IN EXTRUSION.



Hose Extrusion Lines

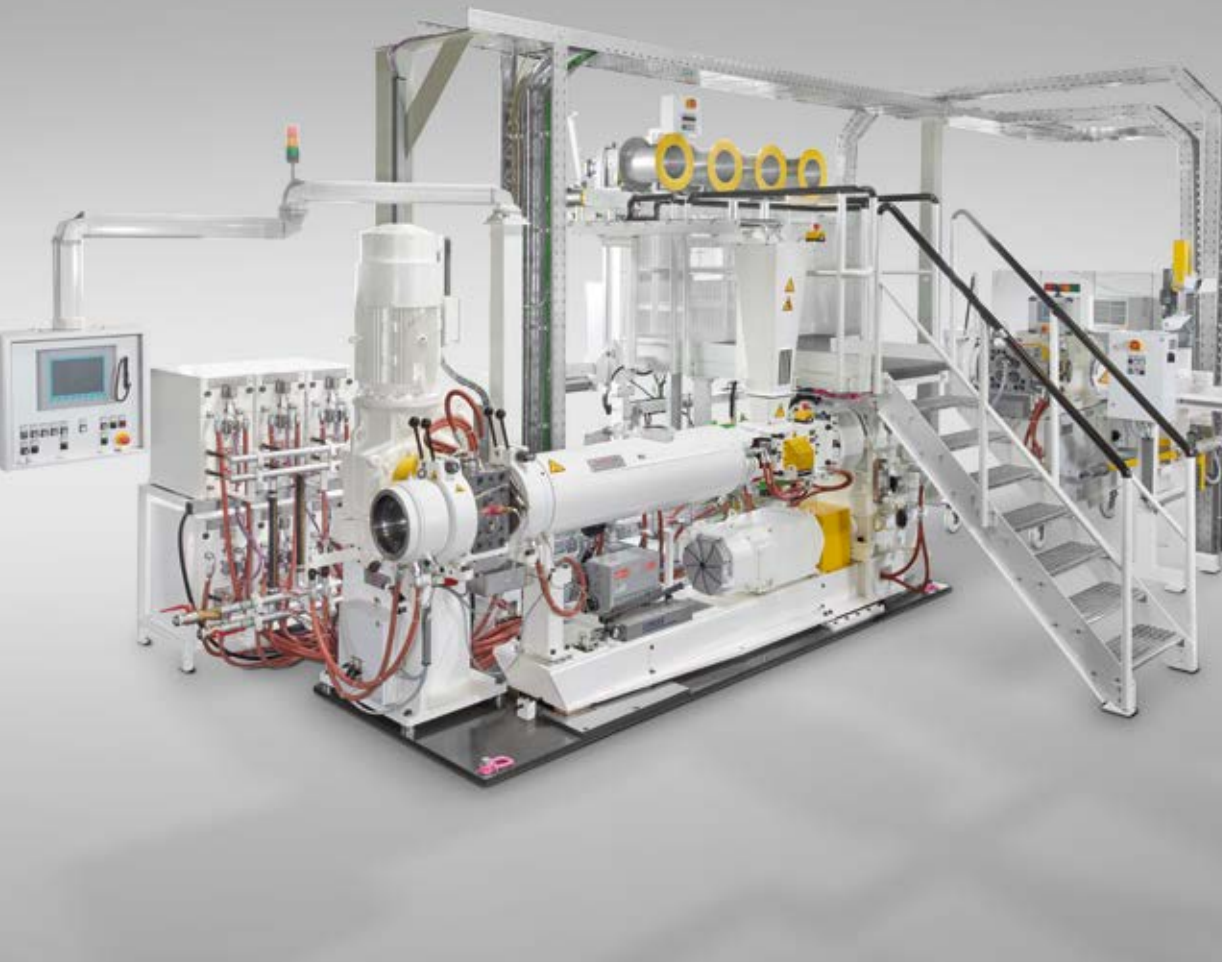




- > Multi-layer hose line
- > Tailor made design
- > Modular arrangement

flexible





Extruders for Rubber-Profile and Hose Extrusion

Key components of profile and hose production machinery are extruders that are tailored to requirements, combined with gear pumps and/or extrusion heads.

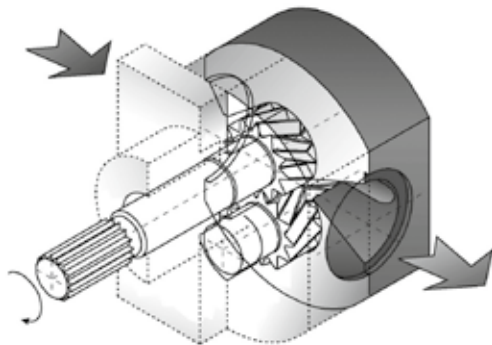
Extruder gear-pump systems are used to extrude profiles in small sizes and with narrow tolerances and to process the rubber compound carefully. The addition of strainer heads allows processing of vast quantities of rubber compounds, for example in the mixing room.

Special requirements on machine technology, both with regard to the process and the product, can be paired with tailored solutions. These include the compact extruder with temperature-control devices integrated into the machinery and all the electrical drive and control components required.





The cross head with hydraulic tool centering enables the extrusion of hoses to high standards of quality and the minimization of losses when production starts. The ROTOMEX gear extruder allows the rubber component to be strained as closely as possible to the extruder.





TROESTER Solutions for the Tire and Rubber Industry by the Experts

The key feature of all TROESTER machines and systems is their superior process technology. Highly skilled development engineers create durable and highly efficient machinery which fully responds to customers' requirements for top levels of production efficiency and quality.

High-tech production processes for the rubber-processing industry are based on sophisticated system technology. TROESTER develops efficient machinery and systems concepts, as well as controls, where leading manufacturers' hardware components are used flexibly.

Skilled service and support personnel guarantee that equipment is available. At the design stage already, emphasis is placed on making our products easy for customers' on-site personnel to use. Detailed and in-depth training of our customers' staff, help in the initial phases and an extensive spare-parts service round out the support.

When it comes to advanced solutions for the tire and rubber industry, the TROESTER Group has the experts.





Outstanding Project Management

Management for Your Success

Individual projects require individual support as well as distinct technical skills: TROESTER project management goes even further.

TROESTER project managers are customer's link to technical and commercial departments. With broad engineering know-how they are able to provide a customer-oriented realization of the projects.

Worldwide Installation Competence

Complete planning and realization of installations, also for demanding factors TROESTER finds appropriate solutions. With its global settlements, the TROESTER Group is flexible and experienced to send out service engineers short-termed worldwide.

Servicing the Future

TROESTER's experts analyze required wear parts and consult about system technology upgrades to maintain an up-to-date production.

Reliable Partner in Supply Chain

With a short-termed reaction time and an extensive stock of spare parts, TROESTER enables an uninterrupted operation of the customer's machinery.

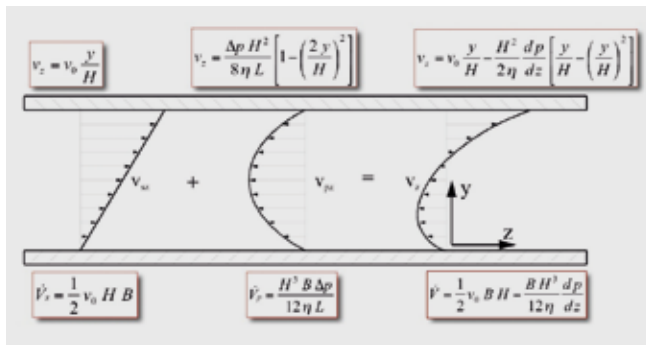
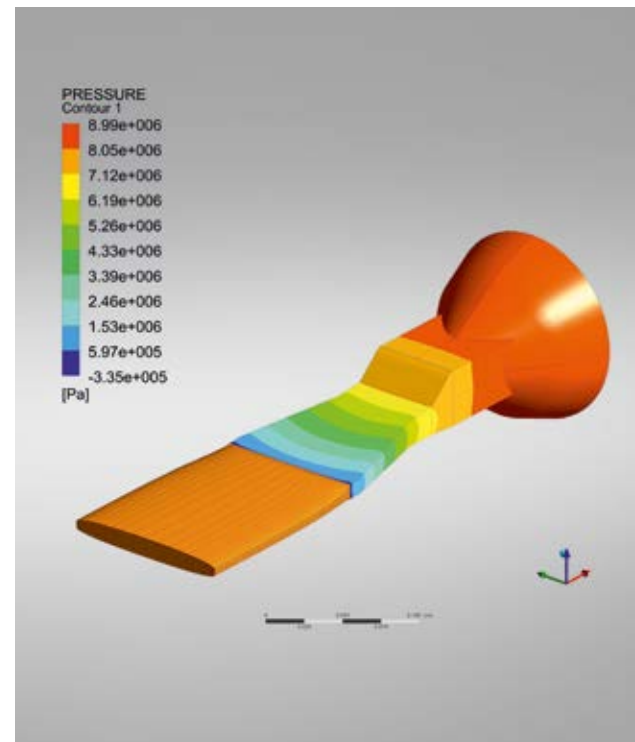


Shaping the Future

Because development is an on-going process, we optimize our machines and systems continuously to offer our customers maximum functionality and quality. We use state-of-the-art tools to include the latest findings and innovations in our products and collaborate with a range of different partners from industry and the world of science.

To implement specific solutions and concepts, TROESTER has a well-equipped pilot plant where trials and ideas can be put into practice and carried out. In addition to extruders with different extrusion heads and in key dimensions, we can offer a wide variety of extruder screws to suit virtually any application. TROESTER also has roller head machinery to create rubber sheets as required under production-related conditions.

To produce the often tailor-made solutions in time, TROESTER uses databases, process expertise and simulation tools, all of which is underpinned by a highly qualified and dedicated team of people. We liaise with our customers to develop tailored solutions to meet all requirements and specifications.





Manufacturing and Assembly

Customers have come to expect a high degree of quality from TROESTER because the true efficiency of machinery only becomes apparent during a long product life cycle. To meet these expectations TROESTER places huge emphasis on in-house manufacturing. In the past few years, the level of in-house manufacturing of TROESTER machinery has steadily increased. Insourcing instead of outsourcing is the roadmap pursued.

The cornerstones for increasing production and enhancing product quality were substantial investment in TROESTER's machinery, CNC-driven production processes and stepping up training of all personnel.





The drive to manufacture products made in Germany has given an enormous boost to TROESTER employees' identification with the company. TROESTER's well-trained personnel works in three shifts and takes its responsibility towards customers very seriously. As a result, personal store is set by checking the quality of machinery made in-house.

- > Screw milling
- > Hard-facing of screws
- > CNC controlled machining
- > Final finishing of process relevant surfaces
- > Thorough inspection process





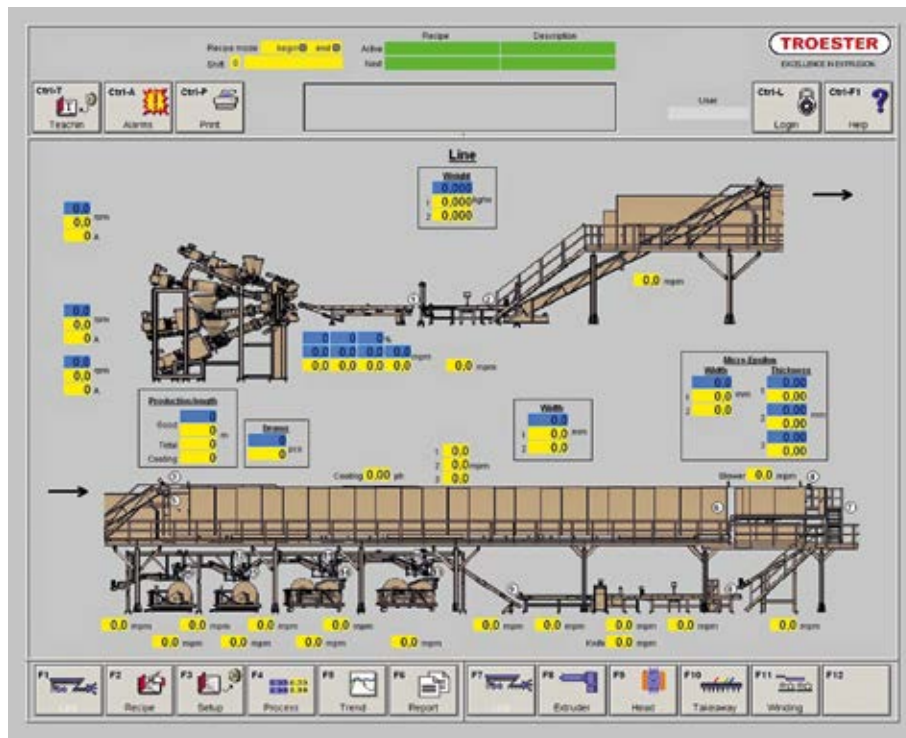
Electrical Equipment and Line Control – Solutions from One Source

The extrusion line control systems as well as the design of electrical components are significant elements of TROESTER's equipment portfolio. The extrusion unit works with the downstream equipment as a functional unit enabling constant product dimensions in the various production stages. The control is developed, designed and programmed in-house, specialists for several control-, drive- and measuring-systems are available. Electrical components can be delivered according to customer's requirements.

Typically the line control consists of a PLC-PC architecture. In the field area up to 100 electrical devices like drives, sensors, measuring equipment, identification and marking systems are usually linked by an Ethernet based fieldbus system and controlled by the PLC. The Line-PC is used for visualization and process trending, recipe handling and the long-term production and quality protocol. For each production run the production parameters as well as the quality results will be stored. Such production results are summed up in statistically evaluated parameters like CPK-values (statistical process ratio).

A configuration with the PC as a redundant system is available, to ensure that quality documentation and production reports are provided without any lag.





Ready for Industry 4.0

- > Remote access for PC, PLC, drives and further control and measuring systems
- > Customized MES interfaces for production schedule, recipe data, quality data, material validation, production data and further information
- > Quality-, process- and machine data collection and storage (for analyzing on external systems)
- > Integration of Barcode- and RFID-systems
- > Maintenance schedule and protocol
- > Web interface for machine visualization (machine operation blocked)
- > Development of further service and support tools in cooperation with customers



The container construction allows for an extensive pre-assembly and the pre-acceptance by the manufacturer and thus results in shorter commissioning times on site.



TROESTER GmbH & Co. KG, Germany



TROESTER Machinery Ltd., USA
TROESTER Machinery (Shanghai) Co., Ltd.
X-Compound GmbH, Switzerland



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