

# Extrusion Equipment

for the Tire Industry

**TROESTER**

EXCELLENCE IN EXTRUSION.



# Innovations for the Tire 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.





<b>Foundation Year</b>	1892
<b>Managing Directors</b>	Dr. Peter Schmidt (Managing Partner) Dipl.-Ing. Bernd Pielsticker
<b>Staff</b>	approx. 500 employees in administration, mechanical and electrical design, R&D and manufacturing
<b>Subsidiary Companies</b>	TROESTER Machinery, Ltd./USA TROESTER Machinery (Shanghai) Co., Ltd./PR China X-Compound GmbH, Switzerland
<b>Representative Offices</b>	in Russia and France
<b>Representations</b>	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 build 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 cables, tires, automotive and industrial rubber goods 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. During the whole project the customer only has one contact partner, who also coordinates transport, installation and commissioning: TROESTER.

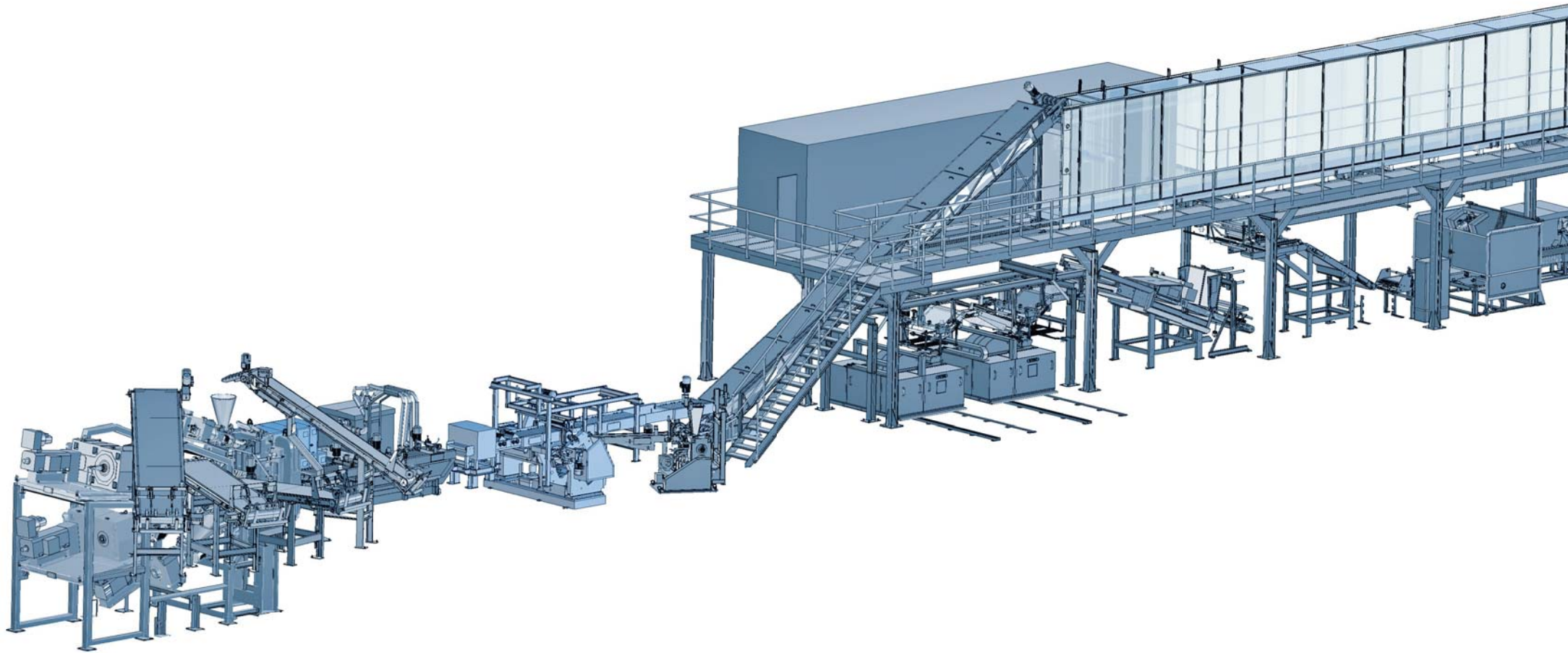
This solution also offers advantages for the finished quality of tires. Car and truck tire components which are produced on TROESTER lines are characterized by high dimensional accuracy as well as extremely small positional tolerances between the individual components.

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".



EXCELLENCE IN EXTRUSION.





TROESTER CoEx 4/C with slab feeders  
Cushion calender  
TROESTER CoEx 3/H  
Rotating cross cutter as part of a wind-up system  
Cassette wind-up station

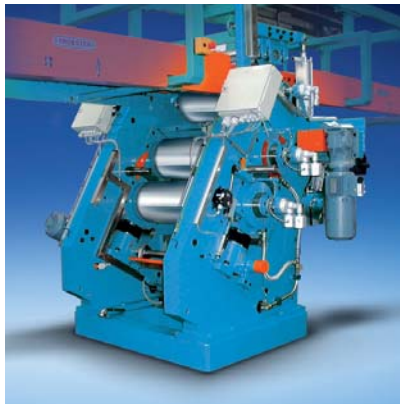


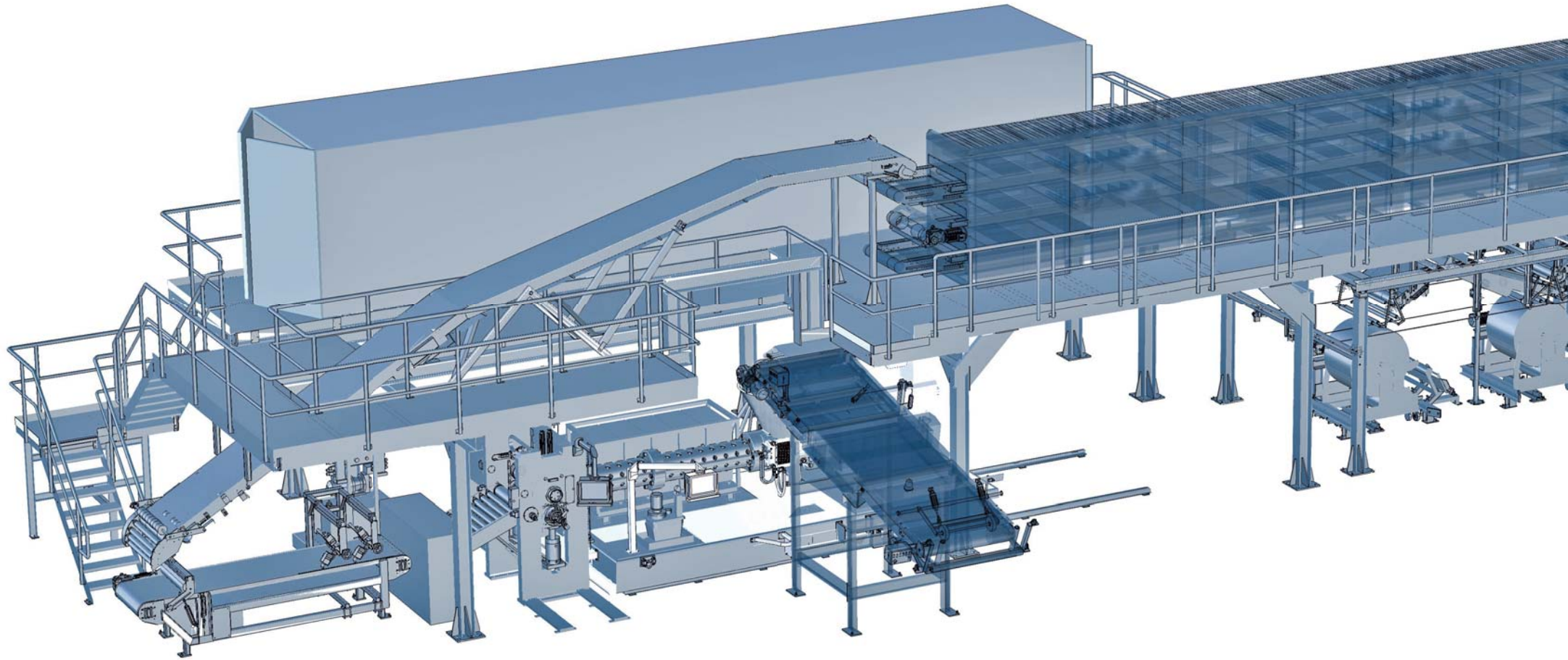




- > High speed Line (50 m/min) for tread and sidewall
- > Take away conveyor with shock cooling for sidewall components
- > E-house container
- > Special water treatment (ph-value and conductivity)
- > Optimized material flow with winders close to the extruder area

# high speed

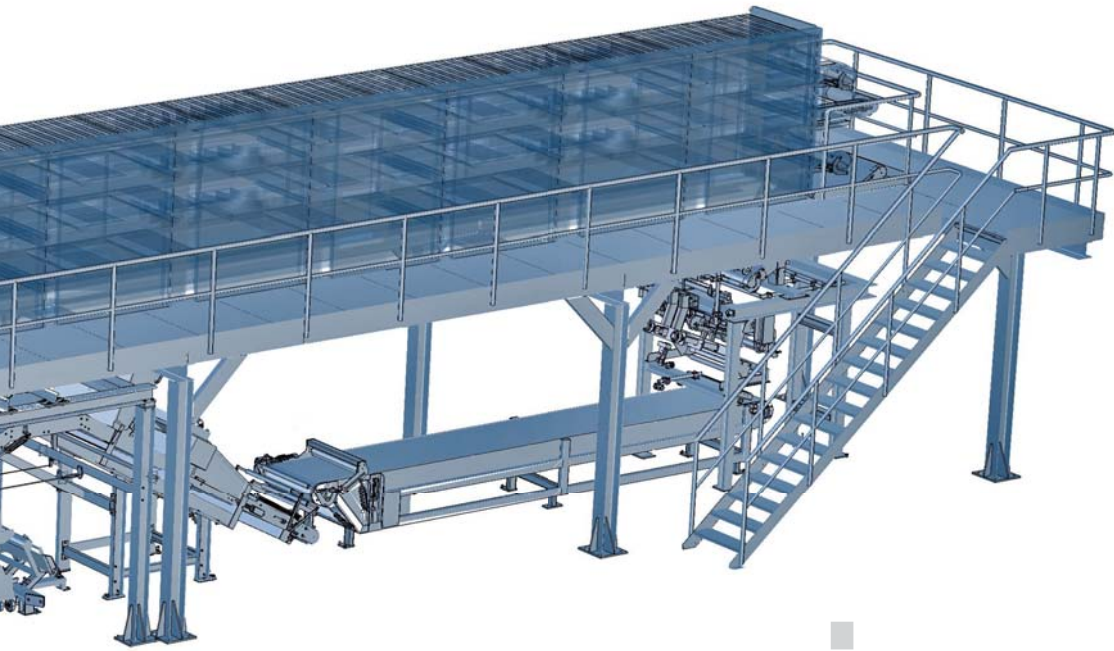




Extruder with extrusion head  
Air Cooling section  
Winding Area  
Rotating cross cutter



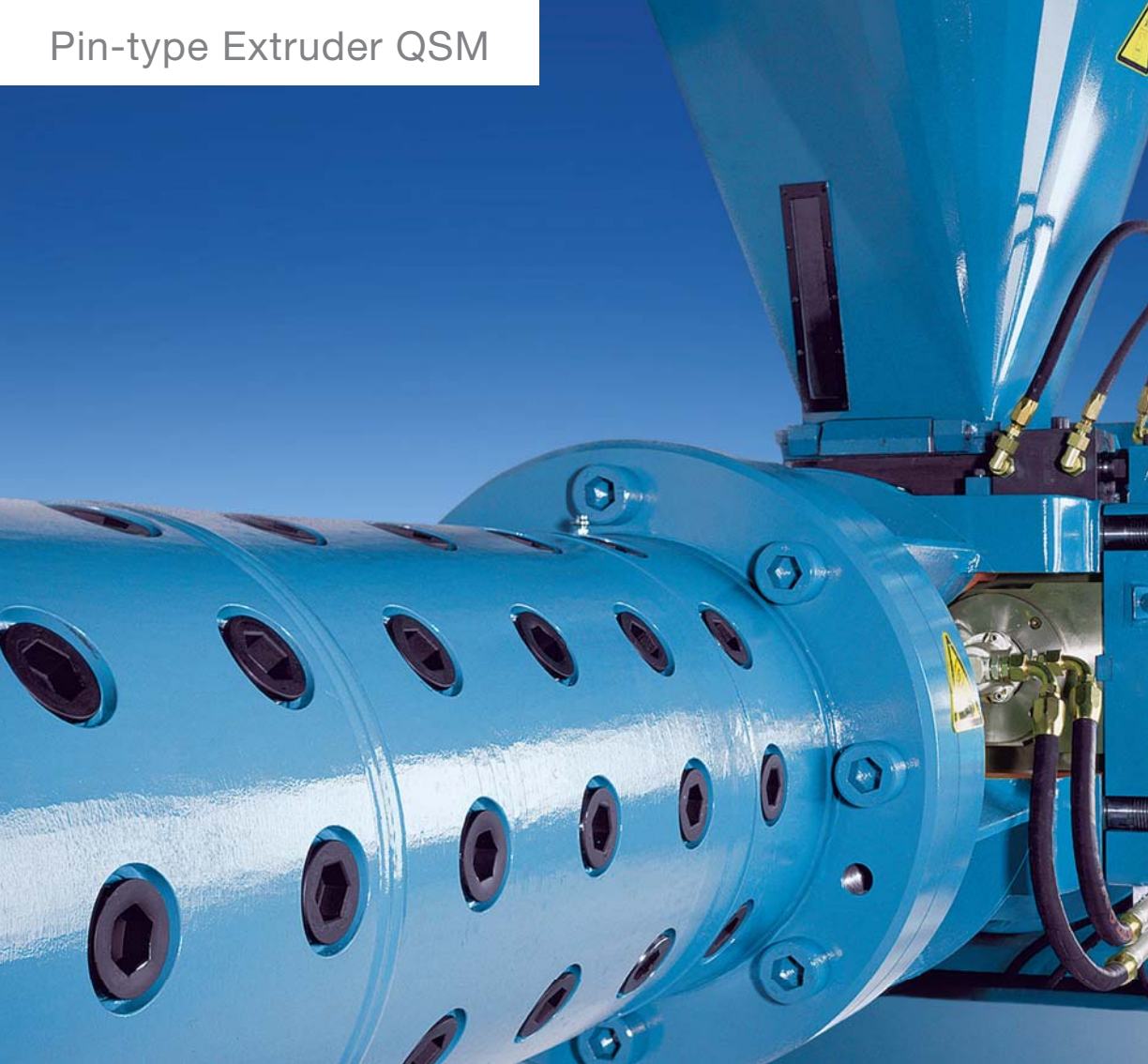




- > Minimized floor space
- > Air Cooling of extruded profiles with optimized cooling efficiency
- > High energy efficiency
- > Cold edge cutting
- > Automatic calender sleeve change

# air cooling





### The QSM Extruder

The QSM technology was substantially co-developed, in the mid 1970's, 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 product quality
- > 60 – 250 mm screw diameters
- > Self-cleaning
- > Also available as vacuum-version





## Roller-Head Systems

Roller-Head units are used to produce sheets and strips. The typical tire profiles are inner liner, cushion, squeegee etc. As opposed to multi-roll calenders the rubber compound is fed through the roll gap directly from a wide sheet head. As the required shape has been pre-formed by the sheet head porosity free rubber sheets/profiles can be produced.

Modern Roller-Head systems offer a wide variety of automation and rationalization possibilities as opposed to the conventionally fed calenders. It is to be noted that a Roller-Head system can process virtually any type of rubber compound. Various contours can be produced by changing the profiled roll sleeves on the calender. TROESTER Roller-Head calenders can be fitted with hydraulic roll adjustment. This allows for exact roll positioning and facilitates a range of process technical advantages as well as a high degree of accuracy.





## Extrusion Heads

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. 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.

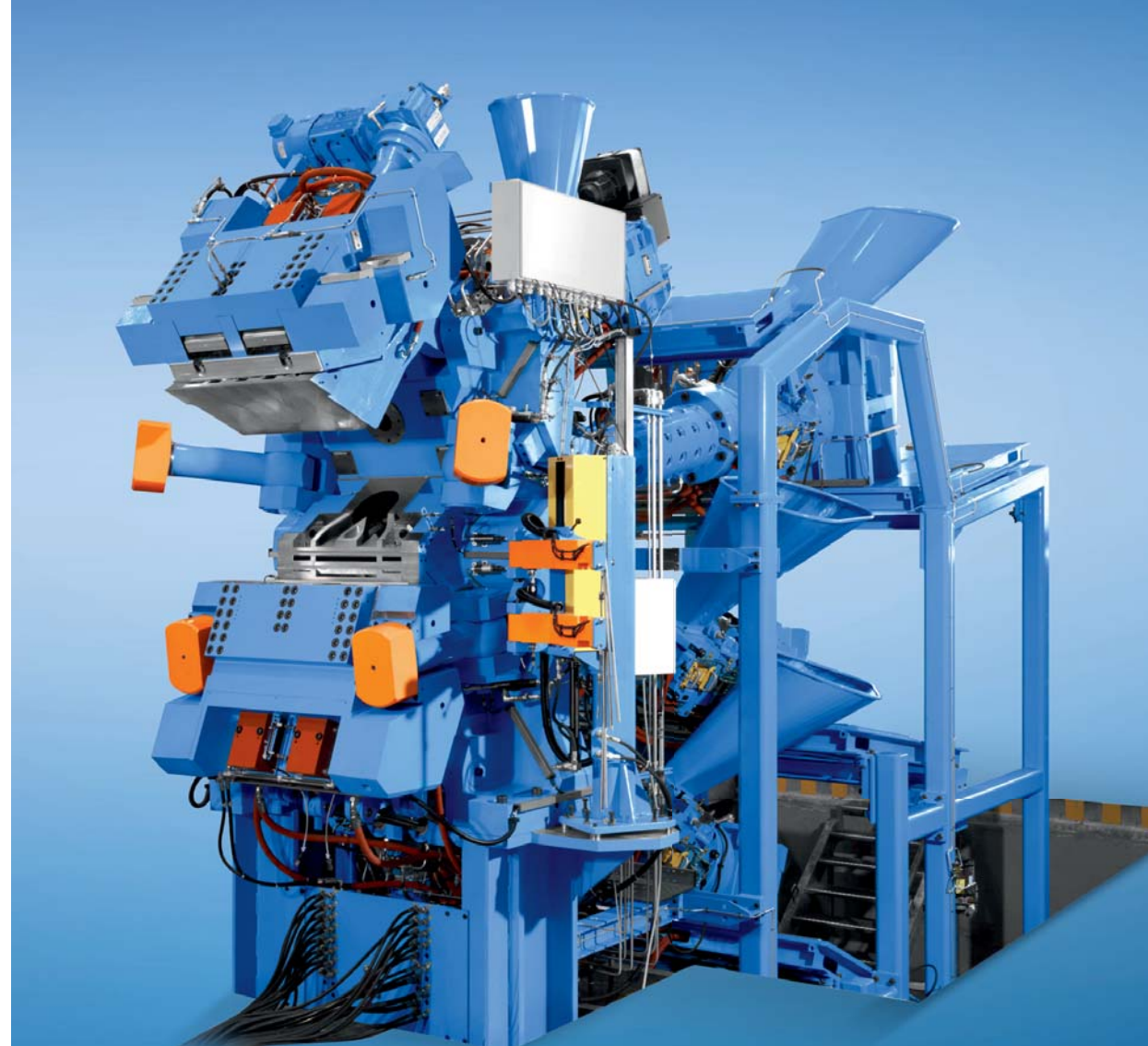
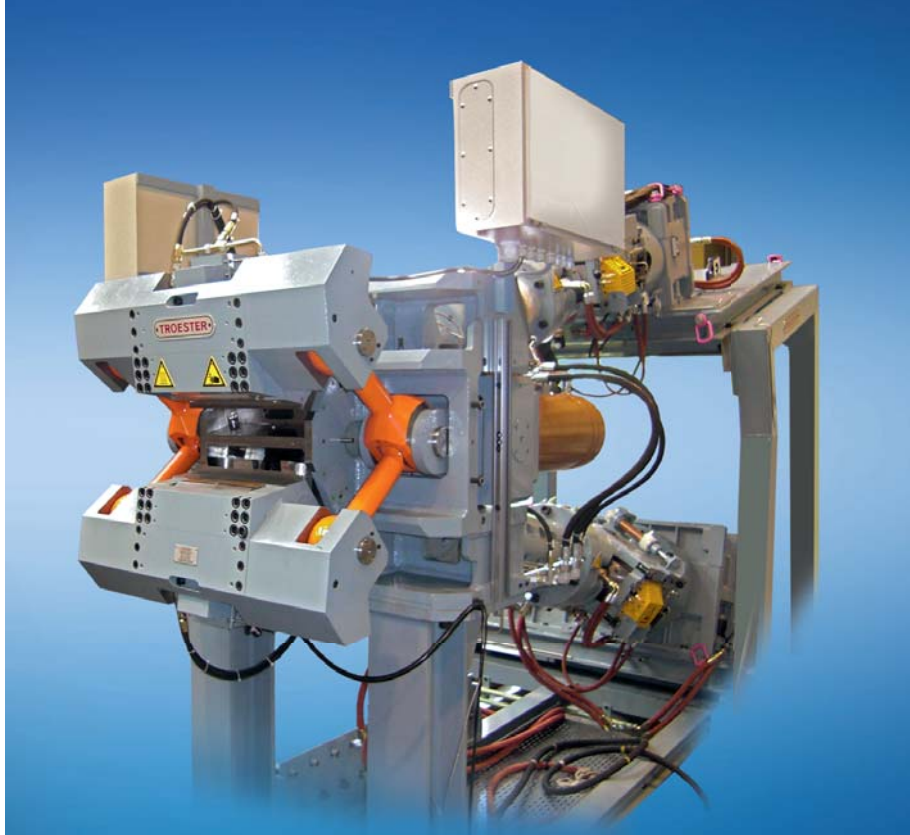
The general goal is a material-independent flow channel design in order to allow an easier design of the subsequent flow-segments.

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.

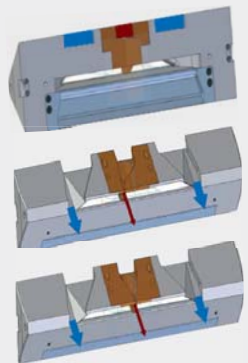




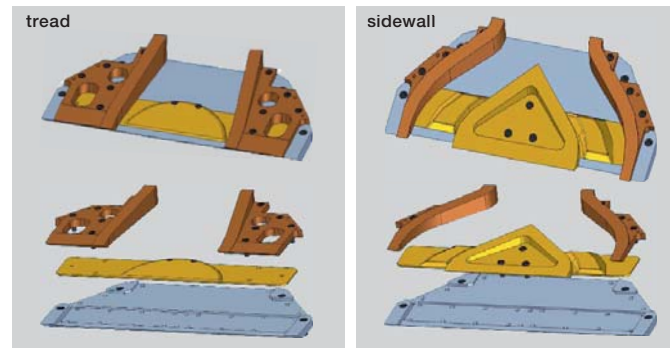


## Design advantages

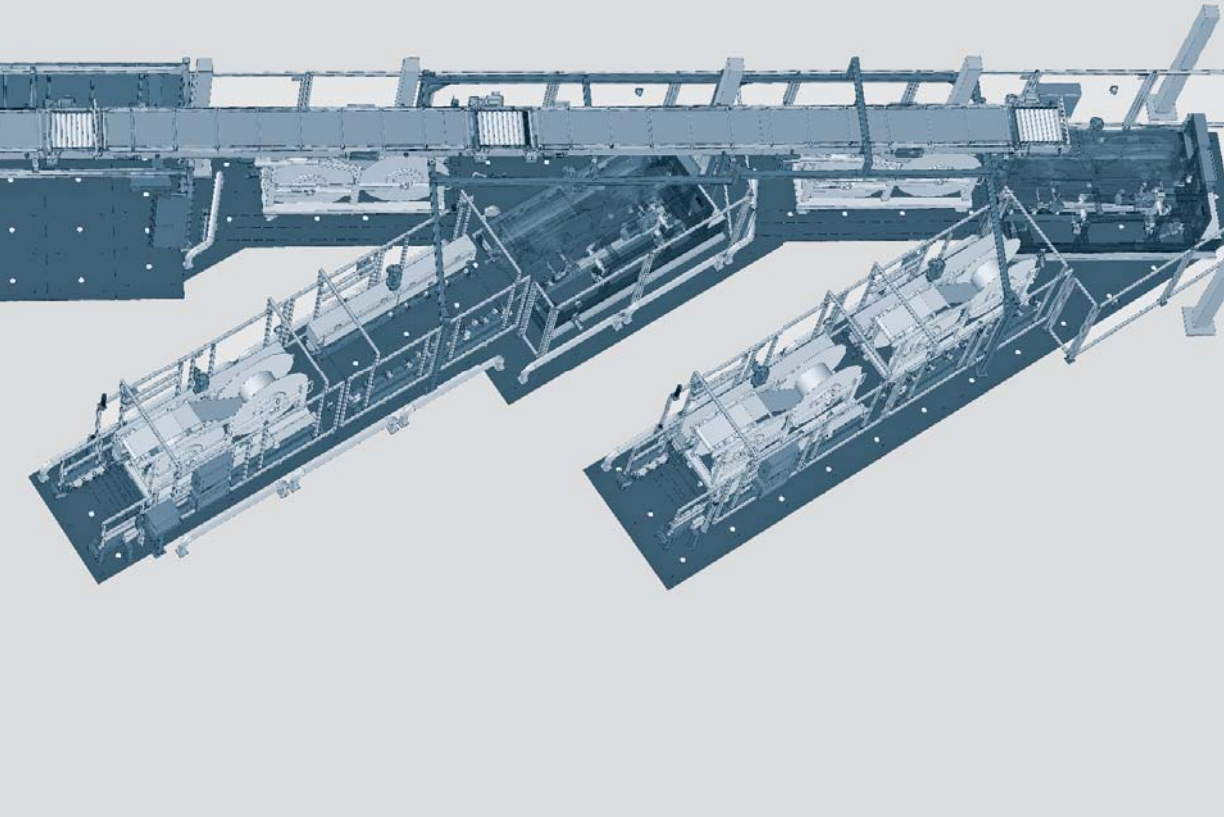
Chimney extrusion –  
pre die



- > 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



Modular tools – flow channels

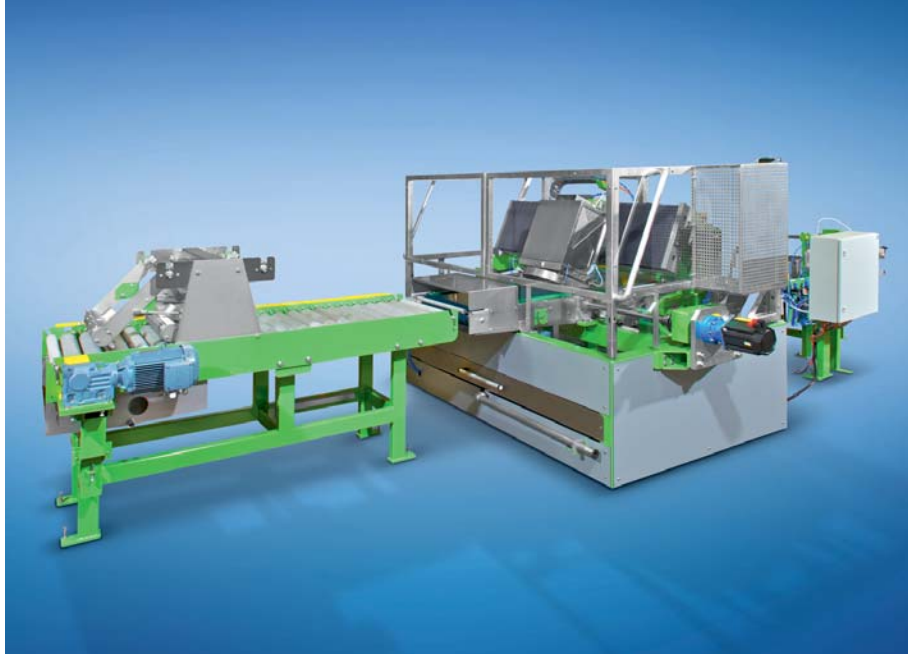


### Downstream Engineered in Germany

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.

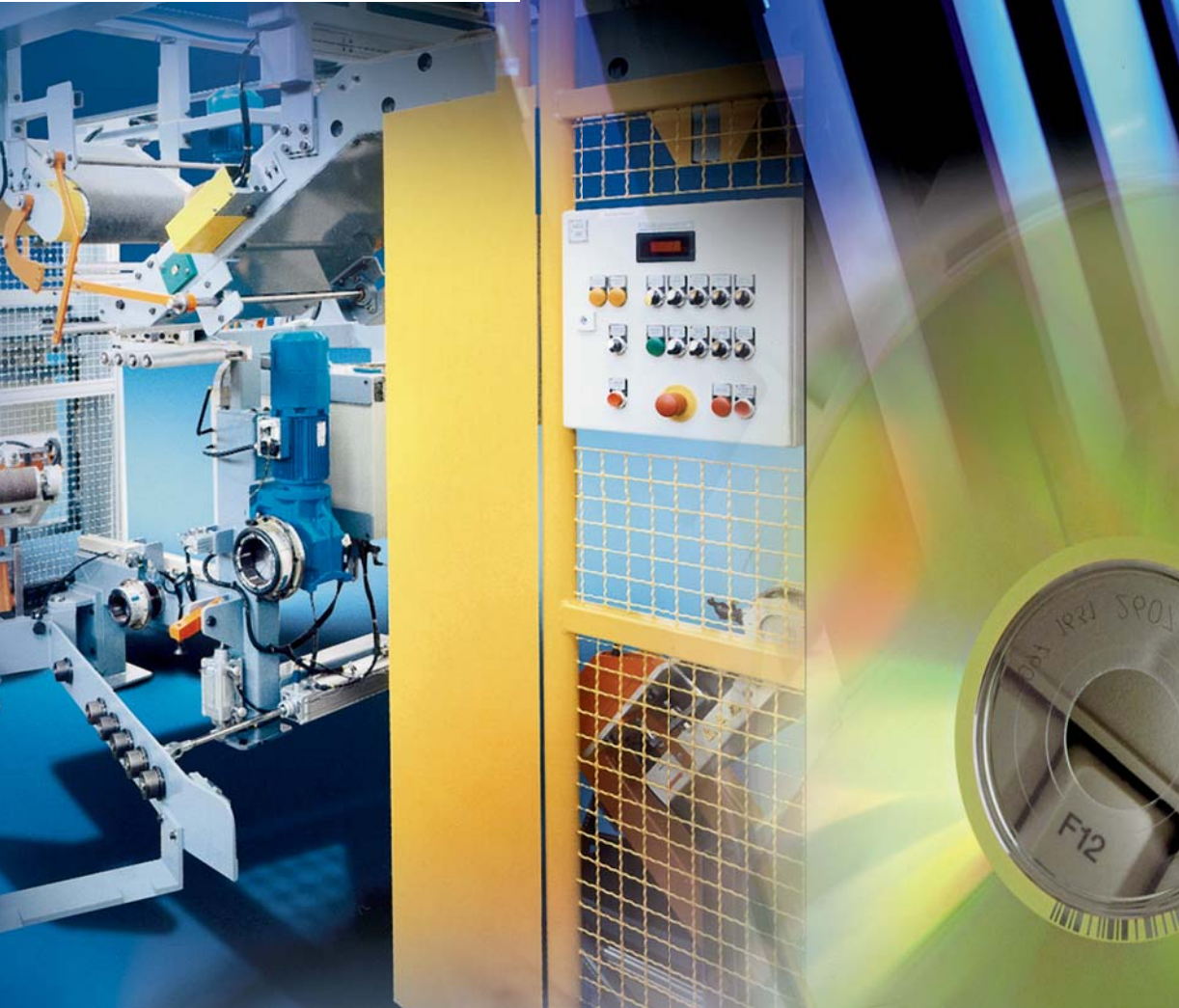




## Downstream Equipment Portfolio

- > Shrinkage system
- > 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





## Electrical Equipment and Line Control – Solutions from One Source

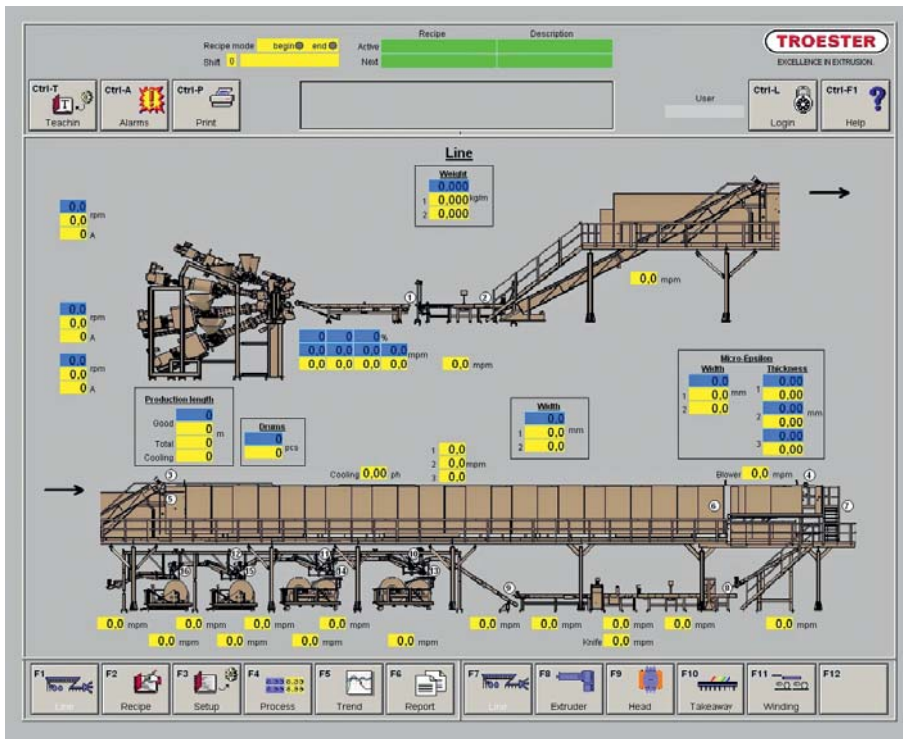
The extrusion line control systems as well as the design of electrical components are significant elements of TROESTER's equipment portfolio. The extrusion unit works with the downstream equipment as a functional unit enabling constant product dimensions in the various production stages. The control is developed, designed and programmed in-house by using the latest available electrical components. Specifications and preferred subsuppliers are considered according to the individual needs of the tire manufacturer.

Typically the line control consists of a PLC-PC architecture. In the field area all electrical units like drives, sensors, measuring equipment, identification and marking systems are controlled by the PLC. For many years the most well-known field bus systems with distributed I/O stations are used. The advantage is i.e. reduced cabling on customers site and more efficient checking of machine groups before delivery.

As a further development step TROESTER lately installs complex tire production lines by using Ethernet instead of typical field bus systems. More than 80 units like drives, distributed I/O stations, measuring devices, PLCs and Line-PC are linked together.

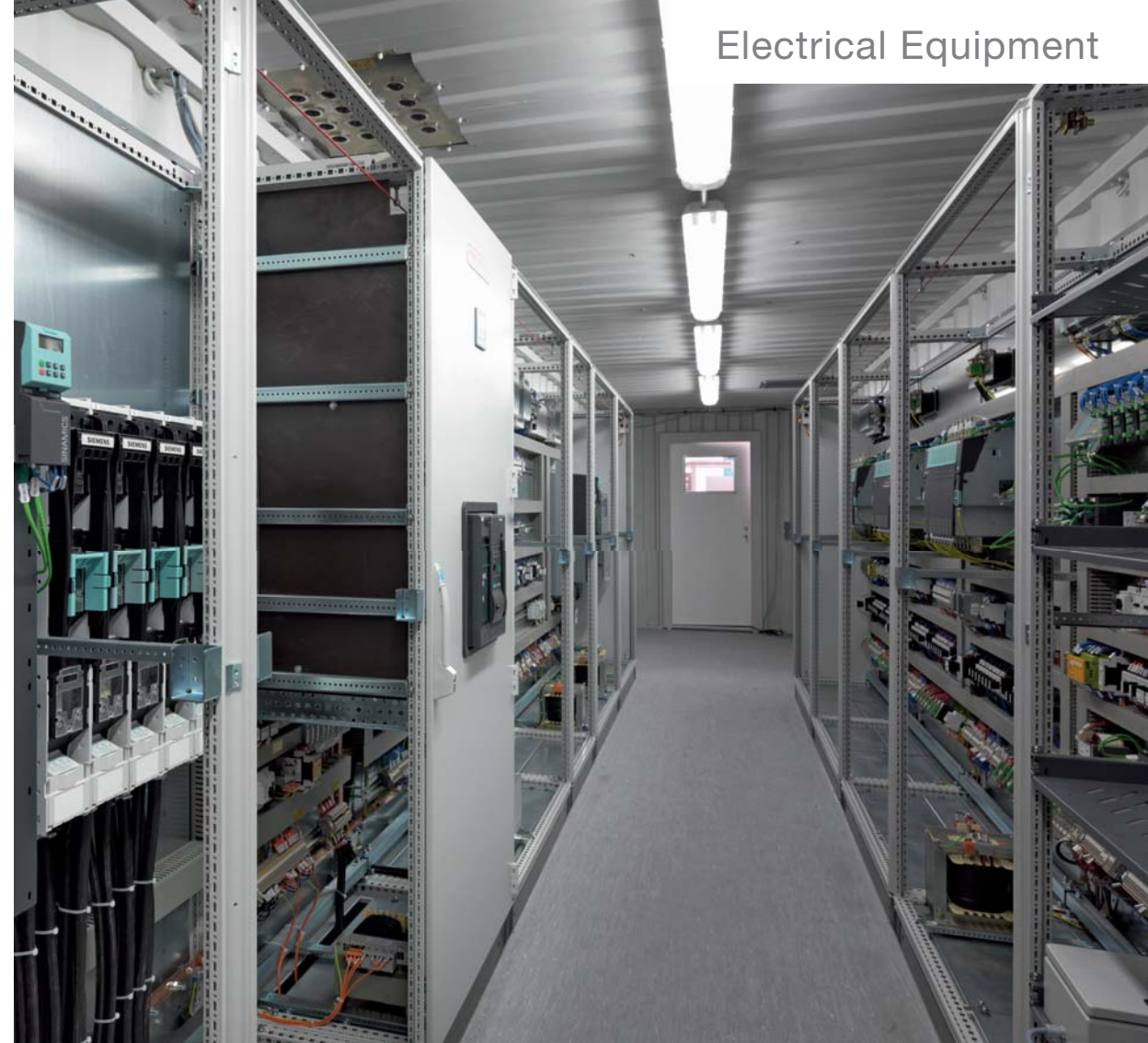
The Line-PC is used for visualisation and process trending, recipe handling and the long-term production and quality protocol. For each production run the production parameters as well as the quality results will be stored. Such production results are summed up in statistically measured parameters like CPK-values (statistical process ratio). Besides having long-term information about the production history, the data can also be used for labelling the manufactured goods.





There is a tendency towards connecting the Line-PC to the plant network to receive the pre-selected daily production schedule of the line from a host and to provide the production data automatically from the line via network to a plant server. State of the art is a configuration with the PC as a redundant system to ensure that quality documentation and production reports are provided without any lag.

The thorough Ethernet concept supports teleservice up to each end-connected unit. This way TROESTER engineers can support the operators on site in real-time from the Headquarter in Hannover, Germany. Ethernet supports the tendency of merging the company network together with the entire line control.



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.



### Management for Your Success

To achieve all of the customers project goals, TROESTER has a unique project management. Individual projects require individual support as well as the development of distinct technical skills.

The project manager is the customers link to technical and commercial departments. He also has broad engineering know-how and can give quick assistance.

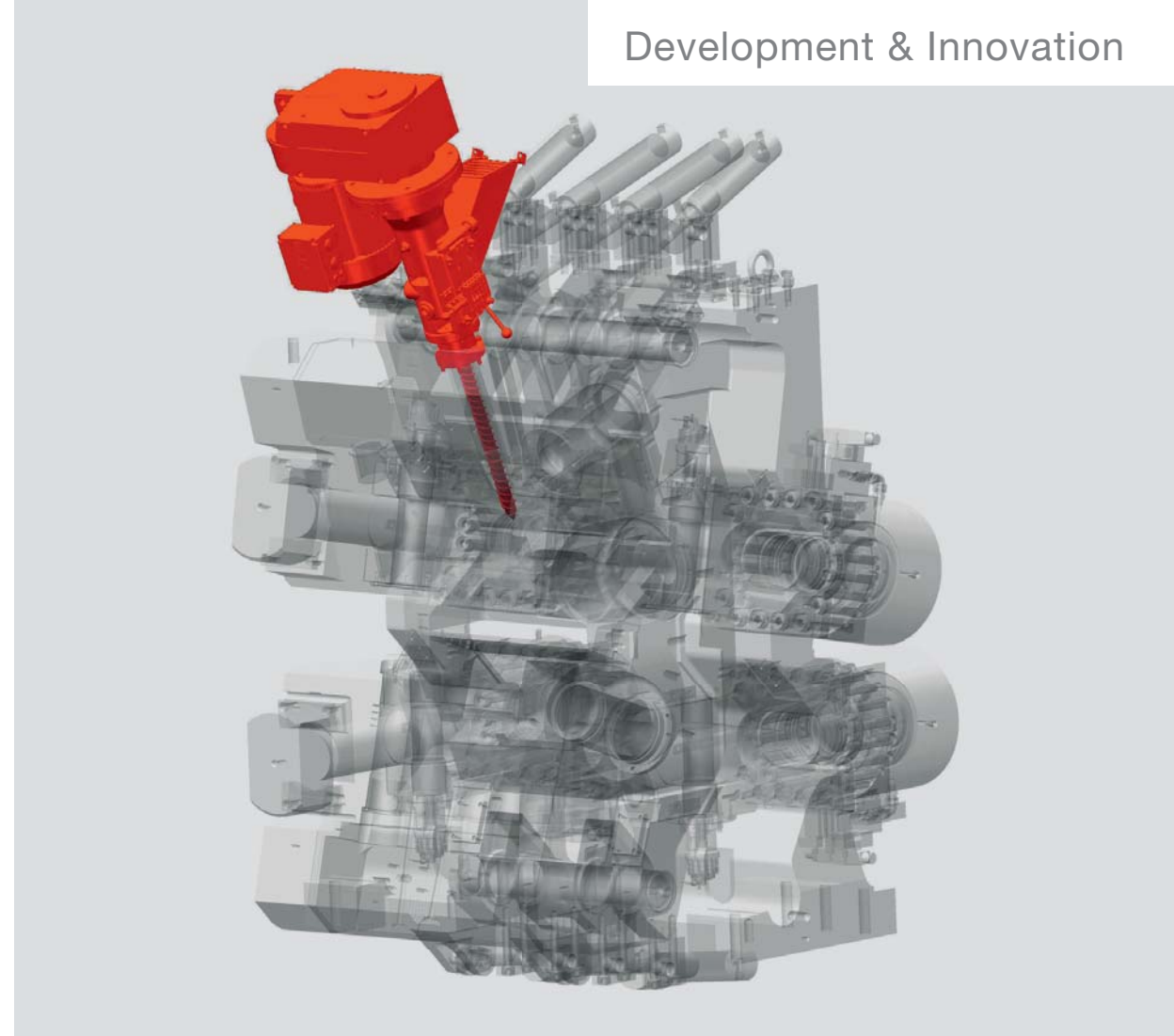




## Technology for the Freedom of Tire Design

Since silica-compounds have a poor electro-conductivity, today's tire designers apply a thin radial portion of carbon-black-based compound to the tread which avoids the electrostatic build in the tire.

For the economical extrusion of the chimney rubber portion, TROESTER developed the new piggy-back extrusion principle »Xplus1« – realised in different multiple extrusion aggregates such as TROSTER CoEx 3plus1, CoEx 4plus1 and CoEx 5plus1.



### The additional extruder is part of the moveable upper body of the extrusion head:

- > Compact GS45 rubber extruder
- > Quick material change
- > Simple flow channel and die design
- > Maximum output performance
- > Existing TROESTER heads can be upgraded to the »Xplus1«-technology.



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