

# Tire & rubber machinery: technology trends in 2025

Leading players respond to *ERJ*'s call to identify the most significant machinery technology developments in the rubber and tire industries this year

For our first issue of the year, *ERJ* invited suppliers of tire & rubber processing equipment to identify technologies they are most focused on introducing to the market during 2025 – receiving replies from three major players.

At the forefront of current developments at HF Group are the company's 'Smart final mix' and 'Electrical tire curing' (E-curing) technologies: both designed to enhance the sustainability and operational efficiency of customers' manufacturing practices.

With Smart final mix, HF is leveraging the power of artificial intelligence (AI) to optimise the final mixing process, enabling CO<sub>2</sub> emissions reductions of up to 30% on final mixing lines by raising throughput while delivering fast, secure, and efficient process optimisation.

As a digital guidance system, the Smart final mix service integrates decades of process engineering expertise with advanced algorithms to monitor and optimise the final mixing process, said HF.

Notably, it added, the service



HF spotlights e-curing advance

operates without requiring sensitive recipe or raw material data, ensuring maximum security, while reducing cycle times, lowering production costs and reducing emissions.

Meanwhile, HF's E-curing solution is said to be a significant advance in environmentally-friendly tire production and can "dramatically reduce energy-consumption and CO<sub>2</sub> emissions by up to 100% for the curing shop when powered by renewable energy."

Other reported benefits of the E-curing technology include: more precise control through independent management of temperature and pressure; and enhanced quality due to more consistent temperature distribution from top to bottom.

The AI-driven performance of the system enables heat-distribution to be controlled within a 20–220°C range, said HF, while also highlighting other features, including nitrogen recovery and cooling systems, extended bladder life and ease-of-maintenance.

E-curing is available as a retrofit for existing HF curing presses or as an integrated feature in new HF curing presses, ensuring compatibility with a wide range of op-



Smart tech for the mixing room

erational needs, the group's statement further pointed out.

In a further curing press development, the German machinery major is extending the capabilities of its HF Curemaster PCR range with individual press control, offering enhanced flexibility to meet diverse operational requirements.

Additionally, HF is introducing a revised design for the Curemaster series this year to deliver "significant advancements" in functionality, ease-of-maintenance,



Target: Automated and autonomous

material savings, ergonomics and intuitive control.

For VMI the strongest focus for 2025 will be on innovative developments that “extend and strengthen automated and autonomous operation in its core tire-building machines: Maxx (passenger tire) and Milexx (truck), enhancing the role of software as we do so.”

For Maxx, the Dutch-based major pointed to an advanced CCMO-3 vision system, incorporating a new generation of high speed cameras to bring much greater accuracy to real-time monitoring/measurement of the carcass package.

Here, the initial focus is on “PA, body ply and chafer centering, width and splice measurements, while also enabling additional scans,” stated VMI, also noting that the package is retrofittable to ‘existing CCMF.’

For Milexx, a new ‘innerliner splice quality monitoring’ (ISQM) system – patent applied for – enables automated final inspection of green tires, which is normally carried out by operators. This uses a line profile scanner on the inside of the tire, with software review and automated approval/alert features.

For 2025, VMI added that it will also be driving further growth on two key recent innovations: Revolute and Unixx Belt Maker.

The Revolute bead apex assembly system is designed to accelerate production and provide a higher Apex (and wider range) while enabling use of advanced compounds.

Customers find it reduces costs, increases quality and simplifies multiple SKU production, with more innovative compounds, reported VMI, adding: “Now the industry fully understands the potential benefits, we expect Revolute to grow fast.”

Market tested over the past two years, the Unixx Belt Maker can “replace calendaring and steel-cutting lines entirely: freeing up space in factories while delivering savings in terms of labour, inventory & internal transportation, energy-consumption and waste.”

According to the supplier, the system produces very accurate belts, contributing to the production of tires with lower rolling resistance. This, it said, “is a key interim stage for an industry in transition, and VMI expects this

to be a major theme for the year.”

At Troester, meanwhile, Wieland Hoffmann, head of R&D rubber highlighted the Hanover, Germany-based company’s progress in developing a leading-edge technology for advanced tire production.

Troester’s X+1 noted Hoffmann started with a small 45 mm extruder when carbon black in tire compounds was increasingly replaced by silica, and it became obvious that the chimney component had to be extruded separately.

With a short flow path, moderate compound pressure and preformers that are easily cleaned, the X+1 proved to be a solid solution. Gradually, X+1 was adapted to other Troester extrusion heads with three, four or five main extruders and its size was increased to 60mm and 90 mm.

The progress led to the development of the X+2 with two auxiliary extruders, one in the upper and one in the lower portion of the extrusion head, continued Hoffmann.

X+2 can be utilised to produce additional tire profile components like cover strips, dual chimney and further elements that allow more freedom in tire design.

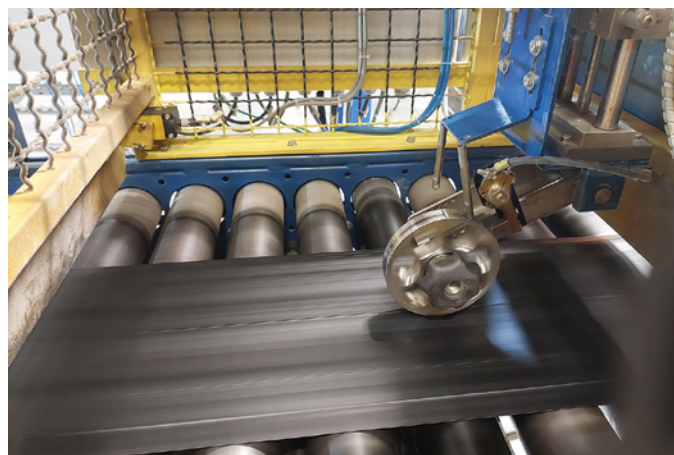
Extrusion profiles that typically require additional equipment to manufacture, if possible, can now be realised with the handling and accuracy advantages of co-extrusion, added the R&D leader.

Since the integrity of the chimney may not be visible from outside, its placement and functionality has to be verified immediately after extrusion to avoid costly non-spec tires: existing measuring systems have major limitations with product geometry and measuring accuracy.

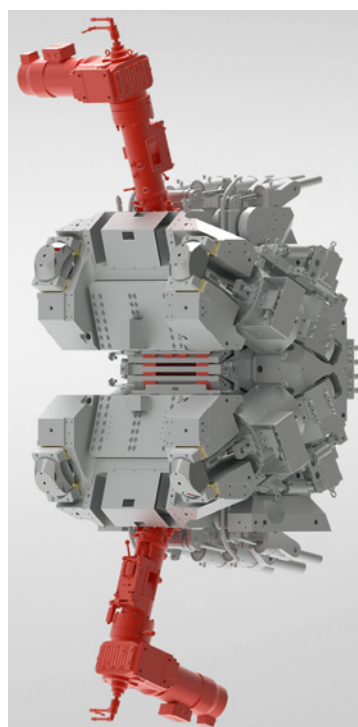
The Troester chimney detection system measures the electrical resistance directly: adjusting its measuring range automatically and providing the true value. This value is then rated against upper and lower control limits to identify areas where the chimney compound may not be fully exposed, explained Hoffmann..

This measurement, which is continuous along the length of the extrusion, is assessed by the algorithm to allow an accurate classification of the tread.

Troester stated that it is now offering intelligent controls to improve product-quality and uni-

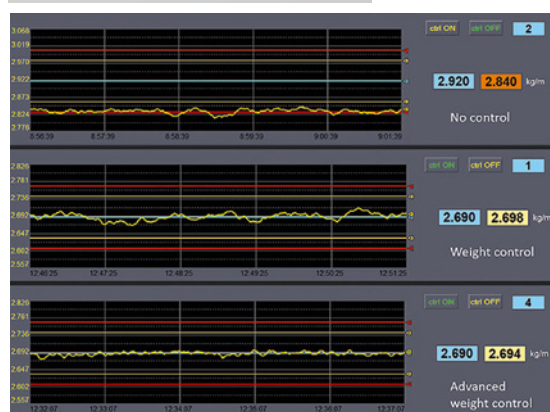


Advanced chimney detection



Troester CoEx head

Quality gains via screen controls



formity. The pictured chart compares the weight per meter with no control, standard weight control and advanced control.

While the standard control correctly regulates the weight, the advanced control is reacting to short-term variations, resulting in much better product uniformity.