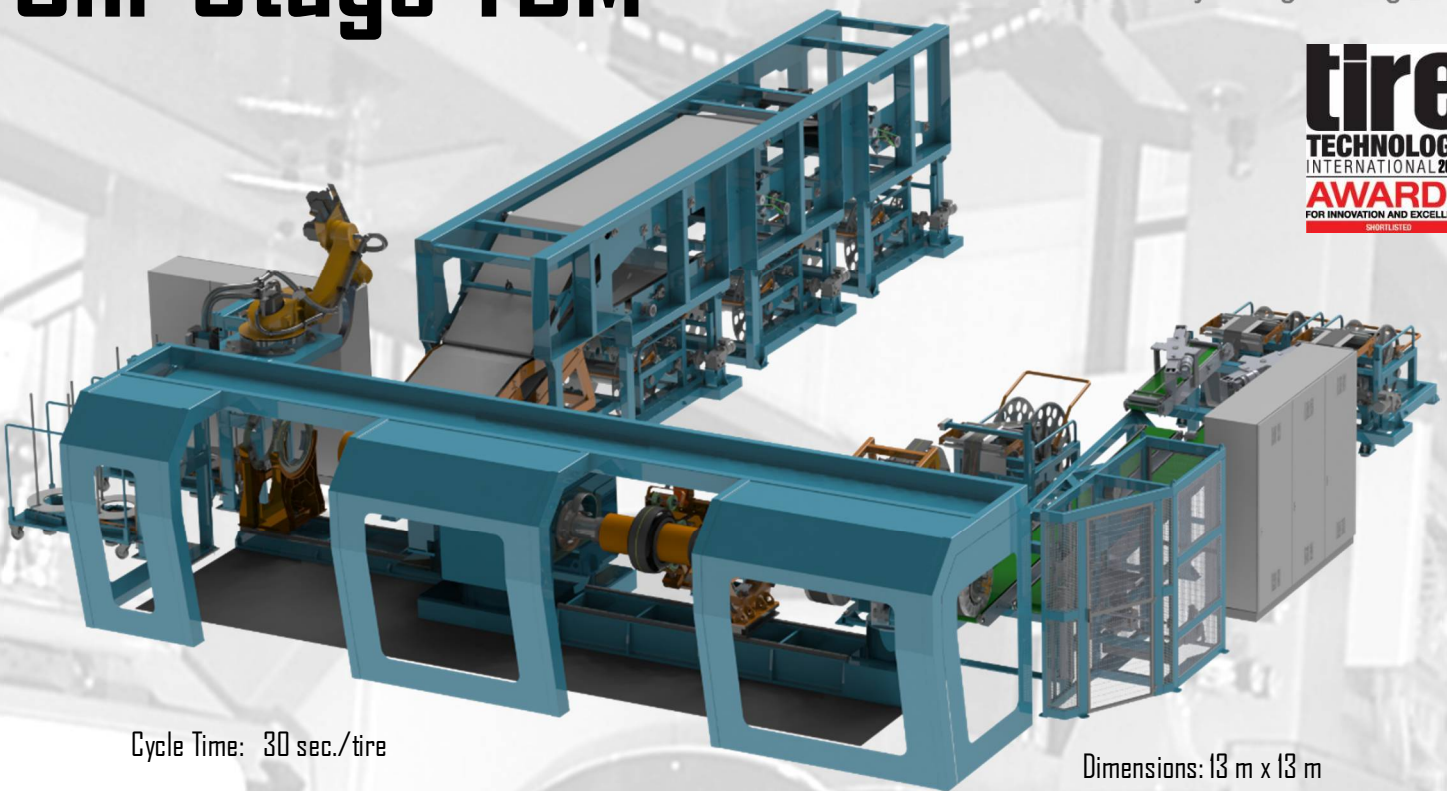


# Uni-Stage TBM



Cycle Time: 30 sec./tire

Dimensions: 13 m x 13 m

The new generation of the INTEREUROPEAN's fully automatic Tire Assembling Machines provide a fully automatic solution for building high performance tires with uni-stage technology, which has received a worldwide recognition and nomination to the "Tire Technology International Awards for Innovation and Excellence 2015" by the Tire Technology International Magazine.

The Uni-Stage TBM is equipped with active guiding systems for all the rubber components, automatic cutting and application systems, flat drum tire assembling technology, advanced control and supervision system with touch screen computer interface and advanced receipt management and diagnostics.

Beads loading into the bead setters is performed by a robot, while the finished green tire unloading from the uni-stage drum is performed by the transfer ring.

Machine configuration can be adapted to any customer's specifications, including 1 or 2 plies, steel or textile chafers, online / off-line preassembling of IL+SW, Tread out of Spool / Precut to length, **separate Sidewalls Application**, etc.

The Uni-Stage Drums used in the machine can be supplied by INTEREUROPEAN (double bladder / single bladder / mechanical turn-up type), or the machine can be designed to use the Customer's own standard uni-stage drums.

Twin breaker drums and twin uni-stage drums are used to achieve the 30 sec./tire cycle time in the top machine configuration.

One preassembly line for off-line Innerliner+Sidewalls preassembling can be supplied by INTEREUROPEAN with the machines in order to reduce costs and increase the productivity of the Uni-Stage TBMs.

The total machine **cycle time** depends on the drum type and servicers configuration and varies from **30 to 35** seconds per tire in fully automatic mode.

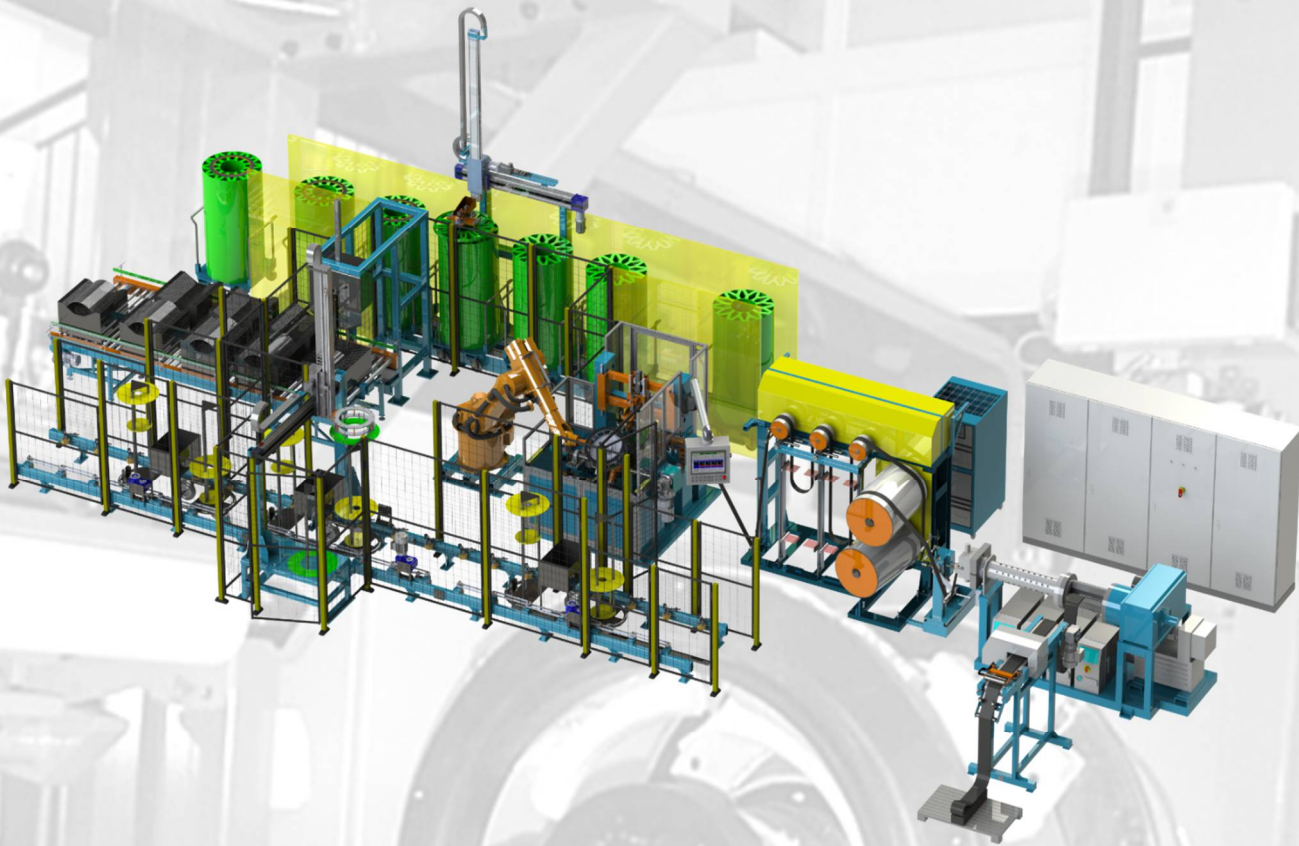
As an option, Innerliner and Sidewalls can be applied separately on the uni-stage drum for maximum tire design flexibility and optimum splice distribution on the circumference of the tire. The Separate Sidewalls Server with ultra-sonic cutting and electronic guiding systems provides for a fully automatic separate application of sidewalls on a uni-stage drum.

The Machine cycle time increase in this case is just 5 seconds.



**Machine Body**

Special cassettes with beads and separators arrive from the company's well-known Bead Apexing Lines, working in fully automatic mode and equipped with a robot that places the beads and separators into the cassettes. One bead apexing line can produce enough beads for two Uni-Stage TBMs and is offered as standard with the building machine.

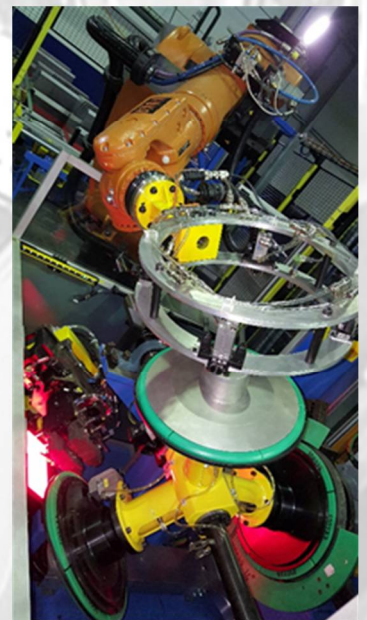


The same type of robot is used in the Uni-Stage TBM for loading the beads into the automatic bead setters, providing for precise automatic placement of the beads on the uni-stage drum during the machine cycle.

The carcass components, such as IL+SW complex, ply 1 and ply 2, are automatically centered by active guiding systems, pre-cut to length and applied on the uni-stage drum by the Carcass Components Servicer (see the picture above).

IL+SW complex cutting is performed by a special ultrasonic cutting device with a vertically adjustable cutting angle. This solution enables extremely low angle cutting, thus increasing the contact surface between the layers of the material in the splice area to avoid any possibility of air entrapment. Special multi-disk presser roll helps to push the air out during material application on the drum.

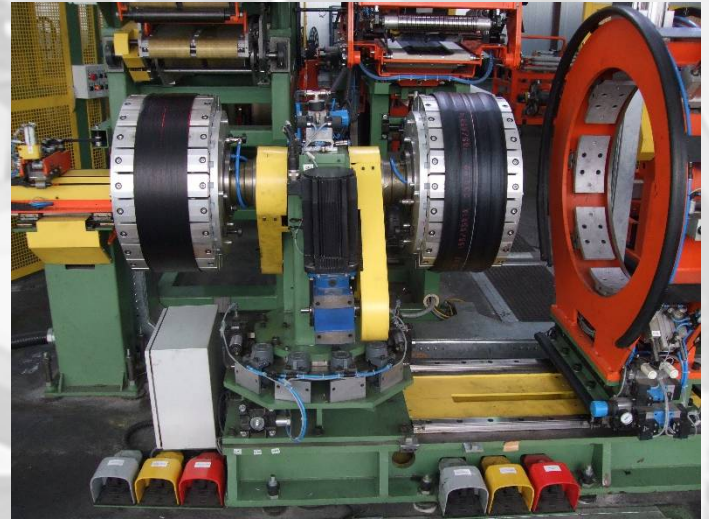
At the same station, the beads are placed into the bead setters by a robot at the beginning of each cycle and the bead setting and turn-up operations are performed on the un-stage drum.



Carcass always stays on the same uni-stage drum during the whole assembling process. After performing the turn-up operation the unistage drum moves to the second position, while pre-shaping, to receive the belt & tread package from the breaker drum by transfer ring.

The belt and tread package is assembled in two steps on two independent breaker drums, installed on a rotating turret. The new generation of breaker servicer enables high-speed and butt-splice application of breakers on the drum from the bottom by means of magnetic-type conveyor belts. Active guiding of breakers is executed by high-resolution cameras, while length measurement is checked by various electronic systems, enabling the material length to be distributed evenly on the circumference of the drum.

Spiral nylon overlay is applied immediately after the breakers by a high-speed application head with tension-control system, ensuring constant material tension during the various stages of application. Any spiral winding patterns can be programmed and memorized in the machine recipes.



At the next station, the tread band is applied out of spool. The tread band is automatically applied and cut over the drum after application by ultrasonic blade. This application system, called the 7/8<sup>th</sup>, gives maximum precision of the tread splicing, as the positioning tolerance is limited only to the short tail of the material remaining to be applied after cutting over the drum. The ultrasonic cutting device has a vertically adjustable cutting angle, enabling extremely low angle cutting, thus considerably increasing the contact surface between the layers of tread in the splice area and making the splice almost invisible to the human eye. A multi-disk presser roll with adjustable pressure stitches the tread during material application on the drum. The active guiding system ensures precise centering of the tread before application.

After tread application, a transfer ring picks up the belt & tread package from the breaker drum and moves it to the uni-stage drum over the pre-shaped carcass. The final shaping, dynamic stitching and green-tire unloading by the transfer ring completes the machine's cycle.



### Automatic Servicers

Every let-off station is equipped with a double set of removable let-off carriages. This enables a service technician to replace the bobbins outside the let-off station while the machine continues operating. Replacing a let-off carriage with a new one is simply a matter of switching the carriages and splicing the ends of the material in the let-off station. This system enables very quick spool changes, reducing machine downtime.

The Uni-Stage TBM control system is designed with a modular architecture using the newest hardware components available on the market. Based on customer preference, the machine can be supplied with Allen Bradley or Siemens PLCs and components.

A touchscreen HMI is provided as standard, with graphical interface and dedicated screens for every machine function, recipe management, extensive alarms handling and production statistics.

Other optional components and servicers can be added, such as chafers, strips, nylon cap-ply, etc. Different versions of uni-stage drums (bladder / mechanical turn-up type), breaker drums with motorized diameter adjustment, and full range transfer rings can be supplied upon request to speed up tire size changes.

Intereuropean's Uni-Stage TBM is supplied with motorized adjustments of all the key machine parameters according to the recipe settings. This includes motorized conveyor angle adjustments based on the new drum diameter, centering device adjustments based on the material width, stitching device adjustment based on the new tire size, etc.

All these additional functions help to minimize the time required for size changes, which is the key to achieving the winning combination of high flexibility and high production output in this new tire building system

## Standard configuration of Uni-Stage Tire Building Machine

- a. Indexing Machine body with two uni-stage building drums
- b. Splice control system for checking components application on the drum
- c. Indexing turret with two Breaker Drums, covering the full range of diameters
- d. Mobile transfer ring unit with set of segments, covering the full range of diameters
- e. Laser Position marking systems with automatic positioning (3 pcs.)
- f. Multi-disk type stitching roll for components stitching during application
- g. Automatic Bead setter rings

### Robot for automatic placement of the beads into the bead setters

#### Automatic Server for carcass components

- a. Configured for manufacturing of two plies tire construction
- b. Four component let-off stations, one of which is dual (for sidewalls)
- c. Active guiding systems for innerliner and sidewalls
- d. Mechanical pre-centering on let-off stations for innerliner and ply
- e. Automatic cut-to-length systems for all the semi-finished components
- f. Automatic super-assembly system for innerliner and sidewalls
- g. Component Feeding conveyors from the let-off stations to the application conveyor
- h. Automatic mobile Application conveyor with active fine centering of components before application on the drum.
- i. Multi-disk type stitching roll for components stitching during application
- j. Sensors for detection of spool change splices and material folds on component feeding conveyors
- k. Sensors for material presence inside the spools
- l. Robust Server main frame for elimination of vibrations during operation

#### Automatic Server for Belt & Tread assembly components

- a. Server for the 1st and the 2nd Breaker with contact type application system from the bottom, consisting of cutting and application conveyors.
- b. Dual Let-off Stations for each Breaker for minimizing the downtime at spool changes
- c. Automatic active guiding and cutting to length system for breakers
- d. Additional breaker length control system after cutting for double checking the actual length of the breaker and its precise distribution over the circumference of the drum by synchronization of the motors
- e. Automatic Server for Spiral Nylon Overlay (JLB) with single application head. Optional dual application head is available upon request for special type applications.
- f. High capacity festoon with tension control system
- g. Tension control and regulation device, integrated into the JLB application head.
- h. Automatic Tread Server with dual let-off station for quick spool changes
- i. New and upgraded version of the multi-step active guiding system for tread during application right before application on the drum
- j. Ultra-sonic type cutting device for tread cutting after application on the drum, with adjustable angle up to 15°
- k. Multi-disk type tread stitching roll with adjustable pressure
- l. Sensors for detection of spool change splices and material deformations on component feeding conveyor
- m. Sensors for material presence inside the spools

#### Dynamic Green Tire Stitching Device

- a. Fully automated stitching device with automatic setting of all the stitching parameters at the size change, according to the new receipt settings
- b. Possibility of stitching of tires of different construction (TOS or SOT)

## **Integrated Tire Assembling Cell (ITAC) for production of 2.5 million tires / year**

Integrated Tire Assembling Cell (ITAC) includes the following components:

- 4 fully automatic Tire Assembling Machines
- 2 Bead Apexing Lines
- 1 Bead Winding Line

ITAC is designed for production of 8000 tires per day or 2.5 million tires per year, and it is capable of manufacturing 4 different tire sizes at the same time.

ITAC requires 6 operators to run complete system (1 for each tire assembling machine, 1 for the two Bead Apexing Lines and 1 for the Bead Winding Line). Operators provide also for the spool replacement and material feeding to their machines.

Beads are manufactured directly inside the ITAC system on a dedicated bead winding line, which can be supplied in configuration for square section beads or hexagonal beads production.

Manufactured beads are automatically unloaded from the drum and loaded into the cassettes, which then are transferred automatically to one of the two Bead Apexing Lines for further application of Apex.

Once the beads arrive to the Bead Apexing Line, they are automatically loaded into the machine by a robot. Upon application of apex, beads are unloaded by the same robot and placed into mobile trucks, separated by special plastic spacer rings. Mobile trucks are then transferred automatically to one of the four Tire Assembly Machines (TAM), producing corresponding tire size.

Accumulation loops for incoming trucks on each TAM have sufficient capacity to guarantee uninterrupted production of tires for 24 hours.

Each Bead Apexing Lines makes one size change every 12 hours of operation (or 4000 beads), feeding two TAMs with two different sizes of beads with apex.

The cassettes and trucks handling process is controlled by the integrated control system, which manages the entire production process and controls all the machines working inside the ITAC system.

Control of beads manufacturing, apex application and tire assembling is executed in automatic mode by means of cameras and sheet laser systems, checking material application precision and splice quality at every step of the assembling process.

Automated size change operations allow to reduce to minimum production losses due to frequent size changes, while availability of 4 independent Tire Assembly Machines inside the system allows to optimize their performance by dedicating each of them to a particular tire size and making only quick changes of the tire dimensions within the same bead diameter. Such approach allows to dramatically increase the flexibility of production and makes it possible to manufacture small lots of tires without considerable production losses.

INTEREUROPEAN's Tire Building Drums and tooling, available in both Uni-Stage and 1<sup>st</sup> & 2<sup>nd</sup> Stage version, can be adapted to the customer's production process and specifications. As an option, it is possible to customize the machines to use the customer's own existing drums, if that does not compromise the machine operation.

The new generation of fully automatic Bead Apexing Lines, offered as part of the ITAC system are fully industrialized and operating in different tire plants.

The ITAC system can be supplied in either Uni-stage or Combi configuration, depending on the customer's preferences and production process.

Tire size range covers all the PCR & LT tires up to 24", including ultra-high performance tires.

# Uni-Stage TBM

## for PCR & LT Tires

Technical Data	PCR-LT20	PCR-LT24
Bead Diameter (inch)	13"-20"	15"-24"
Green tire diameter	800mm	1000mm
Bead Setting width – max	600mm	700mm
Breaker drum diameter	750mm	980mm
IL+SW complex width, max	1000mm	1200mm
1 <sup>st</sup> Ply width	900mm	1000mm
2 <sup>nd</sup> Ply width	900mm	1000mm
Sidewalls width max	240mm	260mm
Steel/Textile chafers width	25mm – 90mm	25mm – 90mm
Breaker width	280mm	350mm
Breaker cutting angle	18° - 30°	18° - 30°
Tread Band width	350mm	450mm
Tread length	2500mm	3200mm
JLB/Spiral Nylon Overlay width	10mm - 25mm	10mm - 25mm
PLC type	Allen Bradley SLC 5000	Allen Bradley SLC 5000
Pneumatics	FESTO	FESTO
Cycle time per carcass	30 sec.	40 sec.
Production output, up to	~2500 tires/day *	~2000 tires/day *
Operators required	1 machine operator	1 machine operator
Required floor space (with 2 plies configuration)	12.510 x 12.940mm	13.010 x 13.450mm

(\*) - depending on production conditions, skill level and efficiency

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