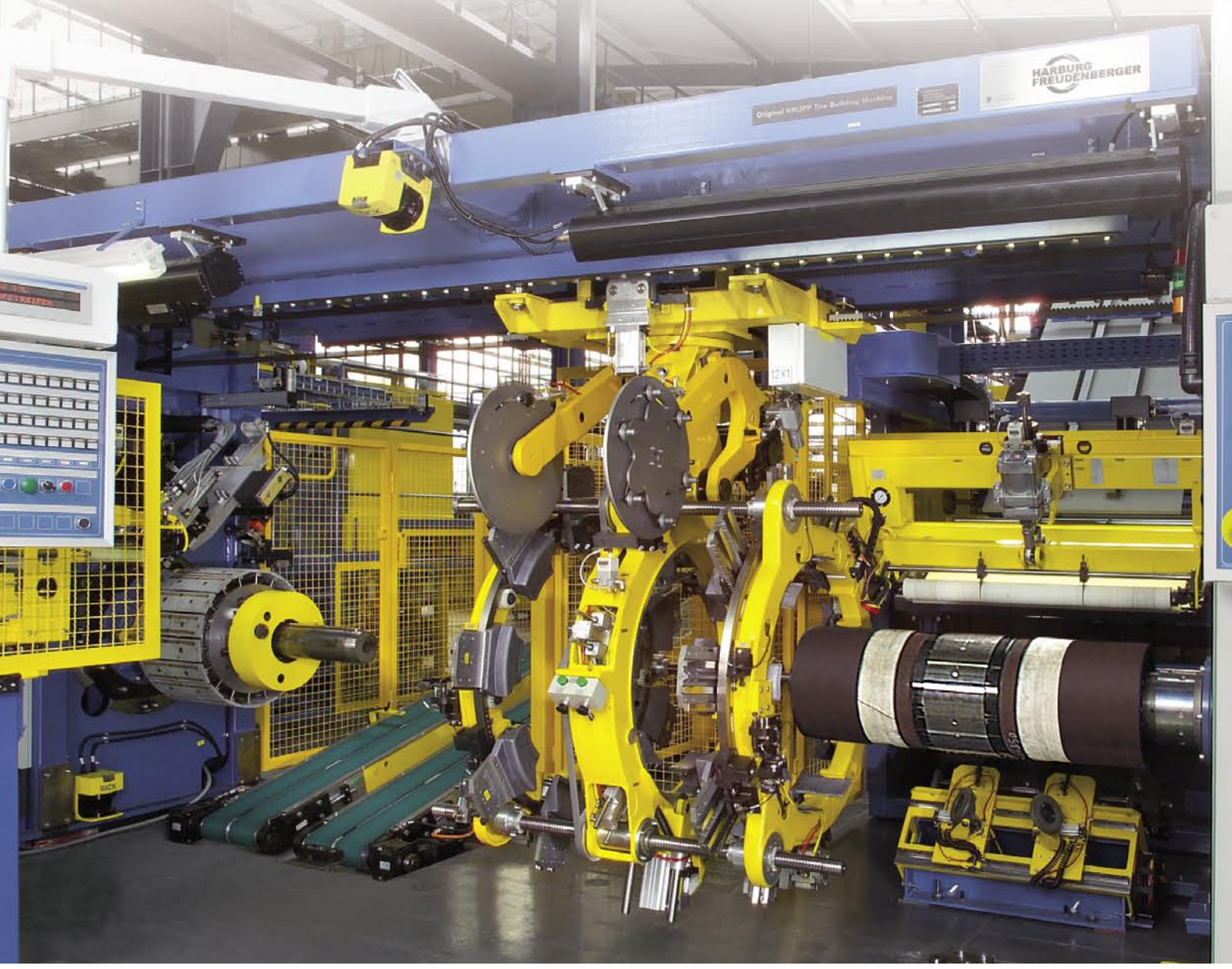
Tire Building Machines for the Production of High Performance PCR and LTR Tires

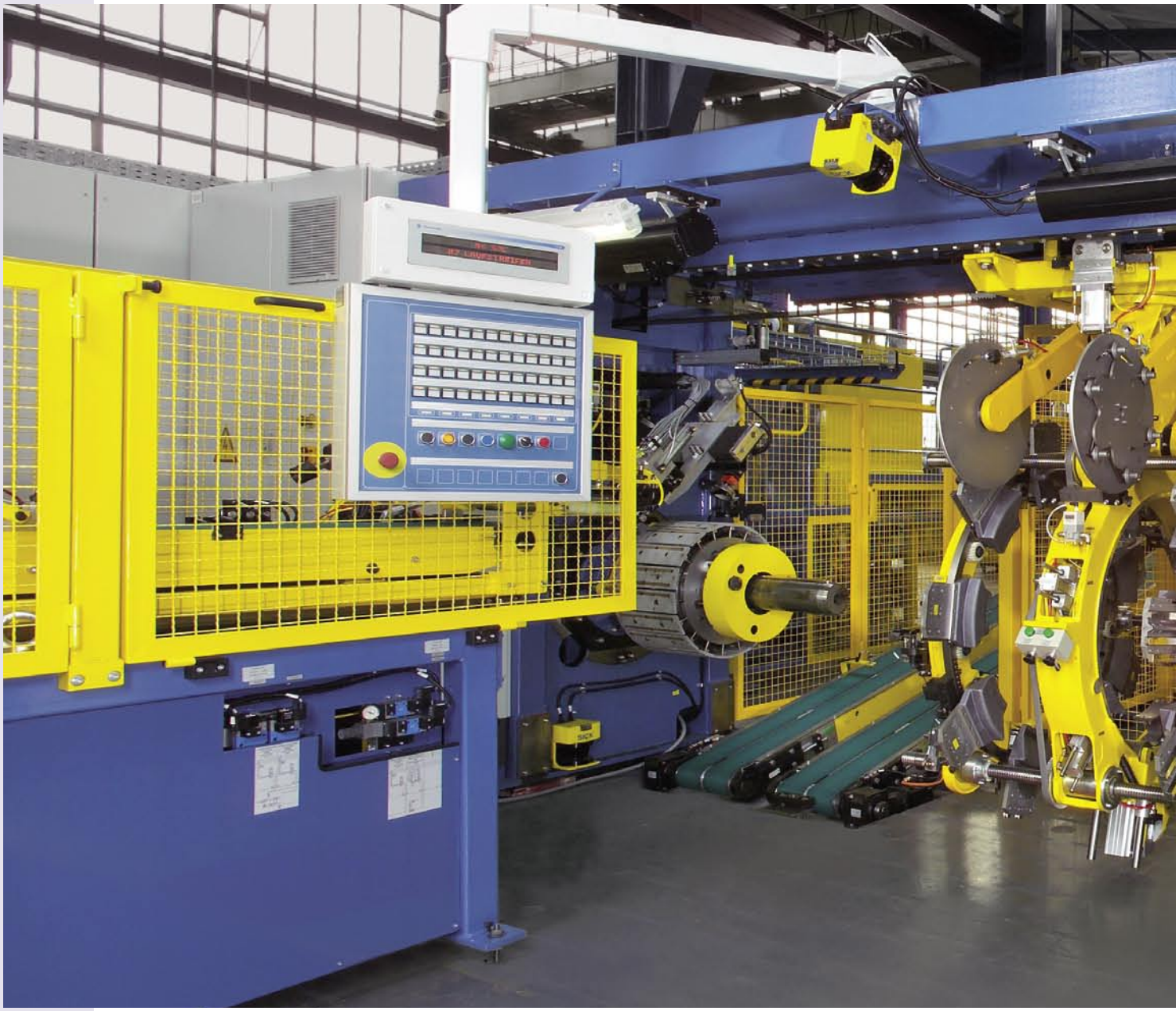


HARBURG
FREUDENBERGER

We meet our customers' expectations.

Harburg-Freudenberger supply the machinery you need for the production of high performance and ultra high performance tires.

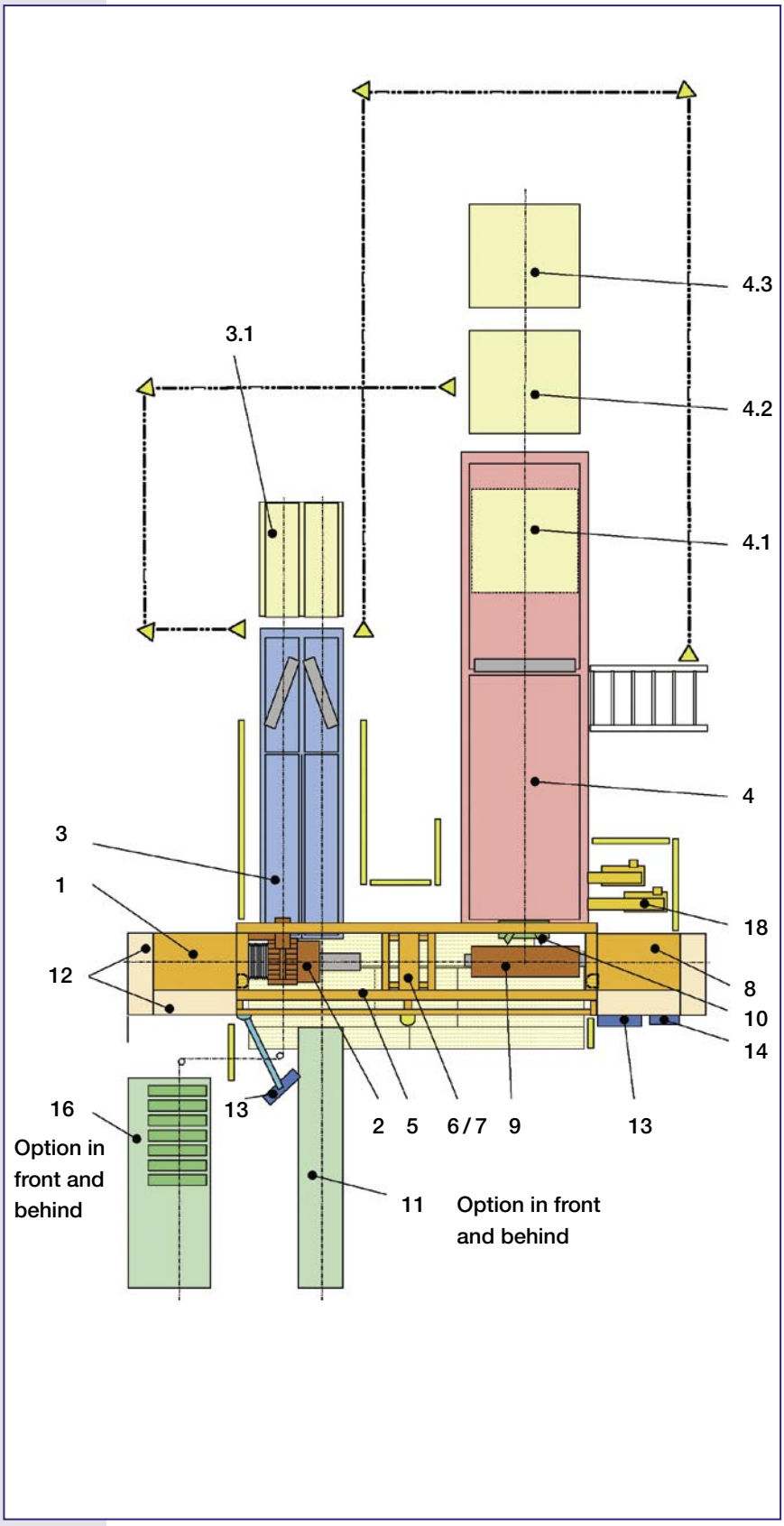
Tires built on our machinery meet leading car manufacturers' requirements, especially with respect to uniformity.



Unistage Tire Building Machine PCR/LTR-1+2

To achieve this, our tire building machines are designed and built with greatest accuracy. Once assembled and aligned, it guarantees many years of high precision perfomance. Output exceeds 1,200 tires a day, generally reaching up to 1,400 while maintaining constant tire uniformity.

Our highly automated machines combine high production output and consistently high product quality with low manpower requirements and low maintenance costs.



Unistage Tire Building Machine
PCR/LTR-1+2

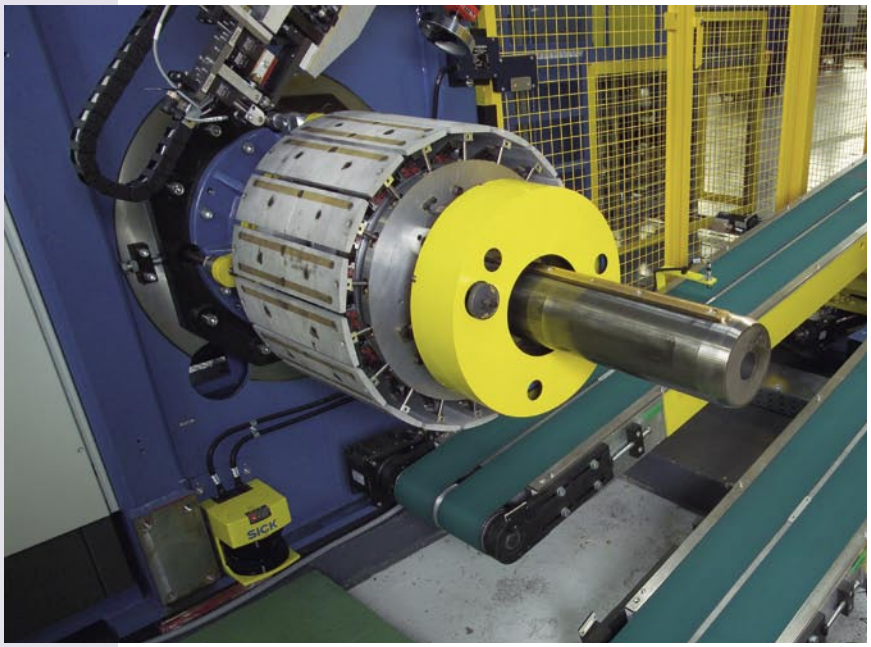
1 Belt building machine
2 Belt building drum
3 Automatic belt server
3.1 Let off station belt
4 Automatic ply server with integrated pre-assembling
4.1 PA let off station
4.2 BP1 let off station
4.3 BP2 let off station
5 Transfer station
6 Transfer ring
7 Bead setting device
8 Tire building machine
9 Tire building drum
10 Dynamic stitcher
11 Reel tread server
12 Main switch cabinet
13 Operator`s panel
14 Industrial PC
16 JLB server /let-off station
18 Chafer server

Unistage Tire Building Machine PCR/LTR-1+2

Machine Type		**TBM Unistage**** **PCR 1+2 Tires**
Bead range/size	in	12 - 20
Green tire ø	mm	480 - 800
Tire assembly drum ø	mm	286 - 482
Bead to bead distance (outer edges of bead)	mm	280 - 600
Shaping stroke	mm	max. 150
Body ply width (BP)	mm	280 - 870
Pre-assembly width (PA)	mm	380 - 1000
Belt building drum ø (expanded)	mm	460 - 560
	mm	490 - 590
	mm	540 - 640
Belt building drum ø with slip-on segments (expanded)	mm	590 - 690
	mm	640 - 740
	mm	640 - 770
Belt length form tip to tip	mm	max. 3405
Belt width	mm	100 - 350
Cap ply width	mm	115 - 250
JLB tension control width of material	mm	10 - 25
Transfer ring, working range ø	mm	480 - 670
	mm	650 - 820
Tread length	mm	max. 2500
Tread width	mm	max. 350
Chafer strips or cushion strips	mm	40 - 80 (min./max. width)
	mm	240 - 640 (distance)
Connect load	kW	approx. 30
Total weight of tire building machine	kg	max. 20000 - 23000
Production output of green tire (attainable)		800 - 1400* tires per day

* depending on customer‘s material, operator‘s skill and number of tire components

** other dimensions upon customer request are possible



1 Belt building machine

3 Automatic belt server with customized let-off station(s)

1 Belt building machine

- precision drive with AC servomotor
- compact design, low space requirements
- belt building drum with two lateral setting positions for fast and precise belt component assembly

2 Belt building drum

- infinitely variable diameter setting for various tire sizes
- all belt building drum segments equipped with magnets which hold the first and second belt ply
- diameter can be changed by using a set of slip-on segments

3 Automatic belt server with customized let-off station(s)

- for steel cord belts
- automatic precision splicing
- belt ply placement monitored by CCD camera systems
- compensation of belt tip deviations
- stop and alarm messages for unacceptable material deviations
- automatic change of tire size via PLC tire menu

4 Automatic ply server for assembled innerliner (PA) and one or two carcass plies (BP)

- automatic cutting of pre-assembled innerliner and carcass ply to pre-determined lengths
- automatic length checks to regulate the feeding speed and to control the splice width
- automatic width measurement
- automatic center control of components via CCD camera systems

4 Automatic ply server for assembled innerliner (PA) and one or two carcass plies (BP)

- automatic component application and splicing via multidisc roll
- automatic adjustment of the carcass splice distances
- large reel let-off stations

5+6 Transfer station with transfer ring

- infinitely variable automatic adjustment to the belt diameter
- high repetitive accuracy of transfer ring positioning by mechanical locking when the belt is being transferred from the belt building drum to the tire building drum

7 Bead setting & pushing device

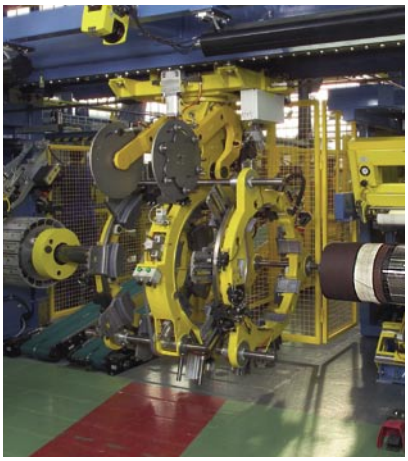
- the beads are centered and precisely set by a bead setting device integrated in the transfer unit
- a mechanically adjustable pusher device guarantees precise symmetrical turnover; parameter settings are used to adjust the pusher forces

8 Tire building unit

- precision drive with AC servomotor
- standard flange seat for various tire building drums
- compact design, low space requirements, good accessibility

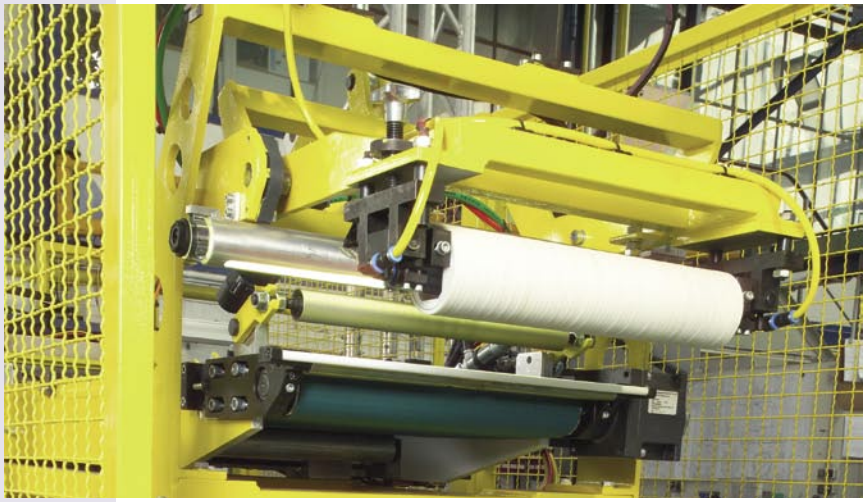
9 Tire building drum

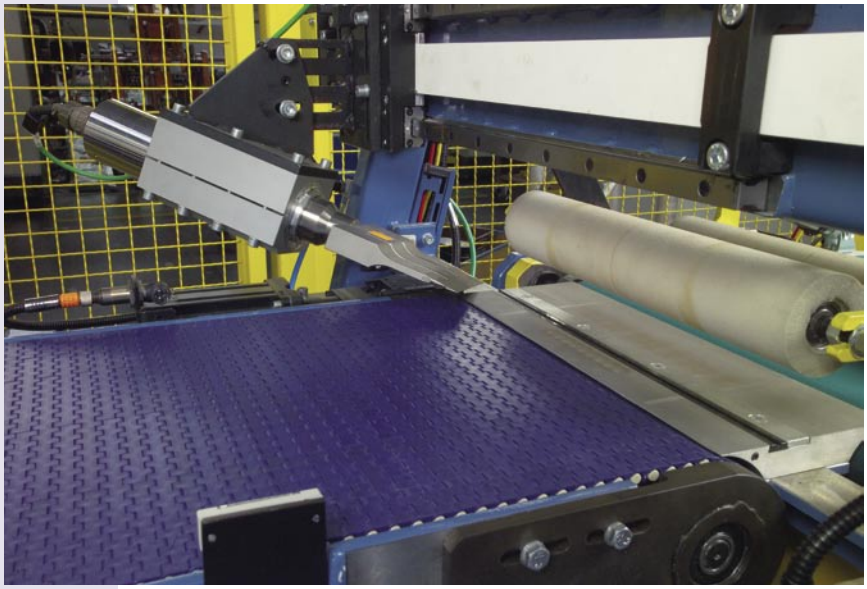
- diameter-limited bead clamping system ensuring true running
- adjustable in width by spacer
- short changing times due to the drum's symmetrical structure
- internal precision spindle for width adjustment
- "sidewall over tread" and "tread over sidewall" assembly methods
- customized drum systems with six, four, two bladders or without bladders available



5-7 Transfer station with transfer ring/ Bead setting & pushing device

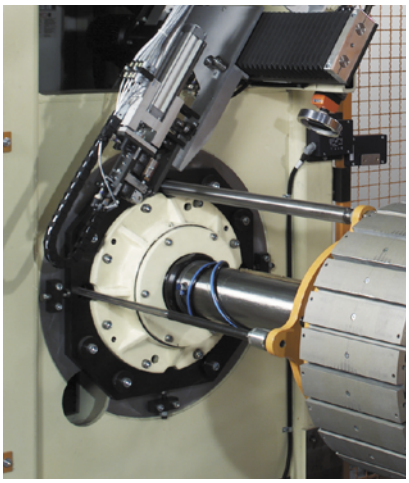
8 Tire building unit





11 Reel tread server/15 Automatic reel tread cutting

16 JLB



JLB applicator

11 Reel tread server

- precision guidance of tread ensured by center or edge control
- mechanical height adjustment to the belt building drum diameter

15 Automatic reel tread

- automatic centering, length measuring, ultrasonic cutter
- placement of tread from the top

16 JLB server-tension control

- narrow cap strip (jointless band) can be processed, various winding patterns, freely programmable

17 Automatic cap ply server

- cap ply can be processed as required

19 Chafer server

- for textile and steel cord material

19.1 Cushion strip server

- automatic application and cutting of cushion strip material

Unistage Tire Building Machine PCR/LTR-1+2: The tire building process

Process sequence (Unistage)

Step 1
Carcass building by use of pre-assembled innerliner, abrasion strip and sidewalls (PA), body ply. Manual bead loading, automatic bead setting.

Step 2
Belt building with cap ply /JLB and tread. Manual tread loading and splicing. Option: reel tread processing and manual splicing. (Step 2 synchronized with steps 1 and 3)

Step 3
Automatic shaping and assembly of the carcass and the belt package, stitching. Manual green tire removal. Option: automatic removal of green tire.

Operating personnel: 1 operator;
tire design: radial tires (textile cord); 1/0 or 2/0 ply turn-up mode; unistage process; including 2 belt plies (steel cord); cap ply or jointless band (JLB), TOS and SOT tire construction.

To meet our customers' expectations, every tire building machine must be able to produce a large amount of different tire types and sizes while making a change of dimensions within minutes possible.

The tough requirements of everyday production call for a rugged machine which is wear-resistant and easy to maintain. Know-how and experience gained over decades have enabled us to design machines which are up to the task.

The PCR/LTR-1+2 has following advantages:

- automatic pusher/bead setting system, PLC-controlled
- short stop periods due to tooling components which fit several tire dimensions
- individually adjustable pusher forces and movements
- increased production stability through fault diagnosis system
- increased production output through optimized operating cycles

Product quality

The automation of all essential work steps such as component length cutting, feeding, positioning, and splicing make the outstanding quality of the assembled green tires possible. Length deviations caused by the material used are automatically corrected by adjusting the feeding and drum speed to guarantee product tolerances to within fractions of one millimeter. All machine components comply with tire industry quality standards.

Performance

The PCR/LTR-1+2 tire building machine can produce up to 1,400 green tires per day. The high degree of automation allows even larger output quantities in correlation with an optimization of production logistics. This is achieved by meshing individual production steps and through the high speed of up to 60 m/min with which the tire components are transported and applied (up to 400 m/min of JLB).

Retooling time

Short retooling times are made possible through tire recipes stored in the PLC. These recipes contain all essential parameters for automatic production of individual tire types and sizes. A further reduction of retooling time can be achieved during change of dimension by using variable toolings.

Machine logistics

Enhanced output performance through

- large material rolls supplied by customer
- material cassette systems
- personnel to (un)load the materials
- optimization of existing logistic systems through better cooperation between customer/supplier

Highlights of the new PCR/LTR-1+2 control system

The modular control system is programmed to meet today's demands, such as

- digital technology
- bus system technology
- hardware and software modularly implemented according to TBM-function, programmed according to IEC 61131-3
- intelligent HMI- and diagnosis systems
- digital servo drives
- high degree of availability
- menu-guided recipes
- intelligent fault handling systems
- communication (PC) with the higher ranking computer systems

Unistage Tire Building Machine PCR/LTR-1+2
Important Developments

Main machine

- use of components well-proved in production
- head, tailstock and bridge are one welding part
- higher rigidity
- easier installation and maintenance
- cost-saving (no foundationframe etc.)
- integrated switch cabinets

Transfer system

- combined bead setting and pusher device (servo controlled pushing, suitable for TOS or SOT)
- segmented pusher / bead setting components (suitable for 2 inch-sizes each)

Safety equipment

- safety analyses due to demand for CE conformity
- protection of operator and complete TBM via protective railing, light barriers, safety mats and scanners

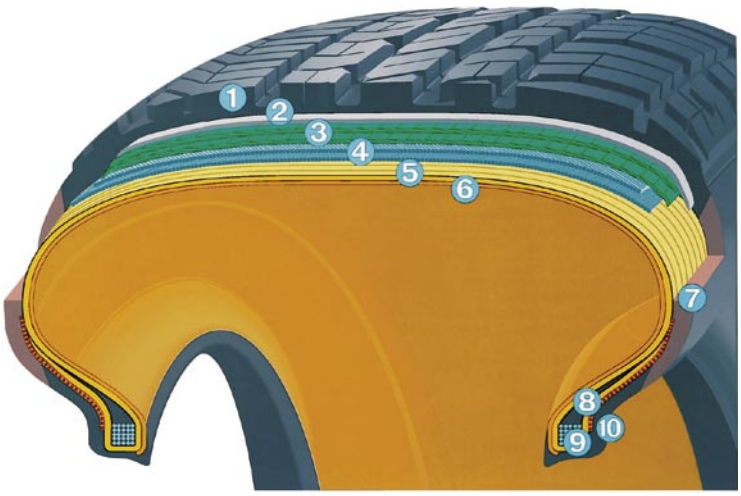
Dynamic stitcher

- axial and radial movements by servo drives
- separate sidewall stitching possible
- quick and precise motions
- modular design / cost-saving

Service

We take pride in being a reliable service partner after the machinery has been delivered. Detailed service requirements should be determined in an individual meeting.

Operating Tools	**PCR/LTR-1+2**	**12 - 20 in**		
Carcass Drum Types	pusher bladder	>type B6	6 bladders	P0/TU/SB
	pushing device	>type B4	4 bladders	-/TU/SB
	pushing device	>type B2	2 bladders	-/TU/-
	Movements, PLC-Control	>type SMT (Semetrical-Mechanical-Turnup)		
Pushing/Bead Setting Segments for	**2-inch sizes each**			
	12/13 in; 14/15 in; 16/17 in; 17/18 in; 18/19 in; 19/20 in (other dimensions possible)			



Parts of a Modern PCR Tire

1. **tread**
2. **base**
3. **cap ply/JLB**
4. **steel cord belt**
5. **carcass**
6. **innerliner**
7. **side wall**
8. **apex**
9. **bead**
10. **abrasion strip**

The complete Range of Mixing Room Systems, Rubber Processing and Tire Manufacturing Processing Machinery

Complete Mixing Room Systems
for the tire industry and for the technical rubber goods industry including plant for storage, weighing and feed of compound components.

Heavy Duty Internal Mixers

- with tangential rotor system
- with intermeshing rotor system

Laboratory-size Mixers

- with tangential rotor system
- with intermeshing rotor system

Heavy Duty Mixing Mills

- with individual roll drive and hydraulic roll nip adjustment

Single-Screw Dump Extruders EAE
as hot-feed extruder

- with roller-die
- with strainer device
- with pelletiser head
- with strainer/tube slitter head

Conical Twin Screw Extruder DSE

- with roller-die

PLC Control Systems

as single machine and systems control

Process Control Computer PKS

as mixing room automation system

Venting extruders

- processing extruders
- extrusion lines

Extrusion lines

- for the economic, processcontrolled production of tubes and profiles for both mono- and co-extrusion with and without metal inserts

Compounding extruders

- roller-die extruders
- strainers
- pelletizers

Processing extruders

- hot-feed
- cold-feed, pin-type extruders for all extrudable tire components and profiles, e.g. tread and sidewall profiles and innerliners; complete extrusion lines

Tire building machines and accessory equipment

- 1st + 2nd stage - car and light truck tires (unistage)
- 2nd stage - car tires
- servicers, tread supplier drums, band applicators

Hydraulic tire curing presses

- for car tires
- for truck, tractor and EM tires

Detailed individual brochures are available on all the machines and lines indicated.

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

Harburg-Freudenberger Maschinenbau GmbH
Kautschuktechnik • Speiseöltechnik
Seevestraße 1 • 21079 Hamburg • Germany
Postfach 90 05 52 • 21045 Hamburg • Germany
Tel.: +49 40 77179 - 0 • Fax: +49 40 77179 - 325

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

Hamburg-Harburg Freudenberg Belišće Topeka Akron Paris Teheran Moskau

www.harburg-freudenberger.com

L3-0206/2. 1-Tö