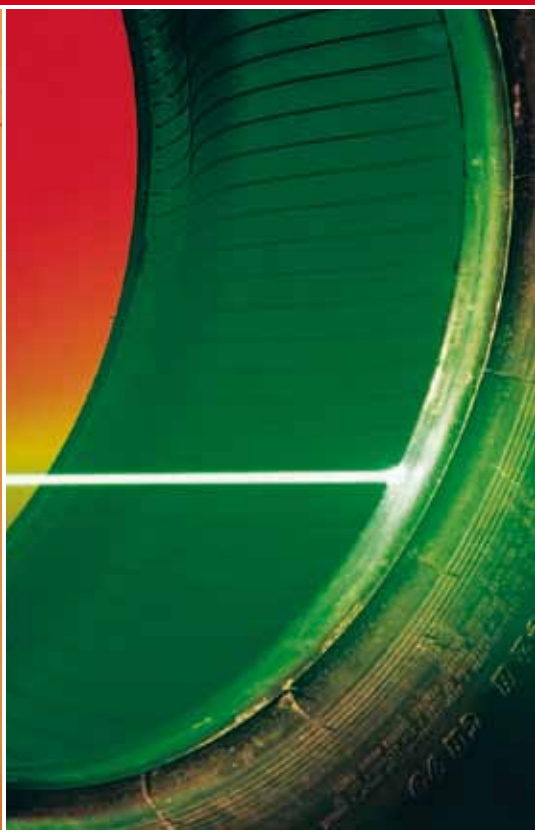
Intact®

SHEAROGRAPHY TIRE INSPECTION



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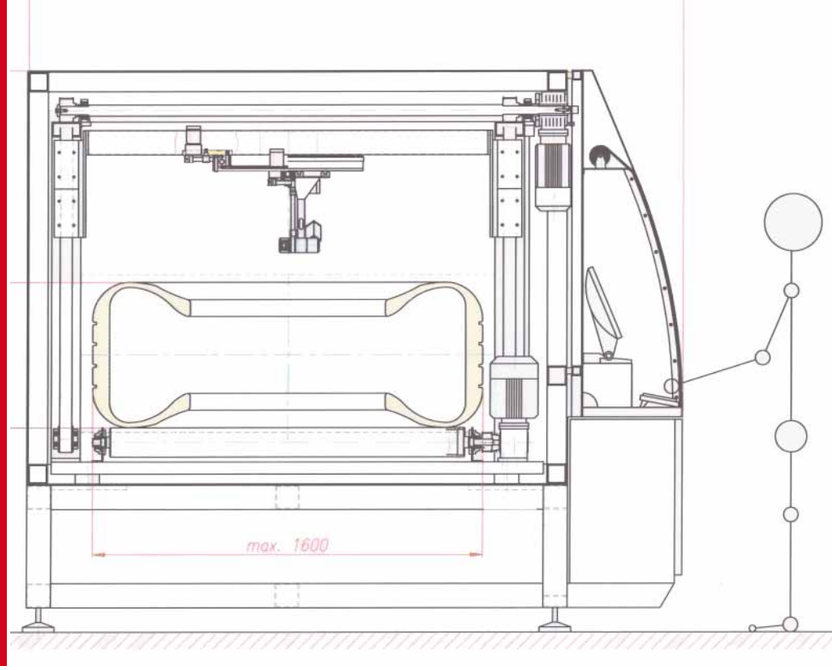
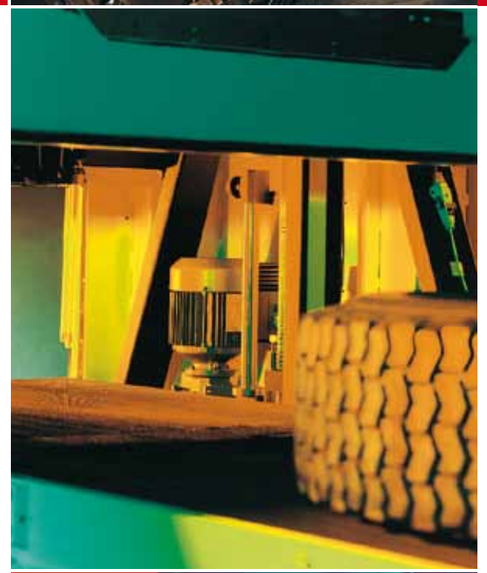
TIRE INSPECTION WITH Intact® FOR ENHANCED SAFETY AND QUALITY

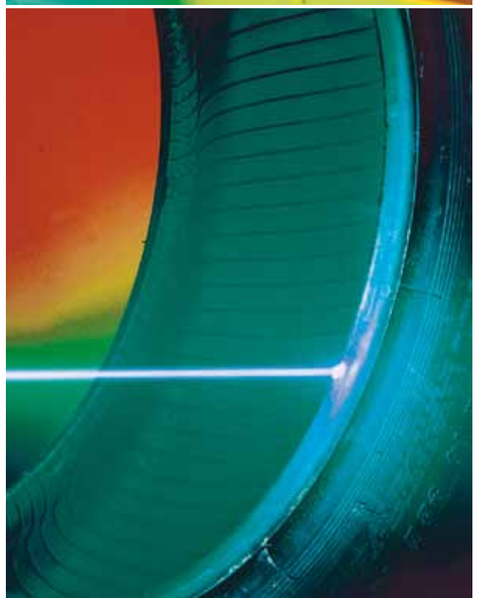


The shearography tire test systems from Steinbichler Optotechnik have been developed for the non-destructive testing of new tires in R&D and quality control, as well as for the inspection of tire carcasses in the retreading industry. The technical basis of the systems is the phase shearography system.

During the test cycle, a pressure difference (vacuum, e.g., 50 mbar) is generated in the vacuum chamber, thereby inducing deformations which are caused by the expansion of air pockets occuring in faulty areas in a tire carcass. With the phase shearography technique - a holographic measurement method which reliably detects material deformations in the range of microns - faulty areas can be localized clearly and reproducably.

The Intact tire test systems by Steinbichler Optotechnik have successfully proven their functionality in the worldwide car-, truck-, and aircraft industries, as well as in the Formula 1 racing tire business.





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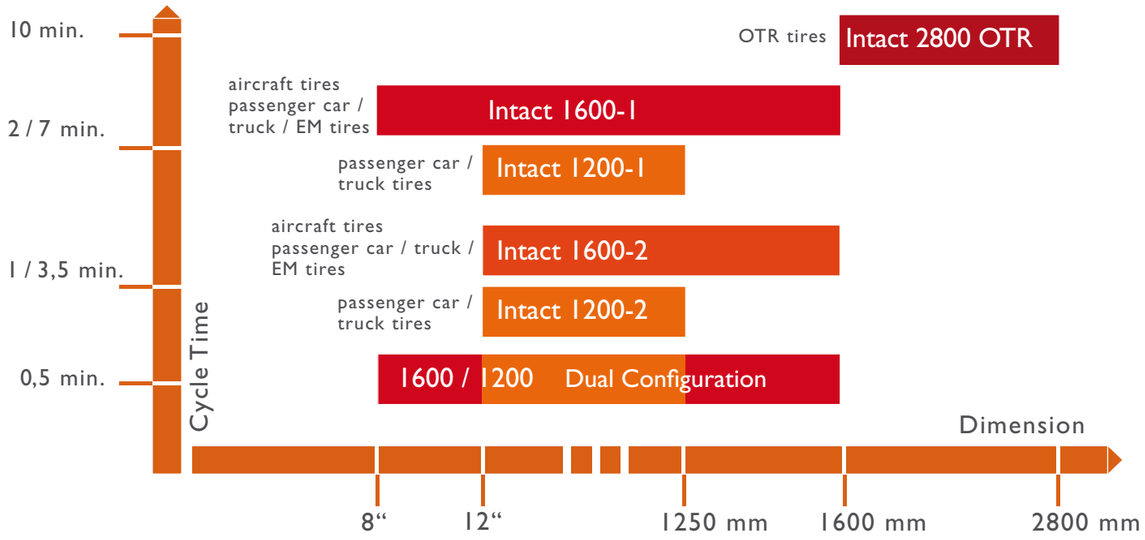
PHASE SHEAROGRAPHY: PRINCIPLE AND ADVANTAGES

By phase shearography the interferogram is directly recorded by a CCD-videocamera. The phase image of the original state of the tire at normal pressure is stored in the image memory of the computer. The phase images of the deformed states of the tire at decreased pressure are subtracted from the stored phase image in real-time (video frequency).

Fault-typical deformations are displayed as phase difference and interference fringes on the system monitor. The results can be stored for documentation on: hard disk of computer, CD, DVD, laserprinter, customer network.

- On-line evaluation, thereby enabling a direct quality verdict of the casing immediately after test procedure
- No influence by vibration in comparison to conventional interferometric methods
- No film material is consumed
- Compact, reliable set-up
- Operation by semi-skilled staff

APPLICATION AREAS OF THE Intact® SYSTEMS:

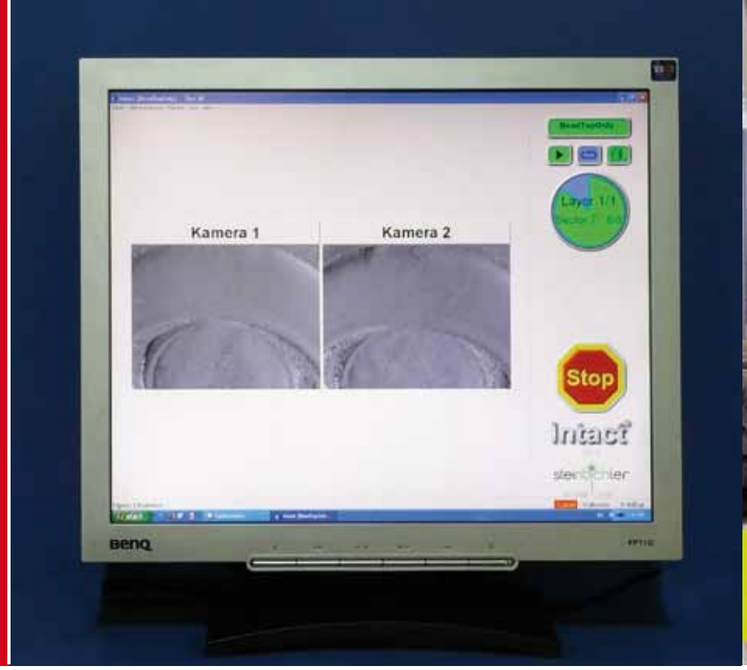


Typically, the inner side of the tire tread is measured in 8 sectors. Before starting the test cycle, the tire is horizontally loaded into the vacuum chamber. The measuring head rotates inside the tire. The high flexibility of the tire testers allows testing of tires with a wide range of diameters and sizes without any system changes. With a tilting axis on the measuring head the inspection of the bead and sidewall of the tire is also possible.

Owing to the fact that all typical faults in a tire can be detected with the Intact systems, high safety standards are achieved. Especially for the retreading business the systems offer a high economic potential because useless carcasses can already be rejected before further processing takes place.

In comparison to ultrasound test systems, the decisive advantage lies in the fact that the tires do not need to be put into a water tank.

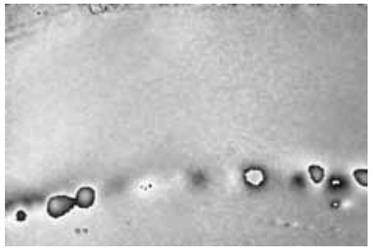
Intact®
SOFTWARE

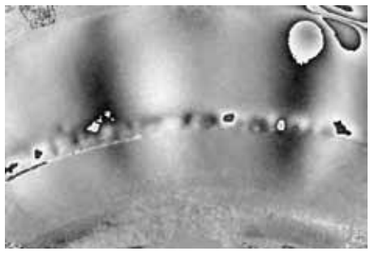


A significant feature of the tire test systems from Steinbichler Optotechnik is the easy operation based on a user-friendly Windows software. The Intact system series is especially designed for performing test cycles without needing continuous input from the operator regarding test parameters and decisions in selecting an appropriate test program. Thus, the user can concentrate on the tires to be tested, only ensuring the tire supply and optionally deciding whether the sidewall area should be also inspected. In a matter of minutes, the systems deliver clear results.

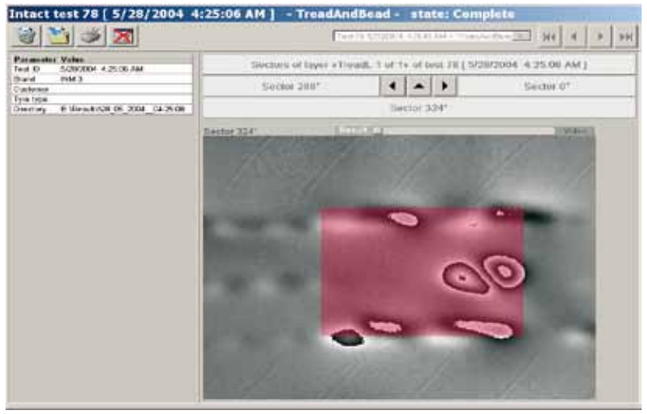
Automatic functions control the loading and the centering of the tires inside the vacuum chamber, as well as the position of the measuring head for the single sectors, corresponding to the automatically registered dimensions of the tire to be tested. Also, a complete display of all sectors (with or without sidewall inspection) is available.

The flexible software concept offers optimal support in archiving the test results. With the displayed result images, the operator can quickly make decisions about the further processing of the tested tire. The test results can be stored, printed, or sent as an e-mail attachment.





The Intact software represents the GUI (Graphical User Interface) developed by Steinbichler Optotechnik which provides a unique and user-friendly desktop based on the well-known Windows tools. The software has been developed in close cooperation with our customers providing their valued input directly from the shop floor. For an example, the integrated diagnosis functionality reduces service work to a minimum. Using simple and self-explaining buttons and a well-designed, clear windows structure, we achieved a high level of system integration which has set standards in shearography tire testing.



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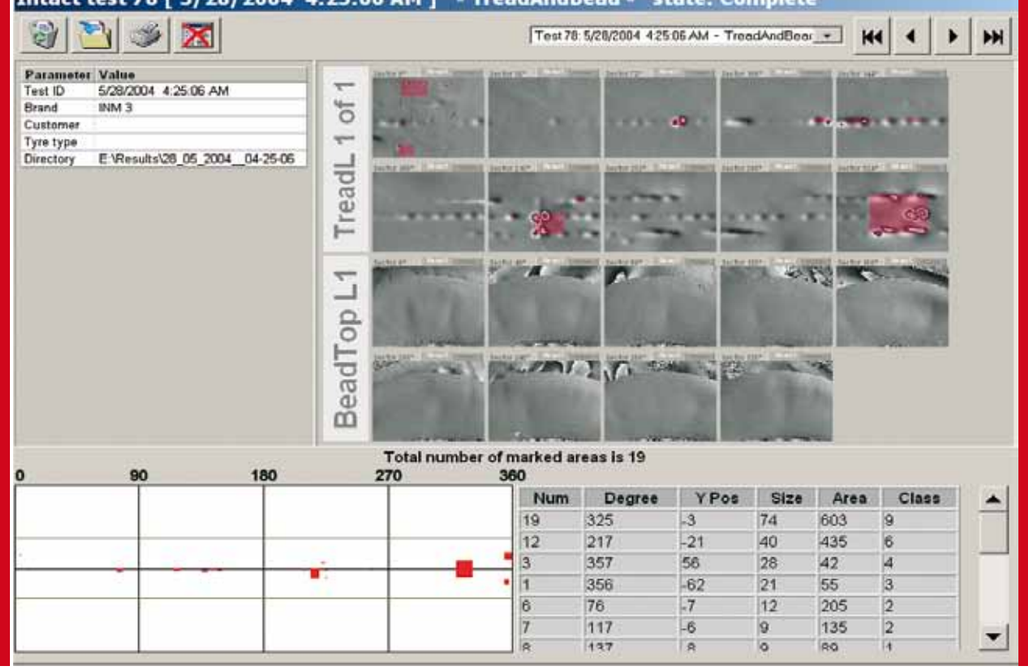
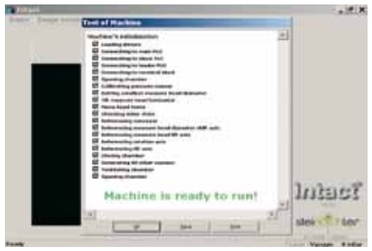
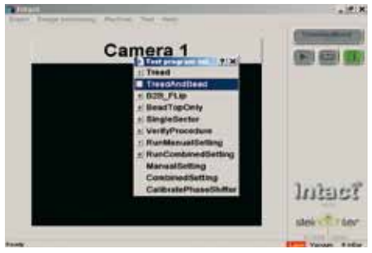


Intact® SOFTWARE

Due to the used computer technology, the systems can be perfectly integrated into existing network and database environments. A high number of the systems already delivered are equipped with a barcode reader and connected with customer-specific conveyor systems. Thus, the system can be operated in a fully automatic mode with subsequent result classification.

Optionally available fault detection algorithms further enhance the automation in the interpretation of fault areas by offering automatic recognition of fault-free or definitely faulty tires. This means that only critical decisions have to be made by the operator.





FUNCTION OVERVIEW
Intact® SOFTWARE

FUNCTIONS	
Fully automatic tire loading	•
Automatic tire size detection	•
Automatic parameter selection for the loaded tire without the need of operator input	•
Measuring technology applicable even for new tires with extremely shiny surface	•
Automatic hardware system test with every program start	•
Program for manual parameter settings (with collision protection); e.g., for tire development	•
Tread, bead-to-bead, bead only and continuous run mode for every test type	•
Hot-key or button functionality on GUI	•
Freely selectable supervisor, operator and non-operator mode	•
Automatic result display with all tested sections	•
Automatic zoom function when specific result is selected	•
Superimposing of result image with video image for easier defect allocation	•
Customized data file for image storage	•
Data compression for reduced file size	•
Display of test progress	•
Result images can be viewed independently from Intact system via HTML file format	•
Various optional print functions, e.g., for all results, single result or video image	•
Verification of result image parallel to acquisition of test results	•
Software available in Chinese, German, English, French, Spanish, Portuguese, Japanese	•
Remote control via modem for system service	•
Output for good/bad tires • Automatic defect detection and marking • Automatic defect localization and classification file with unwind graphics for tread inspection • Verify block for automatic quality control of optical components • Touchscreen interface with optimized buttons for easier operation • Barcode support from „Read Only“ to full integration into customer data base • Verify functionality for ASTM test block • Interface to existing production data base	• options

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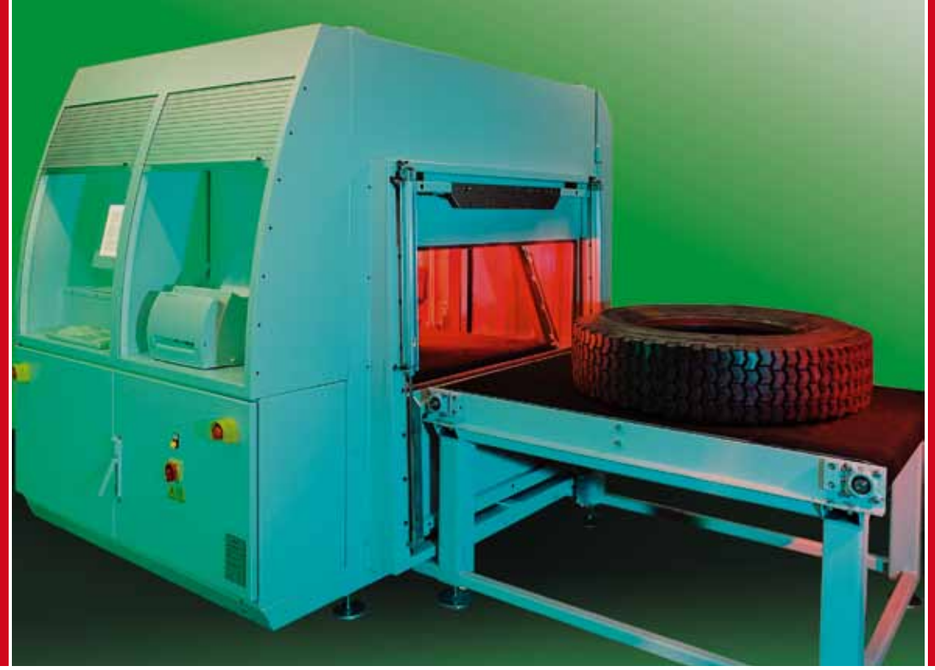
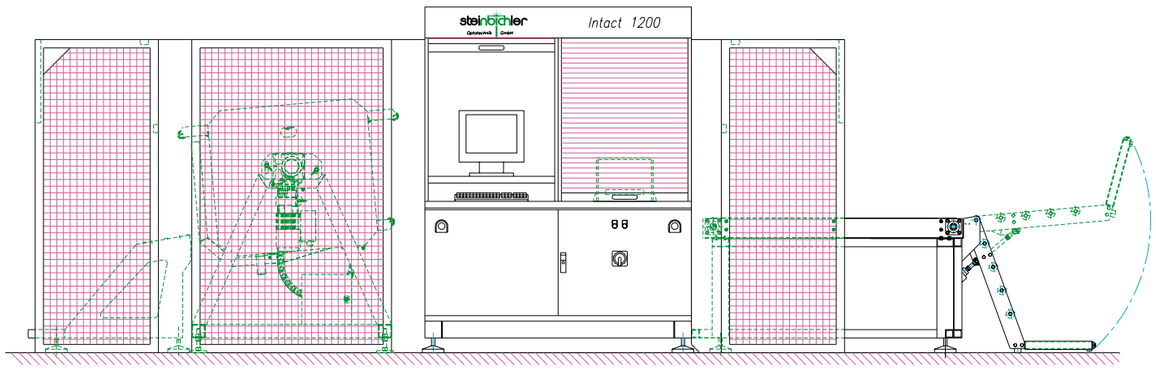
Intact® 1200-1 / Intact® 1200-2: PASSENGER CAR / (LIGHT)TRUCK TIRES



The shearography tire test system Intact 1200-2 for passenger car, light truck and truck tires has been especially developed for tire manufacturers and retreaders operating with a high daily capacity. Owing to its high efficiency, the Intact 1200 can be used for a 100 % control. Due to the short cycle time of only 1 minute which includes the loading/unloading as well as the complete test of the tread and shoulder area of a tire, the system is suitable for testing both the incoming carcasses and the retreaded tires as well as new tires.

The system variant Intact 1200-1 offers a wide field of applications especially for the use at retreaders operating with smaller numbers of tires, in test laboratories and for tire development purposes.



Intact 1200-2: System configuration with basic unit, loading unit with conveyor/tilt table, tire flipper, drop-off unit

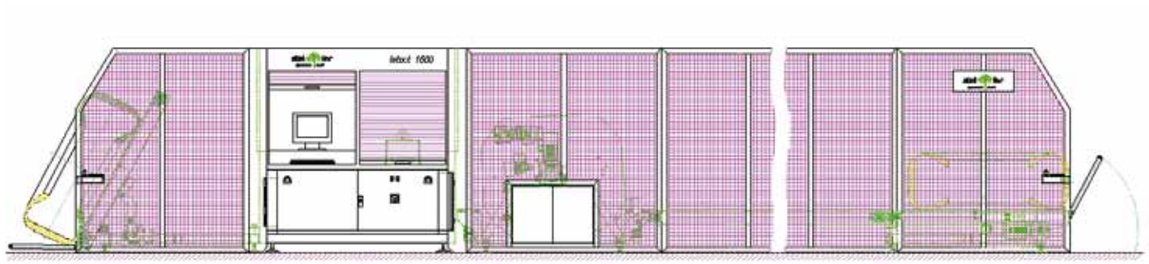
FEATURES	Intact 1200-1	Intact 1200-2
illumination	integrated IR-laser	
technology	patented spatial phase shift	
measuring heads	1 (optional: 2)	2
measurement area	tread, shoulder, bead and sidewall area	
defect size	1 mm or larger	
defect type	separations in tread, shoulder, bead and sidewall area	
positioning of measuring head	fully automatic or manually	
cycle time	2 min.	1 min.
tire size	12“ ID up to 1250 mm OD	
tire width	510 mm	
loading	integrated tilt table	integrated tilt table (optionally: interface to existing customer conveyor system, automatic tire flipper)
unloading	via loading unit	passive (optionally: active)
transport direction	from right to left side	from right to left side (optionally: from left to right side)
display of results	all tested sections with zoom function	
result classification	by operator (optionally: fully automatic)	
storage of test results	HTML file with compressed results (optionally: other file formats)	
system diagnosis	automatic system test (optionally: additional verify block)	
remote service	yes	
painting	main unit: RAL 7016 (grey), moving parts: RAL 1003 (yellow) (optionally: according to customer specification)	
environmental conditions	from + 10°C to + 40°C; temperature difference between tire and ambience max. +/-10° C	
external connectors	360 - 500 V, 16 A 6 bar, 20 l/min.	
dimensions	2.55 m x 2.15 m x 2.10 m (L x W x H)	
weight	approx. 3,200 kgs	

Intact® 1600-1 / Intact® 1600-2: PASSENGER CAR, (LIGHT)TRUCK, EM, AIRCRAFT TIRES

The shearography tire system Intact 1600-1 is the most versatile system from Steinbichler Optotechnik. Featuring an extremely manoeuvrable single measuring head, it enables a wide variety of tire dimensions to be tested fully automatically.

Thus, Intact 1600-1 is especially suitable for the retreading of aircraft tires and has already been installed at well-known international tire companies to guarantee a high safety level in aviation.

The shearography tire test system Intact 1600-2 is designed for the serial testing of retreaded or new passenger car, (light) truck, EM and aircraft tires, as well as for the control of tire carcasses before retreading. With Intact 1600-2, tires with an outer diameter of up to 1600 mm can be inspected in the tread and shoulder areas in a short test cycle of one minute.



Intact 1600-1: System configuration with basic unit, tire flipper, loading unit with tilt table, conveyor/fence, drop-off unit with tilt table/rollers

FEATURES	STANDARD	OPTIONS
illumination	integrated IR-laser	
technology	patented spatial phase shift	patented temporal phase shift
measuring heads	1 / 2	
measurement area	tread, shoulder, bead and sidewall area	
defect size	1 mm or larger	
defect type	separations in tread, shoulder, bead and sidewall area	
positioning of measuring head	fully automatic and manually	
cycle time	1 min.	
tire size	12“ ID; OD from 500 to 1600 mm	8“ ID; OD 450 mm or larger
tire width	600 mm	
loading/unloading	automatic	interface to existing customer conveyor system, automatic tire flipper
display of results	all tested sections with zoom function	
result classification	by operator	fully automatic
storage of test results	HTML format	other file formats
system diagnosis	automatic system test	additional verify block
remote service	yes	
painting	main unit: RAL 7016 (grey) moving parts: RAL 1003 (yellow)	according to customer specification
environmental conditions	from + 10°C to + 40°C, tire temperature max. 10° C above ambient temperature	
external connectors	360 - 500 V, 16 A, 6 bar, 20 l/min.	max. 25 A
dimensions	2.75 m x 1.95 m x 2.14 m (L x W x H)	
weight	approx. 3,450 kgs	

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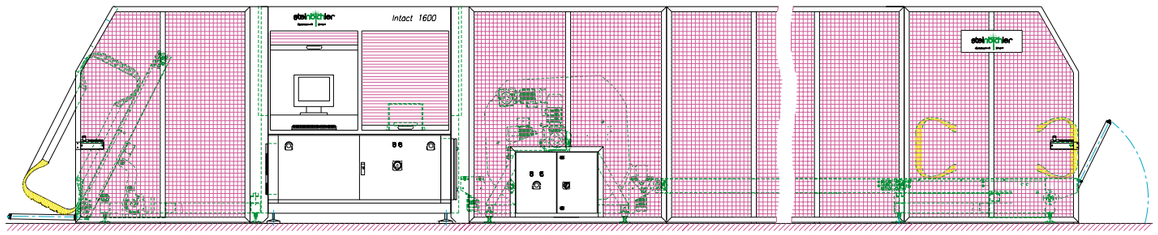
Intact® DUAL CONFIGURATION

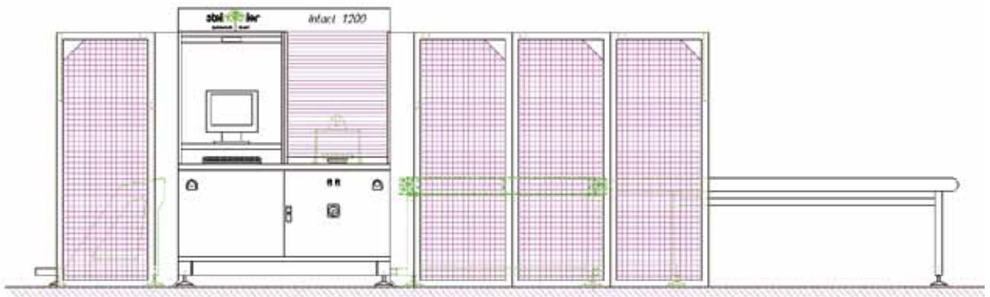
To achieve an even faster and more efficient system configuration, two inspection units can be combined with a tire flipper. This enables one operator to perform more tire test cycles per hour in comparison with having two operators using single systems. Due to the low test costs per tire (labor time, required space) and the short cycle times, the shearography technique is a highly cost-effective tool for the quality assurance in new tire production. Tire retreaders with high quantities can dramatically reduce their inspection costs using the dual Intact configurations.

Intact 1600: Dual system configuration with 2 basic units, tire flipper, loading unit with tilt table, drop-off unit with tilt table/rollers

Intact® OPTIONS

- Automatic fault detection with:
  - marking of fault areas on the monitor
  - recognition of fault-free tires
  - tire and fault classification
- Connection with conveyor systems
- Barcode interface
- Spare parts package
- Tire flipper
- Verify block
- Custom color coating
- Touchscreen





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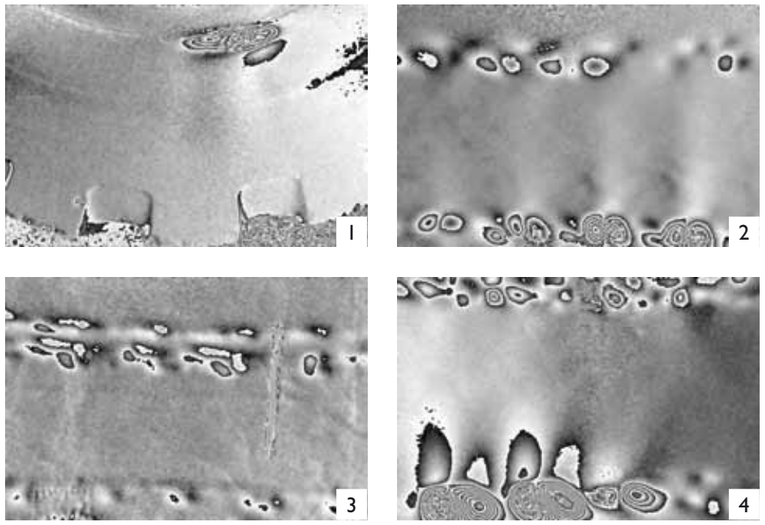
Intact® 2800: OTR/EM TIRES

For many years, the Intact system series by Steinbichler Optotechnik is setting standards for innovative and highly precise technology in non-destructive tire testing. With the revolutionary system concept „Intact 2800“ we are now proud to launch a powerful and efficient solution for the inspection of OTR tires.

- easy tire handling with forklift
- no tire flipping necessary for inspection of second sidewall
- no stress points on tread and sidewall due to tire flipping
- no stress points in shoulder area caused by tire weight
- no dirt and tire wear caused by test procedure
- heavy-duty vacuum chamber. pressure difference of up to 200 mbar (= 20 % of atmospheric pressure) for maximum fault sensitivity
- for tire sizes up to 2800 mm outer diameter (max. dimensions e.g., 2700 R49) (system configuration to outer diameter of up to 4300 mm possible)

Intact® 2800: TYPICAL RESULT IMAGES

Bead separation in sidewall view (1),
Belt edge separations (2-4)



REFERENCES
TIRE TESTING (EXCERPT)

Aeolus, China • Aircraft Components Solutions, Canada • Bandag, USA • Bandvulc Tyres, UK • Birla Tires, India • Black Star, France • Bridgestone, USA/Japan/Poland/Hungary • Bundeswehr/MOD, Germany • Chaoyang Longmarch Tyre, China • Cheng Shin, China/Taiwan/Vietnam/Thailand • Colmec, Sweden • Covencaucho Industrias S.A., Venezuela • Dae Hyun Tire, Korea • Deli Tire, Indonesia • Double Coin (Chongqing), China • Dunlop Aircraft Tyres Limited, UK • Edler Reifen, Austria • Emigholz, Germany • Federal Tire, China • Fu-Chian Tire, Taiwan • GITI, China • Goodtire, China • Goodyear, USA • Guizhou Tyre, China • HWA Fong Rubber, Taiwan • Junhong Tire, China • Kenda, China/Taiwan • Kumho Tire, China/Korea • Lanyu Aircraft, China • Llanteras Atlas, Mexico • Lodge Tire, UK • Maxxis International Co., Thailand • Mesas S.A., Spain • Michelin, USA/France/Spain• Newera, Malaysia • Nexen, Korea • Nokian Renkaat, Finland • Otani, Thailand • Petlas, Turkey • Pirelli, Italy/China/ Egypt/Turkey/Germany/Mexico/Romania • Pneu Laurent, France • Povolzhskaya Shinnaya Kompania, Russia • Radburg, Romania • Reifen Hinghaus, Germany • Reifen Ihle, Germany • Reifen John, Germany • Reifen Müller, Germany • Rhoden Tire, Taiwan • Sailun, China • Sky Blue Aviation, Spain • Shanghai Tyre & Rubber Co., China • Shenyang Tire, China • Silverstone, Malaysia • South China Tire & Rubber, China • Sun Tire, Malaysia • Suntex Rubber Enterprise, Taiwan • Vacu-Lug, Great Britain • Vredestein, Netherlands • Wilkerson, USA • Wontyre Inc., Taiwan • Yokohama Rubber, Japan • Yu-San Tire, Taiwan • ...

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EXPERTS
IN OPTICAL MEASUREMENT AND SENSOR TECHNOLOGY

For more than 20 years, Steinbichler Optotechnik GmbH is a worldwide leader in innovative measurement and sensor technology.

- Intact: Shearography Tire Inspection
- T-SCAN: 3D Digitizing with Handheld Laser Scanner
- COMET: 3D Digitizing with White Light Fringe Projection
- ABIS: Surface Inspection
- ISIS: Shearography-NDT of CFRP Components
- ESPI/PulsESPI: Deformation and Vibration Analysis

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