SIKORA
Technology To Perfection

X-RAY 6000 PRO

Diameter/wall thickness/eccentricity/ovality measuring system
for hose and tube extrusion lines

www.sikora.net

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Measurement of the wall thickness, eccentricity, diameter and ovality of single and multi-layer products

When manufacturing hoses and tubes, quality control of wall thickness, eccentricity, ovality and inner and outer diameter is essential. The applications where hoses and tubes are used today are quite diverse and so are the demands with regard to quality control. The X-RAY 6000 PRO is a measuring device that has proven its high precision in the aircraft industry, the automotive industry, gas and water business as well as in medical and industrial applications.

X-ray technology for the measurement in the areas described before is independent from the material of the product to be measured and from temperature. It does not need any coupling media nor calibration. For that reason, the X-RAY 6000 PRO is an essential device for stable and reproducible processes.

X-RAY 6000 PRO for single and multi-layer products

The X-RAY 6000 PRO measures the wall thickness, eccentricity, inner and outer diameter and ovality of hoses, composite pipes, pressure hoses with textile reinforcement, small or large diameter hoses made of PE, HDPE, PVC as well as foamed products, products made of EPDM, nylon, rubber or silicone with up to three layers. Moreover, it is suitable for quality control of medical and cosmetic tubes.

Display and control device ECOCONTROL 6000

As standard, the X-RAY 6000 PRO includes the processor-based display and control device ECOCONTROL 6000 with a vertically arranged 22" TFT monitor. The ECOCONTROL 6000 is conveniently and intuitively operated via touch screen. All relevant measuring values are numerically as well as graphically and as trend and statistical data shown at a glance.

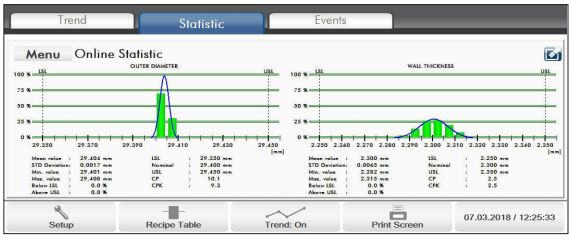
Features of the ECOCONTROL 6000 at one glance:

- Line presentation with pictograms of the connected devices
- Display of the single values and eccentricity of the wall thickness incl. highlighting of the min. wall thickness in color
- Length related trend diagram with zoom function for all values
- Statistics with the minimum/maximum/mean value, standard deviation, Cp and CpK values
- Reel and length related data storage

Typical features X-RAY 6000 PRO

- Measurement of the wall thickness, eccentricity, the inner and outer diameter and ovality of up to three different material layers
- Automatic control of the line speed and extruder rpm under consideration of the minimum values
- Selectable measuring rate from 1 to 3 Hz (optional 10/25 Hz)
- 22" TFT monitor (optional 15")
- No calibration

X-RAY 6120 PRO with 22" TFT monitor



Statistics

Automatic mode and Hot/Cold Control

With the control module SET POINT, all conditions are met for fast and precise control of the wall thickness or the diameter through the line speed or extruder rpm under consideration of the minimum values. Other signal outputs allow the automatic centering of the crosshead. To ensure the best possible quality with simultaneous minimization of material over-consumption, SIKORA recommends the Hot/Cold Control module HC 2000, combined with the X-RAY 6000 PRO and a diameter gauge head of the LASER Series 2000 or LASER Series 6000 for measuring the cold diameter. With the Hot/Cold Control module HC 2000, the material shrinkage is continuously calculated and automatically taken into consideration at the control of the diameter and/or the wall thickness.

Automatic crosshead centering

Especially for the manufacture of rubber hoses at the extrusion process, the X-RAY 6000 PRO provides measuring values for automatic wall thickness centering. By using this technique, a manual centering during production is not necessary. In addition, the online concept continuously ensures an optimum hose centering, and thus, a uniform wall thickness distribution over the entire hose circumference.

X-RAY 6070 PRO integrated in a production line

Virtual gauge technology

The virtual gauge technology VIRTUAL 2000 is suitable for all applications for which a fast wall thickness control is required, but due to line configuration or product structure, a diameter or wall thickness measurement directly after the extruder is not possible.

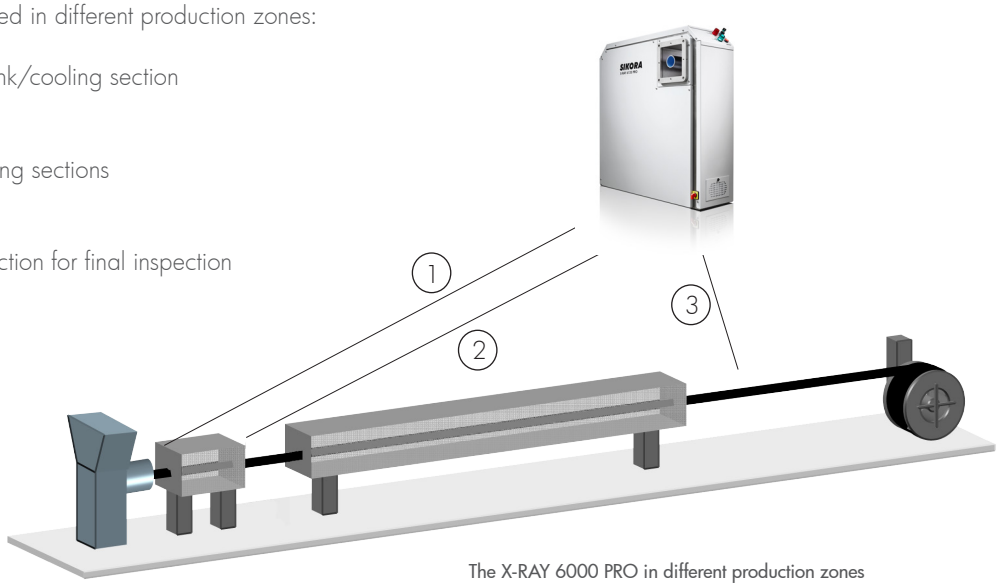
Positioning

The X-RAY 6000 PRO can be installed in different production zones:

1. Between extruder and vacuum tank/cooling section
   Hot measurement

2. Between two vacuum tanks/cooling sections
   Pre-cooled measurement

3. After the vacuum tank/cooling section for final inspection
   Cold measurement



The X-RAY 6000 PRO in different production zones

Specific measuring systems for individual applications

X-RAY 6020 PRO

The X-RAY 6020 PRO is suitable for product diameters from 0.65 to 15 mm and for ultra-thin wall thicknesses down to 100 µm. The device is designed for the area of medical tubes where 100 % quality is a vital requirement.

CENTERWAVE 6000

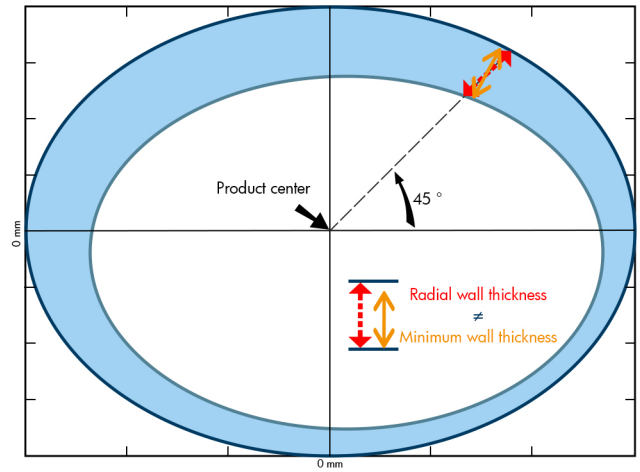
In the rotating version, the innovative CENTERWAVE 6000 also provides a total recording of wall thickness, diameter and ovality over 360 degrees of the circumference. Its integrated groundbreaking millimeter waves technology is used for the measurement of large pipes.*

* For more information please refer to the CENTERWAVE 6000 product brochure.

ECOCONTROL 6000: The production data of the X-RAY 6000 PRO is clearly visualized at the vertical 22" TFT monitor

Determination of the minimum wall thickness

By using a physical model for the absorption and the knowledge of precise and individual device geometry, statements about the entire circumference of the product can be made. This allows for a determination of the minimum wall thickness over 360 degrees of the circumference.



The wall thickness under 45 degrees from the outside (red dotted line) is larger than the actual minimum wall thickness (yellow solid line)

Quality assurance and significant cost savings

From the first day of operating, the X-RAY 6000 PRO assures a continuous online quality control at the hose and tube extrusion. A time consuming offline quality control is no longer necessary. At the same time, the X-RAY 6000 PRO works to reduce the wall thickness to the smallest permissible value by taking into account the statistical fluctuation. Both quality assurance and the reduction of material lead to a significant increase of productivity.

An example:

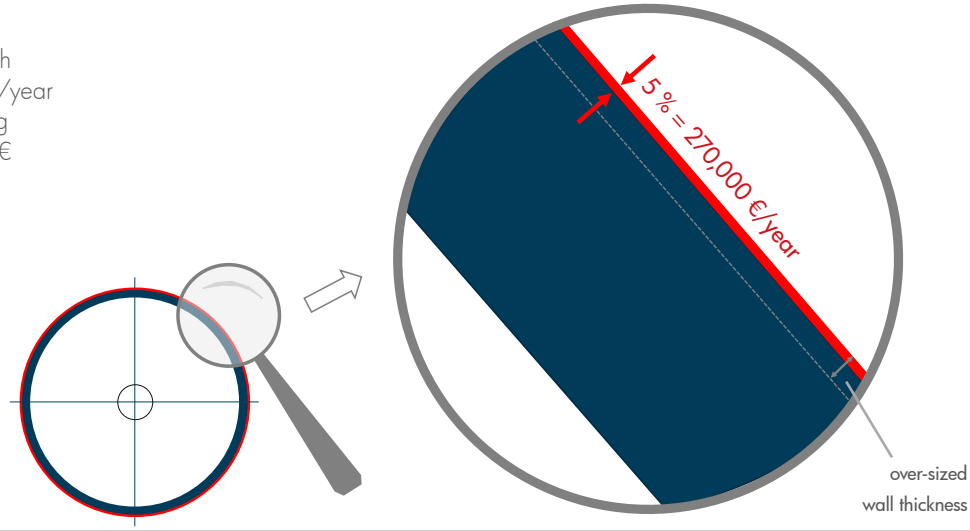
The capital expenditure for a measuring system may be 95,000 €. The material cost may be 5.4 million €/year (600 kg/h extruder output, 6,000 working hours/year, material costs 1.5 €/kg). With the X-RAY 6000 PRO, material savings of at least 5 % can be achieved, resulting in savings of 45 €/h (270,000 €/year).

In consideration of costs for maintenance and service in the amount of 0.5 €/h and a depreciation of 1.46 €/h (depreciation, i. e. the reduction in the value of an asset, over eight years, 6,000 h/year) the profit of the company improves from the first day of initial operation by 43.04 €/h. If this is multiplied with the assumed 6,000 h/year, the impressive profit for a business year would be 258,240 €. This results in a Return On Investment (ROI) of 4.4 months (95,000 €/258,240 € = 0.37 years).

Check your specific material savings associated with the purchase of an X-RAY 6000 PRO by using our online ROI calculator at: www.sikora.net/roi.

Note:

Extruder output: 600 kg/h
Operating time: 6,000 h/year
Material costs: 1.50 €/kg
5 % savings = 270,000 €



X-RAY 6000 PRO – outstanding measuring system

The X-RAY 6000 PRO provides reliable measurement and control in hose and tube extrusion lines at all line speeds. The system is as simple to use as a diameter gauge, but including the eccentricity measurement and the possibility to measure the minimum wall thickness, it offers the highest potential for savings in respect to material over-consumption and start-up scrap and assures, in addition, reliable and controlled processes.

Safety

Concerns on the safety of X-ray devices are arbitrary, as the radiation is, because of the low energy, of no relevance. In fact, a human is exposed to a much higher radiation on a flight from New York to Frankfurt.

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Certified according to DIN EN ISO 9001

Technical Data X-RAY 6000 PRO

Measuring Principle
Non-contact with state-of-the-art X-ray technology

Application
Hose and tube extrusion lines

Material
PE, PVC, HDPE, foamed plastic, EPDM, nylon, rubber, silicone and many others

Wall Thickness
≥ 0.3 - 30 mm for PE, HDPE
≥ 0.3 - 2 mm for PVC and EPR[1)]
≥ 3.5 - 30 mm for foamed PE[2)]
(min. outer diameter 8 mm)

[1)] Products with PVC/EPR wall thickness ≥ 2 mm and a diameter > 50 mm require a higher X-ray power

[2)] Foamed PE requires lower X-ray power and a higher measuring rate

Calibration
The X-RAY 6000 PRO requires no calibration

Safety (Radiation)
Radiation measurements by independent experts have revealed that the radiation of the X-RAY 6000 PRO is below limiting values of all international regulations

Measuring Rate
1 to 3 Hz (optional 10/25* Hz)

Power Supply
100 - 240 V AC ± 10 %, 50/60 Hz, 1,200 VA

Permissable Temperature
+ 5 to + 45°C

Interfaces
RS232, USB
Optional: industrial fieldbus (e.g. Profinet IO, EtherNet/IP, Profibus-DP, CANopen, DeviceNet), LAN, OPC DA/UA

* 25 Hz are optionally available at X-RAY 6035 PRO and X-RAY 6070 PRO

	X-RAY 6020 PRO	X-RAY 6035 PRO	X-RAY 6070 PRO	X-RAY 6120 PRO	X-RAY 6200 PRO	X-RAY 6300 PRO
Diameter	0.65 - 15 mm min. wall: 0.1 mm	5 - 30 mm	6 - 65 mm	10 - 110 mm	20 - 180 mm	30 - 270 mm
Accuracy	5 µm	5 µm	10 µm	10 µm	20 µm	30 µm
Sight Field	20 mm	35 mm	70 mm	120 mm	200 mm	300 mm
Opening	25 mm	100 mm	100 mm	180 mm	350 mm	400 mm

Technical data is subject to change

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