TubeInspect

Efficient quality assurance for tube and wire bending

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BendingStudio

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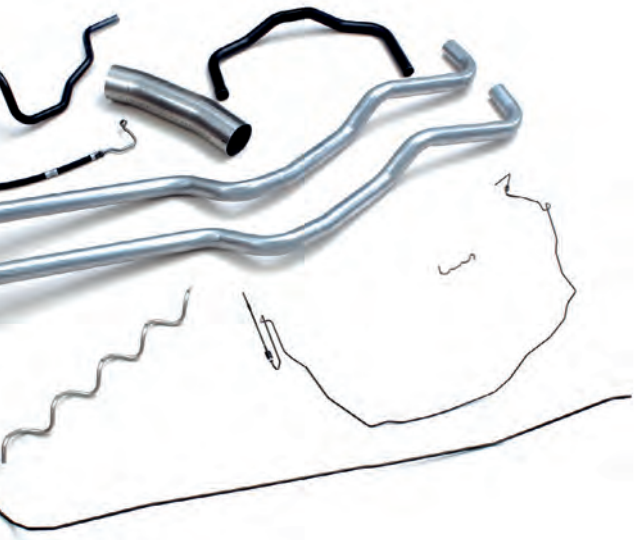

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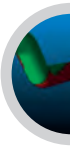


Optical tube measuring system

The demand for ever more cost-effective tube production as well as the increasingly stringent requirement for product quality are constant challenges in today's tube bending industry.

TubeInspect, an optical tube measuring system, incorporates advanced technology for the high-precision measurement of tubes, the determination of set-up and correction data and quality assurance of the final product. TubeInspect can entirely replace mechanical gauges.

MEASURE THE

How TubeInspect works

TubeInspect, a non-contact measuring system, merely requires that the tube to be measured is placed in an optical measuring cell. Sixteen high-resolution digital cameras accurately measure the tube's geometry in a few seconds. The tube does not need to be moved. The geometry is reported in an easily understandable way, that is as sheath tolerance. The measuring range of TubeInspect is 2,500 mm x 1,100 mm x 700 mm (approx. 8.2 feet x 3.6 feet x 27.6 inches) and this can be extended by repositioning the tube.

TubeInspect measures tubes with diameters ranging from 3.2 mm to 200 mm. Bends between 1° and 180° can also be measured easily. Moreover TubeInspect has the capability of measuring tubes with connected bends or with flexible parts. For example tubes with hose-sections, shaped hoses, and tubes with fixtures or mounting attachments. Beyond that TubeInspect is able to measure free-form geometries.

Thus AICON extends the spectrum of optical measurement applications significantly.
Tube measurements can be compared with a previously recorded sample part or with an imported CAD model.

ADVANTAGE

Accuracy

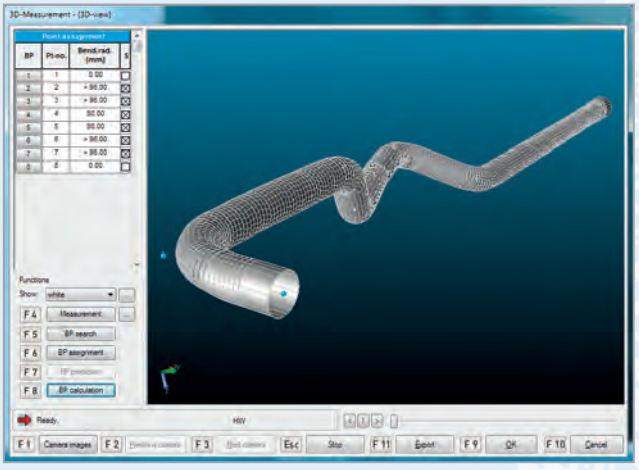
The system acquires information about the tube with sixteen permanently mounted high-resolution digital cameras. Therefore no movement of the part or the acquisition device is necessary.

A part can be measured without the need for special fixtures or clamping devices. Sheath tolerance can be determined to an accuracy of ± 0.1mm.

TubeInspect is suitable for high volume production

High volume production requires that product quality be maintained. A further requirement is the ability to switch production to new models or model variants with minimal production delays.

TubeInspect enables you to achieve this flexibility in tube manufacturing quality assurance. When production changes to new models or model variants, lengthy set-up procedures are no longer necessary: TubeInspect is ready for use immediately after digital nominal data has been entered into the system. All component related measurements can be stored and analyzed with statistical process control programs.



The 3D cylinder model is compared against design data.

TubeInspect measures quickly and easily

TubeInspect's unique measuring principle allows the measurement of any tube geometry without elaborate preparation, and is not affected by form, color or surface texture.
Tubes with varying diameters or changing radii (free-form tubes) can be measured along with attachments such as hangers and brackets. Components with cylindrical profiles, such as bent wires, moulded tubes or even subassemblies of tubes and flexible parts can also be measured.

TubeInspect eliminates test equipment and reduces change-over time

TubeInspect eliminates the need for numerous bending gauges and reduces change-over time. Because TubeInspect uses optical measuring technology, it has proved to be very reliable and requires little maintenance, even when being used in a continuous production environment.

TubeInspect allows efficient prototype production

Would you like to manufacture prototypes under production conditions? TubeInspect, as an optical gauge for bending machine set-up and quality assurance, is particularly suitable for the manufacturing of prototypes. It is also suitable for the quick and precise measurement of sample tubes.

Long and thin tubes can also be measured without fixtures.

TubeInspect is suitable for all types of tubes

TubeInspect is suitable for all types of industrial tube manufacturing, from highly flexible thin brake lines to large exhaust pipes for heavy trucks. It can also be used to measure tubes designed to carry hydraulic and cooling liquids or fuel.

Optimized data handling with BendingStudio

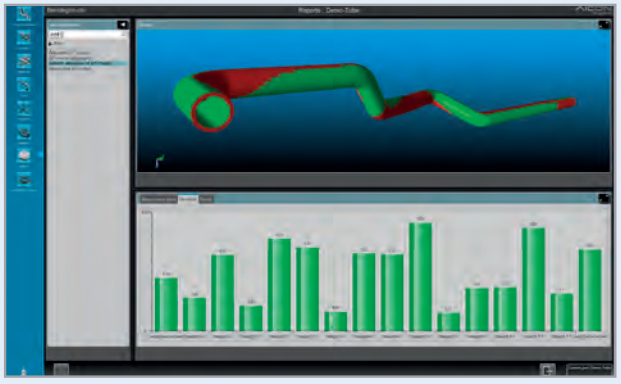
There are several steps between a drawing and an actual part, each one requiring different types of data: CAD data from design, bend programs and bend corrections for manufacturing, inspection plans and measurement reports for quality and data analysis for process control. BendingStudio bridges all these data types, enabling manufacturers to monitor, quantify, visualize and document all changes in the different process steps. All data stays together and nothing gets lost. And the required data are ready for quick access at any time.

TubeInspect is totally integrated in BendingStudio and benefits from its various evaluation possibilities. BendingStudio supports the individual configuration of virtual optical gauges to measure the quality related measuring points of a component. This is also possible for further functional dimensions, such as distances and angles.

TubeInspect provides online corrections to bending machines

With BendingStudio TubeInspect may be directly linked to Computer Numerically Controlled (CNC) bending machines. If tube measurements indicate that adjustments need to be made to the tube manufacturing process, corrections are directly transmitted to the bending machine via the CNC program.

Corrections will be made more quickly so that dimensionally correct tubes are produced with minimal waste. Machine set-up becomes predictable, and down time is drastically reduced.



Graphical output allows the user to quickly judge whether a tube is within tolerance or not.

System Specifications

	TubeInspect	**TubeInspect S**	**TubeInspect HS**
			
Technical specifications			
Measurement area	2,500 mm x 1,100 mm x 700 mm	1,100 mm x 1,100 mm x 700 mm	1,080 mm x 980 mm x 500 mm
Cameras	16 metric cameras	10 metric cameras	10 high performance metric cameras
Tube diameter	3.2 mm - 200 mm	3.2 mm - 200 mm	2 mm - 100 mm
Bending angle	1° - 180 °	1° - 180 °	1° - 180 °
Minimum push between two bends	bend in bend and free-form possible	bend in bend and free-form possible	bend in bend and free-form possible
Software	BendingStudio	BendingStudio	BendingStudio
Reference field	Stability optimized steel structure with LED reference targets	Stability optimized steel structure with LED reference targets	Stable glass reference including elevated targets for highest 3D position
Dimensions	3,200 mm x 1,680 mm x 2,300 mm	1,750 mm x 1,680 mm x 2,300 mm	1,750 mm x 1,680 mm x 2,300 mm
Weight	2,000 kg	1,200 kg	1,300 kg
Accuracy			
Sheath tolerance	± 0.1 mm	± 0.1 mm	± 0.050 mm (50 µm)

For all tubes up to 6 m in length

The TubeInspect optical gauge is the universal tube measurement system for all tube lengths. Tubes of up to 2,500 mm can be inspected in one step. Longer tubes are measured in several steps while the results are automatically connected.

TubeInspect has successfully run in various production facilities for several years and saves our clients the cost of buying expensive gauges.

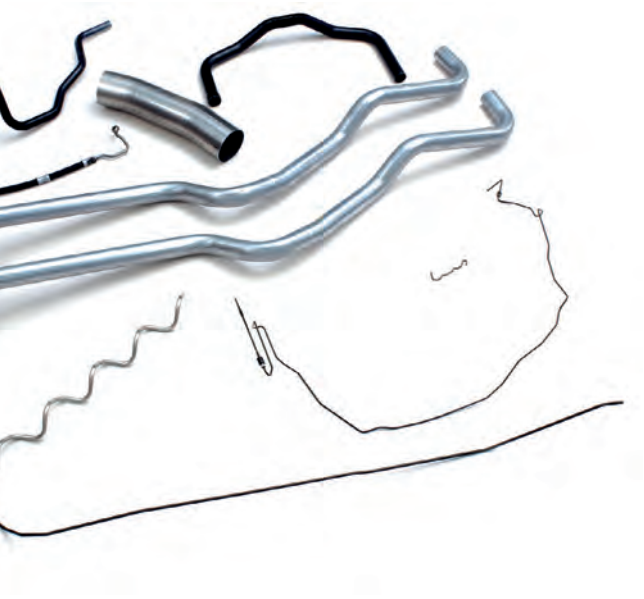
Cost effective solution for the bulk of applications

With TubeInspect S, producers of short tubes have a customized solution that provides TubeInspect's complete functionality with no constraints.

TubeInspect S measures tubes of up to 1,100 mm in one step. The ideal use is inspection of cooling-, gas- or hydraulic tubes or tubes with flexible parts.

Improved accuracy for tight quality requirements

TubeInspect HS is applied when especially high accuracies are requested (e. g. in case of injection pipes).



TubeInspect

Efficient quality assurance for tube and wire bending

- Optical tube and wire inspection system
- Programmable optical gauge
- Set-up and correction of bending programs
- Reverse Engineering and inspection of sample tubes
- Automatic 100 % inspection in a robot cell

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TubeInspect

Testimonials

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Approval for production in record time

“With TubeInspect we are in the position to monitor our processes in a fast and effective way as the measuring system shows accuracy information for the bent tubes after only a few seconds. Therefore, the approval for production can now be given in record time. In the past, when the measurement was tactile, we had to wait for the approval for a really long time. Moreover we have reduced the setup time of our bending machines considerably. The gained free machine capacities mean hard cash to us.“

Ralf Unger, Quality Assurance at König Metall GmbH & Co. KG, Gaggenau (Germany)

Enormous saving of time

”When starting the series production of a new product, we have to measure 30 to 50 tubes in a sequence. While this has taken us five to six hours with our CMM, we only need one hour or less now. This implies an enormous saving of time, allowing us to be a lot more flexible with respect to customer demands.“

Mikael Karlsson, Ekenäs Mekaniska, Vetlanda (Sweden)

Gigantic improvement

”In the past, we inspected our tubes with CNC coordinate measurement machines. It took us averagely 45 minutes to measure a tube. However, the measurement of tubes longer than 700mm and with more than 8 bends took up to four hours because we had to measure them in several clampings. Today, with TubeInspect S, a measurement is completed within several seconds: Put the tube into the measuring machine, select the tube model in the data base and the result is displayed instantly. I can't remember for how long I haven't been called any more at night because a tube bend hasn't been correct… TubeInspect has brought a gigantic improvement!”

Alexander Schmidt, Technical Director at Argus Fluidtechnik, Ettlingen (Germany)

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TI Automotive

Fast measurement of plastic pipes with checkable reports

“We at the location Fuldabrück are specialized in manufacturing prototypes of fuel pipes. TubeInspect was implemented in our plant in June 2008, and we can totally rely on this measuring machine. With TubeInspect, we can give our suppliers support for the production of the bending moulds at an incredibly early stage because already the first manufactured pipe is measurable without any difficulty. Furthermore, TubeInspect fulfils the requirements regarding the checkability of the measurement results. The automatically generated report doesn’t leave any room for interpretation by the operator. TubeInspect outputs a coordinate table that can be controlled by everyone - that means also by our customers. That satisfies them much more than the old, usual reports. As some of our customers, for example Volkswagen, also own a TubeInspect system, we even profit from synergy effects.”

Daniel Bock, Quality Engineer TI (Fuldabrück) GmbH (Germsny)

Considerable decrease of material costs

“With TubeInspect, the number of deficient tubes has strikingly reduced. When a new production run starts, the second tube meets the requirements. As we mainly manufacture tubes made of expensive materials, we clearly notice the strong decrease of costs in this area. Moreover, we are very happy about TubeInspect’s accuracy. The machine is much less susceptible to operator errors than a tactile system. TubeInspect has pushed us far forward in the area of quality assurance. And that’s what our customers approve!“

Joe Girtanner, Production Manager at Serto AG, Aadorf (Switzerland)

STAM INC.

Fantastic

“TubeInspect is a fantastic machine. We use it at least ten hours per day. I periodically have customer visits. They are impressed.“

Kent Marvin, Owner of STAM Inc., Grand River, OH (USA)

Fortunately we have come across TubeInspect

“For a long time, we have looked for a measuring system that would help us to determine the bending data of sample tubes faster, and to transfer them directly to the bending machines. So we have analyzed the market of tube measuring systems. We have taken a closer look at different articulated arms, partly with laser probes. However, not a single system could persuade us. Then, fortunately, we have come across TubeInspect. “

Karl Eberl, Owner of EMW Rohrformtechnik, Türkenfeld (Germany)

GS-Hydro

Much faster

„The speed of the measurement is fascinating. With TubeInspect, we can measure our tubes faster and more frequently.“

Klaus Landauer, Technical Director at GS-Hydro Austria, Pasching (Austria)

Pioneer in wire technology:

Kokinetics deploys tube measuring system for measuring bent wire parts

Can wire be measured using a tube measuring system? This was the question hanging in the air in 2007 when Kokinetics GmbH was considering the procurement of an optical tube measuring system as an alternative to their conventional gaging checks. The question was quickly answered with a clear "Yes". Kokinetics purchased a TubeInspect S optical Measuring System and since spring 2008 the system has proven successfully in the routine testing of bent wires, making Kokinetics a pioneer in wire bending industry.

Valentin Medvedkins: "Thanks to TubeInspect, readjustment of our CNC bending machines is done instantly."

A company with a future

Kokinetics GmbH, based in Kriftel near Frankfurt/Main, can look back on a long and successful company history. Founded in 1890, the company made a name for itself after World War II as supplier to the aviation industry and as a tool manufacturer. The company gradually developed a concentration on the automotive sector following its success in the product categories of seat structures, seat mechanics, transmission parts, hinges and locks. Today Kokinetics has a workforce of 250 employees. From product development to prototype construction, tool manufacturing and jig making all the way to series production, every division relevant for production is operated directly in the company.

Kokinetics' global customer base - including seat manufacturers like Johnson Controls and Faurecia and big automobile corporations like Volkswagen, General Motors and Audi - all rely on the high quality of Kokinetics products.

Expensive gaging routines are outdated

A high standard of quality coupled with optimum flexibility is essential for competitive viability as a supplier to the automotive industry. Quality checks in the past relied on mechanical gages into which the formed wires were placed and visually checked. However, as even slight changes in geometry make readjustment of the gages necessary, this checking routine is inflexible and cost-intensive. A major contract for seat mechanics was acquired in 2007, which led Kokinetics to consider installing an innovative and, above all, flexible checking concept. Harald Helling, production manager for the Wire Division, remembers: "The fundamental issue was: Do we invest in the tried and tested, or in the future? The traditional gages for the new products would require an investment of approximately 90.000 €, plus numerous ongoing expenses for product changes and storage costs. So we simply had to come up with something completely new."

And Kokinetics found it in TubeInspect, the optical tube measuring system from AICON.

Harald Helling, production manager at Kokinetics, with his team puts it in a nutshell: "Procuring TubeInspect was simply a very good decision."

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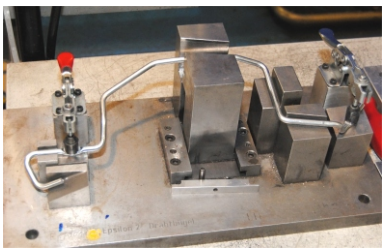
But wire is not the same as tube. Compared to tube bends, the bent wire components required adherence to tighter tolerances: 0.5 to 0.3 mm! Nevertheless, through intensive discussions and scores of comparative measurements AICON was able to demonstrate its capability to measure wire in a tube measuring device. Moreover, the new technology even delivered an additional advantage: it supports readjustment of the wire bending machines with the calculated correction values. As a result, set-up times can subsequently be drastically reduced.

Quality control 24/7

TubeInspect S has been in use at Kokinetics since the spring of 2008 and has contributed substantially to reducing production costs. Manufacture of the bent parts with the three CNC bending machines, which include a Robomac made by Latour (today Numalliance) and a Macsoft F37 from Numalliance, is done in three shifts. The machines are in operation around the clock: 24 hours a day, 7 days a week. This means continuous operation for TubeInspect as well.

Checking the parts with the optical measuring device is easy. For non-contact measurement of the geometry, the wire to be measured is simply placed in the measuring cell. TubeInspect only needs a few seconds to scan the component with high-resolution digital cameras and evaluate the test specimen. If a bent part fails to meet specifications, the deviations are reported by the TubeInspect software and subsequently analyzed. The correction values calculated by TubeInspect are then transmitted to

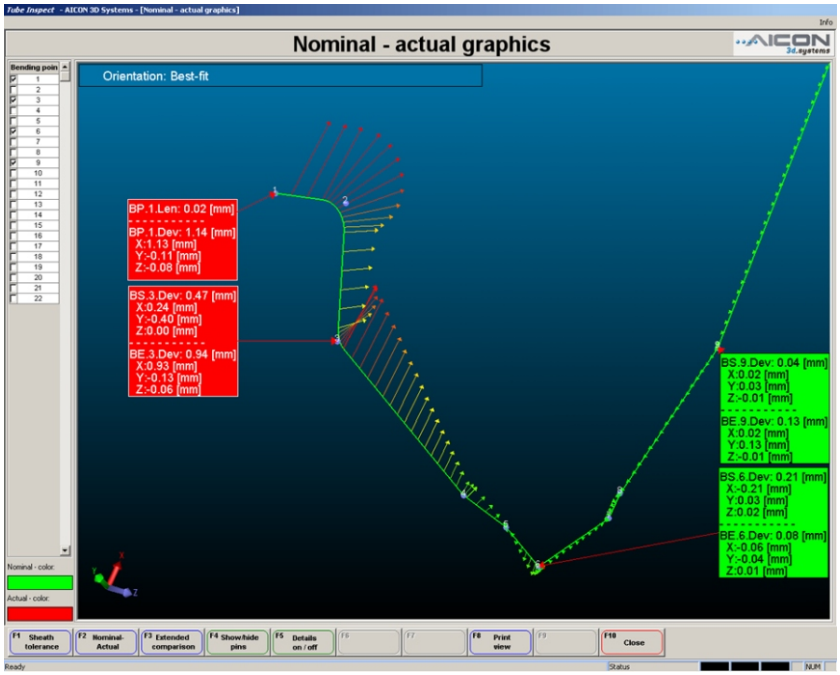


Mechanical gages are outdated and only rarely in use anymore.

the bending machine. Set-up or readjustment of the bending machine is accomplished in seconds! With an average of up to five product changes per day, the savings in time and costs for Kokinetics is thus substantial. Valentin Medvedkins and Oleg Sjasin, who have been operating the TubeInspect S since 2008, agree: “Back then, setting-up the bending machine was a complex process, and the manual gaging test was really time-consuming. Thanks to TubeInspect, testing goes very fast and set-up and readjustment of the CNC bending machines is done in the blink of an eye. Everything's become much easier!”

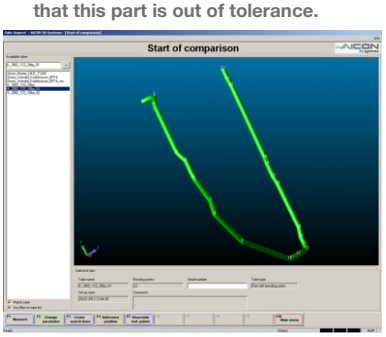
TubeInspect: An all-around carefree package

TubeInspect S, owing to its wide range of possibilities and user-friendliness, has led to a streamlining of the entire production process at Kokinetics. From setting-up the bending machines before start of production, to quality control for series production, all the way to the transmission of correction data to the bending machine without interruption to production - TubeInspect S is distinguished through its enormous time-saving benefits. Past doubts have given way to the conviction that the path taken has assured the future viability of this branch of production. Harald Helling puts it in a nutshell: “Procuring TubeInspect was simply a very good decision.”



The Nominal - Actual graphic allows a detailed analysis and localization where bending errors are.

The virtual gage inspection presents that this part is out of tolerance.



TubeInspect is the alternative for the conventional gauging check.