Bright spot for quality

Color sensor detects weld seam in annealed pipes

Which supplier doesn't have to contend with rising cost pressure and increasingly stringent quality requirements from their customers? However, those who know how to use intelligent sensor technology where it promises real advantages can master the balancing act and are probably a step ahead. One example of this is a company specializing in cold and forming technology, which produces screws and pressure pipes as well as media-conducting pipes for the automotive industry, household appliance industry and wind energy.

Clear alignment of the weld seam required

In a specific case, the company has to produce bent tube parts for the automotive industry from welded and annealed tubes with a length of around 600 mm and a diameter of around 20 mm. During the manufacturing process, in which the workpieces are first bent and then pressed, the internal weld seam of the tubes must have a clear alignment.

"The position of the tube weld seam in the end product is specified by the customer with tight tolerances. It must never be within the bending radius during the bending process, as cracks could occur in the workpiece, especially during the subsequent pressing process," emphasizes the company's technical manager. In view of these specific parameters, the company was looking for a sensor technology that was able to reliably identify the position of the weld seam, which is more or less clearly visible inside the tube, before bending.

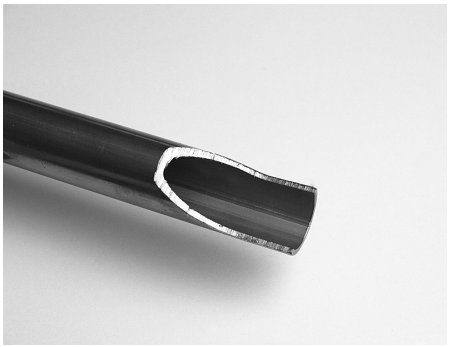
Manual positioning faster than automation

A magnetic resonance eddy current test was initially considered as a solution because one of the company's suppliers for cold and forming technology was already achieving very good results with this method in identifying pipe weld seams. "Reliable recognition of the seam is the time-critical factor in the entire production process," the technical manager points out. The magnetic resonance eddy current test requires automated positioning of the workpiece, as the weld seam has to pass through the detection range of a sensor a total of four times in order to be clearly identified.

"Despite the automated positioning, this procedure would take more time than bringing the pipe into the correct position for subsequent processing by hand and using a different method for weld seam recognition. As the eddy current test would also have required additional attachments to our production line, for which there was simply not enough space, we rejected this proposal." The desired solution therefore had to be compact, could be integrated into the production process without a great deal of assembly work and also enable the weld seam to be identified quickly and extremely reliably.

Real challenges for sensor technology

A promising alternative to the magnetic resonance eddy current test finally came from ipf electronic, which developed a color sensor of the **OF50series,** more precisely the **OF500180recommended.** "The solution, consisting of a color sensor, photoconductive fiber optics with a linear light exit and magnifying optics, won us over instantly thanks to its compact design and simple installation. However, it still had to prove its performance in the process-reliable recognition of the weld seam, which is no easy task with annealed pipes," says the technical manager, white. In the case of non-annealed workpieces, a very clear heat-affected zone can be seen along with the weld seam on both sides, which stands out in color from the substrate. "With annealed pipes, such tempering colors have either completely disappeared or are only very faintly visible due to 'normalization'."



So that the **OF500180** was able to clearly recognize a weld seam inside the pipe despite these challenges, ipf electronic supplemented the hardware with additional intelligence in the form of parameterization software. This software, specially developed for color sensors, enables reliable color evaluation of objects even under extremely difficult conditions.

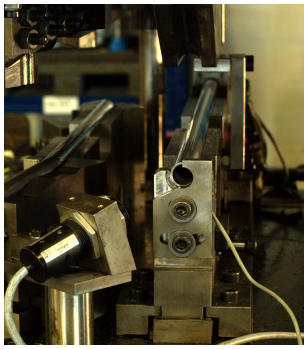
Form groups instead of puzzling for a long time

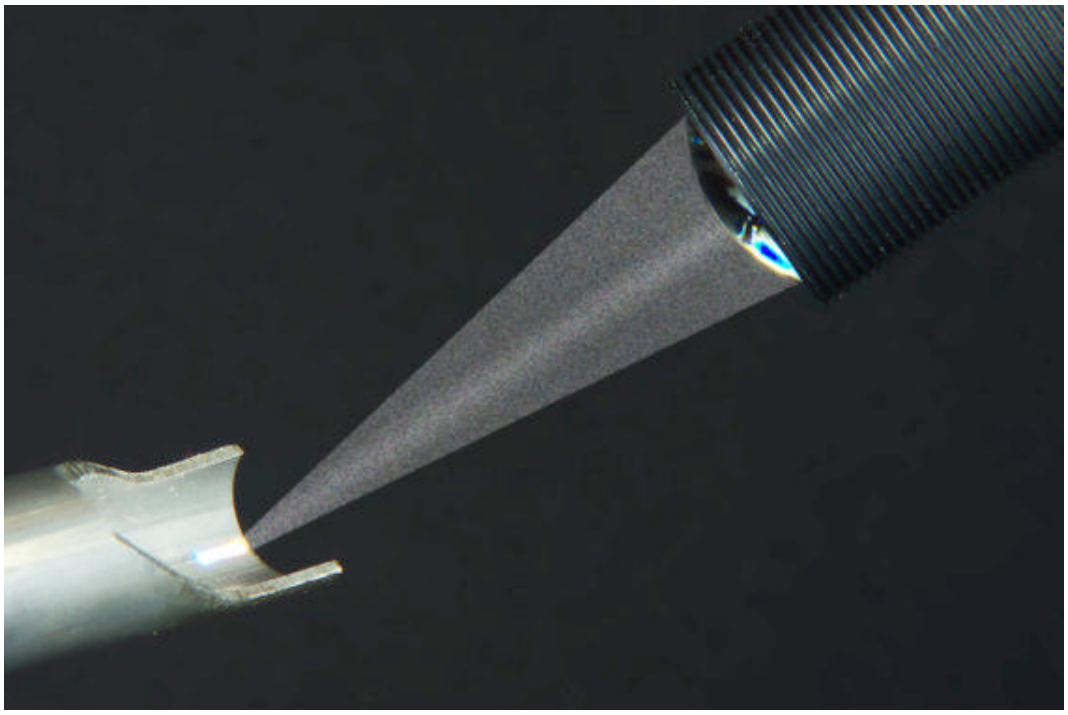
In this context, users of ipf electronic's system solutions benefit from a "special feature" of the software that allows several taught-in values of an object or object area to be combined into color or reference groups as references for IO or NOK statuses. For the application described so far, this meant teaching in several weld seams in a wide variety of characteristics and storing them in a group for the status "weld seam present" in the software's reference/teaching table. In addition, several other values were taught for the surfaces on the inside of the pipe: areas without weld seams or areas with streaks, streaks and discolorations that look very similar to weld seams but can occur when the pipes are annealed, for example. These values were stored in a second group in the reference/teach table for the status "weld seam not present".

In this way, two "color or reference groups" are available to the sensor for evaluating the inside of the pipe, one group containing all values that represent the presence of a weld seam, while the other group combines all references that indicate an NOK status of the detection area, i.e. "no weld seam present".

Clear differentiation through linear light spot

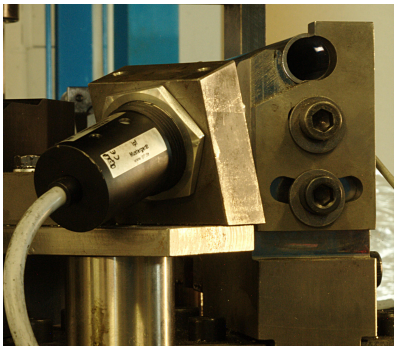
The sensor was mounted at an operating distance of around 80 mm from the detection area lateral to the bending and pressing tool in such a way that it does not interfere with the handling of the workpieces in the production process. For the recognition of the weld seam, the focusing lens of the OF500180 together with the fiber optics generates a linear light spot at an angle of incidence of approximately 50 degrees to the inspection area. This light spot ensures that the sensor has a sufficiently "long" detection range to be able to clearly distinguish between a weld seam and, for example, remnants of annealing processes (such as dark lines or streaks).





Correct positioning of the workpiece

For the machining process, the pipe is first inserted into the bending tool and rotated by hand until the sensor recognizes the weld seam. To do this, the device compares the currently recorded values with the entries in the two groups of the reference/teach table. If these matches are in the group for the IO status, a weld seam has been recognized. The sensor then transmits a signal to the machine's PLC (programmable logic controller), which in turn sends a switching signal to a pneumatic cylinder that firmly fixes the pipe in the tool. Now that the weld seam has the correct alignment for processing, the workpiece can be bent and pressed in a subsequent work step.



A matter of a few seconds

The system from ipf electronic has been in use at the cold and forming technology company since March 2014 and has so far impressed the company's technical manager in terms of process reliability: "The complete processing of a workpiece, which includes detection of the weld seam for correct positioning of the tube for the bending process, only takes a few seconds, so we can produce an estimated several hundred bent tube parts per hour."