

Used in a wide variety of industrial and commercial products, metal tubing is processed into various components by bending and/or tube end forming operations. Facing a twofold challenge, machine/fabrication shops must remain competitive in terms of cost, while producing precision in-tolerance parts quickly.

Previously, tube verification methods were a tedious, time-consuming trial-and-error process. However, given the advancements in 3D measurement technology, solutions designed specifically for tube and pipe applications are now available for fabricators to quickly calculate the length, rotation, and angle measurements needed to provide precise measurements for bender adjustments.

The Traditional Method

Reducing scrap and producing correct parts without rework are two major concerns for tube fabricators. Given the level of competition in the manufacturing environment, fabricators are under pressure to keep costs down while increasing production efficiency. In order to improve inspection processes, many tube fabricators rely on hard fixtures, such as full-contour, L-style and pin-style fixtures to provide in-process control and final audit verification of tubing.

Designed specifically for each new part introduced to the bender, hard fixtures are used to verify that a tube conforms to dimensional specifications and tolerances. During inspection, if the tube does not fit the fixture perfectly, manual adjustments are made to the bender, the tube is re-bent, and the part is brought back to the fixture for verification. This process is repeated until the part is within tolerance.



Although check fixtures allow quality specialists to measure parts relatively quickly, the process is an expensive, time-consuming "go or no-go" method, and can result in excess scrap of valuable materials. Given the critical functions of various types of tubing, accuracy is a key variable, and the trial-and-error method of making adjustments to the bender can cause delays in production, taking several hours, or even days before the part is produced exactly to specifications.

Accumulating check fixtures is also a challenge because each fixture requires that shelf space be set aside for storage. Eventually entire warehouses may be required to store the check fixtures.

A Better Way - The Modern Method

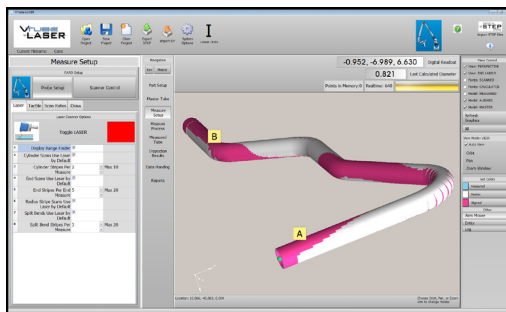
While the trial-and-error approach has worked for many years, technology has helped to streamline

production efficiencies. Rather than developing complex check fixtures to fit each fabricated tube's specific geometry, portable CMM technology can inspect tubes directly on the shop floor or bender, lending itself well to lean manufacturing techniques.

Offering tube and pipe benders a fast and accurate alternative to the traditional method of tube verification, portable 3D measurement solutions along with special application software eliminate costly check fixtures while reducing scrap and rework. An articulating arm combined with a laser line scanner provides a robust contact/non-contact solution in a single device. The hardware interfaces directly with the tubing software to allow for seamless tube qualifications and bender corrections.



The solution works by attaching the non-contact scanner, or laser line probe (LLP) to an articulating arm. A high performance laser projects a beam onto the surface of the tube, capturing thousands of X, Y, and Z points. A camera on the probe uses the reflection of the beam to determine three-dimensional locations through standard triangulation methods to create a 3D model of the part for comparison to CAD models, or master data.



Allowing operators to visualize deviations, the software fits the measured tube with the master tube using sophisticated fit technology, and displays an inspection results grid using color coding to quickly indicate pass/fail for part qualification.

For areas that are difficult to capture accurately using the scanner, operators can alternate between the hard probe and the laser line probe within the same part. The data collected is automatically imported into the software, where it calculates deviations compared to master data and connects to and provides corrections to in-process CNC benders.

Capable of measuring any diameter without changing probes, the seamless integration between the handheld laser scanner and software provides an efficient, precise solution to tube and pipe fabricators with minimal setup.

While check fixtures rarely provide direct feedback to CNC benders, the tubing software prints reports of all bender corrections and can even communicate those corrections back to many types of benders for bender setup correction. This saves the operator valuable time and eliminates any user error.

Summary

Increasing accuracy requirements in a competitive manufacturing environment has forced tube and pipe fabricators to seek more efficient solutions for dimensional verification of tubing. Utilizing portable metrology solutions, manufacturers can eliminate the need for custom check fixtures, while increasing inspection efficiencies on the shop floor. Improving accuracy while minimizing use of costly resources needed for manual adjustments to ensure a part meets tolerance, the portable CMM solution greatly reduces scrap while improving profitability.

For this unique solution, FARO has partnered with Advanced Tubular Technologies, the maker of VTube-LASER software. Used in applications such as inspection,

**VTUBE
LASER**



point cloud-to-CAD comparison, rapid prototyping, reverse engineering and 3D modeling, this system provides a versatile solution taking advantage of the ScanArm's contact/non-contact measurement capabilities. Integrating the FARO ScanArm with the advanced capabilities of VTube-LASER software, this robust technology offers a wide range of benefits, offering easy setup and measurement capabilities, and allowing operators to connect to and correct CNC benders in-process based on scan data deviations.

To learn more about the FARO ScanArm and VTube-LASER integration – visit www.faro.com/vtube