CMM CERTIFIES WOODEN CHECKING FIXTURES

"Making tubing gages for bent and formed tubing requires measuring fixtures with better three-dimensional precision than is available with manual inspection methods," says Blair T. McKendrick, CEO and president of ArtCraft Pattern Works, Inc., Westland, MI. "For this," McKendrick emphasizes, "we would need to use a direct computer control (DCC) CMM."

This was a radically different idea for two reasons:

The tubular checking fixture industry had yet to depart from the historical practice of measuring tubing checking fixtures with simple, single-axis height gages.

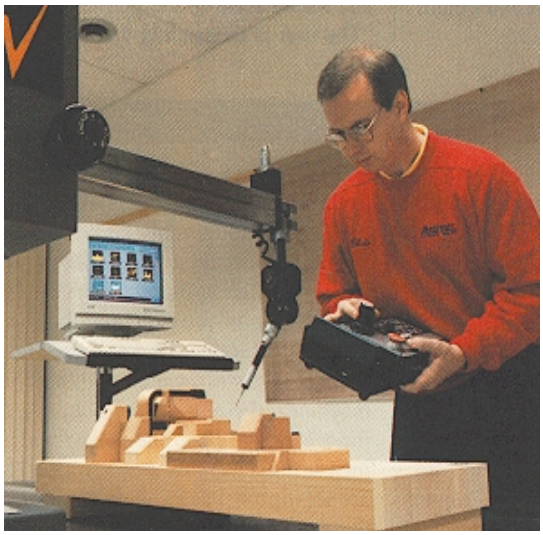
For most companies, the cost of acquiring a large, accurate DCC CMM capable of measuring 95 percent of ArtCraft's fixture production is difficult to justify.

Regardless, ArtCraft acquired a Brown & Sharpe 2000 series horizontal CMM with an 8-foot table and Avail geometric measurement software. A former Brown & Sharpe applications engineer taught McKendrick how to program the system and create measurement programs specifically for ArtCraft's tubular checking fixtures.

ArtCraft's CMM programming measures a multitude of dimensionally different tubular checking fixtures without changing the program. An operator only needs to place a checking fixture on the CMM table (no holding clamps required) and run the program, which includes an alignment routine that takes advantage of the patented alignment system built into each of ArtCraft's gages. (For gages longer than the CMM's reach, the alignment systems allows for fast, accurate measurement in sections--a technique called "fleeting.") From that point on, the measuring system does the rest, comparing measured coordinates with nominal customer coordinates that are downloaded from a computer network database along with other information necessary for the inspection procedure.

The CMM measures a tubular checking fixture in about one-fifth the time it takes with a height gage. Measuring duplicate fixtures with the CMM requires even less time because data are recalled for use on any subsequent fixtures, even months or years later.

"The CMM saves time, but the real issue is precision measurement of complex projections in space. We are working with wood on handmade checking fixtures, but the unusual thing about measuring our gages is that we are not really measuring the physical surfaces of the gages as one might think. We are creating XYZ intersect points for the coordinates of the theoretical center line of an ideal tube, if mounted in our gage. So we are measuring a mathematical model rather than a physical one," says McKendrick.



Brown & Sharpe's horizonal 2000 CMM measures a tubular checking fixture in about one-fifth the time it formerly took using a height gage. One specialized measuement program can be used to measure a multitude of dimensionally different tubular checking fixtures.

ArtCraft measures checking fixtures for their conformity to the nominal tolerance zone of a tubular part. The closer the gage approaches theoretical perfection, the larger the in-spec tolerance envelope. As a result, fewer parts are rejected needlessly and less scrap is created on the manufacturing line.

"This kind of work requires an accurate CMM. On average, we hold intersect points to +/- 0.254 mm of a theoretical tube centerline on most of our gages," says McKendrick. This may not sound like high accuracy to someone used to measuring discrete parts to tenths. But the distances measured at ArtCraft are intersects of angular projections. Minuscule uncertainties in measuring angles can magnify the error at projected intersects. For this level of precision, a DCC machine was critical to drive the probe at a consistent speed and at a precise angle to the vector being measured.

A useful feature of the measurement software is its ability to rotate alignment planes. The gages are designed in a suitable view using a proprietary CAD program, than they are laser-processed using a system designed by ArtCraft in which parts are laser-etched and laser-cut. The completed fixture is then measured using a coordinate system that is integrated with ArtCraft's manufacturing processes. Finally, the coordinate system is rotated so ArtCraft's certification reports display results in the customer's print format. The means that ArtCraft's customers have documentation that confirms that the fixture meets their dimensional requirements.

Because of the intensive work done to develop its measurement procedures and systems, ArtCraft recently was placed on General Motor's list of approved dimensional laboratories. ArtCraft can certify its own fixtures and inspect its customers' parts, relieving them of an overflow of process qualification inspection and creating a new business opportunity for ArtCraft. As a result of the dimensional measurement accreditation, customers have been using measurement data provided by ArtCraft to meet criteria for becoming qualified suppliers and obtaining ISO 9000 certification. The company is studying additional ways to expand its measurement capabilities.

"At first, others in the industry did not understand our decision to purchase a CMM--until they saw the certification reports that reflect the improvement in our products. Since we began this program, no CMM-certified gage has been found to be out of tolerance," says McKendrick.

While the wooden components used to produce the checking fixtures are historically designed and laid out manually, it is far more accurate to design the gages using CAD and then laser process them. ArtCraft introduced its laser-cutting process first, but it wasn't until the company purchased the CMM that the benefits of both machines were clearly obvious. Now ArtCraft is one of the few, if not the only, computer integrated manufacturing facility for the production of certified tubular checking fixtures in the country.