

Application Note 1005

Tube End Chamfer Measurements



Pictured above is a Chamfer Scan System. The front door can be closed if used in a factory environment. A PC is mounted in the box at the right. The geometric laser (red) is looking at the chuck assembly.

Introduction

Tube manufacturers frequently need to measure the outside and inside chamfers on the end of a tube to determine the chamfer angle(s) and the length of the chamfer. One such method is to use our Chamfer Scan System. The system can measure small and large chamfers. We have measures angles as steep as 20 degrees from the tube axis.

Measurement Technique

The measurement is accomplished by using a geometric laser. The laser sensor utilizes CCD Digital Signal Processing (DSP) technology which significantly reduces the laser speckle problem enabling it to easily measure materials ranging in color from black to white without any recalibration. Likewise steep angles can also be measured with the DSP technology.

Specifications

The specifications listed below are based on using a 1000 DSP Series laser displacement sensor with a measurement range of 10mm to accommodate the chamfer length.

- Resolution to 1:60,000 of the measurement range.
- Max. chamfer angle 80 degrees from center axis of tube.
- Max. OD of tubes to date is 84mm.
- Up to 0.025mm resolution on chamfer height.
- ± 2 degree resolution of chamfer angle from center axis of machine chuck.
- Measures OD/ID.
- User selectable number of scans per full rotation.
- Automatically plots the external and internal tapers
- Custom measurement ranges are available.

Application Brief 1005

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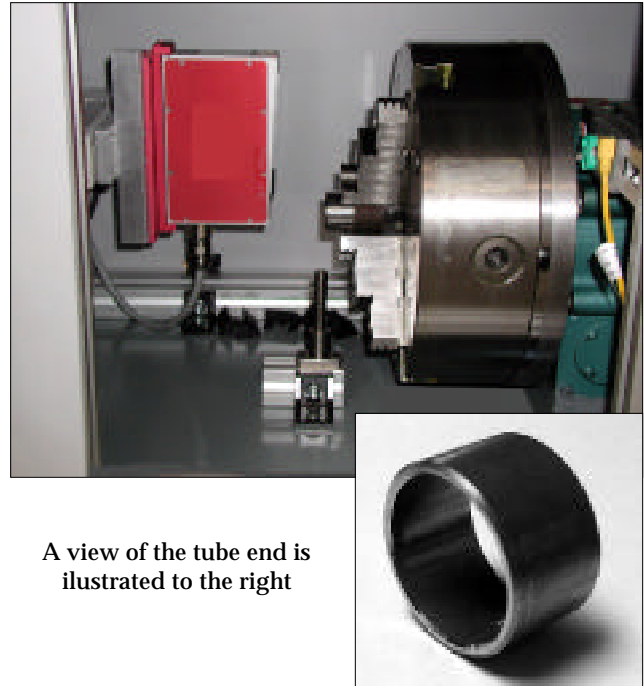
Laser Gauge

Typically one of the 1000 Series DSP distance measuring lasers is used to make the measurement. The laser is mounted perpendicular to the tube's end. The laser selection is based on the required accuracy. Pictured to the right is the system setup. A 1000 series DSP laser is mounted to a frame and is looking at the cross section of the tube end. The tube end is mounted in a rotating chuck. The laser moves horizontally across the cross section of the tube to determine the OD and ID chamfer(s) length and angle of the chamfer(s), and the OD of the tube all automatically.

Data Reporting

After every scan cycle, multiple measurements can be displayed and recorded in a tab delimited text file. Typical measurements are:

- Min/max chamfer height
- Min/max chamfer width
- Average chamfer angle
- Rotational position OD min./max dimensions



A view of the tube end is illustrated to the right

Application Software

The chamfer scan system is controlled by user friendly PC based commands. Users can easily set up inspection of new tubes by simply entering the nominal OD, ID and number of scans desired per 360 degrees. Once the cycle is started, the machine is fully automatic until the cycle is completed. The inspected chamfer measurements are clearly displayed both digitally and graphically.

Summary

This application note was based on using our 1000 DSP Series displacement sensor. The sensor has a resolution of 0.2µm. It was necessary to use this sensor for the required accuracy. For larger with longer chamfers, we can use a 1000 DSP sensor with a longer measurement range to handle the length of the chamfer. Measurement ranges up to 400mm are available with the 1000 DSP Sensor Series.



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