Measurement of Throttle Valve & Components Using Laser Trackers

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Project Overview

The purpose of this project is to develop a measurement and inspection procedure for a Siemens' steam turbine throttle valve component through the use of a portable FARO laser tracker.

Project Goals:

- Reduce current metrology efforts by 40-50%
 (12 hour manual measurement and inspection)
- Maintain or improve accuracy level of inspection.
- Improve productivity in repair and maintenance operations i.e. reduced cycle times, product quality



Using Laser Trackers for Metrology

- Spherically Mounted Retroreflector, SMR
- Two types of distance meters
 - Interferometer
 - Absolute distance measurement, ADM
- Angular Encoders
 - Azimuth axis
 - Zenith axis (elevation)





Spatial Analyzer Software

- 3-D graphical metrology platform
- Spatial transformations
- Measurement uncertainty
- Environmental temperature compensation
- Standard CAD exchange (IGES, VDA)





Throttle Valve Component

- Steam turbine throttle valve component
- ~70 in. Diameter
- Approximately 12000 lb
- Measured on skid in
 "As shipped" orientation
- Both internal and external critical features





Component Measurement Procedure

- Siemens' current charting procedure
 - 1-D probe and vertical boring machine
 - Hand micrometer and bore gages
- Employed measurement procedure
 - Single stable point scan indexing at 45° intervals
 - "Scan type" measurement



Continuous Surface Scanning

- Manufactured "Scan type" SMR pin nest
- Spring-loaded to apply constant force on SMR
- 3 points of contact to not over constrain motion
- Utilized to achieve better characterization of form error







Data Processing

- Coordinate system defined after data collection
- Geometry fitting through spatial analyzer software
- Out of roundness of liner bore & bushing surfaces
- Flatness run out of spigot surface
- Uncertainty analysis
- Error anticipated ~0.001 in (0.025 mm)



Future Outlook

- Further data collection with loaner throttle valve
- Improve measurement process
- Determine optimal frequency for "scan type" measurements
- Reduce error in external feature data collection



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Sources:

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- 2. New River Kinematics Metrology Institute Spatial Analyzer User's Manual, www.kinematics.com.



Questions

