Actemium NDS Nürnberg

A system for the nondestructive inspection of forgings for wind energy components

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Klaus Leupoldt, Heinz-Josef Otte

Dirostahl, Remscheid
Actemium NDS Nürnberg
Dirostahl + Actemium NDS Nürnberg
Components to be inspected
Difference to standard inspection systems (for turbines)

Challenge
Description of the inspection system
Acceptance
Time frame of the complete project
Summary
Dirostahl, Karl Diederichs KG

Owner operated private company, located in Remscheid, Germany

500 employees

Products in alloyed and unalloyed steel grades:

- open-die forgings from 10 kg up to 35,000 kg
- seamless rolled rings up to 3,500 mm OD
- forged bars up to 850 mm OD / square and up to 15 m in length
35 employees
Service provider for conventional and nuclear power stations
Provider of turnkey inspection systems for forgeries, energy machine manufacturers and Deutsche Bahn AG (inspection of hollow axles)
Components to be inspected


Difference to standard inspection systems

- Single pieces (rotors and discs):
  - high reproducibility: 1 – 2 mm
  - high inspection sensitivity: FBH Ø 1 mm at sound path 1000 mm
  - inspection time: several hours or even days

- Mass production:
  - high reproducibility: 1 – 2 mm
  - high inspection sensitivity: FBH Ø 0,5 mm at sound path 500 mm
  - inspection time: 5 – 10 minutes
System description / general

Dimensions of parts to be inspected
- Diameter up to 3500 mm
- Height up to 2000 mm
- Weight up to 10000 kg

Inspection technique
- Conventional UT and Phased Array
- Type of UT system, software, probes…
Two turning units
- Inspection on one unit
- Loading and unloading in parallel on the other unit

One manipulator
- Vertical mast
- Horizontal boom
- Probe system

⇒ No idle time
System description / mechanical part_2

Real system
System description / inspection technique

Application of a linear phased array probe / principle

For each point in scan direction several elements of the phased array probe are grouped together.

Electronic scanning

➤ Result:

Big probe index / small UT index
Application of a linear phased array probe / principle

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Electronic scanning

Result:

Big probe index / small UT index
System acceptance

Detection of a FBH Ø 2 mm with a linear array probe

<table>
<thead>
<tr>
<th>Defect type</th>
<th>Diam. Ø</th>
<th>Depth pos</th>
<th>Probe</th>
<th>Detect. diam</th>
<th>Detect. depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBH ¹</td>
<td>1</td>
<td>495</td>
<td>Array</td>
<td>1.1</td>
<td>496</td>
</tr>
<tr>
<td>SDH ²</td>
<td>2</td>
<td>3</td>
<td>Paintbr.</td>
<td>1,1³</td>
<td>2.8</td>
</tr>
<tr>
<td>SDH ²</td>
<td>2</td>
<td>4</td>
<td>Paintbr.</td>
<td>1,8³</td>
<td>4</td>
</tr>
<tr>
<td>FBH</td>
<td>2</td>
<td>245</td>
<td>Array</td>
<td>2.1</td>
<td>246</td>
</tr>
<tr>
<td>FBH</td>
<td>1</td>
<td>245</td>
<td>Array</td>
<td>1.1</td>
<td>246</td>
</tr>
</tbody>
</table>

¹ FBH = flat bottom hole
² SDH = side drilled hole
³ calculated value (SDH → FBH)
<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 2012</td>
<td>First contact by email</td>
</tr>
<tr>
<td>March 3, 2013</td>
<td>Quotation based on a preliminary functional specification</td>
</tr>
<tr>
<td>April 2, 2013</td>
<td>Order placed (after clearing of techn. and fin. aspects)</td>
</tr>
<tr>
<td>May 23, 2013</td>
<td>Layout for concrete works, foundation</td>
</tr>
<tr>
<td>July 7, 2013</td>
<td>Design of manipulator, control unit, wiring diagrams</td>
</tr>
<tr>
<td>Nov/Dec 2013</td>
<td>Training of Dirostahl personnel (2 weeks)</td>
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<tr>
<td>Dec. 12 2013</td>
<td>Factory Acceptance Test</td>
</tr>
<tr>
<td>Jan/Feb 2014</td>
<td>Installation and preliminary SAT (3 1/2 weeks)</td>
</tr>
<tr>
<td>June 4, 2014</td>
<td>Final FAT after 3 months of successful operation</td>
</tr>
</tbody>
</table>
Summary

- Applying of the system results in a competitive advantage by short inspection/cycle time resulting in a high throughput of components at a verifiable constant high quality
- Unique selling position for products
- Contribution to a reliable, safe and sustainable supply of power
Thanks for your attention

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