RotoTest Inspection Improvements.

Airbus Customer Services
Structure Engineering Support

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RotoTest Inspection Improvements (NTM 51-10-01).
Rototest NTM 51-10-01

Existing procedures (A & B) have been revised to give clearer examples (photo’s) of typical indications

Added a new procedure (C) for after repair/re-work
RotoTest Inspection Improvements – Mono-Frequency

RotoTest Improvement's
(NTM 51-10-01 Procedure A)
RotoTest Inspection Improvements – Mono-Frequency.

NTM 51-10-01 / ANDT 51-96-29, Procedure A & Procedure B, update:

- General review of the Text & Illustrations, (eg Rename X-T as Y-t),
- Add conductivity ranges for typical materials to be inspected,
- Re-arrange Calibration Blocks, Materials and specifications (Steel 15-5PH, AlLi Alloys and Tiβ added),
- Clarify the Add or Remove 6dB after Calibration,
- Add inspection frequencies between 500KHz and 2MHz, (eg for Steel 1~2Mhz)
- Add rotor RPM adjustment to between 1000 & 3000 RPM, (eg lower rpm to optimize signal for large diameter’s),
- Clarify typical indications, with Figures and photographs:
  - Cracks,
  - Scratches
  - Cold Worked Holes,
  - Burrs,
  - Corrosion, including complementary borescope inspection,
  - Mechanical Damage,
  - Effect of Shims & different Material in the stack.
## Calibration clarification when using the different Calibration Blocks:

<table>
<thead>
<tr>
<th>Instrument Adjustment</th>
<th>Step</th>
<th>SPLIT PARALLEL and SPLIT CONICAL CALIBRATION BLOCKS</th>
<th>HOLE PLATE CALIBRATION BLOCKS</th>
<th>CALIBRATION BLOCK SET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase Angle Calibration (X-Y Mode)</td>
<td>Set the instrument gain to obtain a signal above the zero datum at</td>
<td>100% SH</td>
<td>100% SH</td>
<td>100% SH</td>
</tr>
<tr>
<td></td>
<td>Adjust the phase angle to position the signal</td>
<td>20 degree right from the vertical</td>
<td>0 degree on the vertical</td>
<td>10 degree right from the vertical</td>
</tr>
<tr>
<td></td>
<td>Use the slot level</td>
<td>N/A</td>
<td>0,5 mm (0.020 in) (through slot)</td>
<td>0,5 mm (0.020 in) (corner 45°)</td>
</tr>
<tr>
<td>Sensitivity Final Setting (Y-t Mode)</td>
<td>Set the instrument gain to obtain a signal above the zero datum at</td>
<td>75% SH</td>
<td>75% SH</td>
<td>75% SH</td>
</tr>
<tr>
<td></td>
<td>Modify the instrument gain</td>
<td>Add 6 dB</td>
<td>Add 6 dB</td>
<td>Remove 6 dB</td>
</tr>
<tr>
<td></td>
<td>The noise level must be less than</td>
<td>15% SH for hole diameter ≤ 4,5 mm (0.177 in): 10% SH for hole diameter &gt; 4,5 mm (0.177 in):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RotoTest Inspection Improvements – Mono-Frequency.

Sensitivity adjustment – Using a Split Conical Calibration Block (after phase angle adjustment):

75% Screen Height, + 6dB
Clarification of interpretation, for scratches):

<table>
<thead>
<tr>
<th>Scratches</th>
<th>Long, narrow superficial mark done with a sharp or pointed object.</th>
</tr>
</thead>
</table>

| Damage width: Scratch < Nick < Ding | All indications to the left of vertical and do not exceed 40-50% SH. Perform visual inspection for confirmation. |

![Image of RotoTest inspection results showing different views with and without dB adjustment.](image-url)
Clarification of interpretation, this time for changes in stack materials AL to Steel:

<table>
<thead>
<tr>
<th>Change of material 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel – Al</td>
</tr>
<tr>
<td>Adjustment in Al</td>
</tr>
<tr>
<td>Passing from Al to</td>
</tr>
<tr>
<td>Steel, signal in X-Y</td>
</tr>
<tr>
<td>increases in</td>
</tr>
<tr>
<td>amplitude and its</td>
</tr>
<tr>
<td>angle rotates</td>
</tr>
<tr>
<td>clockwise</td>
</tr>
<tr>
<td>NOTE: cracks in</td>
</tr>
<tr>
<td>steel will feature</td>
</tr>
<tr>
<td>an indication left</td>
</tr>
<tr>
<td>to the vertical.</td>
</tr>
</tbody>
</table>

Typical signal in steel after adjustment in Al

Steel with no crack

Steel with crack
RotoTest Improvement's
(NTM 51-10-01 Procedure B)
Clarification of crack signal for Manual RotoTest:

![Diagram showing crack indication and lift-off]
RotoTest Improvement's
(NTM 51-10-01
Procedure C)
(After Re-work)
RotoTest Inspection Improvements – Mono-Frequency.

This new Procedure C, is basically the same as Procedure A:

The important differences are in the acceptance criteria, since we already know we had a defect!

All indications at the same orientation of the marked crack prior to rework with maximized amplitudes clearly above noise level must be considered as cracks.

<table>
<thead>
<tr>
<th>Sensitivity Final Setting (Y-t Mode)</th>
<th>Set the instrument gain to obtain a signal above the zero datum at</th>
<th>75% SH</th>
<th>75% SH</th>
<th>75% SH</th>
</tr>
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<tbody>
<tr>
<td>Modify the instrument gain</td>
<td>Add 6 dB</td>
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<td></td>
<td>10% SH for hole diameter &gt; 4,5 mm (0.177 in):</td>
<td></td>
<td></td>
<td></td>
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</table>
RotoTest NTM 51-10-01: Multi-Frequency RotoTest.
• This method introduces the possibility to determine ‘estimate’ within certain limits the ‘depth’ of a defect into the material from the bore hole, and to measure the length of defect along the bore hole.

• Also the tooling trialed, provides the possibility to ‘auto-calibrate’, which should help to reduce the variability of the calibration due to human influences.
RotoTest Inspection Improvements – Multi-frequency

• Currently the tooling is a little more cumbersome, than single frequency equipment:
  • The Instrument is
    – Laptop PC sized, with additional module,
    – And needing mains power.
    – Is more transportable than portable.

• The Rotor Unit is roughly the same size as a ‘mini-rotor’:
  – Has an added encoder, for depth measurement,
RotoTest Inspection Improvements – Multi-frequency

- Signal interpretation, is similar to current single frequency interpretation:
  - Larger signal = larger defect
  - Phase angle relates to defect type
    - As explained in NTM 51-10-01

- Plus, using the C-Scan and amplitude display, it is possible to estimate the defect depth into the material.

- However, for small crack defects, burrs and hole ovality:
  - you can see the phase angle, is quite similar, making them a little difficult to differentiate!
CONCLUSION:

Airbus is continuously looking for innovation and improvement in NDT technics and tooling to always support our customers in Aircraft Maintenance activity.

Your feedback remains key for our progress.

Airbus customer support remains at your disposal for:

- Daily Technical Request
- On-site assistance
- Engineering Workshops
Thank you
Questions ?