CRACK DETECTION USING ULTRASONIC TESTING

Technique: Conventional pulse-echo angle-beam ultrasonic testing

FIELD OF APPLICATION

Equipments / Parts
- Machined parts, extrusions, castings, shafts

Standards
- ASTM, E 587-00 (R05)

Materials
- Aluminum
- Stainless Steel
- Carbon Steel
- Titanium

Thicknesses
- Min.: 1 mm (0.040"")
- Max.: 100 mm (4.000"")

Diameters
- Min.: 51 mm (2.0"")
- Max.: Flat

Temperatures
- Min.: -20°C (-4°F)
- Max.: 45°C (113°F)

Surface Conditions
- Paint:
  Usually functional through well bonded paint layers, but there would be more attenuation than without paint. Refer to task requirements.
- Corrosion:
  Must be buffered

Indications of interest
- Contact surface cracks
- Opposite surface cracks

BRIEF DESCRIPTION

This technique consists of pulsing ultrasonic waves through the material. When a discontinuity essentially perpendicular cuts the beam, part of the ultrasonic waves are reflected, returned to the transducer and displayed on screen showing the distance of the indication and its amplitude. Generally, an angle is given to the beam using an angled plastic wedge, common angles are 45, 60 and 70°. When the ultrasonic waves hit a smooth surface, it is reflected as in a mirror. Using an angled beam, this feature often makes it possible to reach inaccessible areas.

ADVANTAGES

- Inspection through material volume, not only the accessible surface
- Accurate position measurement of indications
- Require a small contact surface

DISADVANTAGES

- Sensitive to discontinuity orientation
- Competent interpretation is required to distinguish geometric features indications from defect indications
- Requires couplant

REPRESENTATION(S)

Picture of a crack detection inspection in a noise landing gear upper drag link of a Pilatus PC-12

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**LIMITS OF DETECTION**
- Smallest detectable crack in good conditions:
  - Length: 3 mm (0.120”)
  - Depth: 0.5 mm (0.020”)

These minimum values may vary significantly, but would be typical for smaller components.

**MEASUREMENTS ACCURACY**
- Crack length: ± 2 mm (0.080”)
- Crack depth: ± 1 mm (0.040”)
  Generally evaluated by comparison of indication amplitude with reference reflectors

**ESTIMATED EFFICIENCY**
- Except access to the inspection location, count about 15 minutes for preparation and calibration of the equipment.
- Once on site:
  - For example, in the case of a mainly linear scanning for crack detection between fastener holes, it should be possible to cover approximately 10 feet / hour.
  - An inspection of a really small but complex area would take around 15 minutes.
- From 10 to 15 minutes per task should be counted to report inspection results.

  *These estimations should be used only as guidelines and can’t be a commitment, since every job has its own particularities. For a fixed price, please ask for a quotation.*

**REPORTING**
- Inspection reports contain:
  - Inspected aircraft details
  - Performed task details
  - Evaluation and interpretation of indications that would be unacceptable
  - Certified inspector approval

**OTHER COMMENTS FOR SITE INSPECTION**
- The technician must have a safe access to put the transducer in direct contact with the surface to be inspected.
- A free space from the inspection surface of approximately 2” (50 mm) is necessary.
- A contact surface of at least 1” x 1” (25 x 25 mm) is required to apply the transducer.
- The instrument is powered with batteries, there is no need of electric current.

**Procedure:** According to the NDT manual of the aircraft  
**Certification:** NAS 410, UT Level 2

This document only aims to express the main frame of this application et does not necessarily represent the absolute limitations of this technique. For any needs outside this scope, simply contact us to validate feasibility.