

491.

## Misapplication of Ultrasonic Testing (UT)

The Standards Committee has received reports concerning the alleged misuse of Ultrasonic Testing (UT) as an inspection technique. We would therefore like to remind members of some of the limitations of UT and of some broader issues regarding NDT.

Quoting from paragraph 249 of Advice for Inspection In Service Annual (ADIPS, 2008):

"In UT high-frequency sound waves are passed into the test object and reflections are returned to a receiver from internal or surface flaws and from the part's geometrical configuration. This technique is widely used in the fairground industry and is a highly efficient method of detecting sub-surface imperfections and defects. It is important that the interpretation of results is carried out thoroughly. As with all other test techniques it has limitations, for example:

- If the test area is rough, irregular in shape or small, it can be difficult to detect flaws.
- Cast iron and other coarse-grained materials are difficult to inspect due to high attenuation and signal noise.
- Linear defects oriented parallel to the sound beam may go undetected; correct techniques must be utilised to minimise this effect."

Whilst UT is a useful technique for detecting internal flaws within a component, we would like to reiterate that the presence of irregularities (such as grease nipples, spiral grooves for grease lubrication or machined holes for split pins, etc.) might render it difficult or even impossible to carry out a satisfactory test of a component using UT. Certainly, specific procedures would be required in cases where irregularities are present.

Also, even when considering a uniform shaft with no geometrical irregularities, UT will only reliably be able to detect surface-breaking defects once they reach a certain depth. Surface-breaking cracks are always best detected by alternative techniques such as MPI and DP.

It has been reported to the Standards Committee that inspectors have been carrying out in-situ UT of small diameter machined pins with grease nipples and machined holes for split pins. It is our understanding that in this specific case a meaningful ultrasonic test could not have been undertaken due to the smallness of the pin's diameter and the presence of these geometrical irregularities. We assume that in-situ UT was selected for expediency (i.e. to avoid removing the pins), but we would like to remind members that "If inappropriate NDT is applied or NDT is not applied correctly, the results may give a false impression of the integrity and safety of the device." [Paragraph 3, ADSC Safety of Amusement Devices Non-Destructive Testing]. Furthermore, "difficulty of access is not a valid reason for failing to inspect safety-critical components" [Paragraph 157, HSG175 (2017)].

Further information regarding the use of NDT as part of Annual Inspections can be found in Advice for Inspection, HSG 175 and ADSC Safety of Amusement Devices Non-Destructive Testing (from the latter of which the following extracts have been taken):

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<sup>1</sup> The minimum detection size, using a specific probe, could be evaluated by machining notches of varying sizes into a series of identical components and then carrying out UT to assess what size of defect is detectable.

19. In order to be effective, the inspection techniques selected must be capable of detecting the deterioration at a sufficiently early stage and with sufficient reliability.

23. All NDT should be applied under the control of a procedure which is produced and approved by competent personnel. This information is likely to be provided by the NDT IB undertaking the inspection but may have already been provided by the designer.

24. Inspection requirements will change during the life of a device in response to changes to the device and in-service experience, etc. The amendment of NDT schedules therefore requires appropriate change control processes.

50. The schedule should designate the particular NDT methods to be used. The competent person should have knowledge of the method together with any significant limitations in its use.

59. Competency requirements for the amendment of NDT schedules are the same as those required for their development.

60. A documented review should be performed before any removal or change to the requirements of an NDT schedule. The purpose of this review is to enable both the controller and competent person to satisfy themselves that the safety of the device will not be compromised if the schedule changes.