



A flexible approach to eddy current weld inspections

Bill Ziegenhagen, product manager at global NDT equipment specialist, Zetec, talks about eddy current testing (ET) and the use of ergonomic, powerful and light weight modern instruments such as Zetec's MIZ-21C.

Eddy current testing (ET) is a fast, accurate, chemical-free

way to detect surface and sub-surface defects, including cracks, corrosion and heat damage. It's a proven technology for inspections of welds, rivet holes, tubing and other ferrous and non-ferrous components in aviation, aerospace, oil and gas and other industries.

ET has the added benefit of producing an electronic inspection record, a big advantage over dye penetrant testing (PT) and magnetic particle testing (MT). These digital test results can be analysed, saved, shared, stored and compared at any time.

Eddy current testers can also 'see' through non-conductive coatings such

as paint, without technicians having to pre-treat the surface.

Modern ET insights

ET involves using a portable instrument and a probe with a coil in it that fires electronic currents into the material. Eddy current array (ECA) probes have multiple coils that fire at coordinated times and can capture more information in a single pass, transforming a process that might last several minutes per weld or joint to one that takes seconds.

One practical limitation of eddy current technology is that the coils in the probe need to be close to the material under test, which is a challenge when the inspection involves complex shapes or rough surfaces like a positive curvature of the circumferential weld crown bead or the non-uniform surface of the weld itself.

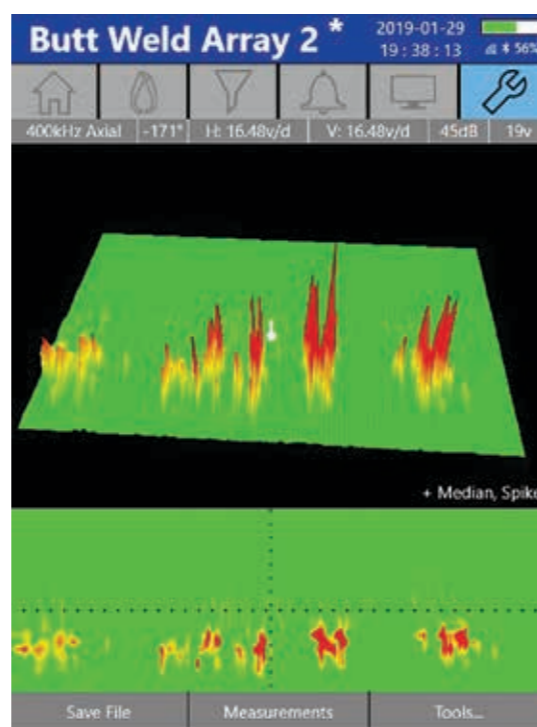
Because inspection points can be physically hard to reach, most technicians prefer instruments and probes that are battery powered and easy to handle yet don't compromise data-acquisition speed, performance or probability of detection.

Fortunately, eddy current tools and probes are evolving in several important ways.

Portable Instruments

Taking their cue from consumer electronics, the latest instruments feature ergonomic designs with small form factor, powerful software, light weight, long battery life and colourful multi-touch displays.

For example, Zetec's MIZ-21C handheld eddy current instrument weighs just 1.2 kg. It has a large, colourful, sun-



ET surface array indications for the butt weld of a mining drum. Zetec's MIZ-21C has a large, colourful, sunlight-readable C-scan display that allows the technician to rotate, zoom and manipulate the data with his fingers.

light-readable C-scan display that allows the technician to rotate, zoom and manipulate the data with his or her fingers. The 5.7-inch (480x640 pixels) screen is large enough to handle a range of modes, including two signals side by side; or a reference signal and a live test signal simultaneously.

Software that supports single- and dual-frequency eddy current, rotating scanners and conductivity, with viewing tools for impedance, sweep, waterfall, and C-scans, enables inspectors to maximise the instrument's ability to manage signal-to-noise ratios and deliver accurate, detailed inspection results.

Advanced software, however, requires maximum storage and increased processing power. The MIZ-21C has the capacity to store inspection configurations within the instrument, manipulate signals and views for each test application, and use automation to remove steps or remove certain tasks, which is key to a fast, efficient inspection. One example is the MIZ-21C's

'auto lift-off/rotate' button. By automating this task, the technician can repeat the test more consistently while using fewer steps.

Finally, long battery life is important, but so is convenience to maximise user productivity. The MIZ-21C offers both. With up to 10 hours of battery life, users can operate the unit for an entire shift without recharging, while replaceable batteries support 24-hour operation. Even something as simple as the MIZ-21C battery cover design, where no separate tool is required to open it, can be a significant productivity factor.

Flexible probes

During an inspection, one way to ensure that the probe coils are aligned with the surface is to build a surface array probe that is shaped for one specific application or component, such as gear teeth, rivets, bolt holes or something that has to be subjected to repeated non-destructive testing.

Using CAD drawings and 3D printing technology, it is possible to manufacture an eddy current probe that's precisely formed to fit an exact shape or surface. Though designed to do only one job, a custom-made probe can be extremely effective at producing consistent data acquisition conditions over and over again.

Another approach is to use an ECA probe with a flexible, durable wear surface that allows the coils to bend and remain nominally perpendicular to the surface when that surface is rough, irregular, or complex. In the case of a weld, for example, a flexible surface array probe with just two inches of coverage can encapsulate the weld bead, transition zone and heat-affected zones in a single pass.

Because this type of flexible probe can conform and adapt to different surfaces and contours, it can handle a range of ECA inspections on the same job ticket: for example, a technician can inspect welds on a curved tower and weld joints on turbine rotors with the same flexible surface array probe.

For very high weld crowns, some surface array probes have '+point' coils at the tip of the probe. These types of coils can be especially effective when examining the top of a weld.

One important consideration is the material on the probe's wear surface. The thickness of the wear surface will affect the proximity of the coils to the material as well as the probe's overall flexibility and eddy current signal quality.

In some cases, the flex circuit may not be durable enough to withstand repeated



The Surf-X Array Probe can handle a range of inspection applications, from inspecting corrosion or cracking in pipes, pressure vessels, or tanks, to assessing and sizing cracks in raised welds and friction stir welds.

abrasion against rough metal surfaces. Probe manufacturers offer a variety of materials as a wear surface, including plastic films and abrasion-resistant fabrics such as SuperFabric™.

Modular approach

Customised and flexible surface array probes can quickly and accurately test a wide range of materials and geometries, but the entire assembly must be replaced if one element of the probe wears out or fails.

One new approach to improving the versatility and service life of ECA probes is a modular one. Last year, Zetec introduced Surf-X, a flexible ECA probe with swappable coil sets for specific applications. Each probe is comprised of an electronics module and detachable encoder that can be used interchangeably with different array probe coil sets. Users in the field can switch out a coil set in less than a minute.

Currently, Zetec offers five coil sets, including one set for welds, which uses a mix of 32 array coils and two +point coils for complete inspection coverage of butt and T-weld joints; two versions of very flexible tape probes for inspecting small surface flaws on complex geometries such as turbine dovetails; and another set for a range of surface array testing applications where PT or pencil probes might be used today. The encoder can connect in multiple locations on both the handle and electronics module – and the module, encoder and cables can be re-used, saving time and money.

The coil sets have four wear-surface op-

tions: no wear surface on the tape probes for inspecting small indications on smooth materials; a thin UHMW plastic wear surface to protect coils and reduce lift-off; a cloth wear surface for protecting the array coils on smooth or polished surfaces such as gear teeth; and SuperFabric for protecting array coils on rough surfaces such as butt and T-welds.

The Surf-X line of probes is fully compatible with the MIZ-21C family, delivering a complete platform for eddy current inspections: making this a cost-effective handheld instrument with surface array capabilities, powerful embedded software and compatibility with new and legacy probes and scanners.

More coverage and versatility

Regardless of whether a custom probe shape, a flexible surface array probe or a modular approach is being used, today's ECA probes provide greater inspection coverage in a fraction of the time compared to PT, MT or pencil probes.

The key is to focus the probe's flexibility – literally, in terms of the surfaces and geometries it can handle; and figuratively in its ability to help technicians be more productive. With a focus on portability, ease of use, connectivity and high probability of detection, Zetec's MIZ-21C and Surf-X probes deliver every inspection advantage available today, while also setting up for the future.

Zetec NDT instruments are available in South Africa through GammaTec.

gammatecsa.com



Zetec's MIZ-21C handheld eddy current instrument weighs just 1.2 kg and features an ergonomic design with a small form factor, powerful software, light weight, long battery life and colourful multi-touch displays.