### How latest sensor and communication technologies help to improve UCI (ultrasonic contact impedance) hardness testing method

Tom Ott, Proceq USA





### UCI is one of the most popular portable hardness testing methods



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### Frequency shift is used to infer the hardness of the test piece



Longitudinal oscillation of resonating rod at ultrasonic frequency Vickers indenter forced into test piece Measured frequency shift converted to hardness

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# International standards ASTM A1038 and DIN 50159 specify UCI in detail

- Widely established
- Well standardized
- Diamond indenter in UCI: same tip shape as in stationary Vickers

#### Hardness scale: HV, indicated as "HV(UCI)"



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# Different applications require different UCI test loads

#### HV1 (1 kgf, ~10 N)

#### HV5 (5 kgf, ~50 N)

#### HV10 (10 kgf, ~98 N)

- Precisions parts
- Thin coatings
- Hardened layers

- Hardened material
- Carburized material
- Welds and HAZs

- Small forgings
- Cast material
- Welds and HAZs







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#### The mechanical working principle of conventional UCI probes only allows one fixed load per probe



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### The test results with conventional UCI probes are highly user-dependent



Why?

- 1. Constant and continuous load application is needed
- 2. Conventional UCI probes are **not able to** track the loading process
- No help provided to reduce the dependency on user skill

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### The end-to-end process with conventional UCI probes is rather "manual"



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### In Lean Manufacturing, eight "wastes" make processes slow, ineffective and/or inefficient



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# 5 of the 8 Lean wastes are evident during the traditional UCI testing process



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## A force sensor allows real-time monitoring and recording of the load



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### User guidance can be shown based on the load monitoring



User guidance:

- Start to apply force
- Target force reached lift probe
- Force applied too fast/slow

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### New communication technologies now improve the UCI hardness testing process



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## Bluetooth creates wireless connectivity reduces the waste of motion for data



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### Cloud-based data eliminates worries of defective or lost data



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## Full data traceability reduces waiting and defects in communicating results



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## Cloud-connected app enables on-the-spot data analysis and reporting



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### Cloud connectivity enables real-time data and report sharing



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### New digital technology makes UCI testing overall more accurate, convenient and efficient



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#### Thank you for your attention.

### **Any Questions?**

Tom Ott, Proceq USA



