

# Metallurgy for Industries

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A Monthly News Letter

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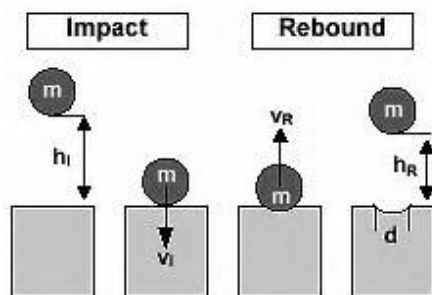
## Portable Hardness test

*A comparison of Rebound & UCI Method*

### REBOUND HARDNESS TESTING - ASTM A956

Rebound hardness commonly referred as Equotip Hardness test. The rebound type hardness testers are standardized in ASTM according to A956-12 "Standard Test Method for Leeb Hardness Testing of Steel Products". This standard was originally approved and published in 1996, and the last edition was published in 2012. This is the only ASTM standard that currently addresses hardness testing with the Leeb method.

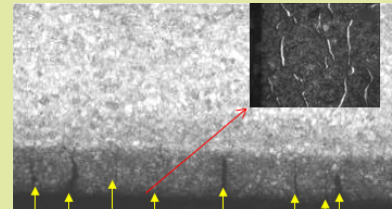
Leeb hardness test—a dynamic hardness test method using a calibrated instrument that impacts a spherically shaped carbide ball or diamond tipped body with a fixed velocity (generated by a spring force) onto a surface of the material under test. The ratio of the rebound velocity to the impact velocity of the impact body is a measure of the hardness of the material under test. The following figure shows principle of rebound hardness.



The accuracy of a Leeb test is dependent on proper test conditions – surface roughness, test piece thickness, and mass – which are defined in the A956 standard.

The A956 standard is not known to be specifically referenced by any current API standard. However, the Equotip conveniently

## Microstructure of the Month



**Magnification:** 1000X

**Component:** Pressure let down valve assembly

**MOC:** DIN 1.2343

**Observation:** Panoramic view of the nitriding case along the length of stem away from the tip. Lots of parallel hair line cracks are seen within the nitrided case. Matrix microstructure is tempered martensite

Higher magnification indicates needles of iron nitride along with alloy nitrides within the case.

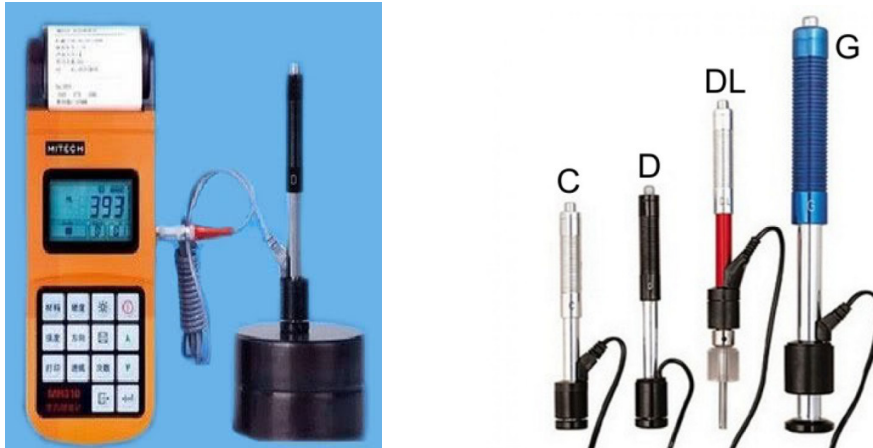
**Cause:** The premature failure of stem is on account of nitriding done on a stem having decarburization that rendered the nitrided layer brittle. During operation it developed cracks within one month of service.

**Useful Hint:**

1. Quality control for nitriding may be performed at the manufacturing stage.
2. WFMPi may be performed to identify the cracks.

converts hardness measurement values and displays the results in other hardness scales, such as Brinell, Rockwell, and Vickers. The ASTM standards governing these test methods are generally mentioned in API standards. The year 2012 edition of ASTM E 140 includes the conversion of leeb hardness to other hardness scales such as Brinell or Vickers hardness. B

Following figure shows a rebound hardness tester and different probe models..



### HARDNESS TESTING BY UCI METHOD - ASTM A1038

Standard A1038 covers the method named Ultrasonic Contact Impedance (UCI),

Basic Principle – The Vickers diamond is attached to the tip of round metal rod. This metal rod is excited to longitudinal oscillations in its resonant frequency in the range of 78 KHz. If the Vickers diamond and a test material come in to contact with each other, the resonant frequency changes. This happens as a function of size of indentation surface of the Vickers diamond. This is in turn the measure of the hardness of the material tested.

This method is strongly affected by a change in material, and therefore must be calibrated specifically to a sample of the material to be tested. It cannot use the concept of material groups like the Leeb method, as the relationship between the frequency shift and the common hardness scales is immensely material-dependent



### When to use UCI Method

The UCI method is recommended for testing materials having almost any shapes and sizes. It is especially used whenever material properties have to be determined within close tolerances.



The small UCI probe is equipped with a Vickers diamond are also a choice for hardness testing on welded components- predominantly in all critical heat affected zones. MIC 20 consequently places the complete range of applications at your disposal.

UCI testing is preferred for following applications

- On ready assembled machines
- In the HAZ (pipeline)
- On coatings
- On hardened surfaces (Eg. Tooth flanks or tooth gullet)

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