
Hardness Testing

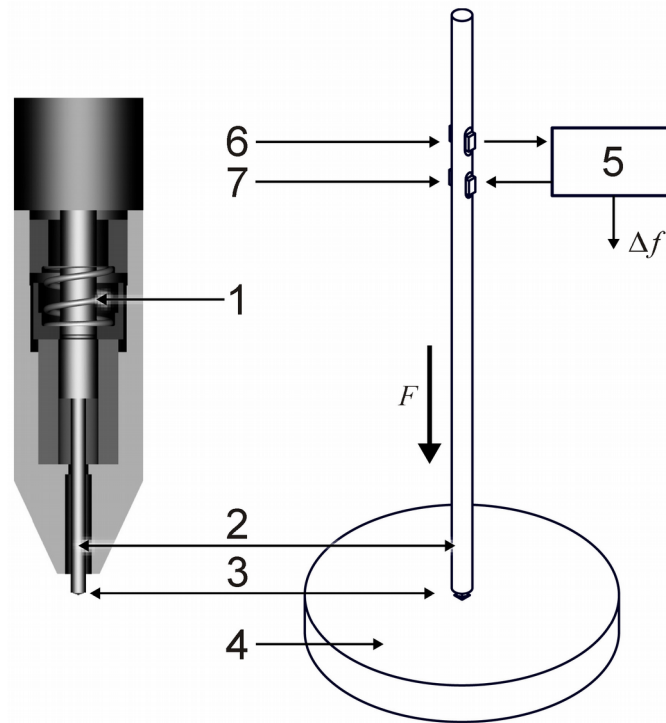
according to the

UCI-Procedure

Normative Basis

- ◆ DIN 50159:
Metallic materials – Hardness testing with the UCI method
- ◆ ASTM A1038:
Standard Test Method for Portable Hardness Testing by the Ultrasonic Contact Impedance Method

Functionality

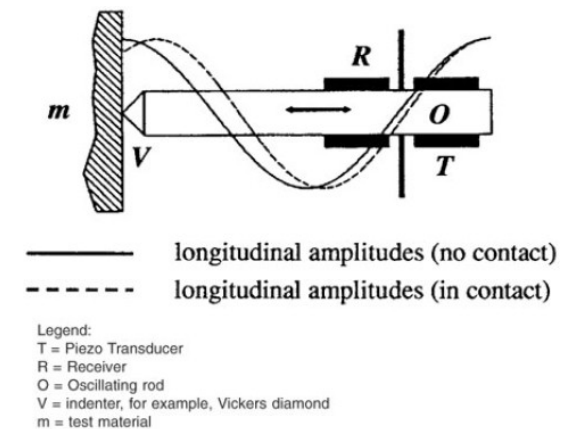


Schematic View of a UCI-Probe; Source: DIN 50159-1 / BAQ

- 1 Metalspring for generating the test load
- 2 Vibrating rod
- 3 Indenter (Vickersdiamond)
- 4 Test piece
- 5 Resonance amplifier
- 6 Receiving piezo element
- 7 Sending piezo element

UCI-Hardness Values

- ◆ The frequency shift is measured, when touching the material
- ◆ Declaration of the hardness value in Vickers, e.g. 500 HV10 (UCI)
- ◆ Theoretical measuring range from 10 – 3000 HV



Quelle: ASTM A1038

Comparison UCI – Vickers

Pro:

- ◆ Fast execution (No optical determination)
- ◆ Direction-independent (Upright to the surface)

Con:

- ◆ Depending on the E-Modulus of the work piece

Selection of the proper test load – Surface Roughness

Max. acceptable surface roughness in Ra in relation to the test load.

Test load (N)	10	50	98
Ra (µm) / DIN	0,5	0,8	1,0
Ra (µm) / ASTM	5	10	15

Selection of the propper test load – Surface Roughness

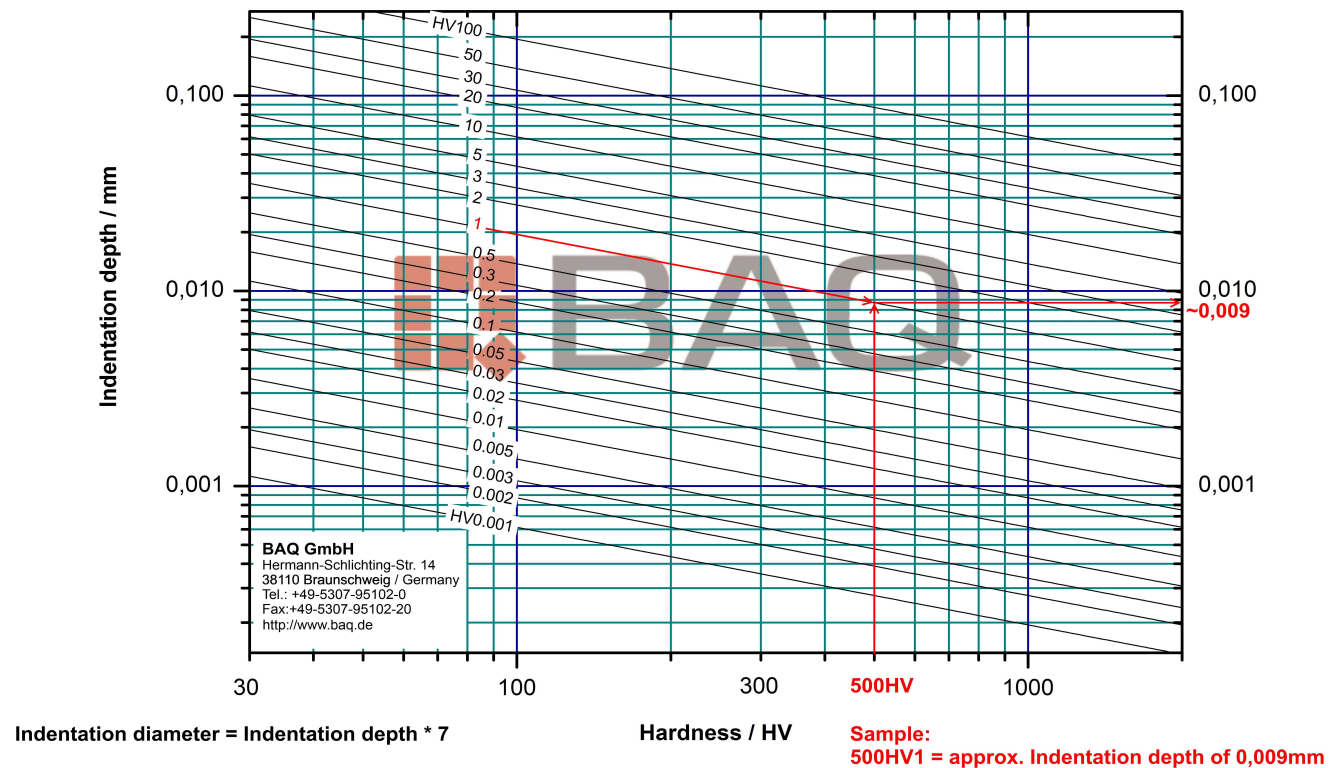
Connection surface roughness to abrasive grits for steels

Grain sizes according to FEPA-Standard (**F**ederation of the **E**uropean **P**roducers of **A**brasives)

Grain size	P120	P180	P240
Ra (µm)	app. 1,2	app. 1,0	app. 0,6

Selection of the proper test load – Layer Thickness

Vickers: Indentation depth



Sample Geometry

	DIN 50159	ASTM A1038
Mass	Min. 300 g → otherwise coupling	
Wall thickness	5 mm	2 – 3 mm
Layer thickness	---	10x Indentation depth
Curvature radius	Max. 3 mm	---

Hardness Test Blocks

- ◆ DIN: Edge length of 50 mm; wall thickness of 15 mm
Steel with a e-modulus of 210 ± 10 GPa
- ◆ ASTM: Ø80 x 16 mm
Steel

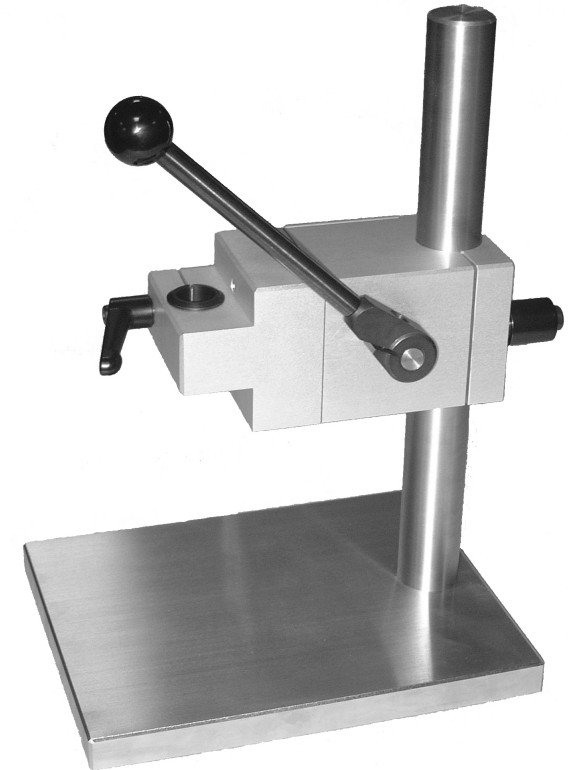


Handling of the Probe / Performing a measuring



- ◆ Touch down carefully (vertical, max. acceptable deviation 5°)
- ◆ Raise the test load gently; no transverse forces

Accessories to guide the UCI-Probe



Verification / Calibration of the Probe

- ◆ DIN: Daily, in the relevant hardness range, before using the device
- ◆ Every 12 months through the manufacturer in the complete range

Hardness scale	Acceptable Deviation in % (DIN)			
	< 250 HV	250 – 500 HV	500 – 800 HV	> 800 HV
HV 1	5	5	6	7
HV 5	5	5	5	5
HV 10	5	5	5	5

UCI in stationary application





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