

APPLICATION NOTE

DCM – Direct CHD measurement

Rockwell, Direct Depth CHD (Briro E)



Use of the DCM 1000 method:

- DCM 1000 is a depth difference measurement, comparable to the standard HRC Rockwell test.
- The general requirements of a Rockwell test apply.
- Fast direct CHD measurement on components in series production during the hardening process.
- Complementary measurement for direct monitoring of the hardening process
- Main area of application: Gear wheels, shafts and axles
- Components with complex geometries that cannot be measured can be tested by using dummy parts with similar dimensions.
- Minimum diameter of the components $\varnothing 25 \text{ mm}$, $< \varnothing 25 \text{ mm}$ must be prepared accordingly.

Description of DCM 1000 Measurement

The so-called DCM method (DCM = Direct CHD Measurement) is not standardized, but can be used for fast, non-destructive evaluation of the case hardening depth.

The process description, definition and its limits are based on the article by Dipl.-Ing. Otto Dettinger, which can be found in the book "Werkstatttechnik und Maschinenbau" 45. Volume, Magazine no. 3, Year 1955.

As the traditional method for determining the case hardening depth (CHD) with Vickers requires very complex sample preparation by separating, pouring in resin and then grinding / polishing the sample, the DCM method is considerably faster and therefore more economical. Sample preparation not only requires the appropriate machines (cutting / mounting / grinding / polishing machine), but also the time required to prepare the samples.

However, the DCM method does not replace the classic CHD method. This is a supplement to achieve fast results during series production.

Benefit

Instead of the previously time-consuming preparation of polished cut samples, this efficient method offers the possibility of one hundred percent batch testing. The case hardness can be determined and evaluated within one minute. The test method allows a quick and non-destructive statement as to whether workpieces have an inhomogeneous hardness distribution in the surface zone.

Use and application of the DCM method

The DCM process can be used for the CHD limit values of 525 HV, 550 HV and 600 (610) HV with a minimum hardening depth of 0.15 mm and a maximum of 1.50 mm.

Table	Limit hardness	Min. depth	Max. depth
HT 525 (GRE 2028)	525 HV	0.20 mm	1.50 mm
HT 550 (GRE 2267)	550 HV	0.20 mm	1.50 mm
HT 600 (GRE 2029)	600 HV	0.15 mm	1.30 mm

Each limiting hardness has an empirically determined table in the background, which is used to calculate the DCM (CHD) result.

DCM 1000 Measurement cycle

The workpiece or dummy is inserted into the machine or fixture and clamped accordingly with the clamping device.

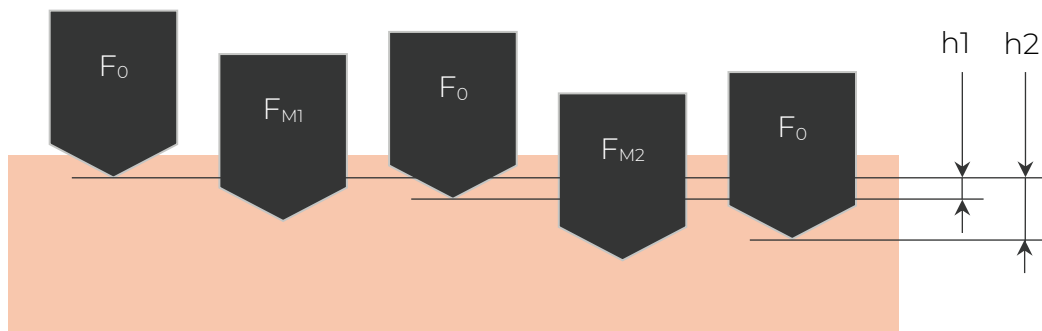
The DCM 1000 test cycle is performed with a Rockwell indenter (120° diamond tip). The measurement consists of two consecutive depth measurements HR 187.5 and HR 1000 within one indentation.

The test cycle is started by triggering the measurement in the software or by pressing the start button on the device.

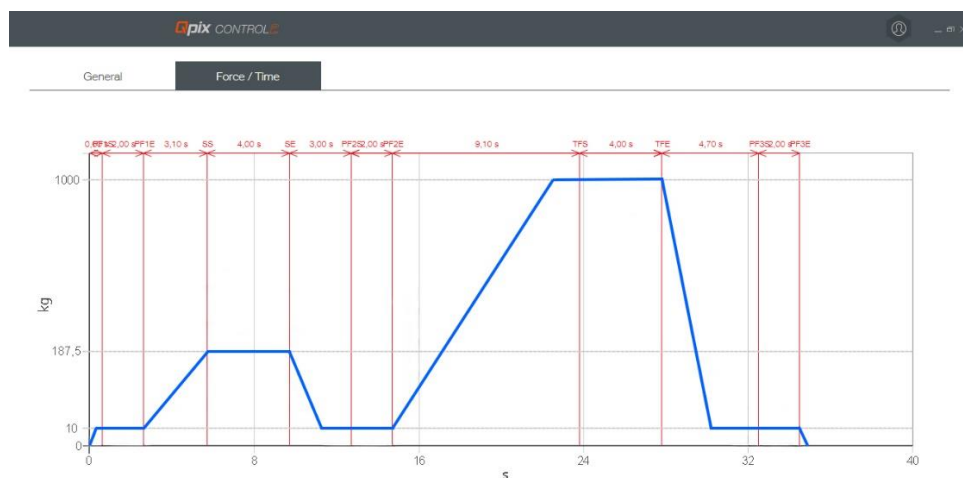
After applying the first pre load (F_0) with 10 kgf (98.07 N), the preload depth PL_1 is recorded and then the main test load (F_{M1}) 187.5 kgf (1838.6 N) is applied, after a defined duration of application the main additional load is removed and the pre load (F_0) depth PL_2 is recorded. The resulting depth difference corresponds to the result of the HR 187.5 measurement.

The main test load (F_{M2}) of 1000 kgf (9807 N) is then applied and reduced again accordingly to record the pre load (F_0) depth PL_3 . This depth difference measurement corresponds to the HR 1000 measurement.

The CHD depth is determined based on the selected CHD limit hardness and the two measured values using the tables.



$$HR\ 187.5 = 100 - \frac{h1}{0.002} \quad HR\ 1000 = 500 - \frac{h2}{0.002}$$



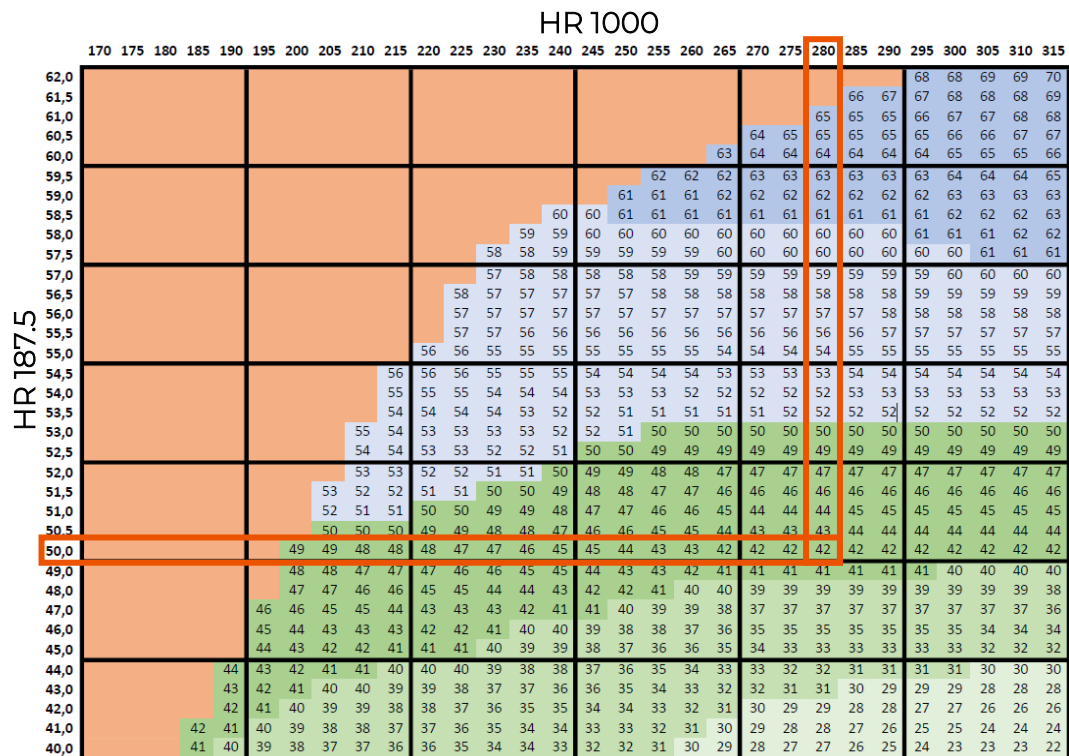
QpixControl2 Software for the evaluation of the case hardening depth.

Example at CHD limit hardness 550 HV

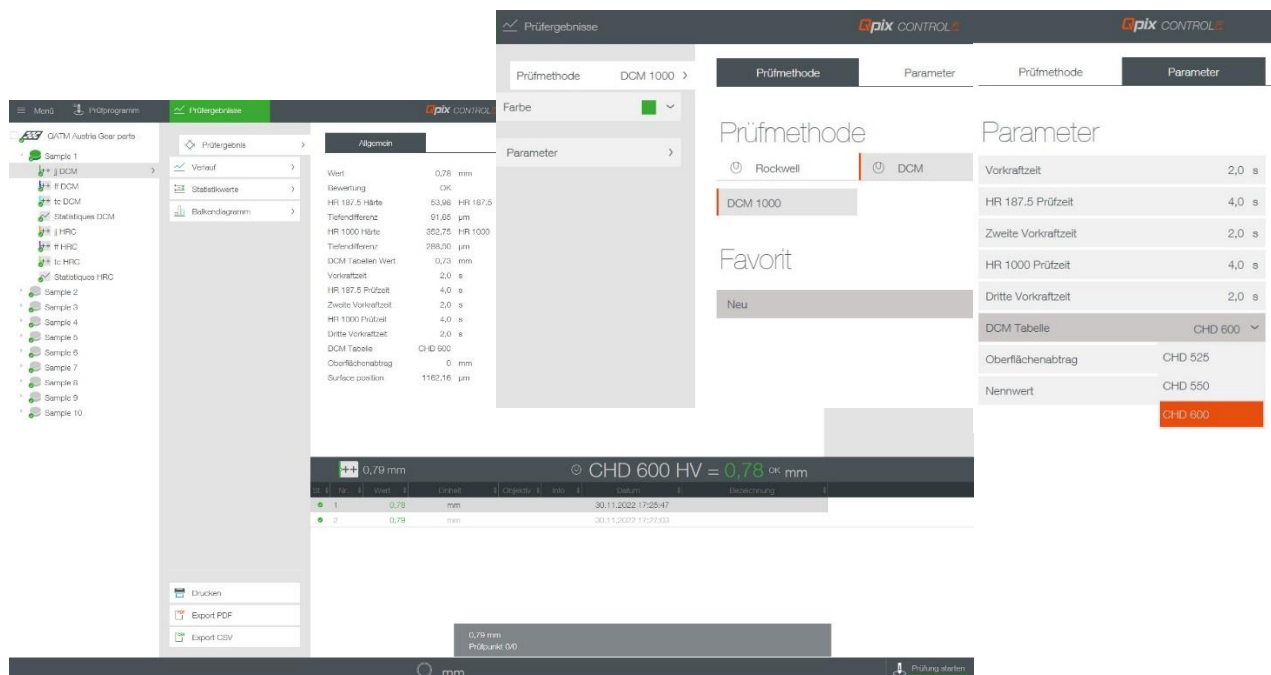
HR 187,5 = 50

HR 1000 = 280

CHD 550 = 0.42 mm



Software QpixControl2





Technical specifications

			
Machine	Qness 1000 DCM CS EVO	Qness 1000 DCM C EVO	Qness 1000 DCM E EVO
Supported test methods	DCM 1000 (Briro E) Rockwell HRA, HRC		
Test force range	10 - 1000 kg (98.07 - 9807 N)		
Height adjustment	manual / spindle		Motorized
Test height	175 mm	395 mm	510 mm
Throat depth	220 mm		320 mm
Test anvil	Ø 100 mm (Option: Ø 220 mm)		584 x 450 mm
Max. work piece weight	"unlimited"		
Test sequence	fully automatic / electronic force control		
Software	QpixControl2 "M", controlled via external PC-System		
Power supply	110 - 240 VAC ~1/N/PE		230 VAC ~1/N/PE Option 110 VAC
Max. power consumption	~ 480 W		~ 1230 W
Additional options	designer pedestal, collision protection, cross laser, test anvils, prisms, data connections, barcode/QR code reader etc.		