

Indirect tolerances for Rockwell testing machines.

ASTM E18-19 Table A1.3 Maximum Allowable Repeatability and Error of Testing Machines for Ranges of Standardised Test Blocks. EN ISO 6508-2:2015 Table 2 Permissible Repeatability Range and Bias of the Testing Machine.

Range of Standardised Test Blocks ^A	Maximum Repeatability, R (HR units)	Maximum Error, E (HR units)	Rockwell Hardness Scale	Hardness Range of the Reference Block	Permissible Bias (HR units)	Permissible Repeatability Range of the Testing Machine ^B
HRA	< 70	2.0	±1.0	A	±2 HRA	≤ 0.02 / (100 - or 0.8 Rockwell unit) ^b
	≥ 70 and < 80	1.5	±1.0			
	≥ 80	1.0	±0.5			
HRBW	< 60	2.0	±2.5	A	±1.5 HRA	≤ 0.02 / (100 - or 0.8 Rockwell unit) ^b
	≥ 60 and < 88	1.5	±2.5			
	≥ 88	1.5	±1.0			
HRC	< 35	2.0	±1.0	B	±4 HRBW	≤ 0.04 / (130 - Rockwell unit) ^b
	≥ 35 and < 60	1.5	±1.0			
	≥ 60	1.0	±0.5			
HRD	< 51	2.0	±1.0	B	±3 HRBW	≤ 0.04 / (130 - Rockwell unit) ^b
	≥ 51 and < 71	1.5	±1.0			
	≥ 71	1.0	±0.5			
HREW	< 84	1.5	±1.0	B	±2 HRBW	≤ 0.04 / (130 - Rockwell unit) ^b
	≥ 84 and < 93	1.5	±1.0			
	≥ 93	1.0	±1.0			
HRFW	< 80	1.5	±1.0	C	±1.5 HRC	≤ 0.02 / (100 - or 0.8 Rockwell unit) ^b
	≥ 80 and < 94	1.5	±1.0			
	≥ 94	1.0	±1.0			
HRGW	< 55	2.0	±1.0	D	±2 HRD	≤ 0.02 / (100 - or 0.8 Rockwell unit) ^b
	≥ 55 and < 80	2.0	±1.0			
	≥ 80	2.0	±1.0			
HRHW	< 96	2.0	±1.0	D	±1.5 HRD	≤ 0.02 / (100 - or 0.8 Rockwell unit) ^b
	≥ 96	2.0	±1.0			
		2.0	±1.0			
HRKW	< 65	1.5	±1.0	E	±2.5 HREW	≤ 0.04 / (130 - Rockwell unit) ^b
	≥ 65 and < 85	1.0	±1.0			
	≥ 85	1.0	±1.0			
HR15N	< 78	2.0	±1.0	E	±2 HREW	≤ 0.04 / (130 - Rockwell unit) ^b
	≥ 78 and < 90	1.5	±1.0			
	≥ 90	1.0	±0.7			
HR30N	< 55	2.0	±1.0	F	±3 HRFW	≤ 0.04 / (130 - Rockwell unit) ^b
	≥ 55 and < 77	1.5	±1.0			
	≥ 77	1.0	±0.7			
HR45N	< 37	2.0	±1.0	F	±2 HRFW	≤ 0.04 / (130 - Rockwell unit) ^b
	≥ 37 and < 66	1.5	±1.0			
	≥ 66	1.0	±0.7			
HR15TW	< 81	2.0	±1.5	G	±6 HRGW	≤ 0.04 / (130 - Rockwell unit) ^b
	≥ 81 and < 87	1.5	±1.0			
	≥ 87	1.5	±1.0			
HR30TW	< 57	2.0	±1.5	G	±4.5 HRGW	≤ 0.04 / (130 - Rockwell unit) ^b
	≥ 57 and < 70	1.5	±1.0			
	≥ 70	1.5	±1.0			
HR45TW	< 33	2.0	±1.5	G	±3 HRGW	≤ 0.04 / (130 - Rockwell unit) ^b
	≥ 33 and < 53	1.5	±1.0			
	≥ 53	1.5	±1.0			
HRLW ^B , HRMW ^B , HRPW ^B , HRRW ^B , HRSW ^B , HRVW ^B , HR15WW ^B , HR30WW ^B , HR45WW ^B , HR15XW ^B , HR30XWW ^B , HR45XWW ^B , HR15YW ^B , HR30YW ^B , HR45YW ^B	2.0	±1.0				

^A The user may find that high, medium and low range test blocks are unavailable commercially for some scales. In these cases, one or two standardised test blocks where available may be used. It is recommended that all high range test blocks for Rockwell scales using a ball indenter should be less than 100 HR units.
^B Appropriate ranges of standardised test blocks for the L, M, P, R, S, V, W, X and Y scales shall be determined by dividing the usable range of the scale into two ranges, if possible.

^a \bar{H} is the mean hardness value.
^b The one with a greater value becomes the permissible repeatability range of the testing machine.

**CALIBRATION CERTIFICATE
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Issued By: EURO PRODUCTS CALIBRATION LABORATORY
Date of Issue: 23 October 2019 **Certificate Number: 999999**

Customer: Euro Products Ltd

Description: HRC Rockwell Reference Hardness Block (ASTM E18-19) (BS EN ISO 6508-3:2015)

Mean Hardness Value: 60.0 HRC

Block Serial Number: EP19123456

SKU:

Date of Calibration: 23 October 2019

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Description: Rockwell Reference Hardness Block

Block Serial Number: EP19123456

Date of Calibration: 23 October 2019

Calibration Details: The above Reference Hardness Block has been examined in the EURO PRODUCTS calibration laboratory and was found to comply with the requirements of BS EN ISO 6508-3 2015 clause 3 and ASTM E18:2019 Annex A4. The above Reference Hardness Block value was calibrated on a standardising machine complying with the requirements of BS EN ISO 6508-3 2015 clause 4 and ASTM E18:2019 Annex A2, having hardness scales traceable to the UK National Scales as defined by NIST and PTB.

Reference Indenter Identification: E104 A,C,D,N, E116 1/16", E117 1/8", E118 1/4", E119 1/2"

Calibration made at: 23 ± 2°C

Humidity: < 70%

Reference Hardness Block Thickness: 15.00 mm

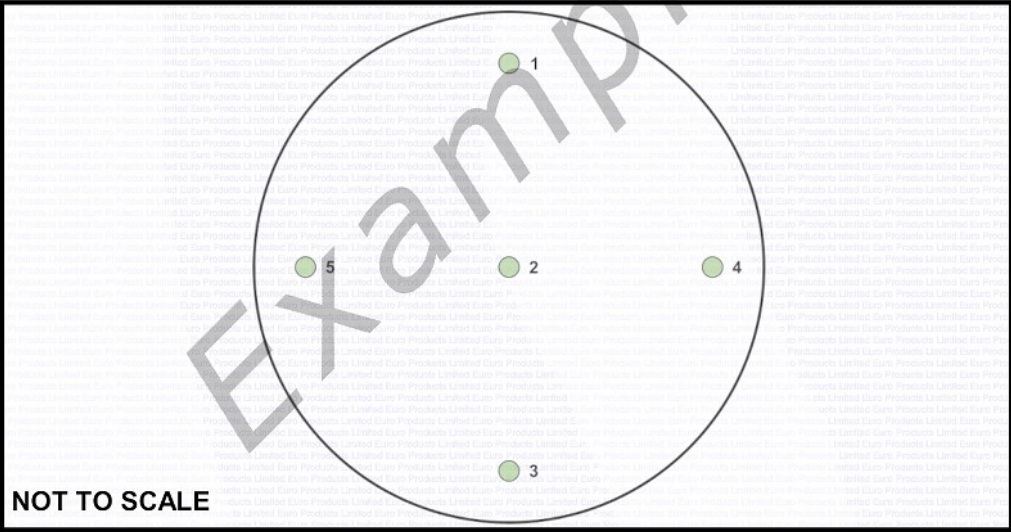
Approved Signatory:



Validity: This Hardness Reference Block is only valid for the scale for which it was calibrated. The calibration validity should be limited to a duration of 5 years. Attention is drawn to the fact that, for Al-alloys and Cu-alloy, the calibration validity could be reduced to 2 to 3 years.

Results: The above Reference Hardness Block was found to comply with the requirements of BS EN ISO 6508-3 2015 Table 5 and ASTM E18:2019 Table A4.2 and the hardness values obtained are given below:

Mean Hardness Value:	60.0 HRC
Maximum Hardness Value:	60.1 HRC
Minimum Hardness Value:	60.0 HRC
Indentation 1:	60.0 HRC
Indentation 2:	60.0 HRC
Indentation 3:	60.0 HRC
Indentation 4:	60.0 HRC
Indentation 5:	60.1 HRC
Uniformity of Hardness, R:	0.1 units
$R = H_n - H_f$	
Time Cycle: Preliminary Force:	2.0 secs
Total Force:	4.0 secs
Elastic Recovery:	4.4 secs



Uncertainty of Mean Measurement:	0.15 HRC
(Taken from ISO 6508-3:2015 B.2 direct method) Thickness:	± 0.005mm
	Time Cycle: ± 0.1 secs

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $K=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

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