

Leeb hardness testing method – General information

| Impact device | Min. Mass (no fixed contact area) | Min. Mass (fixed contact area) | Min. Thickness (without coupling) | Min. Thickness (with coupling) |
|-----------------|---|--------------------------------------|---|-----------------------------------|
| | kg | kg | mm | mm |
| D, DC, DL, D+15 | 5 | 2 | 25 | 3 |
| G | 15 | 5 | 70 | 10 |
| C | 1,5 | 0,5 | 10 | 1 |

REMARK 1 An inappropriate coupling affects incorrect test results.

| Impact device | Symbol | Application scale | similar to | Mass of the Indenter | Radius of the Indenter ball |
|---------------|--------|----------------------|------------|-------------------------|--------------------------------|
| | | HL | HV | g | mm |
| D | HLD | 300 to 890 | 81 to 955 | 5,45 | 1,5 |
| DC | HLDC | 300 to 890 | 81 to 955 | 5,45 | 1,5 |
| DL | HLDL | 560 to 950 | 81 to 939 | 7,25 | 1,39 |
| D+15 | HLD+15 | 330 to 890 | 81 to 928 | 7,75 | 1,5 |
| C | HLC | 350 to 960 | 80 to 994 | 3,1 | 1,5 |
| G | HLG | 300 to 750 | 95 to 550 | 20,0 | 2,5 |

The test is done vertical to the test surface.

The radius of curvature at the measuring point should be not lower than 50 mm for impact device G or 30 mm for the other impact devices.

In all other cases special support rings are needed to ensure a stabile position of the measuring device on the test surface.

| Impact device | app. Diameter | | |
|---------------|----------------------|----------------------|----------------------|
| | low hardness | medium hardness | high hardness |
| D | 0,54mm at ~570HLD | 0,45mm at ~760HLD | 0,35mm at 840HLD |
| DC | 0,54mm at ~570HLD | 0,45mm at ~760HLD | 0,35mm at 840HLD |
| DL | 0,54mm at ~760HLDL | 0,45mm at ~880HLDL | 0,35mm at ~925HLDL |
| D+15 | 0,54mm at ~585HLD+15 | 0,45mm at ~765HLD+15 | 0,35mm at ~845HLD+15 |
| C | 0,35mm at ~635HLC | 0,32mm at ~820HLC | 0,3mm at ~900HLC |
| G | 1,03mm at ~535HLG | 0,9mm at ~710HLG | -* |

* Out of the normal application scale

An impact is done on the best way, if the distance between the center of the indentation and the edge of the sample allows, that the complete support ring lies on the testing material. For impact device **type G** a minimum distance of **10 mm** is required and for the impact devices **type D, DL, D+15** and **C** not less than **5 mm**.

| Impact device | Max. medium roughness depth |
|-----------------|-----------------------------|
| | Ra in μm |
| D, DC, DL, D+15 | 2 |
| C | 0,4 |
| G | 7 |

[Source]: DIN EN ISO 16859-1:02-2016 Metallische Werkstoffe – Härteprüfung nach Leeb – Teil 1

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| Impact device | Leeb-Hardness of the Test block | coefficient of variation of testing instrument V % | max. allowed Error of testing instrument E _{rel} % |
|-----------------------------|--|--|---|
| | HL | | |
| D, DC, D+15 DL G C | <500 <700 <450 <600 | 2,5 | ± 4,0 |
| D, DC, D+15 DL G C | 500 to 700 700 to 850 450 to 600 600 to 750 | 2 | ± 3,0 |
| D, DC, D+15 DL G C | >700 >850 >600 >750 | 1,5 | ± 2,0 |

Coefficient of variation V

$$V = \frac{s(H)}{\bar{H}}$$

Here is s(H) the standard deviation of n=10 Leeb-Hardness values:

$$s(H) = \sqrt{\frac{\sum_{i=1}^n (H_i - \bar{H})^2}{n-1}}$$

The arithmetic average \bar{H} of n=10 measured Leeb-Hardness values will calculate with:

$$\bar{H} = \frac{H_1 + H_2 + \dots + H_n}{n} \quad (n=10)$$

Error of testing instrument

$$E = \bar{H} - H_{CRM}$$

Here is H_{CRM} the Leeb-Hardness of used Test block.

The max. allowed Error of testing instrument will calculate with:

$$E_{rel} = \frac{\bar{H} - H_{CRM}}{H_{CRM}} \cdot 100 \text{ in \%}$$

Requirements on mass and thickness of hardness test blocks

| Impact device | Min. Thickness mm | Min. Diameter mm | Min. Mass kg |
|--------------------|----------------------|---------------------|-----------------|
| D, DC, D+15, DL, C | 33 | 85 | 2,7 |
| G | 65 | 115 | 6,0 |

[Source]: DIN EN ISO 16859-1:02-2016 Metallische Werkstoffe – Härteprüfung nach Leeb – Teil 2 & Teil 3