# The Influence of Elevated Temperatures on Leeb Hardness Testing

## Reliable hardness testing of heat treated parts and hot test pieces

## Article Highlights (2 min read)

- Temperature has an evident impact on hardness testing measurements
- Reports shall typically include the temperature of the test object and the ambient temperature during the measurement
- **It is crucial to be cautious when conducting measurements on hot test pieces, due to the risk of potential equipment damage**

## Scope

Temperature has a direct influence on the mechanical properties of metallic materials. Equotip Leeb testers are used for a wide variety of applications where the influence of temperature is unavoidable.

Applications can include manufacturing environments where components are being tested as they come out of the heat treatment oven or on-site inspection in locations affected by desert heat.

When dealing with elevated temperatures it is very difficult to eliminate the effect. There have been very few case studies highlighting the influence of temperature on hardness testing to date.

**This case study is the first to evaluate the effect of temperature on the Leeb hardness principle.**

## Test setup and procedure

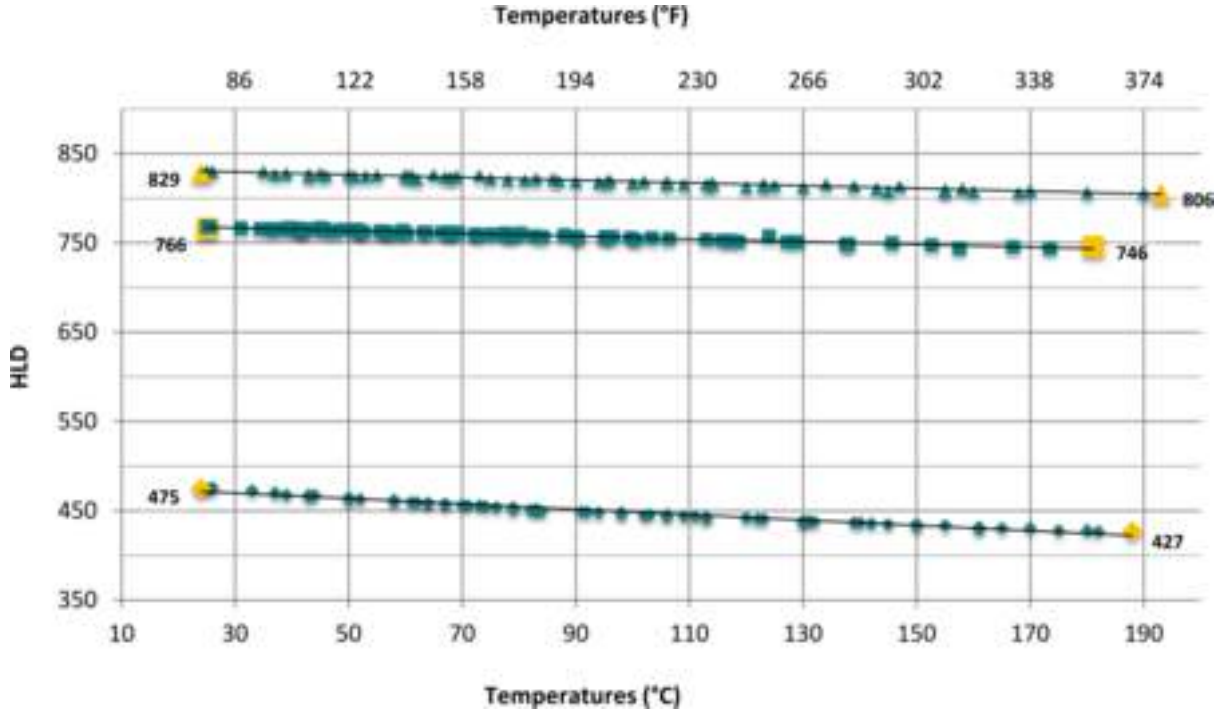
Selected Leeb test blocks at three different HLD hardness levels were physically heated up to 200°C (392°F), and the hardness was measured as the temperature gradually decreased.

The testing was carried out with impact device D on carbon steel test blocks. Note that other metals may show different results.

## Test results and conclusion

Data obtained for each hardness level reveal clear influence of temperature on hardness of the different carbon steel blocks. The results display a linear dependence of the Leeb (HLD) value on temperature, independent of the hardness level.

Notably, when the HLD values are converted to other commonly used hardness scales such as HV, the non-linear temperature-dependent conversion relationship does not yield the same linear dependence.




## What is the best practice?

It is a good practice to report in the test protocol the temperature of the test object and/or ambient temperature. Depending on the temperature of the test piece, there is a risk of equipment damage, when conducting measurements of objects at elevated temperatures. It is always recommended to check the equipment specification before conducting a measurement.

**Disclaimer: Please check equipment specification and recommended operation temperature range.**

## References:

Metallic materials — Leeb hardness test — Part 1: Test method, DIN EN ISO16859-1 Portable Hardness Testing. Theory practice, Applications, guidelines. Burnat, D., Raj, L., Frank, S., Ott, T. Schwerzenbach, Screening Eagle Technologies AG, 2022.

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