

# Standard Reference Material<sup>®</sup> 2216

## Miniaturized Low-Energy Charpy V-Notch KLST Specimens

(Self-Verification)

Lot No: LL-103

### CERTIFICATE

**Purpose:** This Standard Reference Material (SRM) is intended for the verification of maximum force and absorbed energy values measured at 21 °C using a small-scale Charpy machine in accordance with the current ASTM Standard E2248 [1] or the current ISO Standard 14556 [2]. SRM 2216 can be used to verify the absorbed energy scale of a small-scale impact machine at the low-energy level (approximately 1.6 J).

**Description:** A unit of SRM 2216 consists of a set of three KLST-type miniaturized Charpy specimens needed to perform one in-house verification (self-verification). SRM 2216 is made from 4340 alloy steel. Each specimen has a code identifying the energy level (LL) and an identification number (one, two or three digits).

**Certified Values:** Specimens from SRM 2216 were certified for both maximum force ( $F_m$ ) and absorbed energy ( $KV$ ) by means of an international interlaboratory comparison (round-robin) coordinated by the NIST Applied Chemicals and Materials Division [3]. The round-robin results were statistically evaluated in collaboration with the NIST Statistical Engineering Division to ensure consistency among laboratories and establish certified values. A NIST certified value, as used within the context of this certificate, is a value for which NIST has the highest confidence in its accuracy, in that all known or suspected sources of bias have been investigated or taken into account [4,5]. The measurands are absorbed energy, and maximum force as established from the interlaboratory comparison. Traceability is to the International System of Units (SI) units joule (J, absorbed energy) and kilonewton (kN, force). The certified values for SRM 2216 specimens are provided in Table 1.

Table 1. Certified Values and Expanded Uncertainty for SRM 2216<sup>(a)</sup>

| Test temperature: 21 °C ± 1 °C |                             |                       |                              |
|--------------------------------|-----------------------------|-----------------------|------------------------------|
| Absorbed Energy<br>(J)         | Expanded Uncertainty<br>(J) | Maximum Force<br>(kN) | Expanded Uncertainty<br>(kN) |
| 1.59                           | 0.12                        | 2.43                  | 0.15                         |

<sup>(a)</sup> The uncertainties in the certified values provided are expanded uncertainties. The expanded uncertainty is calculated as  $U = ku_c$ , where  $u_c$  represents the combined standard uncertainty consistent with the JCGM Guide [6]. The coverage factor,  $k = 2.306$ , is based on 8 degrees of freedom and corresponds to an approximate 95 % uncertainty interval.

**Period of Validity:** The certified values and uncertainties furnished in this Certificate are valid indefinitely. The certified value is nullified if the material is stored or used improperly, damaged, contaminated, or otherwise modified. The indirect verification result for the absorbed energy scale is valid for one year from the date on which this SRM was tested. If a user's machine is moved or undergoes any major repairs or adjustments, the current verification will be invalidated, and the machine must be reverified.

**Maintenance of Certified Values:** NIST will monitor this SRM over its validity period. If substantive technical changes occur that affect the certification, NIST will issue an amended certificate through the NIST SRM website (<https://www.nist.gov/srm>) and notify registered users. SRM users can register online from a link available on the NIST SRM website or fill out the user registration form that is supplied with the SRM. Registration will facilitate notification. Before making use of any of the values delivered by this material, users should verify they have the most recent version of this documentation, available through the NIST SRM website (<https://www.nist.gov/srm>).

**Storage:** SRM 2216 is anticipated to have an indefinite shelf life under normal storage conditions ( $20\text{ }^{\circ}\text{C} \pm 20\text{ }^{\circ}\text{C}$ ,  $\leq 50\%$  relative humidity).

**Use:** The protective oil coating should be wiped from each specimen with a lint-free cloth just prior to testing. Prior to verifying a small-scale Charpy machine, the machine should be checked to ensure compliance with the appropriate sections of the applicable ASTM or ISO Standard. SRM 2216 shall be tested at  $21\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$  ( $70\text{ }^{\circ}\text{F} \pm 2\text{ }^{\circ}\text{F}$ ) in accordance with the applicable standard (ASTM or ISO).

When using SRM 2216, the user performs a self-service verification of the test machine. The test results and specimens/specimen pictures are not returned to NIST following the test. NIST provides no letter or certification sticker for the machine verified.

The energy level of the SRM appropriate for verifying the performance of a particular Charpy impact machine can be determined by considering the energy for the SRM, the maximum capacity of the machine, and the requirements of the applicable test method (ASTM or ISO).

Currently, there are no requirements for the indirect verification of the force scale. However, it is recommended to verify the calibration of the instrumented striker of a small-scale Charpy machine every time the striker undergoes repairs or adjustment, or damage is suspected, and every time the impact machine is indirectly verified for absorbed energy.

For questions concerning the production or use of this SRM, please contact the NIST Charpy Program Coordinator: telephone (303) 497-3351; fax (303) 497-5939; or e-mail [charpy@nist.gov](mailto:charpy@nist.gov).

## REFERENCES

- [1] ASTM E2248; *Test Method for Impact Testing of Miniaturized Charpy V-Notch Specimens*; Annual Book of ASTM Standards, Vol. 03.01, ASTM, West Conshohocken, PA.
- [2] ISO 14556; *Steel – Charpy V-Notch Pendulum Impact Test – Instrumented test method*; ISO, Geneva, Switzerland.
- [3] Lucon, E.; McCowan, C.; Santoyo, R.; Splett, J.; *Certification Report for SRM 2216, 2219, 2219: KLST (Miniaturized) Charpy V-Notch Impact Systems*; NIST Special Publication 260-180 (2013); available at <https://www.nist.gov/srm/publications.cfm> (accessed June 2023).
- [4] Beauchamp, C.R.; Camara, J.E.; Carney, J.; Choquette, S.J.; Cole, K.D.; DeRose, P.C.; Duewer, D.L.; Epstein, M.S.; Kline, M.C.; Lippa, K.A.; Lucon, E.; Molloy, J.; Nelson, M.A.; Phinney, K.W.; Polakoski, M.; Possolo, A.; Sander, L.C.; Schiel, J.E.; Sharpless, K.E.; Toman, B.; Winchester, M.R.; Windover, D.; *Metrological Tools for the Reference Materials and Reference Instruments of the NIST Material Measurement Laboratory*; NIST Special Publication (NIST SP) 260 136, 2021 edition; U.S. Government Printing Office: Washington, DC (2021); available at <https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-136-2021.pdf> (accessed June 2023).
- [5] JCGM 200:2012; *International Vocabulary of Metrology – Basic and General Concepts and Associated Terms (VIM)*, 3rd ed.; JCGM (2012); available at <https://www.bipm.org/en/publications/guides> (accessed June 2023).
- [6] JCGM 100:2008; *Evaluation of Measurement Data — Guide to the Expression of Uncertainty in Measurement*; (GUM 1995 with Minor Corrections), Joint Committee for Guides in Metrology (JCGM) (2008); available at <https://www.bipm.org/en/publications/guides> (accessed June 2023); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297; U.S. Government Printing Office: Washington, DC (1994); available at <https://www.nist.gov/pml/nist-technical-note-1297> (accessed June 2023).

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| <b>Certificate Revision History:</b> 14 June 2023 (Updated format; editorial changes); 19 January 2018 (Title update; editorial changes); 19 March 2014 (Original certificate issue date). |
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*Certain commercial equipment, instruments, or materials may be identified in this Certificate to adequately specify the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.*

*Users of this SRM should ensure that the Certificate in their possession is current. This can be accomplished by contacting the Office of Reference Materials 100 Bureau Drive, Stop 2300, Gaithersburg, MD 20899-2300; telephone (301) 975-2200; e-mail [srminfo@nist.gov](mailto:srminfo@nist.gov); or the Internet at <https://www.nist.gov/srm>.*

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