



# National Institute of Standards & Technology

## Certificate

### Standard Reference Material® 2216

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

(Self-Verification)

Lot No. LL-103

This Standard Reference Material (SRM) is intended for the verification of maximum force and absorbed energy values measured at room temperature using a small-scale Charpy machine in accordance with the current ASTM Standard E2248 [1] or the current ISO Standard 14556 [2]. A unit of SRM 2216 consists of a set of three KLST-type miniaturized Charpy specimens needed to perform a single verification. 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).

**Material Description:** 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).

**SRM Certification Procedure:** Specimens taken 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 assure consistency among laboratories and establish certified values. A NIST certified value 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]. The measurands are absorbed energy as measured by the NIST Charpy reference machines, and maximum force as established from the interlaboratory comparison. Traceability is to the SI units joule (absorbed energy) and kilonewton (force). The certified values for the SRM 2216 specimens are given in Table 1.

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

Room temperature (21 °C ± 1 °C)			
Absorbed Energy (J)	Expanded Uncertainty (J)	Maximum Force (kN)	Expanded Uncertainty (kN)
1.59	0.12	2.43	0.15

<sup>(a)</sup>The uncertainties in the certified values are expressed as expanded uncertainties,  $U = k u_c$ , where  $u_c$  is the standard uncertainty. The coverage factor,  $k = 2.306$ , is determined from Student's t-distribution corresponding to 8 degrees of freedom and a 95 % confidence level [5,6].

**Expiration of Certification:** The certified values and uncertainties furnished in this certificate are valid indefinitely. The indirect verification result for the absorbed energy scale is valid for one year from the date on which the 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 retested and verified (see "Instructions for Handling, Storage, and Use"). 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 the 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.

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Certificate Issue Date: 19 January 2018  
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Steven J. Choquette, Director  
Office of Reference Materials

**Maintenance of SRM Certification:** NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet or register online) will facilitate notification.

Overall direction and coordination of the technical measurements leading to verification of test specimens and machines are under the direction of the NIST Applied Chemicals and Materials Division, Boulder, CO.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Office of Reference Materials.

## INSTRUCTIONS FOR HANDLING, STORAGE, AND USE

**Handling:** The protective oil coating should be wiped from each specimen with a lint-free cloth just prior to testing.

**Storage:** The SRM 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:** Prior to verifying a small-scale Charpy V-Notch machine, the machine should be checked to ensure compliance with the appropriate sections of the applicable ASTM or ISO standard. SRM 2216 is tested at room temperature ( $21\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ ).

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

The energy level of the SRM appropriate for verifying the performance of a particular small-scale Charpy 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).

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@boulder.nist.gov](mailto:charpy@boulder.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 <http://www.nist.gov/srm/publications.cfm> (accessed Jan 2018).
- [4] May, W.; Parris, R.; Beck II, C.; Fassett, J.; Greenberg, R.; Guenther, F.; Kramer, G.; Wise, S.; Gills, T.; Colbert, J.; Gettings, R.; MacDonald, B.; *Definition of Terms and Modes Used at NIST for Value-Assignment of Reference Materials for Chemical Measurements*; NIST Special Publication 260-136; U.S. Government Printing Office: Washington, DC (2000); available at <http://www.nist.gov/srm/upload/SP260-136.PDF> (accessed Jan 2018).
- [5] 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 [http://www.bipm.org/utls/common/documents/jcgm/JCGM\\_100\\_2008\\_E.pdf](http://www.bipm.org/utls/common/documents/jcgm/JCGM_100_2008_E.pdf) (accessed Jan 2018); 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/sites/default/files/documents/2017/05/09/tn1297s.pdf> (accessed Jan 2018).
- [6] JCGM 101:2008; *Evaluation of Measurement Data – Supplement 1 to the “Guide to the Expression of Uncertainty in Measurement” - Propagation of Distributions Using a Monte Carlo Method*; JCGM (2008); available at [http://www.bipm.org/utls/common/documents/jcgm/JCGM\\_101\\_2008\\_E.pdf](http://www.bipm.org/utls/common/documents/jcgm/JCGM_101_2008_E.pdf) (accessed Jan 2018).

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*Users of this SRM should ensure that the Certificate in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail [srminfo@nist.gov](mailto:srminfo@nist.gov); or via the Internet at <http://www.nist.gov/srm>.*