



# National Institute of Standards & Technology

## Certificate

### Standard Reference Material<sup>®</sup> 2093

#### Low-Energy Charpy V-Notch Impact Specimen

##### Self-Verification (ASTM E23)

Lot No.: LL-140

This Standard Reference Material (SRM) is intended primarily for the verification of Charpy V-Notch impact machines in accordance with the current ASTM Standard E23 [1] or International Organization for Standardization ISO 148-1 [2]. A unit of SRM 2093 consists of a set of five specimens needed to perform one verification test. SRM 2093 is used for in-house verification (self-verification). This SRM complies with both ASTM Standard E23 and ISO 148-1.

**Material Description:** SRM 2093 is made from 4340 alloy steel. The bars are finished to length, stamped, heat-treated, and machined in SRM specimen lots of approximately 1200. Each specimen has a lot number and an identification number (three or four digits) stamped on one end.

**SRM Certification Procedure:** Specimens taken from each SRM lot were tested by the NIST Applied Chemicals and Materials Division on Charpy V-Notch reference machines. These data were statistically evaluated to assess the homogeneity of the lot and establish the certified value. 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 [3]. The measurand is absorbed energy as measured by the NIST reference Charpy impact machines. Traceability is to the SI unit joule. The certified value for energy absorbed by SRM 2093 is provided in Table 1.

Table 1. Certified Absorbed Energy and Expanded Uncertainty for SRM 2093<sup>(a)</sup>

SRM	Lot	-40 °C ± 1 °C	
		Absorbed Energy, J	Expanded Uncertainty, J
2093	LL-140	16.0	0.127

<sup>(a)</sup> The uncertainty in the certified value provided is an expanded uncertainty about the mean to cover the measurand. The expanded uncertainty is calculated as  $U = k u_c$ , where  $u_c$  represents the combined uncertainty consistent with the ISO/JCGM Guide [4]. The coverage factor,  $k = 1.9774$ , is based on 137 degrees of freedom and corresponds to an approximate 95 % confidence interval.

**Expiration of Certification:** The certified value and uncertainty furnished in the verification report are valid indefinitely. The verification statement in the report that is issued for an acceptable machine is valid for a maximum of 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").

**Maintenance of SRM Certification:** NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification, 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, evaluation of test results, and issuance of the report on machine conformance were under the direction of the NIST Applied Chemicals and Materials Division, Boulder, CO.

James R. Fekete, Chief  
Applied Chemicals and Materials Division

Gaithersburg, MD 20899  
Certificate Issue Date: 29 September 2015

Robert L. Watters, Jr., Director  
Office of Reference Materials

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 SRMs are 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 testing a Charpy V-Notch machine, the machine should be checked to ensure compliance with the appropriate sections of the applicable ASTM or ISO Standard. SRM 2093 is tested at  $-40\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$  ( $-40\text{ }^{\circ}\text{F} \pm 2\text{ }^{\circ}\text{F}$ ). The SRM can be used as a substitute for SRM 2092 to meet the indirect verification requirement of ASTM E23 and ISO 148-1 when no-post verification test analysis from NIST is required.

When using SRM 2093, 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 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).

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

## REFERENCES

- [1] ASTM E23, *Standard Test Methods for Notched Bar Impact Testing of Metallic Materials*, Annual Book of ASTM Standards, Vol. 03.01, ASTM, West Conshohocken, PA.
- [2] ISO 148-1:2009, *Metallic Materials – Charpy Pendulum Impact Test – Part 1: Test Method*, International Organization for Standardization (ISO), Vernier, Geneva, Switzerland.
- [3] 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 Sep 2015).
- [4] 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 Sep 2015); 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 <http://www.nist.gov/pml/pubs/index.cfm> (accessed Sep 2015).

*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>.*