

Translated English of Chinese Standard: GB/T229-2007

www.ChineseStandard.net

Sales@ChineseStandard.net

GB

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

ICS 77.040.10

H 22

GB/T 229-2007

Replacing GB/T 229-1994

Metallic Materials - Charpy Pendulum Impact Test Method

(ISO 148-1:2006 Metallic Materials - Charpy Pendulum Impact Test - Part 1:
Test method, MOD)

GB/T 229-2007 How to BUY & immediately GET a full-copy of this standard?

1. www.ChineseStandard.net;
2. Search --> Add to Cart --> Checkout (3-steps);
3. No action is required - Full-copy of this standard will be automatically & immediately delivered to your EMAIL address in 0~25 minutes.
4. Support: Sales@ChineseStandard.net. Wayne, Sales manager

Issued on: November 23, 2007

Implemented on: June 1, 2008

Issued by: General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ);

Standardization Administration (SAC) of the People's Republic of China.

Table of Contents

Foreword	3
1 Scope	5
2 Normative References.....	5
3 Terms and Definitions	5
4 Symbols.....	7
5 Principle.....	8
6 Sample	8
7 Test equipment	11
8 Test Procedures.....	11
9 Test report.....	13
Annex A.....	14
Annex B.....	16
Annex C	18
Annex D	21
Annex E.....	23

Foreword

This standard adopts ISO 148-1:2006 Metallic Materials - *Charpy Pendulum Impact Test - Part 1: Test Method*. In this standard, the contents of the international standard is revised in the following aspects:

- In Normative references, GB/T 2975 *Mechanical Test Sampling Location and Sample Preparation for Steel and Steel Products*, GB/T 8170 *Rules for Rounding-off of Numerical Values* and JJG 145 *Verification Regulation of Pendulum Impact Testing Machines* are added; and ISO 286-1 is canceled;
- In Section 6.2, U-nick sample with 2 mm depth is added, and the U-nick sample (7.5 mm and 5mm in width) is added in Table 2;
- The standard JJG 145 is added in Section 7.2;
- In Section 8.1, the content "the fly-back difference or no-load power consumption of pendulum compacting with no load shall be inspected before test. The span of the anvil base shall be inspected before the test. The span of the anvil base shall be guaranteed within 40+0.2mm" is added;
- In Article 8.2.2, the content "when gas medium is adopted to cool the sample, the distance from the sample to the inner surface of the cryogenic system, and between the samples shall be kept enough. The samples shall be kept under the specified temperature for at least 20 min" is added.
- The capability lower limit of testing machine is added in Section 8.4;
- In Section 8.5, the content "because the compact energy of the testing machine is too smaller to make the sample disconnect completely, the absorbed energy cannot be determined, and the words that the ×J testing machine is adopted in the test, and the sample disconnect completely is marked" is added;
- Test result - Section 8.8 is added;
- Figure B.3 in Annex B is canceled;
- Annex E is added.

This standard replaces GB/T 229-1994 "Metallic Materials - Charpy Notch Impact Test".

The significant revision and supplementation are made for the following contents in this revision:

Metallic Materials - Charpy Pendulum Impact Test Method

1 Scope

This Standard specifies the method to measure the absorbed energy of metallic material in Charpy impact test (V-nick and U-nick samples).

The standard does not refer to the instrumented compact test method. The instrumented compact test method is specified in GB/T 19748-2005 "Steel - Charpy V-notch Pendulum Impact Test - Instrumented Test Method".

2 Normative References

The following standards contain the provisions which, through reference in this text, constitute the provisions of this standard. For dated reference, subsequent revisions (excluding error amendment) or revised edition of these publications do not apply. However, parties who enter into agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards below. For undated references, the latest edition of the normative document is applicable to this Standard.

GB/T 3808 Verification of Pendulum-type Impact Testing Machines (GB/T 3808-2002, ISO 148-2:1998, MOD)

GB/T 2975 Mechanical Test Sampling Location and Sample Preparation for Steel and Steel Products (GB/T 2975-1998, eqv ISO 377:1997)

GB/T 8170 Rules for Rounding-off of Numerical Values

JJG 145 Verification Regulation of Pendulum Impact Testing Machines

3 Terms and Definitions

For the purposes of this Standard, the following terms and definitions apply.

3.1 Energy

3.1.1 Actual initial potential energy (potential energy)

K_p

It refers to the value that directly tested with testing machine.

3.1.2 Absorbed Energy

K

It refers to the energy value indicated by the pointer or other indicating devices.

Note: letters "V" and "U" express the geometric shapes of the nicks. The suffixed number like 2 or 8 expresses the radius of pendulum edge, like KV₂.

3.2 Sample

The following terms (see Figure 1) will be used according to the test position of the samples on the pedestal of testing machine:

3.2.1 Height

h

It refers to the distance from the nick surface to the opposite surface hereof.

3.2.2 Width

w

It refers to the length that is parallel with the axial line of the nick and perpendicular to the height direction.

3.2.3 Length

l

It refers to the maximum size perpendicular to the nick direction.

Note: the nick direction is the direction of the notch depth.

KV_2	J	Absorbed energy of V-nick sample under the compact of 2mm pendulum edge
KV_8	J	Absorbed energy of V-nick sample under the compact of 8mm pendulum edge
LE	mm	Lateral expansion
l	mm	Sample length
T_t	°C	Transition temperature
ω	mm	Sample width

5 Principle

The nicked test sample with specified geometric shape is placed between two pedestals of the testing machine, and the nick backs onto the compacting surface. Compact the sample with pendulum once, and measure the absorbed energy of the sample.

Because the impact values of majority of materials change with the temperature fluctuation, the test shall be carried out under the specified temperature. When the test is not taken out under the room temperature, the sample must be heated or cooled under the specified condition to keep the specified temperature.

6 Sample

6.1 General Requirements

As for the standard compact test sample, the length hereof is 55 mm, and the cross section is square cross section (10 mm× 10 mm). V-shaped or U-shaped nick is on the middle of the sample length, which is specified in Article 6.2.1 and Article 6.2.2.

If the test sample material is not enough to prepare a standard sample, the mini-size sample (7.5mm, 5mm or 2.5 mm in length) may be adopted (see Figure 2 and Table 2).

Note: as for the impact test of low energy, the application of gasket is very important because the pendulum absorbs the extra energy. As for the impact test of high energy, it is not very important. The gasket with proper thickness shall be placed on the pedestal to make the height of the sample compact center reach 5 mm (equivalent to the height of the compact center of 10 mm standard sample).

The surface roughness (R_a) of sample shall be higher than 5 μ m, except tip.

As for the test material that need be heat treated, it shall be heated before finish machining, unless the order change of two processes results in the difference of the property.

6.2 Geometric shape of the nick

temperature, if there is specified temperature. The test shall be carried out within the range of $23^{\circ}\text{C}\pm 5^{\circ}\text{C}$ at room temperature, if there is no specified temperature.

8.2.2 When liquid medium is used for cooling sample, the sample shall be laid on grille of a container. The grille shall be no less than 25mm higher than the container bottom and liquid shall soak and also be 25mm higher than the sample. In addition, the space between sample and container side wall shall be 10 mm at least. The liquid medium shall be uniformly and continuously stirred to keep temperature equalization. The instrument for measuring the medium temperature shall be laid in the middle of a sample group. Medium temperature shall be 1°C higher or lower than the specified temperature and kept for 5min at least. When gas medium is use for cooling sample, it is required to keep adequate distance from the sample to internal surface of cryogenic device and also between samples. Samples are required to maintain for 20 min at specified temperature.

Note: when the liquid medium approaches to boiling point, samples shall be taken out of liquid medium and then laid at the impact interval. Evaporation cooling of liquid medium will distinctly lower the temperature of sample.

8.2.3 As for high-temperature test not exceeding 200°C , samples shall be laid in the liquid bath which is $\pm 2^{\circ}\text{C}$ on the basis of specified temperature and kept for 10min at least. As for test carried out in the environment exceeding 200°C , samples shall be laid in the high temperature service which is $\pm 5^{\circ}\text{C}$ on the basis of specified temperature and kept for 20min at least.

8.3 Sample transfer

Provided that the test is not carried out at room temperature, the interval after transferring samples from high/low temperature device shall be no larger than 5s.

Design and application of the transfer device shall be able to keep the temperature of sample in allowable temperature range. The section of transfer device contacting with sample shall be heated or cooled together with the sample. Measures shall be adopted to guarantee that the sample's centering device will not create inaccurate energy fly-down indication resulting from the low energy and high strength sample rebounding to pendulum after breaking. It is obvious that the space between sample end and centering device or that between fixing parts shall be larger than 13mm. Otherwise, the end of sample may rebound to the pendulum in the breaking-down process.

Note 1: provided that the interval from taking out sample from high/low temperature device to impacting is 3s~5s, the method of overcooling or superheating sample may be adopted to compensate the temperature loss, and the degree of super-cooling or superheating shall comply with annex E. As for high temperature sample, the influence of superheating on the material properties shall be taken full consideration.

Note 2: Being similar to V-nick showed in annex A, automatic centering cramps are currently used to take sample out of the temperature-control medium to proper test position. Such kind of cramp is used to eliminate the potential space

caused by the interaction between broken sample and fixed centering device.

8.4 Capacity of testing machine

The absorbed energy K of sample shall not exceed 80% of the actual initial potential energy K_p . Otherwise, it is required to report the approximate value in the test report and give clear indication of exceeding 80% of testing machine's capacity. Lower limit of sample's absorbed energy K is suggested to be no less than 25 times of the minimum discernment of the testing machine.

Note: ideal impact test shall be carried out at constant impact velocity. In the pendulum impact test, impact velocity shall lower with the breaking progress. As for samples whose impact absorbed energy approaching to the striking power of pendulum, the pendulum velocity has lowered to the level being unable to acquire impact energy accurately during impact period.

8.5 Incomplete break of sample

In the situation of incomplete break after sample test, it is required to report the impact absorbed energy, or report after making an average with the complete break samples.

Owing to insufficient impact energy of testing machine, the sample can't break completely and the absorbed energy is uncertain. It is required to indicate that test was carried out with $\times J$ testing machine and samples didn't break up completely.

8.6 Blocked hammer of sample

If the test results are invalid because the sample block at the testing machine, the testing machine shall be completely inspected. Otherwise, the damage of testing machine may affect the accuracy of measurement.

8.7 Examination of fracture

If the inspection after breaking shows that sample marks are made at location with obvious deformation, the test results mayn't fully show performance of the material and also shall be indicated in the test report.

8.8 Test results

It is required to read the impact absorbed energy of each sample and read by estimation to 0.5 J or 0.5 scale units (take the smaller value). It is required to reserve two significant figures at least as the test results and round off according to GB/T 8170.

9 Test report

The test report shall include the following contents:

9.1 Necessary contents

- (a) Serial number of this Standard;
- (b) Related data about the samples (for example, types of steel, Furnace No. and others);
- (c) Nick types (notch depth);
- (d) Sample sizes different from the standard size
- (e) Test temperature;
- (f) Absorbing energies KV_2 , KV_8 , KU_2 , KU_8
- (g) Abnormal circumstance affecting the test

9.2 Optional content

- (a) Direction Selection of sample
- (b) Nominal capacity of the testing machine, J
- (c) Lateral expansion LE (see Annex B)
- (d) Nick shape and shearing area rate (see Annex C)
- (e) Absorbed energy- temperature curve (This is shown in D.1 of Annex D)
- (f) Transition temperature, standard of criterion (This is shown in D.2 of Annex D)
- (g) Number of non- completely broken samples

Annex B

(Informative)

Lateral expansion value

B.1 General Requirements

When the charpy test sample is used for measure the resistance of the material to resist the triaxial stress failure, the deformation generated by this position shall be considered. The deformation is compression deformation. Due to difficult measurement of deformation, even if the rupture is so afterwards, the expansion of the opposite side of the cross section shall be used as compression.

B.2 Measuring method

The measurement of the lateral expansion value shall consider the maximum expansion value of both sides of the sample sections, a half of sample may include maximum expansion size of both sides, likely to present to one side or on the sample section of other half. The measuring technique shall guarantee that the lateral expansion value is the sum of the maximum expansion value on both side of the two cross section. For this reason, when measuring the expansion capacity of the two-half sample section, it is necessary to take the natural size of the samples as standards, saw Figure B.1. The instruments, vernier calipers or image analysis instruments in Figure may be used to measure the expansion capacity of the two-half samples. First, check the burr appeared on the sides of the samples, if any the burr shall be wiped off with hairbrush or emery cloth. When roughing the burr, the ledges of the lateral sample section shall not be wearied away, and then set halves samples to even the original side, measuring the halves samples using respectively the original sides as the foundation(X and Y in figure B.1), and the maximum value of the both sides shall adopt the overhung. For example. When $A_1 > A_2$, $A_3 = A_4$, $LE = A_1 + (A_3 \text{ or } A_4)$. If $A_1 > A_2$, $A_3 > A_4$, then $LE = A_1 + A_2$

If one or more of ledges appeared on the sides of the samples and the anvil base of the testing machines has been damaged in measurement or installation, then the measurement shall not be made and the lateral expansion value of various samples shall be marked in the reports.

Annex C

(Informative)

Nick Shape

C.1 General

The nick surface of Charpy compact sample is commonly assessed by the Shearing Section Rate. The higher the Shearing Section Rate is, the higher the toughness of material is. The nick shape of most Charpy compact test sample is combination of shearing and cleavage fracture. Because there is higher subjectivity in the assessment of U-nick, this proposal is not used for the technical specification.

Note: the shear fracture is commonly fiber nick, and the reverse assessment is commonly taken out for cleavage nick and crystalline nick. 0% shear nick is 100% cleavage nick.

C.2 Measuring Method

The following methods are generally used for measure the Shearing Section Rate:

- a) Measure the length and width of the cleavage fracture (namely, "glistening" part) part of the nick. The Shearing Section Rate is calculated according to figure C.1 and Table C.1;
- b) Compare the sample nick feature with standard nick indicated in Figure C.2;
- c) Magnify the nick, compare it with the prepared comparison diagram, or measure the Shearing Section Rate with planimeter (subtract the cleavage cross section rate from 100%);
- d) Shot the nick as a enlarged image, and measure the Shearing Section Rate with planimeter (subtract the cleavage cross section rate from 100%);
- e) Measure the Shearing Section Rate with image analysis technology.

- a) When the impact absorbed energy reaches a certain value, like KV8 = 27 J;
- b) When the impact absorbed energy reaches a percentage on the upper platform, like 50%;
- c) When the Shearing Section Rate reaches a percentage, like 50%;
- d) The lateral expansion reaches a certain value, like 0.9 mm.

The method to determine the transition temperature shall be specified in the related product standard, or through the agreement.

Annex E

(Informative)

Thermal compensation (broken within 3s~5s) of samples shifted out from high or cryogenic device

Table E.1 Super-cool thermal compensation

Test temperature /°C	Supercool thermal compensation/°C
-192~-100	3~<4
-100~-60	2~<3
-60~<0	1~<2

Table E.2 Superheat Thermal Compensation

Test temperature	Superheat thermal compensation/°C
35~<200	1~<5
200~<400	5~<10
400~<500	10~<15
500~<600	15~<20
600~<700	20~<25
700~<800	25~<30
800~<900	30~<40
900~<1 000	40~<50

_____ **END** _____

This is an excerpt of the PDF (Some pages are marked off intentionally)

Full-copy PDF can be purchased from 1 of 2 websites:

1. <https://www.ChineseStandard.us>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Select your country (currency), for example: USA (USD); Germany (Euro).
- Full-copy of PDF (text-editable, true-PDF) can be downloaded in 9 seconds.
- Tax invoice can be downloaded in 9 seconds.
- Receiving emails in 9 seconds (with download links).

2. <https://www.ChineseStandard.net>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Add to cart. Only accept USD (other currencies - <https://www.ChineseStandard.us>).
- Full-copy of PDF (text-editable, true-PDF) can be downloaded in 9 seconds.
- Receiving emails in 9 seconds (with PDFs attached, invoice and download links).

Translated by: Field Test Asia Pte. Ltd. (Incorporated & taxed in Singapore. Tax ID: 201302277C)

About Us (Goodwill, Policies, Fair Trading...): <https://www.chinesestandard.net/AboutUs.aspx>

Contact: Wayne Zheng, Sales@ChineseStandard.net

Linkin: <https://www.linkedin.com/in/waynezhengwenrui/>

----- The End -----