INTERNATIONAL STANDARD

ISO 17657-5

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Resistance welding — Welding current measurement for resistance welding —

Part 5: Verification of welding current measuring system

Soudage par résistance — Mesurage des courants en soudage par résistance —

Partie 5: Vérification des systèmes de mesurage du courant de soudage

Reference number
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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 17657-5 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 6, *Resistance welding*.

ISO 17657 consists of the following parts, under the general title *Resistance welding — Welding current measurement for resistance welding*:

— *Part 1: Guidelines for measurement*

— *Part 2: Welding current meter with current sensing coil*

— *Part 3: Current sensing coil*

— *Part 4: Calibration system*

— *Part 5: Verification of welding current measuring system*

Introduction

Requests for official interpretations of any aspect of this part of ISO 17657 should be directed to the Secretariat of ISO/TC 44/SC 6 via your national standards body. A complete listing of these bodies can be found at http://www.iso.org.

Resistance welding — Welding current measurement for resistance welding —

Part 5: Verification of welding current measuring system

1 Scope

This part of ISO 17657 specifies a verification procedure for welding current meters and monitoring devices with current sensing coil, which are applied in measuring welding current in resistance welding using alternating current of 50 Hz or 60 Hz, or with direct current.

This verification procedure is applicable for a current range between 0,5 kA and 25 kA.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 669, *Resistance welding — Resistance welding equipment — Mechanical and electrical requirements*

ISO 17657-2:2005, *Resistance welding — Welding current measurement for resistance welding — Part 2: Welding current meter with current sensing coil*

ISO 17657-4:2005, *Resistance welding — Welding current measurement for resistance welding — Part 4: Calibration system*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 669 and the following apply.

3.1
test (current sensing) coil
current sensor to be verified

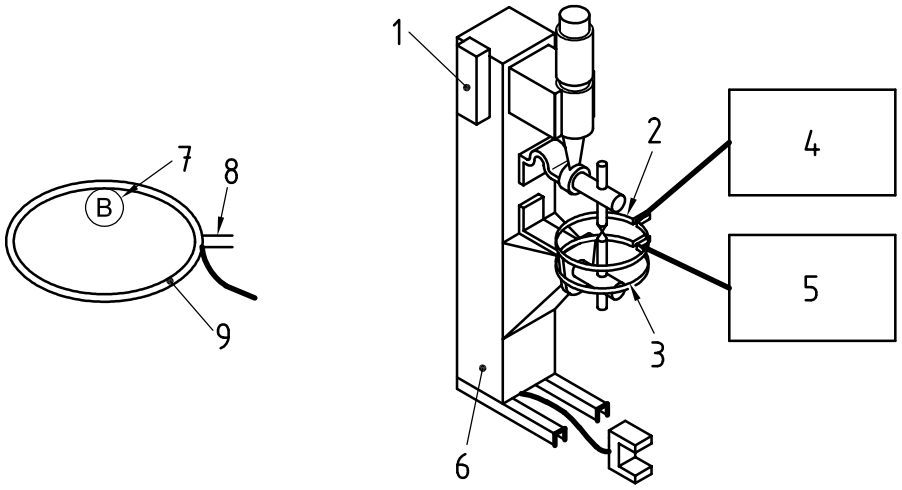
3.2
master (current sensing) coil
current sensor known as Rogowski-type coil, calibrated against a reference current sensor

3.3
test welding current meter
welding current meter to be verified

3.4
master welding current meter
welding current meter that has been calibrated against a reference welding current meter

4 Test set-up

Test set-up for verification consists of a resistance welding machine, a master welding current meter with its coil, and a test welding current measuring system or monitoring device with coil to be tested. A typical test set-up is shown in Figure 1. The sensing coil positioning should be in accordance with positions B, F and H in Figure 1 of ISO 17657-2:2005.



Key

1	welding controller	6	resistance welding machine
2	master coil	7	electrode position
3	test coil	8	fixing
4	master welding current meter	9	coil
5	test welding current meter	B	Recommended position of the master coil

Figure 1 — A typical set-up for verification of a welding current meter

5 Physical environment and operating conditions

Unless otherwise specified, the verification system shall be capable of operating under the following conditions without any adverse effect on its accuracy:

— at an ambient air temperature between +5 °C and +40 °C;

— in relative humidity up to 95 %;

— at altitudes up to 1 000 m above mean sea level;

— where gas, fine dust, oil mist, spatters, etc. are included in the air such as those caused by ordinary arc or spot welding work.

6 Verification requirements

6.1 Master welding current measuring system

The master welding current measuring system shall be calibrated by using a reference welding current measuring system at least once a year in accordance with the procedure stipulated in ISO 17657-4:2005, 8.2. The accuracy of the master welding current measuring system shall be higher than the accuracy of the measuring system to be tested.

The master welding current measuring system shall be classified as shown in Table 1, and shall be selected depending on the required measuring accuracy.

Table 1 — Classification of master welding current measuring system by accuracy

Classification	Measuring accuracy	Application
Highly accurate class	± 1,0 % of full scale	For checking of accurate class or ordinary class
Accurate class	± 2,0 % of full scale	For checking of ordinary class
Ordinary class	± 5,0 % of full scale	Not to be used for checking

The specification, name of certifying body and relevant date for the master welding current meter, and master current sensing coil shall be recorded on all documents, see in Annex A.

6.2 Master (current sensing) coil

The sensor position error of master current sensing coil should be within 0,5 %, or the sensor/coil position should be set at the same position in which it was calibrated. If the master coil requires a fixed position to guarantee the accuracy, the calibrated position shall be marked on the master coil.

NOTE The master coil should be set at the same position as the one at which it was calibrated. Position B as illustrated in Figure 1 is recommended as the setting position of master coil in order to keep the accuracy of master coil after multi-repeat setting and detaching.

6.3 Welding machine used for verification

Resistance spot, projection and seam welding machines as defined in ISO 669 can be used as the power sources, and should be capable of delivering a current within the range of the test welding current measuring system.

7 Test report

The following shall be recorded during verification of a welding current measuring system including monitoring devices for measuring welding current:

a) model and type of master welding current meter and current sensing coil, the full scale or the measuring range and the measuring accuracy;

b) sensor position of master coil to guarantee the measuring accuracy;

c) model and type of test welding current meter and the rated class;

d) measuring range of the test meter to be tested;

e) setting positions of meter and test coils (see Figure 1 of ISO 17657-2:2005);

f) type and frequency of power source used for the test (alternating current 50 Hz or 60 Hz, direct current);

g) time of current application;

h) room temperature;

also each measurement:

i) read-out of the master welding current meter expressed as an r.m.s. value, in kiloamps (kA);

j) read-out of the test welding current meter expressed as an r.m.s. value, in kiloamps (kA);

k) deviation from the reference value defined as the ratio between both read-outs and full scale reading of the test meter at the setting range;

l) the weld time displayed on the master current meter;

m) the weld time displayed on the test welding current meter;

and for information:

n) evaluation results of the measuring accuracy and read-out of weld time (approved or not approved);

o) test date, name and signature of the testing or examining person.

8 Test procedure

The measuring range of the master current meter shall be adapted to the required current level to improve the measuring accuracy. Measurements for each test sequence shall be recorded as shown in Annex B.

The master welding current measuring system shall have been calibrated and certified in a laboratory or by a test body before using.

The test coil shall be checked for any damage before verification. Any deviation of read-out displayed on the test welding current meter relative to the master meter shall be measured. The deviation should be expressed as a percentage, which shall be calculated as a ratio of full scale of the test current meter at the setting range.

The verification shall be carried out by using a resistance welding machine in short circuit condition. The test shall be carried out at a measurement of three current levels including near full scale and medium current level conditions of the test current meter. The time of current application for the test should be greater than 0,1 s.

If the maximum deviation of read-out values is larger than the required measuring accuracy, the test welding current meter and the coil shall be adjusted or repaired before further use.

Annex A
(informative)

Items to be recorded or filed as reference documentation for verification

A.1 Master welding current meter

Following items should be recorded and filed as the reference documents:

a) model;

b) type;

c) type of measuring current (alternating or direct);

d) maximum measuring current, in kiloamps or amps (kA or A);

e) maximum measuring time, in cycles or milliseconds (ms);

f) measuring accuracy, in percent (%);

g) setting requirements to guarantee the accuracy;

h) allowable temperature range, in degrees centigrade (°C);

i) manufacturer's name and name of certifying test body.

A.2 Master current sensing coil

Following items should be recorded and filed as the reference documents:

a) model;

b) type;

c) rated conversion coefficient, in millivolts per kiloamp (mV/kA), and the frequency, in hertz (Hz);

d) measuring accuracy, in percent (%);

e) frequency response, in kilohertz (kHz);

f) pre-connected output load of current sensor, in ohms (Ω);

g) required input impedance of integrator, kilohms (kΩ);

h) setting requirements to guarantee the accuracy;

i) allowable temperature range, in degrees centigrade (°C);

j) manufacturer's name and name of certifying test body.

Annex B
(informative)

Test report for verification of a welding current measuring system in accordance with this part of ISO 17657

Welding current measuring system to be tested			**Test set-up**		**Master current measuring system**	
Model:			Model or type:		Model:	
Type and class:					Type:	
Measuring current range:			**Power source**		Full scale of the range used:	kA
Range 1:	kA	kA	Type:		Measuring accuracy:	%
Range 2:	kA	kA	Frequency:	Hz	Sensor position when calibrated:	

Test conditions

Time of current application: cycles or ms

Setting position of coils: Test coil: Master coil:

Range 1

Test No.	**Read-out of master meter** kA	**Read-out of test meter** kA	**Deviation from reference** %	**Read-out of weld time on master meter** cycles or ms	**Read-out of weld time on test meter** cycles or ms
1					
2					
3					

Range 2

Test No.	**Read-out of master meter** kA	**Read-out of test meter** kA	**Deviation from reference** %	**Read-out of weld time on master meter** cycles or ms	**Read-out of weld time on test meter** cycles or ms
1					
2					
3					

Verified results (approved or not approved)

Range 1: Displayed current value: Displayed weld time:

Range 2: Displayed current value: Displayed weld time:

Checked by:	Date:	Signature:

NOTE The deviation described as a % shall be calculated using the following equation:

$$\text{Deviation from reference} = \frac{\text{Difference between the both readout (kA)}}{\text{Full scale of test welding current meter (kA)}} \times 100 \quad (\%)$$

ICS 25.160.10

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