DRAFT INTERNATIONAL STANDARD ISO/DIS 17657-4

ISO/TC **44**/SC **6** Secretariat: **DIN**

Voting begins on **2002-04-18** Voting terminates on **2002-09-18**

Resistance welding — Welding current measurement for resistance welding —

Part 4:
Calibration system

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

Partie 4: Système d'étalonnage

ICS 25.160.10

Contents

Page

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 3.

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 part of ISO 17657 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 17657-4 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: Guideline 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.*

Resistance welding — Welding current measurement for resistance welding —

Part 4:
Calibration system

1 Scope

This International Standard specifies calibration systems and calibration procedures for welding current measuring systems, current sensors, welding current meters, and monitoring devices with the current sensor which are applied for measurements of welding current in resistance welding with alternating current of 50 Hz or 60 Hz, or with dc.

The procedures are applicable for a current range between 0,5 kA and 25 kA.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 17657. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 17657 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

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

ISO/DIS 17657-3:2001, *Resistance welding — Welding current measurement for resistance welding — Part 3: Current sensing coil.*

3 Terms and definitions

For the purposes of this part of ISO 17657, the terms and definitions given in ISO 669 and the following apply:

3.1
test (current) sensor
a current sensor to be calibrated

3.2
reference (current) sensor
a current sensor calibrated in high accurate condition, which is used for calibration of current sensors

3.3
test welding current meter
a welding current meter to be calibrated

3.4
non-inductive shunt
a high precision and low value resistance with a very low inductive component

3.5
ADC (Analogue-to-digital converter)
a device to convert analogue input signals into digital signals

3.6
data acquisition device
an instrument or device used to acquire analogue data that tracks changes in physical variables such as voltage, current, and temperature, etc. in factories, process plants and laboratories

3.7
measuring accuracy of reference welding current measuring system
sum of measuring accuracy values of each component calibrated by a certified reference equipment (e.g. reference sensor, integrator, and ADC etc.)

4 Construction of calibration system

4.1 Reference welding current measuring system

Components of a reference welding current measuring system shall be calibrated by certified reference equipment according to clause 6. The reference welding current measuring system consists of a calibrated current sensor, a data acquisition system, and a display unit or a recorder.

4.2 Test set-up

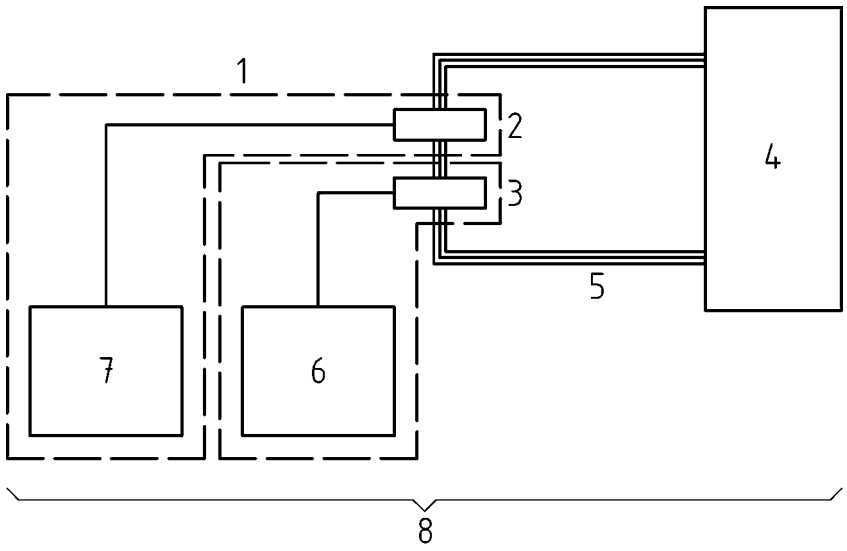
Test set-up consists of a test stage or an appropriate circuit for conducting high current, and a power source with a current control unit for supplying a test current.

All signal cables shall be twisted and shielded. The cable resistance shall be very small and negligible compared to the impedance of the current sensor. Typical examples of the test set-up are shown in annex A.

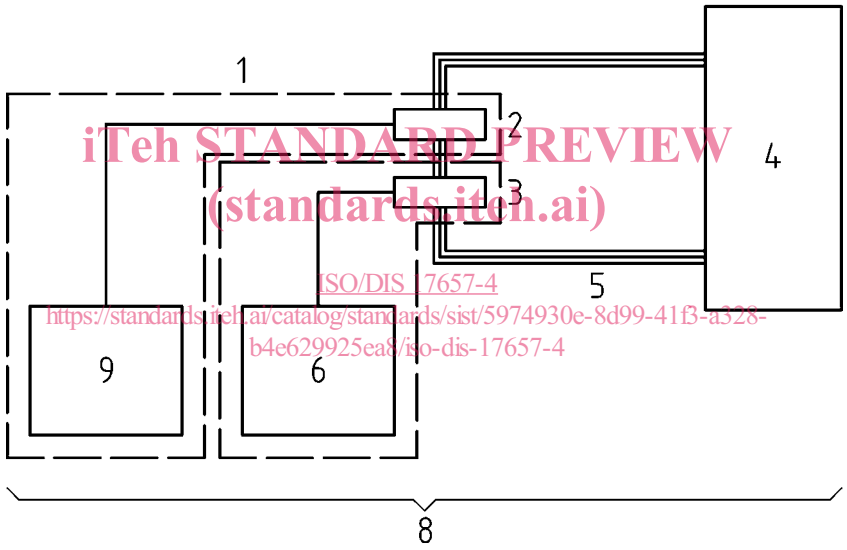
NOTE Resistance welding machine/transformer can be used as a test set-up.

4.3 Basic feature for calibration of welding current measuring system

A welding current meter with a current sensor should be calibrated in a set of the meter and the sensor. Calibration systems for a welding current meter with its sensor consist of a test set-up, a reference welding current measuring system, and a welding current measuring system to be tested. The function of reference welding current meter can be replaced with a calibrated data acquisition device. Figure 1 shows the basic features required for calibration of welding current measuring system.



a)



b)

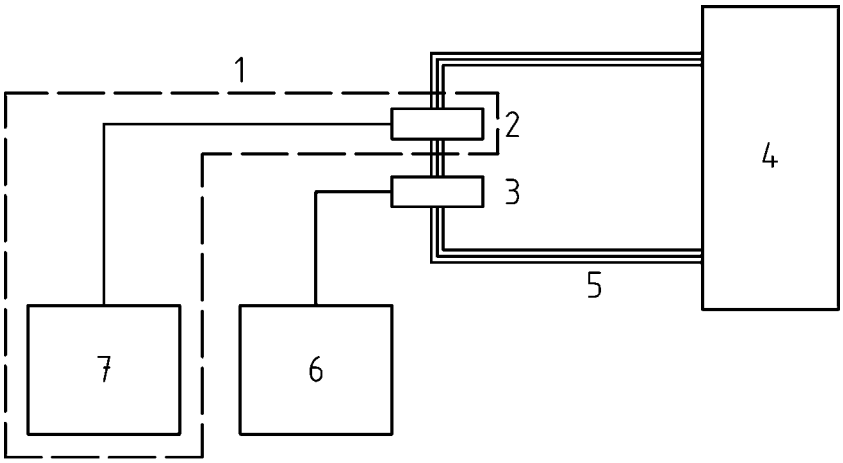
Key

1 Reference welding current measuring system
2 Reference sensor
3 Test sensor
4 ac/dc power source
5 Secondary circuit
6 Test welding current meter
7 Reference welding current meter
8 Test welding current measuring system
9 Data acquisition device

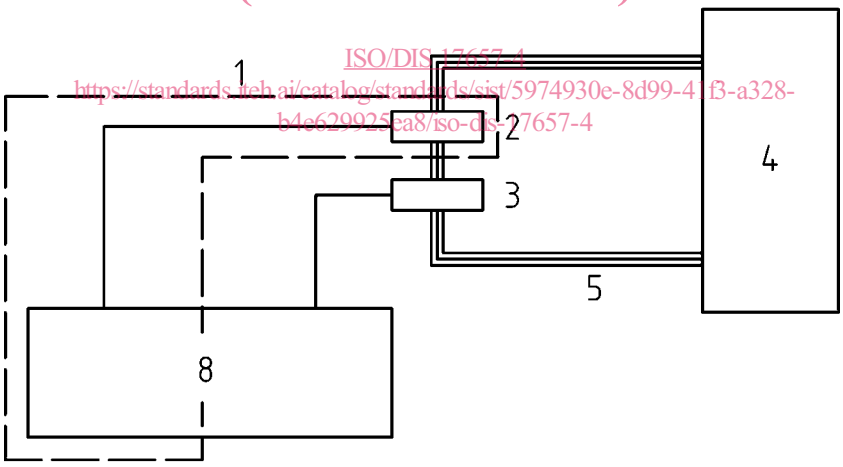
Figure 1 — Basic feature for calibration of welding current measuring system

4.4 Basic feature for calibration of current sensor

A calibration system for a current sensor consists of a test set-up, a reference welding current measuring system and a calibrated data acquisition device connected to a current sensor to be tested. The function of the reference welding current meter can be replaced by using another channel of the data acquisition device. Figure 2 shows the basic feature required for the calibration of current sensor.



a)



b)

Key

1	Reference welding current measuring system	5	Secondary circuit
2	Reference sensor	6	Data acquisition device
3	Test sensor	7	Reference welding current meter
4	ac power source	8	Data acquisition device

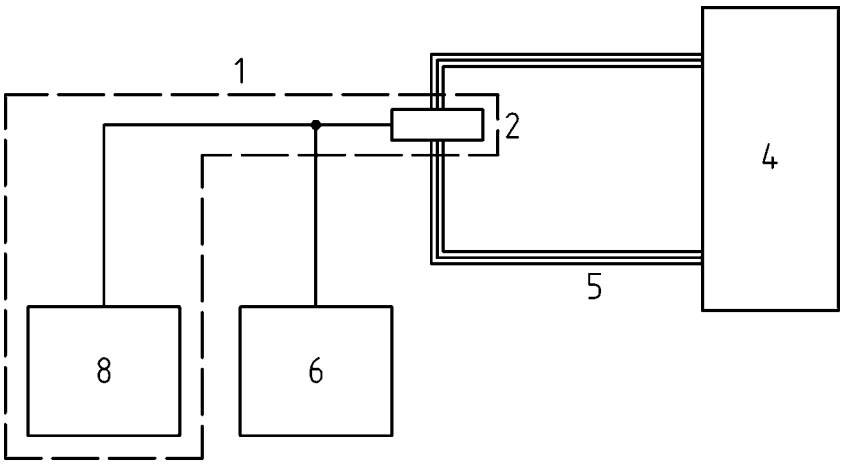
Figure 2 — Basic feature for the calibration of current sensor

4.5 Basic feature for calibration of welding current meter without sensor

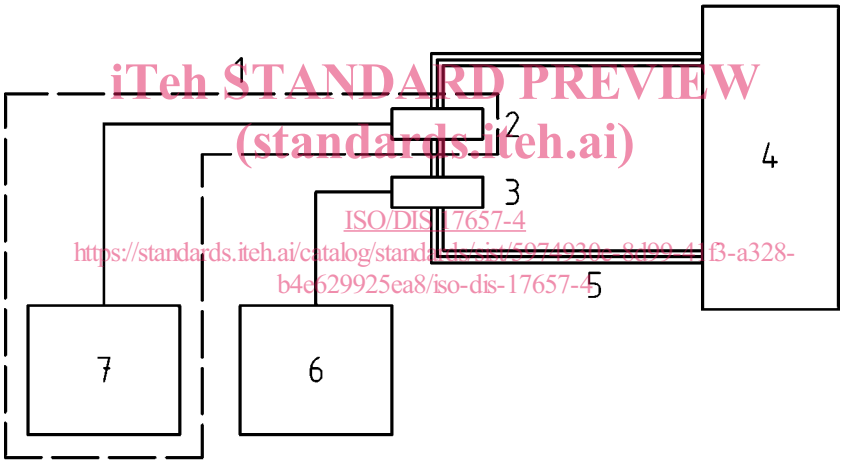
A calibration system for a welding current meter of high impedance integrator type without current sensor consists of a calibrated data acquisition device of high input impedance integrator type, a calibrated reference sensor, and the test welding current meter, see figure 3 a). A welding current meter to be tested is connected to the same output port of the reference current sensor. The data acquisition device shall not be replaced by a reference welding current meter of low impedance integrator type.

For calibration of a welding current meter with the low impedance integrator unit, and when two reference coils are used for the calibration, the calibration system shall consist of a calibrated reference welding current measuring system, a calibrated second reference sensor connected to a welding current meter to be tested, see figure 3 b).

Figure 3 shows the basic features required for calibration of welding current meter without sensor.



a)



b)

Key

1	Reference welding current measuring system	5	Secondary circuit
2	Reference sensor	6	Test welding current meter
3	Second reference sensor	7	Reference welding current meter
4	ac/dc power source	8	Data acquisition device

Figure 3 — Basic feature for calibration of welding current meter without sensor

5 Physical environment and operating conditions

Unless otherwise specified, the calibration systems shall be capable of operating under the following conditions without any adverse effect on its accuracy. Any deviation from those conditions shall be agreed between the test laboratory and the client.

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

— In relative humidity up to 95 %;

— At altitudes up to 1000m above mean sea level.

6 Calibration requirements

6.1 Reference welding current measuring system

Components of the reference welding current measuring system shall be calibrated by using a certified reference equipment at least every year. The total measuring accuracy defined as the sum of measuring accuracy of each component of the reference welding current measuring system, and shall be better than that stipulated for the high accurate class stipulated in ISO/DIS 17657-2.

The specification, name of certifying test body and relevant data for the reference welding current measuring system including the data acquisition device, and the reference current sensor shall be recorded on all documentation, see annex B.

6.2 Reference current sensor

Properties of reference current sensor shall be measured accurately with no external influences (e.g. strong magnetic field caused by the high current), and calibrated by using a certified reference equipment at a full wave ac of 50 Hz or 60 Hz, or dc.

In a case of using non-inductive shunt as the reference current sensor, the conversion coefficient shall be between 10 mV/kA and 150 mV/kA, and the error shall be less than ± 0,25 %. The phase shift between a measured welding current and the output voltage shall be less than 1° for a sinusoidal wave current of 10 kHz.

Measuring accuracy of the reference current sensor including positioning error shall be within ± 0,5 %, or the position should be fixed with pre-mounted current sensors on the current conductor to prevent any positioning error.

NOTE Current sensing coil used as a reference current sensor should be made with as low internal impedance as possible. Recommended specifications for a current sensing coil to be cased as a reference current sensor are shown below:

— toroidal coil with return winding so-called Rogowsky coil;

— $L < 250$ µH;

— $r_i < 50$ Ω;

— K: The measuring accuracy shall be within ± 0,25 %;

— R_L= 1 000 Ω (± 0,2 % and non-inductive type).

