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Validacija opreme za obločno varjenje

Validation of arc welding equipment

Validierung von Lichtbogenschweißeinrichtungen

Validation du matériel de soudage à l'arc

Ta slovenski standard je istoveten z: EN 50504:2008

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25.160.30	Varilna oprema	Welding equipment

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Validation of arc welding equipment

Validation du matériel de soudage à l'arc

Validierung von Lichtbogenschweißeinrichtungen

This European Standard was approved by CENELEC on 2008-06-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

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Foreword

This European Standard has been prepared by the Technical Committee CENELEC TC 26A, Electric arc welding equipment.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50504 on 2008-06-01.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2009-06-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2011-06-01

This European Standard has been developed under the authority of CLC/TC 26A, Electric arc welding equipment. Welding is considered to be a special process because the final result may not always be capable of being verified by testing, hence it requires continuous control and/or adherence to documented procedures.

This European Standard has been developed to identify the controls and procedures required. It requires the use of calibrated welding equipment, then the quality/consistency of the weld depends upon accurate and repeatable setting of parameters such as current, voltage, speed, gas flow, etc.

This European Standard concentrates on validating equipment built to the constructional standard EN 60974-1. The accuracy of this equipment is designated as standard grade. A higher level of accuracy (precision grade) is introduced in this document.

As a code of practice, this European Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

A standard does not purport to include all necessary provisions of a contract. Users of standards are responsible for their correct application.

Compliance with a standard does not of itself confer immunity from legal obligations.

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Introduction

The quality and consistency of a weld depends on the welder, the materials and the welding equipment. Variability in the output of the welding equipment will affect the quality of the weld. In some arc welding processes, e.g. MMA, the welder controls the process through his experience and measurement of run out length is used to monitor the heat input. However, in other arc welding processes the quality of the weld depends upon accurate and repeatable setting of parameters such as current, voltage, speed, gas flow, pulse characteristics, etc.

The relevant construction standard for arc welding equipment is EN 60974-1. This standard sets the reference level for the accuracy and consistency of the welding output. EN 60974-1 derives its specification for performance accuracy from the requirements of manual welding. In manual welding the welder plays a key role in adapting and adjusting the output of the equipment to meet the requirements of the weld. This adaptability allows equipment to be constructed with a relaxed specification for calibration of output.

Mechanised welding methods lack the skilled adaptability of the manual welder and require precise control of all aspects of the welding process. The control of the output of the welding equipment is of particular importance. Manufacturers have responded to this need by producing equipment with an accuracy of output control and calibration, which exceed the requirements of EN 60974-1.

In addition to the demands of mechanized welding, manual welding methods have become more refined and welding procedures often call for the precise control of power source outputs to limit the freedom of the manual welder in order to produce particular results.

The improvement in equipment construction, the adoption of mechanized welding, the introduction of quality assurance programmes and the increased understanding of the factors which control weld quality have led to the demand for more rigorous calibration and validation of welding equipment performance.

The term calibration has been used in the foregoing text to introduce the general subject of checking that the welding equipment output meets the manufacturer's specification and is fit for the purpose of making welds. This is a commonly accepted term for this checking operation but it does not meet the strict definition of the word calibration.

Clause 3 of this document gives the definition of calibration. The operation of calibration can be applied only to determining and adjusting the errors of a measuring instrument. An item of welding equipment is not a measuring instrument though the meters fitted to the welding equipment are and can be calibrated. The difficulty of terminology and the checking task is further compounded as many pieces of welding equipment do not have calibrated outputs but are scaled in arbitrary units. Again this is a function of the manual welding usage in which the skill of the manual welder is used to adjust and set the welding variables. It is necessary to use an alternative term to describe the operation of verifying that the welding equipment is fit for the intended purpose. The term selected is validation.

Validation is the operation which verifies that the welding equipment conforms to the operating specification for that equipment. If the equipment fails to conform to the specification then the correction of the errors within the equipment is outside the scope of this European Standard. That operation is the province of the manufacturers or equipment specialists.

It is implicit in the introduction of a more rigorous standard of accuracy of control of output for welding equipment that the scope of application of that standard should be defined. This European Standard defines two levels of accuracy. One is derived directly from EN 60974-1 and is called standard grade. A higher level of accuracy for more exacting welding applications is defined, called precision grade, and this is given in Annex A for information. The use of precision grade is dependent upon the welding application.

The welding equipment covered by this European Standard will be fitted with controls intended to regulate the output of the welding equipment. The controls may be scaled in absolute units (amperes, volts and metres per minute) or in arbitrary units (numbers, letters, geometrical marks). Controls scaled in absolute units may be validated and the consistency of those controls scaled in arbitrary units may be assessed.

The welding equipment may be fitted with meters that measure the output of the equipment and these meters should normally be validated against the appropriate standard, unless a different method is used to control the welding process.

The use of meters and measuring instrument packages with welding equipment that is required to produce welds of integrity and reliability is strongly recommended.

This code of practice recommends the use of resistive loads to validate the power source and associated meters. Alternatively, independent instrumentation may be used to monitor the welding process, rather than validating the power source itself. The method of control and type of instrumentation should be detailed on the welding procedure sheet.

1 Scope

This European Standard specifies validation methods for arc welding equipment constructed and used to the accuracy specified in EN 60974-1 or other equivalent standards. The accuracy of this equipment is designated as standard grade.

This European Standard is applicable to

a) arc welding power sources,

b) wire feeders,

c) welding instrumentation.

This European Standard is not applicable to arc striking and stabilizing device.

Calibration, verification and validation of equipment for other welding processes and ancillary equipment which may affect the quality of the weld, e.g. flow gauges, thermocouples, robots and manipulators are given in EN ISO 17662.

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.

EN 60051-1:1998, *Direct acting indicating analogue electrical measuring instruments and their accessories – Part 1: Definitions and general requirements common to all parts* (IEC 60051-1:1997)

EN 60974-1, *Arc welding equipment – Part 1: Welding power sources* (IEC 60974-1)

EN ISO 17662, *Welding – Calibration, verification and validation of equipment used for welding, including ancillary activities* (ISO 17662)

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 60974-1 and the following apply.

3.1
calibration
operations for the purpose of determining the magnitude of the errors of a measuring instrument and if necessary to determine other metrological properties

3.2
validation
operations for the purpose of demonstrating that an item of welding equipment or a welding system conforms to the operating specification for that welding equipment or system

3.3
accuracy
closeness of an observed quantity to the defined or true value

3.4
consistency test
test to determine the repeatability of the equipment output over a period of time

NOTE The results obtained from the present validation are compared to the results of the initial tests. The repeatability/consistency is the difference between these readings.

3.5
class
designation according to the accuracy of a measuring instrument conforming to EN 60051-1

NOTE For example class 2,5 refers to ± 2,5 % full scale deflection.

3.6
portable welding monitor (brief case monitor)
assembly of measuring instruments packaged in a portable case used to measure, record and/or analyse the welding equipment output

3.7
standard grade
grade of validating equipment built to the constructional standard EN 60974-1

3.8
precision grade
grade of validating equipment built to the constructional standard EN 60974-1 but with a higher level of accuracy for more exacting welding applications

NOTE See Annex A for power sources and Annex B for wire feeders.

4 Validation accuracies

When tested in accordance with Clause 9, the validation accuracies for standard grade power source controls and instrumentation should conform to Table 1.

Table 1 – Validation accuracies for standard grade power sources

Quantity	Accuracy	
Current and voltage	± 10 % ± 2,5 %	of the true value, between 100 % and 25 % of the maximum setting of the maximum setting, below 25 % of the maximum setting
Analogue meters	Class 2,5	See 3.5
Digital meters - Current - Voltage	 ± 2,5 % ± 2,5 %	 of maximum rated welding current of no-load voltage, or according to the manufacturer's specification

Validation may be carried out over a limited range, as agreed by the manufacturer and user or specified in the welding procedure.

5 Consistency

It is recognized that the consistency of the equipment is important and in Clause 9 tests for consistency are recommended.

A consistency test should be carried out on controls, which are not graduated in absolute units.

Absolute values are assigned to control positions during an initial characterization. The results obtained from subsequent tests are compared to initial values to determine the consistency of the output.

The same percentage values for accuracy, as specified in Table 1, should be used in the consistency test as for standard or precision grade as appropriate.

6 Frequency of validation and calibration

The welding equipment should be validated or calibrated at yearly intervals. Following an initial consistency test it is recommended that the equipment be retested after three months.

It may be necessary to validate or calibrate at more frequent intervals, depending upon the recommendation of the manufacturer, the requirements of the user, or where there is reason to believe that the performance of the equipment may have deteriorated. Validation should always be carried out after any repair or operation liable to affect the validation.

NOTE Recommendations for precision grade equipment are given in Annex A.

7 Validators of welding equipment

The welding equipment should be validated in accordance with Clause 9 by an expert, using equipment which has calibration traceable to national standards.

Validation does not require third party certification although an equipment repairer or validation agent often carries it out. Manufacturers of equipment may provide a validation service or the users may carry out the work themselves.

8 Validation

8.1 General

Unless specified otherwise, e.g. by the user, all power source meters and controls, which are graduated in absolute units and adjust the output, shall be validated.

The requirements and method of power source and meter validation will depend on the type of power source, i.e. whether it is a constant current (drooping characteristic) or constant voltage (flat characteristic) power source.

Welding power sources can be classified as follows:

a) a.c. power sources with constant current (drooping characteristic);

b) d.c. power sources with constant current (drooping characteristic);

c) d.c. power sources with constant voltage (flat characteristic).

CAUTION The output of a constant voltage power source should not be short-circuited as a very high current will flow; use a load resistor.

Welding power sources may have analogue or digital meters fitted. The general practice is to fit arithmetic mean instruments on direct current power sources and r.m.s. instruments on alternating current power sources.

Arithmetic mean analogue instruments measure the average or mean value of the instantaneous parameter with respect to time. r.m.s. analogue instruments give an indicated rather than a true r.m.s. reading, see 9.3.

Digital meters may give true or indicated r.m.s. readings. For some equipment a single digital meter may be used to measure a.c. and d.c. voltage and current. Expert knowledge may be required to validate such equipment and the manufacturer should be consulted.

The standard methods of measurement are as follows:

a) d.c. welding supplies shall be measured with averaging techniques;

b) a.c. supplies shall be measured with root mean square methods using true r.m.s. meters or using indicated r.m.s. meters (i.e. assuming pure sinusoidal form).

NOTE For power sources with non-sinusoidal waveforms e.g. square waves, averaging techniques may be used and the manufacturer should be consulted (see 9.3).

8.2 Manual metal arc welding with covered electrodes

Manual metal arc (MMA) power sources have a constant current characteristic with a.c. or d.c. output. The current control if marked in absolute units should be validated at conventional load voltages. An arbitrarily marked scale should be checked for consistency.

The MMA process is often controlled by measurement of run-out length where measurement of welding current is not necessary. However, if accurate measurement of the welding current is required it is preferable to use a calibrated ammeter (fitted to the power source or separate), or to use independent monitoring equipment.

MMA power sources do not have voltage controls but could be fitted with voltmeters, which can be calibrated.

8.3 Tungsten inert gas

Tungsten inert gas (TIG) power sources have a constant current characteristic with a.c. or d.c. output. The current control should be marked in absolute units and can be validated at conventional load voltages. Generally, TIG power sources are fitted with ammeters and possibly voltmeters, which can be calibrated. TIG power sources do not have voltage controls

TIG welding power sources are used in complex TIG welding systems and it may be required to validate the system with load conditions, which closely duplicate the arc load conditions. The resistance of the load is calculated for a specific welding condition using the welding current and the arc voltage at that current. The welding conditions could be taken from the welding procedure. Alternatively, a stable arc may be used with a mechanically held torch with or without arc voltage control.

CAUTION Care should be taken to ensure damage does not occur to instrumentation. See Annex D for recommended precautions.

A validation method for pulsed TIG power sources is recommended in Annex C.