



# SLOVENSKI STANDARD SIST EN ISO 14327:2004

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**Elektrooporovno varjenje - Postopki za ugotavljanje zvarljivosti za varjenje mest upora, izboklin in šivov (ISO 14327:2004)**

Resistance welding - Procedures for determining the weldability lobe for resistance spot, projection and seam welding (ISO 14327:2004)

Widerstandsschweißen - Verfahren für das Bestimmen des Schweißbereichsdiagramms für das Widerstandspunkt-, Buckel- und Rollennahtschweißen (ISO 14327:2004)

Soudage par résistance - Modes opératoires pour la détermination du domaine de soudabilité pour le soudage par résistance par points, par bossages et a la molette (ISO 14327:2004)

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**ICS:**

25.160.10 Varilni postopki in varjenje Welding processes

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EUROPEAN STANDARD  
 NORME EUROPÉENNE  
 EUROPÄISCHE NORM

**EN ISO 14327**

April 2004

ICS 25.160.10

English version

**Resistance welding - Procedures for determining the weldability  
 lobe for resistance spot, projection and seam welding (ISO  
 14327:2004)**

Soudage par résistance - Modes opératoires pour la  
 détermination du domaine de soudabilité pour le soudage  
 par résistance par points, par bossages et à la molette  
 (ISO 14327:2004)

Widerstandsschweißen - Verfahren für das Bestimmen des  
 Schweißbereichsdiagramms für das Widerstandspunkt-,  
 Buckel- und Rollennahtschweißen (ISO 14327:2004)

This European Standard was approved by CEN on 17 December 2003.

CEN 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 CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



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EN ISO 14327:2004 (E)

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## Foreword

This document (EN ISO 14327:2004) has been prepared by Technical Committee CEN/TC 121 "Welding", the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 44 "Welding and allied processes".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2004, and conflicting national standards shall be withdrawn at the latest by October 2004.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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**EN ISO 14327:2004 (E)****Introduction**

This European Standard enables the weldability lobe to be determined for resistance spot, projection and seam welding. This standard does not invalidate procedures for the determination of the weldability lobe or their approval documents in current use which complied with the national or International Standards or regulations existing at that time, provided the intent of the technical requirement is satisfied and the specified application, its performance and equipment with which it is performed remain unchanged.

When this standard is referenced for contractual purposes, all questions relating to the specification and implementation of welding procedures should be agreed between the contacting parties at the time of enquiry or at the contract stage.

It has been assumed in this standard that the execution of its provisions is entrusted to appropriately trained, skilled and experienced personnel.

For the quality of welded structures the relevant part of EN ISO 14554 should be applicable. The specification of procedures should follow guidelines as in EN ISO 15609-5.

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## 1 Scope

This European Standard specifies procedures for determining the weldability lobe for producing quality welds. The tests are used in particular to determine the weldability lobe for coated/uncoated steels, stainless steels and aluminium and its alloys but may also be used for other metallic materials.

The aim of this procedure is to allow determination of the range of welding parameters which give rise to an acceptable weld quality as defined within precise limits. The procedure can be used to determine:

- a) The influence of electrode material, electrode shape and dimensions on the available welding range for a particular material and welding machine.
- b) The influence of material type and thickness on the available welding range when using a particular combination of welding electrodes and welding machine.
- c) The influence of welding machine type, or electrode cooling on the available welding range for a particular material using a particular electrode shape.
- d) The available welding range in a production situation.

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN ISO 14329:2003, *Resistance welding — Destructive tests of welds — Failure types and geometric measurements for resistance spot, seam and projection welds (ISO 14329:2003)*.

EN ISO 15609-5:2004, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 5: Resistance welding (ISO 15609-5:2004)*.

ISO 669:2000, *Resistance welding — Resistance welding equipment — Mechanical and electrical requirements*.

ISO 693, *Dimensions of seam welding wheel blanks*.

ISO 5182, *Welding — Materials for resistance welding electrodes and ancillary equipment*.

EN 25184, *Straight resistance spot welding electrodes (ISO 5184:1979)*.

EN 25821, *Resistance spot welding electrode caps (ISO 5821:1979)*.

ISO 5830, *Resistance spot welding — Male electrode caps*.

EN 28167, *Projections for resistance welding (ISO 8167:1989)*.

ISO/DIS 14373, *Resistance welding — Procedure for spot welding of uncoated and coated low carbon steels*.

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### 3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in ISO 669:2000 and EN ISO 14329:2003, and the following apply.

NOTE Further definitions are given in ISO/DIS 17657-1 (see Bibliography)

#### weldability lobe

welding current domain allowing the production without splash of spot welds of a diameter equal or more than a pre-determined value under either constant welding time or constant electrode force

### 4 Weldability lobe limits

The weldability lobe will define the available welding conditions in terms of:

- a) Weld current and time at a constant electrode force. Or:
- b) Weld current and electrode force at a constant weld time.

In the case of resistance seam welding, welding speed (m/min) is used instead of weld time.

To meet these requirements, the weldability lobes can be a two dimensional plot as indicated in a) and b) above or a three dimensional plot indicating the inter relationship between weld time (welding speed in the case of seam welding), welding current and electrode force.

For the purpose of this standard, the lower and upper limits of the weldability lobe should be as follows:

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- 1) Lower limit – This equates to the welding conditions which result in a weld diameter equal to  $3,5 \sqrt{t}$  where  $t$  equal sheet thickness in mm. In the case of two dissimilar thicknesses, " $t$ " refers to the thinner sheet.

NOTE 1 A limit other than  $3,5 \sqrt{t}$  may be acceptable by agreement between contracting parties provided the strength of the weld or welded assembly satisfy the necessary design requirements.

NOTE 2 Guidelines for measuring weld diameter for both plug and interface failure are given in EN ISO 14329. The weld diameter should be measured from a broken specimen, e. g. peel test.

NOTE 3 In 3 or 4 thickness welding the minimum of the diameter specified will depend on the position of the thinner sheets from design process requirements.

- 2) Upper limit – This corresponds to the welding conditions which give rise to interfacial splash in the case of spot and projection welding. In seam welding the limit corresponds to surface splash or surface cracking in the weld or heat-affected zone areas.

NOTE 4 Alternative criteria may be specified, such as the minimum value of the shear force that the weld can withstand based on recommendations made in ISO or product standards in the case of coated/uncoated steels. Minimum surface indentation or the amount of weld nugget penetration can be specified by agreement.

In the case of resistance seam welding, other intermediate limits may be chosen based on alternative weld sizes or the onset of surface cracking. The use of such limits depend on the application being welded and should be by agreement between contracting parties.

Typical weldability lobes are shown in Figure 1.



## 5 Test equipment

### 5.1 Welding electrodes

#### 5.1.1 General

The welding electrodes shall conform to alloys specified in ISO 5182 unless otherwise agreed between contracting parties. Electrodes should be of sufficient cross-sectional area and strength to carry the welding current and electrode force without overheating, deformation or excessive deflection.

#### 5.1.2 Spot welding

In the case of spot welding, the electrode dimensions shall conform to the requirements of ISO 5184, ISO 5821 and ISO 5830 where applicable. Alternative electrode shapes and dimensions may be used by agreement between contracting parties. Pre-conditioned electrodes should be used for each individual weldability lobe determined. Electrodes shall be pre-conditioned as summarised below. Where appropriate, dimensions of the water cooling holes and pipes shall comply with the relevant requirements of the appropriate ISO standard.

**NOTE** It is recommended that the water flow should be a minimum of 4 l/min per electrode although, higher flow rates are recommended when welding coated steels. The water cooling feed tube should be arranged to impinge the water onto the back face of the electrode. The distance between the back and the working face of the electrode should not exceed the values given in the appropriate ISO standard. Separate water supplies should be used for top and bottom electrodes and should be independent of other cooling circuits. It is recommended that the inlet water temperature should not exceed 20 °C (293 K) and the outlet temperature should not exceed 30 °C (303 K) (except when water cooling temperature is the parameter being studied). Higher inlet/outlet water temperatures can be used by agreement between contracting parties.

Both top and bottom electrodes shall be properly aligned prior to commencement of the test. The electrode face of the top and bottom electrodes should be parallel to each other and have an electrode diameter that is within the specified tolerances of the diameter called for any given sheet thickness or that agreed between the contracting parties. Alignment of electrodes should be checked using carbon imprints.

When welding uncoated/coated steels and stainless steels, the welding electrodes should be pre-conditioned for 50 welds prior to determining the weldability lobe. Pre-conditioning should be carried out at a nominal weld time of approximately e. g. 8 cycles at 50 Hz on uncoated sheets in the same material and with the same thickness. For pre-conditioning a welding current equal to that which gives a stuck weld condition or a weld of diameter equal to  $3\sqrt{t}$  should be used. When welding aluminium and aluminium alloys, pre-conditioning of electrodes should not be carried out.

#### 5.1.3 Seam welding

In the case of wide wheel seam welding, the electrode face dimensions shall conform with the requirements of ISO 693 and follow similar criteria as used for spot welding, i.e. tread width equal  $5\sqrt{t}$ . However, for thin wheel seam welding, alternative electrode dimensions, i. e. electrode thickness and face dimensions, may be used by agreement between contracting parties. The welding wheels should be pre-conditioned by producing 10 rotations of weld wheel at a welding current which gives a stuck weld condition.

#### 5.1.4 Projection welding

Similar criteria may be used for the lobe limits when projection welding. In this case, projection dimensions shall conform to the requirements of ISO 8167.