INTERNATIONAL STANDARD

ISO 15614-12

Third edition

Specification and qualification of welding procedures for metallic materials — Welding procedure test —

Part 12: Spot, seam and projection welding

Descriptif et qualification d'un mode opératoire de soudage pour les matériaux métalliques — Épreuve de qualification d'un mode opératoire de soudage

Partie 12: Soudage par points, à la molette et par bossages

PROOF/ÉPREUVE

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: 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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 6, *Resistance welding and allied mechanical joining*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding and allied processes*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 15614-12:2014), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Clause 2 and the Bibliography have been updated;

— Clauses 7 and 8 have been updated;

— Table 1 has been modified;

— ISO 14732 has been added to the Bibliography and has replaced EN 1418.

A list of all parts in the ISO 13919 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

Introduction

It is intended that all new welding procedure qualifications be carried out in accordance with this document from the date of its issue.

However, this document does not invalidate previous welding procedure qualifications made to other standards or specifications, provided the intent of its technical requirements is satisfied and the previous welding procedure qualifications are relevant to the application and production work on which they are to be employed.

Also, where additional tests need to be carried out to make the qualification technically equivalent, it is necessary only to perform the additional tests on a test piece made in accordance with this document.

Details on the ISO 15614 series on welding are given in ISO 15607:2019, Annex A.

Specification and qualification of welding procedures for metallic materials — Welding procedure test —

Part 12: Spot, seam and projection welding

1 Scope

This document specifies the tests which can be used for qualification of welding procedure specifications for spot, seam, and projection welding processes.

NOTE The procedures are written for embossed projection welding. They can be adapted for solid projections as well, e.g. nut welding, stud welding. cross wire welding.

This document defines the conditions for carrying out tests and the limits of validity of a qualified welding procedure for all practical welding operations covered by this document.

This document covers the following resistance welding processes, as defined in ISO 4063:

— 21 – resistance spot welding;
  — 211 – indirect spot welding;
  — 212 – direct spot welding;
— 22 – resistance seam welding;
  — 221 – lap seam welding;
  — 222 – mash seam welding;
  — 223 – Prep-lap seam welding;
  — 224 – Wire seam welding;
  — 225 – foil butt-seam welding;
  — 226 – seam welding with strip;
— 23 – projection welding;
  — 231 – indirect projection welding;
  — 232 – direct projection welding.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 669:2016, *Resistance welding — Resistance welding equipment — Mechanical and electrical requirements*

ISO 15607:2019, *Specification and qualification of welding procedures for metallic materials — General rules*

ISO 15609-5:2011, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 5: Resistance welding*

ISO 17653:2012, *Resistance welding — Destructive tests on welds in metallic materials — Torsion test of resistance spot welds*

ISO 17677-1:2019, *Resistance welding — Vocabulary — Part 1: Spot, projection and seam welding*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 669, ISO 15607 and ISO 17677-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Preliminary welding procedure specification (pWPS)

The preliminary welding procedure specification shall be prepared in accordance with ISO 15609-5.

5 Welding procedure test

The preparation and testing of test pieces shall be in accordance with Clauses 6 and 7.

6 Test piece

6.1 General

The welded assembly to which the welding procedure will relate to in production shall be represented by actual components or by preparing a standardized test piece in accordance with 6.2.

Test specimens shall be cut from the actual components; the test piece is welded separately according to 6.3. Test specimens or test pieces from the same material(s) with relevant flange widths or overlap length should be used. When applicable, shunting and inductive effects shall be taken into account.

If required by the application standard, the direction of plate rolling shall be recorded and/or marked on the test piece.

6.2 Shape and dimensions of test pieces and test specimens for destructive testing

6.2.1 General

The shape and dimensions of the test pieces and test specimens and the test procedures are specified in ISO 14270, ISO 14271, ISO 14272, ISO 14273, ISO 17653, ISO 10447 and ISO 17654.

6.2.2 Macrosection

The test specimens shall be prepared and etched to produce transverse and/or longitudinal sections in order to clearly show the nugget, the heat affected zone (HAZ) and, if necessary, the weld profile.

The transverse macrosection shall include the unaffected parent material.

6.3 Welding of components, test pieces or test specimens

Preparation of components, test pieces or test specimens, and welding of test pieces or test specimens shall be carried out in accordance with the PWPS and under the general conditions of production welding (parameters, equipment, etc.), which they shall represent.

If tack welds are used in the case of seam welds, they should be included in the final test piece.

Welding and testing of the test pieces shall be witnessed by an examiner or examining body and the details of this shall be established before any qualification is undertaken.

7 Examination and testing

7.1 Extent of testing

The testing includes both non-destructive testing (NDT) and/or destructive testing.

The selection of test types and the number of test specimens depends on the performance and quality requirements of the component/assembly and shall be established before any qualification is undertaken. Examples are given in Table 1.

Table 1 — Examples for testing spot, seam, and projection welding joints

Test piece/specimen	Test type	Minimum number of samples[p]
One-spot or projection specimen	Visual test	all
	Shear test	3
	Cross-tension[a]	3
	Macrosection[b]	2
	Hardness test	if requested
	Torsion test[c]	3
	Peel test	3
	Chisel test	3

[a] Substitute test for the shear test with predominant cross-tension loading.

[b] Two macrosections displaced by 90° and arranged perpendicular to the plane of the plate; elongated projections shall be located in the major axes.

[c] Substitute test for the shear/cross-tension test, if specimen preparation conforming to standards is not possible, or in the case of predominant torsion loading.

[d] Only with push-pull welding and indirect welding.

[e] The two-spot weld specimen shall be cut into single-spot weld specimens for the shear test. Deviations of the specimen width from the standard specimen result from the spot weld pitch.

[f] Two-spot welds.

[g] The multi-spot weld specimen shall be welded and tested with the same spot weld pitch, edge distance and row spacing as on the component in production.

[h] In the case of spot weld rows, proceed in the same way as in two-spot weld testing.

[i] Substitute test for the peel test in case of predominant shear loading.

[j] Only if leak-tightness is required (pressure test).

[k] Only if high leak-tightness is required.

[l] One transverse section and one longitudinal section.

[m] At right angle to the weld, if applicable.

[n] Each side (top and bottom side).

[o] Only mash seam weld: each three specimens from the start, middle and end of seam weld.

[p] For statistical analysis, a higher number of samples, e.g. 11, shall be tested to compute average and standard deviation.

Table 1 *(continued)*

Test piece/specimen	Test type	Minimum number of samples[p]
Multi-spot test or projection specimen[g]	Visual test	all
	Shear test[h]	3
	Peel test	3
	Macrosection[b]	2
	Hardness test[f]	if requested
	Chisel test	3
Seam weld specimen forming an overlapped joint	Visual test	all
	Peel test	3
	Shear test[i]	3
	Pillow test[j]	3
	Helium leakage test[k]	3
	Macrosection[l]	2
	Hardness test	if requested
Seam weld specimen forming a butt-joint (foil butt-seam welding, mash seam welding)	Visual test	all
	Shear test[m]	3
	Bend test[n]	2
	Peel test[o]	3
	Pillow test[j]	3
	Helium leakage test[k]	3
	Macrosection[l]	2
	Hardness test	if requested
	Cupping test	3

[a] Substitute test for the shear test with predominant cross-tension loading.

[b] Two macrosections displaced by 90° and arranged perpendicular to the plane of the plate; elongated projections shall be located in the major axes.

[c] Substitute test for the shear/cross-tension test, if specimen preparation conforming to standards is not possible, or in the case of predominant torsion loading.

[d] Only with push-pull welding and indirect welding.

[e] The two-spot weld specimen shall be cut into single-spot weld specimens for the shear test. Deviations of the specimen width from the standard specimen result from the spot weld pitch.

[f] Two-spot welds.

[g] The multi-spot weld specimen shall be welded and tested with the same spot weld pitch, edge distance and row spacing as on the component in production.

[h] In the case of spot weld rows, proceed in the same way as in two-spot weld testing.

[i] Substitute test for the peel test in case of predominant shear loading.

[j] Only if leak-tightness is required (pressure test).

[k] Only if high leak-tightness is required.

[l] One transverse section and one longitudinal section.

[m] At right angle to the weld, if applicable.

[n] Each side (top and bottom side).

[o] Only mash seam weld: each three specimens from the start, middle and end of seam weld.

[p] For statistical analysis, a higher number of samples, e.g. 11, shall be tested to compute average and standard deviation.

