DRAFT INTERNATIONAL STANDARD

ISO/DIS 15614-12

ISO/TC **44**/SC **6**

Secretariat: **DIN**

Voting begins on:
2020-04-24

Voting terminates on:
2020-07-17

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

ICS: 25.160.10

This document is circulated as received from the committee secretariat.

ISO/CEN PARALLEL PROCESSING

Reference number
ISO/DIS 15614-12:2020(E)

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Published in Switzerland

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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.

The committee responsible for this document is ISO/TC 44, *Welding and allied processes*, Subcommittee SC 6, *Resistance welding and allied mechanical joining* and by CEN/TC 121, *Welding and allied processes* in collaboration.

This third edition cancels and replaces the second edition (ISO 15614-12:2014), of which it constitutes a minor revision with the following changes:

— Annex ZA has been removed;

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

ISO 15614 consists of the following parts, under the general title *Specification and qualification of welding procedures for metallic materials — Welding procedure test:*

— *Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*

— *Part 2: Arc welding of aluminium and its alloys*

— *Part 3: Fusion welding of non-alloyed and low-alloyed cast irons*

— *Part 4: Finishing welding of aluminium castings*

— *Part 5: Arc welding of titanium, zirconium and their alloys*

— *Part 6: Arc welding of copper and its alloys*

— *Part 7: Overlay welding*

— *Part 8: Welding of tubes to tube-plate joints*

— *Part 10: Hyperbaric dry welding*

— *Part 11: Electron and laser beam welding*

— *Part 12: Spot, seam and projection welding*

— *Part 13: Upset (resistance butt) and flash welding*

— *Part 14: Laser-arc hybrid welding of steels, nickel and nickel alloys*

Requests for official interpretations of any aspect of this International Standard 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 "www.iso.org."

Introduction

It is intended that all new welding procedure qualifications be carried out in accordance with this Part of ISO 15614 from the date of its issue.

However, this Part of ISO 15614 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 have 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 Part of ISO 15614.

The various parts of ISO 15614 comprise, in their turn, a series of International Standards on welding, details of which are given in ISO 15607, Annex A.

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

Part 12: Spot, seam and projection welding

1 Scope

This Part of ISO 15614 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 International Standard is Part of the ISO 15614 series. Details of this series are given in ISO 15607, Annex A.

This Part of ISO 15614 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 Part of ISO 15614.

The tests required to qualify the procedure for a particular component/assembly depend on the performance and quality requirements of the component/assembly and shall be established before any qualification is undertaken.

Tests shall be carried out in accordance with this Part of ISO 15614 unless more severe tests are specified by the relevant application standard or contract when these shall apply.

The acceptability of applying the principles of this Part of ISO 15614 to other resistance welding processes should be established before any qualification is undertaken.

NOTE Specific service, material, or manufacturing conditions might require more comprehensive testing than is specified by this Part of ISO 15614.

Such tests can include:

— method for fatigue testing for spot welded joints;

— specimen dimensions and procedure for impact, shear and cross-tension testing resistance spot and projection welds;

— bend test;

— surface crack detection;

— ultrasonic tests and X-ray test;

— chemical analysis and corrosion tests;

— micro examination, including assessment of hot cracking behaviour;

— tests of components or complete welded assemblies.

This Part of ISO 15614 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;
  - 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, *Resistance welding — Resistance welding equipment — Mechanical and electrical requirements*

ISO 10447, *Resistance welding — Testing of welds — Peel and chisel testing of resistance spot and projection welds*

ISO 14270, *Resistance welding — Destructive testing of welds — Specimen dimensions and procedure for mechanized peel testing resistance spot, seam and embossed projection welds*

ISO 14271, *Resistance welding — Vickers hardness testing (low-force and microhardness) of resistance spot, projection, and seam welds*

ISO 14272, *Resistance welding — Destructive testing of welds — Specimen dimensions and procedure for cross tension testing of resistance spot and embossed projection welds*

ISO 14273, *Resistance welding — Destructive testing of welds — Specimen dimensions and procedure for tensile shear testing resistance spot and embossed projection welds*

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

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

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

ISO 17654, *Resistance welding — Destructive tests of welds — Pressure test of resistance seam welds*

ISO 17677-1, *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.

4 Preliminary welding procedure specification (pWPS)

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

5 Test piece

5.1 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.

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

5.2.1 General

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

5.2.2 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.

5.3 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.

6 Examination and testing

6.1 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.