

# 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**

ICS 25.160.10

## National foreword

This British Standard is the UK implementation of EN ISO 15614-1:2004+A2:2012. It is identical to ISO 15614-1:2004, incorporating amendments 1:2008 and 2:2012. It supersedes BS EN ISO 15614-1:2004+A1:2008 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to ISO text carry the number of the ISO amendment. For example, text altered by ISO amendment 1 is indicated by **A1** **A1**.

BSI, as a member of CEN, is obliged to publish EN ISO 15614-1:2004+A2:2012 as a British Standard. However, the UK Committee has expressed concern at the change in the range of qualification for material thickness of fillet welds (Table 6).

It should be noted that for a test piece within the thickness range  $3 < t \leq 30\text{mm}$ , the maximum thickness qualified has been increased from  $1,2t$  to  $2t$ . It is an essential requirement when welding materials of specific steel groups that the appropriate preheat level is used in accordance with requirements of EN 1011. Users should also be aware that the permitted maximum hardness values given in Table 2 may be exceeded if the appropriate preheat temperature is not applied.

The UK participation in its preparation was entrusted to Technical Committee WEE/36, Qualification of welding personnel and welding procedures.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

**Compliance with a British Standard cannot confer immunity from legal obligations.**

### Amendments/corrigenda issued since publication

| Date          | Comments                                                                                                  |
|---------------|-----------------------------------------------------------------------------------------------------------|
| 30 April 2008 | Implementation of ISO amendment 1:2008 with CEN endorsement A1:2008                                       |
| 30 April 2012 | Implementation of ISO amendment 2:2012 with CEN endorsement A2:2012: Annexes ZB and ZC have been amended. |
|               |                                                                                                           |
|               |                                                                                                           |

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**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 (ISO 15614-1:2004)**

Descriptif et qualification d'un mode opératoire de soudage pour les matériaux métalliques - Epreuve de qualification d'un mode opératoire de soudage - Partie 1: Soudage à l'arc et aux gaz des aciers et soudage à l'arc des nickels et alliages de nickel (ISO 15614-1:2004)

Anforderung und Qualifizierung von Schweißverfahren für metallische Werkstoffe - Schweißverfahrensprüfung - Teil 1: Lichtbogen- und Gasschweißen von Stählen und Lichtbogenschweißen von Nickel und Nickellegierungen (ISO 15614-1:2004)

This European Standard was approved by CEN on 7 May 2003.

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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.

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## Foreword

This document (EN ISO 15614-1:2004) has been prepared by Technical Committee CEN/TC 121 "Welding", the secretariat of which is held by DS, 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 December 2004, and conflicting national standards shall be withdrawn at the latest by December 2004.

This document replaces EN 288-3:1992.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annexes ZB and ZC, which are an integral part of this document.

Annex A is informative.

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## Foreword to amendment A1

This document (EN ISO 15614-1:2004/A1:2008) 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 Amendment to the European Standard EN ISO 15614:2004 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2008, and conflicting national standards shall be withdrawn at the latest by August 2008.

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## **Foreword to amendment A2**

This document (EN ISO 15614-1:2004/A2:2012) has been prepared by Technical Committee ISO/TC 44 "Welding and allied processes" in collaboration with Technical Committee CEN/TC 121 "Welding" the secretariat of which is held by DIN.

This Amendment to the European Standard EN ISO 15614:2004 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2012, and conflicting national standards shall be withdrawn at the latest by August 2012.

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### **Endorsement notice**

The text of ISO 15614-1:2004/Amd 2:2012 has been approved by CEN as a EN ISO 15614-1:2004/A2:2012 without any modification.

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## Introduction

All new welding procedure tests are to be carried out in accordance with this standard from the date of its issue.

However, this European Standard does not invalidate previous welding procedure tests made to former national standards or specifications or previous issues of this standard.

Where additional tests have to be carried out to make the qualification technically equivalent, it is only necessary to do the additional tests on a test piece which should be made in accordance with this standard.

## 1 Scope

This European Standard is part of a series of standards, details of this series are given in EN ISO 15607:2003, annex A.

This standard specifies how a preliminary welding procedure specification is qualified by welding procedure tests.

This standard defines the conditions for the execution of welding procedure tests and the range of qualification for welding procedures for all practical welding operations within the range of variables listed in clause 8.

Tests shall be carried out in accordance with this standard. Additional tests may be required by application standards.

This standard applies to the arc and gas welding of steels in all product forms and the arc welding of nickel and nickel alloys in all product forms

Arc and gas welding are covered by the following processes in accordance with EN ISO 4063:

- 111 - manual metal arc welding (metal-arc welding with covered electrode);
- 114 - self-shielded tubular-cored arc welding;
- 12 - submerged arc welding;
- 131 - metal inert gas welding, MIG welding;
- 135 - metal active gas welding, MAG welding;
- 136 - tubular-cored metal arc welding with active gas shield;
- 137 - tubular-cored metal arc welding with inert gas shield;
- 141 - tungsten inert gas arc welding; TIG welding;
- 15 - plasma arc welding;
- 311 - oxy-acetylene welding.

The principles of this European Standard may be applied to other fusion welding processes.

## 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 (including amendments).

**A1** Text deleted **A1**

EN 571-1, *Non destructive testing – Penetrant testing – Part 1: General principles.*

EN 875, *Destructive tests on welds in metallic materials - Impact tests - Test specimen location, notch orientation and examination.*

EN 895, *Destructive tests on welds in metallic materials – Transverse tensile test.*

EN 910, *Destructive tests on welds in metallic materials – Bend tests.*

EN 970, *Non-destructive examination of fusion welds - Visual examination.*

EN 1011-1 *Welding –Recommendations for welding of metallic materials –Part 1: General guidance for arc welding*

EN 1043-1:1995, *Destructive tests on welds in metallic materials – Hardness testing – Part 1: Hardness test on arc welded joints.*

EN 1290, *Non-destructive examination of welds - Magnetic particle examination of welds.*

EN 1321, *Destructive tests on welds in metallic materials - Macroscopic and microscopic examination of welds.*

EN 1418, *Welding personnel - Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials.*

EN 1435, *Non destructive examination of welds – Radiographic examination of welded joints.*

EN 1714, *Non destructive examination of welds – Ultrasonic examination of welded joints.*

**A1** EN 12062, *Non-destructive examination of welds — General rules for metallic materials*

ISO 4063:1998, *Welding and allied processes — Nomenclature of processes and reference numbers*

ISO 5817:2003, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections*

ISO 6947:1990, *Welds — Working positions — Definitions of angles of slope and rotation*

ISO 9606-1, *Qualification test of welders — Fusion welding — Part 1: Steels*

ISO 9606-4:1999, *Approval testing of welders — Fusion welding — Part 4: Nickel and nickel alloys*

ISO 14175, *Welding consumables — Gases and gas mixtures for fusion welding and allied processes*

ISO 15607:2003, *Specification and qualification of welding procedures for metallic materials — General rules*

ISO/TR 15608:2005, *Welding — Guidelines for a metallic materials grouping system*

ISO 15609-1:2004, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding*

ISO 15609-2:2001, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 2: Gas welding*

ISO 15613:2004, *Specification and qualification of welding procedures for metallic materials — Qualification based on pre-production welding test* **A1**

### 3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN ISO 15607:2003 apply.

### 4 Preliminary welding procedure specification (pWPS)

The preliminary welding procedure specification shall be prepared in accordance with prEN ISO 15609-1 or EN ISO 15609-2.

### 5 Welding procedure test

The welding and testing of test pieces shall be in accordance with clauses 6 and 7.

The welder or welding operator who undertakes the welding procedure test satisfactorily in accordance with this standard is qualified for the appropriate range of qualification according to prEN ISO 9606-1 or EN ISO 9606-4 or EN 1418, providing that the relevant testing requirements are met.

### 6 Test piece

#### 6.1 General

The welded joint to which the welding procedure will relate in production shall be represented by making a standardized test piece or pieces, as specified in 6.2. Where the production/joint geometry requirements do not represent the standardized test pieces as shown in this standard, the use of EN ISO 15613 shall be required.

#### 6.2 Shape and dimensions of test pieces

The length or number of test pieces shall be sufficient to allow all required tests to be carried out.

Additional test pieces, or longer test pieces than the minimum size, may be prepared in order to allow for extra and/or for re-testing specimens (see 7.6).

For all test pieces except branch connections (see Figure 4) and fillet welds (see Figure 3) the material thickness,  $t$ , shall be the same for both plates/pipes to be welded.

If required by the application standard, the direction of plate rolling shall be marked on the test piece when impact tests are required to be taken in the Heat Affected Zone (HAZ).

The thickness and/or pipe outside diameter of the test pieces shall be selected in accordance with 8.3.2.1 to 8.3.2.3.

The shape and minimum dimensions of the test piece shall be as follows:

##### 6.2.1 Butt joint in plate with full penetration

The test piece shall be prepared in accordance with Figure 1.

##### 6.2.2 Butt joint in pipe with full penetration

The test piece shall be prepared in accordance with Figure 2.

NOTE The word "pipe", alone or in combination, is used to mean "pipe", "tube" or "hollow section".

### **6.2.3 T-joint**

The test piece shall be prepared in accordance with Figure 3.

This may be used for fully penetrated butt welds or fillet welds.

### **6.2.4 Branch connection**

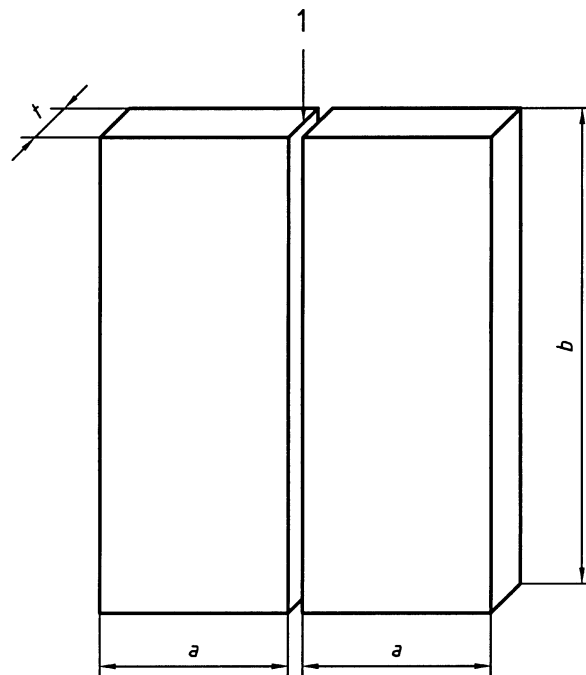
The test piece shall be prepared in accordance with Figure 4. The angle  $\alpha$  is the minimum to be used in production.

This may be used for fully penetrated joints (set-on or set-in or set-through joint) and for fillet welds.

## **6.3 Welding of test pieces**

Preparation and welding of test pieces shall be carried out in accordance with the pWPS, and under the general conditions of welding in production which they shall represent. Welding positions and limitations for the angle of slope and rotation of the test piece shall be in accordance with EN ISO 6947. If tack welds are to be fused into the final joint they shall be included in the test piece.

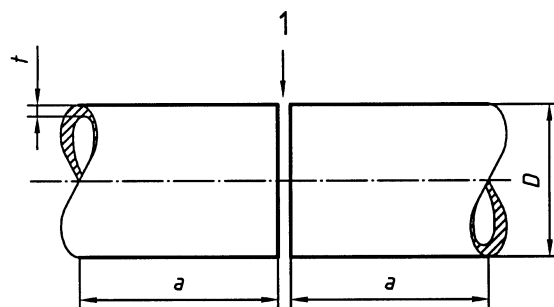
Welding and testing of the test pieces shall be witnessed by an examiner or an examining body.



### Key

- 1 Joint preparation and fit-up as detailed in the preliminary Welding Procedure Specification (pWPS)
- $a$  Minimum value 150 mm
- $b$  Minimum value 350 mm
- $t$  Material thickness

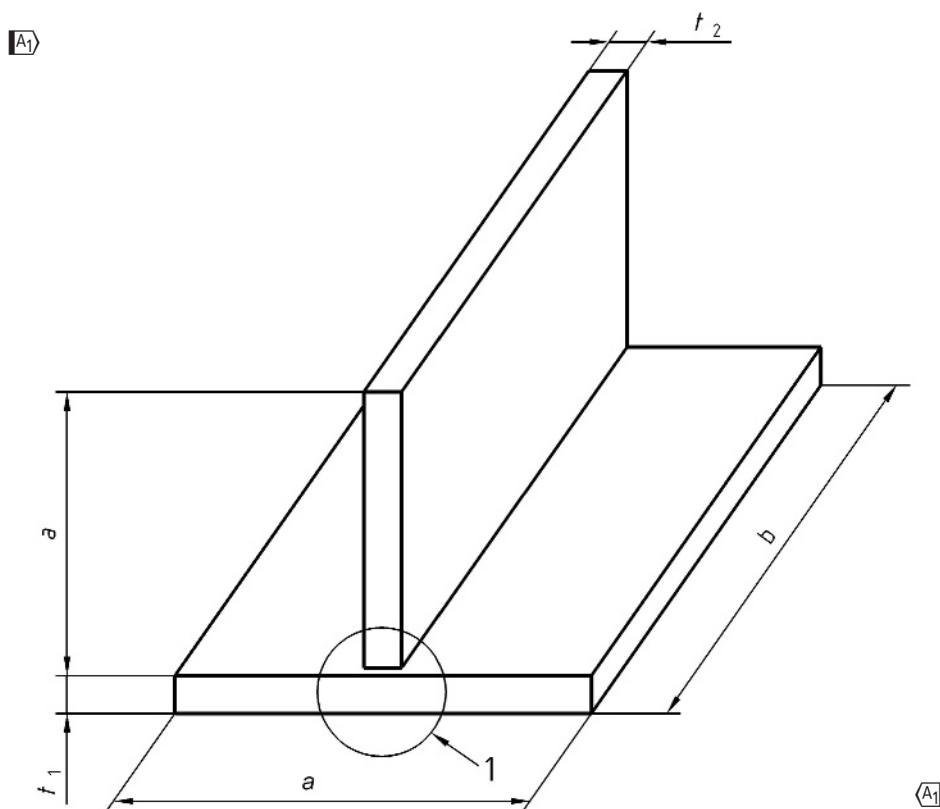
**Figure 1 — Test piece for a butt joint in plate with full penetration**



#### Key

- 1 Joint preparation and fit-up as detailed in the preliminary Welding Procedure Specification (pWPS)
- $a$  Minimum value 150 mm
- $D$  Outside pipe diameter
- $t$  Material thickness

Figure 2 — Test piece for a butt joint in pipe with full penetration



#### Key

- 1 Joint preparation and fit-up as detailed in the preliminary Welding Procedure Specification (pWPS)
- $a$  Minimum value 150 mm
- $b$  Minimum value 350 mm
- $t$  Material thickness

Figure 3 — Test piece for a T-joint