

ISO 15620:2019 (E)

Welding — Friction welding of metallic materials

Contents

| | |
|-----------|--|
| | Foreword |
| | Introduction |
| 1 | Scope |
| 2 | Normative references |
| 3 | Terms and definitions |
| 4 | Welding knowledge |
| 4.1 | Process |
| 4.1.1 | General |
| 4.1.2 | Direct drive rotational friction welding |
| 4.1.3 | Stored energy (inertia) friction welding |
| 4.1.4 | Further processes |
| 4.1.5 | Friction welding arrangements |
| 4.2 | Materials and material combinations |
| 4.3 | Friction welding machines |
| 4.3.1 | General |
| 4.3.2 | Features |
| 5 | Quality requirements |
| 5.1 | General |
| 5.2 | Pre-welding requirements |
| 5.2.1 | Condition of raw materials |
| 5.2.2 | Preparation of the components to be welded |
| 5.2.3 | Component holding |
| 5.3 | Post-welding treatment |
| 5.4 | Quality assurance |
| 6 | Welding procedure specification (WPS) |
| 6.1 | General |
| 6.2 | Information related to the manufacturer |
| 6.3 | Information related to the material |
| 6.4 | Welding parameters |
| 6.5 | Joint |
| 6.6 | Optional devices |
| 7 | Welding procedure approval |
| 7.1 | Principles |
| 7.2 | Welding procedure tests |
| 7.2.1 | Application |
| 7.2.2 | Preliminary welding procedure specification (pWPS) |
| 7.2.3 | Number of test weldments |
| 7.2.4 | Specification for test specimens |
| 7.2.4.1 | Solid sections — Specimens from bar to bar weldments for bend test |
| 7.2.4.2 | Hollow sections |
| 7.2.4.2.1 | Specimens from tube to tube weldments for bend test |
| 7.2.4.2.2 | Specimens from tube to bar weldments and tube to plate weldments for bend test |
| 7.2.5 | Test procedures |
| 7.2.5.1 | Bend test |
| 7.2.5.2 | Alternative tests |
| 7.2.6 | Acceptance criteria |

- 7.3 Welding procedure approval record (WPQR)
 - 7.4 Previous experience
 - 7.5 Circumstances mandating requalification
 - 7.6 Machine-specific nature of a WPS
 - 7.7 Requalification procedure requirements
- 8 Welding personnel**
- 8.1 Friction welding machine operator
 - 8.2 Friction welding machine setter
 - 8.3 Welding coordination personnel (supervisor)
- Annex A (informative) Relationship of welding parameters**
- A.1 Welding parameters for direct drive rotational friction welding
 - A.1.1 General
 - A.1.2 Friction phase
 - A.1.3 Deceleration phase
 - A.1.4 Forge phase
 - A.2 Welding parameters for stored energy (inertia) friction welding
 - A.2.1 General
 - A.2.2 Energy
 - A.2.3 Axial force
- Annex B (informative) Additional processes based on friction**
- B.1 Radial friction welding
 - B.2 Friction stud welding
 - B.3 Friction surfacing
 - B.4 Friction taper plug welding
 - B.5 Friction taper stitch welding
 - B.6 Friction stir welding
 - B.7 Friction seam welding
 - B.8 Friction lap seam welding (the Luc process)
 - B.9 Friction plunge welding
 - B.10 Third body friction welding
 - B.11 Friction co-extrusion cladding
 - B.12 Friction hydro-pillar processing
 - B.13 Friction brazing
 - B.14 Linear friction welding
 - B.15 Orbital friction welding
 - B.16 Overlap friction welding
 - B.17 Friction mash seam welding
 - B.18 Friction element welding
- Annex C (informative) Material combinations weldable by friction welding**
- Annex D (informative) Guidelines for quality assurance**
- Annex E (informative) Examination and test**
- E.1 Non-destructive testing
 - E.1.1 General
 - E.1.2 Visual examination
 - E.1.3 Dimension check
 - E.1.4 Dye penetration test
 - E.1.5 Magnetic particle test
 - E.1.6 Eddy current test
 - E.1.7 Ultrasonic test
 - E.2 Destructive testing
 - E.2.1 General
 - E.2.2 Tensile test
 - E.2.3 Impact test
 - E.2.4 Metallographic examination
 - E.3 Proof testing
- Annex F (informative) Manufacturer's friction welding procedure specification (WPS)**

Annex G (informative) Characteristics of friction welded components

**Annex H (informative) Welding procedure approval record form (WPQR) Welding procedure approval —
Test certificate**

Page count: 40