
Welding for aerospace applications — Visual inspection of welds

*Soudage pour applications aérospatiales — Inspection visuelle des
soudures*

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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).

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For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 14, *Welding and brazing in aerospace*.

Requests for official interpretations of any aspect of this document should be directed to the Secretariat of ISO/TC 44/SC 14 via your national standards body. A complete listing of these bodies can be found at www.iso.org.

Welding for aerospace applications — Visual inspection of welds

1 Scope

This document specifies the requirements for visual inspection of welds in metallic materials and requirements for qualification and certification of personnel for visual weld inspection.

This document is also applicable to the visual inspection of the joint prior to or between welding sequences, and of brazed joints. In this case, the contents of theoretical and practical training will need to be adapted accordingly.

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 18490, *Non-destructive testing — Evaluation of vision acuity of NDT personnel*

EN 4179¹⁾, *Aerospace series — Qualification and approval of personnel for non-destructive testing*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

authorization

written statement by an employer that an individual is entitled to perform visual weld inspection within the organization

3.2

examiner

person who is designated by the employer to certify and recertify visual weld inspectors

Note 1 to entry: The examiner can be at the employer's or an external organization.

3.3

employer

organization employing or contracting the services of one or more individuals who perform visual weld inspection, including self-employed individuals

1) Under a Memorandum of Understanding, this is identical to NAS 410^[10].

3.4

inspection plan

document providing an overview of the sequence of inspections and tests, including appropriate resources and procedures to be referenced by the manufacturing plan

[SOURCE: ISO 13880:1999, 3.7]

3.5

weld zone

zone containing the weld metal and the heat-affected zones

[SOURCE: ISO/TR 25901-1:2016, 2.1.2.3]

4 General

Weld zones shall meet all specified requirements, as defined in the applicable engineering documents and as detailed in an inspection plan.

As a minimum, the following aspects shall be included in the visual inspection process of weld zones:

- a) presence and location of joints as specified in drawings;
- b) appearance (e.g. colouration, oxidation, contamination);
- c) visible discontinuities (e.g. surface cracks, lack of fusion, overlaps, undercut, spatter);
- d) joint dimension (e.g. fillet weld size, weld reinforcement, weld width);
- e) joint geometry (e.g. mismatch, concavity);
- f) welds shall be correctly located according to drawing or engineering definition.

5 Documentation of visual weld inspection result

The result of visual weld inspection shall be documented. This can be done by a personalized inspector stamp and/or signature in the manufacturing documentation.

If a comprehensive inspection report is requested, the recommended minimum requirements are given in [Annex C](#).

6 Inspection conditions and equipment

6.1 Post weld inspection condition

Unless otherwise specified, weld zones shall be inspected in the as-welded condition.

In case of a mechanical weld zone rework (dressing) or re-welding, the weld zone shall be re-inspected after rework or re-welding.

If, as an aid to manufacture, any attachment that is temporarily welded to the component to facilitate production or assembly is removed, it shall be removed in a way that the component is not damaged. The area where the attachment was fixed shall be inspected for defects.

Where there is doubt as to the result of visual inspection, the engineering/design authority shall be consulted.

6.2 Lighting conditions

The lighting conditions for inspection are best achieved by oblique dominant illumination combined with subdued background lighting. The minimum white light illumination of a 1 000 lx shall be available within the inspection area.

6.3 Inspection equipment

Examples of equipment applicable to visual inspection are given in [Annex D](#).

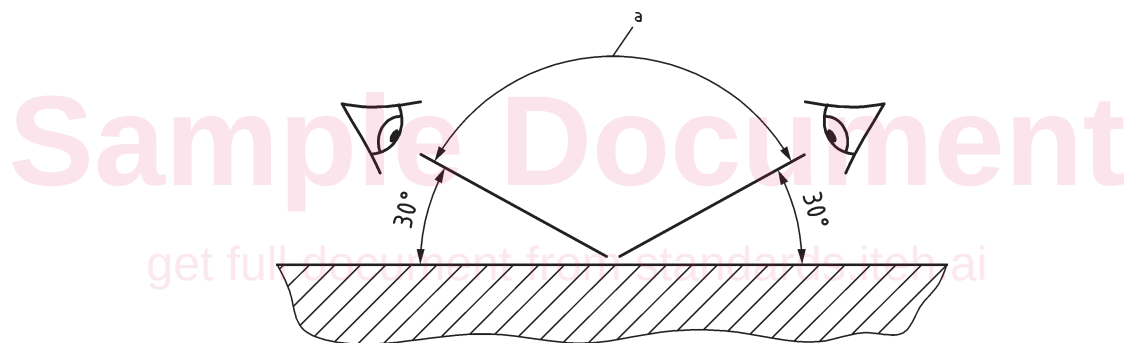
6.4 Direct inspection

For direct inspection, there shall be a direct line of sight to the surface being inspected.

Direct inspection may be performed with the aid of magnification up to maximum 10 $\times$.

For direct inspection, the access shall be sufficient to view the surface to be inspected within a maximum of 400 mm. The angle of inspection should not be less than 30° (see [Figure 1](#)), unless required by specific lighting and surface texture condition. Indirect inspection may be used to supplement direct inspection.

NOTE The optimum angle of inspection depends on surface textures and lighting conditions.



a Range of angles for direct inspection.

Figure 1 — Access for direct inspection

6.5 Indirect inspection

Indirect inspection using visual aids (for example, mirrors, borescopes, fibre optics or cameras) shall be applied when the access for inspection in accordance with [Figure 1](#) is not possible or as specified by the engineering/design authority.

Equipment used shall be suitable for inspecting all features to enable assessment of discontinuities defined within the relevant quality acceptance standards.

The lighting may be adjusted to improve the contrast between surface features and background.

Lighting conditions of [6.2](#) may not apply to indirect inspection.

6.6 Limitations of visual inspection

When a weld zone cannot be completely visually inspected, the engineering/design authority shall be informed.