

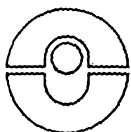
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**Technical specification for the
quality control of welded joints
on steel rolling stock**



International Union of Railways

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Leaflet to be classified in volumes:

- V - Transport stock
- VI - Traction
- VIII - Technical specifications

Amendments

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Preliminary remarks:

The double vertical line (||) in the margin denotes modifications introduced at the date shown at the foot of the page.

Enforcement of this leaflet is governed by the provisions listed under "Application" at the end of this document.

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Note

This Leaflet is part of a series which also includes:

Leaflet 800-51	Permissible variations on dimensions when no tolerances are given for welded structures
Leaflet 897-4	Technical specification for the acceptance and supply of combinations of wire electrodes and flux for automatic submerged arc welding of carbon, carbon-manganese and low-alloy steels
Leaflet 897-6	Technical specification for the acceptance of combinations of wire electrodes (solid or cored) and gases and also for the supply of wire electrodes (solid or cored) for automatic and semi-automatic gas-shielded welding of plain carbon or low-alloy steels
Leaflet 897-8	Technical specification for determining the nominal output and coefficient of deposition of cored wire electrodes for automatic and semi-automatic gas-shielded welding of plain carbon or low-alloy steels
Leaflet 897-11	Technical specification for the acceptance of welders for fusion welding of steels

Leaflet 897-12	Technical specification for the acceptance of welding procedures for arc welding in steels
Leaflet 897-14	Technical specification for the execution and control of test joints in steel (test pieces)

1 - Purpose and classification

1.1 - Purpose

This Leaflet defines the conditions for the welding and inspection of welded joints already defined using an accepted welding procedure.(1)

It shall apply to welded joints on steel structures (1)

It shall define:

- the classification of welded joints

It shall include:

- the acceptance of welding procedures (1),
- inspection of welding conditions on test joints (mock-ups),
- inspections made before, during and after the weld is executed.

For special applications, the customer railway may also stipulate special rules of execution in the specification.

This Leaflet shall apply to the arc welding procedures coded below. Each welding procedure may be manual, semi-automatic or automatic, as the case may be.

- 11 arc welding with core wire (without shielding gas)
- 12 arc welding in powdered flux

(1) In accordance with UIC Leaflet 897-12

- 13 arc welding with core wire and shielding gas
- 14 welding with refractory electrode and shielding gas
- 15 plasma arc welding.

For other procedures not mentioned above, a special acceptance program shall be made out.

1.2 - Classification of welded joints

The class of a welded joint shall be decided by the study bureaux taking into account the stresses undergone by the joints in service, and approved by the technical department of the user.

The class of a welded joint shall correspond to an admissible level of defects tolerated, as indicated on the drawing.

Class B: high-quality welded joints exposed to severe conditions and subject to dynamic stress in service. For certain limited areas heavily subjected to fatigue, post-welding treatment may be performed (Area of Post-Welding Treatment) (1)

Class C: quality welded joints concerning assemblies, sub-assemblies or parts affecting the resistance of a material.

(1) Post-Welding Treatment is not part of the thermal treatment. It includes operations such as removal of waste metal, shot blasting, remelt of the weld using a process such as TIG, etc.

Class D: standard quality welded joints.

The permitted tolerances for defects in these classes are covered in the Appendix to this Leaflet.

2 - Characteristics

2.1 - Physical characteristics of the welds

2.1.1 - Appearance

The appearance of the welds shall be such that the acceptability criteria given in the Appendix are respected.

2.1.2 - Internal condition

The internal condition of the weld shall be such that the nature, form, number and frequency of the hidden defects comply with the acceptability criteria laid down in the Appendix.

2.2 - Geometric characteristics of the welds

The geometry of the welds shall be such that their form and dimensions comply with the values laid down by the drawings (1) and the acceptability criteria.

In the absence of any indication in the specification, the defects and tolerances to be respected shall be those given in the Appendix to this Leaflet.

(1) According to ISO 2553

2.3 - Geometric characteristics of the welded joints

After welding, the geometry of the welded parts, sub-assemblies and assemblies shall comply with the dimensions and tolerances determined by the drawings.

2.4 - Mechanical characteristics of the welded joints

The mechanical characteristics shall be guaranteed by the acceptance of the WP and by specimen lengths if required in the order.

2.4.1 - Tensile strength across the weld

The tensile strength across the weld, measured on a standard test piece (1), shall be equal to at least the minimum guaranteed tensile strength of the parent metal.

2.4.2 - Fracture test

The broken cross-sections of the test pieces shall not show defects exceeding the limits defined in the Appendix.

2.4.3 - Included angle tests on fillet welds

The included angle of the test pieces shall show no crack or latent fissure particularly at the join between the weld and the sheet.

The penetration and the fusion at the root shall be examined on included angle test pieces.

This examination must not reveal defects that exceed the limits laid down in the Appendix.

(1) According to ISO 4316

2.4.4 - Macrographic examination of cross-sections

This examination must not reveal defects that exceed the limits laid down in the Appendix.

The penetration and fusion at the root shall be examined on macrographic cross-sections of the welds.

In case of doubt, a micrographic examination shall be carried out.

2.4.5 - Vickers hardness under the weld bead

The Vickers hardness under the weld bead (1) for Group 1 steels shall be lower than 350 HV10. For steels in Groups 2, 3 and 4 it shall be lower than 380 HV10.

3 - Execution

3.1 - Approval of welders or operators

All welds must be executed by welders or operators previously approved under the terms of UIC Leaflet 897-11.

3.2 - Approval of welding procedures

For class B and C welds, the procedures used shall have been approved beforehand in accordance with UIC Leaflet 897-12.

(1) The hardness shall be measured in accordance with documents CEN/TC 121/WG 5A N 61 "Welded joints in metallic materials hardness testing" and ISO 9015.6.

3.3 - Approval of filler products

Only filler products approved by the railways may be used (1).

3.4 - Welding

3.4.1 - General conditions

Welding operations shall be executed under shelter.

If the temperature of the parts to be welded is lower than 10°C for steels with minimum yield strength greater than or equal to 300 MPa (except stainless austenitic steels) or 5°C for other steels, the parts shall be fired.

Where gaseous flux is used, special protection shall be required if the welding process is at risk from draughts.

Where pre-heating is necessary, the minimum preheat temperature shall be maintained throughout all the welding operations.

At the moment when the parts are applied, irrespective of the preparation procedure used, the welding grooves and the area in their immediate vicinity shall be clean, free from rust, grease, oil, marking chalk, paint and any other impurity, with the exception of specially-approved paints.

Where the use of a primary paint suitable for welding is required, the maximum value shall be agreed between the manufacturer and the customer railway. In the absence of any such agreement, the maximum value shall be set at 15µm.

(1) According to UIC Leaflets 897-1, 897-4, 897-6, 897-8 and 897-12.