

Workshop specification

**General tolerances,
building an assembly**



Novelis PAE

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Generality

Purpose

This document specifies:

- Principles governing assembly at each stage of fabrication,
- Assembly inspection data,
- General fabrication information,
- General tolerances.

Standards documents

NF E 83-100-2 : Construction d'ensembles mécanosoudés - Techniques de soudage - Partie 2 : matériaux - conception.

NF E 83-100-3 : Construction d'ensembles mécanosoudés - Techniques de soudage - Partie 3.

NF E 83-100-4 : Construction d'ensembles mécanosoudés - Techniques de soudage - Partie 4 : Fabrication - Contrôle.

NF E 83-100-5 : Construction d'ensembles mécanosoudés - Techniques de soudage - Partie 5 : Qualification d'un mode opératoire de soudage.

NF EN 473 : Essais non destructifs - Qualification et certification du personnel - Principes généraux.

NF EN 287-1 : Epreuve de qualification des soudeurs - Soudage par fusion - Partie 1 : Aciers.

NF EN 462-2 : Essais non destructifs – Qualité d'image des radiogrammes – Indicateur de qualité d'image (à trous et à gradins) – Détermination de l'indice de qualité d'image.

NF EN 571-1 : Essais non destructifs – Examen par ressuage - Principes généraux.

NF A 09-590 : Essais non destructifs - Magnétoscopie - Principes généraux de contrôle.

Generality (cont'd)

Standards documents (cont'd)

NF EN ISO 5817 : Soudage – Assemblage en acier, nickel, titane et leurs alliages soudés par fusion – Niveaux de qualité par rapport aux défauts

NF EN 1011-1 : Soudage – Recommandations pour le soudage des matériaux métalliques – Partie 1 : lignes directrices générales pour le soudage à l’arc.

NF EN 1011-2 : Soudage – Recommandations pour le soudage des matériaux métalliques – Partie 2 : soudage à l’arc des aciers ferritiques.

NF EN 1011-3 : Soudage – Recommandations pour le soudage des matériaux métalliques – Partie 3 : soudage à l’arc des aciers inoxydables.

NF ISO 2768-2 : Tolérances géométriques pour éléments non affectés de tolérances individuelles.

Welding assembly

- Welding procedure** The fabricator shall be assisted by a qualified welding engineer in drawing up welding procedures.
- Ferritic steel welding conditions shall comply with Standards NF EN 1011-1 and NF EN 1011-2.
- Stainless steel welding conditions shall comply with Standard NF EN 1011-3.
- Position** The fabricator shall construct assembly templates for orienting the part to be welded such that welds are horizontally executed whenever possible.
- Welder and operator qualification** Welds shall be executed by personnel qualified for welding processes, types of assembly, materials and filler metals, thicknesses to be assembled and weld positions in compliance with the requirements of Standard NF EN 287-1.
- Qualification: Level I for all welds.
- Filler metal** In general, filler metal grade shall be close as possible to that of the metals to be assembled.

Welding assembly (cont'd)

Welding inspection and testing

Inspection and testing are included in the fabricator's scope of work and self-inspections shall therefore be organised, performed and interpreted at every stage of fabrication.

Visual inspection after welding

100% of welds shall be visually inspected.

Heavily stressed assemblies: check that each welder or operator has permanently marked the welds he/she has executed.

- Bead aspect,
- Weld regularity
- Search for visible defects.

Non-destructive testing of welds

These inspections shall be performed on highly stressed welds using suitable specific equipment:

- Liquid penetrant testing in accordance with Standard NF EN 571-1
- X ray testing in accordance with Standard NF-EN 462-2
- Magnetic particle inspection in accordance with Standard NF A 09-590.

Relevant welds shall be detailed on the detailed drawings of each equipment item.

Defect interpretation is defined in Standard NF EN ISO 5817. The level of weld defect acceptance shall be D (moderate requirement).

Welding assembly (suite)

Welding inspection and testing (suite)

Special cases

Compressed air lines Welded steel pipe network welds shall be inspected in the following way:

- Compressed air pressure applied to network under test (6 bar)
- Pressure holding period (2h)
- Allowable pressure loss (0.1 bar)



If the pressure loss after 2h of holding exceeds 0.1 bar, defective welds shall be determined using soapy water. After rewelding, the above pressure loss test shall be re-conducted.

- Combustible gaz lines
- Welds shall be liquid penetrant-tested.
 - Welded steel pipe network welds shall be inspected in the following way:
 - Compressed air pressure applied to network under test (6 bar)
 - Pressure holding period (2h)
 - No pressure loss allowed



If a pressure loss is detected after 2h of holding, defective welds shall be determined using soapy water. After rewelding, both the above pressure loss tests shall be re-conducted.

Water troughs Welds shall be liquid penetrant-tested.

Fabrication

Steel certification

The fabricator shall provide NOVELIS PAE with all material certificates before starting fabrication. (CCPU)

Format

The fabricator shall comply with the material formats (type of steel sheet, sections, etc.) to be used. Any changes with respect to detailed drawings shall be covered by an exemption request duly submitted to NOVELIS PAE.

Bonding of sheets

Steel sheet bonding operations shall be prohibited, when not explicitly indicated on detailed drawings. All sheet bonding requests shall be covered by specific exemption requests duly submitted to NOVELIS PAE.

General tolerances

Machined parts

Unless otherwise stated on detailed drawings, machined parts shall comply with the following general tolerances:

Dimension range	Linear dimensions	Angular dimensions	Sharp corners	Roughness
< 50 mm	± 0.2	± 5'	Break corners	6.3
> 50 mm	Js13 js13	± 5'	Break corners	6.3

For the geometrical tolerances, the range of tolerance is : **ISO-2768-K**

Structurally welded parts

Unless otherwise stated on detailed drawings, structurally welded parts shall comply with the following general tolerances:

Nominal dimension ranges (mm)				
≤ 30	> 30 and ≤ 400	> 400 and ≤ 1000	> 1000 and ≤ 2000	> 2000
± 1	± 1.5	± 2	± 2.5	± 3.5

Linear dimension ranges for dulled edges (radii and bevels)		
≤ 3	> 3 and ≤ 6	> 6
± 0.3	± 1	± 1.5

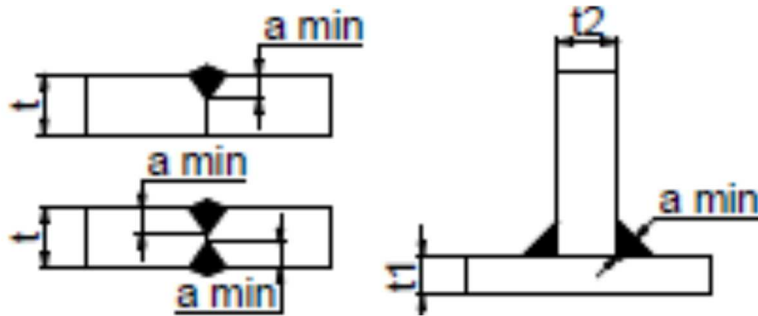
Allowable deviations for length ranges (mm) on shortest side of considered corner				
≤ 10	> 10 and ≤ 50	> 50 and ≤ 120	> 120 and ≤ 400	> 400
± 1°30'	± 1°	± 0°30'	± 0°15'	± 0°10'

General tolerances (cont'd)

Welds

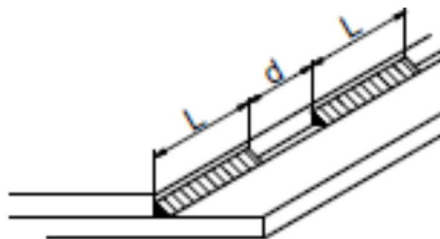
Unless otherwise stated on detailed drawings, machined parts shall comply with the following general tolerances (in accordance with Standards NF E83-100-2 and NF E83-100-3):

Bead cross section



t or max. value of t1 or t2	a min
$3 < t \leq 5$	2
$5 < t \leq 6$	3
$6 < t \leq 12$	5
$12 < t \leq 20$	6
$20 < t \leq 40$	8

Bead length for discontinuous welds



If $a \leq 6$	If $a > 6$
$L = 100 \text{ mm}$	$L = (16 \times a) \text{ mm}$
$d = 18 \times \text{min sheet thickness}$	$d = 18 \times \text{min. sheet thickness}$