

**ELECTRICAL TRANSITION JOINTS
FOR HIGH TEMPERATURE APPLICATIONS
ALUMINIUM / TITANIUM / CARBON STEEL
ETJ 2000**

Specification NC 604

Revision N° 1 of 07 February 2002

Date of revision	Number of revision	Written by	Checked by	Approved by	Remarks
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The dimensions in inches are for information only.

1 - SCOPE

This specification concerns anodic transition joints with high thermal resistance, used in alumina electrolysis cells. These joints, called "ETJ 2000" are cut in aluminium / titanium / steel explosive bonded clad plates.

2 - FIELD OF APPLICATION

Field of application of this specification applies is limited to products with a steel 38.1 mm (1.5") thick, a Titanium interlayer 1.5 mm (0.06") thick and an Aluminium 12.7 mm (0.5") thick. This field of application can be extended for steel thicknesses between 18 and 100 mm (0.7" to 4") after agreement.

3 - COMPOSITION

- 3.1.** The cladding metal is commercially pure aluminium, quality 1050 A or equivalent, 12.7 mm (0.5") thick.
- 3.2.** The interlayer is pure titanium, ASTM B 265 Gr 1 or equivalent, 1.5 mm (0.06") thick.
- 3.3.** The backer metal is low carbon steel, 1008-type or equivalent. The carbon content is 0.10 % maximum. Nominal thickness is 38.1 mm (1.5").

4 – SUPPLY CONDITIONS

ETJ 2000 are not heat treated after explosive bonding.
Surface finish is guaranteed with a roughness of 3.2 μm (140 RMS) maximum after grinding.

5 - TOLERANCES

5.1. THICKNESS

1

Total tolerance : $50,8 \pm 2$ mm

If the field of applications has been extended (cf. § 2), thickness tolerances will be reviewed.

5.2. LENGTH AND WIDTH

- 5.2.1. Tolerances for joints are ± 2 mm (0.08").
- 5.2.2. Tolerances for plates are $- 0 + 20$ mm ($- 0'' + 0.8''$).
- 5.2.3. Other tolerances can be applied after agreement.

5.3. FLATNESS

The flatness shall be measured according to specification NF EN 10029, § 10.6, from the Aluminium side.

- 5.3.1. For widths greater than 150 mm (6"), the variation from a flat surface is not greater than 1 % of the width.
- 5.3.2. For widths up to 150 mm (6"), the variation from a flat surface is not greater than 1.5 mm (0.06").

6 - ULTRA-SONIC TESTING

All bonded plates shall be 100 % ultrasonically tested by a qualified staff. Gauging of the ultra-sonic equipment is performed according to ASTM A 578 standard (the transducer has a diameter of 25 mm (1") or less).

Test is carried out from the Aluminium side.

Complete loss of back reflection, accompanied by an echo indication from the plane of the interface, shall be interpreted as a non-bonded zone. This area, 40 mm (1.6") extended, is cause of rejection.

When the plant provides plates, non-bonded zones (40 mm extended) are clearly identified on Aluminium face with paint.

7 - BOND QUALITY

The bond quality is measured with the tensile test, as delivered and after heat treatment at 550 °C during 24 hours.

The test is carried out on samples described in Annex 1.

ISO 5022 is the reference standard :

- chapter 5.6 with a AQL (Acceptable Quality Level) equal to 1.5 %
- chapter 3.2.1

- 7.1.** A lot corresponds to 20 plates. Every 5 plates, 6 samples are taken, 3 will be heat treated ; so, this means 24 samples per lot totally.

Average value (m) and standard deviation (σ_{n-1}) are calculated considering 10 tensile values.

With a K factor equal to 1.42 (according to ISO 5022, chapter 5.6)

The lot is conform if :

m (MPa) \geq 150 + 1.42 σ_{n-1} as delivered

and

m (MPa) \geq 80 + 1.42 σ_{n-1} after heat treatment at 550 °C during 24 hours

Retests are carried out on plate(s) which bring a lot non conform. After these retests, if the plate(s) is (are) always non conform, the plate(s) is (are) turned down. Then, new plates are tested.

This rule is for at least 20 plates.

Note :

For orders with less than 20 plates, statistical is carried out using the last 10 values.

8 – TEST REPORTS

Upon request in the order, following test reports can be provided :

- 8.1.** Attestation certifying that the bonded metal conforms to this specification (model 2.1 following EN 10204).
- 8.2.** Certificates of chemical composition of the materials used.
- 8.3.** Mechanical tests reports

9 – DIE STAMPING

A systematic die stamping of the mother plate number is carried out on the edge of each joint.

10 – PACKAGING

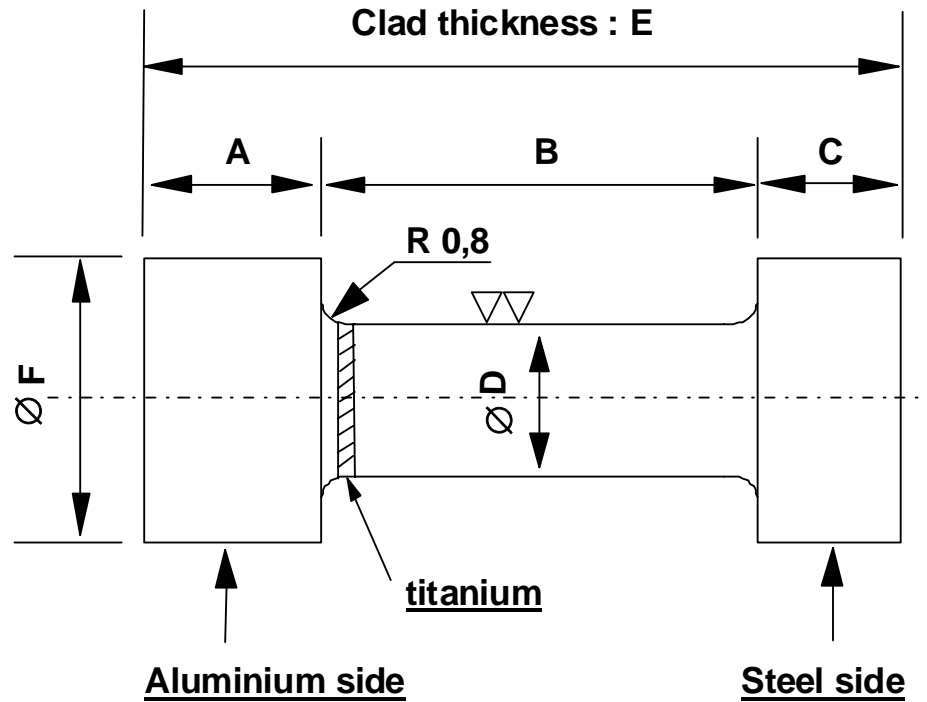
"Maritime" packaging are used with or without plastic covers. Dehydrator bags can be added in the last case.

Note : Joints are not oiled.

**NC 604 SPECIFICATION
ANNEX 1 - TENSILE TEST**

SPECIMEN FOR TENSILE TEST

Scale 2:1



	Dimensions in millimetres
A	12 -1 + 0
B	≈ 31.8
C	10 -1 + 0
D	10 ± 0.1
E	Steel thickness + Titanium thickness + Aluminium thickness = 52.1 mm nom.
F	20 -1 + 0

SAMPLING SPECIMEN PROCEDURE

Sampling :

Choice of the plates to be tested (numbers ending with 0 or 5).

The specimens (at least 6) come from a sample cut in an area shown to be sound for the Ultrasonic Testing.

Marking :

The sample is hard stamped with the plate number from which it has been taken.

Cutting :

The specimens are cut by sawing into lengths from the sound area, approximately 75 mm (3") from the edge of the parent plate and at least 40 mm (1.6") from any no-bonded metal area.