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GROUPE SNPE

**NT 304**
**Rev. 2 - January 2003**

# New Electrical Transition Joints for High Temperature Applications

# ETJ 2000 - ETJ 2001

ETJ 2000 is the result of development work carried out by our R&D department in 1999 to produce joints more suited to use in high current (typically 360,000 A) electrolysis cells. ETJ 2000 is manufactured by explosive bonding, with a titanium interlayer between the steel and the aluminium, they are resistant to bond degradation up to an interface temperature of 600 °C.

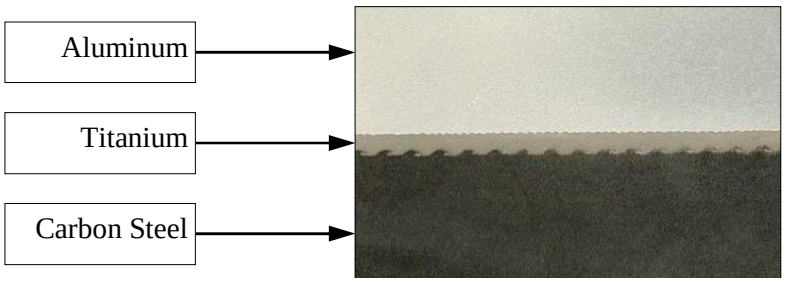
The improved performance results from the fact that the titanium interlayer prevents the formation of intermetallic compounds of steel and aluminium, the cause of permanent weakening of conventional joints exposed to high temperatures (250 °C and above). The intermetallics decrease strength and conductivity leading to higher energy use, and, ultimately can result in bond failure.

The implementation of ETJ 2000 does not present any particular difficulty provided that usual welding principles used for solid metals and NOBELCLAD recommendations are applicable. This product has been qualified by major companies including ALCAN, ALCOA, COMALCO, PECHINEY, and others.

**The Only ETJ able to work reliably up to 600°C (1110°F)**

## A large Range of Thicknesses and Sizes

- ETJ 2000 Composition: Cladding metal is Aluminum 1050 or eq. - 12.7 mm thick (0.5-inch)
  Interlayer metal is Titanium Grade 1 or eq. - 1.5 mm thick (0.0625-inch)
  Backer metal is Steel AISI 1008 or eq. - 25.4 mm thick (1.0-inch)
  38.1 mm thick (1.5-inch)
  50.8 mm thick (2.0-inch)
  (3 steel thickness options)




- ETJ 2001 Composition: Cladding metal is Aluminum 1050 or eq. - 12.0 mm thick (0.475-inch)
  Interlayer metal is Titanium Grade 1 or eq. - 1.0 mm thick (0.0425-inch)
  Backer metal is Steel AISI 1008 or eq. - 11.0 mm thick (0.425-inch)

## Bond Strength

The strength of the ETJ 2000 is evaluated by through thickness tensile tests according to NC 604 or customer's specification. Average values are:

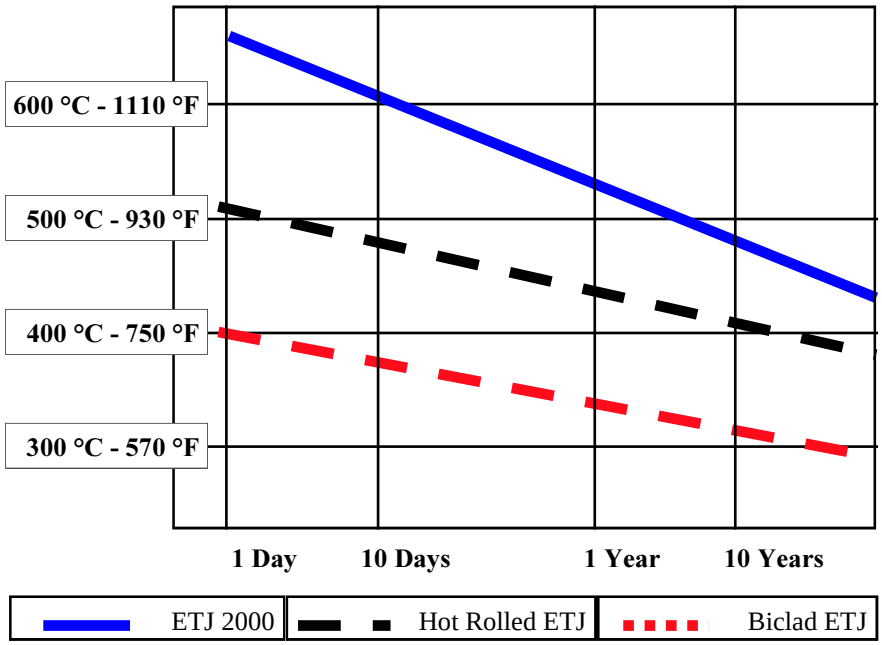
**220 MPa** (30 000 Psi) **as manufactured.**

**150 MPa** (22 000 Psi) **after heat treatment 550 °C x 24 hours.**

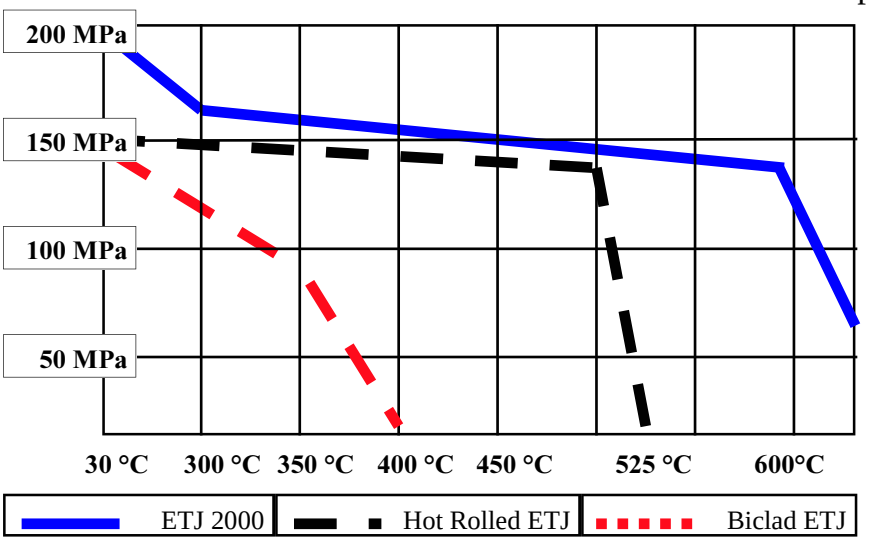
# High Temperature Performance

ETJ 2000 titanium interlayer provides a barrier which prevents formation of the Al-Fe intermetallics. The Ti-Aluminium system exhibits greater mechanical integrity than most other intermetallic systems at the temperatures and times applicable to aluminum reduction ETJ's.

For more information, please ask for a copy of our technical paper "Aluminum-Steel Electric Transition Joints, Effect of Temperature and Time upon Mechanical Properties" 2002 TMS.




Time to failure vs temperature for three types of joints




Tensile strength after 24 hours at temperature

ETJ 2000 exhibits the lowest rate of failure in operations due to its capacity to support overheating up to 600°C - 1100 °F. Such temperature is easily reachable during welding operations and cells life.

NOBELCLAD recommends its welding guideline GW/JLE/002 to avoid any alteration of the joint during welding.

# Low Electrical Resistance

The as manufactured electrical resistance of ETJ 2000 and ETJ 2001 is equal to the sum of resistances of the component metals in series. Time and temperature have no effect on the electrical resistance contrary to the hot-rolled product. For more information, please ask for a copy of our NT306 "Electrical Resistance of Transition Joints for Reduction Cells".

# ETJ 2000 Manufacturing operations

ETJ 2000 is manufactured by explosion cladding with plate sizes typically 6 sq-meters area. The plates are ultrasonically inspected using computed automated equipment to assure freedom from bond defects. Through-thickness tensile tests are performed on a statistical basis to verify strength compliance. ETJ 2000 blocks are cut using automated sawing machines assuring precise dimensions and geometry.

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