

**GUIDELINES FOR WELDING  
 NOBELCLAD ELECTRICAL TRANSITION JOINTS  
 TRICLAD – ETJ 2000 – ETJ 2001**

**GW/JLE/002**

**Revision N° 1 – September 2003**

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Note:

The following recommendations are provided to assist the end-users in the use of Nobelclad electrical transition joints also called “bi-metallic” or “clad”.

These recommendations have been based on both our own experience and that of our major customers.

It is therefore strongly recommended to pre-qualify previously welding conditions characteristics of the equipment used.

Welding should be carried out by a qualified staff.

**1. PREPARATION**

- ① As recommended for all aluminum welding operations, it is important to degrease and clean the aluminum. It should also be remembered that the weld seams must be thoroughly cleaned between each pass to remove any dirt or inclusions.

During tack welding, the clad has to be in close contact with the aluminum stem.

- ① We also recommend avoiding wide variations in temperature at the interface, throughout the welding process. The maximum temperature difference must be less than 200°C. It is mandatory to limit the maximum peak temperature at the interface below **500°C** to avoid the formation of brittle intermetallic compounds that could reduce clad quality. The penetration must not touch the interface. We recommend a minimum of 3 mm between the interface and the melting zone (see figure 3).

In order to achieve this, we recommend:

- To preheat the clad piece when temperature is less than 10°C.
- Not to bevel the aluminum of the clad piece as shown in figure 1.
- To weld the aluminum side first ; thus, the assembled clad and aluminum bar will act as a heat sink when welding the steel.

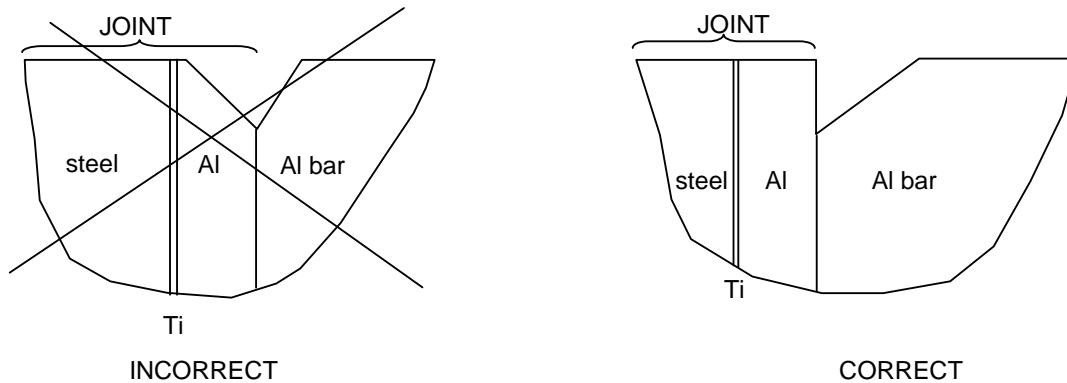
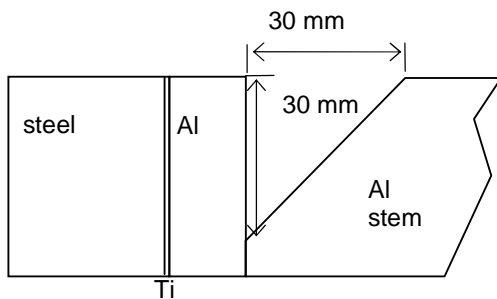


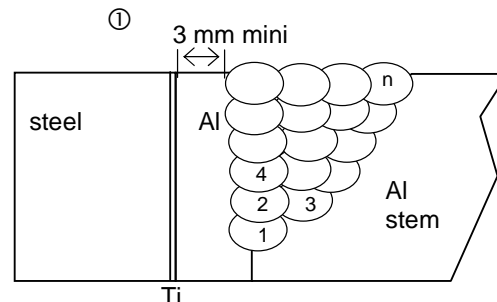
Figure 1

- ① The chamfer size has to be adapted to the clad size. As example, a common chamfer size for a 220x200 mm clad is 30mmx30mm on the aluminum stem (see figure 2).



PREPARATION EXAMPLE (joints 220 x 200 mm)

Figure 2



WELD BUILT-UP SEQUENCE

Figure 3

① Two different procedures can be applied. The first allows automatic equipment (manual welding is also possible). The second is usually used for manual welding. The second procedure limits the temperature at the interface.

Procedure #1: the clad is totally welded before starting another one. Clad is welded on each side successively.

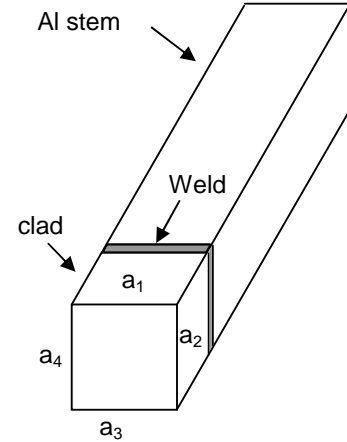
*Welding order:*

Root passes:  $a_1 - a_2 - a_3 - a_4$  (only 1 weld seam on each side)

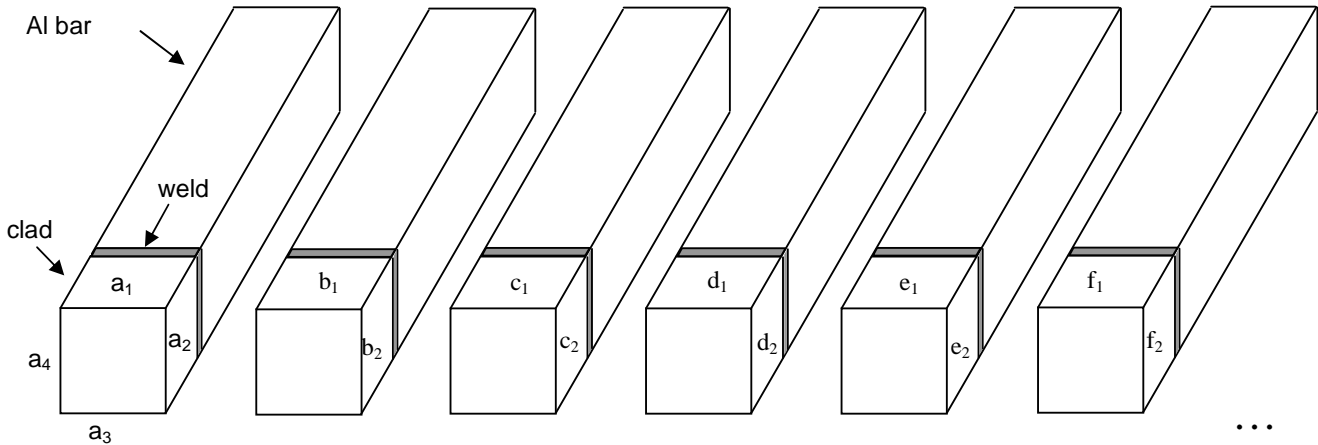
2<sup>nd</sup> passes:  $a_1 - a_2 - a_3 - a_4$  (only 1 weld seam on each side)

3<sup>rd</sup> passes:  $a_1 - a_2 - a_3 - a_4$  (only 1 weld seam on each side)

...



Procedure #2: several clads (6 for example) are welded in the same time.



*Welding order:*

Root passes:  $a_1 - b_1 - c_1 - d_1 - e_1 - f_1$  (only 1 weld seam on each side)

2<sup>nd</sup> passes:  $a_2 - b_2 - c_2 - d_2 - e_2 - f_2$  (only 1 weld seam on each side)

3<sup>rd</sup> passes:  $a_3 - b_3 - c_3 - d_3 - e_3 - f_3$  (only 1 weld seam on each side)

4<sup>th</sup> passes:  $a_4 - b_4 - c_4 - d_4 - e_4 - f_4$  (only 1 weld seam on each side)

5<sup>th</sup> passes:  $a_1 - b_1 - c_1 - d_1 - e_1 - f_1$  (only 1 weld seam on each side)

...

Figure 4

## 2. WELDING OF ALUMINIUM

Note:

As there are many welding processes, the manufacturer should determine the best procedure process. MIG -Metal Inert Gas-(GMAW) process gives satisfactory results.

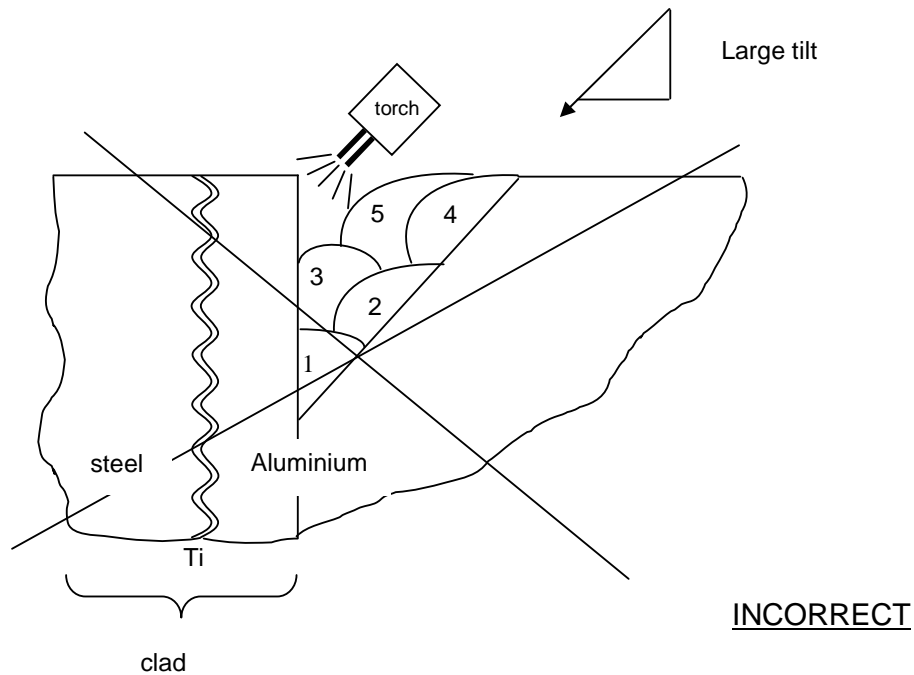
Aluminum should be perfectly dry and carefully degreased before carrying out welding operations. A brush with stainless steel bristles can be used to clean the parts to be welded. It is also essential to avoid welding in a humid atmosphere.

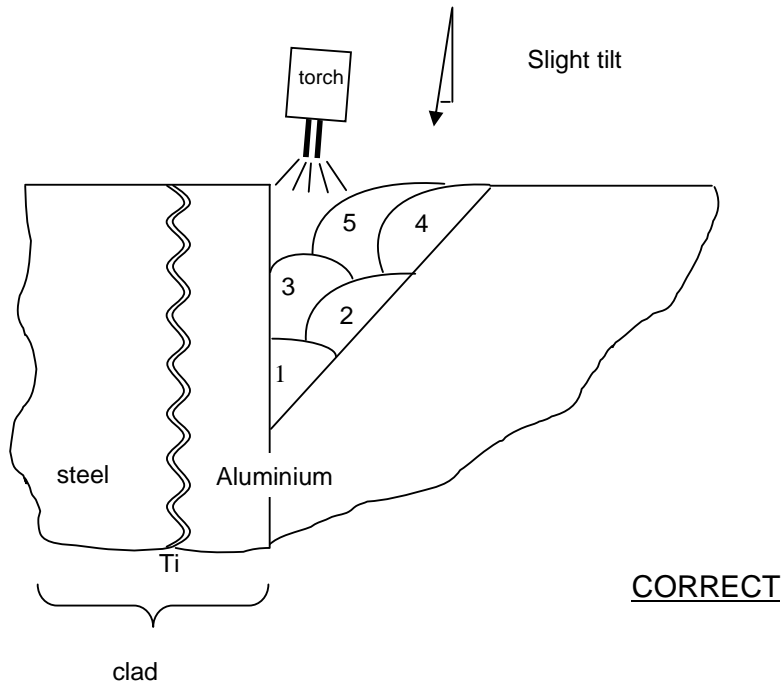
Examples of parameters for MIG welding:

	passes n° 1 to n
Position	flat
Filler metal	Al Si 5 (ER 4043)
Diameter (mm)	1.6
Gas	Pure Argon
Gas flow (l/min)	20/25
Intensity (A)	280-300
Arc stream voltage (V)	27-29
Wire feed Speed (m/min)	4 – 6,6

Perform small straight weld passes, avoiding "scanning". The use of a smaller diameter wire (1.2 mm) will lower the energy input.

We do not recommend to incline the torch in the clad direction to limit the temperature in the clad as shown in figure 5.





**TORCH POSITION**  
*Figure 5*

### 3. **WELDING OF STEEL**

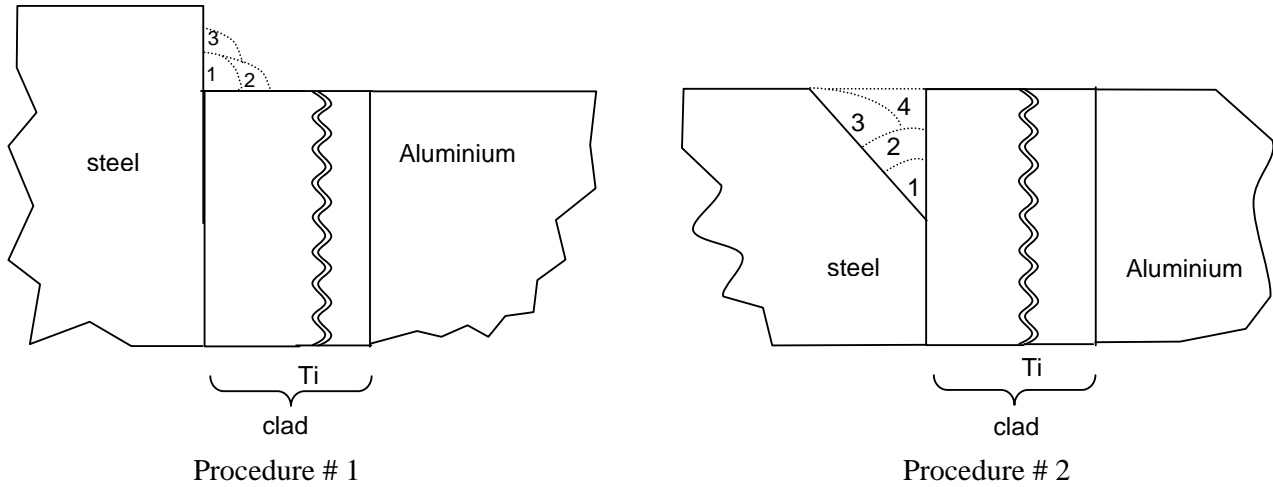
- ① During steel welding, maximum peak temperature should not exceed 500 °C at the interface. It is important to degrease and clean the steel to assure a good weld quality.

The grade of the filler metal must be similar to that of the brackets. Generally speaking, any conventional technique can be used.

For instance, the MIG process with a 1.2 mm wire in steel with a low content of metalloids (carbon, manganese) will provide good results.

	<b>passes n° 1 to n</b>
Position	flat
Diameter (mm)	1.2
Gas	CO <sub>2</sub> welding quality or ATAL (Ar – 18 % CO <sub>2</sub> )
Gas flow (l/min)	18 – 22 l / min
Intensity (A)	220 – 350 A
Arc stream voltage (V)	30 – 32 V

① We recommend to tack weld the joint before welding it. Two procedures are generally used as shown in the following picture.

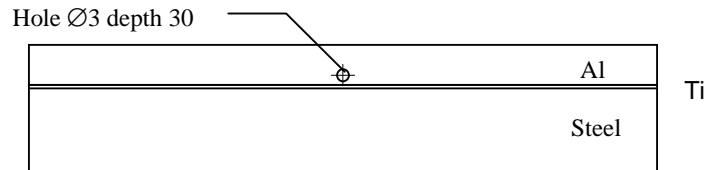


STEEL SIDE WELDING  
 Figure 6

**4. TEMPERATURE CONTROL**

① During welding, manufacturer must monitor the temperature at the interface and ensure that it does not exceed 500°C. Some thermocouples can be put in aluminium and steel as close as possible to the interface (see figure 7).

Whilst adjusting the welding parameters, temperature indicators such as "TEMPILSTIK®" can give a good indication of the temperature reached during welding operations.



EXAMPLE OF DRILLINGS FOR TEMPERATURE CONTROL IN THE ALUMINIUM  
 Figure 7