



**ACCIAIERIE VALBRUNA SpA**

**SURFACE REBAR CONTAMINATION**



This document is based on the results of Tests effected by:



**POLITECNICO DI MILANO**

DIPARTIMENTO DI CHIMICA, MATERIALI ED INGEGNERIA CHIMICA "Giulio NATTA"  
Sezione Chimica Fisica Applicata – Prof. Pietro Pedferri

During handling , transportation, cutting & bending and storage , Stainless steel rebar could show some sign of rust in some part.



Valbruna together with the Italian University Laboratories of Politecnico di Milano has carried out this particular survey of possible contamination problems due to handling, cutting & bending during the fabrication.

The Director of the University , **Dr. Prof. Pietro Pedefferri** made the following considerations:.

### **The effects of surface rusting in Stainless steel rebar .**

The rusting can be found in the rebar surface for two different reasons :

1. Surface contamination due to steel products coming out from cutting , bending , and other operations carried out with steel equipment.
2. Surface corrosion in certain parts without protection in marine environment ( worse if is tropical or marine-industrial).

Point n°1 : The rusting is not coming from stainless steel but from small steel particles in the bar surface after the operations. **The presence of this steel rusting don't affects the corrosion resistance of stainless steel.** As a matter of fact , when the bar is inside the concrete, the alkalinity around the bar, reinforces the passivity condition and has the same behaviour to the stainless steel rebars in the concrete without surface rusting .

To affirm that the use of normal cut and bending machines is not indicated for the stainless steels material its only confusing the users.

The presence of this kind of rust is obviously not conform from an aesthetic and psychological point of view, but it doesn't mean that it decreases the corrosion resistance of stainless steel.

Only in two conditions that are not due to the cutting and bending operations , we can see a decreasing of corrosion resistance to chlorides attack and these are the following:

#### □ **1**

- a) In the case that the operations involves the presence of oxide coloured film ( ex. Tinted zone near the welding line, where the limit content of chloride decrease from the usual one ( between 5 & 8 %) to the critical one around the 3,5 %. ( **P.Pedferri, R. Polder, Corrosion of steel in the concrete Wiley-VCH, Weinheim 2004).**
- b) In the case when crevice corrosion can occur if in the surface there are for any reason crusts or thick stratum of rust, oil or different products that obstruct the oxygen,.

N.B. : The use of carbon wire to tie the stainless steel rebars doesn't produce crevice corrosion. The carbon steel wire could be corroded and the corrosion producing a volume 4-5 times more than the steel could produce local cracks in the concrete. For this reason the use of stainless steel tie is recommended.

## □ 2

In the particular case that the bar's surface is attacked from marine and very aggressive environment in tropical zone without a correct protection.

Having said that that also the most resistant stainless steel to the chlorides (both, austenitic and duplex) with moly and nitrogen, can suffer the localised attack (pitting) above all in the cutting and bending zones. The effects of this attack are some occluded cells where chlorides and acidity increase and the consequence can be the following:

- a) If the corrosion attack is superficial ( means is less than 0,1- 0.2 mm ) when the stainless steel is embedded in the concrete , the passivity of reinforcing is taking place in two three days especially by 316 and Duplex grades). This case is quite normal and can occur when the material has not been protected for some months.
- b) If the attack is not superficial ( means more than 0.1 –0.2 mm), and moreover if the ratio penetration (mm) and surface attack (mm) is high it is not possible to guarantee that after embedding in the concrete the stainless steel bars are able to passive completely their selves after 2-3 months , even if in general this is what is happening

During this period of time it can be supposed a speed reduction of the pitting attack as soon as the chloride value goes down and the Ph increases , the aggressivity in the pit is diminishing (in this particular situation it happens the opposite of what occurs when the pit corrosion starts i.e. auto catalytic effect

Data about a reduction of the PITTING EQUIVALENT RESISTANCE and therefore of the behaviour after many years of stainless reinforcing whit this particular attack do not exist.

**Pietro Pedferri**  
**Milan, 21/05/06**

**Due to this letter the quality dept. of Acciaierie Valbruna suggests to the customers:**

### **shipping & handling**

- All chains and steel bands should not come into direct contact with the stainless steel rebars.
- When carbon steel and stainless steel rebars must be shipped one on top of the other, the stainless steel rebars should be loaded on top and use wooden spacers to separate the two materials.
- Outside storage is acceptable using some covering (nylon or polypropylene) if dry conditions are assured.
- Stainless steel bars should be stored off the ground or shop floor on wooden supports. Stainless should be stored separately from carbon steel rebars.
- Keep carbon steel tools, chains, slings, etc. off stainless steel rebars.
- Do not use carbon steel lifting devices. Use nylon or polypropylene slings.

### fabrication

- Ensure that stainless steel rebar is free of mill scale prior fabrication. If mill scale is present, it should be removed by pickling or abrasive blasting (please consult our office).
- All hand tools should be stainless tools that have not been previously used on carbon steel. Before cutting and bending stainless rebar on the normal equipment it is recommended to clean properly the machine.
- Do not use grinding tools or abrasive cut off discs that have been previously used on carbon steel.
  - Iron pick up/contamination can be removed with pickling paste.
- Excessive thermal oxidation (blueing) caused by cutting with an abrasive cut off disc could be removed with pickling paste. Using a cut off wheel with ample water-cooling will usually avoid this potential problem.
- Shaped rebars are often shipped to the job site in bundles, held together with wire. In the case of stainless steel rebars, the bundling wire should be plastic coated or should be made of stainless steel. Do not use carbon steel ties.
- Particular attention during the placement is required using tie wire in stainless steel.

### Cleaning

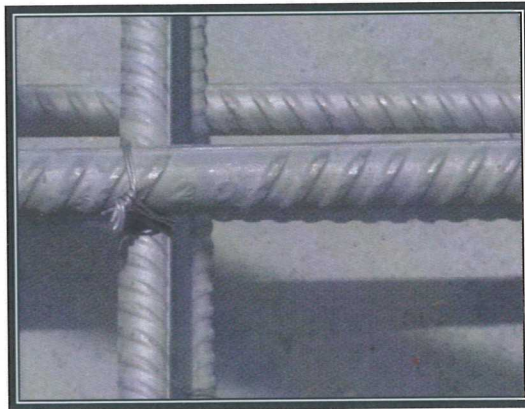
Stainless steel rebars received in the pickled condition, can usually be easily cleaned with a mild soap and water. In some cases a degreaser may be needed. In cases where rusting, iron contamination or weld oxide must be removed, stainless steel brushes can be employed in localized areas. For more general cleaning, stainless steels are often cleaned with a commercial pickling paste.



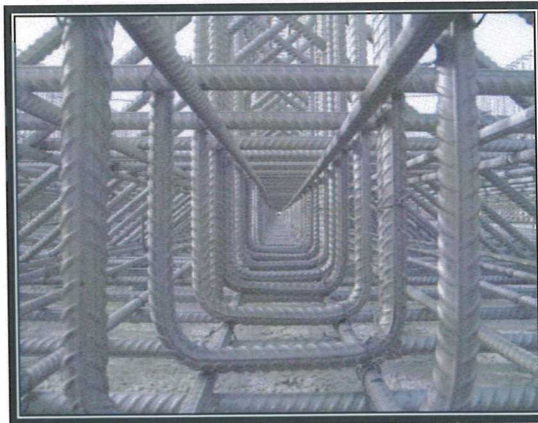
the bending machine must be clean of carbon contamination



stainless steel rebars must be covered with nylon during storage at the job site and wooden/concrete support separate it from the floor



rebars must be hold together with stainless steel tie wire



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