WELDING OF REINFORCING STEEL

Introduction

Vanstone is a precast concrete manufacturing company. Its products are manufactured in factories, where controlled production offers several advantages over site construction, including improved quality control, the use of sophisticated plant and equipment, shorter production times, and greater economy.

As a factory, Vanstone is certified as meeting the requirements of SANS/ISO: 9001: 2015 *Quality Management Systems*.

Products are manufactured in mass or semi-mass production by different production units. For example, reinforcing steel is cut, bent and accurately assembled in the steel workshop before being transported to the casting yard, which may be some distance away. During this process, the reinforcement may be handled, loaded, transported and placed twice.

It is essential that the reinforcing cage retains its shape during handling. Otherwise, it may not fit the casting mould correctly, critical bars may be displaced, and the required concrete cover may not be maintained.

Reinforcing cages assembled solely with fixing wire are suitable for in-situ assembly but are not sufficiently stable for the handling and transportation described above.

The Nature of the Welding

The purpose of fixing reinforcement with wire or welding is solely to maintain the reinforcement in its required position during casting. Once the concrete has hardened, the fixing serves no further purpose.

Welding incurs a cost and is limited to what is necessary to maintain the shape and stability of the reinforcing cage. Welds are consequently limited to spot welds or very short weld runs. Not every touch point is spot-welded but only those necessary to ensure the stability of the cage.

WELDABILITY OF REINFORCING STEEL

Reference:
SANS 920:2011 Edition 2.3, *Steel Bars for Concrete Reinforcement*

When high-strength reinforcing steel was first introduced for reinforced concrete, higher strength was achieved by deforming or cold-forming the steel. Bars with surface ridges were pulled and twisted to produce work hardening and increased yield stress. This process altered the steel's crystal structure.

Reheating the steel allowed the crystal structure to relax towards its original condition. Consequently, these reinforcing bars could not be reheated or welded, as welding would cause localised loss of yield strength.

Cold-formed reinforcing steel bars have not been commercially available for at least 20 years.

Present-Day High-Yield Reinforcing Steel

Modern high-yield reinforcing steel does not rely on cold forming to achieve its strength. Instead, the required yield strength is achieved through the chemical composition of the steel.

Heating the steel does not alter its chemical composition and therefore does not affect its strength.

Provision in SANS 920

SANS 920, Appendix D, permits the welding of high-yield stress steel provided that its carbon equivalent (CE) value does not exceed **0.51%**.

Extract:

Appendix D

Weldability of steel bars

(This appendix does not form part of the requirements of the specification) **Amdt 1**

D.1 Mild steel

A mild steel bar that complies with the applicable requirements of this specification may be considered capable of being welded, provided that the correct welding procedures are followed.

D.2 High yield stress steel

A high yield stress steel bar may only be considered capable of being welded if the carbon equivalent (CE) value does not exceed 0,51 %, where

$$\text{CE } \%(m/m) = \text{C} + \frac{\text{Mn}}{6} + \frac{\text{Cr}+\text{Mo}+\text{V}}{5} + \frac{\text{Ni}+\text{Cu}}{15}$$

and C = carbon content, % (*m/m*)

Mn = manganese content, % (*m/m*)

Cr = chromium content, % (*m/m*)

Mo = molybdenum content, % (*m/m*)

V = vanadium content, % (*m/m*)

Ni = nickel content, % (*m/m*)

Cu = copper content, % (*m/m*)

as determined by means of ladle analysis.

The CE value is regularly tested by steel manufacturers as part of their quality-assurance procedures. The chemical composition and calculated carbon equivalent value (CEV%) are recorded on the relevant Test Certificates (Mill Certificates). Typical values are under 0.40% average and never more than **0.51%.**

Conclusion

In accordance with SANS 920, high-yield stress reinforcing steel may safely be welded, provided that it is purchased from a reputable supplier and the relevant Mill Certificates are regularly checked to confirm compliance with the specified **0.51% maximum CEV**.

Vanstone does this in line with its Quality Management System as certified by SANS/ISO: 9001: 2015.