Steel Reinforcement Institute of Australia

ISSUE No 42/2 June 2016

# COMMON QUESTIONS REGARDING REINFORCEMENT

The SRIA provides a free technical advisory service to designers and specifiers. Some of the common issues raised from these enquiries are included below and we hope that you find the information helpful.

**a) Weldability of reinforcing steels.** Steels conforming to the reinforcement material Standard AS/NZS 4671 are deemed to be weldable under the conditions specified for each class in AS 1554.3-2014 Structural steel welding - Welding of reinforcing steel.

If you do not have third party certification (such as an ACRS Certificate), verify that the reinforcing steel complies with the material standard, otherwise the welding procedures contained in the welding Standard may be inappropriate. This is particularly relevant when sourcing reinforcement from an overseas non-ACRS certified supplier.

**b) Tack welds used for prefabrication of reinforcement.** Tack welds are used to hold parts of weldment in alignment until the final weld is made. Tack welds are permitted on any bent portion of a reinforcing bar. If tack welds are made in accordance with the minimum provisions in Clause 5.6 of AS 1554.3, then tack welds may be left in prefabrications in order to keep reinforcement components in their correct position during handling, transport and lifting. Welds not meeting the minimum criteria, must either be consumed in the final weld, or removed from the bar.

The persons undertaking the welding need to be qualified in accordance with one of the two methods given in Clause 4.12.2 of AS/NZS 1554.3. This is to minimise the risk of the tack weld either undercutting or otherwise forming a stress concentration along the bar. Tack welds require a minimum 4 mm throat and a minimum length equal to the diameter of the smaller bar being welded.

Where welded reinforcing joints need to take structural loads such as the weight of prefabricated reinforcement cages, then these should be designed by a suitably qualified person with broad experience in the design of welding and handling of prefabricated cages. They must not be used for lifting purposes unless prior approval has been obtained from the design engineer.

The AS 3600 reference in Clause 13.2.1(f) is applicable to the types of structural welds required for the splicing of reinforcement. It is generally accepted that these longer runs of welds must be kept clear of bends and not just in situations (as stated in the Clause) where the bars have been 'bent and restraightened'.

**c) Welds in reinforcing mesh.** Mesh is fabricated by resistance welding the longitudinal and transverse ribbed bars. For mesh supplied in sheets, Clause 7.5.7 of AS/NZS 4671-2001 allows up to 1% of welded joints in any sheet to have broken welds provided no more than 50% of broken welds are located on any one bar.

**d) Surface rust on reinforcement.** The bond and anchorage properties of bars and mesh are not detrimentally affected by a light coating of rust which may have formed on the steel surface after normal exposure to the atmosphere. Clause 17.2.4 of AS 3600 states that 'the presence of mill scale or surface rust shall not be cause for rejection of reinforcement' as they will not impair the bond to the concrete or the reinforcements performance in the member.

With the supply of reinforcement in Australia being a 'just-in-time' product, the reinforcement is fabricated and delivered to site when required (to reduce congestion on site) and is therefore generally not exposed to the weather long enough for surface rust to be a problem.

**e) Mill scale on reinforcement.** Mill scale is formed on the surface of hot-rolled reinforcing bars as part of the production process within the hot rolling mill as the high-temperature steel surface oxidizes. Mill scale consists basically of magnetite, $Fe_3O_4$, with a characteristic blue-grey colour. The thin coating (usually less than 0.1mm) is typically removed from the surface during the processing of reinforcement, but if present, does not affect the bond or performance in concrete as stated in Clause 17.2.4 of AS 3600.

**f) Anchorage of reinforcement.** Cogs and hooks at the ends of bars are a common way to provide the necessary anchorage or development length so the bar can develop its yield strength at the face of the support. Cogs and hooks are deemed to provide 50% of the development length of a bar (Clause 13.1.2.6 of AS 3600). Clause 17.2.3.1 of AS 3600 sets out the requirements for bending reinforcement, with Clause 17.2.3.2 providing the minimum diameter of bends and hooks. If the bend radius is equal to or greater than 10 times the bar diameter, then the bar is taken as developing stress around a curve (Clause 13.1.2.5 of AS 3600) rather than the bent end contributing 50% of the development length.

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## SRIA STAFF YOUR REINFORCEMENT SUPPORT TEAM

**Scott Munter – Executive Director**

Scott is a Structural Engineer and represents the SRIA by presenting conference papers in specialty areas of steel reinforcement and is actively involved in numerous industry forums and bodies.

**Eric Lume – National Engineer**

Eric supports the work of the SRIA by lecturing to future engineers as part of the Tertiary Education Program, publication development, Standards representation, seminars, conferences, technical enquiries and national safety committee.

**Brigitte Bowling – Administration Assistant**

Brigitte is responsible for the day-to-day office administration, enabling the specialised services that SRIA provides to the design and construction industries, academic national Tertiary Education Program and our internal membership services.

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