

AD 365

Welding of shear studs to galvanized steel beams

This Advisory Desk note confirms the advice that shear studs should not be welded to hot-dipped galvanized beams. This advice at first appears to contradict the common practice of through-deck welding of shear studs, as steel decking itself is formed from hot-dipped galvanized steel. It is the purpose of this Advisory Desk Note to clarify why through-deck welding of shear studs is acceptable but welding to galvanized supporting steel beams is not.

Welding shear studs directly to non-galvanized steel beams is normally done using electric arc stud welding involving the drawn-arc process. The power source and the stud welding control system are set to control the amperage and the arc duration, which vary due to the type of stud, stud diameter, and base steel conditions. The welding sequence is to initiate a weld current, then lift the stud, creating an arc and a pool of molten metal, and finally to plunge the stud into the molten pool.

The presence of zinc in the weld pool would be a contaminant that would affect the weld metallurgy, causing brittle welds. Generally, when welding to galvanized material, zinc must therefore either be eliminated locally before welding or the galvanizing removed locally (an expensive option) or the galvanizing must be carried out after the studs are welded to the beam.

In the case of galvanized metal decking, removing zinc from the area of the weld is impractical. However, for through-deck welding of shear studs a modified welding sequence was developed that involves a (lower current) pilot arc to burn off the zinc on the profiled sheet (but see further comments below about health and safety concerns) and then higher current arc is developed to make the stud-to-beam fusion weld through the sheeting. This

sequence prevents the zinc volatilising in the arc drawn between the stud and the beam, thus avoiding gross porosity and fusion defects. The strength of the weld is not prejudiced because the small quantity of zinc present on the decking (typically a total of 275 g/m², half on the top surface and half on the bottom surface) has been burnt off locally.

Steel decking may be specified with a thicker galvanized coating, up to 600 g/m² of zinc, but through-deck welding of shear studs is not recommended for galvanized decking with more than 350 g/m² of zinc coating because of the risk of substandard weld quality.

For galvanized steel beams, the same drawn-arc process cannot be performed because the quantity of zinc will be considerably greater than the quantity present on steel decking. Referring to Table 3 of BS EN ISO 1461:2009, the minimum mean coating thickness for an element greater than 6 mm is 610 g/m². In fact, often the coating is greater than 610 g/m² when the appropriate corrosion class is selected from BS EN ISO 14713-1:2009. It is clear that even with the minimum thickness of the zinc coating, the quantity of zinc present will be much greater than the case where the beam is not galvanized. Therefore shear studs should not be welded to a galvanized steel beam, either through decking or directly.

When carrying out through-deck welding, the fumes from the burnt zinc are a potential health and safety hazard which should be considered. Good ventilation is essential.

Contact: **JA Lucey**
Tel: **01344 636525**
Email: **advisory@steel-sci.com**

New and revised codes & standards

From BSI Updates December 2011 and January 2012

BRITISH STANDARDS

BS 2853:2011

Specification for the testing of steel overhead runway beams for hoist blocks
Supersedes BS 2853:1957

BRITISH STANDARDS REVIEWED AND CONFIRMED

BS 4-1:2005

Structural steel sections. Specification for hot-rolled sections

UPDATED BRITISH STANDARDS

BS EN ISO 5173:2010+A1:2011

Destructive tests on welds in metallic materials. Bend tests
AMENDMENT 1

NEW WORK STARTED

PD 6696-2:2007/A1

Background paper to BS EN 1994-2 and the UK National Annex to BS EN 1994-2. Eurocode 4. Design of composite steel and concrete structures. General rules for bridges

EN 1998-1:2004/A1

Eurocode 8. Design of structures for earthquake resistance. General rules, seismic actions and rules for buildings

EN 10088-1

Stainless steels. List of stainless steels
Will supersede BS EN 10088-1:2005

EN 10088-2

Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes
Will supersede BS EN 10088-2:2005

EN 10088-3

Stainless steels. Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes
Will supersede BS EN 10088-3:2005

EN 10293

Steel castings and forgings. Steel castings for general engineering uses
Will supersede BS EN 10293:2005

CEN EUROPEAN STANDARDS

EN 1090-1:2009+A1:2011

Execution of steel structures and aluminium structures. Requirements for conformity assessment of structural components

DRAFTS FOR PUBLIC COMMENT

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BS EN ISO 18275 Welding consumables. Covered electrodes for manual metal arc welding of high-strength steels. Classification