

CANADIAN SHEET STEEL BUILDING INSTITUTE
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**RECOMMENDATIONS FOR WELDING STEEL DECK
TO OPEN WEB STEEL JOISTS**

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Background

Steel deck is often fastened to open web steel joists (OWSJ) by means of arc spot welding, made by melting through the steel deck from above. Since arc spot welds are usually required to resist wind uplift and horizontal shear forces, it is important that the welds are sufficient in number, properly located and of sound quality.

Properly locating arc spot welds is a condition of erection tolerances and workmanship. Structural steel work is fabricated and erected within specified tolerances; recognition of the possible consequences of these tolerances, by both the installer of the steel deck and the designer/fabricator of the OWSJ, is essential.

The Standard governing arc spot welding of steel deck is CAN/CSA-S136-M89, *Cold Formed Steel Structural Members*. This standard specifies that for an arc spot weld to have recognized structural strength it must have a minimum visible diameter of 12 mm. In practice, however, a visible diameter of 16 to 20 mm would be typical.

The Standard governing the design and erection of the OWSJ is CAN/CSA-S16.1-M89, *Limit States Design of Steel Structures*, which specifies a minimum flat width of the joist chord 5 mm larger than the nominal design dimensions of the connecting arc spot weld. This allows a minimum joist chord flat width of 17 mm using a minimum 12 mm diameter arc spot weld, and a 25 mm chord flat width using a typical 20 mm diameter arc spot weld. S16.1 also permits a maximum sweep for the joist of 1/500th of its length.

Although structures have been erected to the minimum specifications outlined above, there have been instances where the specification of a minimum joist chord flat width coincident with joist sweep have lead to very undesirable field situations. Specifically, holes have been burnt through the deck where the welds have missed the joist chord entirely, or the edges of the joist chord have been damaged where welds have only been partially on the chord.

It should be noted that the S136 and S16.1 provisions for weld sizes and flat chord widths are *minimum* provisions. In order to limit potential problems in the field, the CSSBI has prepared the following specification for the welding of steel deck to open web steel joists which recommends a joist chord flat width in excess of this *minimum*.

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Recommended Specification

The designer/specifier of the building structure should be aware of the interface problems that can be encountered when welding steel deck to OWSJ, and has the obligation to make suitable provision in the design and specification documents prior to tendering. The following recommendations may assist in this regard and help to assure that steel deck and OWSJ construction will perform in service as anticipated.

- OWSJ Size Limits** - Minimum flat width of the top chord surface, where welding contact will be made, shall be 38 mm. (See figure below). Top chord minimum thickness, at point of welding, is 2.5 times the aggregate thickness of the steel deck material to be welded.
- Steel Deck Thickness Limits** - The maximum base steel thickness of the steel deck shall be 2.0 mm for a single sheet, and the aggregate thickness of two sheet plies (i.e. for cellular deck) shall be limited to 2.5 mm. Minimum base steel thickness of the steel deck shall be 0.70 mm.
- Arc Spot Weld Size Limits** - The visible surface diameter of an arc spot weld shall be limited to a minimum of 12 mm and a maximum of 20 mm. The recommended arc spot weld size is 20 mm nominal top diameter.
- Fit-Up** - The steel deck shall be generally in full contact with the joist chord at point of welding, with no gap greater than 1.5 mm and no deleterious material interposed between deck and joist chord. Primer on joist chord is acceptable.
- Welding Procedures** - Selection of welding procedures will be determined by the deck installer based on the site conditions and standard set-up parameters. E6010 or E7018 electrodes are often used when welding to joist chords with a specified yield point of 310 MPa or less and when the ambient temperature is not less than -18°C at the time of welding. E7018 electrodes are often used when welding to joist chords with a specified yield point greater than 310 MPa or whenever the ambient temperature is below -18°C at time of welding. Preheating is not required due to the heat generated by the high amperage necessary.
- Welding Qualifications** - Erection companies must be certified by the Canadian Welding Bureau (CWB) under CSA W47.1 *Certification of Companies for Fusion Welding of Steel Structures*, and welding operators must be qualified by CWB for deck welding.
- Touch-Up** - When steel deck is welded in place, all topside areas where the metallic coating has been destroyed shall be covered by a suitable primer. Touch-up of the burn mark on joist chords is not necessary.

