

Steel Quiz

Steel Quiz, a monthly feature in *Modern Steel Construction*, allows you to test your knowledge of steel design and construction. Answers can generally be found in the *LRFD Manual of Steel Construction*, 2nd edition, but other industry standards are often referenced.

This month's *Steel Quiz* was contributed by the **Tom Schlafly**, Director of Certification, **Charles Carter**, Director of Engineering and Continuing Education, and **Keith Mueller**, Staff Engineer, at AISC, Chicago, IL.

If you or your firm are interested in submitting a Steel Quiz question or column, please contact:

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Questions

1. True or false: UT tends to find linear defect parallel to the surface better than RT but RT finds linear defects perpendicular to the surface better than UT.
2. True or false: All group 4 & 5 shapes and shapes made from plates over 1 ½ inches thick are CVN tested and meet 20 ft lbs at 70 degrees F.
3. Is there a difference between the terms filler metal and weld metal?
4. How are seal welds sized and made?
5. Is steel in older existing structures weldable?
6. The term matching weld metal is used in LRFD Specification Section J2. To what are these weld metals matched, and in

what document are the matching weld metals defined?

7. How are parent-metal discontinuities handled that prohibit UT examination of the weld zone?
8. When welded surfaces are to be painted, what considerations are required?
9. What repair is appropriate for material that is cut too short?
10. In a built-up I-shaped cross-section, how are welds connecting the plates designed?

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Answers

1. True.
2. False: This is a requirement only for these shapes that are subject to primary tension stresses and must be specified by the engineer.
3. Yes, although it's a somewhat esoteric one. Filler metal is the product sold by the manufacturer used to make a weld. Weld metal is what's in place after the filler metal has been melted to form the joint.
4. Seal welds are sometimes made to provide a water- or air-tight joint that otherwise would not be. In building construction, seal welded joints are rarely required to withstand internal pressures as would be common in steel tanks and piping circuits. Consequently, they can be sized for any load transfer requirements or from minimum size requirements in AWS D1.1. In most case, seal welds commonly assume a fillet weld profile. Any aesthetic requirements for seal welds should be specified in the contract documents.
5. Possibly. If the chemical properties of steel to be welded are known, either by valid mill certification or by laboratory sample testing, its weldability can be judged by computing the carbon equivalent value. A more obvious approach would be to examine the existing structure for evidence of original welding. Alternatively, an on-site investigation could be performed to address weld ductility and base-metal hardening. Other factors should also be considered, such as past history of the structure, the nature of the loads, weather conditions, and whether the members to receive welds are loaded.
6. Weld metals are matched to the steel grade being welded. Matching weld metals are specified in AWS D1.1 Table 3.1.
7. Parent metal sometimes contains discontinuities that are within the acceptance criteria but prevent a full examination of a weld under UT inspection. In such cases, the alternate scanning procedures of AWS D1.1 Section 6.26.5.2 should be used. When such procedures still do not allow full examination of the weld, the condition should be reported to the SER for resolution.
8. Some by-products of welding may be detrimental to paint performance and should be removed or neutralized prior to painting. Slag, chemical residue, and spatter compounds other than weld metal that are determined to be incompatible with the coating system should be removed or neutralized. Compatible residue, spatter compounds, and spattered weld metal that cannot be removed by hand scraping need not be removed provided that it is not detrimental to the performance of the structure or paint system.
9. When material is short of the minimum required length, welded splices or deposited weld metal (when applied with appropriate welding procedures and specified material) should be permitted with the approval of the SER.
10. Assuming that continuous fillet welds are used, the welds may be minimum size per AISC LRFD Specification Table J2.4 (fillet welds) if the member is subjected only to axial compression or tension. If the member is subjected to flexure, the shear flow (kips/in.) can be calculated from the beam shear V_u as $V_u Q/I$ and the weld sized to provide for this required strength; Q is the first moment about the neutral axis of the flange area, and I is the moment of inertia of the entire cross-section.