

steel quiz

The answers to this month's Steel Quiz can be found in AISC Design Guide 27 as well as on the AISC and *Modern Steel Construction* websites (www.aisc.org and www.modernsteel.com). And for more on DG 27, see "A New Guide for Stainless" in the December 2013 issue.

- 1 How much does the coefficient of thermal expansion for austenitic stainless steel differ from that for carbon steel?
 - a) 10% higher
 - b) 20% lower
 - c) 30% higher
 - d) 40% lower
- 2 True or False: Stainless steels for structural applications are generally austenitic.
- 3 True or False: When welding stainless steel, the welder does not need to be qualified to weld stainless if they are qualified to weld carbon steel.
- 4 The properties of cast stainless steels differ from their rolled versions. For example, austenitic stainless steel castings may be slightly _____.
 - a) Deformed
 - b) Blue in color
 - c) Magnetic
- 5 True or False: There is not a specific welding code for welding carbon steel to stainless steel.
- 6 The "L" designation in the material (such as 304L, 316L, etc.) stands for _____.
 - a) Low-carbon
 - b) Lite (contains less nickel)
 - c) Less ductile
 - d) Low-chromium
- 7 True or False: When designing with stainless steels, the material test report yield and tensile strengths are used.
- 8 True or False: Austenitic stainless steels can exhibit high-impact toughness.
- 9 Plastic analysis of frames is _____ stainless steel.
 - a) not applicable to
 - b) applicable to
- 10 True or False: Even stainless steels may be subject to various forms of corrosion under certain circumstances.

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ANSWERS

- 1 c) The coefficient of thermal expansion for austenitic stainless steels is about 30% higher than that for carbon steel. Where carbon steel and austenitic stainless steel are used together, the effects of differential thermal expansion coefficients should be considered in design.
- 2 True. Structural applications that use stainless steel require a combination of good strength, corrosion resistance, formability (this includes the ability to make tighter bends), field and shop weldability and elongation. The austenitic stainless steels provide these combined qualities.
- 3 False. Stainless weld metals run differently than carbon or low-alloy steel weld metals. The welder should be qualified by welding using a stainless wire of the same F number that they will use in production. AWS D1.6 provides qualification information for both the welder and the welding procedure.
- 4 c) Magnetic. Austenite is soft, ductile and nonmagnetic, while ferrite is harder, less ductile and magnetic. Austenitic stainless steel castings may contain higher levels of ferrite than rolled products, increasing magnetism. The additional ferrite also contributes to increased strength, increased resistance to stress corrosion cracking, less severe consequences of intergranular corrosion, and increased resistance to cracking during welding and casting (see www.stainlessfoundry.com/magnetic.asp).
- 5 True. Welding carbon steel to carbon steel has one set of requirements, which are covered by the AWS D1.1 welding code. Welding stainless steel to stainless steel has a separate set of requirements, which are covered in the AWS D1.6 welding code. No AWS document covers the mixing of products directly; however, there is some discussion of this topic in the Commentary to AWS D1.6.
- 6 a) The "L" in the designation indicates a low-carbon version with reduced risk of sensitization (of chromium carbide precipitation) and of intergranular corrosion in heat affected zones of welds.
- 7 False. It is recommended that the specified minimum yield stress, F_y , and the specified minimum tensile strength, F_u , be taken as the minimum values specified in the relevant ASTM standard, just as with carbon steels.
- 8 True: Even at low temperatures, austenitic stainless steels behave well. Often, they are used for cryogenic applications and can demonstrate impact toughness well above 74 ft-lb (100 J) at $-320\text{ }^\circ\text{F}$ ($-196\text{ }^\circ\text{C}$).
- 9 a) Plastic analysis of frames is not applicable to stainless steel due to a lack of research in this area.
- 10 True. However, good design and proper stainless steel selection provides suitable performance.