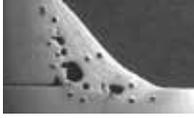


steel quiz

Most of the answers to this month's Steel Quiz can be found in the AISC *Specification*, AISC *Steel Construction Manual* and AISC *Steel Design Guides*, as well as on the AISC and *Modern Steel Construction* websites, www.aisc.org and www.modernsteel.com.

1 Which welding defect is depicted in the figure below?



- a) Porosity
- b) Base Metal Discontinuity
- c) Spatter
- d) Inclusions

2 True/False: Fins, scabs, seams and laps are all terms that describe base metal discontinuities located in the heat-affected zone of the weld and result from fabrication operations.

3 Weld _____ is the amount of a groove weld that extends beyond the surface of a plate or weldment.

4 True/False: Excessive misalignment is a defect.

5 Which of the following terms describes the condition that results when the molten weld metal does not fuse with the base metal or with previously deposited weld passes?

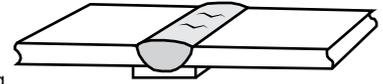
- a) Incomplete Fusion
- b) Inadequate Joint Penetration
- c) Cracks
- d) None of the Above

6 True/False: A discontinuity is an interruption in the physical consistency of a welded part.

7 When a discontinuity, by nature or accumulated effect, can render a part or product unable to meet minimum applicable acceptance standards or specifications, it is called a _____.

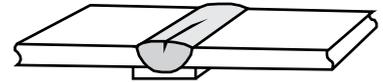
8 The picture below shows what type of welding crack?

- a) Transverse
- b) Centerline
- c) HAZ
- d) Lamellar Tearing



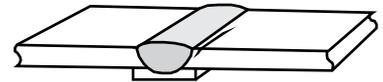
9 The picture below shows what type of welding crack?

- a) Transverse
- b) Centerline
- c) HAZ
- d) Lamellar Tearing



10 The picture below shows what type of welding crack?

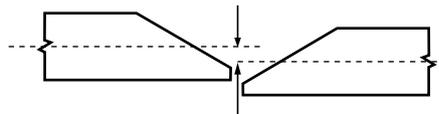
- a) Transverse
- b) Centerline
- c) HAZ
- d) Lamellar Tear



TURN PAGE FOR ANSWERS

- 1 a) Porosity is caused by gases trapped in the molten weld metal, which creates volumetric voids. It can be avoided by welding on clean substrate with uncontaminated consumables. You get bonus points if you also noticed the lack of fusion at the root and the crack.
- 2 False. These discontinuities are located on the surface of the steel and result from mill rolling. Routine handling during fabrication may cause these surface irregularities to be revealed. Additionally, thermal cutting, preheating and welding may cause them to open up. Grinding may reveal imperfections that were hidden by mill scale.
- 3 The missing term is *reinforcement*. The weld surface profile is affected by position, amperage and speed of welding. The figure defining acceptable weld profiles was revised in the 2010 AWS D1.1 welding code (see AWS D1.1-10 Figure 5.4).

- 4 True. A misalignment of 10% of the thinner member is the limit permitted by AWS D1.1 for butt joints in plate (see clause 5.22.3).



- 5 a) Incomplete fusion, also called lack-of-fusion, is a planar discontinuity. The most common cause is the use of improper welding parameters. It also may be caused by welding on materials with excessive mill scale or by an improperly selected or improperly prepared weld joint detail.
- 6 True. A discontinuity is an interruption of the typical structure of a material, such as in its mechanical, metallurgical, or physical characteristics. Examples of discontinuities include cracks, seams, laps, porosity and inclusions. Discontinuities may or may not be considered defects. Some weld discontinuities, such as porosity, have acceptable limits. In

the case of cracking, however, AWS D1.1 permits none.

- 7 The missing term is *defect*. A defect is an excessive condition, outside the acceptance limits of deviations. Defects are not acceptable.
- 8 a) A transverse crack occurs perpendicular to the axis of the weld, generally in weld metal that is high in strength, and is driven by excessive hydrogen, a susceptible microstructure and applied or residual stresses. See Chapter 5 in *AISC Steel Design Guide 21* for causes and solutions to weld cracking.
- 9 b) A centerline crack results from one of three phenomena: segregation, the bead shape or the surface profile.
- 10 c) A HAZ crack is characterized by separation that occurs in the region immediately adjacent to the weld bead. It typically results from a level of hydrogen, a susceptible HAZ microstructure and applied or residual stresses.