Q: The AWS C3.2M/C3.2:2008, Standard Methods for Evaluating the Strength of Brazed Joints, does not contain a method or any information about measuring yield strength and elongation of lap brazed joints. However, evaluation of ductility and elongation is often needed in practice, for example, to compare with mechanical characteristics of a base metal. If you use such measurements in your work, can you please recommend an approach for mechanical testing, or at least technical information about how to evaluate the ductility of lap joints in industrial applications?

A: Very little information is published about testing the ductility of lap brazed joints, and no standards exist yet. However, some companies and certified labs have experience in testing the yield strength and elongation of lap brazed joints. Below, I will describe one of the existing approaches to characterize ductility of lap joints that has been used by our company for many years.

Design of testing specimens is the same as the standard single-lap brazed specimen according to Fig. 5 of the above-mentioned AWS standard C3.2M/C3.2:2008. Standard overall length of the specimen, 8 in. (~203 mm), is more than enough for installation of an extensometer fixed sym-

![Diagram of test setup.](image1)

Fig. 1 — Setup of a tested single-lap brazed joint (carbon steel brazed by BAg-24 filler metal) in the grips of a tension testing machine with the extensometer fixed on the tested specimen.

![Diagram of loading-displacement.](image2)

**Fig. 2** — The loading-displacement diagram of a steel lap joint brazed by BAg-24 filler metal.

![Diagram of yield point and shear strength.](image3)

**Fig. 3** — The loading-displacement diagram of a Titanium Grade 2 lap joint brazed by B11-5 amorphous foil.

![Diagram of another test setup.](image4)

**Fig. 4** — The loading-displacement diagram of a Titanium Grade 5 lap joint brazed by B11-5 powder.
metrically according to the lap brazed joint to be tested — Fig. 1. As we can see, the extensometer is measuring elongation of the brazed joint together with a part of the base metal on two sides of the joint because the base of the extensometer is longer than the overlap of the brazed joint. However, there is no other way to fix an extensometer on the brazed specimen. Sometimes, we use the overall length 5 in. (125 mm) instead of 8 in. to increase the rigidity of the specimen and diminish the influence of ductility on the base metal.

The overlap size and the width of the specimen are uploaded to the controller of the testing machine. The resulting loading-displacement diagram is shown in Fig. 2. The extensometer software recalculates data for peak stress (shear strength of brazed joint), yield stress (yield strength), and elongation.

The approximate value of a yield strength can be found on a loading-displacement diagram without the application of the extensometer, upon the pattern of a recorded curve — Fig. 3. A point, where the loading-displacement curve changes its direction after the strait (elastic) deformation, can be taken as the yield strength of the brazed specimen. This type of loading-displacement diagram testifies that mechanical behavior of the tested lap-joint specimen is ductile.

If the diagram pattern does not have such a point after the elastic deformation of the brazed specimen (Fig. 4), we can consider the mechanical behavior of a brazed joint as brittle.

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Readers are requested to email their questions for use in this column to the authors, cweill@aws.org or send to their attention at Welding Journal, 8669 NW 36 St. #130, Miami, FL 33166.

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Your brazing question may be chosen for this bimonthly column and help other individuals better understand how to solve a particular problem.

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