Q: Should I specify the size of braze fillets on the production drawings I am making, as shown in my copy of AWS A2.4:2007, Standard Symbols for Welding, Brazing, and Nondestructive Examination? How else could I control the size of the braze fillet to keep the filler metal from spreading onto critical surfaces that must be kept free of filler metal? I don’t want it to interfere with our production fitups.

A: This is a good question, and one that needs to be carefully answered, because a mistake here can cost your company a lot of money in wasted time and scrap. Your letter further specified that you were using the 2007 edition of AWS A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination, as shown in Fig. 1.

You then referenced Fig. 49, shown on page 89 of that standard (labeled Fig. 51 on page 93 of the 2012 edition) — Fig. 2.

First of all, it is very important to remember that once a braze-fillet size is specified on a drawing, it must be inspected and measured to verify compliance. Is this something you really want to do? This can be time consuming and expensive.

To anyone who is somewhat new to the world of brazing, it might be assumed after reviewing the information in A2.4 shown in Fig. 2 that it is proper (and even desirable) to always dimension any braze fillets shown on drawings. However, when I spoke a number of years ago to one of the key people at AWS who put this information into the document, that person told me the braze-fillet dimensioning information shown in A2.4 was not intended as an effort to get people to start dimensioning braze fillets. Instead, the information in A2.4 was put there to guide readers in the correct methods for such dimensioning if someone wanted to know how to properly dimension a braze fillet, or if they were required to show such dimensions on a drawing, for whatever
reason. And I stress the "if" — thus, the information was presented if someone needed, or was required, to dimension a braze fillet.

Another question you need to ask if you are using AWS A2.4 is this: "Are the braze-fillet dimensions shown in A2.4 merely a general value, as a suggested guideline, or would you need to treat the dimension shown as always having a min/max tied to it?" You will have to determine that ahead of time, and specify it clearly on your drawings.

**The Difficulty with Dimensioning**

For example, what would happen if you were to treat the fillet size as a dimension with a min/max value attached to it, and a braze fillet turned
out to be a bit smaller than the allowed min/max range? If properly handled, that component would need to be sent back to the brazing department, where additional braze filler metal (BFM) would be applied to meet the minimum required fillet dimensions. But, what if it is determined after that rebrase that the added BFM increased the dimension of the braze fillet so that it was larger than the maximum allowed by the drawing? The excess would have to be ground away to bring the fillet size into the range allowed by the drawing. That’s a lot of extra work, in addition to all the time it would take to develop an effective “fillet-measuring tool,” and the time it would take to measure each of the braze fillets that the drawing requires you to measure, etc. All this work can be a very real consequence of not properly understanding the actual intent of the information given in AWS A2.4 regarding braze-fillet dimensioning.

Here is another interesting question that would need to be addressed: Does this dimensioned fillet apply to all parts manufactured to this drawing, or only to those parts involved in qualification/approval of the drawing and approval of those initial preproduction parts? If it applies to 100% of the parts being subsequently produced, then that is a lot of inspection work that would be required as part of your production costs. But, if it only applies to initial preproduction qualification parts, then how are fillet sizes to be controlled when regular production begins? And if dimensional inspection of fillets will only apply on an acceptable quality limit basis in your regular production, what would happen if I, as an outside auditor, came into your plant and took some random parts from your production line and found that the fillets didn’t meet the specified drawing dimensions? Does that mean that I should just let them go, or reject parts that don’t meet those fillet dimensions? If I let them go, then what was the real purpose and value of that fillet dimensioning in the first place?

**Other Ways to Control Brazing Filler Metal**

Here is an important question: Is there an alternative to specifying the fillet dimensions on a drawing if you feel you need to control the amount of BFM in that fillet, for whatever reason? Yes, there are some good alternatives, such as that shown in Fig. 3.

Notice the brazed joint is next to a critical threaded hole in this theoretical assembly. Yes, it is important to control the amount of BFM in that fillet so that molten BFM will not flow into the threaded hole and ruin the part.

So, how can we control this situation? Should there be a drawing note specifying the maximum allowable size of the fillet, or should the drawing note merely try to control the effect of the molten BFM?

My recommendation is to use the drawing note to control the effect of the BFM. Thus, you might simply state in a drawing note (with an arrow pointing to the threaded hole on the component being brazed in Fig. 3): “No BFM is allowed in this location.” Or use any other similar wording that does not specify a braze-fillet size as a way to achieve this, but instead merely specifies which areas on the parts need to be free of any BFM flow.

Remember that braze fillets are just the natural outcome of the brazing process, and merely give an observer physical evidence that a joint has been brazed. Thus, the actual size (dimension) of a braze fillet is not sufficiently controllable that one can specify its dimensions accurately on a drawing. Molten BFM will flow in different directions when pulled by gravity, by heat, etc.

It is important to remember that all the goodness of a brazed joint is found inside the brazed joint between the faying surfaces (i.e., the inside surfaces of the joint). It is the filling of the capillary space between the closely fitted faying surfaces that will provide joint strength, leak tightness (hermeticity), and fatigue resistance. The fillet (meniscus) on the outside of a brazed joint has little, if anything, to do with overall joint integrity.

**Proper Wording for Brazing Fillet Callout on Drawings**

Therefore, rather than dimensioning a braze fillet, a good drawing note might be: “There shall be evidence of braze filler metal at all edges of a brazed joint.” That’s all. No dimensions; just a statement that the braze fillet (meniscus) shall be visible all around the joint. Keep the fillet small. Remember, all the good things about a braze joint happen inside the joint, not in any external fillets (which are obviously on the outside of the joint).

Additionally, if you are concerned about the effect of molten BFM flowing onto surfaces where it shouldn’t be, you can add a drawing note, as mentioned earlier, that says: “No BFM allowed on this surface,” or “No BFM allowed in this area,” etc.

**Conclusion**

I have never actually found, in my 45 years of working in the brazing industry, a situation in which it was absolutely necessary that the braze fillets be dimensioned. So my comment to the reader is: “No, I do not think it is wise to dimension braze fillets.” However, I’m always willing to learn, and if someone can show me an actual situation where dimensioning of fillets is truly beneficial, or is the only way to effectively control a braze fillet, for whatever reason, I’d like to see it.

---

This column is written sequentially by TIM P. HIRTHE, ALEXANDER E. SHAPIRO, and DAN KAY. Hirthe and Shapiro are members of and Kay is an advisor to the C3 Committee on Brazing and Soldering. All three have contributed to the 5th edition of AWS Brazing Handbook.

Kay (Dan@kaybrazing.com), with 40 years of experience in the industry, operates his own brazing training and consulting business.

Readers are requested to post their questions for use in this column on the Brazing Forum section of the BSMC website brazingandsoldering.com.
TOUGH GEAR FOR TOUGH WORK

From now until June 30, 2016 you can earn Carhartt® gear when you buy Weiler Bonded Abrasives. Weiler’s Cutting and Grinding wheels get the most demanding jobs done right, and done fast. Our high quality lineup helps Welding & Fabrication professionals select the best solution for the toughest jobs. Whether you’re looking for serious stock removal, beveling, grinding, notching, facing, cutting or edge softening, Weiler will get it done.

Learn how to earn your Carhartt gear at WeilerRebates.com

800.835.9999 / weilercorp.com
For Info, go to www.aws.org/ad-index