steelwise

THE NEW GROOVE WELD SYMBOL

BY THOMAS J. SCHLAFLY

For years the groove weld symbol dictated too much, in some cases, by mandating complete joint penetration; now designers have options.

REMEMBER THE KODAK INSTAMATIC? It had one-button operation, no adjustments, and enabled anyone to take pretty good photographs. Today's cameras, and other gadgets, offer similarly simple operation, despite the complexity of the underlying technology.

As we have grown more knowledgeable about the controls of the electronic gadgets we buy, it has become apparent that when we buy one with a simple control, one button can establish many functions in a setting that the designer thought would be suitable to the primary use of the device. If we buy a gadget with a complex set of controls, we have the options to set individual functions to suit our use of the device, but then we have decisions to make. It is often the case that devices for amateurs are designed to be simple, where similar devices for professionals are designed to give the user the ability to use the talent and knowledge of the profession—not simple.

In welding there is a symbol that for years combined "settings" in a way that eliminated options that professionals should have had at their disposal. Recently, it has been changed to allow those options and has been made very slightly more complex for those who want the results of the old symbol. We are talking about the groove weld symbol, and those who want the results of the old symbol now must add three letters to the symbol.

Stating the past and current AWS code requirements as succinctly as possible:

- Prior to 2008, AWS D1.1 stated that the groove weld symbol with no tail note shown on a design drawing meant a complete joint penetration groove weld was required.
- From 2008 on, AWS D1.1 states that the groove weld symbol with no tail note shown on a design drawing means the strength of the connected part has to be developed in tension and shear. If the engineer intends to require a complete joint penetration (CJP) groove weld, the letters "CJP" are to be shown in the tail of the symbol.

This is still a very simple rule, yet it permits some desirable options. It does not permit unconservative welds. For example, butt joints connecting equal-thickness members can only be developed in accordance with the AWS D1.1 code using complete joint penetration groove welds. Therefore, the change in the meaning of the symbol has no effect on these types of connections. This is because the only alternative to CJP is the use of partial joint penetration (PJP) groove welds and PJP groove welds have reduced effective throats and may have reduced available strength. The code does not permit qualification of a weld detail that does not achieve a full thickness weld to be designed for the full strength of the connected part.

The new groove weld symbol gives the designer more control over the joint detail without sacrificing the science.

Corner and T joints, on the other hand, offer alternatives to CJP groove welds that may be efficient and still provide the strength to resist any load the connected part can impose on the weld. For the relatively small parts that form the large majority of connections, such as single-plate shear connections, fillet welds on both sides of the connected part are routinely designed to exceed the strength of the plate. When those plates are skewed, an appropriate combination of fillet welds and PJP groove welds easily accomplishes that goal. In other applications, a fillet weld on top of a PJP groove weld can be efficient. This can be true where the PJP groove weld is made in the horizontal position and the fillet weld is an unavoidable byproduct

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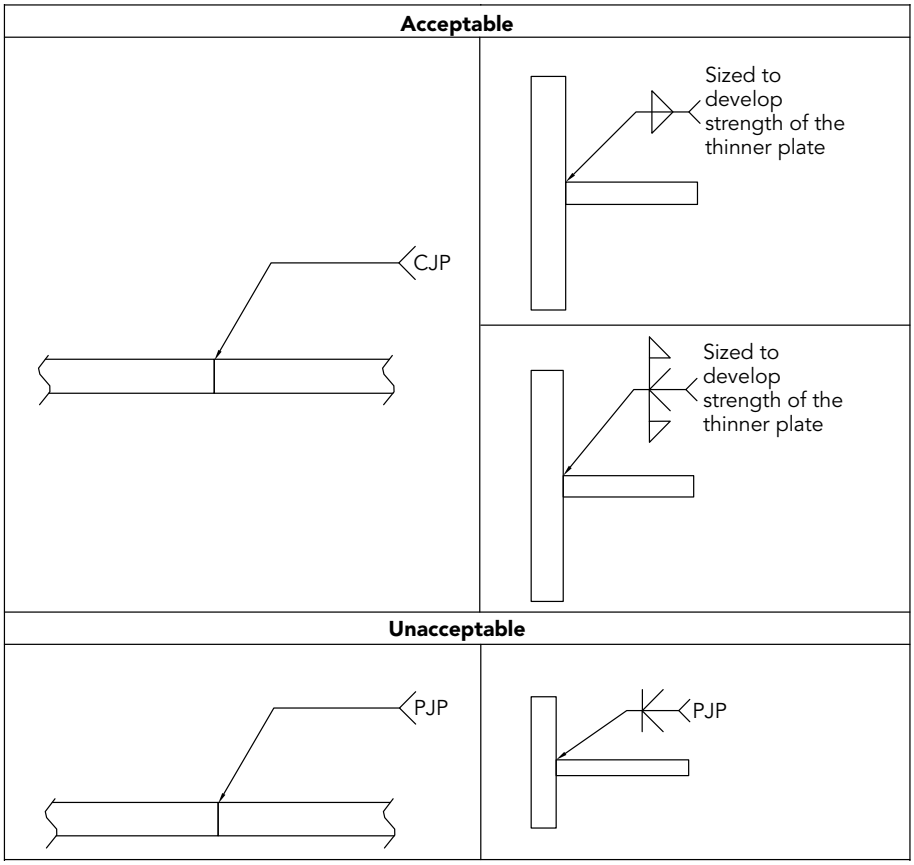

Acceptable and unacceptable applications of the groove weld symbol.

of the weld procedure. The welder cannot avoid building the weld beyond the vertical face of the part but this "extra" weld can be counted in the weld strength determination.

One of the "settings" that is grouped with the decision to use CJP groove welds can be the need for nondestructive examination. The revised symbol permits reduction of NDE where it previously has been an automatic byproduct of the use of the groove weld symbol.

There certainly are places where CJP groove welds are the appropriate choice. Some have complained that this change will permit potentially non-conservative results, and that this change will permit joints that do not develop the strength of the parts. That is not true if the code is followed. If the code is not followed, there is no symbol that will correct the problem.

The accompanying figure shows two common types of welded joints, a butt joint and a T joint. The upper sketches show acceptable applications of the groove weld symbol; it cannot be used as shown in the the lower two sketches. As previously discussed, the PJP groove weld shown for the butt joint is unacceptable because the PJP groove weld does not develop the tensile and shear strength of the connected members.

Consider a corner joint, or T joint, joining two members that are not the same thickness. The old groove weld symbol would have forced the fabricator to prepare the connected parts and provide a CJP weld. The new, more versatile, groove weld symbol gives flexibility to the designer and options for the fabricator.

One of the acceptable applications for the T joint, as shown in the figure, is a fillet weld sized appropriately to develop the strength of the thinner part. Assuming the required fillet weld size is practical (e.g., leg size less than or equal to approximately ½ in.), this option provides for a much more economical connection relative to a CJP groove weld, and eliminates the need for NDE. Where the required fillet weld size is impractical (e.g., leg size greater than approximately ½ in.), it may be more economical to provide a CJP groove weld. Herein lies the real power of the new groove weld symbol; there are options.

Just as a more sophisticated camera gives the photographer more control over shutter speed and focus without sacrificing the art, the new groove weld symbol gives the designer more control over the joint detail without sacrificing the science. MSC