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Recommended Practices for Stud Welding

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Recommended Practices for Stud Welding

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Abstract

These recommended practices for stud welding, prepared by the Subcommittee on Stud Welding of the AWS Committee on Arc Welding and Cutting, are intended to serve as a basic guide for those interested in attaching fasteners by arc and capacitor discharge stud welding.

The variations of the process, stud design, equipment, welding procedures, quality control, and safety precautions are discussed. The information presented will guide the designer and the shop in the utilization of studs in many fields including automotive manufacture, boiler and building construction, farm and industrial equipment, railroads and shipbuilding, aircraft and aerospace, metal furniture, and other metal working industries.

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1. Process Description

Stud welding is a general term for joining a metal stud or similar part to a workpiece.[1] Welding can be done by a number of welding processes including arc, resistance, friction, and percussion. The arc stud welding process (SW), including capacitor discharge methods, will be covered in this document.

In arc stud welding, the base (end) of the stud is joined to the other work part by heating them with an arc drawn between the two. When the surfaces to be joined are properly heated, they are brought together under pressure. Stud welding guns are used to hold the studs and move them in proper sequence during welding. There are two basic power supplies used to create the arc for welding studs. One type uses dc power sources similar to those used for shielded metal arc welding. The other type uses a capacitor storage bank to supply the arc power.

The arc stud welding processes using these power sources are commonly known as *arc stud welding* and *capacitor discharge stud welding* respectively.

1.1 Arc Stud Welding. The arc stud welding process involves the same basic principles as any other arc welding process. Application of the process consists of two steps:

(1) Welding heat is developed with an arc between the stud and the plate (work).

(2) The two pieces are brought into intimate contact when the proper temperature is reached.

The equipment consists of the stud gun, a control unit (timing device), studs and ferrules, and an available source of dc welding current. Typical arc stud welding equipment connections are shown in Figures 1A and 1B. The mechanics of the process are illustrated in Figure 2. The stud is loaded into the chuck, the ferrule (also known as an *arc shield*) is placed in position over the end of the stud, and the gun is properly positioned for welding, Figure 2(A). The trigger is then depressed, starting the automatic welding cycle.

A solenoid coil within the body of the gun is energized. This lifts the stud off the work and, at the same time, creates an arc, Figure 2(B). The end of the stud and part of the workpiece are melted by the arc. When the preset arc period is completed, the welding current is automatically shut off and the solenoid de-energized by the control unit. The mainspring of the gun plunges the stud into the molten pool on the work to complete the weld, Figure 2(C). The gun is then lifted from the stud and the ferrule is broken off, Figure 2(D).

The time required to complete a weld varies with the cross-sectional area of the stud. For example, weld time typically would be about 0.13 seconds for a 10 gage (0.134 in. [2.6 mm]) stud, and 0.92 seconds for a 7/8 in. (22 mm) diameter stud. Application rates vary with the size of the stud and other factors such as working conditions. An average rate is approximately six studs per minute, although a rate of fifteen studs per minute is common in many applications.

The equipment involved in stud welding compares with that of manual shielded metal arc welding with regard to portability and ease of operation. The initial cost of such equipment varies with the size of the studs to be welded.

The gun and the control unit are connected to a dc power source. The control unit connections shown in Figure 1 are for power sources designed for secondary interruption, as is the case with motor-generator sets, battery units, and

1. Stud welding is also discussed in the *Welding Handbook*, Vol. 2, 8th Ed., American Welding Society, 1991.