**General Requirements:**

Studs shall be of suitable design for arc welding to steel members with the use of automatically timed stud welding equipment, SMAW, FCAW and GMAW process. Studs which are applied in the flat position to base metals shown in group I and group II materials are prequalified. All other materials and positions require qualification. The type and size of the stud shall be as specified by the drawings and/or specifications. Studs shall be made from cold drawn bar conforming to the requirements of ASTM A 29 or other approved material grades. When welding directly to base metal, the base metal shall be no thinner than 1/3rd diameter of the stud. When welding through deck, the stud diameter shall be no greater than 2.5 times the base material thickness. In no case studs be welded through more than two plies of metal decking. Copies of stud manufacture’s certification shall be kept in project folders.

**Technique/Qualification/Testing**

1. Suds shall be welded with automatically timed stud welding equipment connected to a suitable source power source (DCEN).
2. Welding voltage, current, time and gun settings for lift and plunge should be set at optimum settings, based on practice, recommendations of stud equipment manufacturer, or both.
3. Welding gun shall be held in position without movement until the weld metal has solidified. If two or more stud welding guns are operated suing same power source, they shall be interlocked so that only one gun can operate at the same time.
4. Welding shall not be done when the base metal temperature is below 0ºF or when the surface is wet or exposed to falling rain or snow.
5. When FCAW, GMAW and SMAW process is used, surfaces to be welded and surfaces adjacent to welding shall be free from loose or thick scale, slag, rust, moisture, grease, and other foreign material that would prevent proper welding or produce objectionable fumes. For fillet welds, the base of the stud shall be prepared so that the base of the stud fits against the base metal. When fillet welds are used, minimum size fillet welds shall be used per AWS D1.1, table 7.2. Prior to welding, base metal shall be preheated as per table 3.2. SMAW welding shall be performed using low hydrogen electrodes 5/32” or 3/16” diameter for studs greater than 7/16” diameter.
6. When welding procedure is required prior to production welding, test specimens shall be prepared in accordance with AWS section 7.6.3. A-36 base material can be used when group I and II materials are used in production. For all other materials, use the same base material to be used in production. Ten specimens shall be welded consecutively using the same settings for each diameter, position, and surface geometry.
7. Studs welded for welding procedure qualification shall be tested by alternately bending 30º in opposite directions in a typical test fixture until failure occurs (See AWS D1.1, fig. 7.4). Alternatively, studs may be bent 90º from its original axis. Stud application shall be considered qualified when fracture occurs in the plate or shape material or in the shank of the stud and not in the weld. If torque testing is used, stud application is considered qualified if all the test specimens are torqued to destruction without failure in the weld.
8. Each stud qualification test require data that shall include (1) drawings that show shapes and dimensions of studs and arch shields, (2) complete description of stud and base materials and a description (part number) of the arc shield; (3) welding position and settings (current, time etc).
9. Testing of first two studs shall be performed before production welding is started. If automatic welding machine is used, studs shall exhibit 360º flash with no evidence of undercut into the stud base. When FCAW, GMAW and SMAW process is used, welds shall be in compliance to visual acceptance criteria as shown in AWS D1.1, table 6.9. After welding is cooled, bend two studs to 30º from their original axes by either striking the studs with hammer on the unwelded end or placing a pipe or other suitable hollow device (pipe) over the stud and manually or mechanically bending the stud.
10. Welding operator used to qualify the stud welding procedure is qualified when procedure is successfully performed per items 1-8. If welding operators are required to be qualified, two studs shall be welded and tested in accordance with item 9 above.
11. Welded studs not conforming to the requirements of AWS code, shall be repaired or replaced. Welding procedure shall be revised if necessary.