

**FABRICATOR AND WELDING MACHINE APPROVAL PROCEDURE FOR ULTIMATE
SPLICE RESISTANCE (FLASH) WELDED HOOPS ON
ASTM A706 REINFORCING STEEL**

- I. Supplier provides:
 - A. Quality control procedures for materials and manufacturing process(es). As a minimum, the QC manual shall include the following:
 1. The pre-production procedures for the qualification of materials and equipment.
 2. The methods and frequencies for performing QC procedures during production.
 3. The calibration procedures and calibration frequency for all equipment.
 4. A signed welding procedure for each bar diameter and for each welding machine used. The resistance welding procedure must include:
 - a. Welding machine's model name/number
 - b. Welding machine's serial number
 - c. Name and signature of Quality Manager or person responsible for the quality control of resistance welding
 5. All pertinent information needed to set up the equipment, including:
 - a. Program settings
 - b. Percent heat input
 - c. Cycle time settings
 - d. Any other necessary adjustments required to successfully perform the resistance welding process
 6. A system for the identification and tracking of each lot of materials. Material traceability shall include heat number, lot number and mill certificates. The system shall have provisions for permanently identifying each lot and the parameters during fabrication
 - B. A request to have a Caltrans inspector review and witness the welding procedure once it has been submitted to Caltrans. Contact the Structural Materials Testing Branch.
 - C. For certification/approval purpose of large diameter hoops (greater than 2.5 feet diameter), the hoops shall be resistance welded in the presence of a Caltrans inspector. After welding is completed the inspector shall be responsible for randomly selecting the specimens to be submitted to the Caltrans laboratory. The number of samples to be submitted to the Caltrans laboratory for testing shall be:
 1. 10 resistance welded hoops/partial hoops for each bar size and for each welding machine used. When qualification is requested for a range of bar sizes welded using the same welding machine, samples are only required for the largest, smallest and the #8 bars sizes.
 2. Minimum length required is as follows: 5 ft. for bar #9 or smaller with the weld located at midpoint and 6.5 ft. for bar #10 or larger with the weld located at midpoint.

- D. For certification/approval of small welded hoops (2.5 feet in diameter or smaller), hoops 2.0 feet in diameter shall be resistance welded using bars #7 or #8, in the presence of a Caltrans inspector. After welding is completed, the inspector shall be responsible for randomly selecting the specimens to be submitted to the Caltrans laboratory. Ten (10) whole resistance welded hoops shall be submitted to the Caltrans laboratory for testing.
- E. Ship the specimens along with the required paperwork to Caltrans' Transportation Laboratory in Sacramento:

Division of Materials Engineering And Testing Services – MS #5
Attention: Structural Materials Testing Branch
5900 Folsom Boulevard
Sacramento, CA 95819

II. Caltrans will:

- A. Ensure all required documentation and samples are received.
- B. Review the technical information and corresponding samples provided. Misalignment shall not be greater than allowed by AWS D1.4 Sec 4.2.1.
- C. Perform low cycle fatigue test on four samples per Test Method CT 670. Upon completion of the cycle test, these samples shall undergo tensile test to failure. Samples must not fail at the weld or heat affected zone during the cycle test.
- D. Perform tensile test on four samples per CT 670 method without any fatigue loading. At least six of the eight fatigue and/or tensile tested specimens must:
 - 1. Fail in the reinforcing bar but outside the affected zone, provided that the sample splice has visible necking or
 - 2. Fail anywhere provided that the sample splice has achieved the strain requirement for necking.
 - 3. When tested in conformance with the requirements in California Test 670, "Necking (Option I)," the visible necking shall be such that there is a visible decrease in the sample's cross-sectional area at the point of rupture.
 - 4. When tested in conformance with the requirements in California Test 670, "Necking (Option II)," the strain requirement for necking shall be such that the largest measured strain is not less than 6 percent for No. 11 and larger bars, or not less than 9 percent for No. 10 and smaller bars.
 - 5. In addition, all bars must meet the minimum ASTM A706 Grade 60 mechanical specifications.
 - 6. Brittle failure at points where leads have been connected will be cause for rejection.
- E. Perform Metallographic examination on two samples to determine soundness of the weld. Test results shall meet AWS D1.4 requirements.
- F. Upon evaluation of results from II.A to II.G above, issue a rejection or an acceptance letter valid for two years:

1. When qualification is requested for large diameter hoops in a range of bar sizes and samples are submitted for the largest, smallest and the #8 bars sizes, and the testing is successful, the fabricator will be approved for welding all bar sizes included between the largest and the smallest size tested. Re-testing, in case of failure of any of these bar sizes, will require that specimens from the next in size above and below the failed bar size also be tested. If a re-test fails, each bar size shall be tested. Individual re-testing will be allowed if the specimens fail due to a base metal defect.
 2. When qualification is requested for small diameter hoops and the testing is successful, the fabricator will be approved for flash welding any diameter (small and large) hoops using the bar size tested (#7 or #8) and for the flash welding of rebar hoops of less than 2.5 ft in diameter using any smaller bar size than #7 or #8.
- G. Update the Caltrans Flash Weld Approvals list, if applicable.
- III. For more information, you may contact the Structural Materials Testing Branch at (916) 227-7251.