

**STRSW (Squeeze Type Resistance Spot Welding) Equipment Acceptance  
Criteria for the Collision Repair Industry****1. Scope**

This SAE Recommended Practice provides a minimum standard for evaluating squeeze-type resistance spot welding (STRSW) equipment and minimum weld performance criteria for two-sided automotive collision repair welding. This document contains several standardized test methods that are designed for evaluating equipment performance in a laboratory environment.

**1.1 Purpose**

This SAE Recommended Practice provides manufacturers of STRSW equipment with minimum performance criteria for collision damage repairs. Collision repair centers and related businesses will also benefit by having a guideline for selecting STRSW equipment that meets this minimum performance criteria.

**1.2 Background**

The use of STRSW in the automotive collision repair market has continued to grow. STRSW is being used in the collision repair process to help closely duplicate the appearance and function of the original production welds. The proper performance of STRSW is especially critical during a collision, as the welds play an important role in the structural integrity and energy management of the vehicle.

**2. References****2.1 Applicable Publications**

The following publications form a part of this specification to the extent specified herein.

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**SAE WEB ADDRESS:**

2.1.1 AMERICAN WELDING SOCIETY (AWS) PUBLICATIONS

Available from American Welding Society, PO Box 351040, Miami, FL 33135

AWS D8.7-88—Recommended Practices for Automotive Weld Quality—Resistance Spot Welding.

AWS D8.9-97—Recommended Practices for Test Methods for Evaluating the Resistance Spot Welding Behavior of Automotive Sheet Steels

AWS PARW—The Professional's Advisor on Resistance Welding, American Welding Society

AWS A3.0—Standard Terms and Definitions

2.1.2 RESISTANCE WELDER MANUFACTURERS' ASSOCIATION PUBLICATION

Available from Resistance Welder Manufacturers' Association (RWMA), 1900 Arch Street, Philadelphia, PA 19103-1498.

Resistance Welder Manufacturers' Association—Resistance Welding Manual—December, 1989

**3. Definitions**

For additional welding terms, see AWS A3.0, Standard Welding Terms and Definitions.

**3.1 Button or Weld Button**

That part of a weld, including all or part of the nugget, that tears out in the destructive testing of spot-, seam- or projection-welded specimens.

**3.2 Coupon**

A single, small piece of test material, with specified dimensions, that is used to make up test samples.

**3.3 Faying Surface**

The mating surface of a member that is in contact with or in close proximity to another member to which it is to be joined.

**3.4 Fracture Mode**

The appearance of the weld button after peel testing.

**3.5 Indentation**

In a spot, seam, or projection weld, the depression on the exterior surface of the work pieces.

**3.6 Nugget or Weld Nugget**

The weld metal joining the work pieces in spot-, seam- or projection-welding.

### **3.7 Peel Test**

A destructive test for determining a spot weld's fracture mode and button size. The test involves mechanically separating the lap joint by peeling.

### **3.8 Resistance Spot Welding (RSW)**

A resistance welding process that produces a weld at the faying surfaces of a joint by the heat obtained from resistance to the flow of welding current through the work pieces from electrodes that serve to concentrate the welding current and pressure at the weld area.

### **3.9 Weld Current**

The effective (RMS) welding current of a spot weld that is measured at the secondary side of the welding transformer by an integrating current meter (ammeter).

## **4. Standard Units of Measurements**

### **4.1 Stated Values**

All units in this document are hard metric. Metric was purposely selected for ease of use, because metric is the standard unit of the United States, because automotive companies have converted to metric, and so that the document may be internationally usable. If necessary, conversions of units of measurement shall be performed according to ANSI/AWS A1.1 Metric Practice Guide for the Welding Industry. It is highly recommended that all measurements be made with metric instruments in the application of these test methods. If this is not possible and non-metric instruments are used, it shall be noted on all data and report sheets that non-metric instruments were used and that the values recorded or reported are conversions from non-metric measurements.

## **5. Applicable Sheet Steel for Equipment Testing**

### **5.1 Material Applications**

This Recommended Practice is applicable to resistance spot welding applications of all automotive components fabricated from un-coated (bare) and galvanized (hot-dip, zinc-coated), galvanized (zinc-iron alloy-coated), or electrogalvanized (zinc- or zinc-iron alloy-coated) steel.

### **5.2 Coating Limitations**

The surface of the material at the time of welding should be free of all contaminants such as rust, dirt, paint, sealers, adhesives oils, etc. that would adversely affect weld quality. The use of weld-through primers and sealers is acceptable where the limitations and special requirements imposed by the specific primer or sealer are recognized.

### **5.3 Thickness Requirements**

Sheet metal used for this Recommended Practice is two layers of 1.27 mm (18 gauge) 60/60 electrogalvanized steel (ASTM 591).

**6. Equipment Minimum Requirements**

**6.1** The welder must provide a two-sided weld.

**6.2** The welder must operate from a minimum of 220 volts, single-phase power. Three-phase power is preferred for cabletype welders.

**6.3** The welder must maintain a minimum electrode tip force of 182 kg (401 pounds) with all available arm sets, as measured with a force gauge.

**7. Equipment Performance Requirements**

**7.1 Visual Inspection**

All welds must pass the visual inspection (Reference Para. 7) before being subjected to the destructive tests (Reference para. 8).

**7.2 Destructive Tests**

After passing the visual inspection, all welds must pass the destructive tests (Reference para. 8).

**8. Visual Inspection**

The test welds must pass this visual inspection before they are subjected to the required destructive tests in Section 8.

**8.1 Excessive Indentation**

The depth of depression on sheet surfaces caused by welding electrodes must not exceed 25 percent of the sheet thickness.

**8.2 Distortion**

The base metal must not be distorted to the extent that the face of the weld is more than 30 degrees out of the plane of the metal surface or the sheet is pulled out of line by more than twice its thickness immediately around the weld.

**8.3 Missing and Mislocated Welds**

Welds that are not made at specified locations, or welds that are located outside the tolerance limits are substandard welds.

**9. Destructive Testing**

The test welds must pass these destructive tests to qualify for repairing collision-damaged vehicles.

## 9.1 Duty Cycle Test

The duty cycle test consists of making a series of welds using 6 mm electrode tips on two layers of 1.27 mm (18 gauge) 60/60 electrogalvanized steel (ASTM 591) as shown in Figure 1. The 48 welds must be made continuously, in one direction, within a period of 6 minutes, without redressing the electrode tips. The welds made at locations 12, 24, 36, and 48 must pass the peel test in para. 8.2.

[Show on diagram: peel-test locations 12, 24, 36, and 48; minimum overlap of 30 mm; minimum edge distance of 13 mm to center of welds.]

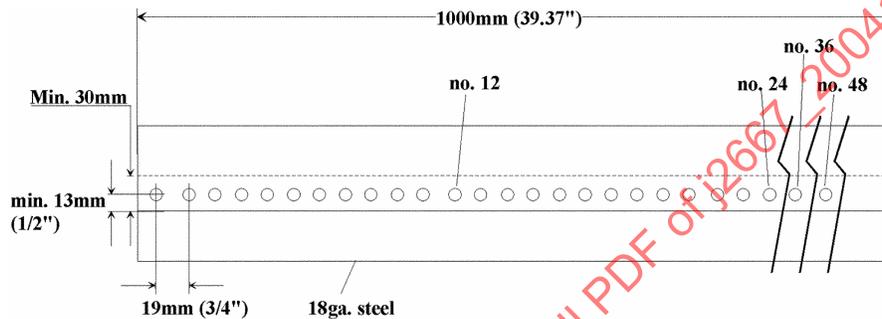
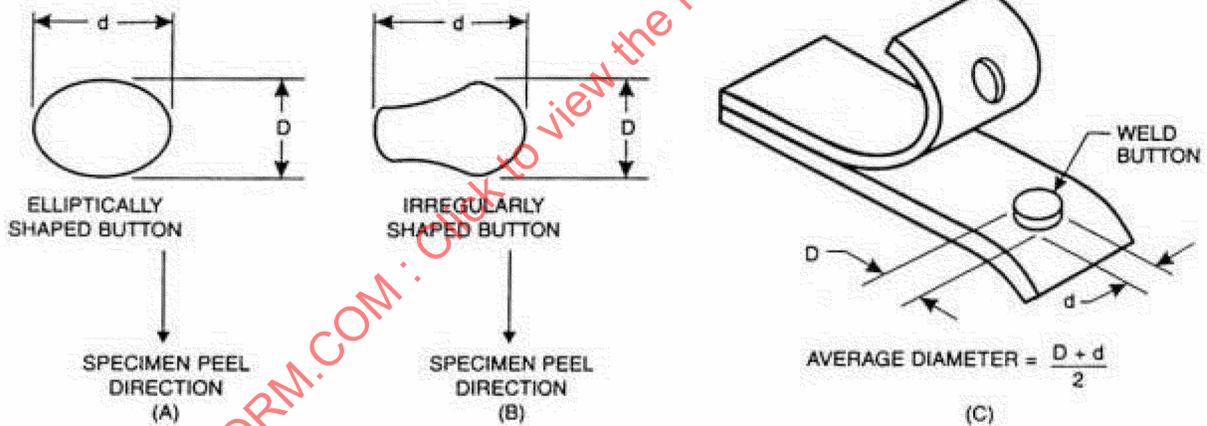
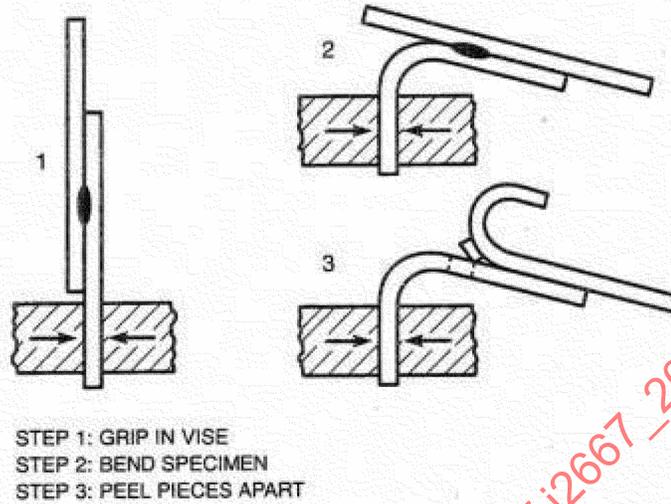


FIGURE 1—DUTY CYCLE TEST LAYOUT

## 9.2 Peel Test

The peel test is performed by completely peeling apart a welded lap joint. Where feasible, the direction of peel should be in the direction of the joint line or line of welds. The average diameter of each of the resultant buttons must be a minimum of 5mm, measured at the faying surface of the weld button. See Figure 2.

NOTE—The 5mm button applies only when welding two layers of 1.27 mm (18 gauge) 60/60 electrogalvanized steel (ASTM 591). Test results will vary when welding other thicknesses or multiple layers of sheet metal.



NOTE: USE KNIFE EDGE DIAL CALIPER TO MEASURE BUTTON SIZE.

FIGURE 2—MEASUREMENT OF A WELD BUTTON RESULTING FROM THE PEEL TEST

### 9.3 Twist Test

The twist test consists of making a weld using 6 mm electrode tips on two layers of 1.27mm (18 gauge) 60/60 electrogalvanized steel (ASTM 591) as shown in the figures below. The weld must create a weld button that has a diameter equal to or larger than 5 mm. (See Figures 3 through 6.)

NOTE—The 5mm button applies only when welding two layers of 1.27 mm (18 gauge) 60/60 electrogalvanized steel (ASTM 591). Test results will vary when welding other thicknesses or multiple layers of sheet metal.

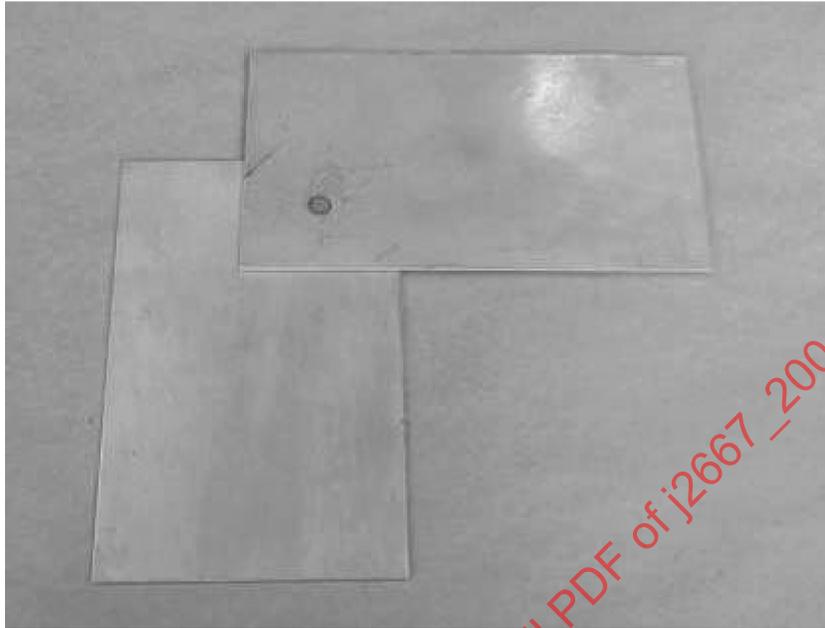


FIGURE 3—TEST COUPON ASSEMBLY AND WELD LOCATIONS FOR TWIST TEST



FIGURE 4—SECURE THE WELDED TEST COUPONS IN A VISE AND TWIST TO SEPARATE THE COUPONS



FIGURE 5—THE TWIST TEST CREATES A TEAROUT HOLE IN ONE COUPON AND A NUGGET ON THE OTHER

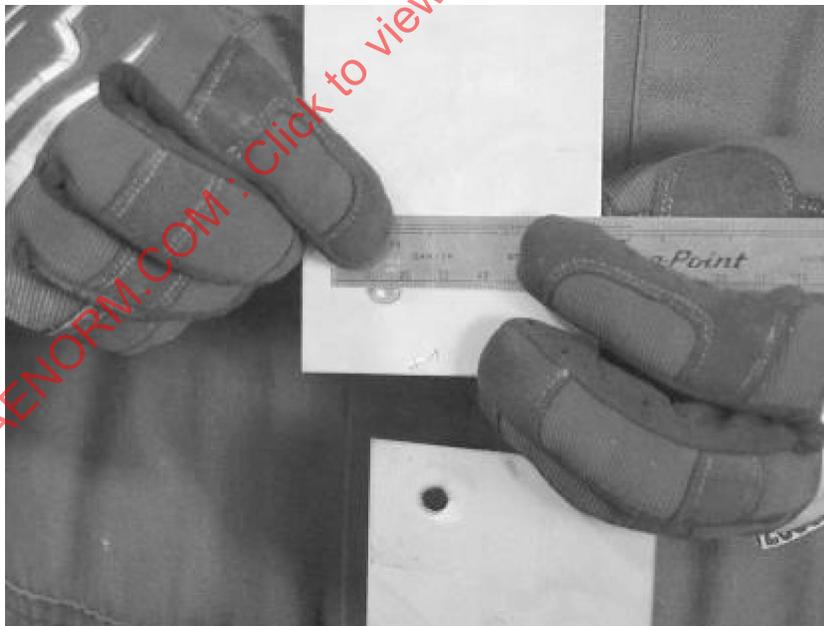


FIGURE 6—THE DIAMETER OF THE WELD NUGGET MUST BE EQUAL TO OR LARGER THAN 5 mm