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Recommended Practices for Test Methods for Evaluating the Resistance Spot Welding Behavior of Automotive Sheet Steel Materials

American Welding Society

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Prepared by
AWS D8 Committee on Automotive Welding

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This document presents recommended practices for evaluating the resistance spot welding behavior of automotive sheet steels. The document contains a number of tests and test methods useful in determining the spot welding performance of coated and uncoated automotive sheet steels of all strength levels and compositions. The test methods are designed to assess current range, electrode endurance, and weld properties of automotive sheet steels. The weld property tests include tests for hold time sensitivity, weld hardness, shear-tension strength, and cross-tension strength. *The document and the test methods, parameters, and test criteria it contains are designed exclusively for laboratory testing and are not intended as recommended practices or standards for manufacturing operations*.

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1. Introduction

1.1 Scope. This document contains several standardized test methods that are designed for evaluating the resistance spot welding behavior of coated and uncoated sheet steels in a laboratory environment. The test procedures allow for standardized testing of automotive sheet steels to determine the following:

(1) The effect of the interaction between a sheet steel's coating (metallic, nonmetallic, or both) and the welding electrodes on electrode deterioration and weld size/quality behavior over an extended number of welds

(2) Current levels and current ranges

(3) Mechanical properties of welds at different weld sizes and hold times

(4) Metallurgical and hardness properties of welds

(5) The effects of sheet lubricants, conductive paints, or other surface treatment on current break-through.

The test methods are intended for application in a laboratory environment to characterize certain aspects of the welding behavior of sheet steel products under highly controlled experimental conditions. **They are not intended to simulate production welding practices or to predict welding performance in production operations.** The test methods and parameters are designed to be used for sheet steels ranging in thickness from 0.6 mm–3.0 mm. The tests may be used for sheet steel materials of all yield strengths typically used in the automotive applications. In the endurance test, a minimum of two tests per material is recommended to obtain an accurate assessment. Replications of the other tests are at the discretion of the user or the specifying party. The specific types and number of tests that are required shall be left to the specifying party. While these test methods were developed to compare the welding behavior of different materials, they can be judiciously applied to evaluate other aspects of welding behavior.

Resistance spot welding behavior is dependent upon a wide variety of interacting material and weld process factors. To obtain repeatable and reproducible performance data, it is imperative that all experimental variables and the way a test is conducted be closely controlled. Therefore, the instructions for the various sampling and testing procedures in this manual are stated in mandatory language (even though this document is classified as a Recommended Practice document), and should be followed as closely as possible. Deviations from the prescribed procedures or test methods, permissible with the consent of the party for whom the testing is performed, have to be noted and reported.

1.2 Safety Precautions. Resistance welding and allied processes can be safely performed with minimum health risks if proper safety procedures and precautions are taken. Remember that:

(1) FUMES AND GASES may be dangerous to your health. Inhalation of fumes should be avoided and adequate ventilation or an exhaust system should be used to remove fumes and gases from the work area.

(2) INFRARED RADIATION (HEAT) can burn. Proper safety attire and suitable gloves should be worn when handling hot samples.

(3) ELECTRIC SHOCK can kill. Live electrical or electronic components must never be touched. Equipment instructions, applicable Material Safety Data Sheets (MSDSs), and the employer's safety practices or Job Safety Analyses (JSAs) should be read and followed.

Safety guidelines, practices, and precautions can be found in the latest edition of ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, published by the American Welding Society (AWS). In addition to ANSI Z49.1, safety guidelines and practices pertaining to resistance welding can be found in the following Safety Fact Sheets published by AWS:

- Fumes and Gases
- Noise
- Chromium and Nickel in Welding Fumes
- Electrical Hazards
- Fire and Explosion Prevention
- Burn Protection