



AEROSPACE MATERIAL SPECIFICATION

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Parallel Gap Welding Microelectronic Interconnections to Thin Film Substrates

RATIONALE

AMS2690D stabilizes this document because this document contains mature technology that is not expected to change and thus no further revisions are anticipated.

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1. SCOPE:

1.1 Purpose:

This specification defines the equipment, procedures, and requirements for joining leads by parallel gap resistance welding.

1.2 Application:

For attaching leads by parallel gap resistance welding in the assembly of micro-electronic circuitry to thin film substrates.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 Standards and Test Methods

2.2 U.S. Government Publications:

Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.2.1 Military Standards:

MIL-STD-794 Parts and Equipment, Procedures for Packaging and Packing of

2.3 AWS Publications:

Available from American Welding Society, P.O. Box 351040, Miami, FL 33135.

2.3.1 AWS A3.0 Welding Terms and Definitions

3. TECHNICAL REQUIREMENTS:

3.1 Welding Machine:

The parallel gap welding machine shall have a controlled source of electrical power and a means of reliably controlling the power and the welding force.

3.2 Electrodes:

Electrodes shall be so designed as to provide a constant cross-section which shall extend not less than 0.010 inch (0.25 mm) above the tip after dressing. Newly installed electrodes shall be dressed to ensure proper alignment with the welding platen or stage. The gap between electrodes may be fixed or adjustable.

- 3.2.1 Electrodes showing evidence of pitting, excessive wear, warpage, or excessive degradation or contamination of insulating gaps shall not be used. Electrodes may be cleaned or redressed using fine grit emery paper or polishing stones. Redressed electrode surfaces shall be flat and equivalent in roughness to that obtained with a 3/0 or finer polishing paper. Electrodes shall be redressed in a direction parallel to the gap to prevent bridging or shorting of the gap.

3.3 Alignment Equipment:

Suitable micro-positioning equipment shall be used to accurately align and position leads for welding. Jigs, fixtures, or vacuum holding devices shall be used to minimize lateral movement of the lead relative to the substrate during the welding process.

3.4 Tensile Test Machine:

The machine and related equipment used to determine weld strengths shall operate at a pull rate of less than 5 inches (127 mm) per minute and be capable of measuring a load of 0 - 500 grams to an accuracy of $\pm 2.0\%$ of full scale rating. Scale graduations shall be 5 grams or smaller.

3.5 Equipment Maintenance:

All equipment shall receive maintenance as necessary to ensure that welding on any setting of the machine is reproducible within the requirements of this specification.

3.6 Procedure:

Welds shall be made in accordance with the following; terms used are defined in AWS A3.0:

- 3.6.1 Qualification and Certification: Before any welding is performed in accordance with this specification, welding machines and operators shall be qualified and certified in accordance with the following:

- 3.6.1.1 Welding Machine: The welding equipment shall be qualified as a system including power supply, welding head, and electrodes. Each system shall be qualified for certification by satisfying specified calibration and proof-testing requirements.
- 3.6.1.1.1 Calibration: Pulse amplitude, pulse duration, number of pulses, and pulse rise and fall times shall be measured. Measurements shall be made at not less than six predetermined power settings, selected to verify all operator-controlled parameters of the equipment at three levels of operation (low, medium, and high power). Measurements shall be taken using a standard load shunt in place of the electrodes or against the electrodes using a specified pressure.
- 3.6.1.1.2 Electrode Force: A calibration curve, setting vs actual electrode force in pounds (N), shall be determined for each welding head or settings may be made using an external force gage. Repeatability of force setting shall be maintained within ± 0.1 pound (0.5 N).
- 3.6.1.1.3 Proof Testing: Weld-test specimens shall be prepared in accordance with the following:
- 3.6.1.1.3.1 Prepare specimens of the following combinations:
- 10 specimens of 0.003 x 0.010 inch (0.08 x 0.25 mm) pure gold ribbon welded to a thin-film substrate.
- 10 specimens of 0.004 inch (0.10 mm) diameter pure gold wire welded to thin-film substrate.
- 3.6.1.1.3.2 The thin film selected shall show prior evidence of being suitable for microwelding (3.6.6.1). Actual thin film materials or specially designed test patterns may be used. Welds shall be made using the applicable welding schedule.
- 3.6.1.1.3.3 All weld strengths shall exceed the minimum value specified in the welding schedule in order to qualify the machine.
- 3.6.1.1.4 Certification: Welding machines that have been qualified shall be certified by the cognizant quality assurance organization.
- 3.6.1.1.5 Maintenance of Certification: Qualification and certification of a welding machine shall be repeated at intervals of not more than six months, whenever evidence indicates out-of-control production welding, or when major maintenance on the equipment is performed.
- 3.6.1.2 Operator Qualification: Welding operators shall satisfactorily complete a training program to ensure adequate familiarization with handling procedures for microminiature components, circuits, and modules, the operation of the welding equipment, and weld requirements as specified herein. Operators, in addition to the training program, shall demonstrate ability to produce satisfactory welds by completing requirements in 3.6.1.1.3.