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**AEROSPACE
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**SPARK IGNITER SEMICONDUCTOR RESISTANCE
MEASUREMENT USING CONTROLLED ENERGY LEVELS**

PURPOSE The purpose of this report is to provide specific information on instrumentation and procedures to measure spark igniter tip semiconductor resistance at an applied voltage level of 500 to 1000 volts without introducing heating effects.

SCOPE This report describes a method of semiconductor resistance measurement using controlled energy levels and a digital processing oscilloscope to acquire and process test data.

1. INTRODUCTION:

1.1 The technique of resistance measurement described herein allows measurements to be made at high voltage without producing appreciable localized heating of the sample. The igniter tip semiconductor under test is subjected to a high voltage pulse of controlled energy level, and a digital processing oscilloscope is used to monitor the resultant current and voltage waveforms. The effective resistance is then computed at a specified voltage level. Empirical tests have indicated that at an energy level in the order of three millijoules, the heating effects have no perceptible impact on the resistance measurement. These techniques are recommended for use as a laboratory measurement procedure during igniter development rather than as a manufacturing test procedure.

2. DESCRIPTION OF EQUIPMENT AND TEST PROCEDURE:

2.1 Figure 1 illustrates the test circuit utilized. A 0.01- μ F capacitor is charged through the igniter tip under test and a current shunt each time the mercury relay is energized. Contact is maintained with the semiconductor by means of needle-tipped probes held in a fixture so as to maintain a probe tip spacing of approximately 0.100 inches.

2.2 A Norland 3001 digital processing oscilloscope or equivalent is used to acquire simultaneous voltage and current waveforms for the igniter tip under test. The oscilloscope is programmed to locate the specific point on the

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2.2 (Continued):

voltage waveform corresponding to 500 volts. The respective current level on the current waveform is then determined. These instantaneous voltage and current levels are used to compute the equivalent resistance. It should be noted that the oscilloscope must be programmed to subtract that portion of the instantaneous voltage which results from including the current shunt in the voltage measurement. Attempts to locate the current shunt in the ground circuit were not successful due to spurious triggering of the oscilloscope. The oscilloscope is then programmed to accumulate data from five successive tests on the same sample piece and then compute the arithmetic average of the computed resistance measurements.

2.3 Figures 2, 3 and 4 illustrate the displayed data for five successive tests on a representative test sample.

2.4 The labels on the oscilloscope display correspond to the following quantities:

- A = Instantaneous voltage
- B = Computed resistance
- C = Summation of resistances measured
- D = Number of tests completed
- E = Average resistance for five successive tests

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