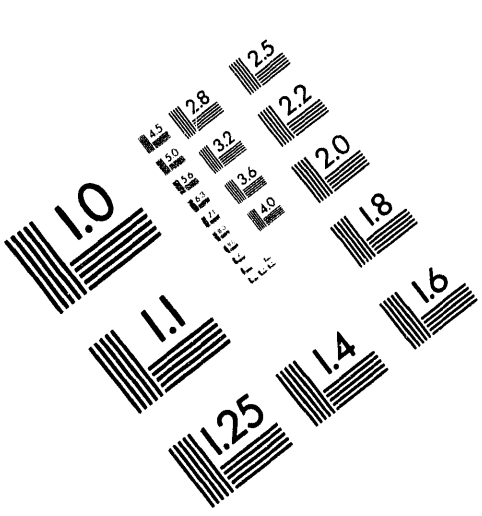


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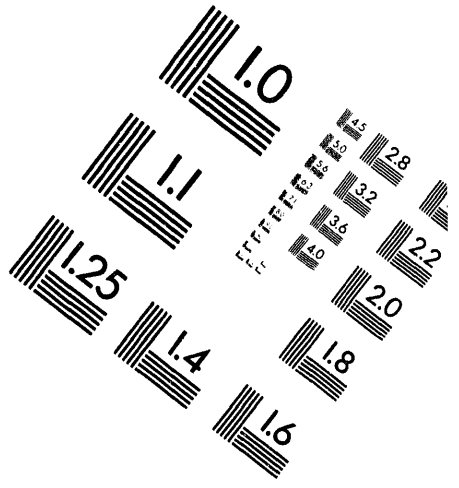


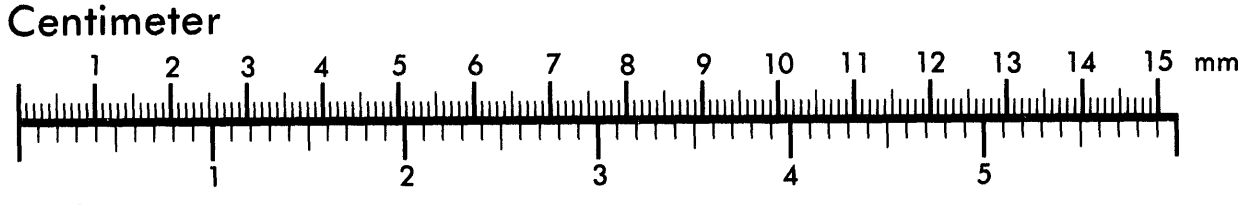


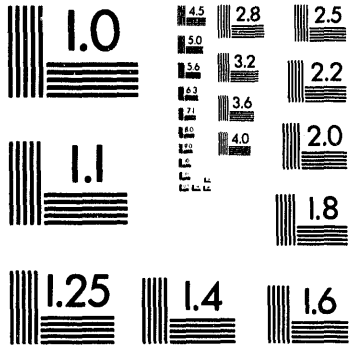


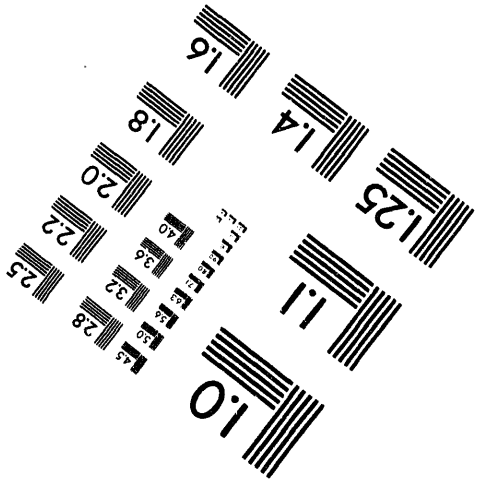


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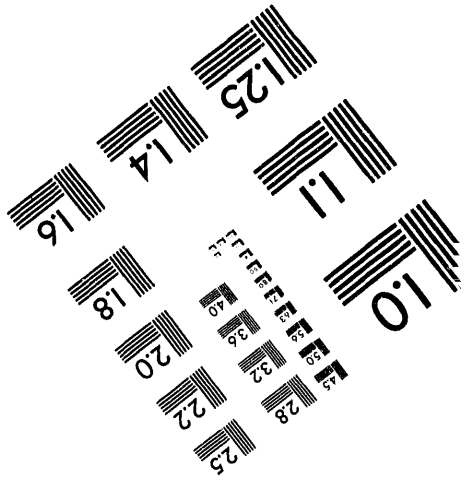

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# Procedure For Contact Electrical Resistance Measurements As Developed For Use At Sandia National Laboratories

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## Abstract

Military Specifications call out general procedures and guidelines for conducting contact resistance measurements on chemical conversion coated panels. This paper deals with a test procedure developed at Sandia National Laboratories used to conduct contact electrical resistance on non-chromated conversion coated test panels. MIL-C-81706 "Chemical Conversion Materials For Coating Aluminum and Aluminum Alloys" was the reference specification used for guidance.



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## Introduction

Electrical contact resistance is measured through the coating to the panel surface. MIL-C-5541 " Chemical Conversion Coatings On Aluminum And Aluminum Alloys" describes the test method and acceptable resistance measurements. MIL-C-81706 "Chemical Conversion Materials For Coating Aluminum And Aluminum Alloys" describes the test procedure in more detail. The test procedure written here follows those Mil-Specifications and describes the specific apparatus and procedures used for resistance measurements done at Sandia National Laboratories.

## Equipment

MIL-C-81706, paragraph 4.5.5, describes the test method, equivalent equipment and test circuitry. The method explains that an applied load shall be within 1% of a calculated 200 psi applied pressure. The contacting electrodes shall be of copper, flat so that no light can be seen between them and finished with at least 000 metallographic paper. Following the Mil Specifications requiring a mechanical apparatus to deliver the specified load, a Chatillon USTM load frame with a 500 lb. load cell is used.

Two copper electrodes were made, both having an area of 1 square inch . The surface of the electrodes was mill finished and then polished to a mirror finish. The electrodes gave a resistance reading of less than 1 micro-ohm when polished and cleaned with methyl alcohol.

A Keithley Model 580 Micro-ohmmeter was used to measure the resistance with model 5806 test leads. These leads were made for a four wire connection on one set of clip leads.

## Procedure

Eight resistance measurements will be made on each 4" x 5" panel. The following set up of the equipment is used to take these measurements.

1.) The Chatillon load frame is configured for a direct reading of load on the Hi load scale. The digital output reads direct in pounds of force. The meter is to be zeroed with no load applied. The rate is set to variable with 1 on the indicator dial. This can be varied.

2.) The Keithley meter is set for a pulsed drive, dry circuit test on the 200m range. Have the meter in Standby mode to start.

3.) Without a test panel between the electrodes, connect the test leads to the upper and lower copper electrodes. Apply 200 lbs. of force using

the travel switch on the load frame. Put the Keithley meter in operate mode and make sure this reading is less than 5 micro ohms. This is the reading of the electrodes and the test leads together. Push the REL button on the Keithley meter, this reading will now be automatically subtracted from subsequent readings. Put the meter in standby.

4.) Using an abrasive, clean off a small corner of the test panel on both sides. This will give the clip lead a good connection to the test panel without a coating.

5.) Mount the test panel in the frame between the electrodes so that the top electrode is located in the area of the # 1 square on the panel data sheet.

6.) Apply 200 lbs. of force and connect the clip leads. One lead to the upper electrode the other lead to the cleaned area of the test panel (Fig. 1).

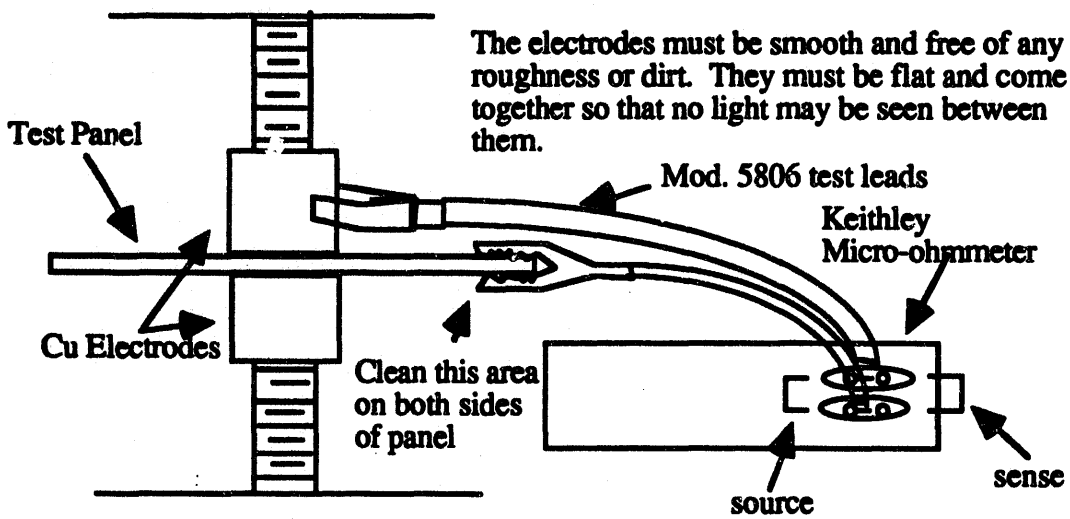



Figure 1. The test setup.

7.) Put the meter in operate mode and record the reading in the #1 square on the test panel data sheet (Fig. 2).

8.) Repeat steps 5 to 7 for each of the remaining 7 locations on the test panel.

Steps 4 to 8 will be used for each test panel. After every 5 or 6 test panels it is good practice to recheck the readings on the electrodes. The panels can leave dirt and salt deposits on the electrodes that will start deteriorating the resistance readings.

If the electrodes read above 5 micro-ohms they should be removed, repolished and cleaned before they are used again.

To store the setup for later use, clean the electrodes with methyl alcohol and put a clean soft cloth between them with 2 to 5 lbs. of force.

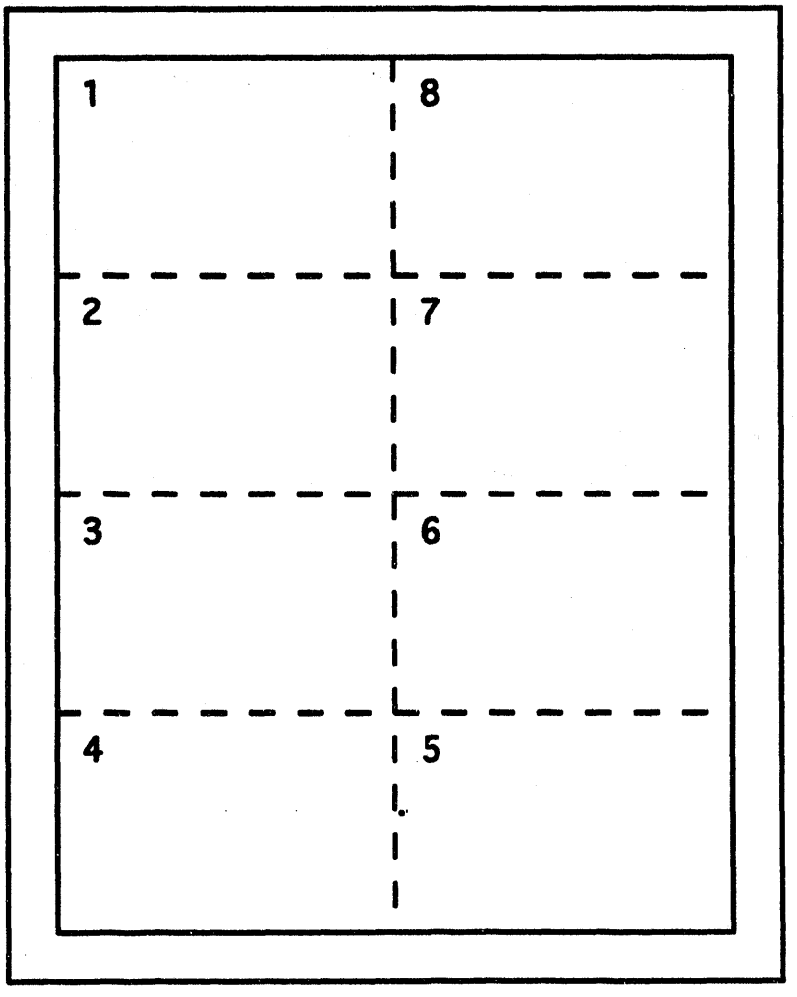
Electrical Contact Resistance Panel
MIL-C5541

Date _____

Job Title _____

Test Analyst _____

Panel Number _____
Non-Salt Spray _____ Salt Spray ____




Note : Do not measure in the framed 1/4 in. area on the panel.

Figure 2. Test Panel Data Sheet.

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