

**TEST REPORT
STABILITY TESTING
CHOMERICS PREMIER™
CONDUCTIVE PLASTIC**

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Chomerics Approved Signatory:

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1. INTRODUCTION

This document is written to report the stability testing of PREMIER conductive plastic materials. The primary tests performed are tensile strength and through resistance. The tests are performed after the material has undergone some environmental conditions for some period of time.

The tests performed are tensile testing per ASTM D 638: Standard Test Method for Tensile Properties of Plastics; and through resistance per Chomerics Document Number PRE-012: Through Resistance of Conductive Thermoplastics.

The environmental conditions consist of heat/humidity exposure at various temperatures and lengths of time, salt fog exposure, thermal shock and thermal cycling. Not all the materials are exposed to the same conditions.

2. ADMINISTRATIVE DATA

2.1 Test Facility

All testing is done at Chomerics in the Quality Assurance Lab or in the Research and Development Lab. Test personnel are Chomerics employees.

The results and/or conclusions within this test report refer and/or apply only to the unit(s) tested as defined by this report.

2.2 Equipment

The following is standard equipment for tensile strength testing and through resistance as defined by the test procedures.

Equipment for tensile testing

Testing Machine: A testing machine of the constant rate-of-crosshead-movement type. The testing machine used by Chomerics is an Instron model 1125. A load cell of 10,000 pounds is used for testing of PREMIER parts.

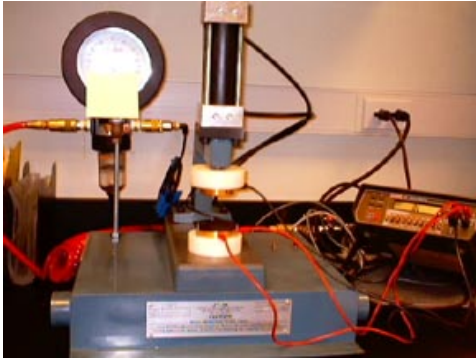


Figure 1: Instron model 1125

Equipment for through resistance measurement

Digital ohmmeter with a measurement range down to 0.00001 Ohm (0.01mOhm) with an accuracy of +/- 0.02%.
Two gold plated electrodes 2" in diameter with a current lead and a potential lead in each electrode.
A pneumatic press capable of accurately applying 100 psi to the surface area of the specimen.

Figure 2: Resistance test equipment



3. TEST SET UP AND CONFIGURATION

3.1. Test samples

PREMIER tensile test samples are 6.5 inches x .5 inches wide (at the ends) and 0.125 inches in the middle x 0.125 inches thick. Test samples conform to the ASTM standard.

Figure 3: Tensile test sample



PREMIER through resistance measurement samples are 2.5 inches diameter x 0.125 inch thick Gardner impact disc molded from the ASTM family mold.

Figure 4: Through resistance measurement samples

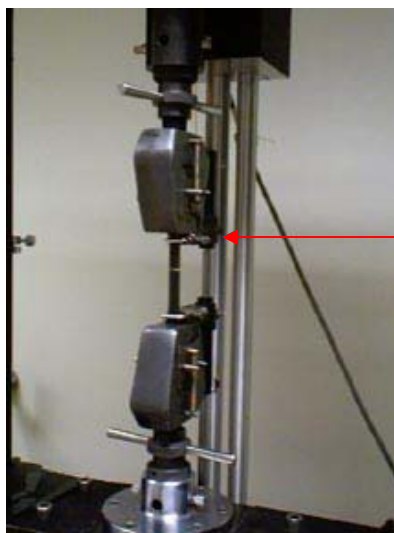


3.2. Tensile Test Set Up

Tensile testing involves mounting the specimen in the Instron and subjecting it to tension. The tensile force is recorded as a function of the increase in gage length. The gage length is the region over which the measurements are made and is centered with the reduced section (see Figure 3 above). Please refer to the ASTM D 638 standard for the exact procedure. Tensile strength is defined as the force per unit area required to fracture the specimen. The results of tensile tests are used for quality and development purposes as well as to select materials for engineering applications.

The tensile strength of PREMIER conductive plastic materials will be calculated before and after the parts have been subjected to various environmental conditions.

Figure 5: Tensile Test Set Up

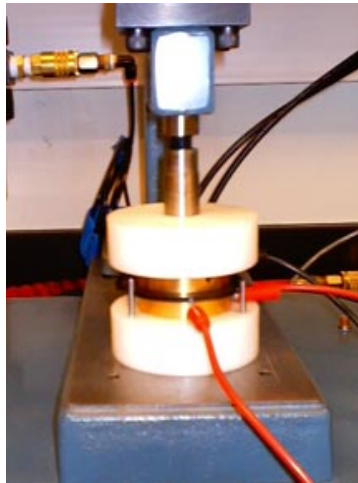


Broken PREMIER sample

3.3. Through Resistance Test Set Up

Through resistance test measures the volume resistance of the PREMIER conductive plastic materials. This test is performed before and after the PREMIER parts have been subjected to various environmental conditions. The test sample is placed between the electrodes and the pneumatic press closes the electrodes on the sample. The resistance (mOhm) reading off the ohmmeter is recorded when the pneumatic press releases the pressure.

Figure 6: During resistance test



3.4 Environmental Conditions for PREMIER Stability Testing

- 3.4.1 168 Hour Salt Fog Test: This test is set up per ASTM B 117: Standard Procedure for Operating Salt Spray (Fog) Apparatus. In this test, the samples are suspended in a 5 percent salt solution. The temperature of the water is 119F. The water is sprayed over the top of the chamber.
- 3.4.2 Thermal shock: thermal shock is performed as follows: one hour at -40C, one hour at the relative temperature index (RTI) of the polymer. This is done for four cycles.
- 3.4.3 Thermal cycling: thermal cycling is performed as follows: one hour at room temperature, one hour to ramp to relative temperature index (RTI), one hour at RTI, one hour ramp to -40C, one hour at -40C, one hour ramp to room temperature. This is done for twelve cycles.
- 3.4.4 Heat exposure: Different PREMIER materials were subjected to various temperatures and relative humidity for various amounts of time.

3.5 These PREMIER materials were environmentally conditioned as follows:

Environmental Condition	A230-HTHF	A240-HTHF	A220-FR	A230-FRHF	A240-FRHF
168 hour salt fog	X	X	X	X	X
168 hours at -40C	X	X		X	X
1000 hours at 70C				X	X
1000 hours at 85C	X	X			
1000 hours at 65C/50%RH				X	X
1000 hours at 50C/85%RH	X	X			
Thermal Shock	X	X		X	X
Thermal Cycling	X	X		X	X

4. PREMIER TEST RESULTS

4.1 The data from the PREMIER materials in the chart above is shown in section 4.2. The data is reported as compared to the typical values as reported in the PREMIER brochures. This represents change in either the tensile strength or the through resistance of the material after being subjected to the stated condition.

The tensile strength of all the materials is within a 20% change margin. The through resistance percentages are greater than tensile strength, however, the values themselves are within the range of typical PREMIER properties for the respective materials. Tests are on-going for all PREMIER materials to subject them to the same conditions, based on their Relative Temperature Indexes.

4.2 PREMIER Test Results

Environmental Condition	A230-HTHF	A240-HTHF	A220-FR	A230-FRHF	A240-FRHF
Typical tensile (psi)	10300	10400	9900	10300	10400
Typical resistance (Ohms)	.060	.030	.800	.060	.030
168 hour salt fog					
Tensile strength (psi)	10477	11377	10589	10203	11689
Resistance (Ohms)	.058	.031	.720	.071	.049
168 hours at -40C					
Tensile strength (psi)	11895	12769		10601	11278
Resistance (Ohms)	.027	.024		.039	.027
1000 hours at 70C					
Tensile strength (psi)				12183	12923
Resistance (Ohms)				.052	.034
1000 hours at 85C					
Tensile strength (psi)	11131	12921			
Resistance (Ohms)	.048	.027			
1000 hours at 65C/50%RH					
Tensile strength (psi)				10592	10694
Resistance (Ohms)				.083	.042
1000 hours at 50C/85%RH					
Tensile strength (psi)	10360	11302			
Resistance (Ohms)	.047	.029			
Thermal Shock					
Tensile strength (psi)	11988	12253		10763	1114
Resistance (Ohms)	.027	.024		.038	.040
Thermal Cycling					
Tensile strength (psi)	11954	12739		11097	11432
Resistance (Ohms)	.025	.024		.043	.026