Title/Subject:	Standard Test Procedure – Maximum Surface Temperature Test	
EDDS No. : ASTP2233	Version Date: 2005-01-04	Signature/Initial: *David C. Chirdon* /s

1.0 PURPOSE

This Standard Test Procedure (STP) is to be used by Electrical Safety Division (ESD) investigators to determine the maximum surface temperature of a component.

2.0 SCOPE

This procedure applies to surface temperature tests conducted by the Electrical Safety Division on components to determine compliance with the requirements of 30 CFR 18.23 and ACRI2001: "Criteria for the Evaluation and Test of Intrinsically Safe Apparatus and Associated Apparatus".

3.0 REFERENCES

3.1 30 CFR Part 18.23, "Electric Motor-Driven Mine Equipment and Accessories"

3.2 30 CFR Par 19 "Electric Cap Lamps"

3.3 30 CFR Part 20 "Electric Mine Lamps Other Than Standard Cap Lamps"

3.4 30 CFR Part 22 "Portable Methane Detectors"

3.5 30 CFR Part 23 "Telephones and Signaling Devices"

3.6 30 CFR Part 27 "Methane Monitoring Systems"

3.7 CDS No. ACRI2001 "Criteria for the Evaluation and Test of Intrinsically Safe Apparatus and Associated Apparatus"

4.0 DEFINITIONS

4.1 **Constant Temperature** - The equilibrium temperature of the device with the prescribed test parameters. This temperature is obtained whenever three consecutive temperature readings taken at intervals of no less than 5 minutes indicate a total change of less than 3%.

4.2 **Current-Interrupting Device** - A fuse or other device designed to prevent another component from overheating and is effective after applying up to two independent faults to the circuit.

4.3 **Maximum Fault Voltage** – The highest voltage that can be applied across the component being tested under the worst case, two fault condition.

5.0 TEST EQUIPMENT

5.1 Data recorder with at least 3 channels, sufficient voltage range for the parameters of the test circuit, a resolution of at least 3 significant figures, an accuracy of at least ±1.5% of the reading, a minimum of 1000 data points per test, and able to plot voltage of 3 or more channels versus time with a resolution of 1 minute, and an accuracy of ±1 minute. [Example, Hewlett-Packard HP7090A].

5.2 Power supply or batteries with adequate capacity. Fresh or fully charged batteries equivalent to those normally powering the component under test may be used in lieu of a power supply.

5.3 Switch rated for the maximum voltage and current of the test circuit, as necessary.

5.4 Digital thermometer with analog/digital output, range of at least the maximum permissible surface temperature of the component under test, resolution of at least 0.2°C, and an accuracy of at least ±1°C. The sensing element of this thermometer must not significantly cool the component under test. Thermocouple wires must not be larger than No. 24 AWG. [Example, Fluke 2170A].

5.5 Series connected resistor with a known resistance value less than 1% of the value of the component under test, or equivalent device, to measure the current flow through the test circuit. The power rating of this device shall not be exceeded during this test. [Example, Dale RH-250, 0.1Ω, 1%, 250 watt resistor].

5.6 Various connecting wires, test chamber, etc. as necessary.

5.7 An ohmmeter to measure the value of the series connected resistor, and the component under test with a resolution of at least 3 significant figures, and an accuracy of at least ±1% of reading. [Example, Hewlett Packard Model 3478A Multimeter].

6.0 TEST SAMPLE

6.1 Ten samples of the component under test.

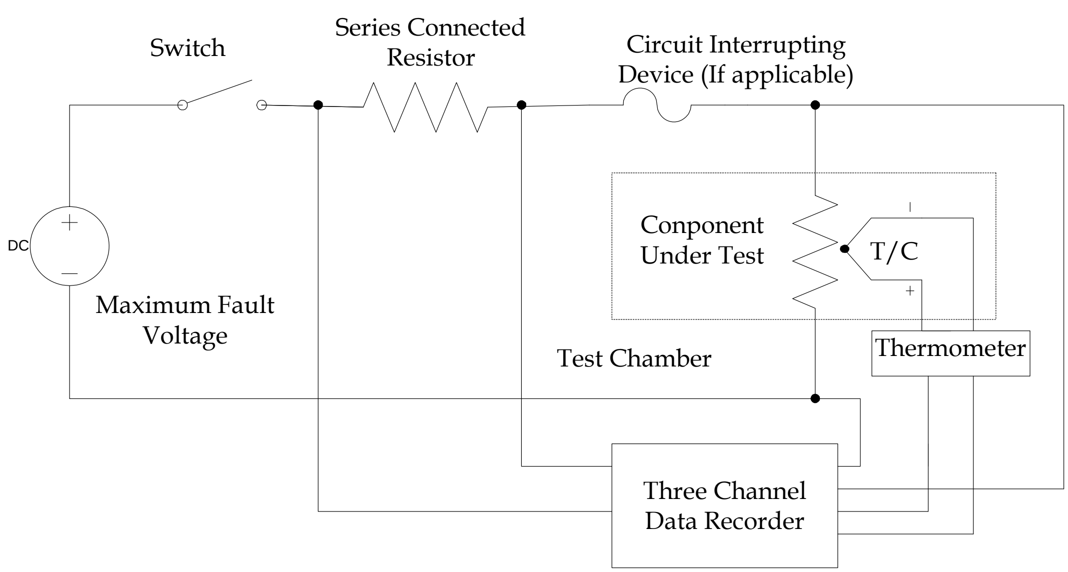
6.2 Ten samples of the current-interrupting device (if applicable).

7.0 PROCEDURE

7.1 The test shall be conducted at ambient room conditions of 25±5°C. Record the ambient room temperature.

7.2 Measure and record the resistance of the series connected resistor and the component under test to verify that the series connected resistor is less than 1% of the value of the component under test. If not, change to a lower value series connected resistor, and repeat this step.

7.3 Connect the test circuit (see the following diagram) using wiring methods that will minimize the resistance and heat-sinking affects of the test circuit. If applicable, connect a sample of the current-interrupting device in series with the component to be tested. Place the test circuit in a location that reduces the likelihood that air currents will affect the surface temperature of the component under test.



7.4 Place the thermocouple junction in secure contact with the surface of the component under test at a point on the component most likely to be the hottest. If no specific location on the component can be considered the hottest, place the thermocouple near the top center of the component.

7.5 Set the open circuit voltage of the power supply to the maximum fault voltage. Record the test voltage.

7.6 Set the short-circuit current of the power supply to a value that will ensure it does not limit the current to the component under test.

7.7 Apply the maximum fault voltage to the component under test by closing the switch. Continue the test until the component reaches a constant surface temperature or the current interrupting device opens. During the test, record the voltage across the component under test, the voltage across the series connected resistor, and the temperature of the component versus time.

7.8 Repeat the test described in 7.1 through 7.7 on two additional samples of the component under test.

7.9 If during the test described in section 7.7, the component under test or the current interrupting device fails in the open condition then the test described in Section 7.1 to 7.7 should be repeated with a new sample of the component and/or the current interrupting device at a reduced voltage. The voltage applied should be increased in steps until the maximum constant temperature of the component is achieved without the component or the current interrupting devices failing open circuited. One way to accomplish this is to use one of the samples to experimentally determine the fuse or resistor opening voltage or current by slowly increasing the test voltage. After determining the fuse opening voltage, increase the test voltage in 10 equal steps from 0 volts to the experimentally determined voltage. Repeat this test on two more samples of the component.

8.0 TEST DATA

The test report should include the following data:

8.1 Ambient temperature prior to testing for each test conducted.

8.2 Resistance of the series connected resistor, and its specified power rating.

8.3 Resistance of the component under test prior to testing for each test conducted.

8.4 Continuous recording of the voltage versus time across the component under test for each test conducted.

8.5 Continuous recording of the current versus time through the component under test for each test conducted.

8.6 Continuous recording of the surface temperature versus time of the component under test for each test conducted.

8.7 Manufacturer, model, serial number or other identification number and calibration due date (if applicable) for each piece of test equipment.

8.8 Description of the component under test including any relevant electrical specifications such as manufacturer, type (surface mount, wirewound, metal film, axial lead, surface mount, etc.), power rating, resistance value, and tolerance.

8.9 Description of the current-interrupting device (if applicable) including manufacturer, type of device (fuse, PTC, etc.), nominal current rating, maximum operating time versus current curve (if necessary), and any other relevant manufacturer's specifications.

8.10 Observation of flaming, deformation or any other potentially hazardous behavior.

8.11 Description or circuit diagram of test being conducted.

9.0 PASS/FAIL CRITERIA

9.1 The component under test shall not exhibit any effects deemed hazardous (i.e. flaming, deformation that compromises circuit spacing, or the creation of an ignition source for any components/material located near the component under test, etc.).

9.2 If the maximum surface temperature of any of the components tested exceeds 150°C and the component is not in a dust tight enclosure, then the component must be tested according to EDDS No. ASTP 2207 (Coal Dust Thermal ignition Test).

9.3 If the maximum surface temperature exceeds 530°C then the component must be tested according to EDDS No. ASTP2208 (Small Component Ignition Test).