

Title/Subject: Standard Test Procedure – Coal Dust Thermal Ignition Test		
EDDS No. : ASTP2207	Version Date: 2004-06-14	Signature/Initial: <i>David C. Chirden</i>

## 1.0 PURPOSE

- 1.1 This test procedure is used by the Electrical Safety Division (ESD) during the evaluation of intrinsically safe apparatus to determine if a component, that under normal or fault conditions exceeded 150° C (302° degrees F) during surface temperature testing, is capable of causing a coal dust thermal ignition. This procedure only applies to components that may be subjected to exposure of coal dust, and therefore, does not apply to components located in a dust-tight enclosure or in an MSHA-certified explosion-proof enclosure.
- 1.2 To provide a person knowledgeable in the appropriate technical field with a written procedure that will assure consistent repeatable test data and results, independent of the person conducting the test.

## 2.0 SCOPE

This Standard Test Procedure (STP) applies to components of equipment evaluated, approved, or certified under 30 CFR Parts 18, 19, 20, 22, 23, and 27.

## 3.0 REFERENCES

- 3.1 ACRI2001 “Criteria for the Evaluation and Test of Intrinsically Safe Apparatus and Associated Apparatus”
- 3.2 30 CFR Part 18 “Electric Motor-Driven Mine Equipment and Accessories”
- 3.3 30 CFR Part 19 “Electric Cap Lamps”
- 3.4 30 CFR Part 20 “Electric Mine Lamps Other Than Standard Cap Lamps”
- 3.5 30 CFR Part 22 “Portable Methane Detectors”
- 3.6 30 CFR Part 23 “Telephones and Signaling Devices”
- 3.7 30 CFR Part 27 “Methane-Monitoring Systems”

## 4.0 DEFINITIONS

- 4.1 Constant Temperature – when three successive readings, taken at intervals of 10 percent of the previously elapsed duration of the test (but no less than 5-minute intervals), indicate less than a 5 percent change in temperature.

- 4.2 Smoldering – occurs when the heat generated by the coal dust exceeds the heat being supplied by the component under test. This is generally evident when the coal dust temperature (temperature 1/4 inch above the component under test) exceeds the temperature of the component under test either during the test or after power to the component under test is removed.

## 5.0 TEST EQUIPMENT

- 5.1 A low contact resistance switch or relay for opening and closing the test circuit, having adequate voltage and current ratings.
- 5.2 If a relay is used, a power supply capable of energizing the relay.
- 5.3 A 0.1 ohm ( $\pm 1\%$ ) load resistor ( $R_{load}$ ) with a minimum 50 ampere rating (Dale RH-250). Note: the value of the load resistor should be less than 10% of the nominal value of the component under test.
- 5.4 Data recorder having at least 3 channels with sufficient voltage range for the parameters of the test circuit, a resolution of at least 3 significant figures, and an accuracy of at least  $\pm 1.5\%$  of the reading. The data recorder must be able to record the voltage of the channels Vs. time with a resolution of 1 minute, an accuracy of  $\pm 1$  second, and a minimum of 1000 data points per test. The parameters to be recorded are: the temperature of the component under test; the temperature 1/4 inch above the component under test; and the current through the component under test. [Hewlett-Packard HP7090A].
- 5.5 Two Digital Thermometers or one with multiple channel inputs with analog/digital outputs, each with a range of at least 600 degrees Celsius, resolution of at least 0.2 degrees Celsius, and accuracy of at least  $\pm 1$  degree Celsius. One is for measuring the surface temperature directly on the component under test and the other is for measuring the temperature of the coal dust 1/4 inch above the component under test. [Fluke 2170A]
- 5.6 Thermocouples consisting of wires not larger than No. 24 AWG or equivalent. (Type K).
- 5.7 Power Supply or batteries with adequate capacity.
- 5.8 Various connecting wires, test chamber, etc. as necessary.
- 5.9 200 mesh screen Pittsburgh Seam Coal Dust
- 5.10 Voltmeter and ammeter as necessary.

Note: Equipment models listed are acceptable equipment currently used by the ESD to perform the test. Equivalent or more accurate equipment may be used.

## 6.0 TEST SAMPLES

Five samples of the component to be tested.

## 7.0 PROCEDURES

- 7.1 Mount the component in its normal position inside the test chamber.
- 7.2 Place one thermocouple directly on the component and the other thermocouple  $\frac{1}{4}$  inch above the component.
- 7.3 Cover the component with Pittsburgh Seam coal dust filtered by a 200 - mesh screen until no more will stay on the component or to a depth of at least 12 mm (0.48 inches).  
  
Note: Do not place a cover over the test chamber since this may restrict oxygen to the coal dust preventing it from smoldering.
- 7.4 Connect the data recorder to both digital thermometers used for measuring temperature on the component and  $\frac{1}{4}$  inch above the component.
- 7.5 Connect the data recorder to the load resistor for monitoring the current through the component under test.
- 7.6 Apply the test voltage to the component.
- 7.7 Observe on the data recorder or thermometers a steady increase in both the surface temperature of the component and the temperature  $\frac{1}{4}$  inch above the component. Observe for smoldering of the coal dust. Smoldering will be evident if the temperature  $\frac{1}{4}$  inch above the component under test exceeds the component temperature. Continue the test until either smoldering is observed, the temperature  $\frac{1}{4}$  inch above the component is constant, or the temperature  $\frac{1}{4}$  inch above the component is decreasing.
- 7.8 Remove power from the component. Observe for smoldering of the coal dust. This will be evident if the temperature  $\frac{1}{4}$  inch above the component is increasing.
- 7.9 Repeat steps 7.1 through 7.8 for the additional test samples.

## 8.0 TEST DATA

- 8.1 The manufacturer, manufacturer's part number, type of component, and general specifications for each sample tested.
- 8.2 A graphical representation of both temperature curves.
- 8.3 A description or graph of the applied voltage(s) and a graph of the current applied to the component under test. The description, if no graph is included on the test sheet, should include voltage(s) applied, and the applied time duration(s).

Multiple input parameters and time durations may be necessary if applied to the component under test in steps.

- 8.4 Equipment used for testing. This should include: manufacturer, model number, serial number, and calibration due date for each piece of equipment.
- 8.5 Ambient temperature at time of test.
- 8.6 Observations made during the test (e.g. point at which the component or coal dust began smoking, glowing red, and/or flaming).
- 8.7 Description of test chamber, if any is used (e.g. dimensions and material).

#### 9.0 PASS / FAIL CRITERIA

The component under test fails if there is evidence of smoldering or ignition of the coal dust.