Title/Subject:	Standard Test Procedure - Cap Lamp Performance Test	
EDDS No. : ASTP2213	Version Date: 2004-12-16	Signature/Initial: *David C. Chirdon* /s

1.0 PURPOSE

This test procedure is used by the Electrical Safety Division (ESD) to determine if:

1.1 representative samples of a miner's cap lamp assembly meet the minimum time of burning and candlepower requirements of 30 CFR 19.9(a).

1.2 representative samples of a miner's cap lamp assembly having an accessory receptacle with a specified maximum current draw will meet the minimum time of burning and candlepower requirements of 30 CFR 19.9(a).

2.0 SCOPE

This Standard Test Procedure (STP) applies to:

2.1 miner's cap lamp assemblies submitted for approval under 30 CFR Part 19.

2.2 miner's cap lamp assemblies having an accessory receptacle submitted for approval under 30 CFR Part 19.

3.0 REFERENCES

30 CFR 19.9(a): *Time of burning and candlepower*. Permissible electric cap lamps shall burn for at least 10 consecutive hours on one charge of the battery and shall give during that period a mean candlepower of light beam of not less than 1.

4.0 DEFINITIONS

4.1 **Beam Angle -** The field of light between the left horizontal axis and the right horizontal axis.

4.2 **Mean Candlepower –** The average candlepower of the cap lamp light beam at the angles shown in Section 7.12.

4.3 **Photometer -** A device used to measure light luminance intensity.

5.0 TEST EQUIPMENT

5.1 Voltmeter. Minimum resolution of 0.01 volts.

5.2 Ammeter. Minimum resolution of 0.001 ampere. (if necessary)

5.3 Adjustable auxiliary resistive load -or- five samples of each external device to be connected to the cap lamp (if known). (if necessary)

5.4 Interconnecting wires.

5.5 Digital Thermometer. Minimum resolution of 0.2^{o} Celsius.

5.6 Photometer. Minimum resolution of 0.001 foot-candles (FC) [Tektronix Model J17 photometer].

5.7 Device capable of rotating the headpiece through a horizontal angle of rotation of 130^{o} (measured 65^{o} to the left of the center axis through 65^{o} to the right of the center axis).

6.0 TEST SAMPLES

Five samples of each cap lamp, in their proposed marketable form, including all different bulb and battery types, to be tested. Two samples shall not have undergone any potentially destructive mechanical tests. The three remaining samples shall have undergone the "Battery Drop Test" and "Headpiece Drop Test".

7.0 PROCEDURES

7.1 Test shall be conducted in an ambient temperature of 25^{o} ±10^{o} Celsius.

7.2 Conduct the test in a dark room.

7.3 Fully charge the cap lamp according to manufacturer's instructions.

Note: It may be necessary to cycle the battery several times to obtain full capacity of the battery.

7.4 Turn on the headpiece.

7.5 For cap lamps with an accessory receptacle, skip this step and go to Section 7.6. Monitor and record the voltage of the battery hourly go to Section 7.8.

7.6 Connect the adjustable auxiliary resistive load (with ammeter in series), or the specified auxiliary device, as appropriate, to the accessory receptacle of a fully charged cap lamp and adjust for the maximum specified current draw.

Note: If the specified auxiliary device is connected as the auxiliary load, the device must be set to draw the maximum input current (e.g., transmitter in the transmitting mode).

7.7 Monitor and record the voltage of the battery hourly. Record the current draw of the auxiliary load hourly. Adjust the auxiliary resistive load as necessary to maintain the specified maximum current draw.

Note: Current readings must meet or exceed the specified maximum current draw for the accessory load.

7.8 After the cap lamp has been energized 10 hours mount the headpiece to the rotation device and adjust it for a spot beam.

Note: If the cap lamp has a dual filament bulb, select the filament with the narrower beam angle.

7.9 Mount the photometer's light sensor on a horizontal plane level with the bulb filament at a distance of 2 feet (±1 inch) from the bulb.

7.10 Rotate the headpiece to determine the left portion of the beam at 65^{o}.

7.11 Measure and record light output using the photometer. If the photometer is not calibrated in candlepower, record the unit of measurement and calculate candlepower.

Note: The Tektronix Model J17 Photometer used in the ESD laboratory displays intensity in foot-candles (FC) that can be converted to candlepower using the formula:

Candlepower = FC x $(\text{distance in feet})^2$
distance is from the bulb filament to the photometer sensor.

7.12 Continue rotating the headpiece until light output measurements have been recorded for each of the following angles:

7.12.1 Left: 60°, 55°, 50°, 45°, 40°, 35°, 30°, 25°, 20°, 15°, 10°, 5°, and 0°.

7.12.2 Right: 5°, 10°, 15°, 20°, 25°, 30°, 35°, 40°, 45°, 50°, 55°, and 60°.

7.13 Calculate the mean candlepower of the horizontal 120° angle light beam of the cap lamp.

7.14 Repeat steps 7.1 through 7.13 on the remaining samples of the cap lamp.

7.15 If more than one type of bulb is specified, repeat steps 7.1 through 7.14 for each type bulb.

7.16 If more than one type of battery is specified, repeat steps 7.1 through 7.15 for each type.

8.0 TEST DATA

8.1 Sample number.

8.2 Elapsed time of test when measurements are made.

8.3 Voltage of the cap lamp battery (hourly for a total of 10 hours).

8.4 Current drain through the auxiliary circuit (hourly for a total of 10 hours). (if applicable)

8.5 Candlepower of the light beam at the specified beam angles in Section 7.12 at 10 hours.

8.6 Mean candlepower for each bulb at 10 hours.

8.7 Manufacturer, model or type number, and MSHA approval number or I.S. evaluation number of the auxiliary devices tested, if appropriate. (if applicable)

8.8 Manufacturer and model number of the cap lamp.

8.9 Manufacturer and part number of the bulb.

8.10 Test equipment used in conducting the test with the calibration due dates.

8.11 Ambient temperature.

9.0 PASS / FAIL CRITERIA

9.1 Without an accessory receptacle - The cap lamp shall burn for at least 10 consecutive hours on one charge of the battery and shall give during that period a mean candlepower of light beam of not less than 1; i.e., the mean candlepower of the light beam at an angle of 120^{o} at 10 hours shall not be less than 1.

9.2 With an accessory receptacle - The cap lamp shall burn for at least 10 consecutive hours on one charge of the battery, while maintaining the maximum auxiliary load current draw, and shall give during that period a mean candlepower of light beam of not less than 1; i.e., the mean candlepower of the light beam at an angle of 120^{o} at 10 hours shall not be less than 1.