1.0 PURPOSE

The purpose of this procedure is to provide a Standard Test Procedure (STP) to be used by Independent Light Laboratories to generate iso-footcandle illumination curves. It is to be followed by the independent light labs when acquiring the iso-footcandle illumination curves of mine luminaires. These luminaires are listed by the luminaire manufacturer in their Statement of Test and Evaluation (STE) applications to MSHA. The STE confirms compliance with the MSHA machine lighting regulations in 30 CFR Sections 75.1719-1 and 75.1719-2(g).

2.0 SCOPE

This procedure applies to all Independent Light Laboratories generating iso-footcandle curves of luminaires for use with the Crewstation Analysis Program (CAP) software program to acquire light survey data for STE applications.

3.0 REFERENCES

3.1. Criteria for Using the Crewstation Analysis Program to Acquire Light Survey Data Required for STE Applications, ACRI2006

Note: Copies of these criteria are available upon request to the Approval & Certification Center, 765 Technology Drive, Triadelphia, West Virginia 26059.

3.2. The procedures in this STP are based upon the methods published in the National Institute for Occupational Safety and Health (NIOSH), formerly United States Bureau of Mines (USBM), Special Publication 23-94, titled "PROCEDURES TO COLLECT PHOTOMETRIC DATA FOR THE COMPUTER MODELING OF UNDERGROUND MACHINE MOUNTED LIGHTING SYSTEMS". These procedures were developed from the iso-footcandle illumination collection procedures in the A&CC's darkroom. The NIOSH publication also explains the use of two computer utility programs (PROMEAS and LUMREG) to convert the raw iso-footcandle data for use with the CAP software program.

3.3. Unless otherwise noted in this document, all laboratory procedures and testing techniques shall be consistent with published Illuminating Engineering Society (IES) practices contained in the "IES Lighting Handbook", particularly with reference to the structure of the darkroom, ambient temperature, drafts, electrical supply and regulation, lamp selection and stabilization, and instrument accuracy.

3.4. IES Guide LM-54 - Guide to Lamp Seasoning

3.5. IES Guide LM-49 – Approved Method for Life Testing of Filament Lamps

Note: These publications may be purchased from the Illuminating Engineering Society of North America (IESNA) at www.iesna.org.

4.0 DEFINITIONS

4.1. Iso-footcandle curve - A plot about a light source, in which all the footcandle values are the same.

4.2. Independent Light Lab - A company that has demonstrated to MSHA the ability to conduct iso-footcandle illumination curve collection under this standard test procedure. The lab should have no connection to the luminaire manufacturer.

4.3. Luminaire - A lighting fixture containing a lamp.

4.4. NIOSH – National Institute for Occupational Safety and Health. NIOSH was formerly the United States Bureau of Mines (USBM).

5.0 TEST EQUIPMENT

5.1. Photometer

An incident photometer, calibration traceable to the National Institute of Standards and Testing (NIST), shall be used. It shall be cosine-corrected to 15º and color corrected according to the Commission International de l'Eclairage (CIE) Spectral Luminous Curve. The meter must be accurate to within 0.1 footcandle (fc) with a resolution no less than 0.01 fc.

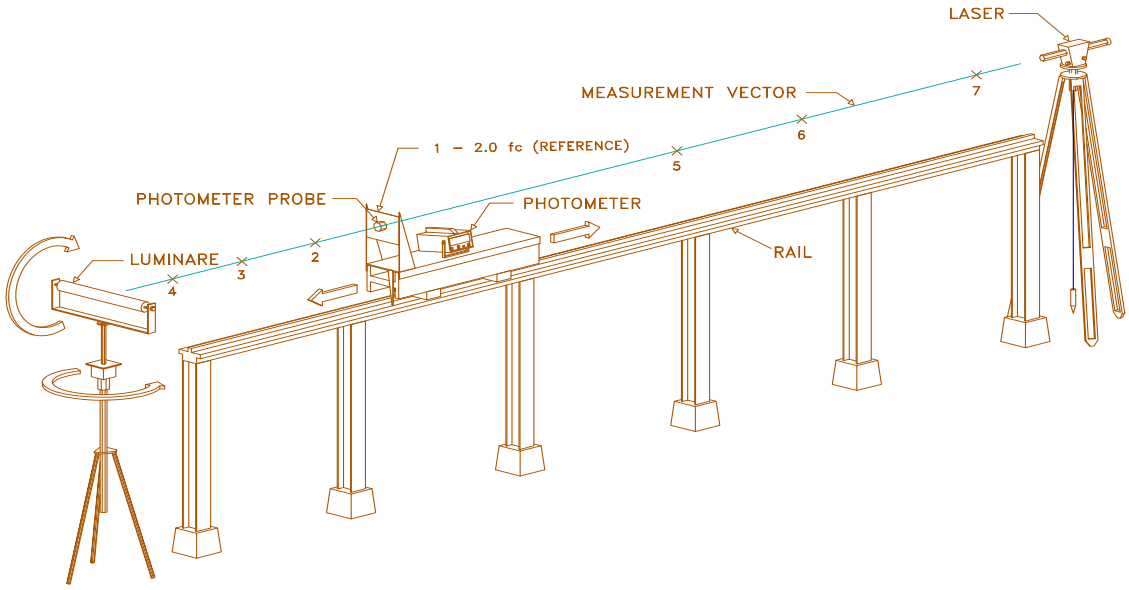
5.2. Darkroom

The darkroom should exclude exterior light such that illumination measurements, with internal light sources turned off, are less than 0.1 fc at any point. In addition, any surface that receives light from the test luminaire should have a reflectance of less than 5 percent.

5.3. Laboratory Setup (rail)

Figure 1 illustrates the suggested testing setup for collecting the iso-footcandle luminaire data. The luminaire is rotated in the horizontal and vertical planes

about a fixed axis in ten degree increments and the photometer is moved toward or away from the luminaire along a fixed line.



5.3.1. The luminaire is placed on a heavy duty camera tripod, or similar device. The device shall allow rotation of the luminaire 360º for both the azimuth and elevation about the center of the luminaire's lens/enclosure. (See Section 7.3)

5.3.2. A monorail, or similar device, that allows the photometer sensing head to move along a straight path away from the center of the luminaire. This straight path is called the measurement vector.

6.0 TEST SAMPLES

6.1. The lamps should be seasoned by the independent light lab in accordance with the IES Guide LM-54 - Guide to Lamp Seasoning. The test lamp shall be identical to those used with the luminaire for in-mine use.

6.2. Luminaires with ballasts shall be tested using the same type ballast that the luminaire manufacturer provides for field use.

7.0 PROCEDURES

7.1. A signed written request for acceptance as an Independent Light Laboratory, to generate ISO-Footcandle illumination curves (see Appendix No. 1), shall be submitted to the Chief of the Electrical Safety Division (ESD), when an independent light laboratory wants to be considered for acceptance under this STP. This request should include a signed statement certifying

that the independent light lab will test in accordance with the procedures of this STP.

7.2. Two computer utility programs, PROMEAS and LUMREG, are used to collect illumination data. The PROMEAS and LUMREG programs are DOS-based utility programs to support the main CAP software program. They are used for storing and viewing luminaire illumination profile data. The measurements obtained must be entered into the PROMEAS computer program and the PROMEAS data is then entered into the LUMREG program. The LUMREG data is then entered into the CAP illumination software program. Copies of these computer utilities, the CAP Software program and the NIOSH publications, referenced in Section 3.2, may be obtained from CDC NIOSH's Pittsburgh Research Laboratory. Instructions and short tutorials for these programs are included in the publication. The mailing address is:

CDC - NIOSH - Pittsburgh Research Laboratory
626 Cochrans Mill Road
P.O. Box 18070
Pittsburgh, PA 15236-0070

7.3. Align the center of the luminaire's lens/enclosure with the center of the photometer's sensing head (see figures no. 2 - 5). An instrument, such as a laser, should be used. It is essential in collecting valid data that this alignment is precise.

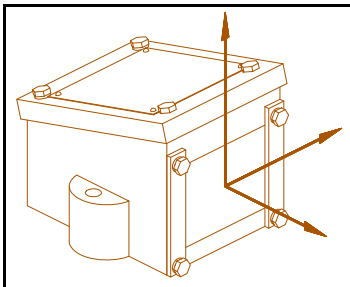


Figure no. 2

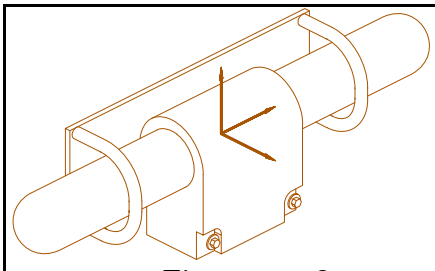


Figure no. 3

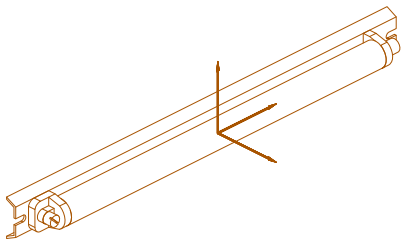


Figure no. 4

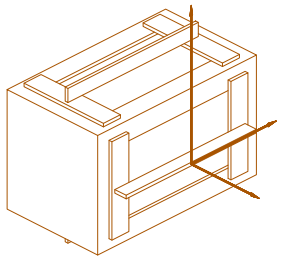


Figure no. 5

7.4. The luminaire should be level side-to-side and front-to-back. This orientation will be the luminaire's zero azimuth, zero elevation setting.

7.5. Voltage and current measurements shall be taken at the luminaire terminals for incandescent lamps, and at the ballast input terminals for ballasted lamps. Voltages (AC or DC) must be maintained according to IES Guide LM-49 - Life Testing of General Lighting Incandescent Filament.

7.6. All surfaces lighted by the test lamp should be treated to reduce reflectance. Lab personnel must wear clothing of low reflectivity and remain outside the field of measurement.

7.7. The luminaire/ballasts shall reach thermal stabilization before tests are conducted.

7.8. Begin measurements with the luminaire at zero azimuth, zero elevation. All measurements are to be made along the measurement vector.

7.9. Move the sensing head (that is rail mounted) along the measurement vector until the photometer reads 2.00 fc, and record the illuminance (2.00 fc) and the distance from the luminaire. This is the reference value for subsequent measurements on this vector. If the light is so dim that 2.00 fc can not be read anywhere along the measurement vector, skip the vector entirely. If the light is so bright that 2.00 fc can not be located anywhere along the measurement vector, choose an appropriate reference number at a higher value, such as 4.00 fc or 6.00 fc.

7.10. Measure the illuminance at six additional locations along the vector. Two sets of three measurements are taken on each side of the reference value. One of the first set of three measurements should be taken as close to the luminaire as possible, the other set of three should include a measurement taken as far from the luminaire as possible or to a distance where the

reading falls to 0.10 fc. To simplify measurements, divide the distances equally.

7.11. Once the illuminance measurements are made for all azimuths at 10^o increments, the elevation of the luminaire is changed by an increment of 10^o and the procedure repeated. If the luminaire has a narrow beam spread, fewer measurements will be necessary. A luminaire using a fluorescent lamp will require more measurements.

7.12. At regular intervals during the measurement process, the accuracy of the collected data shall be checked, usually after 100 measurements. Two measurements on either side of the zero azimuth measurement vector should be selected and checked for consistency with the initial readings.

7.13. The data obtained can be entered directly into the PROMEAS software computer program described in Section 7.2.

7.14. ESD personnel will conduct an inspection of the dark room and the rail setup including the test equipment. The independent light laboratory personnel must demonstrate to MSHA the ability to independently collect ISO-Footcandle Curves in accordance with this procedure before the laboratory is permitted to submit iso-footcandle curve data under this procedure.

8.0 TEST DATA

8.1. The results of the tests and related documentation will be sent to the luminaire manufacturer. The luminaire manufacturer will provide the ESD investigator with a copy of the test results.

8.2. After completing the iso-footcandle illumination testing, the independent light lab shall submit a signed and dated Independent Light Laboratory Testing Confirmation Form (see Appendix No. 2) or equivalent for every luminaire tested. This form should be submitted to the A&CC along with a copy of the independent light lab test report (see Appendix No. 3).

Note: The A&CC will not consider any luminaire's iso-footcandle curve valid unless accompanied by a confirmation form. Any changes to the luminaire that would affect the light output, (e.g., different lens material, diffusion, lamp placement or type) must be reported to the A&CC by the luminaire manufacturer.

(Appendix No 1)

Request for Acceptance as an Independent Light Laboratory

Chief, Approval and Certification Center
765 Industrial
Industrial Park Road
Triadelphia, West Virginia 26059

Date: _____

Laboratory Name: _____
Contact: _____
Address: _____
_____
_____

This is a request for acceptance as an Independent Light laboratory under the Mine Safety and Health Administration (MSHA), Approval and Certification Center's (A&CC) document "**Standard Test Procedure to Collect ISO-Footcandle Illumination Curves at Independent Light Laboratories".**

We confirm that we will follow this standard test procedure when conducting the subject tests and will provide the required documentation. It is understood that the luminaire manufacturer is responsible for all costs associated with the testing.

We agree to permit MSHA representatives to conduct an on-site inspection of our facilities relative to our ability to conduct testing for the Collection of ISO-Footcandle curves, as a condition of acceptance under this standard test procedure. We also permit MSHA to conduct follow-up on-site inspections as deemed necessary.

Please provide copies of the software utilities programs **PROMEAS** and **LUMREG**.

Signed: _____

Title: _____

(Appendix No. 2)

Independent Light Laboratory Testing Confirmation Form

Date: _____

Laboratory Name: _____
Contact: _____
Address: _____
_____
_____

LUMINAIRE INFORMATION

Manufacturer: _____ Model No. _____

MSHA X/P or IA No. _____

Type of Lens Diffusion: _____

Laboratory Report No. _____

Computer Files Included: (yes) ____ (no) _____ Remarks: _____

LAMP INFORMATION

Manufacturer: _____ ANSI Code: _____

Lamp Designation: _____

Input Voltage: _____ Input Current: _____ Wattage: _____

Lamp Manufacturers Initial Lumen Rating: _____

Measured Lumen Value: _____

I (name) _____ , (title) _____ ,
certify that the procedures used to collect the test data for the subject Model _____
Luminaire and its lamp are in accordance with published illuminating Engineering Society (IES) Standards, and MSHA's **"Standard Test Procedure to Collect ISO-Footcandle Illumination Curves at Independent Light Laboratories, ASTP2050."**

Signature: _____

(Appendix No. 3)

EXAMPLE TEST LAB REPORT

IES SUSTAINING MEMBER

NITE-BRITE TESTING LABORATORY

DATE: 4-06-2009

234 Main Street. Allentown, PA 18103 (610) 357-2400

NTL NUMBER: 06655

PREPARED FOR: NEW AGE MFG, INC.

MODEL NUMBER: J43-2700

MSHA XP / IA NUMBER: X/P-7777

LUMINAIRE DESCRIPTION: CAST ALUMINUM BASE WITH AMBER COLORED PLASTIC GLOBES AROUND LAMPS

LAMP(S): (TWO) PHILIPS EARTH LIGHT UNIVERSAL 23W

LAMP SAMPLE NUMBERS: M21 AND M22

LAMP ANSI NUMBER: SLS23

LAMP ELECTRICAL CHARACTERISTICS: 120.0V, O.61A, 41.5W

LAMP MANUFACTURER'S INITIAL LUMEN RATING: 1500

CANDELA READING AT 0 DEGREES VERTICAL, 0 DEGREES LATERAL: 49.63

COMMENTS: NONE TESTED BY: JOHN KESSLER