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U.S. DEPARTMENT OF TRANSPORTATION

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

LABORATORY TEST PROCEDURE

FOR

FMVSS 125

Warning Devices

SAFETY ASSURANCE
Office of Vehicle Safety Compliance
Room 6115, NSA-30
400 Seventh Street, SW
Washington, DC 20590

OVSC LABORATORY TEST PROCEDURE NO. 125

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1. PURPOSE AND APPLICATION

The Office of Vehicle Safety Compliance (OVSC) provides contracted laboratories with Laboratory Test Procedures (TPs) which serve as guidelines for obtaining compliance test data. The data are used to determine if a specific vehicle or item of motor vehicle equipment meets the minimum performance requirements of the subject Federal Motor Vehicle Safety Standard (FMVSS). The purpose of the OVSC Laboratory Test Procedures is to present a uniform testing and data recording format, and provide suggestions for the use of specific equipment and procedures. Any contractor interpreting any part of an OVSC Laboratory Test Procedure to be in conflict with a Federal Motor Vehicle Safety Standard or observing any deficiencies in a Laboratory Test Procedure is required to advise the Contracting Officer's Technical Representative (COTR) and resolve the discrepancy prior to the start of compliance testing.

Contractors are required to submit a detailed test procedure to the COTR before initiating the compliance test program. The procedure must include a step-by-step description of the methodology to be used.

The OVSC Laboratory Test Procedures are not intended to limit or restrain a contractor from developing or utilizing any testing techniques or equipment which will assist in procuring the required compliance test data.

NOTE:

The OVSC Laboratory Test Procedures, prepared for use by independent laboratories under contract to conduct compliance tests for the OVSC, are not intended to limit the requirements of the applicable FMVSS(s). In some cases, the OVSC Laboratory Test Procedures do not include all of the various FMVSS minimum performance requirements. Sometimes, recognizing applicable test tolerances, the Test Procedures specify test conditions which are less severe than the minimum requirements of the standards themselves. Therefore, compliance of a vehicle or item of motor vehicle equipment is not necessarily guaranteed if the manufacturer limits certification tests to those described in the OVSC Laboratory Test Procedures.

2. GENERAL REQUIREMENTS

FMVSS 125 establishes requirements for devices, without self-contained energy sources, that are designed to be carried in motor vehicles and used to warn approaching traffic of the presence of a stopped vehicle, except for devices designed to be permanently affixed to the vehicle.

The purpose of this standard is to reduce deaths and injuries due to rear end collisions between moving traffic and disabled vehicles.

The test procedures and methods outlined herein are based on the requirements of FMVSS 125, effective Nov 11, 1974, and all amendments thereto.

Reflex reflective material and fluorescent material that meet the requirements of this standard shall be affixed to both faces of the warning device. Alternatively, a dual purpose orange fluorescent and red reflective material that meets the requirements of this standard (hereafter referred to as "dual purpose material") may be affixed to both faces in place of the reflective and fluorescent materials.

3. SECURITY

The contractor shall provide appropriate security measures to protect the OVSC test specimens from unauthorized personnel during the entire compliance testing program. The contractor is financially responsible for any acts of theft and/or vandalism which occur during the storage of test specimens. Any security problems which arise shall be reported by telephone to the Industrial Property Manager (IPM), Office of Contracts and Procurement, within two working days after the incident. A letter containing specific details of the security problem will be sent to the IPM (with copy to the COTR) within 48 hours. The contractor shall protect and segregate the data that evolves from compliance testing before and after each test. No information concerning the compliance testing program shall be released to anyone except the COTR, unless specifically authorized by the COTR, the COTR's Branch or Division Chief or by the Contracting Officer.

NO INDIVIDUALS, OTHER THAN CONTRACTOR PERSONNEL, SHALL BE ALLOWED TO WITNESS ANY COMPLIANCE TEST UNLESS SPECIFICALLY AUTHORIZED BY THE COTR.

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire compliance testing area, test fixtures and instrumentation in a neat and clean condition with test instruments arranged in an orderly manner consistent with good test laboratory housekeeping practices.

5. TEST SCHEDULING AND MONITORING

The contractor shall submit a test schedule to the COTR prior to testing. Tests shall be completed as required in the contract. All testing shall be coordinated with the COTR to allow monitoring by the COTR or other OVSC personnel.

6. TEST DATA DISPOSITION

The contractor shall make all preliminary compliance test data available to the COTR within four hours after the test. Final test data, including digital printouts and computer generated plots (if applicable), shall be furnished to the COTR in accordance with the contract schedule. Additionally, the contractor shall analyze the preliminary test results as directed by the COTR.

All backup data sheets, strip charts, recordings, plots, technicians notes, etc., shall be retained by the contractor for a minimum of 3 years after conclusion of each delivery order, purchase order, etc. The COTR shall direct final disposition at that time.

7. GOVERNMENT FURNISHED PROPERTY (GFP)

ACCEPTANCE OF TEST SPECIMENS

All highway warning device test samples shall be inspected within one week of receipt at the laboratory. The devices must be in an undamaged condition. Date of receipt and condition of all devices shall be recorded.

NOTIFICATION OF COTR

The COTR must be notified within 24 hours after the compliance test specimens have been received at the test laboratory.

TEST SAMPLE IDENTIFICATION AND STORAGE

Upon receipt at the laboratory, each brand of warning device to be tested shall be assigned a laboratory test group number, and each individual warning device shall be assigned a serial number or letter for identification.

An inventory shall be made of the number, name and condition of warning devices received, and then they shall be stored in a dry, clean, dark and dust free area to prevent damage in any manner which may affect the compliance test results.

8. CALIBRATION OF TEST INSTRUMENTS

Before the contractor initiates the safety compliance test program, a test instrumentation calibration system will be implemented and maintained in accordance with established calibration practices. Guidelines for setting up and maintaining such calibration systems are described in MIL-C-45662A, "Calibration System Requirements". The calibration system shall be set up and maintained as follows:

A. Standards for calibrating the measuring and test equipment will be stored and used under appropriate environmental conditions to assure their accuracy and stability.

B. All measuring instruments and standards shall be calibrated by the contractor, or a commercial facility, against a higher order standard at periodic intervals NOT TO EXCEED TWELVE (12) MONTHS! Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.

C. All measuring and test equipment and measuring standards will be labeled with the following information:

(1) Date of calibration
(2) Date of next scheduled calibration
(3) Name of the technician who calibrated the equipment

D. A written calibration procedure shall be provided by the contractor which includes as a minimum the following information for all measurement and test equipment unless the calibration is performed by a licensed commercial facility.

(1) Type of equipment, manufacturer, model number, etc.
(2) Measurement range
(3) Accuracy
(4) Calibration interval
(5) Type of standard used to calibrate the equipment (calibration traceability of the standard must be evident)

E. Records of calibration for all test instrumentation shall be kept by the contractor in a manner which assures the maintenance of established calibration schedules. All such records shall be readily available for inspection when requested by the COTR. The calibration system will need the acceptance of the COTR before the test program commences. The records of instrumentation used in a specific test are to be included in Appendix B of the Final Report.

9. PHOTOGRAPHIC DOCUMENTATION

Photographs shall be glossy black and white, 8 x 10 inches, and legible. A tag, label or placard identifying the test specimen shall appear in each photograph and be legible. One set of glossy prints shall be included in the final test report which will be optically scanned by the OVSC. Each photograph shall be labeled as to subject matter. The test setup and equipment used in all tests shall be photographed for the record before and at prescribed time periods during testing listed in this test procedure. Any failure must be photographed at various angles to assure complete coverage.

Each final test report shall include a photograph of each assembled test specimen as received by the laboratory. It is suggested that the following format be used for these photographs (test specimen includes opaque container if furnished with product).

A. Side view

B. Three-quarter front view

C. Three-quarter rear view

In addition, any visually apparent damage, associated with the failure or the inability of the specimen to complete the test program, shall be photographed and the photograph included in the final test report.

The photograph of the "test setup" for each phase of testing shall be required in each final test report. Multiliths or other suitable photographic copying techniques maybe used to reproduce the original photographs. Include all photographs in Appendix C of the final report.

10. DEFINITIONS

ENTRANCE ANGLE

The angle having as its sides the line through the center, and normal to the face, of the object to be tested, and the line from the center of the object to the center of the source of illumination as shown in Figure 1.

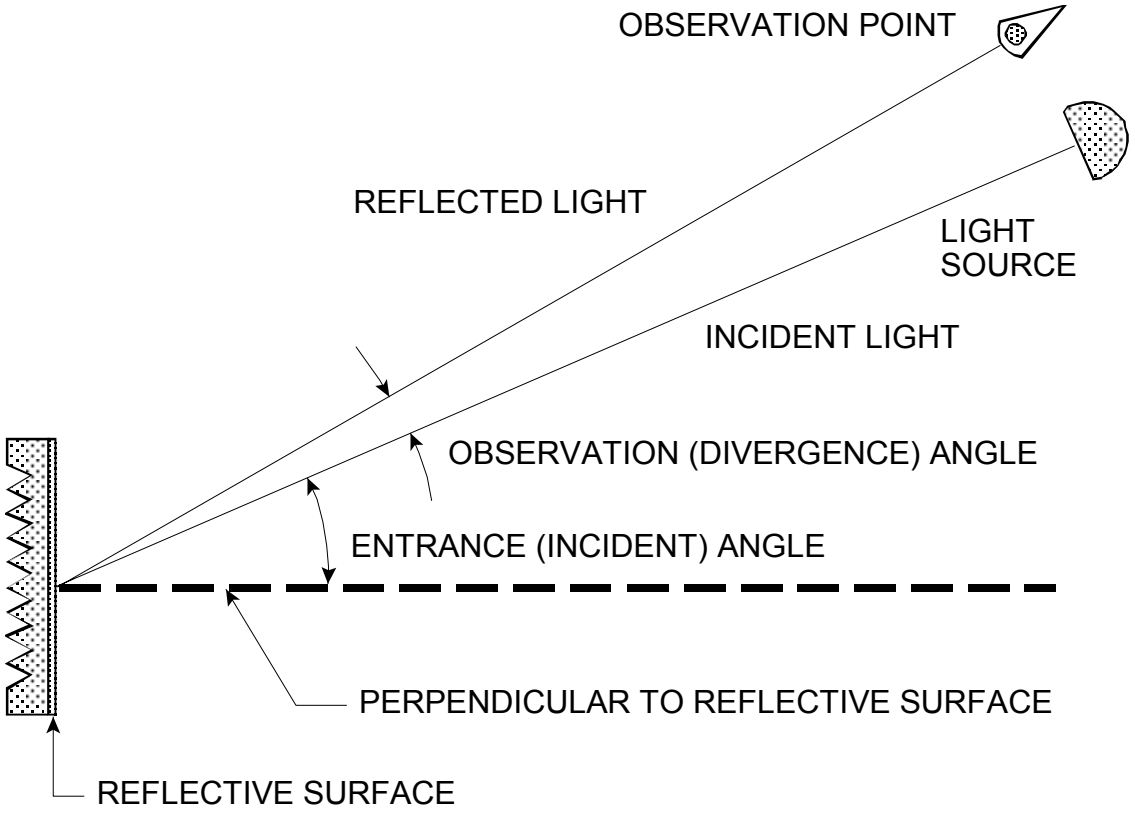

FIGURE 1 - DESIGNATION OF MEASUREMENT ANGLES

FLUORESCENT

The property of emitting visible light due to the absorption of radiation of a shorter wave-length which may be outside the visible spectrum.

OBSERVATION ANGLE

The angle having as its sides the line from the observation point to the center of the object to be tested and the line from the center of that object to the center of the source of illumination which is shown in Figure 1.

REFLEX REFLECTIVE MATERIAL

Material which reflects light in directions close to the direction of incident light, over a wide range of variations in the direction of incident light.

11. PRETEST REQUIREMENTS

IN-HOUSE TEST PROCEDURE

Prior to conducting any compliance test, contractors are required to submit a detailed in-house compliance test procedure to the COTR which includes a step-by-step description of the methodology to be used. Written approval must be obtained from the COTR before initiating the compliance test program so that all parties are in agreement.

The procedure shall contain the following items:

A. Sample tagging and marking
B. Sample stowage
C. Testing setup
D. Testing procedure (step-by-step)
E. Data recording
F. Setup photographs
G. Failure samples photographs showing samples before and after, and illustrating point(s) of failure
H. Description of failure(s)

INTERIM FAILURE REPORTS

When a failure is encountered during the test, the COTR shall be notified by telephone within 24 hours. A completed interim failure report form and a copy of the data sheet(s) shall be prepared and FAXed to the COTR (FAX No. 202-366-1024). The failed test specimen shall be placed in a bonded storage area unless otherwise directed by the COTR.

TEST DATA LOSS

A compliance test is not to be conducted unless all of the various test conditions specified in this OVSC Laboratory Test Procedure have been met. Failure of a contractor to obtain the required test data and to maintain acceptable limits on test parameters in the manner outlined in the procedure may require a retest at the expense of the contractor. The retest costs will include the cost of the replacement item of motor vehicle equipment (warning device) and all costs associated with conducting the retest. The original test specimen used for the invalid test shall remain the property of OVSC, and the retest specimen shall remain the property of the contractor. If there is a test failure, the contractor shall retain the retest specimen for a period not exceeding 3 years. If there is no test failure, the Contractor may dispose of the test specimen upon notification from the COTR that the final test report has been accepted.

11. PRETEST REQUIREMENTS....Continued

The Contracting Officer of NHTSA is the only NHTSA official authorized to notify the contractor that a retest is required. The retest shall be completed within two (2) weeks after the contractor obtains a replacement test specimen. If a retest is conducted, no test report is required for the original test.

TEST CONDITIONS

Unless otherwise specified, all tests and measurements shall be conducted under the following environmental conditions:

A. Room Ambient - 70º ± 10ºF
B. Relative Humidity - 40% to 60%
C. Atmospheric Pressure - 28 to 32 inches of mercury

Continuous recording of environmental temperature and humidity conditions shall be provided for during all phases of testing. Test samples, unless subjected to environmental conditioning, shall be stabilized at test room conditions for a period of a least 24 hours immediately prior to compliance testing.

TEST PERSONNEL PERFORMANCE

Personnel supervising and/or performing the compliance test program shall be thoroughly familiar with the requirements, test conditions, equipment for the test to be conducted, and safety requirements.

RECORDING OF TEST DATA

Environment

Environmental data (test area and conditioning environments) and test data shall be continuously and permanently recorded on strip charts, circular charts or other suitable print-out media throughout the testing period.

Test Data

Test data acquired with appropriate equipment and instrumentation, shall be permanently recorded for the following tests:

A. Equipment (Data Sheet 1)

B. Configuration (Data Sheet 2)

C. Color (Data Sheet 3)

11. PRETEST REQUIREMENTS....Continued

D. Reflectivity (Data Sheet 4)

E. Luminance (Data Sheet 5)

F. Stability (Data Sheet 6)

G. Durability (Data Sheet 7)

REPORTING OF TEST DATA

In addition to the instrument recording data (which may be in analog form), all test data shall be recorded, in standard engineering units, on forms specifically prepared for this purpose such as those shown as the data sheet for each test. Changes or corrections of data sheets shall be made by drawing a line through the original entry, which must still remain legible, and adding the change alongside. The initials of the changer shall appear alongside of the change.

Data sheets presented in a final form must be typewritten, signed, and include the date of test and date of signoff. The report number must appear at the top of each data sheet. The collection and printing of data by computer controlled equipment used in conducting the tests is also acceptable provided the same end results are obtainable.

SAMPLE INFORMATION AND SUMMARY OF RESULTS

Preceding the test data sheets in the final report, shall be specimen information and a summary of results. These sheets will describe the articles tested, list the various tests performed, and indicate the result of either a Pass (P) or Fail (F) as supported by the information tabulated on the test data sheets.

TEST EQUIPMENT

Each item of equipment used in the compliance test program and subject to calibration must be entered in Appendix B as part of the final report. The following headings and format are suggested for the tabulation of calibrated equipment:

A. Equipment description

B. Equipment manufacturer

C. Type and/or model

D. Serial number

11. PRETEST REQUIREMENTS....Continued

E. Limits

F. Accuracy

G. Frequency of calibration

H. Expiration date of calibration

I. Test number for instrumentation usage

12. COMPLIANCE TEST EXECUTION

TEST QUANTITIES

The quantities of test specimens to be tested will be specified in the contract.

TEST SEQUENCE

Each specimen shall be subjected to the following sequence of tests per the specified sections of FMVSS 125 and shall be conducted in the order shown:

A. Before environmental conditioning - -

(1) Visual inspection and assembly - S5.1

(2) Configuration - S5.2

(3) Stability - S5.6

(4) Reflectivity - S5.4

(5) Color - S5.3

(6) Luminance - S5.5

(7) Durability - S5.7 (to establish baseline for comparison)

B. After environmental conditioning - -

(1) Durability - S5.7

(2) Reflectivity - S5.4

(3) Color - S5.3

(4) Luminance - S5.5

ENVIRONMENTAL CONDITIONING

Environmental conditioning when required shall be accomplished by assembling and erecting the warning devices and subjecting them to conditioning as follows:

A. Exposure at - 40ºF, + 8ºF,- 0ºF for 16 hours, + 0 minutes, - 15 minutes, in a circulating air chamber using ambient air with a relative humidity not less than 30 and not more than 70 percent measured at 70ºF ± 10ºF.

12. COMPLIANCE TEST EXECUTION....Continued

B. Return to ambient air at 70º ± 10º F for a minimum of 2 hours.

C. Exposure to circulating ambient air in an oven at 150ºF, + 0ºF, - 10ºF, for 16 hours, + 0 minutes, - 15 minutes, using air which would have a relative humidity of between 30 and 70 percent at 70º ± 10ºF.

D. Return to ambient air at 70º ± 10º for a minimum of 2 hours.

E. Exposure to 100ºF, + 0ºF, - 10ºF, and 90%, + 0%, - 10%, relative humidity for 16 hours, + 0 minutes, - 15 minutes.

F. Return to ambient air at 70ºF ± 10ºF for a minimum of 2 hours.

G. Exposure to salt spray (ASTM Standard B-117) for a period of 4 hours, + 0 minutes, -15 minutes. Rinse only, do not wipe or scrub.

H. Return to ambient air at 70ºF ± 10ºF for a minimum of 2 hours.

I. Immersion in distilled water at 100ºF, + 0ºF, - 10ºF, for 2 hours ± 5 minutes.

J. Return to ambient conditions for 2 hours + 15 minutes, - 0 minutes.

K. Conduct the Durability test within the time allocated in Step J.

L. Start the Reflectivity test within 2.5 hours of the completion of Step I.

M. Conduct the Color and Luminance tests after completion of the test of Step L without any time restriction in terms of minutes after completion of Step I.

VISUAL INSPECTION AND ASSEMBLY OF TEST ARTICLES - All results of these tests shall be recorded on Data Sheet 1.

Reflective and Fluorescent Material

Inspect and verify that a reflex reflective material and a fluorescent material or a combination reflective and fluorescent material (dual purpose material) are securely affixed to both faces of the warning device.

Reusable Container Inspection and Test

Inspect and verify that each warning device is enclosed in an opaque protective reusable container. Multi-warning devices intended to be sold for use with a

12. COMPLIANCE TEST EXECUTION....Continued

single vehicle as a set may be enclosed in a single container. The warning devices are to be securely supported in the container to minimize damage that would affect the assembly or performance of the warning device.
Test the opacity of the container for transmission of light in the ultraviolet range of 200 nm to 400 nm. There shall be less than 0.01 percent UV transmission over the required range. The measurements shall be conducted on the thinnest region of the container and shall cover the required range in 20 nm steps. In addition to the quantitative UV test, verify that there is no gap along any joint line which would allow visual light between portions of the container used to install or remove the devices from the container. In addition, observe that the overall container is opaque to visual observation of the contents.

Assembly

Verify that the warning device can be erected, set up for use, and replaced in its container, without the use of tools.

Remove, assemble, and replace warning device as follows:

A. Remove warning device from container

B. Erect or assemble warning device, per manufacturer's instructions, without tools

C. Dismantle warning device without tools by reversing assembly procedure or per manufacturer's instructions. Replace warning device in container

Manufacturer's Labeling And Instructions For Use

Inspect and verify that the warning device is permanently and legibly marked. Legibility of markings shall be acceptable if they can be read by an observer having corrected visual acuity of 20/40 (Snellen ratio) at a distance of one foot. Permanency of markings shall be deemed acceptable if they are cast on the device. Acceptability of printed markings or labels shall be determined by wiping with a clean, dry cloth within 1/2 hour of removal from the environmental conditioning (previous Step I). The printing shall still be legible and the label shall still adhere to the device after rubbing.

The markings shall contain the following:

A. Name of manufacturer

B. Month and year of manufacture

12. COMPLIANCE TEST EXECUTION....Continued

C. The DOT Symbol, or a statement of compliance with the applicable FMVSS.

D. Instructions for erection and use which - -

(1) Are indelibly printed or cast on the warning device or are attached in such a manner that they cannot be easily removed

(2) Recommend that the driver activate vehicular hazard warning signal lamps before leaving vehicle to erect the warning device

(3) Include an illustration on how to setup and use the warning device similar to that shown in Figure 2.

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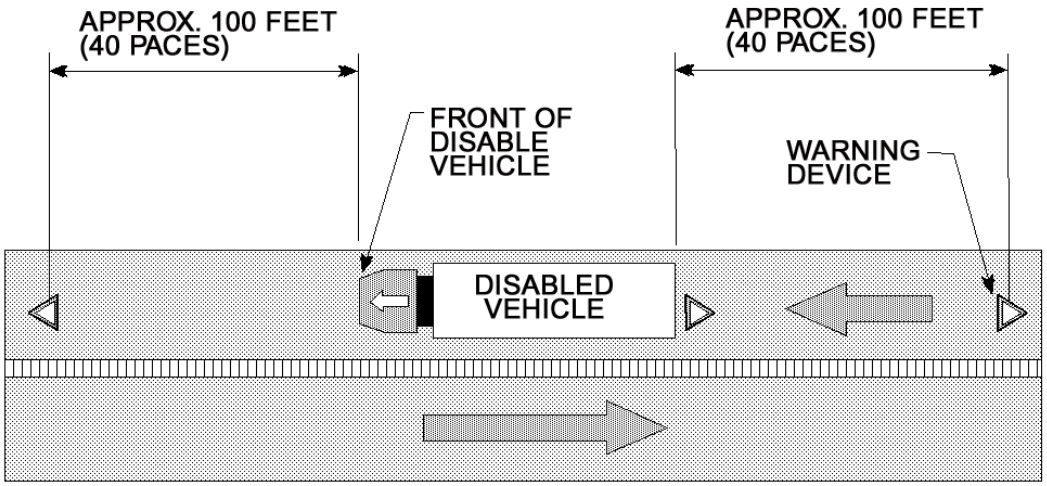

PLAN VIEW OF ROADWAY

FIGURE 2 - RECOMMENDED WARNING DEVICE POSITIONING

CONFIGURATION

Inspect and measure the assembled and erected warning device as stated below.

Linear measurements shall be made with a scale to an accuracy of ± 0.10 inch and angular measurements shall be made with a protractor to an accuracy of ± ½°. All test data should be recorded on Data Sheet 2.

12. COMPLIANCE TEST EXECUTION....Continued

Inspection

A. Verify that the required reflective and fluorescent materials are unobscured, except as necessary to provide fasteners, pivoting beads, or other means to allow collapsibility or support of the device.

B. Verify that all edges of the warning device, whether plastic or metal, shall be chamfered or rounded as necessary to reduce possibility of harm to the user from sharp edges.

Measurement of Triangle

Verify that the triangle - -

A. Has lower edge not less than one inch above the ground, with the device erected on a horizontal surface.

B. Is equilateral and stands in a plane not more than 10º from the vertical when the lower edge is horizontal.

C. Is not less than 17.0 inches and not more than 22.0 inches in length on the outer border as shown in Figure 3.

D. Is not less than 2.0 and not more than 3.0 inches wide.

E. Has vertices with radii not less than 0.25 inches nor more than 0.50 inches. An external radius measurement template may be used to verify radii.

Measurements of Reflective and Fluorescent Materials

Verify that each face of the triangle of a warning device with separate reflective and fluorescent materials has - -

A. An outer section of red reflex reflective material of uniform width not less than 0.75 nor more than 1.75 inches wide,

B. An inner section of orange fluorescent material of uniform width not less than 1.25 nor more than 1.30 inches wide. A warning device utilizing dual purpose material must have a total face width of not less than 2.0 inches and not more than 3.0 inches.

12. COMPLIANCE TEST EXECUTION....Continued

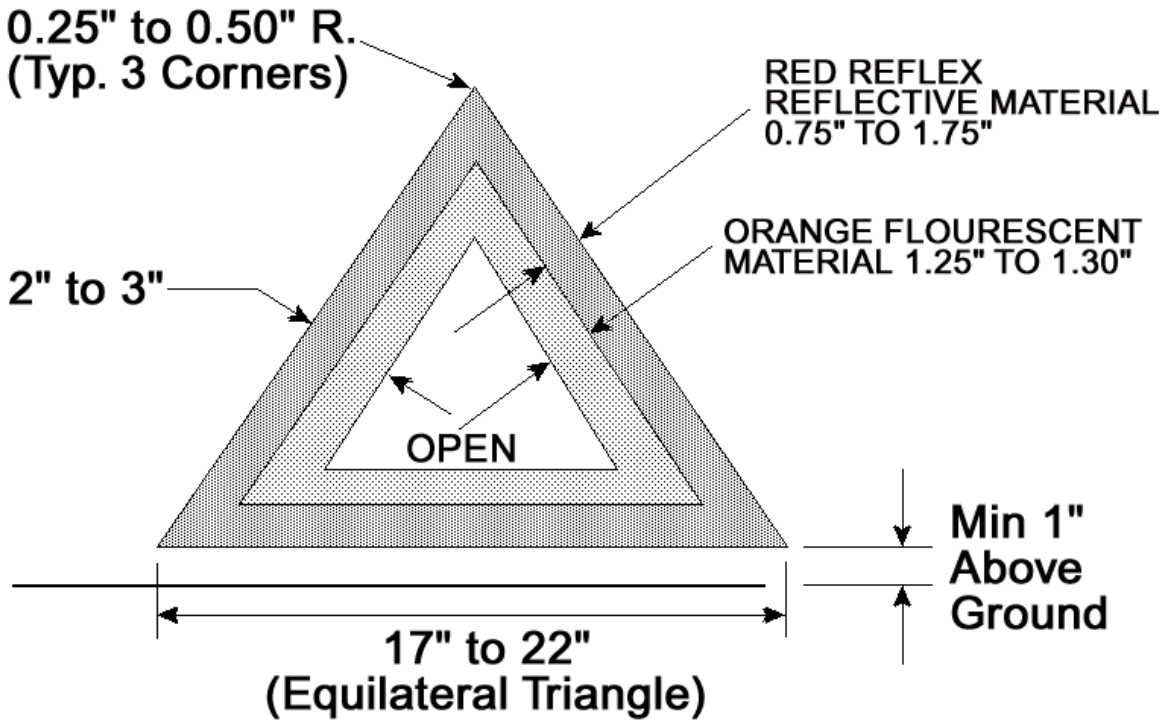

FIGURE 3 - DIMENSIONS OF WARNING DEVICE

COLOR

The color tests, as shown in Figure 5, shall be conducted using a colorimeter or spectrophotometer or an equivalent device capable of measuring the chromaticity coordinates when using the specified light sources indicated.

Color tests shall be conducted on the specimen before and after conditioning of the materials.

Red Reflex Reflective Material

Expressed in terms of the International Commission on Illumination (CIE) 1931 standard colorimetric observer system, using a spectrum source of illumination from a tungsten filament lamp operating at 2,856º Kelvin color temperature, the chromaticity coordinates of the red reflex reflective material shall be within the region bounded by the spectrum locus and the lines, shown in Figure 4, and defined by the following equations:

BOUNDARY	**EQUATIONS**
Yellow	y # 0.33
White	x + y $ 0.98

12. COMPLIANCE TEST EXECUTION....Continued

Orange Fluorescent Material

Expressed in terms of the International Commission on Illumination (CIE) 1931 standard colorimetric observer system, when tested with an unmodified spectrum source of illumination from a 150-watt high pressure Xenon compact arc lamp, the chromaticity coordinates of the orange fluorescent material shall lie within the region bounded by the spectrum locus and the lines, shown in Figure 4, and defined by the following equations:

BOUNDARY	EQUATIONS
Yellow	y # 0.49x + 0.17
White	x + y $ 0.93
Red	y $ 0.35

Dual Purpose (Reflective and Fluorescent) Material

Expressed in terms of the International Commission on Illumination (CIE) 1931 standard colorimetric observer system, using a spectrum source of illumination from a 150-watt high pressure Zenon compact arc lamp whose light is diffused by an integrating sphere, the red reflex reflective chromaticity coordinates and the orange fluorescent chromaticity coordinates shall be within the regions defined previously in this procedure.

Test Procedure

The following general procedures are recommended for obtaining the x and y chromaticity coordinates of the color of the test specimen using the proper light source as specified.

12. COMPLIANCE TEST EXECUTION....Continued

The device shall be wiped clean with a soft lint free cloth and handled by the edges only during all color measurements.

The device shall be visually inspected for uniform distribution of color. If color is not uniform throughout the device, each region of color variation shall be measured for color. The region of measurement shall be flat and free of any markings.

A. Scan the spectrum from 380 nm to 770 nm.

12. COMPLIANCE TEST EXECUTION....Continued

CIE CHROMATICITY DIAGRAM

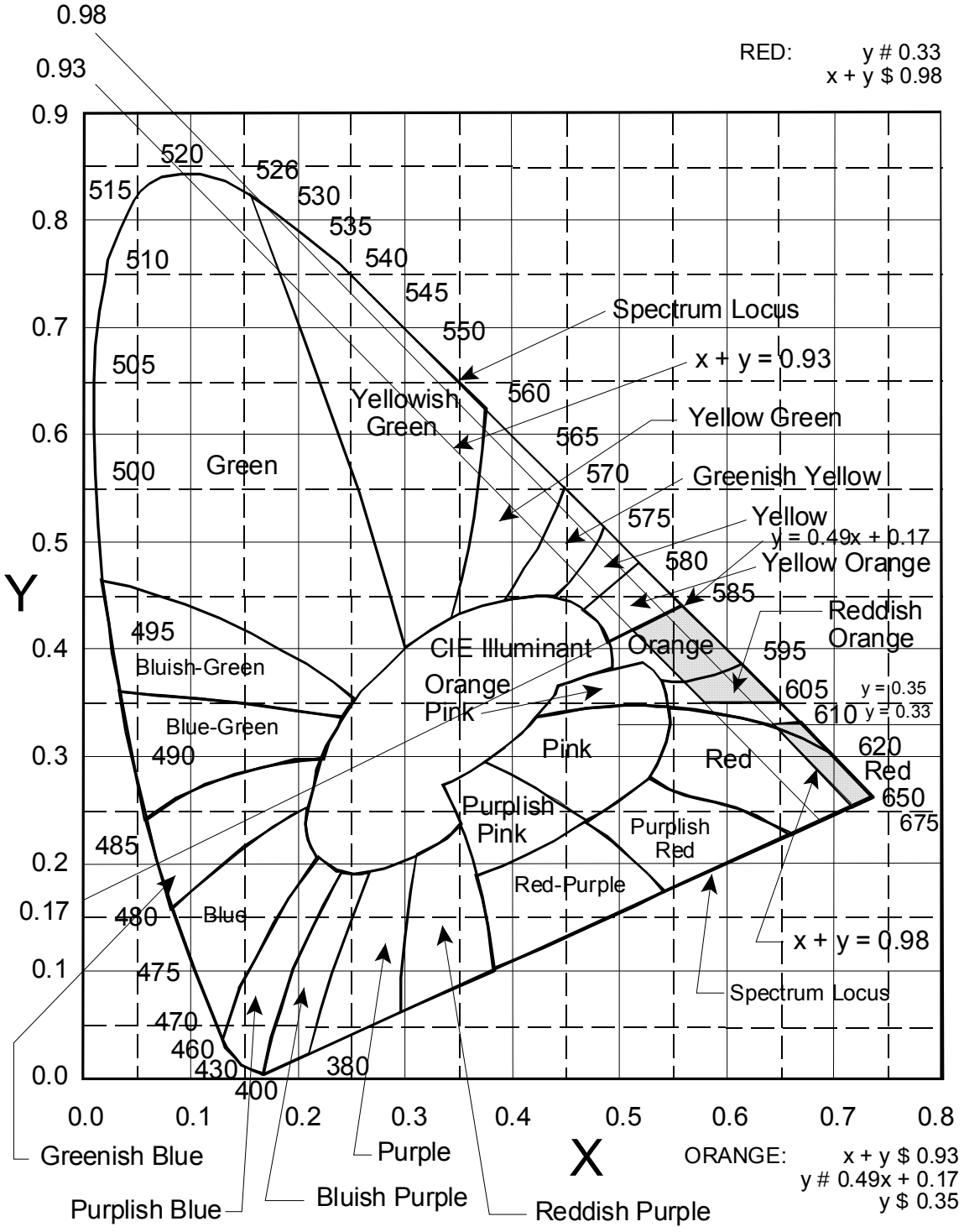

FIGURE 4

12. COMPLIANCE TEST EXECUTION....Continued

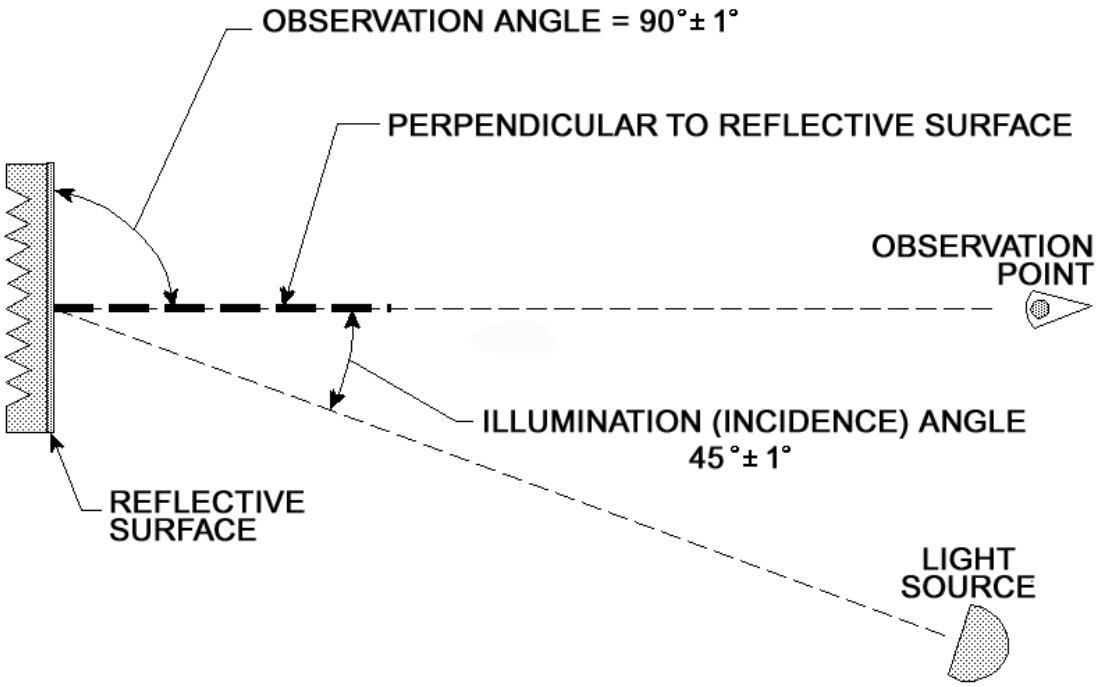

FIGURE 5 - LUMINANCE COLOR DIAGRAM

B. Record data from detector chart on Data Sheet 3 and compute x and y coordinates. See sample computation shown below. Equipment which performs these functions automatically may be used.

C. Compare chromaticity (x and y coordinates) of the color being tested with the requirements set forth in Data Sheet 3 to determine if the color is acceptable.

D. Record all required data on Data Sheet 3.

NOTE: The coordinates for the orange material may also be obtained during conduct of the Luminance Test.

COMPUTATION OF TRISTIMULUS VALUES

Reference:

Data Sheet 3, sheets 3 of 10 - 10 of 10
Data Sheet 5, sheets 1 of 5 - 5 of 5

12. COMPLIANCE TEST EXECUTION....Continued

Obtain a printout from the spectrophotometer of a curve with percent reflectance plotted against wavelength (nm) as shown in Figure 6. Using the tables supplied as the above referenced data sheets, take the required readings from the graph and fill-in the appropriate reflectance (ρ) columns as shown in the Table 1. The remaining columns are simple horizontal computations as noted in each column heading. When completed, total the columns vertically for the Tristimulus Values. The chromaticity coordinate (x) is obtained by dividing the vertical sum of the $(\rho)E_c$ column by the sum of the vertical sum of the $(\rho)E_c(\bar{x})$, $(\rho)E_c(\bar{y})$ and $(\rho)E_c(\bar{z})$ columns. A similar procedure will be used for obtaining y and z coordinates.

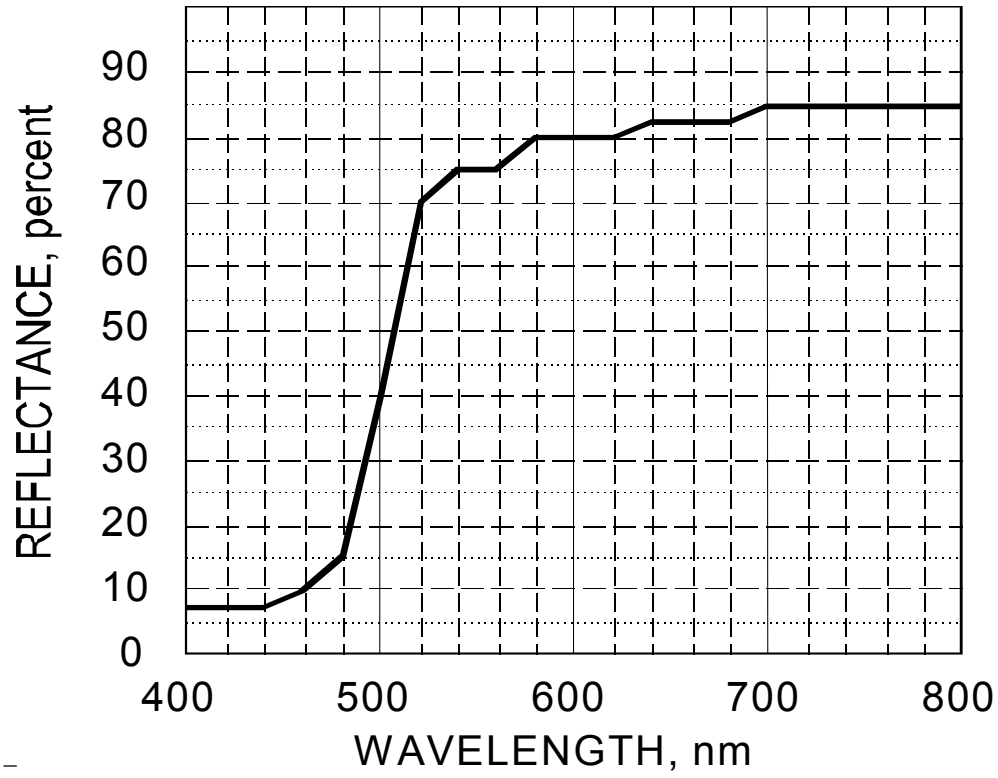

FIGURE 6 – REFLECTANCE VS. WAVELENGTH

REFLECTIVITY

The red reflex reflective material, prior to and after conditioning, is to be tested for reflectivity using the following method:

A. If the orange fluorescent and red reflective materials are separated on the face of the warning device, mask or remove the orange portion of the reflective material. If dual purpose material is used in the warning device, the reflectivity of both orange and red colors are to be measured simultaneously.

12. COMPLIANCE TEST EXECUTION....Continued

TABLE 1 - SAMPLE COMPUTATION OF TRISTIMULUS VALUES

WAVE-LENGTH	REFLECT-ANCE			
λ(nm)	ρ	$\rho E_c \bar{x}$	$\rho E_c \bar{y}$	$\rho E_c \bar{z}$
380	0.091	0		2
390	0.089	2		8
400	0.085	7	0	34
410	0.079	26	1	124
420	0.077	95	3	458
430	0.076	228	9	1112
440	0.077	306	20	1535
450	0.086	337	38	1775
460	0.095	319	66	1833
470	0.108	245	114	1617
480	0.145	161	235	1372
490	0.250	91	590	1319
500	0.445	23	1513	1274
510	0.635	57	3069	365
520	0.708	408	4575	504
530	0.725	1104	5752	281
540	0.733	2041	6706	143
550	0.743	3182	7305	64
560	0.752	442	7400	29
570	0.768	5623	7025	15
580	0.782	6582	6250	13
590	0.787	7070	5215	8
600	0.790	7070	4200	6
610	0.793	6602	3312	2
620	0.798	5642	2516	2
630	0.803	4263	1759	0
640	0.809	2988	1167	
650	0.814	1912	721	
660	0.818	1113	412	
670	0.822	582	213	
680	0.824	304	110	
690	0.827	141	51	
700	0.829	68	24	
710	0.832	32	12	
720	0.833	16	5	
730	0.835	7	3	
740	0.836	3	2	
750	0.837	2	1	
760	0.838	1	1	
770	0.839	1	0	
Tristimulus Values	X,Y,Z	63,076	70,395	14,495
Chromaticity Coordinates	X,Y,Z	0.4263	0.4758	0.0980

12. COMPLIANCE TEST EXECUTION....Continued

B. The directed light source for illumination is to be a tungsten filament lamp operating at 2,856º Kelvin color temperature.

C. Setup the warning device in a dark area 100 feet from the illumination source. Use a black drop cloth behind the warning device. The directed light source should be impinged on the reflective surface at the following entrance (incidence) angles:

10º up	10º down
20º left	20º right
30º left	30º right

All entrance angle measurements shall be made with an accuracy of ± 1º. The zero (0º) position will be with the face of the reflective surface perpendicular to the light source as shown in Figure 7.

D. The observation point shall be located above the illumination source at a distance to provide the required observation (divergence) angles of 0.2º ± 0.02º and 1.5º ± 0.15º.

E. Measure the reflectivity of the warning device with a calibrated sensitive foot candle meter or a light sensitive cell that can be traced to a Institute of Standards and Technology calibrated foot candle rating. Measure or compute the total candlepower per incident foot candle at each observation point. The results measured at each position must equal or exceed the required values listed on Data Sheet 4.

LUMINANCE

The orange fluorescent material, before and after conditioning, shall be tested for luminance in accordance with the following procedure:

A. A spectroradiometer or equivalent instrument shall be used as the analytical instrument for the luminance test.

B. A 150-watt high pressure Xenon compact arc lamp shall be used as the light source to illuminate the material. If dual purpose material is being tested, the illuminating light shall be diffused by an integrating sphere. The incident angle of illumInation shall be 45º ± 1º and the angle of observation shall be 90º ± 1º from the test sample as shown on the next page. Measure the luminance of the material with no ray of the reremitted light being more than 5º ± 0.5º from the perpendicular to the specimen.

12. COMPLIANCE TEST EXECUTION....Continued

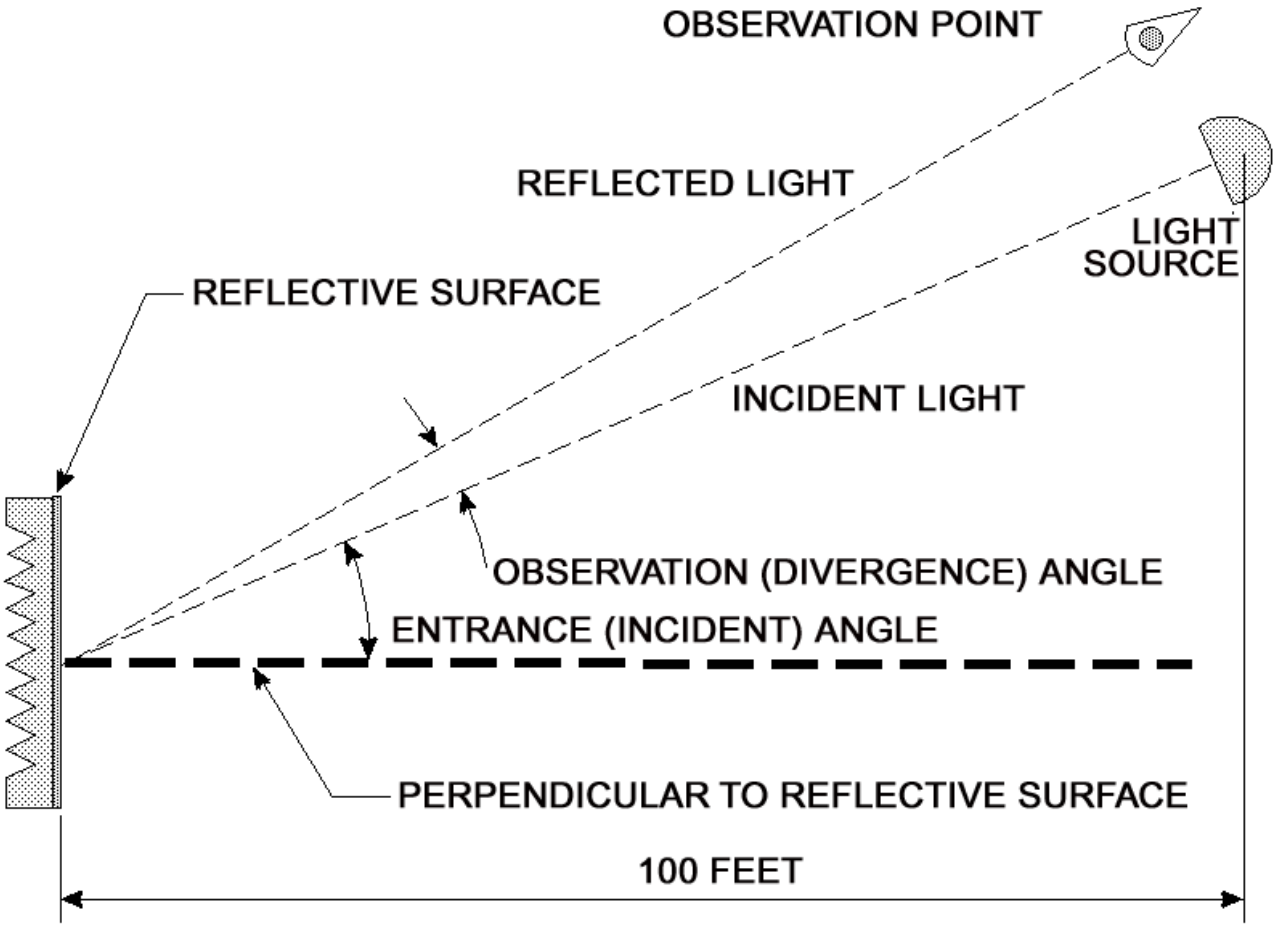

FIGURE 7 - REFLECTIVITY TEST DIAGRAM

C. If the orange fluorescent and red reflective materials are separated on the face of the warning device mask the red reflective area to prevent it from affecting the photometric measurements of orange area luminance. If dual purpose material is used, the luminance of both orange and red areas are to be measured simultaneously.

D. Insert the test specimen in a spectroradiometer adjusted to the angles specified previously. The luminance test and color test may be conducted on automated equipment including data computation and recording.

E. Scan the spectrum from 380 nm to 770 nm with measurements made every 10 nm.

F. Compute and record y coordinates on Data Sheet 5

G. Repeat the procedure for flat magnesium oxide surface (Ref. ASTM E-259).

12. COMPLIANCE TEST EXECUTION....Continued

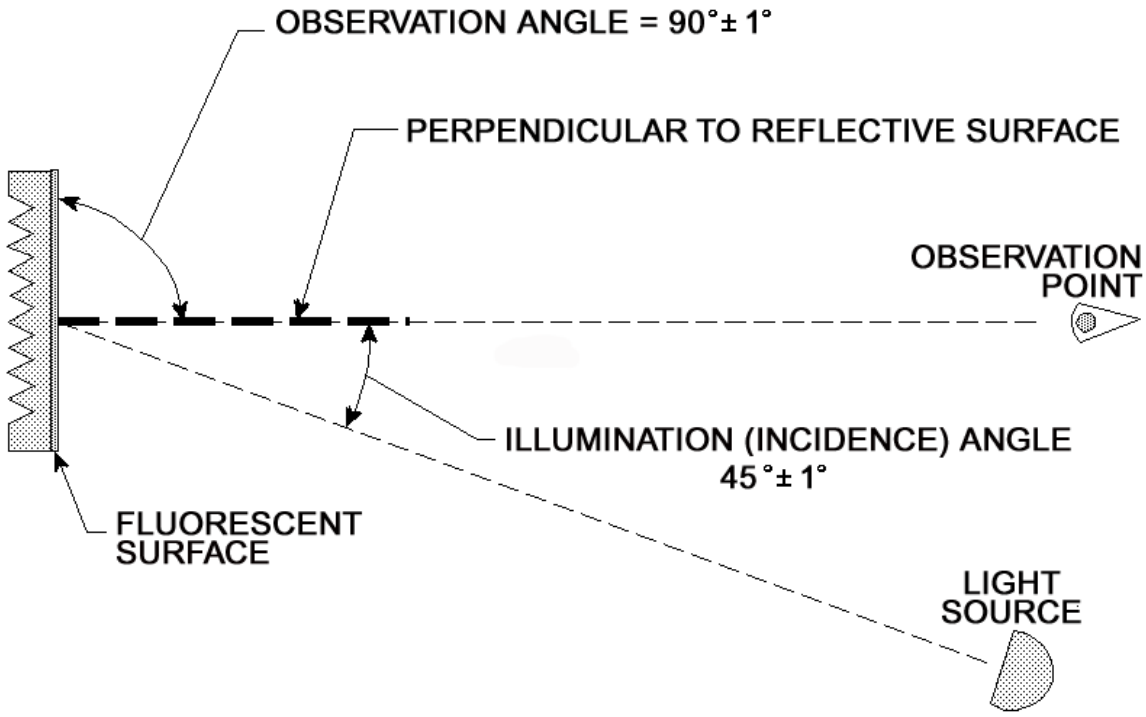

FIGURE 8 - LUMINANCE DIAGRAM

H. Compute the quotient (percentage) of the luminance material relative to that of the magnesium oxide surface. The acceptable minimum relative luminance is 25% and the acceptable minimum product of that value of relative luminance expressed as a percentage, and the orange width in inches is 44.

STABILITY

The warning device shall be erected per manufacturer's instructions and placed on a brushed concrete surface having the following characteristics:

A. Coefficient of friction = 1.0 ± 0.2

B. Number of brush marks per inch = 10 ± 2

C. Depth of brush marks = 12 ± 3 mils

A safety restraining line or equivalent restraint should be attached to the warning device to prevent damage to the equipment in the event the device is blown off of the concrete surface.

12. COMPLIANCE TEST EXECUTION....Continued

The test for stability is conducted by subjecting the device to a 40 mph, + 0 mph, - 2 mph wind blowing from any horizontal direction for a sustained period of 3 minutes, + 0 minutes, - 0.2 minutes. The concrete surface shall be level to ± 1º.

At any wind direction, with the triangle parallel to or perpendicular to the brush marks in the concrete surface, the following requirements shall be met:

A. Rotation: 10º max.

B. Linear movement: 3 inches max.

C. Triangle tilt from vertical: 10º max.

Procedure

A. Align the warning device with the triangle portion of the device perpendicular to the brush marks of the concrete surface.

B. Mark the position and orientation of the warning device on the concrete for reference in the event of movement.

C. The orientation of the wind shall be horizontal to achieve the following wind impact angles with the front face of the triangle. The front face is arbitrarily defined as the face having the manufacturer's name. Angle tolerances shall be ± 1º.

0º (wind perpendicular to the vertical front face of the triangle)

45º 135º

90º (edgewise) 180º (back face)

D. Apply wind at 40 mph, +0 mph, - 2 mph at each position for 3 minutes, +0 minutes, -0.2 minutes.

E. Measure any rotation, linear movement, and tilt angle of the warning device at each direction of wind. Angular measurements shall have an accuracy of ± 1º; linear measurements shall have an accuracy of ± 0.1 inch.

F. Record test data on Data Sheet 6.

G. Align warning device with the triangle portion of the device parallel to the brush marks of the concrete surface.

H. Repeat Steps B through F.

12. COMPLIANCE TEST EXECUTION....Continued

DURABILITY

Following the conditioning, in preparation for the performance tests, the warning device shall be inspected as follows to determine any physical changes due to conditioning.

A. Warping or distortion of any type in or on any parts.

B. Delamination or joint separation.

C. Seizing or binding of joints or movable parts.

D. Discoloration of parts.

E. Rust or corrosion on any metal parts.

Record results on Data Sheet 7. Comments relative to any difficulty or failure should be entered on the Data Sheet. Changes in warping or delamination of over 100 percent of any value recorded prior to conditioning shall constitute a test failure. Seizing, discoloration and rust are to be recorded for information only.

13. POST TEST REQUIREMENTS

The contractor shall re-verify all instrumentation and check data sheets and photographs. Make sure data is recorded in all data block on every compliance test data sheet.

14. REPORTS

14.1 MONTHLY STATUS REPORTS

The contractor shall submit a monthly Test Status Report and an Equipment Status Report to the COTR. The Equipment Status Report shall be submitted until all final reports are accepted. Samples of the required Monthly Status Reports are contained in the report forms section.

14.2 APPARENT TEST FAILURE

Any indication of a test failure shall be communicated by telephone to the COTR within 24 hours with written notification FAXed within 48 hours (Saturdays and Sundays excluded). A Notice of Test Failure (see report forms section) with a copy of the particular compliance test data sheet(s) and preliminary data plot(s) if any shall be included. In the event of a test failure, a post test calibration check of some critically sensitive test equipment and instrumentation may be required for verification of accuracy. The necessity for the calibration shall be at the COTR's discretion and shall be performed without additional costs to the OVSC.

14.3 FINAL TEST REPORTS

14.3.1 COPIES

In the case of a test failure, **SEVEN** copies of the Final Test Report shall be submitted to the COTR for acceptance within three weeks of test completion. The Final Test Report format to be used by all contractors can be found in the "Report Section".

Where there has been no indication of a test failure, **FOUR** copies of each Final Test Report shall be submitted to the COTR within three weeks of test completion. Payment of contractor's invoices for completed compliance tests may be withheld until the Final Test Report is accepted by the COTR. Contractors are requested to NOT submit invoices before the COTR is provided copies of the Final Test Report.

Contractors are required to submit the first Final Test Report in typed draft form within two weeks after the compliance test is conducted. The contractor and the COTR will then be able to discuss the details of both test conduct and report content early in the compliance test program.

Contractors are required to PROOF READ all Final Test Reports before submittal to the COTR. The OVSC will not act as a report quality control office for contractors. Reports containing errors may be returned to the contractor for correction, and a "hold" placed on invoice payment for the particular test.

14. REPORTS....Continued

14.3.2 REQUIREMENTS

The Final Test Report, associated documentation (including photographs) are relied upon as the chronicle of the compliance test. The Final Test Report will be released to the public domain after review and acceptance by the COTR. For these reasons, each final report must be a complete document capable of standing by itself.

The contractor should use **detailed** descriptions of all compliance test events. Any events that are not directly associated with the standard but are of technical interest should also be included. The contractor should include as much **detail** as possible in the report.

Instructions for the preparation of the first three pages of the final test report are provided below for the purpose of standardization.

14.3.3 FIRST THREE PAGES

A. FRONT COVER --
A heavy paperback cover (or transparency) shall be provided for the protection of the final report. The information required on the cover is as follows:

(1) Final Report Number such as 125-ABC-9X-001, where - -
125 is the FMVSS tested
ABC are the initials for the laboratory
9X is the Fiscal Year of the test program
001 is the Group Number (001 for the 1st test, 002 for the 2nd test, etc.)

(2) Final Report Title And Subtitle such as

SAFETY COMPLIANCE TESTING FOR FMVSS NO. 125
Warning Devices
****
Safety Equipment Company
Model 845 "Safe-T-Triangle"
Part No. 8456782

(3) Contractor's Name and Address such as

COMPLIANCE TESTING LABORATORIES, INC.
4335 West Dearborn Street
Detroit, Michigan 48090

14. REPORTS....Continued

NOTE: DOT SYMBOL WILL BE PLACED BETWEEN ITEMS (3) AND (4)

(4) Date of Final Report completion

(5) The words "FINAL REPORT"
(6) The sponsoring agency's name and address as follows

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Safety Assurance
Office of Vehicle Safety Compliance
400 Seventh Street, SW
Room 6115 (NSA-30)
Washington, DC 20590

14. REPORTS....Continued

B. FIRST PAGE AFTER FRONT COVER --
A disclaimer statement and an acceptance signature block for the COTR shall be provided as follows

This publication is distributed by the U. S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared By: _____

Approved By: _____

Approval Date: _____

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: _____

Acceptance Date: _____

14. REPORTS....Continued

C. SECOND PAGE AFTER FRONT COVER --
A completed Technical Report Documentation Page (Form DOT F1700.7) shall be completed for those items that are applicable with the other spaces left blank. Sample data for the applicable block numbers of the title page follows.

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125-ABC-9X-001

Block No. 2 -- GOVERNMENT ACCESSION NUMBER

Leave blank

Block No. 3 -- RECIPIENT'S CATALOG NUMBER

Leave blank

Block No. 4 -- TITLE AND SUBTITLE

Final Report of FMVSS 125 Compliance Testing of Model 845 "Safe-T-Triangle", Part No. 8456782, Manufactured by APEX Plastics

Block No. 5 -- REPORT DATE

March 1, 199X

Block No. 6 -- PERFORMING ORGANIZATION CODE

ABC

Block No. 7 -- AUTHOR(S)

John Smith, Project Manager / Bill Doe, Project Engineer

Block No. 8 -- PERFORMING ORGANIZATION REPORT NUMBER

ABC-DOT-XXX-001

Block No. 9 -- PERFORMING ORGANIZATION NAME AND ADDRESS

ABC Laboratories
405 Main Street
Detroit, MI 48070

14. REPORTS....Continued

Block No. 10 -- WORK UNIT NUMBER

Leave blank

Block No. 11 -- CONTRACT OR GRANT NUMBER

DTNH22-9X-D-12345

Block No. 12 -- SPONSORING AGENCY NAME AND ADDRESS

US Department of Transportation
National Highway Traffic Safety Administration
Safety Assurance
Office of Vehicle Safety Compliance (NSA-31)
400 Seventh Street, SW, Room 6115
Washington, DC 20590

Block No. 13 -- TYPE OF REPORT AND PERIOD COVERED

Final Test Report
Feb. 15 to Mar. 15, 199X
(Enter "Start Date" to "Completion Date")

Block No. 14 -- SPONSORING AGENCY CODE

NSA-30

Block No. 15 -- SUPPLEMENTARY NOTES

Leave blank

Block No. 16 -- ABSTRACT

Compliance tests were conducted on the APEX Plastics Model 845 "Safe-T-Triangle" Warning Device in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-125-01 for the determination of FMVSS 125 compliance. Test failures identified were as follows:

None

NOTE: Above wording must be shown with appropriate changes made for a particular compliance test. Any questions should be resolved with the COTR.

14. REPORTS....Continued

Block No. 17 -- KEY WORDS

Compliance Testing
Safety Engineering
FMVSS 125

Block No. 18 -- DISTRIBUTION STATEMENT

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Add appropriate number

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14. REPORTS....Continued

14.3.4 TABLE OF CONTENTS

Final test report Table of Contents shall include the following:

A. Section 1 — Purpose of Compliance Test

B. Section 2 — Compliance Data Summary

C. Section 3 — Test Data

D. Section 4 — Test Equipment List and Calibration Information

E. Section 5 — Photographs

F. Section 6 — Notice of Test Failure (if applicable)