



U.S. Department
of Transportation

Federal Aviation
Administration

Advisory Circular

Subject: SPECIFICATION FOR L-853,
RUNWAY AND TAXIWAY
RETROREFLECTIVE MARKERS

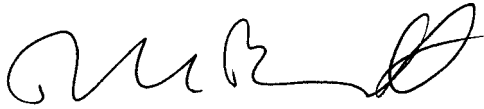
Date: 09/14/06
Initiated by: AAS-100

AC No.: 150/5345-39C
Change:

- 1. PURPOSE.** This Advisory Circular (AC) contains the Federal Aviation Administration (FAA) standards for retroreflective markers for airport runways and taxiways.
- 2. EFFECTIVE DATE.** Effective 6 months after the date of this circular, only that equipment qualified per this specification will be listed in AC 150/5345-53, *Airport Lighting Equipment Certification Program*.
- 3. CANCELLATION.** AC 150/5345-39B, *FAA Specification L-853, Runway and Taxiway Retroreflective Markers*, dated December 9, 1980, is cancelled.
- 4. APPLICATION.** The standards contained herein are recommended by the FAA in all applications involving airport development of this nature. The use of these standards is mandatory for airport projects receiving Federal funds under the airport grant assistance program and those using funds under the passenger facility charge (PFC) program.
- 5. PRINCIPAL CHANGES.**
 - a. Separated color strips (banding) on markers are no longer permitted.
 - b. The sheet retroreflector material is updated to ASTM 4956-05 Type III and above.
 - c. Tethering of frangible elevated markers is required.
 - d. All applicable documents and document sources have been updated.
- 6. METRIC UNITS.** To promote an orderly transition to metric units, this AC contains both English and metric dimensions. The metric conversions may not be exact metric equivalents and, until there is an official changeover to the metric system, the English dimensions will govern.
- 7. COMMENTS OR SUGGESTIONS** for improvements to this AC should be sent to:

Manager, Airport Engineering Division
Federal Aviation Administration
ATTN: AAS-100
800 Independence Avenue, S.W.
Washington DC 20591

- 8. COPIES OF THIS AC.** The Office of Airport Safety and Standards is in the process of making ACs available to the public through the Internet. These ACs may be found through the Federal Aviation Administration (FAA) home page (www.faa.gov).

A handwritten signature in black ink, appearing to read 'DLB', with a stylized flourish at the end.

David L. Bennett
Director of Airport Safety and Standards

CHAPTER 1. SCOPE AND CLASSIFICATION.

1.1 Scope.

This specification covers the requirements for retroreflective markers for airport runways and taxiways.

1.2 Classification.

Two types and two styles of retroreflective markers are covered by this specification.

1.2.1 Types.

- a. Type I, Semiflush Marker for Centerline Marking.
- b. Type II, Elevated Marker for Edge Marking.

1.2.2 Styles.

The style designation applies to Type I markers only:

- a. Style I, Plowable Markers.
- b. Style II, Non-plowable Markers .

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CHAPTER 2. REFERENCED DOCUMENTS.

2.1 General.

The following is a listing of documents referenced in this AC:

2.1.1 Federal Aviation Administration (FAA) Publications.

2.1.1.1 FAA Advisory Circulars (ACs).

AC 150/5345-53 *Airport Lighting Equipment Certification Program*

2.1.2 Military and Federal Publications.

2.1.2.1 Military Standard.

MIL-STD-810F *Environmental Engineering Considerations and Laboratory Tests*
1 January 2000

2.1.2.2 Federal Specifications and Standards.

L-P-380 *Plastic Molding Material Methacrylate*

2.1.3 American Society for Testing and Materials (ASTM) Standard.

ASTM D 4280-04 *Standard Specification for Extended Life Type, Nonplowable, Raised Retroreflective Pavement Markers*

ASTM D 4383-05 *Standard Specification for Plowable, Raised Retroreflective Pavement Markers.*

ASTM D 4956-05 *Standard Specification for Retroreflective Sheeting for Traffic Control*

2.1.4 Document Sources.

FAA ACs may be obtained from:

U.S. Department of Transportation
Subsequent Distribution Office
Ardmore East Business Center
3341 Q 75th Ave.
Landover, MD 20785

Telephone: (301) 322-4961

FAX: (301) 386-5394

Website: www.faa.gov/airports_airtraffic/airports/resources/advisory_circulars/

Military standards and specifications publications may be obtained from:

DAPS/DODSSP
Building 4, Section D
700 Robbins Avenue
Philadelphia, PA 19111-5094

Telephone: (215)697-2179
FAX: (215)697-1460
Website: dodssp.daps.dla.mil

Federal specifications and standards may be obtained from:

Federal Supply Services
Specification Section
470 L'Enfant Plaza East
SW Suite 8100
Washington, DC 20407

Telephone: (202) 619-8925
FAX: (202) 619-8985
Website: www.dsp.dla.mil

ASTM standards may be obtained from:

ASTM International
100 Barr Harbor Drive
P.O. Box C700
West Conshohocken, PA 19428-2959

Telephone: (610) 832-9585
FAX: (610) 832-9555
Website: www.astm.org

CHAPTER 3. REQUIREMENTS.

3.1 Retroreflective Material Requirements.

3.1.1 General.

3.1.1.1 Construction.

Retroreflective material is designed to reflect light at an oblique angle back toward its source. Two types of retroreflective material are in wide use:

- a. Sealed plastic lenses with a smooth face and a prismatic configuration on the back (referred to herein as lens retroreflectors).
- b. Flexible sheeting with a smooth face, embedded optical retroreflective elements, and an adhesive backing (referred to herein as sheet retroreflectors).

3.1.1.2 Configuration.

The configuration of the retroreflective material on a marker should be designed to maximize its visibility. When the viewer is facing the marker, it must be visible as a single color with a continuous unbroken surface. Separated color strips (bands) of the same color or differing colors laid out across the marker face must not be used. In the case of a bidirectional marker, only a single color per side must be visible.

3.1.1.2.1 Type I Lens Retroreflectors.

The configuration of the Type I marker will be as follows:

- a. Runway centerline markers will be white in color.
- b. Taxiway centerline markers will be green in color.

3.1.1.2.2 Type II Lens Retroreflectors.

The configuration of the Type II marker will be as follows:

- a. Runway edge markers will be solid white in color.
- b. Taxiway edge markers will be solid blue in color.
- c. Runway threshold markers will be green in color.
- d. Runway end markers will be red in color.
- e. Runway threshold markers and runway end markers may be combined in one bidirectional marker.

3.1.1.2.3 Type II Sheet Retroreflectors.

- a. Runway edge markers will be solid white in color.
- b. Taxiway edge markers will be solid blue in color.
- c. Runway threshold markers will be green in color.
- d. Runway end markers will be red in color.
- e. Runway threshold markers and runway end markers may be combined in one bidirectional marker.

3.1.2 Sheet Retroreflector Requirements.

- a. The sheet retroreflector material must be manufactured and perform per the requirements of ASTM D 4956-05, *Standard Specification for Retroreflective Sheeting for Traffic Control*. The manufacturer may use Class 1 through 4 adhesive backings.
- b. The sheet retroreflector material used must be Type III Sheeting or higher. See ASTM D 4956-05, Table 8 for the minimum reflection coefficients (R_A) for colors white, green, red, and blue.

3.1.3 Lens Retroreflector Requirements.**3.1.3.1 Specific Intensity (SI).**

- a. Lens retroreflectors used in Type I markers must have the minimum SI per Table 1.
- b. Lens retroreflectors used in Type II markers must have the minimum specific intensities (SI) per Table 2.
- c. The values listed in both tables are for a clear (white) lens retroreflector. Red and green lens retroreflectors must be at least 25 percent of this value and blue must be at least 8 percent of this value.

Table 1. Minimum SI for clear (white) Type I markers.

Observation angle (degrees)	Entrance angle (degrees)	Specific intensity (candelas per foot-candle)
0.2	0	3.0
0.2	20 Right	1.2
0.2	20 Left	1.2

Table 2. Minimum SI per unit area for clear (white) Type II lens retroreflectors.

Observation angle (degrees)	Entrance angle (degrees)	Specified brightness (candelas per foot-candle per square inch)
0.1	0	14.0
0.1	20	5.6
0.167	0	10.0
0.167	20	4.0
0.33	0	7.0
0.33	20	2.8

3.1.3.2 Chromaticity.

- a. For Type I markers, the approved colors are per paragraph 3.1.1.2.1. Style I markers must meet the color boundaries only (no other parts of the standard are applicable) per ASTM D4283-05, paragraph 6.2, *Color*. Style II markers must meet the color boundaries only (no other parts of the standard are applicable) per ASTM D4280-04, paragraph 6.2.4, *Color*.
- b. The colors approved for use on Type II lens retroreflector markers are per paragraph 3.1.1.2.2 and must meet the color boundaries only (no other parts of the standard are applicable) per ASTM D4280-04, paragraph 6.2.4, *Color*.
- c. The markers may be unidirectional, bi-directional with the same color, or bi-directional with two different colors. The particular color depends on the intended use.

3.1.3.3 Fabrication.

- a. The lens retroreflector must be one of the colors specified in paragraphs 3.1.1.2.1 and 3.1.1.2.2.
- b. The lens retroreflectors must consist of a transparent plastic face (the lens) and an opaque back fused to the lens (under heat and pressure) around the entire perimeter to form a homogeneous unit permanently sealed against dust, water, and water vapor.
- c. The lens retroreflector must consist of a smooth front surface free from projections or indentations other than for identification and a rear surface bearing a prismatic configuration so that it will effect total internal reflection of light.
- d. The manufacturer's trademark must be molded legibly into the face of the lens.
- e. The lens retroreflector shell material must conform to Federal Specification L-P-380, *Plastic Molding Material Methacrylate*, Type I, Class 3.

3.2 Environmental Requirements.

All retroreflector markers must withstand the following environmental conditions:

3.2.1 Temperature.

Exposure to any temperature from -67° F to +149° F (-55° C to +65° C).

3.2.2 Wind.

Exposure to wind speeds up to 100 mph (161 kilometers per hour (km/h)) from any direction.

3.2.3 Salt Fog.

Exposure to a salt-laden atmosphere.

3.2.4 Sunshine.

Exposure to solar radiation.

3.2.5 Weather.

Exposure to all normal operating environmental conditions.

3.2.6 Humidity.

Exposure to any relative humidity between 10 and 95 percent.

3.3 Type I Marker.**3.3.1 Design.**

- a. Style I markers must withstand the impact of a snowplow blade without damage or must be configured so that the blade passes over the marker.
- b. The base must have adequate area to dissipate the loading specified in paragraph 4.2.8 and provide for secure bonding to the pavement.
- c. The marker may be unidirectional or bi-directional, depending on the user's requirements.
- d. The design of the marker must minimize scratching and abrasion of the retroreflective material.

3.3.2 Dimensions.

- a. The Type I marker must not project more than 3/4 inch (20 mm) above the pavement surface.
- b. All corners and edges of the marker projecting above the pavement must be rounded to a minimum radius of 1/8 inch (3 mm).
- c. The minimum retroreflective area in each viewing direction must be 1.5 in² (9.7 cm²) for Style I markers and 3 in² (19.3 cm²) for Style II markers.

3.3.3 Bonding.

- a. Type I, Style I and II markers bonded to the pavement surface must have a clean, flat, hard, rough-textured surface that will promote bonding.
- b. The bonding material must be specified or supplied by the manufacturer and must meet the requirements of paragraph 4.2.6.

3.4 Type II Marker.

3.4.1 Design.

- a. There are three configurations of Type II markers:
 - (1) Plane (flat) surface with lens retroreflectors attached;
 - (2) Plane (flat) surface with sheet retroreflectors attached; or
 - (3) Cylindrical surface with sheet retroreflectors attached.
- b. The marker must be as compact as practical while presenting the required retroreflective area.
- c. The retroreflective material must be at least 2 inches (5.1cm) above the ground when mounted or 3 inches (7.6 cm) if a frangible coupling is used.

3.4.2 Dimensions.

3.4.2.1 Plane Markers.

- a. For a plane surface Type II marker with lens retroreflectors, the retroreflector surface area must be at least 6.5 in² (41.9 cm²).
- b. For a plane surface Type II marker with sheet retroreflector material, the retroreflector surface area must be at least 24 in² (155 cm²).
- c. If the plane markers are bidirectional, the surface areas in paragraphs 3.4.2.1a and b represent the required retroreflector surface area facing each direction.

3.4.2.2 Cylindrical Markers.

- a. For a cylindrical surface marker, at least 96 in² (619 cm²) of sheet retroreflector material must be wrapped uniformly about the cylinder. The sheeting must extend up to the top of the cylinder.
- b. The minimum cylinder diameter is 2 inches (5.1 cm) and the maximum cylinder diameter is 8 inches (20.3 cm).
- c. The overall height of the marker must not be less than 14 inches (35.6 cm) above ground and not greater than 30 inches (76.2 cm) so as to present less of an obstruction to aircraft and a lower profile to the wind.

3.4.3 Construction.

3.4.3.1 Mounting System.

- a. The Type II marker is intended to delineate active aircraft areas. Therefore, it may be mounted on paved or unpaved surfaces.
- b. The manufacturer must provide a satisfactory mounting system for the appropriate type of surface.

- c. The mounting system must withstand the required wind loading and must be designed to prevent the marker or its components from being ingested by jet aircraft.

3.4.3.2 Type II Marker Frangibility.

- a. The Type II marker must be designed to be either flexible or mounted with a frangible fitting (with a breaking point no more than 3 inches above grade) so that it will minimize damage to an aircraft if it strikes the marker.
- b. To utilize a non-frangible mounting, the Type II marker must readily bend or flex when struck so as to minimize damage to an aircraft or vehicle.
- c. Each Type II marker and mounting system must withstand a wind speed of 100 mph (161 km/h) without permanent deformation and must retain its original shape and position in winds up to 50 mph (80 km/h).
- d. A tether anchor hard point is required for Type II markers that are designed to break rather than bend or flex. The tether must be a weather and corrosion resisting material capable of securing the retroreflector when separated from its base or mounting stake and prevent a Foreign Object Debris (FOD) hazard.

3.4.3.3 Materials.

- a. Any metal used in the Type II marker or associated mounting hardware must be corrosion resisting, plated, or treated to resist corrosion.
- b. The Type II plane-type (flat) markers and mounting hardware must be constructed so that the plane orientation will not change when the marker is subjected to the specified wind conditions.
- c. The sheet retroreflector material for all Type II markers must be securely fastened to the marker body so that it will not slip or loosen when exposed to the specified environmental conditions.

CHAPTER 4. EQUIPMENT QUALIFICATION REQUIREMENTS.

4.1 Qualification Procedures.

Procedures for qualifying equipment to be furnished under the Federal grant assistance program for airports are contained in AC 150/5345-53, *Airport Lighting Equipment Certification Program*.

4.2 Qualification Tests.

The following tests must be performed on each unit submitted for qualification, to demonstrate compliance with the specifications:

4.2.1 Retroreflector Material.

- a. This section specifies tests for the retroreflector material component of the marker.
- b. For Type II markers using sheet retroreflector material, the manufacturer must submit the material to the third party certification body for testing. In lieu of testing, the manufacturer may provide a certificate of compliance (issued by the material supplier) to the third party certification body attesting that the material meets the standards in ASTM 4956-05.
- c. All Type I or Type II markers using lens retroreflectors must be tested by the third party certification body.

4.2.1.1 Sheet Retroreflector Material.

The sheet retroreflector material must pass the tests listed for Type III or higher sheeting in ASTM Standard D 4956-05, Paragraph 7, *Test Methods*.

4.2.1.2 Lens Retroreflectors.

- a. Type I, Style I lens retroreflectors must meet the requirements for specific intensity and chromaticity in paragraph 3.1.3. See ASTM D 4383-05, Paragraph 10, *Test Methods* for test procedures.
- b. Type I, Style II lens retroreflectors must meet the requirements for specific intensity and chromaticity in paragraph 3.1.3. See ASTM D 4980-04, Paragraph 9, *Test Methods*, for test procedures.

4.2.2 High Temperature Test.

- a. Nonmetallic markers must be subjected to a temperature of $+149^{\circ}\text{F} \pm 3.6^{\circ}$ ($+65^{\circ}\text{C} \pm 2.0^{\circ}$) for a period of not less than 7 hours.
- b. Any evidence of heat damage, such as deformation, blistering, cracking or crazing of plastic material, or deterioration of filler material, will be cause for rejection.

4.2.3 Low Temperature Test.

- a. Nonmetallic Type I and II markers must be subjected to a temperature of $-67^{\circ}\text{F} \pm 3.6^{\circ}$ ($-55^{\circ}\text{C} \pm 2.0^{\circ}$) for a period of 24 hours.
- b. Evidence of damage will be cause for rejection.

4.2.4 Salt Fog Test.

- a. Markers with no ferrous metal are exempt from this test. The sample marker (with all accessory hardware) must be subjected to a salt fog test per MIL-STD-810F, Method 509.4, Salt Fog, paragraph 4.5.2, Procedure.
- b. The test duration must be 48 hours exposure and 48 hours drying.
- c. Analyze any corrosion for its immediate and potential long-term effects on the proper functioning and structural integrity of the test item.

4.2.5 Sunshine Test.

- a. A sunshine test must be conducted per MIL-STD-810F, Method 505.4, Solar Radiation, and paragraph 4.4.3, Procedure II for all Type I and II markers with nonmetallic exterior parts.
- b. The markers must be subjected to a minimum of 56 cycles. Any evidence of deterioration will be cause for rejection.

4.2.6 Type I Marker Bond Test.

- a. A 2 1/4-in. $\pm 1/4$ in. (5.7 cm \pm 0.6 cm) diameter steel fitting must be bonded to the bottom surface of the Type I marker with an adhesive material specified for use with the marker.
- b. After the adhesive material cures, the steel fitting must be pulled away from the marker at a force not greater than 2,500 pounds (1133.9 kg).
- c. The adhesive material and bottom surface of the marker is considered unsatisfactory if there is complete separation with a pull of less than 1,500 pounds (680.3 kg).

4.2.7 Type I Seal Test.

- a. To demonstrate the integrity of the watertight gasket seal, Type I markers must be subjected to the immersion test described in MIL-STD-810F, Method 512.4, Immersion, paragraph 4.4.2, Procedure I.
- b. Any evidence of water or condensation in the marker housing is considered unsatisfactory performance.

4.2.8 Type I Marker Load Test.

- a. This test must be the last test performed.
- b. The Type I marker must be bonded to a flat steel plate mounted in a standard testing machine.
- c. The load must be applied to the top part of the marker through a block of rubber, 4 inches (10 cm) in diameter, 1 inch (2.5 cm) thick with Shore A hardness of 55 to 70.
- d. A total of 10,000 pounds (4,536 kg) must be applied uniformly over the area of the rubber at a rate of not greater than 2,500 pounds (1,134 kg) per minute.

- e. The results will be considered unsatisfactory if there is any permanent deformation, cracking, or breaking of any materials used.

4.2.9 Type II Marker Wind Load Test.

- a. The Type II marker and its mounting system must be subjected to wind load tests.
- b. Apply a wind load of 50 mph (80 km/h) for 10 minutes to a flexible marker to demonstrate that the marker remains upright at this wind speed.
- c. Apply a wind load of 100 mph (161 km/h) for 10 minutes to all Type II markers; the markers and mounting system must not show any signs of permanent distortion or failure.
- d. An equivalent static force calculated from the wind velocities in paragraphs 4.2.9b and c may be used to demonstrate the wind loading requirement. The equivalent force must be applied perpendicular to the vertical axis of the Type II marker.

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CHAPTER 5. PRODUCTION TEST REQUIREMENTS.

5.1 Production Tests.

A visual examination must be performed on all components to verify proper materials, dimensions, finish, and quality of workmanship.

5.2 Production Test Records.

Records showing actual test results of all tests required by paragraph 5.1 must be maintained for a period of three years by the manufacturer.

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