



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: Specification for L-853, Runway and
Taxiway Retroreflective Markers

Date: Draft

AC No: 150/5345-39E

Initiated By: AAS-100

Change:

Purpose.

This Advisory Circular (AC) contains the Federal Aviation Administration (FAA) standards for retroreflective markers for airport runways and taxiways.

Effective Date.

Effective six months after the issue date of this AC, only equipment **that is** qualified **within this AC** will be listed **according to the requirements in** AC 150/5345-53, Airport Lighting Equipment Certification Program.

Cancellation.

AC 150/5345-39D, *FAA Specification L-853, Runway and Taxiway Retroreflective Markers*, dated September 26, 2011, is cancelled.

Application.

The Federal Aviation Administration (FAA) recommends the guidance and specifications in this Advisory Circular for retroreflective markers. In general, use of this AC is not mandatory. However, use of this AC is mandatory for all projects funded with federal grant monies through the Airport Improvement Program (AIP) and with revenue from the Passenger Facility Charges (PFC) Program. See Grant Assurance No. 34, "Policies, Standards, and Specifications," and PFC Assurance No. 9, "Standards and Specifications." All retroreflective marker designs contained in this standard are the only means acceptable to the Administrator to meet the lighting requirements of Title 14 CFR Part 139, *Certification of Airports*, Section 139.311, Marking, Signs and Lighting.

Principal Changes.

The AC incorporates the following principal changes:

1. Paragraph 3.1.1.2.3, item 5, is added for yellow Type II sheet retroreflectors.
2. All document sources are updated where applicable.

26 The format of the document has been updated in this version, and minor editorial
27 changes have been made throughout.

28 Hyperlinks (allowing the reader to access documents located on the internet and to
29 maneuver within this document) are provided throughout this document and are
30 identified with underlined text. When navigating within this document, return to the
31 previously viewed page by pressing the “ALT” and “ ←” keys simultaneously.

32 6 **Use of Metrics.**

33 Throughout this AC, U.S. customary units are used followed with “soft” (rounded)
34 conversion to metric units. The U.S. customary units govern.

35 7 **Where to Find this AC.**

36 You can view a list of all ACs at
37 http://www.faa.gov/regulations_policies/advisory_circulars/. You can view the Federal
38 Aviation Regulations at http://www.faa.gov/regulations_policies/faq_regulations/.

39 8 **Feedback on this AC.**

40 If you have suggestions for improving this AC, you may use the [Advisory Circular](#)
41 [Feedback](#) form at the end of this AC.

John R. Dermody
Director of Airport Safety and Standards

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61 CHAPTER 1. Scope and Classification

62 1.1 Scope.

63 This specification **details** the requirements for retroreflective markers for airport
64 runways and taxiways.

65 1.2 Classification.

66 Two types and two styles of retroreflective markers are **in** this specification.

67 1.2.1 Types.

- 68 1. Type I, Semiflush Marker for Centerline Marking
- 69 2. Type II, Elevated Marker for Edge Marking

70 1.2.2 Styles.

71 The style designation applies to Type I markers only:

- 72 1. Style I, Plowable Markers.
- 73 2. 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).**

FAA ACs may be obtained from:

http://www.faa.gov/airports/resources/advisory_circulars/

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

AC 150/5340-30 *Design and Installation Details for Airport Visual Aids*

2.1.2 Military and Federal Publications.

Military and federal standards and specifications may be obtained from:

<http://quicksearch.dla.mil/>

Note: User must establish and be approved for a personal account to download documents. See ASSIST website instructions.

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 ASTM International Standard.

ASTM standards may be obtained from: <http://www.astm.org>

ASTM D4280-08 *Standard Specification for Extended Life Type, Nonplowable, Raised Retroreflective Pavement Markers*

ASTM D4383-05 *Standard Specification for Plowable, Raised Retroreflective Pavement Markers*

ASTM D4956-09 *Standard Specification for Retroreflective Sheeting for Traffic Control*

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CHAPTER 3. Requirements

3.1 Retroreflective Material Requirements.

3.1.1 General.

3.1.1.1 **Construction.**

Retroreflective material is designed to reflect light in the same direction as the light source (example: aircraft taxi lights). Two types of retroreflective material are in wide use:

1. Sealed plastic lenses with a smooth face and a prismatic configuration on the back surface (referred to in this document as lens retroreflectors).
2. 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.

Type I, Semiflush Marker for Centerline Marking, is to be used as centerline marker only. The configuration of the Type I marker will be as follows:

1. Runway centerline markers will be white in color.
2. 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:

1. Runway edge markers will be solid white in color.
2. Taxiway edge markers will be solid blue in color.
3. Runway threshold markers will be green in color.
4. Runway end markers will be red in color.
5. Runway threshold markers and runway end markers may be combined in one bidirectional marker.

3.1.1.2.3 Type II Sheet Retroreflectors.

1. Runway edge markers will be solid white in color.
2. Taxiway edge markers will be solid blue in color.
3. Runway threshold markers will be green in color.
4. Runway end markers will be red in color.
5. Retroreflective markers in front of the engineered materials arresting system (EMAS) bed will be yellow in color.
6. Retroreflective markers on the side and the rear of the engineered materials arresting system (EMAS) bed will be red in color.
7. Runway threshold markers and runway end markers may be combined in one bidirectional marker.

3.1.2 Sheet Retroreflector Requirements.

1. The sheet retroreflector material must be manufactured and perform per the requirements of ASTM D4956-09. The manufacturer may use Class 1 through 4 adhesive backings.
2. The sheet retroreflector material used must be Type III Sheeting or higher per ASTM D4956-09. See ASTM D4956-09, Table 4, Type III Sheeting, for the minimum reflection coefficients (RA) for colors white, green, red, blue, and yellow.

3.1.3 Lens Retroreflector Requirements.

3.1.3.1 **Specific Intensity (SI).**

1. Lens retroreflectors used in Type I markers must have the minimum specific intensities (SI) per Table 3-1.
2. Lens retroreflectors used in Type II markers must have the minimum SI per Table 3-2.
3. 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 3-1. 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 3-2. 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.

1. For Type I lens retroreflector 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 D4383-05, paragraph 6.2, Color. Style II markers must meet the color boundaries only (no other parts of the standard are applicable) per ASTM D4280-08, paragraph 6.2.4, Color.
2. 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 D4280-08, paragraph 6.2.4, Color.
3. 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.

1. The lens retroreflector must be one of the colors specified in paragraphs 3.1.1.2.1 and 3.1.1.2.2.
2. 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 perimeter to produce a unit that is permanently sealed against dust, water, and water vapor.
3. The lens retroreflector must consist of a smooth front surface free from projections or indentations other than those used for identification.
4. The rear surface of the retroreflector must use a prismatic configuration so that it will cause the internal reflection of light.

5. The manufacturer's trademark must be molded legibly into the face of the lens.
6. The lens retroreflector shell material must conform to Federal Specification L-P-380, 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° Fahrenheit (F) to +149° F (-55° Celsius (C) to +65° C).

3.2.2 Wind.

Exposure to wind speeds up to 100 miles per hour (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.

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

3.3.2 Dimensions.

1. The Type I marker must not project more than 3/4-inch (19 mm) above the pavement surface.
2. All corners and edges of the marker projecting above the pavement must be rounded to a minimum radius of 1/8-inch (3.2 mm).
3. The minimum retroreflective area in each viewing direction must be 1.5 square inches (9.7 square centimeters (cm²)) for Style I markers and 3 square inches (19.4 cm²) for Style II markers.

3.3.3 Bonding.

1. 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.
2. The bonding material must be specified or supplied by the manufacturer and must meet the requirements in paragraph 4.2.6.

3.4 **Type II Marker.**

3.4.1 Design.

1. There are three configurations of Type II markers:
 - a. Plane (flat) surface with lens retroreflectors attached;
 - b. Plane (flat) surface with sheet retroreflectors attached; or
 - c. Cylindrical surface with sheet retroreflectors attached.
2. The marker must be as compact as practical while presenting the required retroreflective area per paragraphs 3.4.2.1 and 3.4.2.2.
3. 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.**

1. For a plane surface Type II marker with lens retroreflectors, the retroreflector surface area must be at least 6.5 square inches (42 cm²).
2. For a plane surface Type II marker with sheet retroreflector material, the retroreflector surface area must be at least 24 square inches (155 cm²).
3. If the plane markers are bidirectional, the surface areas in paragraph 3.4.2.1, items 1 and 2 represent the required retroreflector surface area facing each direction.

3.4.2.2 Cylindrical Markers.

1. For a cylindrical surface marker, at least 96 square inches (619 cm²) of sheet retroreflector material must be wrapped uniformly about the cylinder. The sheeting must extend up to the top of the cylinder.
2. The maximum cylinder diameter must not exceed 8 inches (20.3 centimeters (cm)).
3. The standard installed height of the reflector must be 14 inches (35.6 cm) above finish grade. See the installation requirements for the height of the edge reflector versus distance from the defined pavement edge in AC 150/5340-30.

3.4.3 Construction.

3.4.3.1 Mounting System.

1. The manufacturer must provide a mounting system that is appropriate for the type of surface (asphalt, grass, concrete).
2. The mounting system must withstand the wind loading per paragraph 3.2.2.
3. The mounting system must be designed to prevent the marker or its components from being ingested by jet aircraft engines.

3.4.3.2 Type II Marker Frangibility and Tethering.

1. 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) to minimize damage to an aircraft striking the marker.
2. To utilize a non-frangible mounting, the Type II marker must readily bend or flex when struck, to minimize damage to an aircraft or vehicle.
3. 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).
4. A tether anchor hard point is required for Type II markers 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.

1. Any metal used in the Type II marker or its associated mounting hardware must be corrosion resisting, plated, or treated to resist corrosion.

- 291 2. The Type II plane type (flat) markers and mounting hardware must be
292 constructed so that the plane orientation (in both horizontal and
293 vertical directions) will not change when the marker is subjected to the
294 wind conditions per paragraph 3.2.2.
- 295 3. The sheet retroreflector material for all Type II markers must be
296 securely fastened to the marker body so that it will not slip or loosen
297 when exposed to the environmental conditions per paragraph 3.2.

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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 in AC 150/5345-53.

4.2 Qualification Tests.

The following tests must be performed on each unit submitted for qualification.:

4.2.1 Retroreflector Material.

1. This section specifies tests for the retroreflector material component of the marker.
2. For Type II markers using sheet retroreflector material, the manufacturer must submit the material to the third-party certification body for testing.
3. 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 D4956-09.
4. 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 D4956-09, paragraph 7, Test Methods.

4.2.1.2 **Lens Retroreflectors.**

1. Type I, Style I lens retroreflectors must meet the requirements for specific intensity and chromaticity in paragraph 3.1.3. See ASTM D4383-05, paragraph 10, Test Methods, for test procedures.
2. Type I, Style II lens retroreflectors must meet the requirements for specific intensity and chromaticity in paragraph 3.1.3. See ASTM D4280-08, paragraph 9, Test Methods, for test procedures.

4.2.2 High Temperature Test.

1. 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 not less than 7 hours.
2. 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.

1. 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 24 hours.
2. Evidence of damage will be cause for rejection.

4.2.4 Salt Fog Test.

1. Markers with no ferrous metal are exempt from this test. A 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.
2. The test duration must be 48 hours exposure and 48 hours drying.
3. Analyze any corrosion present for its immediate and potential long-term effects on the proper functioning and structural integrity of the test item.

4.2.5 Sunshine Test.

1. A sunshine test must be conducted per MIL-STD-810F, Method 505.4, Solar Radiation, paragraph 4.4.3, Procedure II for all Type I and II markers with nonmetallic exterior parts.
2. 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.

1. A 2-1/4 inch \pm 1/4-inch (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.
2. 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 kilograms (kg)).
3. 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.

1. 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.
2. Any evidence of water or condensation in the marker housing is considered unsatisfactory performance.

4.2.8 Type I Marker Load Test.

1. This test must be the last test performed.
2. The Type I marker must be bonded to a flat steel plate mounted in a standard testing machine.
3. 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.
4. 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.

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

369 4.2.9 Type II Marker Wind Load Test.

- 370 1. The Type II marker and its mounting system must be subjected to wind load tests.
371 2. Apply a wind load of 50 mph (80 km/h) for 10 minutes to a flexible marker to
372 demonstrate that the marker remains upright at this wind speed.
373 3. Apply a wind load of 100 mph (161 km/h) for 10 minutes to all Type II markers; the
374 markers and mounting system must not show any signs of permanent distortion or
375 failure.
376 4. An equivalent static force calculated from the wind velocities in paragraph 4.2.9,
377 items 2 and 3, may be used to demonstrate the wind loading requirement. The
378 equivalent force must be applied perpendicular to the vertical axis of the Type II
379 marker.

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CHAPTER 5. Production Test Requirements

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5.1 Production Tests.

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

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5.2 Production Test Records.

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

Advisory Circular Feedback

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by (1) mailing this form to Manager, Airport Engineering Division, Federal Aviation Administration ATTN: AAS-100, 800 Independence Avenue SW, Washington DC 20591 or (2) faxing it to the attention of the Office of Airport Safety and Standards at (202) 267-5383.

Subject: AC 150/5345-39E

Date: _____

Please check all appropriate line items:

- ☐ An error (procedural or typographical) has been noted in paragraph _____ on page _____.
- ☐ Recommend paragraph _____ on page _____ be changed as follows:

- ☐ In a future change to this AC, please cover the following subject:
(Briefly describe what you want added.)

- ☐ Other comments:

- ☐ I would like to discuss the above. Please contact me at (phone number, email address).

Submitted by: _____

Date: _____