TAD-484.4

AC NO: 150/5345-39A

DATE: 17 Sept 71

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: FAA SPECIFICATION L-853, RUNWAY AND TAXIWAY RETROREFLECTIVE MARKERS

1. PURPOSE. This circular describes specification requirements for L-853, Runway and Taxiway Retroreflective Markers, for the guidance of the public.

2. CANCELLATION. Advisory Circular 150/5345-39, FAA Specification L-853, Runway and Taxiway Centerline Reflective Markers, dated 10 January 1969.

3. DESCRIPTION OF SPECIFICATION. This specification establishes the performance and pertinent construction details for retroreflective markers used to delineate airport runways, taxiways, and aprons.

4. EXPLANATION OF REVISIONS. In addition to minor changes in the text, details were added for elevated retroreflective markers.

5. HOW TO OBTAIN THIS CIRCULAR. Additional copies of this circular, Advisory Circular 150/5345-39A, FAA Specification L-853, Runway and Taxiway Retroreflective Markers, may be obtained from the Department of Transportation, Distribution Unit, TAD-484.3, Washington, D. C. 20590.

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1. SCOPE.

1.1 Scope. The equipment covered by this specification consists of retroreflective markers for delineating airport runways and taxiways, or for marking aprons.

1.1.1 Centerline Markers. The retroreflective markers are small, low profile units designed for securing in place on concrete or asphaltic surfaces.

Type I - Bidirectional clear
Type II - Bidirectional red-clear
Type III - Bidirectional green
Type IV - Bidirectional yellow-clear
Type V - Bidirectional red
Type VI - Unidirectional green

1.1.2 Elevated Markers.

1.1.2.1 Retroreflective Markers - 360 DEGREES. These retroreflective markers are cylindrical, with centerband retroreflective tape and provisions for an optional top and bottom bands of flourescent for daytime visibility conditions. These markers may be designed to secure to a one-inch diameter support. The optional bands are yellow-orange flourescent, red-orange flourescent, or yellow flourescent. Provide frangible fittings or a mount with the equivalent performance for rigid type markers. If reflectors are of a nonrigid type, which will readily bend when struck and then return to their upright position, frangible mounts are not required. Make provisions in the retroreflective marker design and mounts to prevent the marker or its components from being ingested in jet aircraft engines.

1.1.2.1.1 Retroreflective Markers Styles.

Style A - 360° white retroreflective
Style B - 360° green retroreflective
Style C - 360° red retroreflective
Style D - 360° yellow retroreflective

1.1.2.1.2 Retroreflective Markers Flat Surfaces. These markers have flat surfaces necessary to provide guidance during daytime visibility conditions. The flat surfaces may be a combination of retroreflective material and flourescent or markers similar in design to those specified in paragraph 1.1.1 secured to the flat surface. Design the markers to meet the mounting requirements of paragraph 1.1.2.1.

1.1.2.2 Retroreflective Markers - 360° and Flat Surfaces. These markers are in accordance with the performance requirements of Military Specification MIL-R-7264B (USAF) and fabricated with sheeting conforming to Federal Specification L-S-300A, Reflectivity 1. (See paragraph 1.1.2.1 for details on mounting elevated markers.)

2. APPLICABLE DOCUMENTS. The following Military Publications of the issue in effect on the date of Application For Qualification (paragraph 4.1) form a part of this specification to the extent specified herein:

2.1 Military Specifications and Standard

MIL-C-25050 Colors, Aeronautical Lights and Lighting Equipment, General Requirements for

MIL-R-7264B (USAF) Reflector, Taxiway Strip and Runway, Type B-1

MIL-F-22735B, Film, Elastromeric, Flourescent, for Weapons Systems

(Obtain copies of the Military specifications from the Commanding Officer, Naval Supply Depot, 580, Tabor Avenue, Philadelphia, Pennsylvania 19120.)

2.2 Federal Specifications. Obtain copies of Federal Specification L-S-300A, Sheeting and Tape, Reflective; Nonexposed Lens, Adhesive Backing from the appropriate Regional General Services Administration Office.

3. REQUIREMENTS.

3.1 Performance requirements.

3.1.1 Optical Performance.

3.1.1.1 Definitions.

3.1.1.1.1 Angle of Divergence. The angle formed by a ray of light from the light source to the retroreflective marker, and the returned ray from the marker to the measuring receptor.

3.1.1.1.2 Angle of Incidence. The angle formed by a ray from the light source to the marker, and the normal to the leading edge of the marker face.

3.1.1.1.3 Specific Intensity. The intensity of the reflected light at a given divergence and incidence angle per footcandle at the marker on a plane perpendicular to the incident light.

3.1.1.2 Minimum Specific Intensity.

3.1.1.2.1 Centerline Markers. The specific intensity of the reflective surface shall not be less than the values shown in Figure 1 below:

Incidence Angle Degrees	Divergence Angle Degrees	Clear	Yellow	Red	Green
0	0.2	3.0	1.5	0.6	1.0
20	0.2	1.2	0.60	0.24	0.42
0	0.5	1.7	0.85	0.34	0.60
20	0.5	0.68	0.34	0.14	0.24

FIGURE 1. SPECIFIC INTENSITY

3.1.1.2.2 Elevated Markers. Sheeting used shall be in accordance with Reflectivity 1 of Federal Specification L-S-300A.

3.1.1.3 Chromaticity Requirements.

3.1.1.3.1 Centerline Markers. These markers shall conform to the requirements of Specification MIL-C-25050 for Type I colors.

3.1.1.3.2 Elevated Markers. These markers shall conform to the requirements of paragraph 3.4 of Federal Specification L-S-300A.

3.1.2 Environmental Conditions. Each type of reflective marker shall perform satisfactorily under the following conditions:

3.1.2.1 Temperature. Any ambient temperature ranging from +65°C. to -43°C. (see paragraphs 4.1.2 and 4.1.3).

3.1.2.2 Humidity. Any relative humidity up to 100 percent. (see paragraph 4.1.4).

3.1.2.3 Service.

3.1.2.3.1 Centerline Markers. The marker shall be designed, constructed, and bonded to the surface of portland cement concrete or asphalt concrete pavements to withstand normal operations of aircraft and airport maintenance vehicles.

3.1.2.3.2 Elevated. The markers shall be designed, constructed, and mounted to meet the requirements of paragraph 1.1.2.1 and to withstand normal aircraft operations.

3.2 Design Requirements. Class I - Markers can withstand velocities up to 350 miles per hour. Class II - Markers can withstand velocities up to 100 miles per hour.

3.2.1 Types I, II, III, IV, V, and VI Markers.

3.2.1.1 General. The shape of the marker is optional. Shapes which in plan view appear as squares, circules, or regular polygons are considered best for this application. The area of the base shall not be less than 15 square inches and not more than 50 square inches. All exterior surfaces, except the base underside, shall be smooth. The bidirectional design shall incorporate retroreflective in two opposing faces. Retroreflectors shall consist of a mosaic of retroreflecting elements.

3.2.1.2 Material. All markers shall have a clean, flat, hard, rough-textured base surface to promote adhesive bonding. Adhesive material furnished with the marker shall meet the bond requirement in paragraph 4.1.5. The deviation of the base of the marker from a flat surface shall not exceed 0.05 inch.

3.2.1.3 Construction Details. The design of the marker shall be such that no portion of the unit will project more than 3/4-inch above the adjacent paved surfaces when the marker is installed in place. The retroreflector faces shall have maximum slopes of 30°. All edges and corners shall be rounded to radii of not less than 1/8-inch.

3.2.2 Style A, B, C, and D Markers.

3.2.2.1 General. The shape of the reflective markers is cylindrical. Shape will appear as a square reflective surface from a distance in response to existing light source. Maximum viewing response is from 360° and up to 45° from vertical plane. Flourescent surface can be viewed from same angles. Combined reflective and flourescent surfaces extend to 12 inches in height and 7 inches in diameter with 276 square inches of visibility.

3.2.2.2 Material. All markers shall be bonded properly, in accordance with the tape manufacturer's instructions, to promote lasting adhesion. Reflective tapes conforming to Federal Specification L-S-300A, Reflectivity 1 and flourescent tapes conforming to Military Specification MIL-F-22735B shall be utilized.

3.2.2.3 Construction Details. The design of the marker shall be such that, when installed properly, no portion will exceed 14 inches total height above mounting surface. The markers shall consist of a suitable

material formed into cylinders with an adequate protective coating. The outer surface of the cylinder is covered with 3-inch wide bands of flourescent vinyl tape at top and bottom, with a 6-inch wide band of high intensity retroreflective tape in the center. The flourescent bands and retroreflective band colors vary depending upon the intended location of the marker. The cylinder is secured to a support. The support runs the complete length of the cylinder and extends 12 inches below the cylinder. Attach the marker to the support with noncorrosive hardware. Means shall be provided to prevent marker from turning on support during normal aircraft operational and weather conditions.

4. QUALITY ASSURANCE PROVISIONS.

4.1 Qualification Testing. The manufacture shall furnish two copies of certified test reports, samples, and installation instructions for each type of reflective marker to the Federal Aviation Administration, Airports Service, Washington, D. C. 20590, for inspection, review, and approval in accordance with this specification. These tests may be witnessed by a representative of FAA, Airports Service. When approved, the name of the qualified manufacturer and a description of his equipment will be included in Advisory Circular 150/5345-1C, Approved Airport Lighting Equipment. The manufacturer will bear all testing costs. After listing in Advisory Circular 150/5345-1C, manufactures shall not change quality or quantity of materials, method of manufacture, catalog or style numbers, or make any substitutions without prior concurrence of Airports Service.

4.1.1 Optical Test.

4.1.1.1 Centerline Markers. In the optical test, the general arrangement of test equipment and test sample shall be as shown in Figure 2. The marker shall be located with the center of the retroreflecting face at a minimum distance of five feet from a uniformly bright light source. When a five-foot test distance is used, the light source shall have an effective diameter of 0.2 inch, and the photocell receptor width shall be 0.05 inch and shall be shielded to eliminate stray light. The distance from the center of the light source aperture to the center of the photocell shall be 0.21 inch and 0.525 inch for divergence angles of 0.2 degrees and 0.5 degrees, respectively. If a test distance of other than five feet is used, the source and receptor and their separation shall be modified in the same proportion as the test distance. The color of the light source shall be 2854K. The response of the photocell shall be corrected to approximate the CIE luminous efficiency function.

4.1.1.2 Elevated Markers. Measurement shall be made in accordance with paragraph 4.4.7 of Federal Specification L-S-300A.

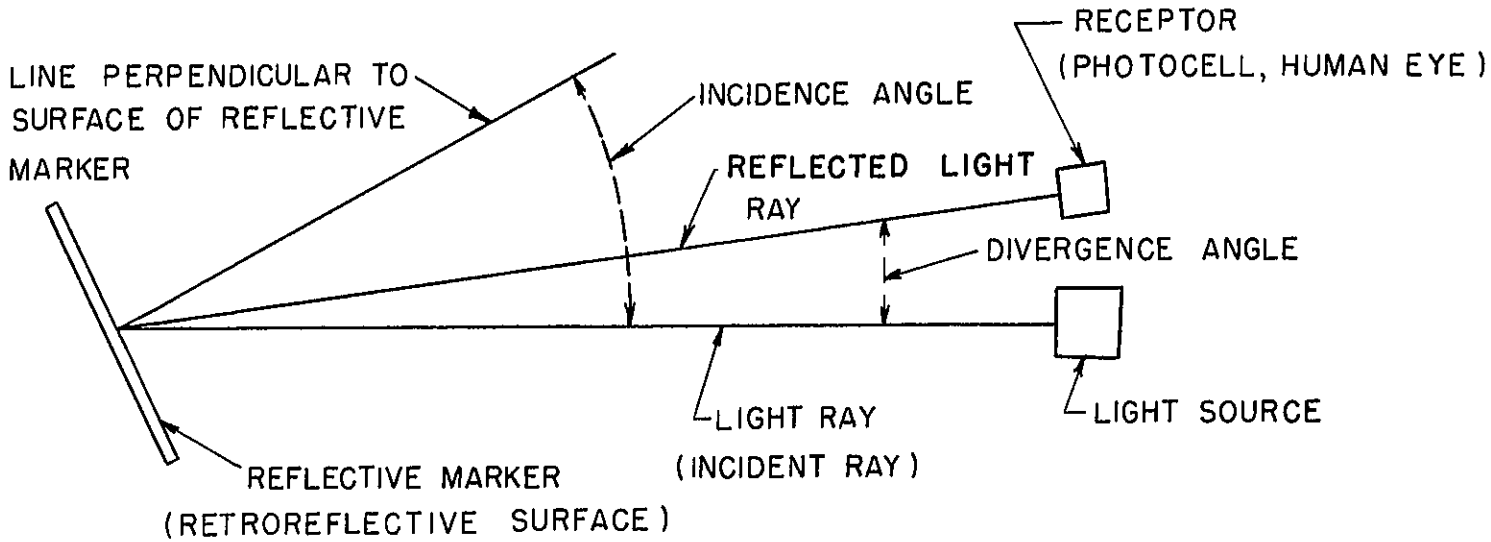

FIGURE 2 SKETCH ILLUSTRATING THE INCIDENCE AND DIVERGENCE ANGLE OF A LIGHT RAY REFLECTED BACK FROM A RETROREFLECTIVE SURFACE

4.1.2 High Temperature Test. The marker shall be subjected to a high ambient environment temperature of +55°C. (±2°C.) for a period of not less than seven hours. Any evidence of heat damage, such as deformation, blistering, cracking or crazing of the plastic material, or deterioration of filler material shall be cause for rejection.

4.1.3 Low Temperature Test. The marker shall be totally immersed in water, and while immersed, subjected to a temperature of -43°C. (±2°C.) for a period of 24 hours. This shall result in a total encasement of the marker with a minimum of one inch of ice on all exposed surfaces above the base surface. Immediately following this 24-hour period, the marker shall be heated to +55°C. (±2°C.) and maintained at this temperature for not less than three hours. Evidence of damage or porosity shall be cause for rejection.

4.1.4 Humidity Test. The sample marker shall be immersed in a saturated salt solution for not less than six hours. At the end of that period the unit shall be removed from the bath and allowed to dry naturally for not less than 18 hours. The drying shall not be assisted by wiping, fanning, or heating. This 24-hour wetting and drying cycle shall be repeated three times. The bath temperature and the ambient air temperature shall be within the range of plus 16°C. to plus 30°C. At the end of the three cycles, any evidence of damage, rust, or corrosion shall be cause for rejection.

4.1.5 Centerline Marker Bond Test. A steel fitting with a 2 1/4-inch ± 1/4-inch diameter shall be sealed to the bottom surface of the marker with a material compatible with the marker and portland concrete or asphaltic pavement. After the sealer material cures, the steel fitting shall be pulled away from the marker at a rate not greater than 2,500 pounds per minute. The sealer material and bottom surface of the marker shall be considered unsatisfactory if there is complete separation with a pull of 1,500 pounds.

4.1.6 Centerline Marker Load Test. This test shall be the last test made. The marker shall be placed on a flat steel plate mounted in a standard testing machine. The load shall be applied to the top part of the marker through a block of rubber, four inches in diameter, one inch thick with Shore A hardness of 55 to 70. A total of 10,000 pounds shall be applied uniformly over the area of the rubber at a rate of not greater than 2,500 pounds per minute. The marker shall be considered unsatisfactory if there is any permanent deformation, cracking, or breaking of any materials used.

5. PREPARATION FOR DELIVERY.

5.1 Cleaning. Each retroreflective marker shall be cleaned of oil, grease, and other foreign material by any process which will accomplish thorough cleaning without damage to the item.

5.2 Packaging. Each marker shall be packaged to the extent necessary for protection against physical damage during shipment from the supply source to the receiving activity. The unit package shall consist of (Number) reflective marker(s).

5.3 Packing. Packages that require over-packing shall be packed in shipping containers in a manner that will insure safe transportation at the lowest rate to the point of delivery and shall meet, as a minimum, the requirements of the rules and regulations of the mode of transportation selected.

5.4 Marking. Unit packages and shipping containers shall be marked in accordance with MIL-STD-129.

5.5 Installation Details. Installation details for runway and taxiway reflective markers are contained in the latest issuance of Advisory Circular 150/5340-20, Installation Details and Maintenance Standards for Reflective Markers for Airport Runway and Taxiway Centerlines. Obtain copies of Advisory Circular 150/5340-20 from the Department of Transportation, Distribution Unit, TAD-484.3, Washington, D.C. 20590.

GPO 917-382

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