



U.S. Department
of Transportation

Federal Aviation
Administration

Advisory Circular

Subject: SPECIFICATION FOR RUNWAY
AND TAXIWAY SIGNS

Date: 9/28/2007

AC No: 150/5345-44H

Initiated by: AAS-100 **Change:**

1. **PURPOSE.** This advisory circular (AC) contains the Federal Aviation Administration (FAA) specifications for unlighted and lighted signs to be used on taxiways and runways.
2. **EFFECTIVE DATE.** Effective six months after the issue date of this AC, only that equipment qualified in accordance with the specifications herein will be listed in accordance with AC 150/5345-53, *Airport Lighting Equipment Certification Program*.
3. **CANCELLATION.** AC 150/5345-44G, *Specification for Runway and Taxiway Signs*, dated July 8, 2004, is cancelled.
4. **APPLICATION.** The FAA recommends the guidelines and standards in this AC for all applications involving development of this nature. This AC does not constitute a regulation and in general is not mandatory. However, use of these guidelines is mandatory for runway and taxiway signs funded under the Airport Improvement Program (AIP) or Passenger Facility Charge (PFC) Program. Mandatory terms such as “must” apply only to those using AIP or PFC funds for such projects and/or to those who intend to meet this specification for any other reason.
5. **PRINCIPAL CHANGES.** The following principal changes are incorporated:
 - a. In paragraphs 1.2.4 and 3.2.1, lighted sign Class 2 low temperature operation is changed to -40 degrees F (-40 degrees C) and storage and shipping low temperature requirement is -67 degrees F (-55 degrees C).
 - b. The separation between multiple signs is clarified in paragraph 3.2.5.2 and Appendix C, Figure 12.
 - c. In paragraph 3.2.5.4f, a new requirement for sign panel joints is added.
 - d. A note is added to paragraph 3.2.5.5f referencing 150/5340-30 for additional information relevant to the effect of various sign power supplies upon constant current regulator operation. Paragraph is clarified for luminance requirements for regulator brightness steps
 - e. Applicable only to new designs, a requirement for a lighted sign minimum power factor is added in paragraph 3.2.5.5k. Testing requirements are added in paragraph 4.1.1.9.
 - f. In paragraph 3.2.5.7, a new requirement for lighted sign internal lamp failure is added. Test requirements are added in paragraph 4.1.1.3.5.

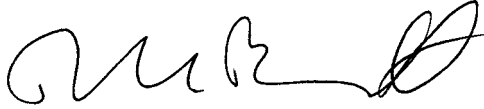
- g. In paragraph 3.2.5.10f, new requirements are added for replacement panels.
- h. In paragraph 3.2.5.12, new requirements for nameplates are added. Nameplates must be resistant to the fading and cracking caused by exposure to sunshine, salt laden air, and weather.
- i. Paragraph 4.1.1.3.3 photometry test requirements are clarified for lighted sign faces.
- j. Paragraph 4.1.1.3.5 testing requirements are added for lighted sign light source failure.
- k. A surge voltage test is added for ALD signs in paragraph 4.1.1.10
- l. Requirements for spring mounted signs and testing are deleted.
- m. Paragraph 6.4.2b is clarified for dot matrix sign photometric measurements.
- n. Paragraph 7.3.2 clarifies light module failure requirements in ALD signs.
- o. Paragraph 7.3.4 clarifies the luminance requirements of ALD signs.
- p. Paragraph 7.5 requires that ALD signs must be energized for 4 hours during production test.
- q. An exception for arrow spacing related to retrofit sign panels is clarified in Appendix A, Figure 6. Arrow spacing requirement is changed to 4 inches.
- r. Appendix A, Table 7 is corrected to reference Tables 2 and 3 for letter and numeral spacing requirements.
- s. Appendix C, Figure 11 has added captions to describe lighted sign array examples.
- t. Dimensions are added in Appendix E, Figure 14 for 1/2 Distance Remaining sign.

6. METRIC UNITS. To promote an orderly transition to metric units, this specification includes both “English” and “Metric” dimensions. The metric conversions may not be exact 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 FAA home page (www.faa.gov). A printed copy of this AC and other ACs can be ordered from the U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785.

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

DAVID L. BENNETT
Director of Airport Safety and Standards

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SECTION 1. SCOPE AND CLASSIFICATION.

1.1 Scope.

This AC presents the requirements for both lighted and unlighted signs used on airport taxiways and runways. Section 6 allows for a dot matrix presentation of an L-858B sign. Section 7 allows the use of alternative lighting devices (ALD).

1.2 Classification.

Six types of signs are specified in any of five sizes, five styles, and two classes, with any exceptions noted.

1.2.1 Types of Signs.

The following types of signs are part of this specification:

- a. Type L-858Y Direction, Destination, and Boundary signs - black legend on a yellow background.
- b. Type L-858R Mandatory Instruction sign - 3/4-inch (19 mm) \pm 1/8-inch (3.2 mm) black outline on outside edge of white legend on a red background (see Appendix C and 4 for examples of lighted and unlighted signs).
- c. Type L-858L Taxiway and Runway Location signs - yellow legend and border on a black background.
- d. Type L-858B Runway Distance Remaining sign - white legend on a black background.
- e. Type L-858Ba dot matrix Runway Distance Remaining sign - white legend on a black background (see section 6).
- f. Type L-858C Taxiway Ending Marker sign, yellow 45 degree diagonal stripes on a black background.
- g. Type L-858H One-Half Distance Remaining Sign – white legend on a black background.

NOTE: *Type L-858H signs must not be used in combination with L-858B signs.*

1.2.2 Sizes of Signs.

Signs of the following sizes are part of this AC:

- a. Size 1 * 18 inch (in.) (460 millimeters (mm)) legend panel with a 12 in. (300 mm) legend.
- b. Size 2 * 24 in. (610 mm) legend panel with a 15 inch (380 mm) legend.
- c. Size 3 * 30 in. (760 mm) legend panel with an 18 inch (460 mm) legend.
- d. Size 4 ** 48 in. (1220 mm) legend panel with a 40 in. (1020 mm) legend.

e. Size 5 ** 30 in. (760 mm) legend panel with a 25 in. (640 mm) legend.

* Applicable only to Types L-858R, L-858Y, and L-858L.

** Applicable to Types L-858B, L-858Ba.

f. L-858H, One-Half Distance Remaining Sign, is Size 5 only.

g. L-858C, Taxiway Ending Marker, is size 1, 2, and 3 with a 48.0 (1220 mm) or 72.0 inch (1.8 meter) maximum overall length (see Appendix G for examples).

1.2.3 Styles of Signs.

Signs of the following styles are part of this AC:

a. Style 1 - powered from a 120 volt AC power source.

b. Style 2 - powered from a series lighting circuit of 4.8 to 6.6 amperes (A).

c. Style 3 - powered from a series lighting circuit of 2.8 to 6.6 A or 8.5 to 20 A.

d. Style 4 - unlighted signs - applicable only to Type L-858C, L-858R, L-858Y, L-858L, and L-858H.

e. Style 5 - powered from a series lighting circuit of 5.5 A.

1.2.4 Classes of Signs.

Lighted signs of the following classes are part of this AC:

a. Class 1 - operation from -4 degrees Fahrenheit (F) (-20 degrees Celsius (C)) to 131 degrees F (55 degrees C) environment.

b. Class 2 - operation from -40 degrees F (-40 degrees C) to 131 degrees F (55 degrees C) environment.

c. Shipping and storage temperature ranges for Class 1 and 2 signs are from -67 degrees F (-55 degrees C) to 131 degrees F (55 degrees C).

1.2.5 Modes of Signs.

Signs of the following modes are part of this specification:

a. Mode 1 - must withstand wind loads of 100 miles per hour (mph) (161 kilometers per hour (kph)) and is only applicable to unlighted signs, Style 4.

b. Mode 2 - must withstand wind loads of 200 mph (322 kph).

c. Mode 3 - must withstand wind loads of 300 mph (483 kph).

NOTE: *Mode 3 is applicable only to special circumstances where the sign location poses an increased safety risk arising from jet blast. See paragraphs 4.1.1.2, Lighted Sign Wind Load and Frangibility Test and 4.2.1.2, Unlighted Sign Wind Load and Frangibility Test.*

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SECTION 2. APPLICABLE DOCUMENTS.

The following documents are referenced in this AC:

a. **FAA Advisory Circulars.**

- (1) AC 150/5340-18, *Standards for Airport Sign Systems.*
- (2) AC 150/5345-10, *Specification L-828 Constant Current Regulator.*
- (3) AC 150/5345-26, *Specification for L-823 Plug and Receptacle, Cable Connectors.*
- (4) AC 150/5345-42, *Specification for Airport Light Base and Transformer Housings, Junction Boxes, and Accessories.*
- (5) AC 150/5345-47, *Isolation Transformers for Airport Lighting Systems.*
- (6) AC 150/5345-53, *Airport Lighting Equipment Certification Program.*

b. **FAA Advisory Circulars**

Electronic copies of FAA ACs may be obtained from:

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

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

Telephone: (301) 322-4961

FAX: (301) 386-5394

c. **Federal Communications Commission (FCC) Code of Federal Regulation (CFR)**

Part 15, Subpart B, *Unintentional Radiators*, of Title 47, CFR

Copies of FCC documents may be obtained from:

Government Regulations website:
www.regulations.gov/index.cfm

d. American Society for Testing and Material (ASTM) Standard.

D 4956, *Specification for Retroreflective Sheeting for Traffic Control*

Copies of ASTM standards may be obtained from:

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

e. Military Standards (MIL-STD).

MIL-STD-810F, 1 January 2000, *Environmental Test Methods*

Copies of Military Standards may be obtained from:

Internet: dodssp.daps.dla.mil/

or compact discs (CDs) on website order form by standard mail from:

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

f. Illuminating Engineering Society (IES).

LM-52, *Calibration*

Copies of IES standards may be obtained from:

Internet: www.iesna.org/

or by standard mail from:

Illuminating Engineering Society
120 Wall Street
17th Floor
New York, New York 10002

g. Society of Automotive Engineers (SAE).

AS25050, General Requirements for Color, Aeronautical Lights, and Lighting Equipment

Copies of SAE Standards are available from:

Internet: www.sae.org

or by standard mail at:

SAE World Headquarters
400 Commonwealth Drive
Warrendale, PA 15096-0001

h. Institute of Electrical and Electronics Engineers (IEEE) Publications.

IEEE C62.41-1991 IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

IEEE C62.45 IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits

Copies of IEEE standards may be obtained from:

IEEE Customer Service Center
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855-1331

Tel: (800) 678-4333
FAX: (732) 981-0060 (Worldwide)
FAX: (732) 981-9667

E-mail: storehelp@ieee.org
Website: shop.ieee.org/ieeestore

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SECTION 3. EQUIPMENT REQUIREMENTS.

3.1 Equipment Supplied with Sign.

Each sign, including the mounting legs and hardware, must meet all the specification requirements in this document. Lighted signs must include:

- a. An electrical disconnect (paragraph 3.2.5.8).
- b. Any series lighting circuit adapter units (see paragraph 3.2.5.9c) for Style 2, 3, and 5 signs.
- c. Two instruction booklets (see paragraph 3.2.5.15).

3.2 Sign Environmental Requirements.

Signs and all their required components must be designed for continuous outdoor use under the following conditions:

3.2.1 Sign Temperature Requirements.

Signs must withstand the following ambient temperature ranges:

- a. Class 1 signs: -4 degrees to +131 degrees F. (-20 degrees to +55 degrees C).
- b. Class 2 signs: -40 degrees to +131 degrees F. (-40 degrees to +55 degrees C).
- c. Shipping and storage temperature ranges for Class 1 and 2 signs are from -67 degrees F (-55 degrees C) to 131 degrees F (55 degrees C).

3.2.2 Wind.

Exposure to wind velocities of 300 mph (483 kph) for Style 1, 2, 3, 4, and 5 signs.

- a. Mode 1 signs must withstand exposure to a wind speed of 100 mph (161 kph); this is only applicable to Style 4 signs.
- b. Mode 2 signs must withstand exposure to a wind speed of 200 mph (322 kph).
- c. Mode 3 signs must withstand exposure to a wind speed of 300 mph (483 kph).

NOTE: Mode 3 is applicable only to special circumstances where the sign location poses an increased safety risk arising from aircraft jet blast. See paragraphs 4.1.1.2, Lighted Sign Wind Load and Frangibility Test, and 4.2.1.2, Unlighted Sign Wind Load and Frangibility Test.

3.2.3 Rain.

All signs must withstand exposure to wind driven rain.

3.2.4 Sunlight.

All signs must withstand exposure to direct sunlight.

3.2.5 Lighted Signs.

3.2.5.1 Lighted Sign Construction.

- a. Signs must be constructed of lightweight, nonferrous materials for installation on a concrete pad or stakes.
- b. All the required mounting hardware, except anchor bolts, must be supplied with each sign.
- c. Signs must be designed so lamps are easily accessible for replacement.

3.2.5.2 Lighted Sign Sizes.

The dimensions of lighted signs must be per Table 1 below. Sign lengths must be chosen to show only complete message elements. When required, a sign array may contain multiple signs of the same size (mounting and face height) installed end-to-end on a straight line.

- a. When multiple signs are used, the separation distance between individual sign housings must be 3 to 12 in. (76 to 305 mm). Internally and externally lighted signs may not be installed in the same sign array. See Appendix C for examples of sign arrays.
- b. The separation distance between message elements in a sign array within a common housing must be no more than 3 to 12 inches (76 to 305 mm).
- c. Separating a message element on a destination sign (L-858Y) should be avoided. If a destination sign message element is separated into separate sign housings, an arrow should be included with each sign.

Table 1. Lighted Sign Dimensions

Sign Size	Legend Height		Legend Panel Height		Overall Mounting Height		Maximum Overall Length	
	in.	mm	in.	mm	in.	mm	in.	mm
1	12	300	18	460	24-30	610-760	120	3050
2	15	380	24	610	30-36	760-910	145	3690
3	18	460	30	760	36-42	910-1070	170	4320
4	40	1020	48	1220	54-60	1370-1520		
5	25	640	30	760	36-42	910-1070		

NOTES:

The required legend heights for:

1. Runway Safety Area/Obstacle Free Zone (OFZ) sign;
2. Runway Approach Area Boundary sign;
3. Instrument landing systems (ILS) Critical Area Boundary sign;
4. No Entry signs;

are in Appendix B, Tables 10, 11, and 12.

3.2.5.3 Lighted Sign Mounting Legs.

- a. The frangible groove in the mounting legs for each sign must be located 2 in. (51 mm) or less above the concrete base pad or stake.
- b. Mode 2 sign frangible points must withstand wind loads from jet blasts up to 200 mph (322 kph), but must break before reaching an applied static load distributed over the legend panel surface of 1.3 pounds per square inch (psi) (8.96 kilo Pascals (kPa)).
- c. Mode 3 sign frangible points must withstand wind loads from jet blasts up to 300 mph (483 kph) but must break before reaching an applied static load distributed over the legend panel surface of 2.8 psi (19.3 kPa).
- d. Legend panels and panel supports must withstand, at a minimum, the same pressure at which the frangible points are designed to break.
- e. Sign tether anchor hard points must be provided on one sign mounting leg above the frangible breaking point. Tether anchor hard points must be provided so that one end of the tether attaches to the sign structure, and the other end attaches below the frangible point on the coupling to either one of the leg mounting bolts or an independent bolt in the concrete mounting pad.
- f. Signs must have a minimum of one tether per module.
- g. For sign arrays, a tether must be used at either end.

3.2.5.4 Lighted Sign Faces.

- a. Signs must be either single face with a message on one side or double face with a message on two sides.
- b. The sign faces must use retroreflective material and meet the color and reflectivity requirements of ASTM D 4956, Type I Sheeting, Retroreflective Material, when installed. The retroreflective material must not be warped or wrinkled.
- c. The spacing, stroke, and shape of legend characters, numerals, and symbols must be as shown in Appendices 1 and 2 of this specification.
- d. Type L-858L sign faces must have a margin and a border per paragraph 3.2.5.4.1 and be as shown in Appendix C, Figure 11.
- e. Lighted sign message dividers must be per paragraph 3.2.5.4.2
- f. Panel joints must be the same color as the sign background so as not to give the appearance of a message divider.

3.2.5.4.1 Margin and Border for Type L-858L Signs.

The sign faces of sign Type L-858L must have the following characteristics:

- a. A continuous border 13/16 in. (21 mm) wide for size 1 signs.

- b. A continuous border 1-1/16 in. (27 mm) wide for size 2 signs.
- c. A continuous border 1-1/4 in. (32 mm) wide for size 3 signs.
- d. The border color must be the same as the legend.
- e. The border must be set in from the edge of the sign to yield a continuous margin of 11/16 in. (17 mm) for Size 1 signs.
- f. The border must be set in from the edge of the sign to yield a continuous margin of 1-7/16 in. (37 mm) for Size 2 signs.
- g. The border must be set in from the edge of the sign to yield a continuous margin of 2 in. (51 mm) for Size 3 signs.
- h. The horizontal distance from the edge of a sign character or numeral to the inside edge of the sign border must conform to the dimensions in Appendix A, Table 8.

3.2.5.4.2 Lighted Sign Message Dividers.

- a. Vertical message dividers must be used to separate the message elements of a sign array (e.g. "C →", "←T →", "15 - APCH") shown in Appendix C, Figures 11 and 12.
- b. Message dividers must not be used to separate Type L-858L signs from Type L-858Y or Type L-858R signs when they are co-located.
- c. Message dividers must be:
 - (1) 1-5/16 in. (33 mm) in width for size 1 signs.
 - (2) 1-11/16 in. (43 mm) in width for size 2 signs.
 - (3) 2 in. (51 mm) in width for size 3 signs.
- d. Sign message dividers must extend from the top to the bottom of the legend panel.
- e. The sign message divider color must be the same as the legend.

3.2.5.5 Lighted Sign Power.

- a. Style 1, 2, 3, and 5 signs must be internally lighted.
- b. Style 1 signs must operate from a 120 volt AC power source.
- c. Style 2 signs must operate from an airport series lighting circuit with a current range of 4.8 to 6.6 amperes (A).
- d. Style 3 signs must operate from an airport series lighting circuit with a current range of 2.8 to 6.6 A or 8.5 to 20 A.
- e. Signs installed on a 20 A circuit should use an appropriate isolation transformer with a 6.6 A secondary.

f. For Style 2 and Style 3 signs, there should be no noticeable variance of luminance throughout the range of constant current regulator brightness steps. The signs must meet the luminance requirements in paragraph 3.2.5.6 throughout the current ranges of the associated series circuit.

NOTE: See 150/5340-30, *Design and Installation Details for Airport Visual Aids, Appendix F for additional information about the possible adverse effects of sign power supply loading on a constant current regulator.*

g. Style 5 signs must be designed for operation from an airport series lighting circuit with a current of 5.5 amperes.

h. Style 5 signs must be installed on a circuit, containing only these signs, powered from a three-step regulator preset to 5.5 A output.

i. The regulator control system must be designed to meet the “Sign Operation” requirements in AC 150/5340-18, *Standards for Airport Sign Systems.*

j. Intensity control must not be provided for Style 5 sign circuits.

k. Style 2, 3, and 5 sign power factor, when measured at the input power leads (at the nominal operating current), must be not less than 0.8. This requirement also applies to dot matrix and ALD sign designs in Section 6 and 7.

3.2.5.6 Sign Luminance.

a. The background of Type L-858Y signs and the legends of Type L-858R and L-858L signs must have an average luminance of 10 to 30 foot lamberts (fL). See Section 6 for Type L-858Ba dot matrix luminance requirements.

b. The sign type must be readily identifiable up to 800 feet (ft.) (244 meters (m)) when it is viewed during the day or lighted at night.

c. Lamps must be easily accessible for replacement.

d. Style 2, 3, and 5 signs must be compatible with all L-828 regulators specified in AC 150/5345-10, *Specification for Constant Current Regulator.*

3.2.5.7 Sign Internal Lamp Failure

The failure of any light source within a sign must not result in a potential miscommunication of the intended message to a pilot. If the failure of an internal lamp(s) in a sign causes a panel or any section of a panel to be dark, or have an average luminance less than the minimum required in paragraph 3.2.5.6, sign operation must be automatically discontinued.

3.2.5.8 Electrical Disconnect.

a. All lighted signs must be equipped with a power input disconnect cable terminated with a Type II plug under the requirements of AC 150/5345-26, *Specification for L-823 Plug and Receptacle Cable Connectors.*

- b. The length of power disconnect cable must be at least 6 in. (150 mm) longer than required to permit the plug end to reach the top of the concrete pad or stake on which the sign is mounted.
- c. A cable clamp or similar restraining device must be provided in the sign to prevent strain on the cable terminal connections when the cable plug is pulled apart.
- d. Power to the sign must be provided through breakaway cable connectors installed within the frangible point portion of the sign's mounting legs.
- e. There must be no above ground electrical connection between signs in a sign array.

3.2.5.9 Style 2, Style 3 and Style 5 Signs.

- a. Signs operated in a series lighting circuit must work at any current value within the circuit current range without flickering.
- b. Power input to lighted signs from the series lighting circuit must be made through an isolation transformer of the proper rating, conforming to AC 150/5345-47, *Isolation Transformers for Airport Lighting Systems*.

NOTE: *The isolation transformer will not be supplied with the sign.*

- c. If the design requires external power adapter circuitry, all circuitry must be enclosed in a watertight container for installation in a transformer housing, conforming to AC 150/5345-42, *Specification for Airport Light Base and Transformer Housings, Junction Boxes and Accessories*. All external power adapter units must be provided with the sign. The transformer housing will not be supplied with the sign.

NOTE: *Do not attempt to power any signs that are not specifically recommended by the power adapter manufacturer. Be aware that the sign and/or power adapter power factor can affect requirements relevant to the size of the constant current regulator.*

- d. The external power adapter unit must be delivered with an output cable at least 24 inches (610 mm) long and terminated with a Type II, Class A, Style 7 receptacle, under AC 150/5345-26.
- e. If an isolation transformer is integral with the external power adapter unit, the power input leads must be at least 24 inches (610 mm) long, with one lead terminating in a Type I, Class A, Style 9 receptacle, under AC 150/5345-26.

3.2.5.10 Lighted Sign Materials and Components.

- a. All materials used in fabrication of the signs and mounting hardware must be suitable for their purpose and protected against corrosion.
- b. All sign assembly hardware and latches must be A-2 or 18-8 stainless steel.
- c. All wiring and components must be properly rated and not operated in excess of the component manufacturer's recommended ratings.
- d. At the time of certification, sign lamps used are listed and inclusive of the original equipment manufacturer (OEM) or lamp supplier. Deviations from the lamp or supplier listed are not authorized.

NOTE: *Lamp manufacturers and distributors are not required to either test or burn-in lamps to FAA specifications. This is especially true for pre-focused lamps. Only the OEM assures appropriate testing and burn-in are done.*

e. All replacement sign panels must be supplied by the OEM or a manufacturer that is certified to provide them. If an OEM exits the sign business, they must designate a certified alternate manufacturer for replacement sign materials and components.

NOTE: *Replacement lighted sign materials and components must maintain the certified sign characteristics.*

f. When replacing sign panels due to damage or taxiway/runway re-designation, the entire message element should be replaced. This will avoid panel-to-panel color changes that may be distracting to pilots.

3.2.5.11 Lighted Sign Finish.

a. External surfaces of signs, excluding the mounting legs and face panel, must be a low luster black finish.

b. Paint coatings or surface treatments on nonmetallic surfaces must be equal in quality to those on metal surfaces.

c. Paint coatings and surface treatments must be free from any runs, blotches, and scratches.

3.2.5.12 Nameplate.

a. Each sign must have a nameplate showing:

- (1) Type
- (2) Size
- (3) Style
- (4) Class
- (5) Manufacturer's name and address
- (6) Date of manufacture
- (7) Catalog number
- (8) Lamp data including the lamp type and rating.

b. The nameplate on Style 1 signs must show the total volt-ampere load and power factor of the sign, including any required ballasts or adapter units.

c. The nameplate on Style 2, 3 and 5 signs must show the total maximum volt-amp load and power factor measured on the primary side of the isolation transformer. The load indicated must represent the worst case volt-amp loading anticipated on the lighting circuit regulator including any ballasts and/or adapter units required for sign operation.

d. Nameplates must be fabricated from materials that will resist fading and cracking arising from exposure to weather, salt laden air, and sunshine.

3.2.5.13 Frangible Couplings.

Each frangible coupling must be permanently marked with the manufacturer's name (may be abbreviated) and the size of sign for which the coupling is rated.

3.2.5.14 Workmanship.

- a. All signs must be fabricated under the highest quality commercial assembly standards and workmanship.
- b. All wiring must be neatly run and laced.
- c. All sharp edges and burrs must be removed.
- d. Painted surfaces must be free from runs, blotches, and scratches.

3.2.5.15 Instruction Booklet.

- a. Two instruction booklets must be included with each order of signs.
- b. The instruction booklets must include:
 - (1) Sign installation instructions.
 - (2) Sign maintenance procedures.
 - (3) Troubleshooting procedures (including operating voltages and point readings).
 - (4) Complete parts list.
 - (5) The lamp voltage or current necessary to meet the luminance levels in paragraph 3.2.5.6 of this document.

3.2.6 Unlighted Sign Requirements.

3.2.6.1 Unlighted Sign Construction.

- a. The sign panel must be designed for installation on stakes or a concrete pad.
- b. All required mounting hardware, except the anchor bolts, must be supplied with the sign.
- c. Style 4 signs must not be designed to swing.

3.2.6.2 Unlighted Sign Materials and Components.

- a. Sign panels must be made from aluminum, except when a tested lighted sign is used as an unlighted sign.
- b. The aluminum sheet must be free from any laminations, blisters, open seams, pits, holes, or other defects.

- c. The aluminum sheet thickness must be uniform and the fabricated sign blank flat to commercial standards.
- d. All sign mounting hardware must be suitable for its intended purpose and protected from corrosion.
- e. All sign screws, bolts, nuts, and washers, must be A-2 or 18-8 stainless steel.
- f. An insulating material must be used between any aluminum and steel material in direct contact to prevent galvanic corrosion.
- g. Any retroreflective material used must meet both the color and reflectivity requirements of ASTM D4956, *Specification for Retroreflective Sheeting for Traffic Control*, for Type III or Type IV sheeting.

3.2.6.3 Unlighted Sign Sizes.

a. The sign dimensions given in Table 1 must be used for all unlighted signs, with the addition of the following **minimum** sign length dimensions:

- (1) Size 1 - 30 in. (762 mm)
- (2) Size 2 - 36 in. (914 mm)
- (3) Size 3 - 42 in. (1067 mm)

b. Sign lengths must be selected to fit only complete message elements.

c. When required, a sign array may contain multiple signs of the same size (mounting height and face height) installed end-to-end on a straight line.

d. When multiple signs are used, the separation distance between legend panels must be 3 to 6 in. (76 to 152 mm). See Appendix D for examples of multiple sign arrays.

3.2.6.4 Unlighted Sign Mounting Legs.

See paragraph 3.2.5.3; all requirements apply with the following additions:

a. Sign support legs must be mounted to the back surface of the sign so there is no obstruction to any portion of the sign front.

b. The frangible points for mode 1 signs must withstand wind loads from jet blasts of 100 mph (161 kph), but must break before reaching an applied static load over the legend panel of 0.9 psi (6.21 kPa).

c. Mode 1 signs must withstand 100 mph (161 kph) winds and jet blast/prop wash from aircraft without bending or changing shape.

3.2.6.5 Unlighted Sign Faces.

(With the exception of a prior tested lighted console sign to be used as an unlighted sign.)

- a. The sign background, except for black, must consist of retro-reflective sheeting and be applied to signs prepared per the recommendations of the sheeting manufacturer.
- b. The sign panel and sheeting must be a smooth surface of uniform color, free of cracks, wrinkles, blisters, and warps.
- c. Sign messages must be formed to provide a continuous stroke width with smooth edges and present a flat surface free from warps, blisters, wrinkles, and burrs.
- d. The background and legend color must meet the requirements in this AC for each type of sign.
- e. Sign faces must be constructed by the direct applied characters process or the screen process per paragraphs 3.2.6.5.1 and 3.2.6.5.2.
- f. The spacing, stroke, and shape of legend characters, numerals, and symbols must be as described in Appendices 1 and 2.
- g. Type L-858L sign faces must have a margin and a border per paragraph 3.2.6.6 and as illustrated in Appendix D, Figure 13.
- h. Message dividers must be per paragraph 3.2.6.7.
- i. Corners of sign faces must be rounded to a radius of 1-1/2-in. \pm 1/8-in. (38-mm \pm 3-mm). See Appendices D and G for examples.

3.2.6.5.1 Direct Applied Character Process.

Letters, numerals, symbols and the border of signs must be cut from retroreflective sheeting and applied per the manufacturer's recommendations.

3.2.6.5.2 Screen Process.

- a. Letters, numerals, symbols, and the border of signs must be applied to the retro-reflective sheeting or opaque background of sign by direct or reverse screening.
- b. Messages for Type L-858Y signs must be applied to retroreflective sheeting by a direct screening process.
- c. Sign messages for Types L-858L and L-858R signs must be produced by the reverse screening process.

3.2.6.6 Margin and Border for Type L-858L Unlighted Signs.

See paragraph 3.2.5.4.1; all requirements apply to unlighted signs.

3.2.6.7 Unlighted Sign Message Dividers.

See paragraph 3.2.5.4.2, all requirements apply to unlighted signs.

3.2.6.8 Unlighted Sign Finish.

The back panel of the sign must be painted with a primer coat and low luster, flat black, finish coat or equivalent.

3.2.6.9 Unlighted Sign Frangible Couplings.

See paragraph 3.2.5.13; all requirements must apply to unlighted signs.

3.2.6.10 Workmanship.

The sign must be fabricated so all sharp edges and burrs are removed. Painted surfaces must be free from any runs, blotches, and scratches.

3.2.6.11 Instruction Booklet.

An instruction booklet must be included with each order of sign as follows:

- a. sign installation procedures,
- b. operation details,
- c. complete parts list.

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SECTION 4. QUALIFICATION PROCEDURES.

Procedures for qualifying equipment to be furnished under the Federal grant assistance program for airports are contained in Advisory Circular 150/5345-53, *Airport Lighting Equipment Certification Program*, with all the detailed testing procedures and requirements in this document.

4.1 Lighted Sign Qualification Tests.

All tests contained in paragraphs 4.1.1 and 4.2 of this document apply for any product certification of taxiway and runway signs.

4.1.1 General Qualification Tests.

4.1.1.1 Lighted Sign Visual Examination.

For this test:

- a. Type L-858Y signs must have at least two message elements separated by a message divider.
- b. Type L-858R signs must have a legend that reads, "**18-36**".
- c. Type L-858L signs must have a legend that reads "**B**".
- d. All signs must be examined for the following under the requirements of this AC for:
 - (1) Dimensions
 - (2) Materials
 - (3) Component ratings
 - (4) Finish
 - (5) Quality of workmanship
- e. Signs must be viewed in daylight from 800 ft. (244 m) The sign type, defined in paragraph 1.2.1 of this document, must be easily identifiable.
- f. The sign face and retroreflective material must be smooth in appearance and free of any visual aberrations (except at the panel joints of modular signs). Retroreflective sheeting type must be per paragraph 3.2.5.4
- g. Both the legend and background colors on modular signs must be continuous across panel joints.
- h. Signs must be viewed from 800 ft. (244 m) at night to determine if the luminance level is sufficient to make the Type L-858Y and L-858R background colors and Type L-858L legend and border colors readily discernible.
- i. Type L-858B, Runway Distance Remaining signs, must be viewed from 800 ft. (244 m) at night to determine if the legend is readily discernible.
- j. Style 2 and Style 3 signs must be viewed while the input current is varied throughout the range on which the sign is to operate.

k. Modular signs must be viewed from 200 ft. (61 m) at full brightness.

(1) Panel joints must not interfere with the legibility of the sign or leak light to create a color discontinuity across the joint.

(2) Signs must be evenly illuminated with no dark areas or banding that interferes with legibility.

4.1.1.2 Lighted Sign Wind Load and Frangibility Test.

a. Mode 2 signs must be tested to withstand loads of 200 mph (322 kph) without damage.

b. Mode 3 signs must be tested to withstand wind loads of 300 mph (483 kph) without damage.

c. All testing must be performed with sign fully assembled and mounted on its base.

NOTE: *If wind loading is applied with the sign mounted on a vertical surface, the weight of the sign must be included as part of the total applied weight.*

d. Wind loading tests must be designed to ensure the sign legend panel receives the full wind load.

e. To simulate wind loading, a static force equivalent to the specified wind velocity (0.9 psi (6.21 kPa) for a Mode 2 flat panel sign and 2.0 psi (13.8 kPa) for a Mode 3 flat panel sign) must be uniformly applied to the entire surface of the legend panel for 10 minutes.

(1) The sign must not break at the frangible points.

(2) Both the legend panel and panel supports must be inspected for damage. If there is any breakage or permanent deformation, it is considered as a test failure and a cause for rejection.

f. The static force (equivalent to the specified wind velocity) applied in paragraph 4.1.1.2e must be increased until the sign breaks at the frangible points. Frangible point failure must occur before the legend panel loading reaches a maximum equivalent static force of 1.3 psi (8.96 kPa) for a Mode 2 flat panel sign and 2.8 psi (19.3 kPa) for a Mode 3 flat panel sign.

NOTE: *Mode 1 is only applicable to unlighted signs, refer to paragraph 4.2.1.2.*

(1) When the loading test is complete, both the legend panel and panel supports must be inspected for damage.

(2) If there is any breakage or deformation, it is considered a test failure and a cause for rejection.

4.1.1.3 Lighted Sign Photometric Testing.

4.1.1.3.1 Photometer Parameters.

a. A photometer or telephotometer must be used for this test.

b. IES, LM-52-98, *IESNA Guide for Photometric Measurements of Roadway Sign Installations*, (provides test procedures and methods of obtaining and reporting data) must be used for guidance for all sign photometric testing.

c. The photometric equipment calibration must be verified before performing any tests, and, if necessary, calibrated, under the most current National Institute of Standards (NIST) traceable standards.

d. Meters must measure luminance expressed in fL and be well color corrected.

e. Meters must measure a "spot" on the sign face that is 1.5 in. (38.1 mm) diameter.

f. Only light emitted from the sign must be permitted to reach either meter type.

g. If using a photometer, a 6 inch (150 mm) collimated adapter tube must be placed between the meter and the sign to limit the measurement field to 1.5 in. (38.1 mm) In addition, the adapter tube must be calibrated with the instrument.

h. If using a telephotometer, the meter aperture and distance from the sign must be selected as closely as possible to evaluate a 1.5 inch (38.1 mm) area.

i. Style 2 and 3 signs must be tested at the high and low input currents within the range of the series lighting circuit power.

4.1.1.3.2 Lighted Sign Types and Sizes Testing.

a. Photometric testing must be conducted on sizes 1, 2, and 3 for each of Type L-858Y, L-858R, and L-858L signs. Photometric testing must also be conducted on Type L-858Ba dot matrix and ALD signs (see sections 6 and 7).

b. If a luminaire design of a double face sign is symmetrical for both faces, then only one face is required to be tested.

c. The length of Types L-858Y and L-858R signs tested must be 45 in. (1140 mm) minimum.

d. Signs using modular construction must contain at least two modules for photometric testing.

4.1.1.3.3 Lighted Sign Faces.

a. Type L-858Y and L-858L signs must have an entirely yellow sign face fabricated from the same material used to create the background on production L-858Y signs or the legend and border on production L-858L signs.

b. Type L-858R, L-858B, and L-858H signs must have an entirely white face fabricated from the same material used to create the legend on production L-858R signs.

c. Photometry tests are to be done on a sign with one white panel installed on one side and one yellow panel installed on the other side.

4.1.1.3.4 Measurements.

- a. Measurements must be made on a 3 in. (76 mm) grid over the entire face of the sign, with no measurement closer than 3 in. (76 mm) to the sign frame.
- b. The average of all measurements must be between 10 and 30 fL.
- c. The ratio between maximum and minimum luminance over the whole sign face must not exceed 5:1.
- d. Adjacent grid measurements must not exceed a 1.5:1 luminance ratio.

NOTE: See paragraph 6.4 for photometric measurements on Type L858B(a) dot matrix signs.

4.1.1.3.5 Lighted Sign Light Source Failure Test.

- a. Simulate a failure of a light source within the sign.
- b. Check that the sign meets the requirements in paragraph 3.2.5.7.

4.1.1.4 Lighted Sign Rain Test.

a. A rain test for Style 1, 2, 3, and 5 signs must be conducted using MIL STD-810F, 1 January 2000, Method 506, paragraph 4.4.2, Procedure I, Rain and blowing rain.

NOTE: The design must be checked for gaps between the sign face and frame that could allow the entry of windblown snow or rain into the sign interior.

- (1) Signs must be designed to quickly drain any accumulated water.
 - (2) Sign circuit components must not be mounted in areas where water will accumulate.
- b. The presence of any water inside the sign must not change the electrical load of the sign.
 - c. The sign must be operated during the last 10 minutes of the test. Failure of the sign to operate is considered a failed test.

4.1.1.5 Lighted Sign Low Temperature Test.

- a. A low temperature test must be conducted under MIL-STD-810F, 1 January 2000, Method 502.4, Procedure II.
- b. Any required power adapter units (see paragraph 3.2.5.9c) must be included in the test.
- c. The lowest operating temperature for Class 1 signs is -4 degrees F (-20 degrees C).
- d. The lowest operating temperature for Class 2 signs is -40 degrees F (-40 degrees C).
- e. With the sign temperature stabilized at the lowest temperature, inspect the sign face for any damage, such as cracking, peeling, delaminating, and flaking.

f. Any damage, including subparagraph c. above, to the sign face or structure, is considered as a failed test and a cause for rejection. Failure to operate or failure to reach normal sign illumination within 2 minutes after it is energized is also cause for rejection.

g. The sign must be re-stabilized at the lowest test temperature after an examination.

4.1.1.6 Lighted Sign High Temperature Test.

a. A temperature shock test must be conducted for lighted signs using MIL-STD-810F, 1 January 2000, Method 503.4, Procedure II, Shock to/from Cyclic High Temperatures and include any required adapter units.

b. The maximum environmental chamber temperature must be 131 degrees F (+55 degrees C). This test must immediately follow the low temperature test in paragraph 4.1.1.5.

c. The high temperature chamber must be preheated and stabilized at the maximum temperature before performing the test.

(1) The sign must be transferred within 5 minutes or less from the low temperature chamber to the high temperature chamber.

(2) When the sign temperature is stabilized at the maximum chamber hot temperature, inspect the sign face for any cracking, peeling, bubbling, delaminating, and flaking. If any structural damage is evident, it is considered as a failed test and cause for rejection. In addition, if a sign fails to operate, it is also considered as a test failure and a cause for rejection.

d. After the sign cools to ambient temperature, re-inspect the sign face. Any damage is considered as a failed test.

4.1.1.7 Solar Radiation Test.

a. A solar radiation test must be conducted using MIL-STD-810F, 1 January 2000, Method 505.4, paragraph 4.4.2, Procedure II.

b. The sign must be subjected to a minimum of 56 cycles.

c. Sign legend panels are not required for this test. All other external non-metallic parts must be tested.

d. At the end of the test, any evidence of structural damage, cracking, peeling, bubbling, flaking, delaminating or corrosion is considered as a failed test and a cause for rejection.

4.1.1.8 External Sign Power Adapter Immersion Test.

a. A water immersion test must be conducted using MIL-STD-810F, 1 January 2000, Method 512.4, Procedure I, on the external sign power adapter unit after it is subjected to the high temperature testing in paragraph 4.1.1.6.

NOTE: *The immersion test confirms whether or not the adapter gasket material was adversely affected after its exposure to high temperatures.*

- b. Any evidence of water in the adapter unit is considered a failed test and cause for rejection.

4.1.1.9 Lighted sign Power Factor Test

Style 2, 3, 5, Dot Matrix, and ALD lighted signs must be tested for a power factor of not less than 0.8. All signs must be tested at their nominal operating current at the input power leads.

4.1.1.10 ALD Sign Surge Voltage Test

NOTE: *The equipment may be damaged by this test. Perform this test only after photometric testing in paragraph 4.1.1.3 is complete.*

- a. Apply 2 pulses at 15 second intervals per the descriptions in IEEE C62.41, Table 4, Location Category C, to the ALD sign power input (sign AC power off).
- b. See IEEE C62.41-1991 Section 9.3 for test condition and test generator information.
- c. See IEEE C62.41-1991 Section 9.4 for a detailed combination pulse generation and parameters discussion.
- d. See also IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1,000 volts (V) and Less) AC Power Circuits for guidance about equipment test methods.
- e. The equipment under test must operate normally at the conclusion of the test.

4.2 Unlighted Sign Qualification Procedures.

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

4.2.1 Unlighted Sign Conformance Tests.

4.2.1.1 Unlighted Sign Visual Inspection.

For this test:

- a. Type L-858Y signs must have at least two message elements separated by a message divider. Type L-858R signs must have a legend, that, for example, reads, "**18-36**."
- b. Type L-858L signs must have a legend that, for example, reads "**B**."
- c. All signs must be examined for compliance with the requirements of this AC for:
 - (1) Dimensions,
 - (2) Materials,
 - (3) Finish,

(4) Quality of workmanship.

d. All signs must be viewed in daylight and at night from 800 ft. (244 m) The sign types, described in paragraph 1.2.1 of this document, must be readily identifiable.

e. Both the sign face and retroreflective material must have a smooth appearance and be free of any aberration (excepting minor seams between retroreflective sheets) and sharp edges. Unlighted sign retroreflective sheeting types must be per paragraph 3.2.6.2.

4.2.1.2 Unlighted Sign Wind Load and Frangibility Test.

See paragraph 4.1.1.2; all requirements apply with the following exceptions for Mode 1:

a. Mode 1 unlighted signs or substitute lighted signs must be tested to withstand wind loads of 100 mph (161 kph).

b. A static force (equivalent to the specified wind velocity) of 0.23 psi (1.59 kPa) for mode 1 unlighted sign flat panel designs must be uniformly applied over the full surface of the legend panel for 10 minutes. The sign must not break at the frangible points or suffer any permanent distortion.

c. The frangible points must break before the static force (equivalent to the specified wind velocity) applied to the legend panel reaches 0.9 psi (6.21 kPa) for Mode 1 unlighted flat panel designs.

4.2.1.3 Unlighted Sign Low Temperature Test.

See paragraph 4.1.1.5; all requirements apply to unlighted signs.

4.2.1.4 Unlighted Sign High Temperature Test.

See paragraph 4.1.1.6; all requirements apply to unlighted signs.

4.2.1.5 Unlighted Sign Solar Radiation Test.

See paragraph 4.1.1.7; all requirements apply to unlighted signs including aluminum panels.

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SECTION 5. PRODUCTION.

All production sign panels must be inspected for compliance to the requirements of this AC for:

- a. dimensions,
- b. materials,
- c. finish,
- d. quality of workmanship.

Panels using retroreflective material must also be inspected to ensure that it is smooth and free from aberration with the exception of the panel joints in modular signs.

All the panel joints of modular signs must be inspected to ensure they do not interfere with the legibility of the sign.

5.1 Warranty.

The manufacturer must agree to provide each customer with the following guarantee:

This sign is manufactured under AC/150-5345-44H, *Specification for Runway and Taxiway Signs*, and warranted for 2 years after the installation date. Any defects in material or workmanship will be corrected or the sign replaced by the manufacturer at no cost to the airport owner.

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SECTION 6. DOT MATRIX SIGNAGE.

Dot matrix signs use fiber optics or LEDs that produce a sign legend character.

The use of dot matrix technology for airport signs applies only to Type L-858Ba, Size 4 and 5, Runway Distance Remaining, signs.

6.1 General Dot Matrix Sign Requirements.

a. All the specification and quality assurance requirements for lighted signs in this document, including the requirements in this section, apply to Type L-858Ba dot matrix signs.

b. Type L-858Ba signs must only be used for new installations and upgrades and not mixed with conventionally illuminated signs.

c. All dot matrix fixtures using LEDs for the dot matrix or as source lamps must also conform to the requirements of paragraph 7.3, ALD Sign Power.

6.2 Construction.

Cooling fans must not be used in the sign design.

6.2.1 Dot Matrix Sign Face.

a. The sign face legend must be a fixed matrix type.

b. The sign face background must be black with a white legend as shown in Appendix F, Figure 15.

c. Individual fiber optic points must not exceed a 0.8 in. (20 mm) distance from the legend character endpoints.

d. The fiber optic points that illuminate a character must be spaced not more than 0.8 in. (20 mm), and must follow the center (loci) of the character with the following exception:

e. The fiber optic points loci must be shifted to the left edge of the vertical member for the numeral "5."

f. If multiple lamps are used to illuminate the sign, a single lamp failure must not cause any dark fiber optic points on the sign face.

6.2.2 Fiber Optic Materials and Components.

a. Dot matrix signs must use end lit fiber optic designs; side lit designs must not be used.

b. Fiber optic materials used in a dot matrix sign must have a minimum glass transition temperature of 212 degrees F (100 degrees C).

c. All fiber optic bundles must be jacketed with opaque material.

6.3 Dot Matrix Sign Luminous Intensity.

- a. The legend of Type L-858Ba dot matrix signs must have a minimum average luminous intensity of 2 candelas when measured with the method in paragraph 6.4.2.
- b. The sign must be easily identified up to 800 ft. (244 m) during the day or when lighted at night.

6.4 Quality Assurance.

6.4.1 Dot Matrix Sign Photometric Test.

- a. A photometer must be used for this test.
- b. Before performing any tests, the photometric equipment calibration must be verified to be current. The equipment must be calibrated under the most current National Institute of Standards (NIST) traceable standards.
- c. Use IES publication, LM-35, Photometric Testing of Floodlights Using Incandescent Filament or Discharge Lamps, Paragraph 6 for the photometric equipment setup.

6.4.2 Photometric Performance.

- a. The sign must be operated for a minimum of 15 minutes at ambient temperature before making any measurements.
- b. A minimum sample of the output of 8 randomly selected dot matrix points over the emitting sign surface must be measured.
- c. The sign dot matrix point luminous intensity and distribution must be per Figure 1.
- d. The luminance ratio of the sign must be between 0.8 and 1.2 where:
 - (1) $I_{\text{average}} \div I_n = 0.8 \text{ to } 1.2$
 - (2) I_{average} = average luminance of all samples
 - (3) I_n = maximum luminance for all sample points

6.4.3 Dot Matrix Sign Chromaticity.

The type L-858Ba sign legend must be aviation white and conform to the chromaticity requirements in SAE AS25050, Section 3.1.6, Aviation white, type I(e), when measured at ± 35 degrees horizontal and vertical.

6.5 Dot Matrix Sign Production.

Production test must be the same as other signs in section 5. In addition, dot matrix signs must be energized for a minimum of 8 hours at 100 percent intensity under normal operating conditions at ambient temperature before shipment. Any dark spots or areas will constitute a failure.

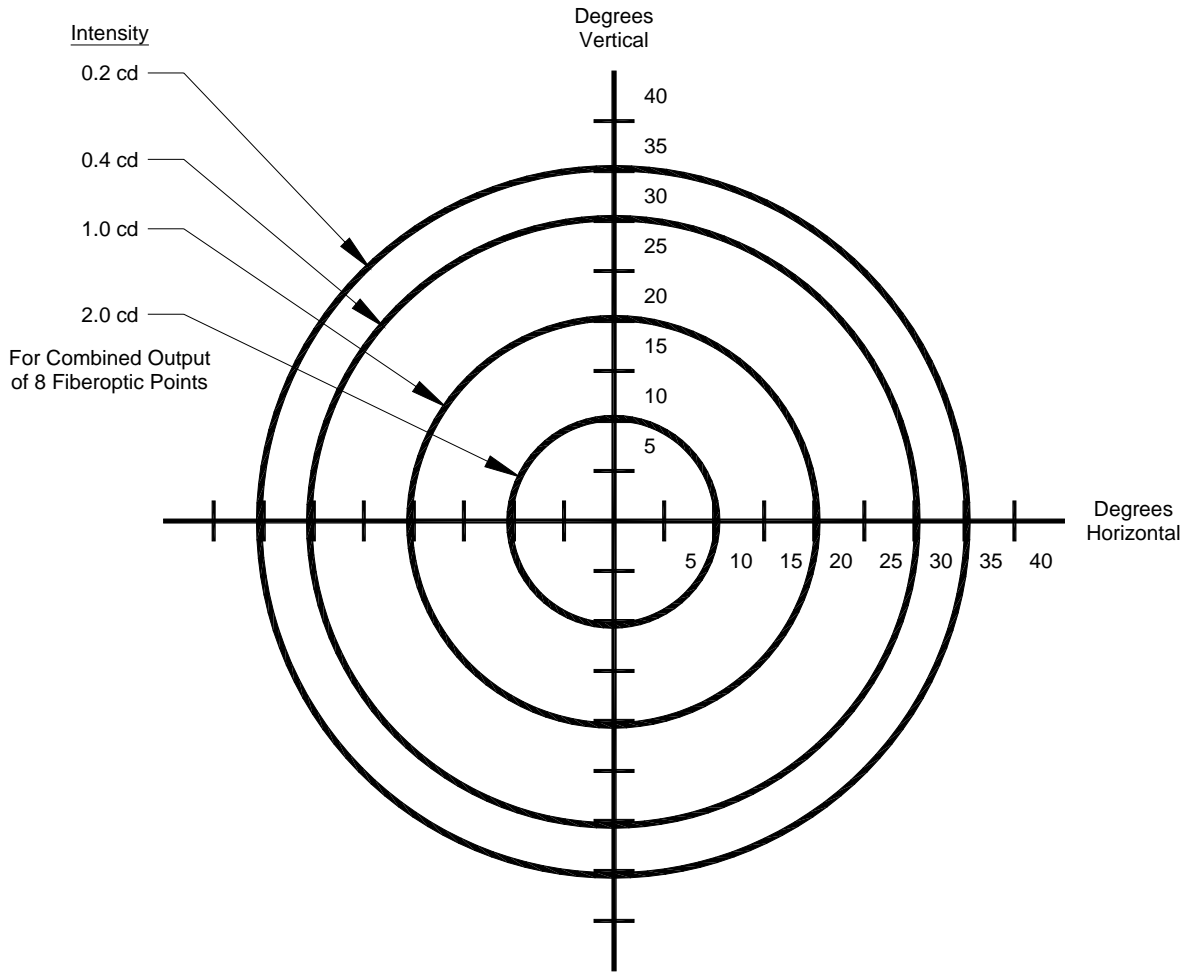


Figure 1. Dot Matrix Sign Intensity Distribution

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SECTION 7. ALDs FOR AIRPORT SIGNS.

ALD airport signs are lighted fixtures that use an internal lighting source other than incandescent and xenon lamps. Example: LED, cold cathode, etc.

7.1 General ALD Airport Sign Requirements.

ALD signs must meet all the specifications and quality assurance requirements for lighted signs in this document, including the requirements in this section.

7.2 Construction.

Cooling fans must not be used in the sign design.

7.3 ALD Sign Power.

a. ALD signs must be designed to operate and interface with existing airport lighting equipment systems.

b. The interface circuitry (if any) and solid state devices shall be designed to withstand and/or include separate surge protection devices which have been tested against defined waveforms detailed in Table 4, Location Category C1 of ANSI/IEEE C62.41-1991 "Recommended Practice on Surge Voltages in Low Voltage AC Power Circuits", namely, 3000 Amps, 8/20us - short circuit current pulse and 6000 Volt, 1.2/50us - open circuit voltage pulse.

7.3.1 ALD Sign Conducted and Radiated Emissions.

The ALD sign and its circuitry must meet FCC Title 47, Subpart B, Section 15 requirements concerning the emission of electronic noise. Both the conducted and radiation limits must be tested.

7.3.2 Light Module Failures.

If multiple light devices are combined to produce a single source of light (example: using 15 LEDs combined to make a single light source), the design must ensure the sign meets the requirements in paragraph 7.3.4. All multiple light devices must be randomly connected to ensure that there will be no axial failures in the horizontal or vertical. If less than 25% of the multiple light devices that form a single source fail, the sign must continue to meet the requirements in paragraph 7.3.4. If 25% of the individual light devices used to produce a single light source fail, the operation of the sign must be discontinued per paragraph 3.2.5.7.

7.3.3 Chromaticity.

a. All signs must meet the chromaticity requirements of this advisory circular for the color of light emitted.

b. Testing must be done spectroradiometrically in increments of 2 nanometers (nm) or less.

7.3.4 ALD Luminance.

The luminance of an ALD sign must be per paragraph 3.2.5.5 and 3.2.5.6.

7.4 Quality Assurance.

7.4.1 ALD Photometric Test.

See paragraphs 4.1.1.3, Lighted Sign Photometric Testing, and 4.1.1.3.3, Lighted Sign Faces. All requirements apply to ALD signs.

7.4.2 High Temperature.

a. Photometric measurements must be conducted after 15 minutes of operation at ambient temperature and after 4 hours continuous at 131 degrees F (55 degrees C).

b. Manufacturers must ensure the light output of the ALD sign does not decrease more than 30% from the requirements of this AC during high temperature tests.

7.5 ALD Sign Production.

Alternative light sources must be energized for a minimum of 4 hours at 100 percent intensity at standard ambient temperature before shipment. Any failure within an alternative light source after burn-in will be cause for rejection.

APPENDIX A - INSCRIPTIONS FOR SIGN FACES

This Appendix shows the shapes of the letters, numbers, and symbols used in inscriptions for sign faces.

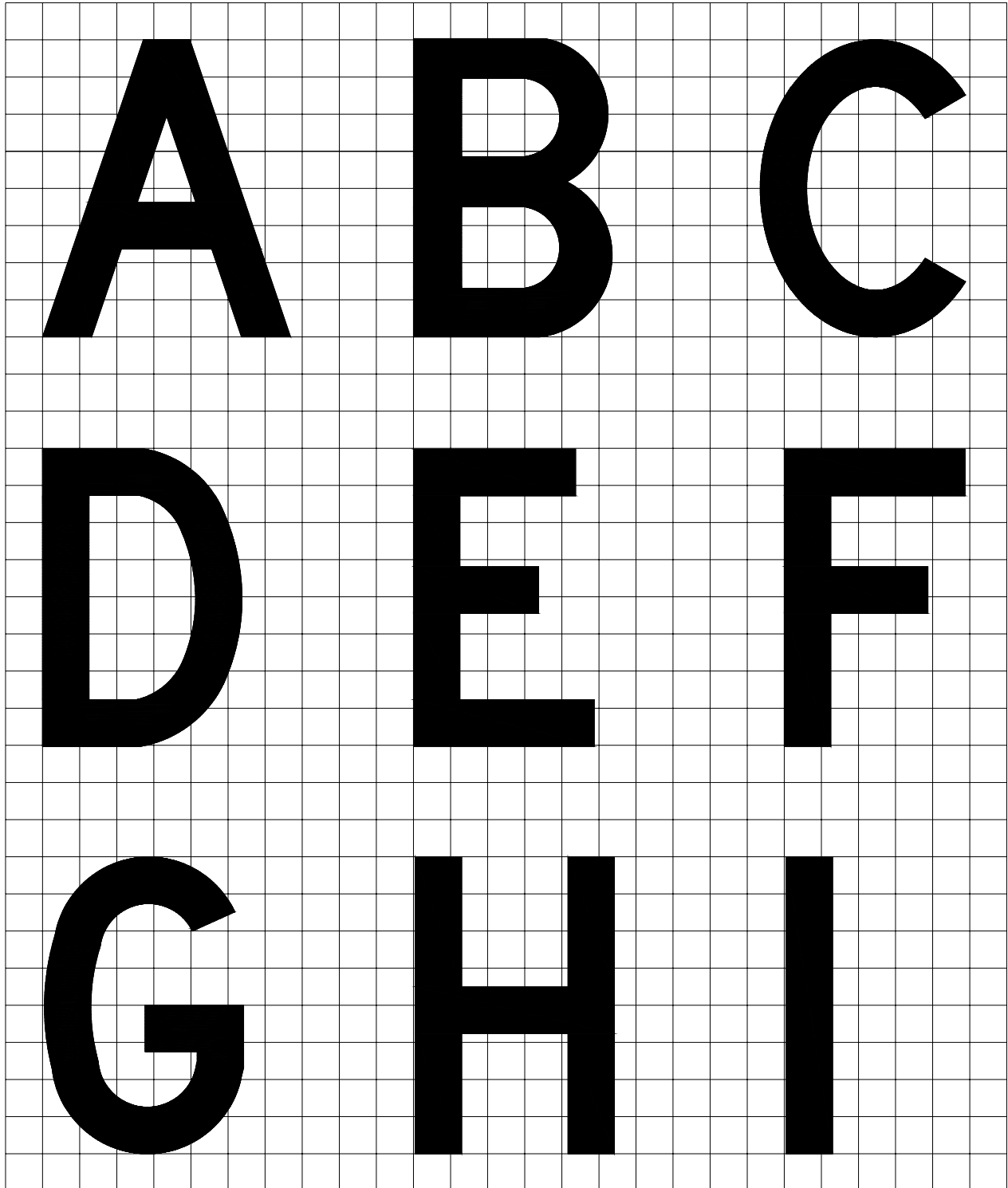


Figure 2. Sign Legend Characters for Size 1, 2, and 3 Signs

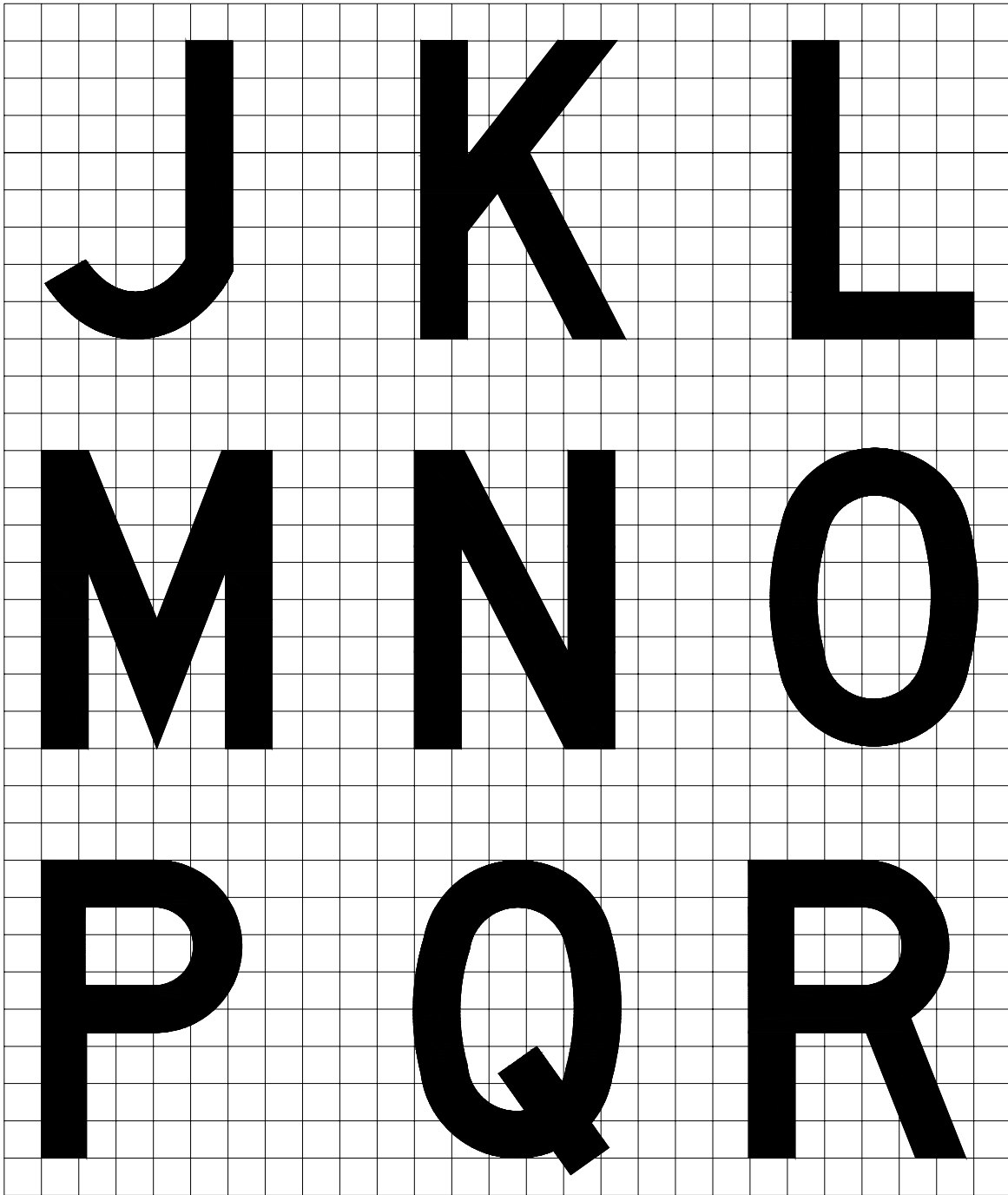


Figure 3. Sign Legend Characters for Size 1, 2, and 3 Signs

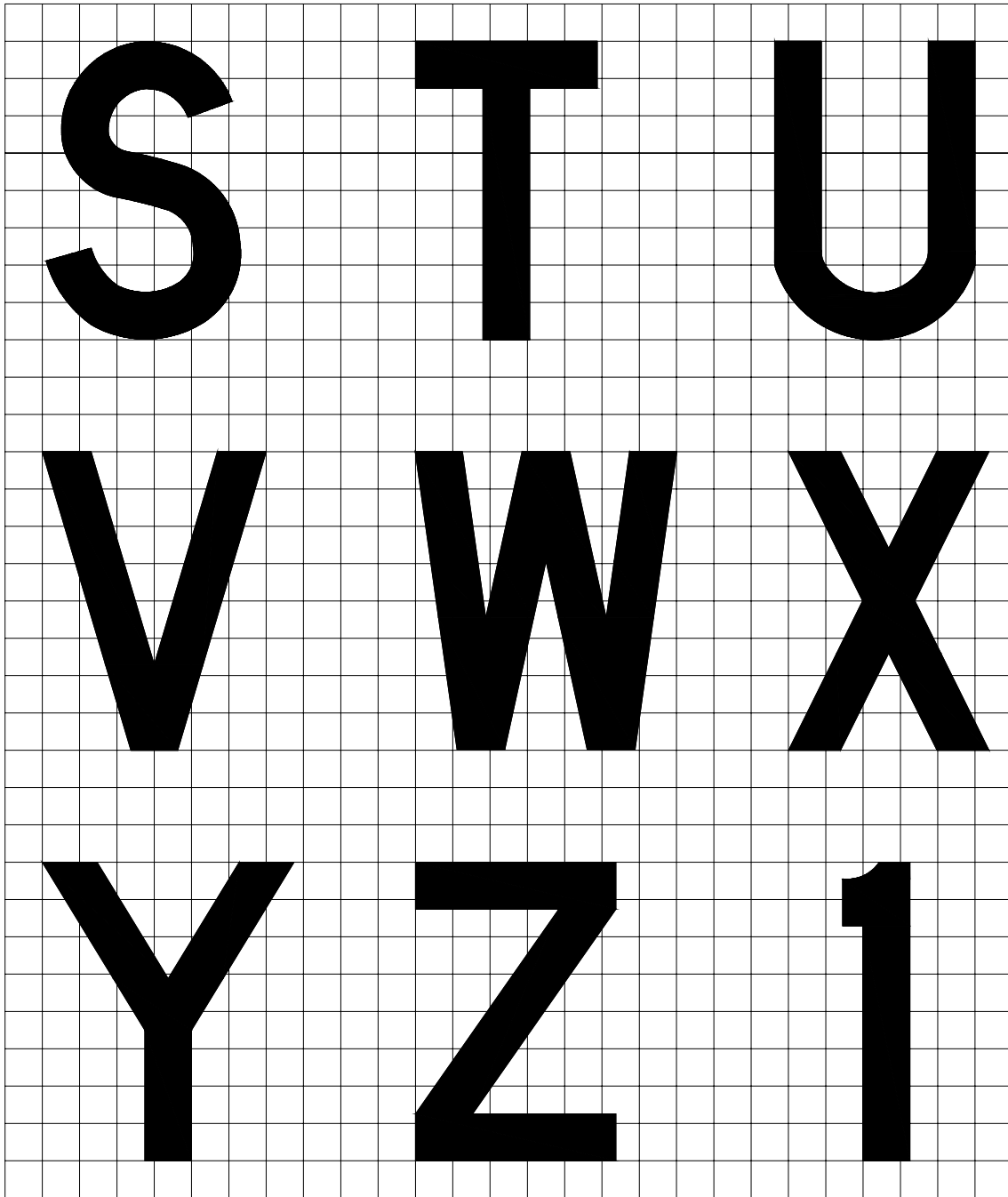


Figure 4. Sign Legend Characters and Numeral 1 for Size 1, 2, and 3 Signs

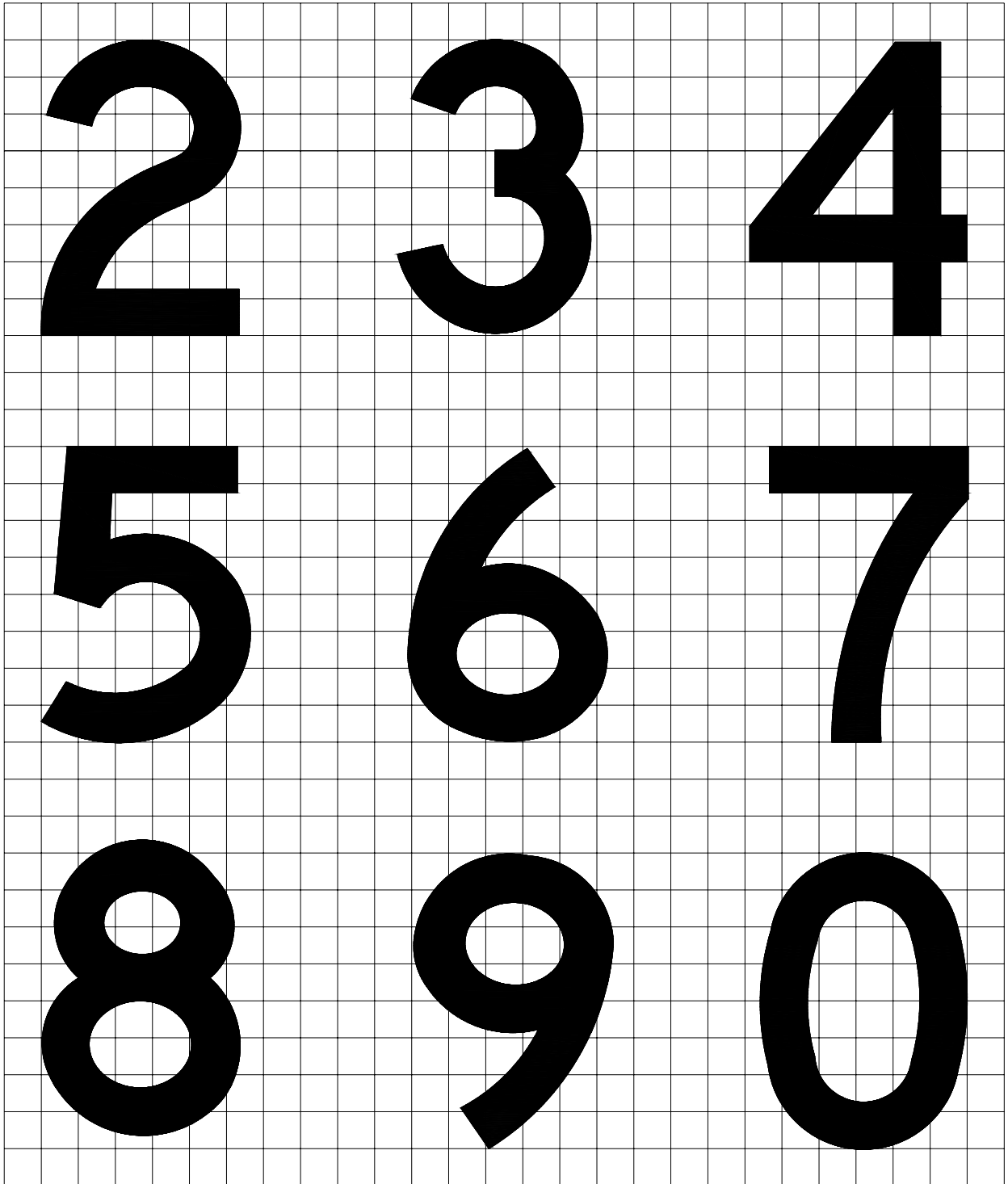


Figure 5. Numerals for Size 1, 2, and 3 Signs

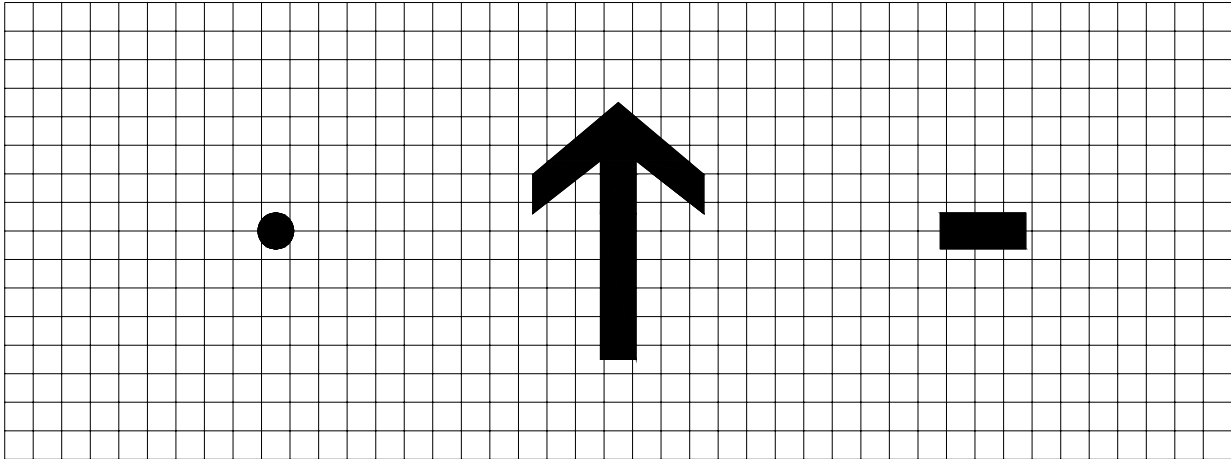


Figure 6. Dot, Arrow, and Dash

NOTES:

- (a) The arrow stroke width, diameter of the dot, and both the width and length of the dash must be proportional to the character stroke width defined in Table 4.
- (b) The dimensions of the arrow, without regard to its orientation, must remain the same for all sign types.
- (c) The minimum spacing between a letter or numeral and a dash or dot, or arrow must be 4 inches. For an arrow, the border of the sign must be per the requirements in Table 8 (minimum horizontal spacing between the legend and border or sign edge, if no border).

NOTE: *The following is applicable only to an arrow:* For the purposes of retrofit panels only, the minimum spacing goal for an arrow should be 4 inches per Figure 6. If an existing sign frame cannot accommodate this dimension, the arrow may be spaced closer to the character to which the arrow refers to allow fitting a new panel into the frame. However, the retrofitted panel must not adversely affect the overall proportionality or readability of the sign. In addition, the border of the sign must remain per requirements in Table 8 (minimum horizontal spacing between legend and border or sign edge, if no border).

Table 2. Letter to Letter Code Number

Preceding Letter	Following Letter		
	B, D, E, F, H, I, K, L, M, N, P, R, U	C, G, O G, S, X, Z	A, J, T, V, W, Y
A	2	2	4
B	1	2	2
C	2	2	3
D	1	2	2
E	2	2	3
F	2	2	3
G	1	2	2
H	1	1	2
I	1	1	2
J	1	1	2
K	2	2	3
L	2	2	4
M	1	1	2
N	1	1	2
O	1	1	2
P	1	2	2
R	1	2	2
S	1	2	2
T	2	2	4
U	1	1	2
V	2	2	4
W	2	2	4
X	2	2	3
Y	2	2	4
Z	2	2	3

NOTES:

- (a) To determine the proper space between letters or numerals, obtain the code number from Table 2 or 3.
- (b) Use the code number and Table 7 to find the desired letter or numeral height.

Table 3. Numeral to Numeral Code Number

Preceding Numeral	Following Letter		
	1, 5	2, 3, 6, 8, 9, 0	4, 7
1	1	1	2
2	1	2	2
3	1	2	2
4	2	2	4
5	1	2	2
6	1	2	2
7	2	2	4
8	1	2	2
9	1	2	2
0	1	2	2

Table 4. Width of Strokes

Letter Height		Stroke Width	
(in.)	(mm)	(in.)	(mm)
12	304.8	1.88	47.8
15	381.0	2.35	59.7
18	457.2	2.81	71.4
25	635.0	3.53	89.5
40	1000.0	5.64	143.3

Dimensions may be rounded to the nearest 1/16-inch (0.0625) or 1.6 mm

Table 5. Width of Letters

Letter	Letter Height					
	12 in. (300 mm)		15 in. (380 mm)		18 in. (460 mm)	
	(in.)	(mm)	(in.)	(mm)	(in.)	(mm)
A	10.03	254.8	12.55	318.8	15.06	382.5
B	8.06	204.7	10.08	256.0	12.09	307.1
C	8.06	204.7	10.08	256.0	12.09	307.1
D	8.06	204.7	10.08	256.0	12.09	307.1
E	7.31	185.7	9.14	232.2	10.97	278.6
F	7.31	185.7	9.14	232.2	10.97	278.6
G	8.06	204.7	10.08	256.0	12.09	307.1
H	8.06	204.7	10.08	256.0	12.09	307.1
I	1.88	47.8	2.35	59.7	2.81	71.4
J	7.50	190.5	9.38	238.3	11.25	285.8
K	8.25	209.6	10.32	262.1	13.38	314.5
L	7.31	185.7	9.14	232.2	10.97	278.6
M	9.28	235.7	11.61	294.9	13.94	354.1
N	8.06	204.7	10.08	256.0	12.09	307.1
O	8.44	214.4	10.55	268.0	12.66	321.6
P	8.06	204.7	10.08	256.0	12.09	307.1
Q	8.44	214.4	10.55	268.0	12.66	321.6
R	8.06	204.7	10.08	256.0	12.09	307.1
S	8.06	204.7	10.08	256.0	12.09	307.1
T	7.31	185.7	9.14	232.2	10.97	278.6
U	8.06	204.7	10.08	256.0	12.09	307.1
V	9.00	228.6	11.25	285.8	13.50	342.9
W	10.50	266.7	13.13	333.5	15.75	400.1
X	8.06	204.7	10.08	256.0	12.09	307.1
Y	10.12	257.0	12.66	321.6	15.19	385.8
Z	8.06	204.7	10.08	256.0	12.09	307.1
<i>Dimensions may be rounded to the nearest 1/16-inch (0.0625) or 1.6 mm</i>						

Table 6. Width of Numerals

Numeral Height										
Numeral	12 in. (300mm)		15 in. (380 mm)		18 in. (460 mm)		25 in. (635 mm)		40 in. (1000 mm)	
	(in.)	(mm)	(in.)	(mm)	(in.)	(mm)	(in.)	(mm)	(in.)	(mm)
1	2.91	73.9	3.65	92.5	4.38	111.3	5.08	129.0	8.12	206.2
2	8.06	204.7	10.08	256.0	12.09	307.1	13.7	348.0	21.88	555.8
3	8.06	204.7	10.08	256.0	12.09	307.1	13.7	348.0	21.88	555.8
4	8.81	223.8	11.02	279.9	13.22	335.8	15.23	386.8	24.36	618.7
5	8.06	204.7	10.08	256.0	12.09	307.1	13.7	348.0	21.88	555.8
6	8.06	204.7	10.08	256.0	12.09	307.1	13.7	348.0	21.88	555.8
7	8.06	204.7	10.08	256.0	12.09	307.1	13.7	348.0	21.88	555.8
8	8.06	204.7	10.08	256.0	12.09	307.1	13.7	348.0	21.88	555.8
9	8.06	204.7	10.08	256.0	12.09	307.1	13.7	348.0	21.88	555.8
0	8.44	214.4	10.55	268.0	12.66	321.6	14.4	365.0	23.12	587.2

Dimensions may be rounded to the nearest 1/16-inch (0.0625) or 1.6 mm

Table 7. Letter and Numeral Spacing

Space measured horizontally from the extreme right edge of the preceding letter or numeral to the extreme left edge of the following letter or numeral.										
Letter or Numeral Height										
Code Number (See Table 2 or 3)	12 in. (300 mm)		15 in. (380 mm)		18 in. (460 mm)		25 in. (635 mm)		40 in. (1000 mm)	
	(in.)	(mm)	(in.)	(mm)	(in.)	(mm)	(in.)	(mm)	(in.)	(mm)
1	2.81	71.4	3.52	89.4	4.22	107.2	5.14	130.6	8.22	208.8
2	2.25	57.2	2.82	71.6	3.38	85.9	4.23	107.4	6.76	171.7
3	1.50	38.1	1.88	47.8	2.25	57.2	3.03	77.0	4.84	122.9
4	0.75	19.1	0.94	23.9	1.12	28.4	1.40	35.6	2.24	56.9

Dimensions may be rounded to the nearest 1/16-inch (0.0625) or 1.6 mm

Table 8. Spacing for Borders and Message Dividers (Lighted Signs)

Letter or Numeral Height									
12 in. (300 mm)		15 in. (380mm)		18 in. (460 mm)		25 in. (640 mm)		40 in. (1020 mm)	
Minimum horizontal spacing between legend and border (or sign edge, if no border.)									
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
1.50	38.1	2.00	50.8	2.50	63.5	3.00	76.2	4.00	101.6
Minimum Horizontal spacing between legend and border for Type L-858L, taxiway location signs, that contain a single character. <i>Not applicable for 25 in. or 40 in. letters.</i>									
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
3.00	76.2	3.50	88.9	4.00	101.6	N/A	N/A	N/A	N/A
Minimum horizontal spacing between legend and border (or sign edge, if no border) for types L-858R or L-858L, runway location signs, that contain a single digit. <i>Not applicable for 25 in. or 40 in. letters.</i>									
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
6.00	152.4	6.50	165.1	7.00	177.8	N/A	N/A	N/A	N/A
Minimum horizontal spacing between legend and message divider. <i>Not applicable for 25 in. or 40 in. letters.</i>									
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
3.00	76.2	3.50	88.9	4.00	101.6	N/A	N/A	N/A	N/A
<i>Dimensions may be rounded to the nearest 1/16-inch (0.0625) or 1.6 mm</i>									

Table 9. Spacing for Borders and Message Dividers (Unlighted Signs)

Letter or Numeral Height					
12 in. (300 mm)		15 in. (380 mm)		18 in. (460 mm)	
Minimum horizontal spacing between legend and border (or sign edge, if no border.)					
in.	mm	in.	mm	in.	mm
1.50	38.1	2.00	50.8	2.5	63.5
Minimum Horizontal spacing between legend and border for type L-858L, taxiway location signs that contain a single character.					
in.	mm	in.	mm	in.	mm
3.00	76.2	3.50	88.9	4.0	101.6
Minimum Horizontal spacing between legend and border (or sign edge, if no border) for types L-858R or L-858L, runway location signs that contain a single digit.					
in.	mm	in.	mm	in.	mm
6.00	152.4	6.5	165.1	7.00	177.8
Minimum horizontal spacing between legend and message divider.					
in.	mm	in.	mm	in.	mm
3.00	76.2	3.50	88.9	4.0	101.6
<i>Dimensions may be rounded to the nearest 1/16-inch (0.0625) or 1.6 mm</i>					

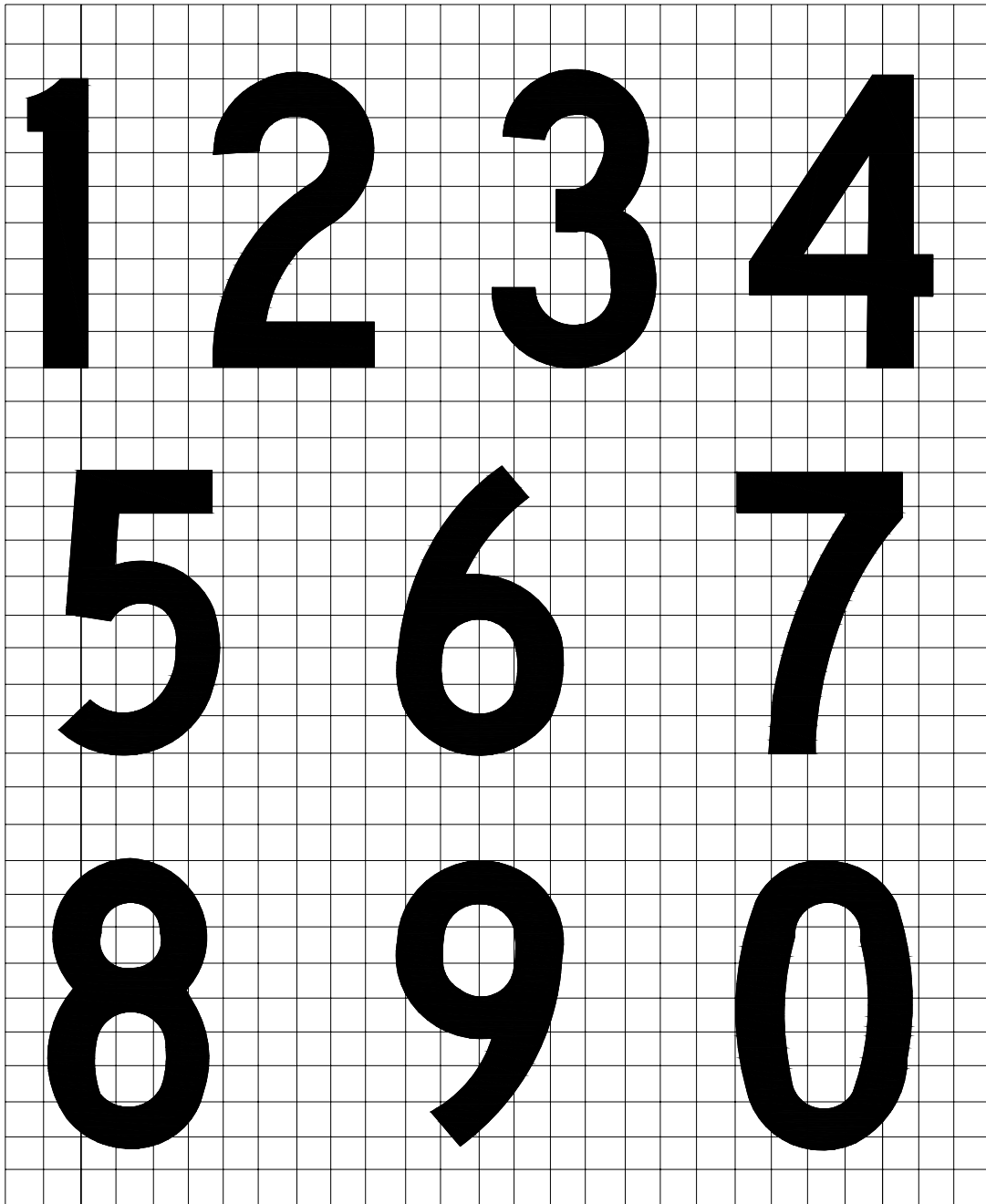


Figure 7. Numerals for Size 4 and 5 Signs

APPENDIX B - SIGN LEGENDS

This Appendix shows the dimensions for runway safety area/OFZ, runway approach boundary, ILS critical area, and no entry sign.

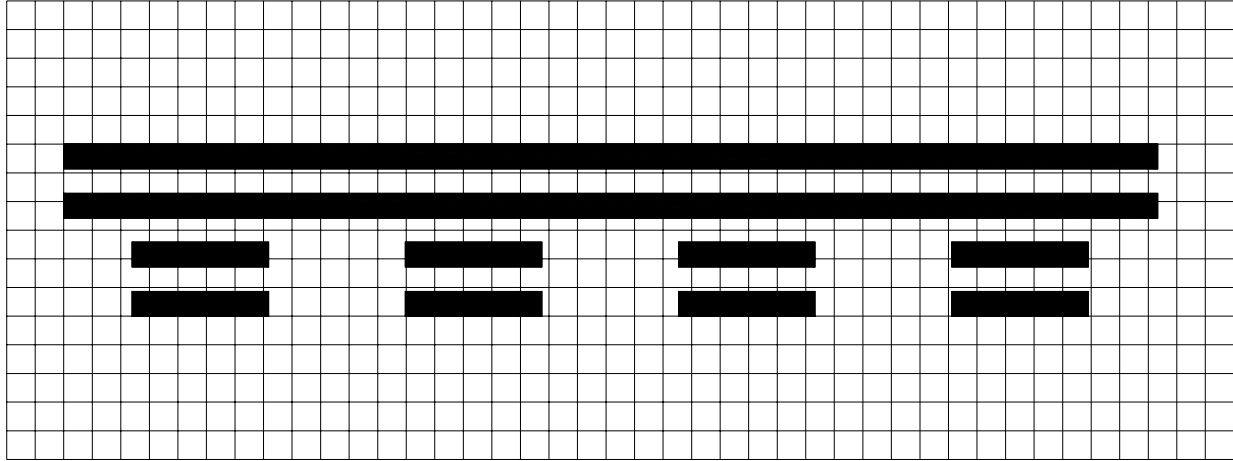


Figure 8. Runway Safety Area/OFZ and Runway Approach Boundary Sign

Table 10. Dimensions for Runway Safety Area/OFZ and Runway Approach Boundary Signs

Sign Elements	Size 1		Size 2		Size 3	
	(in.)	(mm)	(in.)	(mm)	(in.)	(mm)
Legend Height	9.0	228.8	12.0	304.8	15.0	381.0
Legend Length	57.5	1460.5	73.0	1854.2	84.0	2133.6
Stroke Width	1.29	32.8	1.72	43.7	2.14	54.4
Dash Length	7.18	182.4	9.12	231.6	10.5	266.7
<i>Dimensions may be rounded to the nearest 1/16-inch (0.0625) or 1.6 mm</i>						

NOTES:

- (a) Legend length may vary ± 2 inches (50.8 mm).
- (b) Vertical spacing between bars must be equal to the stroke width.
- (c) Horizontal spacing between dashes must be equal to the dash length.
- (d) Dash length and horizontal spacing must vary proportionally to legend length.
- (e) The yellow background of the boundary sign should not extend beyond the ends of the solid horizontal bars.

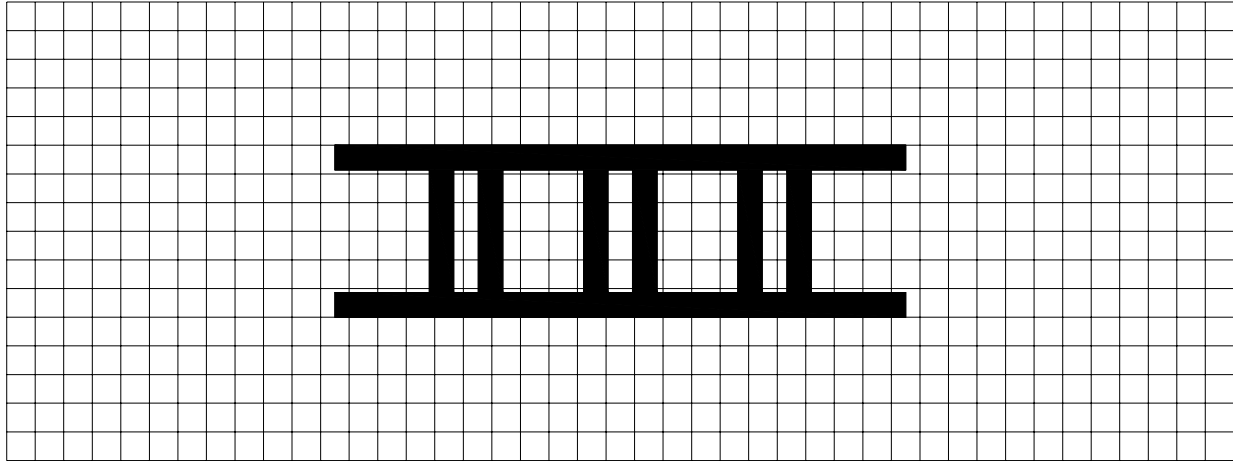


Figure 9. ILS Critical Area Boundary Sign

Table 11. Dimensions for ILS Critical Area Boundary Signs

Sign Elements	Size 1		Size 2		Size 3	
	(in.)	(mm)	(in.)	(mm)	(in.)	(mm)
Legend Height	9.0	228.8	12.0	304.8	15.0	381.0
Legend Length	30.0	762.0	36.0	914.4	42.0	1066.8
Stroke Width	1.29	32.8	1.72	43.7	2.14	54.4
<i>Dimensions may be rounded to the nearest 1/16-inch (0.0625) or 1.6 mm</i>						

NOTES:

- (a) Legend length may vary ± 2 inches (50.8 mm).
- (b) The space within a pair of vertical bars must be equal to the stroke width.
- (c) The space between each pair of vertical bars must vary proportionally to legend length.
- (d) The yellow background of the boundary signs should not extend beyond the ends of the horizontal bars.

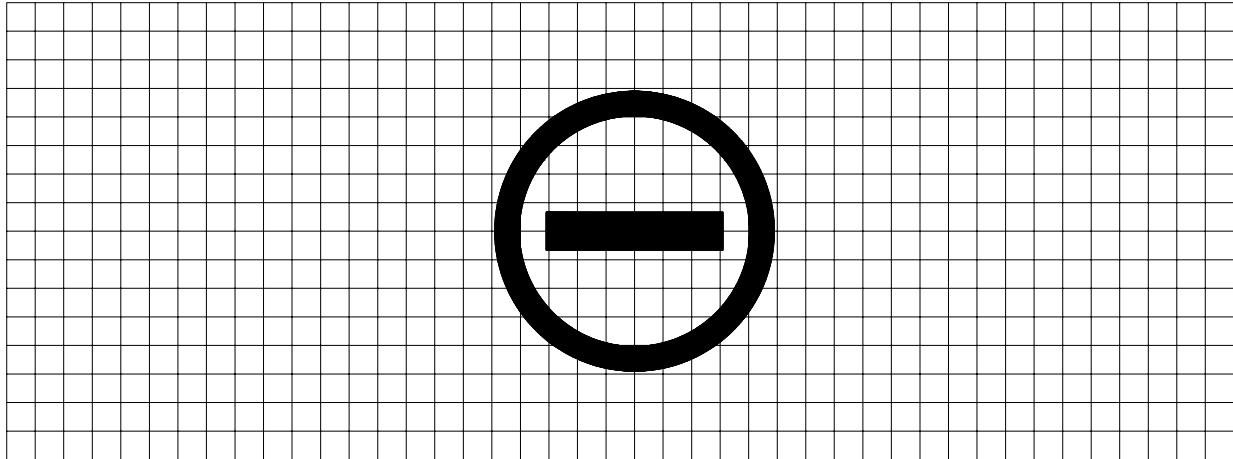


Figure 10. No Entry Sign

Table 12. Dimensions for No Entry Signs

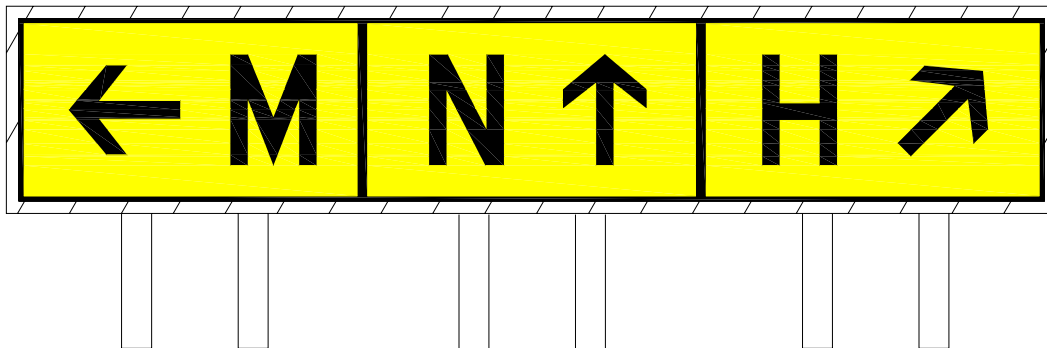
Sign Elements	Size 1		Size 2		Size 3	
	(in.)	(mm)	(in.)	(mm)	(in.)	(mm)
Minimum Legend Panel Length	24.0	609.6	32.0	812.8	40.0	1016.0
Outer Radius	7.35	186.7	9.75	247.7	12.2	309.9
Inner Radius	6.05	153.7	7.95	201.9	10.0	254.0
Dash Length	9.3	236.2	12.4	315.0	15.5	393.7
Dash Width	2.0	50.8	2.7	68.6	3.3	83.8
<i>Dimensions may be rounded to the nearest 1/16-inch (0.0625) or 1.6 mm</i>						

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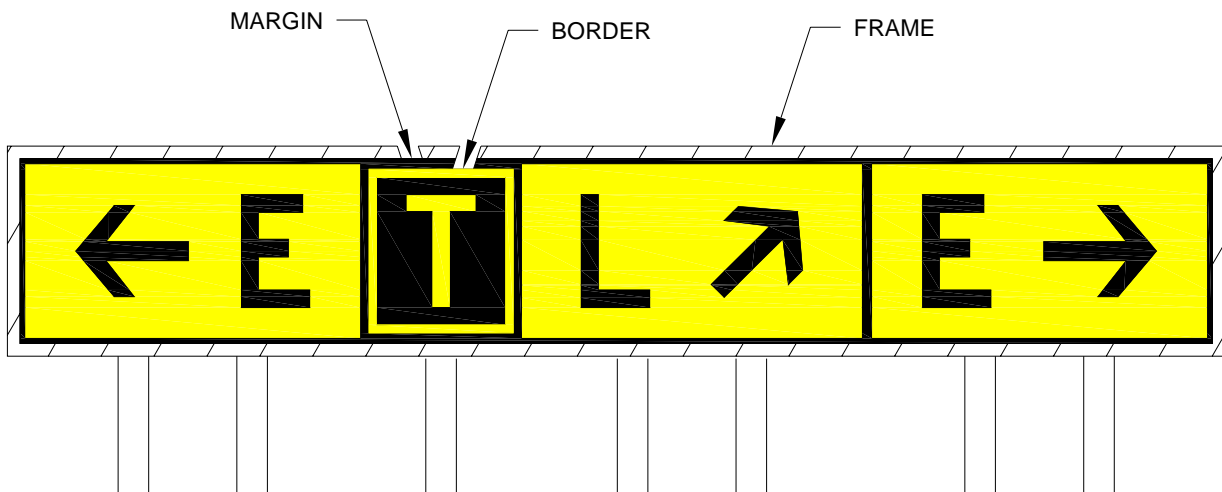
APPENDIX C - SIGN ARRAYS (LIGHTED SIGNS)

This Appendix represents typical installations of signs containing multiple message elements and sign types.

Figures are examples only and not drawn to scale.



Type L-858Y direction sign array composed of three message elements separated by message dividers. On modular signs, the message dividers may be coincident with panel joints.



Sign array that has three L-858Y (Taxiway Direction) signs separated by an L-858L (Taxiway Location) sign. Note that on the right hand side of the sign array, the two message elements are separated by a black divider.

Figure 11. Lighted Sign Array Examples

Figures are examples only and not drawn to scale.



Type L-858R sign array containing two message elements. Note black outline on L-858R white legend. When multiple lighted signs are used, the separation between sign housings is 3 to 12 in. (76 to 305 mm) – see paragraph 3.2.5.2 for detailed requirements.



Sign array (multiple signs) that contains a Type L-858L taxiway location sign and L-858R runway holding position signs.

Figure 12. Lighted Sign Array Examples

APPENDIX D - SIGN ARRAYS (UNLIGHTED SIGNS)

Figures are examples only and not drawn to scale.

This Appendix represents typical installations of signs containing multiple message elements and sign types.



A sign array, that contains two Type L-858Y direction signs separated by a Type L-858L taxiway location sign. The Type L-858Y signs on the right contain two message elements separated by a message divider. When multiple signs are used, the separation between legend panels for unlighted signs is 3 to 6 inches (76 to 152 mm).

Note the radius on sign corners (paragraph 3.2.6.5i and square corners on L-858L border.



Sign array composed of multiple signs, which contains a Type L-858L taxiway location sign and an L-858R runway holding position sign.

Figure 13. Unlighted Sign Array Examples

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APPENDIX E - ONE-HALF RUNWAY DISTANCE REMAINING SIGN

Figures are examples only and not drawn to scale.

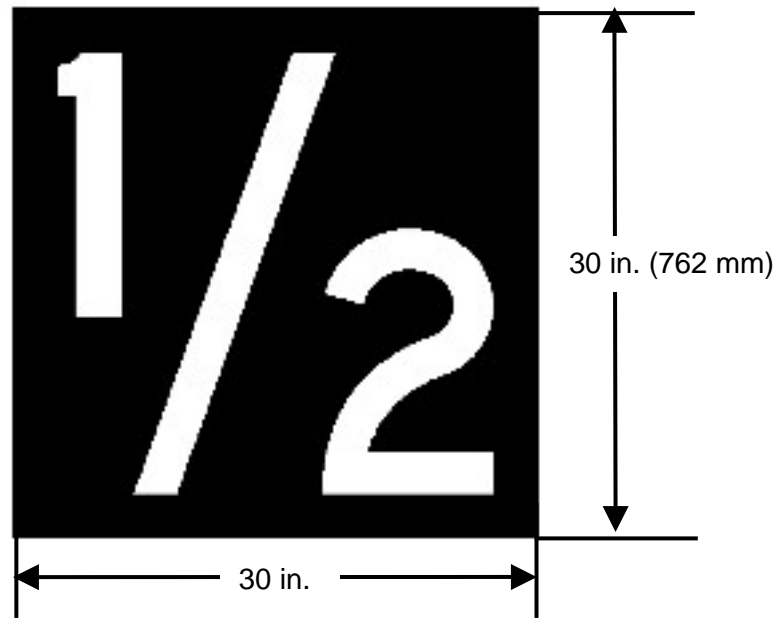


Figure 14. One-Half Distance Remaining Sign, Type L-858H

NOTE: *Type L858H signs must not be used in combination with L-858B, Runway Distance Remaining signs.*

Dimensions:

Numeral height:	15 in (381 mm).
Numeral stroke width:	per Table V.
Angle of slash:	20 degrees.
Slash stroke width:	same as stroke width for numerals.
Horizontal spacing between slash and upper numeral:	4 in. (127 mm) at closest point.
Horizontal spacing between slash and lower numeral:	4 in. (127 mm) at closest point.
Total legend height:	25 in. (635 mm), 2.5 in. (63.5 mm) from panel top and bottom.

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APPENDIX F - DOT MATRIX RUNWAY DISTANCE REMAINING SIGN

Figures are examples only and not drawn to scale.

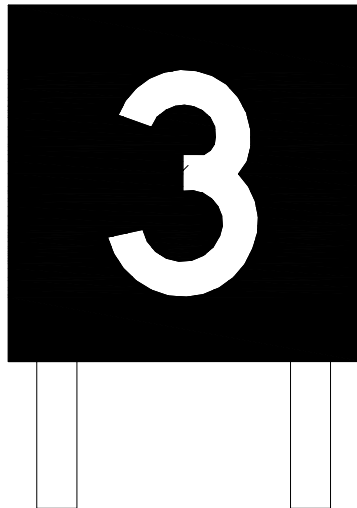


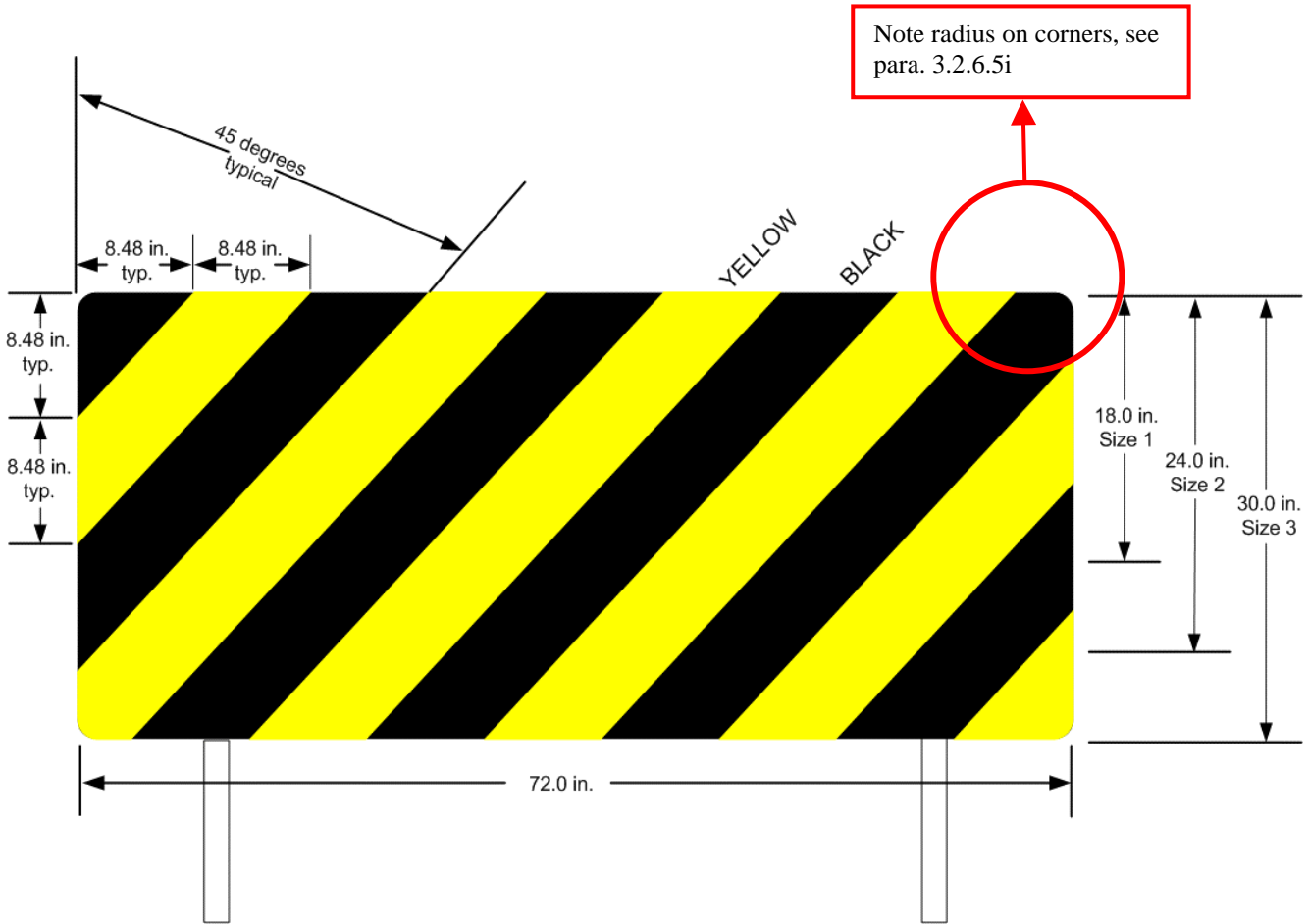
Figure 15. Runway Distance Remaining Sign, Type L-858B, L-858B(a) Dot Matrix

NOTE: *Sign must be Size 4 or 5.*

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APPENDIX G - TAXIWAY ENDING MARKERS (UNLIGHTED SIGNS)

Figures are examples only and not drawn to scale.



8.48 in. = 215 mm

24.0 in. = 610 mm

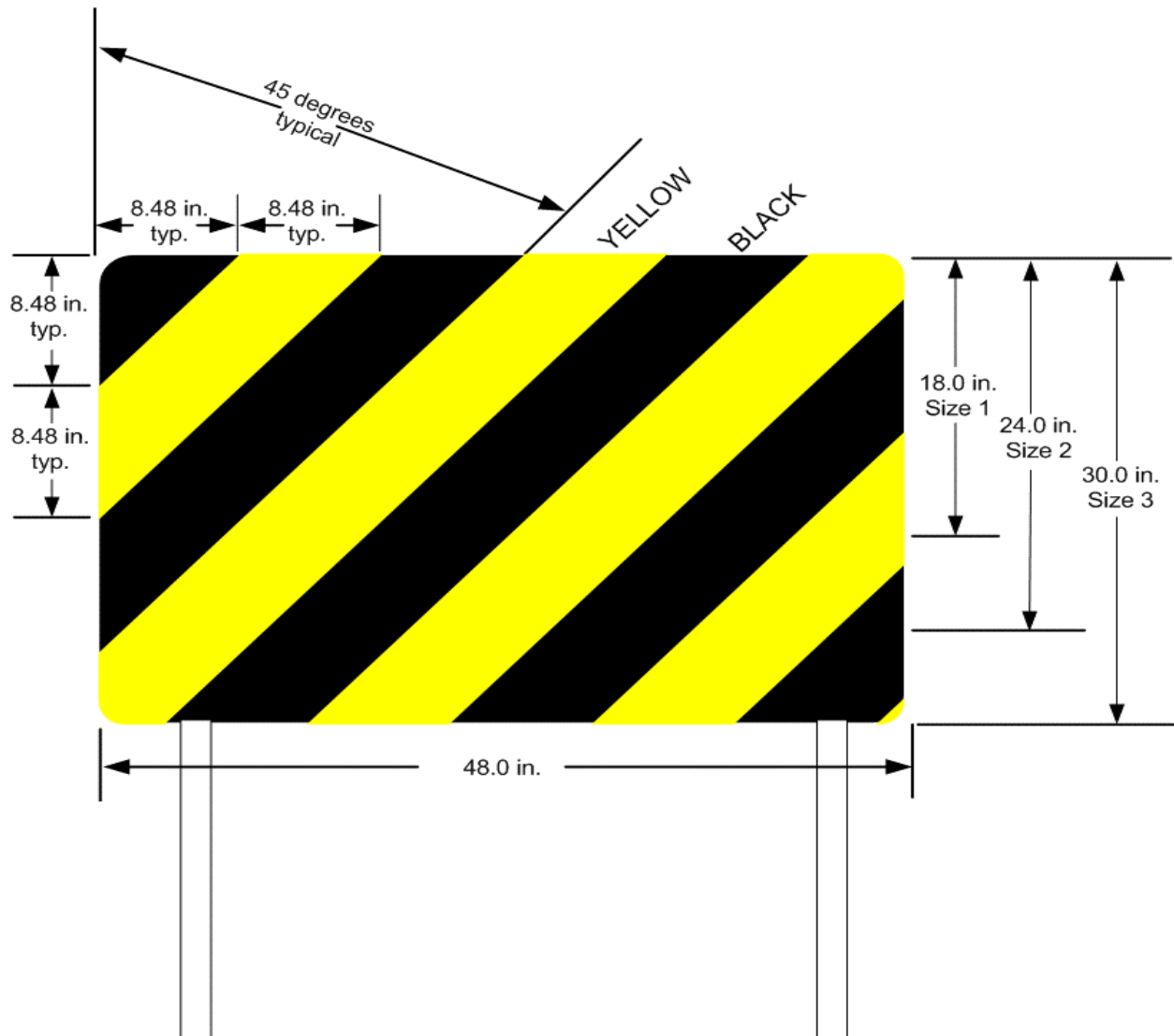
72.0 in. = 1.83 meters

18.0 in. = 457 mm

30.0 in. = 762 mm

Figure 16. Type L-858C, 72.0 Inch Taxiway Ending Marker Signs

Figures are examples only and not drawn to scale.



8.48 in. = 215 mm	24.0 in. = 610 mm	72.0 in. = 1.83 meters
18.0 in. = 457 mm	30.0 in. = 762 mm	

Figure 17. Type L-858C, 48.0 Inch Taxiway Ending Marker