American National Standard

ANSI C78.379-1994

Classification of the Beam Patterns of Reflector Lamps

NEMA

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American National Standard

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ANSI®
C78.379-1994

American National Standard
for Electric Lamps

Classification of the Beam Patterns of Reflector Lamps

Secretariat
National Electrical Manufacturers Association

Approved August 18, 1994
American National Standards Institute

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Foreword (This Foreword is not part of American National Standard C78.379-1994)

This American National Standard, *Classification of the Beam Patterns of Reflector Lamps*, describes a system for classification of beam pattern of reflector lamps by means of beam angles.

Suggestions for improvement of this standard will be welcome. They should be sent to the Secretary of Committee C78. National Electrical Manufacturers Association, 2101 L Street, NW, Washington, DC 20037.

This standard was processed and approved for submittal to ANSI by Accredited Standards Committee on Electric Lamps, C78 and Subcommittee C78-1 on Incandescent Lamps. Committee approval of the standard does not necessarily imply that all committee members voted for its approval.

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AMERICAN NATIONAL STANDARD FOR ELECTRIC LAMPS CLASSIFICATION OF THE BEAM PATTERNS OF REFLECTOR LAMPS

1 Scope, purpose, and application

1.1 Scope

This standard describes a system for classification of beam patterns of reflector lamps by means of beam angles. Also, a method of describing light output is defined.

Reflector lamps are considered to be those lamps having a reflective coating applied to the reflector part of the bulb or a reflector permanently attached to the bulb, the reflector being specifically contoured for control of the light-flux distribution. Partial reflector lamps are also covered. Both symmetrical and asymmetrical beams can be classified. Lamps with various kinds of light sources are covered.

1.2 Purpose

The purpose of this classification system is to provide a convenient means of description that will differentiate lamps according to beam angles and thereby help assure interchangeability of lamps. This classification applies only to bare lamps and excludes lamps in luminaires or other systems.

1.3 Application

The definitions and classification included in this standard apply only to lamps for general lighting applications. They do not apply to lamps intended for precision aiming systems such as automotive headlights, special tractor lamps or photographic projection systems.

2 Normative references

The following publications contain provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the publications indicated below.

ANSI C78.21-1989, *American National Standard for Incandescent Lamps, PAR & R Shapes*

ANSI C78.40-1985, *Specification for Mercury Lamps*

ANSI C78.380-1984, *Method of Designation of HID Lamps*

ANSI C78.1340-1990, *American National Standard Mercury Lamps 450-Watt, 230-Volt Self-Ballasted*

ANSI C78.1341-1990, *American National Standard Mercury Lamps, 750-Watt, 120-Volt, Self-Ballasted*

ANSI C78.1342-1990, *American National Standard Mercury Lamps, 160-Watt, 120-Volt, Self-Ballasted*

ANSI C78.1350-1990, *American National Standard for Electric Lamps – 400-Watt, 10-Volt, S51 Single-Ended High-Pressure Sodium Lamps*

ANSI C78.1353-1990, *American National Standard for Electric Lamps – 70-Watt, 52-Volt, S62 Single-Ended High-Pressure Sodium Lamps*

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ANSI C78.1358-1988, *American National Standard for Electric Lamps – 35-Watt, S76 Single-Ended High-Pressure Sodium Lamps (includes supplement ANSI C78.1358a-1990)*

ANSI C78.1380-1988, *American National Standard for Mercury Lamps, Specification for 250-Watt, 120-Volt, Self-Ballasted Mercury Lamps*

ANSI/IES RP-16-1986, *Nomenclature and Definitions for Illuminating Engineering*

IES LM20, *IES Approved Method for Photometric Testing of Reflector Type Lamps*

3 Definitions

3.1 Beam axis
The axis about which the light flux distribution is substantially symmetrical.

NOTES
1 It is assumed that only small (negligible) errors occur when symmetry is determined visually.
2 The beam axis is not necessarily the same as the lamp axis through the lamp base or the lamp axis normal to the plane of any fixed points on the reflector.

3.2 Center beam intensity (Ic)
The value of the light flux intensity, measured on the beam axis.

Units: Candelas (cd)

NOTES
1 See figures 1, 2, and A1
2 The formerly used terms "maximum center beam candlepower", and "approximate average candlepower in central 5°/10° cone" are superseded by the term center beam intensity.

3.3 Peak intensity (Ip)
The highest value of light flux intensity regardless of whether or not it occurs on the beam axis.

Units: Candelas (cd)

NOTES
1 See figure A1.
2 An Ip point that falls outside of the beam angle may be ignored.

3.4 Beam angle (of symmetrical beams)
The angle between the two directions, within a plane, which contain the points of 50% center beam intensity.

Units: Degrees (°)

NOTES
1 See figure 1.
2 The beam angle is the angle between the two defined limitation points with its apex at the face of the lamp. It is not an angle between one limitation point and the beam axis.

3.5 Beam angle (of asymmetrical beam)
Those two angles, the largest and smallest each derived in accordance with 3.4, which lie in two planes at 90° to each other.

NOTE—See figure 2.

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3.6 Nominal beam angle

That beam angle which is established as being representative of a manufacturer's production.

3.7 Beam pattern

The pattern of light displayed on a surface normal to the beam axis.

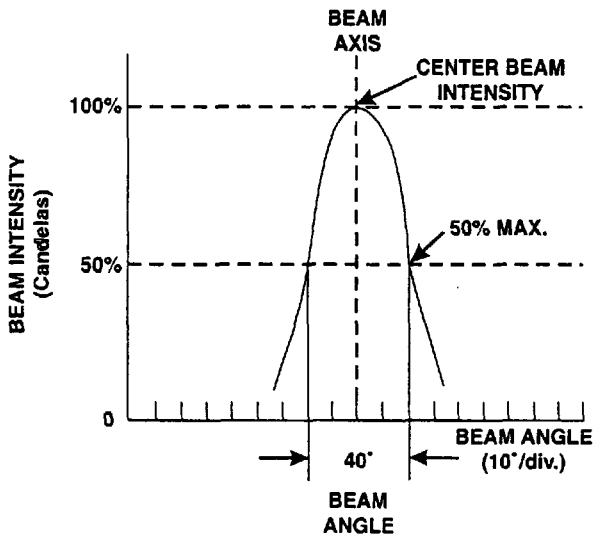

Figure 1 – Simplified presentation of an asymmetric beam angle 40°

4 Beam angle classifications and tolerances

4.1 Beams shall be classified by nominal beam angles obtained by rounding the average beam spread to the nearest number as described below.

For beams of less than 13° the classification shall be formed from the average beam angle rounded to the nearest whole number: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.

For beam angles of 13° to 50° the classification shall be formed from the average beam angle rounded to the nearest 5° (starting at 15°): 15, 20, 25, 30, 35, 40, 45 & 50.

For beam angles of 51° or greater, the classification shall be formed from the average beam angle rounded to the nearest 10°: 60, 70, 80 & 90.

Example: A set of test lamps which exhibit an average beam angle of 13° degrees would be assigned a classification of 15° as the nominal beam angle.

NOTES
1 The use of the words "spot" or "flood" in addition to the beam angle classification is optional and may vary depending on the particular family of lamps involved.
2 Average refers to the numerical result obtained by dividing a sum of two or more quantities by the number of quantities added.

4.2 For asymmetrical beam patterns, for example an oval beam, the overall classification shall contain a wide angle sub-classification and a narrow angle sub-classification. Classification angles established using the method of 4.1 shall be employed for each part of a lamp description. In the classification of an asymmetrical pattern, the wide angle sub-classification shall appear first followed by the narrow angle sub-classification.

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An example of an asymmetrical beam angle classification is: 60x20.

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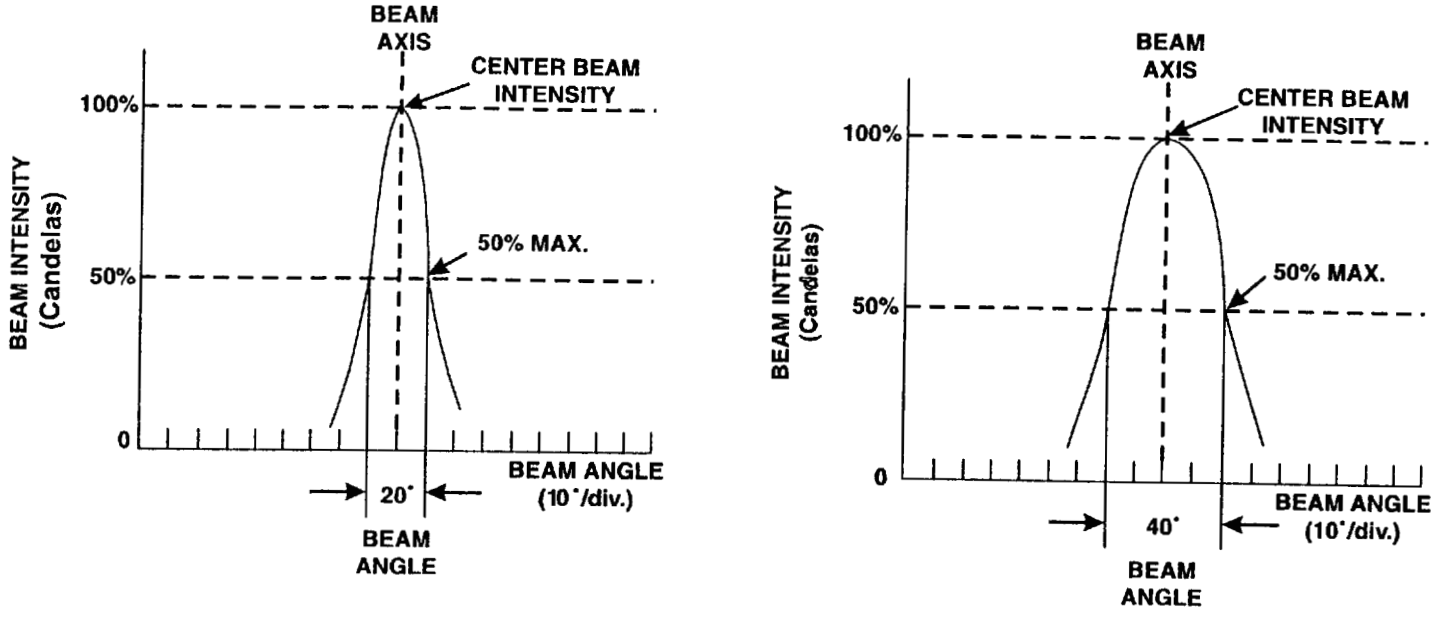

Figure 2 – Simplified presentation of an asymmetric beam angle 40° x 20°

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4.3 Beam angle tolerance of PAR and R lamps

Beam angle values listed in 4.1 and 4.2 are nominal values. In actual practice (over a 12-month period) the actual average beam angles vary considerably due to wear in mold tooling for the lens and reflectors in pressed glassware "PAR" lamps.

Also, blown glassware "R" lamps have a wide variation due to changes in frost density and light center length.

Beam Angle Tolerance

PAR Lamps*		*R** Lamps*	
Beam Angle	Tolerance	Beam Angle	Tolerance
1° to 12°	±3°	All	±12°
15°	±4°		
20° to 40°	±6°		
4° & higher	±10°		

*Pressed glassware including MR's.
**Blown glassware including BR, ER, and one-piece PARs.

NOTE: Beam Angle Tolerances are applied to the nominal (See Section 4.1 and 4.2) beam angle. Therefore, a lamp that falls into a 13° to 17° range is marketed/labeled as a 15 nominal lamp with a tolerance of ± 4° (11° to 19°). The tolerances do not apply to the actual lamp manufacturing range.

5 Procedure for determining a beam angle

General procedures for the photometric testing of reflector lamps having symmetric or asymmetric beams can be found in IES LM20.

NOTE: The definitions and classifications of this standard are based on the goniometer method of light intensity distribution measurement. Re-interpretation of a beam angle to the "flat wall" concept would involve certain correction factors.

5.1 Visually determine the center of a beam pattern. Move the lamp or the photodetector until the photodetector is on the beam axis, as defined in 3.1. At this point, measure the center beam intensity, Ic.

NOTES
1 The center of a beam pattern can be determined visually with sufficient accuracy.
2 Visual determination of the center of a beam pattern applies to asymmetrical as well as symmetrical beams.

Record the measured value of Ic for use in the determination of the light output rating of a lamp.

5.2 Tilt or rotate the lamp or move the photodetector to find the two points with an intensity of Ic/2, in the same plane on opposite sides of the beam axis.

5.3 Determine the angle between the two Ic/2 points.

5.3.1 For symmetrical beams, repeat the measurement of 5.2 in a second plane, 90° from the original. Average the results from the two planes.

5.3.2 For asymmetrical beams, make the measurement of 5.2 in the widest and narrowest planes, 90° to each other. (See 4.2.) Report these results separately.

5.4 For lamps with more complex beam patterns indicating more than one peak, refer to Annex A.

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5.5 To determine a nominal beam angle, repeat measurements as necessary to obtain an arithmetic average which is representative of production lamps. Round the average value to a nominal beam angle as specified in 4.1.

6 Determination of light output intensity

Utilize the Ic measurements obtained in 5.1. Repeat as necessary to obtain an arithmetic average which is representative of production lamps. For reporting, round the average center beam intensity to the nearest two significant figures.

7 Lamp descriptions

7.1 Both the beam angle classification and the intensity of light output are pertinent to the description or rating of a reflector lamp. It is recommended that beam classifications be incorporated in lamp markings and descriptions.

An example of a 150 Watt PAR38 lamp with a 30 beam angle is 150 PAR38/30°.

7.2 These descriptions apply to reflector type incandescent lamps (ANSI C78.21), self-ballasted mercury lamps (ANSI/ASC C78.1340 series), mercury lamps (ANSI C78.40), high pressure sodium lamps (ANSI/ASC C78.1350 series), metal-halide lamps (ANSI/ASC C78.1375 series), and display lamps.

7.3 Recommended lamp descriptions, including beam angle classifications, for some lamps are shown in Annex B.

8 Administration

This standard requires no administration. It is intended to provide a uniform method of classification of the beam patterns of reflector lamps. Standard C78.380 requires identification of a beam angle for HID reflector lamps in order that a lamp designation can be assigned.

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Annex A
(normative)

Center Beam Intensity

A.1 In general, this procedure would be appropriate for use in those cases where:
- — The angle between the maxima is 10° or larger
- — The maxima have a luminous intensity of at least 10% higher than the lowest intensity

A.2 Measure the beam of the test lamp in order to obtain a luminous intensity distribution curve.

A.3 Use the following procedure, with reference to figure A1.
a. Determine the point of peak intensity (Ip).
b. Determine the points on the distribution curve where the intensity is Ip/2.
c. Define the beam axis as being along the line which is the bisection of the angle α between these two points.
d. Define the center beam intensity (Ic) as the point of intersection of the beam axis and the distribution curve.
e. Determine the points on the distribution curve where the intensity is Ic/2.
f. The beam angle is then defined as the angle between these two points.

A.4 It is recommended that at least two measurements be made in 8 planes (every 22.5°). Alternatively, at least 60 measurements in the field should be made if plotting iso-candela diagrams.

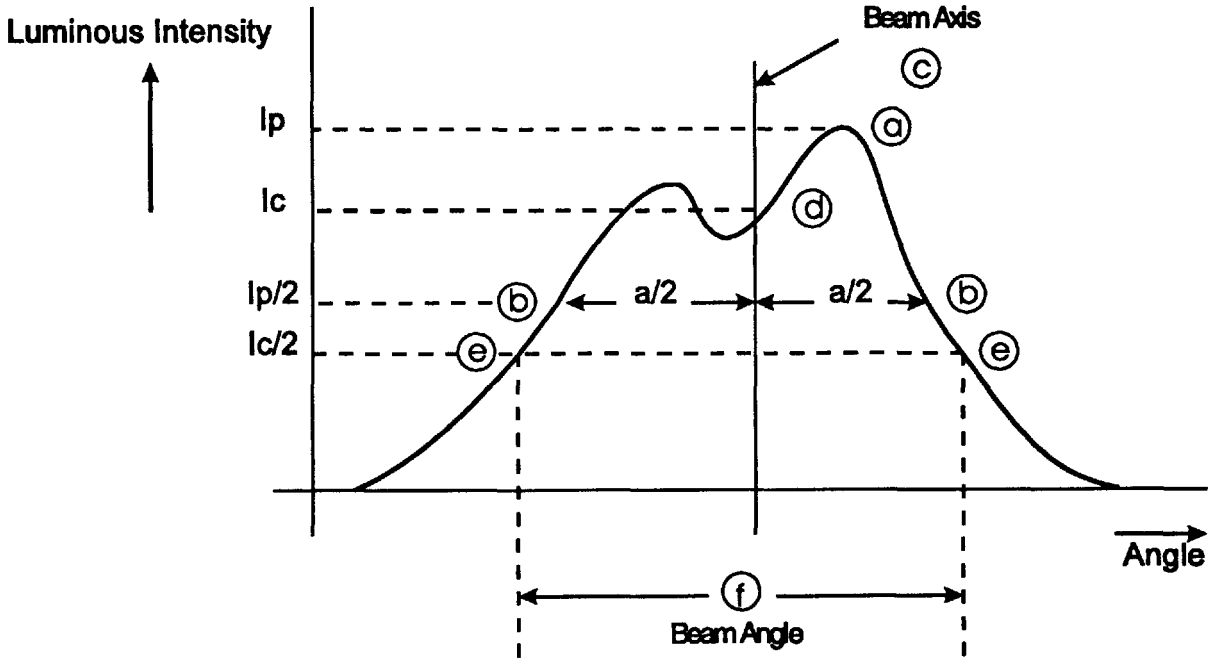

Figure A1 – Center beam intensity

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Annex B
(Informative)

Descriptions for MR lamps

ANSI 3 Letter Designation*	New Lamp Abbreviation
BAB	20MR16/40°
ESX	20MR16/10°
EXN	50MR16/40°
EXT	50MR16/15°
EXZ	50MR16/25°
FPA	65MR16/15°
FPB	65MR16/40°
FPC	65MR16/25°
EYC	75MR16/40°
EYF	75MR16/15°
EYJ	75MR16/25°
FTB	20MR11/10°
FTC	20MR11/15°
FTD	20MR11/30°
FTE	35MR11/08°
FTF	35MR11/20°
FTH	35MR11/30°

* Made obsolete three years from the revision date of ANSI C78.370-1982(R1989).

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Annex C
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Descriptions for PAR lamps

Old Lamp Abbreviation	New Lamp Abbreviation
100PAR/FL	100PAR/30°
100PAR/SP	100PAR/15°
150-120PAR/FL	120PAR/30°
150-120PAR/SP	120PAR/15°
150PAR/FL	150PAR/30°
150PAR/SP	150PAR/15°
75-65PAR/FL	65PAR/30°
75-65PAR/SP	65PAR/15°
75PAR/FL	75PAR/30°
75PAR/SP	75PAR/15°
90PAR38/CAP/FL	90HPAR/30° *
90PAR38/CAP/SP	90HPAR/12° *

*The letter H denotes Halogen.

NOTE—The continued use of the words "spot" and "flood", in addition to the beam spread, is accepted as an option until 1997.

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Annex D
(informative)

Descriptions for reflector lamps

Old Lamp Abbreviation	New Lamp Abbreviation
30R20	30R20/40°
50R20	50R20/40°
75R30/FL	73R30/65°
75R30/SP	75R30/25°
75R/FL	75R/65°
100R/FL	100R/65°
100R/SP	100R/25°
150R/FL	150R/65°
150R/SP	150R/25°
300R/FL	300R/65°
300R/SP	300R/25°
500R/3FL	500R/3/65°
500R/3SP	500R/3/25°

NOTE—The continued use of the words "spot" and "flood", in addition to the beam spread, is accepted as an option until 1997.

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