Please refer to the IES Bookstore after you purchase this IES Standard for possible Errata, Addenda, and Clarifications: www.ies.org/store.

CONTENTS

1.0 Introduction

This is the fifth revision of this Standard. Since its introduction in 1986 (IES LM-63-1986), this Standard has proved to be very useful and powerful. This revision further clarifies the standard to make its use as simple as possible. This update is intended as the final update to LM-63, which will put this file format into a long-term stability mode, ensuring it remains available as a reference. This Standard will eventually be replaced by a new XML-based file format, *ANSI/IES TM-33-18, Standard Format for the Electronic Transfer of Luminaire Optical Data* (see **Informative References**). However, both Standards are valid until this transition is complete and this Standard has been deprecated.

2.0 Scope

This document describes the standard data system and how to build a file using this system. The document addresses photometric data file formats specifically for data transfer, data storage and retrieval, and other data usage purposes.

3.0 Definitions

3.1 absolute (or direct) photometry
Consists of the direct measurement of a source of light.

3.2 delimiter
Used to delineate data in a file. Acceptable delimiters are: a comma, a space, multiple spaces, or a carriage-return and line-feed character sequence.

3.3 goniophotometer
A photometer for measuring the directional light distribution characteristics of sources, luminaires, media, and surfaces.

3.4 horizontal angles
Measurements in degrees of angular displacement, measured counterclockwise in a horizontal plane for Type C photometry and clockwise for Type A and B photometry.

3.5 keyword
Square bracketed word(s) used in IES LM-63 to label data.

3.6 photometric horizontal
The direction directly in front of the source relative to its testing position. This direction is coincident with horizontal angle 0° and vertical angle 90° for Type B and C photometry. For Type A photometry, the direction is coincident with horizontal angle 0° and vertical angle 0°.

3.7 photometric plane
A plane, not a cone, upon which photometric data are measured. In Types A and C photometry, the planes are all vertical and share a common vertical axis. In Type B photometry, the planes share a common horizontal axis.

3.8 photometric zero
Direction directly below the source relative to its testing position. This direction is coincident with horizontal angle 0° and vertical angle 0° for Types B and C photometry. For Type A photometry, the direction is coincident with horizontal angle 0° and vertical angle -90°.

3.9 relative photometry
Consists of the evaluation of the photometric characteristic of a light source or luminaire by comparison with the assumed lumen or spectral output of a bare test light source. Measured candela values are scaled according to the ratio of the measured bare light source lumens to the light source manufacturer's rated light source lumens.

3.10 search string
A group of characters created by the user of the photometric file, located to the right of the keyword [SEARCH]. These strings may be used by software to locate photometric files based on encoded characteristics.

3.11 vertical angles
The angular displacement in degrees from straight down.

3.12 zero-degree photometric plane
A vertical plane passing through photometric center containing photometric zero and photometric horizontal.

4.0 Summary of Modifications From ANSI/IES LM-63-02

The following is a summary of the major changes from LM-63-02 to LM-63-19:

- Clarified definitions of *Photometric Horizontal*, *Photometric Zero*, *Absolute Photometry*, and *Relative Photometry*.
- Changed the <future use> data field to <file generation type>, to describe how the file was generated.
- Removed TILT=<filename> option
- Added [FILEGENINFO] Keyword for additional information about the file generation type.

5.0 Detailed Description of Data

The following is a file format specification. All ANSI/IES LM-63-2019 filenames shall end with the file extension **ies** or **IES** (the file extension is not case specific); e.g., SAMPLE.IES.

Each of the items listed in the format are described in the sections below. Each line marked with a bullet (•) shall begin a new line in the file. Any unmarked field, such as <lumens per lamp>, may either be placed on the same line as the field before it or may be used to start a new line of data.

- **IES:LM-63-2019**
- [Keyword 1] Keyword data
- [Keyword 2] Keyword data
- [Keyword 3] Keyword data
- :

- [Keyword n] Keyword data
- **TILT=INCLUDE** or **TILT=NONE**

• <lamp to luminaire geometry> • <number of tilt angles> • <angles> • <multiplying factors>	These four lines shall be present if and only if TILT=INCLUDE

- <number of lamps> <lumens per lamp> <candela multiplier> <number of vertical angles> <number of horizontal angles> <photometric type> <units type> <width> <length> <height>
- <ballast factor> <file generation type> <input watts>
- <vertical angles>
- <horizontal angles>
- <candela values for all vertical angles at 1st horizontal angle>
- <candela values for all vertical angles as 2nd horizontal angle>
- :
- <candela values for all vertical angles at last horizontal angle>

5.1 IES:LM-63-2019

The first line of any photometric file shall be **IES:LM-63-2019**. This character string distinguishes it from files using other formats and marks the beginning of the file.

5.2 Keywords

Following **IES:LM-63-2019**, and prior to **TILT**=, any number of defined IES keywords may be used (see **Annex A** and **Annex B**). Each keyword line shall begin with an appropriate keyword.

All files shall contain the following keywords:

[TEST] Test report number

[TESTLAB] Photometric testing laboratory

[ISSUEDATE] Date that the manufacturer issued the LM-63 file

[MANUFAC] Manufacturer of luminaire

All other keywords are optional. In addition to the required keywords, the following are a suggested minimum:

[LUMCAT] Luminaire catalog number

[LUMINAIRE] Luminaire description

[LAMPCAT] Lamp catalog number

[LAMP] Lamp description (e.g., type, wattage, size)

5.3 TILT=NONE or TILT=INCLUDE

This line indicates whether the light output varies as a function of the luminaire tilt angle and, if so, the location of the tilt multiplier information. If the output of the lamp does not vary as a function of the tilt angle, **TILT=NONE** shall appear on this line (skip to **Section 5.4**).

If the output of the lamp does vary as a function of the tilt angle, **TILT=INCLUDE** shall appear on this line. **TILT=INCLUDE** indicates that the tilt information is included as part of the photometric file. The format for the tilt information is discussed in **Annex F**.

Note: The phrase **TILT=** shall be exactly as shown and shall begin in column 1. This is important because this phrase is used to signify the end of the keyword information.

5.4 <number of lamps>
This field shall contain a number indicating the total number of lamps in the luminaire.

5.5 <lumens per lamp>
This field shall contain a number indicating the lumens-per-lamp value on which the photometric test is based. In the case of absolute photometry, where the lumens per lamp are not the basis for the photometric data, a negative one (-1) shall be entered.

Note: For most luminaires with more than one lamp, the lamps will all be of the same type with the same lumen output.

- For those luminaires with two or more lamps with different lumen output, this value shall be treated as the average lumens per lamp. (The product: <lumens per lamp> x <number of lamps> shall be the total lumen output by all lamps operating in the luminaire.)
- When creating reports with absolute photometry (<lumens per lamp> = -1), it is suggested to include the keyword [OTHER], followed by words indicating that the candela values are absolute and should not be factored for different lamp ratings.

5.6 <multiplier>
This field shall contain a number indicating the multiplying factor that shall be applied to all candela values in the file. This is often 1.0, but may be a value other than 1.0.

5.7 <number of vertical angles>
This field shall contain a number indicating the total number of vertical angles in the photometric report.

5.8 <number of horizontal angles>
This field shall contain a number indicating the total number of horizontal angles in the photometric report.

5.9 <photometric type>
This is an integer indicating the type of photometry that exists for the luminaire being described, and shall be the value 1, 2, or 3, according to the following schedule:

1. Type C
2. Type B
3. Type A

(Refer to IES LM-75-01/R12 for a detailed explanation of goniophotometer types.)

5.10 Luminous Dimensions
The following dimensions refer to the luminous (that is, light emitting) opening of the luminaire, not its physical dimensions. They are meant to approximate the luminous opening (either as a luminous area or volume) for lighting calculations. They are not intended for computer-generated renderings of the luminaire. It is assumed that there is only one luminous opening in each IES LM-63-2019 data file.

The luminous dimensions apply to a luminaire aimed at photometric zero (0° horizontal, 0° vertical,). *Photometric horizontal* would then be 0° horizontal, 90° vertical.

The *length* and *width* values refer only to their orientation with respect to the zero-degree photometric plane; they do not refer to the luminaire dimensions or lamp orientation. In particular, the *length* value may be less than the *width* value.

5.10.1 <units type>. This is an integer indicating the type of units used for the luminous dimensions of the luminaire and shall be the value 1 or 2, according to the following schedule:

1. Luminous dimensions are given in feet
2. Luminous dimensions are given in meters

5.10.2 <width>. This field shall contain a number indicating the distance across the luminous opening when measured perpendicular to the 0° photometric plane (perpendicular to *photometric horizontal* (see **Figure 1**, **Table 1**, and **Annex D** for additional details).

5.10.3 <length>. This field shall contain a number indicating the distance across the luminous opening when measured parallel to the 0° photometric plane (along *photometric horizontal*). (See **Figure 1**, **Table 1**, and **Annex D** for additional details).

5.10.4 <height>. This field shall contain a number indicating the overall height of the luminous opening, measured parallel to *photometric zero* (see **Figure 1**, **Table 1**, and **Annex D** for additional details).

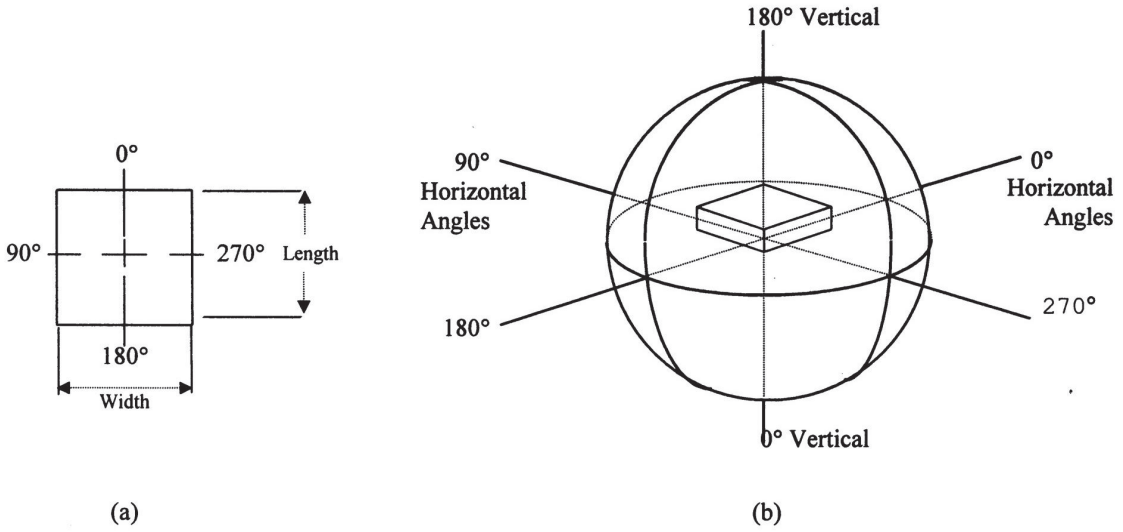

Figure 1. Conventions for vertical and horizontal angles for Type C photometry used in standard IES format: (a) plan view of luminaire showing length and width in relation to horizontal angles, and (b) schematic showing vertical and horizontal angles.

5.11 Luminous Shape

As defined in the previous paragraphs, the luminous opening is assumed to be rectangular. **Table 1** provides guidance for describing luminous openings of other shapes (including 3D). This table is based on a simple principle: if the dimension is positive, it represents a rectangular shape. If two dimensions are negative, the luminous opening is rounded (but not necessarily circular) when viewing the plane containing those two dimensions.

This document acknowledges that not all luminous openings can be specified using the indicated width, length, and height values. It is the responsibility of the supplier to select the shape that best describes the luminous opening.

Table 1. Shapes of Luminous Areas and Solids

Luminous Opening*	<width>	<length>	<height>
Point	0	0	0
Rectangular	Width	Length	0
Rectangular with Luminous Sides	Width	Length	Height
Circular	-1 x Diameter	-1 x Diameter	0
Ellipse	-1 x Width	-1 x Length	0
Vertical Cylinder	-1 x Diameter	-1 x Diameter	Height
Vertical Ellipsoidal Cylinder	-1 x Width	-1 x Length	Height
Sphere	-1 x Diameter	-1 x Diameter	-1 x Diameter
Ellipsoidal Spheroid	-1 x Width	-1 x Length	-1 x Height
Horizontal Cylinder Along Photometric Horizontal	-1 x Diameter	Length	-1 x Diameter
Horizontal Ellipsoidal Cylinder Along Photometric Horizontal	-1 x Width	Length	-1 x Height
Horizontal Cylinder Perpendicular to Photometric Horizontal	Width	-1 x Diameter	-1 x Diameter
Horizontal Ellipsoidal Cylinder Perpendicular to Photometric Horizontal	Width	-1 x Length	-1 x Height
Vertical Circle Facing Photometric Horizontal	-1 x Diameter	0	-1 x Diameter
Vertical Ellipse Facing Photometric Horizontal	-1 x Width	0	-1 x Height

* *Table note:* Refer to **Annex D** for drawings of these shapes.

5.12 <ballast factor>

This field shall contain a number indicating the ballast factor of the luminaire. The ballast factor describes the application characteristics of the luminaire. It represents the fractional lumens of a lamp(s) operated on a commercial ballast compared to the lumens when operated on a standard (reference) ballast used for rating lamp lumens. If ballast factor is not known, default value shall be 1.0.

For application purposes, this factor is used to adjust luminaire performance data from laboratory test conditions to actual field conditions. Values in the file do not include ballast factor. This factor shall be applied to all candela values in the file at application time.

5.13 < file generation type >

This field shall be set to a decimal value, based on how the file was generated, with the options detailed in **Table 2** and the parameters described in **Sections 5.13.1** through **5.13.5**. The method used to arrive at the specific decimal values in **Table 2** is detailed in **Annex H**.

Programs parsing **IES LM-63-2019** files shall identify the file generation type using only the exact Title and Description text in **Table 2**. Programs shall not give any indication beyond the title and description of how trustworthy one set of data is compared to another. This is a judgment reserved for the user of the file and requires additional information (for example, how the data was scaled, how it was simulated, and the lab it was tested at).

In order to aid the user in this judgment, the keyword [FILEGENINFO] should be used, followed by additional comments about the way the file was generated. This may include a description of how the lumen values were scaled, or the computer software that was used to generate the IES file.

Table 2. File Generation Types

Decimal Value	Title	Description
1.00001	Undefined	The file generation type is unspecified, or the file is an older file.
1.00010	Computer Simulation	Raytracing software generated the IES file using models of the lamp and optical system. User should request more information from manufacturer on method of simulation.
1.00000	Test at an unaccredited lab	An absolute test at a lab without accreditation for this test method.
1.00100	Test at an unaccredited lab that has been lumen scaled	An absolute test at a lab without accreditation for this test method. A test at one lumen level has been scaled to another lumen level based on a method chosen by the manufacturer. User should request more information from manufacturer on method of scaling.
1.01000	Test at an unaccredited lab with interpolated angle set	An absolute test at a lab without accreditation for this test method. Some angles in the IES file were not directly measured, but interpolated from adjacent angles.
1.01100	Test at an unaccredited lab with interpolated angle set that has been lumen scaled	An absolute test at a lab without accreditation for this test method. A test at one lumen level has been scaled to another lumen level based on a method chosen by the manufacturer. User should request more information from manufacturer on method of scaling. Some angles in the IES file were not directly measured, but interpolated from adjacent angles.
1.10000	Test at an accredited lab	An absolute test at a lab with accreditation for this test method.
1.10100	Test at an accredited lab that has been lumen scaled	An absolute test at a lab with accreditation for this test method. A test at one lumen level has been scaled to another lumen level based on a method chosen by the manufacturer. User should request more information from manufacturer on method of scaling.
1.11000	Test at an accredited lab with interpolated angle set	An absolute test at a lab with accreditation for this test method. Some angles in the IES file were not directly measured, but interpolated from adjacent angles.
1.11100	Test at an accredited lab with interpolated angle set that has been lumen scaled	An absolute test at a lab with accreditation for this test method. A test at one lumen level has been scaled to another lumen level based on a method chosen by the manufacturer. User should request more information from manufacturer on method of scaling. Some angles in the IES file were not directly measured, but interpolated from adjacent angles.

5.13.1 Undefined. This shall be used when the origin of the file is not known.

5.13.2 Computer Simulation. This shall be used when the file was generated using raytracing or other simulation software.

5.13.3 Accredited Lab. Tests at physical labs should be categorized by whether or not the lab is accredited for goniometer testing for a given product type as a Nationally Recognized Testing Lab (NRTL) or equivalent in the country where the testing was performed. In the case of lumen scaling or interpolated angle sets, the file can be considered to be from an accredited lab if the base file was from an accredited lab. Note that the lab must be accredited for goniometer testing, which is a different accreditation than sphere testing or basic LM-79 testing.

5.13.4 Lumen Scaling. If the candela values in the IES file do not exactly represent what was measured, the data should be considered lumen scaled. All relative photometry is therefore lumen scaled. Another example of lumen scaling is a test performed on an LED luminaire at a drive current of 700 mA that is then scaled down to represent the lumens at a drive current of 350 mA. There are numerous ways to perform this lumen scaling, some more accurate than others. Identifying the method of scaling and assigning a trust factor to that method is beyond the scope of this document.

5.13.5 Angle Interpolation. There are some cases where the measured angle set may have been inadequate or inappropriate for the final IES file. This could include measuring in one photometric coordinate system and translating to another, or measuring in one orientation and then rotating to a new orientation. In these cases, the candela values in the IES file are interpolated from nearby values. The flag shall be set to show an interpolated angle set when more than 5% of the candela values are at positions that were not directly measured.

5.14 <input watts>

This field shall contain a number indicating the total watts input to the luminaire, including ballast watts.

5.15 <vertical angles>

The vertical angles for which data are present in the photometric report shall be listed in ascending order.

- For Type C photometry, the first value shall be either 0 or 90 degrees, and the last angle value shall be either 90 or 180 degrees.
- For Type A or B photometry, the first vertical angle shall be -90 or 0 degrees, and the last angle value shall be 90 degrees.

5.16 <horizontal angles>

The horizontal angles for which data are present in the photometric report shall be listed in ascending order.

- For Type C photometry, the first value shall always be 0 degrees, and the last value shall be one of the following:
  - 0. There is only one horizontal angle, and the luminaire is assumed to be laterally symmetric in all planes.
  - 90. The luminaire is assumed to be symmetric in each quadrant.
  - 180. The luminaire is assumed to be symmetric about the 0-to-180-degree plane.
  - 360. The luminaire is assumed to exhibit no lateral symmetry.
- For Type A or B photometry, there are two possibilities:
  - The luminaire is laterally symmetric about a vertical reference plane. In this case, the first horizontal angle shall be 0 degrees, and the last horizontal angle shall be 90 degrees.
  - The luminaire is not laterally symmetric about a vertical reference plane. In this case, the first horizontal angle shall be -90 degrees, and the last horizontal angle shall be 90 degrees.

5.17 <candela values>

- <candela values for all vertical angles at the 1st horizontal angle>
- <candela values for all vertical angles at the 2nd horizontal angles>
- <candela values for all vertical angles at the last horizontal angle>

This is a list of candela values corresponding to each vertical angle of photometry. The order of the candela values shall exactly correspond to the list of vertical angles. Successive planes are listed in a sequence corresponding to the list of horizontal angles, and the first candela value for each horizontal angle shall begin a new line. Any of the values may be continued on a subsequent line if necessary.

6.0 Programming and File Conventions

There are several conventions that shall be used in constructing and using IES standard photometric files. They are as follows:

- All lines shall end with a carriage-return and line-feed character sequence.
- All lines from the first through the **TILT=** line are read using text-mode.
- It is the responsibility of the programmer to allow for trailing blanks on lines **IESLM-63-2019** through **TILT=**.
- Keywords may be presented in any order (prior to the **TILT=** line).
- Only keywords and user-defined keywords shall be enclosed in brackets.
- **Annex F** provides information regarding the **TILT=INCLUDE** data type.
- All remaining data are real values except: <# of lamps>, <# of vertical angles>, <# of horizontal angles>, <photometric type>, and <units type>, which are integer values (exponential notation is not allowed).
- The individual values on any one line shall be separated by a delimiter.
- Any of the specified data lines may be continued on an additional line (or lines), if necessary.
- A "Null" file may be created by having a minimum of one horizontal angle and two vertical angles. In this case, two corresponding candela values would be required, and they should be shown as zeroes. Such a file shall also have all of the correct numeric items, as outlined in the above requirements.
- It is the responsibility of the programmer to display and report all factors applied to the photometric file.

Photometric center, used for luminaire placement, is beyond the scope of this document. It is described in various IES Testing Procedures documents (for example, *IES LM-41-14*, *Approved Method for Photometric Testing of Indoor Fluorescent Luminaires* and *IES LM-46-04*, *Photometric Testing of Indoor Luminaires Using High Intensity Discharge or Incandescent Filament Lamps*).

INFORMATIVE REFERENCES

International Commission on Illumination (CIE). Photometry of Luminaires for Street Lighting. Vienna: CIE; 1973. (CIE Report No. 27-1973).

International Commission on Illumination (CIE). Photometry of Floodlights. Vienna: CIE; 1979. (CIE Report No. 43-1979).

Illuminating Engineering Society. IES LM-75-01, Goniophotometers and Photometric Coordinates. New York: IES; 2001.

Illuminating Engineering Society. ANSI/IES TM-33-18, Standard Format for the Electronic Transfer of Luminaire Optical Data. New York: IES; 2018.

McCulloch JH, McCulloch H. Floodlight photometry without special photometer and without tipping luminaire – a computer application. Illuminating Engineering. 1967;42(4):243-245.

Annex A – General Rules for Keywords

The keyword:

- Shall be the first non-blank character in a new line.
- Shall be in uppercase.
- Shall occur prior to **TILT=**.
- Shall not contain any characters (including spaces and/or non-printing characters) that are not specifically listed as part of the keyword.
- Shall be contained in square brackets.
- Shall occur only once, except for the keywords [MORE] and [OTHER].
- Shall be 20 characters or fewer, counting the brackets. User-defined keywords may be included. User-defined keywords shall have an underscore character immediately following the first bracket and preceding the actual keyword (e.g., [_USERKEYWORD]). The underscore character distinguishes user-defined keywords from those defined in **Annex B**.
- Shall be read as descriptive text if not listed in **Annex B**.

The keyword data:

- Shall be preceded with a keyword.
- Shall conform to the official IES LM-63-2019 format for that keyword.
- Shall end with a carriage-return and line-feed character sequence.
- Shall begin with the keyword [MORE] if additional lines of data are required.

Annex B – Valid Keywords and Their Descriptions

Required	Keyword	Description
YES	[TEST]	Test report number
YES	[TESTLAB]	Photometric testing laboratory
	[TESTDATE]	Date that the photometric report was generated
	[NEARFIELD]	D1,D2,D3 This indicates that the report was tested using near field photometry. D1 = Distance from photometric center to horizontal surface to which luminaire is mounted. D2 = Distance from photometric center to vertical surface along the 0-degree plane. D3 = Distance from photometric center to vertical surface along the 90-degree plane
YES	[MANUFAC]	Manufacturer of luminaire
	[LUMCAT]	Luminaire catalog number
	[LUMINAIRE]	Luminaire description
	[LAMPCAT]	Lamp catalog number
	[LAMP]	Lamp description (for example: type, wattage, size, etc.)
	[BALLAST]	Ballast description (for example: watts, volts, magnetic or electronic, etc.)
	[BALLASTCAT]	Ballast catalog number
	[MAINTCAT]	A digit (1-6) indicating the IES maintenance category (see Reference 1)
	[DISTRIBUTION]	General description of the photometric distribution (e.g., Type II, Medium, Direct, SC=1.5)
	[FLASHAREA]	Light emitting area of the luminaire projected under 76 degrees in square meters. Used in calculation of CIE Discomfort Glare Mark.
	[COLORCONSTANT]	Used in calculation of CIE glare control
	[LAMPPOSITION]	Two angles, separated by a space or comma delimiter, that determine lamp position within the luminaire with respect to the photometric angles (see **Annex E**).
YES	[ISSUEDATE]	Date that the manufacturer issued the IES LM-63-2019 file
	[FILEGENINFO]	Additional information about the file generation type
	[SEARCH]	User created search string
	[MORE]	More information tied to previous keyword

Annex C – Example of an IES File

The following is an example of an IES LM-63-2019 photometric file using Type C photometry.

```
IES:LM-63-2019
[TEST] ABC1234
[TESTLAB] ABC Laboratories
[ISSUEDATE] 28-FEB-2019
[MANUFAC] Aardvark lighting Inc.
[LUMCAT] SKYVIEW 123-XYZ-abs-400
[LUMINAIRE] LED Wide beam flood
[MAINTCAT] 4
[FILEGENINFO] This file was generated from the original file
[MORE] Lumens were factored by 1.2 per new LED driver
[OTHER] This luminaire is useful as an indirect flood
[MORE] and to reduce light pollution in down light applications
[SEARCH] POLLUTION SPORTS INDIRECT
[_NEMATYPE] 4h x 6v
[_PRICE] Make us an offer
TILT=INCLUDE
1
13
0 15 30 45 60 75 90 105 120 135 150 165 180
1.0 .95 .94 .90 .88 .87 .98 .87 .88 .90 .94 .95 1.0
1 -1 1.2 5 3 1 1 .5 .6 0
1.0 1.10100 495
0 22.5 45 67.5 90
0 45 90
100000 50000 25000 10000 5000
100000 35000 16000 8000 3000
100000 20000 10000 5000 1000
```

Annex D – Describing Luminous Openings

With the use of <width>, <length>, and <height> it is possible to describe various luminous openings as shown in **Figures D-1a** and **D-1b**.

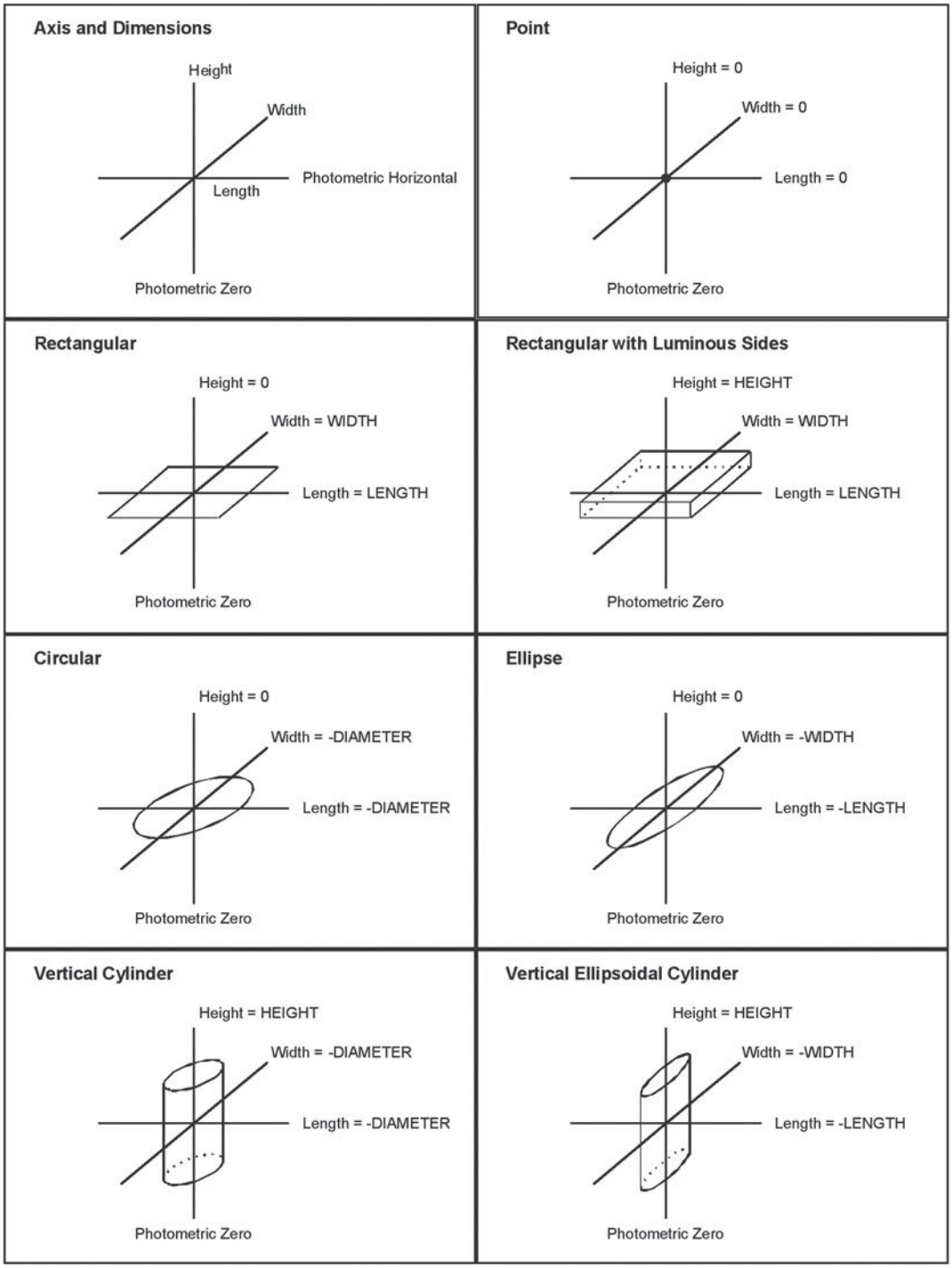

Figure D-1a. Luminous Openings.

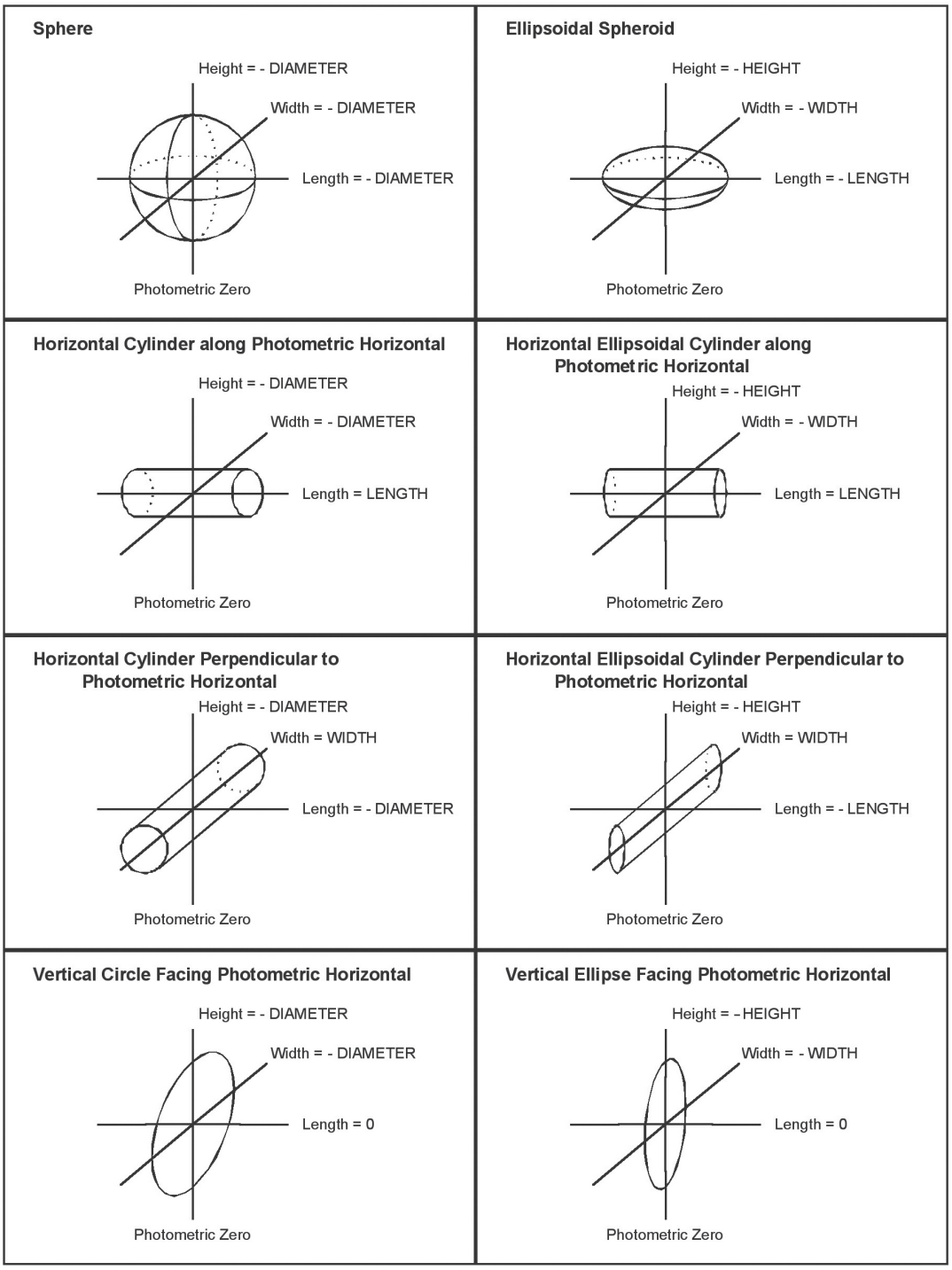

Figure D-2b. Luminous Openings.

Note: For type B photometry, the luminous dimensions apply to a floodlight aimed down, at nadir (0 degrees vertical).

Annex E – Lamp Position

The keyword [LAMPPOSITION], if present, shall be followed by two numbers separated by a space or comma delimiter, as follows:

Lamp position within a luminaire shall be expressed as two angles (horizontal and vertical), which describe the direction of the lamp's vector with respect to the luminaire photometric measurements. The lamp's vector is defined as a line from the lamp's base through the opposite end of the lamp. For lamps with bases on each end (double-ended lamps), the vector may run in either direction.

The first angle, the horizontal position angle, ranges from 0.00 to 359.99 degrees. This angle shall be measured in a counter-clockwise direction, looking down on a horizontal plane, from *photometric horizontal* to the lamp's vector projected onto that horizontal plane. For a lamp mounted vertically, this will be 0° (default). For a lamp mounted horizontally with the lamp vector pointing along *photometric horizontal*, this will be 0°. If the lamp vector points "West" when *photometric horizontal* is considered "North," this will be 90°.

The second angle, the vertical position angle, ranges from 0.00 to 180.00 degrees. This angle shall be measured from photometric zero to the terminal point of the lamp's vector. When the luminaire is aimed straight down (nadir), this angle will be 0°for a vertical base-up lamp, 90° for a horizontal lamp, and 180° for a vertical base-down lamp.

Notes:
If [LAMPPOSITION] is specified, the tilt of the lamp can be determined no matter how the luminaire is oriented (aimed).

[LAMPPOSITION] supersedes the <lamp to luminaire geometry> specification when **TILT=INCLUDE** (see **Annex E**).

Figures E-1 through **E-8** show drawings of many typical lamp positions. **Photometric zero** is shown in those drawings as *V=0°*. *Photometric horizontal* is shown as *H=0°*.

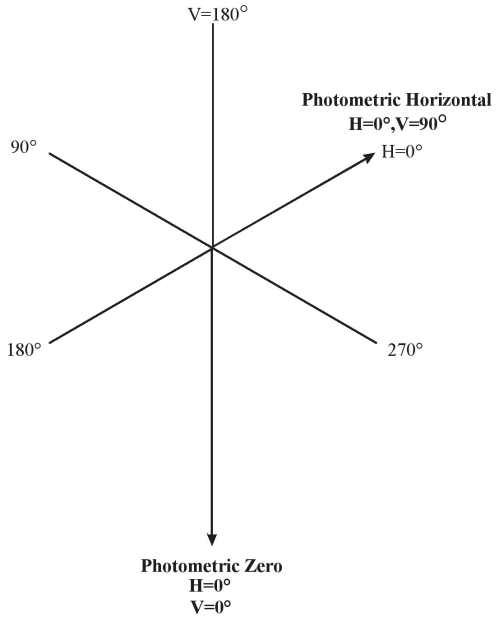

Figure E-1. Photometric Zero, Photometric Horrizontal, and Horizontal Angles in Type C photometry.

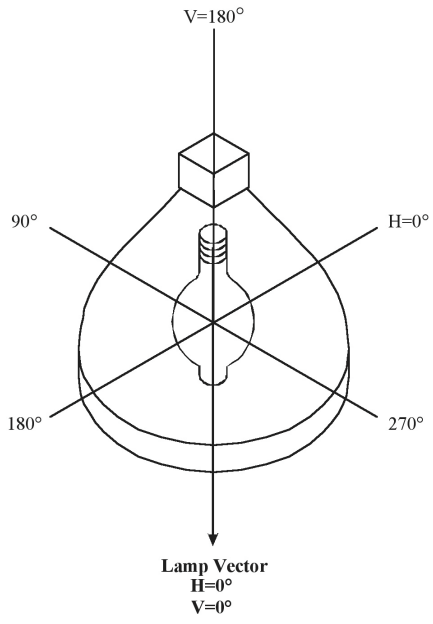

Figure E-2. Lamp mounted base up, parallel to Photometric Zero (0°,0°). Luminaire may be tilted up when installed.

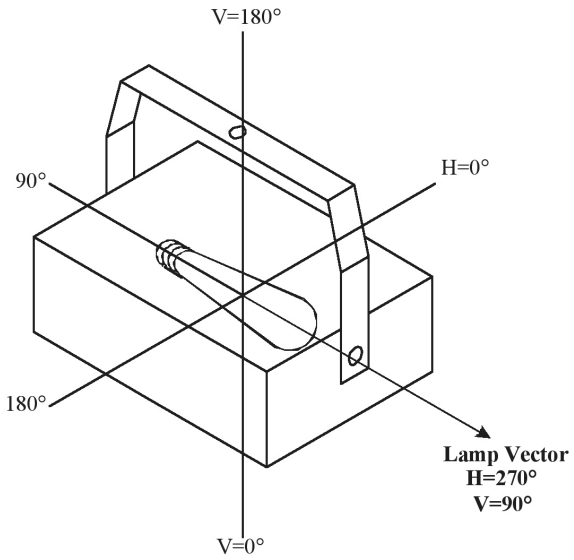

Figure E-3. Lamp mounted horizontally, perpendicular to Photometric Horrizontal. Luminaire may be tilted up when installed.

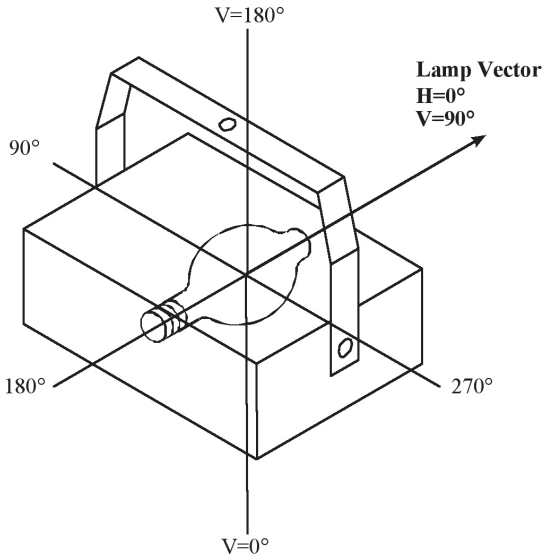

Figure E-4. Lamp mounted horizontally, parallel to Photometric Horrizontal. Luminaire may be tilted up when installed.

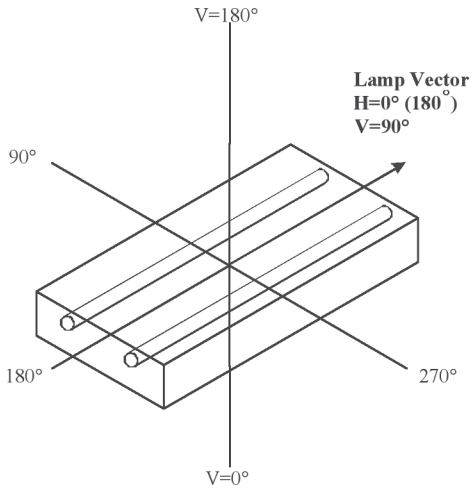

Figure E-5. Lamp(s) mounted horizontally, parallel to Photometric Horrizontal.

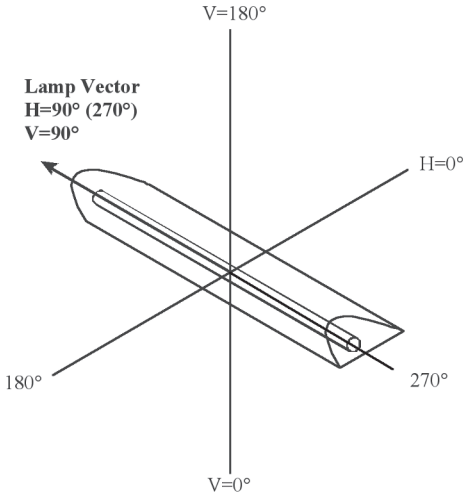

Figure E-6. Lamp mounted horizontally, perpendicular to Photometric Horrizontal.

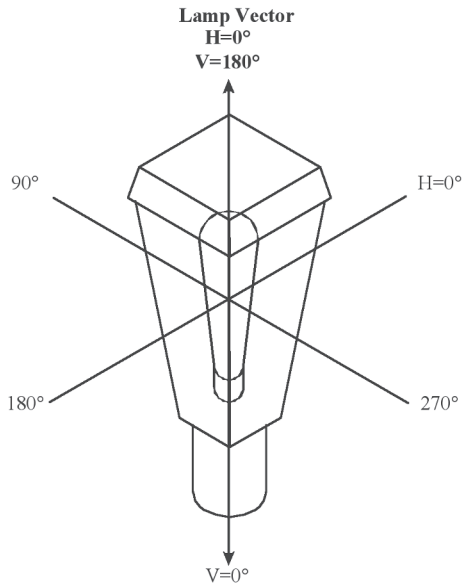

Figure E-7. Lamp mounted base down, parallel to Photometric Zero.

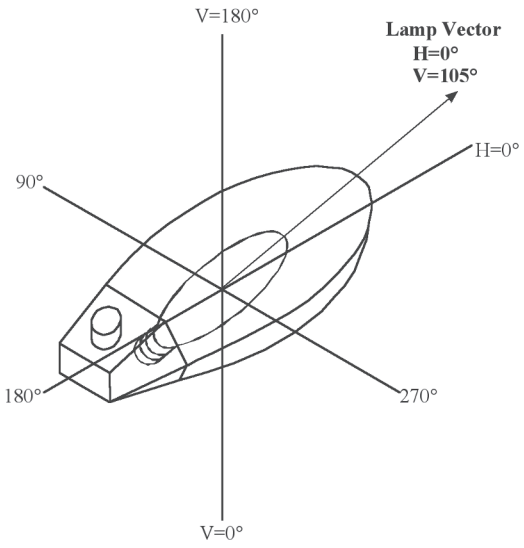

Figure E-8. Lamp tilted up, in the plane containing Photometric Horrizontal. Vertical angle measured from Photometric Zero (V=0°).

Annex F – Format for TILT=INCLUDE

The format for tilt information is the same whether it is in a separate file or included as part of the photometric file. Each of the items listed in the format are described in the sections below. Each line shall begin a new line in the file. *Note:* The tilt data are real values except for <lamp to luminaire geometry> and <number of tilt angles>, which are integer values (exponential notation is not allowed).

- <lamp to luminaire geometry>
- <number of tilt angles>
- <angles>
- <multiplying factors>

F.1 <lamp to luminaire geometry>

This indicates the orientation of the lamp within the luminaire, and shall be a value 1, 2, or 3, according to the following schedule (see **Figure F-1**).

1. When the luminaire is aimed straight down, the lamp is either vertical base-up or vertical base-down.
2. When the luminaire is aimed straight down, the lamp is horizontal. The lamp remains horizontal when the luminaire is tilted up in the 0° horizontal plane.
3. When the luminaire is aimed straight down, the lamp is horizontal. When the luminaire is tilted in the 0° horizontal plane, the lamp tends toward a base-up or base-down condition as a result of the luminaire tilt.

Note: If a [LAMPPOSITION] keyword is specified, it should be considered to supersede the <lamp to luminaire geometry> specification (see **Annex E**).

F.2 <Number of tilt angles>

This field shall contain a number indicating the total number of pairs of angles and corresponding multiplying factors.

F.3 <angles>

The angles shall be listed in increasing order, and shall go from 0 to 90 degrees or from 0 to 180 degrees, inclusive.

F.4 <multiplying factors>

The multiplying factors shall be listed in order, corresponding to the angles given in the line above.

F.5 Examples

The following is an example of including the tilt information in the photometric file.

```
TILT=INCLUDE
1
7
0 15 30 45 60 75 90
1.0 .95 .94 .90 .88 .87 .94
```

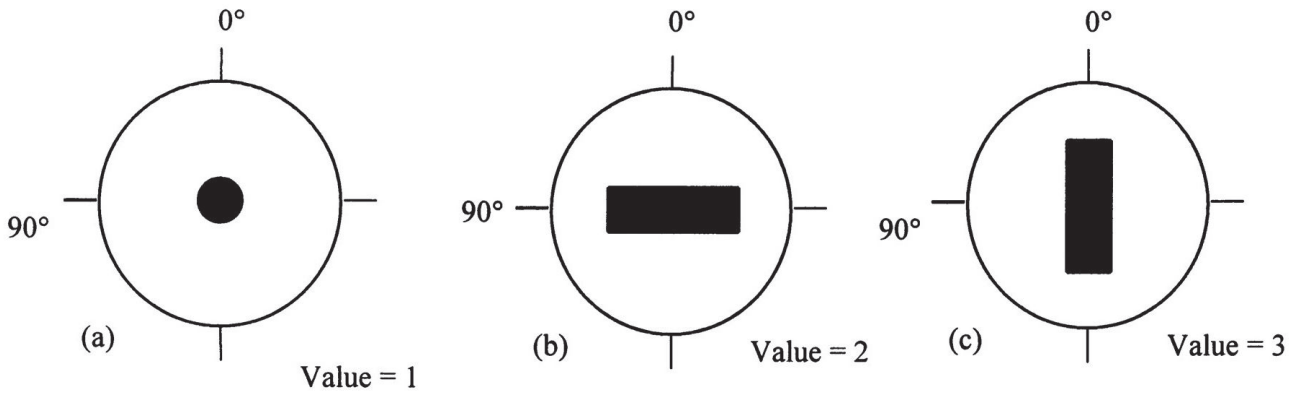

Figure F-1. Plan view of lamp-to-luminaire geometry when luminaire tilt information is included using the TILT=INCLUDE option. Labeled angles are horizontal angles. The lamps are: (a) vertical base up or vertical base down, (b) horizontal along the 90° plane, and (c) horizontal along the 0° plane.

Annex G – Use of *Shall*, *Should*, *May*, and *Can*

The following terms are used throughout this document. The use of these terms is based on the following IES descriptions:

- **Shall:** Used to convey a strict requirement, from which the reader/user may not deviate in order to be considered in conformance with the publication.
- **Should:** Used to convey a recommendation.
- **May:** Used to show that the publication is giving the reader/user permission to follow a certain course of action.
- **Can:** Used to convey possibility or capability, whether material, physical, or casual.
- The negative forms of these verbs (shall not, should not, may not, and cannot) carry equal weight and meaning as the positive forms just listed.

Annex H – *File Generation Type* Value Determination

The *file generation type* value is determined based on a set of 5 parameters, each of which may be true, false, or not applicable.

As shown in **Table H-1**, those 5 parameters are: Undefined, Accredited, Interpolated, Scaled, simulated.

Not all combinations of parameters are valid, for example, a file may not be undefined and Accredited.

Yes is translated to a 1 in the value, *No* or *N/A* is translated to a 0. The first of the 6 digits is set to 1 since it has no matching parameter. The remaining digits (after the decimal) are in the following order: Accredited, Interpolated, Scaled, Simulated, Undefined.

Table H-1. Parameters for File Generation Type Value Determination

Decimal Value	Title	Accredited	Interpolated	Scaled	Simulated	Undefined
1.00001	Undefined	N/A	N/A	N/A	N/A	Yes
1.00010	Computer Simulation	N/A	N/A	N/A	Yes	N/A
1.00000	Test at an unaccredited lab	No	No	No	N/A	N/A
1.00100	Test at an unaccredited lab; data have been lumen scaled	No	No	Yes	N/A	N/A
1.01000	Test at an unaccredited lab with interpolated angle set	No	Yes	No	N/A	N/A
1.01100	Test at an unaccredited lab with interpolated angle set; data have been lumen scaled	No	Yes	Yes	N/A	N/A
1.10000	Test at an accredited lab	Yes	No	No	N/A	N/A
1.10100	Test at an accredited lab; data have been lumen scaled	Yes	No	Yes	N/A	N/A
1.11000	Test at an accredited lab with interpolated angle set	Yes	Yes	No	N/A	N/A
1.11100	Test at an accredited lab with interpolated angle set; data have been lumen scaled	Yes	Yes	Yes	N/A	N/A