



# ENERGY STAR® Lamps V1.0 Draft 2 Specification

August 8, 2012



# Speakers

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# Webinar Agenda

## Topics

- Spec Activities, Comment Period, Objectives
- Specification Scope and Lamp Classification
- Product Qualification
- Photometric Performance Requirements
- Lumen Maintenance & Rated Life Requirements
- Electrical Performance & Toxics, Dimensional Requirements
- Labeling and Packaging Requirements
- Test Methods
- Q&A Session



# Activities to Date – Lamps V1.0

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- **March 22, 2011:** Framework Document released
- **October 21, 2011:** Draft 1 Released
- **October 24, 2011:** Lab/Accreditation Body/Certification Body Round Table
- **November 30, 2011:** Draft 1 Webinar
- **July 6, 2012:** Draft 1 Comments Received and Agency Response Summary Posted
- **July 6, 2012:** Lamps Draft 2 Released
- **August 8, 2012:** Discussion of Lamps V1 Draft 2

# Comments

- Stakeholders are encouraged to submit questions through the “Ask a Question” feature during the webinar and to send comments to: [lamps@energystar.gov](mailto:lamps@energystar.gov)

**Comment Deadline**

August 24, 2012

- Comments will be posted at [www.energystar.gov/lamps](http://www.energystar.gov/lamps) unless noted “DO NOT POST”

# Webinar Objectives

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1. Overview of Draft 2 proposal
2. Opportunity to ask clarifying questions on proposed requirements
3. Confirm next steps for Lamps specification
  - Stakeholder role in specification development
  - Outstanding items (e.g. TBD requirements)

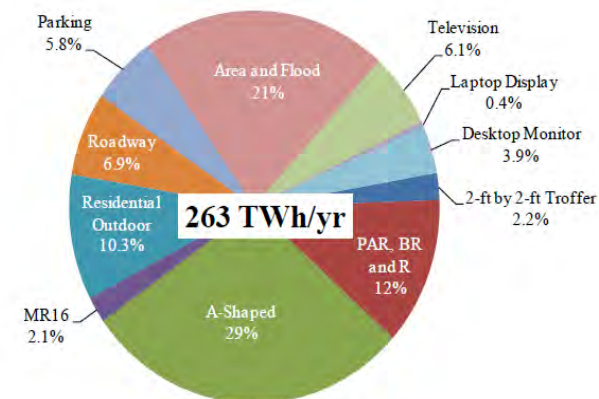
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# Specification Scope and Lamp Classification

# Scope and Lamp Classification: Low Voltage MR-16

## Added Low Voltage MR-16 lamps (Commercial Grade requirements)

- Most MR16 use is in the commercial sector
  - **80,000 Commercial** MR16s operating at **3,270 hrs/yr** compared to **40,000 Residential** MR16s at **840 hrs/yr**
- Lack of energy efficient alternatives
- Higher confidence in proper installation and energy savings in commercial applications
- Low energy savings potential in the residential market and high probability of misapplication.



Data source: 2011 DOE Report: Energy Savings Estimates of Light Emitting Diodes in Niche Lighting Applications  
[http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/nichefinalreport\\_january2011.pdf](http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/nichefinalreport_january2011.pdf)





## *Scope and Lamp Classification:* **Base Types**

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- Added GU-10 base type for line voltage MR16 lamps
  - Pending resolution of dimensional standards
- Added GU5.3 & GX5.3 base types
  - Low Voltage MR16 lamps

# Scope and Lamp Classification: Organization

- Clarifications
  - Added Semidirectional Lamp Type
  - Inclusion of Standard Compliance Column
  - Inclusion of Applicable Qualification Path under Lamp Shape and Description

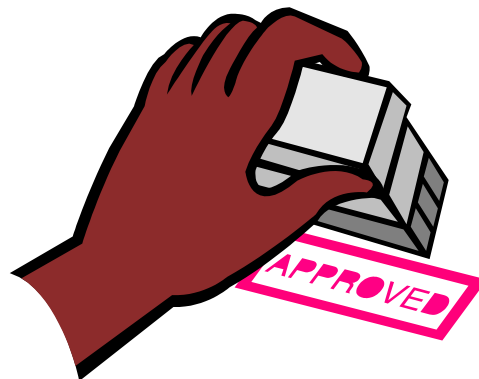


Standard Compliance	Lamp Type	Lamp Shapes or Description
ANSI Standard	Directional	Lamps meeting applicable directional performance requirements in this specification in ANSI standard lamp shapes R, BR, ER, MR and PAR.

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# Questions?

# Product Qualification





*Product Qualification:*  
**Allowable Product Variations**

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- Lamp Attributes
- Variations Include:
  - Paint color
  - Beam angle
  - Lamp base type
  - Envelope shape
  - Envelope finish

# Product Qualification:

## Table 2 Allowable Variation

Lamp Attribute	Allowable Variation
Paint Color	Variations in lamp body color/pigment only, not the type of paint or plastic.
Beam Angle (solid state only)	<p>Variations in the dimensions of lamp secondary optics only (e.g. lens thickness, refractor patterns). Variation in secondary optical material not allowed.</p> <p>Variation not allowed where, in a sample of five units of the representative lamp model, the average of <i>in situ</i> temperatures measured at each unit's highest temperature <math>TMP_{LED}</math> is within 5°C of the maximum case temperature tested in the corresponding IES LM-80 report.</p>
Lamp Base (solid state)	<p>Variations in the lamp base so long as base material is unchanged.</p> <p>Variation not allowed where, in a sample of five units of the representative lamp model, the average of <i>in situ</i> temperatures measured at each unit's highest temperature <math>TMP_{LED}</math> is within 5°C of the maximum case temperature tested in the corresponding IES LM-80 report.</p>
Base Type (compact fluorescent)	Variations in the lamp base so long as base material is unchanged.
Envelope Shape (decorative shapes only)	Variations in lamp envelope shape so long as the envelope material and thickness are unchanged. The surface area and volume of the tested representative model's envelope shall be less than or equal to that of the variant.
Envelope Finish (decorative shapes only)	Variations in lamp envelope finish so long as the envelope material and thickness are unchanged. The surface area and volume of the tested representative model's envelope shall be less than or equal to that of the variant.

## Product Qualification:

# Conditions for Allowable Product Variations

- Same rated input voltage
- Average in situ temperature of critical components does not vary more than 2.5°C
- Safety Listing/Certification Report to demonstrate identical construction
- Test reports confirm variance of  $\pm 5\%$ 
  - Input current
  - Input wattage
  - Power factor
  - MOL and MOD



# Product Qualification: Photos

- Added requirement for photos in test report documenting:
  - Lamp optics
  - Lamp profile
  - Lamp labeling

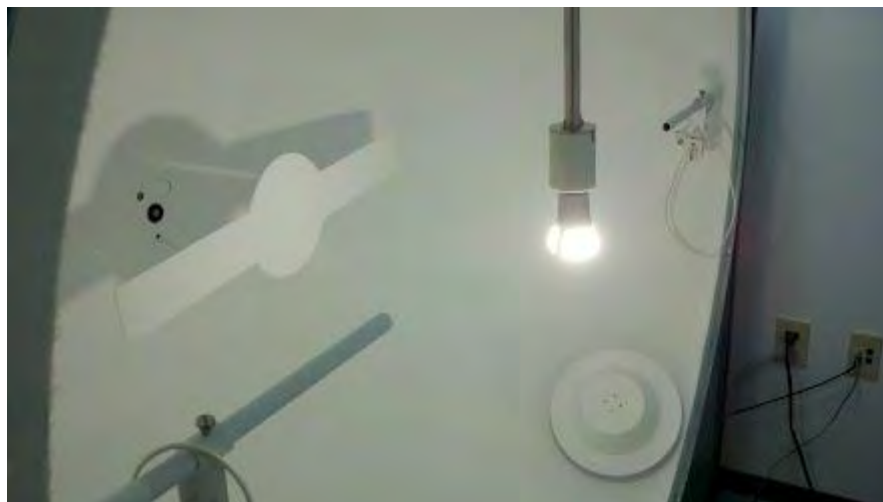




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# Questions?

# Photometric Performance Requirements



# Photometric Performance Requirements:

## Luminous Efficacy

- Minor clarifications only
  - Minimum lamp efficacy = Measured initial lumens per watt
  - Average of unit values and  $\geq 9$  units individually required to pass (regardless of test orientation)
  - Added guidance for reported values

13 Watt Omnidirectional Lamp (minimum 60lm/W)											
Orientation	VBU	VBU	VBU	VBU	VBU	VBD	VBD	VBD	VBD	VBD	AVERAGE
Sample	1	2	3	4	5	6	7	8	9	10	
Lamp A	61.3	60.7	61.5	61.1	60.8	60.4	60.5	60.1	59.4	60.9	60.67
Lamp B	60.8	60.9	61.6	61.2	60.9	59.2	60.7	60.9	59.3	61.2	60.67



# *Photometric Performance Requirements:* **Light Output**

- Added guidance for reported values
- New minimum light output requirement for non-standard Semidirectional lamps
  - 400 lumens



# Light Output

- New Minimum Light Output: R, BR, ER
  - For lamps exempt from DOE’s energy efficiency ruling
    - Light output  $\geq 10X$  the incandescent lamp’s rated wattage (e.g. a lamp replacing a 25W incandescent shall produce  $\geq 250$  lumens)
    - Aligns with requirements in Integral LED Lamps V1.4
  - All other lamps use minimum levels in the Table.

Rated Wattage of the Referenced Incandescent Lamp (watts)	Light Output for R20 (Lumens)	Light Output for Lamps Larger Than R20 (Lumens)
45	630	750
50	720	850
65	1,010	1,190
75	1,210	1,420
90	1,520	1,790
100	1,740	2,050
120	2,190	2,580
150	2,910	3,430

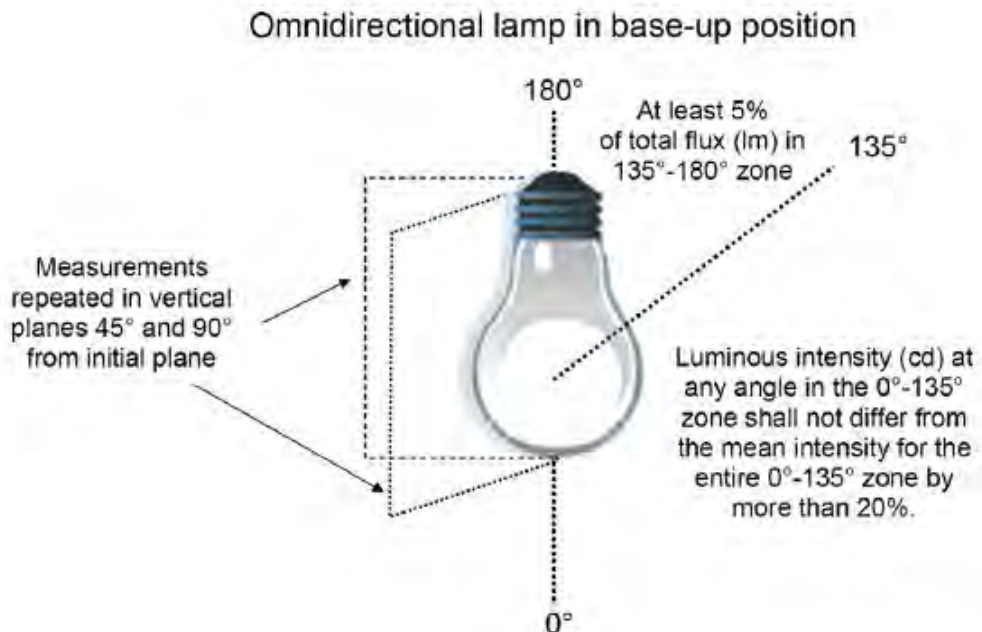


# **Luminous Intensity Distribution**

# Luminous Intensity Distribution: Omnidirectional ANSI Standard A Lamps

Lamp Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
<b>ANSI Standard Omnidirectional Shapes</b>	<p>Lamp luminous intensity distribution shall emulate that of the referenced incandescent lamp as follows.</p> <p>Each luminous intensity measured value (candelas) shall vary by no more than 20% from the average of all measured values.</p> <p>No less than 5% of total flux (lumens) shall be emitted in the 135° to 180° zone.</p> <p>See Appendix A for illustration.</p>	<p><b>Measurement (fluorescent):</b> IES LM-66-11</p> <p><b>Measurement (solid state):</b> IES LM-79-08</p>	<p><b>Sample Size:</b> One new unit.</p> <p><b>Passing Test:</b> The unit shall meet the requirement.</p> <hr/> <p>Lamp luminous intensity shall be measured in vertical planes 0°, 45°, and 90° about the lamp axis, at 5° increments (max) within each plane's 0° to 135° zone.</p>

- ANSI Standard Omnidirectional requirements remain the same from ILL1.4 with clarification for measurements





# *Luminous Intensity Distribution Requirements:* **ANSI PAR and Low Voltage MR Lamps**

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- Integrated LED Lamp specification had CBCP requirement
- Draft 2 includes additional lamp beam performance metrics

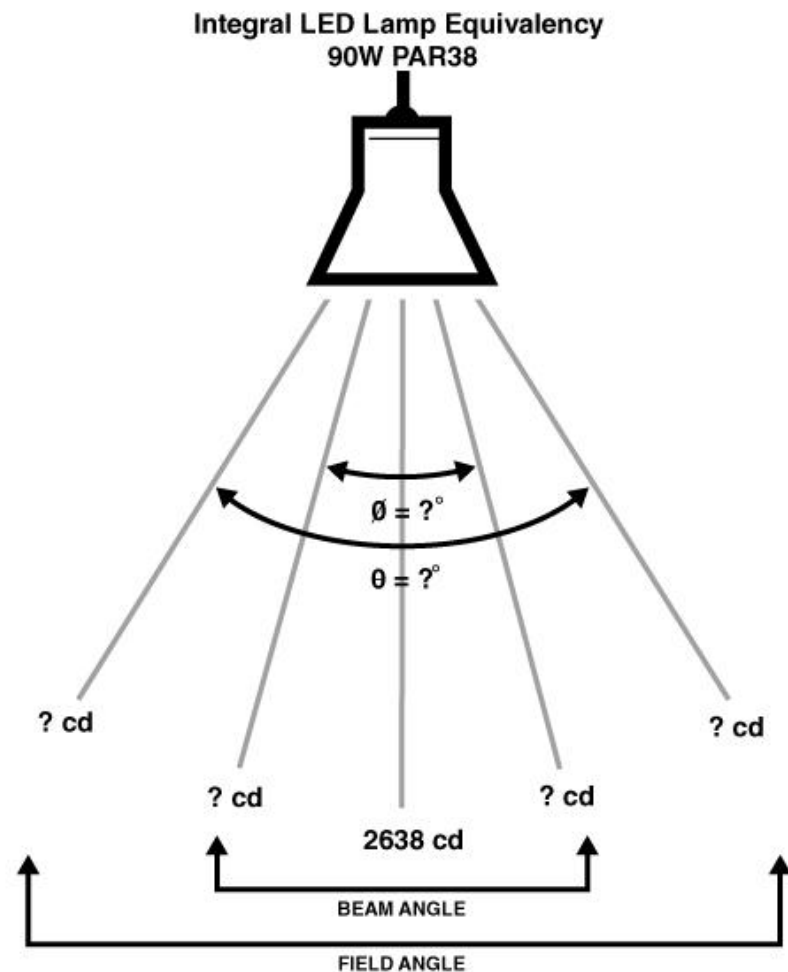
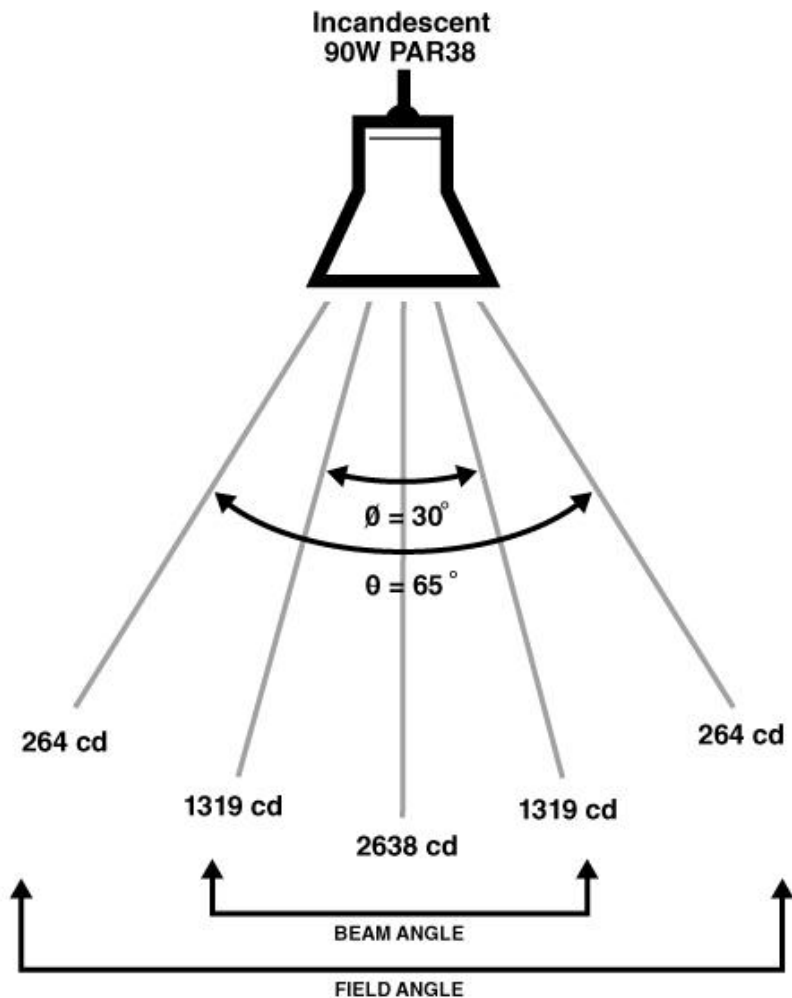


# *Luminous Intensity Distribution Requirements:* **ANSI PAR and Low Voltage MR Lamps**



- Requirements
  - Reference Angle
  - Minimum Intensity
  - Axial Symmetry
- Supplemental Testing Guidance
  - Sample size: 1 unit
  - Tolerance:  $\pm 0.5^\circ$  may be applied to all measurement angles
  - The reported beam angle shall be  $\angle_{\text{ref}}$ .
- Measurement
  - IES LM-20-12 (Fluorescent)
  - IES LM-79-08 (Solid State)
- Reference Document
  - ANSI C78.379-2006 (sections 3 and 4.1)

# Photometric Performance Requirements: Luminous Intensity Distribution



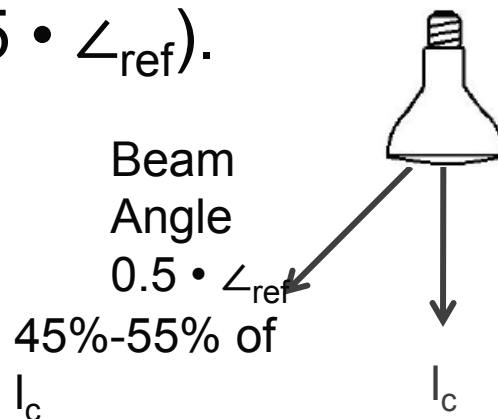
# *Luminous Intensity Distribution:* **Nominal Beam Angle Guidelines**

- Requirement: Lamp luminous intensity distribution shall emulate that of the referenced incandescent lamp, including its nominal beam angle (“reference angle” or  $\angle_{\text{ref}}$ ), as follows.
- From ANSI C78.379-2006:
  - For beam angles of less than  $13^{\circ}$  the angle rounded to the nearest whole number should be used: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.
  - For beam angles of  $13^{\circ}$  to  $50^{\circ}$  the angles rounded to the nearest 5 (starting at 15) should be used: 15, 20, 25, 30, 35, 40, 45, 50.
  - For beam angles of  $51^{\circ}$  or greater, the angle rounded to the nearest 10 should be used: 50, 60, 70, 80 and 90.

# Luminous Intensity Distribution: Beam Angle Analysis and Requirements

Percentile distribution of luminous intensity at nominal beam angle (% of $I_c$ )										
	10th	20th	30th	40th	50th	60th	70th	80th	90th	100th
All Products	27.4%	34.6%	40.9%	44.5%	47.9%	49.4%	50.4%	51.7%	54.5%	90.6%

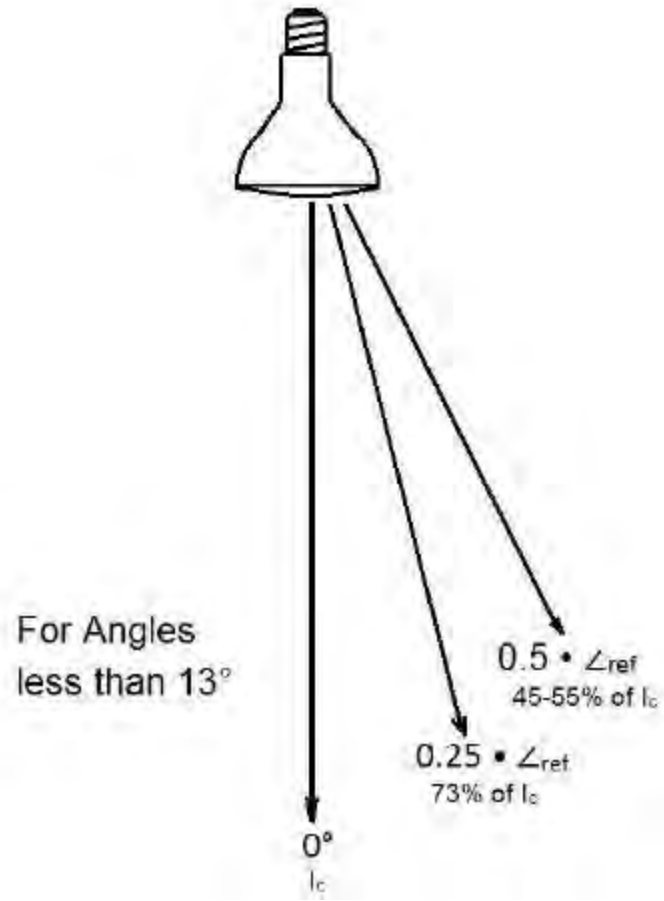
- For all beam angles: Measured on two rotational planes  $90^\circ$  from each other around and through the beam axis, lamp luminous intensity within each plane shall measure no less than 45% and no greater than 55% of the center beam intensity ( $I_c$ ) on each edge of the beam ( $0.5 \cdot \angle_{ref}$ ).



# Luminous Intensity Distribution: Reference Angle Less Than 13°

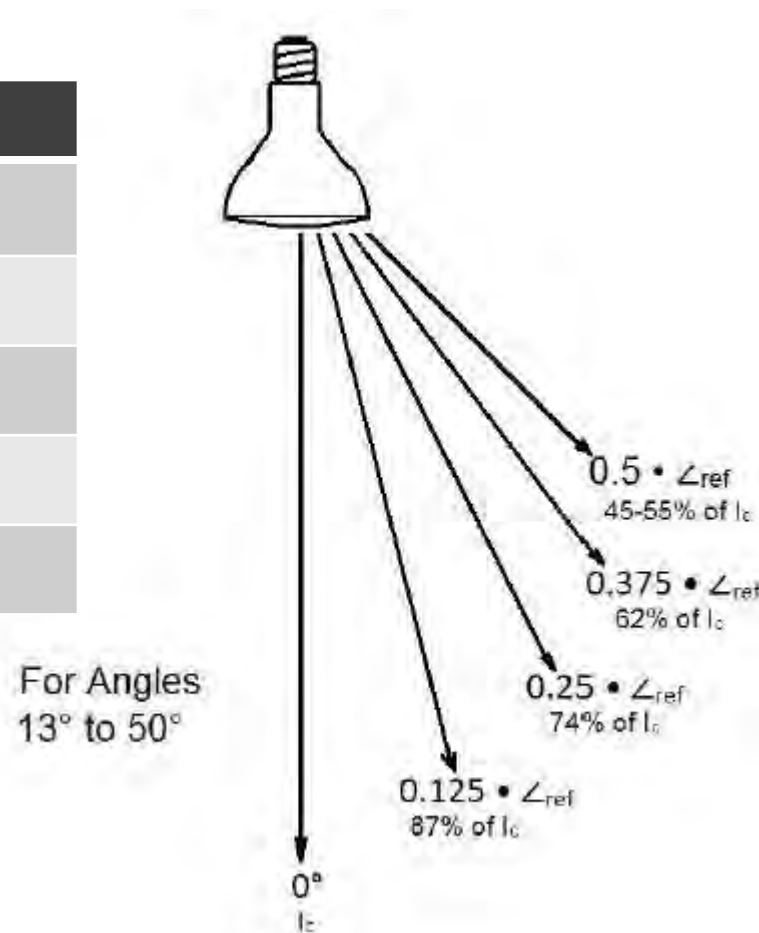
- For reference angles less than 13°, on each side of the beam angle at  $(0.25 \cdot \angle_{ref})$ , lamp luminous intensity within each plane shall measure no less than 73% of  $I_c$ .

Intensity Distribution by Beam Angle					
Across beam angle	Degrees	Min	10 <sup>th</sup> Percentile	Mean	Median
0.25	0-10	0.715	0.739	0.749	0.750
	11-20	0.698	0.742	0.783	0.763



# Luminous Intensity Distribution: Reference Angles 13°-50°

Reference Angle	Intensity
0°	$I_c$
$0.125 \cdot \angle_{ref}$	$\geq 87\%$ of $I_c$
$0.25 \cdot \angle_{ref}$	$\geq 74\%$ of $I_c$
$0.375 \cdot \angle_{ref}$	$\geq 62\%$ of $I_c$
$0.5 \cdot \angle_{ref}$	45-55% of $I_c$





# Luminous Intensity Distribution: Reference Angles 13°- 50°

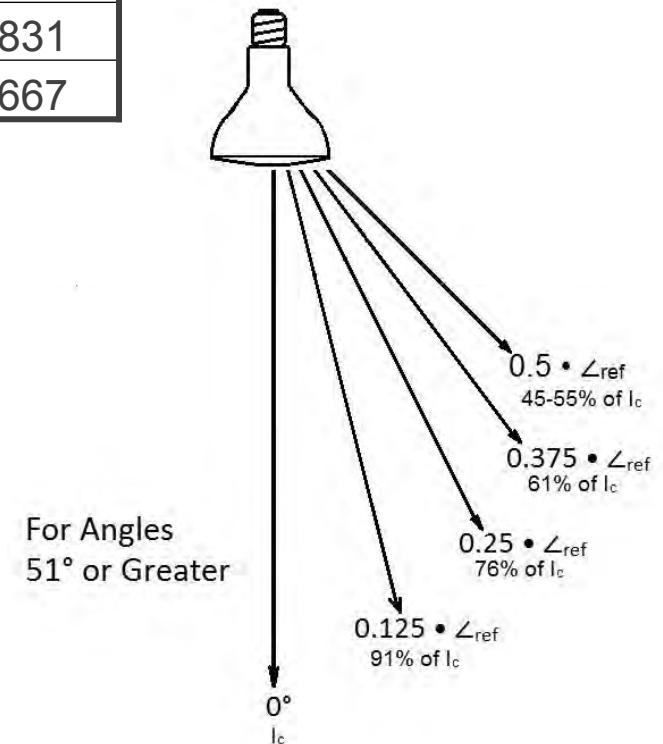
Across Beam Angle	Beam Angles	Minimum	10 <sup>th</sup> Percentile	Mean	Median
0.125	11-20	0.849	0.871	0.893	0.882
	21-27	0.887	0.920	0.947	0.946
	28-35	0.865	0.920	0.949	0.946
	36-44	0.900	0.906	0.953	0.958
	45-68	0.895	0.912	0.955	0.947
0.25	11-20	0.698	0.742	0.783	0.763
	21-27	0.770	0.810	0.854	0.858
	28-35	0.779	0.800	0.845	0.845
	36-44	0.807	0.811	0.870	0.873
	45-68	0.739	0.766	0.854	0.831
0.375	11-20	0.584	0.619	0.651	0.640
	21-27	0.527	0.667	0.712	0.720
	28-35	0.594	0.643	0.689	0.695
	36-44	0.686	0.690	0.725	0.715
	45-68	0.598	0.610	0.689	0.667

# Luminous Intensity Distribution: Reference Angle 51° or Greater



Across Beam Angle	Beam Angles	Minimum	10 <sup>th</sup> Percentile	Mean	Median
0.125	45-68	0.895	0.912	0.955	0.947
0.25		0.739	0.766	0.854	0.831
0.375		0.598	0.610	0.689	0.667

Reference Angle	Intensity
0°	$I_c$
$0.125 \cdot \angle_{ref}$	≥91% of $I_c$
$0.25 \cdot \angle_{ref}$	≥76% of $I_c$
$0.375 \cdot \angle_{ref}$	≥61% of $I_c$
$0.5 \cdot \angle_{ref}$	45-55% of $I_c$





# Luminous Intensity Distribution: Axial Symmetry



- Requirement: Comparing two rotational planes, each of the corresponding aforementioned values should not vary by more than 20%.

Difference in intensity at beam angle										
	Percentiles									
Vertical Axes	10 <sup>th</sup>	20 <sup>th</sup>	30 <sup>th</sup>	40 <sup>th</sup>	50 <sup>th</sup>	60 <sup>th</sup>	70 <sup>th</sup>	80 <sup>th</sup>	90 <sup>th</sup>	100 <sup>th</sup>
0 <sup>o</sup> axis to 90 <sup>o</sup> axis	1.8%	3.8%	4.9%	6.9%	8.6%	11.3%	13.0%	15.5%	34.4%	56.7%

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# Questions?




# Photometric Performance Requirements:

# Color

# Photometric Performance Requirements: Correlated Color Temperature

- Added 6500 Kelvin as allowable CCT
  - Stakeholder feedback indicated strong consumer interest in 6500K lamps
- Updated Supplemental Testing Guidance
  - 7-step ellipses/quadrangles
  - Adjusted passing requirement to 10 out of 10

Lighting Facts Per Bulb	
<b>Brightness</b>	870 lumens
<b>Estimated Yearly Energy Cost</b>	\$1.57
Based on 3 hrs/day, 11¢/kWh Cost depends on rates and use	
<b>Life</b>	5.5 years
Based on 3 hrs/day	
<b>Light Appearance</b>	
<b>Energy Used</b>	8 watts
<b>Contains Mercury</b>	For more on clean up and safe disposal, visit <a href="http://epa.gov/cfl">epa.gov/cfl</a> .



# Photometric Performance Requirements:

## Color Rendering

- Maintained positive R9 requirement for both CFLs and LED lamps
  - Targeting color quality benefit to consumers regardless of technology
  - R9 value rendition of saturated shades of red
  - Human skin tones, wood, and other materials





## *Photometric Performance Requirements:* **Color Maintenance**

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- Adjusted value to .007 to align with current specifications
  - Acknowledging the need to maintain the cost effectiveness
  - Maintain consistency across ENERGY STAR lighting specifications

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# Questions?

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# Lumen Maintenance and Rated Life Requirements



# Lumen Maintenance Requirements: Draft 1

- Lamps  $\geq$  5 watts required the Elevated Temperature Life Test (ETLT).
  - Evaluating robustness of lamps in thermal environment created by luminaires
  - Steady stream of consumer complaints citing early failures under proper use and misapplication
- Stakeholders commented:
  - Existing 10W threshold adequately addresses consumer concerns
  - Recommended applicability only to lamps used in recessed cans
  - Raised questions about ETLT testing capacity

# Lumen Maintenance Requirements: Evaluation and Analysis

- Test lab capacity
  - ETLT requirement would apply to majority of lamps
  - Analysis of existing testing infrastructure

Test Sockets <sup>1</sup>			
Ambient <sup>2</sup>	Halo Can (Option A)	Apparatus (Option B)	Hot Room (Option C)
30,000	1200	200+	15,800

Note 1: Estimate of available sockets for Elevated Temperature Life Test at EPA-recognized laboratories

Note 2: Estimate of available sockets available for Ambient Temperature Life Test at EPA-recognized laboratories

- Application and thermal contribution evaluation
  - Lamps likely to be installed in enclosed or recessed conditions, including proper use and misuse
  - Higher wattage lamps

- Elevated Temperature Testing
  - All Directional and Semi-directional lamps
  - Omnidirectional lamps  $\geq 10$  watts
- Normal Ambient Testing
  - All Decorative lamps
  - Omnidirectional lamps  $< 10$  watts

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# Rated Life Requirements

## *Rated Life Requirements:* **Life**

- Draft 1 proposed a minimum life claim of  $\geq 10,000$  hours for all lamps
  - Opportunities for less expensive products
- Draft 2
  - 10,000 hour min. – CFLs only
  - 15,000 hour min. – decorative LEDs
  - 25,000 hour min. – non-decorative LED lamps
  - 35,000 hour min. – All commercial grade lamps
  - Maintained that all tested units to be operational at the first rated life milestone

# Rated Life Requirements: Life

Example Operating Hour Milestones for Rated Lifetime Lumen Maintenance Qualification			
Lifetime Rating	1 <sup>st</sup> (Early Interim) Qualification Milestone <sup>1</sup>	2nd (Interim) Qualification Milestone <sup>2</sup>	Full Lifetime Qualification
CFL - 10,000 Hrs	4,000 Hrs (40% of Life)	6,000 Hrs	10,000 Hrs (100% of Life) <sup>3</sup>
CFL - 12,000 Hrs	4,800 Hrs (40% of Life)	6,000 Hrs	12,000 Hrs (100% of Life) <sup>3</sup>
CFL - 15,000 Hrs	6,000 Hrs (40% of Life)	6,000 Hrs	15,000 Hrs (100% of Life) <sup>3</sup>
LED - 15,000 Hrs	3,000 Hrs	6,000 Hrs	
LED - 20,000 Hrs	3,000 Hrs	6,000 Hrs	
LED - 25,000 Hrs	3,000 Hrs	6,000 Hrs	
LED - 30,000 Hrs	3,000 Hrs	6,000 Hrs	7,500 Hrs
LED - 35,000 Hrs	3,000 Hrs	6,000 Hrs	8,750 Hrs
LED - 40,000 Hrs	-	6,000 Hrs	10,000 Hrs
LED - 45,000 Hrs	-	6,000 Hrs	11,250 Hrs
LED - 50,000 Hrs	-	6,000 Hrs	12,500 Hrs

Note 1: 100% of lamps must be operational

Note 2: 90% of lamps must be operational

Note 3: 50% of lamps must be operational

## *Rated Life Requirements:* **Rapid Cycle Stress Test**

- Maintained Draft 1 proposal
  - Cycling once per hour of rated life
    - Aligns cycle time across technologies (5 min on, 5 min off)
- Added: **15,000 cycle cap** (regardless of rated life)
  - Reduces test time and testing burden for lamps with rated life  $>15,000$
  - Ensures that rapid cycle stress testing does not impede early interim certification

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# Questions?



# Electrical Performance Requirements





# Electrical Performance Requirements: Power Factor

- Draft 1 proposed 0.7 power factor for all lamps except lamps  $\leq 5W$ .
- Adjusted levels to Luminaires specification

Technology	Existing Specifications	Draft 1 Requirement	Draft 2 Requirement
<b>Compact Fluorescent</b>	$\geq 0.5$ All Lamps	$\geq 0.7$ All Lamps	$\geq 0.5$ Residential Lamps $\geq 0.9$ Commercial Lamps
<b>Solid State</b>	$\geq 0.7$ for Lamps $>5W$	$\geq 0.7$ All Lamps	$\geq 0.7$ Residential Lamps $\geq 0.9$ Commercial Lamps

# Electrical Performance Requirement: Start Time

- Adjusted start time from 0.5 to 1 second
  - Aligns with existing specification (CFL V4.3)
  - Noted conflict between decreasing Start Time requirement and increasing Rapid Cycle Stress Test requirement
- Start Time Test Method introduced in Annex D
  - Collaboration with CFL Technical and Research Working Group





## *Electrical Performance Requirement:* **Run-Up Time**

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- People don't like to wait
- Consumer dissatisfaction and misunderstandings about full light output versus slow run-up times

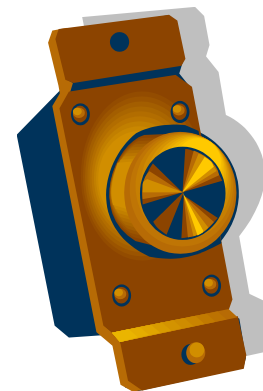
# Electrical Performance Requirement: Run-Up Time

- Exempted solid state products
- Maintained Draft 1 levels
  - Covered CFLs – 100% stabilized light output in  $\leq 90$  seconds
  - All Other CFLs -  $\geq 50\%$  of stabilized light output in  $\leq 30$  seconds; and;  $\geq 80\%$  of stabilized light output in  $\leq 45$  seconds; and; 100% stabilized light output in  $\leq 60$  seconds
- Run-Up Time Test Method introduced in Annex E
  - Collaboration with CFL Technical and Research Working Group



# Electrical Performance Requirements: Dimming

- Seeking stakeholder input in the areas of:
  - Dimming level
  - Flicker
  - Audible noise
  - Compatibility



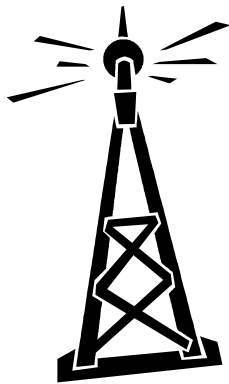
## *Electrical Performance Requirements:* **Transient Protection**

- New exemption for low voltage lamps
  - Clarified applicability to lamps that will see overvoltage conditions on the line
- Removed lamp base orientation language from testing guidance



# *Electrical Performance Requirements:* **Electromagnetic & Radio Frequency Interference**

- Reference to FCC requirements removed from specification
  - Compliance with requirements of the United States Federal Communications Commission is required by law.





## *Lamp Toxics Reduction Requirements*

- Added test procedure reference (IEC 62554) for documenting mercury content
- Clarified that levels are based on rated lamp wattage



## *Dimensional Requirements:* **Lamp Base & Shape**

- **Lamp Base Dimensions and Tolerances**
  - Requirement was deleted from Draft 2
  - Considered redundant since lamp base dimensions are verified during electrical safety evaluation
- **Lamp Shape Dimensional Requirements**
  - Clarified applicability to ANSI standard lamps only



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# Questions?

# Lamp Labeling and Packaging Requirements



# Lamp Labeling and Packaging Requirements

- Goals were to:
  - Eliminate redundancies
  - Simplify
- Reviewed markings required by other agencies and safety requirements to reduce overlap
  - FTC
  - ANSI/UL

<b>Lighting Facts</b> Per Bulb	
Brightness	870 lumens
Estimated Yearly Energy Cost	\$1.57
Based on 3 hrs/day, 11¢/kWh Cost depends on rates and use	
Life	5.5 years
Based on 3 hrs/day	
Light Appearance	
Warm <span style="float: right;">Cool</span>  2700 K	
Energy Used	13 watts
<b>Contains Mercury</b>	
For more on clean up and safe disposal, visit <a href="http://epa.gov/cfl">epa.gov/cfl</a> .	

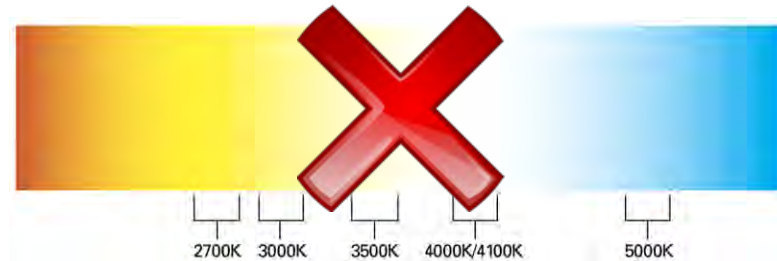
# Lamp Labeling and Packaging Requirements: Product Labeling

- All Lamps:
  - Manufacturer or Brand Name
  - Model Number as will appear on QPL
  - Nominal CCT
- For lamps not covered by FTC
  - Rated Wattage
  - Rated Lumen Output



# Lamp Packaging Requirements: All Lamps

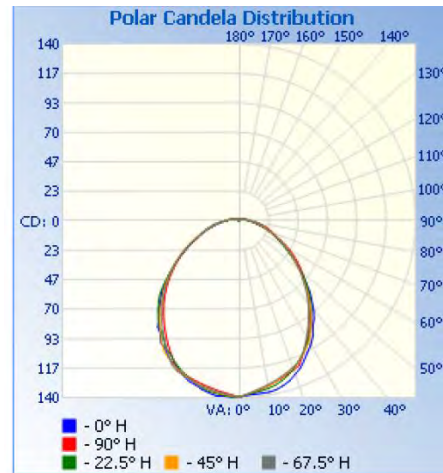
- Removed items covered by other agencies or requirements
  - Mercury language
  - FTC label
  - Color spectrum tool
- Moved requirements out of packaging to appropriate sections
  - Minimum Operating Temperature, Equivalency
- Packaging remnants
  - Model Number, Controls Compatibility, Restricted Position, Starting Temperature, Warranty



# Lamp Packaging Requirements: Non-Standard Lamps



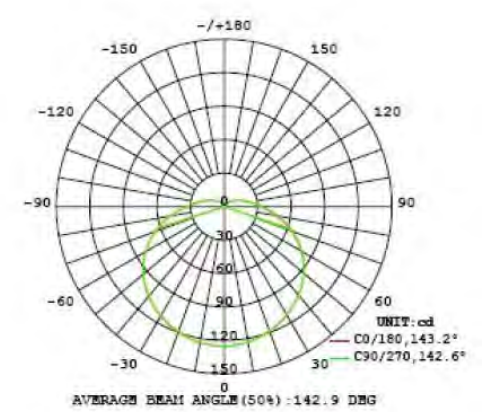
- Researched implementation of non-standard lamp icons in Integral LED Lamps V1.4, found challenges:
  - Current icons being used inappropriately
  - Not easily understood



Polar Candela Distribution

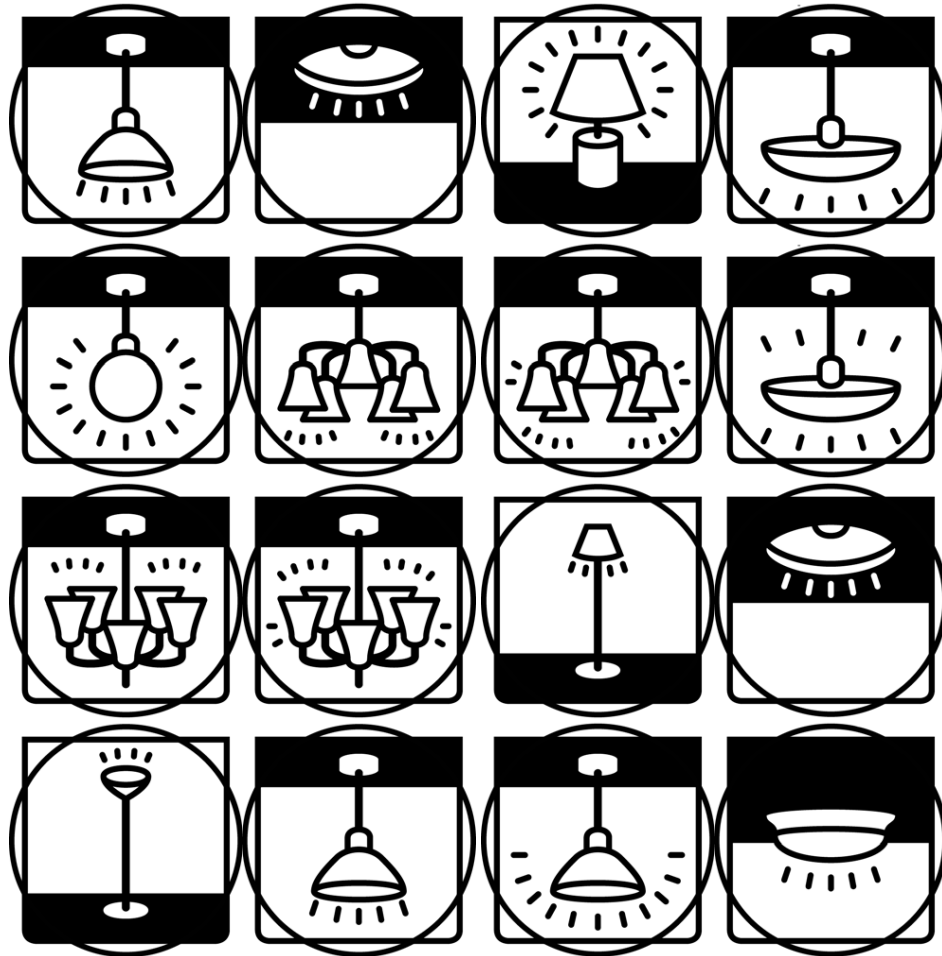


LUMINOUS INTENSITY DISTRIBUTION DIAGRAM





# Lamp Packaging Requirements: Non-Standard Lamps

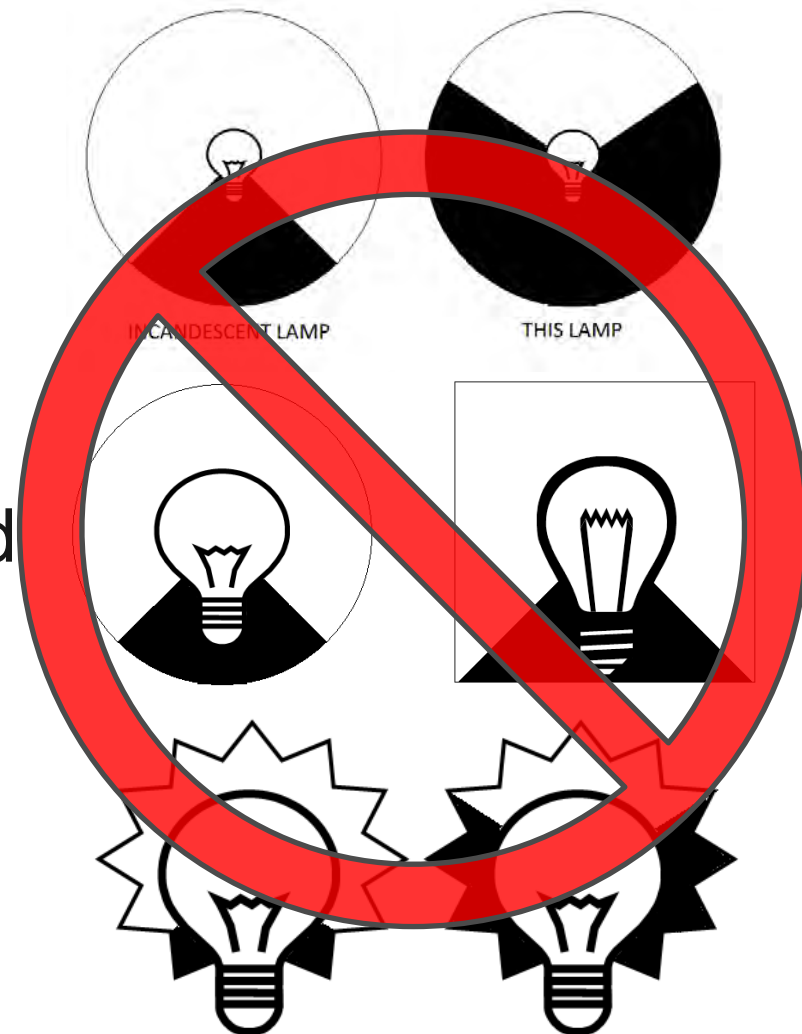


- Integral LED Lamps V1.4 Icons
  - Multitude of icons
  - Impossible to show all applications
  - Difficult to determine “appropriate”
- Determined that new, clearer, more measurable icons were needed



# Lamp Packaging Requirements: Non-Standard Lamps

- Multiple options for new icons were explored.
  - Comparative with incandescent
  - Different shapes and scale



# Lamp Packaging Requirements: Non-Standard Lamps



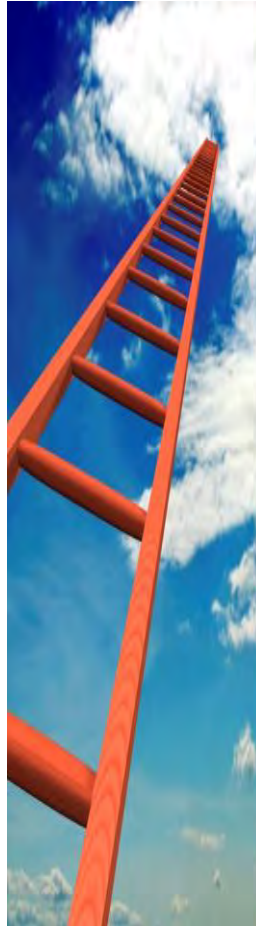
- New Non-Standard Lamp Icons
- Simplified, more flexible and tied to performance
  - Area of light = intensities above 10% of peak
  - Area of “dark” = intensities below 10% of peak
  - Allows stylized drawing of actual lamp



# Setting the Bar Higher: Commercial Grade Lamps



- Commercial Grade Designation
  - Allows distinction for robust products
  - All lamps may elect commercial designation
  - MR16 low voltage lamps must be commercial



- Commercial Grade Requirements:
  - Rated Life  $\geq 35,000$  hours
  - Power Factor  $\geq 0.9$
  - Warranty  $\geq 5$  years at 10 hours per day
  - Life testing for commercial Directional lamps in recessed can

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# Questions?

# Test Methods - Annexes A through E



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# Annex A - Elevated Temperature Life Test

## **Elevated Temperature Life Test (ETLT)**

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- Based on methods from CFL and Integral LED Lamps Specifications
- Operating Cycle of 180 minutes on / 20 minutes off
  - Consistent between LED and CFL
  - Provides more realistic operating conditions
  - Allows testing infrastructure to be used for both technologies



## **Elevated Temperature Life Test (ETLT)**

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- Three (3) methods of testing from CFL and Integral LED Lamps specifications
  - Option A: Recessed Can
  - Option B: Elevated Temperature Apparatus
  - Option C: Elevated Temperature Room
- Options B and C are performed at 55°C



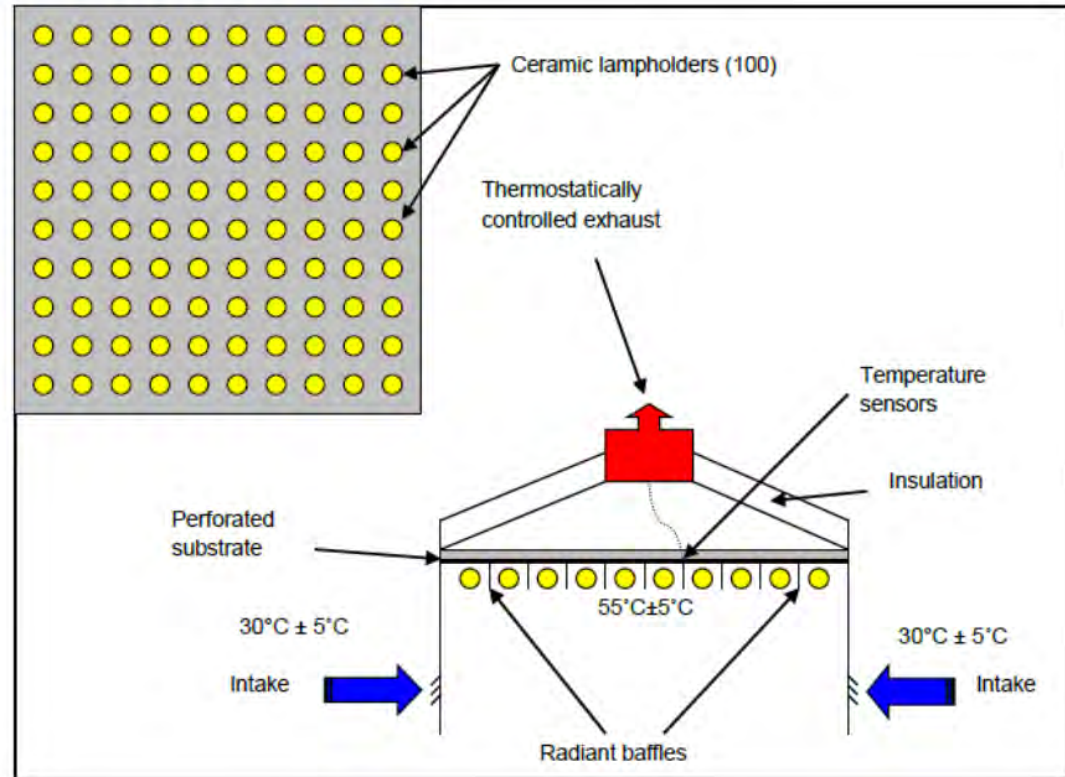
*Annex A:*

## **Elevated Temperature Life Test - Option A**

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- Recessed Can Luminaire Option
- Carried over from CFL specification
- Applicable to:
  - Directional and Semi-directional lamps
  - Vertical Base-Up Orientation

- Elevated Temperature Apparatus Option
- Carried over from CFL specifications
- Applicable to:
  - All Lamps
  - Vertical Base-Up Orientation



- Elevated Temperature Room Option
- Carried over from Integral LED Lamp specification
- Applicable to:
  - All Lamps
  - All Orientations



Figure 1: Hot Room that may not meet ETLT Requirements

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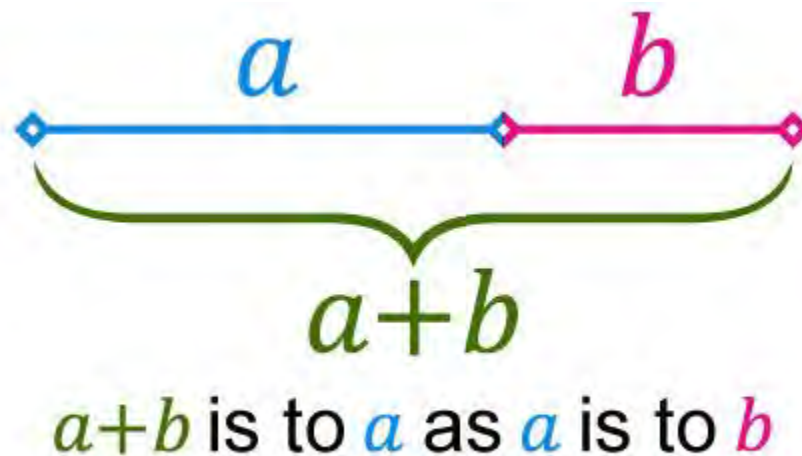
# **Annex B: Ambient Temperature Life Test**

## **Ambient Temperature Life Test (ATLT)**

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- Method for life testing lamps that do not require Elevated Temperature Life testing
- Identical to the 2 controlled temperature options of Elevated Temperature Life Tests
  - Option A: Elevated Temperature Apparatus
  - Option B: Controlled Temperature Room
  - Both life tests are performed at 25°C
- Operating cycle 180 minutes on / 20 minutes off

# Annex C: Elevated Temperature Initial Light Output Ratio Test





*Annex C:*

## **Elevated Temp Initial Light Output Ratio**

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- Elevated Temperature Initial Light Output Ratio (ETILOR) was adapted from the CFL specification
  - Carried over option of testing in place with ETLT Options A and B
  - Allowed for testing with an Integrating Sphere for Option C



Annex C:

# Elevated Temp Initial Light Output Ratio



ETILOR Example:		Lamp 1	Lamp 2
Lumens (lm)	25°C	721	824
	50°C	662	731
ETILOR		0.92	0.89

# Annex D

## Start Time Test



## Annex D: Start Time Test

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- Definition:
  - Time between the application of power and the point where it reaches 98% of the initial plateau
- Test method came from CFL working group
  - Tests start time in an ambient air temperature
  - Requires controlled temperature storage of lamps for 24 hours prior to test

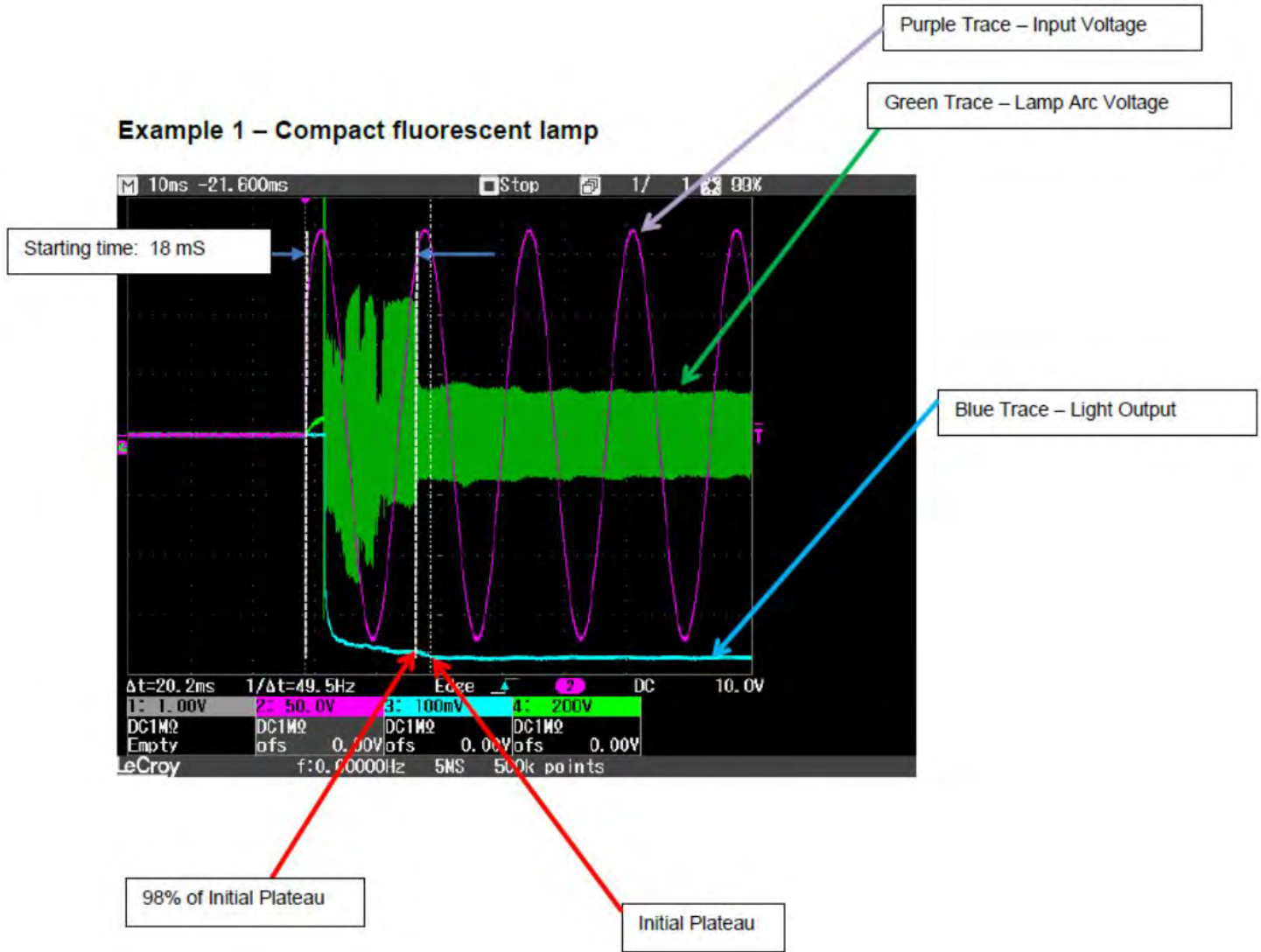
## Annex D: Start Time Test

- Required Equipment:
  - Regulated AC or DC power supply (as applicable)
  - Multichannel oscilloscope with data storage capability
  - 10X probe
  - Photodetector



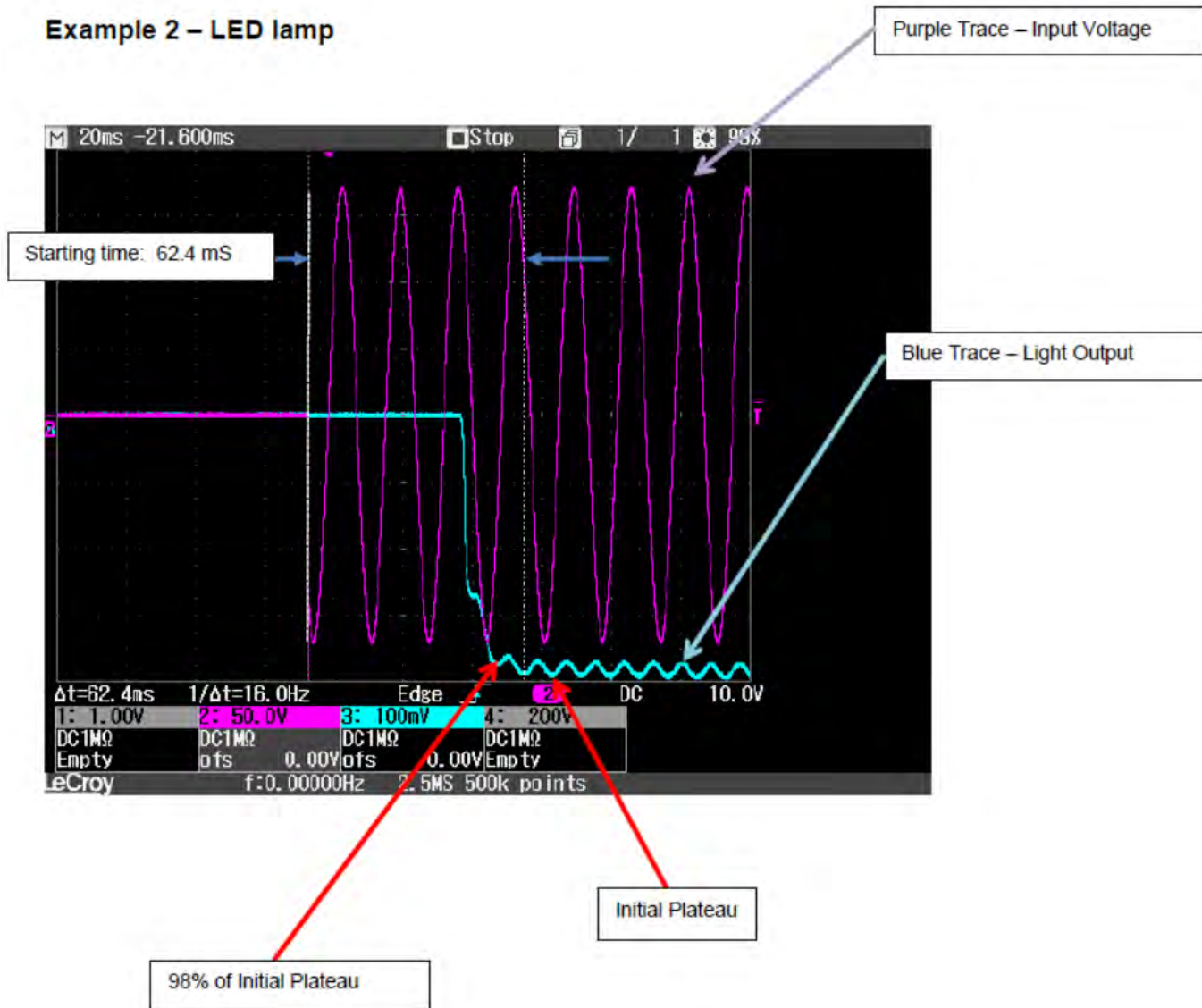
# Annex D: Start Time Test

Example 1 – Compact fluorescent lamp



# Annex D: Start Time Test

Example 2 – LED lamp



# Annex E

## Run-Up Time Test



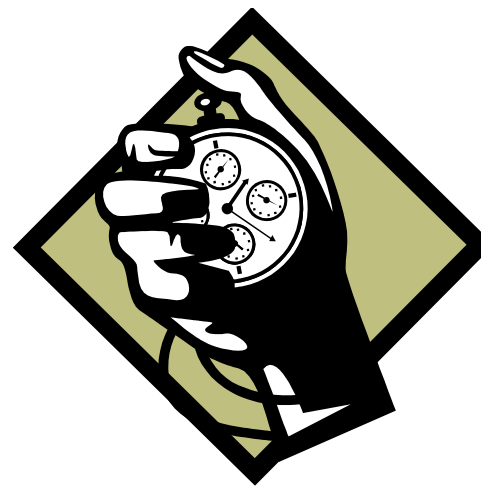
## Run-Up Time Test

- Definition:
  - The time between the application of power to the device and the time when the light output first reaches a specified percentage of stable light output
- Test method came from CFL working group
  - Tests Run-Up time in an ambient air temperature
  - Requires controlled temperature storage of lamps for 24 hours prior to test



## Annex E: Run-Up Time Test

- Required Equipment:
  - Regulated AC or DC power supply (as applicable)
  - Integrating sphere, cube or similar device and associated equipment
  - Means of recording light output vs. time in one second intervals or less
  - Photodetector



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# Questions?

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# Next Steps

# Next Steps

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- Stakeholder's role in specification development
  - ENERGY STAR partners and other stakeholders
  - Test laboratories and certification bodies
  - Alliance for Solid-State Illumination Systems and Technologies (ASSIST)
  - CFL Technical and Research Working Group
  - IEEE PAR 1789 Working Group
  - IES Testing Procedures Committee
  - Lighting Research Center
  - NEMA
  - NRDC

# Next Steps

- TBD
  - Dimming Level
  - Audible noise
  - Dimming compatibility
  - Flicker (Operating Frequency for LED Lamps)
  - Color Angular Uniformity – scanning angles



# Next Steps

- All comments are welcome!
- Specifically seeking data, direction or information for:
  - Dimming level, flicker, noise, and compatibility





# Contacts

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Hunter Fans  
Intelligent Lighting  
Intematix  
ITL  
Joinluck  
Kichler  
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Switch Lighting  
TCP  
Toshiba  
TOSIA  
TOSPO  
UL  
Xiamen Leedarson Lighting  
Xiamen Longstar Lighting Co.



# Q & A Session

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[www.energystar.gov/3rdpartycert](http://www.energystar.gov/3rdpartycert)