

Acronym Overload

2016 ENERGY STAR® Products Partner Meeting
New Orleans, Louisiana

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Agenda

- Published Standards, Methods of Measurement, and Technical Memoranda
- Standards, Methods of Measurement, and Technical Memoranda in Development
 - American National Standards Institute
 - International Commission on Illumination
 - International Electrotechnical Commission
 - Illuminating Engineering Society
 - National Electrical Manufacturers Association





Caution

Standards development is a dynamic process with input from many stakeholders.

New standards & revisions often have different outcomes than originally anticipated at project fruition.

It is strongly recommended that you not make business or design decisions based upon standards in draft.

The following is an overview only.

World Standards Day

October 14, 2016



Published Standards, Methods of Measurement, and Technical Memoranda

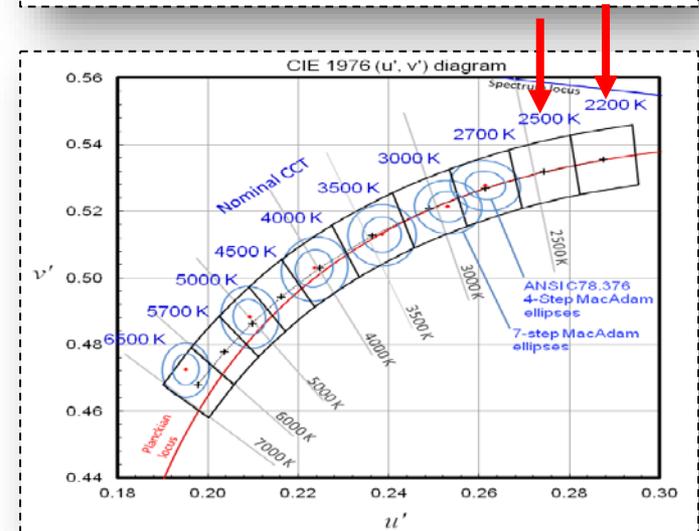
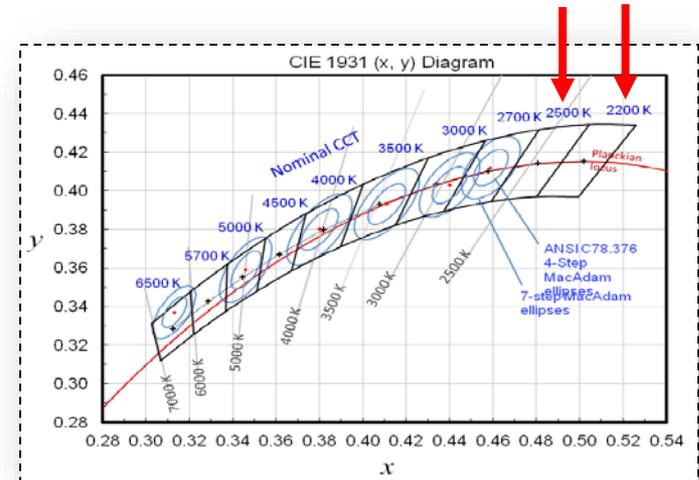
ANSI

C78.377-2015: Specifications for the Chromaticity of Solid State Lighting Products

Status: second revision published in 2015;
2017 revision in development

Scope: indoor LED lamps & luminaires, also
de facto global standard for LED package binning

- Keeps existing ANSI nominal CCTs 2700 through 6500 Kelvin, adds 2200 and 2500 Kelvin
 - provide for a dimmed incandescent look
- Maintains quadrangles in CIE 1931 (xy) and 1976 (u'v') color spaces
- Adds provisions for developing 4-step quadrangles around the same center points
- Maintains “flexible CCT” provisions
- Adds provisions for developing 4-step circles, per CIE TN 001:2014



ANSI

C82.16-2015: Light Emitting Diode Drivers — Methods of Measurement



Status: first edition published in 2015; first revision in development

Scope: method of measurement for LED driver performance for general, exterior and roadway lighting

- Up to 600 VDC or VAC
- Constant-current or constant-voltage DC output
- Fixed, variable, PWM, programmable output power
- External (standalone) or internal (enclosed in luminaire)
- Measurements are very thorough, too numerous to detail here
- Revisions under consideration:
 - Enhancements to LED driver test method
 - LED driver standby power test method
 - Add energy efficiency and standby power uncertainty calculation methods

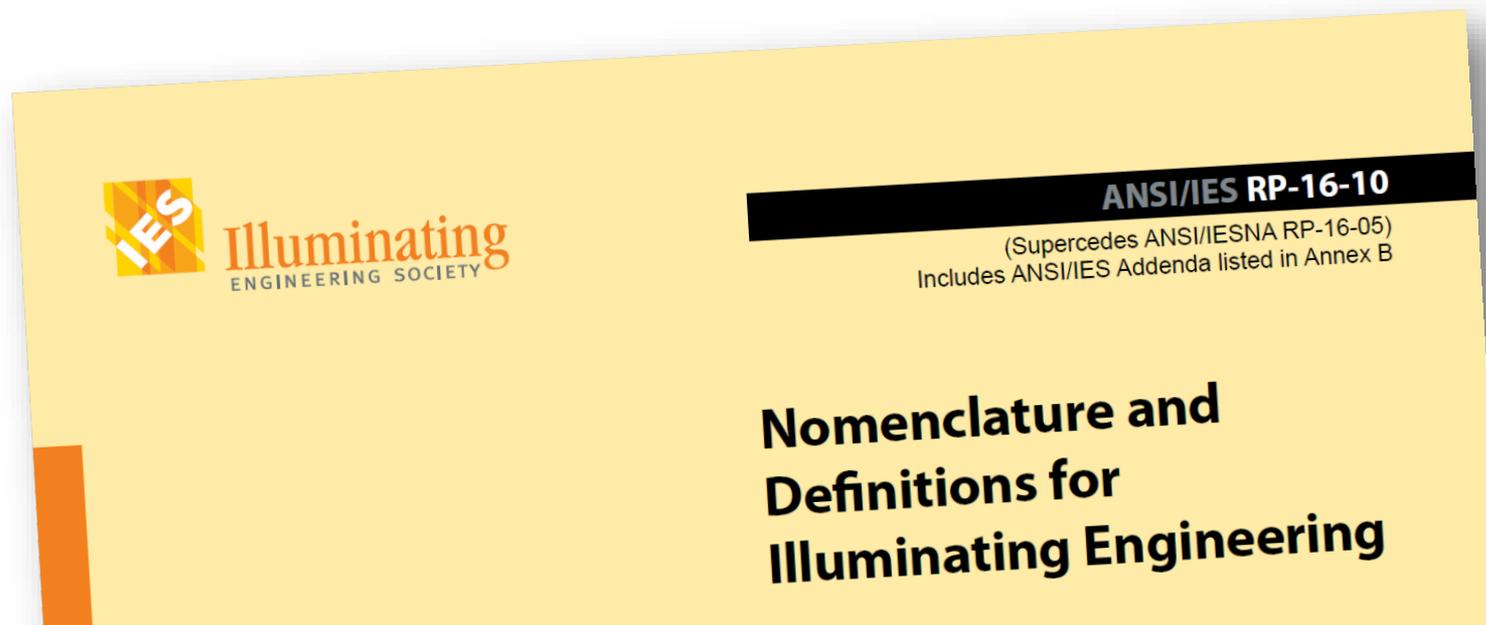
ANSI / IES

ANSI / IES RP-16-1x: Nomenclature and Definitions for Illuminating Engineering

Status: 2010 edition published; 2017 revision in development

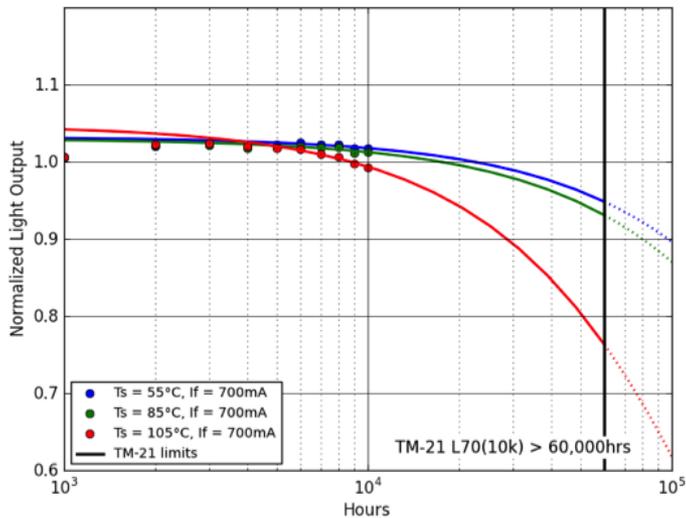
Scope: “production, measurement and application of light... [and] radiant energy also in the adjoining infrared and ultraviolet regions”

- Direction by IES New York office to Nomenclature Committee:
 - Add definitions found in other IES publications (LMs, TMs, RPs, etc)
 - Place RP-16 online as a free public resource



ANSI / IES

LM-80-15: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules



Status: first revision published in 2015; errata is forthcoming

Scope: now includes luminous, photon and radiant flux maintenance, with chromaticity shift over time

- Now an American National Standard
- Incorporates changes from LM-80-08 Addendum A
- Adds pulse width modulation (PWM), DC constant voltage and AC regulated voltage drive
- Maintenance test duration and measurement interval no longer specified
- Errata forthcoming:
 - To change a 0 (zero) to a “t”
 - Passed subcommittee ballot, next, full committee ballot



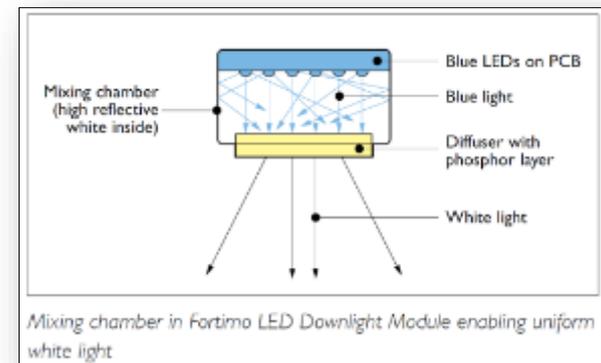
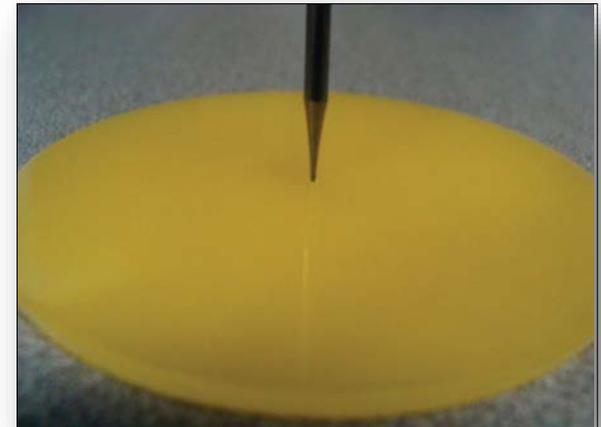
IES

LM-86-15: Measuring Luminous Flux and Color Maintenance of Remote Phosphor Components

Status: first edition published in 2015

Scope: method for measuring long-term degradation of “remote phosphor components”

- Unique: evaluates a non-electrical lighting component
- “Remote phosphor component”: an element of any shape, mechanically separable from pump LED source(s) containing one or more phosphor materials
- “Pump LED source”: an LED irradiance source which excites the remote phosphor component to produce white light
- Luminous flux & color maintenance can now be measured and reported at each integration level:
 - LM-80: LED package / array / module
 - LM-84: LED lamp or luminaire
 - LM-86: remote phosphor component (only)



Philips Lighting

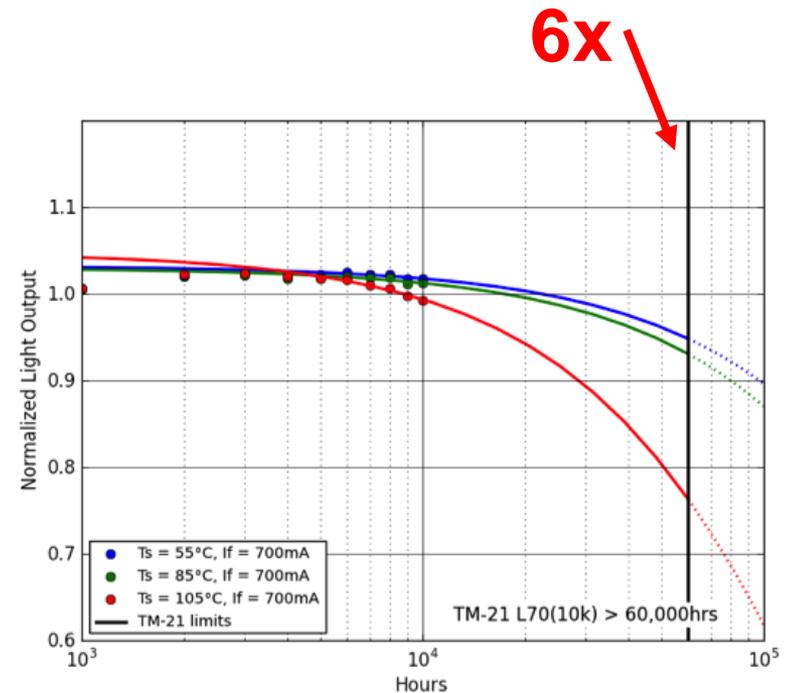
IES

TM-21-11 Addendum B

Status: first edition published in 2015, [free download](#), EPA has implemented Addendum B in the ENERGY STAR TM-21 Calculator

Scope: replaces specific sections of TM-21-11, and *replaces Addendum A entirely*

- Big problem outside of ENERGY STAR:
 - TM-21 “6x rule”: no projections longer than 6 times the test duration are allowed
 - e.g. with a 10,000 hour LM-80 report, 107,567 hours → capped: “> 60,000 hours”
 - Longer than 6x: statistically invalid
 - “Calculated L_{70} ” is uncapped
 - “Reported L_{70} ” is capped at 6x
 - Many manufacturers competing using non-compliant projections, e.g. claiming L_{70} at 100,000 hours with a 10,000 hour LM-80 report



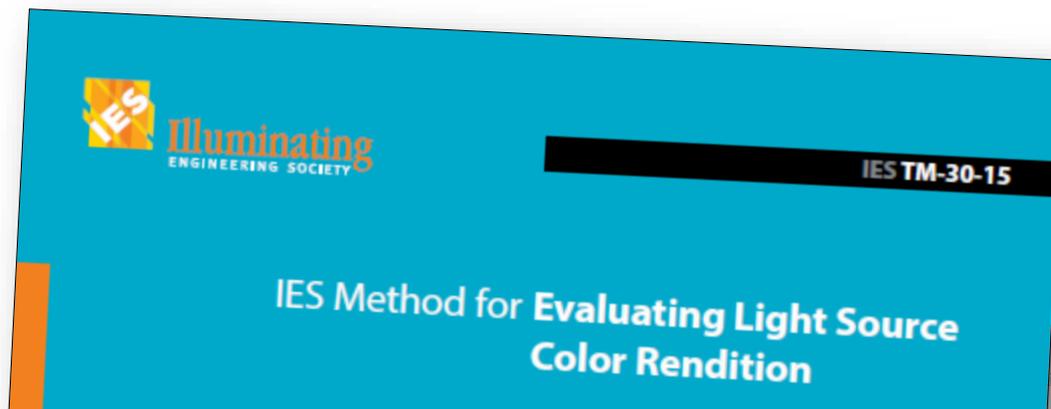
IES

TM-30-15: Evaluating Light Source Color Rendition

Status: first edition published in 2015; errata available as [free download](#)

Scope: a new Technical Memorandum for evaluating white light sources and systems for indoor general illumination and outdoor at photopic light levels

- Not a regulation; not required
- Well vetted by illumination and perception experts
- Lighting industry reaction is one of caution:
 - CIE [Position Statement](#)
 - IES Position Statement: [IES PS-8-15](#)
 - Global Lighting Association: 18 September [Position Statement](#)
 - NEMA Lighting Systems Division [Position Paper](#)



Standards, Methods of Measurement, and Technical Memoranda In Development

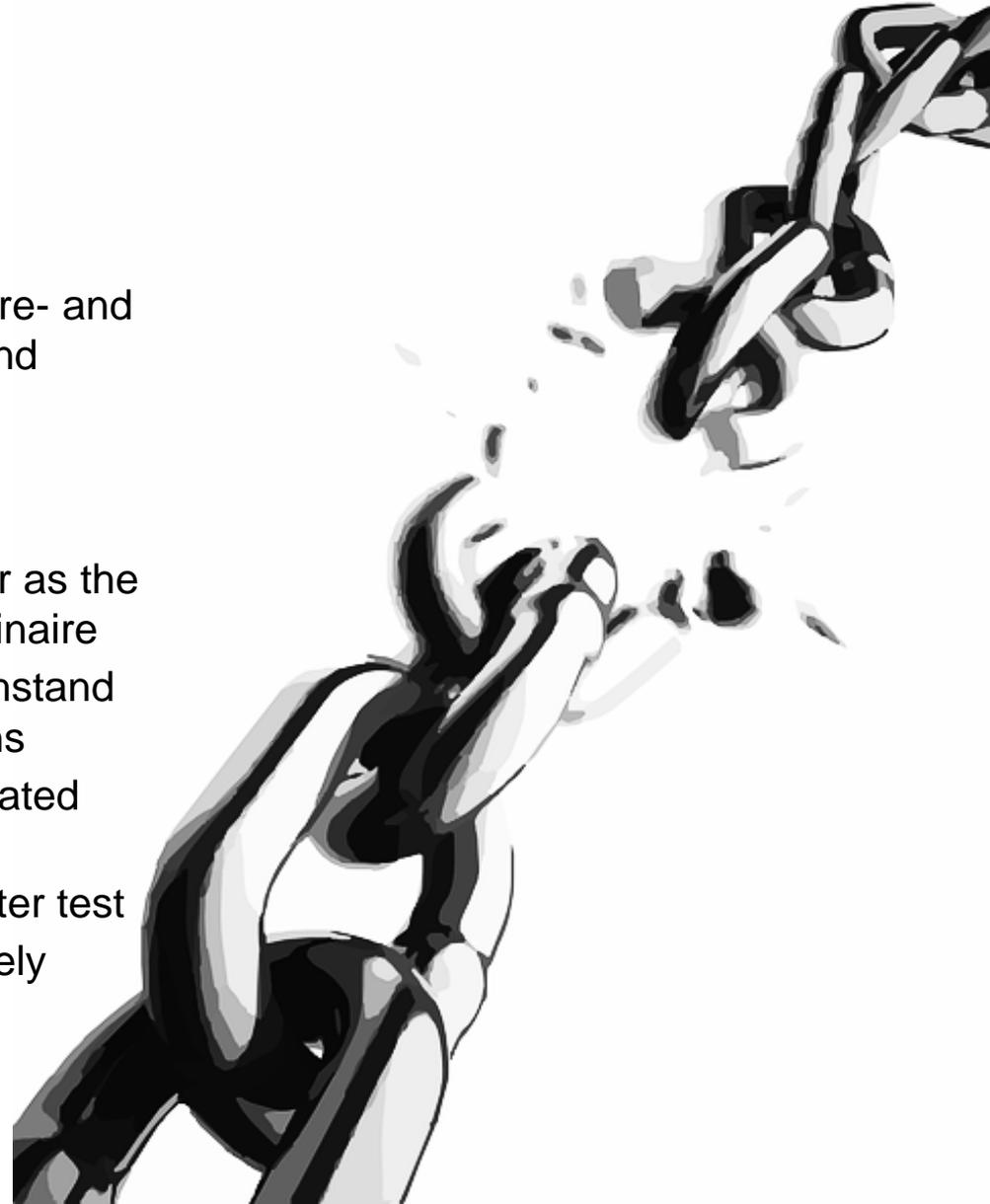
ANSI

C82.15-201x: LED Driver Robustness

Status: first edition in development (CDV: committee draft for vote)

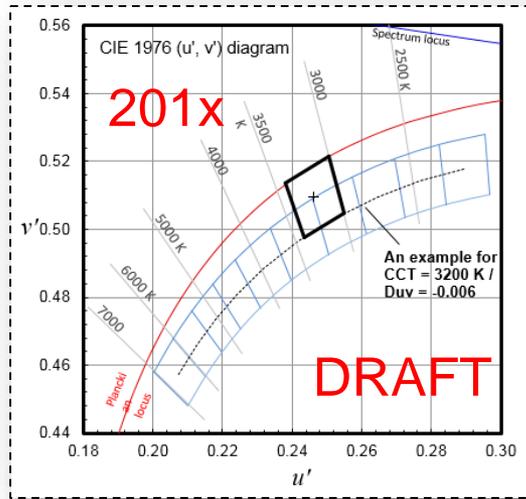
Scope: testing methods to evaluate hardware- and software-based LED driver ability to withstand stress, to define a high level of robustness

- First of its kind for the lighting industry
- May fill a longstanding gap: the LED driver as the potential weak point in an LED lamp / luminaire
- Robustness is defined as the ability to withstand or overcome variable or adverse conditions
- Defines Failure Types (A, B, C, D) and related Acceptability Criteria
 - “A”: operates as intended during and after test
 - “D”: permanently damaged but fails safely



ANSI

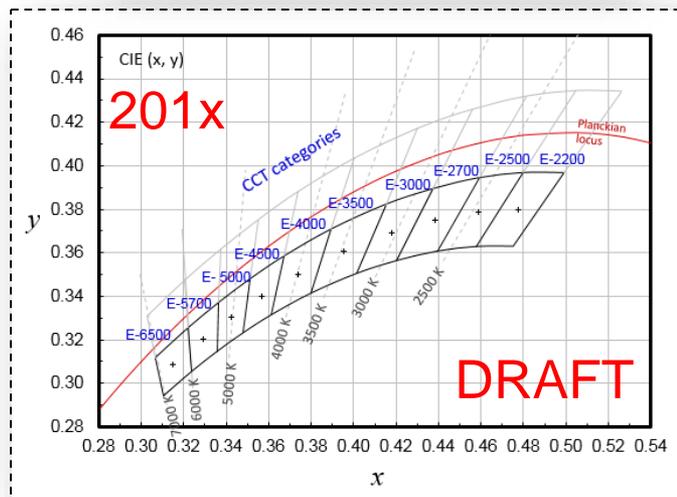
C78.377-201x: Specifications for the Chromaticity of Solid State Lighting Products



Status: 2015 revision published; third revision in development (CDC; committee draft for comment)

Scope: expansion of existing scope: new “extended” quadrangles for white light chromaticities below the black body locus

- Ad hoc has evaluated research by RPI’s Lighting Research Center and NIST indicating observer preference for white light chromaticities plotting below the black body locus
- Adding provisions for “flexible Duv” for those specifying tolerance space between traditional and “extended” quadrangles



CIE

Technical Report: Colour Fidelity Index for Accurate Scientific Use

Status: first edition in development (TC 1-90); currently at recirculation ballot (31 October deadline)

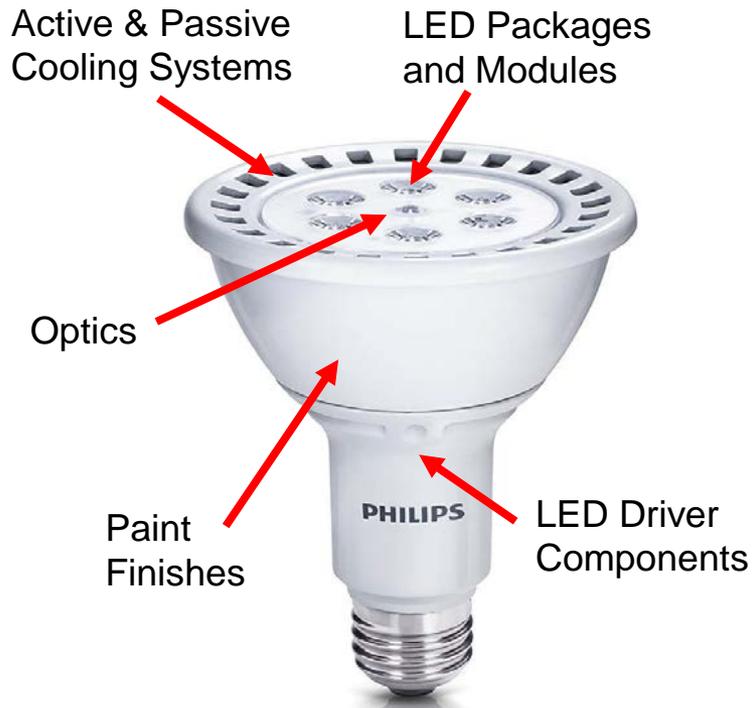
Scope: “develop a scientifically accurate colour fidelity index”

- “a research report describing a general colour fidelity index (R_f) as a scientifically accurate measure of colour fidelity with respect to a reference illuminant”
- Based on IES TM-30-15
- “does not address the need for perception-related colour quality measure(s) beyond fidelity”, e.g. saturation preferences and hue dependence (i.e. the work of CIE TC 1-91)

01	02	03	04	05	06	07	08	09	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	W

IEC

IEC/TS 62861 Ed. 1: Guide to Principal Component Reliability Testing for LED Light Sources and LED Luminaires



Also:

- Mechanical & electrical interconnects
- Chemical interactions
- Final product testing

Status: first edition in development

Scope: “provides guidance for establishing confidence in product reliability using principal component testing of LED light sources and LED luminaires for general lighting”

- “The performance of any principal component will influence the performance of the final product”
- Includes principal component tests:
 - accelerated stress tests (AST; rel model exists)
 - initial qualification tests (IQT; no rel model, no acceleration applied)
- Includes failure criteria by component
- Rel acronym overload: AST, IQT, LTOL, HTOL, PLT, TMCL, VVF, WHTOL, DHC, ESD-HBM, H2S, FMGC, SO2, DPA, BW, OW, HTE, TH, TL, PTC, HOT, ALT, TLT, CT, FTA

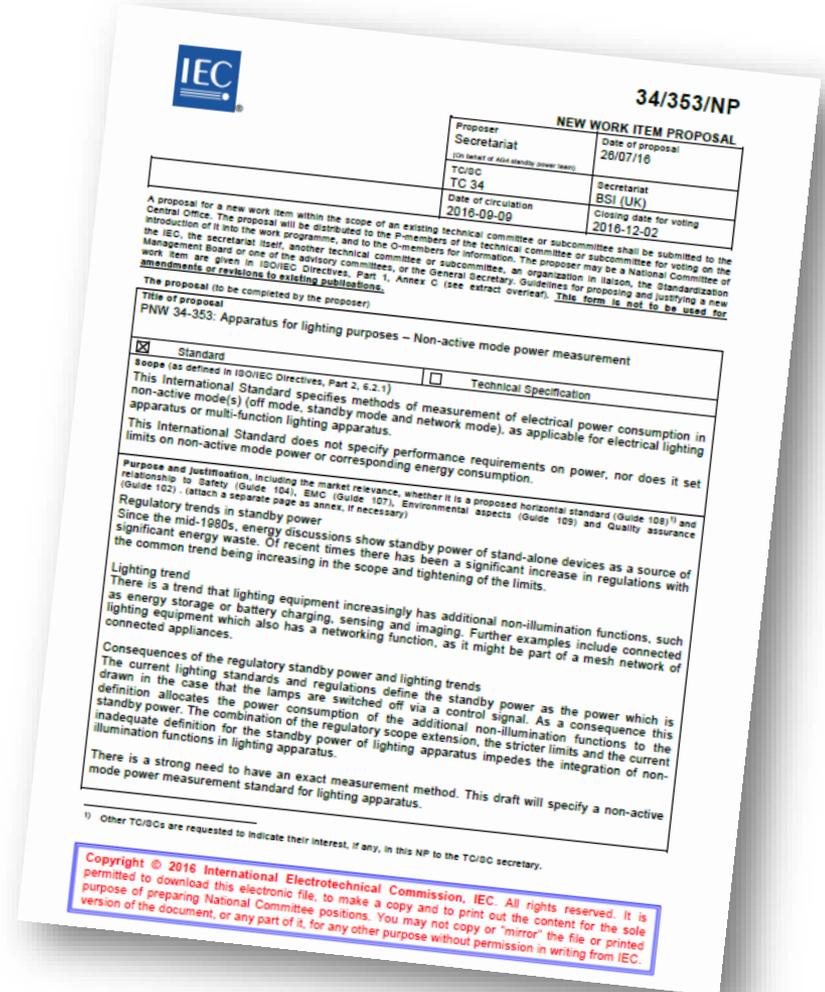
IEC

34/353/NP: Apparatus for Lighting Purposes – Non-Active Mode Power Measurement

Status: new proposal (NP) ballot out now

Scope: “specifies methods of measurement of electrical power consumption in non-active mode(s) (off mode, standby mode and network standby mode), as applicable for electrical lighting apparatus or multi-function lighting apparatus.”

- Expected to make normative reference or borrow heavily from IEC 62301 Ed. 2.0 2011, Household Electrical Appliances - Measurement of Standby Power (referenced in ENERGY STAR specs)
- Expected to be approved and move forward as formal project



IEC **34/353/NP**

NEW WORK ITEM PROPOSAL

Proposer Secretariat	Date of proposal 26/07/16
TC/SC TC 34	Secretariat BSI (UK)
Date of circulation 2016-09-09	Closing date for voting 2016-12-02

A proposal for a new work item within the scope of an existing technical committee or subcommittee shall be submitted to the Central Office. The proposal will be distributed to the P-members of the technical committee or subcommittee for voting on the introduction of it into the work programme, and to the O-members for information. The proposer may be a National Committee of the IEC, the secretariat itself, another technical committee or subcommittee. The proposer may be a National Committee of the Management Board or one of the advisory committees, or the General Secretary. An organization in liaison, the Standardization work item are given in IEC Directives, Part 1, Annex C (see extract overleaf). Guidelines for proposing and justifying a new amendments or revisions to existing publications.

The proposal (to be completed by the proposer)

Title of proposal
PNW 34-353: Apparatus for lighting purposes – Non-active mode power measurement

Standard Technical Specification

Scope (as defined in IEC Directives, Part 2, 6.2.1)
This International Standard specifies methods of measurement of electrical power consumption in non-active mode(s) (off mode, standby mode and network mode), as applicable for electrical lighting apparatus or multi-function lighting apparatus.
This International Standard does not specify performance requirements on power, nor does it set limits on non-active mode power or corresponding energy consumption.

Purpose and Justification, including the market relevance, whether it is a proposed horizontal standard (Guide 108)¹⁾ and relationship to Safety (Guide 104), EMC (Guide 107), Environmental aspects (Guide 109) and Quality assurance (Guide 102) (attach a separate page as annex, if necessary)

Regulatory trends in standby power
Since the mid-1980s, energy discussions show standby power of stand-alone devices as a source of significant energy waste. Of recent times there has been a significant increase in regulations with the common trend being increasing in the scope and tightening of the limits.

Lighting trend
There is a trend that lighting equipment increasingly has additional non-illumination functions, such as energy storage or battery charging, sensing and imaging. Further examples include connected lighting equipment which also has a networking function, as it might be part of a mesh network of connected appliances.

Consequences of the regulatory standby power and lighting trends
The current lighting standards and regulations define the standby power as the power which is drawn in the case that the lamps are switched off via a control signal. As a consequence this definition allocates the power consumption of the additional non-illumination functions to the standby power. The combination of the regulatory scope extension, the stricter limits and the current inadequate definition for the standby power of lighting apparatus impedes the integration of non-illumination functions in lighting apparatus.

There is a strong need to have an exact measurement method. This draft will specify a non-active mode power measurement standard for lighting apparatus.

¹⁾ Other TC/SCs are requested to indicate their interest, if any, in this NP to the TC/SC secretary.

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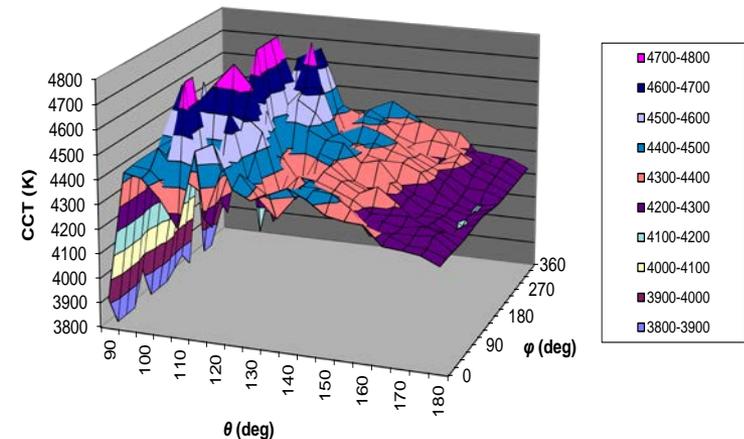
IES

LM-79-1x: Method for the Electrical & Photometric Measurement of Solid-State Lighting Products

Status: 2008 edition published; first revision in development; will make extensive reference to IES LM-75 (goniophotometers) and LM-78 (integrating sphere)

Scope: LED luminaires and integrated lamps for illumination operating on AC mains or DC voltage power supply

- Making subtle improvements based on industry experience with 2008 document, to help labs avoid common pitfalls, without disruption to global regulatory references
 - method for laboratories to validate their color angular uniformity measurements, e.g. lowest light level at which results are valid
 - adding ballast to electrical circuit, switched in and out to determine product sensitivity to impedance effects (90% of the market is not sensitive)
- Table of contents changing to new IES LM format
 - Section number references will change, may create minor disruptions in laboratory accreditation documentation (e.g. currently section 9 is integrating sphere, section 10 is goniophotometers)



IES

The Project Formerly Known As...

LM-87-1x: IES Approved Methods for Robustness Tests for LEDs

Status: first edition in development; project recently reset; reballotted as a Technical Memorandum (TM); new working group forming

Scope: method for robustness testing of LED packages



- Not directly relevant for ENERGY STAR, more for manufacturing partners
- Will make extensive normative reference to a variety of JEDEC semiconductor reliability standards
- May include:
 - HTOL (high temperature operating life)
 - TMCL (temperature cycling)
 - RSH (resistance to soldering heat)
 - WHTOL (wet high temperature operating life)
 - ESD (electrostatic discharge test)
 - Continuous switching cycles until failure test

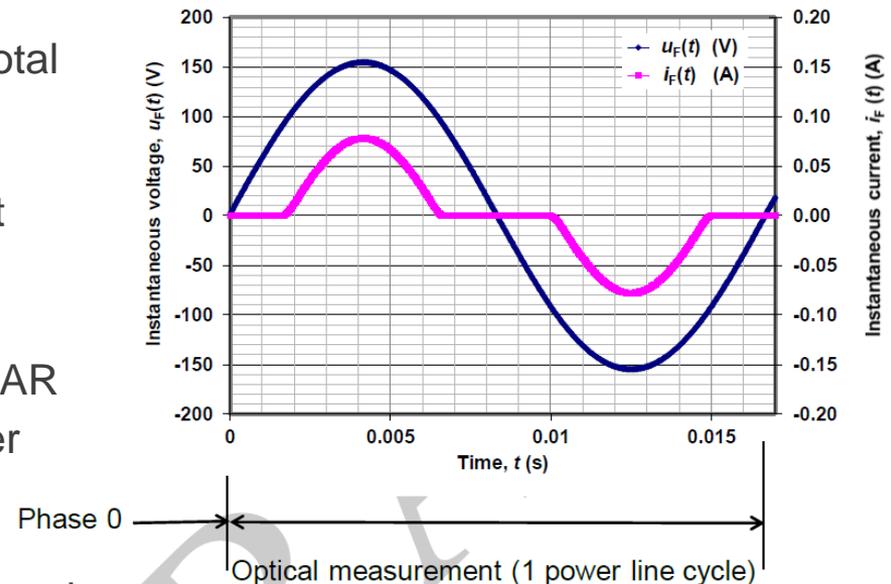
IES

LM-88-1x: IES Approved Method for the Electrical and Photometric Measurements of AC-Driven LEDs

Status: first edition in development, passed SSL subcommittee and full committee ballots

Scope: “measurements of total luminous flux, total radiant flux, total photon flux, electrical power, luminous efficacy, chromaticity, and wavelength characteristics of high-power alternating-current driven light emitting diodes (AC-LEDs)”

- More for manufacturers than for ENERGY STAR
- Includes white and monochromatic high-power and remote phosphor AC-LEDs that do not contain control electronics
- Covers measurements under single cycle AC and continuous AC operation from a 50 or 60 Hz mains supply
- Extensive normative reference to IES LM-85-14, Method for the Electrical and Photometric Measurements of High-Power LEDs



IES

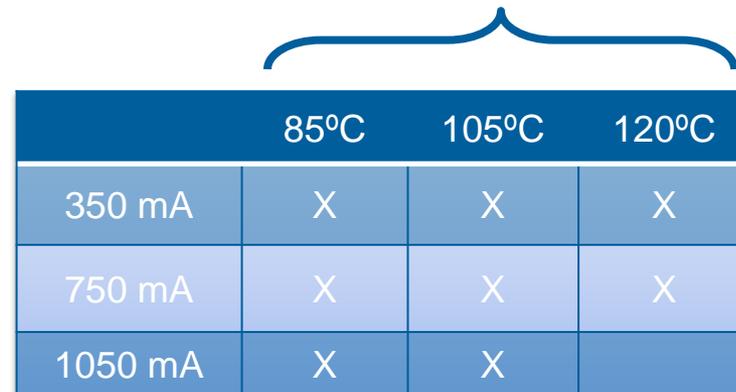
TM-21-1x: Projecting Long Term Lumen Maintenance of LED Light Sources

Status: first edition published in 2011; first revision in development

Scope: expansion of existing to include drive current interpolation method, and to incorporate changes made in Addendum B

- Data show that for LM-80 data for some LED packages, with case temperature held constant, some lumen depreciation can be a function of drive current
- Working group exploring drive current interpolation for potential addition to 201x revision
- Potential for more flexibility with the 5.5x / 6x rule

2011: temperature interpolation (only)



	85°C	105°C	120°C
350 mA	X	X	X
750 mA	X	X	X
1050 mA	X	X	

201x revision:
adding drive current
interpolation

IES

TM-31-1x: Projecting Long-Term Color Maintenance of LED Packages, Arrays and Modules



Status: first edition in development

Scope: developing white LED chromaticity projection method(s) using LM-80 chromaticity data

- Data submitted by multiple manufacturers for multiple LED package types (high power, plastic mid-power, 'chip on board', etc), data anonymized by NIST
- For white phosphor converted LEDs (PCLEDs) only; does not apply to monochromatic LEDs
- Publication anticipated in late 2017

IES

S0417: Variations in LED Packages, Arrays and Modules Known to Affect Flux and Color Maintenance

Status: first edition in development, yours truly as Technical Coordinator

Scope: LED packages/arrays/modules tested per IES LM-80-08 or LM-80-15 (including white and single color LED packages)

- Will document expert consensus on LED package variations (e.g. materials, construction, assembly processes) that affect LM-80 test results, and by extension, TM-21 projections
- Intended to provide guidance that can be used by market transformation programs, certification schemes, manufacturers, regulators
- Could be used in place of ENERGY STAR Lumen Maintenance Guidance



IES

S0421: Method of Measuring and Quantifying Temporal Light Artifacts

Status: proposal passed SSL subcommittee ballot, now at full committee ballot

Scope: “provides description of the method of measurement, equipment requirements, and formulation of calculated quantities for temporal light artifacts (TLA) from light sources intended for use in general service lighting”

- Future IES LM (light measurement method)
- Includes flicker and stroboscopic effects between 1 and 3000 Hz under various control conditions including dimming
- Reporting formats are to be described
- Awaiting publication of NEMA LSD-75



NEMA

LSD-75: Temporal Light Artifacts: Test Methods & Guidance for Acceptance Criteria



Status: first edition in development; approaching ballot

Scope: “to recommend a method of quantifying the visibility of temporal light artifacts (TLA), and to recommend initial, broad application-dependent limits on TLA”

- Intended to provide rough guidance for broad application areas
- Will define practical levels of acceptability
- Will not guarantee comfort / safety in all circumstances but will serve general illumination well
- Includes specific methods of measurement and recommendations for phase-cut dimming
- Applicable to limited speed of motion (e.g. office environment), not for stroboscopic effects (e.g. machine shop)



Thank You

Contact

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