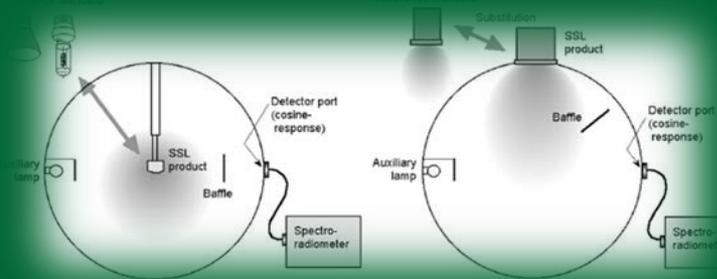


LED Product Standards and Test Methods Update on Development and Application



LIGHTFAIR International

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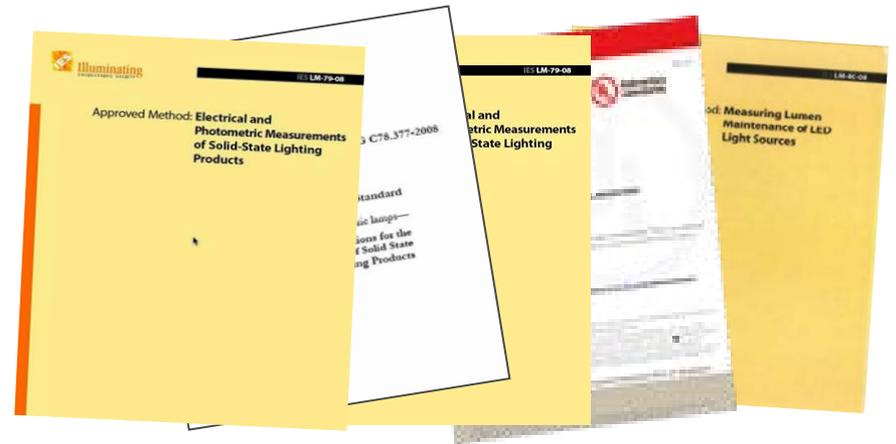
Eric Richman

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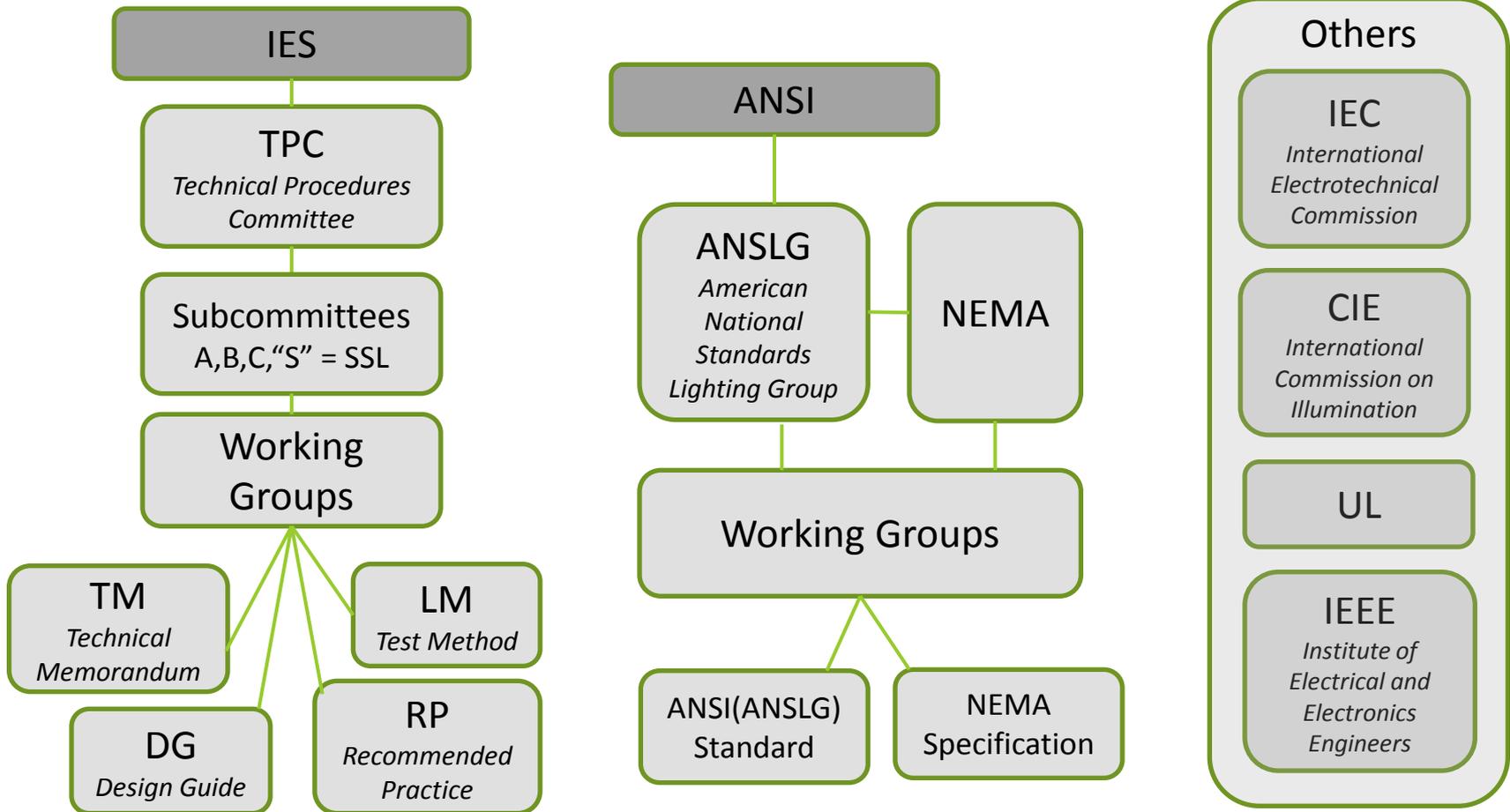
Standards and Test Development

Two primary sources:

- Industry development
 - IES
 - ANSLG (ANSI)
 - NEMA
 - UL
 - IEC/CIE/IEEE
- Regulatory/Program development
 - Federal Commercial Equipment Standards
 - Energy Star



Industry Development



- IES and ANSI working groups share some members and coordinate with each others efforts
- Both IES and ANSI efforts try to harmonize or at least be aware of IEC and CIE efforts
- IES tends to mostly produce **test methods, application guidance and technical information**
- ANSLG/NEMA tend to mostly produce **standards for products and product performance**

Regulatory/Program Development

- Federal commercial Equipment Standards
 - Looks to industry standards for primary adoption
 - Will modify, adapt, and develop as needed to apply to specific federal regulation purposes
- Energy Star
 - Looks to industry standards for primary adoption
 - Will modify, adapt, develop as needed to meet program requirements (or fill gaps)

Many other programs (LF, DLC, FTC, Utilities, etc.) refer to standards and tests but typically do not do any development

Application of Standards and Tests

Standards and Tests are applicable ONLY when adopted by a regulatory body or program

- Industry creates voluntary standards and methods through IES, ANSLG, etc. but does not mandate them
- Regulatory bodies (Federal, State) either adopt, modify from industry, or develop new for specific regulatory purposes with an effective date for enforcement
- Programs (Energy Star, DLC, LF, FTC, etc.) adopt, modify, or create new for purposes of rating, certification or providing comparable data

Current Standards and Test Methods:

For Classification, Definition, and Safety

- ANSI C78.377 - Chromaticity for white light LED
 - Color categories aligned with fluorescent
- IES RP-16 – Lighting definitions
 - Modified to include specific LED terms
- UL 8750 LED Safety
 - General safety requirements for LED components and luminaires including self ballasted LED tubes
- UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits
 - Specifically for troffer upgrade kits



Current Standards and Test Methods:

For Initial performance.....

....of complete LED lamps and luminaires



- LM-79 LED Luminaire Photometric and Electrical testing
 - Applies to complete LED luminaires and lamps
 - Tests for total light output, distribution, color, power, etc.
 - Useful for consumer comparison of initial performance
 - Widely adopted for use by most rating and information programs
 - Currently under revision

Beware of “LM-79 verified”, LM-79 compliant”, and similar claims. LM-79 is just a test – not a compliance rating.

Current Standards and Test Methods:

For long term performance and reliability.....

...of LED sources (packages, arrays, modules)



- LM-80 LED Source Lumen Depreciation Testing
 - Applies only to package, array, module components
 - Works with TM-21 for lumen decay projection estimate
 - Currently under revision
- TM-21 Projection of Source Lumen Depreciation
 - Works with LM-80 data for lumen depreciation estimate
 - Limited projection allowed
 - Widely adopted (with LM-80) for use by most programs

Beware of “LM-80/TM-21 compliant”, and similar claims. These are test and calculations – not a compliance rating.

Current Standards and Test Methods:

For long term performance and reliability.....

....of LED sources (packages, arrays, modules)

- TM-26 Methodologies for Projecting Failure Rate of LED Packages
 - Defines consistent methods for projecting catastrophic failure rates
 - Along with lumen degradation projections (i.e. TM-21) provides useful information on LED package reliability
 - Can be used to help understand LED product reliability
 - **NEW** and close to publication so not yet applied



Current Standards and Test Methods:

For Initial performance.....

...of LED light engines and lamps



- LM-82 LED Light Engines and Lamp Photometric and Electrical testing at temperature
 - Applies to complete LED Light Engines and lamps
 - Tests for total light output, distribution, color, efficacy, etc. at a specific temperature
 - **For use primarily for manufacturer's of LED end products (lamps, luminaires) to verify performance**
 - **NEW** (just published) and not yet widely applied

Current Standards and Test Methods:

For LED driver performance

- NEMA SSL-7a Dimming SSL Luminaires with Phase Cut Dimmers
 - First of hopefully several that help define effective dimming for LED products
 - **For use primarily for manufacturer's of LED end products (lamps, luminaires) to verify performance**
 - **NEW** (just published) but not yet widely applied



Under Development:

For long term performance and reliability.....

....of LED light engines and lamps

- LM-84 LED Light Engine and Lamp Lumen Depreciation Testing
 - Applies primarily to “light engine” components
 - Works with TM-28 for lumen decay projection estimate
 - **NEW** and close to publication so not yet applied
- TM-28 Projection of Light Engine and Lamp Lumen Depreciation
 - Works with LM-84 data for lumen depreciation estimate
 - **NEW** and close to publication so not yet applied



Under Development:

For LED driver reliability

- ANSLG/ANSI C82.15 and 16 LED Drivers Test Methods and Reliability
 - Intended to provide standards for driver reliability as well as test methods
 - **Not yet completed**

Other Notable Efforts Underway

- LM-85, LED Reliability Tests
 - Intended to provide consistent testing for package reliability
- LM-86 measurement of remote phosphor products
 - Remote phosphor (compared to integral phosphor products have different test issues
- S408-11 Optical Waveform Measurements
 - Useful for flicker and similar measurement issues
- S412-13 Color Point Stability
 - Useful in understanding color shift issues over time



Other Notable Efforts Underway

- CIE TC1-69, Color Quality Scale
 - Still looking for a replacement of the CRI metric that is more appropriate for LED and other sources.
- IEEE - P1789 Biological Effects and Health Hazards From Flicker

