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**OFFICE OF
AIR AND RADIATION**

**Summary of Rationale for Version 3.2 ENERGY STAR® Residential
Light Fixture Specification**

I. Introduction and Background

This memorandum provides a summary of the rationale and key changes that appear in the Residential Light Fixture Version 3.2 specification. It contains the following information:

- Summary of the Version 3.2 specification and the key changes from the last specification
- Summary of key milestones in the development of the Version 3.2 specification
- Summary of comments provided by stakeholders
- EPA's rationale for deciding on key elements of the final Version 3.2 specification

II. Summary of Version 3.2 Specification

EPA's goal in revising the Version 3.1 residential light fixture specification was three-fold: (1) provide further clarification on existing technical and testing requirements; (2) add recessed downlight retrofit kits to the list of qualifying products; and (3) specify durability requirements.

The following key changes were made to the specification:

- Recessed downlight retrofit kits are now included in Section 2, Qualifying Products.
- The durability placeholder, included in Table 1 of the Version 3.1 specification, was replaced with new ANSI-IEC lamp standardization requirements and a reference to the pre-existing ANSI Ballast Standardization and Maximum Ballast Operating Case Temperature for Optimal Performance requirement, presented in Table 1 under the heading *Performance Characteristics for Electronic Fluorescent Ballasts*.
- The requirement for maximum ballast operating case temperature that appears in Table 1 and Table 3 was re-written to clarify that the specification refers to maximum ballast operating case temperature for performance, not for safety.
- The optimal performance requirement in Tables 1 and 3 was revised to clarify that every fixture type eligible for ENERGY STAR qualification must meet this requirement.
- Language has been added to clarify when it is acceptable to provide maximum ballast operating case temperature for performance data per UL 1598.

- Lamp Life and Electromagnetic and Radio Frequency Interference requirements from Table 1 (Indoor fixtures) have been added to Table 2A (qualifying outdoor fixtures must also meet these performance characteristics).
- The term “lamp base” has been added to the durability requirement for non ANSI-IEC Standardized Lamps in Table 1, to clarify that even if a non-standardized lamp is used, it still must use a standardized lamp base.
- The ENERGY STAR Specification for Fixture Lumen Output and Fixture Efficiency in Table 1A (for Indoor Recessed Downlight Retrofit Kits) has been removed.

III. Key Milestones of Specification Revision

The final Version 3.2 specification was developed and finalized over the course of three months, which included the following key milestones:

- An ENERGY STAR residential light fixture partner and industry round table meeting was held during the Dallas Market trade show on June 23, 2003. During this meeting EPA presented its strategy for implementing durability requirements and plans for amending the specification.
- Two draft specifications were released on July 18, 2003 and September 8, 2003 for stakeholder comment prior to finalization.

Industry meeting notes, draft and final versions of the specification and stakeholder comments were posted to the ENERGY STAR Product Development Web site throughout the development process. Note: all stakeholder comments were posted with the approval of the submitter.

IV. Summary of Stakeholder Input

In addition to feedback provided during the June 2003 partner meeting, EPA received written comments from a number of ENERGY STAR partners and other industry stakeholders. The key comments are summarized below, along with EPA’s response:

DURABILITY

- In general, those who commented on this issue supported EPA’s efforts to enhance the durability of qualified products through lamp standardization and associated reporting requirements. A number of the stakeholders shared EPA’s concerns about the quality of the products carrying the ENERGY STAR.
- Overall, stakeholders supported EPA’s efforts to allow only standardized bases into the program, as consumers may face difficulties in replacing proprietary bases.
- Some of the comments indicated concern that manufacturers would now be required to send fixtures to an independent laboratory for maximum ballast operating case temperature testing.

EPA Response

It was never EPA's intention to require manufacturers to have products tested for maximum ballast operating case temperature by a third party or NVLAP accredited laboratory. To address this concern, EPA clarified the testing requirement for maximum ballast operating case in *Table 3 – Reference Standards and Required Documentation* under "Maximum Ballast Operating Case Temperature for Optimal Performance" by including the following statement: "The laboratory test report may come from one of the following: 1) "In-house" fixture manufacturer laboratory; 2) lamp or ballast manufacturer laboratory; 3) third party independent laboratory."

- In general, stakeholders supported EPA's efforts to enforce this specification requirement by requesting test data from recessed and electronically ballasted flush mount ceiling fixtures. With regard to the test protocol used to generate the maximum ballast operating temperature, it was suggested that EPA clarify which test method should be used. Both the LRC test method and UL 1598 are listed, but these methods are not identical. The LRC method is based on UL 1598 but measures performance, rather than safety, and requires thermocouples to be placed in different locations.

EPA Response

EPA acknowledges that these two methods are not identical; however, both are acceptable testing methods as long as certain requirements are met. EPA will accept test data per UL 1598 when the thermocouple is placed at the hot-spot location indicated by the ballast manufacturer for performance. As suggested, a clarification is included in the Version 3.2 specification.

- A few of the stakeholders suggested that EPA postpone the revised date of the new Version 3.2 requirement so that the [manufacturers] have enough time to redesign the product and perform the maximum ballast operating case temperature test to qualify for ENERGY STAR.

EPA Response

The maximum ballast operating case temperature requirements are not new to the RLF specification. In fact, the requirements provided in Version 3.2 are identical to the requirements of the Version 3.1 document; EPA simply clarified that the required specification referred to maximum ballast operating case temperature for performance, not for safety. It is expected that all fixtures that have earned the ENERGY STAR already meet the maximum ballast operating case temperature requirements.

RECESSED DOWNLIGHT RETROFIT KITS

- A few of the stakeholders specifically voiced their support for the inclusion of recessed downlight retrofit kits in the ENERGY STAR program and the requirements proposed by EPA. However, two of the comments also included requests that EPA remove the language in the definition section of the specification that requires pigtail connections to be non-reversible. These stakeholders believe that reversibility is an important consumer consideration because unlike other fixture types, a non-reversible recessed can requires replacement by an electrician.

EPA Response

EPA is pleased by the industry support regarding recessed downlight retrofit kits in the ENERGY STAR program and shares industry concerns regarding reversibility. As a result,

the language included in the definition for “pigtail” that required pigtail connections to be non-reversible was removed.

- One of the comments received by EPA disagreed with the proposed “Fixture Lumen Output” requirement for recessed downlight retrofit kits, stating that by holding the fixture to 900 Lumens or greater it would be problematic for many residential applications, hindering the designers from doing their job. The stakeholder further stated that it was not appropriate for a standard to attempt to dictate product design.

EPA Response

After considering these design implications, EPA decided to remove the “Fixture Lumen Output” and “Fixture Efficiency” requirements for recessed downlight retrofit kits. EPA feels that since these are new requirements, it is more appropriate to consider them when the specification is fully revised.

LAMP LIFE

- In general, stakeholders supported the 10,000-hour lamp life requirements, although some had concerns with the lack of data required to substantiate these life claims. Some of the stakeholders asked that EPA request test results from a random group of qualified products to ensure that they are fully meeting this component of the specification. If a problem were to be discovered through this data request, then EPA could collect test data from all qualified products in the future.

EPA Response

EPA appreciates this concern and would like to assure all stakeholders that lamp life test data has been requested from several manufacturers. To date, all of the lamps undergoing testing continue to operate. EPA will continue to request this information from manufacturers on a case-by-case basis.

UNIT SHIPMENT DATA

- As is required under the partner commitment section, all ENERGY STAR partners agree to provide unit shipment data to EPA on an annual basis. Many of the regional stakeholders felt that this information continues to be extremely valuable in tracking program market impacts and urged EPA to share the data with efficiency programs, as appropriate.

In addition, these stakeholders suggested that EPA increase the frequency of data submission to a bi-annual basis, which would be consistent with the proposed CFL specification. To the extent that state-level data is available, it would also be extremely beneficial in informing the on going planning of state-wide and regional efficiency programs, and should be pursued by EPA.

EPA Response

While manufacturer-specific data is not published or shared outside of EPA, aggregated data may be shared with other energy efficiency programs to assist in their program evaluation efforts.

The reporting of unit shipment data is still a relatively new requirement and therefore, EPA does not think it is appropriate to request this data more frequently than once per year. As

manufacturing partners become more accustomed and comfortable with the reporting process, EPA may consider increasing the reporting frequency to a bi-annual basis.

OUTDOOR

- Data from an on-going lighting program in New England has shown that photocells are a contributor to higher than average failure rates for ENERGY STAR qualified fixtures.¹ Specifically, fixtures with photocells were found to have a 12.2% return rate, significantly higher than the 5.7% return rate of fixtures without photocells. Some of the stakeholders have concerns about products with photocells and would like EPA to investigate the issue further.

EPA Response

EPA appreciates this concern and is interested in receiving periodic updates from industry regarding failure rates. Conducting the necessary research into these claims goes beyond EPA's original intention, which was to amend and clarify, not revise, the specification requirements. However, EPA will continue to monitor the situation and, given continued interest, will consider addressing this issue in future specification revisions.

CORRELATED COLOR TEMPERATURE (CCT)

- Many of the regional stakeholders recommended that EPA work in coordination with the Department of Energy (DOE) to develop an improved measure of CCT. The Lighting Research Center has provided DOE with a proposal requiring reporting of chromaticity coordinates using a 4-point MacAdam ellipse as tested by ANSI C78-376-1996. A recommendation was made to consider this new method for reporting CCT, and to include new requirements in future versions of the specification.

EPA Response

EPA agrees that there is value in considering the Lighting Research Centers' proposal to require reporting of chromaticity coordinates using a 4-point MacAdam ellipse as tested by ANSI C78-376-1996. EPA will continue to participate in discussions with both DOE and industry members on this topic moving forward.

V. EPA Rationale for Specification

EPA uses a consistent set of criteria in the development and revision of specifications for ENERGY STAR qualified products. These criteria guide EPA in its decision making and help EPA ensure that the ENERGY STAR will continue to be a trustworthy symbol for consumers to rely upon as they purchase products for the home or business and so that their purchases will deliver substantial environmental protection. These criteria include:

- Significant energy savings and environmental protection potential on a national basis;
- Product performance is maintained or enhanced;
- Qualified products will be cost-effective to the consumer and manufacturer;

¹ Documented in "An Examination of the Performance and Acceptance of Compact Fluorescent Bulbs and Fixtures in the Residential Market" by Brad Steele. Presented at the 2002 ACEEE Summer Study in Residential Buildings.

- Efficiency can be achieved with several technology options, at least one of which is non-proprietary (i.e., not exclusive to proprietary technology);
- Product differentiation and testing are feasible; and
- Labeling would be effective and recognizable in the market.

Below EPA addresses the Version 3.2 Specification relative to each of these criteria.

- *Expected Energy Savings and Environmental Benefits.* EPA believes that this amendment ensures the energy savings and quality that consumers have come to expect from ENERGY STAR qualified light fixtures. Furthermore, the addition of recessed downlight retrofits provides the opportunity for additional nationwide energy savings. According to data collected by Pacific Northwest National Laboratory (PNNL), recessed downlights are one of the most popular residential fixtures. In fact, PNNL states that multiple sources estimate that greater than 350 million recessed downlights are installed in American homes and only 0.44% are fluorescent. EPA estimates that if just one percent of the 350 million recessed cans currently installed in American homes were retrofitted with ENERGY STAR qualified recessed cans then approximately 219,100 mWh would be saved annually. (See Table below for assumptions used in this analysis.)

According to one manufacturer of recessed downlight retrofits, their target market is six-inch cans, which typically use a 75-watt incandescent bulb. A retrofit could be used to replace the 75-watt incandescent bulb with a 26-watt compact fluorescent pin based lamp. See the energy savings example, provided in the table below, for a single downlight retrofit using these lamp wattages:

Recessed Downlight Retrofit Kit Energy Savings Potential

	One 75W Inc. Lamp	One 26W CFL Lamp	Results	
Maintained Lumens*	1220	1530	25%	increase in light levels**
Energy Used (Watts)	75	26	49	watts saved
kWh	96	33	63	kWh saved
\$/kWh	\$8.05	\$2.79	\$5.26	Saved per year***

* Philips Lighting catalog data for 75W A19 Frost.

** Bare bulb comparison does not include ballast losses.

*** Assumes light is on 3.5 hours per day and electric rate of 8.4 cents per kWh.

- *Product Performance is Maintained or Enhanced.* EPA believes that the added durability requirements (ANSI lamp standardization) in combination with the existing minimum requirements provided in the Version 3.2 specification will not only maintain, but enhance product performance for the following reasons:
 - Standardization is one way in which fixture manufacturers can make sure the lamp and ballast being used in their fixtures are compatible.
 - Standardization provides fixture manufacturers the information needed to select or design a ballast that will operate the lamp. EPA also believes that the requirements will also

make sure the fixture manufacturers understand the relationship between lamp and ballast in the fixture.

- Adding the ANSI lamp base standardization requirement will ensure non-proprietary lamps are used, reducing the number of pin configurations making it easier for the consumer to find replacement lamps.
- *Cost-effectiveness.* While consumers will pay more upfront for ENERGY STAR qualified light fixtures, the savings achieved by the fixture will typically cover this initial cost within the first five years of use. Paybacks will vary depending on hours of use, electricity rates, wattage replaced, and cost of fixtures. However, using the recessed can example shown in the table above, the cost of a typical retrofit kit is \$37.90; this initial cost would be recovered in approximately 7.2 years.

EPA believes that the changes to Version 3.2 specification are easily attainable without increased cost to the manufacturer. No additional testing procedures have been added that require third party or NVLAP accredited documentation.

- *Several Technology Options.* The Version 3.2 specification, like all previous versions, differentiates products based on performance not technology. EPA continues to believe that there are several technology options, all of which are non-proprietary, that exist for improving the energy performance of residential light fixtures. In fact, part of the rationale for amending the specification to require ANSI standardized lamp bases is to reduce or eliminate proprietary technologies. Furthermore, industry, represented by the American Lighting Association (ALA) and the National Electrical Manufacturers Association (NEMA) joined forces to publish a matrix of lamps and ballasts that use non-proprietary technologies that fixture manufacturers can use when qualifying their products for ENERGY STAR.
- *Product Differentiation and Testing Procedure.* As was the case when EPA initially established ENERGY STAR efficiency criteria for residential light fixtures, product performance varies within a sufficient range to allow for meaningful differentiation to the consumer. The testing and documentation procedure developed for verifying residential light fixture performance continues to be effective. Strict ENERGY STAR performance requirements including efficacy, color rendition, instant on, no hum and a two-year warranty, continue to allow consumers to identify high quality fluorescent fixtures in the marketplace.
- *Labeling.* EPA believes the ENERGY STAR mark serves an important role in the marketplace due to the absence of any other objective basis for buyers to identify and manufacturers to promote highly efficient residential light fixtures. Examples of the impact made to date by ENERGY STAR qualified residential light fixtures are provided below:
 - There are more than 9,000 residential light fixture models that have earned the ENERGY STAR and over 60 partners participating in the program to date. Adding recessed can retrofits to the list of qualified products will provide even more qualified skus to this list.
 - ENERGY STAR qualified residential light fixtures are now sold in many different distribution channels, including showrooms, mass retailers, wholesalers, and e-tailers, which provides a number of opportunities for the ENERGY STAR mark to impact purchasing decisions in the marketplace.

- EPA is continuing to receive interest in ENERGY STAR residential light fixtures from manufacturers who want to join as partners and utilities that are looking to provide rebates and promote qualified models.

VI. Noteworthy Aspects of the Specification

- Recessed Downlight Retrofit Kits: Over the last year, EPA participated in discussions with stakeholders and conducted Internet, trade publication and other market and industry research to determine whether or not to include recessed downlight retrofit kits in the specification. Based on this research, industry interest, and the potential energy savings that this product type offers, recessed downlight retrofit kits are included in Version 3.2 as a qualifying product type in section 2, Qualifying Products.
- ANSI-IEC Lamp Standardization: Standardization is one way in which fixture manufacturers can make sure the lamp and ballast being used in their fixtures are compatible. In addition standardization provides fixture manufacturers the information needed to select or design a ballast that will properly operate the lamp. It should be noted that ANSI compliance does not reduce uncertainty as to premature failures or ensure that products will meet rated life.
- Maximum Ballast Operating Case Temperature Clarification: Research conducted by the LRC as well as anecdotal reports of premature failures from industry, retailers, and consumers, provided compelling evidence that heat is a likely cause of premature failure in fluorescent fixtures, especially ceiling flush mount and recessed applications. For this reason EPA decided to enforce the maximum ballast operating case temperature requirement that existed in Version 3.1 at the same time that this amendment process took place.

It should be noted that the maximum ballast operating case temperature requirements are not new to the RLF specification. In fact, the requirements provided in Version 3.2 are identical to Version 3.1 document; EPA simply clarified a few items. For example, this performance characteristic, referred to as “Maximum Case Temperature” in the Version 3.1 specification, was renamed in the Version 3.2 specification to “Maximum Ballast Operating Case Temperature for Performance” to clarify that this performance requirement refers to the maximum ballast operating case temperature for both performance.