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Proposed changes to requirements for approval of LED lighting products

POSITION PAPER

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Background

In the Victorian Energy Efficiency Target (VEET) scheme, light emitting diode (LED) lighting products are rapidly overtaking compact fluorescent lamps (CFLs) as the dominant technology in both commercial lighting upgrades (VEET Regulations, Schedule 34) and residential downlight replacement (Schedules 21C and 21D). As an emerging technology, there is a dearth of appropriate Australian standards and so it has been necessary to rely on international standards to ensure low-quality products are excluded from the scheme.

For LED lumen maintenance and product lifetime, VEET product analysts rely on the IES LM-80-08 standard, approved by the Illuminating Engineering Society of North America (IES) – generally known as LM-80 (the '08' refers to the year of approval). LM-80 has required NATA-accredited laboratories to test LED light sources (often referred to as chips, which create the light within the luminaire) at two temperatures.

The industry standard definition for the lifetime of an LED luminaire is the time expected for it to drop to 70% of its initial light output, known as L_{70} . This is calculated using the IES TM-21-11 method, which uses the LM-80 results for the chip within the luminaire, plus the temperature of the chip in the luminaire, determined by an in situ temperature measurement test or ISTMT (using the ANSI/UL 1598 standard) to interpolate between the two LM-80 temperatures. If the chip operating temperature determined using the ISTMT is above the highest LM-80 test temperature, then TM-21 cannot be used to calculate the L_{70} estimated lifetime of the luminaire, and to do so requires the LM-80 to be redone at a temperature above that found in the ISTMT.

The rationale for this approach is that the relatively expensive and time-consuming LM-80 lifetime testing of the chip can then be applied to individual luminaires which use that chip by using the TM-21 methodology and the ISTMT, which is specific to each luminaire but relatively inexpensive and of short duration.¹

Discussion

The current approach used in VEET was introduced approximately two years ago. It uses LM-80 and TM-21 without an ISTMT – using the higher LM-80 test temperature result as the input to TM-21, yielding a 'worst case' L_{70} . At that time, the ESC was advised that a reliable standard for ISTMT tests did not exist. It was also considered that requiring LM-80 for the LED chip would ensure luminaire manufacturers had adequate control of their supply chain and therefore of their luminaire design. The combination of these two considerations lent weight to the decision to require only LM-80 for the LED chip, without the need to provide an ISTMT linking the LM-80 chip lifetime directly to the luminaire.

The situation has now changed in two ways. Firstly, the ESC's advice now is that a reliable ISTMT methodology exists, which is in wide use in North America and elsewhere. Secondly, the wide use of

¹ An alternative is a new standard, called LM-84, which basically applies the LM-80 rigour to each luminaire rather than to the chip, which can be a component in many luminaires. The disadvantage of this method is that the relatively expensive and time-consuming approach is required for every luminaire – hence this method is more expensive for very little extra accuracy and is therefore only likely to be used for very high volume luminaires unlikely to be subject to component changes.

this ISTMT, combined with the fact that LED chips can run at high temperatures in actual luminaires (significantly above the temperatures normally tested in LM-80) means that the lack of an ISTMT requirement for VEET approval is now a higher risk than it was two years ago. Adding the ISTMT requirement will reduce this risk and better align the ESC's assessment criteria with those used elsewhere.

Notwithstanding, adding an ISTMT to VEET product assessment requirements is a significant change. The methodology standards which are suitable may be unfamiliar to some Australian luminaire suppliers. Given these concerns, in 2014 the ESC undertook stakeholder consultation on this proposed change.

Options proposed in the 2014 consultation paper

The ESC's published documentary requirements for LED lighting product approvals under VEET already included an LM-80 test report. As stated above, relying only on an amended LM-80 standard does not provide the additional, and crucial, requirement of an ISTMT. This requirement is only included in US Energy Star and Department of Energy (DoE) guides.² The Energy Star guide requires only one temperature in the LM-80 test, while the DoE guide requires two temperatures – the same as a subsequent addendum to LM-80. The VEET product approval explanatory note was amended to refer specifically to the LM-80-08 addendum to avoid any confusion between it and the earlier version of LM-80, which required three temperatures at a single drive current.

Options proposed in the ESC's 2014 consultation paper included:

Option 1 – US Department of Energy approach – 2 LM-80 temperatures plus ISTMT

This option would reference the new LM-80-08 addendum and add the requirement for an ISTMT as described in the DoE methodology. This was considered the simplest and safest approach to achieve an accurate lamp lifetime extrapolation, as it added the ISTMT while maintaining the requirement of two temperatures in the LM-80 test, albeit allowing those two temperatures to be at different drive currents.

Option 2 – US Energy Star approach – 1 LM-80 temperature plus ISTMT

This option was to allow applicants to submit reports tested to the LM-80-08 standard, but at only one temperature and the additional requirement of an ISTMT as described in the Energy Star methodology. This was a higher risk option, as only one temperature would be required, but this risk of a less accurate lamp lifetime extrapolation was offset by the addition of the ISTMT requirement.

Option 3 – Amended LM-80-08 only – 2 LM-80 temperatures and no ISTMT

This option would simply reference the new LM-80-08 addendum, with no additional requirement for an ISTMT. This would be the highest risk approach, as it would rely only on chip temperatures in isolation from the luminaire and was least likely to ensure an accurate lamp lifetime extrapolation.

² Please note that these guides cover a wider range of issues than those addressed in this position paper.

The ESC preferred Option 1, as it was lower risk (two LM-80 temperatures) with the addition of an ISTMT test to link the LM-80 testing of the chip component with the luminaire as a whole. A majority of respondents also favoured adding the ISTMT requirement to the ESC product approval regime, provided an adequate transition period was given.

Following the consultation process, the option to reduce the number of temperatures required in the LM-80 from three to two, but without the additional requirement of an ISTMT, was implemented as an interim measure until such time as the future of the VEET scheme was determined. Subsequently, in 2015 the ESC obtained further expert advice about the various options. This further advice strongly supported the implementation of an ISTMT requirement as even more appropriate than it was a year ago, as a result of rapid industry development.³

The application of an ISTMT to LED lifetime determination, as used in the NSW Energy Savings Scheme (ESS) and elsewhere, were also discussed with industry experts. These related to specifying that the temperature and drive current used in the L_{70} calculation using LM-80 and TM-21 should be equal to or higher than those used in the ISTMT test. This extra safeguard partly reflects the additional rigour now part of ESS requirements (which specify the temperature only) and are designed to further reduce risk by more closely aligning the modelled lifetime with real world operating conditions expected for the luminaire. These additional requirements also make it more difficult for unscrupulous applicants to 'game' the tests by providing LM-80 and TM-21 results which appear to indicate a long lifetime for the luminaire, but are predicated on unrealistic assumptions of operating temperature and drive current.

A suitable transition period was also canvassed in the earlier public consultation. Submissions varied widely on this question but generally supported a six-month transition. This would mean that there would be no retrospectivity – all currently approved products would never need to provide an ISTMT. All new applicants could choose not to provide an ISTMT for six months but could do so if they wished. After the expiration of six months, all new applicants would be required to provide an ISTMT.

Proposed changes to apply from 1 July 2015

1. Subject to a transition period, LED lighting product applications to include an ISTMT as detailed in ANSI/UL 1598, with the additional requirement that the temperature and drive current used in the TM-21 report calculation of L_{70} must be equal to or greater than those used in the ISTMT test.
2. A six month transition period. Under this arrangement:
 - applications received before 1 July 2015 will be assessed using the current regime
 - applications received from 1 July 2015 to 31 December 2015 will be assessed with or without ISTMT data, and
 - applications received from 1 January 2016 will be assessed using the new regime only.

³ Additional issues canvassed, such as new the LM-82 and LM-84 tests, component changes and power factor questions, were either not supported or not seen as suitable for immediate implementation.

Next steps

Stakeholders are invited to comment on the proposed changes to requirements for the approval of LED lighting products. Comments should be received by no later than **Friday 12 June 2015**.

Submissions should be made via email to veet@esc.vic.gov.au and contain the following subject line: 'Changes to LED lighting approval requirements'.

Should you require further information, please contact Rod Woolley, Manager VEET, at rod.woolley@esc.vic.gov.au or 03 9032 1390.