

V5.1 testing constraints: Linear Ambient Products

Testing linear ambient products with a length greater or equal to five feet:

Under the SSL V5.1 Premium UGR requirement, a product family's highest total lumen output configuration, without consideration of the effect of color properties, must be tested in a goniophotometer. The DLC understands that conducting this testing may be difficult due to the size of the product. Due to this limitation, **linear ambient products with a length greater than or equal to five feet** may deviate from the published requirement that "the multiplier field in .ies files shall be 1.0 and cannot be scaled," by following the requirements and procedure below:

- Products with a length equal to or greater than five feet must be submitted in a family with equivalent shorter products that can be tested in a goniophotometer.
 - Equivalent shorter products are defined as products whose cross-sectional distribution is equivalent to that of the 5+ foot configuration at issue. The configuration at issue is the configuration that would be tested to demonstrate compliance with the UGR requirement, were there to be no testing constraints.
 - Families that do not contain equivalent shorter products must follow the testing constraints procedure described in the [V5.1 Technical Requirements](#).
- A full LM-79/color report must be provided for the 5+ foot configuration at issue and must be conducted strictly according to LM-79, with no scaling. This is anticipated to be an integrating sphere test.
- A full LM-79/color report and a full LM-79/distribution report must be provided for the equivalent shorter product.
- A full LM-79/distribution report must be provided for the 5+ foot configuration at issue, and must contain:
 - Electrical characteristics from the full LM-79/color report of the 5+ foot configuration at issue.
 - Luminous intensity distribution (candela array) derived from the goniophotometer testing of the equivalent shorter product and a multiplier whose value is the lumen output result of the full LM-79/color report of the 5+ foot configuration at issue divided by the lumen output result of the full LM-79/color report of the equivalent shorter product. The luminous surface

information in the .ies file must be reflective of the 5+ foot configuration at issue.

If using this alternative method, data from scaled .ies files will not be shown on the QPL as tested data. The equivalent shorter product will be listed on the QPL as a parent product with tested data from the equivalent shorter product's .ies file shown on the QPL.

The DLC reserves the right to seek clarification on any aspect of the process described above and manufacturers should be prepared to provide documentation that addresses concerns that arise.

Alternative testing for linear ambient luminaires with indirect components

The DLC understands that for **linear ambient luminaires with indirect components**, complying with the full LM-79/distribution report requirements under the [V5.1 Testing Requirements](#) may not be feasible due to testing burden.

For most products, distribution changes cannot easily be scaled. Developing engineering logic to estimate light distribution can require sophisticated ray-tracing lighting software, which also has some technical limitations. Additionally, small, seemingly insignificant changes to optics can have large impacts to the light distribution. This uncertainty informed the DLC requirement that all unique optical variations are tested and a full LM-79/distribution report is provided during the submission process.

Linear ambient luminaires with indirect components can represent an exception to this rule because simple engineering logic can be used to estimate certain distribution changes. For these products, lumen output can differ for the direct and indirect components individually, which can cause differences in the overall luminaire light distribution. Since lumen output can be easily and accurately scaled, these types of distribution changes can also be scaled accurately.

Due to the V5.1 testing burden and confidence in the ability to scale certain distribution changes, linear ambient products with direct and indirect lighting components can, but are not required to, deviate from the requirement that “the multiplier field in .ies files shall be 1.0 and cannot be scaled” by following the requirements and procedure below:

- a. A completed [Linear Ambient with Indirect Component Distribution Performance Summary Excel file](#) must be provided, containing all models to be qualified.
 - Please reference the “[Understanding Unified Glare Rating \(UGR\)](#)” on the [V5.1 resources page](#) for any confusion about the metric, in particular the process to evaluate UGR on bi-directional or uplight-only luminaires.

- As opposed to the typical UGR evaluation required under V5.1, worst-case analysis conducted using the procedure described herein must take into account the effect of color properties.
 - As a reminder, worst-case UGR configuration is based on the overall worst-case UGR when looking at all UGR crosswise and endwise values.
- b. A detailed description of the scaling methodology used to generate the estimated zonal lumen density and UGR values (if included) must be included in the distribution performance summary Excel.
- The recommended method for scaling is as follows:
 - LM-79 sphere tests to be conducted at each lumen output option for downlight and uplight individually at a single optic, CCT, and CRI configuration.
 - Based on this testing, generate a factor to apply to estimate lumen output based on the change of lumen package.
 - This testing will also provide the wattages for each lumen package, which, in general, does not change significantly based on color characteristics or optics.
 - LM-79 sphere tests to be conducted with each distribution pattern at a single lumen package, CCT, and CRI combination.
 - Based on this testing, generate a factor to apply to estimate lumen output based on optical changes.
 - LED manufacturers can provide factors to apply to estimate lumen output based on CRI or CCT changes.
 - Goniometer testing must be conducted on each unique direct and each unique indirect distribution pattern. This testing is not only recommended to scale performance data, but is also required to submit applications using this method.
 - The lumen output factors for lumen output option, distribution pattern, CRI, and CCT can then be applied to the .ies files to estimate the lumen output, wattage, efficacy, ZLD, and UGR for all configurations.
 - For configurations with uplight and downlight, the scaled .ies file for the product with only the downlight energized can be combined with the scaled .ies file for the product with only the uplight energized to output a bi-directional .ies file.

- The DLC does not require the use of this scaling methodology; however, other scaling methods will undergo increased scrutiny during the review process.
- c. A full LM-79/distribution report must be provided for each unique direct distribution pattern at any lumen output in isolation (that is, with the indirect component de-energized).
- d. A full LM-79/distribution report must be provided for all unique indirect distribution patterns at any lumen output in isolation (that is, with the direct component de-energized).
- e. Full LM-79/distribution reports must be provided for the worst-case configurations (UGR, if applicable, and zonal lumen density) with only the direct component energized.
- f. Full LM-79/distribution reports must be provided for the worst-case configurations (UGR, if applicable, and zonal lumen density) with only the indirect component energized.
- g. Full LM-79/color reports must be provided for the worst-case configurations with both direct and indirect components energized.
- h. Full LM-79/distribution reports must be provided for the worst-case configurations containing:
 - Electrical characteristics from the full LM-79/color reports with both direct and indirect components energized.
 - Luminous intensity distribution (candela array) derived from a combination of the direct and indirect distribution reports.
 - .ies file with distribution information derived from a combination of the goniophotometer testing of the direct and indirect LM-79/distribution reports, a lumen output multiplier whose value is the lumen output result of the full LM-79/color report of the worst case configuration, and a luminous area reflective of the direct component of the worst-case configuration.

If using this alternative method, data from scaled .ies files will not be shown on the QPL as tested data.

The DLC reserves the right to seek clarification on the any aspect of the process described above and manufacturers should be prepared to provide documentation that addresses concerns that arise.