Family Grouping Application Requirements for LED-based Horticultural Lighting

Version 2.0

Effective Date: March 31, 2021

The DLC allows family grouping applications for horticultural lighting products starting with the V2.0 Technical Requirements effective date (March 31, 2021). Family grouping applications are designed to reduce the total testing and application fees required to list groups of products that comply with the family grouping definition. Typically, parent products are based on tested data from worst-case models within a family group, and child products are based on reported data. Generally, limited testing can be provided if the worst-case models demonstrate compliance with the Technical Requirements.

Family grouping application eligibility, testing, and application guidance are described below. For additional information on the Technical Requirements, please review the V2.0 Testing and Reporting Requirements for LED-based Horticultural Lighting.

Family Grouping Application Eligibility

To submit a family grouping application, a product family must meet the following definition:

- A family may contain a single LED package/module/array, a standardized set of LED packages/modules/arrays, and/or variations in standardized sets of LED packages/modules/arrays.
    - Families comprised of different models that correlate to fixture-level variations of spectral distribution will be grouped in spectral sub-groups.
        - Spectral sub-groups are defined as distinct product offering spectrum variations within the family. This is commonly shown on specification sheets as a “light color” or “spectrum” options.
    - Child products are required to emit the same relative Spectral Quantum Distribution (SQD) as a representative parent. If not the same relative SQD, a separate spectral sub-group is required.
        - The DLC acknowledges that different lumen packages, optics, etc. can cause small changes to SQD. These variations do not typically result in different

spectral sub-groups. However, differences that result from changes to specific LED type, relative quantities of LEDs, etc., do specifically require spectral sub-groups or separate family grouping applications.

        - To limit testing burden, SQD images generated from parent-level spectral data will be used to represent child products.

    - Products employing multiple types of LEDs – that is, those that are not dual-sourcing and/or utilizing 'equivalent' LEDs – are eligible, so long as the construction, types, and quantities of the LED packages/modules/arrays are documented.

        - An LM-80, ISTMT, and TM-21 projection is required for each type of LED present in the product. As per normal testing rules, ISTMTs should measure the applicable temperature measurement point (TMP) and must be conducted on the hottest LED of each type.

        - Each LED must demonstrate the required $Q_{90} \geq 36{,}000$ hours, with exceptions noted in the Testing and Reporting Requirements for LED-based Horticultural Lighting V2.0 policy.

        - If variable numbers of LEDs are dynamically chosen, and therefore the precise construction of any given product is not defined, the products are not eligible for family grouping applications. Policy development for appropriate evaluation of this type of product is under consideration.

    - Products employing varying output channels beyond simple, single-axis dimming of the whole product (i.e. spectrally-tunable products) are eligible so long as testing and reporting requirements as described in the "Special Considerations for Spectrally-Tunable Devices" subsection of the Testing and Reporting Requirements for LED-based Horticultural Lighting V2.0 policy are satisfied.

- The family must demonstrate scalability or modular use of the identical LED packages/modules/arrays, electronics, optics, heat sinking, and any other applicable features employed in the fixture.
- Provided that the impact on performance is well understood and explained by the applicant, other design parameters and components, such as electronics, optics, heat sinking, and other performance-affecting and non-performance-affecting features, are typically allowed to vary. The DLC reserves the right to request additional information confirming that these features do not affect performance.
- A family may contain multiple driver variations as well as different LED drive currents achieved by a programmable driver. Please refer to the testing requirements for fixtures with multiple drivers described in the Testing and Reporting Requirements for LED-based Horticultural Lighting V2.0 policy for specific instructions.
- The overall physical fixture housing and assembly of the fixtures in the family group must be of identical material and construction, and may only differ in overall physical dimensions for different models within the grouping.

- A family may contain variations in fixture mounting systems provided that the mounting systems do not change thermal management characteristics.
- In all application submissions, manufacturers must list full and complete model numbers that clearly demonstrate all fixture options offered in the family grouping.
    - "Full and complete model numbers" means model numbers that include all performance-affecting and non-performance-affecting variations offered, and which do not omit any option that is available to customers in the market. In general, options that do not affect the performance of the fixture can be submitted as a single model number with multiple options bracketed in the model number.

      For example, a fixture that has multiple non-performance-affecting mounting options may include all mounting options in brackets (e.g. "[M1, M2, M3]"). Low and high voltage options may be submitted as a single model number (e.g. "ABC PAR [120V-277V, 347V-480V] M1") with the worst-case performance reported. Multiple or alternate drivers may also be listed in a single model number as long as the drivers perform nominally the same. If the alternate drivers perform nominally differently (that is, they are not presented to customers as having the same performance other than input voltage, and result in different ordering codes) then the unique drivers must be listed in separate model numbers. Options that affect photosynthetic photon flux (PPF) output, presence or lack of fans, dimming, or spectral tuning capabilities, etc. may not be bracketed and submitted as a single model number.
    - DLC reviewers may check web listings and other marketing materials and reserve the right to request additional information to document the full and complete model number. A lack of clarity in model numbers will result in delayed application processing. Misrepresentation of model numbers discovered outside the application process will generally be considered a violation of the DLC program rules and Logo and Trademark Use Guidelines.
    - Each model number may only represent the fixture under a single brand. If the fixture can be sold under multiple brands, model numbers must be listed separately for each brand.
- Decisions on whether a given group of fixtures are eligible to be submitted in the same family grouping application are at the sole discretion of the DLC. Variation in materials, designs that change the position of key components relative to one another, and other variations that, by the judgement of the DLC, have potential to cause differences in spectral, optical, electrical, or thermal performance, will not be allowed within the same family group or spectral sub-group, as appropriate.

Please review the V2.0 Testing and Reporting Requirements for additional policy clarifications and contact horticulture@designlights.org with any questions about submitting an application to the DLC.

Testing Family Grouping Products

The family grouping testing policy is designed to reduce testing burden as well as to reduce the total application fees required to list groups of horticultural products, as compared to listing products individually. By identifying the models with the worst-case performance within a family group, limited testing can be provided if the worst-case models demonstrate compliance with the Technical Requirements.

Testing Product Families under Technical Requirements V2.0

An example of the typical testing and reporting required under V2.0 for a family of products is provided in **Table 1**. Specific testing and reporting requirements for each of the Technical Requirements can be found in the corresponding sections of the V2.0 policy.

- As necessary, family groups are further separated into spectral sub-groups. In general, a product family application with configurations correlated to different spectral distribution variations will be required to report spectral sub-groups.
- Each family group or spectral sub-group, as applicable, requires testing and reporting for each of the criterion below. Descriptions of all the criterion in Table 1 (below) can be found in the guidance section that follows for each family and each spectral sub-group, as applicable.

Table 1: Worst-case Criteria Descriptions

Criterion	Which Model(s)	Test Required
Minimum PPF	Worst-case photosynthetic photon flux output variation	LM-79, including accompanying TM-33-18 document. Note: A single LM-79 report may fulfill several criteria
Minimum Photosynthetic Photon Efficacy (PPE)	Worst-case efficacy	
Photosynthetic Photon Intensity Distribution (PPID)	Each unique optical and distribution pattern	
Minimum Q_{90} Photon Flux Maintenance, Photosynthetic (PFM_p)	ISTMT at worst-case thermal conditions for each unique LED type LM-80 for each LED package/module/array as required for flux maintenance projection	ISTMT
		LM-80/LM-84
		TM-21/TM-28
Driver Lifetime	Worst-case driver temperature for each non-relatable driver	ISTMT
Fan Lifetime	Worst-case fan temperature for each unique fan	ISTMT

Power Quality: Total Harmonic Distortion – Current (THDi) and Power Factor (PF)	Worst-case performing driver	Benchtop Electrical Testing or LM-79

Testing Guidance for Technical Requirements V2.0

The following provides detail on the testing requirements for worst-case fixtures within family applications under the V2.0 Technical Requirements.

Minimum PPF Output

- The fixture in each family group and spectral sub-group (as applicable) that is expected to have the lowest overall photosynthetic photon flux output must be tested and an LM-79 report must be provided.
- In general, this is expected to be the fixture with the fewest number of LEDs, lowest drive current, and least efficient optic within the family group or each spectral sub-group (as applicable).

Minimum PPE

- The fixture in each family group and each spectral sub-group (as applicable) that is expected to have the lowest micromoles per Joule must be tested and an LM-79 report must be provided.
- When determining minimum PPE, manufacturers must demonstrate that they are factoring in all variations that will affect this metric, including light output (LED counts and drive current), optical efficiencies, driver and applicable operating conditions, and thermal effects.
- There are many factors that can influence efficacy. Manufacturers shall determine and justify the combination of factors that result in the worst-case efficacy of the family and each spectral sub-group (as applicable). The DLC reserves the right to ask for additional information to clarify or verify technical justification.
- If the family group or spectral sub-group contains multiple drivers, benchtop electrical testing must be provided documenting the fixture wattage at the applicable loading conditions and at the applicable input voltages for each driver. From this electrical characterization testing, the product and conditions representing worst-case efficacy must undergo formal LM-79 testing.

PPID

- All fixture variations that result in a different optical and/or distribution pattern in each family group or spectral sub-group (as applicable) must be tested. An accompanying TM-33-18 document and .jpg image must be provided for each PPID variation within the family group or spectral sub-group (as applicable). To facilitate time for accredited labs to develop or purchase TM-33-18 reporting software, the DLC offers a 9-month grace period for applicants to provide LM-63 and TM-27 (i.e. .ies and .spdx files, respectively) for parent products.

Minimum Q_{90} PFM_p

- To demonstrate compliance with the minimum Q_{90} PFM_p (Photosynthetic Photon Flux Maintenance) requirement, thermal testing must be conducted on the worst-case configuration within the family group or spectral sub-group (as applicable).
    - In general, this is expected to be on the fixture where the LED is operating at its highest temperature within the group. An ISTMT conducted on the hottest LED (for each LED type) in this hottest fixture must be submitted to support TM-21 projections for Q_{90} PFM_p.
- Worst-case thermal measurements are required for each family group or spectral sub-group (as applicable).

Driver Lifetime

- The family group must demonstrate that the driver(s) used in the family meet the driver lifetime requirements. An ISTMT of the driver(s) must be conducted on the worst-case fixture within the family and spectral sub-group (as applicable) and must be supplied along with the appropriate driver specification sheets showing TMP location and reliability under allowable operating temperatures.
- In general, the worst-case model is expected to be the highest wattage model within the family and spectral sub-group (as applicable).
- The ISTMT report must be conducted at the applicable TMP location on the driver for the fixture where the driver operating temperature is worst-case. The temperature at the tested TMP location must be equal to or lower than temperature noted on the driver specification sheet to predict a lifetime ≥ 50,000 hours.
- If multiple drivers exist within the family group or spectral sub-group, manufacturers are required to demonstrate which driver will result with the worst-case condition. Thermal testing for each non-relatable driver variation is required. In general, drivers are considered to be relatable if defined on driver specification sheets as being in the same series by the driver manufacturer. The DLC reserves the right to require thermal test data on each unique driver if rationale is not specific enough to demonstrate worst-case.

Fan Lifetime

- The manufacturer must demonstrate that the fan(s) used in the family group meet the fan lifetime requirements. An ISTMT of the fan(s) must be conducted on the worst-case fixture within the family and spectral sub-group (as applicable) and must be supplied along with the appropriate fan specification sheets showing TMP location and reliability under allowable operating temperatures.
    - In general, the worst-case model is expected to be the highest wattage model within the family and spectral sub-group (as applicable).
- The ISTMT report must be conducted at the applicable TMP location on the fan for the fixture where the fan operating temperature is worst-case. The temperature at the tested TMP location

must be equal to or lower than temperature noted on the fan specification sheet to predict a lifetime ≥ 50,000 hours.

Power Quality (THDi and PF)

- Electrical testing must be provided for the fixture that is expected to have the worst-case THDi and PF in the family group or the spectral sub-group (as applicable).
    - In-house (i.e. non-accredited lab) testing is allowed.
- In general, this is expected to be on the fixture with the driver with the worst-case loading and output condition. In situations where there is more than one driver in the group or spectral sub-group, in-house testing is needed to demonstrate that the worst-case driver, loading condition, and input voltage have been selected for testing.
- For each unique driver used within a family group or spectral sub-group, manufacturers must provide electrical testing to demonstrate which driver variation will result in the overall worst-case metrics identified.
- The testing should include the input voltage, current, and wattage; the output voltage, current, and wattage; and the THDi and PF, for the worst-case loading condition of each driver within the family group or spectral sub-group (as applicable). This information should be factored into the scaled performance methodology and identification of worst-case efficacy and power quality.