City of San José
Innovative LED Streetlight Replacement

Phase 2: RFP 15-16-01
Full Proposal

March 30, 2016

PHILIPS

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This data furnished pursuant to this proposal shall not be disclosed outside the City procurement team, be duplicated, or used in whole or in part, for any purpose other than to evaluate the offer, provided that, if a contract is awarded on the basis that offer, the City shall have the right to use and disclose this data for all purposes in connection with the execution and fulfillment of such contract.

This notice does not limit the City's right to use information contained in this proposal if it is or has been obtained by the City from another independent legitimate source.

1.0 Cover Letter (RFP 11.2.1.)

Philips Lighting North America Corporation is pleased to submit Phase 2: RFP 15-16-01, Innovative LED Streetlight Replacement full proposal. San José is among the first to advance a strategy to connect the intellectual resources of the Valley to upgrade infrastructure through a connected lighting strategy making the city brighter, safer, more energy efficient, and smarter. It increases network capacity to foster entrepreneurism, it leverages infrastructure as an asset not only as a liability, and it makes better use of energy resources and helps to enhance the quality of life in Silicon Valley.

The City has already shown its confidence in Philips by awarding Philips a technology demonstration project approved unanimously by the City Council on February 24, 2015. We are proud to have this project be a part of the Vision Zero San José initiative in the City's Technology Innovation Zone (TIZ), as it represents two years of working together to develop a public private partnership for the deployment of the Philips connected city experience (CCE) smart pole program. Our proposal is based upon an enhancement and expansion of the CCE demonstration project and is designed with the following considerations:

- Accomplishing an LED conversion of the City's streetlights, including controls for all four zones combined with the installation of Philips smart poles within city boundaries with no capital outlay.
- Offering similar versions of our proposed solution that are being implemented successfully in San José and Los Angeles, CA; and ongoing lighting projects in major cities throughout the world.
- Advancing the San José Green Vision goals under our fully compliant proposal approach.
- Meeting the designated time frame of this RFP by implementing the Philips proposed solution
- Acknowledging no known legal or policy hurdles that would affect our proposal.
- Avoiding personal privacy issues by not using data analytics or attempting to monetize data collection from sensors, cameras or other methods.

To accomplish these goals, we have assembled a team of globally recognized technology companies and San José-based market leaders. This prospective team, led by Philips, is comprised of Ericsson, Lumileds, Rosendin Electric, PG&E, Santa Clara County IBEW/NECA and the WMH Corporation. We have a proven record of working together with more than 400 years combined experience. We have local knowledge of the City's infrastructure, as well as the global knowledge needed to implement complex projects in real world environments. It is our desire to strengthen our existing partnership with the City. We propose an innovative concept that provides multiple community benefits and the means to achieve the City's ultimate goal of converting the remaining 40,000 streetlights across all four zones to LEDs with no capital outlay.

Recognizing the City of San José as a municipal leader in technological advancements, it makes perfect sense to partner with Philips, the global leader in lighting technologies for your Innovative LED Streetlight Replacement project. We are available at your convenience to discuss our proposal in more detail.

Sincerely,

Amelia A. Huntington, President
200 Franklin Square Dr.
Somerset, NJ 08873
Phone: (732) 563-3474
Fax: (732) 563-3500

2.0 Executive Summary (RFP 11.2.2.)

Philips' proposal delivers the highest and best value with proven implementation as we outline below. Philips is proud to be a current Smart City partner advancing Mayor Liccardo's Smart City vision.

> *"At little capital cost, and by leveraging the innovation for which this Valley has become globally renowned, we can implement a solution that leaves San José wealthier, better connected, and safer."*
> *Mayor Sam Liccardo,*
> *Vice-Mayor Rose Herrera and Councilmember Ash Kalra*
> *Recommendation to Council – February 20, 2015*

The City of San José has the ability to convert, with no capital outlay, the remaining 40,000 streetlights with the approved Philips LED RoadFocus cobra head, decorative luminaires, and an Owlet wireless control system. The conversion also includes an enhanced citywide deployment of Philips smart poles to enhance coverage and extend the existing 4G LTE wireless broadband service to businesses, visitors, and residents. Philips smart poles discreetly house FCC certified mobile network operator equipment, enabling an alternative and attractive deployment methodology of "Small Cell" 4G LTE broadband services and future standards.

The City's infrastructure will dramatically improve, achieve significant energy savings, reduce operation and maintenance costs, reduce light pollution, support sustainable design, and enhance mobile data access at service levels not previously possible. The concept is designed to declutter the cityscape, while using a standard deployment methodology with a uniform planning and permit processing.

Proposed Approach

On October 1, 2015, the City of San José issued permits for installation of the first cluster of 14 Philips smart poles and 287 Philips RoadFocus luminaires that were fully deployed by November 30, 2015. Our proposed solution presented below is based on the last 28 months of collaborative work with numerous City staff in multiple departments. Our recommended approach augments the current project to all four zones deploying additional Philips smart poles throughout San José's city limits. In addition to the lighting conversion, Philips has collaborated directly with PG&E to develop a pioneering, fully integrated wireless electric metering solution for the Philips smart poles that allows for accurate tracking and billing of electrical usage.

Wireless Lighting Controls Approach

To remain compliant with the RFP requirements, Philips submits this response using Schreder's Owlet controls system on the remaining 40,000 streetlights.

Community Benefit

In addition to the benefit received directly from the lighting and controls system, Philips is committed to generating local community benefits. We have designed a program with the Santa Clara County IBEW/NECA to generate jobs for San José residents linking qualified graduates of the City's Work2Future's "Trades Orientation Program" (TOP). This progressive approach is fully aligned with the Work2Future's goal: ***"To strengthen the economic base in San José and Santa Clara County by increasing employment opportunities and job retention for all residents."***

Overall Proposal Valuation

With no capital outlay by the City, Philips estimates the value of our proposal at approximately $105.2 million. The project will be funded by a combination of energy and operational savings, utility incentives, and rental income from Philips smart poles. The Philips smart poles are transferred to the City at the end of the agreed term. To deliver increased benefit to the City, we are investigating project enhancements including the possibility of making available to the City two strands of fiber for noncommercial use.

Project Team

Philips Lighting is the world's largest and most capable lighting company. As the global market leader with recognized expertise in the development, manufacturing, and application of innovative lighting solutions, Philips is uniquely qualified to deliver an innovative LED streetlight replacement to the City. Philips has organized and will lead a project team (Figure 1) with the ability, knowledge, and strong connections to the City of San José local work force to complete a citywide LED conversion within the timeframe of the RFP.

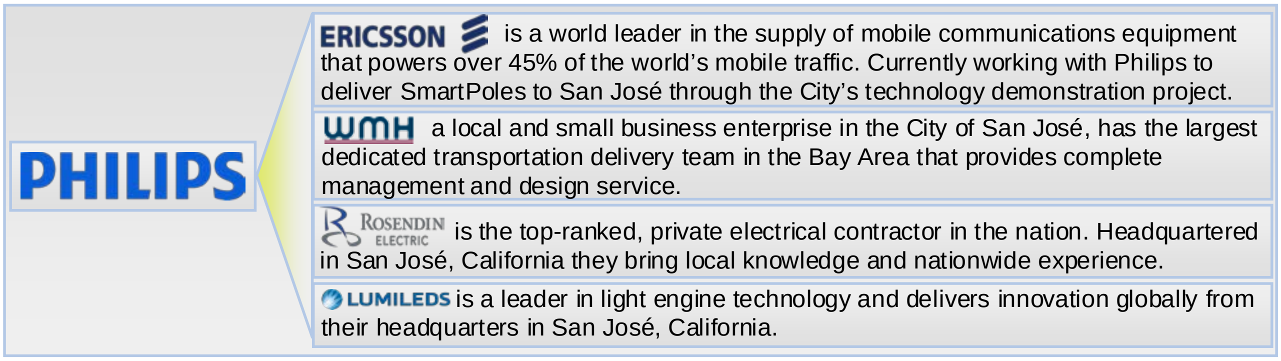


Figure 1. Team Philips Innovative LED Streetlight Replacement

Supporting City Staff

Our proposal includes a dedicated Philips project manager responsible for assisting the City to ensure that the project is efficiently and effectively implemented. Philips continues to demonstrate our responsiveness to the City staff thorough the CCE pilot. For the past 28 months, Philips has diligently worked with the City to negotiate a Master Installation Agreement, develop and implement a specialized public outreach policy, and create a streamlined cluster permit methodology. Philips commits to continuing this support as demonstrated by our ongoing ability to provide the City with improved electrical infrastructure records.

Forward Thinking

Philips' innovative approach has the potential to unlock millions of dollars of investments, which underpin an infrastructure build-out that enables new viable technology such as the Connected Car and other Internet of Things (IoT) solutions. The Philips solution directly provides:

- local jobs;
- fosters economic development; and
- can help create a greater feeling of safety for the public with state of the art municipal lighting.

As an option to our submitted proposal, Philips has developed an innovative enhancement offering which includes:

- Replacement of the existing 40,000 luminaires with LED;
- installation of up to 1,000 smart poles over a 5 to 8 year period;
- making available to the City two strands of fiber for noncommercial use; and
- replacement of existing Owlet controls with state of the art CityTouch connected node, wireless and self-commissioning controls on all luminaires. The CityTouch system, a simpler, more reliable controls system would deliver greater overall value to the City.

This innovative approach could serve as the backbone of a Smart City platform for the future of San José. This strategy will create many economic and social benefits for the City and bring millions of dollars in infrastructure upgrades. As with the submitted compliant proposal, this alternative solution would be implemented with no capital outlay.

At the City's availability, we are eager to discuss our alternative solutions in greater detail.

3.0 Proposal Checklist (RFP 11.2.3.)

ATTACHMENT A
Proposal Checklist (REQUIRED)

The Proposal Checklist is required for all proposers. It is intended to assist you in determining if you have included all items in your proposal response.

Required Items for All Proposals Unless Noted
☒ Attachment A, Proposal Checklist
☒ Cover Letter (See Section 11.1)
☒ Executive Summary (Section 11.2), maximum of two pages
Project Team (Section 11.4) ☒ Management Plan – 11.4.1 ☒ High Level Project Plan with timeline – 11.4.2 ☒ Key Personnel Assignments/Responsibilities - 11.4.3 o Organizational Chart with reporting structure – 11.4.3.1 o Key personnel with job titles and project manager – 11.4.3.2 ☒One Page Resume for each Key Personnel – 11.4.4 ☒Contractor or Installation Partner documents (if applicable) – 11.4.6 o Contractor/Installation Partner's Key Personnel Assignments/Responsibilities o Contractor/Installation Partner's Organizational Chart with reporting structure o Contractor/Installation Partner's Key Personnel with job titles and project manager o One Page Resume for each of Contractor/Installation Partner's Key Personnel ☒ Streetlight Design and Engineering documents (if applicable) – 11.4.5 o Streetlight Design/Engineering Key Personnel Assignments/Responsibilities o One Page Resume for Streetlight Design/Engineering Key Personnel
☒ Attachment B, Proposal Specifics Worksheet
☒ Attachment C, Proposal Valuation and Cost Form with Designated Responsible Parties
☒ Attachment D, Proposal Certification Form
☒ Attachment E, Project Team and Financial Background Information Worksheet
Attachment F, Previous Customer Reference Form ☒ Reference 1 Form ☒ Reference 2 Form ☒ Reference 3 Form Contractor/Installation Partner Customer References (if applicable, use Attachment F) ☒ Contractor/Installation Partner Reference 1 Form ☒ Contractor/Installation Partner Reference 2 Form ☒ Contractor/Installation Partner Reference 3 Form
☒ Attachment G, Environmentally Preferred Procurement Program (EP3) Information Sheet
☒ Response to Section 21, Exemplar Agreements (if applicable)

ATTACHMENT A
Proposal Checklist (REQUIRED)
CONTINUED

Required for Telecomm and Other Proposals Requiring Backhaul, Power, etc.
☒ Attachment H, Backhaul Specifications (if applicable)
☒ Attachment I, Power Specifications (if applicable)
☒ Attachment J, Telecommunications Specifications (if applicable)
Required for Streetlight Installation Proposals
☐ Attachment K, Streetlight Control & Management System Specification Response Form
☒ Attachment L, LED Luminaire Specifications
☒ Product Sample Submissions per Appendix 3, Scope of Services for Streetlight Installation Proposals, Section 4, Product Sample Submission
Optional Attachments
☒ Attachment M, Local and Small Business Preference

4.0 Project Team (RFP 11.2.4.)

To ensure the seamless and swift execution of your Innovative LED Streetlight Replacement, Philips has assembled a team of local partners with extensive City knowledge. The Philips' San José project team has collaboratively prepared this response. Our team is fully apprised of the City's requirements, goals, timelines, and overall expectations. For San José, this means no downtime or learning curve to overcome in commencing your project.

4.1 Management Plan (RFP 11.2.4.1.)

Leveraging the recent success of our collaborative management plan with the City for the implementation of the Philips CCE smart pole pilot program, Philips recommends using the same approach for the Innovative LED Streetlight Replacement project. Philips and the City stakeholders jointly developed a standard deployment methodology with a uniform planning and permit processing. This proven approach provides for expedited planning, review, implementation, and enables the timely and successful completion of your LED streetlight conversion project by the December 2018 deadline.

Open dialogue and collaborative project management – Two teams, both comprised of City and Philips stakeholders, are available to meet on a regular basis to discuss progress and proactively address issues that may arise during the project. These project meetings promote project alignment and ensure the City's goals are being met throughout all project phases. Figure 2 shows the teams and objectives for regular meetings.

Figure 2. Teams and Objectives for Regular Meetings

Team	Member	Purpose
Project	City Manager's Office City Department of Transportation City Director of Engineering City Director of Planning Philips Lighting	Set Policy, establish direction for technical team, discuss contractual issues, and provide schedule inputs.
Technical	City Engineers City Department of Planning City Department of Zoning Philips Lighting	Technical review of submission, review of engineering drawings, permitting, and provide project reports.

Expedited permitting process – Philips and City staff jointly developed a cluster permit schedule process that will be followed during the citywide Innovative LED Streetlight Conversion project. The process allows for Philips smart pole permitting to be completed in under five weeks.

Reduced startup time – Philips' project plan delivers greater efficiencies to the City as we have an established, and successful, way of working with the City. This proven plan allows the City and Philips to commence project implementation without delay. We will continue to utilize the mutually agreeable cluster permitting process in accordance with the Philips smart pole pilot Master Installation Agreement. Figure 3 shows the cluster site license agreement application schedule.

Permit Review Process	Proposed Location List	90% Plans	Permit Set	Materials
Philips to provide information submittals	Verified smart pole locations	Responses to City comments and civil specification for construction (see Note 3)	Final check set (see Note 1)	Pole, luminaire, electrical materials, structural materials, etc. (see Note 2)
City review turnaround time, from receipt of complete submittals to return of comment	1 week	2 weeks	1 week	2 weeks (see Note 2)
Note 1: Permits will be issued after final Materials approvals. Note 2: Materials to be used in the project may be submitted for review before permit issuance, providing no major comments remain regarding materials. Note 3: Philips smart pole Foundation designs and Philips smart pole structural analysis approval have been approved by the City, and all per location permits shall refer to one of the approved Foundation designs and Philips smart pole structure approval.				

Figure 3. Cluster Site License Agreement Application Schedule

4.2 High Level Project Plan with Timeline (RFP 11.2.4.2.)

High Level LED and Controls Project Plan – Using the best practices and lessons learned from the smart pole pilot project, Philips recommends the high level LED and controls project plan shown in Figure 4.

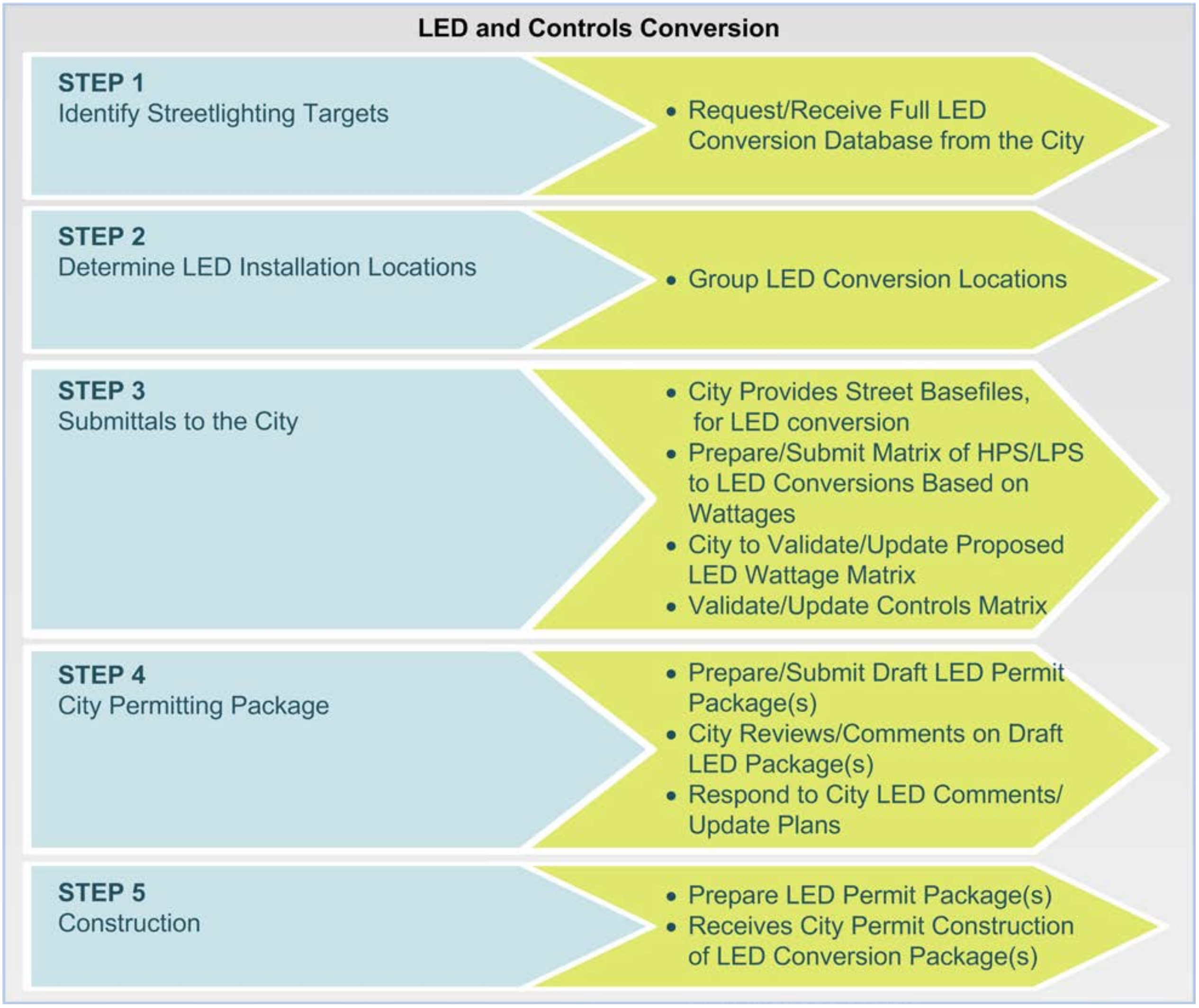


Figure 4. LED and Controls Conversion

High Level Smart Poles Project Plan – Using the best practices and lessons learned from the smart pole pilot project, Philips recommends the high level smart poles project plan shown in Figure 5.

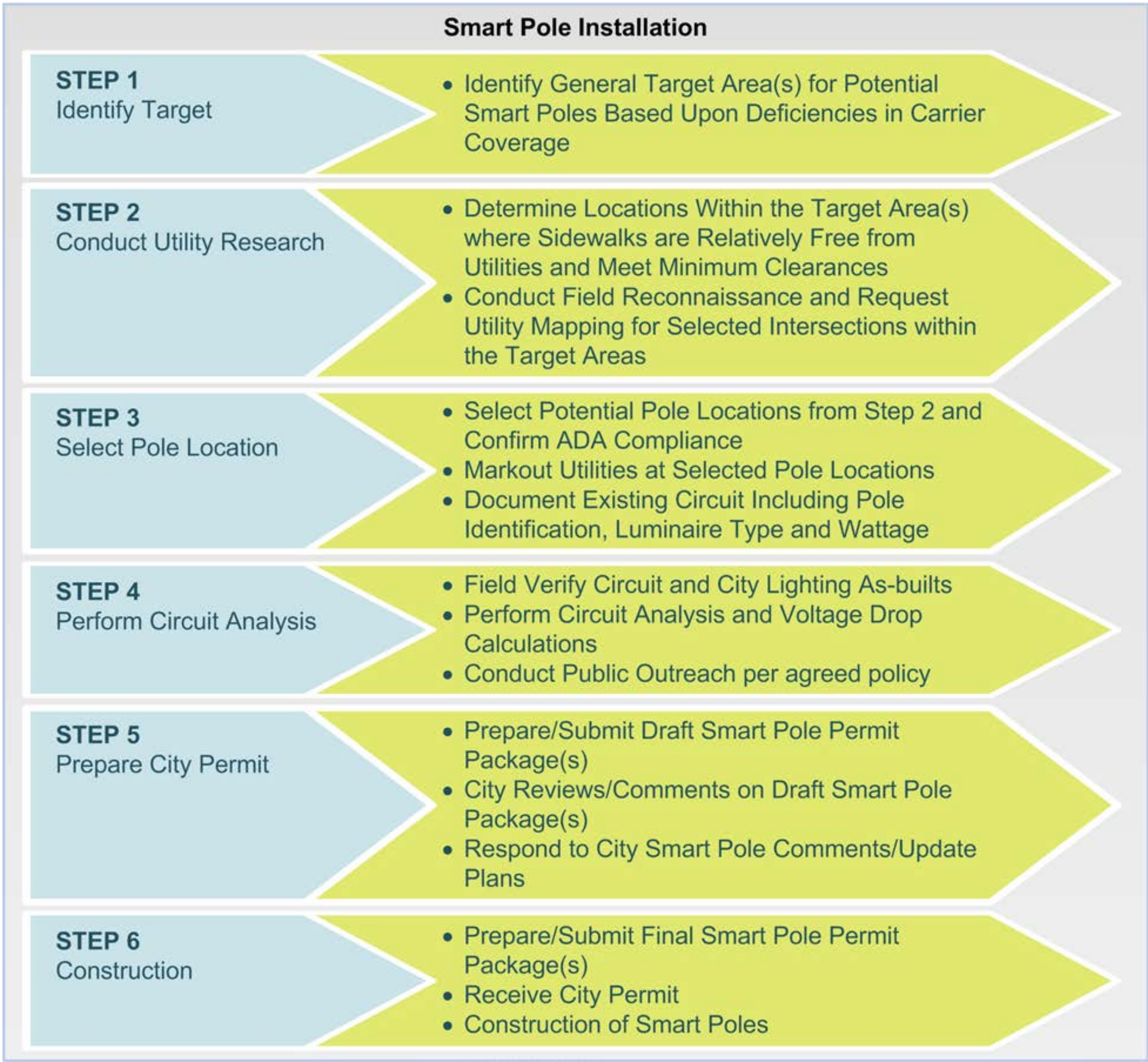


Figure 5. Smart Pole Installation

High Level Project Timeline – Philips timeline for the LED conversion, based on current bid dates for the project, spans approximately 33 months, from April 2016 through December 2018 as shown in Figure 6. It incorporates the three major concurrent work streams for the project:

- Design, Engineering, and City Approvals – During this ongoing collaborative phase, Philips works with City stakeholders to ensure Philips design and installation plans meet the City's vision.
- Equipment Supply – With City-approved submittals, Philips begins to supply the products necessary for the project.
- Construction – During this period, Philips installs the luminaires and controls. Philips smart poles are installed in alignment with the mobile network operators' needs and may require three years to install a quantity of 200.

Figure 6. Philips High Level Timeline for the City of San José Innovative LED Streetlight Replacement

The first ongoing work stream occurs throughout a 23 month period. During this period, Philips will design and engineer the comprehensive installation plans and submit to the City for review, feedback, and approval. Philips' strategy is to develop the plans and have the plans approved by the City approximately one month before commencing installation work for each construction segment. As anticipated with the other two phases, the phases run concurrently and complement each other. This ongoing project phase will be complete by February 2018 when the project has approved plans for the final construction phase.

The ongoing second work stream spans 30 months and includes the supply of all luminaires and controls equipment. Philips will place equipment orders in advance, based upon approved submittals, to ensure products arrive at the job site on time.

The third ongoing work stream occurs during a 29 month period and it includes installation/construction, user training, final inspections, and City acceptance. Per this schedule, Philips will complete the project, including final inspection and acceptance by the City, in 33 months - from April 2016 to December 2018.

4.3 Key Personnel Assignments/Responsibilities (RFP 11.2.4.3.)

4.3.1 Team Organizational Chart (RFP 11.2.4.3.1.)

Figure 7 provides a company organizational chart showing reporting structure, assignments, and responsibilities for the project.

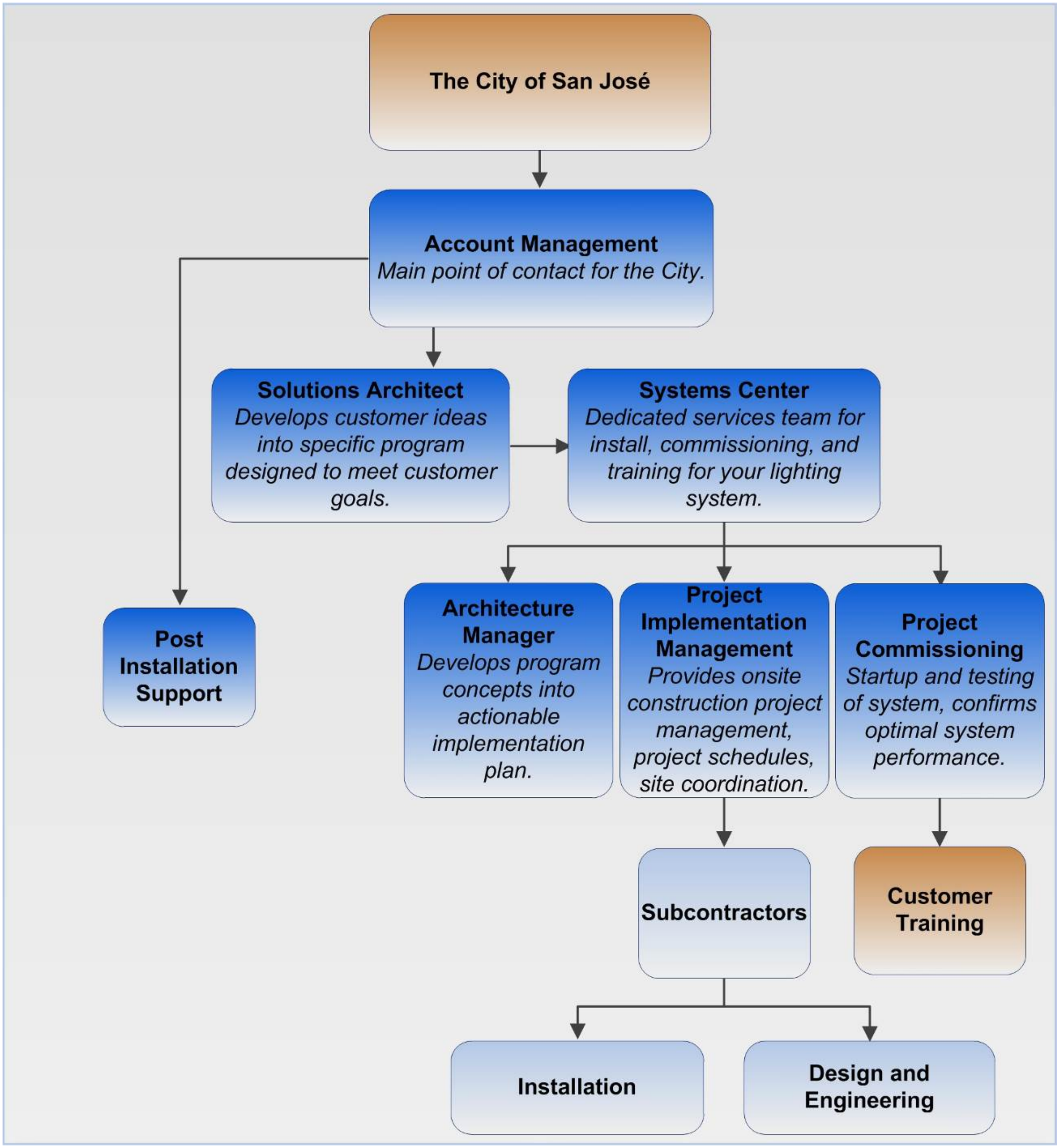


Figure 7. Philips Project Team Organization for the City of San José LED Innovative Streetlight Replacement

4.3.2 Key Personnel and Job Titles (RFP 11.2.4.3.2.)

Figure 8 is a list of the Philips Team key personnel, their job titles and responsibilities. The next section provides a short description of each team member's qualifications followed by the resumes of key personnel.

Figure 8. The Philips Team Key Personnel

Key Personnel Name	Title	Assignment/Responsibility
Bill McShane **Philips**	National Director, Philips Connected City Experience	Account Management. Main point of contact for the City on smart pole installations.
David Theriault **Philips**	Regional Public Sector Manager, Southwestern U.S.	Account Management. Main point of contact for the City for LED and control installations. California based.
Shaquinta Morgan **Philips**	Solutions Architect	Develops customer ideas into specific program designed to meet customer goals
Orlando Nova **Philips**	Construction Project Manager	Project Implementation Management. Provides onsite construction project management, project schedules, site coordination.
Stephen Cassens **Philips**	Outdoor Lighting & Controls, Senior Project Manager	Project Commissioning. Startup and testing of system, confirms optimal system performance.
John Boehm **Philips**	Systems Architecture Manager	Architecture Manager. Develops program concepts into actionable implementation plan.
William Hadaya, PE **WMH**	Principal-in-Charge	Design and Engineering Support
Jim Helmer, PE **WMH**	Senior Consultant	Design and Engineering Support
Dan Collen, PE **WMH**	Senior Consultant	Design and Engineering Support
Brian Casby **Rosendin Electric**	General Foreman	Philips Smart Pole Installation
Robert C. Leung, PE **Rosendin Electric**	Senior Project Manager	Philips Smart Pole Installation
Robert Lauderdale **Ericsson**	Solution Lead	Philips Smart Pole Partnership
Sridhar Vadlamudi **Ericsson**	Head of Ericsson-Philips smart pole Partnership	Philips Smart Pole Partnership

4.3.2.1 Philips

When undertaking a lighting project, the City benefits from working with a lighting company, a specialist and innovator in the field. The Philips team is uniquely qualified to deliver an Innovative LED Streetlighting project to the City of San José. Our team members are experts at all project phases including design development, systems and equipment engineering, fabrication and supply, project management, installation, and beyond. In addition to the specific key personnel listed in Figure 8, the City benefits from the thousands of lighting professionals – both in California and across the world who can support this initiative. We are well known by our clients, and throughout the industry, for providing a high level of personal attention to each project, delivering unsurpassed service and attention along with quick responses - qualities that are necessary in a high-profile project of such distinction. Resumes are provided in Section 4.4.

4.3.2.2 WMH - Streetlight Design and Engineering (Installation Proposals) (RFP 11.2.4.5)

A Local and Small Business Enterprise in San José, WMH provides logistical support, design and engineering services to supplement Philips' in-house capabilities. WMH, our partners on the Philips smart poles technology demonstration project, expand our capabilities and provide further consistency and experience to the project. Located in San José, and throughout the Bay Area, WMH has a dedicated staff of industry-recognized experts who have demonstrated capabilities to meet the technical and managerial challenges encountered on a broad range of infrastructure projects. Resumes are provided in Section 4.4.

4.3.2.3 Rosendin Electric - Contractor/Installation Partner (Installation Proposals) (RFP 11.4.6)

Philips and Rosendin Electric are already demonstrating great synergy and project excellence bringing Philips smart poles to San José in the City's technology demonstration project. We will continue this successful relationship for the Innovative LED Streetlight Replacement project in San José. Rosendin Electric is the top-ranked, private electrical contractor in the nation. Headquartered in San José, they bring local knowledge and nationwide experience to this project. Resumes are provided in Section 4.4.

4.3.2.4 Ericsson – Philips Smart Poles Technology Partner

The City of San José benefits from the Philips smart poles expertise provided by our technology partners at Ericsson. Ericsson is a world leader in the rapidly changing environment of communications technology – providing equipment, software and services to enable transformation through mobility. Some 40 percent of global mobile traffic runs through networks as supplied by Ericsson. In addition, more than 1 billion subscribers around the world rely every day on networks they manage. With more than 39,000 granted patents, Ericsson has of the industry's strongest intellectual property rights portfolios. Ericsson will provide the project management of the smart pole deployment as well as the installation of telecommunication equipment contained in each smart pole to be installed in the City of San José. Resumes are provided in Section 4.4.

4.4 Key Personnel Resumes (RFP 11.2.4.3.3., 11.2.4.4.1, 11.2.4.5.1.)

The following pages are the resumes for the key personnel listed in Section 4.3.2 Figure 8 of this proposal.

National Director, Philips Connected City Experience - Bill McShane - Philips

Mr. McShane develops strategy and is a core team member for the Philips connected city experience initiative, an innovative public private partnership service offering from Philips. Mr. McShane designs go to market approaches for the municipal market. He is a key liaison for multiple Cities and alliance partners. With more than 14 years of experience in the lighting industry, five years in state and local government sales, and 10 years' experience in construction management, Mr. McShane brings a customer oriented approach to his projects.

Education

Bachelor of Arts, Political Science, Duquesne University, Pittsburgh, Pennsylvania
International Finance Certificate, Richmond School of London

Awards and Honors

- 2015 IPI Award for New Sustainable Excellence Parking and Transportation Facilities
- Presenter at the 2011 National Association of State Energy Officers

Project Experience as Business Leader

City of San José
Completion Date: 2016

Through an unsolicited proposal, led negotiations toward execution of a Master Installation Agreement with the City of San José for the deployment of 50 Philips smart poles and 750 LED luminaires. This included negotiation of all sub-contractor agreements, development of an alliance with PG&E and leading a team to develop a wireless electric meter to the City's requirements. Developed a strong working relationship with the San José/Santa Clara IBEW.

City of Los Angeles, CA
Completion Date: In Progress

Proposed and negotiated a Master Installation Agreement with the City of Los Angeles to install over 300 Philips smart poles. Established a working relationship with multiple city departments, developed a cluster permitting process, and held regularly scheduled project meetings to ensure deployment met agreed upon timelines.

Washington Metro Area Transportation Authority, District of Columbia
Completion Date: In Progress

As business lead, designed, installed, and maintains over 15,000 LED luminaires with wireless controls for the extensive transportation system over a 10-year period. Energy savings fund the debt service. The project received a National Award for Sustainable Design.

Cleveland Clinic 100th Street Garage, Cleveland, Ohio
Completion Date: 2014

As business lead, oversaw the turnkey installation of over 600 LED luminaries with wireless controls. Producing 70% saving every year.

Regional Public Sector Manager, Southwestern U.S. - David Theriault - Philips

Mr. Theriault is an experienced sales and program development manager with over twenty years of diverse and managerial, commercial, sales and technical experience in the domestic utility markets. His collaborative customer approach ensures customer goals are met and exceeded. His skill set includes more than fifteen years of diversified energy services experience in the New England, Texas, Southern California and Northern California marketplaces. Mr. Theriault's major strengths include sales development, strategic market development, program management, risk management, deal structuring, opportunity identification, cash flow analysis, commodity supply, and account planning.

Education

Bachelor of Arts, Communicating Arts, University of Hartford, Hartford, Connecticut

Professional Membership/Certification

- Association of Energy Engineers Certified Sustainable Development Professional, Certified Energy Manager, and Certified Demand-Side Management Professional
- State of California and State of Connecticut Certified Energy Auditor

Project Experience

<u>NASA AMES Mountain View, CA</u>
Completion Date: 2014

Developed and negotiated a sole-source design-build energy retrofit project for the NASA AMES Research Center (NARC) using Pacific Gas & Electric’s (PG&E) Utility Energy Services Contract (UESC) program. As designed, the project aimed to put NARC on a path to exceed all federal energy mandates and executive orders. The project implemented a variety of energy efficiency and renewable energy conservation measures including installation of a 100 kW photovoltaic system, installation of new high-efficiency HVAC equipment to replace aging and energy- inefficient systems, expansion of the energy management control system, installation of a small fuel cell and implementation of a center-wide retro-commissioning program.

<u>California Department of Corrections and Rehabilitation, Los Angeles County Prison, Lancaster, CA</u>
Completion Date: 2006

Worked closely with the project engineering development team to deliver a program to meet the stringent needs of the CDCR for this site including payback period, use of rebates and material savings.

<u>Sausalito Marin City Elementary School District, CA</u>
Completion Date: 2004

Successfully co-developed, negotiated, and sold a demand-side management program for the District. This performance contract sale included energy efficient lighting, space heating controls, finance and vending controls.

Solutions Architect - Shaquinta Morgan - Philips

Mrs. Morgan has been designing and developing complex enterprise solutions for over 13 years. Her project experience includes a broad range projects in several market areas. Her focus has been on energy efficient upgrades to lighting systems for K-12, State and Local Government, Higher Education, and Federal customers.

Education

Bachelor of Science, Engineering, University of Mississippi, University, Mississippi

Professional Membership/Certification

- Professional Engineering License (PE)
- Certified Energy Manager (CEM)
- LEED Accredited Professional (LEED AP)
- Member, Association of Energy Engineers
- Member, University of Mississippi School of Engineering Advisory Board

Project Experience

<u>Puerto Rico Aqueduct Sewer Authority</u>
Completion Date: 2014

Developed water meter retrofit and automated meter reading project for high usage water meters throughout the city of San Juan, Puerto Rico. Provided guidance to engineering resources and subject matter experts to efficiently and cost effectively deliver the project, from qualification through close. Directed a cross-functional team during development for multiple components of the bundled sale. Performed risk management assessments. Built detailed cost estimates and scopes of work for the project in conjunction with operations team. Performed financial analysis to quantify cost savings and other customer benefits. Managed relationships with and provided direction to subcontractors and suppliers.

<u>Grundy County Schools</u>
Completion Date: 2013

Performed on-site data collection (at customer facilities) required to perform detailed development tasks. Identified opportunities for energy conservation including: lighting systems retrofits, implementation of renewable energy technologies, HVAC equipment replacement, installation of energy management controls, chilled water and boiler plant redesigns and other energy conservation or cost saving measures applicable at project sites. Prepared costing and savings estimates, as well as written technical assessments for existing and proposed site conditions. Participated in transition meetings with project management team to ensure project scope, timeline and customer requirements were properly understood.

<u>Alabama Department of Corrections</u>
Completion Date: 2012

Crafted a customized solutions for 20+ correctional institutions throughout the state of Alabama. Performed energy simulation and modeling, engineering calculations, and cost/savings analyses of energy efficient and sustainable designs. Identified opportunities for energy conservation including: lighting systems retrofits, implementation of renewable energy technologies, HVAC equipment replacement, installation of energy management controls, chilled water and boiler plant redesigns and other energy conservation or cost saving measures at project sites.

Construction Program Manager - Orlando Nova - Philips

Mr. Nova joined Philips after 26 years of working as a Senior Engineering Manager for the City of Los Angeles, Bureau of Street Lighting. Information below highlights his expertise in the lighting industry, municipal lighting projects, and project management. During his time with the City of Los Angeles, he completed globally important energy efficiency projects, which saved the City millions of dollars in energy and maintenance. His work on innovative lighting technologies and installation procedures increased the Bureau's productivity and efficiency. He played an integral role in the introduction, implementation and completion of the LED Roadway Program in the City of Los Angeles (the largest completed project of its kind in the world at the time), and brings tremendous experience and knowledge of best practices for municipal LED streetlighting programs.

Education

Bachelor of Science, Electrical Engineering, California State University, Los Angeles, CA

Professional Memberships

- State of California Professional Engineer
- Illuminating Engineering Society
- Institute of Electrical and Electronic Engineers

Project Experience

City of Los Angeles, California
Completion Date: 2013

LED street lighting conversion for more than 140,000 fixtures. Managed Divisions during design and construction phases in all aspects but mainly: project finances, cost control, schedule control, and levels of quality consistent with approved City standards, controlled contracts and agreements related to the project budget.

Sepulveda Tunnel Project, Los Angeles, California
Completion Date: 2014

At half a mile long, this is Los Angeles's longest tunnel that connects a freeway to the main entrance of the Los Angeles International Airport. The project involved replacing existing outdated high pressure sodium lighting and control systems (in the tunnel and adjacent areas) with state of the art LED and control systems.

Senior Project Manager, Outdoor Lighting & Controls - Stephen Cassens - Philips

Mr. Cassens is a senior project manager at Philips. His focus is on design and construction/engineering deployment projects for new and cutting edge Philips lighting systems and controls. He brings over 35 years of project team building experience to ensure that projects are completed on time and on budget. Mr. Cassens previously worked for The Boeing Company as a manager of design and construction engineering programs, responsible for new business development, proposal development and submittal, engineering project management, and team-building programs. His depth of outdoor lighting and controls experience provides his clients with the some of the most expert project support in the industry.

Education

Bachelor of Science, Electrical Engineering and Technology, Bradley University, Peoria, Illinois

Professional Membership/Certification

Certified Lighting Energy Engineer

Project Experience

City of Markham, Ontario, Canada
Completion Date: 2014

LED streetlighting conversion with Philips lighting control system for over 12,000 fixtures. The projected savings from the conversion is approximately $1 million a year in streetlight energy use and streetlight maintenance costs.

City of Bethlehem, Pennsylvania
Completion Date: 2014

Citywide conversion of 5,800 streetlights to LED and a Philips lighting control system. The expected energy costs are estimated to decrease from $1.5 million annually to $500,000.

Bristol Township, Pennsylvania
Completion Date: 2014

In addition to providing the Township with over 4,000 LED roadway luminaires, a Philips lighting control system with commissioning and services, and project management, Philips helped Bristol Township realize their energy efficiency goals by financing the project through a tax-exempt lease purchasing program.

Systems Architecture Manager - John Boehm - Philips

Mr. Boehm has led multiple teams worldwide in business development, marketing, program/project management, and sales management. He successfully grew markets in LED, commercial lighting, controls, consumer electronics, automotive, aerospace, computer security, and health care. He has experience with managing major original equipment manufacturer accounts, distributors, and sales representatives. Mr. Boehm has also developed business and strategic plans, marketing plans, and launched multiple successful products worldwide. Through the combination of Mr. Boehm's technical and engineering expertise paired with his streetlight and controls project experience, he is able to provide his client's with a comprehensive project approach.

Education

Bachelor of Science, Electrical Engineering, University of Notre Dame, Notre Dame, Indiana

Project Experience

City of Markham, Ontario, Canada
Completion Date: 2014

LED streetlighting conversion with a Philips lighting control system for over 12,000 fixtures. The projected savings from the conversion is approximately $1 million a year in streetlight energy use and streetlight maintenance costs.

City of Bethlehem, Pennsylvania
Completion Date: 2014

Citywide conversion of 5,800 streetlights to LED and a Philips lighting controls system. The expected streetlighting energy costs are expected to decrease from $1.5 million annually to $500,000.

Bristol Township, Pennsylvania
Completion Date: 2014

In addition to providing the Township with over 4,000 LED roadway luminaires, a Philips lighting control system with commissioning and services, and project management, Philips helped Bristol Township realize their energy efficiency goals by financing the project through a tax-exempt lease purchasing program.

Principal-in-Charge - William Hadaya, PE - WMH

Mr. Hadaya has over 28 years of experience in project management and coordination of large infrastructure engineering projects. He has delivered transportation projects within Santa Clara County for over 20 years, and is well versed in the importance of delivering high quality projects to support the City's vision. He will be responsible for quality control, commitment of resources and contract compliance.

Education

Bachelor of Science, Civil Engineering, Ohio State University, Columbus, Ohio
Master of Science, Civil Engineering, Ohio State University, Columbus, Ohio

Professional Membership/Certification

California PE (C-049135)
Ohio PE (E-053481)

Project Experience

<u>Philips Smart Poles, City of San José</u>
Completion Date: 2016

Plan, design and install 50 Philips smart poles throughout the City of San José. Lead the team and worked closely with stakeholders to ensure seamless communication and timely delivery of the project.

<u>Eastbound I-80 Truck Inspection Facility, Cordelia</u>
Completion Date: 2015

Design and environmental re-evaluation of the new Truck Inspection Facility (TIF) and Commercial Vehicle Management System (CVMS) located on eastbound I-80 near Cordelia, Solano County. Technical leadership, project coordination, and supervise the multi-disciplinary team required for delivery of the plans, specifications, and estimates. Separate CVMS Technology (Truck Sorting) Integration contract for STA. Extensive coordination required with the California Highway Patrol (CHP), Caltrans Offices of Transportation Architecture, Design, Structural Engineering, Maintenance, Hydraulics, and Weigh in Motion as well as the Office of the State Architect. Received the 2014 CTF Transportation Award for 'Safety Project of the Year and the 2014 Best of ITS America Award.

<u>Mathilda Avenue Improvements at SR 237 and US 101, Sunnyvale</u>
Completion Date: 2015

Planning, environmental studies and design for local street intersection and interchange improvements to alleviate congestion and improve access for all modes of travel along a critical segment of Sunnyvale's primary arterial, and significantly improve pedestrian and bicycle facilities.

<u>I-680 Northbound Express Lane (SR 237 to SR 84)</u>
Completion Date: 2017

PSR, PA/ED and PS&E to widen 15 miles of northbound I-680. Combine HOV/express lane facility in Alameda County. Constructed in phases and includes 64 overhead sign structures, auxiliary lanes, modify 14 bridge crossings, 45 new retaining walls, sound wall replacement, extensive safety lighting in the median and outside of the freeway, and ramp metering modifications. Right of way requirements include 13 property acquisitions, and utility relocations. A continuous access express lane facility is proposed and will be operated and enforced consistent with other express lane projects in the Bay Area Regional Express Lane network.

Senior Consultant - Jim Helmer, PE - WMH

Mr. Helmer has over 40 years' experience implementing successful transportation safety and innovative lighting solutions, focusing on safe and efficient movement of people. As the former Director at the Department of Transportation for the City of San José he was responsible for the planning, development, and operations of the transportation system and maintenance of all transportation infrastructure, including storm and sanitary sewer lines, pavement, traffic signals, roadway lighting and an extensive bikeway network. Jim worked for the City of San José for 21 years and continues to work on projects for the City.

Education

B.S., Transportation Engineering California Polytechnic State University
M.S., Transportation Management, Mineta Transportation Institute San José State University

Professional Membership/Certification

California PE (CA 27933)
California TE (TR 1519)
PTOE (670)

Project Experience

Director, Department of Transportation, City of San José

Led a department of 470 employees and managed a combined operating and capital budget of $68 million. Responsible for the planning, development, and operations of the transportation system and maintenance of all transportation infrastructure, including storm and sanitary sewer lines, pavement, traffic signals, roadway lighting and an extensive bikeway network within 2,200 miles of street right-of-way. Responsible for the management and operation of an extensive on-street and off-street public parking system. Developed policies on traffic calming, clean car parking incentives, and solid-state roadway lighting, created area-wide and specific transportation land-use plans. Developed and oversaw the highly acclaimed Street Smarts program, an educational and public awareness program on traveling safely. Created the first office of Sustainability in the City, leading to the creation of a sustainability strategic plan and numerous business model, equipment and materials policy and procurement changes.

Philips Smart Poles, City of San José
Completion Date: 2016

Plan, design and install 50 "Philips smart poles" throughout the City of San José. Lead the team and worked closely with stakeholders to ensure seamless communication and timely delivery of the project.

Samsung Innovation Center, Menlo Park, CA
Completion Date: 2015

Provide strategic support to Samsung Innovation Center, Menlo Park, CA. involving the development of LED lighting components and sensors. Interviewing U.S. and Canadian cities, and preparing a White Paper on the Internet of Things and LED lighting for municipalities.

Traffic Logix, Montreal, CA
Completion Date: 2015

Provided strategic support to Traffic Logix, Montreal, CA. for the development of integrated, smart traffic warning, control and parking information systems.

Senior Consultant - Dan Collen, PE - WMH

Mr. Collen is the former Deputy Director of Santa Clara County Roads and Airport Division. He led the Infrastructure Development Division, responsible for the capital projects program, operation of the County's traffic signals, and other administrative and support duties such as traffic engineering, planning, land development coordination, survey, permits, streetlights, project engineering and inspection. Dan worked for the County of Santa Clara for 35 years and was instrumental in a highway design, expressway design, land development, airport and transit projects. He served on the VTA Technical Advisory Committee as Chairperson.

Education

B.S., Civil Engineering, University of Texas
M.A. Public Administration, San José State University

Professional Membership/Certification

California PE (31010)

Project Experience

<u>County Expressway Intersection Safety Lighting – Administration</u>
Completion Date: 2015

Served as manager responsible for administration of expressway intersection lighting, generally the lights mounted at approximately 30' height, on second level pole and mast arm above the traffic signal head mast arm. Led re-lamping effort from high pressure sodium to inductive florescent. The plan created called for coordination of re-lamping streetlight with re-lamping red and green traffic signal heads, and with other preventive maintenance, in order to achieve efficiencies, minimize worker exposure in traffic, and limit traffic impacts to the one activity, rather than a series of separate lane closures.

<u>County Lighting Service Area – Administration</u>
Completion Date: 2015

Served as manager responsible for administration of traffic signals and CLSA streetlights (approximately 3000). Took initiative to obtain funding for second round of LED traffic signal head lighting (original lights had exceeded warrantee), adding LED pedestrian crossing signage with countdown feature making the signals all-LED. Investigated options for LED re-lamping prior to PG&E programs for category 1A lights (approximately 75% of CLSA lights are Category 1A, which are PG&E maintained).

<u>Infrastructure Development – Administration</u>
Completion Date: 2006-2015

As manager responsible for operation and maintenance of the County's traffic signals, led two major technological breakthroughs resulting from collaboration of traffic engineering staff, field maintenance technicians, and product vendors: Pedestrian adaptive signals and Predictive traffic signal operation. Both operational enhancements resulted in significant capital improvement grants to implement the new operations technology, and the "15 minutes in the future" operation is considered to be cutting edge on a global basis, with only Cologne, Germany doing something similar, and using a less precise target of "30 minutes in the future."

General Foreman - Brian Casby - Rosendin Electric

Mr. Casby has over 30 years industry experience. He coordinates all aspects of his jobs and works with subcontractors to oversees the installation of electrical work. He works closely with project managers and general contractors on scheduling to make sure the job runs smoothly. He is responsible for laying the work out, ordering material, and tending to manpower and equipment needs on a daily basis.

Education

Five year accredited IBEW Apprenticeship

License/Certification

California Electrical License
Competent Person Trenching and Shoring

Project Experience

Caltrans Emergency Traffic Operating Systems Contract, San José, CA
Completion Date: 2014

At various locations throughout San José, troubleshoot and repair existing electrical systems. Included cameras, traffic loops, pull boxes, and wiring, for CMS, ramp metering, CCTV, and detectors.

Apple Off-Site Improvements AC-2 Campus, San José, CA
Completion Date: 2015

Installation of multiple municipality utility duct bank, manholes, and pull boxes.

Google Campus Signal Improvements, Mountain View, CA
Completion Date: 2015

Installation of traffic signal system, street lighting, and signal interconnect.

VTA LRT Efficiency Project – Tasman Rd, Santa Clara, CA
Completion Date: 2015

Underground power and communication duct bank and manholes. Including traffic signal foundation, poles, and signal gear.

VTA Capitol Corridor Project, San José, CA
Completion Date: 2013

Install street and pedestrian lighting along Capital Expressway and infrastructure for VTA communication system.

San José Traffic Signal Project Various Locations, San José, CA
Completion Date: 2012

Install 8 traffic signal intersections including underground, pull boxes, signal poles, and signal heads.

Senior Project Manager - Robert C. Leung, PE - Rosendin Electric

Mr. Leung has over 19 years of industry experience. Mr. Leung has experience in highway design, geotechnical investigations, environmental investigations, and construction management of various disciplines. He has worked and managed various projects representing the owner's perspective and also the contractor's side. The type of design projects Mr. Leung has directly been involved with are highway horizontal and vertical alignment changes throughout the Sacramento, California area. His construction management experience ranges from grade changes, pavement, and pertinent highway features to the installation of San Francisco Municipal Transportation Agency's (SFMTA) new trolley bus and light rail line. The new trolley bus and light rail lines consisted of underground electrical infrastructure in addition to new overhead contact system to power the trolley bus and light rail lines. In addition, Mr. Leung managed a brand new 13 acre light rail maintenance facility for SFMTA. The maintenance facility consisted of a 180,000 square foot maintenance building, new rails, train signals, overhead contact system (OCS), and substations. Along with the design and construction management experience, Mr. Leung has performed and managed various Phase I Environmental Site Assessments.

Education

Bachelor of Science, Civil Engineering, California Polytechnic State University, San Luis Obispo, CA

License/Certification

Professional Engineer Civil Engineering – C62780
Hazardous Waste Operations and Emergency Response (29 CFR 1910.120, 40 hour)
APWA Public Works Construction Inspection Seminar
U.S. Army Corps of Engineers CQM for Contractors

Project Experience

Space Systems Loral – 12KV Distribution System Improvements Phase I and II, Palo Alto, CA
Completion Date: 2014

Includes commercial installation of electrical duct bank and above ground electrical gear and switches.

Apple C2 Offsite Utility (High Tech Industry), Cupertino, CA
Completion Date: 2015

Installation of multiple municipality utility duct bank, manholes, and pull boxes.

VTA LRT Efficiency Pocket Track (Transportation Industry), Santa Clara, CA
Completion Date: 2015

Underground power and communication duct bank and manholes. Including traffic signal foundation, poles, and signal gear.

Caltrans Highway 80 Traffic Operations System (Transportation Industry), California
Completion Date: September 2012

Various locations on Highway 80, installed infrastructure and changeable message signs for Alameda and Contra Costa Counties traffic operating system.

Solution Lead, Robert Lauderdale - Ericsson

Education

BSEE, Electrical Engineering, University of Florida, Gainesville, FL
MSEE, Electrical Engineering, Southern Methodist University, Dallas, TX

Professional Membership/Certification

Project Experience

Zero Site Type 2 Development, Lewisville, TX
Completion Date: 2015

Design, Development, Product / Lifecycle management for the Ericsson ZT2 (Philips smart pole). Project successfully developed, tested, and deployed the integrated Streetlight/Cell site solution for use in dense urban areas with deployments in Los Angeles and San José.

Outdoor Enclosure 6501 Development, Lewisville, TX
Completion Date: 2015

Design, Development, Product / Lifecycle management for the Ericsson ODE 6501. Project successfully developed, tested, and deployed the integrated small cell enclosure for dense urban areas with deployments in the Pacific Northwest areas.

Sprint Network Vision RF Performance, Plano, TX
Completion Date: 2014

Overall responsible for RF performance of the Ericsson portion (11,000 + sites) of the Sprint Network Vision deployment. Ensured adherence to contractual commitments for performance during network rollout.

CDMA Radio Product Management
Completion Date: 2013

CDMA radio portfolio new product development and existing product lifecycle management.

Head of Ericsson-Philips Partnership - Sridhar Vadlamudi - Ericsson

Mr. Vadlamudi brings a depth of Ericsson experience to Philips smart poles projects. During his career with Ericsson he gained valuable experience through many roles including: Head of Partnerships and Alliances, Region North America, CTO, Airtel-Bharti Account (Largest Operator in India), Director, Head of RAN and Site Solutions for Region India, LTE Head for Ericsson India, and LTE Technical Sales, Region North America. Mr. Vadlamudi is equipped to provide the knowledge and service to deliver a successful Philips smart poles project.

Education

MBA, University of Texas Dallas
MS (Computer Science), University of Texas Dallas
Bachelors (Electronics and Communications), JNTU, India

Professional Membership/Certification

PMP Certified

Project Experience

<u>LA Philips smart pole Project</u>
Completion Date: 2016

Ericsson Partnership head and overall project responsible for the LA Philips smart pole project. This project included replacing 100 lightpoles with the new Ericsson-Philips smart pole. Ericsson was responsible for all services (including Logistics, Warehousing, installation, integration and commissioning) and Telecom equipment.

<u>San José Smart Pole Project</u>
Completion Date: 2016

Ericsson Partnership head and overall project responsible for the San José Philips smart pole project. This project included replacing 50 lightpoles with the new Ericsson-Philips smart pole. Ericsson was responsible for all services (including Logistics, Warehousing, installation, integration and commissioning) and Telecom equipment.

4.5 Attachment E, Project Team & Financial Background Information Worksheet (RFP 11.2.4.6.)

ATTACHMENT E

Project Team and Financial Background Information Worksheet (REQUIRED)

All information requested in the Worksheet shall be furnished by the Proposer, and shall be submitted with the Proposal. Statements shall be complete and accurate and in the form requested. Omission, inaccuracy, or misstatement may be cause for the rejection of a proposal.

☒ Proposer confirms that they meet the requirements stated above.

Part 1 – Corporate Information Background Questions (Required)

1. If a corporation, answer the following:

When incorporated?	**1997**
In what state?	**Delaware**
Authorized to do business in California?	**Yes**
If so, what date?	**December 9, 2015 PLNAC registered with the CA Secretary of State**

2. If NOT a corporation, answer the following:

A. Name of Organization	**Not applicable.**
Date of Organization	
General, Limited Partnership, or Joint Venture	
	(if applicable)
Registered in California?	**If so, when?**

3. Have you ever had a bond or surety denied, canceled, or forfeited?

YES ☐ **NO** ☒ If yes, state name of bonding company, date, amount of bond and reason for such cancellation or forfeiture in an attached statement.

Not to our knowledge.

4. Have you ever declared bankruptcy or been declared bankrupt?

YES ☐ **NO** ☒ If yes, state date, court jurisdiction, docket number, amount of liabilities and amount of assets.

No, Philips Lighting North America Corporation (PLNAC) has never declared bankruptcy nor been declared bankrupt.

5. Has your company ever had any agreements cancelled?

YES ☐ **NO** ☒ If yes, give details.

6. Has your company ever been sued by any organization for issues pertaining to fee payment, performance, or other related issues?

   YES [ ] **NO** [X] If yes, give details.

7. Are you currently engaged in merger or acquisition negotiations, or do you anticipate entering into merger or acquisition negotiations within the time period of this Request for Proposal?

   YES [ ] **NO** [X] If yes, give details. Attach copy of such agreements(s).

   Philips Lighting solutions is currently a standalone business within Royal Philips. Royal Philips is currently exploring the possibility of a strategic transaction that may result in Royal Philips no longer being the sole or majority owner of the lighting business

8. Are you now engaged in any litigation which does now or could in the future affect your ability to pay fees or perform under this Agreement?

   YES [ ] **NO** [X] If yes, give details.

9. Has your company or subcontractors for this project ever been disbarred, suspended, declared ineligible or voluntarily excluded from participation in this transaction by any federal department or agency, any California State agency, or any local governmental agency?

   YES [ ] **NO** [X] If yes, give details.

The undersigned hereby declares under penalty of perjury that all statements, answers and representations made in this questionnaire are true and accurate, including all supplementary statements hereto attached. In the case of a corporate Proposer, the signature of one duly authorized representative is sufficient.

Amelia A Huntington 3/28/16	**Not Applicable**
Signature Date	Signature Date
Amelia A. Huntington	
(Please Print or Type Name)	(Please Print or Type Name)
President, Philips Lighting North America Corporation	
Title	Title

4.6 Attachment F, Previous Customer Reference Form (Required) - Philips (RFP 11.2.4.7.)

ATTACHMENT F

Previous Customer Reference Form (required)

Proposer must submit three references using this form. References must be current (within the last 3 years) customer references where the proposed system has been implemented and accepted and where the Proposer's Contractor services have been successfully demonstrated.

(Copy this form as necessary to complete each reference.)

Name of Customer:	**The City of San José**			
Address:	**200 East Santa Clara Avenue**			
	San José, California			
Customer Contact Name:	**Teri Killgore, Dave Sykes**			
Customer Contact Telephone:	**(408) 920-7007**			
Customer Email:	**teri.killgore@sanJoséca.gov, dave.sykes@sanJoséca.gov**			
Date of Agreement/Contract:	**July 15 2015**			
Period of Performance:	From:	**2015**	To:	**In progress**
Type of Contract:	☐ Firm Fixed Price		☐ Not to Exceed	
	☐ Time & Material		☐ Cost + Fixed Fee	
	Other:	**Public Private Partnership - Philips Connected City Experience Pilot**		
What is the dollar value of the contract?	**This project is a pilot program with no upfront cost to the City.**			
If contract was terminated or cancelled for convenience, please indicate the circumstances:	**Not Applicable.**			
Is this a reference for work Proposer has performed? (Yes or No)	**Yes.**			
Provide a detailed description of work that you performed for this customer, including the size of the project, specifications for the project, technology deployed, or other details. If the customer is no longer using the Proposer's technology, provide a brief description explaining the reason(s). (Attach additional sheets if necessary.)				
Connected City Experience received a unanimous approval from City Council for the Pilot program. Philips is installing 50 Philips smart poles and 750 LED luminaires with controls throughout the City of San José. The Philips smart pole is a modified streetlighting pole designed to house 4G FCC licensed telecommunication equipment to help densify the wireless carrier's network due to increasing user demand. Philips conducted in depth engineering studies of each Philips smart pole location to ensure that the installation would be compatible with the City of San José existing electrical infrastructure. PGE has developed a wireless electrical meter specifically for this application. All electrical usage of the Philips smart poles, will be paid by Philips. The Philips LED luminaires have been approved by the City's DOT, extensive photometric analysis performed and approved by the City.				

ATTACHMENT F - Philips

Previous Customer Reference Form (required)

Proposer must submit three references using this form. References must be current (within the last 3 years) customer references where the proposed system has been implemented and accepted and where the Proposer's Contractor services have been successfully demonstrated.

(Copy this form as necessary to complete each reference.)

Name of Customer:	**City of Los Angeles**			
Address:	**Bureau of Street Lighting, City of Los Angeles**			
	1149 S. Broadway, Ste. 200			
Customer Contact Name:	**Ed Ebrahimian, Director**			
Customer Contact Telephone:	**(213) 847-2020**			
Customer Email:	**ed.ebrahimian@lacity.org**			
Date of Agreement/Contract:	**January 2015**			
Period of Performance:	From:	**January 2015**	To:	**January 2025**
Type of Contract:	☒ Firm Fixed Price		☐ Not to Exceed	
	☐ Time & Material		☐ Cost + Fixed Fee	
	Other:			
What is the dollar value of the contract?	**$15,290,000**			
If contract was terminated or cancelled for convenience, please indicate the circumstances:	**Not Applicable**			
Is this a reference for work Proposer has performed? (Yes or No)	**Yes**			
Provide a detailed description of work that you performed for this customer, including the size of the project, specifications for the project, technology deployed, or other details. If the customer is no longer using the Proposer's technology, provide a brief description explaining the reason(s). (Attach additional sheets if necessary.)				
Please see the following page for project details.				

City of Los Angeles

Project:	Citywide Central Lighting Management Systems	**Year:**	2015

- **City of Los Angeles selects Philips' CityTouch System to be its single streetlighting asset management system.**
- **First city in the world to control its streetlighting through mobile and cloud-based technologies.**

Los Angeles by the numbers

215,000
street lights

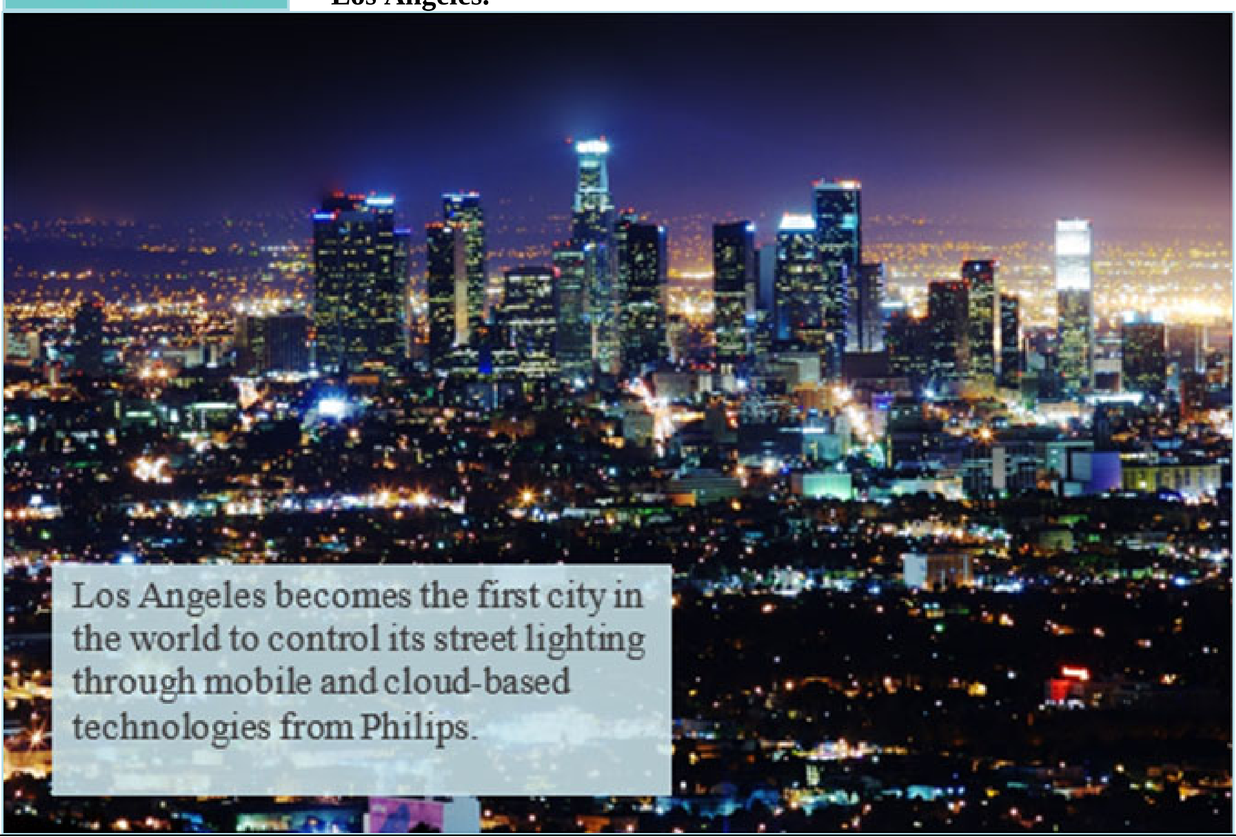
400
different street light styles

4,500
miles of illuminated roadway

165,000
street lighting converted to LED

110,000
connector nodes planned

- **Remotely controls lighting fixtures, and monitors energy use and status of lights.**
- **Mobile chip technology embedded into each node, streetlights are able to identify themselves and network instantly.**
- **Plug and play approach reduces the cost of programming each fixture, and reduces the time of installation and commissioning from days to minutes.**
- **Eliminates on-site commissioning completely.**
- **Integration with the street bureau's existing management systems, and system is future proof through software as a service delivery.**
- **10 years of software and communications costs included.**
- **Works on every manufacture's LED roadway fixture, that uses standard 5-7 pin NEMA socket.**
- **Selected as "the best product, at the best price" according to the City of Los Angeles.**



ATTACHMENT F - Philips

Previous Customer Reference Form (required)

Proposer must submit three references using this form. References must be current (within the last 3 years) customer references where the proposed system has been implemented and accepted and where the Proposer's Contractor services have been successfully demonstrated.

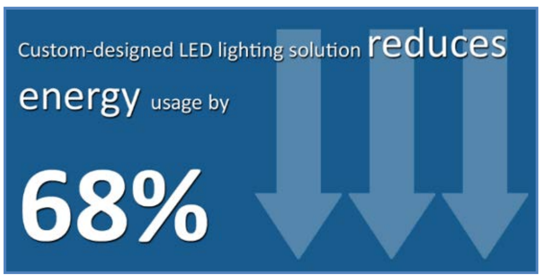
(Copy this form as necessary to complete each reference.)

Name of Customer:	**Washington Metropolitan Area Regional Transit Authority (WMATA)**			
Address:	**600 5th Street, NW**			
	Washington, D.C. 20001			
Customer Contact Name:	**Patrick Schmitt**			
Customer Contact Telephone:	**(202) 962-1783**			
Customer Email:	**rpschmitt@wmata.com**			
Date of Agreement/Contract:	**November 2013**			
Period of Performance:	From:	**January 2013**	To:	**January 2023**
Type of Contract:	☐ Firm Fixed Price		☐ Not to Exceed	
	☐ Time & Material		☐ Cost + Fixed Fee	
	Other:	**Energy Savings Performance Contract**		
What is the dollar value of the contract?	**$20,000,000**			
If contract was terminated or cancelled for convenience, please indicate the circumstances:	**Not Applicable**			
Is this a reference for work Proposer has performed? (Yes or No)	**Yes**			
Provide a detailed description of work that you performed for this customer, including the size of the project, specifications for the project, technology deployed, or other details. If the customer is no longer using the Proposer's technology, provide a brief description explaining the reason(s). (Attach additional sheets if necessary.)				
Please see the following page for project details.				

Washington Metropolitan Area Transit Authority (WMATA)			
Project:	Enhanced Lighting for Parking Garages	**Year:**	2013-2023

- **Public-private-partnership between Philips and WMATA to upgrade and connect lighting in 25 WMATA garages.**
- **Project paid for through guaranteed energy and operational savings.**

- **Philips provides full solution: manufacture of product, maintenance, financing, installation, savings performance guarantees.**
- **Over 13,000 lighting fixtures to be converted to an innovative, custom-designed LED lighting solution that reduces energy usage by 68 percent or 15 million kilowatt (kW) hours per year, and provide real time data on energy consumption.**



- **System brightens garages, provides a safer environment for WMATA's 66,000 parking garage customers, and removes >11,000 metric tons of CO_2 from the environment.**
- **Philips monitors and maintains the lighting solution, financed through energy cost savings requiring no up-front capital costs.**
- **Philips and WMATA in discussions for Phase 2 of project.**

ATTACHMENT F - Philips

Previous Customer Reference Form (required)

Proposer must submit three references using this form. References must be current (within the last 3 years) customer references where the proposed system has been implemented and accepted and where the Proposer's Contractor services have been successfully demonstrated.

(Copy this form as necessary to complete each reference.)

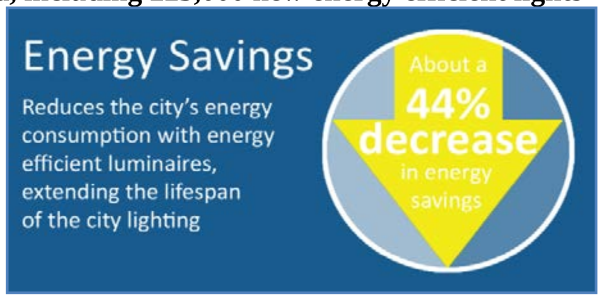
Name of Customer:	**City of Madrid, Spain**			
Address:	**c/Barco 22 – 28004 Madrid**			
	Spain			
Customer Contact Name:	**Alejandro Oliver**			
Customer Contact Telephone:	**915880286**			
Customer Email:	**oliverma@madrid.es**			
Date of Agreement/Contract:	**2014**			
Period of Performance:	From:	**August 2014**	To:	**May 2015**
Type of Contract:	☒ Firm Fixed Price		☐ Not to Exceed	
	☐ Time & Material		☐ Cost + Fixed Fee	
	Other:			
What is the dollar value of the contract?	**Value of the contract is proprietary.**			
If contract was terminated or cancelled for convenience, please indicate the circumstances:	**Not Applicable**			
Is this a reference for work Proposer has performed? (Yes or No)	**Yes**			

Provide a detailed description of work that you performed for this customer, including the size of the project, specifications for the project, technology deployed, or other details. If the customer is no longer using the Proposer's technology, provide a brief description explaining the reason(s). (Attach additional sheets if necessary.)

Please see the following page for project details.

City of Madrid Outdoor Lighting Project			
Location:	Madrid, Spain	**Year:**	2014 – 2015

- **Largest LED Street Lighting project in the world, including 225,000 new energy efficient lights to support its ambition of becoming a Smart City.**
- **Teaming collaboration with other companies to provide comprehensive solutions for the leading-edge project.**
- **Upgrade includes 84,000 locally manufactured Philips LED lamps and luminaires, including 51,000 globe-shaped lampposts and 33,000 LED plates to be installed within existing lampposts.**



- **Our LED and controls solution delivers 44% energy savings which provides the funding for the technology upgrade, providing the City of Madrid with the best quality of street lighting for a brighter, safer and smarter city at no additional cost to its citizens.**
- **Project reduces the City's energy consumption with energy efficient luminaires, extending the lifespan of the city lighting and controlling light pollution by enabling the regulation of the intensity of light when and where it's needed.**


Largest LED street lighting project in the world.

4.6.1 Philips Smart Pole Installation Partner Customer References – Rosendin Electric Customer References (RFP 11.2.4.7.1.)

ATTACHMENT F

Previous Customer Reference Form (required)

Proposer must submit three references using this form. References must be current (within the last 3 years) customer references where the proposed system has been implemented and accepted and where the Proposer's Contractor services have been successfully demonstrated.

(Copy this form as necessary to complete each reference.)

Name of Customer:	**Caltrans Emergency Repairs**			
Address:	**111 Grand Avenue**			
	Oakland, CA 94623			
Customer Contact Name:	**Salvador Borrayo**			
Customer Contact Telephone:	**(510) 286-4559**			
Customer Email:	**Salvador.borrayo@dot.ca.gov**			
Date of Agreement/Contract:	**January 2013**			
Period of Performance:	From:	**February 2013**	To:	**July 2013**
Type of Contract:	☐ Firm Fixed Price		☐ Not to Exceed	
	☒ Time & Material		☐ Cost + Fixed Fee	
	Other:			
What is the dollar value of the contract?	**$3,436,609**			
If contract was terminated or cancelled for convenience, please indicate the circumstances:	**Not Applicable**			
Is this a reference for work Proposer has performed? (Yes or No)	**Yes**			

Provide a detailed description of work that you performed for this customer, including the size of the project, specifications for the project, technology deployed, or other details. If the customer is no longer using the Proposer's technology, provide a brief description explaining the reason(s). (Attach additional sheets if necessary.)

At multiple Caltrans locations throughout San José, Rosendin Electric performed troubleshooting and emergency repair to existing electrical systems for traffic operations. The emergency repairs included correction to numerous complex systems including cameras, traffic loops, pull boxes, and wiring, for CMS, ramp metering, CCTV, and detectors.

ATTACHMENT F - Rosendin

Previous Customer Reference Form (required)

Proposer must submit three references using this form. References must be current (within the last 3 years) customer references where the proposed system has been implemented and accepted and where the Proposer's Contractor services have been successfully demonstrated.

(Copy this form as necessary to complete each reference.)

Name of Customer:	**Agbayani Construction Corp.**			
Address:	**P.O. Box 819**			
	Concord, CA 94522			
Customer Contact Name:	**Vince Agbayani**			
Customer Contact Telephone:	**(415) 221-8065**			
Customer Email:	**Vince_agbayani@agbayani.com**			
Date of Agreement/Contract:	**July 9, 2013**			
Period of Performance:	From:	**July 2013**	To:	**November 2013**
Type of Contract:	☒ Firm Fixed Price		☐ Not to Exceed	
	☐ Time & Material		☐ Cost + Fixed Fee	
	Other:			
What is the dollar value of the contract?	**$345,632**			
If contract was terminated or cancelled for convenience, please indicate the circumstances:	**Not Applicable**			
Is this a reference for work Proposer has performed? (Yes or No)	**Yes**			
Provide a detailed description of work that you performed for this customer, including the size of the project, specifications for the project, technology deployed, or other details. If the customer is no longer using the Proposer's technology, provide a brief description explaining the reason(s). (Attach additional sheets if necessary.)				
Provide and install new switchgear along with new pole mounted air switches, fused cutouts, and surge arresters.				

ATTACHMENT F - Rosendin

Previous Customer Reference Form (required)

Proposer must submit three references using this form. References must be current (within the last 3 years) customer references where the proposed system has been implemented and accepted and where the Proposer's Contractor services have been successfully demonstrated.

(Copy this form as necessary to complete each reference.)

Name of Customer:	**Space Systems Loral**			
Address:	**3825 Fabian Way**			
	Palo Alto, CA 94303			
Customer Contact Name:	**Greg Jones**			
Customer Contact Telephone:	**(650) 852-5023**			
Customer Email:	**greg.jones@sslmda.com**			
Date of Agreement/Contract:	**October 2014**			
Period of Performance:	From:	**December 2014**	To:	**December 2015**
Type of Contract:	☒ Firm Fixed Price		☐ Not to Exceed	
	☐ Time & Material		☐ Cost + Fixed Fee	
	Other:			
What is the dollar value of the contract?	**$1,100,000**			
If contract was terminated or cancelled for convenience, please indicate the circumstances:	**Not Applicable**			
Is this a reference for work Proposer has performed? (Yes or No)	**Yes**			

Provide a detailed description of work that you performed for this customer, including the size of the project, specifications for the project, technology deployed, or other details. If the customer is no longer using the Proposer's technology, provide a brief description explaining the reason(s). (Attach additional sheets if necessary.)
Construct new substation building from the ground up. Install both underground and above ground electrical conduits and boxes. Install owner supplied electrical panels, switchgears, and transformers.

4.6.2 WMH Customer References (RFP 11.2.4.7.2.)

ATTACHMENT F

Previous Customer Reference Form (required)

Proposer must submit three references using this form. References must be current (within the last 3 years) customer references where the proposed system has been implemented and accepted and where the Proposer's Contractor services have been successfully demonstrated.

(Copy this form as necessary to complete each reference.)

Name of Customer:	**California Highway Patrol**			
Address:	**Cordelia Inspection Facility** **3895 Interstate 80**			
	Fairfield, CA 94534			
Customer Contact Name:	**Lt. Mike Ferrell**			
Customer Contact Telephone:	**(707) 864-5558**			
Customer Email:	**mferrell@chp.ca.gov**			
Date of Agreement/Contract:	**December 2008**			
Period of Performance:	From:	**December 15, 2008**	To:	**Present**
Type of Contract:	☐ Firm Fixed Price		☒ Not to Exceed	
	☐ Time & Material		☐ Cost + Fixed Fee	
	Other:			
What is the dollar value of the contract?	**$3,200,000**			
If contract was terminated or cancelled for convenience, please indicate the circumstances:	**Not Applicable**			
Is this a reference for work Proposer has performed? (Yes or No)	**Yes**			

Provide a detailed description of work that you performed for this customer, including the size of the project, specifications for the project, technology deployed, or other details. If the customer is no longer using the Proposer's technology, provide a brief description explaining the reason(s). (Attach additional sheets if necessary.)

New Commercial Vehicle Enforcement Facility was constructed to replace an existing outdated facility that was causing delays on I-80 due to its inefficiencies. The new site includes seven inspection bays, weight-in-motion scales and state of the art sorting technology. WMH developed and oversaw a separate technology contract for coordination of cameras, weight and visual sorting vehicles. Several key technologies were incorporated into the design of the Cordelia Truck Scale facility, including automated CVSA Decal Reader technology, an Advanced Lane Control system, and Vehicle Waveform Identification (VWI). VWI electronically tags and tracks commercial vehicles based on their magnetic fingerprint. This patent pending technology identifies and matches commercial vehicles from location to location with an accuracy exceeding 96%. This technology was integrated with an electronic lane control system to offer complete weigh station traffic management and tracking.

ATTACHMENT F - WMH

Previous Customer Reference Form (required)

Proposer must submit three references using this form. References must be current (within the last 3 years) customer references where the proposed system has been implemented and accepted and where the Proposer's Contractor services have been successfully demonstrated.

(Copy this form as necessary to complete each reference.)

Name of Customer:	**City of Sunnyvale**			
Address:	**221 Commercial Street**			
	Sunnyvale, CA 94086			
Customer Contact Name:	**Manuel Pineda**			
Customer Contact Telephone:	**(408) 730-7426**			
Customer Email:	**mpineda@sunnyvale.ca.gov**			
Date of Agreement/Contract:	**August 19, 2013 - Contract through funding agency VTA for customer City of Sunnyvale**			
Period of Performance:	From:	**August 2013**	To:	**Present**
Type of Contract:	☐ Firm Fixed Price		☒ Not to Exceed	
	☐ Time & Material		☐ Cost + Fixed Fee	
	Other:			
What is the dollar value of the contract?	**$1,400,000**			
If contract was terminated or cancelled for convenience, please indicate the circumstances:	**Not Applicable**			
Is this a reference for work Proposer has performed? (Yes or No)	**Yes**			

Provide a detailed description of work that you performed for this customer, including the size of the project, specifications for the project, technology deployed, or other details. If the customer is no longer using the Proposer's technology, provide a brief description explaining the reason(s). (Attach additional sheets if necessary.)

Mathilda Avenue Improvements at SR237 and US 101, Sunnyvale ($21M). WMH is responsible for the PID, PA/ED and PS&E to construct local street intersection and interchange improvements to alleviate congestion and improve access for all modes of travel along a critical segment of Sunnyvale's primary arterial.

ATTACHMENT F - WMH

Previous Customer Reference Form (required)

Proposer must submit three references using this form. References must be current (within the last 3 years) customer references where the proposed system has been implemented and accepted and where the Proposer's Contractor services have been successfully demonstrated.

(Copy this form as necessary to complete each reference.)

Name of Customer:	**Alameda County Transportation Authority**			
Address:	**1111 Broadway, Suite 880**			
	Oakland, CA 95607			
Customer Contact Name:	**Gary Sidhu**			
Customer Contact Telephone:	**(510) 208-7421**			
Customer Email:	**gsidhu@alamedactc.org**			
Date of Agreement/Contract:	**August 15, 2011**			
Period of Performance:	From:	**2011**	To:	**Present**
Type of Contract:	☐ Firm Fixed Price		☐ Not to Exceed	
	☒ Time & Material		☐ Cost + Fixed Fee	
	Other:			
What is the dollar value of the contract?	**$7,000,000**			
If contract was terminated or cancelled for convenience, please indicate the circumstances:	**Not Applicable**			
Is this a reference for work Proposer has performed? (Yes or No)	**Yes**			

Provide a detailed description of work that you performed for this customer, including the size of the project, specifications for the project, technology deployed, or other details. If the customer is no longer using the Proposer's technology, provide a brief description explaining the reason(s). (Attach additional sheets if necessary.)

I-680 Northbound Express Lanes (SR 237 to SR 84) ($317M) WMH is Responsible for PSR, and PA/ED to widen approximately 15 miles of northbound I-680 to provide a combined HOV/express lane facility from SR 237 in Santa Clara County to SR 84 (Vallecitos Road) in Alameda County. The Project will be constructed in phases and includes 64 overhead sign structures, auxiliary lanes, modify 14 bridge crossings, 45 new retaining walls, sound wall replacement, extensive safety lighting in the median and outside of the freeway, and ramp metering modifications. Right of way requirements include 13 property acquisitions, and utility relocations. A continuous access express lane facility is proposed and will be operated and enforced consistent with other express lane projects in the Bay Area Regional Express Lane network.

5.0 Proposal Specifics (RFP 11.2.5.)

5.1 Attachment B, Proposal Specifics Worksheet (RFP 11.2.5.1.)

ATTACHMENT B

Proposal Specifics Worksheet (REQUIRED)

1. Please describe how you intend to achieve the outcomes and goals outlined in this RFP, particularly those specified in Sections 1 (Introduction) and 2 (Goals and Objectives).

Philips Proposed Project Structure

Philips' proposed deal structure for the City of San José Innovative Street lighting RFP is outlined below. Our construct allows the City to achieve installation of 40,000 cobra head and decorative streetlights with wireless controls without any capital outlay and is compliant with the requirements of RFP. In accordance with the City's RFP, Philips' approach enables the City to convert its existing streetlights to LEDs with an Owlet controls system without relying solely on energy and/or operational savings. As an additional benefit, our program enables a future ready public network infrastructure that will enhance the wireless broadband experience for citizens, local businesses, and visitors, as well as creating a platform for future connected city applications. Philips will deliver these infrastructure enhancements through a citywide deployment of the Philips' smart pole, enabling densification of the City's existing 4G LTE wireless broadband service. Philips smart poles discreetly house FCC certified mobile network operator equipment, enabling an alternative and attractive deployment methodology of "Small Cell" 4G LTE broadband services and future standards. This innovative infrastructure upgrade will provide the backbone of the Internet of Things to help prepare San José for future connected city applications.

The details of our proposal are as follows:

- Philips is working with financial institutions to fund the full amount of the cost of the City's street lighting replacements. This will allow Philips to manufacture, design, and install the new LED streetlights with a wireless controls system throughout the City within the time period allotted in the RFP.
- The City will continue to make the same electrical payment for their streetlight energy usage over the course of 17 years with a 3% escalation for utility rates. A portion of such payment will be paid to PG&E based on the new lower LED tariff and the remaining portion of the payment (which represents the reduction in energy costs) will be paid to the financial institution. Beginning in year 18 the City will enjoy the full benefits of the lower electricity costs.
- In connection with the smart poles portion of the project, Philips will enter into a citywide Master Installation Agreement with the City San José for a term of 25 years. We expect that this agreement will be based, in large part, on the Master Installation Agreement that Philips has executed with the City for the ongoing pilot deployment.
- The City will receive $1,500 per pole, per year, for every active smart pole installed after the first 200 quantity.

The table below demonstrates the features and benefits of choosing the Philips solution for the City's Innovative LED Streetlight Replacement.

<table>
<tr><th>RFP Criteria</th><th>RFP Weight</th><th>Benefit</th><th>Feature</th></tr>
<tr><td>1 Highest Verified Value</td><td>35%</td><td>With no capital outlay by the City, Philips estimates the value of our proposal at approximately $105.2 million. The project will be funded by a combination of energy and operational savings, utility incentives, and generated revenue through SmartPole rental income.</td><td>Quantifiable Benefits to the City of San José

Source | Projected Value
Philip Smart Poles (Active poles 201-1,000) | $ 26,400,000
Energy Expense Avoidance | $ 63,300,000
Maintenance Expense Avoidance | $ 3,500,000
Philips Project Incentive | $ 2,000,000
Circuit Analysis and Underground Survey Documentation | $ 10,000,000
Total Projected Value | $105,200,000</td></tr>
<tr><td>2 Practicality of Implementation</td><td>35%</td><td>As proven recently in the City's Technology Demonstration Project, the Philips SmartPole solution and LED lighting can be seamlessly implemented. Underpinned by the successful San José – Philips way of working, by selecting Philips, the City will be able to achieve your stated timeline for project completion by December 2018.</td><td>• Philips solution will be completed within the designated time frame of the RFP
• Philips prior versions of proposed CCE solution are being implemented successfully in San José and in Los Angeles, CA
• Philips has ongoing lighting projects in major cities throughout the world
• Philips solution meets the RFP goals fully and advances the City's Green Vision goals
• Philips solution does not face any known legal or policy hurdles
• Philips solution accomplishes an LED conversion, including controls for all four zones combined with the installation of Philips Connected Poles within city boundaries
• Philips solution will not use data analytics or attempt to monetize data collection from sensors, cameras or other methods, avoiding potentially troubling personal privacy issues</td></tr>
<tr><td>3 Community Benefit and Impact</td><td>10%</td><td>Philips' innovative approach will unlock millions of dollars of investments, which underpin an infrastructure build-out that enables new viable technology such as the Connected Car and other Internet of Things (IoT) solutions. The Philips solution directly provides local jobs, fosters economic development, and can help create a greater feeling of safety for the public with state of the art municipal lighting.</td><td>• Philips has designed a program with the Santa Clara County IBEW/NECA to generate jobs for San José residents linking qualified graduates of the City's Work-to-Future's "Trades Orientation Program" (TOP) and is fully aligned with the Work2Future's goal
• Philips uses local labor
• Philips Connected Pole declutters the cityscape, providing an aesthetic pleasing solution
• Philips solution has minimal impact from construction
• Philips solution of connected node reduces amount of clutter on streetlight poles
• Philips solution brings proven technology partners</td></tr>
<tr><td>4 Experience</td><td>10%</td><td>Philips is the largest and most capable lighting company in the world. For more than 120 years, Philips has been designing, manufacturing, and installing lighting. Philips' experience, complemented by the robust qualifications of our local subcontractor team, ensures the City will receive the highest quality lighting project available.</td><td>• Philips Lighting is a global market leader with recognized expertise in the development, manufacturing, and application of innovative lighting solutions
• We bring an experienced team of industry leaders

PHILIPS
ERICSSON is a world leader in the supply of mobile communications equipment that powers over 45% of the world's mobile traffic. Currently working with Philips to deliver SmartPoles to San José through the City's technology demonstration project.
WMH a local and small business enterprise in the City of San José, has the largest dedicated transportation delivery team in the Bay Area that provides complete management and design service.
Rosendin Electric is the top-ranked, private electrical contractor in the nation. Headquartered in San José, California they bring local knowledge and nationwide experience.
LUMILEDS is a leader in light engine technology and delivers innovation globally from their headquarters in San José, California.</td></tr>
<tr><td>5 Environmental Stewardship</td><td rowspan="3">5%</td><td>A huge advancement toward achieving the City's Green Vision goals. By selecting Philips' proposal, the City is choosing to work with a company who designs, manufactures, ships, and installs innovative lighting systems with a lighter ecological footprint. Our commitment to the environment means a 'greener' project for the City.</td><td rowspan="3">• Environmental Stewardship
- Installation of LED technology helps the City of San José meet its sustainability goals
- CDP - Philips has been recognized as a world leader for corporate action on climate change. For the 3rd year in a row, we've achieved a perfect score (100A) in the CDP Climate Change survey
- Dow Jones Sustainability Index (DJSI)-Philips is named the industry leader in the Industrial Conglomerates category with a score of 91 out of 100 points
- Reduction in electrical spend and usage
• Local Business Preference
- Lumileds
- WMH Corporation
- Rosendin Electric
• Small Business Preference
- WMH Corporation is a registered small business in the City of San José</td></tr>
<tr><td>6 Local Business Preference</td><td>Philips values the expertise local businesses add to the success of our projects. For that reason, we have assembled a qualified team comprised of several local businesses including WMH, Rosendin Electric, and Lumileds</td></tr>
<tr><td>7 Small Business Preference</td><td>Like the City, Philips understands the importance of supporting and fostering the growth of local and small companies. That is why we have chosen to work with WMH, a qualified Small and Local Business Enterprise for the City's Innovative LED Streetlight Replacement and beyond.</td></tr>
</table>

Superior Streetlight Technology for San José - Philips will convert the City's remaining sodium vapor and metal halide streetlights to San José DOT approved Philips LED RoadFocus streetlights.

San José DOT approved Philips LED RoadFocus Streetlights

We understand streetlighting can be a personal experience for citizens; poles are often in front of their houses, residents walk their dogs under the lights and talk to their neighbors on the sidewalk. To ensure that this project is done correctly, it is important that the City's approach be thorough and precise. Such an approach includes a host of key issues such as correct application, proper light levels, excellent uniformity, color index, fixture aesthetics, dimming abilities, directional optics and many more. The dedicated Philips team of lighting professionals is eager and equipped to be part of the City's future in lighting and to share this message with residents and businesses.

The RoadFocus family of products allows San José to benefit from LED performance far surpassing that of your existing conventional luminaires while retaining the familiar cobra head design. The aesthetics of the luminaire get high marks from our customers and their citizens.

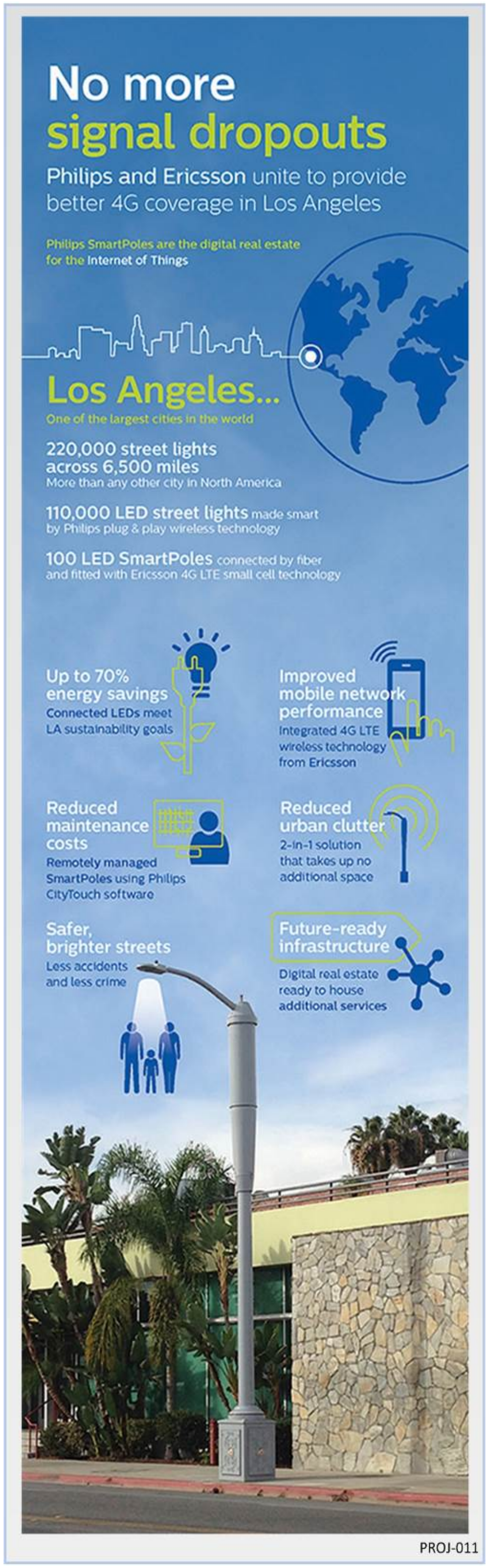
As demonstrated by the 287 Philips RoadFocus already installed in San José, at night, RoadFocus LED luminaires come alive – blanketing your roadways with uniform, high-quality, white illumination, while avoiding the shadows and streaks that traditional roadway lighting can produce. This downward blanket of light helps achieve the City's stated goal of lessening light pollution in the night sky. The RoadFocus provides no uplight for (U0) Dark Sky friendly lighting. As an additional benefit to upgrading to the Philips RoadFocus, our luminaires greatly contribute to the City's environmental stewardship and Green Vision goals through significant energy savings and reduced carbon footprint. RoadFocus product specifications are included in Appendix D.

Our approach to retrofitting the City's existing decorative luminaires is flexible and collaborative. Philips understands that, as noted in the RFP, the City does not have an existing detailed inventory of the different styles of decorative luminaires. As part of our project implementation, Philips will perform a field survey to determine exactly what is needed.

Once our field survey is performed, Philips will provide the City a detailed inventory and a more tailored approach.

Expanded Broadband through Citywide Philips Smart Pole Installation –

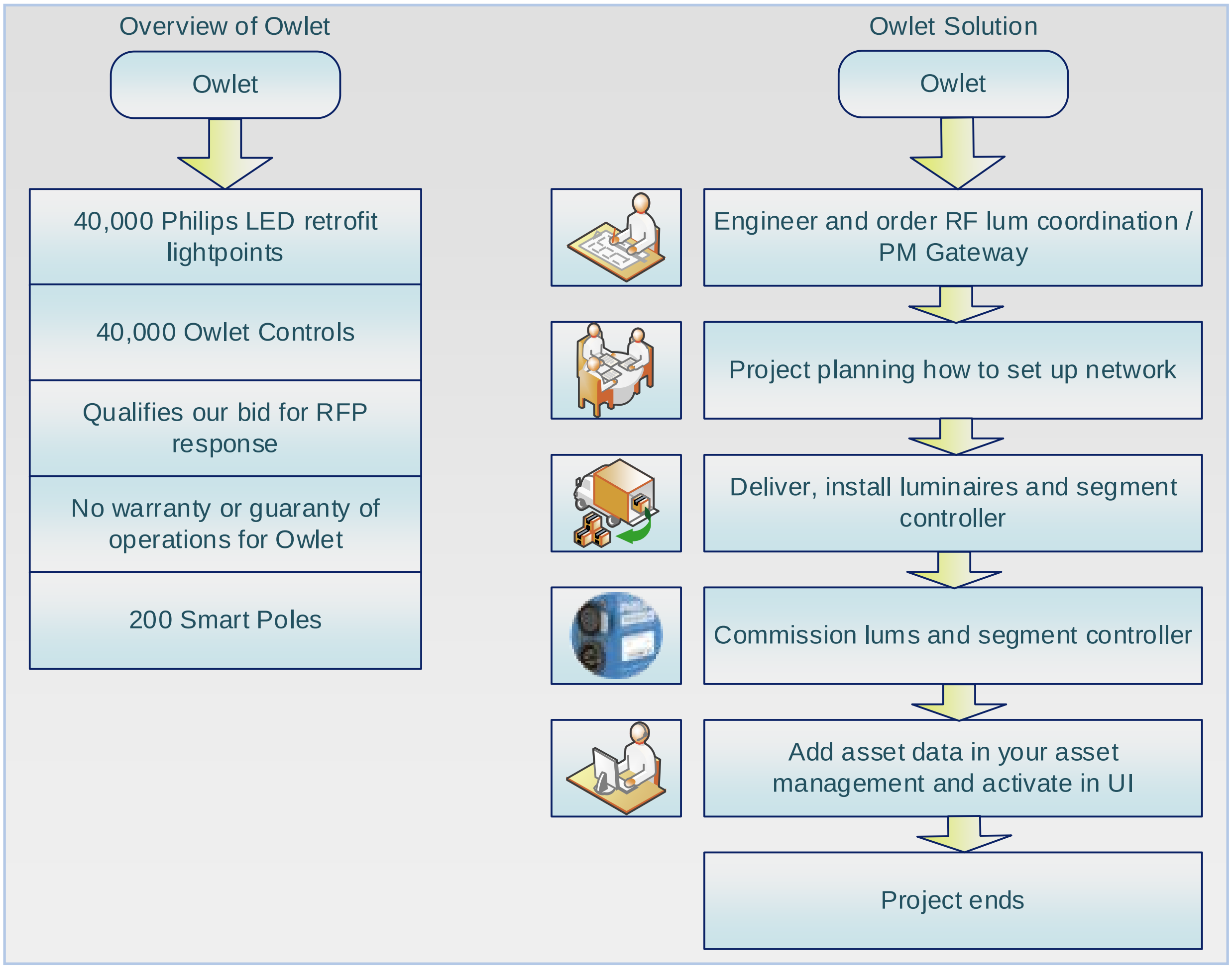
The streetlighting system is quickly becoming one of the most valuable assets a City owns in the Smart City experience. As proven recently in our Technology Demonstration Project, our Philips smart pole solution, through a global strategic alliance with Ericsson can help turn a City's street lights into valuable digital real estate. Converting certain light poles to Philips smart poles provide increasingly important digital connectivity opportunities thereby transforming these poles from static cost assets into revenue generating properties. Our proposal is based upon an enhancement and citywide expansion of the CCE demonstration.



Philips and Ericsson: A Strategic Alliance - Philips, the global leader in lighting, and Ericsson, a top provider of communications technology and services, have jointly launched an innovative new smart street lighting model. The partnership solves two major issues that cities are facing today: 1) providing citizens with improved cellular network performance in dense urban areas; and 2) providing high quality, public lighting that is energy efficient. Philips and Ericsson combine the benefits of mobile connectivity and LED lighting for the cities. It allows city authorities to offer space within their connected lighting poles to network service providers for mobile broadband infrastructure.

Our Philips smart pole integrates the latest mobile high-speed data capacity technology, known as Small Cells into the pole. By integrating these Small Cells into our Philips smart poles it allows for a standardized process and rapid deployment of new cell sites while maintaining the City's visual aesthetics.

The Owlet System: To remain compliant with the RFP requirements, Philips submits this response using Schreder's Owlet controls system on the remaining 40,000 streetlights.



2. Describe the Community Benefit of your proposal, including aesthetics, reduction of clutter in the right-of-way, etc.

Adoption of Philips' suggested approach not only provides the City with a method to convert existing streetlights with no capital outlay, Philips' approach dramatically improves the City's infrastructure, achieves significant energy savings, reduces levels of light pollution, supports sustainable design, and enhances mobile data access to San José businesses, residents, visitors and businesses at service levels not previously possible. This concept declutters the cityscape, by eliminating electrical meter pedestals, visible antennas, and associated cabling while utilizing a standard deployment methodology with a uniform planning and permit processing. In addition to the benefits received directly from the lighting and controls system, Philips is committed to generating local community benefits including job creation.

Demonstrating Philips' commitment to generate further local community benefit, we designed a program with the Santa Clara County International Brotherhood of Electrical Workers AFL-CIO (IBEW), the National Electrical Contractors Association (NECA), and Rosendin Electric to generate jobs for San José residents linking qualified graduates of the City's Work2Future's "Trades Orientation Program" (TOP) Our progressive approach is fully aligned with the Work2Future's goal:

"To strengthen the economic base in San José and Santa Clara County by increasing employment opportunities and job retention for all residents."

Our local smart pole contractor, Rosendin Electric, will hire qualified TOP graduates directly into the new jobs created by this project. IBEW and NECA will support this program by facilitating the hiring of the local resident TOP graduates. TOP graduates will be hired at the material handler classification, a precursor to apprenticeship, and will be partnered with a licensed electrician to perform work installing Philips smart poles.

We will require our local contractors to adhere to a strict "Electrical Safety Policy" that will require all contractors and subcontractors awarded work to comply with the certification and training requirements. This will create a safer environment for both workers and commuters.

As an added community benefit, Philips is investigating the possibility of providing fiber access to the smart poles as well as providing two strands of fiber to the city for non-commercial use as described in the forward thinking section of our Executive Summary.

3. Describe the City assets that will be required to implement your proposal.

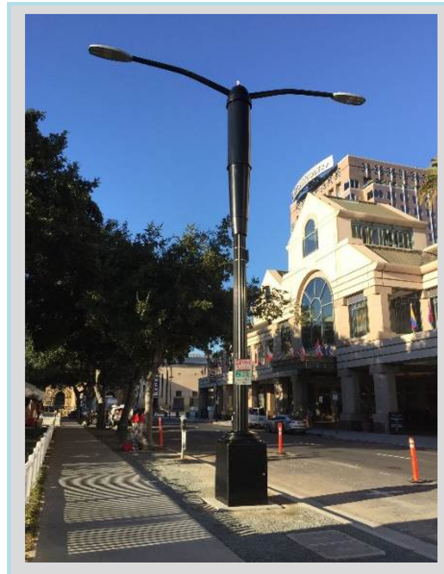
Our program requires that the City allow Philips to deploy its smart poles citywide. The Philips' smart pole design has already been approved by the City and will replace existing streetlight poles in the City. Philips will work with its partners to determine which locations are optimal for installation of a Philips' smart pole. All Philips smart poles installed in the course of our program also become the City's asset. The Philips smart poles at the end of an agreed term are returned to the City. The remaining City owned streetlights and other City assets such as naming rights or spare land can be used, to generate additional revenue for the City. The Philips proposal will not use data analytics or attempt to monetize data collection from sensors, cameras or other methods, avoiding personal privacy issues.

4. Has your proposal been implemented elsewhere?

YES X **NO** ☐ If yes, provide locations and dates of previous projects, as well as contact information for the jurisdiction or project.

Toward the end of 2015, Philips implemented the proposed solution in the City of San José as a technology demonstration project. The project was approved unanimously by the City Council on February 24, 2015. We are proud to have this project be a part of the *Vision Zero* San José initiative in the City's Technology Innovation Zone (TIZ), as it represents two years of working together to develop a public private partnership for the deployment of the Philips Connected City Experience Philips smart pole Program (CCE).

Contact Information:
The City of San José
200 East Santa Clara Avenue
San José, California
Attn: Teri Killgore (408)920-7007
teri.killgore@sanJoséca.gov



Philips smart pole in San José.

The City of Los Angeles is enjoying the benefits of their recently implemented Philips Connected City Experience Philips smart pole Program (CCE). Los Angeles was the first city to deploy Philips' Philips smart pole Streetlighting with fully built in 4G LTE wireless technology from Ericsson.

Los Angeles CCE Highlights –

- Delivers enhanced and more reliable wireless data broadband coverage to businesses and citizens in one of the largest cities in the world.
- 100 LED light poles fitted with new small cell technology from Ericsson that hosts mobile network operator equipment.
- Leading-edge energy efficiency LED streetlighting to help LA meet sustainability goals while improving mobile network performance and reducing urban clutter.

Contact Information:
The City of Los Angeles
1149 S. Broadway, Ste. 200
Los Angeles, California 90015
Attn: Ed Ebrahimian
Director – Bureau of Street Lighting (213)847-2020
ed.ebrahimian@lacity.org

Philips smart pole in Los Angeles.

5. Have you (or your installation partner) completed installations of LED streetlights in other locations?

   YES [X] **NO** [ ] If yes, provide locations, number of lights installed, project completion dates, and contact information for the jurisdiction or project.

   Philips, and our teammates, have a substantial portfolio of streetlighting projects. Reference projects are available in Section 4.7, Attachment F.

6. Will you be in any way attaching or placing equipment or otherwise utilizing City right-of-way, facilities, or property?

   YES [X] **NO** [ ] If yes, please complete Attachments H through J as applicable.

   Please refer to the Attachments H through J.

   No telecommunication equipment will be placed on or attached to any City owned property. A minimum of 200 approved Philips smart poles will be installed in the City right of way in selected areas throughout the City.

   The Owlet segment controllers will be installed on City owned light poles throughout the City.

7. Will you be placing telecommunications or other equipment on City lightpoles?

   YES [ ] **NO** [X] If yes, please complete Attachments H through J as applicable.

   Other than noted in question 6, Philips will not install or place other equipment on City light poles.

8. Will your project limit or prevent access to City lightpoles or facilities by other providers or vendors due to technological or space factors or for other reasons?

   YES [X] **NO** [ ] If yes, please describe limitations to access in your proposal.

   The City will not be denied access to the Philips smart poles. City will have access per the terms of the Master Installation Agreement for regular maintenance of the pole. Due to space limitations, the Philips smart pole will only house FCC licensed wireless mobile operator equipment. City will have access to the Philips smart poles for regular maintenance issues of the luminaires.

9. Does your proposal require a power source for any use other than powering the individual streetlights?

   YES [X] **NO** [ ] If yes, please complete Attachment I, Power Specifications.

   Philips will use the City's existing electrical infrastructure to power the telecommunication equipment housed within the Philips smart pole. (Please refer to the answer for Question 10).

10. For proposers answering "Yes" to Question 9:

    a. Do you have understand that PG&E has limitations on the size and types of uses that may use streetlight circuits for power?

    YES [X] **NO** [ ] If you are unable to use these circuits, you must outline your power solution in Attachment I.

    Philips will continue the same methodology as used in the pilot program for the citywide Philips smart pole deployment. The existing electrical circuits that are used to service a Philips smart pole will be analyzed for load availability.

    - All circuit analysis completed as part of this project can be used by the City for civic purposes.

- For existing circuits that have 20% reserve, reserve at least 20% circuit load Capacity for the City's future use for each circuit where a Telecommunications Equipment is installed. For existing circuits that have less than 20% reserve, reserve no less than the existing circuit load capacity for the City's future use for each circuit where a Telecommunications Equipment is installed.
- Where circuit upgrades are required, all costs are the full responsibility of the company as it relates to the telecom equipment.

b. Are you willing to provide a sample piece of equipment for PG&E testing, as well as any and all technical information they require?

YES [ ] **NO** [X]

During August 2015 Pacific Gas and Electric (PG&E) employees visited the Ericsson facility located in Lewisville, Texas and conducted intensive testing of the Philips smart pole and the new wireless electric meter. PG&E concluded that the wireless electric meter functioned correctly when attached to the Philips smart pole. Presently, 21 of these new PG&E wireless electric meters are installed on Philips smart poles located throughout the City of San José.

11. Does your proposal require backhaul?

Please note: Available City of San José backhaul is limited. Proposer should not assume availability of City-supplied backhaul.

YES [X] **NO** [ ] If yes, please delineate the source of backhaul to be used in Attachment H.

See Attachment H.

12. Does your proposal require the placement of utility cabinets, vaults, or other equipment in the City right-of-way?

YES [ ] **NO** [X] If yes, please indicate the type and quantity.

All of the telecommunications equipment is housed within the Philips smart pole. Depending on LED Lighting control system solution selected by the City, there may be the need external gateways to be placed in the City right of way.

13. Does your proposal reduce the number of utility cabinets, vaults, etc. in the City right-of-way?

YES [ ] **NO** [X] If yes, how many of each type will be eliminated?

The proposed Philips solution the Philips smart pole discreetly houses telecommunication equipment in the interior of the modified streetlight pole instead of having the equipment attached to the exterior of building, rooftops and or streetlight poles and eliminates the need for PG&E Meter pedestals and cabinets. The number of each type depends on the number of Philips smart poles installed.

With the deployment of the Owlet control system, gateway cabinets will be required to be installed in the public space.

5.2 Attachment D, Proposer Certification Form (RFP 11.2.5.2.)

ATTACHMENT D

Proposal Certification Form (Required)

No proposal shall be accepted which has not been signed in ink in the appropriate space below.

Proposing Firm Name:	**Philips Lighting North America Corporation**
Address:	**200 Franklin Square Drive** **Somerset, New Jersey 08873**
Telephone:	**(732) 563-3474**
Facsimile:	**(732) 563-3500**
Email:	**amy.huntington@philips.com**
Contact Person Name and Title:	**Amelia A. Huntington** **President**

PROPOSER REPRESENTATIONS

1. Proposer did not, in any way, collude, conspire or agree, directly or indirectly, with any person, firm, corporation or other Proposer in regard to the amount, terms, or conditions of this proposal.
2. Proposer additionally certifies that neither Proposer nor its principals are presently disbarred, suspended, proposed for disbarment, declared ineligible or voluntarily excluded from participation in this transaction by any federal department or agency, any California State agency, or any local governmental agency.
3. Proposer acknowledges that all requests for deviations, exceptions, and approved equals are enclosed herein and that only those deviations, exceptions, and approved equals included in the RFP document or permitted by formal addenda are accepted by the City.
4. Proposer did not receive unauthorized information from any City staff member or City Consultant during the Proposal period except as provided for in the Request for Proposals package, formal addenda issued by the City, or the pre-proposal conference.
5. Proposer certifies that this submission includes full consideration of the information and/or requirements identified in Addenda __**1**__ through **13**__.
6. Proposer hereby certifies that the information contained in the proposal and all accompanying documents is true and correct.
7. Please check the appropriate box below:

   ☐ If the proposal is submitted by an individual, it shall be signed by him or her, and if he or she is doing business under a fictitious name, the proposal shall so state.

   ☐ If the proposal is submitted by a partnership, the full names and addresses of all members and the address of the partnership, the full names and addresses of all members and the addresses of the partnership, the full names and addresses of all members and the address of the partnership shall be stated and the proposal shall be signed for all members by one or more members thereof.

   ☒ If the proposal is submitted by a corporation, it shall be signed in the corporate name by an authorized officer or officers.

   ☐ If the proposal is submitted by a limited liability company, it shall be signed in the corporate name by an authorized officer or officers.

☐ If the proposal is submitted by a joint venture, the full names and addresses of all members of the joint venture shall be stated and it shall be signed by each individual.

By signing below, the submission of a proposal with all accompanying documents shall be deemed a representation and certification by the Proposer that they have investigated all aspects of the RFP, that they are aware of the applicable facts pertaining to the RFP process, its procedures and requirements, and that they have read and understand the RFP.

Authorized Representative Name (print name):	**Amelia A. Huntington**
Authorized Representative Signature (sign name):	Amelia A. Huntington
Authorized Representative Title (print title):+	**President**
Complete additional signatures below as required per # 7 above	
Authorized Representative Name (sign name):	**Not Applicable**
Authorized Representative Signature (print name):	
Authorized Representative Title (print title):+	
Authorized Representative Name (sign name):	**Not Applicable**
Authorized Representative Signature (print name):	
Authorized Representative Title (print title):+	

5.3 Attachment G, Environmentally Preferred Procurement Program (EP3) Information Sheet (RFP 11.2.5.3.)

ATTACHMENT G

Environmentally Preferred Procurement Program (EP3) Information Sheet (required)

Please review the contents of this document then provide the information requested at the end of this document regarding the product and/or service offered. This document is to be submitted with your Bid or Proposal. The document will not be utilized in the determination of the overall low bidder. The complete Council Policy (4-6) can be viewed at:
www.municode.com/Resources/gateway.asp?pid=14440&sid=5

Background

The City of San José has adopted an Environmentally Preferable Procurement (“EPP”) Policy (Council Policy 4-6). The goal is to encourage the procurement of products and services that help to minimize the environmental impact resulting from product consumption during the completion of services, as well as the use and disposal of products purchased. These products include, but are not limited to, those that contain recycled content, conserve energy or water, minimize waste or reduce the amount of toxic material used and disposed.

The City encourages the use of products that minimize adverse environmental and health effects and take into consideration both the costs associated with the full product life cycles.

What Is Environmentally Preferable Procurement (EPP)?

Environmentally Preferable Procurement (EPP) is a process for selecting products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose. In the simplest terms, EPP means adding environmental considerations to purchasing decisions along with such traditional factors as performance, price, health, and safety. EPP considerations include:

- Durability
- Energy and water efficiency
- Remanufactured parts and recycled content
- Ability to reuse or recycle
- Existence of harmful or dangerous chemicals

The EPP process builds on these single attributes and encourages purchasers to examine multiple attributes such as energy efficiency ***and*** recycled content ***and*** toxicity ***and*** the use of renewable resources ***and*** other environmental attributes. The mix of attributes will depend on the specific product or service being evaluated.

The City is interested in understanding positive environmental attributes as outlined below. You may attach additional sheets as may be required.

Philips has attached more information on our commitment to sustainability and the environment on the table below.

Product or Service Environmental Profile	Yes	No	Detailed Product/Service Information
1. Are the Products offered or utilized in providing this service certified by independent certification programs such as Energy Star, Green Seal, EcoLogo, or EPEAT?	☑	☐	For the third consecutive year, in 2015, Philips was named the Energy Star partner of the year by the U.S. Environmental Protection Agency for outstanding contribution to environmental protection through energy efficiency.  The RoadFocus product family is listed on the Design Lights Consortium website as Qualified products. See below explanation: The DesignLights Consortium™ (DLC) is a project of Northeast Energy Efficiency Partnerships (NEEP), a regional non-profit founded in 1996 whose mission is to serve the Northeast and Mid-Atlantic to accelerate energy efficiency in the building sector through public policy, program strategies and education. The DLC promotes quality, performance and energy efficient commercial sector lighting solutions through collaboration among its federal, regional, state, utility, and energy efficiency program members; luminaire manufacturers; lighting designers and other industry stakeholders throughout the U.S. and Canada. Over its 14 year history the DLC program has driven the lighting market towards innovation by providing information, education, tools and technical expertise for cutting edge technologies. Since 2010, the DLC has administered the Qualified Products List (QPL), a leading resource that distinguishes quality, high efficiency LED products for the commercial sector. Today, the QPL sets the bar for efficiency program incentives across the U.S. and Canada while informing manufacturer product development. Next to this certification, our products are certified according to the relevant UL/ANSI standards by UL and/or CSA. Relevant Certificates of Compliance can be obtained upon the City's requests.

Product or Service Environmental Profile	Yes	No	Detailed Product/Service Information
2. Do the Products offered or utilized in providing this service contain recycled material content?	☑	☐	Our EcoDesign program results in Green products that offer customers environmental improvements in local areas such as energy efficiency, packaging, hazardous materials, weight, and recycling and disposal. Our green product portfolio can be found at: http://www.philips.com/about/sustainability/ourenvironmentalapproach/greenproducts/greenproductsportfolio.page We have included information on the recyclability content for the RoadFocus fixtures below this table.
3. Do the Products offered or utilized in providing this service reduce energy consumption?	☑	☐	Philips LEDs results in significant energy and cost savings, in addition to using less energy, LEDs have a longer lifespan which reduces maintenance costs. The use of LED based luminaires reduces energy consumption (possible savings compared to HID based lighting can be up to 70% savings). As noted above, our EcoDesign program results in Green products, which offer customers, environmental improvements in focal areas such as energy efficiency, packaging, hazardous materials, weight, and recycling and disposal. Our green product portfolio can be found at: http://www.philips.com/about/sustainability/ourenvironmentalapproach/greenproducts/greenproductsportfolio.page
4. Do the Products offered or utilized in providing this service reduce toxicity, including emissions?	☑	☐	Philips Lighting products comply with all applicable Federal and State requirements. LEDs are less toxic and contain no mercury or lead, therefore lowering the environmental footprint. Several of our products are analyzed for Toxicity Characteristic Leaching Procedure (TCLP) compliant where testing methodology is used to determine if a waste is characteristically hazardous. Our green products are qualified in building LEED certification that has U.S. Green Building Council seal and have minimal or no mercury.
5. Do the Products offered or utilized in providing this service reduce water consumption?	☐	☑	Although these specific products do not impact the water consumption, it is Philips' policy, as part of the Green Operations Program in EcoVision, to minimize the impact of our manufacturing operations in all environmental aspects, including water consumption.
6. Do the Products offered or utilized in providing this service reduce waste?	☑	☐	Metal, LEDs, and circuitry can be recycled using a certified recycler. One-hundred percent of the fixture is recyclable, therefore reducing waste.

5.3.1 Philips RoadFocus Luminaries Recyclability Content

The Philips RoadFocus luminaire recyclability content is calculated by raw material weight. All mechanical components and IP66 optical modules are considered for this calculation. Driver module is not included on this report. Additionally, the cardboard packaging it is shipped in is 100% recyclable. Detailed percentage luminaire weight for the various materials is listed below.

Standard RFS Model

- 79.8% of the material used in the RoadFocus Small RFS luminaire is made of recyclable aluminum
- 6.6% of the material used in the RoadFocus Small RFS luminaire is made of recyclable steel
- 0.8% of the material used in the RoadFocus Small RFS luminaire is made of recyclable cooper
- 8.0% of the material used in the RoadFocus Small RFS luminaire is made of recyclable plastic
- 4.8% of the material used in the RoadFocus Small RFS luminaire is electrical components

Standard RFM Model

- 78.2% of the material used in the RoadFocus Medium RFM luminaire is made of recyclable aluminum
- 5.5% of the material used in the RoadFocus Medium RFM luminaire is made of recyclable steel
- 0.7% of the material used in the RoadFocus Medium RFM luminaire is made of recyclable cooper
- 6.3% of the material used in the RoadFocus Medium RFM luminaire is made of recyclable plastic
- 9.3% of the material used in the RoadFocus Medium RFM luminaire is electrical components

Standard RFL Model

- 71% of the material used in the RoadFocus Large RFL luminaire is made of recyclable aluminum
- 4.4% of the material used in the RoadFocus Large RFL luminaire is made of recyclable steel
- 0.5% of the material used in the RoadFocus Large RFL luminaire is made of recyclable cooper
- 15.2% of the material used in the RoadFocus Large RFL luminaire is made of recyclable plastic
- 8.9% of the material used in the RoadFocus Large RFL luminaire is electrical components

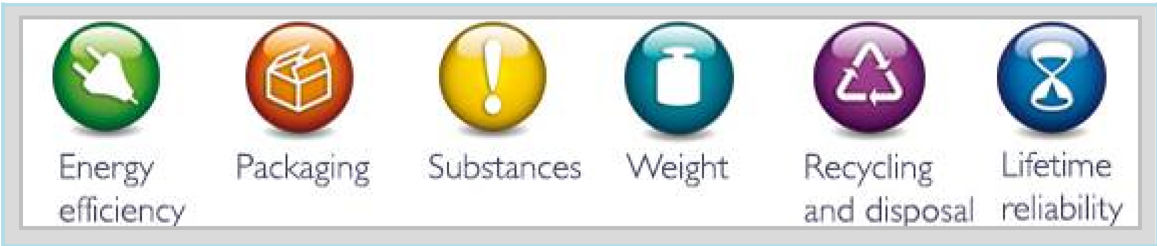
5.3.2 Philips Sustainability Overview

Philips has focused on the environmental impact of its operations since the 1970's. Our current activities are combined in our Green Operations program and address most contributors to climate change, but also water, recycling of waste and chemical substances. In 2012, we achieved our EcoVision4 carbon reduction target as our operational CO_2 emissions decreased 25% compared to 2007, the baseline year. Therefore, we established a new operational CO_2 reduction target of -40% compared to 2007 to be achieved by 2015. We were able to achieve this significant reduction for a number of reasons, including our ongoing energy efficiency improvement program and Green logistics programs.

Wind turbine that powers Philips lighting manufacturing facility in Fall River, Massachusetts.

We report our Carbon Footprint on a semi-annual basis internally, and report externally in our integrated financial, social and environmental report. Our Carbon Footprint has been verified by KPMG accountants at Reasonable Assurance level. Next, we report our Carbon Footprint data to the Carbon Disclosure Project (CDP). Philips is recognized as a world leader in climate change strategy by CDP for the fourth year in a row. In 2014 we again achieved the highest score, both for performance ("A") as well as for disclosure ("100"). To continue this positive trend, Philips purchased 55% of its electricity from renewable sources in 2014 (i.e. wind, solar, hydro). Philips has taken various initiatives to de-couple economic growth from the use of natural resources, also known as the "Circular Economy". To support this substantial initiative, we have established a partnership with the Ellen MacArthur Foundation and started a variety of projects in Philips and with select customers.

At Philips, sustainability means creating simpler solutions with a lighter ecological footprint and higher societal benefits. Building on Philips' tradition of innovation and technological expertise, we have developed procedures for Environmentally Conscious Product Design. Across our product range, we take into account the concerns of society and the environment in our EcoDesign Program. Introduced in 1994, our EcoDesign procedures deal with all phases of product development and improves the environmental impact of our products across their whole Life Cycle – material used, production, packaging, transport, usage and end of life. Our EcoDesign Program results in green products, which offer customers, environmental improvements in focal areas such as energy efficiency, packaging, hazardous materials, weight, recycling and disposal, and lifetime reliability.



Philips EcoDesign Program Focus Areas.

We continue to strengthen our Supplier Sustainability Program, further embedding it throughout our supply management organization. Environmental responsibility is part of the Philips Supply Management/Purchasing Code of Ethics. We also hold ourselves and our suppliers to the Electronics Industry Code of Conduct (EICC) and audit our priority suppliers in risk countries to assure conformance. Philips maintains a Regulated Substances List which includes restricted substances that are banned from our products and declarable substances. The list is part of the Philips terms of reference for suppliers. All suppliers are required to comply with the Regulated Substances List and our framework of substance management.

All suppliers with an annual spend of over $100k must sign and adhere to the Supplier Sustainability Declaration. This constitutes an integral part of our purchase agreements, purchase orders and terms and conditions. To help us determine our criteria for supplier sustainability audits, we identified risk Countries based on independent sources and also determined a threshold on spend. Philips conducts onsite sustainability audits to gain a representative picture of the supplier's overall sustainability performance and compliance with the EICC. The audits are conducted by a Philips in-house auditor or an EICC-certified auditing body. They are carried out using the Philips Supply Sustainability Audit Tool and cover the entire site, not just the production lines set up exclusively for Philips products.

Philips has received many awards and recognition over the past years with regard to its sustainability strategy, programs and performance. Please find below a brief overview:

- Philips has been recognized 2015 Energy Star partner of the year by the US Environmental Protection Agency for outstanding contribution to environmental protection through energy efficiency
- Philips was recognized, for the third consecutive year, as a leader in the carbon disclosure
- Project on both disclosure and performance
- Philips achieved top results in the 2014 Dow Jones Sustainability Index (90/100) with "Best in Class" results in Climate Strategy and Product Stewardship
- Philips received the Responsible Supply Chain Management Award from the Dutch Association of Investors for Sustainable Development (VBDO) for the seventh time, ranking first among the forty largest publicly listed Dutch companies
- Philips cited top riser in Interbrand's annual ranking of the top 50 Best Global Green Brands, moving up nine places to the 14th position
- Philips received the "Champion for Change" award from Practice GreenHealth, the US leading sustainable health care community

Philips maintains a Regulated Substances List which includes restricted substances that are banned from our products and declarable substances. Declarable substances on the Philips list need to be monitored due to regulatory requirements or because Philips wants to monitor their use from a precautionary point of view. The list is part of the Philips Terms of Reference for suppliers. All suppliers are required to comply with the Regulated Substances List found at is http://www.philips.com/about/sustainability/ourenvironment/chemicalmanagement.page.

These requirements, as set up in the Philips Regulated Substances List, are a world-wide policy of Philips. In other words, those requirements are applicable to all Philips products, packaging, and transport materials world-wide, even if local regulatory requirement may be less strict. Furthermore Philips Lighting has programs in place to proactively reduce the content of arsenic and antimony in lamp glass and PVC and Brominated Flame Retardants (BFR) in consumer products where feasible.

Philips limits the impact of our own operations on the environment:

- Green operations program (part of Philips sustainability program Ecovision 5) as published in our annual sustainability report http://www.2014.annualreport.philips.com
- Recycling materials of the production sites, the warehouses or other operations
- Use of alternative fuel for vehicles or vehicles equipped with diesel control devices for delivery of transportation purposes
- Greening logistics (part of Philips program Ecovision 5); overall targets on reducing carbon footprint of logistics, but no special programs (yet) on mentioned topics. See chapter on operational carbon footprint. http://www.2014.annualreport.philips.com
- Use of energy efficient office equipment, signage or the incorporation of green building design elements
- Philips has implemented a green IT policy
- Use of recycled paper in their marketing and/ or resource materials

Please note that "Closing the materials loop" is one of the key performance indicators of our EcoVision program. We calculated the amount of recycled materials used in our products in 2014 at some 13,000 tonnes (2013: 14,000 tonnes), by focusing on the material streams including aluminum in Lighting division. More information can be found in the annual report: http://www.2014.annualreport.philips.com.

Compliance and education is of high importance for Philips Lighting. Therefore we participate at global level in programs that have the objective to establish legislation for end-of-life treatment for electric and electronic waste, of which lighting products are a part. Information on legislative status as well as concrete support when relevant will be provided when necessary. This approach has proven to be successful in reducing environmental impact, reducing the costs to society of these activities, raising consumer awareness, and increasing effectiveness of recycling. Philips participates in product take-back activities where mandated by country legislation. In most of these recycling activities we have an active role in the governance structure via the board seats we hold as Philips.

Philips Group
Sustainability commitments
2014

	target 2015	baseline year
Green Product Sales	50% of total sales	
Lives Improved	2 billion	
Green Innovation		
- Investments	EUR 2 billion (cumulative)	2010
- Energy Efficiency	50.3 lumen/watt (up 50%)	2009
- Materials		
- Collection & Recycling	45,000 tonnes (up 100%)	2009
- Recycled content	15,000 tonnes (up 100%)	2009
Green Operations		
- CO_2 reduction	40%	2007
- Health & Safety	0.26 Lost Workday Injury Cases per 100 FTE	
Supplier Sustainability [1]	72% compliant	

U.S. adopted Dodd-Frank Act requires companies to disclose use of conflict minerals originating from Congo and adjoining countries. The scope covers US stock listed companies, and indirectly their suppliers. Conflict Minerals (3TGs) are Tantalum, Tin, Tungsten, and Gold. Conflict minerals are mined in conditions of armed conflict and human rights abuses in eastern Congo. Companies must disclose in their annual report to the SEC whether conflict minerals used in their products originated from Congo and surrounding countries, and perform supply chain due diligence. Philips is working with EICC to address this topic on an industry level to standardize tools to collect data in the supply chain and develop a conflict free smelter audit program. Philips was one of the first companies to survey our suppliers to identify smelters used in the supply chain that produce the metals of concern, and one of the four companies to have our SEC Conflict Minerals report audited in 2014.
http://www.philips.com/about/company/businesses/suppliers/conflict_minerals.page.

6.0 Cost Proposal (RFP 11.2.6.)

6.1 Attachment C, Proposal Valuations and Cost Form with Designated Responsible Parties (RFP 11.2.6.1)

For the City’s review and determination, Philips has provided a completed Attachment C.

Attachment C

Proposal Valuation and Cost Form

With Designated Responsible Parties (required)

NAME OF LEAD PROPOSER: Philips Lighting North America Corporation

Proposal Type: LED Street Lighting Solution - Philips LED Luminaires and Owlet Solution

☒ **LED Streetlight Installation**
Which zones will you be selecting for installation of LED streetlights and wireless controllers? *See Appendix 2 for more information. Proposer may select more than one zone. Quantity of lights in chart below should match the total number of lights in zone(s) selected.* X -Central San José 11,090 lights X - North-East San José 10,780 lights X -South San José 10,280 lights X - West San José 7,135 lights
Total Stated Value of Proposal: $105,200,000 ***(includes the City's $85 permits/inspection fees and future revenue stream)***
Term of Proposal (up to 25 years): 25 years

☐ **In Lieu Payment**
A. Total Stated Value of Proposal: __________________________ *(Note: Minimum value must be more than $2 million for in lieu payments.)*
B. City of San José Project Management Cost ______________________ 20% of Line A *(All in-lieu projects will be assessed PMC for City Staff to manager installation of streetlights with in-lieu funds.)*
C. Final Value for Proposal __________________________ Line A – Line B = Line C
Term of Proposal (up to 25 years): __________________________

Proposal Description: Please describe your concept. What City assets do you want to use? What benefit will your proposal provide in return? What revenues will the City receive? (Use Additional Pages)

Please describe your concept:

Our concept is to establish a program which allows the City to convert its existing streetlights to LEDs and upgrade its streetlighting controls system without relying solely on energy and/or operational savings. As previously described, our program also contemplates a citywide deployment of the Philips' smart pole that will enable densification of the existing 4G/LTE wireless broadband service to the City's businesses, visitors, and residents. Philips smart poles discreetly house FCC certified mobile network operator equipment, enabling an alternative and attractive deployment methodology of "Small Cell" 4G/LTE broadband services and future standards beyond 4G/LTE.

In connection with the Philips' smart pole deployment, we plan to enter into a citywide Master Installation Agreement with the City San José for a term of 25 years. We expect that this agreement will be based, in large part on the Master Installation Agreement that Philips has executed with the City for the ongoing pilot deployment. Further, Philips will work with a financial institution to finance the full amount of the cost of the City's street lighting replacements. This will allow Philips to manufacture, design, and install the new LED streetlights with a wireless controls system throughout the city within the time period allotted in the RFP.

Our program requires the City to continue paying its current electrical rate for its streetlights energy usage after installation of the LEDs for a period of 17 years with a 3% escalation for utility rates. A portion of this payment will be paid to PG&E based on the new lower LED tariff and the remaining portion of the payment (which represents the reduction in energy costs) will be paid to the financial institution. Beginning in year 18 the City will enjoy the full benefits of the lower electricity costs. The short repayment in period is due, in part, to the smart poles installed base.

What City assets do you want to use?

Our program requires the City to allow Philips to deploy its smart poles citywide. The Philips' smart pole design has already been approved by the City and will replace certain existing streetlight poles in the City. Philips will work with its partners to determine which locations are optimal for installation of a Philips' smart pole.

What benefit will your proposal provide in return?

As described above, the City (including its visitors, residents, and businesses) will benefit from state of the art LEDs and a wireless controls system for the City's streetlights. As a result of the smart pole portion of the program, the City will also benefit from a reduced payback period of the LED and controls installation. Further, deployment of Philips' smart poles will result in increased broadband coverage for the City's residents and business, at no additional cost to the City and with minimum clutter to the cityscape.

From year 18 to 25 of the agreement, the City will enjoy the benefits of lower electricity payments based on the installation of the citywide LED conversion.

During the 10 year product warranty period the city will avoid expenses related to replacement of LED fixtures.

As proven in the smart pole pilot, Philips is providing the city with accurate extensive street lighting electrical circuitry and underground engineering documentation, which city can use for public benefit in future projects and ongoing maintenance in the public right of way.

Project Value Table C1 – All Proposers					
Projected Revenues: Please detail any revenues the City is projected to receive over the course of the proposal timeline, the source of said revenues, how they will be calculated, and any other relevant information.					
#	**Source**	**Qty**	**Unit of Measure**	**Unit Revenue**	**Projected Revenue**
1	**Philips Smart Poles* *Active poles 201-1,000**	**Up to**	**Annual fee (up to 22 years – see notes)**	**$1,500**	**$26,400,000**
	Total Projected Revenues				**$26,400,000**
Value of other items: Please delineate any quantifiable benefits to the City that are not direct revenues.					
#	**Source**	**Qty**	**Unit of Measure**	**Unit Revenue**	**Projected Value**
1	**Energy Expense Avoidance**	**1**			**$63,300,000**
2	**Maintenance Expense Avoidance**	**10**	**Years**	**$350,000**	**$3,500,000**
3	**Philips Project Incentive**	**1**			**$ 2,000,000**
4	**Circuit Analysis and Underground Survey Documentation**	**Up to 1,000**	**Per installed smart pole**	**$10,000**	**$10,000,000**
	Total Projected Value				**$78,800,000**

What revenues will the City receive? (Use Additional Pages)

In connection with the smart pole portion of the program, Philips intends to enter into long term contracts with the mobile network operators which allow such operators to install, operate and maintain their telecommunications equipment in the Philips' smart pole in accordance with the Master Installation Agreement. Once Philips' has recouped its expenses from the initial costs of the program, such contracts with the mobile network operators will be transferred from Philips to the City of San José, creating a future revenue stream for the City.

After the successful installation and activation of 200 smart poles Philips will provide to the City of San Jose a revenue stream for every active smart pole thereafter of $1,500.00 per year. We expect the initial deployment of 200 smart poles to be completed within 3 years. This means for smart poles number 201 to 1,000 the City has the potential of receiving up to $26.4M in revenues from years 4 to 25.

At the end of the term, the City will retain ownership of the SmartPoles and can negotiate a lease agreement with the mobile operators.

LED Streetlight/Controller Unit Installation Provisioning

Table C2: Installation Proposals ONLY

The matrix below delineates steps and items required to provision LED streetlights and controller units. Using the matrix, delineate which items will be Proposer Responsibilities and which will be City Responsibilities, and the cash value.

Table C2: Installation Proposals ONLY						
#	Description	Qty	Unit of Measure	Unit Cost	Extended Cost	Responsible Party
Luminaires and Equipment						
1	Lightpoints: Lightheads/luminaires *Note: average cost for purchase and installation is $650/lighthead.*	**39,285**		**$645**	**$25.34M**	☒ Proposer ☐ City
2	Luminaire controller *Note: average cost for purchase and installation of baseline unit is $150 /controller. If using alternative, add costs for interoperability solution or conversion of City's existing 23,000 LED streetlights to new system in line 2A.*	**39,285**		**$150**	**$5.89M**	☒ Proposer ☐ City
2A	Luminaire controller (alternate system).					☐ Proposer ☐ City
3	Wireless Luminaire Device (if separate from luminaire controller)					☐ Proposer ☐ City
4	Wireless Gateway (quantity = # of gateways)				***Included above***	☒ Proposer ☐ City
5	Temporary Communication from Gateway to Central Software (quantity = # of gateways multiplied by 6 months)				***Included above***	☒ Proposer ☐ City
6	Software License (one-time purchase)					☐ Proposer ☐ City
7	Annual Software Maintenance Fee (Three Year Minimum) – *10 year average price/yr*	**39,285**		**$0.83**	**$32.74K**	☒ Proposer ☐ City
8	Annual Software Maintenance Fee (Contract Extension)					☐ Proposer ☐ City
9	Power (if required for any use other than the luminaire itself)					☐ Proposer ☐ City
10	Backhaul (if applicable)					☐ Proposer ☐ City
11	other					☐ Proposer ☐ City
Professional Services						
12	Engineering *All work must be done by a certified engineer.*				***Philips to perform circuit***	☒ Proposer ☒ City

Table C2: Installation Proposals ONLY						
#	**Description**	**Qty**	**Unit of Measure**	**Unit Cost**	**Extended Cost**	**Responsible Party**
					analysis for smart poles	
13	Permitting *Note: Average permitting cost is $80/lighthead. Additional permitting fees may apply based on nature of proposal. This illustrative figure does not include Proposer staff or consultant time to prepare, submit or obtain permits.*	**39,285**		**$80**	**$3.14M**	☒ Proposer ☐ City
14	CEQA Clearance					☐ Proposer ☒ City
15	Project Management	**39,285**		**$17**	**$667K**	☒ Proposer ☐ City
16	Inspection Fees (other)	**39,395**		**$5**	**$195K**	☒ Proposer ☐ City
Construction						
17	Installation *Note: average cost for purchase and installation is $650/lighthead.*				***Included above***	☒ Proposer ☐ City
18	Disposal/recycling of old lightheads. *Note: Standard cost for Disposal/Recycling is $5/lighthead.*				***Included above***	☒ Proposer ☐ City
19	Other - **Rebates**	**1**			**-$1,900,000***	☒ Proposer ☒ City*
20	Other					☐ Proposer ☐ City
21	Other					☐ Proposer ☐ City
22	Other					☐ Proposer ☐ City

***City to assign rebates to Philips**

Additional information: Please attach additional pages for additional background information.

7.0 Telecommunications and Other Proposals Requiring Backhaul or Power (RFP 11.2.7.)

7.1 Attachment H, Backhaul Specifications (RFP 11.2.7.1.1)

ATTACHMENT H

Backhaul Specifications (If applicable)

If proposal requires backhaul and proposer is not supplying their own private backhaul, the proposer shall provide the following information:

1. Name and address of private or public backhaul provider

Not currently applicable.

In the event Philips determines the City would benefit from a fiber enhancement, and the City chooses to enhance their smart poles with two strands of fiber, Philips would require the following:

- Authorization to micro trench fiber network backbone and laterals to SmartPoles located throughout the City of San José.
- Authorization to install hand-holes at select locations to facilitate access to the Smart Pole fiber network.
- Access to and authorization to use City of San José Rights-of-Way for implementation of the Smart Pole fiber access network.
- Access to and authorization to use any City of San José conduit that has available space for implementation of the Smart Pole fiber access network.

2. • Access to existing street pole conduit that is owned or controlled by the City of San José and has space for a fiber access to a Smart Pole. Map or description of backhaul access points

Not applicable.

3. Letter of intent (or equivalent) documenting agreement to provide backhaul as the responsibility of the proposer should backhaul proposal be accepted by the City

As demonstrated in the technology pilot demonstration project, Philips will not be using any of the City fiber or backhaul network. Mobile network operators are responsible for installation of fiber/backhaul from a commercially viable source to each Philips smart pole.

Please note: Availability of City of San José backhaul is limited. Proposer shall not assume availability of City-supplied backhaul.

7.2 Attachment I, Power Specifications (RFP 11.2.7.1.2.)

ATTACHMENT I

Power Specifications (IF APPLICABLE)

Proposals requiring the use of electrical power must address how power will be provided and must comply with all PG&E restrictions and regulations.

If proposal requires electrical power, the following information is required:

1. Name and address of private or public power source

Pacific Gas and Electric
308 Stockton Ave
San José, CA 95126

2. Map or description of power access points

Philips will use the City of San José's existing electrical infrastructure throughout the City as is demonstrated in the pilot deployment.

3. Letter of intent (or equivalent) documenting agreement to provide power should Proposal be accepted by the City

Philips entered into an Absolving Service Agreement that will be furnished upon request to demonstrate that PG&E will furnish electric power to the Philips smart poles.

During August 2015 Pacific Gas and Electric employees visited the Ericsson facility located in Lewisville, Texas, and conducted intensive testing of the Philips smart pole and the new wireless electric meter. PG&E concluded that the wireless electric meter functioned correctly when attached to the Philips smart pole. Presently, 21 of these new PG&E wireless electric meters are installed on Philips smart poles located throughout San José. PG&E is now developing a fully integrated wireless electric meter. Through this new metering technology, we are able to connect power from PG&E to the poles. Electrical usage of the telecommunications equipment installed in each Philips smart pole is transmitted directly into PGE's billing system.

Philips will continue employing the same methodology as used in the pilot program for the citywide Philips smart pole deployment. The existing City of San José street lighting electrical circuits will be used to provide power to the telecommunications equipment installed in each of the Philips smart poles and will be analyzed for load availability. As a further benefit of the Philips' approach, all circuit analysis completed as part of this project can be used by the City for civic purposes.

We will continue to follow the terms of the previously executed Master Installation Agreement, particularly as it relates to circuit impacts:

- Permit COMMUNICATIONS EQUIPMENT to be connected to CITY's streetlight circuit with separate utility approved metering for power usage by Telecommunications Equipment.
- All circuit analysis completed as part of this project can be used by the CITY for civic purposes.
- For existing circuits that have 20% reserve, reserve at least 20% circuit load capacity for CITY future use for each circuit where a Telecommunications Equipment is installed. For existing circuits that have less than 20% reserve, reserve no less than the existing circuit load capacity for CITY future use for each circuit where a Telecommunications Equipment is installed.
- Where circuit upgrades are required as it relates to telecom equipment, all costs are the full responsibility of the Company.

PLEASE NOTE: THERE ARE SEVERE RESTRICTIONS ON THE USE OF UNMETERED CITY STREETLIGHTS AS A POWER SOURCE. ANY CIRCUIT OR OTHER ELECTRICAL UPGRADES TO CITY INFRASTRUCTURE (INCLUDING SETTING METERS, ETC.) ARE THE RESPONSIBILITY OF THE PROPOSER. THE PROPOSER MUST RESOLVE ANY POWER ISSUES BEFORE AN AWARD OR CONTRACT WILL BE GRANTED.

7.3 Attachment J, Telecommunications Specifications (RFP 11.2.7.1.3.)

Attachment J

Telecommunications Specifications (if applicable)

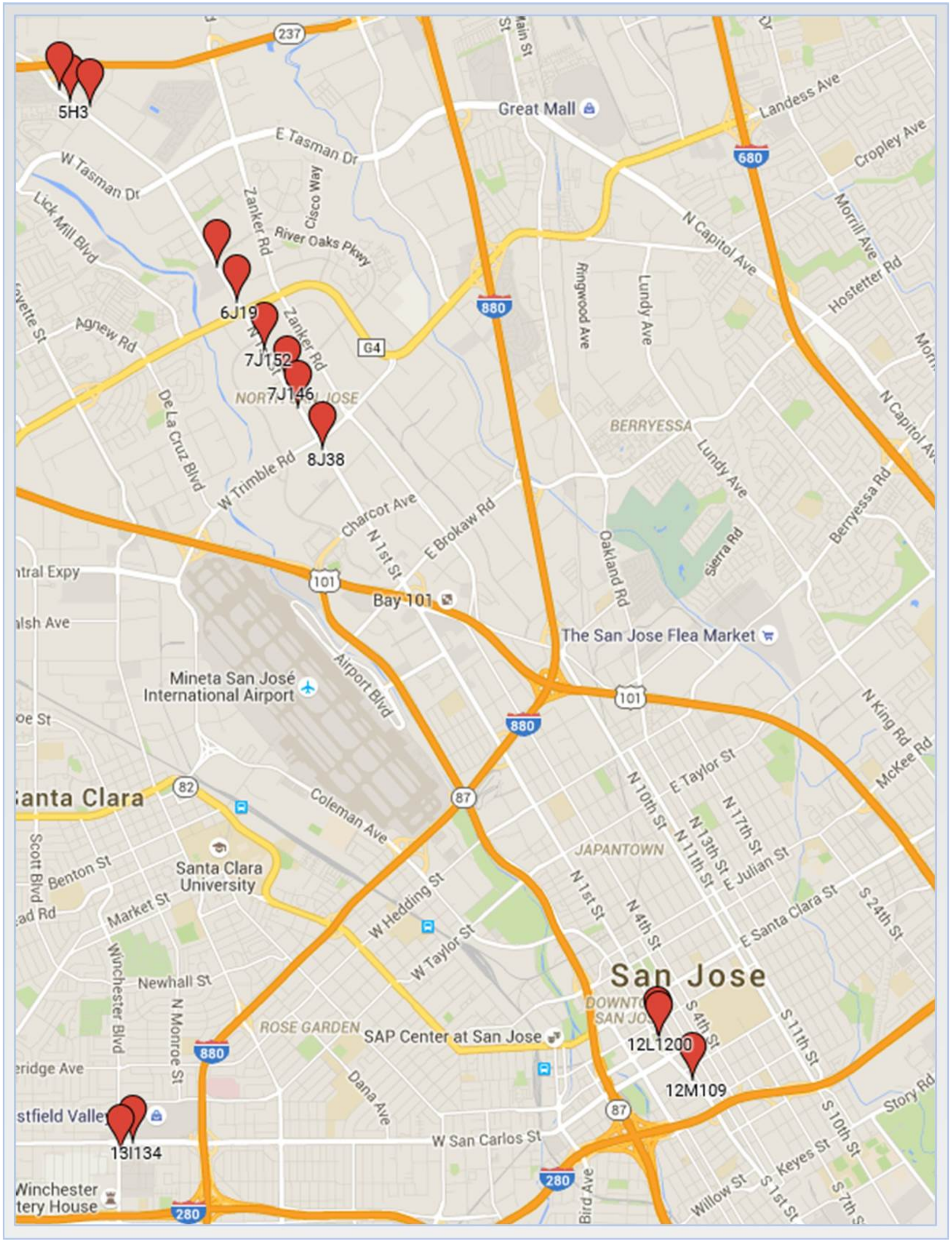
Proposers submitting telecommunications proposals must submit Attachment J.

Attachment J is required for all telecommunications proposals, whether project is an installation project or payment in lieu of installation, and whether equipment will be installed on streetlights or other City property.

For telecommunications projects, the following information is required.

1. Map or description of installation locations

Philips will perform a site survey to determine the best installation locations for the Philips smart poles. In all installations, the Philips smart poles are located adjacent to the roadway. Below is a sample map of the initial 14 Philips smart pole locations installed as part of Philips' technology demonstration project with the City.


5H3
6J19
7J152
7J146
8J38
12L1200
12M109
13I134
Great Mall
Landess Ave
Cropley Ave
E Tasman Dr
W Tasman Dr
Lick Mill Blvd
Zanker Rd
Cisco Way
River Oaks Pkwy
N Capitol Ave
Morrill Ave
Hostetter Rd
Agnew Rd
Ringwood Ave
Lundy Ave
De La Cruz Blvd
W Trimble Rd
BERRYESSA
Berryessa Rd
Charcot Ave
N 1st St
E Brokaw Rd
Oakland Rd
Sierra Rd
Bay 101
The San Jose Flea Market
Mineta San José International Airport
Airport Blvd
N King Rd
McKee Rd
Santa Clara
Coleman Ave
E Taylor St
N 10th St
N 13th St
N 11th St
N 17th St
JAPANTOWN
E Julian St
Scott Blvd
Benton St
Santa Clara University
Market St
W Hedding St
W Taylor St
N 4th St
E Santa Clara St
S 24th St
Winchester Blvd
Newhall St
N Monroe St
San Jose
ROSE GARDEN
SAP Center at San Jose
S 4th St
S 11th St
Dana Ave
Story Rd
W San Carlos St
S 10th St
Keyes St
Willow St
S 1st St
S 7th St
Bird Ave
Winchester

2. Make and model of telecommunications equipment to be installed at each location

Philips acts as a landlord and does not own or provide the telecommunications equipment to be installed in the smart poles, which will vary depending on mobile network operator. Specifications sheets are not available at this time and will depend on smart pole location

3. Detailed specifications for the telecommunications equipment listed in #2, including power requirements, capacity, etc.

Existing Pilot locations typically consume between 2 and 8 amps depending upon the telecom equipment configuration.

4. If equipment will be placed on streetlights, provide specifications for weight load and wind factors.

No telecommunications equipment will be placed on the City's streetlight poles.

5. If backhaul is required, proposer must submit Attachment H, Backhaul Specifications.

See completed Attachment H.

6. If electrical power is required, proposer must submit Attachment I, Power Specifications.

See completed Attachment I.

8.0 Streetlight Installation Proposals (RFP 11.2.8.)

8.1 Attachment L, LED Luminaire Specifications (RFP 11.2.8.1.2.)

Attachment L

LED Luminaire Specifications (If applicable)

Proposers shall complete the form per instructions below and submit with their proposal AND luminaire sample:

Indicate compliance or non-compliance by placing an “X” in the appropriate column. Under “Reference” write the location (Binder/Section/Page Number) of the discussion of the specification in the submittal.

Requirements		**Yes**	**No**	**Reference**
General:				
DLC Qualified Product	Product on DesignLights Consortium Qualified Products List by the sample submission date. For product listing details, see DesignLights Consortium websites. If the luminaire is not on the current DesignLights Consortium Qualified Product List by the sample submission date, then the City, in its sole discretion, may reject the proposal.	X		
Environmental Stewardship	Constructed with materials that minimize hazardous waste and indicate if hazardous waste disposal is provided in accordance with the European Union’s ”RoHS” compliance for hazardous materials, and “Waste, Electrical & Electronic (W.E.E.) initiative or similar U.S. programs.	X		**Environmental attributes, including recyclability, are detailed in Attachment G.**
LED Luminaire Performance:				
Mesopic Luminance	• Lighting performance evaluations shall be done using the luminance metric with mesopic adjustments applied.	X		
	• Luminaire replacement shall be done in accordance with the City’s “Public Streetlight Design Guide – Replacement Guide”.	X		
Correlated Color Temperature (CCT)	4000° K +/- 300° K.	X		**3985K +/- 275K.**
Wavelength Distribution Range	Percentage of emissions below 550 nm should be equal to or less than 45% to minimize adverse affects to astronomy research at the Lick Observatory verified by independent laboratory report.	X		**Details are available in the LM79 Report in Appendix D.**

Requirements		Yes	No	Reference
Uplight Rating/ Cut Off	Full cutoff: UL & UH = 0	X		**Details are available in the LM79 Report in Appendix D.**
L70 Lifetime	Minimum 70,000 hours	X		**Details are available in the TM21 Report in Appendix D.**
Lumen Efficacy	Minimum 90 lumens/Watt	X		**Up to 119 Lm/W on some models.**
IESNA LM-79 Photometric Test and Report	• Shall be IESNA LM 79 tested from a CALiPER or NVLAP certified lab and provide testing documentation and photometric report that includes: - Total light output - Luminous intensity distribution - Color characteristics - Electrical data	X		**Details are available in the LM79 Report in Appendix D.**
IESNA LM-80 Test and Report	• Shall be IESNA LM 80 tested from a CALiPER or NVLAP certified lab and include testing documentation.	X		**Details are available in the LM80 Report in Appendix D.**
	• The results shall show relative (%) light output over time at 55° C, 85° C, and a third temperature of the manufacturer's choice.	X		**Details are available in the LM80 Report in Appendix D.**
	• In-situ temperature test report in conformance with ANSI/UL 1598-04 (hardwired) with measurements showing that the temperature of the hottest LED junction temperature is within the recommended temperature specified by the chip manufacturer in order to conform to the L70 test data. Measurement at the nearest accessible locations are acceptable with thermal model of heat dissipation and airflow throughout the luminaire calculating the LED junction temperature. Model and test shall have at least 4 matching points for measuring and calculating temperature respectively.	X		**Details are available in the LM80 Report and Heat Test in Appendix D.**
Power Supply/Driver:				
Dimming Capability	0-10 volts dimming input driver	X		**Details available in the driver specification sheet in Appendix D.**
Power Factor	Minimum power factor of 0.90	X		**Details available in**

Requirements		Yes	No	Reference
				the driver specification sheet in Appendix D.
Operating Temperature	Power supply shall operate between -20° C and 50° C.	X		**Details available in the driver specification sheet in Appendix D.**
Frequency	• Output operating frequency shall be > 120 Hz (to avoid visible flicker).	X		**Details available in the driver specification sheet in Appendix D.**
	• Input operating frequency shall be 60 Hz.	X		**Details available in the driver specification sheet in Appendix D.**
Interference	Power supply shall meet FCC 47 CFR Part 15/18 (Consumer Emission Limits).	X		**Details available in the driver specification sheet in Appendix D.**
Noise	Power supply shall have a Class A sound rating per ANSI standard C63.4.	X		**Details available in the driver specification sheet in Appendix D.**
Off-state Power Consumption	Power draw of the luminaire shall not consume more than 0.5 watts when in the off-state (not including control systems).	X		**Details available in the driver specification sheet in Appendix D.**
Luminaire Housing:				
Accessibility	• Luminaire housing shall allow tool-less entry to access: - Terminal strip for landing feeder wiring in the luminaire - Dimming driver - Over current protection	X		**Details available in the luminaire specification sheet in Appendix D.**
Construction	• Shall be constructed of aluminum.	X		**Details available in the luminaire specification sheet in Appendix D.**
	• Shall be powder-coated gray with rust resistant finish.	X		**Details available in the luminaire specification sheet in Appendix D.**

Requirements		Yes	No	Reference
	• All screws shall be stainless steel.	X		**With ceramic coating.**
	• Shall have captive screws on any component that requires maintenance after installation.	X		**If applicable.**
	• No parts shall be constructed of polycarbonate unless it is UV stabilized (lens discoloration shall be considered a failure under warranty).	X		**Details available in the luminaire specification sheet in Appendix D.**
	• Luminaire circuitry shall include quick connect/disconnects to allow easy separation and removal of: • Dimming driver	X		**Details available in the luminaire specification sheet in Appendix D.**
	Shall have no wire exposure	X		
	• Gaskets are permissible - Silicone sealants are not allowed	X		**If applicable.**
	• Shall have a minimum rating of IP66 as specified in IEC 60529, with the ability to shed water from inside the housing (i.e. weep holes).	X		**Only the optic chamber is IP66 the housing is IP54. Details available in the luminaire specification sheet in Appendix D.**
Cooling System	• Shall consist of a passive heat sink with no fans, pumps, or liquids.	X		**Details available in the luminaire specification sheet in Appendix D..**
	• Shall be resistant to debris buildup and any build up shall not degrade the heat dissipation performance.	X		**Details available in the luminaire specification sheet in Appendix D.**
Mounting	• Must fit on a 2-inch nominal pipe size tenon and be compatible with the City's existing streetlight mast arms per Appendix 5, Exhibit 5.A, "City Standard Detail Drawings," Drawings No. E-09 and E-10.	X		**Details available in the luminaire specification sheet in Appendix D.**
	• Provide information on mounting of proposed street lights.	X		**Details available in the luminaire specification sheet in Appendix D.**
Control Receptacle	ANSI C136.41 7-pin twist-lock receptacle.	X		**Details available in the luminaire specification sheet in Appendix D.**

Requirements		**Yes**	**No**	**Reference**
Weight of Luminaire	Complete assembly shall not exceed 31.5 pounds (not including control system).	**X**		**Details available in the luminaire specification sheet in Appendix D.**
Wind Load	Maximum wind load of 2.25 square feet effective projected area.	**X**		**Details available in the luminaire specification sheet in Appendix D.**
UL Standards	The entire luminaire assembly shall be UL listed and approved.	**X**		**Details available in the luminaire specification sheet in Appendix D.**
IEEE C62.41. 2-2002	IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.	**X**		**Details available in the luminaire specification sheet in Appendix D.**

8.2 Sample Submissions (RFP 11.2.8.1.3.)

RoadFocus has already been approved by the City.

9.0 Optional and Post Award Submittals (RFP 11.2.9.)

9.1 Attachment M, Local and Small Business Enterprise Preference (RFP 11.2.9.1.1.)

Philips Lighting North America Corporation, the Bidder, is not a local or small business that would qualify for the Local and Small Business Preference pursuant to Chapter 4.12 of the San José Municipal Code. However, Philips understands the importance of supporting and fostering the growth of small, local, and diverse companies. To that end, we regularly use the services of these business classifications. Philips aims to ensure all small and diverse business concerns have an equitable opportunity to compete for subcontracts. Philips outreach activities typically include the following: contacting minority and small business trade associations and contacting business development organizations. Philips also uses source lists, guides and other data sources to identify HUBZone, small disadvantaged, veteran-owned, service disabled veteran-owned and women-owned small business concerns. For the City of San José's Innovative LED Streetlight Replacement Project, we have teamed with WMH, a qualified Local and Small Business Enterprise. For reference, we have included WMH's information on Attachment M.

ATTACHMENT M
Local and Small Business Preference (IF APPLICABLE)

City of San José
Request for Contracting Preference for Local and Small Businesses

Chapter 4.12 of the San José Municipal Code provides for a preference for Local and Small Businesses in the procurement of contracts for supplies, materials and equipment and for general and professional consulting services. The amount of the preference depends on whether the vendor qualifies as a Local Business Enterprise* or Small Business Enterprise** and whether price has been chosen as the determinative factor in the selection of the vendor.

In order to be a Local Business Enterprise (LBE) you must have a current San José Business Tax Certificate Number and have an office in Santa Clara County with at least one employee. If you qualify as an LBE you can also qualify as a Small Business Enterprise (SBE) if the total number of employees (regardless of where they are located) of your firm is 35 or fewer.

There are two ways in which the preference can be applied. In procurements where price is the determinative factor (i.e. there are not a variety of other factors being considered in the selection process) the preference is in the form of a credit applied to the dollar value of the bid or quote. For example, a non-local vendor submits a quote of $200 per item and a LBE submits a quote of $204 per item. The LBE receives a 2.5% credit on the quote, which equals approximately $5 and thus the LBE will win the award because the quote is evaluated as if it had been submitted as $199.

In procurements where price is not the determinative factor such, as an RFP, typically a variety of factors are evaluated to determine which proposal best meets the City's needs. In procurements such as these, a qualified LBE will be given 5% and a qualified SBE will be given an additional 5% of the total **points** in the **scoring**.

The following determinations have been made with respect to this procurement: (for official use only)

Type of Procurement	☐ Bid	☐ Request for Quote	☒ Request for Proposal
Type of Preference	☐ Price is Determinative		☒ Price is Not Determinative
Amount of Preference	LBE preference = 2.5% of Cost SBE preference = 2.5% of Cost		LBE preference = 5% of Cost SBE preference = 5% of Cost

In order to be considered for any preference you must fill out the following statement(s) under penalty of perjury.

Business Name	WMH Corporation		
Business Address	50 West San Fernando Street, Suite 950, San José, CA 95113		
Telephone No.	408.971.7300		
Type of Business	☒ Corporation	☐ LLC	☐ LLP
	☐ General Partnership	☐ Sole proprietorship	☐ Other (explain)

*LOCAL BUSINESS ENTERPRISE (LBE) PREFERENCE
In order to qualify as an LBE you must provide the following information:

Current San José Business Tax Certificate Number	1153272210
Address of Principal Business Office or Regional, Branch or Satellite Office with at least one employee located in Santa Clara County:	50 West San Fernando St., Suite 950, San José, CA

In order to qualify as an SBE you must qualify as an LBE and have 35 or fewer employees. This number is for your entire business --NOT just local employees, or employees working in the office address given above.

Please state the number of employees that your Business has: 31

Based upon the forgoing information I am requesting that the Business named above be given the following preferences (please check): ☒ Local Business Enterprise ☒ Small Business Enterprise

I declare under penalty of perjury that the information supplied by me in this form is true and correct.

Executed at: San Jose ,California

Date: 9/8/15

Signature:

Print name: WILLIAM HADAYA

9.2 Post Award Submittal Requirements (RFP 11.2.9.2., 11.2.9.2.1., 11.2.9.2.2., 11.2.9.2.3., 11.2.9.2.4.)

Philips acknowledges that upon award we will submit the following documents within the timeframes prescribed in the RFP:

- Insurance Requirements (see Appendix 7, Certificate(s) of Insurance). Awardee(s) shall provide within 10 (ten) days from the final day of the protest period date after the Recommendation of Award. *Note: if proposer is using a contractor or installation partner, Certificate must be provided for contractor/installation partner as well as proposer*
- Appendix 6, PG&E Report Requirements. Report shall be completed with the installation of the control system
- Attachment N, Public Agency Participation Form. Awardee(s) shall provide within 10 (ten) days from the final day of the protest period date after the Recommendation of Award
- Performance/Payment Bond, 100% of final Proposal Valuation (as represented in Attachment C, Proposal Valuations and Cost Form with Designated Responsible Parties). Awardee shall provide bond upon signing final agreement with the City

Appendix A Exemplar Agreement

Below is the redacted negotiated agreement between the City and Philips for the Philips smart poles pilot project. Philips can make agreed upon adjustments given the larger scale of the full Innovative LED Streetlight Replacement project. Any contractual arrangement between Philips and the City shall include an overall liability cap for Philips and a waiver of consequential and indirect damages consistent with industry standards.

MASTER INSTALLATION AND PROPERTY USE AGREEMENT BETWEEN THE CITY OF SAN JOSÉ AND PHILIPS LIGHTING NORTH AMERICA [redacted]

This MASTER INSTALLATION AND PROPERTY USE AGREEMENT ("**MASTER AGREEMENT**") is made and entered into by and between the CITY OF SAN JOSÉ, a municipal corporation ("**CITY**"), and Philips Lighting North America Corporation, a Delaware corporation, ("**COMPANY**" or "**PHILIPS**"), and shall be effective upon execution by both parties ("**EFFECTIVE DATE**").

RECITALS

A. **WHEREAS,** City owns or controls various real property and public rights-of-way located in and around the [redacted] SmartPole Locations and [redacted] LED Fixture Location (as each term is defined below) located within the City of San Jose, County of Santa Clara, California (the "**PROPERTY**"); and

B. **WHEREAS**, the City of San José seeks to support innovation in industry and develop mutually-beneficial partnership with companies involved in creative solutions to emerging challenges while supporting City Green Vision goals [redacted]; and

C. **WHEREAS**, Philips has developed an innovative solution to the issues of burgeoning wireless demand while minimizing clutter in the public right-of-way, and has created a path to replace [redacted] sodium fixtures to more energy efficient LED lighting fixtures; and

D. **WHEREAS**, Philips and Pacific Gas and Electric (PG&E) have agreed to pilot next generation Smart Meter wireless technology as part of this agreement; and

E. **WHEREAS**, Company desires to (i) construct and install at no cost to City SmartPoles technology described on Exhibit E attached hereto ("**SMARTPOLES**") which has the capability to house certain telecommunications facilities, appurtenant structures, and (ii) replace certain existing street light fixtures to LED fixtures ("**LED FIXTURES**"), and CITY desires to have Philips do so in accordance with the terms and conditions contained herein; and

F. **WHEREAS,** each location in which (i) a SmartPole will be installed by Philips (each a "**SMARTPOLE LOCATION**") and (ii) LED Fixture will be replaced by Philips (each a "**LED FIXTURE LOCATION**") shall be identified on the Cluster Site License Agreement (as defined below); and

G. **WHEREAS**, in connection with installation of the SmartPoles and LED Fixtures, the City desires to permit the Company to license the portion of each SmartPole described on Exhibit E attached hereto (the "**LICENSED PORTION**") to certain third parties in order to house wireless Small Cell level communication equipment, which shall mean wireless communications equipment that operates in licensed spectrum in the Commercial Mobile Radio Service that emits no more than 360 watts ERP, and are used to increase Sublicensee network data capacity while meeting

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the FCC regulations and guidelines for maximum permissible radio frequency exposure when the Antenna is mounted at no more than 32 feet elevation above street level] (the "**COMMUNICATIONS EQUIPMENT**"); and

H. **WHEREAS**, the CITY and COMPANY each desire to enter into this Master Agreement in order to set forth the terms and conditions for CITY's granting of rights to use specified PROPERTY for the purposes of (i) installation of the SmartPole and LED Fixtures and (ii) maintaining, upgrading and operation of the Communication Equipment located within the Licensed Portion of each SMARTPOLES; and

I. **WHEREAS,** the City will own the SmartPoles and the LED Fixtures upon acceptance and Philips shall have the exclusive right to sublicense the Licensed Portion integral to the structure to wireless carriers not party to this agreement and exclusive use of the Smartpole for any communications use other than communications related to electrical power metering and LED Fixture(s) control systems.

NOW, THEREFORE, for valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties hereto agree as follows:

<u>SECTION 1.</u> <u>RIGHT TO USE CITY PROPERTY</u>

A. <u>Right to Use</u>.

1. City hereby grants the Company the right to use the Property as follows:

   a. Company and its subcontractors and Sublicensees shall have access to each SmartPole Location for the purpose of installing the SmartPoles and Communications Equipment;

   b. Company and its subcontractors shall have access to each LED Fixture Location for the purpose of replacing the existing street lights to LED fixtures [redacted] as further described on Exhibit B; and

   c. during the Term, Company shall have exclusive rights to license the Licensed Portion to a third party carrier (the "**SUBLICENSEE**") for the purpose of housing Communications Equipment and exclusive use of the Smartpole for any telecommunications use other than communications related to electrical power metering and LED Fixture(s) control systems, and such Sublicensee shall have access to each SmartPole Location and surrounding Property for the purpose of maintaining and operating the Communications Equipment. Any agreement between COMPANY and SUBLICENSEE shall be consistent with the terms of this Master Agreement.

2. In connection with each cluster of SmartPole Locations and LED Fixture Locations that Company wishes to become subject to this Master Agreement, Company shall submit to City the information and documentation described on Exhibit F attached hereto or otherwise reasonably requested by the City (the "**CLUSTER SITE LICENSE APPLICATION**"). The parties agree that a

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cluster may consist of up to [redacted] SmartPole Locations and up to [redacted] LED Fixture Locations. [redacted]

a. Such Cluster Site License Application shall (i) identify each SmartPole Location relevant to such Cluster Site License Application and (ii) description of the SmartPole, including the designated wattage, (iii) a description of the LED replacement that will be completed by Philips, along with LED Fixture Locations.

b. City shall process and respond to each Cluster Site License Application pursuant to the schedule set forth in Exhibit F, provided all documentation described on Exhibit F has been provided by Company.

c. Upon issuance of an improvement permit the parties shall enter into a Cluster Site License Agreement substantially in the form set forth on Exhibit A for such cluster in accordance to the schedule set forth on Exhibit F (the **"CLUSTER SITE LICENSE AGREEMENT"** OR **"CSLA"**).

B. Access.

1. Installation of the SmartPole and LED Fixtures. CITY hereby grants COMPANY the right to use on a non-exclusive basis (i) each Smartpole Location for the purpose of installing a SmartPole at such location and (ii) each LED Fixture Location for the purpose of replacing the existing street light to LED [redacted] in accordance with Exhibit B. Such right to use shall include:

   a. non-exclusive right of ingress and egress from a public right-of-way day to each SmartPole Location and LED Fixture Location, including surround Property, for the purpose of installation of the SmartPole, Communications Equipment and LED Fixtures in a manner consistent with the terms of the improvement permit required for construction.

   b. a right of access sufficient for Company or its representatives to install the SmartPole, Communications Equipment and/or LED Fixture, as applicable, including access to such wires and cables as required to connect the SmartPole or Communications Equipment to electrical utility sources and fiber optic or telecommunications lines located at the SmartPole Location.

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c. During the installation period, COMPANY agrees to: (1) keep SMARTPOLE Location in neat, clean and orderly condition at all times; (2) not cause rubbish, garbage or debris to accumulate or remain on or around any such location at any time; (3) not commit, suffer or allow any acts to be done at or around such location in violation of any law, regulation, permit or rule; and, (4) not use or allow the use such location for any illegal or immoral purpose.

2. Access to Communications Equipment. During the Term, in connection with the license granted by the City of the Licensed Portion pursuant to Section 1(A) above, the Sublicensee shall have non-exclusive right of ingress and egress from a public right-of-way, seven (7) days a week, twenty four (24) hours a day for the purpose of maintaining and operating of the Communications Equipment, provided, however, (i) Sublicensee shall provide CITY with prior notification via email to Department of Transportation Electrical Superintendent that Company requires access to that portion of the SMARTPOLE LOCATION, (ii) all work shall be in compliance with all traffic laws and restrictions and (iii) work that impedes traffic lanes shall be not completed between the hours of 6am - 8:30am and 3:30pm – 6:00pm.

During the maintenance and operations of the Communications Equipment COMPANY shall use reasonable efforts to ensure that the Sublicensee: (1) keep SMARTPOLE Location in neat, clean and orderly condition at all times; (2) not cause rubbish, garbage or debris to accumulate or remain on or around any such location at any time; (3) not commit, suffer or allow any acts to be done at or around such location in violation of any law, regulation, permit or rule; and, (4) not use or allow the use such location for any illegal or immoral purpose.

3. Emergency Repairs. If an emergency repair of Communications Equipment is necessary, the Sublicensee shall be allowed reasonable access to the applicable SMARTPOLE LOCATION at any time, provided that Sublicensee notifies CITY post any emergency repair work. Such notification shall be sent via email to Department of Transportation Electrical Superintendent at the following address: angel.alvarez@sanjoseca.gov. City may provide contact information for a different employee by providing written notice of the change to COMPANY.

4. City Observer. COMPANY shall allow a representative of the CITY to observe any repair, maintenance or removal work performed at a SMARTPOLE LOCATION or any other portion of the applicable PROPERTY, provided that City provide prior email notice to Company in accordance with Section 15. The parties agree that the presence (or lack of presence) of such observer shall not require Company (or Sublicensee) to change or delay its work schedule.

C. Relocation Event.

1. During the Term of an CSLA, CITY may require the permanent relocation of the Communications Equipment or Smartpole to a mutually agreeable location only in the event that (i) the SMARTPOLE LOCATION is needed to accommodate the construction, installation, operation, repair or maintenance of any improvement

desired by CITY; or (ii) the SMARTPOLE LOCATION is needed for another CITY use or purpose; provided, however, in each case, such event has been approved in advanced by the City of San Jose City Council (each, a "**RELOCATION EVENT**"). CITY shall provide COMPANY with a one hundred eighty (180) day prior written notice of any Relocation Event.

2. In connection with any Relocation Event, the Parties shall use reasonable efforts to identify a relocation site that is mutually acceptable. Upon mutual agreement of a relocation site, the parties shall execute an amendment to the applicable Cluster Site License Agreement setting forth the new location of the sites with no change in the then-remaining Term, or other substantive change in the terms and conditions applicable to the Cluster Site License Agreement.

3. The Company shall be responsible for the costs and expenses related to relocating the SmartPole, provided that the City shall be responsible for restoration of the existing SmartPole Location, provided, however, to the extent that the relocation site requires surrounding street lights to be converted to LED for sufficient electrical capacity, City shall only be responsible for up to a maximum of [redacted] LED lightheads. Any circuitry upgrades required by the Communications Equipment or to maintain circuit capacity pursuant to Exhibit B after the conversion of LEDs by City shall be the responsibility of COMPANY.

D. Title to the COMMUNICATIONS EQUIPMENT.

The parties agree and acknowledge that title to the Communications Equipment located within each SmartPole shall be and remain with the Sublicensee while each such Communications Equipment is installed and maintained at the applicable PROPERTY in accordance and compliance with all of the terms of this MASTER AGREEMENT and applicable CSLA. Neither Company nor City will hold title to such Communications Equipment during the Term.

E. Title to improvements to the PROPERTY.

Notwithstanding **SECTION 1.D** above, title to the improvements to any PROPERTY or SMARTPOLE LOCATION, including SMARTPOLES and LED Fixtures, shall transfer to the CITY upon the City accepting the SmartPole after installation of the last SmartPole identified in the Cluster Site License Agreement. Installation of a SmartPole shall be deemed accepted by the City upon delivery of a certificate of acceptance by the City to Company substantially in the form attached hereto as Exhibit D. Final inspection shall be completed by the City within 5 business days of notice from Company that all of the punch list items in the permit has been completed.

F. No Warranties of Suitability of PROPERTY.

1. It is COMPANY's election to license and sublicense the Licensed Portion for the installation and operation of certain Communications Equipment and COMPANY does so solely at its own risk. CITY makes no representations or warranties regarding the suitability, condition or fitness of any PROPERTY or SMARTPOLE LOCATION for the installation, maintenance or use of the Communications

Equipment, provided, however, Company shall in no way be responsible for any hazardous materials found at the SmartPole Location or LED Fixture Location, including, without limitation, the existence of any substances, chemicals, compounds, solids, liquids, gases, materials, pollutants, contaminants, hazardous substances, hazardous wastes, toxic materials, oil or petroleum products, asbestos or substances containing asbestos, polychlorinated biphenyls or any other material subject to regulation under any environmental law ("**HAZARDOUS MATERIALS**") that may be at such location or encountered in the performance of the Company's obligations described herein. Upon discovery of such Hazardous Materials at a SmartPole Location or LED Fixture Location, Company will notify City immediately and cease work at such location until proper remediation procedures have been completed. To the extent that installation of a SmartPole is not feasible due to such Hazardous Materials, the Parties shall use reasonable efforts to identify a relocation site that is mutually acceptable.

2. All actions or services relating to the existence, use, detection, removal, storage, handling, transportation, treatment, disposal, discharge, removal, abatement or containment of Hazardous Materials which are not specifically provided for in this Master Agreement as the responsibility of Company, are the responsibility of City.

3. To the extent the Company encounters any conditions at the SmartPole Location or LED Fixture Location that are (a) that differ materially from those ordinarily found to exist in properties of a type and condition similar to such Site or (b) unknown, concealed or materially differ from the conditions observed during the preliminary site visit or information provided by the Company, the parties shall use reasonable efforts to identify a relocation site that is mutually acceptable. In the event Company needs to relocate a site pursuant to this section, Company shall restore the property to its prior condition if practicable given the unknown, concealed or materially different condition of the site.

G. Right of CITY Access, Banners, Inspection and Return of Poles.

1. CITY reserves, and COMPANY agrees to, the right of CITY, its authorized officers, employees, agents or contractors, to enter into and access any SMARTPOLE LOCATION and PROPERTY at any time, provided that, (a) CITY provide prior email notice to the Company pursuant to Section 15 and (b) except as described in Section 14 below, in no event shall City be permitted to handle the Communications Equipment.

2. For any existing street light poles that have the capability to hang banners which have been chosen as a SmartPole Location, Company will install SmartPoles at such locations that have the ability to hang banners. City shall provide at least fourteen (14) days prior notice to Company to identify times and locations when banners will be replaced by the City. Upon prior request by the City, Company shall make such banner brackets to be installed on other SmartPoles available for sale to the City subject to the Company's standard terms of conditions of purchase.

3. Without limiting the foregoing, CITY and COMPANY agree that CITY may: (1) inspect any PROPERTY, SMARTPOLE LOCATION and COMMUNICATIONS for COMPANY's compliance with the terms of this MASTER AGREEMENT and applicable CSLA with prior email notice to Company in accordance with Section 15; (2) make repairs, alterations or additions to any PROPERTY or SMARTPOLE LOCATION (excluding the Licensed Portion) or maintain or use any PROPERTY or SMARTPOLE LOCATION (excluding the Licensed Portion) in any manner not prohibited by the terms of this MASTER AGREEMENT or applicable CSLA, all without a claim by COMPANY for any loss of occupation or use of, or any abatement of, the use of the applicable SMARTPOLE LOCATION.

4. Company agrees that the replaced street lighting pole at each SmartPole Location shall be returned to the City's Mabury Yard facility. In no event will the Company be responsible or liable for storage or safekeeping of such replaced street lighting poles.

SECTION 2. TERM

A. Term of MASTER AGREEMENT.

The term of this MASTER AGREEMENT shall commence on the EFFECTIVE DATE set forth above, and shall continue until [redacted], unless earlier terminated as pursuant to the terms of this MASTER AGREEMENT.

B. Term of CSLA.

The term of each CSLA commence on the date that the last SmartPole of a Cluster Site License Agreement has been accepted ("**CSLA ACCEPTANCE DATE**"), and shall continue for [redacted] following the CSLA Acceptance Date but no later than [redacted] unless earlier terminated as pursuant to the terms of this MASTER AGREEMENT.

C. End of Term Options for CSLA. In connection with the expiration of a CSLA, the Parties agree as follows:

1. One year prior to the expiration of the CSLA, the City shall begin good faith negotiations with the Sublicensee in order to enter into a property use agreement, subject to receiving City Council approval, with respect to the Licensed Portion for each SmartPole Location that is (i) consistent with the City's laws, regulations and codes and (ii) to the extent not contrary to such laws, regulations and codes, consistent with the terms and conditions described herein with acknowledgement that ongoing financial terms will be renegotiated.

If the City and Sublicensee has not entered into an agreement with respect to use of the Licensed Portion for each SmartPole Location thirty (30) days prior to expiration of the CSLA, subject to receiving prior City Council approval, the City and Company hereby agree that, the Term of the CSLA shall automatically renew for a period of ten (10) years ("**RENEWAL TERM**"). During the Renewal Term, the City and Sublicensee shall continue to negotiate in good faith to enter into a property use agreement described in Section 2.C.1 above and upon execution of definitive agreement between City and Sublicensee, the CSLA shall expire automatically, provided that City provide Company with thirty (30) days prior written notice of such event.

SECTION 3. Compensation.

COMPANY shall provide and install [redacted] new Philips LED Fixtures [redacted] at each LED Fixture Location specified in the Cluster Site License Application for every SMARTPOLE installed and SMARTPOLE LOCATION (inclusive of the LED Fixture installed on the SmartPole) and complete all work as described in Exhibit B. [redacted]. Except as described in Section 6(C) below, the parties hereby agree and acknowledge that Company shall have no further responsibility with respect to the LED Fixtures following CITY acceptance Cluster Site License Agreement and associated SmartPoles and LED Fixtures.

SECTION 4. Right to Use Applicable Only to PROPERTY.

This MASTER AGREEMENT shall not be construed to permit construction, installation, maintenance or use of the Communications Equipment on any property other than the Licensed Portion of each SMARTPOLE.

SECTION 5. Compliance with Applicable Law and Approvals.

A. Facility to be Constructed in Accordance with Law.

COMPANY shall construct and install each and every SMARTTPOLE and LED Fixture in accordance with all applicable federal, state and local governmental laws, rules and regulations now in existence or enacted as of the date of installation, and shall ensure that its Sublicensee operates and maintains the Communications Equipment in accordance all Federal Communications Commission guidelines. Without limiting the foregoing, COMPANY shall obtain, maintain and fully comply with any and all permits or approvals required from the CITY.

B. Utility User's Tax.

COMPANY acknowledges and agrees that CITY requires users of communications services to pay to CITY a utility users' tax pursuant to Chapter 4.68 of Title 4 of the San José Municipal Code, as the same may be amended from time to time. The parties agree and acknowledge that this Master Agreement in no way alters the the Company's or Sublicensee's obligation to pay such taxes and Company or Sublicensee shall continue to be required to pay and utility users' tax all in the manner described in, and in compliance with, Chapter 4.68 of Title 4 of the San José Municipal Code.

C. Licensing and Authorization.

COMPANY shall ensure that the Company or Sublicensee operates Communications Equipment that satisfies all Federal Communications Commission requirements, and COMPANY agrees provides documentation evidencing such licensing and authorization within ten business (10) days of a receiving a request by CITY for such documentation.

D. PREVAILING WAGES.

COMPANY acknowledges that portions of the services authoirized by this MASTER AGREEMENT may be a Public Work, subject to the provisions of Section 1771 of the California Labor Code. COMPANY shall pay, or cause to be paid, prevailing wages, as set forth in the California Labor Code Section 1770 et. seq., for all labor performed to facilitate the professional services provided under this Master Agreement to the extent the payment of prevailing wages is required by the California Labor code, the San Jose Municipal Code or related resolutions. COMPANY shall include in all agreements for such labor, a requirement that the employer provide all workers with written notice that prevailing wages apply.

COMPANY shall maintain, or cause to be maintained, all records documenting the payment of prevailing wages as required by the State prevailing wage law. COMPANY shall maintain these records for a minimum period of three (3) years, or for any longer period required by law, from the date of final payment to COMPANY under this Master Agreement. COMPANY shall provide to the CITY, at no cost to the CITY, a copy of all such records within ten(10) working days of a request for such records by the CITY.

COMPANY expressly agrees that the compensation agreed to between the parties includes all payment necessary to meet State prevailing wage law requirements. COMPANY shall indemnify the CITY for any claims, costs or expenses which the CITY incurs as a result of COMPANY's failure to pay, or cause to be paid, prevailing wage.

SECTION 6. Maintenance and Repair.

A. Upon installation of the SmartPole, Company shall not be responsible for any further maintenance of the SmartPole, provided that City may maintain the SmartPoles at their own expense. Except as provided in Section 14, City agrees that it will not handle or touch the Communications Equipment.

B. In the event that the SmartPole is damaged or vandalized to the extent that structural integrity has been compromised or the Communications Equipment is no longer operational, Company shall be responsible for installing a new SmartPole, provided that the City shall be responsible for clearing and disposing of the damaged pole.

a. In the event of a pole knockdown, CITY will make best effort to respond to the SmartPole Location to remove any debris from damaged materials including materials from Licensed Portion and SMARTPOLE. COMPANY is responsible to pick up such materials from CITY'S Mabury Yard upon prior notice from City. Company shall use commercially reasonable efforts to ensure that a functional SmartPole is installed within 30 days of the knockdown unless agreed to otherwise between CITY and COMPANY.

b. In order for Company to replace damaged poles in a timely manner, City agrees that it will provide storage for two spare SmartPoles at no additional cost to the Company. City shall not be responsible for any damage that occurs to the Smartpoles that are stored at City facilities, provided that City shall be responsible for any damage that is caused by City's gross negligence or willful misconduct.

C. During the commercial warranty period of the LED Fixtures, COMPANY will provide its standard product warranty with respect to such LED Fixtures.

D. COMPANY shall provide a safe and radiation free environment for CITY to access LED Fixtures for purposes of maintenance and hanging banners. CITY reserves the right to request power to be shut off to the Communications Equipment with 3 business day's notification from CITY to COMPANY (or to Sublicensee, as directed by Company) for such access via email.

E. During installation of the SmartPoles or subsequent maintenance, COMPANY shall be responsible to provide tree trimming at no cost to CITY as deemed necessary by COMPANY to provide clearance for SmartPole. Such work must be performed by a licensed tree trimming contractor and shall conform to adopted American National Standard for Tree Care Operations (ANSI A300) Pruning Standards and Best Management Practices. COMPANY shall contact the Department of Transportation's City Arborist at (408) 794-1914 to request and receive a free tree pruning permit prior to performing any clearance trimming.

SECTION 7. Termination or Relocation.

A. CITY Termination of CSLA. Except as otherwise provided in this MASTER AGREEMENT, CITY shall have the right to terminate any CSLA as follows:

(i) immediately on written notice if COMPANY fails to install any LED Fixtures pursuant to the mutually agreed time table, and such failure shall continue for thirty (30) days after receipt of written notice thereof to COMPANY; or

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(ii) immediately on written notice if COMPANY fails to cure a material breach of an CSLA of any term or condition hereof, within thirty (30) days after CITY has notified COMPANY of such breach; or

(iii) immediately on written notice if COMPANY's operation of the subject Communications Equipment is deemed by a governmental authority with jurisdiction over such equipment to endanger or pose a threat to the public health, safety or welfare; or

(iv) if CITY is mandated by law, a court order or decision, or the federal, state or local government to take certain actions that will cause or require the removal of the Communications Equipment from a SMARTPOLE LOCATION.

(B). Termination of Master Agreement.

Except as otherwise provided in this MASTER AGREEMENT, CITY shall have the right to terminate the Master AGREEMENT as follows:

(i) immediately on written notice if COMPANY fails to install any LED fixtures required under this MASTER AGREEMENT within six (6) months from the CSLA Acceptance Date, and such failure shall continue for thirty (30) days after receipt of written notice thereof to COMPANY.

D. Removal of COMMUNICATIONS EQUIPMENT Upon Expiration or Termination.

(i) Expiration of MASTER AGREEMENT. Upon expiration of the applicable CSLA and any amendments thereto, City may request that the COMPANY, at its sole cost and expense, remove all Communication Facilities, while leaving in place the LED Fixture and SMARTPOLES which are property of the CITY.

(iii) Termination of CSLA. Following termination of an CSLA pursuant to **SECTION 7.A** above of a SmartPole Location, the City may request that the COMPANY, at its sole cost and expense, remove the applicable Communications Facility, while leaving in place the LED Fixture and SMARTPOLES, no later than sixty (60) days after notice of termination.

SECTION 8. No Liability.

A. Liability.

CITY, its agents, officers, employees or contractors, shall not be liable for any damage from any cause whatsoever to any Communications Equipment, specifically including, without limitation, damage, from vandalism or unauthorized use of any Communications Equipment, except as such damage is solely caused by the gross negligence or willful misconduct of CITY, its agents, officers, employees or contractors.

B. Security.

CITY shall not be liable for any vandalism or other damage that may occur to any Communications Equipment or in any SMARTPOLE LOCATION or any unauthorized use of any Communications Equipment except as provided in **SECTION 8.A.**

SECTION 9. PLANS AND SPECIFICATIONS: PERMITS

A. Prior to the execution of any CSLA, the CITY as licensor shall have the right of prior review and approval of all information contained in a Cluster Site License Application, which approval shall not be unreasonably withheld. CITY shall also have the right to inspect each and every Communications Equipment at any time during and after installation upon fifteen (15) days prior written request to Company. COMPANY shall not commence installation or alteration of any SmartPole, or any portion thereof, until the CITY has approved the applicable Plans, Specifications and proposed COMMUNICATIONS EQUIPMENT, and frequencies and COMPANY has hosted the agreed upon public outreach processes and obtained all applicable permits described on Exhibit G attached hereto. Approval of Cluster Site License Application shall not release COMPANY from the responsibility for, or the correction of, any errors, omissions or other mistakes that may be contained in the Cluster Site License Application. COMPANY shall be responsible for notifying CITY and all other relevant parties immediately upon discovery of such omissions and/or errors.

B. COMPANY agrees to perform any work in furtherance of the Cluster Site License Agreement at COMPANY's sole expense and in accordance with and in a manner that conforms to Cluster Site License Agreement as may be approved by CITY in furtherance of this MASTER AGREEMENT.

C. COMPANY shall apply for and obtain all permits as are required by the CITY to perform the work described in this MASTER AGREEMENT and applicable CSLA, and shall comply with all of the terms and conditions set forth in such permits, including, without limitation, allowing CITY personnel to inspect the installation of each Communications Equipment on the PROPERTY. COMPANY shall arrange for, obtain and bear costs of all: permits (including without limitation any fees as required by any federal, state or local law, statue, ordinance, rule or regulation); plan check and inspection fees; licenses; site preparation, surface treatment and relocation of any facilities on the PROPERTY as necessary or required for health or safety in the construction or alteration of the PROPERTY. As a condition of this MASTER AGREEMENT, COMPANY agrees to perform the covenants and conditions contained in any permit issued or to be issued to COMPANY for the Communications Equipment by CITY's Chief Engineer or his/her designees.

D. Company and City hereby acknowledge and agree that the total permit, inspection, plan check and addressing fees (including without limitation any fees as required by any local law, statue, ordinance, rule or regulation) payable by the Company in connection with the terms herein shall not exceed the aggregate amount of $[redacted] COMPANY agrees to pay the full amount to City prior to issuance of any permits described herein, and such amount shall be held by the CITY until utilized. CITY will track and keep a written recording of all expenses related to the

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permitting, inspection and addressing fees for the SmartPoles and shall provide an accounting to COMPANY in respect of such fees upon request. After acceptance of the final SmartPole, a reconciliation will be done and any unused monies will be refunded to COMPANY.

E. COMPANY shall not commence physical installation of any SmartPole before execution of the applicable Cluster Site License Agreement and obtaining approval of all applicable permits pursuant to **SECTION 9.C**. Approval of Plans and Specifications by CITY Departments shall not release COMPANY from the responsibility for, or the correction of, any errors, omissions or other mistakes that may be contained in Plans and Specifications. COMPANY agrees to perform any work at COMPANY'S sole cost and at COMPANY'S sole expense and in accordance with and in a manner CITY is satisfied conforms to Plans and Specifications as may be approved by CITY in furtherance of this MASTER AGREEMENT and applicable SLA.

SECTION 10. Indemnification.

COMPANY shall protect, defend, indemnify, and hold harmless CITY, its officers, employees and agents against any third party claim, loss or liability arising from or related to any damage, injury or loss caused by, or resulting from, the installation, maintenance, operation or use of each and every Smartpole, LED fixture or Communications Equipment, or resulting in any way from COMPANY's occupation or use of each and every Property and Licensed Portion, including, without limitation, that which is due, in whole or in part, to the willful misconduct or negligent acts (active or passive) or omissions by COMPANY, its officers, employees, consultants or agents. COMPANY's obligation to indemnify and hold harmless excludes only such claim, loss or liability that is due to the sole negligence or willful misconduct of CITY and/or its employees. All of COMPANY's obligations under this SECTION are intended to apply to the fullest extent permitted by law and shall survive the expiration or sooner termination of this MASTER AGREEMENT.

In an action or claim against CITY in which COMPANY is defending CITY, CITY shall have the right to approve legal counsel providing CITY's defense.

SECTION 11. Taxes.

A. COMPANY shall pay before delinquency any and all taxes, assessments, licenses, fees and other public charges which may be levied, assessed or imposed upon any of COMPANY's interests herein, upon COMPANY's businesses, upon COMPANY for the privilege of conducting business, or upon any property of COMPANY at a PROPERTY. COMPANY is advised that this MASTER AGREEMENT and/or individual CSLA may, but is not intended to, create a possessory interest in the applicable SMARTPOLE LOCATION, for which COMPANY may be subject to payment of possessory interest taxes therefor, for which CITY shall not be liable. Payment of any possessory interest tax shall not reduce in any way any charges or other fees required to be paid by COMPANY hereunder.

B. COMPANY shall not permit or suffer any liens to be imposed upon any PROPERTY or any portion thereof, without promptly discharging the same, provided, however, that COMPANY may, if it so desires, contest the legality of same following prior written notice to CITY. In the event of a contest of a lien, COMPANY shall provide a bond in an amount and in a form acceptable to CITY immediately following request therefor by CITY.

SECTION 12. Insurance.

A. COMPANY, at COMPANY's own expense throughout the Term of this MASTER AGREEMENT, as extended, shall comply with the insurance requirements attached hereto as **Exhibit "C"** and incorporated by reference herein. The procuring of the policy or policies of insurance required by **Exhibit "C"** shall neither be construed to limit COMPANY's liability hereunder nor to fulfill the indemnification provisions and requirements of this MASTER AGREEMENT. Notwithstanding the policy or policies of insurance, COMPANY shall be obligated for the full and total amount of any damage, injury or loss caused by its negligence or willful misconduct arising out of this MASTER AGREEMENT, individual CSLA, or COMPANY's use of any PROPERTY or the SMARTPOLE LOCATION thereon.

B. COMPANY shall deposit with the City on or before the commencement date of the applicable CLSA certificates of insurance and the required endorsements in forms reasonably satisfactory to CITY, indicating compliance with the insurance provisions of this MASTER AGREEMENT. COMPANY shall keep the insurance in effect, and the certificates evidencing the insurance on deposit with CITY, during the term of each CSLA and as the same may be extended.

C. The required coverage amounts may be met by a combination of underlying and umbrella policies so long as in combination the limits equal or exceed those stated in this **SECTION 12**.

SECTION 13. Frequency Interference, Communications Equipment.

A. If Company (or its Sublicensee) desires to replace or modify the Communications Equipment such that the equipment will be materially different from the previously specified and installed equipment, Company shall first obtain City's prior written consent with respect to modifications (i) to the enclosures and protective housings within which the Communications Equipment is located, (ii) that would result in an increase in the structural load of the Communications Equipment , (iii) that would result in an increase to the power consumption of the Communications Equipment, which consent shall not be unreasonably withheld. Any increase in power consumption that necessitates upgrading of City circuits, if approved by CITY, will be the financial responsibility of the COMPANY.

B. COMPANY will not cause, permit or allow the installation, operation, maintenance or use of any Communications Equipment or any other equipment installed pursuant to this MASTER AGREEMENT to cause interference which is measurable in accordance with then existing industry standards with: (1) any CITY use of the applicable PROPERTY; (2) CITY communications, including the CITY's

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public safety transmissions, police and fire communications, or communications used in the connection with the San Jose International Airport; and/or (3) or any pre-existing third party uses of the applicable PROPERTY or any other CITY property, including uses of communications equipment, which uses were authorized or planned by CITY prior to the execution of this MASTER AGREEMENT or individual CSLA. COMPANY shall provide, in writing, to the CITY herein, the types of COMMUNICATIONS EQUIPMENT and frequencies utilized in the operation of each and every COMMUNICATIONS EQUIPMENT as part of the CLSA. COMPANY shall also provide the CITY, at the address sect forth in section 15, with written notice of any intended changes in those frequencies or related COMMUNICATIONS EQUIPMENT, a description of those frequencies and the dates that those frequency changes are anticipated to occur, at least thirty (30) days prior to the date that those frequency changes are anticipated to occur. COMPANY shall not begin any work on any PROPERTY pursuant to this MASTER AGREEMENT until these equipment changes and/or frequencies have been approved in writing by the CITY's demonstration policy coordinator or other person identified by the CITY. Nine of the 50 SmartPole locations have been designated to operate at higher wattages, and all others will be operated with lower wattage equipment; provided, however the number of high wattage configurations may change in the event that the anticipated SmartPoles locations change due to unforeseen circumstances with consent of the CITY.

C. In the event any of the Communications Equipment installed in the Licensed Portion is found to cause such interference, City and Company shall each reasonably cooperate with the other and take all commercially reasonable steps to correct and eliminate the interference.

D. COMPANY shall operate each and every Communications Equipment in compliance with all Federal Communications Commission guidelines.

E. If COMPANY (or Sublicensee's) construction, installation, maintenance, operation or use of the Communications Equipment violates this provision, COMPANY shall use good faith efforts to eliminate such violation or interference as soon as practicable. If COMPANY fails to eliminate such violation or interference within a reasonable period of time, CITY may, in addition to and without compromising any other remedy available to CITY, if such interference may could endanger or pose a threat to the public health, safety or welfare, immediately cut off power to the facility in the manner set forth in **SECTION 14** below. CITY shall immediately provide notice to COMPANY of any interference or the exercise of CITY's shut off rights pursuant to this SECTION. In no event will City be entitled to terminate a Cluster Site License Agreement or relocate the equipment as long as Company is making a good faith effort to remedy the interference issue.

F. COMPANY shall ensure that the operator of the Communications Equipment will operate its communications equipment in a manner that is consistent with all applicable frequencies assigned to it by the Federal Communications Commission ("FCC"), if any, and in compliance with all applicable FCC rules and regulations.

SECTION 14. EMERGENCY

A. COMPANY understands that emergency situations may develop from time to time which require power to the Communications Equipment to be shut off in order to protect to protect lives and/or property. Notwithstanding **SECTION 13**, COMPANY agrees that in the event that such a situation occurs, and there are frequency interferences of any nature between CITY's communication equipment and that of COMPANY, CITY shall have the right to shut off immediately any power to the applicable Communications Equipment and, if necessary, any equipment of COMPANY's located on the applicable PROPERTY for the duration of the emergency. COMPANY agrees not to hold CITY responsible or liable for any damage, loss, claim or liability of any nature suffered as a result of the loss of the use of the applicable Communications Equipment or other communication facilities at the applicable PROPERTY or affected by the power outage at the PROPERTY.

B. COMPANY agrees to install a master power "cut-off" device on their equipment at each and every Communications Equipment for the purpose of assisting CITY in such an emergency.

C. Unless otherwise specifically provided in a notice of termination of this MASTER AGREEMENT, CITY's exercise of the right to shut off any power to any Communications Equipment pursuant to this SECTION is not intended to constitute a termination of this MASTER AGREEMENT or applicable CSLA by either party. COMPANY and CITY shall meet after the CITY determines that an emergency situation has ended to establish the time and manner in which power shall be restored to the applicable Communications Equipment.

D. CITY shall have the right to determine what constitutes an "emergency situation" pursuant to this SECTION.

SECTION 15. NOTICES

Except as otherwise specifically set forth and allowed under this MASTER AGREEMENT, all notices herein required to be given or which may be given by either party to the other shall be deemed to have been fully given when served personally on CITY or COMPANY, or when made in writing and deposited in the United States Mail, certified mail, return receipt requested, through electronic mail, postage prepaid and addressed as follows:

To CITY:
City of San Jose
City Manager's Office
Attn: Demonstration Policy Coordinator
200 E. Santa Clara Street
San Jose, CA 95113

With a copy to:
Office of the City Attorney
City of San José
200 E. Santa Clara Street
San José, CA 95113-1905
Attn: Real Estate Attorney

To COMPANY:
Philips Lighting North America Corporation
200 Franklin Square Drive

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Somerset, NJ 08873
Email: William.McShane@philips.com
Attn: Bill McShane

Philips Lighting North America Corporation
3000 Minuteman Road, Building 1
Andover, MA 01810
Email: michael.l.manning@philips.com
Attn: Michael L. Manning, General Counsel

Either party may change its address for notice by notifying the other party in the manner provided in this SECTION.

SECTION 16. FORCE MAJEURE

Company shall not be liable to City for any delay or omission in the performance of any obligation under this Master Agreement if the delay or omission arises from a Force Majeure Event. City shall not be liable to Company for any delay or omission in the performance of any obligation under this Master Agreement if the delay or omission arises from a Force Majeure Event. "**Force Majeure Event**" shall mean a force beyond the fault or reasonable control of the Company or its affiliate, as applicable, including, but not limited to: any earthquake, flood, natural event, or other act of God; acts of the City, utility outage; fire; public disorders, riots, strikes, or work stoppages; war (declared or undeclared); act of terrorism or public enemy; embargo; epidemic or quarantine restrictions; inability to procure or unpredictable shortage of labor, equipment, utilities, materials or supplies in the open market; delays of subcontractors or suppliers at any tier arising from causes other than normal weather beyond the control and without the fault or negligence of both the Company and such subcontractors or suppliers, acts, omissions or failure or refusal to act of any government agency or authority (de jure or de facto) acting in either its sovereign or contractual capacity; or any other similar event.

SECTION 17. ASSIGNMENT.

COMPANY shall not voluntarily or by operation of law, assign, transfer, mortgage, sublet, or otherwise transfer or encumber all or any part of COMPANY's interest in this MASTER AGREEMENT, individual CSLA or any SMARTPOLE LOCATION, without CITY's prior written consent, which will not be unreasonably withheld, delayed or conditioned; provided, however upon written notice to the City, Company may assign any or all of its rights and/or obligations under this Master Agreement or CSLA to (i) its ultimate parent corporation, wholly owned subsidiary of its ultimate parent corporation or to any present or future affiliate of Company to which Company transfers all or substantially all of its lighting business without such consent. COMPANY shall have the right to issue sublicenses under this Master Agreement as described in Section (1)(A)(1)(c).

SECTION 18. GOVERNING LAW.

This MASTER AGREEMENT shall be construed by, and in accordance with, the laws of the State of California.

SECTION 19. NO INTEREST IN PROPERTY.

Except as specifically provided herein, nothing herein shall be deemed to create a lease, or easement of any property, or to grant any interest in any PROPERTY, other than a real property license to use the applicable Licensed Portion, revocable as set forth herein.

SECTION 20. INSPECTION

Except with respect to the Licensed Portion, each and every SMARTPOLE LOCATION shall be at all times under control of the CITY, whose officials, employees and agents shall have the right to enter the applicable SMARTPOLE LOCATION, and all portions thereof, for purposes of inspection (and other purposes contemplated by this MASTER AGREEMENT) at all times during the period covered by this MASTER AGREEMENT.

SECTION 21. UTILITIES

COMPANY shall be solely responsible for ensuring that each and every LICENSED PORTION has adequate electrical power and any other utility service necessary or useful to operation of each and every LICENSED PORTION. COMPANY shall install separate meters for utilities. CITY is not obligated to make electricity or other utilities available if there is an interruption in such service to any LICENSED PORTION or PROPERTY unless such interruption is related to the City's circuitry.

CITY shall use reasonable efforts to minimize any disruptions to CITY's circuits. City shall make reasonable efforts, consistent with current City streetlight maintenance standards and resource levels, to respond in a timely fashion to incidences of vandalism, damage, or wire theft that affect City circuitry, provided that City shall provide an assessment of the damage within forty eight (48) hours of notice and mutually agree to a remediation plan. To the extent the Company incurs costs from such remediation, the City agrees to reimburse the Company for such costs. COMPANY will immediately alert CITY if it becomes aware of an interruption of service. CITY shall be solely responsible for the utility service necessary to operate the LED Fixtures and paying for such utilities.

SECTION 22. NOT AGENT OF CITY

Neither anything in this Master Agreement nor any acts of COMPANY shall authorize COMPANY or any of its employees, agents or contractors to act as agent, contractor, joint venturer or employee of CITY for any purpose.

SECTION 23. RESERVATION OF RIGHTS.

COMPANY understands, acknowledges and agrees that any and all authorizations granted to COMPANY under this MASTER AGREEMENT and/or individual CSLA shall remain subject to all prior and continuing regulatory and proprietary rights and powers of CITY to regulate, govern and use CITY property, as well as any existing encumbrances, deeds, covenants, restrictions, easements, dedications and other claims of title that may affect CITY property. CITY and COMPANY agree that nothing contained in, or contemplated by, this MASTER AGREEMENT and/or individual CSLA is intended to confer, convey, create or grant to COMPANY any perpetual interest in any CITY property or in any of CITY's public rights of way.

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SECTION 24. CONFLICT OF INTEREST.

COMPANY shall avoid all conflict of interest or the appearance of conflict of interest in the performance of this MASTER AGREEMENT and/or individual CSLA.

SECTION 25. GIFTS.

A. COMPANY is familiar with CITY's prohibition against the acceptance of any gift by a CITY officer or designated employee, which prohibition is found in Chapter 12.08 of the San José Municipal Code.

B. COMPANY agrees not to offer any CITY officer or designated employee any gift prohibited by said Chapter.

C. The offer or giving of any gift prohibited by Chapter 12.08 shall constitute a material breach of this MASTER AGREEMENT by COMPANY. In addition to any other remedies CITY may have in law or equity, CITY may terminate this MASTER AGREEMENT or individual CSLA for such breach as provided in **SECTION 7** of this MASTER AGREEMENT.

SECTION 26. DISQUALIFICATION OF FORMER EMPLOYEES.

COMPANY is familiar with the provisions relating to the disqualification of former officers and employees of CITY in matters, which are connected with former duties, or official responsibilities as set forth in Chapter 12.10 of the San José Municipal Code ("Revolving Door Ordinance"). COMPANY shall not utilize either directly or indirectly any officer, employee, or agent of COMPANY to perform services under this MASTER AGREEMENT, if in the performance of such services, the officer, employee, or agent would be in violation of the Revolving Door Ordinance.

SECTION 27. MISCELLANEOUS

A. Whenever the singular number is used in this MASTER AGREEMENT and when required by the context, the same shall include the plural and the masculine gender shall include the feminine and neuter genders.

B. This instrument contains all of the agreements and conditions entered into and made by and between the parties and may not be modified orally, or in any manner, other than by an agreement in writing signed by all the parties hereto or their respective successors-in interest.

C. Time is, and shall be, of the essence for each term and provision of this MASTER AGREEMENT.

D. The headings of the several paragraphs and sections of this MASTER AGREEMENT are inserted only as a matter of convenience and for reference and in no way define, limit or describe the scope or intent of any provisions of this MASTER AGREEMENT and shall not be construed to affect in any manner the terms and provisions hereof or the interpretation or construction thereof.

E. In the event any covenant, condition or provision herein contained is held to be invalid by a court of competent jurisdiction, the invalidity of any such covenant,

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condition or provision shall in no way affect any other covenant, condition or provision herein contained, provided the invalidity of any such covenant, condition or provision does not materially prejudice either CITY or COMPANY in its respective rights and obligations contained in the valid covenants, conditions and provisions of this MASTER AGREEMENT.

F. All exhibits and addenda referred to herein, and any exhibits or schedules which may from time to time be referred to in any duly executed amendment hereto, are by such reference incorporated herein and shall be deemed a part of this MASTER AGREEMENT as if set forth fully herein.

G. This MASTER Agreement shall be interpreted and construed only by the contents hereof, and there shall be no presumption or standard of construction in favor of or against either party.

H. "Days", unless otherwise specified, shall mean calendar days and "business days" shall mean means any day except Saturday, Sunday or any other day on which commercial banks located in California are authorized or required by law to be closed for business. Each reference to Company shall include the Company, its subcontractors, representatives, consultants and the Sublicensee.

I. Whenever in this MASTER AGREEMENT the approval or consent of a party is required, such approval or consent must be in advance, shall be in writing, and shall be executed by a person having the express authority to grant such approval or consent unless the terms of this MASTER AGREEMENT specifically allow an oral approval or consent of a party.

J. This MASTER AGREEMENT may be executed (i) simultaneously in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument and (ii) and delivered by email in a portable document format (.pdf) and delivery of the signature page by such method will be deemed to have the same effect as if the original signature had been delivered to the other Party.

M. The persons who have executed this MASTER AGREEMENT represent and warrant that they are duly authorized to execute this MASTER AGREEMENT in their individual or representative capacity as indicated.

N. In the event of a conflict between the terms and conditions contained in this MASTER AGREEMENT and the terms and conditions contained in an individual CSLA entered into hereunder, the terms and conditions of the CSLA shall supersede.

O. Each and every term, condition, covenant and provision of this MASTER AGREEMENT is and shall be deemed to be a material part of the consideration for CITY's entry into this MASTER AGREEMENT and any breach hereof by COMPANY shall be deemed to be a material breach. Each term and provision of this MASTER AGREEMENT performable by COMPANY shall be construed to be both a covenant and a condition.

IN WITNESS WHEREOF, the parties have executed this MASTER AGREEMENT as of the EFFECTIVE DATE.

APPROVED AS TO FORM

____
Jon Calegari
Deputy City Attorney

"CITY"
City of San Jose,
a municipal corporation

By: ___________________________
Name: ________________________
Title: _________________________

Date: _________________________

"COMPANY"
Philips Lighting North America Corporation

By: ___________________________
Name: ________________________
Title: _________________________

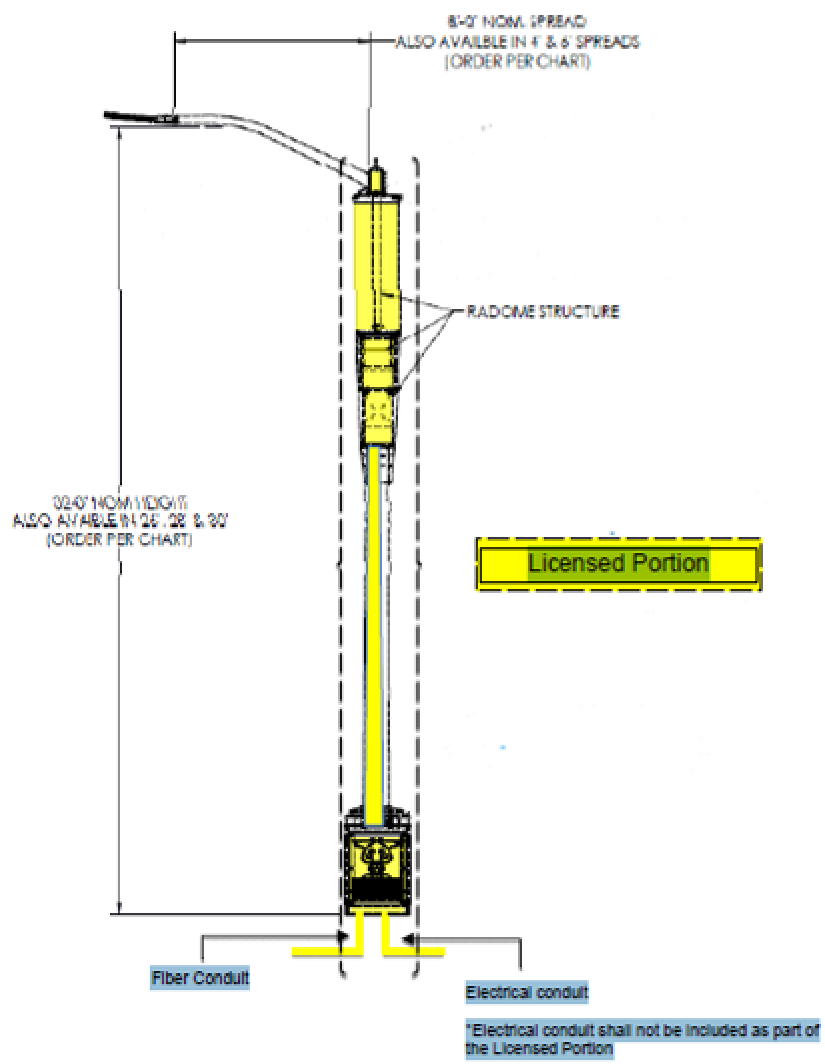
Appendix B Project Notes

1. Philips will continue to use the negotiated Construction Agreement with the City of San José, however, Philips suggests that one construction agreement be executed for the citywide lighting conversion instead of multiple agreements per cluster permit.
2. We reserve the ability adjust our proposal, including any pricing information, in the event of a Material Adverse Change. Material Adverse Change for purposes of this proposal shall mean any (i) material changes in general economic or political conditions, including financing and/or capital markets, (ii) material changes in laws, orders of any governmental authority or interpretations thereof by any governmental authority or changes in accounting requirements or principles applicable to Philips or the City, (iii) material changes affecting generally the industries or markets in which the Philips (or its affiliates) conduct its businesses, or (vi) any act of God, natural disaster or any acts of terrorism, military action or war that has a material adverse effect on Philips.
3. This proposal is **not** subject to the City's recently passed wireless ordinance.
4. Philips will need nominal line voltage to power some of the control node system.
5. Philips is not a licensed contractor in the State of California, however we will hire licensed subcontractors.
6. Quotation is based upon current rebates available, in the amount of $1.9M, at the time of proposal submission. Rebates must be assignable to Philips. Quote subject to change based upon rebate availability.
7. All financial models presume a tax free municipal lease at 3% interest rate.
8. All proposed solutions and financial models presume an award of all four zones.
9. All proposed solutions and financial models presume the ability to install a minimum of 200 Philips smart poles.
10. This proposal passes through the Owlet standard warranty. Philips does not offer any additional guaranty or warranty on the Owlet product or system.
11. Proposal is valid for 60 days.
12. Schedules and timelines included in Philips' proposal presume a project start date no later than 60 days after proposal submission.
13. No updates to existing conditions. Philips' proposal assumes the existing electrical and mechanical infrastructure, including but not limited to circuitry, fuses, wiring, and conduits are capable of supporting the new LED lightpoints.
14. All terms subject to final negotiation between the City of San José and Philips.
15. Proposal is based on audit and fixture count information provided by the City of San José.

Appendix C Philips Smart Pole Specifications

EXHIBIT "E"

LICENSED PORTION



Appendix D RoadFocus Luminaire Specifications

Pages to follow.

PHILIPS
LUMEC

Roadway

RoadFocus

RFS : 35 and 54W

Project:	
Location:	
Cat.No:	
Type:	
Lamps:	Qty:
Notes:	

The Philips Lumec RoadFocus LED Cobra Head luminaires feature a sleek design that provides seamless replacement of existing HID luminaires. RoadFocus is available in three sizes, offers multiple lumen packages, and a complete array of optical distributions, making it an outstanding solution for multiple roadway applications.

Ordering guide

example: RFS-35W16LED4K-T-R2S-UNIV-DMG-CLO-RCD-PH8XL-GY3

Luminaire	LED Module	Optical System	Voltage	Driver and Dimming	Wattage Switch	Twist-Lock Receptacle	Surge Protection	Luminaire Options	Finish
RFS									
RFS RoadFocus Small	**35W16LED4K-T** or **54W16LED4K-T**[2]	**R2S** Type II Short **R2M** Type II Medium **R3S** Type III Short **R3M** Type III Medium **5** Type V	**UNIV** 120-277VAC	*Standard:* **DMG**[1,6] Dimmable driver 0-10V *Optional:* **AMPD**[2,5,6] Amplight Dimming **Dynadimmer** Economy Profile **CDMGE25**[2,5,6] **CDMGE50**[2,5,6] **CDMGE75**[2,5,6] Median Profile **CDMGM25**[2,5,6] **CDMGM50**[2,5,6] **CDMGM75**[2,5,6] Safety Profile **CDMGS25**[2,5,6] **CDMGS50**[2,5,6] **CDMGS75**[2,5,6] **DALI**[2,5,6] Digitally Adressable Lighting Interface **DMG-AST***[2] Adjustable Startup Time **DMG-CLO***[2,5] Constant Light Output **DMG-OTL***[2] Over The Life **Includes 0-10v dimming*	None (leave blank) **FAWS**[5] Field Adjustable Wattage Selector (optional)	*Standard:* **RCD**[1,3,7] Receptacle for twist-lock photocell or shorting cap, 5-pin (standard) *Optional:* **RCD7**[3,7] Receptacle for twist-lock photocell or shorting cap, 7-pin (optional)	**SP2**[8] 20kV / 20kA Surge Protector (optional)	**HS** House side shield, 1 per 16 LED light engine **PH8**[3] Twist-lock Photoelectric Cell, UNIV (120-277VAC) **PH8XL**[3] Twist-lock Photoelectric Cell, extended life, UNIV (120-277VAC) **PH9**[3] Shorting cap	**BK** Black finish **BR** Bronze finish **GY3** Gray finish **WH** White finish

1. Please note these integrated features come standard with RoadFocus luminaires.
2. Denotes programmable driver option. Not available on 1050 mA version (54W16LED).
3. Use of photoelectric cell or shorting cap is required to ensure proper illumination.
4. Not available with HVU (347-480volt).
5. FAWS not available with AMPD, CDMG options, DALI or CLO.
6. Dimming choices: Select either DMG or AMPD or one of the CDMG options or DALI.
7. When RDC7 option is selected you will get 7-pin instead of standard RCD 5-pin.
8. When SP2 option is selected you will get SP2 instead of standard SP1.

RFS RoadFocus

Small, LED Cobrahead: 35 and 54W

Accessories (must be ordered as separate line items – quickly and easily installed in the field)

ACC-RFS-RFM-RFL-UNIV-SPC[1,2] Starsense twist-lock photoelectric cell and antenna node, UNIV (120-277VAC).	**ACC-RFS-RFM-RFL-UNIV-SPCD**[1,2] Starsense dimmable twist-lock photoelectric cell and antenna node, UNIV (120-277VAC).

1. Use of photoelectric cell or shorting cap is required to ensure proper illumination.
2. Please note that more hardware as well as software are required.
   Please contact the quotations department for help with putting together the entire control system.

LED Wattage and Lumen Values

LED = Philips Lumileds LUXEON T, CRI = 70, CCT = 4000K (+/- 350K)
System (LED + driver) rated life = 100,000 hrs[1]

LED Module	Typical Delivered Lumens	Typical System Wattage (W)[2]	LED Current (mA)	Typical System Current (A) @				Efficacy (Lm/W)	BUG Rating
				120V	208V	240V	277V		
35W16LED4K-T-R2S	4,167	38	700	0.32	0.19	0.17	0.15	110	B1-U0-G1
35W16LED4K-T-R2M	3,955	38	700	0.32	0.19	0.17	0.15	104	B1-U0-G1
35W16LED4K-T-R3S	4,083	38	700	0.32	0.19	0.17	0.15	107	B1-U0-G1
35W16LED4K-T-R3M	4,030	38	700	0.32	0.19	0.17	0.15	108	B1-U0-G1
35W16LED4K-T-5	3,800	38	700	0.32	0.19	0.17	0.15	100	B2-U0-G1
54W16LED4K-T-R2S	5,593	54	1050	0.46	0.27	0.23	0.20	104	B2-U0-G1
54W16LED4K-T-R2M	5,309	54	1050	0.46	0.27	0.23	0.20	99	B1-U0-G1
54W16LED4K-T-R3S	5,480	54	1050	0.46	0.27	0.23	0.20	102	B1-U0-G1
54W16LED4K-T-R3M	5,405	54	1050	0.46	0.27	0.23	0.20	100	B1-U0-G1
54W16LED4K-T-5	5,100	54	1050	0.46	0.27	0.23	0.20	96	B3-U0-G1

1. L_{70} >100,000 hrs (at ambient temperature = 25°C).
2. System wattage or total luminaire wattage includes the LED module and the LED driver.

Note: Due to rapid and continuous advances in LED technology, LED luminaire data is subject to change without notice and at the discretion of Philips.

RFS RoadFocus

Small, LED Cobrahead: 35 and 54W

Field Adjustable Wattage (FAWS) Multiplier Chart

35W16LED4K-T (700mA)

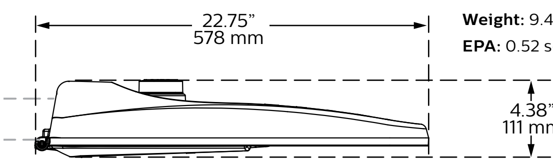
FAWS Position	Typical Delivered Lumens Multiplier	Typical System wattage and typical current
1	0.37	0.29
2	0.55	0.50
3	0.62	0.58
4	0.71	0.69
5	0.77	0.75
6	0.81	0.81
7	0.84	0.87
8	0.94	0.91
9	0.98	0.96
10	1.00	1.00

54W16LED4K-T (1050mA)

FAWS Position	Typical Delivered Lumens Multiplier	Typical System wattage and typical current
1	0.33	0.27
2	0.56	0.48
3	0.64	0.57
4	0.71	0.65
5	0.79	0.74
6	0.84	0.79
7	0.89	0.85
8	0.92	0.90
9	0.96	0.95
10	1.00	1.00

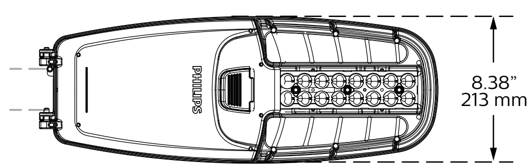
Dimensions

Side View



Weight: 9.4 Lbs
EPA: 0.52 sq. ft.

Bottom View



Predicted Lumen Depreciation Data

Predicted performance derived from LED manufacturer's data and engineering design estimates, based on IESNA LM-80 methodology. Actual experience may vary due to field application conditions. L_{70} is the predicted time when LED performance depreciates to 70% of initial lumen output. Calculated per IESNA TM21-11. Published L_{70} hours limited to 6 times actual LED test hours

Ambient Temperature °C	Driver mA	Calculated L_{70} Hours	L_{70} per TM-21	Lumen Maintenance % at 60,000 hrs
25°C	**up to 1050 mA**	**>100,000 hours**	**>60,000 hours**	**>96%**

Specifications

Housing

Made of a low copper die cast Aluminum alloy (A360), 0.100" (2.5mm) minimum thickness. Fits on a 1.66" (42mm) O.D. (1.25" NPS), 1.9" (48mm) O.D. (1.5" NPS) or 2 3/8" (60mm) O.D. (2" NPS) by 5 1/2" (140mm) minimum long tenon. Comes with a zinc plated clamp fixed by 2 zinc plated hexagonal bolts 3/8 16 UNC for ease of installation. Provides an easy step adjustment of +/- 5° tilt in 2.5º increments. Includes integral bubble level standard (always included). A quick release, tool less entry, single latch, hinged, removable door opens downward to provide access to electronic components and to a terminal block. Door is secured to prevent accidental dropping or disengagement. A clearance of 13" (330mm) at the rear is required in order to remove the door. Complete with a bird guard protecting against birds and similar intruders and an ANSI label to identify wattage and source (both included in box). Housing (including electrical compartment) rated IP54 per ANSI C136.37.

Light Engine

Composed of 4 main components: LED Module / Optical System / Heat Sink / Driver.

Electrical components are RoHS compliant, IP66 sealed light engine equipped with Philips Lumileds LUXEON T LEDs.LEDs tested by ISO 17025-2005 accredited lab in accordance with IESNA LM-80 guidelines in compliance with EPA ENERGY STAR, extrapolations in accordance with IESNA TM-21. Metal core board ensures greater heat transfer and longer lifespan.

LED Module (Included), LED type Philips Lumileds LUXEON T. Composed of high performance white LEDs. Color temperature as per ANSI bin 4000 Kelvin nominal (3985K +/ 275K), CRI 70 Min. 75 Typical.

Optical System: Composed of high performance UV stabilized optical grade polymer refractor lenses to achieve desired distribution optimized to get maximum spacing, target lumens and a superior lighting uniformity. System is rated IP66. Performance shall be tested per LM-63, LM-79 and TM-15 (IESNA) certifying its photometric performance. Dark Sky compliant with 0% uplight and U0 per IESNA TM-15.

Heat Sink: Built in the housing, designed to ensure high efficacy and superior cooling by natural vertical convection air flow pattern always close to LEDs and driver optimising their efficiency and life. Product does not use any cooling device with moving parts (only passive cooling). Wide openings enable natural cleaning and removal of dirt and debris. Entire luminaire is rated for operation in ambient temperature of -40°C / -40°F up to +40°C / +104°F.

RFS RoadFocus

Small, LED Cobrahead: 35 and 54W

Specifications (continued)

Light Engine (continued)

Driver: High power factor of 90% min. Electronic driver, operating range 50/60 Hz. Auto adjusting universal voltage input from 120 to 277 VAC rated for both application line to line or line to neutral, Class I, THD of 20% max.

DMG: Dimming compatible 0-10 volts.
The current supplying the LEDs will be reduced by the driver if the driver experiences internal overheating as a protection to the LEDs and the electrical components. Output is protected from short circuits, voltage overload and current overload. Automatic recovery after correction. Standard built in driver surge protection of 2.5kV (min).

Integrated Features

DMG: Dimmable driver 0-10V.

RCD*: Receptacle with 5 pins enabling dimming, can be used with a twist lock Starsense or photoelectric cell or a shorting cap.

SP1: Surge protection device tested in accordance with ANSI/IEEE C62.45 per ANSI/IEEE C62.41.2 Scenario I Category C High Exposure 10kV/10kA waveforms for Line-Ground, Line-Neutral and Neutral-Ground, and in accordance with DOE MSSLC Model Specification for LED Roadway Luminaires Appendix D Electrical Immunity High test level 10kV/10kA.

Please note that these integrated features always come with RoadFocus luminaire.

** Use of photoelectric cell or shorting cap is required to ensure proper illumination.*

Driver and Luminaire Options

AMPD: Driver pre-programmed for compatibility with Amplight control system.

AST: Pre-set driver for progressive start-up of the LED module(s) to optimize energy management and enhance visual comfort at start-up.

CLO: Pre-set driver to manage the lumen depreciation by adjusting the power given to the LEDs offering the same lighting intensity during the entire lifespan of the LED module.

DALI: Pre-set driver compatible with the DALI control system.

OTL: Pre-set driver to signal end of life of the LED module(s) for better fixture management.

CDMG: Dynadimmer standard dimming functionalities including pre-programmed scenarios to suit many applications and needs from safety to maximum energy savings.

Safety Mode:
CDMGS25: 4 hours, 25% power dimming
CDMGS50: 4 hours 50% power dimming
CDMGS75: 4 hours 75% power dimming

Median Mode:
CDMGM25: 6 hours 25% power dimming
CDMGM50: 6 hours 50% power dimming
CDMGM75: 6 hours 75% power dimming

Economy Mode:
CDMGE25: 8 hours 25% power dimming
CDMGE50: 8 hours 50% power dimming
CDMGE75: 8 hours 75% power dimming

FAWS: Field Adjustable Wattage Selector, pre-set to the highest position, can be easily switched in the field to the required position. This reduces total luminaire wattage consumption and reduces the light level – see the FAWS multiplier chart for more details.
Note: It is not recommended to use FAWS with other dimming or controls; if you do, set the switch to position 10 (maximum output) to enable the other dimming or controls. Switching FAWS to any position other than 10 will disable the other dimming or controls.

SP2: 20kV / 20kA surge protection device that provides extra protection beyond the SP1 10kV/10kA level.

RCD7*: Receptacle with 7 pins enabling dimming and additional functionality (to be determined), can be used with a twist lock Starsense node or photoelectric cell or a shorting cap.

Please note: Additional hardware will be required to utilize the additional 2 pins on this receptacle.

HS: House side shield, 1 per 16 LED light engine.

PH8*: Twist-lock Photoelectric Cell, UNIV (120-277VAC).

PH8XL*: Twist-lock Photoelectric Cell, extended life, UNIV (120-277VAC).

PH9*: Shorting cap.

** Use of photoelectric cell or shorting cap is required to ensure proper illumination.*

Luminaire Useful Life

Refer to IES files for energy consumption and delivered lumens for each option. Based on ISTMT in situ thermal testing in accordance with UL1598 and UL8750, Philips System Reliability Tool, Philips Advance data and Philips Lumileds LM-80/TM-21 data, expected to reach 100,000 + hours with >L70 lumen maintenance @ 25°C. Luminaire Useful Life accounts for LED lumen maintenance AND all of these additional factors including: LED life, driver life, PCB substrate, solder joints, on/off cycles, burning hours and corrosion.

Wiring

The connection of the luminaire is done using a terminal block connector 600V, 85A for use with #2 14 AWG. wires from the primary circuit, located inside the housing. Due to the inrush current that occurs with electronic drivers, recommend using a 10Amp time-delay fuse to avoid unwanted fuse blowing (false tripping) that can occur with normal or fast acting fuses.

Hardware

All exposed screws shall be complete with Ceramic primer seal to reduce seizing of the parts, also offers a high resistance to corrosion. All seals and sealing devices are made and/or lined with EPDM and/or silicone and/or rubber.

Finish

Color in accordance with the AAMA 2603 standard. Application of polyester powder coat paint (4 mils/100 microns) with ± 1 mils/24 microns of tolerance. The Thermosetting resins provides a discoloration resistant finish in accordance with the ASTM D2244 standard, as well as luster retention in keeping with the ASTM D523 standard and humidity proof in accordance with the ASTM D2247 standard.

The surface treatment achieves a minimum of 3000 hours for salt spray resistant finish in accordance with testing performed and per ASTM B117 standard.

LED products manufacturing standard

The electronic components sensitive to electrostatic discharge (ESD) such as light emitting diodes (LEDs) are assembled in compliance with IEC61340-5-1 and ANSI/ESD S20.20 standards so as to eliminate ESD events that could decrease the useful life of the product.

Vibration Resistance

The RFS meets the ANSI C136.31, American National Standard for Roadway Luminaire Vibration specifications for Bridge/overpass applications. (Tested for 3G over 100,000 cycles by independent lab)

Certifications and Compliance

cULus Listed for Canada and USA. Luminaire meets DOE and MSSLC Model Specification for LED Roadway Luminaires. RoadFocus LED Cobrahead luminaires are DesignLights Consortium qualified. Luminaire complies with or exceeds the following ANSI C136 standards: .2, .3, .10, .14, .15, .22, .25, .31, .37, .41.

Limited Warranty

10-year limited warranty.
See philips.com/warranties for details and restrictions.

Brackets/Arms

For brackets / arms available with this luminaire, see Lumec 3D for details.

philips.com/roadfocus

Philips Lighting, North America Corporation
200 Franklin Square Drive, Somerset, NJ 08873
Tel. 855-486-2216

Imported by: Philips Lighting,
A division of Philips Electronics Ltd.
281 Hillmount Rd, Markham, ON, Canada L6C 2S3
Tel. 800-668-9008

PHILIPS
LUMEC

Roadway

RoadFocus

RFM : 72, 108 and 160W

Project:	
Location:	
Cat.No:	
Type:	
Lamps:	Qty:
Notes:	

The Philips Lumec RoadFocus LED Cobra Head luminaires feature a sleek design that provides seamless replacement of existing HID luminaires. RoadFocus is available in three sizes, offers multiple lumen packages, and a complete array of optical distributions, making it an outstanding solution for all types of roadway applications.

Ordering guide

example: RFM-72W32LED4K-T-R2S-UNIV-DMG-AST-FAWS-RCD-SP2-PH8XL-GY3

Luminaire	LED Module	Optical System	Voltage	Driver and Dimming	Wattage Switch	Twist-Lock Receptacle	Surge Protection	Luminaire Options	Finish
RFM									
RFM RoadFocus Medium	**72W32LED4K-T** or **108W32LED4K-T**[2,4] or **108W48LED4K-T** or **160W48LED4K-T**[2,4]	**R2S** Type II Short **R2M** Type II Medium **R3S** Type III Short **R3M** Type III Medium **5** Type V	**UNIV** 120-277VAC **HVU** 347-480VAC	*Standard:* **DMG**[1,6] Dimmable driver 0-10V *Optional:* **AMPD**[2,4,5,6] Amplight Dimming **Dynadimmer** Economy Profile **CDMGE25**[2,4,5,6] **CDMGE50**[2,4,5,6] **CDMGE75**[2,4,5,6] Median Profile **CDMGM25**[2,4,5,6] **CDMGM50**[2,4,5,6] **CDMGM75**[2,4,5,6] Safety Profile **CDMGS25**[2,4,5,6] **CDMGS50**[2,4,5,6] **CDMGS75**[2,4,5,6] **DALI**[2,4,5,6] Digitally Adressable Lighting Interface **DMG-AST***[2,4] Adjustable Startup Time **DMG-CLO***[2,4,5] Constant Light Output **DMG-OTL***[2,4] Over The Life **Includes 0-10v dimming*	None (leave blank) **FAWS**[5] Field Adjustable Wattage Selector (optional)	*Standard:* **RCD**[1,3,7] Receptacle for twist-lock photocell or shorting cap, 5-pin (standard) *Optional:* **RCD7**[3,7] Receptacle for twist-lock photocell or shorting cap, 7-pin (optional)	**SP2**[8] 20kV / 20kA Surge Protector (optional)	**HS** House side shield, 1 per 16 LED light engine **PH8**[3] Twist-lock Photoelectric Cell, UNIV (120-277VAC) **PH8/347**[3] Twist-lock Photoelectric Cell, HVU (347VAC) **PH8/480**[3] Twist-lock Photoelectric Cell, HVU (480VAC) **PH8XL**[3] Twist-lock Photoelectric Cell, extended life, UNIV (120-277VAC) **PH9**[3] Shorting cap	**BK** Black finish **BR** Bronze finish **GY3** Gray finish **WH** White finish

1. Please note these integrated features come standard with RoadFocus luminaires.
2. Denotes programmable driver option. Not available with HVU (347-480volt). Not available with 1050 mA versions (108W32LED, 160W48LED).
3. Use of photoelectric cell or shorting cap is required to ensure proper illumination.
4. Not available with HVU (347-480volt).
5. FAWS not available with AMPD, CDMG options, DALI or CLO.
6. Dimming choices: Select either DMG or AMPD or one of the CDMG options or DALI.
7. When RDC7 option is selected you will get 7-pin instead of standard RCD 5-pin.
8. When SP2 option is selected you will get SP2 instead of standard SP1.

RFM RoadFocus

Medium, LED Cobrahead: 72, 108, and 160W

Accessories (must be ordered as separate line items - quickly and easily installed in the field)

ACC-RFS-RFM-RFL-UNIV-SPC[1,2]	ACC-RFM-RFL-HVU-SPC[1,2]	ACC-RFS-RFM-RFL-UNIV-SPCD[1,2]
Starsense twist-lock photoelectric cell and antenna node, UNIV (120-277VAC).	Starsense twist-lock photoelectric cell and antenna node, HVU (347-480VAC).	Starsense dimmable twist-lock photoelectric cell and antenna node, UNIV (120-277VAC).

1. Use of photoelectric cell or shorting cap is required to ensure proper illumination.
2. Please note that more hardware as well as software are required.
   Please contact the quotations department for help with putting together the entire control system.

LED Wattage and Lumen Values

LED = Philips Lumileds LUXEON T, CRI = 70, CCT = 4000K (+/- 350K)
System (LED + driver) rated life = 100,000 hrs[1]

LED Module	Typical Delivered Lumens	Typical System Wattage (W)[2]	LED Current (mA)	Typical System Current (A) @						Efficacy (Lm/W)	BUG Rating
				120V	208V	240V	277V	347V	480V		
72W32LED4K-T-R2S	8,330	73	700	0.62	0.36	0.31	0.28	0.21	0.15	114	B2-U0-G1
72W32LED4K-T-R2M	8,140	73	700	0.62	0.36	0.31	0.28	0.21	0.15	112	B2-U0-G2
72W32LED4K-T-R3S	8,085	73	700	0.62	0.36	0.31	0.28	0.21	0.15	111	B1-U0-G2
72W32LED4K-T-R3M	8,178	73	700	0.62	0.36	0.31	0.28	0.21	0.15	112	B2-U0-G2
72W32LED4K-T-5	7,496	73	700	0.62	0.36	0.31	0.28	0.21	0.15	103	B3-U0-G2
108W32LED4K-T-R2S	11,169	108	1050	0.91	0.53	0.47	0.41	N/A		103	B2-U0-G2
108W32LED4K-T-R2M	10,914	108	1050	0.91	0.53	0.47	0.41			101	B2-U0-G2
108W32LED4K-T-R3S	10,841	108	1050	0.91	0.53	0.47	0.41			100	B1-U0-G2
108W32LED4K-T-R3M	10,965	108	1050	0.91	0.53	0.47	0.41			102	B2-U0-G2
108W32LED4K-T-5	10,050	108	1050	0.91	0.53	0.47	0.41			93	B3-U0-G2
108W48LED4K-T-R2S	12,507	106	700	0.93	0.53	0.46	0.40	0.32	0.23	118	B3-U0-G2
108W48LED4K-T-R2M	12,222	106	700	0.93	0.53	0.46	0.40	0.32	0.23	115	B2-U0-G2
108W48LED4K-T-R3S	12,140	106	700	0.93	0.53	0.46	0.40	0.32	0.23	115	B2-U0-G2
108W48LED4K-T-R3M	12,279	106	700	0.93	0.53	0.46	0.40	0.32	0.23	116	B2-U0-G2
108W48LED4K-T-5	11,255	106	700	0.93	0.53	0.46	0.40	0.32	0.23	107	B4-U0-G2
160W48LED4K-T-R2S	16,778	161	1050	1.34	0.76	0.66	0.58	N/A		104	B3-U0-G2
160W48LED4K-T-R2M	16,396	161	1050	1.34	0.76	0.66	0.58			102	B3-U0-G3
160W48LED4K-T-R3S	16,285	161	1050	1.34	0.76	0.66	0.58			101	B2-U0-G3
160W48LED4K-T-R3M	16,472	161	1050	1.34	0.76	0.66	0.58			102	B3-U0-G3
160W48LED4K-T-5	15,098	161	1050	1.34	0.76	0.66	0.58			94	B4-U0-G2

1. L_{70} >100,000 hrs (at ambient temperature = 25°C).
2. System wattage or total luminaire wattage includes the LED module and the LED driver.

Note: Due to rapid and continuous advances in LED technology, LED luminaire data is subject to change without notice and at the discretion of Philips.

RFM RoadFocus

Medium, LED Cobrahead: 72, 108, and 160W

Field Adjustable Wattage (FAWS) Multiplier Chart

72W32LED4K-T or 108W48LED4K-T (700 mA)

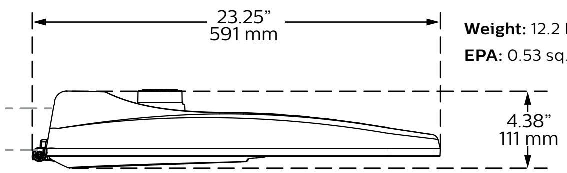
FAWS Position	Typical Delivered Lumens Multiplier	Typical System wattage and typical current
1	0.37	0.29
2	0.55	0.50
3	0.62	0.58
4	0.71	0.69
5	0.77	0.75
6	0.81	0.81
7	0.84	0.87
8	0.94	0.91
9	0.98	0.96
10	1.00	1.00

108W32LED4K-T OR 160W48LED4K-T (1050mA)

FAWS Position	Typical Delivered Lumens Multiplier	Typical System wattage and typical current
1	0.33	0.27
2	0.56	0.48
3	0.64	0.57
4	0.71	0.65
5	0.79	0.74
6	0.84	0.79
7	0.89	0.85
8	0.92	0.90
9	0.96	0.95
10	1.00	1.00

Dimensions

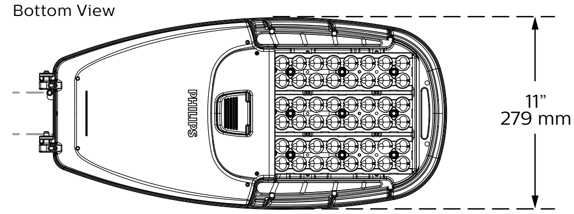
Side View



Weight: 12.2 Lbs

EPA: 0.53 sq. ft.

Bottom View



Predicted Lumen Depreciation Data

Predicted performance derived from LED manufacturer's data and engineering design estimates, based on IESNA LM-80 methodology. Actual experience may vary due to field application conditions. L_{70} is the predicted time when LED performance depreciates to 70% of initial lumen output. Calculated per IESNA TM21-11. Published L_{70} hours limited to 6 times actual LED test hours

Ambient Temperature °C	Driver mA	Calculated L_{70} Hours	L_{70} per TM-21	Lumen Maintenance % at 60,000 hrs
25°C	**up to 1050 mA**	**>100,000 hours**	**>60,000 hours**	**>96%**

Specifications

Housing

Made of a low copper die cast Aluminum alloy (A360), 0.100" (2.5mm) minimum thickness. Fits on a 1.66" (42mm) O.D. (1.25" NPS), 1.9" (48mm) O.D. (1.5" NPS) or 2 3/8" (60mm) O.D. (2" NPS) by 5 1/2" (140mm) minimum long tenon. Comes with a zinc plated clamp fixed by 2 zinc plated hexagonal bolts 3/8 16 UNC for ease of installation. Provides an easy step adjustment of +/- 5° tilt in 2.5º increments. Includes integral bubble level standard (always included). A quick release, tool less entry, single latch, hinged, removable door opens downward to provide access to electronic components and to a terminal block. Door is secured to prevent accidental dropping or disengagement. A clearance of 13" (330mm) at the rear is required in order to remove the door. Complete with a bird guard protecting against birds and similar intruders and an ANSI label to identify wattage and source (both included in box). Housing (including electrical compartment) rated IP54 per ANSI C136.37.

Light Engine

Composed of 4 main components: LED Module / Optical System / Heat Sink / Driver.

Electrical components are RoHS compliant, IP66 sealed light engine equipped with Philips Lumileds LUXEON T LEDs.LEDs tested by ISO 17025-2005 accredited lab in accordance with IESNA LM-80 guidelines in compliance with EPA ENERGY STAR, extrapolations in accordance with IESNA TM-21. Metal core board ensures greater heat transfer and longer lifespan.

LED Module: (Included), LED type Philips Lumileds LUXEON T. Composed of high performance white LEDs. Color temperature as per ANSI bin 4000 Kelvin nominal (3985K +/ 275K), CRI 70 Min. 75 Typical.

Optical System: Composed of high performance UV stabilized optical grade polymer refractor lenses to achieve desired distribution optimized to get maximum spacing, target lumens and a superior lighting uniformity. System is rated IP66. Performance shall be tested per LM-63, LM-79 and TM-15 (IESNA) certifying its photometric performance. Dark Sky compliant with 0% uplight and U0 per IESNA TM-15.

Heat Sink: Built in the housing, designed to ensure high efficacy and superior cooling by natural vertical convection air flow pattern always close to LEDs and driver optimising their efficiency and life. Product does not use any cooling device with moving parts (only passive cooling). Wide openings enable natural cleaning and removal of dirt and debris. Entire luminaire is rated for operation in ambient temperature of -40°C / -40°F up to +40°C / +104°F.

Driver: High power factor of 90% min. Electronic driver, operating range 50/60 Hz. Auto adjusting universal voltage input from 120 to 277 or 347 to 480 VAC rated for both application line to line or line to neutral, Class I, THD of 20% max.

RFM RoadFocus

Medium, LED Cobrahead: 72, 108, and 160W

Specifications (continued)

Light Engine (continued)

DMG: Dimming compatible 0-10 volts.
The current supplying the LEDs will be reduced by the driver if the driver experiences internal overheating as a protection to the LEDs and the electrical components. Output is protected from short circuits, voltage overload and current overload. Automatic recovery after correction. Standard built in driver surge protection of 2.5kV (min).

Integrated Features

DMG: Dimmable driver 0-10V.

RCD*: Receptacle with 5 pins enabling dimming, can be used with a twist lock Starsense or photoelectric cell or a shorting cap.

SP1: Surge protection device tested in accordance with ANSI/IEEE C62.45 per ANSI/IEEE C62.41.2 Scenario I Category C High Exposure 10kV/10kA waveforms for Line-Ground, Line-Neutral and Neutral-Ground, and in accordance with DOE MSSLC Model Specification for LED Roadway Luminaires Appendix D Electrical Immunity High test level 10kV/10kA.

Please note that these integrated features always come with RoadFocus luminaire.

** Use of photoelectric cell or shorting cap is required to ensure proper illumination.*

Driver and Luminaire Options

AMPD*: Driver pre-programmed for compatibility with Amplight control system.

AST*: Pre-set driver for progressive start-up of the LED module(s) to optimize energy management and enhance visual comfort at start-up.

CLO*: Pre-set driver to manage the lumen depreciation by adjusting the power given to the LEDs offering the same lighting intensity during the entire lifespan of the LED module.

DALI*: Pre-set driver compatible with the DALI control system.

OTL*: Pre-set driver to signal end of life of the LED module(s) for better fixture management.

CDMG*: Dynadimmer standard dimming functionalities including pre-programmed scenarios to suit many applications and needs from safety to maximum energy savings.

Safety Mode:
CDMGS25: 4 hours, 25% power dimming
CDMGS50: 4 hours 50% power dimming
CDMGS75: 4 hours 75% power dimming

Median Mode:
CDMGM25: 6 hours 25% power dimming
CDMGM50: 6 hours 50% power dimming
CDMGM75: 6 hours 75% power dimming

Economy Mode:
CDMGE25: 8 hours 25% power dimming
CDMGE50: 8 hours 50% power dimming
CDMGE75: 8 hours 75% power dimming

** Not available with HVU (347-480V)*

FAWS: Field Adjustable Wattage Selector, pre-set to the highest position, can be easily switched in the field to the required position. This reduces total luminaire wattage consumption and reduces the light level – see the FAWS multiplier chart for more details.
Note: It is not recommended to use FAWS with other dimming or controls; if you do, set the switch to position 10 (maximum output) to enable the other dimming or controls. Switching FAWS to any position other than 10 will disable the other dimming or controls.

SP2: 20kV / 20kA surge protection device that provides extra protection beyond the SP1 10kV/10kA level.

RCD7*: Receptacle with 7 pins enabling dimming and additional functionality (to be determined), can be used with a twist lock Starsense node or photoelectric cell or a shorting cap.

Please note: Additional hardware will be required to utilize the additional 2 pins on this receptacle.

HS: House side shield, 1 per 16 LED light engine.

PH8*: Twist-lock Photoelectric Cell, UNIV (120-277VAC).

PH8/347*: Twist-lock Photoelectric Cell, HVU (347VAC).

PH8/480*: Twist-lock Photoelectric Cell, HVU (480VAC).

PH8XL*: Twist-lock Photoelectric Cell, extended life, UNIV (120-277VAC).

PH9*: Shorting cap.

** Use of photoelectric cell or shorting cap is required to ensure proper illumination.*

Luminaire Useful Life

Refer to IES files for energy consumption and delivered lumens for each option. Based on ISTMT in situ thermal testing in accordance with UL1598 and UL8750, Philips System Reliability Tool, Philips Advance data and Philips Lumileds LM-80/TM-21 data, expected to reach 100,000 + hours (72W32LED and 108W48LED at 700mA) or 94,500 hours (108W32LED and 160W48LED at 1050mA) with >L70 lumen maintenance @ 25°C. Luminaire Useful Life accounts for LED lumen maintenance AND all of these additional factors including: LED life, driver life, PCB substrate, solder joints, on/off cycles, burning hours and corrosion.

Wiring

The connection of the luminaire is done using a terminal block connector 600V, 85A for use with #2 14 AWG. wires from the primary circuit, located inside the housing. Due to the inrush current that occurs with electronic drivers, recommend using a 10Amp time-delay fuse to avoid unwanted fuse blowing (false tripping) that can occur with normal or fast acting fuses.

Hardware

All exposed screws shall be complete with Ceramic primer seal to reduce seizing of the parts, also offers a high resistance to corrosion. All seals and sealing devices are made and/or lined with EPDM and/or silicone and/or rubber.

Finish

Color in accordance with the AAMA 2603 standard. Application of polyester powder coat paint (4 mils/100 microns) with ± 1 mils/24 microns of tolerance. The Thermosetting resins provides a discoloration resistant finish in accordance with the ASTM D2244 standard, as well as luster retention in keeping with the ASTM D523 standard and humidity proof in accordance with the ASTM D2247 standard.

The surface treatment achieves a minimum of 3000 hours for salt spray resistant finish in accordance with testing performed and per ASTM B117 standard.

LED products manufacturing standard

The electronic components sensitive to electrostatic discharge (ESD) such as light emitting diodes (LEDs) are assembled in compliance with IEC61340-5-1 and ANSI/ESD S20.20 standards so as to eliminate ESD events that could decrease the useful life of the product.

Vibration Resistance

The RFM meets the ANSI C136.31, American National Standard for Roadway Luminaire Vibration specifications for Bridge/overpass applications. (Tested for 3G over 100,000 cycles by independent lab)

Certifications and Compliance

cULus Listed for Canada and USA. Luminaire meets DOE and MSSLC Model Specification for LED Roadway Luminaires. RoadFocus LED Cobrahead luminaires are DesignLights Consortium qualified. Luminaire complies with or exceeds the following ANSI C136 standards: .2, .3, .10, .14, .15, .22, .25, .31, .37, .41.

Limited Warranty

10-year limited warranty.
See philips.com/warranties for details and restrictions.

Brackets/Arms

For brackets / arms available with this luminaire, see Lumec 3D for details.

philips.com/roadfocus

Philips Lighting, North America Corporation
200 Franklin Square Drive, Somerset, NJ 08873
Tel. 855-486-2216

Imported by: Philips Lighting,
A division of Philips Electronics Ltd.
281 Hillmount Rd, Markham, ON, Canada L6C 2S3
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PHILIPS
LUMEC

Roadway

RoadFocus

RFL: 145, 180, 215 and 241W

Project:

Location:

Cat.No:

Type:

Lamps: Qty:

Notes:

The Philips Lumec RoadFocus LED Cobra Head luminaires feature a sleek design that provides seamless replacement of existing HID luminaires. RoadFocus is available in three sizes, offers multiple lumen packages, and a complete array of optical distributions, making it an outstanding solution for all types of roadway applications.

Ordering guide

example: RFL-145W64LED4K-T-R2S-UNIV-DMG-OTL-RCD7-SP2-PH8XL-GY3

Luminaire	LED Module	Optical System	Voltage	Driver and Dimming	Wattage Switch	Twist-Lock Receptacle	Surge Protection	Luminaire Options	Finish
RFL									
RFL RoadFocus Large	**145W64LED4K-T** or **180W80LED4K-T** or **215W96LED4K-T** or **241W112LED4K-T**	**R2S** Type II Short **R2M** Type II Medium **R3S** Type III Short **R3M** Type III Medium **5** Type V	**UNIV** 120-277VAC **HVU** 347-480VAC	*Standard:* **DMG**[1,6] Dimmable driver 0-10V *Optional:* **AMPD**[2,4,5,6] Amplight Dimming **Dynadimmer** Economy Profile **CDMGE25**[2,4,5,6] **CDMGE50**[2,4,5,6] **CDMGE75**[2,4,5,6] Median Profile **CDMGM25**[2,4,5,6] **CDMGM50**[2,4,5,6] **CDMGM75**[2,4,5,6] Safety Profile **CDMGS25**[2,4,5,6] **CDMGS50**[2,4,5,6] **CDMGS75**[2,4,5,6] **DALI**[2,4,5,6] Digitally Adressable Lighting Interface **DMG-AST***[2,4] Adjustable Startup Time **DMG-CLO***[2,4,5] Constant Light Output **DMG-OTL***[2,4] Over The Life **Includes 0-10v dimming*	None (leave blank) **FAWS**[5] Field Adjustable Wattage Selector (optional)	*Standard:* **RCD**[1,3,7] Receptacle for twist-lock photocell or shorting cap, 5-pin (standard) *Optional:* **RCD7**[3,7] Receptacle for twist-lock photocell or shorting cap, 7-pin (optional)	**SP2**[8] 20kV / 20kA Surge Protector (optional)	**HS** House side shield, 1 per 16 LED light engine **PH8**[3] Twist-lock Photoelectric Cell, UNIV (120-277VAC) **PH8/347**[3] Twist-lock Photoelectric Cell, HVU (347VAC) **PH8/480**[3] Twist-lock Photoelectric Cell, HVU (480VAC) **PH8XL**[3] Twist-lock Photoelectric Cell, extended life, UNIV (120-277VAC) **PH9**[3] Shorting cap	**BK** Black finish **BR** Bronze finish **GY3** Gray finish **WH** White finish

1. Please note these integrated features come standard with RoadFocus luminaires.
2. Denotes programmable driver option. Not available with HVU (347-480volt).
3. Use of photoelectric cell or shorting cap is required to ensure proper illumination.
4. Not available with HVU (347-480volt).
5. FAWS not available with AMPD, CDMG options, DALI or CLO.
6. Dimming choices: Select either DMG or AMPD or one of the CDMG options or DALI.
7. When RDC7 option is selected you will get 7-pin instead of standard RCD 5-pin.
8. When SP2 option is selected you will get SP2 instead of standard SP1.

RFL RoadFocus

Large, LED Cobrahead: 145, 180, 215, and 241W

Accessories (must be ordered as separate line items - quickly and easily installed in the field)

ACC-RFS-RFM-RFL-UNIV-SPC[1,2] Starsense twist-lock photoelectric cell and antenna node, UNIV (120-277VAC).	**ACC-RFM-RFL-HVU-SPC**[1,2] Starsense twist-lock photoelectric cell and antenna node, HVU (347-480VAC).	**ACC-RFS-RFM-RFL-UNIV-SPCD**[1,2] Starsense dimmable twist-lock photoelectric cell and antenna node, UNIV (120-277VAC).

1. Use of photoelectric cell or shorting cap is required to ensure proper illumination.
2. Please note that more hardware as well as software are required.
   Please contact the quotations department for help with putting together the entire control system.

LED Wattage and Lumen Values

LED = Philips Lumileds LUXEON T, CRI = 70, CCT = 4000K (+/- 350K)
System (LED + driver) rated life = 100,000 hrs[1]

LED Module	Typical Delivered Lumens	Typical System Wattage (W)[2]	LED Current (mA)	Typical System Current (A) @						Efficacy (Lm/W)	BUG Rating
				120V	208V	240V	277V	347V	480V		
145W64LED4K-T-R2S	16,349	137	700	1.15	0.66	0.58	0.51	0.41	0.31	119	B3-U0-G2
145W64LED4K-T-R2M	16,046	137	700	1.15	0.66	0.58	0.51	0.41	0.31	117	B3-U0-G3
145W64LED4K-T-R3S	15,763	137	700	1.15	0.66	0.58	0.51	0.41	0.31	115	B2-U0-G3
145W64LED4K-T-R3M	15,697	137	700	1.15	0.66	0.58	0.51	0.41	0.31	115	B3-U0-G2
145W64LED4K-T-5	14,747	137	700	1.15	0.66	0.58	0.51	0.41	0.31	108	B4-U0-G2
180W80LED4K-T-R2S	20,444	174	700	1.46	0.86	0.76	0.69	0.52	0.39	117	B3-U0-G2
180W80LED4K-T-R2M	20,065	174	700	1.46	0.86	0.76	0.69	0.52	0.39	115	B3-U0-G3
180W80LED4K-T-R3S	19,711	174	700	1.46	0.86	0.76	0.69	0.52	0.39	113	B2-U0-G3
180W80LED4K-T-R3M	19,628	174	700	1.46	0.86	0.76	0.69	0.52	0.39	113	B3-U0-G3
180W80LED4K-T-5	18,440	174	700	1.46	0.86	0.76	0.69	0.52	0.39	106	B4-U0-G2
215W96LED4K-T-R2S	24,538	207	700	1.74	1.01	0.89	0.80	0.62	0.46	119	B3-U0-G2
215W96LED4K-T-R2M	24,084	207	700	1.74	1.01	0.89	0.80	0.62	0.46	116	B3-U0-G3
215W96LED4K-T-R3S	23,658	207	700	1.74	1.01	0.89	0.80	0.62	0.46	114	B3-U0-G4
215W96LED4K-T-R3M	23,559	207	700	1.74	1.01	0.89	0.80	0.62	0.46	114	B3-U0-G3
215W96LED4K-T-5	22,133	207	700	1.74	1.01	0.89	0.80	0.62	0.46	107	B5-U0-G3
241W112LED4K-T-R2S	28,633	248	700	2.03	1.17	1.02	0.91	0.72	0.53	115	B4-U0-G3
241W112LED4K-T-R2M	28,102	248	700	2.03	1.17	1.02	0.91	0.72	0.53	114	B3-U0-G4
241W112LED4K-T-R3S	27,606	244	700	2.03	1.17	1.02	0.91	0.72	0.53	113	B3-U0-G4
241W112LED4K-T-R3M	27,490	244	700	2.03	1.17	1.02	0.91	0.72	0.53	113	B3-U0-G4
241W112LED4K-T-5	25,826	242	700	2.03	1.17	1.02	0.91	0.72	0.53	107	B5-U0-G3

1. L_{70} >100,000 hrs (at ambient temperature = 25°C).
2. System wattage or total luminaire wattage includes the LED module and the LED driver.

Note: Due to rapid and continuous advances in LED technology, LED luminaire data is subject to change without notice and at the discretion of Philips.

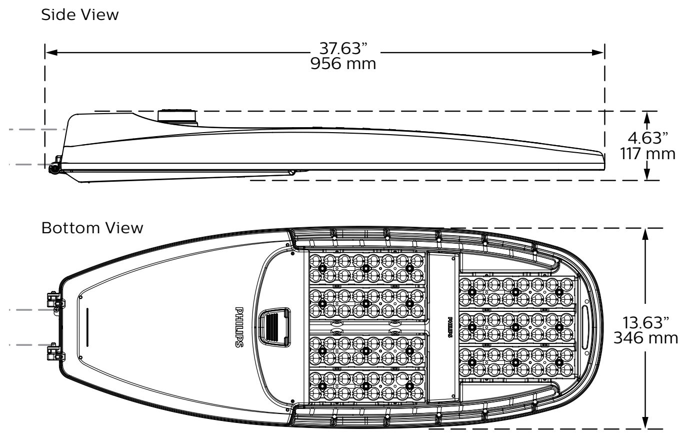
RFL RoadFocus

Large, LED Cobrahead: 145, 180, 215, and 241W

Field Adjustable Wattage (FAWS) Multiplier Chart

FAWS Position	Typical Delivered Lumens Multiplier	Typical System wattage and typical current
1	0.37	0.29
2	0.55	0.50
3	0.62	0.58
4	0.71	0.69
5	0.77	0.75
6	0.81	0.81
7	0.84	0.87
8	0.94	0.91
9	0.98	0.96
10	1.00	1.00

Dimensions



Weight: 27.3 Lbs

EPA: 0.92 sq. ft.

Predicted Lumen Depreciation Data

Predicted performance derived from LED manufacturer's data and engineering design estimates, based on IESNA LM-80 methodology. Actual experience may vary due to field application conditions.L_{70} is the predicted time when LED performance depreciates to 70% of initial lumen output. Calculated per IESNA TM21-11. Published L_{70} hours limited to 6 times actual LED test hours

Ambient Temperature °C	Driver mA	Calculated L_{70} Hours	L_{70} per TM-21	Lumen Maintenance % at 60,000 hrs
25°C	**700 mA**	**>100,000 hours**	**>60,000 hours**	**>94%**

Specifications

Housing

Made of a low copper die cast Aluminum alloy (A360), 0.100" (2.5mm) minimum thickness. Fits on a 1.66" (42mm) O.D. (1.25" NPS), 1.9" (48mm) O.D. (1.5" NPS) or 2 3/8" (60mm) O.D. (2" NPS) by 5 1/2" (140mm) minimum long tenon. Comes with 2 zinc plated clamps fixed by 4 zinc plated hexagonal bolts 3/8 16 UNC for ease of installation. Provides an easy step adjustment of +/- 5° tilt in 2.5º increments. Includes integral bubble level standard (always included). A quick release, tool less entry, single latch, hinged, removable door opens downward to provide access to electronic components and to a terminal block. Door is secured to prevent accidental dropping or disengagement. A clearance of 13" (330mm) at the rear is required in order to remove the door. Complete with a bird guard protecting against birds and similar intruders and an ANSI label to identify wattage and source (both included in box). Housing (including electrical compartment) rated IP54 per ANSI C136.37.

Light Engine

Composed of 4 main components: LED Module / Optical System / Heat Sink / Driver.

Electrical components are RoHS compliant, IP66 sealed light engine equipped with Philips Lumileds LUXEON T LEDs.LEDs tested by ISO 17025-2005 accredited lab in accordance with IESNA LM-80 guidelines in compliance with EPA ENERGY STAR, extrapolations in accordance with IESNA TM-21. Metal core board ensures greater heat transfer and longer lifespan.

LED Module: (Included), LED type Philips Lumileds LUXEON T. Composed of high performance white LEDs. Color temperature as per ANSI bin 4000 Kelvin nominal (3985K +/ 275K), CRI 70 Min. 75 Typical.

Optical System: Composed of high performance UV stabilized optical grade polymer refractor lenses to achieve desired distribution optimized to get maximum spacing, target lumens and a superior lighting uniformity. System is rated IP66. Performance shall be tested per LM-63, LM-79 and TM-15 (IESNA) certifying its photometric performance. Dark Sky compliant with 0% uplight and U0 per IESNA TM-15.

Heat Sink: Built in the housing, designed to ensure high efficacy and superior cooling by natural vertical convection air flow pattern always close to LEDs and driver optimising their efficiency and life. Product does not use any cooling device with moving parts (only passive cooling). Wide openings enable natural cleaning and removal of dirt and debris. Entire luminaire is rated for operation in ambient temperature of -40°C / -40°F up to +40°C / +104°F.

Driver: High power factor of 90% min. Electronic driver, operating range 50/60 Hz. Auto adjusting universal voltage input from 120 to 277 or 347 to 480 VAC rated for both application line to line or line to neutral, Class I, THD of 20% max. 1 driver (64 LED); 2 drivers (all others).

DMG: Dimming compatible 0-10 volts. The current supplying the LEDs will be reduced by the driver if the driver experiences internal overheating as a protection to the LEDs and the electrical components. Output is protected from short circuits, voltage overload and current overload. Automatic recovery after correction. Standard built in driver surge protection of 2.5kV (min).

RFL RoadFocus

Large, LED Cobrahead: 145, 180, 215, and 241W

Specifications (continued)

Integrated Features

DMG: Dimmable driver 0-10V.

RCD*: Receptacle with 5 pins enabling dimming, can be used with a twist lock Starsense or photoelectric cell or a shorting cap.

SP1: Surge protection device tested in accordance with ANSI/IEEE C62.45 per ANSI/IEEE C62.41.2 Scenario I Category C High Exposure 10kV/10kA waveforms for Line-Ground, Line-Neutral and Neutral-Ground, and in accordance with DOE MSSLC Model Specification for LED Roadway Luminaires Appendix D Electrical Immunity High test level 10kV/10kA.

Please note that these integrated features always come with RoadFocus luminaire.

** Use of photoelectric cell or shorting cap is required to ensure proper illumination.*

Driver and Luminaire Options

AMPD*: Driver pre-programmed for compatibility with Amplight control system.

AST*: Pre-set driver for progressive start-up of the LED module(s) to optimize energy management and enhance visual comfort at start-up.

CLO*: Pre-set driver to manage the lumen depreciation by adjusting the power given to the LEDs offering the same lighting intensity during the entire lifespan of the LED module.

DALI*: Pre-set driver compatible with the DALI control system.

OTL*: Pre-set driver to signal end of life of the LED module(s) for better fixture management.

CDMG*: Dynadimmer standard dimming functionalities including pre-programmed scenarios to suit many applications and needs from safety to maximum energy savings.

Safety Mode:
CDMGS25: 4 hours, 25% power dimming
CDMGS50: 4 hours 50% power dimming
CDMGS75: 4 hours 75% power dimming

Median Mode:
CDMGM25: 6 hours 25% power dimming
CDMGM50: 6 hours 50% power dimming
CDMGM75: 6 hours 75% power dimming

Economy Mode:
CDMGE25: 8 hours 25% power dimming
CDMGE50: 8 hours 50% power dimming
CDMGE75: 8 hours 75% power dimming

** Not available with HVU (347-480V)*

FAWS: Field Adjustable Wattage Selector, pre-set to the highest position, can be easily switched in the field to the required position. This reduces total luminaire wattage consumption and reduces the light level – see the FAWS multiplier chart for more details.
Note: It is not recommended to use FAWS with other dimming or controls; if you do, set the switch to position 10 (maximum output) to enable the other dimming or controls. Switching FAWS to any position other than 10 will disable the other dimming or controls.

SP2: 20kV / 20kA surge protection device that provides extra protection beyond the SP1 10kV/10kA level.

RCD7*: Receptacle with 7 pins enabling dimming and additional functionality (to be determined), can be used with a twist lock Starsense node or photoelectric cell or a shorting cap.

Please note: Additional hardware will be required to utilize the additional 2 pins on this receptacle.

HS: House side shield, 1 per 16 LED light engine.

PH8*: Twist-lock Photoelectric Cell, UNIV (120-277VAC).

PH8/347*: Twist-lock Photoelectric Cell, HVU (347VAC).

PH8/480*: Twist-lock Photoelectric Cell, HVU (480VAC).

PH8XL*: Twist-lock Photoelectric Cell, extended life, UNIV (120-277VAC).

PH9*: Shorting cap.

** Use of photoelectric cell or shorting cap is required to ensure proper illumination.*

Luminaire Useful Life

Refer to IES files for energy consumption and delivered lumens for each option. Based on ISTMT in situ thermal testing in accordance with UL1598 and UL8750, Philips System Reliability Tool, Philips Advance data and Philips Lumileds LM-80/TM-21 data, expected to reach 100,000 + hours with >L70 lumen maintenance @ 25°C. Luminaire Useful Life accounts for LED lumen maintenance AND all of these additional factors including: LED life, driver life, PCB substrate, solder joints, on/off cycles, burning hours and corrosion.

Wiring

The connection of the luminaire is done using a terminal block connector 600V, 85A for use with #2 14 AWG. wires from the primary circuit, located inside the housing. Due to the inrush current that occurs with electronic drivers, recommend using a 10Amp time-delay fuse to avoid unwanted fuse blowing (false tripping) that can occur with normal or fast acting fuses.

Hardware

All exposed screws shall be complete with Ceramic primer seal to reduce seizing of the parts, also offers a high resistance to corrosion. All seals and sealing devices are made and/or lined with EPDM and/or silicone and/or rubber.

Finish

Color in accordance with the AAMA 2603 standard. Application of polyester powder coat paint (4 mils/100 microns) with ± 1 mils/24 microns of tolerance. The Thermosetting resins provides a discoloration resistant finish in accordance with the ASTM D2244 standard, as well as luster retention in keeping with the ASTM D523 standard and humidity proof in accordance with the ASTM D2247 standard.

The surface treatment achieves a minimum of 3000 hours for salt spray resistant finish in accordance with testing performed and per ASTM B117 standard.

LED products manufacturing standard

The electronic components sensitive to electrostatic discharge (ESD) such as light emitting diodes (LEDs) are assembled in compliance with IEC61340-5-1 and ANSI/ESD S20.20 standards so as to eliminate ESD events that could decrease the useful life of the product.

Vibration Resistance

The RFL meets the ANSI C136.31, American National Standard for Roadway Luminaire Vibration specifications for Bridge/overpass applications. (Tested for 3G over 100,000 cycles by independent lab)

Certifications and Compliance

cULus Listed for Canada and USA. Luminaire meets DOE and MSSLC Model Specification for LED Roadway Luminaires. RoadFocus LED Cobrahead luminaires are DesignLights Consortium qualified. Luminaire complies with or exceeds the following ANSI C136 standards: .2, .3, .10, .14, .15, .22, .25, .31, .37, .41.

Limited Warranty

10-year limited warranty.
See philips.com/warranties for details and restrictions.

Brackets/Arms

For brackets / arms available with this luminaire, see Lumec 3D for details.

philips.com/roadfocus

Philips Lighting, North America Corporation
200 Franklin Square Drive, Somerset, NJ 08873
Tel. 855-486-2216

Imported by: Philips Lighting,
A division of Philips Electronics Ltd.
281 Hillmount Rd, Markham, ON, Canada L6C 2S3
Tel. 800-668-9008

PHILIPS

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Methodology for Lumen Maintenance Calculations

Currently accepted procedure is to project lumen maintenance for a luminaire by taking LM-80 data for the LED package and making calculations per IES TM-21-11*. As administrator of the Energy Star program, the US EPA makes available an Excel based calculator for that purpose.

To validate that the LED package operates in the luminaire at a case temperature that does not exceed the highest case temperature of the LM-80 results, an in-situ temperature measurement test (ISTMT) is performed on the luminaire.

For the ISTMT, the largest available model in this product series was tested per UL1598 at 25 degrees Celsius. The maximum measured LED case temperature from this report was used as input data for the TM-21 lumen maintenance calculations. The Philips laboratory that performed the ISTMT participates in the UL Data Acceptance Program.
Philips used the EPA's TM-21 calculator, with input data from its ISTMT and Philips Lumileds LM-80, to arrive at these lumen maintenance projections. The TM-21 report generated by the EPA calculator is included in this submittal. The projected time to L70 is 451,000 hours, and reported (limited by TM-21 extrapolation rules) is >60,000 hours.

Additionally, the EPA calculator will calculate lumen maintenance percentages, at specific points in time, from this data. Some results of those calculations for the **Philips Lumec Roadfocus RFS** are in the table, below:

Hours	Lumen Maintenance
50,000	97.02%
60,000	96.24%
70,000	95.46%
75,000	95.07%
80,000	94.68%
90,000	93.92%
100,000	93.16%

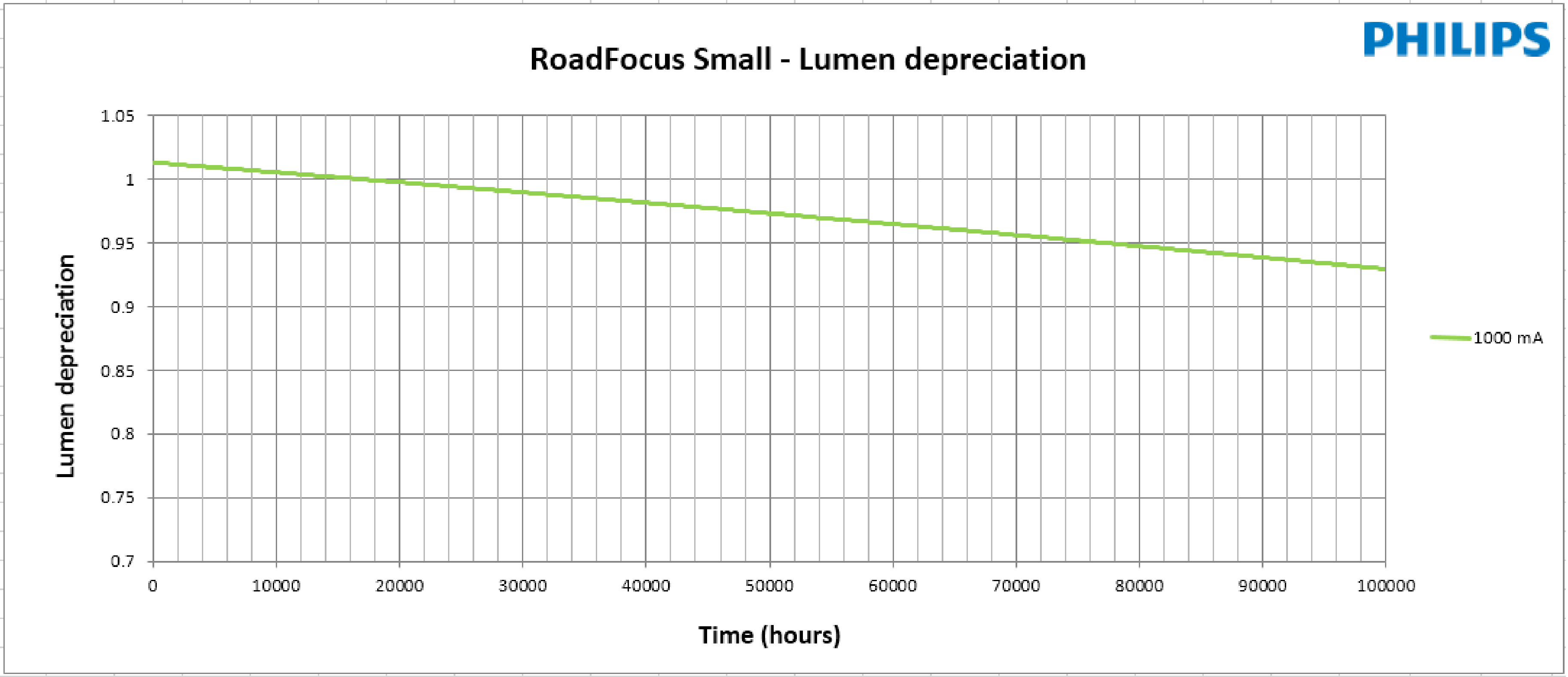
**Reference: The US DOE MSSLC Model Spec, Appendix B, Option 1.*
http://www1.eere.energy.gov/buildings/ssl/specification.html

TM-21 Report

Table 1: Report at each LM-80 Test Condition					
Description of LED Light Source Tested (manufacturer, model, catalog number)	RFM-110W32LED4K-T @25C				
Test Condition 1 - 55^{0}C Case Temp		Test Condition 2 - 85^{0}C Case Temp			
Sample size	25	Sample size	25	Sample size	-
Number of failures	0	Number of failures	0	Number of failures	-
DUT drive current used in the test (mA)	1000	DUT drive current used in the test (mA)	1000	DUT drive current used in the test (mA)	-
Test duration (hours)	10,000	Test duration (hours)	10,000	Test duration (hours)	-
Test duration used for projection (hour to hour)	5,000 - 10,000	Test duration used for projection (hour to hour)	5,000 - 10,000	Test duration used for projection (hour to hour)	-
Tested case temperature (^{0}C)	55	Tested case temperature (^{0}C)	85	Tested case temperature (^{0}C)	-
α	8.528E-07	α	6.966E-07	α	-
B	1.007	B	1.014	B	-
Calculated L70(10k) (hours)	427,000	Calculated L70(10k) (hours)	531,000	Calculated L70(10k) (hours)	-
Reported L70(10k) (hours)	>60000	Reported L70(10k) (hours)	>60000	Reported L70(10k) (hours)	-

Table 2: Interpolation Report (projection based on *in-situ* temperature entered)	
$T_{s,1}$ (^{0}C)	55.00
$T_{s,1}$ (K)	328.15
α_1	8.528E-07
B_1	1.007
$T_{s,2}$ (^{0}C)	85.00
$T_{s,2}$ (K)	358.15
α_2	6.966E-07
B_2	1.014
E_a/k_b	-7.93E+02
A	7.617E-08
B_0	1.010
$T_{s,i}$ (^{0}C)	61.60
$T_{s,i}$ (K)	334.75
α_i	8.132E-07
Projected L70(10k) at	451,000
Reported L70(10k) at 61.6^{0}C (hours)	>60000

Report Generated By: Pascal Pavao	Notes:
Company: Philips Lumec	
Date: 2013-10-07	


PHILIPS
RoadFocus Small - Lumen depreciation
Lumen depreciation
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
Time (hours)
1000 mA

PHILIPS

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Methodology for Lumen Maintenance Calculations

Currently accepted procedure is to project lumen maintenance for a luminaire by taking LM-80 data for the LED package and making calculations per IES TM-21-11*. As administrator of the Energy Star program, the US EPA makes available an Excel based calculator for that purpose.

To validate that the LED package operates in the luminaire at a case temperature that does not exceed the highest case temperature of the LM-80 results, an in-situ temperature measurement test (ISTMT) is performed on the luminaire.

For the ISTMT, the largest available model in this product series was tested per UL1598 at 25 degrees Celsius. The maximum measured LED case temperature from this report was used as input data for the TM-21 lumen maintenance calculations. The Philips laboratory that performed the ISTMT participates in the UL Data Acceptance Program.
Philips used the EPA's TM-21 calculator, with input data from its ISTMT and Philips Lumileds LM-80, to arrive at these lumen maintenance projections. The TM-21 report generated by the EPA calculator is included in this submittal. The projected time to L70 is 502,000 hours, and reported (limited by TM-21 extrapolation rules) is >60,000 hours.

Additionally, the EPA calculator will calculate lumen maintenance percentages, at specific points in time, from this data. Some results of those calculations for the **Philips Lumec Roadfocus RFM** are in the table, below:

Hours	Lumen Maintenance
50,000	97.42%
60,000	96.71%
70,000	96.00%
75,000	95.65%
80,000	95.30%
90,000	94.61%
100,000	93.92%

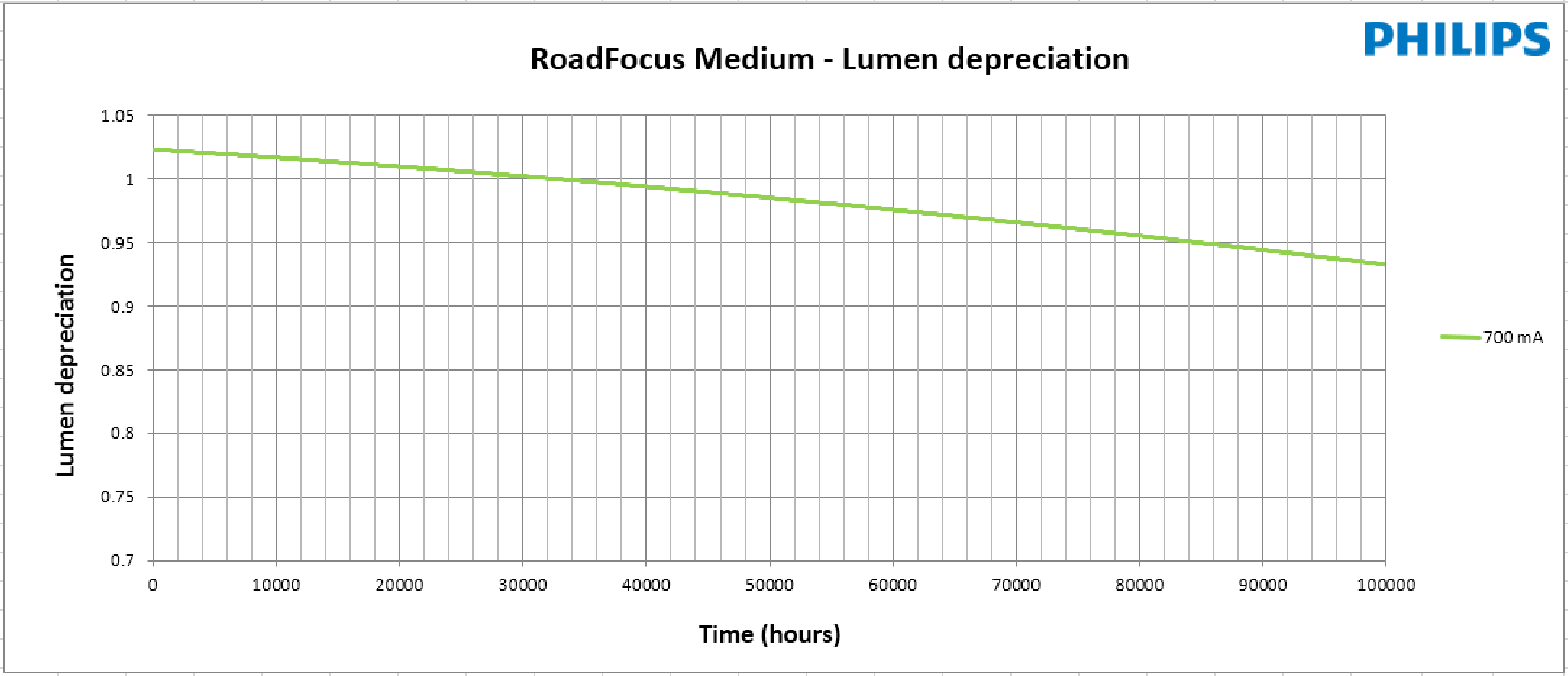
**Reference: The US DOE MSSLC Model Spec, Appendix B, Option 1.*
http://www1.eere.energy.gov/buildings/ssl/specification.html

TM-21 Report

Table 1: Report at each LM-80 Test Condition					
Description of LED Light Source Tested (manufacturer, model, catalog number)	RFM-110W32LED4K-T @25C				
Test Condition 1 - 55^{o}C Case Temp		**Test Condition 2 - 85^{o}C Case Temp**			
Sample size	25	Sample size	25	Sample size	-
Number of failures	0	Number of failures	0	Number of failures	-
DUT drive current used in the test (mA)	1000	DUT drive current used in the test (mA)	1000	DUT drive current used in the test (mA)	-
Test duration (hours)	10,000	Test duration (hours)	10,000	Test duration (hours)	-
Test duration used for projection (hour to hour)	5,000 - 10,000	Test duration used for projection (hour to hour)	5,000 - 10,000	Test duration used for projection (hour to hour)	-
Tested case temperature (^{o}C)	55	Tested case temperature (^{o}C)	85	Tested case temperature (^{o}C)	-
α	8.528E-07	α	6.966E-07	α	-
B	1.007	B	1.014	B	-
Calculated L70(10k) (hours)	427,000	Calculated L70(10k) (hours)	531,000	Calculated L70(10k) (hours)	-
Reported L70(10k) (hours)	>60000	Reported L70(10k) (hours)	>60000	Reported L70(10k) (hours)	-

Table 2: Interpolation Report (projection based on *in-situ* temperature entered)	
$T_{s,1}$ (^{o}C)	55.00
$T_{s,1}$ (K)	328.15
α_1	8.528E-07
B_1	1.007
$T_{s,2}$ (^{o}C)	85.00
$T_{s,2}$ (K)	358.15
α_2	6.966E-07
B_2	1.014
E_a/k_b	-7.93E+02
A	7.617E-08
B_0	1.010
$T_{s,i}$ (^{o}C)	77.20
$T_{s,i}$ (K)	350.35
α_i	7.318E-07
Projected L70(10k) at	502,000
Reported L70(10k) at 77.2^{o}C (hours)	>60000

Report Generated By: Pascal Pavao	Notes:
Company: Philips Lumec	
Date: 2013-10-07	



PHILIPS
RoadFocus Medium - Lumen depreciation
Lumen depreciation
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
Time (hours)
700 mA

PHILIPS

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Methodology for Lumen Maintenance Calculations

Currently accepted procedure is to project lumen maintenance for a luminaire by taking LM-80 data for the LED package and making calculations per IES TM-21-11*. As administrator of the Energy Star program, the US EPA makes available an Excel based calculator for that purpose.

To validate that the LED package operates in the luminaire at a case temperature that does not exceed the highest case temperature of the LM-80 results, an in-situ temperature measurement test (ISTMT) is performed on the luminaire.

For the ISTMT, the largest available model in this product series was tested per UL1598 at 25 degrees Celsius. The maximum measured LED case temperature from this report was used as input data for the TM-21 lumen maintenance calculations. The Philips laboratory that performed the ISTMT participates in the UL Data Acceptance Program.
Philips used the EPA's TM-21 calculator, with input data from its ISTMT and Philips Lumileds LM-80, to arrive at these lumen maintenance projections. The TM-21 report generated by the EPA calculator is included in this submittal. The projected time to L70 is 244,000 hours, and reported (limited by TM-21 extrapolation rules) is >60,000 hours.

Additionally, the EPA calculator will calculate lumen maintenance percentages, at specific points in time, from this data. Some results of those calculations for the **Philips Lumec Roadfocus RFL** are in the table, below:

Hours	Lumen Maintenance
50,000	95.53%
60,000	94.01%
70,000	92.52%
75,000	91.79%
80,000	91.05%
90,000	89.61%
100,000	88.19%

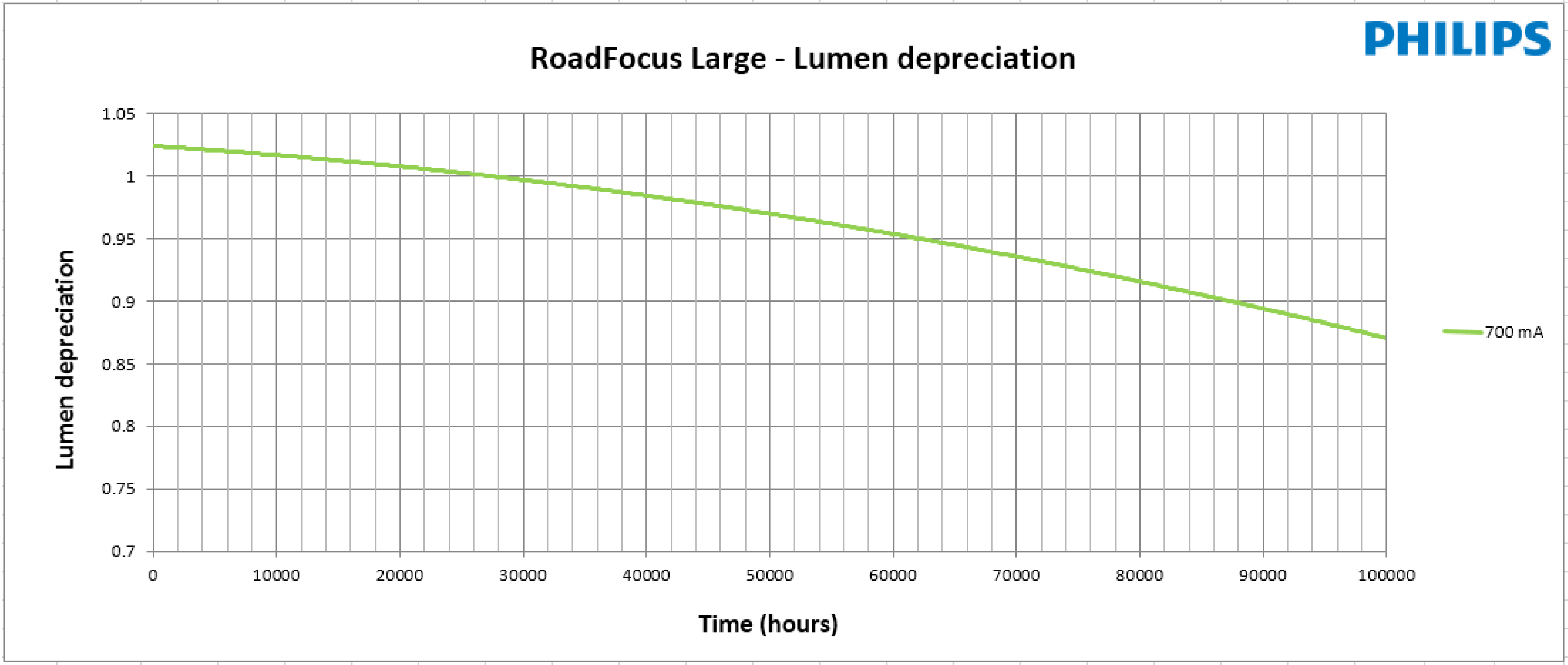
**Reference: The US DOE MSSLC Model Spec, Appendix B, Option 1.*
http://www1.eere.energy.gov/buildings/ssl/specification.html

TM-21 Report

Table 1: Report at each LM-80 Test Condition					
Description of LED Light Source Tested (manufacturer, model, catalog number)	RFL-241W112LED4K-T @ 25C		Max measured Tca:		
Test Condition 1 - 55°C Case Temp		**Test Condition 2 - 85°C Case Temp**			
Sample size	25	Sample size	25	Sample size	-
Number of failures	0	Number of failures	0	Number of failures	-
DUT drive current used in the test (mA)	700	DUT drive current used in the test (mA)	700	DUT drive current used in the test (mA)	-
Test duration (hours)	10,000	Test duration (hours)	10,000	Test duration (hours)	-
Test duration used for projection (hour to hour)	5,000 - 10,000	Test duration used for projection (hour to hour)	5,000 - 10,000	Test duration used for projection (hour to hour)	-
Tested case temperature (°C)	55	Tested case temperature (°C)	85	Tested case temperature (°C)	-
α	-2.009E-06	α	1.599E-06	α	-
B	1.006	B	1.035	B	-
Calculated L70(10k) (hours)	(180,000)	Calculated L70(10k) (hours)	244,000	Calculated L70(10k) (hours)	-
Reported L70(10k) (hours)	(180,000)	Reported L70(10k) (hours)	>60000	Reported L70(10k) (hours)	-

Table 2: Interpolation Report (projection based on *in-situ* temperature entered)	
$T_{s,1}$ (°C)	85.00
$T_{s,1}$ (K)	358.15
α_1	1.599E-06
B_1	1.035
$T_{s,2}$ (°C)	-
$T_{s,2}$ (K)	-
α_2	-
B_2	-
E_a/k_b	-
A	-
B_0	1.035
$T_{s,i}$ (°C)	85.00
$T_{s,i}$ (K)	358.15
α_i	1.599E-06
Projected L70(10k) at 85°C	244,000
Reported L70(10k) at 85°C (hours)	>60000

Report Generated By: Pascal Pavao	Notes:
Company: Philips Lumec	
Date: 2013-10-07	


PHILIPS
RoadFocus Large - Lumen depreciation
Lumen depreciation
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
Time (hours)
700 mA

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Test Report

Heat test no.: **2905** Running

Product Identification:	RFS-54W16LED4K-T- LE2-GY3			Frequency:	60 Hz
Ballast Factory	X1050C105V050CNY1M	Voltage:	120 volts	Isolation Class:	1
Ballast Lumec no.:	170872	UL Ballast Coil Rise 1029:	n/a	Capacitor:	n/a uF
Lamp Type:	1X SLE Luxeon T	Systeme Power:	55 watts	Product:	ROADFOCUS
Notes:	TEST UL/CSA	Temperature Index:	80		
Date of test:	2014-10-24 at 08:00:00	Length of test:	08:00:00		
Lumec File No.:	LRQB0074-61	Average Room temp.:	24.7		
UL File No.:	n/a	**REF UL STD NO. 1598 sec.14**		**UL Project:**	
CSA File	n/a	**REF. CSA STA: C22.2 NO. 250.0-08 sec.14**			

All temperatures corrected for 25ºC room temp.

TC	Description	Value at 30 min. of end	Value at 15 min. of end	Value at end of test	Maximum value	Time of maximum value	Max. admissible value
0	Room temperature	25.2	25.2	25.3	25.3	08:00:00	40.0
1	Driver TC 1	40.4	40.4	40.3	40.9	04:00:00	80.0
2	~~Bloc Connector~~	N/A	N/A	N/A	N/A	N/A	N/A
3	~~MOV~~	N/A	N/A	N/A	N/A	N/A	N/A
4	Board 1 Led 9	66.2	66.2	66.1	66.5	04:00:00	120.0
5	Board 1 Lens 8	58.3	58.3	58.3	58.7	04:00:00	120.0
6	Board 1 Led 13	56.4	56.4	56.3	56.7	02:15:00	120.0
7	~~Gasket Rc~~	N/A	N/A	N/A	N/A	N/A	N/A
8	~~1/4 inch lack Wire Driver~~	N/A	N/A	N/A	N/A	N/A	N/A
9	Advance Tc	43.9	43.8	43.7	44.2	04:00:00	80.0
10	Between Heat Sink & Board	53.1	53.0	52.9	53.6	04:00:00	120.0
11	Wago Connector	39.4	39.4	39.3	39.8	04:15:00	105.0
12	Internal Wall Near Connector	40.1	40.1	39.9	40.4	02:15:00	105.0
13	~~Door Plastic Loquet~~	N/A	N/A	N/A	N/A	N/A	N/A
14	Bord Connector	43.9	43.9	43.8	44.2	04:00:00	120.0
15	~~Sle Red Wire~~	N/A	N/A	N/A	N/A	N/A	N/A
16	Sle Red Wire	41.4	41.3	41.2	41.6	04:00:00	120.0
17		N/A	N/A	N/A	N/A	N/A	N/A
18	Rc	N/A	N/A	N/A	N/A	N/A	N/A
19	LVI Hatch	29.7	29.7	29.6	29.9	02:15:00	120.0
20	Faws	N/A	N/A	N/A	N/A	N/A	N/A
21		N/A	N/A	N/A	N/A	N/A	N/A
	ALampe (dc)	46.3	46.2	46.3	46.4	00:15:00	
	ALampe (dc)	1.046	1.046	1.046	1.046	08:00:00	
22							
	Input voltage (volts)	120.4	120.4	120.4	120.4	03:45:00	±10
	System power (watts)	54.3	54.1	54.3	56.2	00:15:00	
	Power factor	1.000	1.000	1.000	1.000	7:30:00	

Coils temperature calculated by rise-of-resistance	Com-X		Lamp-X		

Room B D-400-020

Data acquisition by Fluke NetDAQ (setup by Jean-Pierre Mathieu, PEng., M.A. Sc.).

Test done by: Ghislain Léveillé	Date: 2014-10-27	Signature: Ghislain Léveillé
Reviewed by: Marc Jetté	Date: 2014-10-27	Signature:

Last calibration 2014/05/28; next calibration 2015/05/28

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Boisbriand (Qc) Canada J7G 2A7
Tel: (450) 430-7040
Fax: (450) 430-1453

Test Report

Heat test no.: **2903-25°** Running

Product Identification:	RFM-160W48LED4K-SLE-T-LE2-GY3			Frequency:	60 Hz
Ballast Factory	LEDINTA1050C140DO	Voltage:	120 volts	Isolation Class:	1
Ballast Lumec no.:	167489	UL Ballast Coil Rise 1029:	n/a	Capacitor:	n/a uF
Lamp Type:	3X SLE Luxeon T	Systeme Power:	155 watts	Product:	RFM
Notes:	TEST UL/CSA	Temperature Index:	80		
Date of test:	2014-10-22 at 15:59:42	Length of test:	08:00:00		
Lumec File No.:	LRQB0104-3	Average Room temp.:	40.1		
UL File No.:	n/a	**REF UL STD NO. 1598 sec.14**		**UL Project:**	
CSA File	n/a	**REF. CSA STA: C22.2 NO. 250.0-08 sec.14**			

All temperatures corrected for 25°C room temp.

TC	Description	Value at 30 min. of end	Value at 15 min. of end	Value at end of test	Maximum value	Time of maximum value	Max. admissible value
0	Room temperature	40.5	40.0	39.5	**40.5**	00:30:00	40.0
1	Driver tc 1	59.6	60.3	60.1	60.4	04:45:00	80.0
2	Board 1 Led 1	76.6	76.4	76.8	76.9	05:00:00	120.0
3	Board 1 Led 5	76.5	76.2	76.6	76.9	03:15:00	120.0
4	Board 1 Led 9	80.4	80.2	80.6	80.6	05:00:00	120.0
5	Board 1 Led 13	72.0	71.6	72.1	72.4	03:15:00	120.0
6	Board 1 Lens 13	62.1	61.8	62.6	62.6	02:00:00	90.0
7	Board 2 Led 1	77.9	77.7	78.2	78.2	08:00:00	120.0
8	Board 2 Led 5	75.8	75.4	75.9	76.1	05:00:00	120.0
9	Board 2 Led 9	84.0	83.8	84.2	84.2	08:00:00	120.0
10	Board 2 Led 13	74.5	74.2	74.6	74.7	05:00:00	120.0
11	Board 3 Led 1	66.9	66.6	67.1	67.1	03:15:00	120.0
12	Board 3 Led 5	73.0	72.4	73.1	73.2	03:15:00	120.0
13	Board 3 Led 9	82.9	82.5	83.1	83.1	05:00:00	120.0
14	Board 3 Led 13	72.8	72.1	72.9	73.0	02:00:00	120.0
15							
16	Driver tc 2	64.2	64.6	64.7	65.0	06:00:00	80.0
17							
18							
19							
20							
21							
	Vlampe (dc)	136.1	136.1	136.1	136.2	00:15:00	
	ALampe (dc)	1.050	1.050	1.050	1.050	00:15:00	
22							
	Input voltage (volts)	121.1	121.1	121.1	121.1	02:15:00	±14
	System power (watts)	150.6	150.3	150.6	150.9	00:15:00	
	Power factor	1.000	1.000	1.000	1.000	1:30:00	

Coils temperature calculated by rise-of-resistance	Com-X		Lamp-X		
	N/A		N/A		

Room B D-400-022

Data acquisition by Fluke NetDAQ (setup by Jean-Pierre Mathieu, PEng., M.A. Sc.).

Test done by: Ghislain Léveillé	Date: 2015-04-22	Signature: Ghislain Léveillé
Reviewed by: Marc Jetté	Date: 2015-04-22	Signature:

Last calibration 2014/05/28; next calibration 2015/05/28

PHILIPS LUMEC
640, boul. Curé Boivin
Boisbriand (Qc) Canada J7G 2A7
Tel: (450) 430-7040
Fax: (450) 430-1453

Test Report

Heat test no.: **7628** Running

Product Identification:	RFL-241W112LED4K-T- LE2-GY3			Frequency:	60 Hz
Ballast Factory	LED-HCNA-0700C-210-DN	Voltage:	347 volts	Isolation Class:	1
Ballast Lumec no.:	161901	UL Ballast Coil Rise 1029:	n/a	Capacitor:	n/a uF
Lamp Type:	7X SLD Luxeon T	Systeme Power:	241 watts	Product:	R028
Notes:	TEST UL/CSA	Temperature Index:	80		
Date of test:	2014-08-21 at 13:16:04	Length of test:	07:30:00		
Lumec File No.:	LRQB0074-01	Average Room temp.:	23.3		
UL File No.:	n/a	**REF UL STD NO. 1598 sec.14**		**UL Project:**	
CSA File	n/a	**REF. CSA STA: C22.2 NO. 250.0-08 sec.14**			

All temperatures corrected for 25ºC room temp.

TC	Description	Value at 30 min. of end	Value at 15 min. of end	Value at end of test	Maximum value	Time of maximum value	Max. admissible value
0	Room temperature	23.6	23.7	23.8	23.8	07:30:00	25.0
1	Driver TC 1	60.3	60.4	60.4	60.6	04:15:00	80.0
2	Driver TC 2	62.3	62.3	62.4	62.7	06:15:00	80.0
3	1/4 in. wire from driver 1	48.1	48.1	48.2	48.3	06:15:00	105.0
4	1/4 in. wire from driver 2	46.1	46.1	46.2	46.3	06:15:00	105.0
5	SP1	37.9	37.9	38.0	38.1	03:45:00	85.0
6	Connector block	41.5	41.5	41.6	41.7	03:45:00	120.0
7	Gasket RC	38.8	38.9	38.9	39.0	03:45:00	90.0
8	LVI Hatch	35.0	35.0	35.0	35.1	06:15:00	120.0
9	FAWS	37.9	37.9	37.9	38.1	06:15:00	120.0
10	Plastic latch	40.0	40.1	40.1	40.1	03:45:00	120.0
11	RC	40.1	40.2	40.2	40.4	03:45:00	155.0
12	Plastic wire cap	53.6	53.7	53.7	53.7	02:45:00	120.0
13	Led wire 1/4 in. From board led	48.0	48.1	48.0	48.1	03:45:00	105.0
14	Heatsink near wires	55.6	55.6	55.5	55.6	07:00:00	105.0
15	Crimp conector	51.7	51.7	51.7	51.7	07:15:00	105.0
16	Board 1 led 5	63.1	63.0	62.9	63.1	06:30:00	120.0
17	Board 1 Led 13	62.9	62.9	62.8	63.0	06:30:00	120.0
18	Board 2 Led 5	62.0	61.9	62.0	62.1	06:15:00	120.0
19	Board 2 Led 11	63.0	63.0	63.0	63.1	02:45:00	120.0
20	Board 2 Lens	56.6	57.0	56.8	57.6	04:45:00	120.0
21	Board 3 led 5	60.9	60.9	60.9	61.0	02:45:00	120.0
22	Board 3 led 6	62.0	62.0	62.0	62.1	02:45:00	120.0
	Vlampe (dc) Driver 1	181.3	181.3	181.3	181.3	06:15:00	
	ALampe (dc) Driver 1	0.705	0.705	0.705	0.705	00:15:00	
	Vlampe (dc) Driver 2	137.0	137.0	137.0	137.0	06:15:00	
	ALampe (dc) Driver 2	0.715	0.715	0.715	0.715	00:15:00	
	Input voltage (volts)	347.6	347.9	348.0	349.1	00:15:00	±10
	System power (watts)	247.0	247.2	247.0	248.9	00:15:00	
	Power factor	0.995	0.995	0.995	0.995	3:45:00	

Coils temperature calculated by rise-of-resistance	Com-X		Lamp-X		
	N/A		N/A		

Room A D-400-013

Data acquisition by Fluke NetDAQ (setup by Jean-Pierre Mathieu, PEng., M.A. Sc.).

Test done by:	Ghislain Léveillé	Date:	2014-08-25	Signature:	Ghislain Léveillé
Reviewed by:	Marc Jetté	Date:	2014-08-25	Signature:	

Last calibration 2014/05/28; next calibration 2015/05/28

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ISO/IEC 17025

NVLAP LAB CODE: 200899-0

Moving Mirror Goniophotometer Test Report

Standard(s): IESNA LM-31-95, IES LM-79-08, IESNA TM-15-11, ANSI C82.77-2002

Customer: Philips Lumec, 640 Curé Boivin, Boisbriand, Québec, Canada, J7G 2A7

General Information		SSL Details		Driver Details	
Test Report	S1502163-R1	**Description**	54W White SSL	**Type**	Commercial
Test Date	16 February 2015	**Serial Number**	SRIS 1785	**Description**	54W
Report Date	17 February 2015	**Photometric Method**	Absolute	**Manufacturer**	Advance
Ambient	24.7 °C	**Lamp Lumens**	-1	**Catalog No.**	XI055C105V052CNY1M
Humidity	5.5 %	**Test Position**	Vertical Base Up	**Voltage**	120.00 V
Lamp Type	SSL	**Comments**	1 Cluster of 16 Luxeon T LED's	**Power Factor**	0.9900

Luminaire Data

General Information		Optics		Aperture (feet)	
Manufacturer	Philips Lumec	**Reflector**	None	**X**	0.6667
Name	Roadfocus	**Housing**	Die Cast Aluminum	**Y**	0.1667
Catalog No.	RFS-54W16LED4K-T-5	**Lens**	1X16 Clear Acrylic LED Collimators	**Z**	0.0000

SKT Position: Fixed
Lamp Stabilization Time: 45 minutes, 11 seconds

Tested By: Jean-Paul Ojeil **Approved Signatory: Chrisnel Blot**

Signature:

Luminaire Test Method

Precise installation and alignment of the luminaire to the rotation axis of the photometer is governed by a servomotor controlled via a microcontroller. A laser is used to validate the luminaire positioning. Before photometric measurements are taken, luminaire is operated long enough to reach stabilization and temperature equilibrium.

All movement commands issued to the photometer axes are mediated by the software to ensure the motion is within the limits of operation. The photometric detector used is a silicon detector corrected to closely match the spectral luminous efficiency photopic curve with a quality index less than 1.5%. Proper shielding is incorporated to the photometric test bench such that only the light from the unit under test is measured.

Luminous intensity measurements are performed at a distance great enough so that the inverse-square law applies. During each measurement the computer records the luminous intensity associated to the corresponding angles of radiation, as well as input electrical operational parameters and temperature measurements. Candela values are reported in IES format as per LM-63.

Equipment, reference standards are traceable to National Institute of Standards and Technology (NIST) and National Research Council of Canada (NRC).

Electrical Equipment

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Power Supply	Elgar	CW801	30527	N.P.C.R.	N.P.C.R.
Input Power Meter	Yokogawa	WT210	91L236541	2014/03/25	2015/04/16
Output Power Meter	N/A	N/A	N/A	N.P.C.R.	N.P.C.R.

Photometric Equipment

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Photometer	Gigahertz-Optik	X11	4502	2014/05/06	2015/09/17
Photodetector	INPHORA	IPR-PDET 19	110802	2014/05/16	2015/05/16

Environment Equipment

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Temperature Humidity Sensor	Omega	HH311	120504178	2014/04/16	2016/04/16

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ISO/IEC 17025

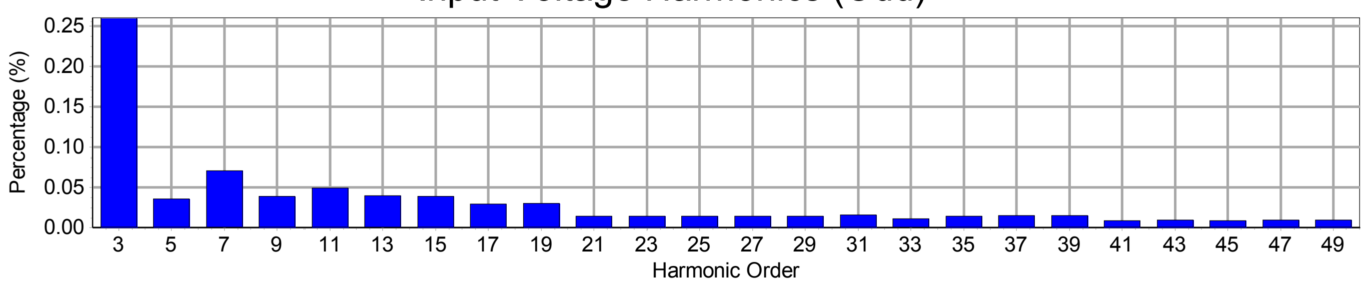
NVLAP LAB CODE: 200899-0

Electrical Measurements

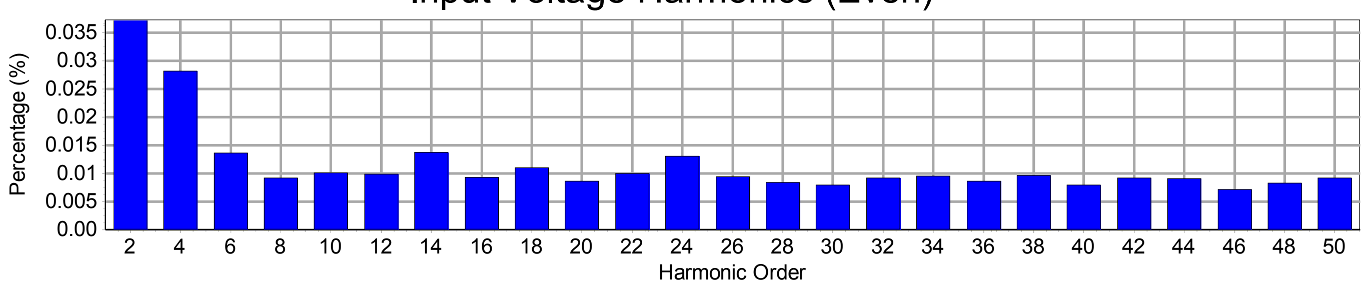
Input

Frequency	60 Hz	Active Power	53.37 W	THDV [ANSI]	0.30 %
Voltage	120.4 V(rms)	Apparent Power	53.53 VA	THDA [ANSI]	5.37 %
Current	0.4445 A(rms)	Power Factor	0.997	Max. Harmonic At	7th order

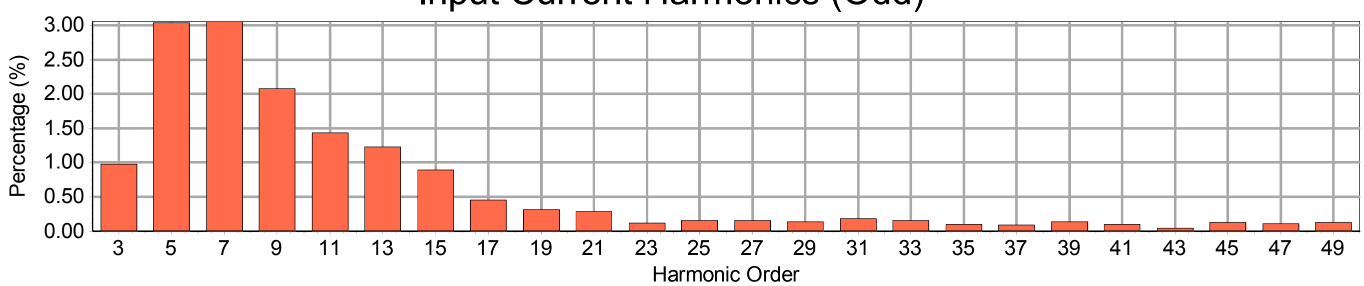
Input Voltage Harmonics (Odd)



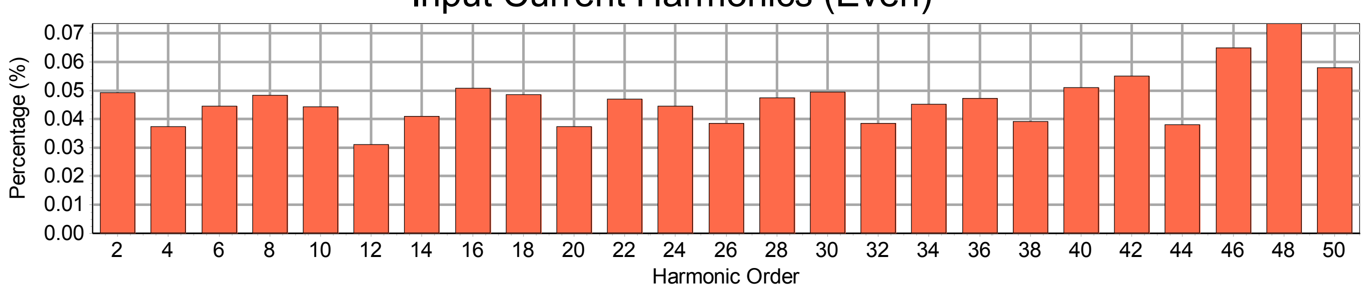
Input Voltage Harmonics (Even)



Input Current Harmonics (Odd)



Input Current Harmonics (Even)



Harmonic Measurements

Odd Harmonics				Even Harmonics			
Harmonic Order	Frequency (HZ)	Voltage Harmonics (%)	Current Harmonics (%)	Harmonic Order	Frequency (HZ)	Voltage Harmonics (%)	Current Harmonics (%)
1	60	100.000	100.000	2	120	0.037	0.049
3	180	0.260	0.975	4	240	0.028	0.037
5	300	0.035	3.036	6	360	0.014	0.045
7	420	0.070	3.062	8	480	0.009	0.048
9	540	0.038	2.076	10	600	0.010	0.044
11	660	0.049	1.432	12	720	0.010	0.031
13	780	0.039	1.230	14	840	0.014	0.041
15	900	0.038	0.890	16	960	0.009	0.051
17	1020	0.029	0.451	18	1080	0.011	0.049
19	1140	0.030	0.313	20	1200	0.009	0.037
21	1260	0.014	0.285	22	1320	0.010	0.047
23	1380	0.014	0.116	24	1440	0.013	0.045
25	1500	0.014	0.154	26	1560	0.009	0.038
27	1620	0.014	0.159	28	1680	0.008	0.047
29	1740	0.014	0.135	30	1800	0.008	0.050
31	1860	0.016	0.182	32	1920	0.009	0.038
33	1980	0.011	0.157	34	2040	0.010	0.045
35	2100	0.014	0.099	36	2160	0.009	0.047
37	2220	0.014	0.086	38	2280	0.010	0.039
39	2340	0.015	0.137	40	2400	0.008	0.051
41	2460	0.008	0.093	42	2520	0.009	0.055
43	2580	0.009	0.044	44	2640	0.009	0.038
45	2700	0.008	0.126	46	2760	0.007	0.065
47	2820	0.009	0.112	48	2880	0.008	0.074
49	2940	0.009	0.122	50	3000	0.009	0.058

Photometric Report: S1502163-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFS-54W16LED4K-T-5

Photometric Luminaire Characteristics as per IESNA RP-8-00

Nominal SSL Power	54.00 W
Luminaire Luminous Flux	5086
Measured Input Power	53.37 W
Luminaire Luminous Efficacy	95.3 lm/W
Maximum Candela Value	2292
Maximum Candela Location	42.5 °H, 72.5 °V
Maximum Candela at 90° Vertical	0
Maximum Candela at 80° Vertical	63
IES Classification	Type IV, Short, Full Cutoff
Downward Street Side Lumens	2607
Downward Street Side Efficiency	N/A
Downward House Side Lumens	2479
Downward House Side Efficiency	N/A
Downward Total Efficiency	N/A
Upward Street Side Lumens	0
Upward Street Side Efficiency	N/A
Upward House Side Lumens	0
Upward House Side Efficiency	N/A
Upward Total Efficiency	N/A
Total Luminaire Lumens	5086
Total Luminaire Efficiency	N/A

Notes

1) Luminaire tested in accordance to IES LM-31-95 and IES LM-79-08 at a distance great enough so that the inverse-square law applies.

2) Field performance may differ from laboratory measurements.

3) Results are valid for the tested material only.

4) All data published in this report are based on absolute photometry.

5) The luminaire classification is based on IESNA RP-8-00.

6) The original electronic file or paper report cannot be edited in whole or in part without written consent of Spectralux Industries Inc.

7) This photometric file describes the performance of a single luminaire and does not necessarily represent the average performance of a group of the same SSL luminaires.

8) The previous IESNA cutoff classifications (Full Cutoff, Cutoff, Semi-Cutoff and Non-Cutoff) are superseded by the Luminaire Classification System (LCS) which defines the standard solid angles for evaluation and comparison of outdoor luminaires.

Photometric Report: S1502163-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFS-54W16LED4K-T-5

Luminaire Classification System as per IESNA TM-15-11

Nominal SSL Power	54.00 W
Luminaire Luminous Flux	5086
Measured Input Power	53.37 W
Luminaire Luminous Efficacy	95.3 lm/W
Maximum Candela Value	2292
Maximum Candela Location	42.5 °H, 72.5 °V
IES Classification	Type IV, Short
Downward Street Side Lumens	2607
Downward Street Side Efficiency	N/A
Downward House Side Lumens	2479
Downward House Side Efficiency	N/A
Downward Total Lumens	5086
Downward Total Efficiency	N/A
Upward Street Side Lumens	0
Upward Street Side Efficiency	N/A
Upward House Side Lumens	0
Upward House Side Efficiency	N/A
Upward Total Lumens	0
Upward Total Efficiency	N/A
Trapped Light Lumens	0
Total Luminaire Lumens	5086
Total Luminaire Efficiency	N/A

Notes

1) Luminaire tested in accordance to IES LM-31-95 and IES LM-79-08 at a distance great enough so that the inverse-square law applies.

2) Field performance may differ from laboratory measurements.

3) Results are valid for the tested material only.

4) All data published in this report are based on absolute photometry.

5) The luminaire classification is based on IESNA TM-15-11.

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7) This photometric file describes the performance of a single luminaire and does not necessarily represent the average performance of a group of the same SSL luminaires.

Photometric Report: S1502163-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFS-54W16LED4K-T-5

Luminaire Lumens Distribution based on 5086 total luminaire lumens as per IESNA TM-15-11

Downward Forward Light	**Lumens**
Total	2607
Lumens Distribution	
Forward Light Low (0° - 30°)	219
Forward Light Mid (30° - 60°)	1100
Forward Light High (60° - 80°)	1278
Forward Light Very High (80° - 90°)	10

Downward Back Light	**Lumens**
Total	2479
Lumens Distribution	
Back Light Low (0° - 30°)	217
Back Light Mid (30° - 60°)	1073
Back Light High (60° - 80°)	1182
Back Light Very High (80° - 90°)	7

Uplight	**Lumens**
Total	0
Lumens Distribution	
Uplight Low (90° - 100°)	0
Uplight High (100° - 180°)	0

Trapped Light	**Lumens**
Total	0

Notes

1) Luminaire tested in accordance to IES LM-31-95 and IES LM-79-08 at a distance great enough so that the inverse-square law applies.

2) Field performance may differ from laboratory measurements.

3) Results are valid for the tested material only.

4) All data published in this report are based on absolute photometry.

5) The luminaire classification is based on IESNA TM-15-11.

6) The original electronic file or paper report cannot be edited in whole or in part without written consent of Spectralux Industries Inc.

7) This photometric file describes the performance of a single luminaire and does not necessarily represent the average performance of a group of the same SSL luminaires.

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ISO/IEC 17025
NVLAP LAB CODE: 200899-0

Photometric Report: S1502163-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFS-54W16LED4K-T-5

IESNA TM-15-11 : Backlight, Uplight and Glare (BUG) Ratings

Table A-1 : Backlight Ratings (maximal zonal lumens)

Control of Backlight / Trespass

Backlight Rating

Zone	B0	B1	B2	B3	B4	B5
BH	110	500	1000	2500	5000	>5000
BM	220	1000	2500	5000	8500	>8500
BL	110	500	1000	2500	5000	>5000

Backlight Ratings

Zone	Lumens	Rating
BH	1182	B3
BM	1073	B2
BL	217	B1

The Backlight Rating is B3.

Table A-2 : Uplight Ratings (maximal zonal lumens)

Control of Uplight / Skyglow

Uplight Rating

Zone	U0	U1	U2	U3	U4	U5
UH	0	10	50	500	1000	>1000
UL	0	10	50	500	1000	>1000

Uplight Ratings

Zone	Lumens	Rating
UH	0	U0
UL	0	U0

The Uplight Rating is U0.

Table A-3 : Glare Ratings (maximum zonal lumens)

Control of Glare / Offensive Light

Glare Rating for Asymmetrical Luminaire Types (Type I, Type II, Type III, Type IV)

Zone	G0	G1	G2	G3	G4	G5
FVH	10	100	225	500	750	>750
BVH	10	100	225	500	750	>750
FH	660	1800	5000	7500	12000	>12000
BH	110	500	1000	2500	5000	>5000

Glare Ratings for Type IV

Zone	Lumens	Rating
FVH	10	G0
BVH	7	G0
FH	1278	G1
BH	1182	G3

The Glare Rating is G3.

The BUG Rating is B3 U0 G3

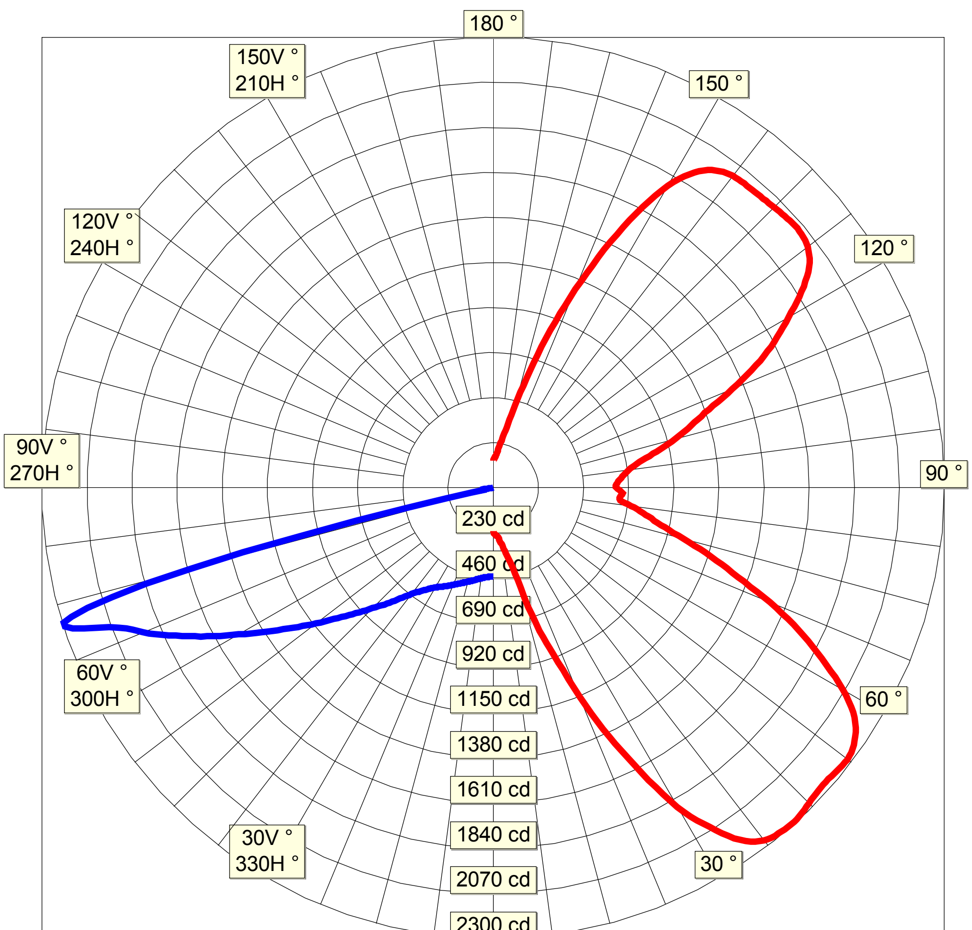
Photometric Report: S1502163-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFS-54W16LED4K-T-5

Maximum Plane and Maximum Cone Plots of Candela (1)

Plane Angles	Candela Values
0.0	451
2.5	454
5.0	458
7.5	465
10.0	474
12.5	485
15.0	495
17.5	507
20.0	521
22.5	536
25.0	552
27.5	568
30.0	587
32.5	611
35.0	643
37.5	683
40.0	738
42.5	800
45.0	868
47.5	947
50.0	1032
52.5	1136
55.0	1243
57.5	1365
60.0	1496
62.5	1641
65.0	1785
67.5	1929
70.0	2080
72.5	2292
75.0	1597
77.5	246
80.0	60
82.5	35
85.0	19
87.5	9
90.0	0
92.5	0
95.0	0
97.5	0
100.0	0
102.5	0
105.0	0
107.5	0



Plane Through Maximum Candela	Cone Through Maximum Candela
72.5 (Vertical Degrees) = 2292	42.5 (Horizontal Degrees) = 2292

Cone Angles	Candela Values
0.0	220
2.5	239
5.0	248
7.5	274
10.0	315
12.5	379
15.0	486
17.5	730
20.0	906
22.5	1153
25.0	1399
27.5	1637
30.0	1879
32.5	2053
35.0	2193
37.5	2267
40.0	2288
42.5	2292
45.0	2275
47.5	2265
50.0	2268
52.5	2276
55.0	2249
57.5	2182
60.0	2060
62.5	1889
65.0	1719
67.5	1527
70.0	1329
72.5	1165
75.0	1004
77.5	876
80.0	790
82.5	709
85.0	645
87.5	660
90.0	629
92.5	635
95.0	661
100.0	758
105.0	961
110.0	1170
115.0	1479
120.0	1739

Photometric Report: S1502163-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFS-54W16LED4K-T-5

Maximum Plane and Maximum Cone Plots of Candela (2)

Plane Angles	Candela Values
110.0	0
112.5	0
115.0	0
117.5	0
120.0	0
122.5	0
125.0	0
127.5	0
130.0	0
132.5	0
135.0	0
137.5	0
140.0	0
142.5	0
145.0	0
147.5	0
150.0	0
152.5	0
155.0	0
157.5	0
160.0	0
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167.5	0
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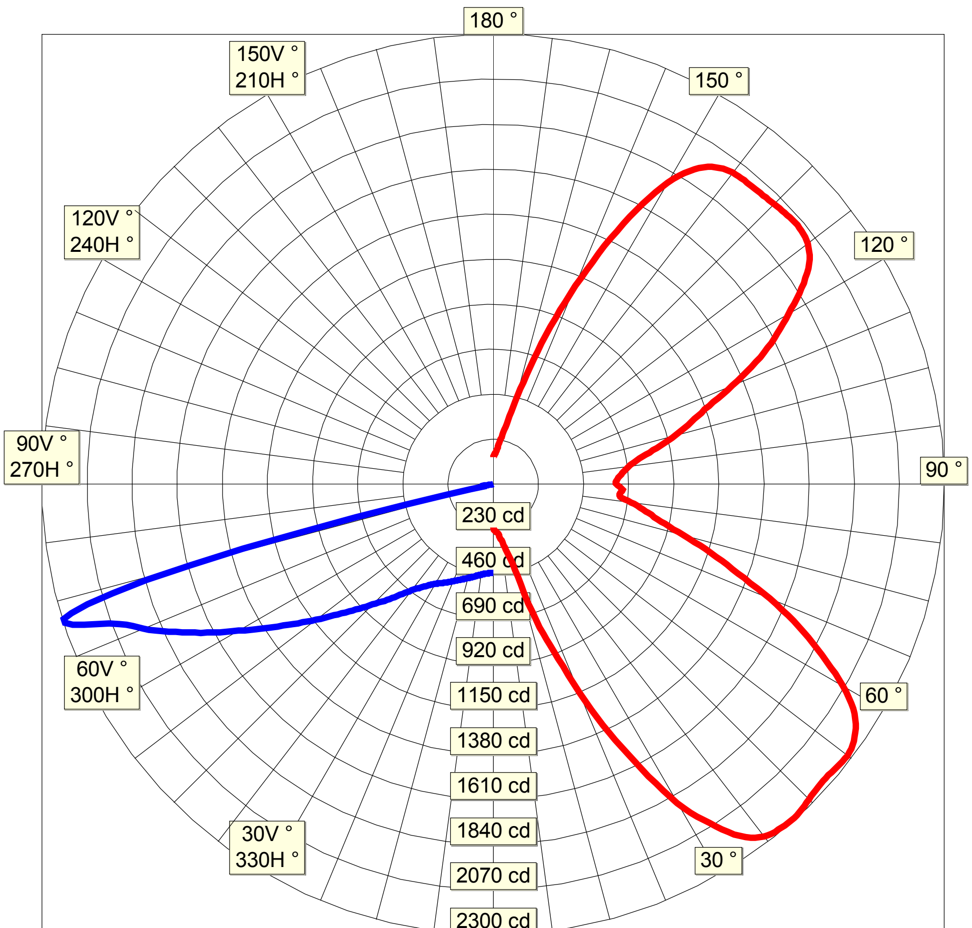
175.0	0
177.5	0
180.0	0



Plane Through Maximum Candela	Cone Through Maximum Candela
72.5 (Vertical Degrees) = 2292	42.5 (Horizontal Degrees) = 2292

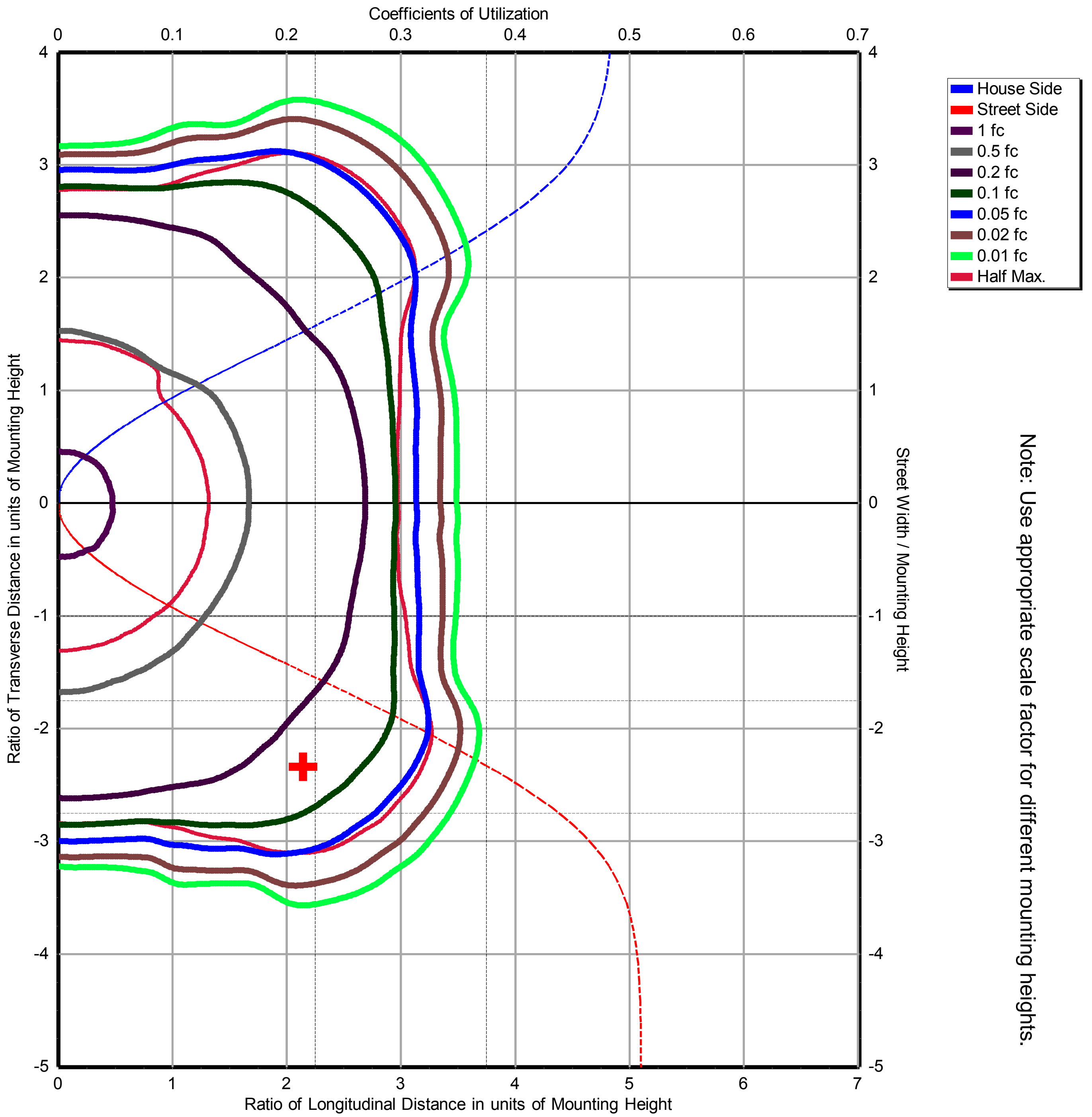
Cone Angles	Candela Values
125.0	1965
130.0	2037
135.0	2024
140.0	2012
145.0	1978
150.0	1778
155.0	1342
160.0	856
165.0	439
170.0	244
175.0	167
180.0	138

Les Industries Spectralux Inc.
Spectralux Industries Inc.

2750 Sabourin, Saint-Laurent (Quebec) H4S 1M2 Canada
Tel.: (514) 332-0082 Fax: (514) 332-3590 www.spectralux.ca

ISO/IEC 17025
NVLAP LAB CODE: 200899-0

Isoilluminance based on 20 feet of Mounting Height and Coefficients of Utilization Diagram (Right Side)

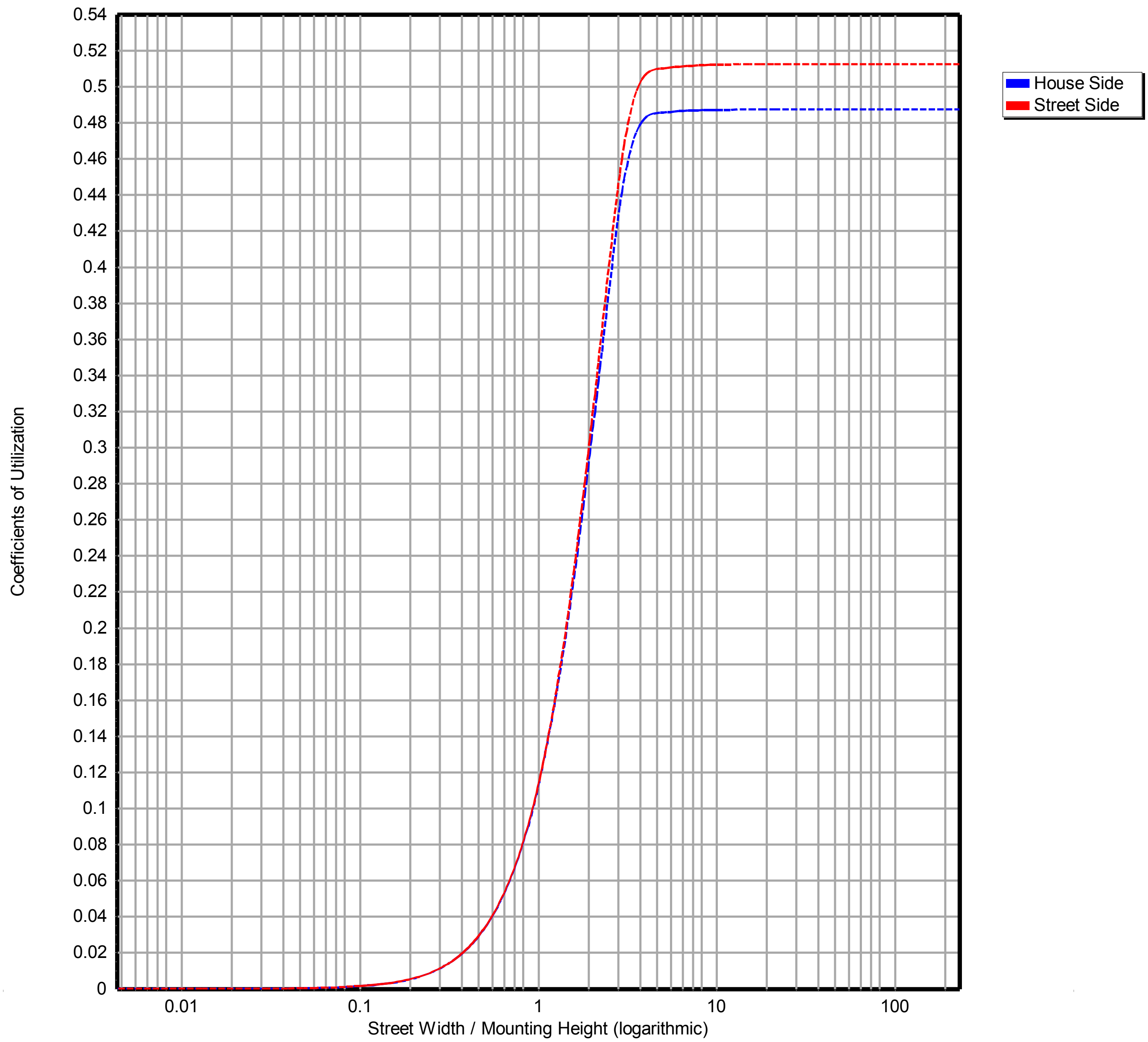


Photometric Report: S1502163-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFS-54W16LED4K-T-5

Coefficients of Utilization



IES File Headers

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IESNA:LM-63-2002
[ISSUEDATE]     16 February 2015
[TESTLAB]       Spectra Lux Industries Inc.
[TEST]          S1502163-R1
[MANUFAC]       Philips Lumec
[LUMCAT]        RFS-54W16LED4K-T-5
[LUMINAIRE]     Roadfocus
[LAMP]          (1 Cluster of 16 Luxeon T LED's) White 54W SSL c/w Advance Driver XI055C105V052CNY1M @
120.00V
[_LAMPDETAILS] AC Voltage=51.4V, Current=1.05A, CCT=N/K, CRI=N/K, x=N/K, y=N/K
[_BURNING]      Vertical Base Up (5,086 Luminaire Lumens)
[_REFLECTOR]    None
[_LENS]         1X16 Clear Acrylic LED Collimators
[_HOUSING]      Die Cast Aluminum
[_SKTPOSITION] Fixed
[DISTRIBUTION] Type IV, Short
```

Candela Table

Lateral Angles

Vertical Angles	**0.0**	**2.5**	**5.0**	**7.5**	**10.0**	**12.5**	**15.0**	**17.5**	**20.0**
0.0	451	451	451	451	451	451	451	451	451
2.5	453	453	452	452	452	452	453	455	453
5.0	457	457	456	456	456	456	457	458	457
7.5	464	464	463	463	463	463	464	466	464
10.0	472	473	472	472	472	472	472	474	473
12.5	482	483	482	483	483	483	483	485	484
15.0	493	494	493	494	493	494	493	496	494
17.5	503	504	503	504	504	504	505	507	505
20.0	514	515	515	516	515	516	517	519	517
22.5	527	528	528	529	528	529	529	532	530
25.0	540	541	541	542	542	543	544	546	543
27.5	555	555	555	557	557	558	558	560	557
30.0	575	575	575	577	577	578	577	580	576
32.5	601	601	601	602	603	603	603	605	603
35.0	634	633	633	635	635	636	636	639	636
37.5	673	672	673	675	675	676	677	679	677
40.0	724	723	724	726	726	727	728	730	728
42.5	779	778	779	780	780	781	783	785	784
45.0	848	847	848	848	848	848	850	851	851
47.5	936	934	935	935	935	936	938	938	939
50.0	1028	1027	1029	1028	1029	1029	1032	1030	1032
52.5	1140	1138	1140	1141	1143	1141	1142	1138	1141
55.0	1258	1255	1257	1257	1256	1253	1251	1246	1251
57.5	1395	1394	1395	1395	1393	1387	1381	1372	1378
60.0	1537	1536	1537	1535	1531	1523	1514	1506	1510
62.5	1686	1684	1685	1680	1675	1667	1657	1647	1652
65.0	1835	1831	1831	1822	1814	1806	1792	1782	1787
67.5	1971	1977	1978	1976	1975	1972	1960	1947	1948
70.0	1431	1468	1481	1515	1560	1615	1681	1752	1830
72.5	220	239	248	274	315	379	486	730	906
75.0	75	76	77	78	80	82	85	88	98
77.5	48	48	49	51	53	57	60	61	62
80.0	31	32	32	33	35	37	40	43	45
82.5	25	25	26	26	26	26	27	28	30
85.0	19	19	19	19	20	20	20	21	21

Lateral Angles

Vertical Angles	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0
87.5	12	13	13	13	13	13	13	13	13
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	22.5	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5
0.0	451	451	451	451	451	451	451	451	451
2.5	454	455	454	453	453	454	455	455	454
5.0	458	459	459	457	457	458	459	459	458
7.5	465	466	466	464	465	466	466	466	465
10.0	474	475	475	473	474	475	475	475	474
12.5	484	485	485	484	484	485	485	486	485
15.0	494	496	495	493	494	495	495	496	495
17.5	506	507	506	505	505	506	507	508	507
20.0	517	519	518	516	516	517	519	521	521
22.5	530	532	530	529	529	531	533	535	536
25.0	544	545	545	544	545	547	550	553	552
27.5	558	560	561	560	562	565	568	570	568
30.0	577	580	581	581	584	587	589	590	587
32.5	604	606	608	608	610	612	614	614	611
35.0	638	640	642	642	644	644	645	645	643
37.5	679	682	683	682	683	684	684	685	683
40.0	731	734	735	735	735	735	737	740	738
42.5	788	792	796	794	794	794	797	801	800
45.0	855	860	864	862	861	861	865	870	868
47.5	941	944	948	944	943	943	948	951	947
50.0	1033	1037	1039	1034	1034	1036	1038	1038	1032
52.5	1142	1145	1147	1142	1141	1143	1144	1144	1136
55.0	1248	1250	1252	1245	1246	1249	1251	1252	1243
57.5	1372	1373	1376	1371	1369	1374	1376	1375	1365
60.0	1501	1501	1505	1503	1501	1505	1504	1503	1496
62.5	1640	1640	1647	1644	1642	1648	1646	1646	1641
65.0	1773	1779	1788	1789	1786	1793	1791	1792	1785
67.5	1928	1928	1931	1931	1928	1938	1933	1931	1929
70.0	1921	2011	2082	2119	2117	2109	2088	2080	2080
72.5	1153	1399	1637	1879	2053	2193	2267	2288	2292
75.0	134	217	379	762	1034	1256	1433	1538	1597
77.5	66	71	76	84	104	141	195	229	246
80.0	48	50	54	57	60	62	63	62	60
82.5	32	35	37	38	39	39	38	36	35
85.0	21	21	21	21	21	21	20	19	19
87.5	13	12	12	12	11	10	10	9	9
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles

	22.5	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	45.0	47.5	50.0	52.5	55.0	57.5	60.0	62.5	65.0
0.0	451	451	451	451	451	451	451	451	451
2.5	453	452	453	452	452	453	453	452	452
5.0	457	456	456	456	456	457	457	455	455
7.5	464	463	463	463	463	463	463	461	461
10.0	473	472	472	472	472	472	472	470	470
12.5	484	483	483	483	483	483	483	482	481
15.0	494	494	494	494	495	496	496	495	494
17.5	507	507	508	507	509	510	509	509	508
20.0	521	521	522	522	524	524	523	521	520
22.5	536	536	537	536	536	535	533	532	531
25.0	551	550	550	548	548	547	547	546	544
27.5	565	564	563	562	563	563	562	561	560
30.0	583	583	583	582	583	582	582	581	579
32.5	608	609	608	607	609	607	606	604	602
35.0	641	642	642	641	641	640	639	638	634
37.5	681	683	683	682	683	681	680	679	675
40.0	735	737	736	735	734	732	732	731	728
42.5	797	798	796	793	793	791	789	789	785
45.0	864	864	861	858	857	854	853	852	848
47.5	942	941	938	936	935	932	931	930	928
50.0	1026	1025	1023	1022	1022	1020	1018	1019	1016
52.5	1130	1128	1127	1125	1127	1126	1125	1126	1123
55.0	1234	1231	1231	1228	1230	1230	1231	1231	1227
57.5	1356	1354	1353	1350	1352	1351	1353	1355	1355
60.0	1485	1483	1482	1479	1482	1483	1486	1489	1489
62.5	1630	1627	1626	1625	1627	1630	1633	1633	1631
65.0	1773	1772	1773	1768	1772	1774	1775	1775	1772
67.5	1915	1910	1911	1913	1920	1923	1924	1922	1917
70.0	2065	2058	2058	2066	2078	2092	2099	2092	2060
72.5	2275	2265	2268	2276	2249	2182	2060	1889	1719
75.0	1676	1677	1687	1667	1585	1443	1171	820	444
77.5	279	268	249	213	166	125	96	79	74
80.0	60	57	56	54	52	50	47	44	42
82.5	34	33	32	32	32	31	30	28	27
85.0	18	18	17	17	16	15	14	13	13
87.5	9	8	8	6	6	6	5	5	5
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	45.0	47.5	50.0	52.5	55.0	57.5	60.0	62.5	65.0
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	67.5	70.0	72.5	75.0	77.5	80.0	82.5	85.0	87.5
0.0	451	451	451	451	451	451	451	451	451
2.5	451	451	451	452	453	453	452	453	453
5.0	455	455	455	456	456	456	456	456	457
7.5	461	461	460	461	462	463	463	462	463
10.0	470	469	469	469	470	471	471	471	472
12.5	481	481	480	480	481	481	482	482	482
15.0	494	494	493	492	493	493	492	492	492
17.5	508	508	506	506	506	505	505	503	503
20.0	520	519	518	518	517	517	516	514	514
22.5	531	531	530	530	530	529	528	526	526
25.0	544	544	544	545	544	544	543	541	540
27.5	559	559	559	560	560	560	559	558	556
30.0	578	578	578	579	580	580	579	577	574
32.5	601	601	602	604	605	606	605	603	599
35.0	633	633	633	635	637	637	637	635	632
37.5	673	673	672	674	675	675	675	674	671
40.0	725	725	725	727	728	729	729	727	724
42.5	782	783	782	782	784	785	784	782	779
45.0	846	847	845	847	848	849	850	848	844
47.5	926	928	928	929	931	933	934	932	928
50.0	1016	1019	1019	1022	1025	1027	1028	1027	1023
52.5	1123	1126	1127	1131	1135	1136	1139	1139	1133
55.0	1230	1234	1235	1239	1243	1245	1250	1251	1246
57.5	1359	1364	1365	1372	1377	1382	1387	1389	1385
60.0	1493	1499	1503	1508	1514	1519	1525	1529	1526
62.5	1634	1639	1641	1648	1656	1665	1672	1678	1679
65.0	1775	1778	1780	1784	1792	1803	1810	1818	1821
67.5	1916	1919	1923	1935	1949	1970	1986	2002	2008
70.0	2004	1939	1886	1840	1807	1800	1784	1772	1789
72.5	1527	1329	1165	1004	876	790	709	645	660
75.0	256	159	115	93	79	74	70	67	67
77.5	66	59	53	49	46	44	41	39	39
80.0	38	36	33	31	29	28	26	25	25
82.5	25	23	21	20	18	18	17	17	16
85.0	12	11	10	10	9	9	8	8	8
87.5	5	5	5	5	5	5	5	5	5
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles

	67.5	70.0	72.5	75.0	77.5	80.0	82.5	85.0	87.5
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	90.0	92.5	95.0	100.0	105.0	110.0	115.0	120.0	125.0
0.0	451	451	451	451	451	451	451	451	451
2.5	454	454	454	453	452	452	451	450	451
5.0	457	458	458	457	456	456	455	454	454
7.5	464	465	464	463	463	463	463	461	461
10.0	473	473	473	473	472	472	472	471	470
12.5	483	484	484	483	482	482	482	481	481
15.0	493	493	494	493	492	492	492	491	491
17.5	504	504	504	504	503	503	503	503	503
20.0	515	515	515	516	515	515	515	515	515
22.5	527	528	527	528	526	527	527	527	528
25.0	540	541	541	542	540	541	541	541	544
27.5	555	556	556	557	556	556	556	557	561
30.0	573	574	575	575	574	575	575	576	580
32.5	598	599	599	599	598	599	599	602	605
35.0	631	631	632	632	631	633	633	636	636
37.5	670	669	670	671	670	674	675	676	676
40.0	724	722	722	723	721	724	727	728	730
42.5	778	776	775	776	776	781	787	790	792
45.0	844	841	841	842	842	848	857	860	863
47.5	928	926	926	928	929	935	943	945	947
50.0	1023	1021	1022	1024	1024	1028	1037	1037	1040
52.5	1133	1132	1133	1137	1136	1140	1148	1147	1150
55.0	1247	1246	1247	1250	1247	1250	1256	1255	1258
57.5	1385	1387	1388	1392	1386	1384	1384	1382	1382
60.0	1528	1530	1532	1536	1529	1525	1523	1517	1492
62.5	1681	1683	1685	1685	1675	1667	1667	1656	1549
65.0	1823	1827	1827	1825	1814	1808	1809	1728	1607
67.5	2010	2015	2011	1999	1973	1950	1912	1809	1722
70.0	1777	1780	1785	1807	1850	1908	1946	1923	1873
72.5	629	635	661	758	961	1170	1479	1739	1965
75.0	65	65	66	70	80	103	241	830	1273
77.5	38	38	39	41	43	46	55	69	116
80.0	24	24	24	25	27	29	32	38	43
82.5	16	16	16	17	17	19	21	24	26
85.0	8	8	8	8	8	9	10	11	12
87.5	5	5	5	5	5	5	5	5	5
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles

	90.0	92.5	95.0	100.0	105.0	110.0	115.0	120.0	125.0
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

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Lateral Angles

Vertical Angles	130.0	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0
0.0	451	451	451	451	451	451	451	451	451
2.5	450	449	450	448	448	448	448	448	449
5.0	454	452	453	452	451	451	451	451	453
7.5	461	460	459	458	457	458	457	457	459
10.0	470	469	469	468	467	466	465	465	467
12.5	481	480	481	480	480	479	476	476	476
15.0	491	492	493	493	493	493	490	487	487
17.5	503	504	507	506	505	505	503	500	499
20.0	516	518	520	518	516	516	514	512	510
22.5	529	531	532	530	526	526	525	524	522
25.0	544	545	544	542	539	539	538	537	536
27.5	560	558	557	556	554	554	553	551	551
30.0	578	576	577	576	573	574	572	569	572
32.5	602	601	601	601	597	596	595	594	597
35.0	635	635	635	634	630	629	628	627	630
37.5	676	677	676	675	673	672	672	669	673
40.0	731	733	729	730	729	729	727	725	727
42.5	796	797	791	793	791	791	788	783	786
45.0	869	870	861	863	863	862	856	845	839
47.5	954	955	946	949	947	927	906	888	879
50.0	1046	1046	1038	1032	1002	971	950	933	927
52.5	1154	1154	1120	1097	1050	1026	1012	1010	1014
55.0	1259	1231	1165	1127	1119	1122	1121	1119	1126
57.5	1353	1280	1221	1210	1226	1235	1236	1237	1243
60.0	1406	1340	1324	1329	1349	1360	1359	1362	1368
62.5	1481	1464	1457	1466	1485	1489	1487	1490	1500
65.0	1604	1600	1591	1598	1616	1615	1611	1619	1636
67.5	1732	1729	1718	1726	1751	1757	1756	1763	1775
70.0	1876	1868	1860	1887	1922	1838	1663	1508	1366
72.5	2037	2024	2012	1978	1778	1342	856	439	244
75.0	1426	1466	1411	1230	808	221	79	67	61
77.5	198	257	224	126	69	59	50	45	39
80.0	47	48	50	50	46	39	33	28	23
82.5	25	24	26	27	26	24	20	16	15
85.0	13	12	11	11	10	8	6	6	6
87.5	5	5	5	5	5	5	5	5	5
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

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Lateral Angles

Vertical Angles

	130.0	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles

	175.0	180.0
0.0	451	451
2.5	450	454
5.0	454	458
7.5	460	465
10.0	468	473
12.5	477	482
15.0	488	491
17.5	498	501
20.0	509	512
22.5	520	523
25.0	534	536
27.5	550	551
30.0	569	569
32.5	596	595
35.0	630	629
37.5	672	671
40.0	728	726
42.5	786	785
45.0	834	830
47.5	875	872
50.0	927	925
52.5	1020	1019
55.0	1133	1131
57.5	1254	1251
60.0	1377	1375
62.5	1512	1509
65.0	1656	1656
67.5	1785	1775
70.0	1283	1227
72.5	167	138
75.0	58	56
77.5	36	34
80.0	21	20
82.5	14	14
85.0	6	6
87.5	5	5
90.0	0	0
92.5	0	0
95.0	0	0
97.5	0	0
100.0	0	0
102.5	0	0
105.0	0	0
107.5	0	0
110.0	0	0
112.5	0	0
115.0	0	0
117.5	0	0
120.0	0	0
122.5	0	0
125.0	0	0
127.5	0	0
130.0	0	0
132.5	0	0

Lateral Angles

Vertical Angles

	175.0	180.0
135.0	0	0
137.5	0	0
140.0	0	0
142.5	0	0
145.0	0	0
147.5	0	0
150.0	0	0
152.5	0	0
155.0	0	0
157.5	0	0
160.0	0	0
162.5	0	0
165.0	0	0
167.5	0	0
170.0	0	0
172.5	0	0
175.0	0	0
177.5	0	0
180.0	0	0

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ISO/IEC 17025

NVLAP LAB CODE: 200899-0

Sphere Test Report

Standard(s) CIE 84-1989, IESNA LM-16-93, IESNA LM-58-94, IES LM-79-08, ANSI C82.77-2002

Customer Philips Lumec, 640 Curé Boivin, Boisbriand, Québec, Canada, J7G 2A7

General Information		Lamp Details: CY1933		Driver Details: CY683	
Test Report	L1502173-C1	**Description**	1 Cluster of 16 Luxeon T LED's	**Type**	Commercial
Test Date	17 February 2015	**Manufacturer**	Philips	**Description**	54W
Report Date	17 February 2015	**Catalog No.**	RFS-54W16LED4K-T-5	**Manufacturer**	Advance
Sphere Temperature	25.9 °C	**Serial No.**	SRIS 1785	**Catalog No.**	XI055C105V052CNY1M
Humidity	6.8 %	**Diameter**	N/A mm	**Voltage**	120.00 V
Lamp Type	SSL	**Color**	White	**Power Factor**	0.9900

Stabilization Time: 45 minutes

Tested By: Jean-Paul Ojeil

Approved Signatory: Chrisnel Blot

Signature:

Notes

1) Field performance may differ from laboratory measurements. Results are valid for tested material only.

2) The original electronic file or paper report cannot be edited in whole or in part without written consent of Spectra Lux Industries Inc.

3) This test report describes the performance of a single product and does not necessarily represent the average performance of a group of the same SSL product.

Realization of Sphere Test

A 4π sphere-spectroradiometer equipped with auxiliary lamp to correct self-absorption was used during the measurements of electrical, photometric and colorimetric properties of the sample under test. The size of the integrating sphere used is large enough to ensure that the measurement errors due to effects of baffle and self-absorption by the sample test are not significant.

During the test, a commercial driver was used and adjusted to nominal electrical characteristics specified by the driver manufacturer or the client. Good electrical contacts have been used to ensure the control of electrical parameters of the commercial driver and an adequate stabilization period prior to collecting data. The self-absorbance was measured and a geometrical correction factor was applied to the luminous flux value to take into account the sphere configuration.

Results of the measurements are traceable to reference standards developed and maintained by the National Institute of Standards and Technology (NIST) and National Research Council of Canada (NRC).

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NVLAP
NVLAP LAB CODE: 200899-0

Electrical Equipment

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Auxiliary Power Supply	Sorenson	DSC-60-18E	051B1142	N.P.C.R.	N.P.C.R.
Test Power Supply	California Instruments	801RP	05816	N.P.C.R.	N.P.C.R.
Input Power Meter	Yokogawa	WT210	91L236540	2014/10/22	2015/10/22
Output Power Meter	N/A	N/A	N/A	N.P.C.R.	N.P.C.R.
Shunt Resistor	Fluke	Y5020	5675014	2014/08/06	2015/08/06
Current Multimeter	HP Agilent	HP34401A	US36121202	2014/08/06	2015/08/06
Voltage Multimeter	Fluke	Fluke8842A	5750288	2014/04/16	2015/04/16

Spectrometer Equipment

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Spectrometer	Ocean Optics	USB2000N	USB2E3864	2014/08/24	2015/08/24

Environment Equipment

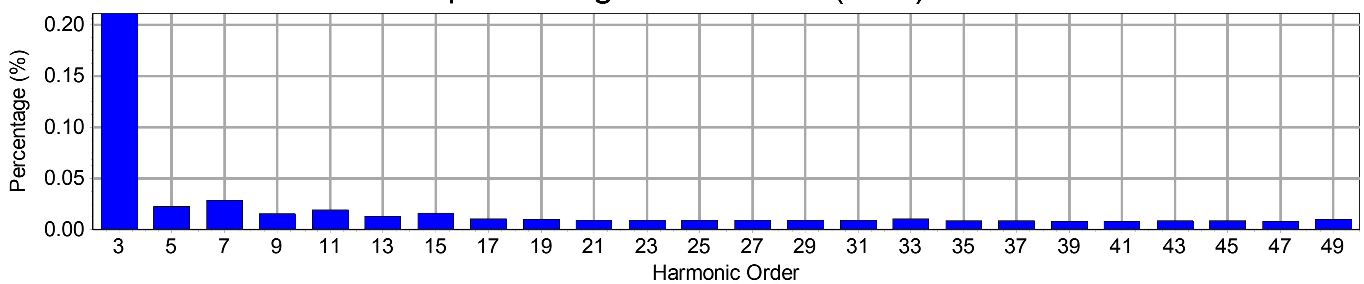
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Temperature Humidity Sensor	Omega	HH311	120504176	2014/04/16	2016/04/16

Electrical Measurements

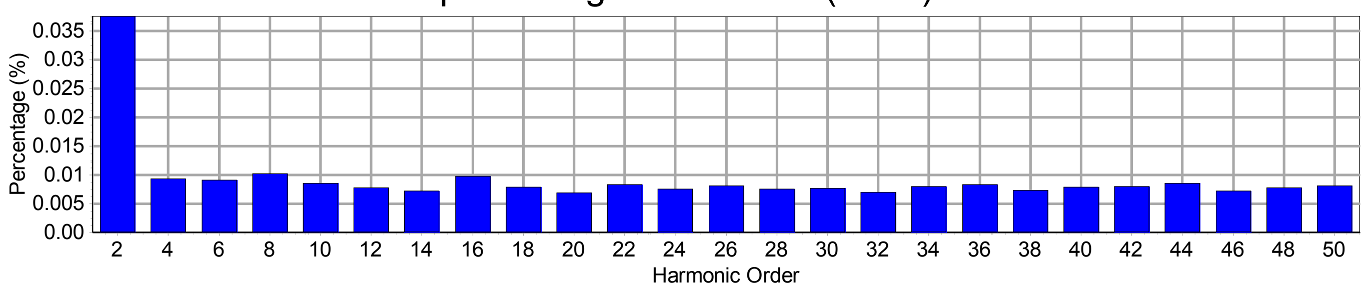
Input

Frequency	60 Hz	Active Power	53.34 W	THDV [ANSI]	0.23 %
Voltage	120.2 V(rms)	Apparent Power	53.57 VA	THDA [ANSI]	5.30 %
Current	0.4457 A(rms)	Power Factor	0.996	Max. Harmonic At	7th order

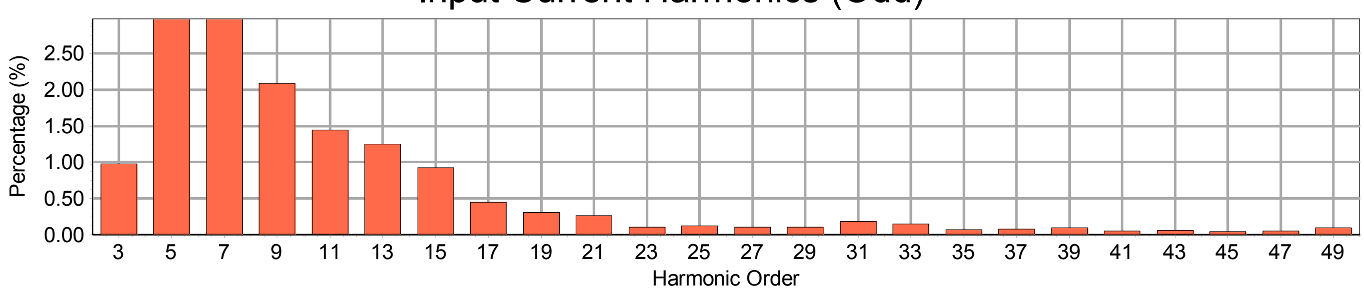
Input Voltage Harmonics (Odd)



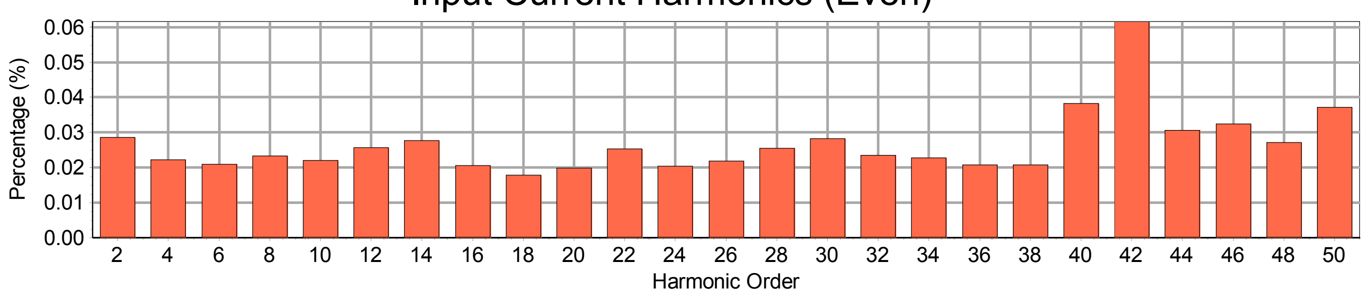
Input Voltage Harmonics (Even)



Input Current Harmonics (Odd)



Input Current Harmonics (Even)



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Harmonic Measurements

Odd Harmonics				Even Harmonics			
Harmonic Order	Frequency (HZ)	Voltage Harmonics (%)	Current Harmonics (%)	Harmonic Order	Frequency (HZ)	Voltage Harmonics (%)	Current Harmonics (%)
1	60	100.000	100.000	2	120	0.038	0.029
3	180	0.212	0.977	4	240	0.009	0.022
5	300	0.022	2.979	6	360	0.009	0.021
7	420	0.029	2.983	8	480	0.010	0.023
9	540	0.015	2.085	10	600	0.009	0.022
11	660	0.019	1.443	12	720	0.008	0.026
13	780	0.013	1.246	14	840	0.007	0.028
15	900	0.016	0.919	16	960	0.010	0.021
17	1020	0.010	0.449	18	1080	0.008	0.018
19	1140	0.010	0.303	20	1200	0.007	0.020
21	1260	0.009	0.263	22	1320	0.008	0.025
23	1380	0.009	0.097	24	1440	0.007	0.020
25	1500	0.009	0.122	26	1560	0.008	0.022
27	1620	0.009	0.101	28	1680	0.008	0.025
29	1740	0.009	0.100	30	1800	0.008	0.028
31	1860	0.009	0.180	32	1920	0.007	0.023
33	1980	0.010	0.150	34	2040	0.008	0.023
35	2100	0.008	0.070	36	2160	0.008	0.021
37	2220	0.008	0.076	38	2280	0.007	0.021
39	2340	0.008	0.092	40	2400	0.008	0.038
41	2460	0.008	0.053	42	2520	0.008	0.062
43	2580	0.008	0.056	44	2640	0.009	0.031
45	2700	0.009	0.043	46	2760	0.007	0.032
47	2820	0.008	0.051	48	2880	0.008	0.027
49	2940	0.010	0.092	50	3000	0.008	0.037

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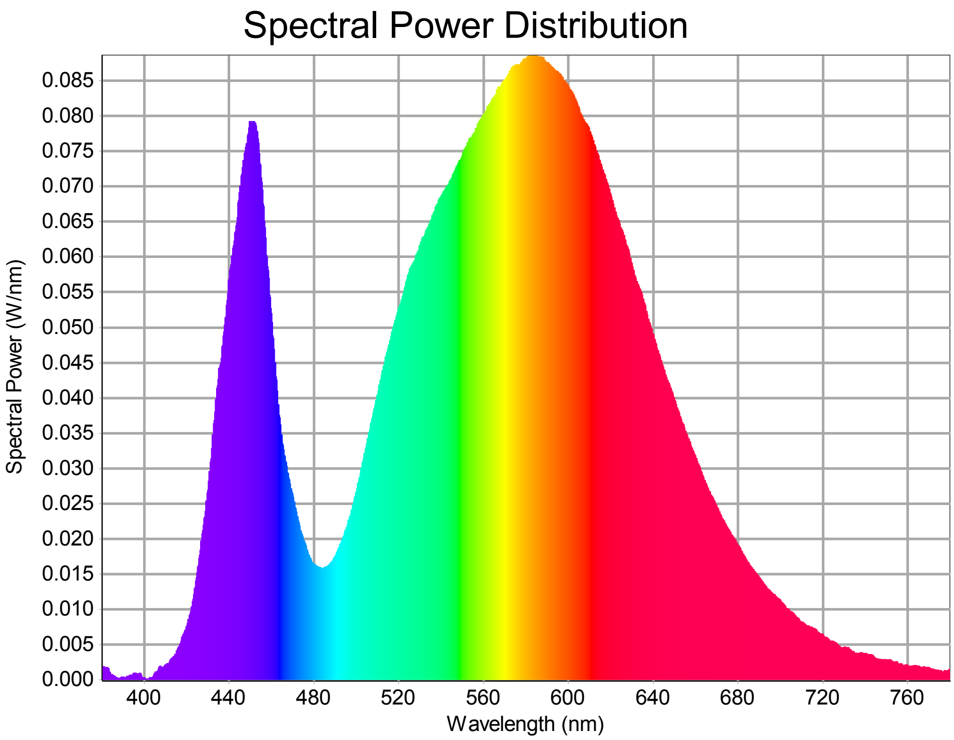
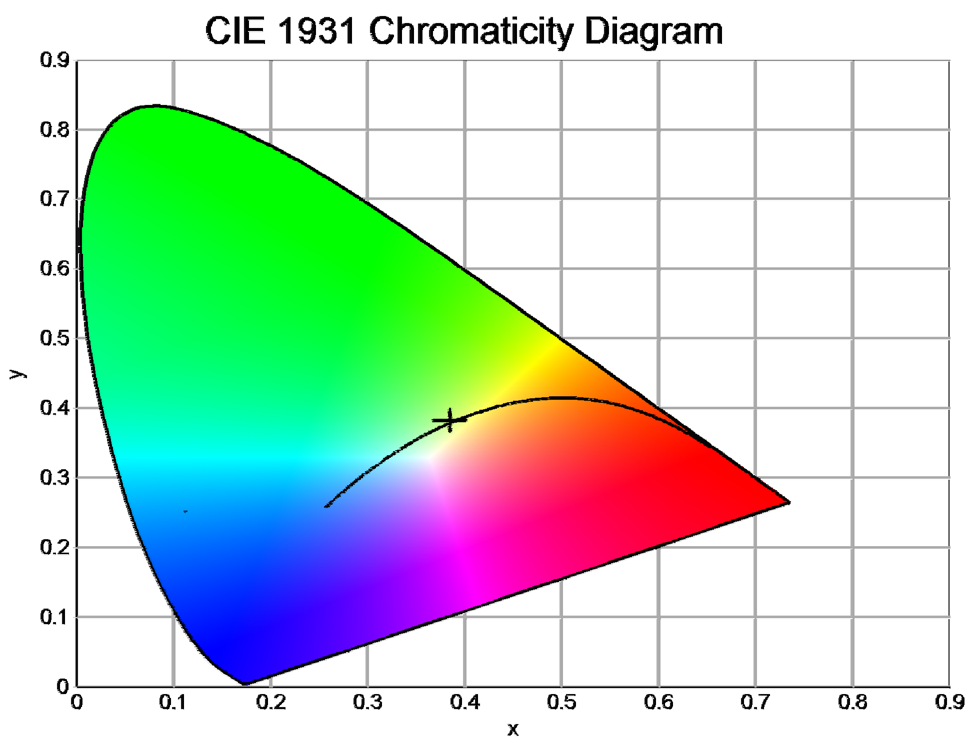


Peak Wavelength	584 nm
Luminous Flux	4978 lm
Input Power	53.34 W
Lumens/Watt	93.3
Full Width/Half Maximum	131.75
Center Wavelength	579 nm
Centroid Wavelength	367 nm
Dominant Wavelength	488 nm
Excitation Purity	0.1606
Colorimeric Purity	0.1067



x	0.3845	CCT	3937 K
y	0.3829	CRI	74
u	0.2253	L*	25.67
v	0.3366	a*	-5.29
u'	0.2253	b*	-14.03
v'	0.5048	Duv	0.0017

R1	70.9	R9	-21.0
R2	80.5	R10	53.4
R3	87.9	R11	67.9
R4	72.7	R12	46.8
R5	70.5	R13	72.4
R6	72.2	R14	93.0
R7	82.5		
R8	55.0		

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Spectral Power Distribution Table (1/4)

Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)
380	0.00199	405	0.00098	430	0.02663	455	0.07127
381	0.00193	406	0.00119	431	0.02961	456	0.06760
382	0.00181	407	0.00176	432	0.03287	457	0.06275
383	0.00170	408	0.00183	433	0.03647	458	0.05865
384	0.00090	409	0.00178	434	0.03981	459	0.05472
385	0.00074	410	0.00225	435	0.04269	460	0.05080
386	0.00059	411	0.00236	436	0.04472	461	0.04697
387	0.00044	412	0.00264	437	0.04735	462	0.04306
388	0.00024	413	0.00310	438	0.05041	463	0.03913
389	0.00036	414	0.00337	439	0.05326	464	0.03624
390	0.00046	415	0.00380	440	0.05666	465	0.03365
391	0.00025	416	0.00460	441	0.05894	466	0.03187
392	0.00056	417	0.00516	442	0.06131	467	0.03036
393	0.00071	418	0.00615	443	0.06344	468	0.02870
394	0.00069	419	0.00681	444	0.06564	469	0.02720
395	0.00096	420	0.00758	445	0.06924	470	0.02597
396	0.00092	421	0.00862	446	0.07156	471	0.02457
397	0.00075	422	0.00977	447	0.07374	472	0.02325
398	0.00101	423	0.01120	448	0.07566	473	0.02193
399	0.00043	424	0.01304	449	0.07726	474	0.02087
400	0.00040	425	0.01533	450	0.07927	475	0.01986
401	0.00024	426	0.01729	451	0.07898	476	0.01909
402	0.00006	427	0.01974	452	0.07909	477	0.01813
403	0.00042	428	0.02203	453	0.07787	478	0.01741
404	0.00042	429	0.02402	454	0.07476	479	0.01675

Spectral Power Distribution Table (2/4)

Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)
480	0.01647	505	0.03366	530	0.06166	555	0.07733
481	0.01624	506	0.03498	531	0.06256	556	0.07777
482	0.01609	507	0.03641	532	0.06298	557	0.07839
483	0.01598	508	0.03788	533	0.06379	558	0.07923
484	0.01581	509	0.03910	534	0.06431	559	0.07965
485	0.01598	510	0.04041	535	0.06508	560	0.08014
486	0.01615	511	0.04184	536	0.06589	561	0.08064
487	0.01629	512	0.04324	537	0.06660	562	0.08133
488	0.01665	513	0.04455	538	0.06744	563	0.08174
489	0.01704	514	0.04586	539	0.06813	564	0.08229
490	0.01756	515	0.04703	540	0.06861	565	0.08266
491	0.01819	516	0.04813	541	0.06919	566	0.08322
492	0.01896	517	0.04945	542	0.06965	567	0.08410
493	0.01958	518	0.05057	543	0.07006	568	0.08414
494	0.02037	519	0.05162	544	0.07070	569	0.08482
495	0.02124	520	0.05275	545	0.07120	570	0.08518
496	0.02212	521	0.05352	546	0.07191	571	0.08552
497	0.02317	522	0.05454	547	0.07266	572	0.08606
498	0.02418	523	0.05569	548	0.07321	573	0.08655
499	0.02542	524	0.05697	549	0.07372	574	0.08712
500	0.02663	525	0.05785	550	0.07436	575	0.08728
501	0.02803	526	0.05875	551	0.07532	576	0.08737
502	0.02933	527	0.05924	552	0.07569	577	0.08723
503	0.03080	528	0.06000	553	0.07644	578	0.08765
504	0.03218	529	0.06073	554	0.07697	579	0.08814

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ISO/IEC 17025

NVLAP LAB CODE: 200899-0

Spectral Power Distribution Table (3/4)

Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)
580	0.08802	605	0.08095	630	0.05863	655	0.03532
581	0.08841	606	0.08020	631	0.05750	656	0.03457
582	0.08861	607	0.07955	632	0.05660	657	0.03392
583	0.08848	608	0.07902	633	0.05582	658	0.03303
584	0.08861	609	0.07862	634	0.05517	659	0.03230
585	0.08861	610	0.07782	635	0.05413	660	0.03154
586	0.08839	611	0.07701	636	0.05311	661	0.03075
587	0.08842	612	0.07601	637	0.05187	662	0.03003
588	0.08830	613	0.07512	638	0.05081	663	0.02919
589	0.08783	614	0.07437	639	0.04990	664	0.02839
590	0.08763	615	0.07331	640	0.04892	665	0.02765
591	0.08737	616	0.07241	641	0.04785	666	0.02694
592	0.08696	617	0.07166	642	0.04677	667	0.02631
593	0.08670	618	0.07061	643	0.04590	668	0.02585
594	0.08641	619	0.06977	644	0.04489	669	0.02522
595	0.08621	620	0.06859	645	0.04401	670	0.02454
596	0.08597	621	0.06752	646	0.04293	671	0.02389
597	0.08554	622	0.06648	647	0.04226	672	0.02315
598	0.08499	623	0.06560	648	0.04150	673	0.02270
599	0.08465	624	0.06473	649	0.04062	674	0.02216
600	0.08417	625	0.06391	650	0.03974	675	0.02156
601	0.08370	626	0.06314	651	0.03871	676	0.02113
602	0.08319	627	0.06188	652	0.03791	677	0.02055
603	0.08250	628	0.06119	653	0.03700	678	0.02012
604	0.08172	629	0.05995	654	0.03635	679	0.01959

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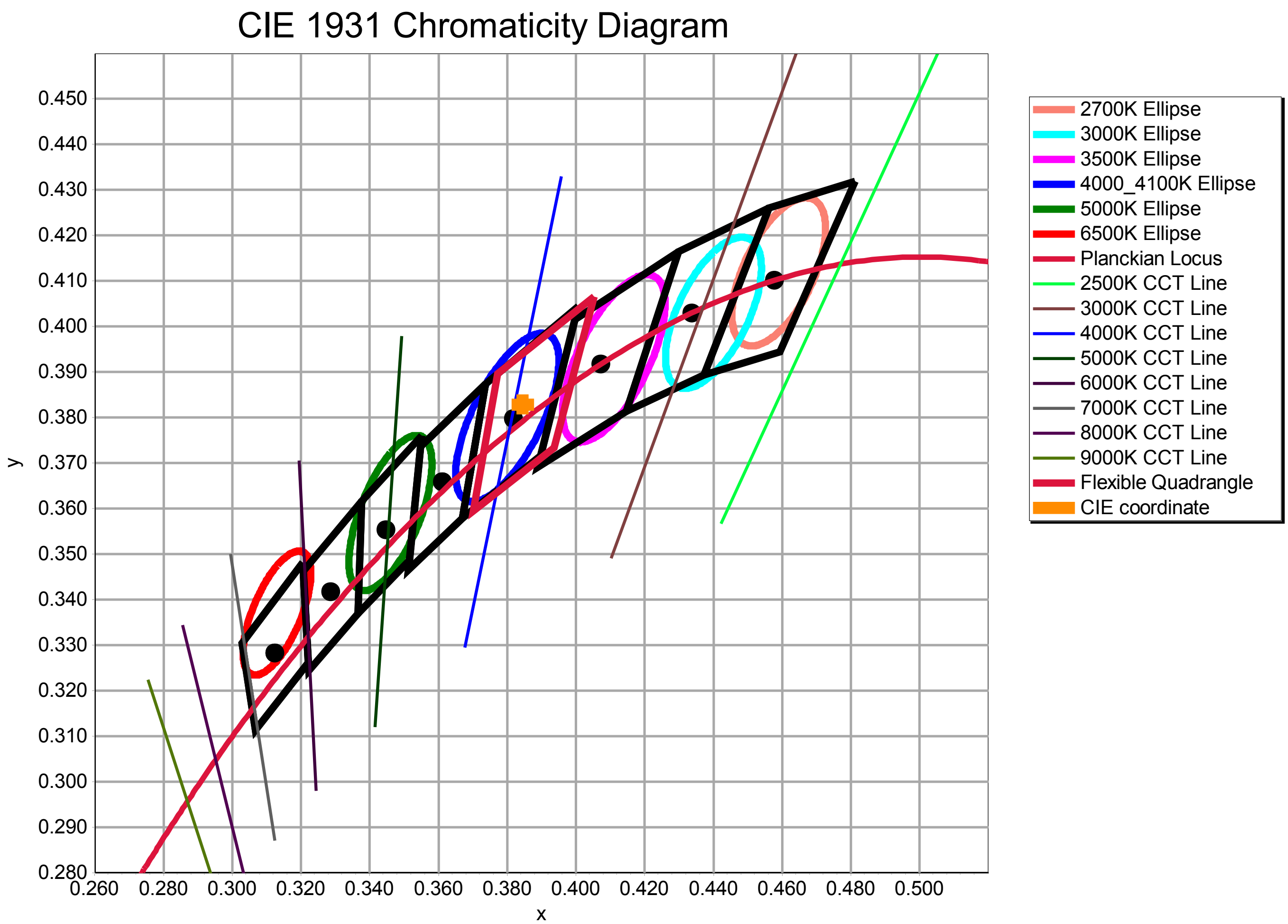
Spectral Power Distribution Table (4/4)

Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)
680	0.01913	706	0.00953	732	0.00459	758	0.00204
681	0.01859	707	0.00911	733	0.00431	759	0.00221
682	0.01796	708	0.00887	734	0.00417	760	0.00203
683	0.01754	709	0.00845	735	0.00386	761	0.00202
684	0.01697	710	0.00828	736	0.00387	762	0.00208
685	0.01657	711	0.00804	737	0.00384	763	0.00210
686	0.01606	712	0.00779	738	0.00392	764	0.00202
687	0.01575	713	0.00772	739	0.00384	765	0.00201
688	0.01530	714	0.00758	740	0.00380	766	0.00189
689	0.01497	715	0.00737	741	0.00361	767	0.00173
690	0.01457	716	0.00730	742	0.00369	768	0.00178
691	0.01414	717	0.00704	743	0.00359	769	0.00185
692	0.01369	718	0.00672	744	0.00333	770	0.00182
693	0.01336	719	0.00655	745	0.00314	771	0.00165
694	0.01295	720	0.00641	746	0.00299	772	0.00158
695	0.01263	721	0.00612	747	0.00295	773	0.00147
696	0.01234	722	0.00599	748	0.00298	774	0.00148
697	0.01219	723	0.00553	749	0.00290	775	0.00134
698	0.01179	724	0.00559	750	0.00286	776	0.00125
699	0.01160	725	0.00546	751	0.00286	777	0.00123
700	0.01121	726	0.00529	752	0.00279	778	0.00132
701	0.01093	727	0.00491	753	0.00258	779	0.00136
702	0.01054	728	0.00475	754	0.00254	780	0.00165
703	0.01017	729	0.00465	755	0.00248		
704	0.00993	730	0.00470	756	0.00224		
705	0.00972	731	0.00461	757	0.00229		

CIE Chromaticity Diagram for Indoor SSL products



Chromaticity tolerance of Flexible CCT at nominal CCT of 3900K

				x	y
		Center Point		0.3856	0.3818
Min CCT	3626		A	0.4052	0.4066
Max CCT	4174	Tolerance	B	0.3773	0.3896
Delta T	274	Quadrangle	C	0.3701	0.3595
Center Duv	0.0009		D	0.3937	0.3734

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NVLAP LAB CODE: 200899-0

Moving Mirror Goniophotometer Test Report

Standard(s): IESNA LM-31-95, IES LM-79-08, IESNA TM-15-11, ANSI C82.77-2002

Customer: Philips Lumec, 640 Curé Boivin, Boisbriand, Québec, Canada, J7G 2A7

General Information		SSL Details		Driver Details	
Test Report	S1502162-R1	**Description**	108W White 3902K SSL	**Type**	Commercial
Test Date	16 February 2015	**Serial Number**	SRIS 1786	**Description**	108W
Report Date	17 February 2015	**Photometric Method**	Absolute	**Manufacturer**	Advance
Ambient	24.7 °C	**Lamp Lumens**	-1	**Catalog No.**	LEDINTAO700C21ODO
Humidity	5.3 %	**Test Position**	Vertical Base Up	**Voltage**	120.00 V
Lamp Type	SSL	**Comments**	3 Clusters of 16 Luxeon T LED's	**Power Factor**	0.9900

Luminaire Data

General Information		Optics		Aperture (feet)	
Manufacturer	Philips Lumec	**Reflector**	None	**X**	0.6667
Name	Roadfocus	**Housing**	Die Cast Aluminum	**Y**	0.6250
Catalog No.	RFM-108W48LED4K-T-5	**Lens**	3X16 Clear Acrylic LED Collimators	**Z**	0.0000

SKT Position: Fixed
Lamp Stabilization Time: 59 minutes, 11 seconds

Tested By: Jean-Paul Ojeil **Approved Signatory: Chrisnel Blot**

Signature:

Luminaire Test Method

Precise installation and alignment of the luminaire to the rotation axis of the photometer is governed by a servomotor controlled via a microcontroller. A laser is used to validate the luminaire positioning. Before photometric measurements are taken, luminaire is operated long enough to reach stabilization and temperature equilibrium.

All movement commands issued to the photometer axes are mediated by the software to ensure the motion is within the limits of operation. The photometric detector used is a silicon detector corrected to closely match the spectral luminous efficiency photopic curve with a quality index less than 1.5%. Proper shielding is incorporated to the photometric test bench such that only the light from the unit under test is measured.

Luminous intensity measurements are performed at a distance great enough so that the inverse-square law applies. During each measurement the computer records the luminous intensity associated to the corresponding angles of radiation, as well as input electrical operational parameters and temperature measurements. Candela values are reported in IES format as per LM-63.

Equipment, reference standards are traceable to National Institute of Standards and Technology (NIST) and National Research Council of Canada (NRC).

Electrical Equipment

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Power Supply	Elgar	CW801	30527	N.P.C.R.	N.P.C.R.
Input Power Meter	Yokogawa	WT210	91L236541	2014/03/25	2015/04/16
Output Power Meter	N/A	N/A	N/A	N.P.C.R.	N.P.C.R.

Photometric Equipment

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Photometer	Gigahertz-Optik	X11	4502	2014/05/06	2015/09/17
Photodetector	INPHORA	IPR-PDET 19	110802	2014/05/16	2015/05/16

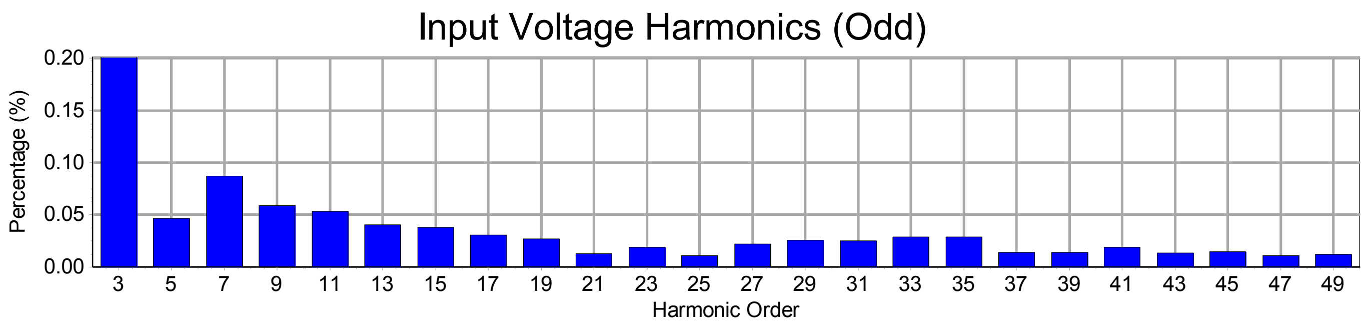
Environment Equipment

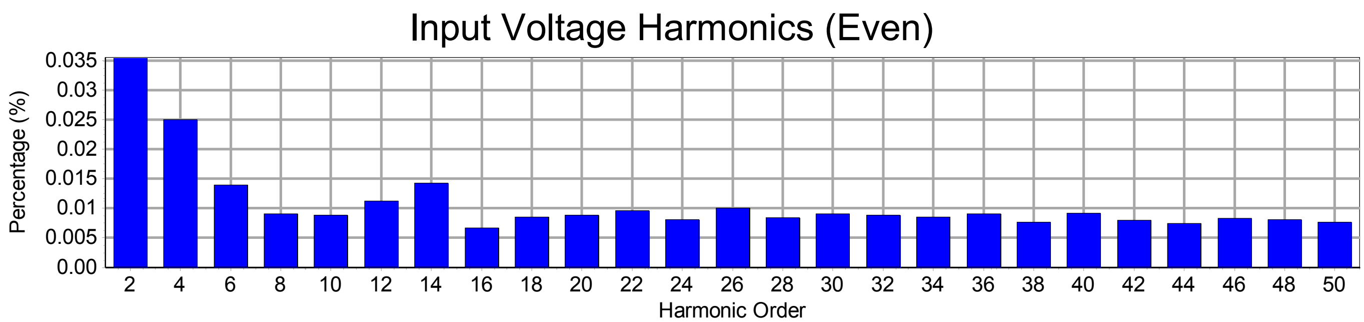
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Temperature Humidity Sensor	Omega	HH311	120504178	2014/04/16	2016/04/16

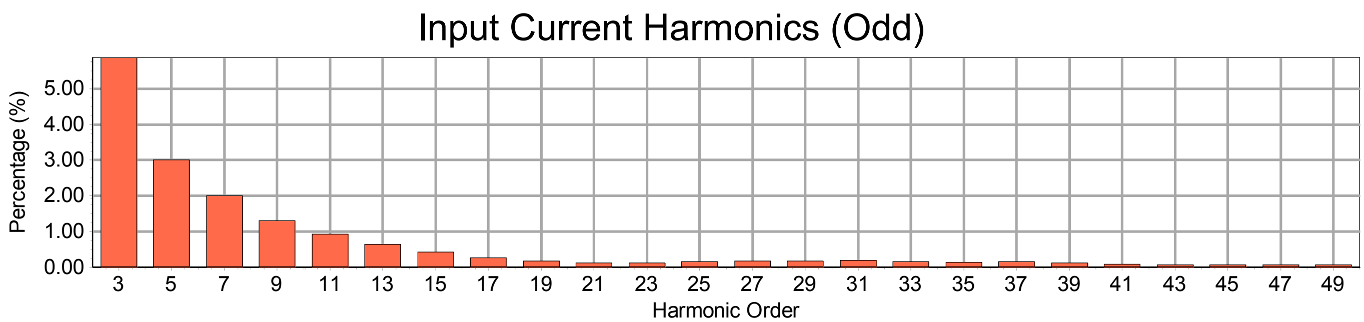
Electrical Measurements

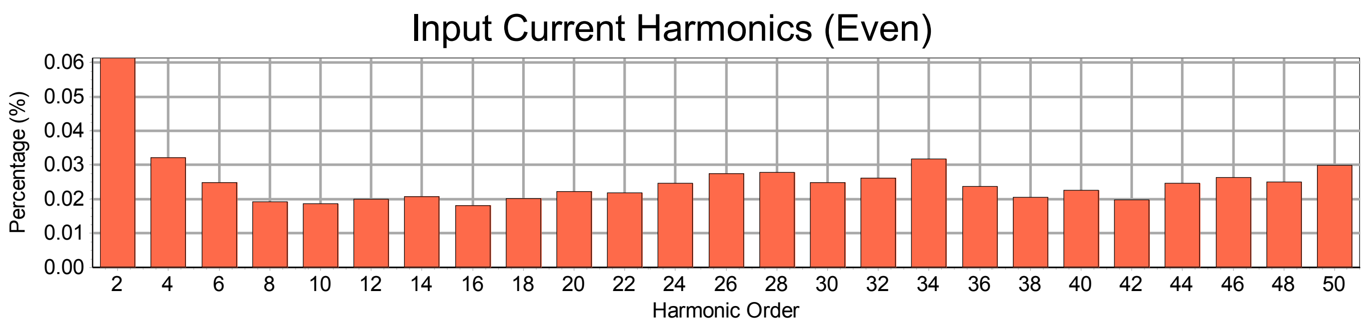
Input

Frequency	60 Hz	Active Power	104.74 W	THDV [ANSI]	0.26 %
Voltage	120.1 V(rms)	Apparent Power	105.09 VA	THDA [ANSI]	7.15 %
Current	0.8748 A(rms)	Power Factor	0.997	Max. Harmonic At	3rd order









Harmonic Measurements

Odd Harmonics				Even Harmonics			
Harmonic Order	Frequency (HZ)	Voltage Harmonics (%)	Current Harmonics (%)	Harmonic Order	Frequency (HZ)	Voltage Harmonics (%)	Current Harmonics (%)
1	60	100.000	100.000	2	120	0.036	0.061
3	180	0.202	5.884	4	240	0.025	0.032
5	300	0.046	3.005	6	360	0.014	0.025
7	420	0.087	2.006	8	480	0.009	0.019
9	540	0.059	1.306	10	600	0.009	0.019
11	660	0.053	0.924	12	720	0.011	0.020
13	780	0.040	0.635	14	840	0.014	0.021
15	900	0.038	0.423	16	960	0.007	0.018
17	1020	0.030	0.263	18	1080	0.009	0.020
19	1140	0.027	0.164	20	1200	0.009	0.022
21	1260	0.013	0.115	22	1320	0.010	0.022
23	1380	0.019	0.120	24	1440	0.008	0.025
25	1500	0.011	0.152	26	1560	0.010	0.027
27	1620	0.022	0.163	28	1680	0.008	0.028
29	1740	0.026	0.167	30	1800	0.009	0.025
31	1860	0.025	0.180	32	1920	0.009	0.026
33	1980	0.029	0.148	34	2040	0.009	0.032
35	2100	0.028	0.127	36	2160	0.009	0.024
37	2220	0.014	0.147	38	2280	0.008	0.020
39	2340	0.014	0.114	40	2400	0.009	0.023
41	2460	0.019	0.086	42	2520	0.008	0.020
43	2580	0.013	0.071	44	2640	0.007	0.025
45	2700	0.014	0.056	46	2760	0.008	0.026
47	2820	0.011	0.058	48	2880	0.008	0.025
49	2940	0.012	0.068	50	3000	0.008	0.030

Photometric Report: S1502162-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFM-108W48LED4K-T-5

Photometric Luminaire Characteristics as per IESNA RP-8-00

Nominal SSL Power	108.00 W
Luminaire Luminous Flux	11224
Measured Input Power	104.74 W
Luminaire Luminous Efficacy	107.2 lm/W
Maximum Candela Value	4978
Maximum Candela Location	40.0 °H, 72.5 °V
Maximum Candela at 90° Vertical	0
Maximum Candela at 80° Vertical	144
IES Classification	Type IV, Short, Full Cutoff
Downward Street Side Lumens	5710
Downward Street Side Efficiency	N/A
Downward House Side Lumens	5514
Downward House Side Efficiency	N/A
Downward Total Efficiency	N/A
Upward Street Side Lumens	0
Upward Street Side Efficiency	N/A
Upward House Side Lumens	0
Upward House Side Efficiency	N/A
Upward Total Efficiency	N/A
Total Luminaire Lumens	11224
Total Luminaire Efficiency	N/A

Notes

1) Luminaire tested in accordance to IES LM-31-95 and IES LM-79-08 at a distance great enough so that the inverse-square law applies.

2) Field performance may differ from laboratory measurements.

3) Results are valid for the tested material only.

4) All data published in this report are based on absolute photometry.

5) The luminaire classification is based on IESNA RP-8-00.

6) The original electronic file or paper report cannot be edited in whole or in part without written consent of Spectralux Industries Inc.

7) This photometric file describes the performance of a single luminaire and does not necessarily represent the average performance of a group of the same SSL luminaires.

8) The previous IESNA cutoff classifications (Full Cutoff, Cutoff, Semi-Cutoff and Non-Cutoff) are superseded by the Luminaire Classification System (LCS) which defines the standard solid angles for evaluation and comparison of outdoor luminaires.

Photometric Report: S1502162-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFM-108W48LED4K-T-5

Luminaire Classification System as per IESNA TM-15-11

Nominal SSL Power	108.00 W
Luminaire Luminous Flux	11224
Measured Input Power	104.74 W
Luminaire Luminous Efficacy	107.2 lm/W
Maximum Candela Value	4978
Maximum Candela Location	40.0 °H, 72.5 °V
IES Classification	Type IV, Short
Downward Street Side Lumens	5710
Downward Street Side Efficiency	N/A
Downward House Side Lumens	5514
Downward House Side Efficiency	N/A
Downward Total Lumens	11224
Downward Total Efficiency	N/A
Upward Street Side Lumens	0
Upward Street Side Efficiency	N/A
Upward House Side Lumens	0
Upward House Side Efficiency	N/A
Upward Total Lumens	0
Upward Total Efficiency	N/A
Trapped Light Lumens	0
Total Luminaire Lumens	11224
Total Luminaire Efficiency	N/A

Notes

1) Luminaire tested in accordance to IES LM-31-95 and IES LM-79-08 at a distance great enough so that the inverse-square law applies.

2) Field performance may differ from laboratory measurements.

3) Results are valid for the tested material only.

4) All data published in this report are based on absolute photometry.

5) The luminaire classification is based on IESNA TM-15-11.

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7) This photometric file describes the performance of a single luminaire and does not necessarily represent the average performance of a group of the same SSL luminaires.

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Photometric Report: S1502162-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFM-108W48LED4K-T-5

Luminaire Lumens Distribution based on 11224 total luminaire lumens as per IESNA TM-15-11

Downward Forward Light	Lumens
Total	5710
Lumens Distribution	
Forward Light Low (0° - 30°)	473
Forward Light Mid (30° - 60°)	2352
Forward Light High (60° - 80°)	2862
Forward Light Very High (80° - 90°)	23

Downward Back Light	Lumens
Total	5514
Lumens Distribution	
Back Light Low (0° - 30°)	477
Back Light Mid (30° - 60°)	2339
Back Light High (60° - 80°)	2682
Back Light Very High (80° - 90°)	16

Uplight	Lumens
Total	0
Lumens Distribution	
Uplight Low (90° - 100°)	0
Uplight High (100° - 180°)	0

Trapped Light	Lumens
Total	0

Notes

1) Luminaire tested in accordance to IES LM-31-95 and IES LM-79-08 at a distance great enough so that the inverse-square law applies.

2) Field performance may differ from laboratory measurements.

3) Results are valid for the tested material only.

4) All data published in this report are based on absolute photometry.

5) The luminaire classification is based on IESNA TM-15-11.

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7) This photometric file describes the performance of a single luminaire and does not necessarily represent the average performance of a group of the same SSL luminaires.

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Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFM-108W48LED4K-T-5

IESNA TM-15-11 : Backlight, Uplight and Glare (BUG) Ratings

Table A-1 : Backlight Ratings (maximal zonal lumens)

Control of Backlight / Trespass

Backlight Rating

Zone	B0	B1	B2	B3	B4	B5
BH	110	500	1000	2500	5000	>5000
BM	220	1000	2500	5000	8500	>8500
BL	110	500	1000	2500	5000	>5000

Backlight Ratings

Zone	Lumens	Rating
BH	2682	B4
BM	2339	B2
BL	477	B1

The Backlight Rating is B4.

Table A-2 : Uplight Ratings (maximal zonal lumens)

Control of Uplight / Skyglow

Uplight Rating

Zone	U0	U1	U2	U3	U4	U5
UH	0	10	50	500	1000	>1000
UL	0	10	50	500	1000	>1000

Uplight Ratings

Zone	Lumens	Rating
UH	0	U0
UL	0	U0

The Uplight Rating is U0.

Table A-3 : Glare Ratings (maximum zonal lumens)

Control of Glare / Offensive Light

Glare Rating for Asymmetrical Luminaire Types (Type I, Type II, Type III, Type IV)

Zone	G0	G1	G2	G3	G4	G5
FVH	10	100	225	500	750	>750
BVH	10	100	225	500	750	>750
FH	660	1800	5000	7500	12000	>12000
BH	110	500	1000	2500	5000	>5000

Glare Ratings for Type IV

Zone	Lumens	Rating
FVH	23	G1
BVH	16	G1
FH	2862	G2
BH	2682	G4

The Glare Rating is G4.

The BUG Rating is B4 U0 G4

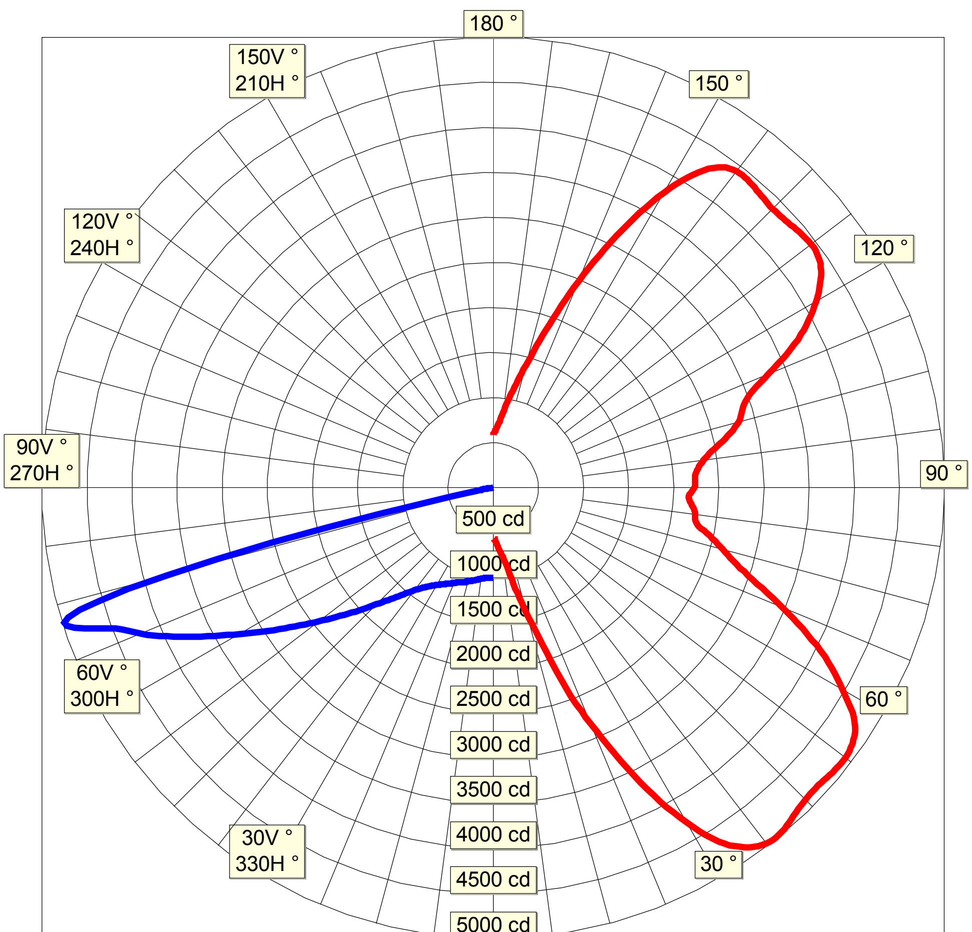
Photometric Report: S1502162-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFM-108W48LED4K-T-5

Maximum Plane and Maximum Cone Plots of Candela (1)

Plane Angles	Candela Values
0.0	996
2.5	995
5.0	1002
7.5	1016
10.0	1034
12.5	1054
15.0	1073
17.5	1100
20.0	1117
22.5	1143
25.0	1172
27.5	1205
30.0	1244
32.5	1290
35.0	1351
37.5	1432
40.0	1542
42.5	1673
45.0	1827
47.5	2012
50.0	2209
52.5	2432
55.0	2676
57.5	2952
60.0	3243
62.5	3566
65.0	3901
67.5	4230
70.0	4551
72.5	4978
75.0	3732
77.5	801
80.0	141
82.5	88
85.0	45
87.5	24
90.0	0
92.5	0
95.0	0
97.5	0
100.0	0
102.5	0
105.0	0
107.5	0



Plane Through Maximum Candela	Cone Through Maximum Candela
72.5 (Vertical Degrees) = 4978	40.0 (Horizontal Degrees) = 4978

Cone Angles	Candela Values
0.0	567
2.5	586
5.0	672
7.5	752
10.0	899
12.5	1143
15.0	1448
17.5	1811
20.0	2368
22.5	2835
25.0	3340
27.5	3841
30.0	4285
32.5	4649
35.0	4868
37.5	4974
40.0	4978
42.5	4930
45.0	4894
47.5	4886
50.0	4907
52.5	4921
55.0	4873
57.5	4739
60.0	4467
62.5	4189
65.0	3839
67.5	3473
70.0	3116
72.5	2829
75.0	2633
77.5	2460
80.0	2291
82.5	2256
85.0	2213
87.5	2169
90.0	2229
92.5	2239
95.0	2268
100.0	2486
105.0	2814
110.0	3026
115.0	3638
120.0	4128

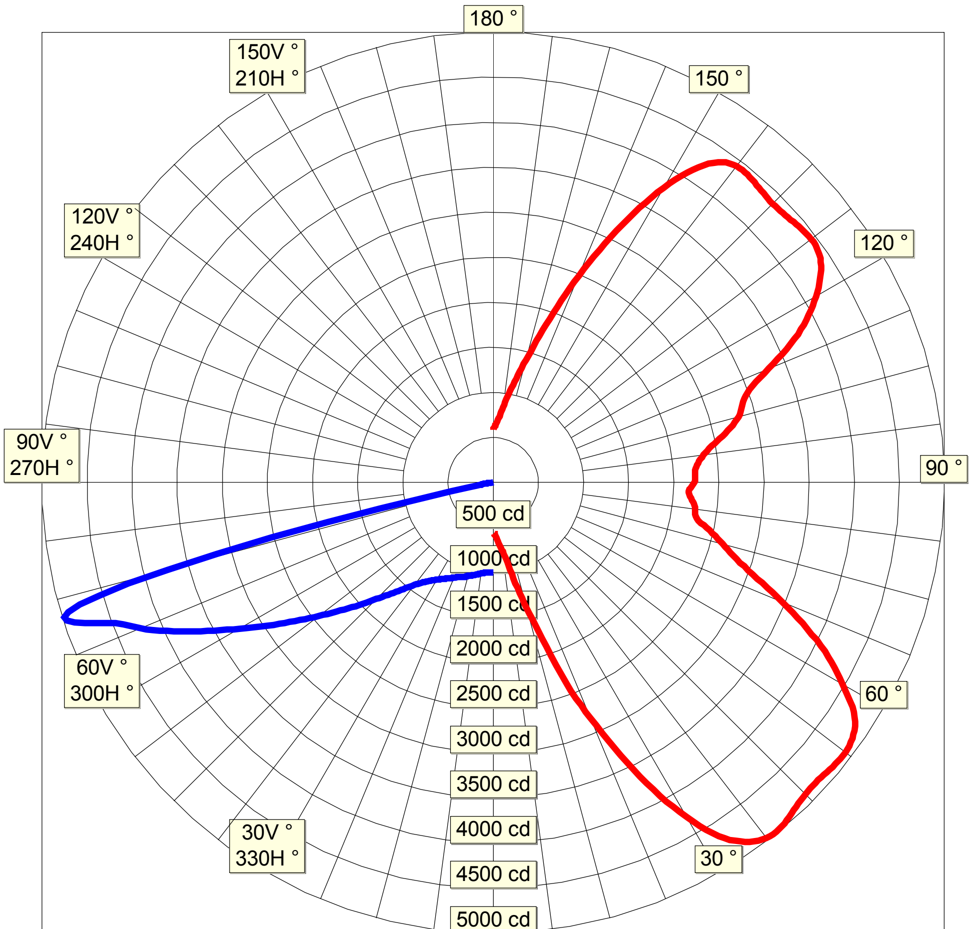
Photometric Report: S1502162-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFM-108W48LED4K-T-5

Maximum Plane and Maximum Cone Plots of Candela (2)

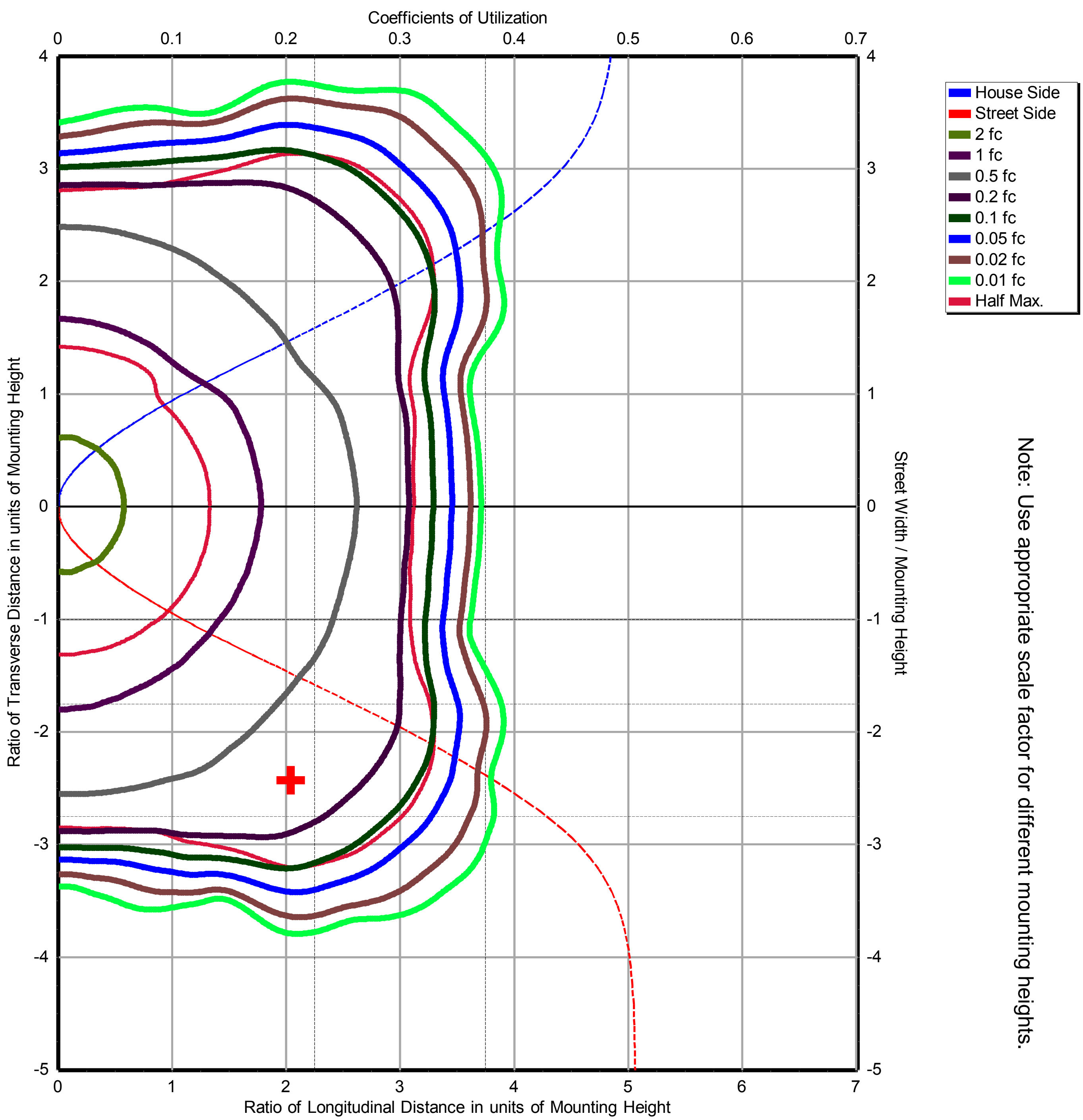
Plane Angles	Candela Values
110.0	0
112.5	0
115.0	0
117.5	0
120.0	0
122.5	0
125.0	0
127.5	0
130.0	0
132.5	0
135.0	0
137.5	0
140.0	0
142.5	0
145.0	0
147.5	0
150.0	0
152.5	0
155.0	0
157.5	0
160.0	0
162.5	0
165.0	0
167.5	0
170.0	0
172.5	0
175.0	0
177.5	0
180.0	0



Cone Angles	Candela Values
125.0	4413
130.0	4421
135.0	4379
140.0	4424
145.0	4341
150.0	3777
155.0	2929
160.0	2076
165.0	1409
170.0	1002
175.0	720
180.0	589

Plane Through Maximum Candela	Cone Through Maximum Candela
72.5 (Vertical Degrees) = 4978	40.0 (Horizontal Degrees) = 4978

Isoilluminance based on 20 feet of Mounting Height and Coefficients of Utilization Diagram (Right Side)

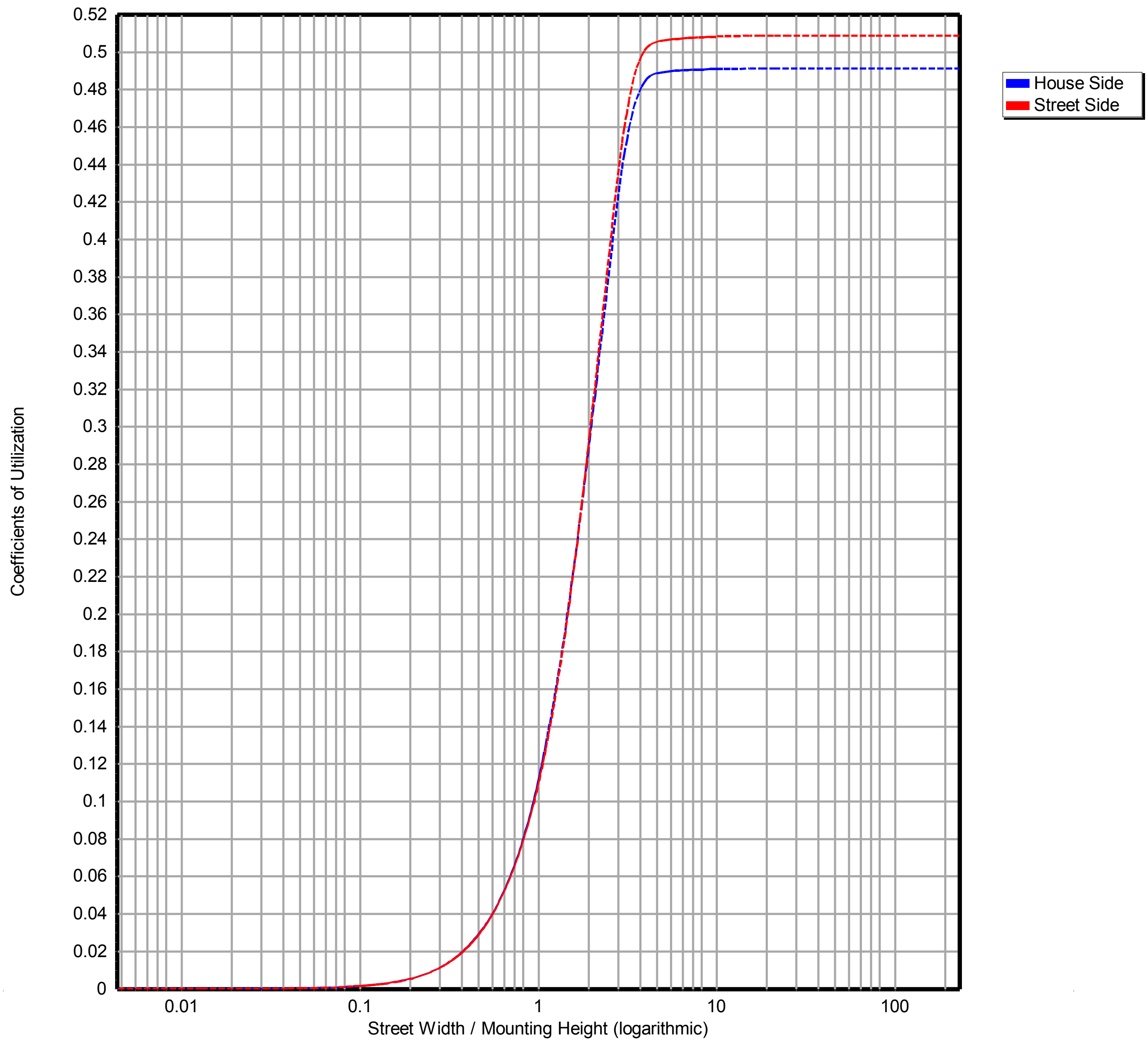


Photometric Report: S1502162-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFM-108W48LED4K-T-5

Coefficients of Utilization



Les Industries Spectralux Inc.
Spectralux Industries Inc.

2750 Sabourin, Saint-Laurent (Quebec) H4S 1M2 Canada
Tel.: (514) 332-0082 Fax: (514) 332-3590 www.spectralux.ca

ISO/IEC 17025
NVLAP
NVLAP LAB CODE: 200899-0

IES File Headers

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IESNA:LM-63-2002
[ISSUEDATE]    16 February 2015
[TESTLAB]      Spectra Lux Industries Inc.
[TEST]         S1502162-R1
[MANUFAC]      Philips Lumec
[LUMCAT]       RFM-108W48LED4K-T-5
[LUMINAIRE]    Roadfocus
[LAMP]         (3 Clusters of 16 Luxeon T LED's) White 108W SSL c/w Advance Driver LEDINTAO700C210DO @
120.00V
[_LAMPDETAILS] DC Voltage=154.28V, Current=0.7A, CCT=3902K, CRI=74, x=0.3863, y=0.3844
[_BURNING]     Vertical Base Up (11,224 Luminaire Lumens)
[_REFLECTOR]   None
[_LENS]        3X16 Clear Acrylic LED Collimators
[_HOUSING]     Die Cast Aluminum
[_SKTPOSITION] Fixed
[DISTRIBUTION] Type IV, Short
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Candela Table

Lateral Angles

Vertical Angles	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0
0.0	996	996	996	996	996	996	996	996	996
2.5	996	995	997	999	999	1000	999	997	998
5.0	1003	1002	1005	1007	1007	1007	1008	1005	1006
7.5	1017	1016	1019	1021	1022	1022	1022	1020	1021
10.0	1034	1034	1036	1039	1039	1040	1040	1038	1039
12.5	1054	1054	1058	1060	1060	1061	1061	1059	1060
15.0	1074	1075	1079	1081	1081	1082	1082	1080	1081
17.5	1100	1099	1099	1102	1102	1103	1103	1101	1103
20.0	1115	1115	1118	1123	1124	1124	1123	1122	1124
22.5	1138	1139	1143	1147	1148	1148	1146	1145	1146
25.0	1166	1165	1169	1174	1175	1174	1172	1170	1171
27.5	1196	1194	1198	1202	1204	1204	1202	1200	1200
30.0	1234	1231	1236	1240	1243	1243	1241	1238	1237
32.5	1285	1282	1285	1291	1292	1294	1292	1287	1287
35.0	1353	1350	1352	1358	1359	1360	1358	1354	1354
37.5	1437	1434	1436	1442	1442	1443	1441	1437	1437
40.0	1547	1544	1544	1550	1550	1551	1549	1546	1545
42.5	1668	1662	1662	1669	1668	1670	1667	1664	1663
45.0	1816	1812	1810	1814	1814	1813	1812	1808	1807
47.5	2008	2006	2003	2006	2004	2004	2003	1997	1993
50.0	2219	2216	2209	2212	2213	2214	2209	2203	2200
52.5	2468	2467	2455	2459	2463	2458	2451	2444	2439
55.0	2740	2740	2725	2732	2734	2723	2714	2707	2701
57.5	3047	3049	3036	3042	3043	3024	3012	3003	2989
60.0	3360	3366	3351	3360	3357	3330	3314	3305	3284
62.5	3697	3703	3687	3691	3683	3654	3637	3629	3602
65.0	4037	4037	4012	4008	3995	3957	3939	3931	3901
67.5	4362	4367	4366	4372	4371	4334	4318	4302	4252
70.0	3200	3224	3323	3392	3501	3633	3778	3934	4127
72.5	567	586	672	752	899	1143	1448	1811	2368
75.0	168	169	175	180	184	189	194	202	233
77.5	111	112	115	118	123	134	141	144	150
80.0	69	70	72	74	78	85	94	101	107
82.5	55	55	56	57	58	59	59	63	69
85.0	41	41	42	42	42	43	43	44	45

Lateral Angles

Vertical Angles

	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0
87.5	24	25	25	26	26	27	27	26	27
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	22.5	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5
0.0	996	996	996	996	996	996	996	996	996
2.5	997	997	997	997	998	999	996	995	996
5.0	1005	1004	1005	1005	1006	1006	1003	1002	1003
7.5	1021	1019	1020	1019	1021	1021	1017	1016	1016
10.0	1039	1037	1038	1037	1038	1039	1036	1034	1034
12.5	1059	1057	1057	1057	1057	1058	1055	1054	1054
15.0	1079	1077	1077	1077	1077	1077	1074	1073	1073
17.5	1101	1099	1100	1100	1099	1100	1100	1100	1100
20.0	1122	1119	1119	1118	1117	1119	1116	1117	1118
22.5	1144	1141	1141	1140	1140	1142	1141	1143	1145
25.0	1169	1167	1167	1167	1168	1171	1170	1172	1175
27.5	1197	1196	1197	1198	1199	1204	1204	1205	1206
30.0	1234	1233	1236	1239	1240	1245	1245	1244	1241
32.5	1285	1283	1286	1291	1293	1296	1295	1290	1286
35.0	1353	1352	1354	1359	1360	1362	1358	1351	1349
37.5	1436	1436	1438	1441	1440	1440	1437	1432	1429
40.0	1545	1544	1546	1548	1546	1546	1546	1542	1539
42.5	1666	1669	1674	1677	1676	1677	1677	1673	1669
45.0	1811	1815	1823	1826	1824	1826	1829	1827	1820
47.5	1996	2000	2007	2008	2004	2009	2015	2012	2003
50.0	2203	2204	2208	2208	2206	2210	2215	2209	2198
52.5	2442	2441	2442	2439	2436	2441	2443	2432	2420
55.0	2697	2694	2691	2685	2683	2685	2689	2676	2662
57.5	2984	2979	2973	2965	2964	2962	2968	2952	2934
60.0	3271	3269	3264	3260	3257	3252	3261	3243	3221
62.5	3587	3584	3592	3586	3585	3575	3586	3566	3541
65.0	3889	3899	3911	3911	3910	3902	3919	3901	3870
67.5	4229	4228	4227	4229	4229	4227	4245	4230	4195
70.0	4304	4481	4600	4643	4629	4591	4581	4551	4515
72.5	2835	3340	3841	4285	4649	4868	4974	4978	4930
75.0	313	688	1315	2068	2761	3205	3489	3732	3836
77.5	158	166	180	199	245	339	586	801	919
80.0	113	120	128	136	142	144	140	141	140
82.5	73	78	84	90	93	93	90	88	85
85.0	45	46	46	46	48	47	45	45	46
87.5	27	26	26	26	25	25	24	24	23
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	22.5	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles

	45.0	47.5	50.0	52.5	55.0	57.5	60.0	62.5	65.0
0.0	996	996	996	996	996	996	996	996	996
2.5	995	995	996	998	997	995	996	996	995
5.0	1002	1002	1002	1003	1003	1001	1002	1001	1001
7.5	1016	1016	1015	1016	1014	1013	1013	1012	1012
10.0	1033	1033	1033	1034	1032	1030	1029	1029	1028
12.5	1054	1054	1054	1055	1053	1051	1051	1050	1049
15.0	1073	1074	1075	1076	1076	1075	1076	1076	1074
17.5	1100	1100	1101	1102	1102	1101	1104	1104	1103
20.0	1120	1123	1125	1127	1127	1125	1127	1126	1125
22.5	1148	1150	1152	1154	1151	1147	1147	1146	1144
25.0	1177	1177	1178	1176	1172	1168	1168	1168	1167
27.5	1204	1203	1202	1200	1197	1194	1196	1195	1195
30.0	1238	1235	1234	1234	1232	1229	1230	1229	1229
32.5	1284	1283	1283	1281	1278	1274	1274	1272	1272
35.0	1349	1348	1349	1347	1344	1339	1337	1333	1332
37.5	1431	1430	1432	1430	1427	1423	1422	1416	1415
40.0	1541	1539	1541	1537	1535	1532	1532	1527	1526
42.5	1672	1669	1668	1663	1661	1659	1661	1656	1653
45.0	1821	1816	1814	1807	1806	1804	1804	1798	1797
47.5	1998	1992	1992	1986	1984	1980	1979	1972	1973
50.0	2192	2187	2189	2184	2184	2181	2179	2171	2174
52.5	2417	2414	2418	2411	2411	2413	2412	2404	2408
55.0	2659	2658	2660	2654	2656	2661	2665	2658	2659
57.5	2931	2931	2934	2927	2930	2939	2946	2943	2945
60.0	3217	3218	3220	3210	3212	3228	3240	3241	3240
62.5	3538	3537	3540	3529	3530	3549	3561	3559	3550
65.0	3861	3857	3859	3854	3853	3866	3868	3860	3855
67.5	4174	4163	4166	4168	4174	4190	4182	4165	4158
70.0	4491	4478	4480	4488	4495	4533	4545	4528	4490
72.5	4894	4886	4907	4921	4873	4739	4467	4189	3839
75.0	3891	3938	3910	3795	3616	3273	2734	2211	1534
77.5	972	1027	997	874	708	377	254	211	176
80.0	139	139	137	133	130	129	120	114	105
82.5	84	83	83	83	83	81	76	72	66
85.0	45	45	44	43	45	44	42	40	38
87.5	23	22	22	21	21	20	19	19	18
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles

	45.0	47.5	50.0	52.5	55.0	57.5	60.0	62.5	65.0
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	67.5	70.0	72.5	75.0	77.5	80.0	82.5	85.0	87.5
0.0	996	996	996	996	996	996	996	996	996
2.5	996	997	997	997	997	998	998	1000	1002
5.0	1001	1003	1003	1003	1002	1003	1005	1006	1008
7.5	1012	1013	1013	1013	1014	1015	1017	1018	1020
10.0	1028	1029	1029	1029	1029	1031	1032	1034	1037
12.5	1049	1049	1049	1048	1048	1050	1051	1054	1057
15.0	1075	1074	1073	1071	1069	1070	1071	1074	1077
17.5	1104	1103	1101	1101	1101	1100	1100	1100	1100
20.0	1126	1126	1123	1120	1118	1115	1115	1116	1118
22.5	1145	1146	1145	1143	1141	1139	1137	1138	1141
25.0	1168	1170	1170	1169	1167	1166	1163	1164	1167
27.5	1196	1197	1198	1197	1195	1195	1193	1194	1196
30.0	1231	1230	1231	1232	1231	1232	1230	1230	1232
32.5	1274	1273	1274	1277	1277	1279	1277	1278	1282
35.0	1331	1330	1333	1336	1337	1342	1340	1340	1345
37.5	1412	1409	1412	1414	1414	1419	1418	1418	1425
40.0	1521	1519	1521	1524	1524	1528	1526	1526	1533
42.5	1646	1644	1645	1646	1644	1648	1645	1645	1651
45.0	1788	1785	1783	1783	1783	1784	1783	1784	1792
47.5	1967	1965	1964	1966	1965	1968	1968	1971	1978
50.0	2172	2171	2170	2171	2172	2174	2175	2180	2187
52.5	2409	2415	2410	2410	2414	2418	2419	2425	2436
55.0	2662	2677	2671	2669	2673	2677	2679	2689	2701
57.5	2949	2965	2960	2960	2966	2974	2978	2991	3005
60.0	3240	3262	3258	3259	3264	3274	3279	3294	3309
62.5	3549	3567	3568	3569	3579	3597	3601	3621	3639
65.0	3855	3866	3867	3863	3875	3895	3901	3925	3943
67.5	4152	4163	4176	4181	4209	4251	4263	4298	4318
70.0	4409	4310	4230	4173	4139	4108	4121	4133	4132
72.5	3473	3116	2829	2633	2460	2291	2256	2213	2169
75.0	980	614	346	271	228	206	199	193	189
77.5	155	139	134	126	118	109	105	103	101
80.0	98	89	84	79	74	69	67	65	64
82.5	61	57	52	48	45	43	41	40	39
85.0	36	33	31	30	28	27	27	26	25
87.5	17	16	15	15	14	13	13	13	13
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	67.5	70.0	72.5	75.0	77.5	80.0	82.5	85.0	87.5
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles

	90.0	92.5	95.0	100.0	105.0	110.0	115.0	120.0	125.0
0.0	996	996	996	996	996	996	996	996	996
2.5	1001	1001	1000	997	995	996	996	995	997
5.0	1008	1007	1006	1003	1002	1003	1003	1001	1003
7.5	1021	1020	1019	1016	1016	1016	1017	1015	1017
10.0	1038	1037	1036	1033	1033	1034	1035	1034	1037
12.5	1058	1059	1057	1054	1053	1054	1056	1055	1058
15.0	1078	1079	1077	1075	1074	1075	1077	1077	1080
17.5	1100	1100	1100	1100	1100	1100	1100	1100	1104
20.0	1120	1120	1119	1116	1119	1119	1121	1121	1126
22.5	1144	1144	1144	1140	1143	1144	1145	1146	1151
25.0	1168	1170	1170	1168	1168	1170	1172	1174	1181
27.5	1195	1197	1198	1198	1197	1199	1203	1207	1215
30.0	1230	1232	1234	1234	1234	1236	1241	1249	1256
32.5	1278	1279	1282	1284	1283	1284	1291	1303	1308
35.0	1340	1343	1345	1348	1350	1353	1360	1374	1375
37.5	1420	1422	1423	1426	1430	1436	1446	1460	1460
40.0	1527	1529	1529	1531	1535	1542	1555	1573	1576
42.5	1645	1648	1648	1649	1655	1665	1685	1705	1710
45.0	1786	1790	1789	1788	1797	1813	1837	1855	1866
47.5	1971	1977	1974	1971	1983	2001	2024	2041	2051
50.0	2181	2186	2182	2180	2192	2207	2231	2245	2255
52.5	2427	2432	2426	2425	2433	2450	2469	2480	2488
55.0	2696	2698	2691	2688	2693	2711	2724	2729	2739
57.5	3004	3005	2998	2990	2989	3000	3004	3009	3018
60.0	3313	3316	3311	3299	3295	3301	3296	3302	3231
62.5	3649	3650	3641	3622	3610	3609	3608	3570	3349
65.0	3955	3956	3941	3918	3906	3903	3895	3663	3508
67.5	4333	4332	4306	4251	4209	4190	4020	3784	3763
70.0	4172	4171	4153	4182	4253	4258	4144	4059	4050
72.5	2229	2239	2268	2486	2814	3026	3638	4128	4413
75.0	191	191	193	215	257	626	1650	2759	3434
77.5	101	101	101	108	112	119	156	266	832
80.0	63	63	64	67	69	76	87	101	105
82.5	39	39	39	39	41	47	55	58	63
85.0	25	25	25	24	25	26	27	30	31
87.5	13	13	13	13	13	13	13	13	13
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	90.0	92.5	95.0	100.0	105.0	110.0	115.0	120.0	125.0
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	130.0	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0
0.0	996	996	996	996	996	996	996	996	996
2.5	999	998	994	998	998	999	999	1000	999
5.0	1004	1004	1000	1004	1005	1005	1006	1008	1007
7.5	1019	1018	1013	1018	1018	1018	1019	1022	1022
10.0	1039	1039	1034	1038	1038	1036	1036	1039	1039
12.5	1063	1064	1059	1064	1064	1061	1059	1060	1060
15.0	1085	1087	1084	1101	1101	1102	1086	1085	1082
17.5	1110	1114	1113	1119	1120	1119	1117	1113	1106
20.0	1134	1139	1138	1143	1144	1142	1139	1137	1128
22.5	1162	1167	1164	1166	1164	1164	1164	1163	1154
25.0	1193	1196	1189	1191	1193	1192	1194	1194	1186
27.5	1224	1223	1217	1223	1225	1222	1224	1227	1221
30.0	1261	1260	1259	1265	1265	1264	1265	1270	1267
32.5	1311	1313	1313	1317	1316	1315	1316	1326	1324
35.0	1380	1385	1384	1390	1390	1384	1388	1400	1401
37.5	1469	1475	1474	1483	1485	1478	1483	1492	1494
40.0	1585	1593	1593	1602	1607	1602	1607	1612	1616
42.5	1723	1731	1730	1740	1746	1739	1740	1743	1746
45.0	1881	1888	1888	1899	1902	1894	1887	1870	1856
47.5	2070	2076	2078	2091	2076	2027	1994	1965	1947
50.0	2270	2277	2284	2257	2188	2128	2098	2070	2055
52.5	2498	2505	2450	2376	2301	2252	2255	2256	2261
55.0	2742	2670	2565	2493	2468	2469	2490	2496	2501
57.5	2931	2793	2711	2704	2726	2732	2748	2758	2766
60.0	3054	2954	2956	2968	2994	2995	3011	3021	3030
62.5	3238	3228	3247	3251	3272	3265	3282	3295	3311
65.0	3515	3505	3529	3526	3532	3523	3537	3558	3585
67.5	3790	3773	3792	3789	3792	3798	3831	3867	3912
70.0	4068	4043	4066	4097	4143	4008	3702	3371	3156
72.5	4421	4379	4424	4341	3777	2929	2076	1409	1002
75.0	3652	3610	3408	2830	1890	779	195	141	130
77.5	1066	1031	907	390	153	122	105	92	79
80.0	109	111	113	106	93	78	66	55	47
82.5	62	61	63	62	56	47	39	31	28
85.0	29	28	28	29	24	21	18	15	15
87.5	13	13	12	11	11	10	10	10	10
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles

	130.0	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	175.0	180.0
0.0	996	996
2.5	1000	994
5.0	1008	1004
7.5	1024	1019
10.0	1042	1038
12.5	1063	1059
15.0	1084	1080
17.5	1107	1103
20.0	1127	1125
22.5	1153	1150
25.0	1182	1180
27.5	1216	1212
30.0	1262	1256
32.5	1319	1312
35.0	1396	1387
37.5	1490	1480
40.0	1611	1599
42.5	1740	1729
45.0	1841	1828
47.5	1933	1921
50.0	2048	2043
52.5	2262	2264
55.0	2505	2508
57.5	2772	2776
60.0	3040	3048
62.5	3326	3336
65.0	3605	3615
67.5	3922	3917
70.0	2948	2830
72.5	720	589
75.0	123	118
77.5	71	68
80.0	42	40
82.5	27	27
85.0	14	14
87.5	10	10
90.0	0	0
92.5	0	0
95.0	0	0
97.5	0	0
100.0	0	0
102.5	0	0
105.0	0	0
107.5	0	0
110.0	0	0
112.5	0	0
115.0	0	0
117.5	0	0
120.0	0	0
122.5	0	0
125.0	0	0
127.5	0	0
130.0	0	0
132.5	0	0

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Lateral Angles

Vertical Angles

	175.0	180.0
135.0	0	0
137.5	0	0
140.0	0	0
142.5	0	0
145.0	0	0
147.5	0	0
150.0	0	0
152.5	0	0
155.0	0	0
157.5	0	0
160.0	0	0
162.5	0	0
165.0	0	0
167.5	0	0
170.0	0	0
172.5	0	0
175.0	0	0
177.5	0	0
180.0	0	0

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ISO/IEC 17025

NVLAP LAB CODE: 200899-0

Sphere Test Report

Standard(s) CIE 84-1989, IESNA LM-16-93, IESNA LM-58-94, IES LM-79-08, ANSI C82.77-2002

Customer Philips Lumec, 640 Curé Boivin, Boisbriand, Québec, Canada, J7G 2A7

General Information		Lamp Details: CY1932		Driver Details: CY681	
Test Report	L1502164-C1	**Description**	3 Clusters of 16 Luxeon T LED's	**Type**	Commercial
Test Date	16 February 2015	**Manufacturer**	Philips	**Description**	108W
Report Date	17 February 2015	**Catalog No.**	RFM-108W48LED4K-T-5	**Manufacturer**	Advance
Sphere Temperature	26.0 °C	**Serial No.**	SRIS 1786	**Catalog No.**	LEDINTAO700C21OD O
Humidity	6.4 %	**Diameter**	N/A mm	**Voltage**	120.00 V
Lamp Type	SSL	**Color**	White	**Power Factor**	0.9900

Stabilization Time: 60 minutes

Tested By: Jean-Paul Ojeil

Approved Signatory: Chrisnel Blot

Signature:

Notes

1) Field performance may differ from laboratory measurements. Results are valid for tested material only.

2) The original electronic file or paper report cannot be edited in whole or in part without written consent of Spectra Lux Industries Inc.

3) This test report describes the performance of a single product and does not necessarily represent the average performance of a group of the same SSL product.

Realization of Sphere Test

A 4π sphere-spectroradiometer equipped with auxiliary lamp to correct self-absorption was used during the measurements of electrical, photometric and colorimetric properties of the sample under test. The size of the integrating sphere used is large enough to ensure that the measurement errors due to effects of baffle and self-absorption by the sample test are not significant.

During the test, a commercial driver was used and adjusted to nominal electrical characteristics specified by the driver manufacturer or the client. Good electrical contacts have been used to ensure the control of electrical parameters of the commercial driver and an adequate stabilization period prior to collecting data. The self-absorbance was measured and a geometrical correction factor was applied to the luminous flux value to take into account the sphere configuration.

Results of the measurements are traceable to reference standards developed and maintained by the National Institute of Standards and Technology (NIST) and National Research Council of Canada (NRC).

Electrical Equipment

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Auxiliary Power Supply	Sorenson	DSC-60-18E	051B1142	N.P.C.R.	N.P.C.R.
Test Power Supply	California Instruments	801RP	05816	N.P.C.R.	N.P.C.R.
Input Power Meter	Yokogawa	WT210	91L236540	2014/10/22	2015/10/22
Output Power Meter	N/A	N/A	N/A	N.P.C.R.	N.P.C.R.
Shunt Resistor	Fluke	Y5020	5675014	2014/08/06	2015/08/06
Current Multimeter	HP Agilent	HP34401A	US36121202	2014/08/06	2015/08/06
Voltage Multimeter	Fluke	Fluke8842A	5750288	2014/04/16	2015/04/16

Spectrometer Equipment

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Spectrometer	Ocean Optics	USB2000N	USB2E3864	2014/08/24	2015/08/24

Environment Equipment

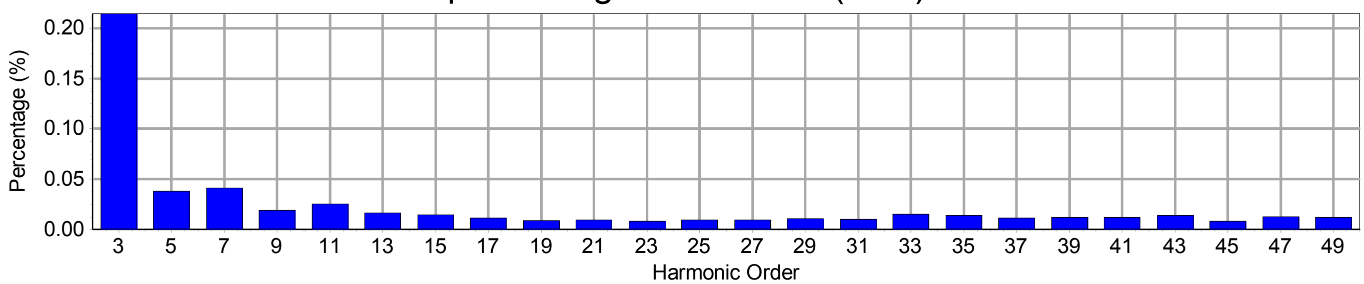
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Temperature Humidity Sensor	Omega	HH311	120504176	2014/04/16	2016/04/16

Electrical Measurements

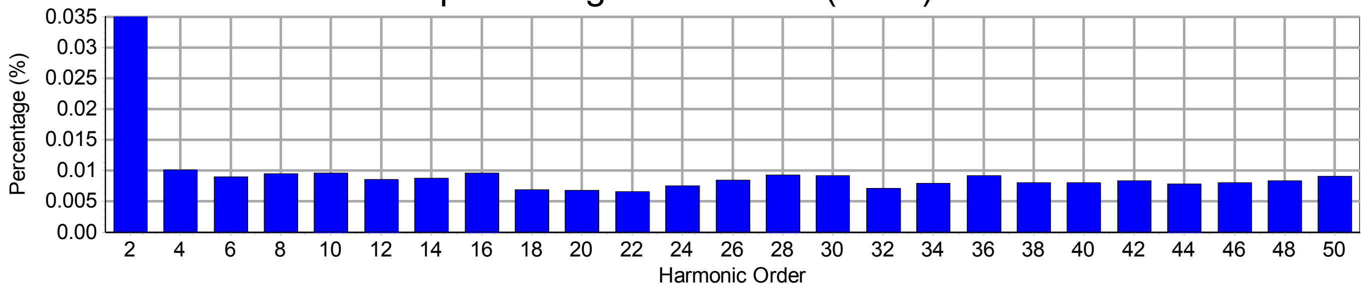
Input

Frequency	60 Hz	Active Power	104.95 W	THDV [ANSI]	0.23 %
Voltage	120.1 V(rms)	Apparent Power	105.30 VA	THDA [ANSI]	7.12 %
Current	0.8765 A(rms)	Power Factor	0.997	Max. Harmonic At	3rd order

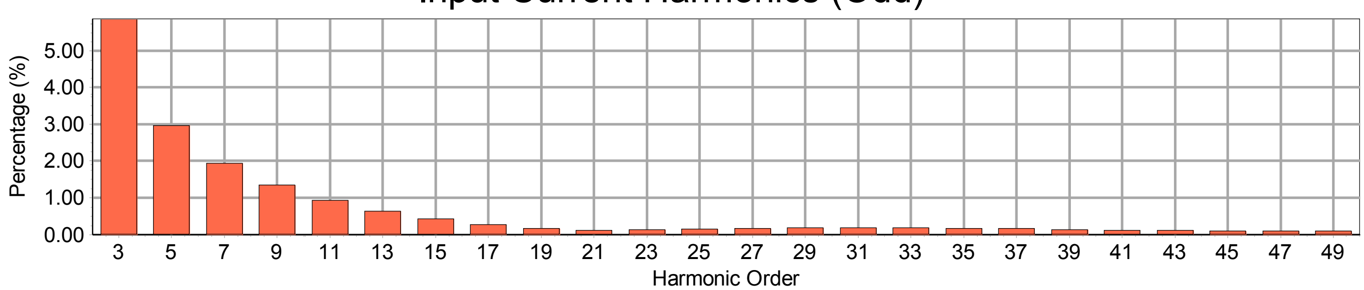
Input Voltage Harmonics (Odd)



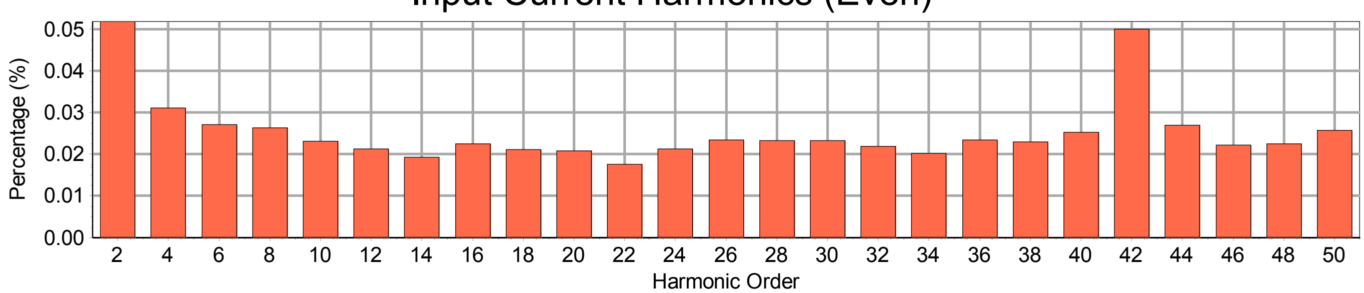
Input Voltage Harmonics (Even)



Input Current Harmonics (Odd)



Input Current Harmonics (Even)



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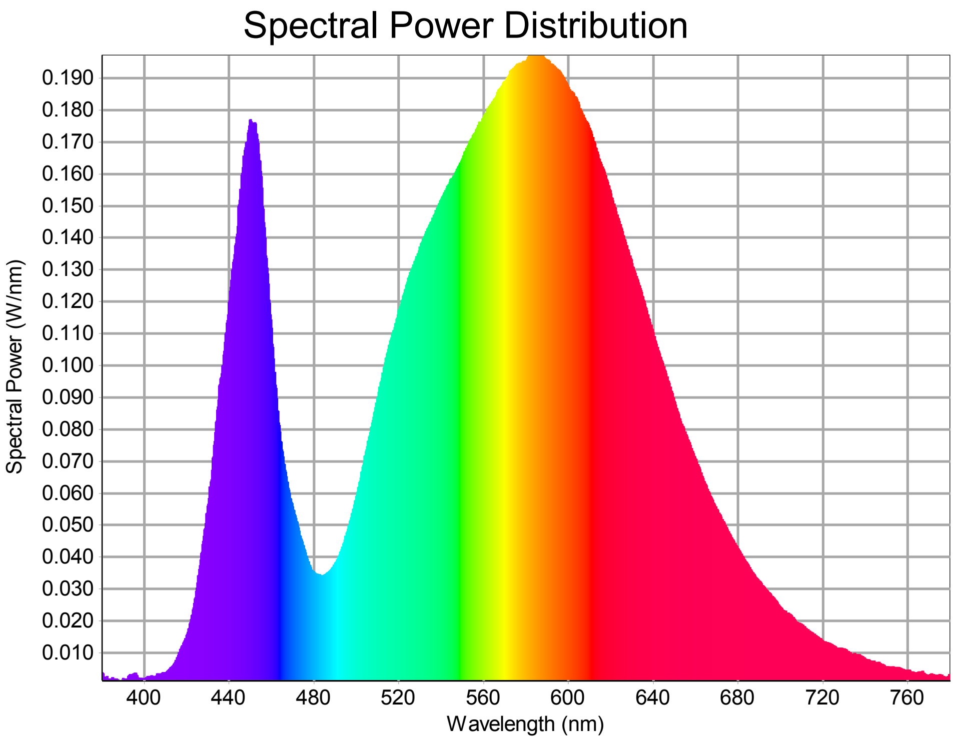
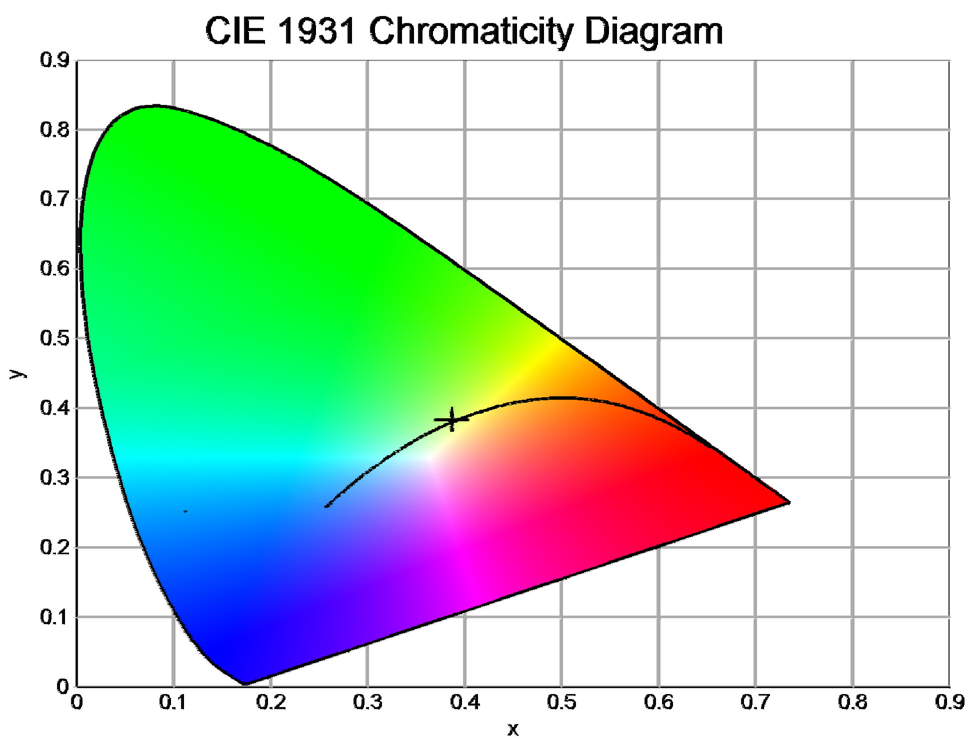
Harmonic Measurements

Odd Harmonics				Even Harmonics			
Harmonic Order	Frequency (HZ)	Voltage Harmonics (%)	Current Harmonics (%)	Harmonic Order	Frequency (HZ)	Voltage Harmonics (%)	Current Harmonics (%)
1	60	100.000	100.000	2	120	0.035	0.052
3	180	0.215	5.875	4	240	0.010	0.031
5	300	0.038	2.965	6	360	0.009	0.027
7	420	0.041	1.944	8	480	0.010	0.026
9	540	0.019	1.339	10	600	0.010	0.023
11	660	0.025	0.925	12	720	0.009	0.021
13	780	0.016	0.636	14	840	0.009	0.019
15	900	0.014	0.428	16	960	0.010	0.023
17	1020	0.011	0.261	18	1080	0.007	0.021
19	1140	0.009	0.164	20	1200	0.007	0.021
21	1260	0.009	0.107	22	1320	0.007	0.018
23	1380	0.008	0.128	24	1440	0.008	0.021
25	1500	0.009	0.142	26	1560	0.008	0.023
27	1620	0.009	0.170	28	1680	0.009	0.023
29	1740	0.011	0.182	30	1800	0.009	0.023
31	1860	0.010	0.189	32	1920	0.007	0.022
33	1980	0.015	0.182	34	2040	0.008	0.020
35	2100	0.014	0.167	36	2160	0.009	0.023
37	2220	0.011	0.160	38	2280	0.008	0.023
39	2340	0.012	0.132	40	2400	0.008	0.025
41	2460	0.012	0.120	42	2520	0.008	0.050
43	2580	0.013	0.105	44	2640	0.008	0.027
45	2700	0.008	0.087	46	2760	0.008	0.022
47	2820	0.013	0.094	48	2880	0.008	0.023
49	2940	0.012	0.102	50	3000	0.009	0.026



Peak Wavelength	588 nm
Luminous Flux	11083 lm
Input Power	104.95 W
Lumens/Watt	105.6
Full Width/Half Maximum	132.75
Center Wavelength	579 nm
Centroid Wavelength	368 nm
Dominant Wavelength	488 nm
Excitation Purity	0.1555
Colorimeric Purity	0.1049



x	0.3863	CCT	3902 K
y	0.3844	CRI	74
u	0.2259	L*	25.67
v	0.3372	a*	-5.25
u'	0.2259	b*	-13.50
v'	0.5058	Duv	0.0019
R1	71.1	R9	-20.4
R2	80.6	R10	53.7
R3	88.0	R11	68.1
R4	72.8	R12	46.6
R5	70.6	R13	72.6
R6	72.4	R14	93.0
R7	82.6		
R8	55.1		

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Spectral Power Distribution Table (1/4)

Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)
380	0.00407	405	0.00273	430	0.05618	455	0.16090
381	0.00267	406	0.00355	431	0.06209	456	0.14993
382	0.00246	407	0.00338	432	0.06739	457	0.14015
383	0.00208	408	0.00349	433	0.07520	458	0.13063
384	0.00208	409	0.00400	434	0.08239	459	0.12055
385	0.00234	410	0.00395	435	0.08936	460	0.11176
386	0.00204	411	0.00447	436	0.09604	461	0.10222
387	0.00202	412	0.00523	437	0.09996	462	0.09401
388	0.00163	413	0.00577	438	0.10735	463	0.08597
389	0.00148	414	0.00659	439	0.11339	464	0.07927
390	0.00215	415	0.00774	440	0.11994	465	0.07380
391	0.00205	416	0.00935	441	0.12679	466	0.06931
392	0.00198	417	0.01124	442	0.13238	467	0.06531
393	0.00317	418	0.01242	443	0.13777	468	0.06170
394	0.00277	419	0.01411	444	0.14374	469	0.05851
395	0.00367	420	0.01567	445	0.15182	470	0.05599
396	0.00379	421	0.01769	446	0.15969	471	0.05356
397	0.00241	422	0.02069	447	0.16570	472	0.05127
398	0.00225	423	0.02360	448	0.17003	473	0.04828
399	0.00212	424	0.02710	449	0.17296	474	0.04587
400	0.00175	425	0.03207	450	0.17703	475	0.04384
401	0.00239	426	0.03624	451	0.17525	476	0.04149
402	0.00261	427	0.04122	452	0.17611	477	0.03948
403	0.00268	428	0.04667	453	0.17280	478	0.03770
404	0.00276	429	0.05068	454	0.16639	479	0.03606

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Spectral Power Distribution Table (2/4)

Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)
480	0.03542	505	0.07468	530	0.13726	555	0.17224
481	0.03492	506	0.07769	531	0.13894	556	0.17308
482	0.03469	507	0.08069	532	0.14048	557	0.17457
483	0.03448	508	0.08391	533	0.14200	558	0.17627
484	0.03433	509	0.08696	534	0.14345	559	0.17643
485	0.03454	510	0.09006	535	0.14489	560	0.17799
486	0.03506	511	0.09335	536	0.14625	561	0.17910
487	0.03547	512	0.09624	537	0.14770	562	0.18057
488	0.03614	513	0.09939	538	0.14936	563	0.18161
489	0.03716	514	0.10247	539	0.15070	564	0.18261
490	0.03821	515	0.10529	540	0.15229	565	0.18349
491	0.03933	516	0.10777	541	0.15355	566	0.18460
492	0.04086	517	0.11005	542	0.15485	567	0.18634
493	0.04237	518	0.11201	543	0.15628	568	0.18704
494	0.04433	519	0.11467	544	0.15748	569	0.18832
495	0.04661	520	0.11738	545	0.15875	570	0.18920
496	0.04885	521	0.11942	546	0.15956	571	0.19000
497	0.05137	522	0.12191	547	0.16086	572	0.19119
498	0.05372	523	0.12388	548	0.16225	573	0.19251
499	0.05642	524	0.12634	549	0.16356	574	0.19313
500	0.05914	525	0.12817	550	0.16497	575	0.19377
501	0.06198	526	0.13000	551	0.16699	576	0.19461
502	0.06497	527	0.13161	552	0.16808	577	0.19472
503	0.06838	528	0.13351	553	0.16979	578	0.19486
504	0.07165	529	0.13505	554	0.17093	579	0.19537

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ISO/IEC 17025

NVLAP LAB CODE: 200899-0

Spectral Power Distribution Table (3/4)

Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)
580	0.19544	605	0.18172	630	0.13216	655	0.07940
581	0.19666	606	0.17994	631	0.12997	656	0.07784
582	0.19711	607	0.17856	632	0.12814	657	0.07611
583	0.19712	608	0.17704	633	0.12605	658	0.07412
584	0.19714	609	0.17614	634	0.12419	659	0.07257
585	0.19727	610	0.17447	635	0.12185	660	0.07100
586	0.19704	611	0.17261	636	0.11950	661	0.06919
587	0.19723	612	0.17036	637	0.11714	662	0.06755
588	0.19728	613	0.16826	638	0.11491	663	0.06555
589	0.19613	614	0.16614	639	0.11277	664	0.06390
590	0.19579	615	0.16396	640	0.11051	665	0.06247
591	0.19550	616	0.16239	641	0.10800	666	0.06069
592	0.19465	617	0.16083	642	0.10589	667	0.05928
593	0.19409	618	0.15855	643	0.10381	668	0.05785
594	0.19346	619	0.15662	644	0.10181	669	0.05647
595	0.19283	620	0.15396	645	0.09988	670	0.05516
596	0.19223	621	0.15173	646	0.09767	671	0.05398
597	0.19112	622	0.14975	647	0.09548	672	0.05269
598	0.18993	623	0.14738	648	0.09348	673	0.05137
599	0.18881	624	0.14537	649	0.09142	674	0.05013
600	0.18737	625	0.14324	650	0.08898	675	0.04870
601	0.18606	626	0.14079	651	0.08671	676	0.04745
602	0.18567	627	0.13867	652	0.08484	677	0.04619
603	0.18445	628	0.13655	653	0.08258	678	0.04509
604	0.18344	629	0.13449	654	0.08109	679	0.04392

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Spectral Power Distribution Table (4/4)

Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)
680	0.04279	706	0.02122	732	0.01062	758	0.00503
681	0.04174	707	0.02029	733	0.01014	759	0.00445
682	0.04047	708	0.01963	734	0.00970	760	0.00482
683	0.03942	709	0.01948	735	0.00990	761	0.00462
684	0.03842	710	0.01907	736	0.00954	762	0.00428
685	0.03741	711	0.01850	737	0.00955	763	0.00404
686	0.03621	712	0.01786	738	0.00927	764	0.00372
687	0.03521	713	0.01737	739	0.00884	765	0.00411
688	0.03425	714	0.01677	740	0.00826	766	0.00421
689	0.03338	715	0.01640	741	0.00795	767	0.00432
690	0.03267	716	0.01595	742	0.00778	768	0.00361
691	0.03182	717	0.01548	743	0.00753	769	0.00327
692	0.03098	718	0.01492	744	0.00762	770	0.00322
693	0.03015	719	0.01462	745	0.00707	771	0.00349
694	0.02936	720	0.01386	746	0.00712	772	0.00340
695	0.02879	721	0.01362	747	0.00685	773	0.00307
696	0.02790	722	0.01339	748	0.00653	774	0.00312
697	0.02718	723	0.01323	749	0.00620	775	0.00342
698	0.02643	724	0.01280	750	0.00575	776	0.00316
699	0.02521	725	0.01238	751	0.00583	777	0.00288
700	0.02446	726	0.01199	752	0.00574	778	0.00246
701	0.02372	727	0.01167	753	0.00575	779	0.00271
702	0.02323	728	0.01154	754	0.00552	780	0.00309
703	0.02270	729	0.01159	755	0.00564		
704	0.02238	730	0.01141	756	0.00552		
705	0.02200	731	0.01115	757	0.00515		

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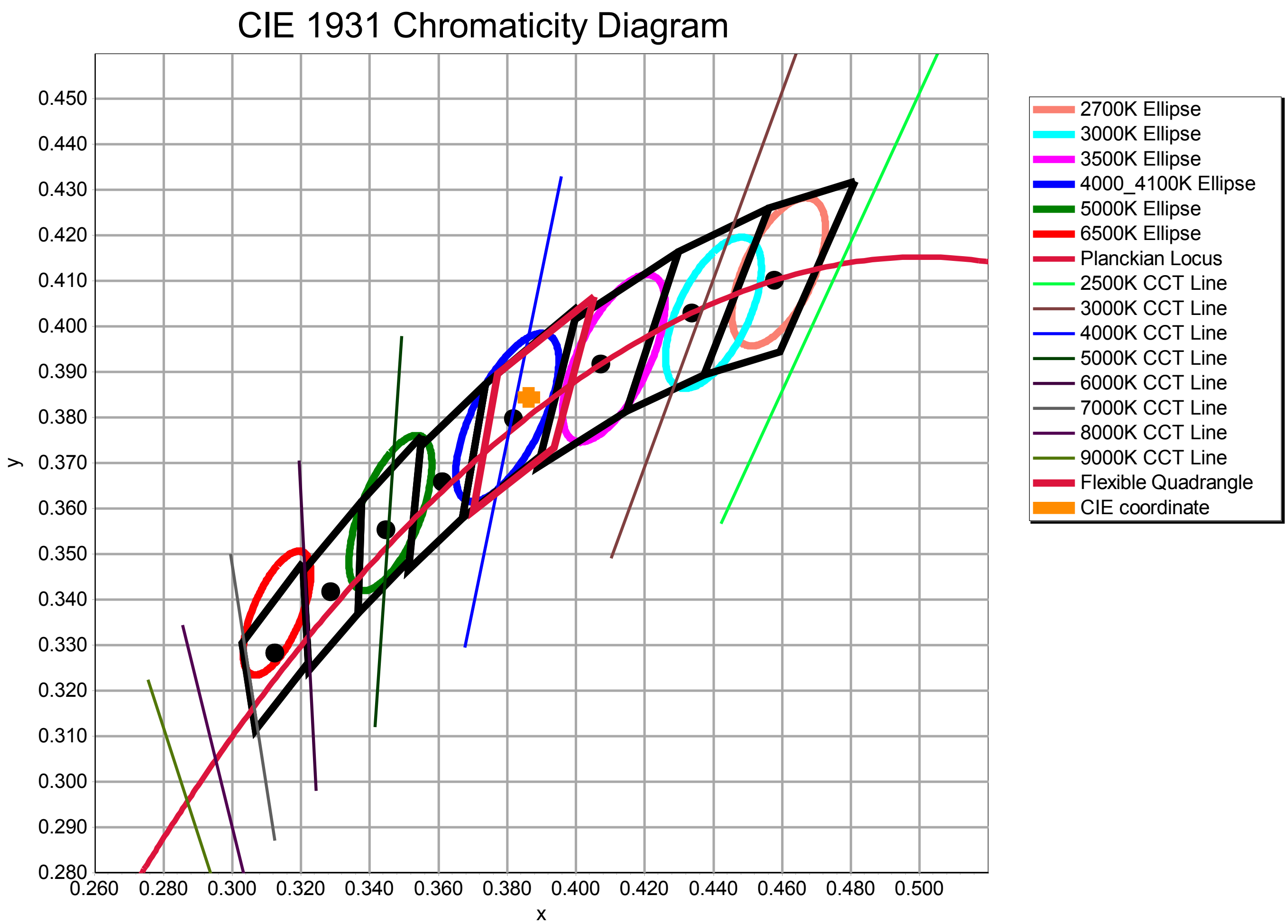
NVLAP LAB CODE: 200899-0

CIE Chromaticity Diagram for Indoor SSL products



Chromaticity tolerance of Flexible CCT at nominal CCT of 3900K

				x	y
		Center Point		0.3856	0.3818
Min CCT	3626		A	0.4052	0.4066
Max CCT	4174	Tolerance	B	0.3773	0.3896
Delta T	274	Quadrangle	C	0.3701	0.3595
Center Duv	0.0009		D	0.3937	0.3734

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NVLAP LAB CODE: 200899-0

Moving Mirror Goniophotometer Test Report

Standard(s): IESNA LM-31-95, IES LM-79-08, IESNA TM-15-11, ANSI C82.77-2002

Customer: Philips Lumec, 640 Curé Boivin, Boisbriand, Québec, Canada, J7G 2A7

General Information		SSL Details		Driver Details	
Test Report	S1502164-R1	**Description**	241W White SSL	**Type**	Commercial
Test Date	16 February 2015	**Serial Number**	SRIS 1789	**Description**	241W
Report Date	17 February 2015	**Photometric Method**	Absolute	**Manufacturer**	Advance
Ambient	24.1 °C	**Lamp Lumens**	-1	**Catalog No.**	(2) LEDINTAO700C21ODO
Humidity	5.1 %	**Test Position**	Vertical Base Up	**Voltage**	120.00 V
Lamp Type	SSL	**Comments**	7 Clusters of 16 Luxeon T LED's	**Power Factor**	0.9900

Luminaire Data

General Information		Optics		Aperture (feet)	
Manufacturer	Philips Lumec	**Reflector**	None	**X**	1.6667
Name	Roadfocus	**Housing**	Die Cast Aluminum	**Y**	1.0000
Catalog No.	RFL-241W112LED4K-T-5	**Lens**	7X16 Clear Acrylic LED Collimators	**Z**	0.0000

SKT Position: Fixed
Lamp Stabilization Time: 1 hour, 45 minutes, 3 seconds

Tested By: Jean-Paul Ojeil **Approved Signatory: Chrisnel Blot**

Signature:

Luminaire Test Method

Precise installation and alignment of the luminaire to the rotation axis of the photometer is governed by a servomotor controlled via a microcontroller. A laser is used to validate the luminaire positioning. Before photometric measurements are taken, luminaire is operated long enough to reach stabilization and temperature equilibrium.

All movement commands issued to the photometer axes are mediated by the software to ensure the motion is within the limits of operation. The photometric detector used is a silicon detector corrected to closely match the spectral luminous efficiency photopic curve with a quality index less than 1.5%. Proper shielding is incorporated to the photometric test bench such that only the light from the unit under test is measured.

Luminous intensity measurements are performed at a distance great enough so that the inverse-square law applies. During each measurement the computer records the luminous intensity associated to the corresponding angles of radiation, as well as input electrical operational parameters and temperature measurements. Candela values are reported in IES format as per LM-63.

Equipment, reference standards are traceable to National Institute of Standards and Technology (NIST) and National Research Council of Canada (NRC).

Electrical Equipment

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Power Supply	Elgar	CW801	30527	N.P.C.R.	N.P.C.R.
Input Power Meter	Yokogawa	WT210	91L236541	2014/03/25	2015/04/16
Output Power Meter	N/A	N/A	N/A	N.P.C.R.	N.P.C.R.

Photometric Equipment

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Photometer	Gigahertz-Optik	X11	4502	2014/05/06	2015/09/17
Photodetector	INPHORA	IPR-PDET 19	110802	2014/05/16	2015/05/16

Environment Equipment

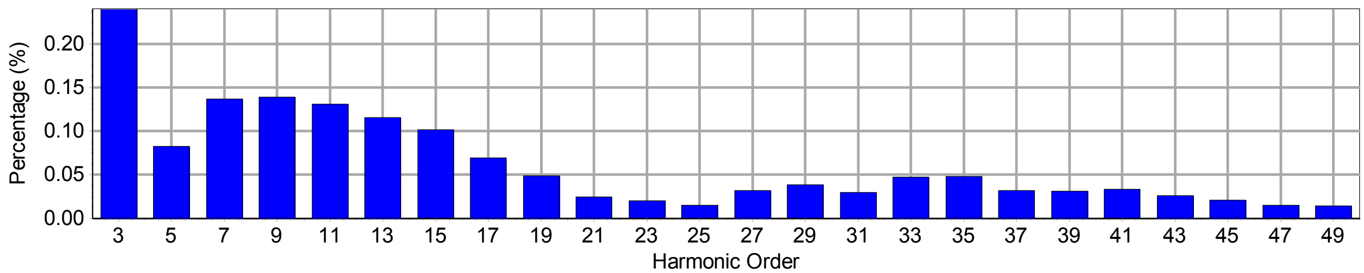
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Temperature Humidity Sensor	Omega	HH311	120504178	2014/04/16	2016/04/16

Electrical Measurements

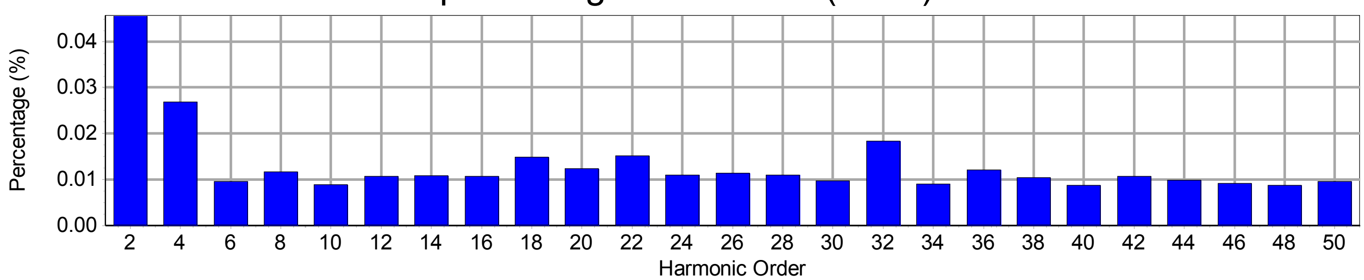
Input

Frequency	60 Hz	Active Power	241.92 W	THDV [ANSI]	0.41 %
Voltage	120.0 V(rms)	Apparent Power	242.53 VA	THDA [ANSI]	6.54 %
Current	2.0212 A(rms)	Power Factor	0.997	Max. Harmonic At	3rd order

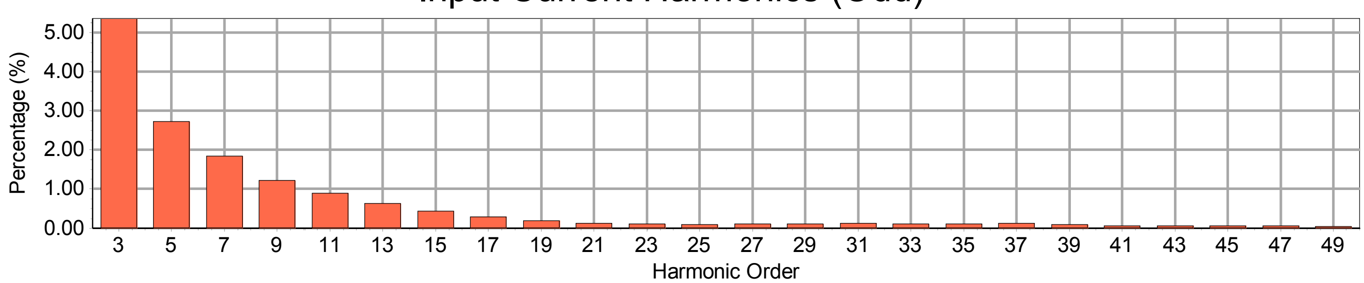
Input Voltage Harmonics (Odd)



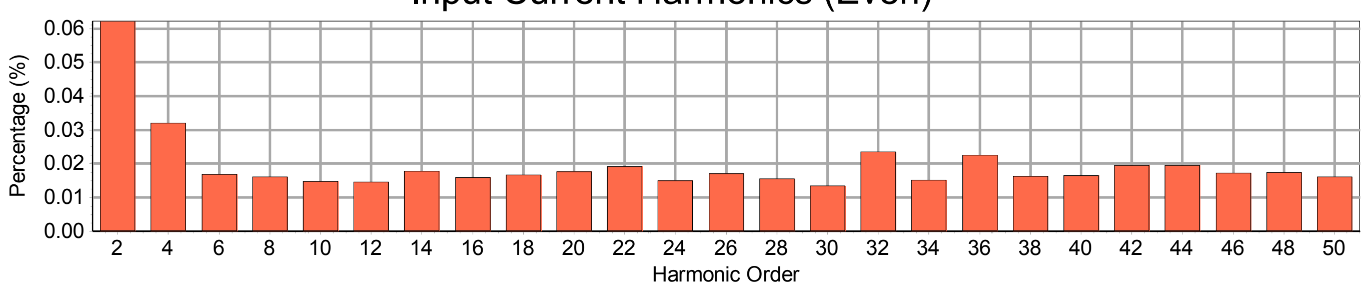
Input Voltage Harmonics (Even)



Input Current Harmonics (Odd)



Input Current Harmonics (Even)



Harmonic Measurements

Odd Harmonics				Even Harmonics			
Harmonic Order	Frequency (HZ)	Voltage Harmonics (%)	Current Harmonics (%)	Harmonic Order	Frequency (HZ)	Voltage Harmonics (%)	Current Harmonics (%)
1	60	100.000	100.000	2	120	0.046	0.062
3	180	0.241	5.370	4	240	0.027	0.032
5	300	0.083	2.728	6	360	0.010	0.017
7	420	0.137	1.839	8	480	0.012	0.016
9	540	0.140	1.226	10	600	0.009	0.015
11	660	0.131	0.887	12	720	0.011	0.015
13	780	0.115	0.626	14	840	0.011	0.018
15	900	0.101	0.431	16	960	0.011	0.016
17	1020	0.069	0.285	18	1080	0.015	0.017
19	1140	0.049	0.195	20	1200	0.012	0.018
21	1260	0.025	0.122	22	1320	0.015	0.019
23	1380	0.020	0.099	24	1440	0.011	0.015
25	1500	0.015	0.097	26	1560	0.011	0.017
27	1620	0.032	0.100	28	1680	0.011	0.016
29	1740	0.038	0.108	30	1800	0.010	0.013
31	1860	0.030	0.122	32	1920	0.018	0.023
33	1980	0.047	0.110	34	2040	0.009	0.015
35	2100	0.048	0.100	36	2160	0.012	0.023
37	2220	0.032	0.115	38	2280	0.010	0.016
39	2340	0.031	0.087	40	2400	0.009	0.016
41	2460	0.034	0.063	42	2520	0.011	0.019
43	2580	0.026	0.062	44	2640	0.010	0.019
45	2700	0.021	0.050	46	2760	0.009	0.017
47	2820	0.015	0.053	48	2880	0.009	0.017
49	2940	0.015	0.046	50	3000	0.010	0.016

Photometric Report: S1502164-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFL-241W112LED4K-T-5

Photometric Luminaire Characteristics as per IESNA RP-8-00

Nominal SSL Power	241.00 W
Luminaire Luminous Flux	25753
Measured Input Power	241.92 W
Luminaire Luminous Efficacy	106.5 lm/W
Maximum Candela Value	11129
Maximum Candela Location	37.5 °H, 72.5 °V
Maximum Candela at 90° Vertical	0
Maximum Candela at 80° Vertical	388
IES Classification	Type IV, Short, Full Cutoff
Downward Street Side Lumens	13128
Downward Street Side Efficiency	N/A
Downward House Side Lumens	12625
Downward House Side Efficiency	N/A
Downward Total Efficiency	N/A
Upward Street Side Lumens	0
Upward Street Side Efficiency	N/A
Upward House Side Lumens	0
Upward House Side Efficiency	N/A
Upward Total Efficiency	N/A
Total Luminaire Lumens	25753
Total Luminaire Efficiency	N/A

Notes

1) Luminaire tested in accordance to IES LM-31-95 and IES LM-79-08 at a distance great enough so that the inverse-square law applies.

2) Field performance may differ from laboratory measurements.

3) Results are valid for the tested material only.

4) All data published in this report are based on absolute photometry.

5) The luminaire classification is based on IESNA RP-8-00.

6) The original electronic file or paper report cannot be edited in whole or in part without written consent of Spectralux Industries Inc.

7) This photometric file describes the performance of a single luminaire and does not necessarily represent the average performance of a group of the same SSL luminaires.

8) The previous IESNA cutoff classifications (Full Cutoff, Cutoff, Semi-Cutoff and Non-Cutoff) are superseded by the Luminaire Classification System (LCS) which defines the standard solid angles for evaluation and comparison of outdoor luminaires.

Photometric Report: S1502164-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFL-241W112LED4K-T-5

Luminaire Classification System as per IESNA TM-15-11

Nominal SSL Power	241.00 W
Luminaire Luminous Flux	25753
Measured Input Power	241.92 W
Luminaire Luminous Efficacy	106.5 lm/W
Maximum Candela Value	11129
Maximum Candela Location	37.5 °H, 72.5 °V
IES Classification	Type IV, Short
Downward Street Side Lumens	13128
Downward Street Side Efficiency	N/A
Downward House Side Lumens	12625
Downward House Side Efficiency	N/A
Downward Total Lumens	25753
Downward Total Efficiency	N/A
Upward Street Side Lumens	0
Upward Street Side Efficiency	N/A
Upward House Side Lumens	0
Upward House Side Efficiency	N/A
Upward Total Lumens	0
Upward Total Efficiency	N/A
Trapped Light Lumens	0
Total Luminaire Lumens	25753
Total Luminaire Efficiency	N/A

Notes

1) Luminaire tested in accordance to IES LM-31-95 and IES LM-79-08 at a distance great enough so that the inverse-square law applies.

2) Field performance may differ from laboratory measurements.

3) Results are valid for the tested material only.

4) All data published in this report are based on absolute photometry.

5) The luminaire classification is based on IESNA TM-15-11.

6) The original electronic file or paper report cannot be edited in whole or in part without written consent of Spectralux Industries Inc.

7) This photometric file describes the performance of a single luminaire and does not necessarily represent the average performance of a group of the same SSL luminaires.

Photometric Report: S1502164-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFL-241W112LED4K-T-5

Luminaire Lumens Distribution based on 25753 total luminaire lumens as per IESNA TM-15-11

Downward Forward Light	**Lumens**
Total	13128
Lumens Distribution	
Forward Light Low (0° - 30°)	1098
Forward Light Mid (30° - 60°)	5352
Forward Light High (60° - 80°)	6619
Forward Light Very High (80° - 90°)	59

Downward Back Light	**Lumens**
Total	12625
Lumens Distribution	
Back Light Low (0° - 30°)	1112
Back Light Mid (30° - 60°)	5516
Back Light High (60° - 80°)	5964
Back Light Very High (80° - 90°)	33

Uplight	**Lumens**
Total	0
Lumens Distribution	
Uplight Low (90° - 100°)	0
Uplight High (100° - 180°)	0

Trapped Light	**Lumens**
Total	0

Notes

1) Luminaire tested in accordance to IES LM-31-95 and IES LM-79-08 at a distance great enough so that the inverse-square law applies.

2) Field performance may differ from laboratory measurements.

3) Results are valid for the tested material only.

4) All data published in this report are based on absolute photometry.

5) The luminaire classification is based on IESNA TM-15-11.

6) The original electronic file or paper report cannot be edited in whole or in part without written consent of Spectralux Industries Inc.

7) This photometric file describes the performance of a single luminaire and does not necessarily represent the average performance of a group of the same SSL luminaires.

Photometric Report: S1502164-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFL-241W112LED4K-T-5

IESNA TM-15-11 : Backlight, Uplight and Glare (BUG) Ratings

Table A-1 : Backlight Ratings (maximal zonal lumens)

Control of Backlight / Trespass

Backlight Rating

Zone	B0	B1	B2	B3	B4	B5
BH	110	500	1000	2500	5000	>5000
BM	220	1000	2500	5000	8500	>8500
BL	110	500	1000	2500	5000	>5000

Backlight Ratings

Zone	Lumens	Rating
BH	5964	B5
BM	5516	B4
BL	1112	B3

The Backlight Rating is B5.

Table A-2 : Uplight Ratings (maximal zonal lumens)

Control of Uplight / Skyglow

Uplight Rating

Zone	U0	U1	U2	U3	U4	U5
UH	0	10	50	500	1000	>1000
UL	0	10	50	500	1000	>1000

Uplight Ratings

Zone	Lumens	Rating
UH	0	U0
UL	0	U0

The Uplight Rating is U0.

Table A-3 : Glare Ratings (maximum zonal lumens)

Control of Glare / Offensive Light

Glare Rating for Asymmetrical Luminaire Types (Type I, Type II, Type III, Type IV)

Zone	G0	G1	G2	G3	G4	G5
FVH	10	100	225	500	750	>750
BVH	10	100	225	500	750	>750
FH	660	1800	5000	7500	12000	>12000
BH	110	500	1000	2500	5000	>5000

Glare Ratings for Type IV

Zone	Lumens	Rating
FVH	59	G1
BVH	33	G1
FH	6619	G3
BH	5964	G5

The Glare Rating is G5.

The BUG Rating is B5 U0 G5

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ISO/IEC 17025
NVLAP LAB CODE: 200899-0

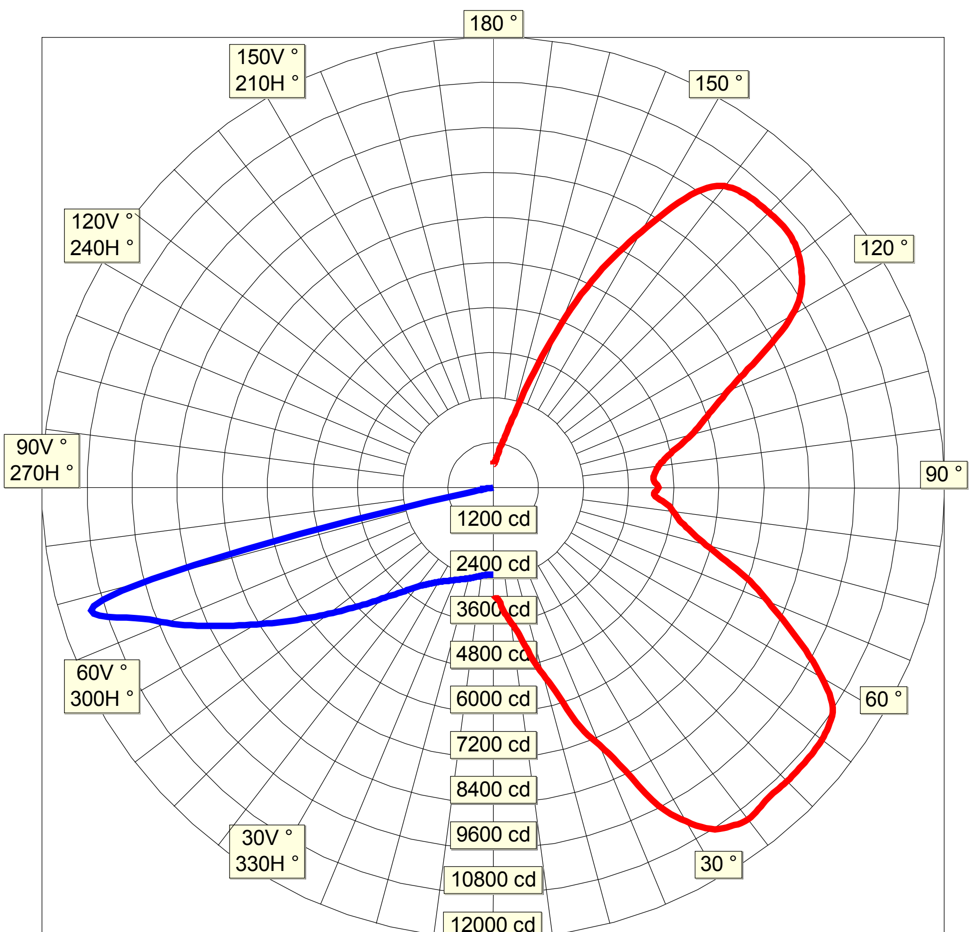
Photometric Report: S1502164-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFL-241W112LED4K-T-5

Maximum Plane and Maximum Cone Plots of Candela (1)

Plane Angles	Candela Values
0.0	2315
2.5	2314
5.0	2328
7.5	2359
10.0	2400
12.5	2447
15.0	2493
17.5	2542
20.0	2595
22.5	2653
25.0	2724
27.5	2800
30.0	2892
32.5	3003
35.0	3144
37.5	3318
40.0	3556
42.5	3838
45.0	4167
47.5	4567
50.0	5006
52.5	5514
55.0	6053
57.5	6650
60.0	7268
62.5	7961
65.0	8673
67.5	9388
70.0	10118
72.5	11129
75.0	9385
77.5	2678
80.0	383
82.5	258
85.0	140
87.5	67
90.0	0
92.5	0
95.0	0
97.5	0
100.0	0
102.5	0
105.0	0
107.5	0



Plane Through Maximum Candela	Cone Through Maximum Candela
72.5 (Vertical Degrees) = 11129	37.5 (Horizontal Degrees) = 11129

Cone Angles	Candela Values
0.0	2973
2.5	2967
5.0	3296
7.5	3596
10.0	3954
12.5	4550
15.0	5139
17.5	5832
20.0	6776
22.5	7417
25.0	8308
27.5	9540
30.0	10251
32.5	10772
35.0	10998
37.5	11129
40.0	11071
42.5	11027
45.0	11048
47.5	11047
50.0	11046
52.5	11012
55.0	10927
57.5	10691
60.0	10093
62.5	9373
65.0	8605
67.5	7904
70.0	7269
72.5	6503
75.0	5862
77.5	5392
80.0	5047
82.5	4835
85.0	4591
87.5	4283
90.0	4392
92.5	4277
95.0	4310
100.0	4675
105.0	5450
110.0	6255
115.0	7472
120.0	9176

Photometric Report: S1502164-R1

Prepared for: Philips Lumec · Test Date: 16 February 2015

Luminaire: Roadfocus · Lumcat: RFL-241W112LED4K-T-5

Maximum Plane and Maximum Cone Plots of Candela (2)

Plane Angles	Candela Values
110.0	0
112.5	0
115.0	0
117.5	0
120.0	0
122.5	0
125.0	0
127.5	0
130.0	0
132.5	0
135.0	0
137.5	0
140.0	0
142.5	0
145.0	0
147.5	0
150.0	0
152.5	0
155.0	0
157.5	0
160.0	0
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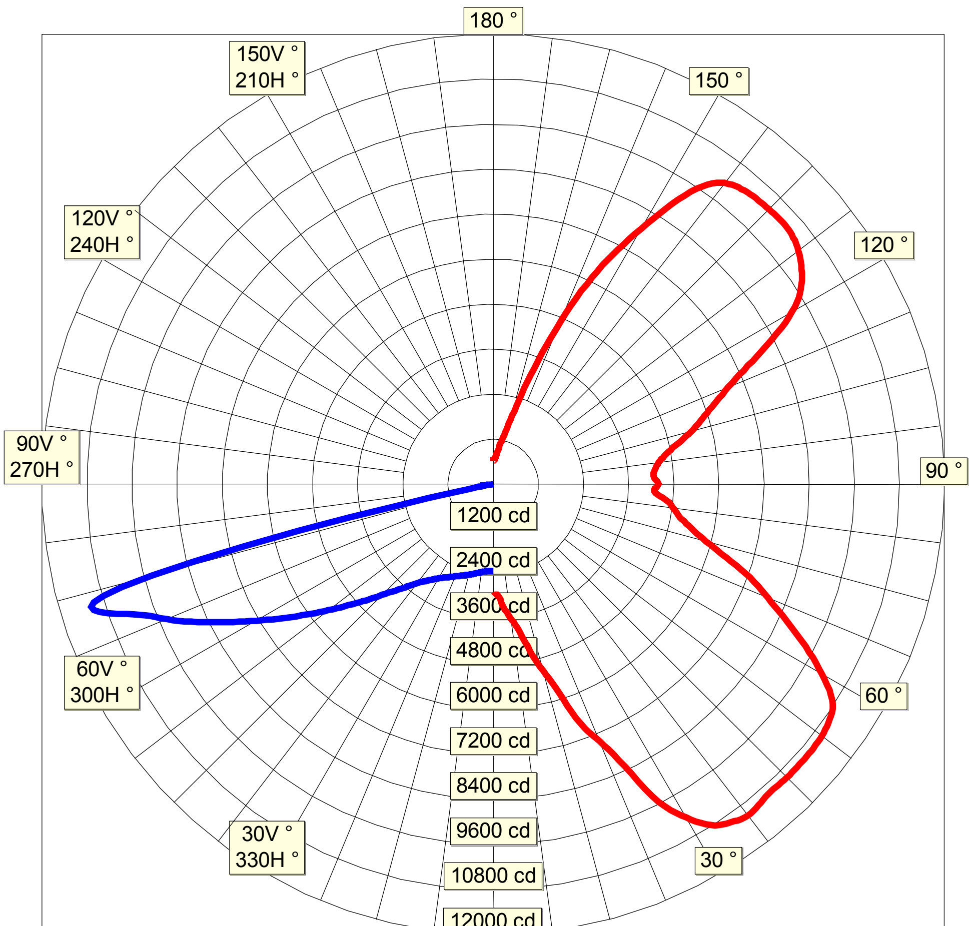
170.0	0
172.5	0
175.0	0
177.5	0
180.0	0



Plane Through Maximum Candela	Cone Through Maximum Candela
72.5 (Vertical Degrees) = 11129	37.5 (Horizontal Degrees) = 11129

Cone Angles	Candela Values
125.0	10008
130.0	10361
135.0	10371
140.0	10274
145.0	9693
150.0	7865
155.0	5886
160.0	3507
165.0	1784
170.0	1074
175.0	723
180.0	615

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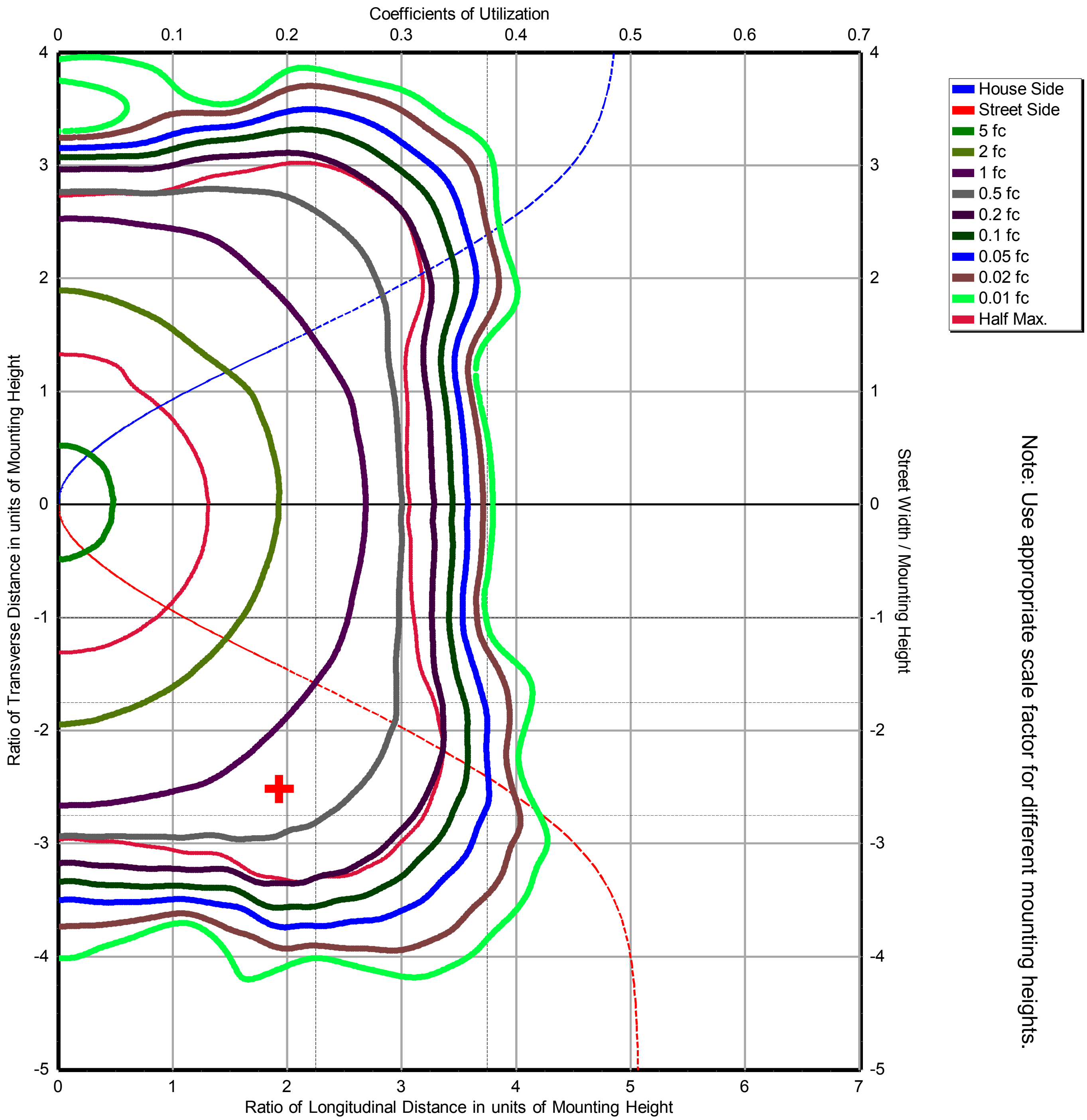
ISO/IEC 17025
NVLAP LAB CODE: 200899-0

Isoilluminance based on 20 feet of Mounting Height and Coefficients of Utilization Diagram (Right Side)



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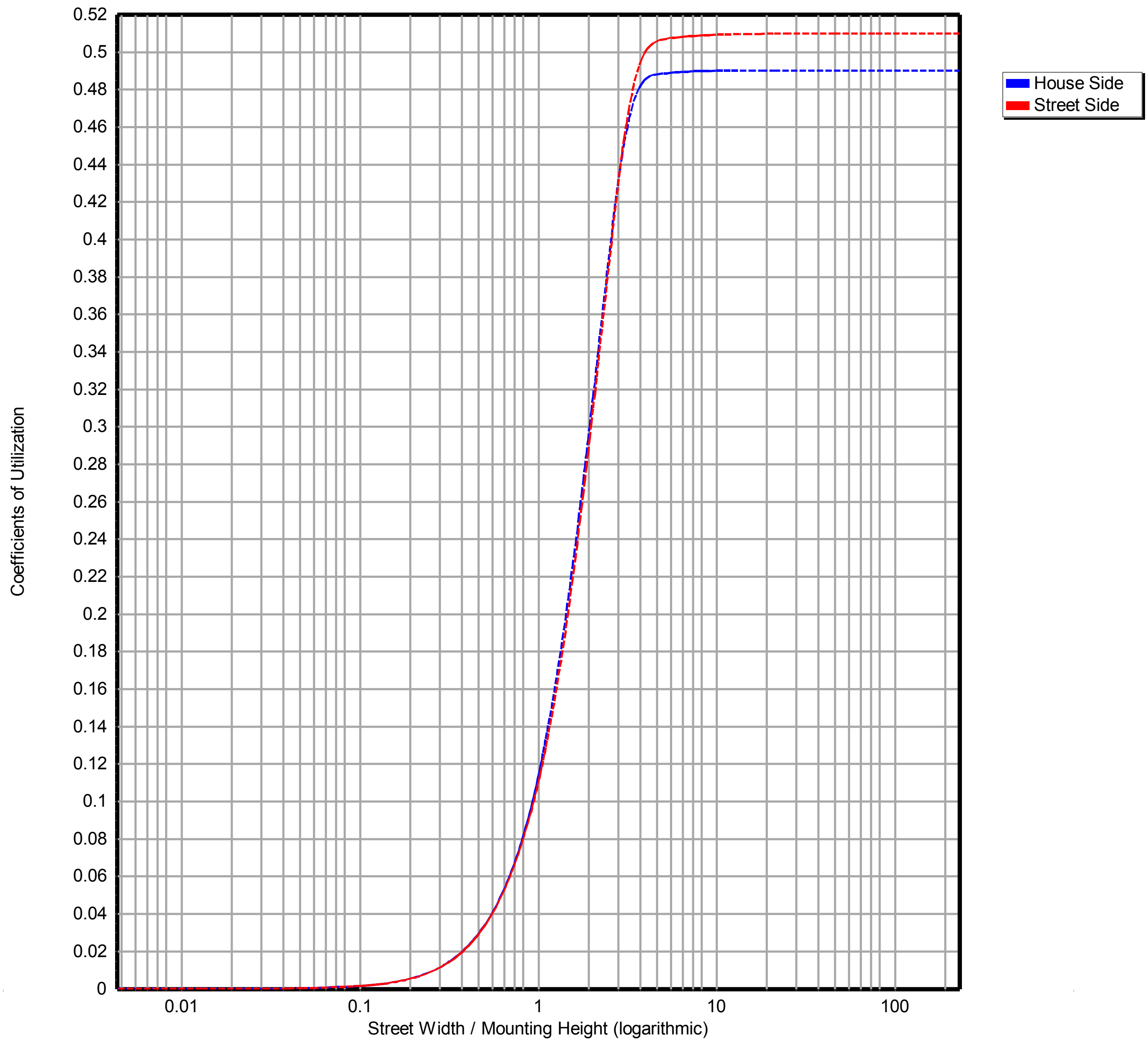
Coefficients of Utilization



IES File Headers

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IESNA:LM-63-2002
[ISSUEDATE]    16 February 2015
[TESTLAB]      Spectra Lux Industries Inc.
[TEST]         S1502164-R1
[MANUFAC]      Philips Lumec
[LUMCAT]       RFL-241W112LED4K-T-5
[LUMINAIRE]    Roadfocus
[LAMP]         (7 Clusters of 16 Luxeon T LED's) White 241W SSL c/w Advance Driver (2) LEDINTAO700C210DO @
120.00V
[_LAMPDETAILS] AC Voltage=344.29V, Current=0.7A, CCT=N/K, CRI=N/K, x=N/K, y=N/K
[_BURNING]     Vertical Base Up (25,753 Luminaire Lumens)
[_REFLECTOR]   None
[_LENS]        7X16 Clear Acrylic LED Collimators
[_HOUSING]     Die Cast Aluminum
[_SKTPOSITION] Fixed
[DISTRIBUTION] Type IV, Short
```

Candela Table

Lateral Angles

Vertical Angles	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0
0.0	2315	2315	2315	2315	2315	2315	2315	2315	2315
2.5	2331	2333	2337	2334	2331	2328	2325	2323	2321
5.0	2346	2348	2354	2350	2347	2343	2340	2340	2336
7.5	2375	2379	2385	2381	2380	2376	2374	2373	2369
10.0	2413	2418	2424	2421	2420	2416	2414	2413	2410
12.5	2459	2465	2471	2469	2468	2464	2462	2460	2457
15.0	2506	2512	2521	2518	2517	2513	2510	2509	2504
17.5	2554	2560	2570	2566	2564	2561	2558	2558	2554
20.0	2601	2607	2617	2614	2613	2611	2608	2608	2606
22.5	2653	2660	2671	2668	2667	2665	2662	2661	2659
25.0	2714	2720	2730	2729	2728	2726	2721	2719	2716
27.5	2780	2785	2796	2794	2795	2792	2787	2784	2779
30.0	2866	2869	2881	2880	2882	2878	2873	2867	2863
32.5	2978	2978	2990	2989	2991	2988	2984	2977	2973
35.0	3125	3125	3138	3135	3138	3135	3131	3124	3124
37.5	3310	3309	3321	3317	3322	3316	3314	3311	3310
40.0	3556	3550	3557	3551	3556	3548	3546	3543	3546
42.5	3826	3818	3824	3814	3820	3810	3806	3804	3810
45.0	4148	4137	4140	4125	4131	4119	4115	4111	4123
47.5	4562	4549	4552	4533	4539	4527	4524	4521	4531
50.0	5009	4998	4995	4975	4987	4980	4974	4969	4976
52.5	5545	5532	5521	5512	5521	5505	5492	5486	5490
55.0	6140	6124	6108	6093	6099	6070	6057	6052	6053
57.5	6825	6804	6784	6777	6770	6734	6708	6690	6689
60.0	7537	7520	7500	7487	7472	7422	7388	7361	7353
62.5	8304	8277	8251	8244	8213	8145	8105	8071	8057
65.0	9055	9012	8984	8959	8913	8828	8785	8744	8735
67.5	9936	9891	9863	9824	9767	9651	9574	9515	9477
70.0	8471	8426	8604	8719	8851	9030	9214	9441	9679
72.5	2973	2967	3296	3596	3954	4550	5139	5832	6776
75.0	465	461	470	477	486	504	546	730	1220
77.5	294	293	301	312	329	349	359	360	381
80.0	191	191	197	205	216	231	249	261	278
82.5	141	141	144	146	148	152	159	174	190
85.0	109	109	111	113	114	115	117	119	123

Lateral Angles

Vertical Angles

	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0
87.5	75	75	76	77	77	77	77	76	76
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	22.5	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5
0.0	2315	2315	2315	2315	2315	2315	2315	2315	2315
2.5	2321	2320	2319	2319	2317	2315	2314	2314	2315
5.0	2336	2336	2334	2335	2333	2330	2328	2328	2328
7.5	2369	2367	2366	2366	2364	2362	2359	2359	2358
10.0	2409	2408	2406	2406	2405	2402	2400	2399	2398
12.5	2456	2455	2453	2452	2452	2450	2447	2446	2446
15.0	2503	2503	2500	2499	2498	2497	2493	2493	2494
17.5	2553	2552	2549	2550	2547	2546	2542	2543	2546
20.0	2603	2603	2598	2600	2597	2597	2595	2598	2603
22.5	2657	2656	2649	2652	2651	2652	2653	2660	2667
25.0	2715	2715	2710	2715	2715	2721	2724	2731	2739
27.5	2778	2780	2779	2787	2788	2797	2800	2806	2809
30.0	2861	2866	2867	2878	2882	2889	2892	2892	2890
32.5	2973	2979	2981	2996	2999	3005	3003	2996	2991
35.0	3123	3131	3133	3148	3150	3152	3144	3134	3131
37.5	3312	3317	3319	3331	3332	3328	3318	3310	3311
40.0	3552	3555	3556	3565	3565	3563	3556	3551	3552
42.5	3816	3824	3830	3844	3841	3844	3838	3833	3835
45.0	4131	4141	4154	4166	4158	4166	4167	4168	4165
47.5	4540	4545	4550	4562	4548	4561	4567	4568	4559
50.0	4987	4991	4992	5003	4987	5002	5006	4999	4988
52.5	5499	5507	5503	5512	5501	5517	5514	5496	5487
55.0	6062	6061	6047	6055	6046	6060	6053	6027	6022
57.5	6685	6678	6663	6665	6651	6657	6650	6617	6609
60.0	7335	7323	7311	7306	7282	7275	7268	7223	7217
62.5	8042	8022	8007	8006	7981	7966	7961	7902	7894
65.0	8720	8712	8703	8699	8683	8662	8673	8603	8594
67.5	9425	9403	9392	9394	9378	9363	9388	9321	9302
70.0	9877	10110	10250	10251	10199	10134	10118	10041	10018
72.5	7417	8308	9540	10251	10772	10998	11129	11071	11027
75.0	1793	2755	5053	6332	7743	8255	9385	9772	10079
77.5	403	423	509	770	1378	1922	2678	3098	3436
80.0	293	305	331	337	360	372	383	386	388
82.5	203	212	229	239	253	256	258	254	246
85.0	127	129	134	137	143	144	140	135	130
87.5	75	73	73	71	71	69	67	65	64
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles

	22.5	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	45.0	47.5	50.0	52.5	55.0	57.5	60.0	62.5	65.0
0.0	2315	2315	2315	2315	2315	2315	2315	2315	2315
2.5	2313	2314	2315	2317	2316	2312	2314	2311	2312
5.0	2327	2327	2328	2330	2328	2325	2327	2324	2326
7.5	2356	2355	2356	2358	2355	2350	2351	2347	2349
10.0	2395	2394	2394	2396	2392	2389	2389	2384	2386
12.5	2444	2443	2443	2445	2443	2438	2437	2433	2433
15.0	2492	2492	2496	2498	2498	2494	2496	2491	2490
17.5	2544	2547	2553	2557	2559	2557	2560	2558	2558
20.0	2603	2609	2616	2620	2620	2618	2618	2616	2614
22.5	2670	2675	2680	2681	2678	2672	2667	2664	2663
25.0	2739	2740	2742	2738	2731	2723	2719	2719	2720
27.5	2805	2801	2799	2797	2791	2786	2784	2786	2786
30.0	2880	2875	2876	2878	2875	2870	2867	2870	2868
32.5	2984	2983	2984	2987	2982	2975	2971	2972	2970
35.0	3131	3131	3132	3135	3128	3119	3115	3112	3107
37.5	3313	3314	3315	3320	3313	3304	3302	3299	3290
40.0	3556	3554	3554	3556	3546	3540	3541	3539	3532
42.5	3838	3833	3829	3827	3818	3812	3816	3817	3809
45.0	4165	4152	4146	4142	4132	4127	4132	4130	4120
47.5	4559	4540	4535	4537	4521	4514	4520	4516	4509
50.0	4994	4974	4973	4979	4961	4957	4961	4958	4955
52.5	5503	5485	5487	5493	5475	5477	5483	5472	5474
55.0	6043	6031	6035	6036	6022	6029	6040	6030	6037
57.5	6629	6628	6631	6638	6628	6640	6658	6653	6662
60.0	7237	7231	7239	7247	7242	7261	7293	7294	7306
62.5	7907	7904	7909	7916	7913	7932	7965	7970	7974
65.0	8597	8589	8588	8594	8592	8599	8623	8629	8629
67.5	9281	9273	9268	9273	9281	9283	9296	9278	9265
70.0	9985	9973	9964	9974	9984	10027	10081	10058	9960
72.5	11048	11047	11046	11012	10927	10691	10093	9373	8605
75.0	10069	10064	9817	9353	8653	7977	6554	5187	3610
77.5	3381	3422	3232	2766	2438	1603	832	513	412
80.0	380	383	376	358	343	319	287	275	249
82.5	237	236	231	228	222	212	194	180	161
85.0	125	124	121	121	120	116	105	100	92
87.5	61	59	57	55	53	52	49	48	45
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

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Lateral Angles

Vertical Angles

	45.0	47.5	50.0	52.5	55.0	57.5	60.0	62.5	65.0
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Les Industries Spectralux Inc.
Spectralux Industries Inc.

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ISO/IEC 17025

NVLAP

NVLAP LAB CODE: 200899-0

Lateral Angles

Vertical Angles

	67.5	70.0	72.5	75.0	77.5	80.0	82.5	85.0	87.5
0.0	2315	2315	2315	2315	2315	2315	2315	2315	2315
2.5	2315	2314	2312	2309	2310	2309	2309	2309	2310
5.0	2328	2327	2325	2323	2324	2323	2324	2323	2325
7.5	2351	2350	2349	2348	2348	2349	2350	2351	2353
10.0	2387	2385	2384	2383	2384	2386	2388	2390	2392
12.5	2435	2431	2428	2428	2428	2429	2432	2435	2439
15.0	2492	2486	2481	2480	2477	2477	2479	2482	2487
17.5	2559	2551	2545	2541	2534	2531	2530	2532	2536
20.0	2615	2607	2599	2595	2586	2582	2580	2581	2585
22.5	2664	2659	2655	2652	2644	2639	2635	2635	2640
25.0	2722	2721	2719	2716	2712	2705	2700	2699	2703
27.5	2788	2789	2789	2787	2783	2778	2773	2772	2773
30.0	2871	2870	2872	2872	2870	2868	2865	2863	2862
32.5	2973	2973	2978	2981	2982	2983	2980	2979	2978
35.0	3105	3107	3116	3119	3123	3128	3127	3126	3125
37.5	3282	3281	3292	3293	3298	3303	3303	3304	3304
40.0	3520	3519	3531	3530	3536	3540	3542	3542	3541
42.5	3792	3786	3795	3790	3796	3796	3799	3801	3800
45.0	4101	4090	4094	4088	4095	4095	4103	4109	4108
47.5	4496	4487	4494	4494	4502	4503	4512	4524	4526
50.0	4948	4941	4948	4948	4959	4956	4968	4984	4988
52.5	5473	5465	5471	5480	5498	5490	5508	5528	5538
55.0	6039	6031	6040	6057	6073	6066	6087	6110	6123
57.5	6667	6662	6672	6696	6711	6711	6738	6767	6786
60.0	7308	7302	7318	7339	7352	7358	7393	7420	7453
62.5	7977	7961	7977	8006	8032	8049	8092	8126	8169
65.0	8631	8613	8624	8638	8673	8696	8739	8775	8821
67.5	9266	9253	9290	9344	9415	9485	9549	9603	9673
70.0	9828	9644	9439	9273	9182	9130	9103	9078	8997
72.5	7904	7269	6503	5862	5392	5047	4835	4591	4283
75.0	2493	1687	1030	697	501	460	437	417	400
77.5	369	331	297	277	265	248	237	229	222
80.0	233	215	198	185	169	160	152	146	141
82.5	149	137	122	111	101	97	93	88	85
85.0	85	80	74	70	66	63	61	59	57
87.5	44	42	40	38	36	34	33	32	30
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

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Lateral Angles

Vertical Angles

	67.5	70.0	72.5	75.0	77.5	80.0	82.5	85.0	87.5
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

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Lateral Angles

Vertical Angles

	90.0	92.5	95.0	100.0	105.0	110.0	115.0	120.0	125.0
0.0	2315	2315	2315	2315	2315	2315	2315	2315	2315
2.5	2314	2311	2309	2304	2307	2310	2311	2314	2314
5.0	2330	2326	2324	2320	2321	2326	2327	2328	2328
7.5	2359	2356	2354	2351	2353	2358	2361	2362	2364
10.0	2398	2396	2394	2392	2394	2399	2402	2406	2408
12.5	2445	2444	2443	2440	2443	2447	2452	2456	2459
15.0	2494	2493	2492	2487	2490	2496	2501	2507	2510
17.5	2543	2542	2543	2537	2541	2546	2554	2561	2567
20.0	2592	2591	2593	2590	2597	2602	2610	2619	2626
22.5	2648	2648	2651	2647	2656	2662	2670	2680	2691
25.0	2713	2715	2719	2712	2721	2727	2737	2751	2768
27.5	2781	2786	2791	2785	2793	2798	2810	2830	2849
30.0	2868	2873	2879	2877	2886	2890	2909	2932	2949
32.5	2982	2986	2995	2995	3007	3009	3033	3059	3074
35.0	3128	3132	3143	3146	3162	3170	3197	3222	3235
37.5	3308	3309	3320	3322	3344	3359	3393	3424	3432
40.0	3541	3539	3554	3555	3578	3601	3643	3677	3695
42.5	3796	3794	3809	3814	3842	3876	3933	3976	4005
45.0	4105	4106	4123	4127	4163	4209	4278	4323	4363
47.5	4521	4525	4545	4550	4593	4639	4702	4749	4795
50.0	4979	4993	5015	5024	5068	5116	5177	5224	5264
52.5	5521	5542	5569	5575	5618	5671	5726	5769	5811
55.0	6111	6134	6160	6171	6211	6262	6303	6347	6403
57.5	6774	6809	6835	6843	6866	6911	6930	6982	7054
60.0	7444	7484	7511	7523	7530	7571	7575	7641	7687
62.5	8158	8207	8235	8232	8212	8247	8252	8349	8108
65.0	8810	8859	8883	8874	8857	8892	8926	8781	8316
67.5	9663	9699	9711	9665	9568	9559	9524	8907	8765
70.0	9048	9013	9006	9082	9267	9639	9496	9478	9481
72.5	4392	4277	4310	4675	5450	6255	7472	9176	10008
75.0	400	392	397	417	473	852	2412	5050	6523
77.5	221	219	220	229	242	252	311	402	885
80.0	141	139	141	147	149	166	190	214	221
82.5	85	84	84	83	83	100	114	125	137
85.0	57	56	56	54	54	54	56	56	56
87.5	30	30	30	29	29	29	29	27	26
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles

	90.0	92.5	95.0	100.0	105.0	110.0	115.0	120.0	125.0
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles

	130.0	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0
0.0	2315	2315	2315	2315	2315	2315	2315	2315	2315
2.5	2315	2313	2315	2320	2322	2324	2324	2325	2331
5.0	2330	2327	2330	2334	2337	2340	2341	2345	2353
7.5	2365	2360	2365	2366	2368	2371	2374	2380	2389
10.0	2413	2409	2413	2414	2413	2413	2414	2421	2430
12.5	2467	2465	2472	2476	2476	2472	2469	2472	2478
15.0	2519	2522	2532	2540	2546	2541	2534	2528	2529
17.5	2578	2586	2594	2604	2612	2609	2604	2592	2586
20.0	2640	2653	2658	2664	2668	2665	2664	2656	2646
22.5	2707	2720	2721	2719	2721	2723	2727	2724	2711
25.0	2783	2789	2784	2786	2790	2796	2798	2797	2786
27.5	2860	2860	2860	2864	2869	2872	2875	2877	2875
30.0	2955	2957	2963	2965	2967	2972	2978	2986	2990
32.5	3077	3084	3090	3095	3093	3098	3107	3123	3129
35.0	3241	3253	3262	3274	3275	3273	3282	3301	3311
37.5	3446	3467	3476	3492	3501	3495	3507	3526	3538
40.0	3720	3744	3751	3766	3784	3786	3795	3814	3828
42.5	4040	4062	4066	4084	4104	4111	4116	4127	4108
45.0	4405	4427	4431	4453	4470	4482	4492	4501	4514
47.5	4839	4863	4876	4906	4923	4920	4907	4882	4859
50.0	5305	5340	5358	5394	5366	5282	5201	5135	5084
52.5	5842	5893	5895	5833	5705	5541	5471	5450	5436
55.0	6419	6449	6313	6100	5981	5893	5896	5920	5949
57.5	7053	6884	6583	6428	6426	6449	6489	6534	6576
60.0	7509	7161	6964	6957	7021	7058	7093	7149	7202
62.5	7763	7586	7584	7610	7673	7697	7718	7799	7858
65.0	8197	8197	8227	8239	8295	8311	8335	8454	8549
67.5	8811	8812	8829	8854	8956	9028	9014	8987	8980
70.0	9503	9512	9573	9693	9611	9029	7941	6824	6196
72.5	10361	10371	10274	9693	7865	5886	3507	1784	1074
75.0	7586	7420	6645	5218	2893	960	333	287	262
77.5	1529	1328	1083	590	315	253	215	189	157
80.0	233	233	231	215	197	162	133	107	84
82.5	136	129	130	128	113	90	70	58	55
85.0	53	52	49	49	42	36	33	29	28
87.5	25	24	24	23	23	23	23	23	23
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
107.5	0	0	0	0	0	0	0	0	0
110.0	0	0	0	0	0	0	0	0	0
112.5	0	0	0	0	0	0	0	0	0
115.0	0	0	0	0	0	0	0	0	0
117.5	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
122.5	0	0	0	0	0	0	0	0	0
125.0	0	0	0	0	0	0	0	0	0
127.5	0	0	0	0	0	0	0	0	0
130.0	0	0	0	0	0	0	0	0	0
132.5	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	130.0	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0
135.0	0	0	0	0	0	0	0	0	0
137.5	0	0	0	0	0	0	0	0	0
140.0	0	0	0	0	0	0	0	0	0
142.5	0	0	0	0	0	0	0	0	0
145.0	0	0	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0	0	0
155.0	0	0	0	0	0	0	0	0	0
157.5	0	0	0	0	0	0	0	0	0
160.0	0	0	0	0	0	0	0	0	0
162.5	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
167.5	0	0	0	0	0	0	0	0	0
170.0	0	0	0	0	0	0	0	0	0
172.5	0	0	0	0	0	0	0	0	0
175.0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0

Lateral Angles

Vertical Angles	175.0	180.0
0.0	2315	2315
2.5	2336	2331
5.0	2359	2356
7.5	2396	2395
10.0	2438	2439
12.5	2489	2491
15.0	2540	2541
17.5	2593	2592
20.0	2650	2649
22.5	2711	2714
25.0	2783	2787
27.5	2868	2868
30.0	2983	2977
32.5	3127	3115
35.0	3310	3297
37.5	3537	3523
40.0	3830	3810
42.5	4149	4130
45.0	4513	4491
47.5	4841	4815
50.0	5080	5060
52.5	5459	5456
55.0	5991	6002
57.5	6626	6641
60.0	7260	7277
62.5	7936	7955
65.0	8679	8719
67.5	8940	8869
70.0	5602	5318
72.5	723	615
75.0	239	224
77.5	142	135
80.0	77	74
82.5	53	52
85.0	28	28
87.5	23	24
90.0	0	0
92.5	0	0
95.0	0	0
97.5	0	0
100.0	0	0
102.5	0	0
105.0	0	0
107.5	0	0
110.0	0	0
112.5	0	0
115.0	0	0
117.5	0	0
120.0	0	0
122.5	0	0
125.0	0	0
127.5	0	0
130.0	0	0
132.5	0	0

Lateral Angles

Vertical Angles

	175.0	180.0
135.0	0	0
137.5	0	0
140.0	0	0
142.5	0	0
145.0	0	0
147.5	0	0
150.0	0	0
152.5	0	0
155.0	0	0
157.5	0	0
160.0	0	0
162.5	0	0
165.0	0	0
167.5	0	0
170.0	0	0
172.5	0	0
175.0	0	0
177.5	0	0
180.0	0	0

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ISO/IEC 17025

NVLAP LAB CODE: 200899-0

Sphere Test Report

Standard(s) CIE 84-1989, IESNA LM-16-93, IESNA LM-58-94, IES LM-79-08, ANSI C82.77-2002

Customer Philips Lumec, 640 Curé Boivin, Boisbriand, Québec, Canada, J7G 2A7

General Information		Lamp Details: CY1934		Driver Details: CY688	
Test Report	L1502172-C1	**Description**	7 Clusters of 16 Luxeon T LED's	**Type**	Commercial
Test Date	17 February 2015	**Manufacturer**	Philips	**Description**	241W
Report Date	17 February 2015	**Catalog No.**	RFL-241W112LED4K-T-5	**Manufacturer**	Advance
Sphere Temperature	25.8 °C	**Serial No.**	SRIS 1789	**Catalog No.**	(2) LEDINTAO700C21ODO
Humidity	6.1 %	**Diameter**	N/A mm	**Voltage**	120.00 V
Lamp Type	SSL	**Color**	White	**Power Factor**	0.9900

Stabilization Time: 2 hours

Tested By: Jean-Paul Ojeil

Approved Signatory: Chrisnel Blot

Signature:

Notes

1) Field performance may differ from laboratory measurements. Results are valid for tested material only.

2) The original electronic file or paper report cannot be edited in whole or in part without written consent of Spectra Lux Industries Inc.

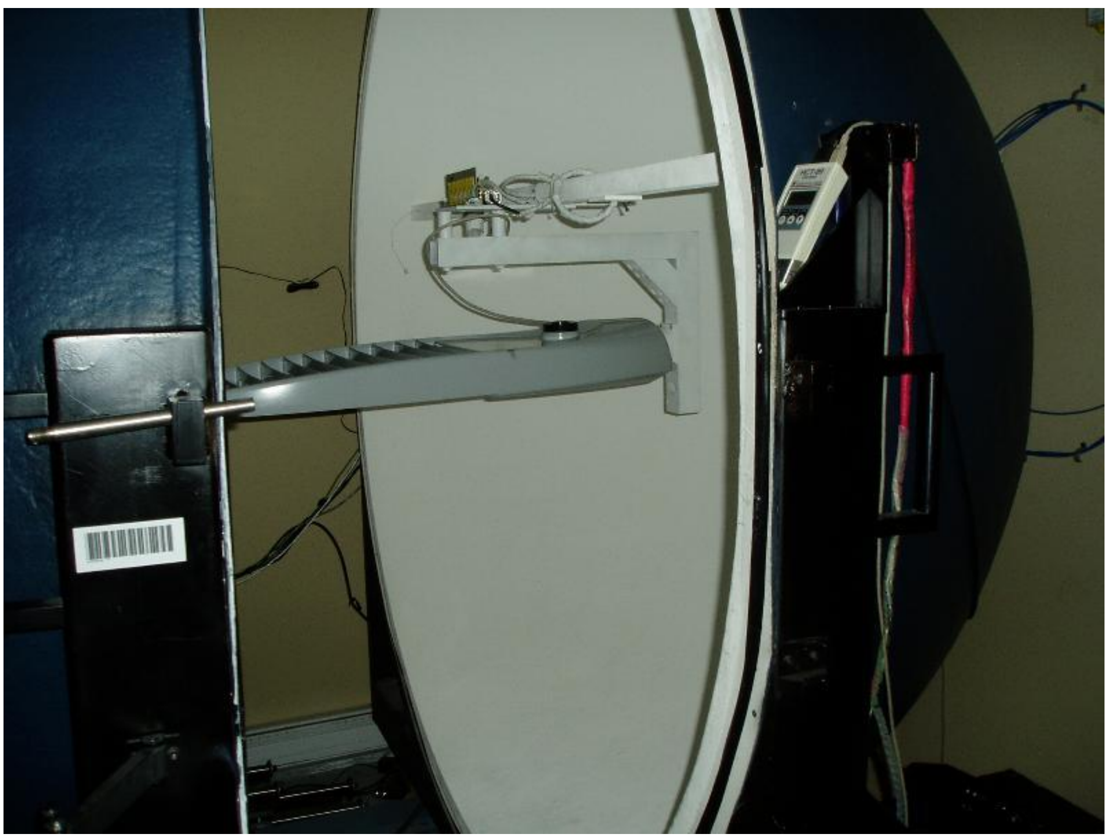
3) This test report describes the performance of a single product and does not necessarily represent the average performance of a group of the same SSL product.

Realization of Sphere Test

A 4π sphere-spectroradiometer equipped with auxiliary lamp to correct self-absorption was used during the measurements of electrical, photometric and colorimetric properties of the sample under test. The size of the integrating sphere used is large enough to ensure that the measurement errors due to effects of baffle and self-absorption by the sample test are not significant.

During the test, a commercial driver was used and adjusted to nominal electrical characteristics specified by the driver manufacturer or the client. Good electrical contacts have been used to ensure the control of electrical parameters of the commercial driver and an adequate stabilization period prior to collecting data. The self-absorbance was measured and a geometrical correction factor was applied to the luminous flux value to take into account the sphere configuration.

Results of the measurements are traceable to reference standards developed and maintained by the National Institute of Standards and Technology (NIST) and National Research Council of Canada (NRC).



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Electrical Equipment

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Auxiliary Power Supply	Sorenson	DSC-60-18E	051B1142	N.P.C.R.	N.P.C.R.
Test Power Supply	California Instruments	801RP	05816	N.P.C.R.	N.P.C.R.
Input Power Meter	Yokogawa	WT210	91L236540	2014/10/22	2015/10/22
Output Power Meter	N/A	N/A	N/A	N.P.C.R.	N.P.C.R.
Shunt Resistor	Fluke	Y5020	5675014	2014/08/06	2015/08/06
Current Multimeter	HP Agilent	HP34401A	US36121202	2014/08/06	2015/08/06
Voltage Multimeter	Fluke	Fluke8842A	5750288	2014/04/16	2015/04/16

Spectrometer Equipment

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Spectrometer	Ocean Optics	USB2000N	USB2E3864	2014/08/24	2015/08/24

Environment Equipment

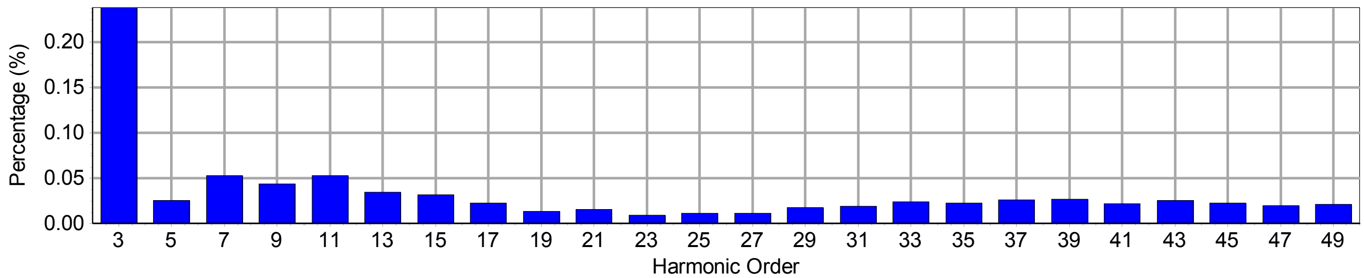
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Temperature Humidity Sensor	Omega	HH311	120504176	2014/04/16	2016/04/16

Electrical Measurements

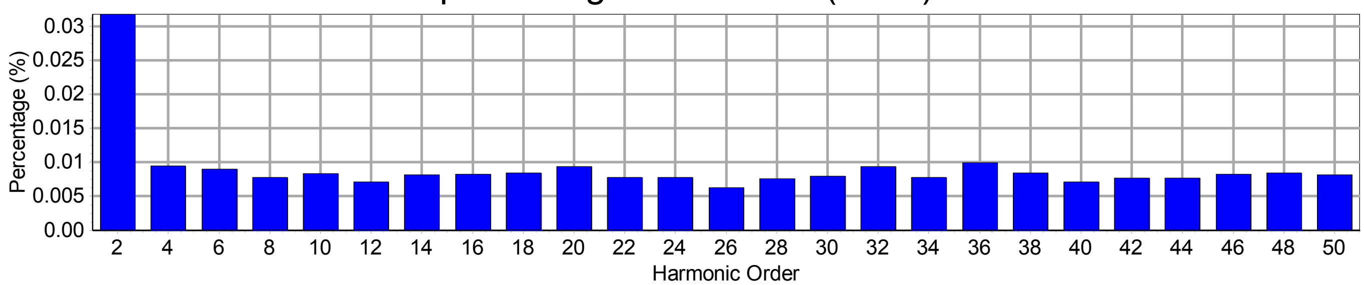
Input

Frequency	60 Hz	Active Power	242.08 W	THDV [ANSI]	0.27 %
Voltage	120.2 V(rms)	Apparent Power	242.69 VA	THDA [ANSI]	6.53 %
Current	2.0189 A(rms)	Power Factor	0.997	Max. Harmonic At	3rd order

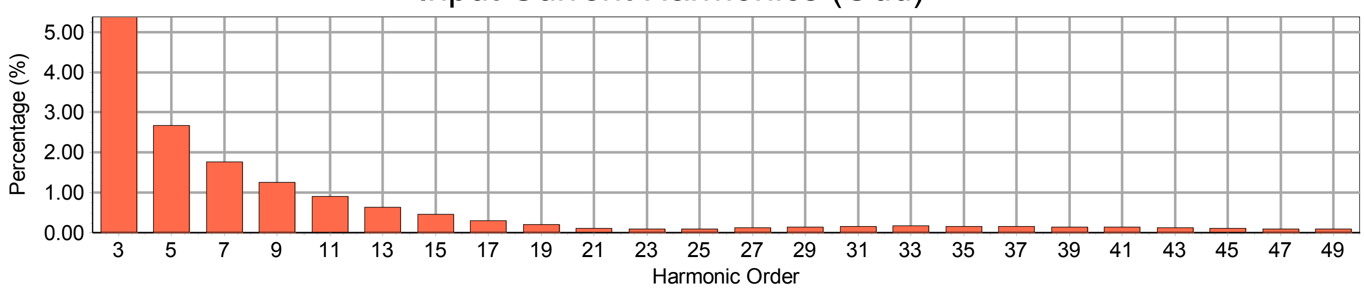
Input Voltage Harmonics (Odd)



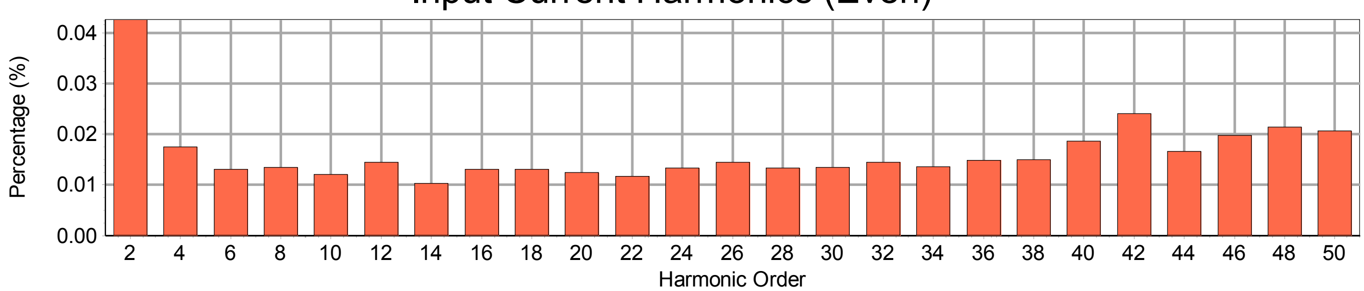
Input Voltage Harmonics (Even)



Input Current Harmonics (Odd)



Input Current Harmonics (Even)



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Harmonic Measurements

Odd Harmonics				Even Harmonics			
Harmonic Order	Frequency (HZ)	Voltage Harmonics (%)	Current Harmonics (%)	Harmonic Order	Frequency (HZ)	Voltage Harmonics (%)	Current Harmonics (%)
1	60	100.000	100.000	2	120	0.032	0.043
3	180	0.239	5.389	4	240	0.009	0.017
5	300	0.025	2.677	6	360	0.009	0.013
7	420	0.053	1.761	8	480	0.008	0.013
9	540	0.044	1.249	10	600	0.008	0.012
11	660	0.052	0.895	12	720	0.007	0.014
13	780	0.035	0.635	14	840	0.008	0.010
15	900	0.031	0.447	16	960	0.008	0.013
17	1020	0.023	0.292	18	1080	0.008	0.013
19	1140	0.013	0.192	20	1200	0.009	0.012
21	1260	0.015	0.111	22	1320	0.008	0.012
23	1380	0.009	0.089	24	1440	0.008	0.013
25	1500	0.011	0.094	26	1560	0.006	0.014
27	1620	0.011	0.121	28	1680	0.008	0.013
29	1740	0.017	0.142	30	1800	0.008	0.013
31	1860	0.019	0.146	32	1920	0.009	0.015
33	1980	0.024	0.161	34	2040	0.008	0.014
35	2100	0.022	0.152	36	2160	0.010	0.015
37	2220	0.026	0.155	38	2280	0.008	0.015
39	2340	0.027	0.139	40	2400	0.007	0.019
41	2460	0.022	0.129	42	2520	0.008	0.024
43	2580	0.025	0.118	44	2640	0.008	0.017
45	2700	0.022	0.098	46	2760	0.008	0.020
47	2820	0.019	0.093	48	2880	0.008	0.021
49	2940	0.021	0.082	50	3000	0.008	0.021

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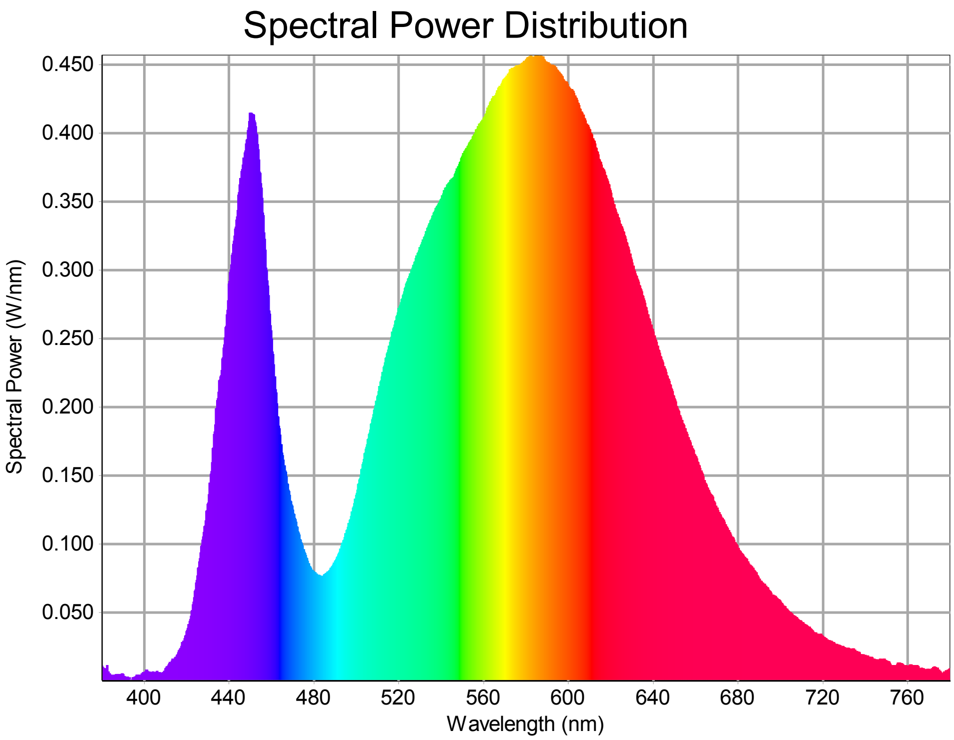
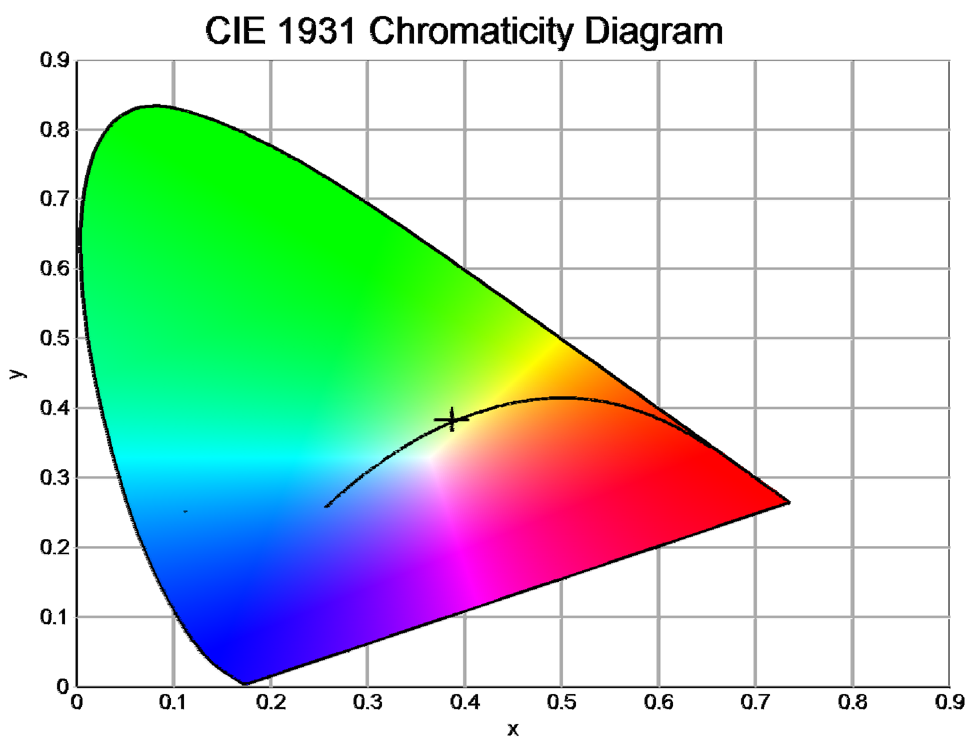


Peak Wavelength	585 nm
Luminous Flux	25658 lm
Input Power	242.08 W
Lumens/Watt	106.0
Full Width/Half Maximum	132.43
Center Wavelength	579 nm
Centroid Wavelength	368 nm
Dominant Wavelength	488 nm
Excitation Purity	0.1555
Colorimeric Purity	0.1046



x	0.3863	CCT	3900 K
y	0.3843	CRI	74
u	0.2260	L*	25.67
v	0.3372	a*	-5.23
u'	0.2260	b*	-13.52
v'	0.5057	Duv	0.0018

R1	70.9	R9	-20.6
R2	80.4	R10	53.2
R3	87.7	R11	68.1
R4	72.7	R12	46.4
R5	70.5	R13	72.4
R6	72.1	R14	92.9
R7	82.5		
R8	55.1		

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Spectral Power Distribution Table (1/4)

Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)
380	0.01131	405	0.00578	430	0.12933	455	0.36382
381	0.00919	406	0.00743	431	0.14471	456	0.34228
382	0.00776	407	0.00670	432	0.15998	457	0.31479
383	0.00713	408	0.00559	433	0.18042	458	0.29269
384	0.00480	409	0.00656	434	0.19895	459	0.27050
385	0.00393	410	0.00937	435	0.21146	460	0.25010
386	0.00473	411	0.01109	436	0.22237	461	0.23157
387	0.00536	412	0.01390	437	0.23562	462	0.21335
388	0.00520	413	0.01518	438	0.25091	463	0.19346
389	0.00460	414	0.01534	439	0.26781	464	0.17993
390	0.00546	415	0.01790	440	0.29039	465	0.16668
391	0.00340	416	0.02095	441	0.30443	466	0.15765
392	0.00341	417	0.02414	442	0.31916	467	0.14939
393	0.00290	418	0.02841	443	0.33056	468	0.13982
394	0.00081	419	0.03124	444	0.34401	469	0.13182
395	0.00297	420	0.03667	445	0.36243	470	0.12552
396	0.00389	421	0.04154	446	0.37257	471	0.11919
397	0.00355	422	0.04786	447	0.38210	472	0.11318
398	0.00426	423	0.05622	448	0.39242	473	0.10700
399	0.00582	424	0.06613	449	0.40237	474	0.10160
400	0.00629	425	0.07720	450	0.41487	475	0.09656
401	0.00841	426	0.08745	451	0.41320	476	0.09197
402	0.00666	427	0.09863	452	0.40929	477	0.08777
403	0.00622	428	0.10899	453	0.39995	478	0.08413
404	0.00715	429	0.11759	454	0.38065	479	0.08141

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Spectral Power Distribution Table (2/4)

Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)
480	0.08005	505	0.17318	530	0.31667	555	0.39768
481	0.07862	506	0.18023	531	0.32081	556	0.40069
482	0.07779	507	0.18774	532	0.32414	557	0.40314
483	0.07697	508	0.19471	533	0.32839	558	0.40687
484	0.07684	509	0.20162	534	0.33260	559	0.40864
485	0.07813	510	0.20810	535	0.33627	560	0.41121
486	0.07925	511	0.21530	536	0.33998	561	0.41402
487	0.08054	512	0.22271	537	0.34337	562	0.41868
488	0.08282	513	0.22960	538	0.34681	563	0.42237
489	0.08511	514	0.23626	539	0.34926	564	0.42523
490	0.08785	515	0.24224	540	0.35254	565	0.42687
491	0.09094	516	0.24785	541	0.35623	566	0.42961
492	0.09471	517	0.25497	542	0.36032	567	0.43310
493	0.09869	518	0.26030	543	0.36270	568	0.43436
494	0.10273	519	0.26646	544	0.36474	569	0.43818
495	0.10809	520	0.27238	545	0.36671	570	0.44041
496	0.11272	521	0.27646	546	0.36794	571	0.44206
497	0.11786	522	0.28185	547	0.37231	572	0.44449
498	0.12379	523	0.28712	548	0.37567	573	0.44665
499	0.12997	524	0.29218	549	0.37914	574	0.44780
500	0.13626	525	0.29564	550	0.38372	575	0.44850
501	0.14396	526	0.29987	551	0.38682	576	0.44956
502	0.15053	527	0.30400	552	0.38914	577	0.44984
503	0.15837	528	0.30883	553	0.39275	578	0.45113
504	0.16625	529	0.31277	554	0.39493	579	0.45270

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Spectral Power Distribution Table (3/4)

Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)
580	0.45374	605	0.42078	630	0.30553	655	0.18472
581	0.45554	606	0.41607	631	0.30043	656	0.18057
582	0.45645	607	0.41343	632	0.29613	657	0.17617
583	0.45560	608	0.40937	633	0.29160	658	0.17224
584	0.45573	609	0.40632	634	0.28698	659	0.16863
585	0.45726	610	0.40317	635	0.28175	660	0.16463
586	0.45596	611	0.39910	636	0.27635	661	0.16033
587	0.45678	612	0.39503	637	0.27064	662	0.15570
588	0.45611	613	0.38970	638	0.26499	663	0.15239
589	0.45275	614	0.38469	639	0.26050	664	0.14701
590	0.45111	615	0.37958	640	0.25543	665	0.14366
591	0.45118	616	0.37491	641	0.24989	666	0.14000
592	0.44950	617	0.37210	642	0.24502	667	0.13680
593	0.44970	618	0.36755	643	0.23996	668	0.13459
594	0.44834	619	0.36307	644	0.23492	669	0.13049
595	0.44601	620	0.35651	645	0.23006	670	0.12690
596	0.44397	621	0.35067	646	0.22579	671	0.12330
597	0.44191	622	0.34529	647	0.22101	672	0.12029
598	0.43853	623	0.34100	648	0.21708	673	0.11823
599	0.43770	624	0.33661	649	0.21158	674	0.11463
600	0.43423	625	0.33243	650	0.20649	675	0.11194
601	0.43235	626	0.32832	651	0.20116	676	0.10876
602	0.43150	627	0.32300	652	0.19712	677	0.10585
603	0.42764	628	0.31786	653	0.19249	678	0.10342
604	0.42432	629	0.31226	654	0.18851	679	0.10039

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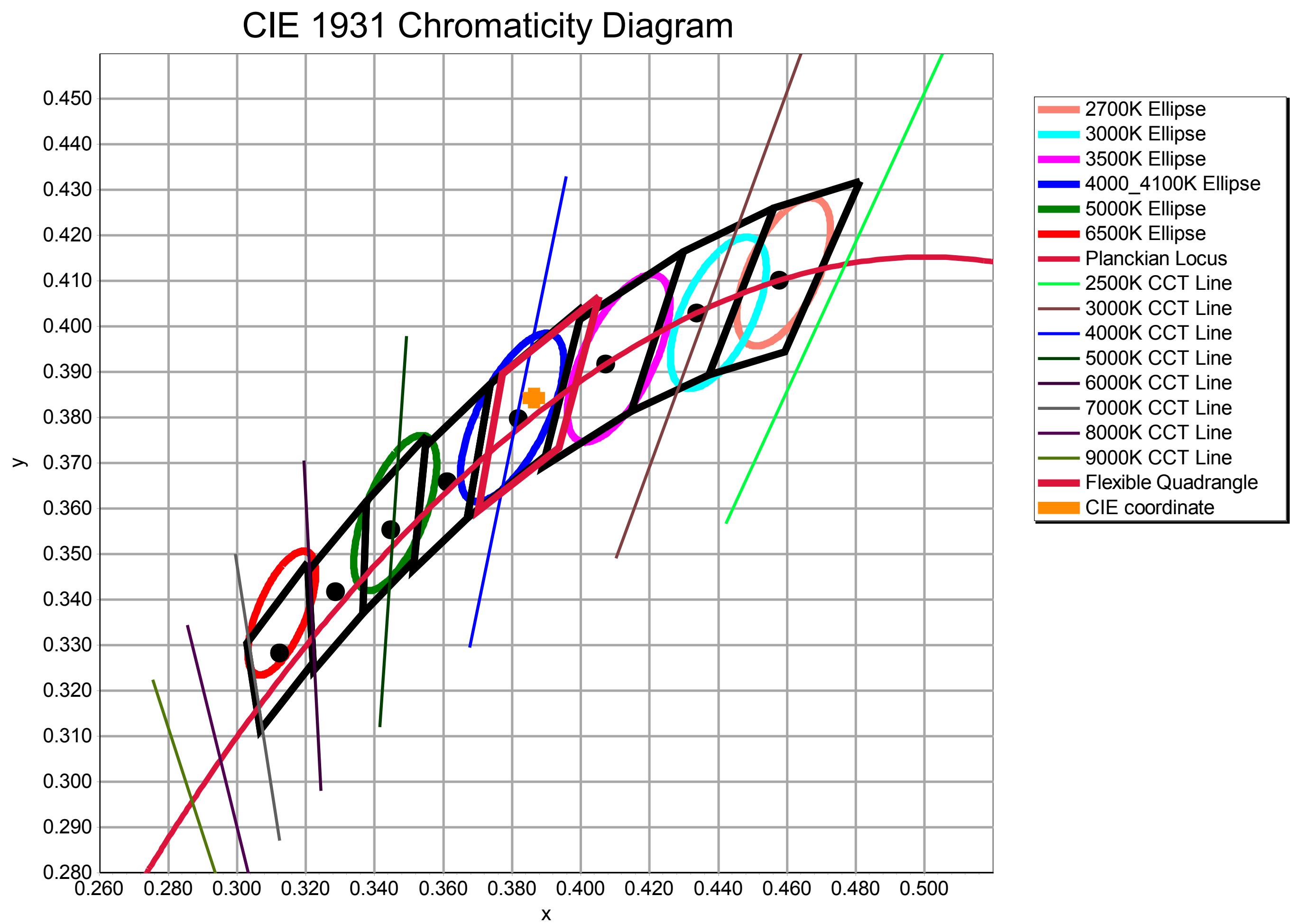
Spectral Power Distribution Table (4/4)

Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)	Wavelength (nm)	Spectral Power (W/nm)
680	0.09732	706	0.04833	732	0.02427	758	0.01195
681	0.09477	707	0.04708	733	0.02355	759	0.01200
682	0.09302	708	0.04584	734	0.02376	760	0.01106
683	0.09074	709	0.04453	735	0.02301	761	0.01216
684	0.08916	710	0.04313	736	0.02223	762	0.01157
685	0.08611	711	0.04212	737	0.02146	763	0.01158
686	0.08457	712	0.04146	738	0.01960	764	0.01188
687	0.08285	713	0.03973	739	0.01960	765	0.01086
688	0.08025	714	0.03895	740	0.01913	766	0.00949
689	0.07754	715	0.03732	741	0.01894	767	0.00937
690	0.07489	716	0.03565	742	0.01778	768	0.00855
691	0.07280	717	0.03481	743	0.01777	769	0.00903
692	0.07115	718	0.03441	744	0.01633	770	0.00893
693	0.06984	719	0.03450	745	0.01613	771	0.00831
694	0.06812	720	0.03302	746	0.01582	772	0.01037
695	0.06600	721	0.03167	747	0.01630	773	0.01034
696	0.06338	722	0.03061	748	0.01583	774	0.00982
697	0.06277	723	0.02983	749	0.01630	775	0.00776
698	0.06138	724	0.02935	750	0.01503	776	0.00585
699	0.06005	725	0.02867	751	0.01472	777	0.00698
700	0.05817	726	0.02700	752	0.01143	778	0.00787
701	0.05606	727	0.02656	753	0.01189	779	0.00832
702	0.05482	728	0.02622	754	0.01166	780	0.00952
703	0.05274	729	0.02537	755	0.01271		
704	0.05089	730	0.02486	756	0.01372		
705	0.05006	731	0.02395	757	0.01332		

CIE Chromaticity Diagram for Indoor SSL products



Chromaticity tolerance of Flexible CCT at nominal CCT of 3900K

				x	y
		Center Point		0.3856	0.3818
Min CCT	3626		A	0.4052	0.4066
Max CCT	4174	Tolerance	B	0.3773	0.3896
Delta T	274	Quadrangle	C	0.3701	0.3595
Center Duv	0.0009		D	0.3937	0.3734

PHILIPS

Philips RoadFocus Luminairies Recyclability Content

The Philips RoadFocus luminaire recyclability content is calculated by raw material weight. All mechanical components and IP66 optical modules are considered for this calculation. Driver module is not included on this report. Additionally, the cardboard packaging it is shipped in is 100% recyclable. Detailed percentage luminaire weight for the various materials is listed below.

Standard RFS model:

79.8% of the material used in the RoadFocus Small RFS luminaire is made of recyclable aluminum.
6.6% of the material used in the RoadFocus Small RFS luminaire is made of recyclable steel.
0.8% of the material used in the RoadFocus Small RFS luminaire is made of recyclable cooper.
8.0% of the material used in the RoadFocus Small RFS luminaire is made of recyclable plastic.
4.8% of the material used in the RoadFocus Small RFS luminaire is electrical components.

Standard RFM model:

78.2% of the material used in the RoadFocus Medium RFM luminaire is made of recyclable aluminum.
5.5% of the material used in the RoadFocus Medium RFM luminaire is made of recyclable steel.
0.7% of the material used in the RoadFocus Medium RFM luminaire is made of recyclable cooper.
6.3% of the material used in the RoadFocus Medium RFM luminaire is made of recyclable plastic.
9.3% of the material used in the RoadFocus Medium RFM luminaire is electrical components.

Standard RFL model:

71% of the material used in the RoadFocus Large RFL luminaire is made of recyclable aluminum.
4.4% of the material used in the RoadFocus Large RFL luminaire is made of recyclable steel.
0.5% of the material used in the RoadFocus Large RFL luminaire is made of recyclable cooper.
15.2% of the material used in the RoadFocus Large RFL luminaire is made of recyclable plastic.
8.9% of the material used in the RoadFocus Large RFL luminaire is electrical components.

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Luminaire	Driver	Part #	Voltage	LED Current	Driver qty in luminaire
RFS-35W16LED4K-T-UNIV	XI040C070V056CNJ1	169253	120-277V	700 mA	1
RFS- 54W16LED4K-T-UNIV	XI050C105V050CNY1M	170872	120-277V	1050 mA	1
RFM-72W32LED4K-T-UNIV	XI075C070V105CNY2	166113	120-277V	700 mA	1
RFM-72W32LED4K-T-HVU	XH150C070V210CNF1M	161901	347-480V	700 mA	1
RFM-108W32LED4K-T-UNIV	XI150C105V140CNF1	167489	120-277V	1050 mA	1
RFM-108W48LED4K-T-UNIV	LEDINTAO700C21ODO	159890	120-277V	700 mA	1
RFM-108W48LED4K-T-HVU	XH150C070V210CNF1M	161901	347-480V	700 mA	1
RFM-160W48LED4K-T-UNIV	XI150C105V140CNF1	167489	120-277V	1050 mA	1
RFL-145W64LED4K-T-UNIV	LEDINTAO700C21ODO	159890	120-277V	700 mA	1
RFL-145W64LED4K-T-HVU	XH150C070V210CNF1M	161901	347-480V	700 mA	1
RFL-180W80LED4K-T-UNIV	LEDINTAO700C21ODO	159890	120-277V	700 mA	2
RFL-180W80LED4K-T-HVU	XH150C070V210CNF1M	161901	347-480V	700 mA	2
RFL-215W96LED4K-T-UNIV	LEDINTAO700C21ODO	159890	120-277V	700 mA	2
RFL-215W96LED4K-T-HVU	XH150C070V210CNF1M	161901	347-480V	700 mA	2
RFL-241W112LED4K-T-UNIV	LEDINTAO700C21ODO	159890	120-277V	700 mA	2
RFL-241W112LED4K-T-HVU	XH150C070V210CNF1M	161901	347-480V	700 mA	2

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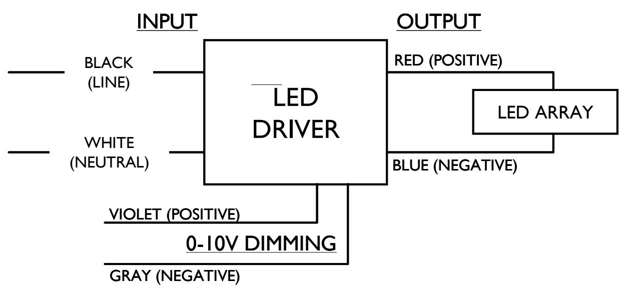
LEDINTA0700C210DO	
Brand Name	XITANIUM
Description	150W 0.70A 0-10V Isolated Dimming
Input Voltage	120~277V
Input Frequency	50/60Hz
RoHS	Yes
Approbations	UL,CSA
Status	Active

Electrical Specifications

Max. Output Power (W)	Output Voltage (V)	Output Current (A)	Tcase Max	Input Current	Max. Input Power (W)	Inrush Current (A_{pk}/µs)	Max. THD (%)	Min. Power Factor	Surge Protection (KV)	Weight (Lbs)	Envir. Protection Rating
150	60~210	0.70	80°C	1.4A@120VAC 0.6A@277VAC 0.67A@250VDC	165	190/400	20	0.90	3.0	2.8/1270	UL Dry & Damp

Wiring Diagram



Input, Output and 0-10V Dimming use lead-wires. Lead-wires are 18AWG 105C/600V solid copper

Standard Lead Length

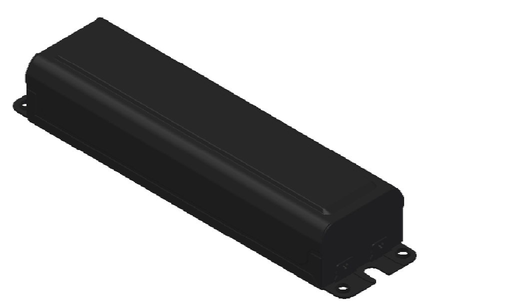
	in.	cm.
Black	10	25
White	10	25
Blue	10	25
Red	10	25
Gray	10	25
Violet	10	25

Maximum Wiring Distance (at full load)

Wire Size (AWG)	Distance (feet)
26	8
24	13
22	21
20	34
18	54
16	85
14	137
12	210
10	357

Dimming Method	Dimming Range (%)	Other Comments
0-10V	100% ~ 10%	Dimming source current: 150 µA

Enclosure



	in. (mm)
Case Length	8.38 (211.1)
Case Width	2.35 (59.1)
Case Height	1.47 (37.1)
Mounting Length	9.0 (226.2)
Mounting Width	1.7 (42.9)
Overall Length	9.54 (240.5)

c US
C US

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LEDINTA0700C210DO	
Brand Name	XITANIUM
Description	150W 0.70A 0-10V Isolated Dimming
Input Voltage	120~277V
Input Frequency	50/60Hz
RoHS	Yes
Approbations	UL,CSA
Status	Active

Installation & Application Notes:

Section I – Physical Characteristics
1.1 LED Driver shall be installed inside an electrical enclosure.
1.2 Wiring inside electrical enclosure shall comply with 600V/105°C rating or higher.

Section II – Performance
2.1 LED Driver complies with UL standard UL1012.
2.2 LED Driver has Class A sound rating.
2.3 LED Driver has a minimum ambient operating temperature of -40°C.
2.4 LED Driver has a 400 maximum switching cycle between -40°C to -20°C.
2.5 LED Driver has a life expectancy of 50,000 hours at Tcase of ≤ 75°C.
2.6 LED Driver has a life expectancy of 100,000 hours at Tcase of ≤ 65°C.
2.7 LED Driver has a typical self rise of 25°C at maximum load in open air without heat sink.
2.8 LED Driver maximum allowable case temperature is 80°C – see product label for measurement location.
2.9 LED Driver reduces output power to LEDs if max allowable case temperature is exceeded.
2.10 LED Driver has a failure rate of ≤ 0.01% per 1,000 hours at Tcase ≤ 70°C.
2.11 LED Driver tolerates sustained open circuit and short circuit output conditions without damage.
2.12 LED Driver complies with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR Part 15 Non-Consumer (Class A).

Section III – UL Conditions of Acceptability (File E321253)
When installed in the end-use equipment, the following are among the considerations to be made:
3.1 The equipment shall be installed in compliance with the enclosure, mounting, spacing, casualty and segregation requirements of the ultimate application.
3.2 Consideration should be given to measuring the temperatures on electronic components of power circuits and transformer windings when the unit is installed in the end-use equipment based upon mounting orientation, operating ambient and ventilation. Magnetic components L2, T3, L5 and T2 employ Class 130 (B) insulation.
3.3 These drivers should be used within the recognized ratings.
3.4 The driver is suitable for use in "DAMP" and "DRY" locations.
3.5 The maximum available output parameters from the (0-10V) dimming circuit provided on LED driver model LEDINTA0700C210DO were tested in accordance with supplement (SB) of UL935 and were found permissible for connection via Class 2 wiring.
3.6 When the drivers are installed in the end-use application, the case temperature should not exceed the temperature limits specified in the following table:

Model No.	Input Voltage, Hz	Max. Case @ Tc, °C
LEDINTA0700C210DO	120-277, 60 Horizontal 250VDC Horizontal	80

3.7 The maximum measured leakage current was 0.210 MIU while connected to a 120V branch source and 0.56 MIU while connected to a 277V source of supply.
3.8 For 250 Vdc application, driver must be additionally provided with an external DC fuse in the end-use application. Fuse must be Listed, CSA certified, manufactured LittelFuse, designated CCMR, rated 250 Vdc, 10A maximum. Fuse to be wired into the Hot leads of the driver. The method of adding the external fuse and fuse holder to be evaluated in the end-use application.

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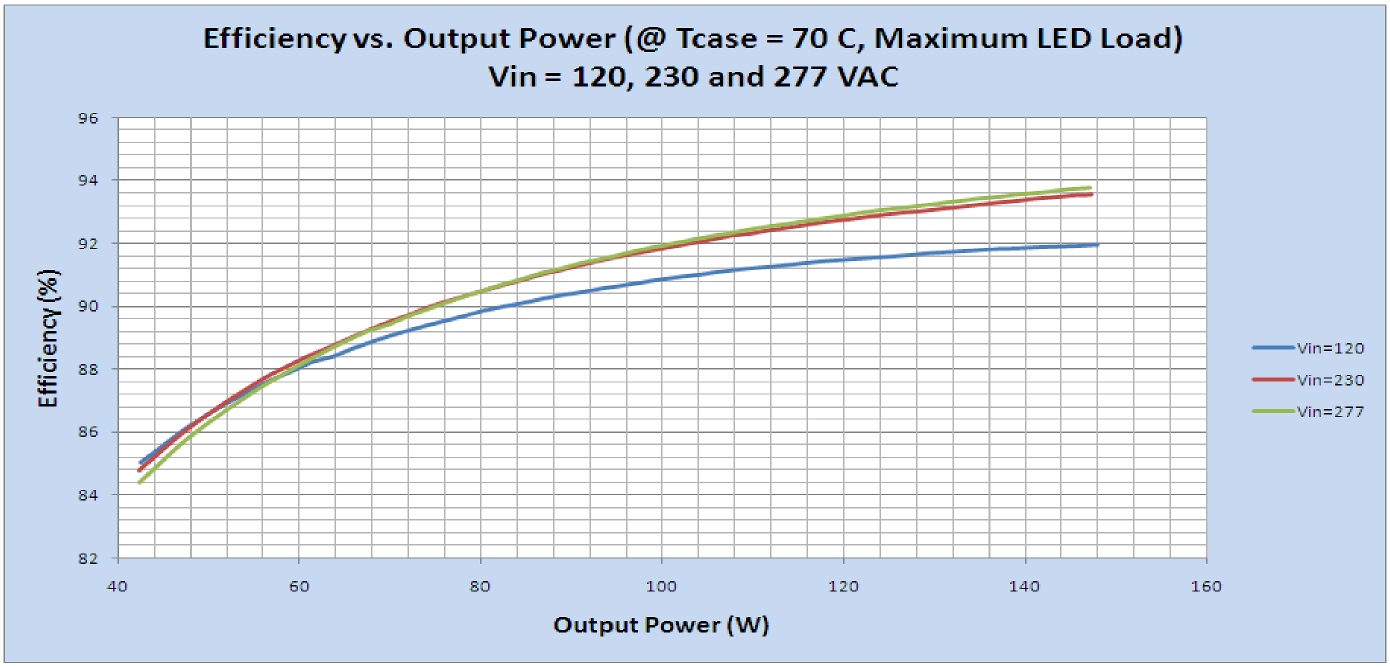
LEDINTA0700C210DO	
Brand Name	XITANIUM
Description	150W 0.70A 0-10V Isolated Dimming
Input Voltage	120~277V
Input Frequency	50/60Hz
RoHS	Yes
Approbations	UL,CSA
Status	Active

Electrical Specifications



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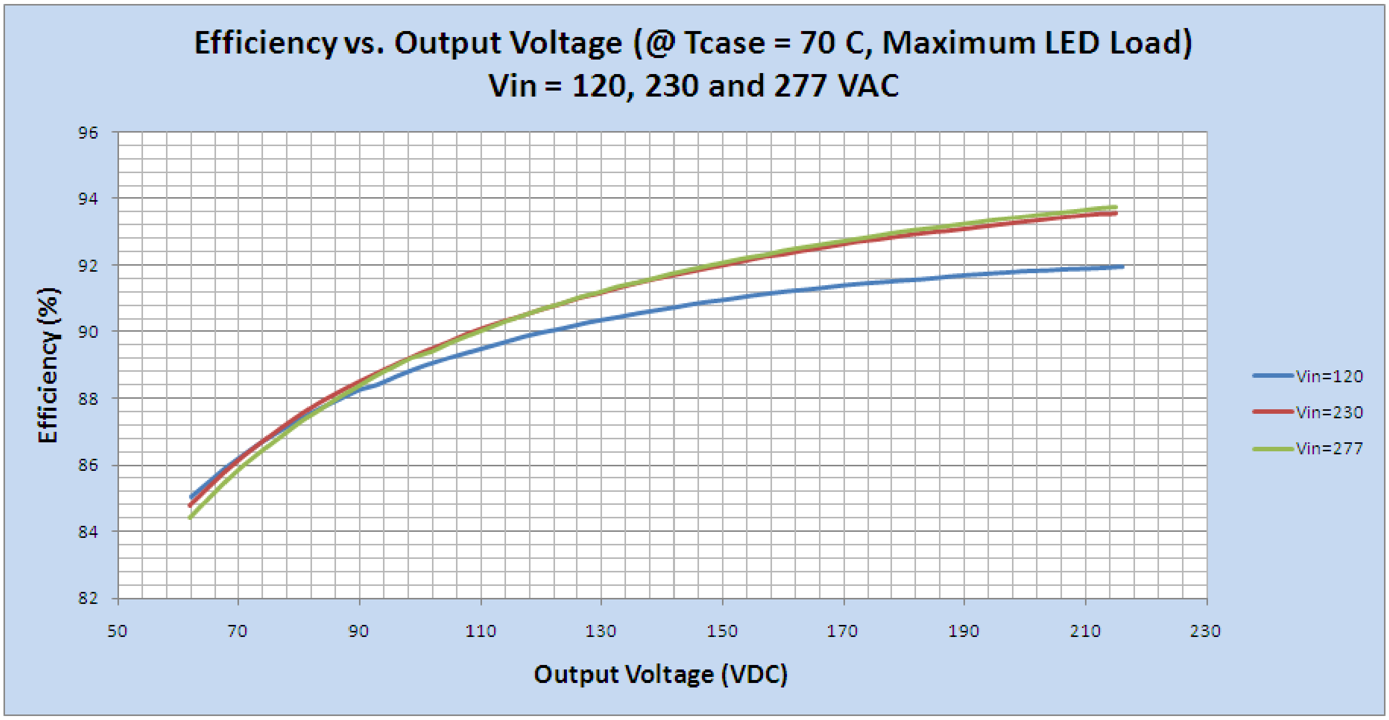

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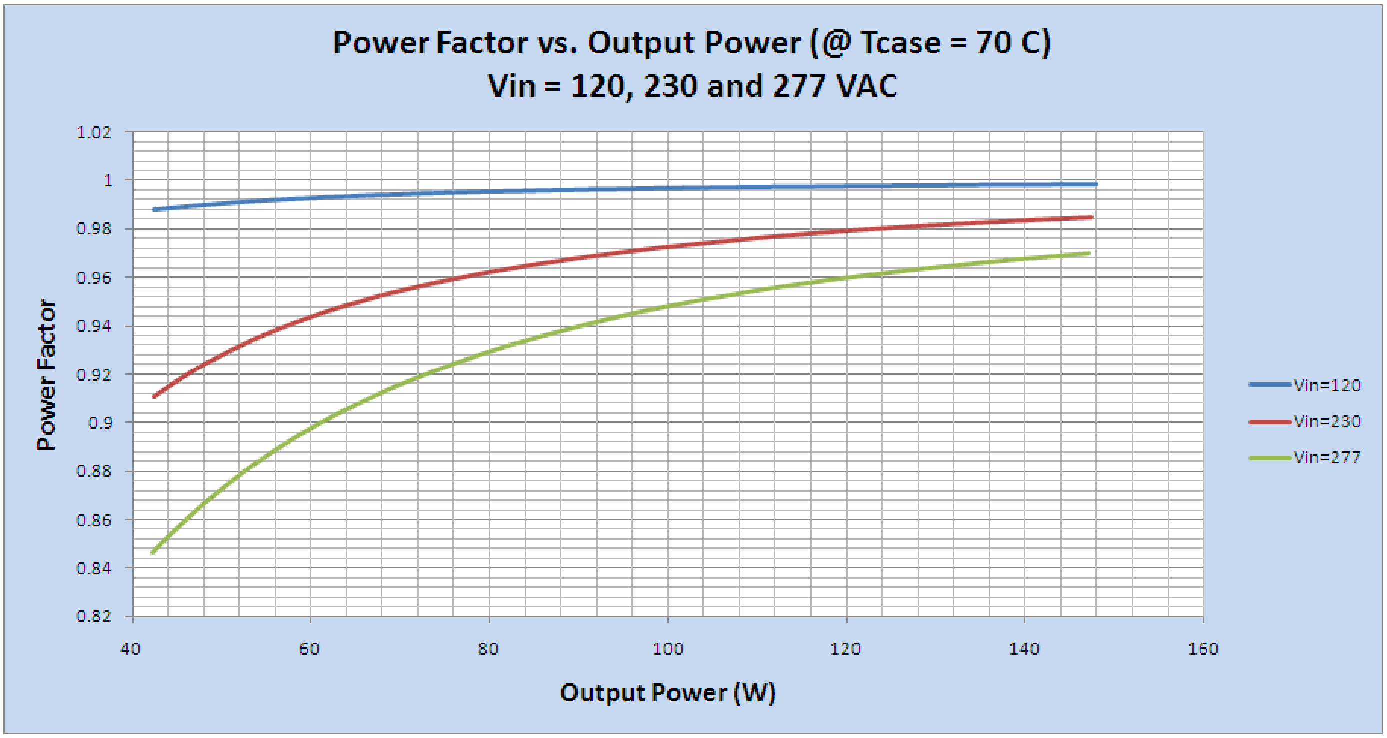

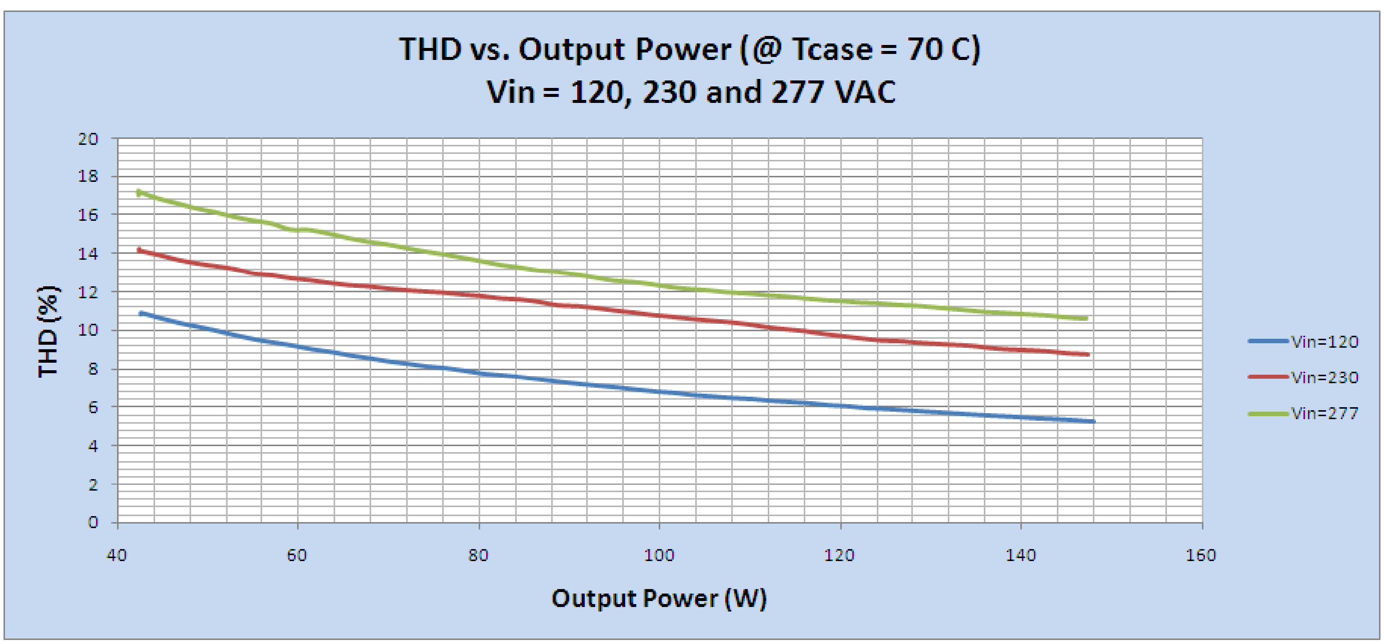

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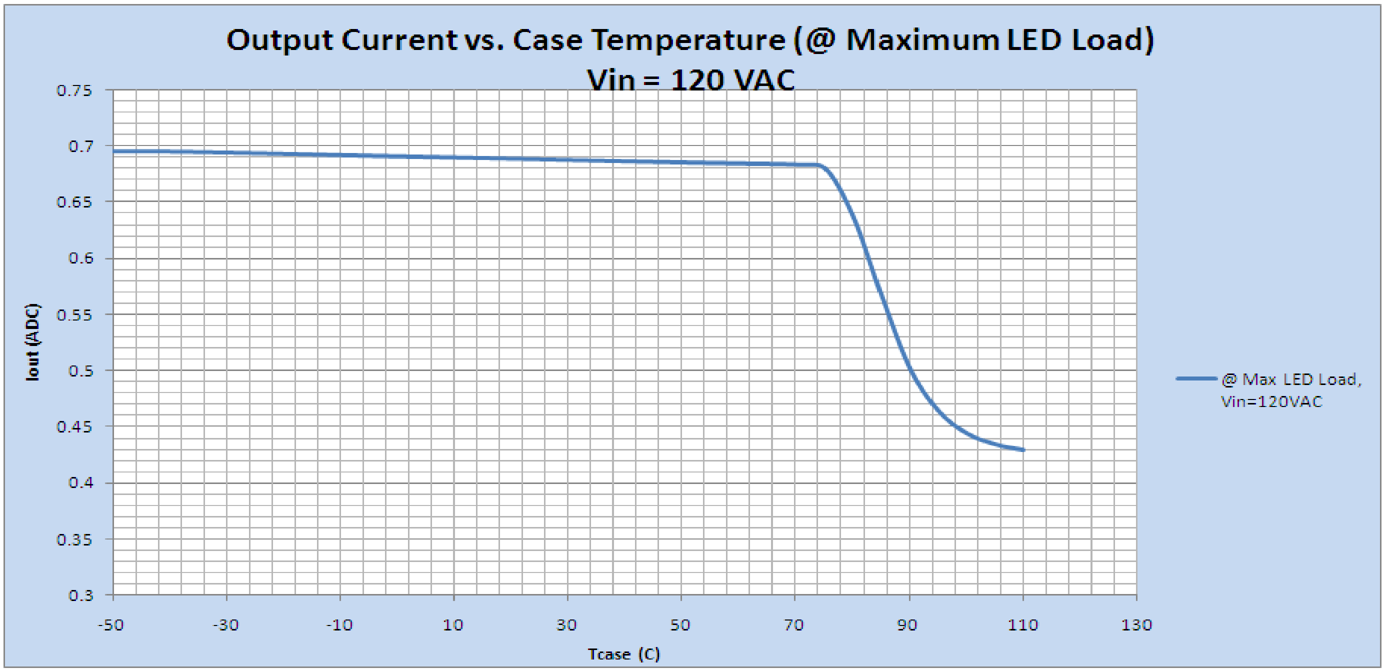

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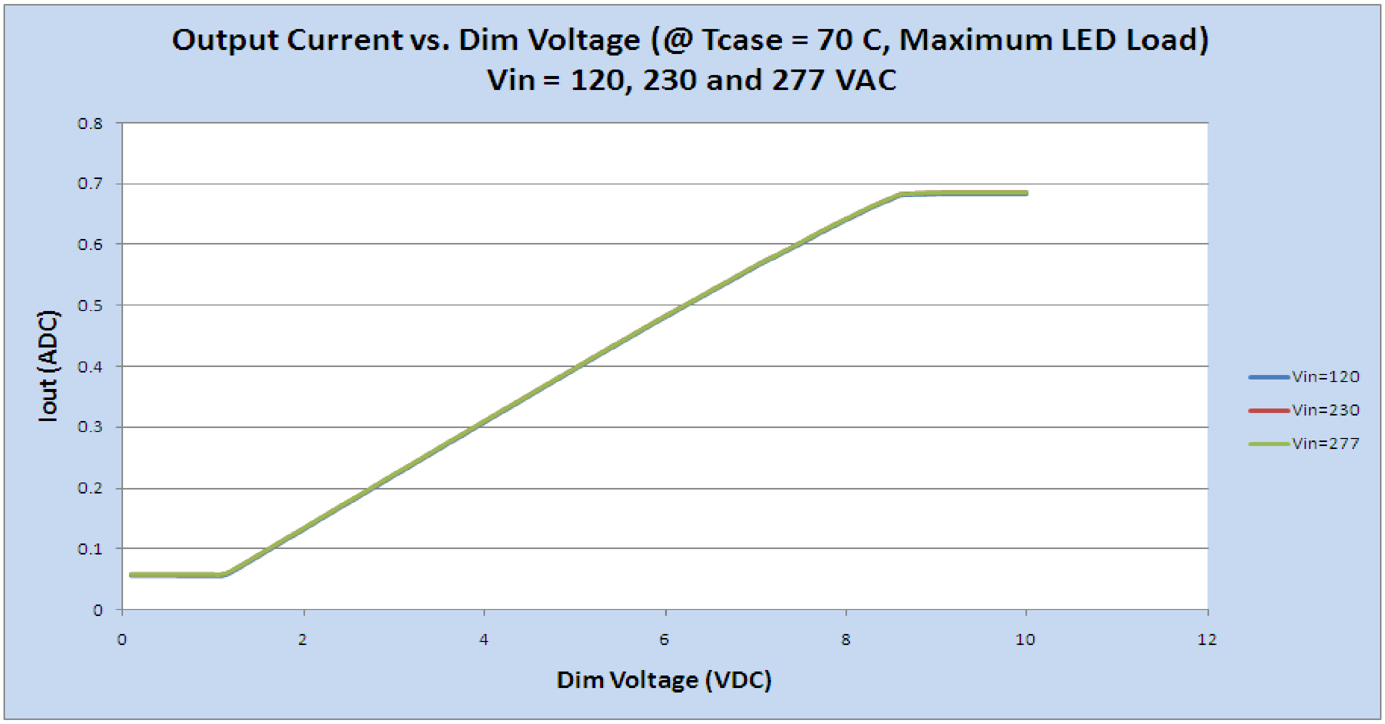

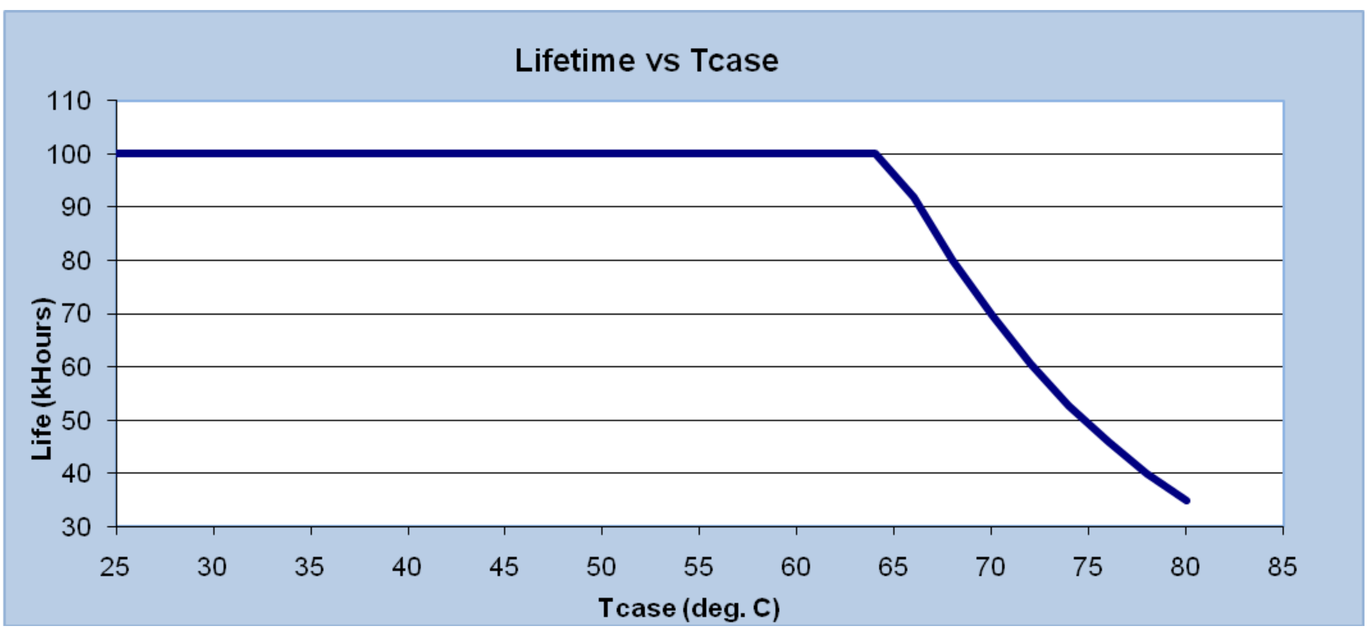

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Brand Name	XITANIUM
Description	150W 0.70A 0-10V Isolated Dimming
Input Voltage	120~277V
Input Frequency	50/60Hz
RoHS	Yes
Approbations	UL,CSA
Status	Active

Failure Rate Info:

1. **<0.01% per 1kHr @<= Tcase 65°C**

Revision History:

Rev No.	Date	Description	Approval	Remarks
1.1	01/13/2012	* Add Envir. Protection Rating	N.T.	
1.2	02/01/2012	*Add Dimming source current: 150 µA	N.T.	
1.3	02/02/2011	*Remove graph "Failure rate vs. Tcase *Add Failure Rate Info	N.T.	
1.4	2/27/2012	*Modify Part #(Remove Dashes)	N.T.	
1.5	04/09/2012	*Add Installation & Application Notes: Section II – 2.4: Max Switching Cycles	N.T.	
1.6	04/17/2012	*Remove Min .Output Power (W)		
1.7	04/18/2012	* Add Approbations: UL,CSA		

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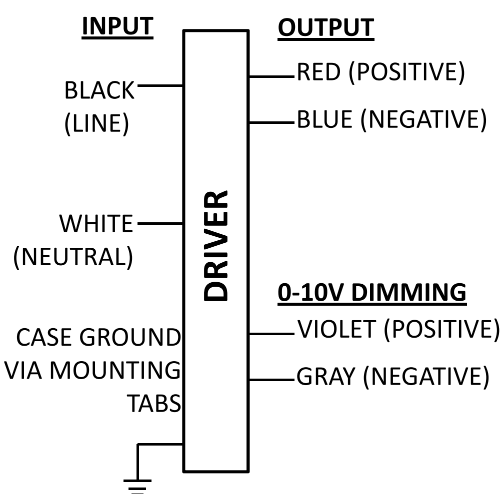
Product Overview

XI040C070V056CNJ1M	
Brand Name	XITANIUM
Description	Xitanium 40W 0.70A 0-10V INT-J
Input Voltage	120 - 277V
Input Freq.	50/60Hz
RoHS	Yes
Status	Released

Input Voltage (Vac)	Max Output Power (W)	Output Voltage Range (V)	Output Current (A)	Efficiency@ Max Load and 70°C Case	Max Case Temp. (°C)	Input Current (Arms)	Max. Input Power (W)	Inrush Current (Apk/50%-µs)	THD @ Max Load (%)	Power Factor @ Max Load	Surge Protection Common/ Diff (KV)	Weight (Lbs/kgs)	Envir. Protection Rating
120	40	12 - 54	0.70	86	80 °C	0.36	47	25 / 100	< 8%	>0.95	4/4	1.0/ 0.45	UL damp and dry
277				89		0.16		65 / 100	<12%				

Wire Diagram



Product Data:

Input and output use lead- wires.
Lead-wires are 18AWG 105C/600V solid copper per UL1452.
Lead Length outside enclosure: 270 mm (±30mm) on all wires

Dimming	Dimming Range	Minimum Output Current (A)	Other Comments
0-10V Analog Class 2 Wiring Only	10% ~ 100%	0.070	Dimming source current: 150 µA (±3%)

Enclosure

	in.	mm
Case Length	5.58	139.50
Case Width	1.83	45.75
Case Height	1.13	28.32
Mounting Length	5.77	144.25
Mounting Width	1.10	27.50
Overall Length	5.93	148.25

Class 2 Power Unit Dry & Damp Location

Revised 4/11/2013

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Electrical Specifications

All the specifications are typical and at 25°C Tcase unless specified otherwise.

XI040C070V056CNJ1M	
Brand Name	XITANIUM
Description	Xitanium 40W 0.70A 0-10V INT-J
Input Voltage	120 - 277V
Input Freq.	50/60Hz
RoHS	Yes
Status	Released

Order code	XI040C070V056CNJ1M
Full product code	XI040C070V056CNJ1M
Full product name	XITANIUM 40W 0.70A 0-10V INT-J
Line Voltage	120-277Vac rms
Line Current	0.36A @ 120V, 0.16A @ 277V
Line Frequency	50/60Hz
Min. Mains voltage operational	108 V [min]
Max. Mains voltage operational	305V [max]
THD (total)	Refer to graph
Power Factor (PF)	Refer to graph
Efficiency	Refer to graph
Inrush Current	Per NEMA 410
Input Over-voltage	Can survive input over-voltage stress of 320VAC for 48 hours and 350VAC for 2 hours
Lightning Surge Protection	Per IEEE C62.41.2 2002 (4KV, 1.2/50 µs.8/20 µs Combination Wave with 2 Ohms source impedance, L-N, L-PE, N-PE)
Output voltage range	12V to 54Vdc
Maximum open circuit voltage	56 (±5%)
Output Current Ripple (ripple = peak to peak / average)	10% max @ max Iout and max Vout Low frequency (≤120 Hz) content < 5%
Protections	Short Circuit and Open Circuit Protection for LED + and LED-
Operating Ambient Temp. Range	-40C to +55C
Max Case Temperature (Tcase)	80C
Encapsulation	Yes, Fully potted
Interfaces	0-10V Dimming
0-10V Dimming Specifications	150µA ± 3% source current from driver. See dim curve for detail.
Environmental Protection Rating	UL damp and dry
Life @ Tcase 70C	refer to graph below
Life @ Tcase 80C	refer to graph below
Agency Approbations	UL8750, UL1310, UL935, CSA-C22.2 No. 250.13-12, CSA C22.2 No. 223
Electromagnetic Compliance	FCC Title 47 Part 15 Class A
Isolation	Refer to table

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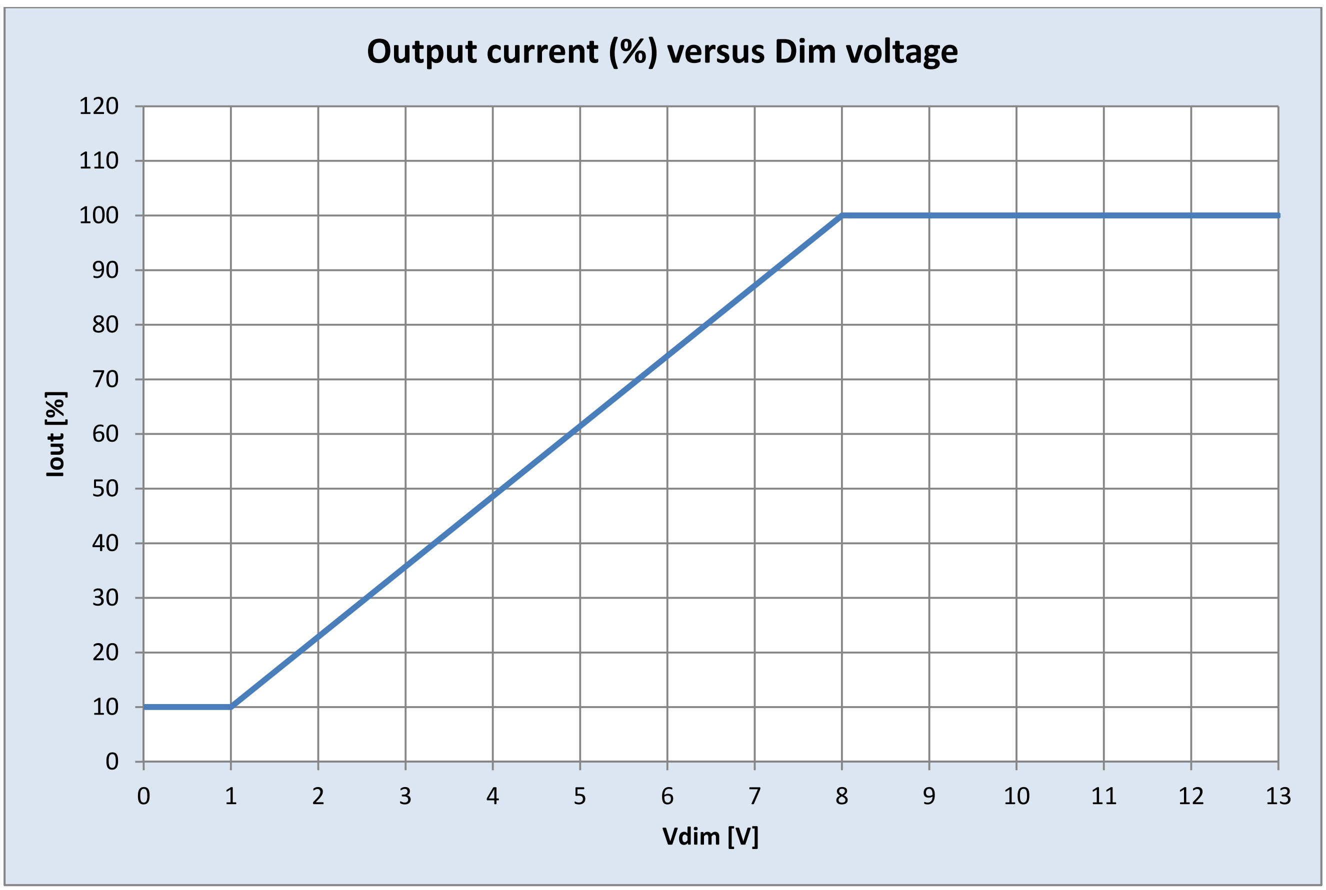
Electrical Specifications

All the specifications are typical and at 25°C Tcase unless specified otherwise.

XI040C070V056CNJ1M	
Brand Name	XITANIUM
Description	Xitanium 40W 0.70A 0-10V INT-J
Input Voltage	120 - 277V
Input Freq.	50/60Hz
RoHS	Yes
Status	Released

0-10V Dimming Curve:

Dimming source current from the driver: 150µA (±3%) (@ 0<Vdim<8V)
LED Current Tolerance at 700mA ≤ 5% over temperature and component variations and ≤ 10% at any dim level.
Minimum Dim Level: 10% of Iout (minimum 70mA)
Maximum output voltage on the dimming wires: 13V



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Electrical Specifications

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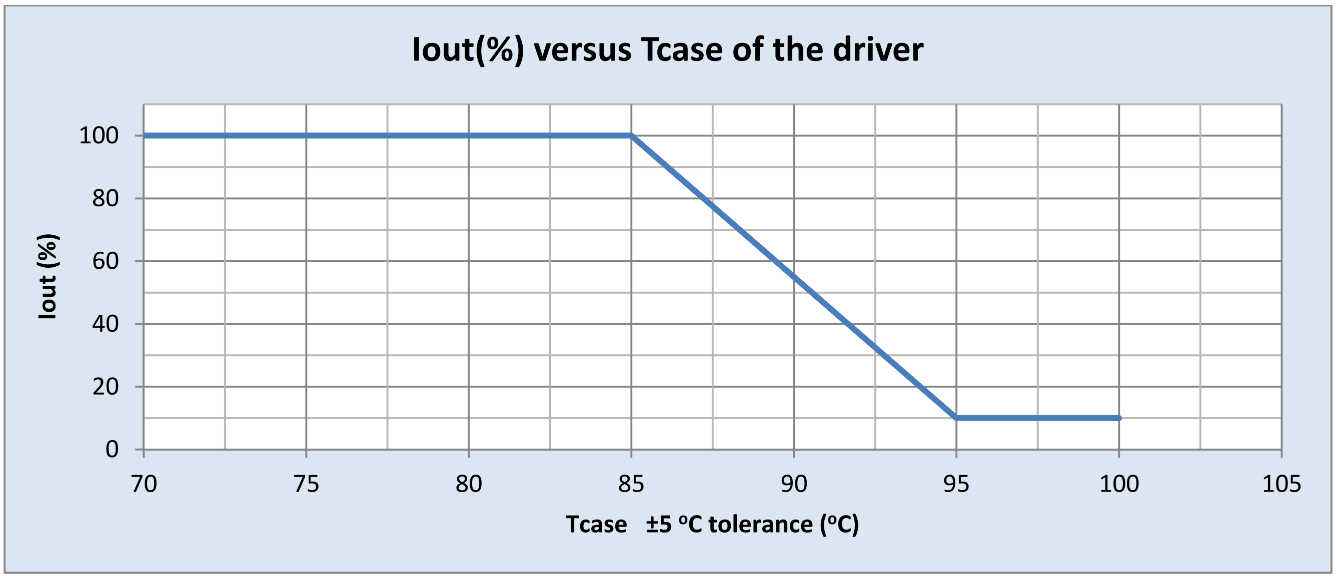
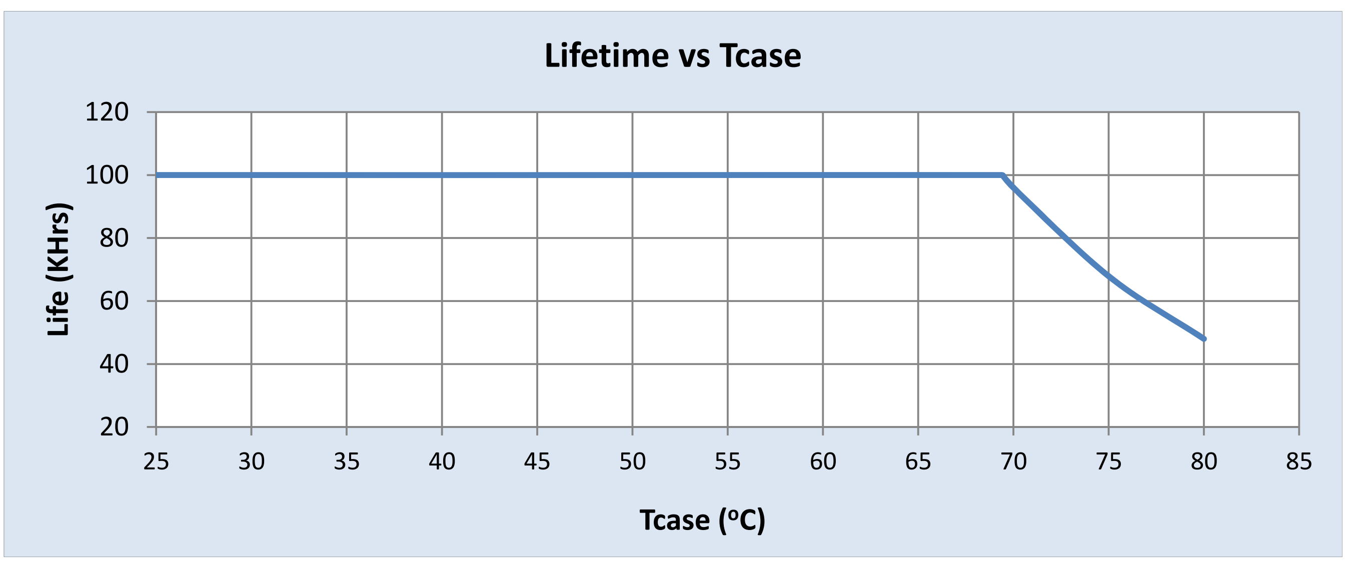
Input Voltage	120 - 277V
Input Freq.	50/60Hz
RoHS	Yes
Status	Released

Iout vs. Tcase of Driver:



Lifetime vs. Tcase of Driver:



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Electrical Specifications

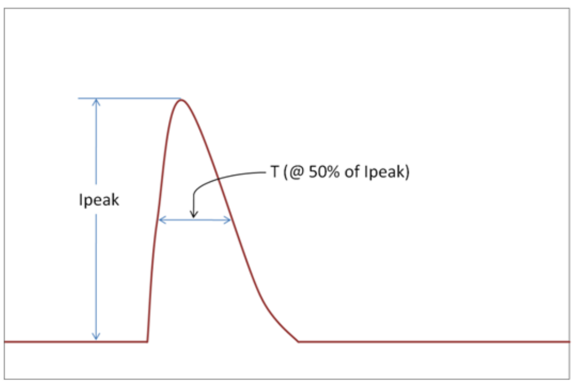
All the specifications are typical and at 25°C Tcase unless specified otherwise.

XI040C070V056CNJ1M	
Brand Name	XITANIUM
Description	Xitanium 40W 0.70A 0-10V INT-J
Input Voltage	120 - 277V
Input Freq.	50/60Hz
RoHS	Yes
Status	Released

Failure Rate based upon field call rate data:

- <0.01% per 1 kHr @<= Tcase 70 C

Inrush Current Info:



Vin	Ipeak	T (@ 50% of Ipeak)
120 Vrms	**25 A**	**100 µs**
277 Vrms	**65 A**	**100 µs**

Inrush current is measured at peak of the corresponding line voltage, source impedance per NEMA 410.

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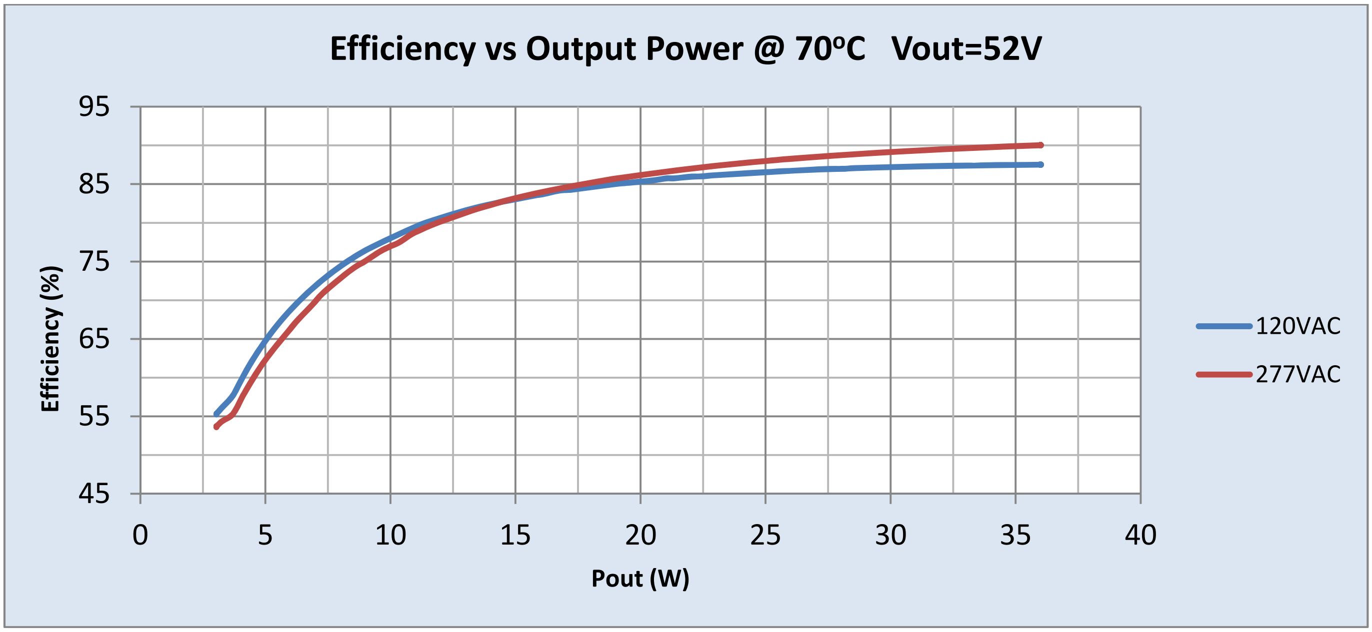
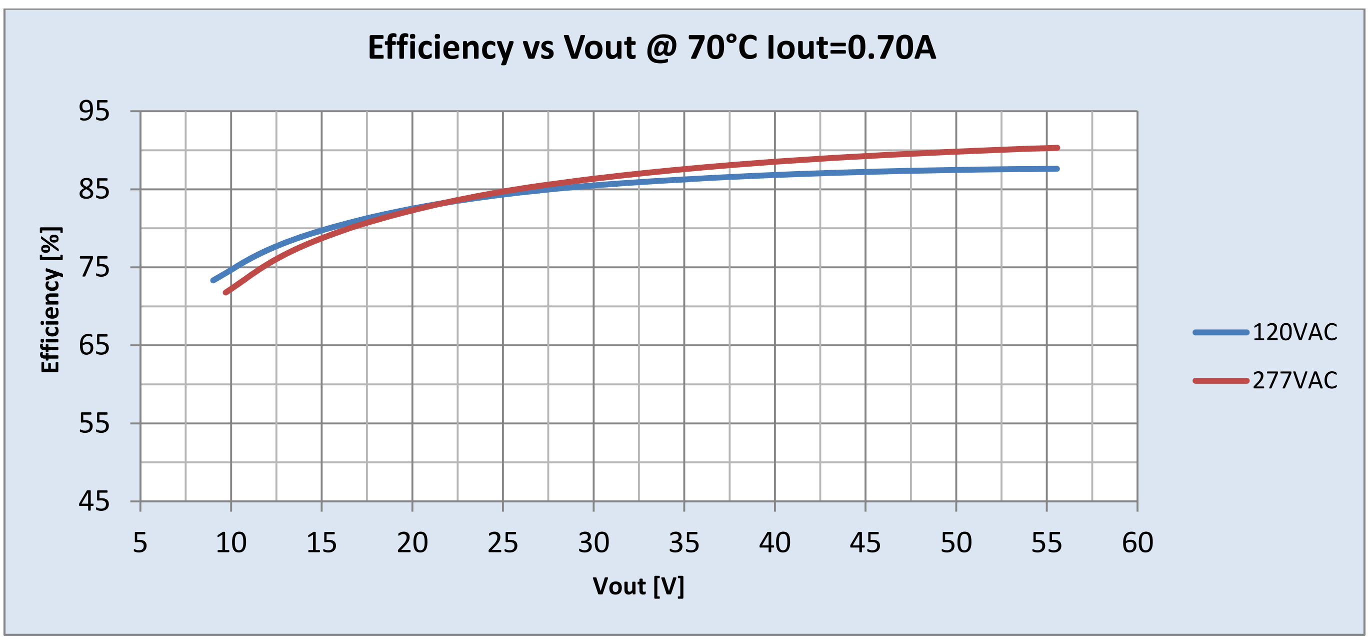
Performance Characteristics

Based on measurements on a typical sample. The accuracy of the measurements is within the tolerance of the measurement instruments. The graphs are meant to be a guideline and not a specification.

XI040C070V056CNJ1M	
Brand Name	XITANIUM
Description	Xitanium 40W 0.70A 0-10V INT-J
Input Voltage	120 - 277V
Input Freq.	50/60Hz
RoHS	Yes
Status	Released





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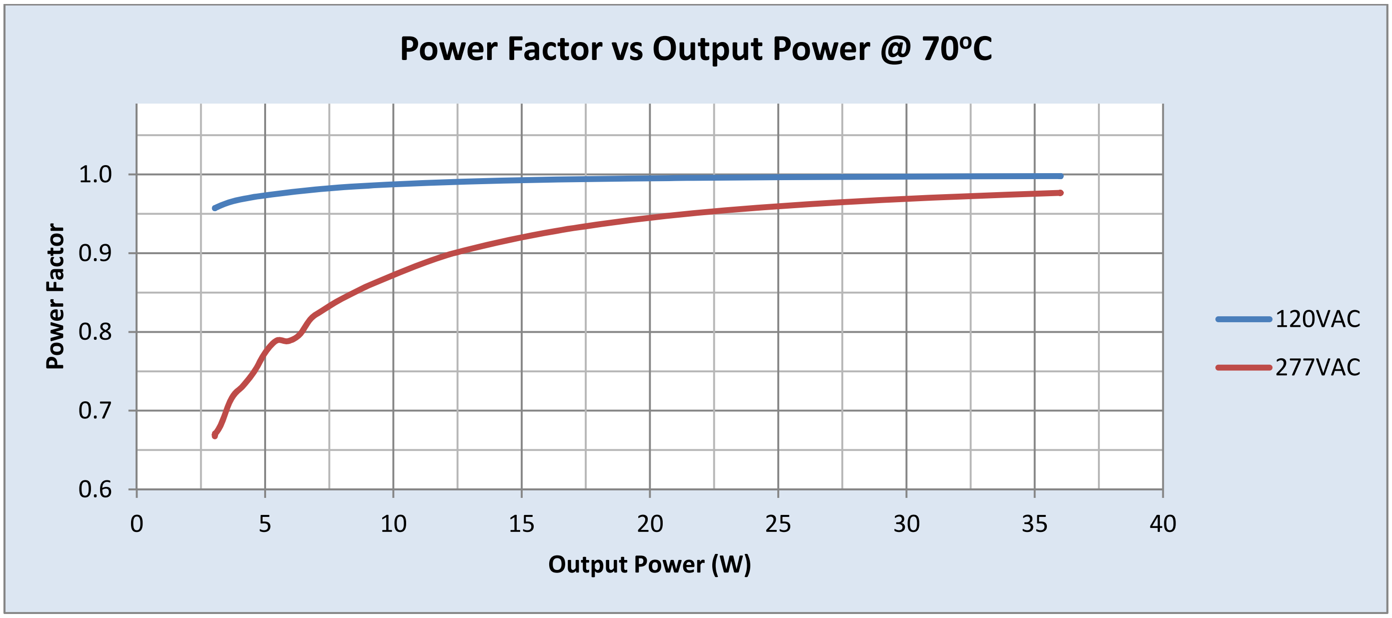
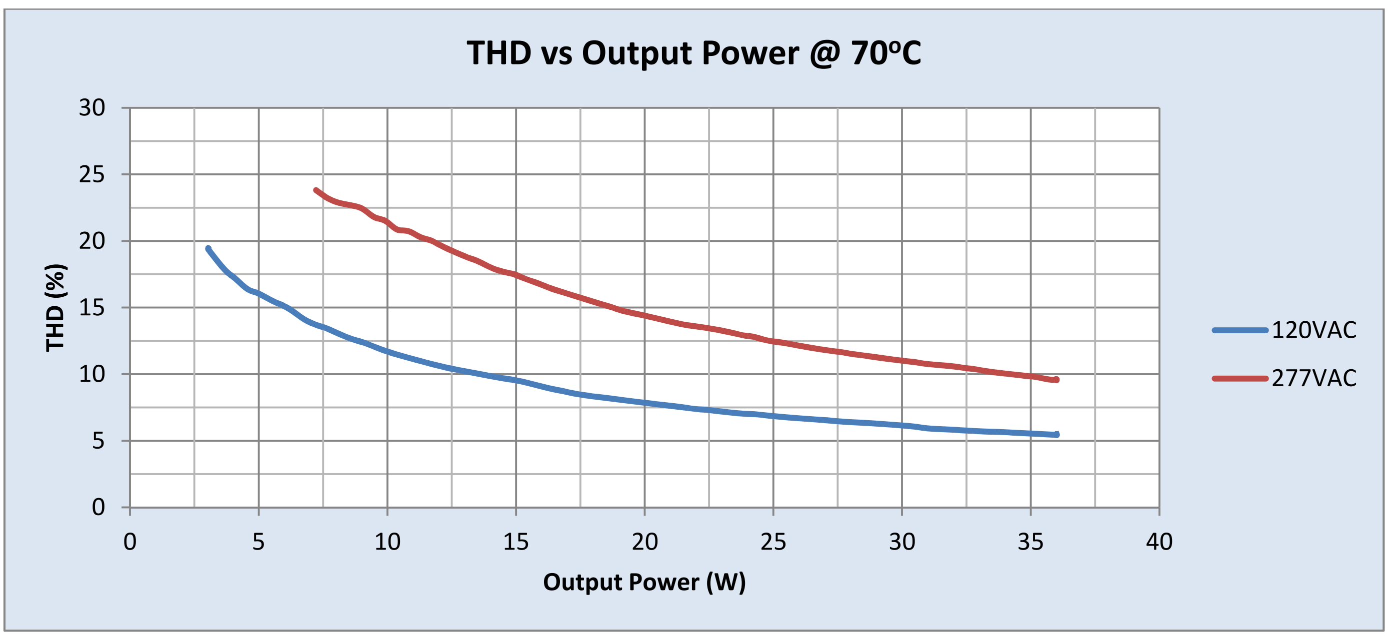
RoHS	Yes
Status	Released





Revised 4/11/2013

PHILIPS LIGHTING ELECTRONICS N.A.
10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Tel: 800-322-2086 · Fax: 888-423-1882 · www.philips.com/advance
Customer Support/Technical Service: 800-372-3331 · OEM Support: 866-915-5886

Application Notes:

XI040C070V056CNJ1M	
Brand Name	XITANIUM
Description	Xitanium 40W 0.70A 0-10V INT-J
Input Voltage	120 - 277V
Input Freq.	50/60Hz
RoHS	Yes
Status	Released

Isolation:

Isolation	Input Wires	Output Wires	0-10V Wires (class 2)	Enclosure
Input Wires	NA	2xU+1KV	2.5KVac	2xU+1KV
Output Wires	2xU+1KV	NA	NA	500V
0-10V Wires (class 2)	2.5KVac	NA	NA	500V
Enclosure	2xU+1KV	500V	500V	NA

UL Conditions of Acceptability:

Please contact your Philips representative for a copy of the latest UL Conditions Of Acceptability (COA).

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PHILIPS ADVANCE

LED Driver

Xitanium

50W 120-277V 1.05A 0-10V
XI050C105V050CNY1

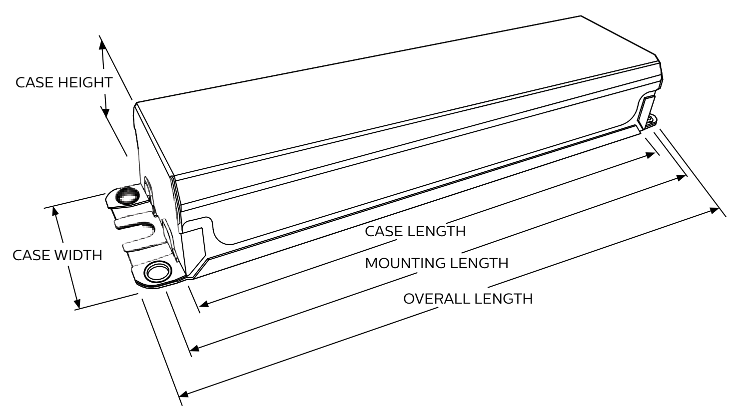
Long-lasting and low maintenance, LED-based light sources are an excellent solution for all lighting applications. For optimal performance, these solutions require reliable drivers matching the long lifetime of the LEDs. The Philips Advance Xitanium LED Outdoor Driver portfolio offers a range of products specially designed to operate LED solutions in outdoor applications. These drivers are designed for hard-wired integration into outdoor luminaires for the most rugged applications. They operate to specification under wide temperature and electrical ranges to ensure reliability.

Specifications

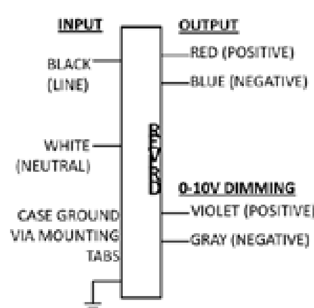
Input Voltage (Vrms)	Output Power (W)	Output Voltage (V)	Output Current (A)	Efficiency@ Max Load and 70°C Case	Max. Case Temp. (°C)	Input Current (Arms)	Max. Input Power (W)	Inrush Current (A_{pk}/10%-μs)	THD @ Max. Load	Power Factor @ Max. Load	Surge Protection Common/ Diff (KV)	Weight (Lbs/kgs)	Envir. Protection Rating
120	52.5	25 - 50	1.05	86	75	0.51	61	8/280	<10%	>0.95	2.5/2.5	1.24/0.56	UL Dry & Damp
277				87		0.22		16/240	<15%				

Enclosure

	In. (mm)
Case Length	5.43 (138.00)
Case Width	2.32 (59.00)
Case Height	1.50 (38.00)
Mounting Length	5.98 (152.00)
Mounting Width	1.69 (42.88)
Overall Length	6.61 (168.00)



Wiring Diagram



Input and output use lead-wires.

Lead-wires are 18AWG 105C/600V solid copper per UL1452.

Lead Length outside enclosure:
270 mm (±30mm) on all wires.

Dimming	Dimming Range	Minimum Output Current (A)	Other Comments
0-10V Analog Class 2 Wiring Only	10% ~ 100%	0.105	Dimming source current: 150 μA (±3%)

UL Conditions of Acceptability:

Please contact your Philips representative for a copy of the latest UL Conditions of Acceptability (COA).

Xitanium 50W 120-277V 1.05A 0-10V Dimming

Electrical Specifications

All the specifications are typical and at 25°C Tcase unless specified otherwise.

Features

- 50,000+ hour lifetime[1]
- Isolated 0-10V dimming
- New housing with high thermal capability

Benefits

- Enables long life luminaire designs
- Helps to maximize energy savings and allows application specific light levels
- Allows luminaire designs for ambient environments

Application

- Area
- Roadway
- Parking garages
- Floodlights

1. Philips Advance Xitanium LED Drivers are designed and manufactured to engineering standards correlating to an average life expectancy of 50,000 hours of operation at maximum rated case temperature. Minimum 90% survivals based on MTBF modeling.

Product Data

Order Information	
Order Code	XI050C105V050CNY1
Full Product Code	XI050C105V050CNY1M (Mid-Pack, 12pcs/Box)
Full Product Name	XITANIUM 50W 1.05A 0-10V INT-Y
Line Voltage	120-277Vac_rms
Line Current	0.51A @ 120V, 0.22A @ 277V
Line Frequency	50/60Hz
Min. Mains Voltage Operational	108V
Max. Mains Voltage Operational	305V
THD (total)	Refer to graph
Power Factor (PF)	Refer to graph
Efficiency	Refer to graph
Inrush Current	Per NEMA 410
Lightning Surge Protection	Refer to table
Output Information	
Output Voltage Range	25V to 50Vdc
Maximum Open Circuit Voltage	58V
Output Current (ripple = peak to average / average)	15% max @ max Iout @ max Vout (52Vdc) Low frequency (≤120 Hz) content <5%
Protections	Short Circuit and Open Circuit Protection for LED + and LED –
Operating Ambient Temp. Range	-40C to +55°C
Max Case Temperature (Tcase)	75°C
Features	
Interfaces	0-10V Dimming
0-10V Dimming Specifications	150μA source current from driver. See dim curve for detail.
Environment & Approbation	
Environmental Protection Rating	UL dry and damp, Type HL
Agency Approbations	UL8750, UL1310, UL935, CSA-C22.2 No. 250.13-12, CSA C22.2 No. 223
Electromagnetic Compliance	FCC Title 47 Part 15 Class A
Isolation	Refer to table
Audible Noise	<24dB Class A

Xitanium 50W 120-277V 1.05A 0-10V Dimming

Electrical Specifications

All the specifications are typical and at 25°C Tcase unless specified otherwise.

0-10V Dimming Curve:

Dimming source current from the driver: 150µA (±3%) (@ 0<Vdim<8V)

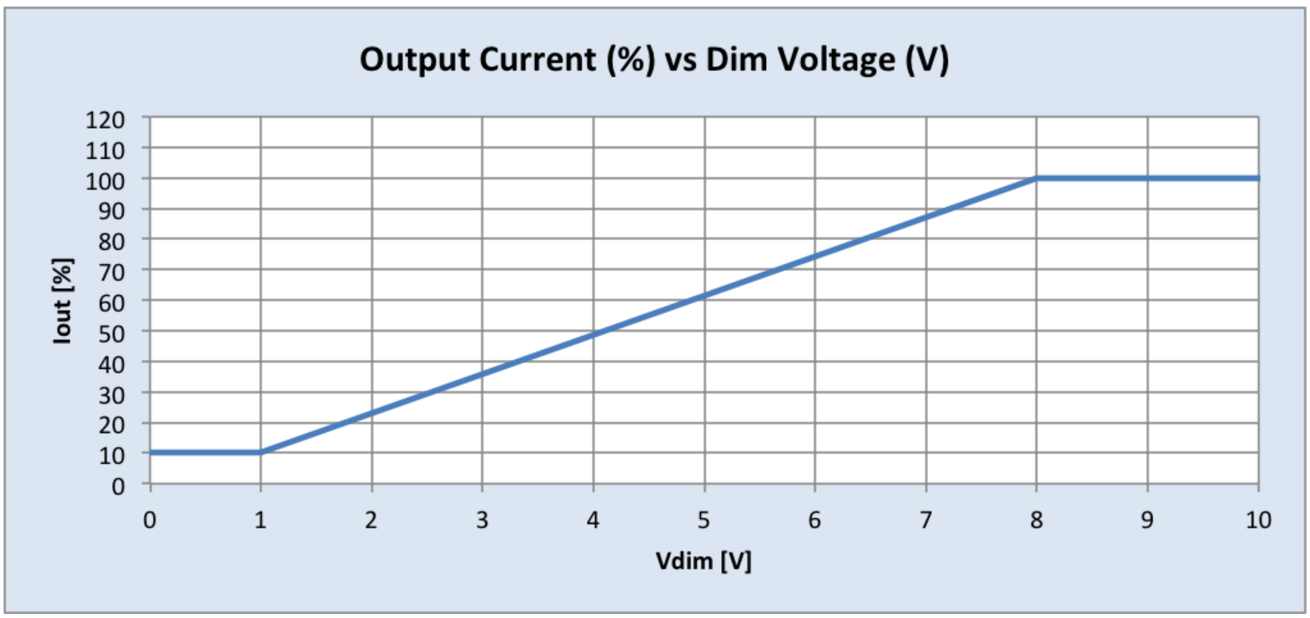
LED Current Tolerance at 1050mA ≤ 5% over temperature and component variations and ≤ 10% at any dim level

Minimum Dim Level: 10% of Iout (minimum 105mA)

Maximum output voltage on the dimming wires: 13V

Approved Dimmer List

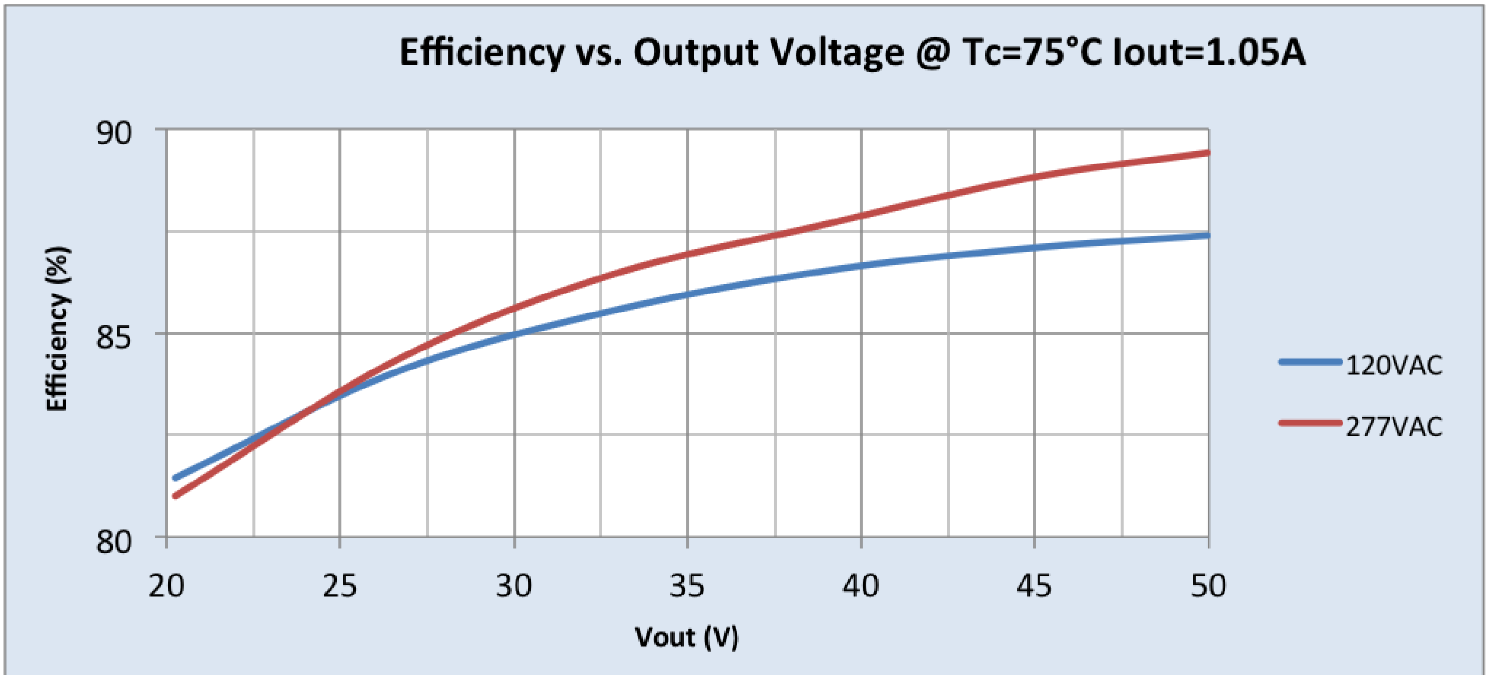
Manufacturer	Manufacturer Part Number
Lutron	Visit www.lutron.com/ advance for a list of dimmers (Mark VII) that will work with sthis driver
Leviton	IllumaTech IP7 series
Philips	Sunrise - SR1200ZTUNV



Xitanium 50W 120-277V 1.05A 0-10V Dimming

Performance Characteristics

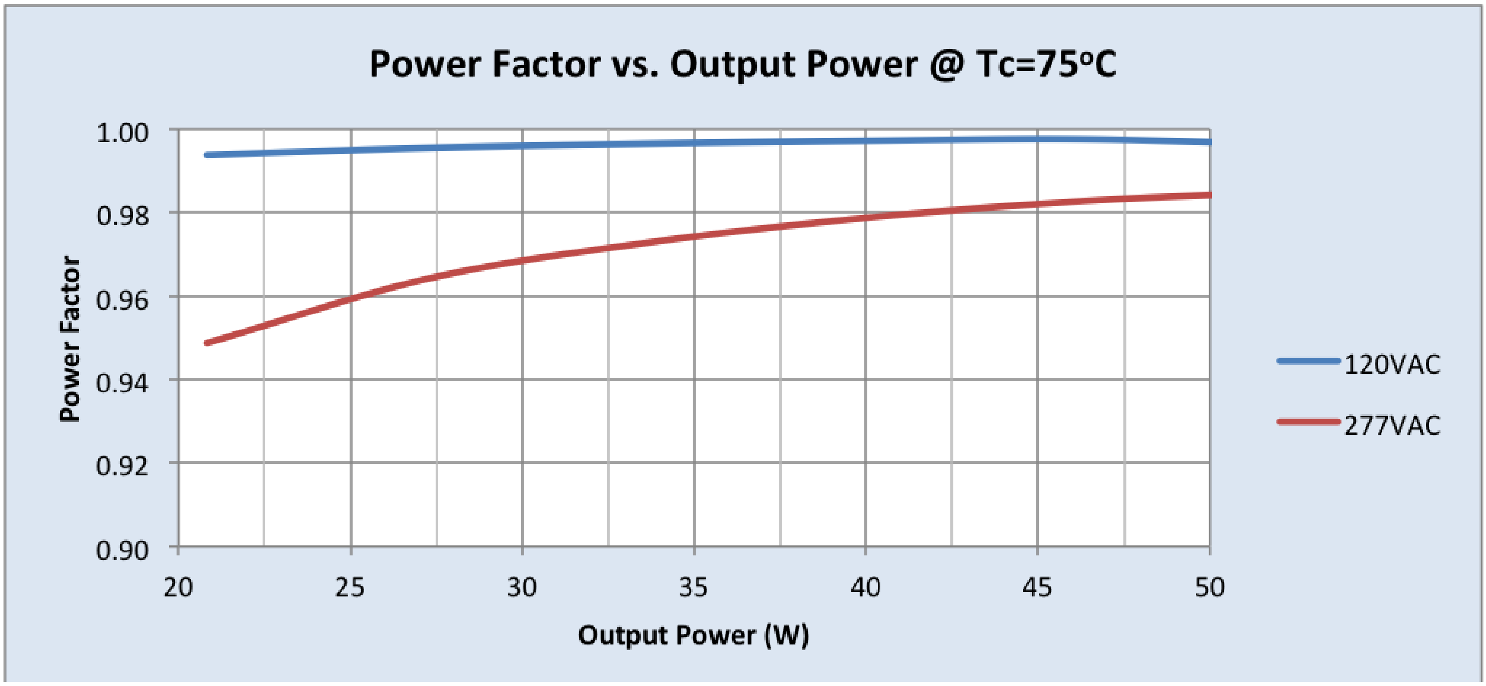
Based on measurements on a typical sample. The accuracy of the measurements is within the tolerance of the measurement instruments.
The graphs are meant to be a guideline and not a specification.

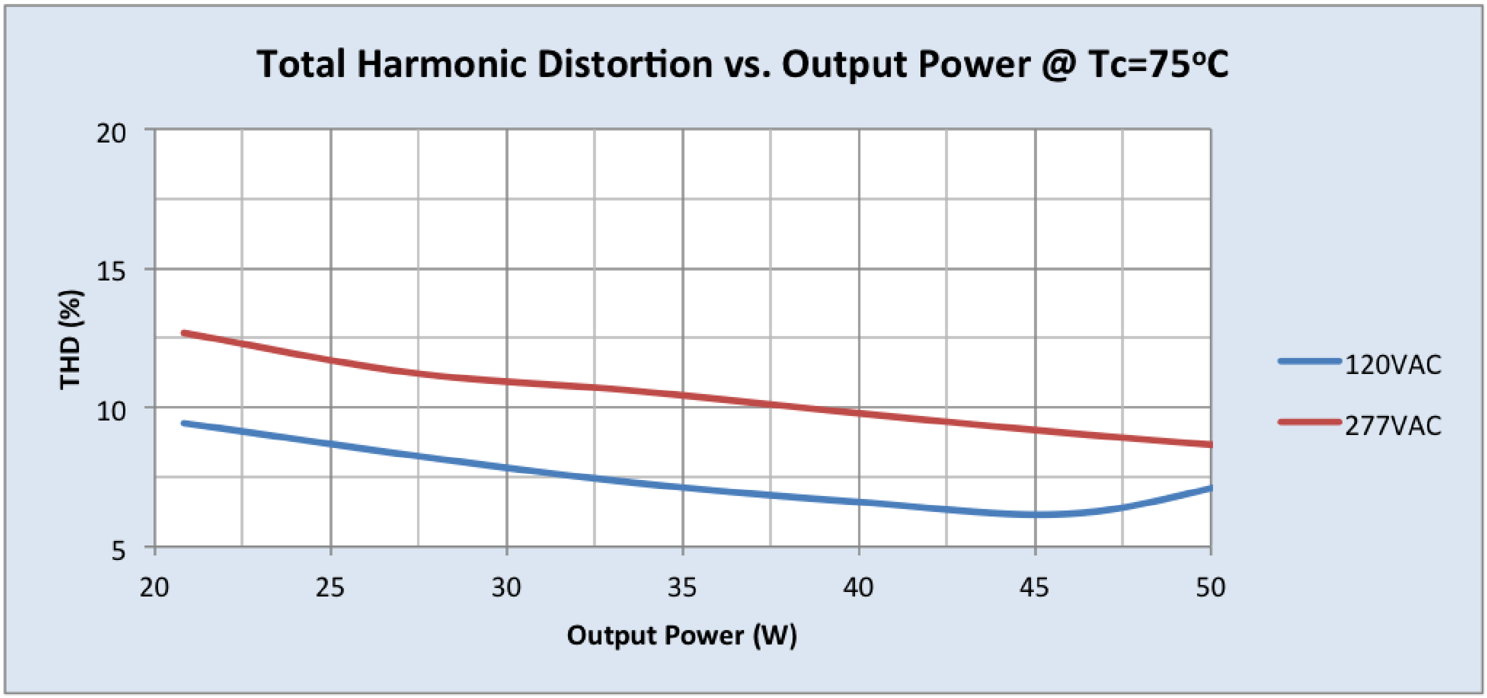


Xitanium 50W 120-277V 1.05A 0-10V Dimming

Performance Characteristics

Based on measurements on a typical sample. The accuracy of the measurements is within the tolerance of the measurement instruments. The graphs are meant to be a guideline and not a specification.



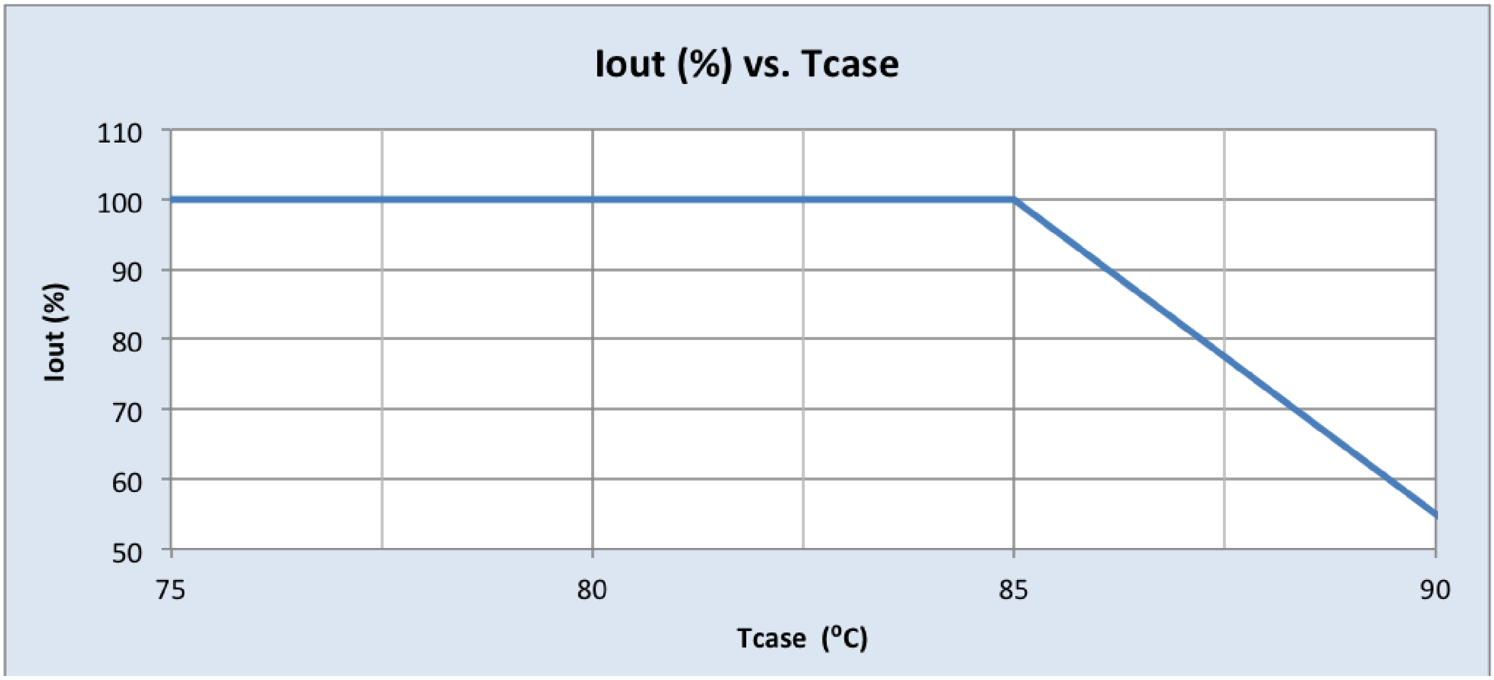


Xitanium 50W 120-277V 1.05A 0-10V Dimming

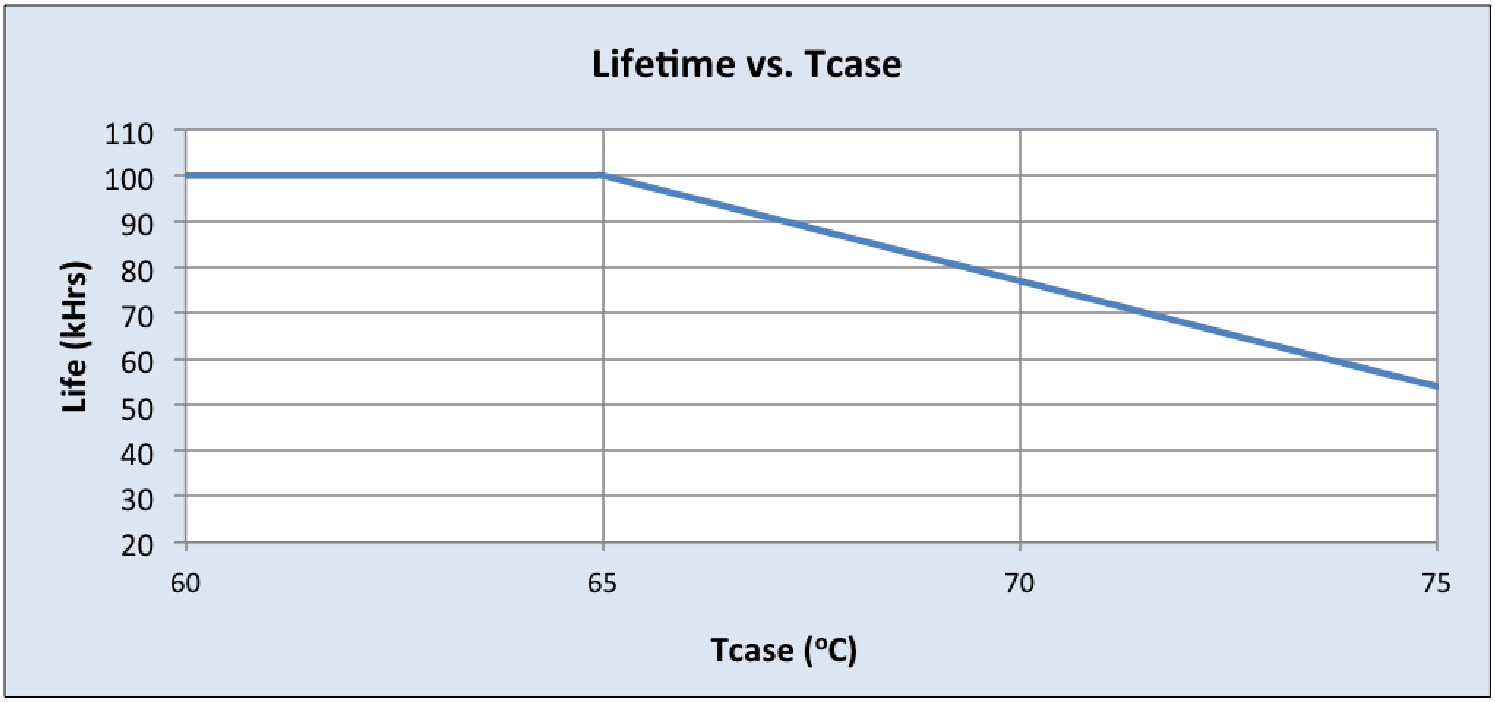
Electrical Specifications

All the specifications are typical and at 25°C Tcase unless specified otherwise.

Output Current vs. Driver Case Temperature:

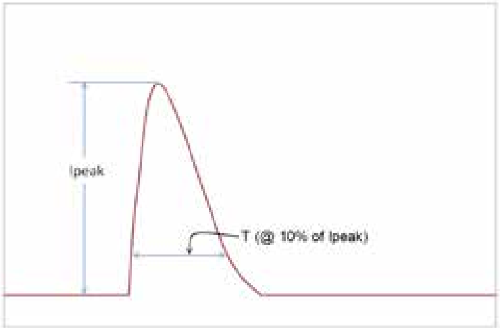


Driver Lifetime vs. Driver Case Temperature:



Xitanium 50W 120-277V 1.05A 0-10V Dimming

Inrush Current Info:



Vin	Ipeak	T (@ 10% of Ipeak)
120 Vrms	8A	280µs
277 Vrms	16A	240µs

Inrush current is measured at peak of the corresponding line voltage, source impedance per NEMA 410.

Lightning Surge Info:

ANSI Surge Type	Differential Mode (L-N)	Common Mode (L-G, N-G, L&N-G)
1.2/50µs Combination Wave (w/t 2Ω)	2.5kV	2.5kV

Isolation:

Isolation	Input	Output	0-10V (Class 1 & 2)	Enclosure
Input	NA	2xU+1kV	2.5KVac	2xU+1kV
Output	2xU+1kV	NA	NA	500V
0-10V (Class 2)	2.5KVac	NA	NA	500V
Enclosure	2xU+1kV	500V	500V	NA

Class 2
Power Unit
Dry & Damp
Location

philips.com/leddrivers

Philips Lighting North America Corporation
10275 W. Higgins Road, Rosemont IL 60018
Tel: 800-322-2086 Fax: 888-423-1882
Customer/Technical Service: 800-372-3331
OEM Support: 866-915-5886

Imported by: Philips Lighting
A division of Philips Electronics Ltd.
281 Hillmount Rd, Markham, ON, Canada L6C 2S3
Tel. 800-668-9008

PHILIPS
ADVANCE

LED Driver

Xitanium

75W 120-277V 0.70A 0-10V
XI075C070V105CNY2

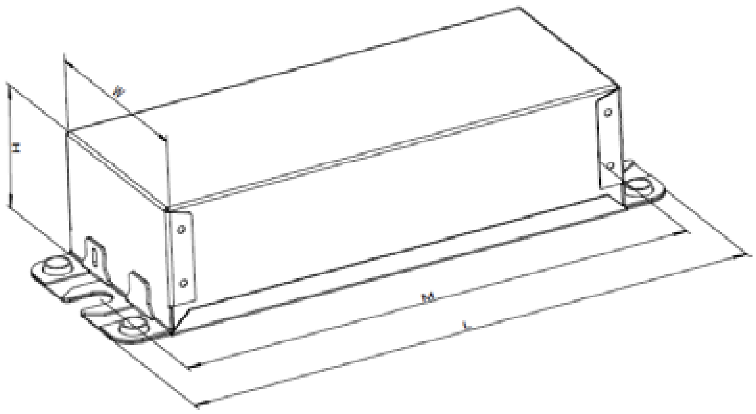
Long-lasting and low maintenance, LED-based light sources are an excellent solution for all lighting applications. For optimal performance, these solutions require reliable drivers matching the long lifetime of the LEDs. The Philips Advance Xitanium LED Outdoor Driver portfolio offers a range of products specially designed to operate LED solutions in outdoor applications. These drivers are designed for hard-wired integration into outdoor luminaires for the most rugged applications. They operate to specification under wide temperature and electrical ranges to ensure reliability.

Specifications

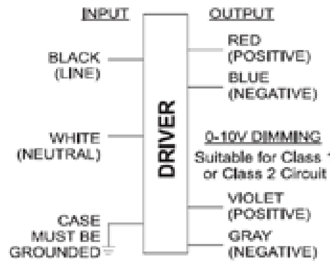
Input Voltage (Vrms)	Output Power (W)	Output Voltage (V)	Output Current (A)	Efficiency@ Max Load and 70°C Case	Max. Case Temp. (°C)	Input Current (Arms)	Max. Input Power (W)	Inrush Current (A_{pk}/10%-µs)	THD @ Max. Load	Power Factor @ Max. Load	Surge Protection Common/ Diff (KV)	Weight (Lbs/kgs)	Envir. Protection Rating
120	75	43 - 107	0.70	90.5	80	0.70	84	36 / 223	<10%	>0.95	4/4	1.53/0.57	UL Dry & Damp
277				92.5		0.30		92 / 188	<10%				

Enclosure

	In. (mm)
Case Length	5.43 (138.00)
Case Width	2.32 (59.00)
Case Height	1.50 (38.00)
Mounting Length	5.98 (152.00)
Mounting Width	1.69 (42.88)
Overall Length	6.61 (168.00)



Wiring Diagram



Input and output use lead-wires.

Lead-wires are 18AWG 105C/600V solid copper per UL1452.

Lead Length outside enclosure:
270 mm (±30mm) on input, output and dimming wires.

Dimming	Dimming Range	Minimum Output Current (A)	Other Comments
0-10V Analog Class 1 and 2 Wiring	10% ~ 100%	0.07	Dimming source current: 150 µA (±3%)

UL Conditions of Acceptability:

Please contact your Philips representative for a copy of the latest UL Conditions of Acceptability (COA).

Xitanium 75W 120-277V 0.70A 0-10V Dimming

Electrical Specifications

All the specifications are typical and at 25°C Tcase unless specified otherwise.

Features

- 50,000+ hour lifetime[1]
- Isolated 0-10V dimming
- New housing with high thermal capability

Benefits

- Enables long life luminaire designs
- Helps to maximize energy savings and allows application specific light levels
- Allows luminaire designs for ambient environments

Application

- Area
- Roadway
- Parking garages
- Floodlights

1. Philips Advance Xitanium LED Drivers are designed and manufactured to engineering standards correlating to an average life expectancy of 50,000 hours of operation at maximum rated case temperature. Minimum 90% survivals based on MTBF modeling.

Product Data

Order Information	
Order Code	XI075C070V105CNY2M
Full Product Code	XI075C070V105CNY2M (Mid-Pack, 12pcs/Box)
Full Product Name	XITANIUM 75W 0.70A 0-10V Dimming
Line Voltage	120-277Vac_rms
Line Current	0.70A @ 120V, 0.30A @ 277V
Line Frequency	50/60Hz
Min. Mains Voltage Operational	108V
Max. Mains Voltage Operational	305V
THD (total)	Refer to graph
Power Factor (PF)	Refer to graph
Efficiency	Refer to graph
Inrush Current	Per NEMA 410
Lightning Surge Protection	Refer to table
Output Information	
Output Voltage Range	43Vdc to 107Vdc
Maximum Open Circuit Voltage	180Vdc
Output Current (ripple = peak to average / average)	15% max @ max Iout and max Vout Low frequency (≤120 Hz) content <5%
Protections	Short Circuit and Open Circuit Protection for LED + and LED –
Operating Ambient Temp. Range	-40°C to +55°C
Max Case Temperature (Tcase)	80°C
Features	
Interfaces	0-10V Dimming
0-10V Dimming Specifications	150μA ± 3% source current from driver. See dim curve for detail.
Environment & Approbation	
Environmental Protection Rating	UL dry and damp
Agency Approbations	UL879, UL1012, UL935, (cRUs/CSA)
Electromagnetic Compliance	FCC Title 47 Part 15 Class A
Isolation	Refer to table
Audible Noise	<24dB Class A

Xitanium 75W 120-277V 0.70A 0-10V Dimming

Electrical Specifications

All the specifications are typical and at 25°C Tcase unless specified otherwise.

0-10V Dimming Curve:

Dimming source current from the driver: 150µA (±3%) (@ 0<Vdim<8V)

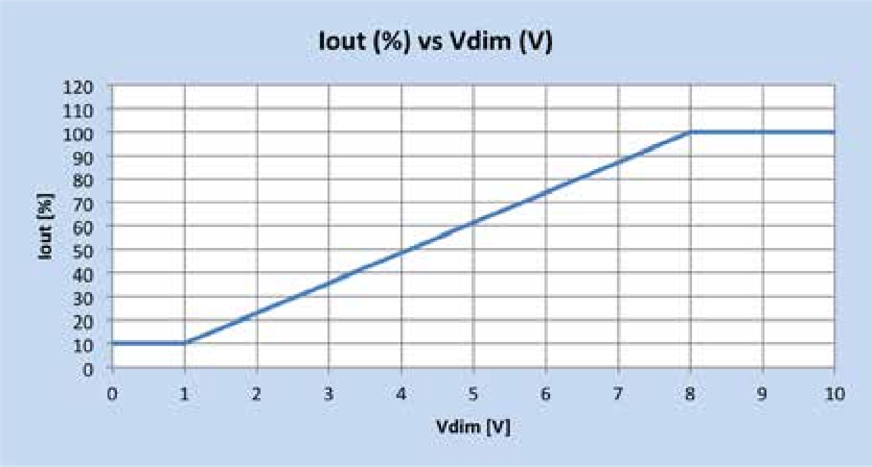
LED Current Tolerance at 700mA ≤ 5% over temperature and component variations.

Minimum Dim Level (nominal): 70 mA

Maximum output voltage on the dimming wires: 12V

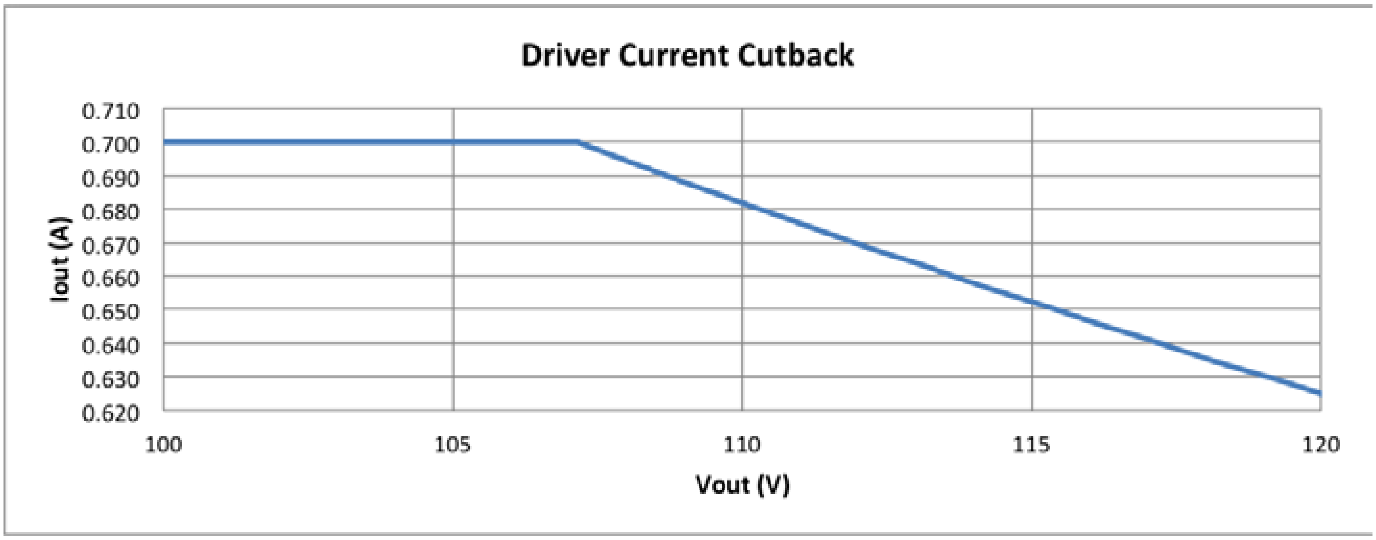
Approved Dimmer List

Manufacturer	Manufacturer Part Number
Lutron	Visit www.lutron.com/ advance for a list of dimmers (Mark VII) that will work with sthis driver
Leviton	IllumaTech IP7 series
Philips	Sunrise - SR1200ZTUNV



Driver Current Cutback

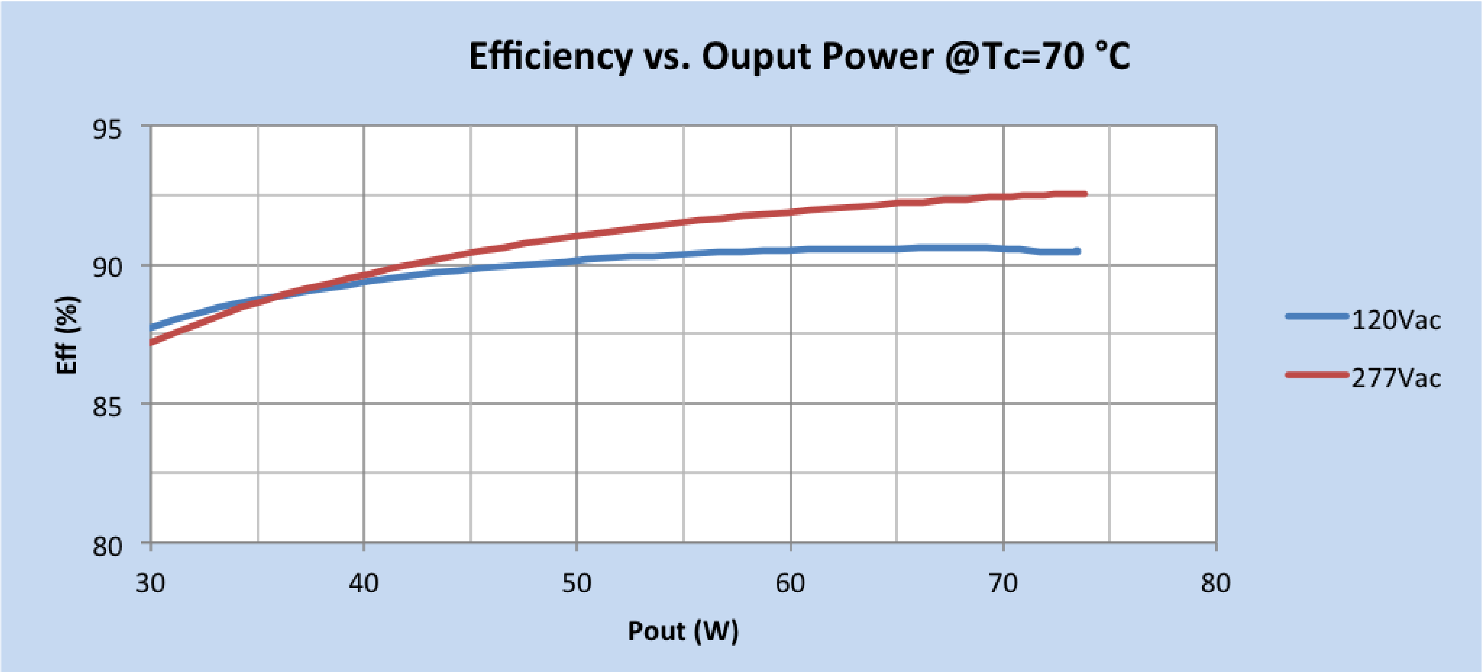
The Driver Current Cutback feature provides for an increased output voltage with a reduced output current during abnormal LED operation, such as cold weather starting.

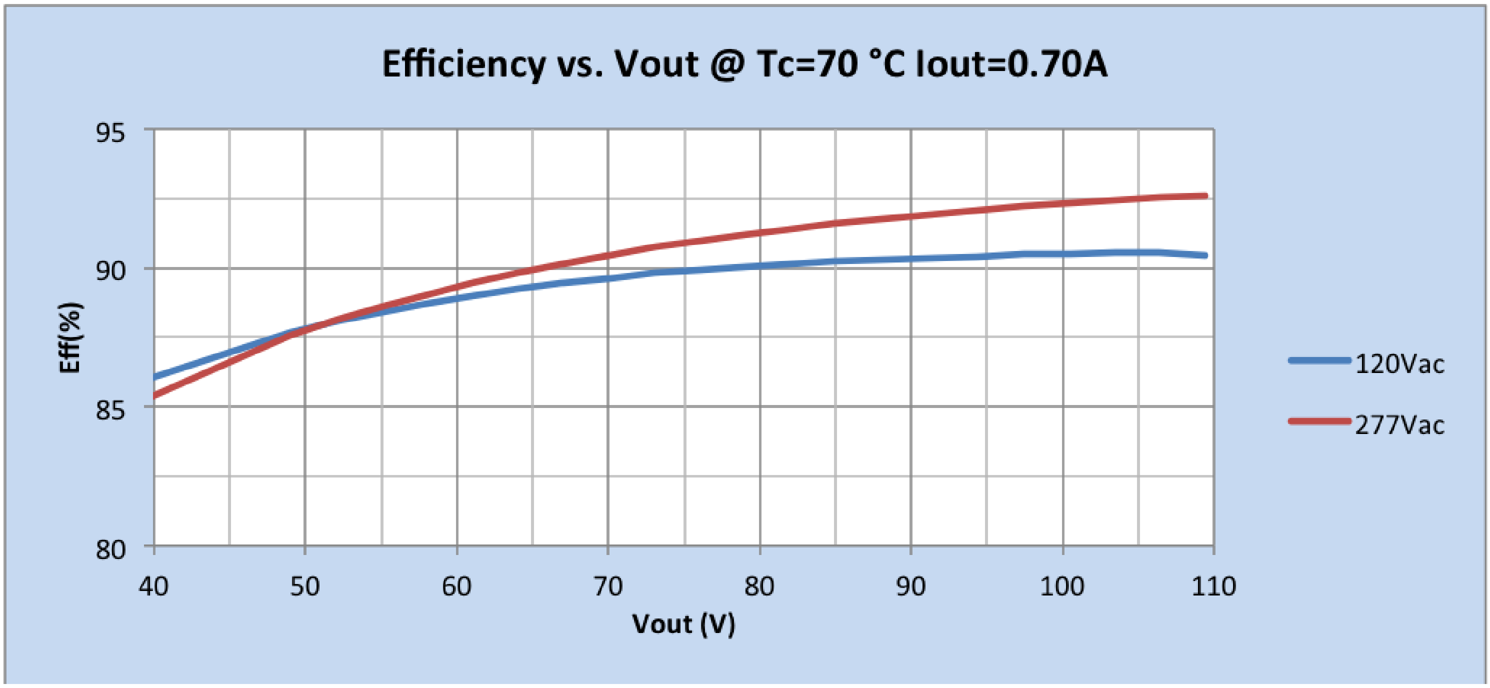


Xitanium 75W 120-277V 0.70A 0-10V Dimming

Performance Characteristics

Based on measurements on a typical sample. The accuracy of the measurements is within the tolerance of the measurement instruments.
The graphs are meant to be a guideline and not a specification.

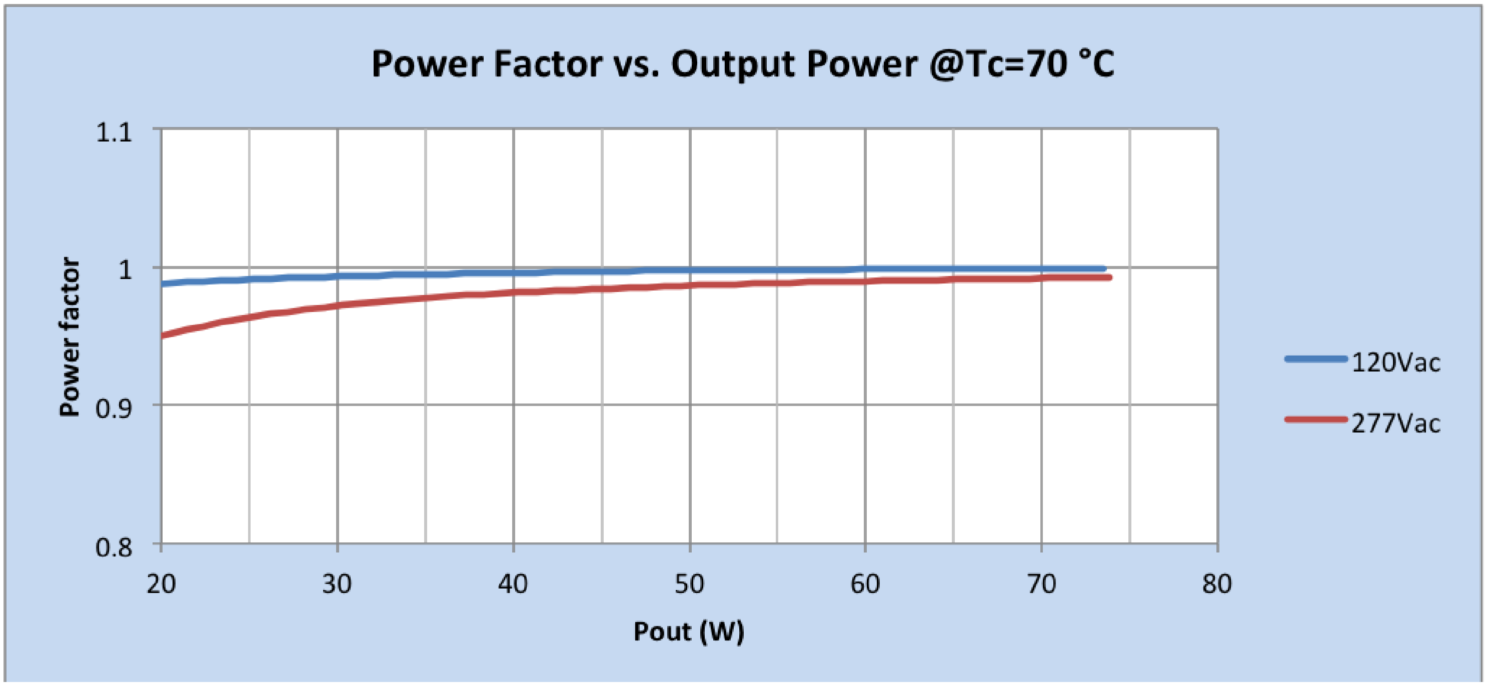


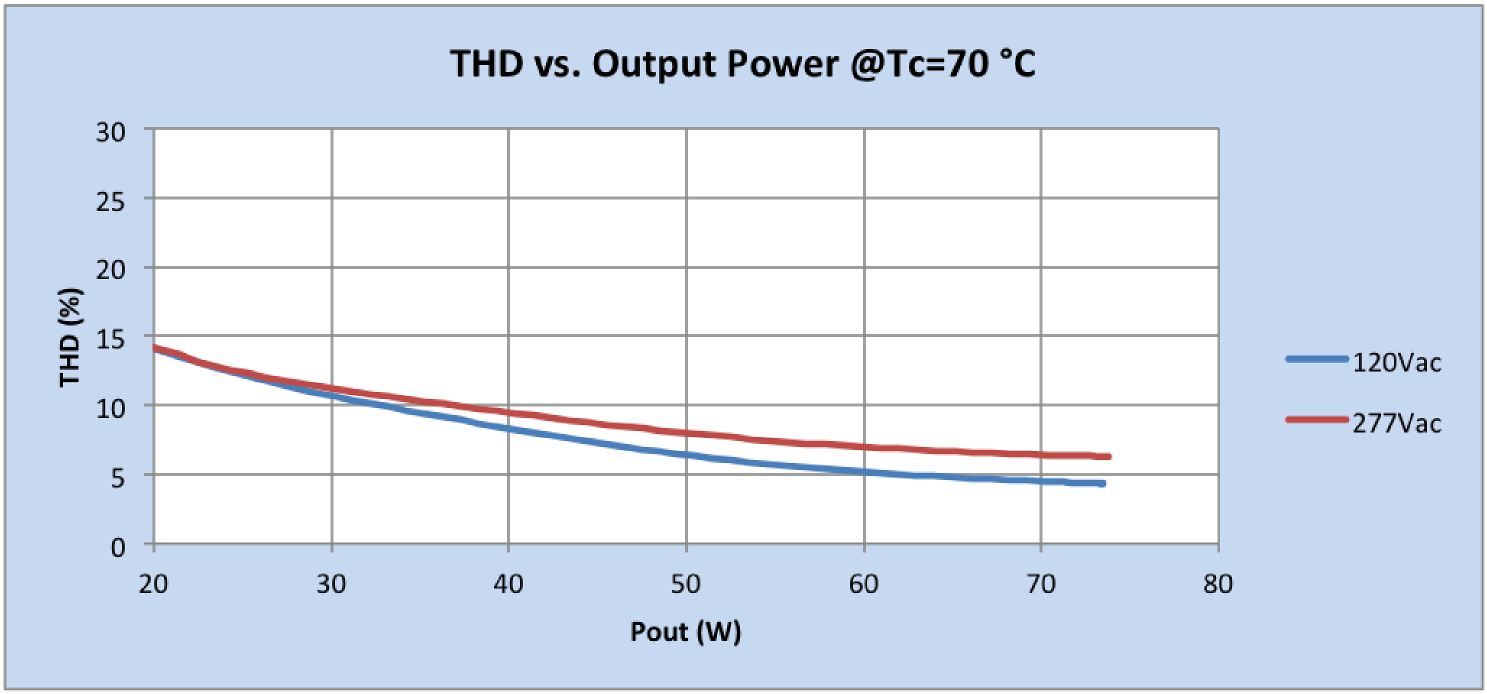


Xitanium 75W 120-277V 0.70A 0-10V Dimming

Performance Characteristics

Based on measurements on a typical sample. The accuracy of the measurements is within the tolerance of the measurement instruments.
The graphs are meant to be a guideline and not a specification.



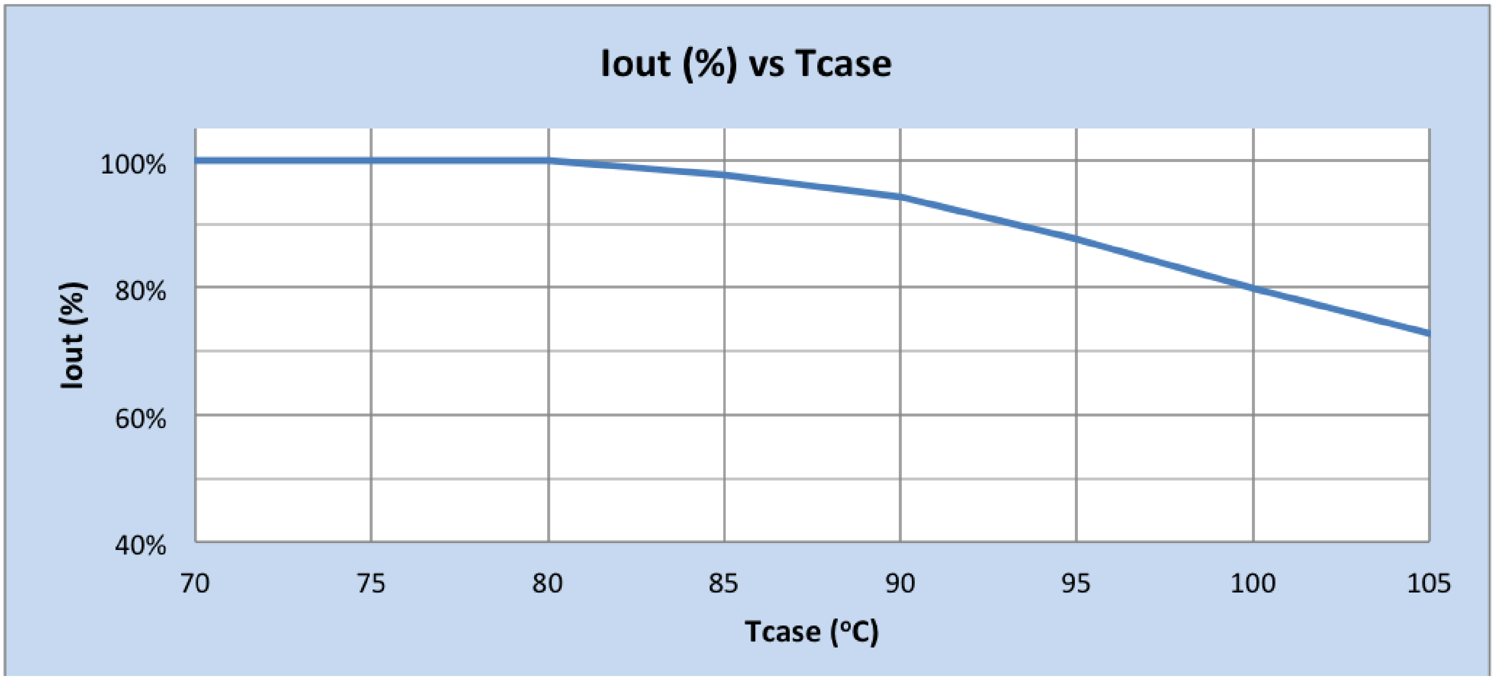


Xitanium 75W 120-277V 0.70A 0-10V Dimming

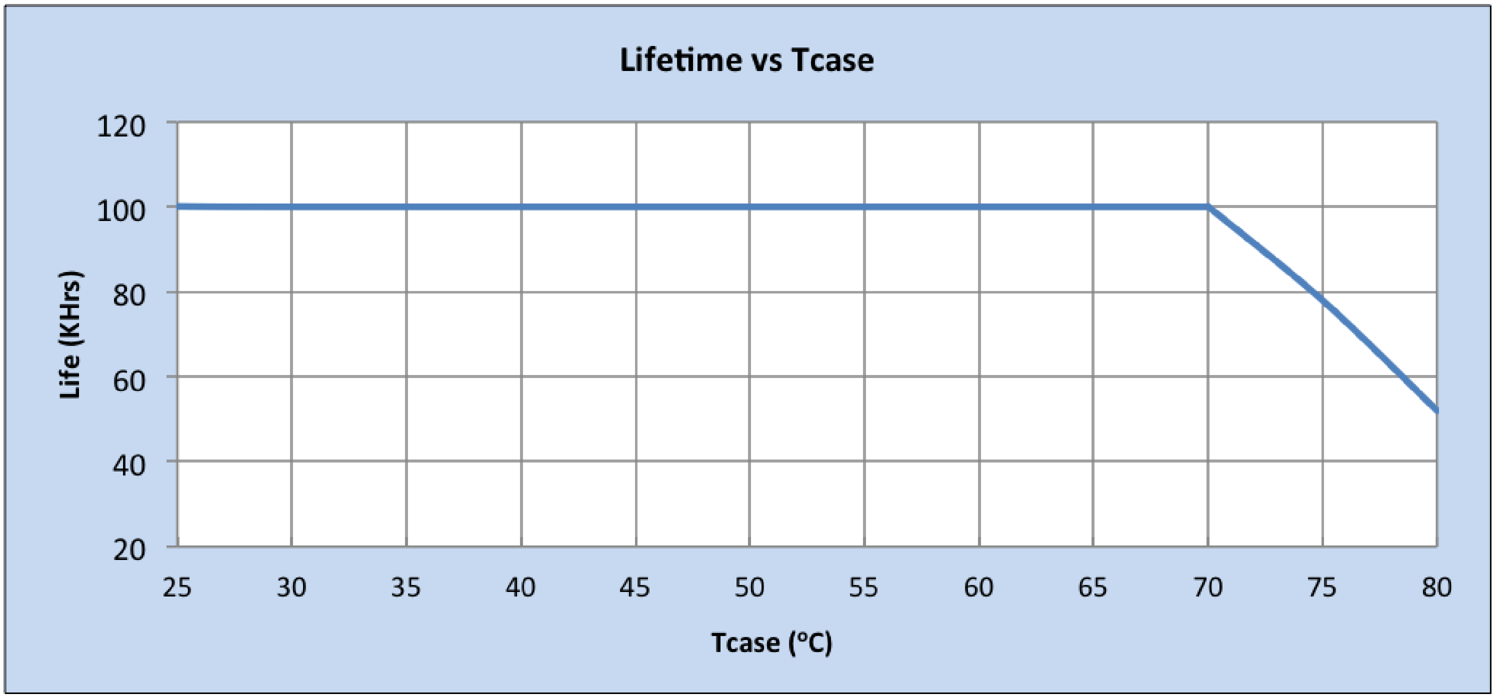
Electrical Specifications

All the specifications are typical and at 25°C Tcase unless specified otherwise.

Output Current vs. Driver Case Temperature:

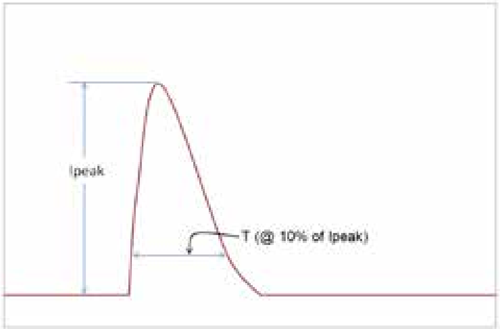


Driver Lifetime vs. Driver Case Temperature:



Xitanium 75W 120-277V 0.70A 0-10V Dimming

Inrush Current Info:



Vin	Ipeak	T (@ 10% of Ipeak)
120 Vrms	36A	223µs
277 Vrms	92A	188µs

Inrush current is measured at peak of the corresponding line voltage, source impedance per NEMA 410.

Lightning Surge Info:

ANSI Surge Type	Differential Mode (L-N)	Common Mode (L-G, N-G, L&N-G)
1.2/50µs Combination Wave (w/t 2Ω)	4kV	4kV

Isolation:

Isolation	Input	Output	0-10V (Class 1 & 2)	Enclosure
Input	NA	2xU+1kV	2.5KVac	2xU+1kV
Output	2xU+1kV	NA	2.5KVac	2xU+1kV
0-10V (Class 1 & 2)	2.5KVac	2.5KVac	NA	2xU+1kV
Enclosure	2xU+1kV	2xU+1kV	2xU+1kV	NA

c US Dry & Damp location

philips.com/leddrivers

Philips Lighting North America Corporation
10275 W. Higgins Road, Rosemont IL 60018
Tel: 800-322-2086 Fax: 888-423-1882
Customer/Technical Service: 800-372-3331
OEM Support: 866-915-5886

Imported by: Philips Lighting
A division of Philips Electronics Ltd.
281 Hillmount Rd, Markham, ON, Canada L6C 2S3
Tel. 800-668-9008

PHILIPS ADVANCE

LED Driver

Xitanium

150W 120-277V 1.05A 0-10V
XI150C105V140CNF1

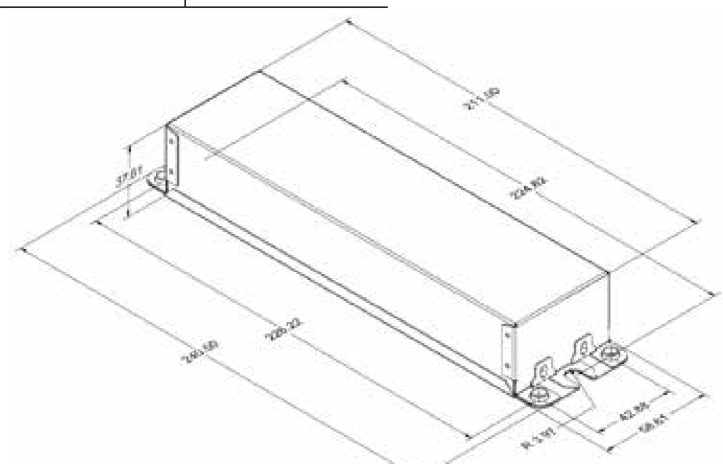
Long-lasting and low maintenance, LED-based light sources are an excellent solution for all lighting applications. For optimal performance, these solutions require reliable drivers matching the long lifetime of the LEDs. The Philips Advance Xitanium LED Outdoor Driver portfolio offers a range of products specially designed to operate LED solutions in outdoor applications. These drivers are designed for hard-wired integration into outdoor luminaires for the most rugged applications. They operate to specification under wide temperature and electrical ranges to ensure reliability.

Specifications

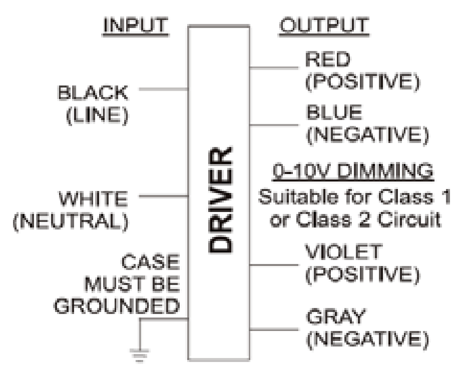
Input Voltage (Vrms)	Output Power (W)	Output Voltage (V)	Output Current (A)	Efficiency@ Max Load and 70°C Case	Max. Case Temp. (°C)	Input Current (Arms)	Max. Input Power (W)	Inrush Current (A_{pk}/10%-μs)	THD @ Max. Load	Power Factor @ Max. Load	Surge Protection Common/ Diff (KV)	Weight (Lbs/kgs)	Envir. Protection Rating
120	150	44-140	1.05	90.7	80	1.4	169	57 / 300	<10%	>0.95	4/4	2.1/0.95	UL Dry & Damp
277				92.8		0.6		132 / 276	<10%				

Enclosure

	In. (mm)
Case Length	8.38 (211.1)
Case Width	2.35 (59.1)
Case Height	1.49 (37.6)
Mounting Length	9.0 (226.2)
Mounting Width	1.7 (42.9)
Overall Length	9.54 (240.5)



Wiring Diagram



Input and output use lead-wires.

Lead-wires are 18AWG 105C/600V solid copper per UL1452.

Lead Length outside enclosure: 270 mm (±30mm) on all wires

Dimming: 270mm (±30mm)

Dimming	Dimming Range	Minimum Output Current (A)	Other Comments
0-10V Analog	10% ~ 100%	0.105	Dimming source current: 150 μA (±3%)

UL Conditions of Acceptability:

Please contact your Philips representative for a copy of the latest UL Conditions of Acceptability (COA).

Xitanium 150W 120-277V 1.05A 0-10V Dimming

Electrical Specifications

All the specifications are typical and at 25°C Tcase unless specified otherwise.

Features

- 50,000+ hour lifetime[1]
- New housing with high thermal capability

Benefits

- Enables long life luminaire designs
- Allows luminaire designs for ambient environments

Application

- Area
- Roadway
- Parking garages
- Floodlights

1. Philips Advance Xitanium LED Drivers are designed and manufactured to engineering standards correlating to an average life expectancy of 50,000 hours of operation at maximum rated case temperature. Minimum 90% survivals based on MTBF modeling.

Product Data

Order Information	
Order Code	XI150C105V140CNF1
Full Product Code	XI150C105V140CNF1M (Mid-Pack, 10pcs/Box)
Full Product Name	XITANIUM 150W 1.05A 0-10V Dimming
Line Voltage	120-277Vac rms
Line Current	1.40A @ 120Vac, 0.60 @ 277Vac, 0.67A @ 250Vdc
Line Frequency	50/60Hz
Min. Mains Voltage Operational	108V
Max. Mains Voltage Operational	305V
THD (total)	Refer to graph
Power Factor (PF)	Refer to graph
Efficiency	Refer to graph
Inrush Current	Per NEMA 410
Lightning Surge Protection	Refer to table
Output Information	
Output Voltage Range	44Vdc to 140Vdc
Maximum Open Circuit Voltage	220Vdc
Output Current (ripple = peak to average / average)	15% max @ max Iout and max Vout Low frequency (≤120 Hz) content <5%
Protections	Short Circuit and Open Circuit Protection for LED + and LED -
Ambient Operating Temp. Range	-40°C to +55°C
Max Case Temperature (Tcase)	80°C
Features	
Interfaces	0-10V Dimming
0-10V Dimming Specifications	150µA ± 3% source current from driver. See dim curve for detail.
Environment & Approbation	
Environmental Protection Rating	UL dry and damp
Agency Approbations	UL879, UL1012, UL935, (cRUs/CSA)
Electromagnetic Compliance	FCC Title 47 Part 15 Class A
Isolation	Refer to table
Audible Noise	<24dB Class A

Xitanium 150W 120-277V 1.05A 0-10V Dimming

Electrical Specifications

All the specifications are typical and at 25°C Tcase unless specified otherwise.

0-10V Dimming Curve:

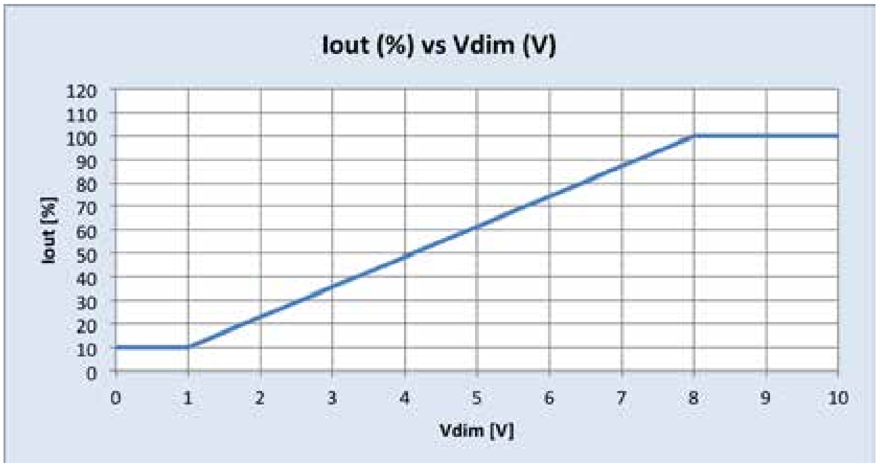
Dimming source current from the driver: 150µA (±3%) (@ 0<Vdim<8V)

LED Current Tolerance at 1050mA ≤ 5% over temperature and component variations and ≤ 10% at any dim level

Minimum Dim Level (nominal): 105 mA

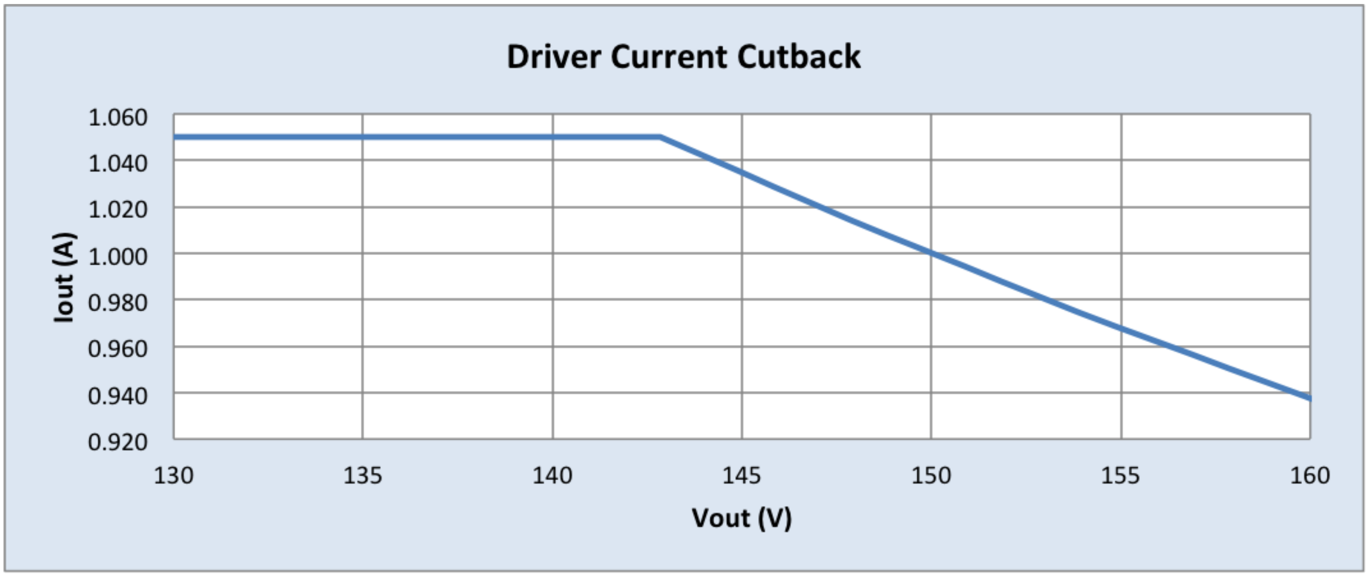
Approved Dimmer List

Manufacturer	Manufacturer Part Number
Lutron	Visit www.lutron.com/ advance for a list of dimmers (Mark VII) that will work with sthis driver
Leviton	IllumaTech IP7 series
Philips	Sunrise - SR1200ZTUNV



Driver Current Cutback

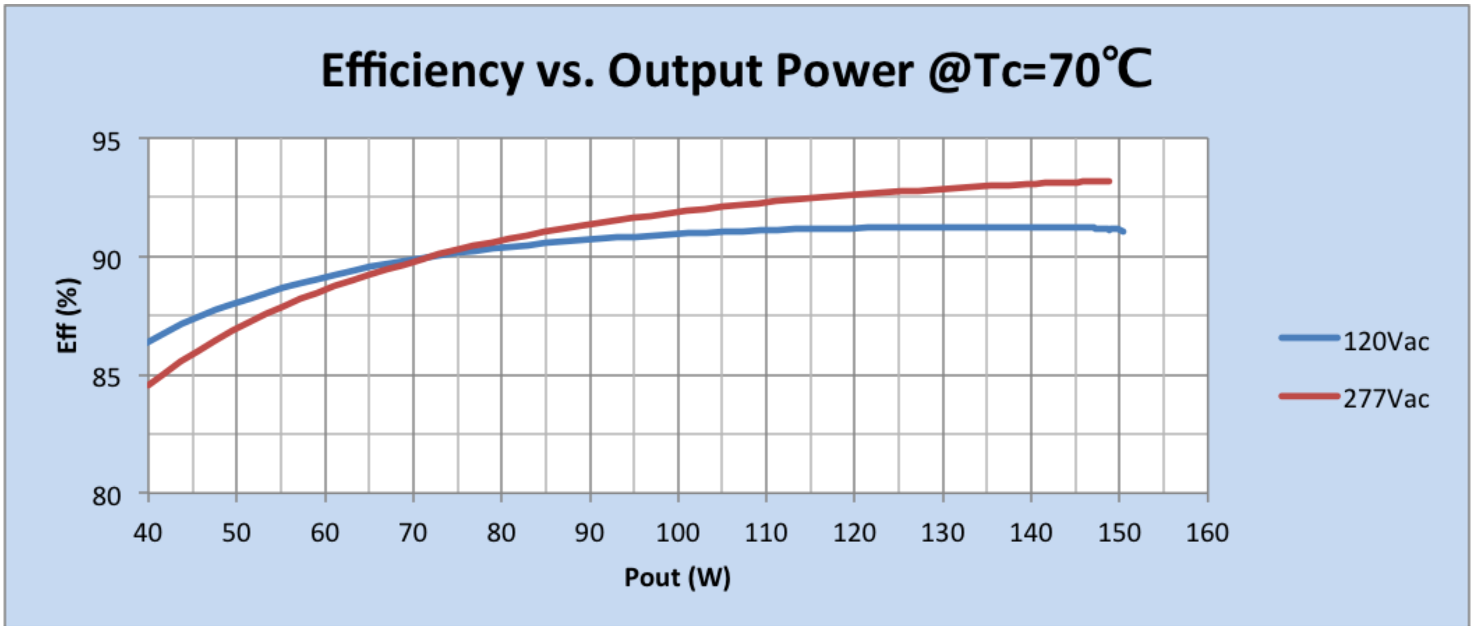
The Driver Current Cutback feature provides for an increased output voltage with a reduced output current during abnormal LED operation, such as cold weather starting.

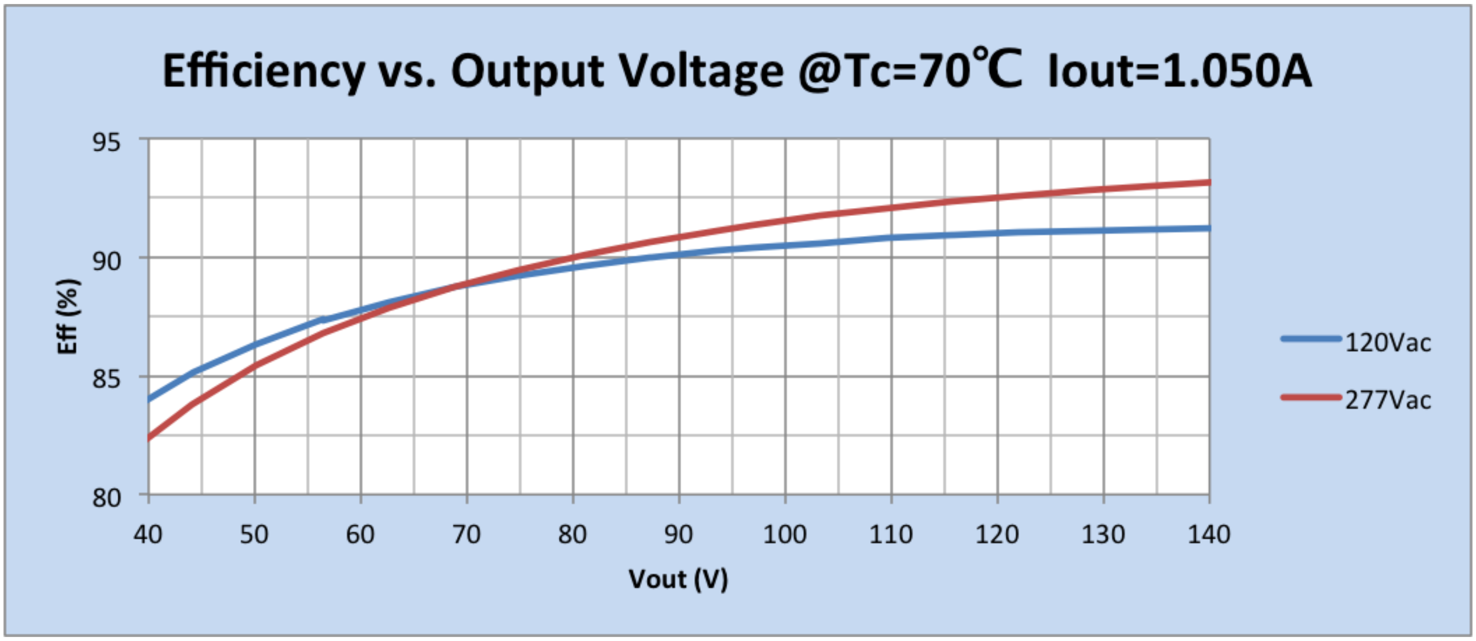


Xitanium 150W 120-277V 1.05A 0-10V Dimming

Performance Characteristics

Based on measurements on a typical sample. The accuracy of the measurements is within the tolerance of the measurement instruments.
The graphs are meant to be a guideline and not a specification.

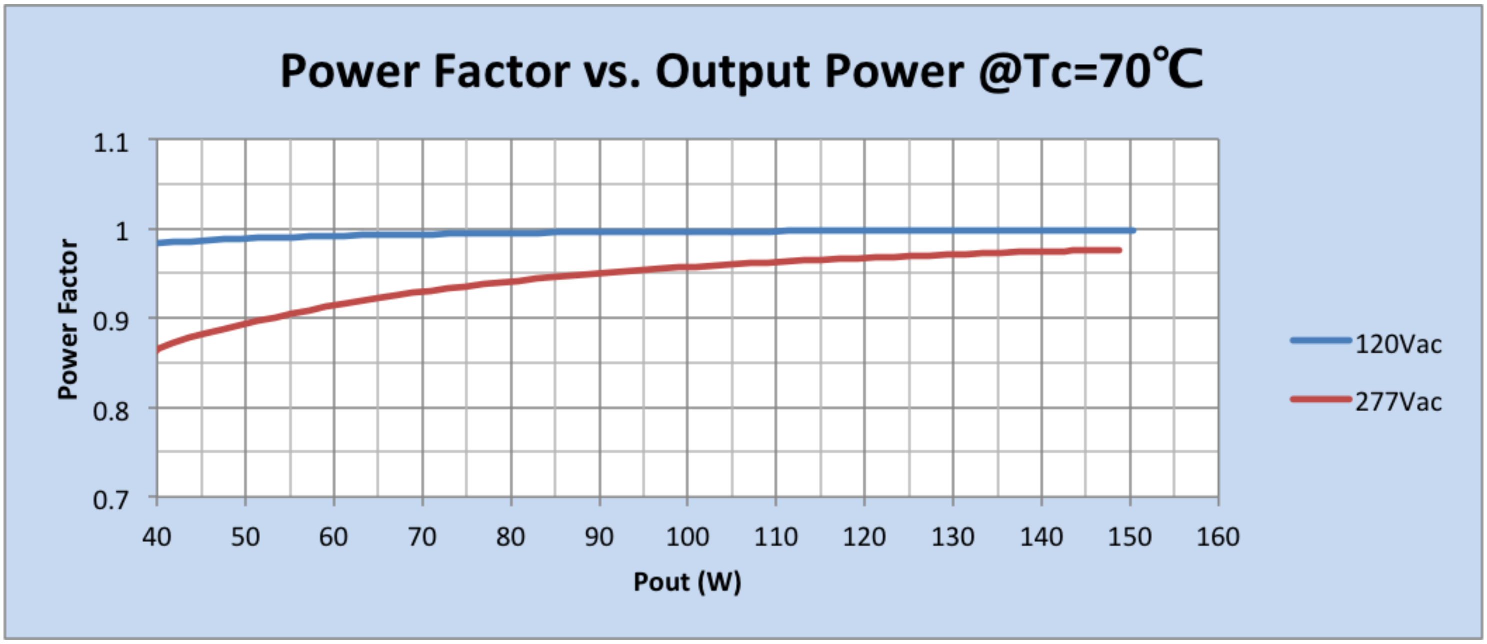


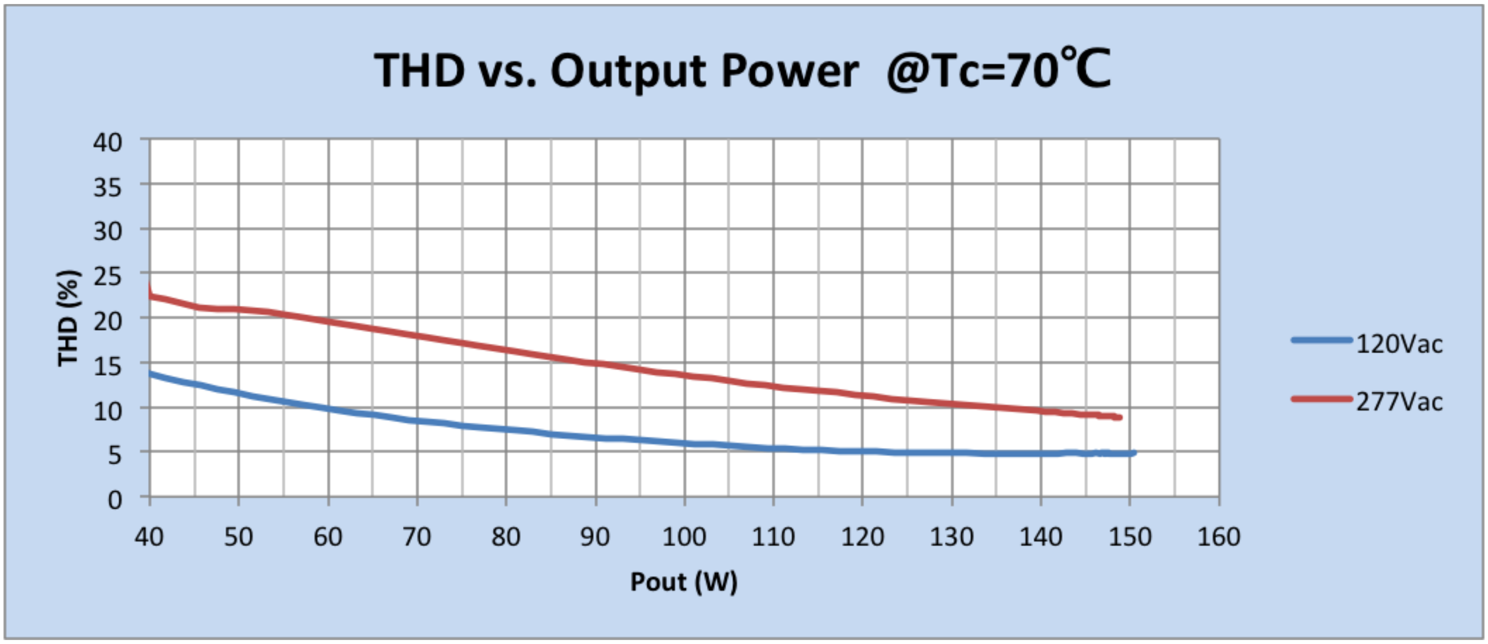


Xitanium 150W 120-277V 1.05A 0-10V Dimming

Performance Characteristics

Based on measurements on a typical sample. The accuracy of the measurements is within the tolerance of the measurement instruments.
The graphs are meant to be a guideline and not a specification.



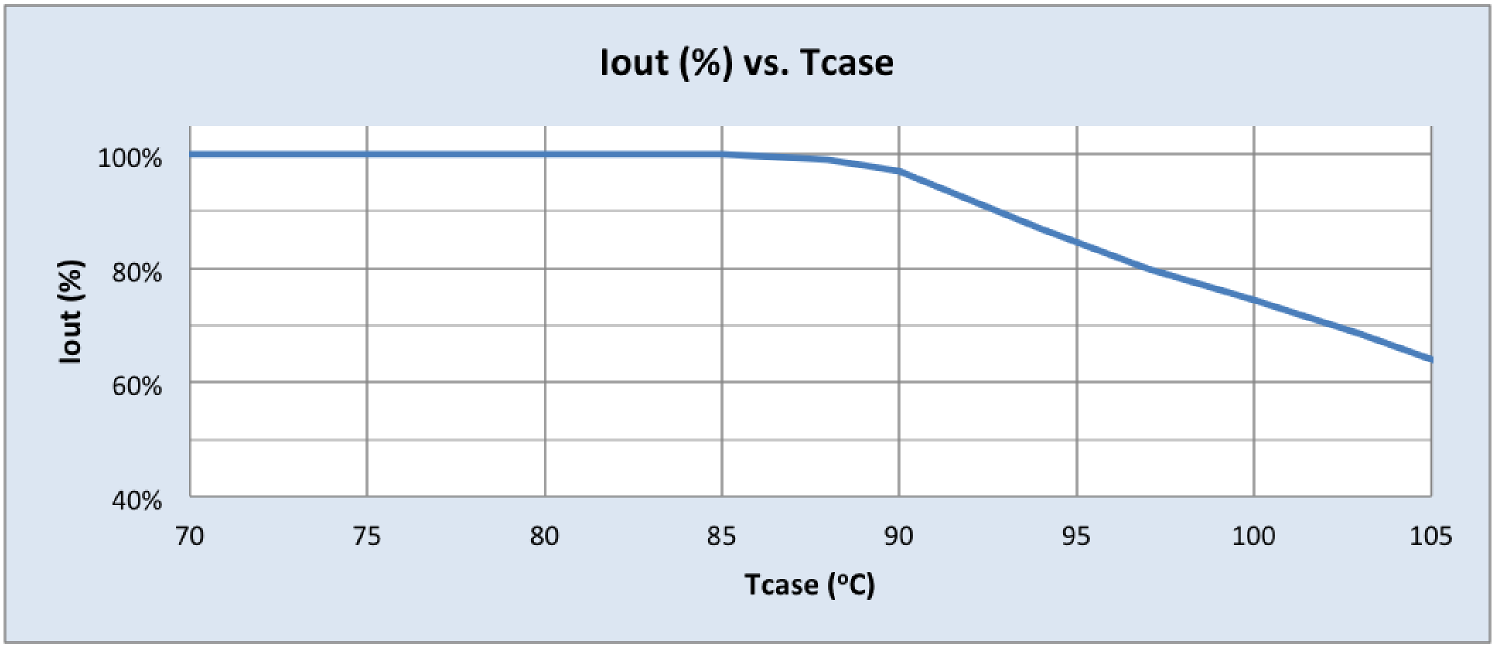


Xitanium 150W 120-277V 1.05A 0-10V Dimming

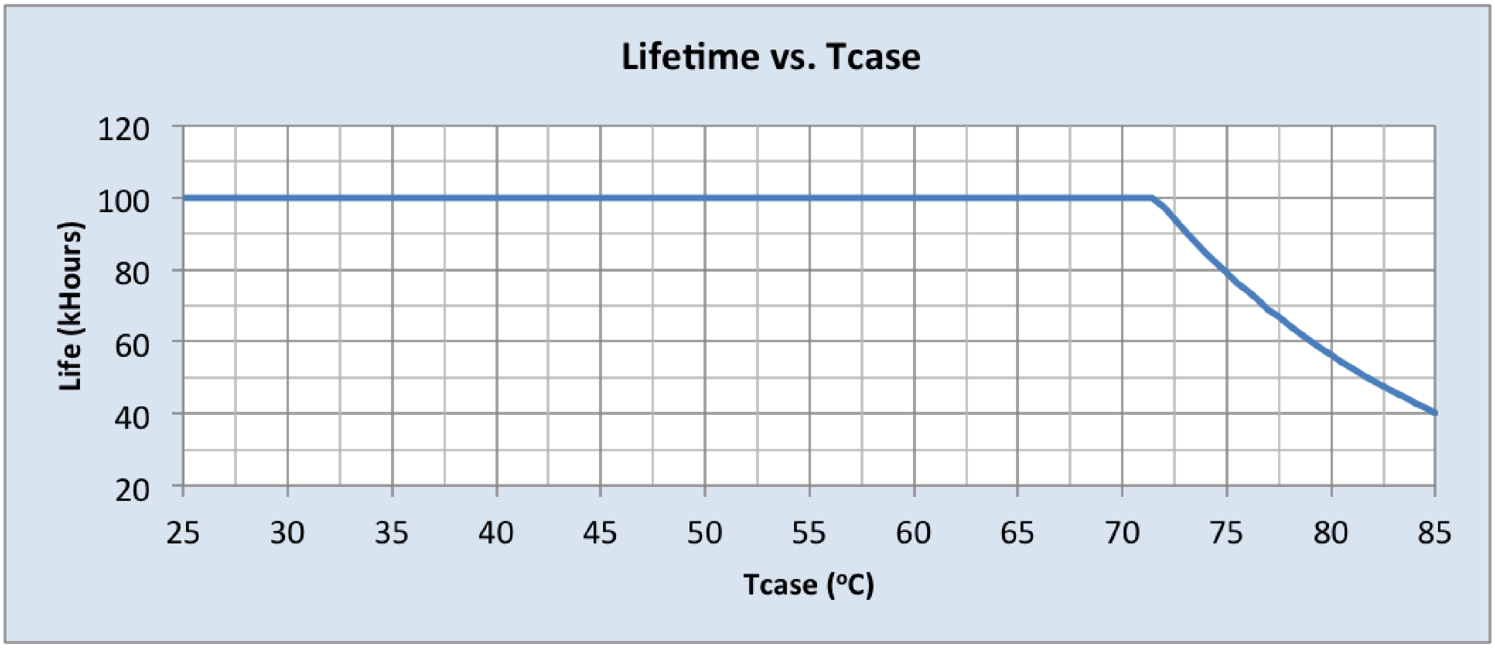
Electrical Specifications

All the specifications are typical and at 25°C Tcase unless specified otherwise.

Output Current vs. Driver Case Temperature:

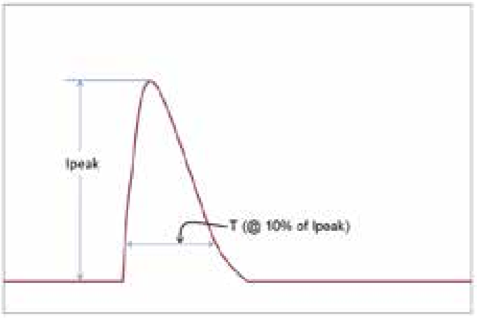


Driver Lifetime vs. Driver Case Temperature:



Xitanium 150W 120-277V 1.05A 0-10V Dimming

Inrush Current Info:



Vin	Ipeak	T (@ 10% of Ipeak)
120 Vac	57A	300μs
277 Vac	132A	276μs

Inrush current is measured at peak of the corresponding line voltage, source impedance per NEMA 410.

Lightning Surge Info:

ANSI Surge Type	Differential Mode (L-N)	Common Mode (L-G, N-G, L&N-G)
1.2/50μs Combination Wave (w/t 2Ω)	4kV	4kV

Isolation:

Isolation	Input	Output	0-10V (Class 1 & 2)	Enclosure
Input	NA	2xU+1kV	2.5KVac	2xU+1kV
Output	2xU+1kV	NA	2.5KVac	2xU+1kV
0-10V (Class 1 & 2)	2.5KVac	2.5KVac	NA	2xU+1kV
Enclosure	2xU+1kV	2xU+1kV	2xU+1kV	NA

C US
c US Dry & Damp location

philips.com/leddrivers

Philips Lighting North America Corporation
10275 W. Higgins Road, Rosemont IL 60018
Tel: 800-322-2086 Fax: 888-423-1882
Customer/Technical Service: 800-372-3331
OEM Support: 866-915-5886

Imported by: Philips Lighting
A division of Philips Electronics Ltd.
281 Hillmount Rd, Markham, ON, Canada L6C 2S3
Tel. 800-668-9008

Philips Lumileds
IESNA LM-80 Test Report

Design Resource DR05-2

LUXEON
NEVER BEFORE POSSIBLE

Philips Lumileds

IESNA LM-80 Test Report

1. Applicable LUXEON Series part numbers

This IESNA LM-80 Test Report applies to the LUXEON part numbers in Table 1:

Table 1.

Product	Nominal CCT
LXA7-PW40	4000K
LXH7-PW40	4000K
LXH8-PW40	4000K
LXW8-PW40	4000K
LXML-PWN2	4100K
LXA7-PW50	5000K
LXH8-PW50	5000K
LXW8-PW50	5000K
LXML-PWC2	5650K
LXA7-PW57	5700K
LXA7-PW65	6500K
LXML-PR02	Royal-Blue

PHILIPS
LUMILEDS

2. L70 Extrapolations per IESNA TM-21-11

Table 2.

	0.5A	0.7A	1A
120C	> 54,000	> 54,000	
105C	> 54,000	> 54,000	> 54,000
85C	> 54,000	> 54,000	> 54,000
55C	> 54,000	> 54,000	> 54,000

= Limited by TM-21 6x rule.

3. Light Sources Tested

LUXEON Rebel p/n: LXML-PWN2 (nominal CCT 4000K)

4. Dates Tests Started

DATA SETs 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61: December 3, 2010

5. Date Report First Issued

DATA SETs 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61: new to this report.

6. Package Pictures

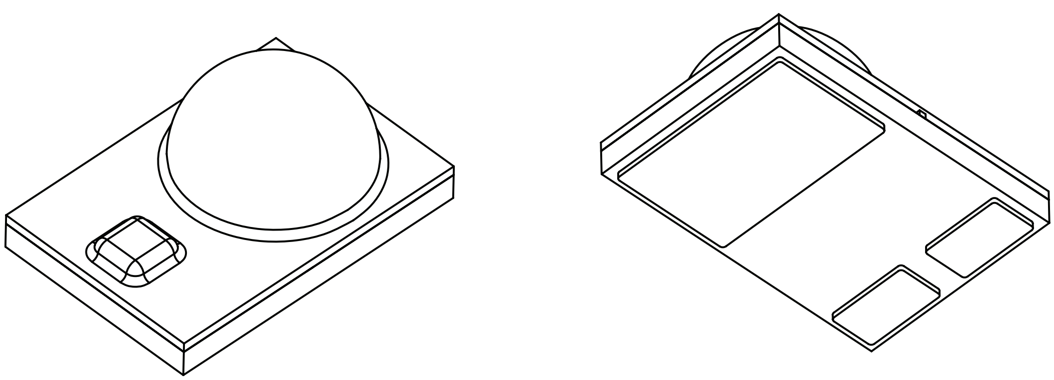


Figure 1. Isometric drawing for 2mm^2 package.

7. Mechanical Drawing

For detailed mechanical drawings, please see individual product data sheet.

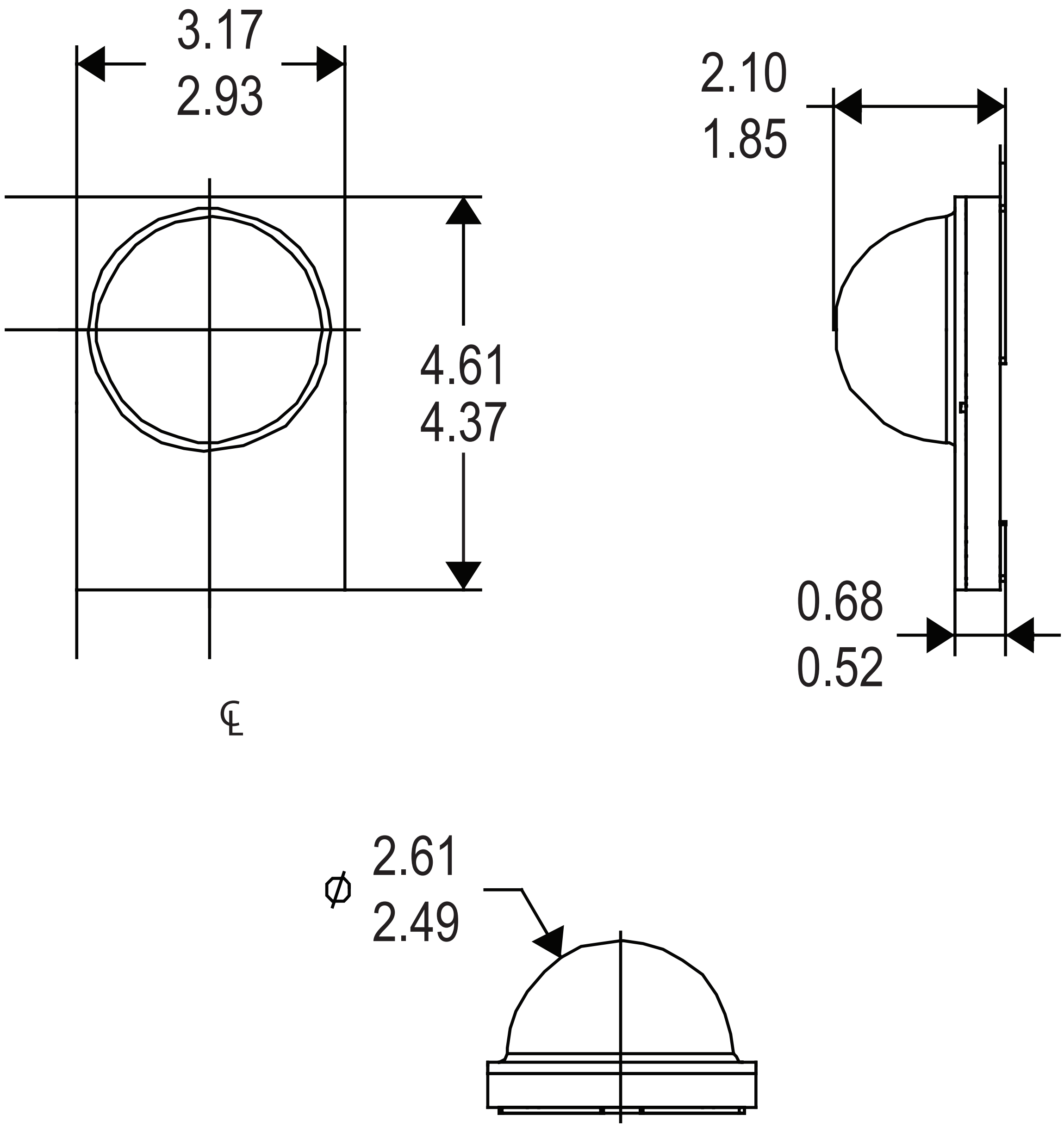


Figure 2. Mechanical Drawings.

Notes for Figure 2:

- Drawings not to scale. All dimensions are in millimeters.
- The thermal pad is electrically isolated from the anode and cathode contact pads.

8. T_S Measurement Point

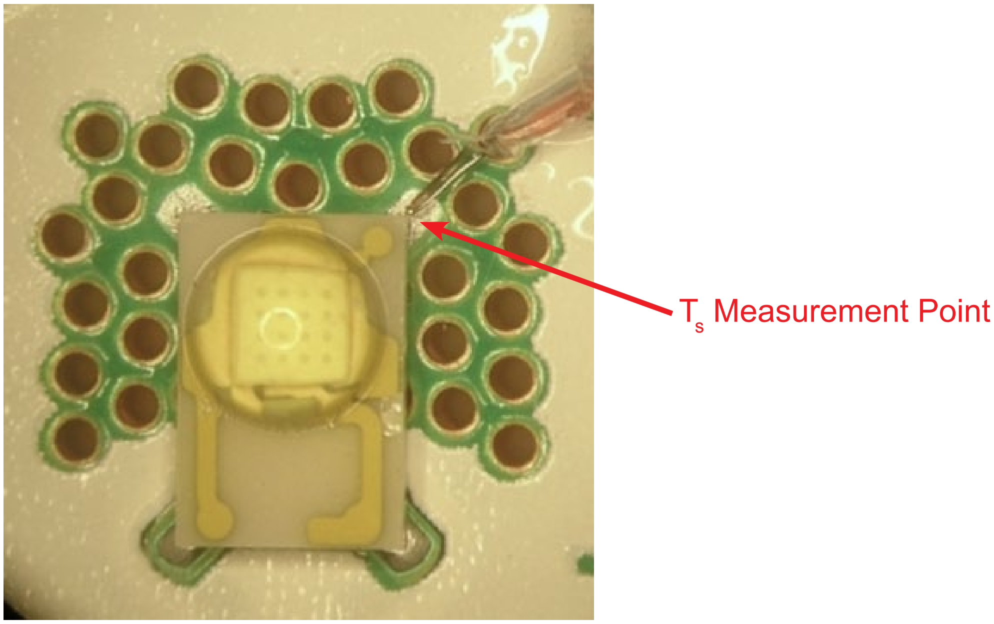


Figure 3. LUXEON Rebel with T_s thermocouple.

For further information on measuring the in-situ T_S, please see Philips Lumileds AB33 *"LUXEON LED Thermal Management Guidelines"*, February 28, 2012.

SUMMARY

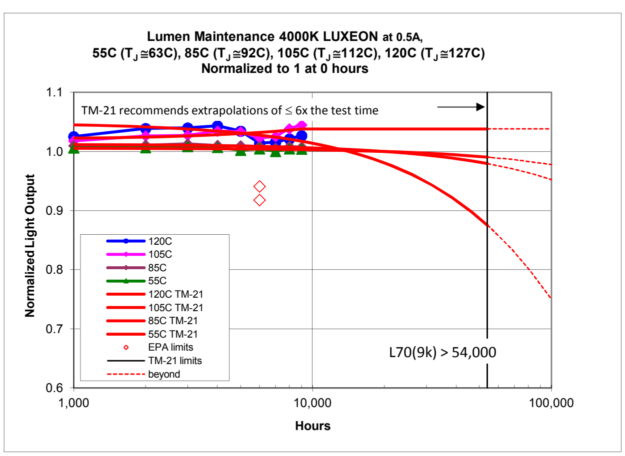
LUXEON, CCT = 4000K, I_F = 0.5A

Normalized Flux

		0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	alpha	B	r2	:L70
DATA SET 51 $T_S = T_{AIR}$ = 120C	median =	1.0000	0.9963	0.9976	1.0105	1.0238	1.0378	1.0395	1.0417	1.0385	**1.0147**	1.0184	1.0258	1.0284					
	average =	**1.0000**	**0.9963**	**0.9982**	**1.0113**	**1.0252**	**1.0389**	**1.0398**	**1.0433**	**1.0343**	**1.0137**	**1.0157**	**1.0212**	**1.0266**		3.3407E-06	1.0483	0.318	120,878
	st dev =	0.0000	0.0047	0.0047	0.0061	0.0072	0.0103	0.0130	0.0124	0.0129	**0.0128**	0.0132	0.0129	0.0121			**TM-21 L70(9k) >**		**54,000**
	min =	1.0000	0.9908	0.9919	1.0030	1.0156	1.0240	1.0201	1.0222	1.0023	**0.9846**	0.9869	0.9921	1.0001					
	max =	1.0000	1.0158	1.0168	1.0331	1.0483	1.0699	1.0782	1.0691	1.0545	**1.0377**	1.0366	1.0393	1.0455					
DATA SET 52 $T_S = T_{AIR}$ = 105C	median =	1.0000	0.9955	0.9973	1.0070	1.0172	1.0251	1.0267	1.0344	1.0330	**1.0208**	1.0240	1.0365	1.0432					
	average =	**1.0000**	**0.9955**	**0.9973**	**1.0084**	**1.0177**	**1.0263**	**1.0274**	**1.0345**	**1.0336**	**1.0230**	**1.0253**	**1.0383**	**1.0449**		-1.8899E-06	1.0206	0.201	-199,520
	st dev =	0.0000	0.0028	0.0031	0.0046	0.0048	0.0045	0.0048	0.0048	0.0049	**0.0059**	0.0069	0.0085	0.0097			**TM-21 L70(9k) >**		**54,000**
	min =	1.0000	0.9890	0.9881	1.0023	1.0118	1.0203	1.0196	1.0255	1.0258	**1.0111**	1.0088	1.0189	1.0209					
	max =	1.0000	1.0006	1.0023	1.0188	1.0279	1.0366	1.0377	1.0448	1.0443	**1.0364**	1.0373	1.0536	1.0600					
DATA SET 53 $T_S = T_{AIR}$ = 85C	median =	1.0000	0.9890	0.9847	1.0080	1.0094	1.0108	1.0122	1.0107	1.0094	**1.0080**	1.0052	1.0084	1.0068					
	average =	**1.0000**	**0.9891**	**0.9846**	**1.0082**	**1.0098**	**1.0107**	**1.0127**	**1.0102**	**1.0097**	**1.0084**	**1.0055**	**1.0082**	**1.0074**		6.1160E-07	1.0122	0.475	603,077
	st dev =	0.0000	0.0032	0.0041	0.0046	0.0040	0.0051	0.0048	0.0059	0.0057	**0.0066**	0.0064	0.0065	0.0063			**TM-21 L70(9k) >**		**54,000**
	min =	1.0000	0.9812	0.9781	0.9995	1.0002	0.9987	1.0006	0.9961	0.9942	**0.9917**	0.9895	0.9926	0.9927					
	max =	1.0000	0.9948	0.9952	1.0203	1.0171	1.0189	1.0204	1.0188	1.0185	**1.0179**	1.0144	1.0174	1.0169					
DATA SET 54 $T_S = T_{AIR}$ = 55C	median =	1.0000	0.9859	0.9828	1.0036	1.0048	1.0049	1.0071	1.0054	1.0048	**1.0030**	0.9988	1.0035	1.0030					
	average =	**1.0000**	**0.9864**	**0.9827**	**1.0051**	**1.0062**	**1.0063**	**1.0084**	**1.0068**	**1.0020**	**1.0045**	**1.0003**	**1.0045**	**1.0041**		2.8084E-07	1.0055	0.055	1,289,606
	st dev =	0.0000	0.0052	0.0050	0.0062	0.0072	0.0063	0.0066	0.0058	0.0120	**0.0069**	0.0069	0.0065	0.0060			**TM-21 L70(9k) >**		**54,000**
	min =	1.0000	0.9761	0.9747	0.9960	0.9870	0.9965	0.9958	0.9963	0.9781	**0.9935**	0.9892	0.9936	0.9931					
	max =	1.0000	0.9981	0.9946	1.0195	1.0231	1.0218	1.0247	1.0216	1.0225	**1.0193**	1.0163	1.0194	1.0201					

Delta u' v'

		0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 51 $T_S = T_{AIR}$ = 120C	median =	0.0000	0.0001	0.0002	0.0004	0.0004	0.0009	0.0012	0.0015	0.0016	**0.0015**	0.0039	0.0043	0.0041	
	average =	**0.0000**	**0.0001**	**0.0003**	**0.0004**	**0.0006**	**0.0011**	**0.0013**	**0.0015**	**0.0016**	**0.0015**	**0.0040**	**0.0043**	**0.0042**	
	st dev =	0.0000	0.0001	0.0004	0.0002	0.0004	0.0006	0.0007	0.0007	0.0006	**0.0005**	0.0005	0.0005	0.0005	
	min =	0.0000	0.0000	0.0000	0.0001	0.0002	0.0003	0.0006	0.0006	0.0008	**0.0009**	0.0033	0.0034	0.0032	
	max =	0.0000	0.0008	0.0011	0.0009	0.0014	0.0023	0.0027	0.0027	0.0026	**0.0024**	0.0050	0.0054	0.0053	
DATA SET 52 $T_S = T_{AIR}$ = 105C	median =	0.0000	0.0003	0.0002	0.0004	0.0003	0.0005	0.0004	0.0004	0.0003	**0.0004**	0.0015	0.0024	0.0026	
	average =	**0.0000**	**0.0003**	**0.0002**	**0.0004**	**0.0004**	**0.0007**	**0.0006**	**0.0006**	**0.0006**	**0.0007**	**0.0017**	**0.0026**	**0.0028**	
	st dev =	0.0000	0.0001	0.0001	0.0002	0.0002	0.0004	0.0005	0.0006	0.0006	**0.0006**	0.0007	0.0006	0.0006	
	min =	0.0000	0.0002	0.0001	0.0001	0.0001	0.0003	0.0001	0.0002	0.0001	**0.0002**	0.0011	0.0018	0.0020	
	max =	0.0000	0.0004	0.0003	0.0006	0.0009	0.0017	0.0019	0.0020	0.0020	**0.0022**	0.0033	0.0041	0.0042	
DATA SET 53 $T_S = T_{AIR}$ = 85C	median =	0.0000	0.0003	0.0004	0.0006	0.0007	0.0004	0.0005	0.0006	0.0006	**0.0006**	0.0006	0.0007	0.0006	
	average =	**0.0000**	**0.0003**	**0.0004**	**0.0006**	**0.0006**	**0.0004**	**0.0004**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	
	st dev =	0.0000	0.0001	0.0001	0.0002	0.0003	0.0002	0.0002	0.0002	0.0003	**0.0003**	0.0003	0.0003	0.0003	
	min =	0.0000	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	**0.0001**	0.0000	0.0001	0.0000	
	max =	0.0000	0.0004	0.0007	0.0009	0.0010	0.0006	0.0007	0.0009	0.0010	**0.0010**	0.0011	0.0010	0.0010	
DATA SET 54 $T_S = T_{AIR}$ = 55C	median =	0.0000	0.0003	0.0005	0.0008	0.0010	0.0010	0.0010	0.0011	0.0011	**0.0011**	0.0010	0.0010	0.0009	
	average =	**0.0000**	**0.0003**	**0.0005**	**0.0008**	**0.0010**	**0.0010**	**0.0010**	**0.0011**	**0.0011**	**0.0010**	**0.0010**	**0.0008**	**0.0007**	
	st dev =	0.0000	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	**0.0004**	0.0005	0.0004	0.0004	
	min =	0.0000	0.0001	0.0001	0.0002	0.0004	0.0005	0.0006	0.0005	0.0005	**0.0004**	0.0002	0.0002	0.0001	
	max =	0.0000	0.0004	0.0007	0.0010	0.0016	0.0013	0.0014	0.0015	0.0015	**0.0014**	0.0022	0.0014	0.0012	



SUMMARY, Continued

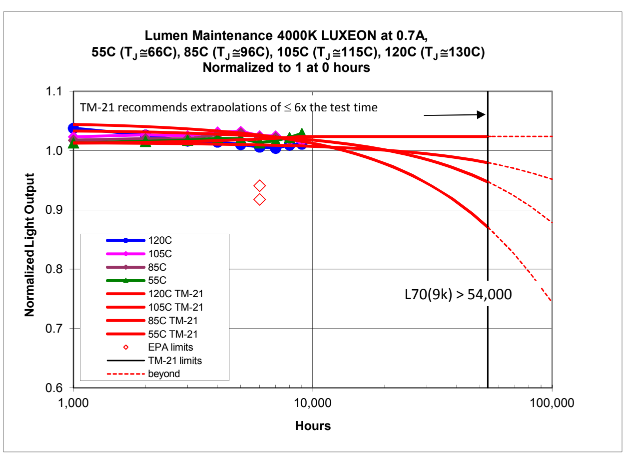
LUXEON, CCT = 4000K, I_F = 0.7A

Normalized Flux

Data set		0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	alpha	B	r2	:L70
DATA SET 55 $T_S = T_{AIR}$ = 120C	median =	1.0000	0.9977	1.0011	1.0154	1.0395	1.0255	1.0163	1.0161	1.0116	**1.0080**	1.0045	1.0103	1.0118					
	average =	**1.0000**	**0.9980**	**1.0017**	**1.0159**	**1.0379**	**1.0262**	**1.0166**	**1.0148**	**1.0105**	**1.0063**	**1.0041**	**1.0096**	**1.0113**		6.2917E-07	1.0136	0.099	588,316
	st dev =	0.0000	0.0024	0.0030	0.0050	0.0121	0.0151	0.0141	0.0141	0.0145	**0.0157**	0.0147	0.0152	0.0149		**TM-21 L70(9k) >**			**54,000**
	min =	1.0000	0.9932	0.9973	1.0050	1.0126	0.9959	0.9935	0.9936	0.9866	**0.9813**	0.9812	0.9833	0.9875					
	max =	1.0000	1.0158	1.0168	1.0331	1.0483	1.0699	1.0782	1.0691	1.0545	**1.0377**	1.0366	1.0393	1.0455					
DATA SET 56 $T_S = T_{AIR}$ = 105C	median =	1.0000	0.9985	0.9996	1.0168	1.0220	1.0254	1.0270	1.0309	1.0331	**1.0266**	1.0259	1.0200	1.0195					
	average =	**1.0000**	**0.9981**	**1.0004**	**1.0175**	**1.0234**	**1.0268**	**1.0252**	**1.0313**	**1.0326**	**1.0250**	**1.0249**	**1.0171**	**1.0161**		3.4273E-06	1.0475	0.905	117,621
	st dev =	0.0000	0.0030	0.0033	0.0060	0.0088	0.0090	0.0103	0.0123	0.0137	**0.0139**	0.0137	0.0132	0.0131		**TM-21 L70(9k) >**			**54,000**
	min =	1.0000	0.9909	0.9921	1.0084	1.0114	1.0126	0.9999	1.0049	1.0031	**0.9974**	0.9989	0.9935	0.9953					
	max =	1.0000	1.0024	1.0056	1.0354	1.0460	1.0518	1.0461	1.0549	1.0509	**1.0449**	1.0477	1.0402	1.0431					
DATA SET 57 $T_S = T_{AIR}$ = 85C	median =	1.0000	0.9945	0.9978	1.0158	1.0173	1.0202	1.0212	1.0280	1.0303	**1.0224**	1.0205	1.0203	1.0224					
	average =	**1.0000**	**0.9951**	**0.9979**	**1.0158**	**1.0177**	**1.0202**	**1.0197**	**1.0271**	**1.0294**	**1.0228**	**1.0220**	**1.0200**	**1.0212**		1.6331E-06	1.0347	0.720	239,284
	st dev =	0.0000	0.0035	0.0039	0.0054	0.0050	0.0056	0.0064	0.0065	0.0062	**0.0066**	0.0068	0.0067	0.0070		**TM-21 L70(9k) >**			**54,000**
	min =	1.0000	0.9890	0.9891	1.0060	1.0083	1.0094	1.0052	1.0130	1.0156	**1.0103**	1.0101	1.0049	1.0050					
	max =	1.0000	1.0069	1.0103	1.0302	1.0305	1.0345	1.0340	1.0426	1.0451	**1.0425**	1.0416	1.0371	1.0376					
DATA SET 58 $T_S = T_{AIR}$ = 55C	median =	1.0000	0.9937	0.9954	1.0062	1.0139	1.0163	1.0173	1.0199	1.0212	**1.0138**	1.0174	1.0230	1.0290					
	average =	**1.0000**	**0.9935**	**0.9954**	**1.0059**	**1.0131**	**1.0160**	**1.0176**	**1.0206**	**1.0205**	**1.0133**	**1.0167**	**1.0224**	**1.0285**		-1.3520E-06	1.0114	0.250	-272,209
	st dev =	0.0000	0.0027	0.0038	0.0057	0.0060	0.0058	0.0057	0.0058	0.0069	**0.0059**	0.0062	0.0070	0.0070		**TM-21 L70(9k) >**			**54,000**
	min =	1.0000	0.9874	0.9860	0.9945	0.9983	1.0016	1.0026	1.0056	1.0003	**0.9982**	0.9991	1.0025	1.0089					
	max =	1.0000	0.9983	1.0015	1.0161	1.0239	1.0264	1.0271	1.0319	1.0327	**1.0243**	1.0279	1.0349	1.0411					

Delta u' v'

Data set		0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 55 $T_S = T_{AIR}$ = 120C	median =	0.0000	0.0001	0.0002	0.0003	0.0005	0.0018	0.0020	0.0020	0.0025	**0.0035**	0.0049	0.0059	0.0061	
	average =	**0.0000**	**0.0001**	**0.0003**	**0.0003**	**0.0006**	**0.0018**	**0.0020**	**0.0020**	**0.0027**	**0.0035**	**0.0050**	**0.0059**	**0.0063**	
	st dev =	0.0000	0.0001	0.0003	0.0002	0.0004	0.0004	0.0006	0.0005	0.0010	**0.0008**	0.0007	0.0009	0.0009	
	min =	0.0000	0.0000	0.0001	0.0000	0.0001	0.0010	0.0013	0.0013	0.0016	**0.0025**	0.0040	0.0043	0.0047	
	max =	0.0000	0.0002	0.0010	0.0007	0.0015	0.0029	0.0038	0.0036	0.0050	**0.0053**	0.0065	0.0076	0.0080	
DATA SET 56 $T_S = T_{AIR}$ = 105C	median =	0.0000	0.0002	0.0001	0.0005	0.0004	0.0004	0.0004	0.0008	0.0005	**0.0004**	0.0014	0.0006	0.0006	
	average =	**0.0000**	**0.0002**	**0.0003**	**0.0005**	**0.0005**	**0.0006**	**0.0006**	**0.0014**	**0.0007**	**0.0007**	**0.0017**	**0.0008**	**0.0007**	
	st dev =	0.0000	0.0001	0.0004	0.0003	0.0003	0.0005	0.0005	0.0010	0.0006	**0.0006**	0.0010	0.0006	0.0005	
	min =	0.0000	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	**0.0001**	0.0001	0.0001	0.0000	
	max =	0.0000	0.0003	0.0014	0.0011	0.0013	0.0019	0.0020	0.0041	0.0020	**0.0019**	0.0041	0.0021	0.0020	
DATA SET 57 $T_S = T_{AIR}$ = 85C	median =	0.0000	0.0003	0.0003	0.0007	0.0006	0.0004	0.0004	0.0001	0.0003	**0.0004**	0.0003	0.0005	0.0005	
	average =	**0.0000**	**0.0003**	**0.0003**	**0.0007**	**0.0006**	**0.0005**	**0.0004**	**0.0004**	**0.0004**	**0.0004**	**0.0004**	**0.0005**	**0.0005**	
	st dev =	0.0000	0.0001	0.0001	0.0003	0.0002	0.0002	0.0003	0.0004	0.0003	**0.0003**	0.0004	0.0003	0.0003	
	min =	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	**0.0000**	0.0001	0.0000	0.0000	
	max =	0.0000	0.0004	0.0005	0.0011	0.0008	0.0010	0.0012	0.0015	0.0013	**0.0013**	0.0015	0.0012	0.0012	
DATA SET 58 $T_S = T_{AIR}$ = 55C	median =	0.0000	0.0003	0.0002	0.0008	0.0008	0.0007	0.0003	0.0002	0.0002	**0.0004**	0.0007	0.0020	0.0020	
	average =	**0.0000**	**0.0003**	**0.0003**	**0.0008**	**0.0008**	**0.0007**	**0.0003**	**0.0002**	**0.0003**	**0.0004**	**0.0008**	**0.0021**	**0.0022**	
	st dev =	0.0000	0.0001	0.0001	0.0002	0.0001	0.0002	0.0001	0.0001	0.0002	**0.0002**	0.0004	0.0004	0.0004	
	min =	0.0000	0.0001	0.0001	0.0004	0.0005	0.0002	0.0001	0.0001	0.0001	**0.0001**	0.0004	0.0014	0.0015	
	max =	0.0000	0.0004	0.0004	0.0010	0.0010	0.0009	0.0005	0.0007	0.0009	**0.0009**	0.0018	0.0032	0.0034	



SUMMARY, Continued

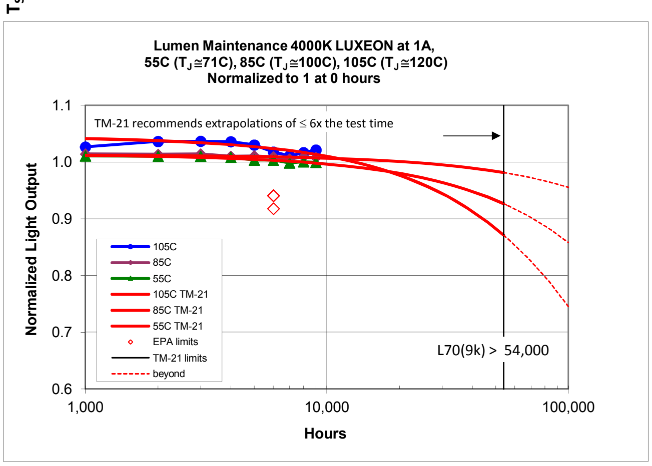
LUXEON, CCT = 4000K, I_F = 1A

Normalized Flux

		0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	alpha	B	r2	:L70
DATA SET 59 $T_S = T_{AIR}$ = 105C	median =	1.0000	0.9956	1.0010	1.0154	1.0268	1.0369	1.0405	1.0387	1.0293	**1.0211**	1.0139	1.0161	1.0219					
	average =	1.0000	0.9955	1.0008	1.0158	1.0268	1.0365	1.0368	1.0361	1.0302	**1.0179**	1.0111	1.0168	1.0214		3.3710E-06	1.0449	0.483	118,827
	st dev =	0.0000	0.0028	0.0038	0.0060	0.0056	0.0079	0.0098	0.0123	0.0154	**0.0179**	0.0154	0.0154	0.0147				TM-21 L70(9k) >	54,000
	min =	1.0000	0.9909	0.9922	1.0069	1.0172	1.0199	1.0162	1.0073	1.0032	**0.9733**	0.9747	0.9842	0.9902					
	max =	1.0000	1.0025	1.0106	1.0335	1.0419	1.0505	1.0521	1.0544	1.0560	**1.0454**	1.0355	1.0441	1.0455					
DATA SET 60 $T_S = T_{AIR}$ = 85C	median =	1.0000	0.9935	0.9909	1.0138	1.0153	1.0147	1.0157	1.0107	1.0119	**1.0093**	1.0057	1.0105	1.0087					
	average =	1.0000	0.9927	0.9894	1.0136	1.0144	1.0138	1.0145	1.0104	1.0112	**1.0095**	1.0055	1.0096	1.0081		5.8261E-07	1.0129	0.290	634,144
	st dev =	0.0000	0.0032	0.0055	0.0064	0.0054	0.0065	0.0058	0.0067	0.0067	**0.0081**	0.0088	0.0099	0.0094				TM-21 L70(9k) >	54,000
	min =	1.0000	0.9815	0.9697	0.9946	0.9968	0.9933	0.9966	0.9903	0.9933	**0.9889**	0.9855	0.9858	0.9864					
	max =	1.0000	0.9973	0.9971	1.0296	1.0205	1.0210	1.0213	1.0211	1.0252	**1.0272**	1.0251	1.0302	1.0292					
DATA SET 61 $T_S = T_{AIR}$ = 55C	median =	1.0000	0.9951	0.9924	1.0121	1.0137	1.0117	1.0112	1.0102	1.0063	**1.0056**	1.0015	1.0026	1.0029					
	average =	1.0000	0.9947	0.9909	1.0118	1.0109	1.0103	1.0103	1.0087	1.0036	**1.0035**	0.9985	1.0007	0.9998		1.6575E-06	1.0133	0.721	223,162
	st dev =	0.0000	0.0029	0.0066	0.0093	0.0089	0.0107	0.0115	0.0114	0.0108	**0.0121**	0.0124	0.0127	0.0125				TM-21 L70(9k) >	54,000
	min =	1.0000	0.9853	0.9693	0.9893	0.9860	0.9838	0.9822	0.9810	0.9771	**0.9758**	0.9700	0.9719	0.9709					
	max =	1.0000	0.9982	0.9967	1.0318	1.0219	1.0281	1.0251	1.0222	1.0155	**1.0183**	1.0136	1.0164	1.0146					

Delta u' v'

		0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 59 $T_S = T_{AIR}$ = 105C	median =	0.0000	0.0002	0.0002	0.0004	0.0003	0.0006	0.0007	0.0009	0.0011	**0.0009**	0.0024	0.0031	0.0031	
	average =	0.0000	0.0002	0.0002	0.0004	0.0004	0.0007	0.0008	0.0010	0.0011	**0.0009**	0.0025	0.0031	0.0031	
	st dev =	0.0000	0.0001	0.0001	0.0002	0.0002	0.0004	0.0004	0.0004	0.0004	**0.0004**	0.0005	0.0004	0.0004	
	min =	0.0000	0.0001	0.0000	0.0001	0.0001	0.0001	0.0002	0.0004	0.0004	**0.0001**	0.0016	0.0023	0.0022	
	max =	0.0000	0.0004	0.0005	0.0008	0.0008	0.0017	0.0018	0.0018	0.0018	**0.0019**	0.0035	0.0043	0.0041	
DATA SET 60 $T_S = T_{AIR}$ = 85C	median =	0.0000	0.0004	0.0003	0.0004	0.0004	0.0005	0.0005	0.0005	0.0005	**0.0006**	0.0006	0.0005	0.0005	
	average =	0.0000	0.0004	0.0003	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	**0.0005**	0.0005	0.0004	0.0004	
	st dev =	0.0000	0.0001	0.0001	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	**0.0002**	0.0003	0.0003	0.0002	
	min =	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0000	**0.0001**	0.0001	0.0000	0.0000	
	max =	0.0000	0.0005	0.0005	0.0010	0.0010	0.0009	0.0009	0.0009	0.0008	**0.0008**	0.0009	0.0008	0.0008	
DATA SET 61 $T_S = T_{AIR}$ = 55C	median =	0.0000	0.0003	0.0005	0.0007	0.0010	0.0010	0.0009	0.0007	0.0008	**0.0009**	0.0011	0.0010	0.0009	
	average =	0.0000	0.0003	0.0005	0.0007	0.0009	0.0009	0.0008	0.0006	0.0007	**0.0008**	0.0009	0.0008	0.0007	
	st dev =	0.0000	0.0001	0.0001	0.0002	0.0003	0.0004	0.0004	0.0003	0.0003	**0.0004**	0.0004	0.0004	0.0003	
	min =	0.0000	0.0002	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0000	0.0001	
	max =	0.0000	0.0004	0.0007	0.0010	0.0013	0.0013	0.0013	0.0010	0.0011	**0.0012**	0.0013	0.0012	0.0011	



$T_S = T_{AIR} = 55°C$, $I_F = 0.5A$

$T_S \geq 53C$, $T_{AIR} \geq 50C$ in compliance with LM-80-08

Lumen Data

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	Lumen Maintenance % at 6khours
DATA SET 54: CCT = 4000K, T_J = 63C	A1	4031	146.096	144.530	143.908	147.255	146.942	147.373	147.492	146.888	146.791	146.389	146.335	146.614	146.530		**100.2**
	A2	4252	143.334	142.157	141.676	145.185	145.159	145.008	145.314	145.000	144.267	144.471	143.979	144.508	144.338		**100.8**
	A3	4051	149.549	147.843	146.849	151.014	151.150	150.930	151.429	151.094	150.870	150.579	148.853	150.775	150.581		**100.7**
	A4	4118	146.612	144.964	144.386	148.047	148.150	147.335	148.362	148.004	147.939	147.590	147.026	147.360	147.434		**100.7**
	A5	4136	148.114	146.613	146.235	149.940	150.270	150.296	150.675	150.300	150.127	150.164	149.651	150.020	149.834		**101.4**
	A6	4172	145.620	144.609	143.925	147.268	147.431	147.545	147.902	147.399	147.486	147.600	146.847	147.415	147.104		**101.4**
	A7	4064	148.697	147.688	147.122	150.168	150.757	150.762	150.950	150.676	150.685	150.729	150.189	150.783	150.377		**101.4**
	A8	4124	148.968	147.649	146.843	150.764	151.035	151.151	151.272	150.979	150.823	151.039	150.323	150.881	150.657		**101.4**
	A9	4150	150.812	149.239	148.621	152.083	152.206	152.559	152.492	152.256	151.929	152.280	151.480	152.120	151.947		**101.0**
	A10	4125	150.516	148.545	148.006	151.270	151.505	151.450	152.035	151.721	151.469	151.857	151.037	151.580	151.319		**100.9**
	A21	4237	143.504	140.600	140.000	143.905	144.075	143.999	142.899	144.077	144.149	143.061	143.334	143.845	143.909		**99.7**
	A22	4295	135.718	132.759	132.288	136.067	136.241	136.380	136.540	136.344	136.407	136.043	135.440	135.919	136.000		**100.2**
	A23	4178	143.558	140.122	140.053	144.472	144.852	144.717	145.098	144.821	144.688	144.375	143.876	144.460	144.417		**100.6**
	A24	4170	140.915	140.646	140.157	143.670	144.165	143.993	144.398	143.964	144.080	143.636	143.211	143.655	143.744		**101.9**
	A25	4279	145.763	143.537	142.925	146.075	146.465	146.322	146.799	146.442	146.358	146.209	145.661	146.159	146.292		**100.3**
	A26	4229	146.201	143.239	142.686	145.917	145.775	145.903	146.582	146.279	146.142	146.114	145.459	145.954	146.059		**99.9**
	A27	4237	145.946	143.620	143.079	145.759	146.316	145.856	146.831	146.522	146.049	146.286	145.645	146.244	146.301		**100.2**
	A28	4310	146.179	143.610	142.784	145.727	146.130	146.550	146.713	146.505	146.381	146.310	145.685	146.406	146.223		**100.1**
	A29	4368	145.402	142.783	142.308	145.091	145.530	145.850	146.121	146.306	146.021	145.841	145.102	145.919	145.806		**100.3**
	A30	4201	148.352	146.020	145.319	147.880	148.368	148.503	148.963	148.929	148.603	148.474	147.870	148.330	148.580		**100.1**
	A41	4102	139.827	138.055	137.728	140.017	140.172	139.806	140.245	139.928	137.008	139.411	138.826	139.511	139.535		**99.7**
	A42	4289	141.973	139.949	139.619	141.399	140.132	141.475	141.738	141.445	139.093	141.056	140.445	141.066	140.989		**99.4**
	A43	4198	142.273	140.103	139.696	142.437	142.621	142.414	142.537	142.214	139.632	141.583	140.999	141.683	141.555		**99.5**
	A44	4245	140.121	138.143	137.706	140.580	140.637	140.408	140.493	140.209	137.054	139.631	138.915	139.635	139.758		**99.7**
	A45	4235	141.130	138.974	138.594	141.635	141.751	141.600	141.858	141.546	138.863	140.873	140.224	140.854	141.006		**99.8**
	ave	**4192**															**100.4**

$T_S = T_{AIR} = 55°C$, $I_F = 0.5A$

$T_S \geq 53C$, $T_{AIR} \geq 50C$ in compliance with LM-80-08

Normalized flux

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 54: CCT = 4000K, T_J = 63C	A1	4031	1.0000	0.9893	0.9850	1.0079	1.0058	1.0087	1.0096	1.0054	1.0048	1.0020	1.0016	1.0035	1.0030	
	A2	4252	1.0000	0.9918	0.9884	1.0129	1.0127	1.0117	1.0138	1.0116	1.0065	1.0079	1.0045	1.0082	1.0070	
	A3	4051	1.0000	0.9886	0.9819	1.0098	1.0107	1.0092	1.0126	1.0103	1.0088	1.0069	0.9953	1.0082	1.0069	
	A4	4118	1.0000	0.9888	0.9848	1.0098	1.0105	1.0049	1.0119	1.0095	1.0091	1.0067	1.0028	1.0051	1.0056	
	A5	4136	1.0000	0.9899	0.9873	1.0123	1.0146	1.0147	1.0173	1.0148	1.0136	1.0138	1.0104	1.0129	1.0116	
	A6	4172	1.0000	0.9931	0.9884	1.0113	1.0124	1.0132	1.0157	1.0122	1.0128	1.0136	1.0084	1.0123	1.0102	
	A7	4064	1.0000	0.9932	0.9894	1.0099	1.0139	1.0139	1.0152	1.0133	1.0134	1.0137	1.0100	1.0140	1.0113	
	A8	4124	1.0000	0.9911	0.9857	1.0121	1.0139	1.0147	1.0155	1.0135	1.0125	1.0139	1.0091	1.0128	1.0113	
	A9	4150	1.0000	0.9896	0.9855	1.0084	1.0092	1.0116	1.0111	1.0096	1.0074	1.0097	1.0044	1.0087	1.0075	
	A10	4125	1.0000	0.9869	0.9833	1.0050	1.0066	1.0062	1.0101	1.0080	1.0063	1.0089	1.0035	1.0071	1.0053	
	A21	4237	1.0000	0.9798	0.9756	1.0028	1.0040	1.0035	0.9958	1.0040	1.0045	0.9969	0.9988	1.0024	1.0028	
	A22	4295	1.0000	0.9782	0.9747	1.0026	1.0039	1.0049	1.0061	1.0046	1.0051	1.0024	0.9980	1.0015	1.0021	
	A23	4178	1.0000	0.9761	0.9756	1.0064	1.0090	1.0081	1.0107	1.0088	1.0079	1.0057	1.0022	1.0063	1.0060	
	A24	4170	1.0000	0.9981	0.9946	1.0195	1.0231	1.0218	1.0247	1.0216	1.0225	1.0193	1.0163	1.0194	1.0201	
	A25	4279	1.0000	0.9847	0.9805	1.0021	1.0048	1.0038	1.0071	1.0047	1.0041	1.0031	0.9993	1.0027	1.0036	
	A26	4229	1.0000	0.9797	0.9760	0.9981	0.9971	0.9980	1.0026	1.0005	0.9996	0.9994	0.9949	0.9983	0.9990	
	A27	4237	1.0000	0.9841	0.9804	0.9987	1.0025	0.9994	1.0061	1.0039	1.0007	1.0023	0.9979	1.0020	1.0024	
	A28	4310	1.0000	0.9824	0.9768	0.9969	0.9997	1.0025	1.0037	1.0022	1.0014	1.0009	0.9966	1.0016	1.0003	
	A29	4368	1.0000	0.9820	0.9787	0.9979	1.0009	1.0031	1.0049	1.0062	1.0043	1.0030	0.9979	1.0036	1.0028	
	A30	4201	1.0000	0.9843	0.9796	0.9968	1.0001	1.0010	1.0041	1.0039	1.0017	1.0008	0.9967	0.9999	1.0015	
	A41	4102	1.0000	0.9873	0.9850	1.0014	1.0025	0.9999	1.0030	1.0007	0.9798	0.9970	0.9928	0.9977	0.9979	
	A42	4289	1.0000	0.9857	0.9834	0.9960	0.9870	0.9965	0.9983	0.9963	0.9797	0.9935	0.9892	0.9936	0.9931	
	A43	4198	1.0000	0.9847	0.9819	1.0011	1.0024	1.0010	1.0019	0.9996	0.9814	0.9951	0.9910	0.9958	0.9950	
	A44	4245	1.0000	0.9859	0.9828	1.0033	1.0037	1.0020	1.0026	1.0006	0.9781	0.9965	0.9914	0.9965	0.9974	
	A45	4235	1.0000	0.9847	0.9820	1.0036	1.0044	1.0033	1.0052	1.0029	0.9839	0.9982	0.9936	0.9980	0.9991	
	ave	**4192**	**1.0000**	**0.9864**	**0.9827**	**1.0051**	**1.0062**	**1.0063**	**1.0084**	**1.0068**	**1.0020**	**1.0045**	**1.0003**	**1.0045**	**1.0041**	

$T_S = T_{AIR} = 55°C$, $I_F = 0.5A$

$T_S \geq 53C$, $T_{AIR} \geq 50C$ in compliance with LM-80-08

TM-21 extrapolation

		CCT (t=0)	alpha	B	r2	L70
DATA SET 54: CCT = 4000K, T_J = 63C	A1	4031	4.6342E-07	1.0064	0.338	783,459
	A2	4252	6.0852E-07	1.0116	0.237	605,115
	A3	4051	8.7022E-07	1.0118	0.091	423,321
	A4	4118	9.9724E-07	1.0130	0.555	370,616
	A5	4136	6.0257E-07	1.0168	0.508	619,597
	A6	4172	4.7428E-07	1.0147	0.218	782,825
	A7	4064	3.2999E-07	1.0148	0.156	1,125,336
	A8	4124	4.0753E-07	1.0149	0.193	911,439
	A9	4150	3.3327E-07	1.0101	0.103	1,100,313
	A10	4125	4.7106E-07	1.0096	0.207	777,465
	A21	4237	2.9360E-07	1.0035	0.033	1,226,681
	A22	4295	7.9547E-07	1.0075	0.339	457,729
	A23	4178	6.3272E-07	1.0103	0.275	579,890
	A24	4170	5.5571E-07	1.0236	0.243	683,730
	A25	4279	3.7051E-07	1.0053	0.134	976,997
	A26	4229	4.5331E-07	1.0016	0.187	790,308
	A27	4237	2.2674E-07	1.0030	0.043	1,586,447
	A28	4310	3.8247E-07	1.0030	0.127	940,357
	A29	4368	6.9419E-07	1.0075	0.223	524,556
	A30	4201	6.1028E-07	1.0047	0.231	592,183
	A41	4102	-1.0303E-06	0.9877	0.064	-334,176
	A42	4289	-6.2199E-07	0.9869	0.038	-552,232
	A43	4198	-4.6815E-07	0.9900	0.019	-740,339
	A44	4245	-9.9118E-07	0.9870	0.052	-346,666
	A45	4235	-5.4189E-07	0.9925	0.023	-644,224
	ave	**4192**	**2.8084E-07**	**1.0055**	**0.055**	**1,289,606**

$T_S = T_{AIR} = 55°C$, $I_F = 0.5A$

$T_S \geq 53C$, $T_{AIR} \geq 50C$ in compliance with LM-80-08

u'

DATA SET 54: CCT = 4000K, T_J = 63C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4031	0.2223	0.2221	0.2221	0.2220	0.2220	0.2220	0.2220	0.2220	0.2220	0.2219	0.2221	0.2220	0.2220	
A2	4252	0.2235	0.2233	0.2234	0.2233	0.2233	0.2232	0.2233	0.2233	0.2233	0.2232	0.2234	0.2233	0.2233	
A3	4051	0.2221	0.2219	0.2220	0.2219	0.2218	0.2218	0.2218	0.2218	0.2218	0.2217	0.2230	0.2218	0.2219	
A4	4118	0.2228	0.2226	0.2227	0.2225	0.2226	0.2225	0.2225	0.2225	0.2225	0.2225	0.2227	0.2226	0.2226	
A5	4136	0.2230	0.2229	0.2229	0.2228	0.2228	0.2228	0.2228	0.2227	0.2228	0.2227	0.2228	0.2228	0.2228	
A6	4172	0.2231	0.2230	0.2231	0.2229	0.2229	0.2229	0.2229	0.2229	0.2229	0.2229	0.2230	0.2230	0.2230	
A7	4064	0.2222	0.2221	0.2221	0.2220	0.2220	0.2219	0.2219	0.2219	0.2220	0.2219	0.2220	0.2220	0.2220	
A8	4124	0.2227	0.2225	0.2226	0.2225	0.2225	0.2224	0.2224	0.2225	0.2225	0.2224	0.2226	0.2225	0.2226	
A9	4150	0.2227	0.2226	0.2227	0.2225	0.2225	0.2224	0.2225	0.2225	0.2225	0.2225	0.2226	0.2226	0.2226	
A10	4125	0.2227	0.2225	0.2226	0.2225	0.2225	0.2224	0.2224	0.2224	0.2225	0.2225	0.2226	0.2225	0.2225	
A21	4237	0.2220	0.2219	0.2220	0.2218	0.2218	0.2217	0.2218	0.2218	0.2218	0.2218	0.2218	0.2219	0.2219	
A22	4295	0.2226	0.2225	0.2225	0.2224	0.2224	0.2223	0.2223	0.2223	0.2223	0.2223	0.2224	0.2225	0.2225	
A23	4178	0.2218	0.2217	0.2217	0.2216	0.2215	0.2215	0.2215	0.2215	0.2215	0.2215	0.2216	0.2216	0.2217	
A24	4170	0.2215	0.2214	0.2214	0.2213	0.2213	0.2212	0.2212	0.2212	0.2213	0.2213	0.2213	0.2214	0.2214	
A25	4279	0.2225	0.2224	0.2224	0.2223	0.2223	0.2222	0.2223	0.2223	0.2223	0.2223	0.2224	0.2224	0.2224	
A26	4229	0.2221	0.2220	0.2220	0.2219	0.2219	0.2219	0.2218	0.2219	0.2220	0.2219	0.2221	0.2221	0.2221	
A27	4237	0.2222	0.2220	0.2221	0.2220	0.2220	0.2220	0.2219	0.2220	0.2221	0.2221	0.2222	0.2222	0.2222	
A28	4310	0.2226	0.2224	0.2224	0.2224	0.2224	0.2223	0.2223	0.2224	0.2225	0.2225	0.2226	0.2226	0.2226	
A29	4368	0.2228	0.2227	0.2227	0.2226	0.2226	0.2226	0.2226	0.2226	0.2227	0.2228	0.2229	0.2229	0.2229	
A30	4201	0.2219	0.2217	0.2218	0.2217	0.2217	0.2216	0.2216	0.2217	0.2218	0.2218	0.2219	0.2220	0.2220	
A41	4102	0.2221	0.2220	0.2220	0.2219	0.2219	0.2219	0.2219	0.2219	0.2219	0.2219	0.2220	0.2220	0.2220	
A42	4289	0.2220	0.2218	0.2219	0.2218	0.2224	0.2218	0.2217	0.2218	0.2218	0.2218	0.2219	0.2219	0.2219	
A43	4198	0.2220	0.2219	0.2219	0.2218	0.2218	0.2218	0.2218	0.2218	0.2218	0.2218	0.2219	0.2219	0.2220	
A44	4245	0.2228	0.2226	0.2227	0.2225	0.2225	0.2225	0.2225	0.2225	0.2225	0.2225	0.2226	0.2226	0.2226	
A45	4235	0.2227	0.2226	0.2227	0.2225	0.2225	0.2224	0.2225	0.2225	0.2225	0.2225	0.2226	0.2226	0.2227	
ave	**4192**														

$T_S = T_{AIR} = 55°C$, $I_F = 0.5A$

$T_S \geq 53C$, $T_{AIR} \geq 50C$ in compliance with LM-80-08

v'

DATA SET 54: CCT = 4000K, T_J = 63C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4031	0.5060	0.5057	0.5056	0.5053	0.5052	0.5050	0.5050	0.5049	0.5049	0.5048	0.5049	0.5050	0.5051	
A2	4252	0.4919	0.4916	0.4912	0.4909	0.4908	0.4907	0.4906	0.4904	0.4905	0.4905	0.4903	0.4906	0.4908	
A3	4051	0.5052	0.5049	0.5048	0.5044	0.5043	0.5041	0.5040	0.5039	0.5039	0.5039	0.5032	0.5040	0.5041	
A4	4118	0.5000	0.4998	0.4995	0.4992	0.4991	0.4990	0.4988	0.4987	0.4986	0.4987	0.4987	0.4988	0.4989	
A5	4136	0.4985	0.4983	0.4980	0.4977	0.4975	0.4974	0.4974	0.4972	0.4971	0.4972	0.4972	0.4972	0.4974	
A6	4172	0.4965	0.4962	0.4959	0.4956	0.4954	0.4952	0.4951	0.4951	0.4950	0.4951	0.4949	0.4951	0.4953	
A7	4064	0.5041	0.5039	0.5038	0.5035	0.5033	0.5032	0.5032	0.5031	0.5030	0.5031	0.5030	0.5031	0.5032	
A8	4124	0.4998	0.4995	0.4993	0.4989	0.4988	0.4986	0.4986	0.4985	0.4985	0.4985	0.4984	0.4985	0.4986	
A9	4150	0.4984	0.4982	0.4979	0.4975	0.4974	0.4972	0.4972	0.4971	0.4971	0.4971	0.4969	0.4971	0.4972	
A10	4125	0.4999	0.4997	0.4994	0.4991	0.4990	0.4989	0.4987	0.4987	0.4987	0.4987	0.4986	0.4987	0.4988	
A21	4237	0.4955	0.4953	0.4951	0.4946	0.4945	0.4943	0.4942	0.4941	0.4942	0.4943	0.4942	0.4943	0.4944	
A22	4295	0.4917	0.4916	0.4916	0.4910	0.4909	0.4907	0.4907	0.4904	0.4906	0.4905	0.4907	0.4907	0.4908	
A23	4178	0.4988	0.4988	0.4986	0.4981	0.4978	0.4978	0.4978	0.4975	0.4977	0.4977	0.4978	0.4978	0.4979	
A24	4170	0.5000	0.5002	0.5003	0.4999	0.4996	0.4996	0.4995	0.4994	0.4995	0.4995	0.4997	0.4996	0.4997	
A25	4279	0.4925	0.4922	0.4919	0.4916	0.4913	0.4914	0.4914	0.4913	0.4914	0.4914	0.4915	0.4916	0.4916	
A26	4229	0.4957	0.4955	0.4952	0.4948	0.4947	0.4947	0.4947	0.4947	0.4948	0.4949	0.4950	0.4951	0.4951	
A27	4237	0.4951	0.4948	0.4946	0.4943	0.4941	0.4944	0.4941	0.4942	0.4943	0.4943	0.4945	0.4946	0.4947	
A28	4310	0.4911	0.4907	0.4905	0.4902	0.4900	0.4901	0.4902	0.4902	0.4902	0.4905	0.4905	0.4906	0.4908	
A29	4368	0.4880	0.4878	0.4874	0.4872	0.4869	0.4871	0.4871	0.4871	0.4873	0.4875	0.4875	0.4876	0.4878	
A30	4201	0.4975	0.4971	0.4969	0.4968	0.4966	0.4967	0.4966	0.4965	0.4967	0.4968	0.4969	0.4970	0.4971	
A41	4102	0.5022	0.5020	0.5018	0.5017	0.5016	0.5016	0.5016	0.5017	0.5017	0.5019	0.5020	0.5020	0.5021	
A42	4289	0.4932	0.4928	0.4927	0.4925	0.4917	0.4925	0.4927	0.4926	0.4926	0.4928	0.4929	0.4930	0.4932	
A43	4198	0.4974	0.4971	0.4969	0.4967	0.4965	0.4966	0.4967	0.4966	0.4967	0.4969	0.4971	0.4972	0.4973	
A44	4245	0.4937	0.4933	0.4930	0.4927	0.4926	0.4927	0.4928	0.4928	0.4928	0.4931	0.4931	0.4933	0.4934	
A45	4235	0.4942	0.4938	0.4936	0.4932	0.4931	0.4932	0.4932	0.4932	0.4932	0.4935	0.4936	0.4938	0.4939	
ave	**4192**														

$T_S = T_{AIR} = 55°C$, $I_F = 0.5A$

$T_S \geq 53C$, $T_{AIR} \geq 50C$ in compliance with LM-80-08

delta u' v'

DATA SET 54: CCT = 4000K, T_J = 63C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4031	0.0000	0.0004	0.0004	0.0008	0.0009	0.0010	0.0010	0.0011	0.0011	0.0013	0.0011	0.0010	0.0009	
A2	4252	0.0000	0.0004	0.0007	0.0010	0.0011	0.0012	0.0013	0.0015	0.0014	0.0014	0.0016	0.0013	0.0011	
A3	4051	0.0000	0.0004	0.0004	0.0008	0.0009	0.0011	0.0012	0.0013	0.0013	0.0014	0.0022	0.0012	0.0011	
A4	4118	0.0000	0.0003	0.0005	0.0009	0.0009	0.0010	0.0012	0.0013	0.0014	0.0013	0.0013	0.0012	0.0011	
A5	4136	0.0000	0.0002	0.0005	0.0008	0.0010	0.0011	0.0011	0.0013	0.0014	0.0013	0.0013	0.0013	0.0011	
A6	4172	0.0000	0.0003	0.0006	0.0009	0.0011	0.0013	0.0014	0.0014	0.0015	0.0014	0.0016	0.0014	0.0012	
A7	4064	0.0000	0.0002	0.0003	0.0006	0.0008	0.0009	0.0009	0.0010	0.0011	0.0010	0.0011	0.0010	0.0009	
A8	4124	0.0000	0.0004	0.0005	0.0009	0.0010	0.0012	0.0012	0.0013	0.0013	0.0013	0.0014	0.0013	0.0012	
A9	4150	0.0000	0.0002	0.0005	0.0009	0.0010	0.0012	0.0012	0.0013	0.0013	0.0013	0.0015	0.0013	0.0012	
A10	4125	0.0000	0.0003	0.0005	0.0008	0.0009	0.0010	0.0012	0.0012	0.0012	0.0012	0.0013	0.0012	0.0011	
A21	4237	0.0000	0.0002	0.0004	0.0009	0.0010	0.0012	0.0013	0.0014	0.0013	0.0012	0.0013	0.0012	0.0011	
A22	4295	0.0000	0.0001	0.0001	0.0007	0.0008	0.0010	0.0010	0.0013	0.0011	0.0012	0.0010	0.0010	0.0009	
A23	4178	0.0000	0.0001	0.0002	0.0007	0.0010	0.0010	0.0010	0.0013	0.0011	0.0011	0.0010	0.0010	0.0009	
A24	4170	0.0000	0.0002	0.0003	0.0002	0.0004	0.0005	0.0006	0.0007	0.0005	0.0005	0.0004	0.0004	0.0003	
A25	4279	0.0000	0.0003	0.0006	0.0009	0.0012	0.0011	0.0011	0.0012	0.0011	0.0011	0.0010	0.0009	0.0009	
A26	4229	0.0000	0.0002	0.0005	0.0009	0.0010	0.0010	0.0010	0.0010	0.0009	0.0008	0.0007	0.0006	0.0006	
A27	4237	0.0000	0.0004	0.0005	0.0008	0.0010	0.0007	0.0010	0.0009	0.0008	0.0008	0.0006	0.0005	0.0004	
A28	4310	0.0000	0.0004	0.0006	0.0009	0.0011	0.0010	0.0009	0.0009	0.0009	0.0006	0.0006	0.0005	0.0003	
A29	4368	0.0000	0.0002	0.0006	0.0008	0.0011	0.0009	0.0009	0.0009	0.0007	0.0005	0.0005	0.0004	0.0002	
A30	4201	0.0000	0.0004	0.0006	0.0007	0.0009	0.0009	0.0009	0.0010	0.0008	0.0007	0.0006	0.0005	0.0004	
A41	4102	0.0000	0.0002	0.0004	0.0005	0.0006	0.0006	0.0006	0.0005	0.0005	0.0004	0.0002	0.0002	0.0001	
A42	4289	0.0000	0.0004	0.0005	0.0007	0.0016	0.0007	0.0006	0.0006	0.0006	0.0004	0.0003	0.0002	0.0001	
A43	4198	0.0000	0.0003	0.0005	0.0007	0.0009	0.0008	0.0007	0.0008	0.0007	0.0005	0.0003	0.0002	0.0001	
A44	4245	0.0000	0.0004	0.0007	0.0010	0.0011	0.0010	0.0009	0.0009	0.0009	0.0007	0.0006	0.0004	0.0004	
A45	4235	0.0000	0.0004	0.0006	0.0010	0.0011	0.0010	0.0010	0.0010	0.0010	0.0007	0.0006	0.0004	0.0003	
ave	**4192**	**0.0000**	**0.0003**	**0.0005**	**0.0008**	**0.0010**	**0.0010**	**0.0010**	**0.0011**	**0.0011**	**0.0010**	**0.0010**	**0.0008**	**0.0007**	

$T_S = T_{AIR} = 55°C$, $I_F = 0.5A$

$T_S \geq 53C$, $T_{AIR} \geq 50C$ in compliance with LM-80-08

Forward voltage

DATA SET 54: CCT = 4000K, T_J = 63C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4031	2.881	2.879	2.883	2.882	2.885	2.883	2.884	2.882	2.882	2.882	2.884	2.883	2.883	
A2	4252	2.885	2.884	2.887	2.886	2.885	2.886	2.886	2.885	2.886	2.883	2.887	2.887	2.885	
A3	4051	2.922	2.923	2.925	2.923	2.924	2.923	2.924	2.924	2.924	2.924	2.926	2.926	2.924	
A4	4118	2.901	2.900	2.905	2.904	2.904	2.902	2.902	2.901	2.902	2.900	2.902	2.902	2.900	
A5	4136	2.914	2.910	2.914	2.912	2.913	2.913	2.912	2.914	2.914	2.912	2.914	2.915	2.913	
A6	4172	2.889	2.887	2.891	2.888	2.891	2.889	2.889	2.889	2.888	2.888	2.891	2.887	2.889	
A7	4064	2.905	2.901	2.904	2.903	2.905	2.903	2.904	2.905	2.905	2.902	2.906	2.904	2.904	
A8	4124	2.926	2.924	2.930	2.930	2.931	2.927	2.929	2.930	2.929	2.928	2.932	2.931	2.930	
A9	4150	2.945	2.944	2.947	2.946	2.948	2.945	2.947	2.946	2.947	2.945	2.950	2.947	2.946	
A10	4125	2.919	2.916	2.920	2.918	2.920	2.919	2.918	2.919	2.919	2.918	2.921	2.920	2.919	
A21	4237	2.916	2.913	2.916	2.912	2.912	2.910	2.908	2.911	2.910	2.908	2.910	2.910	2.909	
A22	4295	2.954	2.950	2.955	2.949	2.949	2.946	2.947	2.946	2.947	2.945	2.950	2.946	2.946	
A23	4178	2.935	2.929	2.930	2.929	2.928	2.925	2.924	2.923	2.924	2.921	2.926	2.924	2.923	
A24	4170	2.892	2.890	2.893	2.889	2.888	2.886	2.885	2.886	2.886	2.884	2.886	2.885	2.885	
A25	4279	2.956	2.950	2.953	2.949	2.951	2.946	2.947	2.947	2.949	2.945	2.948	2.948	2.947	
A26	4229	2.942	2.940	2.942	2.939	2.940	2.936	2.937	2.936	2.937	2.935	2.939	2.935	2.936	
A27	4237	2.931	2.926	2.930	2.930	2.929	2.925	2.926	2.926	2.926	2.924	2.927	2.925	2.924	
A28	4310	2.959	2.956	2.958	2.956	2.957	2.956	2.954	2.954	2.954	2.953	2.955	2.954	2.953	
A29	4368	2.979	2.977	2.980	2.977	2.978	2.973	2.973	2.974	2.973	2.972	2.974	2.974	2.973	
A30	4201	2.986	2.978	2.980	2.977	2.979	2.977	2.973	2.973	2.971	2.971	2.973	2.971	2.970	
A41	4102	3.077	3.070	3.071	3.067	3.068	3.062	3.058	3.056	3.056	3.052	3.052	3.052	3.050	
A42	4289	3.050	3.045	3.048	3.044	3.047	3.039	3.038	3.037	3.037	3.033	3.039	3.036	3.032	
A43	4198	3.088	3.078	3.077	3.068	3.068	3.057	3.054	3.051	3.048	3.045	3.047	3.042	3.040	
A44	4245	3.025	3.020	3.022	3.015	3.017	3.011	3.008	3.007	3.005	3.003	3.006	3.002	3.001	
A45	4235	3.030	3.025	3.026	3.021	3.022	3.016	3.014	3.012	3.010	3.008	3.008	3.006	3.005	
ave	**4192**	**2.952**													

T_S = T_{AIR} = 85°C, I_F = 0.5A

$T_S \geq$ 83C, $T_{AIR} \geq$ 80C in compliance with LM-80-08

Lumen Data

DATA SET 53: CCT = 4000K, T_J = 92C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	Lumen Maintenance % at 6khours
A1	4141	146.852	145.595	144.610	148.069	148.128	148.649	148.892	148.420	148.199	147.638	147.512	147.715	147.655		**100.5**
A2	4128	146.434	145.354	144.520	148.186	148.449	148.859	148.884	148.609	148.289	148.005	147.853	148.083	147.880		**101.1**
A3	4138	148.306	146.746	145.491	149.282	149.454	149.809	149.929	149.550	149.432	148.998	148.807	148.936	148.715		**100.5**
A4	4133	147.306	146.047	144.077	148.492	148.555	148.938	149.100	148.737	148.537	148.164	147.819	148.079	147.394		**100.6**
A5	4094	150.885	149.640	148.872	151.847	151.994	152.412	152.543	152.195	152.071	151.802	151.410	151.776	151.368		**100.6**
A6	4224	143.660	142.906	142.974	145.324	145.838	146.382	146.489	146.109	146.170	146.086	145.335	145.883	145.735		**101.7**
A7	4111	145.260	144.463	143.979	147.161	147.424	147.787	147.864	147.737	147.504	147.619	147.096	147.440	147.129		**101.6**
A8	4110	141.907	140.513	140.140	143.815	143.981	144.487	144.647	144.570	144.533	144.443	143.957	144.378	143.981		**101.8**
A9	4066	147.773	145.900	145.239	150.772	149.336	149.587	149.923	149.854	149.687	149.699	149.139	149.414	149.083		**101.3**
A10	4158	149.556	148.559	147.981	150.620	151.040	151.733	151.763	151.758	151.618	151.633	151.091	151.277	150.019		**101.4**
A21	4326	143.388	141.765	140.786	144.233	144.741	144.632	145.046	144.194	144.740	144.203	143.961	144.218	144.360		**100.6**
A22	4194	143.222	141.596	140.239	143.948	144.417	144.468	144.881	144.243	144.518	144.289	144.040	144.285	144.405		**100.7**
A23	4274	145.307	143.374	142.519	145.927	146.304	146.110	146.578	146.042	146.133	145.938	145.524	145.878	145.900		**100.4**
A24	4341	144.508	142.772	142.291	144.592	145.217	145.090	145.509	144.773	145.075	144.838	144.380	144.723	144.860		**100.2**
A25	4356	137.378	136.122	135.552	138.886	139.148	139.284	139.751	139.545	139.517	139.260	138.899	139.262	139.527		**101.4**
A26	4322	132.504	131.183	130.433	134.547	134.773	134.840	135.208	134.685	134.543	134.710	134.214	134.634	134.749		**101.7**
A27	4291	142.420	140.779	140.292	143.606	144.006	144.062	144.408	144.184	144.062	144.247	143.903	144.475	144.456		**101.3**
A28	4326	142.543	140.703	139.475	143.771	144.121	143.545	144.535	144.575	144.271	144.413	143.966	144.522	144.275		**101.3**
A29	4388	143.496	141.920	141.103	144.973	145.398	145.332	145.752	145.533	145.341	145.337	144.929	145.423	145.144		**101.3**
A30	4321	146.084	144.501	143.865	146.586	147.069	147.325	147.689	147.492	147.300	147.248	146.841	147.308	146.995		**100.8**
A41	4166	144.234	142.163	142.183	145.263	145.550	145.461	145.766	145.114	145.130	144.795	144.372	144.627	144.963		**100.4**
A42	4136	143.315	141.389	141.472	144.436	144.582	144.452	144.794	144.197	144.256	143.857	143.500	143.996	144.252		**100.4**
A43	4164	147.626	144.857	144.526	147.552	147.659	147.433	147.715	147.044	146.765	146.404	146.070	146.527	146.554		**99.2**
A44	4162	148.876	146.651	146.908	150.163	150.471	150.488	150.698	150.626	150.421	150.133	149.462	150.242	150.557		**100.8**
A45	4295	142.432	140.305	140.221	142.850	142.786	142.684	142.790	142.254	142.007	141.673	141.063	141.527	141.619		**99.5**
ave	**4215**															**100.8**

T_S = T_{AIR} = 85°C, I_F = 0.5A

$T_S \geq$ 83C, $T_{AIR} \geq$ 80C in compliance with LM-80-08

Normalized flux

DATA SET 53: CCT = 4000K, T_J = 92C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4141	1.0000	0.9914	0.9847	1.0083	1.0087	1.0122	1.0139	1.0107	1.0092	1.0054	1.0045	1.0059	1.0055	
A2	4128	1.0000	0.9926	0.9869	1.0120	1.0138	1.0166	1.0167	1.0149	1.0127	1.0107	1.0097	1.0113	1.0099	
A3	4138	1.0000	0.9895	0.9810	1.0066	1.0077	1.0101	1.0109	1.0084	1.0076	1.0047	1.0034	1.0043	1.0028	
A4	4133	1.0000	0.9915	0.9781	1.0080	1.0085	1.0111	1.0122	1.0097	1.0084	1.0058	1.0035	1.0052	1.0006	
A5	4094	1.0000	0.9917	0.9867	1.0064	1.0073	1.0101	1.0110	1.0087	1.0079	1.0061	1.0035	1.0059	1.0032	
A6	4224	1.0000	0.9948	0.9952	1.0116	1.0152	1.0189	1.0197	1.0171	1.0175	1.0169	1.0117	1.0155	1.0144	
A7	4111	1.0000	0.9945	0.9912	1.0131	1.0149	1.0174	1.0179	1.0171	1.0155	1.0162	1.0126	1.0150	1.0129	
A8	4110	1.0000	0.9902	0.9875	1.0134	1.0146	1.0182	1.0193	1.0188	1.0185	1.0179	1.0144	1.0174	1.0146	
A9	4066	1.0000	0.9873	0.9828	1.0203	1.0106	1.0123	1.0146	1.0141	1.0130	1.0130	1.0092	1.0111	1.0089	
A10	4158	1.0000	0.9933	0.9895	1.0071	1.0099	1.0146	1.0148	1.0147	1.0138	1.0139	1.0103	1.0115	1.0031	
A21	4326	1.0000	0.9887	0.9819	1.0059	1.0094	1.0087	1.0116	1.0056	1.0094	1.0057	1.0040	1.0058	1.0068	
A22	4194	1.0000	0.9886	0.9792	1.0051	1.0083	1.0087	1.0116	1.0071	1.0090	1.0075	1.0057	1.0074	1.0083	
A23	4274	1.0000	0.9867	0.9808	1.0043	1.0069	1.0055	1.0087	1.0051	1.0057	1.0043	1.0015	1.0039	1.0041	
A24	4341	1.0000	0.9880	0.9847	1.0006	1.0049	1.0040	1.0069	1.0018	1.0039	1.0023	0.9991	1.0015	1.0024	
A25	4356	1.0000	0.9909	0.9867	1.0110	1.0129	1.0139	1.0173	1.0158	1.0156	1.0137	1.0111	1.0137	1.0156	
A26	4322	1.0000	0.9900	0.9844	1.0154	1.0171	1.0176	1.0204	1.0165	1.0154	1.0166	1.0129	1.0161	1.0169	
A27	4291	1.0000	0.9885	0.9851	1.0083	1.0111	1.0115	1.0140	1.0124	1.0115	1.0128	1.0104	1.0144	1.0143	
A28	4326	1.0000	0.9871	0.9785	1.0086	1.0111	1.0070	1.0140	1.0143	1.0121	1.0131	1.0100	1.0139	1.0122	
A29	4388	1.0000	0.9890	0.9833	1.0103	1.0132	1.0128	1.0157	1.0142	1.0129	1.0128	1.0100	1.0134	1.0115	
A30	4321	1.0000	0.9892	0.9848	1.0034	1.0067	1.0085	1.0110	1.0096	1.0083	1.0080	1.0052	1.0084	1.0062	
A41	4166	1.0000	0.9856	0.9858	1.0071	1.0091	1.0085	1.0106	1.0061	1.0062	1.0039	1.0010	1.0027	1.0051	
A42	4136	1.0000	0.9866	0.9871	1.0078	1.0088	1.0079	1.0103	1.0062	1.0066	1.0038	1.0013	1.0047	1.0065	
A43	4164	1.0000	0.9812	0.9790	0.9995	1.0002	0.9987	1.0006	0.9961	0.9942	0.9917	0.9895	0.9926	0.9927	
A44	4162	1.0000	0.9851	0.9868	1.0086	1.0107	1.0108	1.0122	1.0118	1.0104	1.0084	1.0039	1.0092	1.0113	
A45	4295	1.0000	0.9851	0.9845	1.0029	1.0025	1.0018	1.0025	0.9987	0.9970	0.9947	0.9904	0.9936	0.9943	
ave	**4215**	**1.0000**	**0.9891**	**0.9846**	**1.0082**	**1.0098**	**1.0107**	**1.0127**	**1.0102**	**1.0097**	**1.0084**	**1.0055**	**1.0082**	**1.0074**	

$T_S = T_{AIR} = 85°C, I_F = 0.5A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

TM-21 extrapolation

		CCT (t=0)	alpha	B	r2	
DATA SET 53: CCT = 4000K, T_J = 92C	A1	4141	1.0427E-06	1.0137	0.629	355,097
	A2	4128	8.5087E-07	1.0171	0.678	439,139
	A3	4138	1.1213E-06	1.0125	0.845	329,186
	A4	4133	1.6268E-06	1.0162	0.864	229,137
	A5	4094	1.0187E-06	1.0125	0.743	362,357
	A6	4224	6.8249E-07	1.0200	0.348	551,640
	A7	4111	7.2814E-07	1.0197	0.597	516,621
	A8	4110	7.7057E-07	1.0220	0.582	491,165
	A9	4066	1.0002E-06	1.0181	0.769	374,567
	A10	4158	1.9412E-06	1.0240	0.722	195,984
	A21	4326	1.9362E-07	1.0075	0.041	1,880,574
	A22	4194	2.7992E-08	1.0077	0.002	13,015,443
	A23	4274	3.6913E-07	1.0065	0.233	983,813
	A24	4341	2.1271E-07	1.0032	0.064	1,691,959
	A25	4356	2.4849E-07	1.0159	0.067	1,498,759
	A26	4322	-2.0194E-08	1.0156	0.001	-18,428,518
	A27	4291	-4.4567E-07	1.0097	0.292	-822,021
	A28	4326	2.3626E-07	1.0141	0.084	1,569,076
	A29	4388	4.1441E-07	1.0152	0.272	897,058
	A30	4321	5.5662E-07	1.0113	0.419	660,921
	A41	4166	5.3001E-07	1.0076	0.234	687,280
	A42	4136	1.7175E-07	1.0060	0.024	2,111,278
	A43	4164	6.8037E-07	0.9972	0.321	520,083
	A44	4162	2.9544E-07	1.0111	0.038	1,244,616
	A45	4295	1.0528E-06	1.0016	0.462	340,337
	ave	**4215**	**6.1160E-07**	**1.0122**	**0.475**	**603,077**

$T_S = T_{AIR} = 85°C, I_F = 0.5A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

DATA SET 53: CCT = 4000K, T_J = 92C

u'

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4141	0.2227	0.2226	0.2227	0.2226	0.2226	0.2226	0.2226	0.2226	0.2226	0.2226	0.2227	0.2227	0.2226	
A2	4128	0.2225	0.2224	0.2225	0.2223	0.2224	0.2224	0.2224	0.2223	0.2224	0.2223	0.2224	0.2224	0.2224	
A3	4138	0.2225	0.2224	0.2225	0.2224	0.2224	0.2224	0.2224	0.2224	0.2224	0.2224	0.2225	0.2225	0.2225	
A4	4133	0.2228	0.2226	0.2227	0.2226	0.2227	0.2227	0.2227	0.2227	0.2227	0.2227	0.2228	0.2228	0.2227	
A5	4094	0.2224	0.2224	0.2225	0.2223	0.2224	0.2223	0.2224	0.2223	0.2223	0.2224	0.2225	0.2224	0.2224	
A6	4224	0.2237	0.2236	0.2237	0.2236	0.2236	0.2235	0.2236	0.2236	0.2236	0.2236	0.2237	0.2236	0.2236	
A7	4111	0.2228	0.2227	0.2228	0.2227	0.2227	0.2227	0.2227	0.2227	0.2227	0.2227	0.2228	0.2228	0.2228	
A8	4110	0.2229	0.2228	0.2229	0.2227	0.2228	0.2227	0.2228	0.2228	0.2228	0.2228	0.2229	0.2229	0.2229	
A9	4066	0.2222	0.2221	0.2222	0.2220	0.2221	0.2220	0.2221	0.2221	0.2222	0.2221	0.2222	0.2222	0.2222	
A10	4158	0.2227	0.2226	0.2227	0.2226	0.2226	0.2226	0.2226	0.2226	0.2227	0.2226	0.2228	0.2228	0.2228	
A21	4326	0.2225	0.2224	0.2225	0.2224	0.2224	0.2224	0.2224	0.2225	0.2225	0.2224	0.2225	0.2225	0.2225	
A22	4194	0.2219	0.2218	0.2219	0.2218	0.2218	0.2219	0.2219	0.2219	0.2219	0.2218	0.2219	0.2219	0.2219	
A23	4274	0.2225	0.2224	0.2224	0.2224	0.2224	0.2224	0.2224	0.2225	0.2225	0.2224	0.2225	0.2225	0.2225	
A24	4341	0.2226	0.2225	0.2225	0.2225	0.2225	0.2226	0.2226	0.2226	0.2226	0.2226	0.2226	0.2227	0.2227	
A25	4356	0.2218	0.2217	0.2217	0.2216	0.2217	0.2217	0.2216	0.2217	0.2217	0.2217	0.2217	0.2218	0.2218	
A26	4322	0.2225	0.2224	0.2224	0.2224	0.2224	0.2224	0.2224	0.2224	0.2225	0.2225	0.2225	0.2225	0.2225	
A27	4291	0.2222	0.2221	0.2221	0.2221	0.2221	0.2221	0.2221	0.2221	0.2222	0.2222	0.2222	0.2222	0.2222	
A28	4326	0.2223	0.2222	0.2223	0.2222	0.2222	0.2222	0.2222	0.2222	0.2223	0.2223	0.2223	0.2224	0.2224	
A29	4388	0.2227	0.2226	0.2226	0.2225	0.2225	0.2225	0.2225	0.2226	0.2227	0.2226	0.2227	0.2227	0.2227	
A30	4321	0.2223	0.2221	0.2222	0.2221	0.2221	0.2222	0.2222	0.2223	0.2223	0.2222	0.2223	0.2224	0.2223	
A41	4166	0.2220	0.2219	0.2220	0.2219	0.2219	0.2219	0.2219	0.2219	0.2219	0.2219	0.2220	0.2220	0.2220	
A42	4136	0.2219	0.2218	0.2218	0.2218	0.2218	0.2218	0.2218	0.2218	0.2218	0.2218	0.2219	0.2219	0.2219	
A43	4164	0.2220	0.2219	0.2219	0.2219	0.2219	0.2219	0.2219	0.2219	0.2220	0.2219	0.2220	0.2220	0.2220	
A44	4162	0.2221	0.2219	0.2220	0.2219	0.2220	0.2219	0.2219	0.2219	0.2220	0.2219	0.2220	0.2220	0.2220	
A45	4295	0.2230	0.2229	0.2229	0.2229	0.2229	0.2229	0.2229	0.2229	0.2230	0.2229	0.2230	0.2230	0.2230	
ave	**4215**														

$T_S = T_{AIR} = 85°C, I_F = 0.5A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

DATA SET 53: CCT = 4000K, T_J = 92C

v'

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4141	0.4989	0.4986	0.4984	0.4980	0.4980	0.4983	0.4984	0.4982	0.4981	0.4980	0.4980	0.4980	0.4981	
A2	4128	0.5000	0.4997	0.4996	0.4992	0.4991	0.4994	0.4995	0.4993	0.4993	0.4992	0.4993	0.4992	0.4993	
A3	4138	0.4995	0.4992	0.4991	0.4986	0.4987	0.4989	0.4990	0.4988	0.4988	0.4988	0.4988	0.4987	0.4989	
A4	4133	0.4992	0.4989	0.4990	0.4984	0.4984	0.4987	0.4987	0.4986	0.4985	0.4985	0.4986	0.4985	0.4987	
A5	4094	0.5020	0.5016	0.5015	0.5013	0.5012	0.5015	0.5015	0.5013	0.5013	0.5013	0.5013	0.5013	0.5014	
A6	4224	0.4929	0.4925	0.4922	0.4921	0.4920	0.4924	0.4923	0.4922	0.4921	0.4922	0.4921	0.4921	0.4922	
A7	4111	0.5003	0.4999	0.4999	0.4996	0.4995	0.4998	0.4998	0.4997	0.4997	0.4997	0.4997	0.4996	0.4997	
A8	4110	0.5002	0.5000	0.4999	0.4995	0.4994	0.4997	0.4996	0.4995	0.4995	0.4995	0.4994	0.4994	0.4995	
A9	4066	0.5041	0.5039	0.5038	0.5034	0.5033	0.5035	0.5036	0.5034	0.5034	0.5034	0.5035	0.5034	0.5034	
A10	4158	0.4980	0.4976	0.4975	0.4971	0.4972	0.4974	0.4974	0.4973	0.4972	0.4972	0.4971	0.4971	0.4973	
A21	4326	0.4904	0.4901	0.4901	0.4901	0.4901	0.4907	0.4909	0.4907	0.4907	0.4906	0.4906	0.4906	0.4906	
A22	4194	0.4978	0.4975	0.4976	0.4975	0.4975	0.4980	0.4982	0.4981	0.4981	0.4980	0.4981	0.4981	0.4981	
A23	4274	0.4928	0.4925	0.4925	0.4925	0.4926	0.4931	0.4932	0.4931	0.4930	0.4930	0.4930	0.4930	0.4930	
A24	4341	0.4896	0.4892	0.4892	0.4893	0.4894	0.4900	0.4900	0.4900	0.4899	0.4898	0.4898	0.4898	0.4898	
A25	4356	0.4905	0.4902	0.4901	0.4900	0.4900	0.4904	0.4905	0.4903	0.4903	0.4902	0.4902	0.4903	0.4902	
A26	4322	0.4906	0.4904	0.4905	0.4902	0.4901	0.4905	0.4905	0.4904	0.4903	0.4902	0.4903	0.4903	0.4902	
A27	4291	0.4926	0.4924	0.4923	0.4920	0.4919	0.4923	0.4923	0.4921	0.4920	0.4920	0.4920	0.4920	0.4920	
A28	4326	0.4909	0.4906	0.4906	0.4900	0.4900	0.4905	0.4904	0.4901	0.4899	0.4899	0.4900	0.4899	0.4900	
A29	4388	0.4876	0.4872	0.4871	0.4867	0.4866	0.4870	0.4869	0.4867	0.4866	0.4867	0.4865	0.4866	0.4866	
A30	4321	0.4912	0.4908	0.4907	0.4906	0.4905	0.4908	0.4907	0.4905	0.4904	0.4904	0.4903	0.4904	0.4903	
A41	4166	0.4991	0.4987	0.4987	0.4986	0.4987	0.4990	0.4991	0.4990	0.4990	0.4990	0.4991	0.4990	0.4991	
A42	4136	0.5008	0.5006	0.5006	0.5004	0.5006	0.5009	0.5009	0.5009	0.5008	0.5008	0.5010	0.5009	0.5009	
A43	4164	0.4991	0.4989	0.4991	0.4990	0.4992	0.4996	0.4995	0.4995	0.4994	0.4994	0.4995	0.4994	0.4994	
A44	4162	0.4992	0.4989	0.4989	0.4988	0.4989	0.4992	0.4994	0.4991	0.4991	0.4991	0.4993	0.4992	0.4992	
A45	4295	0.4909	0.4905	0.4905	0.4906	0.4909	0.4911	0.4912	0.4911	0.4910	0.4910	0.4911	0.4910	0.4910	
ave	**4215**														

$T_S = T_{AIR} = 85°C, I_F = 0.5A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

delta u' v'

DATA SET 53: CCT = 4000K, T_J = 92C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4141	0.0000	0.0003	0.0005	0.0009	0.0009	0.0006	0.0005	0.0007	0.0008	0.0009	0.0009	0.0009	0.0008	
A2	4128	0.0000	0.0003	0.0004	0.0008	0.0009	0.0006	0.0005	0.0007	0.0007	0.0008	0.0007	0.0008	0.0007	
A3	4138	0.0000	0.0003	0.0004	0.0009	0.0008	0.0006	0.0005	0.0007	0.0007	0.0007	0.0007	0.0008	0.0006	
A4	4133	0.0000	0.0004	0.0002	0.0008	0.0008	0.0005	0.0005	0.0006	0.0007	0.0007	0.0006	0.0007	0.0005	
A5	4094	0.0000	0.0004	0.0005	0.0007	0.0008	0.0005	0.0005	0.0007	0.0007	0.0007	0.0007	0.0007	0.0006	
A6	4224	0.0000	0.0004	0.0007	0.0008	0.0009	0.0005	0.0006	0.0007	0.0008	0.0007	0.0008	0.0008	0.0007	
A7	4111	0.0000	0.0004	0.0004	0.0007	0.0008	0.0005	0.0005	0.0006	0.0006	0.0006	0.0006	0.0007	0.0006	
A8	4110	0.0000	0.0002	0.0003	0.0007	0.0008	0.0005	0.0006	0.0007	0.0007	0.0007	0.0008	0.0008	0.0007	
A9	4066	0.0000	0.0002	0.0003	0.0007	0.0008	0.0006	0.0005	0.0007	0.0007	0.0007	0.0006	0.0007	0.0007	
A10	4158	0.0000	0.0004	0.0005	0.0009	0.0008	0.0006	0.0006	0.0007	0.0008	0.0008	0.0009	0.0009	0.0007	
A21	4326	0.0000	0.0003	0.0003	0.0003	0.0003	0.0003	0.0005	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	
A22	4194	0.0000	0.0003	0.0002	0.0003	0.0003	0.0002	0.0004	0.0003	0.0003	0.0002	0.0003	0.0003	0.0003	
A23	4274	0.0000	0.0003	0.0003	0.0003	0.0002	0.0003	0.0004	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	
A24	4341	0.0000	0.0004	0.0004	0.0003	0.0002	0.0004	0.0004	0.0004	0.0003	0.0002	0.0002	0.0002	0.0002	
A25	4356	0.0000	0.0003	0.0004	0.0005	0.0005	0.0001	0.0002	0.0002	0.0002	0.0003	0.0003	0.0002	0.0003	
A26	4322	0.0000	0.0002	0.0001	0.0004	0.0005	0.0001	0.0001	0.0002	0.0003	0.0004	0.0003	0.0003	0.0004	
A27	4291	0.0000	0.0002	0.0003	0.0006	0.0007	0.0003	0.0003	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	
A28	4326	0.0000	0.0003	0.0003	0.0009	0.0009	0.0004	0.0005	0.0008	0.0010	0.0010	0.0009	0.0010	0.0009	
A29	4388	0.0000	0.0004	0.0005	0.0009	0.0010	0.0006	0.0007	0.0009	0.0010	0.0009	0.0011	0.0010	0.0010	
A30	4321	0.0000	0.0004	0.0005	0.0006	0.0007	0.0004	0.0005	0.0007	0.0008	0.0008	0.0009	0.0008	0.0009	
A41	4166	0.0000	0.0004	0.0004	0.0005	0.0004	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0000	
A42	4136	0.0000	0.0002	0.0002	0.0004	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	
A43	4164	0.0000	0.0002	0.0001	0.0001	0.0001	0.0005	0.0004	0.0004	0.0003	0.0003	0.0004	0.0003	0.0003	
A44	4162	0.0000	0.0004	0.0003	0.0004	0.0003	0.0002	0.0003	0.0002	0.0001	0.0002	0.0001	0.0001	0.0001	
A45	4295	0.0000	0.0004	0.0004	0.0003	0.0001	0.0002	0.0003	0.0002	0.0001	0.0001	0.0002	0.0001	0.0001	
ave	**4215**	**0.0000**	**0.0003**	**0.0004**	**0.0006**	**0.0006**	**0.0004**	**0.0004**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	

$T_S = T_{AIR} = 85°C, I_F = 0.5A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

Forward voltage

DATA SET 53: CCT = 4000K, T_J = 92C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4141	2.892	2.892	2.893	2.893	2.894	2.891	2.890	2.891	2.892	2.889	2.894	2.890	2.892	
A2	4128	2.920	2.919	2.921	2.921	2.919	2.919	2.920	2.919	2.921	2.919	2.922	2.921	2.921	
A3	4138	2.929	2.930	2.931	2.930	2.930	2.928	2.929	2.931	2.928	2.929	2.933	2.930	2.930	
A4	4133	2.902	2.901	2.902	2.901	2.901	2.900	2.900	2.900	2.901	2.899	2.902	2.901	2.898	
A5	4094	2.934	2.934	2.935	2.934	2.935	2.933	2.931	2.934	2.934	2.931	2.937	2.935	2.936	
A6	4224	2.882	2.883	2.882	2.881	2.883	2.881	2.879	2.882	2.881	2.879	2.884	2.881	2.881	
A7	4111	2.913	2.917	2.917	2.912	2.917	2.915	2.914	2.916	2.917	2.915	2.918	2.915	2.916	
A8	4110	2.857	2.858	2.859	2.857	2.858	2.857	2.856	2.858	2.859	2.856	2.860	2.858	2.857	
A9	4066	2.899	2.902	2.903	2.900	2.903	2.902	2.901	2.901	2.903	2.899	2.903	2.901	2.903	
A10	4158	2.951	2.949	2.951	2.950	2.950	2.948	2.951	2.950	2.952	2.949	2.953	2.951	2.951	
A21	4326	2.964	2.963	2.965	2.961	2.961	2.959	2.959	2.961	2.960	2.958	2.963	2.961	2.962	
A22	4194	2.934	2.933	2.933	2.930	2.930	2.929	2.929	2.930	2.929	2.927	2.933	2.931	2.932	
A23	4274	2.943	2.941	2.942	2.940	2.939	2.938	2.937	2.937	2.938	2.936	2.941	2.938	2.938	
A24	4341	2.965	2.966	2.965	2.965	2.962	2.960	2.962	2.962	2.963	2.959	2.963	2.962	2.961	
A25	4356	2.935	2.936	2.934	2.931	2.930	2.929	2.927	2.930	2.929	2.928	2.933	2.931	2.931	
A26	4322	2.955	2.955	2.955	2.952	2.952	2.949	2.950	2.950	2.950	2.948	2.953	2.951	2.951	
A27	4291	2.927	2.930	2.927	2.928	2.928	2.925	2.925	2.926	2.926	2.926	2.930	2.928	2.928	
A28	4326	2.931	2.931	2.932	2.928	2.930	2.926	2.928	2.927	2.929	2.928	2.931	2.929	2.930	
A29	4388	2.965	2.965	2.966	2.964	2.965	2.962	2.961	2.961	2.962	2.961	2.963	2.962	2.963	
A30	4321	2.981	2.983	2.981	2.980	2.980	2.979	2.977	2.976	2.979	2.975	2.980	2.977	2.979	
A41	4166	3.033	3.032	3.031	3.028	3.026	3.025	3.023	3.024	3.023	3.020	3.025	3.024	3.025	
A42	4136	3.076	3.074	3.074	3.069	3.067	3.063	3.061	3.060	3.060	3.056	3.063	3.060	3.059	
A43	4164	3.209	3.191	3.164	3.143	3.130	3.116	3.108	3.102	3.097	3.093	3.095	3.089	3.087	
A44	4162	3.090	3.089	3.087	3.082	3.080	3.075	3.073	3.073	3.071	3.071	3.075	3.073	3.073	
A45	4295	3.084	3.080	3.072	3.059	3.054	3.045	3.038	3.034	3.033	3.030	3.031	3.030	3.028	
ave	**4215**	**2.963**													

$T_S = T_{AIR} = 105°C, I_F = 0.5A$

$T_S \geq 103C, T_{AIR} \geq 100C$ in compliance with LM-80-08

Lumen Data

DATA SET 52: CCT = 4000K, T_J = 112C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	Lumen Maintenance % at 6khours
A1	4029	155.531	155.175	155.503	156.572	158.506	159.948	160.125	161.013	160.594	159.921	160.028	161.572	162.528		**102.8**
A2	4109	156.216	155.408	155.781	157.221	158.061	159.769	160.387	161.152	160.835	159.340	159.993	161.651	163.054		**102.0**
A3	4089	151.167	150.300	150.721	151.894	153.833	154.933	155.115	155.949	155.427	154.312	154.350	155.935	156.989		**102.1**
A4	4083	148.459	147.916	148.309	149.213	150.753	151.566	151.979	152.861	152.519	151.326	151.561	153.190	154.473		**101.9**
A5	3956	154.323	153.766	153.990	156.847	158.275	159.419	159.680	160.605	160.266	159.175	159.063	161.143	162.241		**103.1**
A6	4026	154.755	154.523	154.820	157.670	158.946	160.160	160.587	161.684	161.611	160.393	160.265	162.813	163.832		**103.6**
A7	4125	152.748	152.724	152.980	154.982	156.226	157.274	157.180	158.006	157.632	155.919	156.101	158.037	159.025		**102.1**
A8	4058	155.820	155.628	155.822	157.877	159.420	160.386	160.390	161.261	160.957	158.809	159.294	161.309	162.396		**101.9**
A9	4037	154.689	154.689	155.048	157.258	158.998	160.348	160.354	161.600	161.487	159.357	160.239	162.107	163.347		**103.0**
A10	4123	153.710	153.804	153.445	156.089	157.392	158.748	158.693	159.574	159.467	157.600	158.093	160.162	161.086		**102.5**
A21	4220	152.899	151.220	151.072	153.963	154.953	156.450	156.715	157.840	157.494	155.658	156.043	158.156	159.246		**101.8**
A22	4275	150.982	149.941	149.979	152.401	153.585	155.118	155.274	156.654	156.436	155.071	155.669	157.925	159.163		**102.7**
A23	4228	153.138	152.245	152.260	154.137	155.358	157.058	157.155	158.584	158.378	156.770	157.413	159.506	160.758		**102.4**
A24	4187	153.224	152.040	152.040	154.102	155.365	156.981	157.060	158.679	158.963	157.548	158.491	160.947	162.416		**102.8**
A25	4199	152.071	151.380	151.353	152.903	154.480	155.596	155.680	156.798	156.648	155.202	155.783	157.894	158.887		**102.1**
A26	4197	154.313	153.569	153.633	154.858	156.229	157.453	157.334	158.248	158.550	156.899	157.323	159.322	160.286		**101.7**
A27	4198	151.247	150.571	150.742	152.007	153.398	154.651	155.127	156.690	157.143	155.882	156.884	159.358	160.315		**103.1**
A28	4172	154.308	153.635	153.722	155.127	156.161	157.604	157.644	158.757	158.796	157.069	157.804	160.112	160.975		**101.8**
A29	4180	145.210	144.735	145.001	146.384	147.762	148.849	148.274	149.636	149.639	148.059	148.311	150.399	151.326		**102.0**
A30	4163	153.258	152.591	152.636	154.350	155.870	156.769	156.790	158.287	158.666	157.405	158.082	160.677	162.076		**102.7**
A41	4047	152.691	151.901	152.820	153.933	155.656	156.915	157.744	158.766	158.350	156.532	156.357	158.270	158.848		**102.5**
A42	4180	146.825	145.815	146.391	147.162	148.580	150.028	149.955	150.867	150.612	148.452	148.124	149.594	149.891		**101.1**
A43	4061	159.144	157.833	159.074	160.300	161.878	163.152	163.575	164.565	164.593	162.697	162.949	164.794	165.445		**102.2**
A44	4110	155.337	154.224	155.034	156.460	158.241	159.684	159.900	160.783	160.679	158.524	158.825	160.536	161.372		**102.1**
A45	4101	147.997	147.067	147.593	148.633	150.033	151.646	152.065	153.001	152.622	150.029	149.851	151.255	151.783		**101.4**
ave	**4126**															**102.3**

$T_S = T_{AIR} = 105°C, I_F = 0.5A$

$T_S \geq 103C, T_{AIR} \geq 100C$ in compliance with LM-80-08

Normalized flux

DATA SET 52: CCT = 4000K, T_J = 112C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4029	1.0000	0.9977	0.9998	1.0067	1.0191	1.0284	1.0295	1.0352	1.0326	1.0282	1.0289	1.0388	1.0450	
A2	4109	1.0000	0.9948	0.9972	1.0064	1.0118	1.0227	1.0267	1.0316	1.0296	1.0200	1.0242	1.0348	1.0438	
A3	4089	1.0000	0.9943	0.9970	1.0048	1.0176	1.0249	1.0261	1.0316	1.0282	1.0208	1.0211	1.0315	1.0385	
A4	4083	1.0000	0.9963	0.9990	1.0051	1.0155	1.0209	1.0237	1.0297	1.0273	1.0193	1.0209	1.0319	1.0405	
A5	3956	1.0000	0.9964	0.9978	1.0164	1.0256	1.0330	1.0347	1.0407	1.0385	1.0314	1.0307	1.0442	1.0513	
A6	4026	1.0000	0.9985	1.0004	1.0188	1.0271	1.0349	1.0377	1.0448	1.0443	1.0364	1.0356	1.0521	1.0587	
A7	4125	1.0000	0.9998	1.0015	1.0146	1.0228	1.0296	1.0290	1.0344	1.0320	1.0208	1.0220	1.0346	1.0411	
A8	4058	1.0000	0.9988	1.0000	1.0132	1.0231	1.0293	1.0293	1.0349	1.0330	1.0192	1.0223	1.0352	1.0422	
A9	4037	1.0000	1.0000	1.0023	1.0166	1.0279	1.0366	1.0366	1.0447	1.0440	1.0302	1.0359	1.0480	1.0560	
A10	4123	1.0000	1.0006	0.9983	1.0155	1.0240	1.0328	1.0324	1.0382	1.0375	1.0253	1.0285	1.0420	1.0480	
A21	4220	1.0000	0.9890	0.9881	1.0070	1.0134	1.0232	1.0250	1.0323	1.0300	1.0180	1.0206	1.0344	1.0415	
A22	4275	1.0000	0.9931	0.9934	1.0094	1.0172	1.0274	1.0284	1.0376	1.0361	1.0271	1.0310	1.0460	1.0542	
A23	4228	1.0000	0.9942	0.9943	1.0065	1.0145	1.0256	1.0262	1.0356	1.0342	1.0237	1.0279	1.0416	1.0498	
A24	4187	1.0000	0.9923	0.9923	1.0057	1.0140	1.0245	1.0250	1.0356	1.0375	1.0282	1.0344	1.0504	1.0600	
A25	4199	1.0000	0.9955	0.9953	1.0055	1.0158	1.0232	1.0237	1.0311	1.0301	1.0206	1.0244	1.0383	1.0448	
A26	4197	1.0000	0.9952	0.9956	1.0035	1.0124	1.0203	1.0196	1.0255	1.0275	1.0168	1.0195	1.0325	1.0387	
A27	4198	1.0000	0.9955	0.9967	1.0050	1.0142	1.0225	1.0257	1.0360	1.0390	1.0306	1.0373	1.0536	1.0600	
A28	4172	1.0000	0.9956	0.9962	1.0053	1.0120	1.0214	1.0216	1.0288	1.0291	1.0179	1.0227	1.0376	1.0432	
A29	4180	1.0000	0.9967	0.9986	1.0081	1.0176	1.0251	1.0211	1.0305	1.0305	1.0196	1.0214	1.0357	1.0421	
A30	4163	1.0000	0.9956	0.9959	1.0071	1.0170	1.0229	1.0230	1.0328	1.0353	1.0271	1.0315	1.0484	1.0575	
A41	4047	1.0000	0.9948	1.0008	1.0081	1.0194	1.0277	1.0331	1.0398	1.0371	1.0252	1.0240	1.0365	1.0403	
A42	4180	1.0000	0.9931	0.9970	1.0023	1.0120	1.0218	1.0213	1.0275	1.0258	1.0111	1.0088	1.0189	1.0209	
A43	4061	1.0000	0.9918	0.9996	1.0073	1.0172	1.0252	1.0278	1.0341	1.0342	1.0223	1.0239	1.0355	1.0396	
A44	4110	1.0000	0.9928	0.9980	1.0072	1.0187	1.0280	1.0294	1.0351	1.0344	1.0205	1.0225	1.0335	1.0389	
A45	4101	1.0000	0.9937	0.9973	1.0043	1.0138	1.0247	1.0275	1.0338	1.0313	1.0137	1.0125	1.0220	1.0256	
ave	**4126**	**1.0000**	**0.9955**	**0.9973**	**1.0084**	**1.0177**	**1.0263**	**1.0274**	**1.0345**	**1.0336**	**1.0230**	**1.0253**	**1.0383**	**1.0449**	

$T_S = T_{AIR} = 105°C$, $I_F = 0.5A$

$T_S \geq 103C$, $T_{AIR} \geq 100C$ in compliance with LM-80-08

TM-21 extrapolation

		CCT (t=0)	alpha	B	r2	L70
DATA SET 52: CCT = 4000K, T_J = 112C	A1	4029	-1.8767E-06	1.0222	0.326	-201,775
	A2	4109	-2.2266E-06	1.0158	0.266	-167,233
	A3	4089	-1.2356E-06	1.0204	0.121	-304,988
	A4	4083	-1.9190E-06	1.0155	0.228	-193,875
	A5	3956	-1.8961E-06	1.0267	0.222	-202,012
	A6	4026	-2.4982E-06	1.0284	0.301	-154,000
	A7	4125	-1.1723E-06	1.0230	0.081	-323,602
	A8	4058	-1.2765E-06	1.0226	0.080	-296,924
	A9	4037	-2.0221E-06	1.0295	0.189	-190,741
	A10	4123	-1.8088E-06	1.0244	0.173	-210,534
	A21	4220	-1.6981E-06	1.0181	0.138	-220,629
	A22	4275	-3.1920E-06	1.0173	0.391	-117,116
	A23	4228	-2.6711E-06	1.0176	0.306	-140,064
	A24	4187	-4.5591E-06	1.0106	0.569	-80,536
	A25	4199	-2.6770E-06	1.0137	0.339	-138,327
	A26	4197	-2.3213E-06	1.0113	0.302	-158,505
	A27	4198	-4.6492E-06	1.0117	0.636	-79,210
	A28	4172	-2.8235E-06	1.0111	0.341	-130,238
	A29	4180	-2.0877E-06	1.0161	0.223	-178,480
	A30	4163	-4.5818E-06	1.0082	0.584	-79,635
	A41	4047	1.2384E-09	1.0338	0.000	314,847,344
	A42	4180	1.5714E-06	1.0293	0.155	245,333
	A43	4061	-9.1032E-07	1.0255	0.065	-419,474
	A44	4110	-5.0104E-07	1.0274	0.017	-765,854
	A45	4101	1.9469E-06	1.0362	0.179	201,446
	ave	**4126**	**-1.8899E-06**	**1.0206**	**0.201**	**-199,520**

$T_S = T_{AIR} = 105°C$, $I_F = 0.5A$

$T_S \geq 103C$, $T_{AIR} \geq 100C$ in compliance with LM-80-08

u'

DATA SET 52: CCT = 4000K, T_J = 112C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4029	0.2235	0.2234	0.2235	0.2235	0.2234	0.2232	0.2236	0.2236	0.2236	0.2238	0.2240	0.2242	0.2242	
A2	4109	0.2235	0.2234	0.2235	0.2235	0.2235	0.2233	0.2236	0.2236	0.2236	0.2238	0.2241	0.2243	0.2242	
A3	4089	0.2235	0.2234	0.2235	0.2235	0.2234	0.2233	0.2236	0.2236	0.2236	0.2238	0.2241	0.2242	0.2242	
A4	4083	0.2235	0.2233	0.2235	0.2235	0.2234	0.2233	0.2236	0.2236	0.2236	0.2238	0.2241	0.2242	0.2242	
A5	3956	0.2231	0.2230	0.2231	0.2230	0.2229	0.2228	0.2231	0.2231	0.2232	0.2233	0.2236	0.2238	0.2237	
A6	4026	0.2233	0.2232	0.2232	0.2231	0.2231	0.2230	0.2233	0.2233	0.2233	0.2235	0.2238	0.2240	0.2239	
A7	4125	0.2240	0.2239	0.2240	0.2239	0.2239	0.2238	0.2241	0.2241	0.2242	0.2243	0.2246	0.2248	0.2247	
A8	4058	0.2236	0.2235	0.2236	0.2235	0.2235	0.2234	0.2237	0.2238	0.2238	0.2240	0.2243	0.2244	0.2244	
A9	4037	0.2236	0.2235	0.2235	0.2235	0.2234	0.2233	0.2236	0.2237	0.2237	0.2239	0.2242	0.2243	0.2243	
A10	4123	0.2242	0.2241	0.2241	0.2241	0.2240	0.2240	0.2243	0.2244	0.2243	0.2245	0.2248	0.2249	0.2249	
A21	4220	0.2230	0.2229	0.2229	0.2229	0.2229	0.2227	0.2230	0.2230	0.2230	0.2232	0.2234	0.2236	0.2236	
A22	4275	0.2234	0.2233	0.2234	0.2234	0.2233	0.2232	0.2235	0.2235	0.2235	0.2236	0.2238	0.2240	0.2240	
A23	4228	0.2232	0.2230	0.2232	0.2231	0.2231	0.2230	0.2233	0.2233	0.2233	0.2234	0.2236	0.2238	0.2238	
A24	4187	0.2231	0.2230	0.2230	0.2230	0.2230	0.2229	0.2231	0.2231	0.2231	0.2233	0.2235	0.2236	0.2236	
A25	4199	0.2233	0.2232	0.2232	0.2233	0.2232	0.2231	0.2234	0.2234	0.2234	0.2235	0.2237	0.2239	0.2239	
A26	4197	0.2232	0.2231	0.2231	0.2231	0.2231	0.2230	0.2233	0.2233	0.2233	0.2235	0.2237	0.2238	0.2238	
A27	4198	0.2233	0.2232	0.2233	0.2232	0.2232	0.2231	0.2234	0.2234	0.2234	0.2236	0.2237	0.2239	0.2239	
A28	4172	0.2231	0.2230	0.2230	0.2230	0.2230	0.2229	0.2232	0.2233	0.2233	0.2234	0.2236	0.2238	0.2238	
A29	4180	0.2232	0.2230	0.2231	0.2231	0.2230	0.2230	0.2233	0.2233	0.2233	0.2235	0.2237	0.2239	0.2238	
A30	4163	0.2230	0.2228	0.2228	0.2228	0.2228	0.2228	0.2230	0.2231	0.2231	0.2232	0.2234	0.2236	0.2235	
A41	4047	0.2227	0.2225	0.2226	0.2227	0.2226	0.2225	0.2227	0.2227	0.2227	0.2229	0.2231	0.2233	0.2233	
A42	4180	0.2238	0.2237	0.2238	0.2238	0.2238	0.2237	0.2239	0.2239	0.2239	0.2240	0.2243	0.2244	0.2244	
A43	4061	0.2228	0.2227	0.2227	0.2228	0.2228	0.2226	0.2229	0.2229	0.2229	0.2230	0.2233	0.2234	0.2234	
A44	4110	0.2234	0.2232	0.2233	0.2233	0.2233	0.2232	0.2234	0.2234	0.2234	0.2236	0.2238	0.2240	0.2240	
A45	4101	0.2234	0.2233	0.2233	0.2234	0.2234	0.2233	0.2235	0.2235	0.2235	0.2236	0.2239	0.2240	0.2240	
ave	**4126**														

$T_S = T_{AIR} = 105°C$, $I_F = 0.5A$

$T_S \geq 103C$, $T_{AIR} \geq 100C$ in compliance with LM-80-08

v'

DATA SET 52: CCT = 4000K, T_J = 112C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4029	0.5033	0.5035	0.5031	0.5029	0.5030	0.5036	0.5036	0.5036	0.5036	0.5036	0.5047	0.5054	0.5056	
A2	4109	0.4989	0.4992	0.4987	0.4985	0.4987	0.4994	0.4992	0.4993	0.4993	0.4992	0.5004	0.5012	0.5014	
A3	4089	0.5000	0.5004	0.4998	0.4997	0.4998	0.5005	0.5004	0.5004	0.5004	0.5003	0.5015	0.5023	0.5024	
A4	4083	0.5004	0.5008	0.5003	0.5002	0.5004	0.5011	0.5010	0.5011	0.5011	0.5010	0.5021	0.5029	0.5030	
A5	3956	0.5087	0.5090	0.5085	0.5082	0.5083	0.5089	0.5089	0.5089	0.5089	0.5088	0.5098	0.5104	0.5106	
A6	4026	0.5040	0.5043	0.5038	0.5034	0.5037	0.5042	0.5043	0.5043	0.5043	0.5042	0.5053	0.5061	0.5063	
A7	4125	0.4971	0.4975	0.4969	0.4967	0.4969	0.4977	0.4975	0.4976	0.4976	0.4975	0.4987	0.4995	0.4997	
A8	4058	0.5014	0.5017	0.5012	0.5009	0.5010	0.5017	0.5016	0.5016	0.5016	0.5015	0.5026	0.5034	0.5036	
A9	4037	0.5027	0.5030	0.5025	0.5021	0.5023	0.5029	0.5028	0.5029	0.5029	0.5028	0.5039	0.5047	0.5050	
A10	4123	0.4968	0.4971	0.4965	0.4962	0.4963	0.4972	0.4969	0.4970	0.4969	0.4969	0.4980	0.4988	0.4991	
A21	4220	0.4944	0.4948	0.4944	0.4938	0.4941	0.4949	0.4947	0.4948	0.4947	0.4946	0.4956	0.4967	0.4968	
A22	4275	0.4910	0.4914	0.4909	0.4904	0.4908	0.4917	0.4915	0.4915	0.4915	0.4914	0.4925	0.4936	0.4937	
A23	4228	0.4936	0.4939	0.4935	0.4932	0.4935	0.4942	0.4941	0.4942	0.4941	0.4940	0.4951	0.4961	0.4962	
A24	4187	0.4958	0.4961	0.4957	0.4953	0.4956	0.4962	0.4962	0.4961	0.4961	0.4960	0.4971	0.4981	0.4983	
A25	4199	0.4947	0.4950	0.4946	0.4943	0.4945	0.4952	0.4951	0.4951	0.4950	0.4949	0.4960	0.4970	0.4972	
A26	4197	0.4951	0.4953	0.4949	0.4946	0.4947	0.4954	0.4953	0.4953	0.4952	0.4950	0.4961	0.4972	0.4973	
A27	4198	0.4948	0.4950	0.4946	0.4944	0.4944	0.4950	0.4950	0.4951	0.4950	0.4949	0.4960	0.4972	0.4974	
A28	4172	0.4965	0.4968	0.4964	0.4962	0.4964	0.4970	0.4969	0.4970	0.4969	0.4968	0.4979	0.4989	0.4990	
A29	4180	0.4960	0.4962	0.4960	0.4958	0.4959	0.4962	0.4964	0.4964	0.4963	0.4962	0.4973	0.4984	0.4985	
A30	4163	0.4973	0.4975	0.4971	0.4969	0.4970	0.4975	0.4975	0.4976	0.4975	0.4974	0.4984	0.4995	0.4996	
A41	4047	0.5041	0.5043	0.5041	0.5042	0.5044	0.5051	0.5053	0.5054	0.5054	0.5055	0.5065	0.5073	0.5073	
A42	4180	0.4947	0.4950	0.4948	0.4949	0.4952	0.4961	0.4962	0.4963	0.4964	0.4965	0.4978	0.4988	0.4989	
A43	4061	0.5031	0.5033	0.5032	0.5033	0.5037	0.5043	0.5045	0.5047	0.5047	0.5048	0.5060	0.5068	0.5069	
A44	4110	0.4992	0.4995	0.4995	0.4997	0.5001	0.5009	0.5011	0.5012	0.5011	0.5011	0.5022	0.5030	0.5031	
A45	4101	0.4996	0.4999	0.4999	0.4999	0.5005	0.5012	0.5014	0.5016	0.5016	0.5018	0.5029	0.5037	0.5038	
ave	**4126**														

$T_S = T_{AIR} = 105°C, I_F = 0.5A$

$T_S \geq 103C, T_{AIR} \geq 100C$ in compliance with LM-80-08

delta u' v'

DATA SET 52: CCT = 4000K, T_J = 112C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4029	0.0000	0.0002	0.0002	0.0004	0.0003	0.0004	0.0003	0.0003	0.0003	0.0004	0.0015	0.0022	0.0024	
A2	4109	0.0000	0.0003	0.0002	0.0004	0.0002	0.0005	0.0003	0.0004	0.0004	0.0004	0.0016	0.0024	0.0026	
A3	4089	0.0000	0.0004	0.0002	0.0003	0.0002	0.0005	0.0004	0.0004	0.0004	0.0004	0.0016	0.0024	0.0025	
A4	4083	0.0000	0.0004	0.0001	0.0002	0.0001	0.0007	0.0006	0.0007	0.0007	0.0007	0.0018	0.0026	0.0027	
A5	3956	0.0000	0.0003	0.0002	0.0005	0.0004	0.0004	0.0002	0.0002	0.0002	0.0002	0.0012	0.0018	0.0020	
A6	4026	0.0000	0.0003	0.0002	0.0006	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003	0.0014	0.0022	0.0024	
A7	4125	0.0000	0.0004	0.0002	0.0004	0.0002	0.0006	0.0004	0.0005	0.0005	0.0005	0.0017	0.0025	0.0027	
A8	4058	0.0000	0.0003	0.0002	0.0005	0.0004	0.0004	0.0002	0.0003	0.0003	0.0004	0.0014	0.0022	0.0023	
A9	4037	0.0000	0.0003	0.0002	0.0006	0.0004	0.0004	0.0001	0.0002	0.0002	0.0003	0.0013	0.0021	0.0024	
A10	4123	0.0000	0.0003	0.0003	0.0006	0.0005	0.0004	0.0001	0.0003	0.0001	0.0003	0.0013	0.0021	0.0024	
A21	4220	0.0000	0.0004	0.0001	0.0006	0.0003	0.0006	0.0003	0.0004	0.0003	0.0003	0.0013	0.0024	0.0025	
A22	4275	0.0000	0.0004	0.0001	0.0006	0.0002	0.0007	0.0005	0.0005	0.0005	0.0004	0.0016	0.0027	0.0028	
A23	4228	0.0000	0.0004	0.0001	0.0004	0.0001	0.0006	0.0005	0.0006	0.0005	0.0004	0.0016	0.0026	0.0027	
A24	4187	0.0000	0.0003	0.0001	0.0005	0.0002	0.0004	0.0004	0.0003	0.0003	0.0003	0.0014	0.0024	0.0025	
A25	4199	0.0000	0.0003	0.0001	0.0004	0.0002	0.0005	0.0004	0.0004	0.0003	0.0003	0.0014	0.0024	0.0026	
A26	4197	0.0000	0.0002	0.0002	0.0005	0.0004	0.0004	0.0002	0.0002	0.0001	0.0003	0.0011	0.0022	0.0023	
A27	4198	0.0000	0.0002	0.0002	0.0004	0.0004	0.0003	0.0002	0.0003	0.0002	0.0003	0.0013	0.0025	0.0027	
A28	4172	0.0000	0.0003	0.0001	0.0003	0.0001	0.0005	0.0004	0.0005	0.0004	0.0004	0.0015	0.0025	0.0026	
A29	4180	0.0000	0.0003	0.0001	0.0002	0.0002	0.0003	0.0004	0.0004	0.0003	0.0004	0.0014	0.0025	0.0026	
A30	4163	0.0000	0.0003	0.0003	0.0004	0.0004	0.0003	0.0002	0.0003	0.0002	0.0002	0.0012	0.0023	0.0024	
A41	4047	0.0000	0.0003	0.0001	0.0001	0.0003	0.0010	0.0012	0.0013	0.0013	0.0014	0.0024	0.0033	0.0033	
A42	4180	0.0000	0.0003	0.0001	0.0002	0.0005	0.0014	0.0015	0.0016	0.0017	0.0018	0.0031	0.0041	0.0042	
A43	4061	0.0000	0.0002	0.0001	0.0002	0.0006	0.0012	0.0014	0.0016	0.0016	0.0017	0.0029	0.0037	0.0038	
A44	4110	0.0000	0.0004	0.0003	0.0005	0.0009	0.0017	0.0019	0.0020	0.0019	0.0019	0.0030	0.0038	0.0039	
A45	4101	0.0000	0.0003	0.0003	0.0003	0.0009	0.0016	0.0018	0.0020	0.0020	0.0022	0.0033	0.0041	0.0042	
ave	**4126**	**0.0000**	**0.0003**	**0.0002**	**0.0004**	**0.0004**	**0.0007**	**0.0006**	**0.0006**	**0.0006**	**0.0007**	**0.0017**	**0.0026**	**0.0028**	

$T_S = T_{AIR} = 105°C, I_F = 0.5A$

$T_S \geq 103C, T_{AIR} \geq 100C$ in compliance with LM-80-08

Forward voltage

DATA SET 52: CCT = 4000K, T_J = 112C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4029	2.928	2.923	2.923	2.927	2.927	2.918	2.930	2.932	2.935	2.937	2.947	2.954	2.959	
A2	4109	2.948	2.945	2.946	2.948	2.946	2.940	2.948	2.954	2.959	2.960	2.966	2.975	2.981	
A3	4089	2.897	2.892	2.896	2.896	2.896	2.887	2.896	2.895	2.898	2.900	2.905	2.904	2.909	
A4	4083	2.917	2.910	2.914	2.915	2.914	2.910	2.919	2.916	2.920	2.921	2.928	2.932	2.938	
A5	3956	2.897	2.891	2.896	2.895	2.892	2.885	2.895	2.892	2.898	2.902	2.905	2.908	2.911	
A6	4026	2.909	2.903	2.908	2.909	2.907	2.902	2.912	2.913	2.919	2.923	2.932	2.940	2.946	
A7	4125	2.887	2.883	2.887	2.888	2.884	2.878	2.885	2.888	2.887	2.889	2.890	2.895	2.897	
A8	4058	2.916	2.911	2.910	2.912	2.910	2.905	2.911	2.915	2.914	2.916	2.923	2.927	2.930	
A9	4037	2.915	2.910	2.909	2.912	2.912	2.909	2.918	2.922	2.927	2.930	2.942	2.952	2.960	
A10	4123	2.892	2.891	2.890	2.892	2.890	2.885	2.893	2.894	2.896	2.901	2.903	2.906	2.907	
A21	4220	2.986	2.978	2.982	2.982	2.979	2.973	2.982	2.982	2.985	2.990	2.995	3.000	3.008	
A22	4275	2.969	2.964	2.964	2.968	2.964	2.959	2.970	2.970	2.977	2.986	2.997	3.005	3.026	
A23	4228	2.961	2.957	2.956	2.958	2.955	2.950	2.960	2.961	2.968	2.973	2.986	2.994	3.007	
A24	4187	2.952	2.948	2.948	2.951	2.948	2.944	2.955	2.961	2.969	2.981	2.998	3.018	3.046	
A25	4199	2.942	2.937	2.937	2.935	2.934	2.927	2.939	2.939	2.946	2.952	2.959	2.964	2.974	
A26	4197	2.978	2.976	2.976	2.977	2.975	2.970	2.980	2.984	2.984	2.990	3.000	3.005	3.013	
A27	4198	2.909	2.909	2.908	2.909	2.907	2.907	2.916	2.925	2.935	2.948	2.971	2.994	3.023	
A28	4172	2.939	2.932	2.934	2.935	2.935	2.928	2.938	2.943	2.947	2.956	2.965	2.976	2.991	
A29	4180	2.968	2.961	2.963	2.963	2.959	2.951	2.965	2.966	2.970	2.976	2.987	2.993	3.007	
A30	4163	2.947	2.941	2.941	2.943	2.940	2.938	2.947	2.954	2.960	2.973	2.989	3.011	3.032	
A41	4047	3.069	3.065	3.066	3.064	3.061	3.057	3.077	3.088	3.101	3.112	3.125	3.134	3.142	
A42	4180	3.020	3.017	3.018	3.018	3.017	3.012	3.028	3.033	3.044	3.058	3.068	3.078	3.085	
A43	4061	3.111	3.103	3.100	3.100	3.095	3.093	3.104	3.112	3.121	3.135	3.146	3.154	3.162	
A44	4110	3.146	3.134	3.126	3.119	3.111	3.108	3.124	3.130	3.140	3.149	3.159	3.164	3.173	
A45	4101	3.016	3.011	3.013	3.015	3.013	3.018	3.036	3.052	3.072	3.088	3.100	3.111	3.114	
ave	**4126**	**2.961**													

$T_S = T_{AIR} = 120°C, I_F = 0.5A$

$T_S \geq 118C, T_{AIR} \geq 115C$ in compliance with LM-80-08

Lumen Data

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	Lumen Maintenance % at 6khours
DATA SET 51: CCT = 4000K, T_J = 127C	A1	3986	155.087	154.851	155.138	158.297	160.422	163.078	163.559	164.759	163.544	160.937	160.768	161.189	161.899		**103.8**
	A2	4046	157.490	156.928	157.058	159.485	161.333	163.838	164.053	165.726	165.058	161.606	161.767	161.947	163.019		**102.6**
	A3	4068	156.925	156.087	156.264	159.312	161.137	163.361	163.123	164.850	164.377	161.289	161.368	162.087	162.617		**102.8**
	A4	4039	157.937	157.474	157.605	159.994	161.951	163.926	163.782	165.483	165.353	161.897	162.559	163.233	163.762		**102.5**
	A5	4050	155.023	154.827	155.060	156.655	158.439	160.419	159.916	161.184	161.129	158.543	158.951	159.051	159.273		**102.3**
	A6	4037	157.784	157.395	157.701	159.762	161.718	164.228	164.424	165.618	163.985	160.098	160.678	161.850	162.633		**101.5**
	A7	4055	156.891	156.324	156.517	158.630	160.560	162.335	162.269	163.966	163.919	160.449	160.502	161.164	161.966		**102.3**
	A8	4038	157.493	157.143	157.274	159.042	161.042	162.607	162.408	163.983	164.107	161.651	161.721	162.064	162.335		**102.6**
	A9	4056	158.649	158.164	158.305	159.860	161.863	163.731	163.512	165.263	165.079	161.721	161.891	162.525	163.017		**101.9**
	A10	4002	157.105	156.574	157.233	158.576	159.828	161.776	161.828	163.422	163.421	160.747	160.593	160.748	161.240		**102.3**
	A21	4210	146.333	148.643	148.797	151.177	153.398	156.568	157.779	156.440	152.510	149.745	149.537	150.324	151.465		**102.3**
	A22	4178	152.484	151.568	151.367	154.078	156.166	158.254	158.596	160.477	159.310	154.354	152.542	152.730	153.440		**101.2**
	A23	4081	153.629	152.432	152.512	155.376	158.171	161.917	161.831	157.261	154.843	152.108	152.438	153.480	154.728		**99.0**
	A24	4148	154.446	153.814	153.734	155.540	158.197	161.765	162.577	157.869	154.798	152.068	152.418	153.219	154.455		**98.5**
	A25	4224	155.546	155.115	155.127	156.414	158.525	160.643	161.787	164.049	160.907	156.999	156.968	157.654	158.869		**100.9**
	A26	4268	153.991	153.352	153.463	155.216	157.255	159.394	160.356	162.497	159.886	156.043	156.034	156.791	157.987		**101.3**
	A27	4164	156.406	155.596	155.695	156.881	158.849	160.162	160.436	161.241	159.179	155.159	154.586	155.548	156.486		**99.2**
	A28	4214	154.426	152.998	153.169	155.114	157.437	159.877	161.896	161.751	158.036	155.093	155.265	156.292	157.476		**100.4**
	A29	4172	154.281	153.714	153.897	155.445	157.954	160.976	163.128	160.438	157.548	154.650	155.016	156.409	157.463		**100.2**
	A30	4257	152.955	152.721	152.871	154.452	156.525	158.762	160.523	161.966	158.069	154.694	154.965	156.179	157.091		**101.1**
	A41	4146	147.159	146.255	147.356	149.736	152.715	155.110	152.296	152.606	152.120	149.405	150.395	151.931	152.726		**101.5**
	A42	4187	146.006	144.815	145.305	147.393	149.324	150.186	149.085	149.761	149.359	146.713	147.978	149.267	150.149		**100.5**
	A43	4096	154.703	153.699	154.786	156.937	159.747	160.880	160.047	160.776	160.659	157.825	159.222	160.752	161.744		**102.0**
	A44	4163	157.813	156.411	157.043	158.538	160.460	161.629	160.982	161.855	161.841	158.650	160.472	161.901	162.817		**100.5**
	A45	4217	146.171	145.564	146.318	148.167	150.346	150.811	149.879	150.609	150.232	147.456	148.855	150.029	150.777		**100.9**
	ave	**4124**															**101.4**

$T_S = T_{AIR} = 120°C, I_F = 0.5A$

$T_S \geq 118C, T_{AIR} \geq 115C$ in compliance with LM-80-08

Normalized flux

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 51: CCT = 4000K, T_J = 127C	A1	3986	1.0000	0.9985	1.0003	1.0207	1.0344	1.0515	1.0546	1.0624	1.0545	1.0377	1.0366	1.0393	1.0439	
	A2	4046	1.0000	0.9964	0.9973	1.0127	1.0244	1.0403	1.0417	1.0523	1.0481	1.0261	1.0272	1.0283	1.0351	
	A3	4068	1.0000	0.9947	0.9958	1.0152	1.0268	1.0410	1.0395	1.0505	1.0475	1.0278	1.0283	1.0329	1.0363	
	A4	4039	1.0000	0.9971	0.9979	1.0130	1.0254	1.0379	1.0370	1.0478	1.0470	1.0251	1.0293	1.0335	1.0369	
	A5	4050	1.0000	0.9987	1.0002	1.0105	1.0220	1.0348	1.0316	1.0397	1.0394	1.0227	1.0253	1.0260	1.0274	
	A6	4037	1.0000	0.9975	0.9995	1.0125	1.0249	1.0408	1.0421	1.0497	1.0393	1.0147	1.0183	1.0258	1.0307	
	A7	4055	1.0000	0.9964	0.9976	1.0111	1.0234	1.0347	1.0343	1.0451	1.0448	1.0227	1.0230	1.0272	1.0323	
	A8	4038	1.0000	0.9978	0.9986	1.0098	1.0225	1.0325	1.0312	1.0412	1.0420	1.0264	1.0268	1.0290	1.0307	
	A9	4056	1.0000	0.9969	0.9978	1.0076	1.0203	1.0320	1.0307	1.0417	1.0405	1.0194	1.0204	1.0244	1.0275	
	A10	4002	1.0000	0.9966	1.0008	1.0094	1.0173	1.0297	1.0301	1.0402	1.0402	1.0232	1.0222	1.0232	1.0263	
	A21	4210	1.0000	1.0158	1.0168	1.0331	1.0483	1.0699	1.0782	1.0691	1.0422	1.0233	1.0219	1.0273	1.0351	
	A22	4178	1.0000	0.9940	0.9927	1.0105	1.0241	1.0378	1.0401	1.0524	1.0448	1.0123	1.0004	1.0016	1.0063	
	A23	4081	1.0000	0.9922	0.9927	1.0114	1.0296	1.0539	1.0534	1.0236	1.0079	0.9901	0.9922	0.9990	1.0071	
	A24	4148	1.0000	0.9959	0.9954	1.0071	1.0243	1.0474	1.0526	1.0222	1.0023	0.9846	0.9869	0.9921	1.0001	
	A25	4224	1.0000	0.9972	0.9973	1.0056	1.0192	1.0328	1.0401	1.0547	1.0345	1.0093	1.0091	1.0136	1.0214	
	A26	4268	1.0000	0.9958	0.9966	1.0080	1.0212	1.0351	1.0413	1.0552	1.0383	1.0133	1.0133	1.0182	1.0259	
	A27	4164	1.0000	0.9948	0.9955	1.0030	1.0156	1.0240	1.0258	1.0309	1.0177	0.9920	0.9884	0.9945	1.0005	
	A28	4214	1.0000	0.9908	0.9919	1.0045	1.0195	1.0353	1.0484	1.0474	1.0234	1.0043	1.0054	1.0121	1.0198	
	A29	4172	1.0000	0.9963	0.9975	1.0075	1.0238	1.0434	1.0573	1.0399	1.0212	1.0024	1.0048	1.0138	1.0206	
	A30	4257	1.0000	0.9985	0.9995	1.0098	1.0233	1.0380	1.0495	1.0589	1.0334	1.0114	1.0131	1.0211	1.0270	
	A41	4146	1.0000	0.9939	1.0013	1.0175	1.0378	1.0540	1.0349	1.0370	1.0337	1.0153	1.0220	1.0324	1.0378	
	A42	4187	1.0000	0.9918	0.9952	1.0095	1.0227	1.0286	1.0211	1.0257	1.0230	1.0048	1.0135	1.0223	1.0284	
	A43	4096	1.0000	0.9935	1.0005	1.0144	1.0326	1.0399	1.0345	1.0393	1.0385	1.0202	1.0292	1.0391	1.0455	
	A44	4163	1.0000	0.9911	0.9951	1.0046	1.0168	1.0242	1.0201	1.0256	1.0255	1.0053	1.0168	1.0259	1.0317	
	A45	4217	1.0000	0.9958	1.0010	1.0137	1.0286	1.0317	1.0254	1.0304	1.0278	1.0088	1.0184	1.0264	1.0315	
	ave	**4124**	**1.0000**	**0.9963**	**0.9982**	**1.0113**	**1.0252**	**1.0389**	**1.0398**	**1.0433**	**1.0343**	**1.0137**	**1.0157**	**1.0212**	**1.0266**	

$T_S = T_{AIR} = 120°C$, $I_F = 0.5A$

$T_S \geq 118C$, $T_{AIR} \geq 115C$ in compliance with LM-80-08

TM-21 extrapolation

DATA SET 51: CCT = 4000K, T_J = 127C

	CCT (t=0)	alpha	B	r2	
A1	3986	3.7751E-06	1.0717	0.504	112,821
A2	4046	3.9553E-06	1.0631	0.457	105,648
A3	4068	3.1365E-06	1.0585	0.396	131,857
A4	4039	2.4822E-06	1.0534	0.271	164,653
A5	4050	2.7432E-06	1.0486	0.499	147,325
A6	4037	3.6183E-06	1.0542	0.283	113,157
A7	4055	3.1960E-06	1.0542	0.365	128,105
A8	4038	2.5046E-06	1.0496	0.470	161,750
A9	4056	3.2616E-06	1.0510	0.409	124,610
A10	4002	3.3617E-06	1.0519	0.566	121,157
A21	4210	5.8939E-06	1.0768	0.424	73,073
A22	4178	1.0359E-05	1.0904	0.750	42,788
A23	4081	3.0160E-06	1.0231	0.211	125,848
A24	4148	3.9358E-06	1.0238	0.289	96,597
A25	4224	6.3397E-06	1.0667	0.467	66,444
A26	4268	5.6985E-06	1.0660	0.440	73,811
A27	4164	6.3592E-06	1.0463	0.514	63,199
A28	4214	4.7460E-06	1.0505	0.325	85,542
A29	4172	3.2283E-06	1.0386	0.205	122,215
A30	4257	5.3480E-06	1.0637	0.350	78,243
A41	4146	-1.9506E-07	1.0284	0.002	-1,971,921
A42	4187	-5.6246E-07	1.0159	0.015	-662,123
A43	4096	-1.1592E-06	1.0275	0.061	-331,082
A44	4163	-1.2039E-06	1.0138	0.060	-307,664
A45	4217	-3.1350E-07	1.0218	0.005	-1,206,349
ave	**4124**	**3.3407E-06**	**1.0483**	**0.318**	**120,878**

$T_S = T_{AIR} = 120°C, I_F = 0.5A$

$T_S \geq 118C, T_{AIR} \geq 115C$ in compliance with LM-80-08

u'

DATA SET 51: CCT = 4000K, T_J = 127C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	3986	0.2231	0.2230	0.2231	0.2230	0.2229	0.2228	0.2231	0.2231	0.2231	0.2233	0.2236	0.2237	0.2236	
A2	4046	0.2235	0.2234	0.2235	0.2234	0.2233	0.2233	0.2236	0.2236	0.2236	0.2237	0.2240	0.2241	0.2241	
A3	4068	0.2237	0.2236	0.2237	0.2236	0.2235	0.2235	0.2238	0.2238	0.2238	0.2239	0.2242	0.2243	0.2242	
A4	4039	0.2234	0.2233	0.2234	0.2233	0.2232	0.2232	0.2235	0.2235	0.2236	0.2237	0.2239	0.2240	0.2240	
A5	4050	0.2238	0.2237	0.2238	0.2237	0.2236	0.2236	0.2239	0.2239	0.2239	0.2241	0.2244	0.2244	0.2244	
A6	4037	0.2235	0.2235	0.2235	0.2234	0.2234	0.2234	0.2236	0.2236	0.2236	0.2238	0.2240	0.2241	0.2240	
A7	4055	0.2235	0.2235	0.2235	0.2235	0.2234	0.2234	0.2236	0.2236	0.2237	0.2238	0.2240	0.2241	0.2241	
A8	4038	0.2235	0.2234	0.2234	0.2234	0.2233	0.2233	0.2236	0.2236	0.2237	0.2238	0.2240	0.2241	0.2240	
A9	4056	0.2234	0.2233	0.2234	0.2234	0.2233	0.2233	0.2236	0.2236	0.2236	0.2238	0.2240	0.2241	0.2240	
A10	4002	0.2230	0.2230	0.2230	0.2230	0.2230	0.2230	0.2233	0.2233	0.2233	0.2235	0.2237	0.2238	0.2237	
A21	4210	0.2232	0.2232	0.2232	0.2231	0.2231	0.2230	0.2231	0.2231	0.2231	0.2233	0.2235	0.2236	0.2236	
A22	4178	0.2233	0.2233	0.2233	0.2232	0.2231	0.2231	0.2233	0.2233	0.2232	0.2234	0.2236	0.2237	0.2237	
A23	4081	0.2226	0.2225	0.2226	0.2225	0.2224	0.2223	0.2225	0.2225	0.2225	0.2226	0.2229	0.2230	0.2229	
A24	4148	0.2229	0.2229	0.2229	0.2229	0.2228	0.2227	0.2229	0.2229	0.2229	0.2230	0.2232	0.2234	0.2233	
A25	4224	0.2233	0.2232	0.2232	0.2232	0.2231	0.2231	0.2233	0.2232	0.2232	0.2234	0.2235	0.2237	0.2236	
A26	4268	0.2235	0.2234	0.2235	0.2234	0.2234	0.2233	0.2235	0.2235	0.2234	0.2236	0.2238	0.2239	0.2238	
A27	4164	0.2229	0.2228	0.2229	0.2229	0.2228	0.2228	0.2230	0.2230	0.2229	0.2231	0.2233	0.2234	0.2233	
A28	4214	0.2232	0.2232	0.2233	0.2232	0.2232	0.2231	0.2233	0.2232	0.2232	0.2234	0.2235	0.2237	0.2236	
A29	4172	0.2230	0.2229	0.2230	0.2230	0.2229	0.2228	0.2230	0.2230	0.2229	0.2231	0.2233	0.2234	0.2233	
A30	4257	0.2234	0.2233	0.2234	0.2234	0.2233	0.2233	0.2234	0.2234	0.2233	0.2235	0.2237	0.2238	0.2237	
A41	4146	0.2234	0.2234	0.2235	0.2234	0.2233	0.2232	0.2234	0.2235	0.2234	0.2236	0.2238	0.2239	0.2239	
A42	4187	0.2237	0.2237	0.2238	0.2237	0.2236	0.2236	0.2238	0.2238	0.2238	0.2240	0.2242	0.2243	0.2242	
A43	4096	0.2230	0.2229	0.2230	0.2230	0.2229	0.2228	0.2230	0.2231	0.2230	0.2232	0.2234	0.2236	0.2235	
A44	4163	0.2232	0.2232	0.2232	0.2232	0.2231	0.2231	0.2233	0.2234	0.2233	0.2235	0.2237	0.2238	0.2237	
A45	4217	0.2238	0.2238	0.2238	0.2238	0.2237	0.2237	0.2239	0.2239	0.2239	0.2240	0.2242	0.2243	0.2243	
ave	**4124**														

$T_S = T_{AIR} = 120°C, I_F = 0.5A$

$T_S \geq 118C, T_{AIR} \geq 115C$ in compliance with LM-80-08

v'

DATA SET 51: CCT = 4000K, T_J = 127C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	3986	0.5069	0.5068	0.5068	0.5065	0.5066	0.5073	0.5075	0.5077	0.5078	0.5079	0.5102	0.5103	0.5103	
A2	4046	0.5024	0.5024	0.5024	0.5020	0.5022	0.5030	0.5031	0.5033	0.5036	0.5037	0.5062	0.5066	0.5065	
A3	4068	0.5008	0.5008	0.5008	0.5004	0.5006	0.5014	0.5015	0.5016	0.5019	0.5020	0.5047	0.5051	0.5050	
A4	4039	0.5030	0.5030	0.5030	0.5027	0.5028	0.5036	0.5037	0.5038	0.5040	0.5041	0.5066	0.5070	0.5070	
A5	4050	0.5015	0.5015	0.5015	0.5012	0.5014	0.5022	0.5023	0.5024	0.5025	0.5025	0.5051	0.5055	0.5055	
A6	4037	0.5029	0.5028	0.5028	0.5025	0.5027	0.5035	0.5036	0.5040	0.5043	0.5044	0.5068	0.5069	0.5069	
A7	4055	0.5019	0.5018	0.5019	0.5015	0.5016	0.5024	0.5025	0.5027	0.5029	0.5030	0.5056	0.5059	0.5058	
A8	4038	0.5030	0.5029	0.5030	0.5027	0.5027	0.5035	0.5036	0.5036	0.5038	0.5038	0.5064	0.5068	0.5067	
A9	4056	0.5021	0.5020	0.5021	0.5017	0.5018	0.5026	0.5027	0.5028	0.5030	0.5031	0.5057	0.5060	0.5059	
A10	4002	0.5059	0.5058	0.5058	0.5055	0.5056	0.5062	0.5065	0.5066	0.5066	0.5067	0.5091	0.5094	0.5093	
A21	4210	0.4945	0.4953	0.4956	0.4953	0.4954	0.4961	0.4965	0.4967	0.4966	0.4965	0.4987	0.4990	0.4988	
A22	4178	0.4958	0.4958	0.4960	0.4956	0.4958	0.4965	0.4967	0.4969	0.4970	0.4970	0.4994	0.4996	0.4994	
A23	4081	0.5024	0.5025	0.5027	0.5024	0.5026	0.5032	0.5036	0.5038	0.5036	0.5035	0.5057	0.5058	0.5056	
A24	4148	0.4981	0.4980	0.4982	0.4980	0.4983	0.4990	0.4993	0.4997	0.4997	0.4995	0.5019	0.5021	0.5019	
A25	4224	0.4937	0.4936	0.4939	0.4938	0.4940	0.4947	0.4949	0.4952	0.4955	0.4954	0.4977	0.4981	0.4978	
A26	4268	0.4912	0.4912	0.4915	0.4913	0.4917	0.4924	0.4925	0.4929	0.4930	0.4930	0.4954	0.4958	0.4955	
A27	4164	0.4974	0.4974	0.4979	0.4978	0.4981	0.4988	0.4989	0.4991	0.4992	0.4991	0.5016	0.5018	0.5016	
A28	4214	0.4942	0.4944	0.4951	0.4949	0.4952	0.4959	0.4962	0.4966	0.4967	0.4964	0.4990	0.4993	0.4991	
A29	4172	0.4968	0.4970	0.4977	0.4977	0.4980	0.4986	0.4990	0.4993	0.4992	0.4990	0.5014	0.5017	0.5014	
A30	4257	0.4919	0.4921	0.4929	0.4928	0.4932	0.4938	0.4940	0.4944	0.4945	0.4942	0.4967	0.4970	0.4968	
A41	4146	0.4973	0.4972	0.4978	0.4977	0.4980	0.4991	0.4997	0.4998	0.4996	0.4995	0.5018	0.5021	0.5020	
A42	4187	0.4945	0.4946	0.4955	0.4954	0.4959	0.4968	0.4972	0.4972	0.4970	0.4969	0.4995	0.4999	0.4998	
A43	4096	0.5008	0.5007	0.5011	0.5011	0.5014	0.5023	0.5027	0.5026	0.5025	0.5024	0.5049	0.5052	0.5051	
A44	4163	0.4968	0.4967	0.4973	0.4973	0.4976	0.4983	0.4986	0.4986	0.4985	0.4983	0.5009	0.5013	0.5012	
A45	4217	0.4929	0.4928	0.4934	0.4935	0.4941	0.4950	0.4952	0.4952	0.4951	0.4949	0.4976	0.4980	0.4979	
ave	**4124**														

$T_S = T_{AIR} = 120°C$, $I_F = 0.5A$

$T_S \geq 118C$, $T_{AIR} \geq 115C$ in compliance with LM-80-08

delta u' v'

DATA SET 51: CCT = 4000K, T_J = 127C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	3986	0.0000	0.0001	0.0001	0.0004	0.0004	0.0005	0.0006	0.0008	0.0009	0.0010	0.0033	0.0035	0.0034	
A2	4046	0.0000	0.0001	0.0000	0.0004	0.0003	0.0006	0.0007	0.0009	0.0012	0.0013	0.0038	0.0042	0.0041	
A3	4068	0.0000	0.0001	0.0000	0.0004	0.0003	0.0006	0.0007	0.0008	0.0011	0.0012	0.0039	0.0043	0.0042	
A4	4039	0.0000	0.0001	0.0000	0.0003	0.0003	0.0006	0.0007	0.0008	0.0010	0.0011	0.0036	0.0040	0.0040	
A5	4050	0.0000	0.0001	0.0000	0.0003	0.0002	0.0007	0.0008	0.0009	0.0010	0.0010	0.0036	0.0040	0.0040	
A6	4037	0.0000	0.0001	0.0001	0.0004	0.0002	0.0006	0.0007	0.0011	0.0014	0.0015	0.0039	0.0040	0.0040	
A7	4055	0.0000	0.0001	0.0000	0.0004	0.0003	0.0005	0.0006	0.0008	0.0010	0.0011	0.0037	0.0040	0.0039	
A8	4038	0.0000	0.0001	0.0001	0.0003	0.0004	0.0005	0.0006	0.0006	0.0008	0.0009	0.0034	0.0038	0.0037	
A9	4056	0.0000	0.0001	0.0000	0.0004	0.0003	0.0005	0.0006	0.0007	0.0009	0.0011	0.0036	0.0040	0.0038	
A10	4002	0.0000	0.0001	0.0001	0.0004	0.0003	0.0003	0.0007	0.0008	0.0008	0.0009	0.0033	0.0036	0.0035	
A21	4210	0.0000	0.0008	0.0011	0.0008	0.0009	0.0016	0.0020	0.0022	0.0021	0.0020	0.0042	0.0045	0.0043	
A22	4178	0.0000	0.0000	0.0002	0.0002	0.0002	0.0007	0.0009	0.0011	0.0012	0.0012	0.0036	0.0038	0.0036	
A23	4081	0.0000	0.0001	0.0003	0.0001	0.0003	0.0009	0.0012	0.0014	0.0012	0.0011	0.0033	0.0034	0.0032	
A24	4148	0.0000	0.0001	0.0001	0.0001	0.0002	0.0009	0.0012	0.0016	0.0016	0.0014	0.0038	0.0040	0.0038	
A25	4224	0.0000	0.0001	0.0002	0.0001	0.0004	0.0010	0.0012	0.0015	0.0018	0.0017	0.0040	0.0044	0.0041	
A26	4268	0.0000	0.0001	0.0003	0.0001	0.0005	0.0012	0.0013	0.0017	0.0018	0.0018	0.0042	0.0046	0.0043	
A27	4164	0.0000	0.0001	0.0005	0.0004	0.0007	0.0014	0.0015	0.0017	0.0018	0.0017	0.0042	0.0044	0.0042	
A28	4214	0.0000	0.0002	0.0009	0.0007	0.0010	0.0017	0.0020	0.0024	0.0025	0.0022	0.0048	0.0051	0.0049	
A29	4172	0.0000	0.0002	0.0009	0.0009	0.0012	0.0018	0.0022	0.0025	0.0024	0.0022	0.0046	0.0049	0.0046	
A30	4257	0.0000	0.0002	0.0010	0.0009	0.0013	0.0019	0.0021	0.0025	0.0026	0.0023	0.0048	0.0051	0.0049	
A41	4146	0.0000	0.0001	0.0005	0.0004	0.0007	0.0018	0.0024	0.0025	0.0023	0.0022	0.0045	0.0048	0.0047	
A42	4187	0.0000	0.0001	0.0010	0.0009	0.0014	0.0023	0.0027	0.0027	0.0025	0.0024	0.0050	0.0054	0.0053	
A43	4096	0.0000	0.0001	0.0003	0.0003	0.0006	0.0015	0.0019	0.0018	0.0017	0.0016	0.0041	0.0044	0.0043	
A44	4163	0.0000	0.0001	0.0005	0.0005	0.0008	0.0015	0.0018	0.0018	0.0017	0.0015	0.0041	0.0045	0.0044	
A45	4217	0.0000	0.0001	0.0005	0.0006	0.0012	0.0021	0.0023	0.0023	0.0022	0.0020	0.0047	0.0051	0.0050	
ave	**4124**	**0.0000**	**0.0001**	**0.0003**	**0.0004**	**0.0006**	**0.0011**	**0.0013**	**0.0015**	**0.0016**	**0.0015**	**0.0040**	**0.0043**	**0.0042**	

$T_S = T_{AIR} = 120°C$, $I_F = 0.5A$

$T_S \geq 118C$, $T_{AIR} \geq 115C$ in compliance with LM-80-08

Forward voltage

DATA SET 51: CCT = 4000K, T_J = 127C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	3986	2.899	2.899	2.899	2.900	2.900	2.915	2.946	2.978	3.009	3.030	3.048	3.060	3.055	
A2	4046	2.933	2.936	2.935	2.935	2.940	2.949	2.982	3.021	3.059	3.094	3.116	3.135	3.130	
A3	4068	2.938	2.937	2.937	2.941	2.940	2.951	2.979	3.005	3.036	3.071	3.091	3.118	3.111	
A4	4039	2.934	2.931	2.931	2.933	2.936	2.944	2.968	2.994	3.020	3.058	3.085	3.109	3.105	
A5	4050	2.897	2.894	2.896	2.895	2.893	2.900	2.913	2.930	2.947	2.967	2.991	3.014	3.013	
A6	4037	2.937	2.934	2.934	2.939	2.942	2.957	2.994	3.037	3.068	3.088	3.102	3.113	3.110	
A7	4055	2.925	2.922	2.921	2.922	2.923	2.933	2.954	2.981	3.010	3.045	3.067	3.084	3.080	
A8	4038	2.906	2.907	2.907	2.908	2.908	2.916	2.932	2.949	2.974	3.001	3.028	3.050	3.047	
A9	4056	2.922	2.918	2.916	2.922	2.920	2.931	2.948	2.972	3.002	3.030	3.053	3.071	3.066	
A10	4002	2.895	2.895	2.894	2.898	2.898	2.901	2.920	2.938	2.962	2.992	3.017	3.038	3.035	
A21	4210	2.900	2.900	2.897	2.898	2.903	2.932	3.005	3.089	3.109	3.124	3.135	3.151	3.134	
A22	4178	2.946	2.944	2.943	2.945	2.950	2.964	2.998	3.046	3.096	3.134	3.151	3.161	3.147	
A23	4081	2.937	2.933	2.930	2.938	2.950	2.997	3.113	3.180	3.188	3.203	3.217	3.233	3.217	
A24	4148	2.932	2.934	2.931	2.935	2.944	2.987	3.104	3.209	3.220	3.238	3.248	3.264	3.245	
A25	4224	2.963	2.960	2.962	2.968	2.970	2.988	3.044	3.145	3.217	3.238	3.252	3.264	3.244	
A26	4268	2.988	2.985	2.983	2.986	2.989	3.009	3.065	3.162	3.234	3.259	3.270	3.284	3.266	
A27	4164	2.987	2.984	2.981	2.988	2.987	3.003	3.039	3.083	3.119	3.140	3.151	3.158	3.147	
A28	4214	2.964	2.958	2.962	2.966	2.973	3.001	3.089	3.233	3.265	3.278	3.290	3.303	3.285	
A29	4172	2.946	2.941	2.943	2.946	2.957	2.994	3.104	3.238	3.256	3.269	3.281	3.296	3.277	
A30	4257	2.962	2.962	2.960	2.964	2.970	2.993	3.062	3.193	3.248	3.263	3.274	3.285	3.268	
A41	4146	3.008	3.005	3.004	3.012	3.026	3.085	3.137	3.147	3.151	3.162	3.176	3.186	3.173	
A42	4187	3.101	3.093	3.078	3.075	3.075	3.089	3.112	3.119	3.120	3.133	3.139	3.147	3.139	
A43	4096	3.108	3.104	3.100	3.106	3.117	3.156	3.182	3.195	3.202	3.212	3.225	3.233	3.221	
A44	4163	3.183	3.172	3.149	3.138	3.136	3.145	3.163	3.168	3.170	3.179	3.186	3.192	3.184	
A45	4217	3.124	3.116	3.104	3.106	3.122	3.156	3.178	3.189	3.196	3.207	3.219	3.227	3.214	
ave	**4124**	**2.969**													

$T_S = T_{AIR} = 55°C, I_F = 0.7A$

$T_S \geq 53C, T_{AIR} \geq 50C$ in compliance with LM-80-08

Lumen Data

DATA SET 58: CCT = 4000K, T_J = 66C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	Lumen Maintenance % at 6khours
B36	4232	202.872	200.319	200.036	201.756	202.521	203.190	203.409	204.015	202.942	202.506	202.691	203.381	204.678		**99.8**
B37	4158	214.820	212.395	213.039	214.162	215.736	216.650	217.379	218.215	217.441	216.578	217.190	218.237	219.472		**100.8**
B38	4111	201.904	200.218	200.921	202.107	203.945	204.929	204.996	205.628	205.168	203.887	204.444	205.317	206.477		**101.0**
B39	4202	194.232	192.158	192.707	194.450	195.705	196.546	196.743	197.395	197.013	195.418	196.323	197.016	198.141		**100.6**
B40	4108	210.667	208.311	209.095	211.028	212.449	213.517	213.971	214.784	214.397	212.806	214.055	214.737	216.210		**101.0**
B51	4378	195.213	194.029	194.278	196.820	198.285	198.170	199.356	199.719	199.631	198.019	198.735	199.932	201.044		**101.4**
B52	4274	202.349	201.002	201.097	201.714	203.369	203.426	204.312	204.627	204.584	203.281	203.609	204.918	206.022		**100.5**
B53	4212	198.889	197.412	197.700	200.117	201.771	202.310	202.779	202.929	203.204	201.625	202.354	203.539	204.927		**101.4**
B54	4210	203.247	202.056	202.403	204.985	206.309	206.947	207.542	207.296	207.721	205.894	206.921	208.082	209.235		**101.3**
B55	4165	201.138	200.103	200.412	203.055	204.440	205.083	205.497	205.638	205.897	204.057	205.098	206.244	207.405		**101.5**
B56	4262	201.938	200.448	199.320	202.695	204.019	204.266	205.031	205.695	205.660	204.709	204.925	205.989	207.308		**101.4**
B57	4259	202.779	201.346	201.523	203.331	204.519	205.854	206.282	206.487	206.611	205.625	205.801	206.844	208.223		**101.4**
B58	4192	200.451	199.322	199.537	201.380	203.014	204.105	204.389	204.807	205.101	204.320	204.451	205.438	206.776		**101.9**
B59	4253	206.850	205.539	205.687	207.959	209.497	210.488	210.903	211.438	211.233	210.441	210.691	211.613	212.842		**101.7**
B60	4168	204.697	203.357	203.518	205.304	206.768	207.695	208.085	208.765	208.782	207.923	208.262	209.008	210.466		**101.6**
B71	4101	196.991	196.657	197.204	199.231	200.871	201.001	201.191	201.899	201.934	200.260	200.988	202.607	203.664		**101.7**
B72	4221	203.994	203.193	203.669	205.284	206.986	207.322	207.338	208.048	208.198	206.356	207.159	208.618	209.631		**101.2**
B73	4222	202.048	200.938	201.556	203.341	204.859	204.696	203.868	205.385	205.770	204.241	205.010	205.896	207.397		**101.1**
B74	4197	203.618	202.257	202.686	205.220	206.791	207.262	207.092	208.032	208.002	206.269	207.124	208.647	209.760		**101.3**
B75	4127	200.718	200.164	201.012	203.182	204.523	204.915	205.075	205.600	205.843	204.231	204.893	206.329	207.511		**101.8**
B76	4167	199.810	199.119	199.587	201.931	203.272	203.318	203.702	204.387	204.459	202.586	203.619	205.128	206.361		**101.4**
B77	4059	195.845	194.979	195.529	196.443	197.878	198.428	198.651	199.150	199.526	197.222	198.601	199.972	201.163		**100.7**
B78	4207	192.685	191.962	192.707	195.786	197.300	197.768	197.899	198.834	198.801	196.963	197.749	198.913	200.110		**102.2**
B79	4132	203.908	202.524	203.146	206.921	208.459	209.227	209.349	210.322	210.449	208.869	209.601	211.018	212.297		**102.4**
B80	4152	202.508	201.593	202.255	205.429	206.821	207.667	207.961	208.874	209.127	207.144	208.141	209.355	210.688		**102.3**
ave	**4191**															**101.3**

$T_S = T_{AIR} = 55°C, I_F = 0.7A$

$T_S \geq 53C, T_{AIR} \geq 50C$ in compliance with LM-80-08

Normalized flux

DATA SET 58: CCT = 4000K, T_J = 66C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
B36	4232	1.0000	0.9874	0.9860	0.9945	0.9983	1.0016	1.0026	1.0056	1.0003	0.9982	0.9991	1.0025	1.0089	
B37	4158	1.0000	0.9887	0.9917	0.9969	1.0043	1.0085	1.0119	1.0158	1.0122	1.0082	1.0110	1.0159	1.0217	
B38	4111	1.0000	0.9916	0.9951	1.0010	1.0101	1.0150	1.0153	1.0184	1.0162	1.0098	1.0126	1.0169	1.0226	
B39	4202	1.0000	0.9893	0.9921	1.0011	1.0076	1.0119	1.0129	1.0163	1.0143	1.0061	1.0108	1.0143	1.0201	
B40	4108	1.0000	0.9888	0.9925	1.0017	1.0085	1.0135	1.0157	1.0195	1.0177	1.0102	1.0161	1.0193	1.0263	
B51	4378	1.0000	0.9939	0.9952	1.0082	1.0157	1.0151	1.0212	1.0231	1.0226	1.0144	1.0180	1.0242	1.0299	
B52	4274	1.0000	0.9933	0.9938	0.9969	1.0050	1.0053	1.0097	1.0113	1.0110	1.0046	1.0062	1.0127	1.0182	
B53	4212	1.0000	0.9926	0.9940	1.0062	1.0145	1.0172	1.0196	1.0203	1.0217	1.0138	1.0174	1.0234	1.0304	
B54	4210	1.0000	0.9941	0.9958	1.0086	1.0151	1.0182	1.0211	1.0199	1.0220	1.0130	1.0181	1.0238	1.0295	
B55	4165	1.0000	0.9949	0.9964	1.0095	1.0164	1.0196	1.0217	1.0224	1.0237	1.0145	1.0197	1.0254	1.0312	
B56	4262	1.0000	0.9926	0.9870	1.0037	1.0103	1.0115	1.0153	1.0186	1.0184	1.0137	1.0148	1.0201	1.0266	
B57	4259	1.0000	0.9929	0.9938	1.0027	1.0086	1.0152	1.0173	1.0183	1.0189	1.0140	1.0149	1.0200	1.0268	
B58	4192	1.0000	0.9944	0.9954	1.0046	1.0128	1.0182	1.0196	1.0217	1.0232	1.0193	1.0200	1.0249	1.0316	
B59	4253	1.0000	0.9937	0.9944	1.0054	1.0128	1.0176	1.0196	1.0222	1.0212	1.0174	1.0186	1.0230	1.0290	
B60	4168	1.0000	0.9935	0.9942	1.0030	1.0101	1.0146	1.0166	1.0199	1.0200	1.0158	1.0174	1.0211	1.0282	
B71	4101	1.0000	0.9983	1.0011	1.0114	1.0197	1.0204	1.0213	1.0249	1.0251	1.0166	1.0203	1.0285	1.0339	
B72	4221	1.0000	0.9961	0.9984	1.0063	1.0147	1.0163	1.0164	1.0199	1.0206	1.0116	1.0155	1.0227	1.0276	
B73	4222	1.0000	0.9945	0.9976	1.0064	1.0139	1.0131	1.0090	1.0165	1.0184	1.0109	1.0147	1.0190	1.0265	
B74	4197	1.0000	0.9933	0.9954	1.0079	1.0156	1.0179	1.0171	1.0217	1.0215	1.0130	1.0172	1.0247	1.0302	
B75	4127	1.0000	0.9972	1.0015	1.0123	1.0190	1.0209	1.0217	1.0243	1.0255	1.0175	1.0208	1.0280	1.0338	
B76	4167	1.0000	0.9965	0.9989	1.0106	1.0173	1.0176	1.0195	1.0229	1.0233	1.0139	1.0191	1.0266	1.0328	
B77	4059	1.0000	0.9956	0.9984	1.0031	1.0104	1.0132	1.0143	1.0169	1.0188	1.0070	1.0141	1.0211	1.0272	
B78	4207	1.0000	0.9962	1.0001	1.0161	1.0239	1.0264	1.0271	1.0319	1.0317	1.0222	1.0263	1.0323	1.0385	
B79	4132	1.0000	0.9932	0.9963	1.0148	1.0223	1.0261	1.0267	1.0315	1.0321	1.0243	1.0279	1.0349	1.0411	
B80	4152	1.0000	0.9955	0.9988	1.0144	1.0213	1.0255	1.0269	1.0314	1.0327	1.0229	1.0278	1.0338	1.0404	
ave	**4191**	**1.0000**	**0.9935**	**0.9954**	**1.0059**	**1.0131**	**1.0160**	**1.0176**	**1.0206**	**1.0205**	**1.0133**	**1.0167**	**1.0224**	**1.0285**	

$T_S = T_{AIR} = 55°C, I_F = 0.7A$

$T_S \geq 53C, T_{AIR} \geq 50C$ in compliance with LM-80-08

TM-21 extrapolation

		CCT (t=0)	alpha	B	r2	L70
DATA SET 58: CCT = 4000K, T_J = 66C	B36	4232	-6.7507E-07	0.9981	0.094	-525,465
	B37	4158	-1.2148E-06	1.0061	0.239	-298,639
	B38	4111	-7.2839E-07	1.0113	0.095	-505,084
	B39	4202	-6.7204E-07	1.0092	0.070	-544,402
	B40	4108	-1.2484E-06	1.0099	0.204	-293,634
	B51	4378	-1.1767E-06	1.0142	0.178	-315,113
	B52	4274	-1.1567E-06	1.0031	0.204	-311,023
	B53	4212	-1.6441E-06	1.0103	0.310	-223,160
	B54	4210	-1.6205E-06	1.0103	0.312	-226,446
	B55	4165	-1.5123E-06	1.0128	0.269	-244,239
	B56	4262	-1.2833E-06	1.0102	0.288	-285,864
	B57	4259	-1.3179E-06	1.0101	0.303	-278,284
	B58	4192	-1.5258E-06	1.0133	0.428	-242,446
	B59	4253	-1.1328E-06	1.0144	0.282	-327,469
	B60	4168	-1.2981E-06	1.0118	0.335	-283,800
	B71	4101	-1.6325E-06	1.0140	0.267	-227,022
	B72	4221	-1.3667E-06	1.0106	0.218	-268,706
	B73	4222	-1.5517E-06	1.0074	0.320	-234,632
	B74	4197	-1.5655E-06	1.0110	0.255	-234,839
	B75	4127	-1.6166E-06	1.0143	0.298	-229,399
	B76	4167	-1.7992E-06	1.0112	0.286	-204,424
	B77	4059	-1.8271E-06	1.0055	0.263	-198,199
	B78	4207	-1.0754E-06	1.0233	0.136	-353,074
	B79	4132	-1.6669E-06	1.0208	0.309	-226,347
	B80	4152	-1.4654E-06	1.0217	0.231	-258,063
	ave	**4191**	**-1.3520E-06**	**1.0114**	**0.250**	**-272,209**

$T_S = T_{AIR} = 55°C, I_F = 0.7A$

$T_S \geq 53C, T_{AIR} \geq 50C$ in compliance with LM-80-08

u'

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 58: CCT = 4000K, T_J = 66C	B36	4232	0.2233	0.2232	0.2232	0.2230	0.2230	0.2230	0.2232	0.2233	0.2233	0.2234	0.2237	0.2239	0.2239	
	B37	4158	0.2227	0.2226	0.2225	0.2225	0.2225	0.2224	0.2226	0.2227	0.2227	0.2227	0.2231	0.2233	0.2232	
	B38	4111	0.2225	0.2223	0.2224	0.2224	0.2223	0.2222	0.2224	0.2224	0.2225	0.2225	0.2229	0.2231	0.2231	
	B39	4202	0.2233	0.2232	0.2232	0.2232	0.2231	0.2231	0.2232	0.2233	0.2233	0.2233	0.2237	0.2239	0.2238	
	B40	4108	0.2223	0.2222	0.2221	0.2221	0.2220	0.2220	0.2222	0.2222	0.2222	0.2223	0.2226	0.2228	0.2228	
	B51	4378	0.2228	0.2227	0.2227	0.2226	0.2225	0.2225	0.2226	0.2228	0.2228	0.2230	0.2233	0.2234	0.2234	
	B52	4274	0.2219	0.2218	0.2218	0.2219	0.2218	0.2217	0.2219	0.2220	0.2222	0.2223	0.2225	0.2227	0.2227	
	B53	4212	0.2223	0.2222	0.2221	0.2221	0.2221	0.2220	0.2222	0.2223	0.2224	0.2225	0.2228	0.2230	0.2229	
	B54	4210	0.2224	0.2224	0.2223	0.2223	0.2222	0.2222	0.2223	0.2225	0.2225	0.2226	0.2229	0.2230	0.2230	
	B55	4165	0.2222	0.2221	0.2221	0.2219	0.2218	0.2218	0.2220	0.2222	0.2222	0.2223	0.2226	0.2228	0.2228	
	B56	4262	0.2228	0.2227	0.2227	0.2226	0.2226	0.2225	0.2227	0.2227	0.2228	0.2229	0.2232	0.2233	0.2233	
	B57	4259	0.2227	0.2227	0.2226	0.2225	0.2225	0.2224	0.2226	0.2227	0.2227	0.2227	0.2231	0.2233	0.2233	
	B58	4192	0.2224	0.2223	0.2222	0.2222	0.2222	0.2221	0.2223	0.2223	0.2223	0.2223	0.2228	0.2229	0.2230	
	B59	4253	0.2231	0.2230	0.2229	0.2229	0.2228	0.2228	0.2230	0.2231	0.2230	0.2231	0.2234	0.2235	0.2236	
	B60	4168	0.2223	0.2222	0.2222	0.2221	0.2221	0.2220	0.2222	0.2223	0.2222	0.2223	0.2226	0.2227	0.2228	
	B71	4101	0.2223	0.2223	0.2222	0.2221	0.2221	0.2220	0.2222	0.2222	0.2223	0.2225	0.2227	0.2229	0.2229	
	B72	4221	0.2228	0.2227	0.2227	0.2227	0.2226	0.2226	0.2227	0.2228	0.2228	0.2228	0.2233	0.2234	0.2234	
	B73	4222	0.2229	0.2228	0.2228	0.2227	0.2227	0.2226	0.2228	0.2228	0.2229	0.2230	0.2233	0.2235	0.2235	
	B74	4197	0.2228	0.2227	0.2228	0.2226	0.2226	0.2226	0.2227	0.2227	0.2228	0.2228	0.2232	0.2234	0.2234	
	B75	4127	0.2227	0.2227	0.2226	0.2225	0.2225	0.2224	0.2225	0.2227	0.2226	0.2227	0.2230	0.2232	0.2232	
	B76	4167	0.2231	0.2230	0.2229	0.2228	0.2228	0.2228	0.2229	0.2229	0.2230	0.2231	0.2233	0.2235	0.2235	
	B77	4059	0.2229	0.2228	0.2227	0.2227	0.2226	0.2226	0.2227	0.2227	0.2228	0.2229	0.2232	0.2233	0.2233	
	B78	4207	0.2236	0.2235	0.2235	0.2234	0.2233	0.2233	0.2234	0.2235	0.2235	0.2236	0.2240	0.2241	0.2240	
	B79	4132	0.2230	0.2229	0.2229	0.2228	0.2227	0.2227	0.2228	0.2229	0.2229	0.2229	0.2233	0.2235	0.2234	
	B80	4152	0.2232	0.2231	0.2231	0.2229	0.2229	0.2228	0.2230	0.2230	0.2231	0.2231	0.2235	0.2236	0.2236	
	ave	**4191**														

$T_S = T_{AIR} = 55°C, I_F = 0.7A$

$T_S \geq 53C, T_{AIR} \geq 50C$ in compliance with LM-80-08

v'

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 58: CCT = 4000K, T_J = 66C	B36	4232	0.4933	0.4930	0.4932	0.4926	0.4927	0.4930	0.4934	0.4936	0.4937	0.4933	0.4942	0.4956	0.4956	
	B37	4158	0.4982	0.4978	0.4980	0.4976	0.4977	0.4978	0.4983	0.4984	0.4985	0.4980	0.4991	0.5003	0.5004	
	B38	4111	0.5009	0.5007	0.5007	0.5004	0.5001	0.5004	0.5008	0.5010	0.5008	0.5007	0.5015	0.5027	0.5028	
	B39	4202	0.4946	0.4943	0.4943	0.4938	0.4938	0.4941	0.4945	0.4947	0.4947	0.4945	0.4953	0.4967	0.4967	
	B40	4108	0.5016	0.5014	0.5015	0.5011	0.5010	0.5012	0.5016	0.5018	0.5017	0.5015	0.5023	0.5035	0.5035	
	B51	4378	0.4878	0.4875	0.4876	0.4868	0.4869	0.4873	0.4876	0.4879	0.4879	0.4876	0.4887	0.4902	0.4902	
	B52	4274	0.4940	0.4937	0.4938	0.4935	0.4935	0.4939	0.4945	0.4947	0.4948	0.4945	0.4955	0.4967	0.4968	
	B53	4212	0.4962	0.4958	0.4959	0.4954	0.4953	0.4957	0.4961	0.4965	0.4966	0.4964	0.4973	0.4985	0.4986	
	B54	4210	0.4960	0.4957	0.4958	0.4952	0.4951	0.4953	0.4958	0.4961	0.4961	0.4958	0.4967	0.4980	0.4980	
	B55	4165	0.4988	0.4985	0.4985	0.4979	0.4979	0.4980	0.4984	0.4986	0.4986	0.4984	0.4993	0.5005	0.5006	
	B56	4262	0.4928	0.4925	0.4926	0.4918	0.4918	0.4920	0.4924	0.4926	0.4925	0.4923	0.4932	0.4945	0.4946	
	B57	4259	0.4930	0.4927	0.4927	0.4922	0.4922	0.4923	0.4926	0.4928	0.4928	0.4926	0.4935	0.4949	0.4949	
	B58	4192	0.4970	0.4968	0.4967	0.4962	0.4962	0.4962	0.4966	0.4968	0.4966	0.4965	0.4973	0.4986	0.4987	
	B59	4253	0.4927	0.4923	0.4924	0.4918	0.4918	0.4919	0.4924	0.4924	0.4924	0.4922	0.4931	0.4945	0.4946	
	B60	4168	0.4984	0.4982	0.4982	0.4978	0.4977	0.4978	0.4981	0.4982	0.4982	0.4980	0.4988	0.5001	0.5001	
	B71	4101	0.5019	0.5017	0.5017	0.5012	0.5010	0.5011	0.5014	0.5015	0.5015	0.5012	0.5019	0.5032	0.5033	
	B72	4221	0.4947	0.4946	0.4945	0.4940	0.4939	0.4940	0.4943	0.4945	0.4944	0.4941	0.4950	0.4964	0.4964	
	B73	4222	0.4945	0.4944	0.4943	0.4938	0.4937	0.4940	0.4943	0.4944	0.4944	0.4941	0.4949	0.4962	0.4965	
	B74	4197	0.4959	0.4958	0.4957	0.4951	0.4951	0.4952	0.4956	0.4957	0.4956	0.4954	0.4962	0.4975	0.4976	
	B75	4127	0.4996	0.4993	0.4994	0.4988	0.4988	0.4990	0.4993	0.4994	0.4994	0.4992	0.4999	0.5012	0.5013	
	B76	4167	0.4969	0.4966	0.4967	0.4961	0.4960	0.4961	0.4965	0.4967	0.4966	0.4965	0.4972	0.4986	0.4988	
	B77	4059	0.5030	0.5028	0.5029	0.5026	0.5025	0.5027	0.5030	0.5032	0.5032	0.5031	0.5038	0.5051	0.5052	
	B78	4207	0.4938	0.4936	0.4936	0.4930	0.4929	0.4934	0.4941	0.4944	0.4946	0.4947	0.4956	0.4970	0.4972	
	B79	4132	0.4988	0.4985	0.4986	0.4979	0.4978	0.4981	0.4986	0.4988	0.4989	0.4989	0.4998	0.5013	0.5014	
	B80	4152	0.4974	0.4971	0.4971	0.4967	0.4965	0.4967	0.4972	0.4975	0.4976	0.4975	0.4985	0.4999	0.5001	
	ave	**4191**														

$T_S = T_{AIR} = 55°C, I_F = 0.7A$

$T_S \geq 53C, T_{AIR} \geq 50C$ in compliance with LM-80-08

delta u' v'

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 58: CCT = 4000K, T_J = 66C	B36	4232	0.0000	0.0003	0.0001	0.0008	0.0007	0.0004	0.0001	0.0003	0.0004	0.0001	0.0010	0.0024	0.0024	
	B37	4158	0.0000	0.0004	0.0003	0.0006	0.0005	0.0005	0.0001	0.0002	0.0003	0.0002	0.0010	0.0022	0.0023	
	B38	4111	0.0000	0.0003	0.0002	0.0005	0.0008	0.0006	0.0001	0.0001	0.0001	0.0002	0.0007	0.0019	0.0020	
	B39	4202	0.0000	0.0003	0.0003	0.0008	0.0008	0.0005	0.0001	0.0001	0.0001	0.0001	0.0008	0.0022	0.0022	
	B40	4108	0.0000	0.0002	0.0002	0.0005	0.0007	0.0005	0.0001	0.0002	0.0001	0.0001	0.0008	0.0020	0.0020	
	B51	4378	0.0000	0.0003	0.0002	0.0010	0.0009	0.0006	0.0003	0.0001	0.0001	0.0003	0.0010	0.0025	0.0025	
	B52	4274	0.0000	0.0003	0.0002	0.0005	0.0005	0.0002	0.0005	0.0007	0.0009	0.0006	0.0016	0.0028	0.0029	
	B53	4212	0.0000	0.0004	0.0004	0.0008	0.0009	0.0006	0.0001	0.0003	0.0004	0.0003	0.0012	0.0024	0.0025	
	B54	4210	0.0000	0.0003	0.0002	0.0008	0.0009	0.0007	0.0002	0.0001	0.0001	0.0003	0.0009	0.0021	0.0021	
	B55	4165	0.0000	0.0003	0.0003	0.0009	0.0010	0.0009	0.0004	0.0002	0.0002	0.0004	0.0006	0.0018	0.0019	
	B56	4262	0.0000	0.0003	0.0002	0.0010	0.0010	0.0009	0.0004	0.0002	0.0003	0.0005	0.0006	0.0018	0.0019	
	B57	4259	0.0000	0.0003	0.0003	0.0008	0.0008	0.0008	0.0004	0.0002	0.0002	0.0004	0.0006	0.0020	0.0020	
	B58	4192	0.0000	0.0002	0.0004	0.0008	0.0008	0.0009	0.0004	0.0002	0.0004	0.0005	0.0005	0.0017	0.0018	
	B59	4253	0.0000	0.0004	0.0004	0.0009	0.0009	0.0009	0.0003	0.0003	0.0003	0.0005	0.0005	0.0018	0.0020	
	B60	4168	0.0000	0.0002	0.0002	0.0006	0.0007	0.0007	0.0003	0.0002	0.0002	0.0004	0.0005	0.0017	0.0018	
	B71	4101	0.0000	0.0002	0.0002	0.0007	0.0009	0.0009	0.0005	0.0004	0.0004	0.0007	0.0004	0.0014	0.0015	
	B72	4221	0.0000	0.0001	0.0002	0.0007	0.0008	0.0007	0.0004	0.0002	0.0003	0.0006	0.0006	0.0018	0.0018	
	B73	4222	0.0000	0.0001	0.0002	0.0007	0.0008	0.0006	0.0002	0.0001	0.0001	0.0004	0.0006	0.0018	0.0021	
	B74	4197	0.0000	0.0001	0.0002	0.0008	0.0008	0.0007	0.0003	0.0002	0.0003	0.0005	0.0005	0.0017	0.0018	
	B75	4127	0.0000	0.0003	0.0002	0.0008	0.0008	0.0007	0.0004	0.0002	0.0002	0.0004	0.0004	0.0017	0.0018	
	B76	4167	0.0000	0.0003	0.0003	0.0009	0.0009	0.0009	0.0004	0.0003	0.0003	0.0004	0.0004	0.0017	0.0019	
	B77	4059	0.0000	0.0002	0.0002	0.0004	0.0006	0.0004	0.0002	0.0003	0.0002	0.0001	0.0009	0.0021	0.0022	
	B78	4207	0.0000	0.0002	0.0002	0.0008	0.0009	0.0005	0.0004	0.0006	0.0008	0.0009	0.0018	0.0032	0.0034	
	B79	4132	0.0000	0.0003	0.0002	0.0009	0.0010	0.0008	0.0003	0.0001	0.0001	0.0001	0.0010	0.0025	0.0026	
	B80	4152	0.0000	0.0003	0.0003	0.0008	0.0009	0.0008	0.0003	0.0002	0.0002	0.0001	0.0011	0.0025	0.0027	
	ave	**4191**	**0.0000**	**0.0003**	**0.0003**	**0.0008**	**0.0008**	**0.0007**	**0.0003**	**0.0002**	**0.0003**	**0.0004**	**0.0008**	**0.0021**	**0.0022**	

$T_S = T_{AIR} = 55°C, I_F = 0.7A$

$T_S \geq 53C, T_{AIR} \geq 50C$ in compliance with LM-80-08

Forward voltage

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 58: CCT = 4000K, T_J = 66C	B36	4232	3.177	3.167	3.150	3.144	3.127	3.121	3.113	3.108	3.105	3.100	3.100	3.099	3.098	
	B37	4158	3.249	3.238	3.229	3.223	3.211	3.198	3.198	3.192	3.189	3.182	3.186	3.185	3.182	
	B38	4111	3.121	3.114	3.112	3.113	3.104	3.104	3.101	3.098	3.097	3.094	3.096	3.097	3.095	
	B39	4202	3.112	3.107	3.099	3.098	3.094	3.092	3.089	3.085	3.085	3.081	3.082	3.080	3.078	
	B40	4108	3.206	3.198	3.186	3.183	3.168	3.162	3.158	3.153	3.150	3.144	3.147	3.148	3.145	
	B51	4378	3.021	3.016	3.013	3.012	3.010	3.007	3.007	3.006	3.005	3.005	3.007	3.009	3.006	
	B52	4274	3.013	3.010	3.005	3.004	3.002	3.001	2.998	3.000	2.997	2.999	2.998	3.003	3.000	
	B53	4212	3.012	3.009	3.004	3.004	3.001	2.999	3.000	2.998	2.997	2.995	2.998	3.000	2.998	
	B54	4210	3.031	3.026	3.020	3.023	3.018	3.013	3.014	3.015	3.012	3.010	3.017	3.012	3.013	
	B55	4165	2.993	2.990	2.987	2.988	2.986	2.980	2.981	2.981	2.979	2.979	2.982	2.980	2.981	
	B56	4262	3.030	3.025	3.023	3.020	3.017	3.017	3.018	3.015	3.015	3.012	3.017	3.017	3.016	
	B57	4259	3.032	3.027	3.023	3.024	3.021	3.017	3.018	3.016	3.015	3.015	3.017	3.018	3.016	
	B58	4192	2.975	2.973	2.971	2.970	2.968	2.964	2.965	2.964	2.964	2.962	2.965	2.965	2.962	
	B59	4253	3.062	3.062	3.057	3.056	3.055	3.055	3.054	3.052	3.052	3.050	3.054	3.054	3.051	
	B60	4168	3.007	3.008	3.005	3.000	2.999	2.996	2.998	2.995	2.996	2.993	2.999	2.997	2.994	
	B71	4101	2.942	2.939	2.937	2.939	2.937	2.936	2.934	2.937	2.934	2.935	2.937	2.938	2.937	
	B72	4221	3.002	3.004	3.002	3.005	3.002	3.002	3.003	3.000	3.001	3.002	3.005	3.003	3.004	
	B73	4222	2.984	2.985	2.981	2.985	2.983	2.984	2.985	2.982	2.981	2.983	2.983	2.984	2.983	
	B74	4197	2.997	2.995	2.998	2.998	2.994	2.993	2.995	2.994	2.996	2.991	2.998	2.999	2.997	
	B75	4127	2.984	2.983	2.982	2.987	2.982	2.983	2.986	2.983	2.983	2.981	2.984	2.987	2.987	
	B76	4167	3.002	3.004	3.001	3.005	3.001	3.003	3.001	3.002	3.002	2.999	3.004	3.004	3.003	
	B77	4059	2.966	2.963	2.964	2.966	2.962	2.963	2.965	2.962	2.962	2.961	2.964	2.965	2.963	
	B78	4207	2.964	2.962	2.960	2.963	2.961	2.958	2.960	2.959	2.957	2.956	2.957	2.958	2.959	
	B79	4132	2.996	2.995	2.992	2.997	2.994	2.991	2.993	2.994	2.994	2.992	2.993	2.996	2.994	
	B80	4152	2.976	2.975	2.974	2.978	2.977	2.974	2.975	2.976	2.974	2.971	2.975	2.972	2.975	
	ave	**4191**	**3.034**													

$T_S = T_{AIR} = 85°C, I_F = 0.7A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

Lumen Data

DATA SET 57: CCT = 4000K, T_J = 96C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	Lumen Maintenance % at 6khours
A1	4145	179.329	178.938	179.208	181.091	181.673	182.161	182.192	183.171	183.422	181.654	181.136	181.582	181.753		**101.3**
A2	4196	195.910	194.838	195.019	199.237	200.027	200.567	200.351	201.777	201.820	200.115	199.555	199.791	200.266		**102.1**
A3	4206	192.916	191.595	192.199	196.697	197.086	197.772	197.564	198.750	198.874	196.937	196.094	196.948	197.245		**102.1**
A4	4196	192.757	191.985	192.419	197.329	197.713	198.255	198.024	199.265	199.536	197.588	196.701	197.386	197.608		**102.5**
A5	4190	197.218	196.118	196.974	200.825	201.262	201.466	201.910	203.338	203.371	201.473	200.801	201.360	201.630		**102.2**
A6	4288	191.339	191.083	191.696	195.553	196.017	196.670	196.596	197.948	198.105	195.982	195.268	195.766	196.142		**102.4**
A7	4135	199.011	198.071	198.583	202.151	202.643	203.197	203.239	204.788	205.042	203.543	202.712	202.960	203.486		**102.3**
A8	4223	196.842	196.168	196.861	200.802	200.715	201.678	201.650	203.162	203.458	201.874	200.761	201.381	201.806		**102.6**
A9	4166	193.961	193.077	193.807	197.176	197.308	197.938	198.161	199.688	200.080	198.556	197.536	197.893	198.723		**102.4**
A10	4123	195.692	195.433	196.257	199.052	199.078	199.823	200.293	201.807	202.468	200.129	199.501	200.055	200.378		**102.3**
A21	4362	190.450	189.109	189.521	192.708	193.206	193.903	193.664	195.018	195.396	194.276	194.703	193.721	194.052		**102.0**
A22	4249	189.902	188.761	189.074	192.469	192.944	193.104	193.439	194.790	195.303	194.232	194.753	193.817	194.073		**102.3**
A23	4287	193.297	191.642	191.186	195.684	196.036	196.498	195.902	197.612	197.662	196.759	197.123	196.173	196.183		**101.8**
A24	4209	187.242	186.083	186.319	189.784	190.044	190.681	190.981	192.452	193.082	192.544	192.967	192.649	192.985		**102.8**
A25	4362	191.410	190.269	190.680	193.182	193.579	194.056	193.913	195.571	195.944	195.225	195.431	194.663	194.845		**102.0**
A26	4264	189.853	188.878	189.396	192.619	192.878	193.593	193.492	195.001	195.597	194.108	195.047	194.135	194.391		**102.2**
A27	4291	188.792	187.897	188.436	191.985	192.258	192.885	192.858	194.309	194.919	194.252	194.206	193.397	193.416		**102.9**
A28	4329	186.951	188.240	188.879	192.590	192.648	193.395	193.300	194.917	195.392	194.895	194.729	193.879	193.987		**104.2**
A29	4371	186.162	186.099	186.651	190.539	190.743	190.965	191.093	192.736	193.239	192.709	192.713	191.830	191.996		**103.5**
A30	4335	190.312	189.565	190.146	193.814	193.915	194.150	194.374	195.639	196.081	195.378	195.002	193.978	194.189		**102.7**
A41	4232	192.929	191.283	192.148	194.895	195.391	195.804	195.509	196.722	197.694	196.533	197.139	196.075	196.119		**101.9**
A42	4318	176.684	175.638	176.456	178.933	179.270	179.676	178.626	180.526	181.328	180.279	180.672	179.649	179.500		**102.0**
A43	4404	181.101	179.630	180.199	182.191	182.595	182.805	182.037	183.452	183.923	182.973	183.196	181.988	181.997		**101.0**
A44	4299	193.290	191.165	192.110	195.392	196.127	196.268	196.038	197.259	198.024	197.124	197.493	196.271	196.306		**102.0**
A45	4275	187.206	185.693	186.482	189.470	189.684	189.502	189.346	190.364	191.045	189.936	190.051	188.498	188.859		**101.5**
ave	**4258**															**102.3**

$T_S = T_{AIR} = 85°C, I_F = 0.7A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

Normalized flux

DATA SET 57: CCT = 4000K, T_J = 96C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4145	1.0000	0.9978	0.9993	1.0098	1.0131	1.0158	1.0160	1.0214	1.0228	1.0130	1.0101	1.0126	1.0135	
A2	4196	1.0000	0.9945	0.9954	1.0170	1.0210	1.0238	1.0227	1.0299	1.0302	1.0215	1.0186	1.0198	1.0222	
A3	4206	1.0000	0.9932	0.9963	1.0196	1.0216	1.0252	1.0241	1.0302	1.0309	1.0208	1.0165	1.0209	1.0224	
A4	4196	1.0000	0.9960	0.9982	1.0237	1.0257	1.0285	1.0273	1.0338	1.0352	1.0251	1.0205	1.0240	1.0252	
A5	4190	1.0000	0.9944	0.9988	1.0183	1.0205	1.0215	1.0238	1.0310	1.0312	1.0216	1.0182	1.0210	1.0224	
A6	4288	1.0000	0.9987	1.0019	1.0220	1.0244	1.0279	1.0275	1.0345	1.0354	1.0243	1.0205	1.0231	1.0251	
A7	4135	1.0000	0.9953	0.9978	1.0158	1.0182	1.0210	1.0212	1.0290	1.0303	1.0228	1.0186	1.0198	1.0225	
A8	4223	1.0000	0.9966	1.0001	1.0201	1.0197	1.0246	1.0244	1.0321	1.0336	1.0256	1.0199	1.0231	1.0252	
A9	4166	1.0000	0.9954	0.9992	1.0166	1.0173	1.0205	1.0217	1.0295	1.0315	1.0237	1.0184	1.0203	1.0246	
A10	4123	1.0000	0.9987	1.0029	1.0172	1.0173	1.0211	1.0235	1.0312	1.0346	1.0227	1.0195	1.0223	1.0239	
A21	4362	1.0000	0.9930	0.9951	1.0119	1.0145	1.0181	1.0169	1.0240	1.0260	1.0201	1.0223	1.0172	1.0189	
A22	4249	1.0000	0.9940	0.9956	1.0135	1.0160	1.0169	1.0186	1.0257	1.0284	1.0228	1.0255	1.0206	1.0220	
A23	4287	1.0000	0.9914	0.9891	1.0123	1.0142	1.0166	1.0135	1.0223	1.0226	1.0179	1.0198	1.0149	1.0149	
A24	4209	1.0000	0.9938	0.9951	1.0136	1.0150	1.0184	1.0200	1.0278	1.0312	1.0283	1.0306	1.0289	1.0307	
A25	4362	1.0000	0.9940	0.9962	1.0093	1.0113	1.0138	1.0131	1.0217	1.0237	1.0199	1.0210	1.0170	1.0179	
A26	4264	1.0000	0.9949	0.9976	1.0146	1.0159	1.0197	1.0192	1.0271	1.0303	1.0224	1.0274	1.0226	1.0239	
A27	4291	1.0000	0.9953	0.9981	1.0169	1.0184	1.0217	1.0215	1.0292	1.0325	1.0289	1.0287	1.0244	1.0245	
A28	4329	1.0000	1.0069	1.0103	1.0302	1.0305	1.0345	1.0340	1.0426	1.0451	1.0425	1.0416	1.0371	1.0376	
A29	4371	1.0000	0.9997	1.0026	1.0235	1.0246	1.0258	1.0265	1.0353	1.0380	1.0352	1.0352	1.0304	1.0313	
A30	4335	1.0000	0.9961	0.9991	1.0184	1.0189	1.0202	1.0213	1.0280	1.0303	1.0266	1.0246	1.0193	1.0204	
A41	4232	1.0000	0.9915	0.9960	1.0102	1.0128	1.0149	1.0134	1.0197	1.0247	1.0187	1.0218	1.0163	1.0165	
A42	4318	1.0000	0.9941	0.9987	1.0127	1.0146	1.0169	1.0110	1.0217	1.0263	1.0203	1.0226	1.0168	1.0159	
A43	4404	1.0000	0.9919	0.9950	1.0060	1.0083	1.0094	1.0052	1.0130	1.0156	1.0103	1.0116	1.0049	1.0050	
A44	4299	1.0000	0.9890	0.9939	1.0109	1.0147	1.0154	1.0142	1.0205	1.0245	1.0198	1.0217	1.0154	1.0156	
A45	4275	1.0000	0.9919	0.9961	1.0121	1.0132	1.0123	1.0114	1.0169	1.0205	1.0146	1.0152	1.0069	1.0088	
ave	**4258**	**1.0000**	**0.9951**	**0.9979**	**1.0158**	**1.0177**	**1.0202**	**1.0197**	**1.0271**	**1.0294**	**1.0228**	**1.0220**	**1.0200**	**1.0212**	

$T_S = T_{AIR} = 85°C$, $I_F = 0.7A$

$T_S \geq 83C$, $T_{AIR} \geq 80C$ in compliance with LM-80-08

TM-21 extrapolation

		CCT (t=0)	alpha	B	r2	L70
DATA SET 57: CCT = 4000K, TJ = 96C	A1	4145	2.0565E-06	1.0292	0.558	187,442
	A2	4196	2.0200E-06	1.0372	0.581	194,663
	A3	4206	2.0425E-06	1.0373	0.467	192,556
	A4	4196	2.2494E-06	1.0424	0.548	177,021
	A5	4190	2.1529E-06	1.0386	0.559	183,288
	A6	4288	2.4311E-06	1.0435	0.563	164,231
	A7	4135	1.9032E-06	1.0366	0.578	206,283
	A8	4223	1.9943E-06	1.0400	0.525	198,496
	A9	4166	1.7809E-06	1.0366	0.448	220,460
	A10	4123	2.1325E-06	1.0400	0.485	185,650
	A21	4362	1.3841E-06	1.0306	0.646	279,496
	A22	4249	1.1053E-06	1.0316	0.534	350,823
	A23	4287	1.6323E-06	1.0296	0.822	236,374
	A24	4209	-2.6556E-07	1.0278	0.132	-1,446,389
	A25	4362	1.0638E-06	1.0273	0.673	360,607
	A26	4264	9.5304E-07	1.0320	0.339	407,271
	A27	4291	1.3367E-06	1.0370	0.689	293,998
	A28	4329	1.3740E-06	1.0504	0.727	295,386
	A29	4371	1.1760E-06	1.0422	0.647	338,426
	A30	4335	2.0417E-06	1.0386	0.813	193,226
	A41	4232	1.0552E-06	1.0266	0.390	362,930
	A42	4318	1.5500E-06	1.0309	0.593	249,778
	A43	4404	2.0088E-06	1.0233	0.765	189,029
	A44	4299	1.4009E-06	1.0289	0.567	274,961
	A45	4275	2.2666E-06	1.0288	0.714	169,911
	ave	**4258**	**1.6331E-06**	**1.0347**	**0.720**	**239,284**

$T_S = T_{AIR} = 85°C$, $I_F = 0.7A$

$T_S \geq 83C$, $T_{AIR} \geq 80C$ in compliance with LM-80-08

u'

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 57: CCT = 4000K, T_J = 96C	A1	4145	0.2221	0.2220	0.2221	0.2221	0.2220	0.2220	0.2221	0.2221	0.2221	0.2221	0.2222	0.2221	0.2221	
	A2	4196	0.2220	0.2219	0.2220	0.2218	0.2218	0.2218	0.2219	0.2219	0.2219	0.2219	0.2220	0.2219	0.2219	
	A3	4206	0.2222	0.2221	0.2222	0.2221	0.2221	0.2220	0.2221	0.2222	0.2222	0.2222	0.2223	0.2222	0.2222	
	A4	4196	0.2222	0.2220	0.2221	0.2220	0.2220	0.2219	0.2220	0.2221	0.2221	0.2221	0.2222	0.2221	0.2221	
	A5	4190	0.2221	0.2220	0.2220	0.2219	0.2219	0.2218	0.2219	0.2219	0.2220	0.2220	0.2221	0.2220	0.2220	
	A6	4288	0.2228	0.2226	0.2227	0.2226	0.2226	0.2226	0.2227	0.2227	0.2227	0.2228	0.2228	0.2227	0.2228	
	A7	4135	0.2214	0.2213	0.2213	0.2212	0.2212	0.2211	0.2212	0.2213	0.2214	0.2213	0.2214	0.2213	0.2213	
	A8	4223	0.2222	0.2221	0.2221	0.2220	0.2220	0.2219	0.2221	0.2221	0.2222	0.2222	0.2223	0.2221	0.2221	
	A9	4166	0.2218	0.2217	0.2218	0.2216	0.2216	0.2216	0.2217	0.2218	0.2218	0.2218	0.2219	0.2218	0.2218	
	A10	4123	0.2214	0.2213	0.2214	0.2212	0.2212	0.2212	0.2213	0.2214	0.2214	0.2215	0.2215	0.2214	0.2214	
	A21	4362	0.2216	0.2215	0.2215	0.2215	0.2214	0.2214	0.2215	0.2215	0.2216	0.2216	0.2216	0.2216	0.2216	
	A22	4249	0.2215	0.2214	0.2214	0.2214	0.2213	0.2213	0.2214	0.2214	0.2215	0.2214	0.2215	0.2214	0.2215	
	A23	4287	0.2216	0.2215	0.2215	0.2215	0.2214	0.2214	0.2215	0.2216	0.2216	0.2216	0.2216	0.2216	0.2216	
	A24	4209	0.2209	0.2207	0.2208	0.2207	0.2207	0.2207	0.2208	0.2208	0.2208	0.2208	0.2208	0.2208	0.2208	
	A25	4362	0.2218	0.2216	0.2217	0.2217	0.2216	0.2216	0.2217	0.2217	0.2218	0.2217	0.2218	0.2217	0.2218	
	A26	4264	0.2212	0.2211	0.2211	0.2211	0.2210	0.2210	0.2212	0.2212	0.2212	0.2212	0.2212	0.2211	0.2212	
	A27	4291	0.2213	0.2212	0.2212	0.2212	0.2211	0.2212	0.2213	0.2213	0.2213	0.2213	0.2213	0.2213	0.2213	
	A28	4329	0.2214	0.2213	0.2214	0.2213	0.2213	0.2213	0.2214	0.2215	0.2215	0.2214	0.2215	0.2214	0.2214	
	A29	4371	0.2218	0.2217	0.2218	0.2217	0.2216	0.2218	0.2219	0.2218	0.2219	0.2218	0.2219	0.2218	0.2218	
	A30	4335	0.2218	0.2216	0.2216	0.2216	0.2216	0.2217	0.2217	0.2217	0.2218	0.2218	0.2218	0.2217	0.2218	
	A41	4232	0.2218	0.2217	0.2217	0.2217	0.2217	0.2217	0.2217	0.2217	0.2218	0.2218	0.2218	0.2218	0.2218	
	A42	4318	0.2226	0.2224	0.2225	0.2225	0.2225	0.2224	0.2225	0.2225	0.2225	0.2225	0.2225	0.2225	0.2225	
	A43	4404	0.2220	0.2219	0.2219	0.2219	0.2219	0.2219	0.2220	0.2220	0.2220	0.2220	0.2220	0.2220	0.2220	
	A44	4299	0.2203	0.2202	0.2203	0.2202	0.2202	0.2202	0.2203	0.2203	0.2203	0.2203	0.2204	0.2203	0.2203	
	A45	4275	0.2215	0.2213	0.2214	0.2213	0.2213	0.2213	0.2214	0.2214	0.2214	0.2214	0.2214	0.2215	0.2214	
	ave	**4258**														

$T_S = T_{AIR} = 85°C$, $I_F = 0.7A$

$T_S \geq 83C$, $T_{AIR} \geq 80C$ in compliance with LM-80-08

v'

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 57: CCT = 4000K, T_J = 96C	A1	4145	0.4999	0.4996	0.4996	0.4995	0.4995	0.4998	0.5000	0.5003	0.5001	0.4999	0.5000	0.4998	0.4999	
	A2	4196	0.4976	0.4973	0.4972	0.4968	0.4970	0.4975	0.4977	0.4979	0.4977	0.4976	0.4978	0.4975	0.4975	
	A3	4206	0.4966	0.4964	0.4963	0.4958	0.4962	0.4966	0.4967	0.4971	0.4968	0.4967	0.4969	0.4966	0.4966	
	A4	4196	0.4972	0.4969	0.4968	0.4961	0.4964	0.4966	0.4967	0.4970	0.4967	0.4966	0.4968	0.4965	0.4966	
	A5	4190	0.4977	0.4974	0.4973	0.4967	0.4970	0.4973	0.4974	0.4977	0.4974	0.4973	0.4974	0.4971	0.4972	
	A6	4288	0.4917	0.4913	0.4912	0.4907	0.4909	0.4912	0.4913	0.4916	0.4913	0.4913	0.4914	0.4911	0.4911	
	A7	4135	0.5020	0.5017	0.5016	0.5012	0.5013	0.5016	0.5017	0.5020	0.5017	0.5017	0.5019	0.5016	0.5016	
	A8	4223	0.4959	0.4956	0.4955	0.4949	0.4952	0.4954	0.4954	0.4958	0.4954	0.4953	0.4956	0.4952	0.4953	
	A9	4166	0.4995	0.4992	0.4992	0.4987	0.4989	0.4991	0.4991	0.4995	0.4992	0.4991	0.4994	0.4990	0.4990	
	A10	4123	0.5025	0.5022	0.5021	0.5017	0.5019	0.5021	0.5021	0.5025	0.5022	0.5022	0.5024	0.5019	0.5020	
	A21	4362	0.4905	0.4903	0.4902	0.4897	0.4899	0.4901	0.4901	0.4904	0.4902	0.4901	0.4902	0.4900	0.4900	
	A22	4249	0.4960	0.4957	0.4957	0.4953	0.4953	0.4956	0.4957	0.4960	0.4957	0.4956	0.4957	0.4955	0.4955	
	A23	4287	0.4939	0.4936	0.4937	0.4931	0.4932	0.4935	0.4935	0.4938	0.4936	0.4935	0.4936	0.4933	0.4934	
	A24	4209	0.4992	0.4990	0.4990	0.4986	0.4986	0.4988	0.4988	0.4991	0.4989	0.4988	0.4990	0.4988	0.4988	
	A25	4362	0.4903	0.4900	0.4900	0.4897	0.4898	0.4901	0.4901	0.4904	0.4902	0.4900	0.4901	0.4899	0.4899	
	A26	4264	0.4958	0.4956	0.4956	0.4951	0.4952	0.4953	0.4955	0.4956	0.4955	0.4955	0.4954	0.4953	0.4953	
	A27	4291	0.4943	0.4941	0.4941	0.4937	0.4938	0.4939	0.4940	0.4943	0.4941	0.4939	0.4941	0.4939	0.4939	
	A28	4329	0.4924	0.4926	0.4927	0.4922	0.4924	0.4924	0.4925	0.4928	0.4926	0.4925	0.4926	0.4923	0.4924	
	A29	4371	0.4898	0.4897	0.4897	0.4891	0.4893	0.4892	0.4894	0.4897	0.4895	0.4894	0.4895	0.4892	0.4893	
	A30	4335	0.4915	0.4912	0.4913	0.4908	0.4909	0.4910	0.4909	0.4914	0.4911	0.4910	0.4911	0.4908	0.4908	
	A41	4232	0.4961	0.4959	0.4960	0.4961	0.4963	0.4967	0.4968	0.4971	0.4969	0.4969	0.4971	0.4969	0.4969	
	A42	4318	0.4907	0.4904	0.4907	0.4909	0.4912	0.4917	0.4919	0.4922	0.4920	0.4920	0.4922	0.4919	0.4919	
	A43	4404	0.4882	0.4878	0.4882	0.4885	0.4886	0.4891	0.4892	0.4896	0.4893	0.4892	0.4895	0.4892	0.4892	
	A44	4299	0.4959	0.4956	0.4958	0.4957	0.4960	0.4963	0.4965	0.4967	0.4965	0.4965	0.4967	0.4963	0.4963	
	A45	4275	0.4948	0.4945	0.4947	0.4946	0.4949	0.4952	0.4952	0.4957	0.4954	0.4953	0.4956	0.4952	0.4952	
	ave	**4258**														

$T_S = T_{AIR} = 85°C, I_F = 0.7A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

delta u' v'

DATA SET 57: CCT = 4000K, T_J = 96C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4145	0.0000	0.0003	0.0003	0.0004	0.0004	0.0001	0.0001	0.0004	0.0002	0.0000	0.0001	0.0001	0.0000	
A2	4196	0.0000	0.0003	0.0004	0.0008	0.0006	0.0002	0.0001	0.0003	0.0001	0.0001	0.0002	0.0001	0.0001	
A3	4206	0.0000	0.0002	0.0003	0.0008	0.0004	0.0002	0.0001	0.0005	0.0002	0.0001	0.0003	0.0000	0.0000	
A4	4196	0.0000	0.0004	0.0004	0.0011	0.0008	0.0007	0.0005	0.0002	0.0005	0.0006	0.0004	0.0007	0.0006	
A5	4190	0.0000	0.0003	0.0004	0.0010	0.0007	0.0005	0.0004	0.0002	0.0003	0.0004	0.0003	0.0006	0.0005	
A6	4288	0.0000	0.0004	0.0005	0.0010	0.0008	0.0005	0.0004	0.0001	0.0004	0.0004	0.0003	0.0006	0.0006	
A7	4135	0.0000	0.0003	0.0004	0.0008	0.0007	0.0005	0.0004	0.0001	0.0003	0.0003	0.0001	0.0004	0.0004	
A8	4223	0.0000	0.0003	0.0004	0.0010	0.0007	0.0006	0.0005	0.0001	0.0005	0.0006	0.0003	0.0007	0.0006	
A9	4166	0.0000	0.0003	0.0003	0.0008	0.0006	0.0004	0.0004	0.0000	0.0003	0.0004	0.0001	0.0005	0.0005	
A10	4123	0.0000	0.0003	0.0004	0.0008	0.0006	0.0004	0.0004	0.0000	0.0003	0.0003	0.0001	0.0006	0.0005	
A21	4362	0.0000	0.0002	0.0003	0.0008	0.0006	0.0004	0.0004	0.0001	0.0003	0.0004	0.0003	0.0005	0.0005	
A22	4249	0.0000	0.0003	0.0003	0.0007	0.0007	0.0004	0.0003	0.0001	0.0003	0.0004	0.0003	0.0005	0.0005	
A23	4287	0.0000	0.0003	0.0002	0.0008	0.0007	0.0004	0.0004	0.0001	0.0003	0.0004	0.0003	0.0006	0.0005	
A24	4209	0.0000	0.0003	0.0002	0.0006	0.0006	0.0004	0.0004	0.0001	0.0003	0.0004	0.0002	0.0004	0.0004	
A25	4362	0.0000	0.0004	0.0003	0.0006	0.0005	0.0003	0.0002	0.0001	0.0001	0.0003	0.0002	0.0004	0.0004	
A26	4264	0.0000	0.0002	0.0002	0.0007	0.0006	0.0005	0.0003	0.0002	0.0003	0.0003	0.0004	0.0005	0.0005	
A27	4291	0.0000	0.0002	0.0002	0.0006	0.0005	0.0004	0.0003	0.0000	0.0002	0.0004	0.0002	0.0004	0.0004	
A28	4329	0.0000	0.0002	0.0003	0.0002	0.0001	0.0001	0.0001	0.0004	0.0002	0.0001	0.0002	0.0001	0.0000	
A29	4371	0.0000	0.0001	0.0001	0.0007	0.0005	0.0006	0.0004	0.0001	0.0003	0.0004	0.0003	0.0006	0.0005	
A30	4335	0.0000	0.0004	0.0003	0.0007	0.0006	0.0005	0.0006	0.0001	0.0004	0.0005	0.0004	0.0007	0.0007	
A41	4232	0.0000	0.0002	0.0001	0.0001	0.0002	0.0006	0.0007	0.0010	0.0008	0.0008	0.0010	0.0008	0.0008	
A42	4318	0.0000	0.0004	0.0001	0.0002	0.0005	0.0010	0.0012	0.0015	0.0013	0.0013	0.0015	0.0012	0.0012	
A43	4404	0.0000	0.0004	0.0001	0.0003	0.0004	0.0009	0.0010	0.0014	0.0011	0.0010	0.0013	0.0010	0.0010	
A44	4299	0.0000	0.0003	0.0001	0.0002	0.0001	0.0004	0.0006	0.0008	0.0006	0.0006	0.0008	0.0004	0.0004	
A45	4275	0.0000	0.0004	0.0001	0.0003	0.0002	0.0004	0.0004	0.0009	0.0006	0.0005	0.0008	0.0004	0.0004	
ave	**4258**	**0.0000**	**0.0003**	**0.0003**	**0.0007**	**0.0006**	**0.0005**	**0.0004**	**0.0004**	**0.0004**	**0.0004**	**0.0004**	**0.0005**	**0.0005**	

$T_S = T_{AIR} = 85°C, I_F = 0.7A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

Forward voltage

DATA SET 57: CCT = 4000K, T_J = 96C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4145	2.966	2.962	2.966	2.966	2.967	2.971	2.967	2.965	2.974	2.974	2.969	2.968	2.968	
A2	4196	2.990	2.989	2.988	2.987	2.982	2.999	2.999	2.994	2.992	2.999	2.998	2.999	3.000	
A3	4206	2.949	2.960	2.953	2.954	2.958	2.961	2.962	2.960	2.961	2.957	2.965	2.962	2.963	
A4	4196	2.977	2.974	2.972	2.973	2.962	2.982	2.982	2.980	2.978	2.983	2.980	2.980	2.982	
A5	4190	2.998	2.996	2.998	2.999	3.001	3.010	3.008	3.008	3.007	3.007	3.010	3.016	3.011	
A6	4288	2.949	2.947	2.949	2.946	2.945	2.954	2.951	2.956	2.955	2.956	2.954	2.954	2.950	
A7	4135	3.000	2.995	2.993	2.998	2.995	3.003	3.007	3.002	3.007	3.007	3.011	3.009	2.997	
A8	4223	3.007	2.995	3.000	3.004	3.004	3.016	3.018	3.017	3.020	3.022	3.022	3.024	3.025	
A9	4166	2.952	2.960	2.950	2.953	2.953	2.968	2.964	2.969	2.972	2.970	2.976	2.968	2.972	
A10	4123	2.961	2.959	2.951	2.948	2.960	2.959	2.965	2.965	2.962	2.966	2.965	2.976	2.977	
A21	4362	3.024	3.020	3.021	3.015	3.017	3.026	3.025	3.024	3.027	3.026	3.026	3.030	3.032	
A22	4249	2.998	2.997	2.989	2.981	2.987	2.999	3.001	3.000	3.000	2.995	3.003	3.007	3.007	
A23	4287	3.058	3.043	3.048	3.051	3.049	3.046	3.055	3.054	3.057	3.052	3.057	3.055	3.063	
A24	4209	2.955	2.961	2.952	2.951	2.954	2.959	2.953	2.964	2.963	2.973	2.975	2.982	2.984	
A25	4362	2.991	3.001	2.988	2.997	2.998	3.002	3.009	3.004	3.005	3.005	3.011	3.015	3.017	
A26	4264	2.996	2.992	2.982	2.990	2.991	2.989	3.000	2.987	3.003	3.004	2.995	3.008	3.005	
A27	4291	2.998	2.991	2.988	2.991	2.988	3.000	2.997	2.992	3.000	3.003	2.994	3.007	3.009	
A28	4329	2.972	2.972	2.969	2.968	2.965	2.976	2.977	2.977	2.974	2.982	2.984	2.976	2.987	
A29	4371	2.959	2.962	2.956	2.954	2.959	2.965	2.968	2.959	2.969	2.964	2.979	2.983	2.984	
A30	4335	3.024	3.025	3.017	3.007	3.008	3.020	3.023	3.022	3.011	3.019	3.023	3.020	3.024	
A41	4232	3.212	3.200	3.192	3.190	3.173	3.178	3.180	3.164	3.176	3.178	3.187	3.186	3.190	
A42	4318	3.112	3.107	3.105	3.087	3.088	3.108	3.101	3.096	3.102	3.102	3.117	3.122	3.120	
A43	4404	3.098	3.092	3.089	3.075	3.085	3.084	3.073	3.081	3.080	3.081	3.088	3.093	3.087	
A44	4299	3.250	3.237	3.219	3.214	3.196	3.196	3.193	3.183	3.191	3.178	3.179	3.189	3.189	
A45	4275	3.163	3.147	3.140	3.129	3.130	3.129	3.126	3.121	3.121	3.122	3.125	3.125	3.115	
ave	**4258**	**3.022**													

$T_S = T_{AIR} = 105°C$, $I_F = 0.7A$

$T_S \geq 103C$, $T_{AIR} \geq 100C$ in compliance with LM-80-08

Lumen Data

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	Lumen Maintenance % at 6khours
DATA SET 56: CCT = 4000K, T_J = 115C	A1	4214	191.272	190.985	191.512	195.222	196.099	196.512	196.929	198.511	199.027	197.905	198.422	197.199	197.731		**103.5**
	A2	4195	195.614	195.238	195.503	198.310	198.508	199.808	200.261	201.662	202.038	200.825	201.122	200.021	200.130		**102.7**
	A3	4211	193.681	193.215	193.339	196.150	196.844	197.312	197.448	198.779	199.059	196.834	197.895	197.014	197.474		**101.6**
	A4	4163	189.464	189.611	190.071	196.168	196.592	197.194	197.527	198.808	199.110	197.963	197.806	197.087	197.628		**104.5**
	A5	4205	193.469	193.645	194.233	197.780	198.513	199.012	199.337	200.674	201.075	199.859	199.664	198.875	199.374		**103.3**
	A6	4151	193.214	193.175	193.417	197.414	198.060	198.623	199.099	200.241	200.816	199.494	199.452	198.724	199.530		**103.3**
	A7	4186	193.088	193.198	193.754	196.890	198.085	199.234	200.342	201.972	201.835	200.491	198.904	196.959	196.611		**103.8**
	A8	4229	190.066	190.131	190.562	193.973	194.354	194.884	194.440	195.902	196.358	195.273	194.931	194.392	194.926		**102.7**
	A9	4327	186.198	186.653	187.229	189.990	190.331	190.947	191.230	192.569	192.760	191.410	191.027	189.877	189.986		**102.8**
	A10	4300	184.630	185.041	185.590	187.918	188.701	189.763	190.501	192.388	193.196	192.160	190.886	189.396	188.639		**104.1**
	A21	4265	189.225	188.813	188.834	191.471	192.435	193.519	194.409	196.454	197.696	196.523	197.265	195.460	193.911		**103.9**
	A22	4349	191.544	191.012	190.901	194.172	195.037	196.066	197.071	199.602	201.002	200.065	200.685	197.446	195.298		**104.4**
	A23	4382	190.528	189.859	189.900	193.003	194.026	194.734	195.586	197.800	199.434	198.473	198.743	195.392	192.900		**104.2**
	A24	4285	188.240	188.060	188.040	191.399	192.969	194.977	196.927	198.579	197.404	194.553	191.715	188.752	188.087		**103.4**
	A25	4390	192.501	191.987	191.976	194.766	195.593	196.090	196.641	198.420	199.163	196.501	198.404	196.913	196.257		**102.1**
	A26	4352	193.071	192.930	192.830	195.653	196.639	197.561	198.413	200.068	199.231	197.175	195.494	192.471	192.249		**102.1**
	A27	4338	190.728	190.575	190.724	194.329	196.716	200.608	195.871	193.233	192.733	191.185	191.297	190.333	190.496		**100.2**
	A28	4362	188.341	188.237	188.822	193.088	196.769	196.803	188.319	189.267	188.921	187.852	188.132	187.124	187.507		**99.7**
	A29	4279	184.075	184.341	185.100	188.926	192.541	189.862	184.424	185.629	185.014	183.927	183.955	183.033	183.205		**99.9**
	A41	4377	183.431	182.533	183.042	185.726	187.091	187.424	187.509	187.965	188.317	186.723	187.189	185.880	185.820		**101.8**
	A42	4304	184.303	183.090	183.985	186.845	187.856	188.325	188.083	188.318	187.921	186.196	186.472	185.283	185.163		**101.0**
	A43	4241	202.325	200.775	202.245	205.429	206.531	206.998	207.789	208.449	208.939	207.696	208.336	206.759	206.776		**102.7**
	A44	4349	188.487	187.464	188.390	190.636	191.064	191.069	191.145	191.299	191.282	189.872	190.040	188.622	188.730		**100.7**
	A45	4289	179.730	179.320	180.360	183.252	184.561	184.639	184.525	185.189	185.270	183.939	184.069	182.876	182.792		**102.3**
	A46	4256	198.000	196.203	196.427	199.662	200.263	200.492	201.156	202.542	202.751	201.532	201.958	200.811	200.847		**101.8**
	ave	**4280**															**102.5**

$T_S = T_{AIR} = 105°C$, $I_F = 0.7A$

$T_S \geq 103C$, $T_{AIR} \geq 100C$ in compliance with LM-80-08

Normalized flux

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 56: CCT = 4000K, T_J = 115C	A1	4214	1.0000	0.9985	1.0013	1.0206	1.0252	1.0274	1.0296	1.0378	1.0405	1.0347	1.0374	1.0310	1.0338	
	A2	4195	1.0000	0.9981	0.9994	1.0138	1.0148	1.0214	1.0238	1.0309	1.0328	1.0266	1.0282	1.0225	1.0231	
	A3	4211	1.0000	0.9976	0.9982	1.0127	1.0163	1.0187	1.0195	1.0263	1.0278	1.0163	1.0218	1.0172	1.0196	
	A4	4163	1.0000	1.0008	1.0032	1.0354	1.0376	1.0408	1.0426	1.0493	1.0509	1.0449	1.0440	1.0402	1.0431	
	A5	4205	1.0000	1.0009	1.0039	1.0223	1.0261	1.0286	1.0303	1.0372	1.0393	1.0330	1.0320	1.0279	1.0305	
	A6	4151	1.0000	0.9998	1.0010	1.0217	1.0251	1.0280	1.0305	1.0364	1.0393	1.0325	1.0323	1.0285	1.0327	
	A7	4186	1.0000	1.0006	1.0035	1.0197	1.0259	1.0318	1.0376	1.0460	1.0453	1.0383	1.0301	1.0200	1.0182	
	A8	4229	1.0000	1.0003	1.0026	1.0206	1.0226	1.0254	1.0230	1.0307	1.0331	1.0274	1.0256	1.0228	1.0256	
	A9	4327	1.0000	1.0024	1.0055	1.0204	1.0222	1.0255	1.0270	1.0342	1.0352	1.0280	1.0259	1.0198	1.0203	
	A10	4300	1.0000	1.0022	1.0052	1.0178	1.0220	1.0278	1.0318	1.0420	1.0464	1.0408	1.0339	1.0258	1.0217	
	A21	4265	1.0000	0.9978	0.9979	1.0119	1.0170	1.0227	1.0274	1.0382	1.0448	1.0386	1.0425	1.0329	1.0248	
	A22	4349	1.0000	0.9972	0.9966	1.0137	1.0182	1.0236	1.0289	1.0421	1.0494	1.0445	1.0477	1.0308	1.0196	
	A23	4382	1.0000	0.9965	0.9967	1.0130	1.0184	1.0221	1.0265	1.0382	1.0467	1.0417	1.0431	1.0255	1.0124	
	A24	4285	1.0000	0.9990	0.9989	1.0168	1.0251	1.0358	1.0461	1.0549	1.0487	1.0335	1.0185	1.0027	0.9992	
	A25	4390	1.0000	0.9973	0.9973	1.0118	1.0161	1.0186	1.0215	1.0307	1.0346	1.0208	1.0307	1.0229	1.0195	
	A26	4352	1.0000	0.9993	0.9988	1.0134	1.0185	1.0233	1.0277	1.0362	1.0319	1.0213	1.0125	0.9969	0.9957	
	A27	4338	1.0000	0.9992	1.0000	1.0189	1.0314	1.0518	1.0270	1.0131	1.0105	1.0024	1.0030	0.9979	0.9988	
	A28	4362	1.0000	0.9994	1.0026	1.0252	1.0447	1.0449	0.9999	1.0049	1.0031	0.9974	0.9989	0.9935	0.9956	
	A29	4279	1.0000	1.0014	1.0056	1.0263	1.0460	1.0314	1.0019	1.0084	1.0051	0.9992	0.9993	0.9943	0.9953	
	A41	4377	1.0000	0.9951	0.9979	1.0125	1.0200	1.0218	1.0222	1.0247	1.0266	1.0179	1.0205	1.0134	1.0130	
	A42	4304	1.0000	0.9934	0.9983	1.0138	1.0193	1.0218	1.0205	1.0218	1.0196	1.0103	1.0118	1.0053	1.0047	
	A43	4241	1.0000	0.9923	0.9996	1.0153	1.0208	1.0231	1.0270	1.0303	1.0327	1.0265	1.0297	1.0219	1.0220	
	A44	4349	1.0000	0.9946	0.9995	1.0114	1.0137	1.0137	1.0141	1.0149	1.0148	1.0073	1.0082	1.0007	1.0013	
	A45	4289	1.0000	0.9977	1.0035	1.0196	1.0269	1.0273	1.0267	1.0304	1.0308	1.0234	1.0241	1.0175	1.0170	
	A46	4256	1.0000	0.9909	0.9921	1.0084	1.0114	1.0126	1.0159	1.0229	1.0240	1.0178	1.0200	1.0142	1.0144	
	ave	**4280**	**1.0000**	**0.9981**	**1.0004**	**1.0175**	**1.0234**	**1.0268**	**1.0252**	**1.0313**	**1.0326**	**1.0250**	**1.0249**	**1.0171**	**1.0161**	

$T_S = T_{AIR} = 105°C, I_F = 0.7A$

$T_S \geq 103C, T_{AIR} \geq 100C$ in compliance with LM-80-08

TM-21 extrapolation

DATA SET 56: CCT = 4000K, T_J = 115C

	CCT (t=0)	alpha	B	r2	L70
A1	4214	1.2785E-06	1.0445	0.532	313,049
A2	4195	1.9068E-06	1.0402	0.786	207,703
A3	4211	1.6726E-06	1.0326	0.457	232,445
A4	4163	1.7478E-06	1.0573	0.732	235,969
A5	4205	1.8985E-06	1.0462	0.751	211,645
A6	4151	1.4118E-06	1.0431	0.531	282,552
A7	4186	6.1666E-06	1.0752	0.954	69,597
A8	4229	1.6257E-06	1.0384	0.684	242,590
A9	4327	3.2779E-06	1.0494	0.909	123,507
A10	4300	4.7047E-06	1.0672	0.872	89,637
A21	4265	2.7294E-06	1.0555	0.536	150,465
A22	4349	4.5565E-06	1.0702	0.583	93,165
A23	4382	5.2999E-06	1.0708	0.608	80,207
A24	4285	1.2016E-05	1.1094	0.977	38,323
A25	4390	2.2646E-06	1.0417	0.484	175,561
A26	4352	8.8980E-06	1.0761	0.966	48,329
A27	4338	3.0946E-06	1.0247	0.878	123,134
A28	4362	2.1115E-06	1.0127	0.814	174,895
A29	4279	2.7960E-06	1.0186	0.901	134,162
A41	4377	2.6843E-06	1.0373	0.814	146,515
A42	4304	3.5825E-06	1.0361	0.904	109,452
A43	4241	1.9620E-06	1.0404	0.702	201,958
A44	4349	3.1065E-06	1.0284	0.889	123,840
A45	4289	2.9559E-06	1.0437	0.900	135,147
A46	4256	1.9642E-06	1.0320	0.804	197,614
ave	**4280**	**3.4273E-06**	**1.0475**	**0.905**	**117,621**

$T_S = T_{AIR} = 105°C$, $I_F = 0.7A$

$T_S \geq 103C$, $T_{AIR} \geq 100C$ in compliance with LM-80-08

DATA SET 56: CCT = 4000K, T_J = 115C

u'

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4214	0.2222	0.2220	0.2221	0.2220	0.2220	0.2219	0.2220	0.2219	0.2220	0.2220	0.2221	0.2221	0.2220	
A2	4195	0.2220	0.2219	0.2220	0.2219	0.2219	0.2219	0.2219	0.2219	0.2220	0.2220	0.2222	0.2220	0.2219	
A3	4211	0.2221	0.2220	0.2221	0.2220	0.2220	0.2220	0.2220	0.2221	0.2221	0.2222	0.2223	0.2222	0.2221	
A4	4163	0.2221	0.2219	0.2221	0.2219	0.2219	0.2219	0.2219	0.2220	0.2220	0.2220	0.2222	0.2221	0.2220	
A5	4205	0.2221	0.2220	0.2221	0.2220	0.2220	0.2219	0.2220	0.2221	0.2221	0.2221	0.2223	0.2221	0.2221	
A6	4151	0.2217	0.2216	0.2217	0.2215	0.2216	0.2215	0.2216	0.2217	0.2217	0.2218	0.2220	0.2218	0.2217	
A7	4186	0.2219	0.2217	0.2218	0.2217	0.2217	0.2217	0.2218	0.2219	0.2220	0.2219	0.2220	0.2219	0.2218	
A8	4229	0.2220	0.2219	0.2220	0.2219	0.2220	0.2219	0.2221	0.2221	0.2222	0.2221	0.2224	0.2222	0.2221	
A9	4327	0.2224	0.2223	0.2224	0.2223	0.2224	0.2223	0.2224	0.2225	0.2226	0.2226	0.2227	0.2226	0.2225	
A10	4300	0.2224	0.2223	0.2224	0.2224	0.2224	0.2223	0.2225	0.2226	0.2226	0.2226	0.2228	0.2226	0.2225	
A21	4265	0.2212	0.2211	0.2211	0.2211	0.2211	0.2210	0.2211	0.2210	0.2211	0.2211	0.2211	0.2210	0.2210	
A22	4349	0.2216	0.2215	0.2216	0.2215	0.2215	0.2215	0.2215	0.2215	0.2215	0.2214	0.2215	0.2214	0.2214	
A23	4382	0.2218	0.2217	0.2217	0.2217	0.2217	0.2217	0.2217	0.2217	0.2217	0.2217	0.2217	0.2216	0.2216	
A24	4285	0.2214	0.2213	0.2214	0.2213	0.2213	0.2212	0.2213	0.2212	0.2213	0.2212	0.2213	0.2212	0.2213	
A25	4390	0.2218	0.2217	0.2218	0.2218	0.2217	0.2217	0.2218	0.2217	0.2218	0.2218	0.2218	0.2217	0.2217	
A26	4352	0.2215	0.2214	0.2215	0.2215	0.2215	0.2215	0.2215	0.2215	0.2215	0.2215	0.2215	0.2215	0.2215	
A27	4338	0.2215	0.2214	0.2215	0.2214	0.2214	0.2213	0.2214	0.2213	0.2214	0.2214	0.2214	0.2213	0.2213	
A28	4362	0.2217	0.2215	0.2216	0.2216	0.2215	0.2215	0.2216	0.2215	0.2216	0.2215	0.2216	0.2215	0.2215	
A29	4279	0.2204	0.2203	0.2204	0.2204	0.2204	0.2203	0.2204	0.2205	0.2205	0.2204	0.2205	0.2204	0.2204	
A41	4377	0.2222	0.2221	0.2222	0.2221	0.2221	0.2220	0.2220	0.2220	0.2221	0.2221	0.2221	0.2221	0.2221	
A42	4304	0.2220	0.2219	0.2219	0.2219	0.2218	0.2218	0.2218	0.2217	0.2218	0.2218	0.2218	0.2218	0.2218	
A43	4241	0.2211	0.2209	0.2210	0.2210	0.2210	0.2209	0.2209	0.2209	0.2209	0.2209	0.2210	0.2209	0.2209	
A44	4349	0.2220	0.2219	0.2220	0.2219	0.2219	0.2219	0.2219	0.2219	0.2219	0.2219	0.2220	0.2219	0.2219	
A45	4289	0.2219	0.2218	0.2219	0.2218	0.2218	0.2217	0.2217	0.2217	0.2218	0.2217	0.2218	0.2217	0.2218	
A46	4256	0.2215	0.2214	0.2214	0.2214	0.2214	0.2214	0.2214	0.2214	0.2215	0.2214	0.2215	0.2214	0.2214	
ave	**4280**														

$T_S = T_{AIR} = 105°C$, $I_F = 0.7A$

$T_S \geq 103C$, $T_{AIR} \geq 100C$ in compliance with LM-80-08

DATA SET 56: CCT = 4000K, T_J = 115C

v'

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4214	0.4964	0.4963	0.4964	0.4958	0.4959	0.4962	0.4962	0.4969	0.4963	0.4962	0.4971	0.4964	0.4965	
A2	4195	0.4976	0.4975	0.4976	0.4971	0.4972	0.4975	0.4974	0.4982	0.4976	0.4975	0.4985	0.4977	0.4979	
A3	4211	0.4966	0.4965	0.4967	0.4961	0.4962	0.4965	0.4965	0.4973	0.4965	0.4965	0.4974	0.4966	0.4967	
A4	4163	0.4991	0.4990	0.4991	0.4980	0.4982	0.4984	0.4983	0.4991	0.4984	0.4983	0.4992	0.4984	0.4985	
A5	4205	0.4969	0.4967	0.4968	0.4963	0.4964	0.4967	0.4967	0.4975	0.4968	0.4967	0.4977	0.4968	0.4969	
A6	4151	0.5005	0.5004	0.5005	0.4997	0.4999	0.5002	0.5001	0.5008	0.5002	0.5002	0.5010	0.5002	0.5004	
A7	4186	0.4983	0.4982	0.4984	0.4978	0.4979	0.4982	0.4982	0.4991	0.4985	0.4985	0.4998	0.4989	0.4991	
A8	4229	0.4959	0.4957	0.4959	0.4952	0.4953	0.4956	0.4956	0.4963	0.4956	0.4955	0.4965	0.4957	0.4959	
A9	4327	0.4906	0.4905	0.4907	0.4901	0.4902	0.4905	0.4904	0.4912	0.4905	0.4904	0.4915	0.4906	0.4908	
A10	4300	0.4918	0.4917	0.4918	0.4914	0.4915	0.4918	0.4917	0.4925	0.4918	0.4918	0.4929	0.4921	0.4923	
A21	4265	0.4958	0.4956	0.4958	0.4954	0.4955	0.4957	0.4958	0.4963	0.4959	0.4959	0.4966	0.4961	0.4961	
A22	4349	0.4912	0.4910	0.4912	0.4907	0.4908	0.4911	0.4911	0.4918	0.4913	0.4913	0.4923	0.4917	0.4918	
A23	4382	0.4895	0.4893	0.4896	0.4891	0.4891	0.4894	0.4894	0.4903	0.4897	0.4897	0.4908	0.4902	0.4902	
A24	4285	0.4944	0.4944	0.4946	0.4942	0.4943	0.4945	0.4946	0.4954	0.4949	0.4948	0.4958	0.4949	0.4948	
A25	4390	0.4890	0.4889	0.4894	0.4892	0.4893	0.4896	0.4895	0.4905	0.4898	0.4900	0.4907	0.4899	0.4899	
A26	4352	0.4912	0.4911	0.4920	0.4919	0.4921	0.4923	0.4923	0.4935	0.4927	0.4927	0.4941	0.4928	0.4927	
A27	4338	0.4920	0.4919	0.4930	0.4928	0.4930	0.4934	0.4939	0.4954	0.4939	0.4938	0.4955	0.4938	0.4937	
A28	4362	0.4905	0.4904	0.4919	0.4915	0.4918	0.4924	0.4925	0.4946	0.4925	0.4924	0.4946	0.4926	0.4925	
A29	4279	0.4966	0.4965	0.4978	0.4976	0.4979	0.4980	0.4979	0.4997	0.4978	0.4977	0.4998	0.4979	0.4978	
A41	4377	0.4888	0.4886	0.4891	0.4890	0.4893	0.4898	0.4898	0.4907	0.4900	0.4899	0.4909	0.4899	0.4899	
A42	4304	0.4925	0.4923	0.4927	0.4924	0.4927	0.4931	0.4933	0.4945	0.4938	0.4937	0.4949	0.4938	0.4937	
A43	4241	0.4972	0.4970	0.4975	0.4973	0.4975	0.4978	0.4981	0.4991	0.4984	0.4983	0.4996	0.4984	0.4984	
A44	4349	0.4904	0.4901	0.4906	0.4904	0.4907	0.4911	0.4911	0.4924	0.4915	0.4914	0.4928	0.4914	0.4914	
A45	4289	0.4933	0.4931	0.4936	0.4934	0.4937	0.4943	0.4944	0.4953	0.4945	0.4944	0.4955	0.4944	0.4943	
A46	4256	0.4957	0.4956	0.4963	0.4960	0.4961	0.4963	0.4963	0.4971	0.4964	0.4963	0.4975	0.4962	0.4962	
ave	**4280**														

$T_S = T_{AIR} = 105°C$, $I_F = 0.7A$

$T_S \geq 103C$, $T_{AIR} \geq 100C$ in compliance with LM-80-08

delta u' v'

DATA SET 56: CCT = 4000K, T_J = 115C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4214	0.0000	0.0002	0.0001	0.0006	0.0005	0.0004	0.0003	0.0006	0.0002	0.0003	0.0007	0.0001	0.0002	
A2	4195	0.0000	0.0001	0.0000	0.0005	0.0004	0.0001	0.0002	0.0006	0.0000	0.0001	0.0009	0.0001	0.0003	
A3	4211	0.0000	0.0001	0.0001	0.0005	0.0004	0.0001	0.0001	0.0007	0.0001	0.0001	0.0008	0.0001	0.0001	
A4	4163	0.0000	0.0002	0.0000	0.0011	0.0009	0.0007	0.0008	0.0001	0.0007	0.0008	0.0001	0.0007	0.0006	
A5	4205	0.0000	0.0002	0.0001	0.0006	0.0005	0.0003	0.0002	0.0006	0.0001	0.0002	0.0008	0.0001	0.0000	
A6	4151	0.0000	0.0001	0.0000	0.0008	0.0006	0.0004	0.0004	0.0003	0.0003	0.0003	0.0006	0.0003	0.0001	
A7	4186	0.0000	0.0002	0.0001	0.0005	0.0004	0.0002	0.0001	0.0008	0.0002	0.0002	0.0015	0.0006	0.0008	
A8	4229	0.0000	0.0002	0.0000	0.0007	0.0006	0.0003	0.0003	0.0004	0.0004	0.0004	0.0007	0.0003	0.0001	
A9	4327	0.0000	0.0001	0.0001	0.0005	0.0004	0.0001	0.0002	0.0006	0.0002	0.0003	0.0009	0.0002	0.0002	
A10	4300	0.0000	0.0001	0.0000	0.0004	0.0003	0.0001	0.0001	0.0007	0.0002	0.0002	0.0012	0.0004	0.0005	
A21	4265	0.0000	0.0002	0.0001	0.0004	0.0003	0.0002	0.0001	0.0005	0.0001	0.0001	0.0008	0.0004	0.0004	
A22	4349	0.0000	0.0002	0.0000	0.0005	0.0004	0.0001	0.0001	0.0006	0.0001	0.0002	0.0011	0.0005	0.0006	
A23	4382	0.0000	0.0002	0.0001	0.0004	0.0004	0.0001	0.0001	0.0008	0.0002	0.0002	0.0013	0.0007	0.0007	
A24	4285	0.0000	0.0001	0.0002	0.0002	0.0001	0.0002	0.0002	0.0010	0.0005	0.0004	0.0014	0.0005	0.0004	
A25	4390	0.0000	0.0001	0.0004	0.0002	0.0003	0.0006	0.0005	0.0015	0.0008	0.0010	0.0017	0.0009	0.0009	
A26	4352	0.0000	0.0001	0.0008	0.0007	0.0009	0.0011	0.0011	0.0023	0.0015	0.0015	0.0029	0.0016	0.0015	
A27	4338	0.0000	0.0001	0.0010	0.0008	0.0010	0.0014	0.0019	0.0034	0.0019	0.0018	0.0035	0.0018	0.0017	
A28	4362	0.0000	0.0002	0.0014	0.0010	0.0013	0.0019	0.0020	0.0041	0.0020	0.0019	0.0041	0.0021	0.0020	
A29	4279	0.0000	0.0001	0.0012	0.0010	0.0013	0.0014	0.0013	0.0031	0.0012	0.0011	0.0032	0.0013	0.0012	
A41	4377	0.0000	0.0002	0.0003	0.0002	0.0005	0.0010	0.0010	0.0019	0.0012	0.0011	0.0021	0.0011	0.0011	
A42	4304	0.0000	0.0002	0.0002	0.0001	0.0003	0.0006	0.0008	0.0020	0.0013	0.0012	0.0024	0.0013	0.0012	
A43	4241	0.0000	0.0003	0.0003	0.0001	0.0003	0.0006	0.0009	0.0019	0.0012	0.0011	0.0024	0.0012	0.0012	
A44	4349	0.0000	0.0003	0.0002	0.0001	0.0003	0.0007	0.0007	0.0020	0.0011	0.0010	0.0024	0.0010	0.0010	
A45	4289	0.0000	0.0002	0.0003	0.0001	0.0004	0.0010	0.0011	0.0020	0.0012	0.0011	0.0022	0.0011	0.0010	
A46	4256	0.0000	0.0001	0.0006	0.0003	0.0004	0.0006	0.0006	0.0014	0.0007	0.0006	0.0018	0.0005	0.0005	
ave	**4280**	**0.0000**	**0.0002**	**0.0003**	**0.0005**	**0.0005**	**0.0006**	**0.0006**	**0.0014**	**0.0007**	**0.0007**	**0.0017**	**0.0008**	**0.0007**	

$T_S = T_{AIR} = 105°C$, $I_F = 0.7A$

$T_S \geq 103C$, $T_{AIR} \geq 100C$ in compliance with LM-80-08

Forward voltage

DATA SET 56: CCT = 4000K, T_J = 115C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4214	2.954	2.955	2.944	2.954	2.944	2.966	2.975	2.972	2.980	2.984	2.987	2.998	3.004	
A2	4195	2.980	2.988	2.981	2.970	2.987	3.002	3.008	3.011	3.024	3.024	3.038	3.038	3.058	
A3	4211	2.975	2.971	2.971	2.972	2.973	2.977	2.987	2.989	2.999	3.003	3.008	3.014	3.023	
A4	4163	2.946	2.945	2.942	2.942	2.939	2.949	2.948	2.958	2.965	2.967	2.977	2.980	2.984	
A5	4205	2.972	2.971	2.970	2.968	2.970	2.983	2.994	2.990	2.995	3.003	3.011	3.010	3.025	
A6	4151	2.960	2.966	2.966	2.965	2.966	2.976	2.987	2.994	2.992	3.001	3.008	3.020	3.026	
A7	4186	2.974	2.984	2.989	2.984	2.994	3.007	3.033	3.056	3.074	3.085	3.106	3.117	3.126	
A8	4229	2.960	2.964	2.960	2.958	2.960	2.973	2.981	2.985	2.990	2.999	3.008	3.002	3.026	
A9	4327	2.961	2.956	2.954	2.954	2.951	2.970	2.978	2.983	2.979	2.999	3.009	3.017	3.026	
A10	4300	2.917	2.918	2.925	2.929	2.928	2.951	2.963	2.974	2.998	3.005	3.029	3.052	3.064	
A21	4265	2.998	2.998	2.991	2.985	2.996	3.005	3.026	3.041	3.045	3.068	3.102	3.130	3.162	
A22	4349	3.019	3.016	3.015	3.016	3.009	3.041	3.054	3.069	3.104	3.131	3.193	3.240	3.267	
A23	4382	2.997	3.003	3.002	3.002	3.008	3.023	3.036	3.053	3.083	3.110	3.165	3.204	3.234	
A24	4285	3.000	2.999	2.997	2.998	3.002	3.035	3.073	3.115	3.150	3.171	3.199	3.205	3.226	
A25	4390	3.027	3.030	3.023	3.022	3.027	3.040	3.053	3.062	3.081	3.094	3.117	3.143	3.162	
A26	4352	3.045	3.044	3.040	3.045	3.050	3.073	3.105	3.132	3.167	3.184	3.213	3.210	3.232	
A27	4338	3.010	3.002	2.990	3.000	3.027	3.127	3.306	3.328	3.317	3.333	3.358	3.358	3.368	
A28	4362	2.989	2.979	2.979	2.992	3.040	3.247	3.322	3.336	3.333	3.344	3.368	3.359	3.374	
A29	4279	2.979	2.989	2.976	2.999	3.046	3.221	3.275	3.296	3.283	3.296	3.316	3.313	3.325	
A41	4377	3.199	3.191	3.170	3.147	3.159	3.177	3.200	3.213	3.217	3.225	3.236	3.240	3.248	
A42	4304	3.102	3.097	3.091	3.091	3.093	3.120	3.137	3.159	3.159	3.175	3.188	3.190	3.196	
A43	4241	3.228	3.222	3.211	3.206	3.206	3.231	3.245	3.254	3.259	3.265	3.282	3.284	3.288	
A44	4349	3.118	3.118	3.100	3.096	3.098	3.118	3.137	3.149	3.155	3.157	3.172	3.174	3.168	
A45	4289	3.147	3.140	3.138	3.134	3.149	3.176	3.200	3.210	3.219	3.218	3.228	3.242	3.246	
A46	4256	3.349	3.332	3.266	3.240	3.238	3.238	3.248	3.258	3.263	3.261	3.282	3.272	3.283	
ave	**4280**	**3.032**													

$T_S = T_{AIR} = 120°C$, $I_F = 0.7A$

$T_S \geq 118C$, $T_{AIR} \geq 115C$ in compliance with LM-80-08

Lumen Data

DATA SET 55: CCT = 4000K, T_J = 130C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	Lumen Maintenance % at 6khours
A1	4074	206.761	206.226	206.714	209.094	211.447	216.900	215.200	213.060	210.984	211.390	210.794	211.441	211.712		**102.2**
A2	4110	205.605	204.694	205.330	208.543	212.531	215.993	211.569	211.389	210.128	210.250	209.342	210.307	210.634		**102.3**
A3	4133	204.794	203.977	204.683	207.301	210.207	211.746	208.368	208.181	207.170	206.437	205.711	206.911	207.218		**100.8**
A4	4055	196.701	196.293	196.397	198.735	202.127	202.530	200.432	200.341	199.232	198.553	197.756	198.987	199.550		**100.9**
A5	4183	189.971	190.980	191.769	194.838	199.002	199.112	197.118	197.336	196.122	195.699	194.871	196.532	196.684		**103.0**
A6	4050	209.690	209.235	209.758	213.247	219.484	217.315	216.488	216.860	215.965	215.470	214.610	216.564	217.088		**102.8**
A7	4111	210.872	210.303	211.414	214.988	220.377	215.294	214.314	215.103	214.089	212.932	212.170	214.152	214.209		**101.0**
A8	4123	209.038	207.626	208.482	212.310	216.487	210.969	209.778	210.530	209.481	208.482	207.731	209.570	209.698		**99.7**
A9	4111	210.172	209.463	209.911	214.390	219.234	213.431	212.516	213.548	212.668	212.239	211.316	213.074	212.978		**101.0**
A10	4134	206.620	206.923	207.397	210.851	214.782	214.433	212.138	212.517	211.633	211.833	210.669	212.336	212.213		**102.5**
A21	4339	183.554	183.347	184.095	186.214	188.978	193.240	190.770	186.064	184.940	184.443	184.093	184.630	184.842		**100.5**
A22	4209	198.302	197.657	198.524	202.447	208.982	200.128	197.967	197.731	197.024	196.427	196.159	197.001	197.597		**99.1**
A23	4259	199.470	199.128	199.927	202.767	207.753	200.692	198.630	198.278	197.554	196.880	196.546	197.307	197.678		**98.7**
A24	4257	202.307	201.544	202.298	206.029	212.666	206.659	205.374	204.780	204.197	203.361	202.752	203.727	203.853		**100.5**
A25	4281	201.671	201.178	201.820	203.652	206.443	208.659	203.138	200.601	198.966	198.196	197.870	198.306	199.144		**98.3**
A26	4274	199.479	199.205	199.778	201.870	205.918	203.774	199.835	198.925	197.836	196.592	196.521	197.490	197.728		**98.6**
A27	4257	203.659	202.960	203.874	206.798	215.867	206.208	205.492	205.193	204.359	202.646	202.799	204.426	204.651		**99.5**
A28	4260	204.881	204.181	204.962	207.233	215.591	204.050	203.544	203.577	202.711	201.040	201.120	202.583	202.943		**98.1**
A29	4284	205.657	205.221	205.982	208.466	214.993	208.724	207.780	207.691	206.836	205.296	205.367	206.744	206.996		**99.8**
A30	4191	198.707	199.041	200.153	202.526	207.028	202.260	198.291	197.624	196.663	195.441	195.366	196.356	196.764		**98.4**
A41	4130	198.151	198.108	199.374	202.830	208.270	205.417	203.888	204.322	204.230	203.074	203.222	203.922	204.455		**102.5**
A42	4127	210.928	210.958	211.757	213.887	216.281	217.178	216.777	216.413	217.141	216.438	215.668	216.425	217.085		**102.6**
A43	4226	204.482	203.592	204.500	206.937	208.803	209.702	208.772	209.258	208.981	207.554	206.689	207.050	207.587		**101.5**
A44	4258	195.374	194.919	195.056	196.352	197.833	197.970	196.890	196.939	196.669	195.241	195.243	195.798	196.340		**99.9**
A45	4182	192.352	191.938	193.543	196.965	199.573	198.683	197.365	197.738	197.063	195.191	195.854	196.545	196.850		**101.5**
ave	**4185**															**100.6**

$T_S = T_{AIR} = 120°C$, $I_F = 0.7A$

$T_S \geq 118C$, $T_{AIR} \geq 115C$ in compliance with LM-80-08

Normalized flux

DATA SET 55: CCT = 4000K, T_J = 130C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4074	1.0000	0.9974	0.9998	1.0113	1.0227	1.0490	1.0408	1.0305	1.0204	1.0224	1.0195	1.0226	1.0239	
A2	4110	1.0000	0.9956	0.9987	1.0143	1.0337	1.0505	1.0290	1.0281	1.0220	1.0226	1.0182	1.0229	1.0245	
A3	4133	1.0000	0.9960	0.9995	1.0122	1.0264	1.0339	1.0175	1.0165	1.0116	1.0080	1.0045	1.0103	1.0118	
A4	4055	1.0000	0.9979	0.9985	1.0103	1.0276	1.0296	1.0190	1.0185	1.0129	1.0094	1.0054	1.0116	1.0145	
A5	4183	1.0000	1.0053	1.0095	1.0256	1.0475	1.0481	1.0376	1.0388	1.0324	1.0302	1.0258	1.0345	1.0353	
A6	4050	1.0000	0.9978	1.0003	1.0170	1.0467	1.0364	1.0324	1.0342	1.0299	1.0276	1.0235	1.0328	1.0353	
A7	4111	1.0000	0.9973	1.0026	1.0195	1.0451	1.0210	1.0163	1.0201	1.0153	1.0098	1.0062	1.0156	1.0158	
A8	4123	1.0000	0.9932	0.9973	1.0157	1.0356	1.0092	1.0035	1.0071	1.0021	0.9973	0.9937	1.0025	1.0032	
A9	4111	1.0000	0.9966	0.9988	1.0201	1.0431	1.0155	1.0112	1.0161	1.0119	1.0098	1.0054	1.0138	1.0134	
A10	4134	1.0000	1.0015	1.0038	1.0205	1.0395	1.0378	1.0267	1.0285	1.0243	1.0252	1.0196	1.0277	1.0271	
A21	4339	1.0000	0.9989	1.0030	1.0145	1.0296	1.0528	1.0393	1.0137	1.0076	1.0048	1.0029	1.0059	1.0070	
A22	4209	1.0000	0.9967	1.0011	1.0209	1.0539	1.0092	0.9983	0.9971	0.9936	0.9905	0.9892	0.9934	0.9964	
A23	4259	1.0000	0.9983	1.0023	1.0165	1.0415	1.0061	0.9958	0.9940	0.9904	0.9870	0.9853	0.9892	0.9910	
A24	4257	1.0000	0.9962	1.0000	1.0184	1.0512	1.0215	1.0152	1.0122	1.0093	1.0052	1.0022	1.0070	1.0076	
A25	4281	1.0000	0.9976	1.0007	1.0098	1.0237	1.0347	1.0073	0.9947	0.9866	0.9828	0.9812	0.9833	0.9875	
A26	4274	1.0000	0.9986	1.0015	1.0120	1.0323	1.0215	1.0018	0.9972	0.9918	0.9855	0.9852	0.9900	0.9912	
A27	4257	1.0000	0.9966	1.0011	1.0154	1.0599	1.0125	1.0090	1.0075	1.0034	0.9950	0.9958	1.0038	1.0049	
A28	4260	1.0000	0.9966	1.0004	1.0115	1.0523	0.9959	0.9935	0.9936	0.9894	0.9813	0.9816	0.9888	0.9905	
A29	4284	1.0000	0.9979	1.0016	1.0137	1.0454	1.0149	1.0103	1.0099	1.0057	0.9982	0.9986	1.0053	1.0065	
A30	4191	1.0000	1.0017	1.0073	1.0192	1.0419	1.0179	0.9979	0.9945	0.9897	0.9836	0.9832	0.9882	0.9902	
A41	4130	1.0000	0.9998	1.0062	1.0236	1.0511	1.0367	1.0290	1.0311	1.0307	1.0248	1.0256	1.0291	1.0318	
A42	4127	1.0000	1.0001	1.0039	1.0140	1.0254	1.0296	1.0277	1.0260	1.0295	1.0261	1.0225	1.0261	1.0292	
A43	4226	1.0000	0.9956	1.0001	1.0120	1.0211	1.0255	1.0210	1.0234	1.0220	1.0150	1.0108	1.0126	1.0152	
A44	4258	1.0000	0.9977	0.9984	1.0050	1.0126	1.0133	1.0078	1.0080	1.0066	0.9993	0.9993	1.0022	1.0049	
A45	4182	1.0000	0.9978	1.0062	1.0240	1.0375	1.0329	1.0261	1.0280	1.0245	1.0148	1.0182	1.0218	1.0234	
ave	**4185**	**1.0000**	**0.9980**	**1.0017**	**1.0159**	**1.0379**	**1.0262**	**1.0166**	**1.0148**	**1.0105**	**1.0063**	**1.0041**	**1.0096**	**1.0113**	

$T_S = T_{AIR} = 120°C$, $I_F = 0.7A$

$T_S \geq 118C$, $T_{AIR} \geq 115C$ in compliance with LM-80-08

TM-21 extrapolation

		CCT (t=0)	alpha	B	r2	L70
DATA SET 55: CCT = 4000K, T_J = 130C	A1	4074	8.0200E-07	1.0286	0.156	479,857
	A2	4110	5.6141E-07	1.0268	0.109	682,380
	A3	4133	8.6994E-07	1.0162	0.165	428,467
	A4	4055	7.8520E-07	1.0172	0.110	475,985
	A5	4183	4.1537E-07	1.0356	0.032	942,933
	A6	4050	-2.7334E-07	1.0287	0.014	-1,408,407
	A7	4111	6.7254E-07	1.0182	0.066	557,158
	A8	4123	6.3185E-07	1.0051	0.062	572,577
	A9	4111	3.4300E-07	1.0140	0.031	1,080,342
	A10	4134	7.7663E-08	1.0259	0.002	4,921,870
	A21	4339	1.1390E-06	1.0145	0.343	325,762
	A22	4209	1.4602E-07	0.9943	0.008	2,403,628
	A23	4259	5.8855E-07	0.9933	0.126	594,567
	A24	4257	9.3171E-07	1.0134	0.261	397,088
	A25	4281	1.3738E-06	0.9948	0.270	255,855
	A26	4274	1.0222E-06	0.9967	0.180	345,747
	A27	4257	3.2867E-07	1.0039	0.014	1,096,948
	A28	4260	4.8809E-07	0.9907	0.032	711,567
	A29	4284	5.0692E-07	1.0073	0.042	718,045
	A30	4191	7.6785E-07	0.9932	0.108	455,591
	A41	4130	1.5883E-08	1.0290	0.000	24,254,796
	A42	4127	-5.7849E-08	1.0262	0.002	-6,612,063
	A43	4226	2.0599E-06	1.0302	0.595	187,582
	A44	4258	8.1549E-07	1.0087	0.170	448,031
	A45	4182	7.7148E-07	1.0269	0.098	496,740
	ave	**4185**	**6.2917E-07**	**1.0136**	**0.099**	**588,316**

$T_S = T_{AIR} = 120°C, I_F = 0.7A$

$T_S \geq 118C, T_{AIR} \geq 115C$ in compliance with LM-80-08

u'

DATA SET 55: CCT = 4000K, T_J = 130C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4074	0.2226	0.2225	0.2225	0.2225	0.2224	0.2223	0.2226	0.2226	0.2226	0.2227	0.2230	0.2232	0.2232	
A2	4110	0.2229	0.2228	0.2229	0.2228	0.2228	0.2225	0.2229	0.2229	0.2230	0.2230	0.2233	0.2235	0.2234	
A3	4133	0.2232	0.2232	0.2233	0.2232	0.2232	0.2229	0.2232	0.2233	0.2234	0.2233	0.2236	0.2237	0.2237	
A4	4055	0.2231	0.2230	0.2232	0.2231	0.2230	0.2229	0.2232	0.2232	0.2234	0.2232	0.2236	0.2237	0.2236	
A5	4183	0.2242	0.2241	0.2242	0.2242	0.2241	0.2240	0.2241	0.2243	0.2243	0.2243	0.2246	0.2247	0.2246	
A6	4050	0.2226	0.2225	0.2226	0.2225	0.2225	0.2224	0.2226	0.2227	0.2228	0.2228	0.2230	0.2231	0.2231	
A7	4111	0.2231	0.2230	0.2231	0.2231	0.2230	0.2229	0.2233	0.2233	0.2234	0.2234	0.2236	0.2237	0.2236	
A8	4123	0.2232	0.2232	0.2232	0.2231	0.2230	0.2230	0.2233	0.2234	0.2234	0.2233	0.2236	0.2237	0.2236	
A9	4111	0.2231	0.2231	0.2231	0.2231	0.2231	0.2229	0.2232	0.2233	0.2233	0.2234	0.2235	0.2237	0.2236	
A10	4134	0.2233	0.2232	0.2232	0.2232	0.2232	0.2231	0.2233	0.2234	0.2234	0.2234	0.2236	0.2238	0.2236	
A21	4339	0.2231	0.2231	0.2232	0.2231	0.2230	0.2229	0.2231	0.2232	0.2232	0.2233	0.2234	0.2236	0.2235	
A22	4209	0.2223	0.2221	0.2222	0.2221	0.2220	0.2219	0.2221	0.2222	0.2223	0.2222	0.2226	0.2228	0.2227	
A23	4259	0.2227	0.2226	0.2227	0.2226	0.2225	0.2224	0.2226	0.2227	0.2227	0.2228	0.2230	0.2231	0.2230	
A24	4257	0.2226	0.2225	0.2226	0.2225	0.2223	0.2222	0.2224	0.2225	0.2225	0.2226	0.2228	0.2229	0.2229	
A25	4281	0.2229	0.2228	0.2229	0.2229	0.2227	0.2226	0.2229	0.2229	0.2229	0.2230	0.2232	0.2233	0.2232	
A26	4274	0.2229	0.2228	0.2229	0.2229	0.2227	0.2226	0.2229	0.2229	0.2229	0.2230	0.2232	0.2233	0.2232	
A27	4257	0.2226	0.2225	0.2226	0.2225	0.2223	0.2223	0.2226	0.2226	0.2227	0.2227	0.2229	0.2230	0.2229	
A28	4260	0.2227	0.2227	0.2227	0.2226	0.2225	0.2225	0.2228	0.2228	0.2229	0.2228	0.2231	0.2232	0.2231	
A29	4284	0.2230	0.2229	0.2230	0.2230	0.2227	0.2228	0.2229	0.2231	0.2231	0.2231	0.2232	0.2233	0.2232	
A30	4191	0.2226	0.2225	0.2226	0.2226	0.2224	0.2225	0.2228	0.2229	0.2228	0.2228	0.2231	0.2231	0.2230	
A41	4130	0.2225	0.2224	0.2225	0.2224	0.2222	0.2221	0.2223	0.2223	0.2224	0.2225	0.2228	0.2229	0.2228	
A42	4127	0.2222	0.2222	0.2222	0.2222	0.2220	0.2220	0.2222	0.2223	0.2223	0.2223	0.2226	0.2227	0.2227	
A43	4226	0.2232	0.2232	0.2232	0.2231	0.2230	0.2230	0.2232	0.2232	0.2233	0.2233	0.2236	0.2237	0.2236	
A44	4258	0.2234	0.2233	0.2234	0.2234	0.2232	0.2232	0.2233	0.2235	0.2235	0.2235	0.2237	0.2238	0.2237	
A45	4182	0.2230	0.2229	0.2230	0.2229	0.2227	0.2227	0.2229	0.2230	0.2230	0.2230	0.2233	0.2234	0.2233	
ave	**4185**														

$T_S = T_{AIR} = 120°C, I_F = 0.7A$

$T_S \geq 118C, T_{AIR} \geq 115C$ in compliance with LM-80-08

v'

DATA SET 55: CCT = 4000K, T_J = 130C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4074	0.5029	0.5029	0.5029	0.5027	0.5030	0.5039	0.5042	0.5045	0.5046	0.5054	0.5069	0.5072	0.5076	
A2	4110	0.5001	0.5001	0.5002	0.4999	0.5003	0.5015	0.5019	0.5019	0.5024	0.5033	0.5047	0.5056	0.5060	
A3	4133	0.4983	0.4983	0.4984	0.4980	0.4985	0.5000	0.5002	0.5003	0.5011	0.5019	0.5033	0.5044	0.5048	
A4	4055	0.5028	0.5029	0.5032	0.5030	0.5034	0.5047	0.5049	0.5048	0.5058	0.5064	0.5077	0.5087	0.5089	
A5	4183	0.4938	0.4938	0.4945	0.4941	0.4948	0.4962	0.4963	0.4961	0.4970	0.4977	0.4992	0.5002	0.5006	
A6	4050	0.5041	0.5040	0.5047	0.5043	0.5049	0.5062	0.5066	0.5063	0.5074	0.5080	0.5091	0.5100	0.5102	
A7	4111	0.4996	0.4997	0.5006	0.5002	0.5011	0.5025	0.5034	0.5032	0.5046	0.5049	0.5061	0.5072	0.5076	
A8	4123	0.4989	0.4990	0.4994	0.4989	0.4999	0.5014	0.5023	0.5021	0.5036	0.5038	0.5052	0.5065	0.5069	
A9	4111	0.4997	0.4996	0.4999	0.4994	0.5000	0.5018	0.5021	0.5022	0.5035	0.5041	0.5053	0.5065	0.5069	
A10	4134	0.4982	0.4980	0.4981	0.4978	0.4983	0.4994	0.4997	0.4998	0.5003	0.5012	0.5028	0.5037	0.5041	
A21	4339	0.4887	0.4889	0.4897	0.4894	0.4895	0.4905	0.4908	0.4908	0.4908	0.4914	0.4931	0.4938	0.4941	
A22	4209	0.4964	0.4964	0.4969	0.4966	0.4970	0.4980	0.4980	0.4979	0.4982	0.4990	0.5007	0.5015	0.5018	
A23	4259	0.4931	0.4932	0.4936	0.4933	0.4937	0.4951	0.4951	0.4951	0.4959	0.4967	0.4983	0.4993	0.4997	
A24	4257	0.4935	0.4934	0.4937	0.4932	0.4938	0.4951	0.4952	0.4952	0.4960	0.4969	0.4984	0.4994	0.4997	
A25	4281	0.4918	0.4917	0.4921	0.4917	0.4921	0.4933	0.4934	0.4933	0.4936	0.4945	0.4962	0.4971	0.4974	
A26	4274	0.4920	0.4919	0.4921	0.4917	0.4922	0.4933	0.4933	0.4933	0.4938	0.4949	0.4965	0.4974	0.4978	
A27	4257	0.4934	0.4934	0.4936	0.4931	0.4938	0.4952	0.4957	0.4957	0.4970	0.4977	0.4991	0.5005	0.5008	
A28	4260	0.4930	0.4930	0.4932	0.4928	0.4935	0.4950	0.4957	0.4956	0.4971	0.4977	0.4991	0.5004	0.5008	
A29	4284	0.4913	0.4913	0.4915	0.4909	0.4916	0.4932	0.4934	0.4934	0.4947	0.4954	0.4969	0.4981	0.4985	
A30	4191	0.4967	0.4966	0.4969	0.4967	0.4971	0.4982	0.4981	0.4981	0.4983	0.4992	0.5008	0.5017	0.5019	
A41	4130	0.5000	0.4999	0.5002	0.5000	0.5004	0.5020	0.5021	0.5020	0.5020	0.5028	0.5043	0.5047	0.5051	
A42	4127	0.5006	0.5004	0.5008	0.5007	0.5013	0.5022	0.5022	0.5023	0.5024	0.5032	0.5048	0.5054	0.5058	
A43	4226	0.4937	0.4937	0.4943	0.4943	0.4950	0.4957	0.4957	0.4958	0.4963	0.4973	0.4988	0.4997	0.5001	
A44	4258	0.4918	0.4916	0.4921	0.4921	0.4929	0.4938	0.4938	0.4938	0.4941	0.4953	0.4967	0.4978	0.4981	
A45	4182	0.4963	0.4961	0.4964	0.4963	0.4971	0.4978	0.4977	0.4978	0.4980	0.4989	0.5005	0.5012	0.5015	
ave	**4185**														

$T_S = T_{AIR} = 120°C$, $I_F = 0.7A$

$T_S \geq 118C$, $T_{AIR} \geq 115C$ in compliance with LM-80-08

DATA SET 55: CCT = 4000K, T_J = 130C

delta u' v'

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4074	0.0000	0.0001	0.0001	0.0002	0.0002	0.0010	0.0013	0.0016	0.0017	0.0025	0.0040	0.0043	0.0047	
A2	4110	0.0000	0.0001	0.0001	0.0002	0.0002	0.0015	0.0018	0.0018	0.0023	0.0032	0.0046	0.0055	0.0059	
A3	4133	0.0000	0.0000	0.0001	0.0003	0.0002	0.0017	0.0019	0.0020	0.0028	0.0036	0.0050	0.0061	0.0065	
A4	4055	0.0000	0.0001	0.0004	0.0002	0.0006	0.0019	0.0021	0.0020	0.0030	0.0036	0.0049	0.0059	0.0061	
A5	4183	0.0000	0.0001	0.0007	0.0003	0.0010	0.0024	0.0025	0.0023	0.0032	0.0039	0.0054	0.0064	0.0068	
A6	4050	0.0000	0.0001	0.0006	0.0002	0.0008	0.0021	0.0025	0.0022	0.0033	0.0039	0.0050	0.0059	0.0061	
A7	4111	0.0000	0.0001	0.0010	0.0006	0.0015	0.0029	0.0038	0.0036	0.0050	0.0053	0.0065	0.0076	0.0080	
A8	4123	0.0000	0.0001	0.0005	0.0001	0.0010	0.0025	0.0034	0.0032	0.0047	0.0049	0.0063	0.0076	0.0080	
A9	4111	0.0000	0.0001	0.0002	0.0003	0.0003	0.0021	0.0024	0.0025	0.0038	0.0044	0.0056	0.0068	0.0072	
A10	4134	0.0000	0.0002	0.0001	0.0004	0.0001	0.0012	0.0015	0.0016	0.0021	0.0030	0.0046	0.0055	0.0059	
A21	4339	0.0000	0.0002	0.0010	0.0007	0.0008	0.0018	0.0021	0.0021	0.0021	0.0027	0.0044	0.0051	0.0054	
A22	4209	0.0000	0.0002	0.0005	0.0003	0.0007	0.0016	0.0016	0.0015	0.0018	0.0026	0.0043	0.0051	0.0054	
A23	4259	0.0000	0.0001	0.0005	0.0002	0.0006	0.0020	0.0020	0.0020	0.0028	0.0036	0.0052	0.0062	0.0066	
A24	4257	0.0000	0.0001	0.0002	0.0003	0.0004	0.0016	0.0017	0.0017	0.0025	0.0034	0.0049	0.0059	0.0062	
A25	4281	0.0000	0.0001	0.0003	0.0001	0.0004	0.0015	0.0016	0.0015	0.0018	0.0027	0.0044	0.0053	0.0056	
A26	4274	0.0000	0.0001	0.0001	0.0003	0.0003	0.0013	0.0013	0.0013	0.0018	0.0029	0.0045	0.0054	0.0058	
A27	4257	0.0000	0.0001	0.0002	0.0003	0.0005	0.0018	0.0023	0.0023	0.0036	0.0043	0.0057	0.0071	0.0074	
A28	4260	0.0000	0.0000	0.0002	0.0002	0.0005	0.0020	0.0027	0.0026	0.0041	0.0047	0.0061	0.0074	0.0078	
A29	4284	0.0000	0.0001	0.0002	0.0004	0.0004	0.0019	0.0021	0.0021	0.0034	0.0041	0.0056	0.0068	0.0072	
A30	4191	0.0000	0.0001	0.0002	0.0000	0.0004	0.0015	0.0014	0.0014	0.0016	0.0025	0.0041	0.0050	0.0052	
A41	4130	0.0000	0.0001	0.0002	0.0001	0.0005	0.0020	0.0021	0.0020	0.0020	0.0028	0.0043	0.0047	0.0051	
A42	4127	0.0000	0.0002	0.0002	0.0001	0.0007	0.0016	0.0016	0.0017	0.0018	0.0026	0.0042	0.0048	0.0052	
A43	4226	0.0000	0.0000	0.0006	0.0006	0.0013	0.0020	0.0020	0.0021	0.0026	0.0036	0.0051	0.0060	0.0064	
A44	4258	0.0000	0.0002	0.0003	0.0003	0.0011	0.0020	0.0020	0.0020	0.0023	0.0035	0.0049	0.0060	0.0063	
A45	4182	0.0000	0.0002	0.0001	0.0001	0.0009	0.0015	0.0014	0.0015	0.0017	0.0026	0.0042	0.0049	0.0052	
ave	**4185**	**0.0000**	**0.0001**	**0.0003**	**0.0003**	**0.0006**	**0.0018**	**0.0020**	**0.0020**	**0.0027**	**0.0035**	**0.0050**	**0.0059**	**0.0063**	

$T_S = T_{AIR} = 120°C$, $I_F = 0.7A$

$T_S \geq 118C$, $T_{AIR} \geq 115C$ in compliance with LM-80-08

DATA SET 55: CCT = 4000K, T_J = 130C

Forward voltage

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4074	2.998	2.997	2.998	3.002	3.011	3.059	3.113	3.147	3.169	3.177	3.189	3.213	3.227	
A2	4110	2.984	2.981	2.984	2.991	3.013	3.141	3.182	3.200	3.214	3.225	3.235	3.257	3.266	
A3	4133	2.992	2.989	2.990	2.995	3.015	3.126	3.152	3.163	3.177	3.182	3.193	3.207	3.214	
A4	4055	2.976	2.974	2.974	2.980	3.005	3.140	3.163	3.167	3.175	3.179	3.188	3.199	3.204	
A5	4183	2.929	2.928	2.926	2.934	2.961	3.102	3.124	3.124	3.125	3.128	3.138	3.147	3.152	
A6	4050	3.001	2.998	3.001	3.011	3.086	3.245	3.264	3.265	3.273	3.280	3.287	3.297	3.301	
A7	4111	2.998	2.995	3.000	3.014	3.140	3.228	3.248	3.254	3.266	3.272	3.279	3.285	3.291	
A8	4123	2.985	2.983	2.988	3.005	3.115	3.179	3.189	3.202	3.214	3.222	3.230	3.237	3.242	
A9	4111	2.990	2.990	2.992	3.003	3.092	3.186	3.201	3.215	3.228	3.236	3.246	3.256	3.269	
A10	4134	2.974	2.971	2.973	2.984	3.012	3.109	3.134	3.145	3.162	3.168	3.181	3.189	3.201	
A21	4339	3.022	3.019	3.019	3.023	3.029	3.084	3.160	3.189	3.198	3.204	3.210	3.217	3.219	
A22	4209	2.998	2.995	2.998	3.007	3.073	3.316	3.347	3.368	3.388	3.405	3.420	3.438	3.445	
A23	4259	2.990	2.987	2.986	2.994	3.043	3.291	3.316	3.332	3.346	3.357	3.368	3.378	3.380	
A24	4257	3.021	3.018	3.021	3.031	3.107	3.394	3.423	3.444	3.463	3.475	3.489	3.500	3.501	
A25	4281	3.031	3.028	3.026	3.029	3.048	3.139	3.183	3.195	3.203	3.208	3.212	3.219	3.225	
A26	4274	3.028	3.025	3.024	3.028	3.057	3.185	3.206	3.210	3.214	3.219	3.229	3.236	3.237	
A27	4257	3.028	3.023	3.025	3.043	3.245	3.482	3.509	3.521	3.538	3.547	3.559	3.560	3.563	
A28	4260	3.016	3.013	3.010	3.020	3.164	3.395	3.415	3.420	3.438	3.448	3.466	3.471	3.480	
A29	4284	3.048	3.049	3.050	3.056	3.142	3.425	3.448	3.454	3.469	3.480	3.491	3.493	3.502	
A30	4191	3.037	3.026	3.022	3.033	3.080	3.244	3.265	3.271	3.283	3.292	3.303	3.312	3.316	
A41	4130	3.057	3.054	3.058	3.075	3.142	3.292	3.317	3.336	3.353	3.369	3.381	3.395	3.400	
A42	4127	3.227	3.218	3.208	3.215	3.233	3.258	3.281	3.292	3.303	3.310	3.319	3.327	3.331	
A43	4226	3.307	3.278	3.258	3.269	3.308	3.349	3.365	3.381	3.392	3.399	3.407	3.411	3.414	
A44	4258	3.167	3.156	3.145	3.148	3.172	3.201	3.220	3.231	3.243	3.252	3.262	3.270	3.272	
A45	4182	3.090	3.088	3.090	3.119	3.185	3.241	3.261	3.275	3.283	3.293	3.301	3.315	3.313	
ave	**4185**	**3.036**													

$T_S = T_{AIR} = 55°C$, $I_F = 1A$

$T_S \geq 53C$, $T_{AIR} \geq 50C$ in compliance with LM-80-08

Lumen Data

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	Lumen Maintenance % at 6khours
DATA SET 61: CCT =4000K, T_J = 71C	A1	4296	256.033	254.980	254.163	260.834	259.691	260.336	260.339	260.011	259.053	257.940	257.428	258.160	258.213		**100.7**
	A2	4273	254.557	254.106	253.592	259.548	256.681	258.243	259.682	259.268	258.104	257.583	256.564	257.369	257.039		**101.2**
	A3	4293	257.882	256.830	256.116	261.668	261.422	261.571	262.531	261.602	260.507	260.369	258.985	259.647	259.595		**101.0**
	A4	4272	257.048	255.972	255.603	262.783	262.670	262.358	263.509	262.758	260.397	261.740	260.536	261.253	260.701		**101.8**
	A5	4252	253.168	251.193	252.166	257.893	258.012	258.164	258.791	258.265	257.096	257.099	256.006	256.634	256.308		**101.6**
	A6	4305	255.893	255.334	254.811	260.608	260.263	261.250	261.033	260.549	258.824	259.330	257.891	258.735	258.167		**101.3**
	A7	4312	258.390	257.798	256.995	262.745	262.757	262.263	262.944	262.627	260.336	261.605	260.253	261.100	260.562		**101.2**
	A8	4284	258.499	257.524	257.133	262.886	262.958	265.751	263.393	262.996	260.739	261.903	260.545	261.460	260.835		**101.3**
	A9	4188	246.366	245.781	245.517	254.193	251.518	251.629	252.060	251.482	250.190	250.806	249.219	250.007	249.958		**101.8**
	A10	4323	257.089	256.626	256.237	260.796	260.912	261.108	261.445	260.796	259.526	259.901	258.084	259.139	258.902		**101.1**
	A21	4164	252.093	251.038	250.056	255.148	254.782	254.473	254.508	254.425	253.233	253.004	251.977	252.231	251.893		**100.4**
	A22	4261	254.487	253.188	252.277	257.029	257.366	256.570	256.821	256.488	255.407	255.360	254.221	254.387	254.339		**100.3**
	A23	4340	256.441	254.935	254.066	258.639	259.217	258.457	258.206	258.040	256.855	256.178	255.184	255.933	255.409		**99.9**
	A24	4250	257.592	256.360	255.000	260.479	260.840	260.787	260.373	259.537	258.820	258.707	257.599	258.067	256.080		**100.4**
	A25	4276	260.719	259.338	258.508	262.613	263.067	262.164	261.787	261.351	259.932	259.937	258.614	259.264	258.690		**99.7**
	A26	4336	245.317	244.422	243.920	248.914	248.990	248.637	248.456	248.292	247.236	247.099	245.732	245.333	246.029		**100.7**
	A27	4437	260.546	259.274	258.569	263.805	264.151	263.450	263.129	263.133	261.336	261.504	260.092	260.055	260.553		**100.4**
	A28	4272	261.425	259.836	259.348	264.394	264.723	264.295	264.177	264.029	262.845	262.662	261.353	261.581	261.929		**100.5**
	A29	4298	258.699	257.222	256.635	261.834	262.107	261.343	261.435	261.198	260.321	260.153	259.093	259.727	259.629		**100.6**
	A30	4336	260.347	258.806	258.154	263.366	264.067	263.366	263.413	263.108	261.918	262.154	261.091	261.264	261.459		**100.7**
	A41	4323	239.207	237.507	234.855	238.879	238.191	236.990	236.911	236.326	235.082	234.446	233.073	233.163	233.582		**98.0**
	A42	4344	243.669	240.076	236.192	241.057	240.250	239.723	239.322	239.050	238.096	237.783	236.364	236.825	236.573		**97.6**
	A43	4360	239.387	237.530	234.876	239.417	239.241	238.422	237.643	237.013	236.086	235.472	233.787	234.544	234.104		**98.4**
	A44	4448	248.479	245.860	242.972	246.230	246.045	245.278	244.921	244.570	243.528	242.950	241.430	242.394	242.238		**97.8**
	A45	4327	251.141	249.721	249.342	254.157	254.716	254.079	253.957	253.703	252.847	252.009	250.962	251.794	251.491		**100.3**
	ave	**4303**															**100.3**

$T_S = T_{AIR} = 55°C$, $I_F = 1A$

$T_S \geq 53C$, $T_{AIR} \geq 50C$ in compliance with LM-80-08

Normalized flux

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 61: CCT =4000K, T_J = 71C	A1	4296	1.0000	0.9959	0.9927	1.0188	1.0143	1.0168	1.0168	1.0155	1.0118	1.0075	1.0054	1.0083	1.0085	
	A2	4273	1.0000	0.9982	0.9962	1.0196	1.0083	1.0145	1.0201	1.0185	1.0139	1.0119	1.0079	1.0110	1.0098	
	A3	4293	1.0000	0.9959	0.9931	1.0147	1.0137	1.0143	1.0180	1.0144	1.0102	1.0096	1.0043	1.0068	1.0066	
	A4	4272	1.0000	0.9958	0.9944	1.0223	1.0219	1.0207	1.0251	1.0222	1.0130	1.0183	1.0136	1.0164	1.0142	
	A5	4252	1.0000	0.9922	0.9960	1.0187	1.0191	1.0197	1.0222	1.0201	1.0155	1.0155	1.0112	1.0137	1.0124	
	A6	4305	1.0000	0.9978	0.9958	1.0184	1.0171	1.0209	1.0201	1.0182	1.0115	1.0134	1.0078	1.0111	1.0089	
	A7	4312	1.0000	0.9977	0.9946	1.0169	1.0169	1.0150	1.0176	1.0164	1.0075	1.0124	1.0072	1.0105	1.0084	
	A8	4284	1.0000	0.9962	0.9947	1.0170	1.0173	1.0281	1.0189	1.0174	1.0087	1.0132	1.0079	1.0115	1.0090	
	A9	4188	1.0000	0.9976	0.9966	1.0318	1.0209	1.0214	1.0231	1.0208	1.0155	1.0180	1.0116	1.0148	1.0146	
	A10	4323	1.0000	0.9982	0.9967	1.0144	1.0149	1.0156	1.0169	1.0144	1.0095	1.0109	1.0039	1.0080	1.0071	
	A21	4164	1.0000	0.9958	0.9919	1.0121	1.0107	1.0094	1.0096	1.0093	1.0045	1.0036	0.9995	1.0006	0.9992	
	A22	4261	1.0000	0.9949	0.9913	1.0100	1.0113	1.0082	1.0092	1.0079	1.0036	1.0034	0.9990	0.9996	0.9994	
	A23	4340	1.0000	0.9941	0.9907	1.0086	1.0108	1.0079	1.0069	1.0062	1.0016	0.9990	0.9951	0.9980	0.9960	
	A24	4250	1.0000	0.9952	0.9899	1.0112	1.0126	1.0124	1.0108	1.0076	1.0048	1.0043	1.0000	1.0018	0.9941	
	A25	4276	1.0000	0.9947	0.9915	1.0073	1.0090	1.0055	1.0041	1.0024	0.9970	0.9970	0.9919	0.9944	0.9922	
	A26	4336	1.0000	0.9964	0.9943	1.0147	1.0150	1.0135	1.0128	1.0121	1.0078	1.0073	1.0017	1.0001	1.0029	
	A27	4437	1.0000	0.9951	0.9924	1.0125	1.0138	1.0111	1.0099	1.0099	1.0030	1.0037	0.9983	0.9981	1.0000	
	A28	4272	1.0000	0.9939	0.9921	1.0114	1.0126	1.0110	1.0105	1.0100	1.0054	1.0047	0.9997	1.0006	1.0019	
	A29	4298	1.0000	0.9943	0.9920	1.0121	1.0132	1.0102	1.0106	1.0097	1.0063	1.0056	1.0015	1.0040	1.0036	
	A30	4336	1.0000	0.9941	0.9916	1.0116	1.0143	1.0116	1.0118	1.0106	1.0060	1.0069	1.0029	1.0035	1.0043	
	A41	4323	1.0000	0.9929	0.9818	0.9986	0.9958	0.9907	0.9904	0.9880	0.9828	0.9801	0.9744	0.9747	0.9765	
	A42	4344	1.0000	0.9853	0.9693	0.9893	0.9860	0.9838	0.9822	0.9810	0.9771	0.9758	0.9700	0.9719	0.9709	
	A43	4360	1.0000	0.9922	0.9812	1.0001	0.9994	0.9960	0.9927	0.9901	0.9862	0.9836	0.9766	0.9798	0.9779	
	A44	4448	1.0000	0.9895	0.9778	0.9909	0.9902	0.9871	0.9857	0.9843	0.9801	0.9777	0.9716	0.9755	0.9749	
	A45	4327	1.0000	0.9943	0.9928	1.0120	1.0142	1.0117	1.0112	1.0102	1.0068	1.0035	0.9993	1.0026	1.0014	
	ave	**4303**	**1.0000**	**0.9947**	**0.9909**	**1.0118**	**1.0109**	**1.0103**	**1.0103**	**1.0087**	**1.0036**	**1.0035**	**0.9985**	**1.0007**	**0.9998**	

$T_S = T_{AIR} = 55°C$, $I_F = 1A$

$T_S \geq 53C$, $T_{AIR} \geq 50C$ in compliance with LM-80-08

TM-21 extrapolation

		CCT (t=0)	alpha	B	r2	
DATA SET 61: CCT =4000K, T_J = 71C	A1	4296	1.3440E-06	1.0184	0.499	278,922
	A2	4273	1.5911E-06	1.0227	0.661	238,266
	A3	4293	1.5362E-06	1.0188	0.667	244,292
	A4	4272	9.7376E-07	1.0227	0.280	389,355
	A5	4252	1.3627E-06	1.0238	0.679	278,985
	A6	4305	1.5000E-06	1.0217	0.589	252,111
	A7	4312	1.0247E-06	1.0172	0.301	364,680
	A8	4284	1.0908E-06	1.0185	0.332	343,772
	A9	4188	1.1126E-06	1.0232	0.448	341,241
	A10	4323	1.3697E-06	1.0180	0.518	273,411
	A21	4164	1.8846E-06	1.0151	0.849	197,234
	A22	4261	1.6726E-06	1.0131	0.814	221,032
	A23	4340	1.8834E-06	1.0116	0.741	195,508
	A24	4250	2.2882E-06	1.0171	0.837	163,295
	A25	4276	1.8288E-06	1.0077	0.760	199,243
	A26	4336	2.1284E-06	1.0193	0.779	176,562
	A27	4437	1.9835E-06	1.0152	0.697	187,410
	A28	4272	1.6965E-06	1.0149	0.708	218,926
	A29	4298	1.1735E-06	1.0128	0.629	314,782
	A30	4336	1.2292E-06	1.0138	0.660	301,301
	A41	4323	2.5387E-06	0.9957	0.771	138,790
	A42	4344	2.1176E-06	0.9880	0.817	162,714
	A43	4360	2.5309E-06	0.9987	0.800	140,398
	A44	4448	1.9480E-06	0.9898	0.651	177,832
	A45	4327	1.7275E-06	1.0153	0.680	215,254
	ave	**4303**	**1.6575E-06**	**1.0133**	**0.721**	**223,162**

$T_S = T_{AIR} = 55°C, I_F = 1A$

$T_S \geq 53C, T_{AIR} \geq 50C$ in compliance with LM-80-08

u'

DATA SET 61: CCT =4000K, T_J = 71C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4296	0.2224	0.2222	0.2223	0.2222	0.2221	0.2220	0.2221	0.2221	0.2221	0.2221	0.2222	0.2222	0.2222	
A2	4273	0.2224	0.2222	0.2222	0.2221	0.2221	0.2220	0.2220	0.2220	0.2221	0.2220	0.2221	0.2221	0.2221	
A3	4293	0.2223	0.2221	0.2222	0.2220	0.2220	0.2219	0.2219	0.2220	0.2220	0.2220	0.2221	0.2221	0.2221	
A4	4272	0.2219	0.2218	0.2219	0.2217	0.2216	0.2216	0.2216	0.2216	0.2219	0.2216	0.2217	0.2217	0.2218	
A5	4252	0.2218	0.2217	0.2217	0.2216	0.2216	0.2215	0.2215	0.2215	0.2216	0.2216	0.2216	0.2217	0.2217	
A6	4305	0.2222	0.2220	0.2220	0.2219	0.2219	0.2218	0.2218	0.2219	0.2219	0.2219	0.2220	0.2221	0.2221	
A7	4312	0.2222	0.2220	0.2221	0.2220	0.2219	0.2219	0.2219	0.2220	0.2221	0.2220	0.2221	0.2222	0.2221	
A8	4284	0.2220	0.2219	0.2220	0.2219	0.2218	0.2218	0.2218	0.2219	0.2220	0.2219	0.2220	0.2221	0.2221	
A9	4188	0.2216	0.2215	0.2216	0.2214	0.2214	0.2213	0.2214	0.2215	0.2215	0.2215	0.2216	0.2216	0.2216	
A10	4323	0.2224	0.2222	0.2222	0.2222	0.2221	0.2221	0.2221	0.2222	0.2223	0.2223	0.2224	0.2224	0.2224	
A21	4164	0.2215	0.2212	0.2213	0.2212	0.2212	0.2212	0.2212	0.2212	0.2212	0.2212	0.2212	0.2214	0.2213	
A22	4261	0.2217	0.2215	0.2216	0.2215	0.2214	0.2214	0.2214	0.2215	0.2215	0.2214	0.2215	0.2216	0.2216	
A23	4340	0.2221	0.2219	0.2220	0.2219	0.2219	0.2219	0.2218	0.2219	0.2220	0.2220	0.2220	0.2220	0.2220	
A24	4250	0.2215	0.2213	0.2214	0.2213	0.2213	0.2211	0.2213	0.2213	0.2214	0.2213	0.2214	0.2214	0.2214	
A25	4276	0.2217	0.2215	0.2216	0.2215	0.2214	0.2214	0.2214	0.2215	0.2216	0.2215	0.2216	0.2216	0.2216	
A26	4336	0.2222	0.2220	0.2221	0.2219	0.2219	0.2219	0.2220	0.2220	0.2222	0.2221	0.2221	0.2222	0.2222	
A27	4437	0.2224	0.2223	0.2223	0.2222	0.2222	0.2222	0.2223	0.2223	0.2224	0.2224	0.2224	0.2225	0.2225	
A28	4272	0.2217	0.2215	0.2216	0.2215	0.2215	0.2214	0.2216	0.2216	0.2216	0.2216	0.2217	0.2217	0.2217	
A29	4298	0.2219	0.2217	0.2217	0.2216	0.2217	0.2216	0.2218	0.2218	0.2219	0.2219	0.2219	0.2220	0.2220	
A30	4336	0.2222	0.2220	0.2220	0.2220	0.2220	0.2219	0.2221	0.2222	0.2223	0.2222	0.2223	0.2223	0.2223	
A41	4323	0.2228	0.2227	0.2227	0.2226	0.2226	0.2226	0.2226	0.2226	0.2227	0.2226	0.2226	0.2228	0.2227	
A42	4344	0.2228	0.2226	0.2227	0.2226	0.2226	0.2226	0.2226	0.2227	0.2227	0.2227	0.2228	0.2228	0.2228	
A43	4360	0.2229	0.2227	0.2229	0.2228	0.2228	0.2227	0.2227	0.2228	0.2229	0.2229	0.2230	0.2229	0.2229	
A44	4448	0.2227	0.2226	0.2226	0.2226	0.2226	0.2226	0.2226	0.2227	0.2227	0.2226	0.2228	0.2227	0.2228	
A45	4327	0.2223	0.2221	0.2221	0.2220	0.2220	0.2219	0.2221	0.2221	0.2222	0.2221	0.2222	0.2222	0.2223	
ave	**4303**														

$T_S = T_{AIR} = 55°C, I_F = 1A$

$T_S \geq 53C, T_{AIR} \geq 50C$ in compliance with LM-80-08

v'

DATA SET 61: CCT =4000K, T_J = 71C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4296	0.4920	0.4918	0.4915	0.4911	0.4907	0.4908	0.4909	0.4910	0.4910	0.4909	0.4908	0.4909	0.4911	
A2	4273	0.4932	0.4929	0.4926	0.4922	0.4921	0.4920	0.4921	0.4923	0.4922	0.4921	0.4920	0.4920	0.4922	
A3	4293	0.4924	0.4922	0.4918	0.4916	0.4914	0.4913	0.4913	0.4915	0.4915	0.4914	0.4912	0.4913	0.4915	
A4	4272	0.4940	0.4938	0.4935	0.4931	0.4929	0.4928	0.4927	0.4930	0.4929	0.4928	0.4927	0.4928	0.4929	
A5	4252	0.4952	0.4949	0.4947	0.4945	0.4943	0.4941	0.4941	0.4944	0.4943	0.4942	0.4942	0.4942	0.4944	
A6	4305	0.4921	0.4918	0.4915	0.4913	0.4912	0.4909	0.4910	0.4912	0.4911	0.4911	0.4910	0.4911	0.4912	
A7	4312	0.4917	0.4915	0.4912	0.4910	0.4908	0.4906	0.4908	0.4909	0.4909	0.4908	0.4906	0.4908	0.4908	
A8	4284	0.4932	0.4930	0.4926	0.4925	0.4922	0.4923	0.4923	0.4924	0.4923	0.4923	0.4921	0.4922	0.4923	
A9	4188	0.4987	0.4984	0.4982	0.4981	0.4978	0.4977	0.4978	0.4978	0.4978	0.4978	0.4977	0.4978	0.4978	
A10	4323	0.4909	0.4906	0.4903	0.4901	0.4899	0.4899	0.4898	0.4900	0.4899	0.4898	0.4897	0.4898	0.4899	
A21	4164	0.5003	0.5002	0.4999	0.4998	0.4995	0.4993	0.4995	0.4995	0.4995	0.4992	0.4993	0.4993	0.4996	
A22	4261	0.4951	0.4949	0.4946	0.4944	0.4941	0.4941	0.4942	0.4944	0.4943	0.4940	0.4940	0.4941	0.4943	
A23	4340	0.4906	0.4904	0.4900	0.4899	0.4896	0.4896	0.4898	0.4900	0.4898	0.4896	0.4895	0.4895	0.4897	
A24	4250	0.4960	0.4956	0.4956	0.4953	0.4950	0.4948	0.4952	0.4953	0.4951	0.4949	0.4948	0.4948	0.4950	
A25	4276	0.4943	0.4941	0.4937	0.4936	0.4933	0.4932	0.4935	0.4936	0.4935	0.4934	0.4932	0.4932	0.4934	
A26	4336	0.4906	0.4904	0.4901	0.4898	0.4895	0.4894	0.4897	0.4899	0.4899	0.4896	0.4895	0.4895	0.4897	
A27	4437	0.4860	0.4856	0.4853	0.4850	0.4847	0.4850	0.4854	0.4856	0.4854	0.4851	0.4849	0.4849	0.4852	
A28	4272	0.4945	0.4943	0.4939	0.4938	0.4936	0.4939	0.4942	0.4944	0.4943	0.4941	0.4940	0.4940	0.4943	
A29	4298	0.4930	0.4927	0.4925	0.4924	0.4921	0.4927	0.4929	0.4932	0.4932	0.4930	0.4929	0.4930	0.4933	
A30	4336	0.4907	0.4903	0.4900	0.4899	0.4897	0.4901	0.4905	0.4908	0.4906	0.4905	0.4904	0.4905	0.4907	
A41	4323	0.4900	0.4897	0.4896	0.4894	0.4893	0.4895	0.4897	0.4899	0.4897	0.4896	0.4895	0.4894	0.4897	
A42	4344	0.4891	0.4892	0.4892	0.4890	0.4888	0.4890	0.4892	0.4893	0.4892	0.4890	0.4887	0.4889	0.4890	
A43	4360	0.4882	0.4880	0.4879	0.4878	0.4876	0.4880	0.4882	0.4885	0.4884	0.4881	0.4880	0.4879	0.4883	
A44	4448	0.4851	0.4848	0.4848	0.4850	0.4849	0.4852	0.4855	0.4857	0.4856	0.4853	0.4853	0.4851	0.4854	
A45	4327	0.4908	0.4905	0.4903	0.4902	0.4901	0.4902	0.4906	0.4909	0.4908	0.4905	0.4906	0.4904	0.4906	
ave	**4303**														

$T_S = T_{AIR} = 55°C, I_F = 1A$

$T_S \geq 53C, T_{AIR} \geq 50C$ in compliance with LM-80-08

DATA SET 61: CCT =4000K, T_J = 71C

delta u' v'

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4296	0.0000	0.0003	0.0005	0.0009	0.0013	0.0013	0.0011	0.0010	0.0010	0.0011	0.0012	0.0011	0.0009	
A2	4273	0.0000	0.0004	0.0006	0.0010	0.0011	0.0013	0.0012	0.0010	0.0010	0.0012	0.0012	0.0012	0.0010	
A3	4293	0.0000	0.0003	0.0006	0.0009	0.0010	0.0012	0.0012	0.0009	0.0009	0.0010	0.0012	0.0011	0.0009	
A4	4272	0.0000	0.0002	0.0005	0.0009	0.0011	0.0012	0.0013	0.0010	0.0011	0.0012	0.0013	0.0012	0.0011	
A5	4252	0.0000	0.0003	0.0005	0.0007	0.0009	0.0011	0.0011	0.0009	0.0009	0.0010	0.0010	0.0010	0.0008	
A6	4305	0.0000	0.0004	0.0006	0.0009	0.0009	0.0013	0.0012	0.0009	0.0010	0.0010	0.0011	0.0010	0.0009	
A7	4312	0.0000	0.0003	0.0005	0.0007	0.0009	0.0011	0.0009	0.0008	0.0008	0.0009	0.0011	0.0009	0.0009	
A8	4284	0.0000	0.0002	0.0006	0.0007	0.0010	0.0009	0.0009	0.0008	0.0009	0.0009	0.0011	0.0010	0.0009	
A9	4188	0.0000	0.0003	0.0005	0.0006	0.0009	0.0010	0.0009	0.0009	0.0009	0.0009	0.0010	0.0009	0.0009	
A10	4323	0.0000	0.0004	0.0006	0.0008	0.0010	0.0010	0.0011	0.0009	0.0010	0.0011	0.0012	0.0011	0.0010	
A21	4164	0.0000	0.0003	0.0004	0.0006	0.0009	0.0010	0.0009	0.0009	0.0009	0.0011	0.0010	0.0010	0.0007	
A22	4261	0.0000	0.0003	0.0005	0.0007	0.0010	0.0010	0.0009	0.0007	0.0008	0.0011	0.0011	0.0010	0.0008	
A23	4340	0.0000	0.0003	0.0006	0.0007	0.0010	0.0010	0.0009	0.0006	0.0008	0.0010	0.0011	0.0011	0.0009	
A24	4250	0.0000	0.0004	0.0004	0.0007	0.0010	0.0013	0.0008	0.0007	0.0009	0.0011	0.0012	0.0012	0.0010	
A25	4276	0.0000	0.0003	0.0006	0.0007	0.0010	0.0011	0.0009	0.0007	0.0008	0.0009	0.0011	0.0011	0.0009	
A26	4336	0.0000	0.0003	0.0005	0.0009	0.0011	0.0012	0.0009	0.0007	0.0007	0.0010	0.0011	0.0011	0.0009	
A27	4437	0.0000	0.0004	0.0007	0.0010	0.0013	0.0010	0.0006	0.0004	0.0006	0.0009	0.0011	0.0011	0.0008	
A28	4272	0.0000	0.0003	0.0006	0.0007	0.0009	0.0007	0.0003	0.0001	0.0002	0.0004	0.0005	0.0005	0.0002	
A29	4298	0.0000	0.0004	0.0005	0.0007	0.0009	0.0004	0.0001	0.0002	0.0002	0.0000	0.0001	0.0001	0.0003	
A30	4336	0.0000	0.0004	0.0007	0.0008	0.0010	0.0007	0.0002	0.0001	0.0001	0.0002	0.0003	0.0002	0.0001	
A41	4323	0.0000	0.0003	0.0004	0.0006	0.0007	0.0005	0.0004	0.0002	0.0003	0.0004	0.0005	0.0006	0.0003	
A42	4344	0.0000	0.0002	0.0001	0.0002	0.0004	0.0002	0.0002	0.0002	0.0001	0.0001	0.0004	0.0002	0.0001	
A43	4360	0.0000	0.0003	0.0003	0.0004	0.0006	0.0003	0.0002	0.0003	0.0002	0.0001	0.0002	0.0003	0.0001	
A44	4448	0.0000	0.0003	0.0003	0.0001	0.0002	0.0001	0.0004	0.0006	0.0005	0.0002	0.0002	0.0000	0.0003	
A45	4327	0.0000	0.0004	0.0005	0.0007	0.0008	0.0007	0.0003	0.0002	0.0001	0.0004	0.0002	0.0004	0.0002	
ave	**4303**	**0.0000**	**0.0003**	**0.0005**	**0.0007**	**0.0009**	**0.0009**	**0.0008**	**0.0006**	**0.0007**	**0.0008**	**0.0009**	**0.0008**	**0.0007**	

$T_S = T_{AIR} = 55°C, I_F = 1A$

$T_S \geq 53C, T_{AIR} \geq 50C$ in compliance with LM-80-08

DATA SET 61: CCT =4000K, T_J = 71C

Forward voltage

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4296	3.091	3.089	3.094	3.094	3.095	3.093	3.093	3.092	3.090	3.090	3.095	3.094	3.093	
A2	4273	3.065	3.063	3.067	3.064	3.066	3.063	3.063	3.060	3.061	3.060	3.063	3.063	3.061	
A3	4293	3.085	3.079	3.083	3.082	3.084	3.082	3.080	3.080	3.079	3.080	3.082	3.081	3.079	
A4	4272	3.096	3.092	3.099	3.097	3.097	3.097	3.096	3.095	3.094	3.093	3.098	3.096	3.096	
A5	4252	3.063	3.060	3.063	3.063	3.063	3.062	3.062	3.060	3.059	3.060	3.062	3.062	3.060	
A6	4305	3.094	3.090	3.093	3.092	3.094	3.090	3.090	3.090	3.091	3.087	3.092	3.090	3.090	
A7	4312	3.103	3.098	3.105	3.103	3.104	3.103	3.100	3.103	3.102	3.102	3.103	3.100	3.103	
A8	4284	3.100	3.095	3.099	3.099	3.101	3.100	3.097	3.096	3.095	3.098	3.100	3.097	3.096	
A9	4188	3.019	3.013	3.017	3.016	3.018	3.014	3.014	3.014	3.014	3.013	3.016	3.014	3.013	
A10	4323	3.086	3.085	3.090	3.088	3.089	3.086	3.085	3.084	3.084	3.083	3.087	3.084	3.083	
A21	4164	3.070	3.059	3.062	3.059	3.057	3.054	3.053	3.051	3.052	3.053	3.055	3.052	3.053	
A22	4261	3.100	3.090	3.091	3.087	3.088	3.084	3.082	3.080	3.080	3.080	3.082	3.081	3.080	
A23	4340	3.117	3.108	3.108	3.104	3.104	3.100	3.098	3.097	3.097	3.095	3.100	3.097	3.097	
A24	4250	3.080	3.071	3.073	3.068	3.068	3.063	3.063	3.064	3.062	3.063	3.064	3.064	3.062	
A25	4276	3.166	3.156	3.157	3.152	3.151	3.144	3.143	3.141	3.141	3.138	3.138	3.138	3.138	
A26	4336	3.126	3.120	3.120	3.117	3.116	3.112	3.112	3.110	3.112	3.111	3.115	3.111	3.111	
A27	4437	3.160	3.153	3.158	3.153	3.154	3.151	3.150	3.149	3.149	3.149	3.150	3.148	3.149	
A28	4272	3.126	3.115	3.114	3.111	3.111	3.106	3.104	3.102	3.103	3.103	3.104	3.102	3.102	
A29	4298	3.104	3.100	3.101	3.099	3.097	3.094	3.094	3.091	3.093	3.094	3.096	3.096	3.094	
A30	4336	3.126	3.120	3.121	3.116	3.117	3.112	3.113	3.111	3.111	3.111	3.115	3.111	3.111	
A41	4323	3.276	3.252	3.235	3.219	3.214	3.200	3.190	3.185	3.183	3.180	3.182	3.176	3.173	
A42	4344	3.396	3.340	3.300	3.273	3.258	3.239	3.229	3.222	3.218	3.215	3.215	3.208	3.207	
A43	4360	3.202	3.191	3.191	3.186	3.183	3.174	3.170	3.166	3.164	3.162	3.162	3.160	3.157	
A44	4448	3.322	3.297	3.272	3.252	3.242	3.227	3.217	3.210	3.208	3.205	3.205	3.201	3.199	
A45	4327	3.315	3.299	3.296	3.285	3.282	3.270	3.264	3.259	3.257	3.253	3.259	3.253	3.252	
ave	**4303**	**3.140**													

$T_S = T_{AIR} = 85°C, I_F = 1A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

Lumen Data

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	Lumen Maintenance % at 6khours
DATA SET 60: CCT = 4000K, T_J = 100C	A1	4211	255.633	253.467	252.964	258.231	257.858	258.596	258.963	257.604	257.234	256.093	255.911	256.214	256.067		**100.2**
	A2	4317	256.366	254.051	253.912	259.898	259.444	259.822	259.925	258.461	258.131	257.037	256.396	256.937	256.769		**100.3**
	A3	4227	259.014	257.277	256.728	262.992	262.965	263.223	263.592	262.153	262.104	261.064	260.809	261.560	261.273		**100.8**
	A4	4300	258.764	257.311	256.906	263.484	263.252	263.712	263.951	262.325	262.351	261.448	260.983	261.661	261.551		**101.0**
	A5	4307	254.521	253.109	252.654	257.889	257.670	258.252	258.505	257.232	256.628	256.574	255.623	256.434	256.053		**100.8**
	A6	4353	248.094	247.414	247.373	252.922	252.790	253.251	253.180	252.078	251.785	251.323	250.366	250.980	250.483		**101.3**
	A7	4325	253.205	252.004	251.544	257.351	257.239	257.708	257.719	256.433	256.331	256.038	254.550	255.867	255.380		**101.1**
	A8	4217	255.256	253.685	253.268	259.329	259.848	260.609	260.408	259.052	259.341	259.199	258.169	259.456	258.911		**101.5**
	A9	4264	253.793	251.384	251.230	261.317	258.435	259.034	259.195	258.208	258.281	258.339	257.280	258.491	257.779		**101.8**
	A10	4299	258.664	257.126	257.090	263.022	263.312	264.069	264.040	262.964	262.968	263.020	261.985	263.198	262.681		**101.7**
	A21	4344	257.839	254.787	253.869	260.303	260.799	259.660	259.486	258.225	257.878	257.172	256.108	257.162	256.665		**99.7**
	A22	4311	254.615	252.579	250.424	257.582	257.925	257.258	257.525	256.738	256.966	256.759	256.075	257.482	257.363		**100.8**
	A23	4178	253.036	251.926	250.042	256.278	256.833	256.254	256.509	255.316	255.747	255.251	254.339	255.549	255.242		**100.9**
	A24	4318	255.427	253.770	252.823	258.037	258.492	258.200	258.330	258.135	258.555	258.474	257.882	259.555	259.592		**101.2**
	A25	4375	247.456	246.416	245.725	250.445	250.773	250.324	250.473	249.722	249.755	249.751	248.713	249.940	249.512		**100.9**
	A26	4436	250.270	248.404	247.661	254.589	255.124	254.426	254.195	253.799	254.112	253.676	252.701	254.091	253.759		**101.4**
	A27	4404	245.875	244.652	244.268	250.403	250.872	250.612	250.378	250.131	250.105	250.625	249.358	250.950	250.330		**101.9**
	A28	4402	256.437	254.985	254.392	260.542	261.198	260.839	260.694	260.120	260.826	260.679	259.803	261.565	259.889		**101.7**
	A29	4255	255.691	254.247	253.638	260.359	260.944	260.476	260.231	260.005	260.409	260.252	259.062	260.445	260.112		**101.8**
	A30	4248	254.747	253.334	252.654	258.790	259.853	259.451	259.730	260.123	261.179	261.676	261.152	262.452	262.183		**102.7**
	A41	4261	266.963	264.836	264.531	270.347	271.104	269.972	270.957	269.163	269.718	268.551	267.670	268.080	267.914		**100.6**
	A42	4274	253.835	251.977	250.450	256.535	257.023	256.196	256.661	254.654	255.832	254.988	253.311	254.259	253.927		**100.5**
	A43	4330	242.349	240.056	238.970	244.124	244.950	244.411	244.661	243.473	243.717	242.570	240.604	240.852	240.793		**100.1**
	A44	4329	264.493	259.608	256.482	263.063	263.634	262.719	263.597	261.916	262.721	261.558	260.652	260.747	260.897		**98.9**
	A45	4319	259.510	256.704	254.345	260.250	260.770	260.313	260.921	259.901	260.326	259.941	256.864	258.541	258.021		**100.2**
	ave	**4304**															**100.9**

$T_S = T_{AIR} = 85°C, I_F = 1A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

Normalized flux

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 60: CCT = 4000K, T_J = 100C	A1	4211	1.0000	0.9915	0.9896	1.0102	1.0087	1.0116	1.0130	1.0077	1.0063	1.0018	1.0011	1.0023	1.0017	
	A2	4317	1.0000	0.9910	0.9904	1.0138	1.0120	1.0135	1.0139	1.0082	1.0069	1.0026	1.0001	1.0022	1.0016	
	A3	4227	1.0000	0.9933	0.9912	1.0154	1.0153	1.0162	1.0177	1.0121	1.0119	1.0079	1.0069	1.0098	1.0087	
	A4	4300	1.0000	0.9944	0.9928	1.0182	1.0173	1.0191	1.0200	1.0138	1.0139	1.0104	1.0086	1.0112	1.0108	
	A5	4307	1.0000	0.9945	0.9927	1.0132	1.0124	1.0147	1.0157	1.0107	1.0083	1.0081	1.0043	1.0075	1.0060	
	A6	4353	1.0000	0.9973	0.9971	1.0195	1.0189	1.0208	1.0205	1.0161	1.0149	1.0130	1.0092	1.0116	1.0096	
	A7	4325	1.0000	0.9953	0.9934	1.0164	1.0159	1.0178	1.0178	1.0128	1.0123	1.0112	1.0053	1.0105	1.0086	
	A8	4217	1.0000	0.9938	0.9922	1.0160	1.0180	1.0210	1.0202	1.0149	1.0160	1.0154	1.0114	1.0165	1.0143	
	A9	4264	1.0000	0.9905	0.9899	1.0296	1.0183	1.0207	1.0213	1.0174	1.0177	1.0179	1.0137	1.0185	1.0157	
	A10	4299	1.0000	0.9941	0.9939	1.0168	1.0180	1.0209	1.0208	1.0166	1.0166	1.0168	1.0128	1.0175	1.0155	
	A21	4344	1.0000	0.9882	0.9846	1.0096	1.0115	1.0071	1.0064	1.0015	1.0002	0.9974	0.9933	0.9974	0.9954	
	A22	4311	1.0000	0.9920	0.9835	1.0117	1.0130	1.0104	1.0114	1.0083	1.0092	1.0084	1.0057	1.0113	1.0108	
	A23	4178	1.0000	0.9956	0.9882	1.0128	1.0150	1.0127	1.0137	1.0090	1.0107	1.0088	1.0052	1.0099	1.0087	
	A24	4318	1.0000	0.9935	0.9898	1.0102	1.0120	1.0109	1.0114	1.0106	1.0122	1.0119	1.0096	1.0162	1.0163	
	A25	4375	1.0000	0.9958	0.9930	1.0121	1.0134	1.0116	1.0122	1.0092	1.0093	1.0093	1.0051	1.0100	1.0083	
	A26	4436	1.0000	0.9925	0.9896	1.0173	1.0194	1.0166	1.0157	1.0141	1.0154	1.0136	1.0097	1.0153	1.0139	
	A27	4404	1.0000	0.9950	0.9935	1.0184	1.0203	1.0193	1.0183	1.0173	1.0172	1.0193	1.0142	1.0206	1.0181	
	A28	4402	1.0000	0.9943	0.9920	1.0160	1.0186	1.0172	1.0166	1.0144	1.0171	1.0165	1.0131	1.0200	1.0135	
	A29	4255	1.0000	0.9944	0.9920	1.0183	1.0205	1.0187	1.0178	1.0169	1.0185	1.0178	1.0132	1.0186	1.0173	
	A30	4248	1.0000	0.9945	0.9918	1.0159	1.0200	1.0185	1.0196	1.0211	1.0252	1.0272	1.0251	1.0302	1.0292	
	A41	4261	1.0000	0.9920	0.9909	1.0127	1.0155	1.0113	1.0150	1.0082	1.0103	1.0059	1.0026	1.0042	1.0036	
	A42	4274	1.0000	0.9927	0.9867	1.0106	1.0126	1.0093	1.0111	1.0032	1.0079	1.0045	0.9979	1.0017	1.0004	
	A43	4330	1.0000	0.9905	0.9861	1.0073	1.0107	1.0085	1.0095	1.0046	1.0056	1.0009	0.9928	0.9938	0.9936	
	A44	4329	1.0000	0.9815	0.9697	0.9946	0.9968	0.9933	0.9966	0.9903	0.9933	0.9889	0.9855	0.9858	0.9864	
	A45	4319	1.0000	0.9892	0.9801	1.0029	1.0049	1.0031	1.0054	1.0015	1.0031	1.0017	0.9898	0.9963	0.9943	
	ave	**4304**	**1.0000**	**0.9927**	**0.9894**	**1.0136**	**1.0144**	**1.0138**	**1.0145**	**1.0104**	**1.0112**	**1.0095**	**1.0055**	**1.0096**	**1.0081**	

$T_S = T_{AIR} = 85°C, I_F = 1A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

TM-21 extrapolation

		CCT (t=0)	alpha	B	r2	
DATA SET 60: CCT = 4000K, T_J = 100C	A1	4211	1.2158E-06	1.0114	0.672	302,725
	A2	4317	1.4070E-06	1.0128	0.688	262,544
	A3	4227	6.8616E-07	1.0141	0.372	540,194
	A4	4300	6.9852E-07	1.0160	0.414	533,369
	A5	4307	8.2705E-07	1.0129	0.526	446,767
	A6	4353	1.2905E-06	1.0209	0.772	292,433
	A7	4325	9.0981E-07	1.0161	0.382	409,593
	A8	4217	1.5382E-07	1.0158	0.026	2,420,556
	A9	4264	2.8516E-07	1.0187	0.093	1,315,808
	A10	4299	1.9164E-07	1.0173	0.047	1,950,520
	A21	4344	1.2221E-06	1.0055	0.578	296,333
	A22	4311	-4.4348E-07	1.0061	0.177	-817,881
	A23	4178	2.0998E-07	1.0101	0.043	1,746,466
	A24	4318	-1.0699E-06	1.0058	0.519	-338,775
	A25	4375	1.7572E-07	1.0097	0.035	2,084,554
	A26	4436	1.3957E-07	1.0146	0.016	2,659,268
	A27	4404	-2.5787E-07	1.0161	0.050	-1,445,009
	A28	4402	-1.9317E-08	1.0156	0.000	-19,267,753
	A29	4255	5.9953E-08	1.0174	0.003	6,237,498
	A30	4248	-1.4863E-06	1.0165	0.751	-250,970
	A41	4261	1.2802E-06	1.0142	0.661	289,626
	A42	4274	1.1260E-06	1.0100	0.375	325,568
	A43	4330	2.8272E-06	1.0171	0.807	132,146
	A44	4329	1.3026E-06	0.9968	0.621	271,325
	A45	4319	1.9672E-06	1.0106	0.495	186,673
	ave	**4304**	**5.8261E-07**	**1.0129**	**0.290**	**634,144**

$T_S = T_{AIR} = 85°C, I_F = 1A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

u'

DATA SET 60: CCT = 4000K, T_J = 100C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4211	0.2217	0.2216	0.2215	0.2215	0.2215	0.2215	0.2215	0.2215	0.2216	0.2215	0.2216	0.2216	0.2216	
A2	4317	0.2224	0.2224	0.2223	0.2223	0.2223	0.2223	0.2223	0.2223	0.2223	0.2223	0.2224	0.2224	0.2224	
A3	4227	0.2217	0.2216	0.2216	0.2215	0.2216	0.2215	0.2215	0.2215	0.2216	0.2215	0.2217	0.2217	0.2216	
A4	4300	0.2221	0.2221	0.2221	0.2220	0.2220	0.2220	0.2220	0.2220	0.2220	0.2220	0.2221	0.2221	0.2221	
A5	4307	0.2223	0.2223	0.2222	0.2222	0.2222	0.2222	0.2222	0.2222	0.2223	0.2222	0.2224	0.2223	0.2223	
A6	4353	0.2228	0.2227	0.2227	0.2226	0.2226	0.2227	0.2227	0.2227	0.2228	0.2227	0.2229	0.2228	0.2228	
A7	4325	0.2225	0.2224	0.2224	0.2223	0.2223	0.2224	0.2225	0.2225	0.2225	0.2225	0.2227	0.2226	0.2226	
A8	4217	0.2217	0.2216	0.2216	0.2214	0.2214	0.2215	0.2216	0.2215	0.2217	0.2216	0.2218	0.2217	0.2217	
A9	4264	0.2220	0.2221	0.2220	0.2219	0.2218	0.2219	0.2220	0.2220	0.2220	0.2220	0.2221	0.2221	0.2221	
A10	4299	0.2220	0.2220	0.2220	0.2219	0.2218	0.2219	0.2220	0.2220	0.2220	0.2220	0.2221	0.2221	0.2221	
A21	4344	0.2222	0.2221	0.2220	0.2220	0.2220	0.2221	0.2222	0.2221	0.2222	0.2221	0.2222	0.2222	0.2223	
A22	4311	0.2220	0.2219	0.2219	0.2219	0.2219	0.2219	0.2220	0.2219	0.2220	0.2219	0.2220	0.2220	0.2220	
A23	4178	0.2212	0.2211	0.2211	0.2211	0.2211	0.2212	0.2211	0.2212	0.2212	0.2211	0.2212	0.2212	0.2212	
A24	4318	0.2218	0.2217	0.2217	0.2217	0.2218	0.2218	0.2218	0.2218	0.2218	0.2218	0.2219	0.2219	0.2219	
A25	4375	0.2218	0.2218	0.2217	0.2217	0.2218	0.2218	0.2219	0.2219	0.2219	0.2217	0.2219	0.2219	0.2219	
A26	4436	0.2221	0.2220	0.2220	0.2219	0.2220	0.2220	0.2221	0.2221	0.2220	0.2221	0.2221	0.2221	0.2221	
A27	4404	0.2225	0.2223	0.2223	0.2223	0.2224	0.2225	0.2225	0.2224	0.2225	0.2224	0.2224	0.2225	0.2224	
A28	4402	0.2224	0.2222	0.2222	0.2222	0.2222	0.2224	0.2224	0.2224	0.2224	0.2223	0.2224	0.2224	0.2223	
A29	4255	0.2217	0.2215	0.2215	0.2215	0.2216	0.2216	0.2217	0.2217	0.2217	0.2216	0.2217	0.2217	0.2216	
A30	4248	0.2216	0.2215	0.2215	0.2215	0.2215	0.2216	0.2217	0.2216	0.2216	0.2215	0.2215	0.2216	0.2215	
A41	4261	0.2213	0.2211	0.2212	0.2211	0.2211	0.2212	0.2212	0.2211	0.2212	0.2211	0.2212	0.2212	0.2213	
A42	4274	0.2216	0.2214	0.2214	0.2214	0.2215	0.2215	0.2215	0.2215	0.2214	0.2214	0.2215	0.2215	0.2215	
A43	4330	0.2224	0.2223	0.2223	0.2223	0.2223	0.2224	0.2223	0.2223	0.2223	0.2223	0.2223	0.2224	0.2224	
A44	4329	0.2225	0.2223	0.2223	0.2223	0.2223	0.2224	0.2224	0.2224	0.2224	0.2223	0.2224	0.2225	0.2225	
A45	4319	0.2225	0.2224	0.2224	0.2224	0.2224	0.2225	0.2224	0.2225	0.2224	0.2224	0.2225	0.2225	0.2225	
ave	**4304**														

$T_S = T_{AIR} = 85°C, I_F = 1A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

v'

DATA SET 60: CCT = 4000K, T_J = 100C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4211	0.4975	0.4971	0.4971	0.4968	0.4970	0.4971	0.4971	0.4970	0.4969	0.4968	0.4970	0.4969	0.4969	
A2	4317	0.4911	0.4907	0.4907	0.4904	0.4905	0.4907	0.4907	0.4906	0.4905	0.4905	0.4906	0.4905	0.4905	
A3	4227	0.4967	0.4963	0.4963	0.4960	0.4961	0.4962	0.4962	0.4962	0.4960	0.4960	0.4962	0.4961	0.4960	
A4	4300	0.4924	0.4919	0.4919	0.4916	0.4917	0.4918	0.4918	0.4918	0.4916	0.4916	0.4916	0.4917	0.4916	
A5	4307	0.4918	0.4913	0.4913	0.4911	0.4911	0.4913	0.4913	0.4913	0.4911	0.4911	0.4910	0.4911	0.4912	
A6	4353	0.4888	0.4883	0.4884	0.4878	0.4878	0.4883	0.4883	0.4883	0.4881	0.4880	0.4881	0.4881	0.4882	
A7	4325	0.4905	0.4900	0.4900	0.4895	0.4896	0.4900	0.4900	0.4900	0.4898	0.4897	0.4898	0.4898	0.4899	
A8	4217	0.4972	0.4968	0.4968	0.4963	0.4964	0.4967	0.4968	0.4967	0.4965	0.4964	0.4966	0.4966	0.4966	
A9	4264	0.4942	0.4938	0.4939	0.4936	0.4934	0.4938	0.4938	0.4937	0.4936	0.4935	0.4936	0.4936	0.4937	
A10	4299	0.4926	0.4921	0.4921	0.4919	0.4917	0.4921	0.4921	0.4921	0.4919	0.4919	0.4919	0.4920	0.4919	
A21	4344	0.4903	0.4902	0.4903	0.4903	0.4905	0.4911	0.4911	0.4911	0.4908	0.4909	0.4909	0.4908	0.4908	
A22	4311	0.4920	0.4917	0.4920	0.4921	0.4923	0.4928	0.4929	0.4928	0.4926	0.4926	0.4929	0.4927	0.4926	
A23	4178	0.5000	0.4998	0.5001	0.5002	0.5003	0.5006	0.5008	0.5007	0.5005	0.5005	0.5007	0.5005	0.5005	
A24	4318	0.4921	0.4919	0.4921	0.4924	0.4927	0.4930	0.4930	0.4930	0.4928	0.4929	0.4930	0.4929	0.4928	
A25	4375	0.4896	0.4893	0.4896	0.4899	0.4900	0.4904	0.4903	0.4903	0.4901	0.4901	0.4902	0.4901	0.4900	
A26	4436	0.4866	0.4863	0.4865	0.4864	0.4867	0.4870	0.4868	0.4869	0.4867	0.4865	0.4868	0.4866	0.4866	
A27	4404	0.4872	0.4869	0.4870	0.4869	0.4872	0.4874	0.4875	0.4874	0.4872	0.4871	0.4874	0.4872	0.4871	
A28	4402	0.4875	0.4873	0.4875	0.4876	0.4879	0.4880	0.4880	0.4881	0.4878	0.4880	0.4882	0.4879	0.4878	
A29	4255	0.4952	0.4950	0.4951	0.4952	0.4954	0.4956	0.4957	0.4955	0.4954	0.4955	0.4956	0.4955	0.4954	
A30	4248	0.4957	0.4956	0.4955	0.4955	0.4957	0.4958	0.4960	0.4959	0.4958	0.4957	0.4960	0.4958	0.4958	
A41	4261	0.4958	0.4954	0.4954	0.4953	0.4955	0.4956	0.4956	0.4956	0.4955	0.4955	0.4958	0.4956	0.4957	
A42	4274	0.4945	0.4941	0.4942	0.4940	0.4940	0.4943	0.4943	0.4942	0.4941	0.4942	0.4945	0.4944	0.4945	
A43	4330	0.4904	0.4900	0.4902	0.4901	0.4900	0.4904	0.4905	0.4904	0.4903	0.4903	0.4906	0.4904	0.4905	
A44	4329	0.4904	0.4904	0.4907	0.4905	0.4904	0.4905	0.4904	0.4903	0.4901	0.4901	0.4904	0.4901	0.4901	
A45	4319	0.4907	0.4906	0.4909	0.4910	0.4909	0.4911	0.4912	0.4910	0.4909	0.4909	0.4913	0.4910	0.4910	
ave	**4304**														

$T_S = T_{AIR} = 85°C, I_F = 1A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

delta u' v'

DATA SET 60: CCT = 4000K, T_J = 100C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4211	0.0000	0.0004	0.0004	0.0007	0.0005	0.0004	0.0004	0.0005	0.0006	0.0007	0.0005	0.0006	0.0006	
A2	4317	0.0000	0.0004	0.0004	0.0007	0.0006	0.0004	0.0004	0.0005	0.0006	0.0006	0.0005	0.0006	0.0006	
A3	4227	0.0000	0.0004	0.0004	0.0007	0.0006	0.0005	0.0005	0.0005	0.0007	0.0007	0.0005	0.0006	0.0007	
A4	4300	0.0000	0.0005	0.0005	0.0008	0.0007	0.0006	0.0006	0.0006	0.0008	0.0008	0.0008	0.0007	0.0008	
A5	4307	0.0000	0.0005	0.0005	0.0007	0.0007	0.0005	0.0005	0.0005	0.0007	0.0007	0.0008	0.0007	0.0006	
A6	4353	0.0000	0.0005	0.0004	0.0010	0.0010	0.0005	0.0005	0.0005	0.0007	0.0008	0.0007	0.0007	0.0006	
A7	4325	0.0000	0.0005	0.0005	0.0010	0.0009	0.0005	0.0005	0.0005	0.0007	0.0008	0.0007	0.0007	0.0006	
A8	4217	0.0000	0.0004	0.0004	0.0009	0.0009	0.0005	0.0004	0.0005	0.0007	0.0008	0.0006	0.0006	0.0006	
A9	4264	0.0000	0.0004	0.0003	0.0006	0.0008	0.0004	0.0004	0.0005	0.0006	0.0007	0.0006	0.0006	0.0005	
A10	4299	0.0000	0.0005	0.0005	0.0007	0.0009	0.0005	0.0005	0.0005	0.0007	0.0007	0.0007	0.0006	0.0007	
A21	4344	0.0000	0.0001	0.0002	0.0002	0.0003	0.0008	0.0008	0.0008	0.0005	0.0006	0.0006	0.0005	0.0005	
A22	4311	0.0000	0.0003	0.0001	0.0001	0.0003	0.0008	0.0009	0.0008	0.0006	0.0006	0.0009	0.0007	0.0006	
A23	4178	0.0000	0.0002	0.0001	0.0002	0.0003	0.0006	0.0008	0.0007	0.0005	0.0005	0.0007	0.0005	0.0005	
A24	4318	0.0000	0.0002	0.0001	0.0003	0.0006	0.0009	0.0009	0.0009	0.0007	0.0008	0.0009	0.0008	0.0007	
A25	4375	0.0000	0.0003	0.0001	0.0003	0.0004	0.0008	0.0007	0.0007	0.0005	0.0005	0.0006	0.0005	0.0004	
A26	4436	0.0000	0.0003	0.0001	0.0003	0.0001	0.0004	0.0002	0.0003	0.0001	0.0001	0.0002	0.0000	0.0000	
A27	4404	0.0000	0.0004	0.0003	0.0004	0.0001	0.0002	0.0003	0.0002	0.0000	0.0001	0.0002	0.0000	0.0001	
A28	4402	0.0000	0.0003	0.0002	0.0002	0.0004	0.0005	0.0005	0.0006	0.0003	0.0005	0.0007	0.0004	0.0003	
A29	4255	0.0000	0.0003	0.0002	0.0002	0.0002	0.0004	0.0005	0.0003	0.0002	0.0003	0.0004	0.0003	0.0002	
A30	4248	0.0000	0.0001	0.0002	0.0002	0.0001	0.0001	0.0003	0.0002	0.0001	0.0001	0.0003	0.0001	0.0001	
A41	4261	0.0000	0.0004	0.0004	0.0005	0.0004	0.0002	0.0002	0.0003	0.0003	0.0004	0.0001	0.0002	0.0001	
A42	4274	0.0000	0.0004	0.0004	0.0005	0.0005	0.0002	0.0002	0.0003	0.0004	0.0004	0.0001	0.0001	0.0001	
A43	4330	0.0000	0.0004	0.0002	0.0003	0.0004	0.0000	0.0001	0.0001	0.0001	0.0001	0.0002	0.0000	0.0001	
A44	4329	0.0000	0.0002	0.0004	0.0002	0.0002	0.0001	0.0001	0.0001	0.0003	0.0004	0.0001	0.0003	0.0003	
A45	4319	0.0000	0.0001	0.0002	0.0003	0.0002	0.0004	0.0005	0.0003	0.0002	0.0002	0.0006	0.0003	0.0003	
ave	**4304**	**0.0000**	**0.0004**	**0.0003**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0004**	**0.0004**	

$T_S = T_{AIR} = 85°C, I_F = 1A$

$T_S \geq 83C, T_{AIR} \geq 80C$ in compliance with LM-80-08

Forward voltage

DATA SET 60: CCT = 4000K, T_J = 100C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4211	3.056	3.056	3.052	3.055	3.054	3.050	3.052	3.052	3.054	3.052	3.058	3.056	3.056	
A2	4317	3.051	3.049	3.045	3.050	3.050	3.047	3.049	3.049	3.049	3.047	3.051	3.050	3.050	
A3	4227	3.088	3.090	3.086	3.088	3.089	3.088	3.088	3.087	3.091	3.090	3.094	3.094	3.094	
A4	4300	3.105	3.108	3.104	3.108	3.108	3.106	3.106	3.107	3.108	3.105	3.116	3.113	3.114	
A5	4307	3.090	3.088	3.086	3.088	3.088	3.088	3.087	3.088	3.089	3.088	3.091	3.092	3.092	
A6	4353	3.060	3.059	3.057	3.056	3.059	3.056	3.056	3.056	3.058	3.056	3.060	3.059	3.059	
A7	4325	3.091	3.093	3.090	3.091	3.089	3.090	3.090	3.089	3.093	3.091	3.095	3.096	3.097	
A8	4217	3.065	3.065	3.061	3.063	3.062	3.062	3.064	3.063	3.065	3.065	3.071	3.071	3.069	
A9	4264	3.053	3.053	3.049	3.052	3.054	3.054	3.053	3.054	3.058	3.058	3.064	3.066	3.066	
A10	4299	3.107	3.106	3.104	3.106	3.107	3.106	3.106	3.107	3.110	3.109	3.116	3.116	3.118	
A21	4344	3.139	3.136	3.132	3.131	3.129	3.128	3.128	3.127	3.129	3.128	3.134	3.133	3.133	
A22	4311	3.091	3.088	3.087	3.085	3.084	3.084	3.087	3.089	3.095	3.099	3.110	3.117	3.124	
A23	4178	3.072	3.068	3.061	3.059	3.060	3.057	3.057	3.056	3.060	3.062	3.069	3.071	3.073	
A24	4318	3.112	3.110	3.106	3.107	3.107	3.108	3.110	3.113	3.124	3.129	3.143	3.153	3.168	
A25	4375	3.107	3.101	3.097	3.095	3.094	3.092	3.094	3.094	3.099	3.101	3.111	3.112	3.118	
A26	4436	3.126	3.123	3.118	3.118	3.119	3.116	3.118	3.120	3.124	3.127	3.137	3.140	3.148	
A27	4404	3.090	3.080	3.075	3.073	3.072	3.072	3.073	3.073	3.078	3.081	3.090	3.092	3.098	
A28	4402	3.145	3.139	3.136	3.138	3.137	3.135	3.139	3.142	3.148	3.157	3.171	3.179	3.192	
A29	4255	3.087	3.082	3.078	3.077	3.076	3.077	3.078	3.078	3.083	3.086	3.095	3.097	3.102	
A30	4248	3.076	3.074	3.069	3.068	3.068	3.070	3.073	3.079	3.089	3.100	3.117	3.129	3.144	
A41	4261	3.370	3.358	3.346	3.334	3.325	3.316	3.311	3.309	3.311	3.314	3.325	3.323	3.327	
A42	4274	3.231	3.226	3.223	3.217	3.216	3.211	3.211	3.213	3.220	3.228	3.239	3.240	3.249	
A43	4330	3.255	3.245	3.237	3.224	3.218	3.213	3.215	3.218	3.229	3.241	3.250	3.252	3.260	
A44	4329	3.515	3.433	3.396	3.356	3.340	3.323	3.318	3.314	3.316	3.314	3.323	3.319	3.321	
A45	4319	3.445	3.395	3.369	3.337	3.324	3.316	3.315	3.320	3.334	3.346	3.357	3.356	3.367	
ave	**4304**	**3.145**													

$T_S = T_{AIR} = 105°C, I_F = 1A$

$T_S \geq 103C, T_{AIR} \geq 100C$ in compliance with LM-80-08

Lumen Data

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	Lumen Maintenance % at 6khours
DATA SET 59: CCT = 4000K, T_J = 120C	A1	4265	264.841	264.359	265.484	269.084	271.647	275.284	274.109	274.599	272.599	270.420	268.881	269.102	269.693		**102.1**
	A2	4251	270.186	269.487	270.384	274.494	277.459	280.787	281.916	282.690	281.317	278.394	276.286	277.777	278.431		**103.0**
	A3	4123	263.478	261.351	261.671	265.303	268.315	271.252	272.757	273.670	273.133	270.104	267.143	268.364	269.506		**102.5**
	A4	4180	273.669	272.841	274.607	279.992	282.357	285.105	285.390	286.142	285.145	281.595	278.241	280.300	281.119		**102.9**
	A5	4160	280.775	279.498	281.186	287.196	288.983	291.667	292.829	294.105	294.271	291.875	288.484	290.206	290.968		**104.0**
	A6	4272	267.600	268.282	270.445	276.578	278.810	281.111	281.157	282.169	282.584	279.759	277.097	279.407	279.772		**104.5**
	A7	4103	276.377	275.166	277.247	281.974	284.702	287.334	288.431	289.985	290.303	287.212	283.881	285.188	285.796		**103.9**
	A8	4218	280.549	278.570	280.418	287.088	290.218	293.089	293.922	295.116	294.605	290.846	287.679	290.053	291.306		**103.7**
	A9	4233	280.664	278.634	280.362	286.251	289.097	291.714	292.055	293.327	293.574	290.496	287.693	289.284	290.027		**103.5**
	A10	4166	278.751	277.441	278.924	283.820	286.114	289.033	290.027	291.367	291.797	289.029	286.057	287.610	288.559		**103.7**
	A21	4287	275.917	275.396	276.608	279.609	282.743	286.262	287.786	289.308	288.438	283.078	279.346	279.478	280.394		**102.6**
	A22	4311	277.790	275.576	277.056	281.790	284.519	287.883	289.102	289.830	286.565	280.375	278.488	278.892	279.674		**100.9**
	A23	4256	276.169	274.963	276.635	280.654	284.485	289.993	290.553	284.531	280.388	277.875	277.207	277.895	279.726		**100.6**
	A24	4242	280.374	279.233	280.848	284.762	287.877	290.643	291.358	291.610	285.793	280.913	279.413	280.009	281.075		**100.2**
	A25	4290	281.393	281.124	282.723	285.226	288.241	291.598	293.318	292.843	287.314	283.749	282.243	283.116	284.608		**100.8**
	A26	4245	263.420	262.524	264.127	267.402	269.804	272.911	273.311	272.681	267.954	263.966	262.896	264.639	266.124		**100.2**
	A27	4347	280.653	280.160	281.552	284.186	287.176	290.474	292.069	289.224	285.335	281.834	281.068	282.917	284.496		**100.4**
	A28	4205	273.513	273.075	273.638	277.713	282.036	286.602	280.540	275.497	274.396	266.213	267.066	269.184	270.835		**97.3**
	A29	4210	282.638	280.486	282.109	285.448	288.960	294.439	293.049	286.906	285.292	282.824	281.609	283.781	285.683		**100.1**
	A30	4165	282.651	280.815	282.278	284.706	287.526	290.947	291.655	290.582	284.198	278.119	275.510	278.814	280.534		**98.4**
	A41	4139	272.617	270.674	271.571	274.892	277.673	278.053	277.021	277.776	277.626	276.374	274.924	276.580	278.588		**101.4**
	A42	4086	296.023	293.963	293.706	298.154	301.652	302.351	302.898	304.097	304.252	302.761	301.813	303.833	306.216		**102.3**
	A43	4252	251.045	248.759	250.980	255.220	259.446	258.595	255.161	256.009	255.618	253.922	252.423	253.941	255.517		**101.1**
	A44	4116	279.379	277.875	279.649	283.542	287.021	286.619	285.850	286.762	287.123	285.275	284.634	286.620	288.351		**102.1**
	A45	4135	291.088	290.575	292.705	295.236	299.111	299.441	299.093	300.154	300.696	298.331	297.955	300.600	302.536		**102.5**
	ave	**4210**															**101.8**

$T_S = T_{AIR} = 105°C, I_F = 1A$

$T_S \geq 103C, T_{AIR} \geq 100C$ in compliance with LM-80-08

Normalized flux

		CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
DATA SET 59: CCT = 4000K, T_J = 120C	A1	4265	1.0000	0.9982	1.0024	1.0160	1.0257	1.0394	1.0350	1.0368	1.0293	1.0211	1.0153	1.0161	1.0183	
	A2	4251	1.0000	0.9974	1.0007	1.0159	1.0269	1.0392	1.0434	1.0463	1.0412	1.0304	1.0226	1.0281	1.0305	
	A3	4123	1.0000	0.9919	0.9931	1.0069	1.0184	1.0295	1.0352	1.0387	1.0366	1.0251	1.0139	1.0185	1.0229	
	A4	4180	1.0000	0.9970	1.0034	1.0231	1.0317	1.0418	1.0428	1.0456	1.0419	1.0290	1.0167	1.0242	1.0272	
	A5	4160	1.0000	0.9955	1.0015	1.0229	1.0292	1.0388	1.0429	1.0475	1.0481	1.0395	1.0275	1.0336	1.0363	
	A6	4272	1.0000	1.0025	1.0106	1.0335	1.0419	1.0505	1.0507	1.0544	1.0560	1.0454	1.0355	1.0441	1.0455	
	A7	4103	1.0000	0.9956	1.0031	1.0203	1.0301	1.0396	1.0436	1.0492	1.0504	1.0392	1.0272	1.0319	1.0341	
	A8	4218	1.0000	0.9929	0.9995	1.0233	1.0345	1.0447	1.0477	1.0519	1.0501	1.0367	1.0254	1.0339	1.0383	
	A9	4233	1.0000	0.9928	0.9989	1.0199	1.0300	1.0394	1.0406	1.0451	1.0460	1.0350	1.0250	1.0307	1.0334	
	A10	4166	1.0000	0.9953	1.0006	1.0182	1.0264	1.0369	1.0405	1.0453	1.0468	1.0369	1.0262	1.0318	1.0352	
	A21	4287	1.0000	0.9981	1.0025	1.0134	1.0247	1.0375	1.0430	1.0485	1.0454	1.0260	1.0124	1.0129	1.0162	
	A22	4311	1.0000	0.9920	0.9974	1.0144	1.0242	1.0363	1.0407	1.0433	1.0316	1.0093	1.0025	1.0040	1.0068	
	A23	4256	1.0000	0.9956	1.0017	1.0162	1.0301	1.0501	1.0521	1.0303	1.0153	1.0062	1.0038	1.0063	1.0129	
	A24	4242	1.0000	0.9959	1.0017	1.0157	1.0268	1.0366	1.0392	1.0401	1.0193	1.0019	0.9966	0.9987	1.0025	
	A25	4290	1.0000	0.9990	1.0047	1.0136	1.0243	1.0363	1.0424	1.0407	1.0210	1.0084	1.0030	1.0061	1.0114	
	A26	4245	1.0000	0.9966	1.0027	1.0151	1.0242	1.0360	1.0376	1.0352	1.0172	1.0021	0.9980	1.0046	1.0103	
	A27	4347	1.0000	0.9982	1.0032	1.0126	1.0232	1.0350	1.0407	1.0305	1.0167	1.0042	1.0015	1.0081	1.0137	
	A28	4205	1.0000	0.9984	1.0005	1.0154	1.0312	1.0479	1.0257	1.0073	1.0032	0.9733	0.9764	0.9842	0.9902	
	A29	4210	1.0000	0.9924	0.9981	1.0099	1.0224	1.0418	1.0368	1.0151	1.0094	1.0007	0.9964	1.0040	1.0108	
	A30	4165	1.0000	0.9935	0.9987	1.0073	1.0172	1.0294	1.0319	1.0281	1.0055	0.9840	0.9747	0.9864	0.9925	
	A41	4139	1.0000	0.9929	0.9962	1.0083	1.0185	1.0199	1.0162	1.0189	1.0184	1.0138	1.0085	1.0145	1.0219	
	A42	4086	1.0000	0.9930	0.9922	1.0072	1.0190	1.0214	1.0232	1.0273	1.0278	1.0228	1.0196	1.0264	1.0344	
	A43	4252	1.0000	0.9909	0.9997	1.0166	1.0335	1.0301	1.0164	1.0198	1.0182	1.0115	1.0055	1.0115	1.0178	
	A44	4116	1.0000	0.9946	1.0010	1.0149	1.0274	1.0259	1.0232	1.0264	1.0277	1.0211	1.0188	1.0259	1.0321	
	A45	4135	1.0000	0.9982	1.0056	1.0143	1.0276	1.0287	1.0275	1.0311	1.0330	1.0249	1.0236	1.0327	1.0393	
	ave	**4210**	**1.0000**	**0.9955**	**1.0008**	**1.0158**	**1.0268**	**1.0365**	**1.0368**	**1.0361**	**1.0302**	**1.0179**	**1.0111**	**1.0168**	**1.0214**	

$T_S = T_{AIR} = 105°C, I_F = 1A$

$T_S \geq 103C$, $T_{AIR} \geq 100C$ in compliance with LM-80-08

TM-21 extrapolation

		CCT (t=0)	alpha	B	r2	
DATA SET 59: CCT = 4000K, T_J = 120C	A1	4265	3.8455E-06	1.0487	0.747	105,110
	A2	4251	3.4715E-06	1.0567	0.581	118,635
	A3	4123	4.0150E-06	1.0531	0.612	101,710
	A4	4180	4.3414E-06	1.0602	0.585	95,627
	A5	4160	3.0576E-06	1.0596	0.545	135,574
	A6	4272	2.4613E-06	1.0637	0.412	169,995
	A7	4103	3.9356E-06	1.0655	0.652	106,757
	A8	4218	3.5038E-06	1.0633	0.459	119,314
	A9	4233	3.1551E-06	1.0573	0.552	130,712
	A10	4166	2.9178E-06	1.0568	0.515	141,189
	A21	4287	7.5550E-06	1.0785	0.798	57,210
	A22	4311	7.6151E-06	1.0677	0.733	55,440
	A23	4256	3.2674E-06	1.0341	0.403	119,431
	A24	4242	7.1615E-06	1.0578	0.655	57,657
	A25	4290	5.4882E-06	1.0519	0.565	74,208
	A26	4245	4.6603E-06	1.0422	0.431	85,414
	A27	4347	3.1616E-06	1.0334	0.326	123,215
	A28	4205	3.9907E-06	1.0150	0.283	93,110
	A29	4210	1.1885E-06	1.0138	0.103	311,669
	A30	4165	6.9355E-06	1.0409	0.466	57,211
	A41	4139	5.6360E-08	1.0164	0.001	6,616,388
	A42	4086	-7.8434E-07	1.0211	0.089	-481,413
	A43	4252	1.0086E-06	1.0207	0.121	373,942
	A44	4116	-5.7479E-07	1.0215	0.053	-657,565
	A45	4135	-1.0661E-06	1.0236	0.126	-356,485
	ave	**4210**	**3.3710E-06**	**1.0449**	**0.483**	**118,827**

T_S = T_{AIR} = 105°C, I_F = 1A

$T_S \geq$ 103C, $T_{AIR} \geq$ 100C in compliance with LM-80-08

u'

DATA SET 59: CCT = 4000K, T_J = 120C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4265	0.2228	0.2227	0.2228	0.2227	0.2227	0.2226	0.2229	0.2230	0.2229	0.2230	0.2232	0.2234	0.2234	
A2	4251	0.2228	0.2228	0.2228	0.2228	0.2227	0.2226	0.2230	0.2231	0.2231	0.2231	0.2234	0.2235	0.2235	
A3	4123	0.2222	0.2222	0.2223	0.2222	0.2222	0.2221	0.2224	0.2225	0.2226	0.2226	0.2230	0.2230	0.2230	
A4	4180	0.2230	0.2229	0.2230	0.2229	0.2229	0.2228	0.2231	0.2233	0.2233	0.2233	0.2235	0.2237	0.2236	
A5	4160	0.2225	0.2225	0.2225	0.2224	0.2224	0.2224	0.2227	0.2228	0.2229	0.2230	0.2232	0.2234	0.2233	
A6	4272	0.2235	0.2234	0.2235	0.2234	0.2233	0.2232	0.2235	0.2238	0.2237	0.2239	0.2242	0.2243	0.2242	
A7	4103	0.2221	0.2220	0.2221	0.2220	0.2219	0.2219	0.2223	0.2224	0.2225	0.2226	0.2229	0.2230	0.2229	
A8	4218	0.2228	0.2227	0.2227	0.2226	0.2226	0.2225	0.2229	0.2231	0.2231	0.2231	0.2233	0.2235	0.2234	
A9	4233	0.2225	0.2225	0.2226	0.2225	0.2224	0.2224	0.2228	0.2229	0.2230	0.2230	0.2234	0.2234	0.2233	
A10	4166	0.2219	0.2218	0.2218	0.2218	0.2217	0.2218	0.2220	0.2222	0.2223	0.2225	0.2227	0.2228	0.2226	
A21	4287	0.2226	0.2225	0.2226	0.2226	0.2226	0.2224	0.2226	0.2226	0.2226	0.2226	0.2229	0.2231	0.2231	
A22	4311	0.2226	0.2225	0.2226	0.2226	0.2225	0.2224	0.2226	0.2226	0.2226	0.2222	0.2229	0.2231	0.2231	
A23	4256	0.2225	0.2224	0.2224	0.2224	0.2224	0.2222	0.2224	0.2224	0.2224	0.2223	0.2228	0.2229	0.2229	
A24	4242	0.2226	0.2224	0.2225	0.2225	0.2224	0.2223	0.2225	0.2225	0.2226	0.2225	0.2228	0.2229	0.2230	
A25	4290	0.2231	0.2229	0.2230	0.2230	0.2230	0.2228	0.2230	0.2231	0.2231	0.2230	0.2234	0.2235	0.2235	
A26	4245	0.2227	0.2226	0.2226	0.2227	0.2226	0.2225	0.2227	0.2227	0.2227	0.2227	0.2230	0.2231	0.2231	
A27	4347	0.2229	0.2228	0.2229	0.2228	0.2229	0.2227	0.2230	0.2229	0.2229	0.2230	0.2232	0.2233	0.2233	
A28	4205	0.2225	0.2223	0.2224	0.2224	0.2224	0.2222	0.2225	0.2225	0.2226	0.2227	0.2229	0.2231	0.2230	
A29	4210	0.2226	0.2225	0.2225	0.2225	0.2225	0.2225	0.2226	0.2226	0.2226	0.2226	0.2228	0.2230	0.2229	
A30	4165	0.2228	0.2228	0.2228	0.2228	0.2228	0.2227	0.2229	0.2230	0.2230	0.2230	0.2232	0.2233	0.2233	
A41	4139	0.2221	0.2220	0.2220	0.2220	0.2220	0.2219	0.2221	0.2222	0.2223	0.2222	0.2225	0.2227	0.2227	
A42	4086	0.2214	0.2213	0.2214	0.2213	0.2213	0.2212	0.2215	0.2215	0.2216	0.2215	0.2219	0.2220	0.2220	
A43	4252	0.2231	0.2229	0.2231	0.2230	0.2230	0.2228	0.2231	0.2231	0.2231	0.2230	0.2235	0.2235	0.2236	
A44	4116	0.2222	0.2222	0.2222	0.2222	0.2221	0.2220	0.2222	0.2223	0.2223	0.2222	0.2226	0.2227	0.2227	
A45	4135	0.2221	0.2220	0.2221	0.2221	0.2220	0.2219	0.2221	0.2222	0.2222	0.2222	0.2225	0.2226	0.2226	
ave	**4210**														

T_S = T_{AIR} = 105°C, I_F = 1A

$T_S \geq$ 103C, $T_{AIR} \geq$ 100C in compliance with LM-80-08

v'

DATA SET 59: CCT = 4000K, T_J = 120C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4265	0.4927	0.4924	0.4925	0.4921	0.4924	0.4931	0.4934	0.4934	0.4936	0.4936	0.4948	0.4958	0.4959	
A2	4251	0.4933	0.4930	0.4930	0.4926	0.4928	0.4937	0.4938	0.4939	0.4941	0.4941	0.4956	0.4964	0.4965	
A3	4123	0.5010	0.5008	0.5012	0.5009	0.5011	0.5017	0.5019	0.5019	0.5020	0.5019	0.5034	0.5040	0.5041	
A4	4180	0.4964	0.4962	0.4969	0.4967	0.4972	0.4981	0.4980	0.4982	0.4982	0.4983	0.4999	0.5006	0.5005	
A5	4160	0.4983	0.4981	0.4987	0.4985	0.4990	0.4998	0.4999	0.5000	0.5000	0.5000	0.5015	0.5022	0.5022	
A6	4272	0.4909	0.4906	0.4905	0.4901	0.4905	0.4913	0.4912	0.4914	0.4912	0.4911	0.4926	0.4936	0.4937	
A7	4103	0.5022	0.5019	0.5019	0.5017	0.5017	0.5023	0.5025	0.5024	0.5025	0.5025	0.5039	0.5046	0.5047	
A8	4218	0.4949	0.4948	0.4948	0.4944	0.4945	0.4953	0.4954	0.4955	0.4956	0.4957	0.4974	0.4980	0.4980	
A9	4233	0.4947	0.4944	0.4944	0.4941	0.4941	0.4948	0.4948	0.4949	0.4949	0.4948	0.4965	0.4973	0.4974	
A10	4166	0.4993	0.4990	0.4990	0.4988	0.4987	0.4993	0.4995	0.4995	0.4995	0.4994	0.5008	0.5017	0.5018	
A21	4287	0.4919	0.4918	0.4917	0.4916	0.4917	0.4925	0.4926	0.4929	0.4930	0.4929	0.4943	0.4952	0.4951	
A22	4311	0.4910	0.4909	0.4908	0.4906	0.4907	0.4915	0.4916	0.4920	0.4921	0.4918	0.4935	0.4942	0.4942	
A23	4256	0.4938	0.4936	0.4937	0.4934	0.4936	0.4944	0.4947	0.4951	0.4951	0.4949	0.4964	0.4969	0.4969	
A24	4242	0.4942	0.4940	0.4940	0.4938	0.4939	0.4947	0.4948	0.4952	0.4953	0.4952	0.4966	0.4972	0.4972	
A25	4290	0.4910	0.4908	0.4907	0.4905	0.4908	0.4916	0.4917	0.4922	0.4924	0.4921	0.4936	0.4943	0.4942	
A26	4245	0.4938	0.4937	0.4937	0.4935	0.4936	0.4940	0.4945	0.4947	0.4948	0.4945	0.4960	0.4966	0.4966	
A27	4347	0.4887	0.4885	0.4885	0.4883	0.4885	0.4893	0.4895	0.4900	0.4900	0.4897	0.4914	0.4919	0.4919	
A28	4205	0.4962	0.4959	0.4960	0.4959	0.4961	0.4967	0.4970	0.4971	0.4970	0.4966	0.4986	0.4990	0.4988	
A29	4210	0.4958	0.4956	0.4957	0.4955	0.4958	0.4964	0.4969	0.4971	0.4971	0.4968	0.4985	0.4988	0.4988	
A30	4165	0.4974	0.4972	0.4971	0.4970	0.4972	0.4978	0.4981	0.4983	0.4983	0.4982	0.4997	0.5002	0.5001	
A41	4139	0.5004	0.5002	0.5004	0.5003	0.5005	0.5008	0.5010	0.5010	0.5009	0.5005	0.5020	0.5026	0.5025	
A42	4086	0.5046	0.5045	0.5048	0.5047	0.5049	0.5051	0.5055	0.5055	0.5054	0.5050	0.5067	0.5070	0.5069	
A43	4252	0.4927	0.4925	0.4926	0.4927	0.4932	0.4942	0.4943	0.4943	0.4942	0.4940	0.4958	0.4963	0.4961	
A44	4116	0.5012	0.5011	0.5012	0.5011	0.5015	0.5024	0.5027	0.5027	0.5026	0.5024	0.5040	0.5043	0.5041	
A45	4135	0.5005	0.5002	0.5005	0.5006	0.5010	0.5019	0.5023	0.5023	0.5022	0.5019	0.5035	0.5039	0.5038	
ave	**4210**														

$T_S = T_{AIR} = 105°C, I_F = 1A$

$T_S \geq 103C, T_{AIR} \geq 100C$ in compliance with LM-80-08

delta u' v'

DATA SET 59: CCT = 4000K, T_J = 120C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4265	0.0000	0.0003	0.0002	0.0006	0.0003	0.0004	0.0007	0.0007	0.0009	0.0009	0.0021	0.0032	0.0033	
A2	4251	0.0000	0.0003	0.0003	0.0007	0.0005	0.0004	0.0005	0.0007	0.0009	0.0009	0.0024	0.0032	0.0033	
A3	4123	0.0000	0.0002	0.0002	0.0001	0.0001	0.0007	0.0009	0.0009	0.0011	0.0010	0.0025	0.0031	0.0032	
A4	4180	0.0000	0.0002	0.0005	0.0003	0.0008	0.0017	0.0016	0.0018	0.0018	0.0019	0.0035	0.0043	0.0041	
A5	4160	0.0000	0.0002	0.0004	0.0002	0.0007	0.0015	0.0016	0.0017	0.0017	0.0018	0.0033	0.0040	0.0040	
A6	4272	0.0000	0.0003	0.0004	0.0008	0.0004	0.0005	0.0003	0.0006	0.0004	0.0004	0.0018	0.0028	0.0029	
A7	4103	0.0000	0.0003	0.0003	0.0005	0.0005	0.0002	0.0004	0.0004	0.0005	0.0006	0.0019	0.0026	0.0026	
A8	4218	0.0000	0.0001	0.0001	0.0005	0.0004	0.0005	0.0005	0.0007	0.0008	0.0009	0.0025	0.0032	0.0032	
A9	4233	0.0000	0.0003	0.0003	0.0006	0.0006	0.0001	0.0003	0.0004	0.0005	0.0005	0.0020	0.0028	0.0028	
A10	4166	0.0000	0.0003	0.0003	0.0005	0.0006	0.0001	0.0002	0.0004	0.0004	0.0006	0.0017	0.0026	0.0026	
A21	4287	0.0000	0.0001	0.0002	0.0003	0.0002	0.0006	0.0007	0.0010	0.0011	0.0010	0.0024	0.0033	0.0032	
A22	4311	0.0000	0.0001	0.0002	0.0004	0.0003	0.0005	0.0006	0.0010	0.0011	0.0009	0.0025	0.0032	0.0032	
A23	4256	0.0000	0.0002	0.0001	0.0004	0.0002	0.0007	0.0009	0.0013	0.0013	0.0011	0.0026	0.0031	0.0031	
A24	4242	0.0000	0.0003	0.0002	0.0004	0.0004	0.0006	0.0006	0.0010	0.0011	0.0010	0.0024	0.0030	0.0030	
A25	4290	0.0000	0.0003	0.0003	0.0005	0.0002	0.0007	0.0007	0.0012	0.0014	0.0011	0.0026	0.0033	0.0032	
A26	4245	0.0000	0.0001	0.0001	0.0003	0.0002	0.0003	0.0007	0.0009	0.0010	0.0007	0.0022	0.0028	0.0028	
A27	4347	0.0000	0.0002	0.0002	0.0004	0.0002	0.0006	0.0008	0.0013	0.0013	0.0010	0.0027	0.0032	0.0032	
A28	4205	0.0000	0.0004	0.0002	0.0003	0.0001	0.0006	0.0008	0.0009	0.0008	0.0004	0.0024	0.0029	0.0026	
A29	4210	0.0000	0.0002	0.0001	0.0003	0.0001	0.0006	0.0011	0.0013	0.0013	0.0010	0.0027	0.0030	0.0030	
A30	4165	0.0000	0.0002	0.0003	0.0004	0.0002	0.0004	0.0007	0.0009	0.0009	0.0008	0.0023	0.0028	0.0027	
A41	4139	0.0000	0.0002	0.0001	0.0001	0.0001	0.0004	0.0006	0.0006	0.0005	0.0001	0.0016	0.0023	0.0022	
A42	4086	0.0000	0.0001	0.0002	0.0001	0.0003	0.0005	0.0009	0.0009	0.0008	0.0004	0.0022	0.0025	0.0024	
A43	4252	0.0000	0.0003	0.0001	0.0001	0.0005	0.0015	0.0016	0.0016	0.0015	0.0013	0.0031	0.0036	0.0034	
A44	4116	0.0000	0.0001	0.0000	0.0001	0.0003	0.0012	0.0015	0.0015	0.0014	0.0012	0.0028	0.0031	0.0029	
A45	4135	0.0000	0.0003	0.0000	0.0001	0.0005	0.0014	0.0018	0.0018	0.0017	0.0014	0.0030	0.0034	0.0033	
ave	**4210**	**0.0000**	**0.0002**	**0.0002**	**0.0004**	**0.0004**	**0.0007**	**0.0008**	**0.0010**	**0.0011**	**0.0009**	**0.0025**	**0.0031**	**0.0031**	

$T_S = T_{AIR} = 105°C, I_F = 1A$

$T_S \geq 103C, T_{AIR} \geq 100C$ in compliance with LM-80-08

Forward voltage

DATA SET 59: CCT = 4000K, T_J = 120C

	CCT (t=0)	0	24	168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A1	4265	3.093	3.092	3.092	3.093	3.098	3.108	3.133	3.151	3.181	3.188	3.203	3.216	3.223	
A2	4251	3.118	3.116	3.117	3.118	3.123	3.133	3.165	3.192	3.237	3.258	3.275	3.294	3.301	
A3	4123	3.067	3.064	3.063	3.065	3.070	3.073	3.100	3.123	3.162	3.185	3.203	3.222	3.231	
A4	4180	3.081	3.076	3.078	3.079	3.082	3.085	3.113	3.131	3.160	3.176	3.190	3.203	3.211	
A5	4160	3.104	3.103	3.102	3.108	3.111	3.114	3.137	3.156	3.189	3.211	3.235	3.255	3.263	
A6	4272	3.044	3.040	3.041	3.041	3.038	3.041	3.052	3.064	3.073	3.082	3.097	3.106	3.120	
A7	4103	3.061	3.058	3.059	3.062	3.060	3.063	3.084	3.100	3.127	3.147	3.170	3.190	3.198	
A8	4218	3.110	3.109	3.109	3.113	3.114	3.124	3.158	3.185	3.225	3.251	3.269	3.286	3.291	
A9	4233	3.095	3.095	3.092	3.096	3.098	3.101	3.124	3.141	3.164	3.185	3.209	3.226	3.234	
A10	4166	3.090	3.091	3.083	3.092	3.093	3.098	3.121	3.141	3.172	3.195	3.223	3.242	3.252	
A21	4287	3.127	3.123	3.121	3.124	3.126	3.135	3.170	3.211	3.282	3.315	3.345	3.353	3.362	
A22	4311	3.127	3.121	3.122	3.123	3.128	3.143	3.190	3.238	3.315	3.339	3.360	3.366	3.374	
A23	4256	3.102	3.098	3.097	3.105	3.115	3.157	3.264	3.346	3.385	3.392	3.412	3.419	3.429	
A24	4242	3.122	3.116	3.115	3.118	3.121	3.140	3.190	3.242	3.308	3.323	3.337	3.342	3.349	
A25	4290	3.154	3.153	3.150	3.156	3.163	3.185	3.256	3.340	3.411	3.427	3.446	3.452	3.459	
A26	4245	3.120	3.113	3.109	3.111	3.119	3.129	3.175	3.215	3.254	3.263	3.275	3.278	3.283	
A27	4347	3.156	3.153	3.153	3.155	3.167	3.201	3.300	3.392	3.436	3.448	3.467	3.473	3.481	
A28	4205	3.050	3.046	3.045	3.050	3.070	3.132	3.213	3.241	3.261	3.271	3.282	3.292	3.297	
A29	4210	3.113	3.113	3.112	3.118	3.136	3.196	3.332	3.394	3.420	3.430	3.448	3.456	3.462	
A30	4165	3.108	3.103	3.100	3.103	3.113	3.136	3.189	3.244	3.288	3.303	3.318	3.323	3.329	
A41	4139	3.349	3.306	3.292	3.284	3.291	3.292	3.303	3.305	3.314	3.313	3.322	3.320	3.327	
A42	4086	3.475	3.443	3.410	3.399	3.397	3.400	3.420	3.426	3.436	3.439	3.454	3.454	3.461	
A43	4252	3.155	3.150	3.153	3.164	3.203	3.250	3.273	3.284	3.307	3.314	3.330	3.327	3.336	
A44	4116	3.257	3.253	3.246	3.251	3.268	3.303	3.330	3.338	3.359	3.361	3.380	3.380	3.386	
A45	4135	3.336	3.338	3.328	3.327	3.342	3.368	3.396	3.402	3.424	3.424	3.446	3.445	3.451	
ave	**4210**	**3.145**													

Company Information

Philips Lumileds is a leading provider of power LEDs for everyday lighting applications. The company's records for light output, efficacy and thermal management are direct results of the ongoing commitment to advancing solid-state lighting technology and enabling lighting solutions that are more environmentally friendly, help reduce CO_2 emissions and reduce the need for power plant expansion. Philips Lumileds LUXEON® LEDs are enabling never before possible applications in outdoor lighting, shop lighting, home lighting, digital imaging, display and automotive lighting.

Philips Lumileds is a fully integrated supplier, producing core LED material in all three base colors, (red, green, blue) and white. Philips Lumileds has R&D centers in San Jose, California and in the Netherlands, and production capabilities in San Jose, Singapore and Penang, Malaysia. Founded in 1999, Philips Lumileds is the high flux LED technology leader and is dedicated to bridging the gap between solid-state technology and the lighting world. More information about the company's LUXEON LED products and solid-state lighting technologies can be found at www.philipslumileds.com.

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