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**Low Power LED Light Engine for AMP\* LIGHT GUIDE\*  
Products**

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**DESIGN OBJECTIVES**

The product described in this document has not been fully tested to ensure conformance to the requirements outlined below. Therefore, Tyco Electronics makes no representation or warranty, express or implied, that the product will comply with these requirements. Further, Tyco Electronics may change these requirements based on the results of additional testing and evaluation. Contact Tyco Electronics Engineering for further details.

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**1. SCOPE**

## 1.1. Content

This specification covers performance, tests and quality requirements for the Tyco Electronics universal, low voltage DC ½ watt LED engine/driver for use with AMP\* LIGHT GUIDE\* products.

## 1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

**2. APPLICABLE DOCUMENTS**

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the latest edition of the document applies. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

## 2.1. Tyco Electronics Documents

- 109-197: Test Specification (AMP Test Specifications vs EIA and IEC Test Methods)
- 114-13241: Application Specification (Low Power Light Engine Assembly)
- 501-TBD: Qualification Test Report (Low Power LED Light Engine for AMP\* LIGHT GUIDE\* Products)

## 2.2. Industry Document

EIA-364: Electrical Connector/Socket Test Procedures Including Environmental Classifications

**3. REQUIREMENTS**

## 3.1. Design and Construction

Product shall be of the design, construction and physical dimensions specified on the applicable product drawing.

## 3.2. Materials

Materials used in the construction of this product shall be as specified on the applicable product drawing.

3.3. Ratings

- Voltage:
  - 7 to 27 volts DC regulated constant current version
  - 5 volts DC on resistor drive version
- Current:
  - 150 ± 5% milliamperes regulated on constant current version
  - 150 milliamperes nominal non-regulated current on 5 volt DC resistor drive
- LED Rating: ½ watt
- Temperature:
  - Operating: -30 to 70°C (limited by LED junction temperature)
  - Storage: -40 to 120°C

3.4. Performance and Test Description

Product is designed to meet the electrical, mechanical and environmental performance requirements specified in Figure 1. Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Initial examination of product.	Meets requirements of product drawing.	EIA-364-18. Visual and dimensional (C of C) inspection per product drawing.
Final examination of product.	Meets visual requirements.	EIA-364-18. Visual inspection.
<b>ELECTRONICS</b>		
Operating voltage range.	LED driver circuit shall provide 150 ± 10% milliamperes drive current over the full 7 to 27 volts DC range.	Measure current through LED at 7, 17 and 27 volts DC, also measure DC input voltage and current to the LED driver circuit and the LED forward voltage so system efficiency can be calculated: System Eff = $(V_f(\text{LED}) * I(\text{LED})) / (V_{in(\text{driver})} * I_{in(\text{driver})}) * 100\%$ .
Electronics water storage test.	Verify LED output for 1 minute with LED driver energized with 24 volts DC before and after test.	Subject specimens to 300 hour water storage test in 25 ± 5°C distilled water. Specimens shall be allowed to dry for a minimum of 24 hours prior to conformation of correct functionality.
<b>MECHANICAL</b>		
Light pipe retention.	Retain a 9.8 ± 0.05 mm diameter light pipe to 100 gf (2008876-1). Retain a 4.9 ± 0.05 mm diameter light pipe to 50 gf (2008876-2). See Note.	Subject specimens to specified forces. See Figure 3.

Figure 1 (continued)

Test Description	Requirement	Procedure
Random vibration.	No electrical discontinuities of 1 microsecond or longer duration. One foot long, 10 mm diameter acrylic light pipe shall be retained in holder. See Note.	EIA-364-28, Test Condition VII, Condition E. Subject specimens to 4.90 G's rms between 20 to 500 Hz. Fifteen minutes in each of 3 mutually perpendicular planes. See Figure 4.
Mechanical shock.	No electrical discontinuities of 1 microsecond or longer duration. One foot long, 10 mm diameter acrylic light pipe shall be retained in holder. See Note.	EIA-364-27, Condition A. Subject specimens to 50 G's half-sine shock pulses of 11 milliseconds duration. Three shocks in each direction applied along 3 mutually perpendicular planes, 18 total shocks. See Figure 4.
<b>ENVIRONMENTAL</b>		
Operating temperature.	Verify LED output for 1 minute with LED driver energized with 24 volts DC before and after test.	Specimens shall be allowed to stabilize at test temperature for a minimum of 10 minutes between each ON" cycle. Each ON cycle shall consist of operating the LED light engine with a 27 volt DC input for 30 minutes. Subject specimens to $-30 \pm 5^{\circ}\text{C}$ for 50 ON/OFF cycles, then check for functionality. Subject specimens to $70 \pm 5^{\circ}\text{C}$ for 50 additional ON/OFF cycles, then check for functionality.
Storage temperature.	Verify LED output for 1 minute with LED driver energized with 24 volts DC before and after test.	Subject specimens to 48 hour low temperature soak at $-40 \pm 5^{\circ}\text{C}$ , then check for functionality. Subject specimens to 48 hour high temperature soak at $120 \pm 5^{\circ}\text{C}$ , then check for functionality.
Thermal cycle.	Verify LED output for 1 minute with LED driver energized with 24 volts DC before and after test.	Subject specimens to 100 thermal cycles between $-30 \pm 5$ and $65 \pm 5^{\circ}\text{C}$ with 1 hour dwells at temperature extremes and 1 hour transition between temperatures. One half of the specimens shall be powered at 27 volts DC continuously throughout the test, the other half shall remain OFF.

Figure 1 (continued)

Test Description	Requirement	Procedure
Thermal shock.	Verify LED output for 1 minute with LED driver energized with 24 volts DC before and after test.	Subject specimens to 10 thermal shock cycles between $-40 \pm 5$ and $100 \pm 5^\circ\text{C}$ with 1 hour dwells at temperature extremes and 10 seconds maximum transition between temperatures. One half of the specimens shall be powered at 27 volts DC continuously throughout the test, the other half shall remain OFF.
Humidity.	Verify LED output for 1 minute with LED driver energized with 24 volts DC before and after test.	Subject specimens to a 48 hour high humidity soak at $50 \pm 5^\circ\text{C}$ and $95 \pm 5\%$ relative humidity. One half of the specimens shall be powered at 27 volts DC continuously throughout the test, the other half shall remain OFF.
LED temperature rise.	LED cathode, anode, and thermal slug shall remain below $110^\circ\text{C}$ when tested at an ambient temperature of $25^\circ\text{C}$ ( $110^\circ\text{C}$ pad temperature equals an LED junction temperature of $125^\circ\text{C}$ at $\frac{1}{2}$ watt input power).	Measure LED pad temperatures at 7, 17 and 27 volts DC input voltages with a 10 mm test light pipe inserted into the holder, with the holder oriented so the pipe faces up, down, and sideways. See Figure 5.

**NOTE**

*Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence shown in Figure 2.*

Figure 1 (end)

3.6. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group (a)			
	1	2	3	4
	Test Sequence (b)			
Initial examination of product	1	1	1	1
Operating voltage range	3			
Electronics water storage test		3		
Light pipe retention		2		
Random vibration			3	
Mechanical shock			4	
Operating temperature			2	
Storage temperature	2			
Thermal cycle				2
Thermal shock				3
Humidity				4
LED temperature rise	4			
Final examination of product	5	4	5	5

**NOTE** (a) See paragraph 4.1.A.  
 (b) Numbers indicate sequence in which tests are performed.

Figure 2

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#### 4. QUALITY ASSURANCE PROVISIONS

##### 4.1. Qualification Testing

###### A. Specimen Selection

Specimens shall be prepared in accordance with applicable Instruction Sheets and shall be selected at random from current production. Each test group shall consist of a minimum of 10 specimens.

###### B. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in Figure 2.

##### 4.2. Requalification Testing

If changes significantly affecting form, fit or function are made to the product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

##### 4.3. Acceptance

Acceptance is based on verification that the product meets the requirements of Figure 1. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

##### 4.4. Quality Conformance Inspection

The applicable quality inspection plan shall specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.

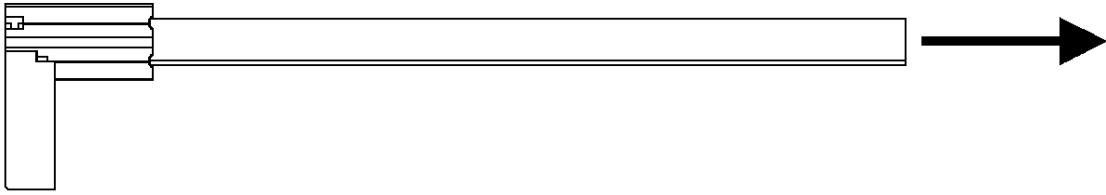


Figure 3  
Light Pipe Retention

**TBD**

Figure 4  
Vibration and Mechanical Shock Mounting Fixture

**DESIGN OBJECTIVES 11Sep08**

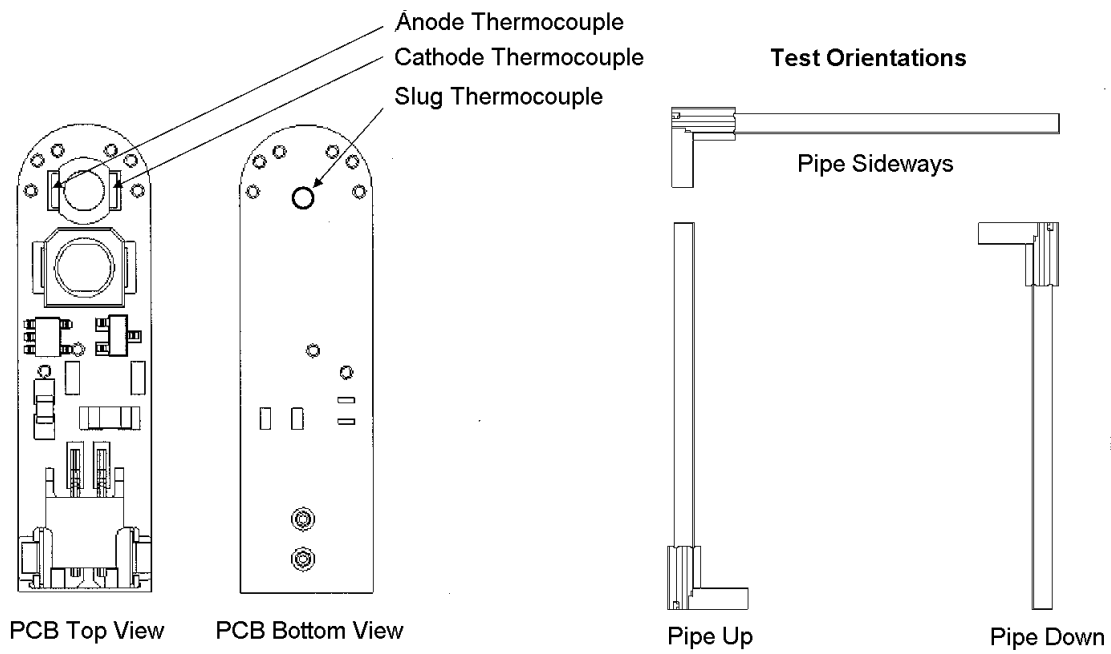


Figure 5  
LED Temperature Rise  
(Thermocouple Locations and Test Orientations)