Purchase Specification of the
Institute of Transportation Engineers

Pedestrian Traffic Control Signal Indications - Part 2: Light Emitting Diode (LED) Pedestrian Traffic Signal Modules

Prepared by Joint Industry and Traffic Engineering Council Committee

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During the service life of this document, use of the metric system in the United States is expected to expand. The following common factors represent the appropriate magnitude of conversion. This is because the quantities given in U.S. Customary units in the text, tables or figures, represent a precision level that in practice typically does not exceed two significant figures. In making conversions, it is important to not falsely imply a greater accuracy in the product than existed in the original dimension or quantity. However, certain applications such as surveying, structures, curve offset calculations, and so forth, may require great precision. Conversions for such purposes are given in parentheses.

Length
1 inch = 25 mm (millimeters—25.4)
1 inch = 2.5 cm (centimeters—2.54)
1 foot = 0.3 m (meters—0.3048)
1 yard = 0.91 m (0.914)
1 mile = 1.6 km (kilometers—1.61)

Volume
1 cubic inch = 16 cm^3 (16.39)
1 cubic foot = 0.028 m^3 (0.02831)
1 cubic yard = 0.77 m^3 (0.7645)
1 quart = 0.95 L (liter—0.9463)
1 gallon = 3.8 L (3.785)

Speed
foot/sec. = 0.3 m/s (0.3048)
miles/hour = 1.6 km/h (1.609)

Temperature
To convert °F (Fahrenheit) to °C (Celsius), subtract 32 and divide by 1.8.

Area
1 square inch = 6.5 cm^2 (6.452)
1 square foot = 0.09 m^2 (0.0929)
1 square yard = 0.84 m^2 (0.836)
1 acre = 0.4 ha (hectares—0.405)

Mass
1 ounce = 28 gm (gram—28.34)
1 pound = 0.45 kg (kilograms—0.454)
1 ton = 900 kg (907)

Light
1 footcandle = 11 lux (lumens per m^2—10.8)
1 footlambert = 3.4 cd/m^2 (candelas per m^2—3.426)

Pedestrian Traffic Control Signal Indications - Part 2: Light Emitting Diode (LED) Pedestrian Signal Modules - A Purchase Specification of the Institute of Transportation Engineers, prepared by the ITE Joint Industry and Traffic Engineering Council Committee.

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1. Purpose

The purpose of this specification is to provide the minimum performance requirements for the LED "walking person" and "hand" icon pedestrian signal modules (hereafter called module or modules). This specification includes the following three sizes (nominal message bearing surface): 406mm x 457 mm (16 in x 18 in), 305mm x 305mm (12 in x 12 in), and 229 mm x 229 mm (9 in x 9 in). This specification is not intended to impose restrictions upon specific designs and materials that conform to the purpose and the intent of this specification. This specification refers to definitions and practices described in "Pedestrian Traffic Control Signal Indications" published in the *Equipment and Materials Standards of the Institute of Transportation Engineers*, referred to in this document as "PTCSI." This specification applies to modules purchased after the effective date of this specification. This specification is not restricted to any specific LED technology.

2. Definitions

The following definitions are in addition to the definitions in the PTCSI.

1. **LED Light Source.** A single light emitting diode (LED) or an array of LEDs.

2. **LED Pedestrian Signal Module** (the module)**.** An array of LEDs and lens that are capable of providing a pedestrian signal indication with "walking person" and "hand" icon. The module shall be capable of replacing the optical units of an existing pedestrian signal indication with "walking person" and "hand" icons.

3. **Luminous Intensity.** The luminous flux per unit solid angle in a given direction, expressed in Candelas (cd).

4. **Power Consumption.** The electrical power in Watts consumed by the module when operated at nominal operating voltage and ambient operating temperature range.

5. **Volt-Amperes.** The product of root-mean-square (RMS) line voltage and RMS line current measured with true RMS meter. The load for each of the walking person and hand icon is to be stated separately.

6. **Nominal Operating Voltage.** The AC RMS Voltage, 120VAC, at which photometric performance and power consumption are specified.

7. **Duty Cycle**. The fraction of time during a specified time period that either the walking person or hand icon of the module is energized, expressed as a percent of the specified time period.

8. **Burn-In Procedure.** The procedure by which a module is energized at an ambient temperature for a specified time duration. Each icon, walking person and hand shall have separate burn-ins.

9. **Light Stabilization Procedure.** The procedure by which the module is energized at a given temperature for a specified time duration to cause stabilization in light output. Each icon, walking person and hand shall have separate light stabilization procedure.

10. **Chromaticity.** The color of the light emitted by the module, specified as x-y chromaticity coordinates on the chromaticity diagram according to the 1931 Commission Internationale d'Eclairage (CIE) standard observer and coordinate system. Each icon, walking person and hand shall have separate chromaticity values.

11. **Long Term Luminous Intensity Degradation.** The reduction in luminous intensity that normally occurs when an LED is illuminated over an extended period of time.

12. **Power Factor (PF).** PF equals Watts divided by Volt-Ampere (VA) or the ratio of power

consumption in Watts to Volt-Amperes. The value for each of the icons, walking person and hand shall be determined.

13. **Total Harmonic Distortion (THD).** THD is the ratio of the root-mean-square (RMS) value of the harmonics to the amplitude of the fundamental component of the ac waveform. The value for equal cycles of each icon, walking person and hand shall be determined.

14. Hard coat. A surface coating or a film used to provide front surface abrasion resistance for both icons.

15. Turn on time. The amount of time required for either the walking person or hand icon of the module to reach 90% of its full illumination**.**

16. Turn Off Time. The amount of time required after removal of the nominal operating voltage for neither the walking person nor hand icon of the module to show any visible illumination.

17. Turn Off Voltage. The voltage below which there is no visible illumination of the module.

3. Physical and Mechanical Requirements

3.1 General

Modules designed as retrofit replacements for existing pedestrian signal indication lamps shall not require special tools for installation. Retrofit replacement modules shall fit into existing pedestrian signal housings built for the PTCSI sizes stated in Section 1 of the "walking person" and "hand" icon pedestrian signal indication Standard without modification to the housing. See PTCSI 4.2.1 for housing sizes.

Installation of a retrofit replacement module into an existing pedestrian signal housing shall only require the removal of the existing optical unit components, i.e., lens, lamp module, gaskets, and reflector; shall be weather tight and fit securely in the housing; and shall connect directly to existing electrical wiring.

3.2 The Module

3.2.1 The retrofit module shall be capable of replacing the optical unit.

3.2.2 Tinting (Optional) - The lens shall be tinted or shall use transparent film or materials with similar characteristics.

3.2.3 The module lens may be a replaceable part without the need to replace the complete module.

3.2.4 Hardcoat (Optional) - If requested, on a non-frosted polymeric lens a surface coating or a film shall be used to provide front surface abrasion resistance.

3.2.5 The configurations of the walking person icon and hand icon are illustrated in Figure 1 and Figure 2 respectively.

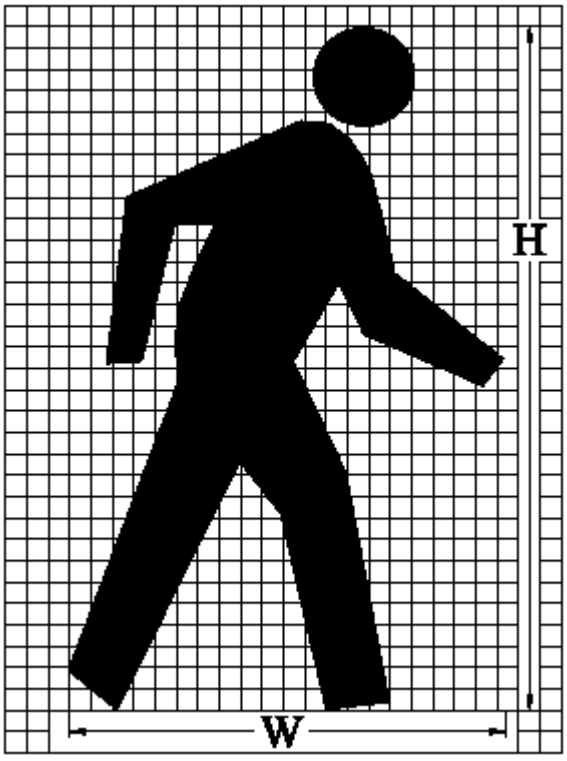

Figure 1

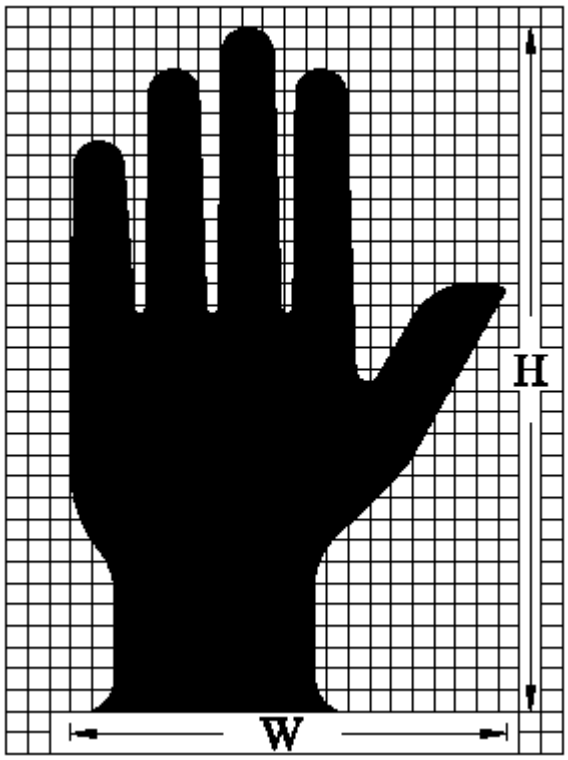

Figure 2

Dimensions for Figure 1 and Figure 2

For each nominal message bearing surface (module) size, use the corresponding H (height) and W (width):

A. 406mm x 457 mm (16 in x 18 in)	H= 297 mm (11”) W= 178 mm (7”)
B. 305 mm x 305 mm (12 in x 12 in)	H= 229 mm (9”) W= 134 mm (5.25”)
C. 229 mm x 229 mm (9 in x 9 in)	H= 152 mm (6”) W= 89 mm (3.5”)

3.3 Environmental Requirements

3.3.1 The module shall be rated for use in the ambient operating temperature range, measured at the exposed rear of the module, of -40°C (-40°F) to +74°C (+165°F).

3.3.2 The pedestrian module shall be protected against dust and moisture intrusion per the requirements of MIL-STD-810F procedure I Rain and Blowing Rain. The test is to be conducted on a stand-alone unit. No protective housing shall be used.

3.3.3 The module lens shall be UV stabilized.

3.4 Construction

3.4.1 The module shall be a single, self-contained device, not requiring on-site assembly for installation into an existing traffic signal housing. The power supply for the module may be either integral or packaged as a separate module. The power supply may be designed to fit and mount inside the pedestrian signal housing adjacent to the module.

3.4.2 The assembly and manufacturing process for the module shall be designed to assure all internal LED and electronic components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.

3.5 Materials

3.5.1 Materials used for the lens and module construction shall conform to ASTM specifications for the materials where applicable.

3.5.2 Enclosures containing either the power supply or electronic components of the module shall be made of UL94VO flame retardant materials. The lens of the module is excluded from this requirement.

3.6 Module Identification

3.6.1 Each module shall be identified on the backside with the manufacturer’s name, model number and serial number.

3.6.2 The following operating characteristics shall be identified: nominal operating voltage, power consumption, and Volt-Ampere.

3.6.3 Modules shall have a prominent and

permanent vertical indexing indicator, i.e., UP ARROW or the word UP or TOP, for correct indexing and orientation inside a pedestrian signal housing.

3.6.4 Modules conforming to this specification, may have the following statement: "Manufactured in Conformance with the Pedestrian Traffic Control Signal Indications - Part 2: Light Emitting Diode (LED) Pedestrian Signal Modules." on an attached label.

4. Photometric Requirements

4.1 Luminance, Uniformity and Distribution

4.1.1 For a minimum period of 60 months, the maintained minimum luminance values for the modules under the operating conditions defined in Sections 3.3.1 and 5.2.1, shall not be less than the values shown Table 1 and Table 2 for the walking person and hand icons respectively, when measured perpendicular to the surface of the module at nine (nine) separate points on the icon. These values may decrease up to 50% of these table values beyond 15^{o} from the perpendicular in either to the left or right on a horizontal plane.

Table 1. Maintained Minimum Luminance value for the Walking Person icon of the Module (candelas/meter square)

5300 cd/m^2

Table 2. Maintained Minimum Luminance value for the Hand icon of the Module (candelas/meter square)

3750 cd/m^2

4.1.2 The uniformity of the walking person and hand icons' illumination shall meet a ratio of not more than 1 to 5 between the minimum and maximum luminance measurements (in Cd/m2).

4.1.3. When operating within the temperature range specified in Section 3.3.1, the average luminance of the module shall not exceed twice the minimum luminance of the modules as defined in Tables 1 and 2.

4.2 Chromaticity

The standard colors for the LED Pedestrian Signal Module shall be White for the walking person and Portland Orange for the hand icon. The colors for these icons shall conform to the CIE chromaticity diagram x, y coordinates as follows.
The white area is defined by the sum of these two areas that are contiguous, and are defined by the following lines:
First area:

Yellow boundary:	x = 0.400
Blue boundary:	x = 0.280
Green boundary:	y = 0.7917x + 0.0883
Purple boundary:	y = 0.4600x + 0.1810

Second area:

Yellow boundary:	x = 0.450
Blue boundary:	x = 0.400
Green boundary:	y = 0.7917x + 0.0483
Purple boundary:	y = 0.4600x + 0.2210

The Portland Orange area is defined as

Red boundary:	y = 0.331
Yellow boundary:	y = 0.390
White boundary:	y = 0.997 – x

5. Electrical

5.1 General

All wiring and terminal blocks shall meet the requirements of Section 13.02 of the VTCSH standard. Two secured, color coded, 914 mm (36 in) long 600 V, 20 AWG minimum, jacketed wires, conforming to the National Electrical Code, rated for service at +105°C, are to be provided for electrical connection.

The following color scheme shall be used: Orange for Hand, Blue for Walking Person and White for the common.

5.2 Voltage Range

5.2.1 The modules shall operate from a 60±3 Hertz ac line power over a voltage range from 80 VAC RMS to 135VAC RMS. The current draw shall be sufficient to ensure compatibility and proper triggering and operation of load current

switches and conflict monitors in signal controller units the procuring traffic authority customer has in use.

5.2.2 Nominal operating voltage for all measurements shall be 120±3 VAC RMS.

5.2.3 Fluctuations in line voltage over the range of 80VAC RMS to 135VAC RMS shall not affect luminous intensity by more than ±10 percent.

5.2.4 The LED circuitry shall prevent flicker at less than 100 Hz over the voltage range specified in Section 5.2.1.

5.2.5 Low Voltage Turn Off: There should be no illumination of the module when the applied voltage is less than 35 VAC RMS. To test for this condition the each icon must first be fully illuminated at the nominal operating voltage. The applied voltage shall then be reduced to the point where there is no illumination. This point must be greater than 35 VAC RMS AC.

5.2.6 Turn-On and Turn-Off Time:
The each icon of the module shall reach 90% of their full illumination (turn-on) within 75 msec. of the application of the nominal operating voltage. The modules shall not be illuminated (turn-off) after 75 msec of the removal of the nominal operating voltage.
For abnormal conditions when nominal voltage is applied to the unit across the two-phase wires (rather than being applied to the phase wire and the neutral wire) the pedestrian signal unit shall default to the hand symbol.

5.3 Transient Voltage Protection

5.3.1 The module's on-board circuitry shall include voltage surge protection to withstand high-repetition noise transients and low-repetition high-energy transients as stated in Section 2.1.6, NEMA Standard TS-2, 1998, or the latest version.

5.4 Nighttime Dimming (Optional)

5.4.1 When requested, the module circuitry shall allow a reduction of the intensity of the light output in response to an input from the traffic signal controller

5.4.2 Dimming, if provided, shall diminish light output to levels established to match threshold ambient light conditions. The dimming may be in stepped increments or may be continuously variable. The minimum light output when dimmed shall not be less than thirty (30) percent of the maintained minimum luminance values shown in Tables 1 or 2.

5.5 Electronic Noise

The modules and associated on-board circuitry must meet Federal Communications Commission (FCC) Title 47, SubPart B, Section 15 regulations concerning the emission of electronic noise.

5.6 Power Factor (PF) and AC Harmonics

5.6.1 The modules shall provide a power factor of 0.90 or greater when operated at nominal operating voltage, and 25ºC (77ºF).

5.6.2 Total harmonic distortion induced into an AC power line by the module, operated at nominal operating voltage, at 25ºC (77ºF) shall not exceed 20 percent.

6. Quality Assurance

6.1 General
Unless otherwise specified all of the test will be conducted at an ambient temperature of 25°C and at the nominal operating voltage of 120 VAC RMS.

6.1.1 Quality Assurance Program
The modules shall be manufactured in accordance with a vendor quality assurance (QA) program. The QA program shall include two types of quality assurance: (1) design quality assurance and (2) production quality assurance. The production quality assurance shall include

statistically controlled routine tests to ensure minimum performance levels of the modules built to meet this specification.

6.1.2 Record Keeping
QA process and test results documentation shall be kept on file for a minimum period of seven years.

6.1.3 Conformance
The module designs not satisfying design qualification testing and the production quality assurance testing performance requirements in Sections 6.3 and 6.4 shall not be labeled, advertised, or sold as conforming to this specification.

6.2 Manufacturers Serial Numbers

Each module shall be identified by a manufacturer's model and serial numbers. Identification of the component and sub-assembly level may be required if the reliability and performance of the module must be traceable to the original item manufacturers of the module components and subassemblies.

6.3 Production Quality Assurance (QA) Testing

All new modules shall undergo the following Production Quality Assurance testing prior to shipment. Failure of any module to meet requirements of these QA tests shall be cause for rejection. QA test results shall be maintained per the requirement of Section 6.1.2.

6.3.1 Production Luminance Test
All modules shall be tested for maintained minimum luminance. Any two point measurements with a correlation to the luminance requirements of Table 1 and Table 2 for the walking person and hand icon respectively in Sections 4.1.1 may be used.

The modules not meeting maintained minimum luminance requirements as per Table 1and Table 2 in Section 4.1.1 shall be rejected.

6.3.2 Power Factor
All modules shall be tested for power factor to the requirements of Section 5.6.1. A commercially available power factor meter may be used to perform this measurement. Failure of the requirements shall be cause for rejection.

6.3.3 Current
All modules shall be measured for the amount of current consumption. The measured current values shall be compared against current values resulting from design qualification measurements in Section 6.4.4.1. Measured current values in excess of 120 percent of the design qualification current values shall be cause for rejection.

6.3.4 Visual Inspection
All modules shall be visually inspected for any exterior physical damage or assembly anomalies. Careful attention shall be paid to the surface of the lens to ensure there are no scratches (abrasions), cracks, chips, discoloration, or other defects. Presence of any such defects shall be cause for rejection.

6.4 Design Qualification Testing

Design Qualification testing shall be performed on new module designs, and when a major design change has been implemented on an existing design.

Unless otherwise specified, all of the tests shall be conducted on the same set of **six** (6) randomly selected modules, hereafter called the sample set, at an ambient temperature of 25°C and at the nominal operating voltage of 120 VAC RMS.

The Photometric (section 6.4.3) and the Electrical (section 6.4.4) tests must be done on the sample set after the units have been subjected to the required burn-in (section 6.4.1), the required temperature cycling (section 6.4.2.2) and the required moisture resistance test (section 6.4.2.3)

Failure to meet requirements of any of these tests shall be cause for rejection.

Testing shall be performed once every 5 years or when the module design or LED technology has been changed. Test data shall be retained by the module manufacturers for a minimum period of 7 years and for a period of at least 5 years beyond the last date of manufacture of that model type.

6.4.1 Burn-in

The modules of the sample set shall be energized for a minimum of 24 hours, at 100 percent on-time duty cycle, in an ambient temperature of +60°C (+140°F) before performing any design qualification testing. Any failure within a module after burn-in shall be cause for rejection.

6.4.2.1 Mechanical Vibration Testing:

Three modules shall be tested per MIL-STD-883, Test Method 2007, using three 4 minute cycles along each x, y, and z axis, at a force of 2.5 Gs, with a frequency sweep from 2 Hz to 120 Hz To assure compliance with section 3.4.2 The loosening of the lens, of any internal components, or other physical damage shall be cause for rejection.

6.4.2.2 Temperature Cycling. To assure compliance with section 3.4.2 temperature cycling shall be performed on the sample set per MIL-STD-883, Test method 1010. The temperature range shall be per Section 3.3.1. A minimum of 20 cycles shall be performed with a 30-minute transfer time between temperature extremes and a 30-minute dwell time at each temperature. Pedestrian signals under test shall be non-operating. Failure of a module to function properly or any evidence of cracking of the module lens or housing after temperature cycling shall be cause for rejection.

6.4.2.3 Moisture Resistance. Moisture resistance testing shall be performed on a sample of three modules per MIL-STD-810F. The rainfall rate shall be 1.7 mm/min (4 in/hr) and droplet size shall predominantly be between 0.5 mm and 4.5 mm. The module shall be rotated through 120 degrees and the duration of the test shall be 30 minutes. The module shall be energized throughout the test. The water shall be at 25 degrees C. The wind velocity shall be 80 km/hr (50 mph). Any evidence of internal moisture into the module shall be cause for rejection. The module shall be deemed to have failed the test if it extinguishes itself at any time during the test.

If the module is equipped with a remote power supply unit, then the test shall be conducted with the remote power supply unit attached to the clamping device holding the LED signal module to the test apparatus.

6.4.2.4 Hard Coat Test: To assure compliance to section 3.2.4, a sample of three (3) modules shall be tested in accordance to the abrasion resistance test ASTM D1044.

A weight of 500 grams shall be applied on a CS10F wheel for 150 cycles and the percentage change in haze shall be less than 15%.

6.4.2.5 UV Stabilization: Documentation shall be provided that clearly demonstrates the Lens material has the ability to comply with the requirements in section 3.3.3.

6.4.3 Photometric Requirements

6.4.3.2 The sample set shall be tested for maintained minimum luminance at 25°C and at 74°C.

The sample set shall be tested for luminance output, allowing each module to achieve thermal equilibrium for 60 minutes, while the module is energized at nominal operating voltage, at **a 100 % duty cycle**. All such measurements shall be made at elevated temperature (74°C), as in Section 4.1.1.

For the elevated temperature testing at 74°C, the modules to be tested shall be mounted in a temperature-testing chamber so that the lensed portion of the module is outside the chamber and all portions behind the lens are within the chamber at a temperature of 74ºC (165ºF). The air temperature in front of the lens of the module shall be maintained at a minimum of 49°C (120°F) during all tests. When the temperatures in the measurement areas are stable, a minimum of nine point luminance measurements shall be recorded spread across the icon.

Measurements shall be made using a luminance meter located on the physical axis of the module lens at a distance such that the selected aperture samples a spot size of 12mm (.5 inch) at the lens surface. The position of the luminance meter shall be translated from side to side and up and down, so as to sample the entire emitting surface of the module.

Modules not meeting requirements of Section 4.1.1 shall be rejected.

6.4.3.3 Uniformity:
The sample set shall be tested in accordance to section 4.1.2. The modules shall be tested for compliance with the requirements for luminance uniformity at a temperature of 25°C (77°F) with a spot size of 12 mm (0.5 inch). The highest and lowest values of luminance shall be recorded.

6.4.3.4 Maximum Luminance.
The sample set shall be measured to the maximum luminance requirements in section 4.1.3

6.4.3.5 Chromaticity:
From the sample set, two modules shall be measured for chromaticity per the requirements of Section 4.2. A spectraradiometer shall be used for this measurement. The ambient temperature for this measurement shall be +25°C (+77°F).

6.4.3.6 Acceptance/Rejection Criteria: The failure of any module to meet the requirements for minimum maintained luminance (4.1.1), or maximum permissible luminance (4.1.3) under standard and high temperatures, or the requirement for luminance uniformity (4.1.3) or the appropriate requirement for chromaticity (4.2) shall be considered a failure of the proposed design.

6.4.4 Electrical

6.4.4.1 Current. The sample set shall be measured for current flow in Amperes. The measured current values shall be used for quality comparison of Production Quality Assurance current measurements on production modules.

6.4.4.2 Temperature vs. Power Consumption:
The sample set shall be tested to measure the change in power consumption in Watts versus the change in temperature over the specified operating temperature range. This data shall be made available to all end users.

6.4.4.3 Power Consumption vs. Long Term Life:
If the rated power consumption of the module at 25°C (77ºF) and 74ºC (165ºF) will change more than 10% over time, the manufacturer shall provide documentation showing the projected power consumption in Watts of the module over a period of 60 months from the date of installation. This documentation must include data for the following temperature points: 0°C (32ºF), 25°C (77ºF), 50ºC (122ºF) and 74ºC (165ºF).

6.4.4.4 Power Factor (PF). The sample set shall be measured for power factor per the requirements of Section 5.6.1. A commercially available power factor meter may be used to

perform this measurement.

6.4.4.5 Total Harmonic Distortion (THD). The sample set shall be measured for total harmonic distortion per the requirements of Section 5.6.2. A commercially available total harmonic distortion meter may be used to perform this measurement.

6.4.4.6 Low Voltage Turn Off: The sample set shall be measured to meet the low voltage turn-off requirement of section 5.2.5.

6.4.4.7 Turn-On and Turn-Off Times: The sample set shall be measured to meet the turn-on and turn-off requirements of section 5.2.6

6.4.4.8 Electronic Noise. From the sample set, a sample of 2 modules shall be tested per the requirements of Section 5.6, with reference to Class A emission limits referenced in Federal Communications Commission (FCC) Title 47, SubPart B, Section 15.

6.4.4.9 Electrical Tests Evaluation: At the conclusion of the Electrical Tests, the measurement data shall be compared to the requirements of Sections 5.2 through 5.6.

6.4.4.9.1 Acceptance/Rejection Criteria: The failure of any module to meet the applicable requirements of Sections 5.2 through 5.6 shall be considered a failure of the proposed design.

6.4.4.10 Controller Assembly Compatibility.
Due to the low load current draw and high off-state impedance of modules, the following design qualification tests shall be performed to ensure the module design is compatible and operates properly with load current switches and conflict monitors in NEMA and Type 170 traffic signal control units.

Before performing the following testing, a module manufacturer should ascertain which type of signal controller unit(s) the procuring traffic authority customer has in use and tailor these tests to meet the requirements of that type of controller unit(s).

6.4.4.10.1 Load Switch Compatibility. The sample set shall be tested for compatibility and proper operation with load current switches. Each module shall be connected to a variable ac voltage supply. The ac line current into the module shall be monitored for sufficient current draw to ensure proper load switch operation while the voltage is varied from 80 VAC RMS to 135 VAC RMS. Failure of the current draw to ensure proper load current switch operation shall be cause for rejection.

6.4.4.10.2 Signal Conflict Monitor (MMU) Compatibility: The sample set shall be tested for compatibility and proper operation with signal conflict monitors. Each module shall be operated from a 135 VAC RMS supply. A 19.5 kΩ resistor shall be wired in series in the hot line between the module monitor and the ac power supply. A single-pole-single-throw switch shall be wired in parallel across the 19.5 kΩ resistor. A 220 kΩ shunt resistor shall be wired between the hot line connection and the neutral line connection on the module. Conflict monitor compatibility shall be tested by measuring the voltage decay across the 220 kΩ shunt resistor as follows: The single-pole-single-throw switch shall be closed, shorting out the 19.5 kΩ resistor, allowing the ac power supply to illuminate the module. Next the switch shall be opened, and the voltage across the 220 kΩ shunt resistor shall be measured for a decay to a value equal to or less than 10 VAC RMS within a time period equal to or less than 100 milliseconds. This test shall be repeated a sufficient number of times to ensure that testing occurs at the peak of the ac line voltage cycle.

A voltage decay across the 220 kΩ shunt resistor to a value greater than 10 VAC RMS or a decay time to 10 VAC RMS greater then 100 milliseconds shall be cause for rejection.

6.4.4.11 Nondestruct Transient Immunity.
The sample set shall be tested for transient immunity using the procedure described in Section 2.1.8, NEMA Standard TS 2-1992. Failure to meet these requirements shall be cause for rejection.