

DATE:

NVLAP LAB CODE:

NIST HANDBOOK 150-1A CHECKLIST ENERGY EFFICIENT LIGHTING PRODUCTS PROGRAM SOLID STATE LIGHTING

Instructions to the Assessor: This checklist addresses specific accreditation requirements prescribed in NIST Handbook 150-1A, Energy Efficient Lighting Products – Solid State Lighting. The Test Method Review Summary, which is used to review the laboratory’s ability to perform Energy Efficient Lighting Products test methods for solid state lighting products and LED sources, is to be used in conjunction with this checklist.

Place an “X” beside any of the following items that represent a nonconformity. Place a “C” beside each item on which you are commenting for other reasons. Record the item number and your nonconformity explanation and/or comments on the appropriate comment sheet(s). Place a check beside all other items you observed or verified at the laboratory.

Note: The numbering of the checklist items correlates to the numbering scheme in NIST Handbook 150-1A, clauses 3, 4, and 5.

3 Accreditation process

3.2 Management system review

___ 3.2.1 Management system shall be fully implemented.

___ 3.2.2 If management system documentation is not organized the same as NIST Handbook 150, a cross-reference document shall be provided.

If a cross-reference document is required, it shall verify that all requirements of this handbook and clauses 4 and 5 and annexes A and B of NIST Handbook 150 and are addressed and their locations clearly identified in the management system documentation.

3.3 On-site assessment

___ 3.3.3 All laboratory equipment required to perform accredited testing shall be available for assessment and in good working order.

Although all test methods need not be set up and operational during the on-site assessment, the laboratory shall be prepared to demonstrate selected test methods as requested by the assessor. For those cases where the test methods are not operational and a demonstration is not requested, the laboratory shall be prepared to describe the test method and the procedures they would follow and the actual equipment, fixtures and arrangements that would be used.

___ 3.3.4 The laboratory shall make available all supporting technical information in a format that is conducive to a detailed review.

DATE:

NVLAP LAB CODE:

-
- ___ 3.3.5 c) Laboratory staff shall be available to answer questions pertaining to the accreditation review.
 - ___ 3.3.5 f) The demonstrations shall include sample energy efficient lighting product(s), preparation of devices, establishment of test conditions, and the setup/use of major equipment.
 - ___ 3.3.6 The laboratory shall have a documented procedure to resolve or formulate a plan to resolve all nonconformities and provide a response to NVLAP within 30 days from the date of the on-site assessment. In the case of initial accreditation, all nonconformities shall be satisfactorily resolved before accreditation can be granted.
 - ___ 3.3.7 The laboratory shall have a documented procedure to review all comments for potential improvements in energy efficient lighting product testing.
 - ___ 3.3.8 The laboratory shall make available all calibration, traceability, verification, and check standard records for all equipment and instrumentation.

3.4 Proficiency testing

- ___ 3.4.2 Laboratories applying for initial accreditation shall participate satisfactorily in a bi-lateral proficiency testing with NIST before accreditation will be granted.
- ___ 3.4.4 Laboratories renewing accreditation shall have satisfactorily participated in all required proficiency testing during their previous accreditation period.
- ___ 3.4.5 The proficiency testing shall not be contracted out to another laboratory.
- ___ 3.4.6 In no case shall proficiency test samples be considered as calibration standards or standard reference materials or be used as substitutes for calibration standards that are traceable to NIST or other national metrology institutes (NMIs).
- ___ 3.4.7 Under the direction of NVLAP or the proficiency testing contractor, proficiency test samples may be temporarily detained (e.g., for retesting) at a laboratory. Also, on occasion, the on-site assessor may hand carry proficiency test samples to the laboratory. All proficiency test samples, like all other samples received by the laboratory, shall be listed or entered into the normal sample tracking and identification system for control and data recording. NVLAP or the proficiency testing contractor will direct the laboratory to send the proficiency test samples to a specified destination (e.g., next laboratory, proficiency testing contractor, NVLAP, or the on-site assessor).

DATE:

NVLAP LAB CODE:

____ 3.4.8 Using the test data from proficiency testing, the laboratory shall monitor its own testing performance.

Procedures for receiving (from NVLAP), analyzing, and monitoring the laboratory's own test results shall be documented in its management system documentation. These procedures shall include comparing the laboratory's proficiency testing results with those from NIST and/or other NVLAP-accredited laboratories.

____ 3.4.9 After notification of unsatisfactory proficiency testing performance, the laboratory shall take corrective action to investigate and resolve nonconformities in a timely manner, according to the requirements in NIST Handbook 150 for the control of nonconforming work.

____ 3.4.10 Proficiency testing results shall be made available to NVLAP assessors during laboratory on-site assessments.

Any problems indicated by proficiency testing shall be discussed at the on-site assessment with appropriate laboratory personnel responsible for developing and implementing plans for resolving the problems.

4 Management requirements for accreditation

4.2 Management system

____ 4.2.1 The laboratory shall ensure that the requirements of NIST Handbook 150 are met so that staff are knowledgeable of the electronic- or paper-based documentation system and can demonstrate, if authorized, the retrieval of needed documents and/or records.

____ 4.2.2 The laboratory shall create a cross-reference document that facilitates both the laboratory and the NVLAP assessor verification that all program requirements have been addressed by the management system.

____ 4.2.3 The laboratory shall have readily available the latest published version of all of the test methods for solid state lighting products and LED sources for which the laboratory seeks or holds accreditation.

____ 4.2.4 If a customer, for whatever reason (e.g., regulatory requirement), requires accreditation to versions of a test method that are not the latest published version, then the laboratory shall document that requirement and shall have readily available the required version of the test method.

____ 4.2.5 When a test method references another test method, guide, practice, or specification, the laboratory shall have readily available the referenced documents, where relevant.

DATE:

NVLAP LAB CODE:

4.2.6 In addition to the information specified in NIST Handbook 150, the management system documentation shall include:

- ___ a) testing facilities and scope of services offered;
- ___ b) policy and procedures for use of subcontractors, if applicable;
- ___ c) procedures and actions concerning damaged or altered solid state lighting product and LED source test specimens;
- ___ d) procedures by which the laboratory describes the solid state lighting product and LED source specimen and the criteria for determining if the specimen is to be accepted or rejected, e.g., rejected due to damage or outside the testing range;
- ___ e) the type and range (e.g., size, shape, level of light output) that a laboratory can test for each test method;
- ___ f) procedures for maintenance and calibration (including in-house calibration) of the equipment used in conducting the tests on solid state lighting products and LED sources that include frequency of maintenance and calibration;
- ___ g) procedures for the laboratory's participation in NVLAP proficiency testing, including analyzing and monitoring the laboratory's results, describing any corrective actions taken because of the results, and comparing the laboratory's proficiency test results with NIST or those from other NVLAP-accredited laboratories;
- ___ h) the personnel training and competency evaluations demonstrating that the test procedures are being conducted correctly.

4.4 Review of requests, tenders, and contracts

___ The laboratory shall ensure that it has the required capability [see 4.2.6 e) in NIST Handbook 150-1A] to conduct testing.

4.6 Purchasing services and supplies

___ The laboratory shall evaluate vendors and verify or test incoming services, equipment, software, materials, and supplies that affect the quality and accuracy of the test results. Examples include general laboratory equipment and supplies, equipment vendors, data acquisition and processing equipment, software vendors, software packages for data processing and calculations, calibration service providers (CSP) and certificates, standard reference lamps, secondary (working) reference lamps, and standard photometers. Records that these evaluations, verifications, and testing of services, equipment, etc. have been reviewed for technical completeness will be examined by the assessor.

DATE:

NVLAP LAB CODE:

4.13 Control of records

___ 4.13.1 In addition to the requirements in 4.13.2.1 of NIST Handbook 150 to identify the personnel responsible for sampling, testing, calibration and checking results, the personnel responsible for specimen preparation, and where appropriate, the associated date(s), shall also be identified in the records (test/calibration/verification, etc.; hard copy and electronic).

4.13.3 The records to be maintained include (but are not limited to):

___ a) acceptance/rejection (e.g., rejected due to damage) of solid state lighting products and LED sources submitted for test [see 4.2.6 d) and 4.2.6 e) in this checklist];

___ b) comprehensive logs for tracking specimens and test activities;

___ c) original data collected by laboratory;

___ d) calibration and verification data;

___ e) data and results of quality control;

___ f) equipment and maintenance records;

___ g) test reports.

___ 4.13.4 Records for each test, including calibration of test equipment, shall contain sufficient information to permit the same or another laboratory to reproduce the test plan in a manner that would make it possible to obtain comparable test results. These records shall be kept for a period of at least three years following the issuance of a test report, unless a longer period is required by the customer, regulation, or the laboratory's own procedures.

4.14 Internal audits

___ 4.14.1 The internal audit shall cover compliance with NVLAP, laboratory management system, contractual, testing, and test method requirements.

___ 4.14.2 An applicant laboratory shall conduct at least one complete internal audit, including the test methods that are requested to be on the scope of accreditation, prior to the first on-site assessment.

___ 4.14.3 For accredited laboratories, reports and pertinent records for internal audits conducted since the previous on-site assessment shall be made available for review.

DATE:

NVLAP LAB CODE:

4.15 Management reviews

- ___ 4.15.1 Periodic reviews of the management system shall reflect adherence to NVLAP requirements and the laboratory's quality objectives.
- ___ 4.15.2 Management reviews shall review all nonconformities and may reflect positive aspects of the management system.
- ___ 4.15.3 An applicant laboratory shall perform at least one complete management review prior to the first on-site assessment.
- ___ 4.15.4 For accredited laboratories, the reports and pertinent records of the management reviews conducted since the previous on-site assessment shall be made available for review.

5 Technical requirements for accreditation

5.2 Personnel

5.2.1 Personnel records

- ___ 5.2.1.1 The laboratory shall maintain a list of personnel designated to fulfill NVLAP requirements including: Laboratory Director, Technical Director, Team Leaders, NVLAP Authorized Representative, NVLAP Approved Signatories, and the staff responsible for conducting the testing.
- ___ 5.2.1.2 The laboratory shall document and maintain records on the required qualifications of each staff member, including a résumé of qualifications; laboratory testing procedures to which the person is assigned and authorized to perform; and the results of periodic testing performance (competency) reviews (see 5.2.3.4 in this checklist), which may include interlaboratory testing and/or repeated testing by the same operator or comparative testing with two or more operators.
- ___ 5.2.1.3 The laboratory shall notify NVLAP when key personnel (see 5.2.1.1 in this checklist) are added to or removed from the staff. Notification to NVLAP of personnel changes shall include a current résumé for each new staff member.

5.2.2 Specific experience and competence of Technical Director

- ___ The laboratory's Technical Director (or an appropriate supervisor) shall be experienced in testing solid state lighting products and LED sources and shall have the technical competence and the supervisory capability to direct the work of professionals and technicians in testing solid state lighting products and LED sources.

DATE:

NVLAP LAB CODE:

5.2.3 Competency reviews

- 5.2.3.1 The personnel competency program for testing solid state lighting products and LED sources includes the applicable portions of the following, as a minimum:
- ___ a) general requirements of the test method;
 - ___ b) specimen preparation and/or mounting techniques;
 - ___ c) techniques for measuring ambient thermal conditions;
 - ___ d) seasoning and stabilization procedures for solid state lighting products and LED sources;
 - ___ e) procedures for transporting solid state lighting products and LED sources between warm-up racks and measurement apparatus;
 - ___ f) voltage, current, and electrical power measurements;
 - ___ g) oscilloscope measurements;
 - ___ h) driver circuit connection and verification;
 - ___ i) photometric calibration techniques;
 - ___ j) thermocouple mounting and calibration;
 - ___ k) colorimetric measurement techniques;
 - ___ l) goniophotometric measurement techniques;
 - ___ m) for solid state lighting products and LED sources assigned, photometric measurement procedures and techniques;
 - ___ n) calibration and calibration-related requirements, including those in 5.6.5 and 5.6.6 in this checklist.
- ___ 5.2.3.2 The laboratory shall evaluate the competency of each staff member for each test method the staff member is authorized to conduct.
- ___ 5.2.3.3 For each staff member, the staff member's immediate supervisor, or a designee appointed by the Laboratory Director, shall conduct annually an assessment and an observation of competency.
- ___ 5.2.3.4 These annual competency reviews shall be documented, dated, signed by the supervisor and the employee, retained in the personnel files and be available for review by the assessor (only personnel files related to competency reviews for NVLAP-accredited testing need be available).

DATE:

NVLAP LAB CODE:

5.2.4 Training

- ___ 5.2.4.1 The laboratory shall have a description of its training program for ensuring that staff is able to perform accredited testing properly.
- ___ 5.2.4.2 The training program shall be updated and implemented. In addition, current staff members shall be given additional training when accredited test methods are updated or procedures change, or when the individuals are assigned new responsibilities.
- ___ 5.2.4.4 The laboratory shall ensure that each new staff member is properly trained to conduct accredited testing. Minimum training requirements for testing of solid state lighting products and LED sources includes the applicable portions of 5.2.3.1 in this checklist.
- ___ 5.2.4.5 Training materials that are maintained within the laboratory shall be kept up-to-date, including applicable versions of standard test methods, as well as appropriate reference documents, texts, and scientific and industry periodicals. These materials shall be readily available to the laboratory staff.

5.2.5 Subcontractors

- ___ The laboratory shall ensure all individuals performing testing activities satisfy all NVLAP requirements, irrespective of the means by which individuals are compensated (e.g., the laboratory must ensure all test personnel receive proper training and supervision and are subject to annual performance reviews, etc.).

5.3 Accommodation and environmental conditions

- ___ 5.3.1 The laboratory workspace and environmentally controlled spaces shall be checked for compliance to the required conditions (see 5.3.2 in this checklist).
- ___ 5.3.2 Monitoring and control devices shall be calibrated (if required – see 5.6.1 and 5.6.2.2.1 and their notes in NIST Handbook 150) and functioning properly so as to maintain and record the required environmental conditions required (a) by the standards or laboratory methods or (b) where the environmental conditions influence the quality of the test results.

DATE:

NVLAP LAB CODE:

-
- ___ 5.3.3 The laboratory shall maintain and document the required environmental conditions as specified in the particular standard test procedure/method to which the laboratory is accredited. The environmental conditions include:
- a) temperature;
 - b) relative humidity;
 - c) air movement;
 - d) ambient lighting.

5.4 Test and calibration methods and method validation

5.4.1 Standard test methods

- ___ 5.4.1.1 The management system documentation shall contain or make reference to detailed written documentation of the procedures, practices, instructions and equipment that the laboratory uses in conducting the test methods for the different types of solid state lighting products and LED sources for which it seeks or holds accreditation.

These detailed instructions, including those for equipment operation, calibration checks, and quality control checks, shall address any laboratory-specific information not contained in the standard method.

When necessary the test method shall be supplemented with additional detailed instructions beyond the test method to ensure consistent application.

- ___ 5.4.1.2 The photometric, colorimetric, electrical, and lumen maintenance test procedures included in the solid state lighting products and LED sources program have been developed to be generally applicable to a variety of solid state lighting products and LED sources that differ by factors such as size, shape, spectral characteristics, and intensity. As a consequence, the management system documentation shall include laboratory-specific (see 5.4.1.1 in this checklist) detailed descriptions of the operation and calibration of the test equipment and instrumentation the laboratory uses for the particular type(s) of solid state lighting products and LED sources it tests.

DATE:

NVLAP LAB CODE:

_____ 5.4.1.3 The Illuminating Engineering Society (IES) LM-58, Spectroradiometric Measurements, prescribes in general terms the instrument and measurement requirements, calibration procedures, and physical standards for conducting the measurements, but is not specific as to instrument, object, or material. Laboratories seeking or holding accreditation for colorimetric measurements of solid state lighting products and LED sources conducted in accordance with IES LM-58 shall include, in the management system documentation, detailed laboratory-specific (see 5.4.1.1 in this checklist) descriptions of the procedures it uses to conduct the tests.

5.4.2 Estimation of measurement uncertainty

_____ At a minimum, the management system documentation shall list the important components that substantially affect the uncertainty of the test results. This can be done for groups of similar test methods (e.g., grouped by electrical, photometric [intensity, flux], colorimetric, or lumen maintenance properties) rather than for each test method.

The uncertainty shall be determined and reported if required by the test method, the regulator, or the customer.

5.5 Equipment

_____ 5.5.1 The laboratory shall notify NVLAP when key testing equipment is added, removed, or altered. Documentation of the validation of the equipment performance shall be provided by the laboratory to NVLAP.

5.6 Measurement traceability

_____ 5.6.2 The laboratory shall determine equipment calibration (and verification and maintenance) intervals based on the equipment's frequency of use and the environment in which it is used, and also in accordance with standard test methods, manufacturer's recommendations, or as recommended in this checklist, whichever results in a shorter time between calibrations. Ultimately the laboratory shall be responsible for the determination and documentation of the calibration (and verification and maintenance) intervals. Extension of the time interval between calibrations is acceptable if the laboratory can provide justification for increasing the interval.

DATE:

NVLAP LAB CODE:

	<i>Apparatus/Instrumentation</i>	<i>Recommended Calibration Frequency</i>
___	automatic data logging and readout	annually
___	ammeters, ohmmeters, voltmeters, wattmeters	annually
___	potentiometer	annually
___	thermocouple and related instrumentation	annually
___	oscilloscope	annually
___	environmental control apparatus	annually
___	shunt resistors	every three years
___	photometers	
	absolute photometry	annually
	relative photometry	every three years
___	current-to-voltage amplifiers	every three years
___	colorimeters	
	absolute colorimetry	annually
	relative colorimetry	every three years
___	spectroradiometers	annually (see Note)
___	reference circuits	per test method
___	thermometers	annually

NOTE It is recommended that spectroradiometer calibrations be verified. If the time between spectroradiometer usage exceeds a week, spectroradiometer calibrations should be verified prior to testing. In addition, it is recommended that spectroradiometers be fully recalibrated annually to ensure they are in good working condition.

- ___ 5.6.3 Proper performance of the testing equipment shall be periodically verified as needed through the use of cross checks and working standards.
- ___ 5.6.4 The reference standards used and the environmental conditions at the time of calibration shall be documented for all calibrations.
- 5.6.5 The following requirements apply for calibrations and calibration certificates.
- ___ a) Certificates shall be required for calibrations performed by outside services. A calibration certificate shall indicate uncertainty or accuracy tolerance limits, and traceability of reference standards.

DATE:

NVLAP LAB CODE:

- ___ b) Certificates may not be required when a laboratory performs its own calibration and records are kept. If the testing laboratory performs its own calibration, the identity of the personnel involved, the standard metrological procedures used, the environmental conditions, and the measurement uncertainty shall be documented. Evidence and demonstration of traceability as required in NIST Handbook 150, Annex B, shall be available. Records shall contain sufficient information to permit repetition of the calibration.
- ___ c) For calibrations performed by the testing laboratory, it shall have properly trained personnel who understand the importance of the various factors that affect the uncertainty of the calibration and its effect on the uncertainty of the final test result (see NIST Handbook 150, 5.4.6 and Annex B).
- ___ d) Laboratories that test solid state lighting products and LED sources shall document, for their standard reference lamps and standard photometers, each step of the traceability chain and, for each step, the magnitude of the associated uncertainty as stated on their calibration certificates (or the uncertainty as determined [or estimated] by the laboratory if it is an in-house calibration conducted by the laboratory).

5.6.6 In addition to the information specified in NIST Handbook 150, 5.5.5, calibration or verification records shall include the following:

- ___ a) a list of all equipment parameters requiring calibration, traceability, or verification;
- ___ b) range of calibration/traceability/verification;
- ___ c) resolution (precision or the number of digits read) of the instrument and its allowable error (i.e., tolerance);
- ___ d) periodic verification dates and schedule;
- ___ e) identity of the laboratory individual/group or external service responsible for calibration;
- ___ f) identity and source of reference standard and traceability.

5.7 Sampling

___ Appropriate sampling plans and procedures shall be included in the management system when they are required by the test method or when the laboratory is required to sample.

DATE:

NVLAP LAB CODE:

5.10 Reporting the results

5.10.1 General

_____ 5.10.1.1 Where appropriate, test reports shall clearly state that the test results apply to the product or system as tested and, if required, conform to regulatory requirements.

_____ 5.10.1.2 Test reports shall clearly reference the test method and edition (year of publication) applied to the product or system tested.

5.10.2 Data analysis and report generation

_____ 5.10.2.1 In some cases, raw data collected by computer are collated, reduced, analyzed, or otherwise treated for direct incorporation in the test report. Such treatment involving transmission of the data, writing, and generation of the test report is generally performed at the laboratory or at an area close to the facility and under the control of laboratory personnel. In such cases, the laboratory personnel responsible for the report writing and generation shall be available during the laboratory's on-site assessment to be interviewed by the assessor for evaluation of the laboratory's compliance with the NVLAP criteria for test reports.

_____ 5.10.2.2 At times, the final report may be written and generated at an off-site facility that is located some distance from the testing laboratory such that the assessor cannot interview the off-site personnel. In such a case, the laboratory shall have in place for assessor review appropriate written descriptions in the management system documentation of procedures and documentation for assuring the accuracy and validity of the data transmission, the incorporation and accurate analysis of the data in the test report, and the compliance of the test report with NVLAP criteria. Depending on the on-site laboratory evaluations of these written descriptions, a visit to the off-site facility may be required. When warranted, an assessor shall visit the off-site facility at additional cost to the laboratory before accreditation is granted or renewed.

_____ 5.10.2.3 When a test report is written at an off-site facility such that the assessor cannot interview the off-site personnel, the report shall include the names and addresses of both those responsible for conducting the laboratory tests and for writing and generating the test report. Copies of typical reports written at an off-site facility shall be available at the laboratory at the time of the on-site assessment and these typical reports shall be reviewed by the assessor for compliance with NVLAP requirements.

DATE:

NVLAP LAB CODE:

- ___ 5.10.2.4 If a laboratory uses several organizational departments for the discrete functions of testing, data collection, data processing, and test report preparation and generation, it is necessary that lines of responsibility with distinct supervisory positions be defined and that no conflicts exist. The assessor shall review the procedures and documentation of the lines of responsibility with distinct supervisory positions during the on-site assessment, and also shall verify that all NVLAP requirements regarding the writing and storage of reports are followed.

6 Additional requirements

The following requirements relate to sample preparation and identification, environmental conditions, calibration of standards, test report and data recording requirements, test equipment and circuitry requirements, absorption corrections, and instrument electrical loss adjustments where appropriate for particular standard specifications.

- ___ a) Proper sample preparation and maintenance, in appropriate conditioned state, before testing.
- ___ b) Sample and test specimen identification for correlation with related record.
- ___ c) Test data forms (as required by the reference standard or developed in-house) are properly completed.
- ___ d) For the accredited testing, the participant staff maintains a dated log book or record.
- ___ e) Test equipment, devices, and instruments meet the required accuracy regulations and calibration conditions for the appropriate standard specifications.
- ___ f) Electrical power is conditioned and regulated as required by the appropriate standard specifications.
- ___ g) Voltage/current maintained within specifications during the test measurements.
- ___ h) The test method(s) is performed correctly, and is appropriate for the given specimen of solid state lighting products and LED sources.
- ___ i) Tests are conducted within the temperature, humidity, and/or air flow conditions as specified by the standard test method(s).
- ___ j) Solid state lighting products and LED sources are tested in the specified orientation, if any.
- ___ k) Specimens of solid state lighting products and LED sources have been properly seasoned.
- ___ l) Measurement circuitry is appropriate for the test method.

DATE:

NVLAP LAB CODE:

-
- m) Calibrations of photometric standards are verified (see 5.6 in this checklist).
 - n) Standard reference lamps are recalibrated at appropriate intervals (for example, every 30 hours to 50 hours of burning time).
 - o) A record is maintained of the number of hours each reference lamp is burned.
 - p) Standard photometers are recalibrated at appropriate intervals.
 - q) Measurements of solid state lighting products and LED sources are reported only after test specimens have stabilized.
 - r) Test reports are complete and accurate for the given solid state lighting product and LED source specimen.
 - s) For photometric measurements, test reports adequately describe the procedures and equipment, including calibration systems.
 - t) For lumen performance tests, laboratory procedures for monitoring and recording lumen maintenance times are appropriate to the test methods.
 - u) Absorption correction procedures are being applied for sphere measurements.
 - v) Adjustments for instrument electrical losses, if any, are made.
 - w) For lumen maintenance tests, laboratory procedures for monitoring and recording specimen failure are appropriate to the test methods.

