DATE: | NVLAP LAB CODE:

NIST HANDBOOK 150-10 CHECKLIST
EFFICIENCY OF ELECTRIC MOTORS PROGRAM

Instructions to the Assessor: This checklist addresses specific accreditation requirements prescribed in NIST Handbook 150-10, Efficiency of Electric Motors. The Test Method Review Summary, which is used to review the laboratory's ability to perform Efficiency of Electric Motors test methods, 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 an "OK" 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 150-10, 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.

____ 3.2.3 If management system documentation is not organized the same as NIST Handbook 150, the cross-reference document shall verify that all requirements of NIST Handbook 150-10 and clauses 4 and 5, as well as annexes A through B, of NIST Handbook 150 are addressed and their locations 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.

The laboratory shall be prepared to demonstrate selected test methods as requested by the assessor.

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

____ 3.3.5 c) Laboratory staff shall be available to answer questions.

____ 3.3.5 f) The demonstrations shall include sample test motor(s), preparation of devices, establishment of test conditions, and the setup/use of major equipment.

____ 3.3.6 The laboratory shall 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.

____ 3.3.7 The laboratory shall review all comments for potential improvements in efficiency of electric motors testing.

____ 3.3.8 The laboratory shall make available all calibration, traceability, and verification records for all equipment and instrumentation.

3.4 Proficiency testing

____ 3.4.2 Each laboratory shall complete and return to NVLAP the proficiency data release form.

____ 3.4.3 The laboratory shall have satisfactorily participated in all required proficiency testing during its previous accreditation period.

Laboratories applying for initial accreditation shall also participate satisfactorily in proficiency testing (or a suitable alternative, if available), provided the proficiency testing is offered during the application period, before accreditation will be granted.

____ 3.4.4 The proficiency testing shall not be contracted out to another laboratory.

____ 3.4.5 Using the test data from proficiency testing, the laboratory shall monitor its own testing performance.

Procedures for analyzing and monitoring the laboratory's own proficiency testing results shall be documented in its management system documentation. These procedures shall include comparing the laboratory's proficiency testing results with those from other laboratories.

____ 3.4.6 If the laboratory performs unsatisfactorily in any proficiency test, the laboratory shall take corrective action to investigate and resolve all nonconformities in a timely manner, according to the requirements of NIST Handbook 150 for the control of nonconforming work.

____ 3.4.7 The results of proficiency testing shall be made available to NVLAP assessors for use during laboratory on-site assessment visits.

Any problems indicated by proficiency testing shall be discussed 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 allowing the laboratory and a NVLAP assessor to verify that all requirements of clauses 4 and 5 and annexes A and B of NIST Handbook 150 and the corresponding requirements of NIST Handbook 150-10 are addressed in the management system documentation.

____ 4.2.3 The laboratory shall have readily available the regulation(s)` and the applicable version of the standard(s) for the test methods for which accreditation has been requested.

____ 4.2.4 If a customer, for whatever reason (e.g., regulatory requirement), requires accreditation to previous versions of a test method, 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.

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 relevant services offered; specifically the range of ratings of motors that the laboratory can test according to IEEE Standard 112-1996, Method B (CSA Standard C390-93, Method 1);

____ b) policy and procedures for use of subcontractors, if applicable;

____ c) procedures for receipt, identification, and tracking of motor test samples;

____ d) procedures by which the laboratory describes the motor test samples and the criteria for determining if the motor is acceptable for testing;

____ e) procedures and actions concerning damaged or altered test motors;

____ f) procedures for maintenance and calibration of the equipment used in conducting the tests on efficiency of electric motors;

____ g) descriptions of the procedures, practices, and equipment that the laboratory uses in conducting efficiency measurements of electric motors according to IEEE Standard 112-1996 Method B or CSA Standard C390-93 Method 1 or both;

____ h) procedures for the laboratory's participation in NVLAP proficiency testing, including receiving, analyzing, and monitoring the laboratory's results, and a description of any corrective actions taken because of the results;

____ i) the personnel training and competency evaluations that demonstrate that the test procedures are being followed correctly.

4.6 Purchasing services and supplies

The laboratory shall evaluate vendors and verify or test incoming equipment, materials, and supplies that affect the quality and accuracy of the test results, including:

____ a) calibration service providers/calibration certificates;

____ b) general laboratory equipment and supplies, including

____ 1) thermocouples,

____ 2) thermocouple wire;

____ c) data processing and acquisition equipment.

4.13 Control of records

____ 4.13.1 The personnel responsible for motor preparation, and where appropriate, the associated date(s), shall also be identified in the records.

4.13.3 The records to be maintained and available for assessor review include (but are not limited to):

____ a) acceptance/rejection of motors submitted for test [see 4.2.6 d)];

____ b) comprehensive logs for tracking motors and test activities;

____ c) original data collected by laboratory;

____ d) calibration certificates and records and verification records;

____ e) data and results of quality control;

____ f) equipment and maintenance records;

____ g) test reports.

____ 4.13.4 Test records, sufficient to reconstruct the test report, 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, as well as regulatory, contractual, and testing requirements.

____ 4.14.2 An applicant laboratory shall conduct at least one complete internal audit prior to the first on-site assessment and the internal audit records shall be made available for review before or during the first on-site assessment.

____ 4.14.3 For accredited laboratories, internal audit reports conducted since the previous on-site assessment shall be made available for review.

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 The report of the management review shall be available during the NVLAP on-site assessment.

5 Technical requirements for accreditation

5.2 Personnel

5.2.1 Personnel records

____ 5.2.1.1 The laboratory shall maintain a list of key 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 also 5.2.3.4), which may include testing among laboratories 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) 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 efficiency of electric motors testing and shall have the technical competence and the supervisory capability to direct the work of professionals and technicians in efficiency of electric motors testing.

5.2.3 Competency reviews

5.2.3.1 Staff responsible for conducting the testing shall have technical competence in the following areas as a minimum:

____ a) general requirements of the electric motor test methods;

____ b) testing laboratory system capabilities (electrical, mechanical, and environmental);

____ c) electric motor specimen preparation and/or mounting techniques;

____ d) connection and operation of the test equipment;

____ e) electric motor pre-test temperature prcedures;

____ f) techniques for measuring ambient thermal conditions;

____ g) use of equipment for measuring:

____ 1) temperature,

____ 2) resistance,

____ 3) torque,

____ 4) power,

____ 5) speed (rpm) and slip,

____ 6) voltage,

____ 7) current,

____ 8) frequency of input power;

____ h) equipment calibration techniques;

____ i) data collection, calculation, and analysis.

____ 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 performance competency.

____ 5.2.3.4 These annual performance competency reviews shall be documented, dated, signed by the supervisor and the employee, retained in the personnel file and be available for review by the assessor.

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 tests properly.

____ 5.2.4.2 The training program shall be updated and current staff members shall be given additional training when 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 trained for the testing duties assigned.

____ 5.2.4.5 Each staff member assigned to conduct accredited testing shall be trained in all the competency requirements listed in 5.2.3.1.

____ 5.2.4.6 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 (subcontractors, students, temporary personnel, etc.) 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 the required conditions.

____ 5.3.2 Monitoring and control devices shall be functioning properly so as to maintain and record the required environmental conditions.

5.3.3 Specific environmental requirements follow:

____ a) The laboratory shall be able to control the ambient air temperature within the temperature range of 10 °C to 40 °C.

____ b) Drafts and air currents shall be minimized in order to achieve required stable temperature rises during testing.

____ c) There shall be sufficient open space around the motor during testing so as not to restrict the normal air flow around or through the motor during testing.

____ d) The method for securing the motor to restrict movement during testing shall not interfere with the cooling of the motor.

____ e) The motor shall be protected from movement of the air resulting from sources other than the motor or loading devices themselves.

____ f) The ambient temperature is relatively stable during the test.

____ g) If the motor was tested at an altitude $\geq$ 1000 m (3300 ft), appropriate corrections are made.

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 instructions of the procedures, practices, instructions and equipment that the laboratory uses in conducting the test methods 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 For compliance with U.S. DOE requirements in the NVLAP EEM Program, the laboratories shall use the test procedures described in IEEE Standard 112-1996 Method B as modified by 10 CFR Part 431, Appendix B to Subpart B – *Uniform Test Method for Measuring Nominal Full Load Efficiency of Electric Motors*, or

CSA International (or Canadian Standards Association) Standard C390-93 Test Method (1).

a) ***Heat run***

____ 1) The initial resistance measurement shall be taken after the motor is exposed to the ambient temperature for a sufficient time for the windings to reach a stable reference temperature.

____ 2) If a heat run is to be performed, it shall be performed first in the test sequence.

____ 3) The heat run shall be performed at rated voltage, rated frequency, and rated load (1.0 service factor).

____ 4) If the motor is overloaded at the start of the test to shorten the total test time, the overload shall be kept under 150 % of rated load.

____ 5) The motor shall be operated at rated load, voltage, and frequency for a sufficient period of time for the temperatures to stabilize with not more than a 1 °C change in temperature rise between two successive readings taken at ½ hour intervals.

____ 6) At the conclusion of the test, the resistance between two lines shall be measured

- Within 30 seconds of shutdown for motors rated 50 hp or less,
- Within 90 seconds of shutdown for motors rated 51 hp to 200 hp, or
- Within 120 seconds of shutdown for motors rated above 200 hp.

If the time limits above are exceeded, then resistance shall be measured as a function of time after shutdown, and the results plotted and extrapolated back to the appropriate time delay to determine the resistance at shutdown.

b) ***Load performance test***

____ 1) The load test shall be performed following a heat run, or performed at another time. The motor temperature shall be adjusted by briefly operating the motor at rated load or some overload condition.

____ 2) The temperature of the stator winding shall be within 10 °C of the hottest thermosensor temperature reading during the heat run at rated operating conditions on a machine under test or on a duplicate machine for the rated full load operating temperature prior to beginning the test.

____ 3) The temperature shall be stable at the start of a test. The test should be performed as quickly as possible to minimize temperature changes in the motor during the test.

____ 4) The motor shall be loaded in decreasing order from the highest to the lowest load.

____ 5) The load readings shall be taken at two points suitably chosen above 100 % but not exceeding 150 % of rated load, and at four points including 100 % of rated load and approximately equally spaced between 100 % and 25 % of rated load.

____ 6) The load shall be steady during the time that the data at each load are recorded.

____ 7) The dynamometer correction test shall be performed properly.

____ 8) The dynamometer correction test shall be performed after the load test is completed.

c) ***No-load test***

____ 1) The motor shall be operated at no-load until the input power at rated voltage and frequency does not vary by more than 3 % between two successive readings over a half hour time interval before starting the test.

____ 2) The test shall be begun at the highest voltage level and the voltage reduced in steps from that level to the lowest test value.

____ 3) The readings shall be taken at voltages from approximately 125 % of rated voltage down to the point where further voltage reduction increases the current or the motor becomes unstable.

5.4.2 Off-site testing

____ 5.4.2.2 The laboratory shall maintain records of its off-site testing.

5.4.2.3 If a laboratory selects off-site testing methods to be included in its scope of accreditation, it shall provide to the NVLAP assessor the following:

____ a) complete step-by-step procedure for personnel to follow when performing the standard off-site test;

____ b) demonstration of the test procedure;

____ c) folder or file containing raw data from off-site tests;

____ d) test reports and test data sheets;

____ e) demonstration of compliance with NVLAP calibration and traceability requirements;

____ f) evidence that adequate supervision during the off-site testing is provided by a qualified staff member of the accredited laboratory.

5.4.3 Additional requirements

The following requirements relate to test methods, calibrations, and conduct of tests.

____ a) Electric motor specimens shall be properly stored, prepared, and maintained in the appropriate state before testing.

____ b) Electric motor tests shall be performed correctly.

____ c) Tests shall be conducted within the specified operating conditions.

____ d) Electric motors shall be uniquely identified for correlation with the related test report and records.

____ e) Test data forms shall be properly completed.

____ f) Test reports shall be complete and accurate for the electric motor specimens.

____ g) Participant staff for the test shall maintain a dated log book or record.

5.4.4 Estimation of measurement uncertainty

____ 5.4.4.1 At a minimum, the management system documentation shall list the important variables that substantially affect the uncertainty of the test results.

____ 5.4.4.2 The uncertainty shall be determined and reported if required by the test method, regulator, or the customer.

5.5 Equipment

____ a) ***Grounding of motor and test equipment***

Provisions shall be available to properly ground the motor and test equipment as may be necessary during testing for purposes of safety.

b) ***Power supply***

____ 1) The power supply shall be at rated voltage for the motor being tested.

____ 2) The power source shall provide balanced voltages.

____ 3) The line voltages shall be balanced within 0.5 %.

____ 4) The voltages should be sinusoidal and shall have a voltage waveform deviation factor not exceeding 10 %.

____ 5) The average frequency shall be within ± 0.1 % of the specified test value.

____ 6) The frequency variation during the tests shall not exceed 0.33 % of the average frequency.

____ 7) Any deviation of frequency from the rated frequency shall be taken into consideration when calculating the slip.

c) ***Other equipment requirements***

____ 1) Test instrumentation shall be properly selected and installed to minimize errors introduced by:

- loading of the signal source,
- lead calibration,
- range, condition, and calibration of the instrument,
- inductive or electrostatic coupling of signal leads to power systems,
- common impedance coupling or ground loops,
- inadequate common mode rejection, and
- conducted interference from the power line.

____ 2) The loading device, such as a dynamometer, shall be appropriate for the size of the motor.

____ 3) The motor shall be aligned correctly with the loading device (dynamometer).

____ 4) When determining the cold winding resistance, a double bridge shall be used, or other means of equivalent accuracy, and checked by a second instrument, if possible.

____ 5) If thermocouples are used to monitor temperature, they shall be installed correctly.

____ 6) Multiple thermocouples shall be cross-checked at ambient temperature for accuracy and agreement.

5.6 Measurement traceability

____ 5.6.2 To account for the effects on traceability of the calibration of measurement and test equipment, the laboratory shall determine equipment calibration, 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 specified in the following table, whichever results in a shorter time between calibrations.

Extension of the time interval between calibrations is acceptable if the laboratory can provide justification for increasing the interval.

		Apparatus/Instrumentation	*Calibration or Verification Frequency*
____	a)	ammeters, voltmeters and wattmeters	Annually
____	b)	current transformers (CTs)	Every 5 years
____	c)	potential transformers (PTs)	Every 5 years
____	d)	shunts	Every 2 years
____	e)	data acquisition systems	Annually
____	f)	electronic transducers	Annually
____	g)	frequency meters	Annually
____	h)	resistance measurement equipment	Annually
____	i)	speed sensors	Annually
____	j)	temperature measuring equipment	Annually
____	k)	torque measuring equipment	See Annex A for requirements for the calibration interval for torque measurement equipment
____	l)	calibration weights and torque arm	1 to 3 years *

* With regard to torque measurement, the frequency of recalibration of masses (weights) and arm length needs to be determined by the laboratory. Depending on how often the masses and arm are used, their care and storage, and records that the laboratory develops and maintains to see if any change has occurred, the laboratory may determine that the masses and arm length need to be recalibrated relatively infrequently; that is with sufficient documentation for masses and arm length, the laboratory may determine to extend the calibration frequency interval of one year to an interval not exceeding three years.

____ 5.6.3 Proper performance of the testing equipment shall be periodically verified as needed.

____ 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

5.6.5.1 The following requirements apply for calibrations and calibration certificates:

____ a) Certificates are required for calibrations performed by outside services. A calibration certificate shall indicate uncertainty or accuracy tolerance limits, and traceability of reference standards.

____ b) 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. These records shall contain sufficient information to permit repetition of the calibration. Certificates may not be required when a laboratory performs its own calibrations and records are kept.

____ 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).

5.6.5.2 The accuracy of the test equipment shall be within the following limits:

____ a) Instrumentation for measuring voltage, current, and power shall have an accuracy of ± 0.2 % of full scale.

____ b) Instrument transformers shall have an accuracy of ± 0.3 %.

____ c) Instrumentation used to measure speed shall have an accuracy within ± 1 rpm of the reading.

____ d) Instrumentation used to measure the output torque of the motor shall have an accuracy of ± 0.2 % of full scale.

NOTE When the instrumentation in checklist items 5.6.5.2 a) and 5.6.5.2 b) are calibrated as a system, the accuracy shall be ± 0.2 % of full scale.

____ 5.6.5.3 The range of each instrument chosen shall be as low as practical for the motor being tested such that readings are in the upper region of the scale.

____ 5.6.5.4 Properly sized dynamometers shall be used such that the coupling, friction, and windage losses of the dynamometer measured at the rated speed of the motor being tested are not greater than 15 % of the rated output of the motor being tested.

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 variables 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.

5.10 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 regulator requirements.

____ 5.10.1.2 Hardware and software used in testing, analyzing, and reporting test results shall be periodically validated and verified for accuracy.

____ 5.10.1.3 Test reports shall state the test method used.

____ 5.10.1.4 Test reports shall contain sufficient information for the conditions to be reproduced at a later time if a retest is necessary.

____ 5.10.1.5 Test reports shall contain the required technical information.

____ 5.10.1.6 The correlation factor for smoothing stray-load loss shall be 0.90 or higher with no more than one of the six points omitted from the analysis.

____ 5.10.1.7 When necessary to repeat the test to obtain a correlation factor of 0.90 or higher, the source of error shall be investigated and corrected prior to rerunning the test.

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. The assessor shall perform an independent calculation of the efficiency based on laboratory test results and compare the independently-calculated efficiency with that calculated by the laboratory.

____ 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 its 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 will 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. The assessor shall perform an independent calculation of efficiency and compare it to that calculated at the off-site facility as required in 5.10.2.1.

____ 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.

NIST HANDBOOK 150-10 CHECKLIST

ANNEX A (normative)

Calibration frequency of torque measurement equipment

A.1 Background

In measuring the energy efficiency of electric motors, the mechanical output power is directly proportional to the torque; therefore torque is a primary factor in the measurement of efficiency. There are a variety of torque measuring devices including torque transducers and cradle dynamometers with load cells for determining force. In addition there are differing operating practices for starting the machines which affect the stress on the torque measuring equipment. Some laboratories have a practice of taking a locked rotor test as a part of the test sequence. Laboratories may or may not have temperature control. Because of these varying conditions, NVLAP has concluded that the previous annual calibration interval for torque measuring equipment is too long, unless evidence is available to justify it.

Calibration intervals are most properly determined by examining and analyzing the long-term results of repeated calibrations. As described above, torque transducers can be subjected to excessive stress during the testing which can result in distortion. Load cells can also be subjected to excessive stress. The calibration interval of torque measurement equipment must account for the possibility of excessive stress and distortion.

For many laboratories weekly or even daily calibration does not present a problem since the calibration of torque measuring equipment is usually completed on-site using calibrated torque arms and calibrated weights (calibration arm may be available from the torque measurement equipment vendor). This avoids the inconvenience and expense of taking equipment out of service and sending it to a calibration service provider.

However, some laboratories have expressed concern that they do not have in-house calibration capability using calibrated torque arms and calibrated weights and these laboratories cannot afford the time to send the torque measurement equipment out for recalibration. In these cases, it is up to the laboratory to provide evidence that the calibration interval it uses is sufficient to satisfy the required accuracy limits. Evidence of past calibration data can be used to show that the calibration of the torque measurement equipment “as received" by the calibration service provider has remained within the required accuracy limits over the elapsed time since the last calibration. If it is not clear that the data shown on the calibration certificate are for the “as received” condition (before any adjustment was made to the torque measurement equipment), then this should be clarified with the calibration service provider. There is a good likelihood that the calibration service provider has “as received” calibration records even though those records may not have appeared on the calibration certificate.

Extending the time interval between calibrations (but not beyond one year) is permissible provided the laboratory can demonstrate, through past calibration records, that the torque measurement equipment is sufficiently stable during the extended time interval. If the time interval between tests exceeds the laboratory’s calibration interval for the torque measurement equipment, then the laboratory need only calibrate the torque measurement equipment before each test.

A.2 Requirements

____ A.2.1 Laboratories shall determine the equipment calibration interval based on the torque measuring equipment's frequency of use and the environment in which it is used, including subjecting the equipment to excessive stress causing distortion etc., and in accordance with standard test methods.

____ A.2.2 Laboratories shall provide evidence that, throughout the calibration interval used for their torque measuring equipment, the calibration of the torque measuring equipment remains within the required accuracy limits.

____ A.2.3 The calibration interval shall not exceed one year.

DATE: | NVLAP LAB CODE:

NIST HANDBOOK 150-10 CHECKLIST
COMMENTS AND NONCONFORMITIES

Instructions to the Assessor: Use this sheet to document comments and nonconformities. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and nonconformities with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

Item No.	Comments and/or Nonconformities