NIST HANDBOOK 150-24
2010 Edition

National Voluntary Laboratory Accreditation Program

PERSONAL BODY ARMOR

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NVLAP AND THE NVLAP LOGO

Contents

Foreword

The NIST Handbook 150 publication series sets forth the procedures, requirements, and guidance for the accreditation of testing and calibration laboratories by the National Voluntary Laboratory Accreditation Program (NVLAP). The series is comprised of the following publications:

- NIST Handbook 150, *NVLAP Procedures and General Requirements*, which contains the general procedures and requirements under which NVLAP operates as an unbiased third-party accreditation body;

- NIST Handbook 150-xx program-specific handbooks, which supplement NIST Handbook 150 by providing additional requirements, guidance, and interpretive information applicable to specific NVLAP laboratory accreditation programs (LAPs).

The program-specific handbooks are not stand-alone documents, but rather are companion documents to NIST Handbook 150. They tailor the general criteria found in NIST Handbook 150 to the specific tests, calibrations, or types of tests or calibrations covered by a LAP.

NIST Handbook 150-24, *NVLAP Personal Body Armor*, presents the technical requirements and guidance for the accreditation of laboratories that test personal body armor.

The handbook was written with the participation of technical experts in the field of personal body armor and was approved by NVLAP.

This handbook is also available on the NVLAP web site <http://www.nist.gov/nvlap>.

Questions or comments concerning this handbook should be submitted to NVLAP, National Institute of Standards and Technology, 100 Bureau Drive, Stop 2140, Gaithersburg, MD, 20899-2140; phone: 301-975-4016; fax: 301-926-2884; e-mail: nvlap@nist.gov.

Introduction

In 2006, the U. S. Department of Justice (DOJ) National Institute of Justice (NIJ) Office of Science and Technology requested the establishment of a NVLAP program to accredit laboratories that test ballistic- and stab-resistant personal body armor to support the voluntary minimum performance standards developed for NIJ by the National Institute of Standards and Technology (NIST) Office of Law Enforcement Standards (OLES).

NIJ is the research, development, and evaluation agency of the U.S. DOJ and is dedicated to researching crime control and justice issues. NIJ provides objective, independent, evidence-based knowledge and tools to meet the challenges of crime and justice, particularly at the state and local levels. NIJ's principal authorities are derived from the Omnibus Crime Control and Safe Streets Act of 1968, as amended (see 42 USC § 3721-3723), and Title II of the Homeland Security Act of 2002. NIJ develops standards and test methods for law enforcement and corrections equipment, including body armor, and operates the NIJ Compliance Testing Program (CTP). NIJ's testing program exists to ensure that law enforcement and corrections officers have the best information available about the performance and safety of equipment tested by the CTP, and participation by applicants in this program is voluntary.

While NVLAP may accredit any laboratory that meets NVLAP administrative and technical requirements, NIJ has additional requirements. Laboratories performing compliance testing services for the Compliance Testing Program in accordance with NIJ Standards must be independent, third-party laboratories which are located and which perform all testing within the United States. Additionally, all laboratories must be free of and demonstrate their freedom from any actual or potential conflicts of interest with respect to other services they and/or their parent organizations, subsidiaries and affiliates may provide, particularly regarding services pertaining to consultation on the design and manufacture of the types of products for which a laboratory will perform NIJ compliance testing services.

Additional information about the NIJ Compliance Testing Program is available at <www.justnet.org/ctp>, by telephone 800-248-2742, or by e-mail <bactp@nlectc.org>.

1 General information

1.1 Scope

1.1.1 The purpose of this handbook is to set out procedures, technical requirements, and guidance for accreditation of Personal Body Armor testing laboratories.

1.1.2 This handbook supplements the procedures and general requirements found in NIST Handbook 150. The scope of the Personal Body Armor laboratory accreditation program (LAP) is the set of test methods contained in National Institute of Justice Standards 0101.04, 0101.06, 0115.00, and other appropriate standards requested by the National Institute of Justice (NIJ).

1.1.3 The interpretive comments and additional requirements contained in this handbook make the general NVLAP criteria specifically applicable to the Personal Body Armor LAP.

1.1.4 The requirements of NIST Handbook 150, this handbook, and the NIST Handbook 150-24 Checklist are normative (i.e., mandatory) and must be combined to produce the criteria for accreditation in the Personal Body Armor LAP.

1.1.5 When testing armor for consideration by the NIJ Compliance Testing Program (CTP), the laboratory must meet all CTP requirements.

1.2 Organization of handbook

The numbering and titles for first and most second level headings of this handbook match those of NIST Handbook 150. Lower level headings are generally specific to the Personal Body Armor LAP. In some cases, upper level headings have been included in the document with no additional text. In these cases, refer to NIST Handbook 150.

Annex A (normative) presents a list of documents that are required to be available in the laboratory.

1.3 Program description

1.3.1 The purpose of the Personal Body Armor LAP is to accredit laboratories to conduct testing of personal body armor, providing a measure of confidence that such laboratories are competent to perform testing to meet the requirements of NIJ.

1.3.2 Laboratories that achieve NVLAP accreditation and that meet NIJ administrative requirements are eligible for approval by NIJ. The CTP maintains the list of NIJ-approved laboratories to help vendors and purchasing authorities identify resources.

1.3.3 NIJ-approved laboratories test body armor. Laboratory test results are reviewed by the CTP to determine whether the body armor is eligible to be listed on the NIJ Compliant Products List. NIJ makes the determination that the armor is compliant with the applicable standards and requirements.

1.4 References

The following documents are referenced in this handbook. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) shall apply within one year of publication or within another time limit specified by regulations or other requirement documents.

— Compliance Testing Program *CTP Administrative Clarification* series

— CTP *Compliance Test Report*, latest version of spreadsheet for NIJ 0101.06 testing

— CTP *Compliance Test Report*, public version

— *National Institute of Justice Body Armor Compliance Testing Program - Ballistics Test Laboratory - Application Package*

— *National Institute of Justice Body Armor Compliance Testing Program - Body Armor Applicant Package*

— NIJ Standard-0101.04, *Ballistic Resistance of Personal Body Armor*, June 2001 Revision A

— NIJ Standard-0101.06, *Ballistic Resistance of Body Armor*

— NIJ Standard-0115.00, *Stab Resistance of Personal Body Armor*

— NIST Handbook 150, *NVLAP Procedures and General Requirements*, 2006

1.5 Terms and definitions

For the purposes of this handbook, the terms and definitions given in this handbook, NIST Handbook 150, and the relevant NIJ standards apply.

1.6 Program documentation

1.6.1 General

Assessors use NVLAP checklists to ensure that each laboratory receives a comprehensive on-site assessment that is comparable to that received by others. Checklists assist assessors in documenting the assessment to the NVLAP requirements found in NIST Handbook 150, this handbook, and the checklists themselves. Checklists contain definitive statements or questions about all aspects of the NVLAP criteria for accreditation, and form part of the On-Site Assessment Report (see NIST Handbook 150). The current version of each checklist is available on the NVLAP web site <http://www.nist.gov/nvlap>.

1.6.2 NIST Handbook 150 Checklist

All NVLAP programs use the NIST Handbook 150 Checklist, which contains the requirements published in NIST Handbook 150. The checklist items are numbered to correspond to clauses 4 and 5 and Annexes A and B of NIST Handbook 150.

1.6.3 NIST Handbook 150-24 Checklist

The NIST Handbook 150-24 Checklist addresses the requirements specific to body armor testing given in NIST Handbook 150-24. The checklist contains additional requirements expressed at a more detailed level than found in this handbook.

1.6.4 Test Method Review Summary

The assessors use the Test Method Review Summary to review the laboratory's ability to perform the body armor test methods. The review of the test method details by the assessors includes observing tests and having laboratory staff describe the test procedures. The assessors note on the Test Method Review Summary the depth into which each part of the test method was reviewed (Observed Test, Examined Apparatus, Walked/Talked Through Test, Listened to Description of Procedures).

1.6.5 NVLAP Lab Bulletins

NVLAP Lab Bulletins are issued to laboratories and assessors, when needed, to clarify program-specific requirements and to provide information about program additions and changes.

1.6.6 Licenses

NVLAP accreditation does not relieve a laboratory from complying with applicable federal, state, and local laws and regulations. A laboratory must meet federal, state, and local licensing requirements, including import and export, as appropriate.

2 LAP establishment, development and implementation

This clause contains no information additional to that provided in NIST Handbook 150, clause 2.

3 Accreditation process

3.1 General

An overview of the laboratory accreditation process is provided in NIST Handbook 150, clause 3, and includes information pertaining to application for accreditation; management system review; on-site assessment; proficiency testing; accreditation decision; granting accreditation; renewal of accreditation; changes to scope of accreditation; monitoring visits; and suspension, denial, revocation, and voluntary termination of accreditation.

3.2 Activities prior to on-site assessment

3.2.1 Prior to applying to NVLAP, the laboratory shall have a fully implemented management system. A copy of the quality manual and relevant associated documents shall be sent to NVLAP with the application forms.

3.2.2 Prior to an on-site assessment, one or more NVLAP assessors will review laboratory documents to ensure they cover all aspects of the management system and, if followed, satisfy the requirements in NIST Handbook 150 and this handbook. During the review, the assessors may identify nonconformities and require changes to the management system so that it meets the requirements.

3.2.3 The laboratory shall create a cross-reference document allowing the laboratory and NVLAP assessors to verify that all requirements of clauses 4 and 5 and annexes A and B of NIST Handbook 150, NIST Handbook 150-24, and the NIST Handbook 150-24 Checklist are addressed in the management system documentation.

3.2.4 NVLAP will review the management system documentation that addresses the specific requirements of the NIJ body armor CTP.

3.3 On-site assessment

3.3.1 The on-site assessment takes place at the laboratory site(s). For a single-site laboratory with multiple firing ranges, the assessors will observe firing on one or more of the ranges. Efforts will be made to minimize disruption to the normal work routines during the assessment.

3.3.2 The assessors will need time and workspace to complete assessment documentation during his/her time at the laboratory.

3.3.3 The laboratory shall have its facilities and equipment in good working order and be ready for examination according to the requirements identified in this handbook, NIST Handbook 150, and the laboratory's management system documentation, including the quality manual. This includes environmental and conditioning equipment, firing ranges, and clay handling equipment.

3.3.4 At the beginning of the on-site assessment, the laboratory shall make all supporting technical information available in a format that is conducive to a detailed review. This includes the laboratory test procedures, test instructions, and test records.

3.3.5 The assessment activities will include the following:

a) *Opening meeting:* The NVLAP assessors will meet with laboratory management, supervisory personnel, and other staff members at the discretion of the laboratory's management to explain the purpose of the on-site assessment and to discuss the schedule for the assessment activities.

b) *Staff interviews*: The assessors will interview individual staff members filling key positions (e.g., Laboratory Manager, Technical Director, Quality Manager, Authorized Representative) and staff members who have an effect on the outcome of the testing. The assessors may request that the laboratory staff be assembled to allow the assessors to quiz the staff as a whole on details of the standard, conduct of the test, management system, and other technical issues.

c) *Records review*: The assessors will review laboratory documentation, including the management system, quality manual, equipment maintenance and calibration records, recordkeeping procedures, testing procedures, laboratory test records and reports, personnel competency records, personnel training plans and records, and safeguards for the protection of sensitive and proprietary information. The assessors may request additional information in an effort to clarify issues regarding a nonconformity or to delve into a technical issue. Laboratory staff shall be available to answer questions.

d) *Internal audit and management review*: The assessors will review and discuss with the laboratory staff the laboratory internal audit and management review activities. The discussion will include all aspects of those activities including the management system procedures, the audit findings, the results of the management review, and the actions taken to resolve findings.

e) *Equipment and software*: The assessors will examine and determine suitability of all equipment and facilities required to perform the test methods for which the laboratory is accredited (or is seeking accreditation). The appropriate environmental conditions required for testing will be assessed. The assessors will review test data, examine hardware and software for function and appropriateness, and review software validation and verification procedures. This includes data acquisition and Compliance Test Report (CTR) related software.

f) *Demonstrations*: Based on the scope of accreditation, the assessors will observe demonstrations of selected testing procedures conducted by technical personnel assigned to conduct the tests and will discuss the tests to assure that the staff understands the procedure. The assessors may also select and trace the history of one or more samples from receipt to final issuance of a test report. These demonstrations are for the purpose of assessing laboratory competence, not the properties of any particular product. This includes armor conditioning, clay calibration, threat development, ballistics testing, and stab resistance tests.

g) *Proficiency testing*: The assessors will discuss all aspects of proficiency testing results with appropriate staff. Test methodology and records documenting the execution of the proficiency testing will be reviewed and discussed. Trends, outlying test results, and anomalies will also be discussed. The assessors may provide materials and artifacts to the laboratory for proficiency testing during the on-site assessment. The assessors will make arrangements with the laboratory prior to the visit to ensure that facilities are available. Proficiency testing may include the conduct of entire tests or selected portions of tests.

h) *On-site assessment report*: The assessors will complete an on-site assessment report, which documents the findings and clearly lists nonconformities and comments (positive or negative). This report normally consists of the On-site Assessment Report, NIST Handbook 150 Checklist, NIST Handbook 150-24 Checklist, and the Test Method Review Summary.

i) *Closing meeting:* The assessors will conduct a closing meeting with laboratory personnel [see a) and b) above] to discuss findings. During the visit the assessors will have categorized all problems identified as nonconformities or comments, which will be discussed at the closing meeting. Resolutions may be mutually agreed upon. The assessors will specifically note items that have been corrected during the on-site assessment along with requirements for additional action.

The process for resolving nonconformities identified during the on-site assessment is documented in NIST Handbook 150. Any unresolved disagreements between the laboratory and the assessors should be referred to NVLAP headquarters for resolution. All information obtained by the assessors is held in strictest confidence.

The first page of the report is signed by the assessors and the laboratory Authorized Representative to acknowledge the discussion, but this does not necessarily indicate agreement by the laboratory. A copy of the report is given to the laboratory representative for retention, and the assessors send the original to NVLAP.

3.4 Proficiency testing

3.4.1 When proficiency testing programs are available and when instructed by NVLAP, laboratories shall participate in proficiency testing for identified test methods and portions of test methods.

3.4.2 NIST Handbook 150 describes how proficiency testing is included in the accreditation process. Successful completion of available proficiency testing is required prior to initial accreditation and periodically thereafter. Proficiency testing is used to evaluate the competence of the laboratory; it is not meant to be used to evaluate the products included in the Compliance Testing Program. Laboratories renewing accreditation shall have satisfactorily participated in all required proficiency testing during their previous accreditation period.

Proficiency testing may consist of several parts in order to assure the proper evaluation of a laboratory. The proficiency testing concept is designed to allow the evaluation of the laboratory's ability to produce repeatable and reproducible test data. Portions of the testing process may be "highlighted" in proficiency testing, e.g., equipment, software, test techniques, data logging, data analysis, test report generation, etc. Proficiency testing may consist of artifact testing before or during on-site assessments, oral quizzes during on-site assessments, and written examinations.

Laboratories will be informed, in advance, of specific proficiency testing activities. Testing shall be conducted according to instructions provided by NVLAP.

3.4.3 For proficiency testing conducted during on-site assessments, the assessors may bring materials and artifacts and/or the assessors may instruct the laboratory to have materials and test items available. The assessors will also inform the laboratory of any special equipment or configurations that may be required.

3.4.4 Proficiency testing may include testing of vests and packs provided by NVLAP, measurement of artifacts to include weight and length, and examination of prepared artifacts. In some cases, the laboratory will be asked to include color photographs in the test report. For conditioning requirements in the standard, proficiency testing may include measurement of temperature, relative humidity, and other parameters for a complete cycle as specified in the standard, e.g., one day, ten day, etc. For stab resistance, proficiency testing may include testing of NVLAP-provided stab packs and instrumentation of the stab test equipment.

3.4.5 The results of proficiency testing will be reported to the participants in appropriate documents and reports. Problems indicated by proficiency testing will be discussed by NVLAP with the appropriate laboratory personnel responsible for developing and implementing plans for resolving the problems. The results of proficiency testing are also made available to NVLAP assessors for discussion during laboratory on-site assessment visits.

3.4.6 Generally, it is required that the specific proficiency test procedures be conducted in accordance with the applicable standard test method. At times, however, NVLAP may specify special conditions to assure uniformity in procedures and test conditions among participants. These may include the number of replicate measurements, specimen preparation, and other test parameters. Also, proficiency testing may consist of several parts in order that the operation of the laboratory might be evaluated. Portions of the standard test procedure may be emphasized, such as measurement, instrumentation, equipment, data analysis, and reporting. Proficiency testing shall not be contracted out to another laboratory.

3.4.7 When appropriate, proficiency test data are analyzed using statistical procedures to determine distributions and parameters, such as averages, standard deviations, and outliers. Using the test data from proficiency testing, the laboratory shall monitor its own testing performance. Procedures for receiving, analyzing, and monitoring the laboratory's test results shall be documented in its management system documentation.

3.4.8 Unsatisfactory performance in proficiency testing (e.g., outlying test results and incomplete test reports) is a technical nonconformity that shall be resolved by the laboratory to maintain its accreditation for the test method(s) in question. After notification of unsatisfactory performance, the laboratory shall take corrective action to investigate and resolve nonconformities in a timely manner, according to the requirements of NIST Handbook 150 for the control of nonconforming work. Unsatisfactory performance in proficiency testing may result in suspension or revocation of accreditation for those test methods in question.

4 Management requirements for accreditation

4.1 Organization

A laboratory seeking NIJ-Approved Testing Laboratory designation shall meet the additional organizational requirements for independence, domicile, etc., as specified by NIJ.

4.2 Management system

4.2.1 The requirements for a management system are contained in NIST Handbook 150, *NVLAP Procedures and General Requirements.*

4.2.2 The controlled version of the laboratory management system documentation may be either paper- or computer-based. The laboratory shall maintain version control.

4.2.3 If the laboratory uses a computer-based documentation system, then the laboratory should consider the ease of usability by the staff. The laboratory shall ensure that the requirements of NIST Handbook 150 are met so that the staff is knowledgeable of the online documentation system and can retrieve appropriate information.

4.2.4 In addition to the information specified in NIST Handbook 150, the quality manual and/or supporting management system procedures shall include the following:

a) testing facilities and scope of services offered;

b) testing equipment inventory;

c) adoption and incorporation of new test methods and standards;

d) test plan for each test method performed;

e) acceptance criteria for test materials and specimens;

f) action concerning damaged test materials and specimens;

g) policy for utilizing subcontractors;

h) licenses and permits for possession, import, and export of items and materials;

i) NIJ and CTP requirements including: administrative, reporting (status, test results, availability, changes in scope), sampling, technical, non-technical, CTP Administrative Clarifications;

j) procedures and instructions for interactions with the CTP;

k) policies, procedures, and instructions for participation in the CTP Conformity Assessment Follow-Up Process.

4.3 Document control

There are no requirements additional to those set forth in NIST Handbook 150.

4.4 Review of requests, tenders and contracts

Contracts for tests that are to be submitted to the CTP shall meet the requirements of the CTP in addition to all technical and NVLAP requirements.

4.5 Subcontracting of tests and calibrations

4.5.1 An NIJ-Approved Testing Laboratory may subcontract the conditioning of armor. Ballistics tests and stab tests shall not be subcontracted.

4.5.2 The subcontracting laboratory is responsible for the work of and reports from subcontracted laboratories. The requirements of section 4.4 shall be met.

4.5.3 All aspects of subcontracting shall be documented in the laboratory management system, including procedures and instructions for handling and shipping.

4.6 Purchasing services and supplies

4.6.1 The laboratory shall have procedures to verify that expendables meet the laboratory's requirements before those items are used for testing.

4.6.2 The laboratory shall evaluate vendors and verify or test incoming equipment, materials, and supplies that have an effect on the outcome of tests. Evaluations, verifications and tests shall be appropriately documented.

4.7 Service to the customer

There are no requirements additional to those set forth in NIST Handbook 150.

4.8 Complaints

4.8.1 When a Compliance Test Report (CTR) is returned to the laboratory for correction, the laboratory shall treat this as a complaint.

4.8.2 Requests from the CTP for additional information concerning samples, tests, and test results shall be documented in the complaints log or other appropriate records, depending on the nature of the request.

4.9 Control of nonconforming testing and/or calibration work

4.9.1 The laboratory shall follow its documented procedures if it discovers that it has issued a test report that contains errors, including errors in testing, analysis, or reporting.

4.9.2 The laboratory shall inform the customer and offer remediation.

4.9.3 The laboratory shall fulfill any additional NIJ requirements for control of nonconforming testing.

4.9.4 A NVLAP-accredited laboratory that acts as a subcontracted laboratory shall inform the subcontracting laboratory and the CTP in the event that nonconforming work is detected.

4.10 Improvement

There are no requirements additional to those set forth in NIST Handbook 150.

4.11 Corrective action

There are no requirements additional to those set forth in NIST Handbook 150.

4.12 Preventive action

There are no requirements additional to those set forth in NIST Handbook 150.

4.13 Control of records

4.13.1 Test records and test reports shall be kept for at least the period of time specified by the CTP. Records shall be kept longer if required by contract, regulation, or the laboratory's own policies.

4.13.2 Records for each test, including the 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.

4.13.3 The laboratory shall have policies and procedures concerning confidentiality and nondisclosure that meet the requirements of the customer and the CTP.

4.14 Internal audits

4.14.1 Internal audits shall include compliance with CTP and NIJ requirements including Compliance Test Reports (CTRs) and documents and activities specific to NIJ testing.

4.14.2 A laboratory applying to NVLAP for the first time shall conduct at least one complete internal audit and shall submit the audit report to NVLAP with the management system documentation prior to the first on-site assessment.

4.14.3 For accredited laboratories, reports of internal audits conducted since the previous on-site assessment shall be available for review during an on-site assessment.

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 A laboratory applying to NVLAP for the first time shall conduct at least one complete management review and shall submit the report to NVLAP with the management system documentation prior to the first on-site assessment.

4.15.3 For accredited laboratories, reports of management reviews conducted since the previous on-site assessment shall be available for review during an on-site assessment.

5 Technical requirements for accreditation

5.1 General

The management system shall contain or refer to documentation that describes and details the laboratory's implementation of procedures covering all of the technical requirements in NIST Handbook 150 and NIST Handbook 150-24.

5.2 Personnel

5.2.1 The laboratory shall have a detailed and documented description of its training program for new and current staff members who have an effect on the outcome of armor testing. Tests conducted by new staff members shall be monitored by a senior staff member whose performance has been demonstrated to be acceptable until the new staff member demonstrates the required level of performance. The laboratory shall establish and document performance criteria to determine when a new staff member is qualified to work independently.

5.2.2 Laboratory staff members shall be able to obtain enough information from the laboratory management system documentation to perform tests in the absence of the laboratory manager. Specific evidence that all staff members have been trained for their role in the testing quality assurance program is required.

5.2.3 All laboratory staff and supervisors shall understand the basic concepts of personal body armor testing. Staff members shall understand the impact of deviations on the test, and understand how to monitor test conditions in order to prevent deviations from occurring. Laboratory staff members should, upon request during an on-site visit by NVLAP assessors, be able to demonstrate their methodology for verification that deviations have not occurred during the test.

5.2.4 The laboratory shall maintain records of personnel designated to fulfill NVLAP requirements including: Laboratory Director, Technical Director, Team Leaders, NVLAP Authorized Representative, and NVLAP Approved Signatories.

NOTE The staff information may be kept in the official personnel folders or in separate, official folders that contain only the information that the NVLAP assessors need to review. The assessors do not need to see any documents not related to the accreditation of the laboratory.

5.2.5 Individuals hired to perform testing activities are sometimes referred to as "subcontractors." NVLAP does not make a distinction between full-time laboratory employees and individuals hired on a contract. NVLAP requires that the laboratory maintain responsibility for and control of any work performed within its scope of accreditation. 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 are subject to annual performance reviews, etc.).

5.3 Accommodation and environmental conditions

5.3.1 The laboratory shall have appropriate facilities and environment for the secure acceptance and storage of all test materials for the conditioning of materials prior to testing according to the standard, for the safe storage of flammable and explosive materials, and for the safe conduct of all testing.

5.3.2 The laboratory shall take appropriate measures for controlling access to and safe handling of firearms, ammunition, and armor samples.

5.3.3 Laboratories shall achieve, maintain, and monitor laboratory environmental conditions that meet the testing requirements of the standards.

5.3.4 Laboratories conducting environmental conditioning of test items shall have equipment to achieve, maintain, and monitor conditions that meet the requirements of the standards and the laboratory management system.

5.4 Test and calibration methods and method validation

5.4.1 The laboratory's accreditation may be limited to a subset of tests. The laboratory shall have written procedures that describe how each test method is implemented in the laboratory and shall conform in all respects with the test method except when a departure becomes necessary for technical reasons. When a departure is necessary, it shall be approved in writing by the customer and the Compliance Testing Program, as appropriate, and stated in the test report.

5.4.2 The laboratory shall have detailed instructions for the conduct of all tests for which it is accredited. The laboratory shall write, implement, and audit the effectiveness of all applicable instructions before initial accreditation can be granted.

5.4.3 The laboratory shall ensure that it uses the latest valid edition of a standard unless it is not appropriate or possible to do so. When necessary, the standard shall be supplemented with additional details to ensure consistent application, e.g., CTP Administrative Clarifications.

5.4.4 The laboratory shall have procedures and instructions for modifying all relevant management system documents when new versions of standards are issued. This includes drafts of standards when use of those drafts is required by the customer or the CTP. This also includes modification to management system documents when clarifications of standards are issued by appropriate bodies.

5.4.5 The laboratory shall review CTP Administrative Clarifications before beginning a test series and shall implement the clarifications as appropriate.

5.4.6 The laboratory may include old and new versions of standards in its management system when multiple versions are included in its scope of accreditation or when required by customers or the CTP.

5.4.7 The laboratory shall meet equipment calibration and tolerance requirements per the standard, as well as verification of the test setup as detailed in the test method.

5.5 Equipment

5.5.1 The laboratory shall have the equipment necessary to perform the test methods as described in the appropriate NIJ standards, this handbook, and the NIST Handbook 150-24 Checklist, and it shall be documented in the laboratory's management system.

5.5.2 Measuring instruments, e.g., scales, rulers, thermometers, micrometers, and timers, shall be calibrated in accordance with NIST Handbook 150, Annex B.

5.6 Measurement traceability

5.6.1 Laboratory measurements shall be made using measurement and test equipment that has been calibrated and is suitable for use. Calibrations shall be performed by a laboratory that meets the requirements of NIST Handbook 150, Annex B.

5.6.2 A laboratory may calibrate or verify its own measurement and test equipment if it has trained personnel, written instructions, and the proper equipment and environment to provide traceability.

5.7 Sampling

5.7.1 Compliance testing performed by the laboratory shall meet the sampling requirements of the CTP. The term "sampling" is defined in NIST Handbook 150, 5.7.1, Note 1 as "a defined procedure whereby a part of a substance, material or product is taken to provide for testing or calibration of a representative sample of the whole." The term "armor sample" is defined in NIJ Standard 0101.06, 3.7 as "One complete armor garment." For the CTP, sampling concerns the selection of a group of armor samples from a production lot. NIJ Standard 0101.06, 4.1.1.1 "Test Sample Sizes" refers to physical dimensions of the armor to be tested.

5.7.2 When the laboratory is conducting compliance testing, it shall meet the requirements of the CTP including armor selection, number of test items, and location of shots. Issues concerning sampling shall be directed to the CTP.

5.7.3 When the NIJ standard or a customer contract requires that some, but not all, of the armor samples or items being tested are to be treated differently from the rest of the items, this shall be considered sampling. The laboratory shall have procedures and instructions for selecting the items from the group that are to be tested per the NIJ standard or the customer contract.

5.7.4 The laboratory shall have procedures for collecting specimens or for verifying that provided samples meet the laboratory requirements.

5.7.5 The laboratory shall record in its own records and in test reports the organization that selected the items for testing.

5.7.6 When a customer sends test specimens for special or non-standard testing, the laboratory shall meet the customer requirements. An explanation of deviations from documentary standards shall be included in the test report.

5.8 Handling of test and calibration items

5.8.1 The laboratory shall inspect incoming samples and materials and the accompanying documentation. This inspection shall be conducted before any testing begins. The laboratory shall ensure that it has received all required materials and documentation.

5.8.2 The laboratory shall have procedures for handling test specimens to avoid damage or exposure to known sources that may affect specimen performance (i.e., heat, light, moisture, rough handling).

5.8.3 The laboratory shall have instructions to ensure that it meets the requirements of its own standard procedures, the CTP, and customer contracts, as appropriate.

5.8.4 After the testing is completed, the laboratory shall follow its documented procedures for appropriate storage, disposal, or shipping of tested items. When applicable, appropriate chain-of-custody procedures shall be followed.

5.9 Assuring the quality of test and calibration results

5.9.1 The laboratory shall have a system for data-taking that ensures error-free logging, transcription to the CTR, and recording of all relevant data and parameters for ballistics testing, environmental conditions, soft and hard armor conditioning, and stab resistance testing. Where applicable, this shall include two-person verification of readings and recordings. Spoken readings, e.g., backface signature measurements made on the range, shall be verified after the readings have been entered into the CTR.

5.9.2 When the results of a critical measurement are not durable, e.g., the digital display of time or velocity on the chronometer, the laboratory shall have a procedure that ensures the error-free transcription of the information from the instrument to the permanent record.

5.9.3 The laboratory shall ensure that the provisions of NIJ Standard 0101.06, 7.8.5.1 are met. For backface signature (BFS) measurements greater than 40 mm, the laboratory shall ensure that two independent measurements are made and recorded.

5.9.4 Laboratories shall measure and record BFS depth to the best of their ability with a resolution of 0.1 mm. Each instrument reading shall be recorded as read with no round off. The CTR spreadsheet carries all digits (no round off) for calculations. Depth measurements made during clay calibration shall not be rounded.

5.9.5 The laboratory shall have procedures and instructions for velocity development for each threat used for testing by the laboratory. A record of the velocity development for each threat shall be kept in the laboratory records.

5.9.6 The laboratory shall have procedures and instructions for data integrity. This includes handwritten data and computer-generated data. Tables and charts shall be appropriately labeled. Handwriting shall be unambiguously legible. Analog charts shall be fully labeled. Data shall be taken and recorded with sufficient resolution. Where appropriate, photographs may be used to document observations.

5.9.7 Data tables and plots shall be appropriately labeled to enable review for conformance.

5.9.8 Numeric data tables and plotted data shall be examined for conformance to the standard.

5.9.9 Hard Armor Conditioning Protocol 24-hour temperature cycle test (NIJ 0101.06, 6.2.3) temperature and humidity data shall be plotted on one plot for each 24-hour testing cycle.

5.9.10 Explanations for nonconformities and anomalies that appear on the tables and plots shall be recorded and kept in the test records.

5.9.11 Expected anomalies shall be explained with generic notes, e.g., the transient in relative humidity when the temperature is changed or the recorded relative humidity data that has no meaning at certain temperatures in the 24-hour cycle.

5.9.12 Requests for clarification of requirements concerning NIJ standards or the requirements of the CTP shall be addressed to the CTP.

5.9.13 Corrective actions taken at any time shall be documented and audited.

5.10 Reporting the results

5.10.1 CTRs submitted to the CTP for testing to NIJ 0101.06 shall meet the requirements of the standard, the CTP and NVLAP.

5.10.2 The public version of the CTR may be used for tests that will not be submitted to the CTP. The public version CTR and any additional test information shall be kept in the laboratory records system and is required to be clearly marked to indicate any deviation from the standard or other requirements. The report shall be marked in such a way as to prevent misunderstanding or inappropriate use of the report.

5.10.3 Test reports submitted to the CTP for testing to NIJ 0115.00 shall meet the requirements of the standard, the CTP and NVLAP.

5.10.4 If not provided for by the CTR, the laboratory shall record in a notes section of the spreadsheet the following: name of Approved Signatory, NVLAP Lab Code, and, if appropriate, tests included in the CTR that are not within the laboratory's scope of accreditation.

5.10.5 Raw data and other information required by NIST Handbook 150, but not included in the CTP report, shall be documented in the laboratory records. Information contained in test reports and the laboratory records combined shall be sufficient to allow tests to be repeated in the laboratory or reproduced in another laboratory.

5.10.6 Test reports for purposes other than the CTP shall meet the requirements of the contract, regulation, or the laboratory's management system. Raw data and other information required by NIST Handbook 150, but not included in the test report, shall be documented in the laboratory records. The information contained in the report and the records shall be sufficient to allow tests to be repeated or reproduced.

5.10.7 Amendments may be made to CTRs that have been submitted to the CTP or to customers, however, the changes shall be indicated in some fashion and a written explanation given for each change. The explanations are required to be placed in the laboratory records and also submitted along with the amended CTR.

6 Additional requirements

The NIST Handbook 150-24 Checklist contains additional requirements.

Annex A

(normative)

Documents required in the laboratory

The following documents shall be available at the laboratory when appropriate:

a) Compliance Testing Program *CTP Administrative Clarification* series

b) CTP *Compliance Test Report*, latest version of spreadsheet for NIJ 0101.06 testing

c) CTP *Compliance Test Report*, public version

d) *National Institute of Justice Body Armor Compliance Testing Program - Ballistics Test Laboratory - Application Package*

e) *National Institute of Justice Body Armor Compliance Testing Program - Body Armor Applicant Package*

f) NIJ Standard-0101.04, *Ballistic Resistance of Personal Body Armor*, June 2001 Revision A

g) NIJ Standard-0101.06, *Ballistic Resistance of Body Armor*

h) NIJ Standard-0115.00, *Stab Resistance of Personal Body Armor*

i) NIST Handbook 150, *NVLAP Procedures and General Requirements*, 2006