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Minimum Requirements and Recommendations for a Firearm and Toolmark Examiner Training Program

Minimum Requirements and Recommendations for a Firearm and Toolmark Examiner Training Program

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This document may be downloaded from: www.aafs.org/academy-standards-board

Foreword

This document has been developed with the objective of improving the quality and consistency of firearm and toolmark examination training practices.

This document contains an outline of training topics which serve as minimum requirements for firearm and toolmark examiner training programs. The requirements listed in this standard include the essential skills and knowledge needed to perform successfully in the discipline.

The additional recommended topics are considered by the subcommittee to be highly beneficial and worthy of inclusion if the necessary resources are available. These recommended topics will be explicitly identified as such.

The American Academy of Forensic Sciences established the Academy Standards Board (ASB) in 2015 with a vision of safeguarding Justice, Integrity and Fairness through Consensus Based American National Standards. To that end, the ASB develops consensus based forensic standards within a framework accredited by the American National Standards Institute (ANSI), and provides training to support those standards. ASB values integrity, scientific rigor, openness, due process, collaboration, excellence, diversity and inclusion. ASB is dedicated to developing and making freely accessible the highest quality documentary forensic science consensus Standards, Guidelines, Best Practices, and Technical Reports in a wide range of forensic science disciplines as a service to forensic practitioners and the legal system.

This document was revised, prepared, and finalized as a standard by the Firearms and Toolmarks Consensus Body of the AAFS Standards Board. The draft of this standard was developed by the Firearms and Toolmarks Subcommittee of the Organization of Scientific Area Committees (OSAC) for Forensic Science.

Questions, comments, and suggestions for the improvement of this document can be sent to AAFS-ASB Secretariat, asb@aafs.org or 401 N 21st Street, Colorado Springs, CO 80904.

All hyperlinks and web addresses shown in this document are current as of the publication date of this standard.

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Keywords: *TBD*

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Minimum Requirements and Recommendations for a Firearm and Toolmark Examiner Training Program

1 Scope

This standard covers the minimum requirements and recommendations for firearm and toolmark examiner training programs. The requirements include the essential skills and knowledge needed to perform successfully in the discipline. Requirements and recommendations include training topics, documentation, casework exercises, and methods for testing competency of the examiner. This document also provides guidance regarding which training elements may be removed in cases where a trainee is being qualified in only one category of testing. This standard does not preclude agencies from adding additional mission-specific requirements.

2 Normative References

The following references are indispensable for the application of the standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. Annex A, Bibliography, contains informative references.

Association of Firearm and Tool Mark Examiners (AFTE) Training Manual.[a]

ANSI/ASB Best Practice Recommendation 068, *Safe Handling of Firearms and Ammunition*, 2020. 1st Ed.[b]

3 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

3.1
competency test
Evaluation of the knowledge, skills, and abilities (KSAs) in the standard practices necessary to conduct examinations in a discipline or category of testing prior to performing independent casework.

3.2
firearm and toolmark examination
Discipline of forensic science charged with conducting comparison examinations of tools and toolmarks and reporting the conclusion.

NOTE When the tool is a firearm, the discipline also seeks to answer relevant questions about the firearms or ammunition components involved in an incident.

[a] Available from: https://afte.org/resources/afte-training-manual
[b] Available from: https://www.aafs.org/academy-standards-board

3.3
firearm examination
Subdiscipline of firearm and toolmark examination that includes, but is not limited to, the classification and comparison of microscopic toolmarks created by firearms on ammunition components.

NOTE It may also include the examination of firearms, serial number restoration, and muzzle-to-target distance determinations.

3.4
firearm and toolmark examiner trainee
A person who is entering or undergoing, but has not yet completed, training in the discipline of firearm and toolmark examination.

3.5
Forensic Science Service Provider
FSSP
Forensic science agency or forensic science practitioner providing forensic science services.

3.6
known same source
KSS
Toolmarks or specimens known to have been made by the same tool.

3.7
known different source
KDS
Toolmarks or specimens known to have been made by different tools or different working surfaces of the same tool.

3.8
qualified firearm examiner
Individual who has completed training in the discipline of firearm examinations and is currently authorized to perform work in this category of testing by a particular forensic science service provider.

3.9
qualified toolmark examiner
Individual who has completed training in the discipline of (non-firearm) toolmark examinations and is currently authorized to perform work in this category of testing by a particular forensic science service provider.

3.10 task-relevant information[c]
Information that is necessary for drawing conclusions:

— about the propositions in question;

— from the physical evidence that has been designated for examination;

[c] Available from: https://www.justice.gov/ncfs/file/818196/download

— through the correct application of an accepted analytic method by a competent analyst

3.11
toolmark examination
Subdiscipline of firearm and toolmark examination that includes the classification and comparison of microscopic toolmarks created by non-firearm tools.

NOTE The examination of non-firearm tools may also be included.

4 Requirements

4.1 Administrative

4.1.1 Documentation

Training requirements and trainee expectations shall be documented at the beginning of the training period. The documentation shall contain information regarding the training topics to be covered, the expected timeline of their completion, and the various training modules that the trainee shall successfully complete. The completion of all required elements of training shall be documented. Retention of the records shall be determined by the FSSP policies. Trainees should retain a copy of their training records.

4.1.2 Training Materials

The FSSP shall determine the required and recommended training materials for the topics that are provided in the document. The recommended source for the references is the Association of Firearm and Tool Mark Examiners (AFTE) Training Manual. The AFTE Training Manual is periodically updated and provides the best source material for the various training topics.

4.1.3 Required Elements

4.1.3.1 Trainees being trained in firearms, but not toolmarks, shall complete sections 4.1, 4.2.1 through 4.2.13, and 4.2.16 through 4.2.21.

4.1.3.2 Trainees being trained in toolmarks, but not firearms, shall complete sections 4.1, 4.2.1, 4.2.3, 4.2.4, 4.2.7, and 4.2.14 through 4.2.21.

4.1.3.3 Trainees being trained in both firearms and toolmarks shall complete sections 4.1 and 4.2.

4.1.3.4 The requirements in Section 4.2.18 for total KSS and KDS comparisons shall not be reduced based upon categories of training.

4.1.3.5 Trainees being trained in distance determinations (5.1, 5.2), serial number restorations (5.3), and fracture examinations (5.4) shall also complete the corresponding requirements for those categories.

4.1.4 Additional Training Topics

Additional areas of training should be included in the training program based on the needs of the FSSP. FSSPs should add any training topics that are relevant and beneficial.

4.1.5 Selection of Trainers

4.1.5.1 The FSSP shall have a policy that identifies personnel responsible for the selection of trainers, overseeing the performance of the trainers and trainees, developing curriculum, and approval of the training program and the qualification of examiners.

4.1.5.2 FSSP should select trainer(s) who are willing to perform in this role and who have the subject matter expertise to carry out the training. This may require coordination with technical authorities in each training topic to ensure that the qualifications are met.

4.1.5.3 The FSSP shall document the qualifications of selected trainers. Trainer qualifications may include, but are not limited to, good oral and written communication skills, expertise in the subject matter, and receipt of basic instructional skills training. Trainers should be available for the duration of the training to ensure stability for the trainee.

4.1.6 Training Methods

The FSSP shall determine the most effective approach for training each individual in the required modules. A successful training module may include readings, lectures, demonstrations, discussions, examinations under the guidance of a qualified examiner, and practical exercises incorporating firearms, tools, toolmarks, and comparison techniques. The order of the topics listed in this document is not intended to be the recommended order of training. Many of the topics are interrelated and do not necessarily need to be taught separately.

4.1.7 Testing

4.1.7.1 Assessment tools for the various training topics may include, but are not limited to: written tests, oral examinations, mock casework, practical exercises/examinations (comparisons), presentations, and mock trials.

4.1.7.2 Answers to the written tests, questions in oral examinations, intercomparison tests, mock casework, and practical examinations shall be known by the FSSP prior to the tests being administered. Standards for successful completion of these tests shall be clearly defined by the FSSP and provided to the trainee prior to the test being administered.

4.1.7.3 Presentations and mock trials shall be evaluated according to the FSSP policies and the evaluations shared with the trainee upon conclusion.

4.1.7.4 Competency testing shall be performed with realistic casework elements including case notes, comparison examinations, and written reports. A competency test shall be successfully completed in each sub-discipline prior to assuming casework in that specific sub-discipline.

4.1.7.5 Successful completion based on previously defined standards of all assigned topics in the training program shall be required. It is the responsibility of each FSSP to provide the assessment of the trainee and also the pass/fail determination for the test methods they so choose.

4.1.7.6 If the trainee does not successfully complete a test, the FSSP shall provide training directed toward the observed deficiencies, followed by retesting. The FSSP shall have a policy that outlines additional steps that would be necessary in cases of persistent failure to successfully complete training requirements.

4.1.8 Mentored Casework

Prior to performing independent casework, the new examiner shall participate in a period of supervised casework. Mentorship shall include actual or simulated casework and should focus on the depth and breadth of cases routinely encountered by the laboratory as determined by the FSSP. The new examiner's trainer, or other qualified examiner may observe and assist the new examiner as needed and shall perform a documented review of all casework, or simulated casework, completed during mentorship, including a microscopic review of all comparison conclusions. The FSSP shall determine the duration of mentored casework and the criteria for successful completion.

4.1.9 Evaluation of Training Program

The FSSP shall establish a formal mechanism for trainees to provide feedback on the effectiveness of the training program. This information shall be used by the FSSP to evaluate, update, and improve the training program on a periodic basis.

4.1.10 Continuing Education

The FSSP shall have a documented program to ensure technical qualifications are maintained through participation in continuing education. Over a five-year period, examiners shall complete a minimum of 100 hours of discipline-specific continuing education, which could include but is not limited to attending conferences, participating in research, visiting manufacturing facilities, reviewing literature, attending workshops, and publishing peer reviewed research projects. The FSSP shall determine what qualifies as discipline-specific continuing education and how to document compliance. Documentation shall include, at a minimum, the topics or titles, where feasible, of workshops and other kinds of presentations attended to satisfy continuing education requirements.

4.2 Training Topics

4.2.1 General Manufacturing and Machining

4.2.1.1 Understanding general manufacturing and machining processes, especially as they pertain to the production of firearms and tools, is of fundamental importance. This understanding allows the trainee to assess the significance of the toolmarks encountered during initial examinations, during comparison examinations, and when rendering source conclusions.

4.2.1.2 The instruction regarding the following manufacturing and machining techniques shall be included in a training program.

a) Forging:

    1) hand,

    2) drop,

    3) press,

    4) hammer.

b) Casting:

1) sand,

2) investment/lost wax.

c) Fine forming techniques:

1) turning,

2) milling.

d) Drilling.

e) Boring.

f) Reaming.

g) Broaching.

h) Sawing

i) Electrical Discharge Machining (EDM).

j) Electrochemical Machining (ECM).

k) Metal injection molding (MIM).

l) Finishing techniques:

1) grinding/sanding,

2) etching,

3) media blasting,

4) tumbling media.

m) Finishes:

1) bluing,

2) browning,

3) oxide (parkerizing, etc.),

4) plating,

5) coatings/paint.

n) Key machining concepts for toolmark identification:

1) chip formation,

2) plastic deformation,

3) plowing,

4) side flow,

5) tool wear,

6) built-up edge.

4.2.1.3 The following additional recommended topics should be included in a training program.

a) Tours of machine shops or manufacturers, supplemental to any other firearm, ammunition or tool manufacturer tours, to ensure exposure to manufacturing/machining methods listed in 4.2.1.

b) General concepts and practices of additive manufacturing (e.g., 3-D printing).

4.2.2 Firearms Manufacturing

4.2.2.1 In addition to general manufacturing techniques, an understanding of the specific manufacturing and machining processes that pertain to the production of firearms and firearm parts assists a trainee in understanding both the design concepts and the function of firearms. Additionally, an understanding of the common machining methods used for barrels, breech faces, and other surfaces that contact ammunition components allows a trainee to understand the sources and nature of toolmarks present on fired and unfired ammunition components.

4.2.2.2 The following subject areas shall be included in a training program.

a) Barrels:

1) blanks:

i) deep hole drilling,

ii) reaming,

iii) extrusion;

2) rifling:

i) button,

ii) broach (single, double, gang, etc.),

iii) ECM,

iv) EDM,

v) hammer forged,

vi) single point/hook/scrape;

3) finishing:

i) straightening,

ii) chambering,

iii) throating,

iv) crowning,

v) contouring,

vi) honing/lapping/polishing.

b) Common machining techniques that are used to produce the following parts:

1) breech faces,

2) chambers,

3) hammers/firing pins/strikers,

4) firing pin aperture,

5) extractors,

6) ejectors,

7) feed ramps/forcing cones,

8) magazines,

9) ejection port.

c) Common alterations and associated toolmarks:

1) shortened barrel,

2) muzzle attachments,

3) front sight alteration,

4) purposeful damage to internal gun parts.

4.2.2.3 Additionally, firearm and/or barrel manufacturer tours are recommended and should be included in a training program.

4.2.3 Legal History of Firearm and Toolmark Examinations

4.2.3.1 Knowledge of the evolution of firearm and toolmark practice and testimony in courts of law, as well as applicable laws regarding the use of certain firearms and accessories, assists the trainee with understanding the legal context of firearm and toolmark examinations. Recommended articles and references can be located in the AFTE Training Manual.

4.2.3.2 The training program shall include an overview of the legal history of firearm and toolmark examination.

4.2.4 Theory and Validity of Firearm and Toolmark Examinations

4.2.4.1 A complete understanding of the scientific foundation of firearm and toolmark examinations (theory, nomenclature, research, statistical methods, etc.) allows for the successful application of examination techniques and subsequent communication regarding the results of examination. Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual.

4.2.4.2 The following subject areas shall be included in a training program.

a) AFTE Theory of Identification:

b) Class characteristics.

c) Subclass characteristics.

d) Individual characteristics.

e) Types of toolmarks:

    1) impressed toolmarks.

    2) striated toolmarks.

f) Concept of Known Same Source Toolmark (KSST) and Known Different Source Toolmark (KDST) comparisons:

    1) research;

    2) validity testing:

        i) early studies,

        ii) consecutively manufactured parts studies,

        iii) black, white, and gray box studies,

        iv) accuracy,

        v) reproducibility and repeatability,

vi) error rates.

g) Expressions of confidence.

h) Criticisms of current methods.

i) Basic concepts of Quantitative Consecutive Matching Stria (QCMS).

4.2.4.3 The following additional recommended topics should be included in a training program.

— Statistics.

— Toolmark topography instruments and correlation algorithms.

4.2.5 Ammunition

4.2.5.1 Knowledge of industry terminology, the evolution of ammunition designs, and manufacturing methods associated with ammunition provides a foundation for successful examinations of both fired and unfired ammunition components. Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual.

4.2.5.2 The following subject areas shall be included in a training program.

a) Ammunition manufacturing:

1) blanking,

2) cupping,

3) drawing,

4) swaging,

5) annealing,

6) cold heading,

7) punching/headstamps,

8) case/primer materials,

9) loading/assembly,

10) crimping,

11) reloading,

12) bunter marks,

13) mold marks.

b) Terminology associated with both historic and modern ammunition:

1) caliber naming conventions,

2) cartridge case design,

3) terminology associated with shotshell ammunition,

i) components,

ii) gauge,

iii) pellet sizes,

iv) slug designs.

c) Caliber determination of bullets including instrumentation.

d) Caliber determination of cartridges/cartridge cases:

1) headstamps,

2) case dimensions,

3) caliber families,

4) mismatching and interchangeability of ammunition and firearm caliber,

5) wildcat cartridges.

e) Evolution of ammunition:

1) propellants, black powder to modern smokeless powder,

2) rimfire and centerfire,

3) types of primers,

4) bullet shapes and designs,

5) current common brands and types of ammunition.

4.2.5.3 Additionally, ammunition manufacturer tours are recommended and should be included in a training program.

4.2.6 Firearm Design and Terminology

4.2.6.1 Comprehensive knowledge of terminology, evolution of design concepts, firearm parts, and the cycle of operation of firearms provides the foundation for the successful examination of firearms. Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual.

4.2.6.2 The following subject areas shall be included in a training program.

a) Evolution of firearm designs.

b) Firearms terminology:

1) pistol,

2) revolver,

3) rifle,

4) shotgun.

c) Parts and nomenclature associated with types of firearms:

1) assembly and disassembly of firearms, supplemented with owner's manuals, books and videos.

d) Safeties:

1) active/manual safeties,

2) passive safeties.

e) Rifling designs.

f) Cycle of fire:

1) action types:

i) break action,

ii) bolt action,

iii) lever action,

iv) pump action,

2) revolver;

3) blowback;

4) recoil;

5) gas operated;

6) modes of fire:

i) single action,

ii) double action,

iii) hybrid action,

iv) striker vs hammer fired,

v) semi-automatic,

vi) burst/fully automatic;

7) post manufacture alterations and accessories;

8) full auto conversions;

9) incomplete firearms ("80%" firearms, receiver blanks);

10) privately manufactured firearms (home-built, zip guns);

11) drop-in barrels;

12) bump stocks;

13) trigger modifications.

4.2.7 Evidence Handling

4.2.7.1 Firearms, tools and other firearm and toolmark related evidence items recovered during an investigation may contain trace evidence transferred from the crime scene, latent prints, or DNA, whether in the form of blood or as transfer DNA.

4.2.7.2 The following subject areas shall be included in a training plan.

a) Evaluation of evidence.

b) Order of evidence processing.

c) Potential for other discipline evidence being present.

d) Documentation of other discipline evidence.

e) Collection of other discipline evidence, as required by the FSSP.

4.2.8 Examination of Firearms

4.2.8.1 Knowledge of the common examination techniques provide a foundation for a full analysis and documentation of a firearm's design and functional characteristics. Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual.

4.2.8.2 The following subject areas shall be included in a training plan.

a) Safe handling and firing of firearms (i.e., ANSI/ASB Best Practice Recommendation 068, *Safe Handling of Firearms and Ammunition,* 2020. 1st Ed.):

b) Function examinations:

1) searching the firearm recall list,

2) testing of firearm safety mechanisms,

3) testing the operability/functionality of firearms, including designs listed in 4.2.6,

4) inspection of firearms for malfunctions or alterations causing unexpected firing,

5) selection and test firing of appropriate ammunition.

c) Firearms laws:

1) NFA (National Firearms Act),

2) GCA (Gun Control Act),

3) Firearm Owner's Protection Act,

4) relevant state/local specific laws.

d) Firearm components that potentially create toolmarks:

1) lands and grooves,

2) breech/bolt face,

3) firing pin,

4) ejector,

5) ejection port,

6) extractor,

7) chamber,

8) feed ramp,

9) barrel extension,

10) magazine.

e) Evaluation of potential for subclass characteristics in each of the categories above.

f) Casting of firearm parts/alternate tools for creating test marks.

4.2.8.3 The following additional recommended topics should be included in a training program.

— Trigger pull measurement.

— Barrel and overall length measurement.

— Impact testing.

— Sound suppressors (silencers).

4.2.9 Function testing and collection of test-fired samples

Submitted firearms are typically test fired during examination. Training programs shall include instruction in proper use of equipment for safe test firing of live ammunition and collection of known bullet and cartridge case samples.

4.2.10 Microscope Use and Familiarization

4.2.10.1 Microscopes are the primary tools with which firearm and toolmark examiners conduct examinations of fired ammunition components and toolmarked surfaces. Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual.

4.2.10.2 The following subject areas shall be included in a training program.

a) Design and use of a stereoscope.

b) Design and use of a comparison microscope.

c) Light sources and lighting techniques.

d) Photographic techniques.

e) Comparison techniques.

4.2.10.3 The following additional recommended topics should be included in a training program.

— Use of three-dimensional measurement instruments (e.g., focus variation, photometric stereo, and confocal microscopy).

— Virtual comparison techniques.

4.2.11 Bullet Examinations

4.2.11.1 Bullets, when fired through the barrel of a firearm, acquire surface features from the internal surfaces of the barrel. Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual.

4.2.11.2 The following subject areas shall be included in a training program.

a) Caliber determination.

b) Design features.

c) Direction of twist of rifling on fired bullets.

d) Land and groove impression measurement techniques.

e) General rifling characteristics (GRC) database.

f) Recognition of potential subclass characteristics in firearm rifling and on fired bullets.

g) Selection of appropriate ammunition for known sample collection.

h) Evaluation and comparison of test fired bullets.

i) Evaluation and comparison of questioned bullets.

j) Range of conclusions for bullet comparisons.

k) Documentation of examination results and comparisons.

4.2.12 Cartridge/Cartridge Case/Shotshell Examinations

4.2.12.1 Cartridge cases and shotshells, when fired in a firearm, acquire characteristics from the working surfaces of that firearm. Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual.

4.2.12.2 The following subject areas shall be included in a training program.

a) Recognition of marks on cartridges/cartridge cases/shotshells:

1) firing pin impression,

2) breech face marks,

3) aperture impression/shear,

4) extractor,

5) ejector,

6) ejection port marks,

7) firing pin drag,

8) chamber marks,

9) barrel extension marks,

10) magazine lip marks,

11) loaded chamber indicator impressions,

12) shell stop marks,

13) anvil marks.

b) Caliber/gauge determination.

c) Design features characteristic of a brand.

d) Recognition of potential subclass marks on cycled cartridges and fired cartridge cases/shotshells.

e) Recognition of manufacturing marks and potential limitations for their use in comparison (e.g., bunter/ mold marks).

f) Reloading tool/die marks.

g) Selection of appropriate ammunition for known sample collection.

h) Evaluation and comparison of cycled cartridges and test fired cartridge cases/shotshells.

i) Evaluation and comparison of questioned cartridges/cartridge cases/shotshells.

j) Range of conclusions for cartridge/cartridge case/shotshell comparisons.

k) Documentation of examination results and comparisons.

4.2.13 Shotshell Component Examinations

4.2.13.1 Shotshell components, when fired through the barrel of a shotgun, may acquire surface features from the internal surfaces of the barrel. Additionally, shotshell components may be examined for gauge determination, possible manufacture, shot size, and/or composition. Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual.

4.2.13.2 The following subject areas shall be included in a training program.

a) Gauge determination.

b) Design features characteristic of a brand.

c) Shot size and composition determination.

d) Slug examination.

e) Wad/Shotcup examination.

4.2.14 Tool Manufacturing

4.2.14.1 Knowledge of manufacturing and machining processes, specifically the techniques applied to tool working surfaces that may come into contact with evidentiary items, provides a foundation for understanding the significance of toolmarks encountered during examinations and the resulting source conclusions. Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual.

4.2.14.2 The following subject areas shall be included in a training program.

a) The definition of tool, both common and in the context of toolmark examination.

b) Common manufacturing methods for hand tools:

1) broaching,

2) abrasive machining (e.g., grinding, abrasive blasting, reaming),

3) milling,

4) filing,

5) turning,

6) forging/stamping,

7) electrical machining (e.g., EDM, ECM, EDWC),

8) laser machining,

9) metal injection molding/sintering,

10) drilling,

11) sawing,

12) casting.

c) Common types of hand tools, how they are used, and their associated parts:

1) screwdrivers,

2) bolt cutters,

3) knives,

4) chisels,

5) axes,

6) saws,

7) hammers,

8) diagonal cutters,

9) tongue and groove pliers,

10) prying tools,

11) shears/snips.

4.2.14.3 Additionally, tours of tool manufacturers are recommended and should be included in a training program.

4.2.15 Toolmark Examinations

4.2.15.1 Knowledge of common tool actions and the wide variety of ways that tools can leave toolmarks provides a foundation for toolmark examination. Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual.

4.2.15.2 The following subject areas shall be included in a training program.

a) Categories of tool actions:

1) shearing,

2) pinching,

3) scraping,

4) slicing,

5) gripping,

6) prying,

7) crimping,

8) compression,

9) chopping,

10) sawing.

b) Class characteristic evaluation of toolmarks.

c) Creating test marks in different substrates.

d) Casting methods.

e) Recognition of potential subclass characteristics.

f) Evaluation and comparison of toolmarks.

g) Range of conclusions for toolmark comparisons.

h) Documentation of examination results and comparisons.

4.2.16 Casework Documentation

4.2.16.1 The purpose of documentation generated during the analysis of evidence is to support the conclusions in such a way that, in the absence of the primary examiner, another qualified examiner could understand, evaluate, and interpret the work performed and the conclusions reached.

4.2.16.2 The following subject areas shall be included in a training program.

a) Specific case information required by the FSSP.

b) Additional case specific information.

c) Acceptable forms of documentation.

d) FSSP technical record requirements.

4.2.17 Casework Training Exercises

4.2.17.1 Performing casework exercises provides the trainee with a foundational understanding of the FSSP's case management and quality processes.

4.2.17.2 The following subject areas shall be included in a training program.

a) Evidence assignment and chain of custody.

b) Proper evidence handling procedures.

c) Simulated casework.

d) Verification and review.

4.2.18 Known Same Source/Known Different Source Exercises

4.2.18.1 Comparisons of KSSTs and KDSTs are a core component of training for firearm and toolmark examiners. KSST and KDST comparisons develop a trainee's ability to recognize levels of correspondence that are consistent with toolmarks known to have been created by the same tool or same surface of the tool, and levels of correspondence that are consistent with toolmarks known to have been created by different tools or different areas of the same tool.

4.2.18.2 For the purposes of this document, a single KSST or KDST comparison exercise consists of the complete comparison examination of two items (i.e., bullets, cartridge cases, etc.). Samples for use in KSST and KDST exercises are typically produced by trainers or trainees who are direct witnesses to their creation, thereby establishing ground truth.

4.2.18.3 The source of the toolmarks used to meet this requirement should reflect the categories of testing included in training. For example, if the training program is exclusively firearms examinations, most of these exercises should be conducted with bullets, cartridge cases, and shotshells. However, some exposure to sources of toolmarks outside of the trainee's expected categories of testing may also be beneficial. This requirement may be met through the cumulative completion of various training exercises and supplemented as necessary to meet the minimum number.

4.2.18.4 The following studies shall be conducted and documented, regardless of which categories of testing the trainee will be qualified in. Training records shall clearly document the quantity of each type of comparison completed for this requirement. The numbers listed are a combined total, it is not necessary to repeat the exercise for non-firearm toolmarks. Some of the KDST comparisons shall include samples created by consecutively manufactured tools/firearms.

— 200 Known Same Source Toolmark comparisons, including both impressed and striated toolmarks.

— 200 Known Different Source Toolmark comparisons, including both impressed and striated toolmarks[d].

4.2.18.5 The completion of the minimum number of KSST/KDST comparisons does not automatically convey qualification of a firearm/toolmark examiner. The FSSP shall determine final competency based on testing as described in 4.1.7.

4.2.18.6 In order to familiarize trainees with QCMS, the FSSP should consider documenting runs of consecutive matching striae for a portion or all of the above exercises.

4.2.19 Communication, Legal Issues, Court

4.2.19.1 These topics address the intersection of science and the law, and the necessity of effective communication with various stakeholders in the legal system. Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual as well as the AFTE Admissibility Resource Kit located on the AFTE website.

4.2.19.2 The following topics shall be addressed in examiner training.

a) Courtroom procedures (local, state, federal).

b) Contemporary admissibility issues.

c) Role of expert testimony.

d) Public speaking.

e) Communicating within the judicial system.

[d] The number 200 was chosen after a survey of five training manuals currently in use by federal and state/local FSSPs. The five agencies surveyed were the Bureau of Alcohol, Tobacco, Firearms and Explosives, the Federal Bureau of Investigation, the Illinois State Police, the Indiana State Police, and the Los Angeles Police Department.

f) Courtroom etiquette.

g) Discovery.

h) Moot court exercises.

4.2.20 Ethics, Bias, Human Factors

4.2.20.1 Knowledge of common forms of bias may limit the influence of bias within a forensic science discipline. Likewise, a sound institutional knowledge of ethical issues related to forensic science helps build and maintain the integrity of the persons and institutions performing forensic analyses.

4.2.20.2 The following topics shall be addressed in examiner training.

a) Confirmation, cognitive, explicit, and implicit bias.

b) Identifying and avoiding task-irrelevant information.

c) Identifying task-relevant information.

d) Neutrality in forensic science.

e) Codes of ethics.

4.2.21 Forensic Science Service Provider Operations

In the absence of other institutional or FSSP-wide training requirements for examiners in all disciplines, the following topics shall be included in examiner training.

a) Authority structure within the FSSP.

b) FSSP quality system.

c) Accreditation matters.

d) Laboratory safety.

e) Safe handling of evidence/universal precautions.

f) Evidence tracking/laboratory information managements systems (LIMS).

5 Optional Topics

5.1 General

The training requirements in this section are only applicable when authorization in these sub-disciplines is required by the FSSP.

5.2 Distance Determination via Gunshot Residues

5.2.1 In this section, "distance determination" refers to any determinations that can be made regarding the distance from the muzzle of the firearm to an impact surface based upon the examination of gunshot residues present on impact surface(s). Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual.

5.2.2 The following subject areas shall be included in a training program.

a) Factors regarding the deposition of residue from the use of a firearm:

1) ammunition type;

2) firearm type:

i) revolvers,

ii) pistols,

iii) rifles,

iv) shotguns;

3) substrate type:

i) fabric,

ii) skin,

iii) porous surface,

iv) non-porous surface;

4) visual inspection:

i) hole,

ii) ripping/tearing,

iii) singeing/burning/melting,

iv) presence of powder/particulate or vaporous lead,

v) chemistry and examination techniques for,

(1) nitrates,

(2) nitrites,

(3) lead,

(4) copper.

b) Application of appropriate techniques for nitrites and lead:

1) test known distance patterns;

2) test evidence patterns.

c) Comparison of known and unknown patterns, documentation, interpretation, and conclusions, including limitations.

d) Measurement uncertainty.

5.3 Distance Determination via Shot Patterns

5.3.1 In this section, "distance determination" refers to any determinations that can be made regarding the distance from the muzzle of the firearm to an impact surface based upon the examination of damage patterns caused by shotshell components. Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual.

5.3.2 The following subject areas shall be included in a training program.

a) Factors regarding shot patterns from the use of a firearm:

1) ammunition types,

2) pellet sizes,

3) shotshell wadding,

4) buffer material,

5) firearm type,

6) shotgun choke systems,

7) measuring shot patterns,

8) non-orthogonal patterns,

9) creating and measuring shot patterns at known distances,

10) comparison of known and unknown patterns, interpretation and conclusions, including limitations.

b) Measurement uncertainty.

5.4 Serial Number/Obliterated Character Restoration

5.4.1 The recovery of an obliterated serial number on a firearm or characters present on other evidence types can be a valuable piece of intelligence for investigators. This section is designed to

impart knowledge about common destruction processes and both knowledge of and experience using the many recovery methods available to examiners. Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual.

5.4.2 The following subject areas shall be included in a training program.

a) Serial number application processes.

b) Reviewing references for serial numbers:

1) Serial Number Structure Guide

2) Firearm Reference Collection

c) Types of destruction methods:

1) grinding,

2) over stamping,

3) peening,

4) gouging,

5) heating,

6) welding,

7) scratching,

8) drilling.

d) Terminology regarding serial number recovery processes:

1) chemical methods,

2) polishing methods,

3) sanding methods,

4) electro-chemical methods,

5) magnetic particle inspection,

6) barcode decryption,

7) lighting techniques.

e) Use of different recovery processes:

1) application of recovery methods to ferrous surfaces,

2) application of recovery methods to non-ferrous surfaces,

3) application of recovery methods by barcode decryption,

4) application of recovery methods for non-metal surfaces.

f) Documentation of recovery of serial numbers.

g) Photography.

h) Casting prior to recovery if toolmarks are present.

i) Note taking.

j) Reporting conclusions.

k) Alternative sources of serial number recovery:

1) secondary serial numbers,

2) secondary/hidden manufacturer codes.

5.5 Fracture Examinations

5.5.1 The analysis of fractured objects and surfaces to determine if they were once part of the same object is performed by firearm and toolmark examiners in some FSSPs. The list of training topics in this section is designed only to be used in combination with either firearm examiner or toolmark examiner training and does not provide sufficient training and skill if it is completed without firearm or toolmark training. Recommended articles and references for the subject areas in this section can be located in the AFTE Training Manual.

5.5.2 The following topics shall be addressed in examiner training.

a) Failure modes of brittle materials.

b) Plastic deformation.

c) Elastic deformation.

d) Class characteristics.

e) Physical fit:

1) Manufacturer toolmarks.

2) Pre-existing ancillary features.

f) Reverse lighting techniques, microscopic comparison.

g) Casting or coatings for translucent/transparent materials.

h) Range of conclusions.

i) Photography.

j) Documentation/note taking.

5.5.3 KSS and KDS studies shall be performed utilizing a variety of substrate materials and object geometries that are typical of casework.

Annex A
(informative)

Bibliography

The following bibliography is not intended to be an all-inclusive list, review, or endorsement of literature on this topic. The goal of the bibliography is to provide examples of publications addressed in the standard.

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[f] Available from: https://afte.org/uploads/documents/AFTE_Glossary_Version_6.091922_FINAL_COPYRIGHT.pdf
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