

OSAC 2021-N-0012 Requirements and Recommendations for a Firearm and Toolmark Examiner Training Program

*Firearm and Toolmark Subcommittee
Physics/Pattern Interpretation Scientific Area Committee
Organization of Scientific Area Committees (OSAC) for Forensic Science*





OSAC Proposed Standard

Requirements and Recommendations for a Firearm and Toolmark Examiner Training Program

*Prepared by
Firearms and Toolmark Subcommittee*

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Foreword

The following standard identifies the training requirements to become a qualified firearm and toolmark examiner.

This standard was proposed by the Firearms and Toolmarks Subcommittee of the Organization of Scientific Area Committees (OSAC).

This document is intended to provide requirements and recommendations for firearm and toolmark examiner training programs.



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1 Introduction

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

1.2 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.

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

1.4 The Forensic Science Services Provider (FSSP) shall determine the required and recommended reading 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 will provide the best source material for the various training topics.

2 Scope

This document provides the minimum requirements and recommendations for a firearm and toolmark examiner training program. Requirements and recommendations include training topics, documentation, casework exercises, and methods for testing competency. The FSSP shall provide training objectives, training manuals, and training assignments. This standard does not preclude agencies from incorporating additional mission-specific requirements.

3 Normative References

none

4 Terms and Definitions

4.1 Competency Test

A test that demonstrates that a forensic science practitioner has acquired and demonstrated specialized 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.

4.2 Firearm and Toolmark Examination

A discipline of forensic science charged with conducting comparison examinations of tools and toolmarks and reporting the conclusion. When the tool is a firearm, the discipline also seeks to answer relevant questions about the firearms or ammunition components involved in an incident.

4.3 Firearm Examination

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

4.4 Firearm and Toolmark Examiner

A person who has completed training in the discipline of firearm and (non-firearm) toolmark examinations and is currently authorized to perform work in these categories of testing at a particular forensic science service provider.

4.5 Qualified Firearm Examiner

A person who has completed training in the discipline of firearm examinations and is currently authorized to perform work in this category of testing at a particular forensic science service provider.

4.6 Forensic Science Services Provider (FSSP)

A forensic science agency or forensic science practitioner providing forensic science services.

4.7 Known Same Source (KSS)

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

4.8 Known Different Source (KDS)

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

4.9 Qualified Toolmark Examiner

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

4.10 Toolmark Examination

A specialized type of firearm and toolmark examination that includes the classification and comparison of microscopic toolmarks created by non-firearm tools. It may also include the examination of non-firearm tools.

4.11 Trainee

A person who is undergoing, but has not yet completed, training in the disciplines of firearm and/or toolmark examination.

Refer to the Minimum Education Requirements for Firearm and Toolmark Examiner Trainees document.

4.12 Trainer

Instructors who encompass various topics inside or outside of the discipline and should be selected based on their relevant experience in that subject area (i.e - firearm examiner, statisticians, armorers, and other subject matter experts).

4.13 Training Coordinator

A person who is responsible for delivering or monitoring training, or verifying the successful completion of training elements. This person may be a currently qualified or formerly qualified examiner with appropriate expertise who has been authorized by the forensic science service provider to perform training-related duties.

Duties may include, but are not limited to, developing curriculum, delivering training materials, overseeing performance of the trainee, and giving final approval of the training program. The training coordinator may also be the trainer or be a separate individual(s).

5 Requirements

5.1 Administrative

5.1.1 Documentation

A document describing all training requirements and trainee expectations shall be issued to the trainee at the beginning of the training period. This document shall contain information regarding the training topics that will be covered, the expected timeline of their completion, and the various types of tests that the trainee must successfully complete. The completion of all required elements of training shall be documented and retained as recommended by the FSSP.

5.1.2 Required Elements

Trainees being trained in firearms, but not toolmarks, shall complete sections 5.1, 5.2.1 - 5.2.11, 5.2.14 - 5.2.19.

Trainees being trained in toolmarks, but not firearms, shall complete sections 5.1, 5.2.1, 5.2.3, 5.2.4, 5.2.8, 5.2.12 - 5.2.19.

Trainees being trained in both firearms and toolmarks shall complete sections 5.1, 5.2.1 - 5.2.19. The requirements for total KSS and KDS comparisons shall not be reduced based upon categories of training.

Trainees being trained in distance determinations (6.1, 6.2), serial number restorations (6.3), and fracture examinations (6.4) or shall also complete the corresponding requirements for those categories.

5.1.3 Training Topics Not Present

The absence of a particular knowledge area or skill in the training topics listed below is not necessarily intended as an objection to its inclusion in a training plan. FSSPs should add any training topics that are relevant and beneficial.

5.1.4 Training Methods

For most topics, this document does not endorse particular learning methods. It is the responsibility of each FSSP to determine the most effective approach for training each individual. A successful training program includes 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.

5.1.5 Testing

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.

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.

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

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.

Successful completion 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.

If the trainee does not obtain a satisfactory score on any test, the FSSP shall provide training directed toward the observed deficiencies, followed by retesting.

5.1.6 Mentored Casework

Prior to performing independent casework, the new examiner shall participate in a period of mentored 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 including a microscopic review of all comparison conclusions. The FSSP shall determine the duration of mentored casework and the criteria for successful completion.

5.1.7 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.

5.1.8 Continuing Education

After completion of training, examiners shall engage in a minimum of forty hours per year of discipline-specific continuing education (e.g. attending conferences, participating in research, visiting manufacturing facilities, reviewing literature, attending workshops, publishing peer reviewed research projects) FSSPs shall dedicate the necessary resources to ensure compliance. The FSSP shall determine what qualifies as discipline-specific continuing education and how to document compliance.

5.2 Training Topics

5.2.1 General Manufacturing and Machining

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

The following subject areas shall be included in a training program:

Gross Forming Techniques

Forging

- Hand

- Drop

- Press

- Hammer

Casting

- Sand

- Investment/Lost Wax

Fine Forming Techniques

- Turning

- Milling

- Drilling

- Boring

- Reaming

- Broaching

- Sawing

- Electrical discharge machining (EDM)

- Electrochemical machining (ECM)

- Metal injection molding

Finishing Techniques

- Grinding/Sanding

- Etching

- Media blasting

- Tumbling media

Finishes

- Bluing

- Browning
- Oxide (Parkerizing, etc.)
- Plating
- Coatings/Paint
- Key Machining Concepts for Toolmark Identification
 - Chip formation
 - Plastic deformation
 - Tool wear
 - Built Up edge

The following subject areas should be included in a training program:

Tours of machine shops or manufacturers, supplemental to any other firearm, ammunition or tool manufacturer tours, to ensure sufficient exposure to manufacturing/machining methods listed above

General concepts and practices of Additive Manufacturing (e.g. 3-D printing)

5.2.2 Firearms Manufacturing

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 will assist the 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 will allow the trainee to understand the sources and nature of toolmarks present on fired and unfired ammunition components.

The following subject areas shall be included in a training program:

Barrels

Blanks

- Deep hole drilling
- Reaming
- Extrusion (Hi-Point)

Rifling

- Button
- ECM
- EDM
- Gang Broach
- Hammer Forged
- Single Point/Hook/Scrape Rifling

Finishing

- Straightening
- Chambering
- Throating
- Crowning
- Contouring
- Honing/Lapping/Polishing

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

- Breech faces
 - Chambers
 - Hammers/Firing pins/Strikers
 - Firing pin aperture
 - Extractors
 - Ejectors
 - Feed ramps / forcing cones
 - Magazines
 - Ejection port

Common alterations and associated toolmarks

- Sawed off barrel
- Muzzle attachments
- Front sight alteration

The following subject areas should be included in a training program:

Tours

- Firearm Manufacturers
- Barrel Manufacturers

5.2.3 Legal History of Firearm and Toolmark Examinations

An understanding of the legal context of firearm and toolmark examinations requires 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. Recommended articles and references can be located in the AFTE Training Manual.

5.2.4 Theory and Validity of Firearm and Toolmark Examinations

The successful application of examination techniques and any subsequent communication regarding the results of examinations require a complete understanding of the scientific foundation of firearm and toolmark examinations. Theory, nomenclature, research, and statistical methods are all crucial to successful completion of training. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

- AFTE Theory of Identification
 - Class characteristics
 - Subclass characteristics
 - Individual characteristics
- Types of Toolmarks
 - Impressed Toolmarks
 - Striated Toolmarks
- Concept of Known Same Source Toolmark (KSST) and Known Different Source Toolmark (KDST) comparisons
 - Research
 - Validity Testing
 - Early studies

Black, White, and Gray box studies
Error Rates
Expressions of Confidence
Criticisms of Current Methods
Basic concepts of Quantitative Consecutive Matching Stria (QCMS)

The following subject areas should be included in a training program:

Statistics, including likelihood ratios
Toolmark topography instruments and correlation algorithms

5.2.5 Ammunition

Successful examinations of both fired and unfired ammunition components require knowledge of industry terminology, the evolution of ammunition designs, and manufacturing methods associated with ammunition. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

Ammunition manufacturing

- Blanking
- Cupping
- Drawing
- Swaging
- Punching/Headstamps
- Case/primer materials
- Assembly
- Crimping
- Reloading

Terminology associated with both historic and modern ammunition

- Caliber naming conventions
- Cartridge case design

Terminology associated with shotshell ammunition

- Components
- Gauge
- Pellet sizes
- Slug designs

Caliber determination of bullets

- Instrumentation used

Caliber determination of cartridges/cartridge cases

- Headstamps
- Case dimensions
- Caliber families
- Mismatching and Interchangeability of ammunition and firearm caliber
- Wildcat cartridges

Evolution of ammunition

- Propellants, black powder to modern smokeless powder
- Rimmed and centerfire
- Types of primers
- Bullet shapes, designs
- Current common brands and types of ammunition

The following subject areas should be included in a training program:

- Tours of ammunition factories
- Manufacturing toolmark examinations and comparisons (e.g. bunter marks, mold marks), including interpretation limitations

5.2.6 Firearm Design and Terminology

The successful examination of firearms requires comprehensive knowledge of terminology, evolution of design concepts, firearm parts, and the cycle of operation of firearms. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

Evolution of Firearms

- Ignition Systems
- Safeties

Firearms Terminology

- Pistol
- Revolver
- Rifle
- Shotgun

Parts and nomenclature associated with types of firearms

- Assembly and disassembly of firearms, supplemented with owner's manuals, books and videos

Cycle of fire

- Action types
 - Break Action
 - Bolt action
 - Lever action
 - Pump action
 - Revolver
 - Semi-Automatic/Automatic Actions
 - Blowback
 - Recoil
 - Gas operated
 - Modes of Fire
 - Single Action
 - Double Action
 - Burst/Fully Automatic
 - Post manufacture alterations and accessories
 - Full Auto conversions

- Incomplete firearms (“80%” firearms, receiver blanks, home-built)
- Drop-in barrels
- Bump stocks
- Trigger modifications

5.2.7 Examination of Firearms

In addition to design and terminology, examiners must know the common examination techniques that are required for a full analysis and documentation of a firearm’s design and functional characteristics. This must be coupled with safe handling and firing practices and knowledge of the source of important toolmarks within each firearm and any associated accessories. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training plan:

Safe handling and firing of firearms

Function Examinations

- Firearm safety/recall list
- Selection and test firing of appropriate ammunition
- Safety tests
- Trigger Pull
- Barrel and overall length measurements
- Impact test
- Casting of firearm parts/alternate tools for creating test marks

Firearms Laws

- NFA (National Firearms Act)
- GCA (Gun Control Act)
- Relevant State/Local Specific Laws

Firearm components that potentially create toolmarks:

- Lands and grooves
- Breech / bolt face
- Firing pin
- Ejector
- Ejection port
- Extractor
- Chamber
- Feed ramp
- Barrel extension
- Magazine

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

5.2.8 Microscope Use and Familiarization

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 below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

- Design and use of a stereoscope
- Design and use of a comparison microscope
- Light sources and lighting techniques
- Photographic techniques
- Comparison techniques

The following subject areas should be included in a training program:

- Focus variation microscopy
- Interferometric microscopy
- Confocal microscopy
- Photometric microscopy
- Virtual comparison microscopy

5.2.9 Bullet Examinations

Bullets, when fired through the barrel of a firearm, acquire surface features from the internal surfaces of the barrel. Accurate examinations of these characteristics are essential. Additional knowledge of rifling characteristics and bullet design may also allow the examiner to eliminate certain classes of firearms from any association with the fired bullet. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

- Caliber determination
- Design features
- Direction of twist
- Land and groove impression measurement techniques
- General Rifling Characteristics (GRC) database
- Recognition of potential subclass characteristics in both barrels of firearms and areas on bullets
- Evaluation and comparison of test fired bullets and selection of appropriate ammunition
- Evaluation and comparison of questioned bullets
- Range of conclusions for bullet comparisons
- Documentation of examination results and comparisons

5.2.10 Cartridge/Cartridge Case/Shotshell Examinations

Cartridge cases and shotshells, when fired in a firearm, acquire characteristics from the working surfaces of that firearm. Accurate examinations of these characteristics are essential. Additional knowledge of cartridge/shotshell design allows the examiner to eliminate certain classes of firearms from any association with the ammunition component. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

- Recognition of marks on cartridges/cartridge cases/shotshells

- Firing pin impression
- Breech face marks
- Aperture impression/shear
- Extractor
- Ejector
- Ejection port marks
- Firing pin drag
- Chamber marks
- Barrel extension marks
- Magazine lip marks
- Loaded chamber indicator impressions
- Shell stop marks
- Anvil Marks
- Caliber/gauge determination
- Design features
- Recognition of potential subclass marks on fired cartridge cases/shotshells
- Recognition of manufacturing marks
- Evaluation and comparison of test fired cartridge cases/shotshells and selection of appropriate ammunition
- Evaluation and comparison of cartridge cases/shotshells
- Range of conclusions for cartridge/cartridge case/shotshell comparisons
- Documentation of examination results and comparisons

5.2.11 Shotshell Component Examinations

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 below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

- Gauge determination
- Design and manufacture features
- Shot size and composition determination
- Slug examination
- Wad examination

5.2.12 Tool Manufacturing

Building upon manufacturing and machining knowledge, examiners must be familiar with the variety of methods used to create tools. Of specific importance are the techniques applied to tool working surfaces that may come into contact with evidentiary items. This understanding will assist the trainee in assigning significance to the toolmarks encountered during examinations, and will therefore assist with source conclusions. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

- Definition of tool, both common and in the context of toolmark examination

Common types of hand tools, how they are used, and their associated parts.

Common manufacturing methods for hand tools

- Screwdrivers
- Bolt Cutters
- Knives
- Chisels
- Hammers
- Diagonal Pliers
- Tongue and Groove Pliers
- Shears/snips

The following subject areas should be included in a training program:

Tours of tool manufacturers

5.2.13 Toolmark Examinations

Knowledge of common tool actions and the wide variety of ways that tools can leave toolmarks is essential to the toolmark examiner. Additionally, examiners must be able to classify toolmarks, evaluate areas of possible subclass influence, and compare toolmarks for the purpose of rendering source conclusions. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

Categories of tool actions:

- Shearing action
- Pinching action
- Scraping action
- Slicing action
- Gripping action
- Prying action
- Crimping action

Class characteristic evaluation of toolmarks

Creating test marks in different substrates

Casting methods

Recognition of potential subclass characteristics

Evaluation and comparison of toolmarks

Range of conclusions for toolmark comparisons

Documentation of examination results and comparisons

5.2.14 Casework Documentation

Casework documentation is generated during the analysis of evidence. The purpose of this documentation is to support the conclusions that are reached. Casework shall be documented 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.

The following subject areas shall be included in a training program:

- Types of information that must be recorded
- Types of information that may be recorded
- Acceptable forms of documentation
- Quality system requirements for casework documentation

5.2.15 Casework Exercises

Casework exercises should be sufficient to impart to the trainee a full knowledge of a FSSP's casework process.

The following subject areas shall be included in a training program:

- Evidence assignment and chain of custody
- Proper evidence handling procedures
- Simulated casework
- Supervised casework
- Verification and review

5.2.16 Known Same Source/Known Different Source Exercises

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.

For the purposes of this document, a single KSST or KDST comparison exercise consists of a 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.

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. Regardless, training records shall clearly document the quantity of each type of comparison completed for this requirement.

The following studies shall be conducted and documented, regardless of which categories of testing the trainee will be qualified in. The numbers listed are a combined total, it is not necessary to repeat the exercise for non-firearm toolmarks:

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



200 Known Different Source Toolmark comparisons, including both impressed and striated toolmarks.¹

Some of the KDST comparisons shall include samples created by consecutively manufactured tools/firearms.

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.

5.2.17 Communication, Legal Issues, Court

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 below subject areas can be located in the AFTE Training Manual as well as the AFTE Admissibility Resource Kit located on the AFTE website.

The following topics shall be addressed in examiner training:

- Courtroom procedures (local, state, federal)
- Contemporary admissibility issues
- Role of expert testimony
- Public speaking
- Communicating within the judicial system
- Courtroom etiquette
- Discovery requirements
- Moot court exercises

5.2.18 Ethics, Bias, Human Factors

Knowledge of common forms of bias is an essential part of any attempt to 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.

The following topics shall be addressed in examiner training:

- Contextual information
- Confirmation, cognitive, explicit, and implicit bias
- Task relevant information
 - Information is task-relevant if it is necessary for drawing conclusions:
 - about the propositions in question,
 - from the physical evidence that has been designated for examination,

¹ The number 200 was chosen after a survey of five training manuals currently in use by federal and state/local FSSPs. Please note that the provision of a minimum number is intended to prevent insufficient exposure to KSST/KDSTs, and should not be construed as the “perfect” number of studies to be qualified as a toolmark examiner. 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.

through the correct application of an accepted analytic method by a qualified analyst.

Neutrality in forensic science
Codes of ethics

5.2.19 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:

Authority structure within the FSSP
Quality system
Accreditation matters
Laboratory safety
Safe handling of evidence / universal precautions
Evidence tracking / laboratory information managements systems (LIMS)

6 Optional Topics

6.1 Distance Determination via Gunshot Residues

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 below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

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

- Ammunition type
- Firearm type
- Revolvers
- Pistols
- Rifles
- Shotguns

Substrate type

Visual inspection

- Hole
- Ripping/tearing
- Singeing/burning/melting
- Presence of powder/particulate or vaporous lead

Chemistry and examination techniques for:

- Nitrites
- Lead
- Copper

Application of techniques for nitrites and lead

- Test known distance patterns using appropriate techniques
- Test unknown distance patterns using appropriate techniques

Comparison of known and unknown patterns, documentation, interpretation and conclusions, including limitations.
Measurement of Uncertainty

6.2 Distance Determination via Shot Patterns

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

The following subject areas shall be included in a training program:

Factors regarding shot patterns from the use of a firearm

- Ammunition types

- Pellet sizes

- Shotshell wadding

- Buffer Material

- Firearm type

- Shotgun choke systems

- Measuring shot patterns

- Correcting for non-orthogonal patterns

- Creating and measuring shot patterns at known distances

- Comparison of known and unknown patterns, interpretation and conclusions, including limitations

Measurement of Uncertainty

6.3 Serial Number / Obliterated Character Restoration

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 below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

- Serial number application processes

- Types of destruction methods

- Grinding

- Over stamping

- Peening

- Gouging

- Heating

- Welding

- Scratching

- Drilling

- Terminology regarding serial number recovery processes

- Chemical methods
- Polishing methods
- Sanding methods
- Electro-chemical methods
- Magnetic Particle inspection
- Barcode decryption
- Lighting techniques
- Use of different recovery processes
 - Application of recovery methods to ferrous firearms
 - Application of recovery methods to non-ferrous firearms
 - Application of recovery methods by barcode decryption
- Documentation of recovery of serial numbers
- Photography
- Casting prior to recovery if toolmarks are present
- Note taking
- Reporting Conclusions
- Alternative sources of serial number recovery
 - Secondary serial numbers
 - Secondary/hidden manufacturer codes

6.4 Fracture Examinations

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 below 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. Additionally, since this document pertains to firearm and toolmark training, the listed training requirements are for that purpose only; this document imposes no requirements or recommendations on persons training in fracture examinations within other disciplines. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following topics shall be addressed in examiner training:

- Failure modes of brittle materials
- Plastic deformation
- Elastic deformation
- Class characteristics
- Physical fit
- Reverse lighting techniques, microscopic comparison
- Casting or coatings for translucent/transparent materials
- Range of conclusions

KSST and KDST studies shall be performed utilizing a variety of substrate materials and object geometries that are typical of casework.

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