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FIREARMS AND TOOLMARKS
Last Review Date 09/17/24

FOREWORD

The body of knowledge which comprises forensic science is a compilation of procedures adapted from other disciplines that encompass many of the physical and natural sciences. During the history of forensic science, a multitude of scientists have greatly contributed to the protocols, methods and procedures that have become a routine part of analysis. Every effort has been made in this manual to give proper recognition to the authors of specific procedures; however, in some instances, the original source of forensic procedures has been lost in antiquity. For others, the general procedures belong to the public domain and are recorded in many basic references concerning forensic science. In addition, many of the procedures described in this manual have been adapted from standard laboratory practices, and the citation of thousands of references which deserve credit for aiding in the development of these procedures is neither practical nor possible. To all those scientists who have contributed to the knowledge of forensic science contained herein, we do extend collective recognition and gratitude.

Procedures manuals which offer reliable information that is then combined with corresponding training manuals serve as the foundation for effective quality management of analyses. Extensive effort has been made to ensure that the routine procedures described herein will produce accurate and valid analytical results. However, not all possible analyses that may be encountered in casework can be appropriately covered in a procedures manual, nor can all possible variations to a described procedure be included. Therefore, this manual is written with the understanding that minor variations that do not significantly alter the described procedure may be used. An analyst may use a non-routine procedure not specifically stated in this manual, provided all the following conditions are met:

1. The procedure used is based upon documented and scientifically accepted practice.
2. A notation is made on the worksheet indicating the procedure followed is not specified in the procedures manual.
3. The analyst also indicates on the work sheet why the particular procedure was selected over a procedure contained in this manual. Rationale must be detailed sufficiently to withstand close scrutiny by independent examiners.
4. The analyst provides documentation showing that the non-routine procedure had been tested prior to application with evidence. Test criteria shall include test samples that approximate the characteristics of the evidence, the results obtained with the routine procedure, and the results obtained with the non-routine procedure. Documentation will also include related data concerning the non-routine procedure's sensitivity, precision and possible sources of error.
5. The non-routine procedure used will be recorded to a standard such that another scientist of similar skills and experience can understand fully the procedure used and the results obtained.

Additionally, there may be procedures which pertain to all sections. Such is the case with laboratory reagents. In order to standardize the testing and monitor the shelf life of reagents used by analytical sections, the Forensic Sciences Command has developed protocols which are universal for all sections. These protocols regarding reagent expiration and testing are found in the Command Quality Manual.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: STANDARD FIREARM EXAMINATION

PROCEDURE: PHYSICAL EXAMINATION AND CLASSIFICATION OF FIREARMS

Reviewed by:

_____

Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

William E. Demuth II
Director of Training

INTRODUCTION

The initial examination of any firearm will include the completion of a Firearm Panel or an Abbreviated Firearm Panel. These panels will include the manufacturer data of the firearm and will serve as a source to document the condition of the firearm as received and any tests performed to or with the firearm.

OTHER RELATED PROCEDURES

Safe Firearm Handling

Pre-Firing Safety Examinations
Barrel and Overall Length Measurements

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

Appropriate hearing and eye protection must be worn when applicable.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

A Firearm Panel or an Abbreviated Firearm Panel will be filled out according to the Minimum Standards and Controls. This may include determining the following:

Caliber/Gauge
Model
Firing Mechanics
Safeties
Importer/Origin
Breech Face
Firing Pin
Land and Groove Impression Widths
Make
Serial Number
Type of Action
Operating Condition
Rifling Characteristics
Firing Pin Aperture
Barrel and Overall Length

REFERENCES

1. "Firearms Identification Lesson 2." *AFTE Journal* 14.2 (1982): 44-69.

2. National Rifle Association. *NRA Firearms Sourcebook*. Virginia: NRA, 2006.

3. Burrard, Gerald. *The Identification of Firearms and Forensic Ballistics*. New York: A.S. Barnes and Co., 1962.

4. Mathews, Howard. *Firearms Identification*. Volume 1, Springfield, Illinois: Charles C. Thomas, 1962.

5. Mathews, Howard. *Firearms Identification*. Volume 2, Springfield, Illinois: Charles C. Thomas, 1973.

6. Mathews, Howard. *Firearms Identification*. Volume 3, Springfield, Illinois: Charles C. Thomas, 1973.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: STANDARD FIREARM EXAMINATION

PROCEDURE: SAFE FIREARM HANDLING

Reviewed by:

_____

Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Occasionally, loaded firearms are received in evidence for a particular examination. These, of course, need very special handling. **All firearms must be treated as though they are loaded.** This rule cannot be over stressed and must be followed at all times, whether it's in the evidence receiving area, firearms section, test firing area or in court. Safe firearm handling within the laboratory environment corresponds with safe firearm handling in general. The only way to prevent accidents is to practice safety at all times.

OTHER RELATED PROCEDURES

Physical Examination and Classification of Firearms
Barrel and Overall Length Measurements
Pre-Firing Safety Checks
Trigger Pull Examination

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

Appropriate hearing and eye protection must be worn when applicable.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

1. The muzzle of the firearm must always be pointed in a safe direction.

2. Prior to any examination, regardless of which section is receiving the firearm, the loaded or unloaded condition of the firearm must be ascertained by a qualified scientist or technician trained in the clearing of firearms. This process must be accomplished before the firearm enters the laboratory proper and performed according to each laboratory's FOM.

3. Test firing or any examination of the firearm that utilizes unfired ammunition, or an unfired ammunition component, will only be performed in designated test firing areas.

4. A firearm will not be placed in the evidence vault or returned to any agency in either a loaded condition or prior to its loaded or unloaded condition being checked.

REFERENCES

1. National Rifle Association. *The Basics of Pistol Shooting*. Virginia: National Rifle Association, 1991.

2. National Rifle Association. *The Basics of Rifle Shooting*. Washington D.C.: National Rifle Association, 1987.

3. National Rifle Association. *The Basics of Shotgun Shooting*. Virginia: National Rifle Association, 1985.

4. National Rifle Association. *The Muzzleloading Rifle Handbook*. Virginia: National Rifle Association, 1985.

5. National Rifle Association. *The Muzzleloading Shotgun Handbook*. Washington D.C.: National Rifle Association, 1991.

6. National Rifle Association. *The Muzzleloading Pistol Handbook*. Virginia: National Rifle Association, 1985.

7. National Rifle Association. *NRA Firearms Sourcebook.* Virginia: National Rifle Association, 2006.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: STANDARD FIREARM EXAMINATION

PROCEDURE: PRE-FIRING SAFETY EXAMINATIONS

Reviewed by:

_____

Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

It is the responsibility of the firearm examiner to ensure that all appropriate safety function checks are performed on a firearm or item of ammunition prior to test firing. Following is a list of safety checks which shall be considered. The examiner must be mindful that individual case situations may require a more extensive function test process than that which is listed here.

OTHER RELATED PROCEDURES

Safe Firearm Handling
Remote Firing
Physical Examination and Classification of Firearms

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

Appropriate hearing and eye protection must be worn when applicable.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

I. Deciding Whether Or Not A Firearm Can Be Safely Test Fired From The Normal Hand Held Position

   A. Is the chamber/bore clear?

   B. Are there any signs of cracks or weaknesses in major parts of the firearm; such as the frame, slide or barrel?

   C. Does the firearm function, lock-up or dry fire as you would expect it to?

   D. Is the correct ammunition being utilized?

II. Is It Appropriate To Utilize The Evidence Ammunition?

A. Are there signs of reloading? If so, reconsider the need to test fire the evidence ammunition.

B.* Are there splits in the cartridge case neck and/or other significant damage to the cartridge case?

C.* Is the ammunition of the correct caliber? This assessment of caliber cannot be based on the head stamp!

D. Are there existing toolmarks on pertinent surfaces of the ammunition?

E. Is the ammunition needed for other tests; i.e., distance determinations?

III. Muzzle Loaders

A. Does the chamber/barrel appear sound?

B. Do the percussion nipples have oversize flash holes?

C. If a black powder firearm is received in the loaded condition, it must have the bullet and charge removed. It may then be properly loaded prior to test firing.

D. Is this an "original" muzzle loader or a modern reproduction? "Originals" must always be remote fired.

INTERPRETATION OF RESULTS

* If any of the above considerations cannot be answered with a clear "yes" or otherwise rectified and test firing is necessary, that firearm must be remote fired.

REFERENCES

1. ANON. "A Safety Reminder to Shooters." *AFTE Journal* 12.3 (1980): 87-91.

2. George, William. "Black Powder Firearms - Safety Precautions." *AFTE Journal* 20.1 (1988): 57-58.

3. National Rifle Association. *NRA Sourcebook*. Virginia: National Rifle Association, 2006.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: STANDARD FIREARM EXAMINATION

PROCEDURE: BARREL & OVERALL LENGTH MEASUREMENT

Reviewed by:

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Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Barrel lengths and overall lengths are dimensional specifications of firearms that can be mandated by law. Barrel lengths and overall lengths can also be utilized to help determine the correct make and model of a firearm. Procedures are specified here for measuring the barrel and overall length of firearms. Methods for determining the measurement uncertainty of barrel lengths and overall length measurements are described within Appendix V Measurement Uncertainty. The calculations and data to determine the measurement uncertainty are in the Laboratory Asset Management (LAM) module in the Laboratory Information Management System (LIMS).

Federal and Illinois State laws contain requirements for the minimum barrel lengths and minimum overall lengths of rifles, shotguns and other firearms not classified as handguns. Minimum length requirements in Federal law and Illinois State law include: 16 inch barrel length for rifles, 18 inch barrel length for shotguns, and 26 inch overall length for rifles, shotguns and other firearms not classified as handguns.

OTHER RELATED PROCEDURES

Physical Examination & Classification of Firearms
Appendix II Minimum Standards and Controls
Appendix V Measurement Uncertainty

SAFETY CONSIDERATIONS

When handling any firearm, even for the purposes of measuring, safety is the first concern. Make sure the firearm is unloaded before conducting measurements. If there is any doubt about the operation of a firearm, consult with a forensic scientist, the procedures manual, or manufacturers' literature before handling a firearm for measuring.

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

Appropriate hearing and eye protection must be worn when applicable.

PREPARATIONS

Prior to use, measuring devices should be checked for corrosion, damage, or any other condition that might compromise a measurement. If any of these conditions exist, the device in question will be taken out of service in LAM until it is serviced or recertified. Another certified measuring device will be used in its place.

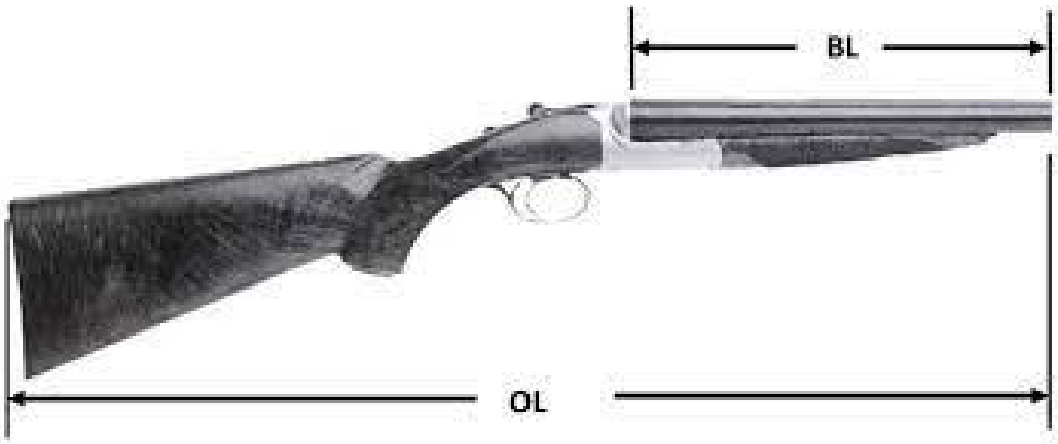
INSTRUMENTATION

NIST Certified Ruler
NIST Certified Tape Measure
Non-marring Dowel rod
Alignment Device

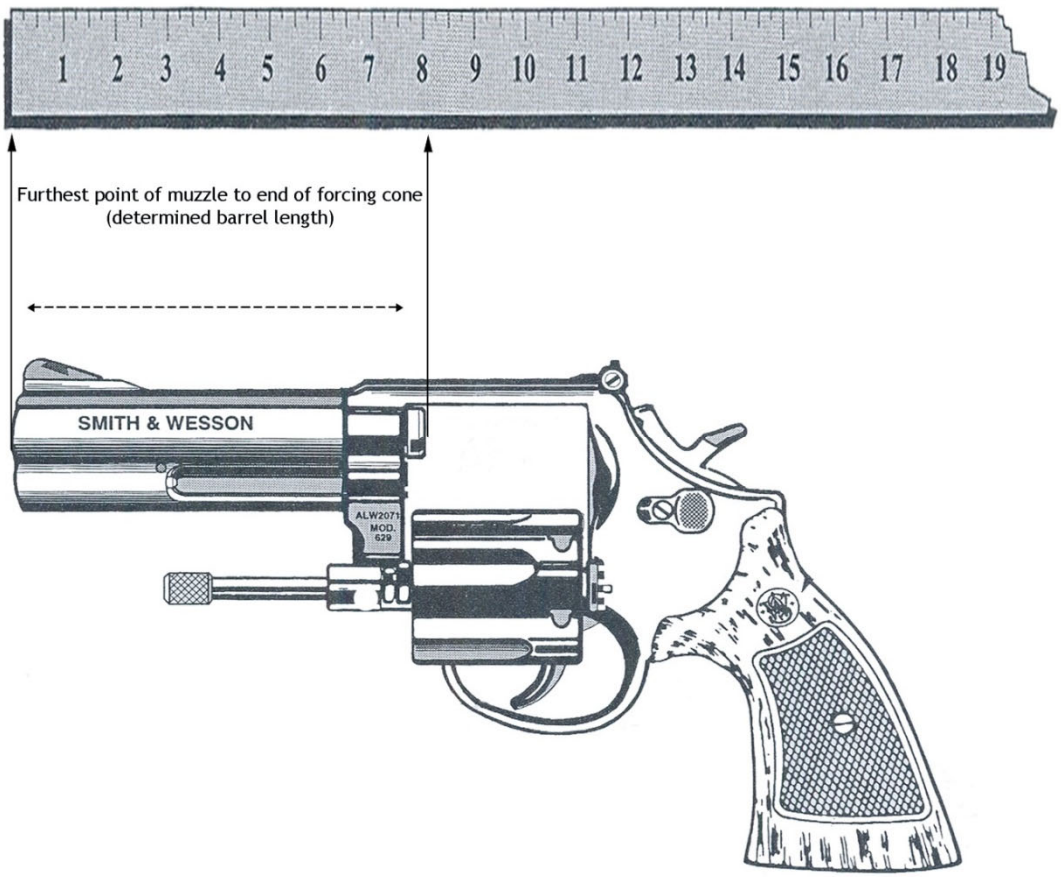
PROCEDURE OR ANALYSIS

Care must be taken if any object is placed down the barrel to assist with the measurement. Only a non-marring item may be placed down the barrel, and only after all other tests are performed.

- When measuring barrel or overall length, ensure that the firearm is free from movement, stable for measuring, and is located in an area with proper lighting. The measuring devices shall have current calibration certificates that provide traceability to the unit of length through accredited calibration laboratories. The calibration certificate and an uncertainty value for each measuring device must be stored in the LAM within LIMS. Additionally, the measuring device must be included in or have been evaluated against the current measurement uncertainty budget table.
- Common devices used to measure barrel and overall lengths are measuring tapes, rulers, and dowel rods. The unique identifier(s) for the device(s) used shall be recorded in the notes within LIMS (not including non-marring dowel rods).
- Measurements for altered or uneven barrels should include the longest portion.
- Removable barrel extensions, poly chokes, flash hiders, etc., are not part of the measured barrel length or overall length.
- Permanently fixed muzzle attachments are part of the barrel length and overall length.
- Overall length will be measured with a folding or telescoping stock at the shortest length.
- The quantities to be measured for barrel length and overall length are described in the ATF National Firearms Act Handbook "The ATF procedure for measuring barrel length is to measure from the closed bolt (or breech face) to the furthermost end of the barrel", and "The overall length of a firearm is the distance between the muzzle of the barrel and the rearmost portion of the weapon measured on a line parallel to the axis of the bore."

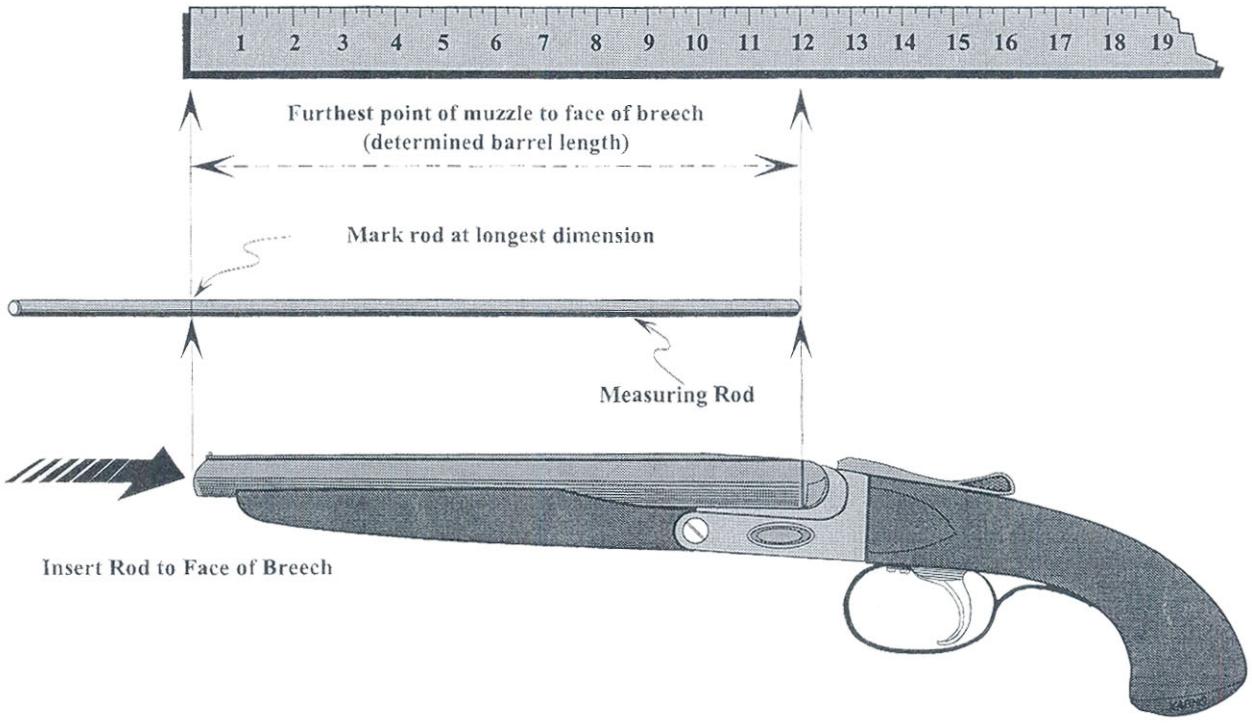


1. Barrel Length Measurements
    a. Revolvers - The length of a revolver barrel is the distance from the rear of the forcing cone to the forwardmost point of the muzzle, measured parallel to the bore axis. This measurement will be recorded in inches to the closest readability unit (e.g. 1/16 inch).
        i. A revolver barrel may be measured by placing a ruler/measuring tape on the exterior of the barrel, parallel to the axis of the bore to determine the barrel length. The ruler marks shall then be perpendicular to the muzzle bore.
        ii. A non-marring dowel rod may be used to measure barrel length; however, consideration should be taken to determine how the starting point can be accurately achieved. A block may be held in contact with the muzzle or forcing cone end of the firearm, perpendicular to the bore axis, to align the end of the measuring rod with the starting point of the barrel. The material of the dowel rod should be soft enough that it does not scratch the barrel. Mark the dowel rod at the muzzle end of the firearm, measure this distance with a certified measuring device and record the certified measuring device that was used. Test firing should be completed prior to barrel measurements made with a dowel rod.



b. Integral Chamber Barrels - When measuring the barrel of a firearm that has an integral chamber, the length is defined as the distance from the breech face (with the action closed) to the forwardmost point of the muzzle, measured parallel to the bore axis. This measurement will be recorded in inches to the closest readability unit (e.g. 1/16 inch).
    i. A barrel with an integral chamber can be measured by placing a ruler/measuring tape on the exterior of the barrel, parallel to the axis of the bore. An external measurement method may not be suitable for firearms that have recessed breech faces or external parts that may make it difficult to determine the location of the breech face for alignment of the exterior measurement device.
    ii. Before measuring a barrel with an integral chamber, ensure that no components or bolt contours are preventing the dowel rod from making contact with the breech face. It may be necessary to cock the firearm in order to withdraw a protruding firing pin. In the case of a fixed firing pin, be certain it is not reducing the barrel length measurement. Ensure that the dowel rod, when inserted in the barrel, is parallel to the bore axis. The material of the dowel rod should be soft enough that it does not scratch the barrel. Mark the dowel rod at the muzzle end of the firearm, measure this distance with a

certified measuring device and record the certified measuring device that was used. Test firing should be completed prior to barrel measurements made with a dowel rod.



2. Overall Length Measurements
    a. The overall length of a firearm is the distance between the forwardmost point of the barrel and the rearmost portion of the firearm measured on a line parallel to the bore axis. This measurement will be recorded in inches to the closest readability unit (e.g. 1/16 inch).
    b. Since the rearmost point of a firearm rarely falls directly along the bore axis, it is particularly important to make sure that it is accurately represented in the measurement, e.g., using a device to ensure that the line between the rearmost point of the firearm and the measurement scale is perpendicular to the axis of the measurement.
    c. Due to the sometimes complicated geometry of the rear of a firearm, misalignment of the bore axis and the measurement axis can cause additional measurement error due to misjudging what is the rearmost point.
    d. An alignment device must be used to ensure that the line between the rearmost point of the firearm and the measurement device is perpendicular to the axis of the measurement device. The alignment device must be used to obtain accurate measurements. Do not use table edges or other flat surfaces when obtaining these measurements because it can lead to additional measurement error.

e. For firearms with folding or retractable stocks, multiple measurements may be taken to encompass the shortest and the longest lengths of the firearm. However, overall length will be measured with a folding or telescoping stock at the shortest length.

INTERPRETATION OF RESULTS

Minimum length requirements in Federal law and Illinois State law include: 16 inch barrel length for rifles, 18 inch barrel length for shotguns, and 26 inch overall length for rifles, shotguns and other firearms not classified as handguns. Any barrel and/or overall lengths for these firearms that fall below the Federal and Illinois State law shall be included in the report. The examination conclusions of the report will also include the calculated measurement uncertainty for the type of instrument used. The primary measurement will be stated followed by the appropriate declaration of the expanded uncertainty based on which type of device was used for the measurement. Please refer to FA-APP-II Minimum Standards and Controls III.C.1.t through III.C.1.w for reporting barrel and overall length of firearms.

If barrel and overall length measurements are recorded in the notes and are at or above the minimum length requirements in Federal and Illinois State law, the measurement uncertainty will be recorded in the Notes section of the panel but not reported. If barrel and overall length measurements are recorded for revolvers or integral chamber firearms, the measurement uncertainty will be recorded in the Notes section of the panel but not reported.

REFERENCES

1. ANSI/ASB Best Practice Recommendation 060, 1st Ed. 2021.
2. Hamby, Jim and Bob Shem. “The Proper Method for Measuring Weapons.” AFTE Journal 14.3 (1981): 10.
3. Illinois Compiled Statutes Annotated Chapter 720 5/24-1(a)(7)(ii).
4. Bureau of Alcohol, Tobacco, Firearms and Explosives. ATF National Firearms Act Handbook. AFT E-Publication 5320.8, Revised: April 2009.
5. OSAC Standard for Barrel and Overall Length Measurements for Firearms, prepared by Firearms & Toolmark Subcommittee

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: MISCELLANEOUS FIREARM EXAMINATION

PROCEDURE: RUSTY FIREARM EXAMINATION

Reviewed by:

_____

Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Rusty firearms or those found in water, etc. may be submitted for examination. Immediate attention must be given to these firearms to prevent further damage to the firearm. The examiner should instruct an agency recovering the firearm in a fluid such as water, to submit the firearm in a container of the fluid. If this is not practical, the firearm can be sprayed with a product that displaces water. It should be noted that the firearm may be too rusted to be functional.

OTHER RELATED PROCEDURES

Safe Firearm Handling
Physical Examination and Classification of Firearms
Pre-Firing Safety Examination

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

Appropriate hearing and eye protection must be worn when applicable.

Any firearm that cannot be unloaded must be examined in an area designated for firing firearms.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

1. Determine if the firearm is loaded and if it is, unload the firearm. If it cannot be readily verified to be unloaded it must be examined in an area designated for the firing of firearms. An examiner must take all necessary steps to insure that the firearm is unloaded which could include complete disassembly or in some cases destruction (e.g. cutting.) of the firearm.

2. The examiner must determine to what extent restoring the firearm is necessary (i.e., for test firing, for recovering manufacturer information, serial number, etc.).

3. Soak the firearm in penetrating oil, de-rusting solvents or similar material.

4. Periodically check the firearm until the firearm functions, or the desired information is recovered.

5. Clean the firearm with gun cleaning solvent and cleaning patches. Care must be taken if any object is placed down the barrel. Only a non-marring item should be placed down the barrel.

REFERENCES

1. Denio, Dominic. "Making a Rusted Gun Functional." *AFTE Journal* 13.3 (1981): 29-30.

2. Bates, J.S. "Cleaning of Rusted Firearms." *AFTE Journal* 5.1 (1973): 11.

3. Dutton, Gerard and Steve Delholm. "Restoration of .38 Caliber Belgian Revolver." *AFTE Journal* 31.4 (1999): 476-478.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: MISCELLANEOUS FIREARM EXAMINATION

PROCEDURE: SILENCER EXAMINATION

Reviewed by:

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Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

A silencer or sound suppressor is any device attached to the barrel of a firearm designed to reduce the noise of discharge. Silencers can be commercially produced or homemade. They are typically tubular metal devices, but may vary in shape or form. Even a 2-liter soda bottle can be used as a silencer. Silencers are illegal in the State of Illinois. Illinois Compiled Statutes Annotated Chapter 720 5/24-1(a)(6) states:

> "A person commits the offense of unlawful use of weapons when he knowingly possesses any device or attachment of any kind designed, used or intended for use in silencing the report of any firearm; . . .

OTHER RELATED PROCEDURES

Safe Firearm Handling

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

Appropriate hearing and eye protection must be worn when applicable.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

1. Examine the device to determine if it is, or is characteristic of, a silencer or sound suppression device.

2. The examiner will document and record his/her findings. After an initial examination, a report can be issued that the device is characteristic of a silencer or sound suppression device.

3. If it is necessary to provide additional testing, test firing a firearm with a sound suppressing device should be conducted in an appropriate setting such as a range or designated shoot room.

3.1 In addition to the physical description of the device, the noticeable reduction of sound between firing the firearm with the device attached versus firing the firearm without the device should be sufficient to determine if it is a sound suppressor.

3.2 If it is necessary to provide sound level readings in decibels for the sound suppressing device, the examiner involved can utilize the services of an outside agency for this reading. The examiner should consider taking multiple readings both with the device affixed to the firearm and the firearm alone.

3.3 A specialized internal examination of the sound suppression device can be done utilizing an x-ray which can display the internal components without taking the device apart. Local law enforcement agencies may have the equipment to help perform this examination.

REFERENCES

1. Hueske, Edward E. "Silencers - A Review and A Look At The State Of The Art." *AFTE Journal* 23.2 (1991): 668-678.

2. Crum, Richard A., and Edward M. Owen. "Silencer Testing." *AFTE Journal* 19.4 (1987): 438-439.

3. Illinois Compiled Statutes Annotated Chapter 720 5/24-1(a)(6).

4. Smith, Stephanie. “Silencers.” *AFTE Journal* 37.2 (2005): 136-141.

5. AFTE Procedures Manual, *Sound Suppressor Examination* (FA-II-2) Version: July 9, 2001.

6. Scientific Working Group of Firearms and Toolmarks.16Nov2010 “Forensic Examination of Silencers”

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: MISCELLANEOUS FIREARM EXAMINATION

PROCEDURE: MALFUNCTIONING FIREARM EXAMINATION

Reviewed by:

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Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

A firearms examiner may be called upon to examine a firearm to determine if the firearm will malfunction. The majority of these cases deal with the question "Will the firearm fire without pulling the trigger?" In these examinations, it is the goal of the examiner to acquire a detailed account of the incident by thoroughly examining and testing the firearm. This may include external and internal examinations, x-ray examinations, or striking or dropping the firearm in attempts to duplicate the actions of the firearm at the time of discharge. The examiner should attempt to keep the firearm in the same condition as received. However, there may be times that the original condition of the firearm may be altered in attempts to determine the cause of the malfunction. During these times, the examiner must specifically document these changes in his/her notes.

OTHER RELATED PROCEDURES

Safe Firearm Handling

Primed Cartridge Case/Shotshell

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

Appropriate hearing and eye protection must be worn when applicable.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

No one procedure can sufficiently outline the steps necessary to examine all firearms for any malfunction. However, the following list of examinations should serve as a guideline for the examiner.

I. Physical Check (Condition of Firearm as Received):

   A. Cocked/uncocked
   B. Safety position

C. Loaded/unloaded
D. Cartridge position
E. Stuck cartridges/discharged cartridge cases
F. Presence and/or location of flares

If the firearm is to be x-rayed, this may be the time to do it.

II. Visual Abnormalities:

A. Barrel (loose, etc.)
B. Receiver (condition)
C. Slide (condition)
D. Parts broken or missing especially:
    1. the firing pin,
    2. the ejector or
    3. the extractor
E. Screws (loose or missing)
F. Alterations or adaptations
G. Sights

III. Action (External):

A. Are the relationships of the action parts correct?
B. Is the assembly correct?
C. Does the action lock normally on closing?
D. Cylinder rotation (securely locks).
E. Hand relationship to the ratchet (worn).
F. Trigger (not returning, sticks, broken spring, etc.)
G. Check the trigger pull (single action, double action) and striking of hammer.

IV. Safeties:

A. ¼, ½, full cock, seating check (any false seating positions, push off, etc.)
B. Grip, magazine, disconnect: function
C. Thumb/finger - note positions when firearm will fire
D. Rebound hammer or inertia firing pin - Will firing pin ride on primers? Is the firing pin frozen or bent?
E. Does the slide or bolt have to be completely closed to fire?
F. Can the safeties be bypassed? Will dropping hammer bypass safeties? (This may require primed cartridge tests.)
G. Will a light blow on the rear of the hammer, when it is in battery, discharge the primer?
H. Is the firing pin impression off center (both single action and double action operation)?

<u>USE CAUTION WHEN FIRING LIVE CARTRIDGES OR PRIMED EMPTY CARTRIDGE CASES</u>

V. Action Check:

A. Check feeding (magazine, carrier or lifter, feed ramp, magazine lips, etc.).
B. Will a cartridge fire on closing of the bolt or slide?
C. Extractor and/or ejector markings on evidence cartridges/discharged cartridge cases consistent and/or normal?
D. Unusual marks exhibited on the cartridges/discharged cartridge cases.

VI. Check for any inherent “quirks” known about the particular firearm based on literature or case data.

VII. Test Fire Firearm (note operation, misfires, etc.):

A. Note any operational problems.
B. Ammunition involved (proper cartridge, type, reloads, etc.)
C. Check consistency of the impression on test and evidence.

VIII. Special Situational Tests:

The examiner should utilize discretion when striking or dropping the firearm in an attempt to duplicate the described malfunction. This form of testing could disturb the internal action and/or cause changes that could prevent determining the cause of the malfunction. A primed empty cartridge case should be utilized during these tests.

IX. Action (Internal) (x-ray, remove side plate or partially disassemble):

A. Hammer notch(s) (worn, burrs, dirt, etc.).
B. Sear (worn, broken, burrs, etc.).
C. Safeties (relationships and general parts relationship).
D. Springs (weak, broken, altered, etc.)
E. Signs of any tampering or faulty assembly.

REFERENCES

1. Thompson, Roger C. "Firearms Malfunction Worksheets." *AFTE Journal* 15.1 (1983): 100-103.

2. American National Standards Institute, Inc. “American National Standard Voluntary Industry Performance Standards Criteria for Evaluation of New Firearms Designs Under Conditions of Abusive Mishandling for the Commercial Manufacturers”; (ANSI/SAAMI Z299.5-1985), November 1985.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: MISCELLANEOUS FIREARM EXAMINATION

PROCEDURE: BORE/CHAMBER CASTING

Reviewed by:

_____

Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Occasionally, firearms are received for which the caliber may not be known or may be different than is designated on the firearm and in the literature. In order to facilitate firing of test shots that are of the correct caliber for a particular firearm, it may be necessary to make a bore and/or chamber cast. Then, by measuring the cast, the correct cartridge can be determined.

OTHER RELATED PROCEDURES

Safe Firearm Handling
Physical Examination and Classification of Firearms

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

Appropriate hearing and eye protection must be worn when applicable.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

Casts can be made using various casting materials such as low melting point metals and silicone rubber compounds. The procedure below is for Mikrosil® and Cerrosafe®.

TECHNIQUE:

1. Insure that the firearm is unloaded.

2. Open the action and remove the bolt or bolt assembly.

3. Check the bore to make sure it is clear.

4. Push a cleaning patch in the barrel, from muzzle end, until it is ⅛ inch to ¼ inch from the beginning of the chamber.

5. Oil the chamber with gun oil or a silicone spray, e.g., W.D 40®

6. Mix Mikrosil® as per manufacturer instructions or melt Cerrosafe® and carefully pour into the chamber until full. Do not allow casting material to flow into breech. It will make extraction difficult.

7. When casting material is set or cool, depending on type used, gently tap end of cleaning rod to loosen cast from the chamber and remove from the breech. If the cast, for some reason, cannot be loosened from the chamber, Cerrosafe® can be melted out of the barrel. This is accomplished by removing the stock and placing breech end in a large container of water and heating to just above its melting temperature.

8. Cerrosafe® can be reused as necessary.

9. Mikrosil® has to be pushed/forced out and is not reusable. Therefore, it is undesirable to let any more the casting material than necessary go into the barrel.

10. The same steps may be used in the casting of the bore. However in bore casting, only the last three (3) inches of the bore need to be cast.

INTERPRETATION OF RESULTS:

The correct caliber of the firearm can be determined by measuring the mouth, base, overall length, rim (if pertinent) and shoulder length of the cast.

REFERENCES

1. Striupaitis, Peter P. "Bore Casting Techniques for Caliber Designation of Rifles." *AFTE Journal* 15.2 (1983): 88-90.

2. Poole, Robert A. "Mikrosil Casting Material Information." *AFTE Journal* 15.2 (1983): 80.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: MISCELLANEOUS FIREARM EXAMINATION

PROCEDURE: FIREARMS REFERENCE COLLECTION

Reviewed by:

_____

Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

A Firearms Reference Collection or Library is maintained by the laboratory for various scientific reasons, to include:

1. To identify the make, model and source of evidence firearms.

2. To provide exemplar firearms for various scientific testing purposes which might otherwise compromise an evidence firearm.

3. To provide an exemplar resource for training new forensic scientists/evidence technicians/other law enforcement agencies or in developing new technology for the scientific examination of firearms.

4. To provide a source of firearms parts for the temporary repair of evidence firearms for test-firing purposes.

5. To provide a resource for the identification of firearms parts recovered at a crime scene.

6. To provide a resource for the location and style of firearm serial numbers.

OTHER RELATED PROCEDURES

Ammunition Reference Collection
Safe Firearm Handling

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

The Command's firearms reference collections will be maintained under strict regulations and controls. Firearms which are deemed unsuitable for scientific purposes will be verifiably destroyed. The Command assumes all responsibility for security, control and destruction of these firearms. All firearms turned over to the Command for this purpose become the sole property of the Illinois State Police and will not be released or returned.

I. A written record will be made immediately upon receipt of a firearm, intended for the reference collection, in the "FIREARM REFERENCE DATABASE and/or the FIREARM LOG BOOK". This entry must initially include:

   A. the log number assigned.
   B. the date received.
   C. the submitting agency or source of the firearm.
   D. the receiver's initials.

II. A printed copy of the electronic record can be maintained. If a printed copy of the electronic record is maintained, it will be updated minimally on an annual basis to include any additions or destructions from the firearms reference collection. The electronic record maintained on the server is considered the official record of the firearms reference collection.

III. The "FIREARM REFERENCE DATABASE" will incorporate all of the below information in sections III.A through III.I, III.K and III.L. Section III.J is an optional field, barrel length is not required.

If the "FIREARM LOG BOOK" is also maintained, it will consist of the following:
a bound ledger-type book with consecutively numbered pages. All entries will be printed clearly in ink. If an error is made, it will be lined through and initialed. "White Out" or other eradicators will not be used in the log book. A key will be kept in the front of the log book detailing the source of all "initials" used. The following data columns will be used in the firearm log books. These columns will be kept in the same order as listed below with the log number being the first entry on the left side of the page(s).

A. LOG NUMBER: Assigned by the receiving laboratory at the time of receipt of the firearm. The log number will consist of the following:

1. A two letter designator, consisting of the current lab letter immediately followed by an "F" (for firearms). These letters will be immediately followed by point 2).

2. The year of receipt of the firearm, designated by the last two (2) digits of the year. All firearms in a laboratory prior to January 1, 1986 will use the "85" designator for the year. This will be immediately followed by a hyphen and point 3).

3. A four digit chronological number for each firearm as received by each laboratory. Every January 1st, the number will start over as the year designator advances.

Therefore a log number of SF88-0258 denotes a reference collection firearm received by the Springfield Laboratory in 1988, and was the 258th firearm received that year for the reference collection or for destruction.

B.	DATE RECEIVED:	Date received at the laboratory.
C.	AGENCY or SOURCE:	The agency or person transferring control of the firearm to the laboratory.
D.	RECEIVER'S INITIALS:	The staff member accepting a firearm will enter their initials here.
E.	CALIBER:	Caliber or gauge of the firearm.
F.	MANUFACTURER:	Make, brand and manufacturer if known.
G.	MODEL:	Model number(s) and/or name if known.
H.	TYPE:	Type of action.
I.	FINISH:	Finish on a firearm.
J.	BARREL LENGTH:	The barrel length of the firearm, measure to the nearest ¼ inch.
K.	SERIAL NUMBER:	The serial number as stamped on the firearm. "NONE" if the serial number does not exist or cannot be found. "OBLIT" if the serial number has been obliterated.
L.	COMMENTS:	Notes regarding transfers, destruction, location case numbers, etc.

IV. A receipt will be issued for every firearm received for the reference collection or destruction utilizing a "RECEIPT OF FIREARM" (ROF) form. The respective log number assigned to each firearm will be recorded on the ROF form. Based on the needs of each individual laboratory, these forms will be maintained in serial number or log number order.

V. Firearms reference collections will be displayed and maintained in such a manner as to prevent the firearms deterioration and to facilitate their inventory, safety and control.

VI. All firearms received for reference or disposal will have their assigned log number inscribed on the frame and/or receiver. Furthermore, all firearms placed in the reference collection will be tagged in such a manner so as to display that firearm's location within the collection.

VII. The transfer of reference firearms from one of the Command's laboratories to another will require appropriate documentation on both the ROF form and the Firearm Reference Database.

VIII. An annual audit must be conducted on the Firearms Reference Collection at each laboratory. The audit must minimally include the number of firearms listed in the inventory, the number of firearms found during the physical inventory as well as a physical signature(s) of the individual(s) who completed the audit. The completion of the audit will be recorded in the Activity Log section of LIMS. Within the Activity Log section, the activity code of Firearms Reference Collection Audit will be used to record the audit. A copy of the audit with a signed memorandum from the individual(s) who completed the audit must be attached to the activity log entry to be able to maintain a detailed recorded history of the audits.

REFERENCES

1. Illinois State Police, Forensic Sciences Command Directives (TCH 1, TCH Appendix 3, ESH Appendix 15, EVH 24, EVH Appendix 11, EVH Appendix 12, and ADM 14); Illinois State Police, Quality Manual (QM-7 and QM-14).

2. 720 ILCS 5/24-6.

3. 765 ILCS 1030/2.

4. "Association of Firearms and Toolmarks Examiners Glossary." Association of Firearms and Toolmarks Examiners.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: MISCELLANEOUS FIREARM EXAMINATION

PROCEDURE: AMMUNITION REFERENCE COLLECTION

Reviewed by:

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Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

The Ammunition Reference Collection is defined as a collection or cataloging of both cartridges and components utilized for various scientific reasons, to include:

1. To identify the manufacturer's cartridge designation and source of evidence ammunition or component parts thereof.

2. To provide an exemplar resource for training new forensic scientists/evidence technicians or in developing new technology for the scientific examination of firearms.

3. To provide a resource for the identification of ammunition components recovered at a crime scene.

OTHER RELATED PROCEDURES

Firearm Reference Collection
Safe Firearm Handling

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

The nature of each laboratory's ammunition reference collection will be dictated or limited by the space, storage containers, and computer equipment available. However the following should be considered:

I. Use of architect blue print cabinets or similar style cabinets for storage of the collection.

II. Use of clear plastic tubes or boxes for storage of each ammunition entry.

III. Recording cartridge information such as:

A. Manufacturer
B. Bullet weight
C. Bullet style or configuration
D. Manufacturer's Index
E. Headstamp
F. Other pertinent information

IV. Catalog in storage cabinet utilizing and/or other manufacturer's data as appropriate to organize.

V. Utilize a computer and appropriate software to track and maintain the collection.

REFERENCES

1. Illinois State Police, Forensic Sciences Command Directives (ESH Appendix 15).

2. 720 ILCS 5/24-6.

3. 765 ILCS 1030/2.

4. "Association of Firearms and Toolmarks Examiners Glossary." Association of Firearms and Toolmarks Examiners.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: TEST FIRING

PROCEDURE: WATER RECOVERY TANK

Reviewed by:

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Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

If possible, a minimum of two (2) test shots will be fired and recovered in order to perform a microscopic comparison of a submitted firearm. Recovery methods include the water tank, the cotton waste recovery box, the bullet trap, or any other similar approved device. The type of firearm and ammunition tested will usually dictate the type of recovery method used. The water recovery tank is usually used to recover fired projectiles.

OTHER RELATED PROCEDURES

Safe Firearm Handling
Downloading
Remote Firing
Primed Cartridge Case/Shotshell

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

Appropriate hearing and eye protection must be worn when applicable.

One should be aware of the maximum velocity of the projectile that can be fired into a particular water tank, as well as the proper water depth needed for firing.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

1. The bullet and cartridge case of each test shot will be marked with the laboratory case number, the item number, and the examiner's markings.

2. The examiner should consider indexing and sequencing each shot and perform these functions if necessary.

3. Proper hearing and eye protection must be worn.

4. Ensure that the water level is appropriate.

5. Ensure that all lids or doors of the water recovery tank are closed and properly secured.

6. Ensure that the exhaust fans or system is turned on.

7. Ensure all warning systems are activated.

8. Load no more than two (2) cartridges into the firearm during the initial testing of the firearm.

9. The muzzle of the firearm should be extended through the shooting port at all times, from the point that ammunition is inserted into the firearm through the end of the firing process. If it is not possible to extend the muzzle through the shooting port, additional caution must be taken to ensure the muzzle is pointed in a safe direction.

10. Fire the firearm through the shooting port. If the firearm is capable of firing both single and double action modes, a minimum of one (1) shot per mode should be obtained.

11. Recover the bullets using a net, pole, or some other appropriate device.

12. Ejected cartridge cases must be retrieved. Devices to catch the discharged cartridge cases are commercially available.

REFERENCES

1. ANON. “New Ballistics Tank from Detroit-Armor Corporation Allows Fast Recovery Without Projectile Distortion.” *AFTE Journal* 16.3 (1984): 106-107.

2. ANON. “Bullet and Cartridge Case Recovery.” *AFTE Journal* 16.2 (1984): 75.

3. Department of Justice. “National Institute of Justice Firearm Examiner Training.” 2010.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: TEST FIRING

PROCEDURE: COTTON WASTE RECOVERY BOX

Reviewed by:

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Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

If possible, a minimum of two (2) test shots will be fired and recovered in order to perform a microscopic comparison of a submitted firearm. Recovery methods include the water tank, the cotton waste recovery box, the bullet trap, or any other similar approved device. The type of firearm and ammunition tested will usually dictate the type of recovery method used. The cotton waste recovery box is usually used to recover bullets from handguns, rifles and slugs fired from shotguns.

OTHER RELATED PROCEDURES

Safe Firearm Handling
Downloading
Remote Firing
Primed Cases

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

Appropriate hearing and eye protection must be worn when applicable.

One should be aware of the maximum velocity of the projectile that can be fired into a particular cotton box.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

1. The bullet and cartridge case of each test shot will be marked with the laboratory case number, the item number, and the examiner's markings.

2. The examiner should consider indexing and sequencing each shot and perform these functions if necessary.

3. Proper hearing and eye protection must be worn.

4. The examiner should consider wetting the first section of cotton in the box.

5. Place partitions of paper at various points in box to ensure tracking of test shot.

6. Ensure that all lids or doors of the cotton waste recovery box are closed and properly secured.

7. Ensure that the exhaust fans or system is turned on.

8. Ensure all warning systems are activated.

9. Load no more than two (2) cartridges into the firearm during the initial testing of the firearm.

10. Fire the firearm through the shooting port. If the firearm is capable of firing both single and double action modes, a minimum of one (1) shot per mode should be obtained.

11. Bullets will be recovered by searching through cotton, using partitions as guides.

12. Ejected cartridge cases must be retrieved. Devices to catch the discharged cartridge cases are commercially available.

REFERENCES

1. Newquist, Andrew M. "Test Bullet Recovery System." *AFTE Journal*. 5.1 (1973): 9.

2. Molnar, S. "A Novel Bullet Recovery Method." *AFTE Newsletter* 16 (1969): 17.

3. ANON, "Bullet and Cartridge Case Recovery." *AFTE Journal* 16.2 (1984): 75.

4. Flater, Jason. "The Ballistics Research Projectile Recovery System." *AFTE Journal* 36.1 (2004): 50-53.

5. Lee, Lansing J. "Bullet Recovery in a Six Foot Cotton Box." *AFTE Journal* 26.4 (1994): 286.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: TEST FIRING

PROCEDURE: BULLET TRAP

Reviewed by:

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Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

If possible, a minimum of two (2) test shots will be fired and recovered in order to perform a microscopic comparison of a submitted firearm. Recovery methods include the water tank, the cotton waste recovery box, the bullet trap, or any other similar approved device. The type of firearm and ammunition tested will usually dictate the type of recovery method used. The bullet trap is usually used to test fire firearms when the recovery of the fired projectile(s) is not necessary.

OTHER RELATED PROCEDURES

Safe Firearm Handling
Downloading
Remote Firing
Primed Cases

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

Appropriate hearing and eye protection must be worn when applicable.

One should be aware of the maximum velocity of the projectile that can be fired into a particular bullet trap.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

1. The cartridge case or shotshell of each test shot will be marked with the laboratory case number, the item number, and the examiner's markings.

2. The examiner should consider indexing and sequencing each shot and perform these functions if necessary.

3. Proper hearing and eye protection must be worn.

4. Ensure that the exhaust fans or system is turned on.

5. Ensure all warning systems are activated.

6. Load no more than two (2) cartridges into the firearm during the initial testing of the firearm.

7. Fire the firearm into the front of the trap. If the firearm is capable of firing both single and double action modes, a minimum of one (1) shot per mode should be obtained.

8. Ejected cartridge cases must be retrieved. Devices to catch the discharged cartridge cases are commercially available.

REFERENCES

1. McBrayer, William S. "What? Another Water Tank and Bullet Stop!" *AFTE Journal* 10.2 (1978): 90.

2. ANON, "Bullet and Cartridge Case Recovery." *AFTE Journal* 16.2 (1984): 75.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: TEST FIRING

PROCEDURE: REMOTE FIRING

Reviewed by:

_____

Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

During the course of examining a firearm, it may be determined that it would be unsafe for the examiner to fire the firearm by holding it as designed. If it is necessary to obtain test standards from this firearm, the firearm will be fired remotely. The Zero-One® (or similar device) can be utilized for firing long arms and some handguns, while the Ransom Rest® (or similar device) can be utilized for firing handguns.

OTHER RELATED PROCEDURES

Safe Firearm Handling
Downloading
Cotton Waste Recovery Box
Bullet Trap

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

Appropriate hearing and eye protection must be worn when applicable.

The examiner must follow all safety recommendations set forth by the manufacturer of the shooting device used.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

1. The bullet, cartridge case, or shotshell of each test shot will be marked with the laboratory case number, the item number, and the examiner's markings.

2. The examiner should consider indexing and sequencing each shot and perform these functions if necessary.

3. Set up the chosen remote firing device, as per guidelines set forth by the manufacturer, in front of the appropriate recovery system.

4. Place firearm in device. It is recommended that the examiner first dry-fire the firearm in the remote firing device before using live ammunition.

5. Proper hearing and eye protection must be worn.

6. Ensure that the exhaust fans or system is turned on.

7. Ensure all warning systems are activated.

8. The examiner should consider loading no more than one cartridge into the firearm during the initial test firing of the firearm.

9. Activate the remote device while standing behind a protective shield or while standing at a safe distance away from the firearm.

10. Obtain fired tests.

REFERENCES

1. Biasotti, A. A. "Vise/Rest for Remote Firing." *AFTE Journal* 11.4 (1979): 16.

2. Ransom International Corporation. 2010

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: TEST FIRING

PROCEDURE: DOWNLOADING

Reviewed by:

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Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Due to the limitations of a firearms identification section's bullet recovery devices, it may be necessary to reduce or change the powder load of the cartridge in order to obtain a velocity suitable for safely collecting test standards for comparison purposes. Even with a reduced load, it may be necessary to fire the firearm remotely. Downloading a cartridge may also be useful when a bullet from a cartridge fragments upon impact of the water. The powder of the cartridge can be reduced and this reduction can eliminate the bullet from fragmenting.

OTHER RELATED PROCEDURES

Safe Firearm Handling
Remote Firing
Water Tank Recovery
Cotton Waste Recovery Box
Bullet Trap

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

Appropriate hearing and eye protection must be worn when applicable.

PREPARATIONS

None

INSTRUMENTATION

Balance/Scale

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

1. Pull the bullet of the cartridge using an inertia bullet puller or a reloading press.

2. Remove existing powder.

3. Weigh the pulled bullet.

4. Consult a reloading manual, such as Lyman, and obtain the powder charge for the weight of the pulled bullet and the new velocity needed.

5. Weigh out the appropriate powder charge and place in existing cartridge case.

6. Loosely pack a small piece of tissue into the case to fill the gap between the bullet and powder.

7. Seat the bullet back into the cartridge case using a rubber mallet or a reloading press.

8. If appropriate powder is not available, a reduced load using 50% of the original powder can be used. It should be noted that great care must be taken when performing this type of downloading. 50% downloading cannot be used with slow burning powders. 50% downloading cannot be used with many non-canister powders.

REFERENCES

1. *Lyman Pistol and Revolver Reloading Handbook.* Middlefield, CT: Lyman Products.

2. "Reduced Powder Loads." *AFTE Newsletter* No. 3 (1969): 14.

3. Jones, Allen ed. *Speer Reloading Manual for Rifle and Pistol*. Lewiston, ID: Blount Inc. Sporting Equipment Division, 1998.

4. Scoville, Dave ed. *Barnes Bullets Reloading Manual Number One*. Prescott, Arizona: Wolfe Publishing Co., 1992.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: TEST FIRING

PROCEDURE: PRIMED CARTRIDGE CASE/SHOTSHELL

Reviewed by:

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Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

During the course of examining a firearm, it may be determined that it would be unsafe for the examiner to fire the firearm as designed. If it is not necessary to obtain test standards for comparison purposes, the firing condition of the firearm can be tested using a primed empty cartridge case or shotshell.

OTHER RELATED PROCEDURES

Safe Firearm Handling
Physical Examination and Classification of Firearms
Malfunctioning Firearm Examination
Bullet Trap
Pre-Firing Safety Examination
Remote Firing

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered.

Appropriate hearing and eye protection must be worn when applicable.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

1. Obtain a primed empty cartridge case in the desired caliber or pull the bullet of a cartridge using an inertia bullet puller or reloading press, retaining only the primed cartridge case. For shotguns, obtain a primed empty shotshell in the desired gauge or cut open a shotshell removing all components, retaining only the primed shotshell. Commercial firing pin testing devices are available for shotguns and may be used.

2. Proper hearing and eye protection must be worn.

3. Ensure that the exhaust fans or system is turned on.

4. Ensure all warning systems are activated.

5. Load the primed empty cartridge case, primed empty shotshell or commercial firing pin testing device into the chamber of the firearm and test fire in front of the bullet trap, water tank or shooting range.

6. Repeat if the firearm has more than one action.

7. Obtain all tests.

REFERENCES

None

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: FIRED EVIDENCE EXAMINATION

PROCEDURE: CALIBER DETERMINATION

Reviewed by:

_____

Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Caliber, or the base diameter, is one of the class characteristics of a fired bullet. The determination of caliber will aid the examiner during the identification or elimination of a suspect firearm. If no firearm is submitted, the bullet's caliber will be used in determining the General Rifling Characteristics of the firearm involved.

OTHER RELATED PROCEDURES

Trace Material Examination
GRC Utilization

SAFETY CONSIDERATIONS

This procedure involves hazardous materials to include evidence that may be contaminated with a biohazard. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

Comparison Microscope
Caliper
Stereo Microscope
Micrometer

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

The following may be utilized to determine the caliber of any fired bullet. The condition of the bullet will determine which steps can be used.

1. Compare physical characteristics of the evidence bullet directly with known fired reference samples.

2. Measure the diameter of the evidence bullet using a measuring device and compare this measurement with known measurements published in reference literature.

3. Determine the number and widths of the lands and grooves and compare to a table within the AFTE glossary that lists the caliber, LIMP and GIMP widths, as well as the total number of land and groove impressions.

4. Physical characteristics of the evidence bullet, such as weight, bullet shape, composition, nose configuration, and number and placement of cannelures, may aid in caliber determination.

INTERPRETATION OF RESULTS

Caliber is written as a numerical term without the decimal point. If the base is mutilated, the examiner may only be able to determine that the evidence is consistent with a range of calibers or that the caliber cannot be determined.

REFERENCES

1. Mathews, J. Howard. *Firearms Identification.* Springfield, IL: Charles C. Thomas, 1962.

2. Barnes, Frank C. *Cartridges of the World 11th Edition.* Iola, WI: Gun Digest Books, 2006.

3. "Association of Firearms and Toolmarks Examiners Glossary." Association of Firearm and Toolmark Examiners.

4. Bussard, Michael, E. and Stanton L. Wormley, Jr. *NRA Firearms Sourcebook.* Virginia: National Rifle Association, 2006.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: FIRED EVIDENCE EXAMINATION

PROCEDURE: RIFLING DETERMINATION

Reviewed by:

_____

Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Rifling characteristics consist of land and groove impressions and their direction of twist. These are two of the class characteristics used in firearms identification. The potential determinations aid the examiner in the identification or elimination of a fired projectile to a firearm or other fired projectiles. If no firearm or additional projectiles are submitted, these class characteristics can be used in determining the rifling characteristics of the firearm used to fire them.

OTHER RELATED PROCEDURES

Caliber Determination
Land and Groove Impression Measurement Techniques
Microscopic Comparison
Physical Examination & Classification of Fired Evidence
GRC Utilization
Trace Material Examination

SAFETY CONSIDERATIONS

This procedure involves hazardous materials to include evidence that may be contaminated with a biohazard. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

Comparison Microscope
Calipers
Stereo Microscope
Micrometer
Magnifying Glass

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

The following will be utilized to determine the rifling characteristics of any fired bullet evidence. The condition of the fired bullet evidence will determine which steps can be used.

1. Count the land and groove impressions on the item and note them on the panel. For partial bullets and fragments, count the number of land and groove impressions that are visible and note them on the panel. A comparison microscope or stereo microscope can be used if needed.

2. Determine the direction of twist by identifying the base end of the item. While assessing the item starting at the base and moving towards the nose, observe the angle of shoulders of the land and groove impressions. A right hand twist will angle to the right. Conversely, a left hand twist will angle to the left. See Figure 1.

3. Compare the bullet, partial bullet or fragment to a known laboratory fired sample(s) or test shots from a firearm to help confirm the total number of land and groove impressions and the direction of twist. Record these comparisons on the panel.

4. A table within the AFTE glossary that lists the caliber, LIMP and GIMP widths, as well as the total number of land and groove impressions can also be used to help determine the rifling characteristics of a bullet, partial bullet, or fragment.

Figure 1:

Left hand twist

Right hand twist

INTERPRETATION OF RESULTS

Rifling of a projectile is written as a numerical term of the total number of lands and grooves of the barrel of the firearm that the projectile was fired from. It also includes the direction of twist of the lands and grooves. In the case of a mutilated bullet, partial bullet, or fragment, the examiner may only be able to determine that the evidence is consistent with the total number of land and groove impressions or that the rifling cannot be determined. Direction of twist of the rifling will be left, right or undetermined.

REFERENCES

1. Mathews, J. Howard. *Firearms Identification.* Springfield, IL: Charles C. Thomas, 1962.

2. Hatcher, Julian S. *Firearms Investigation, Identification and Evidence*, Plantersville, SC: Small-Arms Technical Publication Co., 1935.

3. "Association of Firearm and Tool Mark Examiners Glossary." Association of Firearm and Tool Mark Examiners. <http://www.afte.org/>

4. Jack Gunther & Charles Gunther. *The Identification of Firearms*, New York, NY: John Wiley & Sons Inc.

5. "Firearms Identification Lesson 2." AFTE Journal 14.2 (1982): 44-69.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: FIRED EVIDENCE EXAMINATION

PROCEDURE: LAND AND GROOVE IMPRESSION MEASUREMENT TECHNIQUES

Reviewed by:

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Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

One of the class characteristics used in the discipline of firearms identification is the width of the land impressions and groove impressions. These measurements aid the examiner during the identification or elimination of a suspect firearm. If no firearm is submitted, these measurements will be used in determining the General Rifling Characteristics of the firearm involved. Several instruments and techniques can be used to obtain these measurements.

OTHER RELATED PROCEDURES

Trace Material Examination

GRC Utilization

SAFETY CONSIDERATIONS

This procedure involves hazardous materials to include evidence that may be contaminated with a biohazard. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

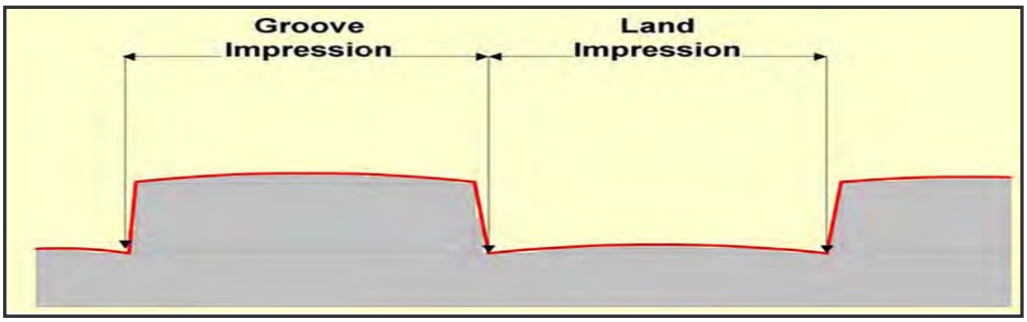
Comparison Microscope
Calipers
Stereo Microscope
Micrometer

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

In measuring a fired bullet to determine the width of the land impression or the groove impression, it is paramount that the points used for beginning and ending a measurement comply with the discipline-wide practice. This practice utilizes the anchor points shown on the following page and is used for all measurement techniques listed.



A. Air Gap

1. The fired bullet in question is mounted on one stage of the comparison microscope. The micrometer or caliper is mounted on the other stage.

2. Both stages must be using the same magnification level (objective setting) and be in focus.

3. Align the image of the measurement gap (opening) of the micrometer or caliper with the image of the appropriate land impression being measured. Adjust the measurement gap to best replicate the width of the land impression and record the measurement to the nearest thousandth of an inch.

4. Repeat the above procedure utilizing the groove impression.

B. Stereo Microscope – Caliper/Micrometer

1. The fired bullet in question and a caliper or micrometer are either held or mounted on a steady surface beneath the stereo microscope.

2. The land impression of the fired bullet is placed perpendicular to the operating direction of the caliper/micrometer.

3. Move the caliper/micrometer, as necessary, in order to measure the distance between both anchor points of a land impression. Record the measurement to the nearest thousandth of an inch.

4. Repeat the above procedure utilizing the groove impression..

INTERPRETATION OF RESULT

It may be necessary to measure several land and groove impressions on a bullet in order to record a reliable measurement.

REFERENCES

1. Molnar, S. “A Simplified Technique for L&G Measurement - Twist Rate.” *AFTE Journal* Newsletter 4 (1969): 28-34.

2. Hart, Robert. “Groove Width Measurements on Fired Bullets.” *AFTE Journal* 8.2 (1976) 63-69.

3. Welch, William Russell Wilhelm. “A Uniform Bullet Classification System.” *AFTE Journal* 9.2 (1977): 26-30.

4. Davis, John. “Land-Impression Widths – A Simplified Measuring Set-Up.” *AFTE Journal* 8.4 (1976): 14-18.

5. U.S. Department of Justice, Federal Bureau of Investigation; NCIC, *Criminalistics Laboratory Information System (CLIS) Operating Manual*, 1978.

6. Walsh, J.F. “Accuracy, Speed and Convenience in Rifling Measurements.” *AFTE Journal* 9.1 (1977): 50.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: FIRED EVIDENCE EXAMINATION

PROCEDURE: GRC UTILIZATION

Reviewed by:

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Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

The Association of Firearms and Toolmark Examiners online General Rifling Characteristics file (GRC File) can be utilized when attempting to determine a list of possible firearms that could have fired an evidence bullet and/or cartridge case when a firearm is not submitted.

OTHER RELATED PROCEDURES

Caliber Determination

Stereo Microscope - Caliper/Micrometer
Air Gap

SAFETY CONSIDERATIONS

This procedure may also involve hazardous materials to include evidence that may be contaminated with a biohazard. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

1. The General Rifling Characteristics File can be accessed in the members area of the AFTE website.

2. Follow the operating instructions listed on the data entry page utilizing the class characteristics of the fired evidence bullet and/or cartridge case.

3. Title the search criteria used with the laboratory case number referencing the current case in question.

4. When entering the land and groove impression dimensions, minimally use +/- 0.003” from the measured land and groove impressions if only one land and groove was measured. If a range was measured it must minimally be +/- 0.003”.

5. After the results of the GRC search are completed save the results and include a copy in the case file.

INTERPRETATION OF RESULTS

The AFTE GRC file is an investigative aid and should not be construed as an all-inclusive list of firearms available with those particular class characteristics.

REFERENCES

1. General Rifling Characteristics Database, www.afte.org member area.

ILLINOIS STATE POLICE
FIREARMS AND TOOLMARKS
PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: FIRED EVIDENCE EXAMINATION

PROCEDURE: WADDING DETERMINATION

Reviewed by:

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Forensic Scientist, Brian Parr Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

By examining wadding, the examiner may be able to determine the gauge/caliber, manufacturer, and if the wad contains markings suitable for comparison to the firearm that discharged it.

OTHER RELATED PROCEDURES

Trace Material Examination

Stereo Microscope – Ruler/Taper Measure/Caliper/Micrometer
Air Gap

SAFETY CONSIDERATIONS

This procedure may also involve hazardous materials to include evidence that may be contaminated with a biohazard. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

Comparison Microscope
Micrometer
Stereo Microscope
Caliper

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

1. Trace material present must be recorded and retained if necessary.

2. If contaminated with blood, the wad must be disinfected.

3. Determine gauge size by directly comparing evidence to known laboratory samples of similar manufacture or composition by comparing the base of evidence to the bases of the samples until a similar size is found. Gauge size can also be determined by measuring the base diameter of the wad and comparing these measurements to known measurements. Measurements may be obtained by utilizing a caliper, a micrometer, ruler/tape measure or the air gap procedure.

4. Manufacturer data can be determined by locating information stamped into the wad or by comparing the wad to known laboratory samples.

5. Microscopic examination may reveal striations suitable for identification of the wad back to the firearm that fired it. The suitability of the wads for comparison purposes will be documented in a findings panel.

6. If evidence shotshells are submitted, it may be necessary to disassemble one for the determination of gauge size or manufacture.

7. Record all information on the wadding panel.

INTERPRETATION OF RESULTS

If the wad is mutilated or soaked with blood or other body fluids, the examiner may not be able to specifically determine gauge size. The examiner should also recognize that some manufacturers may duplicate the design of another manufacturer.

REFERENCES

1. Wright, David C. "Individuality and Reproducibility of Striae and Plastic Wad Components Fired from a Sawed-off Shotgun." *AFTE Journal* 35.2 (2003) 161-166.

2. Thompson, Roger C. "Telltale Shotgun." *AFTE Journal* 10.1 (1978): 17.

3. Christinsen, Robert. "Tricky Wads." *AFTE Journal* 10.1 (1978): 27-28.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: FIRED EVIDENCE EXAMINATION

PROCEDURE: SHOT DETERMINATION

Reviewed by:

_____

Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

By examining recovered shot pellets, the examiner may be able to determine the actual shot size. The determined size can then be compared to the shot size loaded in submitted live shotshells or to the size that the submitted discharged shotshell was marked to have contained.

OTHER RELATED PROCEDURES

Trace Material Examination

SAFETY CONSIDERATIONS

This procedure may also involve hazardous materials to include evidence that may be contaminated with a biohazard. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

Stereo Microscope
Caliper/Micrometer
Scale/Balance

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

The examiner may use one or any combination of the below techniques to determine shot size.

I. Visual/Microscopic Comparison

A. Determine the total number of pellets received.

B. Make note if pellet sizes all appear to be similar in size. If several different sizes are present, determine each specific size.

C. Compare laboratory samples of known shot sizes side by side with the evidence pellets until a known shot size is determined. A stereo microscope may aid in this determination. This can be done one size at a time or several sizes at a time; however, if more than one size is used at a time, care should be taken not to mix up the shot.

D. Record findings on the shot pellet panel.

II. Comparison by Weight

A. Record the total number of pellets received.

B. Document whether the pellets are consistent with lead, steel or other.

C. Determine the number of pellets suitable for weighing. Make note if pellet sizes all appear similar. If several sizes present, determine each specific size.

D. Weigh the pellets in grains.

E. Divide weight of pellets by total number weighed. Consult known pellet weights in Table 1 or Table 2 of the appendices section of the AFTE Glossary and determine the shot size which corresponds to the evidence shot.

F. Record findings on appropriate worksheet.

G. The weight of the evidence pellets can also be directly compared to weight of samples using the same number of pellets until a similar known weight is obtained.

III. Measuring Pellet Size

A. Determine the total number of pellets received.

B. Make note if pellet sizes all appear to be similar in size. If several different sizes are present, determine each specific size.

C. Choose the best specimen and measure diameter using a caliper or micrometer, and record in hundredths or thousandths of an inch.

D. Consult known pellet sizes in Table 1 or Table 2 of the appendices section of the AFTE Glossary and determine the shot size which corresponds to the evidence shot.

REFERENCES

1. "Association of Firearms and Toolmarks Examiners Glossary." Association of Firearms and Toolmarks Examiners.

2. Mann, Mary-Jacque. "Shot-Pellets: An Overview." *AFTE Journal* 26.3 (1994): 223-241.

3. Ernest, Richard. "Exploring the Possibility of Matching Fired Shotgun Ammunition Components to Unaltered Shotguns." *AFTE Journal* 24.1 (1992): 28-36.

4. "Firearms Identification Lesson 4." *AFTE Journal* 14.3 (1982): 46-68.

5. Garrison, D.H. "Modern Shotgun Slug Design and Dynamics." *AFTE Journal* 20.4 (1988): 408-420.

6. Monturo, Chris. “Copper Sabot Shotgun Slugs.” *AFTE Journal* 32.3 (2000): 301-303.

7. Royse, Dan. “Identification Made on Fired “00" Buckshot Pellet.” *AFTE Journal* 28.4 (1996): 252-253.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: FIRED EVIDENCE EXAMINATION

PROCEDURE: PHYSICAL EXAMINATION AND CLASSIFICATION OF FIRED EVIDENCE

Reviewed by:

_____

Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

William E. Demuth II
Director of Training

INTRODUCTION

The initial examination of any fired evidence will include the completion of a fired bullet panel or a fired cartridge case/shotshell panel. These panels will include the physical description of the fired evidence and will serve as a source to document the condition of the evidence as received. Any comparisons performed will be documented on a findings panel.

OTHER RELATED PROCEDURES

Caliber Determination
Land and Groove Impression Measurement Techniques
Trace Material Examination

SAFETY CONSIDERATIONS

This procedure may also involve hazardous materials to include evidence that may be contaminated with a biohazard. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

Stereo Microscope
Caliper/Micrometer
Scale/Balance
Comparison Microscope

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

A fired bullet panel or fired cartridge case/shotshell panel will be filled out according to Appendix II - Minimum Standards and Controls. This may include noting the following:

Fired Bullet Panel:

1. If any trace material present.
2. The caliber.
3. Record the weight of bullets or slugs in grains.

4. The number of lands and grooves on a fired bullet.
5. The direction of twist.
6. The measured width of the land impressions.
7. The measured width of the groove impressions.
8. The jacketing type of the bullet, if applicable.
9. The bullet type.
10. The condition of the fired evidence as received.
11. A description of the base of the bullet.
12. The type and position of cannelures.
13. Any extraneous markings.
14. Any suitability determinations or microscopic comparison results will be documented on a Findings Panel.

Fired Cartridge Case/Shotshell Panel:

1. Brand/Manufacturer.
2. The caliber or gauge.
3. The shape of the firing pin impression.
4. The type of breech face marks.
5. The firing aperture shape
6. The cartridge case composition.
7. The primer composition.
8. Description of other markings to include:

    A. Extractor
    B. Ejector
    C. Resizing marks
    D. Chamber marks
    E. Anvil marks

F. Magazine marks
G. Ejection port marks

9. Any suitability determinations or microscopic comparison results will be documented on a Findings Panel.

REFERENCES

1. Howe, Walter, J. "Laboratory Work Sheets." *AFTE Newsletter* 2 (1969): 13.

2. Shem, Robert. "Computerized Worksheets for Firearm and Toolmark Examiners." *AFTE Journal* 30.3 (1998): 575-578.

3. "Association of Firearms and Toolmarks Glossary." *AFTE Journal*

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: FIRED EVIDENCE EXAMINATION

PROCEDURE: MICROSCOPIC COMPARISON

Reviewed by:

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Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

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William E. Demuth II
Director of Training

INTRODUCTION

In order for a firearms examiner to identify fired evidence back to the firearm that fired it, a microscopic comparison utilizing a comparison microscope must be performed. The comparison microscope allows the examiner to place the evidence on one side of the microscope and the test shot on the other side. This procedure can also be utilized when comparing similar items, such as fired bullets or discharged cartridge cases, to determine if they were fired by the same firearm.

OTHER RELATED PROCEDURES

Trace Material Examination	Magnesium Smoking
Caliber Determination	Physical Examination & Classification of Fired Evidence

SAFETY CONSIDERATIONS

This procedure may also involve hazardous materials to include evidence that may be contaminated with a biohazard. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

Comparison Microscope

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

The procedural steps below do not have to be performed in the order listed: however, all steps must be considered and/or addressed.

1. Select the correct objective (magnification) setting and insure that the objectives are locked in place.

2. Select the correct set of oculars (eyepieces).

3. The illumination (lights) used must be properly adjusted. Oblique lighting is usually preferred.

4. Prior to microscopically comparing any unknown fired evidence to known test shots, the unknown fired evidence will be examined and all discernible class characteristics will be documented in the notes. The unknown fired evidence will also be evaluated for the presence

of suitable identifying characteristics prior to any comparisons to test shots from any submitted weapons or additional items of unknown fired evidence. The results of the macroscopic and microscopic comparison will be reported out as an elimination, identification, inconclusive, or unsuitable finding. If only one item of unknown fired evidence is submitted the results of the macroscopic and/or microscopic evaluation will be reported out as a suitable or unsuitable finding. If the result of the comparison yields an elimination or inconclusive finding for an item(s), an additional suitable or unsuitable finding may also be included.

5. Prior to test firing a firearm, visually inspect the unfired cartridges for the presence of manufacturing tool marks on the primer, head, and case wall of the cartridge. Any manufacturing or other unknown tool marks observed prior to test firing that could have an impact on the microscopic comparison will be documented in the work notes. After the firearm has been test fired, compare the test fired components first to establish the reproducibility of class and individual characteristics.

6. Compare an unknown piece of fired evidence to either another unknown piece of fired evidence or known test shots (standards). This is done by placing the unknown evidence on one stage and the other unknown evidence or known standard on the other stage.

7. The entire evidence surface must be considered.

8. If an identification is not initially made, the examiner should consider the following factors:

    A. Angle of lights
    B. Type of lights
    C. The need for additional known standards
    D. The position of the evidence, the tests or both the evidence and the tests.
    E. The possibility of using magnesium smoke.
    F. The possibility of cleaning the firearm.

9. The findings of identification and elimination based on individual characteristics must be verified by a second firearm/toolmark examiner and properly documented as specified in Appendix II - Minimum Standards and Controls.

10. Care must be taken to verify that all identified toolmarks were caused from the discharge of a firearm and were not toolmarks caused from the manufacture of the ammunition components or toolmarks caused from the loading, extracting, and ejecting of the ammunition components. Although these type of toolmarks can be valuable to an investigation, great care should be made to correctly distinguish the difference between toolmarks caused from the discharge of a firearm and all other types of identified toolmarks.

INTERPRETATION OF RESULTS:

Please refer to the Minimum Standards and Controls and the range of conclusions for a description of the findings.

REFERENCES

1. "American Institute of Applied Science: Firearms Identification Lesson 5." *AFTE Journal* 14.3 (1982): 69.

2. Mathews, J. H. *Firearms Identification Volume I*. Springfield, IL: Charles C. Thomas, 1973.

3. *Organization of Scientific Area Committees – Firearms and Toolmarks Subcommittee*

4. Deforest, P.R., R.E. Gaensslen, H.C. Lee. *Forensic Science: An Introduction to Criminalistics.* New York: McGraw-Hill, 1983.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: FIRED EVIDENCE EXAMINATION

PROCEDURE: TRACE MATERIAL EXAMINATION

Reviewed by:

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Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Fired evidence recovered during an investigation may contain trace material transferred from the crime scene. This trace material may be in the form of blood, tissue, plaster, paint, hairs, fibers, glass, etc. The examiner needs to evaluate the importance of this evidence and, if further examination of the trace material is necessary, remove and preserve a sample of the trace material present. Removal of trace material may also be necessary to allow the proper examination of the fired evidence.

OTHER RELATED PROCEDURES

Physical Examination & Classification of Fired Evidence Microscopic Comparison

SAFETY CONSIDERATIONS

The procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

NFPA LISTING				
Chemical	**Health Hazard**	**Flammability Hazard**	**Reactivity Hazard**	**Contact Hazard**
15% Acetic Acid	3	2	0	
10% Bleach	2	0	1	
Methanol	1	3	0	
Acetone	1	3	0	

Chemical Warnings:

WARNING! Acetic Acid is toxic and can pose a SEVERE HEALTH HAZARD.

WARNING! Methanol is flammable and can pose a SEVERE FLAMMABILITY HAZARD.

WARNING! Acetone is flammable and can pose a SEVERE FLAMMABILITY HAZARD.

The examiner must use eye protection and work within a fume hood or utilize a spot vent. The examiner should consider wearing a respirator and gloves.

PREPARATIONS

NOTE: ALWAYS ADD ACID TO WATER, NEVER ADD WATER TO ACID.

15% Acetic Acid Solution:
Prepare a 15% Acetic Acid Solution utilizing concentrated Glacial Acetic Acid and water.

10% Bleach Solution:
Prepare a 10% Bleach Solution utilizing bleach and water.

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

1. Examine the fired evidence visually and microscopically for any trace material and record in notes.

2. Determine if further examination of trace material is necessary. If so, remove material being careful not to damage the fired evidence. Place the removed trace material in a suitable container/packaging for submission to the appropriate section for further examination. If necessary, consult the appropriate section prior to the removal of any trace evidence. If the trace material is not going to be retained for further examination, proceed with the following steps that are applicable.

3. For evidence containing blood, tissue or other bio-hazards, soak the evidence for at least one (1) minute in a 10% bleach solution.

4. Remove loose material by rinsing the fired evidence with methanol or water.

5. Remove plaster by the soaking the fired evidence in a 15% acetic acid solution.

6. Remove paint by soaking the fired evidence in alcohol or acetone.

REFERENCES

1. Smith, O'Brien C., M.D. Hugh E. Berryman Ph.D. and Steven A. Symer, M.A. "Detrimental Effects of Cleaning or Sterilizing on Bullet Striations." *AFTE Journal* 22.2 (1990): 129-134.

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3. "Firearms Identification Lesson 8." *AFTE Journal* 14.4 (1982): 58-59.

4. Meyers, Charles. "Trace Evidence on Fired Bullets." *AFTE Newsletter 13* (1969): 16-17.

5. Rathman, Gary, and Scott Ryland. "Use of the SEM-EDXA as an Aid to the Firearms Examiner." *AFTE Journal* 19.4 (1987): 388-392.

6. Quevillas, J.A. "An Application of DNA Typing to Firearms and Toolmark Identifications." *AFTE Journal* 29.1 (1997): 58.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: FIRED EVIDENCE EXAMINATION

PROCEDURE: BULLET REPLICA

Reviewed by:

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Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Occasionally, another agency wishes to compare evidence bullets or discharged cartridge cases that this laboratory system has in its custody. Because the evidence must remain in the custody of the laboratory, an easy way to circumvent actually hand-carrying the item to the requesting agency is to make a replica and mail it. Dip-Pak®, Coe-Flex®, Mikrosil® or other types of casting material are similar products and procedurally are equivalent as long as the manufacturers' instructions are followed

OTHER RELATED PROCEDURES

Trace Material Examination

SAFETY CONSIDERATIONS

The procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

Immediately prior to use, mix the casting material as per manufacturer's direction.

INSTRUMENTATION

Comparison Microscope
Stereo Microscope

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

1. Prepare casting material as per manufacturer's specifications.

2. Cast the bullet in question.

3. Allow the cast the appropriate amount of time to cure.

REFERENCES

1. Geradts, Zeno, Jan Keijzer and Cor Van Brakel. "The Production of Replicas of Bullets and Cartridges." *AFTE Journal* 28.1 (1996): 41 - 44.

2. Cassidy, Frank H. “Replication of Identifying Marks When Using ‘Mikrosil’ Castings.” *AFTE Journal* 25.2 (1993): 130 - 131.

3. Biasotti, A.A. “Methods Applied to the Comparison of Class and Individual Characteristics in Firearms and Toolmark Identification.” *AFTE Journal* 21.2 (1989): 260 - 263.

4. Barber, David C., and Frank H. Cassidy. “A New Dimension with ‘Mikrosil’ Casting Material.” *AFTE Journal* 19.3 (1987) 328 - 329.

5. ANON. “Replica Methods.” *AFTE Journal* 16.2 (1984): 62.

6. Poole, Robert A. “Mikrosil Casting Material Information.” *AFTE Journal* 15.2 (1983): 80 - 82.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: NIBIN System
NIBIN ENTRIES

PROCEDURE:

Reviewed by:

_____

Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

NIBIN is a computerized system for acquiring and storing the images of unidentified cartridge cases and test shots from recovered firearms. NIBIN uses state of the art optical and electronic technology to acquire images of the primer, firing pin, or ejector marked areas of fired cartridge cases. Using sophisticated algorithms, the images entered into the database are correlated against other images using filters such as caliber, date of offense, firing pin shape, etc. These correlations produce lists of candidates that are ranked numerically by category (firing pin, breech face, ejector). The examiners reviewing the correlations can compare the candidates to the image they entered. If there is a possible association, the examiner will report the possible association and notify the submitting agency that a confirmatory examination will be conducted upon request.

OTHER RELATED PROCEDURES

Physical Examination & Classification of Fired Evidence
Microscope Comparison

SAFETY CONSIDERATIONS

The procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

NIBIN

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

1. NIBIN Entry
    a. The NIBIN Brasstrax User's Guide may be referenced while making entries into the system.
    b. All primers and heads of the cartridge cases should be cleaned with acetone to remove debris, fibers, and primer sealant.
    c. The firearms examiner will ensure the items are suitable for entry into NIBIN.
    d. Any evidence cartridge case selected for entry into NIBIN must have sufficient individual characteristics within the firing pin impression, breech face marks, or ejector marks to allow for an identification.

e. If there is more than one identified evidence cartridge case suitable for entry to NIBIN, the examiner should select the best one for entry. Due to the potential differences in reproduction of individual characteristics between identified items, the examiner has the option to enter more than one identified item.
f. Information about the identification or grouping of the fired cartridge cases to each other and the selection of certain specimens for entry into NIBIN will be documented within the case notes.
g. All test shots from auto-ejecting firearms that are suitable for entry will be entered into NIBIN. Test shots from revolvers, derringers and single shot firearms will not be entered into NIBIN.
h. All calibers/gauges from fired evidence cases that are suitable for entry will be entered into NIBIN.
i. Ejector marks from rifle calibers (test shots and fired evidence) will be entered into NIBIN if they have sufficient individual characteristic detail. Suitability of the ejector marks will be determined by the examiner entering the Item(s) into the NIBIN database.
j. All entries will utilize the full 12 character laboratory case number in the LIMS.

2. NIBIN Correlation
    a. The NIBIN Matchpoint User's Guide may be referenced for review of the correlation.
    b. At a minimum, the examiner will review the top thirty image sets in the correlation results sorted by the unified score (high to low), when applicable.
    c. This correlation review will include the 2D and 3D images.
    d. Documentation of Correlation Results
        i. When no possible associations are observed, the examiner will print off the top 30 unified scores and scan into LIMS to attach to the NIBIN panel.
        ii. When a possible association is found on the current case, the examiner will do the following:
            1. Mark the case as a possible association in NIBIN.
            2. Print the NIBIN results that minimally contains the side by side case information, the side by side image page and the top thirty unified correlation scores. This information will be scanned and attached to the NIBIN panel within the LIMS case file.
            3. The printed NIBIN results will be utilized to fill out the "Possible Associated Cases" field of the NIBIN panel in LIMS. Examiners do not need to reference previously issued reports to determine how the Item(s) were referenced in those reports. Examiners only need to utilize the information present in NIBIN.
3. NIBIN Reporting and Agency Notification for possible associations
    a. Possible NIBIN associations to cases that were examined within the Illinois State Police laboratory system will require the following:
        i. Create a new assignment for the case(s) that may be associated with the current case.
        ii. Select the appropriate Item number referenced on the printed NIBIN results under the new assignment and create a NIBIN notification task for the new assignment.

iii. Fill out the NIBIN panel in LIMS using the same data in the printed NIBIN results for the possible association. Examiners do not need to reference previously issued reports to see how Items were referenced to report out possible associations.
iv. Attach the NIBIN results paperwork to the NIBIN panel.

b. Possible NIBIN associations to agencies that did not submit evidence to the Illinois State Police laboratory system:
i. Notifications will be handled accordingly by the NIBIN coordinators at each laboratory.
ii. No additional reports in LIMS will be issued for these cases.

4. Duplicate entries of the same Item into the NIBIN system
a. In NIBIN:
i. If viewing a NIBIN correlation and the examiner discovers that the case has been previously entered into NIBIN at another NIBIN site, immediately stop viewing additional correlation image sets.
ii. Print out the correlation list and highlight the NIBIN case entry information demonstrating the duplicate entry and attach to the NIBIN panel in LIMS.
iii. Print out the side by side case information for the case being examined and the duplicate case. Highlight or show the information indicating the entry is a duplicate (same agency, same agency case number, item number, etc). Attach to the NIBIN panel in LIMS.
iv. Do not mark the duplicate as a hit in the Matchpoint.
v. Delete your NIBIN entry on the Brasstrax.
b. In LIMS:
i. Fill out the NIBIN panel with the Item # entered and under the "Results" record "Previously entered into NIBIN at the XXX NIBIN site" and insert the appropriate NIBIN site. Example: Danville Police Department case entered by Champaign Police Department NIBIN site, "Previously entered into NIBIN at the Champaign Police Department NIBIN site".
ii. Do not report out the duplicate entry as a possible association.
iii. In the notes field, record "To reduce redundancies in the NIBIN database, the NIBIN entry created at the XXX Forensic Science Laboratory/Forensic Science Center at Chicago has been deleted."
iv. Ensure that the NIBIN paperwork has been attached to the NIBIN panel.

*In the event that there is a possible association or multiple associations to other cases in addition to the duplicated entry (where the other case(s) is/are actually higher in the correlation list than the duplicate), all associations will need to be properly noted in the case notes. Within NIBIN, the possible association(s) ranked higher than the duplicate will be marked. This entry will not be deleted when there are possible associations ranked higher than the duplicate. This will be more of a rare circumstance and some procedural variances are allowable based on the case(s).

PERFORMANCE CHECK

Overall Procedure

1. A supervisor or designee will ensure that the NIBIN Entry Performance Check is applied once per calendar year. The NIBIN Entry Performance Check is also applied anytime the vendor makes a software update to the NIBIN system. Anytime a NIBIN Performance Check is completed, it will be documented with the LAM in LIMS.
2. The BrassTrax acquisition station and a Matchpoint at each laboratory will be involved in the NIBIN Entry Performance Check.
3. The National Institute of Standards and Technology (NIST) Golden Image is designated as the Benchmark cartridge case. The Standard Reference Material SRM2461-262 cartridge case is designated as the control.
4. The NIST Golden Image has been previously captured by the Bureau of Alcohol, Tobacco, Firearms and Explosives and resides on the NIBIN server.
5. The acquired image for the control will be correlated against the database.
6. The Benchmark cartridge case should rank in the top 30 positions based on the unified score.
7. If the Benchmark cartridge case fails to rank in one of the top 30 positions based on the unified score, then the control will be deleted from the NIBIN database and reacquired.
8. If failure occurs again, then the vendor, Ultra Electronics Forensic Technology Inc. may be notified to help rectify the problem.
9. Once an appropriate ranking has been achieved, the NIBIN user will print a hard copy for the control and will be uploaded into the LAM.

Guide for the User

1. Log into the BrassTrax and create a new case
2. The case will have QC-Lab-Year as the case number (QC-Joliet-2023)
3. The event type will be entered as Quality Control
4. Agency entered as Unknown
5. Contact entered as NIBIN user entering the Standard Reference Material (SRM)
6. Occurrence entered as the date SRM is being entered
7. Add a Cartridge Case
8. Exhibit number is SRM2461-262
9. Caliber is 9 mm Luger
10. Firing Pin Shape is circle
11. Category is Quality Control
12. Reception Date is the date SRM is being entered
13. Log into the Matchpoint
14. Find the case (QC-Lab-Year)
15. Click on the Exhibit number of the case
16. Right click on the Exhibit number of the case
    a. Under category, check Crime Evidence
    b. Under Request Constraints, check Correlation Site Selection

c. Hit Generate
d. Select CSSVR-East and click OK

17. The Benchmark image needs to show up in the top 30 unified scores
18. Print the Results
19. Upload the results into the LAM

REFERENCES

1. Brasstrax User's Guide

2. Matchpoint User's Guide

3. Illinois State Police Command Directive MIS 6

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: PRELIMINARY EXAMINATIONS

PROCEDURE: NIBIN EVALUATION CASES

Reviewed by:

_____

Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

The NIBIN Evaluation procedure provides a truncated preliminary examination process of discharged cartridge cases. The entry of these cartridge cases into NIBIN can be expedited which results in probative information being provided to the agency more quickly than when a full examination is conducted. Utilizing this procedure, a preliminary assessment of the cartridge cases will be conducted and the cartridge cases will be grouped based on a possible number of firearms represented by the evidence. If suitable, a representative sample(s) of the group(s) will be entered into NIBIN and the correlation results will be reviewed. A NIBIN Evaluation report will be generated to notify the submitting agency of the results. The NIBIN Evaluation Procedure will not be used on fired evidence cases that are submitted with a firearm unless approved by laboratory management and documented in the LIMS. The NIBIN Evaluation Procedure will not be used for fired evidence cases classified as "Homicides" or "Death Investigations" unless approved by laboratory management and documented in LIMS.

All submissions will be screened for NIBIN Evaluation eligibility. The NIBIN Evaluation casework approach will be applied to any submissions meeting the criteria for the NIBIN Evaluation casework approach. Any exceptions must be approved by laboratory management and documented in the LIMS.

OTHER RELATED PROCEDURES:

NIBIN Entries
Physical Examination and Classification of Fired Evidence
Microscopic Comparison

SAFETY CONSIDERATIONS

This procedure involves hazardous materials to include evidence that may be contaminated with a bio-hazard. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

NIBIN
Comparison Microscope

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II – Minimum Standards and Controls

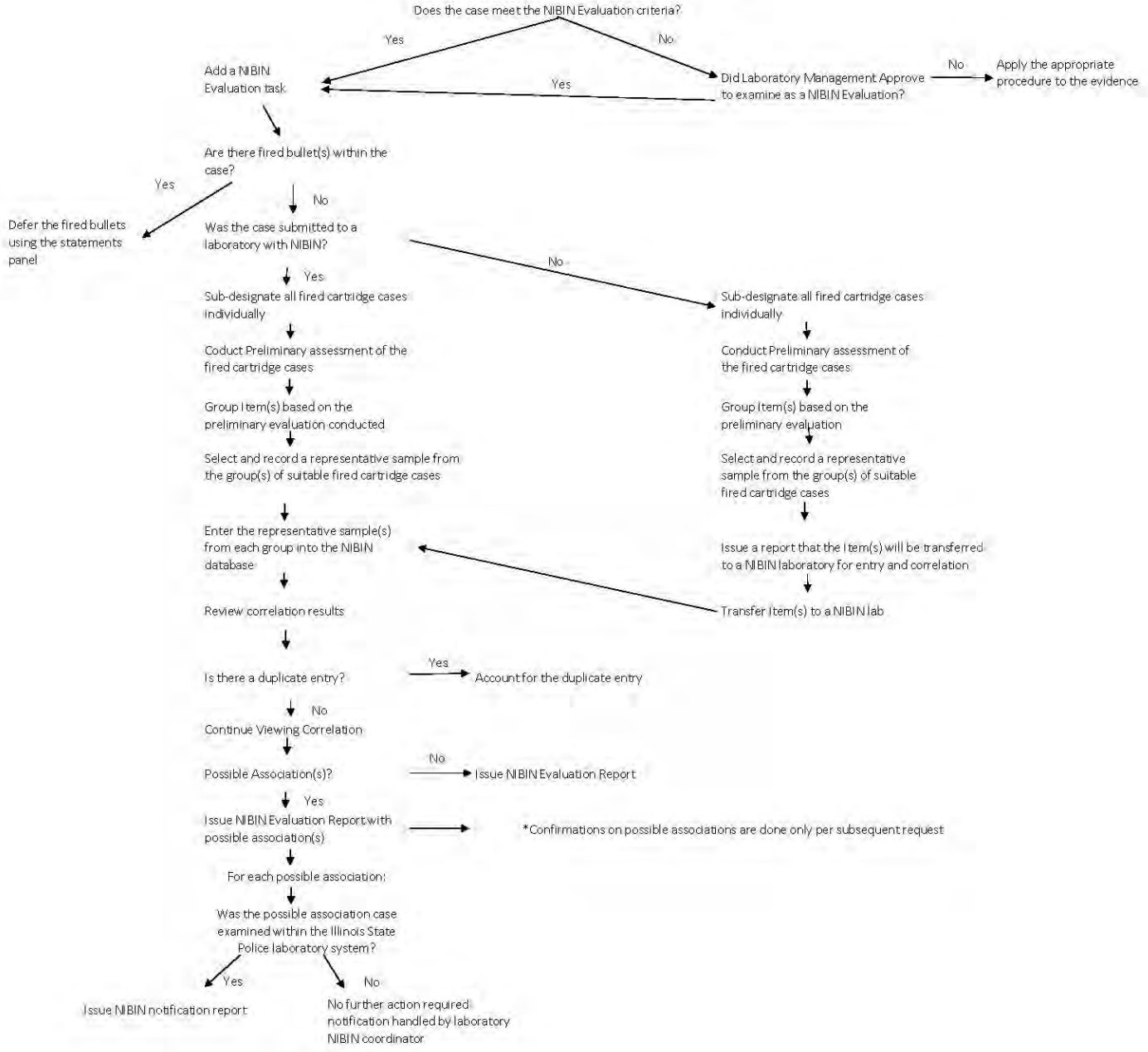
PROCEDURE OR ANALYSIS

1. Review the agency request and other attached agency paperwork to confirm that the case is appropriate for a NIBIN evaluation case. If managerial approval is required to examine the case as a NIBIN Evaluation case, the approval will be documented in LIMS. Add a NIBIN Evaluation task to the assignment for the case.
2. Defer all bullet examinations within the case and document the deferral in the case notes utilizing the Statements Panel.
3. Conduct a preliminary assessment of the submitted cartridge cases utilizing the minimum standards and controls for a NIBIN Evaluation case.
4. Conduct an abbreviated microscopic comparison on a comparison microscope and group the cartridge cases based on a possible number of firearms represented by the evidence.
5. Sub-designate the cartridge cases individually.
6. Select a representative sample(s) from the group(s) of suitable cartridge cases utilizing a comparison microscope.
7. Determine which, if any, of the cartridge cases are suitable for entry into NIBIN utilizing a comparison microscope.
8. The examiner will not form any conclusions from the preliminary microscopic comparison other than determining which cartridge cases to enter into NIBIN. Since no conclusions are formed on the comparison, verifications are not necessary. The documentation should only reflect the analysis conducted.
9. Items will be transferred to a NIBIN laboratory per FA-1G-1 if at a laboratory without NIBIN equipment.
10. Laboratories without NIBIN will issue a report stating that Item(s) have been forwarded to another laboratory for a NIBIN search.
11. Only laboratories with the NIBIN database equipment will do the following:
    a. Enter a representative sample(s) from the group(s) of suitable cartridge cases into NIBIN.
    b. Review the correlation results following the requirements of FA-IE-1.
    c. If there is a possible association(s), the examiner will report the possible association(s) and notify the submitting agency that a confirmatory examination will only be conducted upon request.
    d. All relevant NIBIN paperwork pertaining to the correlation results and any possible associations will be included within the case notes.
    e. Issue any NIBIN Notification reports per FA-IE-1.

REFERENCES

No References

NIBIN Evaluation Casework Approach



ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: FIREARMS EXAMINATION

METHOD: NIBIN System

PROCEDURE: NIBIN Entries – Non-NIBIN Laboratories

Reviewed by:

_____
Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____
Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

The NIBIN Entries – Non-NIBIN Laboratories procedure applies to firearms evidence worked at laboratories that do not have the NIBIN system. Qualifying evidence will be entered into the NIBIN system at another Illinois State Police laboratory.

OTHER RELATED PROCEDURES

Physical Examination & Classification of Fired Evidence
Microscopic Comparison
NIBIN Entries

SAFETY CONSIDERATIONS

The procedure does not purport to address all the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

NIBIN System

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

A. The following is utilized when fired cartridge cases, fired shotshells or test shots are examined at a Non-NIBIN laboratory and transferred to a NIBIN laboratory for entry:
   1. Consult FA-IE-1 NIBIN Entries for the types of evidence that will be entered into NIBIN.
   2. Evidence for NIBIN will be mailed on a weekly basis every Friday. The mailing method will include 2-day shipping with an available shipment tracking number. Exceptions include:
      a. A state holiday that occurs on a Friday (Evidence will be mailed the previous day)
      b. A hand to hand transfer between laboratories that occurs prior to Friday

3. The examiner will prepare the evidence for transfer. Items will not be physically transferred to the NIBIN entry laboratory until the case has gone through technical review and has been approved in LIMS.
4. An examiner will check that the evidence has been marked appropriately for NIBIN acquisition. A dark colored index mark will be placed at 6:00 on the cartridge case head that runs down the side of the cartridge case. All primers and heads should be cleaned with acetone to remove debris, fibers, and primer sealant.
5. The item or sub-item will be prepared in the following manner:
    a. Fired cartridge case(s)/fired shotshell(s)
        i. If an item contains more than one cartridge case, the sub-designated item(s) being sent for NIBIN entry must be sub-itemized. This includes sampling the item(s), printing the label(s), creating new packaging and marking the packaging identifying the contents.
        ii. If the item only contains one cartridge case, the original packaging will be sent to the NIBIN laboratory and no sub-item needs to be created.
        iii. Items and original packaging not sent to the NIBIN laboratory will be placed in a designated secure Firearms section vault location.
        iv. Attach necessary data for NIBIN entry to the evidence being sent.
    b. Test shots
        i. After sub-itemizing test shots, a label will be printed for the test shot sub-item. All eligible test shots will be sent to the NIBIN laboratory. There is no need to further sub-itemize the test shots and only send one. The specific test shot to be entered will be designated on the report. The sequenced sub-item to be entered will be reported in the NIBIN panel Item(s) # field.
        ii. Firearms will not be sent to the NIBIN laboratory. The original packaging will be placed in a designated secure Firearms section vault location. Laboratory Director approval will be needed to send firearms back to the agency without the test shots that were created. Approval needs to be documented within the case.
        iii. Attach necessary data for NIBIN entry to the evidence being sent.
6. The item or sub-item will be scanned to a LIMS transfer container.
7. A forensic scientist, evidence technician or laboratory manager will check the evidence manifest to ensure all items are present by doing a container audit. They will seal the container in the LIMS prior to shipping. The shipment tracking number will be added to the information for the container within the LIMS system.
8. Inside of the box that will be shipped, all items/sub-items should be placed into one larger bag or envelope and mechanically sealed. No evidence seal is needed.

9. A forensic scientist, evidence technician or laboratory manager will send an email notification to the receiving NIBIN laboratory with the LIMS container number, the number of items in the container and the shipment tracking number.

B. The following is utilized when fired cartridge cases, fired shotshells or test shots are received at the NIBIN laboratory for entry into NIBIN:
   1. When the container is received, locate the container to a secure designated area within the laboratory.
   2. Notify the contact person within the firearms section that the container has arrived.
   3. Relocate the container to a designated area in the firearms evidence vault.
   4. A forensic scientist, evidence technician or laboratory manager will check the evidence manifest to ensure all items listed in the container were received.
   5. A forensic scientist, evidence technician or laboratory manager will create a Firearms Section assignment in LIMS and will assign a "NIBIN Entry" task to the transferred items/sub-items.
   6. All items/sub-items will be disbursed to examiners for entry into NIBIN.
   7. Items/sub-items will be entered into NIBIN per the NIBIN Entries procedure (FA-IE-1).
   8. The examiner will prepare the evidence for transfer. Items will not be physically transferred to the submitting Non-NIBIN laboratory until the case has gone through technical review and has been approved in LIMS.
   9. The item/sub-item(s) ready for return to the submitting Non-NIBIN laboratory will be properly sealed and returned to the designated area in the firearms vault.
   10. Evidence for return to the submitting Non-NIBIN laboratory will be mailed on a weekly basis every Friday. The mailing method will include 2-day shipping with an available tracking number. Exceptions include:
      a. A state holiday that occurs on a Friday (Evidence will be mailed the previous day)
      b. A hand to hand transfer between laboratories that occurs prior to Friday
   11. The item or sub-item will be scanned to a LIMS transfer container.
   12. A forensic scientist, evidence technician or laboratory manager will conduct a container audit and seal the container in the LIMS prior to shipping. The shipment tracking number will be added to the information for the container within the LIMS system.
   13. Inside of the box that will be shipped, all items/sub-items should be placed into one larger bag or envelope and mechanically sealed. No evidence seal is needed.
   14. A forensic scientist, evidence technician or laboratory manager will send an email notification to the submitting laboratory with the LIMS container number, the number of items in the container and the shipment tracking number. No new laboratory assignment or tasks need to be assigned to these items/sub-items.

C. The following is utilized when fired cartridge cases, fired shotshells or test shots are returned from the NIBIN laboratory:
   1. When the container is received, locate the container to a secure designated area within the laboratory.
   2. Notify the contact person within the firearms section that the container has arrived.
   3. Relocate the container to a designated area in the firearms evidence vault.
   4. A forensic scientist, evidence technician or laboratory manager will check the evidence manifest to ensure all items listed in the container were received.
   5. The item(s) or sub-item(s) received will be returned to the submitting agency in the following manner:
      a. Fired cartridge case/fired shot shell evidence:
         i. A sub-item containing fired cartridge case/fired shotshell evidence will be repackaged with the parent. New packaging that was created for the sub-item will be retained and returned inside the original packaging. The sub-item label will be cleared in LIMS prior to returning to the agency.
         ii. If no sub-item was created, the item is ready to be returned to the agency
      b. Test shot sub-item(s)
         i. A test shot sub-item will be repackaged with the parent item. The sub-item label will be cleared in LIMS prior to returning to the agency.
         ii. A test shot sub-item may be returned to the submitting agency separate from its parent item with Lab Director approval. When returned separately, the sub-item label is not cleared in LIMS.

D. Due to backlog distribution and transferring cases statewide, evidence may be examined and entered into NIBIN at a different laboratory than where it was originally submitted.
   1. The evidence will be returned to the originating laboratory if it had been transferred for analysis.
   2. The evidence will be returned to the agency if the Non-NIBIN laboratory was the originating laboratory.

REFERENCES

1. Brasstrax User's Guide

2. Matchpoint User's Guide

3. Illinois State Police Forensic Sciences Command MIS 6

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: TOOLMARK EXAMINATION

METHOD: TOOL EXAMINATION

PROCEDURE: PHYSICAL EXAMINATION & CLASSIFICATION

Reviewed by:

_____

Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

The initial examination of a tool will include the completion of a Tool Panel. This panel will include the physical description of the tool. It will serve as a source to document the condition of the evidence as received and to document any tests performed. Documentation of the results of any microscopic comparisons performed with the tool will be done on a Finding Panel..

OTHER RELATED PROCEDURES

Trace Material Examination
Toolmark Examinations
Test Standards

SAFETY CONSIDERATIONS

The procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

Stereo Microscope

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

A Tool Panel utilized for a tool examination will be filled out according to the minimum quality standards and controls. This may include noting the following:

1. If any trace material is present.
2. The class characteristics of the tool.
3. The type of tool.
4. The brand name of the tool.
5. The size of the tool.
6. The condition of the tool.
7. Type of tests conducted (if any).

8. The medium used for testing.

REFERENCES

1. DeForest, P.R., R.E. Gaensslen, and H.C. Lee. *Forensic Science: An Introduction to Criminalistics*; New York: McGraw-Hill, 1983.

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5. "California DOJ Training Syllabus." *AFTE Journal* 16.2 (1984): 71-74.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: TOOLMARK EXAMINATION

METHOD: TOOL EXAMINATION

PROCEDURE: TRACE MATERIAL EXAMINATION

Reviewed by:

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Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Tools recovered during an investigation may contain trace material transferred from the crime scene. This trace material may be in the form of blood, tissue, plaster, paint, hairs, fibers, glass, etc. The examiner needs to evaluate the importance of this evidence and, if further examination of the trace material is necessary, remove and preserve a sample of the trace material present. Removal of trace material may also be necessary to allow the proper examination and testing of a tool.

OTHER RELATED PROCEDURES:

Physical Examination & Classification

SAFETY CONSIDERATIONS

The procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

NFPA LISTING				
Chemical	**Health Hazard**	**Flammability Hazard**	**Reactivity Hazard**	**Contact Hazard**
15% Acetic Acid	3	2	0	
10% Bleach	2	0	1	
Methanol	1	3	0	
Acetone	1	3	0	

Chemical Warnings:

WARNING! Acetic Acid is toxic and can pose a SEVERE HEALTH HAZARD.

WARNING! Methanol is flammable and can pose a SEVERE FLAMMABILITY HAZARD.

WARNING! Acetone if flammable and can pose a SEVERE FLAMMABILITY HAZARD.

The examiner must use eye protection and work within a fume hood or utilize a spot vent. The examiner should consider wearing a respirator and gloves.

PREPARATIONS

NOTE: ALWAYS ADD ACID TO WATER. NEVER ADD WATER TO ACID.

15% Acetic Acid Solution;
Prepare a 15% Acetic Acid Solution utilizing concentrated Glacial Acetic Acid and distilled water.

10% Bleach Solution:
Prepare a 10% Bleach Solution utilizing bleach and distilled water.

INSTRUMENTATION

Scale/Balance.

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

1. Examine the tool visually and microscopically for any trace material and record in notes.

2. Determine if further examination of trace material is necessary. If so, remove material being careful not to damage the tool. Place the removed trace material in a suitable container/packaging for submission to the appropriate section for further examination. If necessary, consult the appropriate section prior to the removal of any trace evidence. If the trace material is not going to be retained for further examination, proceed with the following steps that are applicable.

3. For evidence containing blood, tissue or other bio-hazards, soak the evidence for at least one (1) minute in a 10% bleach solution.

4. Remove loose material by rinsing the tool with methanol or water.

5. Remove plaster by soaking the tool in a 15% acetic acid solution.

6. Remove paint by soaking the tool in alcohol or acetone.

REFERENCES

1. DeForest, P.R., R.E. Gaensslen, and H.C. Lee. *Forensic Science: An Introduction to Criminalistics*; New York: McGraw-Hill, 1983.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: TOOLMARK EXAMINATION

METHOD: TOOL EXAMINATION

PROCEDURE: TEST STANDARDS

Reviewed by:

_____

Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

In order to compare a questioned toolmark with a suspect tool, test standards or marks are usually made with the suspect tool. The basic objective in preparing test standards is to attempt to duplicate the manner in which the tool was used to produce the evidence or questioned toolmark.

OTHER RELATED PROCEDURES:

Physical Examination & Classification - Tool	Trace Material Examination - Tool
Physical Examination & Classification - Toolmark	Trace Material Examination - Toolmark

SAFETY CONSIDERATIONS

This procedure may involve hazardous materials, operations and/or equipment. The procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

The examiner must use eye protection.

PREPARATIONS

Test Media:
The initial test media must be soft enough to prevent alterations of the tool's working surface. Lead is usually the material utilized. Subsequent tests might require the use of a harder test media to better reproduce the toolmarks.

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

A systematic approach should be used for the production of test marks or standards. Consideration should be given to:

1. Areas of recent use on the tool in question.
2. Direction of use.
3. Indexing of test standards/marks.

INTERPRETATION OF RESULTS

See Microscopic Comparison Procedure - FA-IIB-3.

REFERENCES

1. DeForest, P.R., R.E. Gaensslen, and H.C. Lee. *Forensic Science: An Introduction to Criminalistics*; New York: McGraw-Hill, 1983.

2. Cochrane, D.W., "Class Characteristics of Cutting tools and Surface Designation." *AFTE Journal* 17.3 (1985): 73-82.

3. Miller, Jerry. "An Introduction to the Forensic Examination of Toolmarks." *AFTE Journal* 33.3 (2001): 233-248.

4. Davis, John E. *An Introduction to Toolmarks, Firearms and the Striagraph*. Springfield, IL" Bannerstone House, 1958.

5. "California DOJ Training Syllabus." *AFTE Journal* 16.2 (1984): 71-74.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: TOOLMARK EXAMINATION

METHOD: TOOLMARK EXAMINATION

PROCEDURE: PHYSICAL EXAMINATION & CLASSIFICATION

Reviewed by:

_____

Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manger

INTRODUCTION

In order to compare a questioned toolmark with a suspect tool, it is necessary to evaluate the toolmark. This evaluation will consist of a physical evaluation and classification of the toolmark. This evaluation will help determine what course the rest of the examination should take. The basic objective in evaluating a questioned toolmark is to determine the suitability and classification of the toolmark.

OTHER RELATED PROCEDURES

Physical Examination & Classification - Tool
Test Standards
Trace Material Examination - Tool
Trace Material Examination - Toolmark

SAFETY CONSIDERATIONS

This procedure may involve hazardous materials, operations and/or equipment. Some component parts of a cylinder and/or lock are under spring tension and may present a missile hazard. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

Stereo Microscope
Comparison Microscope

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

A systematic approach should be used for the physical examination and classification of questioned toolmarks. Consideration should be given to:

1. If trace material is present.
2. The suitability of the toolmark for comparison purposes.
3. Class of tool that made the toolmark.

A. Major and minor classes of toolmarks.
B. Physical characteristics of toolmarks.

4. Direction of toolmark.

INTERPRETATION OF RESULTS

If the toolmark is suitable for comparison, the examination may continue.

If the toolmark has the same class characteristics as the suspect tool, the examination may continue.

REFERENCES

1. DeForest, P.R., R.E. Gaensslen, and H.C. Lee. *Forensic Science: An Introduction to Criminalistics*; New York: McGraw-Hill, 1983.

2. Cochrane, D.W., "Class Characteristics of Cutting tools and Surface Designation." *AFTE Journal* 17.3 (1985): 73-82.

3. Miller, Jerry. "An Introduction to the Forensic Examination of Toolmarks." *AFTE Journal* 33.3 (2001): 233-248.

4. Davis, John E. *An Introduction to Toolmarks, Firearms and the Striagraph*. Springfield, IL" Bannerstone House, 1958.

5. "California DOJ Training Syllabus." *AFTE Journal* 16.2 (1984): 71-74.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: TOOLMARK EXAMINATION

METHOD: TOOLMARK EXAMINATION

PROCEDURE: TRACE MATERIAL EXAMINATION

Reviewed by:

_____

Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Toolmarks recovered during an investigation may contain trace material transferred from the crime scene. This trace material may be in the form of blood, tissue, plaster, paint, hairs, fibers, glass, etc. The examiner needs to evaluate the importance of this evidence and, if further examination of the trace material is necessary, remove and preserve a sample of the trace material present. Removal of trace material may also be necessary to allow the proper examination and testing of a tool.

OTHER RELATED PROCEDURES

Physical Examination & Classification

Microscopic Comparison

SAFETY CONSIDERATIONS

The procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution to include strict adherence to Universal Precautions and the Blood Borne Pathogen Plan must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

NFPA LISTING				
Chemical	**Health Hazard**	**Flammability Hazard**	**Reactivity Hazard**	**Contact Hazard**
15% Acetic Acid	3	2	0	
10% Bleach	2	0	1	
Methanol	1	3	0	
Acetone	1	3	0	

Chemical Warnings:

WARNING! Acetic Acid is toxic and can pose a SEVERE HEALTH HAZARD.

WARNING! Methanol is flammable and can pose a SEVERE FLAMMABILITY HAZARD.

WARNING! Acetone is flammable and can pose a SEVERE FLAMMABILITY HAZARD.

The examiner must use eye protection and work within a fume hood or utilize a spot vent. The examiner should consider wearing a respirator and gloves.

PREPARATIONS

NOTE: ALWAYS ADD ACID TO WATER, NEVER ADD WATER TO ACID.

15% Acetic Acid Solution:
Prepare a 15% Acetic Acid Solution utilizing concentrated Glacial Acetic Acid and water.

10% Bleach Solution:
Prepare a 10% Bleach Solution utilizing bleach and water.

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

1. Examine the toolmark visually and microscopically for any trace material and record in notes.

2. Determine if further examination of trace material is necessary. If so, remove material being careful not to damage the toolmark. Place the removed trace material in a suitable container/packaging for submission to the appropriate section for further examination. If necessary, consult the appropriate section prior to the removal of any trace evidence. If the trace material is not going to be retained for further examination, proceed with the following steps that are applicable.

3. For evidence containing blood, tissue or other bio-hazards, soak the evidence for at least one (1) minute in a 10% bleach solution.

4. Remove loose material by rinsing the fired evidence with methanol or water.

5. Remove plaster by the soaking the fired evidence in a 15% acetic acid solution.

6. Remove paint by soaking the toolmark in alcohol or acetone.

REFERENCES

1. Deforest, P.R., R.E. Gaensslen, and H.C. Lee. *Forensic Science: An Introduction to Criminalistics*. New York: McGraw-Hill, 1983.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: TOOLMARK EXAMINATION

METHOD: TOOLMARK EXAMINATION

PROCEDURE: MICROSCOPIC COMPARISON

Reviewed by:

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Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

William E. Demuth II
Director of Training

INTRODUCTION

In order for an examiner to identify a toolmark back to the tool that produced it, a microscopic comparison utilizing a comparison microscope must be performed. The comparison microscope allows the examiner to place the evidence on one side of the microscope and the known standard on the other side. This procedure may also be used to compare two unknown toolmarks together to determine if they were made by a single tool.

OTHER RELATED PROCEDURES

Physical Examination & Classification
Test Standards
Trace Material Examination

SAFETY CONSIDERATIONS

This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

Stereo Microscope
Comparison Microscope

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

The procedure steps below do not have to be performed in the order listed; however, all steps must be considered and/or addressed.

1. Select the correct objective (magnification) setting and ensure that the objectives are locked in place.

2. Select the correct set of oculars (eyepieces).

3. The illumination (lights) used must be properly adjusted. Oblique lighting is usually preferred.

4. Prior to microscopically comparing any unknown toolmark evidence to known test marks, the unknown toolmarks will be examined and all discernible class characteristics will be documented in the notes. The unknown toolmarks will also be evaluated for the presence of suitable identifying characteristics prior to any comparisons to test marks from any submitted tools or additional items of unknown toolmarks. The results of the macroscopic and microscopic comparison will be reported out as an elimination, identification, inconclusive, or

unsuitable finding. If only one toolmark item is submitted the results of the macroscopic and/or microscopic evaluation will be reported out as a suitable or unsuitable finding. If the result of the comparison yields an elimination or inconclusive finding for an item(s), an additional suitable or unsuitable finding may also be included.

5. Compare an unknown toolmark to either another unknown toolmark or a known test mark (standard). This is done by placing the unknown evidence on one stage and the other unknown evidence or known standard on the other stage.

6. The entire toolmark must be considered.

7. If an identification is not initially made, the examiner should consider the following factors:

   A. Angle of lights.
   B. Type of lights.
   C. The need for additional known standards.
   D. The position of the evidence, the tests or both the evidence and the tests.
   E. The possibility of using magnesium smoke.
   F. The possibility of cleaning the tool.

8. The findings of identification and elimination based on individual characteristics must be verified by a second firearm/toolmark examiner and properly documented as specified in Appendix II - Minimum Standards and Controls.

INTERPRETATION OF RESULTS

Please refer to the Minimum Standards and Controls and the range of conclusions for a description of the findings.

REFERENCES

1. DeForest, P.R., R.E. Gaensslen, and H.C. Lee. *Forensic Science: An Introduction to Criminalistics*; New York: McGraw-Hill, 1983.

2. Cochrane, D.W., "Class Characteristics of Cutting tools and Surface Designation." *AFTE Journal* 17.3 (1985): 73-82.

3. Miller, Jerry. "An Introduction to the Forensic Examination of Toolmarks." *AFTE Journal* 33.3 (2001): 233-248.

4. Davis, John E. *An Introduction to Toolmarks, Firearms and the Striagraph*. Springfield, IL" Bannerstone House, 1958.

5. "California DOJ Training Syllabus." *AFTE Journal* 16.2 (1984): 71-74.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: TOOLMARK EXAMINATION

METHOD: CASTING/ENHANCEMENT

PROCEDURE: MAGNESIUM SMOKING

Reviewed by:

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Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Magnesium smoking is a technique of reducing the glare of a shiny object by lightly coating the surface with fine magnesium smoke.

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. The procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards. Consult the appropriate MSDS for each chemical prior to use.

NFPA LISTING				
Chemical	**Health Hazard**	**Flammability Hazard**	**Reactivity Hazard**	**Contact Hazard**
Magnesium Ribbon	1	4	3	

Chemical Warnings:

DANGER! Magnesium Ribbon is highly flammable and can pose an EXTREME FLAMMABILITY HAZARD.

WARNING! Magnesium Ribbon is capable of detonation and can pose a SEVERE REACTIVITY HAZARD.

The examiner must use eye protection and work within a fume hood or utilize a spot vent. The examiner should consider wearing a respirator, gloves, and an apron. The examiner should take extra care to not look directly at the burning ribbon.

PREPARATIONS

Cut short strips of magnesium ribbon off the roll. Both the roll and the strips should be stored properly based on the NFPA code.

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

The short pieces of magnesium ribbon are lit and the subject object passed over the smoke generated by the burning magnesium. If the object collects too much smoke, wipe the smoke off and repeat

the process. The coating should be light enough to see the color of the item smoked through the coating of smoke.

INTERPRETATION OF RESULTS

This technique simply reduces the glare of an object under examination and is a non-destructive, non-invasive technique. There are no results to interpret.

REFERENCES

1. Janneli, R. and G. Geyer. “Smoking a Bullet.” *AFTE Journal*, 9.2 (1977): 128.

2. Burd, David Q. “Smoking Bullets.” *The Journal of Criminal Law, Criminology and Police Science* 56.4 (1965): 523-527.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: TOOLMARK EXAMINATION

METHOD: CASTING/ENHANCEMENT

PROCEDURE: CASTING

Reviewed by:

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Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

If an item received for a toolmark examination is too large to be conveniently placed on the microscope's stages a silicone rubber cast can be made of the toolmarks in question. There are also occasions when a cast of a toolmark might be received as evidence. In either case, any test standards made will also have to be cast in order to perform a comparison. Mikrosil®, Duplicast®, or other types of silicone rubber casting material are similar products and procedurally are equivalent as long as the manufacturer's instructions are followed.

OTHER RELATED PROCEDURES

Test Standard
Microscopic Comparison

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. The procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards. Consult the appropriate MSDS for each chemical prior to use.

The examiner must use eye protection.

PREPARATIONS

Immediately prior to use, mix the casting material as per manufacturers' direction.

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

1. Prepare the casting material as per manufacturer's specifications.
2. Cascade the casting material over the toolmark to be cast.
3. Allow the cast the appropriate amount of time to cure.
4. Gently lift the cast off the toolmark.
5. Consideration must be given to placing identifying marks as well as orientation marks on the back of the cast.

REFERENCES

1. ANON. “Mikrosil Casting Material Information." *AFTE Journal* 15.2 (1983): 80.

2. Barber, D.C.; Cassidy, F.H. “A New Dimension with ‘Mikrosil’, Casting Material.” *AFTE Journal* 19.3 (1987): 328.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: SERIAL NUMBER RESTORATION

METHOD: METAL RESTORATION METHOD

PROCEDURE: METAL POLISHING

Reviewed by:

_____

Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Many valuable items manufactured today have serial numbers for identification. These numbers are usually die stamped. This process produces a compression of the metal in the area immediately surrounding and a short distance below the penetration of the die. Serial numbers are removed and/or obliterated in a variety of ways. The serial number may be restored if the removal/obliteration is not taken past the previously mentioned compression zone. It is desirable to remove, through polishing the area, any scratches or damage to the area introduced during obliteration. The Metal polishing procedure can be effective independently in recovering obliterated characters but is more often used in conjunction with various other restoration procedures.

Serial numbers can also be placed on an item through the use of a dot matrix system, laser etching system or by any other means. The use of the metal polishing restoration procedure can be an effective method in restoring serial numbers that have been applied through the use of one of these systems.

OTHER RELATED PROCEDURES

Chemical Restoration
Magnaflux

SAFETY CONSIDERATIONS

This procedure involves hazardous operations and equipment. The procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered to avoid exposure to hazardous conditions.

The examiner must use eye protection, and work within a fume hood or utilize a spot vent. The examiner may wish to consider wearing a respirator and gloves.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

1. If possible, determine the serial number structure and record the source of this information. Possible sources include but are not limited to the BATFE Serial Number Structure Guide, the Royal Canadian Mounted Police Firearm Reference Table

(RCMP-FRT), manufacturer literature, the Firearms Reference Collection, the AFTE.org Member's Area Serial Number Search Database or an internet search. If the serial number structure of the firearm cannot be confirmed utilizing the most current available resources, the examiner must document this within the serial number restoration panel.

2. Capture an image of the serial number prior to any metal polishing and attach the image to the serial number restoration panel.

3. Note and record any visible characters prior to polishing.

4. Using a dremel type tool with a sanding/polishing disc, polish the area of the obliteration.

5. Depending on the extent of the obliteration, continue polishing until the surface is mirror-like removing all scratches. If the obliteration is severe it may not be possible or desirable to remove all the scratches.

INTERPRETATION OF RESULTS

. 1. If any characters become visible note these characters. If all of the characters are visible after metal polishing, capture an image and attach it to the serial number restoration panel.

2. If all of the characters do not become visible, proceed to an appropriate restoration procedure.

REFERENCES

1. Treptow, Richard, S. *Handbook of Methods for the Restoration of Obliterated Serial Numbers*. Chicago, IL: NASA, 1978.

2. Polk, Donald, E. and Bill C. Giessen. "Metallurgical Aspects of Serial Number Recovery." *AFTE Journal* 21.2 (1989): 174-181.

3. Dragan, Paul. "Abrasive Wheels for Serial Number Restoration Preparation." *AFTE Journal* 28.1 (1996): 21.

4. Collins, John M. "Modern Marking and Serial Numbering Methods." *AFTE Journal* 31.3 (1999): 309-317.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: SERIAL NUMBER RESTORATION

METHOD: METAL RESTORATION METHOD

PROCEDURE: CHEMICAL RESTORATION

Reviewed by:

_____

Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Many valuable items manufactured today have serial numbers for identification. These serial numbers are usually die stamped which produces a compression of the metal in the area immediately surrounding and a short distance below the penetration of the die. Serial numbers are removed and/or obliterated in a variety of ways. The serial number may be restored if the removal/obliteration is not taken past the previously mentioned compression zone. The chemical restoration procedure sometimes referred to as the chemical etching procedure is suitable for restoration of serial numbers in metal. The die stamping process is a form of "cold-working" metal. A side effect of cold-working is the decrease of that item's ability to resist chemical attack. Therefore, utilizing this method will affect the compression zone of the obliterated area at a different rate than the non cold-worked area surrounding it. This procedure, in conjunction with the Metal Polishing Procedure is an effective way to restore an obliterated serial number in metal.

Serial numbers can also be placed on an item through the use of a dot matrix system, laser etching system or by any other means. The use of the chemical restoration procedure can be an effective method in restoring serial numbers that have been applied through the use of one of these systems.

OTHER RELATED PROCEDURES

Metal Polishing
Magnaflux

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. The procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered to avoid exposure to hazardous conditions. Consult the appropriate MSDS for each chemical prior to use.

NFPA LISTING				
Chemical	**Health Hazard**	**Flammability Hazard**	**Reactivity Hazard**	**Contact Hazard**
Cupric Chloride	3	0	0	
Hydrochloric Acid	3	0	0	
Nitric Acid	3	0	0	oxy
Ferric Chloride	2	0	0	

Chemical Warnings:

WARNING! Cupric Chloride is toxic and can pose a SEVERE HEALTH HAZARD.

WARNING! Hydrochloric Acid is toxic and can pose a SEVERE HEALTH HAZARD.

WARNING! Nitric Acid is toxic and can pose a SEVERE HEALTH HAZARD.

WARNING! Nitric Acid is a strong solvent possessing oxidizing properties than can pose a SEVERE HEALTH HAZARD.

The examiner must use eye protection and gloves and work within a fume hood or utilize a spot vent. The examiner should consider wearing a respirator.

PREPARATIONS

NOTE: ALWAYS ADD ACID TO WATER. NEVER ADD WATER TO ACID.

This is a list of some chemical solutions that can be used in the acid etching process. For other chemical solutions which may be used, consult Treptow's Handbook of Methods for the Restoration of Obliterated Serial Numbers.

Determine the obliterated serial number medium's physical properties. The metals on which the chemicals perform best with respect to clarity and rapidity are included in parenthesis after the chemical. The chemicals can be used on metals not listed. The chemicals can be tested on an area away from the serial number obliteration.

Fry's Reagent (iron & steel)
90 grams Cupric Chloride ($CuCl_2$)
120 mL Hydrochloric Acid (HCl)
100 mL distilled water (H_2O)
*Any deviation from this ratio of chemicals would constitute Modified Fry's Reagent, which is also a commonly used chemical for serial number restoration.

Acidic Ferric Chloride (non-ferrous metals)
25 grams Ferric Chloride ($FeCl_3$)
25 mL Hydrochloric Acid (HCl)
100 mL distilled water (H_2O)

25% Nitric Acid (iron, steel, & non-ferrous metals) - may be used in other concentrations
25 mL Nitric Acid (HNO_3)
75 mL distilled water (H_2O)

INSTRUMENTATION

Scale/Balance.

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

1. If possible, determine the serial number structure and record the source of this information. Possible sources include but are not limited to the BATFE Serial Number Structure Guide, the Royal Canadian Mounted Police Firearm Reference Table (RCMP-FRT), manufacturer literature, the Firearms Reference Collection, the AFTE.org Member's Area Serial Number Search Database or an internet search. If the serial number structure of the firearm cannot be confirmed utilizing the most current available resources, the examiner must document this within the serial number restoration panel.

2. Capture an image of the obliterated serial number prior to any restoration attempt and attach the image to the serial number restoration panel.

3. When applicable, the Magnaflux procedure must be used prior to using any other destructive techniques such as chemical restoration techniques.

4. Conduct an initial inspection of the serial number area for coatings, trace material or any character remnants, as well as possibly determining the method of obliteration.

5. Utilize the Metal Polishing Procedure if necessary.

6. Note and record any visible characters prior to applying chemical reagents.

7. Utilize the appropriate chemical reagent.

This is a list of some of the chemical solutions that can be used in the acid etching process. For other chemical solutions which may be used, consult Treptow's Handbook of Methods for the Restoration of Obliterated Serial Numbers.

The metals on which the chemicals perform best with respect to clarity and rapidity are included in parenthesis after the chemical. The chemicals can be used on metals not listed. The chemicals can be tested on an area away from the serial number obliteration.

a. Fry's Reagent (iron and steel)
b. 25% Nitric Acid (iron, steel and non-ferrous metals)
c. Acidic Ferric Chloride (non-ferrous metals)

8. Apply the chemical solution to the area of obliteration utilizing cotton tip applicators or swabs that have been moistened with the chemical solution.

INTERPRETATION OF RESULTS

If any characters become visible, note these characters. The examiner must minimally capture an image of the results at the end of or during the restoration. The examiner may choose to capture multiple images during the restoration process.

REFERENCES

1. Treptow, Richard, S. *Handbook of Methods for the Restoration of Obliterated Serial Numbers*. Chicago, IL: NASA, 1978.

2. Polk, Donald, E. and Bill C. Giessen. "Metallurgical Aspects of Serial Number Recovery." *AFTE Journal* 21.2 (1989): 174-181.

3. U.S Department of Justice, Bureau of Alcohol, Tobacco, Firearms and Explosives Firearms Operation Division, *Serial Number Restoration Training*, 2011.

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ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: SERIAL NUMBER RESTORATION

METHOD: METAL RESTORATION METHOD

PROCEDURE: MAGNAFLUX

Reviewed by:

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Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Many valuable items manufactured today have serial numbers for identification. These serial numbers are often die stamped which produces a compression of the metal in the area immediately surrounding and a short distance below the penetration of the die. Serial numbers are removed and/or obliterated in a variety of ways. The serial number may be restored if the removal/obliteration is not taken past the previously mentioned compression zone. The Magnaflux® technique is used by metallurgists to detect surface or subsurface flaws in iron or steel. Magnetic particles, applied to a magnetized specimen, outline the obliterated characters in a successful visualization. The die stamping process is a form of "cold-working" metal. A side effect of cold-working is the increase of that item's magnetism. Therefore, when utilizing this method, the compression zone of the obliterated area will attract the magnetic particles.
Serial numbers can also be placed on an item through the use of a dot matrix system, laser etching system or by other means. The use of the Magnaflux® Procedure can be an effective method in restoring serial numbers that have been applied through the use of one of these systems.

This procedure, in conjunction with the Metal Polishing Procedure, is an effective way to visualize an obliterated serial number in ferrous metals. The Magnaflux® technique is non-destructive and can be applied without hindering other restoration methods. When applicable, the Magnaflux procedure must be used prior to using any other destructive techniques such as chemical restoration techniques.

OTHER RELATED PROCEDURES

Metal Polishing
Chemical Restoration

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. The procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered to avoid exposure to hazardous conditions. Consult the appropriate MSDS for each chemical prior to use.

NFPA LISTING				
Chemical	**Health Hazard**	**Flammability Hazard**	**Reactivity Hazard**	**Contact Hazard**
9CM Prepared Bath	1	4	0	
7HF Prepared Bath	1	4	0	
14AM Prepared Bath	1	4	0	
SKC-S Cleaner/Remover	1	3	0	

Chemical Warnings:

WARNING! 9CM is highly flammable.

WARNING! 7HF is highly flammable.

WARNING! 14AM is highly flammable.

WARNING! SKC-S is highly flammable.

The examiner must use eye protection and work within a fume hood or utilize a spot vent. Wear gloves if hand exposure is unavoidable. If the UV light source is being used, the examiner must minimize exposure to the skin and protect against exposure to the eyes by using glasses with UV resistant lenses.

PREPARATIONS

Prepared Magnaflux® bath solutions are commercially prepared.

INSTRUMENTATION

UV light source (if 14AM Prepared Bath is being used)
Horseshoe magnets
Yoke magnets
Y-7 AC/DC Yoke electromagnet or similar device

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

1. If possible, determine the serial number structure and record the source of this information. Possible sources include but are not limited to the BATFE Serial Number Structure Guide, the Royal Canadian Mounted Police Firearm Reference Table (RCMP-FRT), manufacturer literature, the Firearms Reference Collection, the AFTE.org Member's Area Serial Number Search Database or an internet search. If the serial number structure of the firearm cannot be confirmed utilizing the most current available resources, the examiner must document this within the serial number restoration panel.
2. Capture an image of the obliterated serial number prior to any restoration attempt and attach the image to the serial number restoration panel.
3. Ascertain whether the specimen is suitable for testing with Magnaflux® by placing a magnet on the area of obliteration..
    a. Full Ferrous Frames/Receivers - The Magnaflux procedure will be used on firearms with complete ferrous frames or receivers prior to using any other destructive restoration methods. The exception to this will be if the horseshoe magnet or electromagnetic yoke cannot be easily applied to the area of the

firearm where the serial number is located. This decision will be the examiner's discretion whether or not the horseshoe magnet or electromagnetic yoke can be easily applied. If the horseshoe magnet or electromagnetic yoke cannot be easily applied to the magnetic surface, the Magnaflux procedure does not need to be used. The reason for not applying the Magnaflux procedure will be documented on the serial number restoration panel.

b. Frames/Receivers with partial ferrous areas – A significant number of firearms have only partial ferrous areas or ferrous inserts in polymer frames. These types of firearms present difficulty utilizing the Magnaflux procedure. If the firearm's frame or receiver only has partial ferrous areas or inserts, the Magnaflux procedure will only be used on firearms where the horseshoe magnet or electromagnetic yoke can be easily applied to the firearm or will work for the specific area. This decision will be the examiner's discretion whether or not the horseshoe magnet or electromagnetic yoke can be easily applied. If the horseshoe magnet or electromagnetic yoke cannot be easily applied to the magnetic surface, the Magnaflux procedure does not need to be used. The reason for not applying the Magnaflux procedure will be documented on the serial number restoration panel.

4. Conduct an initial inspection of the serial number area for coatings, trace material or any character remnants, as well as possibly determining the method of obliteration.

5. It is recommended to clean the area of obliteration.

6. Utilize the Metal Polishing Procedure, if necessary.

7. Place a horseshoe magnet or electromagnetic yoke behind the area of obliteration, with the magnetic poles on either side of the area. This placement may be adjusted to reveal more or different areas of the obliteration. When using an electromagnet, turn on the power supply.

8. Apply one of the prepared bath solutions to the area of obliteration with a pipet.

9. Repeat the above steps as needed. When appropriate, apply a different prepared bath to the obliterated area. If 14AM (fluorescent) Prepared Bath is being used, observe the characters under a UV light source.

INTERPRETATION OF RESULTS

1. Note any characters that become visible prior to proceeding with each step. The examiner must minimally capture an image of the results at the end of the restoration or during the restoration. The examiner may choose to capture multiple images during the restoration process.

2. If all of the characters do not become readily visible utilizing the Magnaflux Procedure, proceed to an appropriate alternate restoration procedure. The examiner may need to consider performing an alternate restoration procedure if all of the characters are not readily visible or if any characters need to be confirmed.

REFERENCES

1. O'Reilly, W.E. "Magnetic Restoration of Serial Numbers." *AFTE Journal Newsletter 7* (1970): 26-27.

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5. Utrata, Dave and Johnson, Marcus J. "Magnetic Particle Recovery of Serial Numbers." Midwest Forensics Resource Center. October 2003.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: SERIAL NUMBER RESTORATION

METHOD: PLASTIC RESTORATION METHOD

PROCEDURE: PLASTIC POLISHING

Reviewed by:

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Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Many valuable items manufactured today have serial numbers for identification. These numbers are often die stamped or embossed. This process produces a compression of the plastic in the area immediately surrounding and a short distance below the penetration of the die. Serial numbers are removed and/or obliterated in a variety of ways. The serial number may be restored if the removal/obliteration is not past the previously mentioned compression zone. It is desirable to remove (polish) the grinding and filing scratches introduced during obliteration. The Plastic Polishing procedure can be effective independently but is more often used in conjunction with heat restoration procedures.

OTHER RELATED PROCEDURES

Heat

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. The procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered to avoid exposure to hazardous conditions.

The examiner must use eye protection, and work within a fume hood or utilizing a spot vent. The examiner may wish to consider wearing a respirator and gloves.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

1. If possible, determine the serial number structure and record the source of this information. Possible sources include but are not limited to manufacturer literature or internet search. If the serial number structure of the Item cannot be confirmed utilizing the most current available resources, the examiner must document this within the serial number restoration panel.

2. Capture an image of the obliterated serial number prior to any restoration attempt and attach the image to the serial number restoration panel.

3. Note and record any visible characters prior to polishing.

4. If possible, examine the reverse side of the item to see if any characters are visible.

5. Using a dremel type tool with a sanding/polishing disc, polish the area of the obliteration. Other polishing materials such as sandpaper or emery cloth may also be used.

6. Depending on the extent of the obliteration, continue polishing until all scratches have been removed from the surface. If the obliteration is severe it may not be possible or desirable to remove all the scratches.

INTERPRETATION OF RESULTS

. 1. If any characters become visible, note these characters. If all of the characters are visible after polishing, capture an image and attach it to the serial number restoration panel.

2. If all of the characters do not become visible proceed to the heat restoration procedure.

REFERENCES

1. Treptow, Richard, S. *Handbook of Methods for the Restoration of Obliterated Serial Numbers*. Chicago, IL: NASA, 1978.

2. Polk, Donald, E and Bill C. Giessen. "Metallurgical Aspects of Serial Number Recovery." *AFTE Journal* 21.2 (1989): 174-181.

3. Roberts, Van. "Restoration of Serial Numbers in Plastic." *AFTE Journal* 13. 4 (1981): 40-47.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: SERIAL NUMBER RESTORATION

METHOD: PLASTIC RESTORATION METHOD

PROCEDURE: HEAT

Reviewed by:

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Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Many valuable items manufactured today have serial numbers for identification. These numbers are often die stamped or embossed. This process produces a compression of the plastic in the area immediately surrounding and a short distance below the penetration of the die. Serial numbers are removed and/or obliterated in a variety of ways. The serial number may be restored if the removal/obliteration is not past the previously mentioned compression zone. The Heat procedure is suitable for restoration of serial numbers in plastic. The die stamping or embossing process is a form of "cold-working" plastic. A side effect of cold-working is the decrease of that item's ability to resist heat. Therefore, the utilization of this procedure will affect the compressed area of the obliterated number faster and to a greater degree than the non cold-worked area surrounding it. This procedure, in conjunction with the Plastic Polishing procedure, is an effective way to restore an obliterated serial number in plastic.

OTHER RELATED PROCEDURES

Plastic Polishing

SAFETY CONSIDERATIONS

This procedure involves hazardous materials, operations and equipment. The procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered to avoid exposure to hazardous conditions.

The examiner must use eye protection, and work within a fume hood or utilizing a spot vent. The examiner may wish to consider wearing a respirator and gloves.

PREPARATIONS

None

INSTRUMENTATION

None

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

1. If possible, determine the serial number structure and record the source of this information. Possible sources include but are not limited to manufacturer literature or an internet search. If the serial number structure of the item cannot be confirmed utilizing the most current available resources, the examiner must document this within the serial number restoration panel.

2. Capture an image of the obliterated serial number prior to any restoration attempt and attach the image to the serial number restoration panel.

3. If possible, examine the reverse side of the item to see if any characters are visible.

4. Note and record any visible characters prior to using the Plastic Polishing Procedure, then polish the obliterated area if necessary.

5. Apply heat evenly to the area of obliteration utilizing a high intensity lamp, heat gun or other appropriate heat source.

6. Continue the application of heat until the plastic in the obliterated area starts to liquefy.

INTERPRETATION OF RESULTS

Note any characters that become visible during the application of heat. The examiner must minimally capture an image of the results at the end of or during the restoration. The examiner may choose to capture multiple images during the restoration process.

REFERENCES

1. Treptow, Richard, S. *Handbook of Methods for the Restoration of Obliterated Serial Numbers*. Chicago, IL: NASA, 1978.

2. Polk, Donald, E. and Bill C. Giessen. "Metallurgical Aspects of Serial Number Recovery." *AFTE Journal* 21.2 (1989): 174-181.

3. Roberts, Van. "Restoration of Serial Numbers in Plastic." *AFTE Journal* 13. 4 (1981): 40-47.

4. Desrochers, C., G. Desjarkins, M. Deshenes, A. Chaltchi, R. Gaulin, G. Gravel, M. D'Auteuil, J. Dion and G. Klees. "Serial Number Restoration in Plastic using a Heat Gun." *AFTE Journal* 32.4 (2000): 367.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

PROTOCOL: MUZZLE TO CLOTHING CONTACT EXAMINATION

METHOD: VISUAL & MICROSCOPIC EXAMINATION

PROCEDURE: VISUAL & MICROSCOPIC EXAMINATION

Reviewed by:

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Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

When a firearm is fired, gunshot residues including burnt gun powder particles, partially burnt gun powder particles, unburnt gun powder particles, vaporous lead and particulate metals are discharged from the firearm. The morphology of the bullet hole along with the gunshot residues can effectively be used in determining the possibility of a contact/near contact shot. A contact shot occurs when the muzzle of the firearm is held against the surface of the target at the time of discharge. A near contact shot occurs when the muzzle of the firearm is not in contact with the target, being held a short distance away. The distance is so small, that the powder grains emerging from the muzzle may not have a chance to disperse and mark the target. The zone of soot on the target is widened.

OTHER RELATED PROCEDURES

None

SAFETY CONSIDERATIONS

This procedure involves hazardous materials to include evidence that may be contaminated with a bio-hazard. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered to avoid exposure to any potential hazards.

PREPARATIONS

None

INSTRUMENTATION

Stereo Microscope

MINIMUM STANDARDS AND CONTROLS

Refer to Appendix II - Minimum Standards and Controls.

PROCEDURE OR ANALYSIS

TECHNIQUE:

Each defect on a submitted item will be evaluated separately and a separate conclusion will be drawn for each defect.

The visual and microscopic examination of an item for gunshot residue will include the examination and/or consideration of the following:

1. The presence of vaporous lead (smoke)
2. The presence of particulate metals (shavings of lead, copper, brass)
3. The presence of unburnt/partially burnt gunpowder
4. The presence of melted adhering gunpowder
5. A hole in the item

6. The presence of a visible ring around the perimeter of holes
7. The location of all holes, tears, missing buttons, etc.
8. The presence of burning or singeing or melting
9. The presence of any possible masking effects (blood, dirt, etc)

Data regarding these physical effects and visible residues must be included in the examiner's notes.

INTERPRETATION OF RESULTS

I. Consistent with a Contact/Near Contact Shot.
   A. Cruciform-type ripping or tearing and one or more of the following:
   B. Burning or singeing
   C. Melted artificial fibers
   D. Heavy vaporous lead residues

II. Not Consistent with a Contact/Near Contact Shot.
   A. A hole in the item
   B. Visible ring around the perimeter of holes, which may include:
      1. Particulate metals (shavings of lead, copper, brass)
      2. Light to moderate vaporous lead residues
      3. Unburnt or partially burnt gunpowder
      4. Melted adhering gunpowder
   C. Location of all holes, tears, missing buttons, etc.
   D. Lacking cruciform-type ripping or tearing.

III. Unable to Determine if Consistent with or Not Consistent with a Contact/Near Contact Shot.
   A. Item has a defect, hole, or tear; however, no other physical effects are present that would allow the examiner to determine whether or not the defect, hole, or tear is consistent with a contact/near contact shot.

REFERENCES

1. Federal Bureau of Investigation. U.S. Department of Justice. "Gunshot Residues and Shot Pattern Test." *FBI Law Enforcement Bulletin* 39.9, 1970.

2. Dillon, John H. "A Protocol for Gunshot Residue Examinations in Muzzle-To-Target Distance Determinations." *AFTE Journal* 22.3 (1990): 257 - 74.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

APPENDIX II: MINIMUM STANDARDS AND CONTROLS

Reviewed by:

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Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

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William E. Demuth II
Director of Training

APPENDIX II

MINIMUM STANDARDS AND CONTROLS

I. THE THEORY OF IDENTIFICATION

The Theory of Identification, as it pertains to toolmark comparisons, enables opinions of common origin to be made when the unique surface contours of two toolmarks have sufficient agreement.

Sufficient agreement is determined by looking at the surface contours of a pattern or combination of patterns on the toolmarks. The depth, width, curvature and spatial relationship of these surface contours are then compared to corresponding features in a second set of toolmarks. The comparison involves the critical evaluation of not only the complex patterns present but also the possible influence of sub-class characteristics, ammunition differences, and a lack of a portion(s) of a pattern due to damage of the fired evidence and/or firearm. Both toolmarks are compared and agreement is significant when it exceeds the best agreement between two toolmarks made by different tools and is consistent with agreement observed between patterns known to have been made by the same tool.

When sufficient agreement exists between two toolmarks, it means that the agreement of the individual characteristics is of a quantity and quality that the likelihood another tool could have made the mark is so remote that it is a practical impossibility.

The identification of toolmarks is made to the practical, not absolute, exclusion of all other tools. This is because it is not possible to examine all of the tools in the world, a prerequisite for absolute certainty. The conclusion that sufficient agreement for identification exists between toolmarks means that the likelihood that another tool could have made the questioned toolmarks is so remote as to be considered a practical impossibility.

Note: The phrase “practical impossibility,” which currently cannot be expressed in mathematical terms, describes an event that has an extremely small probability of occurring in theory, but which empirical testing and experience has shown will not occur. In the context of firearms and toolmarks, “practical impossibility” is based on extensive empirical research and validation studies that have been done within the field and also the cumulative results of training and casework examinations that have been performed, peer reviewed or have been published in peer reviewed forensic journals.

The interpretation of an identification is subjective in nature, founded on scientific principles, and based on the examiner’s training and experience.

II. ANALYTICAL STANDARDS AND CONTROLS

A. Acid Etching Reagents used in Serial Number Restorations

The Analytical Standards and Controls for the use of Acid Etching Reagents in Serial Number Restorations consist of testing the reagent for a positive reaction, against the appropriate medium, when the reagents are prepared. A positive reaction involves the visible removal of the metal during the chemical reaction, discoloration of the metal, or bubbling of the reagent. The positive reaction will be recorded in the Laboratory Asset Manager for the reagent being made. Once the reagent is initially prepared and a positive reaction recorded, it will be determined that the reagents are continuing to function properly if there is a positive reaction with the metal when used for casework analysis. This does not need to be recorded in the Laboratory Asset Manager for the reagent used during casework. If no positive reaction is observed, the reagent will immediately be disposed of, and a new lot prepared.

1. Re-authentication

a. Per QM-14 guidelines in the Quality Manual, Acid Etching in-house reagents may be stored up to one year at which time they will be discarded or re-authenticated. If the reagents are re-authenticated, they will be tested and recorded in the Laboratory Asset Manager for the reagent being re-authenticated in the same manner as when a new batch of reagents is made. As long as the reagents continue to exhibit a positive reaction, the current in-house reagent supply can be used in casework.

III. NON-ANALYTICAL STANDARDS AND CONTROLS

A. Range of Conclusions

1. Identification: Agreement of all discernable class characteristics, and sufficient agreement of the microscopic individual characteristics present within a pattern or patterns in a toolmark or series of toolmarks, that leads the examiner to a conclusion that the items originated from the same source.

a. Identifications are based on scientific principles.

b. Identifications are based on utilizing accepted techniques within the field of firearm and toolmark identification and are made by physically comparing the evidence under a comparison microscope.

c. Identifications are based on the examiner's training and experience.

d. The basis of an identification is challenged and confirmed on a consistent basis by the following:
   1. The verification process
   2. Quality Assurance Program
   3. Internal and External Proficiency Testing
   4. Validations Studies
   5. Empirical research done by the related Firearms and Toolmark Scientific Community

e. Identifications are a repeatable conclusion and the same conclusion can be reproduced by a second competently trained firearm/toolmark examiner.

f. An Identification finding means:
   1. The fired evidence in question was either fired by the submitted firearm or the fired evidence in question was fired by the same firearm.
   2. The toolmark evidence in question was either made by the submitted tool or the toolmark evidence in question was made by the same tool.

All microscopic firearm/toolmark identifications are verified by a second competently trained firearm/toolmark examiner. A verification is demonstrated by confirming the identification through logging into the LIMS matrix and electronically initialing the identification. All identifications are also documented by a digital image or a series of digital images within the case notes (See Documentation Standards).

2. Elimination: Disagreement of any class characteristics present that leads the examiner to the conclusion the items did not originate from the same source. It is also possible to support an elimination finding when some of the class characteristics are similar, but there is a demonstrable difference in the pattern of individual characteristics present within a toolmark or series of toolmarks present on the items examined.

a. Eliminations are based on scientific principles.

b. Eliminations are based on utilizing accepted techniques within the field of firearms and toolmarks. Eliminations based on a demonstrable difference of individual characteristics will be made by physically comparing the evidence under a comparison microscope.

c. Eliminations are based on the examiner's training and experience.

d. The basis of an elimination on a demonstrable difference of individual characteristics is challenged and confirmed on a consistent basis by the following:
    1. The verification process
    2. Quality Assurance Program
    3. Internal and External Proficiency Testing
    4. Validation Studies
    5. Research done by the Firearms and Toolmark Scientific Community

e. Elimination conclusions are repeatable, and the same conclusion can be reproduced by a second competently trained firearm/toolmark examiner.

f. An elimination finding means:
    1. The fired evidence in question was either not fired by the submitted firearm or the fired evidence in question was not fired by the same firearm.
    2. The toolmark evidence in question was either not made by the submitted tool or the toolmark evidence in question was not made by the same tool.

An elimination finding made by using a demonstrable difference of individual characteristics between toolmarks must be verified by a second competently trained firearm/toolmark examiner. A verification is demonstrated by confirming the elimination through logging into the LIMS matrix and electronically initialing the

elimination. All eliminations based on a demonstrable difference in the pattern of individual characteristics present within a toolmark or series of toolmarks need also to be documented by a digital image or series of digital images within the case notes (See Documentation Standards).

3. Inconclusive: A correspondence of discernable class characteristics with insufficient detail in the individual characteristics will lead the examiner to the conclusion that no identification or elimination could be made with respect to the two items examined.

Or,

A lack of any discernable class characteristics with insufficient detail in the individual characteristics will lead the examiner to the conclusion that no identification or elimination could be made with respect to the two items examined.

a. Inconclusive findings are based on scientific principles.

b. Inconclusive findings are based on utilizing accepted techniques within the field of firearms and toolmarks. Inconclusive findings will be made by physically comparing the evidence under a comparison microscope.

c. Inconclusive findings are based on the examiner's training and experience.

d. The basis of an inconclusive finding is challenged and confirmed on a consistent basis by the following:
    a. Quality Assurance Program
    b. Internal and External Proficiency Testing
    c. Validation Studies
    d. Research done by the Firearms and Toolmark Scientific Community

e. Inconclusive findings are repeatable, and the same conclusion can be reproduced by a second competently trained firearm/toolmark examiner.

f. An inconclusive finding means:
    1. The fired evidence in question cannot be identified or eliminated as having been fired by the submitted firearm, or the fired evidence in question cannot be identified or eliminated as having been fired by the same firearm.

    2. The toolmark evidence in question cannot be identified or eliminated as having been made by the submitted tool, or the toolmark evidence in

question cannot be identified or eliminated as having been made by the same tool.

4. Unsuitable: The firearm/toolmark evidence in question lacks sufficient microscopic detail and will lead the examiner to the conclusion that the item is not suitable for further microscopic comparison.

a. No further documentation is required for an unsuitable finding.

5. Suitable: The firearm/toolmark evidence in question has sufficient microscopic detail and will lead the examiner to the conclusion that the item is suitable for further microscopic comparison.

a. No further documentation is required for a suitable finding.

B. Documentation

1. Digital Imaging - Digital imaging will be used to document observations and conclusions to supplement the work notes. These digital images will aid in recreating any analysis that was performed during the examination of the case. The images will provide functional documentation that can be used during the process of verifications, peer review, court room demonstrations, and the quality assurance process. The guiding principle should be to use the digital imaging capabilities to assist the examiner in providing useful documentation for the observations and conclusions that were made during the examination.

Images of non-evidentiary items used for representative purposes (i.e. images of laboratory reference ammunition headstamps, images of markings on reference collection firearms etc.) must be indicated as such within the image/notes.

2. Comparison Conclusions – The nature of microscopic comparison examinations performed within the Firearms and Toolmark section best lends itself to be reviewed and replicated with the actual items of evidence. Because this is not always a reasonable possibility, the Firearms and Toolmark section recognizes the benefit of thorough examination documentation for the purpose of scientific review as well as potential presentation in court proceedings. This documentation shall support observations and microscopic comparison conclusions such that in the absence of the original examiner, another competently trained firearm/toolmark examiner could review the case file and reasonably understand the analysis that was performed.

All digital images will be properly annotated and referenced within the work notes. The digital images taken are representative of the markings used for the identification or elimination by individual characteristics but are not necessarily inclusive of all of the markings that were observed during the examination and conclusion of an identification. However, it may be necessary to take several images of more than one

area to adequately document the basis of an identification or elimination by individual characteristics.

To establish a consistent form of documentation between examiners and cases throughout the state, the following information must be minimally included on the images and/or notes for identification or elimination by individual characteristic findings:

a. All identification or elimination by individual characteristics findings must be indexed in some manner and will be indicated on the image and notes. The noted index in the image will document what the index is and which position is documented in the image.

b. All identification or elimination by individual characteristics findings will include the case number and Item number of the items depicted on the image and notes.

c. All identifications for cartridge cases or shotshells will include the basis of the identification (i.e. firing pin impression, breech face marks, firing pin aperture shear marks etc.) on the notes.

d. All identification or elimination by individual characteristics findings must be documented with at least one image that depicts two representative items. The items may be portrayed within the image by using a split screen in which both items share the same field of view, a side by side display or other useful demonstrative means. It may be necessary to take several images of more than one area to adequately document the basis of an identification or elimination.

e. All identifications will include an annotation on the image to indicate every indexed area that was used to reach a conclusion. This annotation will be a visual indicator (box, circle, arrow, etc.) with the purpose of highlighting a phased area of the evidence (firing pin impression, land impression, etc.) used to draw a conclusion.

f. For every type of mark used on an item in an identification and placed within the identification statement, there must be a corresponding image for that area. For example, if blue, red, and green marks on two fired bullets are used to help conclude an identification, there must be a corresponding image for each color mark. If multiple orientations are used for items, a corresponding image for each separate orientation must be included in the notes.

g. The representative image(s) of one comparison may be used to document subsequent comparisons as long as the agreement depicted is representative of the subsequent comparisons.

h. Identification, Inconclusive, and Elimination based on individual characteristics findings will be documented in a manner which shows a microscopic comparison was performed and what comparison microscope(s) was/were used to form the opinion. The specific comparison microscope(s) used for the finding will be documented in the "Comparison Microscope Used" field of the Findings Panel. Further documentation will be written in the notes and can also be included in the annotations of any images related to the finding being documented.

i. Inconclusive findings will be documented in a manner which shows a microscopic comparison was performed; however, there was insufficient detail of the class and/or individual characteristics for an identification or elimination finding. In addition to this statement, the specific reasons that the examiner reached the inconclusive finding will be added to the notes portion of the Findings panel. The specific areas that were examined on the fired evidence will also be documented on the notes portion of the Findings panel. If potential phasing marks are left on the evidence, these marks will be documented on the notes portion of the Findings Panel. Additional documentation can be depicted by using an image(s). If an image is used, the case number, the Item numbers and what is being depicted needs to be included on the image.

j. Specific information which supports an elimination finding must be included in the work notes. Additional documentation can be depicted with an image(s). Examples include but are not limited to differences in breech face marks, firing pin shape, land and groove impression widths, etc. All elimination findings will be listed in the findings panel of the matrix and will be included in the report.

C. Verifier/Verification

1. The verifier is the examiner tasked with reviewing findings regarding the evidence examined by the primary examiner.

2. The verification is an analysis of the items previously examined by the primary examiner to provide a quality check of the primary examiner's findings.

3. The primary examiner's findings of identification and eliminations based on differences of individual characteristics will be subjected to the verification process.

4. The assignment of the verifier shall take into consideration factors such as staff size, availability, avoidance of confirmation bias by minimizing exposure to task irrelevant case information, or other needs and requirements of the section.

5. It is the primary examiner's responsibility to present the correct items to the verifier for the verification process. However, it is incumbent on the verifier to ensure the proper items have been compared during the verification. It is also necessary for the verifier to check the identity of each item before or immediately after the verification process. The verifier must also make sure that each piece of evidence has a phase mark in the correct orientation at the time of verification.

6. The verifier needs to ensure that there is an image, which most accurately reflects what was viewed under the comparison microscope, for each area indicated in the identification statement.

7. When checking the confirm button in LIMS, the identity of the verifier as well as the date of the verification will be recorded within LIMS. This is done by the verifier entering their username and password.

8. The comments field within the confirmation in LIMS is available to the verifier to add any other additional comments pertaining to the verification.

D. Worksheets and LIMS Matrix Panels

Worksheets in the Firearms/Toolmarks Section are considered the output that can be printed after the matrix panel information is filled out in the LIMS. The LIMS matrix data entry screens in the Firearms/Toolmarks Section listed below are used to document information regarding specific items of evidence and will be referred to as "panels" on the following pages. The fields for each specific panel are also discussed. Within a given panel are specific fields which are mandatory. All mandatory fields in the LIMS matrix panels are indicated with a red asterisk (*). Mandatory fields require an entry and blank fields are not allowed. If no data exists for a particular mandatory field, an entry must still be made, e.g., "unknown", "not applicable", "none observed", etc. The LIMS system is set up to alert the analyst when a mandatory field has been left blank before the case can be completed. All other non-mandatory fields in a specific panel can be left blank and do not need to be addressed if no relevant information is noted. The worksheets, when created,

will auto populate an "N/A" on the appropriate worksheet for the non-mandatory fields that are left blank.

***Many fields in the matrix panels that populate the report have drop down options. For consistency across laboratories, these options will be used unless the entry for a specific field lacks the appropriate drop down choice for a field being documented. Analysts will forward any additions for the drop down choices to their respective CAB member for consideration of inclusion as a drop down option.*

***Only the abbreviations listed in section "E" below may be used in the fields that do not populate into the report.*

***All weight or dimension measurements that are documented within the matrix panels will be done using instruments that are tracked in the Laboratory Asset Manager. The instruments used will be required to have a NIST traceable certificate, a certificate of calibration from an outside vendor, or documentation in the LAM that the instrument was performance checked against NIST certified weights or gage blocks. When reporting out illegal barrel and overall lengths a NIST certified instrument must be used.*

***Due to the specific matrix panel automatically creating the report, only the final results for a given matrix field will be populated. If further explanation is required to detail how the analyst arrived at their results for a specific field, the notes field for the specific panel will be used.*

***Specific fields described below whose data will be used to generate a report will be noted next to the field title with an "R".*

1. Firearm Panel - A firearm panel will be completed on all firearms examined, except those covered by the abbreviated firearm panel.

    a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If there are multiple firearms in the same item number, they will be sub-designated and the sub-designation recorded in this field. Do not sub-itemize multiple firearms in the same Item number.

    b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.)

    c. Lab Mark*: Record any lab marks placed on the evidence.

    d. Make*R: Note the make/manufacturer of firearm.

    e. Model*R: Note the model of the firearm.

f. Importer: Note the name of the importer on the firearm and where the importer is located.

g. Origin: Note where the firearm was made or any additional information about the manufacturer of the firearm.

h. Action and Type*R: Select the appropriate description. If further description is desired, use the notes section.

i. Caliber/Gauge*R: Document the cartridge or shotshell for which the firearm is chambered.

j. Finish: Write the appropriate appearance of the firearm.

k. Serial Number*R: List the firearm's serial number. If there is no serial number or, if the serial number has been obliterated, indicate as such. If the serial number is defaced, but the characters are all clearly legible, list the firearm's serial number.

l. Serial Number Location: List the location of the serial number on the firearm.

m. Rifling*R: Record the number and direction of barrel lands and grooves, when applicable. Polygonal or no rifling may be selected, when applicable.

n. Land Impressions (inches)*: Record a single land impression width, the range of several land impression widths, or the average land impression width(s) of the test shots. All measurements will be in inches and do not need the double prime notation (").

o. Groove Impressions (inches)*: Record a single groove impression width, the range of several groove impression widths, or the average groove impression width(s) of the test shots. All measurements will be in inches and do not need the double prime notation (").

p. Measured Using*: Record the specific instrument used to measure the land and groove impression(s). Utilize the unique identifier in the LAM to describe the specific equipment used to take the measurement. If the measurements were not taken then select one of the appropriate drop down options or document further.

q. Firing Mechanics and Additional Action/Type Information*: Select the appropriate descriptions, depending on the type of firearm, concerning the Action (single action, hybrid action, etc.), Action Type (blowback, recoil,

etc.), and Firing Mechanics (striker, hammer, etc.). Other descriptions of the Action, Action Type, and Firing Mechanics may be noted as well.

r. Safety*: Select all safeties that are present using one matrix field for each safety feature noted.

s. Functionality*: Note whether each selected safety was functional, not functional, missing, not tested, or not applicable.

t. Barrel Length (inches): Document the length of the barrel after detaching any removable barrel extensions. All measurements will be in inches and do not need the double prime notation (").

u. Overall Length (inches): Document the overall length of the firearm after detaching any removable barrel extensions. All measurements will be in inches and do not need the double prime notation (").

v. Measured Using: Record the specific instrument used to measure the barrel and overall length, if measured. Utilize the unique identifier in the LAM to describe the specific equipment used to take the measurement.

w. Measurement Uncertainty: Only check this box if you want the barrel and overall length to populate the report.

x. Barrel Comments: Make any relevant notes of the condition of the bore and/or residues present.

y. Breech Face*: Select the type of breech face marks.

z. Firing Pin Aperture*: Record the type of firing pin aperture present on the firearm. If the examiner selects other or undetermined, the examiner needs to explain further and add additional documentation to the notes section of the Firearms Panel. An examiner may also reference an image taken of the firing pin aperture in the notes section.

aa. Firing Pin*: Select the shape of the firing pin.

bb. Test Firing*R: Select whether the firearm was received operable, inoperable, inoperable as received; rendered operable, or not test fired. Detailed documentation to describe the condition of the firearm and any work to describe what was done to render the firearm operable will be done in the notes field.

cc. Test Fired Using(R): Check the corresponding box to document whether laboratory and/or evidence ammunition was used to test fire the firearm.

dd. Description of Test Shots: Document the ammunition used to test fire the firearm. Each test shot must be marked and recorded here as a sequenced sub-Item(s). (Examples: 1A1, 1A2, 1A3, 1A4; 1A1 through 1A4 etc.) The specific sequenced sub-Item does not need to appear in the description of the test shots when the sub-item is created. The specific sequenced sub-Item test shot will be referenced in the NIBIN panel if suitable for entry.

ee. Test Fired By(R): Document whether another analyst or authorized person test fired the firearm. The person who test fired the weapon will sign into the LIMS to verify they test fired it and electronically initial the worksheet.

ff. Notes: Document any further observations and information for the firearm submitted. If the firearm has a defaced serial number where the entire serial number is still clearly legible, it must be minimally documented in the notes section for the Firearm Panel. The examiner also has the option to document a clearly legible defaced serial number under the Reported Remarks for the Firearm Panel if the examiner wants to populate this information to the summary report.

gg. Reported Remarks(R): Use the reported remarks field only to report information that is not covered in any prior fields. The information placed in this field will directly populate at the end of the report and will specify the item number.

hh. Repackaging*: Briefly describe how the evidence was repackaged.

2. Abbreviated Firearm Panel – An abbreviated firearm panel will be completed on all firearms submitted solely for a search within NIBIN. An abbreviated firearm panel may also be used in all other firearm examinations where no fired evidence is submitted to be compared to the firearm (i.e. serial number restoration cases). In situations when a case is completed and an agency requests additional information to be provided regarding a firearm that was not originally covered in the abbreviated firearm panel, the information will be recorded on a general panel or, on a findings panel for microscopic comparison conclusions (fired evidence comparisons).

   a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If there are multiple firearms in the same item number, they will be sub-designated and the sub-designation recorded in this field. Do not sub-itemize multiple firearms in the same Item number.

b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.)

c. Lab Mark*: Record any lab marks placed on the evidence.

d. Make*R: Note the make/manufacturer of firearm.

e. Model*R: Note the model of the firearm.

f. Importer: Note the name of the importer on the firearm and where the importer is located.

g. Origin: Note where the firearm was made or any additional information about the manufacturer of the firearm.

h. Action and Type*R: Select the appropriate description. If further description is desired, use the notes section.

i. Caliber/Gauge*R: Document the cartridge or shotshell for which the firearm is chambered.

j. Serial Number*R: List the firearm's serial number. If there is no serial number or, if the serial number has been obliterated, indicate as such. If the serial number is defaced, but the characters are all clearly legible, list the firearm's serial number.

k. Rifling*R: Record the number and direction of barrel lands and grooves, when applicable. Polygonal or no rifling may be selected, when applicable.

l. Breech Face*: Select the type of breech face marks.

m. Firing Pin Aperture*: Record the type of firing pin aperture present on the firearm. If the examiner selects other or undetermined, the examiner needs to explain further and add additional documentation to the notes section of the Abbreviated Firearms Panel. An examiner may also reference an image taken of the firing pin aperture in the notes section.

n. Firing Pin*: Select the shape of the firing pin.

o. Test Firing*R: Select whether the firearm was received operable, inoperable, inoperable as received; rendered operable, or not test fired. Detailed documentation to describe the condition of the firearm and any work to describe what was done to render the firearm operable will be done in the notes field.

p. Test Fired Using(R): Check the corresponding box to document whether laboratory and/or evidence ammunition was used to test fire the firearm.

q. Description of Test Shots: Document the ammunition used to test fire the firearm. Each test shot must be marked and recorded here as a sequenced sub-Item(s). (Examples: 1A1, 1A2, 1A3, 1A4; 1A1 through 1A4 etc.) The sequenced sub-Item does not need to appear in the description of the test shots when the sub-item is created. The specific sequenced sub-Item test shot will be referenced in the NIBIN panel if suitable for entry.

r. Test Fired By(R): Document whether another analyst or authorized person test fired the firearm. The person who test fired the weapon will sign into the LIMS to verify they test fired it.

s. Notes: Document any further observations and information for the firearm submitted. If the firearm has a defaced serial number where the entire serial number is still clearly legible, it must be minimally documented in the notes section of the Abbreviated Firearm Panel. The examiner also has the option to document a clearly legible defaced serial number under the Reported Remarks section of the Abbreviated Firearm Panel if the examiner wants to populate this information to the summary report.

t. Reported Remarks(R): Use the reported remarks field only to report information that is not covered in any prior fields. The information placed in this field will directly populate at the end of the report and will specify the item number.

u. Repackaging*: Briefly describe how the evidence was repackaged.

3. Magazine Panel – A magazine panel will be completed for all magazines submitted.

a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If there are multiple magazines in the same item number, they will be sub-designated and the sub-designation recorded in the field. Do not sub-itemize magazines.

b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.)

c. Lab Mark*: Record any lab marks placed on the evidence.

d. Number of Magazines*R: Document the number of magazine(s) received.

e. Magazine Type*: Document the type of magazine(s) received.

f. Capacity: Document the capacity of the magazine(s).

g. Capacity Remarks: Document how the magazine(s) capacity was determined.

h. Notes: Document any further observations and information for the magazine(s) submitted.

i. Reported Remarks(R): Use the reported remarks field only to report information that is not covered in any prior fields. The information placed in this field will directly populate at the end of the report and will specify the item number.

j. Conclusions*R: Document the examination results for the magazine(s).

k. Repackaging*: Briefly describe how the evidence was repackaged.

4. Unfired Cartridge(s)/Shotshell(s) Panel – An unfired cartridge(s)/shotshell(s) panel will be completed for all cartridges or shotshells submitted. Do not sub-itemize unfired cartridges unless the unfired cartridges are specifically used for test firing purposes.

   a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If sub-designations are needed due to multiple cartridges or shotshells in the same item number, use the sub-designation.

   b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.)

   c. Lab Mark*: Record any lab marks placed on the evidence.

   d. Quantity*R: Document the quantity of the cartridges or shotshells received.

   e. Brand/Manufacturer(R): Document the brand/manufacturer of the ammunition received.

f. Caliber/Gauge(R): Document the caliber or gauge of the ammunition received.

g. Notes: Document any further observations and information for the ammunition submitted.

h. Reported Remarks(R): Use the reported remarks field only to report information that is not covered in any prior fields. The information placed in this field will directly populate at the end of the report and will specify the item number.

i. Conclusions*R: Document the examination results for the submitted ammunition.

j. Repackaging*: Briefly describe how the evidence was repackaged.

5. Accessory Panel – An accessory panel will be completed for all firearm related accessories submitted.

a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If sub-designations are needed due to multiple accessories in the same item number, use the sub-designation. Do not sub-itemize accessories.

b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.)

c. Lab Mark*: Record any lab marks placed on the evidence.

d. Accessories and Other Items Received*R: List the accessories and other items submitted. Detailed information for any of the specific items should be documented in the accessories description/notes field.

e. Accessories Description/Notes: Document any detailed information of the submitted accessories or other items received.

f. Reported Remarks(R): Use the reported remarks field only to report information that is not covered in any prior fields. The information placed in this field will directly populate at the end of the report and will specify the item number.

g. Conclusions*R: Document the examination results for the submitted accessories or other items.

h. Repackaging*: Briefly describe how the evidence was repackaged.

6. Serial Number Restoration Panel – A serial number restoration panel will be completed on all firearms or other items with obliterated/partially obliterated serial numbers. This will also include serial numbers worn by age that need restoration. Any restoration attempt to the item will require a serial number restoration panel to be filled out (This does not include the use of methanol, acetone or other cleaning agents to clean away dirt, debris or residues to visualize the serial number). If the serial number is defaced, but the characters are all clearly legible, a serial number restoration panel will not be filled out. Defaced serial numbers that are clearly legible will be documented on the Firearms Panel or the Abbreviated Firearms Panel. If restoration techniques are used on areas other than the serial number location (for example Make, Model, Caliber etc.), a serial number restoration panel will be completed.

   a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If there are multiple firearms in the same item number, they will be sub-designated and the sub-designation recorded in this field.

   b. Serial Number Location*: List the location of the serial number on the firearm.

   c. Magnetic*: Document whether the obliterated area was magnetic or not.

   d. Method of Obliteration*: Document the method of obliteration.

   e. Serial Number Structure*: Record the serial number structure after consulting available resources. If the serial number structure of the firearm cannot be confirmed utilizing the most current available resources, the examiner must document this here.

   f. Structure Source*: If possible, determine the serial number structure and record the source of this information. Possible sources include but are not limited to the BATFE Serial Number Structure Guide, the Royal Canadian Mounted Police Firearm Reference Table (RCMP-FRT), manufacturer literature, the Firearms Reference Collection, the AFTE.org Member's Area Serial Number Search Database or an internet search. If the serial number structure of the firearm cannot be confirmed utilizing the most current available resources, the examiner must document this here.

g. Visible Prior to Restoration*: Record and document the characters visible prior to any restoration attempt. The documentation must be done using digital imaging.

h. Notes: Document any further information that was not detailed in the visible prior to restoration field.

i. Visible During/After Restoration*: Record and document the characters visible during and/or after the restoration attempt. The documentation must be done using digital imaging.

j. Notes: Document any further information that was not detailed in the "Visible During/After Restoration" field.

k. Method(s) Used*: Document the method(s) used during the restoration process and any related information. If the Magnaflux technique was not utilized for an item with a ferrous surface, it must be documented here or within the serial number restoration panel notes field why it was not used.

l. Imaging Disposition Statement: Check this box if the analyst needs the following statement to populate to their notes packet; "The character(s) or partial character(s) was/were visible during the restoration process; however, it could not be clearly captured within the image(s) due to the nature of the restoration process and/or digital imaging limitations."

m. Recovered Characters*R: Indicate any characters restored. If no characters are restored, indicate none or another appropriate response. If a partial serial number is recovered or partial characters are recovered indicate the unknown characters with a "?" (i.e. 12??45). Documentation of what the undetermined characters are will be done in the Reported Partial(s) Explained field.

n. Reported Partial(s) Explained(R): Document any partial characters recovered to include what they possibly are. The information in this field will be placed directly into the report so any information for justification of the partial characters restored should be noted elsewhere.

7. Fired Bullet Panel - A fired bullet panel will be completed on all fired bullets, fragments, and shotgun slugs examined. If no microscopic comparison is conducted, the reason for not conducting a comparison will be documented in the case file.

a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If there are multiple pieces of fired bullet evidence in the same item number, they will be sub-designated and the sub-designation recorded in this field. Do not sub-itemize multiple fired bullets in the same Item number.

b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.)

c. Lab Mark*: Record any lab marks placed on the evidence.

d. Item Description*R: Choose the corresponding drop down choice that coincides with the item submitted.

e. Trace*: Document any trace material observed. If no trace material is observed this should be documented as well.

f. Decontaminated: Check this box if the analyst wants "10% bleach solution" to auto populate the notes packet. If further documentation is needed, use the Trace or Notes field to document.

g. Type: Record the appropriate bullet type for the item submitted.

h. Jacketing: Record the bullet or jacket material of the fired bullet evidence.

i. Cannelures: Record the number and type of cannelures.

j. Weight (grains)*: Record the weight of the fired bullet evidence in grains. If multiple lead fragments are documented on one matrix panel entry the total weight of all the fragments can be documented. Further documentation can be done in the notes field, if needed. The "grains" label is not required.

k. Measured Using *: Record the specific balance used to measure the bullet weight. Utilize the unique identifier in the LAM to describe the specific equipment used to take the measurement.

l. Diameter (inches)*: Record the bullet diameter in inches. If the diameter cannot be measured, document this as well. The double prime indicator (") is not required

m. Measured Using*: Record the specific instrument used to measure the diameter. Utilize the unique identifier in the LAM to describe the specific equipment used to take the measurement.

n. Direction of Twist*R: Record the direction of twist. If the direction cannot be determined, document this as well.

o. Total Number of Land and Groove Impressions*R: Document the total number of land and groove impressions. If the total number of land and groove impressions is consistent with, check the preceding box and the appropriate information will populate the report and notes. If the total number of lands and grooves cannot be determined, document this as well using one of the drop down options available. Partial documentation of the total number of lands and grooves will be documented in the notes section (4 visible LIMPS and GIMPS but the final result on the report will be 6).

p. Land Impressions (inches)*: Record a single land impression width, the range of several land impression widths, or the average land impression width(s). All measurements will be in inches and do not need the double prime notation (”). If an average of multiple land impressions is used it will be placed on the land impression measurements field directly below. Each measurement taken will be separated by a comma and then a space (0.100, 0.102, 0.104). The LIMS will calculate the average and place the results in the “average land impression” field.

q. Groove Impressions (inches)*: Record a single groove impression width, the range of several groove impression widths, or the average groove impression width(s). All measurements will be in inches and do not need the double prime notation (”). Each measurement taken will be separated by a comma and then a space (0.100, 0.102, 0.104). The LIMS will calculate the average and place the results in the “average groove impression” field.

r. Measured Using*: Record the specific instrument used to measure the land and groove impression(s). Utilize the unique identifier in the LAM to describe the specific equipment used to take the measurement.

s. Polygonal Rifling*R: Document whether the fired bullet evidence has polygonal rifling.

t. Caliber/Gauge*R: Document the caliber of the fired bullet evidence. For fired shotgun slugs, document the gauge of the slug. If the caliber or gauge

is consistent with, check the preceding box and the appropriate information will populate the report and notes. If the caliber or gauge cannot be determined, document this as well.

u. Notes: Document any further observations and information for the fired bullet submitted.

v. Reported Remarks(R): Use the reported remarks field only to report information that is not covered in any prior fields. The information placed in this field will directly populate at the end of the report and will specify the item number.

w. Repackaging*: Briefly describe how the evidence was repackaged.

8. Fired Cartridge Case/Shotshell Panel - A fired cartridge case/shotshell panel will be completed on all fired cartridge cases/shotshells examined. If no microscopic comparison is conducted, the reason for not conducting a comparison will be documented in the case file. See III.C.11 for an exception with instructions regarding NIBIN evaluation cases.

a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If sub-designations are needed due to multiple fired cartridge cases or shotshells in the same item number, the sub-designation can be utilized. Each item can be listed with a comma separation (1-1, 1-2, 1-3) or a series of items can be listed (1-1 through 1-8). A combination of both of these methods cannot be utilized to configure the report correctly. Do not sub-itemize fired cartridge case(s) if there are multiple fired cartridge cases in the same Item number (fired cartridge case(s) evidence can only be sub-itemized for the purpose of Non-NIBIN laboratory transfer and should not be recorded here; in that instance the sub-item is created for transfer purposes only).

b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.)

c. Lab Mark*: Record any lab marks placed on the evidence.

d. Quantity*R: Record the quantity of fired cartridge cases or shotshells.

e. Brand/Manufacturer(R): Record the brand/manufacturer.

f. Caliber/Gauge*R: Record the caliber or gauge.

g. Breech Face Mark*: Record the type of breech face markings on the cartridge case/shotshell (i.e. parallel, granular, arcs, etc.).

h. Firing Pin Aperture Shape*: Record the firing pin aperture shape present on the cartridge case. If no firing pin aperture shape is observed, that will also be recorded. If the examiner selects other or undetermined, the examiner needs to explain further and add additional documentation to the notes section of the Fired Cartridge Case/Shotshell Panel. An examiner may also reference an image taken of the firing pin aperture shape in the notes section. If the Firing Pin Aperture shape is missing or only partially visible on certain Items, these specific Items need to be documented within the notes section of the Fired Cartridge Case/Shotshell panel.

i. Firing Pin Impression*: Record the type/shape of the firing pin impression (i.e. hemispherical, elliptical, rectangular, etc.).

j. Cartridge Case Composition: Record the type of finish, or color of finish if type is unknown (i.e. brass, nickel, steel, etc.).

k. Primer Composition: Record the type of finish, or color of finish if type is unknown (i.e. brass, nickel, copper, etc.).

l. Notes: Document any further observations and information for the fired cartridge cases or shotshells submitted. Sub-designations not introduced under the Item(s) # field must be recorded here.

m. Reported Remarks(R): Use the reported remarks field only to report information that is not covered in any prior fields. The information placed in this field will directly populate at the end of the report and will specify the item number.

n. Repackaging*: Briefly describe how the evidence was repackaged.

9. NIBIN Panel –A NIBIN panel will be completed to document any future NIBIN entries for Non-NIBIN Laboratories or current NIBIN entries and any results of searches in NIBIN. Any confirmatory microscopic comparisons will be documented on a findings panel.

   a. Item(s) #*R: The most specific reference to the Item(s) being entered into the NIBIN database will be recorded here.
      i. For test shots, the specific sequenced sub-item needs to be recorded in this field. For example, Item #1A is created as test shots from

the firearm in Item #1 labeled Item #1A1 and 1A2. The sequenced sub-item will be recorded in this field (i.e. Item #1A1). The overall sub-item of Item #1A will not be utilized. The Item number of the firearm will not be utilized.

ii. For fired evidence cartridge cases, the Item number will be recorded here or if the Item has been sub-designated, the most specific sub-designation will be recorded here. For example, Item #1 has five cartridge cases so Item #1-1 will be utilized. If Item #1 is sub-designated to multiple groups, Item #1-1-1 will be utilized or 1-1A and not just 1-1.

b. NIBIN Entry By: Enter the analyst or authorized person who entered the Item into NIBIN if it differs from the analyst issuing the report within the case. When the analyst who issued the report is the same as the analyst who entered the fired cartridge case into NIBIN, the field is left blank and will populate as N/A to the notes. If the analyst is forwarding the fired cartridge case to a NIBIN laboratory for entry, the field is left blank and will populate as N/A to the notes. The only time that this field is filled out is when the analyst or authorized person who entered the Item into NIBIN differs from the analyst who is issuing the report.

c. Results*R: Record the results from the NIBIN search or the laboratory where the Item(s) will be entered into NIBIN.

d. Possible Associated Cases(R): Record all the possible associated cases that were found during the NIBIN search utilizing the printed NIBIN results paperwork. Any associations noted here will populate the notes and report in the appropriate locations.

e. Possible Association Disposition: Check this box when possible associations are documented. The disposition statement will populate the notes and report in the appropriate locations.

f. Notes: Document any further observations and information for the NIBIN searches.

10. Findings Panel – The findings panel will be completed to document all conclusions outlined in section III.A. Range of Conclusions.

a. Group/Items*R: Record the first item(s) of evidence in the comparison.

b. Evidence Type*R: Select from the drop down selections available to choose the correct evidence type. When selecting Other for evidence type,

chose based on the type of panel utilized in LIMS (i.e. whether a fired bullet panel or general panel was used for the Item).

c. Finding*R: Document the appropriate finding from the comparison conclusions available.

d. To Group/Items(R): If applicable, record the second item(s) of evidence in the comparison.

e. Evidence Type(R): If applicable, select from the drop down selections available to choose the correct evidence type. When selecting Other for evidence type, choose based on the type of panel utilized in LIMS (i.e. whether a fired bullet panel or general panel was used for the Item).

f. Comparison Microscope Used*: Document the specific comparison microscope(s) used to render the stated opinion. If a comparison microscope was not necessary, or a stereomicroscope was used to determine suitability for a single item, document accordingly in this field.

g. Reason/Notes*: Record the reason or justification for the stated findings per the requirements from III.B.2. Comparison Conclusions. This field is also used to document any other relevant information regarding the microscopic comparison analysis.

h. Confirm: Document in this field whether a verification was performed or was not required. If a verification was performed, the analyst performing the verification will need to apply their credentials in the LIMS prior to completion of the verification.

11. Shot Pellet Panel – A shot pellet panel will be completed on all shot pellet evidence.

a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If sub-designations are needed due to multiple pieces of evidence in the same item number, use the sub-designation.

b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.)

c. Lab Mark*: Record any lab marks placed on the evidence.

d. Item Description*R: Document the type of shot pellets received.

e. Total Number of Pellets Received*R: Record the total number of pellets received.

f. Trace*: Document any trace material observed. If no trace material is observed this should be documented as well.

g. Decontaminated: Check this box if the analyst wants "10% bleach solution" to auto populate the notes packet. If further documentation is needed, use the Trace or Notes field to document.

h. Shot Diameter (inches): Record the diameter of the shot pellet(s) in inches, if applicable. The double prime symbol (") is not required.

i. Measured Using: Record the instrument used to measure the shot diameter. Utilize the unique identifier in the LAM to describe the specific equipment used to take the measurement.

j. Number of Pellets Suitable for Weighing*: Record the number of pellets submitted that are suitable for weighing.

k. Number of Suitable Pellets Weighed*: Record the number of pellets weighed.

l. Total Weight of Pellets Weighed (grains)*: Record the total weight of the pellets weighed. The grains label is not required. Utilize the unique identifier in the LAM to describe the specific equipment used to take the measurement. Put this unique identifier in the notes section.

m. Average Weight (grains)*: Record the average weight in grains. The grains label is not required.

n. Compared to Known Lab Sample Shot Size(s)*: Document any known lab sample shot sizes used for comparison.

o. Shot Size/Shot Size Range*R: Record the shot size or the range of shot sizes the evidence could fall within.

p. Notes: Document any further observations and information for the shot pellets examined.

q. Reported Remarks(R): Use the reported remarks field only to report information that is not covered in any prior fields. The information placed in this field will directly populate at the end of the report and will specify the item number.

r. Repackaging*: Briefly describe how the evidence was repackaged.

12. Wadding Panel – A wadding panel will be filled out for all wadding items submitted.

a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If sub-designations are needed due to multiple pieces of evidence in the same item number, use the sub-designation.

b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.)

c. Lab Mark*: Record any lab marks placed on the evidence.

d. Trace*: Document any trace material observed. If no trace material is observed this should be documented as well.

e. Decontaminated: Check this box if the analyst wants "10% bleach solution" to auto populate the notes packet. If further documentation is needed, use the Trace or Notes field to document.

f. Number of Wadding*R: Record the number of wadding(s) received.

g. Type*R: Document the type of wadding received

h. Diameter Measurement (inches): Record the diameter of the wadding, if applicable. The double prime symbol (") is not required.

i. Measured Using: Record the specific instrument used to measure the wadding diameter. Utilize the unique identifier in the LAM to describe the specific equipment used to take the measurement.

j. Comparison with Lab Sample/Submitted Sample Wadding (size/type)*: Document any laboratory or submitted samples of wadding used during analysis.

k. Notes: Document any further observations and information for the shot pellets examined.

l. Reported Remarks(R): Use the reported remarks field only to report information that is not covered in any prior fields. The information placed in this field will directly populate at the end of the report and will specify the item number.

m. Examination Results*R: Record the results of the examination.

n. Repackaging*: Briefly describe how the evidence was repackaged.

13. Muzzle to Clothing Contact Examination Panel – A distance determination unknown panel will be completed on items with suspected bullet hole(s). The panel should describe the location of the bullet hole(s). When possible, the shape of any gunpowder particles surrounding the hole(s) and the presence of any other gunshot residue(s) should be noted.

    a. Select Item*R: Select the appropriate Item that is being documented.

    b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.).

    c. Item Description with section designators (when applicable)*: Describe the item being examined. If multiple items are included in one item, designate each item accordingly with sub-designators, if needed.

    d. Notes: Document any further observations and information for the packaging and item(s) received.

    e. Lab Mark*: Record any lab marks placed on the evidence.

    f. Repackaging*: Briefly describe how the evidence was repackaged.

    g. Section designation(R): Record the specific section designator for the item being examined, when applicable.

    h. Item Description*: Describe the item, or area on the item, being examined. If multiple holes are going to be tested on one item #, use a separate entry for each hole that will be examined.

Visual/Microscopic Examination

i. Smoke (Lead): Record the presence of any vaporous lead or smoke residues.

j. Bullet Wipe: Record the presence of any observed bullet wipe (residues).

k. Cruciform Type Tearing Visible: Record the presence of any visible cruciform type tearing.

l. Ripping/Tearing: Record the presence of and/or characterize any ripping or tearing observed on the item.

m. Singeing/Burning: Record the presence of and/or characterize any singeing, burning, or melting of the item.

n. Particulate Metals: Record the presence of particulate metals (shavings of lead, copper, brass, etc.)

o. Gun Powder: Record the presence of any unburnt or partially burnt gun powder particles. The shape of the gun powder particles should also be recorded, if determined.

p. Masking Effects/Notes: Record any possible masking effects (i.e. blood, staining, etc.). Document any other relevant information involving the visual and microscopic examination not covered elsewhere.

Overall Comments/Observations

q. Overall Comments/Observations: Document any relevant information for the overall examination of the specific item of evidence, or any other information not covered in the previous fields.

r. Examination Results*R: Document the final examination results after all processes and analyses are completed for the given entry.

s. Reported Remarks(R): Use the reported remarks field only to report information that is not covered in any prior fields. The information placed in this field will directly populate at the end of the report and will specify the item number.

14. Tool Panel – A tool panel will be completed on all tools examined.

a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If sub-designations are needed due to multiple pieces of evidence in the same item number, use the sub-designation.

b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.)

c. Lab Mark*: Record any lab marks placed on the evidence.

d. Tool Brand*R: Document the brand or manufacturer of the tool. If unknown, then document as well.

e. Type*R: Document the type of tool submitted (i.e. pliers, bolt cutters, etc.).

f. Class*: Document the class(s) of the tool submitted (i.e. prying, pinching, cutting, gripping, etc.).

g. Overall Measurements: Record the overall measurements of the tool.

h. Tool Working Surface Measurements: Record the measurements for the working surface of the tool.

i. Measured Using: Record the specific instrument used to take any measurement(s). Utilize the unique identifier in the LAM to describe the specific equipment used to take the measurement.

j. Condition: Record the condition of the tool as received. Any change in condition during analysis can be placed in this field or in the notes field.

k. Trace Material*: Document any trace material observed. If no trace material is observed this should be documented as well.

l. How Removed: Record if and how the trace material was removed. If removed trace material is sub-itemized, document in this field or in the notes field.

m. Tool Working Edge Label Description*: Record how the working edge of the tool was labeled.

n. How Test Marks are Made: Describe how the test marks were made (pushing versus pulling motion for example).

o. Type of Material Used for Testing*: Document the type(s) of material used to make test marks.

p. Test Marks cast and/or Enhanced: Document if the test marks were cast or enhanced.

q. Notes: Document any further observations and information for the tool examined.

r. Reported Remarks(R): Use the reported remarks field only to report information that is not covered in any prior fields. The information placed in this field will directly populate at the end of the report and will specify the item number.

s. Examination*R: Record the results of the examination (i.e. examined and tested). Results for any microscopic comparisons or suitability determinations will be done in the Findings Panel.

t. Repackaging*: Briefly describe how the evidence was repackaged.

15. Toolmark Panel – A toolmark panel will be completed on all toolmarks submitted for comparison to a specific tool. If no microscopic comparison is conducted, the reason for not conducting a comparison will be documented in the case file.

a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If sub-designations are needed due to multiple pieces of evidence in the same item number, use the sub-designation.

b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.)

c. Lab Mark*: Record any lab marks placed on the evidence.

d. Toolmark Description*R: Record the description of the toolmark.

e. Material Toolmark is in: Record the material the toolmark is in.

f. Class*: Document the class(s) of the toolmark submitted (striated, impressed, prying, cutting, etc.)

g. Measurement of Toolmark: Record any measurements of the toolmark

h. Measured Using: Record the specific instrument used to take any measurement(s). Utilize the unique identifier in the LAM to describe the specific equipment used to take the measurement.

i. Trace Material*: Document any trace material observed. If no trace material is observed this should be documented as well.

j. How Removed: Record if and how the trace material was removed. If removed trace material is sub-itemized, document in this field or in the notes field.

k. Notes: Document any further observations and information for the toolmark(s) examined.

l. Reported Remarks(R): Use the reported remarks field only to report information that is not covered in any prior fields. The information placed in this field will directly populate at the end of the report and will specify the item number.

m. Repackaging*: Briefly describe how the evidence was repackaged.

16. General Panel - The general panel may be used for items not covered by another matrix panel. If an item fits into a class of evidence covered by a specific panel listed above, that panel must be used.

a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If sub-designations are needed due to multiple pieces of evidence in the same item number, use the sub-designation.

b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.)

c. Lab Mark*: Record any lab marks placed on the evidence.

d. Item Description*R: Record the description of the item submitted (one firearm barrel, etc.).

e. Notes: Document any further observations and information for the submitted item(s).

f. Examination Results*R: Record the results of the examination for the item submitted.

g. Repackaging*: Briefly describe how the evidence was repackaged.

17. NIBIN Evaluation Panel - A NIBIN Evaluation panel will be used on NIBIN Evaluation cases. The forensic scientist will conduct an abbreviated microscopic comparison on a comparison microscope and determine a possible number of firearms represented by the evidence. The forensic scientist will indicate the grouping of the cartridge cases through labeling of the evidence and through recording the preliminary grouping in the matrix panels. Where possible, each group will be documented on a single NIBIN Evaluation panel entry (Group #1, NIBIN Evaluation panel #1; Group #2, NIBIN Evaluation panel #2). Exceptions can be made. Deferral of all bullet examinations will also be indicated using the statements panel.

    a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If sub-designations are needed due to multiple fired cartridge cases or shotshells in the same item number, the sub-designation can be utilized. Each item can be listed with a comma separation (1-1, 1-2, 1-3) or a series of items can be listed (1-1 through 1-8). A combination of both of these methods cannot be utilized to configure the report correctly. Do not sub-itemize fired cartridge case(s) if there are multiple fired cartridge cases in the same Item number (fired cartridge case(s) evidence can only be sub-itemized for the purpose of Non-NIBIN laboratory transfer and should not be recorded here; in that instance the sub-item is created for transfer purposes only).

    b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.)

    c. Lab Mark*: Record any lab marks placed on the evidence.

    d. Quantity*R: Document the quantity of items examined and grouped.

    e. Caliber/Gauge*R: Record the caliber or gauge.

    f. Breech Face Mark*: Record the type of breech face markings on the cartridge case/shotshell.

g. Firing Pin Aperture Shape*: Record the firing pin aperture shape present on the cartridge case. If no firing pin aperture is observed, that will also be recorded. If the examiner selects other or undetermined, the examiner needs to explain further and add additional documentation to the notes section of the NIBIN Evaluation panel. An examiner may also reference an image taken of the firing pin aperture shape in the notes section. If the Firing Pin Aperture shape is missing or only partially visible on certain Items, these specific Items need to be documented within the notes section of the NIBIN Evaluation panel.

h. Firing Pin Impression*: Record the type/shape of the firing pin impression on the cartridge case/shotshell.

i. Phase Mark*: Indicate the index color and orientation of how the cartridge cases or shotshells were phased. Each cartridge case or shotshell must have a phasing mark. Utilize different colors for the different groups of cartridge cases or shotshells. Identical colors should not be used for multiple groups of cartridge cases or shotshells. When there are numerous groups within the case and additional different colors are not available for phasing, utilize alternate phasing orientations or markings to distinguish the groups of cartridge cases or shotshells.

j. Notes: Document any further observations and information for the submitted item(s). Sub-designations not introduced under the Item(s) # field must be recorded here.

k. Conclusions*R: Document the conclusions from the NIBIN Evaluation.

l. Repackaging*: Briefly describe how the evidence was repackaged.

18. Statements Panel – The statements panel will be used when information not specific to an item needs to be documented in the report (deferral statements, agency requests for comparison, etc.). Refer to the Firearms LIMS user manual for specific directions.

19. Firearms Notes Panel – The Firearms Notes Panel will be a panel used to document information when evidence is resubmitted to the laboratory. This panel will allow documentation of information for items that does not need to go to the report. A Reported Remarks section is included in the Firearms Notes Panel in case information does need to go to the report. This panel does not replace any of the other panels that are required when doing the initial examination of the items.

a. Item(s) #*R: Note the item number of the evidence as listed in the LIMS. If sub-designations are needed due to multiple pieces of evidence in the same item number, use the sub-designation.

b. Packaging*: Document the general description of the package in which the item is received including the condition of the seals (i.e., sealed box, stapled bag, none, etc.)

c. Lab Mark*: Record any lab marks placed on the evidence.

d. Notes*: Document any further observations and information for the submitted item(s).

e. Reported Remarks(R): Use the reported remarks field only to report information that is not covered in any prior fields. The information placed in this field will directly populate at the end of the report and will specify the item number.

f. Repackaging*: Briefly describe how the evidence was repackaged.

E. Instrument Performance Standards

1. Comparison Microscope

a. Annually:
The certified microscope will be cleaned, serviced and certified annually by a qualified technician. These steps will be documented in the Laboratory Asset Manager portion of the LIMS.

b. Usage:
The comparison microscope will be checked periodically to ensure that it is functioning properly. Test shots, an ocular scale or other similarly appropriate items may be utilized to perform magnification checks. This check does not need to be documented.

2. Stereo Microscopes: (if used for measurement purposes)

a. Every Three years:

The stereo microscope will be cleaned, serviced and certified every three years by a qualified technician. These steps will be documented in the Laboratory Asset Manager portion of the LIMS.

3. Balances/Scales:

   a. Quarterly:
   The balance/scale will have balance acceptability checks quarterly minimally utilizing the 0.1 gram, 1.0 gram, 10 gram and 20 gram or 30 gram weights. These weights will have a traceable certificate and must be calibrated by an ISO 17025 accredited calibration vendor every six years. Balance acceptability checks are performed using reference materials. This balance acceptability check will be documented in the Laboratory Asset Manager portion of the LIMS.

   b. Usage:
   The balance/scale will be zeroed prior to use. It is recommended to check the balance with one or both of the provided non-certified weights provided with the balance prior to use. These checks are not required to be documented.

4. Micrometers/Calipers:

   a. All micrometers/calipers must come with an initial NIST certification when purchased. This NIST certification must be entered into the Laboratory Asset Manager within the LIMS.

   b. Annually:
   The micrometers/calipers will be performance checked annually utilizing the appropriate gage blocks to an established tolerance of +/-0.003". This performance check will be documented in the Laboratory Asset Manager portion of the LIMS. The gage blocks used to performance check the micrometers/calipers will have been calibrated by an ISO 17025 accredited calibration vendor.

   c. Usage:
   The micrometer/caliper will be zeroed prior to use. This does not need to be documented.

5. Rulers/Measuring Tapes

a. All rulers/measuring tapes must come with an initial NIST certification when purchased. This NIST certification must be entered into the Laboratory Asset Manager within the LIMS.

b. All rulers/measuring tapes must be calibrated by an ISO 17025 accredited calibration vendor every five years.

6. Gage Blocks

Gage blocks utilized for performance checking micrometers/calipers will be calibrated by an ISO 17025 accredited calibration vendor every 5 years. The calibration certificate will be maintained in the Laboratory Asset Manager portion of the LIMS.

*Unless otherwise noted, a measuring instrument will be considered to be in operating standards if it is within the margin of error published by the manufacturer and contained with the documentation for the specific instrument in the Laboratory Asset Manager portion of the LIMS.

*Should the parameters for calibration/performance checks not be met, the instrument/ equipment will be taken out of service until it meets those parameters by auto-calibration, adjustments, or repairs. If it is determined that the instrument/equipment was used on casework while not meeting these parameters, corrective action will be initiated to document the issue and ensure the validity of reported results.

F. Abbreviations:

Abbreviations are used to more efficiently document evidence in matrix panel fields within the LIMS. The below abbreviations are only to be used in fields that do not populate to the report and fields that would not be used to gather data within the LIMS. No abbreviations will be allowed for microscopic findings (identification, elimination, etc.) in the reports or in any matrix fields. If a field has a drop down option with the abbreviation completely spelled out, the complete word(s) will be what is used. Although the abbreviations listed are capitalized, lower case abbreviations are allowed. Abbreviations may also appear within the procedures manual and can be referenced here.

1. Packaging and lab mark abbreviations:

a. ENV = ENVELOPE
b. PL = PLASTIC
c. CPB = CLEAR PLASTIC BAG
d. SLD = SEALED
e. CE = COIN ENVELOPE
f. ME = MANILA ENVELOPE

g. MCE = MANILA COIN ENVELOPE
h. BPB = BROWN PAPER BAG
i. SBPB = SEALED BROWN PAPER BAG
j. DICI = DATE INITIALS CASE# ITEM#
k. ICI = INITIALS CASE# ITEM#
l. RET = RETURN OR RETURNED
m. PKG = PACKAGE

2. Firearm, magazine, and toolmark abbreviations:
a. FA = FIREARM
b. FP = FIRING PIN
c. BF = BREECHFACE
d. EJ = EJECTOR
e. EXT = EXTRACTOR
f. BBL = BARREL
g. MAG = MAGAZINE
h. TM = TOOLMARK
i. SA = SINGLE ACTION
j. DA = DOUBLE ACTION

3. Bullet and fired bullet abbreviations:
a. GIMP = GROOVE IMPRESSION
b. LIMP = LAND IMPRESSION
c. FB = FIRED BULLET
d. FBF = FIRED BULLET FRAGMENT
e. FBJ = FIRED BULLET JACKET
f. FBJF = FIRED BULLET JACKET FRAGMENT
g. JKT = JACKET
h. FMJ= FULL METAL JACKET
i. TMJ = TOTAL METAL JACKET
j. JHP = JACKETED HOLLOW POINT
k. JSP = JACKETED SOFT POINT
l. LRN = LEAD ROUND NOSE
m. LSWC = LEAD SEMI-WADCUTTER
n. LWC = LEAD WADCUTTER
o. SWC = SEMI-WADCUTTER
p. LHP = LEAD HOLLOW POINT
q. WC = WADCUTTER
r. RN = ROUND NOSE
s. FN = FLAT NOSE

t. FP = FLAT POINT
u. GR = GRAINS
v. PB = LEAD
w. JB = JACKET BRASS
x. JN = JACKET NICKEL
y. JC = JACKET COPPER
z. JS = JACKET STEEL
aa. JA = JACKET ALUMINUM
bb. SJHP = SEMI JACKETED HOLLOW POINT

4. Cartridge, shotshell, fired cartridge case, and fired shotshell abbreviations:
a. DCC = DISCHARGED CARTRIDGE CASE
b. FCC = FIRED CARTRIDGE CASE
c. CTG = CARTRIDGE(S)
d. CC = CARTRIDGE CASE
e. RND = ROUND(S)
f. FS = FIRED SHOTSHELL
g. DS = DISCHARGED SHOTSHELL
h. FPI = FIRING PIN IMPRESSION
i. BFI = BREECH FACE IMPRESSION
j. BFM = BREECH FACE MARKS
k. FPASM= FIRING PIN APERTURE SHEAR MARK
l. FPAM = FIRING PIN APERTURE MARK
m. AL = ALUMINUM
n. NI = NICKEL
o. BR = BRASS
p. CU = COPPER
q. ST = STEEL
r. PR = PRIMER

5. Other abbreviations:
a. AOC = AREA OF CORRESPONDENCE
b. LRC = LABORATORY REFERENCE COLLECTION
c. UNK = UNKNOWN
d. OCU = OCULAR
e. OBJ = OBJECTIVE
f. MAGN= MAGNIFICATION
g. IBIS = INTEGRATED BALLISTIC INFORMATION SYSTEM

h. NIBIN = NATIONAL INTEGRATED BALLISTIC INFORMATION NETWORK
i. N/A = NOT APPLICABLE
j. LFP = LATENT FINGER PRINT
k. ASA = ASSISTANT STATE'S ATTORNEY
l. INV = INVENTORY
m. PD = POLICE DEPARTMENT
n. L = LEFT
o. R = RIGHT
p. vs = VERSUS
q. ISP = ILLINOIS STATE POLICE
r. AFTE = ASSOCIATION OF FIREARM AND TOOLMARK EXAMINERS
s. EM = EVIDENCE MARKER
t. RD = RECORDS DIVISION
u. CSM = CRIME SCENE MARKER
v. FSC-C = FORENSIC SCIENCE CENTER AT CHICAGO
w. GRC = GENERAL RIFLING CHARACTERISTICS
x. W/ = WITH
y. LAM = LABORATORY ASSET MANAGER
z. LIMS = LABORATORY INFORMATION MANAGEMENT SYSTEM
aa. BATFE = BUREAU OF ALCOHOL, TOBACCO, FIREARMS AND EXPLOSIVES
bb. ATF = BUREAU OF ALCOHOL, TOBACCO AND FIREARMS
cc. OSAC = ORGANIZATION OF SCIENTIFIC AREA COMMITTEES
dd. ANAB = ANSI-ASQ NATIONAL ACCREDITATION BOARD
ee. FBI = FEDERAL BUREAU OF INVESTIGATION

G. Firearms/Toolmarks Section Service Requests and Tasks:

The Firearms/Toolmarks Section service request(s) and task(s) within LIMS are used to help identify, triage, prioritize, and determine the specific analysis requested on each Item within a case submitted to the laboratory for Firearms/Toolmark analysis. The Firearms/Toolmark Section service request(s) and task(s) will be designated to submitted Item(s) using two separate areas within LIMS.

1. The Firearms/Toolmarks Section service request(s) will be assigned by the submitting agency within the Pre-Log area in LIMS. These service request(s) will be designated to each Item within a case requesting Firearms/Toolmarks analysis and form the basic service

request for the section assignment. The submitting agency will have the following choice(s) of Firearms/Toolmarks Section service request(s):

a. Firearm and/or Fired Evidence Analysis
b. Case to Case Comparison
c. Toolmark Analysis
d. Muzzle to Clothing Contact Examination

The agency will be required to designate at least one of the above service request(s) to each Item within a case requiring Firearms/Toolmark analysis.

Below is a description of each service request(s) available within the Pre-Log area in LIMS and when the service request(s) should be applied by the agency:

a. Firearm and/or Fired Evidence Analysis: If a submitting agency is requesting analysis on a firearm, analysis on fired evidence, or a firearm to fired evidence comparison, this service request should be designated. This service request will also encompass NIBIN entry, NIBIN Evaluations, serial number restorations, full auto conversions, sound suppression examination, shot pellet/wadding determination, firearm magazines and unfired cartridges. If there is evidence in separate cases that needs to be compared, the Case to Case Comparison service request should also be selected.
b. Case to Case Comparison: If a submitting agency is requesting the current submission be compared to another case, this service request will be designated in addition to one of the three other service requests. The agency will be required to supply the other case(s) information to include case numbers and item numbers.
c. Toolmark Comparison: If a submitting agency is requesting a toolmark comparison of a suspect tool(s) and toolmark(s), this service request should be designated on both the suspect tool(s) and toolmark item(s). If there is evidence in separate cases, the Case to Case Comparison service request should also be selected.
d. Muzzle to Clothing Contact Examination: If a submitting agency is requesting the examination of clothing in an effort to determine if the muzzle of a firearm was held in contact/near contact to the clothing when discharged, this service request should be designated on the item containing the clothing.

Any additional requests not directly covered by the above service request(s) will need to be addressed in other fields within the Pre-Log area in LIMS (Comments, etc.). These additional requests will be addressed at the laboratory level of designating Firearms/Toolmarks Section tasks(s) (see Section 2 below).

2. The Firearms/Toolmarks Section task(s) will be assigned by laboratory personnel after the case has been accepted at the laboratory. These Firearms/Toolmark Section task(s) will be added to the service request(s) from the agency. The Firearms/Toolmark Section tasks

are only available at the laboratory level in LIMS and need to be designated to only one Item within each case assignment. The Firearms/Toolmarks Section service request(s) designated by the submitting agency will be deleted or amended if incorrect. The Firearms/Toolmarks Section service request(s) allow for the case to be submitted by the agency for Firearms/Toolmark Section analysis and the relevant Items from each case requesting Firearms/Toolmarks Section analysis to be delineated. The Firearms/Toolmarks Section task(s) allow for additional specificity for the analysis conducted based on the agency supplied information and service request(s).

The Firearms/Toolmarks Section tasks for laboratory use are:

a. Firearm Only
b. Fired Evidence Comparison
c. NIBIN Evaluation
d. Firearm with Fired Evidence
e. Fired Bullet Only
f. Serial Number Restoration
g. Case to Case Comparison
h. Full Auto Conversion
i. Muzzle to Clothing Contact Examination
j. Shot Pellet/Wadding Determination
k. Sound Suppression Device Examination
l. Toolmark Comparison
m. NIBIN Entry
n. NIBIN Notification
o. QRC Firearms File Review
p. Firearms/Toolmarks Proficiency test
q. Competency Test
r. Firearms Reanalysis
s. QRC NIBIN Review

The designation of Firearms/Toolmarks Section tasks to existing Firearms/Toolmark Section service requests needs to be done in a timely fashion to ensure the proper prioritization of the case assignments and the analysis. For Case to Case Comparisons, the cases will be linked in LIMS via the "Big View" feature at the same time the tasks are being added to the cases.

Below is a description of each laboratory level assigned task and when the task should be applied to the case:

a. Firearm Only: This task is for cases with a firearm(s) that is submitted without any fired evidence. If eligible, analysis of these cases will be a priority and a suitable test shot from the firearm will be entered into NIBIN. The Firearm Only task will also be

used for revolvers/derringers/single-shot firearms if accepted and lab manager approved.

b. Fired Evidence Comparison: This task is for cases that request a full microscopic comparison of fired cartridge cases or fired cartridge cases and fired bullet evidence within the case or to another case(s). If eligible, a fired cartridge case(s) will be entered into NIBIN.
c. NIBIN Evaluation: This task is for cases that meet the NIBIN Evaluation eligibility requirements. If eligible, analysis of these cases will be a priority and a suitable fired cartridge case(s) will be entered into NIBIN.
d. Firearm with Fired Evidence: This task is for cases that request a full microscopic comparison between a firearm(s) and fired evidence in this case or to another case(s). For case to case comparisons, the fired evidence cases will also receive a Firearm to Fired Evidence Comparison task because of the inter-comparison request. If eligible, a suitable test shot from the firearm and/or fired cartridge case(s) will be entered into NIBIN.
e. Fired Bullet Only: This task is for cases that request a full microscopic comparison between fired bullet evidence within this case or to another case(s). A full microscopic analysis will be performed unless otherwise requested. This task is also for single fired bullet cases.
f. Serial Number Restoration: This task is for firearms or any other objects that require the restoration of an obliterated or defaced serial number. Any object can be submitted for a serial number restoration. This task will be added to the Firearm Only task for firearms that are eligible for entry into NIBIN. If the serial number restoration is on a firearm or object not eligible for entry into NIBIN, it will only have this task.
g. Case to Case Comparison: This task is for cases that require comparison to other case(s). The Case to Case comparison task needs to be assigned to each case involved in the inter-comparison request. The Case to Case comparison task will be added in addition to the tasks delineating the type of comparison being conducted (For example: Firearm with Fired Evidence and Case to Case Comparison will be selected).
h. Full-Auto Conversion: This task is for firearms that need an examination to determine if they operate as designed and/or were converted to fire in a full-automatic mode of fire. This task will be added to the Firearm Only task.
i. Muzzle to Clothing Contact Examination: This task is for when clothing is submitted to determine if the muzzle of a firearm was in contact/near contact with the clothing when discharged. The specific firearm is not required to perform this examination.
j. Shot Pellet/Wadding Determination: This task is for determining shot size or a range of shot sizes. The determined shot size can be compared to the shot loaded in submitted live shells or to a shot size marked on a discharged shotshell. This task will also be used for determining a wadding gauge or range of gauges. If suitable marks are present on fired wadding, a comparison can be made with the firearm.
k. Sound Suppression Device Examination: This task is for any device attached to the barrel of the firearm designed to reduce the noise of the discharge. This task will be added to the Firearm Only task for firearms that are eligible for entry into NIBIN. If

the sound suppression device is on a firearm not eligible for entry into NIBIN, it will only have this task.

l. Toolmark Comparison: This task is for the submission of a tool and a toolmark for comparison. Toolmark cases will not be accepted without a tool being submitted. Any requests without a tool being submitted will require lab management approval before accepting the evidence into the laboratory. These cases may need to be transferred to another Illinois State Police laboratory that is currently examining toolmark cases. If the submitting agency added the Toolmark Comparison to the service request, it does not need to be added again at the task level.
m. NIBIN Entry: This task will be used by laboratories with NIBIN equipment on non-NIBIN laboratory transfer cases from laboratories that don't have NIBIN equipment.
n. NIBIN Notification: This task is for case reports to notify the agency of possible NIBIN associations to cases that were examined within the Illinois State Police laboratory system.
o. QRC Firearms File Review: This task will be generated by the Quality Review Coordinator when reviewing another examiner's case file for completeness and accuracy.
p. Firearms/Toolmarks Proficiency test: This task is for proficiency tests that come into the laboratory.
q. Competency test: This task is for competency tests.
r. Firearms Reanalysis: This task will be generated by the Quality Review Coordinator when reanalyzing a case.
s. QRC NIBIN Review: This task will be generated by the Quality Review Coordinator when reviewing NIBIN entries and correlations.

H. Data Rejection

1. If/when an observation, data or calculation is rejected, the reason(s), date and individual taking the action shall be recorded in the technical record. This includes rejection by the analyst, reviewer or verifier. During examination, an analyst's note-taking in LIMS records the identity of the individual taking the action and date of rejection observations. Analysts should retain all images taken in the laboratory and retained within LIMS, whether analytical or record images. In the event that images are not retained, the analyst must document the reason that images were not retained in detail (i.e. not in focus, poor lighting). Any rejections or comments by the verifier shall be recorded in the comments box of the verification screen, ensuring that LIMS records the date and the identity of the individual taking the action.
2. During the technical review process, all original and corrected versions of the analyst's original observations are stored in LIMS. Any changes to be made by the original analyst will be noted in the technical review checklist. Rejected data is retained in the technical record through the LIMS Audit Trail or the attachments. The below categories can be cause for rejection by the technical reviewer:

a. All of the items for which an examination was requested were not accounted for and/or reported.
b. The NIBIN entry and correlation was incorrect.
c. The minimum standards and controls were not followed.
d. The proper examinations and comparisons were not made.
e. The conclusions were not justified in the notes.
f. All of the agency requests were not addressed.
g. The header of the report is not correct.
h. The correct sub-items were not created when necessary.
i. The correct tasks are not associated with the case.
j. The report and notes are not free of administrative issues.
k. There are LIMS related issues requiring resolution related to the case report and supporting notes.

3. Examiners, verifiers and technical reviewers are all responsible for ensuring that adequate documentation is provided for rejection of observations, data or calculations.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

APPENDIX III: MICROSCOPE CLEANING & MAINTENANCE

Reviewed by:

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Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

APPENDIX III

MICROSCOPE CLEANING & MAINTENANCE

INTRODUCTION

These techniques are provided to assist the Forensic Scientist when cleaning any of the microscopes used within their section and maintaining them in proper working condition. These guidelines are not intended to be inclusive of all microscope types (i.e., stereo microscope, compound microscopes, comparison microscopes, etc.) and manufacturers (Olympus, Nikon, Leica, etc.). Rather, its purpose to clarify and supplement the recommendations provided by the instruments' manufacturer.

SAFETY CONSIDERATIONS

Standard Laboratory Precautions.

PREPARATIONS

Standard Laboratory Practices.

Chemical	NFPA
Acetone	1-3-0
Methyl Alcohol	1-3-0
Xylene	2-3-0
Xylene Substitute	2-3-0
Water, distilled	0-0-0

Microscope Cleaning Kit composed of:

- aspirator with camel hair brush
- compressed air
- lens cleaning fluid
- lens tissue (lint free)
- swabs

INSTRUMENTATION

None

PROCEDURE

Care needs to be applied anytime a microscope is cleaned as well as operated. The microscope does contain delicate mechanical parts which can be easily misaligned and even damaged. The use of solvents should be limited to the minimal quantities needed in order to remove the adhering debris. Solvents may destroy the plastic parts of a microscope and, when applied to the lenses, may dissolve the cement used in bonding the various portions of the lens system, as well as eroding the coatings on the surfaces of some of the lenses.

Compressed air or an aspirator with camel hair brush may be used to remove the accumulation of dust on oculars (eyepieces), objectives, stage, condensers, etc. Small amounts of a lens cleaner may be applied to lens tissue to remove simple adhering debris, such as fingerprints, from the lenses without damage to the cement or the coating. Further tough adhering debris can be removed with a minimal amount of an appropriate solvent, such as Xylene (Xylene Substitute) or Acetone applied to a swab. A small amount of the solvent can be placed on a piece of lens paper which is then used to wipe off the debris. Avoid prolonged and repeated contact of the solvent with any of the lenses. A small amount of alcohol on a swab or lens tissue should then be used to remove any remaining solvent on the lens. Once cleaned by any of the aforementioned methods, the lens should be gently wiped with clean lens paper.

The best way to maintain the microscope in proper working condition is with daily maintenance which should include a cursory inspection of the microscope and examination of the optical paths. At the conclusion of its use, the operator should ensure the microscope is clean and free of any contaminates which may have been deposited during the examination. The microscope(s) should be covered at all times with a lint-free cover when not in use. Disassembling the microscope should be avoided if at all possible, unless by properly trained personnel.

PREVENTATIVE MAINTENANCE

Preventative maintenance will be done by a qualified professional. The maintenance performed will include, but is not limited to:

- thoroughly clean and inspect all exterior surfaces,
- thoroughly clean and inspect optics and illumination system,
- thoroughly clean and inspect mechanical parts,
- remove old lubricant and reapply fresh lubricant where needed,
- clean and inspect all accessories,
- check microscope and attachments for proper operations,
- provide documentation and explanations of the maintenance performed and any repairs made to the instrument and record in the microscope log book.

REFERENCES

1. McCrone, W.C.; McCrone, L.B.; Delly, J.G.; *Polarized Light Microscopy*, Ann Arbor Science: Ann Arbor, MI, 1978; pp. 98-99.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

APPENDIX IV: CLEAN TECHNIQUE PROCEDURE FOR NON-DNA PERSONNEL

Reviewed by:

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Forensic Scientist Aaron Horn, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

APPENDIX IV

CLEAN TECHNIQUE PROCEDURE FOR NON-DNA PERSONNEL

INTRODUCTION

To minimize contact by analysts in other disciplines with potential DNA evidence, agencies will be required to inform the laboratory at the time of submission of the case if the case requires DNA analysis. This Clean Technique Procedure must be followed by any forensic scientist or evidence technician when handling evidence that has been designated for DNA analysis, but the evidence has not yet been to the DNA section for analysis. This situation will occur routinely due to things such as safety issues (like clearing a firearm) or preservation of evidence (micro/trace evidence critical as in EVH 26). Good communication with the submitting agency would help ensure that evidence needing DNA analysis goes to the DNA section first, so that non-routine situations requiring non-DNA scientists to handle DNA evidence is minimal and to comply with TCH 21. If, however, you open an exhibit which did not have a reasonable potential for DNA evidence and you see a potential body fluid stain that could be significant, immediately stop work and contact a DNA analyst for advice and assistance.

1. The analyst must wear a mask, lab coat with disposable sleeve covers or disposable lab coat and gloves while examining any potential DNA evidence.

    A. The gloves must either be sterile or the gloves must be bleached and then dried with a paper towel after the gloves are put on. Gloves must be changed between exhibits. Gloves must also be changed after handling non-evidence items prior to returning to casework. These non-evidence items may include but are not limited to, refrigerators/ freezers, biohazard waste bins, equipment, computers and telephones. Gloves should be changed following common sense and clean technique.

    B. The face mask must be worn over the nose and mouth to prevent the transfer of aerosols from both the nose and mouth of the analyst to the evidence. Whenever the mask is removed from the face it must be disposed of and a new mask used. For example, if an analyst removes the mask to talk on the phone, the mask must be disposed of, not hung around the neck or placed on the counter and reused.

    C. Lab coats must be fully buttoned or snapped.

2. First decontaminate the surface on which samples are to be processed with a 10% bleach Solution. Wet the surface (counter top, lab bench, etc.) that will be utilized to examine evidence thoroughly with 10% bleach solution. Spread the 10% bleach across entire surface with a paper towel. Ensure surface is dry before examining evidence. Don't store bleach solutions in open containers. Replace the bleach solution daily with a fresh bleach solution.

3. All instruments which will be used to process forensic samples (e.g., forceps, scissors, scalpel/razor blades, pipetters and metal probes) must be decontaminated by autoclaving or rinsing with a 10% bleach solution. Caution: some surfaces may resist wetting and will require addition of a detergent. In addition, these items may also be placed under an ultraviolet light source for at least 15 minutes. Note: UV light will not destroy DNA on surfaces that are not directly exposed to the light.

4. Place evidence samples in clean containers or on clean surfaces for processing. Large glassine weighing papers, butcher paper, or similar type clean disposable paper are suggested.

5. Use a 10% bleach solution to rinse or wipe instruments between samples. Instruments may be rinsed with distilled water. After rinsing with a 10% bleach solution, use kimwipes or similar disposable type wipe to wipe the instrument. Use a new kimwipe or similar disposable type wipe each time.

6. Exhibits will be processed one at a time. Put away the previous exhibit before opening the next exhibit. Clean instruments, new gloves, and fresh paper must be used for each exhibit.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS PROCEDURES MANUAL

APPENDIX V: MEASUREMENT UNCERTAINTY

Reviewed by:

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Forensic Scientist Brian Parr, Chairperson
Firearms/Toolmarks Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

APPENDIX V

MEASUREMENT UNCERTAINTY
Barrel Length and Overall Length Measurements

Purpose:

This document assesses the uncertainty levels (Measurement Uncertainty) associated with measurements of overall length and barrel length collected by the Illinois State Police Firearm and Toolmark Section.

Equipment:

This document encompasses the use of the Illinois State Police Firearms and Toolmark Section's NIST traceable rulers/tape measures used in the measurement of overall lengths and barrel lengths of firearms. Different calculations will be done for each type of equipment (i.e. one for rulers and one tape measures).

Analyst:

All Firearms and Toolmark Section personnel trained on IA-5 Barrel & Overall Length Measurement and report results of overall and barrel length must be included in the calculation of measurement uncertainty.

Scope:

This type of measurement is currently the only "critical measurement" in the Firearms and Toolmark Section and is the only measurement that would be typically reported as a numerical value.

Procedure:

A. Full Measurement Uncertainty Calculation

1. A full calculation of the measurement uncertainty will be performed upon the adoption of this procedure and whenever deemed necessary by the evaluation procedure in section C.
2. A selection of firearms from the laboratory firearms reference collection, selected by the firearms QRC or designee, will include firearms in the following categories:

revolver(s), integral chamber barrel(s), and measurements (barrel and/or overall) near or below legal limits.

3. Following the procedure in IA-5, each analyst, as defined above, will measure the overall length and barrel length of each firearm selected and record the two measurements in the LAM under the asset used to measure the firearm, along with the firearm log number.
4. The two measurements will be repeated with each firearm, with each type of measuring device (i.e. ruler and tape measure), on two different days.
5. The selection of firearms will be rotated to each lab for measurement.
6. Upon the completion of all measurement entry into LAM the data will be processed as outlined in the analysis section below using the LAM and confirmed by the firearms QRC or designee.
7. Once complete the firearms QRC or designee will upload the following documents to the measurement uncertainty asset (unless otherwise noted) in the LAM:
    i) Evaluation of Uncertainty Document
    ii) Current budget table (Uncertainty Contributions worksheet of Firearms_MU_Workbook).
    iii) Data used to calculate the uncertainty
        (1) Measurement data and standard deviations
            (a) Data worksheet of Firearms_MU_Workbook
            (b) Individual data points via calibration template (attached to measuring device asset(s))
        (2) Calibration certificates (attached to measuring device asset(s))

(a) Measuring device calibration certificate

(b) Reference length standard calibration certificate, if applicable.

B. Appended Measurement Uncertainty Reanalysis

1. An appended reanalysis of the measurement uncertainty will be performed whenever deemed necessary by the evaluation procedure in section C.
2. The selection of firearms from the laboratory firearms reference collection, selected by the firearms QRC or designee, in the current measurement uncertainty will be used.
3. Following the procedure in IA-5, each analyst or new analyst, as defined above, will measure the overall length and barrel length of each firearm selected and record the two measurements in the LAM under the asset used to measure the firearm, along with the firearm log number.
4. The two measurements will be repeated with each firearm, with each type of measuring device or new type of measuring device (i.e. ruler and/or tape measure), on two different days.
5. The selection of firearms will be rotated to each lab for measurement, as needed.
6. Upon the completion of all measurement entry into LAM the new data will be processed with the existing data as outlined in the analysis section below using the LAM by the personnel responsible for the evaluation, or their designee.
7. Once complete the personnel responsible for the evaluation or their designee will upload the following documents to the measurement uncertainty asset (unless otherwise noted) in the LAM:

   i) Evaluation of Uncertainty Document – noting what has change, if any.

ii) Current budget table (Uncertainty Contributions worksheet of Firearms_MU_Workbook).

iii) Data used to calculate the uncertainty (noting existing data verses new data)

(1) Measurement data and standard deviations

(a) Data worksheet of Firearms_MU_Workbook

(b) Individual data points via calibration template (attached to measuring device asset(s))

(2) Calibration certificates (attached to measuring device asset(s))

(a) Measuring device calibration certificate

(b) Reference length standard calibration certificate.

C. Evaluation of Measurement Uncertainty

1. An evaluation of measurement uncertainty will be performed by the firearms QRC or designee if any of the following conditions are met:

i) Prior to end of Frequency of Review time period in QM-18 of Quality Manual

ii) New analysts are authorized to measure and report overall and/or barrel lengths of firearms (prior to doing casework)

iii) New assets used to measure overall and/or barrel lengths of firearms are procured (prior to use in casework)

iv) Existing assets are re-calibrated (prior to use in casework)

v) Change in procedure of FA PM IA-5 or Appendix V

vi) Anytime deemed necessary by the Patterned Evidence Program Manager

2. Personnel responsible for evaluation of measurement uncertainty

i) Firearms QRC, or designee, is for parts i., iii., iv. of section 1

ii) Firearms Training Coordinator, or designee, is for part ii. of section 1

iii) Firearms CAB chairperson, or designee, is for part v. of section 1

iv) Patterned Evidence Program Manager, or designee, is for part vi. of section 1.

3. Personnel responsible for the evaluation will determine if a Full Measurement Uncertainty Calculation, an Appended Measurement Uncertainty Reanalysis, or neither is necessary. Command's technical measurement uncertainty consultant may be of assistance in this determination. Questions to consider during this determination:

   i) Time until next review per QM-18?

   ii) Number of new analysts?

   iii) Number of new assets?

   iv) Different type of asset? (Always Full Measurement Uncertainty Calculation)

   v) Difference in new calibration uncertainty from current calibration uncertainty?

   vi) How has the procedure changed; what factors are affected?

Analysis:

A. Terms, definitions, and calculations

1. **Expanded Uncertainty** – U_e – The expanded uncertainty is determined from the Combined Uncertainty (U_c) multiplied by a confidence factor (k). A k factor of 2 has been chosen for a confidence level of 95.45%. The expanded uncertainty will be rounded up to the nearest 1/16 inch.

$$U_e = (U_c * k)$$

2. **Combined Uncertainty** – U_c – The combined uncertainty is determined from the square root of the sum of the squares of the standard uncertainties in the uncertainty budget.

$$U_c = \sqrt[2]{U_{mp}^2 + U_s^2 + U_{cp}^2 + U_r^2 + U_t^2 + U_o^2}$$

3. **Uncertainty Contributions**

   i) **Uncertainty from measurement process** – U_{mp} – This component describes the uncertainty resulting from non-reproducible errors in the measurement process. The measurement technique used for calculating the measurement uncertainty will be the same as that used in casework. Therefore, any process induced error, or inherent error will be accounted for in the measurement process uncertainty. Other sources of uncertainty accounted for in this section include but may not be limited to the following: individual error, person to person variation, and time dependent changes. The measurement process uncertainty is in the form of a normal distribution; therefore, the total pooled standard deviation will be divided by one to obtain the standard uncertainty for the measurement process. This is Type A error.

   ii) **Uncertainty of the length scale readability** – U_s – The scale readability component is determined by the smallest change in measurement value that can be observed. For ruler/tape measures that are read without interpolation, this would be the nominal distance between the scale hash marks. To obtain the respective standard uncertainty, we assume that the resulting length measurement error can take any value ± ½ the smallest change with equal probability. For this

rectangular distribution, the respective standard uncertainty is obtained by dividing the width of the distribution, the smallest change, by the square root of 12. This is Type B error.

iii) **Uncertainty from the measuring device calibration process** – U_{cp} – The uncertainty of the calibration process describes the uncertainty due to the errors in the length of the measuring device or scale.

(1) If the uncertainty can be obtained from the calibration certificate of the measuring device(s) used, then the largest uncertainty of a particular type will be used. The uncertainty is often reported as ± an expanded uncertainty. The standard uncertainty is obtained by dividing the expanded uncertainty by the respective coverage factor (k), which is often specified in the calibration report or will need to be obtained. Typical values for the coverage factor are 2 and 3 for levels of confidence of 95.45% and 99.73%, respectively, assuming a normal distribution. This is Type B error.

(2) If the uncertainty is obtained by in-house calibration of the measuring device(s) used, then the uncertainty of the reference length (see iv. below) will need to be considered along with uncertainty of the length scale readability, uncertainty of thermal expansion, and misalignment. See ANSI-ASB current best practices for all considerations needed if this method is used. This is Type A error.

iv) **Uncertainty of reference length standard calibration** – U_r – The uncertainty of the reference length standard calibration describes the uncertainty due to the errors in the length of the reference length standard and its calibration. The

uncertainty can be obtained from the calibration certificate of the reference length standard. The uncertainty is often reported as ± an expanded uncertainty. The standard uncertainty is obtained by dividing the expanded uncertainty by the respective coverage factor (k), which is often specified in the calibration report or will need to be obtained. Typical values for the coverage factor are 2 and 3 for levels of confidence of 95.45% and 99.73%, respectively, assuming a normal distribution. This is Type B error. This uncertainty will only be calculated if iii.2. above is used; otherwise, this uncertainty will be 0 as the reference length standard calibration will be considered in the uncertainty on the measuring device calibration certificate.

v) **Uncertainty of thermal expansion of the measuring device** – U_t – Lengths are defined at a reference temperature of 20°C. If measurements are performed at a different temperature, small error may occur because the firearm and measuring scale may have a different coefficient of thermal expansion. Additional errors may occur if the firearm and measuring scale do not have the same temperature. A very conservative estimate of the possible error due to thermal expansion (L_δ) will be used assuming the following: the coefficient of thermal expansion of the measuring device material (α_L expressed in %/°C), a firearm whose length does not change with temperature, the total length of the measuring device (L_t), and a temperature anywhere between 15°C and 25°C (half of the range is 5°C).

$$L_\delta = \alpha_L \, \%/°C \times 5°C \times L_t \; inches$$

The error due to thermal expansion is assumed to be a rectangular distribution. To obtain the standard uncertainty, the error due to thermal expansion is multiplied by two and then divided by the square root of 12.

vi) **Other sources of errors** – U_o – This component describes any other uncertainty sources.

(1) **Physical Deviation**: Measuring devices will be calibrated by an ISO/IEC 17025 accredited agency prior to initial use and at least once every five years thereafter. Additionally, the measuring device will be checked for physical defects prior to any overall length or barrel length measurement per IA-5. Physical deviation of deformation to the measuring devices has been deemed to be a practical non-issue.

(2) **Alignment Errors**: Misalignment or squareness error between the measurement datum and scale and misalignment of the firearm in the measurement setup, described in detail in the ANSI-ASB best practice recommendation, are sampled during the measurement process and are therefore already addressed by the uncertainty analysis.

4. **Total Pooled Standard Deviation** – s_{pt} – The total pooled standard deviation is the square root of the quantity of the sum squares of the pooled standard deviations (s_{po} and s_{pb}) divided by 2.

$$s_{pt} = \sqrt[2]{\frac{s_{po}^2 + s_{pb}^2}{2}}$$

5. **Pooled Standard Deviations** – s_{po} and s_{pb} – The pooled standard deviation for overall length (s_{po}) and barrel length (s_{pb}) is the square root of the quantity of the sum squares of the standard deviations of the measurements of each firearm (s_{o1} through s_{oy}) and (s_{b1} through s_{by}) each multiplied by its respective number of measurements (n_{o1} through n_{oy}) and (n_{b1} through n_{by}) minus 1 then divided by the number of measurements minus the number of firearms used (y).

$$s_{po} = \sqrt[2]{\frac{(n_{o1}-1)s_{o1}^2 + (n_{o2}-1)s_{o2}^2 + \cdots + (n_{oy}-1)s_{oy}^2}{n_{o1} + n_{o2} + \cdots + n_{oy} - y}}$$

$$s_{pb} = \sqrt[2]{\frac{(n_{b1}-1)s_{b1}^2 + (n_{b2}-1)s_{b2}^2 + \cdots + (n_{by}-1)s_{by}^2}{n_{b1} + n_{b2} + \cdots + n_{by} - y}}$$

6. **Standard Deviations** – s_{o1} through s_{oy} and s_{b1} through s_{by} – The standard deviation of a measurement – either overall (s_o) or barrel (s_b) – for each firearm used (1 through y).

$$s_{oy} = \sqrt[2]{\frac{\sum\left(x_{ioy} - \overline{x_{oy}}\right)^2}{\left(n_{oy} - 1\right)}}$$

7. **Averages (Means)** – The averages of each of the measurements (overall and barrel for each firearm) is also calculated in the excel workbook; however, at this time not used in the actual calculation of the standard deviations.

$$\overline{x}_{oy} = \frac{\sum x_{ioy}}{n_{oy}}$$

B. Data

1. Measurements that are taken and the uncertainty of measurement results will be expressed in terms of inches (").
2. All replicate data will be evaluated for acceptability before being utilized in the measurement uncertainty calculation.
    i) Measurements within ½" of the calculated mean are deemed acceptable.
    ii) Analysts producing measurement data more than ½" outside the calculated mean will be required to:
        (1) Review Firearms & Toolmarks Procedure Manual FA -IA-5 Barrel & Overall Length Measurement,
        (2) Demonstrate their measuring technique to their supervisor (or delegate), and
        (3) Collect updated measurements. The updated measurements will replace their original data.
3. All measurements along with analyst's name and date of measurement will be stored in the LAM along with all of the calculations.