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	<i>Document Manager: Andrew Carriveau</i>	<i>Approved By: Ryan Larrison</i>

5.0 Microscopic Comparison

5.1 Introduction

A comparison microscope allows an examiner to identify a fired component back to the firearm that produced the markings on the evidence or identify a tool mark back to the tool that produced the mark. Prior to conducting any comparisons, examine the submitted evidence, test shots or test tool marks to identify characteristics that are suitable for comparison. This procedure may also be used to compare two unknown fired components or two tool marks to determine if they were fired in/from the same firearm or were produced by the same tool.

5.2 Safety Considerations

Examinations performed in the Firearm and Tool mark Section are inherently hazardous. These procedures involve hazardous chemicals, firearms, ammunition, and power tools. All hazardous procedures must be performed in compliance with the Laboratory Operations Manual and the Health and Safety Manual.

5.3 Preparation of Cleaning Solutions

NONE

5.4 Instrumentation

- Comparison Microscope
- Stereo Microscope
- The unique identifier assigned or serial number of the instrumentation used shall be maintained on the Firearms Discipline page.

5.5 Minimum Analytical Standards and Controls

NONE

5.6 Procedure for Analysis

The procedure steps below do not have to be performed in the order listed; however, all steps should be considered and/or addressed, as appropriate:

5.6.2 Analysis of Comparisons

5.6.2.1 With Firearm or Tool as Evidence

Compare the test fires produced from the firearm or tests produced from a tool to determine what individual characteristics are reproducing.

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Machining marks, such as arches, concentric rings, coarse “sanding” marks or other types of marks associated with a manufacturing process, but not defined as a class characteristic may be present. As these marks are more restrictive than class characteristics, but not individual in nature they could be considered Subclass Characteristics as defined in the AFTE Glossary.

If fired cartridge cases or tool mark evidence being examined displays what the examiner determines to be machining marks and is compared to a firearm or tool without those same marks or with different marks, the conclusion to eliminate those items is acceptable.

If the firearm or tool being examined displays machining marks, and evidence being compared does not display the same type of marks, without additional supporting documentation, such as ejector shape, position, significant differences in individual characteristics..., the conclusion to eliminate is not recommended.

5.6.2.2 Without Firearm as Evidence

When fired cartridge cases are examined and it is determined through microscopic comparison that there are multiple groups, machining marks may be used to eliminate groups. Differences in individual characteristics along with differences in machining marks would be sufficient for items to be eliminated. It should be considered if the items recovered were from the same instance (location, time, incident) when eliminating them without a submitted firearm. The decision to eliminate in this instance is at the examiner’s discretion.

5.6.2.3 Interpretation of Results

Identification: The class characteristics are the same, and there is sufficient agreement in the individual characteristics, as defined by the Association of Firearms and Tool Marks Examiners (AFTE) Criteria for Identification.

Note: The significance of the identification (association) can only be qualified to the standard of practical certainty. Absolute or scientific certainty are not standards or terms that can be used to qualify the significance of the association between two items. See Section 11 of the Firearms Procedure Manual for the required statement for all reports that contain an identification of two or more items.

Inconclusive (could not be identified or eliminated): The class characteristics are the same; however, there is not sufficient agreement in the individual characteristics or there are not sufficient individual characteristics present to make an identification. Additionally, there may be times where an item(s) displays potential subclass characteristics. If no tool or firearm is submitted for further analysis, there is not sufficient agreement of the individual characteristics present and/or subclass cannot be ruled out, a result of Inconclusive should be reported.

Elimination: Class characteristic(s) are different, machining marks on fired or tool mark evidence is not present on the firearm or tool being compared or groups of fired cartridge cases display differences in machining marks and individual characteristics.

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Note: Class characteristics are defined by AFTE as: Measurable features of a specimen which indicate a restricted group source. They result from design factors and are determined prior to manufacture.

Unsuitable: Evidence bears no marks suitable for microscopic comparison.

Requirements listed in LOM 3.3.4 Reporting of Results and AR3125 ISO IEC 2017 Forensic Testing and Calibration Laboratories Accreditation Requirements are:

- When associations/identifications are made, the significance of them shall be communicated clearly, and qualified in the laboratory report
- When no definitive conclusions can be reached (e.g. results are “inconclusive”), the reason(s) shall be communicated clearly in the laboratory report
- When comparative examinations result in the elimination of an individual or object, the laboratory report shall clearly communicate the elimination.

Interpretation of results is to be documented in examination notes and on the microscope worksheet when a microscopic comparison is conducted. A microscope worksheet is not required for eliminations based on differences in caliber or for those class characteristics that can be determined using a stereomicroscope.

At a minimum, all identifications except for test to test comparisons shall be documented with one or more photomicrographs that clearly depict a representative sample of the areas of identification. Examiners may include more photomicrographs as necessary. Photomicrographs must be of sufficient quality and quantity that another qualified examiner is able to see sufficient agreement of the individual characteristics that led to the stated conclusions.

Examinations that are determined to be inconclusive are not required to be documented with photomicrographs.

If an examiner confers with another examiner and there is a change of opinion, both examiners names and a summary of the conversation must appear in the case record. This would be considered a significant collaboration or contribution by the second examiner.

In the case of an elimination, it is at the examiner’s discretion to document class characteristic differences using photomicrographs. However, cases where there is an elimination based on machining marks, Glock aperture shape or land/groove width differences at least one photomicrograph must be taken that clearly represents the differences.

Annotations on all photomicrographs shall include, at a minimum, the date and time the observation was made, the item number(s) being examined or compared and their position (right or left), the lab number, the magnification being utilized and the purpose of the image (Identification, Elimination, Inconclusive...). The electronic approval of the document in the Object Repository containing the photos signifies that the examiner of record acknowledges that the information is accurate.

Microscope worksheet documentation should describe the following:

- The item used as the reference
- The specific area or areas of identification on the item(s)

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- The type of mark or marks identified
- The phase/index mark on fired bullets and if more than one area was identified

It is at the examiner's discretion to use a drawing or diagram of the item(s) examined with notations of the areas of ID and type of marks if the above listed information is documented.

5.6.4 Verifications

All identifications will be verified by a second examiner. At the request of the primary examiner, the verifying examiner may review inconclusive results.

An electronic chain of custody must be maintained for all items during the verification process. The primary and verifying examiners must transfer the items in Forensic Advantage to and from the lab specific scope room area listed in the Storage Area drop down menu of the Transfer Evidence screen. The Transfer Reason should be "For Verification" when the case is ready to be verified, and "For Storage" when complete.

All original observations from the microscopic exam must be retained. To ensure this happens, prior to verification, the primary examiner shall add and approve the initial microscope worksheet in the Object Repository of the related case(s) in Forensic Advantage.

Note: Documents in the OR may be checked out for corrections. If the corrections are a result of the review process, those comments must be in the returned review. If the corrections are found by the examiner or technician after the document is approved and before reviews are set, a comment referencing the correction must be made in the related FA worksheet.

During the verification process, the verifying examiner may add additional notations to the microscope worksheet. The electronic signature (approval) of the document in the Object Repository within the case record will signify that any additional notations were reviewed and accepted by the primary examiner.

If, during the microscope verification there is a difference of opinion regarding the results described on the microscope worksheet the primary and verifying examiners shall discuss the differences. If there is a change of opinion by the primary examiner the context of the conversation must be summarized and added to either the microscope worksheet or the Forensic Advantage worksheet(s) of the related case(s). If no agreement can be reached, either the primary or verifying examiner should refer to section 5.7 Dispute Resolution.

The verifying examiner shall sign and date (electronic or otherwise) the microscope worksheet when all verifications are completed. By doing so, the verifying examiner is acknowledging the information on the microscope worksheet as accurate and correct. This should be considered the final document and added to the appropriate case record(s) in Forensic Advantage.

If there are administrative changes necessary after the microscope worksheet is set for review, a corrected copy must be added. No new, additional items or conclusions can be added to an existing worksheet that has been verified and signed. In this instance a new worksheet must be created and added to the case record(s).

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Note: Corrections must be struck through with a single strike and initialed. Information on electronic scope sheets that requires correction cannot be deleted and replaced or “electronically erased”.

5.7 Dispute Resolution

When there is a disagreement or difference of opinion that arises during the verification process, either the primary or verifying examiner can initiate a dispute resolution.

The primary examiner should request a “Verification” review in case record of the related case(s) in Forensic Advantage and assign it to either the Unit Supervisor or Technical Leader. If the disagreement or difference of opinion is between two examiners and can’t be resolved, both will meet with the Unit Supervisor to discuss the situation. It will be the responsibility of the Unit Supervisor to render a final opinion. Every effort should be undertaken to reach a consensus opinion. Consideration should be given to reporting the most conservative result. The discussion must be summarized and recorded in the case record by the primary examiner.

If the disagreement or difference of opinion is between an examiner and supervisor and can’t be resolved, both will meet with the Technical Leader to discuss the situation. The Technical Leader will be responsible for rendering a final opinion.

5.8 Appendices

Appendix A - Calibration Standards

5.9 References

AFTE (Association of Firearm and Tool Mark Examiners) Glossary 3rd ed. 1994

AFTE (Association of Firearm and Tool Mark Examiners) Glossary 4th ed. 2001

AFTE (Association of Firearm and Tool Mark Examiners) Glossary 6th ed. 2014

AFTE (Association of Firearm and Tool Mark Examiners) Glossary 6th ed. 2017

AFTE (Association of Firearm and Tool Mark Examiners) Newsletter, May 1969 - June 1972

AFTE (Association of Firearm and Tool Mark Examiners) Newsletter, August 1972 - present

DeForest, Gaensslen, and Lee Forensic Science: An Introduction to Criminalistics New York: McGraw-Hill 1983

<http://www.afte.org>