

Firearms/Toolmarks Discipline Technical Procedure for Toolmark Examinations

1 Scope

This procedure is designed for the evaluation and examination of items bearing toolmarks (referred to as item in the remaining document). Toolmark examinations include the evaluation of submitted items to determine the value of any toolmarks that may be present, and the physical and microscopic examination of a toolmark (striated and/or impressed) to determine a source conclusion.

Additionally, the following terms will be used throughout this procedure:

- **Toolmark:** Impressed and/or striated features created when a tool (harder object) makes forceful contact with an item (softer object) transferring physical and/or microscopic features.
- **Physical Characteristics:** Observable features (e.g., shape, color, design) of a specimen which indicate a restricted group source and are determined prior to manufacture.
- **Class Characteristics:** Measurable or discernible features of a specimen which indicate a restricted group source. They result from design factors, including acceptable variability within manufacturer tolerances and are determined prior to manufacture.
- **Subclass Characteristics:** Features that may be produced during manufacture that are consistent among items fabricated by the same tool in the same approximate state of wear. These features are not determined prior to manufacture and are more restrictive than class characteristics.
- **Individual Characteristics:** Marks produced by the random imperfections or irregularities of tool surfaces. These random imperfections or irregularities are produced incidental to manufacture and/or caused by use, corrosion, or damage.
- **Unsuitable:** An item bearing no class or individual characteristics for comparison.
- **Suitable:** An item bearing class and/or individual characteristics for comparison.
- **Microscopic Marks of Value (MOV):** Individual characteristics having quality and/or quantity for a source conclusion comparison.
- **Limited Microscopic Marks of Value (LMOV):** Individual characteristics that are limited in quality and/or quantity for a source conclusion comparison.
- **No Microscopic Marks of Value (NMOV):** Absent of individual characteristics for a source conclusion comparison.
- **Comparison:** The evaluation of two or more items bearing class and/or individual characteristics of value during an examination.
- **Light Comparison Microscopy (LCM):** The use of connected optical microscopes to compare and evaluate microscopic features between two toolmarks.
- **Virtual Comparison Microscopy (VCM):** The use of software to compare and evaluate the digital reproduction of microscopic features between two toolmarks.

- **3D Toolmark Topographical Instrument (3D instrument):** A device that can measure and record the x, y, and z positions of microscopic features contained within a toolmark and produce a digital reproduction of the toolmark.
- **Source Conclusion:** An Examiner's conclusion regarding the origin of a toolmark or fracture.

2 Equipment/Materials/Reagents

- 3D toolmark topographical instruments
- Known exemplars
- Measurement equipment
- Microscope (stereozoom/comparison)
- Personal protective equipment (PPE)
- Casting Material

3 Standards and Controls

Known exemplars produced from evidentiary items during examination serve as controls. Exemplars may include toolmarks produced by a known tool and/or casts collected from a toolmarked item. Exemplars produced from the known item will be treated as secondary evidence and marked in accordance with the *FTD QAM Marking and Examination of Evidence*.

4 Performance Checks

4.1 Performance checks of the measurement equipment and 3D instruments will be performed and recorded as outlined in the *FTD Technical Procedure Measurement, Calibration, Performance Check and Maintenance of Equipment*.

5 Sampling

5.1 Statistical sampling is not applicable in the FTD.

5.2 Non-Statistical sampling is employed in the FTD. It is based on the training, experience and competence of the examiner. No assumptions are made regarding items/portions that were not selected for examination and results of examinations in *Laboratory Reports* are specific to the items/portions that were examined.

6 Procedures

6.1 Evaluation of an Item Bearing Toolmarks or Known Tools

6.1.1 Review all previous observations of the item that were recorded in accordance with

the *FTD Technical Procedure Documentation and Preparation of Evidentiary Items*.

6.1.2 Ensure that the item and/or container has been properly labeled with the appropriate identifier.

6.1.3 Ensure that the item has been reviewed for any trace evidence that could be of probative value. It is at the discretion of the examiner to ensure coordination of the removal and preservation of trace evidence with the appropriate discipline examiner.

6.1.4 If no trace evidence is observed or has no probative value, the item can be cleaned in preparation for examination in accordance with the *FTD Technical Procedure Documentation and Preparation of Evidentiary Items*.

6.2 Level 1 Analysis – Evaluation and Classification of an Item Bearing Toolmarks or Known Tool

6.2.1 Class Characteristics of a Toolmark

6.2.1.1 Evaluate the class characteristics of a toolmark which may include:

- Measurable features that result from the working surface(s) of the tool
- Observed action(s) of the tool that produced the toolmark
- Type of tool that may have produced the toolmark
- Evaluation for any subclass characteristics and their impact on future comparison examination.

6.2.1.2 Class differences may result from intentional design decisions made by the manufacturer or from minor variations in tool dimensions or finishing methods that are within acceptable manufacturing tolerances for a particular tool.

6.2.1.2 Depending on the size and shape of the item bearing the toolmarks, it may be necessary to produce casts of the toolmarks for evaluation of the class characteristics and preservation for future comparisons.

6.2.1.2.1 Casting marked surfaces will be conducted in accordance with the *FTD Technical Procedure Documentation and Preparation of Evidentiary Items*.

6.2.1.3 In some instances, it may not be possible to determine the class characteristics due to the properties or conditions of the substrate, or incomplete tool contact with the substrate.

6.2.2 Class Characteristics of a Known Tool

6.2.2.1 Inspect and evaluate the known item to determine the following:

- Observed action(s) of the known item, to include all working surfaces

- Measurable features of the known item
- Evaluate for potential subclass characteristics and their impact on future comparison examination.

6.3 Level 2 Analysis (Microscopic) – Evaluation, Classification and Comparison of an Item Bearing Toolmarks

6.3.1 Individual Characteristics

6.3.1.1 Evaluate the individual characteristics of any observed toolmarks to determine if the microscopic marks are of value for comparison purposes. Value refers to the significant quality and/or quantity of the individual characteristics present on an item. This evaluation can result in any of the following classifications:

NMOV	Microscopic marks are of <i>no value</i>	No microscopic comparison
LMOV	Microscopic marks are of <i>limited value</i>	Suitable for microscopic comparison
MOV	Microscopic marks are of <i>value</i>	Suitable for microscopic comparison

6.3.2 Evaluate the working surfaces of the known item to determine if any class and/or manufacturing characteristics may assist in restricting and/or eliminating the influence of subclass characteristics, considering where potential subclass characteristics are located, how the tool is used, etc.

6.3.3 All observations of a questioned toolmark, to include evaluations of the physical, class, subclass, and individual characteristics, will be recorded on the appropriate *FTD Worksheet* located in Appendix B of *FTD QAM Case Assignment, Records, Results and Verifications*.

6.3.4 For items with no observed class characteristics and NMOV, no further examinations will be performed.

6.3.5 For items with observed class characteristics and NMOV, additional information may be reported using other Technical Procedures within the FTD (e.g., class characteristics database search, reference materials, *FTD Technical Procedure Physical and Visual Examinations*).

6.4 Level 2 Analysis – Pattern Comparison

6.4.1 A comparison of items bearing toolmarks will be performed in accordance with the *FTD Technical Procedure Pattern Comparison*.

7 Calculations

Not Applicable.

8 Measurement Uncertainty

Not Applicable.

9 Limitations

In some instances, it may not be possible to determine the class characteristics due to the properties or conditions of the substrate or incomplete tool contact with the substrate.

It should be noted that a tool is defined as any harder object that can leave a mark on a softer object. This may loosely extend to an object not conventionally thought of as a “tool.”

Due to variation in substrate, changes in tool working surfaces from wear, corrosion, and damage, or the employment of unusual tool/work piece orientations, it may not be possible for an examiner to reach a source conclusion.

10 Safety

Take standard precautions for handling of all evidentiary items and measurement equipment. PPE should also be utilized.

11 References

Davis, J.E., Tool Marks, Firearms and the Striagraph, Charles C. Thomas, Springfield, IL (1958).

FBI Laboratory Quality Assurance Manual

FBI Laboratory Operations Manual

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Glossary of the Association of Firearm and Tool Mark Examiners, AFTE Training and Standardization Committee, 6th Edition, Version 6.030317.1.

“SWGGUN Admissibility Resource Kit (ARK).” Resources, The Association of Firearm and Tool Mark Examiners. Web. 05 February 2020.

“Theory of Identification, Range of Striae Comparison Reports, and Modified Glossary Definitions – An AFTE Criteria for Identification Committee Report”, AFTE Journal, 1992; 24 (3), 340.

“Theory of Identification as it Relates to Toolmarks: Revised By: Committee for the Advancement of the Science of Firearm & Toolmark Identification”, AFTE Journal, 2011; 43 (4), 287.

United States. Department of Justice. Office of Legal Policy. Forensic Science. (2020, August) *Department of Justice Uniform Language for Testimony and Reports for the Forensic Firearms/Toolmarks Discipline – Pattern Match Examination*. Retrieved from the Department of Justice Web site: <https://www.justice.gov/olp/page/file/1284766/download>

Rev. #	Issue Date	History
10	03/02/20	Minor edits throughout for grammar and clarity. Removed comparison portions of document to a new separate document. Updated titles of referenced documents where needed for consistency. Added definitions: Toolmarks, Physical Characteristics, Source Conclusion. Edited definitions: Class, Subclass, and Individual Characteristics. Edited Section 2 Materials/Equipment/Reagents to make equipment list more generic. Section 4 Performance Checks added. Section 5 Sampling updated to reflect current practices. Section 6 Procedures (6.1, 6.2, 6.3, 6.4) restructured for consistency with E3CV methodology and current FTD document structure. Updated references: FBI QAM and LOM, and the current AFTE Glossary
11	04/15/21	Updated document to remove “Standard Operating Procedure” and “SOP” and replace with “Technical Procedure”; edits for grammar in Sections 5.2, 6.2.1.1, 6.2.1.2, 6.2.2.1; edited Section 6.3.2 to further clarify subclass evaluation considerations; added <i>FTD Technical Procedure Physical and Visual Examinations</i> to Section 6.3.5; edited for correct referenced documents titles.

Approval

Redacted - Signatures on File

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